Albatross Research

Antipodean wandering albatross census and population study 2017

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ABSTRACT

Antipodean wandering albatrosses have been monitored since 1994. They increased in abundance between 1994 and 2004 at about 6.3% per annum, but since 2004 have declined: males at 5% per annum and females at 11%. The population of breeding females is now only 25% of its 2004 level. At the current rate of decline there will be only 250 pairs of Antipodean wandering albatrosses in 28 years.

Coincident with this decline there has been a reduction in nesting success.

The rapid drop in numbers has been caused by high mortality, particularly amongst females.

The most likely cause of this decline is a change in ocean conditions which has led to lower nesting success and birds foraging in areas with a higher fisheries bycatch risk than before.

A comparison of satellite tracking before 2004 and geolocator tracking after 2004 indicates a dramatic shift in the foraging range of females. They now often forage to the north-east of New Zealand and in two areas off the South American coast: near Juan Fernandez Islands and close to the south Chilean coast. Since males visit the Juan Fernandez and north-east New Zealand areas only rarely, and since they have much higher survivorship it seems possible the high female mortality might be happening in these two areas.

Understanding the causes of and solutions to the high female mortality is urgently required as the high and sustained rate of decline has put this species into New Zealand's "Nationally Critical" conservation status category.

INTRODUCTION

Antipodean wandering albatross (*Diomedea antipodensis*) are endemic to the Antipodes Islands, with approximately 99% of the population breeding on Antipodes Island, with 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, collected during a 5 week trip to the island during the 2016/17 summer.

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" 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 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 are counted each year (only 2 of these areas were counted in the period 2007-11). These 3 areas comprise 15% 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.

Changes in the at-sea distribution

Since 2011 we have deployed and retrieved 50 geolocator dataloggers to Antipodean wandering albatrosses to compare the foraging locations when the population was declining, with those used a decade earlier when it was growing.

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 since 2011 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.

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 38% and has continued to decline, albeit more slowly, since then (Table1, Figure 1) 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 2017.

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	91	103	194	341	535
2015	73	86	159	291	450
2016	100	92	192	291	483
2017	57	82	139	230	369

- estimated (see Walker and Elliott 1998).

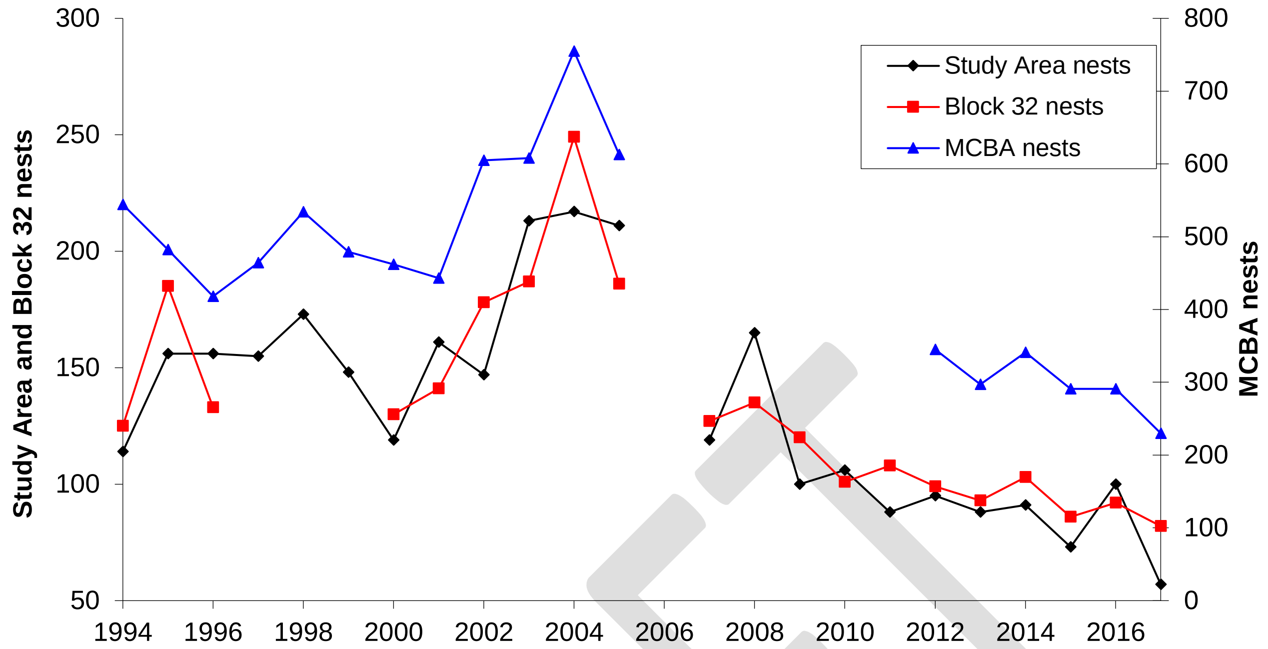

Figure 1. The number of Antipodean wandering albatross nests in three blocks on Antipodes Island since 1994.

