

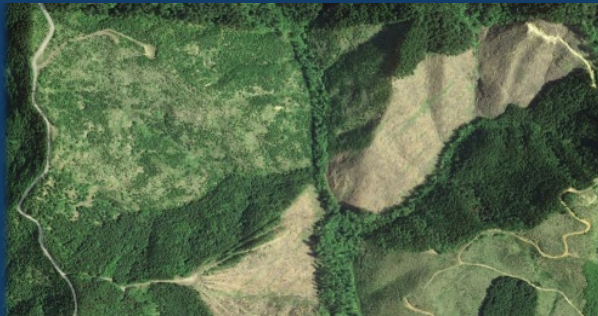


Surveying Forest Streams for Fish Use

Oregon Department of Fish and Wildlife
and
Oregon Department of Forestry

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Surveying Forest Streams for Fish Use

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Definitions

Forest Practices Administrative rules definitions specified in OAR 629-600-0100 that are relevant to the fish survey protocols in this manual, include:

- (3) **"Active channel width"** means the stream width between the ordinary high-water lines, or at the channel bankfull elevation if the ordinary high-water lines are indeterminate.
- (11) **"Bankfull elevation"** means the point on a stream bank at which overflow into a floodplain begins.
- (18) **"Bull Trout"** means fish species *Salvelinus confluentus*.
- (40) **"Eastern Oregon"** means the region east of the Cascade Crest as described in OAR 629-635-0220.
- (45) **"Fish use"** means inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state Endangered Species Act.
- (70) **"High water level"** means the stage reached during the average annual high flow. The "high water level" often corresponds with the edge of streamside terraces, a change in vegetation, or a change in soil or litter characteristics.
- (80) **"Landowner"** means any individual, combination of individuals, partnership, corporation, or association of whatever nature that holds an ownership interest in forestland, including the state and any political subdivision thereof.
- (87) **"Main channel"** means a channel that has flowing water when average flows occur.
- (89) **"Natural barrier to fish use"** is a natural feature such as a waterfall, increase in stream gradient, channel constriction, or other natural channel blockage that prevents upstream fish passage.
- (95) **"Ordinary high-water line"** means the line on the bank or shore to which the high-water ordinarily rises annually in season, as defined in ORS 274.005.
- (109) **"Riparian area"** means the ground along a water of the state where the vegetation and microclimate are influenced by year-round or seasonal water, associated high water tables, and soils which exhibit some wetness characteristics.
- (110) **"Riparian management area"** means an area along each side of specified waters of the state within which vegetation retention and special management practices are required for the protection of water quality, hydrologic functions, and fish and wildlife habitat.
- (118) **"Side channel"** means a channel other than a main channel of a stream that only has flowing water when high water level occurs.
- (130) **"SSBT use"** means a stream with salmon, steelhead, or bull trout present or otherwise used by salmon, steelhead, or bull trout at any time of the year as determined by the State Forester.
- (131) **"State Forester"** means the State Forester or the duly authorized representative of the State Forester.
- (132) **"Steelhead"** means the anadromous life history variant of *Oncorhynchus mykiss*.
- (133) **"Stream"** means a channel, such as a river or creek, which carries flowing surface water during some portion of the year.
 - (a) For the purposes of the forest practice rules, streams include:
 - (A) The water itself, including any vegetation, aquatic life, or habitats therein;
 - (B) Beds and banks below the high water level which may contain water, whether or not water is actually present;
 - (C) The area between the high-water level of connected side channels;
 - (D) Beaver ponds, oxbows, and side channels if they are connected by surface flow to the stream during a portion of the year; and
 - (E) Stream-associated wetlands.
 - (b) "Streams" do not include:

- (A) Ephemeral overland flow (such flow does not have a channel); or
- (B) Road drainage systems or water developments as defined in this rule.

- (148) "**Type F stream**" means a stream with fish use, or both fish use and domestic water use.
- (149) "**Type N stream**" means a stream that meets the criteria of a Type Np or Ns stream.
- (150) "**Type Np stream**" means all perennial streams that are not Type SSBT or Type F.
- (151) "**Type Ns stream**" means all seasonal stream reaches that are not Type SSBT, Type F, or Type Np streams.
- (152) "**Type SSBT stream**" means a stream that is classified as a Type F stream and has SSBT use.
- (153) "**Unit**" means an operation area submitted on a notification of operation that is identified on a map and that has a single continuous boundary. Unit is used to determine compliance with ORS 527.676 (down log, snag and green live tree retention), 527.740 and 527.750 (harvest type 3 size limitation), and other forest practice rules.
- (159) "**Western Oregon**" means the region west of the Cascade Crest as described in OAR 629-635-0220.

Terms

The terms below describe some of the important words and phrases used throughout this document.

Active Channel — The stage associated with water that fills the stream channel to the top of its banks to the point where the water begins to overflow onto a floodplain. This flow is associated with a momentary maximum flow that has an average recurrence interval of 1.5 years as determined using a flood frequency analysis. This stage corresponds to the discharge at which channel maintenance is the most effective (e.g., sediment moves, forms, removes, or reshapes bars, bends, and meanders) resulting in the average morphologic characteristics of channels. The boundary of the active channel can be difficult to determine; use changes in vegetation, slope breaks, a change in particle size on the stream bank, top of deposited bedload (gravel bars), or high-water marks as clues. This can also be referred to as "bankfull elevation".

Active Channel Height — Vertical distance from the average level of the streambed to the top of the active channel. Determined by averaging three equally spaced measurements across the active channel at either the pool tail crest or fast water unit transition.

Artificial Barrier — Human-made structures, such as dams, culverts, weirs, and floodgates, that block or impede the natural migration of fish. These structures often create velocity, shallow water, or jump hazards that prevent fish from travelling upstream or downstream. Artificial barriers do not constitute end of fish use.

End of Fish Use — The identified location in a stream where the classification changes from Type F to Type N for the purposes of administering the Forest Practices Act water protection rules. End of fish use is determined by a combination of physical, hydrological, and topographical factors, and/or the location of the last observed fish, depending on the survey method being used. This location represents the place above which all stream reaches are not expected to be occupied by fish.

Fall Height — The vertical distance from the bed of the jump pool to the lip of the falls.

Jump Pool — A pool at the base of a waterfall where fish accelerate to acquire the necessary momentum to jump upwards and overcome the obstacle to continuing their upstream migration. Jump pool depth is measured from the deepest pool scour to the active channel height.

Last Observed Fish — The identified location of the uppermost fish observed in a stream. This location can be identified through visual observation of a fish in the stream, either by electrofishing or other sampling method where the presence of fish is confirmed. The last observed fish may or may not be coincident with the end of fish use depending on site specific conditions and the survey method being used.

Leap Height — The vertical distance between the active channel height on the downstream side of the falls and the lip of the falls on the upstream end.

Non-Valley Bottom Stream — Streams that have confined hillslopes adjacent to the stream and have a gradient greater than or equal to one percent ($\geq 1\%$).

Operation-specific surveys — A survey to determine fish use only in the specific area of a forest operation.

Pool Depth at Active Channel Height — The maximum pool depth from the deepest pool scour to the active channel height.

Resident Fish — Fish species that live in freshwater year-round rather than migrating to the ocean for a portion of their life cycle. Key species include brook trout, cutthroat trout, and rainbow trout (including native redband) which are frequently the last fish encountered in headwater streams.

Upstream Distribution Survey — A survey to determine the end of fish use on one or more streams within a watershed rather than on a limited portion of stream, such as within a forest operation or timber harvest unit boundary. In some cases, these surveys may encompass one or more ownership(s) or an entire watershed.

Valley Bottom Stream — Streams that have unconfined hillslopes, most often with an adjacent floodplain; are connected to low gradient streams at their mouth; and have a gradient that is less than one percent ($< 1\%$).

Regulatory Framework

The Oregon Forest Practices Act (FPA) establishes a regulatory framework for forest operations on non-federal lands in Oregon. The Oregon Department of Forestry (ODF) administers and enforces the FPA. Identifying streams that contain fish is an important part of the FPA water protection rules (Oregon Administrative Rule [OAR] 629-635-0000 through 629-660-0060). The purpose of the Forest Practices water classification rules

(OAR 629-635-0200 (1)) is to match the physical characteristics and beneficial uses, including fish use, of a water body to a set of appropriate protection measures (OAR Chapter 629, Division 643) required during forest management activities on non-federal forest lands regulated by the FPA. The FPA rules recognize two broad categories of fish streams based on the occurrence of certain fish species and/or suitable habitat:

- “Type F” stream means a stream with fish use, or both fish use and domestic water use (OAR 629-600-0100 (149)). “Fish use” means inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state Endangered Species Acts (OAR 629-600-0100 (45)).
- “Type SSBT stream” means a stream that is classified as a Type F stream and has SSBT use (OAR 629-600-0100 (153)). “SSBT use” means a stream with salmon, steelhead, or bull trout present or otherwise used by salmon, steelhead, or bull trout at any time of the year as determined by the State Forester (OAR 629-100-0100 (131)).

The FPA rules that specify the process to classify streams as Type F and Type SSBT include:

- OAR 629-635-0200 (11) - Procedures to classify streams for fish use.
- OAR 629-635-0200 (12) – Procedures to determine if a stream has fish use or both fish use and SSBT use.
- OAR 629-635-0200 (13) – Standards and procedures to determine if a stream is Type SSBT.

These rules did not include a requirement or methodology for conducting a survey to determine SSBT use. The FPA rules state that a Type SSBT stream classification is determined by incorporating specific Oregon Department of Fish and Wildlife (ODFW) Fish Habitat Distribution observation data into the authoritative [ODF Hydrography Flow Line](#) data (OAR 629-635-0200 (13)) in accordance with existing fish survey information (OAR 629-635-200 (12)). To recognize Type SSBT as a distinct stream classification in the FPA rules, the fish survey protocols in this manual now provide specific methodology to conduct surveys to identify the end of SSBT use as well as the methods needed to continue surveying upstream to determine end of resident fish use when appropriate (*Note: see APPENDIX A for detailed instructions on how to fill out the Physical Habitat & Fish Use Survey Form, which will be elaborated on throughout this manual, and APPENDIX B for the printable survey form and a filled-out example*). **Completing a stream survey to identify or revise SSBT use in association with a fish use survey is voluntary and may be completed under the conditions/circumstances described in this manual. However, if a landowner intends to change the location of the end of SSBT use in the authoritative ODF Hydrography Flow Line data, the surveyor must survey for end of SSBT or provide information regarding a documented observation of an SSBT species if the upstream extent of SSBT was not determined.**

Historical surveys and modeled fish use in the authoritative ODF Hydrography Flow Line data provide a comprehensive framework and valuable information to establish the distribution of fish use and habitat features that impact fish use. Notwithstanding, the FPA rules allow surveys to correct the adopted modeled fish distribution (OAR 629-635-0200 (11)(c)) or verify the designation of fish use in stream segments

associated with a forest operation that were initially classified as fish use based on the model (OAR 629-635-0200 (11)(d)).

If a forest operation is planned in an area which contains streams, a landowner must either use the fish use and stream classification information provided in the authoritative ODF Hydrography Flow Line data or conduct a survey consistent with the guidelines in this manual if they believe the modeled data are inaccurate. ODFW has 21 days following submission to ODF to review and approve or object to surveys for fish use (OAR 629-635-0200 (11)(d)(D)). Surveys for fish use approved by ODFW will be incorporated into the authoritative ODF Hydrography Flow Line data.

The fish survey protocols in this manual provides the methodology for conducting surveys to determine fish use in accordance with OAR 629-635-0200 (11)(e). The methodology and criteria for determining the end of SSBT and resident fish use has been developed, reviewed, and published by representatives from ODFW and ODF in conjunction with stakeholders. If approved by ODFW, other information may also be used to determine the upstream extent of fish use (OAR 629-635-0200 (11)(f)).

These fish survey protocols directly affect aquatic species under the FPA rules. Therefore, further revisions and monitoring efforts of the fish survey protocols in this manual are directed by the rules and processes within the Adaptive Management Program (AMP). The purpose of the AMP rules is to provide science-based recommendations and technical information to assist the Board of Forestry in determining when it is necessary or advisable to adjust rules, guidance, and training programs to achieve the biological goals and objectives (OAR-629-603-0000 through 629-603-0600).

Purpose of Fish Use Surveys

To administer the FPA water classification rules, all surveys for fish use must be conducted according to the survey protocols in this manual. The purpose of the surveys is to collect accurate and reliable field data to determine the presence/absence of fish use in a stream, including SSBT. If you are considering using procedures other than the ODFW/ODF approved methods in this manual for the purposes of stream classification under the FPA rules, the appropriate [ODFW Private Forest Accord \(PFA\) Stream Biologist](#) should be contacted prior to conducting the survey. The ODFW PFA Stream Biologist will determine whether the proposed methods are appropriate, and if so, set the required minimum level of sampling effort for the alternate method.

Background

Flowing water in streams and rivers and the riparian habitats found along the banks of streams and rivers are a key feature of the Oregon landscape. Water is crucial for all fish and wildlife, and high-quality freshwater aquatic systems provide essential habitat to many at-risk species, including important spawning and rearing habitat for salmon and trout (salmonids) as well as aquatic herpetofauna and invertebrates. Riparian corridors link aquatic and upland habitats and have important ecological functions. Riparian habitats often exhibit high species diversity and provide essential habitat and travel corridors for birds, amphibians, reptiles, mammals, and other wildlife. Healthy riparian vegetation protects stream banks from erosion, influences in-channel habitat features, maintains favorable water temperature for fish through shading, filters runoff, and provides

nutrients to support aquatic and terrestrial life. Riparian vegetation also greatly influences the geomorphic processes of rivers and stream channels and how they change in shape and direction over time (e.g., large wood creates meanders and increases habitat complexity). Fish habitat and distribution in a watershed is determined by links and interactions between hydrology, geomorphology, and ecology. The quantity/quality of fish habitat may also change over time through climatic conditions and hydrogeomorphic processes, as well as anthropogenic and restoration activities.

Since 1995, surveys for fish use have been conducted according to the protocol in “Surveying Forest Streams for Fish Use”, published by ODF and ODFW in conjunction with the FPA water classification rules (OAR 629-635-0000 through 629-660-0060). Traditionally, fish presence/absence determinations were made primarily utilizing electrofishing (e-fishing). In 2007, FPA rules were revised to include physical habitat surveys as an approved method for assessing fish use and determining the location of the first natural barrier to fish use based on physical habitat criteria. The FPA rules defining SSBT use were adopted in 2017.

Timber and conservation groups came to an agreement, known as the PFA, and published a report which recommended changes to the FPA. In 2022, Senate Bill 1501 directed the Board of Forestry to adopt FPA rules to implement the PFA. The PFA resulted in significant revisions to the water protection rules which reflected changes to riparian management objectives and the stream classification process, as well as the need for increased efforts to coordinate surveys with ODFW. Major changes to the stream classification system and hydrography network included using a fish distribution model which incorporated information from existing surveys to help predict and classify fish use in stream segments without survey data for streams in eastern and western Oregon.

While a geographical information systems (GIS)-based predictive model is available to predict the upstream extent of fish use, an on-the-ground survey of a stream may be needed or desired in some cases to determine end of fish use. For example, a private landowner or operator may use a field survey to correct the modeled fish distribution or to verify the designation of fish use in stream segments associated with an operation. This document (i.e., “Surveying Forest Streams for Fish Use”) effective January 1, 2027, supersedes and replaces the procedures originally published in 1995. The fish survey protocols in this manual provide updated guidelines, including:

- Determining whether a survey is needed to correct or verify existing fish use and stream classification information in the ODF Hydrography Flow Line data.
- ODFW/ODF-approved survey methods.
- Permit requirements.
- Updated physical habitat criteria (that relied on scientific data and a peer-reviewed process) to identify natural barriers to fish movement.
- The proper way to conduct surveys to determine end of fish use or to substantiate that a segment of stream is absent of fish.
- Instructions to complete and submit survey results.
- Workflows of the survey process from start to finish.

Introduction

Streams with fish receive more vegetative protection than streams without fish making the end of fish use important. In most streams, the upstream migrations and use of habitats by anadromous and resident fish species are eventually limited by physical barriers such as falls, channel steepness, or lack of livable space.

The ability of fish to move upstream past these barriers, however, can also vary annually and seasonally. Species-specific life-history traits and population characteristics can also affect fish distribution in a stream. For example, SSBT species migrate up freshwater rivers from the ocean to spawn and may be present in stream segments at different times of the year or not at all on a given year depending on their life cycle. Conversely, resident fish (e.g., cutthroat trout, rainbow/redband trout) do not make extensive migrations, are typically present in a stream year-round, and are often found higher in the watershed than SSBT species. Cutthroat trout, rainbow/redband trout, and other resident species can be present downstream as well as upstream of certain barriers. Fish use and distribution may also expand or contract in a watershed or stream depending on population abundance and interrelationships with available resources (e.g., sufficient water, food, cover).

The accuracy and reliability of fish use survey results depend greatly on the methods used to conduct the survey. The appropriate survey method used to determine fish use and habitat distribution depends on the size of the stream; flow and clarity of the water; potential occurrence of SSBT, resident fish species, and Endangered Species Act (ESA)-listed species that may require appropriate permits (*Note: see list of anadromous fish, game fish, and threatened or endangered fish species in APPENDIX C*); availability of sampling equipment; and other factors.

The most important survey considerations when dealing with anadromous versus resident fish are timing and abundance of different life stages in the targeted survey segment. The key is knowledge of target species. If surveyors are unfamiliar with the life history traits of target species, consultation with the appropriate [ODFW PFA Stream Biologist](#) prior to conducting surveys is recommended.

Anadromous fish distribution on the landscape is highly affected by general abundance. Higher escapement of anadromous fish into a watershed, due to factors such as larger smolt outmigration and productive ocean conditions, affect the signal for spawning fish to expand or contract within a watershed. During years/seasons of high abundance, spawning adults will typically push farther into the upper reaches of watersheds. During periods with lower abundance, adults will often spawn much lower in a watershed and rarely push to the upper limits.

