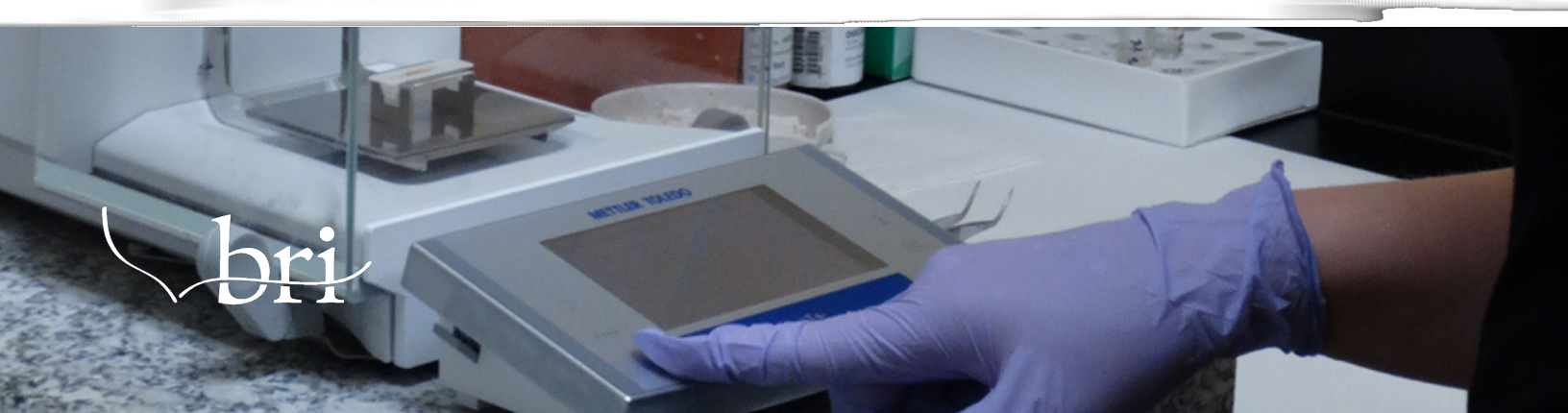
Soil and Sediment Field Sampling Methods

Collection of Samples for Mercury Analysis 2024



SOIL AND SEDIMENT FIELD SAMPLING METHODS

Collection of Soil and Sediments for Mercury Analysis

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Biodiversity Research Institute (BRI) is a 501(c)3 nonprofit organization located in Portland, Maine, USA. Founded in 1998, BRI is dedicated toward supporting global health through collaborative ecological research, assessment of ecosystem health, improving environmental awareness, and informing science-based decision making.

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1.0 Protocol Overview

Mercury is a ubiquitous, persistent pollutant emitted and released into the environment by geogenic and both direct and indirect anthropogenic processes. Once emitted, it can travel far from its source and be transformed into methylmercury, a neurotoxic and bioavailable form. Through the twin processes of bioaccumulation and biomagnification, mercury can increase the risk of reduced reproductive success, lead to behavioral changes, and other adverse impacts with implications for human health and the environment.

The Minamata Convention on Mercury is an international treaty that came into force in 2017 aiming to protect human health and the environment from the anthropogenic effects of mercury (UNEP 2013). It requires periodic evaluation of the effectiveness of its obligations to mitigate mercury emissions and releases at their sources. Sampling mercury in soils and sediments, particularly in combination with atmospheric monitoring and biomonitoring, can provide insight into mercury mechanisms and flow through a system in addition to spatial and temporal gradients of mercury exposure.

This sampling and testing protocol is designed to serve as a guide for collection, storage, shipping, and analysis of soil and sediment samples for the measurement of mercury. The use and application of these recommended sampling protocols will help ensure consistency in sampling across sites and through time so the collected data will be comparable and scientifically sound for comparison with other global monitoring studies.

2.0 Field Planning and Logistics

This sampling protocol is designed as a guide for the collection, processing, and shipping of soil and sediment samples for mercury analyses. Sample collection following these general protocols will allow comparisons to be made across sampling sites, assist in identifying potential sites posing elevated risks to both human and ecosystem health, and inform our understanding of mercury flows and mechanisms.

2.1 Sampling Questionnaire

It is important to obtain all necessary ministry and/or national collection permits and licenses for the collection and exportation of soil and sediment samples. Necessary work should be undertaken towards getting these in place prior to field work.

IMPORTANT:
Please obtain necessary permits before collection of samples.

2.2 Selecting a Sampling Site

Prior to sampling, a sampling plan should be in place posing the questions the study is aiming to answer. To examine spatial patterns, effort should be made to sample sites with similar levels of carbon in order to improve comparability due to correlations between the amount of carbon and mercury in soils. If mercury isotope analyses will be conducted to determine mercury sourcing, samples should also be obtained in close proximity to potential point sources to build a "library" for comparison with samples from the study area. Additionally, for mercury isotope analysis, priority should be given to soils with higher carbon content to maximize the likelihood that mercury concentrations will be high enough for isotope analysis.

