# Field physiochemical parameters including nutrient concentrations and nitrogen specific uptake rates from samples collected between 2017 and 2019 from the Arctic Ocean, California Coastal Current, and a Chesapeake Bay estuary

**Website**: https://www.bco-dmo.org/dataset/896181
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2023-05-17

**Project**
» Collaborative Research: Creatine Cycling in Marine Bacterial and Phytoplankton Assemblages (Creatine Cycling)



| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
Nitrogen is an important macronutrient for biological growth and while research has been traditionally focused on the dissolved inorganic nitrogen pool, dissolved organic nitrogen (DON) is an important, but historically less understood source of nitrogen. This work focused on creatine, a DON metabolite recognized in human nutrition that has not been heavily studied in aquatic systems. Our research investigates the extent and rate at which aquatic organisms may uptake (use) creatine and compares those rates to other nitrogen compounds including ammonium, nitrate, urea, and amino acids. Samples were collected between 2017 and 2019 and cover three North American regions. These include the polar Arctic Ocean, the California Coastal Current (Baja), and a Chesapeake Bay estuary (York River). Included in this dataset are ambient physiochemical parameters for these systems, along with measured specific uptake rates.

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## Coverage

**Spatial Extent**: **N**:72.55 **E**:-76.687 **S**:28.29 **W**:-115.91
**Temporal Extent**: 2017-05-03 - 2019-07-16

### Methods & Sampling

Site water for incubation experiments and for the analysis of ambient nutrients was collected slightly differently for each of the sampling regions. In the Arctic, site water for incubation experiments was collected on the R/V Ukpik and R/V Sikuliaq (cruise ID number SK201712S) during the summer of 2017 using a submersible pump and CTD rosette, respectively. In Baja, sampling occurred twice on the R/V Robert Gordon Sproul during both May and October 2017 (cruise ID numbers SP1714 and SP1727), and site water was collected using a CTD rosette (Turk-Kubo et al. 2021). In Virginia, surface sites in the York River were sampled by directly filling an acid-washed PETG carboy over the side. Filtrations for sample filtrate and filters also varied. These York Rivers samples were obtained during day trips aboard a variety of small powerboats (<21 feet), every other month from June 2018 to July 2019. Powerboats are housed out of the Virginia Institute of Marine Science.

In the Arctic, filtrations were conducted in parallel, which separately passed site water through a larger Nucleopore Membrane filter (3.0 micrometer (µm) nominal pore size) and a smaller Whatman GF-75 filter (nominal pore size 0.3 µm). This same combination of filters was used in Baja in October 2017. In May 2017, Baja sampling used the same filters, but filtered sequentially, meaning that site water was first passed through the Nucleopore filter before passing through the GF-75. The York River site samples were only filtered using the GF-75. Filtrate for all regions was collected from the GF-75 filtration and kept for later nutrient analyses and filters

were used for chlorophyll *a* analysis.

Pigments (chlorophyll *a* and phaeopigments) were measured after extraction with 90% acetone overnight (Parsons et al. 1984; Arar and Collins 1997). Concentrations of ammonium were analyzed using the Koroleff (1983) method and amino acids were measured as dissolved primary amines (DPA; Parsons et al. 1984). Concentrations of nitrate, nitrite, phosphate, and silica were measured using a Lachat 8500 Quickchem autoanalyzer. Urea was analyzed using the monoxime method (Price and Harrison 1987). Concentrations of total dissolved nitrogen and dissolved organic carbon were assessed using a Shimadzu TOC-V TNM (Hansell 1993). Dissolved organic nitrogen is calculated as the difference between total dissolved nitrogen and inorganic nitrogen.

Nitrogen uptakes were measured after incubation for a set time (1 to 24 hours) in either 0.5 or 1-liter PETG bottles. Stable isotope tracer methods were used according to those described in Baer et al (2017). Uptake rates for inorganic and organic nitrogen were measured by incubating water with 15N- ammonium, nitrate, creatine, urea, and/or an amino acid mixture under *in situ* light and temperature conditions in a flow-through system on deck or in a cold room set to ambient site water temperatures. Rate incubation experiments were terminated with the same filtration methods as collection of site water ambients with the exception that a Sterlitech silver filter was used in lieu of the Nucleopore Membrane filter. The exact combination of nitrogen substrates varied between sites and regions. All nitrogen uptake samples were analyzed on a Sercon Integra 2 isotope ratio mass spectrometer.

