

# Population Study of Southern Buller's Albatross on The Snares

Prepared for the Deepwater Group Limited

May 2017

Paul Sagar \*, David Thompson<sup>1</sup> & Paul Scofield<sup>2</sup>



\* [paul.joy.nz@gmail.com](mailto:paul.joy.nz@gmail.com)

<sup>1</sup> NIWA, Wellington, New Zealand

<sup>2</sup> Canterbury Museum, Christchurch, New Zealand

## Summary

This report presents a summary of the results of the collection of demographic data at three study colonies of Southern Buller's Albatross *Thalassarche bulleri bulleri* breeding at The Snares from 3 to 6 April 2017.

Demographic studies at the three study colonies have been undertaken annually since 1992, and so this report incorporates some of these data in the current analysis. Estimates of the numbers of breeding pairs, made by recording the contents of each nest mound, showed increases in all three colonies over the numbers recorded during 2016. With the assumption that the combined total number of breeding pairs in the three study colonies was representative of North East Island as a whole then the breeding population probably peaked in 2005-2006 and has since undergone marked annual variations.

A total of 247 birds that had been banded previously in the study colonies as breeding adults of unknown age were recaptured. A further 56 breeding birds were banded in the study colonies - these are presumed to be first-time breeders. During the period 1992-2004 all chicks that survived to near-fledging in the study colonies were banded and their survival to return to the study colonies in subsequent years has been monitored. This year 124 of these birds were recaptured, with 18 birds from cohorts banded from 1998 to 2004 being recaptured for the first time, and so showing the long-term monitoring required to obtain reliable estimates of survival of such known-age birds. A further 25 known-age birds, from cohorts banded 1996-2004, were found breeding for the first time, and so were recorded as being recruited to the breeding population. One bird banded as a chick in 1972 was recaptured and at 45 years old is the oldest recorded known-age Southern Buller's Albatross.

Estimates of the annual survival of adults shows that this has declined from 0.95 in the period 1992-2004 to 0.91 in the period 2005-2016. However, since 2012 the recruitment rate has increased from 10-11% to 16-21%. It is likely that this higher recruitment is sustaining the breeding population and without it the breeding population would decline.

## **1. Background**

This project was funded by the Deepwater Group Limited. The specific objectives of the project were to:

1. Resurvey three established study colonies.
2. Establish the numbers of pairs breeding in the three established study colonies.
3. Establish annual survival of banded birds from recapture data.

This report describes the field work completed at The Snares under permits (Entry 54183-LND and Wildlife Act Authority 52364-FAU) granted by the Department of Conservation.

Field work centred on obtaining information about the population dynamics of Southern Buller's Albatross, particularly population size, adult survival, breeding frequency, and recruitment of known-age birds in three long-term study colonies. This was the 26th consecutive year of recording demographic data of Southern Buller's Albatross in these study colonies at The Snares.

## **2. Methods**

### **2.1 Logistics**

Logistical support was provided by the yacht *Baltazar* (skipper/owner Andy Whittaker). The field team (comprising Paul Sagar (leader), Joy Sagar and Charlotte Woods), were dropped off at North East Island on 3 April 2016. *Baltazar* moored in Hoho Bay, North East Island for the nights of 3 and 4 April, and then sought shelter along the west coast of North East Island. In the meantime, the field team stayed in the hut at the base of Station Point for the evening of 5-6 April. Sea conditions prevented *Baltazar* from mooring in Hoho Bay again on 6 April and a predicted SW change would remove any shelter on the western side of the island, and so the decision was made to embark the field team about 18:00 h on 6 April and return to Bluff.

