Albatross Research

Antipodean wandering albatross – population study

Report prepared for

Department of Conservation

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1. INTRODUCTION

Antipodean wandering albatross (*Diomedea antipodensis antipodensis*) are endemic to the Antipodes Islands, with approximately 99% of the population breeding on Antipodes Island, and a few pairs nesting on both Campbell Island and at the Chatham Islands. They forage largely in the Pacific Ocean east of New Zealand, and to a lesser extent in the Tasman Sea (Walker & Elliott 2006).

They are a rare, but regular by-catch in New Zealand long-line fisheries, with small numbers annually caught on observed domestic and chartered vessels (Thompson 2009 & 2010). Numbers actually caught are likely to be considerably higher than those reported, as many long-line hooks set in New Zealand waters are from small unobserved domestic vessels, and there are substantial unobserved long-line fleets in international waters in the south Pacific Ocean where the birds mostly forage (Walker & Elliott 2006).

Due to the vulnerability of this long-lived and slow breeding species to fisheries bycatch, their survival, productivity, recruitment and population trends have been monitored during almost annual visits to Antipodes Island since 1994. No monitoring occurred during the 2006 season, and the scale of the monitoring was reduced in 2007-2011, but restored in 2012. In the 1990's the population increased following a major, presumably fisheries-induced, decline during the 1980's (Walker & Elliott 2005, Elliott & Walker 2005 and Walker & Elliott 2006). However, about 2006 there was a sudden drop in the size of the breeding population, and it has continued to decline since then.

This report summarises the most recent findings on the survival, productivity, population trends and at-sea distribution of Antipodean wandering albatrosses, which we collected over a 6 week trip to the island during the 2013/14 summer. It was prepared to inform the Department of Conservation of the steep decline in the Antipodean wandering albatross population, and to alert the Ministry of Primary Industries to the potential for fisheries to be inadvertently contributing to this decline. The report concludes with some recommendations for future research and management.

2. OBJECTIVES

The specific objectives of this project were:

1. To estimate the population size and trend of Antipodean albatrosses on Antipodes Island; and
2. To estimate the adult survival of Antipodean albatrosses on Antipodes Island.

3. METHODS

Details of the methods used, study area locations and earlier results are given in Walker & Elliott 2005, Elliott & Walker 2005 and Walker & Elliott 2006.

In brief, summer visits are made to Antipodes Island and all birds found within or near a 29 ha "Study Area" (Figure 1) are checked for bands. An attempt is made to identify both birds at every nest in the Study Area, and any breeding birds that have no bands are banded. All nests are labelled and mapped, the outcome of the previous year's nesting attempts are assessed, and the chicks produced are banded. This data enables calculation of survivorship, productivity, recruitment and attendance on the breeding grounds.

In addition, the number of active nests in 3 different parts of Antipodes Island (Figure 1) are counted each year (only 2 of these areas were counted in the period 2007-11). These 3 areas comprise 5.4 % of all the nests on Antipodes Island, and the annual census of these blocks provides a reliable estimate of population trends.

Survival is estimated from the banded birds with mark-recapture statistical methods using the statistical software M-Surge (Choquet *et al.* 2005), and populations size is estimated from the actual counts of birds and the sighting probabilities produced when estimating survival.

