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Seabird populations, demography and tracking:

Gibson's albatross, white-capped albatross and white-chinned petrels in the Auckland Islands 2018–19

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DRAFT FINAL Report to Department of Conservation, Conservation Services Programme

April 2019

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Summary

This report details the mark-recapture methods and findings for white-chinned petrels, Gibson's albatrosses and white-capped albatrosses. For Gibson's albatross, we present data on the size of the nesting population in 2019, and updated estimates of survival, productivity and recruitment to help identify causes of current population size and trends. We also document tracking methods and device recoveries for all three species, and for white-capped albatrosses, describe nest camera recoveries and aerial photographic work.

White-chinned petrels. Three global location sensor (GLS) tracking devices were recovered and forty-seven banded white-chinned petrels were recaptured (recapture rate 0.27). Some burrow-switching has occurred, with three banded birds in new burrows ~2–5m from the burrow where first banded, justifying checks in unmarked burrows. With further banding this season, the study area now contains 230 banded white-chinned petrels in 131 marked burrows. Further resighting effort is needed before demographic parameters can be estimated reliably.

Gibson's albatross. Nesting success has returned to levels recorded before the 2005 crash and appears to have stabilised, with 61% productivity in the 2017–2018 breeding season. The survival rate of adult males and females is now similar though survival remains below pre-crash levels. Breeding numbers in 2018–2019 continued the slow post-crash increase. The total estimated number of breeding pairs of Gibson's wandering albatrosses in 2018–19 was 4,180, just under half the number of pairs breeding in 2004 (i.e., 8,728) before the population crashed. With annual mortality a little higher than it used to be, a total population substantially smaller than it used to be and more than a decade of low chick production, population recovery is likely to be slow.

White-capped albatross. Banded white-capped albatrosses were resighted at a rate of 0.34, and a further 122 breeding white-capped albatrosses were banded bringing the study colony total to 679 birds banded. Four GLS tracking devices were retrieved, and one further bird which had lost its GLS (or had it removed) was resighted.

Nest cameras gave up to 9½ months of data from deployment in January 2018. Chick success, or the survival of a chick from hatching to fledging, was lower than expected at 0.29 (5 out of 17 nests). Chicks fledged ~27 July (range 12 July–23 August), and adults returned to the colony from around 30 September. Low chick success is a concern since breeding success (survival from egg lay to fledging) will be lower than chick success. To estimate breeding success, nest cameras must follow the full breeding season, and all parameters (chick success, dates of fledging and adult return) would benefit from following more nests than in this trial.

Aerial photographs of the Disappointment Castaways B area were taken on 7 February around 1400 hrs. 260 suitable photos have been archived for interpretation at a later date. The main difference to previous aerial photography work is the timing: photographs in 2019 were taken 3 weeks later. Nest counts from these photographs will have to be corrected for breeding failures during incubation.

Keywords: Adams, Disappointment, mark-recapture, GPS tracking, geolocation, survival, productivity, population trend

Contents

Introduction

Assessments of the risk of commercial fisheries to seabird populations (e.g. Richard and Abraham 2013) can be affected profoundly by uncertainty in population size and in demographic rate estimates, particularly adult survival (Walker et al. 2015). To reduce uncertainty or bias in estimates of risk from fishing, robust information is needed on key aspects of biology (survival, productivity, recruitment, trends). Long-lived, slow-breeding seabirds that are vulnerable to accidental capture in commercial fisheries are the focus here: white-chinned petrel *Procellaria aequinoctialis* and Gibson's albatross *Diomedea gibsoni* (Adams Island, Auckland Islands), and white-capped albatross *Thalassarche steadi* (Disappointment Island). All are species of high conservation concern (Robertson et al. 2017).

White-chinned petrels breed on islands around the Southern Ocean and remain a major component of commercial fisheries bycatch throughout their range (Robertson et al. 2006; Delord et al. 2010). To understand population dynamics and collect tracking data at the Auckland Islands, New Zealand's largest population, a study was established in 2013 at Fairchild's Garden on Adams Island (Rexer-Huber et al. 2016). Tracking data analysed so far compared the foraging range of Auckland and Antipodes white-chinned petrels (Rexer-Huber 2017). The 20 trackers outstanding are expected to provide different (multi-year) datasets allowing assessment of individual site fidelity.

Gibson's wandering albatrosses are endemic to the Auckland Island archipelago. About 95% of the population breeding on Adams Island. 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 and Elliott 2006). Gibson's albatross survival, productivity, recruitment, and population trends have been monitored during 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 and Elliott 1999). However, between 2005 and 2008 there was a sudden drop of more than 40% in the size of the breeding population, from which recovery has been very slow. The Gibson's wandering albatross population is still only about two-thirds of its estimated size in 2004, having lost the gains slowly made through the 1990's.

The white-capped albatross is also endemic to New Zealand, with ~95% of the population breeding on Disappointment Island (Baker et al. 2014; Sagar 2016). White-capped albatrosses are caught as incidental bycatch in commercial fisheries in New Zealand, and caught in substantial numbers in fisheries off South Africa despite substantial reductions in captures since the late 1990s (Ryan et al. 2002; Watkins et al. 2008; Rollinson et al. 2017). Mortality in high seas fisheries remains largely unknown.

