Fish Sampling Toolkit

Prepared by
Ministry of Sustainable Resource Management
Aquatic Branch
for the
Resources Information Standards Committee

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Version 1.0

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Introduction

Perspective

Good survey information becomes increasingly valuable as time passes and conditions change.

Standards have been developed to document the characteristics of BC's fish and fish habitat resources to provide a factual basis for fish and fish habitat assessment, planning, and management.

Using the Fish Sampling Survey Toolkit

This is one of six toolkits that provide the suite of information capture tools that are required for completing specific surveys.

It elaborates on information located in the Fish Collection Form Field Guide.

Bookmarks and the **Table of Contents** in this Fish Sampling Survey Toolkit provide quick access to three levels of description:

Level 1: The survey phase: data collection and recording, data entry, data reporting, and quality assurance.

Level 2: The category to be described for the survey. For example: **Waterbody**.

Level 3: The metric or supporting information. For example: **Waterbody Type**

There are **three types of tools** that practitioners can access directly from this toolkit: Forms, Databases and Manuals and Resources. Practitioners can also access these tools from the Quick Links located on the web page or from the **Appendix** in this toolkit.

Data Collection and Recording

Forms and Field Guides

Fish Collection Form front (pdf) **Fish Collection Form back** (pdf)

Fish Collection Form Field Guide, Fish Collection Form Field Guide Errata, Fish Collection Form Field guide Errata #2

Streams, Lakes, Wetlands

Use air photo interpretation to determine initially whether an aquatic feature is a wetland, stream or lake, and to give a preliminary class for wetlands. Then verify the waterbody type and wetland class in the field. For a Reconnaissance Inventory, include all shallow open water wetlands as part of the lake inventory. If the wetlands have a distinct channel flowing through them include them in the stream inventory, rather than in the lake inventory.

Stream

In BC, a stream is defined as a reach, flowing on a perennial or seasonal basis having a continuous channel bed, whether or not the bed and banks of the reach are locally obscured by overhanging or bridging vegetation or soil mats, if the channel bed is scoured by water, or contains observable deposits of mineral alluvium.

The primary feature for determining whether a watercourse is a stream is the presence of a continuous channel bed. If a continuous channel bed exists, then either one of two other key features must be present demonstrating fluvial processes; that is, where flowing water has a scoured the channel bed, or deposited any amount of mineral alluvium within the channel. Water flow in the channel may be perennial, ephemeral (seasonal), or intermittent (spatially discontinuous).

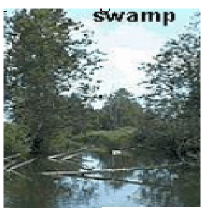
Lake

A lake is an open waterbody with a depth greater than 2 m and with less than 25% of its surface area covered with wetland vegetation. By default, any open waterbody less than 2 m deep is a wetland. In many cases it may not be possible to distinguish shallow, open wetlands from lakes using airphotos; therefore, review and complete your determination of lake/wetland status in the field.

Wetland

A wetland is an area where the water table is at, near, or above the surface, or where soils are water saturated for a sufficient time so that the principle determinants of vegetation and soil development are excess water and low oxygen. Five major types or classes of wetlands have been described in Canada based on vegetation physiognomy, environmental gradients of waterflow, hydrochemistry, and degree of water-level fluctuation.

Table 1 - Wetland Classes

Wetland Class	Description
 **Figure 1 - Shallow water**	Shallow open water wetlands are intermittently or permanently flooded areas with open expanses of standing or moving water up to 2 m deep. Open water, with no emergent vegetation, covers 75% or more of the wetland surface.
 **Figure 2 - Marsh**	Marsh wetlands have mineral and sometimes well-decomposed peat soils. When peat soils are present, they are often enriched with mineral materials. Waters are nutrient rich with near neutral to basic pH. Surface water levels typically fluctuate seasonally with declining levels exposing matted vegetation or mudflats. Emergent vegetation includes grasses, cattails, sedges, rushes, and reeds that cover more than 25% of the wetland surface.
 **Figure 3 - Swamp**	Swamp wetlands have mineral or occasionally peat soils with a water table at, or near the surface. There is a pronounced internal water movement from adjacent mineral areas, making the water nutrient-rich. If peat is present, it is mainly well-decomposed wood and occasional sedges. Coniferous or deciduous trees or dense shrubs and herbaceous species typically dominate the vegetation.
 **Figure 4 - Fen**	Fen wetlands have organic soils and a water table at or above the surface. Soils are primarily moderate to well-decomposed sedge and non-sphagnum moss peats. Waters are mainly nutrient rich with a near neutral to slightly acidic pH. The vegetation consists primarily of sedges, grasses, reeds, mosses, and some shrubs. Scattered trees may be present.
 **Figure 5 - Bog**	Bog wetlands have organic soils with a water table at or near the surface. Soils are predominantly composed of poorly to moderately decomposed sphagnum moss peats. The bog surface is usually unaffected by groundwaters and thus waters are generally acidic and low in nutrients. Bogs are usually covered with sphagnum mosses and ericaceous (belonging to or similar to heath family, genus *Erica*) shrubs, and may be treed or treeless.

