

Feeding ecology of New Zealand land birds

In this project, we set out to investigate how quickly birds respond to changes in their environment. This is a pressing issue to understand if and how species can persist in the face of rapid human-induced changes in the environment. We are investigating whether avian populations can rapidly respond to anthropogenic impacts via changes in their feeding ecology. New Zealand birds are particularly interesting for this, because the population translocations can be seen as a type of large-scale experiment across species.

We created two long-term datasets across different lineages of land-birds using: (1) stable isotope signatures of nitrogen and carbon of feathers (now being complemented with compound specific analysis); and (2) morphology, including classical measurements and geometric morphometrics, with a particular focus on the bill shape (a trait known to undergo rapid change in natural populations). These represent distinct aspects related to feeding ecology and trophic niches. We are investigating 11 endemic New Zealand bird species, divided in three groups of sister taxa (*i.e.*, closely-related and readily comparable): (1) Nestoridae + Strigopsidae (kakapo, kea, and kaka); (2) Callaeidae + Notiomystidae (hihi, North and South Island kokako, North and South Island saddlebacks, and huia); (3) Meliphagidae (tui and bellbird).

The datasets were built using specimens from museum collections worldwide, spanning a period from the 1780s to the present and collected in a variety of locations in New Zealand. In total we located New Zealand bird specimens in 40 museum collections (Fig. 1). From those, we collected samples of 450 specimens, measured 760 and obtained photographs of the bills of over 900 birds deposited in collections all over the world.

This will allow us to assess how rapid species change their feeding ecology and related morphology. Data collection is now close to completion, with only the bill shape measurements from photographs left to be done. We want to use our results to understand if the fate of these species (that varies from extinction to population expansions) can be explained by the breadth of their feeding niche, by rapid changes in morphological traits, and/or shifts in food sources. Feeding ecology could play an important role in the outcome of translocation programs, since a successful settlement depends on the birds' ability to either find similar food items or switch their diet.

Our initial analysis indicates that there have been changes in diet and potentially feeding niche of some species, as well as changes in bill morphology. But it is still early to draw firm conclusions. Because of that, we are now investigating whether these changes are related to one another and what (other) factors might be in play, for example, spatial variation (Fig. 2). We hope to compile the results for publication on an international academic journal and we expect them to have implications to current conservation programs of these species.

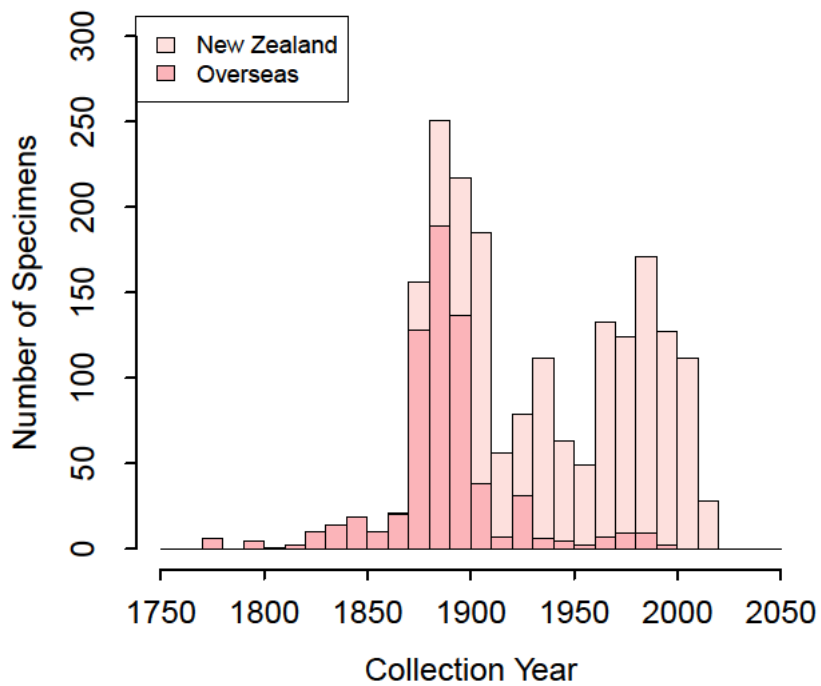


Figure1: Distribution of bird specimens in museums worldwide, collected between 1750 and 2019. Older specimens are almost exclusively found in museums overseas, while more recent specimens were found in New Zealand museums.

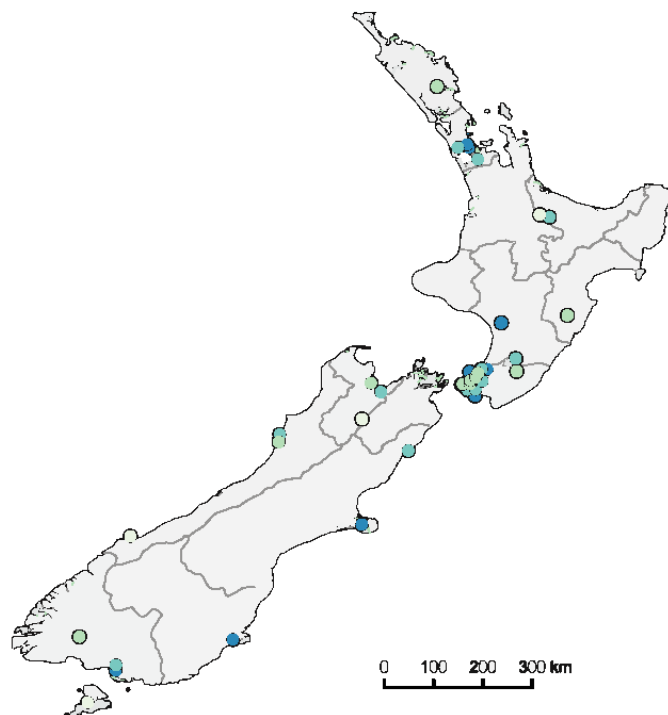


Figure 2. Location of the tui samples, showing no consistent spatial variation in Nitrogen bulk isotopic values (darker symbols = higher delta Nitrogen values).