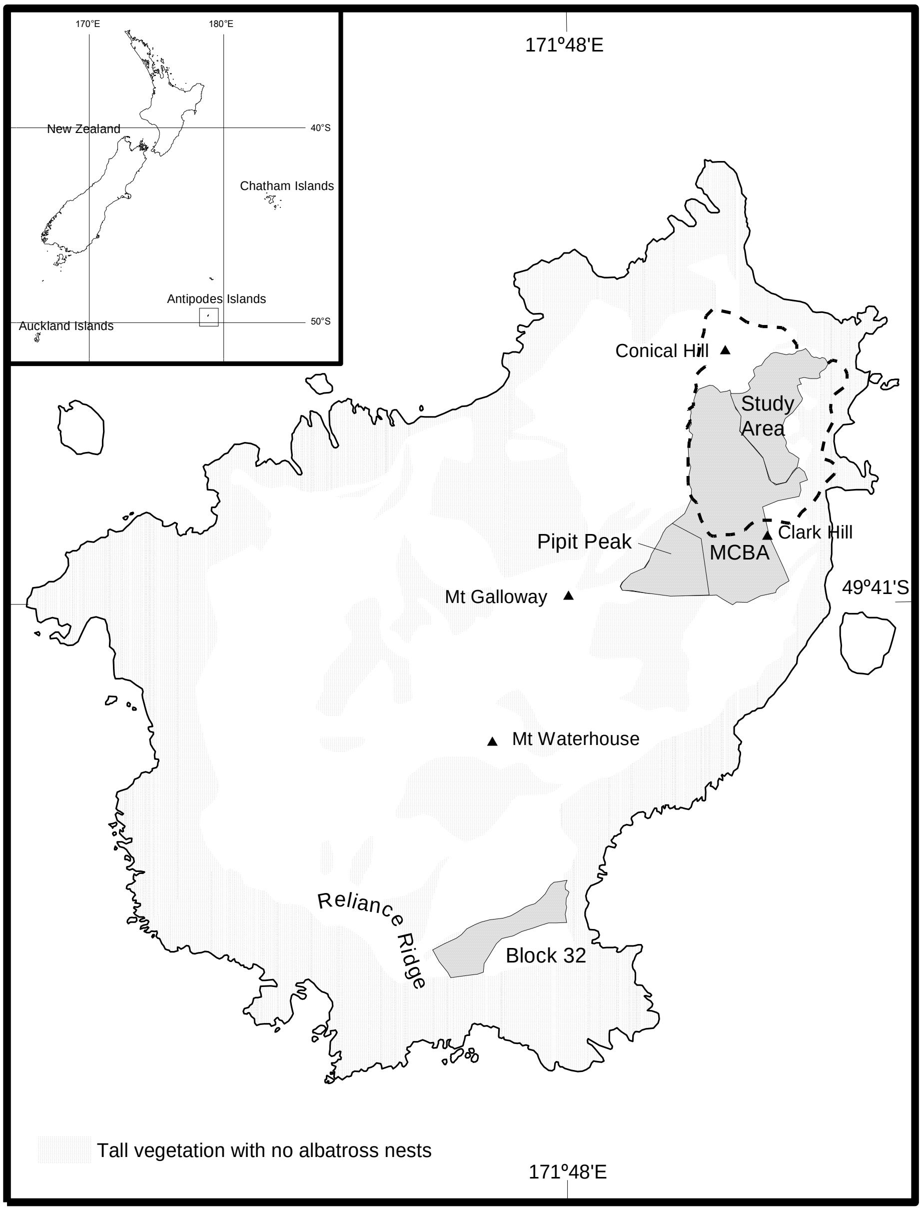


Figure 1. Location of the Antipodean wandering albatross study area on Antipodes Island; the boundary of the buffer zone around the study area regularly checked for banded birds (dashed line) and trend-count assessment areas (MCBA, Block 32, Study Area).

Changes in the at-sea distribution

Since 2011 we have been attaching and retrieving geolocator dataloggers to Antipodean wandering albatrosses to compare the foraging locations when the population was declining from its 2005 highpoint, with those used a decade earlier when it was growing. So far dataloggers have been attached to 37 birds, about 65% of them widowed or adults on a sabbatical year and the remainder adults during a breeding year.

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 compared tracking data collected using geolocator loggers between 2011 and 2013 with data obtained from satellite transmitters between 1996 and 2004 using kernel density plots. 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

After increasing for five years between 2000 and 2005, the number of nests in the study area and Block 32 declined between 2005 and 2007 by about 50% then declined more slowly until about 2011, since when it has been approximately stable (Table1, Figure 2). The pattern of population change in the larger MCBA block, which has been counted less frequently, is approximately the same as the other two blocks.

Table 1: Antipodean wandering albatross nests with eggs in February in three areas on Antipodes Island between 1994 and 2014. (* estimated, see Walker and Elliott 1998).