Name – Gazetted

The Minister of Sustainable Resource Management is responsible for naming geographical features in British Columbia. The Minister delegates this responsibility through the Director of Base Mapping and Geomatic Services Branch to the Geographical Names Unit. The official or gazetted name of a geographical feature in BC is the name that the Government has approved for use on current provincial and federal maps, and has listed as an official place name in Gazetteers of British Columbia and Canada. Coordination of geographical naming by one authority is an essential element in maintaining an effective system for identifying physical features.

The **Gazetteer of Canada** is an alphabetical listing of the official names of places in Canada (e.g. communities, parks, mountains, rivers, lakes and native reserves). Each line item provides the gazetted name, the NTS map number and the exact latitude and longitude of the place.

The **Canadian National Topographic System (NTS)** provides general-purpose topographic map coverage of Canada. These maps are produced by the Government of Canada and depict in detail ground relief (landforms and terrain), drainage (lakes and rivers), forest cover, administrative areas, populated areas, transportation routes and facilities (including roads and railways), and other man-made features. NTS maps are available at a scale of 1:50,000 and 1:250,000.

Terrain Resource Information Management (TRIM) mapping consists of 7027 mapsheets covering the province of British Columbia at a scale of 1:20,000. The Government of British Columbia produces TRIM maps. The cartographic framework for this mapping is the Universal Transverse Mercator coordinate system, based on NAD83 (1983 North American Datum). Each map sheet is precisely 12 minutes of longitude wide by 6 minutes of latitude high. These maps depict man-made features (such as roads, buildings and power lines), natural features (such as streams, lakes and wetlands), and elevations (20 m contours and point elevations).

If an official name exists for an aquatic feature, the name is printed on the **National Topographic Series (NTS)** 1:50,000 maps produced by the federal government. Official names are also printed on the Terrain Resource Information Management (TRIM) 1:20,000 maps produced by the British Columbia Ministry of Sustainable Resource Management, Base Mapping Services Branch. Hardcopy NTS and TRIM maps are available for purchase from private map dealers. To find map dealers in your area, consult the Yellow Pages under the heading of *Maps*. NTS maps can also be ordered on the Internet from *International Travel Maps and Books*. TRIM maps can be ordered in person from a Provincial Government Agent, or online from the LandData BC system.

To find official names for aquatic features from the BC Geographical Names Information System (BCGNIS), either search by name to confirm that the name you have is the official name, or search by location if you have the approximate latitude and longitude of the aquatic feature.

To obtain the gazetted name of an aquatic feature by using the Fish Wizard, you need to know the watershed code of the aquatic feature, or the location of the feature within the province of BC.

Name - Local

Local names are given to many small lakes and streams in British Columbia. Many of these lakes and streams have only a local name and do not have an official government gazetted name or they have local or historic names that differ from the approved gazetted name.

Consult the Geographical Names Branch of the BC Ministry of Sustainable Resource Management, Base Mapping and Geomatic Services Branch to determine if a local or historic name exists for the aquatic feature in question.

Consult the regional or district offices of the BC Ministry of Sustainable Resource Management, the BC Ministry of Forests, and/or the BC Ministry of Water, Land and Air Protection to find local names. Ministry archives containing old lake summary reports could provide local names.

BC Forest Service, Forest Recreation maps often indicate local names for streams and lakes. Other recreation or community maps such as search and rescue maps may give local names.

The BC Ministry of Sustainable Resource Management, Fisheries Data Warehouse, manages the *BC Watershed Dictionary* as part of the *BC Watershed Atlas*. This dictionary lists aliases (local names) for aquatic features that are recognized by the Government. To find if an alias exists for an aquatic feature in the BC Watershed Dictionary, you need to know the official (gazetted) name, the Watershed code or the Waterbody ID of the aquatic feature.

Fish Wizard is a map display tool that allows you to locate an aquatic feature and obtain its official name and alias or local name, without GIS capability. This site can be used if you know the watershed code of the aquatic feature, or if you know where the feature is in the province. If the aquatic feature has a well known local name, it will be displayed as an “alias” on the next line below the official name.

Watershed Code/Waterbody Identifier

BC Watershed/Waterbody Identifier System

The BC Watershed/Waterbody Identifier System assigns every aquatic feature in BC a unique code for identification. This is necessary because many aquatic features are either unnamed, or have the same name as other aquatic features. Many private and public sector organizations gather qualitative and quantitative data that describes waterbodies and watersheds in BC. To ensure that organizations can combine and analyze these data, all data gathering methodologies should use the BC Watershed/Waterbody Identifier System. For additional information refer to the *User’s Guide to the British Columbia Watershed/Waterbody Identifier System, Version 2.2*.

The Watershed/Waterbody Identifier System is a computer-generated coding system developed by the BC Government that uniquely identifies watersheds and waterbodies in BC. It is a component of the 1:50,000 *British Columbia Watershed Atlas*, a computerized base map of aquatic features in the province. Although it was originally designed for use at a scale of 1:50,000 as a component of the BC Watershed Atlas, it has been re-designed to allow for the identification of watersheds and waterbodies represented on 1:20,000 mapping, the TRIM Watershed Atlas.

The Watershed Atlas (WSA) is a digital representation of the stream network of British Columbia as depicted on 1:50,000 National Topographic Series maps along with watershed boundaries or 3rd order and larger watersheds. This atlas also contains the Watershed Dictionary.

