Albatross Research

Gibson’s wandering albatross at Adams Island – population study

Report prepared for

Department of Conservation

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July 2014

1. INTRODUCTION

Gibson's wandering albatrosses (*Diomedea gibsoni*) are endemic to the Auckland Island archipelago, with approximately 95% of the population breeding on Adams Island, the southern-most island in the group. They forage largely in the Tasman Sea, but also along the continental shelf off southern and south eastern Australia, and off eastern New Zealand (Walker & Elliott 2006). The population has been in decline, and is listed as 'Nationally Critical' in the Department of Conservation's threat ranking (Robertson et al. 2012).

There are small numbers annually bycaught in New Zealand commercial fisheries, particularly in surface longline fisheries (Abraham & Thompson 2012). In 2012 it was estimated that from 1998-99 to 2008-09 in the New Zealand fisheries alone, between 35 and 65 Gibson's wandering albatrosses per year were caught (Francis et al. 2012), a significant number for such a long-lived, slow-breeding species. Of the 51 birds caught during this period which were autopsied, all but one were adults and there was an even sex ratio, although it's not known whether the autopsied birds were representative of the bycatch (Francis et al. 2012). Additionally, there are substantial unobserved long-line fleets in international waters in the mid Tasman Sea and the SW Pacific Ocean (Francis et al. 2012) where the birds regularly forage (Walker & Elliott 2006).

Due to the vulnerability of this species, their survival, productivity, recruitment and population trends have been monitored during almost annual visits to Adams Island since 1991. In the 1990's the population slowly increased following a major, presumably fisheries-induced, decline during the 1980's (Walker & Elliott 1999). However, between 2005 and 2008 there was a sudden drop of more than 40% in the size of the breeding population, from which recovery has been very slow. The Gibson's wandering albatross population is now only about two-thirds of its estimated size in 2004, having lost all the gains slowly made through the 1990's.

With ongoing fisheries bycatch of a species in marked decline, further information was sought on the adult survival and population trends of Gibson's wandering albatrosses in 2013/14. This report summarises the most recent findings on the current status of Gibson's wandering albatrosses, collected during the 2013/14 summer and is the second in a series of similar annual reports (Elliott & Walker 2013).

2. OBJECTIVES

The specific objectives of this project were:

1. To estimate the population size and trend of Gibson's albatross at the Auckland Islands; and
2. To estimate the adult survival of Gibson's albatross at the Auckland Islands.

3. METHODS

Population size and trend is estimated using two methods: counting nests in a portion of the island, and from mark-recapture of banded birds in a study area.

Survival is estimated from mark-recapture of banded birds in the study area.

Counting nests

Since 1998, all the nests in three areas (Figure 1) have been counted each year. The three areas support about 25% of the Adams Island albatross breeding population and represent high (Fly Square), medium (Astrolabe to Amherst including the mark-recapture study area) and low (Rhys's Ridge) density nesting habitat.