Year	Study area	Block 32	***Subtotal***	MCBA	**Total**
1994	114	125	***239***	544*	**783**
1995	156	185	***341***	482*	**823**
1996	154	133	***287***	418*	**705**
1997	150			464*	
1998	160			534	
1999	142			479	
2000	119	130	***249***	462	**711**
2001	160	141	***301***	443	**744**
2002	148	178	***326***	605	**931**
2003	214	187	***401***	608	**1009**
2004	216	249	***465***	755	**1220**
2005	211	186	***397***	613	**1010**
2006					
2007	119	127	***246***		
2008	165	135	***300***		
2009	98	120	***218***		
2010	106	101	***207***		
2011	88	108	***196***		
2012	95	104	***199***	345	**543**
2013	88	93	***181***	297	**478**
2014	90	103	***193***	341	**534**

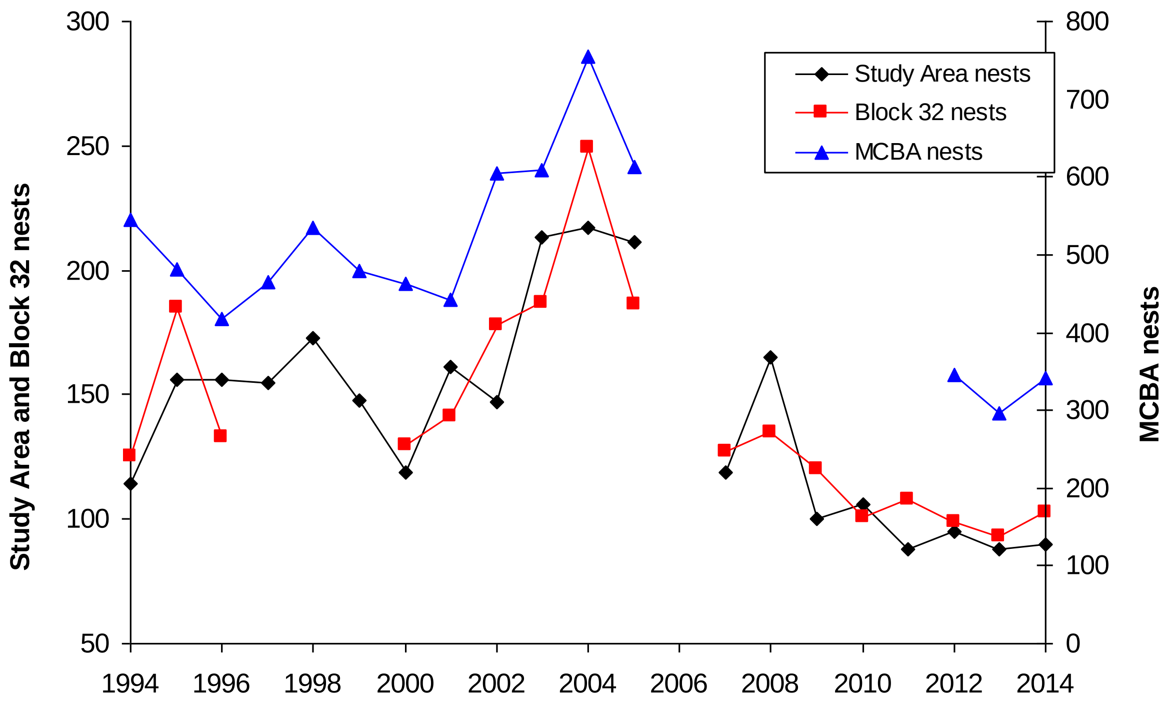


Figure 2. The number of Antipodean wandering albatross nests in three blocks on Antipodes Island since 1994.

Population size

The size of the breeding population as estimated by mark-recapture was increasing up until 2004 at a rate of about 7% per annum for both sexes. After 2004, numbers of both the males and females decreased, with the number of females falling at a higher rate (-9% per annum) than that of males (-5.2%), resulting in a marked sex imbalance since then (Figure 3).

