Bull Trout Population and Habitat Surveys in the Middle Fork Willamette and McKenzie Basin

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Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

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Bull Trout (*Salvelinus confluentus)* Population and Habitat Surveys in the McKenzie and Middle Fork Willamette Basins, 2000

Greg Taylor

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

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INTRODUCTION

Prior to 1978, Dolly Varden *Salvelinus malma* were classified into an anadromous and interior form. Cavender (1978) classified the interior form as a distinct species, *Salvelinus confluentus*, the bull trout. Bull trout are large char weighing up to 18 kg and growing to over one meter in length (Goetz 1989). They are distinguished by a broad flat head, large downward curving maxillaries that extend beyond the eye, a well developed fleshy knob and a notch in the lower terminus of the snout, and light colored spots normally smaller than the pupil of the eye (Cavender 1978).

Bull trout are found throughout northwestern North America from lat. 41°N to lat. 60°N. In Oregon, bull trout were once distributed throughout 12 basins in the Klamath and Columbia River systems including the Clackamas, Santiam, McKenzie and Middle Fork Willamette sub-basins west of the Cascades (Buchanan et al. 1997). However, it is believed bull trout have been extirpated from west of the Cascades with the exception of the McKenzie sub-basin.

Before 1963, bull trout in the McKenzie sub-basin were a contiguous population from the mouth to Tamolitch Falls. Following the construction of Cougar and Trail Bridge Reservoirs there are three isolated populations: 1) mainstem McKenzie and tributaries from the mouth to Trail Bridge Reservoir. 2) mainstem McKenzie and tributaries above Trail Bridge Reservoir to Tamolitch Falls. 3) South Fork McKenzie and tributaries above Cougar Reservoir. The study area includes the three aforementioned McKenzie populations, and the Middle Fork Willamette and tributaries above Hills Creek Reservoir.

We monitored bull trout populations in the McKenzie and Middle Fork Willamette basins using a combination of sampling techniques including: spawning surveys, standard pool counts, juvenile trapping, radio tracking, electronic fish counters, and a modified Hankin and Reeves protocol to estimate juvenile abundance and density. In addition, we continued to reintroduce bull trout fry from Anderson Creek (McKenzie Basin) to the Middle Fork Willamette above Hills Creek Reservoir in an attempt to rehabilitate the bull trout population in the Middle Fork Willamette Basin. By monitoring population trends and determining life history characteristics of bull trout in McKenzie and Middle Fork Willamette basins we can make informed management decisions that will help maintain long term and sustainable bull trout populations in the Upper Willamette Basin.

STATUS

On June 10, 1998 the US Fish and Wildlife Service (USFWS) listed the Columbia River bull trout population segment (including the McKenzie sub-basin) as Threatened under the federal Endangered Species Act. Buchanan et al. (1997) listed the bull trout population in the mainstem McKenzie as “of special concern”, the South Fork McKenzie population as “high risk” and the bull trout above Trail Bridge Reservoir as “high risk”. Bull trout in the Middle Fork Willamette are listed as “probably extinct”.

METHODS

Spawning Surveys

We conducted bull trout spawning surveys in Roaring River, Anderson, and Olallie Creeks (McKenzie Basin) during September and October 2000. Surveys occurred bi-weekly to ensure maximum redd visibility and began at the mouth of each stream and continued upstream to natural barriers for migrating adult bull trout. A team of two conducted each survey with one person walking each side of the stream. We marked each redd observed with flagging and recorded the date, redd number, and the number and size of bull trout present.

Standard Pool Counts

We conducted a standard pool count in the South Fork and mainstem McKenzie on 9 August and 15 August 2000, respectively. There are seven standard pools in the mainstem from Olallie Landing downstream to Paradise Campground, a distance of 15 kilometers (km). In the South Fork McKenzie the nine standard pools begin at the confluence of Roaring River and continue downstream to Trap Hole approximately 1.6 km upstream from Cougar Crossing. We surveyed bi-weekly using a team of two divers equipped with snorkeling equipment and dry suits. We recorded the number and size class of bull trout observed in each pool.

Radio Tracking

We captured bull trout at the head of Cougar Reservoir using standard angling equipment in October and November 1998. Radio tags were surgically implanted in bull trout > 20 inches in length using an ODFW protocol (Bellerud 1998). The radio tags are 71 mm x 18 mm, weigh 28 grams, and have a service life of approximately 18 months. We monitored radio tagged bull trout movements weekly by foot, vehicle, or plane using telemetry equipment from Advanced Telemetry System. We recorded the date, location, or “no contact” after tracking each bull trout.

Fish Counter

We installed a “Riverwatcher” fish counter in Anderson Creek and Roaring River to estimate the number and size of spawning adult bull trout in each stream. The “Riverwatcher” is an electronic counter that emits infra-red light beams that are interrupted when a fish swims through the counter and produces a silhouette of the fish. The unit records the date, time, water temperature, direction, length, and depth for each fish passing up or downstream. We constructed a weir in both streams to direct fish passage through the counter. In Roaring River we monitored fish passage from 25 July-7 October and in Anderson Creek from 12 August-24 October 2000. Weekly maintenance performed on the counter and weir included removing debris from the weir, changing batteries, and uploading data.

Juvenile Trapping

USFS personnel trapped juvenile and young-of-the-year (yoy) bull trout migrating down Anderson Creek using a 5 ft. rotary screw trap. The trap is located immediately downstream of the culvert passing under US 126 approximately 0.4 river kilometers (RK) upstream of the confluence with the mainstem McKenzie. The trap operated four days each week from 23 February-03 June 2000. USFS personnel recorded the number, species, and length of all juvenile bull trout and a proportion of the fry captured.

