

PROJECT TITLE: Ecosystem functioning: An assessment of South African freshwater biodiversity

Project Supervisor: Dr Isa-Rita Russo, Cardiff University, Organisms and Environment, Molecular Ecology Lab

Project Enquiries: russoim@cardiff.ac.uk

Project keywords: Freshwaters, genetic diversity, microsatellites, invertebrates, fish

Proposed start date: 17/06/24

Project description: Despite providing crucial ecosystem services globally, freshwater ecosystems are among the most at risk from future global change. In an already drought prone zone, South African freshwater ecosystems are also under increasing pressure from the combined demand on water from changing human demographics and climate change. However, as in many other parts of the world, South African freshwater biodiversity remains poorly understood and this threatens the sustainability of these ecosystems and the services they provide.

This project aims to better understand the genetic, taxonomical and functional diversity of South African freshwater ecosystems as a first critical step to enable conservation and sustainability of these systems on which the poorest rely. To achieve this, we will use modern methodologies such as metabarcoding as well as traditional methods to assess: i) invertebrate communities as key drivers of ecosystem function in freshwater systems, and ii) fish communities as key ecosystem services that depend on invertebrate communities as prey.

Following the collection of fish fin clips and larval macroinvertebrates in the Eastern Cape and KwaZulu-Natal provinces in South Africa, the successful candidate will have the opportunity to analyse the genetic diversity of native freshwater species in the molecular ecology labs at Cardiff University. There are a number of interesting questions the candidate can chose to answer during their time, including but not limited to:



Figure 1. Freshwater invertebrates of southern Africa.

1. Taxonomic identification of freshwater macroinvertebrates (Figure 1), assessing the biodiversity of these communities and investigating variation in presence and abundances of sensitive groups collected from systems with a range of physiochemical parameters and land-use practises.
2. PCR and genotyping of a native endangered fish species, *Sandelia bainsii*, which is now considered to be represented by 3 distinct genetic lineages (Figure 2). The candidate will test 20 developed microsatellite primers on DNA extracted from fin clips to determine their specificity. Successful amplification can lead to sequencing, scoring of microsatellites and analysis of genetic structure and diversity for these 3 proposed lineages.

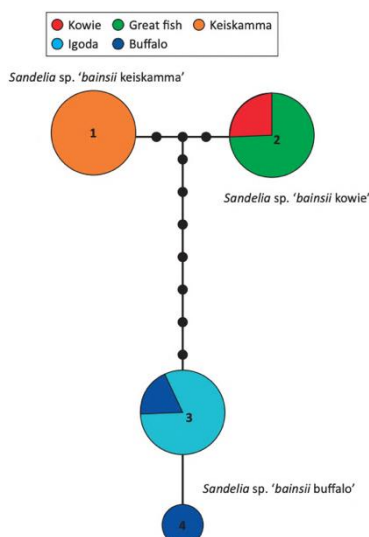


Figure 2. TCS haplotype network, *Sandelia bainsii*.

3. DNA extraction, PCR and genotyping of select macroinvertebrate species. The candidate will test microsatellite primers previously developed for European macroinvertebrate species to determine whether they cross-amplify for closely related South African species. Successful amplification can lead to sequencing, scoring of microsatellites and analysis of genetic structure and diversity.

Candidate requirements: Any experience and interest in conducting genetic lab work; DNA extraction, PCR, gel electrophoresis.

Background reading: [Mabidi et al. \(2017\)](#), [Chakona et al. \(2020\)](#), [Sifundza et al. \(2020\)](#)

Approximate Work Schedule in weeks: (6-7 weeks lab based, 1-2 weeks report writing)