Population size

The size of the breeding population as estimated by mark-recapture was increasing up until 2005 at a rate of about 6.3% per annum for both sexes. After 2005, numbers of both the males and females decreased, with females declining at faster rate (11% per annum) than males (5%), resulting in a sex imbalance since then (Figure 2).

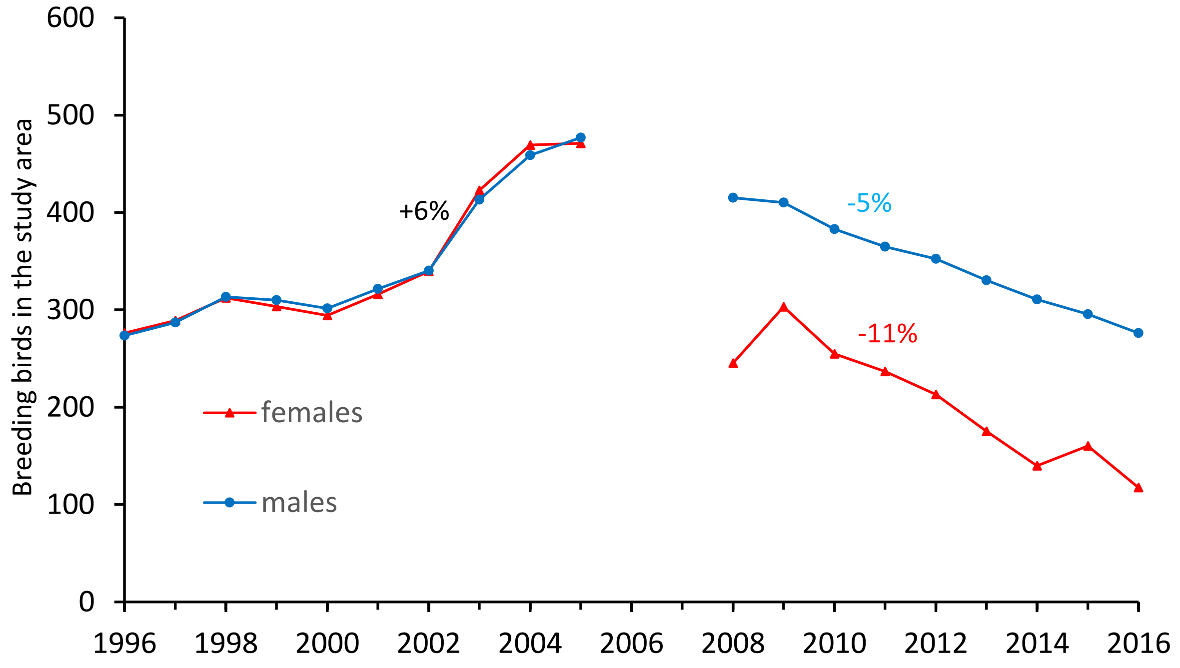

Figure 2. The number of breeding birds in the study area on Antipodes Island estimated by mark-recapture.

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 3).

