

Long Bay ship macronutrient concentrations from R/V Savannah (SAV-12-03, SAV-12-05, SAV-12-11) cruises in the South Atlantic Bight (SAB) continental shelf off Long Bay during 2012 (Long Bay Wintertime Bloom project)

Website: <https://www.bco-dmo.org/dataset/638156>

Data Type: Cruise Results

Version: 1

Version Date: 2016-02-10

Project

» [Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump](#) (Long Bay Wintertime Bloom)

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Abstract

Long Bay ship macronutrient concentrations from R/V Savannah (SAV-12-03, SAV-12-05, SAV-12-11) cruises in the South Atlantic Bight (SAB) continental shelf off Long Bay during 2012.

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Coverage

Spatial Extent: N:33.311727 E:-77.91745 S:32.48273 W:-78.748143

Temporal Extent: 2012-01-26 - 2012-03-20

Methods & Sampling

At selected stations and depths, Niskin water samples were collected using the ship's CTD/carousel water sampler (Sea-Bird SBE 25 Sealogger CTD; Sea-Bird SBE 32C carousel pylon; 8-L Ocean Test Equipment Model 110 external-closure water sampling bottles). Samples were transferred to 2 L polycarbonate bottles from the Niskin bottles via Tycon tubing and processed in the ship's wet lab. Samples for nutrients were filtered through 0.45 µm syringe filters into 100 mL acid-cleaned polyethylene screw cap bottles. Sample bottles were labelled with a numbered adhesive label and logged on a sample log sheet. Sample log sheet information was entered into a spreadsheet on a laptop. Samples bottles were frozen in the ship wet lab freezer (~ -20°C) and transferred to a shore lab freezer following the cruise.

For analyses, selected samples were shipped frozen to the MSI Analytical Lab at the Marine Science Institute of the University of California, Santa Barbara (<http://msi.ucsb.edu/services/analytical-lab/instruments/flow-injection-analyzer>). Analyses were conducted by Flow Injection Analysis (FIA) using a Lachat Instruments model QuickChem 8000. Analytical manifolds for Nitrate plus Nitrite, ortho-Phosphate and Silicate were employed. The analysis results were provided as a spreadsheet files (analysis date 12/14/2012). Standard checks used concentrations of 4 micromolar phosphate, 20 micromolar silicate, and 6 micromolar nitrate along with separate standards of 12 micromolar and 30 micromolar nitrate plus nitrite. Reported method detection limits were 0.10 micromolar for phosphate, 1.0 micromolar for silicate and 0.2 micromolar for nitrate plus nitrite. Sample concentrations below method detection limits were indicated in the data report.

Samples were collected from Long Bay, South Atlantic Bight, SE United States. The primary study area was 60 km in the cross-shelf extending from the middle continental shelf (~ 30 m isobath) to upper slope (~260 m) off Myrtle Beach, SC (between 33.17/-78.33 and 32.85/-78.00) and 60 km in the along-shelf.

Data Processing Description

Sample concentrations for phosphate, silicate and nitrate plus nitrite that were below the reported method detection limits are flagged in the submitted data file.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- changed ~ to nr_ ('near')
- changed blank flag cells to '-'

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Data Files

File
ship_nuts.csv (Comma Separated Values (.csv), 12.26 KB) MD5:3a7f7b4083bfbe0faeb7d49d0abb3f76
Primary data file for dataset ID 638156

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Parameters

Parameter	Description	Units
cruise_id	2012 cruise number for the R/V Savannah	unitless
year	year	yyyy
cast	cast number	unitless
month_gmt	GMT month	1-12
day_gmt	GMT day of month	1-31

time_gmt	GMT time	HH:MM:SS
yday_gmt	year day: UTC day and decimal time; as 326.5 for the 326th day of the year or November 22 at 1200 hours (noon).	day.part of day
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted standard is based on ISO 8601:2004(E) and takes on any of the following forms: 2009-08-30T14:05:00Z (UTC time)	yyyy-mm-ddTHH:MM:SSZ
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
depth_max	maximum depth of cast	meters
station	station: LB# = Middle Transect; LBS# = South Transect; LBN# = North Transect; # = distance counter (km) starting with +00 inshore and increasing offshore	unitless
comment	comment	unitless
depth_sample	Depth of water sample	meters
Phosphate	Concentration of dissolved phosphate	micromoles/L
P_flag	bdl = below detection limit for Flow Injection Analysis (FIA) method used	unitless
Silicate	Concentration of dissolved silicate	micromoles/L
Si_flag	bdl = below detection limit for Flow Injection Analysis (FIA) method used	unitless
NO3_NO2	Concentration of sum of dissolved nitrate and dissolved nitrite	micromoles/L
Nit_flag	bdl = below detection limit for Flow Injection Analysis (FIA) method used	unitless