### **2.2 Study colonies**

All of the three study colonies (Mollymawk Bay, Lower Punui Bay and Upper Punui Bay) were visited; Mollymawk Bay on 3 and 6 April, and Upper Punui Bay and Lower Punui Bay on 4, 5 and 6 April 2017. On the first visit to each colony all nests were inspected and the

contents recorded. Band numbers of all adult birds associated with these nests were recorded, and any unbanded birds incubating or guarding a chick were captured and fitted with a uniquely numbered stainless steel leg band. All adult birds recorded on this first visit were marked with blue raddle (a temporary stock marker) so that they were not recaptured on the subsequent visits. The large majority of the partners of the birds recaptured on this first visit were at sea, and so subsequent visits were made to allow time for these birds to have returned to the colony and taken over incubation or chick-guarding duties. On these subsequent visits to each colony, all nests were checked again and any birds not marked with raddle were captured and band numbers recorded or leg bands applied, as appropriate. In addition, on each visit an attempt was made to recapture as many as possible of the banded non-breeding birds that were loafing in the colonies.

### **2.3 Banded birds outside study colonies**

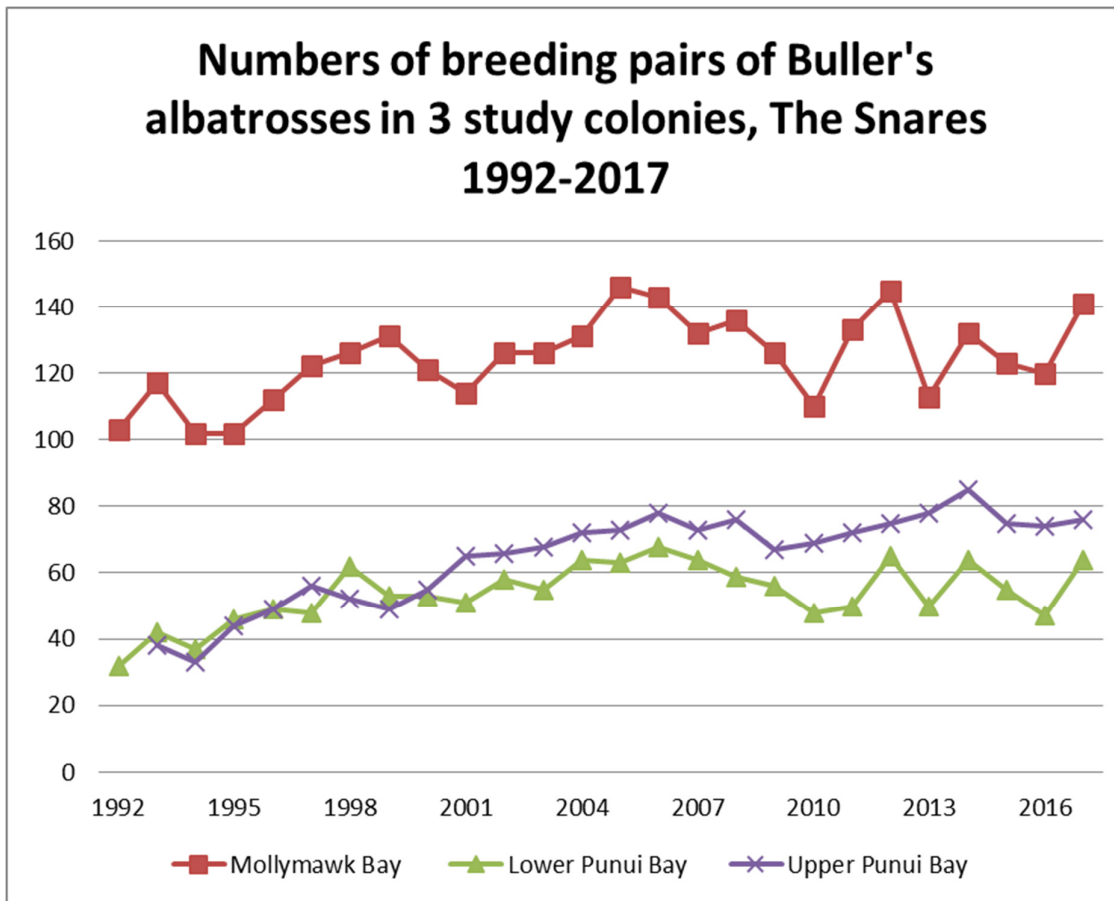
Surveys of breeding albatrosses in colonies immediately adjacent to and up to 300 m from to the study colonies were made to check for banded birds. This information is used to estimate the dispersal rate of birds banded in the study colonies.

