Size fractionated zooplankton, C:N, d13C, and d15N from RRS James Cook cruise JC214

Website: https://www.bco-dmo.org/dataset/880448
Data Type: Cruise Results
Version: 1
Version Date: 2022-09-19

Project
» Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation under High Productivity and High Carbon Flux Conditions (EXPORTS) (EXPORTS OM Degradation Indicators)

Program
» EXport Processes in the Ocean from Remote Sensing (EXPORTS)

Contributors	Affiliation	Role
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Abstract
This dataset includes size fractionated zooplankton, C:N, d13C, and d15N from EXPORTS cruise JC214 on RRS James Cook from May to June 2021.

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Coverage

Spatial Extent: **N**:48.9758 **E**:-14.8018 **S**:48.7422 **W**:-15.0676
Temporal Extent: 2021-05-06 - 2021-05-26

Acquisition Description

Sampling was conducted during RRS James Cook cruise JC214 from May 1 to June 1, 2021 in the North Atlantic. Zooplankton were collected using a multiple opening-closing net and environmental sensing system (MOCNESS). Onboard, zooplankton were wet-sieved in filtered seawater using 0.2, 0.5, 1.0, 2.0 and 5.0 mm mesh sieves into different size fractions and frozen at -20º C. Zooplankton were dried and each fraction ground using a mortar and pestle. Samples were weighed into tin capsules and isotope ratios were determined using a Costech elemental combustion system coupled to an isotope ratio mass spectrometer through a

Conflo-IV interface. For details please see Hannides et al. (2013).

Processing Description

BCO-DMO Processing:
- converted all dates to YYYY-MM-DD format;
- added the ISO8601 (UTC) date-time field;
- renamed fields to comply with BCO-DMO naming conventions.

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Related Publications

Hannides, C. C. S., Popp, B. N., Choy, C. A., & Drazen, J. C. (2013). Midwater zooplankton and suspended particle dynamics in the North Pacific Subtropical Gyre: A stable isotope perspective. Limnology and Oceanography, 58(6), 1931–1946. doi:10.4319/lo.2013.58.6.1931
Methods

Wiebe, P. H., K.H. Burt, S. H. Boyd, A. W. Morton (1976). A multiple opening/closing net and environment sensing system for sampling zooplankton. J. Mar. Res., 34, 313-326.
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise ID number	unitless
R2R_Event	Event number	unitless
Latitude	Latitude	degrees North
Longitude	Longitude	degrees East
ISO_DateTime_UTC	Date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mmZ	unitless
Date	Date (UTC) in format YYYY-MM-DD	unitless
Time	Time (UTC) in format hh:mm	unitless
MOCNESS_Tow	MOCNESS tow number	unitless
DayNight	Indicates if sampling was conducted in day or night	unitless
MOCNESS_Net	MOCNESS net number	unitless
DepthInterval_max	Depth of net opening	meters (m)
DepthInterval_min	Depth of net closing	meters (m)
VolFilt	Volume of water that passed through net opening	cubic meters (m^3)
SizeFraction_min	Size fraction minimum	micrometers (um)
SizeFraction_max	Size fraction maximum	micrometers (um)
SampleWeight	Mass of sample put through EA	milligrams (mg)
N	Mass of nitrogen contained in samples	micrograms (ug)
d15N	Isotopic composition of nitrogen in sample relative to AIR	‰, vs AIR
C	Mass of carbon contained in sample	micrograms (ug)
d13C	Isotopic composition of carbon in sample relative to V-PDB	‰, vs VPDB
C_N_ratio	Molar ratio of carbon to nitrogen in sample	mol/mol

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Instruments

Dataset-specific Instrument Name	Thermo-Finnigan Delta Plus XP isotope ratio mass spectrometer with Conflo IV interface
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	MOCNESS
Generic Instrument Name	MOCNESS
Dataset-specific Description	Multiple opening-closing net and environmental sensing system (MOCNESS) net with 1 m2 opening using 0.2 mm mesh plankton nets (see Wiebe et al., 1976)
Generic Instrument Description	The Multiple Opening/Closing Net and Environmental Sensing System or MOCNESS is a family of net systems based on the Tucker Trawl principle. There are currently 8 different sizes of MOCNESS in existence which are designed for capture of different size ranges of zooplankton and micro-nekton Each system is designated according to the size of the net mouth opening and in two cases, the number of nets it carries. The original MOCNESS (Wiebe et al, 1976) was a redesigned and improved version of a system described by Frost and McCrone (1974).(from MOCNESS manual) This designation is used when the specific type of MOCNESS (number and size of nets) was not specified by the contributing investigator.

Dataset-specific Instrument Name	Costech Model 4010 elemental combustion system
Generic Instrument Name	Costech International Elemental Combustion System (ECS) 4010
Generic Instrument Description	The ECS 4010 Nitrogen / Protein Analyzer is an elemental combustion analyser for CHNSO elemental analysis and Nitrogen / Protein determination. The GC oven and separation column have a temperature range of 30-110 degC, with control of +/- 0.1 degC.