Juvenile Population Estimate

We estimated the abundance and density of juvenile bull trout using pocket habitat in Anderson and Olallie Creek using a modified Hankin and Reeves protocol. Habitat typing identified three unit types; fast (riffle), slow (pool), and pocket. Within fast water units we designated pockets as places with little or no surface turbulence or velocity. For each pocket sampled we recorded length, three width measurements, and a maximum depth. We randomly selected 1/2 of the pocket units for sampling in Anderson Creek and all the pocket units in Olallie Creek. A flag identifying the pocket number was placed at the upper and lower end of each pocket sampled.

Two divers night snorkeled the sample units in Olallie Creek from 16-17 August 2000 and in Anderson Creek from 21-22 August 2000. Divers performed a single pass on all sample units and recorded the number of 0+ and juvenile bull trout ≥ 1+ located within each pocket unit. We calculated mean length, width, depth, and juvenile bull trout density for pocket units in both creeks. We compared mean density in pocket units between years (Anderson 1999 and 2000) and between Creeks (Anderson and Olallie) in 2000.

RESULTS

Mainstem McKenzie

Spawning Survey.--We conducted three spawning surveys of Anderson Creek from 15 September – 17 October 2000. Surveyors observed 83 redds, similar to counts from 1995-99 (Table 1).

Table 1. Bull trout redd counts in Anderson, Olallie, and Sweetwater Creeks, 1989-00.

	Number of Redds Observed				
	Anderson		Olallie	Sweetwater	Total
	Index Area RK 1.3	Total RK 2.6			
Year					
1989	7				
1990	9				
1991	7				
1992	13				
1993	15				
1994	22	30			
1995	30	77	10		87
1996	26	82	8		90
1997	18	85	9		94
1998	29	79	7		86
1999	47	77	6		83
2000	44	83	9	2[a]	94

a *Spawning survey conducted by USFS personnel*

We observed no redds in surveys above the barrier falls. Redd density in Anderson Creek is 31.9 / km with an estimated 2.0 fish / redd. We conducted spawning surveys of Olallie Creek on 12 September and 19 October 2000. Surveyors observed nine redds; (Table 1) all above the culvert passing under US 126. USFS personnel observed two redds in Sweetwater Creek on 19 October 2000. These are the first bull trout redds ever documented in Sweetwater Creek. We believe the adult spawners are derived from introductions of bull trout fry to Sweetwater Creek that began in 1993.

Standard Pool Counts.-- We conducted a single standard pool count in the mainstem McKenzie on 15 August 2000. Snorkelers observed a total of 18 bull trout; well below peak counts observed in 1994-98 (Table 2).

Table 2. Peak number of bull trout observed during standard pool counts in the mainstem McKenzie 1994-00

Year	Number of Bull Trout
1994	32
1995	33
1996	36
1997	19
1998	30
1999	15 [a]
2000	18[b]

a *only two counts were conducted in 1999*
b *only a single count was conducted in 2000*

Juvenile Trapping.--USFS and ODFW personnel trapped bull trout migrating down Anderson Creek using a rotary screw trap for the seventh consecutive year. In 2000, we captured 6,097 bull trout fry and 190 juveniles (Table 3). The estimated number of fry captured decreased by approximately 19% from the mean estimated capture from 1997-99.

Table 3. Number of bull trout fry and juveniles captured in the downstream migrant trap in Anderson Creek,, 1994-00.

	Number of fry		Number ≥ 1^+	
Date	Captured	Estimated migrants[a]	Captured	Estimated migrants[a]
Feb. 15-May 26, 1994	1,808	5,308	129	403
Feb. 15-May 31, 1995	1,877	5,995	261	785
Feb. 19-May 31, 1996	1,995	5,700	179	550
Feb. 11-May 31, 1997	6,540	21,592	64	215
Feb. 10-June 11, 1998	7,902	23,153	151	453

Feb. 23-June 03, 1999	7,406	21,693	100	263
Feb. 21-May 25, 2000	6,097	17,713	190	553

a *Assumes trapping seven days per week and a 60% trap efficiency*

Electronic Fish Counter.--We used an electronic fish counter in Anderson Creek to estimate the number, size, and migration timing of spawning adult bull trout from 12 August-24 October 2000. The counter recorded 138 bull trout passing upstream and 107 downstream (Figure 1). Peak upstream and downstream migration occurred during the first three weeks of September (Figure 1). Peak migration of upstream spawning adult bull trout was similar in 1999 and 2000 (Figure 2).

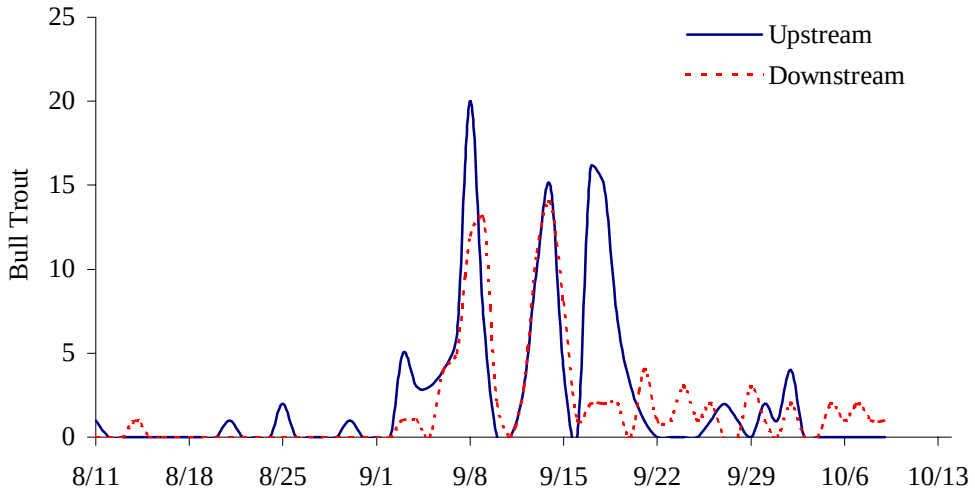

Figure 1. Run timing of adult bull trout through the fish counter in Anderson Creek, 12 August-25 October 2000.

