

Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedure for Field Collection, Processing and Preservation of Finfish Samples at the Time of Collection in the Field

Version 1.1

Author – Patti Sandvik

Date -

Reviewer – Casey Deligeannis

Date -

QA Approval – William R. Kammin, EAP Quality Assurance Officer

Date – 4/21/14

EAP009

Recertified: 4/21/14, 10/21/10

Signatures on File.

Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
08/03/06	V1.0	SOP Publication		
10/19/10	V1.0	Three year review, minor changes		
10/21/10	V1.0	QA approval, recertified		
03/20/14	V1.0	Three year review, minor changes		
04/21/14	V1.1	QA approval, recertified		

Environmental Assessment Program

Standard Operating Procedure for Field Processing and Preservation of Fish Samples.

1.0 Purpose and Scope

- 1.1 This document is the Environmental Assessment Program (EAP) Toxics Study Unit (TSU) Standard Operating Procedure (SOP) for collection, processing and preservation of finfish samples in the field. A separate SOP on resecting samples in the laboratory is also available (SOP #007 *Procedures for Resecting Finfish Whole Body, Body Parts, or Tissue Samples*).
- 1.2 Washington State Department of Ecology investigates the occurrence and concentrations of toxic contaminants in fish tissue. This SOP is intended to provide consistent techniques that ensure the quality of sample collection, tissue preparation (including whole finfish or other body parts) for the purpose of homogenizing samples for chemical analysis by an accredited analytical laboratory. This SOP was adapted from the Environmental Protection Agency's (EPA) *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 Fish Sampling and Analysis Third Edition* (2000).

2.0 Applicability

- 2.1 This procedure is to be followed by Ecology's TSU personnel conducting projects involving the collection of finfish tissue samples for contaminant analysis.
- 2.2 This SOP also addresses fish field processing to be conducted by other agencies (Washington Department of Fish and Wildlife, Tribes, etc) when collecting fish for Ecology. See Attachment 5 for a one page summary that should be presented to, and followed by non Ecology groups when coordinating cooperative fish collection efforts.

3.0 Definitions

- 3.1 Processing Bench Sheet – A table, usually created in Excel®, used to plan and document sample processing data for each fish collected (Attachment 1).
- 3.2 Composite – Composite samples are homogeneous mixtures of samples from two or more individual organisms of the same species collected at a particular site and analyzed as a single sample.
- 3.3 Ecology – Washington State Department of Ecology.
- 3.4 EAP – Environmental Assessment Program.

- 3.5 Field Log Book – A weather resistant logbook used to document any and all field activities, sample data, methods and observations for each and all collection sites.
- 3.6 Lab Analysis & Tracking Plan – A table, usually created in Excel®, used to plan and document lab analyses of samples for single or multiple projects (Attachment 2).
- 3.7 QAPP – Quality Assurance Project Plan.
- 3.8 Resecting – Surgical removal of all or part of an organ, tissue or structure.
- 3.9 TSU – Washington State Department of Ecology’s Toxics Study Unit.
- 3.10 WDFW – Washington Department of Fish and Wildlife.
- 3.11 FFCMP – Freshwater Fish Contaminant Monitoring Program.

4.0 Personnel Qualifications/Responsibilities

- 4.1 Staff leading or participating in fishing operations must meet qualifications described in Scientific Collection Permits (required qualification may vary by permits, so each permit needs to be consulted). Additional requirements are needed to conduct field work and operate Ecology boats. Please see “Safety” section 9.4 of this SOP for details.

5.0 Equipment, Reagents, and Supplies

- 5.1 Fish identification guides.
 - 5.1.1 Wydoski, R. and R. Whitney. 2003. *Inland Fishes of Washington*, Second Edition. University of Washington Press. Seattle, WA.
 - 5.1.2 Sport Fishing Rules for Washington – Current year’s edition located at <https://fortress.wa.gov/dfw/erules/efishrules/index.jsp>.
- 5.2 Field Log Book is a weather resistant notebook – Rite in the Rain™ (Figure 1).
- 5.3 Indelible ink and pens that function when wet.
- 5.4 Marking pens, pencils, pencil sharpener, permanent markers.
- 5.5 Field Identification (ID) tags (Figure 2).
- 5.6 Identifying tape – Blue painter’s masking tape.
- 5.7 Camera.

- 5.8 Bench scale (battery operable), include extra 9v batteries, standard weights, and standards log book for pre and post accuracy checks (Figure 3 and 4).
- 5.9 Fish measuring board (Figure 5).
- 5.10 Heavy-duty aluminum foil typically Reynolds Foodservice Foil 45.7cm x 152.4mm (624) and 38.1cm x 152.4mm (622).
- 5.11 Talc-free nitrile exam gloves.
- 5.12 Paper towels.
- 5.13 Garbage bags.
- 5.14 Polyethylene zip seal bags – Gallon sizes.
- 5.15 Large (11 in X 14 in) polyethylene bags for preserving large fish.
- 5.16 Plastic cable ties (zip ties).
- 5.17 Headlamp with extra batteries and an extra new bulb available.
- 5.18 Flashlights with extra batteries.
- 5.19 Gloves for handling fish.
- 5.20 Coolers with ice – Enough coolers and ice for ice to surround expected fish collected.
- 5.21 5 gallon bucket.
- 5.22 Deionized distilled (DI) water.
- 5.23 Copy of QAPP which specifies the fish to be collected.
- 5.24 Scientific Collection Permits and associated equipment/references required by permits.
- 5.25 Electrofishing log forms (for boat and/or backpack electrofishers).
- 5.26 Fish collection gear such as boat, electrofishers, nets, fishing poles and tackle, and related equipment.
- 5.27 Related forms, fishing permits, checklists, and electrofishing log templates are located at Y:\SHARED Files\TSU Fish.



Figure 1. Field Log Book (Weather resistant notebook – Rite in the Rain™). Used to record fish field data, site information, methods, etc.

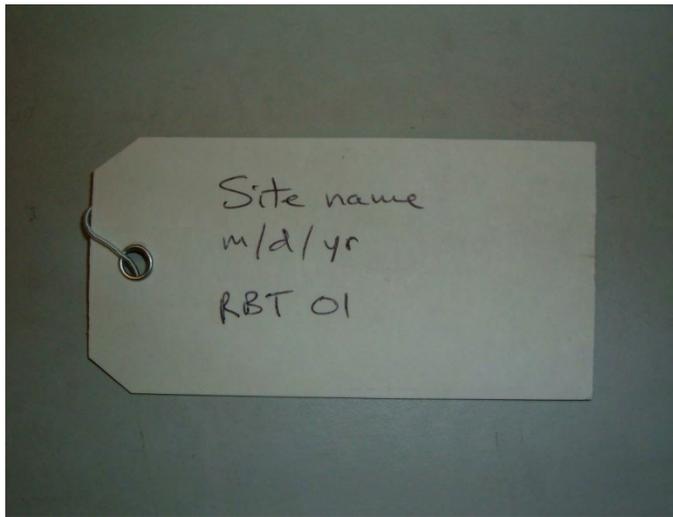


Figure 2. Fish field identification tag.