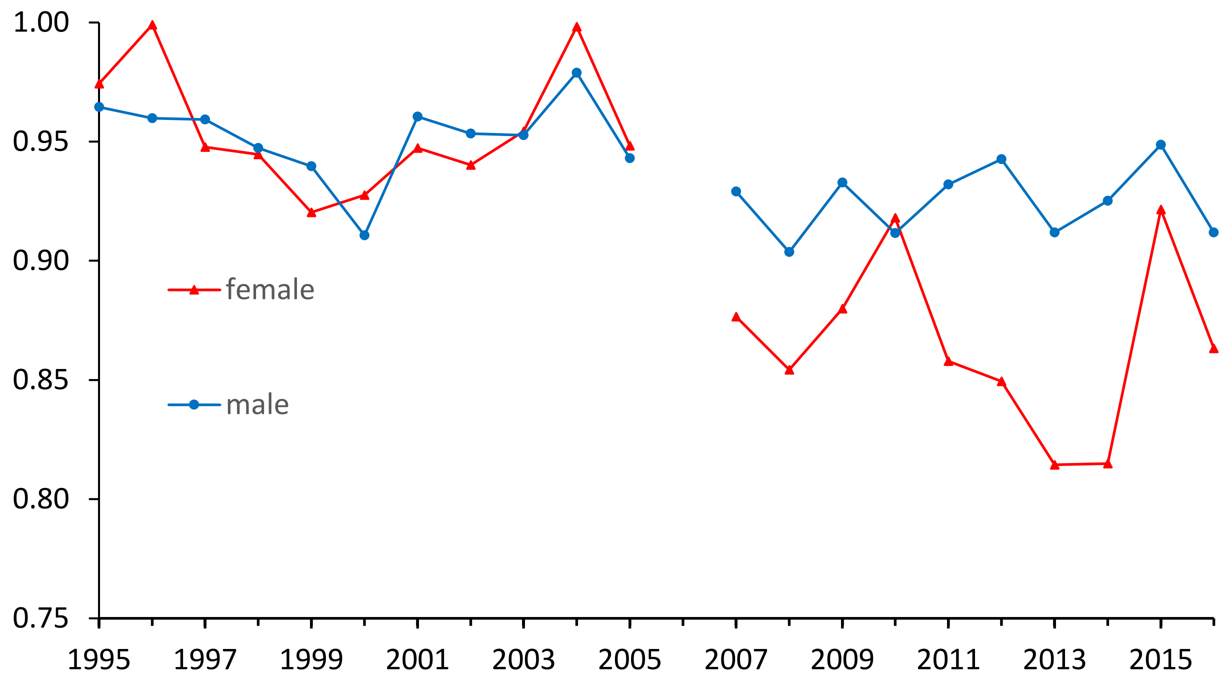

Figure 3. Estimated annual survival of Antipodean wandering albatross on Antipodes Island since 1994. Note that as the island wasn't visited in 2006, survival estimates for 2006 and 2007 were estimated from the survival over a 2 year period and then equally apportioned amongst the two years.

To identify groups of birds that might be suffering higher than usual mortality we separately estimated the survivorship of birds that were breeding and birds that were not breeding (Figure 4). The survival of non-breeding males has remained relatively constant, while the survival of breeding males and females declined dramatically in 2005 with male survival increasing after 2010.