It is essential to use survey methods that provide accurate, reliable results and that are also cost-effective and time-efficient to utilize. For example, just looking at a stream and observing fish at a particular location tells you fish are present at that point in time, but is not an acceptable way to determine end of fish use. Surveys that show that fish are not present or that identify habitat features that restrict the ability of fish movement require increased sampling effort and may require specialized equipment to provide reliable results. Artificial barriers are not used for establishing end of fish use.

A workflow which provides an overview of the survey process is shown in Figure 1. This workflow diagram provides a visual road map or pathway to carrying out surveys from start to finish. Workflow diagrams in the fish survey protocols are intended to help surveyors organize and visualize their activities to collect accurate and reliable information to determine fish use in a stream.

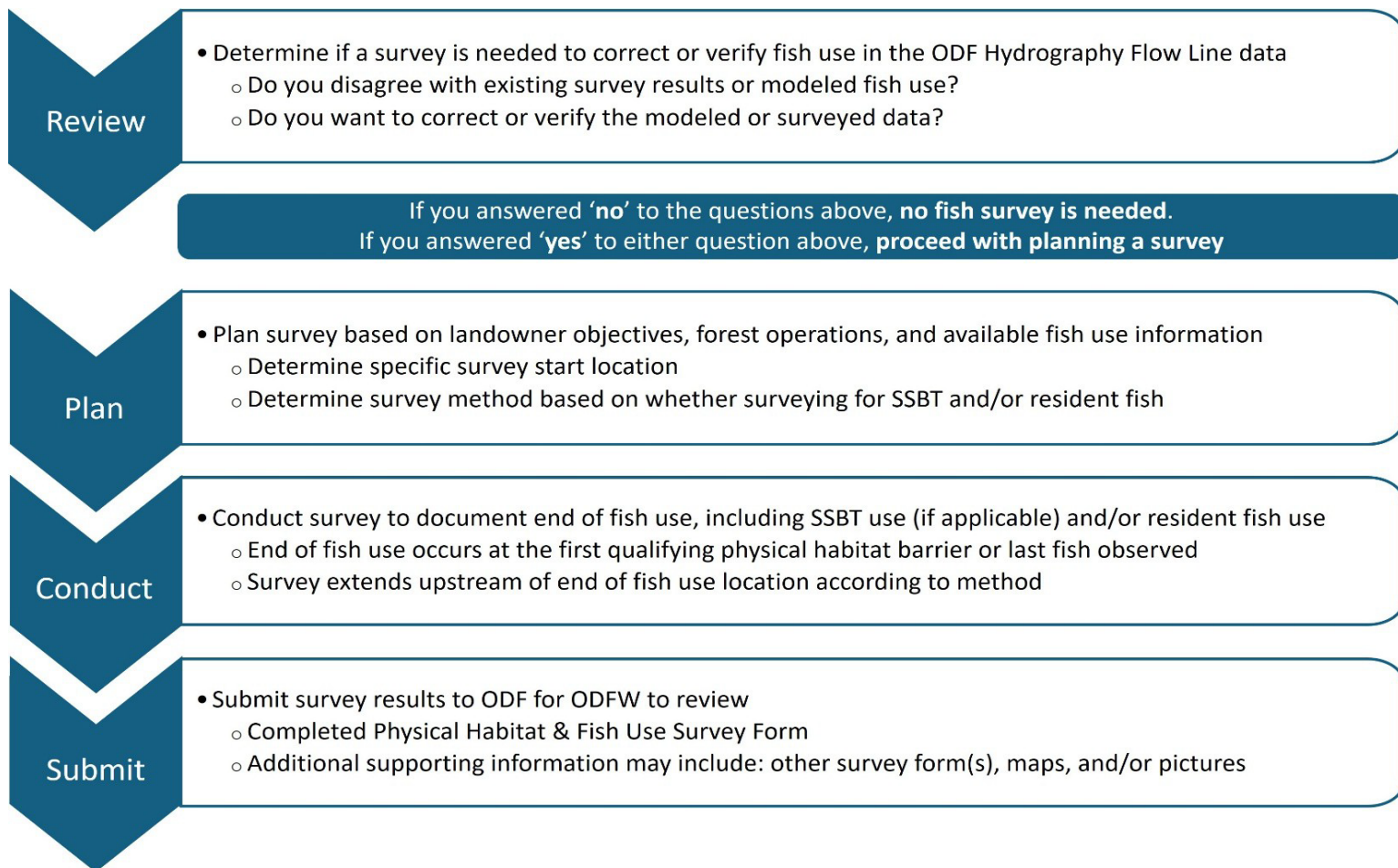


Figure 1. Overview of survey process.

Survey Methods

The methods in this manual reflect changes to the FPA rules and procedures since 1995 which affect surveys for fish use. Survey method options are based on FPA rulemaking, historical background, lessons learned from end of fish use surveys, PFA, and new scientific findings from physical habitat criteria peer review. The following methods are approved (with appropriate permits) by ODFW and ODF to obtain accurate and reliable results about upstream extent of fish use or to demonstrate that a segment of stream is not occupied by fish (*Note: see Determine survey method based on whether SSBT and/or resident fish occur in the stream for more detailed information*).

1. Physical Habitat Only Survey

A physical habitat only survey can be used to determine the extent of fish use for streams up to the first natural barrier to fish use, without respect to any artificial obstructions to fish passage. When conducting a physical habitat survey, a defined set of numerical field criteria are applied to identify fish use and habitat, as well as natural barriers to upstream movement of SSBT and resident fish use. Barriers may be caused by falls, channel gradient, or lack of livable space and are located by walking up the stream to compare barrier criteria with observed channel features. Physical habitat surveys provide accurate, reliable, and cost-effective results when performed correctly. The advantages of

physical habitat surveys include broad applicability, identification of key habitat features, lack of permitting requirements to catch or handle fish, and relative ease of fieldwork, but the drawbacks may include observer bias, being limited by water clarity, and potentially missing observation of cryptic fish species. In this method, e-fishing is not used to validate the end of fish use. Physical habitat surveys are the one and only method to determine end of SSBT use.

2. Physical Habitat with E-fishing Survey

A physical habitat survey in conjunction with e-fishing is the best method to determine fish use and habitat distribution, especially in certain stream conditions. A physical habitat with e-fishing survey can be used to determine the extent of fish use in streams up to the first natural barrier to fish use, without respect to any artificial obstructions to fish passage. Natural barriers (that meet the physical habitat end point criteria for resident fish species) block upstream movement of resident fish and/or result in habitat conditions that are not suitable for long-term resident fish use. Incorporating e-fishing into a physical habitat survey is an additional procedure that can help verify the presence/absence of isolated fish populations upstream of a physical barrier. In these situations, e-fishing is used to supplement the physical habitat survey with additional information on absence/presence of resident fish. E-fishing cannot be used to determine end of SSBT use.

3. E-fishing Only Survey

E-fishing without a physical habitat survey component (i.e., a “stand-alone” e-fishing survey) can be used to obtain information about the end of fish use or demonstrate a stream reach is absent of fish, but only under certain conditions. **A stand-alone e-fishing survey can only be used to determine presence/absence of resident fish species but cannot be used to determine SSBT use.** Resident fish species remain in freshwater streams their entire lives, whereas anadromous fish species are migratory and use freshwater stream habitats for only a portion of their lives. Juveniles of anadromous fish species may not be present in the same freshwater stream habitats every year, especially following low water years or years when returning adult spawning fish abundance was low. E-fishing has advantages in some situations for determining the end of resident fish use in streams because it allows for the detection of fish in real-time. However, e-fishing can be time-consuming, labor-intensive, can harm fishes, and requires permits and animal care permissions. Surveyors may not detect fish when population abundances are low. Furthermore, accurately identifying young-of-the-year salmonids is problematic at certain sizes without genetic analysis (*Note: see Field Identification of Juvenile Salmonids in APPENDIX D*).

Permit Requirements

Surveyors must acquire the necessary permits from the appropriate agency prior to conducting any survey that may take (e.g., capture/handle) fish, such as e-fishing. Furthermore, more than one permit may be necessary and may need to be obtained from multiple agencies. Permits take time to acquire, so plan accordingly.

ODFW regulations require that the surveyor obtains a current Scientific Taking Permit (STP) from ODFW (OAR 635-007-0900). The ODFW permit is needed to handle any species of fish from waters of the state collected by any method for scientific or educational purposes. (*Note: other authorizations are needed for other purposes,*

such as fish rescue/salvage). Applications are submitted online at [National Oceanic and Atmospheric Administration](#) (NOAA) Fisheries and take 4–6 weeks to process and issue. A report is required to be submitted for each issued permit and must include the species and number of fish handled during the permitted period (OAR 635-007-0920). [Email ODFW Fish Research](#) for questions concerning ODFW Fish Division permitting.

In addition, an appropriate federal permit from NOAA Fisheries or U.S. Fish and Wildlife Service (USFWS) may also be required to electrofish in waters that contain federally-listed ESA species. On average, these permits can be obtained from NOAA Fisheries in 6–9 months, and from the USFWS within about 90 days.

NOAA Fisheries has listed 28 population groups of salmon and steelhead on the West Coast as threatened or endangered under the ESA. Primary listing and recovery responsibilities for salmon and steelhead belong to NOAA Fisheries. Salmon and steelhead range data can be downloaded as geodatabases, viewed and queried interactively in the NOAA Fisheries Species and Habitat App, or accessed through [map services](#) to get information on areas with known listed ESA species.

NOAA Fisheries and ODFW have established “Authorizations and Permits for Protected Species” ([APPS](#)) to assist researchers and surveyors in obtaining approval to conduct scientific research, recovery/enhancement, and monitoring activities of marine species, anadromous species, and other fish and invertebrates. Obtaining permits from the USFWS is a separate process. Visit the [USFWS website](#) for more information.

Survey Timing

ODFW recommends conducting surveys for resident fish species during March–May (western Oregon) or April–June (eastern Oregon). These timeframes are optimal for surveying because fish distribution is generally most extensive and habitat attributes are most appropriately observed and measured due to flow conditions. The recommended time periods are based on normal water-flow years, though account for some annual variation.

Physical habitat only and physical habitat with e-fishing surveys to determine end of fish use can be completed at any time of year. When evaluating a potential natural barrier during a physical habitat survey, the water flows expected during the recommended timeframe (March–May in western Oregon and April–June in eastern Oregon, Table 1) must be considered even if the survey is being conducted during other times of the year. E-fishing can also be used at any time of year if the purpose is to supplement the physical habitat survey with additional information on absence/presence of resident fish above physical barriers.

E-fishing only surveys to determine end of resident fish use must be completed during March–May in western Oregon and April–June in eastern Oregon (Table 1). E-fishing only surveys conducted outside of these specified time periods may be used to document fish presence but cannot be used to determine the end of resident fish use or to demonstrate resident fish are absent. If you are considering using an e-fishing only survey outside the recommended time periods, the appropriate [ODFW PFA Stream Biologist](#) should be contacted prior to conducting the survey to determine whether the alternate timeframe is appropriate. Whenever surveys are not conducted during the recommended timing, surveyors must explain the reasons on the survey form so that data can be evaluated for reliability. E-fishing only surveys cannot be used to determine end of SSBT use.

Table 1. Summary of whether a survey method is acceptable for determining end of fish use during normal water years¹ based on timing and location². Factors that affect the accuracy and precision of a survey method depend on water flow and clarity as well as seasonal/long-term distribution variability of anadromous/resident fish species and populations within a stream system.

Survey Method	Survey Timing	
	RECOMMENDED ³ March-May (west) April-June (east)	June-February (west) July-March (east)
Physical Habitat Only	Approved 	Approved 
Physical Habitat with E-fishing ⁴	Preferred 	Approved 
E-fishing Only ⁵	Approved 	Not Approved 

¹U.S. Geological Survey (USGS) [National Water Dashboard](#) displays maps, graphs, and tables describing real-time, recent, and past streamflow conditions for Oregon. Streamflow between the 25th and 75th percentiles is considered normal.

²Geographic regions west and east of the Cascades Crest in Oregon.

³Fish distribution is generally most extensive during the recommended time periods and habitat attributes for fish use are more appropriately observed and measured at these flow conditions. Whenever the recommended survey timing is not used, conditions must be justified.

⁴E-fishing cannot be used to determine end of SSBT. E-fishing is being used to supplement the habitat survey with additional information on absence/presence of resident fish in these conditions.

⁵E-fishing only surveys cannot be used to determine end of SSBT at any time of the year and is only appropriate to determine end of resident fish use during the recommended time periods.

While there are limitations to conducting a survey for fish use during periods of abnormal streamflow, there may still be an opportunity to collect useful data so long as there is a clear understanding of both the limitations and opportunities. For example, e-fishing only surveys may document fish presence, however, extremely low flows may restrict habitat availability and truncate fish distribution, whereas high flows may increase habitat availability and expand fish distribution. If high flows are predicted, adjust the timing of the survey to be conducted during more appropriate conditions. Water is often turbid during periods of high flow and the ability to see and/or capture fish is affected. Safety is the highest priority, and surveys conducted during high flows can be dangerous. Check the stream gage in the closest watershed that represents the conditions at the site to be evaluated.

To better understand streamflow conditions in your area, real-time and historical water data can be accessed directly via the interactive USGS [National Water Dashboard](#). In U.S. Geological Service (USGS) hydrological

data, streamflow classifications compare current water volume to the historical flow for that exact calendar day. Much above or below normal means the current flow is in the top 90th percentile or bottom 10th percentile of all recorded historical flows for a specific date (USGS National Water Dashboard). If seasonal precipitation or stream flow is much above/below normal or there are other difficult and/or unusual circumstances related to streamflow, contact the appropriate ODFW PFA Stream Biologist prior to conducting an e-fishing only survey for their recommendations regarding feasibility to conduct surveys during abnormal stream flows. E-fishing only surveys are typically not recommended when streamflow conditions are much above/below normal. Surveyors must also provide justification for why their end of fish use determination was not impacted by abnormal flow conditions (*see APPENDIX A for detailed instructions on how to fill out the Physical Habitat & Fish Use Survey Form and APPENDIX B for a printable survey form and a filled-out example*).

Physical Habitat Survey Considerations for SSBT and Resident Fish Use

Valley Bottom and Non-Valley Bottom Streams

Streams in Oregon display a variety of channel patterns dictated by variation in watersheds and floodplains that are influenced by a range of geologic, climatic, and topographic factors. The valley bottoms of these streams typically contain the greatest biological diversity and productivity within watersheds. Valley bottoms are one of the most physically dynamic components of the landscape because of their propensity for low gradients, flooding, and channel migration. Because of their unique properties, valley bottom streams play an important role in landscape ecology and fish use. The break between valley bottom streams and non-valley bottom streams is determined by identifying the edge of the floodplain or the presence of any pronounced slope breaks with a corresponding increase in stream gradient (Figure 2). Small valley bottom stream channels have unconfined hillslopes, most often with an adjacent floodplain; are connected to low gradient streams at their mouth; and have a gradient that is less than one percent (<1%). Small non-valley bottom streams are associated with confined hillslopes adjacent to the stream and have a gradient greater than or equal to one percent (≥1%). Surveyors should consider the valley type when determining whether habitat conditions reflect a lack of livable space (Table 2 and Table 3).

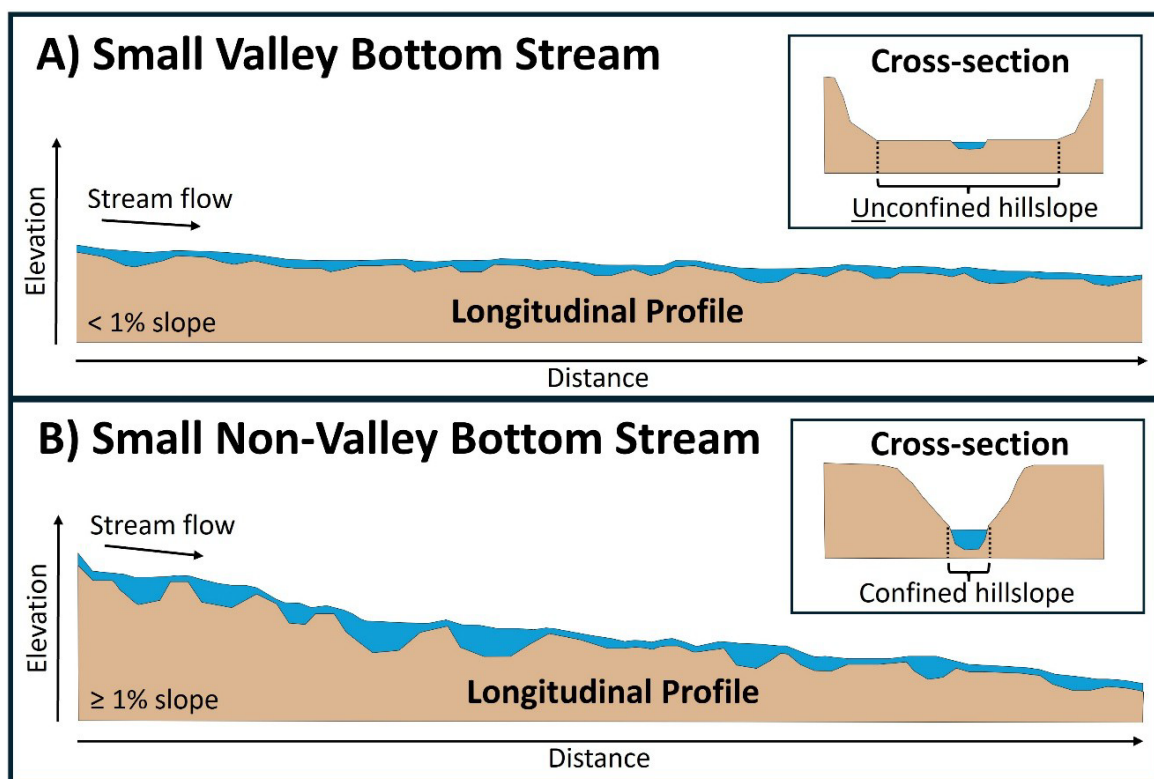


Figure 2. Example of a small A) valley bottom and B) non-valley bottom stream segment. The longitudinal stream profile shows the gradient from upstream to downstream over the length of a given stream segment. The lateral cross-section (top right inset) shows a transverse view across the width of the stream from the left bank to the right bank at a given point within the stream segment.