3.0 Sample Collection

The sampling strategy aims to standardize the collection of soil and sediment samples for mercury analysis.

3.1 Supplies for Collection

Items	Purpose
Data sheet	Record metadata for each sample collected
Trowel, steel spoon, or other hand-held shovel	To collect soil sample
Ziploc™ style bags	For sample storage
Permanent marker	To label storage bags
Small cooler with ice	Temporary field storage
Map and GPS for locating and recording sampling sites	Use to locate target site and record exact location of final site

3.2 Collection

This protocol covers the collection of soil and sediments in the "active" zone and does not cover collection of cores for analysis.

1. In order to focus on organic layers that are of biological relevance, scrape any detritus off and then collect the first 0-2 cm of soil.
2. Target collection of at least 5-10 grams.
3. Focus on high organic carbon (OC) soils over sandy soils.
4. Soil or sediment should be scraped for collection using a small trowel or hand-held shovel.
5. Collected soil and sediment should be immediately placed in a pre-labeled plastic Ziploc™ style bag.
6. Samples should be immediately placed on ice in the field and then transferred to a freezer for storage until analysis.

3.3 Metadata

The following metadata is crucial for interpretation of mercury results:

- [ ] Sample type (soil or sediment)
- [ ] Location coordinates (dd recommended)
- [ ] Location (Site name, city, state or province, and country)
- [ ] Date
- [ ] Brief habitat description (e.g., oxbow lake, mangrove, river channel, deciduous upland forest, etc.)
- [ ] Known Point Source (if available)
- [ ] Distance to Point Source (if available)
- [ ] Organic Carbon Content (recommended)

3.4 Labeling Formating

It is important that all samples are assigned a unique sample ID that is written legibly on the datasheet and the sample storage bag. Each sample ID should include the country code, the matrix sampled, the date, and multi-digit, sequential number for the individual sample. A brief indication of the sampling site should also be included on the sample bag (e.g., Site name, City, State).

Each country is assigned a unique three-letter code, following the country codes developed by the International Organization for Standardization (ISO). The full list of country codes is available online at:

https://www.iso.org/obp/ui/#search/code/

- ☐ The matrix can be soil (SOIL) or sediment (SED).
- ☐ The date should be YYMMDD format
- ☐ The sequential number can be [01, 02, 03, …] or [001, 002, 003, …] depending on the number of anticipated samples. The sequential numbers should be continued for the length of a sampling trip (do not restart at 01 each day for multi-day sampling).

As an example, the first soil sample collected in Ecuador on August 26th, 2024 should be assigned a unique sample ID of ECU-SOIL-240824-001.

ECU-SOIL-240824-001

4.0 Storage of Samples

Soil or sediment samples should be stored in labeled plastic Ziploc™ style bag. Samples should be placed on ice in a cooler while in the field. Samples should be transferred into a standard freezer for storage as soon as possible and remain frozen until analysis.

5.0 Shipment of Samples

Arrangement and confirmation of shipment timing and details should occur with BRI prior to shipment.

5.1 Packaging of Samples

All packages for transport must minimally consist of inner/primary and outer/secondary package, both in a securely sealed tertiary container so that all are effective barriers to prevent escape or unauthorized dissemination of the regulated materials.

The inner/primary package will contain all regulated materials and must be cushioned and sealed inside a secondary container in such a way that both remain sealed during shock, impact, and pressure changes.

The outermost tertiary shipping container must be rigid, strong enough, and sealed to withstand typical shipping conditions without opening.

5.2 Documentation for international shipping, including Hawai'i, Puerto Rico, and US Virgin Islands

A PPQ form 550 (black and white label) will be provided by BRI during preparation for shipment. It will be placed on the outermost shipping/package container and should contain the intended destination/address. It should also be included in a minimum of one of the interior packages should the outermost package become damaged, or the associated labels/shipping information become illegible. This does not qualify as a carrier shipping label and that shipping needs to be organized through an internationally recognized carrier

Place the FedEx or other carrier label on the outermost package and secondary package and include an invoice, packing list, or statement of contents on the inside.

6.0 Required Permits

For shipments outside of the United States, including Hawaii, Puerto Rico, and US Virgin Islands, please include the following:

> All soil and sediment samples must be cleared by all appropriate governmental agencies and customs offices. It is imperative that shipments be accompanied by all the necessary export permits. If a country requires an export permit, be sure to make copies of the permit are included at least in duplicate (one in the carrier label sleeve and one inside the package).

The PPQ form 550* will be provided by BRI and should be placed on the outermost container and an additional copy on an interior package.

IMPORTANT:
Shipments arriving in the United States may be denied entry, destroyed, or returned if they do not include the appropriate permits.

For further questions or clarifications, or if you are interested in collaborating, feel free to contact BRI via phone, email, or visit us at our website:

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