

Institute : Institute of Zoology and Biomedical Research.

Topic: Small worlds: uncovering local and medium scale invertebrate diversity and phylogeography with environmental DNA

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Background information:

Microinvertebrates are one of the most ecologically important groups of animals. They constitute an essential link in the trophic chain and have been proposed as reliable bioindicators to assess the status of ecosystems. Thus, their study is fundamental to understand how ecosystems work. Micrometazoans include representatives of numerous phyla, such as arthropods, nematodes, rotifers, etc. Currently, little is known about the distribution patterns of microinvertebrates at local (1–10 km) and regional (100–1000 km) scales, and this project aims to use the latest molecular techniques based on environmental DNA to address these issues, and also how past biogeographical changes have shaped their current distribution and to explore how human activity may alter their communities.

The main question to be addressed in the project:

The main goal of the project is to determine the distribution patterns of tardigrades, used as a model for microinvertebrates, in local and regional scales, using high throughput sequencing of environmental DNA (eDNA) to get a high coverage of accurate sampling of their biodiversity. We will also determine how the past changes at the tectonically active strait of Gibraltar have affected the current distribution of microinvertebrates in the “archipelago” of mountain ranges around this area. The results of this project will likely be revolutionary for our understanding of the biology and evolution of microinvertebrates.

Information on the methods/description of work:

Samples of mosses will be collected. eDNA will be extracted directly from the moss and three markers will be sequenced (NGS). Tardigrades will be isolated from the samples and their DNA extracted to create a reference library. Molecular OTUs (MOTUs) will be delimited and their distribution through the samples will be correlated with environmental variables. Phylogeographic analyses of the MOTUs found in the Gibraltar strait area will be carried out to determine their evolutionary history.

Additional information (e.g Special requirements from the student):

Enthusiastic, motivated, and hardworking person who is not afraid to learn new things and skills, someone who gets along with people and is happy to work in a team but is also able to operate independently, without a constant supervision. A strong interest in evolutionary biology, with emphasis on phylogeny, biogeography and taxonomy is a must, as is fluency in English (especially in writing) and fondness for tardigrades. Interest in bioinformatics is strongly advantageous. Experience with handling microscopic animals is desirable.

Place/name of potential foreign collaborator: NA

References (max. 3):

[1] Leasi, F., Sevigny, J. L., & Hassett, B. T. (2021). Meiofauna as a valuable bioindicator of climate change in the polar regions. *Ecological Indicators*, 121, 107133.

<https://doi.org/10.1016/j.ecolind.2020.107133>

[2] Majdi, N., Schmid-Araya, J. M., & Traunspurger, W. (2020). Preface: Patterns and processes of meiofauna in freshwater ecosystems. *Hydrobiologia*, 847(12), 2587–2595.

<https://doi.org/10.1007/s10750-020-04301-2>

[3] Morek, W., Surmacz, B., López-López, A., & Michalczyk, Ł. (2021). “Everything is not everywhere”: Time-calibrated phylogeography of the genus *Milnesium* (Tardigrada). *Molecular Ecology*, 30(14), 3590–3609. <https://doi.org/10.1111/mec.15951>