

Integrating genomics and modelling to predict climate change response in the endangered freshwater pearl mussel (*Margaritifera margaritifera*)



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BACKGROUND

- Whole genome sequencing offers a solution to predicting climate change adaptation in endangered species¹.
- Freshwater pearl mussels are critically endangered, keystone species. While their decline has been linked to climate change² this has not been investigated using genomic data.

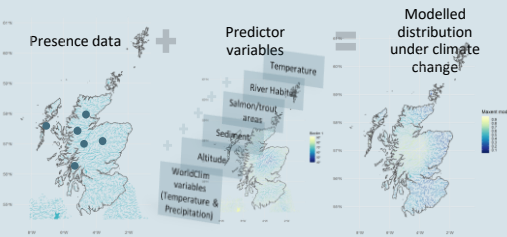
DATA INPUT

- 384 non-invasive mussel DNA samples at 30 locations collected between 2019 and 2021.
- 3-4x low coverage whole genome sequencing by Feb 2023.

RESEARCH AIMS

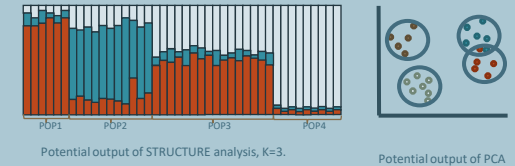
1. Species Distribution Modelling

Define the niche and spatial distribution of the Scottish metapopulation and predict the change in distribution under climate change³.



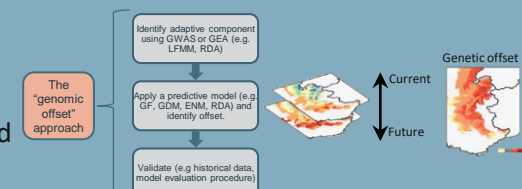
2. Population Genomics

Define the genomic structure of multiple pearl mussel populations across Scotland—understanding connectivity, gene flow and the impact of genetic drift⁴.



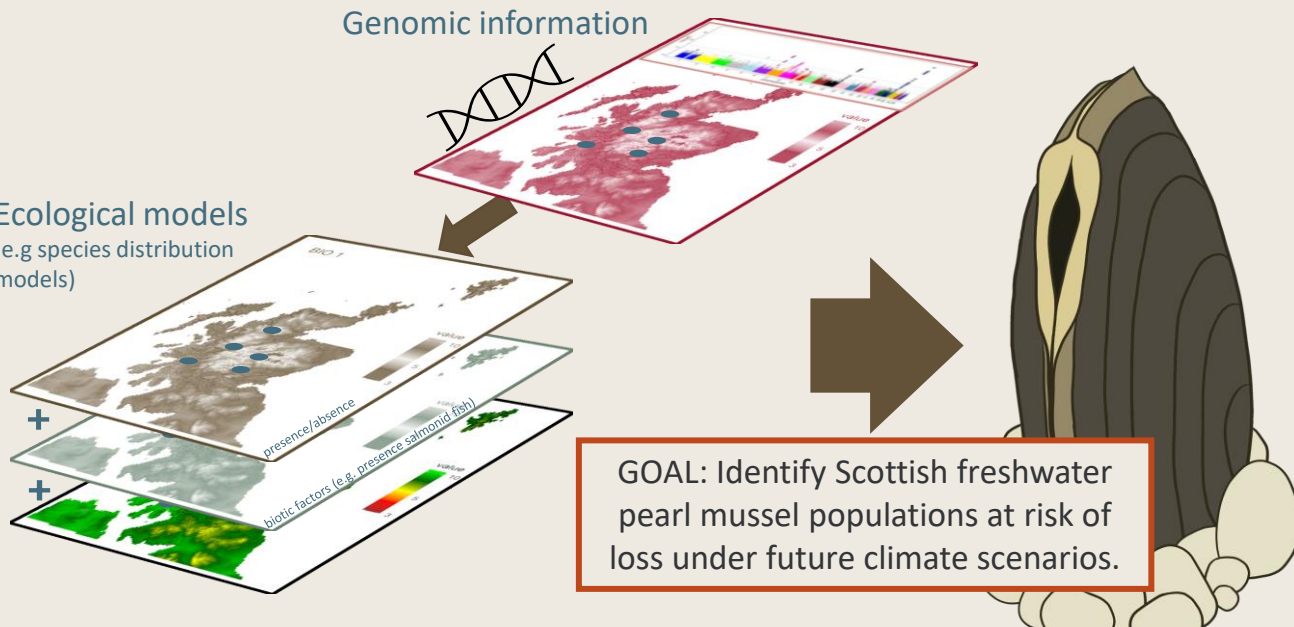
3. (Mal)adaptation of Populations

Identify adaptive components using genome scans, apply a predictive model and determine offset between adaptation to current and future climates¹.



Adapted from Capblancq T, et al. 2020. Annu. Rev. Ecol. Syst. 51:245-69

Ecological models
(e.g species distribution models)



GOAL: Identify Scottish freshwater pearl mussel populations at risk of loss under future climate scenarios.

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References:
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2. Cosgrove, P. et al. (2012) 'Scotland's Freshwater Pearl Mussels: The Challenge of Climate Change', in *River Conservation and Management*. John Wiley & Sons, Ltd, pp. 121–132.

3. Wilson, C.D., Roberts, D. and Reid, N. (2011) 'Applying species distribution modelling to identify areas of high conservation value for endangered species: A case study using *Margaritifera margaritifera* (L.)', *Biological Conservation*, 144(2), pp. 821–829.

4. Gladstone, N.S. et al. (2022) 'Population genomics reveal low differentiation and complex demographic histories in a highly fragmented and endangered freshwater mussel', *Aquatic Conservation: Marine and Freshwater Ecosystems*, 32(8), pp. 1235–1248.