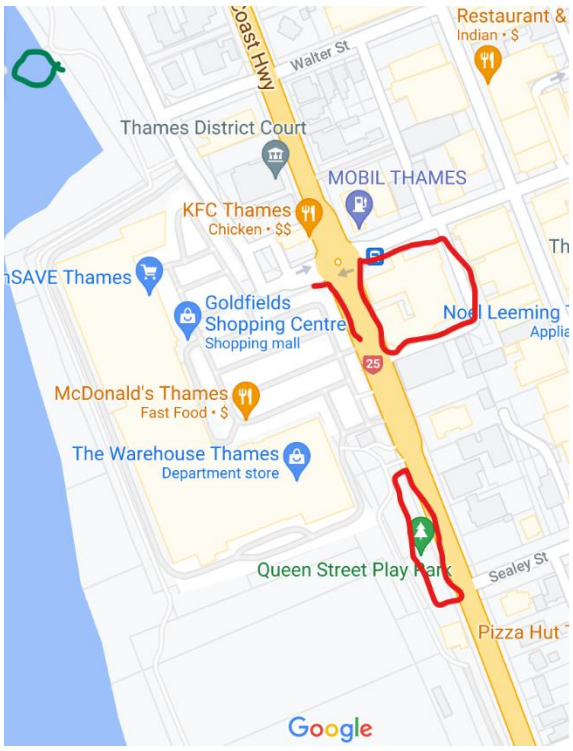
BIRDS NEW ZEALAND
Te Kāhui Mātai Manu o Aotearoa

# NZ Bird Conference 2021
# Thames Civic Centre
# 5-7 June

## Programme

# On behalf of South Auckland Birds New Zealand
# Welcome to Thames!




**Location**
The 2021 NZ Bird Conference will be held at the Thames Civic Centre, 200 Mary Street Thames. (Red Square on the map)

**Registration**
For those that like to sleep in, early Registration is open Friday the 4th - 6-7:30PM at the Civic Centre. Registration opens at 8am on the 5th. Please be seated by 8:45 for the conference opening.

**Presenters**
Those giving a presentation should ensure it is with the organising team at least two sessions before the presentation time.

**Parking**
Parking around Thames is slightly fragmented. If you see a parking space on the road grab it, otherwise you can park in the Pak and Save carpark, but only in the row of the carpark that is right next to the road, immediately across the road from the Civic Centre (red line on map). Take care crossing the road to the Centre. Otherwise, park in the Shoppers Carpark 200m south of the Civic Centre on the Pacific Coast Highway (red rectangle on map). Parking in reserved spaces adjacent to the building will get you towed or clamped – even on the weekend!

**Accessibility**
We've done our best to ensure the conference is accessible, however if there are specific accommodations that would help you please contact the organisers.

**Community Groups**
Several Coromandel community groups will be attending the weekend. We encourage you to take the chance to learn more about what's happening in the area.

**Photo Competition**
**Lodge your entries when registering.** Judging by conference attendees will occur during tea and lunch breaks. Winners will be announced at the close of the conference.

**Field trips –** Lunch will be provided
Marine meanderers: (Boat trip around inner Coromandel Harbour Islands) Bus leaves at 7am from the front of the Civic Centre.

Wetland wanderers: (Pukorokoro Miranda via Kopuatai) meet at 9am at the service lane to the east side of the Civic Centre.

Oputere explorers: (Coromandel bus trip –Opoutere) meet at 9am outside the front door of the Civic Centre.

Atlassing: We will make an announcement about this on Sunday.

**Around Thames**
Go birding, its winter and the oystercatcher numbers will be high. Look at the bird roost by the Pak and Save (Green circle on map) or if you are staying at the north end of town check out Kuranui Bay Reserve (note this is a dogs off-leash area).
Drink Coffee? There are usually lots of options on Saturday, but you will find less on Sunday. Hot Chocolate Café is around the corner from the Civic Centre and is open Sundays.

## AGM documents

AGM Files can be downloaded from the conference page on the Birds New Zealand website:
Visit the page https://www.birdsnz.org.nz/nz-bird-conference/ to see all files or see the individual files.

**AGM Agenda 2021 (Thames)**

**AGM Minutes 2019 (Wellington)**

**Annual President Report for 2020**

**Annual Financial Report for 2020**

**Independent Assurance Practitioner's Review report**

# PROGRAMME: Saturday 5 June

| | | |
|---|---|---|
| **8:45** | ***Welcome and announcements*** | |
| | | |
| **Session 1** | ***Opening, plenary address and mainly seabirds*** | |
| 9:00-9:30 | Plenary address:<br>Paul Sagar | A tale of two islands – albatross research at the Bounty and Snares Islands |
| 9:30-9:45 | Ian Armitage | A new digital database for the Beach Patrol Scheme for recording and analysis of information about birds found dead on New Zealand beaches |
| 9:45–10:00 | Richard Seed | The national kororā monitoring programme and NZ Penguin Database |
| 10:00–10:15 | Thomas Mattern | Mystery on the Bounties – what's up with Erect-crested penguin numbers? |
| 10:15–10:30 | Colin Miskelly | Fifty years of unusual birds and rarities – the role of the Birds New Zealand Records Appraisal Committee |
| **10:30–11:00** | ***Morning tea*** | |
| **Session 2** | ***Conservation and management I*** | |
| 11:00–11:15 | James Russell | Bird disturbance on beaches of the Waitakere Range |
| 11:15–11:30 | Ariel-Micaiah Heswall | Lighting adjustments to mitigate against deck strikes/vessel impacts |
| 11:30–11:45 | Baylee Connor-McClean | Uncovering the apparent and hidden threats of the Nationally Endangered tarapirohe/black-fronted tern breeding success |
| 11:45–12:00 | Jodie Crane | Low hatching success in the critically endangered kākāpō is driven by early embryo mortality not infertility |
| 12:00–12:15 | Lara Urban | Leveraging statistical genomics for the conservation of the critically endangered kākāpō |
| **12:15-1:30** | ***Lunch*** | |
| **Session 3** | ***Diet and foraging*** | |
| 1:30–1:45 | Daria Erastova | Effects of sugar-water feeding on New Zealand native birds |
| 1:45–2:00 | Tim Lovegrove | Foraging ecology of Pārekareka (spotted shag) in the Hauraki Gulf |
| 2:00–2:15 | Phil Battley | Foraging modes and evidence of biofilm feeding in the Wrybill, an unconventional plover |
| 2:15–2:30 | Taylor Hamlin | Do better hunters make better parents? Linking together the breeding and foraging ecology of Adélie penguins |
| 2:30–2:45 | Priscilla San Juan | Can kiwi trust their gut? Captive rearing alters the Brown Kiwi (*Apteryx mantelli*) microbiome |
| **2:45–3:15** | ***Posters*** | |
| | Annie West | Gut microbiome of the threatened takahē: Biogeographic patterns and conservation implications |
| | Ines Moran | Insights into the vocal learning abilities of an Aotearoa bird: How much is innate or learned in titipounamu vocalisations? |
| | Maira Fessardi | Stress physiology of grey-faced petrel as a conservation tool |
| | Oscar Thomas | Understanding seabird distributions around Aotearoa/New Zealand: The situation at sea, and next steps to take. |
| | Sara Coutinho | Can audio recorders replace traditional bird monitoring methods for bird richness estimates? |
| | Simon Lamb | Insights in the breeding performance and recruitment of takoketai/black petrel using social pedigrees |
| **3:15–3:45** | ***Afternoon tea*** | |

| **Session 4** | ***Miscellany*** | |
|---|---|---|
| 3:45–4:00 | Simon Lamb | Does burrow occupancy and movement between burrows occur in response to nesting failure in takotekai/black petrels? |
| 4:00–4:15 | Adrian Riegen | How did Pūkorokoro Miranda Naturalists' Trust end up undertaking wader surveys in the DPRK? |
| 4:15-4:30 | Dan Burgin | NZ Bird Atlas Year 2 Update |
| 4:30 – 4:45 | Michelle Bradshaw | Are we nearly there yet? |
| 4:45-5:00 | Michelle Bradshaw | Banding gathering |
| | | Drinks – a bar will be available at the Civic Centre 5pm – 9pm |
| 7:00 | | Informal Dinner – Civic Centre |