Salmon, Steelhead, Bull Trout (SSBT) Use

A physical habitat survey to determine end of SSBT use should occur when:

1. Juvenile or adult SSBT have been observed by a surveyor in a stream segment that had not been previously classified as Type SSBT in the [ODF Hydrography Flow Line](#) data. The physical habitat survey should start at the uppermost SSBT observation and continue upstream to the location where SSBT use ends according to habitat end point criteria shown in Table 2, or
2. SSBT use, as identified in the ODF Hydrography Flow Line data, occurs concurrently with or upstream of the starting location. If starting the physical habitat survey within or immediately adjacent to Type SSBT, survey upstream to the location where SSBT use ends according to the habitat end point criteria shown in Table 2.

Natural barriers to SSBT use include natural channel features such as falls (see Figure 3 for measurement illustrations), channel gradient changes, or lack of livable space. The location of the first natural barrier must be used to determine the end of SSBT use by identifying physical habitat end point criteria as described in Table 2. *(Note: isolated populations of resident fish species often occupy habitat upstream of SSBT use. In these cases, a survey to determine end of resident fish use may also be warranted upstream from the newly identified end of SSBT if information is needed to correct fish use in the ODF authoritative Flow Line data.)*

Occasionally, end of SSBT use and end of resident fish use are coincident or SSBT use extends further than resident fish use).

Table 2. Summary of physical habitat criteria to determine end of SSBT (salmon, steelhead, or bull trout) use.

Physical Habitat Criteria Used to Determine End of SSBT (Salmon, Steelhead, or Bull Trout) Use			
Stream Size	Barrier Type	Physical Survey Criteria/Description	Criterion indicates barrier ¹
All Streams	Falls ²	Leap height ≥11.5-feet (3.5-m) high	yes
		Leap height 10- to 11.5-feet (3.0- to 3.5-m) high and jump pool ² depth <5-feet (1.5-m) deep at active channel height ³	yes
		Leap height 4- to 10-feet (1.2- to 3.0-m) high and jump pool ² depth at active channel height ³ is < half of the leap height	yes
All Streams	Channel Gradient	≥60 feet (18.3 m) of stream length with ≥30% gradient with pools ≥6-inches (15-cm) deep at active channel height ³	yes
		≥60 feet (18.3 m) of stream length with ≥20% gradient without pools ≥6-inches (15-cm) deep at active channel height ³	yes
Small valley bottom ⁴	Lack of livable space	No pools ≥6 inches (15 cm) at active channel height ³ for 300-ft (91.4-m) stream distance	yes
Small non-valley bottom ⁴	Lack of livable space	No pools >12 inches (30 cm) at active channel height ³ for at least 300-feet (91.4-m) stream distance	End of SSBT has been met when 2 of these 3 criteria have been met.
		<2-feet (0.6-m) average active channel width for 100 feet (30.5 m) ⁵	
		≥30 feet (9.1 m) of stream length with >10% gradient	

¹End of SSBT use is established by identifying physical habitat end point criteria to determine the location of the first natural barrier. For large, medium, and small streams, end of SSBT use has occurred when any one of these criteria for falls or channel steepness have been met. Lack of livable space in upper segments of small streams can determine end of SSBT use when one criterion has been met in small valley bottom streams or when two criteria have been met in small non-valley bottom streams. See footnote 4 for definitions of valley bottom and non-valley bottom streams.

²Fall height is measured from the bed of the jump pool to the lip of the falls. Leap height is measured from the active channel height on the downstream end to the lip of the falls on the upstream end. Jump pool depth is measured from the deepest pool scour to the active channel height. Jump pool depth + Leap Height = Fall height. Falls with a leap height <4-feet (1.2-m) high are not considered natural barriers. Minimum jump pool depths are based on the leap height. A jump pool refers to the pool at the base of a waterfall where fish accelerate to acquire the necessary momentum to jump upwards and overcome the obstacle to continuing their upstream migration. See Figure 3 for a fall height measurement illustration.

³Pool depth at active channel height means the maximum pool depth from the deepest pool scour to the top of the active channel as delineated by observation of physical stream channel features including but not limited to high water mark scars, water-borne debris deposition, and permanent vegetation. Note that minimum pool depths are different for resting pools in gradient obstacles versus pools that define lack of livable space. In a gradient obstacle, the fish will only stay briefly in the pool so the water only needs to be deep enough to provide enough water for propulsion. In instances of livable space, fish live in the pool and have need for greater depth. There is also a difference in the pool depth criteria for small valley bottom streams versus non-valley bottom streams. A 6-inch (15-cm) pool in a stream with a valley bottom is adequate to support juvenile fish because the gradient and thus velocity are lower. In a non-valley bottom stream, higher velocity requires deeper pool depth to provide adequate velocity refuges. See footnote 4 for definitions of valley bottom versus non-valley bottom streams.

⁴The break between small valley bottom and non-valley bottom stream segments is determined by identifying the edge of the floodplain or the presence of any pronounced slope breaks with a corresponding increase in stream gradient such that it is greater than or equal to one percent ($\geq 1\%$).

- Small valley bottom stream channels have unconfined hillslopes, most often with an adjacent floodplain; are connected to low gradient streams at their mouth; and have a gradient that is less than one percent ($< 1\%$).
- Small non-valley bottom stream channels are associated with confined hillslopes adjacent to the stream and have a gradient greater than or equal to one percent ($\geq 1\%$).

⁵Livable space active channel width (ACW) protocol: Once ACW is observed to be < 2 feet (0.6 m), continue upstream and collect two additional ACW observations, one at 50 feet (15.2 m) and another one at 100 feet (30.5 m), from the original observation. If the average ACW of the three measurements is calculated to be < 2 feet (0.6 m), then the first observation would define the upstream end of livable space as defined by ACW. If the average ACW is > 2 feet (0.6 m), then continue upstream from the last measurement by repeating the process of taking two additional measurements until the average is < 2 feet (0.6 m).

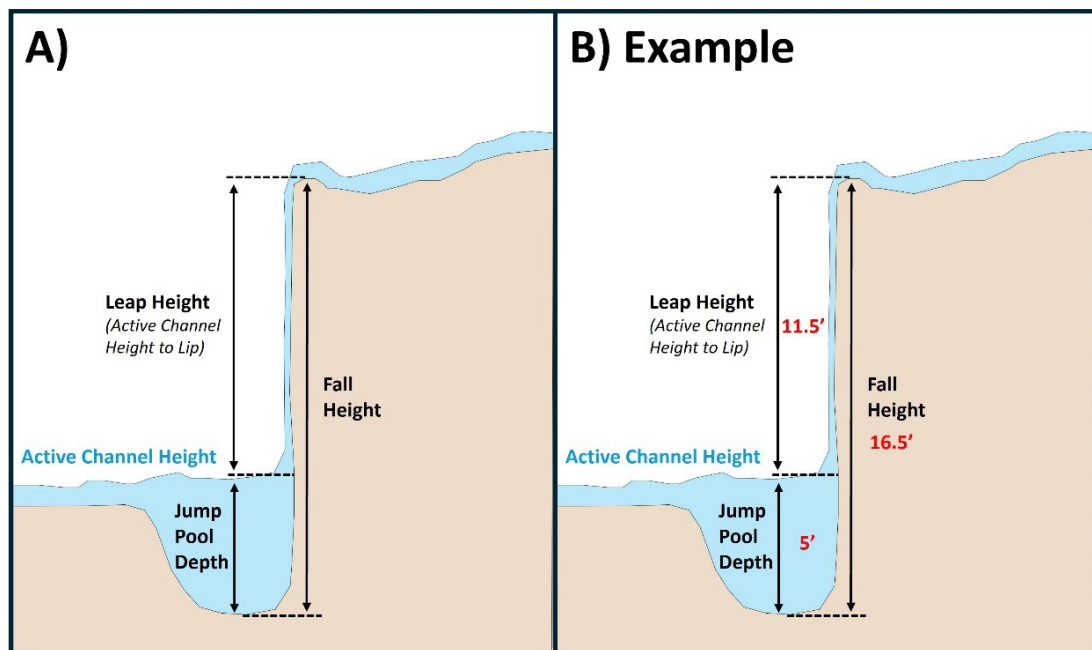


Figure 3. Illustration of how to measure fall height, leap height, and jump pool depth.

Resident Fish Use

Cutthroat trout, rainbow/redband trout, and other resident species use may extend farther upstream than SSBT use. In some streams, isolated populations of resident fish occur above a migration barrier such as a waterfall or other natural barrier that excludes SSBT species from going further upstream. In these cases, the physical habitat survey must continue upstream from the newly surveyed, definitive end of SSBT use by applying physical habitat end point criteria in Table 3 to determine the end of resident fish species use. The end of fish use (or the point at which no fish utilize the stream) is presumed to occur at an identified location where the physical habitat end point criteria for falls, channel gradient, or lack of livable space has been met for both SSBT and resident fish species. End of resident fish use is often farther upstream than the end of SSBT use, although occasionally these two locations are coincident or end of SSBT use may be higher than end of resident fish use in areas where SSBT seasonally use habitats above which resident trout reside.

Alternatively, if SSBT does not occur in the stream, a survey must be conducted to determine the end of resident fish species use. Natural barriers to resident fish species use comprise the same natural channel

features such as falls, channel gradient changes, or lack of livable space, but with different measurement criteria based on life-history traits of resident cutthroat trout and rainbow/redband trout. The location of the first natural barrier (i.e., falls, channel steepness, or lack of livable space) must be used to determine the end of use by applying the physical habitat end point criteria for resident fish in Table 3.

Table 3. Physical habitat criteria to determine end of resident fish use (excluding bull trout).

Physical Habitat Criteria Used to Determine End of Resident Fish Use (excluding Bull Trout)			
<i>Stream Size</i>	<i>Barrier Type</i>	<i>Physical Survey Criteria/Description</i>	<i>Criterion indicates barrier¹</i>
All streams	Falls ²	Leap height ≥ 5 -feet (1.5-m) high	yes
		Leap height 2 to < 5 feet (0.6 to < 1.5 m) and jump pool ² depth $<$ half the leap height at active channel height ³	yes
All streams	Channel Gradient	≥ 20 feet (6.1 m) of stream length with $\geq 20\%$ gradient with pools ≥ 6 -inches (10-cm) deep at active channel height ³	yes
		≥ 20 feet (6.1 m) of stream length with $\geq 12\%$ gradient without pools ≥ 6 -inches (10-cm) deep at active channel height ³	yes
Small valley bottom ⁴	Lack of livable space	No pools ≥ 6 -inches (15-cm) deep at active channel height for 300 feet (91.4 m) ³	yes
Small non-valley bottom ⁴	Lack of livable space	No pools > 12 inches (30 cm) at active channel height for 300 feet (91.4 m) ³	yes

¹End of resident fish use has occurred when any one of these criteria have been met.

²Fall height is measured from the bed of the jump pool to the lip of the falls. Leap height is measured from the active channel height on the downstream end to the lip of the falls on the upstream end. Jump pool depth is measured from the deepest pool scour to the top of the active channel height. Jump pool depth + Leap Height = Fall height. Falls with a leap height < 4 -feet (1.2-m) high are not considered natural barriers. Minimum jump pool depths are based on the leap height. A jump pool refers to the pool at the base of a waterfall where fish accelerate to acquire the necessary momentum to jump upwards and overcome the obstacle to continuing their upstream migration. See Figure 3 for a fall height measurement illustration.

³Pool depth at active channel height means the maximum pool depth from the deepest pool scour to the active channel as delineated by observation of physical stream channel features including but not limited to high water mark scars, water-borne debris deposition, and permanent vegetation. Note that minimum pool depths are different for resting pools in gradient obstacles versus pools that define lack of livable space. In a gradient obstacle, the fish will only stay briefly in the pool so the water only needs to be deep enough to provide enough water for propulsion. In instances of livable space, fish live in the pool and have need for greater depth. There is also a difference in the pool depth criteria for small valley bottom streams versus non-valley bottom streams. A 6-inch (15-cm) pool in a stream with a valley bottom is adequate to support juvenile fish because the gradient and thus velocity is lower. In a non-valley bottom stream, higher velocity requires deeper pool depth to provide adequate velocity refuges. See footnote 4 for definitions of valley bottom versus non-valley bottom streams.

⁴The break between small valley bottom and non-valley bottom stream segments is determined by identifying the edge of the floodplain or the presence of any pronounced slope breaks with a corresponding increase in stream gradient such that it is greater than or equal to one percent ($\geq 1\%$).

- Small valley bottom stream channels have unconfined hillslopes, most often with an adjacent floodplain; are connected to low gradient streams at their mouth; and have a gradient that is less than one percent ($< 1\%$).
- Small non-valley bottom stream channels are associated with confined hillslopes adjacent to the stream and have a gradient greater than or equal to one percent ($\geq 1\%$).

E-fishing Survey Considerations for Resident Fish Use *(Note: a stand-alone e-fishing survey cannot be used to determine SSBT use).*

Traditionally, e-fishing was a widely used approach to delineate the upstream extent of resident fish in streams because it allows for the detection of fish in real-time and provides the exact time and place that a fish is captured. More recently, e-fishing has often been used in combination with an examination of habitat features in the stream to determine fish use. With training that provides both proper electrofisher operation and hands-on field experience, e-fishing is an acceptable method under suitable survey conditions to determine the upstream extent of resident fish or to determine if a stream is absent of resident fish. All e-fishing surveys must be conducted in accordance with NOAA Fisheries (2000) e-fishing guidelines and any updates to those procedures. Careful attention to e-fishing technique minimizes risks to individual fish and reduces the likelihood of long-term demographic impacts. *(Note: see e-fishing survey guidelines in APPENDIX E).*

Incorporating e-fishing with a physical habitat survey is the most effective method for determining resident fish use and habitat distribution, especially in the following situations:

- Large or medium streams above natural barriers. These streams potentially support extensive amounts of suitable fish habitat above the barrier and verification/confirmation of either the presence or absence of resident fish species upstream of the barrier is necessary. Isolated populations of resident fish species may occur upstream of a barrier (e.g., falls or channel steepness) that exceeds the physical habitat end point criteria for SSBT, especially in medium or large streams where there are extensive lengths (>300 feet [91.4 m]) of suitable habitat above the barrier or small streams with low gradient (<5% slope) that have extensive amounts of moderate to high quality habitat. In these situations, e-fishing is recommended to be used in conjunction with a physical habitat survey. *(Note: suitable/high quality habitat is considered to have at least 5 pools, >12 inches [30 cm] deep within those 300 feet [91.4 m] during the recommended survey timing).*
- Small streams with low gradient (e.g., <5% slope) in conjunction with long segments of moderate to high quality habitat, especially where riparian vegetation and/or instream cover impedes/obstructs the ability to walk in the stream channel. In these situations, it is difficult to properly assess stream habitat conditions and natural barriers to fish use such as lack of livable space. E-fishing can improve accuracy in assessing fish use in low-gradient stream segments, which have a higher potential to support resident fish species.
- Streams above barriers which have geomorphologic features or potential alternate passage routes connecting to downstream habitat that are unclear, and where there is also an extensive amount of suitable fish habitat above the barrier. In these situations, the detection of the presence/absence of fish with an electrofisher can help validate whether the barrier blocks fish use above that point.
- Stream segments where a survey is limited to a specific parcel of land because of access restrictions upstream and/or downstream or when the survey must be completed in a downstream direction (rather than in a typical upstream direction) from a starting point where fish use is unknown. In these situations, e-fishing can provide additional assurance of fish presence/absence in the stream segments that were surveyed.

E-fishing only surveys have inherent limitations, so they can only be used as a stand-alone method under certain circumstances and cannot be used to determine SSBT use. E-fishing only surveys rely on fish being present and seen during the survey, which is not always possible. Fish migrate to different parts of a stream

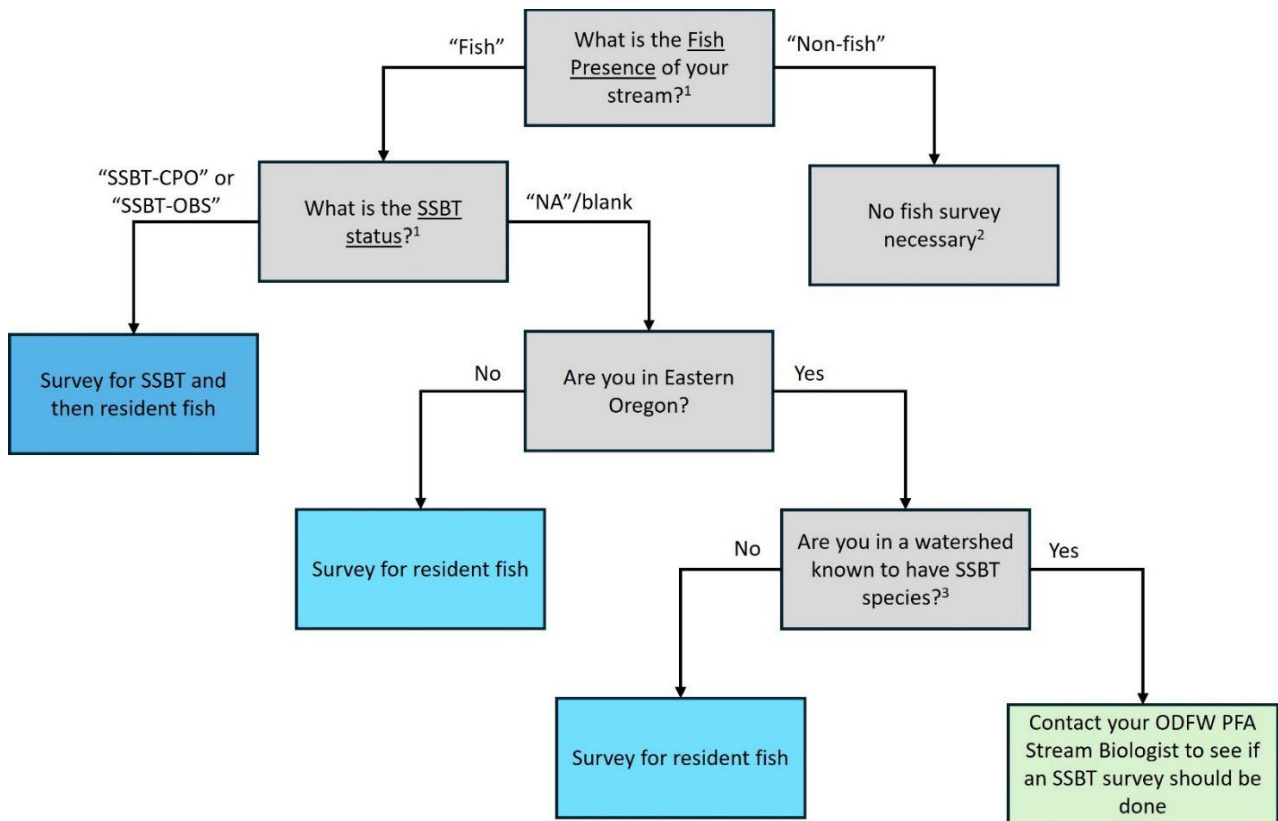
system depending on the time of year, environmental factors (e.g., droughts), and other disturbances (e.g., debris torrents) can temporarily compress fish distribution over one or more years. E-fishing survey effectiveness can be compromised by dense or impenetrable riparian vegetation as well as extremes (both low and high) in stream flow, turbidity, conductivity, and water temperature (see NOAA Fisheries (2000) and e-fishing equipment manufacturers guidelines).

