



DEPARTMENT OF  
**ECOLOGY**  
State of Washington

## **Addendum 2 to Quality Assurance Project Plan**

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### **Measuring Mercury Trends in Freshwater Fish in Washington State**

October 2021

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## Publication Information

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This Quality Assurance Project Plan Addendum is on the Department of Ecology's website at <https://apps.ecology.wa.gov/publications/SummaryPages/2103120.html>. This is an addition to an original Quality Assurance Project Plan (QAPP), not a correction (errata) to the original plan.

This QAPP addendum was approved to begin work in September 2021. It was finalized and approved for publication in October 2021.

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<https://apps.ecology.wa.gov/publications/SummaryPages/2103120.html>.

**EIM:** Data for this project are available on Ecology's Environmental Information Management (EIM) website at [EIM Database](#). Search Study ID HgFish## (XX = last two numbers of the sampling year (i.e., for 2021 data, search HgFish21)).

**Activity Tracker code** for this project is 06-501.

### Original QAPP

Mathieu, C., Bednarek, J. 2020. Quality Assurance Project Plan: Measuring Mercury Trends in Freshwater Fish in Washington State. Publication 20-03-117. Washington State Department of Ecology, Olympia. <https://apps.ecology.wa.gov/publications/SummaryPages/2003117.html>

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# Addendum 2 to Quality Assurance Project Plan

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## Measuring Mercury Trends in Freshwater Fish in Washington State

by  
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October 2021

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EAP: Environmental Assessment Program

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## 3.0 Background

### 3.1 Introduction and problem statement

Since 2005, the Washington State Department of Ecology (Ecology) has carried out a long-term monitoring program to assess temporal trends in mercury levels of freshwater fish throughout Washington state. Each year Ecology collects ten individual smallmouth or largemouth bass from six lakes for analysis of total mercury in edible fillets. Sites are repeated every five years. The monitoring program uses the results to assess whether mercury concentrations in freshwater fish are increasing or decreasing over time.

A secondary goal of this project is to provide information about mercury levels in fish species other than bass to help the Washington State Department of Health craft more informative recommendations for fish consumption advisories. When encountered, three composite samples of up to 2 additional species are collected and analyzed for total mercury.

From 2005 through 2020, field crews euthanized fish in the field and homogenized whole fillets prior to sending samples to the laboratory for mercury analysis. In 2020, the monitoring program carried out a comparison using fish muscle plugs versus whole fillets to determine whether the non-lethal muscle plug method could be used in future sampling events, as described in the original Quality Assurance Project Plan (QAPP) (Mathieu and Bednarek, 2020). For all largemouth and smallmouth bass collected in 2020, a muscle plug was collected from one side of the fish and the full fillet collected from the other side. Both sample types were sent to Manchester Environmental Laboratory (MEL) for analysis of total mercury.

Results of the comparison between muscle plug and full fillet mercury concentrations are reported in a technical memo (Bednarek, 2021). Good agreement was found between the two sample types, and the technical memo made the recommendation to collect fish muscle plugs as the monitoring program's primary collection method for largemouth and smallmouth bass beginning in 2021. A minimum of 10% of fish sampled via muscle plugs will be retained, and the full fillet will be homogenized for quality control (QC) purposes. This QAPP Addendum outlines the change in field collection methods for the program.

## 5.0 Organization and Schedule

### 5.5 Budget and funding

The annual laboratory costs for this study, beginning in 2021, is outlined in Table 1. Minor additional costs for field equipment associated with muscle plug collections will be covered by the equipment and supplies budget of the PBT Monitoring Program.

**Table 1. Laboratory budget details.**

Parameter	Matrix	Number of bass muscle plug samples	Number of bass QC samples (fillet)	Number of ancillary species composite samples (fillet)	Total number of field samples	Number of lab QC samples*	Total number of samples	Cost per sample (\$)	Total lab costs
Total Mercury	Tissue	60	6	36	102	24	126	\$50	\$6,300

\*Number of lab QC samples includes only those that are not free of charge with the analysis: laboratory duplicates, matrix spikes, matrix spike duplicates, and standard reference material.