**Known Issues/Problems:**
Note that for the October sampling in the Baja region, chlorophyll *a* concentrations for the nutrient size fractions are unavailable. Instead, chlorophyll *a* concentrations for the >0.7 µm size fraction are available thanks to the Arrigo and Zehr dataset (listed under "Related Datasets").

**Data Processing Description**

**Data Processing:**
It is important to note that potential specific uptake rates are reported based on sampled size fraction (i.e. >3.0 or >0.3 µm). When applicable, the rates of different size fractions were combined for the final reported specific uptake rate (i.e >3.0 and 0.3 - 3.0 µm fractions added to report a >0.3 µm rate). Rates of ammonium-specific uptake were corrected for isotope dilution when possible. These rates were corrected according to Gilbert et al. (1982).

**BCO-DMO Processing:**
- removed "NA" and "ND" (missing data values are blank/empty in the final .csv data file);
- converted the Date column to YYYY-mm-dd format;
- converted the Time column to HH:MM format;
- created the ISO_DateTime_UTC column, which presents date and time in UTC in ISO 8601 format;
- renamed fields to comply with BCO-DMO naming conventions in which the only allowed characters are letters (A-Z, a-z), numbers (0-9), and underscores.

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## Data Files

| File | |
|---|---|
| **creatine_nutrients_n_rates.csv** | (Octet Stream, 26.24 KB)<br>MD5:8ceb2a679904acfff535b19228a77d46 |
| Primary data file for dataset ID 896181 | |

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## Related Publications

Arar, E. J. & Collins, G. B. (1997). In vitro determination of chlorophyll a and phaeophtin a in marine and freshwater phytoplankton by fluorescence – USEPA Method 445.0. Revision 1.2. In: USEPA methods for determination of chemical substances in marine and estuarine environmental samples. Cincinnati, OH. URL: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NERL&dirEntryId=309417
*Methods*

Baer, S. E., Sipler, R. E., Roberts, Q. N., Yager, P. L., Frischer, M. E., & Bronk, D. A. (2017). Seasonal nitrogen uptake and regeneration in the western coastal Arctic. Limnology and Oceanography, 62(6), 2463–2479. doi:10.1002/lno.10580
*Methods*

Gilbert, P. M., Lipschultz, F., McCarthy, J. J., & Altabet, M. A. (1982). Isotope dilution models of uptake and remineralization of ammonium by marine plankton1. Limnology and Oceanography, 27(4), 639–650. Portico. https://doi.org/10.4319/lo.1982.27.4.0639
*Methods*

Hansell, D. A. (1993). Results and observations from the measurement of DOC and DON in seawater using a high-temperature catalytic oxidation technique. Marine Chemistry, 41(1–3), 195–202. https://doi.org/10.1016/0304-4203(93)90119-9
*Methods*

Koroleff, F. (1983). Simultaneous Oxidation of Nitrogen and Phosphorus Compounds by Persulfate. In K. Grasshoff, M. Eberhardt, and F. Kremling [eds.], Methods of Seawater Analysis. GMB: Verlag Chemie.

*Methods*

Parsons, T. R., Maita, Y., & Lalli, C.M. (1984). A manual of chemical and biological methods for seawater analysis. Pergamon Press. doi:10.1016/c2009-0-07774-5 https://doi.org/10.1016/C2009-0-07774-5
*Methods*

Price, N. M., & Harrison, P. J. (1987). Comparison of methods for the analysis of dissolved urea in seawater. Marine Biology, 94(2), 307–317. doi:10.1007/bf00392945 https://doi.org/10.1007/BF00392945
*Methods*

Turk-Kubo, K. A., Mills, M. M., Arrigo, K. R., van Dijken, G., Henke, B. A., Stewart, B., Wilson, S. T., & Zehr, J. P. (2021). UCYN-A/haptophyte symbioses dominate N2 fixation in the Southern California Current System. ISME Communications, 1(1). https://doi.org/10.1038/s43705-021-00039-7
*Results*