# PROGRAMME: Sunday 6 June

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|---|---|---|
| **8:50** | ***Conference Opening*** | |
| | | |
| **Session 1** | ***Novel methods*** | |
| 9:00-9:15 | Brian Gill | Making sense of moa eggshell fragments |
| 9:15–9:30 | Emma Holvast | Taxonomic predictions of seabird identity using 3D bone shape |
| 9:30-9:45 | Simone Giovanardi | How much does it weigh? The use of Bayesian models to estimate the body mass of extinct birds |
| 9:45–10:00 | Emma Feenstra | To disturb or not disturb: methods of monitoring kiwi |
| 10:00–10:15 | Laura Molles | Acoustic Identification of Individual Birds using Deep Learning |
| 10:15–10:30 | Michelle Roper | What makes a song? A review of the definition in songbirds |
| **10:30–11:00** | ***Morning tea*** | |
| **Session 2** | ***Conservation and management II*** | |
| 11:00–11:15 | Claudia Mischler | Kakī Recovery Programme - where are we now? |
| 11:15–11:30 | Enzo Reyes | The conservation status of the Floreana Mockingbird: Past, present and future of one of the rarest birds on the Galapagos Islands |
| 11:30–11:45 | Johannes Fischer | Predicting translocation success and harvest impact on small populations: A case study of a critically endangered petrel |
| 11:45–12:00 | Emma Williams | Developing sustainable habitat networks for the conservation of mobile terrestrial threatened species in New Zealand |
| 12:00–12:15 | Jacques de Satge | Understanding mangrove-avifauna relations in Aotearoa: using cameras to quantify banded rail habitat use |
| 12:15–12:30 | Aileen Sweeney | Adaptability and responses to threats in a highly successful rail, the pūkeko |
| **12:30-1:30** | ***Lunch*** | |
| **Session 3** | ***Tracking*** | |
| 1:30–1:45 | Scott Forrest | Operation Kākā Repopulation: Understanding utilisation distribution, resource selection and behaviour using GPS transmitters |
| 1:45–2:00 | Taylor Davies-Colley | Kei Hea Ngā Kākā—Where are the kākā? … And are they safe? |
| 2:00–2:15 | Edin Whitehead | Where the Rako roam – tracking Buller's shearwaters |
| 2:15–2:30 | Dan Burgin | Satellite tracking fledging juveniles of a Nationally Vulnerable seabird species: toanui /flesh-footed shearwater |
| 2:30–2:45 | Emma Williams | Tōrea/South Island pied oystercatcher on the move: Linking movements and vital rates to inform conservation of New Zealand mobile species |
| 2:45–3:00 | Phil Battley | Migrating godwits continue to reveal and surprise |
| 3:00 – 3:10 | | Conference Closes |
| **3:10–3:30** | ***Afternoon tea*** | |
| | | |
| **3:30–5:00** | **Awards and AGM** | |
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| | | Drinks – a bar will be available at the Civic Centre 5pm – 9pm |
| | | |
| **7:00** | **Conference Dinner – Civic Centre** | |

# Contents

# A tale of two islands – albatross research at the Bounty and Snares Islands

**Paul M. Sagar**[1], Kalinka Rexer-Huber[2], Graham Parker[2] and David Thompson[3]

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[2] Parker Conservation, Dunedin, New Zealand
[3] National Institute of Water and Atmospheric Research, Wellington, New Zealand

Seabirds comprise a large proportion of New Zealand's avifauna and are negatively impacted by a variety of human-induced threats. Despite their prominence, with a few notable exceptions, relatively little is known about the at-sea distribution, population size and population trend of most species. In this talk I report the latest results of research into two albatross species of conservation concern because of their incidence in fisheries bycatch: the Salvin's albatross at the Bounty Islands, about which little is known, and the southern Buller's albatross at The Snares, which has a relatively long history of research. I will summarise the results of four trips to the Bounty Islands between 2012 and 2019 that concentrated on determining at-sea distribution, and the application of drones and fixed time-lapse cameras to determine population size and basic breeding biology, respectively, of Salvin's albatross. This will be followed by an update on the population size and trend, and survival of southern Buller's albatrosses at The Snares 1992-2020. Finally, I will summarise likely threats to the survival of both populations.

## A new digital database for the Beach Patrol Scheme for recording and analysis of information about birds found dead on New Zealand beaches


### Ian Armitage

50 Ranui Terrace, Tawa, Wellington 5028 (ian.armitage@xtra.co.nz)



The 'Birds New Zealand' Beach Patrol Scheme commenced in 1951 and for 70 years has provided a basis for the systematic documentation of the identity and numbers of sea birds found dead by members of the Society on New Zealand beaches. Beach patrol data provides a unique long-term record of the occurrence and to some extent the distribution of seabird species in New Zealand coastal seas. The development of a new internet-based data management system commenced in 2015 with the aim of overcoming technical shortcomings in data processing and reporting. An important feature of the redesigned system for archiving and analysis of beach patrol records are that it will provide open access to data for scientists and others to study thereby allowing and encouraging collaboration and partnerships with interested persons. Open access will allow the broader benefits of beach patrol data to be realised and will have the advantage for the Society of increasing the visibility and value of this important database. Through the volunteer efforts of several members the transcription from scanned records and checking of data into the new system has progressed well since 2015. It is very pleasing to report that a new high-quality database has now been constructed that will enable summaries and long-term trends for seabird species to be assembled, particularly for species having a conservation threat ranking. The new digital data management system has been developed in consultation with Dragonfly Data Science Ltd. Examples of some analyses will be presented. The development of a proposed on-line facility for the submission of beach patrol information will be described.

## The national kororā monitoring programme and NZ Penguin Database

**Seed, Richard**[1] and Thomas Mattern[2]

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[2] NZ Penguin Initiative, Dunedin, New Zealand (Thomas@nzpi.net)

While extensive research on little penguins/ kororā (*Eudyptula minor)* has been conducted in Australia, we have little robust population data for most of New Zealand. In much of their range, kororā populations appear to have declined but evidence is anecdotal or based on sporadic surveys, providing insufficient data to reliably assess population trends or implement conservation management actions. Monitoring mostly relies on efforts of community groups often working in isolation, using different methods which makes comparison between regions difficult. The NZ Penguin Initiative is driving a national monitoring programme aiming at coordinating and standardising efforts of community groups. A holistic approach is essential to understand factors driving kororā population changes, and to develop management actions required to improve the species' conservation in different parts of New Zealand. Here, we demonstrate the core aspects of the programme; (1) the three-tiered monitoring protocols that deliver a consistent methodology, (2) the NZ Penguin Database that serves to centralise data and make it available for conservation through the Creative Commons (CC) while ensuring data ownership remains with the community groups, (3) the use of a mobile database application facilitating data entry in the field and near-real time reporting of breeding outcomes.

## Mystery on the Bounties – what's up with Erect-crested penguin numbers?

**Thomas Mattern**[1,2,3], Graham Parker[4], Kalinka Rexer-Huber[4], Jacinda Amey[5], Cara-Paige Green[6], Alan Tennyson[7], Paul Sagar[8], David Thompson[8]

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[2] Department of Zoology, University of Otago, Dunedin, New Zealand
[3] Global Penguin Society, Chubut, Argentina
[4] Parker Conservation, Dunedin, New Zealand
[5] Department of Conservation, Haast, New Zealand
[6] University of Tasmania, Hobart, Australia
[7] Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand
[8] National Institute of Water and Atmospheric Research, Wellington, New Zealand

The Erect-crested penguin, endemic to New Zealand's subantarctic Bounty and Antipodes Islands, is one of five penguin species world-wide rated 'endangered' by the IUCN Redlist. This assessment is based on the belief that the species' population has declined significantly from 230,000 breeding pairs in 1978 to 81,000 pairs in the mid-1990s. However, while later estimations were based on dedicated population surveys, information from the seventies derived from crude extrapolations (Bounties) and 'very rough' estimations (Antipodes), limiting the usefulness of direct comparison. Between 1997 and 2011, three population counts of Erect-crested penguins were conducted on Proclamation Island in the Bounty group providing the first comparable penguin numbers. In October 2019, we conducted a fourth Erect-crested penguin survey on the island using a combination of ground counts (following the previous surveys' methodology) and aerial surveys with the help of camera drone imagery. Nest numbers were largely comparable to counts conducted since 1997, casting doubts on the notion of an ongoing population decline on the Bounty Islands. Nest densities varied significantly with terrain and between islands, suggesting that the extrapolation-based estimates from the 1970s substantially over-estimated penguin numbers, thereby contributing to the current 'endangered' assessment. Moreover, nest numbers seem to be lower in years with La Niña conditions but recover in subsequent years, adding further uncertainty to the assessment of the species' population trajectory given that some of the sparse survey data were recorded during La Niña years. Further research is essential to clarify the Erect-crested penguins' population status and threat ranking.

