Size fractionated zooplankton d13C and d15N of individual amino acids from EXPORTS cruise RR1813 in August 2018

Website: https://www.bco-dmo.org/dataset/868193
Data Type: Cruise Results
Version: 1
Version Date: 2022-01-18

Project
» Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation in the Northeast Pacific (EXPORTS) (EXPORTS Isotopes)

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

Contributors	Affiliation	Role
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Abstract
This dataset reports the size fractionated zooplankton d13C and d15N of individual amino acids from samples collected on the EXPORTS cruise (RR1813) in August 2018.

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Coverage

Spatial Extent: **N**:50.5097 **E**:-144.734 **S**:50.471 **W**:-144.737
Temporal Extent: 2018-08-29 - 2018-08-30

Methods & Sampling

Zooplankton were collected using a multiple opening-closing net and environmental sensing system (MOCNESS) on R/V Roger Revelle cruise RR1813 during August-September 2018 (EXPORTS cruise). Onboard, zooplankton were wet-sieved into different size fractions using filtered seawater and 0.2, 0.5, 1.0, 2.0, and 5.0 mm mesh sieves and frozen at -20ºC. Zooplankton were dried and each fraction ground using a mortar and pestle. Samples were weighed and amino acids were isolated and purified by hydrolysis in 6N hydrochloric acid followed by cation exchange chromatography. The purified amino acids were then treated with isopropanol and trifluoroacetic acid yielding trifluoroacetic amino acid esters. The resulting solution was further purified by

liquid-liquid extraction into chloroform before being stored in a dichloromethane-trifluoroacetic acid solution, and then finally transferred into ethyl acetate just prior to mass spectrometric isotopic analysis. CSIA-AA was carried out on a gas chromatograph coupled to an isotope ratio mass spectrometer (GC-IRMS), with all samples measured in triplicate when amino acid concentrations were sufficient.

Data Processing Description

BCO-DMO Processing:
- converted dates to YYYY-MM-DD;
- added the ISO8601 date-time column;
- renamed fields to comply with BCO-DMO naming conventions.

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Data Files

File
zoop_CSIA-AA.csv (Comma Separated Values (.csv), 22.63 KB) MD5:fdd12d891ef2d18c47c9df06192da8ac Primary data file for dataset ID 868193

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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 designation	unitless
R2R_Event	R2R catalog identifier for this cruise	unitless
Latitude	Latitude in decimal degrees North	decimal degrees North
Longitude	Longitude in decimal degrees West	decimal degrees West
ISO_DateTime_UTC	Date and time (UTC) of sampling in ISO8601 format: YYYY-MM-DDThh:mm:ssZ	unitless

Date	Sampling date (UTC); format: YYYY-MM-DD	unitless
Time	Sampling time (UTC)/deployment of net; format: hh:mm:ss	unitless
MOCNESS_Tow	Shipboard MOCNESS tow designation	unitless
DayNight	Indicates if sampling was conducted during day or night	unitless
MOCNESS_Net	Net number out of 10 nets	unitless
DepthInterval_max	maximum depth of sample	meters (m)
DepthInterval_min	minimum depth of sample	meters (m)
SizeFraction_min	minimum wet sieved size fraction	micrometers (um)
SizeFraction_max	maximum wet sieved size fraction	micrometers (um)
Taxa	which taxa were analyzed	text
d15N_Ala	the nitrogen isotopic composition of alanine	permil relative to AIR (‰)
d15N_Gly	the nitrogen isotopic composition of glycine	permil relative to AIR (‰)
d15N_Thr	the nitrogen isotopic composition of threonine	permil relative to AIR (‰)
d15N_Ser	the nitrogen isotopic composition of serine	permil relative to AIR (‰)
d15N_Val	the nitrogen isotopic composition of valine	permil relative to AIR (‰)
d15N_Leu	the nitrogen isotopic composition of leucine	permil relative to AIR (‰)
d15N_Iso	the nitrogen isotopic composition of isoleucine	permil relative to AIR (‰)
d15N_Pro	the nitrogen isotopic composition of proline	permil relative to AIR (‰)

