

Falkland Islands Seabird Monitoring Programme

Annual Report 2017/2018 (SMP25)

Sarah Crofts & Andrew Stanworth

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Falklands Conservation, 41 Ross Road, Stanley, Falkland Islands Corresponding author: Sarah Crofts: <u>cso@conservation.org.fk</u>

Falkland Islands Government Denise Blake (Environmental Officer): environmental.officer@sec.gov.fk

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Summary

The Falkland Islands support seabird populations that are of global importance; both numerically, and in terms of conservation status. Accordingly, fluctuations in local populations may substantially affect the global conservation status of these species.

The Falkland Islands Seabird Monitoring Programme (FISMP) monitors Gentoo Penguin (*Pygoscelis papua*) at 11 sites (16 colonies), Southern Rockhopper Penguin (*Eudyptes c. chrysocome*) and Macaroni Penguin (*Eudyptes chrysolophus*) at five sites (13 colonies) and Magellanic Penguin (*Spheniscus magellanicus*) at one site (one colony). King Penguin (*Aptenodytes patagonicus*) and Black-browed Albatross (*Thalassarche melanophris*) are monitored at single, but key sites, in terms of population numbers. Southern Giant Petrel (*Macronectes giganteus*) is monitored at one site (two colonies), Imperial Shag at three sites (four colonies) and Brown Skua (*Catharacta antarctica*) at one site (four colonies).

Overall

The FISMP 2017 saw partial recoveries of breeding pair numbers for the Gentoo Penguin and Blackbrowed Albatross from 2016 counts. Breeding pair numbers for Southern Rockhopper Penguin remained relatively unchanged from 2016 counts, although still represented a loss of 31 % of pairs from the 2015 counts. The overall breeding success was of notable concern for Gentoo Penguin, Southern Rockhopper Penguin and Southern Giant Petrel. A strong El Niño in place over 2015 – 2016, coinciding with significant drops in seabird breeding pairs during the FISMP 2016, had ended and over the 2017 FISMP period a La Niña event was in place.

Gentoo Penguin breeding pair numbers for 2017 showed an overall improvement from the previous year with numbers partially recovered following a significant drop in 2016. The overall breeding pair count in 2017 was still below the average number of pairs recorded for the years 2010 to 2015. In 2017 overall breeding success fell for a third consecutive year and was the lowest value recorded since monitoring began at these sites in 1990.

Southern Rockhopper Penguin breeding pair numbers were comparable to 2016 and the 2017 value represented a decrease of 31 % since 2015. As expected, breeding success in 2017 was highly variable between locations, but overall it remained well below the annual average and was the second lowest value recorded since monitoring at these sites began.

Macaroni Penguin and Southern Rockhopper Penguin mixed pairs were observed at Berkeley Sound and Sea Lion Island.

Magellanic Penguin monitored at Gypsy Cove remained broadly in three groupings which appear to be associated with the extent of tussac habitat. In 2017 the occupancy rate of 34.3 % was below that of the previous year but just above the annual average for this monitored site.

King Penguin numbers of pre-fledged chicks at Volunteer Point increased by 59 % from 2016. The long-term monitoring at the site shows periodic fluctuations with an overall upward trend, and the dip in 2016 coincided with an overall poor season for seabirds monitored under the FISMP; likely due to the unfavourable environmental sea conditions during the 2015-2016 El Niño event.

Black-browed Albatross breeding pairs at the monitoring sites at Steeple Jason showed an overall small increase from the previous year. Given the high annual fluctuations, the overall FISMP trend since monitoring began in 2005 suggests a stable population despite the significant decrease that occurred in 2016. Breeding success at Steeple Jason increased from 2016, although the 2017 value remains below the annual average for the third consecutive year.

Southern Giant Petrel breeding pair numbers at Steeple Jason remained stable from the previous year. Of note, breeding success at both the Neck and Northwest colonies were near to complete failure. The overall breeding success for these colonies has steadily declined from 59.8 % in 2004 to 3.5 % in 2017.

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Introduction

The Falkland Islands support seabird populations that are of global importance, both numerically, and in terms of conservation status. An estimated 72 % of the global population of Black-browed Albatross (*Thalassarche melanophris*) breeds in the Falkland Islands (ACAP 2010, BirdLife International 2016). This species was down listed to 'Least Concern' on the IUCN Red List in 2017. The Falklands are also home to approximately 36 % of the world's population of Southern Rockhopper Penguin (*Eudyptes c. chrysocome*) (Red Listed as 'Vulnerable') and approximately 34 % of the world's population of Gentoo Penguin (*Pygoscelis papua*). The Gentoo Penguin was recently down listed from 'Near Threatened' on the IUCN Red List to Least Concern (IUCN 2017). Accordingly, fluctuations in local populations may substantially affect the global conservation status of these species.

Falklands Conservation initiated the Falkland Islands Seabird Monitoring Programme (FISMP) in 1989/90. Its initial purpose was to monitor the diet and population dynamics of Gentoo Penguin, Magellanic Penguin (*Spheniscus magellanicus*), Southern Rockhopper Penguin, and Black-browed Albatross. Diet sampling was discontinued in 2003. Since then, population monitoring has continued on an annual basis with some changes taking place to the original format, such as the addition and loss of some monitoring sites and the addition of other species.

Currently the FISMP monitors Gentoo Penguin (*Pygoscelis papua*) at 11 sites (16 colonies), Southern Rockhopper Penguin (*Eudyptes c. chrysocome*) and Macaroni Penguin (*Eudyptes chrysolophus*) at five sites (13 colonies) and Magellanic Penguin (*Spheniscus magellanicus*) at one site (one colony). King Penguin (*Aptenodytes patagonicus*) and Black-browed Albatross (*Thalassarche melanophris*) are monitored at single, but key sites, in terms of population numbers. Southern Giant Petrel (*Macronectes giganteus*) is monitored at one site (two colonies), Imperial Shag at three sites (four colonies) and Brown Skua (*Catharacta antarctica*) at one site (four colonies).

In 2010 monitored colonies made up approximately 18 % of the Falklands' breeding population of Gentoo Penguin (estimated at 132,000 breeding pairs) (Baylis et al. 2013a), approximately 2.6 % of the Falklands' breeding population of Southern Rockhopper Penguin (estimated to be 319,000 breeding pairs) (Baylis et al. 2013b) and approximately 0.5 % – 0.6 % of the total Falklands'

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breeding population of Black-browed Albatross (estimated to be between 475,500 and 535,000 breeding pairs) (Wolfaardt 2012). The monitoring site for Southern Giant Petrel made up approximately 8.6 % of the total Falklands' breeding population (Stanworth & Crofts 2017) based on the latest 2015/16 Island-wide census. The only population estimate for Magellanic Penguin in the Falkland Islands is for 76,000 to 142,000 pairs (Woods & Woods 1997). As a very rough estimate, the current monitoring site is likely to represent less than one percent of this. There are no other significant King Penguin colonies within the Falkland Islands and the small numbers of individuals at other locations are not systematically monitored. The current monitoring site is likely to represent over 95 % of the breeding population at the Falklands.