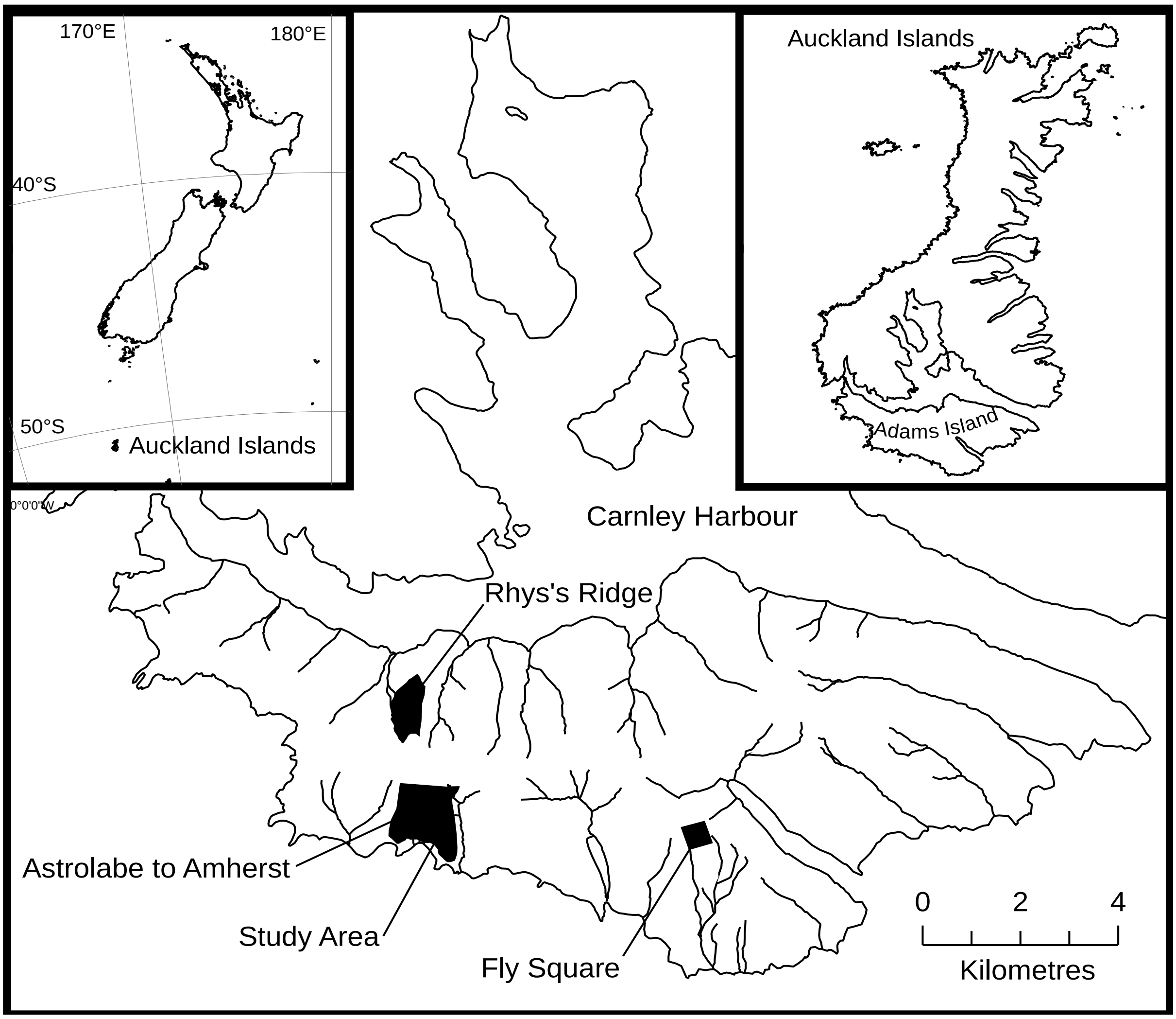

Figure 1: Adams Island, showing the Study Area (black) and the three larger areas in which annual counts of breeders have been made (shaded): Amherst to Astrolabe (162 ha, including the Study Area); Rhys's Ridge (67 ha); and Fly Square (25 ha).

Counts are carried out just after the completion of laying. A strip search method is used where two observers walk back and forth across the area to be counted about 25m apart and count all the nests with eggs in their strip. Up until 2003 the edge of strips was marked with spray paint but since 2004 the boundaries of strips are presented on maps on GPS devices. Every nest with an egg is marked with spray paint and all birds on nests are checked for bands. Most birds on the ground without nests are also checked for bands. The location of all banded birds is recorded, along with a Gibson Plumage Score (Gibson 1967). Once the whole block has been counted, the accuracy of the census is checked by walking straight transects at right angles to the strips, checking all nests within 10-15 m of the transect for paint marks indicating the nest has been counted.

Mark-recapture study

Each year since 1991 a 61ha study area on Adams Island (Figure 1) has been visited repeatedly to band nesting birds and record the band numbers of already banded birds. All birds found nesting within the study area have been banded with numbered metal bands and since 1997 with large, individually numbered brightly coloured plastic bands. Since 1994, every cohort of chicks produced within the study area have been metal-banded, and from 1996 colour-banded, just before they fledged.

In addition, areas within a kilometre of the study area are visited less frequently and any bands seen on nesting or non-nesting birds are recorded.

Survival of birds in the study area is estimated with maximum likelihood mark-recapture statistical methods using the statistical software M-Surge (Choquet *et al.* 2005). For the models used in M-Surge, adult birds are categorised by sex and by breeding status: non-breeders, successful breeders, failed breeders and sabbatical birds taking a year off after a successful breeding attempt. Birds in each of these classes have very different probabilities of being seen on the island but similar survival rates, so the models estimate re-sighting probabilities separately for each class, but survival is estimated separately for only males and females.

Population size is estimated by multiplying the actual counts of birds in each class by its estimated re-sighting probability. The survival estimates assume no emigration which is appropriate because wandering albatrosses have strong nest site fidelity, a pair's separate nesting attempts are rarely more than a few hundred metres apart, and birds nesting at new sites within a few hundred metres of the study area are detected during the census of surrounding country (Walker & Elliott 2005).

