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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water and environment

Monitoring the impact of removal of alien fishes from the Rondegat River

The WRC funded a comprehensive environmental monitoring process as part of a project to remove alien invasive fish from a stream in the Western Cape.

Background

Alien invasive fish pose the greatest threat to the survival of native fishes in the Cape Floristic Region of South Africa. While the majority of invasive fish are now too widely spread to be eradicated, targeted removal of these fishes from key reaches where re-invasion can be prevented offers a near-term way to improve the survival of some threatened fish populations.

The CAPE project, a joint venture between the Western Cape government and civil society organisations, began a process in 2003 to identify priority streams where alien invasive fish could be targeted for removal. The Rondegat River in the Cederberg was identified as an ideal candidate for a pilot project whereby invasive smallmouth bass (*Micropterus dolomieu*) would be removed from the stream using the piscicide rotenone. CapeNature acted as the implementing agent.

This WRC report summarises the findings of a comprehensive environmental monitoring programme undertaken as part of the project.

Objectives of the monitoring programme

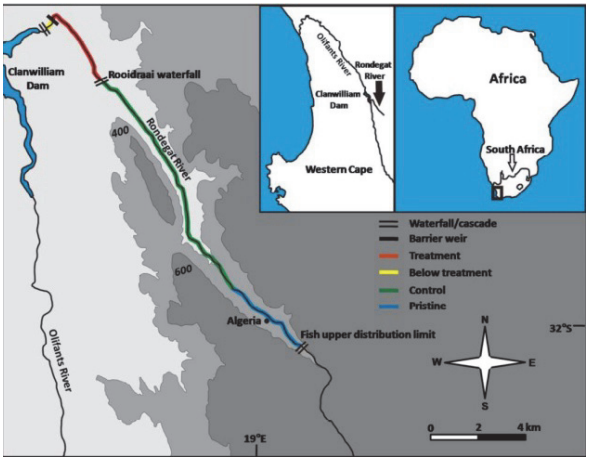
The first aim of the monitoring programme was to confirm the pre-treatment distribution of native and non-native fishes in the Rondegat River, and to confirm early findings that no threatened frog species occurred in the vicinity of the treated reach. The initial aim of the invertebrate monitoring programme was to assess the taxonomic richness of the Rondegat River aquatic insect community.

Secondly, the research team assessed the efficacy of rotenone in removing all fish from the treated river reach. Mortality effects on adult frogs and tadpoles were also assessed during and immediately following the rotenone treatment. During treatment, the effect of rotenone on drift behaviour was assessed, while its effect on the presence and abundance of key taxa in the treatment zone was studied both one week after and two months after the operation.

Following the completion of initial monitoring in the months following the rotenone treatment, the efficacy and practicality of the monitoring protocol were critiqued, and recommendations for an improved future protocol for monitoring rotenone operations on streams were made.

Methodology

Fish surveys were conducted in February 2011 and February



Location of the treated section of the Rondegat River.

2012. The latter survey comprised an immediately before and after treatment survey. To ensure all species present in the river were detected, a combination of electrofishing, mask-and-snorkel surveys and underwater video analysis was employed in all zones of the river.

A specialist amphibian survey was also conducted in the week before treatment, on the day of treatment and shortly thereafter. Visual surveys, including walked and snorkelling transects were employed, together with aural encounter searches to detect frog species.

Invertebrate surveys were undertaken seasonally, beginning in May 2010, and culminating in a survey in May 2012, two months after the rotenone treatment. The invertebrate surveys comprised kick sampling and individual stone surveys to assess diversity and relative densities of key invertebrate taxa. Fieldwork also included rapid assessment of river health using the SASS5 bioassessment method, while food-web effects were measured by assessing algal production on stone surfaces.

Assessing the impact of rotenone on fish

The river is known to support five species of native fish, including two small cyprinid minnows (***Pseudobarbus phlegethon*** and ***Barbus calidus***), a large cyprinid yellowfish (***Labeobarbus capensis***), a small austroglanidid catfish (***Austroglanis gilli***) and a currently undescribed galaxiid (***Galaxias cf. zebratus***). Surveys conducted in 1998 and 2004 showed two alien fish species, the smallmouth bass (***Micropterus dolomieu***) and the bluegill sunfish (***Lepomis macrochirus***) to occupy the lower reaches of the river.

Pre-treatment surveys showed that the treatment area supported only one native species, the yellowfish ***L. capensis***, whereas the other species had been extirpated by ***M. dolomieu***. The ***L. capensis*** population appeared to be adult-dominated sink population with no juvenile recruitment. A baseline dataset of fish densities and distributions is provided in the final report.

Prior to the rotenone operations, a fish rescue operation was conducted, which removed significant proportions of the ***L. capensis*** and ***M. dolomieu*** populations from the stream. The remaining fish were all apparently killed by the rotenone operations, and no live ***M. dolomieu*** were found during fish surveys conducted during the following week.

Juvenile ***L. capensis*** were recorded in the first pool of the treatment area three days after the operation, and two months later both ***L. capensis*** and ***B. calidus*** were recorded as far as 200 m downstream of the bass barrier, indicating recolonisation of the treatment area by native fish was underway.

Post-treatment surveys of frog populations indicated no difference in the numbers of adult frogs, and the removal of fish from the treatment area is expected to result in a short-term increase in amphibian densities, before recolonisation restores these populations to near pre-treatment levels.

With regards to invertebrates, rotenone operations resulted in the apparent loss of ten common species, as well as significant declines in the abundance of mayfly families Baetidae and Heptageneidae and the dipteran family Tipulidae. The treatment also precipitated a catastrophic drift event, in which numbers of invertebrates drifting in the treatment zone rose to 100 times natural levels during rotenone application.

The treatment did not, however, significantly alter the community composition of the treatment area, and five of the ten 'missing' common species had returned by May 2012.

Conclusions and recommendations

The fundamental conclusion of the monitoring programme is that CapeNature's river rehabilitation has been a success, in that all bass appear to have been removed from the treatment area without significant long-term damage being accrued by the other faunas of the Rondegat River.

While this project has indicated rotenone to have limited negative effects on the treated ecosystem, it is strongly recommended that ongoing monitoring be conducted to assess both fish and invertebrate community recovery following the removal of smallmouth bass from the Rondegat River.

Further reading:
To order the report, *Monitoring the impact and recovery of biota of the Rondegat River after the removal of alien fishes* (**Report No. KV 304/1/13**), contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.