*The following supplement accompanies the article*

# DECADAL SHIFT IN FORAGING STRATEGY OF A MIGRATORY SOUTHERN OCEAN PREDATOR

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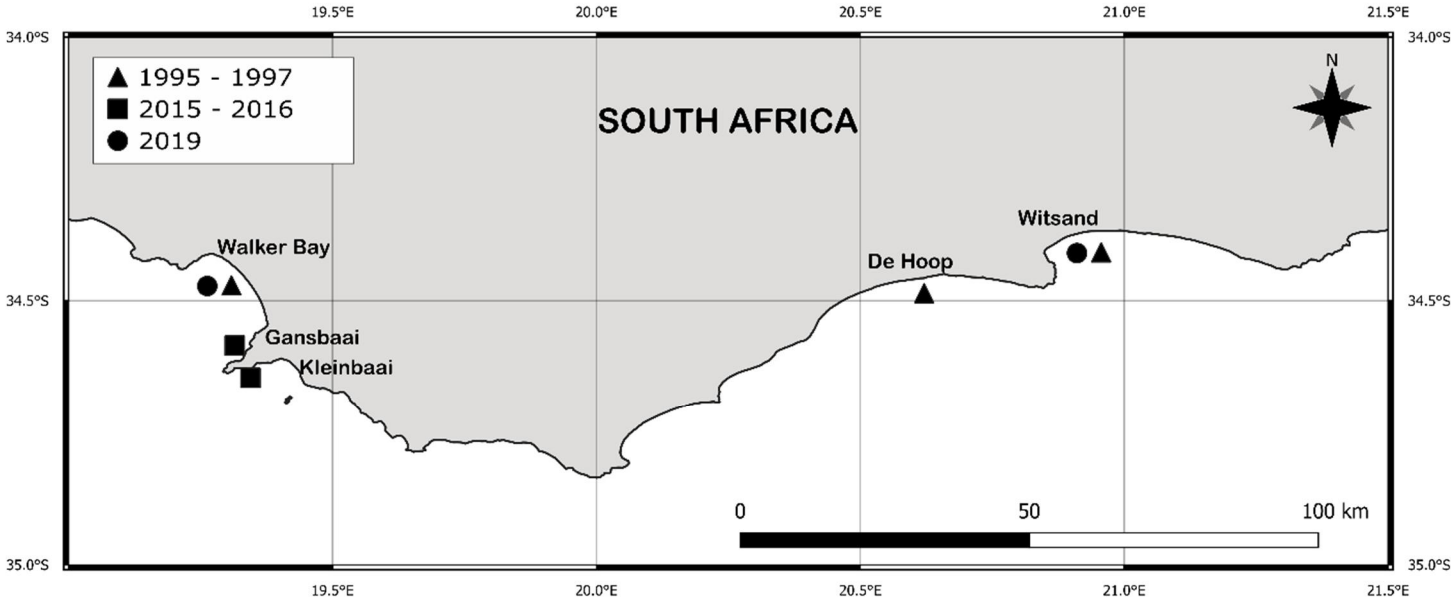


Figure S1. Map of the southern coast of South Africa showing sampling locations of southern right whale skin for 1995 – 1997 (Best et al., 2003), 2015 – 2016 (Carroll et al., 2020), and 2019 (this study).

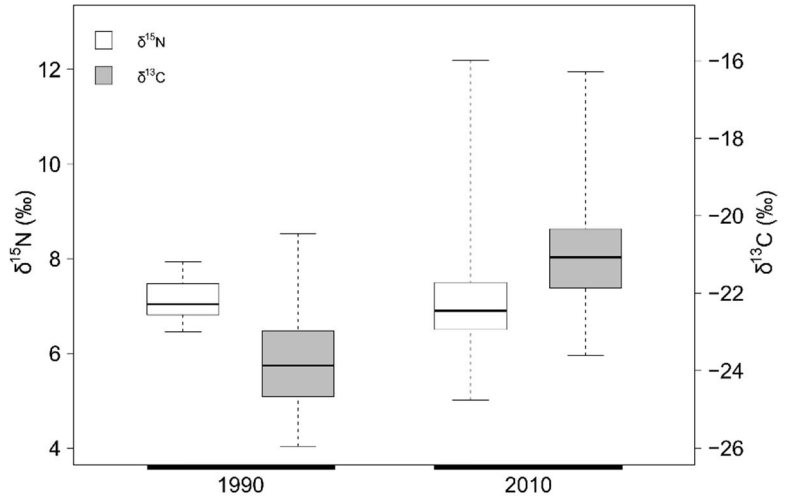


Figure S2. Stable isotope values ($\delta^{13}C$, $\delta^{15}N$) from 122 southern right whale skin biopsy samples grouped by decade of collection (1990's, *n* = 44; 2010's, *n* = 78). Boxplots represent the median, 25$^{th}$ and 75$^{th}$ percentiles, minimum and maximum values.

