GIBSON'S WANDERING ALBATROSS RESEARCH ADAMS ISLAND 2013

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INTRODUCTION

Gibson's wandering albatross (*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 is in decline, and is regarded as a 'Nationally Vulnerable" threatened species (Miskelly et al. 2008).

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). 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 substantial 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).

Numbers actually caught are likely to be considerably higher than those reported, as many long-line hooks set in New Zealand and Australian waters are from small unobserved domestic vessels, and 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, in 2005 there was a sudden drop of more than 40% in the size of the breeding population. Since 2005, the adult population has been declining at 5.7% per year because of substantial reductions in three demographic rates: adult survival (from 0.95 to 0.89), proportion breeding (from 0.53 to 0.37), and the proportion of breeding attempts that are successful (from 0.60 to 0.25) (Francis et al 2012). The Gibson's wandering albatross population is now only about two-thirds of its estimated size in 1991, with slow increases since 2005 in adult survival and proportion breeding, but continuing low productivity (Francis et al 2012).

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 2012/13. This report summarises the most recent findings on the current status of Gibson's wandering albatrosses, collected over the 2012/13 summer.

METHODS

Population study

Details of the methods used, study area locations and earlier results are given in Walker & Elliott 1999, Elliott & Walker 2005, and Walker & Elliott 2006.

In brief, summer visits are made to Adams Island and all birds found within or near a 61 ha "Study Area" are checked for bands. An attempt is made to identify both birds at every nest in the Study Area, and any that have no bands are banded. All nests are labelled and mapped, the success of the previous year's nests is assessed, and the chicks produced are banded. This data enables calculation of survivorship, productivity, recruitment and attendance on the breeding grounds.

The number of active nests in 3 areas representative of low, medium and high density nesting habitat on Adams Island are counted each year. These comprise c.10% of all the nests on Adams Island, and the annual census of these blocks provides an estimate of population trends (Elliott & Walker 2005).

Survival is estimated from the banded birds 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, birds rarely move more than a few hundred metres 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, with those used a decade earlier when it was growing. So far dataloggers have been attached to and retrieved from 49 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 compared tracking data collected using geolocator loggers between 2009 and 2013 with data obtained from satellite transmitters between 1994 and 2003 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

Population trends

The three blocks in which nests have been counted since 1998 were counted again in late January or early February 2013. While still comparatively low relative to the size of the population a decade ago, the number of nests in the three blocks in 2013 was the highest it had been since the population crashed in 2005 (Table 1, Figure 1).

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 1998-2013.