Changes in the at-sea distribution of Gibson's wandering albatrosses

Since 2009 we have been attaching and retrieving geolocator dataloggers to Gibson's wandering albatrosses to compare the foraging locations when the population was declining from its 2004 highpoint, with those used a decade earlier when it was growing. So far dataloggers have been attached to and retrieved from 57 birds.

Locations of the birds were calculated from the light data using BASTRak, TransEdit and BirdTracker software supplied by British Antarctic Survey (Fox 2007). More "reasonable" flight paths were obtained when we used estimated longitude from the logger's light data, and estimated latitude by matching the sea temperature data recorded by the logger with the nearest sea-surface temperature at the estimated longitude. We used monthly sea-surface temperature data available from http://dss.ucar.edu.

We used kernel density plots to compare tracking data collected using geolocator loggers between 2009 and 2014 with data obtained from satellite transmitters between 1994 and 2003. Kernels were estimated using the function kde2d in the MASS package (Venables & Ripley, 2002) in the statistical language R (R Development Core Team, 2011). We used bivariate normal kernels, with a normal reference bandwidth (Venables & Ripley, 2002). Longitudes were transformed by the cosine of latitude to make units of latitude and longitude approximately equal.

4. RESULTS

Nest counts

The three blocks in which nests have been counted since 1998 were counted again in late January or early February 2014. While still comparatively low relative to the size of the population a decade ago, the number of nests in the three blocks is clearly slowly increasing (Table 1, Figure 2).

Table 1: The number of Gibson's wandering albatross nests in late January in three census blocks on Adams Island in the Auckland Islands group in 1998-2014.

Year	Rhys's Ridge (low density)	Amherst-Astrolabe (medium density)	Fly Square (high density)	Total number of nests
1998	60	483	248	781
1999	60	446	237	743
2000	45	284	159	488
2001	64	410	201	675
2002	60	408	246	675
2003	71	496	217	784
2004	77	501	284	862
2005	34	323	72	412
2006	15	185	79	279
2007	38	230	132	400
2008	26	201	91	318
2009	28	238	120	386
2010	32	237	114	383
2011	33	255	137	425
2012	35	224	120	379
2013	39	315	138	492
2014	29	267	134	430

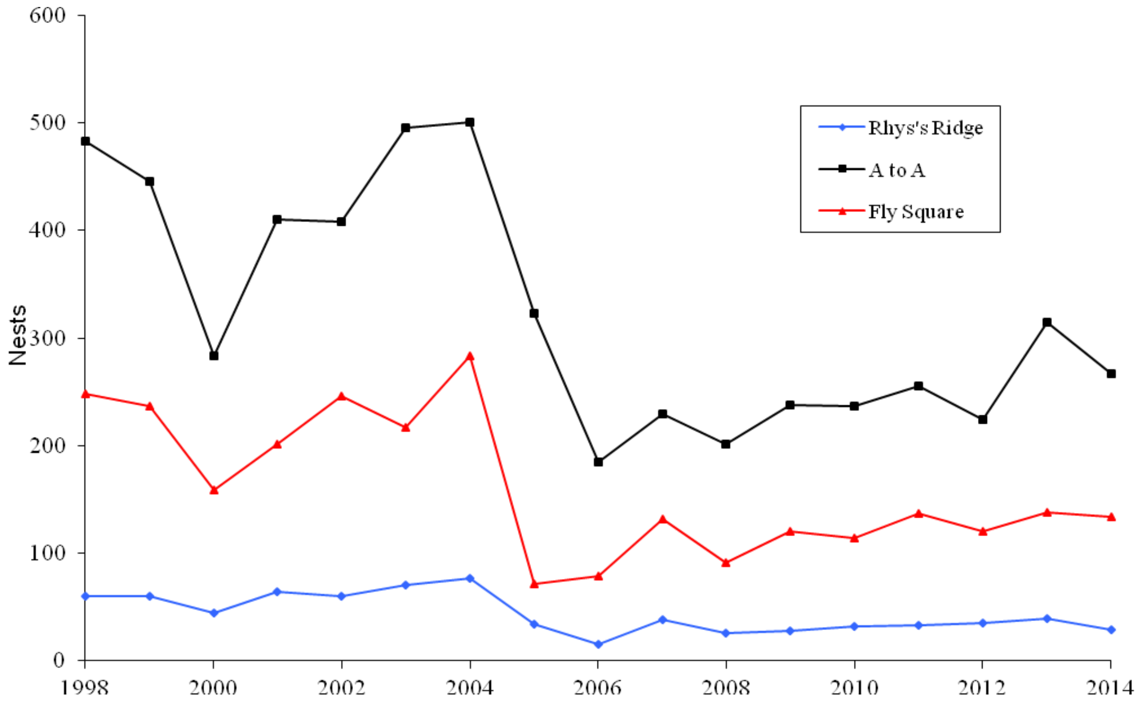

Figure 2. The number of Gibson's wandering albatross nests in late January in three census blocks on Adams Island 1998- 2014.