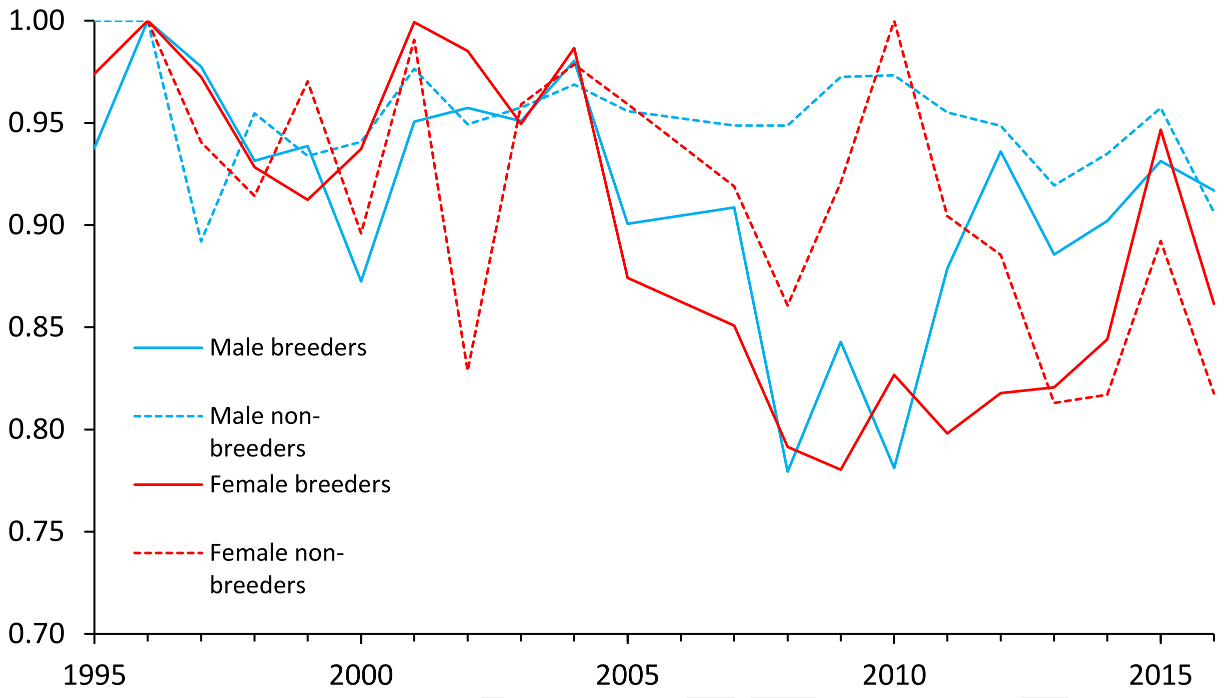

Figure 4. Estimated annual survival of breeding and non-breeding male and female Antipodean wandering albatross on Antipodes Island since 1994. Note that as the island wasn't visited in 2006, survival estimates for 2006 and 2007 were estimated from the survival over a 2 year period and then equally apportioned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

Recruitment

The number of birds breeding for the first time in the Study Area in 2017 is the lowest ever recorded (Figure 5).

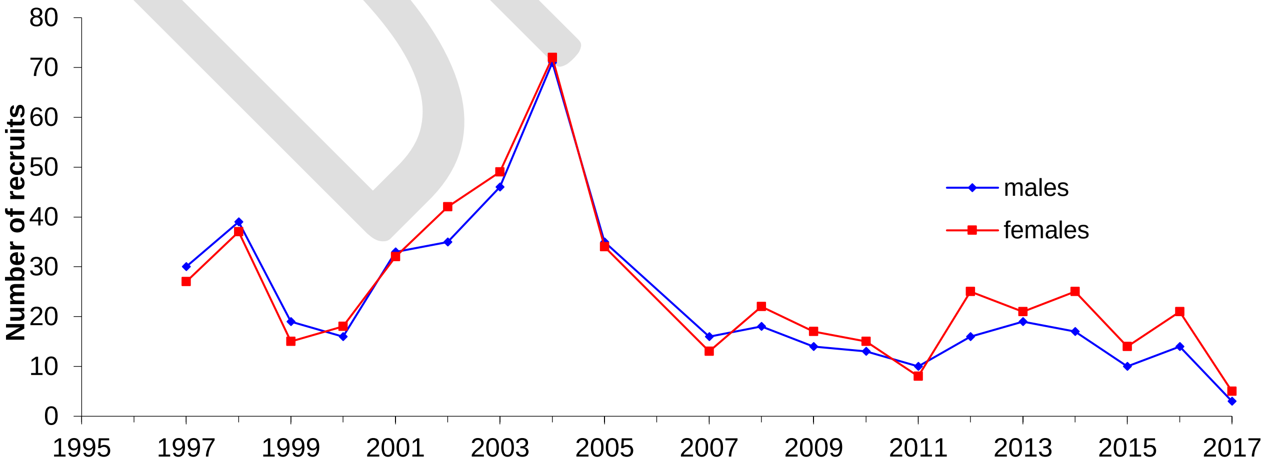

Figure 5. Number of birds recruiting to the breeding population in the study area on Antipodes Island since 1997

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 markedly because of the combined effect of fewer birds nesting and reduced nesting success (Figure 6).