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

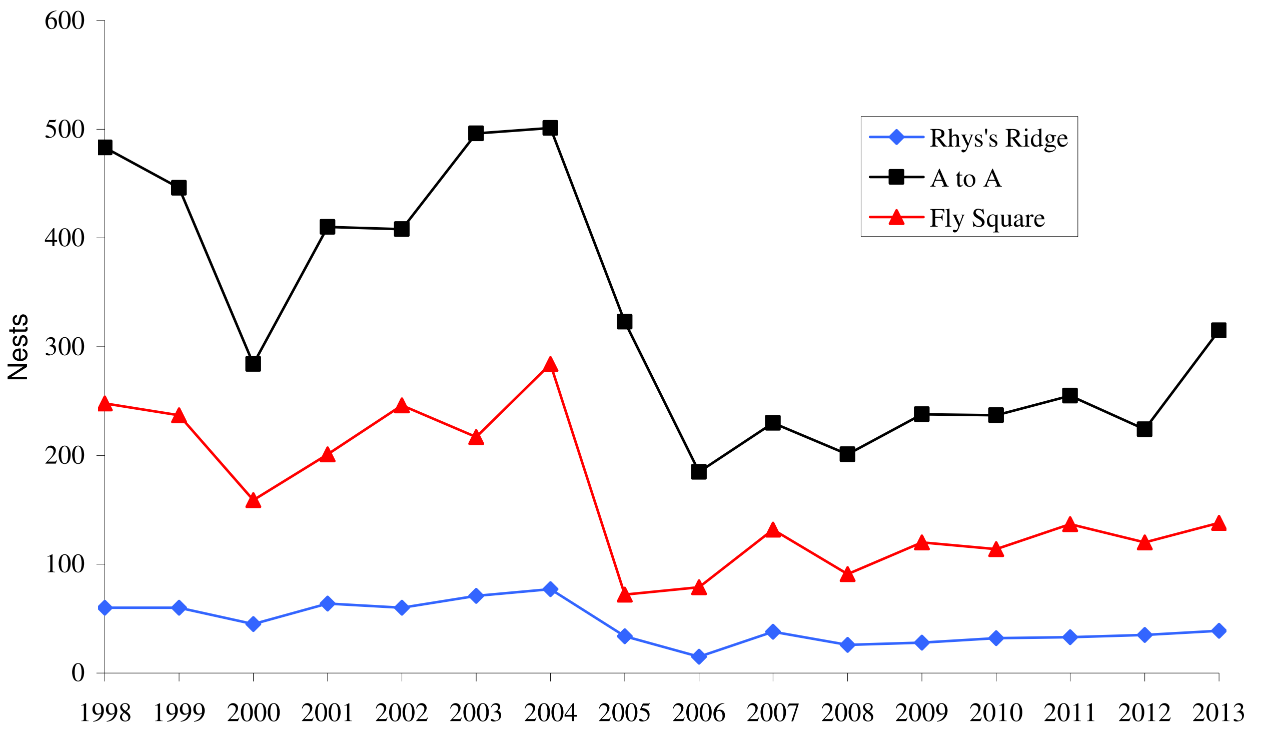

Figure 1. The number of Gibson's wandering albatross nests in late January in three census blocks on Adams Island 1998- 2013.

From the ratio between the number of nests in our census blocks and the total number of nests counted on the Auckland Islands in 1997 (Walker & Elliott, 1999) we can estimate the number of pairs breeding on the Auckland Islands. There were approximately 5000 pairs nesting in 2013, about the same as in 1991, but only 57% 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 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	2004	2005
Pairs	4964	5270	4826	6678	7417	7883	7499	4926	6813	6813	7913	8701	4158

Year	2006	2007	2008	2009	2010	2011	2012	2013
Pairs	2816	4037	3210	3896	3866	4290	3825	4966

Population size

The number of breeding birds estimated by mark-recapture was increasing up until 2004, but between 2004 and 2006 the number of breeding females decreased by more than 50%, 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 2).

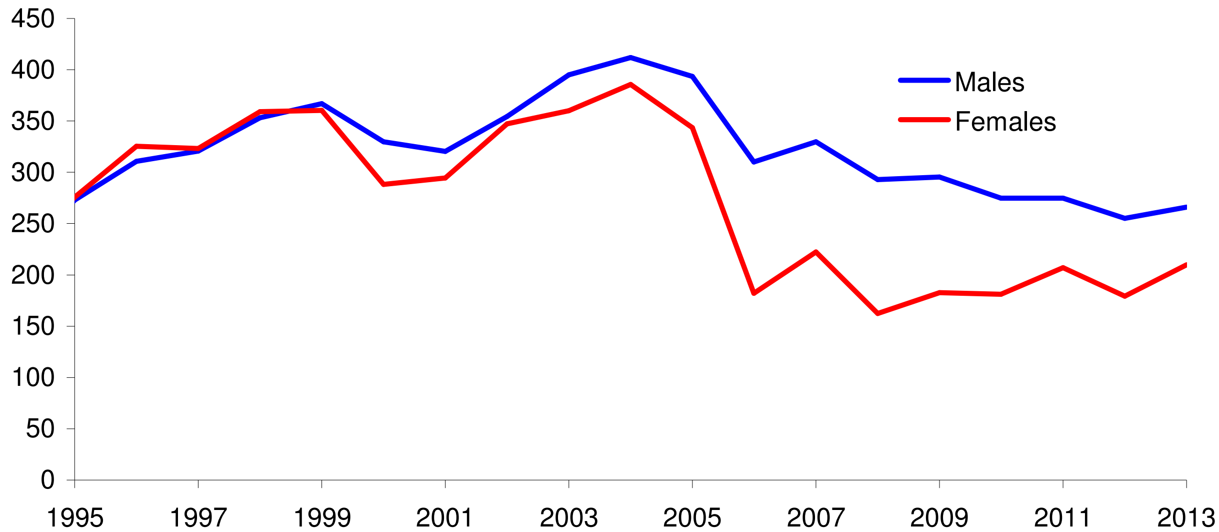

Figure 2. The number of breeding birds in the study area on Adams Island estimated by mark-recapture.