Total number of nests on the island

From the ratio between the number of nests in our census blocks and the total number of nests counted in all blocks on the Auckland Islands in 1997 (Walker & Elliott, 1999) we can estimate the total number of pairs each year which bred on the Auckland Islands. This does not represent the size of the whole breeding population since successful breeding birds do not breed every year. There were approximately 4,340 pairs nesting in 2014, nearly as many as in 1991, but only 50% of the peak population recorded in 2004 (Table 2).

Table 2: Estimated number of pairs of Gibson's wandering albatross nesting on the Auckland Islands. Estimates are derived from the numbers of nests counted in 3 representative census blocks and the proportion of the total number of nests that were counted in these blocks in 1997.

Year	1991	1993	1994	1995	1997	1998	1999	2000	2001	2002	2003
Pairs	4964	5270	4826	6678	7417	7883	7499	4926	6813	6813	7913

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Pairs	8701	4158	2816	4037	3210	3896	3866	4290	3825	4966	4340

Population size estimate from mark/recapture

The number of breeding birds in the study area estimated by mark-recapture was increasing up until 2004, but between 2004 and 2006 the number of breeding females decreased by about 45% with a smaller decrease amongst males. Since 2006, a major disparity in the number of adult males and females alive has gradually narrowed, as the size of the female breeding population remained low but approximately stable, while the size of the male breeding population slowly declined (Figure 3).

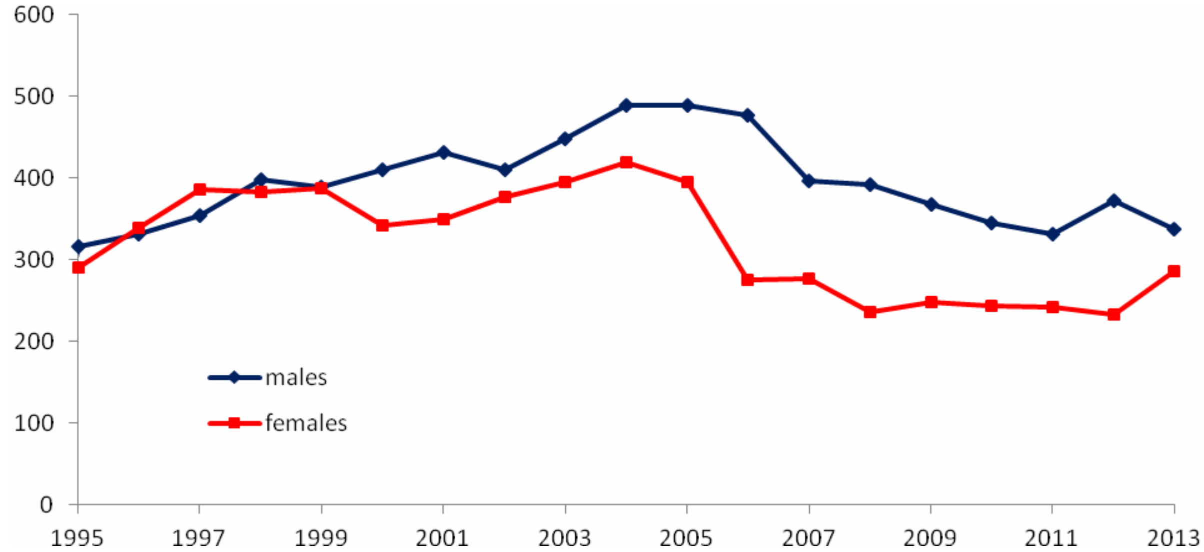

Figure 3. The number of breeding birds in the study area on Adams Island estimated by mark-recapture.

Using the modelling techniques of Francis *et al.* (2012) it is possible to estimate the size of the total population including pre-breeding birds (as opposed to the total number of breeders) but this is beyond the scope of this report.

Survivorship

Data gathered over the 2013/14 summer allowed survival during 2013 to be estimated but since the survival estimates for the last two years for biennially breeding birds invariably have very large confidence intervals, we present results only up to 2012 (Figure 4).

