# Supplementary Information for: Evidence of resource partitioning between fin and sei whales during the twentieth-century whaling period

**Danielle L. Buss · Ella Hearne · Rebecca H. Y. Loy · Andrea Manica · Tamsin C. O'Connell · Jennifer A. Jackson**

**Figure S1**

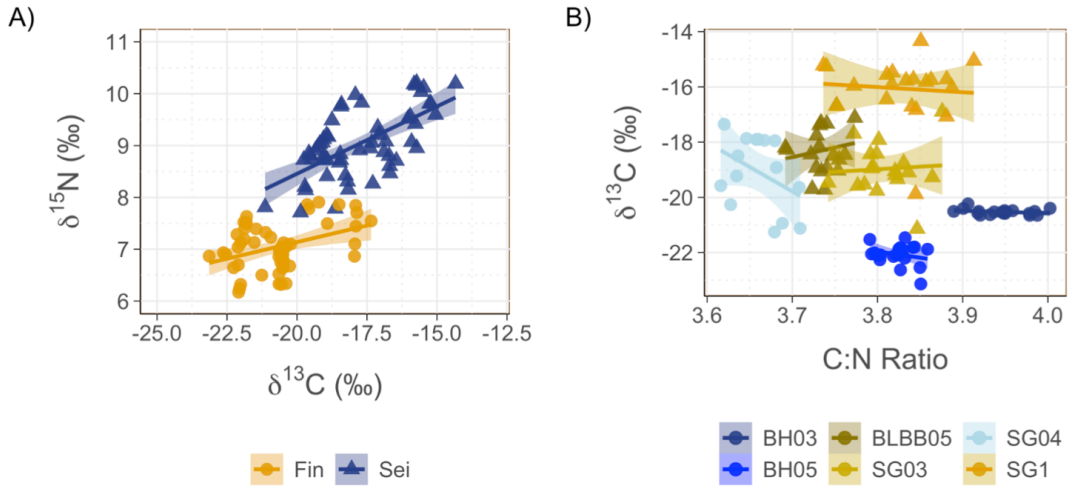



**Figure S1.** (A) Correlation between $\delta^{13}C$ and $\delta^{15}N$ values for fin and sei whale baleen collected from South Georgia. (B) Correlation between $\delta^{13}C$ and atomic C:N ratio of the six baleen plates. Fin whale plates are shown in blue. Sei whale plates are shown in yellow.