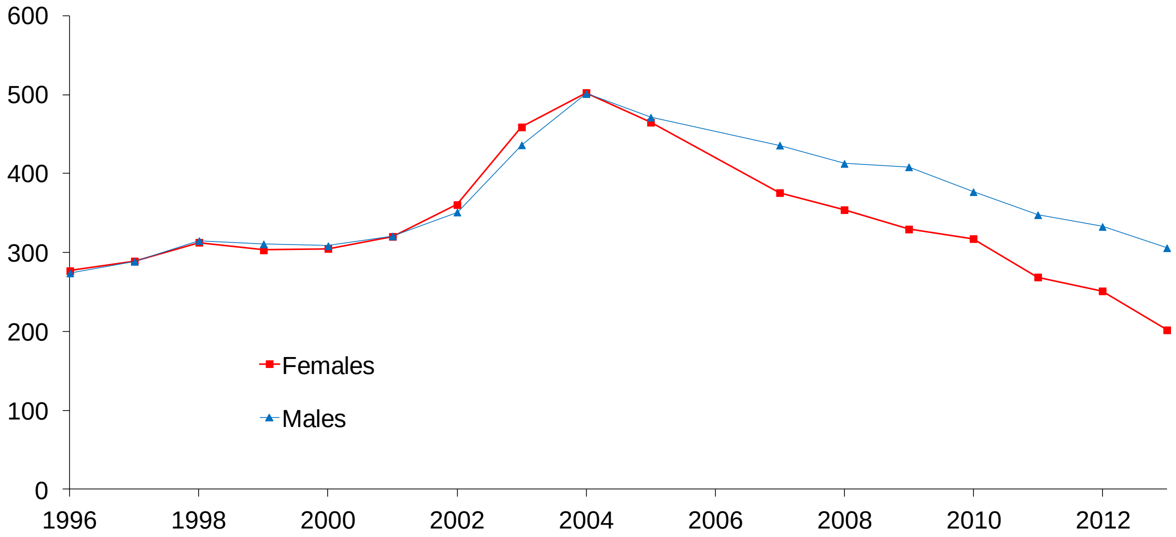


Figure 3. The number of breeding birds in the study area on Antipodes Island estimated by mark-recapture.

Survivorship

Adult survival varied around a mean value of about 0.96 up until 2004 and during this period male and female survival was not significantly different. Since 2004 both male and female survival has declined, with female survival significantly lower than that of males (Figure 4)

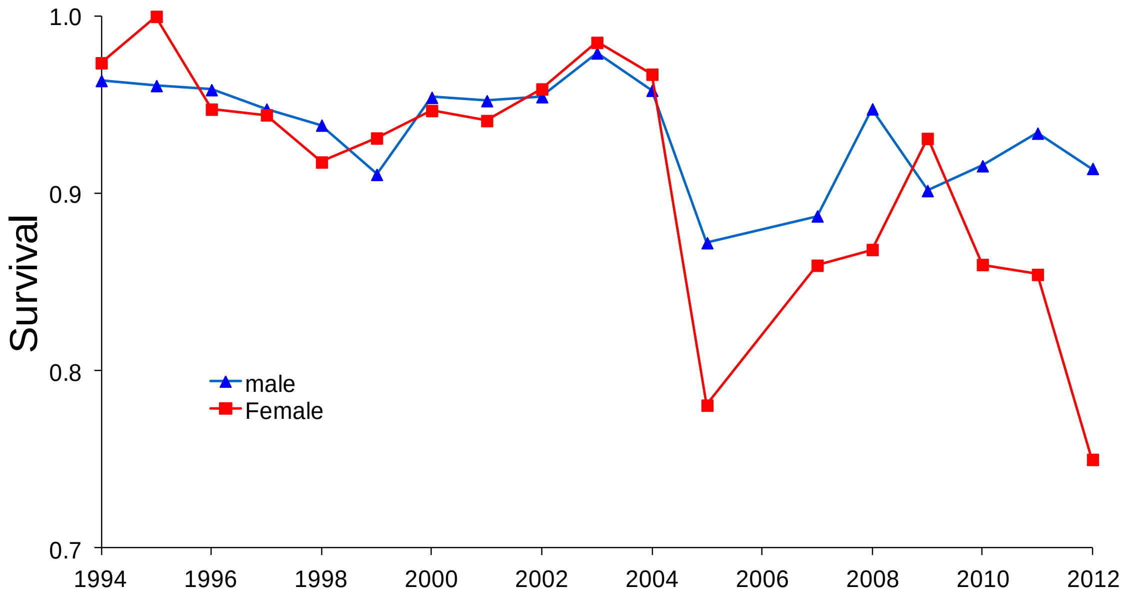


Figure 4 Estimated annual survival of Antipodean wandering albatross on Antipodes Island since 1994. Note that as the island wasn't visited in 2006, survival estimates for 2006 and 2007 were estimated from the survival over a 2 year period and then equally apportioned amongst the two years.

Recruitment

The number of birds breeding for the first time in the Study Area (Figure 5) has been very variable, but dropped significantly in 2005 and 2007 and has remained low ever since.

