Bull Trout (Salvelinus confluentus) Reintroduction and Habitat Surveys in the Middle Fork Willamette River System

Cathleen Rose and Coulter Rose

Oregon Department of Fish and Wildlife
3150 E. Main Street
Springfield, OR 97478

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INTRODUCTION

Bull trout (*Salvelinus confluentus*) are large char weighing up to 18 kg and growing to over one meter in length (Goetz 1989). Bull trout are now thought of as valuable indicators of ecosystem status and health because they require cold, spring-fed water, relatively undisturbed habitat (usually associated with old growth forests), and unrestricted interbasin migrations (Ratliff and Howell 1992).

Status

On June 11, 1997, US Fish and Wildlife Service (USFWS) proposed to list the Columbia River bull trout population segment (including the Middle Fork Willamette and McKenzie populations) as *Threatened* under provisions of the Endangered Species Act. A public comment period ended August 12, 1997, and currently (November 1997) USFWS is determining how to proceed. It is expected that the Columbia population will be listed as *Threatened* in 1998.

BACKGROUND/DESCRIPTION OF PROJECT AREA

In Oregon, bull trout were once found in the Clackamas, Santiam, McKenzie, and Middle Fork of the Willamette sub-basins. However, bull trout have declined throughout their range because of overharvest, poor land management practices, and outright eradication efforts. Due to their piscivorous nature, bull trout were blamed for declines in populations of more “desirable” species such as Pacific salmon (*Oncorhynchus* spp.), rainbow trout (*O. mykiss*), and cutthroat trout (*O. clarki*). Bull trout have been extirpated from all areas west of the Cascades except the McKenzie sub-basin and possibly the Middle Fork Willamette sub-basin. However, the McKenzie sub-basin contains the only verifiable populations of bull trout in western Oregon.
Historically, bull trout were reported in the Middle Fork Willamette sub-basin, including the Middle Fork and North Fork of the Middle Fork Willamette rivers as well as Salt, Swift, and Staley creeks. Fish from the McKenzie population may have ranged occasionally into the mainstem Willamette and spawned with bull trout from the Middle Fork Willamette River (MFW). However, relatively warm water temperatures in the mainstem Willamette and the bull trout’s strong homing instinct probably precluded common genetic exchange between the populations.

In addition to overharvest in the MFW, several specific factors can be identified in the decline of bull trout. Poor timber management and road building practices damaged bull trout spawning and rearing habitat and precluded access to suitable habitat. Construction of Dexter, Lookout Point, and Hills Creek dams modified stream temperatures and restricted migrations to and from spawning grounds. Loss of salmon above the dams eliminated one of the bull trout’s largest food sources. Rotenone poisoning to remove undesirable fish above Hills Creek Dam in 1960 killed bull trout in MFW tributaries. Table 1 shows the last reliable observations of bull trout in the MFW sub-basin.

**Table 1. Bull trout observations in the Middle Fork Willamette sub-basin.**

<table>
<thead>
<tr>
<th>WATERBODY</th>
<th>LAST YEAR OBSERVED</th>
</tr>
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<tbody>
<tr>
<td>MFW below Hills Creek Reservoir</td>
<td>1953</td>
</tr>
<tr>
<td>MFW above Hills Creek Reservoir</td>
<td>1990</td>
</tr>
<tr>
<td>North Fork of MFW</td>
<td>1962</td>
</tr>
<tr>
<td>Hills Creek Reservoir</td>
<td>1988</td>
</tr>
<tr>
<td>Salt Creek</td>
<td>1960</td>
</tr>
</tbody>
</table>

Potential bull trout habitat remains in a few spring-fed portions of the MFW and tributaries above Hills Creek Reservoir. However, despite occasional angler reports, repeated electrofishing and snorkel surveys of the MFW and tributaries have not detected...
any bull trout. Therefore, the Upper Willamette Bull Trout Working Group believes that Middle Fork Willamette bull trout will not continue to persist in the sub-basin without additional help.

OBJECTIVES

The objectives for the first three years of this study were to find any bull trout remaining in the MFW sub-basin through electrofishing, snorkeling, trapping, and angler surveys (see ODFW 1994-1996). Because there were no verifiable bull trout observations during this period, we have moved onto the next objective of this project: re-establishment of a sustainable bull trout population by transferring McKenzie River bull trout to the MFW.

