Fish Tissue Field Collection Manual 2021

Division of Surface Water

Standards Section

August 2021

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Acronyms

COC	Chain-of-Custody Form
DES	Division of Environmental Services
DSW	Division of Surface Water
EAU	Ecological Assessment Unit
FTCMP	Fish Tissue Consumption Monitoring Program
g	Gram
ID	Identification Number
IASFTMC	Inter-Agency Sport Fish Tissue Monitoring Committee
IMS	Inland Management System
IR	Integrated Report (Historical 305b and 303d List)
kg	Kilogram
NAD 83	North American Datum of 1983
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
ODW	Ohio Division of Wildlife
Ohio EPA	Ohio Environmental Protection Agency
OFIS	Ohio Fisheries Information System
QA/QC	Quality Assurance/Quality Control
RLs	Reporting Limits
RM	River Mile
SM	Sample Master™
SFCAP	Sport Fish Consumption Advisory Program
SFF	Skin-off Fillet
SFFC	Skin-off Fillet Composite
SOF	Skin-on Fillet
SOFC	Skin-on Fillet Composite
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
TSD	Technical Support Document
µg	Microgram
WB	Whole Body
WBC	Whole Body Composite

Objectives of Ohio's Sport Fish Tissue Monitoring Program

Ohio's Sport Fish Tissue Monitoring Program is used to support two separate program areas:

1. The Sport Fish Consumption Advisory Program (SFCAP), which recommends how often different species of fish can be safely eaten; and
2. The requirements of the Clean Water Act, including 305(b) (biennial reports on the condition of the State's waters) and 303(d) (prioritized list of impaired waters). A Total Maximum Daily Load (TMDL) may be written for specific waterbodies that are considered impaired for human health based on fish tissue results.

Description of Ohio's Sport Fish Tissue Monitoring Program

Ohio developed and implemented a SFCAP in 1993. The risk assessment protocols used were developed in the early 1990s under the auspices of the Great Lakes Governors Association. Human health fish consumption advisories are determined based upon the concentration of a chemical found in fish (i.e., micrograms per kilogram [ug/kg]). Fish tissue data are used for TMDLs, Technical Support Documents (TSDs), 305(b) and 303(d) reporting, and the state's sport fish consumption advisories. Data can also be used for discharger and non-point source surface water impairment assessment.

State Agencies and Their Responsibilities

Three state agencies are involved in SFCAP: Ohio Department of Health (ODH), the Ohio Department of Natural Resources (ODNR), and the Ohio Environmental Protection Agency (Ohio EPA). Each agency has representatives on the Inter-Agency Sport Fish Tissue Monitoring Committee (IASFTMC) that oversees the implementation of the program. The agencies and their responsibilities are described below:

- ODH acts as a liaison for the program for any health-related issues and associated outreach efforts (e.g., the Women, Infant and Children (WIC) and Help Me Grow Program) and distributes the consumption advisory booklet, a fish brochure, and a fish palm card.
- ODNR, Division of Wildlife collects annual fish samples from inland lakes and reservoirs, the Ohio River, and Lake Erie.
- Ohio EPA, Division of Surface Water (DSW) annually collects fish samples from Ohio's rivers and streams as part of the basin surveys; calculates the advisory based on annual data, maintains a fish tissue contaminant database and a public web site for fish consumption advisories; The Division of Environmental Services (DES) analyzes fish tissue samples from Ohio EPA and ODNR collections for selected tissue contaminants.

Fish Tissue Sample Collection

Selection and Identification of Tentative Fish Tissue Sampling Locations

Fish tissue sampling locations are determined by a study plan coordinator, usually using the risk assessor as a resource. Initially, fish tissue collection stations are identified as tentative due to possible limitations (e.g., stream access, unsuitable habitat, a degraded stream location, or the unavailability of adequate species or numbers of fish). Sampling station information should include: the station name, river mile (RM), location, drainage area, latitude and longitude, previous tissue species collected, updated

consumption advisory booklet information, existing consumption advisories, and any comments (e.g., boat access information).

The number of fish tissue sampling stations in a river or stream is dependent upon its size. In large rivers (greater than 500 mi^2 drainage area like the Scioto River or Muskingum River), sampling stations are typically located every 10 miles. In smaller systems (200-500 mi^2 drainage area like the Olentangy River or Big Darby Creek), sampling stations are typically located every 5 miles. In small streams (50-200 mi^2 drainage area like Scippo Creek), three sampling locations will be located as follows: an upstream control location; a near-field downstream location; and a far-field downstream location. The upstream control station will be sampled above any known contamination sources.

The final number of stations may be adjusted based upon data requirements. Heavily fished streams like the Mad River and the Stillwater River should have fish tissue sampling stations located every 5 miles. A stream location that is visually impacted or that is known to be receiving chemicals of concern may be bracketed by additional sampling locations to evaluate fish tissue chemical uptake.

Field Collection Preparation

Several pre-fieldwork activities should be undertaken before beginning fieldwork to reduce the amount of time and effort spent in the field. Foremost, is to complete a field reconnaissance of all proposed sampling locations to determine the easiest and safest access locations. Situations do arise where stream access may become unsuitable or extremely difficult. In these cases, best professional judgment should be used to determine whether a sample will be collected from the location. In some cases, a site may be moved and still provide adequate data; be sure to exhaust all options for stream access before abandoning a sampling location.

Knife Decontamination Procedure

Knife decontamination should be done at the field facility prior to field work. Use the following method to decontaminate fillet knives and scaling equipment:

1. Wash knives in a regular solution of Liquinox, or other concentrated soap, and rinse.
2. Rinse with deionized water to remove mineral contaminants and any remaining soap residue.
3. Rinse with acetone to remove organic compounds and salts.
4. Wrap the air-dried blade in clean aluminum foil.

Sample Considerations

Fish tissue sample needs are project and program specific but will generally follow the needs described below.

When possible collect the same species that were collected historically, with priority given to species identified in consumption advisories. Fish tissue collected for the consumption advisory program will generally meet the needs of the Integrated Report human health standards which requires a minimum of two samples each from Trophic Level 3 and Trophic Level 4 fish per waterbody (Appendix 2 Fish Trophic Levels). Trophic Level 3 fish are generally omnivores and generalist feeders; Trophic Level 4 fish are top carnivores.

Tissue samples come in three types: skin-off fillet (SFF), skin-on fillet (SOF), and whole body (WB). Each of these samples can consist of tissue from a single fish or tissue of multiple fish of a similar size class, called a composite sample. Whole body samples can also be mixed species composites if called for in the QAPP. For the purposes of the consumption advisory program, the ideal sample set is five composite samples of

at least five individuals (minimum 3) each for each target species per assessed waterbody. The samples should vary in length class, where the smallest length class reflects the minimum size limits set by ODNR. A sample of one or two individuals is acceptable but should be avoided.

All consumption advisory fish tissue samples collected in Lake Erie and the Ohio River should be submitted as SOF; the only exception being scaleless fish, which should be SFF. Fillet samples from all other locations are to be submitted as skin-off fillet composite (SFFC). See Table 1 for the preferred tissue species.

When enough tissue is not collected to meet the ideal sample conditions, it is preferable to maximize the number of samples rather than the number of individuals per sample. For example, fifteen fish of the same species were collected at a site. The preferred method is to create five samples of three individuals rather than three samples of five individuals.

Table 1. Preferred fish tissue species for Ohio consumption advisories.