Figure 3. Bench scale.



Figure 4. Scale Log Book, Standard Weights, 9 volt battery (Items stored in scale case).

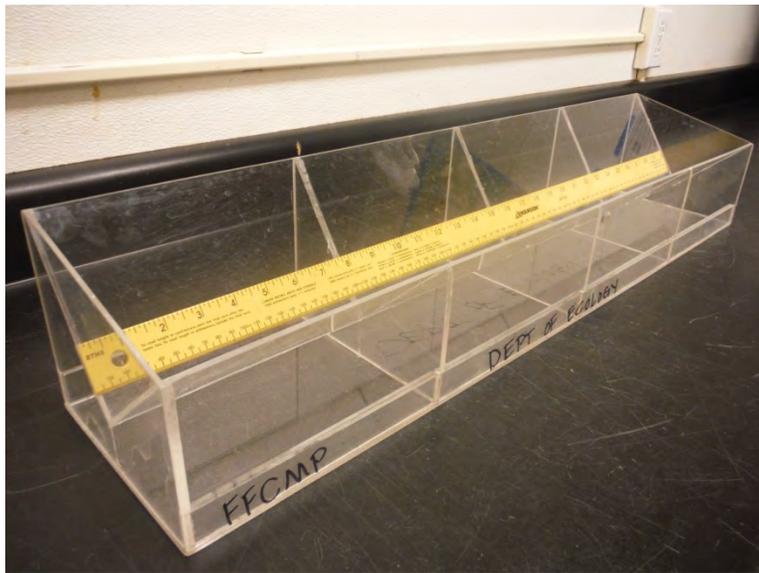


Figure 5. Fish Measuring Board.

6.0 Procedure

6.1 Fish collection planning.

6.1.1 Plan field sampling. Successful fish collection efforts require planning at various levels. The QAPP will describe project goals and help guide the selection of fish to collect from designated sites. Various Scientific Collection Permits are required at all sites and may dictate numerous conditions related to fish collection efforts. Reconnaissance of fish collection locations provides information needed to plan field efforts. Selection of fish collection methods and gear help determine what resources are needed in the field to collect target numbers and species of fish. Finally, field efforts must be documented in order to meet requirements of various permits and to record information about samples collected for the project.

6.1.2 Review QAPP. Identify the specifics needed to meet project objectives. Items of primary concern are: timing and locations of fish collections, numbers and size ranges of target species at each site, collection methods, field processing procedures, and any information relevant to the collection and preservation of samples.

6.1.3 Review collection permits. Determine the need for permits and/or permissions to collect fish at each site and contact the unit permit coordinator to obtain copies of relevant permits. Permits may need to be applied for, and is a process that can take from 2 to 6 months. One or more permits from various agencies and/or documented permission from other entities are needed to collect fish from, or gain access to, any site. Table 1 summarizes the various permits and agencies that may have jurisdiction at fish collection sites. Each permit has unique requirements about: species, locations, time of collection, collection methods and restrictions, personnel authorized for field work, record-keeping and reporting, notification of permitting authority, and more. Permits generally require that the permitting authority be contacted prior to collection within a time frame specified in permits (usually about 4 weeks to 3 days).

Table 1. Summary of Permits or Permissions Needed for Collecting Fish.					
Who Issues	Example	Permit Type	Geographic Coverage	Species	Application Information
WDFW	Washington State Department of Fish and Wildlife	Formal Permit	All waters within state	All species	http://wdfw.wa.gov/licensing/scp/
NOAA - NMFS	National Oceanic and Atmospheric Administration - National Marine Fisheries Service	Formal Permit	Most of state where about 14 ESA-listed anadromous salmonids species occur	Salmon & Steelhead	http://www.nmfs.noaa.gov/pr/permits/esa_permits.htm
USFWS	U.S Fish and Wildlife Service	Formal Permit	Much of state where the ESA-listed Bull Trout has been found	Bull Trout	http://www.fws.gov/engaged/permits/index.html
National Parks	Olympic NP, Lake Roosevelt National Recreation Area	Formal Permit	Within National Park, Nat'l Recreation Area boundaries	All species	https://irma.nps.gov/prs/Home
Other State Agencies	Washington Parks and Recreation	Formal Permit	In waters or access points managed by WA Parks and Recreation	All species	http://www.parks.wa.gov/206/Permits
Tribes	Roughly 30 recognized Tribes in Washington	Documented permission or notification	In waters or access points where Tribes have jurisdiction	All species?	http://www.goia.wa.gov/tribal-directory/tribaldirectory.pdf
Other Federal Agencies	USFS, BLM, BOR, USACE,	Documented permission or notification	In waters or access points where such agencies have jurisdiction	All species?	Individual agencies
Local Government	Cities, towns, counties	Documented permission or notification	In waters or access points managed by local gov't	All species?	Individual governments
Private Landowners	private citizens, utility companies operating dams	Documented permission or notification	In waters or access points managed by local gov't	All species?	Individual private landowners

Table 1. Various permits and agencies that may have jurisdiction at fish collection sites.

- 6.1.4 Site Reconnaissance. Obtain information about the site, access, species, local conditions, and any information that will improve chances of a successful fish collection effort. WDFW and other agency biologists have been very helpful with local knowledge. A site reconnaissance checklist (Attachment 3) can help guide inquiries into site characteristics. Most reconnaissance can be done via phone, email, and office resources (e.g. Gazetteer, GIS, and other staff).
- 6.1.5 Select fish collection methods. Determine which collection gear and methods are appropriate for site characteristics and meeting project objectives. Boat electrofishing and gill netting are the most common methods used by Ecology's Toxics Study Unit (TSU). Other methods include backpack electrofishing, angling, and use of other nets such as beach seines, fyke nets, and otter trawls. Ensure needed equipment is available and in serviceable condition prior to field collection efforts. An inventory of nets and accessory gear (Attachment 4) is located at Y:\SHARED Files\TSU Fish\Fishing Equipment Inventory\Gill Net Inventory 2010.xls. Note that special training is required for boat operations and electrofishing.

- 6.2 Collect fish and document field efforts.
- 6.2.1 Prepare gear and travel to site with crew needed to collect fish.
- 6.2.2 At the site, brief crew on site specific objectives and operations such as: boating plan; safety issues; collection methods and gear; site characteristics; target species, numbers, and size ranges; and record-keeping. Ensure all needed gear is loaded into boat if boat is used.
- 6.2.3 Prepare field logs for recording pertinent data from fishing effort. Set up the Boat Electrofishing Log form for each site (Figure 6) and any electrofishing boat operations. This form is designed for use with the electrofishing boat, yet can be used for other boat operations as well. Other boats may have a log book for similar operations.

