The following supplement accompanies the article

Non-breeding distribution and activity patterns in a temperate population of brown skua

Hendrik Schultz, Rebecca J. Hohnhold, Graeme A. Taylor, Sarah J. Bury, Tansy Bliss, Stefanie M. H. Ismar, Anne C. Gaskett, Craig D. Millar*, Todd E. Dennis

*Corresponding author: cd.millar@auckland.ac.nz

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MATERIALS AND METHODS

Text S1 Characterisation of migration schedules

The R package 'BASTag' (Wotherspoon et al. 2016) was used to plot immersion data and then visually identify departure- and arrival dates at the colony. Departure dates were defined as the first night that the bird spent on water (i.e., the logger was continuously recording 'wet'), and arrival dates were defined as the first night a bird spent on land after a continuous 'wet' period (i.e., when the immersion counts switched from periods of continuous 'wet' to periods of continuous 'dry'). The duration of the non-breeding periods was defined as the number of days that passed between individual dates of departure from and arrival at the colony.

Test S2 Selection of feathers for stable isotope analysis

Brown skuas (*Catharacta antarctica lonnbergi*) undergo moult during the non-breeding period, while away from the colony (Furness 1987). However, little detail is known about moult sequences of specific feather types i.e., body feathers, primaries and rectrices (tail feathers), and moulting patterns may vary among individuals and populations (see comments by Votier et al. (2015) at http://www.surfbirds.com/mb/Features/skua-identification.html). Stable isotope analysis of body feathers has previously been used to infer winter diet of brown skuas (Phillips et al. 2007, Delord et al. 2018). However, a recent study advised caution after observing a small number of individuals in active body feather moult at a breeding colony on King George Island (Graña Grilli & Cherel 2017). Hence, although active moult during breeding seems to be uncommon, isotopic analyses of feathers, specifically those for which moult sequences are unknown, may potentially reflect dietary signatures during pre- or post-breeding period rather than the non-breeding season.

Text S3 Stable isotope analysis

Stable isotope analyses were carried out on a Delta V Plus continuous flow isotope ratio mass spectrometer linked to a Flash 2000 elemental analyser using a MAS200R autosampler (Thermo-Fisher Scientific, Bremen, Germany). Reference gas standards (CO_2 and N_2) were introduced to the mass spectrometer with every sample analysis. ISODAT (Thermo-Fisher Scientific) software was used to calculate $\delta^{15}N$ values against atmospheric air, and $\delta^{13}C$ values against the CO_2 reference gas relative to the National Bureau of Standards 19 – calcite (NBS19-calcite) standard (calibrated against Vienna Pee Dee Belemnite: VPDB), correcting for ^{17}O. Following standard protocols, carbon (^{13}C, ^{12}C) and nitrogen (^{15}N, ^{14}N) isotope ratios were computed as delta notations in units of parts per thousand (‰). Sample $\delta^{15}N$ values were two-point normalised (following Paul et al. 2007) using isotopic data from the daily analysis of National Institute of Standards and Technology NIST 8573 USGS40 L-glutamic acid and NIST 8548 IAEA-N2 ammonium sulphate. Sample $\delta^{13}C$ values were two-point normalised using isotopic data from the daily analysis of NIST 8573 USG40 and NIST 8542 IAEA-CH-6 Sucrose. Percent C and % N values were calculated relative to a solid laboratory reference standard of DL-Leucine (DL-2-Amino-4-methylpentanoic acid, $C_6H_{13}NO_2$, Lot 127H1084, Sigma, Australia) at the beginning of each run. Repeat analysis of NIST standards produced data accurate to within 0.3‰ for $\delta^{15}N$ and $\delta^{13}C$ and a precision of better than 0.2‰ for N and 0.1‰ C.

SUPPLEMENTARY LITERATURE CITED

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Table S1 Retrieval of geolocators (GLS) and results of stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope analysis from feathers of adult female and male brown skuas (*Catharacta antarctica lonnbergi*). The breeding status (successful vs. unsuccessful) of birds from which geolocators were retrieved is shown. Feathers were collected during three consecutive breeding seasons (2014–16). Values of $\delta^{13}C$ and $\delta^{15}N$ are shown as mean ± SD