Preferred Fish Tissue Species		
Percidae	**Centrarchidae**	
Walleye	Largemouth Bass	Black Crappie
Sauger	Smallmouth Bass	White Crappie
Saugeye	Spotted Bass	Bluegill Sunfish
Yellow Perch	Rock Bass	
Moronidae	**Ictaluridae**	
White Bass	Channel Catfish	Flathead Catfish
White Perch	Bullhead (Yellow, Brown, Black)	
Striped Bass	**Esocidae**	**Cyprinidae**
White Bass × Striped Bass	Northern Pike	Common Carp
Sciaenidae		
Freshwater Drum		

Laboratory Considerations

Regardless of sample type, a minimum of 150 grams of tissue per sample is required for full laboratory analysis. Submission of samples containing less than 150 grams of tissue may result in analysis for either metals or organic contaminants, but typically not both. If due to a paucity of fish, or for other reasons when a sampling station fails to yield enough tissue, the field investigator is advised to reject the sample. However, if the purpose of the investigation is narrow and one of the two parameter groups will serve the goal of the study, then the investigator must indicate the preferred suite of analytes (metals or organic) on the fish tissue submission form.

Fish Tissue Sampling Collection Methods

Use sampling methods appropriate for the lake and stream size when targeting species of interest for tissue. Both active and passive methods of capture may be employed in the collection of fish. Electrofishing is the primary collection method; however, other active sampling techniques including trawling and angling may be used. Some common passive methods that can be used include gill, trap, and Fyke nets. Descriptions of the methods can be found in Zale, Parrish, & Sutton, 2013. When electrofishing, the methods described in "Biological Criteria for the Protection of Aquatic Life: Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities" (Ohio EPA, 2015) are typically used. Entities evaluating for contaminant issues may choose from any appropriate method to secure adequate, representative samples.

When sampling rivers and streams, record the RM, latitude and longitude in decimal degrees to at least 6 decimal places at the beginning of each sampling zone to delineate the zone. Set the GPS units to collect waypoints in NAD 83. Fish sampling zone distance varies. If all the priority fish species, numbers and sizes are collected in a small area, the crew processes the samples and then proceeds to the next station. Within a reach, crews generally target habitat suitable for the species of interest. In larger rivers, the sampling zone distance is approximately 300 to 500 meters. At wading sites, crews generally sample approximately 150 to 200 meters. Longer distances may be sampled if there is very good habitat, and the target fish cannot be found within the standard distances. Usually, standard-distance zones require 45 minutes to one hour to either collect the required specimens or to make the decision to move to the next sampling location.

Fish Sample Processing

Numbers and Types of Fish Required

The ideal fish composite sample consists of fillets from five fish of the same species, with the smallest fish in the sample within 90% of the total length of the largest fish in the sample. If the smallest fish is not 90% the total length of the largest fish, under no circumstances should a composite be made up of fish with a size difference less than 75%. Total length of the fish is determined by measuring the greatest distance in a straight line (not following body curves) from the anterior most projecting parts of the head to the farthest tip of the caudal fin when its rays are squeezed together (Trautman 1981).

A composite sample may be made up of a single fillet per fish if one of the following conditions are met:

- If 5 or more fish comprise the sample and the sample will have greater than 150 g of tissue or;
- If three or more fish greater than 400 mm total length comprise the sample

If a single fillet is taken from a fish for a composite sample, it should be taken from the same side of each fish.

In some circumstances, fillets from more than 5 fish may be needed to collect the minimum 150 g necessary for the laboratory to analyze the sample. In some cases, a single fish may be used for a sample if it is large enough to meet the 150 g limit and no other fish are available.

Fish tissue quality control is accomplished by selecting fish according to species and fish selected for composite samples to reduce sample variability. Sample preparation standard operating procedures (SOPs) are designed to reduce the possibility of sample cross contamination. In addition, laboratory quality assurance/quality control (QA/QC) procedures are followed.

Fish Tissue Sample Fillet Preparation

Samples can be processed in the field or at a facility. Unprocessed fish can be placed on ice made from water for up to 48-hours before being processed.

After fish collection heeding the considerations in sample considerations and numbers and types of fish required, fish will be processed into samples in the following manner:

1. Separate fish into samples according to species and size class.
2. Create and place a field label to be placed with the sample (see Appendix 2 for label example). The label needs to include date, location, species, and a unique identifier. The Division of Surface Water uses sequential numbers, all beginning with the six-digit Station ID, followed by a hyphen and a two-digit sample number. (e.g. X99X99 – 01, X99X99 – 02, …, X99X99 – n where n is the number of samples per station) as the unique identifier. The label can also include the length and weight data.
3. Prepare a sample submission form (Fish Tissue Sample Submission Form in Appendix 2).
4. Rinse fish in a bucket of water from the location where the fish were caught; or if processing in a facility, rinse with regular tap water.
5. Sacrifice the fish by administering a moderate blow to the base of the nape using a fiberglass club.
6. Weigh the fish on the 1000-g scale to the nearest gram or on the 10-kg scale to the nearest 50 g and measure the total length to the nearest millimeter using the measuring board (ODNR, 2012). Record weights and lengths on the tissue sample submission form and optionally the field label using waterproof ink, or a pencil.
7. Prepare the fillet samples using the following methods:
    a. Cover the filleting surface with clean aluminum foil from the roll.
    b. Wear powderless, disposable gloves when handling fish for tissue processing, changing gloves between each sample.
    c. If skin-on samples, descale the fish.
    d. Using a clean knife for each sample, fillet both sides of the fish including the belly flesh (or if conditions are met to only use a single fillet [see Sample Considerations above], fillet a single side); remove the skin from skin-off fillets.
    e. Set aside both fillets on a sheet of clean aluminum foil.
8. Wrap fillets together in one clean foil packet with the wrapping at least 0.5" away from the fillets to diminish the likelihood of the foil becoming trapped in the frozen tissue.
9. Place the foil packet in a zip closure plastic bag with the field label.
    a. If the fillets are large (e.g., steelhead trout, common carp), the sample can be split into separate foil packets. Include a field label with each packet and number as follows: 1 of 5, 2 of 5...5 of 5).
10. Place the fish samples in the sample cooler. The cooler can be filled with ice made from water if the samples will be transferred to a freezer in less than 48-hours. To properly freeze fish fillets in the field the cooler should contain about 20 pounds of dry ice for a one-night stay or 40 pounds of dry ice for a two to three-night stay. Place the dry ice in the cooler on the top of the fish initially to provide for quicker freezing when out on an extended field trip. Monitor the amount of dry ice remaining in the cooler to ensure that the samples remain frozen.

11. Store sample submission forms until data entry or delivery to the lab.

Whole Body Sample Preparation

Whole body and whole-body composite samples are collected for the Fish Tissue Baseline Program and the Fish Tissue Targeted Assessment Program. Samples are prepared using the same procedures that are used in the fillet sampling procedure, except for the filleting steps. Refer to Table 1 for preferred fish sample species. Based on the purpose of the tissue collection, common ubiquitous species such as creek chub, gizzard shad, or shiner species may also be tested. In these cases, more than 5 individuals may be needed to ensure an adequate 150 g sample weight. Priority species are collected, rinsed with source water, sacrificed, measured, and weighed. Properly sized fish are selected for composite samples, wrapped in aluminum foil, labeled, bagged and placed in a cooler with ice.

Sample Storage and Transport

Collected samples will be transported the field office for storage until transported to DES. This can be at each organization's respective facilities or at the Ohio EPA Groveport Field Office.

If samples will be transported to the Ohio EPA Groveport Field Office, a representative of the Ohio EPA – EAU will coordinate the transfer and reception of samples. Transfer of fish tissue samples should commence as soon as possible to ensure that the samples will be processed within the analytical sample holding time. Samples should be at the field facility no later than October 15 of the collection year because analyses need to be completed by February 1 of the following year.

