Bottle sample data from CTD casts from the third cruise of SPIROPA project, R/V Thomas G. Thompson cruise TN368, to the New England Shelfbreak in July of 2019

Website: https://www.bco-dmo.org/dataset/849340
Data Type: Cruise Results
Version: 2
Version Date: 2022-06-08

Project
» Collaborative Research: Shelfbreak Frontal Dynamics: Mechanisms of Upwelling, Net Community Production, and Ecological Implications (SPIROPA)

Contributors	Affiliation	Role
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Abstract
Bottle sample data from CTD casts from the third cruise of SPIROPA project, R/V Thomas G. Thompson cruise TN368, to the New England Shelfbreak in July of 2019.

Table of Contents

Coverage

Spatial Extent: **N**:41.391 **E**:-70.0012 **S**:39.1242 **W**:-71.337
Temporal Extent: 2019-07-08 - 2019-07-16

Dataset Description

Cast numbers in version 1 are: [39,62,70:71,81:82, 86, 89,100,118]

Cast numbers in version 2 are: [1:4,6:18,20,24,26,28,30:89,91:140]. Version 2 of the dataset also has extra parameter Triple Oxygen Isotope (TOI).

Methods & Sampling

Location: New England Shelfbreak 40 S 71W depth : 0-2000m.

Standard station CTD profiles measurements (down casts, see related dataset ID: 807119) with water sampling (up casts). This dataset (dataset ID 849340) includes the bottle sample data which is from the up casts.

Twenty-four 10 L Niskin bottles fitted with Teflon-coated external closures were used for water column sampling. At each station, samples were typically collected at 12 discrete depths for assessment of nutrient concentrations. These samples were syringe-filtered and stored at -20°C until analysis at the WHOI Nutrient Analytical Facility. Nitrate and silicate were measured using standard AutoAnalyzer techniques. To measure ammonium concentrations, site water was cartridge-filtered (0.1 µm, Pall Co.) directly from Niskin bottles using a peristaltic pump. Filtrate was collected in FalconTM tubes that were pre-treated with orthophthaldialdehyde (OPA) and measured on-board via the OPA method (Holmes et al., 1999) with a detection limit of 10 nM.

To measure particulate organic carbon and nitrogen, water was collected from the Niskin bottles and filtered through combusted 0.7 µm glass fiber filters (Whatman GF/F), rinsed with a weak acid (0.01 N HCl in seawater) to remove carbonates, then dried in combusted glass vials at 60 °C. Diatom biomass was assessed by sampling for biogenic silica. Samples were filtered through 0.6 µm polycarbonate filters, dried at 60°C in plastic Petri dishes, and dissolved in strong acid.

For incubation-based primary productivity, water samples were taken from Niskin bottles at known isolumes, then placed in sterile 285 mL Qorpak bottles, then ~20 µCi NaH14CO3 was added. An on-deck incubator holding the bottles had surface seawater flowing through it, with irradiance attenuated by neutral density filters to the light levels at the isolumes sampled. Blue filters were used for isolumes below 30% Eo. After 24 h, samples were filtered through GFF filters and placed in 7 mL scintillation vials. Size fractionations were conducted at all stations using 20 µm Poretics filters on subsamples from each bottle. 100 µL 1N HCl was added to volatilize absorbed inorganic 14C. Ecolume (5 mL) was then added to each vial, and all vials were counted after 24 h on a liquid scintillation counter. Total activity was measured by counting 100 µL of non-acidified sample in β-phenethanylamine.

Data Processing Description

CTD Sea-Bird Software:
Data acquisition: SBE Seasave, version 7.26.7.107
Data processing: SBE Data Processing, version 7.26.7.114

BCO-DMO data manager processing notes version 1:
* Data form file tn368_bottle_data_Feb_2021_diatom_hotspot.txt imported into the BCO-DMO data system.
* Data imported with missing data identifier NaN will be displayed differently based on the file type downloaded by the user. It will be blank values in .csv files, NaN in matlab files, etc.
* Constructed ISO_DateTime_UTC from year, month, day and time columns which were NMEA UTC times. I checked the cast start times in the corresponding CTD dataset https://www.bco-dmo.org/dataset/807119 to make sure it was correct to pad 0s for time (e.g. 13 is 00:13 not 13:00).
* Made longitude negative since West is negative in decimal degrees.

BCO-DMO data manager processing notes version 2 (replaces version 1):
* Data imported into the BCO-DMO dataset system from file tn368_bottle_data_Dec_2021.txt
* Constructed ISO_DateTime_UTC from year, month, day and time columns which were NMEA UTC times.