Boat Electrofishing Log					Date(s): 11-14-13	
Site: COLUMBIA R., BLW GRAND COURSE DAM						
Crew: CD, MF, AB						
Weather & conditions: Mostly clear sky w/ scattered clouds, 40°F, calm wtr/wind						
Main Engine Hours						
Date	Time uw	M.E. hrs	Time rtn	M.E. hrs		
11/14/13	1330	020.2	1915	024.5		
Surface WQ						
Location		Time	Temp (C)	Cond (uS/cm)	Vis (ft)	
NR SEASON'S GROVE BL.		1600	11.5	136	10+	
Electronics Log - Generator Hours						
Time	Gen hrs	Seconds	PPS	Vrange	V %	Amps
1700	313.7	0	60	500	70	4.1
1900	315.4	1571	"	"	"	"
list species encountered and other comments on back of page						

Fish Encountered		Site: Col R, BLW GCD.	
Species	Estimated #'s	Date(s)	
LSS	75+	11/14/13	
LNS	50+		
NPM	5		
WAL	5		
RBT	75+		
CCP	2		
FISH < 4"	700+	↓	
Notes: ADD USEFUL NOTES ABT SITE, SPECIES, BOAT ISSUES, WHERE GILL NETS WERE SET (TIME SET & PULLED) ETC...			

Figure 6. Front and back of Boat Electrofishing Log form.

- 6.2.3.1 If boat electrofishing, all fields are required to be filled out (NOAA permit requirement). Enter time of day and engine hours when getting underway and when returning to launch point. Measure and record the surface temperature and conductivity at a point representative of where electrofishing will occur. Fill out generator hours and

electronics settings at start and end of electrofishing effort. Any changes in electrofishing settings during fishing are recorded in the Electronics Log section.

6.2.3.2 The back of the form is used to record the approximate number of individuals for each fish species encountered (WDFW permit requirement). Additional pages can be used for notes required by permits or additional information such as sample collection activities, hydrologic conditions, weather conditions, boat or equipment operations, any other unusual activities observed (i.e. dredging), or problems encountered that would be useful to the manager in evaluating the quality of the fish contaminant monitoring data.

6.2.3.3 If backpack electrofishing, similar electrofishing logs (Figure 7) are required for permitting purposes.

Backpack Electrofishing Log					Date(s): 10-15-08	
Site: PAHATA CRK						
Crew: CD, PS, ST						
Weather & site conditions (note substrate & gen flow): OVERCAST AND COLD 38°F, SLIGHT BRZ, ROCKY SUBSTRATE, OCC ORGANIC MATTER/DOWN LOGS, FLOW 1/2 CFS						
Date	Time UW	Time RTN	Anode #	Cathode #		
10-15-08	1100	1430	2	-		
Surface WQ						
Location		Time	Temp (C)	Cond (uS/cm)	Vis (ft)	
2 ND SECOND FISH WEIR ON F.S. Rd #040		1115	1.6	48	1+	
Electronics Log for Backpack Unit						
Time	Shock Seconds	Right Mode (refers to cycle time 2, 4, 6, 8 or 10 sec)	Left Mode (F30Hz, 145Hz, L60Hz, etc)	Voltage (100-1000)		
1115	0	8	J 60Hz	500		
1345	893	"	"	"		
list species encountered and other comments on back of page						

Fish Encountered			Site: PAHATA CRK
Species	Estimated #'s	Date(s)	
BKT	30+	10-15-08	
RBT	10+	↓	
SCULP	2		
Notes: CREEK IS VERY SHALLOW, RANGES 1"-8" DEEP. LARGER POOLS NEAR FISH WEIRS 6"-14" DEEP. MAJORITY OF FISH WERE COLLECTED BLW WEIRS IN POOLS. FISH RESPONDED WELL TO SHOCK SETTINGS. 2 ND WEIR LOCATION LAT: 46° 15' 33N / LONG 117° 31' 40W			

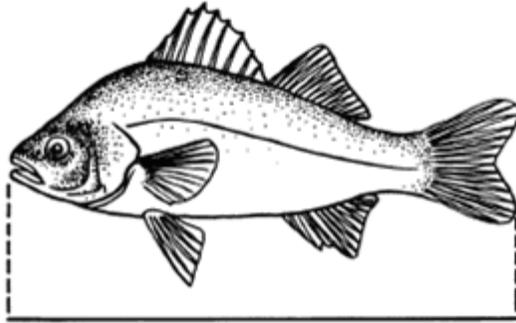
Figure 7. Front and back of Backpack Electrofishing Log form.

6.2.3.4 If setting gill nets, fyke nets, or beach seines; for each net ID, record the location of each net set on a map, chart or GPS coordinates and the times of net set and retrieval. Also record the numbers and species of fish collected with each net set. These notes are made in the field log book and/or on accompanying maps or charts of the site.

6.2.3.5 If trawling, record the net ID used, times and locations of trawl deployment and retrieval, and the numbers and species collected in the field logbook or accompanying maps or charts of the site.

- 6.2.3.6 If angling, record the location and time of effort along with numbers and species of fish encountered and collected in the field logbook or accompanying maps or charts of the site.
- 6.2.4 Collect fish and identify fish to species level as soon as collected. Ensure that adequate numbers and size ranges described in the QAPP are met. See Attachment 6 for target fish species. Nontarget species or specimens that do not meet size requirements should be returned to their home environment. Experienced personnel knowledgeable in local fish identification and taxonomic keys, appropriate to the waters being sampled, should be consulted for species identification. **Correct identification of species in the field is critical to project needs.**
- 6.2.5 Inspect fish to ensure that the specimen has no broken skin, damaged fins or other injuries that may compromise the quality of the sample. Damaged specimens should be discarded. Rinse selected fish in ambient water to remove any foreign material from the external surface.
- 6.2.6 At the end of the fish collection effort, return to the launch point, ensure that the field logs are correctly filled out, and begin preparations to process the fish retained for the study.
- 6.3 Prepare to field-process fish.
 - 6.3.1 Prepare Field Logbook for the following:
 - 6.3.1.1 Project Name
 - 6.3.1.2 Sampling date and time
 - 6.3.1.3 Sampling site location
 - 6.3.1.4 Collection method
 - 6.3.1.5 Collector's names
 - 6.3.1.6 Species collected and number of individuals of each species
 - 6.3.1.7 Field ID number for each fish specimen retained
 - 6.3.1.8 Total length (measured to nearest millimeter)
 - 6.3.1.9 Weight (measured to nearest gram)
 - 6.3.1.10 Notes including visible morphological abnormalities such as fin erosion, skin ulcers, cataracts, skeletal and exoskeletal anomalies, neoplasms, or parasites.