Year	Sex	GLS	Breeding status (success | fail)	Feathers	$\delta^{13}C$	$\delta^{15}N$
2014	F	-	-	9	-18.22 ± 2.23	14.48 ± 1.41
	M	-	-	12	-17.03 ± 0.54	15.16 ± 0.73
2015	F	3	2 | 1	13	-18.25 ± 2.27	11.42 ± 2.74
	M	10	9 | 1	10	-16.77 ± 0.61	11.70 ± 2.42
2016	F	7	5 | 2	17	-16.80 ± 0.89	12.34 ± 2.56
	M	7	5 | 2	11	-16.98 ± 1.08	11.49 ± 2.67
Total		27		72		

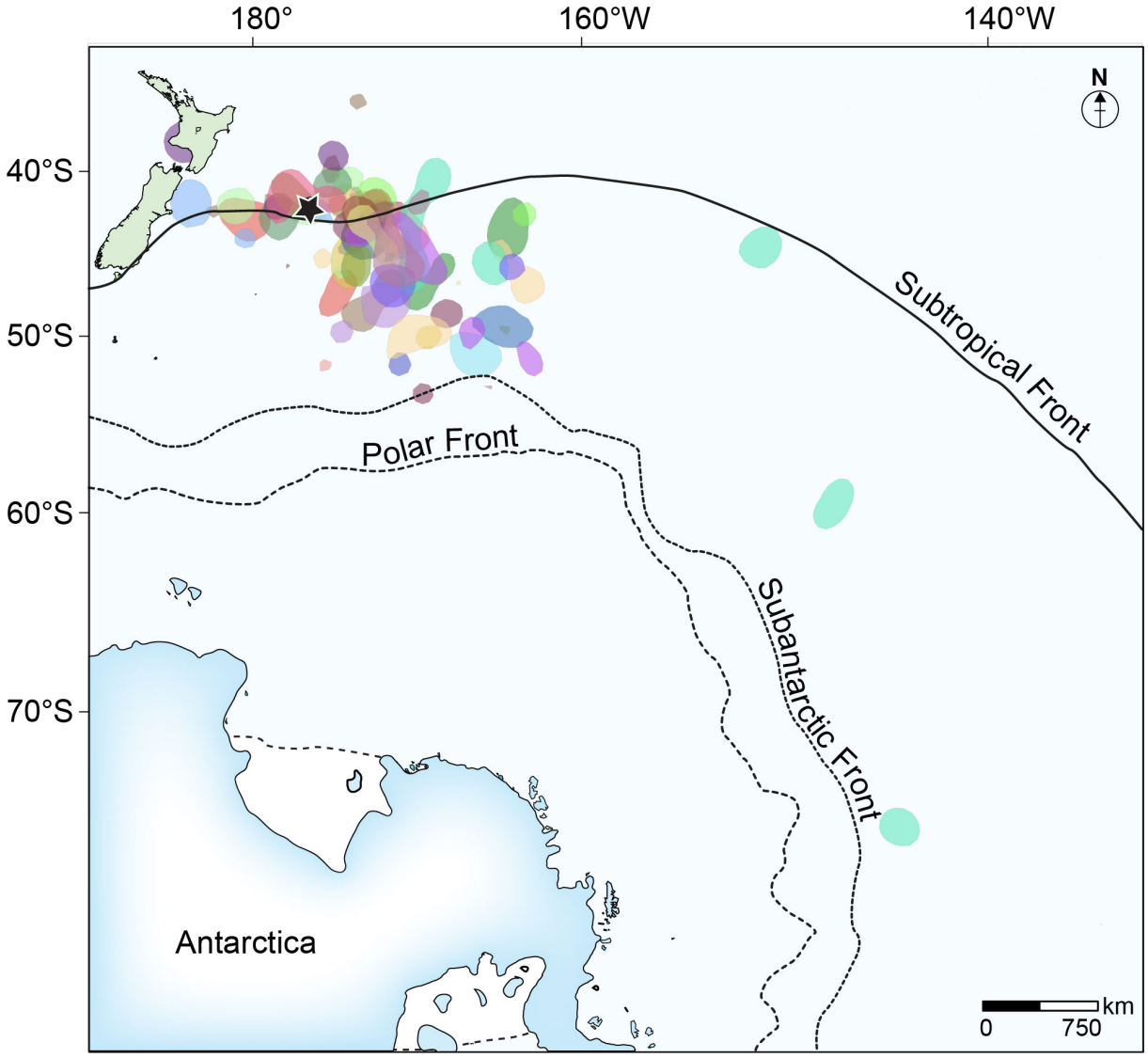

Fig. S1 Individual utilisation distributions (25% UDs) of 27 brown skuas (*Catharacta antarctica lonnbergi*) from the Chatham Islands (black star). Skuas were tracked using geolocators during the 2015 and 2016 non-breeding periods. Distinct colours depict UDs of different individuals