The information gathered as a result of the FISMP has contributed to the identification of local, regional and global conservation priorities and provides information necessary for IUCN Red Listing assessments. The FISMP provides an important long-term data set on population trends and breeding success, which further contributes to other areas of research.

This report details monitoring results from the 2017/2018 breeding year as well as contributed current and historic data collected by landowners at Dunbar and Bleaker Island settlements.

Materials and methods

Within this report, breeding periods are referred to by the year in which they commenced, for example; 2017 describes the 2017/2018 austral summer breeding period. 'Location' or 'site' refers to a named geographical area, such as a settlement or 'camp', and this may support more than one colony. For example, Johnson Harbour has Gentoo Penguin colonies at Volunteer Green, Lagoon Sands and at Cow Bay; Race Point has Gentoo Penguin colonies at Rookery Sands and Fanning Harbour. 'Colony' refers to a group or groups (sub-colonies) of birds in close proximity, typically within 50-100 m of each other and/or with the same or proximate access from the sea. Monitoring locations are shown in **Figure 1**, exact grid references are provided in **Appendices 2** to **5**.



Figure 1: Map of the FISMP monitoring locations.

In addition to those counts undertaken by Falklands Conservation (below), counts have also been undertaken at Dunbar (Black-browed Albatross) and Bleaker Island (Southern Giant Petrel, Southern Rockhopper and Gentoo Penguin) by the landowners. Any variation from the standard methodology is reported in the text.

Gentoo Penguin

Apparently Occupied Nests (AON) of Gentoo Penguins were counted during egg-laying, over the period 2-19 November 2017 to provide a breeding pair estimate. The number of chicks was counted soon before fledging (Pre-Fledged Chicks (PFC)), during the period 31 December 2017 -18 January 2018, and used to estimate breeding success. The monitoring locations (colonies in brackets if more than one) were:

- Johnson Harbour (Volunteer Green, Cow Bay and Lagoon Sands);
- Race Point (Fanning Harbour and Rookery Sands);
- Sea Lion Island;
- New Haven;
- Bull Point (Bull Point and Bull Roads);
- Motley Point;
- Low Bay;
- Bertha's Beach;
- Fox Point;
- Pleasant Roads; and
- Steeple Jason (House and Neck).

Southern Rockhopper Penguin

Southern Rockhopper Penguin breeding pair counts (using AON) were performed from the commencement of egg-laying during the period 7 to 22 November 2017. Chick counts (PFC) were carried out between 4 and 19 January 2018. The locations (colonies in brackets if more than one) were:

- Steeple Jason (Northwest Flat, Northwest Ridge, S5Tip and Southeast);
- Sea Lion Island (Rockhopper Point);
- Race Point (Fanning Head North and Fanning Head South);
- Berkeley Sound (Diamond Cove, Rugged Hill and Eagle Hill); and
- Port Stephens (Stephens Peak).

Magellanic Penguin

Transects were carried out every 100 m (approximately) from Engineer Point to the Car Park at Gypsy Cove on 04 December 2017. Transects were 4 m wide, starting from the shore line, and running perpendicular to it, for a distance 40 m further than the last burrow found. Using a pole with torch attached, burrows within the transect were categorised as either 'occupied',

'unoccupied' or 'unknown', if it was not possible to determine occupancy. Burrow density was derived from each transect as number of burrows in the transect area from the start of the transect to as far as the last recorded burrow.

King Penguin

The only significant population of King Penguins within the Falkland Islands is found at Volunteer Point. This population has been monitored annually since the onset of the FISMP, with the first independent counts having been performed earlier, since 1980. A few individuals also breed at nearby Lagoon Sands. The breeding cycle of King Penguins extends over a year and consequently is not synchronised to summer breeding as with the other penguin species. The chosen unit of measure for King Penguin is pre-fledged chicks (PFC) that have survived the winter. This is not a measure of the total number of chicks produced (as some will have perished over the winter), nor is it an exact indicator of the number of breeding pairs. The counts were conducted on the 19 November 2017.

Imperial Shag

Counts of Imperial Shag (AON) were conducted at Motley Point (05 January 2018), Berkeley Sound (Eagle Hill and Rugged Hill 10 January 2017) and Steeple Jason (17 January 2017). Due to the variable breeding times of Imperial Shag, numbers derived represent the numbers of active nests during the January monitoring.

Brown Skua

Counts of Apparently Occupied Territory (AOT) were conducted at Steeple Jason between 16 and 20 January 2018. Due to the restricted monitoring window at Steeple Jason AOTs were classified by a territory with egg/s and or chick/s observed or an adult sitting tightly on a nest and assumed to be incubating/brooding. All territories were recorded with a GPS position.

Black-browed Albatross and Southern Giant Petrel

Counts of Black-browed Albatross and Southern Giant Petrel breeding pairs (AON) at Steeple Jason were performed between 3 and 7 November 2017, and in order to estimate breeding success, chicks (PFC) from these colonies were counted between 13 and 15 March 2018. Two colonies of Southern Giant Petrel and five sub-colonies (distinct nodes from the main colony, or groups of breeding birds that are discrete from the main colony) of Black-browed Albatross were monitored.

Counts of Black-browed Albatross breeding pairs were made at Penguin Point South in November 2017 and of chicks on 29 January 2018 by the landowner. Counts were made at Bleaker Island by the landowner for Gentoo Penguin (07 November 2017), Southern Rockhopper Penguin (29 November 2017) and Southern Giant Petrel chicks (21 March 2018).

Count methods

Whenever possible the total counts (using the above count units) were made at individual locations, whilst in the field, by paired observers (**Appendix 1**). The decision to utilise photo counting was made on an individual colony/sub-colony basis, where it was felt that a paired tally count in the field would not provide a reliable estimate. This was generally due to the size of some colonies (e.g. Steeple Jason Neck). In some instances, for chick counting, large numbers of highly mobile chicks had merged sub-colonies over large areas. Here again, it was felt, that reliable estimates could not be derived and the decision was made to count the other sub-colonies that had remained distinct. These counts still related to individual breeding pair numbers from the counts earlier in the summer, and from this breeding success could be derived; in essence a sub-sampling technique. The various methods, or combination of methods, employed for each location/colony are presented in **Appendices 2** to **5**. Grid references of individual colonies (due south of the approximate centres, 5m from the colony edge) were taken where possible and are provided in **Appendices 2** to **5**.