Survival was estimated from banded birds, using the mark-recapture programme Mark 7.1 (White & Burnham 1999).

## **3. Results**

### **3.1 Numbers of occupied nests**

Totals of 141, 64 and 76 nests with an egg or chick were counted in the Mollymawk Bay, Lower Punui Bay and Upper Punui Bay study colonies, respectively. Included in these totals, four nests in the Mollymawk Bay, 13 nests in Lower Punui Bay, and eight nests in Upper Punui Bay study colonies each contained the remains of a broken egg or a dead chick. These totals represent increases, relative to numbers counted in April 2016 (Figure 1), in the Mollymawk Bay, Lower Punui Bay and Upper Punui Bay colonies of 17.5%, 36.2% and 2.7%, respectively.

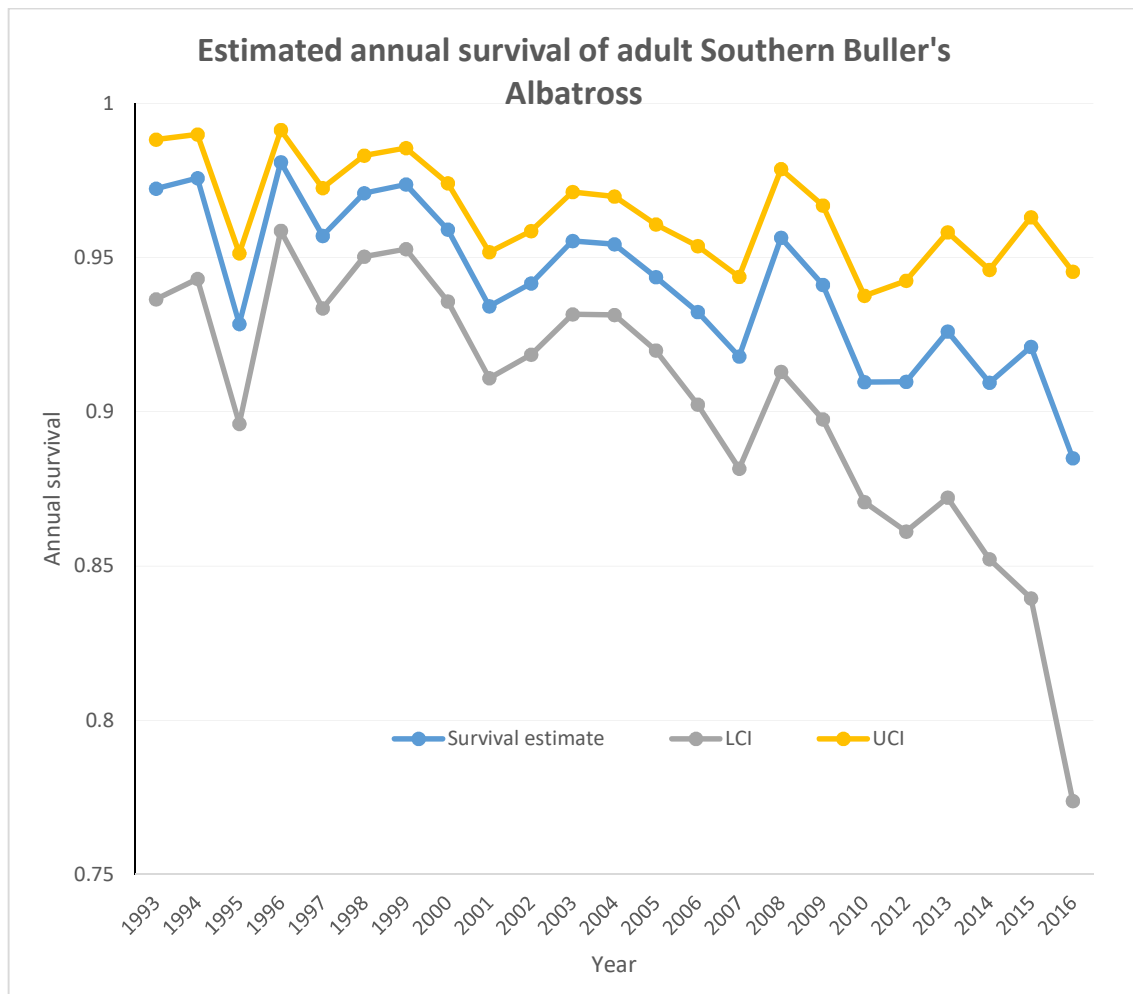


**Figure 1: Numbers of breeding pairs of Southern Buller’s albatross counted annually at three study colonies, The Snares 1992-2017.**