Planning and Conducting a Survey

➤ Determine if a survey is needed to correct or verify SSBT and/or resident fish use in the ODF Hydrography Flow Line data

If landowners, operators, and others determine a potential need for a survey, they should initially perform an office-based review to confirm whether a survey is needed to either correct or verify fish use published in the [ODF Hydrography Flow Line](#) data. The ODF Hydrography Flow Line data includes a synthetic stream model for the entire state, with relevant attributes (i.e., fields) indicating fish presence, flow permanence, and other attributes identified as required for use in implementing the FPA rules.

Surveyors should review the fish use and stream classification information published in the ODF Hydrography Flow Line data (Figure 4). SSBT species occur statewide in Oregon. Therefore, surveyors should consider whether SSBT use is known to occur in a stream when planning a survey. SSBT streams have been identified in the ODF Hydrography Flow Line data, but only in western Oregon. SSBT streams in eastern Oregon have not been identified in the ODF Hydrography Flow Line data. Notwithstanding, SSBT species should also be considered when conducting surveys in eastern Oregon. If planning a field survey in areas of eastern Oregon that are known to have SSBT species (i.e., Deschutes, Grande Ronde, Hood River, Imnaha, John Day, Klamath, Malheur, Pine Creek, Powder, Umatilla, and Walla Walla watersheds), field surveyors should contact the appropriate [ODFW PFA Stream Biologist](#) for more information and assistance related to identifying the known extent of SSBT use relative to the proposed stream segment(s) to be surveyed.



¹Consult the “Fish Presence” and “SSBT status” stream attributes (i.e., field) in the [ODF Hydrography Flow Line](#) data.

Underlined words represent the attribute name and words in quotes represent the “associated attribute value” in the ODF Hydrography Flow Line data. “SSBT-CPO” = SSBT status based on a concurrence of professional opinion. “SSBT-OBS” = SSBT status based on observed SSBT fish presence. “NA”/blank = no data are available regarding SSBT status or SSBT status was not designated (e.g., in eastern Oregon).

²If fish are observed in a stream classified as “non-fish”, surveyors must conduct a survey to determine the end of fish use.

³Watersheds in eastern Oregon known to have SSBT species are the Deschutes, Grande Ronde, Hood River, Imnaha, John Day, Klamath, Malheur, Pine Creek, Powder, Umatilla, and Walla Walla watersheds.

Figure 4. Flowchart to determine whether to survey for SSBT and/or resident fish based on the fish use information and stream classification published in the [ODF Hydrography Flow Line](#) data. Field investigators may voluntarily survey for the end of SSBT use in accordance with the conditions and circumstances described in this manual.

The upper extent of SSBT use in western Oregon, as identified in the ODF Hydrography Flow Line data, may not represent locations that are the definitive end of SSBT use in a stream. This is because ODFW surveys used in the authoritative ODF Hydrography Flow Line data were done to monitor and assess the status of anadromous salmonid populations rather than to identify the definitive upper extent of each species’ habitat in a stream. Thus, in the absence of information that indicates a definitive end of SSBT use (e.g., natural barrier that completely blocks SSBT movement upstream), surveys to determine the upstream extent of SSBT use may be warranted.

Notwithstanding the published fish distribution model, landowners, operators, and others may decide to do surveys to correct modeled fish distribution or verify the designation of fish use in a stream. To determine if a survey is needed to correct or verify fish use in the ODF Hydrography Flow Line data, surveyors should address the following questions:

- Do you disagree with existing survey results or modeled fish use?
- Do you want to correct or verify the modeled or surveyed data?

If you answered “no” to the questions above, **a fish survey is not needed, and no further action is necessary**. If you answered “yes” to either question above, **a survey for fish use can be completed** to revise the extent of Type F and/or Type SSBT stream segments in the ODF Hydrography Flow Line data using the methodology in this manual.

➤ Determine survey start location based on the extent of the survey

There are two primary purposes for which surveys might be conducted: 1) to correct or verify fish use within an operation-specific area or 2) to determine the upstream distribution of fish use in a stream or watershed. Both are acceptable for identifying end of fish use; however, upstream distribution surveys provide a more complete understanding of fish use within a watershed. Surveyors can choose the extent to which they survey based on their operational needs and long-term goals for verifying fish use on their land ownership as well as their resource capacity.

1. Operation-specific survey

Operation-specific surveys are those intended to determine fish use and classify a segment of stream as “fish” or “non-fish” only in the immediate area of a proposed forest operation. End of fish use may not always be identified when confined to an operation-specific survey area. This type of survey takes minimal planning and coordination but may be of limited use based on the objectives and long-term needs of the landowner and future forest activities.

2. Upstream distribution survey

Upstream distribution surveys are intended to determine the end of fish use in a stream regardless of any proposed forest operation. Upstream distribution surveys may encompass an entire or more than one ownership, as well as one or more streams within a watershed. The specific locations of planned forest operations are usually not the main factor in this kind of survey. Field assessments designed to determine the end of fish use in association with upstream distribution surveys may take more planning than operation-specific surveys, but overall, this approach is likely to be the most efficient and cost-effective for long-range planning of forest operations that may occur over a larger geographical area.

After deciding the extent of the survey, identify the location where the survey will begin (Figure 5). It is recommended to start the survey as close to the confluence of a known fish stream or at the most upstream point of known fish use; however, land ownership boundaries may prevent surveyors from being able to start at one of these locations. Regardless of the survey start, identify the fish use and stream classifications at the intended start location based on the [ODF Hydrography Flow Line](#) data. If starting the survey within a stream segment designated as Type SSBT, the surveyor must survey for end of SSBT use (if intending to change the end of SSBT use location) prior to surveying for end of resident fish use.

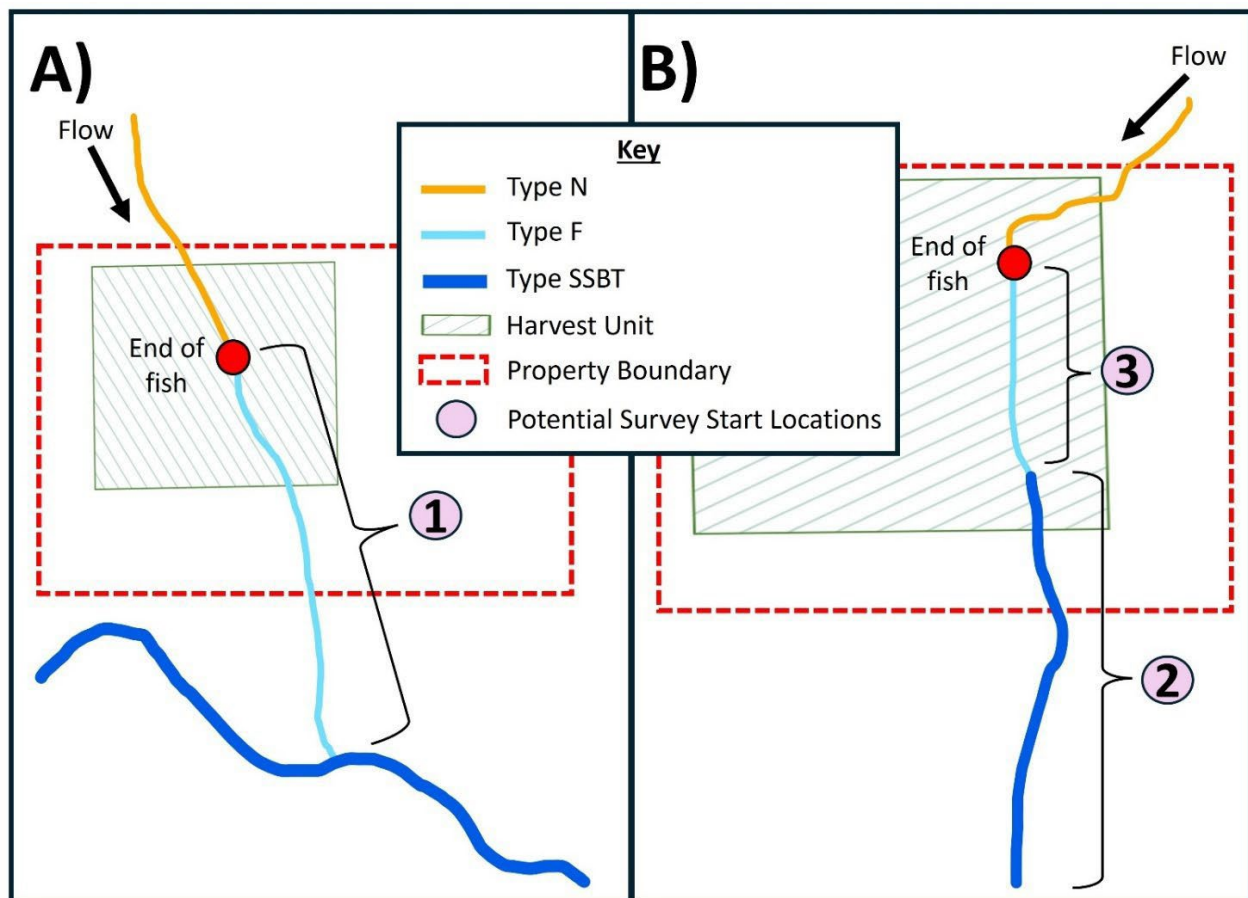


Figure 5. Potential survey areas and species to be considered within those areas when evaluating a fish stream that: A) is a tributary that flows directly into a known SSBT stream or B) has known SSBT use downstream on the same channel. This is an example of stream classification (prior to surveying) based on modeled or surveyed results as published in the [ODF Hydrography Flow Line](#) data. Field investigators have discretion to choose where to initiate their survey as follows:

1. If starting within Type F, survey for end of resident fish use.
2. If starting within Type SSBT, survey for end of SSBT use and then survey for end of resident fish use.
3. If starting anywhere upstream of Type SSBT, survey for end of resident fish use.

(Note: Surveyors may voluntarily survey for end of SSBT if starting the survey at the transition between SSBT and resident fish use classification if they believe the modeled data is inaccurate and intend to change the location of the end of SSBT use in the authoritative ODF Hydrography Flow Line data).

➤ Determine survey method based on whether SSBT and/or resident fish use occurs in the stream

The accuracy and reliability of survey results depend greatly on the methods used to conduct the survey. It is essential to use survey methods that provide accurate, reliable results and that are also cost-effective and time efficient. Surveyors need to consider many factors, including those summarized in Figure 6, when deciding whether to use physical habitat and/or e-fishing survey method(s) to determine fish use and the extent of suitable and accessible habitat.

Checklist to determine appropriate conditions for each survey method:

- **Physical Habitat Only**
 - ✓ Anytime under any conditions for any species. This is the only method for SSBT.
- **Physical Habitat with E-fishing**
 - ✓ Anytime under any conditions for resident fish¹, AND
 - ✓ You have the proper permits and training to use an electrofisher^{2,3}
- **E-fishing Only**
 - ✓ You are surveying for resident fish use only¹,
 - ✓ You have the proper permits and training to use an electrofisher²,
 - ✓ You are within the recommended timeframe to electrofish⁴,
 - ✓ Fish use does not end at an artificial barrier⁵, AND
 - ✓ Environmental conditions are suitable for e-fishing⁶

¹E-fishing cannot be used to determine end of SSBT.

²Permits may be required from multiple agencies and may include a Scientific Taking Permit and/or federal permit(s) for e-fishing in waters that contain federally listed Endangered Species Act species (see *Permit Requirements and APPENDIX C*). Training in e-fishing techniques and safety can be obtained from a manufacturer that offers a course (see *APPENDIX E*).

³E-fishing is being used to supplement the habitat survey with additional information on absence/presence of fish in these conditions.

⁴Recommended timing for an e-fishing only survey is March–May (western Oregon) or April–June (eastern Oregon) (Table 1).

⁵E-fishing only surveys can help validate that a species is present above an artificial barrier but cannot be used to determine that a species is absent. If fish movement upstream appears to be blocked by an artificial obstruction, surveys should go so far as the first natural barrier (Table 3) upstream from the artificial barrier.

⁶The stream should not be too turbid; flow, conductivity, and water temperature should all be moderate (not extremely high or low); and in-stream and stream-side vegetation should not be so dense as to prevent the surveyor from being able to navigate the stream or visually see fish while e-fishing (see *APPENDIX E*).

Figure 6. Checklist summarizing which survey method(s) can be used to determine end of SSBT and/or resident fish use in a stream. All conditions must be met for the survey method to be appropriate.

➤ Conduct survey to identify and document end of SSBT and/or resident fish use

For all survey methods, surveyors should walk upstream from a known point of fish use whenever possible, and surveyors should look for fish during the survey. An operation-specific survey is very simple to complete. Surveyors start at the downstream end of the operation area and move upstream either to the end of the operation area or to the end of fish use, whichever comes first. If the purpose of the operation-specific survey is to demonstrate that a stream segment is absent of fish within the operation

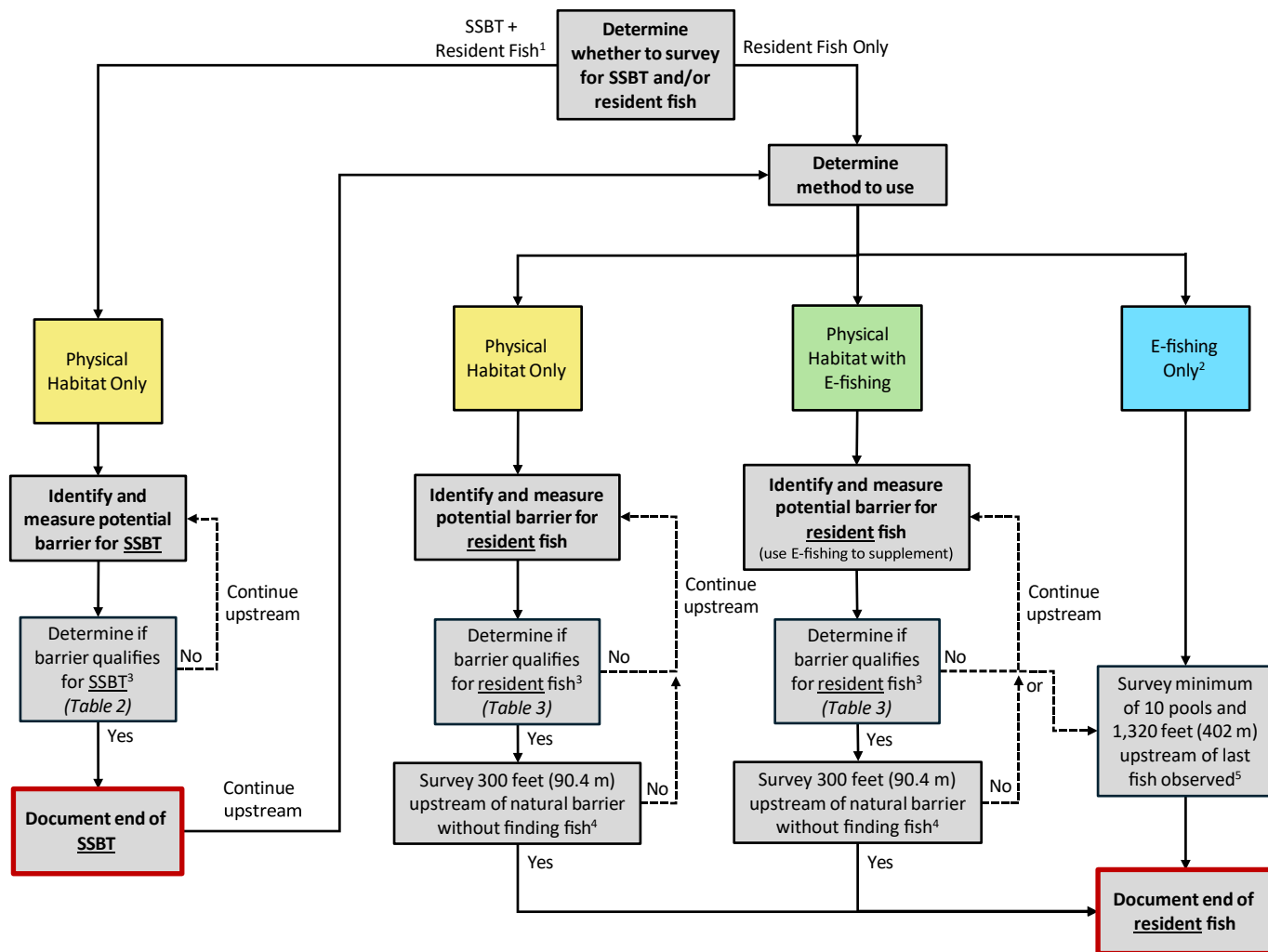
area, the surveyor must be sure to make at least the minimum effort required to find fish (described below).

