One Ph.D. position: thermal vulnerability of multi-trophic communities

One Ph.D. position focusing on the ecological consequences of global warming on aquatic ecosystems is available at the RECOVER laboratory in the freshwater ecology (FRESHCO) team at the INRAE of Aix-En-Provence (France). The student will work under the supervision of Arnaud SENTIS (INRAE), in collaboration with other researchers, post-doc, PhD students and technicians. This position is part of a large European project (ERC project Climate CoundDown) investigating the thermal vulnerability of freshwater communities (https://www.inrae.fr/en/news/erc-grant-evaluate-thermal-limits-lake-communities). The successful applicant will have the opportunity to work and collaborate with other people involved in this project.

Topic:

Ectothermic animals are particularly sensitive to global warming as their body temperature closely matches the surrounding environmental temperature. Most predictive models of ectotherm responses to extreme warm temperature use the upper critical thermal maximum (CTmax) as an indicator of their heat tolerance (Pinsky et al. 2019). CTmax is typically measured in laboratory trials by exposing a single individual to a gradual temperature increase until it loses its locomotor functions. The CTmax is critical in defining the fundamental niche of ectothermic animals, their biogeographical distribution (Sunday et al. 2012, Desforges et al. 2023) and the lethal effects of heat waves (Genin et al. 2020). **Climate change is increasing thermal vulnerability by increasing exposure to heat waves so that extinction risk is becoming critical (Jørgensen et al. 2022).**

The main objective of this PhD project will be to investigate the thermal vulnerability of lake communities. For this purpose, data collected for several biological compartments (from plankton to fish) will be collected alongside information on species thermal limits. These data will then be used to infer the vulnerability of lake communities and explore the links between thermal vulnerability and food web complexity or community structure. This PhD should help determining the current thermal vulnerability of ecological communities to extreme heat events.

Keywords: temperature, food webs, mesocosms, thermal ecology, modelling.

Candidate competences:
We are seeking highly motivated students with good organizational skills and strong interests in both quantitative and experimental ecology, as well as global change ecology. Master students in biology, ecology or a related field are welcome. Students interested in both experimental and theoretical work are particularly encouraged to apply. Candidates should be sufficiently fluent in English to be able to read and write scientific articles, and engage in discussions. Previous experience with freshwater fauna, laboratory/mesocosm experiments,

and statistical analyses (R software) will be strongly appreciated. We are looking for persons with open mind attitude, proactive and capable to carry out research with a certain degree of autonomy.

Practical information:
Starting date: 01/09/2025.
Duration: 3 years
Ph.D. Supervisor: Arnaud Sentis
Funding: already acquired.
Location: INRAE, UMR RECOVER, 3275 route Cézanne, 13182 Aix-en-Provence, France
Dead-line for application: 28/05/2025.
To apply: please send your CV, a motivation letter (1 page maximum), Master diploma/results, as well as a maximum of 2 recommendation letters to Arnaud Sentis (arnaud.sentis@inrae.fr). Informal enquiries are welcome - please contact us by email in french or english.

References

Desforges, J. E., K. Birnie-Gauvin, F. Jutfelt, K. M. Gilmour, E. J. Eliason, T. L. Dressler, D. J. McKenzie, A. E. Bates, M. J. Lawrence, and N. Fangue. 2023. The ecological relevance of critical thermal maxima methodology for fishes. Journal of Fish Biology **102**:1000-1016.

Genin, A., L. Levy, G. Sharon, D. E. Raitsos, and A. Diamant. 2020. Rapid onsets of warming events trigger mass mortality of coral reef fish. Proceedings of the National Academy of Sciences **117**:25378-25385.

Jørgensen, L. B., M. Ørsted, H. Malte, T. Wang, and J. Overgaard. 2022. Extreme escalation of heat failure rates in ectotherms with global warming. Nature **611**:93-98.

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