### 3.2 Adult survival

A total of 247 birds that had been banded previously as breeding adults of unknown age were recaptured. This total comprised breeding birds, non-breeding birds, and failed breeders. In addition, a further 56 breeding birds (i.e. birds that were incubating or guarding a chick) were banded within the study colonies. Because birds breeding in the study colonies have been checked annually and any new birds banded since 1992 we assume that any breeding birds captured that are not banded are first-time breeders, and so likely to be 10-12 years old, the usual age of first breeding (Francis & Sagar 2012).

Of the birds banded previously as breeding adults of unknown age, 15 had been banded in 1992, and so likely to be over 36 years old (26 years since 1992 plus 10-12 years for age of first breeding).



**Figure 2: Estimated annual survival, with upper and lower 95% confidence intervals, of Southern Buller's Albatrosses banded as breeding birds of unknown age in three study colonies at The Snares, 1993-2016.**

Estimated mean annual adult survival varied around 0.95 until 2004, but then declined to about 0.91 from 2005-2016 (Figure 2), thus continuing the trend reported by Francis & Sagar (2012).

### 3.3 Survival and recruitment of known-age birds

#### 3.3.1 Return rate of known-age birds

The return rate of known-age Southern Buller's Albatrosses is the proportion of a cohort of chicks that is recaptured several years after banding. Of the 2765 birds banded as chicks near fledging in the study colonies and adjacent colonies between 1992 and 2004, 124 were

recaptured during April 2017. These birds were from cohorts banded between 1992 and 2004. Of the 18 birds of known age that were recaptured for the first time in 2017, the oldest was from the 1998 cohort, and so was 19 years old. This indicates that many more years of recapture effort are required to obtain reliable estimates of the survival of these known-age birds.

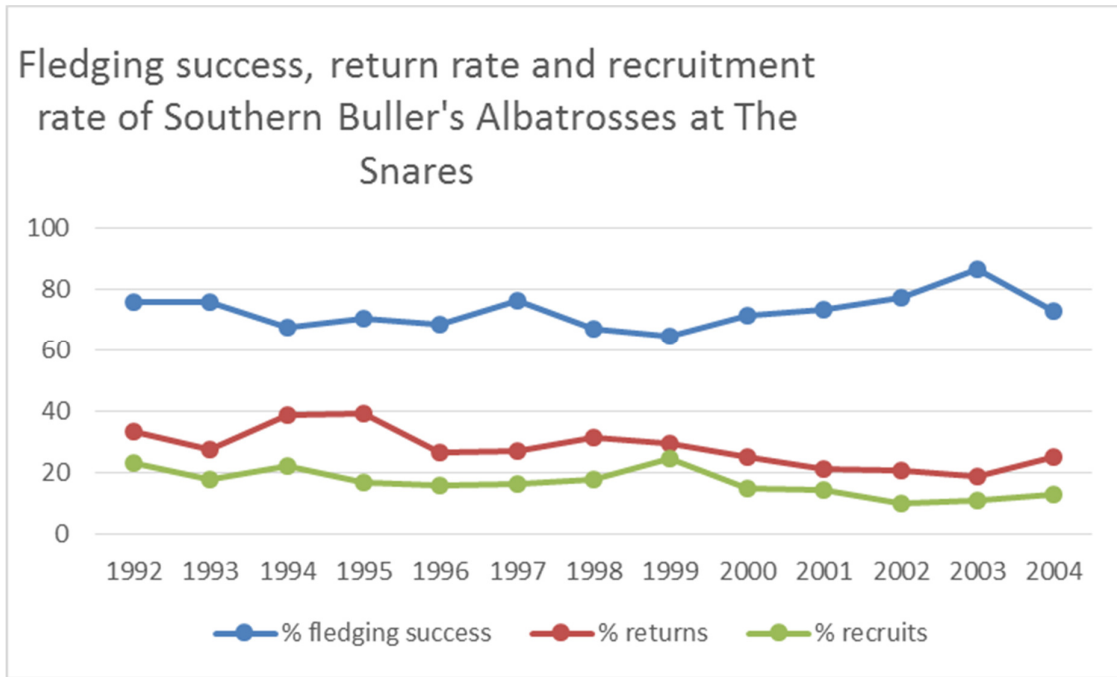
Of the 1991 birds banded as chicks near fledging in the study colonies during the period 1992-2004 (which would now be at least 13 years old), 536 (26.9%) have now been recaptured at The Snares. The lowest rate of return (4.7%, five recaptured from 107 banded) is for the 2003 cohort in Punui Bay (Lower and Upper Punui Bay study colonies combined) and the highest rate of return (44.3%, 27 recaptured from 61 banded) from the 1995 cohort in these same colonies (Table 1).