**Figure S2**

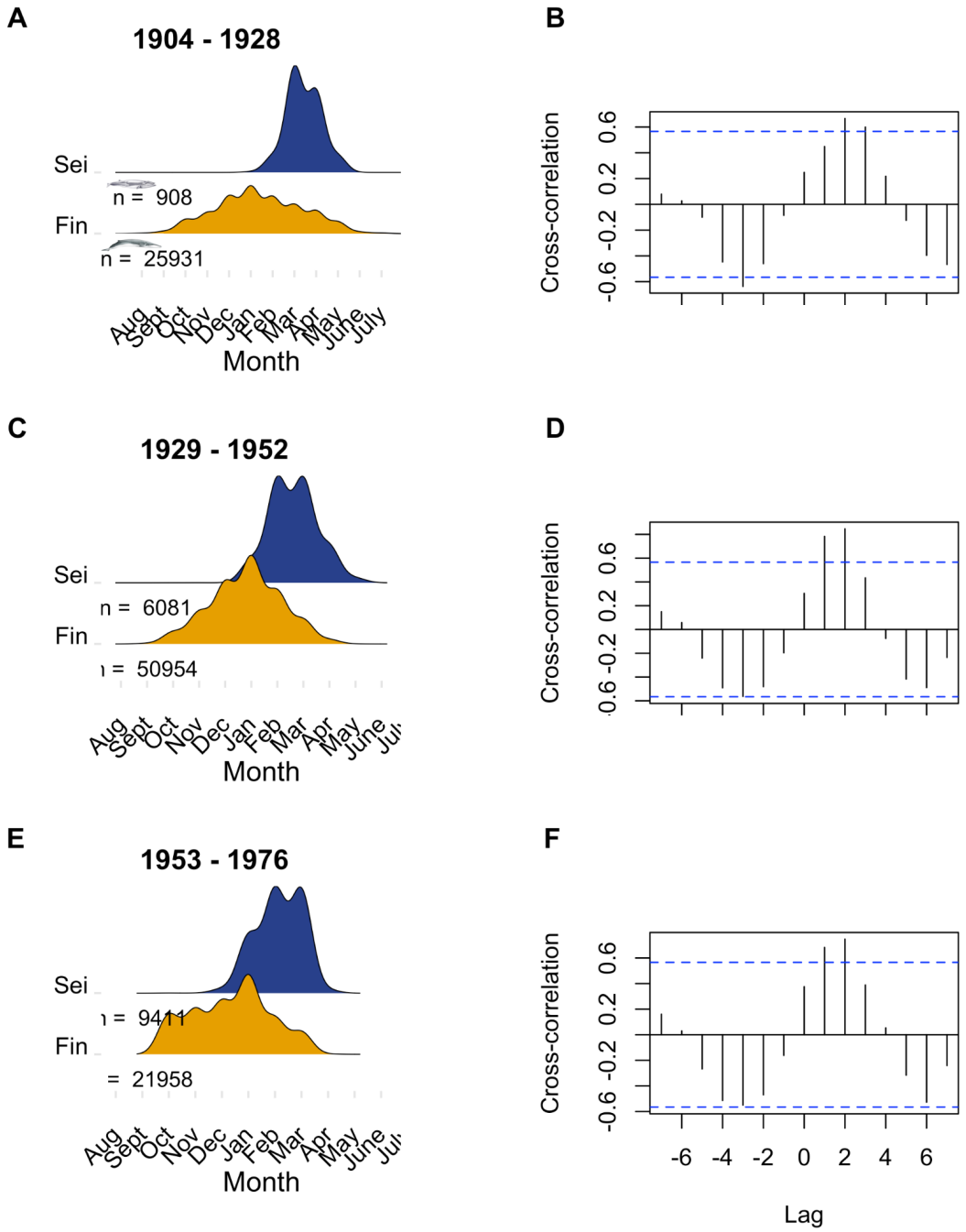



**Figure S2.** Density distributions of monthly commercial catches of sei whale *Balaenoptera borealis* and fin whale *B. physalus* within the South Georgia and South Sandwich Islands Exclusive Economic Zone during the (A) early (1904-1929), (C) middle (1929 - 1952) and (E) late time periods (1953 - 1976). Cross correlation functions graphically representing the lag time of sei whale catches compared with fin whale catches across the (B) early (1904-1929), (D) middle (1929 - 1952) and (F) late time periods (1953 - 1976). Blue dotted lines represent the threshold for statistical significance at $p$=0.05.

