Distribution and abundance of bull trout and redband trout in Leonard and Deming Creeks, July and August, 2005

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Introduction

Klamath River bull trout were listed as threatened under the federal Endangered Species Act in 1998 (USFWS 2002). In the final listing rule, seven subpopulations were identified within the Klamath River basin: Threemile and Sun Creeks (tributary to Upper Klamath Lake), Long Creek (tributary to the Sycan River); and Deming, Leonard, Brownsworth and Boulder/Dixon Creeks (tributary to the upper Sprague River). All of these populations are considered "precariously low." However, very little current information is available for Leonard, Deming or Boulder/Dixon Creeks.

From 12 July to 18 August, 2005, personnel from ODFW's Native Fish Investigations Program (NFIP) and Klamath Watershed District performed quantitative electrofishing surveys in Leonard and Deming Creeks (South Fork Sprague River tributaries; Figure 1). Our goal was to obtain current information about the distribution and abundance of redband and bull trout within the Sprague River subbasin. Results of the 2005 electrofishing surveys are summarized in this report. Where possible, the results of 2005 surveys are compared to the results of surveys conducted in 1989 (Ziller 1992) and 1997 (ODFW Aquatic Inventory Project, unpublished data).

Methods

Leonard and Deming Creek are both small streams with evenly distributed habitat types (ODFW unpublished stream surveys). Therefore, we used systematic sampling techniques to obtain a representative sample. Our goal was to sample at least 10% of the available habitat and a minimum of 20 sample units in each stream. In Leonard Creek, we sampled 20 evenly spaced sections approximately 35 meters long (12% of the available habitat). In Deming Creek, we sampled 20 evenly spaced sections approximately 50 meters long (11% of the available habitat). In each pre-selected sample unit, we used the two pass depletion-removal method to obtain population estimates for age 1+ (≥60 mm Fork Length) bull trout and age 1+ redband trout (≥ 60 mm FL). To establish distribution limits for redband and bull trout, we electrofished upstream and downstream of the first and last sample units.

Prior to electrofishing, sampling units were located and marked according to the systematic sampling design described above. Block nets were placed at the upstream and downstream ends of each unit. Nets were anchored to the bottom with rocks and tied to secure anchors on the stream bank. If necessary, start and end points were adjusted slightly to avoid setting block nets in deep pools or swift water. The water temperature was measured prior to electrofishing. If the water temperature exceeded 57° F (14° C), electrofishing was postponed until the following morning.

We used a Smith-Root model 12 back-pack electrofishing unit to capture fish. At the beginning of each sampling session, frequency and voltage were adjusted to the minimum settings. Without exceeding 40 Hz, the voltage was gradually increased only to the point where fish could be captured. To sample each unit, at least two crew members (one person to operate the electrofishing unit and at least one "netter") electrofished from the downstream block net to the upstream block net. At least two "passes" (one trip upstream ***and*** one trip downstream) were taken through each sampling unit.