d15N_Asx	the nitrogen isotopic composition of aspartic acid	permil relative to AIR (‰)
d15N_Met	the nitrogen isotopic composition of aspartic acid	permil relative to AIR (‰)
d15N_Glx	the nitrogen isotopic composition of glutamic acid	permil relative to AIR (‰)
d15N_Phe	the nitrogen isotopic composition of phenylalanine	permil relative to AIR (‰)
d15N_Tyr	the nitrogen isotopic composition of tyrosine	permil relative to AIR (‰)
d15N_Lys	the nitrogen isotopic composition of lysine	permil relative to AIR (‰)
SD_d15N_Ala	the standard deviation of the nitrogen isotopic composition of alanine	permil relative to AIR (‰)
SD_d15N_Gly	the standard deviation of the nitrogen isotopic composition of glycine	permil relative to AIR (‰)
SD_d15N_Thr	the standard deviation of the nitrogen isotopic composition of threonine	permil relative to AIR (‰)
SD_d15N_Ser	the standard deviation of the nitrogen isotopic composition of serine	permil relative to AIR (‰)
SD_d15N_Val	the standard deviation of the nitrogen isotopic composition of valine	permil relative to AIR (‰)
SD_d15N_Leu	the standard deviation of the nitrogen isotopic composition of leucine	permil relative to AIR (‰)
SD_d15N_Ile	the standard deviation of the nitrogen isotopic composition of isoleucine	permil relative to AIR (‰)
SD_d15N_Pro	the standard deviation of the nitrogen isotopic composition of proline	permil relative to AIR (‰)
SD_d15N_Asx	the standard deviation of the nitrogen isotopic composition of aspartic acid	permil relative to AIR (‰)
SD_d15N_Met	the standard deviation of the nitrogen isotopic composition of aspartic acid	permil relative to AIR (‰)

SD_d15N_Glx	the standard deviation of the nitrogen isotopic composition of glutamic acid	permil relative to AIR (‰)
SD_d15N_Phe	the standard deviation of the nitrogen isotopic composition of phenylalanine	permil relative to AIR (‰)
SD_d15N_Tyr	the standard deviation of the nitrogen isotopic composition of tyrosine	permil relative to AIR (‰)
SD_d15N_Lys	the standard deviation of the nitrogen isotopic composition of lysine	permil relative to AIR (‰)
d13C_Ala	the carbon isotopic composition of alanine	permil relative to VPDB (‰)
d13C_Gly	the carbon isotopic composition of glycine	permil relative to VPDB (‰)
d13C_Thr	the carbon isotopic composition of threonine	permil relative to VPDB (‰)
d13C_Ser	the carbon isotopic composition of serine	permil relative to VPDB (‰)
d13C_Val	the carbon isotopic composition of valine	permil relative to VPDB (‰)
d13C_Leu	the carbon isotopic composition of leucine	permil relative to VPDB (‰)
d13C_Iso	the carbon isotopic composition of isoleucine	permil relative to VPDB (‰)
d13C_Pro	the carbon isotopic composition of proline	permil relative to VPDB (‰)
d13C_Asx	the carbon isotopic composition of aspartic acid	permil relative to VPDB (‰)
d13C_Met	the carbon isotopic composition of aspartic acid	permil relative to VPDB (‰)
d13C_Glx	the carbon isotopic composition of glutamic acid	permil relative to VPDB (‰)
d13C_Phe	the carbon isotopic composition of phenylalanine	permil relative to VPDB (‰)
d13C_Tyr	the carbon isotopic composition of tyrosine	permil relative to VPDB (‰)
d13C_Lys	the carbon isotopic composition of lysine	permil relative to VPDB (‰)

SD_d13C_Ala	the standard deviation of the carbon isotopic composition of alanine	permil relative to VPDB (‰)
SD_d13C_Gly	the standard deviation of the carbon isotopic composition of glycine	permil relative to VPDB (‰)
SD_d13C_Thr	the standard deviation of the carbon isotopic composition of threonine	permil relative to VPDB (‰)
SD_d13C_Ser	the standard deviation of the carbon isotopic composition of serine	permil relative to VPDB (‰)
SD_d13C_Val	the standard deviation of the carbon isotopic composition of valine	permil relative to VPDB (‰)
SD_d13C_Leu	the standard deviation of the carbon isotopic composition of leucine	permil relative to VPDB (‰)
SD_d13C_Ile	the standard deviation of the carbon isotopic composition of isoleucine	permil relative to VPDB (‰)
SD_d13C_Pro	the standard deviation of the carbon isotopic composition of proline	permil relative to VPDB (‰)
SD_d13C_Asx	the standard deviation of the carbon isotopic composition of aspartic acid	permil relative to VPDB (‰)
SD_d13C_Met	the standard deviation of the carbon isotopic composition of aspartic acid	permil relative to VPDB (‰)
SD_d13C_Glx	the standard deviation of the carbon isotopic composition of glutamic acid	permil relative to VPDB (‰)
SD_d13C_Phe	the standard deviation of the carbon isotopic composition of phenylalanine	permil relative to VPDB (‰)
SD_d13C_Tyr	the standard deviation of the carbon isotopic composition of tyrosine	permil relative to VPDB (‰)
SD_d13C_Lys	the standard deviation of the carbon isotopic composition of lysine	permil relative to VPDB (‰)