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 2012/13 summer allowed survival for 2011 and 2012 to be calculated, although results for 2012 should be treated with caution until a further year's data has been collected. Male survival was very low (85.2%) in 2012, with female survival also low at 89.5%. Adult survivorship has been lower than average since 2004, with extremely low female survivorship in 2006 and 2008 (Figure 3), the cause of a major sex imbalance in the breeding population over these years.

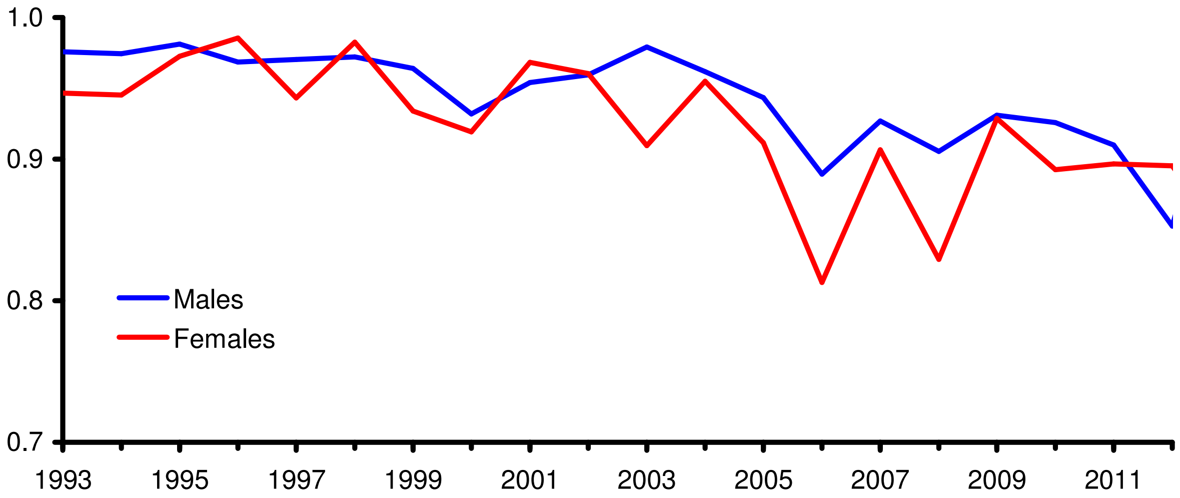

Figure 3. The annual survival of birds in the study area on Adams Island estimated by mark-recapture.

Recruitment

The number of birds breeding for the first time in the Study Area (Figure 4) has been very variable, but dropped significantly in 2005 and 2006 and has been slowly increasing since then.