## Fifty years of unusual birds and rarities – the role of the Birds New Zealand Records Appraisal Committee

**Colin Miskelly**[1] & Biz Bell[2]

[1] Museum of New Zealand Te Papa Atawhai, PO Box 467, Wellington 6140, New Zealand (colin.miskelly@tepapa.govt.nz)
[2] 35 Selmes Road, Rapaura, RD3, Blenheim 7273, New Zealand (rac.secretary@birdsnz.org.nz)

The Ornithological Society of New Zealand initiated a system for assessing reports of rare vagrant birds in the early 1970s. For about 40 years, any Unusual Bird Reports received were assessed by the Rare Birds Committee, until this morphed into the current Records Appraisal Committee in 2010. All submissions were originally received as hard copy via New Zealand Post. They are now mainly received via an online reporting form, along with some received via email, and a very few still as hard copy. Use of online submission processes, and feedback via the Unusual Bird Report database (launched in 2016) have contributed to greater awareness and utilisation of the UBR system. An average of more than 100 UBRs have been received per year since 2010, with a maximum of 124 in 2018. A total of 2125 UBRs were received between 1970 and 2020 (an average of 30 per year for the first 40 years). We report on patterns in UBR submission rates and acceptance rates over time, and present some of the highlights over the last decade, including 13 ‘first records’ for New Zealand.

## Bird disturbance on beaches of the Waitakere Ranges

Anataia T.R. van Leeuwen, and **James C. Russell**

University of Auckland, Symonds St, Auckland, New Zealand (avan587@aucklanduni.ac.nz, j.russell@auckland.ac.nz)

Coastal environments are key feeding and breeding sites for birds, and the actions of people and dogs can negatively impact bird behaviour and security. Increasing use of beaches for recreation and development are intensifying these impacts. We monitored the abundance and behaviour of five coastal bird species at eight beaches (3 dogs prohibited, 4 dogs on leash, 1 dogs off-leash) on the West Cost of the Waitakere Ranges over six consecutive weeks of summer 2020/21. A 200 m stretch of each beach was surveyed for two hours each week at random times and days. Every 5 minutes the observer would instantaneously record the number of birds, dogs and people and their respective behaviours, along with weather and vehicle activity. Bird, dog and human activity all varied with beaches and time of day and week. Bird and dog-walking activity peaked before midday while human activity peaked after midday. The maximum number of birds on the beach was limited by the presence of both people and dogs: birds become scarce when people number over 50 or dogs over 10. Where people and dogs were active disturbed gulls tended to move off the foreshore to adjacent rocks, although gulls were attracted to larger congregations of people particularly when eating. Terns and dotterels were more sensitive to disturbance than gulls or oystercatchers. However, bird activity was regulated by a host of other factors: even with no people or dogs, birds may be absent, while storm wrecked driftwood and seaweed increased bird activity on beaches.

## Lighting adjustments to mitigate against deck strikes/vessel impacts

**Ariel-Micaiah Heswall[1*]**, Anne Gaskett[1], Kerry Lukies[2], Chris Gaskin[2] and Megan Friesen[3]

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[2] Northern New Zealand Seabird Trust, 174 Ti Point Road, RD5, Ti Point, Auckland 0985, Auckland, New Zealand (chris@nzseabirds.com)
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* Student presentation

Artificial light at night (ALAN) can negatively impact nocturnally active seabirds by causing disorientation, exhaustion, injury and/or mortality from collisions. The Hauraki Gulf in Aotearoa/New Zealand has one of the world's highest diversities of seabirds, many of them vulnerable to light pollution, including threatened seabird species. While most of these species breed on offshore islands, the extensive shipping activity in this region puts seabirds at great risk of collisions with vessels. This study, undertaken on two seabird islands, tested which light intensities and colours were least attractive to seabirds through behavioural experiments by projecting lights into the sky and recording the attraction. We also modelled the lights into the visual system of seabirds to identify how seabirds perceive lights differently. We found no statistically significant differences in seabirds' attraction to the lights but did find preliminary evidence that there are likely to be interactions with moon phase and that light intensity could be more influential than wavelengths. The number of seabirds trapped in the light beam differed by location. Most of the seabirds grounded occurred on Pokohinu/Burgess Island during the flood LED treatment. Differences between locations likely reflected the local seabird diversity at each island. Future vessel-based and further land-based behavioural experiments should incorporate a greater range of moon phases and increasing the sample sizes for each lighting treatment.

## Uncovering the apparent and hidden threats of the Nationally Endangered tarapirohe/black-fronted tern breeding success

**Baylee Connor-McClean**, Hine Bell, Keegan Miskimmin, Ed Marshall, Lydia Titterton, Mike Bell and E. (Biz) Bell

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Braided rivers are prominent features along the eastern side of New Zealand's Southern Alps, especially in the Canterbury and Marlborough regions. These ecosystems provide nesting habitats for many native bird species including the endemic tarapirohe/black-fronted tern (*Chlidonias albostriatus*). The Black-fronted tern is an endangered species and without conservation management are predicted to decline to extinction. Between October 2017 and January 2021, we monitored the breeding success of 54 black-fronted tern colonies along the Hurunui and Waiau rivers and identified nesting threats. A combined total of 1,653 nests were monitored over the four breeding seasons. Weekly nest checks and camera monitoring highlighted significant threats including frequent flooding and predation events. A combined total of 94 filmed predation events at nests identified feral cats (*Felis catus*), ship rats (*Rattus rattus*) and Australasian harriers (*Circus approximans*) as being the main causes of nest failures, while Southern black-backed gulls (*Larus dominicanus*) and predation by black-fronted terns within their own colonies have arisen as another less observed threat. Predation and flooding events resulted in poor breeding success with only 31.6% of nests hatching at least one egg, and an average productivity of only 0.06 chicks fledged/nest in the 2020/21 season alone. We discuss the management programme that has been initiated in 2017 to help improve the productivity of black-fronted terns during the subsequent seasons including island enhancement, predator trapping, and weed control.

## Low hatching success in the critically endangered kākāpō is driven by early embryo mortality not infertility

James Savage[1], **Jodie Crane**[2], Kākāpō Recovery Team[2], Nicola Hemmings[1]

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[2] Kākāpō Recovery, Department of Conservation, Invercargill, New Zealand (jcrane@doc.govt.nz)

In many endangered species, reproductive failure is a major barrier to recovery. The critically endangered kākāpō (*Strigops habroptilus*) exemplifies this challenge: 61% of their eggs fail to hatch, and of these 73% show no sign of development. Undeveloped eggs have previously been attributed to male infertility, but recent studies of non-threatened bird species suggest fertilisation failure is rare in the wild. The underlying causes of fertilisation failure and embryo death differ, so distinguishing between them is essential for effective conservation management. Here we show that the majority of undeveloped kākāpō eggs are fertilised, and combine this with conservation programme data on natural copulations, artificial inseminations, and paternity of developed eggs, to generate the most precise estimate to date of fertility in a wild population. We also demonstrate, for the first time in a wild bird, that artificial insemination results in greater numbers of sperm reaching the egg.