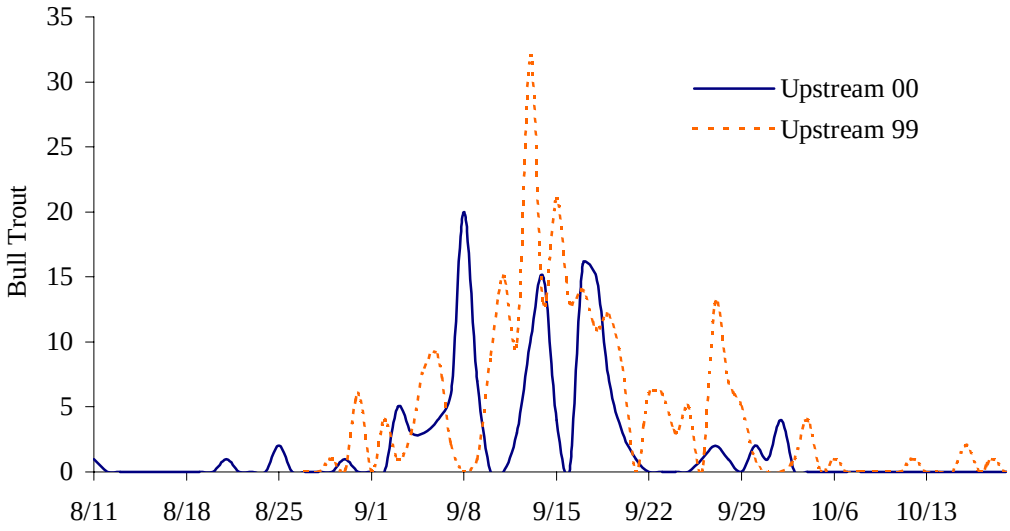

Figure 2. Run timing of adult bull trout upstream through the fish counter in Anderson Creek, 1999-00.

Most bull trout migrated upstream and downstream during daylight hours with peak migration occurring between 12:00-13:00 hours (Figure 3). Bull trout migrated up Anderson Creek in a similar pattern in 1999 and 2000 (Figure 4).

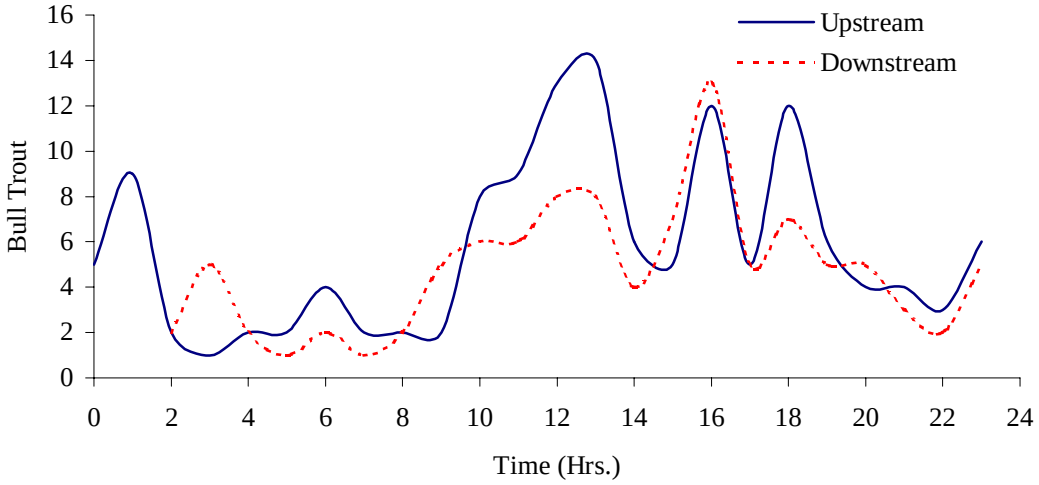

Figure 3. Migration time for adult bull trout through the fish counter in Anderson Creek, 12 August-25 October 2000.

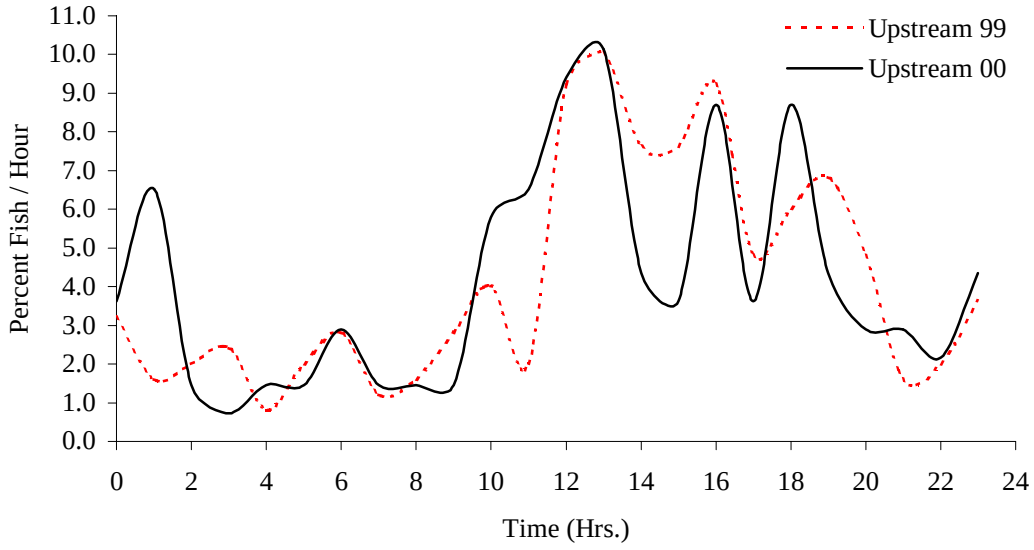

Figure 4. Migration time for adult bull trout moving upstream through the fish counter in Anderson Creek, 1999-00.

