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Introduction

Freshwater ecosystems are highly threatened, with biodiversity declines far greater than those on marine and terrestrial ecosystems. This is especially true for freshwater mussels (FM: Bivalvia: Unionoida), which are responsible for important ecological functions and services and are among the most threatened faunistic groups worldwide. The introduction of invasive alien species (IAS) is one of the most important threats to the conservation of FM. Preliminary results were obtained for the following tasks: T1) the competition for food resources of the invasive bivalve *Corbicula fluminea* and the native FM; T2) the ability of invasive fish to act as host substitutes of native FM; T3) the predation by IAS on native FM; and T4) the selection of the most suitable areas of the River Douro basin for conservation/restoration of FM and fish habitats.

Results

Task 1: Competition for food resources

Based on field and lab experiments, FM exhibited lower growth, lower physiological condition, and higher locomotor activity at higher *Corbicula fluminea* density, suggesting that FM are negatively affected by *C. fluminea* and may be displaced to less favourable habitats

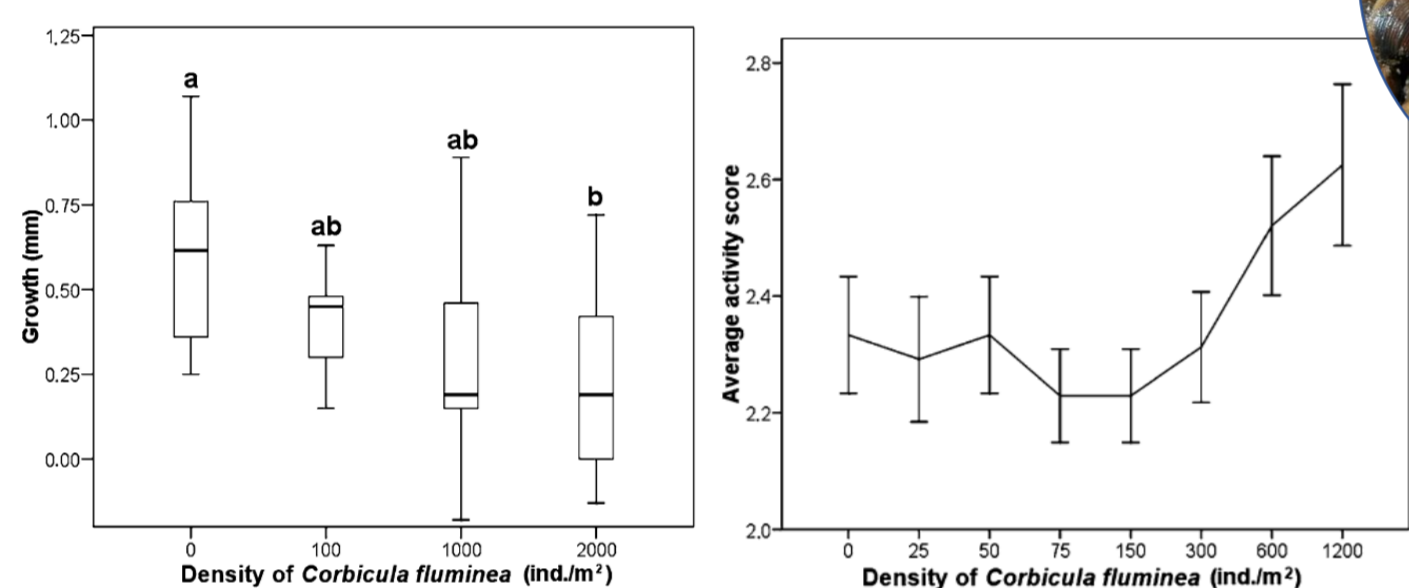
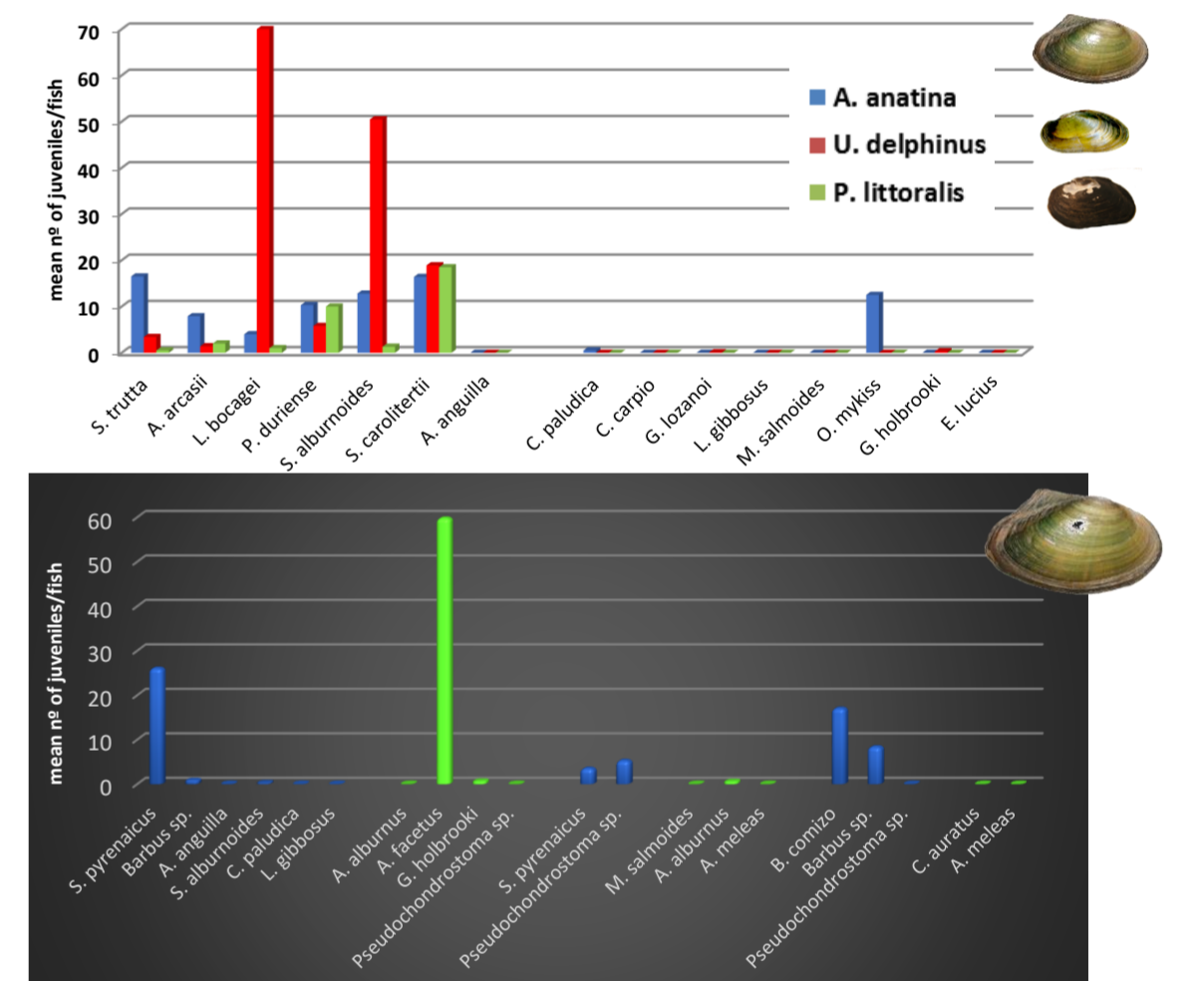