[ ]

Data Files

File
tn368_bottle_v2.csv(Comma Separated Values (.csv), 738.68 KB) MD5:b0744c541649c9fffd05f765777622e9 Primary data file for dataset ID 849340

[table of contents | back to top]

Related Datasets

IsRelatedTo

McGillicuddy, D. J., Sosik, H. M., Zhang, W. G., Smith, W. O., Stanley, R., Turner, J., Petitpas, C. (2022) **Bottle sample data and water processing samples from CTD casts from the first cruise of SPIROPA project, R/V Neil Armstrong cruise AR29, to the New England Shelfbreak in April 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2022-06-08 doi:10.26008/1912/bco-dmo.863240.2 [view at BCO-DMO]
Relationship Description: Bottle data from the first cruise of SPIROPA project taken in April 2018.

McGillicuddy, D. J., Sosik, H. M., Zhang, W. G., Smith, W. O., Stanley, R., Turner, J., Petitpas, C. (2022) **Bottle sample data from CTD casts from the second cruise of SPIROPA project, R/V Ronald H. Brown cruise RB1904, to the New England Shelfbreak in May of 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-05-04 doi:10.26008/1912/bco-dmo.873854.1 [view at BCO-DMO]
Relationship Description: Bottle data from the second cruise of SPIROPA project taken in May 2019.

McGillicuddy, D. J., Sosik, H. M., Zhang, W. G., Smith, W. O., Stanley, R., Turner, J., Petitpas, C. (2022) **CTD casts from the SPIROPA project from R/V Neil Armstrong cruise AR29, Ronald H. Brown cruise RB1904 and R/V Thomas G. Thompson cruise TN368 to the New England Shelfbreak in 2018 and 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 4) Version Date 2022-08-10 doi:10.26008/1912/bco-dmo.807119.4 [view at BCO-DMO]
Relationship Description: CTD profiles measurements (down casts) of the three SPIROPA cruises.

Mulholland, M., Chappell, P. Dreux (2024) **Nitrogen fixation incubation data from cruise TN368 in July 2019 for SPIROPA project.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-23 http://lod.bco-dmo.org/id/dataset/928568 [view at BCO-DMO]

IsSourceOf

Mulholland, M., Chappell, P. Dreux, Selden, C. (2024) **Hydrography, nutrients, and nitrogen uptake rates from SPIROPA cruise TN368 in July 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-20 http://lod.bco-dmo.org/id/dataset/927927 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise	Cruise identifier	unitless
cast	CTD cast number	unitless
station	Station number	unitless
station_id	Station ID: 1-A, 2-B, 3-AUV, 4-AL-CTD, 5-P, 6-NS, 7-EW, 8-NS6A, 9-A10z, 10-SLP, 11-SSF, 12-ALF, 13-AC, 14-AL, 15-HS, 16-S, 17-L'; E.g.: st#=14, stId=1 => stName=14A	unitless
year	NMEA UTC year (yyyy)	year
month	NMEA UTC month (mm)	month number

day	NMEA UTC day (dd)	day of month
time	NMEA UTC time (HHMM)	hhmm
ISO_DateTime_UTC	Cast start time in ISO8601 format yyyy-mm-ddTHH:MMZ (UTC time)	unitless
latitude	NMEA latitude	decimal degrees
longitude	NMEA longitude (west is negative)	decimal degrees
target_depth	target depth	m
depth	depth	m
press	pressure	db
niskin_used	The number of bottles used for CTD BTL data averaging if more than	unitless
sigmat	Sigma-theta density from primary sensors	kg/m^3
sigmat2	Sigma-theta density from secondary sensors	kg/m^3
oxy	Dissolved oxygen concentration	ml/l
oxyM	Dissolved oxygen concentration	Mm/Kg
oxySat	Dissolved oxygen concentration	Mm/Kg
potTemp	Potential temperature from primary sensor	ITS-90, deg C
potTemp2	Potential temperature from secondary sensor	ITS-90, deg C
sal	Salinity practical from primary sensors	unitless
sal2	Salinity practical from secondary sensors	unitless
dens	Density from primary sensors	kg/m^3
dens2	Density from secondary sensors	kg/m^3
svCM	Sound velocity (chen-millero) from primary sensors	m/s
svCM2	Sound velocity (chen-millero) from secondary sensors	m/s
temp	temperature from primary sensor	ITS-90, deg C
temp2	temperature from secondary sensor	ITS-90, deg C
cond	conductivity from primary sensor	S/m
cond2	conductivity from secondary sensor	S/m
oxyV	oxygen raw	V
fluor1	Fluorescence, WET Labs ECO-AFL/FL	mg/m^3
fluor2	Fluorescence, WET labs CDOM	mg/m^3
upoly0	Upoly 0, SUNA 2km ASY-NTR-00081	micromolar nitrate (mmol nitrate per m^3)
trans	CStarTr0: Beam Transmission, WET Labs C-Star	%
turb	turbWETntu0: Turbidity, WET Labs ECO	NTU
alt	Altitude (from Altimeter)	m
salDC	Salinity practical from primary sensor (output from Data Conversion)	Practical Salinity Units (PSU)
spar	SPAR/surface irradiance	microEinsteins/m^2/second
par	PAR/irradiance	microEinsteins/m^2/second
cpar	CPAR/Corrected Irradiance	%
V0	Fluor1 Voltage	Volt

