

2008 Mad River Rainbow/Steelhead Trout Spawning Surveys

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Objective 1: Conduct redd counts to expand local knowledge of steelhead spawner numbers, timing, and locations and establish steelhead spawning index reaches on the Mad River, Tillicum Creek, and Roaring Creek.

Objective 2: Conduct redd counts in areas not commonly surveyed but showing relatively high “intrinsic potential”, as defined by the Interior Columbia Technical Recovery Team (ICTRT 2007). WDFW, in collaboration with NOAA Fisheries, conducted supplemental spawning ground surveys in areas not commonly surveyed to validate/ground truth a GIS based model prediction of areas likely to be capable of supporting steelhead spawning and rearing.

Study Area: The Mad River is a 4th order tributary of the Entiat River at RM 10.6, with annual median discharge values ranging from 22.1 to 43.8 cfs between 2003 and 2007 (WDOE 2008). Tillicum Creek is a 3rd order tributary of the Mad River at RM 1.9 with annual median discharge values ranging from 4.0 to 12.2 cfs between 2005 and 2007 (WDOE 2008). Roaring Creek is a 3rd order tributary of the Entiat River at RM 6.3 with annual median discharge values ranging from 2.0 to 6.7 cfs between 2003 and 2007 (WDOE 2008).

Methods: Forest Service Fishery Biologists Phil Archibald and Emily Johnson conducted the 2008 spring spawning surveys on the lower Mad River (RM 0-7) and Roaring Creek (RM 0.2-1.75), see attached table for specific dates and locations. WDFW surveyed Roaring Creek from RM 1.75 to 2.4, stopping where a series of beaver dams appeared to be a passage barrier for adult steelhead at the time of the surveys. WDFW surveyed Tillicum Creek from its confluence with the Mad River to its confluence with Indian Creek (RM 2.9). WDFW also surveyed the Mad River from its confluence with Windy Creek (RM 8.8) to the footbridge at RM 13.9 (between Young Creek and Cougar Creek).

Data collected included date, flow conditions, water temperature, adult fish observed, redd identification by type (definite, probable, possible), redd development (incomplete, complete, fading, erased) and other relevant observations such as redd dimensions and water velocities. All redd and fish dimensions and water surface velocities over redds were estimated. Redds were enumerated sequentially for each stream in the order encountered.

Spring spawning surveys were targeted for March through May, a time period which has previously been observed to encompass the peak of the steelhead spawning season in the Entiat/Mad Rivers. The mid-April to early-May spawning timeframe comports well with steelhead spawning observed in the Icicle River, Nason Creek, and Wenatchee River (Murdoch and Viola 2003). In 2008, spawning surveys could not be continued past May 19 due to high flows (>600 cfs; WADOE stream gage @ Camp Nine) and turbidity which made wading impossible and visibility poor.

Surveys were conducted by biologists walking along the top of streambanks or from adjacent roads/trails or by wading sections of streams that were not visible from other vantage points. Most of the lower Mad River is easily surveyed from the adjacent County Road and Mad River Trail. Surveyors wear polarized lenses to improve visibility of fish and redds. Binoculars are used to observe adult fish from a distance and detect the presence (or absence) of adipose fins if possible.

This year we were able to revisit most redds several times throughout the spawning season to document the development of each redd through the stages of new-and-bright to complete-and-fading to obscured (erased). The multiple visit procedure is recommended in the Upper Columbia Monitoring Strategy and is being implemented in all the major spawning ground surveys for anadromous salmonids throughout the Upper Columbia region (Hillman 2006). Biologists from the USFWS Mid-Columbia River Fisheries Resource Office (FRO) initiated extensive spawning ground surveys of the Entiat River in 2003 and have continued the extended surveys through 2008. Their results for 2008 are presented in the appendix of this report.

For the USFS, preliminary surveys were initiated in mid-March. Preliminary surveys consisted of weekly (3/18, 3/25, 4/3, 4/10) spot-checks of easily-accessible known spawning locations. More extensive surveys were initiated after first spawning activity was observed (April 17, 2008) and continued on April 18, 22, 25, 29, May 2, 7, 9 (final surveys of Mad River and Roaring Creek).