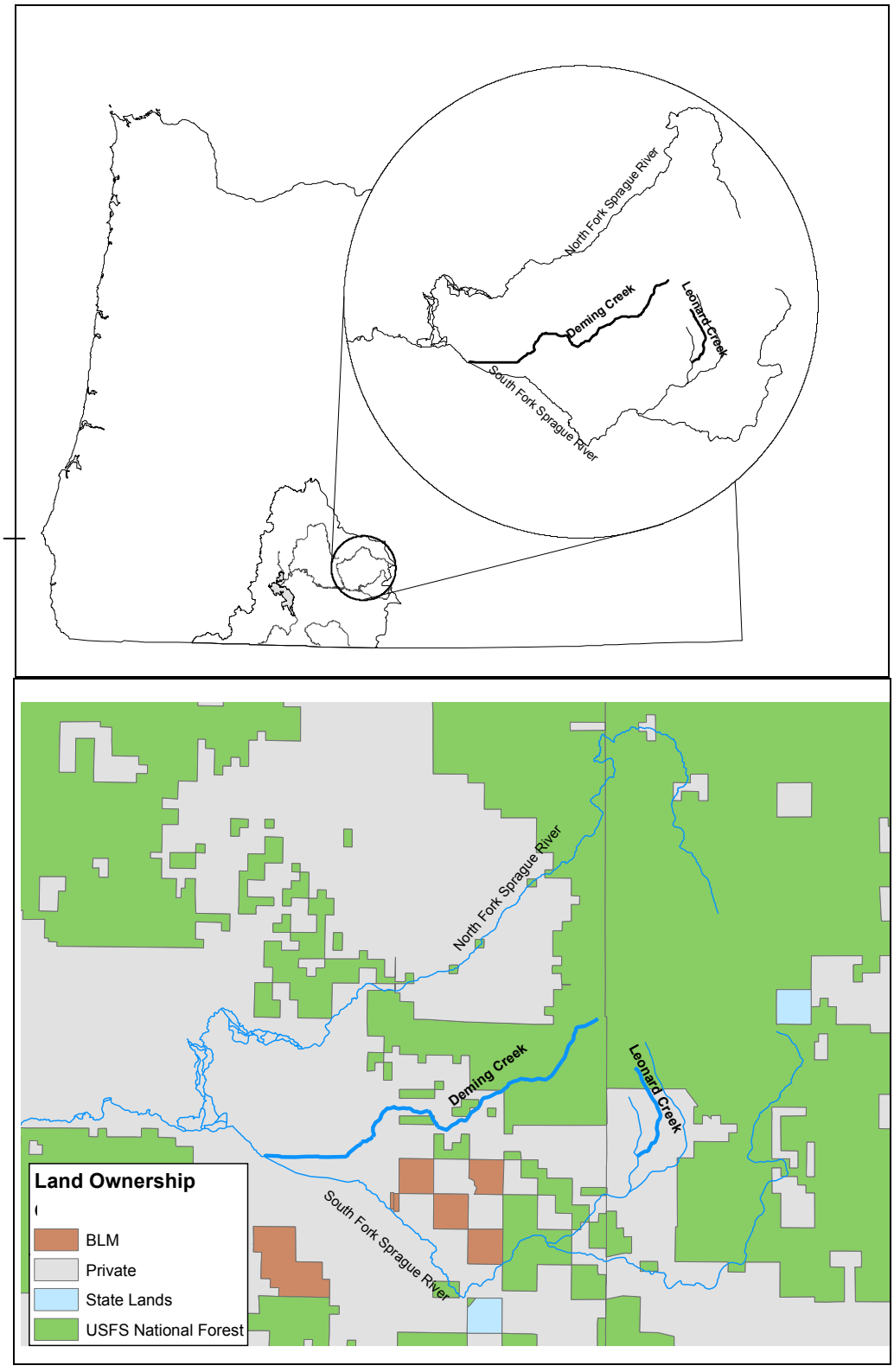

Figure 1. Study Area. Top Panel: Location of Leonard and Deming Creeks within Sprague subbasin. Lower Panel: Land Ownership.

Immobilized fish were captured with dip nets and placed in five gallon buckets filled with fresh, cold stream water. Fish large enough to injure or consume smaller fish were held in a separate bucket. If are signs of injury or handling stress were observed (dark bands on the body and/or long recovery times), we adjusted the settings for the electrofishing unit. Electrofishing operations were terminated if injuries or abnormally long recovery times persisted.

After the first pass was completed, captured fish were anesthetized with buffered MS-222 and measured to the nearest millimeter fork length (FL). Processed fish were placed in aerated recovery buckets. Buckets were placed in the shade and fresh water was added periodically.

The second pass was performed after all fish from the first pass were processed. If the number of age 1+ bull trout and redband trout captured during the second pass was not 50% less than the number captured during the first pass, then one more pass was performed. A fourth pass was performed if more than one of each target species was captured during the third pass. No more than four passes were taken through any unit. Fish were released as soon as possible. If the number of fish captured during the second pass was at least 50% less than the number captured during the first pass, fish captured during the first pass were released before fish from the second pass were processed.

After all fish were processed and released, three representative measurements were taken to estimate average width; and three or more measurements were taken to estimate average depth. Particularly deep pools and other notable habitat features were noted on the data sheet. Garmin 12 GPS units were used to obtain UTM coordinates for the start and end points of each section.

Results

Deming Creek

In 8.5 km of Deming Creek, we captured 142 bull trout and 153 redband trout (Table 1). Length frequency histograms (Figures 2 and 3) show at least three age classes for each species. Because electrofishing is more effective for capturing larger fish, young-of year (YOY) may have been underrepresented in our samples.

Table 1. Summary of length data for all fish captured in Deming Creek; August, 2005.

Species	Number captured	Minimum (mm FL)	Maximum (mm FL)	Mean (± SD)
Bull trout	142	32	221	121 ± 41
Redband trout	153	29	224	98 ± 36

To compare with 1989 data, 2005 length data were also analyzed by size category and percentage (Figure 4). Although similar sized bull trout were captured in August, 2005 and August, 1989 (1997 length data not available); both larger and smaller fish were captured in 2005. This was likely due to increased sampling effort. For example, in 1989, only about 3% of the bull trout habitat in Deming Creek was sampled. No block nets were used; and one “pass” was made through each sample unit. In 2005, approximately 11% of bull trout habitat was sampled, block nets were used; and two passes were made through each sample unit.

Sampling more habitats and using block nets most likely increased the sample size and improved our ability to capture both larger and smaller fish.

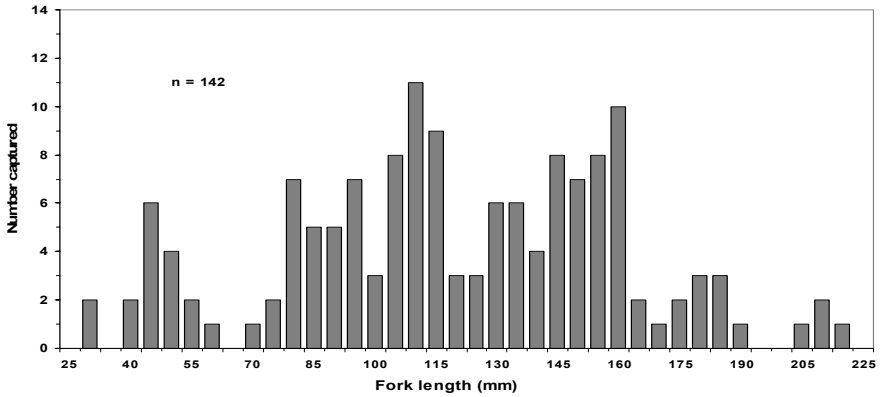

Figure 2. Length frequency histogram for all bull trout captured in Deming Creek, 2005.