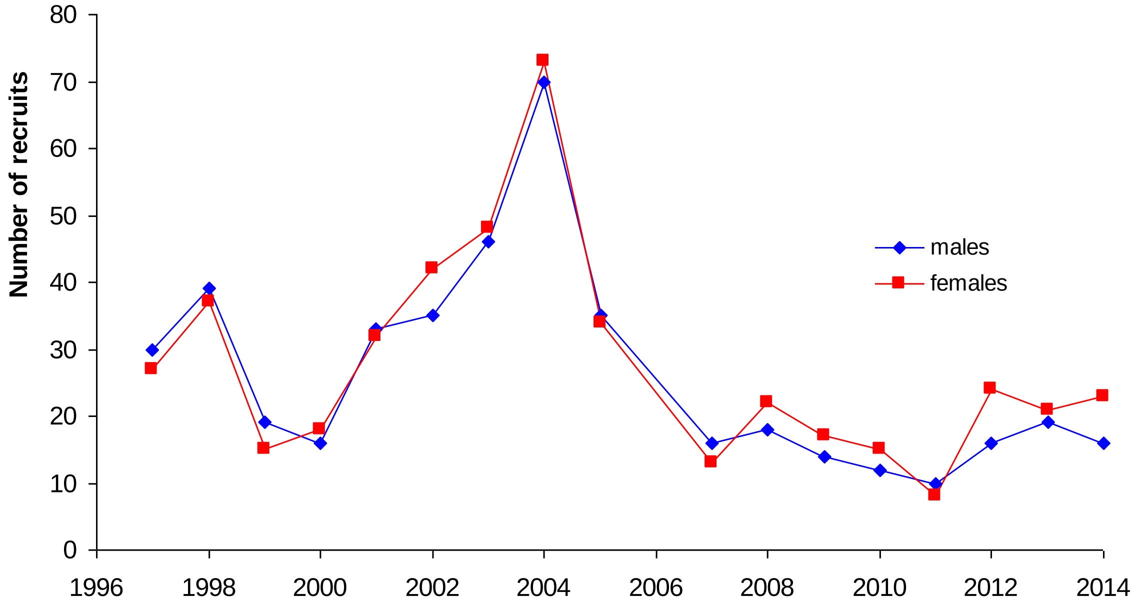


Figure 5: Number of birds recruiting to the breeding population in the study area on Antipodes Island since 1997

Productivity

Since 2005 nesting success has been about 10% below what it was before then, but the number of chicks produced in the study area has declined even more dramatically because of the combined effect of fewer birds nesting and reduced nesting success (Figure 6).

