Chlorphyll a and pheophytin from two cruises performed as part of the STING project from R/V Atlantic Explorer AE2305 and R/V Endeavor EN704 in the Gulf of Mexico near Florida from February to July 2023

Website: https://www.bco-dmo.org/dataset/928980
Data Type: Cruise Results
Version: 1
Version Date: 2024-05-28

Project
» Collaborative Research: Linking iron and nitrogen sources in an oligotrophic coastal margin: Nitrogen fixation and the role of boundary fluxes (Gulf of Mexico DON and Fe)

Contributors	Affiliation	Role
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Abstract
These data include the average (n=3 replicates per measurement) measured chlorphyll a and pheophytin from two cruises performed as part of the STING project. STING I (AE2305) was aboard the R/V Atlantic Explorer from 2023-02-20 to 2023-03-06. STING II (EN704) was aboard the R/V Endeavor from 2023-07-01 to 2023-07-12. 300 to 4300 ml was filtered onto GF/F filters (nominal pore size 0.7 um) and kept frozen (at -20 degrees C) in the dark until analysis. Filters were extracted overnight in 90% acetone before analysis on a Trilogy Fluorometer with the chl a extracted acidification module calibrated using Turner Chl a standards. Following the initial fluorescence reading, 20 ul of 10% HCl was added and another fluorescence reading was recorded.

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Coverage

Location: West Florida Shelf centered around Tampa Bay (~27 N) out to just past the edge of the Florida escarpment (~ -86 E; 3000 m)
Spatial Extent: **N**:28.498467 **E**:-82.515283 **S**:26.13205 **W**:-86.566932
Temporal Extent: 2023-02-20 - 2023-07-12

Methods & Sampling

Whole water was collected using three methods: tow-fish, surface pump deployed on a metal-free line, or ctd rosette. Whole water (300 - 4300 ml) was filtered onto 25 mm GF/F filters (nominal pore size 0.7 um) using a GAST vacuum pump and frozen at -20 degrees C until analysis. Filters were extracted overnight (16-18 hrs) in 90% acetone with a 10% HCl acidificaiton step following the extraction protocol of Strickland and Parsons 1972

(Strickland, J. D. H., and T. R. Parsons. 1972. A practical handbook of seawater analysis. Fisheries Research Board of Canada.) and analyzed on a fluorometer.

The surface pump on STING I was a Wilden Pro-Flo Series P100 PTPE pump. The surface pump on STING II and for all tow-fish samples was an Almatec E15TTT pump. All pump samples were pumped through Teflon tubing. The CTD samples were collected via 10 L Niskin bottles. The fluorometer was a Turner Designs Trilogy Fluorometer with the chl *a* acidification method module. Calibration was done using chl *a* standards from Turner.

Data Processing Description

Duplicates from each sample were averaged together.

BCO-DMO Processing Description

1. Loaded submitted file STING_Chl_ToSubmit.csv into BCO-DMO data processing system laminar.
2. Converted date from the format %d-%b-%Y to an ISO date format of %Y-%m-%d
3. Renamed parameters with units in their name to remove the units from the text. For example, renamed 'Pheophytin_ugperL' to 'Pheophytin'
4. Reordered parameter columns so that location and date metadata comes before data results.

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Related Publications

Strickland, J. D. H., & Parsons, T. R. (1972). *A Practical Handbook of Seawater Analysis, 2nd edition.* Fisheries Research Board of Canada. https://doi.org/10.25607/OBP-1791
Methods

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Parameters

Parameter	Description	Units
Cruise	which cruise sample was collected: STINGI or STINGII	unitless
Station	Station identifier	unitless
Lat	Sampling location latitude, south is negative	decimal degrees
Lon	Sampling location longitude, west is negative	decimal degrees
Depth	Depth of sample collection	meters (m)
Date	Date of sample collection	unitless
STING_ID	Project specific identification number, which is unique to each sample collection	unitless
Collection	Method of collection of water sample. fish = towfish, koubapump = stationary teflon pump, tmctd = trace metal ctd rosette, shipctd = conventional ctd rosette	unitless
Type	Type of sample collection: surface, chl max = chlorophyll maximum, profile = other depth	unitless
Chla	Chlorophyll a concentration	micrograms/liter (ug/l)
Pheophytin	Pheophytin concentration	micrograms/liter (ug/l)

