Concentrations of C, N, P, and trace metals in zooplankton size fractions from R/V Melville cruise MV1008 in the Costa Rica Dome in 2010 (Fe limitation of copepods project)

Website: https://www.bco-dmo.org/dataset/540223
Version: 20 Nov 2014
Version Date: 2014-11-20

Project
» Effects of Fe:C ratios in food on marine copepod productivity and physiology (Fe limitation of copepods)

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Dataset Description

Concentrations of C, N, P and trace metals in zooplankton size fractions from the MV1008 cruise to the Costa Rica Upwelling Dome.

Note: These data are currently restricted as they are part of a publication that is in review. Please contact the PI for access.

Methods & Sampling

Samples were collected as splits from the zooplankton biomass tows conducted by Mike Landry's group on the FluZIE cruise (MV1008) and archived in association with that data. Zooplankton were size fractionated onto nitex nets. Size fractions were then transferred to 47mm filter tower fitted with a 0.2 um membrane. They were then rinsed with a sodium oxalate solution to remove metal adsorbed to external surfaces. Samples were then frozen in 2 mL centrifuge tubes and freeze dried at Stony Brook. Carbon and nitrogen per unit dry weight was determined with a CNH analyser and phosporus was determined with the acid molybdate method after ashing. Trace metal content per dry weight was determined by ICP-MS by Benjamin Twining at Bigelow Laboratory.

Data Processing Description

The data are presented as simple means of samples for some stations collected during a transect (TYPE=Transect), and for day and night samples collected during 4 drifter studies (TYPE + Cycles 1, 2, 3, 4), each of which lasted 4 days.

BCO-DMO edits:

- Changed formatting of date and time columns;
- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced blank values with 'nd' to indicate 'no data';
- Added size_fract_min and size_fract_max columns.

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Parameters

Parameter	Description	Units
size_fraction	Size fraction range.	millimeters (mm)?
size_fract_min	Minimum size fraction.	millimeters (mm)?
size_fract_max	Maxium size fraction.	millimeters (mm)?
event	Unique sampling event number from the cruise (MV1008).	integer
date	Date (local time zone).	mm/dd/YYYY
time_local	Time (local time zone).	HH:MM
type	Type of cruise sampling event. Either "Transect" or "Cycle_n". A transect of stations was sampled from 29 June to 03 July. Five quasi-Lagrangian experiments called "cycles" were conducted during the remainder of the cruise.	text
station	Station number.	integer
lat	Latitude.	decimal degrees
lon	Longitude.	decimal degrees
date_cruise	Date (local time zone) from cruise logs.	mm/dd/YYYY
time_cruise	Time (local time zone) from cruise logs.	HH:MM
N_rows	The number of subsamples used to calculate the mean.	mmol per gram
Cd	Cadmium (Cd) content per dry weight determined by ICP-MS.	mmol per gram
Mo	Molybdenum (Mo) content per dry weight determined by ICP-MS.	mmol per gram

Al	Aluminum (Al) content per dry weight determined by ICP-MS.	mmol per gram
Mn	Manganese (Mn) content per dry weight determined by ICP-MS.	mmol per gram
Fe	Iron (Fe) content per dry weight determined by ICP-MS.	mmol per gram
Co	Cobalt (Co) content per dry weight determined by ICP-MS.	mmol per gram
Cu	Copper (Cu) content per dry weight determined by ICP-MS.	mmol per gram
Zn	Zinc (Zn) content per dry weight determined by ICP-MS.	mmol per gram
Ni	Nickel (Ni) content per dry weight determined by ICP-MS.	mmol per gram
Ti	Titanium (Ti) content per dry weight determined by ICP-MS.	mmol per gram
P_ICPMS	Phospohorus (P) content per dry weight determined with the acid molybdate method after ashing.	P-ICPMS mmol per gram
C	Carbon (C) content per dry weight determined by CNH analyser.	C mmol per gram
N	Nitrogen (N) content per dry weight determined by CNH analyser.	N mmol per gram
RNA_to_DNA	RNA to DNA ratio.	unitless

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Instruments

Dataset-specific Instrument Name	CNH analyser
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	Carbon and nitrogen per unit dry weight was with a CNH analyser.
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Trace metal content per dry weight was determined by ICP-MS by Benjamin Twining at Bigelow Laboratory.
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Dataset-specific Instrument Name	Ring Net
Generic Instrument Name	Ring Net
Dataset-specific Description	Mesozooplankton sampling was conducted using a standard 1-m2 ring net with 202-um Nitex mesh, towed obliquely for 20 minutes at a ship speed of 1-2 kts.
Generic Instrument Description	A Ring Net is a generic plankton net, made by attaching a net of any mesh size to a metal ring of any diameter. There are 1 meter, .75 meter, .25 meter and .5 meter nets that are used regularly. The most common zooplankton ring net is 1 meter in diameter and of mesh size .333mm, also known as a 'meter net' (see Meter Net).