The Trim Watershed Atlas is a digital representation of the stream network of BC as depicted on 1:20,000 TRIM maps. It is currently under development, with representations for the southern part of the province included.

Watershed Code and Waterbody Identifier

The Watershed/Waterbody Identifier System has two parts: a Watershed Code, and a Waterbody Identifier. The BC Government generates watershed codes and waterbody identifiers according to a system and does not randomly assign them. It is mandatory to follow proper procedures to obtain a watershed code from the Government.

Watershed Code

A Watershed Code is a computer generated 45-digit numeric label that uniquely identifies each stream in BC. The numbering system provides information about the location of a stream.

There are nine major watersheds in BC as shown on the map below. The first number in the watershed code indicates the major watershed that the stream is in. Each of the 9 major watersheds is divided into smaller watersheds, which are indicated by the second number in the watershed code. These watersheds can be subdivided further into smaller watersheds which are indicated by the third number in the code.

For example, the Mackenzie watershed identified by the integer 2 has three subsets, the Liard (210), the Hay (220) and the Peace (230). The Peace River watershed (230) has nine sub-divisions coded 231, 232, 233, 234, 235, 236, 237, 238, and 239.

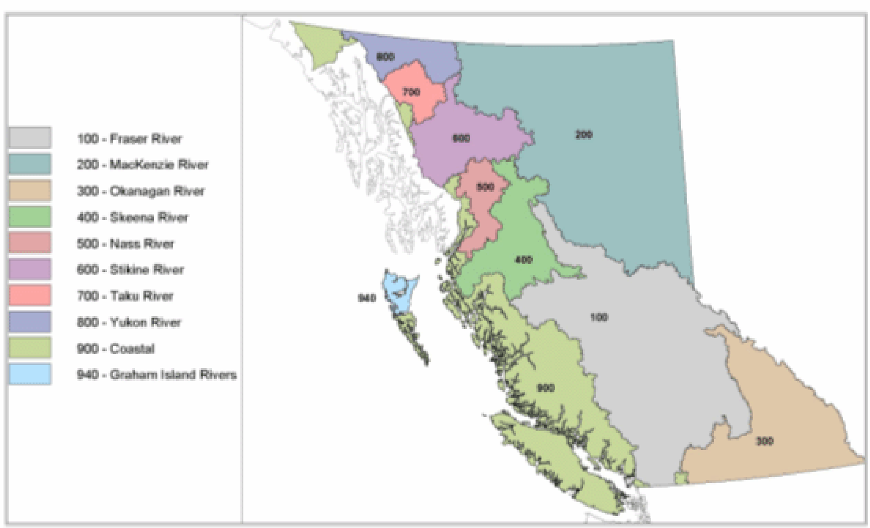


Figure 6- Watersheds in BC

The watershed code for the mainstem Peace River is 230-000000-00000-00000-0000-0000-000-000-000-000-000-000. Each subsequent group of numbers after the first group of three (which indicate the major watershed) represents a tributary to the previous group of numbers.

The remaining numbers in the code, after the first three, reflect the location of the mouth of a tributary along the length of the stream into which it flows. The location of the confluence of a tributary with its parent stream, measured as the proportional distance between the mouth and headwaters of the parent stream, determines the watershed code.

The example below describes the proportional length derivation of watershed codes for Gething Creek. A demonstration follows showing the use of proportional distances in generating the watershed code for Gething Creek.

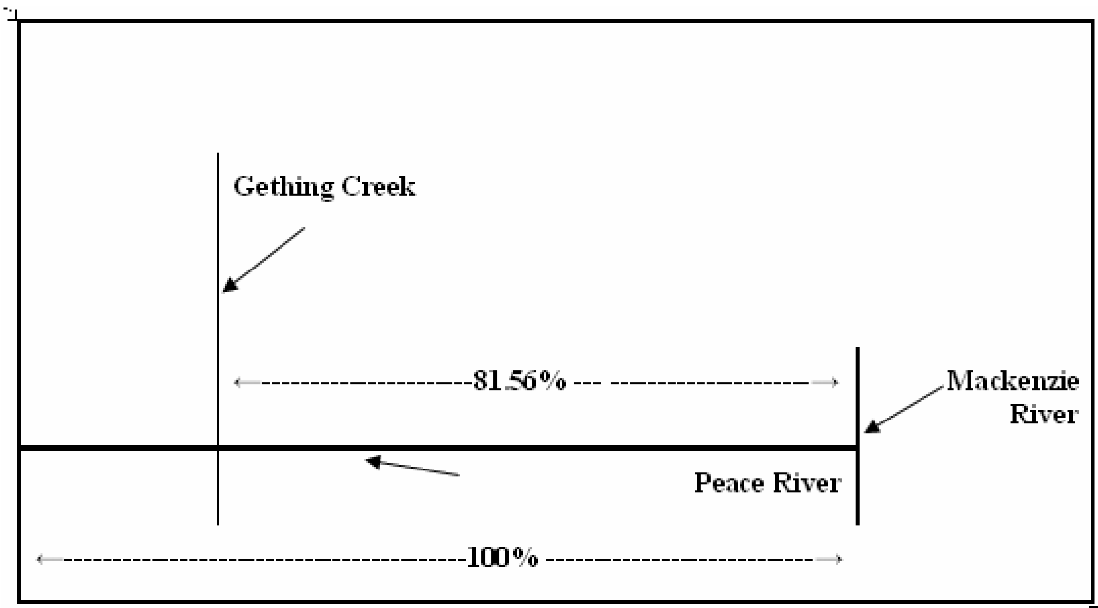


Figure 7 - Diagram of Proportional Length Derivation of Watershed Codes for Gething Creek

