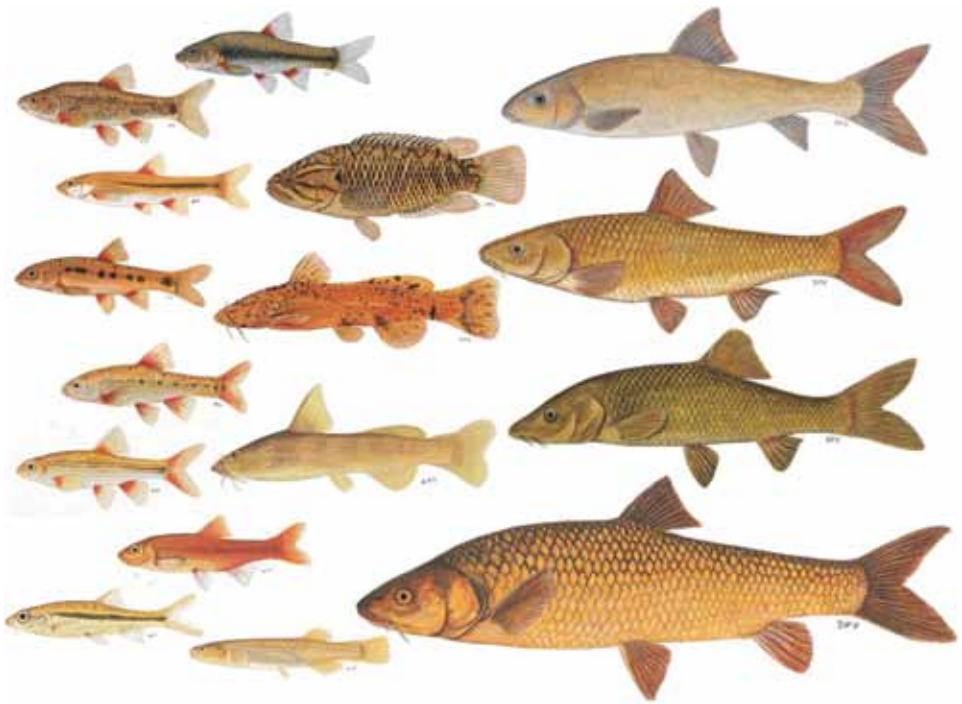
Alien fish removals:

A new beginning for the Rondegat River

Olaf Weyl tells *Quest* how rivers are being rehabilitated after alien invasions.

The Cape Floristic Region of South Africa is a global biodiversity hotspot with an exceptional degree of biodiversity and endemism. Better known for its rich plant communities, the region is also home to 17 fish species which occur nowhere else on earth. Most are restricted to a single river or tributary within a river, which makes them particularly vulnerable to human impacts such as alien fish introductions, habitat destruction, and pollution. Human impacts are particularly severe in lowland rivers which receive run-off from agricultural and urban areas or modified by canal and dam building. This has caused many of our indigenous fishes to now only occur in small headwater streams located high up in mountain catchments where these impacts are absent. More than half of the endemic fishes in South Africa are considered to be in imminent danger of extinction and have been IUCN Red-listed



A collage showing the indigenous fish of the Cape Floristic Region. Image: Olaf Weyl

Top: Rhodes University Department of Ichthyology and Fisheries Science BSc Honours class of 2015 assisting with electrofishing surveys to determine Clanwilliam rock catfish abundance. Image: Olaf Weyl

Rivers such as the Rondegat River in the Cape Floristic Region are conservation priorities for conservation practitioners such as Dean Impson, an aquatic scientist at CapeNature, seen here snorkelling to check on indigenous fish recovery in the Rondegat River. Image: Olaf Weyl

Melanie Duthie of CapeNature checking rotenone drip rates during the treatment of the Rondegat River to remove smallmouth bass. Image: Olaf Weyl

*Clanwilliam rock catfish (*Austroglanis gilli*).* Image: Olaf Weyl/SAIAB

*A school of fiery redfin minnows (*Pseudobarbus phlegethon*).* Image: Olaf Weyl

as Endangered and Critically Endangered. The rivers in the Cape Floristic Region are key areas for conservation of biodiversity and in headwater refuges the main threat to the native fishes are alien fish introductions.

Sport fishing

Indigenous fish in the Cape Floristic Region are typically small, insectivorous species. As a result, they were considered unsuitable as sportfish and more aggressive, predatory fishes were introduced to provide opportunities for angling. The most widespread in headwater streams in the Cape Floristic Region are the smallmouth bass (*Micropterus dolomieu*) and rainbow trout (*Oncorhynchus mykiss*).