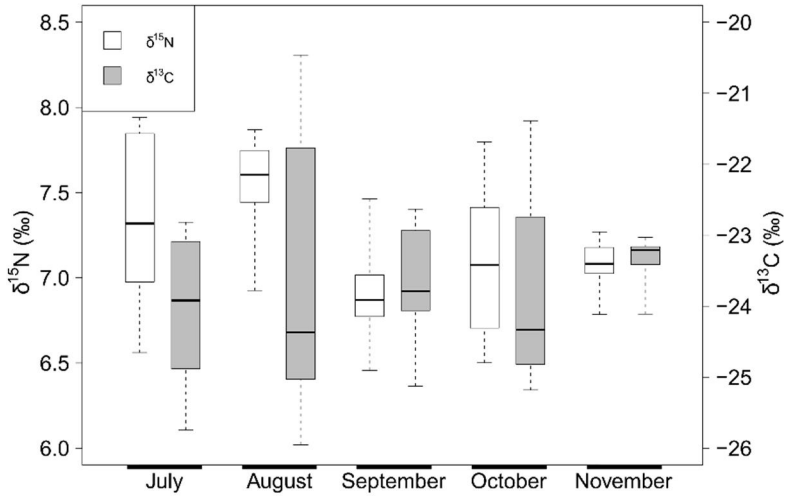


Figure S3. Stable isotope values ($\delta^{13}C$, $\delta^{15}N$) from 44 southern right whale skin biopsy samples collected in the decade of 1990, grouped by month of collection (July, *n* = 10; August, *n* = 6; September, *n* = 13; October, *n* = 10; November, *n* = 5). Boxplots represent the median, 25$^{th}$ and 75$^{th}$ percentiles, minimum and maximum values.

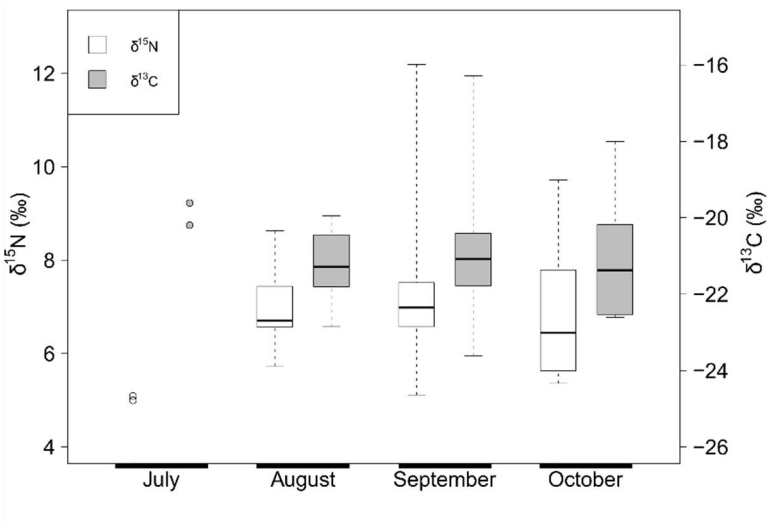


Figure S4. Stable isotope values ($\delta^{13}C$, $\delta^{15}N$) from 78 southern right whale skin biopsy samples collected in the decade of 2010, grouped by month of collection (July, *n* = 2; August, *n* = 5; September, *n* = 63; October, *n* = 8). Boxplots represent the median, 25$^{th}$ and 75$^{th}$ percentiles, minimum and maximum values.