Field counts

Whenever possible, counts were made at least three times by two or more observers using tally counters in accordance with standard methods (Thompson & Riddy 1993). These counts (and those few of reduced replication) were subsequently averaged to give estimates of breeding pair and chick numbers. These counts are referred to as 'Tally repeated'. Counts at Penguin Point South, Dunbar and Bleaker Island were single counts by a single observer. In some instances, groups or count unit numbers were so small that it was felt the number of count units could confidently be counted without error on a single occasion. These counts are referred to as 'Tally agreed'. Breeding success is expressed on graphs as the number of chicks per breeding pair for species with two or more chicks and as a percentage for those with one chick.

Photo counts

The majority of photographs were taken using a GoPro HD Hero. The camera was pole mounted

and held aloft from a vantage point to a height of approximately 5 m whilst a minimum of three photos were taken in 1920x1080 resolution in jpeg format giving a 127° field of view. Where colonies were too large to fit into a single photograph, markers or natural features were used to subdivide the colonies into sections that could be photographed. There was no evidence of disturbance in the colonies from using this technique. A number of other photos were taken using digital SLR cameras using the highest possible resolution images. Photographs were downloaded and counted using ImageJ software. Counts were repeated a minimum of three times and the average taken. These are referred to in Tables as 'Photo counts'.

Drone counts

DJI Phantom 4 drones were trialled in 2016 to capture aerial images of colonies under FIG Research Licence No: R13/2016. All operations were conducted at a minimum launch distance of 15 m from a colony and reaching a minimum flying altitude of 15 m when directly over colonies. Greater caution was used when operating the drone at Southern Giant Petrel or around other flying seabird colonies. Drone use is prohibited by the landowner at Volunteer Point and therefore were not used at this site. The inbuilt camera produces 4000×3000 resolution jpeg format images giving a 94° field of view. There was evidence that birds were aware of the drone but no evidence to suggest disturbance of breeding birds in the colonies using this method (Crofts 2017). Photographs were downloaded and counted using ImageJ software. Counts were repeated a minimum of three times and the average taken. These are referred to in Tables as 'Drone counts'.

Comparativeness of differing counting methods

Multiple count data for the same colony using two or more of the methods were stored for future comparative work. For the purpose of this report, where multiple counting methods exist for the same colony, the data was used which exhibited the least error between counts. Where possible the same counting method was used to calculate breeding success for each colony.

Environment

Global environmental conditions and sea surface temperatures are influenced by the natural climate phenomenon of the El Niño Southern Oscillation (ENSO). ENSO is the dominant feature of climate variability on inter-annual timescales (for description see:

https://www.metoffice.gov.uk/research/climate/seasonal-to-decadal/gpc-outlooks/el-nino-lanina/enso-description). The ENSO is used to describe the environmental proxy for the FISMP reporting period. Data and forecasts are taken from the <u>Climate Prediction Center</u>. Any atypical oceanographic features observed at the Falkland Islands are sourced from personal communications with the Falkland Islands Fisheries Department.

Anthropogenic and other impacts at colonies

For the FISMP 2017 the first measures of anthropogenic and other impacts were introduced. The measures currently involve recording:

- 1) Direct evidence of marine plastics observed in and around the colonies.
- 2) Any signs of oiling to seabirds.
- 3) Evidence of entanglement or ingestion of fishing gear or other items.
- 4) External signs or symptoms of disease.

Results

Gentoo Penguin

Breeding pairs

There is a complete data set for the current annually monitored locations (excluding Pleasant Roads) for the last 14 years. The combined total of estimated breeding pairs for all these locations is shown in **Figure 2**. At these monitored sites, the estimated total number of pairs increased from 19,621 in 2016 to 22,952 in 2017; a small recovery of 17 % following the significant dip in 2016.



Figure 2: Gentoo Penguin breeding pairs at the FISMP locations, 2003–2017.



Figure 3: Percentage change of Gentoo Penguin breeding pair numbers between 2016 and 2017 at individual FISMP locations.





Figure 4: Gentoo Penguin breeding pairs for locations in Northeast Falkland.



Figure 6: Gentoo Penguin breeding pairs for locations in Southeast Falkland.





Figure 5: Gentoo Penguin breeding pairs for locations in Mideast Falkland.



Figure 7: Gentoo Penguin breeding pairs for locations on Falkland Sound.



Figure 9: Gentoo Penguin breeding pairs for Bleaker Island.

Twelve of the Gentoo Penguin colonies showed increased numbers in breeding pairs when compared with 2016, although the increase was highly variable between colonies. Five Gentoo Penguin colonies showed signs of decreases in breeding pair numbers when compared to 2016. The largest increase was at Bull Roads (193 %) and the largest decrease at Steeple Jason House (11.7 %) (**Figures 3**).

Two Gentoo Penguin colonies in the Northeast region showed increased numbers of breeding pairs from 2016, with the largest increase at Cow Bay (109 %), followed by Lagoon Sands (15 %). Volunteer Green showed a decrease at 8 % (**Figure 4**). Three of the colonies in the Mideast region showed increases in pair numbers; the largest at Motley Point (78 %), followed by Pleasant Roads (26 %) and Berthas Beach (20 %). The remaining two colonies at Fox Point and Low Bay showed small decreases (7 %) and (1 %) (**Figure 5**). Colonies at the Southeast (Sea Lion Island, Bull Point, Bull Roads and Bleaker Island) all showed increases ranging from 193 % at Bull Roads to 21 % at Sea Lion Island (**Figure 6**). Similarly, at colonies in the Falkland Sound region increases were also evident from Rookery Sands (127 %) to New Haven (7 %) (**Figure 7**). Decreases were seen at both Steeple Jason House (12 %) and Steeple Jason Neck (2 %); the first signs of a decrease in numbers since 2014 (**Figure 8**).

The largest increase in terms of numbers of breeding pair were seen at Sea Lion Island (668 pairs), Motley Point (663 pairs) and Bull Point (645 pairs). Interestingly, these three colonies showed the largest numbers of pair decreases in 2016. The largest decrease in terms of numbers of breeding pairs was at Steeple Jason House with 517 pairs.

Breeding success

Average estimated breeding success fell from 0.63 ± 0.22 chicks/pair in 2016 to 0.50 ± 0.21 chicks/pair in 2017. This year's figure is well below the FISMP annual average and is the lowest value recorded since monitoring began at these sites in 1990 (**Figure 10**).





