

# Unravelling cryptic species of freshwater snails (Caenogastropoda, Truncatelloidea) in the Loa River basin, Atacama Desert

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## Resumen

Species recognition in freshwater snails of the genus *Heleobia* Stimpson, 1865 in the Loa River basin is a difficult task to perform because these snails are similar in shell morphology. In this complex hydrological network, the genus comprises two endemic species, but the taxonomic status of other previously undescribed sympatric and allopatric populations is uncertain. Here we examined DNA sequences from cytochrome c oxidase subunit I (COI) gene and morphological data to investigate species boundaries along the system. Phylogenetic trees were inferred using maximum parsimony, neighbour joining, maximum likelihood and Bayesian inference methods based on samples ranging from the outlet of the Loa River on the Pacific coast to more than 4,200 m altitude in the Andes. Although not always well supported, four clades were consistently recovered in the phylogenies, one corresponding to *Heleobia loaensis* (Biese, 1947), another to *Heleobia opachensis* (Biese, 1947), and two more additional cryptic lineages. Additionally, a fifth cluster of sequences not recovered in these analyses was inferred in the BEAST analysis. Outline-based geometric morphometrics of the shell was useful to differentiate a single lineage sustaining that typological discrimination in *Heleobia* is challenging. Our results also indicate that all lineages diverged by independent non-adaptive allopatric processes during the Middle Pleistocene.

## Palabras clave

**Palabras clave de autor:** [allopatric speciation](#); [Atacama Desert](#); [Chile](#); [DNA barcode](#); [Heleobia](#); [shell morphometrics](#); [species boundaries](#); [taxonomy](#)

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