V6	UserPoly Voltage	Volt
bottle_nuts	CTD bottle number for nutrient analyses	unitless
NO3	Nitrate concentration	umol L-1
NH4	Ammonium concentration	umol L-1
PO4	Phosphate concentration	umol L-1
Si	Silicate (SiO4) concentration	umol L-1
PPVial	Vial number (primary productivity)	unitless
Volfilt	Filter Volume (primary productivity)	ml
N_mg	Nitrogen	mg
C_mg	Carbon	mg
PON	particulate organic Nitrogen	umol L-1
POC	particulate organic Carbon	umol L-1
CN_ratio	Carbon/Nitrogen ratio	mol/mol
Exp	Experiment ID. 1-experiment; 0-regular	unitless
Proc_io	irradiance/surface irradiance ratio	%
Prod	primary productivity	mg m-3 h-1
IntProd	integrated primary productivity per day	mg C m-2 d-1
Bsi	biogenic silica	umol L-1
Csi	Carbon/silacate ratio	umol kg -1
bottle_chl	CTD bottle number for Chlorophyll analyses	unitless
Filt_0	Filt_0 ID=0. 0 = whole seawater. No water filtering.	unitless
Chl_x_0	Chlorophyll Filt_0	ug L-1
Chl_y_0	Chlorophyll Filt_0 (replicates)	ug L-1
Phaeo_x_0	total phaeopigment Filt_0	ug L-1
Phaeo_y_0	total phaeopigment Filt_0 (replicates)	ug L-1
QCflag_x_0	Filt_0 Quality flag: 1-inspected, 2-some question	unitless
QCflag_y_0	Filt_0 (replicates) Quality flag: 1-inspected, 2-some question	unitless
Filt_10	Filt_10 ID=10. 10 =	unitless
Chl_x_10	Chlorophyll Filt_10	ug L-1
Chl_y_10	chlorophyll Filt_10 (replicates)	ug L-1
Phaeo_x_10	total phaeopigment Filt_10	ug L-1
Phaeo_y_10	total phaeopigment Filt_10 (replicates)	ug L-1
QCflag_x_10	Filt_10 Quality flag: 1-inspected, 2-some question	unitless
QCflag_y_10	Filt_10 (replicates) Quality flag: 1-inspected, 2-some question	unitless
bottle_alk	CTD bottle number for Alkalinity analyses	unitless
CO3	carbonate ion [CO3]2-	umol/kg
HCO3	Bicarbonate.	umol/kg
Ar	Aragonite	umol / kg
Ca	Calcium	umol / kg
Alk	Alkalinity	umol / kg

Dic	dissolved inorganic carbon	umol / kg
PCO2	Partial Pressure of Carbon Dioxide	uatm
PH	pH	total scale
bottle_nh4HR	CTD bottle number for Ammonium High resolution analyses	unitless
NH4HR	Ammonium High resolution	nmol L-1
Sd	Ammonium high resolution Standard deviation.	nmol L-1
bottle_toi	CTD bottle number for Triple Oxygen Isotope (TOI) analyses	unitless
D17corr	D17corr	per meg
Littled17corr	Littled17corr	per mil
D18corr	D18corr	per meg
dO2Arhscorr	O2Arcorr	unitless
Samp_toi	Sample TOI	unitless
Vial_toi	Vial TOI	unitless
Dep_toi	Depth TOI	m
Sample_date_toi	Sanple date TOI	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Dataset-specific Description SeaBird 911+ Rosette 24-position, 10-liter bottle Rosette with dual T/C sensors At each station, CTD casts measured temperature, salinity and PAR. Water samples collected at depths of 500, 300, 250, 200, 150, 120, 100, 80, 60, 40, 30, 20, 10 m, and the surface were filtered, processed or preserved for further analysis.
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	
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	LI-COR Biospherical SPAR
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Dataset-specific Description	The LI-COR Biospherical SPAR Sensor is used to measure Surface Photosynthetically Available Radiation (SPAR).
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	
Generic Instrument Name	Pressure Sensor
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
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	Turbidity, WET Labs ECO
Generic Instrument Name	Turbidity Meter
Generic Instrument Description	A turbidity meter measures the clarity of a water sample. A beam of light is shown through a water sample. The turbidity, or its converse clarity, is read on a numerical scale. Turbidity determined by this technique is referred to as the nephelometric method from the root meaning "cloudiness". This word is used to form the name of the unit of turbidity, the NTU (Nephelometric Turbidity Unit). The meter reading cannot be used to compare the turbidity of different water samples unless the instrument is calibrated. Description from: http://www.gvsu.edu/wri/education/instructor-s-manual-turbidity-10.htm (One example is the Orion AQ4500 Turbidimeter)