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## Related Datasets

### IsRelatedTo

Arrigo, K. R., Zehr, J. P. (2023) **CTD sensor data from two cruises from R/V Robert Gordon Sproul SP1714 in the California Current waters off the coast of Southern California and Baja California from 2017-2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-11-29 doi:10.26008/1912/bco-dmo.774459.1 [view at BCO-DMO]
*Relationship Description: Additional data from the SP1714 and SP1727 cruises in the Baja region.*

Sipler, R. & Bronk, D. (2021). Nutrients, nitrogen fixation, nitrogen uptake and carbon uptake data collected from the Western Arctic Ocean, 2016-2017. Arctic Data Center. urn:uuid:2017c57b-07a7-4e25-98a6-d2954aa59bb6.

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Ship | Name of research vessel | unitless |
| Region | General geogrpaphic region for the data collected | unitless |
| Designator | Numerical cruise number or other descriptor | unitless |
| Site_Name | Name or descriptor of sampled site location | unitless |
| Latitude | Latitude (the North direction is represented by positive numbers) | decimal degrees |
| Longitude | Longitude (the West direction is represented by negative numbers) | decimal degrees |
| Date | Date of sample collection in the local time zone | unitless |
| Time | Time of sample collection recorded in the respective local time using a 24 hour clock | unitless |
| Time_Zone | Respective local time zone where AKDT is Alaska Daylight Time, EST is Eastern Standard Time, and EDT is Eastern Daylight Time | unitless |
| ISO_DateTime_UTC | Date and time of sample collection in UTC in ISO 8601 format | unitless |

| | | |
|---|---|---|
| Water_Depth | General descriptor (e.g., surface, Chlorophyll maximum, etc.) | unitless |
| Sample_Depth | Depth sample collected at in meters | meters (m) |
| Total_Water_Column_Depth | Depth of the total water column in meters | meters (m) |
| Salinity | Salinity of site water in parts per trillion | parts per trillion |
| Temperature | Temperature of site water in degrees Celsius | degrees Celsius |
| Total_Dissolved_N | Total dissolved nitrogen in micromoles nitrogen per liter | micromoles per liter (umol/L) |
| Total_Dissolved_Nz_Std | One standard deviation of Total_Dissolved_N | micromoles per liter (umol/L) |
| Nitrite | Nitrite in micromoles nitrogen per liter; 0.000 = Below detection; Detection limit: 0.05 umol N L-1 | micromoles per liter (umol/L) |
| Nitrite_Std | One standard deviation of Nitrite. "SL" means "Sample lost". | micromoles per liter (umol/L) |
| Nitrate | Nitrate in micromoles nitrogen per liter; 0.000 = Below detection; Detection limit: 0.05 umol N L-1 | micromoles per liter (umol/L) |
| Nitrate_Std | One standard deviation of Nitrate | micromoles per liter (umol/L) |
| Ammonium | Ammonium in micromoles nitrogen per liter; 0.000 = Below detection; Detection limit: 0.03 umol N L-1 | micromoles per liter (umol/L) |
| Ammonium_Std | One standard deviation of Ammonium | micromoles per liter (umol/L) |
| Dissolved_Organic_N | Dissolved organic nitrogen in micromoles nitrogen per liter | micromoles per liter (umol/L) |
| Dissolved_Organic_N_Std | One standard deviation of Dissolved_Organic_N. "SL" means "Sample lost". | micromoles per liter (umol/L) |
| Urea | Urea in micromoles nitrogen per liter; 0.000 = Below detection; Detection limit: 0.1 umol N L-1 | micromoles per liter (umol/L) |
| Urea_Std | One standard deviation of Urea | micromoles per liter (umol/L) |
| Dissolved_Primary_Amines | Dissolved primary amine in micromoles nitrogen per liter; 0.000 = Below detection; Detection limit: 0.025 umol N L-1 | micromoles per liter (umol/L) |
| Dissolved_Primary_Amines_Std | One standard deviation of Dissolved_Primary_Amines | micromoles per liter (umol/L) |