The range of breeding success between locations (n = 14) varied from a minimum of 0.22 ± 0.03 chicks/pair at Fanning Harbour to a maximum of 1.05 ± 0.02 chicks/pair at Pleasant Roads (**Figures 11** to **15**). Eleven (or 69 %) of the monitored colonies showed a decrease in breeding success from the previous year (Lagoon Sands, Rookery Sounds, Fanning Harbour, Sea Lion Island, Motley Point, Low Bay, Bull Point, Fox Point, New Haven, Steeple Jason House and Steeple Jason Neck). The largest decreases were at Lagoon Sands (60 %) and Bull Point (51 %). Colonies showing increased breeding success from 2016 (n = 5) ranged from 76 % at Cow Bay to 18 % at Volunteer Green.



Figure 11: Gentoo Penguin breeding success for locations in Northeast Falkland.



Figure 13: Gentoo Penguin breeding success for locations in Southeast Falkland.



Figure 15: Gentoo Penguin breeding success for locations on Steeple Jason.



Figure 12: Gentoo Penguin breeding success for locations in Mideast Falkland.



Figure 14: Gentoo Penguin breeding success for locations on Falkland Sound.

Southern Rockhopper Penguin

Breeding pairs

Five locations have been monitored annually since 2005 (Race Point, Steeple Jason Study and NW colonies, Sea Lion Island and Berkeley Sound). At these sites, the combined total estimate of the number of breeding pairs slightly decreased from 4,823 in 2016 to 4,780 in 2017, a decrease of 1 % (**Figure 16**).



Figure 16: Southern Rockhopper Penguin breeding pairs at FISMP locations 2005-2017.



Figure 17: Percentage change of Southern Rockhopper Penguin breeding pair numbers between 2016 and 2017 at individual FISMP locations.

Of the colonies that were monitored, four showed signs of decreases in breeding pair numbers (Sea Lion Island, Berkeley Sound, Steeple Jason Northwest and Bleaker Island), whilst a further four

colonies showed signs of increases (Fanning Head North, Port Stephens, Steeple Jason Southeast and Steeple Jason S5 Tip) (**Figure 17**). The percentage decrease in breeding pair numbers ranged from 20 % at Steeple Jason Northwest colonies to 3 % at Bleaker Island. The largest increases in breeding pairs were seen at Port Stephens (41 %) and Fanning Head North (37 %) (**Figures 18 – 20**).



Figure 18: Southern Rockhopper Penguin breeding pairs for locations in mainland East and West Falkland.



Figure 20: Southern Rockhopper Penguin breeding pairs for Bleaker Island.

Breeding success

Average breeding success in Southern Rockhopper Penguin decreased from 0.55 \pm 0.23 chicks/pair in 2016 to 0.45 \pm 0.11 chicks/pair in 2017. The figure remains well below the annual average and is the second lowest value recorded since monitoring in 1993 (**Figure 21**).



Figure 19: Southern Rockhopper Penguin breeding pairs for locations on Steeple Jason



Figure 21: Southern Rockhopper Penguin breeding success at FISMP locations, 1993-2017. (Solid line - annual average). Standard Error bars show error about the overall mean by site means, and do not incorporate error about individual sites.

The range of breeding success varied between locations from a minimum of 0.26 ± 0.02 chicks/pair at Fanning Head North to a maximum of 0.66 ± 0.02 chicks/pair at Berkeley Sound. The largest changes in breeding success between 2016 and 2017 were at Fanning Head North with a 55.1 % decrease and at Steeple Jason Northwest with a 34.5 % increase (**Figure 22 & Figure 23**).



Figure 22: Southern Rockhopper Penguin breeding success for locations in mainland East and West Falkland and Sea Lion Island.



Figure 23: Southern Rockhopper Penguin breeding success for locations on Steeple Jason.

Magellanic Penguin

The location and extents of transects and the estimated occupied burrow densities at Gypsy Cove are shown in **Figure 24**. Thirty-one transects were carried out between Engineer Point and the Car Park at Gypsy Cove, of which, just under half (n = 14) contained occupied Magellanic Penguin burrows (yellow, orange, dark orange and red coloured bars on **Figure 24**).



Figure 24: Transect locations for the Magellanic Penguin survey at Gypsy Cove, 2017 (image from Google Earth). Yellow (≥ 0 and $\leq 10,000$ breeding pairs/km²), light orange (> 10,000 and $\leq 20,000$ breeding pairs/km²), dark orange (> 20,000 and $\leq 30,000$ breeding pairs/km²) and red (> 30,000 breeding pairs/km²) lines show burrow densities between the shore and the furthest burrow from the shore; grey lines show the extent of each transect where no burrows were present.

Where burrows occurred, estimated densities ranged from 5,682 to 119,047 occupied burrows $/\text{km}^2$, with an average density of 12,279 ± 23,955 $/\text{km}^2$. Mean occupancy rate derived from transects using the current methodology for Gypsy Cove was 19.4 ± 6.6 % (± 1 Standard Error, *n* = 14). Taking all burrows where there was no uncertainty over occupancy status (*n* = 67), as per surveys prior to 2012, gave an occupancy rate of 34.3 %, a decrease on the previous two seasons of

high occupancy, but remaining above the annual average for monitored sites (Figure 25).



Figure 25: Magellanic Penguin burrow occupancy rate at Gypsy Cove and Sea Lion Island, 1999-2017.

King Penguin

The number of pre-fledged chicks at Volunteer Point in 2017 was 632. This figure is a 59 % increase from 397 ± 32.1 chicks in 2016 (**Figure 26**). A count conducted by the warden earlier in the year resulted in 675 chicks.



Figure 26: King Penguin pre-fledged chick numbers at Volunteer Point, 1980-2017.

Imperial Shag

Imperial Shag monitoring, initiated in 2013 at two colonies, expanded to four colonies in 2016 and 2017. Numbers of Adult on Nests (AON) of adult Imperial Shags at the colonies continues to be variable over sites and seasons (**Figure 27**).



Figure 27: Imperial shag Apparently Occupied Nests (AON), 2013-2017.

Brown Skua

Brown Skua counts were initiated on Steeple Jason in 2015, with counts in 2016 and 2017 recording specific GPS locations and territory contents (eggs and/or chicks).



Figure 28: Breeding locations of Brown Skua at Steeple Jason in 2016 and 2017.

Total numbers of Apparently Occupied Territories (AOT) of Brown Skua increased from 215 in 2016 to 223 in 2017 or by 4 %. The contents of total territories (eggs and chicks combined), as a broad measure of overall productivity, also increased from 308 contents in 2016 to 325 contents in 2017 or by 6 %. A fifth site was also recorded at the South of Ridge in 2017 (**Figure 28**). Of the site total, the Northwest colony had the largest number of Apparently Occupied Territories (43 %) followed by Neck (27 %), House (20 %), South (8 %) and SOR (2 %).



Figure 29: Number of Brown Skua Apparently Occupied Territories (AOT) and nest content counts at Steeple Jason, 2016-2017.