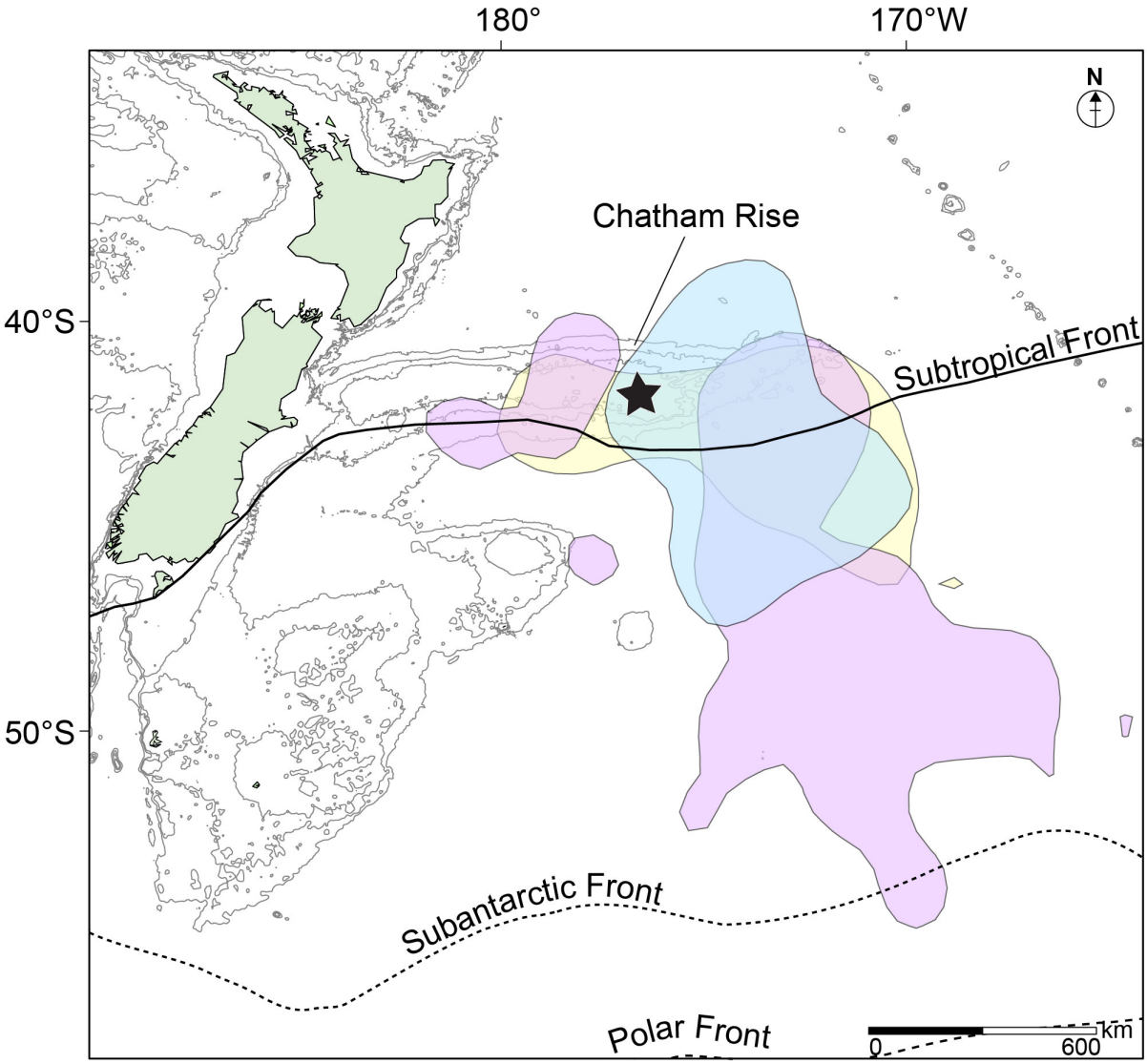

Fig. S2 Core utilisation distributions (50% UDs) for early (February-March, light blue), mid (April-May, purple), and late (June-July, yellow) stages of the non-breeding period of brown skuas (*Catharacta antarctica lonnbergi*) from the Chatham Islands (black star). Grey lines indicate 500 m, 1000 m, and 2000 m bathymetry contours