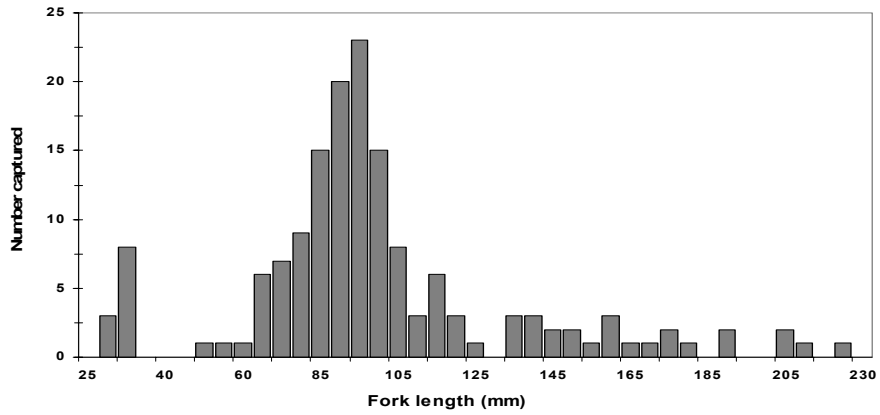

Figure 3. Length frequency histogram for all redband trout captured in Deming Creek, 2005.

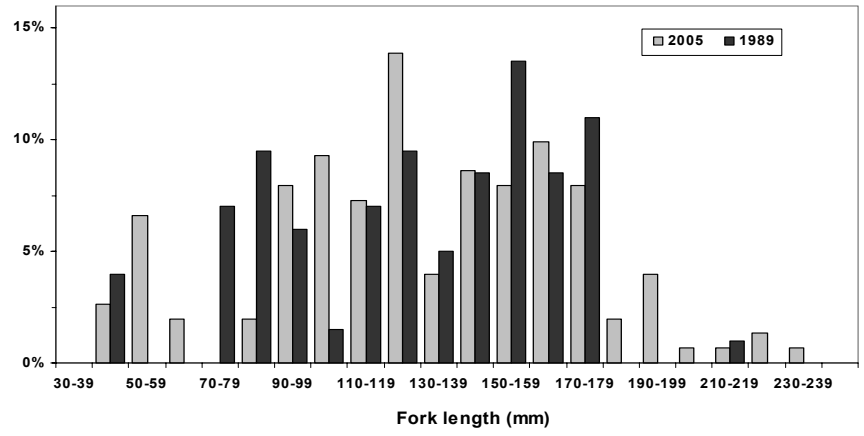

Figure 4. Length frequency histogram for bull trout captured in Deming Creek; August, 1989 and August, 2005.

Population estimates

We obtained population estimates for age 1+ (≥60 mm Fork Length) bull trout and age 1+ redband trout (≥ 60 mm FL; Table 2). Even with a relatively low level of sampling effort, the 1989 survey produced a population estimate for bull trout very similar 1997 and 2005 estimates. This is likely due to physical habitat characteristics. In a small stream with homogeneous habitat, less effort is required to obtain a representative sample. As well, a single "pass" through each sampling unit was probably adequate. For example, in 2005, 89% of bull trout captured in Deming Creek were captured during the first pass.

Table 2. Population estimates for redband and bull trout in Deming Creek, 1989, 1997 and 2005.

Deming Creek population estimates (± 95% confidence interval)				
Bull trout August, 1989	Bull trout July, 1997	Bull trout August, 2005	Redband July, 1997	Redband August, 2005
1,284*	1,470 ± 333	1,316 ± 342	780 ± 123	1,377 ± 505

* *No confidence intervals were calculated for 1989 estimate.*

Distribution

The distribution patterns of all species captured in Deming Creek during August, 2005 are illustrated in Figures 5 and 6. The distribution patterns of all species captured in Deming Creek during August, 1989 are displayed in Figure 7. The 1989 sampling effort was focused on bull trout. Therefore, the downstream limit of 1989 sampling was located approximately 4.0 km upstream of the 1997 and 2005 downstream limits. In Deming Creek, the absolute downstream sampling limit is a private property boundary rather than the mouth of the stream. Consequently, no downstream distribution limits were established for Deming Creek redband in 1989, 1997 or 2005.