ACTIONS

Develop and Evaluate Reintroduction Procedures

In order to develop and evaluate reintroduction procedures, we transferred 178 bull trout fry (age 0+) from Anderson Creek to MFW tributaries in four weekly trips. Each day, bull trout trapped in the Anderson Creek downstream migrant trap were placed in buckets and stored in the trap. At the end of the week, the fish were transported to MFW tributaries that, at the time, appeared to be likely candidates for bull trout reintroduction. Table 2 shows dates and numbers of fry transferred to each location.
Table 2. Summary of bull trout transfers from Anderson Creek to MFW tributaries, 1997.

<table>
<thead>
<tr>
<th>Date</th>
<th># of fry Transferred</th>
<th>Release Location</th>
<th>Temp. (°C)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/22/97</td>
<td>46</td>
<td>Chuckle Springs</td>
<td>5</td>
<td>Released ~70 m below bridge on horse trail</td>
</tr>
<tr>
<td>5/30/97</td>
<td>50</td>
<td>Chuckle Springs</td>
<td>5</td>
<td>Same as above</td>
</tr>
<tr>
<td>6/6/97</td>
<td>56</td>
<td>Skunk Cr.</td>
<td>9</td>
<td>Released ~200 m above MFW trail crossing</td>
</tr>
<tr>
<td>6/13/97</td>
<td>26</td>
<td>Indigo Springs</td>
<td>5</td>
<td>Just below foot bridge crossing in campground</td>
</tr>
<tr>
<td>Total:</td>
<td>178</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transport procedures appeared to be largely successful. Total mortality for fry during storage in the Anderson Creek trap and during transport was 3%. One problem encountered was the regulation of water temperature during transport. Ideally, we would have liked to maintain temperatures close to 5-6°C. However, the water temperature in our transport tank dropped to about 2°C during transport, requiring us to allow a warm-up period before the fry were released. Monitoring procedures were less successful than transport. US Forest Service (USFS) personnel snorkeled Chuckle Springs and Skunk Creek and placed a fry trap at the mouth of Skunk Creek. Although they observed some of the released fry, accurately measuring the fidelity of the fry to the release sites proved impossible.

**Survey Potential Reintroduction Sites**

Considering prior experiences and the *Upper Middle Fork of the Willamette Watershed Analysis* (Willamette National Forest 1996), we identified streams in the MFW watershed that had potential for bull trout use. These potential streams had maximum temperatures of <13°C and were downstream of any known barriers to fish passage. To evaluate these potential sites, in the summer of 1997, we walked and/or snorkeled all or sections of
Swift, Bear, Echo, Beaver, and Tumblebug creeks, as well as the MFW from Beaver Creek to Swift Creek. These surveys included evaluations of substrate, canopy cover, fish migration barriers, water temperature, available gravel for spawning adults, rearing habitat for juveniles, and coarse and fine woody debris. Except for temperature, no measurements were taken. Surveyors independently rated each stream according to the above criteria, and then the ratings were combined to produce a single numerical rating for each stream. Slide photographs and maps documenting each survey are available at ODFW, Springfield.

**Swift Creek**

Swift Creek was surveyed on June 11-12, with a return trip on August 6. We snorkeled/walked Swift Creek from approximately 50 m above the confluence with Bear Creek to the mouth. At the time of the survey, Swift Creek was fairly high with snow melt (inflow into Hills Creek Reservoir was 769 cfs on 6/11 and 854 cfs on 6/12) but was generally clear throughout the survey. A rainstorm added some sediment to the stream near Minnehaha Creek. The weather was cloudy and showery throughout the survey. Cutthroat trout were the only fish species observed.

