

Aerial Census of Northern Royal Albatross
(*Diomedea sanfordi*) fledglings on Rangitatahi
(The Sisters) and Motuhara (Forty-Fours), July 2017



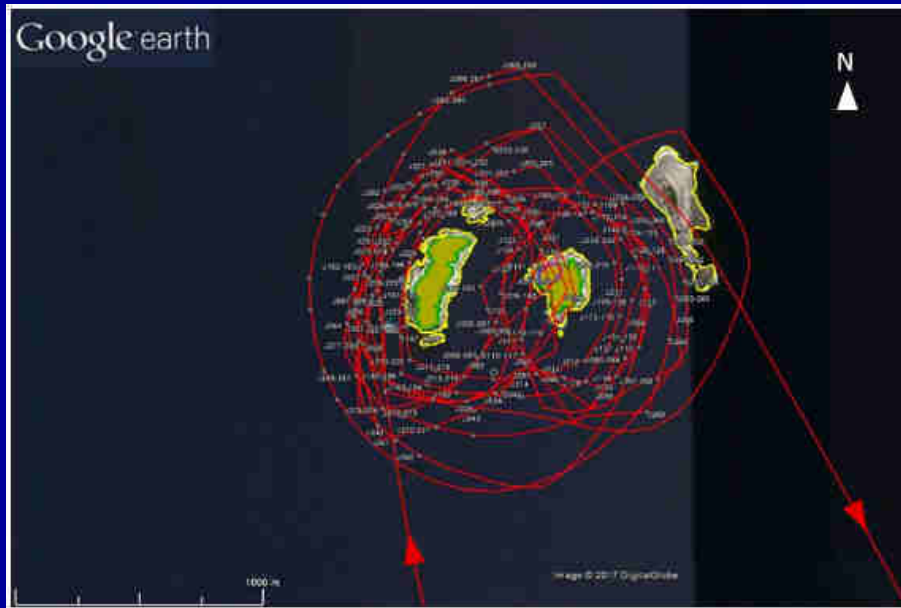
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Context

- Nov-Dec 2016: detail censuses undertaken of Northern Royal Albatross nesting on Rangitatahi (The Sisters) and Motuhara (Forty-Fours)
 - aerial photography, 23/11/2016: 4,406-4,772 annual breeding pairs (depending on correction factors used)
 - ground counts, 8/12/2017 (Motuhara only): 1404 annual breeding pairs
 - satellite-derived counts, 20/12/2017:
 - 2,578 pairs (Rangitatahi)—21% lower than raw aerial count
 - 2,533 pairs (Motuhara)—38% higher than raw aerial count
- Opportunity to census number of chicks later in season close to fledging
- Blanket photographic coverage of the islands obtained by DOC 27 July 2017 (total of 1,179 photographs)

Objectives

- Analyse the photographs from the islands to obtain complete counts of:
 - number of Northern Royal Albatross (NRA) chicks on each island (taking care to distinguish between large chicks and any accompanying adults)
 - number of Northern Giant Petrels (NGP, pre-breeding gatherings)
- Estimate NRA nesting success for 2016/17 breeding season
 - NRA breeds biennially, although early failed breeders in one year may try again the next year, so number of fledglings would represent the productivity of about 50% of the population



Rangituatahi (Big Sister)

6 circuits

Ave. speed (range): 148 km/hr (111-194)

Ave. altitude (range): 206 m asl (168-265)