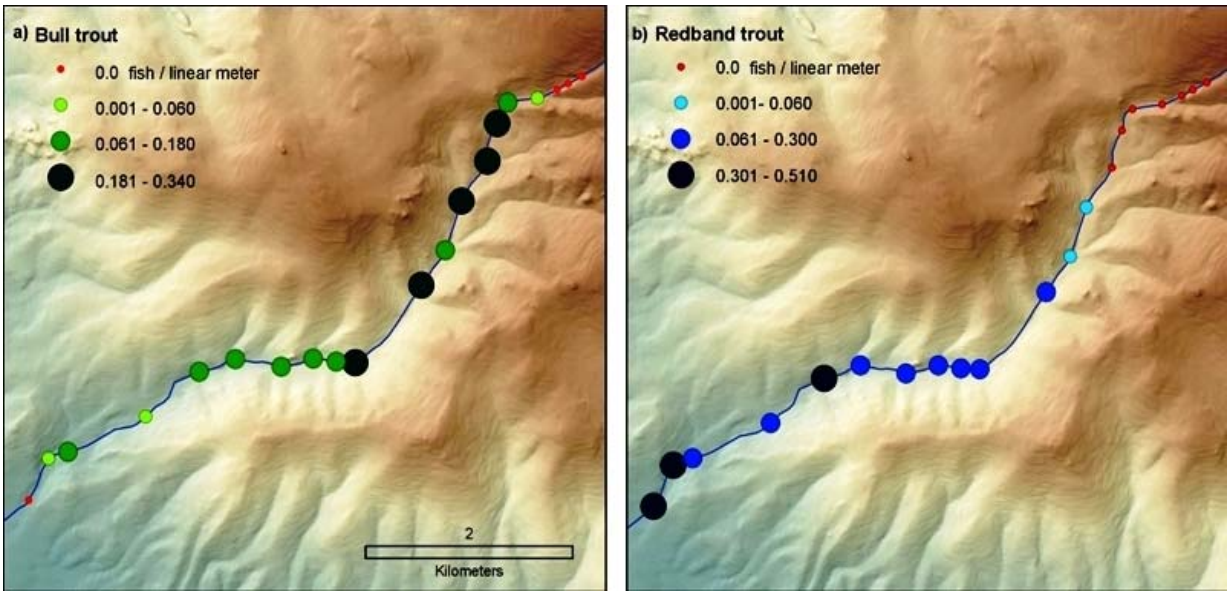

Figure 5. Location of sample points and distribution of redband and bull trout in Deming Creek; August, 2005.

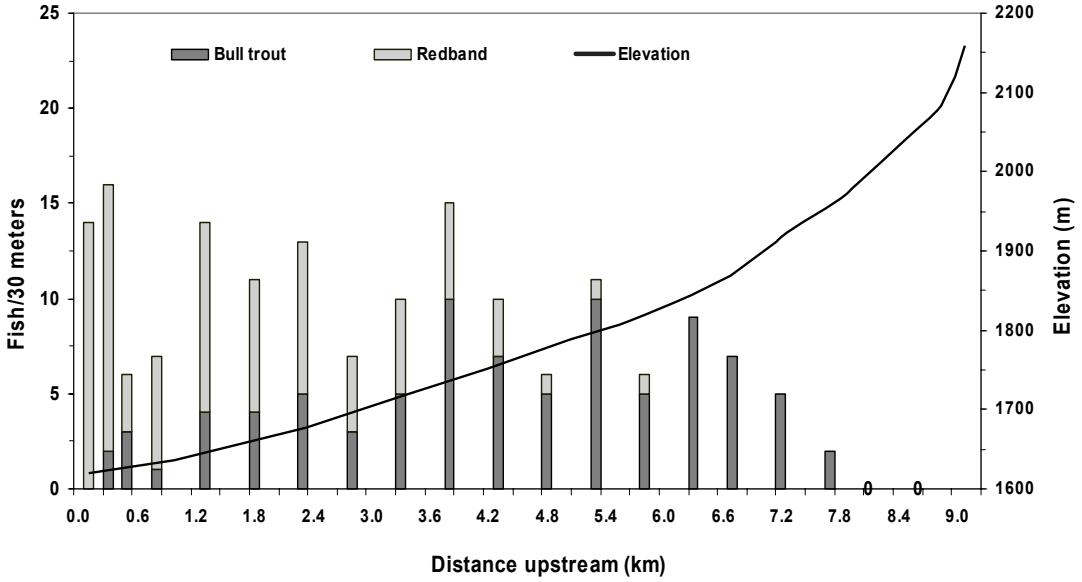

Figure 6. Distribution of redband and bull trout in Deming Creek; August, 2005.