- 6.3.2 Prepare field identification tags for each specimen on a waterproof tag using indelible ink and writing implements that can function when wet (Figure 2). Record the site name, date collected, species or species abbreviation, and a unique field ID for the individual fish at that site, (e.g. RBT 01 through RBT 05 for five rainbow trout collected).
- 6.3.3 Prepare blue painter's tape to serve as specimen identification once the fish has been double-wrapped in foil. Write the abbreviated species and field ID on the tape with a sharpie marking pen. Tear off enough of the labeled tape to wrap around the foil-wrapped fish.
- 6.3.4 Label polyethylene bag(s) with a permanent marker to hold the collected fish. Write the collection location, collection date, species of fish and unique field IDs of the fish placed in the bag.
- 6.3.5 Prepare the battery operated bench scale for weighing fish. Ensure scale is located on flat level surface. Windy conditions may cause scale measurements to drift up and down making it difficult to record accurate weights. If this happens it might be necessary to situate scale out of the wind, or stack field totes and coolers around scale to block wind. Ensure scale accuracy is checked by weighing standard weights before and after each fish processing session. Record accuracy data in scale log book (Figure 4).
- 6.4 Sample Processing and Preservation.
 - 6.4.1 Stun large fish by a sharp blow to the base of the skull with a wooden or metal club to facilitate processing and packaging. Keep the club reasonably clean to prevent contamination of the samples. Small fish may be asphyxiated or stunned by putting on ice immediately after capture (U.S. EPA, 2000).
 - 6.4.2 Measure the total length to the nearest millimeter of each fish using the fish measuring board (Figure 5). Total length (also called maximum body length) is defined as the length from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally) (Figure 8) (U.S. EPA, 2000 referencing Anderson and Gutreuter, 1983). Record total length in the Field Log Book (Figure 1).



Maximum body length

Figure 8. Recommended measurements of body length (total length) and size for fish. Maximum body length (total length) is defined as the length from the anterior-most part of the fish to the tip of the longest caudal fin ray (when the lobes of the caudal fin are compressed dorsoventrally) (U.S. EPA, 2000 referencing Anderson and Gutreuter, 1983).

- 6.4.3 Weigh each fish to the nearest gram using a portable, battery operated bench scale. Record weight in the Field Log Book.
- 6.4.4 Wrap individual fish in two layers of extra heavy duty aluminum foil (dull side in). Wrap completely in the first layer of foil then repeat with the second layer. Place labeled field identification tag between the two layers of foil. Secure wrapped fish with the labeled identifying tape by wrapping the tape around the middle of wrapped fish (Figure 9).



Figure 9. Fish wrapped in two layers of foil (dull side to fish), taped with label and placed with same species into labeled water-tight polyethylene bags.

- 6.4.5 Place fish of the same species into labeled water-tight polyethylene bag(s) and seal by zipping bag or by using zip ties. Place packaged fish in ice immediately.
- 6.4.6 Transport specimens to the processing lab as quickly as possible and place in a freezer at ≤ -20 °C for later processing.

7.0 Records Management

- 7.1 Field Log Book – The Field Log Book is kept with a designated project team member for safe-keeping and retrieval as needed. This log book contains fish field data and site information. These logs are mandatory for permit reporting purposes.
- 7.2 Boat Electrofishing Log – These logs are also mandatory for permit reporting purposes. A template can be found at Y:\SHARED Files\TSU Fish\Field prep\Electrofishing boat log for double rite in rain format.docx. The template is formatted to print on 8 ½” x 11” Rite in the Rain™ paper containing two 4 5/8” x 7” perforated sheets. Contact Casey Deligeannis for assistance.
- 7.3 The Lab Analysis & Tracking Plan and Processing Bench Sheet are tables, usually created in Excel®, used to document and coordinate all activities and data for single or multiple projects per collection and sampling time period and for documenting the tissue sample preparation for lab analysis. See Ecology’s SOP #007 *Resecting Finfish Whole Body, Body Parts or Tissue Samples* Section 7.0 for more information about these two forms.
- 7.4 Record management forms can be found at Y:\SHARED Files\TSU Fish\2013 fish. Note, updated forms can be found in current year’s folder (e.g. 2014 fish).

8.0 Quality Control and Quality Assurance Section

- 8.1 Assure sample integrity is preserved by preventing the loss of contaminants already present in the tissues and by preventing extraneous tissue contamination (U.S. EPA, 2000). Loss of contaminants present in fish can be prevented by ensuring that the skin on fish has not been lacerated by the sampling gear or other mechanisms. Identify possible sources of extraneous tissue contamination such as sampling gear, grease from boat winches or cables, spilled engine fuel, engine exhaust, dust, ice chests and ice and take appropriate steps to minimize or eliminate them (U.S. EPA, 2000).
- 8.2 Verify that all information is filled out on the fish field identification tag for each fish sample. Ensure identification tag coincides with the correct fish ID written in the Field Log Book.
- 8.3 Verify that the Field Log Book contains all documentation of field activities, sample data, methods and observations for each and all collection sites.

8.4 Verify the completeness and accuracy of the information in all hard copy and electronic documentation. When hard copy data is transcribed to electronic files the person responsible for entering that data should perform verification checks and write “QA”, “their initials” and “date completed” at bottom of page to indicate data has been reviewed and entered into appropriate files.

8.5 Drain ice chest often to prevent possible cross contamination from melting ice during transport.

9.0 Safety

9.1 Fish processing should be conducted only by or under the supervision of someone with experience.

9.2 Gloves are required for fish processing to avoid exposure to pathogens and chemicals, and to avoid sample contamination. Hands should be cleaned using soap and clean water after completing work or any time hands become soiled during the process. Gloves should be replaced whenever they get torn, punctured, or anytime used gloves are removed from hands.

9.3 Follow general procedures for safety found in the *Environmental Assessment Program Safety Manual* Chapter 1 (2012). Extra care should be given for night collections and field processing. Ensure adequate lighting. Use of a night head lamp is recommended. Have extra batteries and a new bulb available.

9.4 Boat operations require that staff meet specific training requirements as described in EAP’s Field Safety Manual, such as an EA Boating Course and an approved Boating Safety Course. Additional requirements are needed to operate Ecology’s 16’ Electrofishing boat. See EAP’s Safety Manual section “Operating Electrofishing Boat’s” for details. Most field operations also require training specified in EAP’s Safety Manual such as First Aid, CPR, and Defensive Driving.

10.0 References

10.1 U.S. EPA (Environmental Protection Agency). 2000. *Guidance for assessing chemical contaminant data for use in fish advisories, Volume 1 fish sampling and analysis*. 3rd ed. <http://water.epa.gov/scitech/swguidance/fishshellfish/techguidance/risk/index.cfm>. Accessed April 2014.

10.2 Ecology. 2006. *Environmental Assessment Program Safety Manual*. Environmental Assessment Program. <http://aww.ecology/programs/eap/Safety/New%20Safety%20Plan%2004-05-06.pdf>. Accessed April 2014.

