

# Metadata

<b>Dataset Name</b>	Arctic-ICE 2012 Intracellular Nutrients
<b>Dataset General Type</b>	sea ice core dissolved and particulate data
<b>Dataset Type</b>	Dataset
<b>Dataset Level</b>	1.5
<b>Program Website</b>	
<b>Keyword Vocabulary</b>	Polar Data Catalogue
<b>Keyword Vocabulary URL</b>	<a href="https://www.polardata.ca/pdcinput/public/keywordlibrary">https://www.polardata.ca/pdcinput/public/keywordlibrary</a>
<b>Theme</b>	
<b>Dataset Status</b>	Complete
<b>Maintenance and Update Frequency</b>	As needed
<b>Dataset Last Revision Date</b>	2024-03-06
<b>Dataset DOI</b>	10.34992/q15a-1e88
<b>Metadata Creation Date</b>	2024
<b>Publisher</b>	CanWIN
<b>Dataset Authors</b>	
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## Contributors

### Contributors 1

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**Dataset Collection Start Date** 2012-05-19

**Dataset Collection End Date** 2012-06-08

## Sample Collection

**Sample Collection 1**

**Sampling Instrument Name** Metre stick

**Standardized Sampling Instrument Name** metre stick

**Sample Collection Method Name** Snow depth measurements

**Comment**

**Method Link**

**Method Summary**

**Method Description Type** Methods

### Sample Collection 2

**Sampling Instrument Name** Sea-Bird SBE 19plus V2 conductivity-temperature-depth (CTD) probe

**Standardized Sampling Instrument Name** Seabird CTD

**Sample Collection Method Name** Water column salinity

**Comment**

**Method Link**

**Method Summary** 2-m water depth salinities were extracted from CTD casts.

**Method Description Type** Methods

### Sample Collection 3

**Sampling Instrument Name** Bran-Luebbe 3 autoanalyzer

**Standardized Sampling Instrument Name**

**Sample Collection Method Name** Nutrient concentration

**Comment**

**Method Link**

**Method Summary** Sample was filtered through pre-combusted (450degC for 5 hr) Whatman GF/F filters using a sterilized syringe. Filtrate was collected in acid-cleaned polyethylene tubes after three rinses with the filtrate, and stored at -20degC until analysis within 6 months using a Bran-Luebbe 3 autoanalyzer (adapted from (Grasshoff et al. 1999)). Samples were analyzed for nitrate+nitrite, phosphate and silicic acid. Samples for Si(OH)<sub>4</sub> determination were thawed for at least 24 hr to minimize the issue of silicate polymerization when samples have been stored by freezing (Macdonald et al. 1986). **\*\*Bulk ice nutrients\*\*** - samples were from ice cores melted without filtered seawater addition. **\*\*Water Column\*\*** - 2 m water depth **\*\*Intracellular Nutrients\*\*** - The method used to extract the intracellular nutrient pool was adapted from (Dortch 1982). Within 3 hr of collection, a subsample from the scrape sample was filtered onto a pre-combusted (450°C for 5 h) Whatman GF/F filter within an acid-cleaned filter head mounted on a large Erlenmeyer flask. Once enough material was concentrated on the filter (visible confirmation), vacuum pressure was released and a 60-mL acid-cleaned polyethylene tube, rinsed with boiling reverse osmosis water, was suspended below the filtration head within the Erlenmeyer flask. Then, 40 mL of boiling reverse osmosis water was poured directly into the filter funnel. The water was left for 10 minutes and then vacuum pressure restored and the filtrate was collected in the suspended tube. Following collection of the filtrate, the tube was sealed and placed immediately into the -20degC freezer. Following the above-mentioned protocol, a subsample of the boiling reverse osmosis water was also collected as a blank for every sample day. **\*\*References\*\*** 1. Q. Dortch, Effect of growth conditions on accumulation of internal nitrate, ammonium, amino acids, and protein in three marine diatoms. Journal of Experimental Marine Biology and Ecology 61, 243–264 (1982). 2. K. Grasshoff, K. Kremling, M. Ehrhardt, "Frontmatter" in Methods of Seawater Analysis, (John Wiley & Sons, Ltd, 1999), pp. i–xxxii. 3. R. W. Macdonald, F. A. McLaughlin, C. S. Wong, The storage of reactive silicate samples by freezing. Limnology and Oceanography 31, 1139–1142 (1986).

