Chum Reintroduction Project Habitat Survey Protocol

Version 1

Kristen Homel
Chum Reintroduction Coordinator

Oregon Department of Fish and Wildlife
57420 Old Portland Road, Suite 3
Warren, OR 97053
(503) 910-3091

Cite protocol as:

Homel, K. June 2012. Chum reintroduction project habitat survey protocol, version 1. Oregon Department of Fish and Wildlife, Chum Reintroduction Project, Corvallis, Oregon.

Table of Contents

1.0 INTRODUCTION

Chum salmon were historically abundant in the lower Columbia River but experienced precipitous declines in the 1940's. After listing as "threatened" in 1999, Oregon developed a recovery strategy to rebuild chum salmon populations in Oregon tributaries of the Columbia River. The goals of the chum recovery project are to identify and address factors that limit the abundance of chum, restore chum habitat to promote natural recolonization, and reintroduce chum into locations where they do not currently exist. Initial efforts will focus on collecting data on the availability and quality of spawning habitat and the current distribution and abundance of chum. These baseline data will be used to identify and prioritize habitat restoration sites, and to establish baseline conditions so that we can evaluate the effectiveness of chum reintroduction strategies.

The Chum Reintroduction Project habitat protocol supplements surveys conducted by the Aquatic Inventories Project (AQI). The AQI surveys provide detailed information on habitat conditions in streams but are not designed to provide fine-scale information on spawning habitat. As part of a larger effort to reintroduce chum salmon to Oregon tributaries to the Columbia River, it was necessary to develop a protocol that could characterize the specific habitat associated with chum spawning sites.

Chum spawn in a range of habitat types, but typically substrate size, depth, velocity, and upwelling ground water are associated with redd site selection. Specific ranges for attributes (e.g., spawning substrate size) were collected from the literature. Where there was disagreement in the literature, data collection was designed to test the specific ranges that might be appropriate for chum in Oregon tributaries to the lower Columbia River. Ideally, these spawning habitat metrics would be collected in conjunction with AQI surveys, but because the data are spatially explicit, they can also be aggregated with existing AQI survey data.

This protocol applies, as written, to summer habitat surveys conducted separately from AQI surveys.

2.0 DEFINITIONS

Field Crew Tasks- Each field crew is comprised of two people with each member responsible for specific tasks. Crew member one is responsible for recording all data on the TEMPERATURE and STREAM datasheets. Crew member two is responsible for recording all data on the SUBSTRATE and BARRIERS datasheets. Both crew members will travel together up the stream and make sure that they are both recording data on the same channel unit number at the same time. At times, one crew member may have less data to record and can assist the other crew member with his or her data collection. However, crew members may not switch jobs within a stream. It is okay to switch jobs between streams. Each crew member is responsible for making sure his or her datasheets are completely filled out, legible, accurate, and that unit numbers match up across all datasheets for a particular stream or reach. If waypoints are collected in the field, each crew member is also responsible for downloading waypoints into a file that is associated with the correct datasheets. If GPS coordinates are collected in the field, each crew member is responsible for making sure the GPS was programmed correctly and that the recorded coordinates are accurate.

Population- Populations are groups of fish that are substantially reproductively isolated. Population boundaries on the landscape have been established for listed species and typically describe large areas of the watershed (typically dominated by a major river). The Columbia River Coastal Strata is comprised of the following populations:

Young's Bay
Big Creek
Clatskanie
Scappoose.

The Columbia River Cascade Strata is comprised of the following populations:

Clackamas River
Sandy River

The Columbia River Gorge Strata is comprised of the following populations:

Lower Gorge Populations
Upper Gorge Populations

Stream- Stream names are listed on 1:24,000 topographic maps. If a stream is encountered during a survey that does not have a name on the map, do NOT make up a name. Label the tributary on your topo map and STREAM datasheet as Trib 1, L or R (indicating that it is the first unnamed tributary encountered in the stream reach on either the Left or Right side of the river when looking downstream) and record the GPS location of the tributary. The following abbreviations may be used when writing stream names:

FK = Fork
CK = Creek
RV = River
Compass directions (N, S, E, W)
L or R for Left or Right

Reach- Reaches are defined based on channel morphology and tributary junctions. Where AQI has already defined reach breaks, these breaks will be used. If reaches have not been surveyed before, reaches will be defined from aerial photos and 1:24,000 topos prior to crews entering stream. Reach numbers begin at 1 for each stream.

