

Fish eradication, amphibian recovery and cascading effects on lower trophic levels in Lake Sulzkarsee, National Park Gesäuse, Austria

The project:

Sulzkarsee (1450 m a.s.l.) is the only high-altitude lake in the National Park Gesäuse (Styria, Austria) and is severely degraded by fish introduced almost half a century ago. The lake was stocked for the first time during the 1970s with alien rainbow trout (*Oncorhynchus mykiss*) and minnows (*Phoxinus phoxinus*). After that approximately 80 Arctic charr (*Salvelinus umbla*) together with some rainbow trout and brown trout (*Salmo trutta forma fario*) were introduced annually until 2002 when stocking was finally terminated and salmonids were removed through gill netting. However, the minnows (*Phoxinus phoxinus*) still thrive in the lake.

A wide body of literature provides evidence, that introduced fish can drive sensitive prey species to extinction. While the relatively large (>1 mm) and often pigmented alpine zooplankton organisms are coexisting with natural amphibian predators like the alpine newt (*Ichthyosaura alpestris*), they disappear after stocking as a result of size-selective predation by introduced fish. Finally, rotifers and small crustaceans dominate the zooplankton communities. The reduction of zooplanktivores releases phytoplankton from grazing pressure thereby increasing phytoplankton biomass. Most native amphibian species disappear after fish introduction, as their larvae are particularly vulnerable to fish predation. Only unpalatable species like common toads may survive. Large populations of alpine newts (*Ichthyosaura alpestris*), common toads (*Bufo bufo*), and brown frogs (*Rana temporaria*) used the lake for reproduction before it was stocked and are still present in nearby ponds and puddles.

Since 2003, the lake has been studied intensively (stratification, phyto- and zooplankton, fish densities). In 2018 Lake Sulzkarsee was drained to eradicate alien minnows. However, a few fish survived and reproduced again. We now aim for removing minnows by intensive fishing. Studies in the Pyrenees have shown that minnows can be eradicated. We will catch fish with purse seines, traps and by electrofishing and translocate them to suitable habitats.

We are seeking two motivated Ph.D. students to restore Lake Sulzkarsee.



The working environment:

The National Park Gesäuse was established in 2002. The protected area covers 112 km² and is characterized by its main habitats of rock, alpine meadows, forests and aquatic habitats. High relief intensity shapes the scenery. The alpine pasture is used for cattle grazing during summer. Sulzkarsee is located on an alpine pasture at 1450 m altitude. You will spend most of the vegetation period in a permanent shelter near the lake.

Research and science have played an important role in the region around Admont for quite some time. With the creation of National Park Gesäuse, a systematic exploration of the area started, consisting of basic inventories and management-related research. Today's work is based on a range of management plans, measures and basic inventories on flora and fauna. Within 20 years, 91 scientific papers and 1,000 reports were published.

Three scientific staff members support fieldwork and coordinate projects throughout the year. In 2023 a basic research station will be set up at Sulzkarsee. The trailer will provide two sleeping beds, wood stove and solar power electrification. Further infrastructure is based in the valley.

The University of Salzburg will be your base during the remaining time. Topics at the Department of Environment & Biodiversity at the University of Salzburg range from dynamic processes of the earth's surface and landscape forms to the interactions of organisms with each other and with the physical environment and to the recording of biodiversity and its emergence at the cellular, organismal and ecosystem levels. In addition to basic research with international cooperation partners, the focus is on application-oriented research in close cooperation with mostly regional non-university institutions. The focus is on the Alpine region, but is complemented by research in other climatic regions, including the tropics, the Mediterranean, and marine habitats.

Your roles:

Between May and October, you will stay in a permanent shelter near the lake for extended periods and intensively fish for minnows. The team of two Ph.D. students will be closely working together for the entire 4 years of the study. We encourage people to apply who have worked together in the past under strenuous field conditions. You will fish with purse seines, traps, and by electrofishing to eradicate the minnow population in Sulzkarsee. The fish will be translocated to ponds for further stocking. You will study the population decline all the way to disappearance of fish from the lake. You will tag amphibians (common toads, alpine newts) and assess population sizes using mark-recapture techniques. Common frogs will be assessed by counting egg masses. Concurrently, you will quantitatively assess abiotic parameters (nutrients), benthos- and plankton communities.

One Ph.D. will focus on vertebrates studying the decline of alien fish and the recovery of amphibian populations while the other Ph.D. student will focus on cascading effects on makrozoobenthos, zoo- and phytoplankton and water chemistry.

You will have access to the full data set collected since 2003, that has not yet been published, providing you with data of an ecosystem study spanning more than 2 decades. Your Ph.D. will be a cumulative thesis consisting of manuscripts for peer-reviewed journals. You will be supervised by Robert Schabetsberger and by the National Park management team.

Key facts:

Ph.D. opportunity

Duration: 2023 – 2026, extension for a 5th year potentially possible

Salary: Annual gross income € 19.250,- (half of a full time equivalent)

Accommodation available during fieldwork

Start date: 1st April 2023

Ideal qualifications:

- Master degree in Biological Sciences (finished or being finalised)
- Willingness to work under demanding conditions in alpine environments
- Team player and cooperation skills
- Well-structured and autonomous working style
- Strong English communication skills, both verbally and in writing

Application:

Curriculum vitae

List of publications

Cover letter describing your interest and fit to this position

Email addresses of two referees

Apply to Robert.Schabetsberger@plus.ac.at

Review of applications will begin on 28th February 2023 until positions are filled.

