# Population studies of southern Buller's albatrosses at Tini Heke | The Snares Islands

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Population studies of southern Buller's albatrosses at Tini Heke | The Snares Islands 2025

Final report to Department of Conservation, Conservation Services Programme

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## Summary

This report presents a summary of the results of demographic studies at three study colonies of southern Buller's albatrosses *Thalassarche bulleri bulleri* breeding at Tini Heke | The Snares from 12 to 22 January and 10 to 15 April 2025. Demographic studies at the three study colonies on North East Island, The Snares, have been undertaken annually 1992–2025, with the exception of 2018 and 2021. Estimates of the numbers of breeding pairs, made by recording the contents of each nest mound, increased in all three study colonies compared to 2024, but numbers remain below the levels recorded since 2010. 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, with a general decrease since 2010.

A total of 278 birds that had been banded previously in the study colonies as breeding adults of unknown age were recaptured. A further 51 breeding birds were banded in the study colonies - these are presumed to be first-time breeders. The estimate of adult survival in 2024 was 0.85, one of the lowest recorded during the 33 years of this study. 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, 69 of these birds were recaptured, with birds from cohorts banded from 2000 and 2004 recorded as breeding for the first time. This demonstrates the long-term monitoring required to obtain reliable estimates of survival of such known-age birds. In addition, two birds that had been banded as near-fledging in the study colonies during Sep 2013 and Sep 2014 were also recaptured for the first time.

Alphanumeric darvic bands were leg mounted on 418 newly banded birds or recaptured birds. Four of these have since been sighted at sea – three at the Otago Canyons and one off Bruny Island, Tasmania.

During January 2025, 20 Druid satellite-transmitting trackers were deployed on breeding Buller's albatrosses to follow year-round at-sea distributions. In addition, Global Location Sensing (GLS) light-based geolocators and IgotU Global Positioning System (GPS) data loggers were deployed on eight breeding Buller's albatrosses to investigate at-sea distribution patterns. These deployments were short-term, and devices were recovered from six of these birds during the April trip.

In April 2024 26 GLS tags were deployed on breeding birds at the Mollymawk Bay study colony; 15 of these were retrieved during April 2025. A further 10 Druid trackers were deployed on non-breeding Buller's in April 2025.

SD cards and batteries were replaced in 16 nest cameras deployed at breeding colonies on The Snares and set to record one photograph every hour of nesting Buller's albatrosses during daylight for a further year.

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## Background

This project was funded by the Conservation Services Programme, Department of Conservation (CSP, DOC). The purpose of the project was to continue the demographic study at three study colonies of breeding southern Buller's albatrosses *Thalassarche bulleri bulleri*, which had been initiated in 1992 and continued annually to 2025, with the exception of 2018 and 2021. The specific objectives were to:

- Determine the numbers of pairs breeding in the three established study colonies.
- Estimate annual survival of banded birds from recapture data.
- Deploy Druid satellite tracking devices on breeding birds.
- Deploy IgotU Global Positioning System (GPS) data loggers and Global Location Sensing (GLS) light-based geolocators on breeding birds during January 2025 and retrieve these in April 2025.
- Retrieve GLS tracking devices deployed during April 2024.
- Attach an alphanumeric darvic band to all banded birds.
- Retrieve SD cards and install new SD cards and batteries in trail cameras sited at breeding colonies to record nest survival over a further full 12-month period.

This report describes the field work completed at Tini Heke | The Snares under contract POP2020-03 to the Department of Conservation.

Fieldwork centred on 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. Demographic data of southern Buller's albatrosses in these study colonies at Tini Heke | The Snares were recorded annually 1992–2017, 2019–2020, and 2020–2024.

## Methods

### *Logistics*

Tini Heke | The Snares (48º01'S, 166º36'E) comprise North East Island (280 ha) and Broughton Island (90 ha), plus numerous islets and stacks (Fig. 1).

Transport to and from Tini Heke for both the January and April trips was provided by the ketch *Evohe* (skipper, plus 3–4 crew). In January the field team (comprising Hendrik Schulz and Paul Sagar) was dropped off at Boat Harbour about 11:00 on the 11th and picked up on the 24th. In April the field team (comprising Kalinka Rexer-Huber, Graham Parker, Kate Simister and Paul Sagar) were dropped off at Boat Harbour about 10:00, after a 2-day delay due to weather conditions. The *Evohe* stayed at The Snares for the duration, moored in HoHo Bay or sheltering on the south side of North East Island, near Alert Stack, until forecast bad weather forced us to depart The Snares a day early, on 15 April.