The counter recorded the size of bull trout migrating up and downstream based on a depth measurement and a length to depth ratio we supplied (4.6 / 1). Bull trout ranged in

size from 19-81 cm (Figure 5). Bull trout passing upstream (46.2 cm) were significantly larger than those passing downstream (36.5 cm) ($p < 0.05$).

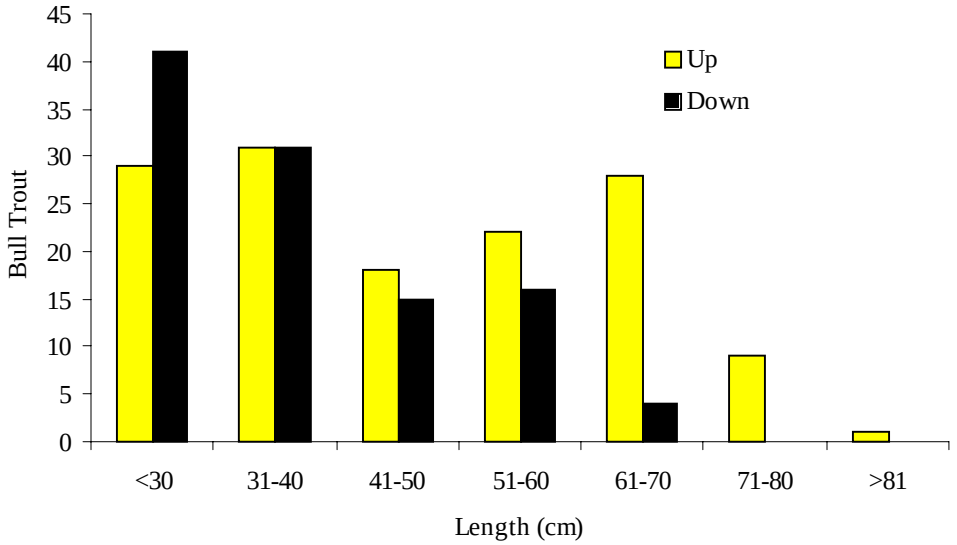

Figure 5. Number and length of bull trout passing up and downstream through a fish counter in Anderson Creek, 12 August-24 October 2000.

Juvenile Population Estimates.--We used a modified Hankin and Reeves protocol to determine density of juvenile bull trout residing in pocket habitat in Anderson and Olallie Creeks. Habitat typing identified 117 pocket units in Anderson Creek and 37 in Olallie Creek on 7-8 August 2000 (Table 4). Mean habitat length, width, and maximum depth were significantly larger in Olallie Creek ($p < 0.05$) (Table 4).

Table 4. Number, average length, width, and maximum depth of pocket units in Anderson and Olallie Creek, 2000.

	Pocket units			
	Number	Average (m)		
Location	Identified / Sampled	Length	Width	Maximum depth
Anderson Creek	117 / 57	3.9	1.7	0.4
Olallie Creek	37 / 37	7.8	2.8	0.6

On 21-22 August 2000 snorkelers randomly sampled ½ of the pockets in Anderson Creek and observed 44 juvenile bull trout. Snorkelers observed 66 juvenile bull trout in 37 pockets in Olallie Creek on 16-17 August 2000. Density of juvenile bull trout in Anderson Creek was similar in 1999 and 2000 (Table 5). In 2000, juvenile bull trout density was similar between Anderson and Olallie Creeks (Table 5).

Table 5. Juvenile bull trout density (/100m^2) for pocket units in Anderson and Olallie Creek, 1999-00.

		Number		
Location	Date	Pocket units	But ≥ 1+	Density (/100m^2)
Anderson Creek	9-12 August 1999	63	30	9.7
Anderson Creek	21-22 August 2000	57	44	11.8
Olallie Creek	16-17 August 2000	37	66	8.0

South Fork McKenzie

Spawning Surveys.--We conducted bull trout spawning surveys of Roaring River on 6 September, 20 September, and 10 October 2000. We observed a total of 25 redds and eight fish during the three surveys. This is the highest redd count recorded for Roaring River (Table 6). Surveyors identified all the redds above Rd. 19 crossing Roaring River and below a barrier 1.1 km upstream.

Table 6. Number of redds observed in Roaring River by USFS and ODFW personnel, 1993-00.

Year	Redds Observed
1993	1
1994	1
1995	2
1996	0
1997	0
1998	6
1999	13
2000	25

Standard Pool Counts.--We conducted a single count of nine standard pools in the South Fork McKenzie River on 9 August 2000. Snorkelers observed four fish; the lowest count ever recorded (Table 7).

Table 7. Peak number of bull trout observed during standard pool counts in the South Fork McKenzie River, 1995-00.

Year	Number of Bull Trout
1995	17
1996	9
1997	10
1998	17
1999	13
2000	4[a]

a *only a single count conducted in 2000*

Radio Tracking.--In January 2000 two bull trout with functioning transmitters remained in Cougar Reservoir. The fish moved out of the reservoir at the end of April and one (#1671entered Roaring River in August (Figure 6).

