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# Gibson's albatross at Disappointment Island—analysis of aerial photographs

**Report prepared for**

**Department of Conservation**

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**May 2014**

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## 1. Introduction

Gibson's albatross (*Diomedea antipodensis gibsoni*) is a biennial-breeding albatross endemic to the New Zealand sub-Antarctic Auckland Islands. The total breeding population of *D. a. gibsoni* was estimated at approximately 9,682 pairs in 2006-09, with an average of 3,277 pairs breeding annually on the Auckland Islands over the four seasons (G. Elliott & K. Walker unpublished data, cited in ACAP 2009). Francis et al (2012) estimated a population size of 3,159 breeding pairs in 2011, following a decline in the early 2000s. Most of the population breeds on Adams Island (92%), with the remaining birds occurring on Disappointment Island (7%) and the southern parts of the main Auckland Island (1%) (ACAP 2009).

The Adams Island population has been relatively well studied since a long-term monitoring programme commenced in 1991 (Walker & Elliott 1999; Elliot & Walker 2013) which has gathered information on demographics and population size. In contrast, the Disappointment Island population is poorly known as the island has only been visited on a few occasions because of access restrictions. Occupied nests on Disappointment Island were counted in 1993 (Walker & Elliott 1999) although the count was not reported. ACAP (2009) report that the island was last surveyed in 1997 when the population was estimated at 352. Logistic and access restrictions mean that ground counts are not feasible at present, so in January 2014 we investigated the potential for aerial photography to estimate population size for this species, looking to extend work we commenced in 2013 with southern royal albatross (*Diomedea epomophora*) on Enderby Island (Baker and Jensz 2013). Until then, aerial censusing had only rarely been attempted for the great albatrosses (*Diomedea* spp.) because most of these species are not highly colonial and typically nests are widely dispersed. Large distances between nests that are placed in essentially featureless topography pose challenges that may not be easily addressed through existing techniques, and their effectiveness needs to be tested for these more dispersed species.

## 2. Methods

*The Site*

The Auckland Islands (50$^{o}$ 44'S, 166$^{o}$ 06'E) lie 460 km south of New Zealand's South Island, and comprise the largest island group in the New Zealand sub Antarctic. The archipelago consists of four larger islands (Auckland, Enderby, Adams and Disappointment Islands, together with a set of smaller islands (Peat 2006). Within the archipelago, Gibson's albatross breed mainly on Adams Island, with smaller numbers of birds occurring on the main Auckland Island and Disappointment Island, located to the west of the main Auckland Island (Tickell 2000). Disappointment Is. is 4 km long by up to 1 km wide, and is covered in *Poa* grassland and giant herbs, with scattered areas of shrubland and fellfield around the top of the island (Peat 2006). The island rises steeply from the sea to a plateau, with Gibson's albatrosses breeding on the plateau but avoiding the slopes.

*Field Work*

In January 2014 we chartered a helicopter from Southern Lakes Helicopters Company to conduct a return flight to the Auckland Islands group. The aircraft, a single-engined Squirrel AS350B3, was piloted by Mark Deaker (Southern Lakes Helicopters Company). On board was Barry Baker (photographer and project coordinator), a back-up photographer, a flight logistics manager and a Department of Conservation representative.

We undertook a photographic survey of Gibson's albatross on Disappointment Island on 20 January 2014, after first conducting a survey of nesting white-capped albatross, *Thalassarche steadi*, on the same island. Most eggs are laid by Gibson's albatross between 26 December and 25 January (Walker and Elliott 1999) so the flight coincided with the late egg-laying/early incubation period of the breeding cycle. At this time it was anticipated that most birds that attempted to breed would be attending active nests.

At the time of the 20 January 2014 flight the weather around the Auckland Islands was overcast, with winds gusting to 40 knots, and a cloud base of 1500 metres. We were able to obtain clear photographs of all nesting birds during two photographic circuits of the island. Photography was timed to occur between 1100 to 1600 NZDT as information from other albatross species indicates that during the early incubation period the ratio of incubating to loafing birds is high as most loafers are at sea during the middle of the day.

In January 2014 we left Enderby Island (Auckland Islands) at c.1300 NZDT with the door on the port side of the helicopter removed, and approached Disappointment Island at c.1310 NZDT. We commenced photographing Gibson's albatrosses at 1354 NZDT, and conducted two circuits of the island to provide the images that were used to count the breeding birds on the island. The survey of Disappointment Island was completed by c.1405 NZDT.

For the photography, two photographers were positioned on the port side of the aircraft to permit each to take photographs of the island simultaneously. All photographs were taken through the open port side of the aircraft using Nikon D800 digital cameras and image-stabilised Nikkor 70— 200 mm F2.8 zoom lens. Shutter speeds were set at 1/1000 s or faster to minimise camera shake, and the focal length of the zoom lens was not adjusted within each pass sequence over the island. From the circuits of the island we produced a complete series of overlapping images that covered the entire area of the island plateau where albatrosses were nesting. The two photographers took approximately 400 digital photographs each during the survey flight. All photographs of the colony were saved as fine JPG format files. The survey photographs of Disappointment Island were taken at an altitude of about 500 metres. Most photographs were taken with the zoom lens set at a focal length of either 70 mm or 135 mm. The entire sets of photographs were subsequently replicated to ensure that four complete back-up sets existed both on portable hard drives and in at least three different locations. A full collection of photographs will also be submitted to the Department of Conservation on the completion of the contract.

