

pmza_metadata_biogeochemistry

Project Name	Start Date	End Date	Lat range	Lon range
PMZA	2015-06-03	2017-05-17	48.6789 48.576	-68.55 -68.5942

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Citation:

Université du Québec à Rimouski. Aquatel Laboratory. (2023). Optical buoy of the Atlantic Zone Monitoring Program (PMZA-RIKI) 2015 to 2017: biogeochemistry data [Version 1.0] Data published on St. Lawrence Global Observatory-SLGO. [<https://slgo.ca>]. Access date: [YYYY-MM-DD].

Project Description:

The Atlantic Zone Monitoring Program (AZMP) of Fish and Oceans Canada (DFO), or Programme de Monitoring de la Zone Atlantique (PMZA), includes a network of autonomous oceanographic buoys across the coastal waters of the Maritime provinces of Canada. The station named PMZA-RIKI just in front of Rimouski was equipped with an autonomous buoy in 2002, including multispectral sensors dedicated to satellite validation of radiometric products. In 2015, a project was put in place to assess the quality of the radiometric measurements available at the station PMZA-RIKI in order to use these data for the validation of operational ocean color radiometric products. The station was visited on several occasions from 2015 to 2017 onboard DFO small (i.e. 30-foot length) craft boats. The database includes several datasets (csv files) related to water optical properties and water biogeochemistry. This particular dataset refers to the biogeochemistry parameters analyzed from water samples.

These datasets were partially presented in Belanger et al. 2017 where more details about the sampling and analysis strategies can be found.

- Bélanger, Simon and Carrascal-Leal, Claudia and Jaegler, Thomas and Larouche, Pierre and Galbraith, Peter, 2017. Assessment of radiometric data, *Journal of Atmospheric and Oceanic Technology*, 4:877-896, Volume 134, doi:10.1175/JTECH-D-16-0176.

Funders: Department of Fisheries and Oceans (DFO)

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data_dictionary_biogeochemistry_pmza.csv

Description:

The “data_dictionary_biogeochemistry_pmza.csv” file contains the description and units of all parameters included in each dataset (each csv file). Parameter’s names are based on SeaBass standardized field names when possible (<https://seabass.gsfc.nasa.gov/wiki/stdfields>).

Dataset Contact:

Name	Affiliation	Email
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Instruments:

NA

Sampling and Analysis:

NA

References:

NA

biogeochemistry_parameters_pmza.csv

Description:

Various biogeochemical parameters analyzed in the lab from water samples.

Start Date: 2015-06-03

End Date: 2017-05-17

Dataset Contact:

Name	Affiliation	Email
Carlos A.S. Araujo	UQAR	araujocas81@gmail.com

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
Salinometer	Guildline Portasal	8410A	
Autoanalyser	Bran and Luebbe	Autoanalyzer 3	
HPLC Analyser	Agilent Technologies	1200 series	
Fluorimeter	Tumer Design	TD10-AU	
TOC-Vcpn Carbon Analyser	Shimadzu	with TNM-1 module	
Flow Cytometer	Beckman Coulter	CytoFLEX	

Sampling and Analysis:

Sampling: Water samples were mainly collected with a Niskin bottle (or bucket) and were kept cool in a sun-protected container until further laboratory procedures.

Analytical procedure:

SALINITY: Salinity was measured using a Guildline Portasal model 8410A salinometer. The average of three readings was taken as the final value.

NUTRIENTS: Nutrients were analyzed by Jean-Éric Tremblay's team (Laval University, Québec, Canada). In Laval University, colorimetric determinations of nutrients were performed on an Autoanalyzer with routine methods (see Tremblay et al. 2008).

HPLC: Measurements of pigments were performed using High Performance Liquid Chromatography (HPLC) at ISMER, according to Zapata et al. (2000). Water samples were filtered and extracted, placed in the HPLC analyser and read with the EzChrome Elite Software, following the method in Galindo et al. (2017). Detection and quantification limits were estimated as described in Bidigare et al. (2005). Peaks having an area under 2000 mAU were eliminated because of identification difficulties. Some pigments where standards were absent from our database were considered as unknown and discarded from future analyses. Those unknowns were too scarce among the samples to allow proper identification. Reading of all pigments was done at 450 nm, except for phaeopigments, which were read at 412 nm because they are undetectable at 450 nm. A small variability was observed in retention time among the samples depending on the vial analyzed.

FLUORIMETER: Chlorophyll a and phaeopigments concentration in the water samples were measured in the lab with a Fluorimeter Turner Design 10-AU (Christian Nozais lab ISMER/UQAR). These parameters were measured following the filtration protocol described by Trees et al. (2002) on three samples for each sampling station. The final values are the average of those three readings, excluding those that exceeded 95% confidence interval. Then pigment concentrations are derived as recommended by Jeffrey and Humphrey (1975). Negative values for PHAEO for 5 samples (sample_id: pmza-56, 57, 58 and 79) were set to 0.

DOC / TOC / DN / TN: DOC concentration was measured in triplicates using a Shimadzu TOC-Vcph carbon analyzer equipped with a TNM-1 module (Total Nitrogen Measurement unit) simultaneously measuring the dissolved nitrogen concentration (DN, inorganic plus organic). The coefficient of variation on three replicates injections was typically <2% for DOC and <5% for DN.

FLOW CYTOMETRY: Cyanobacteria and prokaryotes were counted with a CytoFLEX flow cytometer (Beckman Coulter). For each analysis, duplicate 4 ml subsamples were fixed with glutaraldehyde in the dark room, flash-frozen and then stored at -80 degrees Celsius until analysis. See Belzile et al. (2008) and Kirk (1994).