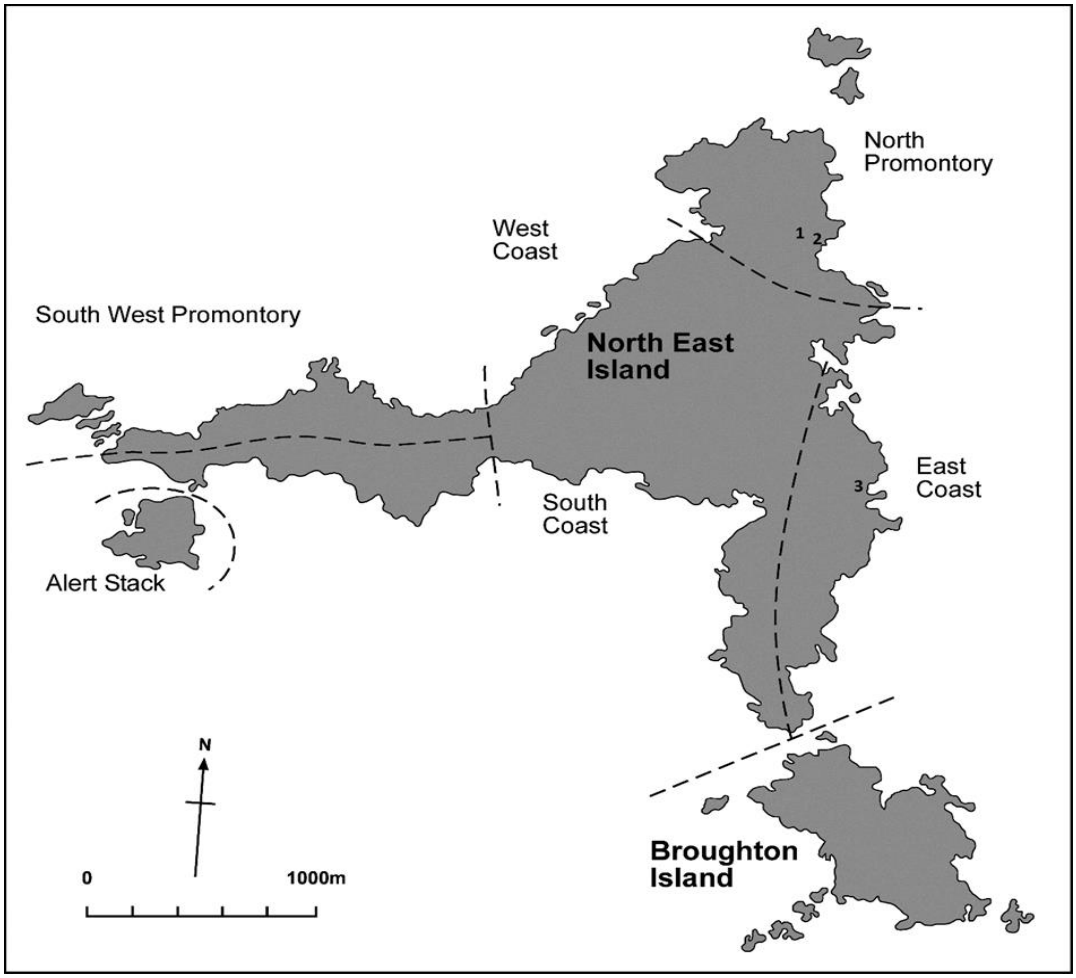


Figure 1. Tini Heke | The Snares, showing locations of the study colonies on North East Island. 1, Upper Punui Bay; 2, Lower Punui Bay; 3, Mollymawk Bay. Dashed lines indicate boundaries of areas for whole-island counts of breeding pairs of southern Buller's albatross (although such counts were not undertaken in 2025).

The laying period of southern Buller's albatrosses at The Snares extends from late December to the end of February, with most eggs laid by the end of January (Sagar & Warham 1998). Hatching occurs from mid-March with a peak in the 1st week of April. Therefore, in 2025 the timing of the January trip was scheduled to occur during peak laying and so allow for breeding birds to be tracked throughout incubation. The timing of the April trip was scheduled to occur close to peak hatching when most birds sitting on a nest were assumed to have shorter incubation stints, so change-overs at the nest were more frequent and allowed a greater proportion of partners to be captured/recaptured. Capturing a greater proportion of breeding birds reduces the variance around estimated mean annual survival rates, and so allows greater confidence in the data.

### *Study colonies*

During January 2025 each of the three southern Buller's albatross study colonies (Upper Punui Bay, Lower Punui Bay, Mollymawk Bay; Fig.1) on North East Island was visited 1–9 times; Upper Punui Bay 12, 14–17, 19, 21–23 January, Lower Punui Bay 14, 22 and23 January, and Mollymawk Bay 21 January. On each of these days all nests were inspected and the contents recorded.

During the April trip each of the three study colonies was visited 2–4 times; Upper Punui Bay 10, 11, 13 and 14 April; Lower Punui Bay on 11, 13 and 14 April; and Mollymawk Bay on 12 and 15 April.