**Figure S3**

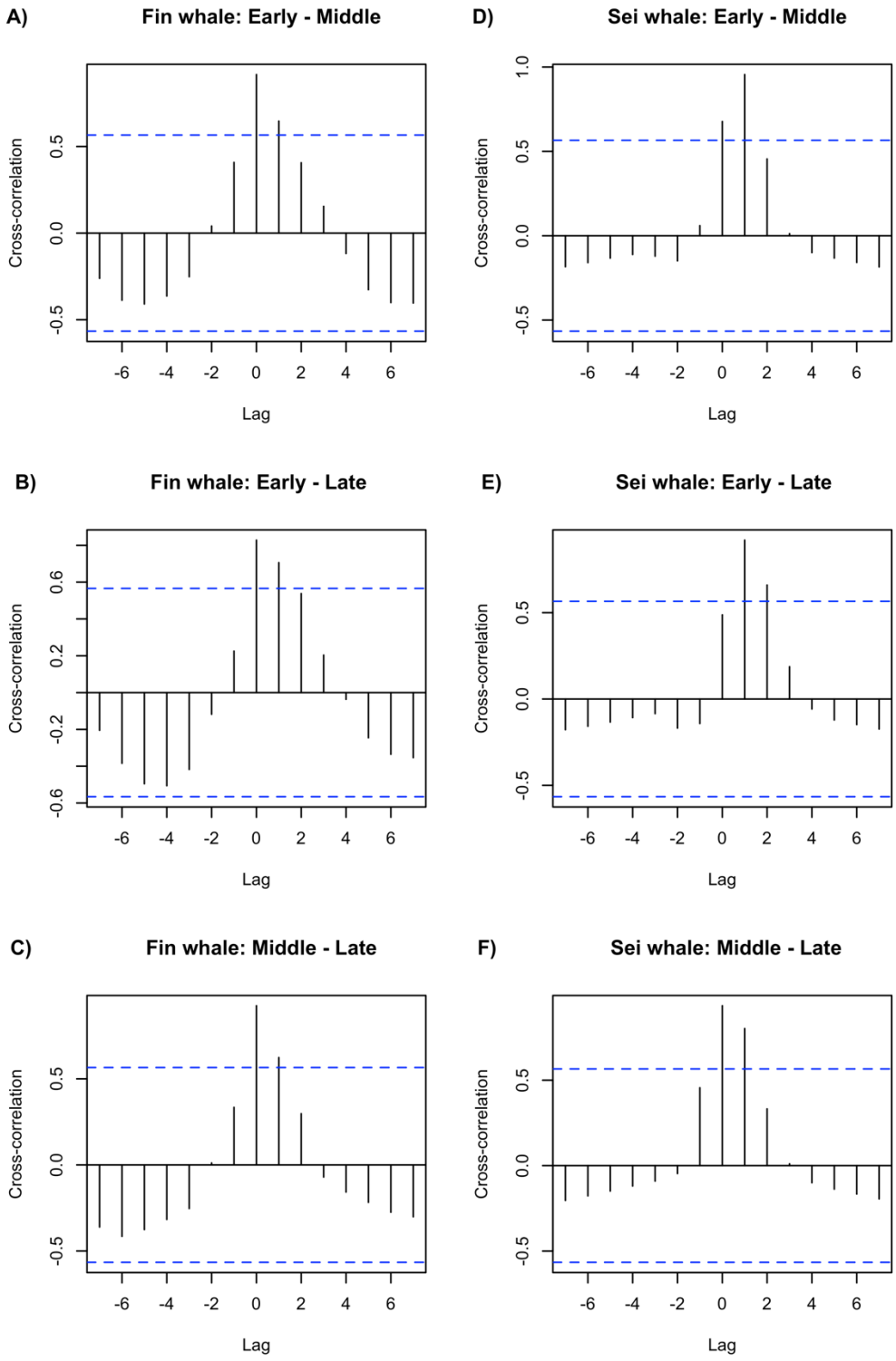



**Figure S3.** Cross correlation functions graphically representing the lag time of fin whale catches (A – C) and sei whale catches (D – E) between time periods (Early: 1904-1929; middle: 1929 – 1952; Late: 1953 - 1976). Blue dotted lines represent the threshold for statistical significance at $p$=0.05.

**Figure S4.**

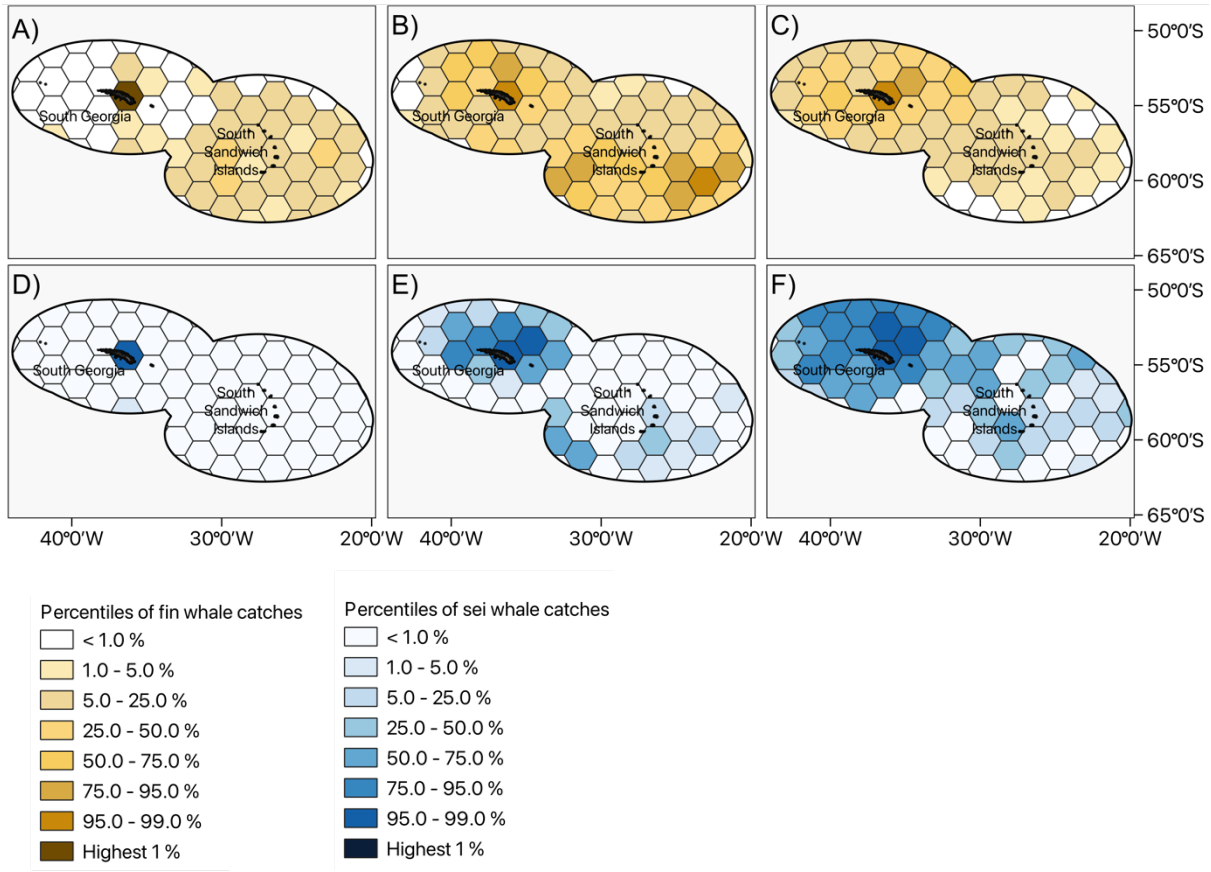



**Figure S4.** Spatial distributions of commercial whaling catches of fin whale, *Balaenoptera physalus*, (A – C) and sei whale, *B.borealis* (D – F) within the South Georgia Exclusive Economic Zone between 1904 – 1928, 1929 – 1952, 1953 – 1976.