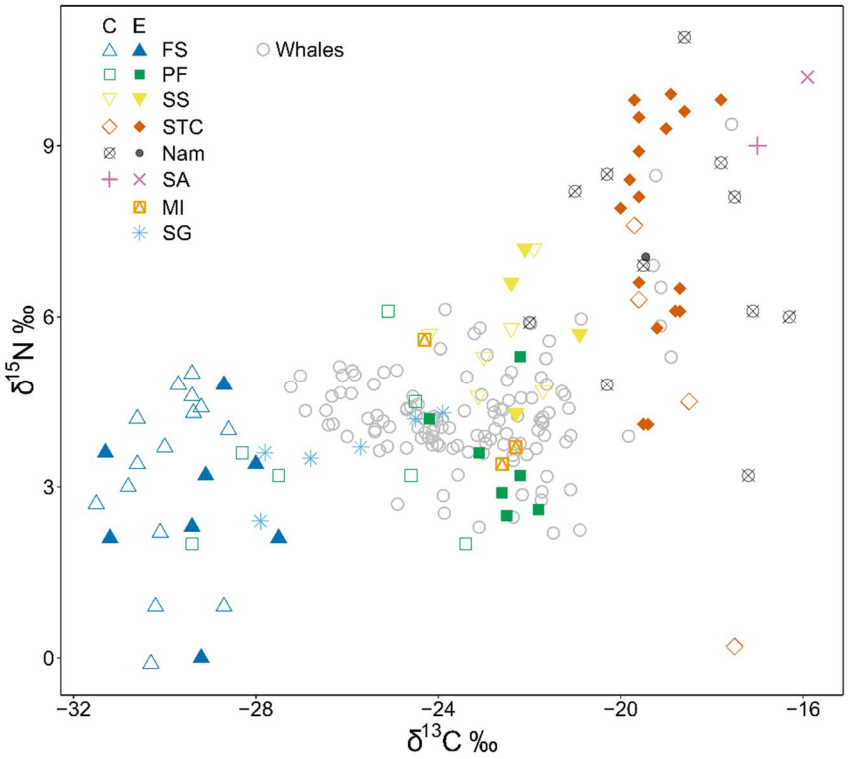


Figure S5 $\delta^{13}C$ and $\delta^{15}N$ values of 122 southern right whale skin biopsy samples and their prey. The $\delta^{13}C$ and $\delta^{15}N$ values from southern right whale skin samples are corrected for trophic level. Prey samples are from a large area that includes the Lazarev Sea, and the Weddell Gyre (FS); the Polar Front (PF); Scotia Sea (SS); Subtropical Convergence (STC); west coast of Namibia (Nam); west and south coast of South Africa (SA); Marion Island (MI) and South Georgia (SG). For details on copepod (C) and euphausiid (E) values see Table S1.

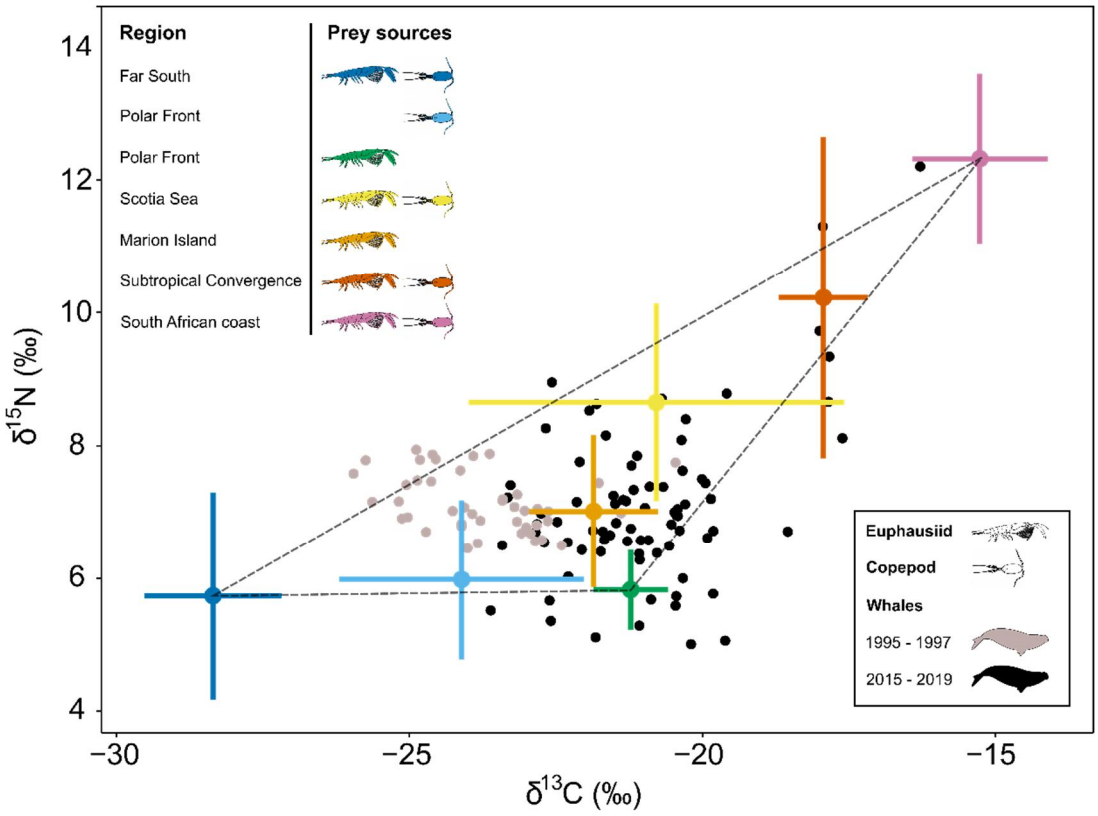


Figure S6 MixSIAR isotope mixing polygon (isospace) for mixing model 2 (*M2*) illustrating source (prey groups) and whale isotope signatures. $\delta^{13}C$ and $\delta^{15}N$ values of southern right whale skin biopsy samples are grouped by decade (1990: grey dots, 2010: black dots). Each source is corrected for trophic level. The error bars in the sources correspond to the standard deviations calculated from data in Table S1. Sources are colour-coded by region and prey source composition is indicated by euphausiid and copepod clipart. See Table S7 for uncorrected prey source statistical summaries.

