

C and N isotope data for Ross, Weddell, and crabeater seal tissues from west Antarctica collected during multiple field seasons from 2008-2010

Website: <https://www.bco-dmo.org/dataset/731407>

Data Type: Cruise Results

Version: 1

Version Date: 2018-03-22

Project

» [Collaborative Research: Exploring the Vulnerability of Southern Ocean Pinnipeds to Climate Change - An Integrated Approach](#) (Southern Ocean Pinnipeds)

Contributors	Affiliation	Role
Hall, Brenda	University of Maine	Principal Investigator
Koch, Paul L.	University of California-Santa Cruz (UCSC)	Principal Investigator, Contact
Costa, Daniel P.	University of California-Santa Cruz (UCSC)	Co-Principal Investigator
Hoelzel, A. Rus	Durham University	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset includes C and N isotope data for Ross, Weddell, and crabeater seal tissues from west Antarctica collected during multiple field seasons from 2008-2010.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

Coverage

Spatial Extent: N:-62.47 E:175.143 S:-78.655 W:166.861

Temporal Extent: 2008-12-12 - 2011-01-11

Dataset Description

These data are published and discussed in:

Brault, E. (2017). An Examination of the Ecological and Oceanographic Effects of Mid-to-Late Holocene Climate Changes on the Ross Sea Ecosystem. UC Santa Cruz. ProQuest ID: Brault_ucsc_0036E_11435. Merritt ID: ark:/13030/m5dg1n5d. Retrieved from <https://escholarship.org/uc/item/99s5j3fk>

Methods & Sampling

Sampling Sites and Sample Collection:

Tissue samples from Ross, Weddell, and crabeater seals were collected along western Antarctica from the

West Antarctic Peninsula (WAP) to the Ross Sea during multiple field seasons and, in most cases, body mass, age class (juvenile, subadult, and adult), gender, and location were recorded for each sampled seal. Seals were sampled during the austral summers of 2008/09 and 2010/11 on RV Oden cruises along the western Antarctic coast. Mostly whole blood samples were obtained. In some cases, clot (blood with serum removed), red blood cells (RBCs, whole blood exposed to an anticoagulant, heparin, before having plasma removed), and hair samples (body fur or whiskers) were also taken. The sampling protocol is described in Aubail et al. (2011); all animal captures were conducted in accordance with the regulations of the Swedish Polar Research Secretariat (Registration No. 2010-112).

All other samples were obtained from animal captures conducted under National Marine Fisheries Service permit No. 87-1851-00. Additionally, the Institutional Animal Care and Use Committee (IACUC) at the University of Santa Cruz (UC Santa Cruz) approved all protocols for the following samples. Whiskers were taken from crabeater seals during multiple cruises on the RV Lawrence M. Gould along the WAP. Plasma was also obtained from a few of the fall 2007 individuals (G105, G110, and G112). In addition, serum or plasma was obtained from two Weddell seals during the fall 2007 sampling in this region, and whiskers were taken from two WAP Weddell seals in the austral summer of 2009/10. Hückstädt et al. (2012b) describe the procedure for sampling the whiskers, and Goetz et al. (2017) describe the protocol used for collecting the seal serum and plasma.

Several blood samples were obtained from Weddell seals in the McMurdo Sound region, Ross Sea, Antarctica over multiple field seasons. Twelve whole blood samples were taken from juvenile Weddell seals near Inexpressible Island (74.9°S, 163.7°E) during the austral summer of 2010/11. Whole blood samples were taken from Weddell seals in the austral summer of 2010/11 and austral spring of 2012. RBCs were sampled in the austral summer of 2009/10, austral summer of 2011/12, and austral spring of 2012. Whole blood, plasma, and serum were obtained from five Weddell seals sampled in the austral spring of 2015, and whole blood from an additional seven Weddell seals was also acquired during this time. Goetz et al. (2017) describe the sampling protocol for these Weddell seals.

Lastly, a few samples were obtained from crabeater seals in McMurdo Sound. Hair samples were taken from three recently deceased juvenile crabeater seals that were found on the seasonal pack ice around Cape Royds in the austral summer of 2009/10. Whole blood was sampled, using the protocol of Goetz et al. (2017), from a male adult crabeater seal found in Erebus Bay during the austral summer of 2010/11.