**Figure S5.**

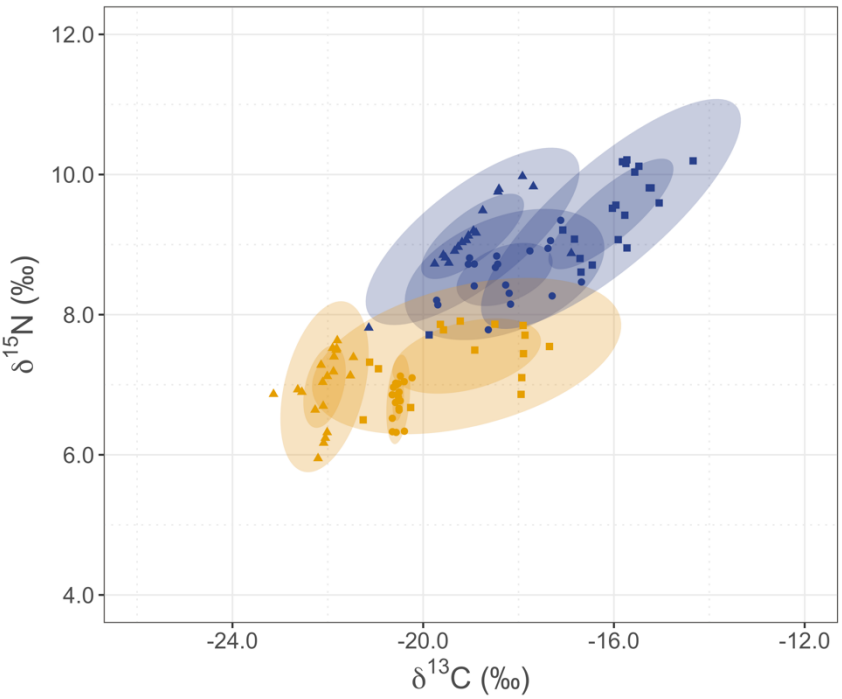



**Figure S5.** Bivariate stable isotope ratios ($\delta^{13}C$ and $\delta^{15}N$) of incremental baleen samples from three fin whale individuals (orange) and three sei whale individuals (blue triangles) collected at South Georgia during the early 1970s. Bivariate ellipse areas representing 40% (inner contour) and 95% (outer contour) of the data are shown.