Field assessments designed to determine end of fish use for upstream distribution surveys may take more planning than an operation-specific survey but are still relatively simple. First, obtain all available fish use information for the drainage basin in question. The authoritative stream mapping and classification information are available for viewing and download using the [ODF Hydrography Flow Line](#) data, which displays the current extent of fish use in streams. It may also help to know the watershed basin area. Fish distribution is correlated to watershed size and the ability of the watershed to provide sufficient water flow persistence and volume to meet the livable space criteria. In general, fish use is likely to occur in streams with watershed sizes greater than 60 acres in western Oregon and 350 acres in eastern Oregon. This information predicts where fish use is likely to end, which will help surveyors decide where to concentrate their surveys. After identifying likely survey areas, look at current road maps to find potential access points to the stream. Surveys finding the end of fish use for an entire stream or for multiple streams within a watershed (as opposed to operation-specific surveys) may require sampling across several land ownerships. Be certain to get permission from other landowners before beginning the survey.

Artificial barriers, such as culverts that block upstream fish movement, should be identified when using any of the three ODFW/ODF-approved survey methods because absence of fish use in the stream segment to be surveyed could be due to an artificial barrier rather than lack of suitable habitat. **Artificial barriers cannot be used to determine the end of fish use.** *(Note: surveyors should coordinate with their appropriate [ODFW PFA Stream Biologist](#) for more information and assistance related to fish passage barriers in their area).*

If a new definitive end of SSBT use is identified, a survey to determine the end of resident fish use may also be warranted. The end of resident fish use is often upstream of the end of SSBT use but can also be coincident with or lower than the end of SSBT use. The end of all fish use is determined when the physical habitat survey criteria for falls, channel gradient, or lack of livable space has been encountered for both SSBT (Table 2) and resident fish (Table 3). End of resident fish use can be identified without surveying for end of SSBT use if the surveyor wishes to start the survey at the end of SSBT use identified in the ODF Hydrography Flow Line data. Documentation of physical habitat conditions and/or fish observations should be noted on the Physical Habitat & Fish Use Survey Form. *(Note: see APPENDIX A for detailed instructions on how to fill out the form, APPENDIX B for the printable survey form and a filled-out example, APPENDIX F for a list of suggested survey equipment, and APPENDIX G for a gear disinfection protocol).*

In addition to these general strategies, there are a few differences in protocol depending on which survey method is used (i.e., physical habitat survey, physical habitat with e-fishing, or e-fishing only) (Figure 7), which are described below.



¹E-fishing cannot be used to determine end of SSBT.

²E-fishing only surveys can help validate that a species is present above an artificial barrier but cannot be used to determine that a species is absent.

³Qualifying natural barriers to SSBT or resident fish use include natural channel features such as falls, channel gradient changes, or lack of livable space, but with different measurement criteria based on life-history traits of the species being surveyed.

⁴Survey 300 feet (90.4 m) upstream of the last barrier to confirm that resident fish are not visually observed.

⁵E-fishing-only surveys require the surveyor to walk further than a physical habitat survey to validate the point that was presumed to be end of fish. The survey must include sampling a minimum of 10 pools and 1,320 feet (402 m) upstream of the last fish observed unless the surveyor first reaches the physical habitat end point criteria for resident fish (Table 3).

Figure 7. Flowchart illustrating how to conduct a fish survey. All surveys should be conducted from downstream to upstream.

Physical Habitat Only and Physical Habitat with E-fishing Surveys

The same survey methods are used for both physical habitat only and physical habitat with e-fishing surveys, but in the latter, e-fishing is incorporated to help surveyors verify the absence of fish upstream of a barrier. This combined method generates the most accurate data to determine the extent of fish use as opposed to using either a physical habitat or e-fishing survey alone (Table 1). Using an electrofisher greatly

increases the probability of seeing a fish if it is present. Most fish species are difficult to observe visually (especially in small stream channels with considerable instream and riparian cover) because of their habitat preferences, small size, and/or cryptic coloration.

The purpose of the physical habitat component of the fish survey is to locate natural stream channel features such as falls, channel steepness, or lack of livable space that may obstruct fish passage. Surveys should continue upstream until the first natural barrier to SSBT and/or resident fish use has been identified as follows:

1. If the [ODF Hydrography Flow Line](#) data classifies the stream reach to be surveyed as “Type SSBT” and the surveyor wants to correct or verify this designation, the surveyor must:
 - A. Identify a natural barrier that meets or exceeds the physical habitat end point criteria for falls, channel steepness, or lack of livable space for SSBT (Table 2); AND
 - B. Identify a natural barrier that also meets or exceeds the physical habitat end point criteria for falls, channel steepness, or lack of livable space for resident fish species (Table 3); (*Note: isolated populations of resident fish species often occupy habitat upstream of SSBT use. In these cases, a survey to determine end of resident fish use may also be warranted upstream from the newly identified end of SSBT if information is needed to correct fish use in the ODF authoritative Flow Line data. Occasionally, end of SSBT use and end of resident fish use are coincident or SSBT use extends further than resident fish use*); or
2. If the ODF Hydrography Flow Line data does not classify the stream reach to be surveyed as “Type SSBT” and the surveyor intends to correct or verify this designation, the survey must be conducted to determine the end of fish use by applying the physical habitat end point criteria for resident fish (Table 3) only.

When conducting a physical habitat only survey, the end of fish use occurs at an identified location where the physical habitat end point criteria for falls, channel gradient, or lack of livable space has been met for SSBT (Table 2) and/or resident fish species (Table 3). Waterfalls are a barrier to upstream fish movement if they are tall enough and/or lack sufficient jump pool depth to allow the fish to leap over it (Table 2, Table 3, and Figure 3). Channel gradients can also pose a barrier to upstream movement if they are steep enough for a long enough distance that the water velocity exceeds the swimming ability of the fish and/or if the water is not deep enough for the fish to maintain an upright position. Fish can navigate steeper gradients when there are pockets of pools in which the fish can rest in-between burst swimming (Table 2 and Table 3). Finally, lack of livable space due to lack of pools or inadequate water volume should be assessed in determining a natural barrier. Lack of livable space may be a barrier if there are no pools at least 6 inches (15 cm) deep at active channel height in small valley bottom streams or if there are no pools at least 12 inches (3 cm) deep at active channel height in small non-valley bottom streams for at least 300 feet (91.4 m) (Table 2 and Table 3).

The obstructions to the upstream movement of fish described above are natural barriers. Organic obstructions such as beaver dams, logjams, or wood accumulations are temporary/deformable and are not considered barriers. Surveyors should also note the location of artificial structures/barriers to fish movement. If fish movement upstream appears to be blocked by an artificial obstruction, surveys should continue upstream until the first natural barrier to SSBT and/or resident fish use has been identified using the physical habitat end point criteria (Table 2 and Table 3). **Fish use cannot end at an artificial obstruction.**

When conducting a physical habitat with e-fishing survey, the last observed fish may or may not be coincident with the end of fish use. In these situations, when the last observed fish is associated with a natural barrier, the end of fish use is at that location. However, if the last observed fish is not associated with a natural barrier, the end of fish use is upstream from that location at the first natural barrier to fish use, without respect to any artificial obstructions to fish passage.

When evaluating a potential natural barrier during a survey, the water flows expected during the recommended timeframe (March–May in western Oregon and April–June in eastern Oregon, Table 1) must be considered even if the survey is being conducted during other times of the year. Conditions for fish passage at a site during low summer or fall flows, for example, can be very different from what occurs during normal flows in early winter/early spring. Surveyors should look for physical stream channel features including but not limited to high water mark scars, water-borne debris deposition, and permanent vegetation to identify active channel height when evaluating potential natural barriers. These features are easiest to identify during the recommended survey timeframe but can also be identified year-round.

Surveyors must continue for at least 300 feet (91.4 m) above a falls, channel steepness, or lack of livable space barrier to verify that no fish are present. If a fish is observed, then the end of fish use has not been determined, and surveyors should continue looking for the next potential barrier. Fish and/or amphibians observed during the survey should be noted on the Physical Habitat and Fish Use Survey Form (*Note: see APPENDIX A for detailed instructions on how to fill out the form, and APPENDIX B for the printable survey form and a filled-out example*).

E-fishing Only Survey (*Note: a stand-alone e-fishing survey cannot be used to determine SSBT use*).

Carrying out effective e-fishing surveys using techniques that result in low risk to fish populations requires careful adherence to NOAA Fisheries (2000) e-fishing guidelines for ESA-listed fish and ODFW Scientific Taking Permit conditions. For those situations where an e-fishing only or stand-alone survey is used without a physical habitat survey component to determine the upstream extent of resident fish use or to prove a stream is absent of resident fish, e-fish upstream from a junction of a known fish-bearing stream or the uppermost point of known fish use, if possible.

E-fishing should only be performed in an upstream direction (i.e., starting downstream and moving upstream against the water flow). A backpack electrofisher introduces an electric current into the stream that temporarily immobilizes fish. Electrofishers must be used carefully to minimize injury or death to fish. Surveyors should quickly net the fish and move it to a bucket with aerated water before transferring it downstream. If captured fish or amphibians cannot be identified, close-up photos should be taken at multiple angles, and a description should be written on the datasheet.

When conducting an e-fishing only survey, the end of fish use is coincident with the last observed fish. In addition, a valid stand-alone or e-fishing only survey must include sampling 1,320 feet (402 m) of stream and a minimum of 10 pools, each at least 12 inches (30 cm) in depth, immediately upstream of the point where the last fish was sampled, unless the surveyor first reaches the physical habitat end point criteria for resident fish species (Table 3 and Figure 4), in which case the surveyor must sample an additional 300 feet (91.4 m) upstream of the physical end point criteria to ensure no fish are found. This additional survey distance is necessary to provide information to validate the point where fish use was presumed to end by

the e-fishing survey. Notwithstanding, if a fish is observed at any point upstream from the last fish sampled, the 1,320 feet (402 m) and minimum pool criteria (10 pools) start over again until sampling has occurred and there are no more observations of fish.

An e-fishing only survey is not appropriate to determine end of fish use in all circumstances. For example, additional survey work may be needed if the upper extent of fish use seems to be affected by an artificial barrier, such as a road culvert. If the stream above the culvert has no fish, electrofish the pool immediately below the culvert. If you find fish in this pool or downstream near the culvert, the culvert may be an artificial barrier to fish passage, which cannot be used to determine end of fish use. Describe the culvert and the stream on the survey form (*see APPENDIX A for instructions for completing the Physical Habitat & Fish Use Survey Form and APPENDIX B for the printable survey form and a filled-out example*). If fish movement upstream appears to be blocked by an artificial obstruction, surveys must continue upstream until the first natural barrier to resident fish use has been identified using the physical habitat end point criteria (Table 3).

➤ Submit survey results and supporting information to ODF for ODFW review

After the survey for fish use is completed, it is important that the survey data get incorporated into the authoritative [ODF Hydrography Flow Line](#) data. The ODF Hydrography Flow Line data includes a synthetic stream model for the state of Oregon, with attributes indicating fish use, flow permanence, and many other attributes identified as required by the ODF Forest Practices rules. This information will be continuously updated with fish and flow permanence survey data following established protocols and workflows developed by ODF and ODFW. Survey results and a completed Physical Habitat & Fish Use Survey Form with appropriate maps and data should be submitted to the ODF Stewardship Forester or State Forester representative. ODFW will have 21 days following submission to review and approve/disapprove surveys for fish use. Surveys for fish use approved by ODFW will be incorporated into the authoritative ODF Hydrography Flow Line data.

Document any stream segments that do not align with hardcopy or digital/GIS layers (i.e., ODF Hydrography Flow Line data). Recording the Global Positioning System (GPS) location of inconsistencies is important to determine the actual location of stream surveys regarding land ownership(s) and timber harvest unit boundaries. Efforts should be made in the field to reconcile the actual and mapped location of a segment which can then be used to correct errors in digital data layers back in the office.

In areas where the surveyor identifies a discrepancy between the authoritative ODF Hydrography Flow Line data and what is on the ground, document the requested change with sufficient information, including field-collected GPS points, and include it with the survey submission. Alternatively, contact the appropriate ODFW stream biologist for assistance. Point types provided on the survey map should include the start and end of the survey, end of SSBT use location, end of resident fish species use location, and tributary junctions. Additional survey points in 100–200-ft (30–61-m) intervals along the stream would help accurately relocate or add segments to the ODF Hydrography Flow Line data. The survey map should also show a clear depiction of the stream channel with a line connecting the field-collected GPS survey points. Segments to be relocated, added, or deleted should be symbolized as such, or clearly labeled. If the stream channel is not clearly visible on Oregon Department of Geology and Mineral Industries (DOGAMI) light detection and ranging (LiDAR) imagery, additional survey points may be required

to properly locate the stream. Additional written documentation on landscape features such as defined banks and stream beds are requested to be included in the survey.

Photos that illustrate stream characteristics, including barriers to fish passage and stream attributes that indicate a lack of livable space, are extremely useful for documenting site conditions. For each photo, enter a note on the survey form that includes a description of the photographed subject and GPS coordinates. Take time and effort with your photos and include a representation of scale in the photo whenever possible.

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Adult steelhead ascending waterfall on upstream migration to spawn.

APPENDIX A. Instructions for Completing the Physical Habitat & Fish Use Survey Form

Survey data should be recorded on the Physical Habitat & Fish Use Survey Form (*see APPENDIX B for a printable survey form and a filled-out example*). The survey form asks for information about the location of the stream; the methods, timing, and effort of the survey; the physical characteristics of the stream; observations of fish and wildlife; and the identification of natural or artificial barriers to fish passage. Take measurements of falls, gradients, and/or pool depths encountered and record all information on the datasheet. It is recommended that surveyors print this appendix to bring with them in the field until they are comfortable making measurements according to the survey protocol and they understand how to fill out the survey form.

The following data should be recorded on the Physical Habitat and Fish Use Survey Form. Complete one form for each stream reach where fish presence and habitat were observed or fish use ends. There are separate spaces on the survey form to denote end of SSBT use versus end of resident fish use. Fill out the appropriate section depending on which species were surveyed.

Survey Site Information

Stream Name: The name of the stream as reported on the [ODF Hydrography Flow Line](#) or USGS map for the area. If the stream is unnamed, report the stream as “unnamed” and list the tributary that it flows into (“Tributary to...”).

Downstream Creek: The name of the main stream (as reported on the ODF Hydrography Flow Line data) into which the surveyed stream flows. This is especially important if the surveyed stream is unnamed.

Start Coordinates: Record the beginning point of the survey in decimal degrees to at least 5 decimal places (e.g., 45.32461, -118.08772) or UTM coordinates (11N 414757m E 5019587m N).

End Coordinates: Record the end point of the survey in decimal degrees to at least 5 decimal places (e.g., 45.32461, -118.08772) or UTM coordinates (11N 414757m E 5019587m N).

End Location: A legal description (Township, Range, and Section) of the location where fish use ends (e.g., T10S R05W S22).

Water Temperature and Time: Indicate degrees Centigrade or Fahrenheit and the time temperature was recorded.

Water Clarity: Ability to visually observe submerged features such as individual pieces of substrate.

- Clear = Visibility is good in deep pools and fast water habitat types.
- Moderate = Visibility is good in shallow pools and low gradient fast water habitat.
- Turbid = Visibility is poor; habitat features are not visually apparent in any habitat units.

Flow: Description of observed discharge condition. Best observed in riffles. If a gauging station is present, be sure to record the stage height.

- Low = Surface water flowing across less than 75% of the active channel surface. Consider general indications of low flow conditions.
- Moderate = Surface water flowing across 75–90% of the active channel surface.
- High = Stream flowing across active channel surface but not above active channel height.

Weather: The weather during most of the survey.

Survey Date: The month, day, and year the survey was conducted (e.g., MM/DD/YYYY or YYYYMMDD).

Survey Start/End Time: The time the survey started and ended using 24-hour (e.g., 1100-1300) or 12-hour (e.g., 11:00 am – 1:00 pm) time.

Surveyor Name(s): First and last names of everyone responsible for conducting the survey and reporting results.

Surveyor Affiliation(s): The name of the agency/company that employs the surveyor(s) (if applicable).

Landowner Name: Name of the landowner of the segment surveyed.

Landowner Contact Info: The address, phone number, and/or email address of the landowner.

ODF District: Record the region that best describes the ODF region where the survey was conducted.

- Astoria
- Cascade (Mollalla, Lyons)
- Central Oregon (The Dalles, John Day, Prineville)
- Douglas (Roseburg)
- Forest Grove (Columbia City, Forest Grove)
- Klamath-Lake (Klamath Falls, Lakeview)
- Northeast Oregon (Pendleton, Baker City, LaGrande, Wallowa)
- South Cascade (Sweet Home, Springfield)
- Southwest Oregon (Grants Pass, Medford)
- Tillamook
- Western Lane (Veneta, Coos Bay)
- West Oregon (Philomath, Toledo, Dallas)

Basin (HUC 10): Use the name of the large river commonly used to describe a region. For example, use McKenzie River as the basin name when sampling Lookout Creek, not Willamette or Columbia.

ODF Stream Class Size: Record the stream size (small, medium, or large) from the ODF Hydrography Flow Line data for the stream reach to be surveyed.

Drainage Area (acres): Record the estimated drainage area contributing to the stream at the barrier feature. This is an office-based exercise. [StreamStats](#) is a good tool to calculate drainage area, although it reports the area in square miles, so it will need to be converted to acres.

End of SSBT and/or Resident Fish Use Documentation

Use this section to document the survey method and rationale for updating the end of fish use location on the [ODF Hydrography Flow Line](#) data. Data on side 2 of the collection sheet will correspond to the information designated in the boxes here. Surveyors only need to fill in the end of fish use table for the species surveyed (i.e., SSBT, resident fish, or both). One qualifying barrier is needed to justify end of SSBT or end of resident fish use, so only the corresponding barrier box needs to be completed (i.e., falls, channel gradient, or livable space) for SSBT and/or resident fish. Helpful reminders and terminology are included above the tables.