A white-capped albatross study area was established on Disappointment Island in January 2015 (Thompson et al. 2015) and data suitable for estimating demographic parameters like adult survival and for population trend assessment has been collected annually since then (Parker et al. 2017; Rexer-Huber et al. 2018). Estimates of white-capped albatross numbers have so far been based on photographs taken by helicopter in mid-December 2006–2010 and mid-January 2011–2017, interpreted to estimate the number of nesting birds present (Baker et al. 2014, 2018). Tracking data are also collected at the Disappointment Island study area to build on existing data on the at-sea range of white-capped albatrosses (Thompson and Sagar 2008; Thompson et al. 2009; Torres et al. 2011). Time-lapse nest cameras were also deployed in early 2018 to test suitability for estimating nest survival, fledging dates, and colony return dates.

In 2018/19 Parker Conservation was contracted by the Conservation Services Programme (CSP) of the Department of Conservation to collect information to estimate key demographic parameters for modelling and understanding the species' conservation status.

Here we report on the following specific aims and objectives:

- For white-chinned petrels, the study aimed to collect resight data from marked birds in the study colony on Adams Island, Auckland Islands, and to recover Global Location Sensor (GLS) tracking devices deployed on white-chinned petrels at the study colony.
- For Gibson's albatross the research aimed to build on estimates of survival, productivity and recruitment at Adams Island, and provide information on the size and trend of the population.
- The white-capped albatross component focused on collecting resight data and nest camera footage from the study colony on Disappointment Island. A secondary objective was to take aerial photographs of white-capped albatrosses suitable for estimating the population size at a later stage.

Methods

Timing and logistics

Seabird research in the Auckland Islands took place over the period December 2018–February 2019, conducted by the same two-person team throughout. Sixty-two days were spent on Adams Island (2 December–4 February), mainly for white-chinned petrel and Gibson's albatross research focusing on population monitoring and tracking. We revisited the white-chinned petrel study colony at Fairchild's Garden over nine days 15–25 December. Gibson's albatross work took place over the period 4 December–30 January. Two and a half days were spent on Disappointment Island (5–7 February) for research on white-capped albatross. Early February (white-capped albatross brood-guard stage, when most chicks have just hatched and only a few eggs remain) is optimal for minimising nest failures and maximising the resighting rate (high parent change-over rate at the nest).

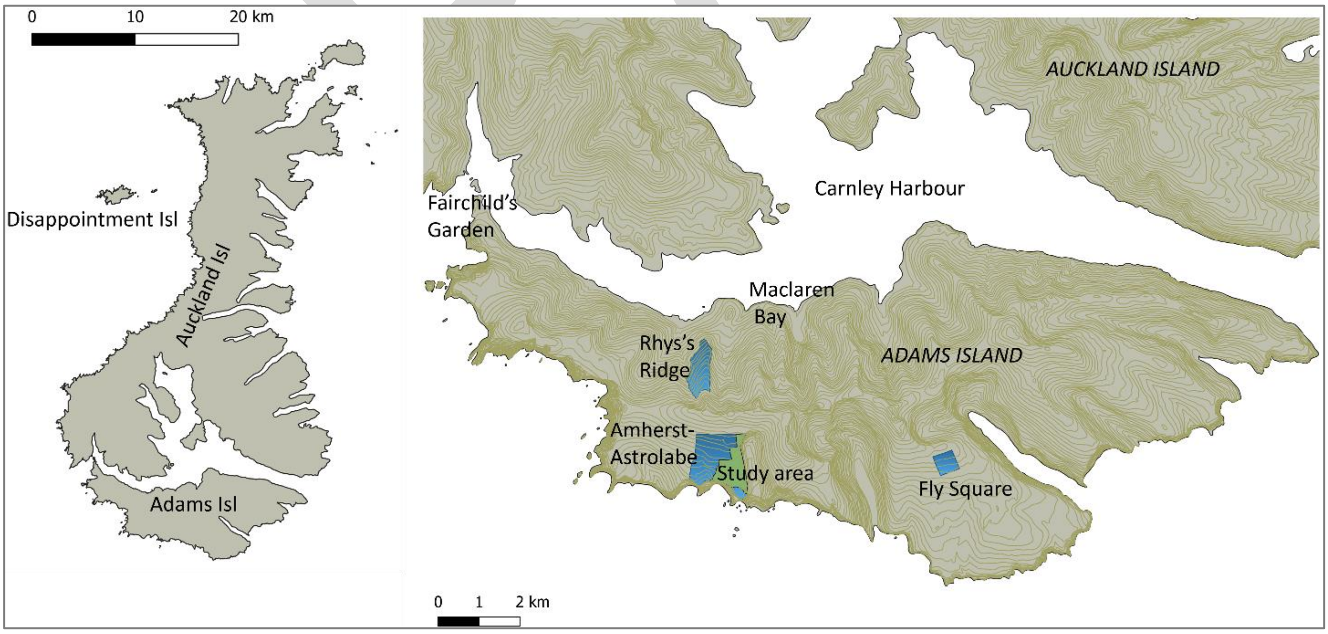

Figure 1. Auckland Island group (left) with inset of with Adams Island at right. Areas in blue are representative nest-count blocks for Gibson's albatross, and the Gibson's study area is shown in green

The yacht *Evohe*, master Steve Kafka, brought us from Bluff to the Auckland Islands in November. *Evohe* supported us for other work around the Port Ross area 23 November to 1 December (Rexer-Huber and Parker 2019), then delivered us to Adams Island on 2 December. *Evohe* landed some gear and provisions at Fairchilds Garden before landing us at Maclaren Bay. *Evohe* also picked us up for return to Bluff in February.