Samples should be stored in freezers with maximum temperatures not to exceed -5 °C. For Ohio EPA – EAU staff, transport the samples from the field to the Ohio EPA Groveport Field Office and immediately place all fish tissue samples in the freezer. Check to verify that all labels are still with the samples. If possible, samples having the same Chain-of-Custody (COC) form should be boxed or bagged together to facilitate handling.

Other Ohio EPA staff and ODNR staff will transfer samples directly to DES. Prior to transfer, coordinate with the sample receiving staff (614-644-4243), located on the Ohio Department of Agriculture campus, 8955 East Main Street, Reynoldsburg, Ohio 43068. Samples must be accompanied by the sample submission form and the COC form.

Sample metadata will be entered into Sample Master™ (SM) and assigned an order Identification Number (ID) prior to analysis. For EAU-generated samples this will occur prior to transfer to the lab by the fish tissue coordinator. The other samples will be entered into the system by DES staff after transfer to the lab. This includes all sample metadata as well as requested analyses. The sample is assigned a sample number by SM™. A label is created by the system with the order and sample ID which is printed off and stored with the sample. The order and sample ID are kept through chemical analysis and is used to link the results with the metadata.

Written SOPs for SM™ are available in the Field Manual Appendix IV, Section D, Sample Master™ Instruction Manual (Ohio EPA, 2019). This document describes run creation, addition of samples and parameters, labels and chains of custody, QC samples, field data entry/approval, and final approval of sampling results.

Chain-of-Custody Form (COC)

The purpose of the COC form is to maintain the integrity of the sample by documenting possession of the sample during collection, storage, transfer, and analysis. A COC form must be completed for each sampling event. A single form may be used if any of the following criteria are met:

- A single site on a single day,
- Multiple sites on the same waterbody on a single day, or
- Multiple sites on the same waterbody on consecutive days within one week.

If none of the above conditions apply, use a separate COC form. Direct any questions about COC forms to the DES sample receiving coordinator at (614) 644-4243.

Blank COC forms can be found in Appendix 2.

Fill out a COC with the name of the person or persons who collected the sample; at least one of these individual's signature must match the first line of the "Relinquished by" field toward the bottom of the form. Sign the COC in blue or black ink. The person receiving the samples will then countersign in the "Received by" slot. Any subsequent transfer of samples will proceed in the same fashion with the person transferring the responsibility of the samples signing the "Relinquished by" slot and the person accepting the samples countersigning the "Received by" slot.

If a copy is desired prior to DES delivery, a photocopy should be made and retained. Copies of the form can be supplied to the sampler after sample submittal to the laboratory.

References

ODNR. 2012. Sport Fish oh Ohio Identification. Columbus: State of Ohio.

Ohio EPA. 2015. Biological Criteria for the Protection of Aquatic Life: Volume III: Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities.

Ohio EPA. 2019. Surface Water Field Sampling Manual For Water Quality Parameters and Flows, version 7.0.

Trautman, M.B. 1981. The Fishes of Ohio. Ohio State University Press. 782 pp.

Zale, A. V., D. L. and Sutton, T. M. 2013. Fisheries Techniques, Third Edition. Bethesda: American Fisheries Society.

Appendix 1 Fish Tissue Program MOU (2006)

Memorandum of Understanding
Between
Ohio Department of Health, Ohio Department of Natural Resources, and Ohio Environmental Protection Agency

THIS Memorandum of Understanding (MOU) regarding the Ohio Sport Fish Tissue Monitoring Program (Program) is made by and between the Directors of the Ohio Environmental Protection Agency (Ohio EPA), Ohio Department of Health (ODH), and Ohio Department of Natural Resources (ODNR), together referred to as "Parties," and individually as "Party," and the Parties' agents, successors and assigns. In consideration of the mutual covenants and stipulations set forth herein, the Parties agree as follows:

PROGRAM HISTORY

The Program began in 1992 as a collaborative effort of Ohio EPA, ODNR, ODH and Ohio Department of Agriculture (ODA). Ohio EPA and ODNR collected fish samples for analyses, Ohio EPA and ODA laboratories analyzed fish tissue samples for contaminants of concern, and ODH evaluated the tissue contaminant data and issued fish consumption advisories where necessary.

Significant changes have occurred in the Program. In 1996, ODA ceased analyzing fish tissue samples; in 2002; ODH discontinued its data evaluation and outreach support; and in 2003, Ohio EPA assumed the data analyses and public outreach, in addition to its existing sampling and analysis duties.

The Parties agree that as a result of these changes a MOU is required.

PARTY ROLES AND RESPONSIBILITIES.

This MOU serves to clarify and memorialize the current rights, duties and obligations of the Parties and constitutes the entire agreement between the Parties. The rights, duties, and obligations of the Parties are as follows:

Ohio Department of Health

ODH shall: (1) act as a liaison for the Program for any health-related issues and associated public outreach efforts, including communication with the Women, Infants and Children's (WIC) and Help Me Grow programs; (2) issue and rescind dermal contact advisories; (3) investigate and report fish or sediment contamination associated with hazardous waste; and (4) participate in such other issues that are within ODH's jurisdiction. ODH shall send a representative to Program Committee meetings to provide technical input on issuing advisories and provide updates regarding health related issues.

Ohio Department of Natural Resources

The ODNR – Division of Wildlife shall: (1) annually collect samples for Program analyses from inland lakes, the Ohio River, and Lake Erie; and (2) provide, through ODNR's fishing regulations digest and website, information to the public regarding the obtaining of State fish consumption advisories. ODNR shall send a representative to the Program Committee meetings to provide technical input on advisory issues.

Ohio EPA

Ohio EPA shall be responsible for three components of the Program, sampling, sample chemical analyses, and outreach. Ohio EPA shall: (1) annually collect fish samples from rivers and streams; (2) analyze all fish samples for the Program for arsenic, cadmium, lead, mercury, selenium, pesticides and PCBs, and other contaminants as necessary; (3) maintain the fish tissue contaminant database containing all Ohio's fish tissue data; (4) analyze laboratory data and translate the data into fish consumption advisories; (5) serve as the Program's liaison to interstate organizations such as the Great Lakes National Program Office (GLNPO) and the Ohio River Valley Water Sanitation Commission (ORSANCO); (6) develop and incorporate any technical changes involving advisory development into the Program; (7) maintain the fish consumption advisory website and respond to public inquiries regarding fish advisories; (8) develop, produce and distribute advisory outreach materials; (9) use fish tissue data from the Program to assess Ohio's surface waters for U.S. EPA's biannual Integrated Report (formerly 303(d) and 305(b) reports); and (10) assess the impact of hazardous waste on human fish consumption when needed. Ohio EPA shall send representatives to the Program Committee meetings to provide technical input on all of the aforementioned areas, including one representative each from its Division of Environmental Services, Division of Surface Water – Standards and Technical Support Section, and Division of Surface Water – Ecological Assessment Section.

PROGRAM COMMITTEE

Program Committee decisions are the result of agreement. When a decision requires a Committee vote, each Party shall have one vote; with the decision based upon a majority of those Parties voting upon the issue.

PARTIES AGREEMENT

By their signature hereto, the Parties to this MOU agree to the rights duties and obligations set forth herein, and agree to commit the necessary resource to adequately implement and maintain the current Program, so as to ensure that the Program continues to provide Ohio's citizens with timely, accurate, and readily available information regarding the safety and

health benefits of consuming Ohio's sport fish. This MOU supersedes all other agreements, oral or written, between the Parties with respect to the subject matter hereof, and may not be modified except by an agreement in writing signed by each of the Parties hereto.

