Carbon biomass estimates of eukaryotic phytoplankton by taxa and size-class, based on epifluorescence microscopy from samples collected on R/V Melville cruise MV1008 in the Costa Rica Dome in 2010 (CRD FLUZiE project)

Website: https://www.bco-dmo.org/dataset/517340
Data Type: Cruise Results
Version: 1
Version Date: 2014-06-19

Project
» Costa Rica Dome FLUx and Zinc Experiments (CRD FLUZiE)

Programs
» Integrated Marine Biogeochemistry and Ecosystem Research -US (IMBER-US)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Abstract
Carbon biomass estimates of eukaryotic phytoplankton by taxa and size-class, based on epifluorescence microscopy. Samples were collected on the MV1008 cruise in the Costa Rica Dome (CRD) region of the Eastern Tropical Pacific Ocean.

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Coverage

Spatial Extent: **N**:10.29979 **E**:-89.99424 **S**:8.39218 **W**:-92.98714
Temporal Extent: 2010-07-04 - 2010-07-19

Dataset Description

Carbon biomass estimates of eukaryotic phytoplankton by taxa and size-class, based on epifluorescence microscopy. Samples were collected on the MV1008 cruise in the Costa Rica Dome (CRD) region of the Eastern Tropical Pacific Ocean.

Methods & Sampling

Seawater samples (500 mL) for microscopical analysis were gently collected from the CTD and immediately preserved for slide preparation according to a modified protocol of Sherr and Sherr (1993). The samples were first preserved with 260 uL of alkaline Lugol's solution, immediately followed by 10 mL of buffered formalin and 500 uL of sodium thiosulfate, with gentle mixing between each addition. Preserved samples were shielded from light and left to rest at room temperature for 1 h. After the rest period, 1 mL of proflavin (0.33% w/v) was added and the samples were stored in the dark for an additional hour. Just prior to filtration, the preserved samples were stained with 1 mL of DAPI (0.01 mg mL-1) and immediately transferred to the filtration manifold. A 50-mL aliquot (small volume, SV) of the sample was filtered through a 25-mm black polycarbonate filter with 0.8-um pore size, and the remaining 450 mL aliquot (large volume, LV) was filtered through a 25-mm black polycarbonate filter with 8.0-um pores. A 10-mm nylon backing filter was placed under all polycarbonate filters to promote even cell distribution, and filtered the samples under gentle vacuum pressure (<100 mm Hg). Each filter was then mounted onto glass slides with one drop of Type DF immersion oil and a No. 2 cover slip, and the prepared slides were frozen at -80°C for later analysis in the lab.

Data Processing Description

Slides were digitally imaged using a Zeiss Axiovert 200 M inverted compound microscope equipped for high-throughput epifluorescence microscopy with a motorized focus drive, stage, objective and filters. Digital images were acquired with a Zeiss AxioCam MRc black and white 8-bit CCD camera. SV samples (50 mL aliquots) were viewed at 630X magnification, and LV samples (450 mL aliquots) were viewed at 200X magnification. A minimum of 20 random positions were imaged for each slide, with each position consisting of three to four fluorescent channels: Chl *a*, DAPI, FITC (SV and LV samples) and phycoerythrin (SV samples only).

Images were analyzed using ImagePro software to semi-automate the enumeration of eukaryotic cells larger than 1.5 um in length (Taylor et al., 2012). Whenever possible, 20 positions and >300 cells were counted for each slide. Each cell was manually identified and grouped into identifiable taxonomic groups. Autotrophic cells were identified by the presence of chlorophyll *a* (red autofluorescence under blue light excitation), generally clearly packaged in defined chloroplasts, and obvious heterotrophic cells with recently consumed prey were manually excluded from the autotroph classification.

Biovolumes (BV; um3) were calculated from the length (L) and width (W) measurements of each cell using the geometric formula of a prolate sphere (BV = 0.524*LWH), assuming H = W. Biomass was calculated as carbon (C; pg cell-1) using the equations of Menden-Deuer and Lessard (2000): C = 0.288 BV^0.811for diatoms and C = 0.216 BV0.939 for non-diatoms.

BCO-DMO Processing Notes:
- size_class and taxon columns were transposed from columns into rows.

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Data Files

File
phyto_epi_biomass.csv (Comma Separated Values (.csv), 192.72 KB) MD5:6418a598051d08a487e2e6c471d4478d Primary data file for dataset ID 517340

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Parameters

Parameter	Description	Units
event	Number referring to the particular activity (event) on the FluZiE cruise.	integer
cast	CTD Cast number from the FluZiE cruise.	integer
cycle	Type and number of cruise sampling event. Either "Stn_n" 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
date_local	Date of CTD cast (local time zone of UTC -6). in the format mmddyyyy	unitless
lat	Latitude in degrees North.	decimal degrees
lon	Longitude in degrees East.	decimal degrees
depth	Sample depth.	meters
niskin	Niskin bottle that the sample was taken from.	integer
taxon	Taxon. autotrophic_dinos = Autotrophic Dinoflagellates; autotrophic_flags = Autotrophic Flagellates; all = all taxonomic groups (diatoms + autotrophic dinoflagellates + autotrophic flagellates + prymnesiophytes + cryptophytes)	text
size_class	Size-Class Distribution (cell lengths are longest major axis): lt2 = cells < 2 um; 2_to_10 = cells 2-10 um; 10_to_20 = cells 10-20 um; gt20 = cells > 20 um; total = all sizes.	micrometers (um)
biomass	Carbon biomass of the taxon size class.	micrograms Carbon per liter (ug C L-1)