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Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Sea-Bird SBE 25 Sealogger CTD; Sea-Bird SBE 33 deck box; Sea-Bird SBE 32C carousel pylon; Sea-Bird SBE 43 oxygen sensor; WET Labs ECO chlorophyll fluorometer; WET Labs ECO CDOM fluorometer; WET Labs ECO BB optical backscatter sensor; LI-COR 193SA PAR sensor; Sea-Bird SBE 5P pump. The carousel was equipped with eight 8-L external-closure water sampling bottles (Ocean Test Equipment Model 110).
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934 .

Dataset-specific Instrument Name	
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Flow Injection Analysis (FIA) using a Lachat Instruments model QuickChem 8000
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.

Dataset-specific Instrument Name	CTD SBE 25
Generic Instrument Name	Sea-Bird SBE 25 Sealogger CTD
Dataset-specific Description	Sea-Bird SBE 25 Sealogger CTD
Generic Instrument Description	<p>The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http://www.seabird.com.</p>

Dataset-specific Instrument Name	SBE 33
Generic Instrument Name	Sea-Bird SBE 33 Carousel Deck Unit
Generic Instrument Description	<p>The rack-mountable SBE 33 provides power and real-time data acquisition and control for an SBE 32 Carousel Water Sampler that has the SBE 33 interface option installed in its pylon. The SBE 33 is compatible with all Carousel sizes - full size, compact, and sub-compact. When powered and controlled by the SBE 33, the Carousel can be used: - with an SBE 19, 19plus, 19plus V2, 25, 25plus, or 49 CTD - without a CTD - with a Neil Brown Mk III CTD (requires optional interface for both SBE 32 and 33) The SBE 33 can also provide power and real-time data acquisition and control for the smaller SBE 55 ECO Water Sampler used with an SBE 19, 19plus, 19plus V2, 25, 25plus, or 49 CTD, or no CTD. See http://www.seabird.com/sbe33-deck-unit for further details.</p>

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Deployments

SAV-12-03

Website	https://www.bco-dmo.org/deployment/58863
Platform	R/V Savannah
Start Date	2012-01-24
End Date	2012-02-02
Description	Glider deployments (Ramses and Pelagia), glider monitoring; Acrobat (towed package) surveys of 3 cross-shelf sections (25 km along-shelf spacing, mid-shelf to upper slope); CTD profiles for hydrography, bio-optical, oxygen; station sampling for chlorophyll, nutrients, flow cytometry; Deployment of 2 moorings off Georgia on return leg to SkIO (75 m and 30 m). Cruise information and original data are available from the NSF R2R data catalog.

SAV-12-05

Website	https://www.bco-dmo.org/deployment/58864
Platform	R/V Savannah
Start Date	2012-02-13
End Date	2012-02-24
Description	Glider recoveries (Ramses, Pelagia), shipboard replacement of batteries, ballast adjustments, then both units were redeployed. Survey work was conducted using the towed Acrobat package and CTD station section from upper slope to shelf. Deck incubation experiment for primary production, station sampling for various properties. Due to gale-force winds, the ship ran into Wilmington (docked at Cape Fear Community College) on 18 February. When heading back out on 20 February for an Acrobat survey and station work, a problem with a shaft coupling forced return to Wilmington on 21 February for repair work. When repairs were completed, strong SW winds had developed and were forecast to continue for several days, so offshore work was not possible the ship returned to SkIO along the coast. Cruise information and original data are available from the NSF R2R data catalog.

