

Northern Royal Albatross tracking from Motuhara, Chatham Islands, and Taiaroa Head in 2021



Samhita Bose, Mike Bell and Graeme Taylor

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Introduction

The northern royal albatross or toroa (*Diomedea sanfordi*) is a large albatross species endemic to New Zealand. The majority (>99%) of the population breeds only on three outlying islands in the Chatham Islands group: Motuhara (Forty-Fours), Rangitatahi (Big Sister) and Te Awanui (Middle Sister). A very small population (30-40 pairs) of northern royal albatross breeds on Taiaroa Head, Otago Peninsula, Dunedin.

The conservation status of northern royal albatross is classified as 'Nationally Vulnerable' (Robertson *et al.* 2021). Although the population at Taiaroa Head has been well monitored and managed (primarily increasing chick survival), the long-term population trend of the species is uncertain due to sporadic assessment of the breeding population and breeding success of northern royal albatross from the main breeding colonies on Motuhara and Rangitatahi.

Northern royal albatross has been recorded as a bycatch species in New Zealand domestic fisheries. Richard *et al.* (2020) estimated that northern royal albatrosses are at risk of bycatch from both trawl and longline fisheries with up to 81 birds killed annually across all commercial fishing activity. Although this value is much lower than other albatross species like Salvin's albatross (*Thalassarche salvini*), the updated risk estimate almost tripled from a median of 0.013 (95% c.i.: 0.002–0.053) to 0.043 (95% c.i.: 0.012–0.163) in recent years (Richard *et al.* 2017).

In 2021, the Conservation Services Programme (CSP) agreed to support a proposal by Toroa Consulting Ltd and the island owners to set up a medium-term project to understand the population trend and breeding success of northern royal albatross from Motuhara. Additionally, a tracking study was proposed to evaluate the at-sea distribution of northern royal albatrosses in order to better understand the spatio-temporal overlap with fisheries activities.

Methods

Study Area

Two study plots, Tuamata and Māweke were established on Motuhara, a privately owned island for the medium-term demographic study. Both study plots were within the main northern royal albatross breeding area at the eastern end of the island. Each plot contained about 100 active nests in January 2021 (Bell 2021).

PTT tag deployment

A total of 30 TAV-2630 Platform Terminal Transmitters (PTT) from Telonics (Telonics Inc., Mesa, Arizona, USA) were deployed on breeding northern royal albatrosses from within the Taumata study plot. The aim was to track both partners from each pair. When some birds did not change over in time, additional birds from different pair were chosen for deployment while attempting to keep an even sex ratio. In total thirteen nests had both partners tracked and four nests had a single bird tracked (Table 1).

Table 1: Summary of nest and PTT devices attached to birds from each nest, Motuhara, January 2021.

Nest ID	Male	Female	Nest status on departure from Island
1	Yes	Yes	Chick
2	Yes	Yes	Egg
3	Yes	Yes	Chick
4	Yes	Yes	Chick
5	Yes	Yes	Egg
6	Yes	Yes	Chick
7	Yes	Yes	Chick
8	Yes	Yes	Chick
10	Yes		Egg
11		Yes	Failed
12	Yes	Yes	Egg
13	Yes	Yes	Chick
14	Yes		Failed
15	Yes	Yes	Chick
16	Yes	Yes	Egg
101	Yes	Yes	Chick
XR	Yes		Chick
Total	16	14	

PTTs were attached to a pre-cut baseplate made from plastic material used for roof guttering. First, the flat base plate was attached with Tesa tape to back feathers over the spine of the bird, in line with the leading edge of the wings. The device was then attached to the base plate with combination of cable ties, and a two-part epoxy glue.



Figure 1: TAV 2630 PTT attached to a breeding northern royal albatross, Motuhara, January 2021

The PTTs were programmed to maximise the operating lifespan of the devices. Each PTT was programmed to acquire locations twice everyday during their breeding period (January- September) and at least once a day September onwards. Because all tags were attached with a combination of tape, glue and cable ties to dorsal feathers, we expected the tags to be dropped off either through degradation of the attachment media, or through moulting of the feathers to which the device was attached. No GPS or PTT devices were retrieved.