320 photographs: 35-300 mm focal length

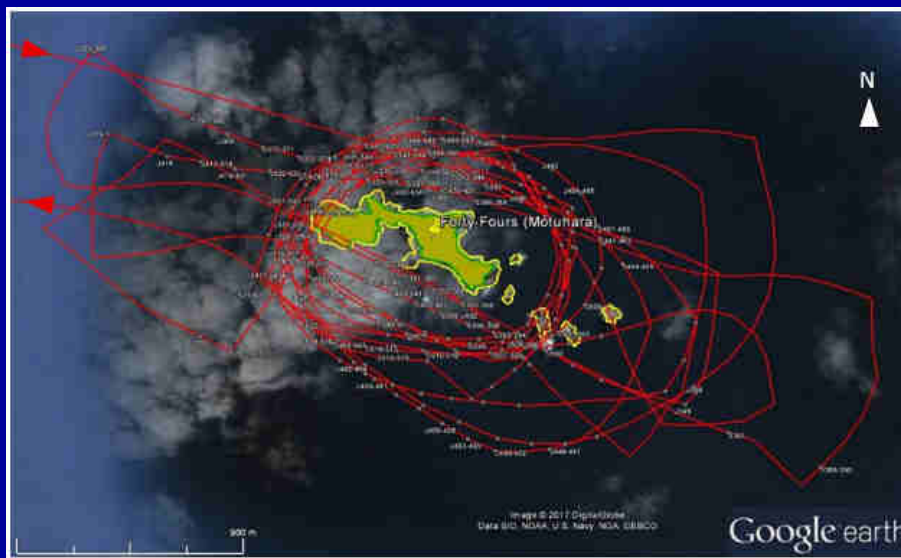
Te Awanui (Middle Sister)

4 circuits

Ave. speed (range): 158 km/hr (115-211)

Ave. altitude (range): 196 m asl (178-211)

209 photographs: 35-300 mm focal length



Motuhara (Forty-Fours)

14 circuits

Ave. speed (range): 152 km/hr (106-227)

Ave. altitude (range): 262 m asl (127-441)

