

Divide and conquer? Investigating potential age-differences in foraging strategies in a pelagic seabird

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Introduction

Seabirds are fascinating animals which spend most of their lives at sea and can fly sometimes thousands of miles across open oceans. They are also invaluable indicators of the ocean health, but are vulnerable to changes in the marine environment such as anthropogenic disturbance (e.g. fisheries, offshore wind farms...) and climate change. To make informed decisions about the sustainable use of ocean resources and the conservation of marine ecosystems (and of seabirds in particular), we need to know where seabirds go and what they do when they are at sea and we cannot see them (which is most of the time). The logistical challenges associated with following birds across oceans have resulted in a lack of knowledge of their at-sea distribution and behaviour. Fortunately, recent technological advances in the development of miniature tracking devices is now making it possible to track seabirds at sea, and in the last few years we have started to learn a lot more about the at-sea movements of these extraordinary creatures. For example, scientists have discovered that Arctic terns migrate from the Arctic to the Antarctic and back every year ¹ while some Atlantic puffins disperse across the Atlantic for the winter ².

However a lot remains to be discovered, in particular about immature birds which have not yet reached the age to breed. These are indeed even more challenging to study: as non-breeders, they may not come back repeatedly to the colony and are difficult to catch. It is important to understand immatures' foraging distributions because they will soon become the future breeders and therefore need as much protection as adult birds, they can also represent a large proportion of a species' population and, last but not least, their higher rate of dispersal might help population resilience to threats and they may act as buffers against climate change.

The project - Methods & Results



Figure 1 - The study colony (red).

With the support of the Alice McCosh trust, I realised the first direct comparison of the foraging movements of immature and breeding Manx shearwaters *Puffinus puffinus* by GPS-tracking simultaneously juvenile and adult birds. Manx shearwaters are migratory seabirds from the Procellariiforme order (which includes petrels and albatrosses); at sea they are very proficient and majestic flyers but very clumsy on land. Every year they breed in burrows on small islands along the Atlantic East coast between April and September, and migrate to the Argentinian coast for the winter ³. Long-lived (the record is 53 years), they only raise a single chick per season. Very vulnerable to terrestrial predators like rats, they are also nocturnal – only returning to land under the cover of darkness.

The study was realised on Skomer Island, a marine nature reserve in Pembrokeshire (Wales), home to over 50% of the world population of Manx shearwaters (>300,000 birds), during the summer 2014. Each night, the return of the shearwaters to land is an incredible wildlife spectacle; the sky fills up with thousands of birds, calling from the air and from their burrows. We caught ~15 adults incubating an egg in their burrows and ~30 immatures off the surface, and attached miniature (<20g) GPS trackers to their back feathers with marine tape (the device falls off naturally within 2-3 weeks if the bird is not recaptured). Our research group has successfully used this method on shearwaters for years and no deleterious effect has been recorded ^{4,5}.



Figure 2 - (a) An adult Manx shearwater on the colony at night. (b) A one-week old Manx shearwater chick taken out of its burrow for weighing. (c) An adult Manx shearwaters with a GPS tracker taped to its back.

In the three following weeks we waited for the birds to return and carefully removed their device before releasing them. We recaptured most adults and 14 immatures. Each device had recorded the location of the bird every 15min.

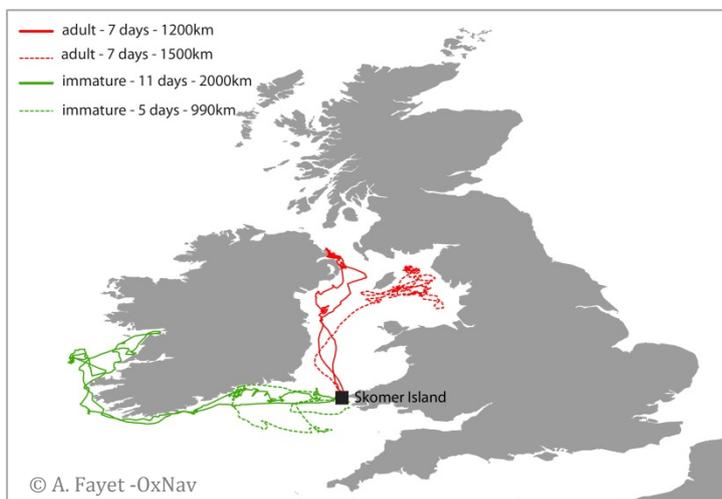


Figure 3 - Examples of foraging trips undertaken by 2 adults (red) and 2 immatures (green).

Most birds undertook trips of several days (up to 15) and flew hundreds (sometimes thousands) of miles away from the colony. Although the analysis is still ongoing, preliminary results suggest that adults and immatures both forage in the Celtic Sea near the colony but that there is a net segregation further north, with many adults and few immatures foraging in the Irish Sea.

Conclusion & Future Work

Future analysis will investigate not only spatial differences but also potential differences in behaviour – it is possible from the GPS data to identify different types of behaviour (e.g. foraging, resting on the water) using complex machine-learning techniques, this would then allow us to compare the actual foraging locations and the differences in activity budget between the two age classes.

Ultimately, the data will shed light on the at-sea behaviour of adult and immature Manx shearwaters, a key species but poorly studied UK-breeding seabird, will start filling the huge gap in our understanding of the at-sea behaviour and distribution of immature seabirds, and will be invaluable to help inform future conservation decisions (Manx shearwaters are amber-listed on the list of UK Birds of Conservation Concern).

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For more details on this project and other seabird tracking projects, visit oxnav.zoo.ox.ac.uk/seabirds or email annette.fayet@zoo.ox.ac.uk.

References

1. Egevang, C., Stenhouse, I., Phillips, R. A., Petersen, A. & Fox, J. Tracking of Arctic terns *Sterna paradisaea* reveals longest animal migration. *Proc. Natl. Acad. Sci. U. S. A.* **107**, 2078–2081 (2010).
2. Guilford, T. *et al.* A Dispersive Migration in the Atlantic Puffin and Its Implications for Migratory Navigation. *PLoS ONE* **6**, (2011).
3. Guilford, T. *et al.* Migration and stopover in a small pelagic seabird, the Manx shearwater *Puffinus puffinus*: insights from machine learning. *Proc. - R. Soc. Sci.* **276**, 1215–1223 (2009).
4. Dean, B. *et al.* Behavioural mapping of a pelagic seabird: combining multiple sensors and a hidden Markov model reveals the distribution of at-sea behaviour. *J. R. Soc. Interface* **10**, 12pp (2013).
5. Freeman, R. *et al.* Predictive ethoinformatics reveals the complex migratory behaviour of a pelagic seabird, the Manx Shearwater. *J. R. Soc. Interface* **10**, 1–8 (2013).