



## COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION

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### **Protocol for Snorkel Surveys of Fish Densities**

A component of

Monitoring Recovery Trends in Key Spring Chinook Habitat Variables  
and Validation of Population Viability Indicators

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## Introduction

This report describes a protocol for monitoring fish densities and fish assemblage structure using snorkel surveys. The Columbia River Inter-Tribal Fish Commission (CRITFC), Oregon Department of Fish & Wildlife (ODFW), and Confederated Tribes of the Umatilla Indian Reservation (CTUIR) have recognized the need to use a common snorkel survey so that information collected by individual entities can help managers determine whether aggregate habitat restoration actions will yield a net improvement in basin-wide habitat quality for ESA-listed fish species (NOAA 2007). To this end, we developed a snorkeling protocol drawing heavily from the protocols of Thurow (1994) and O'Neal (2007), intended for use among all agencies responsible for data collection in the upper Grande Ronde, Catherine Creek, Minam River, and potentially other nearby basins.

## Methods for Snorkel Surveys

During baseflow conditions after fish habitat surveys have been completed, fish abundance and size, along with a semi-quantitative description of fish assemblage structure, will be enumerated at each reach. It is important to note that although this snorkel survey occurs over the length of an entire reach, the data is collected at the channel unit scale. *If snorkeling occurs in reaches where habitat surveys were conducted, the field crew should ensure that all channel units can be referenced to the corresponding channel units in the habitat survey.*

A single snorkeler or a team of two snorkelers (depending on channel unit size and visibility, see below) will identify and count fish species and size classes in all slow water habitats (e.g., pools and runs) and 25% of all fast water, turbulent habitats (e.g., riffles, rapids, and cascades). Fish counts will be standardized by area sampled and reported by habitat unit type and total reach densities.

Before surveys commence each field season, snorkelers will spend a morning and/or afternoon training in habitat types where different species are likely to occur, and will calibrate estimates of fish length by using plastic cut outs of fish in 50 mm size classes. Periodic calibrations of fish size will ensure precise estimates. Field identification of fish species should be practiced and validated by occasional capture of fish using a hand net or electrofisher and checked against the keys of Bond (1973), Dauble (2009), Martinson *et al.* [no date], or other relevant sources. Plates of a few of the commonly-encountered fish species are listed in Appendix A.

### Required Conditions for Snorkeling

- ✓ During low stream flows and when flow conditions are similar to those recorded during the habitat survey.
- ✓ When visibility is equal to or greater than 1.5 m (as measured by minimum distance that a plastic fish cut-out with parr marks can be discerned).
- ✓ Between late morning and early afternoon (i.e., 1000-1600 hrs) when the sun is directly overhead, or during cloudy or overcast conditions if reaches have significant cover.
- ✓ When both stream banks can be observed by a single observer, one snorkeler will be sufficient. When the stream is larger, two snorkelers are required.

## Detailed Procedures

- 1) Locate the downstream-most channel unit to be surveyed in the reach and record the site ID indicated on the flag or marker. If the flag or marker cannot be found record the UTM with accuracy  $\leq 10$  m using a GPS. Complete the top portion of the snorkel survey data sheet; including stream name, date, weather conditions, water temperature using a hand-held thermometer, underwater visibility ranking, note taker and snorkeler names, and start time.
- 2) Determine snorkeler lane widths and decide upon the number of snorkelers that will conduct the survey. Lane widths are defined as the width of stream that an observer can effectively survey, and are determined by doubling the distance which a snorkeler can clearly identify a 100 mm plastic cut-out of a fish with parr marks. Estimates of lane widths may differ among individual channel units in a reach—these estimates should be adjusted when physical obstructions such as shallow water, boulders, or turbulence impede visibility. Where the wetted stream width is greater than the combined lane widths of snorkelers, each observer counts fish only in their lane and fish density estimates are scaled to the area observed.
- 3) Snorkeler(s) enter the stream a short distance below the downstream end of the channel unit to be surveyed, slowly and quietly assuming the face-down snorkeling position. After scanning the channel unit for fish from a stationary position, begin surveying in an upstream direction. A single snorkeler moves in a zig-zag pattern upstream (Figure 1). Or if two people are required, snorkelers move slowly upstream adjacent to one another and at the same speed in the midline of the stream, each snorkeler enumerating only the fish observed between himself and the adjacent stream bank as the snorkelers pass fish. Depending on the type of habitat, the two snorkelers may instead agree upon a centerline in the stream and count fish only on their respective half of the stream (Figure 2). Enumerate steelhead/rainbow trout and juvenile Chinook salmon by species and size classes noted on the data sheet *only after the snorkeler passes upstream of fish* (to reduce double counting). Note presence/absence but do not identify or enumerate young-of-the-year salmonids except Chinook salmon, which can be accurately counted and identified (Thurow 1994). Also record the number of adult Chinook salmon observed and the presence/absence of non-salmonid fishes. All microhabitats are surveyed (e.g., behind log jams, in pocket waters behind boulders, stream margins). Even during daylight hours, handheld lights are useful for searching for fish in complex habitats such as substrate crevices, undercut banks, and logjams.
- 4) In certain low-visibility conditions such as large, deep pools or turbulent channel units, some fish may remain undetected in the upstream pass. In those cases, an additional downstream pass by a single snorkeler may be required. At the top of the channel unit, a snorkeler will turn around and drift facing downstream, *noting only additional fish species or size classes not previously counted*.
- 5) At the end of each channel unit survey, each snorkeler calls out fish counts of steelhead-rainbow trout and Chinook salmon by size class to a note taker, who remains downstream of snorkelers so as not to disturb fish before they are surveyed. Snorkelers may also “download” fish data to the note taker at any point during the channel unit survey if fish

