What can tītipounamu (rifleman, *Acanthisitta chloris*) teach us about the evolution of vocal learning in birds?

Vocal learning (vocal imitation of social peers) is a rare trait, and the origins of vocal learning – when and how vocal learning evolved – is a question that has received considerable attention, but remains unclear. New Zealand wrens may help researchers answering this question. The vocal learning abilities of the New Zealand wrens have never been studied and it is assumed that they are not vocal learners. However, according to new findings, they are closely related to the songbirds and parrots, both vocal learners. This unique position in the avian evolutionary tree gives us the opportunity to answer a fundamental question about the evolution of vocal learning in birds: Do tītipounamu show any evidence of vocal learning? If so, this would change our understanding of when and why vocal learning evolved in birds.

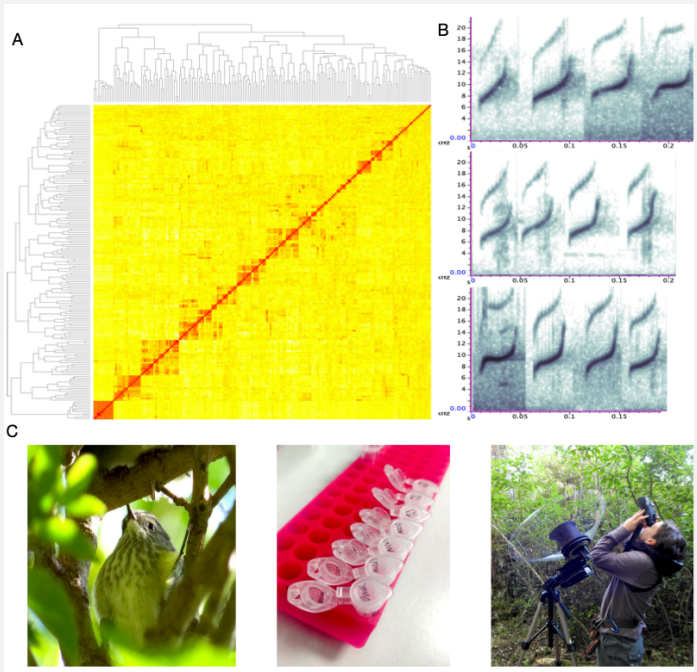

Fig.1. Collection of genetic and bioacoustic data from the tītipounamu rifleman. A) Genetic matrix showing level of relatedness between 186 individuals at Boundary Stream Mainland Island and Mohi Bush (AgResearch SNP sequencing). B) A series of spectrograms of feeding zip calls for three different individuals (Raven Pro software). C) Photos of a tītipounamu fledgling, DNA extraction tubes, and recording session at tītīpounamou nests. Photo credit by I.G. Moran & Y.Y. Loo.

Our research uses genetic and bioacoustic tools to investigate the relationship between genetic and vocal similarity between individuals and populations in one of the two New Zealand wrens, tītipounamu (rifleman; *Acanthisitta chloris*). Thanks to New Zealand Birds Research Funds, we addressed the genetic part of our project – determining the genetic relatedness of individuals from different populations. We obtained DNA from 186 individual tītīpounamou from two populations: Boundary Stream Mainland Island and Mohi Bush (Fig.1.C) and we then used a genetic sequencing method (SNP sequencing using PstI-MspI) developed by AgResearch that is sensitive to small genetic changes and has a high resolution. We then determined the genetic similarity between individuals in the two populations (Fig.1.A). To address the bioacoustics aspects of our project, we recorded the feeding calls of tītipounamu parents and their helpers at nests (Fig.1.B & C). We found that feeding calls are distinct for each individual (Fig.1.B). This will allow us to calculate reliable vocal similarity scores between individuals and then match them to our genetic relatedness data, which we are working on now. The next step in our research is to determine which components of feeding zip calls are heritable and determine the speed at which the two tītipounamu populations have changed in terms of both genetics and vocal traits.

Our research contributes to advancing our fundamental understanding of the origin and evolution of vocal learning in birds. And by doing so, our research also contributes to documenting New Zealand bioacoustic taonga and New Zealand wildlife heritage.

If you are interested in learning more about our research in the Cain Lab (http://kecain.weebly.com) on the origin and evolution of vocal learning in birds, or have any questions, please contact Ines G. Moran (imor384@aucklanduni.ac.nz).