PALEODIVERSITY - HIGH MOUNTAIN LAKE BIODIVERSITY RESILIENCE TO GLOBAL CHANGE: A PALEOECOLOGICAL APPROACH FOR THEIR FUTURE CONSERVATION

The project proposes to study biodiversity resilience by tracking changes in lake community composition over the last ca. 2.000 years in four **Pyrenean lakes** with contrasting history of stressors pressure. We will focus on anthropogenic changes (non-native fish stocking, pasture-based livestock pressure and climate) and the type of biological responses that these changes have induced: gradual or abrupt. We will combine multivariate ordination techniques with nonlinear time-series methods (hierarchical generalized additive models) to characterize trajectories of community responses in each lake, and coherence in such trajectories across lakes. The project will use a space for time approach with regional information of a total of 78 lakes combined with sedaDNA and traditional paleolimnological proxies analysed in the sediment records. The relative importance of the three stressors on high mountain lakes has not been studied in detail. Previous results from our group have shown that fish can have a strong impact on biodiversity, which is higher when minnows have been introduced. We have also shown that it is possible to restore lakes by removing non-native fish. However, it is crucial to know when native biodiversity is fully recovered, and what is the influence of the other stressors on the recovery once fish are eradicated. Furthermore, research linking environmental stressors to lake ecological resilience has traditionally focused on single sentinel sites, hindering the study of spatially synchronous changes across large areas. The results will provide expert criteria for future conservation planning and selection of key lakes with the highest interest for biodiversity restoration, for having the highest recovery potential.

Research line of PhD supervisors:
The PIs of the proposal, who will co-supervise the candidate, cover the main topics of PALEODIVERSITY. **Teresa Buchaca** is a paleolimnologist and limnologist working in changes in community composition of photosynthetic organisms using chemotaxonomical biomarkers (organic pigments). Her research includes studies at different spatial and temporal scales. On a regional scale she has studied the patterns of change in planktonic cyanobacteria and algae and the effect of fish invasions in high mountain lakes. At a palaeoecological scale she has been working on late Quaternary systems to study how in-lake processes modulate the marker pigment signal recorded, to disentangle the effect of different global change stressors (climate, eutrophication and fish invasions) and to better understand the mechanisms involved in long-term environmental change. She has experience on the study of temperate high mountain and lowland European lakes, lakes of the Easter Island and Azorean regions as well as coastal wetlands of the Iberian Peninsula. She is co-leading a research group working on high mountain lake conservation. **Marc Ventura**, is a limnologist and ecologist with expertise in high mountain lake ecology working both at the food web level or species level using different animal groups of models (from crustaceans, macroinvertebrates, amphibians and fish). He is now co-leading a research group working on the conservation of high mountain lakes mainly as a result of fish introductions. Both describing the effects of these invasions (conservation biology or ecology), and studying this phenomenon as a generator of local

adaptations on the species that are not eradicated by invaders (Evolutionary Ecology). He has performed several ecosystem scale experiments to restore lakes to their natural fish-free state. At species level he uses different freshwater species including crustacean zooplankton, amphibians and fish as models for studying the evolution of species traits and their role in lake ecosystem biodiversity. The candidate will also benefit from interacting with the rest of the PALEODIVERSITY team members, who have a strong experience on a wide range of topics directly related to the project such as macroinvertebrate taxonomy, bioinformatics, temperature modelling, pollen and chironomid sediment analyses and molecular techniques (metabarcoding and sedaDNA). The group has coordinated two EC projects (LIFE LIMNOPIRINEUS and LIFE RESQUE ALPYR) and is participating in a Biodiversa+ project (FISHME) which has set up a network of different European collaborations. With them we exchange knowledge and techniques and collaborate in different publications. This network will offer the new PhD student different options to work with an international environment.

Candidate requirements: Degree in biology, genetics or biotechnology and completed Master's degree (preferably in ecology and or genetics). Knowledge of English, is essential, having good skills for team work, experience in writing reports and motivation to learn.

Offered contract: Full-time FPI starting after 1/9/2024 for four years. The job will be at the **Centre for Advanced Studies of Blanes (CEAB-CSIC)** in Blanes (Girona), with occasional trips to the project execution area which are located in the Pyrenees. The project offers a full training program for the selected student.

CEAB holds both field and lab infrastructures/equipment that ensure an adequate development of research. The most important infrastructures needed for the present project include: (1) a laboratory of molecular biology and genetics, (2) a laboratory for the identification and sorting of biological samples; (3) a laboratory of microscopy and microscopic digital photo; (4) one laboratory for analyses of algal pigments with UHPLC and (5) a supercomputing facility CBLab that has all the software needed for state-of-the-art bioinformatics.