SAV-12-11

Website	https://www.bco-dmo.org/deployment/58865
Platform	R/V Savannah
Start Date	2012-03-13
End Date	2012-03-22
Description	Glider recoveries (Ramses, Pelagia), then battery replacement, reballasting, redeployment (at LB2). Acrobat surveys, upper slope to outer shelf CTD surveys, station sampling for water samples and primary productivity experiments (deck incubations and 'photosynthetron'). Attempted to survey a subsurface bloom in the mid-shelf (apparently Phaeocystis). During an Acrobat survey, the tow cable failed over upper slope. The Acrobat package was located with an acoustic range-finder but was too deep for a grapple attempt. With the very mild winter, shelf conditions were already post-winter (warm water across outer to mid-shelf) and not favorable for the winter bloom formation. Given the conditions the cruise was cut short by a few days. Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump (Long Bay Wintertime Bloom)

Website: <http://nccoos.org/projects/long-bay-wintertime-blooms/>

Coverage: outer South Atlantic Bight (SAB) continental shelf off Long Bay

NSF Project Title: Mechanisms of nutrient input at the shelf margin supporting persistent winter phytoplankton blooms downstream of the Charleston Bump

Sustained phytoplankton blooms along the outer South Atlantic Bight (SAB) continental shelf off Long Bay are observed in winter in multi-year satellite chlorophyll imagery. This section of the shelf lies north of the "Charleston Bump" (between 32.5-33.5°N), where the Gulf Stream is often strongly deflected offshore. Due to this offshore deflection, this is not an area where nutrient input to the shelf would be enhanced by upwelling associated with Gulf Stream frontal eddies, a major mechanism of nutrient input in other parts of the SAB shelf (Lee et al., 1991). Yet prior in situ observations suggest that there is recurring input of nutrients from the upper slope to the outer shelf off Long Bay from winter to early spring. This project will investigate a fundamental aspect of physical-biological coupling in the outer shelf to upper slope region. The PIs will test the hypotheses that: 1) the persistence of winter blooms on the outer shelf off Long Bay results from repeated episodes of nutrient input and mixing which maintains nutrient-sufficient conditions for extended periods; 2) several physical mechanisms are involved, including enhanced mixing energy from the internal tide along this section of the upper slope/shelf break; 3) the relatively high nutrient, intermittently turbulent environment will favor larger bloom-forming phytoplankton. The latter could have important implications for higher trophic levels, including early life history strategies of fish that spawn along the shelf margin off Long Bay in winter to early spring.

This project will combine several maturing observational technologies to address the following:

1. What is the frequency and magnitude on on-shelf transport of nitrate from the upper slope?
2. What are the mechanisms of nutrient delivery from the upper slope to the outer continental shelf zone that are operating off Long Bay under the range of hydrographic and forcing conditions encountered in winter?
3. What is the 3-D structure of outer shelf hydrography and associated winter bloom features and how do these evolve through multiple nutrient input/mixing events?
4. What are the rates of nitrate utilization and primary production associated with the winter blooms?
5. Does the winter regime consistently favor a bloom assemblage dominated by larger diatom forms?

Near-continuous cross-shelf and upper slope observations will be obtained with two autonomous gliders, time-series measurements on the outer shelf and slope from a set of moored instruments (including a moored profiling system at the shelf break), and repeated cross- and along-shelf ship surveys using a towed, undulating package. Ship station work will include measurements of primary production and on-board analyses of key functional characteristics of the phytoplankton assemblage (cell forms, abundance, size and bio-volume distributions) using a microfluidics/imaging system. In combination, these systems will provide a level of spatial and temporal resolution of physical, nutrient and biological fields that could not be achieved in earlier, station-based field studies and the basis for improved understanding of physical mechanisms of recurring nutrient input to the shelf, and how the nutrient, mixing, and circulation regime in winter structures the phytoplankton community. Coastal naturalists will be engaged through a seabird survey component of the field program that will augment existing information on pelagic seabirds in winter and define their association with oceanographic features on the central South Atlantic Bight shelf and slope.

This project will provide a deeper understanding of shelf/slope exchange processes and how these influence shelf ecosystems, generating information that will contribute to implementation of ecosystem-based management in the region.

References:

Lee, T. N., J. A. Yoder, and L. P. Atkinson, 1991: Gulf Stream frontal eddy influence on productivity of the southeast U.S. continental shelf. *J. Geophys. Res.*, 96, 22191-22205.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1032285
NSF Division of Ocean Sciences (NSF OCE)	OCE-1032276

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