Work on Disappointment Island was enabled by helicopter, pilot Brian Patterson. The helicopter collected us from the beach at low-tide at Maclaren Bay on 5 February and transferred us to Disappointment Island. To minimise the impact of arriving by helicopter, we were landed on the ridge on the northern side of Castaways Bay on a low sward free from albatross or burrows. The helicopter returned to Disappointment Island 7 February, and after aerial photographic work transferred us back to Adams Island. Since the tide did not allow landing at the beach at Maclaren Bay, we were landed on the ridge just above the scrub-line. The planned visit of 10 days was reduced substantially following three days on standby before departing Adams Island for Disappointment Island, and by being taken off Disappointment Island two days early because the helicopter had to depart the Auckland Islands earlier than expected.

White-chinned petrels

At the Fairchild's Garden (Adams Island) study colony, study birds have been banded with a unique metal band and their burrow marked. Resight data were collected annually from 2014 to 2017, and new (unbanded) breeding white-chinned petrels in study burrows were banded. In 2019, study burrows were revisited to get resightings of banded birds, and new nesting birds were banded. White-chinned petrels that had been handled were given a temporary mark on the head (twink) to avoid second handling during subsequent burrow checks (if a mark was visible using a burrowscope the bird was not extracted). Unmarked burrows within the study colony were also checked to detect study birds that had moved to a new burrow (burrow switching). New burrows suitable for inclusion in the study were identified, marked, and the breeding white-chinned petrels banded.

To look at the at-sea distribution of white-chinned petrels from the Auckland Islands, we deployed 62 geolocator trackers (GLS; BioTrack and Migrate Technology) over the 2013/14 and 2014/15 breeding seasons. Of these, 41 single-year deployments have been retrieved and analyses reported in Rexer-Huber (2017).

Gibson's albatross

Mark-recapture study

Each year since 1991 a 61ha study area on Adams Island (Fig. 1) has been visited repeatedly to band nesting birds and collect resightings of already banded birds. The wider areas around the study area (within a kilometre) are visited less frequently and any banded birds are recorded. All birds found nesting within the study area have been double-banded with individually numbered metal and large coloured plastic bands, and since 1995, most chicks of every cohort have also been banded. The proportion of chicks that are banded each year depends on the timing of the research field trips which in turn is dependent on the availability of transport. In 23 of the last 29 years researchers have arrived at, or soon after, the time at which the first chicks fledge and more than 90% of the chicks were still present and were banded. In the other six years researchers arrived late and as many as 45% of the chicks had already fledged and were not banded.

In the study area we also deployed 34 tracking devices on breeding albatrosses. Twelve were satellite tags transmitting GPS positions (Pinpoint BioTrack), mostly deployed on breeding females. The remaining 22 devices were geolocators (GLS), which archive light data until device recovery. GLS were deployed on equal numbers male and female breeding birds.

Survival of birds in the study area is estimated 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 resighting 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, a pair's separate nesting attempts are rarely more than a few hundred metres apart, and birds nesting at new sites within a few hundred metres of the study area are detected during the census of surrounding country (Walker and Elliott 2005).

Nest counts in representative blocks

Since 1998, all the nests in three areas (Fig. 1) have been counted each year. The three areas support about 10% of the Adams Island albatross breeding population and represent high (Fly Square), medium (Astrolabe to Amherst including the mark-recapture study area) and low (Rhys's Ridge) density nesting habitat.

Counts are carried out between 23–31 January just after the completion of laying, and as close as possible to the same time at each place in each year. A strip search method is used where two observers walk back and forth across the area to be counted, each within a strip about 25 m wide displayed on a GPS, and count all the nests with eggs in their strip. Every bird on a nest is checked for the presence of an egg, and each nest found with an egg is marked with spray paint and counted. All non-breeding birds on the ground are also counted, and they and most breeding birds on eggs are checked for bands, the number and location of which are recorded. Once the whole block has been counted, the accuracy of the census is checked by walking straight transects at right angles to the strips, checking all nests within 10–15 m of the transect for paint marks indicating the nest has been counted.

Total number of nests on the island

The number of pairs of Gibson's wandering albatross nesting on the whole of the Auckland Islands was estimated from a whole-island population count done in 1997, followed by repeated counts of parts of Adams Island, including the count in 2018. The proportion of the total population in 1997 that was nesting in those parts of the island that were subsequently repeatedly counted was used to estimate the total population using the following formula:

$$\hat{t}_i = \frac{t_{1997}}{p_{1997}} \times p_i$$

Where

$\hat{t}_i$ is the estimated total number of pairs nesting in year i;

t_{1997} is the total number of pairs counted nesting in 1997;

p_{1997} is the number of pairs counted nesting in 1997 in those parts of the island that were subsequently repeatedly counted; and

p_i is the number of pairs counted nesting in year i in those parts of the island that are repeatedly counted.