650 photographs: 35-300 mm focal length

Image processing

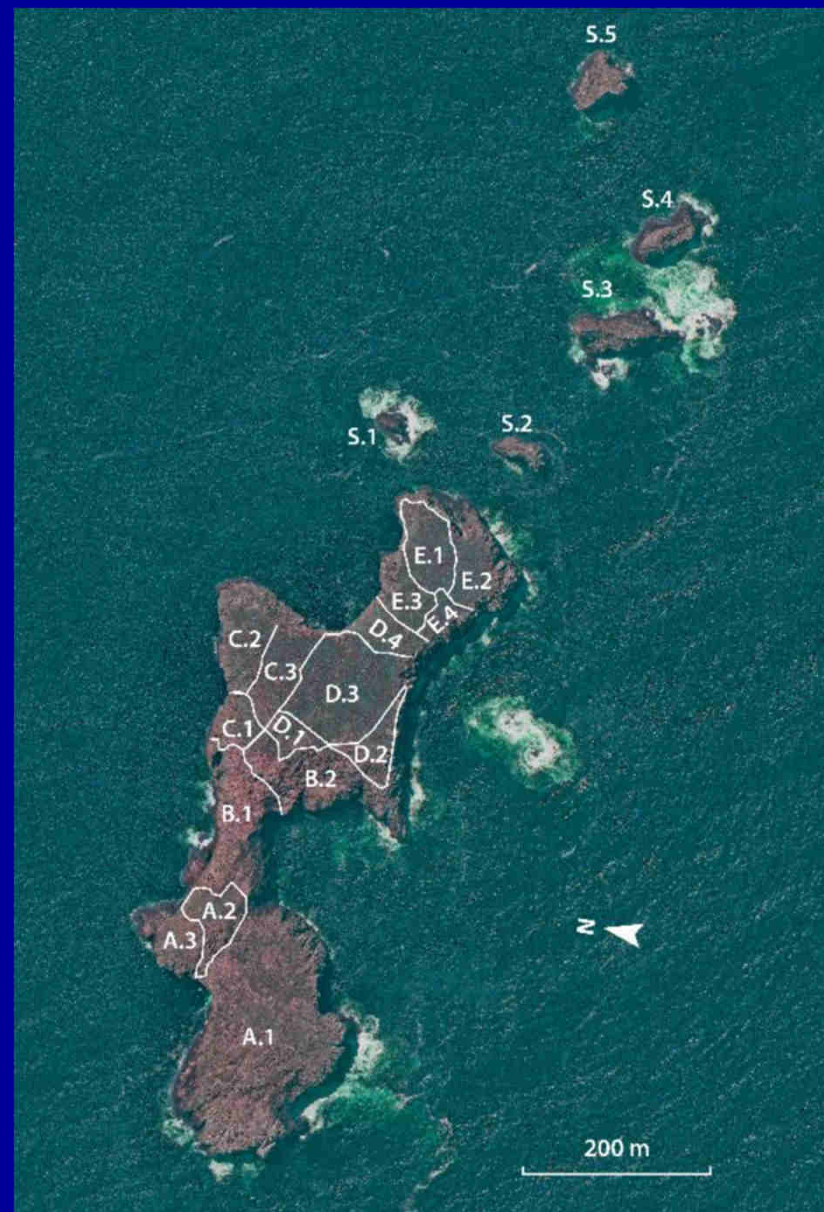


- Correct colour balance, contrast and sharpness, if possible, to bring out salient features
- Find features common to two or more overlapping photographs that can be used to define boundaries between contiguous census areas
- Demarcate the boundaries

Count zones on Rangitatahi



Count zones on Motuhara





Images were gridded digitally, making it easier to focus on one small area at a time; all birds seen were marked, with different colours denoting different species (NRA, NGP) and classes of birds (chicks, adults). The marks were then counted using the ImageJ counting tool.

Census results

Island	<u>Northern royal albatross</u>			<u>Northern Giant Petrel</u>
	Chick	Adult	Carcass	(all ages)
Rangitautahi/Big Sister	574	35	2	59
Te Awanui/Middle Sister	539	14	1	92
Motuhara/Forty-Fours	1,003	29	14	1,738
Total	2,116	78	17	1,889

- Number of NRA chicks on Motuhara higher than the average 315 chicks (range: 115-719) recorded there in August 1989–1993, but lower than the average 1,700 chicks (1,539-1,829) recorded in August 1973–1975
- Number of NGP adults difficult to interpret because of difficulty of surveying this species in comparable ways. The 1,235 NGP chicks counted on Motuhara in Dec. 2016 implies at least 2,470 breeding adults, so 1,738 birds counted in July 2017 suggests either considerable undercounting or not all birds yet present on breeding ground at start of the breeding season

Nesting success

(% of nests fledging a chick, assuming no further mortality to fledging*)

Island group	Nesting adults (Nov 2017)	Fledglings (July 2017)	Nesting success (%)
Rangitatahi	3,047	1,113	36.5
Motuhara	1,726	1,003	58.1

Why the difference?

* *chicks about 170-215 days old at end of July;
fledging expected at c.240 days of age*

Why is there an apparent difference in fledging success?

1. Shortage of nesting material on Rangitatahi ?

- Hard ground, no insulation or protection for eggs leading to cracking, overheating and desiccation of eggs?



Rangitautahi (Area G)



Motuhara (Area C)

- No direct evidence but egg breakage and desiccation of eggs and chicks in nests with little nest material or eggs laid on bare soil have been implicated in egg and chick mortality at Taiaroa Head

2. Differences in breeding cycle?

(Are Rangitatahi colonies ahead of those on Motuhara, and therefore have experienced chick mortality for longer ?