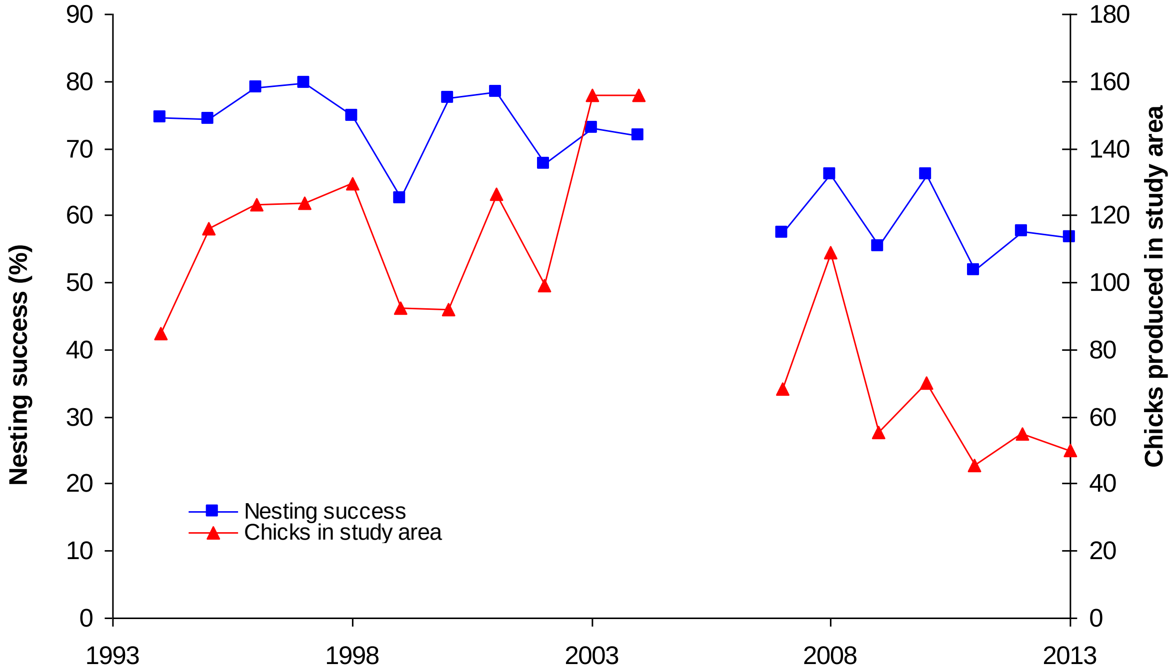


Figure 6. Nesting success and the number of chicks fledged from the study area on Antipodes Island since 1994.

It is possible that reduced nesting success and productivity are a by-product of reduced adult survival – when adults die their nests fail. To determine whether the drop in productivity we observed was caused by reduced adult survivorship, we compared the nesting success in all of the birds in our study with the nesting success of only those birds whose partner was known to be alive while they were incubating or raising their chick (Figure 7). The nesting success of both groups was nearly identical - clearly the reduced nesting success is not a by-product of reduced survivorship.

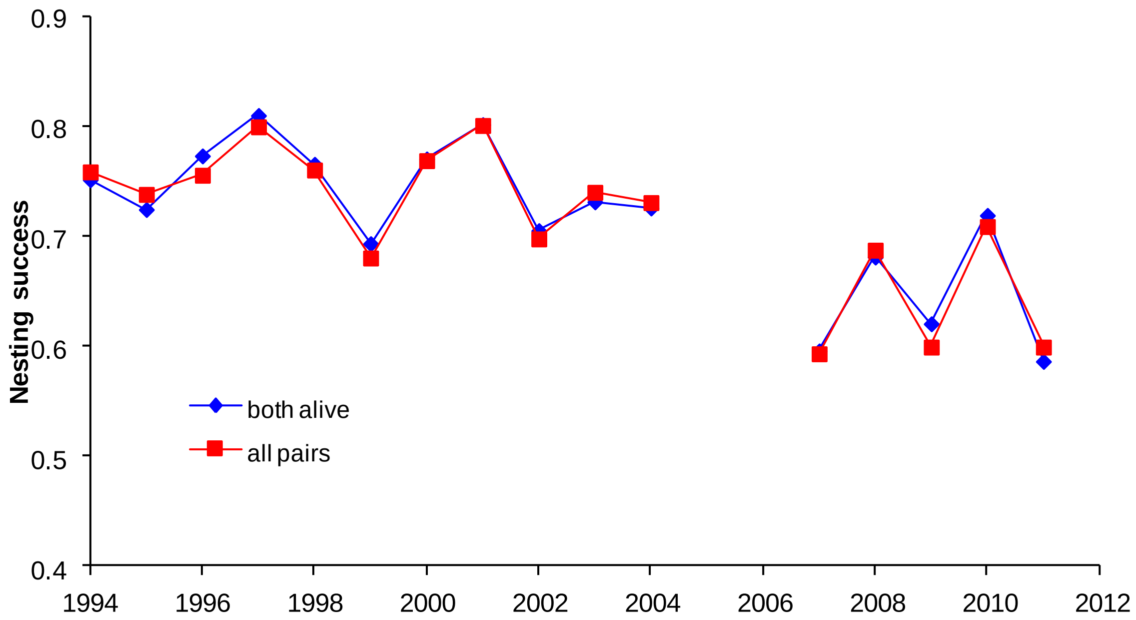


Figure 7. Nesting success since 1994 of all pairs (red) and only those pairs where both partners were known to be alive (blue) in the study area on Antipodes Island.

Changes in the at-sea distribution of Antipodean wandering albatrosses

In 2014 we retrieved geolocator dataloggers from 8 birds and re-deployed them on a further 8 birds.