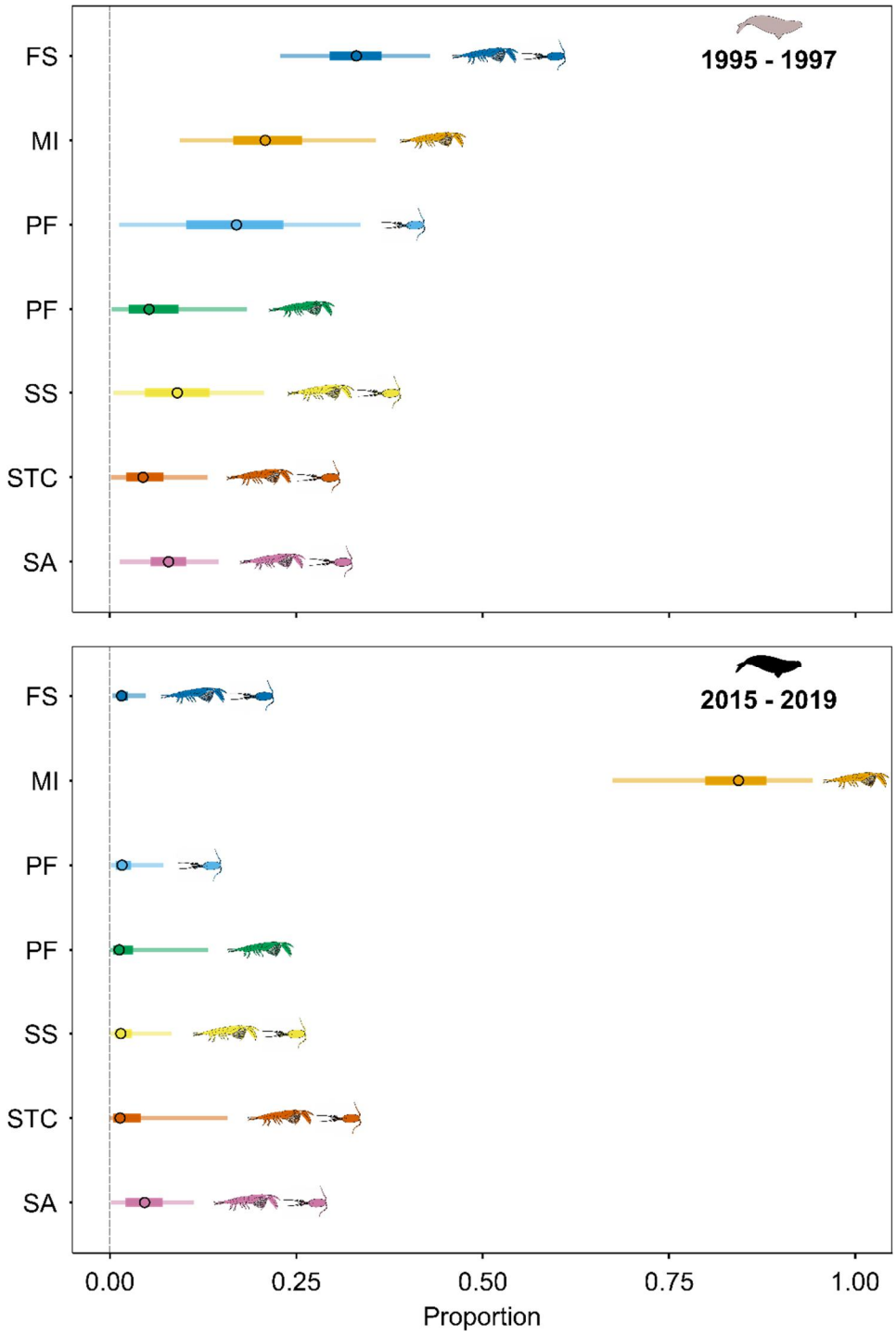


Figure S7 MixSIAR model outputs for mixing model *M2* showing estimates (median, 50% and 95% credibility intervals) of diet composition for South African southern right whales (SRW) sampled in 1995 – 1997 and 2015 – 2019.FS is Far South, MI is Marion Island, PF is Polar Front, SS is Scotia Sea, STC is Subtropical Convergence, SA is west and south coasts of South Africa, and euphausiids and copepods are represented by clipart.

Table S1. Previously published stable carbon and nitrogen isotope profiles of zooplankton samples. Values given as means and standard deviation (SD; when provided by original study). Area codes: FS: Far South; MI: Marion Island; STC: Subtropical Convergence; PF: Polar Front; SS: Scotia Sea; Nam: west coast of Namibia; SA: west and south coast of South Africa; SG: South Georgia. T: Tissue analysed (1: Whole Body; 2: Muscle). IR: Inorganics removed from sample prior to stable isotope analysis (Y: Yes; N: No). LE: Lipids extracted from sample prior to stable isotope analysis (Y: Yes; N: No). LC: Stable isotope values corrected for lipid content if lipid extraction did not take place (Y: Yes; N: No).