Dataset-specific Instrument Name	
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

[table of contents | back to top]

Deployments

TN368

Website	https://www.bco-dmo.org/deployment/848750
Platform	R/V Thomas G. Thompson
Start Date	2019-07-05
End Date	2019-07-18
Description	DOI: https://doi.org/10.7284/908710

[table of contents | back to top]

Project Information

Collaborative Research: Shelfbreak Frontal Dynamics: Mechanisms of Upwelling, Net Community Production, and Ecological Implications (SPIROPA)

Website: http://science.whoi.edu/users/olga/SPIROPA/SPIROPA.html

Coverage: Shelf break south of New England, OOI Pioneer Array

NSF award abstract:

The continental shelf break of the Middle Atlantic Bight supports a productive and diverse ecosystem. Current paradigms suggest that this productivity is driven by several upwelling mechanisms at the shelf break front. This upwelling supplies nutrients that stimulate primary production by phytoplankton, which in turn leads to enhanced production at higher trophic levels. Although local enhancement of phytoplankton biomass has been observed in some circumstances, such a feature is curiously absent from time-averaged measurements, both from satellites and shipboard sampling. Why would there not be a mean enhancement in phytoplankton biomass as a result of the upwelling? One hypothesis is that grazing by zooplankton prevents accumulation of biomass on seasonal and longer time scales, transferring the excess production to higher trophic levels and thereby contributing to the overall productivity of the ecosystem. However, another possibility is that the net impact of these highly intermittent processes is not adequately represented in long-term means of the observations, because of the relatively low resolution of the in-water measurements and the fact that the frontal enhancement can take place below the depth observable by satellite. The deployment of the Ocean Observatories Initiative (OOI) Pioneer Array south of New England has provided a unique opportunity to test these hypotheses. The combination of moored instrumentation and autonomous underwater vehicles will facilitate observations of the frontal system with unprecedented spatial and temporal resolution. This will provide an ideal four-dimensional (space-time) context in which to conduct a detailed study of frontal dynamics

and plankton communities needed to examine mechanisms controlling phytoplankton populations in this frontal system. This project will also: (1) promote teaching, training and learning via participation of graduate and undergraduate students in the research , (2) provide a broad dissemination of information by means of outreach in public forums, printed media, and a video documentary of the field work, and (3) contribute to improving societal well-being and increased economic competitiveness by providing the knowledge needed for science-based stewardship of coastal ecosystems, with particular emphasis on connecting with the fishing industry through the Commercial Fisheries Research Foundation.

The investigators will conduct a set of three cruises to obtain cross-shelf sections of physical, chemical, and biological properties within the Pioneer Array. Nutrient distributions will be assayed together with hydrography to detect the signature of frontal upwelling and associated nutrient supply. The investigators expect that enhanced nutrient supply will lead to changes in the phytoplankton assemblage, which will be quantified with conventional flow cytometry, imaging flow cytometry (Imaging FlowCytobot, IFCB), optical imaging (Video Plankton Recorder, VPR), traditional microscopic methods, and pigment analysis. Zooplankton will be measured in size classes ranging from micro- to mesozooplankton with the IFCB and VPR, respectively, and also with microscopic analysis. Biological responses to upwelling will be assessed by measuring rates of primary productivity, zooplankton grazing, and net community production. These observations will be synthesized in the context of a coupled physical-biological model to test the two hypotheses that can potentially explain prior observations: (1) grazer-mediated control and (2) undersampling. Hindcast simulations will also be used to diagnose the relative importance of the various mechanisms of upwelling. The intellectual merit of this effort stems from our interdisciplinary approach, advanced observational techniques, and integrated analysis in the context of a state-of-the-art coupled model. The project will address longstanding questions regarding hydrodynamics and productivity of an important ecosystem, leading to improved understanding of physical-biological interactions in a complex continental shelf regime. Given the importance of frontal systems in the global coastal ocean, it is expected that knowledge gained will have broad applicability beyond the specific region being studied.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657803

[table of contents | back to top]