Shipboard grazing experiment zooplankton data from the mid-Atlantic Bight Shelfbreak on R/V Neil Armstrong cruise AR29, R/V Ronald H. Brown cruise RB1904 and R/V Thomas G. Thompson cruise TN368 in April 2018 and May/July2019

Website: https://www.bco-dmo.org/dataset/957833
Data Type: experimental
Version: 1
Version Date: 2025-06-16

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

Contributors	Affiliation	Role
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Abstract
As part of the Shelfbreak Productivity Interdisciplinary Research Operation at the Pioneer Array (SPIROPA) Project, twelve grazing experiments were conducted during each of three research cruises (April of 2018, and May and July of 2019) in the Middle Atlantic Bight to estimate community zooplankton grazing and net phytoplankton growth rates. Stations where the experiments were conducted were strategically located in one of three key cross-shelf water mass regimes: (1) at the shelfbreak front, (2) inshore of the front in continental shelf water and (3) offshore of the front in slope water. Grazing incubations were performed on water sampled from the chlorophyll maximum, when present. The experiments included two "treatments": 1. whole water incubations and incubations on the <200 µm fraction of the plankton communinity. All experiments were run in triplicate for 24 hours in flow-thru deck incubators and consisted of a dark treatment incubation and a light treatment incubation at a simulated 30% E0.

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Coverage

Location: Mid-Atlantic Bight Shelf break south of New England, OOI Pioneer Array

Spatial Extent: **N**:40.646633 **E**:-70.399952 **S**:39.583275 **W**:-71.083692
Temporal Extent: 2018-04-16 - 2019-07-18

Methods & Sampling

Daily zooplankton Grazing Experiments were conducted on each of three cruises as a component of the SPIROPA project. 12 experiments/Cruise, targeting 3 water mass regimes: shelf, shelfbreak front and slope waters.

Grazing experiment sample water was collected with a CTD/Niskin bottle rosette at depths ranging from surface (0 m) to 56m, targeting chl-*a* max if present. Two experimental treatments were incubated: 1. whole water to represent the entire plankton community and 2. <200 µm fraction of plankton community to estimate microzooplankton grazing impact.

Data Processing Description

Separate triplicate 4-liter jars of each treatment were concurrently incubated for 24 hrs. in two separate incubation conditions: Dark and Light (30% Eo) flow-through seawater deck incubators. After 24-hour incubations 3 liters of each replicate were poured through 15 µm sieves that were backwashed into 50 ml centrifuge tubes for a 30 ml final concentrate that was preserved in approximately 1% Utermöhl's solution according to Guillard (1973)

In the lab, zooplankton was identified to the lowest practical taxonomic level and quantified utilizing a dissecting microscope.

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Data Files

File
957833_v1_zooplankton.csv (Comma Separated Values (.csv), 111.95 KB) MD5:155a7d034fec5a0bb11fbc6de19e9d45 Primary data file for dataset ID 957833, version 1

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Related Publications

R. R. L. Guillard, "Division Rates," In: J. R. Stein, Ed., Handbook of Phycological Methods: Culture Methods and Growth Measurements, Cambridge University Press, London, 1973, pp. 289-311.
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise identifier	unitless
Latitude	North latitude	decimal degrees