Survey method: Circle which survey method was used. Consult Figure 6 to ensure an appropriate survey method is being used for the location, conditions, and species being surveyed.

- **Physical Habitat Survey**

- Relies on identifying habitat features that are natural barriers for fish passage (see Table 2 and Table 3). These observations are supplemented by visually looking for fish to ensure no isolated populations of resident fish are seen above the qualifying barrier.
- This is the only method that can be used to determine end of SSBT use.
- Surveyor must sample 300 feet (90.4 m) upstream of the qualifying natural barrier without finding fish.
- **Physical Habitat with E-Fishing Survey**
 - Combines physical habitat survey methods with e-fishing to help verify fish are absent above a barrier.
 - This is the best method to determine end of fish use but cannot be used to determine SSBT use.
 - Surveyor must sample 300 feet (90.4 m) upstream of the qualifying natural barrier without finding fish.
- **E-Fishing Only Survey**
 - Uses e-fishing only (without respect to habitat conditions) to determine end of fish use. End of fish use corresponds with the location of the last observed fish.
 - This method cannot be used to determine SSBT use.
 - Surveyors must sample a minimum of 10 pools (at least 12 inches (30 cm) deep at active channel height) and 1,320 feet (402 m) upstream of the last observed fish unless the surveyor first reaches the physical habitat stopping criteria for resident fish species.

If a confirmed end of fish use call is made, the numeric entries for either Falls, Channel Gradient, or Livable Space must meet or exceed the criteria for SSBT (Table 2) and/or resident fish (Table 3). Make sure to circle what units of measurement are being used (i.e., feet or meters). Complete the appropriate box as follows:

- **Falls**
 - Jump pool depth: Measured from the deepest pool scour immediately downstream of the falls to the active channel height.
 - Leap height: The vertical distance between the active channel height on the downstream side of the falls and the lip of the falls on the upstream end.
- **Channel Gradient**
 - Length: Measured stream length of the barrier.
 - Gradient: Measured gradient of the barrier, in percent (*see Illustrated Guide to Measuring Channel Metrics for tips on using a clinometer*).
 - Pools: Use a checkmark to indicate whether pools ≥ 6 -inches (15-cm) deep at active channel height were present within the stream segment being considered a gradient barrier. If pools are present in which fish can rest, they can navigate the gradient for longer distances before the gradient becomes a barrier.
- **Livable Space**
 - The criteria for end of SSBT/resident fish use varies based on valley type. First identify which valley type you are surveying, then determine whether the habitat features present are identified as a barrier to the species being surveyed. Use a checkmark to indicate which conditions are present. A checkmark indicates that the condition is true and suggests a barrier may be present.
 - Valley type:

- Valley bottom streams have unconfined hillslopes, most often with an adjacent floodplain; are connected to low gradient streams at their mouth; and have a gradient that is less than one percent (<1%).
- Non-valley bottom streams have confined hillslopes adjacent to the stream and have a gradient greater than or equal to one percent (≥1%).
- For end of SSBT use:
 - In valley bottom streams there should be no pool(s) ≥6-inches (15-cm) deep at active channel height for at least 300 feet (91.4 m).
 - In non-valley bottom streams at least 2 of the 3 criteria below must be met. Use a checkmark to indicate which conditions apply.
 - No pool(s) >12-inches (30-cm) deep at active channel height for at least 300 feet (91.4 m).
 - The average active channel width is <2 feet (0.6 m) for 100 feet (30.5 m) which is measured by averaging three widths (the first measurement is taken at the first location that is <2 feet, the second 50 feet (15.2 m) upstream, and the third 100 feet (30.5 m) upstream of the initial observation).
 - The stream gradient is >10% for ≥30 feet (9.1 m).
- For end of Resident Fish use:
 - In valley bottom streams there should be no pool(s) ≥6-inches (15-cm) deep at active channel height for at least 300 feet (91.4 m).
 - In non-valley bottom streams there should be no pool(s) >12-inches (30-cm) deep at active channel height for at least 300 feet (91.4 m).

Habitat Conditions at End of Fish Use: Provide supplemental information to describe the physical habitat conditions 300 feet (91.4 m) immediately upstream and 300 feet (91.4 m) immediately downstream of the end of fish use coordinates.

End of Fish Use Coordinates: Record the coordinates of the feature which established end of fish use in decimal degrees to at least 5 decimal places (e.g., 45.32461, -118.08772) or UTM coordinates (11N 414757m E 5019587m N).

Total Distance Surveyed: Total stream distance surveyed. Measured from the survey start coordinates to the survey end coordinates. *(Note: Surveyors must sample at least 300 feet (91.4 m) upstream of a qualifying barrier when using Physical Habitat or Physical Habitat with E-Fishing methods or 1,320 feet (402 m) upstream of a qualifying barrier when using E-Fishing Only; therefore, the survey end coordinates will be upstream from the end of fish use coordinates).*

Fish Observations

Fish Species: List fish species observed during the survey. Use the fish abbreviations below or spell out the name of the species if it is not included in this list:

- SSBT species:
 - Bull Trout (BULL)
 - Chinook (CHIN)
 - Coho (COHO)
 - Steelhead (STHD)
- Resident Fish species:

- Brook trout (BRTR)
- Cutthroat trout (CUTT)
- Lamprey (LAMP)
- Redband/rainbow trout (RBTR)
- Unknown (UNK) species (*Note: Take pictures of any species for which the identification is uncertain*).

Number of Fish: The total number of fish netted for each species.

Fish Length: Measure fork length (tip of the snout to fork of the tail) for all salmonids and the total length (tip of the snout to end of the tail) for all other species.

Last Observed Fish: Indicate whether the fish being recorded in that row was the most upstream fish observed on the survey. Fill out “Y” for yes or “N” for no for each row on the datasheet (*Note: if multiple rows of data are entered, only the last row should be marked as “Y”*). Include GPS coordinates for the last observed fish. If doing an e-fishing only survey, these coordinates will match the end of fish use coordinates. If doing a physical habitat survey or a physical habitat with e-fishing survey, these coordinates will either be downstream of or coincident with the end of fish use location.

Notes: Any pertinent information. Be descriptive. Take photos as needed. Include GPS coordinates for the last observed fish.

Aquatic Wildlife

Species: List the amphibian species and other aquatic wildlife species observed during the survey. Given that several species of amphibians will be covered by the PFA Habitat Conservation Plan (HCP), it would be helpful to include occurrence of these species to refine the species range and identify habitat associations. Use the 4-letter abbreviation below to document any HCP species observed or record the full name of the species if it is not listed (e.g., beaver). The covered amphibian species in the HCP include:

- Columbia torrent salamander (COTS)
- Southern torrent salamander (SOTS)
- Coastal giant salamander (COGS)
- Cope’s giant salamander (COPE)
- Coastal tailed frog (COTF).

Number: The total number of aquatic wildlife of each species or group.

Photo Number: Take photos to aid with species identification and record the identifying photo name/number here.

Notes: Any pertinent information. Be descriptive, such as “beaver dam” or “fresh beaver chewed sticks”.

Potential Barrier Data

Use this table to document any potential and/or qualifying barriers found while surveying. Since surveyors do not know if a feature is the end of fish use location until after they continue upstream to verify no fish are observed, this section can be used to document all questionable features as they are encountered to minimize the number of times the surveyor needs to backtrack to collect data. Even if fish are found upstream of the recorded feature, it is more efficient to record extra data that does not end up denoting the end of fish barrier as these data help the ODFW survey reviewer understand the overall habitat conditions of the survey reach.

This section can also be used to document any artificial structures that may restrict fish movement (e.g., culverts). Although these artificial structures do not indicate end of fish use, documenting them can help inform why fish may not have been observed upstream of that location and/or flags them to be considered for future maintenance/replacement to meet fish passage criteria.

Remember to circle what units were used in this section. Fill out the applicable columns based on the potential barrier type (not all columns will need to be filled out for each barrier type).

Natural or Artificial: Indicate whether the potential barrier is natural (“N”) or artificial (“A”). While only natural barriers indicate end of fish use, artificial barriers are useful to track.

Type: Record the type of barrier. Either spell out the full word or use the abbreviation given in parentheses. (*Note: barriers with an asterisk (*) do not denote end of fish use*):

- Falls
- Channel steepness (STEEP)
- Lack of livable space (LOL)
- Culvert*
- Weir*
- Dam*

Length: Measure the length of the feature.

Height: Measure the height from the active channel height on the downstream end to the lip of the feature on the upstream end.

Slope: Gradient of water surface in the stream segment. Expressed as the percent change in elevation over the length of the unit and estimated with a clinometer using the scale on the right side in the viewfinder.

- Clinometer measurements can vary considerably because of instrument resolution and variability between users (*see Illustrated Guide to Measuring Channel Metrics for tips on using a clinometer*). Measured gradient should meet or exceed criteria (Table 2 and/or Table 3).
- Be sure the pathway traveled by water flow is not substantially different from clinometer sightline.
- *Tip:* You can tie a piece of flagging at eye level on a branch or shrub, walk up or down the stream channel, and then use the clinometer to sight on the flagging while you are standing in the channel.
- Read and report the percent gradient.

Pool Depth at ACH: If a pool is present, record the depth at active channel height which is measured as the vertical distance from the deepest pool scour to the top of the active channel as delineated by observation of physical stream channel features including but not limited to high water mark scars, water borne debris deposition, and permanent vegetation.

Photo(s): Take at least three photographs of the barrier that show scale. Record the identifiable name/number of the photo here.

Notes: Record information regarding the barrier, including GPS coordinates in decimal degrees to at least 5 decimal places (e.g., 45.32461, -118.08772) or UTM coordinates (11N 414757m E 5019587m N) as well as the material, estimated height, estimated width, age, and condition of the feature.

Physical Habitat Data

Use this table to document the pool versus non-pool habitat conditions of the stream channel. This section is especially useful when changing the end of fish use location due to lack of livable space or when using e-fishing as either a stand-alone or supplemental survey method. Streams typically alternate between pool and non-pool segments. Remember to circle what units were used in this section.

Pool/non-pool: Indicate whether the habitat is pool ("P") or non-pool ("NP"; i.e., fast water, channel steepness with and without pool pockets, steps, or culverts) habitat.

ACH or Pool Depth at ACH:

- For non-pool segments: Record the active channel height as the vertical distance from the average level of the streambed to the top of the active channel as delineated by observation of physical stream channel features including but not limited to high water mark scars, water borne debris deposition, and permanent vegetation. Determined by averaging 3 equally spaced measurements across the active channel in non-pool habitat or at the pool tail crest.
- For pools: Record the depth at active channel height, which is the vertical distance from the deepest pool scour to the top of the active channel as delineated by observation of physical stream channel features including but not limited to high water mark scars, water borne debris deposition, and permanent vegetation.

Average Active Channel Width: The average distance across the channel segment at active channel height. Sum the width of all active channels in situations where multiple channels go around an island (i.e., a piece of land that is above active channel height). In situations where the stream flows along multiple paths within a wide channel, but there are no features that rise above active channel height (e.g., streamflow that is separated into multiple flow paths due to gravel bars), active channel width should be measured continuously from the active channel height on one bank to the other.

Wetted Width: The average wetted width of the channel segment at the time of the survey.

Length: The stream length of the habitat feature measured along the middle of the channel (i.e., the thalweg).

Cumulative Survey Distance: Sum of all the stream length measurements. This field is used to keep track of the total survey distance and distance surveyed above a barrier or last observed fish.

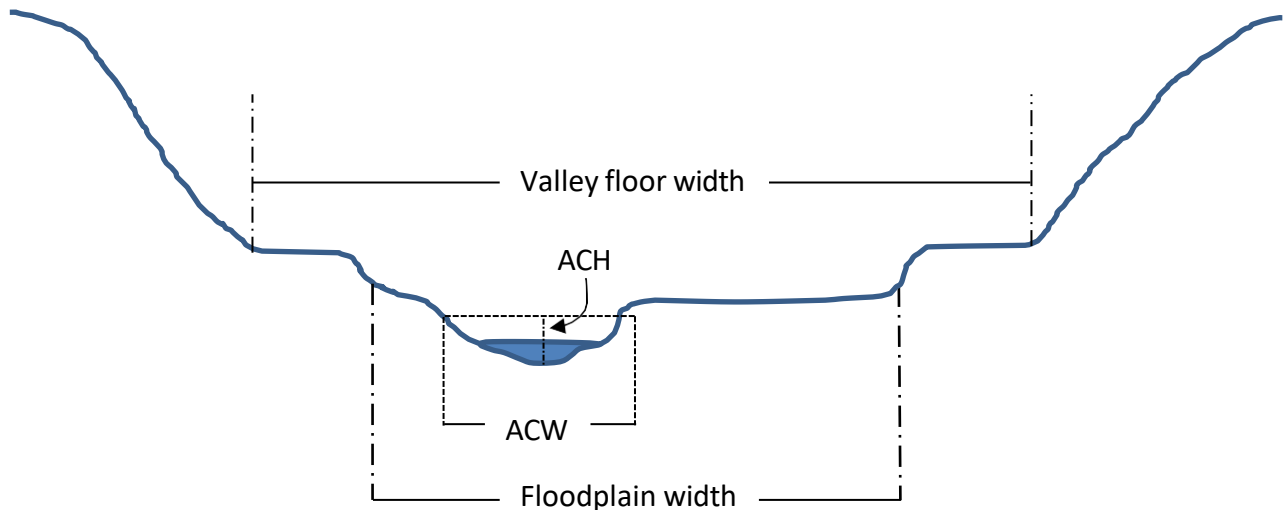
Notes: Any pertinent additional information or items of interest. Be descriptive. Record GPS coordinates in decimal degrees to at least 5 decimal places (e.g., 45.32461, -118.08772) or UTM coordinates (11N 414757m E 5019587m N). Observations may include descriptions of channel structure, names of roads or tributaries, step heights, non-native vegetation, beaver activity, stream or tributary temperature, etc.

Measuring Channel Metrics

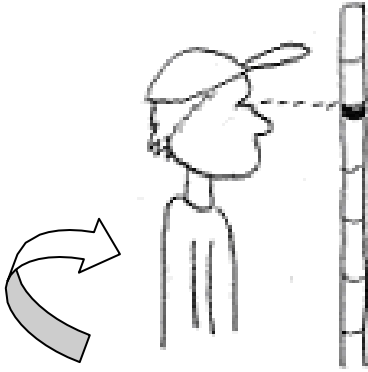
The following are referred to collectively as “Channel Metrics”. The active channel is the foundation for building these measurements. Refer to the Illustrated Channel Metric Measuring Guide for detailed instructions for measuring these values in the field. Be as accurate as possible when identifying features 1 and 2 below.

The active channel is the stage associated with the flow that fills the channel to the top of its banks at a point where the water begins to overflow onto a floodplain (Leopold et al. 1964). This flow is associated with a momentary maximum flow with an average recurrence interval of 1.5 years as determined using a flood frequency analysis. This stage corresponds to the discharge at which channel maintenance is the most effective (e.g., sediment moves and forms, removes, or reshapes bars, bends, and meanders) resulting in the average morphologic characteristics of channels.

1. **Active Channel Height (ACH).** The vertical distance from the average level of the streambed to the top of the active channel. The boundary of the active channel can be difficult to determine; use changes in vegetation, slope breaks, a change in particle size on the stream bank, top of deposited bedload (gravel bars), or high-water marks as clues.
2. **Active Channel Width (ACW).** The distance across the channel at active channel height.
3. **Valley Width.** Width of the valley floor from the toe of the hillslope on one side to the toe of the hillslope on the other.
4. **Floodplain Width.** The width of the active channel plus the widths of the left and right bank floodplains.



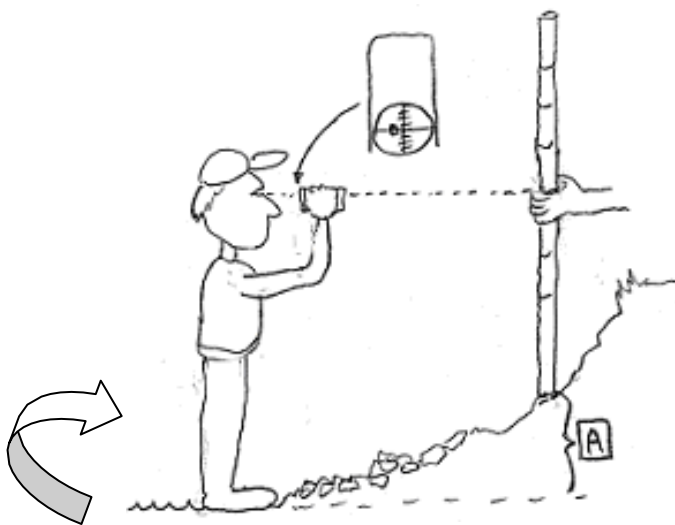
Illustrated Guide to Measuring Channel Metrics



Step 1: Clinometer (CLINO) identifies his eye height on the depth staff.

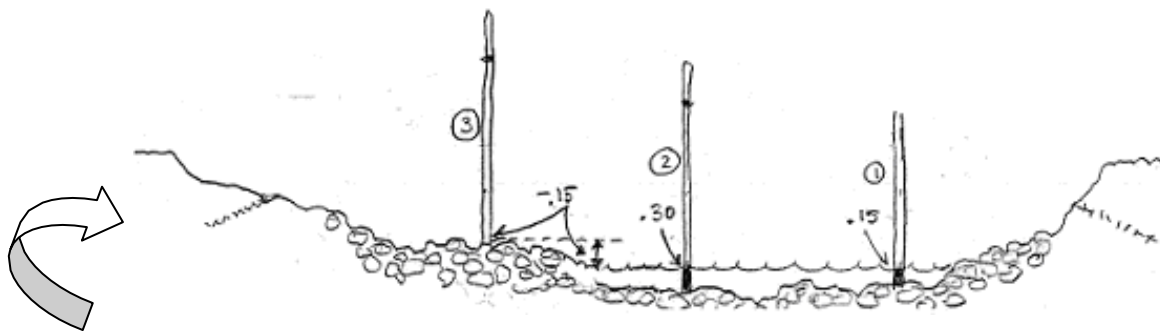


Step 2: CLINO and survey partner (TAPE) discuss and agree on the active channel scour or margin on either side of the stream. **NOTE:** Channel metrics are to be conducted at the pool tail crest or at the top or bottom of a fast water unit type.