Peace River ↓								
230	-	000000	-	00000	-	00000	-	0000
		Gething Creek: a tributary joining the Peace River 81.56% (of the total Peace River mainstream length) upstream from Peace River/Mackenzie River Confluence ↓						
230	-	815600	-	00000	-	00000	-	0000

Figure 8 - Explanation of Gething Creek Watershed Code

The diagram below describes the proportional length derivation of watershed codes for Carbon Creek and Eleven Mile Creek. A demonstration of how the proportional distances are included in the watershed code for Eleven Mile Creek follows.

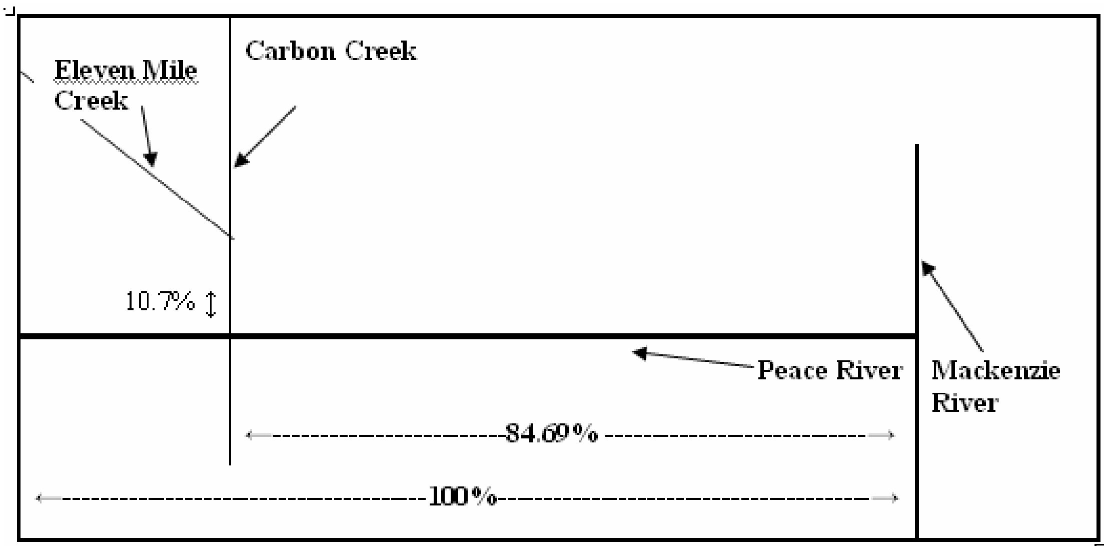


Figure 9 - Diagram of Proportional Length Derivation of Watershed Codes for Carbon Creek

Peace River: ↓								
230		000000		00000		00000		0000
		Carbon Creek: another tributary to Peace River located upstream of Gething Creek. It joins the Peace River 84.69% (of the total Peace River mainstem length) upstream for Peace River confluence with Mackenzie River ↓ ↓ ↓ ↓		**Eleven Mile Creek:** a tributary to Carbon Creek joining it 10.7% (of the total Carbon Creek mainstem length) upstream from Carbon Creek/Peace River confluence ↓				
230		846900		10700		00000		0000

Figure 10 - Explanation of the Eleven Mile Creek Watershed Code, a Tributary to Carbon Creek in the Peace River Watershed

Waterbody Identifier

A Waterbody Identifier is a computer generated alphanumeric label that uniquely identifies a waterbody within a watershed and within the Province of BC. A waterbody is a lake, pond, swamp, marsh, bog, reservoir, or canal or stream segment shown as double lines on 1:50,000 maps. The letters in the waterbody identifier indicate which of the 246 watersheds in BC that which the waterbody is located.

Figure 11 - The 246 Watersheds in BC

Reach Number (#)

Reach Delineation

A stream reach is a relatively homogeneous length of stream having a sequence of repeating structural characteristics (or processes) and fish habitat types. In a stream reach the channel morphology, channel dimension (and thus width and discharge), and gradient are uniform. Reaches are part of a hierarchical classification structure used for many purposes, such as identifying fish habitat.

Reach delineation is performed at the start of a fish and fish habitat inventory process to allow for selection of survey site locations. Dividing streams into homogeneous sections allows for sampling in a portion of a reach to collect information that is representative of the entire reach. For example, if a portion of each reach were surveyed, the fish habitat in the entire stream length could be described, providing an understanding of fish distribution and habitat capability for the whole stream.

A reach break marks the boundary between adjoining reaches. Each reach on a stream is assigned a unique number in an upstream-ascending order, the first being the reach closest to the mouth of the stream.

Reach delineation is initially performed in the office using maps and air photos, and then confirmed in the field. Identify reaches and reach breaks in the project area using all available data sources, including at a minimum, the most recent air photos and maps. Use the scale of maps and air photos that the inventory is based on. Use the following key physical factors to determine reaches:

- Channel pattern
- Channel confinement
- Gradient, and
- Streambed and bank materials.