10.3 Zaroban, D.N., M.P. Mulvey, T.R. Maret, R.M. Hughes and G.D. Merritt. 1999. *Classification of Species Attributes for Pacific Northwest Fishes*. Northwest Science, Vol. 73, No. 2, pp. 81-93. May 1999.

Attachment 1. Processing Bench Sheet, (example only)

Note: The Bench Sheet used during lab processing may look different due to different fields and requirements of the processes involved, but fields will be available for documentation and cross reference of each sample's information.

2009 WSTMP Fish Field and Bench Processing Data																				Processing crew:				
Sort #1: Waterbody, Species, TL descending or ascending										Sort #2: Waterbody, Species, ECY Field ID														
Waterbody	ECY Field ID	Species	WDFW Field ID	WDFW DNA ID (CD10-)	DNA Taken Y/N ¹	Total Length (mm)	Weight (gm)	FCI	Collect Date	Collect Method	Process date	Fillet weight (gm)	L, R, or B fillet	Skin status On/Off	Sex M/F	Fish age	Scale card #	Scale #	otolith tray #	otolith cell #	Opercula or Spines taken Y/N	Comment	WSTMP LAR Field ID	WSTMP MEL Lab #
Whatcom Lk	1	SMB	-	652	Y	443	1420	1.63	10/6/09	ecy-G	12/3/09	203	L	ON	F	7	9	1	3	11	N	Do as indiv for HG Trend. Also do as 5 fish comp for WSTMP. All caught in SW end of Lk. See LTS for more details.	WHATSMB	12
Whatcom Lk	2	SMB	-	646	Y	372	764	1.48	10/6/09	ecy-G	12/3/09	136	L	ON	F	5	9	2	3	12	N	Do as indiv for HG Trend. Also do as 5 fish comp for WSTMP. All caught in SW end of Lk. See LTS for more details.	WHATSMB	12
Whatcom Lk	3	SMB	-	647	Y	375	790	1.50	10/6/09	ecy-G	12/3/09	124	L	ON	F	5	9	3	3	13	N	Do as indiv for HG Trend. Also do as 5 fish comp for WSTMP. All caught in SW end of Lk. See LTS for more details.	WHATSMB	12
Whatcom Lk	4	SMB	-	-	N	340	588	1.50	10/6/09	ecy-G	12/3/09	97	L	ON	M	4	9	4	3	14	N	Do as indiv for HG Trend. Also do as 5 fish comp for WSTMP. All caught in SW end of Lk. See LTS for more details.	WHATSMB	12
Whatcom Lk	5	SMB	-	648	Y	330	573	1.59	10/6/09	ecy-G	12/3/09	105	L	ON	M	4	9	5	3	15	N	Do as indiv for HG Trend. All caught in SW end of Lk. See LTS for more details.	-	-
Whatcom Lk	6	SMB	-	649	Y	284	337	1.47	10/6/09	ecy-G	12/3/09	74	L	ON	M	3	10	6	3	16	N	Do as indiv for HG Trend. All caught in SW end of Lk. See LTS for more details.	-	-
Whatcom Lk	7	SMB	-	650	Y	400	1166	1.82	10/7/09	ecy-G	12/3/09	215	L	ON	M	5	10	7	3	17	N	Do as indiv for HG Trend. Also do as 5 fish comp for WSTMP. All caught in SW end of Lk. See LTS for more details.	WHATSMB	12
Whatcom Lk	8	SMB	-	653	Y	340	565	1.44	10/7/09	ecy-G	12/3/09	119	L	ON	F	4	10	8	3	18	N	Do as indiv for HG Trend. All caught in SW end of Lk. See LTS for more details.	-	-
Whatcom Lk	9	SMB	-	654	Y	306	411	1.43	10/7/09	ecy-G	12/3/09	85	L	ON	F	3	10	9	3	19	N	Do as indiv for HG Trend. All caught in SW end of Lk. See LTS for more details.	-	-
Whatcom Lk	10	SMB	-	655	Y	285	314	1.36	10/7/09	ecy-G	12/3/09	71	L	ON	U	3	10	10	3	20	N	Do as indiv for HG Trend. All caught in SW end of Lk. See LTS for more details.	-	-
Notes:																								
1. In an effort to streamline Ecology's fish processing, DNA samples are only collected when requested by WDFW, USFWS, or stated in permit conditions. Individual project managers typically decide if timeframes and staffing allow for this extra processing step.																								

Attachment 2. Lab Analysis and Tracking Plan, (example only)

Note: The Lab Analysis and Tracking Plan may look different, due to different fields and requirements of the project(s) involved, but fields will be available for documentation and cross reference of each sample's collection and processing information.

