Individual consistency in avian migratory routes and timings

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1. Individual consistency in the wider literature

Background

Migratory species are vulnerable to **rapid environmental changes** arising from human activities¹

Repeatability in avian migration

43 studies tracking birds with **rings**, **geolocators** or **satellite** tags report **repeatability** of migration in *space* and/or *time* Number of studies reporting repeatability:

The **ability** of migratory species to adjust to change will be influenced **start** by the degree of **individual consistency** in migratory routes and timings² **Repeatability index** *r* used to measure individual consistency:³

 $R = \frac{\sigma_{\alpha}^{2}}{\sigma_{\alpha}^{2} + \sigma_{\epsilon}^{2}}$ a measure of **within-** and **between-** individual variation^{4,5}

Advances in tracking technology have increased the number of studies with **repeat migrations** of individuals⁶

Does repeatability vary across the annual cycle? Predictions based on a LMM with study as random term:







Studies are heavily focused in Europe - very few for tropical species

- **Repeatability** in timing **varies** across the annual cycle
- No effect of **taxa** or **method of tracking** was found
- Very few studies estimate spatial repeatability

Arriva Departure Departure breeding

2. Migratory consistency in a tropical breeder - the 'Round Island' petrel



Hybrid complex of at least 3 species of *Pterodroma* petrel:⁷

- **Trindade** petrel
- Kermadec petrel
- Herald petrel



Adults breed all year round

Peak in egg-laying in August-October⁸

Not all birds arriving on RI attempt to breed



422 geolocators deployed on adult petrels between 2009 and 2015⁹

70+ individuals with 2 or more winter migrations

Preliminary analysis

Two examples of Round Island petrels showing **individual consistency** in **migratory routes** and **timings**.









- Calculate repeatability for temporal and spatial elements of Round Island petrel migration Next
- Use genetic and environmental data to explore associations between individual genotype, steps environmental conditions experienced, and the migratory routes and timings undertaken

Individual- and population-level consequences?

References: 1. Walther *et al.* (2002) *Nature* **2.** van Bemmelen *et al.* (2017) *Marine* Ecology Progress Series 3. Carneiro et al. (2017) Marine Ecology Progress Series 4. Lessels & Boag (1987) The Auk 5. Nakagawa & Schielzeth (2010) Biological Reviews 6. López-López (2016) Ardeola 7. Booth Jones et al. (2017) Molecular Ecology 8. Tatayah (2010) PhD thesis, University of Mauritius **9.** Nicoll *et al.* (2017) *Global Change Biology*.