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Deployments

MV1008

Website	https://www.bco-dmo.org/deployment/58834
Platform	R/V Melville
Report	http://dmoserv3.whoi.edu/data_docs/CRD_FLUZiE/CRUISE_REPORT_Melville1008.pdf
Start Date	2010-06-22
End Date	2010-07-25
Description	Research on the cruise was aimed at acquiring a better understanding of plankton dynamics, carbon and nutrient fluxes, and potential trace element limitation in the Costa Rica Dome region of the eastern tropical Pacific. The specific science objectives were: 1) to assess grazing and trace metal/nutrient controls on primary production and phytoplankton standing stocks; 2) to quantify carbon and elemental fluxes and export rates from the euphotic zone; and 3) to measure microbial population, processes, stable isotope abundances associated with the OMZ and nitrite maxima. Operations included: 4-day sediment trap deployments, daily process experiments conducted on satellite-tracked drifters, CTD and trace-metal rosette sampling, shipboard grow-out experiments, net sampling for zooplankton biomass and grazing assessments, and MOCNESS stratified tows to 1000 m. BCO-DMO Note: March 2013 (CLC): The original CTD profile data (85 casts) have been submitted by R2R to NODC. Jim Moffett (USC) was a participant on this cruise and is interested in getting a copy of the full set of CTD cast data (deep and shallow casts). He plans to contact SIO ODF group or Mike Landry (Chief Scientist). Original cruise data are available from the NSF R2R data catalog.

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Project Information

Effects of Fe:C ratios in food on marine copepod productivity and physiology (Fe limitation of copepods)

Coverage: Costa Rican Upwelling Dome; California and Oregon Coast; Long Island, NY

Description from NSF award abstract:
Crustacean zooplankton provide the energetic link between phytoplankton and higher trophic levels in the ocean, including economically important fish species. They also affect biogeochemical cycling through production of fast sinking fecal pellets and the regeneration of nutrients. Historically, marine food-web models have assumed that zooplankton productivity is energy limited, and that productivity therefore scales directly with abundance of food in the environment. However, comparisons of the iron contents of phytoplankton and zooplankton, stoichiometric modeling and preliminary experiments all suggest that in iron-limited regions of the ocean zooplankton growth and reproduction may be limited by the supply of iron via the diet. This project will address three questions regarding the response of copepods to food containing different ratios of Fe:C. First, how the assimilation and retention of iron varies with the Fe:C ratio in food will be determined. The critical threshold Fe:C ratio in food at which copepod production is limited by iron depends on the assimilation of iron and carbon from food, retention of assimilated iron and carbon within copepod tissues and the elemental composition of copepod tissues. Under controlled conditions in the laboratory both pulse chase radioisotope experiments and stable elemental analysis will determine how these variables change with Fe:C in the diet. Second, demographic consequences of variation in Fe:C ratios in food will be assessed. Third, it will be determined whether iron limitation affects copepods indirectly by influencing other aspects of food quality. By selectively supplementing the diet of the copepods and by comparing responses to different algal species the investigators will isolate the characteristic of algal food that correlates most closely with copepod production. In all aspects of the work, a diverse set of phytoplankton will be used as composition and responses to iron limitation vary substantially among major groups. The copepod employed in these experiments will be a cultured coastal calanoid copepod, Acartia tonsa. The ability to culture this organism will allow the investigators to conduct experiments throughout the year without worrying about genotypic variability. In addition they will use copepods species collected from the California Coast which actually experience iron limitation somewhere in their range.

By building a fuller understanding of the factors controlling secondary production in the ocean, this research will be of use to fisheries scientists and managers. It will also inform policy regarding potential economic impacts of climate change and the ecological and biogeochemical consequences of anthropogenic ocean iron fertilization.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0962201

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