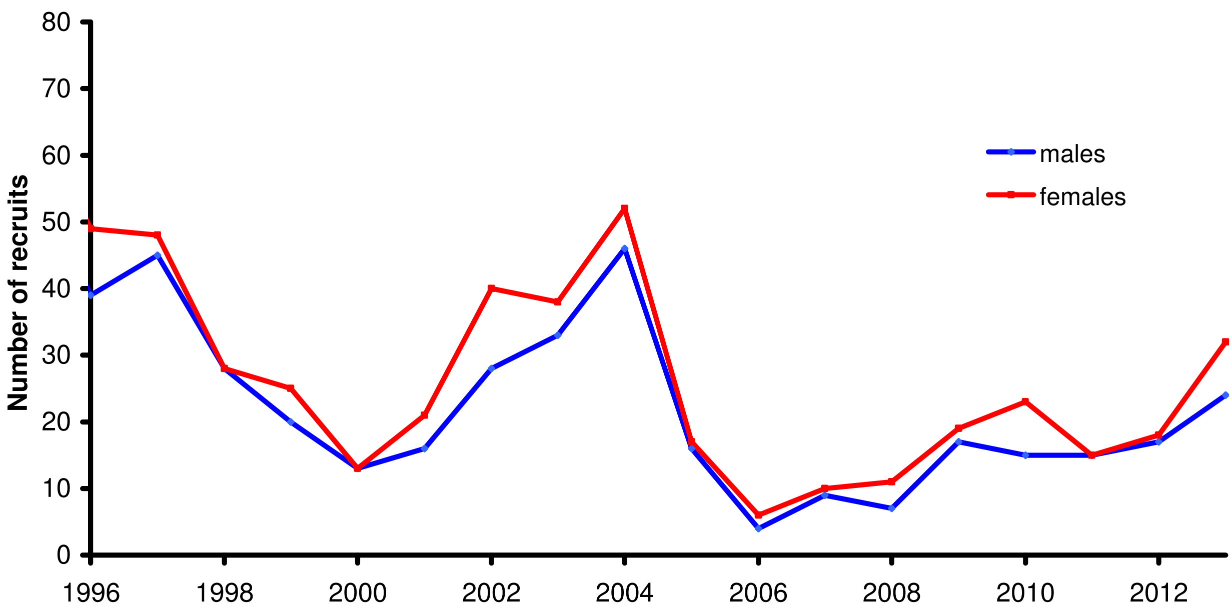

Figure 4: Number of Gibson's wandering albatrosses breeding in the study area on Adams Island for the first time for each year since 1996.

Nesting success and productivity

Nesting success in 2012 was 43%, with 49 chicks fledging. This was similar to the 2011 season, and an improvement on the 24%-25% nesting success rate of 2006-2009. However, it remains much lower than the norm of about 60% prior to the collapse of the population in 2005, and the number of chicks produced remains small because of the smaller numbers of pairs attempting to breed.

Figure 5: Nesting success and number of chicks fledged from the study area on Adams Island since 1993.

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

So far we have successfully tracked 49 birds using geolocator loggers and we have 59 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	11	13	5	4	33
Males	4	17	3	2	26

We have undertaken a preliminary analysis of the logger tracking data between 2009 and 2013 and compared it with the satellite tracking data we obtained from 46 birds tracked between 1994 and 2003 (Walker & Elliott 2006).

Although the pattern of distribution of tracked birds between decades was similar, both males and females went further north, and males further south in 2009-13 than they did in 1994-2003 (Figure 6). There was also a conspicuous increase in use of the oceans in the western Great Australian Bight particularly by female non-breeders, and males and females made more use of oceans to the east of New Zealand in 2009-2013 than they did in 1994-2003 (Figure 6).

