Total Mercury Concentrations Collected from Scripps Pier in La Jolla, CA from December 2020 to December 2024

Website: https://www.bco-dmo.org/dataset/950021
Data Type: Other Field Results
Version: 1
Version Date: 2025-02-04

Project
» Collaborative Proposal: Unravelling the Oceanic Dimethylmercury Cycle (DMHg in the Ocean)

Contributors	Affiliation	Role
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Abstract
weekly collected samples of Total Mercury from Scripps Pier in La Jolla, CA from December 2020 to December 2024 to capture variability over multiple years. Samples were collected using a peristaltic pump equipped with weighted sample tubing into pre-cleaned glass bottles. Samples were analyzed via a Tekran 2600 Automatic Mercury Sampler.

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Coverage

Location: Ellen Browning Scripps Memorial Pier in La Jolla, CA (32.8634 N, 117.2546 W)
Spatial Extent: **Lat**:32.8634 **Lon**:-117.2546
Temporal Extent: 2020-12-04 - 2024-12-04

Methods & Sampling

Weekly sampling was conducted between December 2020 and November 2024 at the Ellen Browning Scripps Memorial Pier (Scripps Pier) in La Jolla, CA (32.8634 °N, 117.2546 °W). Total Hg (THg) and total methylated Hg (MeHg; not shown) were sampled at depths of < 0.5 m and 6 m using a peristaltic pump equipped with weighted sample tubing. Seawater was pumped into clean borosilicate glass bottles (I-Chem) and returned to the lab. MeHg and THg samples were acidified with 0.4% hydrochloric acid (HCl; Trace Metal Grade, J.T. Baker), and stored at 4°C until analysis within 6 months.

Data Processing Description

THg concentrations were measured following U.S. EPA Method 1631e (Lambourg et al., 2012). 30 mL samples were amended by bromine monochloride oxidation, hydroxylamine and tin (II) chloride reduction, and purged onto gold traps followed by cold-vapor atomic fluorescence spectrometry (CV-AFS) using a Tekran 2600 Automated Hg Analyzer. Calibration was based on an aqueous 1000 ppm mercuric chloride ($HgCl_2$) standard (SPEX Certiprep®) and confirmed with a second 1000 ppm $HgCl_2$ standard (Alfa Aesar). To validate concentrations, we analyzed the certified reference material ORMS-3 (National Research Council Canada, Ottawa, Canada) with a certified value of 12.6 ± 1.1 ng L^{-1} (Yang et al., 2005). We determined ORMS-3 concentrations to be 14.8 ± 2.44 ng L^{-1} (n = 12). The detection limit was 0.17 pM (n = 75 reagent blanks) with ongoing precision and recovery of 101 ± 6% (n = 73). Average replicate precision was 6% (n = 130), and matrix spike recovery was 93 ± 12% (n = 36).

BCO-DMO Processing Description

* Added lat/lon to dataset
* Added ISO_DateTime to dataset
* Converted numberic citation style to author citation style

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Data Files

File	
950021_v1_mercurytimeseries.csv	(Comma Separated Values (.csv), 11.70 KB) MD5:6da18252312760ae08953797955c1211
Primary data file for dataset ID 950021, version 1	

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Related Publications

Lamborg, C. H., Hammerschmidt, C. R., Gill, G. A., Mason, R. P., & Gichuki, S. (2012). An intercomparison of procedures for the determination of total mercury in seawater and recommendations regarding mercury speciation during GEOTRACES cruises. Limnology and Oceanography: Methods, 10(2), 90–100. doi:10.4319/lom.2012.10.90
Methods

U.S. Environmental Protection Agency. Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry Method 1631, Revision E: Washington, D.C., 2002. https://www.epa.gov/sites/default/files/2015-08/documents/method_1631e_2002.pdf
Methods

Yang, L., Willie, S., & Sturgeon, R. E. (2005). Ultra-trace determination of mercury in water by cold-vapor generation isotope dilution mass spectrometry. Journal of Analytical Atomic Spectrometry, 20(11), 1226. https://doi.org/10.1039/b506695f https://doi.org/10.1039/B506695F
Methods