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Instruments

Dataset-specific Instrument Name	camera
Generic Instrument Name	Camera
Dataset-specific Description	Digital images were acquired with a Zeiss AxioCam MRc black and white 8-bit CCD camera.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Zeiss Axiovert 200 M inverted compound microscope
Generic Instrument Name	Inverted Microscope
Dataset-specific Description	Slides were digitally imaged using a Zeiss Axiovert 200 M inverted compound microscope equipped for high-throughput epifluorescence microscopy with a motorized focus drive, stage, objective and filters.
Generic Instrument Description	An inverted microscope is a microscope with its light source and condenser on the top, above the stage pointing down, while the objectives and turret are below the stage pointing up. It was invented in 1850 by J. Lawrence Smith, a faculty member of Tulane University (then named the Medical College of Louisiana). Inverted microscopes are useful for observing living cells or organisms at the bottom of a large container (e.g. a tissue culture flask) under more natural conditions than on a glass slide, as is the case with a conventional microscope. Inverted microscopes are also used in micromanipulation applications where space above the specimen is required for manipulator mechanisms and the microtools they hold, and in metallurgical applications where polished samples can be placed on top of the stage and viewed from underneath using reflecting objectives. The stage on an inverted microscope is usually fixed, and focus is adjusted by moving the objective lens along a vertical axis to bring it closer to or further from the specimen. The focus mechanism typically has a dual concentric knob for coarse and fine adjustment. Depending on the size of the microscope, four to six objective lenses of different magnifications may be fitted to a rotating turret known as a nosepiece. These microscopes may also be fitted with accessories for fitting still and video cameras, fluorescence illumination, confocal scanning and many other applications.

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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

Costa Rica Dome FLUx and Zinc Experiments (CRD FLUZiE)

Coverage: Costa Rica Dome, Eastern Tropical Pacific Ocean

Research was aimed at improved 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 of the 2010 R/V Melville cruise (MV1008) 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.

Additional information about MV1008 can be found in the cruise report (PDF).

NOTE: The original proposal and award abstract are not relevant. The project was originally funded by NSF as experimental tests of phytoplankton controls in the Arabian Sea. Piracy concerns in the region led to the cancellation of the research cruise in 2009, and a Change of Scope request was approved to focus the project on related issues in the Costa Rica Dome (CRD).

Though this project is not formally affiliated with any large program, it aligns with IMBER's emphasis on community ecology and biogeochemistry, and the OCB focus on carbon-based measurements of production, grazing and export processes.

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Program Information

Integrated Marine Biogeochemistry and Ecosystem Research -US (IMBER-US)

Website: http://www.imber.info/

Coverage: global

The BCO-DMO database includes data from IMBER endorsed projects lead by US funded investigators. There is no dedicated US IMBER project or data management office. Those functions are provided by US-OCB and BCO-DMO respectively.

The information in this program description pertains to the Internationally coordinated IMBER research program. The projects contributing data to the BCO-DMO database are those funded by US NSF only. The full IMBER data catalog is hosted at the Global Change Master Directory (GCMD).

IMBER Data Portal: The IMBER project has chosen to create a metadata portal hosted by the NASA's Global Change Master Directory (GCMD). The GCMD IMBER data catalog provides an overview of all IMBER endorsed and related projects and links to datasets, and can be found at URL http://gcmd.nasa.gov/portals/imber/.

IMBER research will seek to identify the mechanisms by which marine life influences marine biogeochemical cycles, and how these, in turn, influence marine ecosystems. Central to the IMBER goal is the development of a predictive understanding of how marine biogeochemical cycles and ecosystems respond to complex forcings, such as large-scale climatic variations, changing physical dynamics, carbon cycle chemistry and nutrient fluxes, and the impacts of marine harvesting. Changes in marine biogeochemical cycles and ecosystems due to global change will also have consequences for the broader Earth System. An even greater challenge will be drawing together the natural and social science communities to study some of the key impacts and feedbacks between the marine and human systems.

To address the IMBER goal, four scientific themes, each including several issues, have been identified for the IMBER project: Theme 1 - Interactions between Biogeochemical Cycles and Marine Food Webs; Theme 2 - Sensitivity to Global Change: How will key marine biogeochemical cycles, ecosystems and their interactions, respond to global change?; Theme 3 - Feedback to the Earth System: What are the roles of the ocean biogeochemistry and ecosystems in regulating climate?; and Theme 4 - Responses of Society: What are the relationships between marine biogeochemical cycles, ecosystems, and the human system?

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0826626

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