Standard Stations - SINC from R/V Blue Heron cruises BH09-SINC1, BH10-01, BH10-06, BH10-13, and BH10-22 in the Lake Superior from 2009 to 2010 (SINC project)

Website: https://www.bco-dmo.org/dataset/3681
Version: 03 August 2012
Version Date: 2012-08-03

Project
» Sources and Sinks of Stoichiometrically Imbalanced Nitrate in the Laurentian Great Lakes (SINC)

Program
» Laurentian Great Lakes Ecosystem Studies (Laurentian Great Lakes Ecosystem Studies)

Contributors	Affiliation	Role
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Table of Contents

- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Parameters
- Deployments
- Project Information
- Program Information
- Funding

Dataset Description

The project research team identified named sampling locations to facilitate repeat occupation of those locations and develop time-series data sets.

This is the list of all the standard stations occupied during the SINC Project.

No attempt is made to make them cruise specific so any of the SINC deployments will return all of the SINC stations occupied.

Cruise specific station locations can be retrieved from datasets such as CTD Profiles or BioGeoChem using the CruiseId or CRUISE_CODE.

Methods & Sampling

Complied by Sterner, et al

Data Processing Description

The list of repeat sampling locations was contributed originally as an Excel spreadsheet. Some information was moved to the notes field, and negative signs prepended to longitudes to make them compatible with BCO-DMO database conventions.

BCO-DMO Edit History:
- Added station CH3 (occupied on CARGO2). Using lat/lon from Sterner e-mail - 03August2012/srg
- Added "Project" column identifying on which project(s) the station was occupied - 27July2012/srg
- Added station CB. Using Lat/Lon from CTD profile data - 25July2012/srg
- Added stations Grab 01 - Grab 10 and UMW from Sterner e-mail - 14June2012/srg
- Corrected Latitude position(degs) for WM7 (48 -> 46) - 07June2012/srg
- Changed stations Sterner A thru G to STE-A thru STE-G - 07June2012/srg
- Added stations UW1 - UW15, GRAB #9, GRAB #10 - 06June2012/srg
- Added station GRAB5 - 06March2012/srg

[table of contents | back to top]

Data Files

File
Standard_Stations_Project.csv (Comma Separated Values (.csv), 1.56 KB) MD5:12e8462766a10af23d3c39168420d19c Primary data file for dataset ID 3681

[table of contents | back to top]

Parameters

Parameter	Description	Units
Lake_location	name of the lake	dimensionless
Station	Name of the standard station location.	dimensionless
lat	latitude in decimal degrees (positive is North)	decimal degrees
lon	longitude in decimal degrees (negative is West)	decimal degrees
water_col_depth	estimated depth of the water column at location	meters
dist_to_land	distance to land from location; estimated using Google Earth	kilometers
notes_and_comments	notes and comments	dimensionless
Project	Project or Projects on which the standard station was occupied for sampling	dimensionless

[table of contents | back to top]

Deployments

BH09-SINC1

Website	https://www.bco-dmo.org/deployment/58798
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH09-SINC1_Cruise_synopsis.pdf
Start Date	2009-11-10
End Date	2009-11-12
Description	Cruise Name: SINC 1 Dates: 10 - 12 November 2009 Vessel: R/V Blue Heron UNOLS Cruise ID: (tbd) Participants: R. Sterner, S. Brovold, Aaron Myers, Brenda Scott, Nick Sterner

BH10-01

Website	https://www.bco-dmo.org/deployment/58774
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH10-01_SINC5_synopsis.pdf
Start Date	2010-05-14
End Date	2010-05-16
Description	Cruise Name: SINC 5 Dates: May 14-16, 2010 Vessel: R/V Blue Heron UNOLS Cruise ID: BH10-01 Participants: R. Sterner, B. Beall, S. Brovold, S. Queen, B. Scott, C. Small Cruise information and original data are available from the NSF R2R data catalog.

BH10-06

Website	https://www.bco-dmo.org/deployment/58775
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH10-06_SINC6_synopsis.pdf
Start Date	2010-06-25
End Date	2010-06-27
Description	Cruise Name: SINC 6 Dates: June 25-27, 2010 Vessel: R/V Blue Heron UNOLS Cruise ID: BH10-06 (Not verified srg/13April2012) Participants: R. Sterner, B. Beall, S. Brovold, O. Kutovaya, C. Small, H. Carrick Cruise information and original data are available from the NSF R2R data catalog.

