CTD profiles collected during multiple cruises on the R/V Kilo Moana around the ALOHA observatory and South Pacific Gyre from 2014-2015

Website: https://www.bco-dmo.org/dataset/651963
Data Type: Cruise Results
Version:
Version Date: 2017-02-17

Project
» Evaluating the relative importance of suspended and sinking particles to the meso and bathypelagic food web in the central North Pacific (SuspendSinkPart)
» Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry (Hg_Biogeochemistry)

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Coverage

Spatial Extent: **N**:22.9535 **E**:-154.4007 **S**:4.8807 **W**:-158.1727
Temporal Extent: 2014-02-21 - 2015-09-06

Dataset Description

This dataset contains CTD profile data collected during R/V Kilo Moana cruises around the ALOHA observatory (KM1407, KM1418, and KM1604) and a cruise to the South Pacific Gyre (KM1515). Data collected include pressure, depth, temperature, conductivity, salinity, dissolved oxygen, fluorescence, PAR, and turbidity.

For more information about the ALOHA observatory see: http://aco-ssds.soest.hawaii.edu/

Methods & Sampling

CTD data collected as per ship protocols.

Data Processing Description

Data Processed with the following steps using Seasave software version 7.22.5:

1. Data Conversion... (SBE): Matched CON or XMLCON files accordingly. Up and downcast
2. Window Filter... (SBE): Smoothed profiles & reduce spikes (median filter: 9 for all except cosine 500 for ISUS).
3. Filter... (SBE): Filtered B = 0.15 on Pressure only.
4. Align CTD... (SBE): Oxygen sensors only (4 seconds).
5. Cell Thermal Mass... (SBE): Default settings.
6. Loop Edit (SBE): Default settings
7. Bin Average (SBE): 1 m

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* blank values replaced with no data value 'nd' for 'no data'
* added ISO Date format generated from Date and Time values
* values -9.99e-29 changed to 'nd'
* lat/lon rounded to four decimal places
* script used to convert Excel files for each cast to csv files

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Data Files

File
hg_biochem_ctd.csv (Comma Separated Values (.csv), 48.14 MB) MD5:166b75090410fdc232952a3b1ff54a91 Primary data file for dataset ID 651963

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier	unitless
station	Station identifier	unitless
cast	Cast identifier	unitless
lat	Latitude	decimal degrees
lon	Longitude; west is negative	decimal degrees
ISO_DateTime_UTC	Date and Time (UTC) in format YYYY-mm-ddTHH:MM:SS[.xx]Z	unitless

press	Pressure. Originally named prDM.	decibars
depth	Depth of sample. Originally named depSM.	meters
temp	Primary temperature (ITS-90). Originally named t090C.	degrees Celcius
cond	Primary conductivity. Originally named c0S/m.	Siemens per meter
sal	Salinity. Originally named sal00.	practical salinity unit (PSU)
O2_umol_kg	Dissolved oxygen. Originally named sbeox0Mm/Kg.	micromoles per kilogram
O2_umol_kg2	Dissolved oxygen (SBE 43). Originally named sbeox1Mm/Kg.	micromoles per kilogram
fluor	Fluorescence. Originally named flECO-AFL.	miligrams per meter cubed
fluor_chl	Fluorescence. Originally named flSP.	micrograms of chlorophyll per liter
turbidity	Turbidity. Originally named turbWETntu0.	Nephelometric Turbidity Unit (NTU)
par	Photosynthetically Active Radiation. Originally named par.	microEinsteins per meter squared per second
sigma_e00	Primary sigma theta. Originally named sigma-e00.	kilograms per meters cubed
trans	Beam Transmission. Originally named CStarTr0.	percent
beam_c	Beam Attenuation. Originally named CStarAt0.	per meter

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 911plus CTD
Generic Instrument Description	[tethered, real-time] The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Turner 10-AU
Generic Instrument Name	Turner Designs Fluorometer 10-AU
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA).

Dataset-specific Instrument Name	
Generic Instrument Name	WET Labs (Sea-Bird WETLabs) WETStar fluorometer
Generic Instrument Description	Submersible fluorometer designed for through-flow or pumped CTD applications manufactured by WetLabs and which can be configured for various types of fluorescence. The probe has a temperature range of 0-30 degrees C and a depth rating of 600 meters.

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Deployments

KM1407

Website	https://www.bco-dmo.org/deployment/635932
Platform	R/V Kilo Moana
Start Date	2014-02-19
End Date	2014-02-28
Description	Original cruise data are available from the NSF R2R data catalog

KM1418

Website	https://www.bco-dmo.org/deployment/636002
Platform	R/V Kilo Moana
Start Date	2014-08-29
End Date	2014-09-11
Description	Original cruise data are available from the NSF R2R data catalog

KM1515

Website	https://www.bco-dmo.org/deployment/657964
Platform	R/V Kilo Moana
Start Date	2015-08-15
End Date	2015-09-12

KM1506

Website	https://www.bco-dmo.org/deployment/636095
Platform	R/V Kilo Moana
Start Date	2015-05-03
End Date	2015-05-12
Description	Original cruise data are available from the NSF R2R data catalog

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Project Information

Evaluating the relative importance of suspended and sinking particles to the meso and bathypelagic food web in the central North Pacific (SuspendSinkPart)

Coverage: Subtropical waters north of Hawaii; Station Aloha (22° 45'N, 158° 00'W)