**Table 1: Number (% of total banded) of Southern Buller’s Albatrosses, banded as well-grown chicks in 1992-2004, returning to The Snares, by colony of provenance.**

Colony/cohort	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Mollymawk Bay	19 (27.1)	28 (31.8)	26 (37.1)	6 (26.1)	19 (22.4)	20 (21.0)	32 (39.5)	31 (35.2)	23 (25.8)	17 (21.0)
Punui Bay	20 (43.5)	12 (20.7)	18 (41.9)	27 (44.3)	21 (32.3)	26 (34.7)	18 (23.4)	10 (19.6)	21 (25.0)	18 (21.9)

Colony/cohort	2002	2003	2004
Mollymawk Bay	21 (22.1)	27 (28.4)	22 (22.2)
Punui Bay	18 (19.2)	11 (10.3)	25 (28.1)

The recapture for the first time of a bird from the 1998 cohort was not expected as no new birds from this cohort had been recaptured since 2015. The next youngest birds recaptured for the first time were two from the 2000 cohort. With just one new bird recaptured from the 1992 to 1998 cohorts banded in the study colonies it is unlikely that any further birds from these cohorts will be recorded. A plot of the overall return rate (all three study colonies combined; Figure 3), shows that the percentage of banded known-age birds returning varied from 26.7% (1996 cohort) to 39.3% (1995 cohort) for the cohorts banded 1992 to 1999. Currently, the return rate of cohorts banded 2000-2004 varies from 18.8% (2003 cohort) to 25.4% (2000 cohort) indicating that more birds from these cohorts are likely to be recaptured.



**Figure 3: Fledging success and return and recruitment rates of Southern Buller's Albatrosses banded as chicks in three study colonies at The Snares, 1992-2004.**

### 3.3.2 Recruitment rate of known-age birds

The recruitment rate of known-age Southern Buller's Albatrosses is the proportion of a cohort of chicks that is recaptured as breeding adults several years after banding: the recruitment rate is invariably less than the return rate because usually there are several years difference between when the birds first return to the breeding colonies and when they make their first breeding attempt. Consequently, mortality in the years between returning and the first breeding attempt accounts for the lower recruitment over return rate.

In April 2017, 25 known-age birds, banded as chicks in the study colonies, were found breeding for the first time i.e. they had recruited to the breeding population. It is now 13 years since the last cohort of chicks was banded in the study colonies. With an estimated age of first breeding of 10-12 years the birds recorded this year are in the extended upper range of birds recorded breeding for the first time. Of the 25 known-age birds recruited, seven were aged 13 years (banded as chicks in 2004), four were aged 14 years (banded as chicks in 2003), four were aged 15 years (banded as chicks in 2002), one was aged 16 years (banded as



a chick in 2001), three were aged 17 years (banded as chicks in 2000), three were aged 18 years (banded as chicks in 1999), two were aged 19 years (banded as chicks in 1998), and one was aged 21 years (banded as a chick in 1996).

