CTD profiles from the Great Lakes, North America collected during various R/V Blue Heron cruises between 2009-2012 (SINC project)

Website: https://www.bco-dmo.org/dataset/3632
Data Type: Cruise Results
Version:
Version Date: 2016-08-24

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
Sterner, Robert W.	University of Minnesota Twin Cities (UMTC)	Principal Investigator, Contact
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Coverage

Spatial Extent: **N**:49.997 **E**:-79.894 **S**:41.733 **W**:-92.05
Temporal Extent: 2009-11-10 - 2012-08-17

Dataset Description

This dataset contains CTD profile data collected during R/V Blue Heron cruises in the Great Lakes, North America.

Methods & Sampling

CTD casts were conducted during R/V Blue Heron cruises at designated stations.

Data Processing Description

BCO-DMO Processing Notes
- Generated from original .asc and .xlxs (SINC 6) files contributed by Bob Sterner
- Upcast data removed from original files
- Awk written to reformat original files
- AWK: SINC[x]_CTDasc_2_BCODMO.awk
- Header data (parameter names) for CTD data generated from .hdr files
- Space delimited reformatted to tab delimited
- All records with "#" or "*" ignored
- Blank lines ignored
- BCO-DMO header o/p from routine
- Parameter "sbeox0_Mn" corrected to "sbeox0_Mm" 20July2012/srg
- Dataset generated with parameters common to all cruises 20July2012/srg

Second set of files:
-variable names changed to normalize to BCO-DMO standards
-units included for all variables
- station "michipictoen" lat/lon updated using the ctd lat lon value

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Data Files

File
SINC_CTD.csv (Comma Separated Values (.csv), 134.45 MB) MD5:172d8678df6c98a799c97f1e0f50c4f0 Primary data file for dataset ID 3632

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Parameters

Parameter	Description	Units
CruiseId	Cruise Id	text
Station	Station - From Station List	text
Date	Station date (GMT)	YYYYMMDD
Time	Station time (GMT)	HHMMSS
Lat	Station latitude (South is negative)	decimal degrees
Lon	Station longitude (West is negative)	decimal degrees
press	Pressure digiquartz SBE 9+ SeaBird documentaion for converting pressure in decibars to depth in meters available at: http://www.seabird.com/application_notes/AN69.htm Formula for fresh water: depth (meters) = pressure (decibars) * 1.019716	decibars
temp	Temperature ITS-90 SBE 3+	degrees C
cond	Conductivity SBE 4C	microSiemens per centimeter
cond_spec	Specific Conductance SBE 4C	microSiemens per centimeter
beam_trans	Beam Transmission Chelsea/Seatech/WET Labs Cstar	percentage
fluor	Fluorescence Wetlabs Wetstar WS3S	milligrams per cubic meters
CDOM	CDOM = colored dissolved organic matter Wetlabs Wetstar WSCD	milligrams per cubic meters
PAR	PAR/Irradiance = Photosynthetically available radiation Biospherical QSP-200L	microEinsteins per square centimeters per second
sPAR	Surface Photosynthetially Available Radiation	microEinsteins per square centimeters per second
O2_mg_L	Dissolved Oxygen SBE43	milligrams per liter
O2_sat	Dissolved Oxygen percent saturation	percentage
sal	Salinity SBE 4C	PSU
lat_ctd	Data latitude (South is negative) from the CTD	decimal degrees
lon_ctd	Data longitude (West is negative) from the CTD	decimal degrees
flag	Flag calculated by software	integer
O2_umol_kg	Dissolved oxygen in micromoles per kilogram	micromoles per kilogram
ISO_DateTime_UTC	Date/Time (UTC) in ISO format YYYY-MM-DDTHH:MM:SS[.xx]	unitless

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
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	wetstar WSCD
Generic Instrument Name	Fluorometer
Dataset-specific Description	Wetlabs Wetstar WSCD
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	Wetstar WS3S
Generic Instrument Name	Fluorometer
Dataset-specific Description	Wetlabs Wetstar WS3S
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	Biospherical QSP-200L
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Generic Instrument Description	A PAR sensor measures photosynthetically available (or active) radiation. The sensor measures photon flux density (photons per second per square meter) within the visible wavelength range (typically 400 to 700 nanometers). PAR gives an indication of the total energy available to plants for photosynthesis. This instrument name is used when specific type, make and model are not known.

