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Using elemental microchemistry, fatty acids content and capitulum shape to identify goose barnacle populations from MPAs

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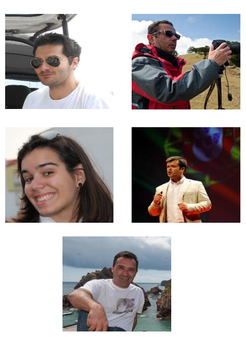

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Abstract

The Berlengas Natural Reserve (BNR) is a Portuguese archipelago and MPA where the goose barnacle *Pollicipes pollicipes* is exploited. The species is the most heavily exploited intertidal biological resource in the Iberian Peninsula, resulting on overexploitation of stocks. In the BNR goose barnacle's harvesting is strictly regulated however, making it a good example of marine resources management. Analytical methods able to identify the origin of goose barnacle would be an important tool to help the management of the trade. For such purpose, we investigated whether goose barnacles have site-specific differences based on its elemental microchemistry (EM), fatty acid content (FA) and capitulum shape (CS). The analysis was performed on specimens collected from 3 sites in the BNR and 7 along a 300 km stretch of the Portuguese coast. For each individual we analysed the largest lateral shell for EM using ICP-MS, the FA content of the muscle using GC-FID, and the CS using geometric morphometrics. Discriminant function analyses (DFA) for both EM and FA separately provided a high reclassification success (77.6% and 99% respectively, of cross-validated cases correctly classified), while for EM combined with FA allowed for a 100% reclassification success. DFA analysis based only on CS, had a low classification success (29.6%). These results show that EM and FA signatures can be a powerful tool to infer goose barnacles origin, helping in establishing an origin certificate and incrementing the value of biological resources from Portuguese MPAs.

Key words: Goose barnacle; ICP-MS; Fatty acid profile; Geometric morphometrics; Source of origin; Discriminant function analysis

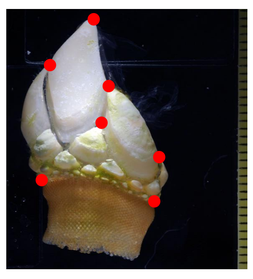
Study area and sampling

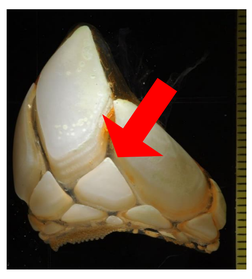
- Portuguese Atlantic coast from Figueira da Foz to Cabo Sardão (Fig. 1)
- 10 sites distributed over a 300 km stretch of the Portuguese Atlantic coast, including 3 sites in the BNR
- Specimens were hand collected at low tide between July-August 2012 and frozen at -80ºC

Fig 1 – Goose barnacle collection sites (BNR – Berlengas Natural Reserve)

Procedures

- "Fingerprint" approach - Each origin should present site-specific differences
  - Capitulum shape
  - Elemental microchemistry
  - Fatty acids content





Results

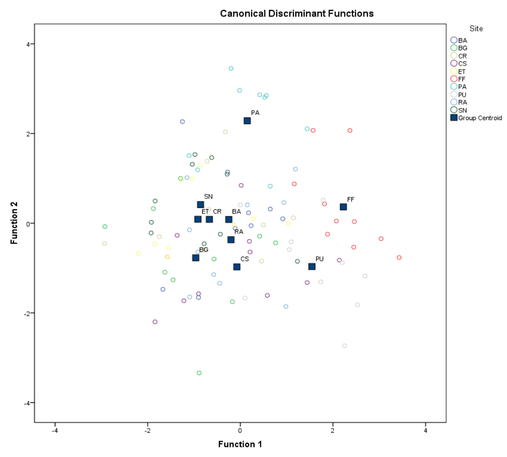


Fig 2 - Results of the canonical discriminant analysis of goose barnacle signatures based on the Capitulum Shape