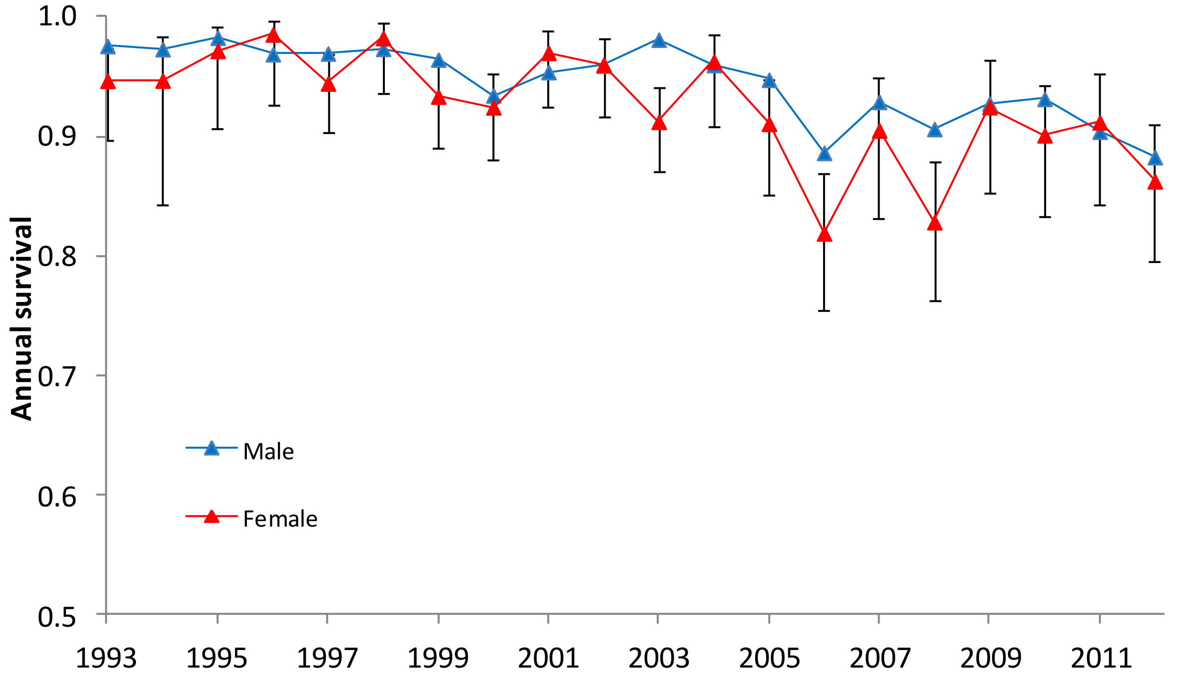

Figure 4. The annual survival of birds in the study area on Adams Island estimated by mark-recapture, with 95% confidence intervals only shown on the females for graph clarity.

Recruitment

The number of birds breeding for the first time in the Study Area (Figure 5) has been variable, but dropped significantly in 2005 and 2006, slowly increased until 2013, then declined again in 2014.