SPM / PIM: SPM were measured according to Neukermans et al., (2012). Known volume of seawater was filtered in triplicate through pre-ashed and pre-weighed glass fiber filters at low vacuum. Each filter was then rinsed with Milli-Qwater, and dried prior to weighing under a dry atmosphere to obtain the SPM concentration. Organic matter loss on ignition (LOI) was determined after baking the filters for 3h at 500 degrees Celsius, weighed again, giving the concentration of particulate inorganic matter (PIM). The final values are considered the averages of the triplicate (excluding those that exceeded 95% confidence interval).

References:

- Belzile C. S, Brugel ., Nozais Y, Gratton and S Demers, 2008. Variations of the abundance and nucleic acid content of heterotrophic bacteria in Beaufort Shelf waters during winter and spring. *J. Mar. Syst.* 74: 946-956

- Bidigare RR, Van Heukelem L, Trees CC, 2005. Analysis of algal pigments by high-performance liquid chromatography. In: Andersen RA (ed) Algal culturing techniques. Elsevier Academic Press, Burlington, MA, p 327_346
- Galindo V, Gosselin M, Lavaud J, Mundy CJ and others, 2017. Pigment composition and photoprotection of Arctic sea ice algae during spring. *Mar Ecol Prog Ser* 585:49-69.
- Jeffrey SW and Humphrey GF, 1975. New spectrophotometric equations for determining chlorophylls a b c1 and c2 in higher plants algae and natural phytoplankton. *Biochem. Physiol. Pflanzen* 167 : 191-194
- Kirk JTO, 1994. Light and photosynthesis in aquatic ecosystems 2nd edition. Cambridge University Press. 509 p; Trees CC et al., 2002. Fluorometric Chlorophyll a : Sampling Laboratory Methods and Data Analysis Protocols. *Ocean Optics Protocols For Satellite Ocean Color Sensor Validation Revision 5 Vol. 5.*
- Neukermans, G, K Ruddick, H Loisel, and P Roose. 2012. "Optimization and Quality Control of Suspended Particulate Matter Concentration Measurement Using Turbidity Measurements." *Limnology and Oceanography: Methods* 10: 1011–23. <https://doi.org/10.4319/lom.2012.10.1011>.
- Tremblay J-E, Simpson K, Martin J, Miller L, Gratton Y, Barber D and Price NM, 2008. Vertical stability and the annual dynamics of nutrients and chlorophyll fluorescence in the coastal southeast Beaufort Sea *J. Geophys. Res.* 113 C07S90 [doi:10.1029/2007JC004547](https://doi.org/10.1029/2007JC004547)
- Zapata M, Rodriguez F and Garrido JL, 2000. Separation of chlorophylls and carotenoids from marine phytoplankton: a new HPLC method using a reversed phase C8 column and pyridine-containing mobile phases. *Marine Ecology Progress Series* 195: 29 to 45. <http://www.jstor.org/stable/24855008>

ad_long_pmza.csv

ag_long_pmza.csv

ap_long_pmza.csv

Description:

CDOM absorption coefficient (ag), particular absorption coefficient (ap) and non-algal particles absorption coefficient (ad, often called anap) measured in the lab from water samples. Refer to the “biogeochemistry_parameters_pmza.csv” dataset for additional parameters analyzed for the same water samples (based on “sample_id”) and/or station (based on “station_id”).

Start Date: 2015-06-03

End Date: 2017-05-17

Dataset Contact:

Name	Affiliation	Email
Carlos A.S. Araujo	UQAR	araujocas81@gmail.com

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
Spectrophotometer	Perkin Elmer	Lambda-850	Integrating sphere for particles

Sampling and Analysis:

Sampling: Water samples were mainly collected with a Niskin bottle (or bucket) and were kept cool in a sun-protected container until further laboratory procedures.

Analytical procedure: Ag, ap and ad were measured following the same method as described in Bélanger et al. 2017 and Araujo and Bélanger 2022. CDOM absorbance (ag) was measured with a Perkin Elmer double-beam Lambda-850 spectrophotometer using a 10 cm quartz cell between 220 and 800 nm against nano pure water. Measurements of ap and ad were done using the integrating sphere and the filter-pad technique described in Röttgers and Gehnke (2012) and Stramski et al. (2015).

References:

- Bélanger S, Carrascal-Leal C, Jaegler T, Larouche P, and Galbraith P, 2017. Assessment of Radiometric Data from a Buoy in the St. Lawrence Estuary. *Journal of Atmospheric and Oceanic Technology*. 34. 10.1175/JTECH-D-16-0176.1
- Carlos A.S. Araújo, Simon Bélanger, 2022. Variability of bio-optical properties in nearshore waters of the estuary and Gulf of St. Lawrence: Absorption and backscattering coefficients, *Estuarine, Coastal and Shelf Science*, Volume 264, 2022, 107688, ISSN 0272-7714, <https://doi.org/10.1016/j.ecss.2021.107688>.
- Röttgers, R, and S Gehnke. 2012. "Measurement of Light Absorption by Aquatic Particles: Improvement of the Quantitative Filter Technique by Use of an Integrating Sphere Approach." *App. Opt.* 51 (9): 1336–51.
- Stramski, D, R Reynolds, S Kaczmarek, J Uitz, and G Zheng. 2015. "Correction of Pathlength Amplification in the Filter-Pad Technique for Measurements of Particulate Absorption Coefficient in the Visible Spectral Region." *Appl. Opt.* 54 (22): 6763–82. <https://doi.org/10.1364/AO.54.006763>.