Physical and geochemical measurements of water and sediments measured from a UNCW 20-ft Center Console Boat in the Cape Fear River Estuary, NC in 2009 (Estuarine ANAMMOX project)

Website: https://www.bco-dmo.org/dataset/4062
Version: 16 Oct 2013
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Project
» Implication of ANAMMOX community structure and microbial interactions in estuarine N removal processes (Estuarine ANAMMOX)

Program
» Emerging Topics in Biogeochemical Cycles (ETBC)

Contributors	Affiliation	Role
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Dataset Description

Physical and geochemical data measured in April and October of 2009 from the water column, porewater, and sediments of the Cape Fear River Estuary (located at the southeast of North Carolina; 34 N 78 W depth range 1 to 20 m).

NOTE: Data are restricted. Please contact the PI for access.

Related Publications and References:
Hirsh, M.D., 2010, Anammox bacterial diversity in various environments and N removal capacity in the Cape Fear River. University of North Carolina Wilmington, Dept. of Biology and Marine Biology, M.S. thesis, 87 p.

Methods & Sampling

Sampling for the Cape Fear River Estuary (CFRE) was conducted using 20-foot center console boats at University of North Carolina Wilmington (UNCW).

Fifteen stations were demarcated about every two kilometers along the estuarine salinity gradient of the CFRE. Sampling was conducted in April and October of 2009. Sediments were collected using a Petite Ponar® grab from west to east along a cross-estuary transect at each station including, where possible, both banks (depth less than two meters) and both sides of the channel (~12 m). Samples were defined as either east or west bank (EB, WB) (0-2 m water column depth), east or west channel (EC, WC) (8-15 m), as well as east mid-bank (EMB), west bank-shore (WBS) and east bank-shore (EBS) at stations where more than 4 samples were collected. Salinity was measured with a YSI model 650 MDS (YSI Inc., Yellow Springs, OH, USA) in the field at the surface and at the bottom when depths were greater than 1 meter. Sediment samples were treated with 35% H_2O_2 until all organic matter was dissolved. Samples were then run on a Coulter Counter (model LS-200, Beckman) to measure the distribution of sediment grain sizes. Organic content was measured as a percentage of the ashed weight/pre-ashed weight. Fe (II) and H_2S were measured spectrophotometrically from porewater that was fixed with ferrozine and/or diamine immediately after centrifugation the day after they were collected from the CFRE (Stookey, 1960, Cline, 1969). Filtered surface and bottom water was analyzed for NO_3^- and NH_4^+ with the standard colorimetric method using a Bran Lubbe continuous flow autoanalyzer.

Data Processing Description

BCO-DMO Processing Notes:
- Parameter names were modified to conform with BCO-DMO naming conventions.
- Latitude and longitude were converted from degrees and decimal minutes to decimal degrees.
- "N/A" was replaced with "nd" to indicate "no data/not available".
- Blank values were replaced with "nd" to indicate "no data".
- "b/d" was replaced with "below_det" to indicate values below the detection limit.

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Parameters

Parameter	Description	Units
month	2-digit month when the sampling occurred.	mm (01 to 12)
year	4-digit year when sampling occurred.	YYYY
station	Station identification number.	integer (1 to 15)
transect	Transect identifier. EB = east bank; WB = west bank; EC = east channel; WC = west channel; EMB = east mid-bank; WBS = west bank-shore; EBS = east bank-shore.	text
lat	Latitude of the sampling location. Positive values = North.	decimal degrees
lon	Longitude of the sampling location. Negative values = West.	decimal degrees
sal_surf	Salinity measured at the surface of the water column.	psu
NO3_surf	NO_3^- measured at the surface of the water column.	micromolar (uM)
NH4_surf	NH_4^+ measured at the surface of the water column.	micromolar (uM)

sal_btm	Salinity measured at the bottom (when depths were greater than 1 meter).	psu
NO3_btm	NO3- measured from the bottom of the water column.	micromolar (uM)
NH4_btm	NH4+ measured from the bottom of the water column.	micromolar (uM)
Fe_pore	Dissolved iron (Fe(II)) measured spectrophotometrically from porewater.	micromolar (uM)
H2S_pore	Hydrogen sulfide (H2S) measured spectrophotometrically from porewater.	micromolar (uM)
NOx_pore	NOx measured from porewater.	unknown
pcnt_H2O_sed	Sediment organic content measured as a percentage of the pre-ashed weight.	% of wet weight
pcnt_org_sed	Sediment organic content measured as a percentage of the ashed weight.	% of dry weight
NH4_sed	NH4+ in sediment.	micromoles N per gram (umol N g-1)
grain_size_sed	Sediment grain size.	micrometers (um)

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Instruments

Dataset-specific Instrument Name	Bottom Sediment Grab Samplers
Generic Instrument Name	Bottom Sediment Grab Samplers
Dataset-specific Description	A Petite Ponar® grab sampler was used to collect sediments.
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	Bran Luebbe AA3 AutoAnalyzer
Generic Instrument Name	Bran Luebbe AA3 AutoAnalyzer
Dataset-specific Description	NO3- and NH4+ were determine with the standard colorimetric method using a Bran Lubbe continuous flow autoanalyzer.
Generic Instrument Description	Bran Luebbe AA3 AutoAnalyzer See the description from the manufacturer.