Unit- When surveys are conducted without AQI crews, a unit will be defined as a 25-50 m section of stream. It may be of any width and it may begin and end in the middle of pools or riffles. If a reach break occurs within a unit, note the length of the unit on the STREAM datasheet and begin a new unit at the beginning of the reach break. Units are numbered continuously within a REACH beginning with 1 at the downstream end. Unit numbers MAY BE repeated between reaches.

Patch- The area of either spawning substrate or cold water within a unit. Patches are numbered continuously within a UNIT beginning with 1 at the downstream end. Patch numbers may be repeated within a reach or stream. Patches may extend across unit or reach breaks. Begin a new patch whenever a unit or reach break is encountered and note in the comment field that a patch is a continuation of the patch from the downstream unit.

Active Channel Width. Distance across channel at "bankfull" flow. Bankfull flow is the level the stream flow attains every 1.5 years on average. The boundary of the active channel can be difficult to determine; use changes in vegetation, slope breaks, or high water marks as clues. The key indicator of bankfull stage (active channel) is the floodplain: a flat depositional surface adjacent to the channel and at the top of point bars (Moore et al. 2011).

Spawning Substrate Size Classes- Chum can spawn in a range of substrate classes but are most frequently described spawning in gravels and small cobbles (Dill and Northcote 1970; Hale et al. 1985; Garland et al. 2003). The following size classes were derived from the literature and will be used to describe chum spawning habitat.

Fines/Sand	< 4 mm
Small Gravel	4-11 mm
Large Gravel	12- 45 mm
Small Cobble	46-128 mm
Large Cobble	129-300 mm
Boulder	> 300 mm

3.0 Stream characteristics: STREAM datasheet

GPS Datum- GPS coordinates can be recorded in latitude and longitude (lat long) or in UTMs. UTMs are a projection of spherical data (the globe) onto a flat surface. There are many ways to project data and each way causes different portions of the projection to be warped. For this project, we use the NAD 83 State lambert projection for zone 10.

Make sure that your GPS device is set to project in NAD 83 zone 10 every time you use it. Every STREAM datasheet should have the GPS datum listed.

When reading the numbers from your GPS unit, the top number is the Easting coordinate and corresponds to small numbers along the top of your USGS quad map. The bottom number is the Northing coordinate and corresponds to similar numbers along the side of your USGS map. Your location should be where a vertical line from the Easting mark and a horizontal line from the Northing mark intersect.

GPS Device #- Each GPS device will have a number on it. Record that number on the STREAM datasheet so that waypoints downloaded from the device each day can be associated with the correct datasheets.

Surveyor- Record the initials of all surveyors on the line and circle the one that recorded data on a particular datasheet.

Weather- Record the value that best describes the conditions during the survey:

CL= Clear
PC= Partly Cloudy
C = Cloudy
R = Raining
D = Downpour

Flow Level- Record the value that best describes the conditions during the survey (defined by Moore et al. 2011):

LF Low Flow. Surface water flowing across 50 to 75 percent of the active channel surface.
MF Moderate Flow. Surface water flowing across 75 to 90 percent of the active channel surface.
HF High Flow. Stream flowing completely across active channel surface but not at bankfull.
BF Bankfull Flow. Stream flowing at the upper level of the active channel bank.
FF Flood Flow. Stream flowing over banks onto low terraces or flood plain.

Date- Record all dates like this: 6 JULY 2012 and never like this: 7/6/12 (is this July 6 or June 7?)

Reach- All reach numbers begin at 1 in a stream and the numbers increase as you progress upstream.