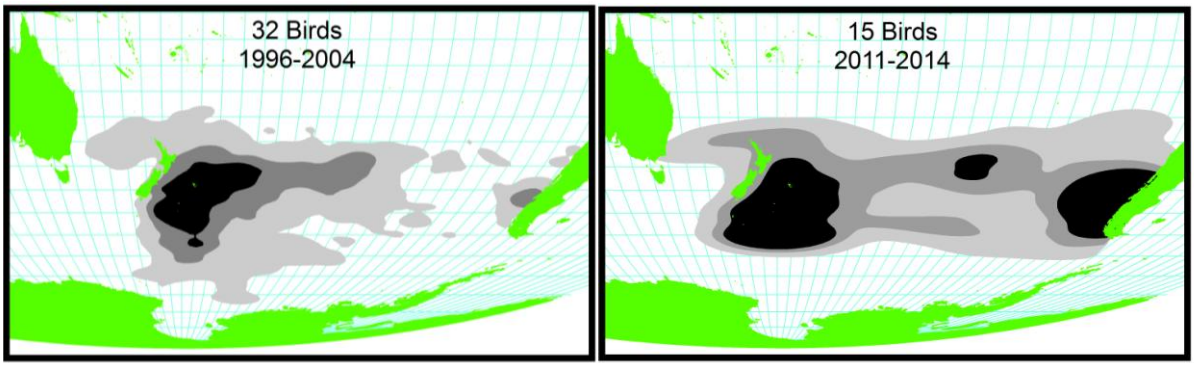
So far we have retrieved data from dataloggers attached to 30 birds. Each bird wore it's logger for either 1 or 2 years. All the birds tracked were adults, with about 65% of them widows or on a sabbatical year, and the remainder birds breeding during the year they were tracked.

We have undertaken a preliminary analysis of this data and compared it with the satellite tracking data we obtained from 65 birds tracked between 1996 and 2004 (Walker & Elliott 2006) (Figure 8).

We found that more of the population, both male and female, were now travelling larger distances to forage in the central and eastern south Pacific Ocean, and along the continental shelf off Chile, as well as more frequently to the eastern coast of Australia. None of the females tracked in 1996-2004 visited South America, but more than half of those tracked since 2011 did.

Some of the differences in the foraging patterns of birds recorded before 2006 and after 2011 are perhaps artefacts of the lower accuracy of location estimates produced by the geolocator dataloggers used after 2011. However, new locations, such as the increased use of the central south Pacific Ocean and the Chilean coast, now conspicuous in the tracks of both males and females, cannot be caused by low accuracy. Both males and females are now visiting the Chilean coast more than they were 10 years ago.

Males



Females

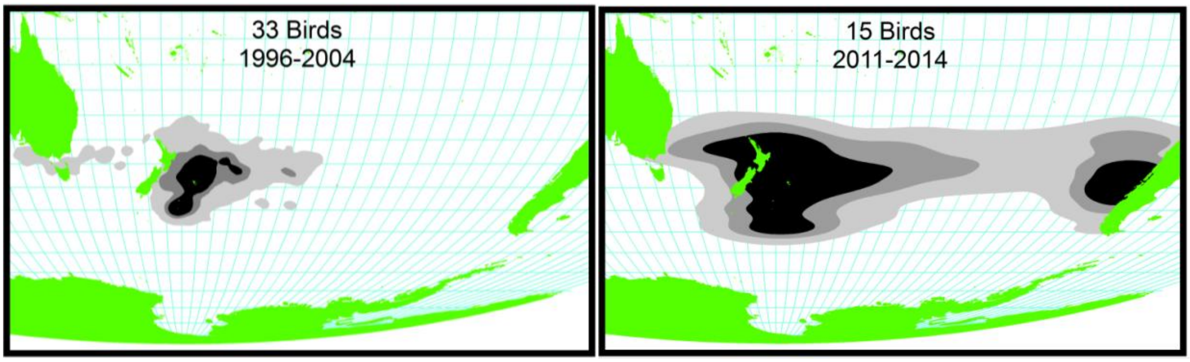


Figure 8: Kernel density plots of adult Antipodean wandering albatrosses tracked while breeding and not breeding in 1996-2004 and in 2011-14. Black indicates the 50% contour, dark grey the 75% contour, and light grey the 95% contour.

5. CONCLUSIONS

Mark–recapture analyses of the Antipodes Island population indicate that the number of breeding adults increased by 7% per annum between 1995 and 2004, but since 2004 females have declined by 9% per annum and males by 5.2% per annum. By 2013 the population of females was only 40% of what it was in 2004. The reduction in number of breeding birds has been caused primarily by high mortality, but also by reduced recruitment. At the same time there has been a reduction in nesting success, and the reduced nesting success combined with the substantial reduction in the number of birds breeding has led to a dramatic reduction in the number of chicks being produced.

