

The Asiatic clam *Corbicula fluminea* (Müller, 1774) in the Minho and Lima estuaries: genetic vs. morphometry

Ronaldo Sousa 1, 2*; Ruth Freire 3; Josefina Méndez 3; Marta Rufino 4; Miguel Gaspar 4; Carlos Antunes 1, 5 and Lúcia Guilhermino 1, 2

1 CIIMAR – Centro Interdisciplinar de Investigação Marinha e Ambiental, Rua dos Bragas 289, 4050-123 Porto, Portugal.
 2 ICBAS – Instituto de Ciências Biomédicas de Abel Salazar, Universidade do Porto, Lg. Prof. Abel Salazar 2, 4099-003 Porto, Portugal.
 3 UDC – Departamento de Biología Celular y Molecular, Facultad de Ciencias, Universidad de Coruña, A Zapateira, La Coruña, Spain.
 4 INIAP/IPIMAR – Instituto Nacional de Investigación Agrária e das Pescas, Av. 5 de Outubro, 8700-305 Olhão, Portugal.
 5 Aquamuseu do Rio Minho – Parque do Castelinho, 4920-290 Vila Nova de Cerveira, Portugal.

*ronaldo.sousa@ciimar.up.pt

1. INTRODUCTION

Species identification within the *Corbicula* genus is very complicated due to their highly variable shell shape, colour and sculpture. Additionally, species of this genus are important nonindigenous invasive species in aquatic ecosystems with potential ecological, environmental and economical impacts. The Minho and Lima estuaries (Fig. 1), located on the NW of the Iberian Peninsula, were recently colonised by individuals belonging to this genus (Sousa et al., 2005, 2006, *in press*). Furthermore, the two populations showed significant morphological differences and have completely different invasive and dispersal behaviour. Therefore, the main objective of this study was to compare and contrast molecular and morphological variation of the *Corbicula fluminea* individuals from the Minho and Lima estuaries. Additionally, we want to compare genetic variation on these populations with pre-existing mtCOI sequences and attempt to identify the source populations introductions in the Minho and Lima estuaries.

2. MATERIALS AND METHODS

2.1. Study Area

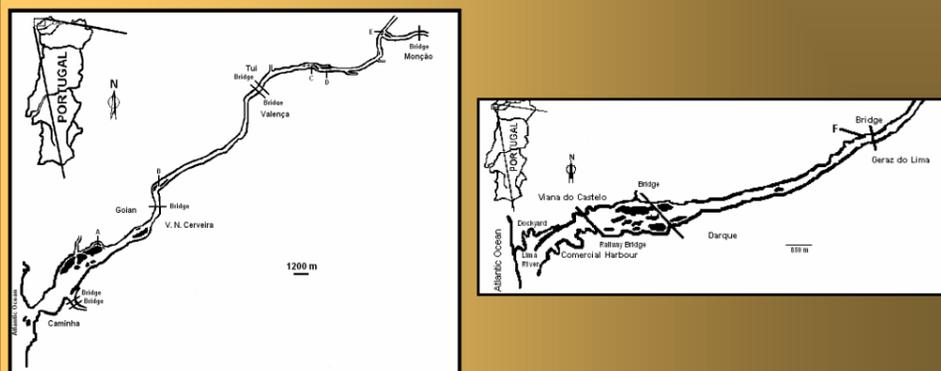


Figure 1. Maps of the Minho (left) and Lima (right) estuaries showing the location of the six sampling stations.

2.2. Morphometry and Genetics

Morphometry and Genetics

Geometric Morphometry:
Landmarks
Outlines
(35 individuals for each site)

Genetics:
mtCOI sequences
(20 individuals for each estuary)



Figure 2. Selected landmarks on *Corbicula fluminea* shell.

3. RESULTS AND DISCUSSION

3.1. Morphometry

The Relative Warps analysis of the first two principal component axes (Fig. 3) revealed a clear distinction between the Minho and the Lima individuals. MANOVA analysis confirmed a clear distinction between the Minho and the Lima individuals based in morphometric data ($F=4.0998$, $p<0.001$). When we look for the contour analysis results we also saw a clear distinction between the individuals from the two estuarine areas (Fig. 4). The Minho individuals are more rounded and elongated and the Lima individuals on the other hand have a more trigonal shape, are taller and have more inflated umbos.

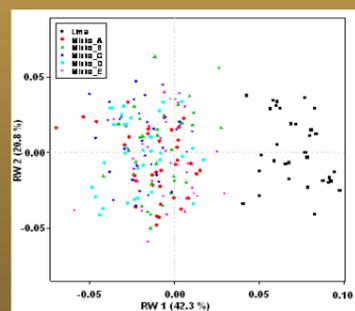


Figure 3. Results of the Relative Warps analysis in the 6 sampling stations.

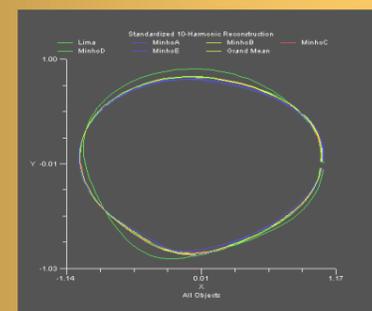


Figure 4. Visual comparison of the averaged shape in the 6 sampling stations.

3.2. Genetic

The analysed mtCOI sequences were very similar in the two populations. The Minho population was not monotypic since 3 individuals have minor substitutions with a maximum of 2 substitutions. The main haplotype of the Minho and Lima populations was coincident to haplotype I of Renard et al. (2000), with form A of Siripattawan et al. (2000) and Lee et al. (2005) (Fig. 5).

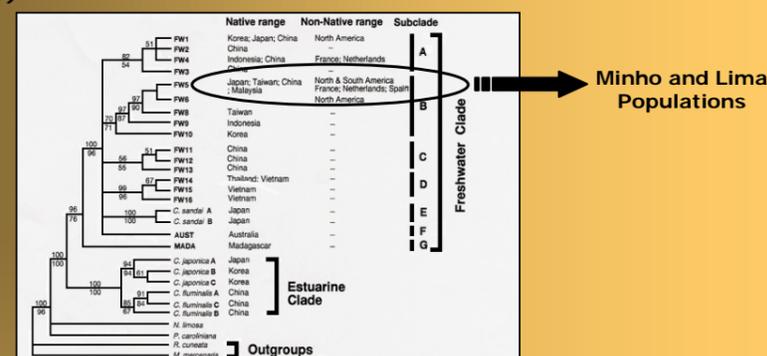


Figure 5. Consensus tree obtained by Park and Kim (2003). The mtCOI sequences from Minho and Lima populations were added to the consensus tree.

4. CONCLUSION

- The specimens gathered in the two estuaries belong to *Corbicula fluminea*. However, several cautions have to be made in the specific affiliations of the *Corbicula* genus only based in morphological analysis;
- These genetic markers did not allow to distinguish the two populations. Possibly, other factors related with the abiotic or biotic conditions are responsible for the distinct morphological characteristics in the two estuaries;
- This study was not informative to assign the possible introduction source of the *Corbicula fluminea* populations in the Minho and Lima estuaries. However, we could verify that our populations shared a similar mtCOI sequence to several Asiatic and non-native populations distributed worldwide;
- Future studies are planned in order to assess the intraspecific levels of genetic diversity in *Corbicula fluminea* (e.g. microsatellites or microarrays).

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