| | | |
|---|---|---|
| Dissolved_Organic_C | Dissolved organic carbon in micromoles carbon per liter | micromoles per liter (umol/L) |
| Dissolved_Organic_C_Std | One standard deviation of Dissolved_Organic_C | micromoles per liter (umol/L) |
| Phosphate | Phosphate in micromoles phosphorus per liter; 0.000 = Below detection; Detection limit: 0.05 umol N L-1 | micromoles per liter (umol/L) |
| Phosphate_Std | One standard deviation of Phosphate | micromoles per liter (umol/L) |
| Silicate | Silicate in micromoles silica per liter; 0.000 = Below detection; Detection limit: 0.11 umol N L-1 | micromoles per liter (umol/L) |
| Silicate_Std | One standard deviation of Silicate | micromoles per liter (umol/L) |
| Chl_a_gt_3um | Chlorophyl a in micrograms per liter in the size fraction representing the community greater than 3.0 micrometers (>3.0um); 0.000 = Below detection; Detection limit: 0.025 ug L-1 | micrograms per liter (ug/L) |
| Chl_a_gt_3um_Std | One standard deviation of Chl_a_gt_3um | micrograms per liter (ug/L) |
| Chl_a_gt_7tenths_um | Chlorophyl a in micrograms per liter in the size fraction representing the community greater than 0.7 micrometers (>0.7um); 0.000 = Below detection; Detection limit: 0.025 ug L-1 | micrograms per liter (ug/L) |
| Chl_a_gt_7tenths_um_Std | One standard deviation of Chl_a_gt_7tenths_um | micrograms per liter (ug/L) |
| Phaeo_gt_3um | Phaeopigment in micrograms per liter in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | micrograms per liter (ug/L) |
| Phaeo_gt_3um_Std | One standard deviation of Phaeo_gt_3um | micrograms per liter (ug/L) |
| Chl_a_gt_3tenths_um | Chlorophyl a in micrograms per liter in the size fraction representing the community greater than 0.3 micrometers (>0.3um); 0.000 = Below detection; Detection limit: 0.025 ug L-1 | micrograms per liter (ug/L) |
| Chl_a_gt_3tenths_um_Std | One standard deviation of Chl_a_gt_3tenths_um | micrograms per liter (ug/L) |
| Phaeo_gt_3tenths_um | Phaeopigment in micrograms per liter in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | micrograms per liter (ug/L) |
| Phaeo_gt_3tenths_um_Std | One standard deviation of Phaeo_gt_3tenths_um | micrograms per liter (ug/L) |
| Creatine_V_gt_3um | Specific uptake rate of creatine per hour in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |

| | | |
|---|---|---|
| Creatine_V_gt_3um_Std | One standard deviation of Creatine_V_gt_3um | per hour |
| Creatine_V_3tenths_to_3um | Specific uptake rate of creatine per hour in the size fraction representing the community between 0.3 and 3.0 micrometers (0.3-3.0um) | per hour |
| Creatine_V_3tenths_to_3um_Std | One standard deviation of Creatine_V_3tenths_to_3um | per hour |
| Creatine_V_gt_3tenths_um | Specific uptake rate of creatine per hour in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| Creatine_V_gt_3tenths_um_Std | One standard deviation of Creatine_V_gt_3tenths_um | per hour |
| Isotope_Dilution_Corrected_Ammonium_V_gt_3um | Specific uptake rate per hour for ammonium, corrected for isotope dilution, in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |
| Isotope_Dilution_Corrected_Ammonium_V_gt_3um_Std | One standard deviation of Isotope_Dilution_Corrected_Ammonium_V_gt_3um | per hour |
| Isotope_Dilution_Corrected_Ammonium_V_gt_3tenths_um | Specific uptake rate per hour for ammonium, corrected for isotope dilution, in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| Isotope_Dilution_Corrected_Ammonium_V_gt_3tenths_um_Std | One standard deviation of Isotope_Dilution_Corrected_Ammonium_V_gt_3tenths_um | per hour |
| Ammonium_V_gt_3um | Specific uptake rate of ammonium per hour in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |
| Ammonium_V_gt_3um_Std | One standard deviation of Ammonium_V_gt_3um | per hour |
| Ammonium_V_3tenths_to_3um | Specific uptake rate of ammonium per hour in the size fraction representing the community between 0.3 and 3.0 micrometers (0.3-3.0um) | per hour |
| Ammonium_V_3tenths_to_3um_Std | One standard deviation of Ammonium_V_3tenths_to_3um | per hour |
| Ammonium_V_gt_3tenths_um | Specific uptake rate of ammonium per hour in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| Ammonium_V_gt_3tenths_um_Std | One standard deviation of Ammonium_V_gt_3tenths_um | per hour |