**Method Description Type** Methods

#### **Sample Collection 4**

**Sampling Instrument Name** Ice thickness tape

**Standardized Sampling Instrument Name**

**Sample Collection Method Name** Ice sample collection

**Comment**

**Method Link**

**Method Summary**

Data were collected every 4 days between 19 May and 8 June. Snow depths were measured at every core extraction location, with targeted sampling of three different sites to capture the available range of snow depth conditions, including thin (<10 cm), medium (10-17 cm), and thick (>17 cm) snow covers. Bottom-ice samples were collected from each of these extraction locations using a Kovacs Mark II coring system (9-cm inner diameter) and processed for analysis of i) bottom-ice chlorophyll a concentration (chl a) and community composition, ii) intracellular nutrients and, iii) bottom-ice bulk nutrients. For quantitative measurements of bottom-ice chl a and community composition, up to three ice cores were extracted from each site and the bottom 3 cm were pooled into isothermal containers before melt in 0.2-µm filtered seawater (FSW) to limit osmotic shock to the algae during melt processing. The FSW-diluted core solution was melted in the dark over a 15 to 20-hr period. For intracellular nutrient measurements, a bottom-ice scrape sample was collected from 1-3 cores per sampling site depending on visible algal coloration. The scrape procedure used a stainless-steel knife to scrape off the soft skeletal bottom-ice layer, which contained the strongest coloration of algal matter (<0.5 cm), directly into 500 mL of FSW at a temperature near freezing. This technique minimizes stress on algal cells during ice melt processing by: i) maintaining sample salinities similar to growth conditions at the ice-ocean interface, and ii) reducing time of exposure to potentially stressful melt conditions, as all scrape samples were processed within 3 hr of collection. For bulk ice nutrient measurements, the bottom 3 cm of an ice core was collected and placed immediately into a sterile bag (Nasco Whirl-Pak) and then melted over a 15 to 20-hr period in the dark.

**Method Description Type**

Methods

**Sample Collection 5****Sampling Instrument Name**

Niskin sampler

**Standardized Sampling Instrument Name**

Niskin Bottle

**Sample Collection Method Name**

Water sampling

**Comment****Method Link****Method Summary**

A Niskin sampler was lowered through an ice hole to collect water at a 2-m depth.

**Method Description Type**

Methods

**Activity Collection Type**

Field Measurement

**Preferred citation****Analytical Instrument**

## Analytical Instrument 1

**Analytical Instrument Name** Cond 330i, WTW

**Standardized Analytical Instrument Name**

**Analytical Instrument Identifier Id**

**Analytical Instrument Title Type** Alternative Title

**Analytical Instrument Identifier Type**

## Analytical Instrument 2

**Analytical Instrument Name** 10-005R Turner Designs fluorometer

**Standardized Analytical Instrument Name**

**Analytical Instrument Identifier Id**

**Analytical Instrument Title Type** Alternative Title

**Analytical Instrument Identifier Type**

## Analytical Method

### Analytical Method 1

**Analytical Method Name** Bulk Ice Salinity

**Method Link**

**Method Summary** **\*\*Instrument\*\***: Cond 330i, WTW Melt ice core without filtered seawater dilution and measure salinity at room temperature.

**Laboratory**

**Comments****Variables Measured**

Salinity

**Analytical Method 2****Analytical Method Name**

Bottom ice chlorophyll (chl) a concentration

**Method Link****Method Summary**

**\*\*Instrument\*\*:** 10-005R Turner Designs fluorometer Melted ice core samples were filtered onto Whatman GF/F glass fiber filters (nominal pore size of 0.7  $\mu\text{m}$ ) for analysis of bottom-ice chl a. Filters were placed in 90% acetone for 18 to 24 hr, and the extracted chl a was measured before and after acidification with 5% HCl using a 10-005R Turner Designs fluorometer. All measurements were made with ice core melt using 3:1 filtered seawater dilution and corrected for the dilution.

**Laboratory****Comments****Variables Measured**

Chl a concentration

**Analytical Method 3****Analytical Method Name**

Algal Taxonomy

**Method Link****Method Summary**

**\*\*Instrument\*\*:** Inverted Microscope Melted ice core samples were preserved with acidic Lugol's solution (Parsons et al. 1984) and stored in the dark at 4°C for later analysis of cell identification and enumeration. Cells > 4  $\mu\text{m}$  were identified to the lowest possible taxonomic rank using inverted microscopy according to (Lund et al. 1958); however, information is only presented on total autotrophic cell abundance and percent contribution of pennate diatoms. All measurements were made with ice core melt using 3:1 filtered seawater dilution and corrected for the dilution. **\*\*References:\*\*** 1. T. R. Parsons, Y. Maita, C. M. Lalli, A Manual of Chemical and Biological Methods for Seawater Analysis. (Pergamon Press, 1984) <https://doi.org/10.25607/OBP-1830> (March 4, 2024). 2. J. W. G. Lund, C. Kipling, E. D. Le Cren, The inverted microscope method of estimating algal numbers and the statistical basis of estimations by counting. *Hydrobiologia* 11, 143–170 (1958).

**Laboratory****Comments****Variables Measured**

Percent contribution of main algal taxa

**Analytical Method 4****Analytical Method Name**

Macronutrient concentrations

**Method Link**

<b>Method Summary</b>	<p>Sample was filtered through pre-combusted (450degC for 5 hr) Whatman GF/F filters using a sterilized syringe. Filtrate was collected in acid-cleaned polyethylene tubes after three rinses with the filtrate, and stored at -20degC until analysis within 6 months using a Bran-Luebbe 3 autoanalyzer (adapted from (Grasshoff et al. 1999)). Samples were analyzed for nitrate+nitrite, phosphate and silicic acid. Samples for Si(OH)4 determination were thawed for at least 24 hr to minimize the issue of silicate polymerization when samples have been stored by freezing (Macdonald et al. 1986). <b>**Bulk ice nutrients**</b> - samples were from ice cores melted without filtered seawater addition <b>**Water Column**</b> - 2 m water depth <b>**Intracellular Nutrients**</b> - The method used to extract the intracellular nutrient pool was adapted from (Dortch 1982). Within 3 hr of collection, a subsample from the scrape sample was filtered onto a pre-combusted (450°C for 5 h) Whatman GF/F filter within an acid-cleaned filter head mounted on a large Erlenmeyer flask. Once enough material was concentrated on the filter (visible confirmation), vacuum pressure was released and a 60-mL acid-cleaned polyethylene tube, rinsed with boiling reverse osmosis water, was suspended below the filtration head within the Erlenmeyer flask. Then, 40 mL of boiling reverse osmosis water was poured directly into the filter funnel. The water was left for 10 minutes and then vacuum pressure restored and the filtrate was collected in the suspended tube. Following collection of the filtrate, the tube was sealed and placed immediately into the -20degC freezer. Following the abovementioned protocol, a subsample of the boiling reverse osmosis water was also collected as a blank for every sample day. Q. Dortch, Effect of growth conditions on accumulation of internal nitrate, ammonium, amino acids, and protein in three marine diatoms. Journal of Experimental Marine Biology and Ecology 61, 243–264 (1982). K. Grasshoff, K. Kremling, M. Ehrhardt, "Frontmatter" in Methods of Seawater Analysis, (John Wiley &amp; Sons, Ltd, 1999), pp. i–xxxii. R. W. Macdonald, F. A. McLaughlin, C. S. Wong, The storage of reactive silicate samples by freezing. Limnology and Oceanography 31, 1139–1142 (1986).</p>
<b>Laboratory</b>	
<b>Comments</b>	
<b>Variables Measured</b>	Macronutrient concentrations
<b>License Name</b>	Creative Commons Attribution 4.0 International
<b>Licence Type</b>	Open
<b>Embargo Date</b>	
<b>Licence URL</b>	<a href="https://spdx.org/licenses">https://spdx.org/licenses</a>
<b>Terms of Access</b>	<p>CanWIN datasets are licensed individually, however most are licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) Public License. Details for the licence applied can be found using the Licence URL link provided with each dataset. By using data and information provided on this site you accept the terms and conditions of the License. Unless otherwise specified, the license grants the rights to the public to use and share the data and results derived therefrom as long as the proper acknowledgment is given to the data licensor (citation), that any alteration to the data is clearly indicated, and that a link to the original data and the license is made available.</p>
<b>Terms of Use</b>	By accessing this data you agree to [CanWIN's Terms of Use](/data/publication/canwin-data-statement/resource/5b942a87-ef4e-466e-8319-f588844e89c0).
<b>Awards</b>	
<b>Awards 1</b>	
<b>Award Title</b>	Discovery and Northern Research Supplements