A stream reach generally shows uniformity in these characteristics and in discharge.

Reach boundaries, called reach breaks, usually occur at:

- Significant changes in stream channel form or confinement (and/or coupling), such as the change from a single channel to braided, multiple channels, or at the change from a wide floodplain to a confined canyon
- Significant changes in gradient
- Significant changes in streambed and bank materials, such as a change from erodible to non-erodible materials and
- Significant tributary confluences

For a Reconnaissance inventory, obstructions or potential barriers to fish distribution are reach boundaries only if they meet both the following characteristics:

- Are less than 100 m or 10 bankfull widths (W_b) in length (if they are longer than these lengths, they are defined as a reach); and
- Are consistent with the changes in physical criteria listed above. For example, a steep bedrock falls, approximately 50 m long, with a cascade step pool reach upstream, and an entrenched gorge with an 8% gradient downstream (the falls characteristics are different from both the upstream and downstream reaches).

Stream Reach Numbering

Reach numbers start at 1 at the mouth and increase sequentially upstream (e.g. 1, 2, 3, etc.). If an additional reach is identified after reach delineation and numbering has been done (for instance during field sampling), and needs to be broken out within the existing reaches, the new reach can be numbered using decimals (e.g. 1, 2.1, 2.2, 2.3, 3, etc.). This will require changing only the numbers of the reaches directly adjacent to the new reach.

Like stream reaches, lakes and wetlands in the stream network are numbered. Assume that each lake or wetland is a single reach and assign each one a unique number in a sequential, upstream-ascending order, consistent with the stream reach numbering system.

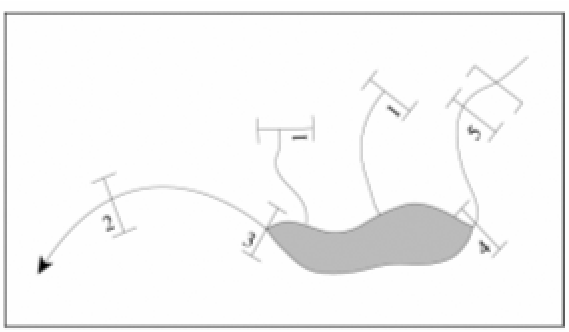


Figure 12 - Excerpt of map showing reach breaks and reach numbering for lakes and streams

Once all of the reaches in the project area have been delineated, collect general physical data for all reaches in the project area including watershed code, mapsheet number, UTM coordinates, and reach number..

Once reaches for field sampling have been chosen, determine the following characteristics for each reach to be surveyed, from maps and air photos: reach order, upstream elevation, downstream elevation, length, gradient, pattern, confinement, anastomosed/braided, basin type, and whether or not it is a wetland.

Reach Order

Reach order, magnitude and gradient are map-derived data. The reach order describes the relative size and topology of a stream in a drainage network. A first order stream has no tributaries. A second order stream results from the joining of two first order streams. A third order stream results from the joining of two second order streams.

Fish Photos and Voucher Specimens

Individual fish information is recorded for a sample of all species captured in the site where large numbers are captured. The sample for each species captured must cover the range of individual fish captured, and must be sufficient to provide results appropriate to the survey objectives.

Fish Photographs

Take colour photographs including an object of scale, such as a ruler, to indicate the relative size of the fish.

Photograph representatives of any fish that the crew is unable to identify, or of any diseased or parasitized fish. The quality of these photographs should enable verification of fish species identifications.

Voucher Specimens

Voucher specimens are representative samples of species identified in the field, collected and preserved to verify the field identification. Only one representative sample of each red/blue listed species should be collected. Refer to the BC Conservation Data Centre website for lists.) For species that are neither rare nor endangered, two to three specimen can be collected. These specimen should represent the size variability encountered at the sampling site. Any mortalities that occur during fish capture for sampling can be submitted as voucher specimens. Samples should be sent to the following by prior arrangement:

Fish Museum, Department of Natural History Section, Vertebrate
Zoology
University of British Columbia, Royal British Columbia Museum,
6270 University Blvd.,675 Belleville St.,
Vancouver, BC V6T 1Z4Victoria, BC V8V 1X4

Fish Preservation Techniques

Careful and correct preservation procedures in both the field and laboratory are important for ensuring the quality of the collected specimens or tissues. Fixatives of the correct concentration, appropriate containers, clean and sharp dissecting tools, waterproof data form/labels, and complete observations will all affect the quality and value of the sampling. Preservation techniques vary depending on how the samples will be used. All voucher specimens must be submitted in 50% isopropyl alcohol in the prescribed jars. The following sections outline some of the most common techniques, and describe the Ministry's requirement regarding the submission of samples.

Field Preservation

Anaesthetizing to kill

All fish must be killed prior to fixation. This is can be achieved by leaving the fish in high doses of the anaesthetizing solution. This is an ethical treatment of a live animal and also serves a scientific purpose: anaesthetized fish relax and can be preserved in a more natural state.

Formalin is commonly used to preserve collected specimens and it is available in liquid or powder forms (Full strength liquid formalin is actually 37% formaldehyde dissolved in water). It is recommended that a solution of 10% formalin be used for the preservation of fish specimens. To make a 10% solution of buffered formalin, combine 1 part full strength formalin with 9 parts distilled water and add approximately 3 ml of borax (buffering agent) per litre of solution (McAllister, 1965).