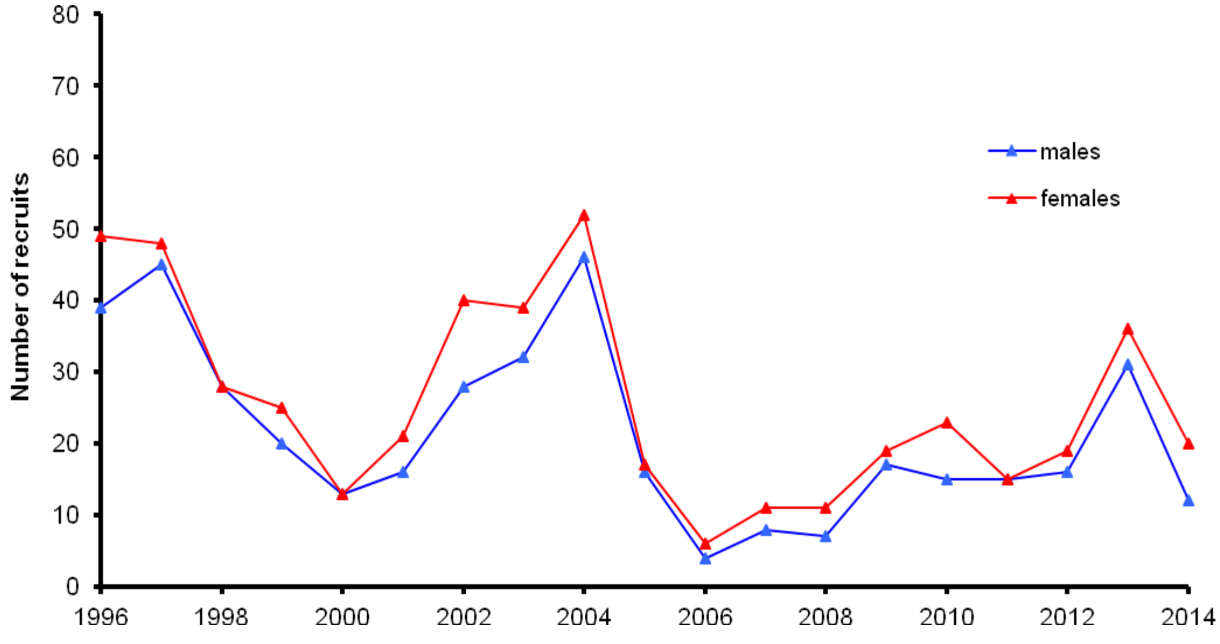

Figure 5: Number of Gibson's wandering albatrosses breeding in the study area on Adams Island for the first time for each year since 1996.

Nesting success and productivity

Nesting success in 2013 was 50%, with 76 chicks fledging. This represents a continued improvement over the 24%-25% nesting success rates of 2006-2009. While nesting success is approaching levels last seen before 2005, the number of chicks produced remains lower than it used to be because of the smaller numbers of pairs attempting to breed (Figure 6).

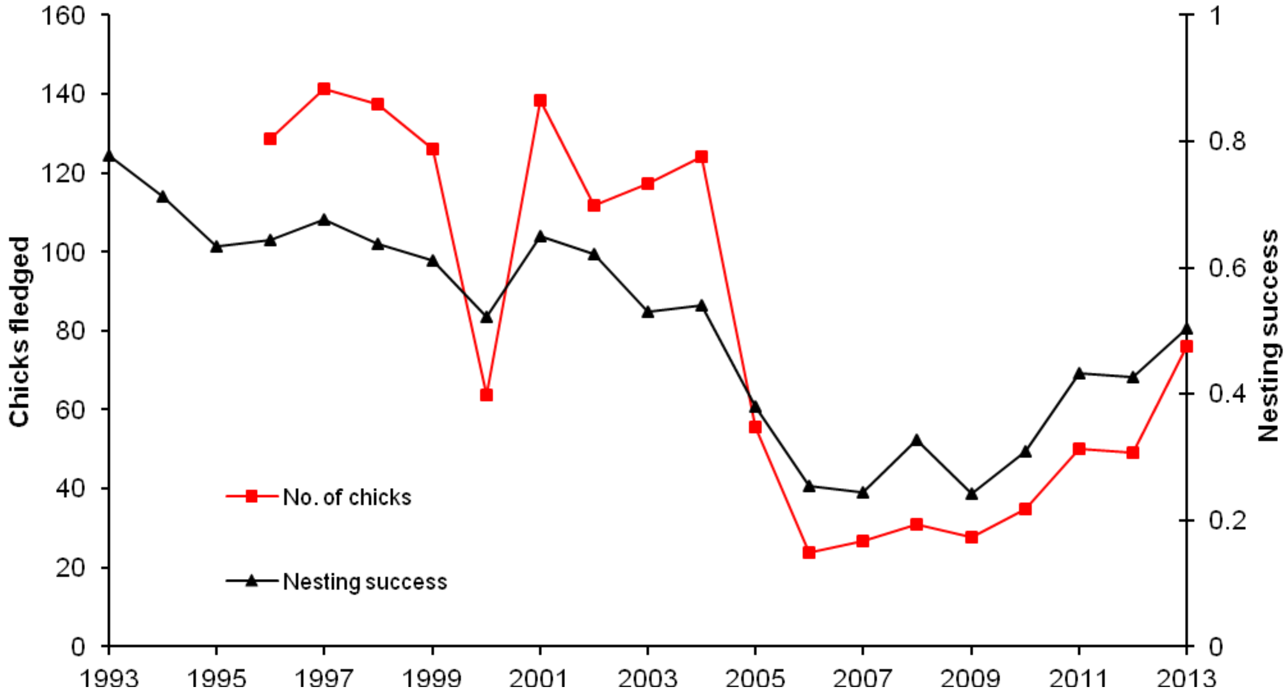

Figure 6: Nesting success and the number of chicks fledged from the study area on Adams Island

Changes in the at-sea distribution of Gibson's wandering albatrosses

We retrieved geolocator dataloggers (GLS) and data from 9 birds during the summer of 2013-14; eight GLS had been on birds for 1 year, and one had been on for two years. So far we have successfully tracked 57 birds using geolocator dataloggers and we have 69 bird-years of tracking data from birds at all stages of their breeding cycle (Table 3).