2009 Lab Analysis & Tracking Plan for Fish Samples																													
7 digit MEL Work Order # for WSTMP: 1001015-(xx)																													
															jar size ->		2 oz	4 oz	4 oz	4 oz	4 oz								
															min amount of tissue needed per jar ->		5 g	40 g	40 g	40 g	up to 90 g								
sort	WSTMP Exp 09 (X)	WSTMP LT 09 (L)	Hg Trends Fish 09 (M)	Lab Dup MEL	Lab Dup Contract	MS/MSD	Sites	Specie	Collect date	# fish avail	# fish in comp	Hg	3 PCB, 3 DDT, lipids	Pest, PCB, PBDE, lipids	PCDD /Fs, lipids	Field ID (for multiple composites use suffix 1,2,3 to indicate groups A,B,C, respectively)	WSTMP MEL Lab # (# assigned during fish processing)	Hg Trends Field ID	Hg Trends MEL Lab #	Process date	Process batch for MEL #	aliquot per fish (g)	skin: off or on	Hg wt (g)	3 PCB, 3 DDT, lipids (g)	Pest, PCB, PBDE, lipids (g)	PCDD/F lipids (g)	Archive wt (g)	COMMENTS (Bold = WSTMP; unbold = Hg Trends)
X							Amber L (S of Cheney)	RBT	10/15/09	10	5	1	1	1	1	AMBERRBT	28	-	-	1/12/10	a	150	ON	17	-	90	88	90	Process 3,4,6,7,10. Tossed extra fish.
X							Black L (nr Colville)	TT	9/30/09	15	5	1	1	1	1	BLACKTT	08	-	-	1/6/10	a	90	ON	12	-	90	-	89	Process 1,4,6,8,11. Tossed extra fish.
X							Duck L, Ocean Shores	LMB	9/21/09	10	5	1	1	1	1	DUCKLMB	19	-	-	1/11/10	a	90	ON	30	-	90	90	90	Process 1,2,3,9,10. Tossed extra fish.
X							Duck L, Ocean Shores	YP	9/21/09	10	5	1	1	1	1	DUCKYP	18	-	-	1/11/10	a	21	ON	10	-	46	-	46	Process 1,2,3,6,9
X							Duck L, Ocean Shores	BC	9/21/09	6	5	1	1	1	1	DUCKBC	17	-	-	1/11/10	a	37	ON	35	-	90	-	59	Process 1,2,3,4,5
X	M						Failor L	LMB	9/22/09	13	5	1	1	1	1	FAILLMB	69	FLHGLMB 1-13	11-23	11/10/09	a	75	ON	28	-	84	-	90	Hg Process Individuals 1-13. WSTMP wants 1,2,3,4,5 as 5-fish composite. CF/MF processed earlier in season. See BS for more info.
X	M						Failor L	CTT	9/22/09	17	5	1	1	1	1	FAILCTT	70	FLHGCTT1 FLHGCTT2 FLHGCTT3	24 25 26	11/12/09	a	47	ON	33	-	50	50	50	FLHGCTT1 - Process 15, 16, 17. FLHGCTT2 - Process 10,11, 9, 8. FLHGCTT3 - Process 3, 4, 7. For FLHGCTT3 - WSTMP wants 3,4,7,2,5 as 5-fish composite. Spare PCDD/F, lipids jar stored with arcs. CF/MF processed earlier in season.
X							Leo L (nr Colville)	YP	10/1/09	10	5	1	1	1	1	LEOYP	29	-	-	1/12/10	a	37	ON	11	-	72	-	42	Process 1,2,3,5,9. Tossed extra fish.
X							Leo L (nr Colville)	PMP	10/1/09	12	5	1	1	1	1	LEOPMP	30	-	-	1/12/10	a	28-33	ON	16	-	74	-	67	Process 3,5,6,7,9. Tossed extra fish.
X							Leo L (nr Colville)	BC	10/1/09	10	5	1	1	1	1	LEOBC	31	-	-	1/12/10	a	40	ON	10	-	62	-	66	Process 3,6,7,8,9. Tossed extra fish.
X	M						Pierre L	SMB	9/29/09	10	5	1	1	1	1	PIERSMB	68	PRHGSMB 1-10	1-10	11/10/09	a	107	ON	29	-	81	84	82	Hg process Individuals 1-10. WSTMP wants 1,2,3,4,5 as 5-fish composite. Spare PCDD/F, lipids jar stored with arcs. CF/MF processed earlier in season.
X	L						Snake R, Central Ferry	CC	10/28/09	13	5	1	1	1	1	SRCFCC1	09	-	-	1/8/10	a	118	off	10	-	90	91	92	A- 3,8,11,12,13
X	L						Snake R, Central Ferry	CC	10/28/09	13	4	1	1	1	1	SRCFCC2	10	-	-	1/8/10	a	106	off	40	90	-	90	90	B- 4,6,9,10
X	L						Snake R, Central Ferry	CC	10/28/09	13	4	1	1	1	1	SRCFCC3	11	-	-	1/8/10	a	137	off	40	85	-	85	85	C- 1,2,5,7
X	L						Snake R, Central Ferry	CCP	10/28/09	11	3	1	1	1	1	SRCFCCP1	63	-	-	1/21/10	a	150	ON	32	-	85	85	85	A- 3,9,10
X	L						Snake R, Central Ferry	CCP	10/28/09	11	3	1	1	1	1	SRCFCCP2	64	-	-	1/22/10	a	140	ON	40	90	-	-	90	B- 1,2,8
X	L						Snake R, Central Ferry	CCP	10/28/09	11	3	1	1	1	1	SRCFCCP3	65	-	-	1/21/10	a	150	ON	30	85	-	-	85	C- 5,6,7
Notes:																													
a = All samples were sent to MEL together (one large batch) on 1/28/10.																													

Attachment 3. Site Reconnaissance Checklist

<p>Fish Sampling Site Recon Checklist (Updated 9/17/13)</p> <p style="color: red;">This file can be found at: Y:\SHARED Files\TSU Fish\Field prep\Fish Site Recon Checklist updated 9-2013.xls Please also visit Y:\SHARED Files\TSU Fish\Field prep\Resources for TSU Fish Collections.xlsx</p>
<p>Site Physical Info</p> <p>Gazetteer Page and Coordinates.</p> <p>Obtain bathymetric and aerial maps of site (e.g. EIM/GIS, WA Lakes book, web sites, USGS quad, NOAA chart. Also see Y:\SHARED Files\Lake Bathymetric Maps).</p> <p>Info on temperature, water levels (high/low flow issues)?</p>
<p>Contacts (note names and phone/email info)</p> <p>WDFW, USFWS, USFS, NOAA and Tribal Bios. <u>Others as required by Scientific Collection Permits</u> (see Y:\SHARED Files\TSU Fish\Permits\2013 Permits... for requirements).</p> <p>Ecology regional staff (Watershed and TMDL Leads, see Y:\SHARED Files\TSU Fish\Field Prep\Resources for TSU Fish Collections.xlsx for useful info/links).</p> <p>Others (e.g. City, County, local clubs, guide services, lake associations, volunteer monitors, etc).</p> <p>Enforcement agencies (Sheriff, WSP, DFW, Tribal, others).</p> <p>Private landowners as needed (e.g. timber companies, power companies, residential).</p>
<p>Fish Info</p> <p>Visit Y:\SHARED Files\TSU Fish\Field Prep\Resources for TSU Fish Collections.xlsx</p> <p>Species present and size info (e.g. DFW bios, DFW WW Program tables, Gazetteer, web sites).</p> <p>Hatchery plant status: species, size, numbers, release dates (DFW database, DFW web site, local bios).</p> <p>Any DFW or other agency surveys being conducted or planned? How can we coordinate?</p> <p>When, where, how to fish/capture - local knowledge, websites (e.g. Bios, locals, Washingtonlakes.com).</p> <p>DFW web site for fishing reports. Check DFW regulations. Review permit guidelines.</p>
<p>ESA-Listed species</p> <p>Review NOAA and USFWS permits regarding BLT & listed species. Water temperatures?</p> <p>Species present (BLT, salmonids, other)?</p> <p>Timing of runs for each listed species (start, peak, end)?</p> <p>Spawning habitat? Specific areas to avoid?</p> <p>Strategies to avoid harassing listed species? Specific permit guidelines, gear allowances?</p>
<p>Site Environment Info</p> <p>Boat launch access - public? private? Gated access? DFW boat launch key or other needed? See http://www.rco.wa.gov/maps/index.shtml, also see WDFW access info http://wdfw.wa.gov/lands/water_access/</p> <p>Primitive or maintained boat launch? Bathroom facilities, onsite campground manager/volunteer? Cost to use..?</p> <p>Able to launch boat due to water level/flows (e.g. reservoirs/dams)?</p> <p>Conditions - weather, wind, current, hazards.</p> <p>Backpack shocking access - is terrain/stream hikeable? Steep canyon walls? High flows? Safe operations?</p> <p>Shoreside residents, night electrofishing bothersome? Any local persons to contact about our ops?</p> <p>Any concerns about fishery, land use, pollutant sources, etc?</p>
<p>Historical data (water, sed, tissue)</p> <p>Study, date, publication info. Brief summary of what's been done and findings. Any fish info.</p>
<p>Invasive or Nuisance species presence</p> <p>Check EAP's Invasive Species webpage at http://aww.ecology/programs/eap/Invasivespecies/AIS-EAPPage.html Also review "WDFW Invasive Species Management Protocols" per permit conditions Y:\SHARED Files\TSU Fish\Permits\Permits 2012\2012 WDFW\Invasive Species Management Protocols Nov 2012_v2.pdf</p> <p>Ever surveyed? When? Who?</p> <p>Toxic algae or other invasive species present?</p> <p>Animals: (e.g. NZ mudsnail in Lwr Col Riv, Long Beach peninsula; zebra and quagga mussels, others).</p> <p>Develop/Review equipment decontamination SOP for areas of "Extreme Concern".</p>