Additionally, a pair of northern royal albatross known as the Royal Cam pair for 2021 (colour-band combinations LGL and LGK ; <https://www.doc.govt.nz/nature/native-animals/birds/birds-a-z/albatrosses/royal-albatross-toroa/royal-cam/meet-the-royal-family/#tiaki-2021>) from Taiaroa Head colony (near Dunedin) were fitted with Rainier-S20 solar-powered transmitting GPS tags (Wildlife Computers Inc., Redmond, Washington, USA) in April 2021. The Royal Cam chick Tiaki was subsequently fitted with a Rainier-S20 solar-powered transmitting GPS tag near to its fledging in September 2021.

Data preparation:

Raw PTT data was downloaded weekly from the ARGOS portal (<https://argos-system.cls.fr/>). Any PTT-derived location with ARGOS accuracy LC A, B, and Z were first discarded from the data set following Douglas et al 2012. Low-quality LC 0 locations were conditionally retained to fill in the temporal gaps in the data. We only retained LC 0 locations with semi-major axis error of less than 50 km in the dataset to avoid introduction of potentially aberrant locations. We then calculated the time difference between two retained consecutive locations for each bird. Low-quality LC 0 locations were removed if they were received within 12 hours of a high-quality location (LC 1, 2, or 3) to avoid dilution of the track quality. Speed between remaining locations were calculated and if consecutive bird locations were too far apart (having required over 50m/s of sustained flight speed to cover the distance between the locations) they were also discarded. Location data from tracked birds is available on the Department of Conservation's shiny app:

<https://docnewzealand.shinyapps.io/NorthernRoyals/>

Clean location data were mapped in ArcMap and overlaid with Exclusive Economic Zone (EEZ) and Regional Fisheries Management Organisations (RFMOs) layers. We only used the non-EEZ portions of the two key RFMO's: Western and Central Pacific Fisheries Commission (WCPFC) and Inter-American Tropical Tuna Commission (IATTC). Area of overlap between WCPFC and IATTC was considered as within IATTC only to avoid double reporting. We also separated the WCPFC in Western and Eastern parts by 180° longitude, which approximates areas west or east of the New Zealand EEZ, respectively. Clean locations were spatially joined to the final EEZ and RFMO to identify the area where each location was.

Results

Out of 30 breeding birds, 2 nests failed at the onset of deployment. Ten more nests failed early in the season. One male failed later in the season and one bird was assigned non-breeder status at the onset of its migration in mid-October as it supposedly finished rearing the chick successfully (Table 2).

Average length of tracks was 119.7 days (Min: 40; Max: 318; SD: 65.18). Twelve out of 30 transmitters stopped transmitting within 3 months of deployment (Table 2).

Table 2: Summary of tracks and breeding status from the location data from 30 TAV 2630 transmitters deployed on Northern Royal albatross in 2021 from Motuhara

PTT ID	Start date	End date	Sex	Status at tagging	Final status	Date failed	Length of track (days)
206304	27/01/2021	8/03/2021	Female	Breeder	Breeder		40
206305	20/01/2021	16/03/2021	Female	Breeder	Breeder		55
206306	27/01/2021	28/05/2021	Male	Breeder	Breeder		121
206307	22/01/2021	19/08/2021	Male	Breeder	Breeder		209
206308	29/01/2021	18/07/2021	Male	Breeder	Breeder		170
206309	29/01/2021	7/04/2021	Male	Breeder	Failed Breeder	11/03/2021	68
206310	20/01/2021	15/04/2021	Female	Breeder	Breeder		85
206311	29/01/2021	16/07/2021	Male	Breeder	Breeder		168
206312	29/01/2021	1/04/2021	Male	Breeder	Breeder		62
206313	21/01/2021	27/04/2021	Male	Breeder	Breeder		96
206314	23/01/2021	7/07/2021	Female	Breeder	Failed Breeder	3/02/2021	165
206315	20/01/2021	15/04/2021	Male	Breeder	Breeder		85
206316	22/01/2021	3/09/2021	Female	Breeder	Breeder		224
206317	22/01/2021	20/04/2021	Female	Breeder	Breeder		88
206318	29/01/2021	15/05/2021	Male	Breeder	Breeder		106
206319	20/01/2021	26/04/2021	Female	Breeder	Failed Breeder	16/03/2021	96
206320	20/01/2021	4/12/2021	Female	Breeder	Non Breeder	17/10/2021	318
206321	20/01/2021	19/05/2021	Male	Breeder	Failed Breeder	21/03/2021	119
206322	22/01/2021	19/03/2021	Female	Breeder	Breeder		56
206323	22/01/2021	11/04/2021	Male	Breeder	Failed Breeder	11/02/2021	79
206324	21/01/2021	12/05/2021	Female	Breeder	Failed Breeder	5/02/2021	111
206325	29/01/2021	6/10/2021	Male	Breeder	Failed Breeder	8/07/2021	250
206326	21/01/2021	6/05/2021	Female	Breeder	Failed Breeder	23/02/2021	105
206327	21/01/2021	16/05/2021	Male	Breeder	Failed Breeder	14/02/2021	115
206328	21/01/2021	1/08/2021	Female	Failed Breeder	Failed Breeder		192
206329	21/01/2021	19/03/2021	Female	Breeder	Breeder		57
206330	21/01/2021	5/03/2021	Female	Breeder	Breeder		43
206331	20/01/2021	16/05/2021	Female	Failed Breeder	Failed Breeder		116
206332	29/01/2021	5/06/2021	Male	Breeder	Failed Breeder	27/01/2021	127

