

Observations from two gliders deployed in the southern Ross Sea from November 2022 through January 2023

Website: <https://www.bco-dmo.org/dataset/996532>

Data Type: Cruise Results

Version: 1

Version Date: 2026-04-14

Project

» [NSFGEO-NERC: Collaborative Research - P2P: Predators to Plankton — Biophysical Controls in Antarctic Polynyas](#) (P2P)

Contributors	Affiliation	Role
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Abstract

Two gliders were launched in the southern Ross Sea and recorded data from November 2022 through January 2023 as part of the Plankton to Predators project. Sensors on the gliders included temperature, salinity, oxygen, fluorescence, optical backscatter and active acoustics; one glider had a photosynthetically active radiation (PAR) sensor and an passive acoustic monitoring sensor. From these data we quantified chlorophyll and particulate organic carbon concentrations, and also an estimate of krill and small fish (those data are not included in this submission). Data were decimated to 3-meter intervals for ease in analysis. The spatial extent of the glider observations ranged from 169.5–172.3°W and 77.4–76.4°S.

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Coverage

Location: Southern Ross Sea

Spatial Extent: N:-76.35993866 E:172.1155 S:-77.40044833 W:169.7357421

Temporal Extent: 2022-11-30 - 2023-01-19

Methods & Sampling

Gliders were deployed from the fast ice near Cape Crozier (Ross Island) on 29 November and 4 December, 2022. Recovery of gliders were from the RVIB Nathaniel B. Palmer Cruise NBP23-02 on January 18, 2023

Two profiling ocean gliders (Seagliders SG613 and SG676) were deployed from the fast ice adjacent to the Ross ice shelf near Cape Crozier. SG613 and SG676 collected 774 and 688 profiles, respectively, where each profile (taking typically 1.5 hours) is either an ascent or descent, with its mean time assigned. Temperature, salinity (Seabird CT sail), dissolved oxygen (Aanderaa 4330 optode), Chl-a fluorescence (a proxy for phytoplankton biomass), and optical backscatter (OBS) at 470 and 700 nanometers (nm) (Seabird Scientific Wetlabs Triplet ECOpuck) were measured. SG613 also carried a photosynthetically active radiation (PAR)

sensor. Glider sensors were factory-calibrated before the deployment. Data were processed using the UEA Seaglider Toolbox (<https://bitbucket.org/bastienqueste/uea-seaglider-toolbox/src/toolbox/>, Queste et al. (2014)), optimizing the hydrodynamic flight model (Frajka-Williams et al., 2011) and correcting conductivity for thermal hysteresis (Garau et al., 2011). The accuracy of glider fluorescence was ensured via cross-calibration of fluorescence measurements from both gliders and the CTD rosette at the recovery stations. Discrete chlorophyll samples were collected via the CTD rosette on glass fiber filters upon glider recovery and analyzed fluorometrically (Knap et al., 1996) aboard the Palmer. Glider fluorescence was converted to Chl-a via a linear regression. Discrete particulate organic carbon (POC) samples were likewise collected from the recovery CTD cast, filtered through combusted glass fiber filters and analyzed in the laboratory by pyrolysis (Gardner et al., 2000).

Data Processing Description

Data were processed using the UEA Seaglider Toolbox (<https://bitbucket.org/bastienqueste/uea-seaglider-toolbox/src/toolbox/>, Queste et al. (2014)), optimizing the hydrodynamic flight model (Frajka-Williams et al., 2011) and correcting conductivity for thermal hysteresis (Garau et al., 2011). All data were binned and averaged over 3-meter intervals.

BCO-DMO Processing Description

- Imported original CSV files named "P2P_sg676_BCODMO(Sheet1).csv" and "P2P_sg613_BCODMO(Sheet1).csv" into the BCO-DMO system.
- Treated NaN as a missing data value (missing data are empty/blank in the final CSV data file).
- Renamed fields/columns to comply with BCO-DMO naming conventions.
- Concatenated the two data files into a single file, adding a column for the Seaglider ID number.
- Converted Matlab_Time (Matlab serial number) to ISO_DateTime.UTC datetime field formatted as %Y-%m-%dT%H:%M:%SZ.
- Saved the final file as "996532_v1_ross_sea_gliders.csv".

Problem Description

While our calibration casts gave a fluorescence to chlorophyll ratio of 1, it is recognized that the normal F:chl ratio in the Southern Ocean is on average ca. 6 (Roesler et al., 2017). The data provided are the raw fluorescence data so any conversion to chlorophyll can be made by each investigator.