Unit #- All Unit numbers begin at 1 in a REACH and the numbers increase as you progress upstream. For mainstem units, simply write the number. If a unit is in a side channel, record the adjacent unit number, then whether the side channel is on river left or right (as you look downstream), then if it is the first, second, etc. unit within the side channel. If a side channel is longer than a single mainstem unit, continue using the mainstem unit

number from the unit where the channel first split off. Record all side channel units on a map, especially if the side channels form a complex. Example: Unit 3 has a side channel that begins on river Left and extends 40 meters. The mainstem is labeled Unit 3. The bottom 25 m of the side channel is labeled 3-LSC-1a (Mainstem Unit 3, Left Side Channel 1, unit a), and the upper 15 m of the side channel is labeled 3-LSC-1b (Mainstem Unit 3, Left Side Channel 1, unit b). Each unit gets its own line on the datasheet. If a second side channel split off the first one, it would be labeled: 3-LSC-2a (Mainstem Unit 3, Left Side Channel 2, unit a) and so on. If a side channel is less than 25 m long, there is no need for a letter to follow the side channel number.

When surveying braided channels, continue upstream, always taking the channel with the greatest flow, until reaching the unit where the stream again forms a single channel. Backtrack, and then survey the sequence of units in the secondary channel, then the sequence of units in the tertiary channel, etc. For particularly complex areas, make a simple sketch in the field book showing the sequence and locations of channel units (type and number).

Length- Record the thalweg length of a unit in meters (e.g., 25.1 m). Units should be 25 m long but may vary in length in side channels or if a reach break occurs part way through a unit. The thalweg length is the length of the path of the deepest channel in the mainstem of the river.

Seeps/ Springs- Seeps and springs are upwelling groundwater that originate from outside the stream channel. Record the number of seeps or springs entering each channel unit.

Location (waypoints)- Record a GPS waypoint at the top and bottom of all streams, reaches, and units. Record a waypoint at all barriers and road crossings and note these points of interest on the Stream datasheet in the comment field associated with whatever reach or unit the feature is found in. Download waypoints EVERY DAY, and make sure they are in a file labeled with the Date, Stream, and Reach (if appropriate). Surveys without accompanying spatial data (GPS locations and maps) are essentially useless.

Waypoints are marked from the main menu on the GPS unit. Hit the button that says "mark waypoint" and then a waypoint number will appear. That is the number to write down on the datasheet. Hit "save" to store that waypoint.

Next, record the accuracy of your waypoint. Accuracy can be found from the "trip computer" screen on the GPS.

Comments- Include comments such as fish or wildlife observations (be specific if possible), evidence of pollution or illegal dumping, names of roads or tributaries, non-native vegetation, debris jam, slides, etc. Specific comments are also indicated on each datasheet (e.g., recording seeps and springs)

Photographs- Take photographs that show the stream and riparian zone at each reach change, in a subset of units (approximately every 100 meters), at every stream barrier, and of

any features that are interesting or that show how work is conducted (to be used in presentations). Record the photo number in the comment field on the STREAM datasheet that corresponds to the unit or reach where the photo was taken.

Rite in the Rain notebook- Maintain a succinct log of your activities in the field book. Each day, record the date, name of the stream you surveyed, and the unit numbers surveyed. Enter the approximate distance covered and number of hours spent working on the stream. Keep track of your travel time separately.

Record relevant details about access to the stream, contact people from cooperating industry or agency groups, and people you contact to gain permission to survey. Record the names and phone numbers of people you may contact as you complete the survey.

Write a paragraph or so of general description for sections of each stream in the field book or on a separate stream report form. Pay particular attention to descriptions of the riparian zone, additional details concerning land use, or factors that influence the fish populations. This is the appropriate place to express your opinions. Other comments, sketches of complex features, suggestions, complaints, etc. are often useful (notebook instructions copied from Moore et al. 2011).

4.0 Groundwater data: TEMPERATURE datasheet

Longitudinal Temperature Profile

1-Sync GPS time and temperature logger time in office prior to survey

2- Program the temperature logger to begin recording data while in the office. Logger should be programmed to record on both temperature channels (air temp from the white section and water temp from the metal section) every 10 seconds.

3- Attach logger to waste belt or place in pocket of survey vest and drag metal end behind you in the water. Logger cannot get wet but metal probe at end can.

4- Note start and end time on TEMPERATURE datasheet under Logger start time and end time

5- Program GPS to record a track. When you turn the GPS on, it will automatically begin recording a track. At the end of the survey, name the GPS track by clicking on "track manager" and then "current track" and then "save track." Then scroll through the date name and add the stream name (and reach name if appropriate) at the end of the date.