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Parameters

Parameter	Description	Units
Latitude	Sampling latitude, south is negative	decimal degrees
Longitude	Sampling longitude, west is negative	decimal degrees
Date	Date in format YYYY-MM-DD	unitless
Time_UTC	UTC time of sampling	unitless
ISO_DateTime_UTC	Sampling DateTime in ISO format (UTC Timezone)	units
Surface_THg_Concentration	Concentration of total mercury in the surface (< 0.5 m) sample, DL = 0.17 pM	picomolar (pM)
Deep_THg_Concentration	Concentration of total mercury in the deep sample, DL = 0.17 pM	picomolar (pM)
Deep_Sample_Depth	Depth of sampling the "deep" sample	meters (m)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Tekran 2600 Automated Total Mercury Analyzer series
Dataset-specific Description	cold-vapor atomic fluorescence spectrometry (CV-AFS) using a Tekran 2600 Automated Hg Analyzer.
Generic Instrument Description	The Tekran 2600 is a total Mercury (Hg) analysis system that can measure sub-picogram quantities of mercury in water, soil, vegetation, and other sample matrices. The system utilizes a Cold Vapour Atomic Fluorescence Spectroscopy (CVAFS) detector. The 2600-IVS (In-Vial Sparging) model is reconfigured for direct in-vial sparging sample introduction, and the 2600-NG (Natural Gas) model is designed for the analysis of gas phase sample cartridges. The system is capable of multiple method configurations: Dual stage gold preconcentration (EPA Method 1631); Direct measurement without preconcentration (EPA Method 245.7); Air sample analysis on gold traps (EPA Compendium Method IO-5); and Natural gas analysis on gold traps (ASTM D-6350, ISO 6978). It has a guaranteed minimum detection limit of < 0.05 nanograms per liter (ng/L). In clean room environments, with low mercury blanks, minimum detection limits as low as 0.02 ng/L are achievable. See: https://www.tekran.com/products/laboratory/tekran-model-2600-automated-t...

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Project Information

Collaborative Proposal: Unravelling the Oceanic Dimethylmercury Cycle (DMHg in the Ocean)

Coverage: Monterey Bay, California Current, Greenland

NSF Award Abstract:
This project will study how dimethylmercury is formed and removed in the oceans. Dimethylmercury is a naturally occurring compound. It is thought to be formed when man-made mercury is converted into monomethylmercury, a toxin that accumulates in fish. Despite representing a large fraction of mercury in the oceans, the origin and fate of dimethylmercury is not known. This research will use state-of-the-art analytical, genomic and modeling tools to address this information gap. It will also train graduate and undergraduate students to use field, experimental, and modeling methods. The results will be used in predictive models to forecast future trends in the oceanic mercury cycle. These models are needed to evaluate the effectiveness of international actions that seek to reverse increasing trends in the bioaccumulation of monomethylmercury in fish.

Methylated mercury species in the ocean are formed in sediment and the water column from inorganic divalent mercury delivered from the atmosphere and rivers. The putative mechanism is a two-step process during which monomethylmercury is formed first, followed by slow methylation into dimethylmercury. The first step, biomethylation of divalent mercury into monomethylmercury, is relatively well-studied in sediment and known to be driven by sulfate- and iron-reducing bacteria and methanogens. The mechanism for monomethylmercury formation in the water column is less well understood, and the process of dimethylmercury formation in sediment or seawater is essentially unknown. Until recently, it was assumed that dimethylmercury represented a small enough fraction of the methylated and total mercury (the sum of all mercury species) pools to be insignificant in the global mercury cycle. Recent measurements, however, show that dimethylmercury levels in seawater can be in the same range as the other mercury species. This project will identify the biological and chemical methylating agents involved in the formation of dimethylmercury. Further, it will test the impact of varying biogeochemical conditions on dimethylmercury production. Results will be used to update the mercury module of the MIT General Circulation Model (MITgcm, a global biogeochemical model, and analyze the impacts of dimethylmercury production and degradation on monomethylmercury concentrations.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023046

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