On the first visit to each colony, all nests were inspected, and the contents recorded. The presence of an abandoned or broken egg and dead chick were also recorded. This figure is useful because unlike at other colonial albatross colonies in the New Zealand subantarctic, predation of albatross eggs or small chicks by red-billed gulls (*Chroicocephalus novaehollandiae*) and subantarctic skuas (*Stercorarius antarcticus*) has not been recorded at The Snares. Therefore, egg or chick remains were included in the estimated total numbers of breeding pairs, and so provided comparable data across all years, despite variation of up to a month in the timing of visits. Band numbers of all adult birds associated with these nests were recorded, and any unbanded birds incubating were captured and fitted with a uniquely numbered stainless-steel band and alphanumeric darvic band (black text on white darvic), and standard measures of minimum bill depth and tarsus width taken for sexing following Sagar et al. (1998). All adult birds recorded on this first visit were marked with blue raddle (a temporary stock marker) so that they were recognisable and not captured on a subsequent colony visit. On the second and subsequent visits to each colony all nests were checked again and any birds not blue-marked were captured and band numbers recorded and alphanumeric bands attached. 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.

### *Banded birds outside study colonies*

As many albatrosses as possible were checked for leg bands in breeding colonies adjacent to the study colonies. This information was used to estimate any dispersal of banded birds from the study colonies.

### *Survival estimation*

Survival was estimated from the banded southern Buller's albatrosses in the study colonies with maximum likelihood mark-recapture statistical methods using MARK via the R package RMark and the standard Cormack-Jolly-Seber model (White & Burnham 1999; Laake 2013; R Core Team 2023). As best as possible, methods followed the approach used for previous Buller's albatross survival analyses from The Snares (Thompson & Sagar 2022; 2023). The model was run using data from 1,897 breeding birds banded 1992–2025, including data on sex assigned using the measurements of minimum bill depth and tarsus width (Sagar et al. 1998), and by cross-referencing with the partner of each bird, where this was known. There were no field visits to the island in 2018 and 2021, and so survival has not been estimated for these years.

We first tested a range of models for best fit, comparing models using AICc. Specifically, we created models where both survival and resighting probability (or detection probability) either varied by time, sex, or were held constant. Annual survival was then estimated using the best-fitting model.

### *Nest cameras*

During the January visit all 12 trail cameras were checked and the SD cards and batteries replaced where applicable. Where necessary the position of cameras was changed to allow coverage of more active nests. In April additional six cameras were deployed to extend the coverage and sample size of nests covered.

## Results

### *Numbers of occupied nests*

Totals of 69, 46 and 112 southern Buller's albatross nests with an egg or chick were counted in the Upper Punui Bay, Lower Punui Bay and Mollymawk Bay study colonies, respectively (Fig. 2, Appendix 2). Included in these totals were three nests in Upper Punui Bay each containing egg fragments indicating that the egg had been broken earlier in the breeding season. No egg or chick losses were noted at either Lower Punui Bay or Mollymawk Bay.

The 2025 totals represent increases, relative to numbers counted in April 2024, in the Upper Punui Bay, Lower Punui Bay and Mollymawk Bay study colonies of 16.9%, 15.0% and 30.2%, respectively.

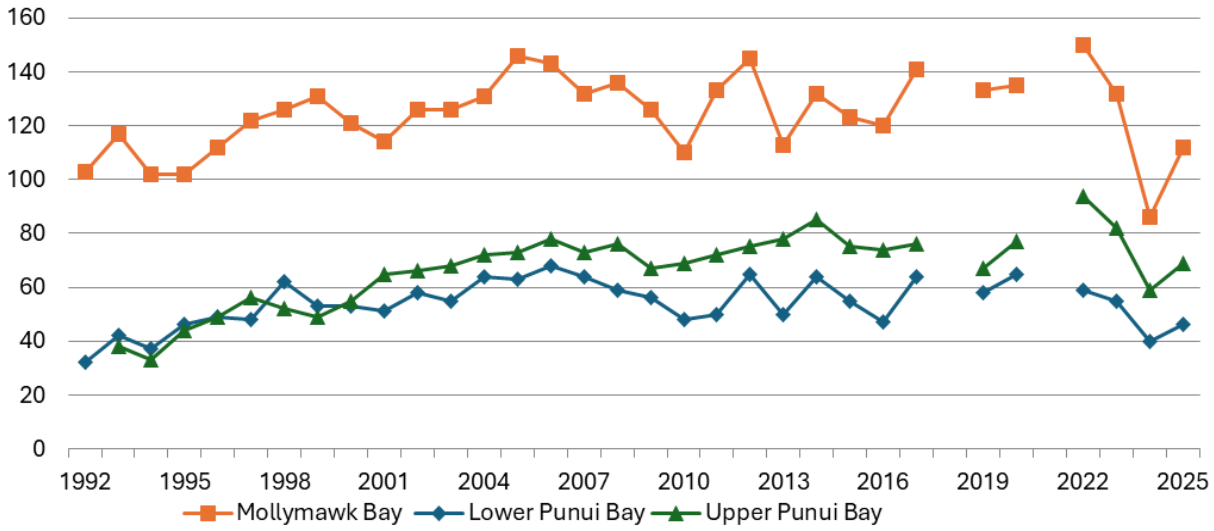


Figure 2. Numbers of breeding pairs of southern Buller's albatrosses counted annually at three study colonies, The Snares 1992–2024. No visits were made to the study colonies in 2018 and 2021, hence the gaps in the data.

