

PhD THESIS

Noise pollution and biological invasions: Understanding the interactions between two major threats to freshwater biodiversity



Type of funding

PhD fundings (3 years; Sept. 2025-August 2028) from the Doctoral School “Sciences Engineering Health” (ED488 SIS). The procedure is specified below.

Hosting lab

ENES Bioacoustics Research Lab, which is a team of the Research Center in Neurosciences of Lyon (CNRS, Inserm), located at the University of Saint-Etienne (<https://www.eneslab.com/>).

Supervision

Supervisor: Vincent Médoc, Associate Professor HDR
(<https://vincentmedoc.wixsite.com/ecology>)

Co-supervisor: Marilyn Beauchaud, Associate Professor

Summary

Freshwater biodiversity is suffering an unprecedented decline and at much higher rates than marine and terrestrial environments. Managers are concerned about over-frequentation of the waters and the increase in nautical activities with ever more powerful motorboats. These generate noise pollution that bothers users and is likely to disturb the aquatic fauna. Sound propagates extremely well underwater and most living organisms have structures that enable them to perceive particle velocity. Although the literature on the biological responses to noise pollution is rich, freshwater species are among the least documented and this « invisible pollutant » has never been studied in conjunction with other symptoms of global change, limiting the extrapolation of results to natural populations. The aim of this PhD project is to study the interaction between noise pollution and biological invasions, which are one of the main causes of freshwater biodiversity loss. Although invasive species are associated with highly anthropised and therefore potentially noisy environments, their response to noise pollution is largely unknown. A high degree of tolerance to environmental stress would explain the success of invasive species, and the present PhD project will address the

question of their tolerance to noise pollution. To answer this question, we will use a hypothetico-deductive approach based on acoustic playback experiments both in the lab (ENES) and in the field (Lake Bourget, one of the French peri-alpine lakes). We will focus on behavioural responses and use fish and invertebrate (crustaceans and bivalves) models that are currently invading the French peri-alpine lakes.

Related scientific publications

Turco T, Casole P, Saint-Marcoux D, Romero-Ramirez A, Beauchaud M, Guillard J, ... & Médoc V (2025) Motorboat noise increases aggregation and alters gaping and filtration behaviors in the invasive quagga mussel. *Biological Invasions* 27, 15.

Minier L, Bertucci F, Gay T, Chamot Z, Turco T, Schligler J, Mills SC, Vidal M, Parmentier E, Sturny V, Mathevon N, Beauchaud M, Lecchini D & Médoc V (2024) Behavioural response to boat noise weakens the strength of a trophic link in coral reefs., *Environmental Pollution* 361, 124770

Rojas E, Gouret M, Agostini S, Fiorini S, Fonseca P, Lacroix G & Médoc V (2023) From behaviour to complex communities: Resilience to anthropogenic noise in a fish-induced trophic cascade. *Environmental Pollution* 335, 122371.

Fernandez-Declerck M, Rojas E, Prosnier L, Teulier L, Dechaume-Moncharmont FX, Boyer N & Médoc V (2023) Adding insult to injury: anthropogenic noise intensifies predation risk by an invasive freshwater fish species. *Biological Invasions* 25, 2775–2785.

The ENES, the Bioacoustics Ecosystem

ENES is a research centre dedicated to bioacoustics. Our scientific activity integrates fundamental research and applications linked to health, biodiversity monitoring, assessment of the impact of anthropogenic noise and the design of environmentally-friendly solutions using bioacoustics. By combining high-level research and international training, ENES has built up a unique scientific ecosystem focused on bioacoustics where leading international researchers and young scientists meet and work together. The primary objective of ENES is to contribute to fundamental advances in bioacoustics. ENES has a long tradition of publishing at the highest international level.

Partnership

Centre Alpin de Recherche sur les Réseaux Trophiques et les Ecosystèmes Limniques (CARRETEL), INRAE, Université Savoie Mont-Blanc

Comité Intercommunautaire pour l'Assainissement du Lac du Bourget (CISALB)

Candidate profile

Because recruitment relies on competitive examination by the Doctoral School (DS), it is extremely important to have very good academic results, which means high marks and ranks.

We look for candidates coming from Masters in ecology, ethology or ecosystem management, or from engineering schools in acoustics.

A background in bioacoustics is welcome but not mandatory.

It is important that candidates appreciate doing experiments both in the lab and the field, and have interest in freshwater systems and biological invasions. Additional required skills include expertise in fundamental statistics, R coding, good writing abilities in English.

Recruitment process

Step 1: up to March 31, noon

Prepare an application file including:

- a CV with your academic background and research experience
- academic results with marks and ranks from the third year of Bachelor (or equivalent)
- a motivation letter explaining your professional project and why you are the best candidate for this PhD thesis
- possibly, support letters from former supervisors

Sent the file to:

- Vincent Médoc (vincent.medoc@univ-st-etienne.fr)
- Marilyn Beauchaud (beauchaud@univ-st-etienne)

Step 2: up to April 15

Auditions of the candidates selected at Step 1 by the supervisors and other people involved in the project (virtual or in person, with fees paid by the lab). At the end of Step 2, a maximum of two candidates will be selected for Steps 3 & 4.

Step 3: up to April 18, noon

Send the electronic application forms to the head of the doctoral school.

Step 4: May 12 - 16

Audition of the candidates by the doctoral school.