| Taxa | Mean | SD | Mean | SD | n | Study Site (area code) | Year/Season | T | IR | LE | LC | Reference |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copepoda | | | | | | | | | | | | |
| Calanoides acutus | -31.5 | | 2.7 | | 4 | 55ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanus propinquus | -28.6 | | 4 | | 4 | 55ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Metridia gerlachei | -30.6 | | 4.2 | | 3 | 55ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Rhincalanus gigas | -29.37 | | 4.3 | | 2 | 55ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanus propinquus | -30 | | 3.7 | | 4 | 65ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Ctenocalanus | -30.8 | | 3 | | 2 | 65ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Metridia gerlachei | -29.7 | | 4.8 | | 4 | 65ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanoides acutus | -30.6 | | 3.4 | | 4 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanus propinquus | -29.4 | | 4.6 | | 19 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Ctenocalanus | -29.2 | | 4.4 | | 4 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Metridia gerlachei | -29.4 | | 5 | | 16 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Copepoda | -19.7 | 0.5 | 7.6 | 0.7 | 17 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Copepoda | -19.6 | 0.3 | 6.3 | 1.1 | 6 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Calanus propinquus | -29.4 | | 2 | | 9 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanus simillimus | -24.6 | | 3.2 | | 23 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Heterorhabdus | -25.1 | | 6.1 | | 6 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Metridia gerlachei | -28.3 | | 3.6 | | 5 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Metridia lucens | -27.5 | | 3.2 | | 8 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Pleuromanna robusta | -24.5 | | 4.5 | | 6 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Rhincalanus gigas | -23.4 | | 2 | | 16 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanoides acutus | -23 | 4.1 | 5.3 | 0.4 | 15 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Calanus propinquus | -21.7 | 1.9 | 4.7 | 1 | 8 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Calanus simillimus | -23.12 | 0.2 | 4.6 | 0.2 | 4 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Euchaeta spp. | -21.9 | 3.3 | 7.2 | 1.7 | 10 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Metridia spp. | -24.2 | 2 | 5.7 | 0.5 | 9 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Rhincalanus gigas | -22.4 | 4.6 | 5.8 | 1.4 | 19 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Copepoda | -18.5 | 0.2 | 4.5 | 1.3 | 4 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Copepoda | -17.5 | 0.2 | 0.2 | 0.2 | 3 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Calanoides acutus | -30.2 | | 0.9 | | 2 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Calanus propinquus | -28.7 | | 0.9 | | 8 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Ctenocalanus | -30.3 | | -0.1 | | 2 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metridia gerlachei | -30.1 | | 2.2 | | 8 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Eucalanus hyalinus | -20.3 | 1.3 | 4.8 | 0.9 | 3 | 17ºS-22ºS (Nam) | 2012/October | 1 | N | N | Y | Bode 2015 |
| Pareucalanus spp. | -17.2 | 1.2 | 3.2 | 1.1 | 7 | 17ºS-22ºS (Nam) | 2012/October | 1 | N | N | Y | Bode 2015 |
| Rhincalanus cornutus | -22 | 1.4 | 5.9 | 0.5 | 3 | 17ºS-22ºS (Nam) | 2012/October | 1 | N | N | Y | Bode 2015 |
| Aetideopsis carinata | -16.3 | 0.3 | 6 | 0.3 | 4 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Calanoides carinatus | -17.1 | 0.2 | 6.1 | 0.3 | 4 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Calanoides carinatus | -17.5 | 0.1 | 8.1 | 0.1 | 3 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Eucalanus hyalinus | -19.5 | 0.3 | 6.9 | 0.5 | 7 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Euchaeta marina | -20.3 | | 8.5 | | 1 | 17ºS-22ºS (Nam) | 2008/March | 1 | N | N | Y | Schukat 2014 |
| Euchaeta marina | -21 | | 8.2 | | 1 | 17ºS-22ºS (Nam) | 2008/March | 1 | N | N | Y | Schukat 2014 |
| Rhincalanus nasutus | -17.8 | 1.2 | 8.7 | 2.1 | 5 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Pleuromamma robusta | -18.6 | | 10.9 | | 1 | 17ºS-22ºS (Nam) | 2009/December | 1 | N | N | Y | Schukat 2014 |
| Copepods | -17 | 1.3 | 9 | 0.8 | 5 | SA coast (SA) | 1988/May-June | 1 | Y | Y | | Sholto-Douglas 1991 |
| Euphausiids | | | | | | | | | | | | |
| Thysanoessa | -29.4 | | 2.3 | | 7 | 65ºS, 5ºW - 20ºE (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia frigida | -28 | | 3.4 | | 6 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -31.3 | | 3.6 | | 20 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -31.2 | | 2.1 | | 23 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -27.5 | | 2.1 | | 16 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Thysanoessa spp. | -29.1 | | 3.2 | | 15 | Lazarev Sea (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia vallentini | -22.6 | 0.6 | 3.4 | 0.5 | 19 | Marion Island (MI) | 2012/April | 1 | Y | Y | | Lübcker 2017 |
| Euphausia frigida | -22.3 | 0.7 | 3.7 | 0.6 | 18 | Marion Island (MI) | 2012/April | 1 | Y | Y | | Lübcker 2017 |
| Thysanoessa spp. | -24.3 | 0.3 | 5.6 | 0.8 | 18 | Marion Island (MI) | 2012/April | 1 | Y | Y | | Lübcker 2017 |
| Euphausia similis | -19.6 | 0.4 | 8.9 | 0.6 | 8 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia similis armata | -18.6 | 0.4 | 9.6 | 1.2 | 3 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia spinifera | -17.8 | | 9.8 | | 1 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia longirostris | -18.9 | 0.5 | 9.9 | 0.8 | 3 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia recurva | -19.6 | 0.8 | 8.1 | 0.5 | 9 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Nematoscelis megalops | -19 | 0.3 | 9.3 | 0.7 | 6 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Stylocheiron abbreviatum | -19.7 | 0.2 | 9.8 | 1.7 | 5 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Thysanoessa longicaudata | -19.8 | 0.3 | 8.4 | 1 | 5 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Thysanopoda pectinata | -19.6 | | 9.5 | | 1 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausiid furcilia | -20 | 0.5 | 7.9 | 1 | 4 | North STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia frigida | -22.5 | | 2.5 | | 31 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia frigida | -24.2 | | 4.2 | | 15 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia frigida | -23.1 | | 3.6 | | 4 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia triacantha | -22.2 | | 3.2 | | 16 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Thysanoessa spp. | -21.8 | | 2.6 | | 8 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Thysanoessa spp. | -22.2 | | 5.3 | | 3 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Thysanoessa spp. | -22.6 | | 2.9 | | 103 | Polar front (PF) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -22.3 | 3.1 | 4.3 | 1 | 20 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Thysanoessa spp. | -22.4 | 3.3 | 6.6 | 0.7 | 15 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Euphausia frigida | -20.9 | 0.9 | 5.7 | 0.9 | 10 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Euphausia triacantha | -22.1 | 1.8 | 7.2 | 0.9 | 20 | Scotia Sea (SS) | 2008/Jan-Feb | 1 | N | Y | | Stowasser 2012 |
| Euphausia superba | -25.7 | | 3.7 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -27.8 | | 3.6 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Euphausia superba | -23.9 | | 4.3 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -27.9 | | 2.4 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -24.5 | | 4.2 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia superba | -26.8 | | 3.5 | | 4 | South Georgia (SG) | 1996/Jan-Feb | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia similis | -19.4 | 0.4 | 4.1 | 0.8 | 6 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia similis armata | -18.8 | 0.2 | 6.1 | 0.3 | 3 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia spinifera | -18.7 | 0.3 | 6.5 | 0.3 | 2 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia longirostris | -18.7 | 0.2 | 6.1 | 1.7 | 7 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Nematoscelis megalops | -19.2 | 0.5 | 5.8 | 0.6 | 3 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Stylocheiron abbreviatum | -19.6 | | 6.6 | | 1 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Thysanoessa longicaudata | -19.5 | | 4.1 | | 1 | South STC (STC) | 2007/April | 1 | Y | N | Y | Richoux 2009 |
| Euphausia frigida | -28.7 | | 4.8 | | 8 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Thysanoessa spp. | -29.2 | | 0 | | 24 | Weddell Gyre (FS) | 1999/March-May | 1 | Y | N | Y | Schmidt 2003 |
| Euphausia hanseni | -19.45 | 0.84 | 7.05 | 0.35 | 6 | 21ºS-26ºS (Nam) | 2011/March | 2 | N | Y | | Huenerlage 2013 |
| Euphausiids | -15.9 | 0.6 | 10.2 | 1.1 | 6 | SA coast (SA) | 1988/May-June | 1 | Y | Y | | Sholto-Douglas 1991 |