### *Adult survival*

A total of 278 birds that had been banded previously as breeding adults of unknown age in the study colonies were recaptured. This total comprises breeding birds, non-breeding birds, and failed breeders. In addition, a further 51 breeding birds (i.e., birds that were incubating or brooding a chick) were banded within the study colonies. Because birds breeding in the study colonies have been checked annually since 1992 (with the exception of 2018 and 2021), we assumed that non-banded birds that are captured from their nests are first-time breeders, and so likely to have been 10–12 years old, the average age of first breeding (Francis & Sagar 2012).

At Tini Heke | The Snares, breeding birds were banded during studies in 1948, 1961 and most years 1968–1977. No banded birds from these studies were recorded in 2025.

Alphanumeric bands were added to 418 newly banded and recaptured birds during the January and April 2025 visits.

All banding data (newly banded birds plus recaptures) have been submitted to FALCON, the banding database operated by the Department of Conservation, Wellington.

A range of mark-recapture models for southern Buller's albatrosses were compared using AICc. The best supported model was one where both survival rate and resighting probability differ over time (model 1, Table 1); in other words, the model that best fit the data was one that explicitly accounts for the varied resighting effort and survival rates seen in the dataset over time. There was less support for survival being constant over time or survival differing by sex (models 2 and 3, Table 1). There was no indication that resighting probability should be treated as a constant over time, or that it varies by sex (models lower-ranking therefore not shown).

Table 1. Model selection table for the top three models of southern Buller's albatross survival, April 2025.

| Model | npar | AICc | ΔAICc |
|---|---|---|---|
| 1. Survival varies with time, resighting probability varies with time | 62 | 23224.19 | 0.00 |
| 2. Survival constant, resighting probability varies with time | 32 | 23420.60 | 196.40986 |
| 3. Survival varies by sex and resighting probability varies with time | 33 | 23420.89 | 196.69918 |

Using the best-supported model to estimate annual survival rates—accounting for varying survival and resighting probabilities over time—annual survival was relatively high before 2012, with values varying around an average of 0.95 ± 0.01 (± 1 SE). Since 2012, point estimates have tended to decline, with average annual survival of 0.91 ± 0.02 (Table 2, Fig. 3). The last five estimates over the period 2018 to 2024 have varied between 0.85 and 0.95 (Table 2). The most recent estimate of annual survival of birds banded as breeders was 0.85 ± 0.04.

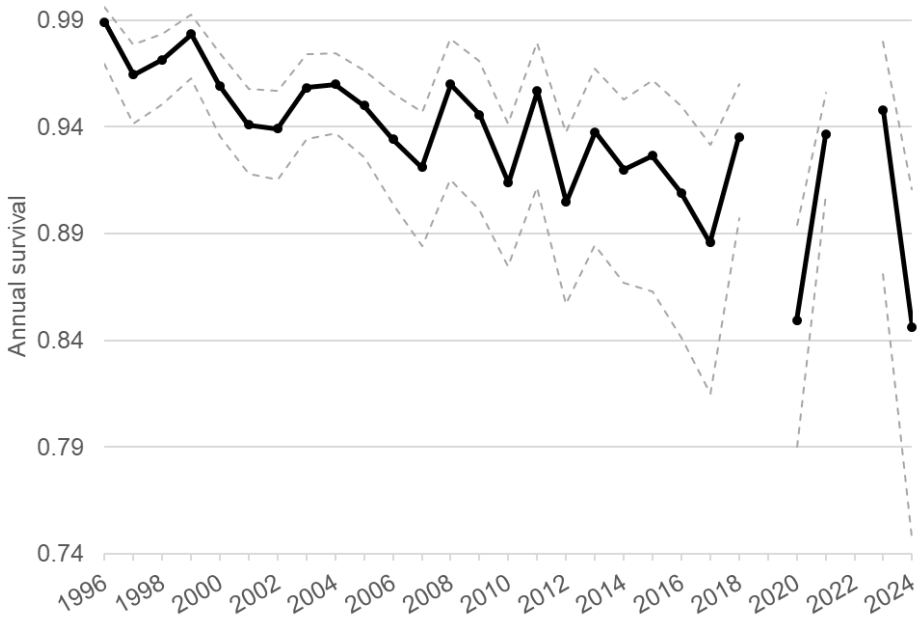


Figure 3. Estimated annual survival of southern Buller's albatrosses at Tini Heke | The Snares. Survival estimates are black dots and black lines; variance estimates (upper and lower 95% confidence intervals) are grey dashed lines. Note: in this date convention, 1996 refers to the 1995–1996 breeding season.