Attachment 4. Net and Accessory Gear Inventory

Net ID	GN-1			GN-2			GN-3			GN-4			GN-5			GN-6			GN-7			GN-8		
Total length (ft)	200			208			250			200			200			97.5			200			192		
Depth (ft)	8			6			6			8			8			8			6			8		
Sink or float	sinking			sinking			sinking			sinking			sinking			sinking			sinking			sinking		
# panels & length (ft)	3 x 67			5 x 50			5 x 50			3 x 67			3 x 67			1 x 30.5, 1 x 67			3 x 67			3 x 67		
Mesh material & color	White twine			Off white twine			Green twine			Monofilament			Green twine			Green twine			Monofilament			Monofilament		
Panel conditon		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf
Panel 1 mesh size (in)	2 1/2	15	3	2 3/8	16	13	2 3/8	18	12	2 1/4	3	-	2 1/2	2	1	2 1/2	1	-	2 1/4	27	8	1 3/4	6	7
Panel 2 mesh size (in)	2	7	2	2 1/8	19	6	2 1/8	22	8	1 7/8	8	-	2	7	-	2	-	-	1	30	2	1 1/2	10	5
Panel 3 mesh size (in)	1 1/2	3	-	1 7/8	25	11	1 7/8	24	2	1 1/4	-	-	1 1/2	12	1	panel missing			3/4	15	0	1	4	0
Panel 4 mesh size (in)				1 3/4	25	3	1 3/4	8	1															
Panel 5 mesh size (in)				1 1/2	40	12	1 1/2	16	5															
Bridle	Yes			Yes			Yes			Yes			Yes			Yes			No			Yes		
When purchased	August 2004			Early 90's			Early 90's			August 2004			June 2005			June 2005			1992			June 2002		
Cost	\$200			?			?			\$230			\$300			\$300			?			\$200		
Mfg.	Memphis Net & Twine			?			?			Memphis Net & Twine			Research Nets Inc.			Research Nets Inc.			?			Memphis Net & Twine		
General condition notes:	New Good Fair Poor			FAIR/POOR. has mini floatline buoys; orig 250'; cut out 10' section between panel 4 & 5 - reattached; cut out 32' section from panel 1 - reattached; repairs made 8/5/05. 3' hole in panel 3; 3' hole between panel 1 & 2; 4' hole in panel 1 near bridle.			FAIR/POOR. 5' hole repaired in panel 1; repairs made 8/5/05.			GOOD (looks new). leader lines on panel 3 - float line 3' 6", lead line 3'; leader lines on panel 1 are 4'; repaired 4' of missing float line from panel 2; 2' section of previously repaired lead line in good shape.			GOOD. Bridle length - top line 13' 6", bottom line 10' 6". Panel 1 has 3' hole nr lead line.			GOOD/Fair. Bridle length - top line 13' 6", bottom line 10' 6". Net shortened and repaired 7/10/09. Lead line was parted at beginning of panel 2. Lead line reattached. Holes mended in both panels.			FAIR/POOR. No bridges. heavy net, small mesh sizes. 4' 5' hole at seam of 1 and 3/4 panels has been repaired 8/5/05.			GOOD. Orig 200'; cut out 8' section on panel 2 - reattached; leader lines on panel 3 roughly 2' 8"; leader lines on panel 1 - float line 3', lead line 2' 3"; repaired 3' hole in panel 3 nr lead line; repaired 4' & 3' holes nr lead line & bridle in panel 1.		
Keep or dispose?	Keep			Keep as back up net - use in areas w invasive sp & excessive debris.			Keep as back up net - use in areas w invasive sp & excessive debris.			Keep			Keep			Keep - Excellent net for fishing where longer net is not necessary.			Keep			Keep		

Attachment 4 (continued). Net and Accessory Gear Inventory

Net ID	GN-9			GN-10			GN-11			GN-12									
Total length (ft)	200			200			200			200									
Depth (ft)	8			8			8			8									
Sink or float	sinking			sinking			sinking			sinking									
# panels & length (ft)	3 x 67			3 x 67			3 x 67			3 x 67									
Mesh material & color	Green twine			Green twine			Green twine			Green twine									
Panel conditon		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf		# holes < 1sf	# holes > 1sf							
Panel 1 mesh size (in)	2 1/2	-	-	2 1/2	-	-	2 1/2	-	-	3	-	-							
Panel 2 mesh size (in)	2	-	-	2	-	-	2	-	-	2 1/2	-	-							
Panel 3 mesh size (in)	1 1/2	-	-	1 1/2	-	-	1 1/2	-	-	2	-	-							
Panel 4 mesh size (in)																			
Panel 5 mesh size (in)																			
Bridle	Yes			Yes			Yes			Yes									
When purchased	May 2010			May 2010			May 2010			May 2010									
Cost	\$306			\$306			\$306			\$300									
Mfg.	Research Nets Inc.			Research Nets Inc.			Research Nets Inc.			Research Nets Inc.									
General condition notes: New Good Fair Poor	NEW. No leader lines. Bridles attached.			NEW. No leader lines. Bridles attached.			NEW. No leader lines. Bridles attached.			NEW. No leader lines. Bridles attached. 5/18/2011 Large hole by footrope in panel 3 repaired. MF									
Keep or dispose?	Keep			Keep			Keep			Keep									

Attachment 5. Summary of Fish Field Processing for Ecology's Toxics Studies in Fish