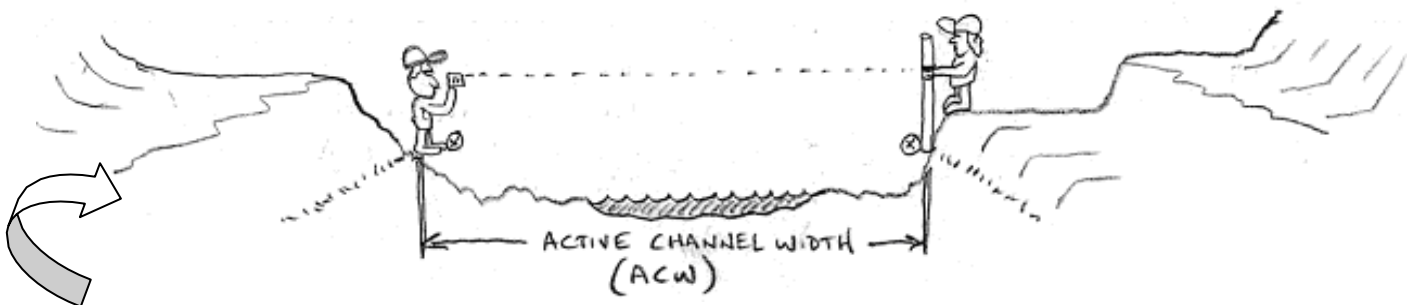
Step 3: TAPE places depth staff at top of the active channel. CLINO stands at the water surface. TAPE slides her hand down the depth staff until CLINO sees the hand come into view while keeping the clinometer on 0% slope.

Step 4: Subtract the height where CLINO saw the hand on the depth staff (Step 3) from the eye height established in Step 1. This is the height above the water surface (A in Step 3).



Step 5: CLINO takes the end of the tape measure and starts across the channel while TAPE stays at the active channel margin. CLINO takes 3 depth measurements at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ distance of the active channel width while crossing the channel (the measurements are usually the water depth but occasionally can be an exposed gravel bar above the water surface - thus a negative value).

Step 6: Take the average of the three measurements. The example in Step 5 has the measurements 6 inches (15 cm), 12 inches (30 cm), and -6 inches (-15 cm). Average = 4 inches (10 cm). Add this value to the measurement "A" obtained in Step 3. This sum is the **Active Channel Height (ACH)**.



Step 7: TAPE repositions her hand at CLINO's eye height on the depth staff. On the other side of the stream, CLINO backs up the bank until his eye is level with TAPE's hand on the depth staff (using the clinometer at 0% slope). CLINO has now established the active channel margin on the other bank. The distance between CLINO and TAPE is the **Active Channel Width (ACW)** as x depicts above.

Culvert Crossing Examples

For all culverts encountered during a survey, record as much information as you can name in the notes section of the “Potential Barrier Data” table, such as the GPS location, length, diameter, material, shape/type of culvert (e.g., round, arch, box), and road name. Photograph any culvert that is a potential fish barrier. If possible, have a depth staff or person in the photo to reference the step height. Record the height from the lip of the culvert to the active channel if the culvert is perched (e.g., A below) or write “no drop” if the culvert is embedded in the stream (e.g., B below) or has a natural stream bottom (e.g., C below).



A. Perched culvert, as evident by the water drop.

Culvert crossing



B. Non-perched culvert. Note that the culvert is embedded so the stream flows through without a major change in streambed elevation.



C. Open-bottom arch culvert.

APPENDIX B. Physical Habitat & Fish Use Survey Form

[See next page for printable survey form]



SURVEYING FOREST STREAMS FOR FISH USE - PHYSICAL HABITAT & FISH USE SURVEY FORM

(See detailed instructions in Appendix A)



Stream Name: _____ Survey Date: _____ Survey Start/End Time: _____
Downstream Creek: _____ Surveyor Name(s): _____
Start coordinates: _____ Surveyor Affiliation(s): _____
End coordinates: _____ Landowner Name: _____
End Location: T _____ R _____ S _____ Landowner Contact Info: _____
Water Temperature (circle °C or °F) and Time: _____ ODF District: _____
Water Clarity: _____ Flow: _____ Basin (HUC 10): _____
Weather: _____ ODF Stream Class Size: _____ Drainage area (acres): _____

SSBT: If a stream is *classified as SSBT* in the ODF Hydrography Flow Line data, conduct a physical habitat survey to determine the end of SSBT use using the physical habitat criteria in Table 2; then, determine the end of resident fish use using physical habitat criteria in Table 3.

Non-SSBT: If a stream is *not classified as SSBT* in the ODF Hydrography Flow Line data, conduct a physical habitat survey (with or without e-fishing) to determine the end of resident fish use using the physical habitat criteria in Table 3 and/or the e-fishing only survey methodology.

Physical Habitat and Physical Habitat with E-Fishing Surveys: Sample at least 300 feet (91.4 m) above a qualifying barrier (Table 2 and Table 3) to verify no fish were observed upstream of the barrier.

E-fishing Only Surveys: Sample at least 1,320 feet (402 m) of stream and a minimum of 10 pools, each at least 12 inches (30 cm) deep, immediately upstream from the last observed fish, unless the surveyor first reaches the physical habitat stopping criteria for resident fish species (Table 3). Notwithstanding, if a fish is observed at any point upstream from the last observed fish, the survey distance and minimum pool criteria start over again until sampling has occurred and there are no more observations of fish. (Note: An E-fishing Only Survey cannot be used to determine SSBT use).

Habitat conditions near end of fish use: Report information for the 300 feet (91.4 m) segment immediately downstream of the end of fish use and the 300 feet (91.4 m) segment immediately upstream of the end of fish use in addition to measuring the habitat characteristics of the qualifying natural barrier.

CONFIRMED END OF <u>SSBT</u> USE (Refer to Table 2)					Complete the applicable section.				Units (circle): Feet Meters			
SSBT	Falls	Channel Gradient	Livable Space		Habitat Conditions at End of <u>SSBT</u> Use							
	Jump pool depth: _____	Length: _____	Valley: _____ no pools ≥6 inches (15 cm)									
	Leap height: _____	Gradient (%): _____	Non-Valley: _____ no pools >12 inches (30 cm) (choose 2)									
	Pools: _____Y _____N	_____ <2 feet (0.6 m) active channel width _____ ≥30 feet (9.1 m) @ 10%										
End of <u>SSBT</u> Use coordinates: _____					Total Distance Surveyed: _____							
CONFIRMED END OF <u>RESIDENT FISH</u> USE (Refer to Table 3)					Complete the applicable section.				Units (circle): Feet Meters			
Resident	Survey method (circle):				Physical Habitat Survey				Physical Habitat with E-fishing Survey		E-fishing Only Survey	
	Falls	Channel Gradient	Livable Space		Habitat Conditions at End of <u>Resident</u> Fish Use							
	Jump pool depth: _____	Length: _____	Valley: _____ no pools ≥6 inches (15 cm)									
	Leap height: _____	Gradient (%): _____	Non-Valley: _____ no pools >12 inches (30 cm)									
Pools: _____Y _____N												
End of <u>Resident Fish</u> Use coordinates: _____					Total Distance Surveyed: _____							
FISH OBSERVATIONS					AQUATIC WILDLIFE							
Fish Species	# of fish	Fish Length	Last Observed Fish (Y or N)	Notes, GPS coordinates	Species	#	Photo #'s	Notes, GPS coordinates				



SURVEYING FOREST STREAMS FOR FISH USE - PHYSICAL HABITAT & FISH USE SURVEY FORM
(See detailed instructions in Appendix A)



Stream Name: Crow Creek Survey Date: 4/15/27 Survey Start/End Time: 1100-1300
Downstream Creek: South Fork Mill Creek Surveyor Name(s): John Smith
Start coordinates: 45.45944, -121.51619 Surveyor Affiliation(s): ODFW
End coordinates: 45.45854, -121.52176 Landowner Name: USFS
End Location: T 1 S R 10 E S 26 Landowner Contact Info: landowner@example.gov
Water Temperature (circle °C or °F) and Time: 15°C @ 1100 ODF District: Central Oregon
Water Clarity: clear Flow: moderate Basin (HUC 10): Mill Creek-Columbia River
Weather: Sunny ODF Stream Class Size: Small Drainage area (acres): 486

SSBT: If a stream is classified as SSBT in the ODF Hydrography Flow Line data, conduct a physical habitat survey to determine the end of SSBT use using the physical habitat criteria in Table 2; then, determine the end of resident fish use using physical habitat criteria in Table 3.

Non-SSBT: If a stream is not classified as SSBT in the ODF Hydrography Flow Line data, conduct a physical habitat survey (with or without e-fishing) to determine the end of resident fish use using the physical habitat criteria in Table 3 and/or the e-fishing only survey methodology.

Physical Habitat and Physical Habitat with E-Fishing Surveys: Sample at least 300 feet (91.4 m) above a qualifying barrier (Table 2 and Table 3) to verify no fish were observed upstream of the barrier.

E-fishing Only Surveys: Sample at least 1,320 feet (402 m) of stream and a minimum of 10 pools, each at least 12 inches (30 cm) deep, immediately upstream from the last observed fish, unless the surveyor first reaches the physical habitat stopping criteria for resident fish species (Table 3). Notwithstanding, if a fish is observed at any point upstream from the last observed fish, the survey distance and minimum pool criteria start over again until sampling has occurred and there are no more observations of fish. (Note: An E-fishing Only Survey cannot be used to determine SSBT use).

Habitat conditions near end of fish use: Report information for the 300 feet (91.4 m) segment immediately downstream of the end of fish use and the 300 feet (91.4 m) segment immediately upstream of the end of fish use in addition to measuring the habitat characteristics of the qualifying natural barrier.

CONFIRMED END OF SSBT USE (Refer to Table 2)				Complete the applicable section.		Units (circle): Feet Meters		
SSBT	Falls	Channel Gradient	Livable Space		Habitat Conditions at End of SSBT Use			
	Jump pool depth: _____	Length: _____	Valley: _____ no pools ≥ 26 inches (15 cm)					
	Leap height: _____	Gradient (%): _____	Non-Valley: _____ no pools > 12 inches (30 cm)					
	Pools: _____ Y _____ N	(choose 2) _____ < 2 feet (0.6 m) active channel width						
End of SSBT Use coordinates: _____				Total Distance Surveyed: _____				
CONFIRMED END OF RESIDENT FISH USE (Refer to Table 3)				Complete the applicable section.		Units (circle): Feet Meters		
Resident	Survey method (circle): <u>Physical Habitat Survey</u>			Physical Habitat with E-fishing Survey		E-fishing Only Survey		
	Falls	Channel Gradient	Livable Space		Habitat Conditions at End of Resident Fish Use			
	Jump pool depth: <u>0.5'</u>	Length: _____	Valley: _____ no pools ≥ 26 inches (15 cm)		<u>bedrock falls, very little "pooling" below, no pools above</u>			
	Leap height: <u>7'</u>	Gradient (%): _____	Non-Valley: _____ no pools > 12 inches (30 cm)					
Pools: _____ Y _____ N								
End of Resident Fish Use coordinates: <u>45.45883, -121.52057</u>				Total Distance Surveyed: <u>1102'</u>				
FISH OBSERVATIONS					AQUATIC WILDLIFE			
Fish Species	# of fish	Fish length	Last Observed Fish (Y or N)	Notes, GPS coordinates	Species	#	Photo #'s	Notes, GPS coordinates
<u>CUTT</u>	<u>3</u>		<u>N</u>	<u>45.45898, -121.51737</u>	<u>none</u>			
<u>* CUTT</u>	<u>1</u>		<u>Y</u>	<u>45.45879, -121.51882</u>				

Fish visually observed (not measured/handled)

Side 1

APPENDIX C. Anadromous Fish, Game Fish, and Threatened or Endangered Fish Species

For the purposes of administering the ODF Forest Practices Act rules, “Fish Use” means inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state Endangered Species Acts (OAR 629-600-0100 (45)).

Some fish species are present on more than one of the lists. These lists were accurate at the time this RFSP was published, but surveyors should consult the original documents for potential updates.

Game Fish ([ODFW sport fishing regulations](#), [ORS 496.009 “Game fish” defined](#)):

- Trout
- Salmon
- Steelhead
- Whitefish
- Shad
- Bass: largemouth, smallmouth, striped, hybrid (white x striped cross)
- Mullet
- Grayling
- Bluegill
- Crappie / sunfish
- Catfish
- Walleye
- Yellow Perch
- Sturgeon

Oregon Threatened and Endangered Fish Species List:

- Hutton Spring Tui Chub
- Snake River Chinook Salmon (fall)
- Lahontan Cutthroat Trout
- Snake River Chinook Salmon (spring/summer)
- Warner Sucker
- Lower Columbia River Coho Salmon
- Lost River Sucker
- Shortnose Sucker

Oregon Fish species Listed under the Federal Endangered Species Act, but not state-listed:

- Columbia River Chum Salmon
- Oregon Coast Coho Salmon
- Bull Trout
- Upper Willamette River Steelhead
- Lower Columbia River Steelhead
- Middle Columbia River Steelhead
- Upper Columbia River Steelhead
- Southern Oregon / Northern California Coast Coho Salmon
- Upper Columbia River Spring Chinook Salmon
- Upper Willamette River Chinook Salmon
- Snake River Steelhead
- Snake River Sockeye Salmon
- Lower Columbia River Chinook Salmon
- Green Sturgeon (southern DPS)
- Pacific Eulachon / Smelt (southern DPS)

Anadromous Fish, but not Game, Threatened or Endangered Fish:

- Pacific Lamprey
- Western River Lamprey

Other Fish Species:

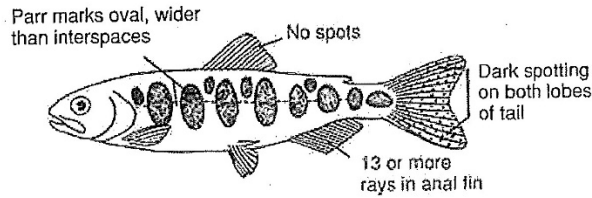
The presence of fish species not listed as game fish, anadromous fish, or threatened or endangered fish does not confer “fish use” designation on a water body. Sculpin and dace are other fish species sometimes encountered during surveys for fish use. However, sculpin and dace do not confer “Fish Use” to a stream or other water body for the purposes of administering the ODF Forest Practices Act rules.

APPENDIX D. Field Identification of Juvenile Salmonids

Identification features of juvenile salmonids

Drawings show approximate relative sizes at migration

Chinook



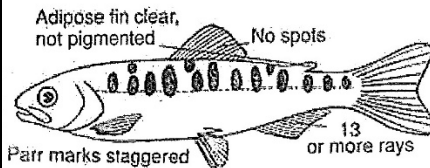
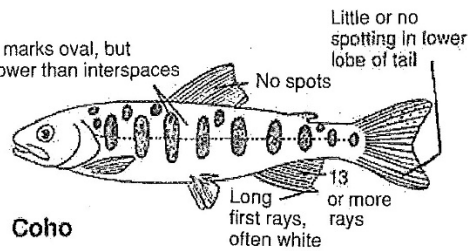
Chum fry

Faint parr marks, extend little, if any, below lateral line. Leaves fresh water as fry.



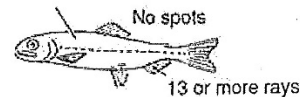
Parr marks oval, but narrower than interspaces

Coho



Sockeye

No parr marks. Leaves fresh water as fry.

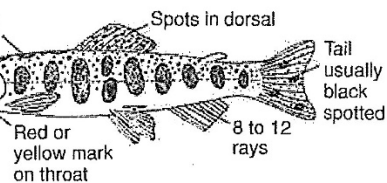


Pink fry

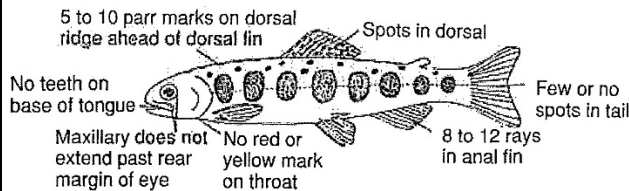
No more than 5 parr marks on dorsal ridge ahead of dorsal fin

Teeth on base of tongue

Maxillary extends past rear margin of eye



Cutthroat



Steelhead

From: Pollard, W.R., G.F. Hartman, C. Groot, and P. Edgell. 1997. Field Identification of Coastal Juvenile Salmonids, Harbour Publishing, Madeira Park, British Columbia, Canada.

Identification of Juvenile Salmon and Trout

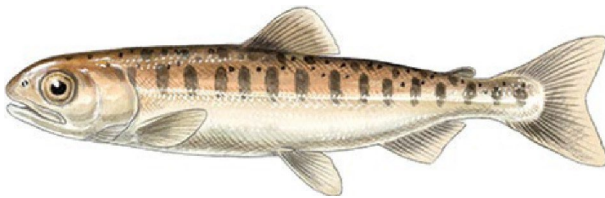


Coho salmon: No spots on dorsal; anal fin is sickle-shaped with a leading edge longer than base; anal and dorsal fins have a stripe of white pigment followed by a stripe of black pigment.

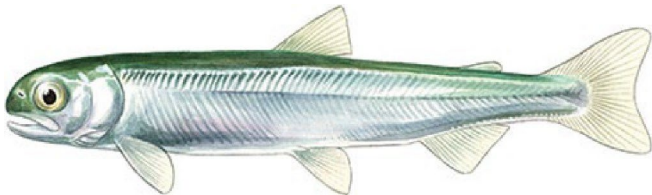


Chinook salmon: No spots on dorsal; base of anal fin is longer than leading edge; anal and dorsal fins only have white pigment stripe.

Photos: Bruce Miller, ODFW



Sockeye salmon: No spots on dorsal; parr marks on or above the lateral line; staggered parr marks; wide body posterior to the dorsal fin; small eye in proportion to size of head.