Black-browed Albatross

Breeding pairs

The total estimated number of breeding pairs of Black-browed Albatross at Steeple Jason monitoring sites increased from 2,535 pairs in 2016 to 2,698 pairs in 2017, or by 6 %. This small increase is best described as a partial recovery following the significant drop in numbers during 2016. Numbers remain below the annual average for the second consecutive year (**Figure 30**).



Figure 30: Black-browed Albatross breeding pairs at FIMSP sites, Steeple Jason, 2005-2017. (Solid line – annual average).

Breeding pair numbers were comparatively improved from the 2016 numbers at four of the monitoring colonies at Steeple Jason, namely; Northwest Flat (40 % increase), Penthouse (14 % increase), Study Area by (6 % increase) and Northwest Ridge (3 % increase). The S5Tip colony decreased by 11 % (**Figure 31**).



Figure 31: Black-browed Albatross breeding pairs at individual FISMP sites on Steeple Jason, 2000-2017.

Breeding success

Overall, mean breeding success for the monitored colonies on Steeple Jason increased from 42.5 % \pm 30.5 in 2016 to 53.5 % \pm 30.5 in 2017 (**Figure 32**). This value remains below the annual average for the third consecutive year.



Figure 32: Black-browed Albatross breeding success at FISMP sites on Steeple Jason, 2004-2017 and at West Point and Saunders Island, 1989-2001. Standard Error bars show error about the overall mean by colony means and do not incorporate error about individual sites.

Breeding success varied highly between the individual colonies. When compared to 2016, the largest decrease was at the Penthouse colony (100 %) which experienced complete breeding failure, and the largest increase was at the Study colony (86 %) (**Figure 33**).



Figure 33: Black-browed Albatross breeding success at FIMSP locations on Steeple Jason, 2004-2017.

Penguin Point South, Dunbar

The breeding pair counts at Dunbar increased by 14 % from 222 in 2016 to 253 in 2017 and represented a partial recovery following the decreases in 2015 and 2016 (**Figure 34**). Breeding success was 49 % which was slightly lower than the average for the Steeple Jason sites at 53.5 %.



Figure 34: Black-browed Albatross breeding pair and chick numbers for Penguin Point South, Dunbar, 2009-2017.

Southern Giant Petrel

Breeding pairs

The overall number of breeding pairs for Southern Giant Petrel at monitored colonies on Steeple Jason increased by 1 % from an estimated 1,803 pairs in 2016 to 1,811 pairs in 2017. An increase was observed at the Neck colony (15 %) compared with 2016, whilst the Northwest colony decreased (29 %) (**Figure 35**).



Figure 35: Southern Giant Petrel breeding pair numbers at FISMP sites on Steeple Jason, 2000-2017.



Breeding success

Figure 36: Southern Giant Petrel average breeding success at FISMP sites on Steeple Jason, 2004-2017. Standard Error bars show error about the overall mean by colony means and do not incorporate error about individual sites.

The average breeding success for the two sites at Steeple Jason decreased from 17.5 ± 19.1 chicks/pair in 2016 to 3.5 ± 3.2 chicks/pair in 2017. The 2017 value is well below the annual average breeding success for the period 2004 to 2017 (34.5 chicks/pair), and the lowest value reached during the monitoring at Steeple (**Figure 36**). When compared with 2016 breeding success the Neck colony decreased by 81 % and the Northwest colony by 69 %. Breeding success at both colonies was close to complete failure (Northwest at 1.2 % and the Neck at 5.8 %) (**Figure 37**).



Figure 37: Southern Giant Petrel breeding success at FISMP sites on Steeple Jason, 2004-2017.

Bleaker Island chick count

The number of Southern Giant Petrel chicks on Bleaker Island fell by 26 % from 279 in 2016 to 206 in 2017; the third consecutive year that chick numbers have fallen at Bleaker Island (**Figure 38**).



Figure 38: Southern Giant Petrel chick counts at Bleaker Island, 2001-2017.

In 2017, fifteen Southern Giant Petrel nests were observed from drone imagery near the Blackbrowed Albatross Northwest Flat colony and 2 along the track at the old House colony at Steeple Jason. A further 6 nests were observed near the Gentoo Penguin colonies at Lagoon Sands. No chicks were successful at the House colony, 3 chicks were observed at the Northwest Flat at Steeple, and a further 1 chick was observed at Lagoon Sands.

Environment

A La Niña cycle remained in force during the 2017 FISMP period (Oct 2017 to March 2018). By the end of the FISMP period (March 2018) through to the early winter the La Niña weakened and is predicted at 50 % for the austral winter period for 2018 to be ENSO neutral (**Figures 39-40**).



Monthly sea surface temperature Niño 3.4 Index Values

Figure 39: Monthly sea surface temperature differences for ENSO: SOURCE: https://www.climate.gov/sites

Period	Seabird Activity	ENSO description
Winter 2017	Winter	The period remained within ENSO neutral thresholds.
April to August		
Early Summer 2017	Egg laying	A La Niña commenced and strengthened which peaked in
October to December	Incubation	November through to December.
	Small chick	
Late Summer 2018	Large chick	The La Niña event weakened and transitioned to ENSO-neutral by
January to March	Fledging	Mav.
	Moulting	
Winter 2018	Winter	Predicted: ENSO-neutral is favoured through to September-
April to August		November 2018.

Figure 40: ENSO description during the FISMP 2017.

Anthropogenic and other impacts at colonies

Marine Plastic

Marine plastic was observed at Steeple Jason Black-browed Albatross Study and NW Ridge colonies. At the Study colony one small plastic button was found in a nest occupied by a Black-browed Albatross chick during monitoring in November 2017. At the NW Ridge colony four Black-browed Albatross nests incorporated blue plastic sheeting (the type that is associated with packaging on commercial fishing vessels).

Oiling

No oiled seabirds were observed during the FIMSP 2017.

Marine entanglements

One large Black-browed Albatross chick was observed with a crude hook and nylon line caught in its oesophagus at Steeple Jason in March 2018 (although outside of the FISMP monitoring plots). The hook and line, assumed to have been fed to the chick by one of the parents, was safely removed.

Disease

No external signs of disease was observed at the FIMSP sites during 2017-18 monitoring. A low number of emaciated Gentoo Penguin chick carcasses were observed at several FIMSP sites, as were reports of signs of starvation in Gentoo Penguin chicks at non-FISMP sites. The levels of reported mortality was relatively low to the overall population numbers and appeared localised to the reported sites.

Discussion

Gentoo Penguin: IUCN status: Least Concern (2017)

Falkland Islands breeding pair estimate: 132,321 ± 2,015 in 2010 (34 % of global population) The FISMP 2017 annual change in breeding pair numbers: Increase (17 %)

In 2017 an increase in estimated pair numbers of 17 %, or 3,331 pairs was observed. This increased can be described as a partial recovery in numbers following a significant drop during 2016.