Note: Formalin preservation destroys the sample if any DNA analysis is anticipated. If DNA analysis is intended, a small tissue sample (fin clip) should be taken from the specimen and stored in an excess (2-3 volumes) of 95% ethanol (see below).

Paraformaldehyde powder can also be used to make a formalin solution. The powder has the advantage of being relatively light-weight and easily transportable. A mixture of 1 part paraformaldehyde, 4 parts anhydrous sodium carbonate, and a small amount of Alconox (wetting agent) can be added in proportions of 20 g powder mixture to 400 ml of distilled water to produce a 10% buffered formalin solution (McAllister, 1965).

Formalin is slightly acidic and will de-calcify and soften bony structures. The addition of a buffering agent helps to slow down this process. Fish preserved in formalin will change in weight and length over time.

Alcohols, such as ethanol and iso-propanol, are also commonly used to fix and preserve fish specimens, especially if skeletal structures such as otoliths are to be examined or the specimen is intended for DNA analysis. Alcohol is a poor fixative and is not recommended for fixation.

Another alternative for preserving specimens is to quickly freeze them in dry ice or liquid nitrogen. This is one of the best methods to preserve the colours and tissues of the specimen. Samples must remain frozen until they arrive at the laboratory and can be permanently preserved. Fish which have been frozen without initial preservation tend to fall apart when thawed. Partly thawing the specimen in 10% formalin solution is an option though freezing is not recommended as a technique of choice for specimen preservation. However, frozen tissue can be used for genetic sampling. If used for genetic analysis, the sample must remain frozen until DNA analysis. Samples should not be thawed and then placed in ethanol as this results in high levels of DNA degradation. Logistically, freezing specimens may be hard to accomplish and maintain, especially on long field surveys.

Disposal of Formalin - Formalin must be oxidized to formic acid prior to disposal in the sanitary sewer as an aqueous waste. Protective gloves, clothes and eye protection is mandatory when working with formalin. Slowly add while stirring, diluted formalin (1 ml of formalin to 10 mls of water) to an excess of household bleach (25 mls of household bleach for each ml of formalin). Stir for 20 minutes and then wash the solution into the drain with at least 50 times its volume of water. (This procedure is from Armour, Browne and Weir in “Hazardous Chemical Information and Disposal Guide”, Dept. of Chemistry, University of Alberta.)

Fixation Procedures

Specimens should be fixed soon after collection to limit deterioration of the tissues. All specimen must be killed **(**see **7.1.1)** prior to fixation. To fix the specimen, place it in a wide-mouthed glass, and fill the jar with the fixative solution. Polypropylene lids with polyfoam liners must be used. (One suggested distributor is Ryco Packing (206) 872-0858 in Kent, Washington). Specimens should be inserted into jars head first to make them easier to remove from the jars in the laboratory. [This often results, however, is frayed or poorly preserved caudal fins. From this standpoint, inserting tail-first is better]. Different species captured in the same set can be fixed and stored together. Though more than one animal can be fixed in the same jar, care must be taken not to pack too many fish in one jar. The fish must be preserved in as natural a state as possible. Where possible, the specimen should float freely in the jar to avoid curling or bending. Before immersing large specimens, fixative should be injected directly into the body cavity to facilitate penetration and preservation of the internal organs. If syringes are not available an incision can be made to the right of the ventral line to allow penetration of the fixative into the body cavity. The stomach should also be incised for internal fixation in order to prevent rotting due to digestive juices. Care should be taken when making the incision to avoid damaging the internal organs.

Once the fixative has been added, the jar is sealed with Parafilm Ò (American National Can Ô), secured with plastic screw-type lids and placed on its side. This prevents curling of the specimen's body and abduction of the fins. For proper fixation, the animal should be immersed in the fixative for several days. Optimum fixation times for fish under six inches in length is one to two weeks. For fish over six inches in length preservation time ranges from two to four weeks. The longest possible fixation time should be allowed as inadequately preserved specimens deteriorate rapidly.

Following fixation, the specimens are thoroughly rinsed and put into 50 % isopropyl alcohol [we use 37.5% in the museum]. The decanted formalin can be reused. Formalin must be denatured before it is disposed, as described in section **7.1.1**. The specimen can be rinsed by putting the jar under running water. Alternately, the jar is filled with water. After several hours, the water is decanted and fresh water is added. This is repeated for several days until no formalin odour can be detected. If during rinsing, the specimen shows signs of deterioration, it is transferred directly to 50% isopropyl alcohol.

Precaution

Formalin has a powerful and irritating smell, is carcinogenic, promotes allergic reaction after prolonged and repeated exposure, and is extremely painful on cuts and open wounds. Alcohols used for preservation are poisonous and highly flammable. Field crews should be informed of the dangers of working with these substances and receive instructions for safe handling (gloves, safety glasses, good ventilation). As well, effort should be made to keep preservation grade alcohols from being stolen and ingested as they can pose a serious health risk.

Specimens stored in formalin and alcohol, which are classified as toxic and dangerous substances, must be identified and labeled with Workplace Hazardous Materials Information System (WHMIS) labels. An up-to-date Material Safety Data Sheet (MSDS) for each substance used should accompany field crews. The MSDS sheet contains important information regarding emergency medical treatment, environmental spill treatment, and transportation restrictions. Federal and provincial transportation guidelines governing the movement of dangerous substances must also be observed. Failure to comply with guidelines may result in costly fines or penalties.