There was a probable barrier to fish passage at a log jam just upstream from the confluence with Bear Creek. Below the barrier, Swift Creek ran through alternating sections of young forest (20 to 30 years old) and mature forest. There were piles of rock and large woody debris throughout the canyon, with high water marks 5 m. or more above the current stream level. Most woody debris was piled above the current stream level. Throughout the survey, we saw evidence of debris torrents and extensive slope failures in tributary canyons. In the first section surveyed, the stream bottom and adjacent riparian areas consisted mainly of large, loose boulders. As we continued downstream of Baboon Creek, the stream gradient decreased. However, most of the channel substrate remained large cobbles, with occasional pockets of gravel behind large boulders. Very few pools were >1 m deep. Just above and below Rd. 21, there were several deeper pools and extensive woody debris in the stream.
The only potential release sites we noted were three side channels, two above Rd. 21 and one below. One of the upper side channels was located between the mouths of Chako and Coulee creeks, and the other was located approximately half-way between Minnehaha and Baboon creeks. Near these channels, spawning habitat was limited to small pockets of gravel behind large boulders. We returned in August and found that the side channels had insufficient flow to be considered as bull trout release sites. The third side channel, below Rd. 21, was longer and showed greater potential as bull trout rearing habitat.

Overall assessment: While stream temperatures are suitable for bull trout, Swift Creek appears to have poor bull trout habitat due to a lack of spawning and rearing habitat and the flashy hydrology of the watershed.

Bear Creek

We surveyed sections of two branches of Bear Creek and spot-checked additional reaches. A priori, these sections showed promise as potential spawning/rearing areas due to their slope and positions in the upper watershed.

The first survey included the stream from Rd. 2149 upstream to just below Happy Lake. The culvert under Rd. 2149 appeared passable. Bear Creek descended in a stair-like fashion from Happy Lake through uncut, mature forest. The stream consisted of small pools and riffles through bedrock and cobbles, with many downed logs spanning the stream channel. Canopy coverage was nearly 100% for the length of the surveyed reach. However, there was very little gravel for spawning and very little woody debris in the stream. Also, temperatures were elevated, apparently due to flow from Happy Lake: Water temperatures were 17°C at both ends of the survey reach.

The second survey covered a portion of the Bear Creek branch flowing from Blue Lake. Above Rd. 2149, this branch of Bear Creek emerged from uncut, mature forest. The stream temperature was 11°C where it emerged from the culvert, which was likely passable by even small fish. We surveyed from the Rd. 2149 culvert to the beginning of a
steep descent, which likely marks a barrier to fish passage. The surveyed reach was completely clear-cut through the riparian zone within the last 20 years, with current canopy coverage less than 10%. The stream bottom consisted entirely of large cobbles and bedrock, with no large woody debris. The stream temperature increased to 16°C at the base of the clear-cut, approximately 250 m downstream of the road crossing. One, approximately 20-cm cutthroat trout was observed at the base of the culvert.

The northernmost branch of Bear Creek merges with the Happy Lake branch just below Rd. 2149. This branch flows through a ~20-year-old clear-cut in which Sitka alders have become densely established in the riparian zone, resulting in nearly 100% canopy coverage. Although the stream was only 8°C at the (likely passable) culvert, it was very small, with large cobble substrate and little or no in-stream wood.

We spot-checked the area below the confluence of the upper two branches of Bear Creek. The stream temperature was 11°C where the stream emerged from uncut forest into a clear-cut. Even in the mature forest, the canyon was open and bright, with canopy coverage ~50%. Most substrate consisted of large cobbles with occasional gravel pockets. We observed very little fine or coarse woody debris. This section was electrofished in 1996 along with approximately 100 m of stream immediately above the confluence with Swift Creek.

Overall assessment: Bear Creek shows some promise as a possible bull trout spawning area in the reach between the junction of the main branches and the confluence with Swift Creek. However, the Swift/Bear watershed is composed of highly unstable, large substrate, with high potential for scour. Little rearing habitat exists in the watershed, and most bull trout fry would likely be washed very quickly to the MFW, where their survival would be questionable.
**Echo Creek**

We began our survey of Echo Creek in a clear-cut, approximately 250 m upstream of the largest (unnamed) tributary on the east side of the stream at a known barrier to fish passage [approximate 3.7 river miles (RM), 6 river kilometers (RK)]. The barrier was an approximately 2-m falls. As we moved downstream, we encountered another probable barrier at the mouth of the unnamed tributary. Then we passed through the only section of Echo Creek that flowed through unharvested forest, a 500-m section immediately downstream of the unnamed tributary. This section contained many small pockets of potential spawning gravel as well as one lengthy side channel with some rearing habitat. Large woody debris was common in the stream channel, though there were few pools. For the remainder of the distance to the MFW, Echo Creek flowed through recent (<30 years) clear-cuts with primarily cobble substrate and minimal alder canopy. Both the road culvert and a falls ~100 m downstream from the culvert appeared to be barriers to passage. High flows will likely eliminate the lower barrier at some point, but the 1.5-m falls could grow higher if debris accumulates at the site. The section below the road culvert contained more, deeper pools, with occasional large woody debris. There was one short side channel below the culvert, with a temperature of 12°C (on 8/7). The main channel of Echo was 11°C at the mouth, when the MFW was 9°C on 8/7.