WDFW conducted surveys in Roaring Creek and Tillicum Creek on April 8, 14, 21, 28 and May 5 and 12. The upper section of the Mad River (RM 8.8-13.9) was surveyed on April 16, 24, 29-30 and May 6-7, 13-15.

Results: During the survey period (mid-March to 5/9/2008), Mad River water temperature averaged 6.2°C as recorded by a datalogger at Mad RM 0.3. Streamflow at Entiat RM 18 was below average from February to mid-May before ramping up rapidly from 506 cfs (5/12/08) to 3120 cfs on 5/19/08. Mad River streamflow at RM 9.9 spiked to 625 cfs on 5/19/08 (Figure 1) and 726 cfs at RM 0.35 (USGS gage at Ardenvoir) on the next day (5/20). Survey flow conditions in the Mad were low and clear until the May 20 spike with good visibility during the first eight weekly surveys. The Mad River is unwadeable at flows greater than 100 cfs.

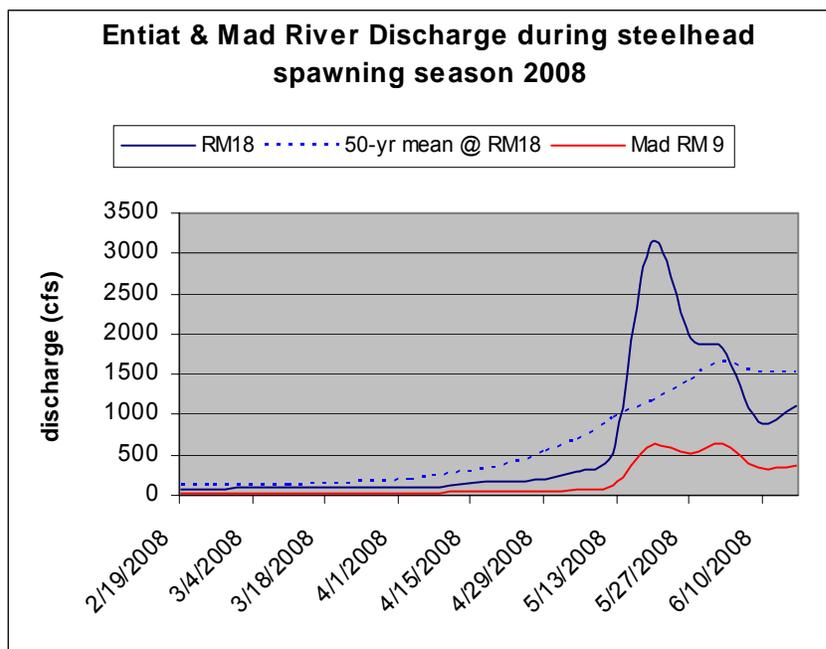


Figure 1. Flow conditions in the Entiat River (RM 18) and Mad River (RM 9.9) during steelhead spawning season 2008.

A total of 48 steelhead redds were identified in the Mad River between rivermiles 0 and 7, consisting of 45 definite redds (37 percent with spawners present) and 3 probable redds (see Table 1, attachment 1, and Figure 2 for specifics). This year no superimposed redds were observed and numerous test digs were noted. Two redds were observed in the Upper Mad River reach, with three steelhead observed on the redd or in close proximity. Both redds were just upstream of a large log jam than has formed at the lower end of Camp 9, just upstream of Windy Creek.

Table 1. Steelhead/Rainbow trout redd counts on the Mad River, 1997 through 2008.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Definite Redds	8		0	3	15	14	38	26	44	23	8	45 index 2 outside
Probable Redds	Not dist.		3	5	2	3	6	9	1	2	1	3 0
RM surveyed	1-3	No survey	1-4	1-10	1-10	1-7	1-7	0-7	0-7	0-7	0-7	0-7 USFS 9-14 WDFW