7- Any time a cold water patch is identified with the thermocoupler, place logger in the patch for at least 2 seconds (while it adjusts and records).

Cold Water Patch Delineation

Time Start and End- Record start time and end time of temperature survey

Temp Start and End- Record temperature at the start and end of the survey using thermocoupler (temperature probe)

GPS point #- Record the GPS point at the downstream end of the patch

Patch #- Record the patch number within the unit. Patch numbers are not repeated within a REACH but may be repeated within a stream.

Length, Width, and Max depth- To measure patch area, begin by delineating the patch boundary within the active channel (as defined above).

(1) A patch is defined as an area of water with a temperature difference from the surrounding area of at least 0.5 C

(2) There is no minimum patch size for delineating cold water patches (or warm water patches if encountered)

(3) Proceed in the upstream direction sweeping the probe slowly across the stream. The sweep rate should be 1 meter^2 per 2 seconds (VERY SLOW). If the temperature probe shows that the temperature is fluctuating, pause until the probe stops fluctuating. Determine if cold water has been encountered and then continue sweeping if it has not. When cold water is encountered, slowly move the probe through the area until boundaries have been established (Torgersen et al. 2012).

(4) For each continuous patch of cold water, record the length, width, and max depth in meters with accuracy to tenths of meters (e.g., 1.6 m)

Dominant Substrate- The dominant substrate is the most common (> 50% of patch area) substrate size.

Subdominant Substrate- The subdominant substrate is the second most common (< 50% of patch area) substrate size. If a patch is 50% each of two substrate categories, note this in the comments for the patch. Likewise, if a patch is equal parts of three categories, note it in the comments field.

% Fines- Record the percent of the patch area that is fine sediment or sand (< 4 mm). If fines and sand are the dominant substrate class, write "FINES" in the dominant or subdominant field and estimate the percent area covered by fines in the % FINES field. Estimate percent fines as 0-10 %, 10-20% and > 20%

Temperature in Patch- Using the thermocoupler, record the coldest temperature of the cold water patch achieved when the thermocoupler values stop fluctuating.

Temperature adjacent to Patch- Using the thermocoupler, record the average temperature of water outside of the cold water patch (at least 1 m away from patch edge either upstream or to the side of the patch).

Time of Day- Record the time of day in HH:MM when a patch was encountered. This will be used to compare to the temperature logger and the GPS track that is being recorded.

Comments- Note the location of any seeps found within any unit and record their temperature in the comments field. Also note other observations that relate to temperature (e.g., shallow ponds, or other hot water sources).

Temperature Logger Placement

One temperature logger will be placed at the downstream end of each surveyed stream above tidewater and above a location where it would be inundated if the confluencing stream is at flood stage. Secure loggers with rebar and cable and record the GPS location in the field notebook. Record logger placement on the STREAM datasheet in the comment field corresponding to the unit in which the logger is placed. Loggers will be programmed to record temperature once per hour.

5.0 Spawning gravel measurements: SUBSTRATE datasheet

Unit #- Record the unit number as defined by the REACH/ TEMPERATURE crew member.

Patch #- Record the patch number within the unit. Patch numbers are not repeated within a UNIT but may be repeated within a reach or stream.

Length and Width- To measure patch area, begin by delineating the patch boundary within the active channel (as defined above).

(1) A patch is defined as an area of substrate comprised entirely **of Small Gravel, Large Gravel, and Small Cobble, with < 20 % Fines/ Sand** interspersed between the substrate (substrate categories defined above), and that is at least **1 m^2 in area.** When assessing Fines and Sand, differentiate between surface flocculants and fine sediment. Fine sediment covers and embeds gravel and cobble, and should be part of your estimate. Surface flocculants are a thin layer of low density fine material over bedrock or boulders and should not be part of the estimate (Moore et al. 2011). If there is > 20% Fines/ Sand, do NOT count the location as a spawning habitat patch.

