

BioGeoChemistry from R/V Blue Heron BH07-09, BH07-17, BH07-19, BH08-01, BH08-11, BH08-19 in Lake Superior from 2007-2008 (CARGO project)

Website: <https://www.bco-dmo.org/dataset/3690>

Version: 07 August 2012

Version Date: 2012-08-07

Project

» [Primary Production and Grazing Dynamics In the Ultra-Oligotrophic Waters of Lake Superior](#) (CARGO)

Program

» [Laurentian Great Lakes Ecosystem Studies](#) (Laurentian Great Lakes Ecosystem Studies)

Contributors	Affiliation	Role
Sternier, Robert W.	University of Minnesota Twin Cities (UMTC)	Principal Investigator, Contact
Brovold, Sandra	University of Minnesota Twin Cities (UMTC)	Technician
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Bio Geo Chemistry Data collected during 2007 and 2008

Cruises CARGO 1, CARGO 2, CARGO 3, CARGO 4, CARGO 5, CARGO 6

Methods & Sampling

[Detailed Acquisition and Processing Metadata for All Parameters](#)

Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sternier

See Individual Deployments/Data Info for cruise specific sampling notes

Data Processing Description

[Detailed Acquisition and Processing Metadata for All Parameters](#)

Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sternier

See Individual Deployments/Data Info for cruise specific sampling notes

BCO-DMO Processing/Edits

- Data generated from original files:

"2007 Great Lakes Biogeochem Data submitted.xlsx, Sheet: Data"

"2008 Great Lakes Biogeochem Data submitted.xlsx, Sheet: Data"

contributed by Bob Sterner

- 2007 and 2008 data combined to create one CARGO BioGeoChem dataset
- Date reformatted to YYYYMMDD
- LATITUDE/LONGITUDE columns added and values for these inserted from Standard Stations dataset
- Parameter names modified to conform to BCO-DMO conventions (blanks to underscores, etc.)
- Parameter WATER_DEPTH changed to SAMPLE_DEPTH
- Parameter "sed/core/water" changed to SAMPLE_TYPE
- Spaces in CRUISE CODES removed
- Station CD-1 changed to CD1 for compatibility with stations list and other datasets
- "nd" (no data) value inserted in blank cells

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Data Files

File
CARGO_BioGeoChem_StnSort.csv (Comma Separated Values (.csv), 346.67 KB) MD5:ef1dd0ef29011e63b9f3147ac2998ed1
Primary data file for dataset ID 3690

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Parameters

Parameter	Description	Units
LOG_NUMBER	A unique internal sample identifier	Dimensionless
CRUISE_CODE	Name of cruise when sample was taken	Dimensionless
SAMPLE_DATE	Date sample was taken from lake	YYYYMMDD
STATION	Station occupied when sample was taken	Dimensionless
LATITUDE	Station Latitude from Standard Stations Dataset (South is negative)	Decimal degrees
LONGITUDE	Station Longitude from Standard Stations Dataset (West is negative)	Decimal degrees
SAMPLE_DEPTH	Depth sample was taken.	m
FRACTION	Pore size of filter used to fractionate before sample collection.	m * 10 ⁻⁶
STORAGE	Method of sample preservation	Dimensionless
VOL_FILT	Volume of sample filtered.	MI
REP	Integer value; replicate number.	Dimensionless
SAMPLE_TYPE	Type of sample (sed/core/water)	Dimensionless
DIC	Dissolved inorganic carbon.	mg/L
DOC	Dissolved organic carbon	mg/L
TN	Total nitrogen	mg/L
TDN	Total dissolved nitrogen.	mg/L
Probe_pH	Hydrogen ion activity (pH)	Dimensionless
SRSi	Soluble reactive silica	mg/L
POC	Particulate Organic Carbon	ug/L
PON	Particulate Organic Nitrogen	ug/L
PP	Particulate phosphorus	uM
Chl_a	Chlorophyll A	ug/L
NO3	Nitrate	uM
NH4	Ammonium	uM

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Instruments

Dataset-specific Instrument Name	Bottom Sediment Grab Samplers
Generic Instrument Name	Bottom Sediment Grab Samplers
Dataset-specific Description	Ponar Sampler Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	These samplers are designed to collect an accurate representative sample of the sediment bottom. The bite of the sampler should be deep enough so all depths are sampled equally. The closing mechanism is required to completely close and hold the sample as well as prevent wash-out during retrieval. Likewise, during descent the sampler should be designed to minimize disturbance of the topmost sediment by the pressure wave as it is lowered to the bottom.