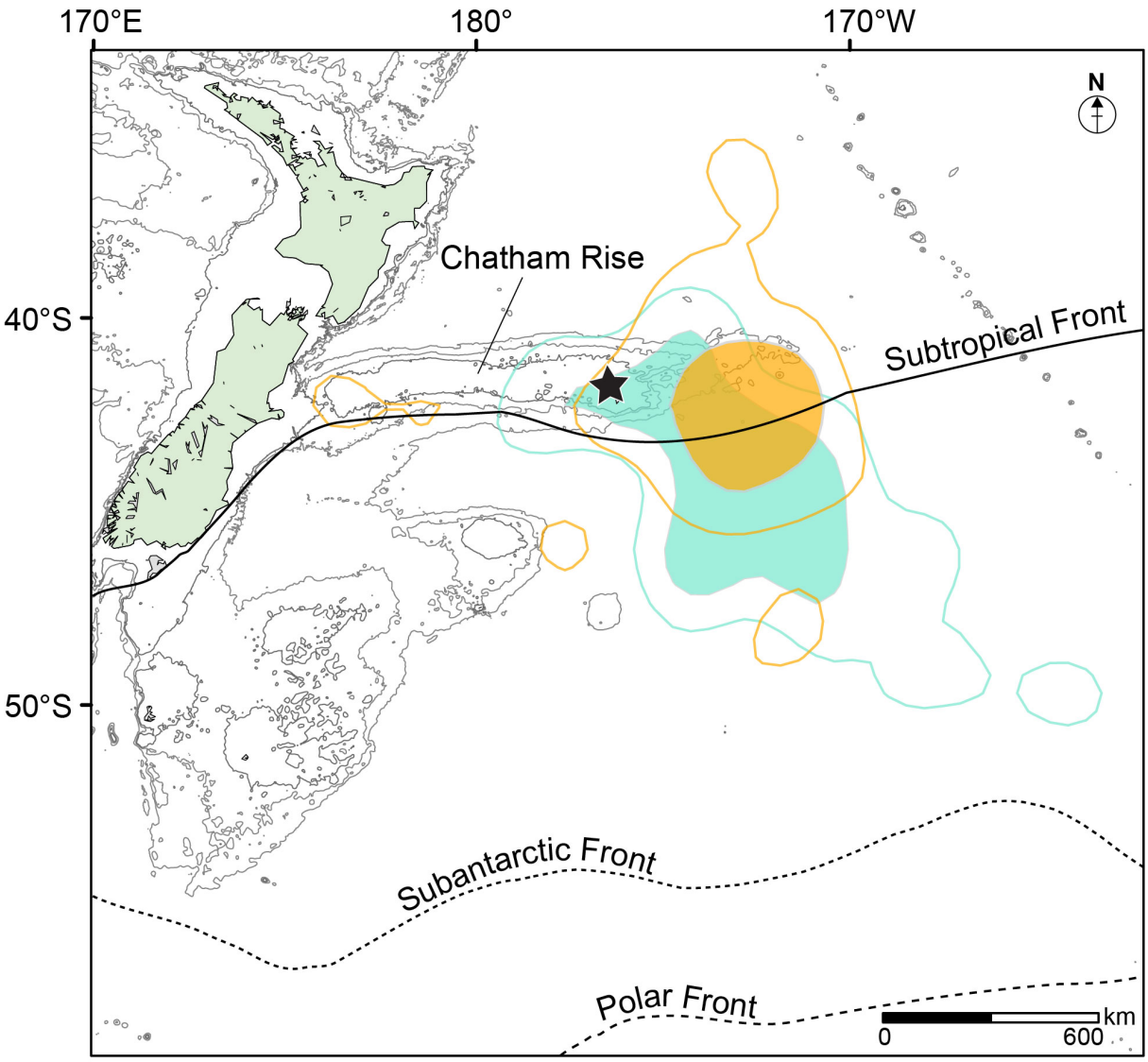

Fig. S3 Non-breeding utilisation distributions (UDs) of 27 brown skuas (*Catharacta antarctica lonnbergi*) from the Chatham Islands (black star). UDs were computed based on individual affiliations with one of two isotopic clusters. Illustrated are 25% (coloured fill) and 50% (solid line) utilisation distribution contours overlaid on bathymetric features (500 m, 1000 m, and 2000 m contours; depicted by grey lines). Cluster I (turquoise) had moderate $\delta^{13}C$ (-17.6 ± 0.4‰, range: -18.3 to -16.6‰) and low $\delta^{15}N$ (9.8 ± 0.7‰, range: 8.9 to 11.2‰) values characteristic of wintering over mixed subtropical-subantarctic waters. Cluster II (orange) comprised individuals with elevated $\delta^{13}C$ (-16.5 ± 0.7‰, range: -17.9 to -15.3‰) and $\delta^{15}N$ (14.8 ± 1.1‰, range: 12.1 to 16. 5‰) levels characteristic of shelf waters