With mortality rates particularly high in females, the breeding population currently has a marked sex imbalance, with many older un-partnered males conspicuous throughout the breeding season. Only small numbers of females were present in the study area to court in 2012, 2013 and 2014, and in each of these years we saw old banded males briefly carrying out courtship dancing with other banded, known-sex males in mid February, when mating was over. This was presumably in response to the current shortage of females, as we'd not noticed this behaviour in previous years.

The recent tracking data suggests that since the dramatic downturn in the Antipodean wandering albatross population in 2006, the birds have been foraging over a greater area of ocean than previously and are now frequently visiting places that they only rarely visited in the past. The change has been particularly marked in females, with 8 of the 15 females tracked in 2011-2014 foraging off the coast of Chile, whereas in the period 1996-2004 when the population was growing, none of the 33 females tracked did so.

In the eastern as well as the western Pacific, females are foraging in more northern waters than are males. Part of the reason for the much lower survival rates of females compared to males may lie in their differing exposures to bycatch risk, as well as to the characteristics (temperature, productivity, wind strength) of the different water bodies they use.

Despite Antipodean wandering albatrosses going further to feed, breeding success is now significantly lower than before the 2006 crash. There are two potential explanations for the decline of the Antipodean wandering albatross population: bycatch in fisheries, and reduced food due to changed oceanic conditions.

The increased mortality of females is coincident with an increase in daytime setting swordfish fleets in the South Pacific Ocean in which Antipodean wandering albatrosses are known to have been caught (Thompson 2010) and with an observed on-going bycatch of "wandering" albatrosses (not identified to species) which comprised the majority (81.7%) of seabird bycatch in large scale Taiwanese longline fleets targeting albacore tuna using daytime setting in the western and central Pacific between 35 and 45° S between 2008 and 2013 (Huang 2014).

However, our data show the conspicuously reduced breeding success is not due to increased mortality in breeding birds, and there seems no mechanism for bycatch to affect the bird's oceanic range. We conclude that while fisheries bycatch may have contributed to the sudden drop in survival of adults, changed oceanic conditions seem a more likely explanation for the low productivity of survivors.

The data we have presented on population size and survivorship is based only on the adult breeding birds. There has been sufficient data collected to enable assessment the trajectory of the whole population (breeders and pre-breeding sub-adults) (see Francis *et al*. in prep.), but this is complex modelling exercise which we have not undertaken. Given that the survivorship of sub-adult birds is invariably less than that of adults it is unlikely that the whole population is performing substantially better than the adults, but this needs to be assessed.

The population size of the Antipodean wandering albatross continues to decline at an alarmingly fast rate such that even the most recent assessment of risk of commercial fisheries to the species (Richard & Abraham in prep.) will be quickly out of date. An overall decline rate of 9% (the current rate for females) would move Antipodean wandering albatrosses from Richard & Abraham's (in prep.) "High risk" category to "Very high risk" category in less than two years.

The Antipodean wandering albatross is categorised as "Nationally critical" in the Department of Conservation's most recent assessment of it's conservation status (Robertson *et al.* 2012); clearly the rapid decline is a cause for concern.

The monitoring of Antipodean wandering albatrosses carried out since 2012 has been carried out almost entirely at our expense, with some logistic help from the Department of Conservation, and the New Zealand Navy. This is no longer possible and some financial assistance is required if monitoring of Antipodean wandering albatrosses is to continue.

6. RECCOMMENDATIONS

1. As a matter of urgency, the trajectory of the whole Antipodean wandering albatross population, not just that of the breeding birds, should be examined in a modelling exercise similar to that undertaken for Gibson's wandering albatross (Francis *et al.* in prep.).

2. The draft assessment of the risk of commercial fisheries to Antipodean wandering albatrosses should be re-evaluated in light of the species' rapid decline rate.

3. Annual monitoring of the Antipodean wandering albatross population should be undertaken and funded until the population trajectory stabilises or starts to increase.

4. New Zealand delegates to the Western and Central Pacific Fisheries Commission should note the high female Antipodean wandering albatross mortality rate and support measures to increase observer coverage and expand the use of mitigation devices in longline fisheries in international waters around 30° S latitude between Brisbane and Santiago.

7. ACKNOWLEDGMENTS

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