206333	21/01/2021	27/03/2021	Female	Breeder	Failed Breeder	5/02/2021	65
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All birds migrated east to South America once they failed breeding or finished breeding (Fig. 2). Birds spent almost 100% of their time inside the NZ EEZ when breeding (Fig. 3). Once they failed or successfully finished rearing a chick, birds spent over 90% of the time outside EEZ, with majority of the time being in Chilean EEZ (57.79%) and Argentinian EEZ (18.84%) (Fig. 4).

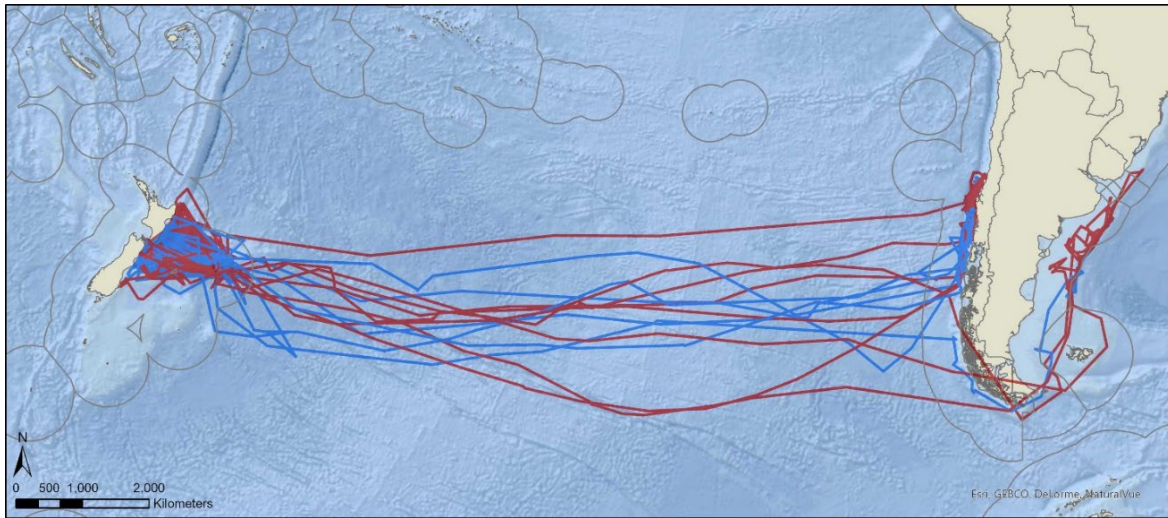


Figure 2: Tracks obtained from 30 northern royal albatross in 2021. Female birds are shown in red and male birds in blue.