IN WITNESS WHEREOF, this MOU is executed and effective as of the date signed by all Parties.

State of Ohio
Department Of Health

J. Nick Baird, MD
Director

2/17/06
Date

State of Ohio
Department of Natural Resources

Samuel W. Speck
Director

2/24/06
Date

State of Ohio
Environmental Protection Agency

Joseph P. Koncelik
Director

2/7/06
Date

Appendix 2

Field Sampling Checklist

A variety of equipment is required to ensure that a proper and valid sample is obtained. The following checklist should be used to ensure possession of the necessary equipment and supplies to prepare a sample without contaminating it:

- Chemistry laboratory chain of custody forms
- Clipboard for storing data sheets
- Coolant material: dry ice or water ice
- Coolers for cold storage of fish tissue samples
- Deionized water for rinsing knives, scalers, and pliers
- Extra heavy-duty aluminum foil, 24" by 500' roll (available at restaurant supply stores)
- Fillet boards with or without hold down (It is more difficult to wrap foil on a fillet board having a hold down)
- Fish club (fiberglass) for sacrificing fish
- Fish Scaler
- Fishes of Ohio identification book
- GPS Unit for generating latitude/longitude (NAD 83 – decimal degrees)
- Knife sharpening equipment (diamond hone, whetstone, etc.) used on clean knives
- Maps
- Maps to the sampling locations
- Metric measuring board for measuring fish total length in millimeters
- Metric weighing scales for weighing fish in grams
- Pesticide grade acetone for decontaminating knives
- Phosphate free liquid detergent for cleaning knives, scalers, and pliers
- Powder free latex gloves for handling the fish, fillets, and knives
- Sharp, decontaminated fillet knives with plastic handles
- Supply of tissue sample submission forms
- Teflon plastic squirt-bottles for dispensing acetone
- Variety of sizes of zip closure plastic bags (Quart to 3-gallon size)
- Waterproof ink pen for recording information
- Waterproof labels for labeling individual fish tissue samples

Fish Trophic Levels

Trophic Levels		
Trophic Level 2		
CENTRAL STONEROLLER		
Trophic Level 3		**Trophic Level 4**
BIGMOUTH BUFFALO	LONGEAR SUNFISH	BOWFIN
BLACK BULLHEAD	NORTHERN HOG SUCKER	BROOK TROUT
BLACK CRAPPIE	ORANGESPOTTED SUNFISH	FRESHWATER DRUM
BLACK REDHORSE	PUMPKINSEED SUNFISH	LARGEMOUTH BASS
BLUE CATFISH	QUILLBACK	MUSKELLUNGE
BLUEGILL SUNFISH	REDEAR SUNFISH	NORTHERN PIKE
BLUNTNOSE MINNOW	RIVER CARPSUCKER	RAINBOW TROUT
BROWN BULLHEAD	ROCK BASS	SAUGER
BROWN TROUT	ROUND GOBY	SAUGER X WALLEYE
CHANNEL CATFISH	SHORTHEAD REDHORSE	SMALLMOUTH BASS
COMMON CARP	SILVER CARP	SPOTTED BASS
COMMON CARP X GOLDFISH	SILVER REDHORSE	STR. BASS X WH. BASS
CREEK CHUB	SMALLMOUTH BUFFALO	STRIPED BASS
FLATHEAD CATFISH	SPOTTED SUCKER	WALLEYE
GOLDEN REDHORSE	SUCKERMOUTH MINNOW	WHITE BASS
GOLDEN SHINER	UNSPECIFIED CATFISH	
GOLDEYE	UNSPECIFIED MINNOW	
GOLDFISH	UNSPECIFIED SUCKER	
GRASS CARP	UNSPECIFIED SUNFISH	
GREEN SF X BLUEGILL SF	WARMOUTH SUNFISH	
GREEN SF X HYBRID	WHITE CATFISH	
GREEN SF X PUMPKINSEED	WHITE CRAPPIE	
GREEN SUNFISH	WHITE PERCH	
HYBRID X MINNOW	WHITE SUCKER	
HYBRID X SUNFISH	YELLOW BULLHEAD	
LONGEAR SF X BLUEGILL SF	YELLOW PERCH	

Chain of Custody (COC) Form

Division of Environmental Services
Chemistry Laboratory Chain of Custody Report

Date Received (Lab use only) Year Month Day

Collected by *

Ohio EPA Districts ☐ NEDO ☐ SWDO ☐ CO ☐ Other ☐ SEDO ☐ NWDO ☐ CDO

Division ☐ DSW ☐ DERR ☐ DDAGW ☐ DSIWM ☐ DAPC ☐ Other

Date of Grab Sample (Y Y M M D D)

Beginning and End Date of Composite Sample

Laboratory Number(s) (Lab use only)

Location(s)

Q.C. - Field Samples # ☐ Trip Blank (organics only) # ☐ Field Bank # ☐ Duplicate

Sample Type(s) ☐ Compliance ☐ Ambient ☐ Organic(s) ☐ Survey ☐ Complaint ☐ Possible Legal Action ☐ With Bioassay

Additional Information/Comments

Condition of Container of Transfer: (Seal all containers) _____ Locked or Tamper Proof _____ Unlocked or Not Tamper Proof _____ Initial

Number of Samples (Containers/Sites)

Relinquished by (must be collector*)

Received by

Relinquished by

Received by

Relinquished by

Received by

Relinquished by

Received by

MILITARY TIME

Year	Month	Day	Hour	Minute

EPA 4705
Printed on Recycled Paper

Distribution
White-Laboratory
Canary-Originator-After Lab Signature
Pink-Q.A.
Goldenrod-Q.A.

Fish Tissue Sample Labels and Submission Form

Field ID Station ID - XX Lab Label	Field ID Station ID - XY Lab Label
Station ID _____ Date ___/___/___	Station ID _____ Date ___/___/___
Waterbody _____ RM ___.___	Waterbody _____ RM ___.___
Location _____	Location _____
Collector _____	Collector _____
Sample Description	Sample Description
Field ID Station ID - XY Lab Label	Field ID Station ID - XX Lab Label
Station ID _____ Date ___/___/___	Station ID _____ Date ___/___/___
Waterbody _____ RM ___.___	Waterbody _____ RM ___.___
Location _____	Location _____
Collector _____	Collector _____
Sample Description	Sample Description
Field ID Station ID - XY Lab Label	Field ID Station ID - YX Lab Label
Station ID _____ Date ___/___/___	Station ID _____ Date ___/___/___
Waterbody _____ RM ___.___	Waterbody _____ RM ___.___
Location _____	Location _____
Collector _____	Collector _____
Sample Description	Sample Description
Field ID Station ID - XY Lab Label	Field ID Station ID - YX Lab Label
Station ID _____ Date ___/___/___	Station ID _____ Date ___/___/___
Waterbody _____ RM ___.___	Waterbody _____ RM ___.___
Location _____	Location _____
Collector _____	Collector _____
Sample Description	Sample Description

Ohio Environmental Protection Agency

Ohio EPA Fish Tissue Sample Submission Form

Date Received _____

Field ID Station ID - XX Order Number (lab) _____ Sample ID (lab) _____

Station ID _____ RM ____.____ Date ____ /____ /____ Time _____:_____

Waterbody _____ Project _____

Location _____ Method Electrofishing

County _____ Lat./ Long. _____

Collector _____ Others _____ Organization _____

Test Information

Survey (Check for regular survey work)
- ☐ DSW Fish Tissue

Other
- ☐ Grind Only

Inorganics
- ☐ ICPMS 6 (As, Cd, Pb, Se)
- ☐ Mercury

Organics
- ☐ Pesticides ☐ Chlordane
- ☐ PCBs ☐ Toxaphene

Note: Only check individual tests when not doing normal survey analysis

Sample Information

Species _____ # of Fish _____ Tissue Type (circle one) Skin-Off / Skin-On / Whole Body