Taxonomic Groups:

Pinnipedia

Phocidae

Lobodon carcinophaga - crabeater seal

Ommatophoca rossii - Ross seal

Leptonychotes weddellii - Weddell seal

Sample Preparation:

After sample collection, all samples were kept frozen at -20 °C. Blood samples were freeze-dried with a Labconco Freeze Dry System (Lyph Lock 4.5) and homogenized manually prior to analysis. Lipid extraction was not performed on the blood samples. Blood has a relatively low lipid content and a test set of blood samples with and without lipid extraction revealed no significant effect of lipid extraction on blood values. Hair samples, which have higher lipid contents, were lipid extracted. Hair samples were washed with Milli-Q water (Thermo Fisher Scientific, Inc.) and then rinsed 3 times in an ultrasonic bath with petroleum ether for 15 minutes. Hückstädt et al. (2012a) used a similar protocol to lipid-extract the crabeater seal whisker samples.

Isotopic Analysis:

For all blood and hair samples, ~1 mg was weighed into tin cups (Costech, 3x5 mm) for elemental analysis-isotope ratio mass spectrometry (EA-IRMS). After the follicle was removed, the entire hair sample was chopped up before being added to the tin cups. This analysis was performed at the Stable Isotope Lab (SIL) of UC Santa Cruz on a Carlo Erba EA 1108 elemental analyzer coupled to a Thermo-Finnigan DeltaPlus XP isotope ratio mass spectrometer. The $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values were referenced to AIR and V-PDB standards. On a day-to-day basis, we measured and calibrated analyses with a laboratory IU Acetanilide standard ($\delta^{15}\text{N} = 1.18\text{‰}$, $\delta^{13}\text{C} = -29.52\text{‰}$, $\% \text{N} = 10.36\%$, $\% \text{C} = 71.02\%$) and a laboratory gelatin standard ($\delta^{15}\text{N} = 5.60\text{‰}$, $\delta^{13}\text{C} = -12.60\text{‰}$, $\% \text{N} = 16.44\text{‰}$, $\% \text{C} = 44.02\text{‰}$). The isotopic and concentration value of these laboratory standards are known by calibration to international standards (IAEA601, IAEA-346, USGS24, USGS25, USGS26, USGS34, USGS35, USGS41). We applied mass and drift corrections during each instrument session using the gelatin standard. Standard deviations for standards were $< 0.1 \text{‰}$ for both $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ and < 0.05 for C/N (seven PUGel standards analyzed at the start of each session and a PUGel and an Acetanilide standard analyzed after every eight samples during the session).

Data Processing Description

BCO-DMO Processing:

- modified parameter names (replaced spaces with underscores);
- added the LSID and AphiaID from WoRMS;
- replaced spaces with underscores in: Common_name, Scientific_name;
- changed date format from mm/dd/yyyy to yyyy-mm-dd.

[[table of contents](#) | [back to top](#)]

Data Files

File
modern_seal_bulk_isotope.csv (Comma Separated Values (.csv), 34.35 KB) MD5:a621623334270fa00cd4e6ec05386033
Primary data file for dataset ID 731407

[[table of contents](#) | [back to top](#)]

Related Publications

Aubail, A., Teilmann, J., Dietz, R., Rig  t, F., Harkonen, T., Karlsson, O., Rosing-Asvid, A., & Caurant, F. (2011). Investigation of mercury concentrations in fur of phocid seals using stable isotopes as tracers of trophic levels and geographical regions. *Polar Biology*, 34(9), 1411–1420. <https://doi.org/10.1007/s00300-011-0996-z>
Methods

Brault, E. (2017). An Examination of the Ecological and Oceanographic Effects of Mid-to-Late Holocene Climate Changes on the Ross Sea Ecosystem. UC Santa Cruz. ProQuest ID: Brault_ucsc_0036E_11435. Merritt ID: ark:/13030/m5dg1n5d. Retrieved from <https://escholarship.org/uc/item/99s5j3fk>
Results

Goetz, K. T., Burns, J. M., H  ckst  dt, L. A., Shero, M. R., & Costa, D. P. (2017). Temporal variation in isotopic composition and diet of Weddell seals in the western Ross Sea. *Deep Sea Research Part II: Topical Studies in Oceanography*, 140, 36–44. <https://doi.org/10.1016/j.dsr2.2016.05.017>
Methods