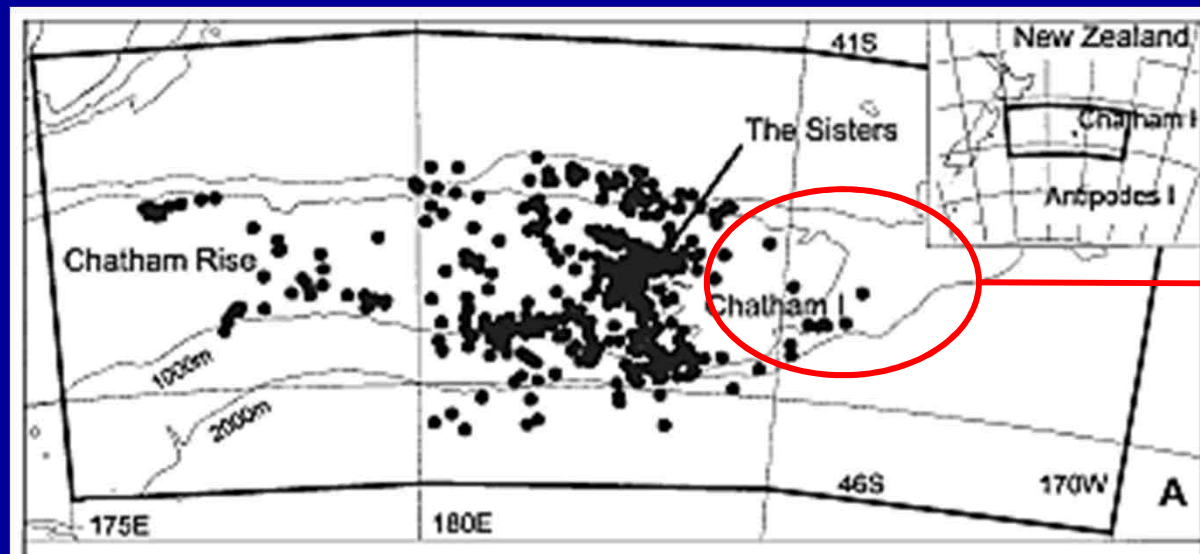
Island	Percent of chicks in size category			Number of chicks sampled	<i>Note: 7-10 close-up photographs analysed for each island</i>
	A. Downy	B. Feathered downy	C. Well-feathered		
Rangitautahi	4.0	16.2	79.8	371	$X^2 = 4.968,$ $p = 0.8339, \text{NS}$ $X^2 = 69.247,$ $p < 0.0001, \text{***}$
Te Awanui	2.3	12.0	85.7	391	
Motuhara	6.1	31.8	62.1	506	
Total	4.3	21.1	74.5	1268	

Significantly more ‘feathered downy’ chicks and fewer ‘well-feathered’ chicks than expected on Motuhara; fewer ‘feathered downy’ chicks than expected on Rangitatahi (X^2 with Bonferroni correction).

3. Were chicks on Motuhara developing more slowly than those on Rangitatahi?

(Implies differences in at-sea feeding areas with adults on Motuhara feeding in less productive waters)

- At-sea foraging of breeding adults on the two island groups poorly known
- NRA forage preferentially over continental shelf and upper shelf-break zones



Do birds from Motuhara forage here?

Distribution of first daily satellite-determined locations of four breeding Northern Royal Albatross nesting on Rangitatahi, February-March 1996 (Fig. 1 Nicholls *et al.* 2002. *Mar. Ecol. Prog. Ser.*, 231, 269-277)

Discussion

- Clear need for long-term monitoring of NRA (long-lived, slow reproducing species implies 'slow' population dynamics) linked to ongoing modelling to forecast population trajectories
- On-ground surveys constrained by expense and difficulties of access (but clearly not impossible)
- Aerial census of both nesting adults and late-stage fledglings most feasible option (produces numbers but not necessarily explanations)
 - Photographic techniques could be improved
 - pre-flight planning; optimise flight heights, speeds, photographic angles; less random photographs [target areas]
 - Permanent markers on the islands
 - form target areas for photography; would simplify demarcating count zones and allow comparison of counts over time

On-going work

- Counting Northern Royal Albatross and Northern Buller's Mollymawk on Dec. 2017 aerial photographs

Island	Apparently occupied sites (individuals, duos)		Ground counts (WMIL, 2018)	
	NRA	NBM	NRA	NBM
Rangatautahi/ Big Sister	1317	1542	1286	1598
Te Awanauai/ Middle Sister	813	442	806	488
Motuhara/ Forty-Fours	Underway	Plots (next slide)	—	—

- Results from intensive ground counts and counts made from aerial photographs are broadly comparable

Example of using sample plots for monitoring Northern Buller's Mollymawk

- Five 10 x 10 m NBM study plots laid out in 2007 (3 plots) and 2009 (2 plots) (Fraser *et al.* 2010. Final Report PRO2006-01D, NIWA)
- Most corner markers still just visible 2017; delineated and counted



Plot	2007	2008	2009	2017
1	47	43	39	55
2	54	42	44	55
3	52	43	37	60
4	—	44	41	57
5	—	48	42	70

- Apparent increases: are they real (i.e. are counts accurate; = overall population increase), or do they reflect shifts in the locations of nesting birds, or are delineations and counts inaccurate?