

What are you doing up there? Utilising genomic information to determine whether there is an additional breeding colony of New Zealand Storm Petrel

The New Zealand Storm Petrel (NZSP) is one of Aotearoa New Zealand's most enigmatic seabirds. Thought extinct for over 100 years, it was rediscovered in 2003. After much detective work, a breeding colony was located on Te Hauturu-o-Toi (Little Barrier Island) in 2013, where the birds appear likely to have persisted at very low numbers until the successful eradication of cats from the island in 1980, and their numbers further helped by removal of kiore in 2004. Today, their population is estimated in excess of 1,600 birds, but Te Hauturu-o-Toi remains the only known breeding site for the species.

NZSP are now often spotted foraging at sea in the inner and outer Hauraki Gulf, but have been sighted along the east coast of the North Island from the Bay of Plenty to North Cape, and even as far as the east coast of Australia. These extensive sightings may suggest one or more additional breeding sites for the species, which would give reassurance that the species doesn't have all their eggs in one island basket.



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For seabirds with distinct breeding colonies, high levels of philopatry and low migration between sites can lead to genetic differences between sites. In 2020, an expedition to the Far North caught and sampled 29 NZSP at sea, over 300 km from their only known breeding site on Te Hauturu-o-Toi. We sought to assess whether there were genetic differences between these birds and those previously sampled from the Hauraki Gulf, which would give a strong indication that the birds originated from another breeding site. We also planned to use this genetic data to determine whether there were any close relatives between the sampling sites that might support the birds simply being on a long foraging trip from their Hauraki Gulf home.

A range of approaches can be utilised to assess genetic differences between individuals and to detect population structure between different sampling locations. In the past, a small number of positions in the genome have commonly been interrogated, which can lead to robust conclusions, especially when genetic differences between populations are large. However, to increase precision, we decided to utilise a larger scale genomic approach that detects variation in the DNA sequence between individuals at thousands of positions across the genome. This method is termed 'reduced representation sequencing' as it doesn't sequence the whole genome (which would be very expensive), but does capture a representative snapshot of variation across the genome.

To test for differences between the Far North (29 blood samples) and Hauraki Gulf (49 blood samples and 12 feather samples) individuals, we extracted DNA and sequenced it using a reduced representation approach. Sadly, there was not enough DNA from the feather samples to successfully sequence them, and a few additional samples also had low amounts of DNA. However, our final dataset included 71 samples (27 of which from the Far North) sequenced at an impressive 5,155 sites across the genome.

Interestingly, our results show no genetic differences between individuals from the Far North and the Hauraki Gulf – on average, two birds from different sampling locations are just as genetically similar as two birds within one sampling site. Further, although no close relatives (i.e., parent-offspring, or siblings) were detected in the data, we did see genetic similarities between birds that might indicate half-siblings, grandparent-grandoffspring or cousins, both within sites but also between sites. This data strongly indicates that we do not have two genetically distinct and unconnected breeding colonies. However, radio tracking will be necessary to determine whether an additional breeding colony has established very recently in the Far North, and/or additional colonies exist but are connected by high levels of migration between them. So – a watch this space for future work to address what New Zealand Storm Petrel are up to in the Far North of New Zealand!

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