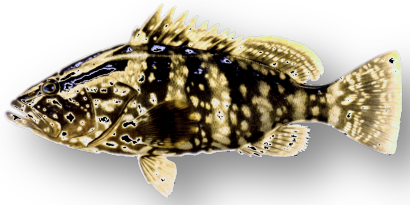
INFORMING POPULATION MODELS WITH EVOLUTIONARY THEORY TO INFER SPECIES' CONSERVATION STATUS



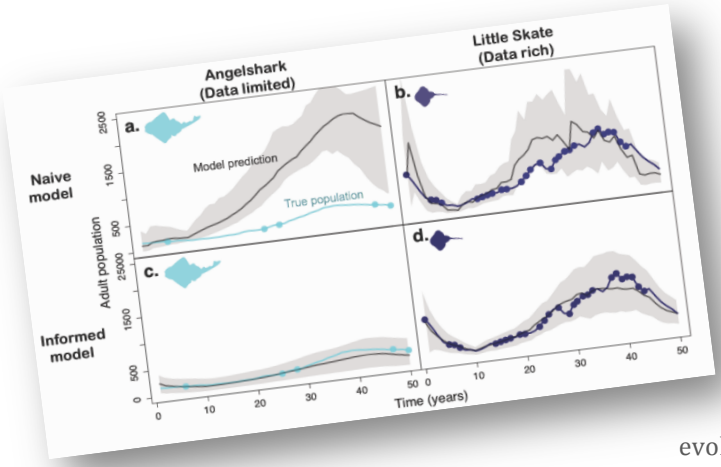
BIOLOGICAL BACKGROUND

Fisheries target over 2000 fish species worldwide (FAO 2013), yet we know the population status of only 150. Of the 1150 described species of shark and ray, 313 are known to have been exploited to the point of decline. But nearly half (486 species) are classified as Data Deficient by the IUCN. One third of grouper species (50 species) and one fifth of tunas (11 species) are likewise Data Deficient. Yet, we usually know at least three things about all of these species: their life history traits, their geographical distribution, and their evolutionary relationships. If we had comprehensive theory linking the evolutionary basis of life histories to population dynamics of related species, we could pool this information to identify the Data Deficient taxa at greatest risk of overexploitation and extinction from anthropogenic pressures.

THE OVERALL PROJECT

This is an international collaboration drawing funds from both NSF in the US and NERC in the UK. The principal investigators are **Holly Kindsvater** (Rutgers, New Jersey, USA), **Jason Matthiopoulos** (University of Glasgow, UK), **Nick Dulvy** (Simon Fraser University, Canada) and **Marc Mangel** (University of California, Santa Cruz, USA).

Our central hypothesis is that evolutionary theory can fill-in for missing data on demographic rates or population trends, and can be used to pool information from similar species to predict population dynamics. To test this idea, we propose to develop unified models of the population dynamics of sharks and rays, groupers, and tunas, equip them with highly informative parameter priors derived from evolutionary theory and fit them hierarchically to all available population and demographic data. In return, the fitting process will refine our evolutionary theory and thus inform our understanding of the processes generating and maintaining marine biodiversity. Methodologically, we will combine two different quantitative approaches: state-dependent life history theory and Bayesian state-space population modeling. We will use state-dependent life history



theory to develop evolutionary priors for demographic rates and use Bayesian state-space models to impute the population trajectories of related species, given our evolutionary priors. This will generate and refine new theory for the evolution of our focal taxa that can ultimately be tested comparatively. We will engage in species' assessments, training, and outreach boost the broader impacts of the work. This project complements the ongoing work of the PIs to understand the evolution of complex life histories, to identify and mitigate species' declines, and to develop methods for effective management of marine species that are crucial economic and nutritional resources for the global human population.

The advertised post

The research fellow will be based in Glasgow at the Institute of Biodiversity Animal Health and Comparative Medicine, and work under the supervision of Prof Matthiopoulos on the development of hierarchical state-space models for the population dynamics of the three groups of species. Therefore, candidates are expected to have a good understanding of Bayesian methods and their applications to dynamical systems. A keen interest in ecological processes and any experience with population dynamics will be a definite advantage. The fellow will be expected to communicate regularly with the project collaborators and attend frequent working groups both in Europe and the US.

Relevant references

Horswill, C., Ratcliffe, N., Green, J. A., Phillips, R.A., Trathan, P.N. and Matthiopoulos, J. (2016), Unravelling the relative roles of top-down and bottom-up forces driving population change in an oceanic predator. Ecology. doi:10.1002/ecy.1452

Matthiopoulos, J., Cordes, L., Mackey, B., Thompson, D., C., Duck, Smout, S., Caillat, M. & Thompsont P. (2014) State-space modelling reveals proximate causes of harbour seal population declines. Oecologia 174: 151. doi:10.1007/s00442-013-2764-y

Applications

Look at http://www.gla.ac.uk/about/jobs/vacancies/ using reference number 013947. The closing date for applications is **4 August 2016**.