

Sample Collection Methods

Sample Collection Method Name*	pCO ₂ system protocol
Method Summary	The pCO ₂ system is an automatic continuous sampler. It draws sample water from the ship's clean water intake and the sample water is passed into a sealed container through a shower headspace. This set up allows the air in the headspace to come into equilibrium with the CO ₂ concentration of the seawater, and the air is then cycled from the container into an LI-7000 gas analyzer in a closed loop. The system also passes a subsample of the water stream through an Idronaut Ocean Seven CTD for further measurement.
Sample Collection Method Name*	FDOM sensor protocol
Method Summary	The FDOM sensor is an automatic continuous sampler that records measurements every 30 sec and is calibrated every 12h with FDOM water samples. It measures fluorescence within the upper 7m in response of dissolved organic matter in the water.
Sample Collection Method Name*	TSG (Thermal-salinograph system) protocol
Method Summary	The TSG is an automatic continuous sampler that records measurements every second. It is on the same intake line as the FDOM sensor and is used for the purpose of data matching.
Sample Collection Method Name*	PIGI (Pressure of In-situ Gases Instrument) system protocol
Method Summary	The PIGI consists of a 2-stage chamber setup that is an automatic continuous sampler. The first chamber (primary chamber) consists of a debubbler that allows bubbles to exist from the top and bubblefree water to exist via the bottom. The bubble free water goes to the second chamber, via a downstream pump, that contains two instruments: an Optode and Gas Tension Device (GTD). The optode measures O ₂ concentration, and the GTD measures total dissolved gas pressure (used to drive N ₂ concentrations).
Sample Collection Method Name*	Radiation sensor system protocol

Method Summary	The radiation sensor system consists of three sensors: Eppley Pyranometer (model PSP), Eppley Pyrgeometer (model PIR), and Kipp & Zonen PARLite, each record measurements every 30 seconds.
Sample Collection Method Name*	Ship Rosette protocol
Method Summary	Measures discrete, surface water samples that are disturbed/mixed. At each sampling station, the rosette collects water samples into 5 individual bottles that are then measured with a CTD.
Sample Collection Method Name*	Surface Water Sampling (ship bow, zodiac, skippy boat)
Method Summary	Measures discrete surface water samples that are disturbed/mixed, which is not possible with the ship's rosette. Surface samples were collected using a submersible pump and/or horizontal Niskin bottle. Samples were collected from the zodiac or skippy boat more than 100m from the ship, but less than 500m. When this wasn't possible, samples were collected from the foredeck immediately upon arrival
	on station, to maximize the chance of collecting undisturbed water. Three depths were sampled, 0m, 1m, and 7m, and a CTD (Idronaut or Cast-Away) was performed immediately after water sampling.
Sample Collection Method Name*	Helicopter Sampling
Method Summary	A helicopter was used to sample from ice floes, rivers, and landfast ice. At each site, ice-water interface water samples were collected, and occasionally a second, deeper sample (7 m), using a submersible pump (Waterra Cyclone pump) powered by a 12V battery. Water was pumped through 3/8" ID vinyl tubing into 250 mL BOD glass bottles with sintered glass stoppers, and 4 L glass jars with narrow mouth plastic screw caps. Samples were stored in the dark and processed/preserved upon return to the ship within 4 hours of sampling. Subsampling from the 4L glass bottle was done using a 50 mL glass syringe with a 15 cm long 1/8" ID vinyl tube attached to the end. The syringe was rinsed 3x with sample water and filled without bubbles before rinsing and filling sample bottles, also without bubbles. CTDs were always performed when water samples were collected by helicopter, up to 50 m depth using an Idronaut.
Sample Collection Method Name*	Ice and Under-ice Water protocol

Method Summary	Ice cores were collected at select ice stations accessed either by the ship's cage or helicopter. Up to 5 x 10cm sections were vacuum sealed from each core and melted at room temperature before subsampling. In many cases only the upper 1m of ice was sampled due to the very thick ice cover and time constraints. Where possible, under ice water was collected by submersible pump and subsampled following the same method used to subsample under-ice water from Helicopter sampling.
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Processing Description