Research by Bruce Ellender, at the South African Institute for Aquatic Biodiversity (SAIAB) has shown that the impact of these introduced fish on native fish is particularly severe because the native fish did not evolve to cope with these large predators. As a result, they were either unable to compete with these new arrivals for food or were eaten, because they did not recognise the predators as a threat. For this reason most native fish now only occur in river reaches where alien fish have been unable to invade because of barriers such as waterfalls. To preserve the unique endemic fish fauna, removal of alien fish from conservation areas is therefore a priority for conservationists such as Dean Impson from CapeNature, who are in charge of conserving our natural heritage.

Eradicating alien fish

In February 2012, after years of careful planning by Dean's team at

SAIAB and CIB researcher Bruce Ellender with a smallmouth bass. Smallmouth bass were introduced into South African Rivers to provide opportunities for angling. Image: Olaf Weyl

CapeNature, South Africa's first non-native fish eradication using rotenone took place in the Rondegat River, a small headwater stream that had been invaded by smallmouth bass. Rotenone is a botanical compound found in the roots of the Derris plant from South America. When added to water it is a highly specific toxin that affects oxygen uptake in organisms that use gills to breathe (e.g. fish). Rotenone is, however, a very unstable compound that degrades rapidly after application. For this reason it is often used for fish control because the water is safe for fishes within a few days after treatment.

In the Rondegat River native fishes such as the fiery redfin minnow (*Pseudobarbus phlegethon*) and Clanwillam rock catfish (*Austroglanis gilli*) had been completely removed by smallmouth bass predation.

It was hoped that removing the bass would result in the recovery of native fish populations, which were still abundant in the stream above

*Clanwilliam yellowfish (*Labeobarbus capensis*).* Image: Olaf Weyl

a small waterfall that marked the upper distribution limit of the bass. More than 470 smallmouth bass were removed during the treatment and the only native fish found during the first treatment were 139 Clanwilliam yellowfish that were too large to be eaten by the bass. Later, a team of researchers from the South African Institute for Aquatic Biodiversity found that the treatment of the river had been successful in removing smallmouth bass and that there was an almost instantaneous increase of fish diversity following the removal of the bass.

Monitoring of the recovery of the native fish communities required the use of a variety of methods. Diurnal fishes which are active during the day, such as fiery redfin minnows and Clanwilliam yellowfish, are best detected using snorkel surveys or with underwater video.

Nocturnal fish, such as the Clanwilliam rock catfish, hide under rocks during the day and can only be counted using electrofishing. Electrofishing uses an electrical current to stun the fish. After a short recovery period, the fish recovers and can be released back into the water. These monitoring surveys demonstrated that native fishes quickly recolonised sections of the river when smallmouth bass were removed. The success of the Rondegat River rehabilitation, where native fishes had been absent from the lower sections for more than 50 years, but returned almost immediately following the successful removal of alien fish, is anticipated to encourage more endemic fish restorations in South Africa. **Q**

Dr Olaf LF Weyl is Principal Scientist at the SAIAB and a core team member of the C•I•B. His research career started with field research on Lake Chicamba in central Mozambique. After obtaining his PhD from Rhodes University in 1999, he worked as an advisor to the Department of Fisheries in Malawi (1998-2002) and as Senior Lecturer in the Department of Ichthyology and Fisheries Science at Rhodes University (2003-2009) before joining the South African Institute for Aquatic Biodiversity (SAIAB) in 2009. His current research is geared towards providing information for the conservation and sustainable utilisation of African aquatic environments. To this end he has worked on freshwater ecosystems in Mozambique, Malawi, Namibia, Botswana, Zambia and South Africa.

*GoPro camera used for underwater video analysis. Clanwilliam redfin minnows (*Barbus calidus*) in the background.* Image: Olaf Weyl

Rhodes University students Nomonde Ndlangisa and Elethu Duna assisting with snorkel surveys. Image: Olaf Weyl

limbovane learner begins her future in science

Leonne Adams was introduced to invasion science during a visit to her school by the limbovane Outreach Project. This sparked Leonne's interest in science, so much so, that she enrolled for a degree in biological sciences. *Quest* asked her a few questions about her studies.

Where did you go to school?

Gerrit du Plessis Secondary School, Riversdale.

What are you studying?

I am doing a Bachelor of Science in Biological Sciences (Human Life Sciences) at Stellenbosch University.

Tell us about your interest in science

My interests lie in nature and in the body, particularly human tissues. I would like to go into forensics. My first experience of real science was during our schools involvement with the limbovane Outreach Project. The project showed me as a Grade 10 learner what science is about, from working outside in the field, doing laboratory work and microscope work and how to explain one's findings. The limbovane Outreach Project played a part in my choice for tertiary studies. I always knew that I wanted to study further after school, but I was not familiar with the different courses offered. Being based at Stellenbosch University during one of the limbovane Outreach Project workshops, I was exposed to the university and what it offers. It made me feel self-assured about coming to Stellenbosch University.

Do you have any advice for school learners that are considering a career in science?

If you want something enough, you will get it. Show interest, go the extra mile and grab every opportunity, so that you can make an informed decision. Talk to people in the field, read up on different research fields and participate in volunteer work.