This estimate assumes that the proportion $\frac{t_i}{p_i}$ is constant from year to year, which is true when the pattern of distribution of nests remains the same from year to year, as it has been found to do on Adams Island (Elliott et al. 2016).

White-capped albatross

Mark-recapture study

We collected resightings of already-banded white-capped albatrosses and banded new nesting birds within the study area on Disappointment Island (Fig. 1). All white-capped albatross nests and loafing birds in the study area were checked for bands. Birds also carrying a GLS tracker were captured to remove the tracker. A 50-m buffer around the study area was checked in case banded birds had moved outside the study area. Unbanded breeding white-capped albatrosses in the study area were double-banded with individually numbered metal and large white plastic bands. White-capped albatross are flighty, so we maintained best-practise release techniques (Rexer-Huber et al. 2018). All birds handled were marked with a small spot of stock marker above the bill.

Recent simulation modelling showed that the precision of demographic parameter estimates improved markedly with a further 2–5 years of consecutive resighting visits (from present) (Rexer-Huber et al. 2018), so demographic parameters are not estimated here/this year.

Nest cameras

Wildlife cameras deployed at three sites in the study colony were removed, with the warratahs that they were secured to. Cameras recorded time-lapse images at hourly intervals during the day from deployment in January 2018.

Because cameras were deployed in pairs, aligned so that the two cameras had slightly overlapping fields-of-view, images from paired cameras were first checked to identify any nest(s) recorded by both cameras. The status of nests seen in both cameras was only recorded once. All nest camera images were reviewed to record nest failures, the number of nests where a chick fledged, the timing of fledging and the timing of adult return to the colony. Two cameras failed months before fledging; since no information on fledging success could be obtained for these nests, they were excluded from calculation of fledging success.

Aerial photographs

Aerial photographs to estimate the size of the breeding population have been taken 2006/07–2016/17 (Baker et al. 2014, 2018). In 2019 there was insufficient helicopter time to photograph all white-capped albatross colonies, so we focused on the representative subset of colonies recommended by Baker et al. (2018): Castaways B on Disappointment Island, and the Southwest Cape waterfall colony.

We took aerial photographs of Castaways B area on 7 February. Methods followed established procedures (Baker et al. 2014, 2018) as closely as possible. We selected good weather (clear with minimal low cloud), timed photography to occur between 1100 to 1600 NZDT when most loafers are thought to be at sea, and took photographs with the helicopter door latched out of the way. Two circuits of the colony, to ensure good coverage, provide the images at photo-extension 112 mm (suitable for counting the breeding birds in each colony), and additional photographs using maximum photo-extension (320 mm) should allow the proportion of empty nests and non-breeding birds in the colonies to be estimated. All photographs were GPS-stamped for georeferencing. Photographs were taken at a lower altitude than in previous work (150–

250 m, instead of ~400 m), but we made every effort to ensure that the photographs were still taken perpendicular to the steep land surface.

All photographs were taken with a Canon 7DMkII camera and image-stabilised lenses (Canon 70–200 f2.8 zoom). Shutter speeds were as high as possible to minimise camera shake. Photographs were recorded as raw and fine JPG files, later replicated to create four back-up sets, archiving three sets in different locations. A full collection of the photographs is held by the New Zealand Government (Department of Conservation).

Results and discussion

White-chinned petrels

Three GLS tags were recovered. One gave data for just over 1 year and 5 months, bringing the total number of multi-year datasets from New Zealand white-chinned petrels to four. The other two GLS tags could not be downloaded so have been returned to the manufacturer for data recovery. Seventeen GLS tags remain to be recovered; of these, 11 are likely to contain multi-year data.

Forty-seven banded white-chinned petrels were recaptured (recapture rate 0.27). The recapture rate was lower than the 0.35 in 2016/17, in part because of the two-year gap in monitoring. Seabird recapture rates also improve if checks span a full incubation changeover. Nine days in mid-December were available for the work, allowing a week between burrow checks. This gave 25% changeover in breeding burrows at early- to mid-incubation. The recapture rate could be improved by allowing longer between burrow checks, or by checking burrows later in incubation (early- to mid- January). Some burrow-switching has occurred since the last study area visit in 2016/17: three banded birds found in new burrows, ~2–5m from the burrow where it was first banded. White-chinned petrels that had moved burrow comprised 6% of recaptures in 2019, justifying time allocated to checks in unmarked burrows.

Within the study area, 54 new breeding birds were banded. The study area now contains 230 banded white-chinned petrels in 131 marked burrows.

Four years of recaptures are not sufficient for robust demographic rate estimates (e.g. Rexer-Huber et al. 2018) so demographic modelling is not conducted here. Monitoring should continue for the project to yield useful data for demographic parameter analyses.

Gibson's wandering albatross

Survival

Data gathered over the 2018/19 summer allowed survival during 2018 to be estimated (Fig. 2). In biennially breeding species, the survival estimates for the last two years invariably have very large confidence intervals, so the 2018 results should be treated cautiously, and we have not presented those for 2019.

Female survival has improved markedly since the catastrophic lows (82%) recorded in 2006–08. Although the survival rates of the sexes are different each year, survival is now on average about the same for females and males. However, at 91% in 2017, survival in both sexes remains much lower than the average prior to the 2005 crash (95%).