Fig. 1 Growth of *Unio delphinus* at four *C. fluminea* densities. **Fig. 3** Average activity scores in *Unio delphinus* exposed to different *Corbicula fluminea* density levels. Error bars represent standard error values, and the black line indicates the median value. The bars indicate the standard error, and extreme outliers identified as values lying above $UQ + 3 \times IQR$ are omitted. Averages with a common letter do not differ from each other based on Tukey's HSD pairwise comparisons at the $P < 0.05$ level of significance

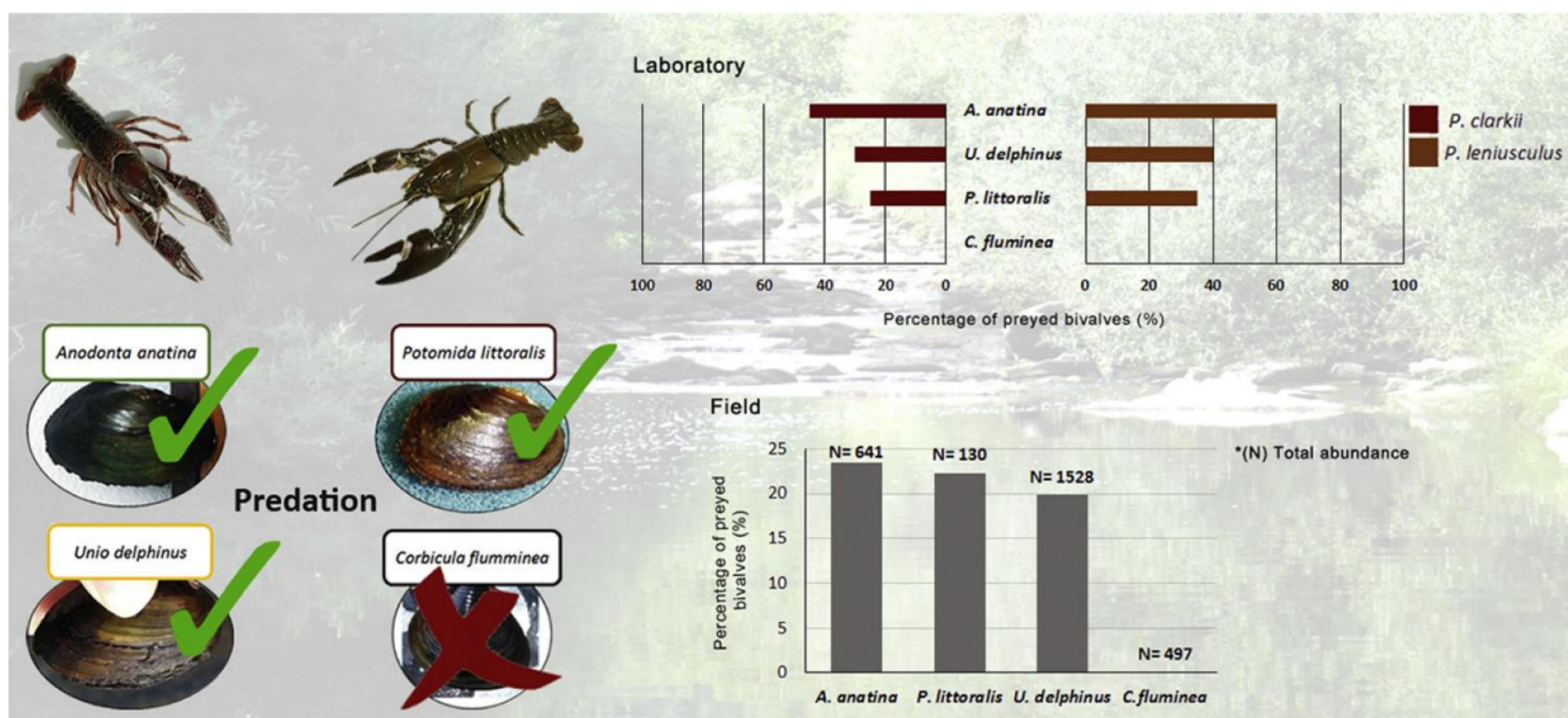
Task 2: Host fish identification & substitution

Only native fishes (mainly endemic cyprinids: *Squalius* sp., *Barbus* sp., *Chondrostoma* sp.), are effective hosts for *Unio delphinus* and *Potomida littoralis*, while *Anodonta anatina* has a more wide range of host fishes that include non-native species (e.g. *Australoheros facetus*, *Gambusia holbrooki*, *Alburnus alburnus*)



Task 3: Impacts of predation by IAS

Molecular and classical detection tools has been used to analyze the diets of selected IAS (*Lepomis gibbosus*, *Pacifastacus leniusculus*, *Procambarus clarkii*, *Neovison vison*). Preliminary results showed that invasive crayfishes can predate on freshwater mussels



Task 4: Multiscale impacts of IAS.

Definition of risk and conservation areas
Mussel and fish assemblages were surveyed in 150 sampling sites in Douro basin and their habitats characterized. Salmonid streams showed good ecological status while large number of median-sized and lowland rivers displayed marked changes in abiotic conditions and biotic composition, including a higher number of non-native species



Conclusion

From an ecological standpoint, the results of this project will help to elucidate the real impacts of the most prominent IAS on the threatened native FM and fish species in Iberia. From a management perspective, main results will facilitate a more effective allocation of resources spent on both native species conservation and IAS management.

References

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