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Related Publications

Frajka-Williams, E., Eriksen, C. C., Rhines, P. B., & Harcourt, R. R. (2011). Determining Vertical Water Velocities from Seaglider. *Journal of Atmospheric and Oceanic Technology*, 28(12), 1641–1656.

<https://doi.org/10.1175/2011jtecho830.1> <https://doi.org/10.1175/2011JTECHO830.1>

Methods

Garau, B., Ruiz, S., Zhang, W. G., Pascual, A., Heslop, E., Kerfoot, J., & Tintoré, J. (2011). Thermal Lag Correction on Slocum CTD Glider Data. *Journal of Atmospheric and Oceanic Technology*, 28(9), 1065–1071.

doi:10.1175/jtech-d-10-05030.1 <https://doi.org/10.1175/JTECH-D-10-05030.1>

Methods

Gardner, W. D., Richardson, M. J., & Smith, W. O. (2000). Seasonal patterns of water column particulate organic carbon and fluxes in the Ross Sea, Antarctica. *Deep Sea Research Part II: Topical Studies in Oceanography*, 47(15–16), 3423–3449. [https://doi.org/10.1016/S0967-0645\(00\)00074-6](https://doi.org/10.1016/S0967-0645(00)00074-6)

[https://doi.org/10.1016/S0967-0645\(00\)00074-6](https://doi.org/10.1016/S0967-0645(00)00074-6)

Methods

Knap, A. H., Michaels, A., Close, A. R., Ducklow, H., & Dickson, A. G. (1996). Protocols for the joint global ocean flux study (JGOFS) core measurements. <http://hdl.handle.net/10013/epic.27912>

Methods

Meyer, M. G., Portela, E., Smith Jr., W. O., & Heywood, K. J. (2025). Critical uncoupling between biogeochemical stocks and rates in Ross Sea springtime production–export dynamics. *Ocean Science*, 21(4), 1223–1236. <https://doi.org/10.5194/os-21-1223-2025>

Results

Portela, E., Meyer, M. G., Heywood, K. J., & Smith, W. O. (2025). Unprecedented Summer Phytoplankton Bloom in the Ross Sea. *Geophysical Research Letters*, 52(3). Portico. <https://doi.org/10.1029/2024gl111264>
<https://doi.org/10.1029/2024GL111264>

Results

Queste, B. (n.d.). UEA Seaglider Toolbox. Bitbucket. <https://bitbucket.org/bastienqueste/uea-seaglider-toolbox/src/toolbox/>

Methods

Queste, B. Y., Heywood, K. J., Smith, W. O., Kaufman, D. E., Jickells, T. D., & Dinniman, M. S. (2015). Dissolved oxygen dynamics during a phytoplankton bloom in the Ross Sea polynya. *Antarctic Science*, 27(4), 362–372. doi:10.1017/s0954102014000881 <https://doi.org/10.1017/S0954102014000881>

Results

Roesler, C., Uitz, J., Claustre, H., Boss, E., Xing, X., Organelli, E., Briggs, N., Bricaud, A., Schmechtig, C., Poteau, A., D’Ortenzio, F., Ras, J., Drapeau, S., Haëntjens, N., & Barbieux, M. (2017). Recommendations for obtaining unbiased chlorophyll estimates from in situ chlorophyll fluorometers: A global analysis of WET Labs ECO sensors. *Limnology and Oceanography: Methods*, 15(6), 572–585. Portico. <https://doi.org/10.1002/lom3.10185>

Methods

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Parameters

Parameter	Description	Units
Seaglider	Seaglider ID number	unitless
Dive	Dive number is defined as one complete up-down oscillation and numbers are continuous through the entire campaign	unitless
Latitude	Latitude in decimal degrees (negative for South). No data are reported until after the first successful surfacing to relay data.	decimal degrees
Longitude	Longitude in decimal degrees (negative for West). No data are reported until after the first successful surfacing to relay data.	decimal degrees
Matlab_Time	Matlab date-time	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO 8601 format	unitless
Depth	Depth from pressure, in meters	meters (m)
Temperature	Temperature in degrees C	degrees Celsius
Salinity	Salinity in parts per thousand	parts per thousand (ppt)
Backscatter_470nm	Optical backscatter measured at 470 nm	arbitrary units
Backscatter_700nm	Optical backscatter measured at 700 nm	arbitrary units
Fluorescence	Chlorophyll fluorescence	arbitrary units
Oxygen	Oxygen concentration in micromoles per liter.	micromoles per liter
Oxygen_Saturation	Oxygen saturation in micromoles per liter calculated from the temperature and salinity data.	micromoles per liter
DACu	Glider power units	unitless?
DaCv	Glider power units	unitless?
PAR	Photosynthetically active radiation (measured only on SG613)	TBD?

