CTD data with chemical and biological discrete samples from R/V Cape Hatteras cruise CH0711 in the Gulf of Mexico; 2007 (GoMX - N2 Fixation project)

Website: https://www.bco-dmo.org/dataset/3805
Version: 29 November 2012
Version Date: 2012-11-29

Project
» Nitrogen fixation, nutrient supply and biological production in the Gulf of Mexico (GoMX - N2 Fixation)

Programs
» Gulf of Mexico - Deepwater Horizon Oil Spill (GoMX - DHOS)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

CTD Data with Chemical and Biological Discrete Samples
Biological survey of phytoplankton in the northern Gulf of Mexico

Comments on parameter names, definitions and units:
Depth (m)
Salinity: practical salinity units
Fluorescence: ~micrograms per liter. Calibrated by the ship's technician
PE (phycoerthrin): micrograms per L. Not considered reliable, provided by the ship
CDOM: mg per meter cubed. Provided by ship, not considered reliable.
Oxygen: ship's sensor, ml or mg per L. calibrated by Technician.
Beam attenuation: ship's equipment
Chlorophyll: micrograms per liter
Nutrient concentrations: micromoles per liter
cell counts: cells per liter for all but Trichodesmium
Trichodesmium: filaments per liter

Methods & Sampling

Nutrients: run fresh, unfiltered on a Seal QuAAtro nutrient analyzer. Standards were made daily in artificial seawater, baseline was artificial seawater. Samples were corrected for residual contamination in the baseline. Values are the mean of two samples (±10%). Level of detection is ~0.1 µM N and P. Si is 0.5µM.

chl: filtered onto either 0.4 or 10 µm pore size polycarbonate filters, extracted in MeOH overnight in the freezer and then run on a Turner TD-700 with the Welschmeyer (1994) non-acidification filters. The instrument was calibrated prior to each batch with a solid standard calibrated against pure chlorophyll a. Results are the average of two duplicates, variation is ±10%.

Cell counts: preserved in 1% hexamine buffered formalin. 25-50 ml of sample was settled overnight in a Utermohl settling chamber and then counted on a Zeiss ICM-405 inverted microscope. A single sample from each depth was counted.

Related files and references:
Welschmeyer NA (1994) Fluorometric analysis of chlorophyll a in the presence of chlorophyll b and pheopigments. Limnology and Oceanography 39: 1985-1992.

Knapke, E. (2012) Influence of Mississippi River Plume on Distributions of Diazotrophs in the Northern Gulf of Mexico During Summer 201. M.S., University of Texas at Austin. http://hdl.handle.net/2152/ETD-UT-2012-08-6107

Data Processing Description

CTD raw data was processed on board ship using the standard Seabird package.

BCO-DMO Processing/Edits
- Generated from file: "GoM2011_Master_ch0711.xlsx" contributed by Tracy Villareal
- Parameter names modified to conform to BCO-DMO conventions (blanks to underscores, etc.)
- "nd" (no data) inserted in black cells

[table of contents | back to top]

Data Files

File
CTD_Bot_Chem_Bio.csv (Comma Separated Values (.csv), 7.93 MB) MD5:59edd5782e4472096375cdb25492bd0b Primary data file for dataset ID 3805

[table of contents | back to top]

Parameters

Parameter	Description	Units
CruiseId	Cruise Id	text
Station	Station Id	integer
Latitude	Station Latitude (South is negative)	decimal degrees
Longitude	Station Longitude (West is negative)	decimal degrees
Type	Station Type	text
Date	Date	YYYYMMDD
Depth	Depth	m
Temp	Temp	Degrees Celsius
Salinity	Salinity	psu
Density	Density	Kg/m^3