Pink salmon: Blunt snout/head; no parr marks or marks that are difficult to see; large eye in proportion to the head; leave freshwater as fry.

Drawings: Kate Spencer, Wild Salmon Center



Bull trout: Dusky to clear dorsal and caudal fins, with light spots on darker background. Dark parr marks may or may not be very apparent, depending on lighting. Subadults (≥ 7.9 in [20 cm] fork length) light spots on darker background, leading edges of pectoral and pelvic fins may be turning white.

Fry (1.1 in [2.7 cm] fork length) generally found in stream margin, under cover (i.e., total blackness, requiring dive light to illuminate) in shallow water (0.8-1.5 in [2-4 cm] depth). Behavior generally stationary, in contact with substrate, not moving and not in the water column until forced to dart under cover.

Photos: Vince Tranquilli, ODFW



Steelhead trout: Spots on dorsal; rounded head/snout; jaw does not extend past rear margin of eye; parr marks superimposed on spots; longer stripe of white pigment on tip of dorsal fins; 3-5 medial-dorsal parr marks.



Cutthroat trout: Spots on dorsal; pointed head/snout; jaw extends past rear margin of eye; spots superimposed on parr marks; shorter stripe of white pigment on tip of dorsal fin; usually no medial-dorsal parr marks.

Photos: Bruce Miller, ODFW

APPENDIX E. Electrofishing Survey Guidelines and Safety Procedures

Surveys for fish use conducted by electrofishing with a backpack electrofisher require a scientific sampling permit from ODFW and, if any federal ESA-listed species may be present, the federal NOAA Fisheries or USFWS. All electrofishing surveys must be conducted in accordance with NOAA Fisheries electrofishing guidelines and any updates to those guidelines (NOAA 2000). These guidelines also establish a minimum level of training that is necessary prior to electrofishing in streams with ESA fish present. Surveyors are encouraged to adhere to all ODFW, NOAA Fisheries, and USFWS permit guidelines regarding fish take as project-specific terms may be different than listed here.

Introduction

Electrofishing equipment can be a great tool for capturing fish for all types of scientific needs including determining fish use in forest streams. The use of electricity in water can be very effective at capturing fish but warrants some basic understanding of the equipment and the dangers that can occur when using this method. Modern electrofishing units are much safer to use, more user-friendly, and with some proper training can be operated safely with minimal impacts to fish and amphibians. A crew leader having at least 100 hours of electrofishing experience in the field using similar equipment must train the crew. The crew leader's experience must be documented and available for confirmation; such documentation may be in the form of a logbook. In addition, it is **HIGHLY RECOMMENDED** that anyone who operates an electrofisher complete an electrofishing principles and safety course by a manufacturer that offers a similar course. These courses cover in detail the capabilities of the units, the physics of electrofishing, and how to safely operate them.

An electrofishing unit has three main settings that control the delivery of electricity to the water: frequency, duty cycle, and voltage. The other main factor that affects the performance of an electrofisher is the conductivity of the water being shocked. Most streams that will be sampled throughout Oregon for forestry and fish use have a low conductivity (the water is generally very clear with few ions or sediment present). When using a modern electrofisher in mountain streams to capture salmonids (trout and salmon) in low conductive water, a good starting point for electrofisher settings is 30 Hz (frequency), 15% (duty cycle), and 300 volts. If the desired response from the fish being sampled is not achieved (i.e. the fish are darting away quickly and hard to capture with the net), turn the voltage up in increments of 50 volts until the fish are able to be captured but are not being "over-shocked." For most uses in forest streams, the frequency and duty cycle can remain constant (30Hz and 15%) while only adjusting the voltage to achieve the desired response from the targeted fish species (commonly between 300–500 volts).

Electrofishing guidelines

- Do not electrofish if the water temperature is above 64°F (18°C) for any site. If the water temperature exceeds 70°F (21°C) at the capture site, all capturing and handling must stop in stream habitats that contain any salmon, steelhead, trout, or lamprey species. Return to the site when temperatures are cooler, such as later in the season or early in the morning.
- To avoid contact with spawning adult salmonids or active redds, surveyors must conduct a careful visual survey of the area to be sampled before beginning electrofishing. Do not electrofish if adult salmonids are observed.
- Do not electrofish if people, pets, or livestock could rapidly enter the stream.
- Make sure all crew members are aware that electrofishing is about to begin.

- The key to setting controls in the field is to use the minimum settings needed to achieve satisfactory electrofishing. Prior to the start of sampling at a new location, water temperature and conductivity measurements should be taken to evaluate electrofisher settings and adjustments.
 - Start with a lower frequency and duty cycle. Duty cycle may be as low as 10% but should not exceed 50%. Scaleless and fine-scaled fishes (e.g., *salmonid*, *ictalurid*, *anguillid*, *cottid*) are more sensitive to electroshock; therefore, start at 20–30Hz frequency and 10–20% duty cycle.
 - If the minimum settings are not adequate, adjust them one at a time in the following order: 1) voltage, 2) duty cycle, and then 3) frequency. Threshold settings with pulsed direct current (DC) may be determined by following this procedure:
 1. Start e-fishing at low voltage (~100V) and low duty cycle (~10%). If e-fishing is unsatisfactory, increase voltage in 20V, 50V, or 100V steps (depending upon fish reaction).
 2. If voltage reaches a maximum and e-fishing is still not satisfactory, dial voltage back to a low setting, increase the duty cycle (~5%), and repeat voltage increases from step 1.
 3. If duty cycle reaches 50% without satisfactory results, reset duty cycle and voltage to low settings and increase frequency (~5Hz) and repeat voltage and duty cycle increases from steps 1 and 2.
 4. Continue the process until satisfactory e-fishing is achieved.
- Surveyors are responsible for compliance with permitting requirements and ensuring that the number of salmonids impacted by electrofishing is within the permit limits.
- Do not “over shock” in areas where fish have good cover. A few seconds should be sufficient.
- Stop electrofishing if mortalities occur.

Electrofishing procedures

The best way to get fish within an effective radius of the anode probe is to “surprise” them. Position the probe in a new area while it is turned off and turn it on once it is in place. Sweeping a live probe about the stream merely introduces the weak border of the electrical field to new areas and fish will easily detect and escape the field. The stream should be covered systematically, moving the anode in a herringbone pattern through the water. Do not electrofish an area for an extended period of time.

Captured fish should be carefully released in a slow water area approximately 30 feet (10 m) downstream from the capture site. This allows the captured fish to recover away from the electrical field of the capture site. Captured fish should not be exposed to air for more than a few seconds, or latent mortality may occur. If you cannot identify the fish or amphibian, write a description, and take a close-up photo from multiple angles.

If fish were observed but not captured, indicate that on the datasheet, and approximate the length. Do not guess data if movement was seen but body length or size was not. Write a note on the fish sheet to describe the observation. It is easy to confuse movement of a salamander with that of a fish.

Fish safety

Electrofishers discharge pulsed DC. Fish can react to this electric field in many ways, depending on the DC strength and their proximity to the electric field (Table B1). Fish recover the ability to swim quickly after electrofishing if the applied current is not too strong and the amount of time they are exposed to the electrical field is short. Ideally, fish will experience equilibrium loss but will not be injured nor escape the electric field. However, the fish may experience physiological stress for several days following shocking. Injury (e.g., damage

to swim bladders, muscles, and skin; fractured vertebrae; and bleeding) or death can result if excessive current is applied. The zone of potential fish injury is ~1.5 feet (0.5 m) from the anode. Care should be taken in shallow waters, undercut banks, or where fish can be concentrated because, in such areas, the fish are more likely to come into close contact with the anode. The preferred method to prevent accidental mortality is to “attract” fish to the ring rather than “rolling” them. Keep the trigger on while “attracting” or “pulling” fish and netting them. Release trigger if you are rolling fish before you can net them.

Table B1. Common fish responses to electrofishing.

Fish Response	Definition	Action Needed
Taxis	Fish pulled towards probe (anode)	None: Desired response
Equilibrium loss	Fish pulled towards probe (anode) but are unconscious or lying on side	None
Not turning	Fish not responding to current.	Increase voltage in 50-volt increments
Escapes	Fish are turning but swim out of the field	Increase frequency (Hz)
Narcosis	Fish immobile with slack muscles	Reduce frequency (Hz)
Tetany	Fish immobile and rigid with flared operculum	STOP. Turn down Hz and voltage. If problem persists, stop sampling.
Branding	Hemorrhaging on skin as shown by dark brands, internal injury	STOP. Turn down Hz and voltage. If problem persists, stop sampling.

Crew members should carefully observe the condition of sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit should be adjusted. **Sampling should be terminated if injuries or abnormally long recovery times occur even after reducing electrofisher settings.**

Surveyor safety

The use of electrofishers can be dangerous. **The electrical energy used in electrofishing is enough to electrocute—meaning to kill with electricity—a human.** Some fatalities have occurred with older electrofishers that lacked tilt switches. Prevent exposure to the electrical field. Use nets with fiberglass handles. Wear leak-free, standard-weight waders and boots. Rubber gloves are required to be worn while electrofishing. Replace ripped or overly worn gloves. *(Note: never place bare hands in the water unless the probe is removed from the water, and it is completely understood that the electrical current is off).*

Stunned fish frequently need to be extracted from crevices in the streambed. Before attempting to pick up a fish, have a well-understood convention. For example, the netter saying "off" and having "off" repeated by the electrofisher operator after the current is stopped and the probe lifted from the water. *(Note: never place bare hands in the water unless it is completely understood that the electrical current is off, and the probe is removed from the water).* Resume electrofishing only after both parties give an "on" command. When reaching into crevices, use only one hand and keep the other arm well out of the water. This prevents passing an arc of current through your chest. Also, there is a chance of shock if you touch the probe in the “on” position while you are touching the box on the backpack.

- To electrofish safely:
 - Do not electrofish alone.
 - All personnel involved in electrofishing, whether operating the electrofisher or not, must wear non-leaking, insulated waders or a drysuit.
 - All personnel must wear black rubber electrician's gloves.
 - Avoid contact with the electrodes and surrounding water.
 - Do not electrofish in thunderstorms or soaking rain.
 - If you need to reach into a stream for any reason or are about to accidentally fall into the stream, have a well-understood convention with the electrofisher operator, such as saying "off" and having the operator cease electrofishing and then repeat "off".
 - Most electrofisher safety features will protect the operator but do nothing to protect other crew members who may be in the electric field netting or bucketing fish. If you feel that you are in danger, especially if you are slipping or falling, speak up loudly so the operator can stop shocking.
- To set up the electrofisher:
 1. Place the electrofisher upright on the ground.
 2. Make sure that the unit is turned off.
 3. Connect the Anode (probe) and Cathode (tail).
 4. Place battery in housing, but do not connect the wiring.
 5. Connect the wiring to the battery.
 6. Turn the unit on and make sure it is set to 30Hz and 300 volts. (If using an older model with knobs on the side of the housing, you can adjust the knobs without turning the unit on.)
 7. Turn the unit back off until you are ready to start sampling.
 8. Place electrofisher on the surveyor's back and adjust straps.
- To conduct the survey:
 1. Enter stream with electrofisher, just downstream of the pool to be sampled.
 2. Place tail and probe in water, about 3.3–6.6 feet (1–2 m) apart. (*Note: Do NOT touch the tail with bare hands!*)
 3. Make sure crew is aware that shocking is about to commence, and everyone is clear of the electrical field.
 4. Turn on electrofisher, communicate with partner, and begin sampling.
 5. Turn off electrofisher when not electrofishing.
 6. Do not place the electrofisher face down. Lay it flat with the pack frame in contact with the ground or place upright with the pack frame against support (tree, boulder, etc.).
- When the survey is complete:
 - Turn unit off and disconnect battery before exiting the creek.

Electrofisher troubleshooting

Malfunction of the electrofishing system often occurs in the field and can be very frustrating. Test the electrofisher at the start of the season and before hauling it into remote sites and make sure the battery is charged. Connect the battery, probe, and tail. Turn the unit on and make sure it is adjusted to the minimum starting settings (e.g., 30Hz, 12%, and 300V). It should produce a short beep. It should also make a continuous

or pulsing beep for the duration of time in which the anode pole switch is depressed. This is a quick initial test of an electrofisher. If this does not work, or if the unit will not shock fish, try the following steps:

1. Turn the power off—disconnect battery.
2. See if all the connections are tight.
3. Be sure that the unit is upright. As a safety feature, electrofishers have a tilt switch that shuts the unit off if it is tilted at too steep of an angle.
4. Be sure the anode (pole) ring is clean and free of oxide coating.
5. Check the Battery/Generator indicator light. If this light is on, there is a problem with the battery. Replace the battery with a known good battery. If the unit begins to work, the battery is the problem.
6. Check the self-test indicator. This should be on when the anode (pole) switch is on. If the self-test indicator does not come on, there are three options: a) Redo the connections, b) Swap the cathode “tail” with the tail from a known working electrofisher to see if the problem is with the tail, c) Swap the anode pole and/or the anode pole ring with the pole and/or anode pole ring from a working electrofisher to see if the problem is with the pole/ring.
7. If the unit overloads, as indicated by the overload light, reduce the voltage setting or move the anode and cathode further away from each other.

A gel cell battery powers Smith-Root backpack electrofishers. Following these simple procedures can prolong a battery’s service life:

1. Always place batteries on a wood surface when in use or in storage. If left directly on the ground, the battery will discharge.
2. Occasionally, try to fully discharge and fully charge a gel cell battery. The gel cell battery has a "memory" and requires this type of full discharge/charge cycling.
3. Protect batteries both in use and in storage by periodically charging them during cold weather. Cold temperatures reduce the amount of cranking capacity a battery can offer, so it is best if batteries are not left in the cold.

References

- Oregon Department of Fish and Wildlife. 1998. Methods for stream fish inventories, Version 7.1. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Natural Production Section, Corvallis, OR.
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- Rodgers, Jeff. 2001. Personal Communication. Oregon Department of Fish and Wildlife, Corvallis, OR.
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- Smith-Root. 1998. Backpack Electrofishers, Rev. 03. Smith-Root, Inc. Vancouver, WA.

APPENDIX F. Survey Equipment

- Maps— Do not go into the field without a hardcopy or digital 7.5-minute quad (1:24,000 scale) U.S. Geological Survey (USGS) topographic maps of the stream and basin. *(Note: data that cannot be linked to the maps are essentially useless)*. Authoritative stream mapping and classification data is available for viewing and download via [ODF Hydrography Flow Line](#) data. Oregon Atlas and Gazetteer (Delorme Mapping) or other road maps by county or fire district.
- Recording materials—waterproof field book, survey forms for each component of the survey, waterproof paper, tablet, and pencils.
- Clothes—chest waders, wading shoes, and/or hip boots (non-slip soles are advised), rainwear, and clothing appropriate for the weather conditions. Insulated waterproof gear is necessary if electrofishing. *(Note: see gear disinfection protocol in APPENDIX G)*.
- Survey equipment—depth staff (marked in feet/inches or meters/tenths), compass, measuring tape, day pack, polarized sunglasses, thermometers, clinometer, rangefinder, clipboard, vest, flagging, permanent markers, digital camera, paper datasheets or tablet, GPS unit, and electrofisher (optional).
- Safety gear—first aid kit, poison oak pretreatment, headlamp, CB radio, cellular phone, whistle, safety or polarized sunglasses. *(Note: wearing polarized glasses will greatly help to reduce the glare off the water and help to see channel features and fish)*.

APPENDIX G. Gear Disinfection Protocol

Background

Aquatic pathogens (bacteria, viruses and parasites, and invasive species such as New Zealand (NZ) mud snails (*Potamopyrgus antipodarum*) can adhere to or be trapped in field gear such as boots, waders, drysuits, nets, coolers, boats, etc. NZ mud snails are an introduced species spreading rapidly among rivers and streams in the western United States. Since they were reported in the Snake River in Idaho in the 1980s, the snails have been discovered in at least ten western states. NZ mudsnails are parthenogenic, so a single introduced snail has the potential to start a new population. In Oregon, NZ mudsnails have been found in tributaries of the lower Columbia River, Devil's Lake on the central coast, Garrison Lake near Port Orford, Deschutes River, and several sites in the Snake River basin. Mudsnails are resistant to desiccation and may survive for days out of the water on moist waders and sampling gear. Researchers believe recreational anglers may be a primary vector by which mudsnails are transported among streams.



In the western U.S., mudsnails can reach a maximum length of 6mm.

Prevent Mudsnail Transport Between Watersheds

Crews should avoid surveying in more than one major river basin (e.g., Yaquina, Applegate, McKenzie) per day. To avoid mudsnail and pathogen transport among basins, crews should sanitize waders and boots daily or between sites if they must survey in two major basins for one day.

(Note: freezing is another method that works well. Waders, boots, wetsuits, etc., can be placed in a deep freezer [chest freezer or walk in] for a few hours. This works great for a crew that returns at the end of the day, places gear in the freezer, then retrieves the gear for work the following morning).

Procedure

Required equipment:

- Formula 409® (100% solution)
- clean water supply (not stream water)
- dishwashing gloves
- scrub brush

1. Remove waders, boots, and drysuits, and remove insoles from wading boots when possible.
2. Use the scrub brush to clean loose dirt or mud off boots, waders, and field gear.
3. Using a spray bottle of Formula 409® cleaning solution (do not dilute), spray waders, wading boots, boot insoles, and the streambed contact end of wading staff with the cleaning solution to the point of saturation. Treat the inside and outside of wading boots, paying special attention to bootlace grommets, seams, felt soles, and places where mudsnails might cling. *(Note: crews should wear gloves while handling Formula 409® to minimize contact with skin. Do not spray 409® on the drysuit booties; they will be damaged).*
4. Allow treated gear to sit for ten minutes.
5. Rinse gear in clean water. DO NOT USE STREAM WATER. Ideal rinse stations are outdoor hoses. When sanitizing gear in the field, a separate spray bottle filled with tap water should be used for rinsing and the process should occur at least 328 feet (100 m) from any waterway or runoff-drain.

References

Hosea, R.C. and B. Finlayson. 2005. Controlling the spread of New Zealand Mudsnails on wading gear. California Department of Fish and Game Administrative Report 2005-02, Rancho Cordova, CA.