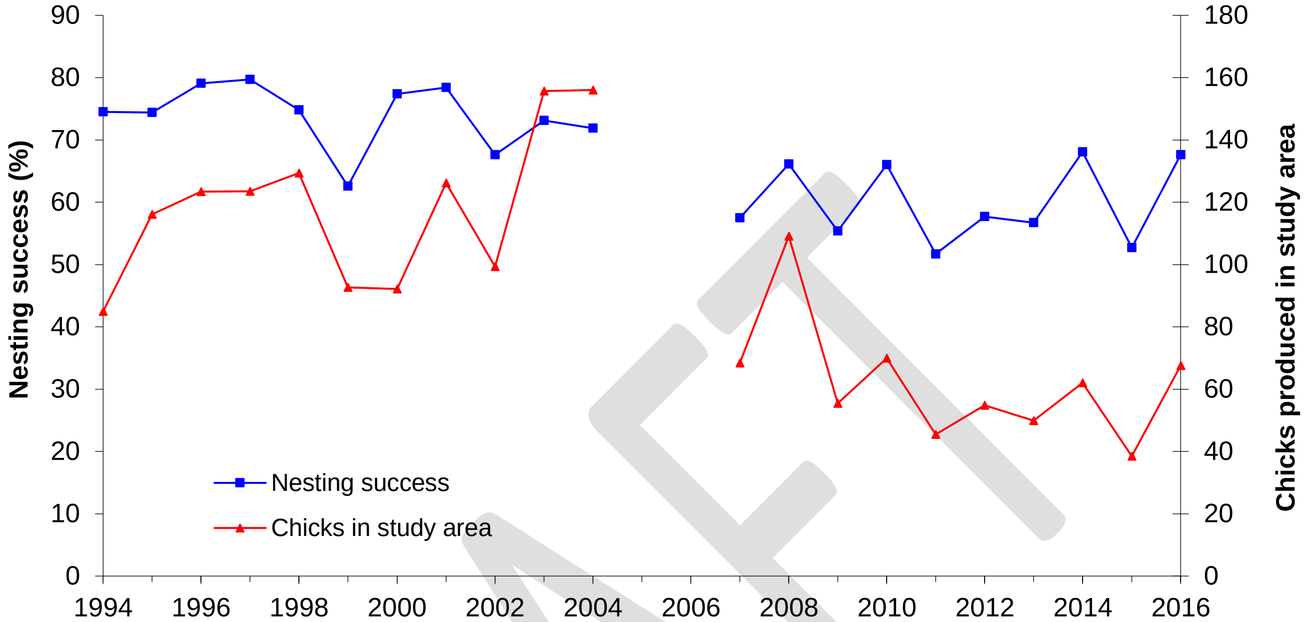

Figure 6. Nesting success and the number of chicks fledged from the study area on Antipodes Island since 1994.

Changes in the at-sea distribution of Antipodean wandering albatrosses

We have retrieved data from dataloggers attached to 50 birds and 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).

The foraging range of breeding birds has changed less than that of non-breeding birds with breeding females foraging further north after 2004 than they did before, while the range of breeding males seems only to have increased a little in all directions (Figure 7) .

In contrast the range of non-breeding birds, particularly females has increased dramatically (Figure 8). Breeding females before 2004 were recorded foraging in a relatively limited area centred east of the Chatham Islands. They were never recorded travelling to South America, but post 2004 almost all do.