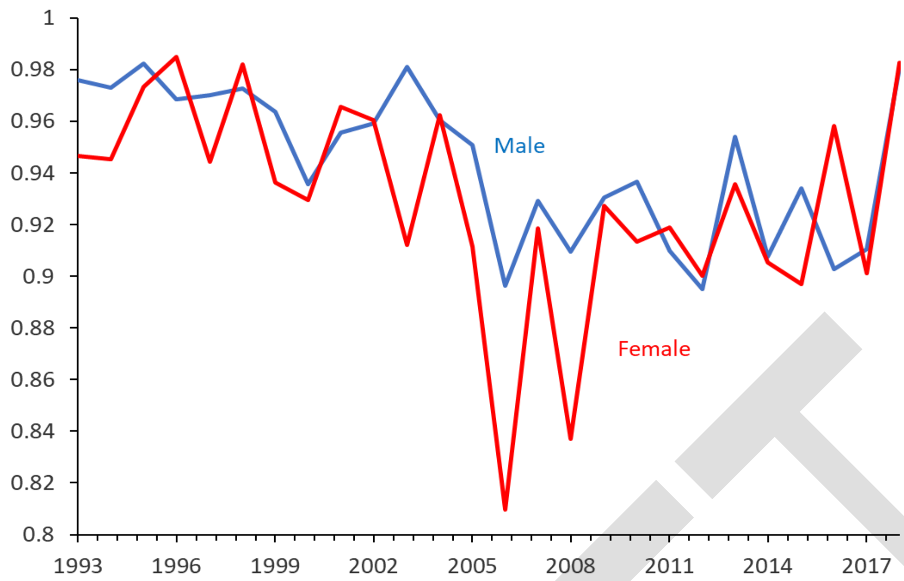

Figure 2. Annual survival of Gibson's albatross in the Adams Island study area since 1993, estimated by mark-recapture

Nesting success, productivity and recruitment

Breeding success was 61% in 2018; slightly down from the 68% of the previous two seasons, but still healthy compared to the productivity range of 40–50% recorded 2011 to 2015 (Fig. 3). Nesting success has increased and is now comparable to levels before 2005 (pre-crash), but the number of chicks produced remains lower than pre-2005 since fewer birds are breeding (Fig. 3).

The number of birds breeding for the first time in the study area has been slowly and erratically rising, following the big decline in 2006 (Fig. 4). Many of the birds recruiting to the breeding population now will have been chicks fledged since the population crashed in 2006. Thus, even if survivorship of young birds is high, the number of birds reaching breeding age will be low because of the low numbers of birds breeding since 2006.

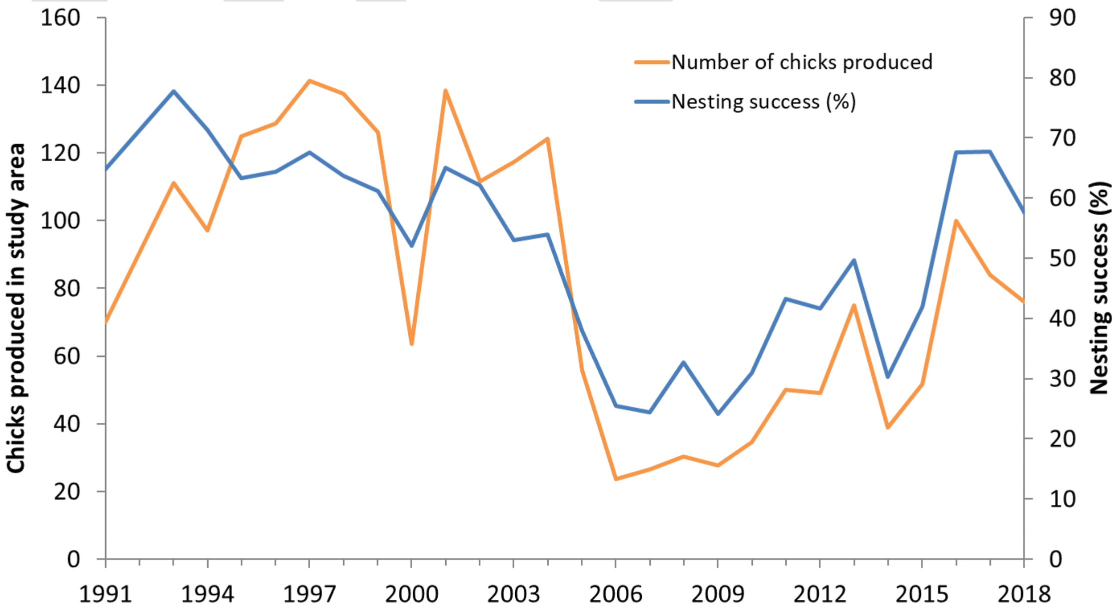

Figure 3. Gibson's albatross nesting success and the number of chicks fledged from the study area on Adams Island