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Instruments

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	10 L Niskin bottles
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	surface pump
Generic Instrument Name	Pump
Dataset-specific Description	The surface pump on STING I was a Wilden Pro-Flo Series P100 PTPE pump. The surface pump on STING II and for all tow-fish samples was an Almatec E15TTT pump. All pump samples were pumped through Teflon tubing.
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Turner Designs Trilogy Fluorometer
Generic Instrument Name	Turner Designs Trilogy fluorometer
Dataset-specific Description	Turner Designs Trilogy Fluorometer with the chl a acidification method module. Calibration was done using chl a standards from Turner.
Generic Instrument Description	The Trilogy Laboratory Fluorometer is a compact laboratory instrument for making fluorescence, absorbance, and turbidity measurements using the appropriate snap-in application module. Fluorescence modules are available for discrete sample measurements of various fluorescent materials including chlorophyll (in vivo and extracted), rhodamine, fluorescein, cyanobacteria pigments, ammonium, CDOM, optical brighteners, and other fluorescent compounds.

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Deployments

AE2305

Website	https://www.bco-dmo.org/deployment/929020
Platform	R/V Atlantic Explorer
Start Date	2023-02-18
End Date	2023-03-07
Description	Start and End port: St. Petersburg, Florida

EN704

Website	https://www.bco-dmo.org/deployment/929032
Platform	R/V Endeavor
Start Date	2023-07-01
End Date	2023-07-13
Description	Start and End port: St. Petersburg, Florida

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Project Information

Collaborative Research: Linking iron and nitrogen sources in an oligotrophic coastal margin: Nitrogen fixation and the role of boundary fluxes (Gulf of Mexico DON and Fe)

Coverage: Gulf of Mexico, West Florida Shelf

NSF Award Abstract:
This project will investigate how groundwater discharge delivers important nutrients to the coastal ecosystems of the West Florida Shelf. Preliminary studies indicate that groundwater may supply both dissolved organic nitrogen (DON) and iron in this region. In coastal ecosystems like the West Florida Shelf that have very low nitrate and ammonium concentrations, DON is the main form of nitrogen available to organisms. Nitrogen cycling is strongly affected by iron availability because iron is essential for both photosynthesis and for nitrogen fixation. This study will investigate the sources and composition of DON and iron, and their influence on the coastal ecosystem. The team will sample offshore groundwater wells, river and estuarine waters, and conduct two expeditions across the West Florida Shelf in winter and summer. Investigators will participate in K-12 and outreach activities to increase awareness of the project and related science. The project will fund the work of six graduate and eight undergraduate students across five institutions, furthering NSF's goals of education and training.

Motivated by preliminary observations of unexplained, tightly-correlated DON and dissolved iron concentrations across the West Florida Shelf (WFS), the proposed work will quantify the flux and isotopic signatures of submarine groundwater discharge (SGD)-derived DON and iron to the WFS, and evaluate the bioavailability of this temporally-variable source using four seasonal near-shore campaigns sampling offshore groundwater wells, estuarine, and riverine endmembers and two cross-shelf cruises. The work will evaluate whether SGD stimulates nitrogen fixation on the WFS, and the potential for the stimulated nitrogen fixation to further modify the chemistry of DON and dissolved iron in the region. The cross-shelf cruises will investigate hypothesized periods of maximum SGD and Trichodesmium abundance (June), and reduced river discharge and SGD (February), thus comparing two distinct biogeochemical regimes. The concentrations and isotopic compositions of DON and dissolved iron, molecular composition of DON, and the concentration and composition of iron-binding ligands will be characterized. Nitrogen fixation rates and Trichodesmium spp. abundance and expression of iron stress genes will be measured. Fluxes of DON and iron from SGD and rivers will be quantified with radium isotope mass balances. The impacts of SGD on nitrogen fixation and DON/ligand production will be constrained with incubations of natural phytoplankton communities with submarine groundwater amendments. Two hypotheses will be tested: 1) SGD is the dominant source of bioavailable DON and dissolved iron on the WFS, and 2) SGD-alleviation of iron stress changes the dominant Trichodesmium species on the WFS, increases nitrogen fixation rates and modifies DON and iron composition. Overall, the work will establish connections between marine nitrogen and iron cycling and evaluate the potential for coastal inputs to modify water along the WFS before export to the Atlantic Ocean. This study will thus provide a framework to consider these boundary fluxes in oligotrophic coastal systems and the relative importance of rivers and SGD as sources of nitrogen and iron in other analogous locations, such as coastal systems in Australia, India, and Africa, where nitrogen fixation and SGD have also been documented.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2341997

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