(5) The downstream boundary of the patch is established when the substrate is composed of small gravel, large gravel, and small cobble (defined above) and covers at least 1 m^2. The upstream boundary of the patch is established when the substrate is composed of substrate sizes outside of the range. A small band of substrate outside of the range WILL count as a patch boundary if there are at least 2 large cobbles within a 1 m^2 patch OR 1 boulder within a patch and that patch is greater than 1 m^2. In other words, a 1 m^2 patch must be entirely comprised of appropriate substrate sizes but a larger patch can have an intermittent piece of large sized substrate here or there (following the guidelines above). Because patches can be relatively large (max 25 m), and we want to

know what the substrate size is per patch, if the composition of substrate changes by 50 % (e.g., all small gravel to 50 % small and large gravels), establish a patch boundary. Substrate within patches should be as homogenous as possible without creating an excessive number of patches. If the upstream edge of a patch comes to a point, define the boundary of the patch where the gravel area is still 1 m wide. If a patch crosses a unit boundary, begin a new patch and note in the comments that it is a continuation of the last patch. This step is critical to have a known location for each patch. Likewise, if two patches with different substrate sizes are next to each other, note that they are a continuation.

(6) For each continuous patch of spawning habitat, record the length and width in meter increments.

(7) Every 10 patches (Marked with an M and shaded in gray on the datasheet), estimate the patch area and record this value on the first half of each length and weight line. Then measure the patch area in decimeters (e.g., 1.3 m) to determine error in estimate. Do not alter your estimate if it does not match up with your measurement. Use this measurement as a way to refine future estimates. There must be at least 3 measurements per reach and no more than one measurement per unit (a unit could have a lot of patches, so there is no need to record more than one measurement per unit if that unit has more than 10 patches).

Substrate Size – For each patch, record the percent of the patch that is Fines/ Sand, Small Gravel (SM Gravel), Large Gravel (LG Gravel), and Small Cobble. Once you are accurate at estimating substrate size classes, you may estimate in lieu of constantly measuring substrate size. However, every 10 units check your measurements using the gravelometer. If a piece of substrate cannot drop through a hole but it can drop through the next larger hole, it is part of the size class beginning 1 mm larger than the hole it cannot drop through. For example, if a rock cannot fit through the 32 mm hole but drops through the 45 mm hole, the rock is 33-45 mm which, according to the defined size classes, would be Large Gravel.

Record the percent of gravels and cobble (in 25% categories), and fine sediment (0-10% HIGH QUALITY; 10-20% MEDIUM QUALITY; >20% UNSUITABLE; Thorsteinson 1965; Rukhlov 1969) within each patch. Gravels and Cobble should add up to 100% and may be interspersed with silt and sand up to 20% of the patch area before the patch is not considered to be spawning habitat and is not counted.

Comments- Record if bedrock is present at the surface and record characteristics of the substrate including whether periphyton growth is observed.

6.0 Migration barriers: BARRIERS datasheet

Barrier- A barrier is defined as any structure at least 1 meter high and extending across the width of the watered channel. Barriers can be natural or man-made. Culverts are recorded as barriers even if there is no drop to the stream (because they could be velocity barriers. Diversion screens are also recorded even if they do not function as a barrier (note their presence in the comment field of the datasheet). Gradient higher than 5% or white water will be recorded as a barrier.

All barriers will be measured and photographed and a GPS point will be taken. Record the picture number and GPS point in the comments field corresponding to the line describing the barrier. At the end of EVERY day, download all pictures into a file labeled by the stream name, reach number, and date. Not all features that we measure will function as barriers, but by quantifying the actual barrier dimensions, we can determine later on what features are actually barriers. Measure all barriers in the field if they meet the required size category, even if they do not appear to be barriers.

Reach #- Record the reach number delineated on the STREAM datasheet. If there are no barriers, list that there are no barriers so that it is clear an area has been thoroughly surveyed.

Unit #- Record the unit number from the STREAM datasheet ONLY when a barrier is present.

Barrier #- Barriers are number sequentially within the UNIT.

Barrier Type- The following codes will be used for barriers:

CC = Circular Culvert
SC = Semicircular Culvert
DL = Dam with fish Ladder
D = Dam without fish ladder
ID = Irrigation Ditch
W = Waterfall (> 1 m drop height)
G = Gradient/ Rapids (> 5 %)
LWD = Large Woody Debris blocking channel
TG = Tide Gate
DK = Dike
O = Other (describe this in comment fields)

Barrier Height from Substrate- Measure the height from the stream bed to the top of the barrier (or the bottom of a culvert). Record values in tenths of meters.

