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.

Website: https://www.bco-dmo.org/dataset/863240
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 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.

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Coverage

Spatial Extent: **N**:41.391 **E**:-70.0012 **S**:39.1242 **W**:-71.337
Temporal Extent: 2018-04-17 - 2018-04-29

Dataset Description

Cast numbers in version 1 are [29, 31:40]

Cast numbers in version 2 are: [1:11, 13:17, 19, 29:44, 56:70, 72:74, 76:102, 19, 111:126, 128:129, 131:132, 140:160, 162:167, 172:175]

Methods & Sampling

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

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 $NaH^{14}CO_3$ 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 7.23.2
* Data processing: SBE Data Processing, version 7.26.7.114

BCO-DMO data manager processing notes version 1 :
- added ISO_DateTime_UTC column
- Added cruise ID to the data
- Made longitude values negative to represent values west of the UTC line.

BCO-DMO data manager processing notes version 2 (replaces version 1):
* Data imported into the BCO-DMO dataset system from file ar29_bottle_data_Nov_2020.txt
* Constructed ISO_DateTime_UTC from year, month, day and time columns which were NMEA UTC times.

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Data Files

File
ar29_bottle_v2.csv(Comma Separated Values (.csv), 500.01 KB) MD5:e0d65c5666ae2312cae9b1a99c8ace27 Primary data file for dataset ID 863240

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Related Datasets

IsRelatedTo

Kosnyrev, O., McGillicuddy, D. J., Zhang, W. G. (2021) **Bottle data from CTD casts from the first cruise of SPIROPA project on April 27, 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-06-17 doi:10.26008/1912/bco-dmo.815450.1 [view at BCO-DMO]
Relationship Description: Bottle files of first SPIROPA cruise taken in April 2018 - Transect 24, in different file format.

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 of the second SPIROPA cruise taken in May 2019.

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 of the third cruise of the SPIROPA project taken in July 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.

IsSourceOf

Stanley, R. H. R., Sandwith, Z. O. (2025) **Discrete Net Community and Gross Primary Production Rates data on the US Northeastern Shelf in the SPIROPA project during spring and summer 2018 and 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-10-03 doi:10.26008/1912/bco-dmo.985985.1 [view at BCO-DMO]

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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 time	hhmm
month	NMEA UTC year	year
day	NMEA UTC month	month number
time	NMEA UTC day	day of month
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	Sigma-theta density from secondary sensors	kg/m^3
oxy	Dissolved oxygen concentration	ml/l
oxyM	Dissolved oxygen saturation	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	Density00; density from primary sensors	kg/m^3
dens2	Density11; 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	Volt
fluor1	Fluorescence, WET Labs ECO-AFL/FL	mg/m^3
turb	turbWETntu0: Turbidity, WET Labs ECO	NTU
spar	SPAR/surface irradiance	microEinsteins/m^2/second
par	PAR/irradiance	microEinsteins/m^2/second
cpar	CPAR/Corrected Irradiance	%
Proc_io_PP	irradiance/surface irradiance ratio	%
Dep_PP	POC/PP/Productivity data: depth apparently taken from the previous Bottle file and rounded	m

Prod	primary productivity	mg m^-3 h^-1
ChlPP	POC/PP/Productivity data: calculated Chlorphyll concentration	ug L^-^1
AN	??	??
Prod_20um	primary productivity (20um)	mg m^-3 h^-1
POC	particulate organic Carbon	umol L^-1
PON	particulate organic Nitrogen	umol L^-1
Bsi	biogenic silica	umol L^-1
CN_ratio	Carbon/Nitrogen ratio	mol/mol
IntProd	integrated primary productivity per day	mg C m^-2 d^-1
IntProd_20um	integrated primary productivity per day (20um)	mg C m^-2 d^-1
Ratio	Carbon/silacate ratio	umol kg ^-1
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
D17	D17	per meg
Littled17	Littled17	per mil

Littled18	Littled18	per mil
O2Ar	O2Ar	umol kg ^-1 ?
Sample_toi	TOI sample number	unitless
Vial_toi	TOI vial number	unitless
bottle_alk	CTD bottle number for Alkalinity analyses	unitless
CO3	Carbon trioxide	umol/kg
HCO3	Bicarbonate	umol/kg
OAr	Aragonite	umol / kg
OCa	Calcium	umol / kg
Alk	Alkalinity	umol / kg
Dic	dissolved inorganic carbon	umol / kg
PCO2	Partial Pressure of Carbon Dioxide	uatm
PH	PH total	total scale
bottle_chl	CTD bottle number for Chlorophyll analyses	unitless
Filt_0	Filt_0 ID=0; 0 = whole seawater	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 = <10um size fractionated chl	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

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Instruments

Dataset-specific Instrument Name	SeaBird 911+ Rosette 24-position
Generic Instrument Name	CTD Sea-Bird 911
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 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with 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	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	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	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 the manufacturer: https://www.seabird.com/products/sbe-43-dissolved-oxygen-sensor

Dataset-specific Instrument Name	Turbidity, WET Labs ECO
Generic Instrument Name	Turbidity Meter
Dataset-specific Description	WET Labs offers the Environmental Characterization Optics (ECO) series of meters that incorporate a common set of options with a single basic design to make them ideal for a wide variety of deployments. The NTU provides: Unparalleled sensitivity of the ECO in an optical scattering measurement at 660 nm for determining turbidity. Turbidity measurement data that is not affected by CDOM concentration, unlike instruments that attempt to measure turbidity by using blue wavelengths. The option of analog output for easy integration into CTD packages. Excellent precision, reliability and overall performance at a fraction of the cost and size of similar instruments.
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/wrj/education/instructor-s-manual-turbidity-10.htm (One example is the Orion AQ4500 Turbidimeter)

Dataset-specific Instrument Name	ECO-AFL/FL
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Dataset-specific 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
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

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Deployments

AR29

Website	https://www.bco-dmo.org/deployment/806753
Platform	R/V Neil Armstrong
Start Date	2018-04-16
End Date	2018-04-29

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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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