Table 2. Estimated annual survival ± 1 SE, for southern Buller's albatross at Tini Heke | The Snares, from field visits 1992–2025. Note we follow the convention where the 1993 estimate is that for the year 1992–1993. There were no research visits in 2018 and 2021. There is no 2025 estimate since mark-recapture estimates for the most recent year of data are not accurate and precise enough to be useful.

| Year | Survival estimate | Standard error |
|---|---|---|
| 1993 | 0.995 | 0.005 |
| 1994 | 1.000 | 0.000 |
| 1995 | 1.000 | 0.000 |
| 1996 | 0.989 | 0.006 |
| 1997 | 0.965 | 0.009 |
| 1998 | 0.971 | 0.008 |
| 1999 | 0.984 | 0.007 |
| 2000 | 0.959 | 0.010 |
| 2001 | 0.941 | 0.010 |
| 2002 | 0.939 | 0.010 |
| 2003 | 0.958 | 0.010 |
| 2004 | 0.960 | 0.009 |
| 2005 | 0.950 | 0.010 |
| 2006 | 0.934 | 0.013 |
| 2007 | 0.921 | 0.016 |
| 2008 | 0.960 | 0.016 |
| 2009 | 0.946 | 0.017 |
| 2010 | 0.914 | 0.017 |
| 2011 | 0.957 | 0.016 |
| 2012 | 0.905 | 0.020 |
| 2013 | 0.938 | 0.020 |
| 2014 | 0.920 | 0.021 |
| 2015 | 0.926 | 0.024 |
| 2016 | 0.909 | 0.027 |
| 2017 | 0.886 | 0.029 |
| 2018 | 0.935 | 0.016 |
| 2019 | | |
| 2020 | 0.849 | 0.026 |
| 2021 | 0.936 | 0.012 |
| 2022 | | |
| 2023 | 0.948 | 0.025 |
| 2024 | 0.846 | 0.041 |

There were no research visits in 2018 and 2021. Mark-recapture estimates tend to be poor for the most recent year of data collection, and so the 2025 survival estimate is omitted. The best-fitting model does not require sex to best describe southern Buller's albatross survival rates (Table 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 banded close to fledging, and subsequently recaptured. Of the 2,765 birds banded as chicks near fledging in the study colonies and adjacent colonies between 1992 and 2004, 69 were recaptured during April 2025. The oldest known-age birds recaptured in the three study colonies for the first time were two from the 2000 cohort, and so were 25 years old. This indicates that many years of recapture effort are required to obtain reliable estimates of the survival of these known-age birds.

Of the 1,991 birds banded as chicks near fledging in the study colonies during the period 1992–2004 (which would now be at least 21 years old), 577 (29.0%) have been recaptured. The lowest rate of return (14.9%, 16 recaptured from 107 banded) is for the 2003 cohort in Punui Bay (Lower and Upper Punui Bay colonies combined) and the highest rate of return (44.3%, 27 recaptured from 61 banded) from the 1995 cohort in these same colonies (Table 3).

Table 3. Number banded, number recaptured and % recaptured of total banded in each cohort (listed in order of top to bottom) of southern Buller's albatrosses that were banded as well-grown chicks in 1992–2004, returning to Tini Heke | The Snares. Data are presented by colony of provenance, with Punui Bay colonies combined.

| Colony/ cohort | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mollymawk | 70 | 88 | 70 | 23 | 85 | 95 | 81 | 88 | 89 | 81 | 95 | 95 | 99 |
| Bay | 19 | 28 | 26 | 6 | 19 | 19 | 32 | 34 | 26 | 17 | 21 | 30 | 31 |
| | *27.1* | *31.8* | *37.1* | *26.1* | *22.4* | *20.0* | *39.5* | *38.6* | *29.2* | *21.0* | *22.1* | *31.6* | *31.3* |
| Punui Bay | 46 | 58 | 43 | 61 | 65 | 75 | 77 | 51 | 84 | 82 | 94 | 107 | 89 |
| | 18 | 12 | 17 | 27 | 22 | 29 | 21 | 12 | 20 | 17 | 24 | 16 | 35 |
| | *39.1* | *20.7* | *39.5* | *44.3* | *33.3* | *38.7* | *27.3* | *23.5* | *23.8* | *20.7* | *25.5* | *15.0* | *39.3* |