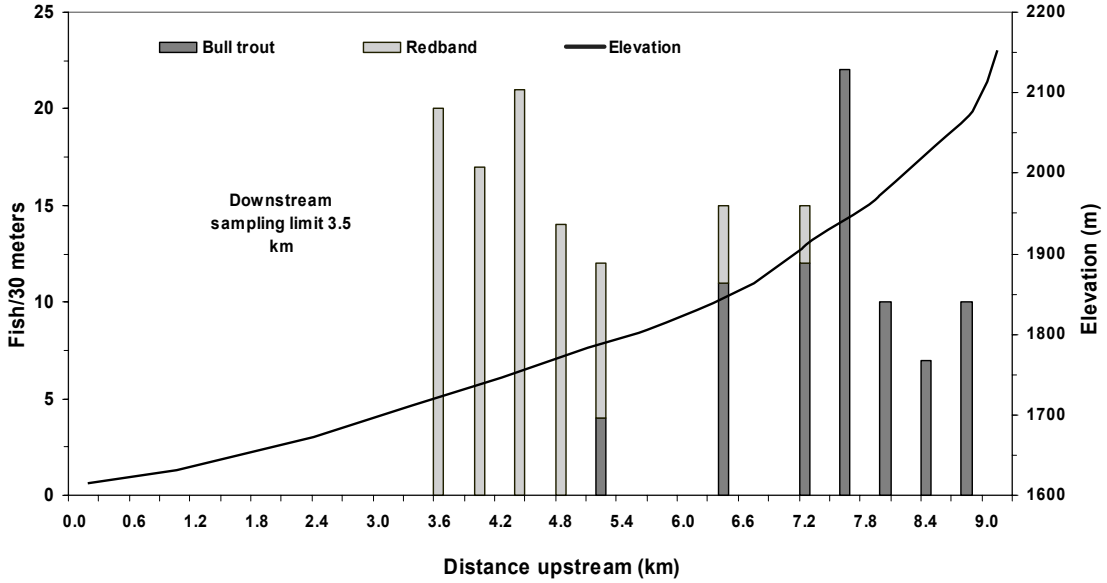

Figure 7. Distribution of redband and bull trout in Deming Creek; August, 1989.

Redband and bull trout were distributed farther downstream in 2005 than in 1989 (Figures 6-7). The 1997 distribution data have not been mapped. However, a preliminary analysis indicates similar fish distribution patterns in 1997 and 2005. It is not clear why cold water fish species would be distributed farther downstream in 2005. According to data from the nearest weather station (Quartz Mountain, USGS Site # 706, Station ID: 20g06s), 1989 was a cooler and wetter year than 2005. If fish distribution were a direct result of precipitation and air temperature, cold

water fish species would be expected to move furthest upstream in 2005. More research pertaining to historical stream conditions will be necessary to explain fish distribution patterns in Deming Creek.

Leonard Creek

In 5.9 kilometers (km) of Leonard Creek, we captured 91 bull trout, 29 redband trout, 10 brown trout and 4 unknown ammocoetes (Table 3). Length frequency histograms (Figures 8-10) show at least two age classes for each species. Because electrofishing is more effective for capturing larger fish, young-of year (YOY) may have been underrepresented in our samples.

Table 3. Summary of length data for all fish captured in Leonard Creek, July, 2005.

Species	Number captured	Minimum length	Maximum length	Mean length (± SD)
Bull trout	91	63	201	124 ± 37
Redband	29	65	188	108 ± 38
Brown trout	10	75	222	140 ± 61
Ammocoetes	4	95	143	128 (n/a)

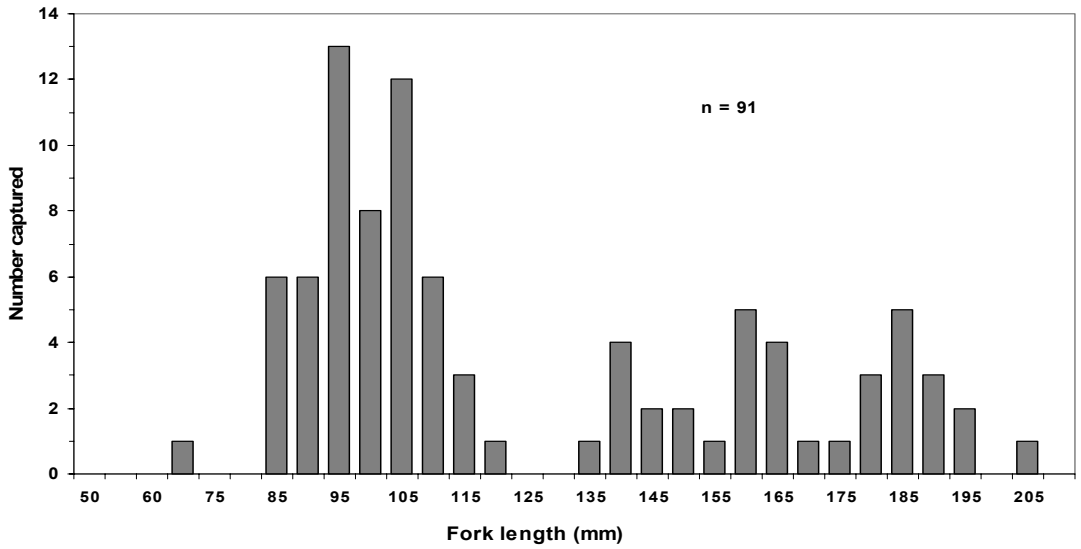

Figure 8. Length-frequency histogram for bull trout captured in Leonard Creek; July, 2005.