Dataset-specific Instrument Name	SBE 4C
Generic Instrument Name	Salinity Sensor
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

Dataset-specific Instrument Name	SBE 43 Dissolved Oxygen Sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	SBE 43
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	SBE 3+
Generic Instrument Name	Sea-Bird SBE-3 Temperature Sensor
Generic Instrument Description	The SBE-3 is a slow response, frequency output temperature sensor manufactured by Sea-Bird Electronics, Inc. (Bellevue, Washington, USA). It has an initial accuracy of +/- 0.001 degrees Celsius with a stability of +/- 0.002 degrees Celsius per year and measures seawater temperature in the range of -5.0 to +35 degrees Celsius. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	
Generic Instrument Name	Transmissometer
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

Dataset-specific Instrument Name	SBE 9+
Generic Instrument Name	Water Depth Logger
Generic Instrument Description	For measuring and recording water levels in rivers, streams, and wells.

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Deployments

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. **Methods & Sampling** * Sea-Bird SBE 9 Data File: * FileName = C:SeasaveRawCTD_2010Sterner_MayCD1_02.hex * Software Version Seasave V 7.20c * Temperature SN = 2723 * Conductivity SN = 2271 * Number of Bytes Per Scan = 34 * Number of Voltage Words = 5 * Number of Scans Averaged by the Deck Unit = 1 * System UpLoad Time = May 14 2010 13:32:16 * NMEA Latitude = 47 03.50 N * NMEA Longitude = 091 24.77 W * NMEA UTC (Time) = May 14 2010 18:32:12 * Store Lat/Lon Data = Append to Every Scan ** Ship: ** Station: ** Operator: # nquan = 15 # nvalues = 36024 # units = specified # name 0 = prDM: Pressure, Digiquartz [db] # name 1 = t090C: Temperature [ITS-90, deg C] # name 2 = c0uS/cm: Conductivity [uS/cm] # name 3 = specc: Specific Conductance [uS/cm] # name 4 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%] # name 5 = wetStar: Fluorescence, Wetlab Wetstar [mg/m^3] # name 6 = dz/dtM: Descent Rate [m/s] # name 7 = ph: pH # name 8 = par: PAR/Irradiance, Biospherical/Licor # name 9 = sal00: Salinity [PSU] # name 10 = sbeox0Mm/Kg: Oxygen, SBE 43 [umol/Kg] # name 11 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l] # name 12 = wetCDOM: Fluorescence, Wetlab CDOM [mg/m^3] # name 13 = scan: Scan Count # name 14 = flag: 0.000e+00 # span 0 = 0.809, 220.882 # span 1 = 2.9832, 3.4509 # span 2 = 56.427799, 59.041880 # span 3 = 100.619, 105.090 # span 4 = 89.1379, 93.8012 # span 5 = 0.7316, 3.6803 # span 6 = -0.723, 0.668 # span 7 = 7.839, 8.003 # span 8 = 1.0000e-12, 2.5855e+03 # span 9 = 0.0434, 0.0454 # span 10 = 0.000, 0.000 # span 11 = 0.00000, 0.00000 # span 12 = 1.1320, 5.3762 # span 13 = 1, 36024 # span 14 = 0.0000e+00, 0.0000e+00 # interval = seconds: 0.0416667 # start_time = May 14 2010 13:32:16 # bad_flag = -9.990e-29 # sensor 0 = Frequency 0 temperature, 2723, 24 Feb 2010 # sensor 1 = Frequency 1 conductivity, 2271, 24 Feb 2010, cpcor = -9.5700e-08 # sensor 2 = Frequency 2 pressure, 75869, 31 Mar 2009 # sensor 3 = Extrnl Volt 0 Oxygen, SBE, primary, 0471, 07-Apr-10p # sensor 4 = Extrnl Volt 1 WET Labs, CDOM # sensor 5 = Extrnl Volt 2 pH, 270135, 18 Mar 2010 # sensor 6 = Extrnl Volt 3 oxidation reduction potential, 270135, 30 Mar 2009 # sensor 7 = Extrnl Volt 4 transmissometer, primary, CST-268PR, 25 Mar 2010 # sensor 8 = Extrnl Volt 5 WET Labs, WETStar fluorometer, WS3S-553P, 7 Apr 2010 # sensor 9 = Extrnl Volt 6 altimeter # sensor 10 = Extrnl Volt 7 irradiance (PAR), primary, 4554, 23 Feb 2010 # sensor 11 = Extrnl Volt 9 surface irradiance (SPAR), degrees = 0.0 # datcnv_date = May 16 2010 17:06:59, 5.37e # datcnv_in = C:SeasaveRawCTD_2010Sterner_MayCD1_02.hex C:SeasaveConfiguration Files2010CTDCon2010_alpha.con # datcnv_skipover = 0 # file_type = ascii *END* **Processing Description** These data have not been processed