A plot of recruitment rate, by cohort, of birds banded as chicks 1992-2004 (Figure 3) shows an apparent decline throughout this period. However, given that the mean age of first breeding of Southern Buller's Albatrosses at The Snares is 10-12 years (Francis & Sagar 2012), more birds from the later cohorts are likely to be recorded breeding in future. Therefore, it is probably prudent to estimate recruitment only for the 1992-1999 cohorts i.e. birds aged 18-25 years. Currently, these range from 8.7% for the 1995 cohort from Mollymawk Bay to 28.4% for the 1992 cohort from Punui Bay (Table 2). It is also worth noting that there is considerable variation in the recruitment rate both between years and between colonies in the same year (Table 2).

**Table 2: Numbers (% of total banded as well-grown chicks) of known-age Southern Buller's Albatrosses recruiting (i.e. returning to breed) to The Snares, by colony of provenance, for cohorts banded 1992-1999.**

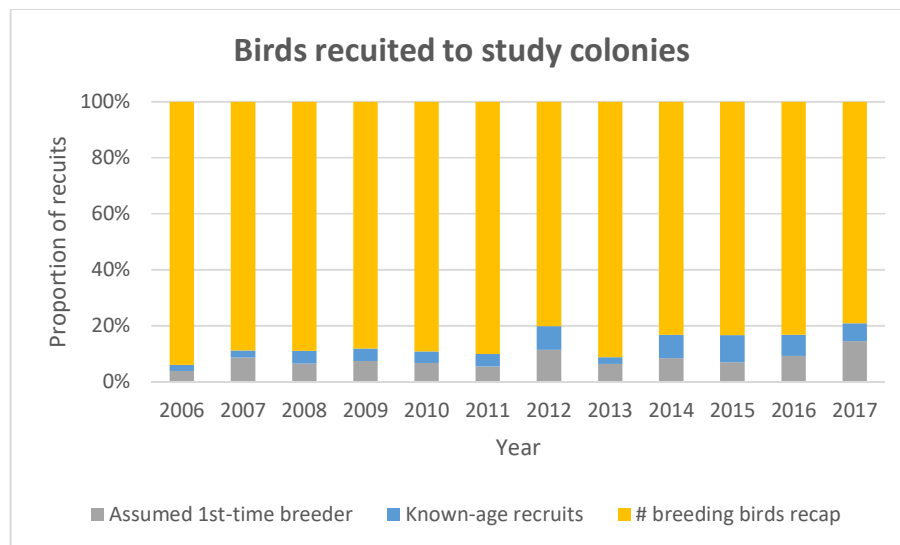
Colony/cohort	1992	1993	1994	1995	1996	1997	1998	1999
Mollymawk Bay	14 (20.0)	18 (20.5)	14 (20.0)	2 (8.7)	10 (11.8)	8 (8.4)	14 (17.3)	25 (28.4)
Punui Bay	13 (28.3)	8 (13.4)	11 (25.6)	12 (19.7)	14 (21.5)	20 (26.7)	14 (18.2)	9 (17.7)

A plot of the overall recruitment rate (all three study colonies combined; Figure 3, shows that the percentage of banded known-age birds from the 1992 to 1999 cohorts that returned and survived to breed varied from 16.0% (1996 cohort) to 24.5% (1999 cohort). Currently, the recruitment rate of known-age birds banded 2000-2004 varies from 10.1% (2002 cohort) to 14.7% (2001 cohort), with more birds likely to be recorded from these cohorts in future. However, as all the birds are now older than the average estimated range of age of first breeding fewer birds are likely to be classified as returning or recruiting with each successive year.

Despite searches for banded birds being made in other colonies adjacent to the three study colonies, some birds, particularly females, will have settled to breed elsewhere on North East Island (Sagar et al. 1998), and so the percentage returns from each cohort should be considered as a minimum.