are numerous or fish assemblages are complex. If a note taker is not available, the snorkeler may record data onto PVC cuffs attached to the snorkeler's arm.

- 6) Record the presence of fish species encountered in the channel unit other than steelhead-rainbow trout and Chinook salmon.
- 7) The note taker records the length and average width of each channel unit surveyed. Width measurements are made at 25%, 50%, and 75% of the channel length, and the average of these three measurements is recorded on the datasheet. If a fastwater channel unit is surveyed, the length of the actual distance surveyed replaces the channel unit length. After the first channel unit is surveyed, continue to reference individual site IDs from flags, habitat datasheet, or acquire UTM coordinates for each channel unit. *Ensure that each channel unit can be referenced to the corresponding habitat survey data.* The previously-drawn reach map can also be used for reference.
- 8) Record the relative abundance of the entire fish assemblage in the reach, including salmonids and non-salmonids, as per Torgersen *et al.* (2006): each species is recorded as dominant (> 50%), common (10-50%), or rare (< 10%) in relation to the total number of fish observed in the reach. See Appendix A for identification of a few commonly-encountered fish species.
- 9) At the end of the survey, record the time and any additional comments.



Figure 1. In small streams, one snorkeler counts fish in a single pass, zigzagging through an entire channel unit while moving upstream. The dashed line represents the approximate path of the snorkeler who counts fish left and right (from Thurow 1994).

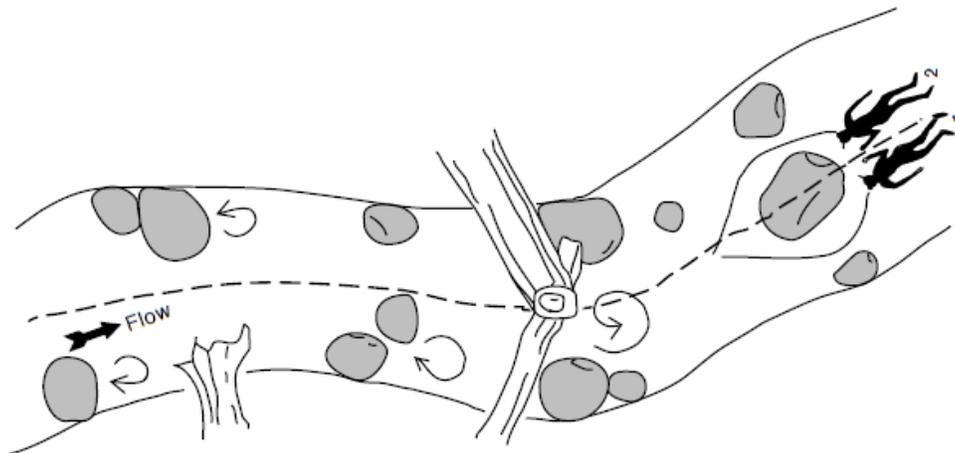


Figure 2. In wider streams, two snorkelers count fish in a channel unit while moving upstream. In a stream smaller than the combined lane width of both snorkelers, observers count fish on their respective side of the stream. In stream wider than the combined lane width of both snorkelers, each observer records all the fish in their respective lanes and records lane width (from Thurow 1994).

## **Change log**

The original version of this document was published on the PNAMP site in May of 2011. Since that time, slight changes have been made to the protocol.

1. At the channel unit scale, non-salmonids will be recorded as present-absent only (versus dominant, common, and rare as in the previous version) (May 2012).
2. At the reach or site scale, the relative abundance of all fishes encountered in the survey including non-salmonids will be recorded as dominant (> 50%), common (10-50%), or rare (< 10%) in relation to the total number of fish observed in the reach (May 2012).