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. **Methods & Sampling** * Sea-Bird SBE 9 Data File: * FileName = C:SeasaveRawCTD_2010Sterner_JuneCD1_01.hex * Software Version Seasave V 7.20c * Temperature SN = 2723 * Conductivity SN = 2271 * Number of Bytes Per Scan = 34 * Number of Voltage Words = 5 * Number of Scans Averaged by the Deck Unit = 1 * System UpLoad Time = Jun 25 2010 13:23:21 * NMEA Latitude = 47 03.89 N * NMEA Longitude = 091 25.77 W * NMEA UTC (Time) = Jun 25 2010 18:22:09 * Store Lat/Lon Data = Append to Every Scan ** Ship: ** Station: ** Operator: # nquan = 15 # nvalues = 34501 # units = specified # name 0 = prDM: Pressure, Digiquartz [db] # name 1 = t090C: Temperature [ITS-90, deg C] # name 2 = c0uS/cm: Conductivity [uS/cm] # name 3 = specc: Specific Conductance [uS/cm] # name 4 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%] # name 5 = wetStar: Fluorescence, Wetlab Wetstar [mg/m^3] # name 6 = dz/dtM: Descent Rate [m/s] # name 7 = ph: pH # name 8 = par: PAR/Irradiance, Biospherical/Licor # name 9 = sal00: Salinity [PSU] # name 10 = sbeox0Mm/Kg: Oxygen, SBE 43 [umol/Kg] # name 11 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l] # name 12 = wetCDOM: Fluorescence, Wetlab CDOM [mg/m^3] # name 13 = scan: Scan Count # name 14 = flag: 0.000e+00 # span 0 = 0.544, 246.599 # span 1 = 3.5446, 12.1537 # span 2 = 57.553451, 74.092591 # span 3 = 97.475, 103.067 # span 4 = 82.4021, 94.2416 # span 5 = 0.6584, 7.6547 # span 6 = -0.591, 0.352 # span 7 = 7.828, 8.185 # span 8 = 1.0000e-12, 1.6487e+03 # span 9 = 0.0437, 0.0480 # span 10 = 0.000, 0.000 # span 11 = 0.00000, 0.00000 # span 12 = 0.9777, 1.9037 # span 13 = 1, 34501 # span 14 = 0.0000e+00, 0.0000e+00 # interval = seconds: 0.0416667 # start_time = Jun 25 2010 13:23:21 # bad_flag = -9.990e-29 # sensor 0 = Frequency 0 temperature, 2723, 24 Feb 2010 # sensor 1 = Frequency 1 conductivity, 2271, 24 Feb 2010, cpcor = -9.5700e-08 # sensor 2 = Frequency 2 pressure, 75869, 31 Mar 2009 # sensor 3 = Extrnl Volt 0 Oxygen, SBE, primary, 0471, 07-Apr-10p # sensor 4 = Extrnl Volt 1 WET Labs, CDOM # sensor 5 = Extrnl Volt 2 pH, 270135, 18 Mar 2010 # sensor 6 = Extrnl Volt 3 oxidation reduction potential, 270135, 30 Mar 2009 # sensor 7 = Extrnl Volt 4 transmissometer, primary, CST-268PR, 25 Mar 2010 # sensor 8 = Extrnl Volt 5 WET Labs, WETStar fluorometer, WS3S-553P, 7 Apr 2010 # sensor 9 = Extrnl Volt 6 altimeter # sensor 10 = Extrnl Volt 7 irradiance (PAR), primary, 4554, 23 Feb 2010 # sensor 11 = Extrnl Volt 9 surface irradiance (SPAR), degrees = 0.0 # datcnv_date = Jun 27 2010 14:26:52, 5.37e # datcnv_in = C:SeasaveRawCTD_2010Sterner_JuneCD1_01.hex C:SeasaveConfiguration Files2010CTDCon2010_alpha.con # datcnv_skipover = 0 # file_type = ascii *END* **Processing Description** These data have not been processed