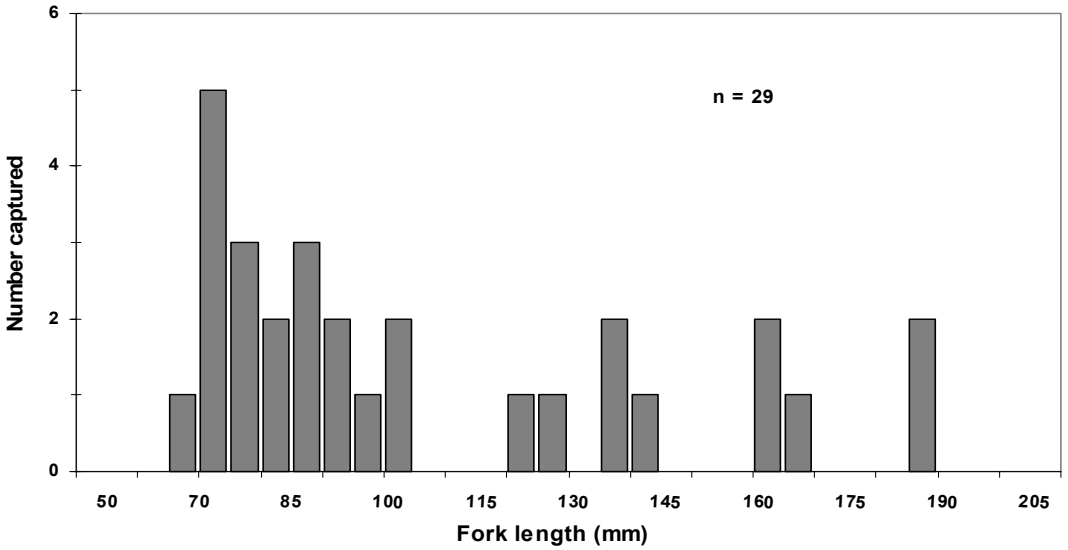

Figure 9. Length-frequency histogram for redband trout captured in Leonard Creek; July, 2005.

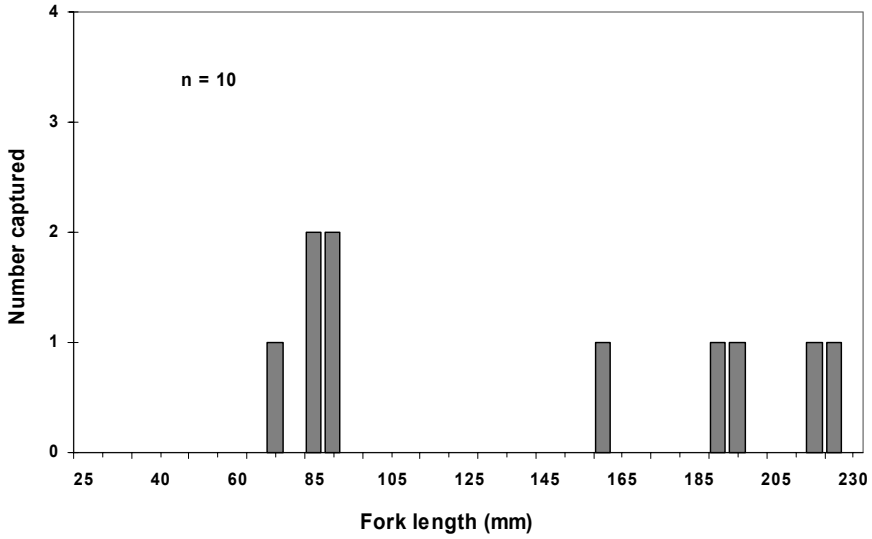

Figure 10. Length-frequency histogram for brown trout captured in Leonard Creek; July, 2005.

To compare with 1989 data, 2005 length data were also analyzed by size category and percentage (Figure 11). Although similar sized bull trout were captured in Leonard Creek during July, 2005 and August, 1989, both larger and smaller fish were captured in 2005. As in Deming Creek, this was likely a result of increased sampling effort.

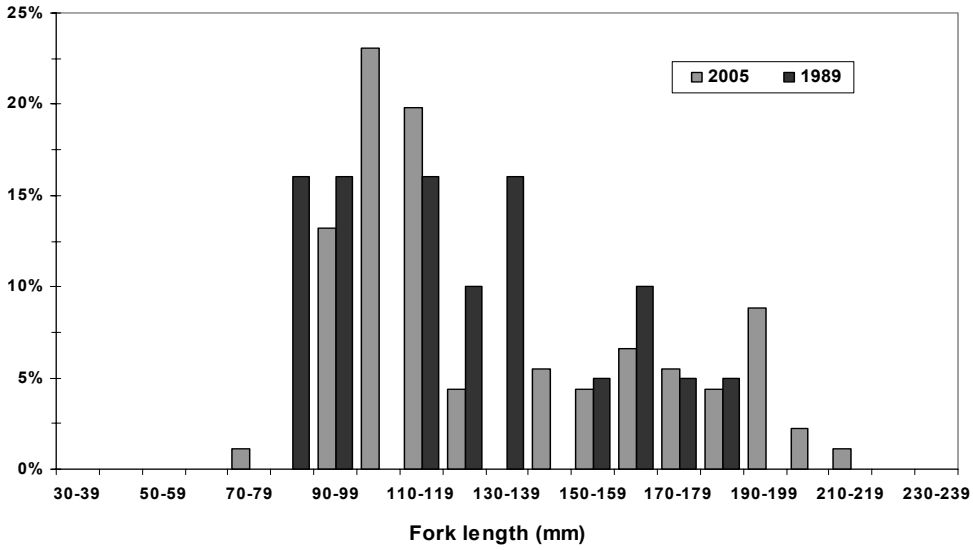

Figure 11. Length frequency histogram for bull trout captured in Leonard Creek, August 1989 and July, 2005.