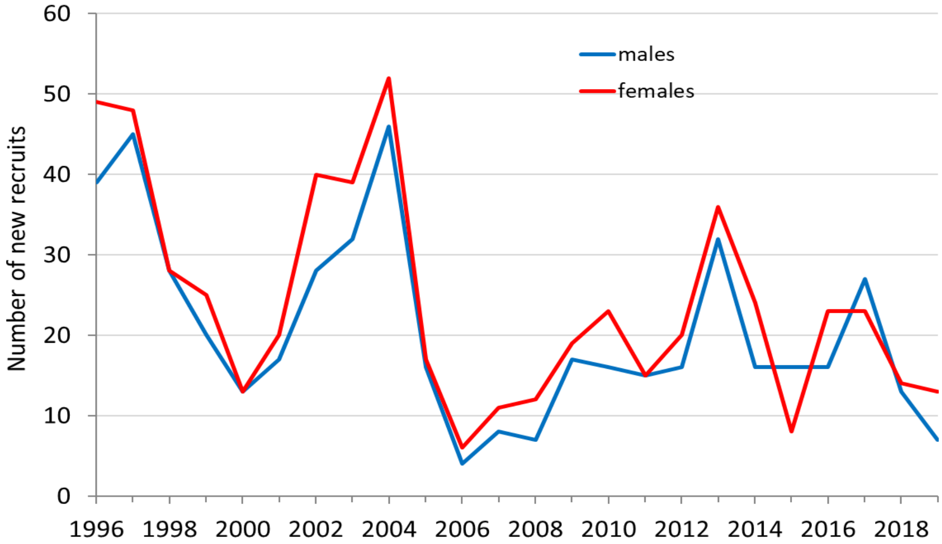

Figure 4. Number of Gibson's albatross breeding for the first time in the study area on Adams Island for each year since 1996

Population size estimate from mark-recapture

The number of breeding birds in the study area estimated by mark-recapture was increasing up until 2005, but between 2005 and 2012 the population declined rapidly. Since 2012 the female population has stabilised, while numbers of males continued decreasing until 2016 (Fig. 5). Breeding male numbers appear to have declined for longer than breeding female numbers because of the uneven sex ratio: there has been a shortage of females and only males that could find a mate could join the breeding population.

Figure 5. The number of breeding Gibson's albatrosses in the Adams Island study area estimated by mark-recapture

The size of the total population including pre-breeding birds (as opposed to the total number of breeders) can be estimated using the modelling techniques of Francis et al. (2015), but this is beyond the scope of this report.

Nest counts and whole-island nest number estimate

The three blocks in which nests have been counted since 1998 were counted again in late January 2019 and the counts corrected to take account of as-yet unlaid eggs and nest failures at the time of census (Elliott et al. 2016). There has been a slow improvement in the numbers nesting since the 2005 crash (Fig. 6, Table 1). Nest numbers in census areas were slightly lower than nest counts two years ago (11–14% lower) (Walker et al. 2017), but numbers appear stable (Fig. 6).

Population trends

The demography of Gibson's albatross continues to improve following the crash in 2006. Nesting success has been at or above pre-crash levels for the last three years and the number of breeding females in the population is roughly stable, so the number of birds nesting on the island continues to increase slowly. However, the number of chicks produced remains much lower than it used to be, since annual mortality is a little higher than before 2005 and the population is still substantially smaller. Wandering albatrosses start breeding at about 12 years old, so most birds joining the breeding population now were produced during a period when chick production was very low. Along with the continued raised adult mortality, this is likely to continue to limit population recovery. Together, these data suggest the conservation status of Gibson's wandering albatross remains of concern, so monitoring the size of the population and its structure and trend on Adams Island remains a priority.

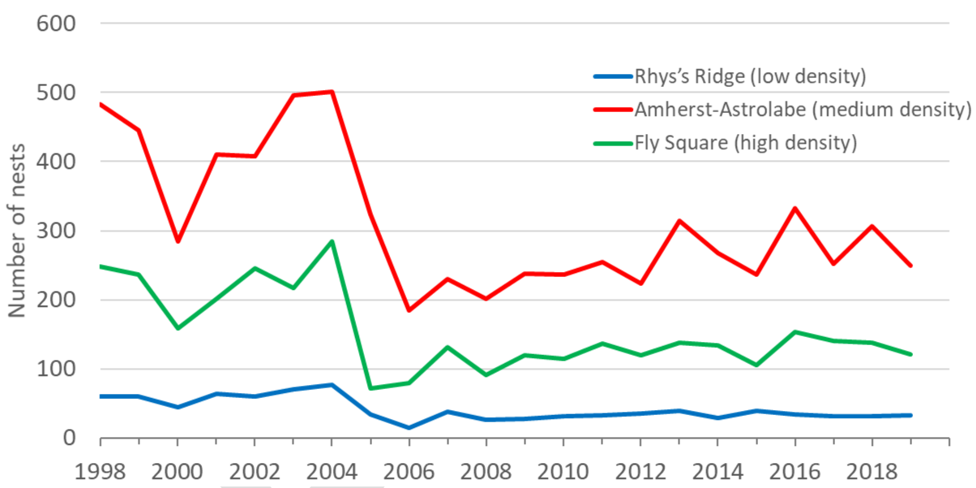

Figure 6. The number of Gibson's wandering albatross nests in late January in each of three census blocks on Adams Island in 1998–2019