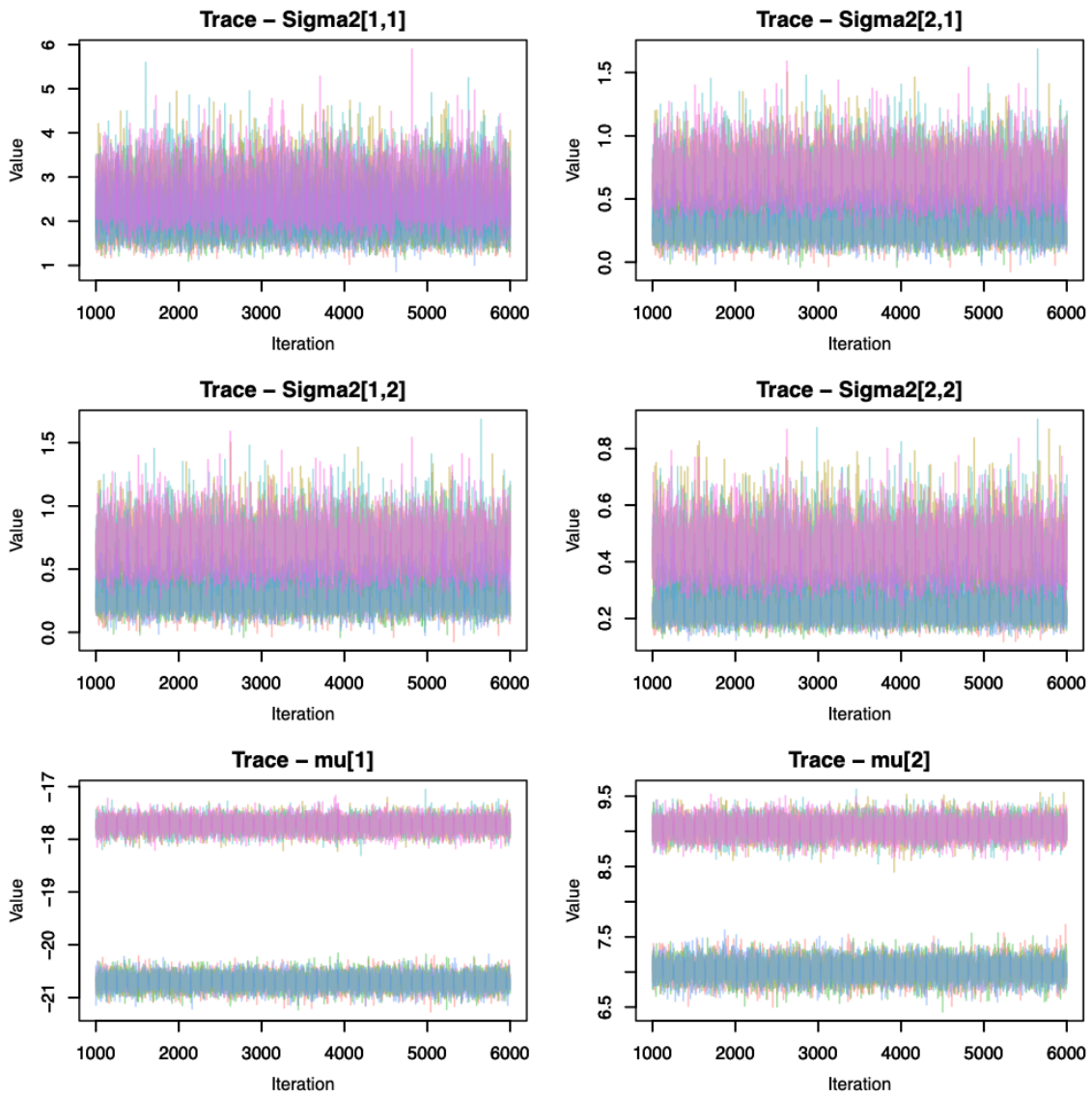



**Figure S6.** Trace plots of the three MCM chains for the six model parameters generated using SIBER.

**Figure S7**

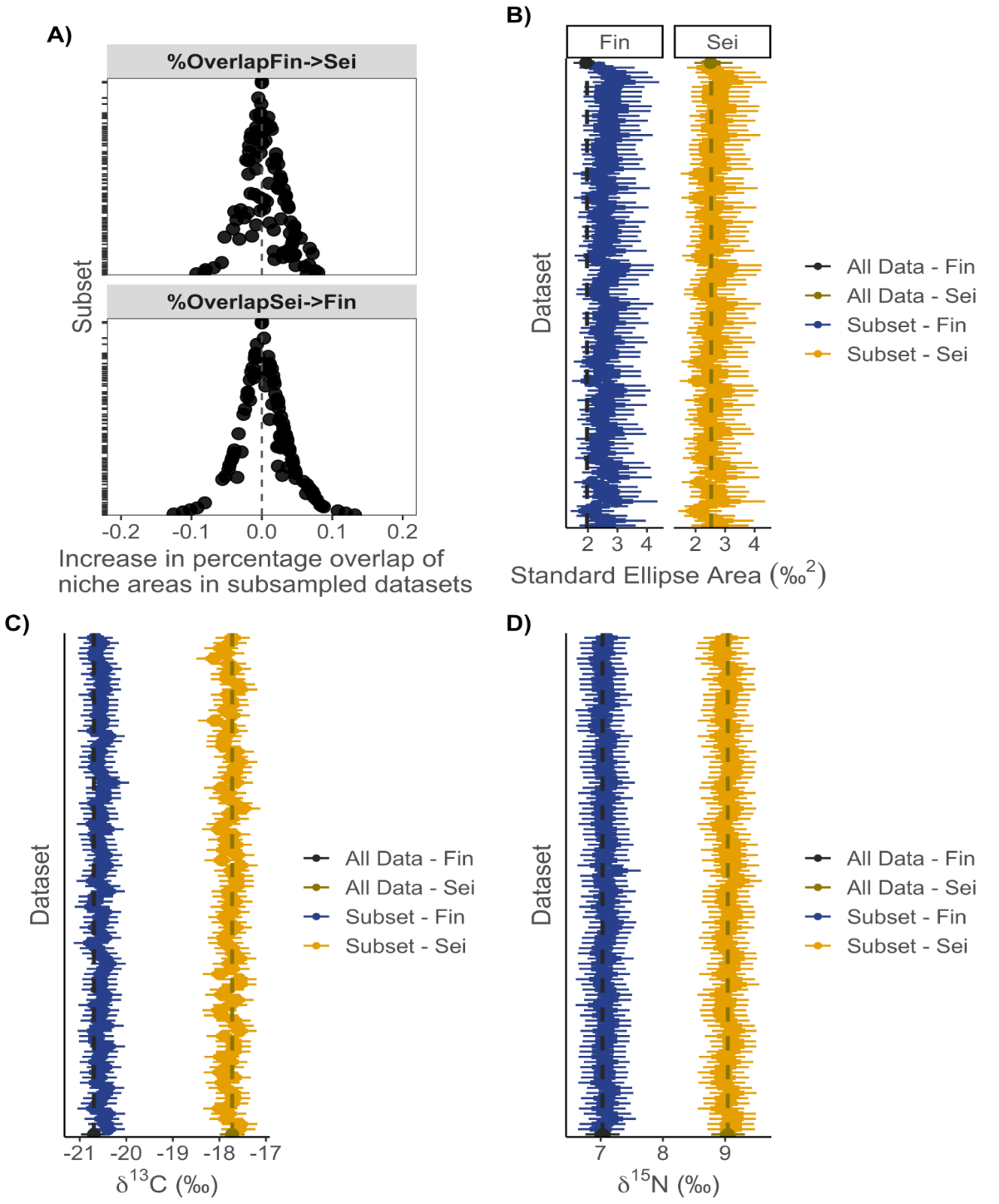
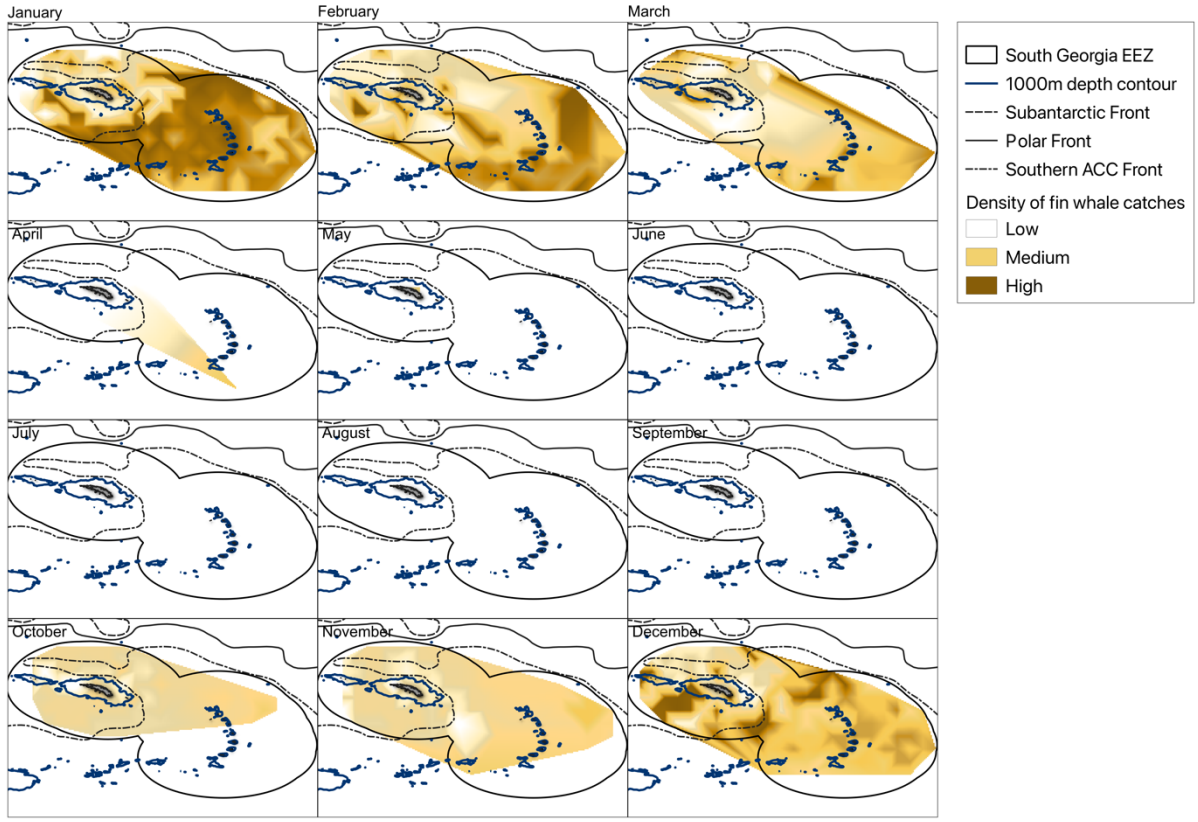



**Figure S7.** Comparison between subsetted datasets (no autocorrelation) and main dataset. A) Difference in the percentage of niche overlap between the subsetted and main dataset. Highest density intervals (95% CIs) of posterior distristributions for fin and sei whales from subsetted datasets using SIBER analysis for B) Bayesian Standard Ellipse Areas (SEA*b*); C) $\delta^{13}$C estimates; D) $\delta^{15}$N estimates. Dashed lines represent the mean of posterior distributions from SIBER analysis using the full dataset.