## Leveraging statistical genomics for the conservation of the critically endangered kākāpō

**Lara Urban**[1], the Kākāpō125+ consortium, the Kākāpō Recovery Team and Ngāi Tahu

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Across the world, wild populations are declining at an unprecedented rate, culminating in the loss of genetic diversity and adaptive potential. Only few genomic studies have informed conservation decisions, often due to failure of complementing genomics with fitness or fertility data. Combining genomic and phenotypic data, however, enables the application of so-called quantitative genomic approaches that link genomic regions with important traits and directly assess the adaptive potential of populations. We leveraged cutting-edge quantitative genomic approaches to explore genomic, phenotypic, and environmental factors that affect the persistence of the critically endangered kākāpō (*Strigops habroptilus*). An extraordinarily detailed phenotypic catalogue allowed us to (i) assess heritability, (ii) identify underlying genes and gene pathways, and (iii) evaluate genomic predictability of various traits of the species. I will report on two exemplary phenotypes, plumage morphology and disease susceptibility, to showcase the power of such quantitative genomic approaches and their potential to benefit conservation management in direct collaboration with Ngāi Tahu as Kaitiaki Rōpū, the Kākāpō Recovery Team and Genomics Aotearoa: We found kākāpō plumage to be a Mendelian trait, with the *LHX8* gene as the potential causative gene impacting early feather development. We further identified several immune genes that contributed to the species' cloacitis susceptibility and found evidence that cloacitis might be caused by a retroviral infection, an important clue in the search for the still unknown causative agent of the disease.

## Effects of sugar-water feeding on New Zealand native birds

**Daria A. Erastova**[1*], Josie A. Galbraith[2], Kristal E. Cain[1], Yolanda van Heezik[2], and Margaret C. Stanley[1]

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*Student presentation

Backyard sugar-water feeding is increasingly popular in urban areas, but its impact on native urban birds in New Zealand is poorly understood. Our research aims to understand what effect this feeding practice has on the behaviour and health of native garden bird species. In the first part of the study, we selected 16 volunteer gardens with existing sugar-water feeders in Auckland and Dunedin and collected behavioural data on sugar water feeder bird visitation rates and the number of aggressive interactions, as well as sampled visiting birds for potential pathogens. In the second part of the study, we selected 15 volunteer households in Auckland with no current sugar water feeding stations in them. We established new standardised sugar water feeders in these volunteer gardens, with gardens divided into two groups: high sugar concentration feeders. We collected data on how rapidly the feeders attracted birds and how often and which birds were visiting. Our results show that sugar water feeders are more frequently visited in Dunedin compared to Auckland, and in winter when compared to summer. Aggression also increased at the end of summer and reached its maximum in winter. Most of the sampled birds had good body condition. Nearly half of sampled individuals were infected with either endo- or ectoparasites, but no contagious pathogens such as *Salmonella* or *Chlamydia* were detected in either the birds or the feeding stations. In Auckland tūī dominated most of the experimental feeders and showed no sugar concentration preference in either visitation frequency or duration.

## Foraging ecology of Pārekareka (spotted shag) in the Hauraki Gulf

Matt J. Rayner[1,4], Todd J. Landers[2,4], Sarah J. Bury[3] and **Tim Lovegrove[2]**

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[4] School of Biological Sciences, University of Auckland, 3A Symonds Street, Auckland, PB 92019, New Zealand

Spotted shags historically bred widely in the Auckland region, yet experienced massive population declines in the 20th century. Reversing the trend of declining numbers is hampered by a lack of information on foraging behaviour and diet of this population. We used GPS tracking and stable isotope analyses to understand the movements and diet of spotted shags in the Hauraki Gulf. Eight spotted shags breeding on Tarahiki Island were tracked for between 30-120 days in length. Tracked shags foraged South East, South and South West of Tarahiki Island in the Tamaki Straight, and Western and Eastern Firth of Thames, travelling up to 50 kilometres from their colony site. Tracking data identified the broad range of resting and roosting sites required by this species, frequently near human disturbance. Isotope data confirm the high trophic feeding level of spotted shags in comparison with other gulf resident seabirds and the spring breeding season tracked birds frequently targeted fish prey species within offshore mussel farms in the Firth of Thames. With the loss of benthic mussel beds in the region through historic dredging and siltation, we hypothesise that this "new" vertical habitat structure promotes a diverse fish life that the birds can exploit. Further research is planned to investigate the ecology of this system.

## Foraging modes and evidence of biofilm feeding in the Wrybill, an unconventional plover

Rachel Withington, Alastair W. Robertson and **Phil F. Battley**

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The laterally-curved bill of the wrybill allows birds to forage around stones on braided rivers, but is also used effectively when foraging on mudflats on the non-breeding grounds. We used videography and stable isotope analyses to study the foraging of overwintering wrybills at Pūkorokoro-Miranda in the Firth of Thames. Wrybills exhibited a flexible foraging strategy, using visual or tactile cues or a mixture of both with the mode used seemingly influenced by sediment properties. Prey size varied with foraging mode, with visual foragers capturing mostly large polychaete worms and tactile foragers sluicing their curved bill sideways through the mud to capture predominantly small worms. Despite differences in foraging methods, the total biomass intake did not differ between visual, tactile and mixed-method foragers. Tactile foraging also frequently involved biting the sediment or sluicing followed by sediment being swallowed but without obvious prey capture, raising the possibility of that Wrybills also ingest biofilm. Stable isotope analysis of faeces and blood suggest some biofilm ingestion was present. The tongue of the Wrybill appears not to have spines as found in sandpipers, but instead is concave dorsoventrally with an almost lamellae-like fringe on the outer edge. This fringe may help capture worms when extruding liquid mud from the bill, but it could also potentially be useful in trapping biofilm. This may be the first evidence of biofilm feeding in a non-scolopacid shorebird.

## Do better hunters make better parents? Linking together the breeding and foraging ecology of Adélie penguins

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Adélie penguins (*Pygoscelis adeliae*) are one of the most widely spread and abundant penguin species in the world, with a circumpolar distribution. While clumsy on land, they are agile marine predators, with their diet primarily consisting of small fish and krill. Because of these factors, and a well-documented relationship between the condition of the Antarctic pack-ice and population viability, Adélie penguins are considered an indicator species for the health of the Antarctic marine environment Given the recent designation of the Ross Sea, off the coast of West Antarctica, as a Marine Protected Area (MPA), research on local Adélie penguin populations can provide an excellent source of information to predict the outcomes of different management decisions and provide advice to stakeholders. Unlike other MPAs, the protection status of the Ross Sea has a sunset provision of 35 years, meaning that it's status and extent will be under review. This research on an established indicator species like the Adélie penguin could, therefore, inform whether such protection should be modified or withdrawn. This presentation will discuss current work describing the at-sea movements of Adélie penguin breeding at Cape Bird in relation to relevant local environmental conditions. Additionally, focus will also be given to the application of mechanistic modelling to link this movement to reproductive outcomes such as fledging success and chick mass, which has applications for the wider movement ecology field.

## Can kiwi trust their gut? Captive rearing alters the Brown Kiwi (*Apteryx mantelli*) microbiome

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Captive rearing is often critical for animals that are vulnerable to extinction in the wild. However, few studies have investigated the extent at which captivity impacts hosts and their gut microbiota, despite mounting evidence indicating that host health is affected by gut microbes. We assessed the influence of captivity on the gut microbiome of the Brown Kiwi (*Apteryx mantelli*), a flightless bird endemic to New Zealand. We collected wild (n = 68) and captive (n = 38) kiwi feces at seven sites on the north island of New Zealand. Using bacterial 16S rRNA and fungal ITS gene profiling, we found that captivity was a significant predictor of the kiwi gut bacterial and fungal communities. Captive samples had lower bacterial (ANOVA, $p < 0.001$) and fungal (ANOVA, $p = 0.012$) diversity and different composition when compared to wild samples (PERMANOVA, $r^2 = 0.07$, $p = 0.001$). To further support this difference, ordination (NMDS) showed clustering by captivity status. Firmicutes dominated the gut microbiome of wild kiwi, while Proteobacteria dominated in captive kiwi. History of coccidiosis, a gut parasite primarily affecting captive kiwi, showed a marginally significant effect on bacteria ($r^2 = 0.048$, $p =0.095$) and fungi ($r^2 = 0.074$, $p = 0.087$). Our findings demonstrate captivity's potential to shape the Brown Kiwi gut microbiome, but further investigation is needed to elucidate the effects of these differences on welfare.