## References

- Bond, C.E. 1973. *Keys to Oregon freshwater fishes*. Corvallis, OR: Agricultural Experiment Station, Oregon State University.
- Dauble, D.D. 2009. *Fishes of the Columbia Basin: A Guide to Their Natural History and Identification*. Sandpoint, ID: Koeke Books.
- Martinson, R., G. Kovalchuk, D. Ballinger, and L. Cowger. *Columbia River basin juvenile fish field guide, including common injuries, diseases, tags, and invertebrates - 4th edition*. Bonneville Power Administration & Pacific States Marine Fisheries Commission, [no date].
- NOAA. 2007. Tributary Habitat Proposed Action Summary. May 21, 2007. NOAA, Portland, Oregon. 295 p.
- O'Neal, J. 2007. Snorkel surveys. In *Salmonid Field Protocols Handbook*, ed. D.H. Johnson, B.M. Shrier, J. O'Neal, J.A. Knutzen, X. Augerot, T.A. O'Neil, and T.N. Pearsons, 325-339. Bethesda, Maryland: American Fisheries Society.
- Thurrow, R.F. 1994. *Underwater Methods for Study of Salmonids in the Intermountain West*. General Technical Report. Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Research Station.
- Torgersen, C.E., C.V. Baxter, H.W. Li, and B.A. McIntosh. 2006. Landscape influences on longitudinal patterns of river fishes: spatially continuous analysis of fish-habitat relationships. *American Fisheries Society Symposium* 48: 473-492.

## Appendix A: Some Common Fishes of the upper Grande Ronde River



Figure 3. Juvenile steelhead/rainbow trout. Note the oval parr marks, prevalent spotting, and white tips on the pelvic and anal fins (from Thurow 1994).



Figure 4. Juvenile Chinook salmon. Note the broad, vertical parr marks, large eye, unspotted dorsal fin, forked tail, and dorsal spotting. The adipose fin has been clipped from this hatchery-reared fish (From Thurow 1994).



**Figure 5. Adult bull trout. Note the large mouth, pale yellow spots, white fin margins, and unpigmented dorsal fin (from Thurow 1994).**



**Figure 6. Adult mountain whitefish. Note slender body, small terminal mouth, silver color, large scales reflecting light, and forked tail (from Thurow 1994).**



**Figure 7. Adult northern pikeminnow. Note the large mouth, forked tail, lack of spots, and absence of an adipose fin (from Thurow 1994).**



**Figure 8. Juvenile reidside shiner. Note the lack of parr marks, lack of spots and parr marks, absence of adipose fin, and a distinct, laterally-compressed shape (from Thurow 1994).**



**Figure 9. Sucker sp. Note the large head, small eye, oval cross section, and ventral mouth (from Thurow 1994).**



**Figure 10. Longnose dace. Note the elongated body shape and nose (courtesy of Ohio Department of Natural Resources).**



**Figure 11. Speckled dace. Note the elongated, fusiform body shape and shorter nose as compared with longnose dace (photo by Dave Giordano, University of California).**

## Appendix B: Equipment List

Equipment	Quantity	Check	Notes
<b>Snorkel Surveys</b>			
Fish identification guides (Bond 1973; Dauble 2009; Martinson <i>et al.</i> [no date])	1	<input type="checkbox"/>	
Plastic fish cutouts (with parr marks) of various multiples of 50 mm in length	7	<input type="checkbox"/>	
Drysuit	2	<input type="checkbox"/>	
Wet suit hood	2	<input type="checkbox"/>	
Neoprene gloves	2	<input type="checkbox"/>	
Neoprene socks	2	<input type="checkbox"/>	
Mask w/ extra strap	2	<input type="checkbox"/>	
Snorkel	2	<input type="checkbox"/>	
Handheld dive light	2	<input type="checkbox"/>	
Handheld thermometer	1	<input type="checkbox"/>	
Meter tape or graduated wading staff (for measuring visibility distance)	1	<input type="checkbox"/>	
GPS, datasheets, clipboard, pencils, wading boots (see "General Field Equipment")		<input type="checkbox"/>	
Completed habitat data sheets		<input type="checkbox"/>	
Rangefinder (for measuring channel unit length & width)	1	<input type="checkbox"/>	
Blank snorkel survey datasheets and pencils		<input type="checkbox"/>	
<b>Personal Field Equipment</b>		<input type="checkbox"/>	
Wading boots	1	<input type="checkbox"/>	
Wading socks	1	<input type="checkbox"/>	
Waders	1	<input type="checkbox"/>	
Rain gear	1	<input type="checkbox"/>	
Hat	1	<input type="checkbox"/>	
Sunscreen	1	<input type="checkbox"/>	
Sun glasses (polarized preferable)	1	<input type="checkbox"/>	
Bug repellent	1	<input type="checkbox"/>	
Pocket knife or multi-tool	1	<input type="checkbox"/>	
Water bottle (1 qt)	1	<input type="checkbox"/>	
Backpack	1	<input type="checkbox"/>	
Cell phone	1	<input type="checkbox"/>	
Cell phone charger	1	<input type="checkbox"/>	
Toilet paper	2	<input type="checkbox"/>	
Food for lunch and lunch bag		<input type="checkbox"/>	
First aid kit	1	<input type="checkbox"/>	

## **Appendix C: Datasheet**