Table 3: Numbers of Gibson's wandering albatrosses at different life history stages tracked using geolocator dataloggers deployed on Adams Island since 2009. The data is in bird-years as some birds were tracked for two years.

Sex	Failed breeders	Non-breeders	Breeders	Sabbatical	Total
Females	12	16	5	4	37
Males	5	22	3	2	32

We have undertaken a preliminary analysis of the logger tracking data between 2009 and 2014 and compared it with the satellite tracking data we obtained from 46 birds tracked between 1994 and 2003 (Walker & Elliott 2006). The additional nine geolocators retrieved and downloaded this summer did not change the conclusions we came to a year ago, but we have included the new data collected in Figures 6 and 7.

Although the pattern of distribution of tracked birds between decades was similar, both males (Figure 7) and females (Figure 8) went further north, and males further south in 2009-14 than they did in 1994-2003. There was also a conspicuous increase in use of the oceans in the western Great Australian Bight particularly by female non-breeders (Figure 8), and males and females made more use of oceans to the east of New Zealand in 2009-2014 than they did in 1994-2003 (Figures 7 & 8).

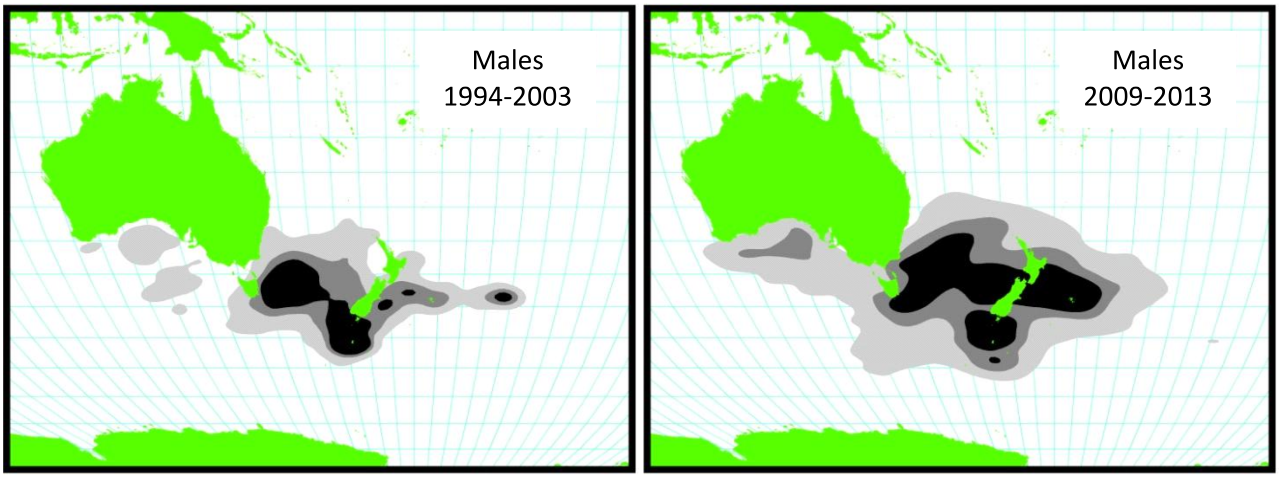

Figure 7: Kernel density plots of male Gibson's wandering albatrosses tracked while breeding and not breeding in 1994-2003 and 2009-2014. Black indicates that 50% contour, dark grey the 75% contour, and light grey the 95% contour.