H  ckst  dt, L. A., Koch, P. L., McDonald, B. I., Goebel, M. E., Crocker, D. E., & Costa, D. P. (2011). Stable isotope analyses reveal individual variability in the trophic ecology of a top marine predator, the southern elephant seal. *Oecologia*, 169(2), 395–406. <https://doi.org/10.1007/s00442-011-2202-y>
Methods

H  ckst  dt, L., Burns, J., Koch, P., McDonald, B., Crocker, D., & Costa, D. (2012). Diet of a specialist in a changing environment: the crabeater seal along the western Antarctic Peninsula. *Marine Ecology Progress Series*, 455, 287–301. <https://doi.org/10.3354/meps09601>
Methods

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
Common_name	Common name of the seal	unitless
Scientific_name	Scientific name (genus and species) of the seal	unitless
WoRMS_LSID	Life Science Identifier (LSID) assigned to the species by the World Register of Marine Species (WoRMS; http://www.marinespecies.org/)	unitless
AphiaID	World Register of Marine Species (WoRMS; http://www.marinespecies.org/) species identifier	unitless
Sample_ID	Sample identification code	unitless
Latitude	Latitude of sample collection (negative values = south)	decimal degress
Longitude	Longitude of sample collection (negative values = west; postivie values = east)	decimal degress
Collection_year_and_season	Year and season of sample collection	unitless
Sampling_date	Date of sample collection formatted as yyyy-mm-dd	unitless
Age_class	Age class of the specimen (juvenile, subadult, adult)	unitless
Gender	Sex of the specimen (male, female, unknown)	unitless
Mass_kg	Mass of the specimen	kilograms (kg)
Sample_type	Description of the type of tissue analyzed (clot, clotted blood, fur, heparin clotted blood, plasma, red blood cells, serum, whisker, whole blood)	unitless
d13C	Stable carbon isotope value	permil (‰), V-PDB
d15N	Stable nitrogen isotope value	permil (‰), AIR
C_to_N_atomic_ratio	Atomic C to N ratio	unitless

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	Carlo Erba EA 1108 elemental analyzer
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	This analysis was performed at the Stable Isotope Lab (SIL) of UC Santa Cruz on a Carlo Erba EA 1108 elemental analyzer coupled to a Thermo-Finnigan DeltaPlus XP isotope ratio mass spectrometer.
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	Thermo-Finnigan DeltaPlus XP isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	This analysis was performed at the Stable Isotope Lab (SIL) of UC Santa Cruz on a Carlo Erba EA 1108 elemental analyzer coupled to a Thermo-Finnigan DeltaPlus XP isotope ratio mass spectrometer.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

[[table of contents](#) | [back to top](#)]

Project Information

Collaborative Research: Exploring the Vulnerability of Southern Ocean Pinnipeds to Climate Change - An Integrated Approach (Southern Ocean Pinnipeds)

Coverage: McMurdo Dry Valleys Region; Royal Society Range, Victoria Land Coast , Antarctic Peninsula, Amundsen Sea, Ross Sea

NSF abstract:

Building on previously funded NSF research, the use of paleobiological and paleogenetic data from mummified elephant seal carcasses found along the Dry Valleys and Victoria Land Coast in areas that today are too cold to support seal colonies (Mirougina leonina; southern elephant seals; SES) supports the former existence of these seals in this region. The occurrence and then subsequent disappearance of these SES colonies is consistent with major shifts in the Holocene climate to much colder conditions at the last ~1000 years BCE).

Further analysis of the preserved remains of three other abundant pinnipeds ? crabeater (Lobodon carciophagus), Weddell (Leptonychotes weddelli) and leopard (Hydrurga leptonyx) will be studied to track changes in their population size (revealed by DNA analysis) and their diet (studied via stable isotope analysis). Combined with known differences in life history, preferred ice habitat and ecosystem sensitivity among these species, this paleoclimate proxy data will be used to assess their exposure and sensitivity to climate change in the Ross Sea region during the past ~1-2,000 years

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1141849
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1142108

[[table of contents](#) | [back to top](#)]