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. **Methods & Sampling** * Sea-Bird SBE 9 Data File: * FileName = C:SeasaveRawCTD_2010Sterner_AugustCD1_01.hex * Software Version Seasave V 7.20c * Temperature SN = 2723 * Conductivity SN = 2271 * Number of Bytes Per Scan = 34 * Number of Voltage Words = 5 * Number of Scans Averaged by the Deck Unit = 1 * System UpLoad Time = Aug 18 2010 10:58:13 * NMEA Latitude = 47 03.91 N * NMEA Longitude = 091 26.30 W * NMEA UTC (Time) = Aug 18 2010 15:55:40 * Store Lat/Lon Data = Append to Every Scan ** Ship: ** Station: ** Operator: # nquan = 18 # nvalues = 38533 # units = specified # name 0 = prDM: Pressure, Digiquartz [db] # name 1 = t090C: Temperature [ITS-90, deg C] # name 2 = c0uS/cm: Conductivity [uS/cm] # name 3 = specc: Specific Conductance [uS/cm] # name 4 = xmiss: Beam Transmission, Chelsea/Seatech/WET Labs CStar [%] # name 5 = wetStar: Fluorescence, WET Labs WETstar [mg/m^3] # name 6 = wetCDOM: Fluorescence, WET Labs CDOM [mg/m^3] # name 7 = par: PAR/Irradiance, Biospherical/Licor # name 8 = spar: SPAR/Surface Irradiance # name 9 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l] # name 10 = sbeox0PS: Oxygen, SBE 43 [% saturation] # name 11 = dz/dtM: Descent Rate [m/s] # name 12 = ph: pH # name 13 = sal00: Salinity, Practical [PSU] # name 14 = latitude: Latitude [deg] # name 15 = longitude: Longitude [deg] # name 16 = scan: Scan Count # name 17 = flag: 0.000e+00 # span 0 = 0.381, 243.916 # span 1 = 3.7360, 5.3268 # span 2 = 57.765617, 60.926259 # span 3 = 99.208, 101.857 # span 4 = 89.5783, 95.4851 # span 5 = 0.5118, 4.0833 # span 6 = 1.2864, 2.0581 # span 7 = 1.0000e-12, 4.5454e+02 # span 8 = 1.8430e+02, 3.7079e+02 # span 9 = 12.68839, 12.98624 # span 10 = 96.16482, 102.22034 # span 11 = -0.673, 0.507 # span 12 = 7.857, 8.144 # span 13 = 0.0436, 0.0449 # span 14 = 47.06516, 47.06614 # span 15 = -91.43976, -91.43832 # span 16 = 1, 38533 # span 17 = 0.0000e+00, 0.0000e+00 # interval = seconds: 0.0416667 # start_time = Aug 18 2010 15:55:40 # bad_flag = -9.990e-29 # # # # # 2723 # 24 Feb 2010 # 1 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.000 # 4.33286070e-003 # 6.42095668e-004 # 2.32440901e-005 # 2.26815230e-006 # 1000.000 # 1.00000000 # 0.0000 # # # # # # 2271 # 24 Feb 2010 # 1 # # 0.0000 # 2000.0000 # 0 # # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.0 # 0.00000000e+000 # # # - 1.04488660e+001 # 1.44573900e+000 # -1.72104845e-003 # 2.03207110e-004 # -9.57000000e-008 # 3.2500e-006 # # 0.00000000e+000 # # 1.00000000 # 0.00000 # # # # # # 75869 # 31 Mar 2009 # -8.206847e+003 # -1.514489e-001 # 2.337490e-003 # 5.245000e-002 # 0.000000e+000 # 3.045671e+001 # -3.560049e-004 # 3.341080e-006 # 2.507800e-009 # 0.99985000 # -0.12820 # 0.000000e+000 # 1.287830e-002 # -8.897580e+000 # # # # # # 0471 # 07-Apr-10p # 1 # # # 0.0000 # 0.0000e+000 # 0.0000 # 0.00e+000 # 0.0000 # 0.0 # # # # 4.9980e-001 # -0.5084 # -2.0487e-003 # 9.5571e-005 # -1.9119e-006 # 2.5826e+000 # 1.92630e-004 # -4.64800e-002 # 3.6000e-002 # 1.0100 # -3.3000e-002 # 5.0000e+003 # 1.4500e+003 # # # # # # # WSCD-1178 # 7 Apr 2010 # 63.200 # 0.070 # # # # # # 270135 # 18 Mar 2010 # 4.6237 # 2.5090 # # # # # # 270135 # 30 Mar 2009 # 2.498000 # -0.494500 # 0.0 # # # # # # CST-268PR # 25 Mar 2010 # 21.2179 # -1.2519 # 0.250 # # # # # # WS3S-553P # 7 Apr 2010 # 15.000 # 0.066 # # # # # # 802 # 20 MAR2004 # 15.000 # 0.000 # # # # # # 4554 # 23 Feb 2010 # 1.00000000 # 0.00000000 # 2994011976.00000000 # 1.00000000 # -0.50320676 # # # # # # # # # 20255 # 7-27-06 # 1796.88720329 # 1.00000000 # # # # # datcnv_date = Aug 24 2010 15:13:03, 7.20f # datcnv_in = C:SeasaveRawCTD_2010Sterner_AugustCD1_01.hex