Barrier Width- Measure the cross-stream width of a barrier. For culverts, measure the width of the culvert and the width of the stream in tenths of meters and put the latter value in the comment field.

Upstream to Downstream Barrier Length- Measure the length of the barrier in the direction of flow in tenths of meters.

Downstream Max Pool Depth- Using the depth staff, record the maximum depth of the stream within 10 m of the barrier.

Gradient- Record the gradient of water surface at any feature that may be a gradient barrier (>5% gradient). Gradient is the percent change in elevation over the length of the feature. Estimate gradient with a clinometer. When looking into the clinometer, the left number is the SLOPE and the right number is the percent change of the horizontal distance. The SLOPE number (on the left side) will be used to measure stream gradient. No transformation of that number is required. Crew member two (substrate and barriers) will position his or herself at the bottom of the feature and crew member one (stream and temperature) will position his or herself at the top of the feature. Both crew members will hold his or her depth staff so that the bottom of the staff is at the water surface. Downstream crew member two will hold the clinometer vertically next to the depth staff and at eye height. Find the same point on the upstream surveyor's depth staff and record the gradient angle.

Comments- If the "other" category is used to describe a barrier, list out barrier type here. If a barrier appears to be a complete migration barrier, mention this in the comment fields and it will be revisited during winter flow conditions.

7.0 GEAR CHECKLIST

1. Maps – waterproof topo map, waterproof landowner map, waterproof aerial photo, laminated topo map, atlas and gazetteer for Oregon

2. List of sample reaches for the day with reach number, length, start and stop coordinates (these should be listed on the GPS unit as well), description of reach breaks, and access points.

3. Datasheets/ notebook- Reach datasheet, Barrier datasheet, Substrate datasheet, Temperature datasheet, rite in the rain notebook, pencils, extra lead, clipboard, permanent marker

4. Clothes - Neoprene chest waders, wading shoes, and/or hip boots (non-slip soles are advised), rainwear, snag and thorn-proof clothing appropriate for the weather, hat, bugspray, sunscreen.

5. Survey equipment - Two-meter-long staff (marked in meters and tenths), compass, 50 meter fiberglass measuring tape, day pack, polarized glasses, thermometers, clinometer, clipboard, vest, flagging, permanent markers, digital camera, GPS unit, range finder, thermocoupler probe, temperature probe, temperature logger (1 per stream), gravelometer, gravel depth staff, and mallet.

6. Safety gear – first aid kit, head lamp, radio, and cellular phone, water filter

7 .Contacts. Names, addresses, and phone numbers of key people to contact with respect to survey. Include ODFW district biologists, interested private individuals, landowners contacted for access, etc.

MAP WORK

Do not go into the field without a topographic map! Use the maps to orient to the stream and to identify the location of reach changes, named tributaries, roads, and bridge crossings. Mark all reach changes and important features on the map. Write the channel unit number on the map at the place that corresponds to the location of named tributary junctions, bridges, and other landmarks. Clearly mark where you start and end the survey and areas of access denial.

A good correspondence between landmarks on the map and the data collected is an essential part of our survey effort. Information from the surveys will be utilized and integrated with Geographic Information System (GIS) analysis. Well documented and accurate maps are required for this process. In addition to a well-marked map, it is essential that the habitat survey follow the USGS named stream on the topo map, regardless of the amount of flow.