Population estimates

Population estimates were calculated for bull trout and redband trout ≥ 60 mm FL (Table 4). No population estimates were calculated for redband in 1989; or brown trout in 2005.

Table 4. Population estimates for redband and bull trout in Leonard Creek, August,1989 and July, 2005.

Leonard Creek population estimates (± 95% confidence interval)		
Bull trout August, 1989	Bull trout July, 2005	Redband trout July, 2005
828*	679 ± 443**	231 ± 133**

* *No confidence intervals were calculated for 1989 estimate.*

** *Wide confidence intervals are likely the result of high variability in fish density among the sample sites.*

The population estimates obtained for bull trout in 1989 and 2005 appear to be similar. However, due to the high variability in fish density among sample sites, we did not obtain precise estimates of either the bull trout or redband trout populations in Leonard Creek. In 2006, we will use mark-recapture techniques to obtain more precise population estimates for salmonids in Leonard Creek.

Distribution

The distribution patterns of all fish species captured in Leonard Creek during July, 2005 and August, 1989 are illustrated in Figures 12-14. As in Deming Creek, all salmonids were distributed further downstream in 2005 than in 1989. Although the downstream sampling limit in 1989 was located approximately 2.0 km upstream of the 2005 downstream sampling limit, bull and brown trout were clearly distributed farther downstream in 2005 based on the locations where the highest densities occurred during each year. The distribution of redband trout appears to be similar for both years.

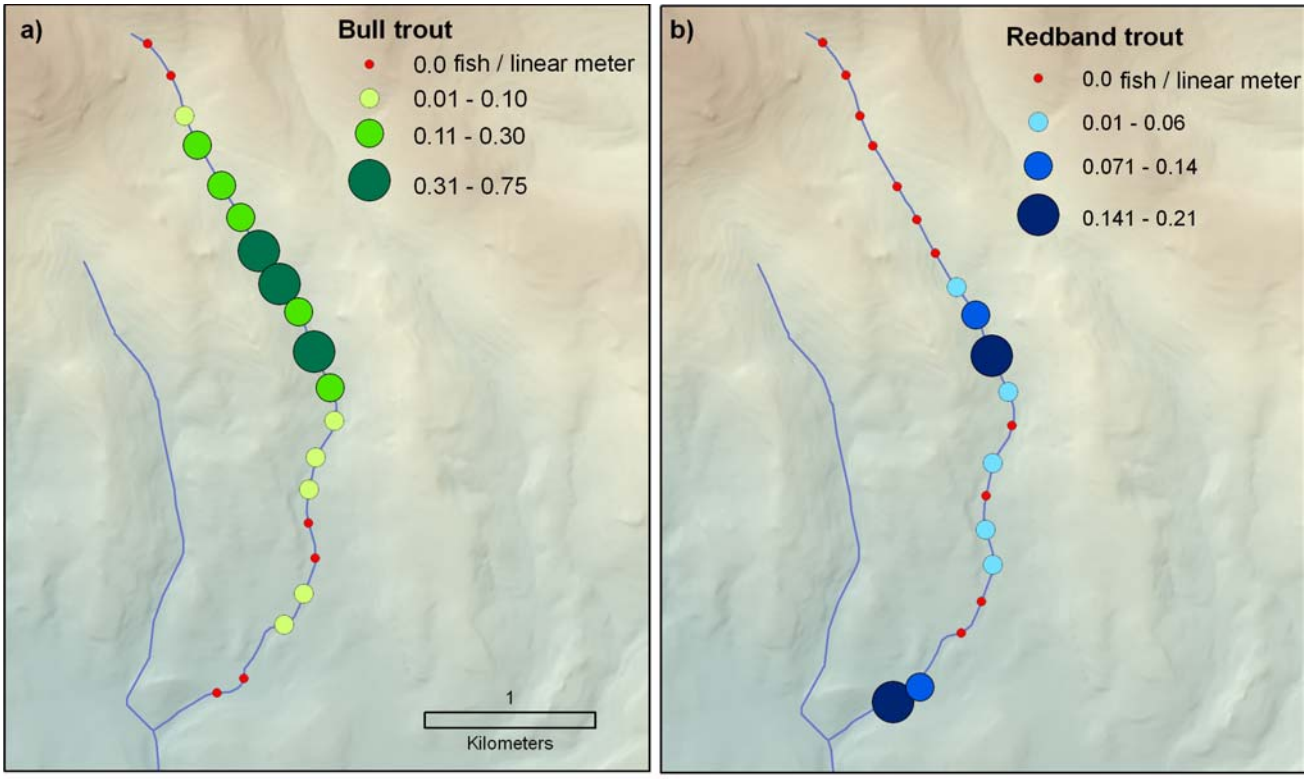

Figure 12. Location of sample points and distribution of redband and bull trout captured in Leonard Creek, July, 2005.