Instruments

Dataset-specific Instrument Name	Two profiling ocean gliders (Seagliders SG613 and SG676)
Generic Instrument Name	Seaglider
Dataset-specific Description	The gliders carried sensors for temperature, salinity (Seabird CT sail), dissolved oxygen (Aanderaa 4330 optode), a WetLabs optical puck to measure Chl-a fluorescence (a proxy for phytoplankton biomass) and optical backscatter (OBS) at 470 and 700 nm (Seabird Scientific Wetlabs Triplet ECOpuck). The PAR sensor was from BioSpherical Instruments.
Generic Instrument Description	The Seaglider is an autonomous underwater vehicle developed through a collaboration between The Applied Physics Laboratory -University of Washington and the University of Washington School of Oceanography. These small, free-swimming vehicles can gather conductivity-temperature-depth (CTD) data from the ocean for months at a time and transmit it to shore in near-real time via satellite data telemetry. Seagliders make oceanographic measurements traditionally collected by research vessels or moored instruments. They can survey along a transect, profile at a fixed location, and can be commanded to alter their sampling strategies throughout a mission.

Deployments

NBP2302

Website	https://www.bco-dmo.org/deployment/996856
Platform	RVIB Nathaniel B. Palmer
Start Date	2023-01-16
End Date	2023-02-28
Description	More information from R2R: https://www.rvdata.us/search/cruise/NBP2302

Project Information

NSFGEO-NERC: Collaborative Research - P2P: Predators to Plankton — Biophysical Controls in Antarctic Polynyas (P2P)

Coverage: Southern Ross Sea

NSF Award Abstract:

NSFGEO-NERC Collaborative Research: P2P: Predators to Plankton – Biophysical controls in Antarctic polynyas

Part I: Non-technical description:

The Ross Sea, a globally important ecological hotspot, hosts 25% to 45% of the world populations of Adélie and Emperor penguins, South Polar skuas, Antarctic petrels, and Weddell seals. It is also one of the few marine protected areas within the Southern Ocean, designed to protect the workings of its ecosystem. To achieve

conservation requires participation in an international research and monitoring program, and more importantly integration of what is known about penguin as predators and the biological oceanography of their habitat. The project will acquire data on these species' role within the local food web through assessing of Adélie penguin feeding grounds and food choices, while multi-sensor ocean gliders autonomously quantify prey abundance and distribution as well as ocean properties, including phytoplankton, at the base of the food web. Additionally, satellite imagery will quantify sea ice and whales, known penguin competitors, within the penguins' foraging area. Experienced and young researchers will be involved in this project, as will a public outreach program that reaches more than 200 school groups per field season, and with an excess of one million visits to a website on penguin ecology. Lessons about ecosystem change, and how it is measured, i.e. the STEM fields, will be emphasized. Results will be distributed to the world scientific and management communities.

Part II: Technical description:

This project, in collaboration with the United Kingdom (UK) National Environmental Research Council (NERC), assesses food web structure in the southwestern Ross Sea, a major portion of the recently established Ross Sea Region Marine Protected Area that has been designed to protect the region's food web structure, dynamics and function. The in-depth, integrated ecological information collected in this study will contribute to the management of this system. The southwestern Ross Sea, especially the marginal ice zone of the Ross Sea Polynya (RSP), supports global populations of iconic and indicator species: 25% of Emperor penguins, 30% of Adélie penguins, 50% of South Polar skuas, and 45% of Weddell seals. However, while individually well researched, the role of these members as predators has been poorly integrated into understanding of Ross Sea food web dynamics and biogeochemistry. Information from multi-sensor ocean gliders, high-resolution satellite imagery, diet analysis and biologging of penguins, when integrated, will facilitate understanding of the 'preyscape' within the intensively investigated biogeochemistry of the RSP. UK collaborators will provide state-of-the-art glider technology, glider programming, ballasting, and operation and expertise to evaluate the oceanographic conditions of the study area. Several young scientists will be involved, as well as an existing outreach program already developed that reaches annually more than 200 K-12 school groups and has more than one million website visits per month.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	ANT-2040571

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