***Poster***

# Gut microbiome of the threatened takahē: Biogeographic patterns and conservation implications

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The Aotearoa New Zealand takahē (*Porphyrio hochstetteri*), once thought to be extinct, is a nationally threatened flightless rail currently under intense conservation management to boost population numbers. While there has been previous research into disease-related microbes in takahē, little is known about the microbes present in the gastrointestinal tract. Given the importance of gut-associated microbes to herbivore nutrition and immunity, knowledge of these communities is likely to be of great conservation value. Here we examined the gut microbiotas of 57 takahē at eight separate locations across Aotearoa New Zealand. Faecal samples, taken as a proxy for the hindgut bacterial community, were subjected to 16S rRNA gene amplicon sequencing using Illumina MiSeq. Phylogenetic analysis of >2200 ASVs (amplicon sequence variants) revealed nine main bacterial phyla (*Acidobacteriota*, *Actinobacteriota*, *Bacteroidota*, *Campilobacterota*, *Firmicutes*, *Fusobacteriota*, *Planctomycetota*, *Proteobacteria*, and *Verrucomicrobiota*) that accounted for the majority of sequence reads. Location was a significant effect (p-value <0.001, 999 permutations) that accounted for 32% of the observed microbiota variation. One ASV, classified as *Lactobacillus aviarius*, was present in all samples at an average relative abundance of 17%. The abundance of the genus *Lactobacillus* also differed significantly between locations (p-value = 0.0017). A previously described common commensal bacterium, *Campylobacter* spp., was also detected in most takahē samples. These data present a first glimpse of the previously unexplored takahē gut microbiota and provide a baseline for future microbiological studies and conservation efforts.

***Poster***

# Insights into the vocal learning abilities of an Aotearoa bird: How much is innate or learned in titipounamu vocalisations?

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Vocal learning is a complex behaviour with both innate and learned components that enables animals to imitate sounds from conspecifics. Disentangling the genetic and sociallyinfluenced components of vocal behaviours can help determine a species' level of vocal learning abilities. In birds, vocal learning is present in three main phylogenetic groups, the parrots, the oscine songbirds and the hummingbirds, and is assumed to be absent in all other avian groups. Yet, the vocal learning abilities of other avian groups is poorly documented, so vocal learning may be more widespread than previously thought. Titipounamu (rifleman, *Acanthisitta chloris granti*) share a common ancestor with both parrots and passerines, and its vocal learning ability is assumed to be entirely innate, however this has never been tested. Here, we investigate the genetic and socially-influenced components of the vocal behaviour of titipounamu. We determined individual relatedness from the Boundary Stream Mainland Island population using high-throughput genotyping-by-sequencing (GBS), recorded titipounamu feeding calls and determined the level of social interactions of individuals. We found that the social, genetic, and residual components (unexplained by either genetic or social components) of acoustic parameters of feeding calls vary for each acoustic parameter and that there was no correlation between relatedness and vocal similarity. This suggests that closely related kin do not sound similar and that titipounamu vocal behavior may be more flexible than previously thought. By investigating genetic and social variance components of a vocal behaviour, our study contributes to advancing our understanding of the evolution of vocal learning in birds.

***Poster***

## Stress physiology of grey-faced petrel as a conservation tool

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Seabirds are the most threatened group of birds globally, as well as ecologically relevant top predators and ecosystem engineers. Breeding seabirds are touted as a potential low-cost bioassay of ocean health. The effectiveness of that relationship, however, remains unclear. Shifts in ocean conditions influence foraging opportunities. Stress hormones show a strong negative relationship to food supply and detrimental effects to organisms, becoming a strategic tool that connects climate change, forage conditions and population processes. In birds, corticosterone (CORT) is the predominant stress hormone. Higher CORT levels in chicks experiencing stress are deposited in developing feathers. Thus, measures of feather CORT are an ideal source of data for estimating environmental stressors. The pattern of regulation in stress hormone levels, however, varies among species, requiring validation studies to allow drawing reliable conclusions. This talk will describe work matching whether variation in grey-faced petrel *(Pterodroma gouldi)* feather CORT can be used as a proxy of ocean conditions and as a monitoring tool for population breeding success. Using three seasons of data, we predicted that our population will show higher detectable levels of feather CORT in years under increased environmental stress, with poorer oceanic foraging conditions, and higher CORT levels in adults will result in lower quality offspring and predict lower population breeding success. This talk will highlight results gathered to date and illustrate the value of seabirds and seabird monitoring as tools to monitor ocean conditions 'beyond the horizon'.

***Poster***

## Understanding seabird distributions around Aotearoa/New Zealand: The situation at sea, and next steps to take?

**Oscar J. W. Thomas**

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Seabirds make up a large portion of Aotearoa/New Zealand's avifaunal identity, yet are difficult to observe and quantify due to their predominately pelagic nature. As a birder studying ecology, I am interested in seeing how seabirds interact with their environment, what causes them to fly and feed exactly where they do, and if these aspects are changing over time. As an aspiring conservationist, I know that the more that we understand about the ecology of seabirds, the better help we can give them in surviving against the endless threats they face - predation, overfishing, bycatch, plastic ingestion, and ocean warming, to name a few. In February 2021 I had the opportunity to visit several of our precious subantarctic islands on a scholarship with Heritage Expeditions. Regular 30-minute bird counts were completed over two days, in transit between mainland Aotearoa/New Zealand, Tini Heke/Snares Islands and Motu Maha/Auckland Islands. Tens of thousands of individual seabirds comprising 38 seabird species were observed total, with the most abundant by far being hākēkeke/Sooty Shearwater (birds observed in the vicinity of Tini Heke may have approached one million individuals) and the most unusual sighting being up to six 'subtropical' Black-winged Petrels, the southernmost record of this species. Dedicated oceanic seabird surveys would be a logistical nightmare, but from these observations it is clear that we still learn new things about them, and the goalposts are shifting. Further research is vital to ensure the protection of our declining seabirds, and I propose a New Zealand pelagic bird scheme as a potential solution.

***Poster***

# Can audio recorders replace traditional bird monitoring methods for bird richness estimates?

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Bird population monitoring is an important indicator of an ecosystems' health. New emerging technologies, such as audio recorders, have the potential to complement or replace traditional bird monitoring methods, but the effectiveness of these new technologies has not yet been widely tested. In this study we compared how the detection of bird species richness varied between traditional five-minute point counts performed by two observers with different levels of expertise and the Department of Conservation AR4 audio recorder. We also compared the effectiveness of two different audiorecorders available for sale in New Zealand: the Department of Conservation AR4 and the 2040 Bird Monitor. We found no significant difference between the mean number of species detected by the novice observer, expert observer and the AR4 audio recorder. There was a large overlap between the species detected by the three approaches, but each identified unique species. We found a significant difference in the mean number of species detected by the two audio recorders. We were able to detect four times more bird vocalisations and 50% more bird species with the AR4 when compared to the 2040 Bird Monitor. Our results suggest that audio recorders can be used as a complement or replacement of traditional bird monitoring methods, but they also revealed differences between the performance of two audio recorders. We therefore recommend evaluating the performance of audio recorders before deploying them in the field and endorse the use of the Department of Conservation AR4 for studies of shorter duration where the main objective is estimating bird species richness.

***Poster***

# Does burrow occupancy and movement between burrows occur in response to nesting failure in takotekai/black petrels?

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During each austral summer, the endemic takotekai/black petrel (*Procellaria parkinsoni*) returns from the West Coast of South America to Aotea/Great Barrier Island and Te Hauturu–o–Toi/Little Barrier Island in the Hauraki Gulf to breed. Throughout the breeding season, male black petrels construct, maintain and defend burrows from rivals and for un-paired males, the entrances of burrows are used as platforms to engage in sexual displays. Pairs are highly philopatric and can be found occupying the same burrow for multiple years in a row. Because black petrel pairs are only able produce one fledgling per year, the choice of breeding burrow is crucial for current and future breeding success. Pairs abandoning and moving to a new burrow is thought to follow breeding failure, however, this question is largely unexplored. Here, we investigated potential factors (breeding failure, divorce, age, and handler disturbance) and discuss how these factors might influence takotekai/black petrel burrow movement within and between breeding seasons.