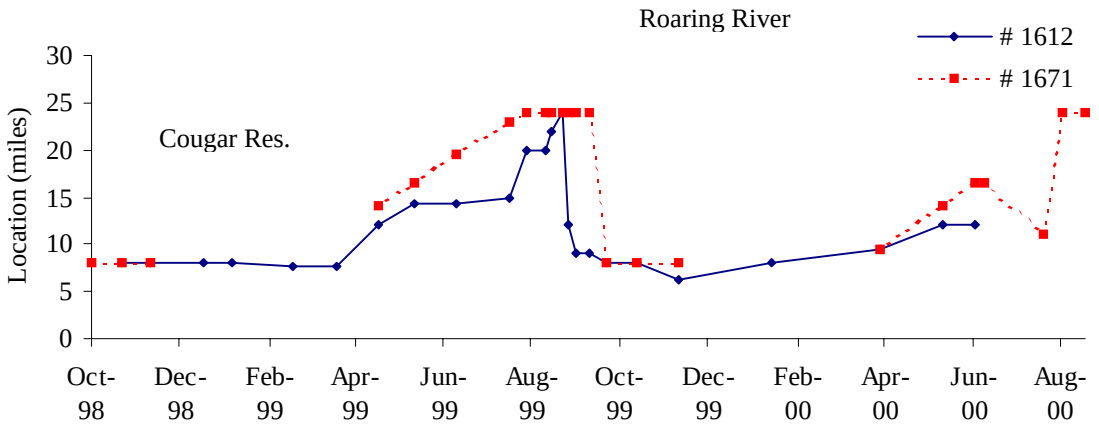

Figure 6. Distribution of two radio tagged bull trout in the South Fork McKenzie River, 1998-00.

Electronic Fish Counter.--We used an electronic fish counter in Roaring River to estimate the number, size, and migration timing of spawning adult bull trout from 25 July-07 October 2000. The counter recorded 81 bull trout passing upstream and 67 downstream (Figure 7).

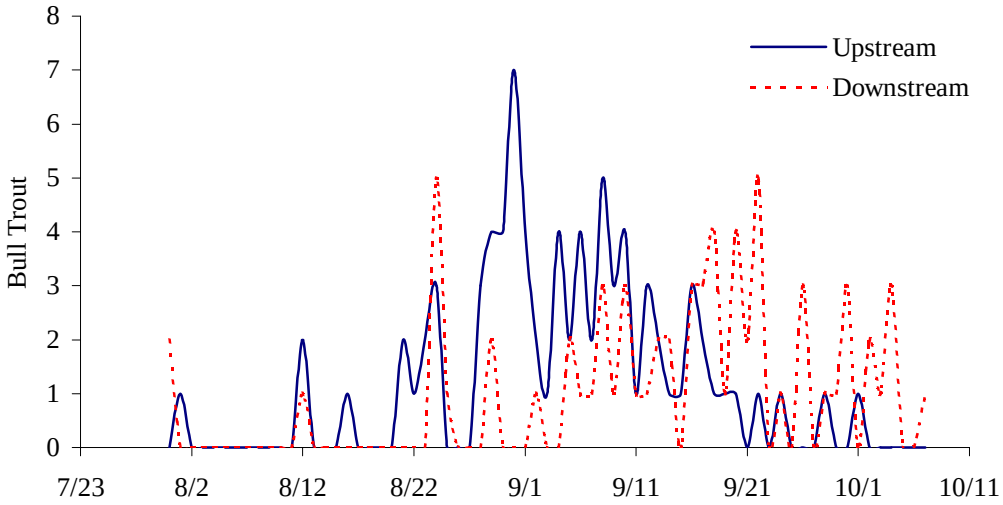

Figure 7. Run timing of adult bull trout through the fish counter in Roaring River, 25 July-07 October 2000.

Peak upstream migration occurred during the first two weeks of September while down stream migration peaked the second and third week of September (Figure 7). Peak migration of upstream spawning adult bull trout was similar in 1999 and 2000 (Figure 8).

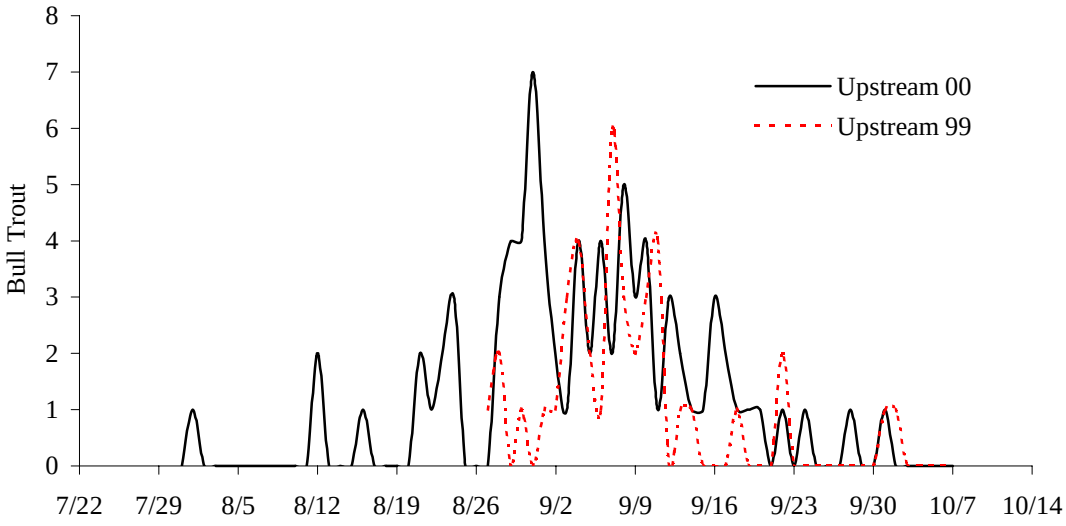

Figure 8. Run timing of adult bull trout through the fish counter in Roaring River, 1999-00.

Most bull trout migrated upstream and downstream during daylight hours with peak migration occurring at 7:00 and 19:00 hours (Figure 9). Bull trout migrated up Roaring River in a similar pattern in 1999 and 2000 (Figure 10).