8.0 EXAMPLES OF DATASHEETS

STREAM DATASHEET

STREAM		Population:_________________		Stream:_________________		GPS Datum:___________________	GPS Device #:_______ Page_______of________
		Surveyors:________________		Weather:__________________		Flow level (circle one) LF MF HF BF FF	Date_________________
REACH	UNIT #	LENGTH (m)	# SEEPS/ SPRINGS	GPS BOTTOM WPT	GPS TOP WPT	GPS ACCURACY	COMMENTS (record observed species or unnamed tributaries/ springs)

TEMPERATURE DATASHEET

TEMPERATURE Population:_____________ Stream:__________________ Time start:_____________ Time end:______________

Surveyors:_________________ Temp start:_____________ Temp end:______________

Substrate: **BR** = Bedrock, **FINES** (< 4 mm), **SG** = Sm Gravel (4 - 11 mm) , **LG** = Lg Gravel (12 - 45 mm), **SC** = Small Cobble (46- 128 mm), **LC**= Cobble (129-300 mm), **B** = Boulder (> 300 mm)

Page_______of________ Date________________

REACH #	UNIT #	PATCH #	LENGTH (m)	WIDTH (m)	MAX DEPTH (decimeters)	DOMINANT SUBSTRATE	SUBDOM. SUBSTRATE	% FINES 0-10, 11-20, > 20	TEMP IN PATCH (^{o}C)	TEMP OUT OF PATCH (^{o}C)	TIME OF DAY HH:MM	COMMENTS (note locations and temperature of any seeps)

SUBSTRATE DATASHEET

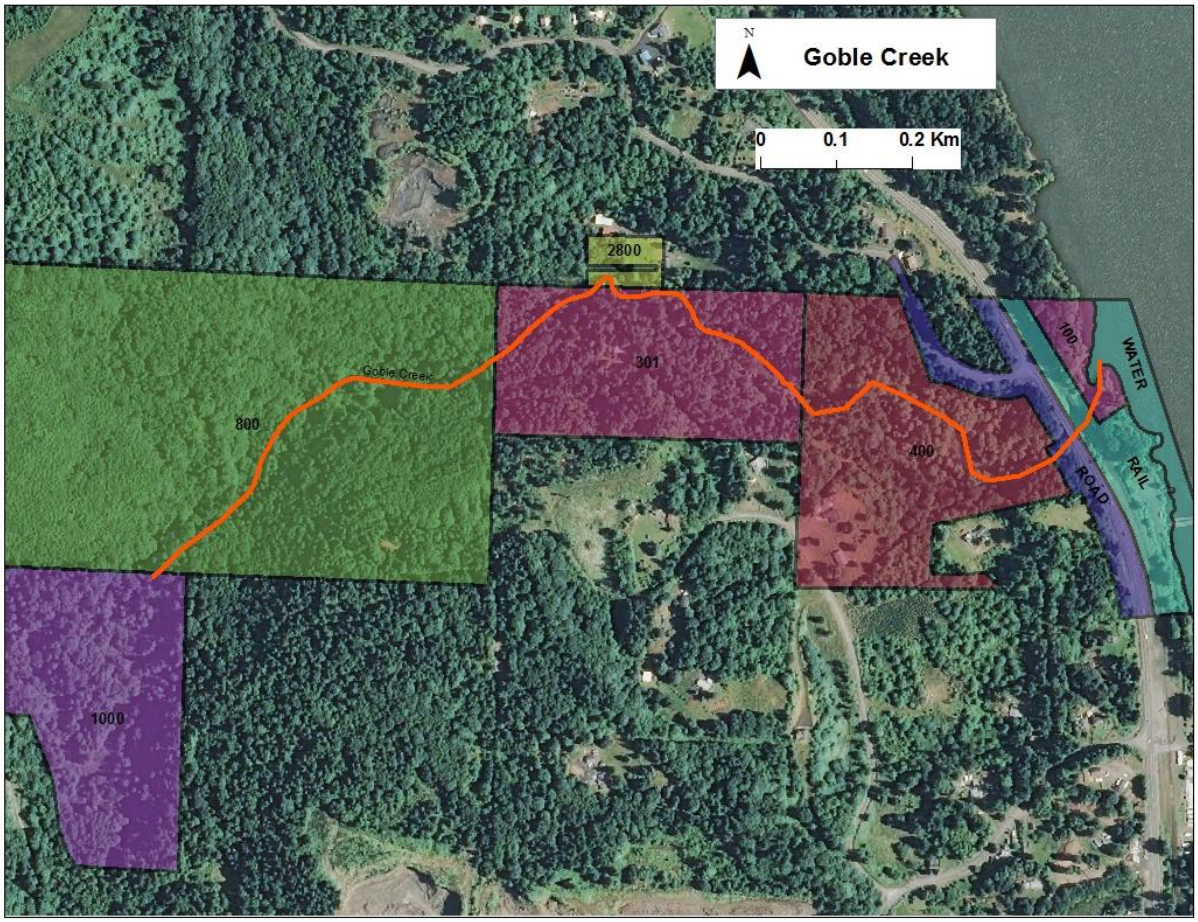
SUBSTRATE		Population:_____		Stream:_____						Page_____of_____
				Surveyors:_____			% FINES can be 0-10% or 10-20% Gravels and cobble measured in 25% categories			Date_____
REACH #	UNIT #	PATCH #	LENGTH (m)	WIDTH (m)	% FINES/ SAND < 4 mm	% SM GRAVEL 4-11 mm	% LG GRAVEL 12-45 mm	% COBBLE 46- 128 mm	GRAVEL DEPTH (up to 50 cm)	COMMENTS (note if bedrock present)
	M		/	/						
	M		/	/						
	M		/	/						