Table 1. The number of Gibson's wandering albatross nests in late January in three census blocks on Adams Island, 1998–2019. Corrected total is the estimated number of nests in the three blocks taking account of the number of failed and unlaid nests at the time of counting. Estimated total is the estimated number of nests on the island, based on the number of nests in the three counted blocks in 1997 when the last whole island count was undertaken

Year	Rhys's Ridge (low density)	Amherst-Astrolabe (medium density)	Fly Square (high density)	Total No. of nests	Corrected total	Estimated total
1997					796	7857
1998	60	483	248	791	798	7875
1999	60	446	237	743	746	7367
2000	45	284	159	488	497	4904
2001	64	410	201	675	706	6969
2002	60	408	246	714	740	7303
2003	71	496	217	784	791	7809
2004	77	501	284	862	884	8728
2005	34	323	72	429	452	4467
2006	15	185	79	279	341	3363
2007	38	230	132	400	430	4245
2008	26	201	91	318	341	3371
2009	28	238	120	386	426	4211
2010	32	237	114	383	392	3872
2011	33	255	137	425	438	4323
2012	35	224	120	379	418	4131
2013	39	315	138	492	519	5120
2014	29	267	134	430	473	4669
2015	39	237	105	381	406	4010
2016	34	332	153	519	545	5385
2017	32	252	140	424	448	4424
2018	31	306	138	475	489	4827
2019	33	249	121	403	423	4180

White-capped albatross

Mark-recapture study

A total of 191 banded white-capped albatrosses were resighted over the 2½ day visit to Disappointment Island in 2019. The resighting rate was 0.34 which compares favourably to 0.33 in 2018 (Table 2), considering effort (48 human hrs in 2019 cf. 72 in 2018). This year's improved resighting rate is likely due to the visit being timed to the brood-guard stage, when changeover rates are maximal, compared to late incubation in 2018 (16–19 January) (Rexer-Huber et al. 2018). No banded birds were seen outside the original banding area.

Other resightings have been reported from boats: two banded white-capped albatrosses were recorded in March 2019, one recovered dead on a fishing vessel on the Stewart Island-Snares shelf, and the other seen alive off Kaikoura. This adds to other records of banded white-capped albatross seen from commercial and recreational fishing boats since 2015, including sightings off Greymouth and Karitane (South Island west coast and east coast, respectively).

Building on study colony numbers, a further 122 breeding white-capped albatrosses were banded (metal left leg and white numeric darvic band right leg) (Table 2). The study colony now has had 679 birds banded, including the 36 birds banded in the study area in 1993 and 2008 (Fig. 7). Only 105 birds banded metal-only remain.

Four GLS tracking devices were retrieved from breeding and loafing white-capped albatrosses, and one further bird which had lost its GLS tag (or had it removed) was resighted.

Table 2. White-capped albatrosses banded and resighted in subsequent years on Disappointment Island 2015–2019

	2015	2016	2017	2018	2019	Total
Banded	150	83	160	128	122	679
Resighted from previous years	na	32 (of 150)	56 (of 233)	130 (of 393)	191 (of 557)	
% resighted	na	21%	24%	33%	34%	
Duration of work (days)	3 †	3 †	2.5	2.5	2.5	

† Duration includes ground-truthing work

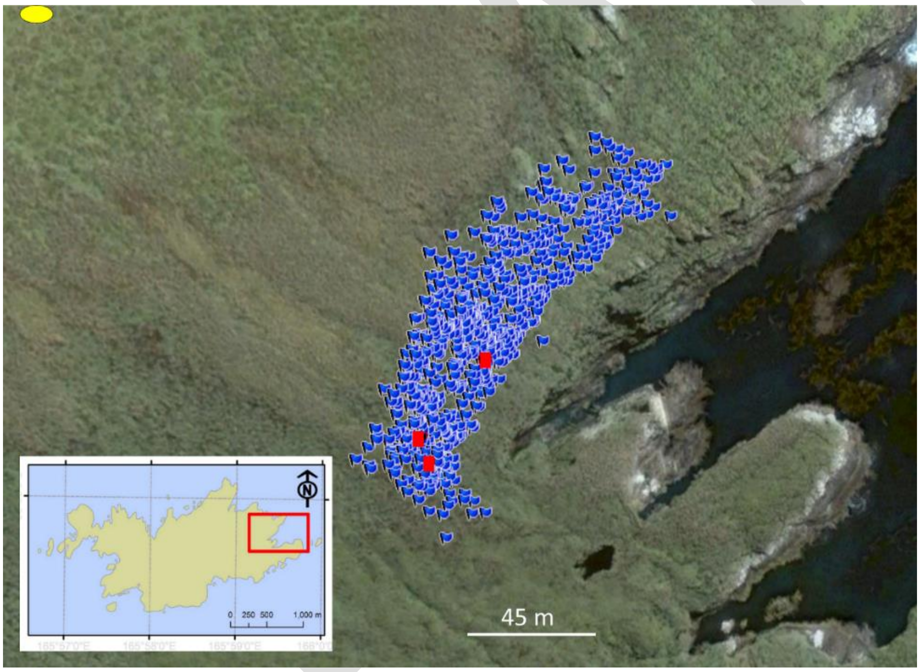

Figure 7. Locations of white-capped albatrosses on banding (blue flags) at Castaways Bay, Disappointment Island 2015–2019. Paired nest cameras (red rectangles) and helicopter ridgeline landing site (yellow oval) are also shown

Nest cameras

The nest camera trial in the study area (red rectangles, Fig. 7) was removed. There was no evidence of problems due to the cameras' presence in the colony, and all six camera mounts remained upright. However, cameras showed substantial weathering, condensation and algal growth inside the lens (three cameras), and even corrosion in the battery-memory compartment (two cameras). Photos were recovered from all six cameras, giving up to 9½ months of data from their deployment in January 2018. The badly-corroded cameras only gave 2½ months of photos.