	C:SeasaveRawCTD_2010Sterner_AugustCD1_01.XMLCON # datcnv_skipover = 0 # datcnv_ox_hysteresis_correction = yes # datcnv_ox_tau_correction = yes # file_type = ascii *END* **Processing Description** These data have not been processed

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. **Methods & Sampling** * Sea-Bird SBE 9 Data File: * FileName = C:SeasaveRawCTD_2010Sterner_OctCD1_01.hex * Software Version Seasave V 7.20c * Temperature SN = 2723 * Conductivity SN = 2271 * Number of Bytes Per Scan = 34 * Number of Voltage Words = 5 * Number of Scans Averaged by the Deck Unit = 1 * System UpLoad Time = Oct 05 2010 10:49:57 * NMEA Latitude = 47 03.84 N * NMEA Longitude = 091 25.95 W * NMEA UTC (Time) = Oct 05 2010 15:46:18 * Store Lat/Lon Data = Append to Every Scan ** Ship: ** Station: ** Operator: # nquan = 18 # nvalues = 57429 # units = specified # name 0 = prDM: Pressure, Digiquartz [db] # name 1 = t090C: Temperature [ITS-90, deg C] # name 2 = c0uS/cm: Conductivity [uS/cm] # name 3 = specc: Specific Conductance [uS/cm] # name 4 = xmiss: Beam Transmission, Chelsea/Seatech/WET Labs CStar [%] # name 5 = wetStar: Fluorescence, WET Labs WETstar [mg/m^3] # name 6 = wetCDOM: Fluorescence, WET Labs CDOM [mg/m^3] # name 7 = par: PAR/Irradiance, Biospherical/Licor # name 8 = spar: SPAR/Surface Irradiance # name 9 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l] # name 10 = sbeox0PS: Oxygen, SBE 43 [% saturation] # name 11 = dz/dtM: Descent Rate [m/s] # name 12 = ph: pH # name 13 = sal00: Salinity, Practical [PSU] # name 14 = latitude: Latitude [deg] # name 15 = longitude: Longitude [deg] # name 16 = scan: Scan Count # name 17 = flag: 0.000e+00 # span 0 = -1.323, 244.848 # span 1 = 3.7131, 9.7931 # span 2 = -1.728774, 68.922486 # span 3 = -2.527, 102.061 # span 4 = 51.4690, 92.9722 # span 5 = 0.4935, 8.9734 # span 6 = 0.9777, 2.5982 # span 7 = 1.0000e-12, 9.9990e+03 # span 8 = 2.0229e+03, 2.1238e+03 # span 9 = 9.60225, 12.60689 # span 10 = 83.42765, 102.64286 # span 11 = -0.506, 0.295 # span 12 = 8.212, 8.778 # span 13 = 0.0000, 0.0471 # span 14 = 47.06340, 47.06410 # span 15 = -91.43350, -91.43236 # span 16 = 1, 57429 # span 17 = 0.0000e+00, 0.0000e+00 # interval = seconds: 0.0416667 # start_time = Oct 05 2010 15:46:18 # bad_flag = -9.990e-29 # # # # # 2723 # 24 Feb 2010 # 1 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.000 # 4.33286070e-003 # 6.42095668e-004 # 2.32440901e-005 # 2.26815230e-006 # 1000.000 # 1.00000000 # 0.0000 # # # # # # 2271 # 24 Feb 2010 # 1 # # 0.0000 # 2000.0000 # 0 # # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.00000000e+000 # 0.0 # 0.00000000e+000 # # # -1.04488660e+001 # 1.44573900e+000 # -1.72104845e-003 # 2.03207110e-004 # -9.57000000e-008 # 3.2500e-006 # # 0.00000000e+000 # # 1.00000000 # 0.00000 # # # # # # 75869 # 31 Mar 2009 # -8.206847e+003 # -1.514489e-001 # 2.337490e-003 # 5.245000e-002 # 0.000000e+000 # 3.045671e+001 # -3.560049e-004 # 3.341080e-006 # 2.507800e-009 # 0.99985000 # -0.12820 # 0.000000e+000 # 1.287830e-002 # -8.897580e+000 # # # # # # 0471 # 07-Apr-10p # 1 # # # 0.0000 # 0.0000e+000