# How did Pūkorokoro Miranda Naturalists' Trust end up undertaking wader surveys in the DPRK?


## Adrian Riegen

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By the year 2000 most of the Yellow Sea coasts of South Korea and China had been surveyed at least once for waders to get an idea where various species of waders and in what numbers were staging in the Yellow Sea. The big unknown was the Democratic Peoples' Republic of Korea (DPRK), where no reliable surveys had been conducted. In 2000 the north coast of Bohai Bay in China had revealed the biggest flocks of Red Knot so far discovered but less than 50% of the estimated flyway population had been accounted for. Could the rest be at a mega site in the DPRK? At the time we did not have the luxury of Google Earth, and satellite images that were available were very costly and not always high enough resolution to be useful. Wishing to discover if the Red Knot were staging in DPRK, I set about trying to find a way in. It would be nine year before members of Pūkorokoro Miranda Naturalists' Trust were able to enter DPRK, which had been made possible with the aid of Foreign Minister Winston Peters, and help from the Department of Foreign affairs. No site was discovered for Red Knot on our first visit, but we were invited back to search further. However, the project stalled until support from DOC in 2014 lead to a resumption of surveys in 2015. An initial three-year project was agreed to, later extended to five year with possibly two more years needed to search the entire Yellow Sea coast of DPRK. Covid-19 put paid to plans in 2020 and 2021 but it is hoped to continue in 2022. Since the project started we have found several sites of international importance to waders, one site has become a Ramsar Site and others may follow, whilst yet another site is under consideration for a UNESCO World Heritage listing.

## Are we nearly there yet?


## Michelle Bradshaw

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As with any long journey, sometimes the end seems to remain forever just around the next corner. The building of the new FALCON Bird Banding Database was no different – there were false starts, u-turns, detours and delays, finding new solutions and reinventing the wheel but also benefiting from paths forged by others. Throughout this journey over the last five years, the Department of Conservation's Banding Office has kept stakeholders informed through newsletter articles, workshops, conference presentations and endless iterations to the "standardised" template for data submission. No doubt a common sentiment would have been (and still is): "Are we nearly there yet?"

The FALCON System – an enterprise database and online interface that keeps track of bands, banders and banded birds – first went live to a Reference Group in August 2020, followed by a rollout of login invitations to certified banders and other interested stakeholders. Feedback so far has been positive, and suggestions for improvements have been included in subsequent software releases.

This presentation will provide an update regarding FALCON's contribution to bird research, the use of FALCON by stakeholders, as well as sighting records reported by members of the public. Record allocation to registered projects, uploading of missing records, and correcting errors found as we delve into data discovery are still ongoing, so in that respect the journey's end is around yet another corner. However, we are confident that at this point we can say, "Yes! We are nearly there… and thank you for joining us on the journey!"

## Making sense of moa eggshell fragments

**Brian Gill**

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Broken moa eggshell (Dinornithiformes) is common in Holocene fossil (and archaeological) sites but remained little studied until recently. In other studies, eggshell fragments of the four North Island moa species, identified from DNA, overlapped greatly in thickness. However, medians were separate: *Pachyornis geranoides* towards the thin extreme, *Dinornis novaezealandiae* at the thick end of the range, and *Anomalopteryx didiformis* and *Euryapteryx curtus* in between. I took a single thickness measurement (range 0.53-1.74 mm) from 6,036 moa eggshell fragments from 12 locations across the North Island. Histograms of eggshell thickness at these locations showed four patterns: thin eggshell only, thick eggshell only, medium-thickness eggshell only, and all thicknesses present. The Gisborne site, poorly-known from moa bones, showed a similar shell-thickness profile to Tokerau Beach which implies a similarity in their moa faunas. Eggshell thicknesses suggested that *D. novaezealandiae* was rare at Port Jackson and that *P. geranoides* was rare at Whananaki and Herbertville. Eggshell thicknesses for an archaeological site at Lake Taupo indicated that just one or a few eggs of a single species were involved, whereas a wide spread of shell thicknesses for an archaeological site on Great Mercury Island implied a contribution from eggs of several sizes and perhaps species. Simple, quick, non-destructive morphological analysis of moa eggshell fragments from a specific site can substitute for, or augment, bones and DNA in indicating the diversity and relative abundance of moas at that site.

## Taxonomic predictions of seabird identity using 3D bone shape

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Identifying a species from an isolated bone can be an important first step in faunal analysis research. Identifications using molecular methods are not always possible (e.g. fossils), and specialist taxonomic expertise is not always available. Here we have investigated a shape-based (i.e. geometric morphometric) method for identifying taxa from a single bone that doesn't require specialised taxonomic knowledge. We tested the hypothesis that digitised humeri and femora from seabirds can be confidently classified at order or family level using partial least squares-discriminant analysis (PLS-DA). Datasets of digitised seabird humeri and femora were generated from the collections at Auckland War Memorial Museum (Auckland), Canterbury Museum (Christchurch) and Te Papa Tongarewa Museum of New Zealand (Wellington). Our classification protocol used both well-established landmark-based techniques and novel landmark-free methods. The PLS-DA models as applied to humerus and femur shape were highly successful in their ability to correctly classify seabird bones at both order and family level. Using humerus shape specimens were assigned to both the correct order and family with an overall 100% model prediction accuracy. Using femur shape specimens were assigned to the correct order and family with an overall 100% and 93.5% model prediction accuracy, respectively. Our promising early results suggest that this method could be used to produce finer-level classifications (genus or species), and can be applied to groups beyond seabirds.

## How much does it weigh? The use of Bayesian models to estimate the body mass of extinct birds

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*Student presentation

Body size is one of the most studied traits in comparative sciences because it is deeply connected with many aspects of an organism's lifestyle (ecology, physiology, behaviour etc). The same is true for extinct birds for which the reconstruction of body size can be used to learn more about their lifestyles. Being able to accurately estimate body masses of fossil birds from a limited amount of information may provide useful insights on the nature of macroevolutionary shifts that occurred in deep time, contributing thus to better comprehend the reasons behind the patterns that we see among modern bird species. Previous investigations into the masses of living and extinct birds have mostly focused on finding a set of bone measurements that might correlate with bird mass. However this approach may often produce misleading predictions due to extreme outliers. Here instead we developed a Bayesian model that uses three dimensional information from bones, as well as knowledge about evolutionary relationships, to estimate the mass of several extinct New Zealand birds. To generate the morphological dataset we 3D scanned the femora from 318 extant bird species from Auckland War Memorial Museum (Auckland), Canterbury Museum (Christchurch) and Te Papa Tongarewa Museum of New Zealand (Wellington) and used the volume of these bones as size-predictor. Compared to previous types of models the new method produces substantially more accurate predictions for known birds mass, increasing uncertainty with outliers and thus allowing for a more flexible option to use in comparative ornithology.

## To disturb or not disturb: methods of monitoring kiwi

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Population monitoring is inarguably the most important tool for evaluating the protection and conservation of species. There are a wide variety of monitoring methods available, though particular methods are often favoured for specific species. In New Zealand, telemetry and call counts are the preferred methods for kiwi (*Apteryx* spp.). On Stewart Island/Rakiura, long-term monitoring of kiwi (*Apteryx australis lawyri*) using telemetry and tracking has given variable results and more information is required before any management action can be taken. Towards this aim we doubled the monitoring sites for kiwi on Rakiura using the same historical methods, included two new methods and expanded our monitoring through the breeding season to investigate the survival of chicks. Results from our comparison of monitoring methods are still pending, but the outcomes of chick survival from a predator free Island and the mainland of Rakiura might surprise you!

## Acoustic identification of individual birds using deep learning

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When you hear the mid-morning song of riroriro, a dawn chorus of korimako, or kiwi calling in the darkness, you're listening to a conversation. Many of the singers you hear know each other as individuals, and they benefit from the ability to recognise one another based on song alone. Conservation can benefit from this too. Being able to acoustically identify individual birds could allow us to monitor individuals, neighbourhoods, and populations with minimal disturbance.

We have successfully developed deep learning approaches for acoustic individual identification of roroa – great spotted kiwi (*Apteryx haastii*) and riroriro – grey warblers (*Gerygone igata*). In the Paparoa Range, we collected and analysed hundreds of roroa calls from thousands of hours of recordings during the 2020/21 roroa breeding season, and have confirmed that individual adult roroa can be distinguished acoustically. We have also successfully applied our methods to songs of riroriro collected with directional microphones in the Christchurch and Banks Peninsula areas.

