Images and associated metadata of individually classified particles imaged and quantified in sediment trap gel layers collected on four research cruises conducted between 2015 and 2018

Website: https://www.bco-dmo.org/dataset/860725
Data Type: Other Field Results
Version: 1
Version Date: 2021-09-14

Project
» Collaborative Research: EAGER: Particle-specific DNA sequencing to directly observe ecological mechanisms of the biological pump (EAGER DNA BioPump)

Contributors	Affiliation	Role
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Abstract
This dataset includes Images and associated metadata of individually classified particles imaged and quantified in sediment trap gel layers collected on four research cruises conducted between 2015 and 2018 (EN572, EN581, FK170124, and RR1813).

Table of Contents

Coverage

Spatial Extent: **N**:50.5113 **E**:-70.9367 **S**:20.99 **W**:-157.8749
Temporal Extent: 2015-11-03 - 2018-09-12

Methods & Sampling

The classified particle images described in this dataset are extracted from gel micrograph images available as dataset 749412 (https://www.bco-dmo.org/dataset/749412) and further classified into categories. Refer to dataset 749412 for additional details on methodologies. In short:

Samples were collected on four research cruises:
- at the New England shelf break aboard the R/V Endeavor on 3-7 November 2017 (EN572) and 13-18 June 2016 (EN581);
- on a transit between Honolulu, Hawaii and Portland, Oregon aboard the R/V Falkor between 24 January-20

February 2017 (FK170124);
- in the Subarctic North Pacific aboard the R/V Roger Revelle between 10 August and 12 September 2018.

Sediment trap collector tubes were deployed on various platform designs, including a neutrally-buoyant sediment trap (NBST), a surface tethered sediment trap (STST), and a Wire Walker (WW) trap.

Upon recovery, collection tubes were allowed to settle for at least 1 hour before the overlying water was siphoned off. Jars containing polyacrylamide gel were removed from trap tubes and the remaining overlying water was carefully pipetted off the gel. Gels were stored at 4 degrees C and imaged within the following 2 days before being stored at -80 degrees C. Polyacrylamide gel layers were imaged on a dissecting microscope (Olympus SZX16) with either a Luminera Infinity 2 or an Allied Vision Technologies StingRay camera attachment. Particles collected in gel layers during EN572 and EN581 were imaged under brightfield illumination. Particles collected in gel layers during FK170124 were imaged under both brightfield and oblique illumination, producing two separate sets of images for each sample.

Particles detected in gel image micrographs were manually sorted into distinct classes. Images are attached as two .tar.gz files.

Data Processing Description

BCO-DMO Processing:
- concatenated two separate.csv files into a single dataset, creating the new column "Type";
- replaced commas in the bounding_box field with semi-colons.

[table of contents | back to top]

Data Files

File	
classified_particle_images.csv Primary data file for dataset ID 860725	(Comma Separated Values (.csv), 17.43 MB) MD5:4222106de8ca38a95196b1d2cf6e0144
Durkin_geltrap_brightfield_particles.tar.gz Geltrap images using brightfield illumination. This file contains folders labeled with the particle class and the contents of each folder are the images assigned to that particle class. File names correspond to the "particle_image_name" field in the tabular dataset.	(GZIP (.gz), 30.39 MB) MD5:6e13ba1447e0f0b5187696ada6949a39
Durkin_geltrap_oblique_particles.tar.gz Geltrap images using oblique illumination. This file contains folders labeled with the particle class and the contents of each folder are the images assigned to that particle class. File names correspond to the "particle_image_name" field in the tabular dataset.	(GZIP (.gz), 76.19 MB) MD5:634d0262cce9d3df356df9d37596e99f

[table of contents | back to top]

Related Publications

Durkin, C. A., Buesseler, K. O., Cetinić, I., Estapa, M. L., Kelly, R. P., & Omand, M. (2021). A visual tour of carbon export by sinking particles. doi:10.1101/2021.02.16.431317
General

[table of contents | back to top]

Related Datasets

IsDerivedFrom

Durkin, C., Estapa, M., Omand, M. (2020) **Images of particles collected in sediment traps for quantitative analysis from multiple platforms from 2016-2017.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2018-11-07 doi:10.26008/1912/bco-dmo.749412.1 [view at BCO-DMO]
Relationship Description: Particles detected in gel image micrographs were manually sorted into distinct classes.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Type	Illumination type (Oblique or Brightfield)	unitless
Area	particle 2-dimensional area	square micrometers (um^2)
ESD	equivalent spherical diameter	micrometers (um)
ID	particle identification	unitless
Number	particle identifier number	unitless
bounding_box	pixel coordinates of particle bounding box in main image; format: [minimum row; minimum column; maximum row; maximum column]	unitless
file_name	name of main micrograph image from which particle was detected	unitless
particle_image_name	name of particle image associated with this metadata	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Luminera Infinity 2 microscope camera (FK170124 and EXPORTS "RR" images)
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Allied Vision Technologies StingRay camera (EN572 and EN582)
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Olympus SZX16 Stereomicroscope
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