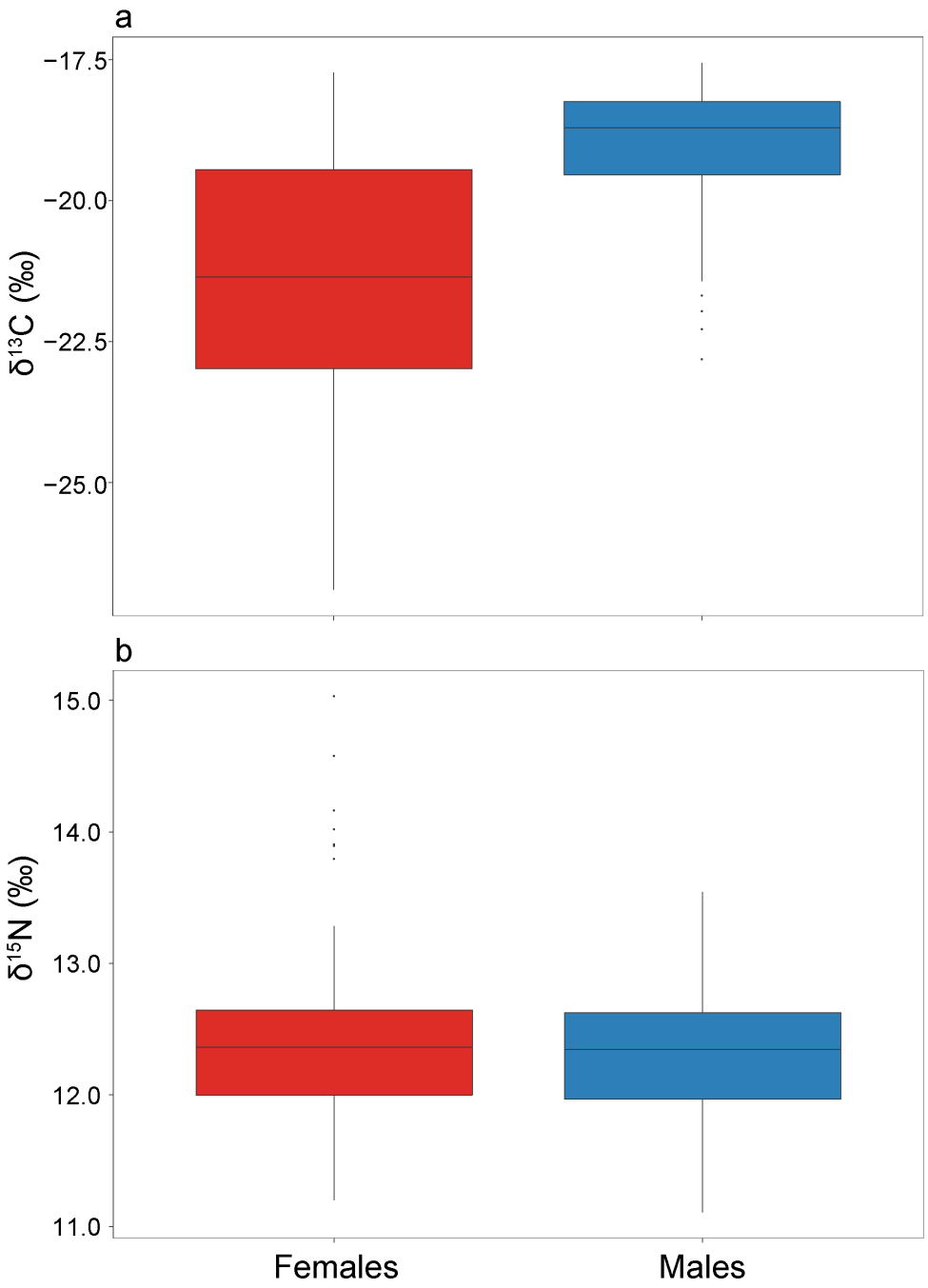

Fig. S4 Boxplots showing the distribution of a) $\delta^{13}C$ and b) $\delta^{15}N$ values from the blood of female (red) and male (blue) brown skuas (*Catharacta antarctica lonnbergi*) breeding on South East Island, Chatham Islands. Blood samples were collected during three consecutive breeding seasons (2014-16). Horizontal lines represent median values and boxes indicate 25% and 75% quantiles