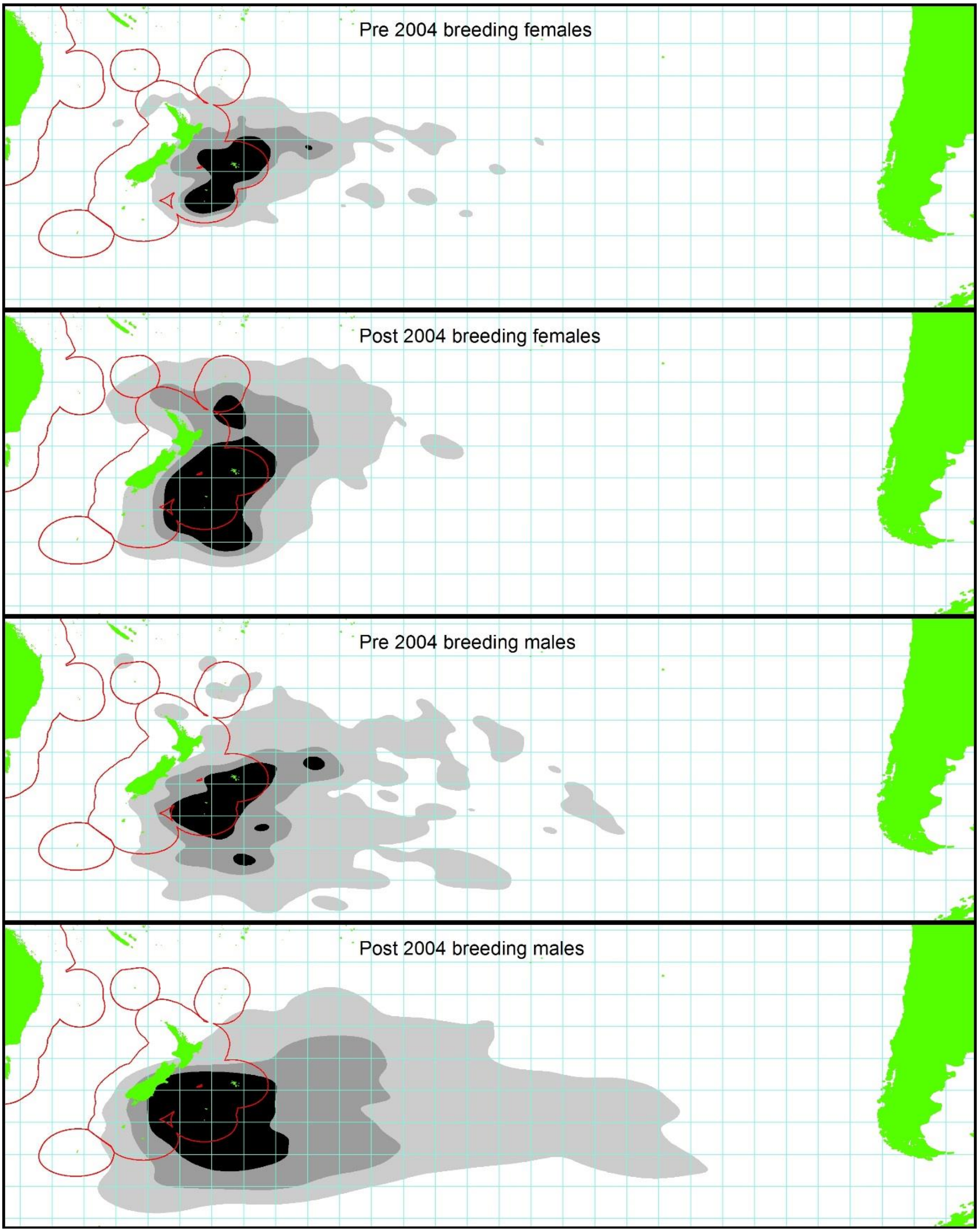

Figure 7. Kernel density plots of breeding Antipodean wandering albatrosses tracked in 1996-2004 and in 2011-17. Black indicates the 50% contour, dark grey the 75% contour, and light grey the 95% contour.