FINS Code _____ Sample Type (circle one) Single / Composite

	Total Length (mm) / Weight (g)		Total Length (mm) / Weight (g)
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

Field Comments

Lab Comments

Appendix 3

Fish Consumption Advisories (ODNR)

Sampling Lake Erie for Fish Tissue: Standard Operating Procedures, June 10, 2015

Prepared by Scott Hale (ODNR Division of Wildlife)

Today's Fish Tissue Consumption Monitoring Program (FTCMP) is led by the Ohio Environmental Protection Agency (Ohio EPA) and implemented in cooperation with the Ohio Department of Health (ODH) and the ODNR Division of Wildlife (ODW), who form the Inter-Agency Sport Fish Tissue Monitoring Committee (IASFTMC). Through this partnership the ODW annually collects fish tissue samples for the program in Lake Erie and inland lakes and reservoirs and Ohio EPA collects samples in rivers and streams and in some inland lakes and reservoirs under special circumstances. Fish consumption advisories are updated annually and communicated with the public via a March 1 press release, hard-copy cards and leaflets, and the internet (http://www.epa.state.oh.us/dsw/fishadvisory/index.aspx).

I. Lake Erie Sampling

NOTE: Prior to sample collection each year the OEPA manual (OEPA 2018) should be carefully reviewed. Procedures from the manual should be uniformly followed except where noted in this guidance (e.g., sampling tissue for microcystin, whereby individual fish are processed instead of composite samples).

Periodic adjustments have been made to the Lake Erie sampling protocols for fish tissue since the program first began over 25 years ago. These adjustments have primarily been associated with the numbers and species of fish collected and the basin (Central vs. Western) from which they were obtained. Some adjustments were related to specific interests regarding species sampled, some were related to logistics, and others were related to funds available for analysis of fish tissue. The current target sample sizes for Lake Erie sampling based on species priorities, logistics, and funds available are listed in Table 1. The same targeted approach will be used in the Central and Western basins each year. **Sampling will be conducted in both basins each year.** Composite samples collected on Lake Erie should be "skin-on" per the Ohio EPA manual.

Table 1. Species, target sample sizes for composite samples of three to five fish, and collection methods for obtaining fish tissue samples from the Central and Western basins of Lake Erie.

Species	Composite samples	Method of collection
Yellow perch	3	Bottom trawls
White perch	3	
White bass	3	Fall gillnetting
Walleye	3	
Smallmouth bass	3	Smallmouth bass assessments
Freshwater drum	3	

Channel catfish	3
Common carp	3

II. Supplemental Sampling at Grand Lake St. Marys and Lake Erie

Annual fish collection will begin at Grand Lake St. Marys (GLSM) and Lake Erie during 2015 to monitor microcystin levels in fish tissue. The purpose of this work is to better understand fish consumption risks associated with harmful algal blooms by developing a long-term dataset from current state-of-the art analysis and banking (freezing) historical samples for future analysis. Banked samples will be processed as analytical techniques improve or as new needs emerge. This work will allow the development of long-term data sets to inform concerns related to the impact of harmful algal blooms on consumption of sport-caught fishes.

Some differences in protocols exist for this microcystin supplemental sampling:

- Sampling will be conducted during specific periods, from mid-May through June in Grand Lake St. Marys and during September in Lake Erie. Each period represents a time of historical algal blooms that have become a concern.
- Grand Lake St. Marys samples will be collected in the west end of the reservoir where water quality is routinely monitored by the City of Celina. District Five Fish Management will conduct the sampling.
- Lake Erie samples will be collected in conjunction with annual assessment surveys in the Western Basin by the **Sandusky Fish Research Unit**.
- **All samples are for individual fish** whereby two fillets are packaged together as one sample and tracked with the same sample ID number. **These are NOT composite samples from multiple fish.**
- Routine field data should be collected for individual fish (species, length (mm), weight (g), date, location, etc.) that is associated with each by using a unique ID number. ID numbers for each sample should be consecutive and continuous, beginning with "1".
- **All samples for microcystin analysis should be processed "skin-off". Current Lake Erie protocols for the FTCMP call for "skin on", but this does not apply to these samples and skin should be removed.**
- In Grand Lake St. Marys, five samples should be obtained from each species, including largemouth bass, crappie, bluegill, channel catfish, and common carp.
- In Lake Erie, 12 samples should be obtained from each species, including walleye, yellow perch, white perch, and white bass. Walleye that are caught in SMB nets are also processed.
- Fish samples should be frozen and transferred to the Ohio EPA (Groveport) and follow the same chain of custody requirements as other tissue samples. OEPA will process these fish into homogenates and store them until they are transferred to the OSU Aquatic Ecology Laboratory. Samples must be maintained at -80 C.
- During fish collection efforts, two grabs of water samples should be collected and stored in 0.5-L cube containers from each of three areas that encompass the tissue sampling sites. These samples should be placed immediately in coolers (kept in the dark) and frozen immediately

upon return from the field. (NOTE: Only samples that will be analyzed in less than five days can be stored in a refrigerator, which is highly unlikely for our sampling.) Field data should include the sample ID, beginning with “1” and the date, time, latitude, and longitude of sample collection sites.

- Tissue and water samples should be submitted to the Ohio EPA no later than July 31 (GLSM) or November 1 (Lake Erie).

This sampling will provide materials for project FADX09, a sponsored research project through OSU, but time should be coded to project FIDS01 (inland) or FSDS01 (Lake Erie) as is the case with other fish tissue collections for the FTCMP. The activity code is 10111 (fish population surveys).

Sampling Ohio's Public Reservoirs: Standard Operating Procedures, May 12, 2015

Prepared by Scott Hale (ODNR Division of Wildlife) and Gary Klase (Ohio EPA)

Overview

Fishes from more than 180 Ohio reservoirs have been sampled from 1993 through 2017 to allow the State of Ohio to analyze fish tissue to: 1) produce fish consumption advisories; 2) investigate the impacts of contaminant incidents; and, 3) inform Total Daily Maximum Load (TMDL) Reports. Today's Fish Tissue Consumption Monitoring Program (FTCMP) is led by the Ohio Environmental Protection Agency (Ohio EPA) and implemented in cooperation with the Ohio Department of Health (ODH) and the ODNR Division of Wildlife (ODW), who form the Inter-Agency Fish Tissue Monitoring Committee (IASFTMC). Fish consumption advisories are updated annually and communicated with the public via a March 1 press release, hard-copy cards and leaflets, and the internet (http://www.epa.state.oh.us/dsw/fishadvisory/index.aspx).

Since inception of the program, annual reservoir sampling has been viewed as a screening program to reveal potential contaminant problems in specific waters. If initial sampling suggested that significant contamination may exist, then a reservoir was resampled a second year and results were used to determine whether an advisory more stringent than the statewide standard of one meal per week was warranted. If an advisory more stringent than the statewide advisory resulted, then two consecutive years of sampling that indicated an improvement was noted was required before a decision could be made to remove such an advisory.