Twelve of the colonies exhibited increases in breeding pair numbers compared to 2016. Bull Roads colony exhibited the most pronounced increase (193 %), and interestingly this colony also displayed the largest decrease of pairs during the dip in 2016. Although the numbers partially recovered at Bull Roads in 2017, the value is still below that for 2015. This scenario generally mirrors the trend seen at the majority of the Gentoo Penguin colonies monitored in 2017.

In 2016 the FIMSP reported the significant decrease in breeding pair numbers for that year was likely (at least partially), due to birds choosing to defer breeding under the unfavourable environmental conditions during that period that coincided with a strong El Niño event (Crofts & Stanworth 2017). The partial recovery in breeding numbers for 2017 is likely explained by some of these birds re-entering the breeding population as environmental conditions had improved. However, as the numbers of breeding pairs did not fully recover in 2017 when compared to 2015, it is likely some birds have either continued to defer breeding for a second year, or that a proportion of adults have been permanently lost to the population through mortality.

Continued monitoring in 2018/19 will help to further explain the nature of the recovery following the dip in 2016.

Southern Rockhopper Penguin: IUCN status: Vulnerable (2017) Falkland Islands breeding pair estimate: 319,163 ± 24,820 in 2010 (36 % of global population) The FISMP 2017 annual change in breeding pair numbers: Decrease (1 %)

The numbers of breeding pairs of Southern Rockhopper Penguin remained static compared to 2016 with no signs of recovery after the significant drop in numbers in 2016.

The overall trend in breeding pair numbers shows a steady increase from 2003, reaching a peak in 2015, followed by a significant drop in 2016 and remaining at this level in 2017. During March 2016, adult Southern Rockhopper Penguin mortality (due to starvation during the moult period) was recorded at the Falklands (Crofts & Stanworth 2016), and an overall decrease of 31 % in breeding numbers was recorded at the FISMP sites in the following November 2016. It is difficult to attribute the 31 % loss in breeding pair numbers entirely to this mortality event, and as with Gentoo Penguins, breeding deferral, which could help explain a decrease in breeding numbers between 2015 and 2017, is reported in *Eudyptes* penguins (Crawford et al. 2006). However, very little is known about this at the Falkland Islands.

Overall breeding success remained well below the annual average and was the second lowest value recorded since monitoring at these sites began. The lowest value for breeding success was recorded in 2010 and coincided with a severe storm event which directly caused nest failures (Wolfaardt et al. 2012). The cause of the poor breeding success in 2017 cannot be pinpointed directly to a cause, such as the storm event in 2010, and any continuation of decreases in breeding success will be of high conservation concern.

Magellanic Penguin: IUCN status: Near Threatened (2017)

Falkland Islands breeding pair estimate: 76,000 – 142,000 (1997) (<10 % of globally population) The FISMP 2017 annual change in burrow occupancy rate: Decrease

At Gypsy Cove, the 2017 breeding Magellanic Penguin remained broadly in three groupings, which appeared to be associated with the extent of tussac habitat at the monitoring site. The occupancy rate of 34.3 % is lower than the previous year by 18 %, and just above the annual average for the monitored site. Heavy rainfall during the spring of 2017 was noted to have caused significant flooding of Magellanic Penguin burrows during the incubation phase at some sites (e.g. Sea Lion Island), and is likely to have had some impact on breeding success for this species this year.

King Penguin: IUCN status: Least Concern (2017)

Falkland Islands breeding pair estimate: 750 in 2012 (<1 % of global population) The FISMP 2017 annual change in chick numbers: Increase (59 %)

In 2017, the number of pre-fledged chicks at Volunteer Point increased by 59 % from 2016. The

long-term monitoring at the site shows periodic fluctuations with an overall upward trend, and the drop in chick numbers during 2016 coincided with an overall poor year for the seabirds monitored under the FISMP; seemingly due to the unfavourable conditions coinciding with a strong El Niño in place.

Black-browed Albatross: IUCN status: Least Concern (2017)

Falkland Island breeding pair estimate: 475,000-535,000 in 2010 (70 % of global population) The FISMP 2017 annual change in breeding pair numbers: Increase (6 %)

Black-browed Albatross breeding pairs at the monitoring sites at Steeple Jason in 2017 showed a partial recovery following the 2016 decrease, although the overall numbers did not reach the annual average of the monitoring period (2005-2017). Given the high annual fluctuations, the overall FISMP trend since monitoring began in 2005 suggests a currently stable population, despite the significant decrease that occurred in 2016.

The overall mean breeding success in 2017 remained below the annual average for the third consecutive year, and complete breeding failure was observed at the Penthouse colony. Breeding pair and chick numbers monitored at Dunbar both increased from the previous year.

Breeding deferral is reported in Black-browed Albatross, and for females evidence suggests the decision to reproduce or defer breeding is associated with their relative fitness (i.e. body condition and hormonal traits) prior to arrival at breeding colonies (Crossin et al. 2012). Breeding deferral may help explain a decrease in breeding numbers in 2016 if feeding conditions were sub-optimal across their winter migration ranges.

Southern Giant Petrel: IUCN status: Least Concern (2017)

Falkland Island breeding pair estimate: 20,970 ± 180 pairs in 2015 (43 % of global population) The FISMP 2017 annual change in breeding pair numbers: Increase/Stable (1 %)

Overall breeding pair numbers of Southern Giant Petrel at Steeple Jason remained stable in numbers from the previous year. The overall trend at the Neck colony (since monitoring began in 2000) shows a steady increase in pair numbers, despite a significant dip in 2015. The Northwest colony demonstrates an overall steady increase from 2000 to 2014, with the period of 2015 to 2017 in a downward phase.

Since the failure of the Northeast colony (located near to the house), birds have re- attempted to establish this area; shown by a high presence of loafing birds and in 2017 two pairs were successful in producing eggs (although neither nest was successful). Disturbance at this colony (sited on the main walking track from the House to the NW Tip) is likely to prevent the re-establishment of breeding at this historic breeding site.

The apparent decline of breeding performance at Steeple Jason in 2017 was notable with almost complete failure at the colonies. The overall breeding success for these colonies has worryingly declined by 90 % from 2004 to 2017.