The full set of 17,270 images was reviewed for chick success, fledging dates and the date of first return to the colony. A total of 26 unique nests were visible at camera deployment, but only four cameras (17 nests) remained running for long enough to determine whether fledging occurred. Five chicks fledged of the 17 nests followed from late incubation, suggesting that chick success is 0.29. Chicks fledged ~27 July (range 12 July–23 August, 5 chicks). The first brief visits of adults returning to the colony occurred 30 September–10 October (2 cameras), and adults had returned full-time to the colony by 17 October (one camera).

Chick success, or the survival of a chick from hatching to fledging, is lower than expected. Low chick success is a concern since breeding success (survival from egg lay to fledging) will be lower than chick success. This is clear from nest cameras, which all contain numerous empty nests in the field of view that appear to be from the current breeding season.

To estimate breeding success, nest cameras must follow the full breeding season. Cameras would need to last for a full year, have batteries and SD cards replaced, and remain in place for the remainder of the breeding season. Battery life may last for the full year if image frequency is decreased: 2-hourly rather than hourly photographs, recorded only during winter daylight hours to further reduce night-time images, would not compromise the quality of nest data here.

All parameters (chick success, dates of fledging and adult return) would benefit from following more nests than in this trial. This would require cameras that are more weatherproof; in this trial, two cameras following nine nests failed early because of battery compartment corrosion. Cameras could also follow more nests if deployed independently, rather than in pairs with field-of-view overlap (intended as a way to obtain half-hourly images, but likely less of a priority than increasing nest numbers).

Aerial photography

We took aerial photographs of the Disappointment Island Castaways B area on 7 February around 1400 hrs, doing two sweeps to ensure good coverage. The mark-recapture study area is included within the Castaways B photography zone. Since the pilot squeezed in the time there was little scope for fine-tuning (testing the most suitable focal length for helicopter distance and speed), but 260 suitable photos were obtained. Photographs have been archived for interpretation at a later date.

There are several differences to previous aerial photography work, but we think the only important difference is the timing: photographs in 2019 were taken 3 weeks later than previous aerial photography (Baker et al. 2018). Nest counts from these photographs will have to be corrected for breeding failure rates during incubation (potentially from nest cameras active during incubation) if an estimate of the breeding population size is required. We also took photos at a lower altitude (150–250 m, instead of ~400 m) and at a closer zoom (photo-extension 112 mm instead of 70 mm), but these merely result in more images with more detail.

Operational factors and other helicopter work priorities meant that the other representative site identified in Baker et al. (2018), the Southwest Cape waterfall colony, could not be photographed.

Recommendations

White-chinned petrel

Four years of recapture data are not sufficient for robust demographic rate estimates, even in studies with a study population twice the size of our white-chinned petrel study (e.g. Rexer-Huber et al. 2018). Monitoring should continue for the project to yield useful data for demographic parameter estimates for white-chinned petrels.

If data collection takes place in mid-December (early incubation), more than nine days are required to allow enough time between burrow checks to capture enough incubation changeovers. Alternatively, burrow checks could take place in late incubation (early- to mid-January) to take advantage of shorter incubation shifts.

Gibson's albatross

The demography of Gibson's albatross continues to improve following the crash in 2005/06. Nesting success has been at or above pre-crash levels for the last three years and the number of breeding females in the population is roughly stable. The number of birds nesting on the island therefore continues to increase, albeit slowly. However, population recovery is likely to remain slow since annual mortality remains a little higher than it used to be, the total population is substantially smaller, and there has been more than a decade of low chick production. Gibson's wandering albatross conservation status remains of concern, so monitoring the size of the population and its structure and trend on Adams Island remains a priority.

White-capped albatross

A resighting rate of 34% in 2019 is encouraging given the short duration of the visit. Future visits should again focus primarily on resighting and take place in early February when mate changeovers are most frequent. A visit of at least five days is recommended to further increase resighting rates. Five days is a minimum to provide some contingency for poor weather; this year's planned 10-day visit was reduced to 2½ days by weather impacts on logistics.

To estimate breeding success from nest cameras over the full breeding season, cameras need to be in place over two years, with battery and SD cards replaced at the January/February visit. Battery life may last the year with 2-hourly images recorded only during winter daylight hours. More nests should be followed to improve reliability of nesting parameters. Cameras are best deployed independently to maximise nest numbers. Cameras that are more weathertight may reduce the likelihood of device failure (and reduced nest numbers) in the wet maritime environment of Disappointment Isl.

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Author contributions

KRH and GCP conducted fieldwork, analysed data and wrote the report. KW and GE provided logistical and analytical support for the Gibson's albatross study. DT supported white-capped albatross fieldwork. All authors contributed to this report.

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