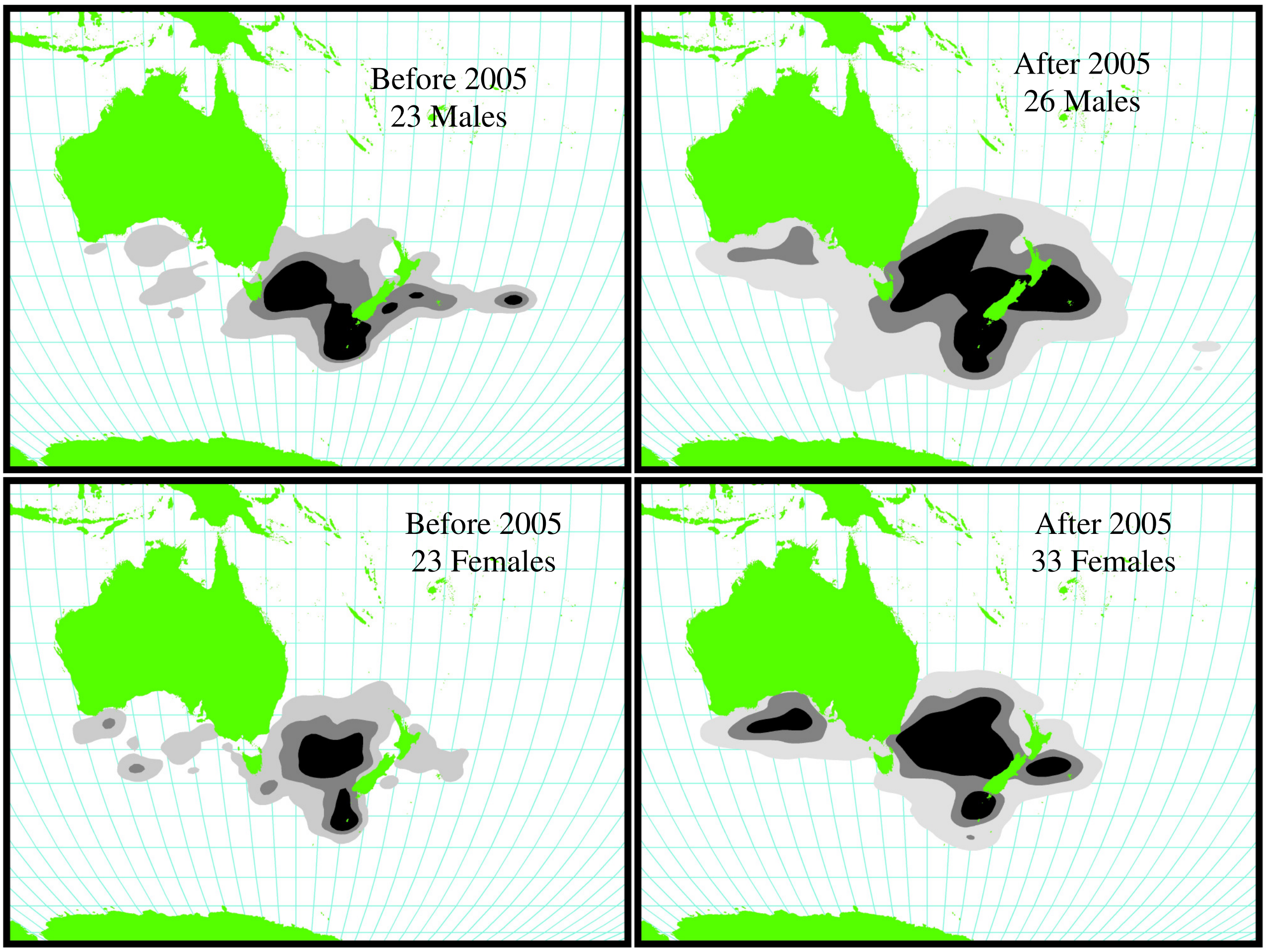

Figure 6: Kernel density plots of Gibson's wandering albatrosses tracked while breeding and not breeding in 1994-2003 and 2009-2013. Black indicates that 50% contour, dark grey the 75% contour, and light grey the 95% contour.

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.

Analysis of tracking data from geolocator dataloggers indicates birds are travelling greater distances and foraging more widely than they did in 1994-2003. Breeding females, in particular have a much bigger 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 collapse in the abundance of the squid and fish populations they prey on, or at least a change in their distribution.

Tracking data lends some support to the theory that there have been deleterious changes to the marine environment west of New Zealand. Changes in the south Tasman Sea and the south west Pacific Ocean appear to have been of sufficient magnitude to significantly alter the distribution of Gibson's wandering albatrosses. Since birds are now foraging further from the breeding island than they used to, in oceans not used a decade ago, the opportunity to encounter long-line fishing fleets and the attractiveness of such fleets to birds may have increased. The energetic costs of rearing a chick has almost certainly risen.

Our data provides no explanation of the cause of the sudden drop in survival in 2005. The drop in survivorship was co-incident with the rapid expansion of a surface long-line swordfish-fishery both inside New Zealand's territorial waters and in international waters in the western Pacific Ocean, but there is no evidence one way or the other that the swordfish-fishery and albatross survivorship are linked.

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

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