Overall assessment: While stream temperatures appear suitable for bull trout, only a short section of Echo Creek contains suitable spawning and rearing habitat. In addition, this minimal habitat is upstream of at least two barriers to fish passage.

**Beaver Creek**

We spot-checked Beaver Creek from just above Rd. 21 to the mouth. Above the road, the creek flows through a brushy clear-cut with little canopy cover. The stream had little flow and was 15°C at the start of the survey. Considering the warm temperature, the lack of adequate flow, and a probable passage barrier just upstream from the MFW, we ruled out Beaver Creek as a potential reintroduction site.
**Tumblebug Creek**

We surveyed Tumblebug Creek from just above Tumblebug Gorge to the confluence with the MFW. We reached the stream via Rd. 2144, approximately 250 m below the mouth of West Branch Tumblebug Creek. In Tumblebug Gorge, the stream cut through a crack in a lava flow, resulting in a canyon with vertical rock walls of > 100 m. The walls of the gorge contained many cracks and caves, with occasional small springs. These springs did not modify the temperature of the stream, as Tumblebug temperatures remained at 13°C throughout the survey. Large rocks and logs that fell from the gorge walls and rim formed many barriers to fish passage, the most dramatic of which was a 6-7 m falls at the mouth of the first tributary encountered in the survey. Substrate consisted of mostly boulders and large cobbles, with numerous pockets of gravel. Trees have become established on occasional islands and rock outcrops. Elk tracks were observed in the gorge.

A debris dam formed at the mouth of the first major tributary below Tumblebug Gorge during a high water event in 1996. Logs, rocks, and soil were piled over 10 m high, damming the stream for at least 200 m upstream. With the higher water table, numerous trees were dying along the impounded section of stream. These trees will likely fall and reinforce the dam in the future.

Below the debris dam, the stream flowed through mature forest until near the confluence with the MFW, where there were two clear-cuts above the riparian area on the west side of the stream. Substrate primarily consisted of cobbles, with occasional gravel. We observed no side channels or main channel habitat suitable for juvenile bull trout rearing. The lowest tributary to Tumblebug was a spring-fed stream of 11°C. However, the stream appeared to be impassable for fish within 100 m of Tumblebug. Tumblebug was 13°C at the mouth, where the MFW was 10°C.
Overall assessment: Tumblebug Creek is an interesting, isolated, largely pristine (where surveyed) stream with little potential for bull trout reintroduction. The stream is probably warmed in clear-cuts upstream of the survey area. The reaches of Tumblebug that are passable to migratory fish are marginal in terms of temperature, have little spawning habitat, and little or no juvenile rearing habitat. Tumblebug should be monitored over time to see how it responds to improved land management practices.

**Middle Fork Willamette River (Beaver Creek to Swift Creek)**

We surveyed the MFW from Beaver Creek downstream to Swift Creek to evaluate barriers to fish passage upstream of Chuckle Springs, and qualitatively evaluate the MFW and short, spring-fed tributaries for potential bull trout spawning and rearing habitat. Just below the mouth of Beaver Creek, a debris dam and falls that was previously considered a barrier had washed out on one side of the channel, opening passage for fish. Downstream, two or more 2-m falls exist on the MFW where it passes through a gorge upstream of Tumblebug Creek. These probable barriers to fish passage are located near the middle and lower end of the gorge, approximately 700-1000 m above the mouth of Tumblebug Creek.

We evaluated every tributary from Chuckle Springs to Swift Creek for potential use by bull trout, noting temperature, cover for juveniles, gravel for spawning adults, and fish passage to and from the MFW. Based on this survey, we chose three sites for bull trout reintroduction in 1998 (described below).