Dataset-specific Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Sea-Bird SBE 9 Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Lachat Flow Injection Analyzer
Generic Instrument Name	Flow Injection Analyzer
Dataset-specific Description	Lachat flow injection analyzer Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

Dataset-specific Instrument Name	Turner 10-AU Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Turner 10-AU Fluorometer Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Multi Corer
Generic Instrument Name	Multi Corer
Dataset-specific Description	Multicorer Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in <i>Oceanologica Acta</i> , 7, pp. 399-408.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
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	Perkin Elmer 2400 CHN Analyzer
Generic Instrument Name	Particulate Organic Carbon/Nitrogen Analyzer
Dataset-specific Description	Perkin Elmer 2400 CHN Analyzer Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	A unit that accurately determines the carbon and nitrogen concentrations of organic compounds typically by detecting and measuring their combustion products (CO ₂ and NO).

Dataset-specific Instrument Name	TNM-1 Attachment
Generic Instrument Name	Total Nitrogen Analyzer
Dataset-specific Description	Shimadzu VCSH TNM-1 Attachment Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	A unit that accurately determines the nitrogen concentrations of organic compounds typically by detecting and measuring its combustion product (NO). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/totalnit.pdf

Dataset-specific Instrument Name	Shimadzu VCSH
Generic Instrument Name	Total Organic Carbon Analyzer
Dataset-specific Description	Shimadzu VCSH Detailed Acquisition and Processing Metadata for All Parameters Metadata generated from original file "2007 Great Lakes Biogeochem Data.xlsx, Sheet: Metadata" contributed by Bob Sterner See Individual Deployments/Data Info for cruise specific sampling notes
Generic Instrument Description	A unit that accurately determines the carbon concentrations of organic compounds typically by detecting and measuring its combustion product (CO2). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/bs116.pdf

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Deployments

BH07-09

Website	https://www.bco-dmo.org/deployment/58792
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-09_CARGO1_Synopsis.pdf
Start Date	2007-07-30
End Date	2007-08-01
Description	<p>Cruise Name: CARGO 1 Dates: 30 July - 01 August 2007 Vessel: R/V Blue Heron UNOLS Cruise ID: BH07-09 (Not verified srg/13April2012) First cruise on Sea Grant project on production and grazing. The lake was stratified and a DCM was present. Participants: Sterner, Brovold, Seegers, Jeyasingh, and Stark</p> <p>Methods & Sampling Refer to BH07-09 CARGO 1 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-09_CARGO1_Sy... CARGO 1 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

BH07-17

Website	https://www.bco-dmo.org/deployment/58793
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-17_CARGO2_Synopsis.pdf
Start Date	2007-10-05
End Date	2007-10-07
Description	<p>Cruise Name:CARGO 2 Dates: 05 - 07 October 2007 Vessel: R/V Blue Heron UNOLS Cruise ID: BH07-17 (Not verified srg/13April2012) Participants: R. Sterner, et al</p> <p>Methods & Sampling Refer to BH07-17 CARGO 2 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to <a _blank">http:="" bcodata.whoi.edu="" bh07-17_cargo2_sy..."="" href="http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-17_CARGO2_Sy...target=" laurentiangreatlakes_chemistry="">http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-17_CARGO2_Sy... target="_blank">BH07-17 CARGO 2 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

BH07-19

Website	https://www.bco-dmo.org/deployment/58794
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-19_CARGO3_Synopsis.pdf
Start Date	2007-11-07
End Date	2007-11-09
Description	<p>Cruise Name:CARGO 3 Dates: 07 - 09 November 2007 Vessel: R/V Blue Heron UNOLS Cruise ID: BH07-19 (Not verified srg/13April2012) Participants: Sterner (Chief Scientist), Brovold, Seegers, Michelle McCrackin (ASU)</p> <p>Methods & Sampling Refer to BH07-19 CARGO 3 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH07-19_CARGO3_Sy... CARGO 3 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

BH08-01

Website	https://www.bco-dmo.org/deployment/58795
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-01_CARGO4_Cruise_Outline.pdf
Start Date	2008-04-29
End Date	2008-05-01
Description	<p>Cruise Name:CARGO 4 Dates: 29 April - 01 May 2008 Vessel: R/V Blue Heron UNOLS Cruise ID: BH08-01 (Not verified srg/13April2012) Participants: R. Sterner, et al</p> <p>Methods & Sampling Refer to BH08-01 CARGO 4 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to <a _blank">"="" href="http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-01_CARGO4_Cr...target=">http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-01_CARGO4_Cr...target="_blank">BH08-01 CARGO 4 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

BH08-11

Website	https://www.bco-dmo.org/deployment/58796
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-11_CARGO5_Cruise_Outline.pdf
Start Date	2008-07-30
End Date	2008-08-01
Description	<p>Cruise Name:CARGO 5 Dates: 30 July - 01 August 2008 Vessel: R/V Blue Heron UNOLS Cruise ID: BH08-11 (Not verified srg/13April2012) Participants: R. Sterner, et al</p> <p>Methods & Sampling Refer to BH08-11 CARGO 5 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to <a _blank">"="" href="http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-11_CARGO5_Cr...target=">http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-11_CARGO5_Cr...target="_blank">BH08-11 CARGO 5 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