Fluorescence	Fluorescence Calibrated by the ship's technician	micrograms per liter
CDOM	CDOM Provided by ship, not considered reliable	mg/m^3
PE	Phycoerthrin Not considered reliable, provided by the ship	micrograms per L
Oxygen_Saturation	Oxygen Saturation	ml/l
Oxygen	Oxygen Ship's sensor, calibrated by Technician	mg/l
Pressure	Pressure	db
Beam_Attenuation	Beam Attenuation Ship's equipment	1/m
Trichodesmium_Colonies_per_L	Trichodesmium Colonies (L-1)	L-1
NO3_to_NO2	NO3/NO2	umol L-1
PO4	PO4	umol L-1
SiO2	SiO2	umol L-1
NH4plus	NH4+	umol L-1
Total_chl	Total chl	µg per L
gt_10_um_chl	>10 um chl	µg per L
percent_Chl_above_10	% Chl above 10	percentage
Prochlorococcus	Prochlorococcus	cells/mL
Synechococcus	Synechococcus	cells/mL
PicoEukaryotes	PicoEukaryotes	cells/mL
Trichodesmium_Colonies_per_M	Trichodesmium Colonies (m-2)	m-2
Acantharian	Acantharian	L-1
Asterolampra	Asterolampra	L-1
Asteromphalus	Asteromphalus	L-1
Bacteriastrum	Bacteriastrum	L-1
Cerataulina_pelagica	Cerataulina pelagica	L-1
Ceratium_Gr_1	Ceratium Gr. 1	L-1
Ceratium_Gr_2	Ceratium Gr. 2	L-1
Ceratium_Gr_3	Ceratium Gr. 3	L-1
Ceratium_praelongum	Ceratium praelongum	L-1
Ceratium_spp_Total	Ceratium spp. Total	L-1
Ceratocorys	Ceratocorys	L-1
Chaetoceros	Chaetoceros	L-1
Chaetoceros_messanensis	Chaetoceros messanensis	L-1
Chaetoceros_peruvianus	Chaetoceros peruvianus	L-1
Chaetoceros_spp_Total	Chaetoceros spp. Total	L-1
Coscinodiscus	Coscinodiscus	L-1
Cylindrotheca	Cylindrotheca	L-1
Dictyocha	Dictyocha	L-1
Dinophysis_caudata	Dinophysis caudata	L-1
Dinophysis_Gr_1	Dinophysis Gr. 1	L-1
Dinophysis_Gr_2	Dinophysis Gr. 2	L-1

Dinophysis_schuettii	Dinophysis schuettii	L-1
Dinophysis_spp_Total	Dinophysis spp. Total	L-1
Foraminifera	Foraminifera	L-1
Glossleriella	Glossleriella	L-1
Gonyaulax	Gonyaulax	L-1
Guinardia	Guinardia	L-1
Guinardia_delicatula	Guinardia delicatula	L-1
Guinardia_striata	Guinardia striata	L-1
Guinardia_spp_Total	Guinardia spp. Total	L-1
Hemiaulus_hauckii	Hemiaulus hauckii	L-1
Hemiaulus_membranaceous	Hemiaulus membranaceous	L-1
Hemiaulus_sinensis	Hemiaulus sinensis	L-1
Hemiaulus_spp_per_L	Hemiaulus spp. (L-1)	L-1
Odontella	Odontella	L-1
Ornithocercus	Ornithocercus	L-1
Pennate	Pennate	L-1
Phalacroma	Phalacroma	L-1
Planktoniella_sol	Planktoniella sol	L-1
Pleurosigma	Pleurosigma	L-1
Podolampas	Podolampas	L-1
Proboscia_alata	Proboscia alata	L-1
Prorocentrum	Prorocentrum	L-1
Protoperidinium	Protoperidinium	L-1
Pseudo_nitzchia	Pseudo nitzchia	L-1
Pseudosolenia	Pseudosolenia	L-1
Pyrophacus	Pyrophacus	L-1
Radiolarian	Radiolarian	L-1
Rhizosolenia	Rhizosolenia	L-1
Rhizosolenia_plus_Symbiont_per_L	Rhizosolenia + Symbiont (L-1)	L-1
Rhizosolenia_spp_Total	Rhizosolenia spp. Total	L-1
Silicoflagellate	Silicoflagellate	L-1
Thalassionema	Thalassionema	L-1
Thalassionema_nitzschioides	Thalassionema nitzschioides	L-1
Thalassionema_spp_Total	Thalassionema spp. Total	L-1
Tintinnid	Tintinnid	L-1
Trichodesmium_Filaments_per_L	Trichodesmium Filaments (L-1)	L-1
Unknown_1	Unknown 1	L-1
Unknown_2	Unknown 2	L-1
Unknown_3	Unknown 3	L-1
Unknown_4	Unknown 4	L-1
Vorticella	Vorticella	L-1

