Project Title: Weather impacts on selection and plasticity in red deer

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Project Background

It is now widely recognised that global climate change as a result of recent human activity is having consequences for animal and plant populations. Understanding how populations respond to this climate change is therefore important in predicting the probability of population persistence [1]. To date, the majority of work on vertebrate populations in this area has focused on birds [2], with the impacts of climate change on mammals less well understood. Of particular interest is identifying which climate variables are important and how these effects are mediated in terms of direct effects on animal physiology or indirect effects e.g. via food availability. The best systems to investigate these questions are where repeated measures exist on individuals across time and where data has been collected for many years. This PhD project will use data from the long term monitoring project of red deer (Cervus elaphus) on the Isle of Rum to investigate the consequences of climate change. While some work has begun to address these question in female red deer [3; 4], we know much less about how males are responding and the particular variables that mediate this response [40; 5].

This project will use detailed data on weather variables, such as temperature, rainfall and wind, as well as vegetation data, to try to understand the drivers of changes in key fitness traits, including antler mass and the phenology of traits associated with the rut. In addition, because we know the identity of males that breed across multiple years we can investigate whether any changes in male traits are due to plasticity within individuals or changes between individuals. Finally there is evidence in the Rum population that the timing of the onset of male and female reproductive seasons is changing at different rates. This has potentially important consequences for the strength of selection acting on male traits, by affecting the variance or skew in male reproductive success. This project will investigate whether the variance in male reproductive success has changed over time, if this is predicted by known climate variables and what the consequences of this may be for selection on male traits.

Key Research Questions:
1. What are the direct (weather) and indirect (vegetation) impacts on key male traits?
2. How much plasticity do individuals show with respect to weather variables and is this sufficient to explain phenotypic change?
3. Is there a relationship between weather and optimal trait values and/or the strength of selection?

Methodology

Intensive monitoring of the Red deer population on the Isle of Rum began in 1972 and individuals have been tracked and key life history traits measured ever since. Detailed information also exists on local climate variables from local weather stations and the vegetation in the study area has been monitored since 1981. There is also the potential to gather additional data on vegetation from satellite imagery. The PhD will involve statistical
analyses of data that has already been collected as well as field work to collect additional data. The student will build statistical models to predict key fitness-related traits in males based on climate and vegetation data. These models will then be extended to investigate variation in plasticity and if/how changing climate alters the relationship between traits and fitness.

Training
A comprehensive training program will be provided comprising both specialist scientific training and generic transferable and professional skills. Specialist training will include the use of complex multivariate statistics including mixed effects models, selection analysis, and remote sensing data.

Requirements:

1. A first class undergraduate degree or MSc in ecology or evolution is desirable
2. Prior experience with complex statistics and/or an aptitude for statistics is desirable
3. Willingness to do field work on a remote island is desirable

References


Project Summary
How do red deer track changes in climate and how does climate change influence the relationship between male traits and fitness?