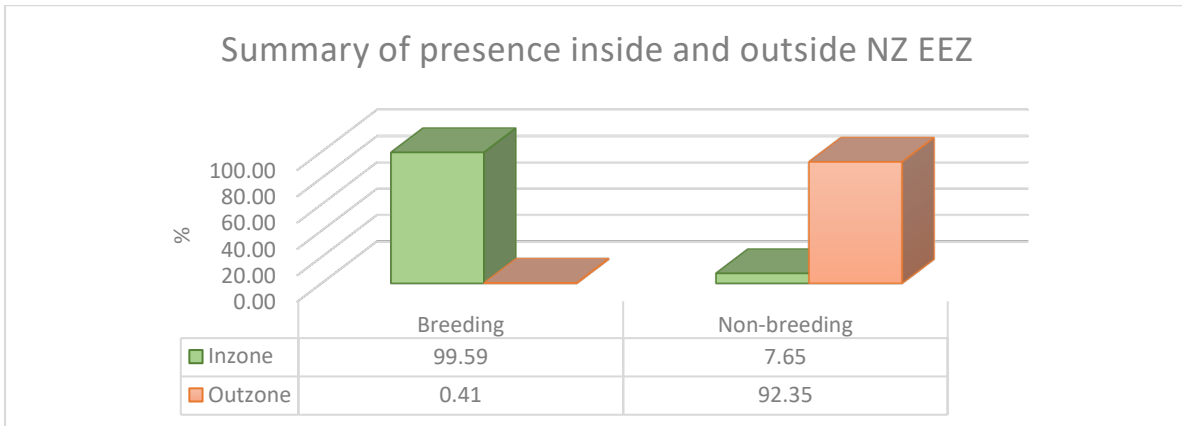


Figure 3: Distribution of bird occurrence (% total) inside and outside NZ EEZ as derived from the location data from the 30 from 30 TAV 2630 transmitters deployed on northern royal albatross in 2021 from Motuhara

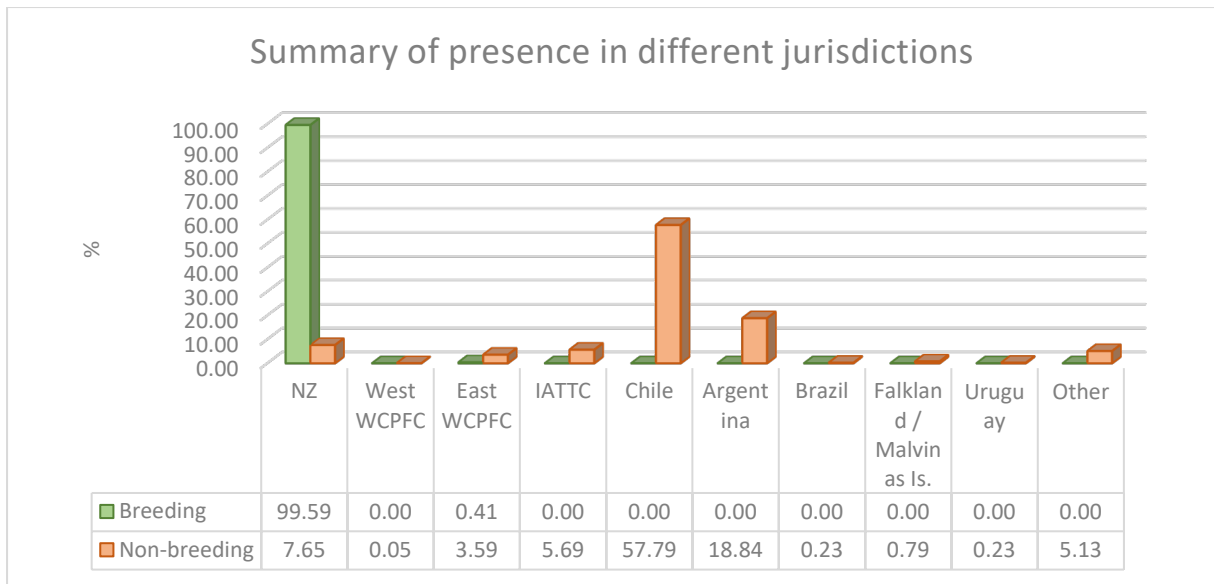


Figure 4: Distribution of bird occurrence (% total days) by Jurisdiction. RFMO areas are for high seas only. *IATTC includes the overlap area with WCPFC.

Discussion:

All the birds tracked from Motuhara colony were restricted to the east of New Zealand foraging along the east coast and Chatham Rise. Bird presence was also recorded from Cook Strait. Of all the birds tracked in 2021, only the male bird from Tairaroa Head (LGK) was recorded foraging on the west coast of New Zealand and in the Tasman Sea (Fig. 5).