DDAs_per_L	DDAs (L-1)	L-1
DDAs_per_M	DDAs (m-2)	m-2
Trichodesmium_Filaments_per_M	Trichodesmium Filaments (m-2)	m-2
Rhizosolenia_plus_Symbiont_per_M	Rhizosolenia + Symbiont (m-2)	m-2
Hemiaulus_spp_per_M	Hemiaulus spp. (m-2)	m-2

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	CTD Sea-Bird
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	R/V Cape Hatteras Research Instrumentation and Technical Support
Generic Instrument Description	Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics, no specific unit identified. This instrument designation is used when specific make and model are not known. See also other SeaBird instruments listed under CTD. More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	Turner TD-700
Generic Instrument Name	Fluorometer
Dataset-specific Description	Turner TD-700
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	Zeiss ICM-405 inverted microscope
Generic Instrument Name	Inverted Microscope
Dataset-specific Description	Zeiss ICM-405 inverted microscope
Generic Instrument Description	An inverted microscope is a microscope with its light source and condenser on the top, above the stage pointing down, while the objectives and turret are below the stage pointing up. It was invented in 1850 by J. Lawrence Smith, a faculty member of Tulane University (then named the Medical College of Louisiana). Inverted microscopes are useful for observing living cells or organisms at the bottom of a large container (e.g. a tissue culture flask) under more natural conditions than on a glass slide, as is the case with a conventional microscope. Inverted microscopes are also used in micromanipulation applications where space above the specimen is required for manipulator mechanisms and the microtools they hold, and in metallurgical applications where polished samples can be placed on top of the stage and viewed from underneath using reflecting objectives. The stage on an inverted microscope is usually fixed, and focus is adjusted by moving the objective lens along a vertical axis to bring it closer to or further from the specimen. The focus mechanism typically has a dual concentric knob for coarse and fine adjustment. Depending on the size of the microscope, four to six objective lenses of different magnifications may be fitted to a rotating turret known as a nosepiece. These microscopes may also be fitted with accessories for fitting still and video cameras, fluorescence illumination, confocal scanning and many other applications.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	R/V Cape Hatteras Research Instrumentation and Technical Support
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	Seal QuAAtro nutrient analyzer
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Seal QuAAtro nutrient analyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

[table of contents | back to top]

Deployments

CH0711

Website	https://www.bco-dmo.org/deployment/58875
Platform	R/V Cape Hatteras
Start Date	2011-07-04
End Date	2011-07-29
Description	This cruise was funded by NSF OCE-0928495. Cruise information and original data are available from the NSF R2R data catalog. The science plan called for sampling in the Gulf of Mexico during the summer, when large populations of N2-fixing organisms are known to be present and the Mississippi plume tends to extend the furthest offshore. The cruise plans included stable isotope (15N, 13C) tracer experiments; one meter MOCNESS tows for zooplankton sampling; and plans to sample Trichodesmium and large diatoms using SCUBA gear.