### 3.3.3 Overall recruitment to the study colonies

Assuming that (1) established breeding birds are highly unlikely to move nests from other colonies between seasons and (2) any unbanded birds breeding in the study colonies are 1<sup>st</sup>-time breeders then any unbanded birds breeding in the study colonies are assumed to be new recruits to the breeding population. The addition of these newly banded birds to the known-age recruits (Figure 4) shows that the proportion of recruits in the overall breeding population varied around 10-11% in the period 2006-2011. However, in the period 2012-2017 it has varied around 16-21%.



**Figure 4: Estimated annual recruitment rate of Southern Buller’s Albatross at three study colonies, The Snares, 2006-2017**

### 3.3.4 Movements of banded birds between colonies

No birds banded as breeding birds within the study colonies were found breeding in adjacent colonies; this has been a consistent finding throughout this study. However, movements of birds from their natal colonies were detected. Of four birds that were now breeding in colonies other than their natal colony, three had moved <100m and one had moved 1250-1500m (from the Razorback to North Mollymawk Bay).

### **3.3.5 Birds banded before 1992**

At The Snares breeding birds were banded during studies in 1948, 1961 and most years 1967-1977. No banded birds from these years were recorded during April 2017; the last such birds were recaptured in 2013. In addition, 859 well-grown chicks were banded at a large number of colonies distributed over much of North East Island during August 1972 (Sagar et al. 1998). One of the latter was recorded during April 2017, guarding a chick at its nest in the Lower Punui Bay study colony. At 45 years this is the oldest known-age Southern Buller's Albatross.

## **4. Discussion**

Information from annual counts of the numbers of Southern Buller's Albatrosses breeding in three study colonies from 1992 to 2017 indicates that such annual counts provide a useful index of trends in the whole-island population. The counts in the three study colonies suggests that the breeding population peaked during 2005-2006, then trended downward until 2010 and subsequently has had marked annual increases and decreases. The population trends until 2007 broadly reflect changes in annual adult survival (Sagar et al. 2000; Francis & Sagar 2012), with higher annual adult survival rates 1992-1997 (Sagar et al. 2000) followed by declines through to 2007 at least. (Francis & Sagar 2012). The survival estimates through to 2016 show that the decline in adult survival has continued and the breeding population in the study colonies appears to have been sustained by an increased rate of recruitment.

The return and recruitment rates of known-age birds banded 1992-2004 shows considerable variation both within colonies between years and between colonies within the same year. Although future fieldwork is likely to increase both return and recruitment rates for the cohorts 2000-2004, few new birds are likely to be recaptured from cohorts banded 1992-1999 inclusive. Currently, the return rates for cohorts banded in 1994 and 1995 are higher than in any other years and there appears to be an annual decline in the recruitment rate for cohorts banded 1992-1998.

## **5. Acknowledgments**

The logistics for this programme were funded by Deepwater Group and special thanks go to Richard Wells for his continued support. The field component was completed by volunteers

Paul Sagar (leader), Joy Sagar and Charlotte Woods. Thanks to staff at the Department of Conservation's Southern Islands Store for their continued efficient and unfailing help during our times in Invercargill. Thanks also to the staff of the Department of Conservation's Stewart Island Field Centre for their daily communication link. Finally, thanks to Andy Whittaker and the crew of *Baltazar* for providing cheerful, efficient and helpful assistance in getting us to and from The Snares.

## 6. References

- Francis, R.I.C.C.; Sagar, P.M. (2012). Modelling the effect of fishing on southern Buller's albatross using a 60-year dataset. *New Zealand Journal of Zoology* 39: 3-17.
- Sagar, P.M.; Molloy, J.; Weimerskirch, H.; Warham, J. (2000). Temporal and age-related changes in survival rates of Southern Buller's albatrosses (*Thalassarche bulleri bulleri*) at the Snares, New Zealand. *Auk* 117: 699-708.
- Sagar, P.M.; Stahl, J.C.; Mollow, J. (1998). Sex determination and natal philopatry of Southern Buller's Mollymawk (*Diomedea bulleri bulleri*). *Notornis* 45: 271-278.
- White, G.C.; Burnham, K.P. (1999). Program MARK: Survival estimation from populations of marked animals. *Bird Study* 46: 120-139.