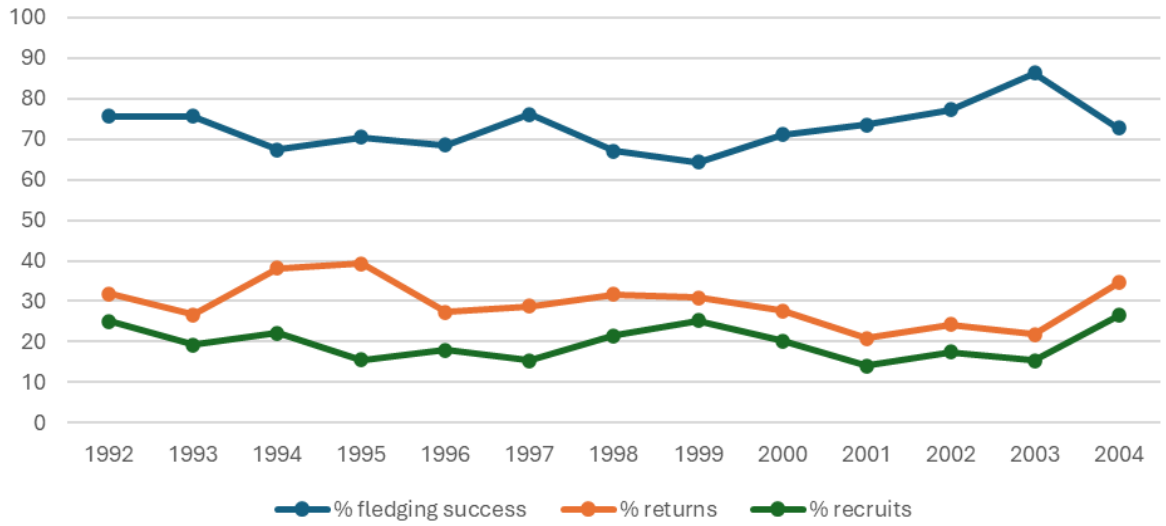


Figure 4. Fledging success and return and recruitment rates of southern Buller's albatrosses banded as well-grown chicks in three study colonies at Tini Heke | The Snares 1992–2004.

A plot of the overall return rate (all three study colonies combined; Fig. 4, Appendix 3), shows that from these cohorts the percentage of banded known-age birds returning varied from 20.9% (2002 cohort) to 39.3% (1995 cohort).

Of 40 birds banded as chicks near fledging in the study colonies during September 2013, 10 (25%) have been recaptured. Likewise, of 82 birds banded as chicks near fledging in the study colonies during September 2014, four (4.9%) have been recaptured. It is likely that more of these cohorts will be recaptured in the future.

### *Recruitment of known-age birds*

The recruitment 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 of mortality in the years between returning and the first breeding attempt.

In April 2025, three known-age birds, banded in the study colonies in the period 1992–2004, were found breeding for the first time i.e., they had recruited to the breeding population. Of these, two were aged 25 years (banded as chicks in 2000) and one was aged 21 years (banded as a chick in 2004). The proportion of chicks from each study colony recruiting to the breeding population varies by cohort and location (Table 4).

Table 4. Number banded, number recruited to the breeding population and *% recruited of total banded in each cohort* (listed in order of top to bottom) of southern Buller's albatrosses that were banded as well-grown chicks in 1992–2004. Data are presented by colony of provenance, with Punui Bay colonies combined.

| Colony/ cohort | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mollymawk Bay | 70 | 88 | 70 | 23 | 85 | 95 | 81 | 88 | 89 | 81 | 95 | 95 | 99 |
| | 14 | 19 | 15 | 2 | 11 | 8 | 17 | 24 | 20 | 10 | 11 | 17 | 20 |
| | *20.0* | *21.6* | *21.4* | *8.7* | *12.9* | *8.4* | *21.0* | *27.3* | *22.5* | *12.3* | *11.6* | *17.9* | *20.2* |
| Punui Bay | 46 | 58 | 43 | 61 | 65 | 75 | 77 | 51 | 84 | 82 | 94 | 107 | 89 |
| | 15 | 9 | 10 | 11 | 16 | 19 | 17 | 11 | 15 | 13 | 22 | 14 | 29 |
| | *32.6* | *15.5* | *23.2* | *18.0* | *24.6* | *25.3* | *22.1* | *21.6* | *17.9* | *15.9* | *23.4* | *13.1* | *32.6* |

It is likely that little additional recruitment will be recorded in future, given that there were just three new recruitment records last year, in 2024. Currently, recruitment rates for all three study colonies combined range from 14.1% in 2001 to 26.6% in 2004. A plot of recruitment rate, by cohort, of birds banded as chicks from 1992 to 2004 (Fig. 4) shows a slight decline during the period 1992 to 1997, followed by an increase 1998 to 1999 and then a slight decline 1999 to 200, before a steep increase in 2004.

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 and recruitment rates noted here should be considered as minima.

A total of 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). None of these birds were recorded during April 2025.

### *Tracking device deployments and retrievals*

During January 2025, the aim was to deploy 20 Druid satellite transmitting tags to 20 breeding southern Buller’s albatrosses at the start of incubation to inform early breeding season at-sea distributions during the egg stage. Therefore, the January trip was timed to occur at peak laying in the third week of January, based on data from three seasons in the 1970s (Sagar & Warham 1998). However, laying was delayed in January 2025 with just six birds on eggs at the Mollymawk Bay study colony on 21 January, two birds on eggs in the Lower Punui Bay study colony on 22 January, and eight birds on eggs in the Upper Punui Bay study colony also on 22 January.

