

Mercury stable isotope values for zooplankton collected during R/V Kilo Moana cruises KM1418 and KM1506 around Station ALOHA in 2014 and 2015

Website: <https://www.bco-dmo.org/dataset/788512>

Data Type: Cruise Results

Version: 1

Version Date: 2020-02-21

Project

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

Contributors	Affiliation	Role
Blum, Joel D.	University of Michigan	Principal Investigator
Benitez-Nelson, Claudia	University of South Carolina	Co-Principal Investigator
Drazen, Jeffrey C.	University of Hawaii at Manoa (SOEST)	Co-Principal Investigator
Popp, Brian N.	University of Hawaii at Manoa (SOEST)	Co-Principal Investigator
Seraphin, Kanesa	University of Hawaii	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset contains the mercury stable isotope ratios collected in zooplankton during R/V Kilo Moana cruises around Station ALOHA (22.75N, 158W). These data were published in Motta et al., (2019) with supporting information.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Acquisition Description](#)

- [Processing Description](#)
 - [Related Publications](#)
 - [Parameters](#)
 - [Instruments](#)
 - [Deployments](#)
 - [Project Information](#)
 - [Funding](#)
-

Coverage

Spatial Extent: Lat:22.75 Lon:-158

Temporal Extent: 2014-09-02 - 2015-05-02

Dataset Description

This dataset contains the mercury stable isotope ratios collected in zooplankton during R/V Kilo Moana cruises around Station ALOHA. For more information about the ALOHA observatory see: <http://aco-ssds.soest.hawaii.edu/>. These data were published in Motta et al., (2019) with supporting information.

Acquisition Description

Zooplankton was collected using a multiple opening-closing net and environmental sensing system (MOCNESS); cod ends were fitted with a 200 micron mesh. Onboard, zooplankton were wet-sieved in filter seawater using different size mesh sieves and frozen at -20 (Degree-Celsius).

The zooplankton was collected at Station ALOHA during the KM1418 and KM1506 research cruises. In the summer cruise, each tow collected material from 9 depth intervals spanning the ocean surface to 1500 m (0-50 m, 50-100 m, 100-150 m, 150-200 m, 200-300 m, 300-500 m, 500-700 m, 700-1000 m, 1000-1500 m). In the spring, four separate net tows were conducted to collected additional samples from a single depth interval (500-700 m). This was done to provide enough sample material.

For total Hg (THg) determination about 10 mg of zooplankton was digested in reverse aqua regis overnight. For THg isotope determination zooplankton samples were combusted in a two-stage combustion furnace and Hg(0) g was trapped in a 1% KMnO₄ solution. The 1% KMnO₄ solution was analyzed for Hg stable isotope composition using a multiple collector inductively coupled plasma mass spectrometer.

All the methods are detailed in Motta et al., (2019).

[[table of contents](#) | [back to top](#)]

Related Publications

Blum, J. D., Popp, B. N., Drazen, J. C., Anela Choy, C., & Johnson, M. W. (2013). Methylmercury production below the mixed layer in the North Pacific Ocean. *Nature Geoscience*, 6(10), 879–884. doi:[10.1038/ngeo1918](https://doi.org/10.1038/ngeo1918) [[details](#)]

Motta, L. C., Blum, J. D., Johnson, M. W., Umhau, B. P., Popp, B. N., Washburn, S. J., ... Lamborg, C. H. (2019). Mercury Cycling in the North Pacific Subtropical Gyre as Revealed by Mercury Stable Isotope Ratios. *Global Biogeochemical Cycles*, 33(6), 777–794. doi:[10.1029/2018gb006057](https://doi.org/10.1029/2018gb006057) <https://doi.org/10.1029/2018GB006057> [[details](#)]

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
Cruise_Number	Cruise ID number	unitless
Date	Sampling date (UTC); format: yyyyymmdd	unitless
Day_or_Night	Time of day when sampling occurred	unitless
Day_Zooplankton_ID	Sample ID	unitless
Mean_Depth	Mean depth of sample	meters (m)
Size_fraction	Size fraction	millimeters (mm)
d202Hg	Stable isotope ratio; $\delta^{202}\text{Hg}$	per mil (‰)
D199Hg	Stable isotope ratio; $\Delta^{199}\text{Hg}$	per mil (‰)
D201Hg	Stable isotope ratio; $\Delta^{201}\text{Hg}$	per mil (‰)
D200Hg	Stable isotope ratio; $\Delta^{200}\text{Hg}$	per mil (‰)
D204Hg	Stable isotope ratio; $\Delta^{204}\text{Hg}$	per mil (‰)

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	MOCNESS
Dataset-specific Description	Zooplankton was collected using a multiple opening-closing net and environmental sensing system (MOCNESS). The cod ends were fitted with a 200 micron mesh.
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.

Dataset-specific Instrument Name	MC-ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	multicollector inductively coupled plasma mass spectrometer (MC-ICP-MS; Nu instruments)
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.

Deployments

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

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

Project Information

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

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1433846

[[table of contents](#) | [back to top](#)]