BARRIERS DATASHEET

BARRIERS	Population:______ ______________	Stream:___________ _____________	Barrier types:	**CC** = Circular Culvert **SC** = Semicircular Culvert **ID**= Irrigation Diversion **DL** = Dam with fish Ladder **D** = Dam without ladder	Page_______of_________
		Surveyors:_________________		**W** = Waterfall (> 2 m drop height) **G** = Gradient/ Rapids (> 5%) **LWD** = Large woody debris blocking channel **TG** = Tide Gate **DK** = Dike **O** = Other- list in comments	Date________________

REACH #	UNIT #	BARRIER #	BARRIER TYPE	HEIGHT FROM SUBSTRATE (m)	BARRIER WIDTH (m)	Upstream to downstream BARRIER LENGTH (m)	DOWNSTREAM MAX POOL DEPTH (m)	COMMENTS / PHOTO NUMBER (note if barrier is on tributary entering surveyed stream)

9.0 EXAMPLE OF LANDOWNER MAP



10.0 EXAMPLE OF REACH MAP WITH MARKINGS

11.0 LITERATURE CITED

Moore, K., K. Jones, J, Dambacher, and C. Stein et al. May 2011. Aquatic Inventories Project: Methods for Stream Habitat Surveys, version 21.1. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Conservation and Recovery Program, Corvallis, Oregon 97333. (541) 757-4263

Torgersen, C. E., J. E. Ebersole, and D. M. Keenana. 2012. Primer for identifying cold-water refuges to protect and restore thermal diversity in riverine landscapes. U.S. EPA, Region 10, Report to EPA agreement number DW-14-95755001-0.

EQUIPMENT CHECK LIST

IN STORAGE BOX:

- ATLAS
- FIELD IDENTIFICATION GUIDES (Amphibian, Non-native plants, Fish)
- USGS TOPOGRAPHIC MAPS
- CAMERA
- CLINOMETER
- CLIPBOARDS
- COMPASS
- DATASHEETS and PENCIL
- GPS / BLUETOOTH unit
- DATA FORMS / FILE BOX
- FIBERGLASS MEASURING TAPE
- FIELD BOOK
- FLAGGING TAPE
- SURVEY METHODS AND INSTRUCTIONS
- THERMOMETER (Pocket Celcius scale)
- VESTS
- STORAGE BOX
- CB RADIO
- LASER RANGE-FINDER (optional)
- PENCILS, SHARPIE WATERPROOF MARKER
- FIRST AID KITS
- CELL PHONE
- AXE / PULASKI
- SHOVEL
- DEPTH STAFF
- ODFW HATS AND UNIFORM SHIRTS
- HIP BOOTS
- BOOTIES
- POLARIZED SUNGLASSES
- WADERS
- WADING SHOES
- RAINGEAR
- HEADLAMP, WHISTLE
- WATER JUG
- OREGON PLAN SIGNAGE (yellow signs, orange whiskers, nails
- VEHICLE SAFETY EQUIPMENT (flares, jumper cables, fire extinguisher)

All equipment must be checked in at the end of the field season. Your supervisor will replace hip boots, wading shoes, and other equipment that may become worn out during the summer. Keep your supervisor informed of your equipment needs.