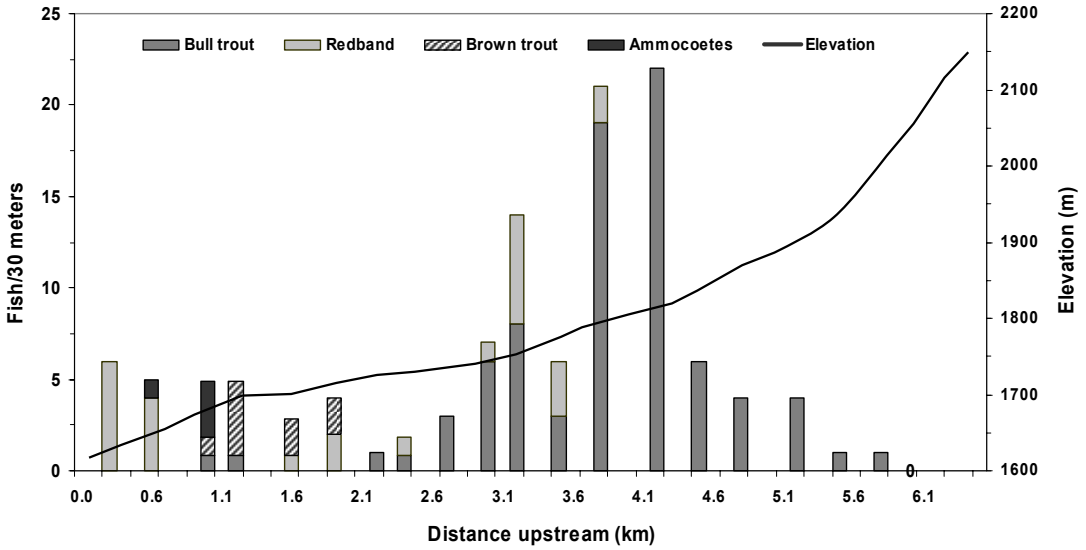

Figure 13. Distribution of all fish species captured in Leonard Creek, July, 2005.

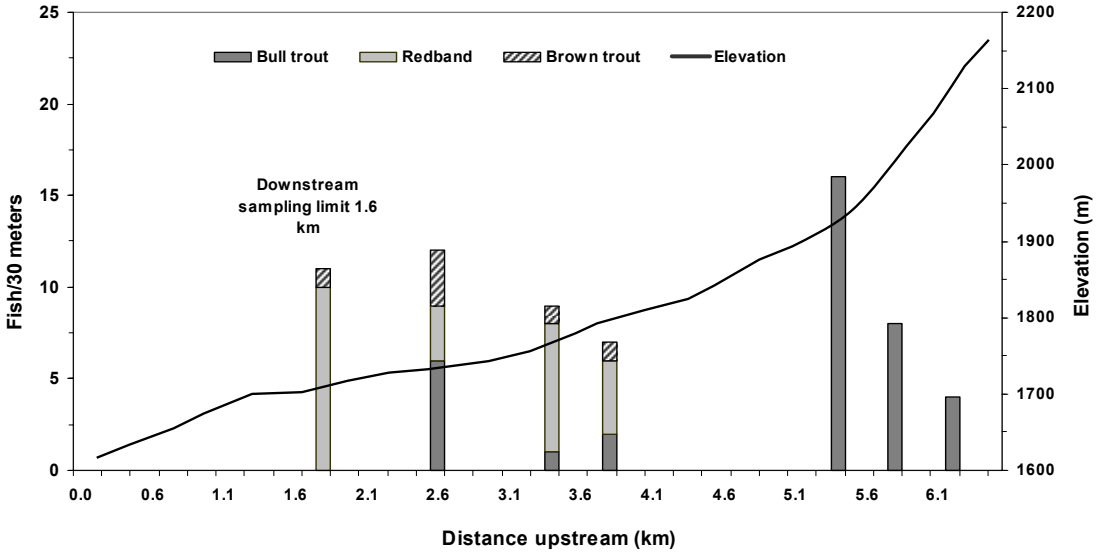

Figure 14. Distribution of all fish species captured in Leonard Creek, August, 1989.

Discussion

Based on the data collected in 1989, 1997 and 2005, populations of redband and bull trout in Deming Creek appear to be stable. Population estimates calculated for Leonard Creek in 1989 and 2005 also appear comparable. However, due to high variability in fish density among sample sites, the 2-pass removal method did not yield a statistically valid population estimate in 2005. In 2006, we will use mark-recapture techniques to obtain population estimates for Leonard Creek.

In both Leonard and Deming Creeks, the distribution of salmonids appears to have shifted downstream since 1989. It is possible that 1989 surveys were performed after bull trout had moved upstream to spawning areas. However, more research will be necessary to explain the observed distribution shifts.

As in 1989, we did not capture any fish large enough to indicate a fluvial life-history. Therefore, populations of redband and bull trout remain at risk due to isolation. Fortunately, invasion by exotic species has not increased. We captured about the same number of brown trout in Leonard Creek in 2005 as in 1989 (10 and 6, respectively); and no brook trout. We did not capture any brook trout or brown trout in Deming Creek.

In 2006, we plan to continue sampling Sprague River tributaries according to priorities set by the High Desert Region and the Klamath bull trout working group. This report will be finalized after the 2006 field season.

Acknowledgements

We wish to thank Andrew Chen and Jens Lovtang for completing the field surveys. We would also like to thank staff of the High Desert Region for assistance with logistics and Timberland Resources LLC for providing access to their land.

References

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Ziller, J.S. 1992. Distribution and relative abundance of bull trout in the Sprague River subbasin, Oregon. Pages 18-28 in P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis.