Body size is a key biological trait in ectothermic organisms, shaping their functioning from the individual level, through populations, to entire communities. In the context of global warming, understanding why these organisms grow faster but reach smaller body sizes at higher temperatures (according to the so-called temperature–size rule, TSR) has become an important scientific and practical challenge.

Two main hypotheses attempt to explain this pattern. The first posits that organisms are constrained physiologically, by factors such as oxygen or energy limitations, which prevent them from reaching larger sizes in warmer environments. The second proposes that organisms adaptively modify their life-history strategies, reproducing earlier as a way to optimise fitness. So far, this adaptive explanation has mainly been interpreted through the lens of energy gain maximisation, overlooking another possible mechanism: minimising predation risk, which increases with temperature.

In the planned project, we will test this understudied hypothesis, beginning with a model predator–prey system: planktivorous fish and water fleas (*Daphnia*). Using multigenerational experiments, we will examine whether life-history changes in *Daphnia* result from physiological constraints or rather from adaptive responses supported by molecular and epigenetic mechanisms. We will also investigate whether elevated temperatures trigger responses similar to those induced by predator presence and whether these responses vary depending on the population's history of predation pressure.

In the next phase, we will expand our research to include other aquatic and terrestrial predator–prey systems, to assess the universality of the proposed mechanism. We will examine whether the stronger TSR pattern in aquatic animals can be explained by greater mobility differences between predator and prey, foraging in three-dimensional (3D) space, and the lower proportion of endothermic predators in aquatic environments.

Key research questions include: Are physiological and molecular responses to elevated temperature more similar to those triggered by oxygen limitation, or by predation threat? Do organisms from environments with differing predation histories respond differently to warming? The results of this project will provide a better understanding of how temperature affects the ecology and evolution of ectotherms and may prove valuable for biodiversity conservation and invasive species management in the face of climate change.