The most recent island-wide census of Southern Giant Petrel at the Falkland Islands (Stanworth & Crofts 2017) suggests that there is no evidence for any long-term declines in this species, however much less is known regarding the species breeding performance, other than at Steeple Jason and Bleaker Island. A high degree of fidelity to the breeding location is reported for this species (Voisin 1988), although the nest location appears more variable and it cannot be ruled out that birds at Steeple Jason are not moving between colonies. At the Falkland Islands, Southern Giant Petrels are known to be sensitive to human activities (e.g. the failure of the Steeple Jason NE (House) colony in 2009). Interestingly, at Signy Island, South Orkney Islands, breeding success of Southern Giant Petrels were noted to be variable ranging from 8.5 % to 61.7 %, but overall showed a 20 % decline from 1996/1997 to 2014/2015 (Dunn *et al.* 2016), suggesting that there are potentially more wider and regional implications to consider.

As the Southern Giant Petrels breeding at the Falkland Islands represent 43 % of the global population (Stanworth and Crofts 2017), continuation of declines in breeding success at Steeple Jason (representing around 8 % of the Falklands breeding population) would be of international concern. It would be desirable to encourage opportunities where possible to better understand breeding performance at a broader scale for the Falklands' population.

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Environment

During the FISMP 2017 a La Niña event was in place, although this had returned to neutral thresholds by April 2018. In terms of the oceanographic variables at the Falkland Islands, observations suggest some sea temperature anomalies from late 2017 (Nov/Dec) through to early 2018 (Jan/Feb), and having normalized by May (Falkland Islands Fisheries Department pers. comm.). Overall the anomalies included warmer than normal sea temperatures, but with a degree of spatial differentiation in that the currents to the north of the Falklands were uncharacteristically warm, whilst currents to the south were colder. In regards to these spatial differences two unusual observations were noted: the colder productive water possibly resulted in much higher squid (*Doryteuthis gahi*) abundances later in the season than normal, and that secondly, jellyfish abundance was reported very high to the north and west of the Falklands' Shelf (Falkland Islands Fisheries Department pers. comm.).

Anthropogenic and other impacts at colonies

Few of the anthropogenic measures were observed at the FIMSP sites. Only Steeple Jason Study and NW colonies had signs of marine plastic at low levels. Although in-depth disease screening is not within the current scope of the FISMP, highlighting factors that may be contributing towards seabird breeding performance at an island-wide scale is important to the context of the FISMP results. Increasing evidence suggests a virus-like disease has manifested itself within the Blackbrowed Albatross populations at the Falklands, including Steeple Jason (Paulo Catry pers. comm., Matias *et al.* unpublished), but other species may be affected. This disease appears to affect only chicks during the brood phase; however, there is currently insufficient information available to understand the impacts of disease on seabird populations in the Islands. Those species identified as conservation concern through the Agreement on Conservation of Albatrosses and Petrels require particular attention in this regard.

IUCN re-assessment

BirdLife International undertake assessments of bird Red List status on behalf of the International Union for Conservation of Nature (IUCN). During 2016 and 2017 the Red List statuses of a number of species monitored as part of the FISMP were published. Data generated by the FISMP was used to inform all of the assessments, highlighting its importance in informing national and global conservation measures. In relation to FISMP species, following the latest assessments, Southern Rockhopper and Macaroni Penguins remained listed as 'Vulnerable' and Magellanic Penguin as 'Near Threatened'. King Penguin and Southern Giant Petrel remained listed as Least Concern, whilst both Black-browed Albatross and Gentoo Penguin moved from 'Near Threatened' to 'Least Concern'.

Setting threshold values for management

It is important to consider monitoring results in the context of past population cycles and breeding success performances. The FISMP long-term data provides a backdrop against which population trends for seabirds are now better understood. Using this data to identify thresholds for concern based on historic fluctuations would greatly improve how we interpret and act upon the FISMP information. This has increasing significance in light of the FISMP 2017 results, particularly for continued poor breeding performances.

Counting effort

This year for the first time, as the photo database ever expands, the FISMP enlisted the help of RSPB volunteer counters. With basic tutorials on counting seabird numbers from images, and using the software ImageJ, we distributed images to volunteers to help count and speed up our data processing. With thanks to Rhoda Ludford and Sallie Crawley of the Volunteer Development Team and Sacha Cleminson for organising this project, and the volunteers that submitted counts to us.

For the 2017-18 year we counted (including repeats) a total of 383,198 birds, both on the ground directly at the colonies and from the 150 photographic images used.

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Appendix 1: Count information

Location	Date of breeding pair count	Counters	Date of chick count	Counters
Volunteer Green	18/11/17	S. Crofts N. Warnock D. Spivack	10/01/18	S. Crofts V. Booth
Race Point	16/11/17	S. Crofts N. Warnock	08/01/18	S. Crofts V. Booth F. Ross
Sea Lion Island	12/11/17	M. Morrison J. Peck	04/01/18	M. Morrison C. Morrison
New Haven	1311/17	A. Stanworth A. Mitham	04/01/18	A. Stanworth v. Booth
Bull Roads	11/11/17	A. Stanworth A. Mitham	06/01/18	A. Stanworth v. Booth
Bull Point	10/11/17	A. Stanworth A. Mitham	06/01/18	A. Stanworth v. Booth
Cow Bay	19/11/17	S. Crofts N. Warnock D. Spivack	10/01/18	S. Crofts V. Booth
Low Bay	11/11/17	A. Stanworth A. Mitham	16/01/18	A. Stanworth v. Booth
Motley Point	12/11/17	A. Stanworth A. Mitham	05/01/18	A. Stanworth v. Booth
Bertha's Beach	04/11/17	M. Morrison J. Peck	31/12/17	M. Morrison J. Peck
Fox Point	04/11/17	M. Morrison J. Peck	31/12/17	M. Morrison J. Peck
Pleasant Roads	07/11/17	M. Morrison J. Peck	01/01/18	M. Morrison J. Peck
Steeple Jason	02-10/11/17	S. Crofts N. Warnock I. Marengo	Gentoo and Rockhopper 16- 19/01/18. Black- browed and Giant Petrel 13-15/03/18	S. Crofts V. Booth E. Hancox S. Hirtle A. Stanworth W. Miles J. Sturgeon
Lagoon Sands	18/11/17	S. Crofts N. Warnock D. Spivack	10/01/18	S. Crofts V. Booth
Diamond Cove	22/11/17	S. Crofts N. Warnock P. Jelbes	10/01/18	S. Crofts V. Booth
Rugged Hill/Eagle Hill	22/11/17	S. Crofts N. Warnock P. Jelbes	10/01/18	S. Crofts V. Booth
Port Stephens	11/11/17	D. Towersey E. Milston D. Robertson	20/01/18	D. Towersey L. Evans
Penguin Point South	Nov 2017	M. Delignieres	29/01/2018	M. Delignieres
Bleaker Island	Gentoo – 07/11/17, Rockhopper – 29/11/17	M. Rendell	Giant Petrel 21/03/18	M. Rendell