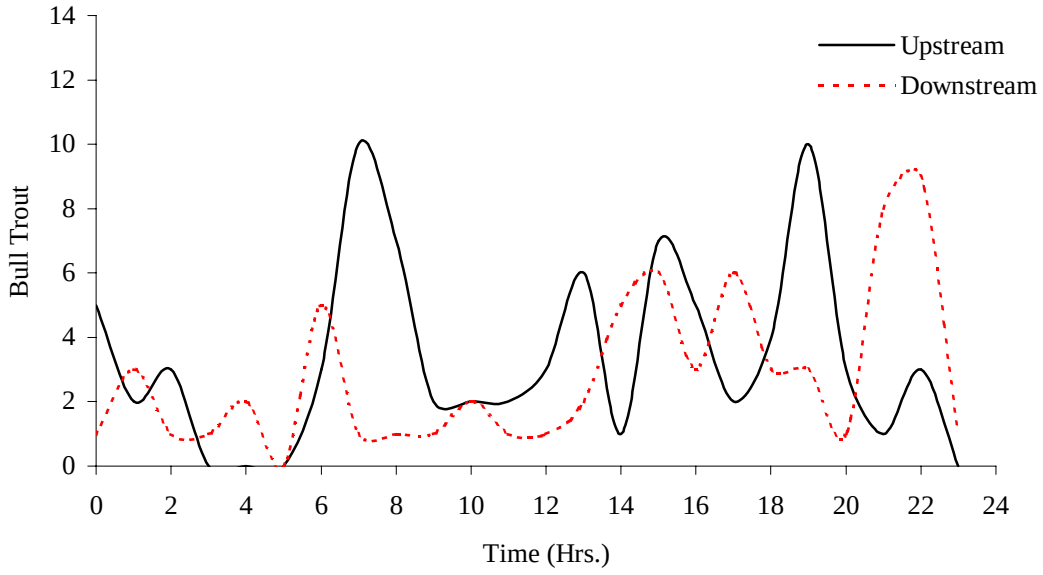

Figure 9. Migration time for adult bull trout moving through a fish counter in Roaring River, 25 July-07 October 2000.

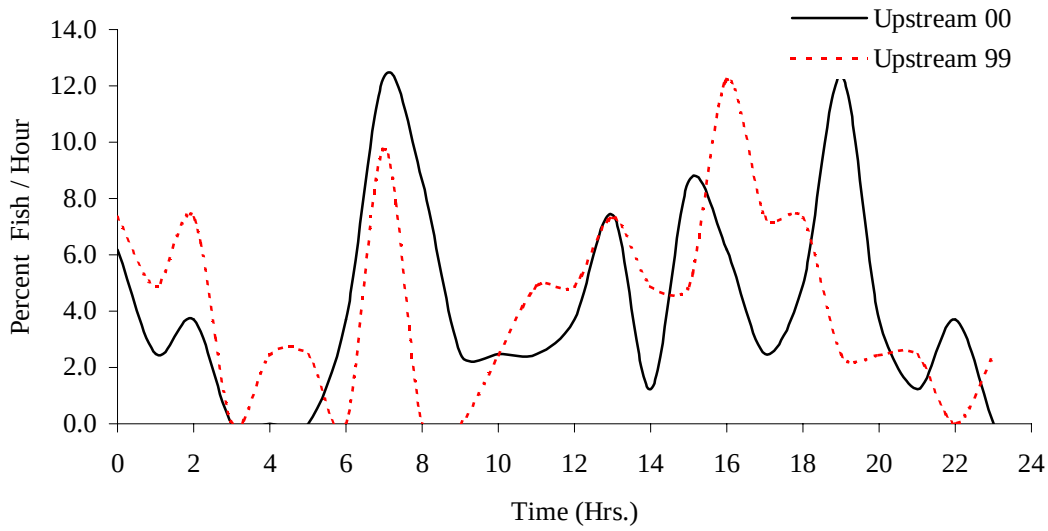

Figure 10. Migration time for adult bull trout through a fish counter in Roaring River, 1999-00.

Bull trout ranged from 18-82 cm in length (Figure 11). Bull trout passing upstream (48.7 cm) were significantly larger than those passing downstream (41.5 cm) ($p < 0.05$).

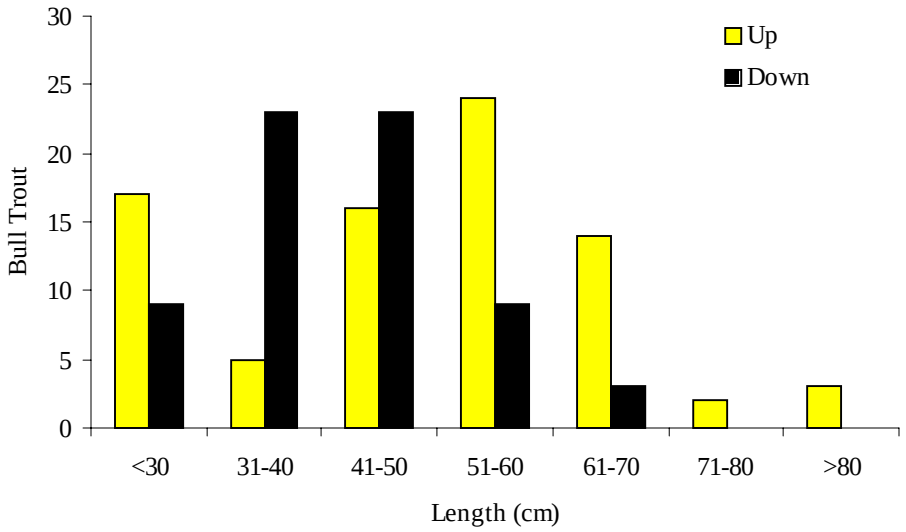

Figure 11. Number and length of bull trout passing up and downstream through a fish counter in Roaring River, 25 July-07 October 2000.

