

**Dataset:** Nitrogen fixation rates from samples collected in the Chukchi Sea, Arctic Ocean near Barrow, Alaska in August of 2011 (ArcticNITRO project)

**Project(s):** Does competition for nitrogen between autotrophs and heterotrophs control carbon fluxes in the western coastal Arctic? (ArcticNITRO)

**Abstract:** This dataset provides rates of nitrogen fixation for the coastal Chukchi Sea near Barrow, Alaska. Nitrogen fixation supplies 'new' nitrogen to the global ocean and supports primary production and impacts global biogeochemical cycles. Historically, nitrogen fixation in marine waters was considered a predominantly warm water process but this and other recent studies have shown that nitrogen fixation is occurring at low rates in polar waters. This dataset reports rates of 3.5 – 17.2 nmol N L<sup>-1</sup> d<sup>-1</sup> in the ice-free coastal Alaskan Arctic. Additional investigations of high-latitude marine diazotrophic physiology are required to refine these N<sub>2</sub> fixation estimates. For a complete list of measurements, refer to the supplemental document 'Field\_names.pdf', and a full dataset description is included in the supplemental file 'Dataset\_description.pdf'. The most current version of this dataset is available at: <http://www.bco-dmo.org/dataset/701789>

**Description:** Size fractionated nitrogen fixation rates

This dataset contains nitrogen fixation rates, as well as ammonium, nitrate, and phosphate concentrations collected in the coastal Chukchi Sea west of Barrow, Alaska between 15 Aug 2011 and 20 Aug 2011. Salinity, temperature, and collection depth are also provided.

Related files and references:

Sipler, R.E., C.T. E. Kellogg, T.L. Connelly, Q.N. Roberts, P.L. Yager, D.A. Bronk. 2017. Microbial Community Response to Terrestrially Derived Dissolved Organic Matter in the Coastal Arctic. *Frontiers of Microbiology*.8: 1018.

Baer, S.E., R.E. Sipler, Q.N. Roberts, P.L. Yager, M.E. Frischer and D.A. Bronk. 2017. Seasonal nitrogen uptake and regeneration in the western coastal Arctic. *Limnol Oceanogr*. DOI: [10.1002/lno.10580](https://doi.org/10.1002/lno.10580)

Sipler, R.E., S.E. Baer, M.E., Frischer, Q.N. Roberts, T.L. Connelly, P.L. Yager, D.A. Bronk. 2017. Chemical and photophysiological impact of terrestrially-derived dissolved organic matter on nitrate uptake in the coastal western Arctic. *Limnol Oceanogr*. DOI: [10.1002/lno.10541](https://doi.org/10.1002/lno.10541)

**Acquisition** Nitrogen fixation rates were calculated according to Montoya et al. (1996) and are reported as the average +/- the standard error for each site (n=3). Sampling methodology and other analytical procedures are described in detail in Baer et al (2017).

Baer, S.E., R.E. Sipler, Q.N. Roberts, P.L. Yager, M.E. Frischer and D.A. Bronk. 2017. Seasonal nitrogen uptake and regeneration in the western coastal Arctic. *Limnol Oceanogr.* DOI: [10.1002/lno.10580](https://doi.org/10.1002/lno.10580)

Montoya, J. P., M. Voss, P. Kahler, and D. G. Capone. 1996. A Simple, High-Precision, High-Sensitivity Tracer Assay for N (inf2) Fixation. *Applied and Environmental Microbiology* 62: 986-993.

**Processing** BCO-DMO Data Manager Processing Notes:

**Description:** \* added a conventional header with dataset name, PI name, version date  
\* modified parameter names to conform with BCO-DMO naming conventions  
\* data with value "surface" in collection depth column changed to 0  
\* Added ISO\_DateTime\_UTC from UTC\_Time and date\_local fields  
\* latitude and longitude converted to decimal degrees from degrees minutes seconds.

## Deployment Information

### Deployment description for ArcticNitro ArcticNitro\_Barrow

Extracted from the NSF proposal Study sites: Because of its unique combination of year-round access to the coastal Arctic Ocean and strong scientific support system (Barrow Arctic Science Consortium we propose to make our primary winter and summer measurements from Barrow, Alaska. At 71 °N, Barrow receives 24- hour sunlight between May 10 and August 2, and is in 24-h darkness between November 18 and January 24. Less than 1 km from shore, shelf depths exceed 10m, and significantly deeper waters (>100 m) are not far away. Twice each year (January and July) for two years, working from Barrow, we will use either small boat or skidoo to travel offshore to sample seawater. We anticipate having access to surface waters of 10-20 m depth within a mile of the town of Barrow. We plan to sample biological and biogeochemical inventories along three offshore transects, with 3-5 depths that sample through the surface mixed layer and into the subsurface layer, accessing both the eastward coastal and the offshore westward currents (Weingartner 2006). More extensive rate measurements and incubation studies will be made at selected sites and depths The rationale for the transects is to sample the microbial community response to the cross-shelf and depth gradients DIN availability. Nearshore stations will be N-limited throughout the water column in the summer. Offshore stations may have significant NO<sub>3</sub> below summer stratification. As part of SNACS (Study of the Northern Alaska Coastal) C. Ashjian and colleagues have recently completed summer research near Barrow, using small (43') boats to investigate environmental controls on zooplankton populations. They will have nutrient profiles offshore, which will help guide our study. During the summer, we will coordinate with native Inupiat subsistence whalers (Barrow Whaling Captain Association. In the winter, safe travel over the ice by foot or snow machine, as far out as

the nearshore lead, will offer access to the ocean using an ice auger. We will not be able to sample far offshore during winter, but gradients will be weaker due to mixing.

## Instrument Information

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| <b>Instrument</b>                     | Shimadzu UV-1601 spectrophotometer                                                                                                                                                                                                                       |
| <b>Description</b>                    | Ammonium concentrations were measured on a Shimadzu UV-1601 spectrophotometer.                                                                                                                                                                           |
| <b>Generic Instrument Name</b>        | UV Spectrophotometer-Shimadzu                                                                                                                                                                                                                            |
| <b>Generic Instrument Description</b> | The Shimadzu UV Spectrophotometer is manufactured by Shimadzu Scientific Instruments ( <a href="http://ssi.shimadzu.com">ssi.shimadzu.com</a> ). Shimadzu manufactures several models of spectrophotometer; refer to dataset for make/model information. |

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| <b>Instrument</b>                     | Lachat QuickChem 8500 autoanalyzer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>                    | Nitrate and phosphate were measured using a Lachat QuikChem 8500 autoanalyzer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Generic Instrument Name</b>        | Flow Injection Analyzer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Generic Instrument Description</b> | An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques. |

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| <b>Instrument</b>  | Europa GEO 20/20                                                                                                                            |
| <b>Description</b> | Isotopic measurements for <sup>15</sup> N fixation rates were analyzed on a Europa GEO 20/20 mass spectrometer with an ANCA-SL autosampler. |
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|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Generic Instrument Name</b>        | Mass Spectrometer                                                                                                                                                                                             |
| <b>Generic Instrument Description</b> | General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components. |