Variable*	Variable description	Variable method speciation	Variable sample fraction*	Variable media type	Activity Collection Type
N2O	Dissolved Nitrous oxide	As N2O	Dissolved	Seawater	Field Measurement
TDN	total dissolved nitrogen	as N	Dissolved	Seawater	Field Measurement
Cdom_mg_m3	CDOM Chromophoric dissolved organic matter	as CDOM	Dissolved	Seawater	Field Measurement
NO3_mmol_m3	nitrate	as NO3	Dissolved	Seawater	Field Measurement
pH	pH	as pH	None	Seawater	Field Measurement
fCO2	Fugacity of CO ₂ of water sample	as CO ₂	None	Seawater	Field Measurement
pCO2	Partial pressure of CO ₂ of water sample	as CO ₂	None	Seawater	Field Measurement

sat_cal	calcium carbonate saturation (Ω_{Ca}) (degree of saturation) for calcite of water sample		None	Seawater	Field Measurement
sat_arg	Ω_{Ar} (Ω_{ar}) (degree of saturation) for aragonite of water sample		None	Seawater	Field Measurement
ConT_degC	Conductivity	None	None	Seawater	Field Measurement
Press_db	Seawater pressure	None	None	Seawater	Field Measurement
Trans_pct	Beam transmission	None	None	Seawater	Field Measurement
Fluo_mg_m3	Fluorescence of the water	None	None	Seawater	Field Measurement
Temp_degC	Seawater temperature	None	None	Seawater	Field

CanWIN Dataset Description

					Measurement
Sal_psu	Salinity of the water	None	None	Seawater	Field Measurement
Dens_kg_m3	Seawater Density	None	None	Seawater	Field Measurement
Svan_m3_kg	Sound velocity	None	None	Seawater	Field Measurement
Sigt_kg_m3	Potential Density	None	None	Seawater	Field Measurement

Sigthe_kg_m3	Density	None	None	Seawater	Field Measurement
Temp_pot_degC	Potential temperature of seawater	None	None	Seawater	Field Measurement
FreezT_degC	Freezing temperature of seawater	None	None	Seawater	Field Measurement
O2_μM	O ₂ concentration	as O2	Whole	Seawater	Field Measurement
Par_microeinstein_s_m2_s	Photosynthetically active radiation/irradiance of sea water	None	None	Seawater	Field Measurement
Spar_microeinstein_s_m2_s	Photosynthetically active radiation	None	None	Seawater	Field Measurement
Asal_g_kg	Absolute salinity	None	None	Seawater	Field Measurement
Salinity_average	Average salinity from the guideline salinometer	None	None	Seawater	Field Measurement
Salinity_std_dev	Standard deviation of salinity from the guideline salinometer	None	None	Seawater	Field Measurement
d18O	Concentration of δ ¹⁸ O of water sample relative to VSMOW	as O2	None	Seawater	Field Measurement
d18O_stddev	Standard deviation of concentration of δ ¹⁸ O of water sample relative to VSMOW	as O2	None	Seawater	Field Measurement
d2H	Deuterium relative to VSMOW	as 2H	None	Seawater	Field Measurement

CanWIN Dataset Description

d2H_stdev	Standard deviation of deuterium relative to VSMOW	as 2H	None	Seawater	Field Measurement
DIC	Dissolved inorganic carbon, (DIC)	as C	Dissolved	Seawater	Field Measurement
TA	Total alkalinity (TA)	None	Whole	Seawater	Field Measurement
d13C_DIC	Concentration of C ¹³ -DIC of water sample	as C13DIC	Filtrate	Seawater	Field Measurement
CH4	Methane (CH ₄)	as CH4	Filtrate	Seawater	Field Measurement
DOC_mgL	Dissolved organic carbon (DOC)	as C	Dissolved	Seawater	Field Measurement
Fsw	Seawater fractional contribution to water mass	None	None	Seawater	Field Measurement
Fmw	Meteoric freshwater fractional contribution to water mass	None	None	Seawater	Field Measurement
Fsim	Sea-ice melt fractional contribution to water mass	None	None	Seawater	Field Measurement

Cleaning Notes by Curator

Data curator has scanned and highlighted some erroneous values.