**Figure S8. Monthly catches within EEZ**



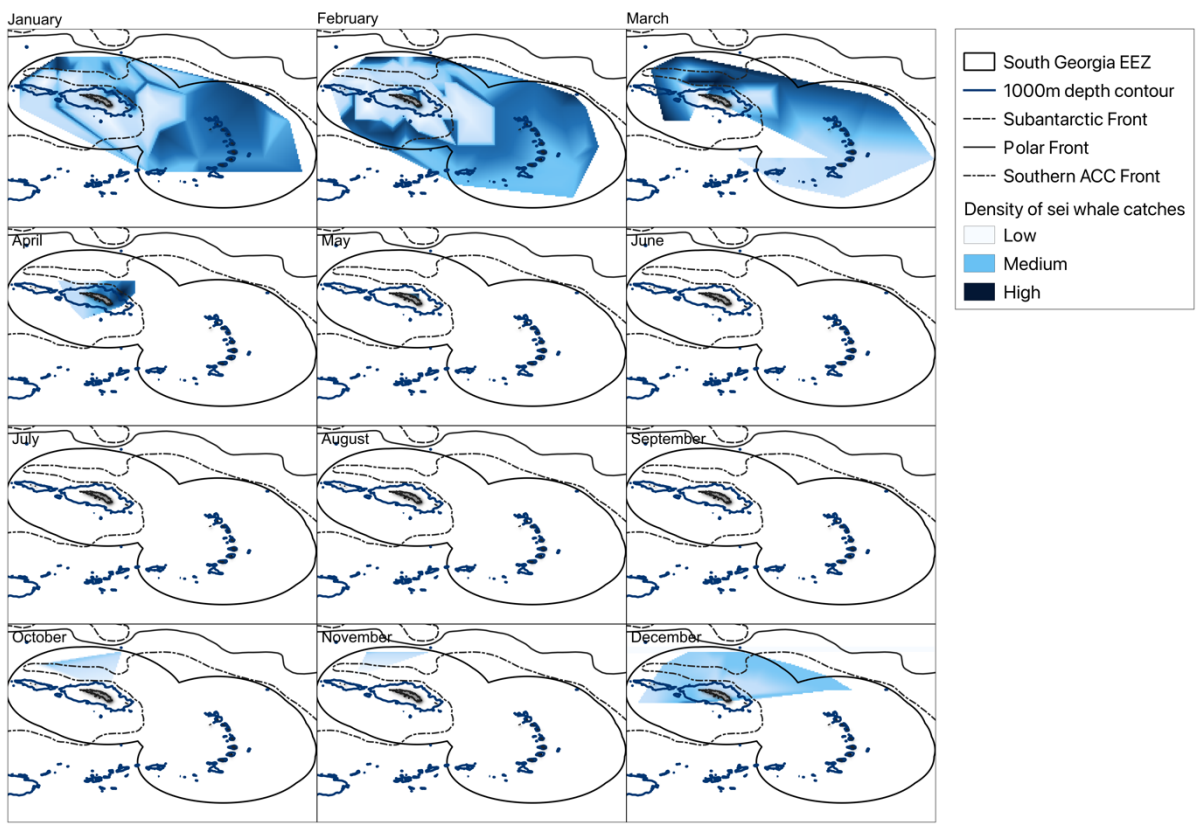



**Table S1.** PCR reaction conditions and Cetacean-specific PCR primers used in this study to amplify variable lengths of the mitochondrial control region (mtDNA). Source – literature where primers had been used previously to amplify whale mtDNA.

| Forward primer (Seq) | Reverse primer (Seq) | Source |
|---|---|---|
| Tprowhale (5'- TCACCCAAA GCTGRARTTCTA -3') | Dlp5 (5' –CCATCGWGATGT CTTATTTAAGRGGAA-3') | *Baker et al. 1998* |
| Tprowhale (5'- TCACCCAAA GCTGRARTTCTA -3') | Dlp4 (5'-GCGGGWTRY TGRTTTCACG-3') | *Baker et al. 1998; Ross et al. 2003* |
| 337F (5' – CTCCATTAGA TCACGAGCTT- 3') | Dlp5 (5'-CCATCGWGATGTCT TATTTAAGRGGAA-3') | *This study; Baker et al. 1998* |

**PCR conditions:**

**PCR reactions**: 1.1 x QSolution (Qiagen), 1 x buffer (containing 4mM MgCl2, Takara), 1.5mM additional MgCL2 (Qiagen) (total 1.9mM MgCl2), 0.25mM dNTP mix (Takara),, 1uM of each primer,, 0.15 u.uL Takara hot start TAQ).

**PCR cycling conditions**: denaturation at 94°C for 240 s; 38 cycles of 94°C for 45s, 56°C for 45 s and 72°C for 1 min with a final extension step of 72°C for 10 mins.