BH10-13

Website	https://www.bco-dmo.org/deployment/58776
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH10-13_SINC10_synopsis.pdf
Start Date	2010-08-18
End Date	2010-08-20
Description	Cruise Name: SINC 10 Dates: August 18-20, 2010 Vessel: R/V Blue Heron UNOLS Cruise ID: BH10-13 Participants: J. Finlay, G. Bullerjahn, S. Brovold, C. Small, B. Scott, M. Mukherjee Cruise information and original data are available from the NSF R2R data catalog.

BH10-22

Website	https://www.bco-dmo.org/deployment/58773
Platform	R/V Blue Heron
Report	http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/BH10-22_SINC11_synopsis.pdf
Start Date	2010-10-05
End Date	2010-10-07
Description	Cruise Name: SINC 11 Dates: October 05-07, 2010 Vessel: R/V Blue Heron UNOLS Cruise ID: BH10-22 Participants: R. Sterner, H. Carrick, S. Brovold, C. Small, B. Scott, B. Beall Cruise information and original data are available from the NSF R2R data catalog.

[table of contents | back to top]

Project Information

Sources and Sinks of Stoichiometrically Imbalanced Nitrate in the Laurentian Great Lakes (SINC)

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

Coverage: Lake Superior; Great Lakes

This award is funded under the American Recovery and Reinvestment Act of 2009 (Public Law 111-5).

Over large scales encompassing heterogeneous conditions, biogeochemical mechanisms act to achieve a stoichiometric balance between nitrogen and phosphorus. Locally, however, imbalances can develop. The Laurentian Great Lakes are a vast freshwater system where nitrate has been steadily accumulating for decades. Previous work has shown that in Lake Superior, the headwaters of the system, nitrate enters the lake water primarily due to in-lake biogeochemical processes, not due to passive accumulation of nitrate as a conservative substance as previously believed. An extreme stoichiometric imbalance of nitrate/phosphate ratios (~ 10,000 by moles) is present and is apparently growing. This set of prior findings opens up two major questions. First, what are the principal biogeochemical control points that tip the N cycle toward buildup of excess nitrate? And second, how does the extreme stoichiometric imbalance affect the ecology and evolution of Lake Superior's biota?

In this project, researchers at the University of Minnesota - Twin Cities and the Bowling Green State University, who previously documented the nitrate buildup in Lake Superior, will continue their research program and address these two questions. The project is organized around making comparative measurements of N assimilation, nitrification, denitrification, anammox, and microbial community structure in Lake Superior and in the central basin of Lake Erie. These two environments differ greatly in many ways including redox state and organic carbon production rates. From the standpoint of N balancing mechanisms, they can be considered end members within the Laurentian Great Lakes. Additional data will be collected across a larger region of the Upper Great Lakes including Lake Huron. Up-to-date mass balance budgets of nitrogen of the most of the Great Lakes (Lake Superior is already done) will be constructed and linked with hydrologic fluxes to gain insights into the dynamics of N across the entire Laurentian Great Lakes System. Observations of water chemistry will be made with ship-board sampling together with field-deployed nitrate sensors in shallow and deep waters. Process studies will be performed in the water column and at the sediment-water interface and will involve sensitive stable isotope techniques. These will include measurements of NO3 and NH4+ uptake into different size fractions, exchanges of different forms of N and C between the water column and sediments, nitrification, denitrification, and anammox. The diversity and abundance of ammonia oxidizing Archea (AOA) and bacteria (AOB) will be studied using quantitative real time PCR and DGGE. Similarly, the genetic composition of denitrifyers and anammox bacteria will be studied to see if they too are represented by novel clades in Lake Superior. Cultured nitrifyers will be characterized in terms of growth under different conditions typically encountered across the Great Lakes. The project will yield valuable information and insight into the operation of the nitrogen cycle under conditions that promote stoichiometric imbalances.

Previous work (2004-2007) by this team of investigators and others investigated the intersection of the nitrogen cycle with the phosphorus and iron cycles in Lake Superior and included studying the responses of plankton communities to differing nutrient supply regimes. Prior to 2004, many of the same investigators

conducted research on the existence, mechanisms, spatial-temporal extent, and significance of trace metal limitation to primary production in Lake Superior. This early research was designed to quantify and characterize total and bioactive trace metal concentrations of Al, Fe, Mn, Zn, Cu, Cd, and Co in Lake Superior. The project included immunological and fluorescence assays to assess metal deficiency in algae in the natural environment and trace metal enrichment experiments in the laboratory to assess limitation experimentally.

The Laurentian Great Lakes are a valuable regional resource and an immense reservoir of planetary fresh water. Lake Superior is often considered to be relatively pristine but the ultimate source of the N converted to nitrate in the lake is as yet unknown and may involve past changes to the watershed or other anthropogenic factors.

[table of contents | back to top]

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

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927512
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927277

[table of contents | back to top]