The 2015 Fish Consumption Advisory posted by the Ohio EPA identified 32 public reservoirs (non-lake association waters) with more stringent or more lenient consumption advisories than the one meal per week guidance for most species or two meals per week guidance for sunfishes (i.e., bluegill, green sunfish, longear sunfish, and redear sunfish). Among these, 16 reservoirs had 21 species-specific advisories that were more restrictive, and 16 reservoirs had 30 species-specific advisories that were less restrictive. The greatest percentage of more restrictive advisories recommended a one meal per month guideline for largemouth bass (57%), with fewer more restrictive guidelines recommended for common carp (24%), channel catfish (10%), bluegill (5%), and northern pike (5%). The contaminants of concern that resulted in these advisories were primarily mercury (71%), followed by PCB (23%) and lead (5%). The greatest percentage of less restrictive advisories recommended a "two meals per week" guideline for largemouth bass (33%), common carp (23%), and black or white crappie (20%), with fewer less restrictive advisories for saugeye (7%), channel catfish (7%), walleye (3%), bluegill (3%), and brown bullhead (3%). These less stringent advisories resulted from low levels of mercury.

The IASFTMC believes that reservoir sampling should continue based on the value of Fish Consumption Advisory Program (FCA) guidance provided to the public from these data. However, during recent team discussions, the idea of sampling more intensively at fewer reservoirs each year was discussed. The rationale was to allow greater sample sizes per reservoir per year to facilitate more rapid and complete guidance while, in the long run, allowing a similar or greater number of reservoirs to be sampled through time. This may occur because reservoirs would not be sampled two or more consecutive years if a problem was detected given that advisories could be based on a more complete annual dataset.

Adjustments in reservoir sampling protocols follow in this document. These represent slight modifications of the Ohio EPA Fish Tissue Collection Manual (OEPA 2018) and have been approved by the IAFTMC. ***Prior to sample collection each year the Ohio EPA manual (OEPA 2018) should be reviewed and items not identified below as deviations from the manual should be followed.***

I. Reservoir Selection

Selection of public fishing reservoirs to sample each year will be determined by Fish Management and Research Group staff in each ODW district. Decisions will be based primarily on fishing effort as determined by creel surveys, the last year that a reservoir was sampled, and insights from fisheries staff. Districts have been provided guidance to select one reservoir per year at this more extensive level, but should be judicious in choices of reservoirs to ensure that gaps in years of sampling are smallest for the most heavily fished reservoirs. Future schedules could potentially be set several years in advance similar to the 6-year cycle of sampling conducted through the ODW Inland Management System (IMS). However, Special sampling events could be added should a reservoir-specific contamination case or concern develop.

II. Sampling

All reservoirs will have only one general FCA sampling location. This is a deviation from the current Ohio EPA manual which establishes the number of locations based on three reservoir sizes, <250 acres, 250-999 acres, and ≥1,000 acres with one, two, and three general locations, respectively. Our new approach is to collect three composite skin off (SFFC) samples for each target species in each reservoir regardless of size. **It is critical that we collect three composite samples for each species with this approach to avoid the need to return to the reservoir the following year.** In reservoirs <1,000 acres, two samples would be collected from the upper end and one sample would be collected from the lower areas when applicable (i.e., tributary and canal reservoirs, but not unground reservoirs). In reservoirs ≥1,000 acres, one sample would be collected for each species from the upper, middle, and lower areas when applicable. The waypoints for each sampling site is mid-point of each portion of the reservoir (upper, middle, lower, where applicable) where fish are collected and is identified by latitude and longitude (NAD83, decimal degrees) as opposed the exact area where each fish is collected.

Composite samples should be collected for each of the following species, as opposed to trophic level, as in the current Ohio EPA manual guidance:

- Largemouth bass
- Crappie (choose white or black if both are present, but not some of each)
- Bluegill (do not mix or match sunfish, collect bluegill)
- Channel catfish
- Common carp
- Walleye or saugeye (if present)
- White bass or hybrid striped bass (if present)

All composite samples are “skin-off” and should be composed of three to eight fish to provide a minimum of 150 g of tissue with fillet preparation as described in the Ohio EPA manual. The entire sample consists of both fillets from each fish up to eight fish with a minimum of two fish per sample.

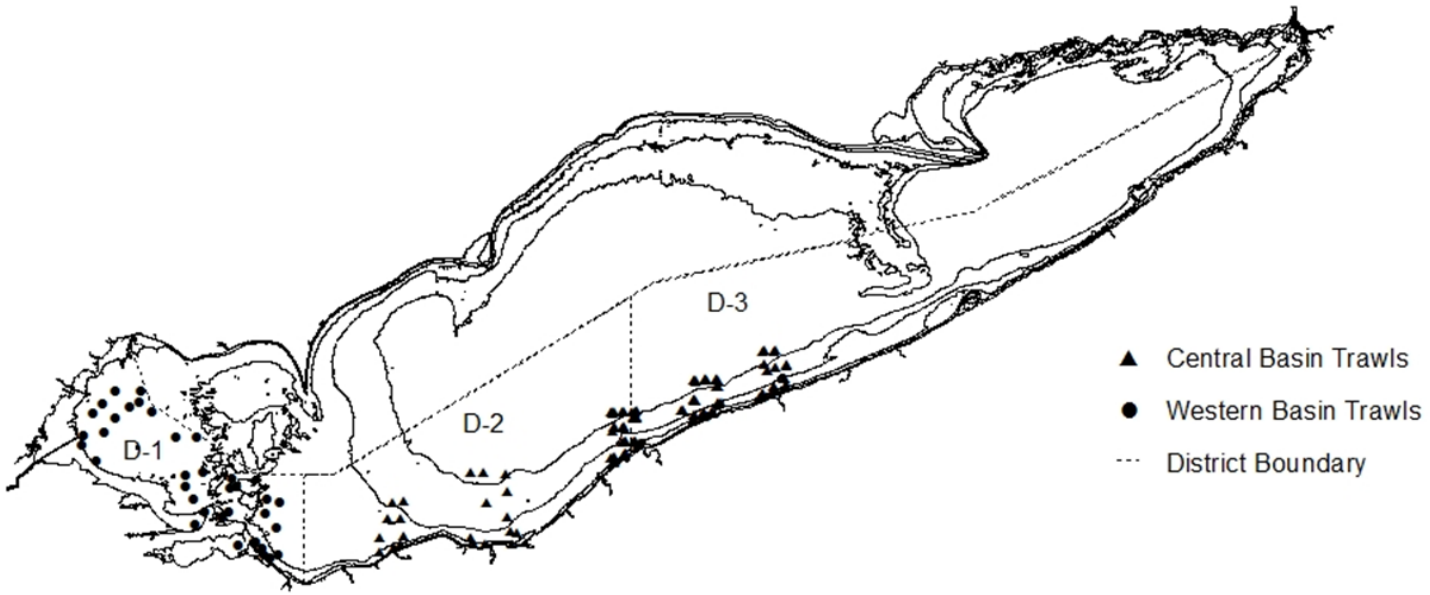
Sampling data should be recorded in standard Inland Management System (IMS) forms and recorded in the Ohio Fisheries Information System (OFIS) as a non-IMS survey. Standard IMS forms should be used to record standard sampling data in the field, including fish length and weight.