Variable Detection Limits

Variable Name	Units	Detection Limit Value and units
Seawater pressure	dbar	[0, 10]
Cruise Temperature	°C	[-3, 50]
Conductivity	mS/cm	[0, 64]
Oxygen concentration	ppm	[0, 25]
Oxygen saturation	%	[0, 250]
pH	pH	[0, 14]
Seawater Temperature	°C	[-5, 35]
Conductivity	S/m	[0, 9]

CanWIN Dataset Description

Florescence	mg/m ³	n/a
Sound Velocity	kg m ⁻³	n/a
Salinity	PSU	n/a
O ₂ Concentration	μmol L ⁻¹	n/a
DIC	μmol/kg	n/a
TA	μmol/kg	n/a
δ ¹⁸ O	δ ¹⁸ O/ml	n/a
C ¹³ -DIC	C ¹³ -DIC/ml	n/a
C13-CH ₄	C13-CH ₄ /ml	n/a
Ba ⁺ and other ions	nmol/L	n/a
Methane, CH ₄	nmol/L	n/a
DOC	mg L ⁻¹	n/a
TDN	mg L ⁻¹	n/a
Salinity	PSU	n/a
Light intensity	μE m ⁻² s ⁻¹	n/a
Surface light intensity	μE m ⁻² s ⁻¹	n/a

Instruments:

CanWIN Instrument Name*	pCO ₂ system – Amundsen
Common Name	General Oceanics 8050 pCO ₂ system
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	Dissolved CO ₂ Dissolved O ₂ Cruise temperature Conductivity Pressure
Additional Comments	The pCO ₂ system instrument is located in the engine room of the CCGS Amundsen
CanWIN Instrument Name*	FDOM system – Amundsen
Common Name	FDOM system
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger

CanWIN Dataset Description

Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	Fluorescence of the water
Additional Comments	The FDOM system instrument is located in the engine room of the CCGS Amundsen

CanWIN Instrument Name*	Thermal-salinograph system (TSG)
Common Name	Thermal-salinograph system (TSG)
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	Sea water temperature Salinity Fluorescence Sound velocity
Additional Comments	The TSG instrument is located in the engine room of the CCGS Amundsen
CanWIN Instrument Name*	<u>Needs to be added</u>
Common Name	PIGI (Pressure of In-situ Gases Instrument) system
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	O ₂ concentration
Additional Comments	The PIGI system instrument is located in the forward lab of the CCGS Amundsen
CanWIN Instrument Name*	PAR and sPAR LI-COR Radiation Sensors – Amundsen
Common Name	Radiation sensors
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	Light intensity Surface light intensity

CanWIN Dataset Description

Additional Comments	The radiation sensors instrument is located above the wheelhouse of the CCGS Amundsen.
CanWIN Instrument Name*	Rosette Sampler
Common Name	CCGS Amundsen CTD rosette
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	Dissolved inorganic carbon, (DIC) Total alkalinity (TA)

	<p>table oxygen and carbon isotopes ($\delta^{18}\text{O}$, C13-DIC; C¹³-CH₄)</p> <p>Ba⁺ and other ions</p> <p>Methane (CH₄)</p> <p>Dissolved organic carbon (DOC)</p> <p>Total dissolved nitrogen (TDN)</p> <p>Salinity</p>
Additional Comments	
CanWIN Instrument Name*	Niskin Bottle
Common Name	Niskin Bottle
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	<p>Dissolved inorganic carbon, DIC</p> <p>TA, Total alkalinity</p> <p>Stable oxygen and carbon isotopes $\delta^{18}\text{O}$, C13-DIC; C¹³-CH₄</p> <p>Ba⁺ and other ions</p> <p>CH₄, Methane</p> <p>DOC, Dissolved organic carbon</p> <p>TDN, Total dissolved nitrogen</p> <p>Salinity</p>
Additional Comments	Niskin bottle has thesame variables as CTD rosette

CanWIN Dataset Description

CanWIN Instrument Name*	Pump/Submersible
Common Name	Waterra Cyclone pump
Activity Collection Type*	Field Measurement/Observation - Portable Data Logger
Variables Measured with units in brackets (e.g. Nitrogen (mg/L))*	DIC TA $\delta^{18}\text{O}$, C13- DIC; C ¹³ -CH ₄ Ba, Barium CH ₄ DOC
	TDN Salinity
Additional Comments	Pump has the same variables as CTD rosette

Data File Details

Header	Description	Units	CanWIN Variable Name	Result Value Type	Result Value Qualifier	Formula or script applied	Statistic Applied
Leg	1 = Leg 1 of the 2018 Hudson Bay Amundsen Campaign 2 = Leg 2 of the 2018 Hudson Bay Amundsen Campaign “Churchill_Nelson_winter 2017” = 2017 Churchill River and Mobile Ice Survey, or 2017 Nelson Estuary and Landfast Ice Survey	None	None	Actual	NC	None	None
Cast	Cast number of the rosette	None	None	Actual			
date	Date the sample was collected	YYYY-MM-DD	None	Actual			
time	Time the sample was collected	HH-MM-SS	None	Actual			
year	Year the sample was collected	YYYY	None	Actual			
month	Month the sample was collected	MM	None	Actual			
day	Day the sample was collected	DD	None	Actual			

CanWIN Dataset Description

hour	Hour the sample was collected	HH	None	Actual			
minute	Minute the sample was collected	MM	None	Actual			
second	Second the sample was collected	SS	None	Actual			
lat	Latitude of the sample site	Decimal degrees	None	Actual			
lon	Longitude of the sample site	Decimal degrees	None	Actual			
Press_db	Pressure of the sample in decibars	dbar	Seawater pressure	Calculated			
Temp_degC	Temperature of sea water	°C	Temperature, water	Actual			
Trans_pct	Beam transmission	%	None	Actual			
Fluo_mg_m3	Fluorescence of sea water	mg m ⁻³	None	Calculated			
Sal_psu	Salinity of sea water	PSU (practical salinity unit)	Sea water practical salinity	Calculated			
Dens_kg_m3	Density	kg m ⁻³	None	Calculated			
Svan_m3_kg	Sound velocity	kg m ⁻³	None	Calculated			

CanWIN Dataset Description

N2_s2	Concentration of nitrogen gas	$\mu\text{mol L}^{-1}$	Total Nitrogen, mixed forms (NH3), (NH4), organic, (NO2) and (NO3)	Calculated			
Sigt_kg_m3	Density, sigma theta	kg m^{-3}	None	Calculated			
Temp_pot_degC	Potential temperature	$^{\circ}\text{C}$	Temperature, water	Calculated			
Sigthe_kg_m3	Density, sigma theta	kg m^{-3}	None	Calculated			
FreezT_degC	Freezing temperature of water	$^{\circ}\text{C}$	Temperature, water	Actual			
O2_μM	Concentration of oxygen gas	$\mu\text{mol L}^{-1}$	Oxygen	Calculated			
Cdom_mg_m3	Coloured dissolved organic matter	mg m^{-3}	CDOM	Calculated			
NO3_mmol_m3	Concentration of nitrate	mmol/m^3	Total Nitrogen, mixed forms (NH3), (NH4), organic,	Calculated			

CanWIN Dataset Description

			(NO2) and (NO3)				
Par_microeins_teins_m2_s	Photosynthetically active radiation/irradiance of sea water	$\mu\text{E m}^{-2} \text{ s}^{-1}$	Light, photosynthetic active radiation (PAR)	Calculated			
Spar_microeins_teins_m2_s	Photosynthetically active radiation	$\mu\text{E m}^{-2} \text{ s}^{-1}$	Light, photosynthetic active radiation (PAR)	Calculated			
Asal_g_kg	Absolute salinity	g/kg	Salinity	Calculated			
ConT_degC	Conductivity	$^{\circ}\text{C}$	Conductivity	Calculated			
D_ct_kg_m3	Density, CT	kg m^{-3}	None	Calculated			
D0ct_kg_m3	Density, CT	kg m^{-3}	None	Calculated			
Bottle	Bottle number of the rosette sample	n/a	None	Actual			
Salinity_averag	Average salinity from the guideline salinometer	PSU (practical salinity unit)	Salinity	Calculated			

CanWIN Dataset Description

Salinity_std_dev	Standard deviation of salinity from the guideline salinometer	PSU (practical salinity unit)	Salinity	Calculated			
d18O	Concentration of $\delta^{18}\text{O}$ of water sample relative to VSMOW	$\delta^{18}\text{O}/\text{ml}$	Oxygen	Calculated			
d18O_stddev	Standard deviation of concentration of $\delta^{18}\text{O}$ of water sample relative to VSMOW	$\delta^{18}\text{O}/\text{ml}$	Oxygen	Calculated			
d2H	Deuterium relative to VSMOW	Deuterium/ml	None	Calculated			
d2H_stddev	Standard deviation of deuterium relative to VSMOW	Deuterium/ml	None	Calculated			
DIC	Concentration of dissolved inorganic carbon of water sample	$\mu\text{mol}/\text{kg}$	Dissolved inorganic carbon	Calculated			
TA	Total alkalinity of water sample	$\mu\text{mol}/\text{kg}$	Alkalinity, total	Calculated			
pH	pH of water sample	pH	pH	Calculated			

CanWIN Dataset Description

fCO2	Fugacity of CO ₂ of water sample	µatm	Dissolved carbon dioxide (DCO)	Calculated		CO2sys_Calc Program: https://cdiac.eess-dive.lbl.gov/ftp/co2sys/	
pCO2	Partial pressure of CO ₂ of water sample	µatm	Dissolved carbon dioxide (DCO)	Calculated			

sat_cal	Ω (degree of saturation) for calcite of water sample	%	None	Calculated		None	
sat_arg	Ω (degree of saturation) for aragonite of water sample	%	None	Calculated			
d13C_DIC	Concentration of C ¹³ -DIC of water sample	C ¹³ -DIC/ml	Dissolved inorganic carbon	Calculated			
CH4	Concentration of CH ₄ of water sample	nmol/L	Total Nitrogen, mixed forms (NH ₃), (NH ₄), organic, (NO ₂) and (NO ₃)	Calculated			

CanWIN Dataset Description

N2O	Concentration of N2O of water sample	nmol/L	Inorganic nitrogen (ammonia, nitrate and nitrite)	Calculated			
DOC_mgL	Concentration of dissolved organic carbon of water sample	mg L ⁻¹	Dissolved organic carbon	Calculated			
TDN	Total dissolved nitrogen of water sample	mg L ⁻¹	Total dissolved nitrogen	Calculated			

Fsw	Seawater fractional contribution to water mass	Fraction out of 1, no units	None	Calculated			
Fmw	Meteoric freshwater fractional contribution to water mass	Fraction out of 1, no units	None	Calculated			
Fsim	Sea-ice melt fractional contribution to water mass	Fraction out of 1, no units	None	Calculated			
region	Manually assigned numeric values by David Capelle to stations from different regions of the bay.	None	None	Actual			

CanWIN Dataset Description

Stn_depth	Depth of the station from the surface	metres	Depth	Actual			
Max_depth	Maximum depth of the station from the surface	metres	Depth	Actual			
station	CanWIN name of the station	None	None	Actual			
SID	Sample ID used during cruise	None	None	Actual			
type	Water sample collection method	None	None	Actual			
rosette_cast_type	Cast type of the rosette	None	None	Actual			
Comments	Comments for samples	None	None	Blank Corrected			
NOTES	Notes for samples	None	None	Blank Corrected			

Table 2. Result Value Qualifier

CanWIN Short Code	Definition	User Code
\$	Incorrect sample container	
EFAI	Equipment failure, sample lost	
FEF	Field equipment failed	
FEQ	Field Equipment Questionable	

CanWIN Dataset Description

FFB	Failed. Field blank not acceptable	
FFD	Field Duplicate, failed	
FFS	Failed. Field spike not acceptable	
H	Holding time exceeded	
ISP	Improper Sample Preservation	
ITNA	Incubation time not attained	
ITNM	Incubation temperature not maintained	
JCW	Sample Container Damaged, sample lost	
NC	Not Collected	NaN, 0, or blank cell
ND	Not detected	
NR	Sample taken/measured on site but information in this field not collected	
NS	Sample collected but not submitted	
OC	Master Coordinate List Used	
P	Analysis requested and result pending	