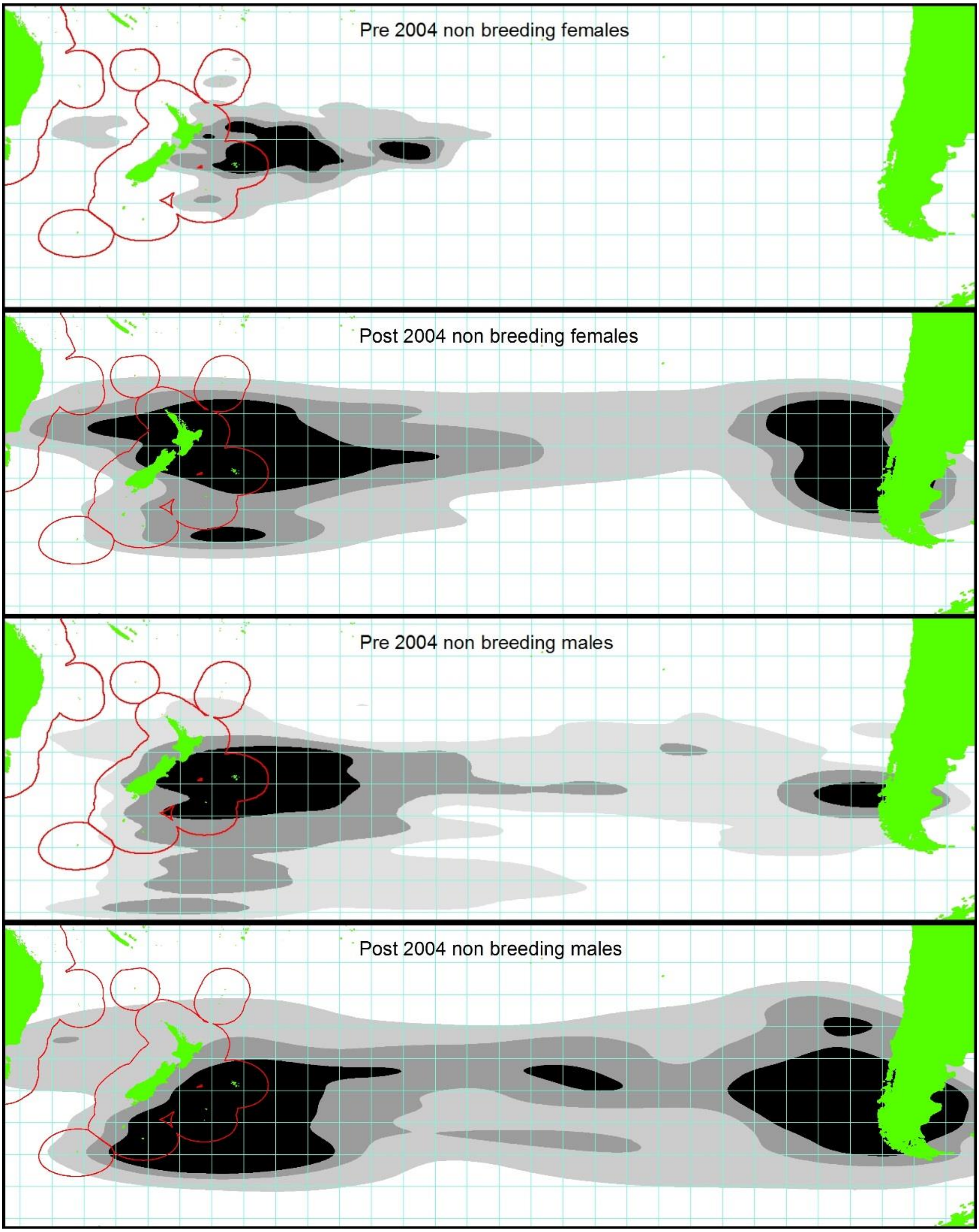

Figure 8. Kernel density plots of non-breeding Antipodean wandering albatrosses tracked in 1996-2004 and in 2011-17. Black indicates the 50% contour, dark grey the 75% contour, and light grey the 95% contour.

Birds are not using all ocean areas at all times of year (Figure 9). Females are confined to the oceans around the Antipodes and Chatham Islands while breeding, but many non-breeding females travel to southern Chile in the autumn and then move up to Juan Fernandez Islands in early winter, return to northern New Zealand waters and the Tasman Sea in mid-winter to early spring then visit the southern Chilean coast again in late spring.