[table of contents | back to top]

Deployments

EN572

Website	https://www.bco-dmo.org/deployment/749440
Platform	R/V Endeavor
Start Date	2015-11-03
End Date	2015-11-07

EN581

Website	https://www.bco-dmo.org/deployment/749505
Platform	R/V Endeavor
Start Date	2016-06-13
End Date	2016-06-18

FK170124

Website	https://www.bco-dmo.org/deployment/732225
Platform	R/V Falkor
Report	https://datadocs.bco-dmo.org/docs/302/EAGER_DNA_BioPump/data_docs/DurkinOmandEstapa_Cruise_report.pdf
Start Date	2017-01-24
End Date	2017-02-20
Description	Station 1: 01/28/2017 17:45 to 02/02/2017 05:43 (GMT) Station2: 02/05/2017 16:06 to 02/08/2017 17:20 (GMT) Station3_dep1: 02/12/2017 04:23 to 02/13/2017 16:42 (GMT) Station3_dep2: 02/13/2017 17:48 to 02/14/2017 18:46 (GMT)

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

[table of contents | back to top]

Project Information

Collaborative Research: EAGER: Particle-specific DNA sequencing to directly observe ecological mechanisms of the biological pump (EAGER DNA BioPump)

Coverage: Eastern Pacific

NSF Award Abstract:
Carbon is fixed into organic matter by phytoplankton growing in the surface ocean, and is naturally sequestered in the ocean interior when particles and organisms sink: a process called the "biological pump." Because of its recognized influence on the global carbon cycle, ocean scientists have studied the biological pump for decades. However, we still do not have a sufficient understanding of the underlying processes to accurately quantify and predict carbon cycling. Much of this uncertainty stems from an inability to directly link specific plankton in the surface ocean with the types of particles sinking out of the surface ocean. To address this missing link in biological pump research, this work will directly observe how plankton are transported out of the surface ocean using novel, particle-specific observational approaches embedded within an interdisciplinary field program that will finely resolve upper ocean plankton groups and the resulting amount of sinking carbon across space and in time. The genetic identity of organisms within different types of sinking particles will be determined by sequencing the genetic contents of individually collected particles. This new application of a molecular method will definitively link surface plankton with sinking particles at five locations across the Pacific Ocean. This work has the potential to transform our understanding of the biological pump by identifying previously unknown links between surface ecosystems and sinking carbon particles. Because this work is embedded within an interdisciplinary field program, including biogeochemical modelers and remote sensing scientists, these data will feed directly into new models of the biological pump, improving our ability to quantify and predict carbon uptake by the ocean. This project will train 1 graduate student and at least 2 undergraduate researchers. Findings will be communicated to the non-scientific public through blogs, videos, and the public communication channels of participating institutions.

Accurate prediction of the global carbon cycle requires an understanding of the specific processes that link surface plankton communities and sinking particulate carbon flux (export) out of the surface ocean, but current methodological paradigms in biological pump research do not directly observe these processes. This project will comprehensively determine who is exported from the surface ocean and how using new, particle-resolving optical and molecular techniques embedded within a sampling scheme that characterizes export events at high time and space resolution. The investigation suggests that different plankton types in the surface waters are transported out of the surface ocean by distinct export pathways, and that an understanding of these connections is critical knowledge for global carbon cycle modeling. If successful, this work has the potential to transform our conceptual understanding of the biological pump by directly identifying mechanisms that link surface plankton with particle export, without relying on bulk sampling schemes and large-scale correlation analysis. Particle export environments will be studied at five open ocean locations during a cruise from Hawaii to Seattle in January-February 2017. The surface plankton communities will be characterized by a combination of satellite observations, sensors attached to a free-drifting, continuously profiling WireWalker, an in situ holographic camera, microscopy, and by sequencing 18S and 16S rRNA gene fragments. Exported particles will simultaneously be captured by various specialized sediment traps and their characteristics will be directly related to their sources in the surface community by identifying the genetic contents of individual particle types. Individual particles will be isolated from gel layers and the 16S and 18S rRNA gene fragments will be amplified and sequenced. This work would, for the first time, combine molecular approaches with particle-specific observations to enable simultaneous identification of both which organisms are exported and the processes responsible for their export.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1703664

[table of contents | back to top]