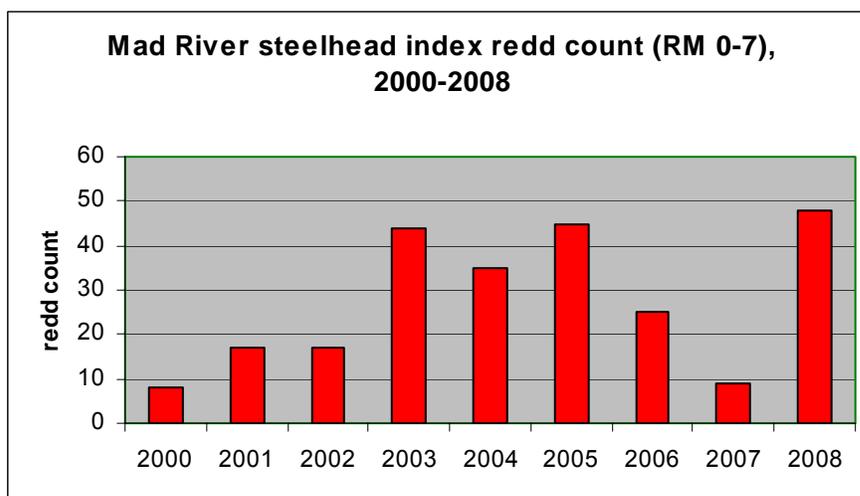


Figure 2. Mad River steelhead index redd count, 2000-2008.

Forty-four adult steelhead were observed on or near redds in the Mad River. Ten of these fish (23%) were observed with intact adipose fins and 3 fish lacked adipose fins. The other 31 adult fish did not permit close enough observation to determine the presence of adipose fins. Overall, Mad River steelhead were larger this year, ranging from 12 to 36 inches estimated total length with a mean length of 24 inches, 2 inches longer than previous year's observations (Figure 3).

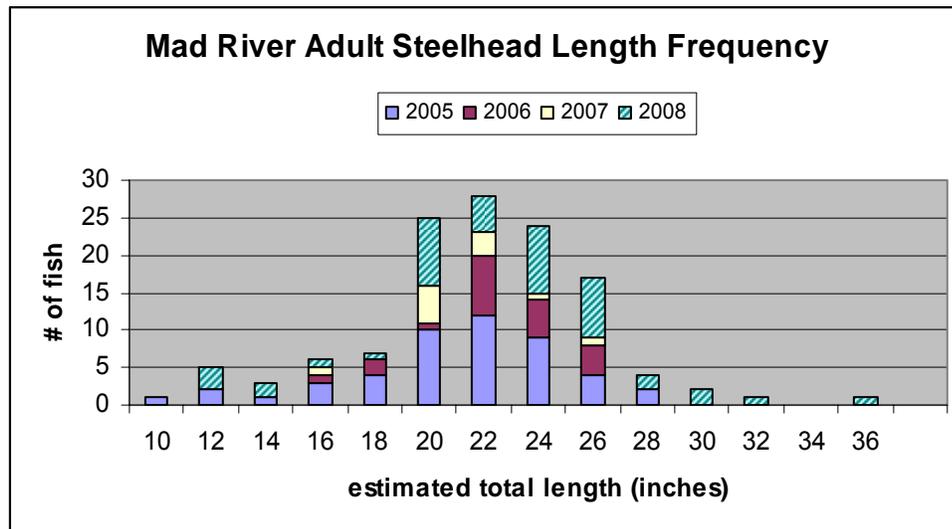


Figure 3. Mad River (n=124) steelhead spawner length-frequency 2005-2008.

Tillicum Creek

Nine steelhead redds were observed in Tillicum Creek between RM 0.07 and 1.75. Tillicum Creek was surveyed to RM 2.9, but no redds were observed between RM 1.75 and 2.9 (Indian Creek). The first redd was observed on April 21 and the last visit to Tillicum Creek on May 12 revealed 2 redds.

Roaring Creek

Seven steelhead redds were observed in Roaring Creek (Figure 4) between RM 0.55 and 1.6 in early May (5/2, 5/7, 5/9). Four Roaring Creek redds were attended by one or two steelhead (7 total seen) that ranged from 20 to 26 inches total length. WDFW surveyors observed an additional 15 redds in Roaring Creek between RM 1.75 and 2.4. Four redds were observed on May 5 and 11 redds were observed on May 12. Unfortunately, high turbid water prevented additional surveys on Roaring Creek after May 12.