**Website**

**Funder Name** NSERC

**Funder Identifier Code**

**Funder Identifier Type**

**Funder Identifier Scheme**

**Grant Number**

**Awards 2**

**Award Title** Network Project and Aircraft support

**Website**

**Funder Name** ArcticNet NCE

**Funder Identifier Code**

**Funder Identifier Type**

**Funder Identifier Scheme**

**Grant Number**

**Awards 3**

**Award Title** Start-up Grant (Mundy)

**Website**

**Funder Name** University of Manitoba

**Funder Identifier Code**

**Funder Identifier Type**

**Funder Identifier Scheme**

**Grant Number**

**Awards 4**

**Award Title** Logistical Support

**Website**

**Funder Name** Polar Continental Shelf Project

**Funder Identifier Code**

**Funder Identifier Type**

**Funder Identifier Scheme**

**Grant Number**

## **Related Resources**

### **Related Resources 1**

**Related Resource Name**

**Resource Code**

**Identifier Type**

**Relationship To This Dataset**

**Resource Type**      Online Resource

**Type**

**Series Name**

## **Publications**

### **Publications 1**

**Publication Name**

**Identifier Code**

**Identifier Type**

**Relationship to this dataset**

**Resource Type**      Online Resource

**Publication Type**

## **Spatial regions**

resolute

<b>Spatial extent West Bound Longitude</b>	95.25
<b>Spatial extent East Bound Longitude</b>	95.25
<b>Spatial extent South Bound Latitude</b>	74.708
<b>Spatial extent North Bound Latitude</b>	74.708

## Data and Resources

<b>URL</b>	<a href="https://canwin-datahub.ad.umanitoba.ca/data/dataset/3c0b49c3-9f53-4930-8642-738495dcd4c8/resource/e186270b-275f-4795-a3e0-5a3ec39f3e85/download/ic_nutrients_dataset_final.xlsx">https://canwin-datahub.ad.umanitoba.ca/data/dataset/3c0b49c3-9f53-4930-8642-738495dcd4c8/resource/e186270b-275f-4795-a3e0-5a3ec39f3e85/download/ic_nutrients_dataset_final.xlsx</a>
<b>Name</b>	IC Nutrients
<b>Description</b>	Nutrient availability influences maximum production, speciation, cellular composition, and overall phenology of the Arctic spring ice algal bloom. However, how ice algae obtain nutrients from their environment is not well-understood. Previously documented positive relationships between sea ice nutrient concentrations and algal biomass evidenced that ice algae maintain an intracellular nutrient pool. Here we provide direct evidence that sea ice diatoms store intracellular nitrate+nitrite and silicic acid well above that available in their ambient environment.
<b>Format</b>	XLSX
<b>Resource Category</b>	data