Appendix 2: Gentoc	Penguin	count	data
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Location	Colony	Grid Ref.	Breeding Pairs (Mean±1SD)		Breeding Success (Mean±1SD)	
			Count	Count Type*	Count	Count Type*
Bertha's Beach	Bertha's Beach	-58.358916 -51.882233	628 ± 24	TR	0.98 ± 0.47	TR
Bull Point	Bull Roads	-59.398188 -52.309364	759 ± 3	TR, D	0.53 ± 0.02	TR
Bull Point	Bull Point	-59.321461 -52.342591	1836 ± 14	TR, D	0.43 ± 0.01	D
Fox Point	Fox Point	-51.92 -58.45	399 ± 1	TR	0.51 ± 0.03	TR
Low Bay	Low Bay	-58.879630 -52.077608	385 ± 2	Ph	0.58 ± 0.06	TR
Motley Point	Motley Point	-58.643177 -52.108576	1519 ± 7	D	0.36 ± 0.05	TR
New Haven	New Haven	-59.222044 -51.742073	719 ± 5	TR, D	0.58 ± 0.02	TR
Pleasant Roads	Pleasant Roads	-51.83 -58.24	187 ± 1	TR	1.05 ± 0.02	TR
Race Point	Fanning Harbour	-59.087958 -51.464667	185 ± 2	TR	0.22 ± 0.06	TR
Race Point	Rookery Sands	-59.106928 -51.434122	1286 ± 5	TR, D	0.23 ± 0.03	TR
Sea Lion Island	Sea Lion Island	-59.072513 -52.426578	3886 ± 30	TR	0.47 ± 0.02	TR
Steeple Jason	House	-61.233113 -51.020186	3919 ± 22	TR, Ph, D	0.43 ± 0.01	TR, D
Steeple Jason	Neck	-61.214888 -51.034787	4546 ± 34	TR, Ph, D	0.49 ± 0.01	TR, D
Johnson Harbour	Cow Bay	-57.879051 -51.428572	1136 ± 4	Ph, TA	0.85 ± 0.02	D, TR
Johnson Harbour	Lagoon Sands	-57.77581 -51.513702	640 ± 6	Ph	0.29 ± 0.03	Ph, TR
Johnson Harbour	Volunteer Green	-57.837858 -51.478494	1110 ± 22	TR	0.58 ± 0.03	TR

* TR – Tally Repeated, TA – Tally Agreed, Ph – Photo count, D – Drone image count

Location	Colony/Sub- colony	Grid Ref.	Breeding Pairs (Mean ± 1 SD)	Count Type*	Breeding Success (Mean ± 1 SD)	Count Type*
Berkeley Sound	Diamond Cove	-57.923512 -51.538059	145 ± 1	TA	0.69 ± 0.01	TA
	Eagle Hill East	-57.785118 -51.544064	102 ± 2	D	0.62 ± 0.04	D
	Eagle Hill	-57.802981 -51.544497	723 ± 5	Ph	0.46 ± 0.01	Ph
	Eagle Hill West	-57.810499 -51.545082	618 ± 9	Ph	0.76 ± 0.02	Ph
	Rugged Hill East	-57.845031 -51.543674	492 ± 9	D	0.59 ± 0.05	D
	Rugged Hill West	-57.851570 -51.543488	652 ± 45	TR	0.83 ±0.7	Ph
Port Stephens	Stephens Peak	-60.859281 -52.133803	1249 ± 36	TR	0.35 ± 0.03	TR
Race Point	Fanning Head North	-59.141540 -51.460831	240 ± 4	Ph	0.26 ± 0.03	Ph
	Fanning Head South	-59.137749 -51.469284	Not done		Not done	
Sea Lion Island	Rockhopper Point	-59.115501 -52.446667	415 ± 10	TR	0.60 ± 0.03	TR
Steeple Jason	Northwest Flat	-61.252682 -51.012810	108 ± 3	D	0.43 ± 0.03	TA
	Northwest Ridge	-61.252884 -51.012939	104 ± 4	TR	0.36 ± 0.04	TA
	S5Tip	-61.220460 -51.037932	919 ± 30	TA	0.38 ± 0.03	TA
	Study Area	-61.206635 -51.046215	791 ± 4	TA	0.48 ± 0.01	TA

Appendix 3: Southern Rockhopper Penguin count data

* TR – Tally Repeated, TA – Tally Agreed, Ph – Photo count, D – Drone image count

Transect	Number of Burrows	Occupancy (%)	Distance to last burrow	Minimum Pair Density per Km ²
T1	0			0
Т2	0			0
Т3	0			0
T4	5	1	4	8833.922261
T5	8	2	6	17123.28767
Т6	6	2	4	17421.60279
Т7	1	1	0	119047.619
Т8	0			0
Т9	0			0
T10	0			0
T11	0			0
T12	1		1	0
T13	0			0
T14	3	2	1	21645.02165
T15	5	1	4	12437.81095
T16	6	1	4	5681.818182
T17	0			0
T18	1	0	1	0
T19	3	1	2	5868.544601
T20	0			0
T21	3		3	0
T22	0			0
T23	0			0
T24	0			0
T25	6	5	1	15413.07028
T26	11	3	4	47332.18589
T27	3	1	1	39062.5
T28	5	1	2	15664.1604
T29	5	2	3	44642.85714
Т30	3	1	2	10460.25105
T31	0			0

Appendix 4: Magellanic Penguin survey data

Appendix 5: Black-browed Albatross and Southern Giant Petrel count data

Black-browed Albatross

Sub-colony	Breeding Pairs (Mean ± 1 SD)	Count Type*	Breeding Success (chicks/pair) (Mean ± 1 SD)	Count Type*
Study Colony	1266 ± 8	TR/TA	0.70 ± 0.01	TR/TA
S5Tip	407 ± 7	TR/TA	0.21 ± 0.02	TR/TA
Penthouse	65 ± 0	TR/TA	0	TR/TA
Northwest Flat	414 ± 10	D	0.41 ± 0.02	TR/TA
Northwest Ridge	546 ± 3	TR/TA	0.56 ± 0.01	TR/TA

* TR – Tally Repeated, TA – Tally Agreed, Ph – Photo count, D – Drone image count

Southern Giant Petrel

Colony	Breeding Pairs (Mean ± 1 SD)	Count Type*	Breeding Success (chicks/pair) (Mean ± 1 SD)	Count Type*
Neck	1484 ± 24	D, TR	0.06 ± 0.02	D, TR
Northwest	325 ± 3	TR	0.01 ± 0.01	TR
House	2	ТА	0	
Northwest Flat	15	ТА	0.02 ± 0.01	TA
Lagoon Sands	6	ТА	0.02 ± 0.01	TA

* TR – Tally Repeated, TA – Tally Agreed, Ph – Photo count, D – Drone image count