*Counting protocol*

We used protocols previously developed for aerial censuses of Chilean albatross colonies (Arata et al, 2003; Robertson et al. 2007) and refined in our survey of other albatross species in the Auckland Islands over the last 8 years (e.g. Baker et al 2014, Baker and Jensz 2013). Briefly, 12 photographic montages of Disappointment Island (Figures 1) were constructed from overlapping photographs using the image editing software package ADOBE PHOTOSHOP (http://www.adobe.com/). Photomontages were made only of the upper slopes and plateau habitats of Disappointment Island as this was the habitat preferred by Gibson's albatross (Mike Double unpublished). Counts of all white-capped albatrosses on each montage were then made by magnifying the image to view birds and using the paintbrush tool in PHOTOSHOP to mark each bird with a coloured circle or square box as they were counted. To assist with counting we used MOUSECOUNT software (http://www.kittyfeet.com/mousecount.htm) and a hand held click counter, as appropriate. Once all birds had been counted on a photo-montage, the file was saved to provide an archival record of the count. Each single bird was assumed to represent a breeding pair. While most birds were alone at nest sites, we also counted instances when two birds were sitting close together (i.e. inside the pecking distance that defines the minimum distance between nests) and assumed to both be members of a nesting pair. In this situation, both birds were counted, and the number of pairs recorded. The number of pairs was subsequently deducted from the total number of birds to derive an estimate of annual breeding pairs.

Counts of photo montages were undertaken by one observer only. Previously we have undertaken multiple counts of photomontages for other species (e.g. white-capped albatross, Baker et al. 2014) to estimate counter variability associated with miscounting and misidentifying white spots on the ground as birds. These count data were statistically modelled by Poisson regression, a special case of a Generalised Linear Model (McCullagh and Nelder, 1989), with observer and area as fixed effects. After allowing for both mean observer and mean area differences, there was no evidence to suggest that our model and data were incompatible, based upon regression diagnostics and model checking. There was also no evidence of a difference between observers and hence an observer bias. We have no reason to believe that data collected subsequently should have different distributional properties to our data for other species and so we assume the current data are also compatible with a Poisson model. Thus we present raw counts only and assume the standard deviation is estimated as the square root of the count, a property of the Poisson model.

## 3. Results

We counted a total of 463 birds on the photomontages, some of which were clearly associated with a nest, some of which were clearly non-breeding birds, and others where breeding status was uncertain. Eleven birds was assessed as being the partner of an incubating bird, and consequently we estimate there were 452 potential pairs of Gibson's albatross breeding on Disappointment Island in January 2014 (Table 1). We were uncertain of the identity of a further two birds, which appeared too small to be Gibson's albatross. Further analysis of the photographs will be undertaken before this report is finalised to provide a minimum estimate of the number of birds that were clearly breeding at the time of the census. In addition, we will use the proportion of nesting:non-breeding birds for birds where breeding status is clear to estimate the number of annual breeding pairs in 2014.

Contrary to what we believed was the case before commencing this project, not all birds were found nesting on the plateau. Birds showed a preference for nesting along ridgelines and in Area 12 this ridgeline extended well below the top plateau of the island, to the extent that these birds were missed in the 'Gibson's photographs' . Counts for this area were taken from the series of photos taken on the same day to estimate white-capped albatross population size (Baker et al. 2014). The areas of the plateau and ridgelines of Disappointment Island where Gibson's albatross were found to be nesting are shown on Figure 2.

## 4. Discussion

Stitching of the images and relating photomontages to one another proved more time-consuming than has been experienced with other nesting albatross species. In particular, trying to determine cut-off points along ridgelines when two photomontages depicted the same ridge but from different sides was difficult and required painstaking work to ensure birds weren't double counted. Nonetheless, we are confident that few birds, if any, were missed when photos were analysed.

We had planned to investigate the use of photographic transects, similar to how we surveyed southern royal albatross on Enderby Island in 2013 (Baker and Jensz 2013) but did not have sufficient time to do so because of weather and time constraints. If carrying out a photographic census of Disappointment Island again, we would trial this technique because it is likely to be easier for photo analysis. We suggest that photography should initially consider the use of transects running East-West at 200 m centres, and a 35 mm lens on a full-frame digital camera, with photographs taken at an elevation of 600 ft above the island plateau. Photography of Area 12 may best be achieved by using the technique we trialled in 2014 and not using the transect approach because the nesting area is generally well below the height of the island plateau.

