Video Plankton Recorder environmental sensor data from the first cruise of SPIROPA project aboard the R/V Neil Armstrong on April 26, 2018

Website: https://www.bco-dmo.org/dataset/805392
Data Type: Cruise Results
Version: 1
Version Date: 2020-03-20

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

Contributors	Affiliation	Role
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Abstract
Video Plankton Recorder environmental sensor data from the first cruise of SPIROPA project in April 2018.

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Coverage

Spatial Extent: **N**:40.25375 **E**:-70.75453 **S**:39.7112 **W**:-70.82971
Temporal Extent: 2018-04-26

Dataset Description

Video Plankton Recorder environmental sensor data from the first cruise of SPIROPA project in April 2018.

Acquisition Description

The instrument was towed behind a ship and undulated within the depth range of 5-100 m below surface.

Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- converted latitude and longitude coordinates to decimal degrees in the lat and lon columns
- created ISO_DateTime_UTC field

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Parameters

Parameter	Description	Units
ISO_DateTime_UTC	Date and time in UTC following ISO 8601 format	yyyy-MM-dd'T'HH:mm:SS'Z'
lat	latitude with positive values indicating North	decimal degrees
lon	longitude with negative values indicating West	decimal degrees
depth	depth	meters (m)
vprtimestep	video plankton recorder time step	unitless
gmt	UTC time in the format hhmmss	unitless
date	serial date number in the format DDMMYY	unitless
latitude	latitude ddmm.mmmm degrees N	degrees decimal minutes
longitude	longitude ddmm.mmmm degrees W	degrees decimal minutes
maxdepth	maximal deptgh	meters (m)
alt	altitude	meters (m)
roll	roll	degrees
pitch	pitch	degrees
fluor	flourescence	volts (V)
turb	turbidity	micrograms per liter (ug/L)
par	PAR/irradiance	microEinsteins/m^2/second (uE/m2/s)
oxy	oxygen	volts (V)
sal	salinity	unitless
temp	temperature	degrees Celsius (C)

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Instruments

Dataset-specific Instrument Name	Video Plankton Recorder environmental sensors
Generic Instrument Name	Video Plankton Recorder
Dataset-specific Description	Environmental data (temperature, salinity, turbidity, fluorescence, irradiance, dissolved oxygen) collected by sensors mounted on the Video Plankton Recorder (VPR)
Generic Instrument Description	The Video Plankton Recorder (VPR) is a video-microscope system used for imaging plankton and other particulate matter in the size range from a few micrometers to several centimeters. The VPR is essentially an underwater microscope. It consists of four video cameras (with magnifying optics) synchronized at 60 fields per second (fps) to a red-filtered 80 W xenon strobe (pulse duration = 1 microsecond). The current lens on each camera can be adjusted to provide a field of view between 5 mm and 10 cm. Use of higher magnification lenses is currently being explored for viewing protozoans (less than 1 micrometer resolution). The four cameras are set for concentric viewing fields so that a range of up to four magnifications can be viewed simultaneously, allowing a wide size range of plankton to be sampled. Depth of field is adjusted by the lens aperture setting, and the volume sampled in each video field ranges from about 1 ml to 1 liter, depending on lens settings. The cameras have been configured for stereoscopic viewing as well.A strobe on the other arm illuminates the imaged volume and flashes 60 times per second, producing 60 images per second of the particles and plankton in the water. The images are then saved internally on a computer hard disk and later plotted. Deployment: Most commonly, the VPR is mounted in a frame and lowered into the water from the stern of the ship. Sometimes, a CTD also is mounted next to the VPR to collect depth, temperature, and salinity information at the same time as each video image. The instrument is lowered down through the water to a maximum depth of 350 meters to generate a profile of plankton/particle abundance and taxon group along with temperature and salinity. In addition to the towed configuration for mapping plankton distributions, it is possible to deploy the VPR in a fixed position (on a mooring) for viewing plankton swimming behaviors in two or three dimensions. The VPR instrument system has been used in both configurations, and deployment on ROVs has been proposed. This definition was taken from the WHOI Ocean Instruments Web site and from a US GLOBEC Newsletter.

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Deployments

AR29

Website	https://www.bco-dmo.org/deployment/806753
Platform	R/V Neil Armstrong

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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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