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Deployments

JC214

Website	https://www.bco-dmo.org/deployment/880457
Platform	RRS James Cook
Start Date	2021-05-01
End Date	2021-06-01
Description	Objective: The aim of the EXPORTS 2021 North Atlantic deployment is to sample the demise of the annual spring bloom. Hence our requested May 1 start of sampling somewhere near the PAP site (49N 16.5W). The exact location will be dependent upon the oceanographic features observed from remote sensing and autonomous vehicles beforehand. We will attempt to measure all aspects of the biological carbon pump – vertical fluxes, food web processes, physics, geochemistry, etc. Hence, there are officially 54 PIs collaborating on EXPORTS, although many will not sail. (from https://www.bodc.ac.uk/resources/inventories/cruise_inventory/report/17792/)

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Project Information

Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation under

High Productivity and High Carbon Flux Conditions (EXPORTS) (EXPORTS OM Degradation Indicators)

Coverage: North Atlantic approximately 49N, 16.5W

NSF Award Abstract:
The downward settling of organic material transports carbon out of the ocean surface, as part of a process called the biological pump. However, only a small fraction of organic material produced by organisms in surface waters makes it to the deep ocean. The rest can be fragmented or consumed (respired) by bacteria or larger organisms; the role of each process remains in question. Guided by recent results from the Pacific Ocean, the investigators will use the stable isotopes of carbon and nitrogen in amino acids to identify the input of fresh algal material, zooplankton feces, and bacteria to the biological pump in the North Atlantic spring bloom. With data from contrasting locations, the investigators will test and develop their isotopic models so they can be used to help predict global patterns in carbon transport. The work will be part of a large oceanographic field program (NASA EXPORTS). The tremendous amount of data collected in this program will aid the development and interpretation of the isotopic models. To share results broadly, the investigators will produce and distribute several episodes of Voice of the Sea, a local television program that will air in Hawaii and the Pacific islands. Episodes will be posted online and publicized through social media to the south Florida community. The project will support a Ph.D. student and an undergraduate student at University of Miami, which serves a 25% Hispanic population, and a Ph.D. student and an undergraduate student at University of Hawaii, a designated minority-serving institution.

The proposed work will assess the relative importance of packaging organic matter in fecal material, particle disaggregation, microbial reworking, and zooplankton dietary usage on vertical patterns of particle flux across contrasting oceanic provinces, using empirical methods independent of incubation techniques or metabolic rate measurements. From their existing work in relatively low-flux environments of the Pacific Ocean, the investigators have developed two nascent models: (1) a mixing model that uses the compound-specific isotope analysis of amino acids (AA-CSIA) to estimate the phytodetritus, fecal pellet, and microbially degraded composition of particles, such that the vertical alteration mechanisms and size distribution of these materials can be detected; and (2) an inverse relationship between carbon flux into the deep ocean and the reliance of mesopelagic food webs on small, degraded particles. In this project, the investigators will test these two models by applying the same methods to the recent NASA EXPORTS field study in a high productivity, high flux regime, the North Atlantic spring bloom. The first EXPORTS field study in the subarctic Pacific provided some of the materials from which the models were developed. Application and refinement of the investigators' newly developed isotopic indicators will enable development of a globally generalized isotopic framework for assessing the degradative history of particulate organic matter and its relationship to mesopelagic dietary resources, including small, microbially degraded particles that are often not accounted for as a metazoan dietary resource. This work capitalizes on existing, comprehensive field programs specifically focused on building a predictive framework relating surface ocean properties to the vertical flux of organic carbon. The proposed work directly addresses EXPORTS Science Question 2: What controls the efficiency of vertical transfer of organic matter below the well-lit surface ocean? The results of this work additionally will provide observational comparisons to global models of carbon flux composition and pelagic food web resources.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Program Information

EXport Processes in the Ocean from Remote Sensing (EXPORTS)

Website: http://oceanexports.org/

EXport Processes in the Ocean from Remote Sensing (EXPORTS) is a large-scale NASA-led field campaign that will provide critical information for quantifying the export and fate of upper ocean net primary production (NPP)

using satellite observations and state of the art ocean technologies.

Ocean ecosystems play a critical role in the Earth’s carbon cycle and the quantification of their impacts for both present conditions and for predictions into the future remains one of the greatest challenges in oceanography. The goal of the EXport Processes in the Ocean from Remote Sensing (EXPORTS) Science Plan is to develop a predictive understanding of the export and fate of global ocean net primary production (NPP) and its implications for present and future climates. The achievement of this goal requires a quantification of the mechanisms that control the export of carbon from the euphotic zone as well as its fate in the underlying "twilight zone" where some fraction of exported carbon will be sequestered in the ocean’s interior on time scales of months to millennia. In particular, EXPORTS will advance satellite diagnostic and numerical prognostic models by comparing relationships among the ecological, biogeochemical and physical oceanographic processes that control carbon cycling across a range of ecosystem and carbon cycling states. EXPORTS will achieve this through a combination of ship and robotic field sampling, satellite remote sensing and numerical modeling. Through a coordinated, process-oriented approach, EXPORTS will foster new insights on ocean carbon cycling that maximizes its societal relevance through the achievement of U.S. and International research agency goals and will be a key step towards our understanding of the Earth as an integrated system.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124416
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124415

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