Table S2. Potential prey sources used in the MixSIAR models, expressed as mean ± standard deviation. For details on the data used to calculate the descriptive statistics, see Table S1.

| Area | Taxa | $\delta^{13}C$ | $\delta^{15}N$ | n | Code |
|---|---|---|---|---|---|
| Far South (FS) | Copepods & Euphausiids | −29.6 ± 1.1 | 2.9 ± 1.5 | 205 | FS_C_E |
| Marion Island (MI) | Euphausiids | −23.1 ± 1.0 | 4.2 ± 1.1 | 55 | MI_E |
| Subtropical Convergence (STC) | Copepods & Euphausiids | −19.2 ± 0.7 | 7.4 ± 2.4 | 98 | STC_C_E |
| Polar Front (PF) | Copepods | −25.5 ± 2.1 | 3.2 ± 1.2 | 73 | PF_C |
| Polar Front (PF) | Euphausiids | −22.6 ± 0.5 | 3.0 ± 0.5 | 180 | PF_E |
| Polar Front (PF) | Copepods & Euphausiids | −23.5 ± 1.8 | 3.1 ± 0.8 | 253 | PF_C_E |
| Scotia Sea (SS) | Copepods & Euphausiids | −22.1 ± 3.2 | 5.8 ± 1.4 | 130 | SS_C_E |
| South Georgia (SG) | Euphausiids | −26.1 ± 1.6 | 3.6 ± 0.6 | 24 | SG_E |
| West coast Namibia (Nam) | Copepods & Euphausiids | −18.4 ± 1.9 | 6.5 ± 2.2 | 45 | Nam_C_E |
| West and south coast South Africa (SA) | Copepods & Euphausiids | −16.6 ± 1.1 | 9.5 ± 1.2 | 11 | SA_C_E |