Determining appropriate transect width and camera/lens combinations requires a trade-off between keeping the number of photo files to a manageable level while ensuring photo detail is sufficient for the purpose in mind. If greater definition of birds on the ground is required to improve estimation of breeding status we could trial 100 m transects and a larger focal-length lens sufficient to provide 10% overlap between each transect. This would substantially increase the number of photographs required to document an area, leading to increased flight times and subsequent data analysis costs. Alternatively, combining wider transects with the use of larger focal length lenses to provide close-up photographs of a sample of the birds on the ground could be considered, as is currently done with white-capped albatross photo-counts on Disappointment Island (Baker et al 2014).

## 5. Acknowledgements

This project was funded by the Department of Conservation. The support of Igor Debski of DOC during the development of the project was greatly appreciated. We thank Louise Chilvers for assistance during the flight and Mark Holdsworth for photographic support. Southern Lakes Helicopters and pilot Mark Deaker provided an excellent photographic platform for the study.

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**Table 1: Counts of Gibson's albatross on Disappointment Island in January 2014**

| Image | Birds | Pairs | Breeding pairs | Possible bird |
|---|---|---|---|---|
| 1 | 32 | 1 | 31 | |
| 2 | 29 | | 29 | |
| 3 | 80 | 3 | 77 | 1 |
| 4 | 52 | | 52 | |
| 5 | 19 | | 29 | |
| 6 | 46 | 1 | 45 | 1 |
| 7 | 28 | 1 | 27 | |
| 8 | 25 | | 25 | |
| 9 | 63 | 2 | 61 | |
| 10 | 10 | | 10 | |
| 11 | 54 | 3 | 51 | |
| 12 | 25 | | 25 | |
| **Total** | **463** | **11** | **452** | **2** |

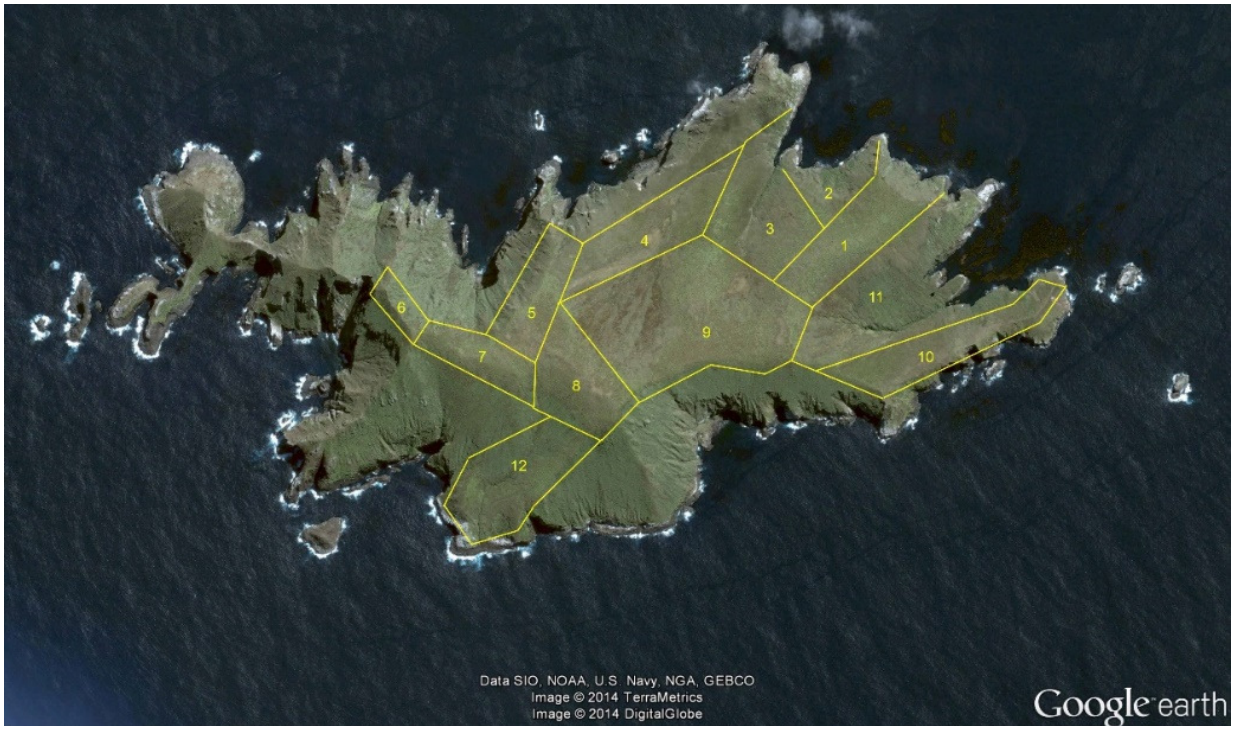


Figure 1. Boundary of photographic montages 1 to 12, Disappointment Island

Figure 2. Areas of the plateau and ridgelines of Disappointment Island where Gibson's albatross were found to be nesting (green shading).

Figure 3. Gibson's albatross nesting birds (left panel) with an extreme crop (right panel). Note how nest is clearly visible

Figure 4. Gibson's albatross non-breeding birds (left panel) with an extreme crop (right panel). Note how nest is not visible, and feet of standing bird can be easily seen.