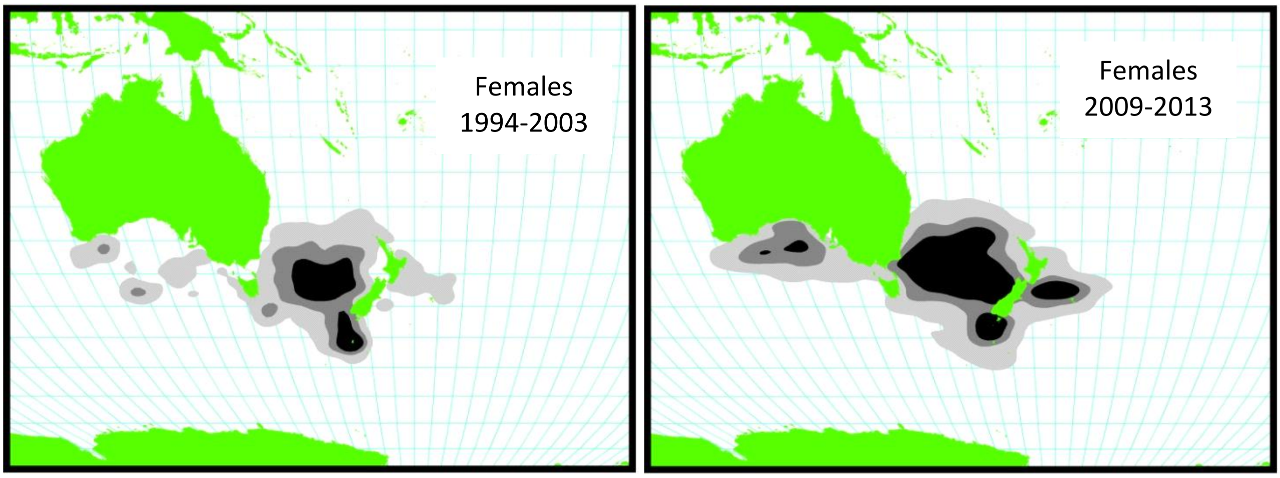

Figure 8: Kernel density plots of female Gibson's wandering albatrosses tracked while breeding and not breeding in 1994-2003 and 2009-2014. Black indicates that 50% contour, dark grey the 75% contour, and light grey the 95% contour.

5. CONCLUSIONS

Nearly all the population parameters with which one might assess the conservation status of Gibson's wandering albatross have been below average since 2004, and although there has been an improvement in recruitment, nesting success and survival from their low points in 2006, these parameters are still below their pre-2004 levels. Since we last reported on Gibson's wandering albatrosses (Elliott & Walker 2013) there has been continued improvement in productivity.

Additional tracking data has not changed the conclusions we reached a year ago. That is, birds are travelling greater distances and foraging more widely than they did between 1994 and 2003. Breeding females, in particular have a wider foraging range

The combination of increased foraging range and poor breeding success suggests that these albatrosses are foraging more widely for a smaller amount of food, which in turn suggests a reduction in the availability of the squid and fish they prey on.

Warming and acidification of the ocean is a possible explanation for this change in survival and breeding success, with the Tasman Sea, the main foraging grounds for this species, increasing in temperature faster than any other southern hemisphere ocean (Cai et al. 2005). An increased bycatch of Gibson's wandering albatrosses in the swordfish fishery is also a potential explanation. There was a substantial bycatch of wandering albatrosses in New Zealand waters in 2006 (Rowe 2009), an increase in swordfish fishing in the southern central Pacific Ocean by a Spanish fleet after 2003 (Mejuto et al. 2007), and a high recorded bycatch of "wandering albatrosses" (species unspecified) in the Taiwanese fleet in the central Tasman Sea in 2008-13 (Huang 2014).

The gradual improvement in the numbers of birds breeding each year, and in breeding success, indicates that the decline in the size of the breeding population is slowing. However, it remains of concern that the increase in numbers of breeding birds is of necessity at the expense of a decline in the size of the pre-breeding population. Since 2006 this pool of pre-breeders has been receiving about 70% fewer juveniles each year than in the years before the sharp and significant decline recorded in 2005 and 2006, because of the dual effects of fewer nesting attempts and lowered success rate. Although an important component of the total population, the pool of pre-breeders is much less visible and impossible to count, though their numbers can be modelled. This was last done for Gibson's wandering albatrosses in 2011 (Francis et al. 2012).

Monitoring the population of Gibson's wandering albatrosses on Adams Island remains an important conservation priority.

6. ACKNOWLEDGEMENTS

Collection of the 2013/14 season data was supported by funding from the Department of Conservation's Conservation Services Programme (www.doc.govt.nz/csp) project POP2013-03, partially through a levy on the quota holders of relevant commercial fish stocks, and we thank the New Zealand long-line fishing industry for their contribution to this CSP funding.

Our thanks to Sandy King who banded the chicks on Adams Island in November 2013, and to Kalinka Rexer-Huber and Graham Parker who carried out the extensive field programme there between December 2013 and February 2014. We also thank Jo Hiscock, Sharon Trainor and Kathryn Pemberton of Southern Islands Area Office of the Department of Conservation for their logistic support for the project, Henk Haazen of *Tiama* for safely transporting the field team to Adams Island, and the officers and crew of HMNZS Wellington who brought them back.

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