**Identify 1998 Bull Trout Reintroduction Sites**

Three streams have been selected as sites for reintroduction of bull trout fry: Chuckle, Shadow, and Iko springs. These short, spring-fed streams emerge from rock on the north side of the MFW between RM 258 and 260.5 (413-417 RK) (Figure 1). The sites were chosen based on their temperatures (5-6°C maximum), juvenile rearing habitat,
accessibility (for fish), and proximity to spawning habitat. Cutthroat trout inhabit the lower reaches of each stream, and there have been no brook trout observations in the vicinity.

The section of Chuckle Springs accessible to fish is 400-500 m long. This reach contains minimal spawning habitat but is adjacent to good spawning habitat in the MFW. Shadow Springs is only about 60 m long and also contains minimal spawning habitat. The third site, Iko Springs, has the best combination of potential bull trout rearing and spawning habitat observed in the MFW watershed. The accessible portion is 500 m long. Iko Springs contains numerous sections of gravel interspersed with more common sandy or silty reaches and large woody debris in various states of decomposition. Spawning habitat in Iko as well as the other two reintroduction streams could be improved dramatically with gravel supplementation. Based on these observations, we propose to place 20% of the bull trout fry in Chuckle and 20% in Shadow Springs in 1998. The remaining 60% will be placed in Iko Springs, which has the best habitat of the three sites. Percentages may be adjusted as deemed appropriate in the future. We assume that fry released over the four-year period will disperse downstream and that adults will return to spawn in any suitable habitat. See *Re-Introduction of Bull Trout into Upper Middle Fork Willamette River: Actions, Risk Analysis, and Monitoring Plan* (ODFW 1997) for more information.
Figure 1. Middle Fork Willamette reintroduction sites.
Increase Public Awareness of Bull Trout

In April and May, creel surveys were conducted on the MFW between Hills Creek Reservoir and Indigo Springs to increase public awareness of bull trout and to measure compliance with new angling regulations designed to protect native stocks. In 1997, regulations were changed to require artificial flies and lures, and to allow take of only fin-clipped trout in anticipation of bull trout reintroduction and in response to angler concerns about native fish stocks. In addition, rainbow trout stocking was limited to the MFW from near Staley Creek downstream to Hills Creek Reservoir, where summer water temperatures are probably too warm for bull trout. This change should help move anglers away from bull trout habitat. While contacting anglers and checking their catches, we talked with anglers about bull trout identification and the rationale behind the change in regulations. Many anglers disputed the need for a change in regulations and we observed several violations of the new tackle regulations. However, we did not observe any catches of wild fish.

SUMMARY AND CONCLUSIONS

ODFW and USFS are prepared to implement the ODFW bull reintroduction plan (ODFW 1997) at the three selected reintroduction sites. These sites were chosen as the best possible sites out of all the tributaries of the upper MFW. We found no ideal bull trout stream with appropriate temperatures, adult spawning habitat, and juvenile rearing habitat, although Iko Springs approaches this ideal in its short length. The MFW sub-basin contains some of the most heavily harvested watersheds on public land in western Oregon. It may take decades for streams such as Swift, Bear, and Echo creeks to regain the characteristics necessary to sustain a bull trout population. It is possible that the MFW never had large amounts of quality bull trout habitat prior to human intervention, and that human activities have further reduced the quality of marginal habitat. However, because anglers reported catching bull trout frequently early in this century, we believe that bull trout were an integral part of the MFW ecosystem in the recent past.
Relationships to Other Projects

Bull trout recovery can only proceed if other aspects of the MFW ecosystem, including the uplands and the streams, recover as well. The Willamette National Forest is continuing habitat improvement projects in the MFW and tributaries, including placement of large woody debris in stream channels and protection of riparian areas. Improvement of fish habitat should increase cover for adult and juvenile bull trout and decrease stream temperatures, improving chances of bull trout survival. The US Army Corps of Engineers (USACE) is continuing to evaluate anadromous fish passage around Corps dams on the MFW as noted in their report, *Middle Fork Willamette River, Oregon: Fishery Restoration Initial Draft Reconnaissance Study* (USACE 1996). In addition, ODFW has been placing adult chinook salmon that returned to Dexter Dam into the upper MFW since 1993 (excluding 1994). This year, 1,038 adult chinook were added to the system. Historically, juvenile salmon were a major portion of bull trout’s diet. Re-establishment of salmon runs to the MFW above Hills Creek Dam would significantly increase the chances of bull trout reintroduction success.
LITERATURE CITED