**Table S2.** Monthly catches of fin and sei whales within the South Georgia EEZ between 1904 - 1976

| Month | sei whale *(B.borealis)* | | fin whale *(B.physalus)* | |
|---|---|---|---|---|
| | *n* | % | *n* | % |
| August | 0 | - | 52 | < 0.1 |
| September | 0 | - | 376 | 0.4 |
| October | 7 | < 0.1 | 7,132 | 7.2 |
| November | 6 | < 0.1 | 11,877 | 12.0 |
| December | 143 | 0.9 | 19,821 | 20.1 |
| January | 2,506 | 15.3 | 28,045 | 28.4 |
| February | 5,963 | 36.4 | 16,724 | 16. |
| March | 6,347 | 38.7 | 9,670 | 9.8 |
| April | 1,257 | 7.7 | 3,486 | 3.5 |
| May | 171 | 1.0 | 1,392 | 1.4 |
| June | 0 | - | 192 | 0.2 |
| July | 0 | - | 76 | 0.1 |
| Total | 16,400 | | 98,843 | |

**Table S3.** Monthly catches of fin and sei whales within the South Georgia EEZ between 1904 - 1928; 1929 - 1952; 1953 - 1976. The percentage of the catch that occurred per month within each time period are shown in parantheses.

| Month | Sei whale *(B.borealis)* *n (%)* | | | Fin whale *(B.physalus)* *n (%)* | | |
|---|---|---|---|---|---|---|
| | *1904-1928* | *1929-1952* | *1953 - 1976* | *1904-1928* | *1929-1952* | *1953 - 1976* |
| August | 0 (0.0) | 0 (0.0) | 0 (0.0) | 52 (<1.0) | 0 (0.0) | 0 (0.0) |
| September | 0 (0.0) | 0 (0.0) | 0 (0.0) | 260 (1.0) | 116 (<1.0) | 0 (0.0) |
| October | 0 (0.0) | 1 (<1.0) | 6 (<1.0) | 1,653 (6.4) | 2,260 (4.4) | 3,219 (14.7) |
| November | 0 (0.0) | 2 (<1.0) | 4 (<1.0) | 2,368 (9.1) | 5,945 (11.7) | 3,564 (16.2) |
| December | 0 (0.0) | 0 (0.0) | 143 (1.5) | 4,321 (16.7) | 11,360 (22.3) | 4,140 (18.9) |
| January | 3 (<1.0 ) | 514 (8.5) | 1,989 (21.1) | 5,469 (21.1) | 16,239 (31.9) | 6,337 (28.9) |
| February | 65 (7.1) | 2,335 (38.4) | 3,563 (37.7) | 4,196 (16.2) | 9,677 (19.0) | 2,851 (13.0) |
| March | 438 (48.2 ) | 2,313 (38.0) | 3,596 (38.2) | 3,322 (12.8) | 4,524 (8.9) | 1,824 (8.3) |
| April | 335 (36.9 ) | 812 (13.4) | 110 (1.2) | 2,643 (10.2) | 820 (1.6) | 23 (<1.0) |
| May | 67 (7.4) | 104 (1.7) | 0 (0.0) | 1,379 (5.3) | 13 (<1.0) | 0 (0.0) |
| June | 0 (0.0) | 0 (0.0) | 0 (0.0) | 192 (<1.0) | 0 (0.0) | 0 (0.0) |
| July | 0 (0.0) | 0 (0.0) | 0 (0.0) | 76 (<1.0) | 0 (0.0) | 0 (0.0) |

**Table S4.** Spatial correlation of fin whale and sei whale catches within South Georgia EEZ between time periods (Early: 1904 - 1928; Middle: 1929 - 1952; Late: 1953 – 1976). Comparisons were performed using the modified t.test.

| Comparison (whaling periods) | Fin whale | Sei whale |
|---|---|---|
| Early - Middle | $t$=0.01, $F$ = 0.02, $df$ = 1, 188, $p$ = 0.87 | NA* |
| Early - Late | $t$=0.01, $F$ = 0.00, $df$ = 1, 188, $p$ = 0.92 | NA* |
| Middle - Late | $t$=-0.01, $F$ = 0.03, $df$ = 1, 188, $p$ = 0.87 | $t$=-0.01, $F$ = 0.03, $df$ = 1, 188, $p$ = 0.86 |

*As sei whales were only caught in one grid cell (see Fig. S4.B), comparisons were not performed for sei whales between the Early and Middle or Late whaling periods.

**References:**


Baker CS, Florez-Gonzalez L, Abernethy B, Rosenbaum HC, Slade RW, Capella J, Bannister JL (1998) Mitochondrial DNA variation and maternal gene flow among humpback whales of the southern hemisphere. Mar Mamm Sci 14:721–737.

Ross HA, Lento GM, Dalebout ML, Goode M, Ewing G, McLaren P, Rodrigo AG, Lavery S, Baker CS (2003) DNA surveillance: web-based molecular identification of whales, dolphins, and porpoises. J Hered 94:111–114.