Longitude	West longitude as indicated by negative	decimal degrees
Date_Collected	Date of sample collection	unitless
Station	Alphanumeric Station identifier.	unitless
Depth_M	Sample depth where dilution experiment water was collected with Niskin bottles	meters
Water_Mass_Region	Identification of water mass type (shelf, slope, front) with hydographic feature (eddy, warm core ring, streamer) descriptor when present	unitless
Date_time_start	Date and time of start of incubation Local Time: EDT	unitless
Date_time_stop	Date and time of incubation stop Local Time: EDT	unitless
delta_t_day	Incubation period= incubation stop date/time minus incubation start date/time	day
Experiment_No	One experiment was conducted per cruise day. This is the consecutive experiment number.	unitless
Treatment	Treatments: X#Whole Water Control (1,2, or 3) is not a true control, but the initial unincubated whole water sample; #Microplankton Control (1,2, or 3) is not a true control, but the initial unincubated <200 µm sample; #Whole Water Light (1,2, or 3) are replicates of whole water sample incubated in the Light treatment incubator; #Whole Water Dark (1,2, or 3) are replicates of whole water sample incubated in darkness; #Microplankton Light (1,2, or 3) are replicates of <200 µm sample incubated in the Light treatment incubator; #Microplankton Dark (1,2, or 3) are replicates of whole water sample incubated in darkness	unitless
Replicate	Replicate number: 1,2 or 3	unitless
copepod_nauplii	zooplankton abundance	animals/cubic meter
Oithona_copepodite	zooplankton abundance	animals/cubic meter
calanoid_copepodite	zooplankton abundance	animals/cubic meter

Acartia_female	zooplankton abundance	animals/cubic meter
Acartia_copepodite	zooplankton abundance	animals/cubic meter
Calanus_copepodite	zooplankton abundance	animals/cubic meter
Centropages_typicus_female	zooplankton abundance	animals/cubic meter
Centropages_typicus_male	zooplankton abundance	animals/cubic meter
Centropages_copepodite	zooplankton abundance	animals/cubic meter
Corycaeus_copepodite	zooplankton abundance	animals/cubic meter
Eucalanus_copepodite	zooplankton abundance	animals/cubic meter
fat_calanoid_female	zooplankton abundance	animals/cubic meter
Microsetella	zooplankton abundance	animals/cubic meter
Oithona_atlantica_female	zooplankton abundance	animals/cubic meter
Oithona_atlantica_copepodite	zooplankton abundance	animals/cubic meter
Oithona_similis_female	zooplankton abundance	animals/cubic meter
Oithona_similis_male	zooplankton abundance	animals/cubic meter
Oncaea_female	zooplankton abundance	animals/cubic meter
Oncaea_copepodiite	zooplankton abundance	animals/cubic meter
Paracalanus_parvus_female	zooplankton abundance	animals/cubic meter
Paracalanus_parvus_copepodite	zooplankton abundance	animals/cubic meter
Pseudocalanus_female	zooplankton abundance	animals/cubic meter

Pseudocalanus_male	zooplankton abundance	animals/cubic meter
Temora_stylifera_female	zooplankton abundance	animals/cubic meter
Temora_copepodite	zooplankton abundance	animals/cubic meter
barnacle_nauplii	zooplankton abundance	animals/cubic meter
bivalve_veliger	zooplankton abundance	animals/cubic meter
crab_zoea	zooplankton abundance	animals/cubic meter
decapod_larva	zooplankton abundance	animals/cubic meter
Evadne	zooplankton abundance	animals/cubic meter
fish_egg	zooplankton abundance	animals/cubic meter
gastropod_veliger	zooplankton abundance	animals/cubic meter
hyperiid_amphipod	zooplankton abundance	animals/cubic meter
Sagitta	zooplankton abundance	animals/cubic meter
salp	zooplankton abundance	animals/cubic meter
tintinnid	zooplankton abundance	animals/cubic meter
fat_calanoid_female_copepodite	zooplankton abundance	animals/cubic meter
Pseudocalanus_female_copepodite	zooplankton abundance	animals/cubic meter

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	CTD/Niskin bottle rosette equipped with a SBE 911 plus CTD system, and twenty-four 10 L Niskin bottles fitted with Teflon-coated external closures were used for water column sampling.
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	Niskin bottle
Dataset-specific Description	CTD/Niskin bottle rosette equipped with a SBE 911 plus CTD system, and twenty-four 10 L Niskin bottles fitted with Teflon-coated external closures were used for water column sampling. Zooplankton were microscopically identified and counted using a Wild M5A dissecting microscope.
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.

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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

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

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

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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-1658054

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