Labels

Two labels are needed for the specimen: a waterproof specimen attached to the jaw or inserted into the mouth or opercular area of each specimen and a waterproof data label on the outside of each jar. All labels must be written in pencil (Figure 11).

The specimen label contains the fish identification number and the species name of the fish.

Specimen Label Fish ID No.:

Species Name

Figure 13 - Fish Collection Specimen Label

Data labels describe: Site number, Gear/number, No. (number of specimen submitted), watershed code and the watershed/waterbody identifier (if applicable), collection date, and the collector’s name(s) (For details on data label fields, see Section 2, Fish Collection Forms). A brief description of the habitat and catch may also be included. The data label for a sample should be referenced to the field notes or data forms. The notes or forms will include the information recorded on the label but will also contain detailed information on habitat, size of sampling site, weather, sampling methods, etc.

Site no: ______________ *Gear/no:* ______________ *No:* ______________

Watershed code: ____

Waterbody ID: ____

Collection date: _______ *Crew:* ______________________________

Comments: ____

Figure 14 - Example of data label to be included in the jar with preserved specimens

Genetic Sampling: Protein Electrophoresis and DNA Analyses

Increasingly more work is being done which utilizes genetic markers and /or genetic parameters for populations. These techniques are useful in fisheries management to identify populations of fish, select brood stock, assess purity of hatchery stock, determine genetic population structure and assess biodiversity at the genetic level (Whitmore, 1990). The methods commonly used to determine genetic differences between stocks include protein electrophoresis and DNA analyses and are project specific. As the procedures for sample collection and preservation are dependent on the project-specific genetic techniques, the Fish Geneticist in the Conservation Section (MELP) must be contacted to obtain the necessary details prior to collecting material for genetic analysis.

Ideally, one would wish to collect the appropriate tissues without sacrificing the donor. Tissue samples required can vary from organ tissue, to fin clips, scales and epithelial tissue. Many tissue preparation techniques are available and laboratories vary in techniques. Before sampling begins, sampling protocol should be confirmed with the lab conducting the analyses to ensure that appropriate samples are taken. This section describes basic field collection and storage techniques for genetic samples.

The type and amount of tissue required will depend on the analyses to be conducted. There are three basic categories:

(1) protein electrophoresis: requires organ tissue including heart, muscle, eye and kidney either fresh or fresh frozen, stringent quality requirements

(2) DNA analyses with no PCR amplification: requires relatively large amounts of tissue often fresh and in specialized buffer solution, stringent quality requirements

(3) DNA analyses with PCR amplification: requires very little tissue (e.g. fin clip, 5-10 scales) and can be preserved in 95% ethanol (even pharmacy rubbing alcohol can work in a pinch) or dried (less preferred); fairly lax quality requirements where some tissue degradation is often not a problem. If sampling fish less than 50 mm total length, the whole animal should be placed in an excess (2-3 x volume of fish) of ethanol because fin clips from small fish leave little room for error. Otherwise a small fin clip (5mm x 5mm, or “half a fingernail-sized” piece) should be taken.

<u>NOTE:</u> The third category is becoming increasingly popular as conservation and non-lethal sampling requirements become more of an issue. In addition, this sampling for this category is far less arduous in the field and requires very little equipment, and the samples do not need to be frozen. Just keep them cool (in the shade, or in a refrigerator, cooler). Almost all current assays use PCR so method 3 is preferred.

Dissections should be done with clean and sharp dissecting tools. Between sampling of different specimens, all tools should be cleaned and rinsed with distilled water. If possible, disposable scalpel blades should be changed to avoid contaminating the samples.

Samples should be placed in small microcentrifuge tubes (1.7 ml) that are cheap and readily available from VWR/Canlab Scientific in Edmonton (403-952-5555).

Double labeling should be done to ensure that samples can be identified. All labels must be filled out using pencil as preservatives etc. can dissolve ink. Waterproof should be stored with the samples. Samples with data labels containing sampling information should be sealed individually in labeled plastic containers or bags.

Collection and Preservation of Parasites and Other Health Related Specimens

Fish can be infected with a variety of internal and external parasites. Sampling specifically for parasites can take a great deal of time and is not within the scope of a reconnaissance inventory. Given the number and types of parasites that may infect fish, no single sampling procedure can be recommended. Much of the thorough examination for parasites requires a full necropsy and use of stereo or compound microscopes to examine the tissues. It is best that this work be done back at the lab or some permanent station where a parasitologist can be consulted to verify observations.

Parasites infect almost any tissue group. If sampling for parasites is a priority, the entire fish should be retained and preserved for laboratory analysis. Ideally, live fish offer the best information as some parasites will leave as the fish dies. Preserving the entire fish in a fixative should only be done if the previous alternative is not possible.

Labeling of the specimens would follow the protocol outlined in previous sections of this manual. Other observations on the health of the fish should also be recorded. These include swimming behaviour of the fish, its colouration, respiration, presence of obvious lesions or parasites on the external surface of the animal (especially around the head and gills), and the appearance of the fins. Researchers at the Pacific Biological Station can direct samples of parasites and other specimens for pathological review to the correct individuals for analysis. Additional information on fish parasites can be found in:

Nothcote T.G.(no date given). Common Diseases and Parasites of Fresh-water Fishes in British Columbia. British Columbia Game Commission Management Publication No. 6: 25 pp.