Table S3. $\delta^{13}C$ and $\delta^{15}N$ value summary from 122 southern right whale skin biopsy samples grouped by year of collection, represented by sample size, median and range.

| Year | n | $\delta^{13}C$ Median | $\delta^{13}C$ Range | $\delta^{15}N$ Median | $\delta^{15}N$ Range |
|---|---|---|---|---|---|
| 1995 | 13 | −24.55 | 5.49 | 7.75 | 1.01 |
| 1996 | 13 | −23.93 | 3.34 | 6.98 | 1.28 |
| 1997 | 18 | −23.31 | 2.50 | 6.89 | 1.01 |
| 2015 | 2 | −20.29 | 4.58 | 7.54 | 4.36 |
| 2016 | 27 | −20.46 | 7.33 | 6.86 | 7.18 |
| 2019 | 49 | −21.12 | 5.80 | 7.00 | 5.53 |

Table S4. Post Hoc Dunn's multiple pairwise comparisons test comparing $\delta^{13}C$ values of 122 southern right whale skin biopsy samples by year of collection. Each cell contains the Dunn's pairwise z-test statistic (above) and its associated *p*-value (below). Significant differences are indicated via asterisks ($\alpha = 0.05$).

| | 1995 | 1996 | 1997 | 2015 | 2016 |
|---|---|---|---|---|---|
| 1996 | 0.227381<br>0.8201 | | | | |
| 1997 | −0.089978<br>0.9283 | −0.335012<br>0.7376 | | | |
| 2015 | −2.113548<br>0.0346* | −2.230967<br>0.0257* | −2.109871<br>0.0349* | | |
| 2016 | -4.618972<br>0.0000* | −4.883165<br>0.0000* | −5.016661<br>0.0000* | 0.062884<br>0.9499 | |
| 2019 | −4.807184<br>0.0000* | −5.093057<br>0.0000* | −5.322614<br>0.0000* | 0.1464<br>0.4418 | 0.248368<br>0.4019 |

Table S5. Post Hoc Dunn's multiple pairwise comparisons test comparing $\delta^{15}N$ values of 122 southern right whale skin biopsy samples by year of collection. Each cell contains the Dunn's pairwise z-test statistic (above) and its associated *p*-value (below). Significant differences are indicated via asterisks ($\alpha = 0.05$).

| | 1995 | 1996 | 1997 | 2015 | 2016 |
|---|---|---|---|---|---|
| 1996 | 2.573294<br>0.0050* | | | | |
| 1997 | 2.867026<br>0.0021* | 0.093962<br>0.4626 | | | |
| 2015 | 1.129803<br>0.1293 | −0.19904<br>0.4211 | −0.248716<br>0.4018 | | |
| 2016 | 3.406116<br>0.0003* | 0.416218<br>0.3386 | 0.349359<br>0.3634 | 0.398031<br>0.3453 | |
| 2019 | 2.844069<br>0.0022* | −0.391171<br>0.3478 | −0.566869<br>0.2854 | 0.0404<br>0.4839 | −1.095407<br>0.1367 |

Table S6. $\delta^{13}C$ and $\delta^{15}N$ value summary from 122 southern right whale skin biopsy samples grouped by month and decade of collection, represented by sample size, median and range.

| Month | Decade | n | $\delta^{13}C$ Median | $\delta^{13}C$ Range | $\delta^{15}N$ Median | $\delta^{15}N$ Range |
|---|---|---|---|---|---|---|
| July | 1990 | 10 | -23.92 | 2.93 | 7.32 | 1.38 |
| | 2010 | 2 | -19.91 | 0.58 | 5.04 | 0.05 |
| August | 1990 | 6 | -24.37 | 5.49 | 7.61 | 0.94 |
| | 2010 | 5 | -21.28 | 2.90 | 6.70 | 2.89 |
| September | 1990 | 13 | -23.79 | 2.50 | 6.87 | 1.01 |
| | 2010 | 63 | -21.08 | 7.33 | 6.98 | 7.08 |
| October | 1990 | 10 | -24.33 | 3.79 | 7.08 | 1.30 |
| | 2010 | 8 | -21.37 | 4.61 | 6.44 | 4.36 |
| November | 1990 | 5 | -23.21 | 1.08 | 7.08 | 0.48 |

Table S7. Post Hoc Dunn's multiple pairwise comparisons test comparing $\delta^{15}N$ values of 44 southern right whale skin biopsy samples collected in the decade of 1990, by month of collection. Each cell contains the Dunn's pairwise z-test statistic (above) and its associated *p*-value (below). Significant differences are indicated via asterisks ($\alpha = 0.05$).

| | August | July | November | October |
|---|---|---|---|---|
| July | 0.809055<br>0.2092 | | | |
| November | 1.307076<br>0.0956 | 0.682242<br>0.2475 | | |
| October | 1.804042<br>0.0356 | 1.148912<br>0.1253 | 0.25584<br>0.399 | |
| September | 2.974723<br>0.0015* | 2.497192<br>0.0063* | 1.285918<br>0.0992 | 1.275646<br>0.101 |