Consequently, Druids were deployed on 14 birds that occupied empty nests over several days, and so were deemed likely to breed, and six birds that were incubating. In addition, eight birds that were incubating were each fitted with an IgotU and GLS device. These were retrieved from six of these birds during April 2025.

In addition, during April 2025 a Druid satellite transmitting tag was attached to each of 10 non-breeding birds.

During April 2025, 15 of the 26 GLS devices deployed on breeding birds during April 2024 were retrieved.

### *Nest cameras*

Nest cameras set up to photograph occupied nests last year (Sagar et al. 2024) were maintained this season: during January 2025 the SD cards and batteries were replaced in 10 of last year's 12 nest cameras. Wherever possible, the cameras were redeployed in the same locations. However, for some cameras doing so would have produced coverage of too few occupied nests, and so they were re-positioned to allow for a greater number of nests to be surveyed. The remaining two cameras suffered battery leakage or water ingress, leading to corrosion, and so were removed.

During April 2025 an additional six cameras were deployed to cover occupied nests, to bolster the number of nests under surveillance. These were added at Punui South and Mollymawk Bay colonies (see Appendix 1 for positions of new cameras and annotated photos of each camera's nest view).

## Discussion

### *Study colonies*

Information from the three Tini Heke | The Snares study colonies overall suggests that the southern Buller's albatross breeding population peaked during 2005–2006, then trended downward until 2010. Subsequently the breeding population has been variable in the Lower Punui Bay and Mollymawk Bay study colonies with marked annual increases and decreases, whilst numbers in the Upper Punui Bay colony have tended to increase in most years. The numbers of breeding pairs in all three study colonies in 2024 were substantially lower than those recorded in 2022 and 2023. While numbers of breeding pairs increased in all three study colonies in 2025, they remain lower than numbers 2022–23 and have not returned to the levels recorded before 2010.

The trends in the numbers of pairs breeding in the study colonies until 2007 broadly reflect changes in annual adult survival (Sagar et al. 2000; Francis & Sagar 2012), with higher annual adult survival rates 1992–2004 (Sagar et al. 2000) followed by declines through to 2016 (Francis & Sagar 2012; Sagar et al. 2017; Fig. 3). Therefore, it is not surprising that the substantial decline in the numbers of breeding pairs in all three study colonies in 2024 is matched by a similarly low estimated survival rate for that year.

Since 2012 the annual recruitment rate (calculated from the numbers of newly banded birds and recaptures of known-age birds) increased from 10–11% to 16–21%, which led Sagar et al. (2017) to suggest that this is likely sustaining the breeding population and without it the population would decline. In 2025, 16.3% of the total number of breeding birds recorded were newly banded or known-age birds breeding for the first time, and without them the breeding population would have declined substantially.

An additional factor leading to the still relatively low breeding numbers could be that reduced food availability resulted in adults not being in sufficient condition to breed and so taking a sabbatical year, therefore reducing their breeding frequency. Reduced food availability is also indicated by the later than expected start to the breeding season. By the end of the 3rd week in January over 40% of eggs had been laid during three breeding seasons 1969–72 (Sagar & Warham 1998), but in 2025 <10% of eggs had been laid. This result is similar to Richdale (1949), who recorded just 7.9% of eggs laid by the 21 January 1948. If reduced natural food production due to warmer seas occurred, then this may

lead to greater attendance of southern Buller's albatrosses at fishing vessels and result in a greater likelihood of bycatch.

### *Estimated annual survival*

Despite two recent survival estimates, for 2021 and 2023, being relatively high at around 0.94, approaching the survival rates more-commonly recorded before 2013, the longer-term decline of the estimated annual survival rates of birds banded as breeding birds is concerning. Since 2011 the estimated annual survival has usually been below the accepted level (0.92) to maintain a stable population and at 0.85, the estimates for 2020 and 2024 are the lowest recorded during the 33 years of the current study.

### *Return and recruitment rates*

The return and recruitment rates of known-age birds banded 1992–2004 show considerable variation both within colonies between years and between colonies within the same year. Although future field work 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. The first recaptures of two birds banded as chicks in 2000 and one in 2004 during April 2025 begs the question of where the birds have been during the period between fledging and breeding.

### *Recommendations*

It is pleasing to note that some of the recommendations made by Sagar et al. (2024) have been actioned. The attachment of uniquely numbered alphanumeric bands during the January and April 2025 trips have already provided at-sea sightings from the Otago Canyons (3 birds) and near Bruny Island, Tasmania (1 bird).

Additionally, a three-year project to visit The Snares in August–September, starting in 2025, to record breeding success and band fledglings is currently under consideration for the 2025/26 draft CSP Annual Plan.