BH08-19

Website	https://www.bco-dmo.org/deployment/58797
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-19_CARGO6_Cruise_Outline.pdf
Start Date	2008-09-16
End Date	2008-09-18
Description	<p>Cruise Name: CARGO 6 Dates: 16 - 18 September 2008 Vessel: R/V Blue Heron UNOLS Cruise ID: BH08-19 (Not verified srg/13April2012) Participants: R. Sterner, et al</p> <p>Methods & Sampling Refer to BH08-19 CARGO 6 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p> <p>Processing Description Refer to http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH08-19_CARGO6_Cr... target="_blank">BH08-19 CARGO 6 Cruise Synopsis for detailed descriptions of acquisition and processing methodologies</p>

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Project Information

Primary Production and Grazing Dynamics In the Ultra-Oligotrophic Waters of Lake Superior (CARGO)

Website: <http://www.tc.umn.edu/~stern007/>

Coverage: Lake Superior

PRIMARY PRODUCTION AND GRAZING DYNAMICS IN THE ULTRA-OLIGOTROPHIC WATERS OF LAKE SUPERIOR ("CARGO" which stands for CARbon Gain and IOss)

All higher organisms including fish ultimately rely on carbon fixed by primary production for their growth. A major gap in our understanding of Lake Superior lies in a highly incomplete knowledge of the rates primary production and grazing in the lake's waters. This data gap impedes the progress of scientific understanding of the lake on many fronts. Primary production is the foundation for all food webs and is a large, perhaps the largest, term in the lake's carbon cycle. Over the years, there have been but a small handful of investigators who have measured primary production in this, Earth's largest lake by area. Attempts to construct comprehensive carbon budgets using literature values for major terms such as DOC import, sedimentation, etc. indicate a large imbalance in the C cycle in the lake. According to current best estimates, organic carbon disappears at much faster rate (14-40, Cotner et al. 2005) or (13-81, Urban et al. 2005) than its rate of input (5.3 Tg/y, Cotner et al. 2004) or (3-8 Tg/y, Urban et al. 2005) (all values in Tg/y). The budget is out of balance by a factor of about 2 to 27. Unless the lake is metabolizing vast quantities of old, "fossilized" carbon (implausible), current out-of-balance budgets must be wrong, meaning we do not have good estimates for one or more of these fundamental processes in the lake.

Of the possible terms in the carbon budget of the lake, a focus on primary production is appropriate because of the large magnitude of this term plus the dearth of actual measurements that have been performed and the many untested assumptions that lurk behind those few measurements. At the same time, a major loss of particulate organic carbon has been almost entirely ignored until now. That loss is the grazing rate, the rate of consumption of lake particles (including bacteria and algae) by living organisms in the water column. As Banse (2002) has described for the oceans, though physical mixing and sinking contribute to the dynamics of phytoplankton and other small planktonic organisms, it is principally production and grazing which determine dynamics. To a first approximation, the rate of change of phytoplankton is equal to the difference between production and grazing.

This project comprises a two-year study that will focus on primary production and grazing in the world's largest lake by area. Primary production will be measured using ¹⁴C additions to shipboard incubations using a photosynthetron device. P-I curves plus other data will be used as input for numerical models of areal production. Production numbers so obtained will be compared to in situ incubations. Grazing assays will be based on the dilution series methods developed by Landry and Hassett (1982) and since employed by many others, including myself and my students; this method provides an overall measure of in situ particle turnover.

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Program Information

Laurentian Great Lakes Ecosystem Studies (Laurentian Great Lakes Ecosystem Studies)

Website: <http://www.tc.umn.edu/~stern007/>

Coverage: Laurentian Great Lakes

A series of studies concerned with the chemistry and biology of the Laurentian Great Lakes. These different studies share a focus on the dynamics of organic pools of carbon, nitrogen and phosphorus, and the stoichiometric linkages among these elements. At different times, work also has focused on trace metal dynamics and interactions with biota, the rates of primary production and herbivory, rates and patterns of primary productivity, and the century-long, steady trend of increasing nitrate in Earth's largest lake by area. Microbial populations have been investigated and linked to these chemical properties.

This Program was created by BCO-DMO staff to bring various Laurentian Great Lakes Research projects under one umbrella for improved discovery and access.

Dates: 1998 - 2014

Funding: NSF/OCE and Minnesota Sea Grant

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Funding

Funding Source	Award
Minnesota Sea Grant (MN Sea Grant)	unknown CARGO MN Sea Grant

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