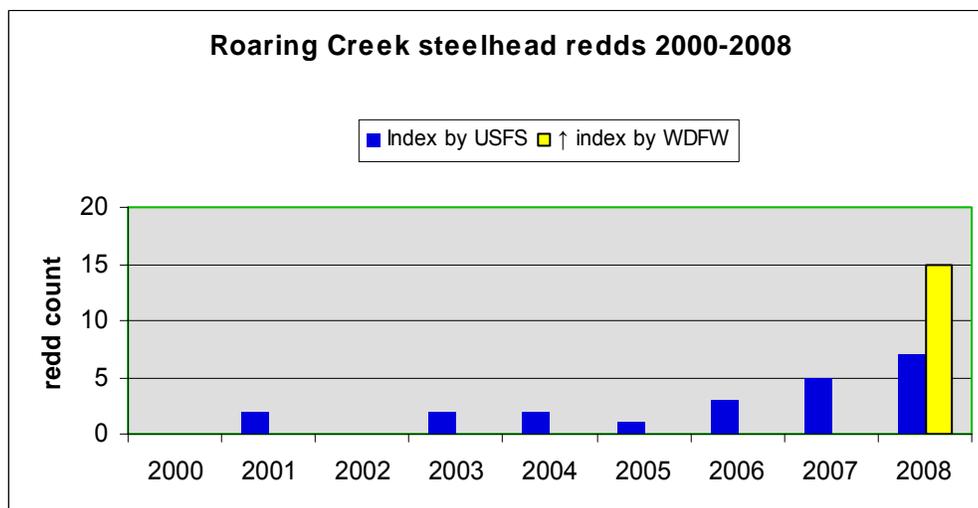


Figure 4. Roaring Creek steelhead redd count, 2000-2008

Discussion and Conclusions: It is widely acknowledged among fishery biologists that spring spawning surveys can be unpredictable and difficult to replicate from year-to-year due to snow conditions, poor visibility due to turbidity, and rising stream flows. Steelhead spawning timing can also vary widely through the months of March through June depending on flow, temperature, and weather conditions. Regardless of these potential drawbacks, we continued spring spawning surveys in the Mad River and Roaring Creek this year with good success.

The results of our spawning ground surveys likely underestimated steelhead spawning in the Mad River in 2008. Increasing streamflow at the end of May hampered repeat surveys of the upper segment of the index reach between river miles 4.5 and 7.2. However, clear water conditions and low flow due to a cold spring provided very good redd observation conditions throughout most of the survey period. Forest Service Mad River survey effort was also reduced this year by other demands resulting from reduced fishery staffing at the Forest level. Entiat Ranger District Biologists Archibald and Johnson provided steelhead survey support on the Wenatchee River Ranger District on 7 days (4/4, 4/8, 4/9, 4/30, 5/16, 5/21 & 5/22). Typically, steelhead spawning proceeds in a longitudinal manner from downstream to upstream as flows rise and water temperatures increase. Many of the definite redds observed between Mad River miles 1.1 and 5.2 were at locations where steelhead redds have been seen in previous years. The 2008 redd count (48 redds) is the highest annual redd count for the nine-year period of record for this survey (Figure 2) and well above the seven-year average (32 redds/year) for the Mad River index reach. Steelhead spawning in the Mad River appeared to peak in late April 2008 (Figure 5), one week later than expected from prior years observations and the results of English et al. (2001). The onset of spawning in the Mad River was 10 days later than expected, likely due to cool spring weather conditions which delayed runoff and kept water temperatures cool.

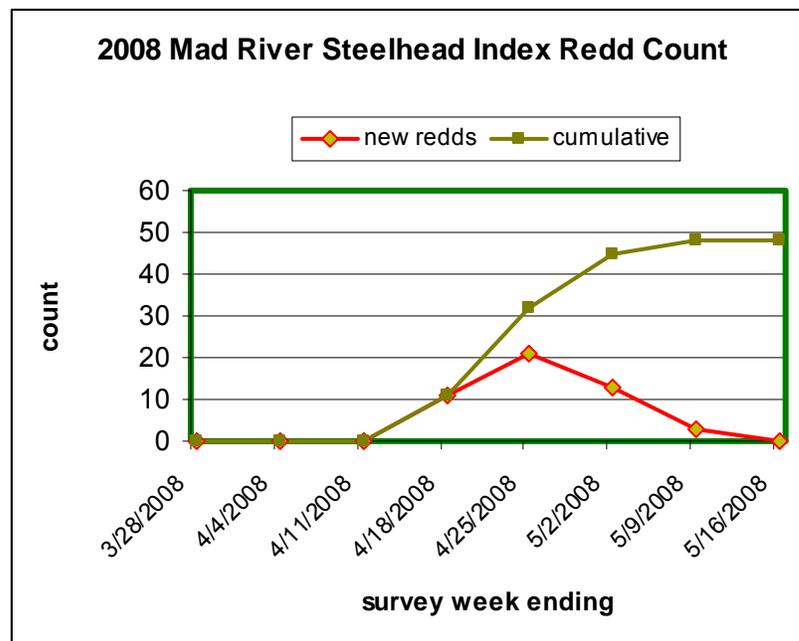


Figure 5. Mad River steelhead redd chronology, 2008.