| | | |
|---|---|---|
| Nitrate_V_gt_3um | Specific uptake rate of nitrate per hour in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |
| Nitrate_V_gt_3um_Std | One standard deviation of Nitrate_V_gt_3um | per hour |
| Nitrate_V_gt_3tenths_um | Specific uptake rate of nitrate per hour in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| Nitrate_V_gt_3tenths_um_Std | One standard deviation of Nitrate_V_gt_3tenths_um | per hour |
| Urea_V_gt_3um | Specific uptake rate of urea per hour in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |
| Urea_V_gt_3um_Std | One standard deviation of Urea_V_gt_3um | per hour |
| Urea_V_gt_3tenths_um | Specific uptake rate of urea per hour in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| Urea_V_gt_3tenths_um_Std | One standard deviation of Urea_V_gt_3tenths_um | per hour |
| AA_V_gt_3um | Specific uptake rate of amino acids per hour in the size fraction representing the community greater than 3.0 micrometers (>3.0um) | per hour |
| AA_V_gt_3um_Std | One standard deviation of AA_V_gt_3um | per hour |
| AA_V_3tenths_to_3um | Specific uptake rate of amino acids per hour in the size fraction representing the community between 0.3 and 3.0 micrometers (0.3-3.0um) | per hour |
| AA_V_3tenths_to_3um_Std | One standard deviation of AA_V_3tenths_to_3um | per hour |
| AA_V_gt_3tenths_um | Specific uptake rate of amino acids per hour in the size fraction representing the community greater than 0.3 micrometers (>0.3um) | per hour |
| AA_V_gt_3tenths_um_Std | One standard deviation of AA_V_gt_3tenths_um | per hour |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | Sercon Integra2 Mass Spectrometer |
| **Generic Instrument Name** | Mass Spectrometer |
| **Dataset-specific Description** | Used to measure isotope ratios and particulate masses |
| **Generic Instrument Description** | 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. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | 8-liter Niskin bottles |
| **Generic Instrument Name** | Niskin bottle |
| **Dataset-specific Description** | Used for site water sampling on R/V Sikuliaq and R/V Robert Gordon Sproul cruises |
| **Generic Instrument Description** | A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Lachat QuickChem 8500 autoanalyzer |
| **Generic Instrument Name** | Nutrient Autoanalyzer |
| **Dataset-specific Description** | Used to measure nitrate, nitrite, phosphate, and silicate concentrations |
| **Generic Instrument Description** | Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Johnson Pump model # 16004 |
| **Generic Instrument Name** | Pump |
| **Dataset-specific Description** | Used to collect site water samples on R/V Ukpik cruise |
| **Generic Instrument Description** | A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Shimadzu 5000A TOC-V/TNM |
| **Generic Instrument Name** | Shimadzu TOC-V Analyzer |
| **Dataset-specific Description** | Used to measure dissolved organic carbon and total dissolved nitrogen concentrations |
| **Generic Instrument Description** | A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Shimadzu RF-600 Spectrofluorophotometer |
| **Generic Instrument Name** | Spectrophotometer |
| **Dataset-specific Description** | Used to measure concentrations of dissolved primary amines |
| **Generic Instrument Description** | An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Turner Design Model 10-AU fluorometer |
| **Generic Instrument Name** | Turner Designs Fluorometer 10-AU |
| **Dataset-specific Description** | Used to measure cholrophyll a and phaeopigement concentrations |
| **Generic Instrument Description** | The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA). |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Shimadzu UV-1800 spectrophotometer |
| **Generic Instrument Name** | UV Spectrophotometer-Shimadzu |
| **Dataset-specific Description** | Used to measure urea and ammonium concentrations |
| **Generic Instrument Description** | The Shimadzu UV Spectrophotometer is manufactured by Shimadzu Scientific Instruments (ssi.shimadzu.com). Shimadzu manufacturers several models of spectrophotometer; refer to dataset for make/model information. |

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## Deployments

**Ukpik_July-August_2017**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/896205 |
| **Platform** | R/V Ukpik |
| **Start Date** | 2017-07-25 |
| **End Date** | 2017-08-03 |
| **Description** | R/V Ukpik July 25 - August 3, 2017 Short day to overnight trips Chief Scientist - Rachel Sipler (rsipler@bigelow.org) |

**SKQ201712S**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/896208 |
| **Platform** | R/V Sikuliaq |
| **Start Date** | 2017-08-06 |
| **End Date** | 2017-08-22 |
| **Description** | R/V Sikuliaq SK201712S August 6 - August 22, 2017 Chief Scientist - Lauren Juranek (laurie.juranek@oregonstate.edu) See more cruise details at R2R: https://www.rvdata.us/search/cruise/SKQ201712S |

**SP1714**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/699986 |
| **Platform** | R/V Robert Gordon Sproul |
| **Start Date** | 2017-05-03 |
| **End Date** | 2017-05-11 |
| **Description** | R/V Robert Gordon Sproul Cruise SP1714 May 3 - 11, 2017 Chief Scientist - Matthew Mills (mmmills@stanford.edu) See more cruise information from R2R: https://www.rvdata.us/search/cruise/SP1714 |

**SP1727**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/774496 |
| **Platform** | R/V Robert Gordon Sproul |
| **Start Date** | 2017-10-04 |
| **End Date** | 2017-10-11 |
| **Description** | R/V Robert Gordon Sproul Cruises SP1727 October 4 - 11, 2017 Chief Scientist - Matthew Mills (mmmills@stanford.edu) See more cruise information from R2R: https://www.rvdata.us/search/cruise/SP1727 |

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## Project Information

**Collaborative Research: Creatine Cycling in Marine Bacterial and Phytoplankton Assemblages (Creatine Cycling)**

**Coverage**: Atlantic bight

*NSF Award Abstract:*
High rates of dissolved organic nitrogen (DON) production and utilization in aquatic systems are typically attributed to microbial activity. Though it is known that there is a tight coupling between the production and consumption of biologically available DON, the composition, dynamics, and ecological significance of this rapidly cycled DON pool are less well understood. This proposal focuses on a component of the DON pool, creatine, which is historically understood as a product of metazoan activity, but appears to be both produced by phytoplankton and consumed by marine bacteria. Creatine is present in seawater in measurable quantities, which led to the hypothesis that creatine may be a significant component of the marine DON cycle. DON cycling likely has a bearing on fundamental marine ecosystem processes with large implications for carbon and nitrogen turnover on a global scale. Broader impacts of this project will include outreach that focuses on connecting scientists with K-12 students through research experiences for teachers and lesson development in collaboration with the K20 Center for Educational and Community Renewal, a statewide education research and development center at the University of Oklahoma. The project will integrate the research with inquiry-based teaching of rural secondary science teachers through Authentic Research Experiences in oceanographic science and microbial ecology. The K20 network includes 96% of Oklahoma schools, providing a unique opportunity to impact STEM education in Oklahoma.

The results of this project will help develop a better understanding of DON cycling, the ecological context of creatine uptake activity, and identify both creatine-producing and consuming organisms in the marine environment. The importance of creatine cycling will be assessed via 15N tracer studies along the natural coastal-to-offshore productivity gradient observed in the North Atlantic. Tracer and molecular approaches will be used to investigate the importance of phytoplankton vs. bacteria in creatine uptake and, the taxonomic identities of creatine-utilizing bacteria will be interrogated via molecular, stable isotope probing (SIP), and RT-qPCR approaches.

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## Funding

| Funding Source | Award |
|---|---|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1635369 |

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