

## Quantifying the evolutionary response to anthropogenic selection in migrating species

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Tracing the effects of human induced selection pressures through the genomes of wild species offers unprecedented insight into the way species evolve and adapt to changing environments. Migratory species which need to navigate barriers put up by humans in order to reproduce, should be particularly likely to respond to the evolutionary selection pressure imposed by human impacts on migratory pathways. We have a track record of successful collaboration with the Environment Agency and Yorkshire Dales Rivers Trust and this PhD proposal is based on an existing project tracking the upstream migration of adult Atlantic salmon, a key-stone migratory species considered vulnerable in Europe according to the IUCN red list of threatened species. Throughout the range of the species, man-made barriers, such as weirs and associated hydropower turbines, affect the ability of the species to migrate and reproduce in headwater rivers and streams. Importantly, barrier intensity varies between sub-catchments of the River Yorkshire Ouse, providing a unique opportunity to compare the evolutionary response of salmon to anthropogenic barriers of varying intensity, using a combination of approaches. This interdisciplinary project will use the synergy between two research groups at the University of Hull - HIFI (Hull International Fisheries Institute) and EvoHull (Evolutionary and Environmental Genomics group) and study the parallel evolutionary response to anthropogenic selection.

The project will test the prediction that evolutionary response increases proportionally with barrier number and complexity, and use genome wide association studies to identify the genetic change associated with this evolutionary response. It will also allow us to assess whether parallel responses evolve independently using the same genetic pathway, or whether there are multiple routes to solving the same evolutionary problems, which will provide a powerful insight into the ability of species to adapt to environmental change.

The project will survey fish from **the River Yorkshire Ouse** and use i) photographs of wild caught individuals to apply geometric morphometrics ii) acoustic telemetry to track the movements of individual fish during their upstream spawning migration iii) genome wide association studies to link genotype to behavioural and physiological phenotype. We are uniquely positioned to carry out this project because of an Environment Agency funded existing study in this river. The collaborative and interdisciplinary nature of the project means that the student will become experienced in a wide range of skills, from field and lab work, performing telemetry investigations on wild fish, extracting and preparing DNA for SNP-chip analysis, to bioinformatic data processing, and they will develop strong links to industry.