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Instruments

Dataset-specific Instrument Name	gas chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	CSIA-AA was carried out on a gas chromatograph coupled to an isotope ratio mass spectrometer (GC-IRMS).
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	Thermo Scientific Delta V Plus
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Thermo Scientific Delta V Plus isotope ratio mass spectrometer with CC-C III combustion interface and Trace gas chromatograph.
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	Thermo Scientific MAT 253
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Thermo Scientific MAT 253 isotope ratio mass spectrometer with GC Isolink combustion interface and Trace GC Ultra gas chromatograph.
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	Multiple opening-closing net and environmental sensing system (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, P. H., K. H. Burt, S. H. Boyd and A. W. Morton (1976) A multiple opening/closing net and environmental sensing system for sampling zooplankton. Journal of Marine Research 34:313-326.)
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.

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Deployments

RR1813

Website	https://www.bco-dmo.org/deployment/772777
Platform	R/V Roger Revelle
Report	https://datadocs.bco-dmo.org/docs/EXPORTS/data_docs/RR1813_Cruise_Report.pdf
Start Date	2018-08-10
End Date	2018-09-12
Description	Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/RR1813

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Project Information

Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation in the Northeast Pacific (EXPORTS) (EXPORTS Isotopes)

Website: http://oceanexports.org/projects/project_id_0000_close.html

Coverage: Station Papa, Northeast Pacific

NSF Award Abstract:
The biological pump is largely responsible for the vertical transport of organic carbon from the surface to the ocean interior. However, only a small fraction of organic material produced in surface waters is sequestered in the deep ocean. The rest is consumed, or respired, by bacteria and larger organisms. The overarching goal of the proposed work is to characterize the relative influences of bacteria versus larger organisms on the degradation of organic material with depth. Guided by recent results from the subtropical Pacific, the investigators will use measurements of stable isotopes of nitrogen in different amino acids (compound-specific

isotopic analysis of amino acids, known as AA-CSIA), along with measurements of the abundances of different forms of amino acids, and other parameters derived from these analyses to identify how the partitioning and flux of large and small particles are affected by different degradation processes. By improving the interpretive power of the AA-CSIA technique the investigators propose to determine: 1) the relative importance of microbial and zooplankton consumption on the efficiency of the biological carbon pump in the subarctic northeast Pacific, and 2) how much microbially-altered small particles fuel the metabolisms of mid-water zooplankton. This work capitalizes on an existing, comprehensive field program (NASA EXPORTS) specifically focused on building a predictive framework relating surface ocean properties to the vertical flux of organic carbon. The tremendous amount of data to be collected on all aspects of the biological pump as part of the EXPORTS program will aid the development and interpretation of the investigators' amino acid isotopic tool. Results will be broadly communicated via production and distribution of several episodes of Voice of the Sea, a local television program that will air in Hawaii and across many Pacific islands. Episodes also will be posted online and publicized through social media to the south Florida community. This project will support a Ph.D. student and an undergraduate student at University of Miami, which serves a 25% Hispanic population, and an M.S. student and an undergraduate student at University of Hawaii, which is a designated minority-serving institution.

The proposed work introduces a new geochemical framework to distinguish microbial versus zooplankton alteration of marine organic matter. Piloted on samples from the subtropical Pacific, this approach interrogates unamended sinking material directly, using amino acid compound-specific isotopic analysis (AA-CSIA) to determine the progressive, cumulative impact of microbial and zooplankton degradative pathways. The proposed work (1) will extend this interpretive framework to explicitly define end-member signatures such as fecal pellets and will apply this refined method to a study site in the subarctic northeast Pacific to (2) determine the vertical progression of degradative mechanisms in an oceanographic location with contrasting productivity and vertical length scales of flux attenuation and (3) determine whether microbially- degraded biomass is important for fueling midwater metazoans under contrasting carbon flux conditions. The proposed work will be conducted in collaboration with the NASA EXPORTS program at the Ocean Station Papa time-series site. Teaming with this program presents a unique opportunity to refine AA-CSIA interpretation in parallel with intensive data collection defining productivity, particle size distribution and flux, and numerous biological parameters. In comparing subtropical and subarctic Pacific locations, the proposed work will test how differences in productivity and plankton community structure influence vertical patterns of consumption and alteration of phytodetritus by microbes and zooplankton, from surface to mesopelagic depths.

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-1830016
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829425

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