In this talk we will focus on our methods and results for both of these species, and briefly discuss our ongoing research program. We are expanding our scope to additional populations and species, and aim to use acoustic identification as a novel way to study avian behaviour in the wild while contributing to monitoring and management goals.

## What makes a song? A review of the definition in songbirds

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Songbird vocal communication ranges from simple calls through to complex song. Birdsong has generally been thought to be a male trait which is used only in the breeding season to attract mates and defend territories. However, we now know this is no longer a representative definition of birdsong as we are finding more species that sing year-round and have female song. This raises the question as to whether we can still rely on other features of birdsong, such as high complexity, to distinguish whether a songbird's vocalisation is classed as a song. We aimed to explore whether measures of vocal complexity can distinguish between a song and call within the honeyeater family; a large and diverse Australasian-Pacific songbird clade. Of those with described vocal behaviour, 41 species are said to produce song and 41 species are song-less. We predicted that higher vocal complexity would correlate with a vocalisation classed as a song. We collected sound recordings of all vocalisations types from online databases and measured several aspects of vocal complexity. Compared to calls, songs had significantly more syllables within a vocalisation, more syllable types and greater syllable transitions, plus the minimum fundamental frequency of vocalisations was significantly lower in songs than calls. This suggests that certain measures of vocal complexity could be used as an appropriate method to define song, but further research is needed on more species. This is especially important for large studies understanding the evolution of birdsong and the applicability of the term 'song' across taxa.

## Kakī Recovery Programme—where are we now?


### Claudia Mischler

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Kakī, or black stilt, are endemic to New Zealand, and have come back from the brink of extinction. Once widespread across the whole country, their range became largely restricted to the Mackenzie Basin. In 1981, there were only 23 known adults remaining in the wild and only four breeding pairs, and it was predicted that the species would be functionally extinct within 8 years without management intervention. This led to the formation of the Kakī Recovery Programme, with the construction of two aviaries built in 1986/87 for captive rearing purposes.

Between 1987/88 to 1999/2000, there were between four to nine productive pairs in the wild from which eggs could be collected for captive rearing. It was not until the early 2000s that the number of adults and wild pairs started to increase. The number of wild pairs reached 37 in 2017/18 and the population reached 169 known adults in 2019/20, the highest in over 40 years. This presentation will focus on data and trends from the last 40 years of the Recovery Programme and will discuss what we have learned and still need to learn.

## The conservation status of the Floreana Mockingbird: Past, present and future of one of the rarest birds on the Galapagos Islands

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The Floreana Mockingbird (*Mimus trifasciatus*) is the most range-restricted member of the four endemic mockingbird species in the Galapagos Archipelago. Their current distribution range consists of only 0.5% of its historical geographic range. The species was distributed in the lowlands of Floreana Island (173 $km^2$) but was driven to local extinction from there in the early 1900s, due to reduction in available habitat and depredation from introduced species. Floreana mockingbirds are restricted to two populations on two islets off the coast of Floreana Island: Champion and Gardner-by-Floreana. These populations represent a source of individuals for reintroduction to Floreana Island, but there are at present significant gaps in knowledge about the behaviour and demography of the species. Numerous population estimates have been conducted in the last 100 years using different methodologies, making a temporal analysis impossible due to the lack of standardization. Important and robust demographic information is the first step to assess the current conservation status of the species. Here we present a preliminary assessment of both populations using models of capture-mark-recapture (CMR) to estimate the main demographic parameters. Our preliminary results show that both populations are more stable than previously thought. However, due to differences in the island systems and lack of gene flow, both populations have different patterns of survival probability. Our study will help to determine the next steps for the conservation of the species.

## Predicting translocation success and harvest impact on small populations: A case study of a critically endangered petrel

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In small populations, harvesting individuals for translocations could negatively impact source populations and thus, translocation cohorts should remain small, limiting potential establishment of recipient populations. The critically endangered Whenua Hou Diving Petrel (*Pelecanoides whenuahouensis*) could benefit from translocations to mitigate threats (e.g., storms, storm surges, and climate change), but only one small population remains. We used a novel metapopulation approach to an integrated population model to estimate vital rates and source population size, predict harvest impact on the source, and project the establishment of a recipient population under various translocation scenarios, while accounting for the return-to-source probability (juveniles recruiting back to the source post-translocation; $\psi_r$). We estimated adult survival at 0.868, juvenile survival at 0.772, productivity at 0.548 fledglings per female, population size at 207 adults, and population growth ($\hat{\lambda}$) at 1.023. Scenarios that resulted in establishment of a recipient without excessive impact on the source were harvests of ~10 fledglings/year for five years and ~5 fledglings/year for 10 years. When accounting for $\widehat{\psi_r}$, recipient populations remained ~29% smaller, and harvest regimes had to be increased (~15 fledglings/year for five years or ~10 fledglings/year for 10 years). We illustrate that establishment of new populations from small (seabird) populations can be feasible but results also show considerable uncertainty. Therefore, we recommend that translocations of small populations are conducted within an adaptive management framework, incorporating consistent monitoring of source and recipient populations, to evaluate projected impact and success and adjust harvest intensities when required.

## Developing sustainable habitat networks for the conservation of mobile terrestrial threatened species in New Zealand

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Mobile species are those that use the environment at district, regional and national landscape scales, often moving across rohe, takiwā or territorial authorities' jurisdictions. Movements may be migratory, seasonal, or nomadic, and are often undertaken to exploit different feeding and breeding resources. The Department of Conservation's network of Ecosystem and Species Management Units (EMUs & SMUs) aims to be representative enough to ensure persistence of all threatened species. However, it has long been suspected that these units account for only part of the life cycle of many mobile species. To investigate this, we reviewed the NZ threatened species listings to 1) determine how many taxa can be considered mobile, 2) describe knowledge gaps needing to be addressed before management prescriptions can be implemented, and 3) assess the relative priority of these research needs. We found 57% of threatened terrestrial bird species and all threatened bat species are mobile under our definition (46 species), and several major knowledge gaps require research before effective landscape-scale management prescriptions can be developed at regional and/or national scales for these species. In addition, mobile species face numerous threats that likely reduce overall survival while moving across the landscape. We suggest that a high proportion of management units are insufficient to sustain mobile species throughout their annual cycle/lifetime, and thus their persistence cannot be assured by maintaining the ecological integrity of EMUs and SMUs alone. We introduce a new Department of Conservation led research programme that, with several collaborators, aims to start addressing these short comings.

## Understanding mangrove-avifauna relations in Aotearoa: using cameras to quantify banded rail habitat use

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Little is known about mangrove-avifauna relationships, either globally or locally. In New Zealand, these relationships are of particular interest as mangrove forests are undergoing dynamic and rapid changes, while mangrove avifauna are notably absent from scientific literature. The repercussions of this knowledge gap are significant for bird species in decline and deemed highly dependent on mangroves, such as the banded rail *Gallirallus philippensis assimilis* on mainland New Zealand. Previously found throughout the country, banded rails are now largely restricted to pockets of coastal saltmarsh and mangrove in the upper North Island. Unfortunately, the cryptic nature of banded rails has hindered the study of their ecology, behaviour, and habitat use. To address this, I have used a suite of monitoring tools – including camera traps, GPS transmitters, and footprint surveys – to better understand the banded rail's use of coastal habitats. Preliminary findings from camera traps show that banded rails move between saltmarsh and mangrove habitats regularly, and most frequently during crepuscular hours. Additionally, tidal cycles may affect banded rail habitat choice, but further data is required to determine the extent of this relationship. Such findings have high conservation relevance in the context of current mangrove management strategies and monitoring methods for cryptic mangrove avifauna.