WDFW efforts (funded by NOAA Fisheries) provided supplemental information on steelhead abundance and distribution that would not have been attainable given USFS budget limitations. Surveying the Upper Mad River, from Camp 9 to Cougar Creek, required considerable additional

effort and expense that yielded only 2 additional redds. One year of surveys is certainly not adequate to determine if steelhead commonly use the Upper Mad River; however, with a record number of fish observed in the Mad River and good redd observation conditions it was a good year for the expanded study. This study did provide the first documentation of steelhead above the Canyon reach between RM 7 and 9. It is possible that more steelhead moved through the surveyed reach (RM 8.8-13.9) and spawned in areas upstream of Cougar Creek. Migratory fluvial bull trout are known to spawn upstream to RM 19.8 (Brown 1992). Likewise, the intrinsic potential model predicts suitable physical conditions for steelhead spawning in those upstream areas. Due to the snow conditions and the remoteness of the Upper Mad River it would be much more difficult to access areas above Cougar Creek (RM 14.9) during the steelhead spawning season.

Past efforts by the USFS have shown steelhead spawning in Tillicum Creek (3 redds between RM 1.1 and 1.3, 4/23/04 [Archibald 2004]). However, the USFS has not been able to establish an index reach and visit it regularly due to budget limitations.

Recommendations: With respect to the 8/11/97 ESA endangered listing of Upper Columbia River steelhead, more and better information on this species is needed for quality Biological Assessments. The Upper Columbia Salmon and Steelhead Recovery Plan (UCSRB 2007) relies heavily on steelhead redd counts as a measure of progress toward recovery of steelhead. Steelhead recovery criteria for the Entiat steelhead population includes an abundance target of 500 spawners (based on 12-year geometric mean [UCSRB 2007]). Therefore, it is recommended that spring spawning surveys be funded and staffed at an appropriate level to ensure the continuity of this vital steelhead metric. Based on the results and knowledge gained during the past nine years of steelhead spawning surveys we recommend continuing the index reach on the Mad River between rivermiles 0 and 7. This Mad River index reach will be our primary focus in the future. We will continue to seek assistance from WDFW, NOAA Fisheries, and USFWS MCRFRO to maintain expanded survey areas (Entiat River, Tillicum Creek, Roaring Creek) and increase survey frequency and continue implementation of a standardized survey protocol.

Considering the number of redds observed in Roaring Creek above the USFS survey reach we recommend that the index reach extend to the beaver ponds (currently at RM 2.4). WDFW and USFS will work with the ISEMP coordinator and NOAA fisheries to see how this extended reach would fit into the Entiat monitoring design and budget of the ISEMP.

Given the number of redds observed in Tillicum Creek this year, and consistent presence of steelhead in Tillicum Creek based on past surveys we recommend including Tillicum Creek as part of the Mad River index area. WDFW and USFS will work with the ISEMP coordinator and NOAA fisheries to see how this extended reach would fit into the Entiat monitoring design and budget of the ISEMP.

WDFW will work with NOAA Fisheries to determine the need / desire to continue surveys of the Upper Mad River (upstream of Windy Creek) as it relates to the Intrinsic Potential model.

The USFS portion of the 2008 survey costs totaled \$5,815. This total includes: 10 days GS-11 surveying and reporting (\$3,300); 9 days GS-9 surveying, reporting, and data management (\$2,340); 1 month of vehicle #7936 (\$167) and 300 miles of travel (\$85). For this survey (2008) the USFS neither requested nor received ISEMP funds from the BPA/NOAA Fisheries. Adding Tillicum and the additional $\frac{3}{4}$ mile of Roaring Creek would require an estimated \$3600 (6 person days/stream x 2 streams x \$300/person day).