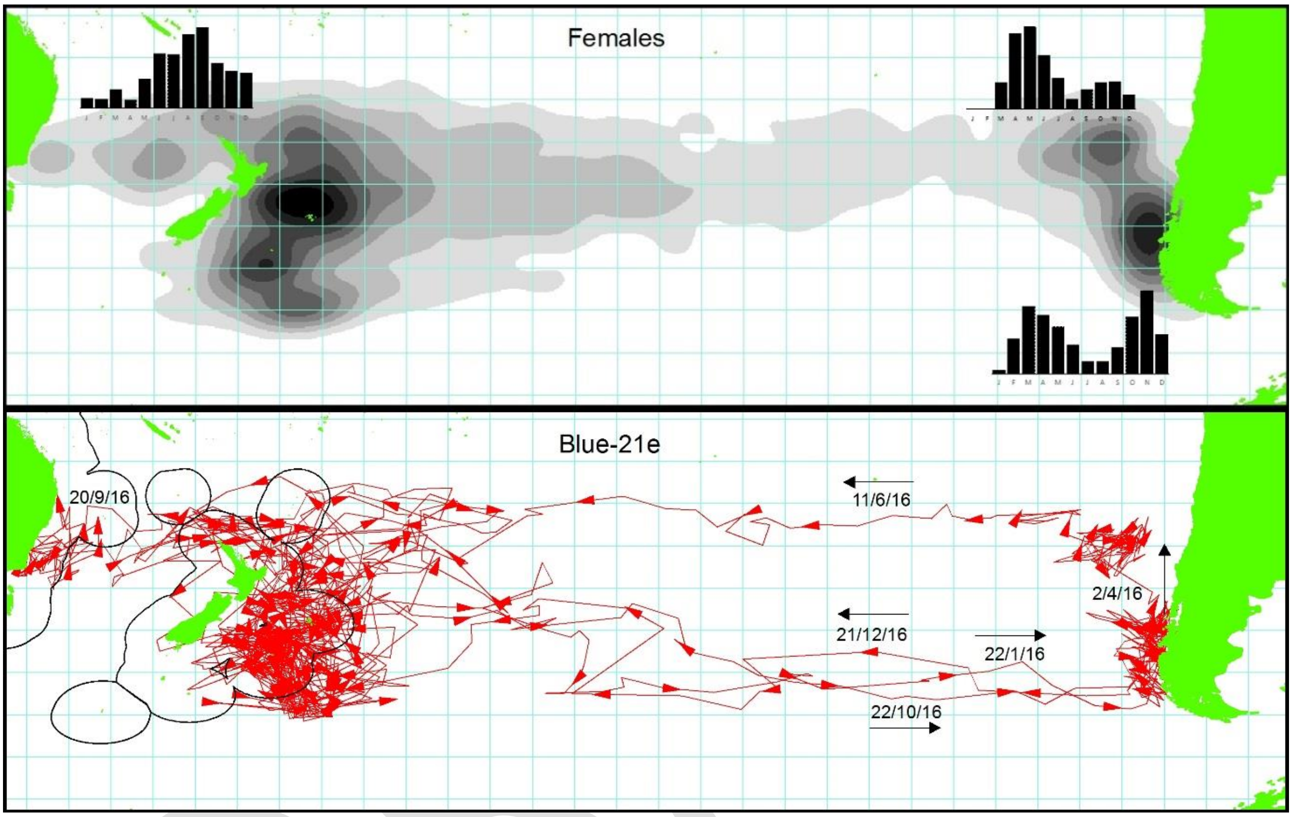

Figure 9. The foraging range of female Antipodean wandering albatrosses. The bar charts in the upper map show the timing of female birds visiting 3 ocean areas, and the lower map shows the foraging range of one female bird breeding in 2015 and having a "sabbatical" year in 2016.

CONCLUSIONS

At the current rate of decline (11% per annum) there will be only 250 breeding pairs of Antipodean wandering albatrosses in 28 years time.

With mortality particularly high in females, the breeding population now has a marked sex imbalance, with many older widowed males conspicuous throughout the breeding season. Only small numbers of females were present in the study area to court in recent years. Since 2012 we have seen adult banded males carrying out courtship dancing with other banded, known-sex males. This was presumably in response to the 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 after 2004, 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. Females, which are suffering higher mortality than males, forage further north than males and now visit two places that they previously never or rarely visited and to which males travel only rarely: the seas around Juan Fernandez Islands and the seas north-east of New Zealand.

There are two potential explanations for the decline of the Antipodean wandering albatross population: reduced food due to changed oceanic conditions and bycatch in fisheries. The decline in nesting success and the change in foraging range are likely a result of changed oceanic conditions, and the high mortality might result from birds visiting new areas where they are at greater risk of fisheries bycatch. The increased mortality of females is coincident not only with their changed foraging range but also with the advent of a swordfish fishery in the South Pacific Ocean to which Antipodean wandering albatrosses are known to be vulnerable (Thompson 2010).

The "nationally critical" status of this bird (Robertson *et al.* 2012) and its rapid decline mean that continued population monitoring and exploration of the likely causes of and solutions to its decline are high priorities.

ACKNOWLEDGEMENTS

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REFERENCES

Elliott, G.; Walker, K. 2005. Detecting population trends of Gibson's and Antipodean wandering albatrosses. *Notornis* 52: 215-222.

Fox, J.W. 2007. Geolocator manual version 6 (06/06/07). Unpublished report, British Antarctic Survey, Cambridge, UK.

Murray, T.E.; Kalish, S.R.; Taylor, P.R.; Bartle, J.A. 1993. Incidental capture of seabirds by Japanese southern bluefin tuna longline vessels in New Zealand waters, 1988-1992. Bird Conservation International 3: 181-210.

Robertson, C.J.R.; Scofield, P.; Bell, E. 2004. Autopsy report for seabirds killed and returned from New Zealand fisheries, 1 October 2001 to 30 September 2002. DOC Science Internal Series 155. Department of Conservation, Wellington. 43pp.

Robertson, H.A.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; O'Donnell, C.F.J.; Powlesland, R.G.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2012. Conservation status of New Zealand birds, 2012. New Zealand threat classification series 4, Department of Conservation, Wellington.

R Development Core Team. 2011. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Thompson, D.R. 2010: Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 October 2006 to 30 September 2007. DOC Marine Conservation services Series 3. Department of Conservation. Wellington. 37 p.

Venables, W.N.; Ripley, B.D. 2002. Modern applied statistics with S. Springer, New York.

Walker, K.; Elliott, G. 2005. Population changes and biology of the Antipodean wandering albatross *Diomedea antipodensis* Notornis 52 (4): 206-214.

Walker, K.; Elliott, G. 2006. At-sea distribution of Gibson’s and Antipodean wandering albatrosses, and relationships with long-line fisheries. *Notornis* 53 (3): 265-290.