Dataset-specific Instrument Name	Laser Diffraction Particle Size Analyzer
Generic Instrument Name	Laser Diffraction Particle Size Analyzer
Dataset-specific Description	A Beckman model LS-200 was used to to measure the distribution of sediment grain sizes. See the description from the manufacturer.
Generic Instrument Description	Laser diffraction is particle sizing technique for materials ranging from hundreds of nanometers up to several millimeters in size. Laser diffraction measures particle size distributions by measuring the angular variation in intensity of light scattered as a laser beam passes through a dispersed particulate sample. One example is the Beckman Coulter LS200.

Dataset-specific Instrument Name	Spectrophotometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Fe (II) and H2S were measured spectrophotometrically from porewater.
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	YSI Sonde 6-Series
Generic Instrument Name	YSI Sonde 6-Series
Dataset-specific Description	A YSI model 650 MDS (YSI Inc., Yellow Springs, OH, USA) was used to measure salinity. See the description from the manufacturer.
Generic Instrument Description	YSI 6-Series water quality sondes and sensors are instruments for environmental monitoring and long-term deployments. YSI datasondes accept multiple water quality sensors (i.e., they are multiparameter sondes). Sondes can measure temperature, conductivity, dissolved oxygen, depth, turbidity, and other water quality parameters. The 6-Series includes several models. More from YSI.

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Deployments

CFRE_Song_2009

Website	https://www.bco-dmo.org/deployment/59111
Platform	UNCW 20-ft Center Console Boat
Start Date	2009-04-01
End Date	2009-10-01
Description	Sampling on the Cape Fear River Estuary (CFRE) was performed from 20-foot center console boats from the University of North Carolina at Wilmington (UNCW) in April and October of 2009 as part of the project "Implication of ANAMMOX community structure and microbial interactions in estuarine N removal processes".

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Project Information

Implication of ANAMMOX community structure and microbial interactions in estuarine N removal processes (Estuarine ANAMMOX)

From NSF Award Abstract:

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

Estuaries, connecting the freshwater and marine environment, are among the most dynamic and the productive ecosystems on Earth. However, they are under threat from anthropogenic N loading, resulting in various symptoms of eutrophication. The intensity and duration of estuarine eutrophication and the rate of estuarine recovery strongly depend on microbial N removal processes (anaerobic ammonium oxidation (ANAMMOX) and denitrification). Denitrification has been intensively studied in various estuaries, while ANAMMOX as a recently discovered N removal pathway is much less studied in estuarine ecosystems. Existing studies indicate that ANAMMOX rates and its contribution to total N2 production (ANAMMOX significance) are system specific and controlled in part by reaction-scale substrate limitations and by environmental parameters. However, community structure (abundance and composition) of ANAMMOX bacteria have not been linked to their activities along environmental gradients. In addition, ANAMMOX community interactions with aerobic ammonia oxidizers and denitrifyers have not been adequately studied in estuarine and coastal environments.

The investigators will examine the importance of ANAMMOX community structure on their activities along estuarine gradients at the CFRE. In addition, microbial interactions among ANAMMOX, denitrifying and aerobic ammonia oxidizing (AAO) communities will be examined to gain a better understanding of sedimentary N cycles in the estuary. They will address the hypothesis that the total abundance of ANAMMOX bacteria will be linearly correlated to their activities, and that members of ANAMMOX communities are influenced differently by environmental parameters present along the estuarine gradients. Depending on the community structure of ANAMMOX bacteria, temporal and spatial variations of the ANAMMOX rates and its significance to N loss will be observed along the estuary. In addition, they will explore functional linkages among ANAMMOX, denitrifying and AAO communities in estuarine sediments that will alter the pathway of N loss. In order to test the proposed hypotheses, the investigators will conduct interdisciplinary and collaborative research by integrating molecular microbial techniques, 15N isotope tracer methods and multivariate statistic analyses. Thus, this project will address key gaps in our understanding of ANAMMOX ecology by understanding how the community structure of ANAMMOX bacteria influences their activities, and lead to a more complete understanding of estuarine N loss.

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Program Information

Emerging Topics in Biogeochemical Cycles (ETBC)

Website: http://www.nsf.gov/pubs/2007/nsf07049/nsf07049.jsp

Coverage: global

The original call for proposals for Emerging Topics in Biogeochemical Cycles (ETBC) was issued in September 2007 by the US NSF Directorate for Geosciences (NSF 07-049).

The Geosciences Directorate (GEO) is substantially augmenting our past funding sources to explicitly support emerging areas of interdisciplinary research. We seek to foster transformational advances in our quantitative or mechanistic understanding of biogeochemical cycles that integrate physical-chemical-biological processes over the range of temporal and/or spatial scales in Earthâ€™s environments. We encourage submission of proposals that address emerging topics in biogeochemical cycles, the water cycle or their coupling, across the interfaces of atmosphere, land, and oceans. Proposals must cross the disciplinary boundaries of two or more divisions in Geosciences (e.g. ATM, EAR, OCE) or of at least one division in Geosciences and a division in another NSF directorate.

Although funding programmatic disciplines continues to provide a robust and adaptable framework to build our understanding of the geosciences and the earth as a system, there are classes of emerging and challenging problems that require integration of concepts and observations across diverse fields. Our goal is to enhance such integration. Successful proposals need to develop intellectual excitement in the participating disciplinary communities. Also encouraged are proposals that have broader educational, diversity, societal, or infrastructure impacts that capitalize on this interdisciplinary opportunity.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0851435

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