Processed CTD (1 m binned) data from R/V Atlantic Explorer cruise AE1918 during July 2019

Website: https://www.bco-dmo.org/dataset/781972
Data Type: Cruise Results
Version: 1
Version Date: 2019-11-18

Project
» Collaborative Research: Diel physiological rhythms in a tropical oceanic copepod (Zooplankton Diel Rhythm)

Contributors	Affiliation	Role
Maas, Amy	Bermuda Institute of Ocean Sciences (BIOS)	Principal Investigator
Blanco-Bercial, Leocadio	Bermuda Institute of Ocean Sciences (BIOS)	Co-Principal Investigator
Tarrant, Ann M.	Woods Hole Oceanographic Institution (WHOI)	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
AE1918 was a cruise of opportunity on which two oceanographic sampling activities were conducted: a CTD cast and a MOCNESS net tow. These are the processed, binned CTD data.

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Coverage

Spatial Extent: **Lat**:32.333 **Lon**:-64.553
Temporal Extent: 2019-07-25

Dataset Description

AE1918 was a cruise of opportunity on which two oceanographic sampling activities were conducted: a CTD cast and a MOCNESS net tow. These are the processed, binned CTD data.

Acquisition Description

The CTD was run using standard operating procedures. Bottles were triggered to check for reliability of the system within the NSF inspection procedure, not for science. Bottle file then not included.

Processing Description

Data was processed with provided config file (AE1918C1.XMLCON). Data was processed (included all data) and then binned in 1 m intervals using SBEDataProcessing software.

BCO-DMO Processing:
- added parameter names (using names from file header).

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Parameters

Parameter	Description	Units
depSM	Depth [salt water]	meters
t090C	Temperature [ITS-90]	degrees Celsius
t190C	Temperature, 2 [ITS-90]	degrees Celsius
sal00	Salinity, Practical	PSU
sal11	Salinity, Practical, 2	PSU
sigma_e00	Density [sigma-theta]	kilograms per cubic meter (kg/m^3)
sigma_e11	Density, 2 [sigma-theta]	kilograms per cubic meter (kg/m^3)
flC	Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]	micrograms per liter (ug/l)
flECO_AFL	Fluorescence, WET Labs ECO-AFL/FL	milligrams per cubic meter (mg/m^3)
sbox0Mm_Kg	Oxygen, SBE 43	micromoles per kilogram (umol/kg)
sbox1Mm_Kg	Oxygen, SBE 43	micromoles per kilogram (umol/kg)
par	PAR/Irradiance, Biospherical/Licor	assumed to be umol (photons) m-2 s-1 (from manufacturer's data)
flag	Flag	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	Seabird 9/11 unit attached to a 24 bottle rosette
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.

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Deployments

AE1918

Website	https://www.bco-dmo.org/deployment/781440
Platform	R/V Atlantic Explorer
Report	http://datadocs.bco-dmo.org/docs/Zooplankton_Diel_Rhythm/data_docs/AE1918_Cruise_Report.pdf
Start Date	2019-07-25
End Date	2019-07-25

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Project Information

Collaborative Research: Diel physiological rhythms in a tropical oceanic copepod (Zooplankton Diel Rhythm)

Coverage: Bermuda

NSF Award Abstract: The daily vertical migration (DMV) of zooplankton and fish across hundreds of meters between shallow and deep waters is a predominant pattern in pelagic ecosystems. This migration has consequences for biogeochemical cycling as it moves a substantial portion of fixed carbon and nitrogen (an estimated 15 to 40 % of the total global organic export) from the surface directly to depth where it feeds the midwater food chain and sequesters nutrients away from atmospheric mixing. Estimates and predictions of these fluxes are, however, poorly understood at present. New observations have shown that one source of uncertainty is due to the assumption that metabolic rates and processes do not vary over the course of the day, except based on changes in temperature and oxygen availability. Rates are, however, also driven by differences in feeding, swimming behavior, and underlying circadian cycles. The objective of this project is to improve the ability of scientists to understand and predict zooplankton contributions to the movement of carbon and nitrogen in the ocean by detailing daily changes in physiological processes of these organisms. By producing a set of respiration and excretion measurements over a daily time series, paired with simultaneously collected gene and protein expression patterns for an abundant vertically migratory species, the investigators will provide unprecedented and predictive insight into how changes in the environment affect the contribution of zooplankton to biogeochemical fluxes. The sampling design of the project will advance discovery and understanding by providing hands-on training opportunities to at least two undergraduate researchers. The project will broaden dissemination of the research via development of an educational module, focusing on rhythms in the ocean. The module will initially be piloted with the Bermuda Institute of Ocean Sciences (BIOS) summer camp students and then disseminated through the BIOS Explorer program, the Teacher Resources Page on the BIOS website, and published in a peer-reviewed educational journal. This project will characterize the metabolic consequences of daily physiological rhythms and DVM for a model zooplankton species, the abundant subtropical copepod Pleuromamma xiphias. Flux processes (oxygen consumption, carbon dioxide production, production of ammonium and fecal pellet production) will be interrogated using directed experiments testing the effects of temperature, feeding and circadian cycle. Circadian cycling will further be examined using transcriptomic and proteomic profiling. These experiments will be related to field samples taken at 6-h intervals over the course of the diel migration using an integrated suite of molecular and organismal metrics. Combined organismal, transcriptomic and proteomic profiles will provide an understanding of which metabolic pathways and associated flux products vary in relation to particular environmental variables (food, light cycle,

temperature). Diel variation in metabolic rates will also be assessed across seasons and species using other important migratory groups (pteropod, euphausiid, and another copepod). The metabolic data will then be contextualized with abundance estimates from archived depth-stratified tows to allow scaling to community-level patterns and will be used to improve calculations of zooplankton contribution to particulate organic carbon, nitrogen and respiratory active flux. The results of this study will both improve our flux estimates and provide predictive insight into how various environmental variables influence the underlying physiological pathways generating carbon and nitrogen flux. Cruise reports are available from the completed cruises:SD031019AE1910AE1918

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829318
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829378

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