Middle Fork Willamette

Juvenile Transfer.--In 2000, we continued efforts to implement the Rehabilitation Plan (ODFW 1997) for the Middle Fork Willamette bull trout population by transferring fry from Anderson Creek to six release sites in the Middle Fork Willamette Basin. ODFW and USFS personnel transferred 2,788 fry (26-31mm) from 09 March-15 May 2000 (Table 8).

Table 8. Location and number of bull trout fry transferred from Anderson Creek to release sites in the Middle Fork Willamette above Hills Creek Reservoir, 1997-00.

	Location							
	Springs				Creeks			
Year	Chuckle	Iko	Indigo	Shadow	Found	Skunk	Swift	Total
1997	96		26			56		178
1998	411	938		150				1,499
1999	302	1,000		148			526	1,976
2000	349	1,075	204	53	285		822	2,788
Total	1,158	3,013	230	351	285	56	1,348	6,441

Monitoring.--We monitored juvenile bull trout reintroduced to the Middle Fork Willamette above Hills Creek Reservoir with a pipe trap and snorkel counts. USFS personnel fished a pipe trap at the mouth of Iko Springs from 15 March to 30 October 2000 to quantify the number juvenile bull trout migrating into the Middle Fork Willamette. The trap fished for > 5,000 hours and eight 0+ bull trout were recovered. USFS personnel calculated trap efficiency at approximately 25%. Assuming 25% trap effiency, we estimate only 3.0% of the 0+ bull trout migrated past the trap from 15 March-30 October 2000. ODFW and USFS personnel conducted a census to estimate the number of juvenile bull trout in Iko Springs. Habitat typing identified 23 units with a mean length of 26.3 m and width of 4.7 m (Table 9). Snorkelers observed 67 juvenile bull trout in each pass of Iko Springs (Figure 12). Juvenile bull trout density was 2.3 / $100m^2$.

Table 9. Number, average length, width, and maximum depth of habitat units in Iko Springs.

	Habitat Units			
	Number	Average (m)		
Location	Identified / Sampled	Length	Width	Maximum depth
Iko Springs	23 / 23	26.3	4.7	0.6

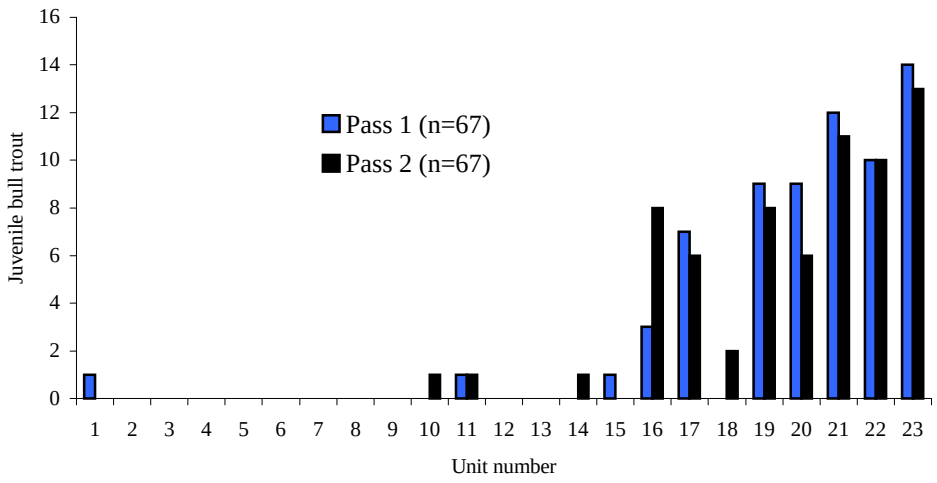

Figure 12. A comparison of the number and location of juvenile bull trout observed by snorkelers in a two pass census of Iko Springs, 21-22 June 2000.

CONCLUSIONS

Mainstem McKenzie

Spawning surveys conducted in tributaries of the mainstem McKenzie River (Anderson and Olallie Creek) have yielded consistent redd counts since more than doubling in 1995 (Table 1). Redd count data indicate a stable adult spawning population in the mainstem McKenzie River. In 2000, we observed redds for the first time in Sweetwater Creek (two). We assume the spawning fish are the result of fry transfers that began in 1993 from Anderson Creek. The age of the bull trout spawning in Sweetwater Creek is unknown. Leary et al. (1993) reported that migratory bull trout begin spawning at Age 5+ to Age 6+. Pratt (1991) determined that most adult bull trout in the Metolius River begin spawing at Age 5. Although the redd count in Anderson Creek was similar in 1999 and 2000 the fish to redd ratio was not. In 1999, we calculated a ratio of 3.7 bull trout per redd in Anderson Creek, which is similar to those reported for streams in the Metolius Basin (Ratliff et al 1996). In 2000, we determined the fish to redd ratio in Anderson Creek to be 2.0. It is uncertain if we overestimated the number of adult spawners in 1999, underestimated the number of adult spawners in 2000, or if this represents a true shift in the fish to redd ratio in Anderson Creek. The density of redds in Anderson Creek (31.9 / kilometer) is among the highest reported in the state (Buchanan et al. 1996) and spawning habitat may be a limiting factor to increased production in Anderson Creek.

The estimated number of emergent bull trout fry captured in Anderson Creek decreased approximately 19% from the mean estimated capture for 1997-99. This is likely not indicative of a reduction in spawning success, but a reflection of a change in distribution of redds in Anderson Creek and a reduction in the number of redds above the trap. The 2000 count is still a significant increase over the counts in 1994-96. The significant increase in fry correlates with an increase in redd counts, with the exception of 1996. In 1996, we believe the number of emergent fry was impacted by the flood in February 1996. USFS surveys, however, found that embeddedness of substrate in Anderson Creek decreased following the flood and this may have been responsible for an increase in spawning success in 1997-99.