	# 0.0000 # 0.00e+000 # 0.0000 # 0.0 # # # # 4.9980e-001 # -0.5084 # -2.0487e-003 # 9.5571e-005 # -1.9119e-006 # 2.5826e+000 # 1.92630e-004 # -4.64800e-002 # 3.6000e-002 # 1.0100 # -3.3000e-002 # 5.0000e+003 # 1.4500e+003 # # # # # # # WSCD-1178 # 7 Apr 2010 # 63.200 # 0.070 # # # # # # 270135 # 18 Mar 2010 # 4.6237 # 2.5090 # # # # # # 270135 # 30 Mar 2009 # 2.498000 # -0.494500 # 0.0 # # # # # # CST-268PR # 25 Mar 2010 # 21.2179 # -1.2519 # 0.250 # # # # # # WS3S-553P # 7 Apr 2010 # 15.000 # 0.066 # # # # # # 802 # 20 MAR2004 # 15.000 # 0.000 # # # # # # 4554 # 23 Feb 2010 # 1.00000000 # 0.00000000 # 2994011976.00000000 # 1.00000000 # -0.50320676 # # # # # # # # # 20255 # 7-27-06 # 1796.88720329 # 1.00000000 # # # # datcnv_date = Oct 07 2010 10:59:51, 7.20f # datcnv_in = C:SeasaveRawCTD_2010Sterner_OctCD1_01.hex C:SeasaveRawCTD_2010Sterner_OctCD1_01.XMLCON # datcnv_skipover = 0 # datcnv_ox_hysteresis_correction = yes # datcnv_ox_tau_correction = yes # file_type = ascii *END* **Processing Description** These data have not been processed