Specimens should be submitted to:

Sherry Guest, Head - Fish Health Unit, Freshwater
Fisheries Society Of B. C., 2080A Labieux Road, Nanaimo B. C. V9T 6J9

Note: There may be some charge to identify a parasite.

Data Entry

Databases

Enter the data into the Field Data Information System (FDIS).

FDIS is a data capture, storage and reporting system that is devoted to field information as it is collected on the standard provincial field cards. It is a two part system where the first part is an MS Access tool to allow contractors and staff to enter, verify and edit data. The second part is the Oracle based components where all the data is eventually loaded. The Oracle components provide for data storage, some data editing, summary of the data to other systems (FISS), integration and access to the data for other systems and data reporting.

For instructions for using FDIS, link to FDIS Getting Started.

Quality Assurance

Manuals and Resources

Refer to *Reconnaissance (1:20 000) Fish and Fish Habitat Inventory: Quality Assurance Procedures*.

Appendix 1

Forms

- Fish Collection Form front (pdf) Fish Collection Form back (pdf)
- Individual Fish Form front (pdf) Individual Fish Form back (pdf)
- Lake Survey Form front (pdf) Lake Survey Form back (pdf)
- Site Card front (pdf) Site Card back (pdf)
- SLAM Boat (Air) form (pdf), SLAM Boat (Ground) form (pdf), SLAM Creel form (pdf), SLAM Fish Data form (pdf)
- SLAM Instructions: SLAM Boat (Air) form (pdf), SLAM Boat (Ground) form (pdf), SLAM Creel form (pdf), SLAM Fish Data form (pdf)

Field Guides

- Fish Collection Form Field Guide, Fish Collection Form Field Guide Errata, Fish Collection Form Field guide Errata #2
- Lake Survey Form Field Guide, Lake Survey Form Field Guide Errata, Lake Survey Form Errata #2
- Site Card Field Guide, Site Card Field Guide Errata, Site Card Field Guide Errata #2

Data Entry Tools

AquaCat

AquaCat is a searchable catalogue and storage system for fisheries and water reports, maps and datasets. It is a two tiered system that is browser based, built with JAVA and stores data to an Oracle database. The first tier allows staff and contractors to use the government's intranet to upload reports, datasets and maps into the catalogue and store the information in Oracle. The second tier produces a searchable browser based catalogue on the Internet site that the public may use to discover information and download their own copies of the reports, datasets and maps.

FDIS (Field Data Information System)

FDIS is a data capture, storage and reporting system that is devoted to field information as it is collected on the standard provincial field cards. It is a two part system where the first part is an MS Access tool to allow contractors and staff to enter, verify and edit data. The second part is the Oracle based components where all the data is eventually loaded. The Oracle components provide for data storage, some data editing, summary of the data to other systems (FISS), integration and access to the data for other systems and data reporting. For instructions for using FDIS, link to FDIS Getting Started.

FISS (Fisheries information Summary System)

FISS is a comprehensive Oracle database providing summary level fish and fish habitat data for water bodies throughout the province of British Columbia that allows the data to be entered, stored, geo-referenced (mapped), distributed (accessed) and reported on. It is a main source of information to many other systems and data products.

FPR (Fisheries Project Registry)

FPR is a joint effort between BC Fisheries and the federal Department of Fisheries ad Oceans to compile an ongoing list of all projects within the province that focus on fish and fish habitats including habitat restoration, biological enhancement, stock and habitat inventories and monitoring, stream mapping, and fish farming to name a few.

Manuals and Resources

- **A Guide to Photodocumentation for Aquatic Inventory**
- **Ambient Fresh Water and Effluent Sampling Manual**
- **Bathymetric Standards for Lake Inventories**
- **BC Conservation Data Centre**
- **British Columbia Standards Specifications and Guidelines for Resource Surveys Using Global Positioning System Technology**
- **British Columbia Watershed Atlas**
- **British Columbia Watershed Dictionary**
- **Channel Assessment Procedures Guidebook**
- **Example Products – Fisheries Overview Map, Fisheries Project Map, Fisheries Interpretive Map, Final Lake Report**
- **Field Key to the Freshwater Fishes of British Columbia**

- **Fish Collection Methods and Standards Version 4.0**
- **Fish Collection Methods and Standards Version 4.0 Errata #1**
- **User's Guide to the Fish and Fish Habitat Assessment Tool (FHAT20) Version 2.0**
- **Fish Inventory Mapping System (FishMap) For 2000 Fish Inventory Data, User Manual, Version 1.0.**
- **Fish Stream Identification Guidebook**
- **FISS Fisheries Information Summary System Data Compilation and Mapping Procedures**
- **LandData BC**
- **Overview Fish and Fish Habitat Inventory Methodology**
- **Riparian Management Area Guidebook**
- **Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Quality Assurance Procedures Version 1.0**
- **Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Reach Information Guide Version 1.0**
- **Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Standards and Procedures Version 2.0**
- **Standards for Fish and Fish Habitat Maps Version 3.0**
- **User's Guide to the BC Watershed/Waterbody Identifier System**