

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.

Website: <https://www.bco-dmo.org/dataset/873854>

Data Type: Cruise Results

Version: 1

Version Date: 2022-05-04

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 second cruise of SPIROPA project, R/V Ronald H. Brown cruise RB1904, to the New England Shelfbreak in May of 2019.

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Coverage

Spatial Extent: N:41.391 E:-70.0012 S:39.1242 W:-71.337

Temporal Extent: 2019-05-12 - 2019-05-25

Dataset Description

Cast numbers in version 1 are: [1:62, 64:67, 69:119]

Acquisition Description

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

Standard station CTD profiles measurements (down casts) with water sampling (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 Falcon™ 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% E₀. 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-phenethylamine.

Processing Description

Sea-Bird Software:

- Data acquisition: SBE Seasave, version 7.26.7.107
- Data processing: SBE Data Processing, version 7.26.7.114

Bad data is indicated with a flag:

Bad data flag=-9.990e-29

BCO-DMO data manager processing notes version 1:

- * Data imported into the BCO-DMO dataset system from file rb1904_bottle_data_Dec_2020.txt
- * Constructed ISO_DateTime_UTC from year, month, day and time columns which were NMEA UTC times.
- * Made longitude negative since West is negative in decimal degrees.
- * Switched columns OxyM and OxySat on request of submitter.

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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 of the first SPIROPA cruise 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 third cruise of SPIROPA project, R/V Thomas G. Thompson cruise TN368, to the New England Shelfbreak in July of 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2022-06-08 doi:10.26008/1912/bco-dmo.849340.2 [[view at BCO-DMO](#)]

Relationship Description: Bottle data from the third cruise of SPIROPA project taken in July 2019.

McGillicuddy, D. J., Zhang, W. G. (2021) **CTD casts from the SPIROPA project from R/V Neil Armstrong cruise AR29 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 3) Version Date 2021-11-08 doi:10.26008/1912/bco-dmo.807119.3 [[view at BCO-DMO](#)]

Relationship Description: CTD profiles measurements (down casts) of the three SPIROPA cruises.

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Parameters

Parameter	Description	Units
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	year
month	NMEA UTC month	month number
day	NMEA UTC day	day of month
time	NMEA UTC time	hhmm
ISO_DateTime_UTC	Cast start time in ISO8601 format yyyy-mm-ddTHH:MMZ (UTC time)	unitless
latitude	NMEA latitude	degrees N
longitude	NMEA longitude	degrees W
target_depth	target depth	m
depth	depth	m
press	pressure	db
niskin_used	The number of niskin bottles used for CTD BTL data averaging	unitless
sigmat	Sigma-theta density from primary sensors	kg/m ³
sigmat2	a	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
trans	CStarTr0: Beam Transmission, WET Labs C-Star	%
turb	turbWETntu0: Turbidity, WET Labs ECO	NTU
alt	Altimeter	m
salDC	Salinity practical from primary sensor (output from Data Conversion)	unitless
spar	SPAR/surface irradiance	microEinsteins/m ² /second
par	PAR/irradiance	microEinsteins/m ² /second
cpar	CPAR/Corrected Irradiance	%
V0	Fluor1 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 concentration	umol L ⁻¹
bottle_toi	CTD bottle number for Triple Oxygen Isotope (TOI) analyses	unitless
D17corr	D17corr	per meg
Littled17corr	Littled17corr	per mil
Littled18corr	Littled18corr	per mil
O2Arcorr	O2Arcorr	unitless
Samp_toi	Sample TOI (Triple Oxygen Isotope)	unitless
Vial_toi	Vial TOI (Triple Oxygen Isotope)	unitless
PPVial	primary productivity	unitless
Volfilt	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
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
bottle_chl	CTD bottle number for Chlorophyll analyses	unitless
Filt_0	Filt_0 ID=0	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	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	Carbon trioxide	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
upoly0	Upoly 0, SUNA 2km ASY-NTR-00081	micromolar nitrate (mmol nitrate per m ³

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Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD profiler
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 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 and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the 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 instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	LI-COR Biospherical PAR
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	SBE 43 Dissolved Oxygen
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	Pressure, Digiquartz with TC
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	ECO-AFL/FL
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

Dataset-specific Instrument Name	Turbidity, WET Labs ECO
Generic Instrument Name	Wet Labs ECO Puck
Generic Instrument Description	The Puck is a miniature version of the ECO series of sensors, specifically designed for use in AUVs, profiling floats, and Slocum gliders with a dry science bay. This compact optical sensor is available in combinations of backscattering and fluorescence measurements. Manufacturer's website: https://www.seabird.com/auv-rov-sensors/eco-puck/family?productCategoryl...

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Deployments

RB1904

Website	https://www.bco-dmo.org/deployment/873906
Platform	NOAA Ship Ronald H. Brown
Start Date	2019-05-12
End Date	2019-05-25

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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.

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Funding

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

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