Description from NSF award abstract:
The ocean's midwaters are the largest living space on the planet. The mesopelagic food web plays key roles in the biological carbon pump and the production of food for commercially harvested species, but its functioning is understudied because it is remote and technologically challenging to sample. Recent estimates indicate respiratory demand outstrips measured sinking particle supply by up to 2-3 orders of magnitude suggesting that some food inputs to the mesopelagic food web have been underestimated or missed. Suspended particles frequently are not sampled effectively and may be an overlooked food source. Because identifying the principal inputs of organic matter to the deep-sea food web is critical to understanding its function, the investigators propose to evaluate the relative importance of suspended and sinking particles to the meso- and bathypelagic food web in the central North Pacific. They will characterize the isotopic compositions of specific groups of mesopelagic and bathypelagic zooplankton and micronekton, and identify the extent to which they consume suspended or sinking particles using mass balance approaches. The investigators recently have recognized differences in delta 15N and delta 13C values of amino acids (AA) of sinking and suspended particles; these patterns diverge with depth, providing a means to distinguish between food web pathways. The research will define the source-specific isotopic values of suspended and sinking particles at several depths from the surface to the bathypelagic and test proposed microbial mechanisms driving these depth patterns. At corresponding depths, MOCNESS trawls will sample diverse metazoa: zooplankton size fractions, plus targeted resident, migrating and likely suspension-feeding taxa of zooplankton and micronekton. Preliminary data suggest that suspended particles are a secondary food source, containing less labile organic matter than sinking particles that exhibit a seasonal cycle in flux in the central North Pacific. This study will determine if

suspended particles become more important to zooplankton and micronekton during a time of year when sinking particle flux is low (Jan/Feb) in comparison to when it is high (Aug), allowing an evaluation of how temporal change in surface ocean productivity affects the functioning of mesopelagic food webs.

Recent research has called for additional study of the ocean's deep midwaters. This study will provide new insights into the functioning of the meso- and bathypelagic food web and its coupling with surface ocean processes in the central North Pacific. The recently-demonstrated ecological tool of amino acid-specific isotopic analysis will provide a novel and comprehensive approach with which to address our hypotheses, and the project will develop the first AA isotopic dataset spanning particles to fish. Results will help identify the ecological underpinnings of increasing delta 15N values with depth in zooplankton -- apparently a common pattern. Zooplankton consumption of suspended particles also could constitute a mechanistic link between the microbial loop and higher trophic levels. The processes controlling the enormous attenuation of particle flux by mesopelagic consumers -- and thereby the strength of carbon sequestration to the deep ocean -- are not understood. Seasonal sampling will help us relate mesopelagic food web processes to changes in surface ocean productivity, furthering our understanding of future climate change impacts on deep-sea food webs and carbon flux. With regard to fisheries, many oceanic top predators such as tuna and swordfish feed on mesopelagic micronekton. A clearer understanding of the structure of mesopelagic food webs will help inform ecosystem models which are used to understand variation in fisheries production.

Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry (Hg_Biogeochemistry)

Coverage: Pacific Subtropical Gyre, Station ALOHA 22.75N 158W; equatorial Pacific (10N 155W, 5N 155W)

NSF award abstract:
Mercury is a pervasive trace element that exists in several states in the marine environment, including monomethylmercury (MMHg), a neurotoxin that bioaccumulates in marine organisms and poses a human health threat. Understanding the fate of mercury in the ocean and resulting impacts on ocean food webs requires understanding the mechanisms controlling the depths at which mercury chemical transformations occur. Preliminary mercury analyses on nine species of marine fish from the North Pacific Ocean indicated that intermediate waters are an important entry point for MMHg into open ocean food webs. To elucidate the process controlling this, researchers will examine mercury dynamics in regions with differing vertical dissolved oxygen profiles, which should influence depths of mercury transformation. Results of the study will aid in a better understanding of the pathways by which mercury enters the marine food chain and can ultimately impact humans. This project will provide training for graduate and undergraduate students, and spread awareness on oceanic mercury through public outreach and informal science programs.

Mercury isotopic variations can provide insight into a wide variety of environmental processes. Isotopic compositions of mercury display mass-dependent fractionation (MDF) during most biotic and abiotic chemical reactions and mass-independent fractionation (MIF) during photochemical radical pair reactions. The unusual combination of MDF and MIF can provide information on reaction pathways and the biogeochemical history of mercury. Results from preliminary research provide strong evidence that net MMHg formation occurred below the surface mixed layer in the pycnocline and suggested that MMHg in low oxygen intermediate waters is an important entry point for mercury into open ocean food webs. These findings highlight the critical need to understand how MMHg levels in marine biota will respond to changes in atmospheric mercury emissions, deposition of inorganic mercury to the surface ocean, and hypothesized future expansion of oxygen minimum zones. Using field collections across ecosystems with contrasting biogeochemistry and mercury isotope fractionation experiments researchers will fill key knowledge gaps in mercury biogeochemistry. Results of the proposed research will enable scientists to assess the biogeochemical controls on where in the water column mercury methylation and demethylation likely occur.

Related background publication with supplemental data section:
Joel D. Blum, Brian N. Popp, Jeffrey C. Drazen, C. Anela Choy & Marcus W. Johnson. 2013. Methylmercury production below the mixed layer in the North Pacific Ocean. Nature Geoscience 6, 879–884. doi:10.1038/ngeo1918

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