Metadata

Field	Value
Dataset Name	Arctic-ICE 2012 Intracellular Nutrients
Dataset General Type	sea ice core dissolved and particulate data
Dataset Type	Dataset
Dataset Level	1.5
Program Website	
Keyword Vocabulary	Polar Data Catalogue
Keyword Vocabulary URL	https://www.polardata.ca/pdcinput/public/keywordlibrary
Theme	
Title	Marine
URL	https://canwin-datahub.ad.umanitoba.ca/data/en/group/marine
Dataset Status	Complete
Maintenance and Update Frequency	As needed
Dataset Last Revision Date	2024-03-06
Dataset DOI	10.34992/q15a-1e88

Field	Value
Metadata Creation Date	2025
Publisher	CanWIN
Dataset Authors	
Dataset Authors 1	
Name	Mundy, CJ
Type of Name	Personal
Email	cj.mundy@umanitoba.ca
Affiliation	Centre for Earth Observation Science - University of Manitoba
ORCID ID	0000-0001-5945-8305
	ORCID
	http://orcid.org/
Contributors	
Contributors 1	
Name	Gosselin, Michel
Role	ProjectMember

Field	Value
Email	michel_gosselin@uqar.ca
Affiliation	Université du Québec à Rimouski
ORCID ID	
Project Data Curator	Mundy, CJ
Project Data Curator email	cj.mundy@umanitoba.ca
Project Data Curator Affiliation	Centre for Earth Observation Science - University of Manitoba
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	

Field	Value
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	

Field	Value
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)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). **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. Grasssshoff, 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

Field	Value
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- m 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.

Field	Value
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	

Field	Value
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	

Field	Value
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 µm) 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	

Field	Value
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 µm 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	

Field	Value
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)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). **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 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. Grasssshoff, K. Kremling, M. Ehrhardt, “Frontmatter” in Methods of Seawater Analysis, (John Wiley & 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).
Laboratory	
Comments	
Variables Measured	Macronutrient concentrations

Field	Value
Licence Name or Copyright Statement	Creative Commons Attribution 4.0 International
Copyright Statement	
Licence Type	Open
Embargo Date	
Licence URL	https://spdx.org/licenses
Terms of Access	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.
Terms of Use	By accessing this data you agree to [CanWIN's Terms of Use](/data/publication/canwin-data-statement/resource/5b942a87-ef4e-466e-8319-f588844e89c0).
Awards	
Awards 1	
Award Title	Discovery and Northern Research Supplements
Website	
Funder Name	NSERC

Field	Value
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	

Field	Value
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	

Field	Value
Identifier Type **Relationship to this dataset** **Resource Type** **Publication Type**	Online Resource
Spatial regions	resolute
Spatial extent West Bound Longitude	95.25
Spatial extent East Bound Longitude	95.25
Spatial extent South Bound Latitude	74.708
Spatial extent North Bound Latitude	74.708

Data and Resources

Field	Value
URL	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
Name	IC Nutrients

Field	Value
Description	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.
Format	XLSX
Resource Category	data