III. Transfer of Samples to Ohio EPA

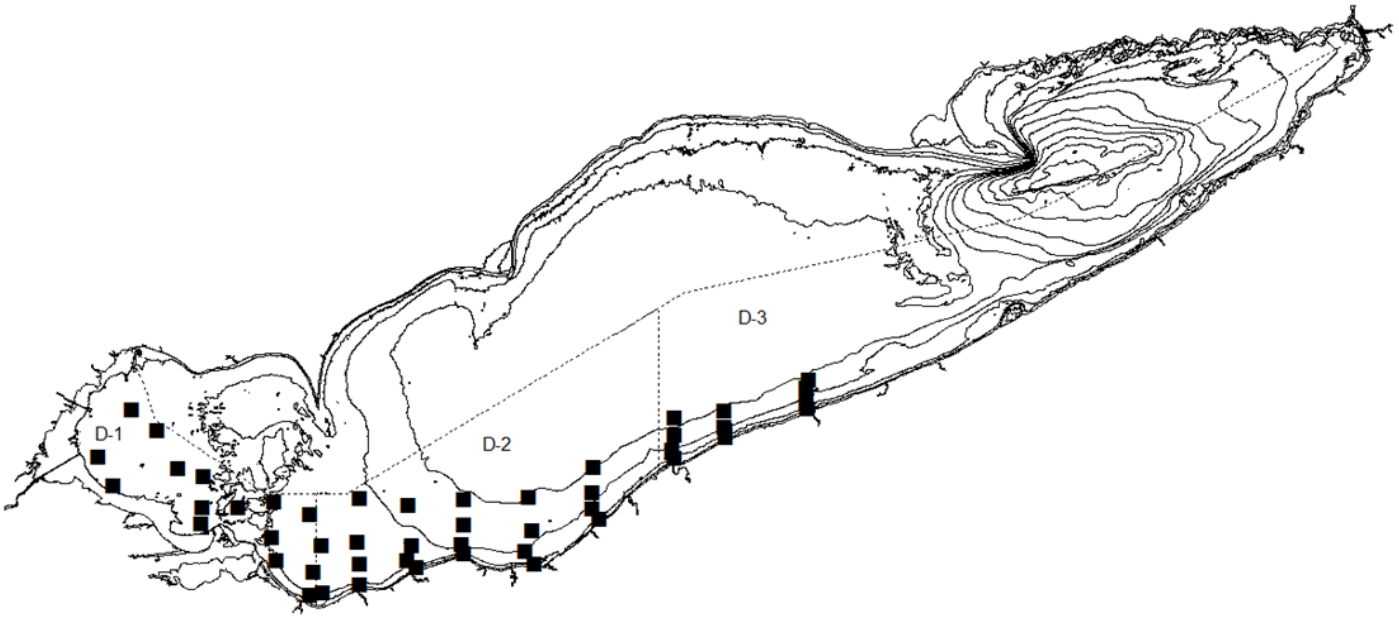
See the Ohio EPA manual. None of these procedures have changed.

Sample Location Maps by Equipment Type

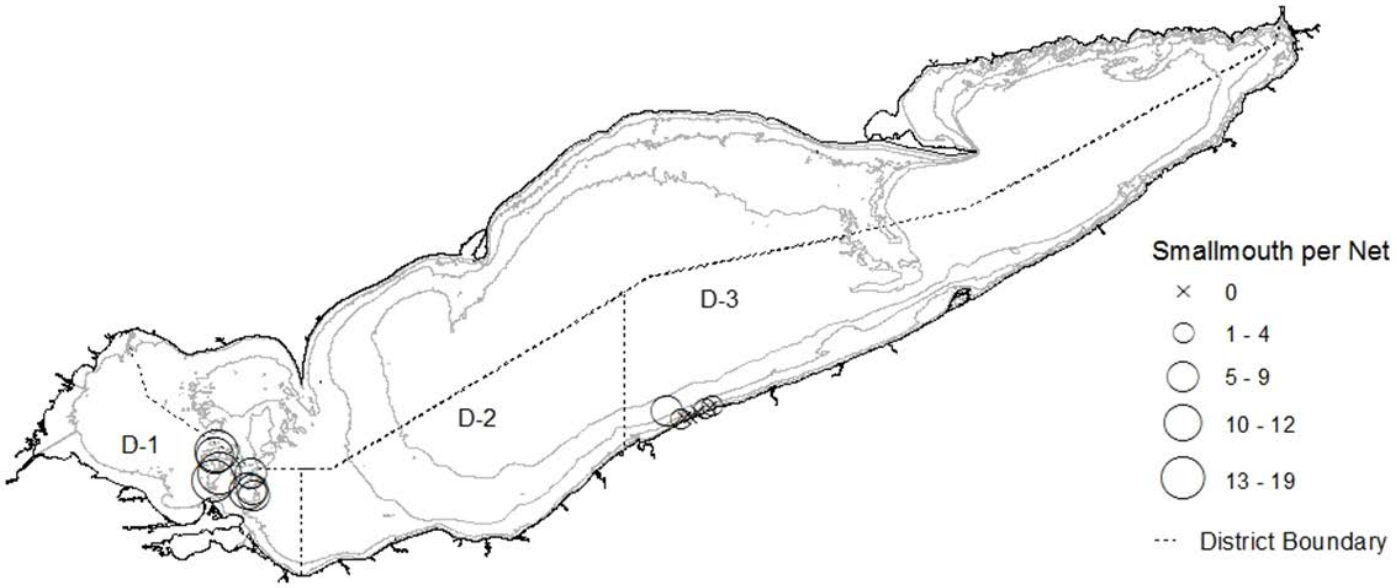
Map 1 – ODNR Trawl Locations (Transects)