	This sheet provides a step by step guide for "non Ecology" groups when collecting fish for Ecology's Toxics Studies. Ecology project managers, or field leads should provide this one page document to outside groups when coordinating cooperative fish collection efforts. This document can be found at: Y:\SHARED Files\TSU Fish\Fish processing\SOP fish field processing summary.xlsx
1	Number of fish to collect: 5 minimum; 6-10 OK if unsure about size distribution. Ecology uses 5-fish composites for most samples. If fish are <6", we may need up to 10 fish in order to give us enough fillet tissue for analyses.
2	Fish size: All fish should be similar size. Guideline is the total length of smallest fish should be no less than 75% of the total length of the largest fish. Larger fish are preferred over smaller fish. Generally want fish that may be sought by anglers (>8").
3	Inspect fish to ensure good specimen - no broken skin or injuries that may compromise quality of sample. For trouts, check and note absence or erosion of any fins (e.g. adipose fin clipped off, pectoral and/or anal fin leading edges eroded) which may indicate hatchery-origin. Once selected, rinse fish in ambient water.
4	Assign ID number for each fish and record total length (mm), weight (g), collect date, and any other useful info regarding collection location and collection method for each fish in field notebook. This information should be sent via email to Ecology contact, or hard copy field notes included when fish are transferred to Ecology.
5	Wrap each fish individually using new aluminum foil (dull side of foil to fish). Double-wrap fish: wrap once in foil, place sample ID tag, then wrap again in foil. Ensure a sample ID tag is placed between foil layers for each fish containing the following information: date, site, species code, and fish ID number. (e.g. 9/21/04, Clean Lk, LMB-1).
6	Put wrapped fish of the same species in large zip-lock or poly trash bags. Different species, different bag.
7	ID bag contents: write following info on bag exterior: FFCMP (or other proj), site, collect date, species and fish IDs in bag (e.g. FFCMP, Clean Lk, 9-16-12, LMB 1-3). Use a Sharpie or other waterproof marker.
8	Place bagged samples on ice as soon as possible. Drain water from cooler occasionally so bagged fish don't get wet or compromised from meltwater. Transfer bagged fish to Ecology HQ freezer upon return.
9	Return field notes and other info to Casey or Keith (or other proj lead as needed). Note date of collection, how collected (electrofished, gillnetted, angled, etc), and general location/land marks if possible.
	Contacts:
	Keith Seiders: 360-407-6689 (keith.seiders@ecy.wa.gov).
	Casey Deligeannis: 360-407-7395 (casey.deligeannis@ecy.wa.gov).
	Patti Sandvik: 360-407-7198 (patti.sandvik@ecy.wa.gov).
	Michael Friese: 360-407-6737 (michael.friese@ecy.wa.gov).

Attachment 6. Target Fish Species

Target fish species for Freshwater Fish Contaminant Monitoring Program: sorted by order of preference using feeding behavior, comparative value to historical data, likelihood of encounter, angler use (2005). Adapted from Northwest Science (1999).

blank	Common name	Scientific name	Habitat	Feeding	Water temp	Tolerance*	order of preference	Family name
	Largemouth bass	<i>Micropterus salmoides</i>	water col.	piscivore	warm	T	1	Centrarchidae
	Smallmouth bass	<i>Micropterus dolomieu</i>	water col.	piscivore	cool	I	2	Centrarchidae
	Walleye	<i>Stizostedion vitreum</i>	water col.	piscivore	cool	I	3	Percidae
	Rainbow trout	<i>Oncorhynchus mykiss</i>	hider	invert/piscivore	cold	S	4	Salmonidae
	Brown trout	<i>Salmo trutta</i>	hider	invert/piscivore	cold	I	5	Salmonidae
	Cutthroat trout	<i>Oncorhynchus clarki</i>	water col.	invert/piscivore	cold	S	6	Salmonidae
	Kokanee salmon	<i>Oncorhynchus nerka</i>	water col.	invertivore	cold	S	7	Salmonidae
	Yellow perch	<i>Perca flavescens</i>	water col.	invert/piscivore	cool	I	8	Percidae
	Channel catfish	<i>Ictalurus punctatus</i>	benthic	invert/piscivore	warm	T	9	Ictaluridae
	Brook trout	<i>Salvelinus fontinalis</i>	hider	invert/piscivore	cold	I	10	Salmonidae
	Lake trout	<i>Salvelinus namaycush</i>	benthic	piscivore	cold	S	11	Salmonidae
	White sturgeon	<i>Acipenser transmontanus</i>	benthic	invert/piscivore	cold	I	12	Acipenseridae
	Green sturgeon	<i>Acipenser medirostrus</i>	benthic	piscivore	cold	S	13	Acipenseridae
	Burbot	<i>Lota lota</i>	benthic	piscivore	cold	I	14	Gadidae
	Mountain whitefish	<i>Prosopium williamsoni</i>	benthic	invertivore	cold	I	15	Salmonidae
	Lake whitefish	<i>Coregonus clupeaformis</i>	water col.	invertivore	cold	I	16	Salmonidae
	Black crappie	<i>Pomoxis nigromaculatus</i>	water col.	invert/piscivore	warm	T	17	Centrarchidae
	Pumpkinseed	<i>Lepomis gibbosus</i>	water col.	invert/piscivore	cool	T	18	Centrarchidae
	White crappie	<i>Pomoxis annularis</i>	water col.	invert/piscivore	warm	T	19	Centrarchidae
	Rock bass	<i>Ambloplites rupestris</i>	water col.	invert/piscivore	warm	I	21	Centrarchidae
	Warmouth	<i>Lepomis gulosus</i>	water col.	invert/piscivore	warm	T	22	Centrarchidae
	Green sunfish	<i>Lepomis cyanellus</i>	water col.	invert/piscivore	warm	T	23	Centrarchidae
	Bluegill	<i>Lepomis macrochirus</i>	water col.	invert/piscivore	warm	T	23.5	Centrarchidae
	Common carp	<i>Cyprinus carpio</i>	benthic	omnivore	warm	T	24	Cyprinidae
	Northern pikeminnow	<i>Ptychocheilus oregonensis</i>	water col.	invert/piscivore	cool	T	25	Cyprinidae
	Peamouth	<i>Mylocheilus caurinus</i>	water col.	invertivore	cool	I	26	Cyprinidae
	Brown bullhead	<i>Ameiurus nebulosus</i>	hider	invert/piscivore	warm	T	27	Ictaluridae
	Yellow bullhead	<i>Ameiurus natalis</i>	hider	invert/piscivore	warm	T	28	Ictaluridae
	Longnose sucker	<i>Catostomus catostomus</i>	benthic	invertivore	cold	I	29	Catostomidae
	Largescale sucker	<i>Catostomus macrochelius</i>	benthic	omnivore	cool	T	30	Catostomidae
	Chiselmouth	<i>Arocheilus alutaceus</i>	benthic	herbivore	cool	I	31	Cyprinidae
	Bridgelip sucker	<i>Catostomus columbianus</i>	benthic	herbivore	cool	T	32	Catostomidae
	Mountain sucker	<i>Catostomus platyrhynchus</i>	benthic	herbivore	cool	I	33	Catostomidae
	Sculpins	<i>Cottus sp.</i>	benthic	invertivore	cool	T	34	Cottidae
	Starry flounder	<i>Platichthys stellatus</i>	benthic	invertivore	cold	S	35	Pleuronectidae

Use order of preference as a guide. Higher trophic level species preferred over lower level. Consider availability of fish, size, historical data available, mix of families/trophic levels per site, angler use.

*Overall pollution tolerance as sensitive (S), tolerant (T), or intermediate (I) - for fish species. Northwest Science 73(2):81-93.