Table S8. Proportional contribution of different prey sources to the diets of South African southern right whales sampled in two different decades (1990, 2010) as estimated by mixing models (*M1* and *M2*).

| Model | Decade | Prey Source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | FS_C_E | MI_E | STC_C_E | PF_C_E | PF_C | PF_E | SS_C_E | SG_E | SA_C_E |
| *M1* | 1990 | **16% (5% – 27%)** | **14% (1% – 27%)** | 6% (0% – 12%) | 10% (0% – 22%) | – | – | 6% (0% – 15%) | **43% (25% – 59%)** | 6% (1% – 11%) |
| | 2010 | 2% (0% – 5%) | **78% (0% – 91%)** | **7% (0% – 34%)** | **4% (0% – 63%)** | – | – | 1% (0% – 6%) | 3% (0% – 9%) | 3% (0% – 10%) |
| *M2* | 1990 | **33% (24% – 42%)** | **21% (11% – 32%)** | 5% (0% – 12%) | – | **17% (3% – 31%)** | 6% (0% – 16%) | 9% (1% –19%) | – | 8% (2% – 14%) |
| | 2010 | 1% (0% – 4%) | **84% (72% – 93%)** | 2% (0% – 13%) | – | 2% (0% – 6%) | 1% (0% – 10%) | 2% (0% – 7%) | – | 5% (0% – 10%) |

Notes: Prey source codes are delineated by area code; *FS* is Far South, *MI* is Marion Island, *STC* is Subtropical Convergence, *PF* is Polar Front, *SS* is Scotia Sea, *SG* is South Georgia, *SA* is west and south coasts of South Africa; C_ indicates copepods; E_ euphausiids; and C_E_ indicates copepods and euphausiids.

Table S9. Comparison of mixing models *M1* and *M2* using the leave-one-out cross-validation method (LOO). dLOOic is the difference in LOOic between each model. Model *M1* had the lowest LOOic and received 87% of the Akaike weighting.

| Model | LOOic | dLOOic | weight |
|---|---|---|---|
| *M1* | 211.2 | 0 | 0.87 |
| *M2* | 215.0 | 3.8 | 0.13 |

References

Bode, M., Hagen, W., Schukat, A., Teuber, L., Fonseca-Batista, D., Dehairs, F., & Auel, H. (2015). Feeding strategies of tropical and subtropical calanoid copepods throughout the eastern Atlantic Ocean - Latitudinal and bathymetric aspects. *Progress in Oceanography*, *138*, 268–282. https://doi.org/10.1016/j.pocean.2015.10.002

Huenerlage, K., & Buchholz, F. (2013). Krill of the northern Benguela Current and the Angola-Benguela frontal zone compared: Physiological performance and short-term starvation in Euphausia hanseni. *Journal of Plankton Research*, *35*(2), 337–351. https://doi.org/10.1093/plankt/fbs086

Lübcker, N., Reisinger, R., Oosthuizen, W., de Bruyn, P., van Tonder, A., Pistorius, P., & Bester, M. (2017). Low trophic level diet of juvenile southern elephant seals Mirounga leonina from Marion Island: a stable isotope investigation using vibrissal regrowths. *Marine Ecology Progress Series*, *577*(June), 237–250. https://doi.org/10.3354/meps12240

Richoux, N. B., & Froneman, P. W. (2009). Plankton trophodynamics at the subtropical convergence, Southern Ocean. *Journal of Plankton Research*, *31*(9), 1059–1073. https://doi.org/10.1093/plankt/fbp054

Schmidt, K., Atkinson, A., Stübing, D., McClelland, J. W., Montoya, J. P., & Voss, M. (2003). Trophic relationships among Southern Ocean copepods and krill: Some uses and limitations of a stable isotope approach. *Limnology and Oceanography*, *48*(1 I), 277–289. https://doi.org/10.4319/lo.2003.48.1.0277

Schukat, A., Auel, H., Teuber, L., Lahajnar, N., & Hagen, W. (2014). Complex trophic interactions of calanoid copepods in the Benguela upwelling system. *Journal of Sea Research*, *85*, 186–196. https://doi.org/10.1016/j.seares.2013.04.018

Sholto-Douglas, A., Field, J., James, A., & van der Merwe, N. (1991). 13C/12C and 15N/14N isotope ratios in the Southern Benguela Ecosystem: indicators of food web relationships among different size-classes of plankton and pelagic fish; differences between fish muscle and bone collagen tissues. *Marine Ecology Progress Series*, *78*, 23–31. https://doi.org/10.3354/meps078023

Stowasser, G., Atkinson, A., McGill, R. A. R., Phillips, R. A., Collins, M. A., & Pond, D. W. (2012). Food web dynamics in the Scotia Sea in summer: A stable isotope study. *Deep-Sea Research Part II: Topical Studies in Oceanography*, *59–60*, 208–221. https://doi.org/10.1016/j.dsr2.2011.08.004