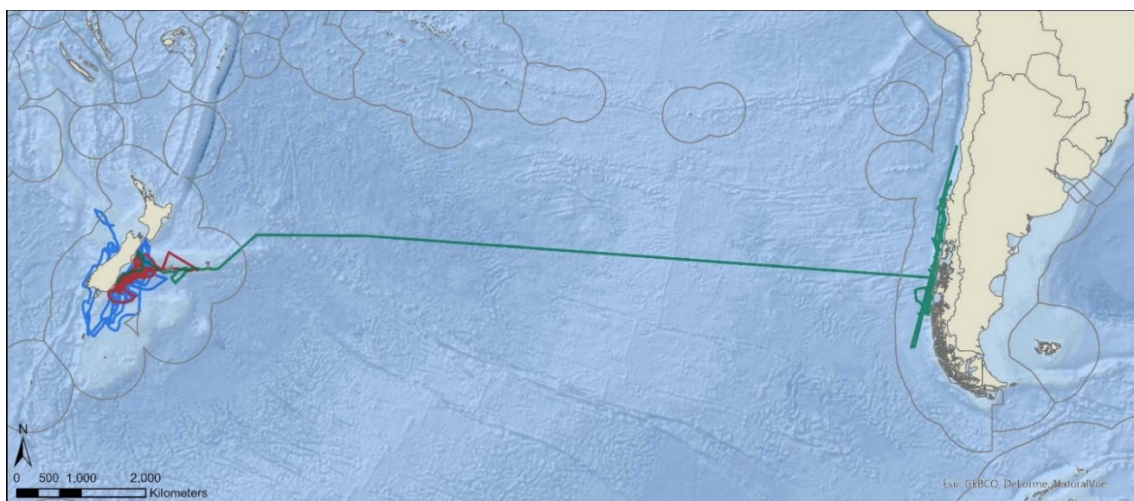


Figure 5: Tracks of northern royal albatross tracked from Tairaroa Head colony in 2021. Red is the female bird (LGL); blue the male bird (LGK) and green the royal cam chick for 2021, Tiaki.

Breeding birds were targeted for deployment, but two nests failed during hatching. Based on the tracking data, at least 5 nests failed in the early chick rearing period and one nest failed later in the season. Thus, tracking data shows a high level of nest failure with at least 8 of 17 nests (47.05 %)

failing in 2021. This figure could be higher as 12 transmitters stopped within 3 months of deployment.

The high rate of early tag failure was initially attributed to attachment technique and tag dislodgement. However, on a pelagic birding trip into Cook Strait, Phil Battley photographed one of the birds with a PTT attached to the back feather. The image clearly shows the absence of the aerial which would prevent data transmission (Fig. 6a). Similar loss of aerial and damage to the tag was also noticed from one of the solar GPS transmitters deployed on the female bird at the Taiaroa Head colony (Fig. 6b).

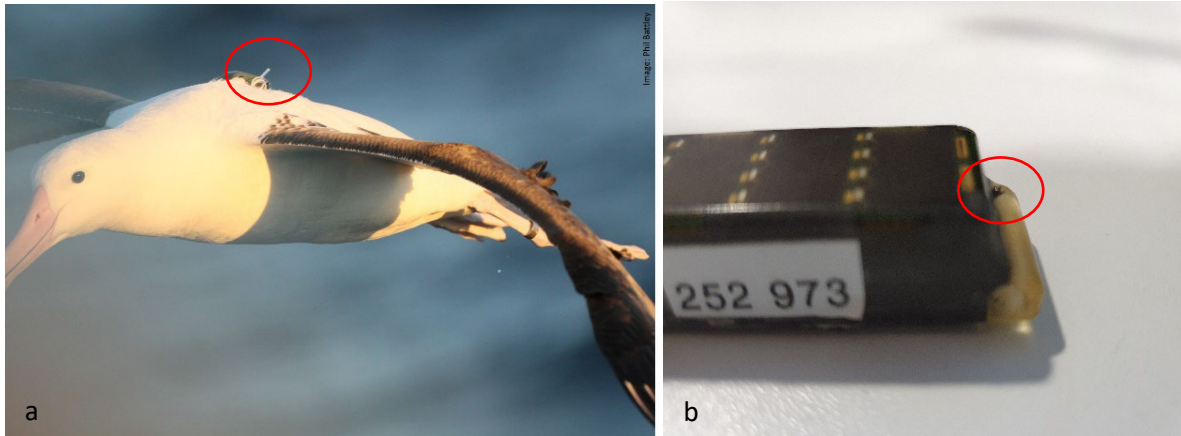


Figure 6: Missing aerials from the transmitters attached to adult breeding northern royal albatross. (a) Northern Royal Albatross photographed in Cook Strait with TAV 2630 PTT device on its back with aerial missing; (b) GPS transmitter Rainier s20 retrieved from LGL, the adult female bird from Taiaroa Head shows the aerial snapped off from the base.

This problem was unique to northern royal albatross as no damage to tags has been reported from tracking Antipodean and Gibson's albatross (*Diomedea antipodensis*) since 2019 using similar tags.

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