

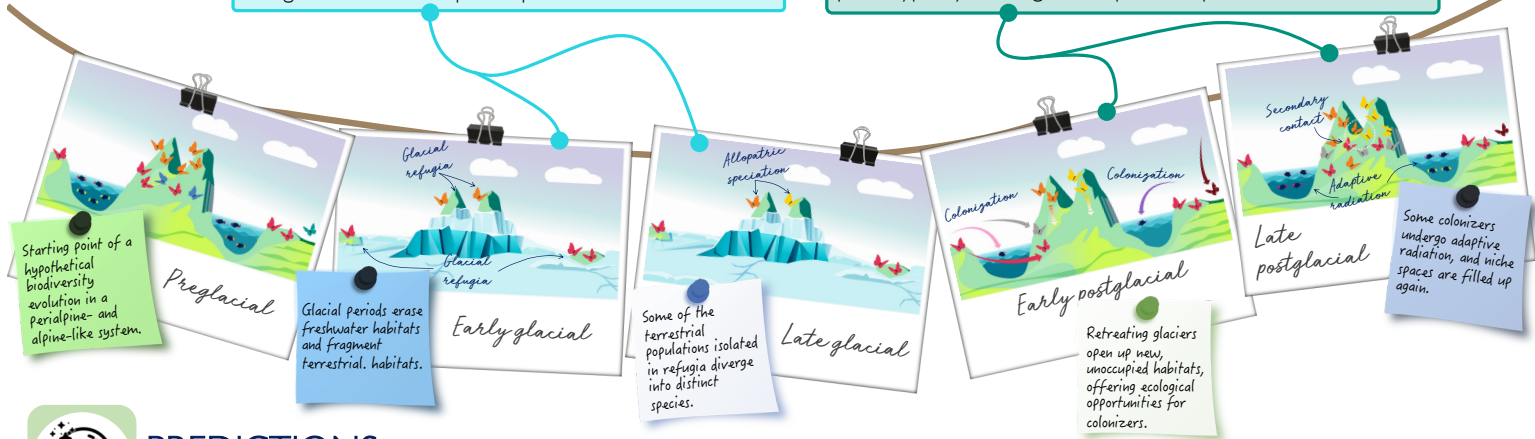


## INTRODUCTION

Quaternary climate fluctuations may have affected biodiversification assembly in two non-exclusive ways:

1) **Glacial species pump**: isolation of populations in glacial refugia accelerated allopatric speciation.

2) **Adaptive radiation** during interglacial periods: niches become available to early colonizers, which diversify ecologically and phenotypically resulting in multiple new species.



## PREDICTIONS

We predicted that a species age structure (SAD) analysis supports two scenarios:

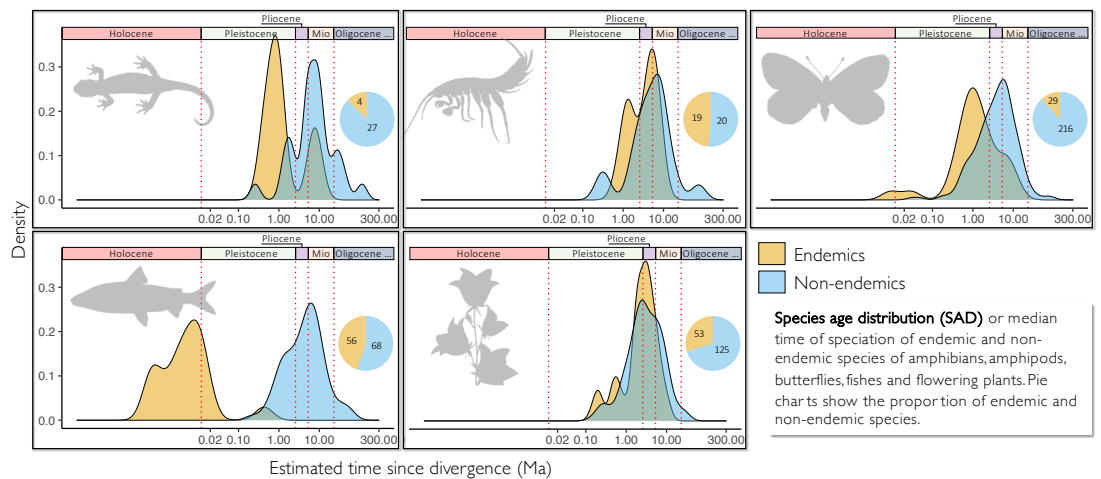
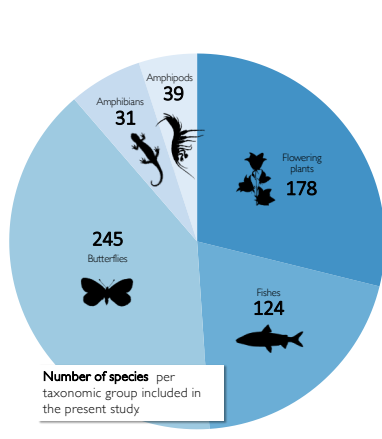
1) Dominance of **glacial species pump** for the origin of endemism in terrestrial groups, with species dating to the Pleistocene.

2) Prominent role of postglacial **adaptive radiation** for groups that depends on surface water habitats, i.e. fishes.



## RESULTS

- Endemics emerged in two time-windows: Holocene (i.e. postglacial origin) and Pleistocene (i.e. during glacial cycles).
- A fraction of non-endemics also emerged in the Pleistocene, but most are from the Miocene.
- Endemic fishes are younger (Holocene) than the remaining taxa (mainly Pleistocene).



## DISCUSSION

The time of speciation pattern observed here may be related to the role played by the following drivers:

- Alpine orogenesis (on Miocene non-endemic species).
- Pleistocene glacial cycles (on Pleistocene species).
- Postglacial adaptive radiations (on Holocene species).

Postglacial speciation dominates in fishes likely because of:

- Lack of open water habitat during glacial periods (extinguishing fish populations), whereas terrestrial or underground refugia allowed other taxa to survive.
- Fishes slowly recolonized the region postglacially while surviving populations in refugia allowed terrestrial groups to expand and colonize faster (offering fewer opportunities for local adaptive radiation to first colonists).



## CONCLUSIONS

1) Terrestrial endemics emerged mostly in the Pleistocene, suggesting that **glacial species pump** played an important role on their diversification.

2) Endemic fishes emerged in the region mostly after the Last Glacial Maximum (~20 ky) and predominantly through **adaptive radiation**.

Ecosystem changes may affect the regional biodiversity differently:

- Given that aquatic groups have a higher fraction of endemics, population extirpation will more often cause global extinction in these groups.
- Fish diversity will be the most vulnerable as these species have locally arisen through adaptation to specific habitats.