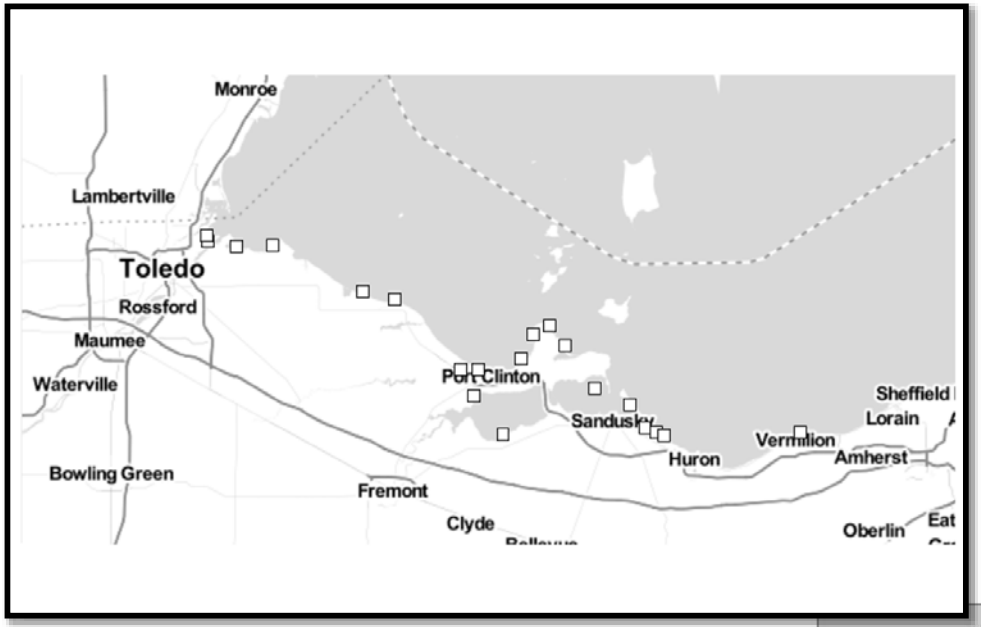


MAP 2 – ODNR Open Water Gill Net Sites

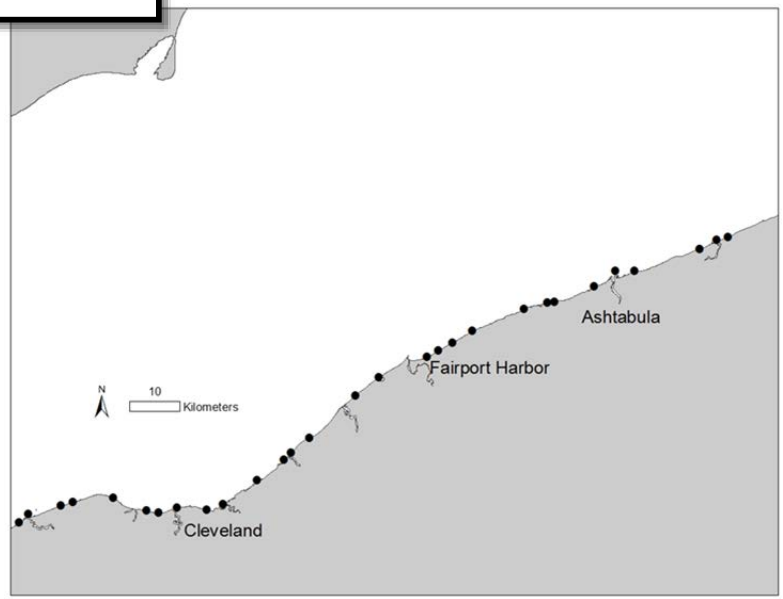


MAP 3 – Smallmouth Bass Gill Net Sites





MAP 4 – ODNR Electrofishing Sites (west basin & east)



Appendix 4

Table 1: DES Analytical SOPs

Appendix 4 Table 1 – DES Standard Operating Procedures

Parameters	DES Test Method	Holding Time	Fish Tissue
Metals Microwave Prep	400.8	6 mos.	X
Mercury	438.13	1 year	X
ICPMS 6	460.4	1 year	X
GPC Cleanup	581.2		X
Tissue Grinding	581.10		X
Florisil Packed Column and FlashMaster™ Cleanup/Fractionation	581.32		X
Pesticide/PCB Prep	581.33		X
Percent Lipids	581.5	1 year	X
Pesticides and PCBs Analysis	590.4	1 year	X

Appendix 4 Table 2 – Fish Tissue Reporting Limits

Test	Parameter	Initial RL	Estimated RL (includes prep volumes)
Arsenic		0.5	0.05
Cadmium		0.1	0.01
Lead		0.4	0.04
Selenium		1.0	0.1
Mercury		0.2	0.024
Pesticides	Aldrin	25	10
	a-BHC	25	10
	b-BHC	25	10
	d-BHC	25	10
	y-BHC	25	10
	4,4'-DDD	25	10
	4,4'-DDE	25	10
	4,4'-DDT	25	10
	Dieldrin	25	10

	Endosulfan I	25	10
	Endosulfan II	25	10
	Endosulfan Sulfate	25	10
	Endrin	25	10
	Endrin Aldehyde	25	10
	Heptachlor	25	10
	Heptachlor Epoxide	25	10
	Hexachlorobenzene	25	10
	Methoxychlor	25	10
	Mirex	25	10
PCBs	1016	50	20
	1221	50	20
	1232	50	20
	1242	50	20
	1248	50	20
	1254	50	20
	1260	50	20

*Appendix 4 Table 3 – Fillet Chemical Upper Bound Limit Concentrations (ppm) and Advisory Meal Consumption Rate (µg/kg/day)**

Chemical (RfD)	Unrestricted	1/week	1/month	6/year	Do Not Eat
Aldrin (0.03)	<0.030	0.131	0.568	1.135	>1.135
Total Arsenic (0.3)	<0.150	0.656	2.838	5.676	>5.676
Total Cadmium (1.0)	<0.500	2.188	9.459	18.91	>18.919
Total Chlordane (0.5)	<0.500	2.188	9.459	18.919	>18.919
Total DDT (0.5)	<0.500	2.188	9.459	18.919	>18.919
Dieldrin (0.05)	<0.050	0.220	1.000	1.999	>1.999
Endosulfan (6.0)	<6.000	26.250	131.514	227.027	>227.027
Endrin (0.30)	<0.300	1.313	5.676	11.351	>11.351
Heptachlor (0.5)	<0.500	2.188	9.459	18.919	>18.919
Heptachlor Epoxide (0.013)	<0.013	0.057	0.246	0.492	>0.492
Hexachlorobenzene (0.8) **	<0.800	3.500	15.135	30.270	>30.270
Total Lead (6.0)	<0.086	0.375	1.622	3.243	>3.243
Lindane (6.0)	<0.3	1.313	5.676	11.315	> 11.315
Methoxychlor (5.0)	<5.000	21.875	94.545	189.189	>189.189
Mirex (0.2)	<0.200	0.875	3.784	7.568	>7.568
Methylmercury (0.1)	<0.050	0.110	0.220	0.999	>1.000
Total PCBs (0.05)**	<0.050	0.220	1.000	1.999	>1.999
Total SAS 305 (50.0)**	<50,000	218,750	945,946	1,891,892	>1,891,892
Total SAS 310 (28.6)**	<28,600	125,125	541,081	1,082,162	>1,082,162
Total Selenium (5.0)	<2.500	10.938	47.927	94.545	>94.545
Toxaphene (0.25)	<0.250	1.094	4.730	9.459	>9.45

* - Concentrations are reported in mg/kg (ppm) raw fish fillet wet weight. Meal consumption rates are: No restrictions (225 meals/year); One meal/week (52 meals/year); One meal/month (12 meals/year); 6meals/year; and Do not eat. All metals results are reported as Total metals, including Mercury. Total PCBs are reported as the sum of Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260; Total Chlordane is reported as the sum of Alpha-Chlordane, Gamma-Chlordane, Oxychlordane, cis-Nonachlor and trans-Nonachlor; Total DDT is reported as the sum of DDT and Metabolites (DDE and DDD).

** - HPV = Health Protection Value; HCB = hexachlorobenzene; Total SAS 305 is a chemical mixture of the following alkylated biphenyls: o-isopropyl-1,1-diphenylethane, m-isopropyl-1,1-diphenylethane, pisopropyl-1,1-diphenylethane and p-isopropyl-1,2-diphenylethane; Total SAS 310 is a chemical mixture of the following alkylated biphenyls: o-sec Butyl diphenylmethane, m-sec Butyl diphenylmethane, p-sec Butyl diphenylmethane, o-sec Butyl 1,1-diphenyl-ethane, m-sec Butyl 1,1-diphenylethane, p-sec Butyl 1,1-diphenylethane, o-sec Butyl 1,2-diphenylethane, m-sec Butyl 1,2-diphenylethane, and p-sec Butyl 1,2-diphenylethane.

Appendix 4 Table 4 – Median Lipid Levels by Species, 1998 – 2006

Species	Lipid (%)
Black Crappie	0.33
Black Redhorse	3.2
Bluegill Sunfish	0.41
Common Carp	3.86
Freshwater Drum	2.7
Golden Redhorse	1.29
Green Sunfish	0.58
Largemouth Bass	0.37
Longear Sunfish	2.15
Northern Hog Sucker	0.99
Northern Pike	0.44
Pumpkinseed Sunfish	0.33
Quillback Carpsucker	1.78
Rainbow Trout	6.66
Redear Sunfish	0.4
Rock Bass	0.37
Sauger	1.0
Saugeye	0.68
Shorthead Redhorse	10.3
Silver Redhorse	2.1
Smallmouth Bass	0.77
Smallmouth Buffalo	4.3
Spotted Bass	0.43
Spotted Sucker	1.39
Striped Bass Hybrid	1.28
Walleye	1.73
White Crappie	0.31
White Sucker	1.35
Yellow Perch	0.38