[table of contents | back to top]

Project Information

Nitrogen fixation, nutrient supply and biological production in the Gulf of Mexico (GoMX - N2 Fixation)

Coverage: Northern Gulf of Mexico

From the NSF proposal abstract
This project will study the interplay of physical, chemical, and biological factors in supplying nitrogen, an essential nutrient, to temperate coastal and offshore waters of the Gulf of Mexico. The Gulf is an economically important but understudied marginal sea with major commercial and recreational fisheries as well as extensive fossil fuel deposits. Diazotrophic (N2-fixing) cyanobacteria bloom regularly in offshore and coastal waters of the Gulf and the limited data suggest that they contribute significant quantities of both nitrogen and carbon to the pelagic food web. These diazotrophs may play also a critical role in supplying N to other organisms, including the ichthyotoxic red tide dinoflagellate Karenia brevis. Despite its importance, little is currently known of the factors that promote N2-fixation in the Gulf or the relative significance of different physical and biological processes in creating conditions that favor N limitation in the water column. The Gulf of Mexico is strongly influenced by both riverine inputs and advective processes, providing an excellent model system for studying nutrient dynamics, physical forcing of productivity, terrestrial-oceanic linkages, and the potential impact of land use and climate change on marine ecosystems.

The relatively small basin of the Gulf of Mexico provides an opportunity to quantify and study interactions among physical, chemical, and biological processes relevant to a broad range of other coastal and oceanic systems. Land-use and climate change are likely to affect the circulation and hydrography of the Gulf, as well as the magnitude and nature of riverine inputs, all with uncertain impacts on the biogeochemistry of the Gulf of Mexico. This research will provide timely insights into these processes and will generate a baseline of understanding for evaluating and predicting the impact of future land use and climate changes in the system. This project will make an important contribution to our understanding of the factors that regulate N2-fixation and its role in supporting the biota in temperate waters. The following specific goals are included in the work:

1. Identify the major diazotroph groups in the Gulf of Mexico and characterize their distribution and activity in different regions and water masses.

2. Quantify the impact of advective processes, mesoscale features, and riverine inputs on nutrient limitation and N2-fixation in the Gulf, and evaluate the controls on N2-fixation and the degree of spatial and temporal niche differentiation among diazotroph assemblages in different regions affected by these processes.

3. Use satellite data and physical models to scale up our measurements spatially and to evaluate the regional

significance of N2-fixation in the Gulf of Mexico. The researchers will also use a coupled physical/biological model to explore variability in the physical forcing and the potential impact of likely land use and climate change scenarios in altering nutrient dynamics and N2-fixation in the Gulf of Mexico.

The investigators and their institutions have a strong commitment to undergraduate and graduate education. This project includes support for graduate students, a technician, and undergraduates. In addition to peer-reviewed papers and websites, workshops aimed at K-12 teachers, and a program involving high school teachers in research will be used to disseminate the results of this project broadly in the local community. The investigators are committed to increasing the diversity of the ocean science community and are active in recruiting and training efforts at their institutions.

[table of contents | back to top]

Program Information

Gulf of Mexico - Deepwater Horizon Oil Spill (GoMX - DHOS)

Coverage: Northern Gulf of Mexico

Grants for Rapid Response Research (RAPID)
The RAPID funding mechanism is used for proposals having a severe urgency with regard to availability of, or access to data, facilities or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events.

GOM - Broader Impacts
The need to understand the impact of this largest oil spill to date on ecosystems and biochemical cycling is self evident. The consequences of the disaster and accompanying clean up measures (e.g. the distribution of dispersants) need to be evaluated to guide further mediating measures and to develop and improve responses to similar disasters in the future. Would it be advantageous if such oil aggregates sink, or should it rather remain suspended? Possibly measures can be developed to enhance sinking or suspension (e.g. addition of ballast minerals) once we understand their current formation and fate. Understanding the particle dynamics following the input of large amounts of oil and dispersants into the water is a prerequisite to develop response strategies for now and in the future.

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical

cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0926699

[table of contents | back to top]