Quantifying the genetic health of wild and captive shark populations

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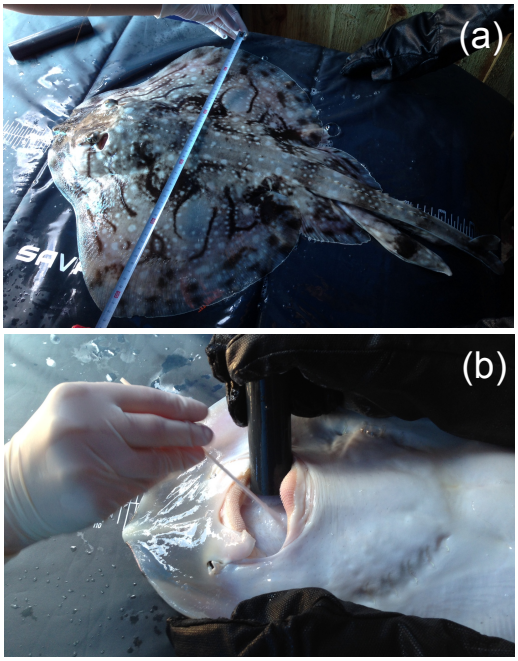
Introduction: The planet is currently in the grips of an unparalleled biodiversity crisis, with around one quarter of vertebrate species now classified as threatened. In the world's oceans, increased fishing effort has pushed many species to the brink of extinction. Sharks are particularly vulnerable as their slow growth and late age of maturity makes the impacts of increased fishing effort particularly detrimental to population persistence. Rapid declines in shark populations have focused attention on the establishment of captive breeding programs, particularly for endangered species. These breeding programs, which represent an important *ex situ* conservation strategy (i.e., conservation in zoos and aquaria), are in their infancy. Consequently, we currently have no idea about the genetic health of sharks in captive populations and if sufficient genetic diversity exists in captive animals to guarantee the long-term viability of these breeding programs. Moreover, how levels of genetic diversity in captive populations compare to wild populations remains an open question. Given the scope of the biodiversity crisis facing sharks globally there is an urgent need to gain a robust understanding of the genetic viability of captive and wild populations. This project will address this need by quantifying genetic diversity of wild and captive shark populations and combine *ex situ* and *in situ* (i.e., conservation in natural habitats) conservation strategies.

Project Summary: This multi-disciplinary project brings together the fields of evolutionary genetics and conservation biology to quantify the genetic viability of wild and captive shark populations. The overall project aim is to use next generation molecular techniques to quantify the genetic health of wild and captive shark populations and to compare levels of genetic diversity between these populations. A key first step will be to develop non-invasive sampling techniques to allow genetic material to be sampled and processed with minimal impact on the animal (Year 1). Next the student will travel to European aquaria and work with an international team of collaborators and artisanal fishers to collect genetic samples from wild and captive shark populations (Year 1-2). In the laboratory, the student will then quantify levels of genetic diversity in these shark populations (Year 2-3). Research will focus on shark species with managed breeding programs that are currently being held in public aquaria around Europe (e.g. sandbar shark, nurse shark). With these data, the student will design breeding programs to maximize genetic diversity in captive populations, identify local populations where inbreeding may be prevalent, and compare levels of genetic diversity between wild and captive populations. The results of this project will provide valuable insights into the genetic health of wild shark populations and evaluate the success of ongoing conservation efforts in maintaining natural levels of genetic diversity in captive populations.



Measuring body size (a) and using a mouth swab to collect DNA (b) from an endangered ray species. Photo credit: SEA LIFE.

The student will emerge with a suite of cross-disciplinary techniques directly relevant to concepts in evolutionary and conservation biology. During this project, the student will be trained in cutting-edge next generation molecular techniques and have the opportunity for a placement in UK aquaria. Molecular analyses will be conducted in the Faculty of Life Sciences state-of-the-art Genomics Facility. The student will also be trained in animal husbandry and handling and gain extensive experience during fieldwork to collect genetic samples. The project would suit students with a background or interest in evolutionary biology, genetics and conservation.

References

1. **Fitzpatrick** & Evans 2009. Reduced heterozygosity impairs sperm quality in endangered mammals. *Biology Letters*, 5(3), 320-323.
2. **Fitzpatrick** et al. 2012. Assessing the potential for postcopulatory sexual selection in elasmobranchs. *Journal of Fish Biology*, 80(5), 1141-1158.
3. Dulvy et al. 2013. Extinction risk and conservation of the world's sharks and rays. eLife 3:e00590.