References:

- Archibald, P.R. 2004. 2004 Rainbow/Steelhead Trout Spawning Surveys, Mad River. Wenatchee National Forest, Entiat Ranger District, Entiat, WA 98822.
- Brown, L.G. 1992. Draft Management Guide for the Bull Trout, *Salvelinus confluentus* (Suckley) on the Wenatchee National Forest. Report prepared by Washington Department of Wildlife for the Wenatchee National Forest. 56 p + appendices.
- English K.K., C. Sliwinski, B. Nass, and J.R. Stevenson. 2001. Assessment of Adult Steelhead Migration through the Mid-Columbia River using Radio-Telemetry Techniques, 1999-2000. Report prepared by LGL Limited for PUD No. 2 of Grant County, PUD No. 1 of Chelan County, and PUD No. 1 of Douglas County. 48 p + appendices.
- Hillman, T. W. 2006. Monitoring Strategy for the Upper Columbia Basin. A report prepared for the Upper Columbia Salmon Recovery Board, Bonneville Power Administration, and the National Marine Fisheries Service. 1 August 2006. <http://www.ucsrb.com/resources.asp>
- Murdoch, A. and A. Viola. 2003. 2002 Wenatchee River Basin Steelhead Spawning Ground Surveys. WDFW Fish Program, Science Division, Mid-Columbia Field Office, Rock Island Evaluation, 610 N. Mission St., Suite B8, Wenatchee, WA 98801.
- UCSRB. 2007. Upper Columbia Spring Chinook Salmon, Steelhead, and Bull Trout Recovery Plan. Upper Columbia Salmon Recovery Board. <http://www.ucsrb.com/plan.asp>
- WDOE. 2008. Washington State Flow Monitoring Network. Washington Department of Ecology. <https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=46C100>.

Appendix:

Figure 6. Comparison of steelhead redd counts in the Mad River (USFS) and Entiat River (USFWS MCRFRO), 2003-2008.

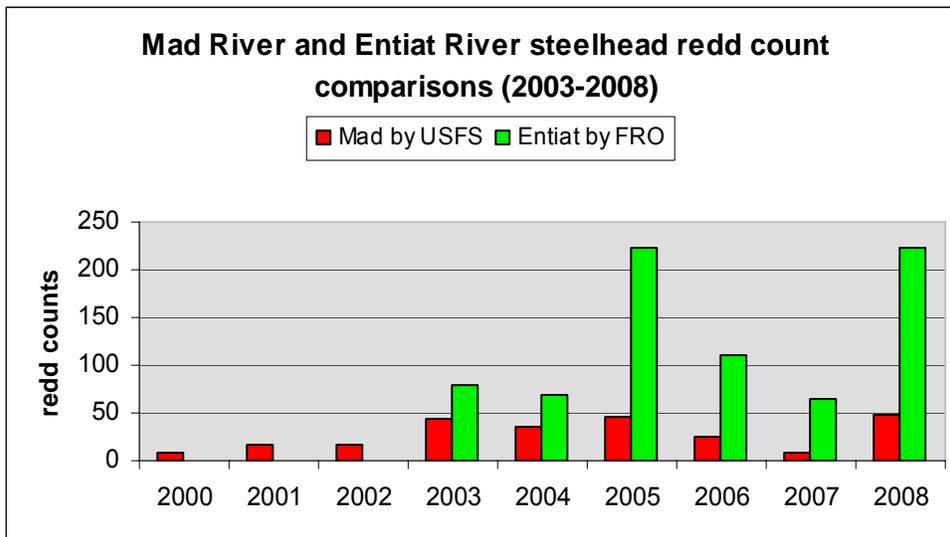


Table 2. Summary of 2008 Entiat Subbasin steelhead redd counts in all surveyed waters by participating agency.

Stream	Survey Segment RM from - to	Surveyed By	Redd Count	Percent of Grand Total
Entiat R.	0.7 – 27.5	USFWS MCRFRO	222	73
Mad R.	0 – 7	USFS	48	17
Mad R.	8.8 - 14	WDFW	2	
Tillicum Cr.	0 – 2.9	WDFW	9	3
Roaring Cr.	0.2 – 1.75	USFS	7	7
Roaring Cr.	1.75 – 2.4	WDFW	15	
Grand Total			303	100%