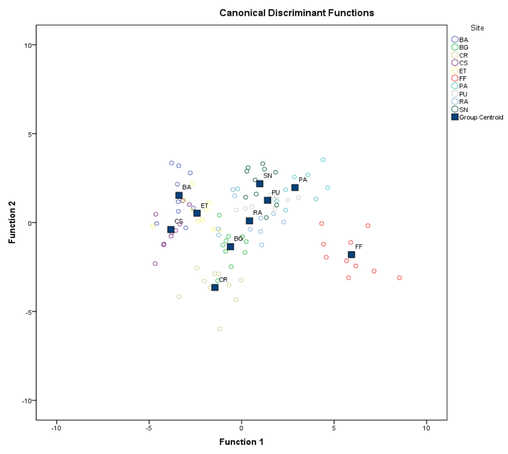


Fig 3 - Results of the canonical discriminant analysis of goose barnacle signatures based on the Elemental microchemistry

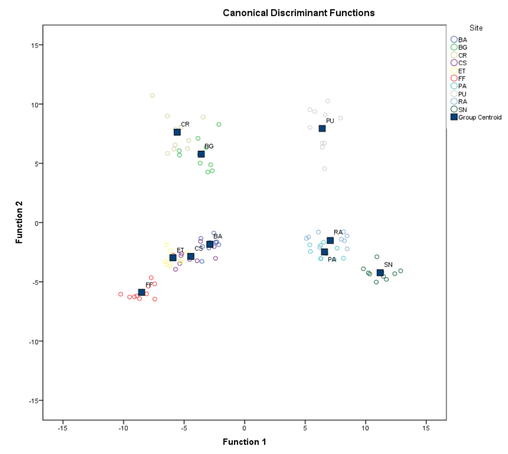


Fig 4 - Results of the canonical discriminant analysis of goose barnacle signatures based on the Fatty acids muscle content

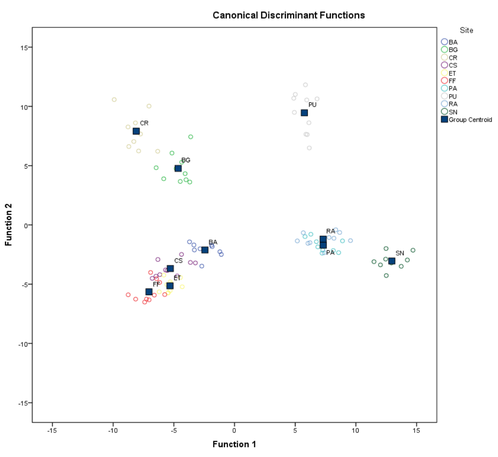


Fig 5 - Results of the canonical discriminant analysis of goose barnacle signatures based on the Elemental microchemistry combined with the Fatty acids muscle content

Discriminant function analysis (DFA) was used to classify the differences in the capitulum shape, elemental microchemistry, fatty acids content of goose barnacles amongst the 10 aforementioned sites. According to our results, we were able to clearly identify our sampling locations into all the 10 sampling sites based on the signatures.

Capitulum shape performed poorly with a low reclassification success (29,6 % of cross-validated grouped cases correctly classified), while elemental microchemistry (77,6 % of cross-validated grouped cases correctly classified) and fatty acids content (99 % of cross-validated grouped cases correctly classified) allow a high reclassification success.

Combining both elemental microchemistry and fatty acid content yielded the highest reclassification success (100% of cross-validated grouped cases correctly classified).

Conclusions

The sampled individuals of *Pollicipes pollicipes* showed differences in microchemistry and fatty acids content that allowed discrimination., while the capitulum shape was not a promising technique.

These results show that a "fingerprint" approach can be an effective instrument to infer goose barnacles source.

It can help in establishing an origin certificate and raise the value of biological resources from Portuguese MPAs.

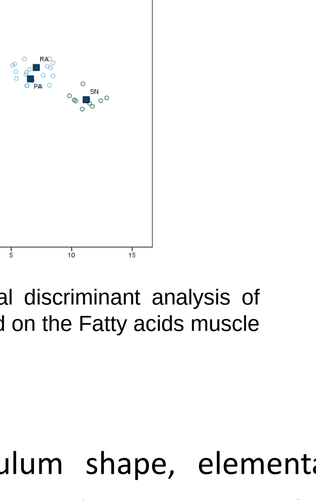
What's next?

Temporal stability of EM and FA signatures

Promote a Geographical Indication scheme for goose barnacles from BNR

Assess other tools to identify the source origin

Evaluate the nutritional quality of BNR barnacles



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