## Adaptability and responses to threats in a highly successful rail, the pūkeko

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The success of a species is inherently linked to behavioural flexibility, especially when faced with novel threats. New Zealand is a classic example of the devastating effects invasive species and anthropogenic disturbances can have on endemic species. However, not all native species have experienced such negative effects. The pūkeko (*Porphyrio m. melanotus*) is a territorial, group-living rail which has become a widespread species since self-introducing from Australia. It is likely that the adaptability of this species plays a role in its overall success. This study explores aspects of this success by analysing responses to threats and some potential factors mediating these responses. Unexpectedly, we found no pronounced sex differences in any examined hormones (testosterone, progesterone, estradiol), and no clear relationship between shield size and testosterone. We tested responses to three potentially threatening intruders (conspecific, ferret, snake). We report that responses to the conspecific intruder did not differ to the control, indicating a potential "nasty neighbour" effect. Pūkeko appear to correctly identify ferrets as potential threats, but not snakes, implying that they may have lost this ability since their self-introduction ~1000 years ago. Finally, we opportunistically examined how the study population responded to a severe habitat disturbance (herbicide application). Despite a severe decline in the 1-3 months immediately following the habitat disturbance event, the population returned to pre-disturbance numbers after seven months. Taken together, these findings support the hypothesis that pūkeko are, at least in part, such a successful species because of their ability to adapt in response to threats.

## Operation Kākā Repopulation: Understanding utilisation distribution, resource selection and behaviour using GPS transmitters

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To achieve conservation goals, one approach is to concentrate effort on a single umbrella species, providing evidence towards ecosystem-level management that will benefit a wide range of taxa. In a semi-urban area, focusing on a charismatic and easily recognisable species can also enhance community engagement and provide opportunities for citizen science. Kākā (*Nestor meridionalis*) are an endemic, lowland forest parrot that have struggled to repopulate the greater Dunedin area after being released into nearby predator-free Orokonui Ecosanctuary in 2008. To investigate factors limiting population growth, the movements and space-use by the free-ranging kākā population were quantified using GPS units that were attached to a subset of the Orokonui kākā. Home ranges and utilisation distributions were estimated using dynamic Brownian Bridge Movement Modelling (dBBMM) and were shown to vary greatly between individuals. The majority of birds spent a significant proportion of time outside the sanctuary, and resource selection analyses indicated use of predominately native forests, particularly those dominated by old-growth trees. The overall findings of this study stress the importance of robust predator control beyond the fence of ecosanctuaries, and the potential danger of human-driven threats.

## Kei Hea Ngā Kākā—Where are the kākā? … And are they safe?


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In 2008 kākā were first reintroduced into Orokonui Ecosanctuary, a 307-hectare fenced sanctuary near Dunedin, in the South Island of New Zealand. The population is the only one on the East coast of the South Island. Since then, the population has grown steadily (albeit slowly), however, many kākā have been presumed lost outside of the protection of the predator proof fence. Kei Hea Ngā Kākā is a Participatory Science Project based around the Ecosanctuary. The project has engaged the local community (including schools) in tracking kākā as they fly beyond the safety of the sanctuary fence using a specially developed database. In addition to tracking kākā, Kei Hea Ngā Kāka is also working with the community to identify potential risks to kākā and their habitat.

Where are the kākā going and spending time outside the fence? Are they safe here? Is there habitat for them? What can we do as a community to ensure the safety of kākā and create spaces that are best for humans and kākā? By working with the community to answer these questions, we will learn more about kākā's activities outside the sanctuary and the risks they face, making us better able to secure the future of this population.

## Where the Rako roam—tracking Buller's shearwaters

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Rako (Buller's shearwater, *Ardenna (Puffinus) bulleri*) are an endemic and largely unstudied seabird that breed only on the Poor Knights islands. Here we profile their migration movements through the North Pacific during the non-breeding season (May-September) in two separate years (2011, 2019) using geolocation technology, and, during chick rearing (March-April 2019) provide a first insight into their foraging movements using high-resolution GPS tracking. Concerns regarding the long duration of provisioning trips observed in 2011 and potential local food shortages prompted the study of their foraging behaviours. During chick-rearing, rako exhibit a dual foraging strategy that has been observed in other Procellariiformes, undertaking short local and longer, more distant foraging trips while provisioning their young. Their long trips take them to pelagic areas that are known foraging hotspots for several other seabird species, indicating that certain oceanographic features provide a predictable food resource. Tracking rako movements in combination with remote-sensing environmental data (eg: Sea Surface Temperature), stable isotope analysis of diet, and population monitoring (physiology, breeding success) allows us to look at the adaptability of the species to different conditions and assess their suitability as 'sentinel' species for monitoring changes in the marine environment.

## Satellite tracking fledging juveniles of a Nationally Vulnerable seabird species: toanui /flesh-footed shearwater

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Recent advances in satellite tracking devices have made it possible to track post–natal dispersal of juvenile seabirds once they leave their breeding colonies. The juveniles of a nationally vulnerable species, toanui/flesh-footed shearwater (*Puffinus carneipes*), were tracked in May 2019 to gain more understanding of their at-sea movements and distribution. Ten Geotrak™ Solar satellite tracking devices were deployed on fledging birds from a breeding colony on Ohinau Island, on the Coromandel Peninsula, New Zealand. All ten fledging flesh-footed shearwaters left Ohinau Island, however one device never transmitted any data, and another only transmitted for a few 100 km before failing. The remaining eight birds flew directly northwards into the Pacific and within 10 days of leaving reached Fiji, or east of Samoa and Tokelau. Once in these areas, all devices stopped transmitting. The reason(s) for this remain unclear. The birds may have been caught by commercial fisheries vessels in this high-intensity fishing region, may have died of natural causes, the devices may have all failed simultaneously, or the birds may have pulled the devices off. We suggest that fisheries, along with differential age-related behaviour skills between adults and juveniles, are the most likely causes of devices no longer transmitting. This work shows the need for continued tracking of all age classes of toanui/flesh-footed shearwater, and other New Zealand seabird species. Considering the known negative impacts of fishing, as well as climate change, this work remains a high priority in order to better protect this and many other species of seabird.

## Tōrea/South Island pied oystercatcher on the move: Linking movements and vital rates to inform conservation of New Zealand mobile species

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Most New Zealand's endemic migratory species are in decline, but management of these species is challenging given they are not at one site year-round. A new research partnership between the Department of Conservation, Manaaki Whenua–Landcare Research and BirdsNZ aims to substantially boost knowledge of which conservation actions are most effective for inland migrants. Tōrea/South Island Pied Oystercatchers (SIPO; *Haematopus finschi*) have been chosen as a focal species to a) test GPS tracking technologies, b) build richer data on flyways and nodes nationally, and c) to develop a spatial population model linking wintering and breeding sites under different management regimes, to better understand how threats and local management regimes affect population dynamics. We report the first field season's results showing high nesting success and chick survival in the upper Rangitata Valley, and pre- and post-breeding movements across New Zealand. So far two national routes have emerged as common flight paths for SIPO: a northern route along the southern alps/up the western Waikato coastline, and a southern route down the eastern side of the South Island. We've also been able to identify regional site networks and hotspots for less mobile non-breeders, as well as tag fledglings to show juvenile migration patterns that remain independent from adults. We're now proposing to combine this research, enabled through technological advances, with citizen science contributions from you, BirdsNZ members. Such a collaboration would allow a more complete picture of sites of importance, annual movements and life history traits for SIPO – enabling better conservation decisions for all.

## Migrating godwits continue to reveal and surprise

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In 2007–2008, satellite tracking of Bar-tailed Godwits from New Zealand revealed details of their epic migrations to Asia, Alaska and back again, a journey that included the two longest endurance flights documented for land-birds. There was considerable public interest in these flights, in particular the record track of 11,680 km by E7. Twelve years on, despite the godwits' fame and legendary status it was notable that E7's track remained the only published complete trans-Pacific flight. Furthermore, habitat changes and food decreases in the Yellow Sea focused attention on the need for information on how birds use these areas on migration. Accordingly, in 2019 we embarked on two major godwit tracking endeavours. One, funded by the Birds NZ Research Fund, tracked adult godwits migrating to Alaska. The other, led by researchers from the Max Planck Institute of Ornithology, set out to track juveniles as they explore New Zealand and establish site-faithfulness. Both were hugely successful. In 2020, 16 adults were tracked, including nine embarking on the Alaska–New Zealand flight. The juvenile project coincided with the best year in living memory for juveniles, and 38 birds were tagged. Combined, these birds are revealing new insights into how behaviours are established and maintained, how birds make good and bad migration decisions and how they cope with adverse conditions during migration, as well as re-writing the record books.