## 7.0 Study Design

### 7.2.2 Field parameters and laboratory analytes to be measured

Field staff will continue to measure and record individual largemouth and smallmouth bass total lengths and weights in the field. Scales will be collected from the fish prior to the plug biopsy, and the scales will be sent to the Washington Department of Fish and Wildlife (WDFW) Fish Age Laboratory for age determination. Scales may not be suitable for ageing from all size classes collected but will still be collected from all fish. Fish sex will no longer be determined for individual bass, as this parameter requires euthanizing and retaining the fish.

### 7.4 Assumptions underlying design

With the addition of muscle plug sampling, the monitoring program makes the assumption that the mercury concentration in muscle plugs will be representative of the full fillet mercury concentration. Paired sampling of both sample types in 2020 found that bass muscle plugs were a strong predictor of fillet mercury concentrations, across the range of fish lengths we typically analyze (Bednarek, 2021).

# 8.0 Field Procedures

## 8.2 Measurement and sampling procedures

### Fish collections

All aspects of fish collection will remain consistent to that outlined in the QAPP, with the following exceptions:

- Muscle plugs will be collected from live fish in the field. The original QAPP had described taking the plug on frozen fish in the laboratory for the comparison study.
- The 10% of bass retained for QC purposes will be euthanized and processed in the manner described in the QAPP, but the muscle plug will be taken from live fish in the field. After the muscle plug biopsy and euthanization, the whole fish will be wrapped in aluminum foil for transport to Ecology headquarters.

### Muscle Plugs

Muscle plugs will be collected from live individual bass at the collection site, following the National Rivers and Streams Assessment operations manual protocols (EPA, 2013). The PBT Monitoring Program will create an Ecology standard operating procedure for muscle plug collection following the 2021 sampling season.

At each sampling site, field crews will take individual fish from the live well and measure their weight and total length. A small area of scales will then be scraped away from the left dorsal area and 5-10 scales will be placed onto scale cards for aging purposes.

Muscle plugs will be collected using an 8 mm disposable biopsy punch then placed into labeled sterile glass scintillation vials and sealed to prevent moisture loss. Approximately 0.5 g of tissue mass will be collected with the plug. Field crews will then apply an animal grade tissue glue to the area where the plug was removed and the fish will be returned to the water after a short holding period in a live well to ensure viability.

Muscle plug sample vials will be placed in labeled LDPE zip lock bags and stored on ice for transport to Ecology headquarters. At Ecology headquarters, all samples will be held at -20 degrees C until shipment to MEL.

### 8.5 Sample ID

Individual muscle plug samples collected in the field will follow the sample ID convention outlined in the QAPP for homogenized samples. The station ID will consist of the following format: AAAYYY##, where AAA = three letter abbreviation for the sampling site, YYY = three letter species code, and ## = consecutive numbers starting with -01. For instance, the first largemouth bass collected from Lake Whatcom would have a station ID of WHALMB01. For the 10% of individual bass retained for QC purposes, the right side of the fillet will be homogenized in the laboratory and given the same station ID as the left-side muscle plug, followed by “-F”.

The lab sample numbers will be assigned as outlined in the QAPP.

## 10.0 Quality Control Procedures

QC procedures will remain the same as detailed in the original QAPP, with the following exceptions. A full-fillet sample will be analyzed for total mercury in ten percent of individual bass selected for muscle plug analysis. The paired full-fillet and muscle biopsy results will be reviewed annually to determine whether the muscle plug collection method continues to meet the needs of the program.

A second muscle plug will be collected from the ten percent of bass retained from the field for laboratory QC tests (matrix spikes, matrix spike duplicates, and lab duplicates). The project manager will communicate to MEL which samples have two plugs and are to be used for laboratory QC.

## 15.0 References

Bednarek, J. 2021. (Unpublished data.) Technical Memo: Evaluating non-lethal fish sampling techniques for measuring mercury trends in freshwater fish. Washington State Department of Ecology, Olympia, WA.

EPA. 2013. National Rivers and Streams Assessment 2013-2014: Field Operations Manual – Wadeable. EPA-841-B-12-009b. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Mathieu, C. and J. Bednarek. 2020. Quality Assurance Project Plan: Measuring Mercury Trends in Freshwater Fish in Washington State. Publication 20-03-117.  
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