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 **Methods & Sampling** * Sea-Bird SBE 9 Data File: * FileName = C:SeasaveRawCTD_2009Sterner Nov 2009CB-1.dat * Software Version Seasave Win32 V 5.37d * Temperature SN = 2723 * Conductivity SN = 2271 * Number of Bytes Per Scan = 34 * Number of Voltage Words = 5 * Number of Scans Averaged by the Deck Unit = 1 * System UpLoad Time = Nov 11 2009 10:41:22 * NMEA Latitude = 46 46.90 N * NMEA Longitude = 090 16.20 W * NMEA UTC (Time) = Nov 11 2009 16:37:34 * Store Lat/Lon Data = Append to Every Scan ** Ship: ** Cruise: ** Station: ** Latitude: ** Longitude: # nquan = 17 # nvalues = 16550 # units = specified # name 0 = prDM: Pressure, Digiquartz [db] # name 1 = t090C: Temperature [ITS-90, deg C] # name 2 = c0uS/cm: Conductivity [uS/cm] # name 3 = specc: Specific Conductance [uS/cm] # name 4 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%] # name 5 = wetStar: Fluorescence, Wetlab Wetstar [mg/m^3] # name 6 = dz/dtM: Descent Rate [m/s] # name 7 = ph: pH # name 8 = par: PAR/Irradiance, Biospherical/Licor # name 9 = sal00: Salinity [PSU] # name 10 = sbeox0Mm/Kg: Oxygen, SBE 43 [umol/Kg] # name 11 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l] # name 12 = wetCDOM: Fluorescence, Wetlab CDOM [mg/m^3] # name 13 = latitude: Latitude [deg] # name 14 = longitude: Longitude [deg] # name 15 = scan: Scan Count # name 16 = flag: 0.000e+00 # span 0 = 0.057, 94.846 # span 1 = 5.6278, 7.1234 # span 2 = 61.724951, 65.099069 # span 3 = 99.777, 101.593 # span 4 = 14.1542, 95.3706 # span 5 = 1.0729, 4.6682 # span 6 = -1.114, 0.872 # span 7 = 10.913, 12.055 # span 8 = 4.2071e+00, 7.9343e+03 # span 9 = 0.0451, 0.0463 # span 10 = 256.933, 314.379 # span 11 = 8.22124, 10.05935 # span 12 = 1.1262, 2.3707 # span 13 = 46.78166, 46.78380 # span 14 = -90.27012, -90.26912 # span 15 = 1, 16550 # span 16 = 0.0000e+00, 0.0000e+00 # interval = seconds: 0.0416667 # start_time = Nov 11 2009 10:41:22 # bad_flag = -9.990e-29 # sensor 0 = Frequency 0 temperature, 2723, 12 Feb 2009 # sensor 1 = Frequency 1 conductivity, 2271, 10 Feb 2009, cpcor = -9.5700e-08 # sensor 2 = Frequency 2 pressure, 75869, 31 Mar 2009 # sensor 3 = Extrnl Volt 0 Oxygen, SBE, primary, 0471, 06 Feb 2009 # sensor 4 = Extrnl Volt 1 WET Labs, CDOM # sensor 5 = Extrnl Volt 2 pH, 270135, 30 Mar 2009 # sensor 6 = Extrnl Volt 3 oxidation reduction potential, 270135, 30 Mar 2009 # sensor 7 = Extrnl Volt 4 transmissometer, primary, CST-268PR, 25 Mar 2009 # sensor 8 = Extrnl Volt 5 WET Labs, WETStar fluorometer, 10 Mar 2009 # sensor 9 = Extrnl Volt 6 altimeter # sensor 10 = Extrnl Volt 7 irradiance (PAR), primary, 4554, 18 Mar 2009 # sensor 11 = Extrnl Volt 9 surface irradiance (SPAR), degrees = 0.0 # datcnv_date = Nov 11 2009 19:34:19, 5.37e # datcnv_in = C:SeasaveRawCTD_2009Sterner Nov 2009CB-1.dat C:SeasaveRawCTD_2009Sterner Nov 2009CB-1.CON # datcnv_skipover = 0 # file_type = ascii *END*

BH11-01

Website	https://www.bco-dmo.org/deployment/655687
Platform	R/V Blue Heron
Start Date	2011-03-29
End Date	2011-03-31
Description	These cruises are part of the Laurentian Great Lakes studies.

BH11-14

Website	https://www.bco-dmo.org/deployment/655704
Platform	R/V Blue Heron
Start Date	2011-07-14
End Date	2011-07-30
Description	these cruises are part of the greater Great Lakes project

BH12-20

Website	https://www.bco-dmo.org/deployment/656336
Platform	R/V Blue Heron
Start Date	2012-08-14
End Date	2012-08-17
Description	part of the Laurentian Great Lakes Project

BH12-10

Website	https://www.bco-dmo.org/deployment/656909
Platform	R/V Blue Heron
Start Date	2012-06-25
End Date	2012-06-30
Description	Part of Great Lakes Project

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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.

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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
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927512
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927277

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