The peak number of bull trout we observed in standard pools in the mainstem McKenzie was 18, the second lowest total recorded since surveys began in 1994. However, we conducted only one standard pool counts in the mainstem McKenzie in 2000 and probably missed the peak because of reduced sampling effort. Bull trout were concentrated in Olallie pool near the mouth of Anderson Creek in just prior to spawning, similar to past years. The standard pool counts indicate a stable adult population with no change in distribution.

In 2000, we used an electronic fish counter to monitor the number, size, date, and time of day spawning adult bull trout entered Anderson Creek. The counter recorded 138 bull trout passing upstream and 107 downstream. The difference in the number of fish recorded is due in part to otter predation and post-spawning mortality. We recovered three carcasses, but are unsure if the fish were killed and eaten by otters or if otters recovered bull trout that were post-spawning mortalities. The electronic fish counter recorded 111 fewer bull trout moving upstream in 2000 than in 1999. This number is

inconsistent with the redd count data collected, however, we are unable to determine whether this represents a true shift in run size, an error with the electronic fish counter, or a change in migration behavior of the fish (more or less double counting of fish). Run size was inconsistent between years, however, run timing and migration timing were consistent (Figure 2) (Figure 4). The consistency between years in the time of day fish are moving could be interrupted as habitual behavior. Radio tagged bull trout display this type of behavior when over-wintering sites in the McKenzie River. Fish passing upstream were significantly larger than those passing downstream. Spawning mortality may claim the oldest and largest individuals and thus reduce the mean size of fish passing downstream. Post spawning fish may also have a physical reduction in depth and because the electronic fish counter uses depth measurements to calculate length it may underestimate length of downstream migrants.

Density estimates for juvenile bull trout ≥ 1+ in Anderson and Olallie Creek are similar to those reported by other investigators (Ratliff et al.1996, Goetz 1994, Smith and Knox 1992). Juvenile bull trout densities for pocket habitat in Anderson and Olallie Creek were similar even though the density of redds was 7.5 times higher in Anderson Creek. This indicates that juvenile bull trout rearing areas can be seeded even when redd density is low (Olallie Creek). It also indicates that a large portion of the fry in Anderson Creek may rear in the mainstem McKenzie. In 2001, we will better quantify juvenile habitat, distribution, and density, in the mainstem McKenzie.

South Fork McKenzie

We observed 25 redds in the South Fork McKenzie Basin, an increase of over 300% since 1998. This dramatic increase in redd counts is similar to an increase observed in Anderson Creek between 1994-95. We believe that changes in angling regulations (catch and release for bull trout) and hatchery trout releases primarily account for the increase in redd counts observed in the mainstem McKenzie. In 1992, we implemented more restrictive angling regulations that allowed only adipose fin marked trout to be taken in the South Fork McKenzie River. In 1997, we discontinued stocking rainbow trout in the South Fork McKenzie. We believe that together these restrictive angling regulations are the primary reason for the increase in redd counts in the South Fork McKenzie.

In 2000, we used an electronic fish counter to monitor the number, size, date, and time of day spawning adult bull trout entered Roaring River. The counter recorded 81 bull trout passing upstream and 68 downstream; twice the number observed in 1999. This is consistent with redd data collected. We believe the difference in the number of fish recorded up and downstream is due in part to post-spawning mortality. It may be that a small number of chinook migrated upstream through the counter and died following spawning, however no redds consistent in size with chinook redds were observed. Run size was inconsistent between years, however, run timing and migration timing were consistent (Figure 8) (Figure 10). We observed bull trout migrating at the same time of day in 1999 and 2000, similar to the pattern in Anderson Creek. Fish passing upstream were significantly larger than those passing downstream. Spawning mortality may claim the oldest and largest individuals and thus reduce the mean size of

fish passing downstream. Post spawning fish may also have a physical reduction in depth and because the electronic fish counter uses depth measurements to calculate length it may underestimate length of downstream migrants.

Peak counts during surveys of standard pools in the South Fork McKenzie were the lowest ever recorded, however, we conducted only a single count in 2000. We have discontinued regular standard pool counts in the mainstem and South Fork McKenzie because these data are inconsistent with redd counts and trapping data collected.

Radio tagged bull trout behavior and distribution in the South Fork McKenzie is similar to radio tagged bull trout in the mainstem McKenzie. The fish over-wintered in the reservoir from October -April. In April they began to move upstream and distribute throughout the South Fork before entering Roaring River in September. Bull trout than moved downstream in late September and early October to the reservoir in approximately one week.

Middle Fork Willamette

We continued to implement the Rehabilitation Plan (ODFW and USFS, 1998) for bull trout in the Middle Fork Willamette Basin. In 2000, we transferred 2,788 bull trout fry to six release sites in the Middle Fork Willamette Basin above Hills Creek Reservoir. Mortality associated with transfer continued to be extremely low (< 1%). Monitoring of bull trout fry (0+) has been difficult, but most effective walking along the release sites during the day. We monitored juveniles (≥ 1+) most successfully with night snorkeling. Divers observed 67 bull trout (≥ 1+) in each pass of a two pass census conducted in Iko Springs. This indicates that a significant number of the fry transferred survived and remained in the release site for ≥1 year. We were surprised by the consistency in diver counts between the first and second passes. Observation probabilities are still unknown, however, with the high complexity of Iko Springs they are 50% or less. Extensive pipe trapping has revealed that very few (3.0%) bull trout are migrating out of Iko Springs from March-October. Further trapping may help identify peak migration of bull trout into the Middle Fork Willamette.

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