The outstanding recommendations are:

- Plan for longer trips to enable recapture of a greater number of banded birds in the study colonies
- Conduct satellite tracking of fledgling southern Buller's albatrosses
- Conduct an up-to-date full island count of breeding Buller's albatrosses at Tini Heke / Snares
- Analyse breeding frequency and mate retention

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## Appendix 1: new nest cameras April 2025

| CameraID | Location | latitude | Longitude |
|---|---|---|---|
| D9 | Punui S | -48.0190 | 166.6057 |
| D5 | Punui S | -48.0189 | 166.6057 |
| D2 | Mollymawk. B | -48.0274 | 166.6135 |
| D6 | Mollymawk. B | -48.0273 | 166.6134 |
| D7 | Mollymawk. B | -48.0274 | 166.6134 |


Examples of camera-vantage photos, annotated to show the nests in view of the camera that were active at time of camera mounting

## Appendix 2: Breeding pairs of southern Buller's albatrosses in three study colonies

Table A2. Numbers of breeding pairs of southern Buller's albatrosses counted annually at three study colonies, The Snares 1992–2025. No visits were made to the study colonies in 2018 and 2021, hence the gaps in the data. Note that the Upper Punui Bay study colony was not established until 1993.

| | Mollymawk Bay | Lower Punui Bay | Upper Punui Bay |
|---|---|---|---|
| 1992 | 103 | 32 | |
| 1993 | 117 | 42 | 38 |
| 1994 | 102 | 37 | 33 |
| 1995 | 102 | 46 | 44 |
| 1996 | 112 | 49 | 49 |
| 1997 | 122 | 48 | 56 |
| 1998 | 126 | 62 | 52 |
| 1999 | 131 | 53 | 49 |
| 2000 | 121 | 53 | 55 |
| 2001 | 114 | 51 | 65 |
| 2002 | 126 | 58 | 66 |
| 2003 | 126 | 55 | 68 |
| 2004 | 131 | 64 | 72 |
| 2005 | 146 | 63 | 73 |
| 2006 | 143 | 68 | 78 |
| 2007 | 132 | 64 | 73 |
| 2008 | 136 | 59 | 76 |
| 2009 | 126 | 56 | 67 |
| 2010 | 110 | 48 | 69 |
| 2011 | 133 | 50 | 72 |
| 2012 | 145 | 65 | 75 |
| 2013 | 113 | 50 | 78 |
| 2014 | 132 | 64 | 85 |
| 2015 | 123 | 55 | 75 |
| 2016 | 120 | 47 | 74 |
| 2017 | 141 | 64 | 76 |
| 2018 | | | |
| 2019 | 133 | 58 | 67 |
| 2020 | 135 | 65 | 77 |
| 2021 | | | |
| 2022 | 150 | 59 | 94 |
| 2023 | 132 | 55 | 82 |
| 2024 | 86 | 40 | 59 |
| 2025 | 112 | 46 | 69 |

## Appendix 3: Fledgling southern Buller's albatross breeding success, return and recruitment rates

Table A3. Breeding success and return and recruitment rate of fledgling southern Buller's albatrosses from three study colonies at the Snares, banded 1992–2004. Bad weather curtailed the 1995 trip and so not all the fledglings were banded.

| Year | No. eggs laid | No. chicks fledged | % chicks fledged | No. fledglings banded | No. returned | % returned | No. recruited | % recruited |
|---|---|---|---|---|---|---|---|---|
| 1992 | 153 | 116 | 75.8 | 116 | 37 | 31.9 | 29 | 25.0 |
| 1993 | 193 | 146 | 75.6 | 146 | 39 | 26.7 | 28 | 19.2 |
| 1994 | 172 | 116 | 67.4 | 113 | 43 | 38.1 | 25 | 22.1 |
| 1995 | 192 | 131 | 70.4 | 84 | 33 | 39.3 | 13 | 15.5 |
| 1996 | 210 | 144 | 68.6 | 144 | 41 | 28.5 | 27 | 18.7 |
| 1997 | 226 | 172 | 76.1 | 170 | 49 | 28.8 | 27 | 15.3 |
| 1998 | 240 | 161 | 67.1 | 158 | 54 | 31.7 | 34 | 21.5 |
| 1999 | 219 | 141 | 64.4 | 139 | 44 | 30.9 | 35 | 25.2 |
| 2000 | 229 | 163 | 71.2 | 163 | 48 | 29.4 | 35 | 21.5 |
| 2001 | 230 | 169 | 73.5 | 163 | 34 | 20.9 | 23 | 14.1 |
| 2002 | 250 | 193 | 77.2 | 189 | 46 | 24.3 | 32 | 17.5 |
| 2003 | 234 | 202 | 86.3 | 202 | 44 | 21.8 | 31 | 15.3 |
| 2004 | 267 | 194 | 72.7 | 188 | 65 | 34.6 | 49 | 26.1 |