Appendix E - Population Characteristics of Potential Donor Stocks

Recent studies of evolutionary lineages of bull trout suggest three major groupings: Coastal, Upper Columbia River, and Snake River (Spruell et al. 2003, Leary et al. 1993, Haas and McPhail 2001, Taylor et al. 1999, and Williams et al. 1997). Bull trout population genetic analyses further suggest bull trout inhabiting tributaries of the Lower Columbia River, including and downstream of the Deschutes River, are more closely related to the Coastal group than to populations in the Upper Columbia River tributaries (Spruell et al. 2001).

Chapter 3 of this assessment summarizes current knowledge of bull trout population genetic information for western North America with a focus on the Coastal evolutionary lineage and in particular bull trout populations in the Lower Columbia River. The CRBTWG limited its assessment of donor populations to the tributaries of the Lower Columbia River based on factors such as evolutionary history, geographic proximity, life history, and potential gene flow through migration. This appendix provides an overview of the status and life history of potential bull trout donor stocks from the Lower Columbia River, including populations from the Willamette, Lewis, Hood, and Deschutes river basins.

Bull Trout in the McKenzie River Subbasin (Willamette River Basin)

Bull trout were historically widespread in multiple tributaries of the Willamette River but are now limited to less than 300 adults in the McKenzie River. A translocation program to move bull trout fry from the McKenzie River to the Middle Fork Willamette River began in 1997. The program has occurred annually to augment the small, or perhaps extirpated, local population of bull trout last documented in the 1980s above Hills Creek Dam. Bull trout spawning has now been documented in the Middle Fork Willamette River in 2005, and 2006.

The bull trout population in the McKenzie River Subbasin was likely a single fluvial population prior to the construction of flood control and hydropower dams in the 1960s. Cougar Dam on the South Fork McKenzie River and Trail Bridge Dam on the upper mainstem McKenzie River effectively isolated bull trout above these dams, resulting in two adfluvial local populations that continue to exist today despite each numbering less than 100 spawning adults. The remaining mainstem, local population in the McKenzie River below these dams is the most viable of the three local populations, although abundance is depressed. The very low numbers, combined with isolation make these local populations highly vulnerable to extirpation and genetic depression. Bull trout in the McKenzie River Subbasin have been monitored since the mid-1990s.

Mainstem McKenzie River Local Population

The majority of spawning for the Mainstem McKenzie River local population occurs in Anderson Creek in approximately 3.8 kilometers (2.4 miles) of stream and to a lesser extent in Olallie Creek. Spawning by individuals from this local population has not been documented in other tributaries. Access to approximately 3.2 kilometers (2.0 miles) of spawning and rearing habitat in Olallie Creek upstream of Highway 126 was restored in 1995, when an additional culvert was installed to provide fish passage. Based on redd counts from 1995 through 1999, spawning in Anderson and Olallie creeks peaks during the third week of September (Taylor and Reasoner 2000).

Annual redd counts in the two spawning streams suggest an adult spawning abundance of approximately 130 bull trout. Most fry and juveniles rear in these two spawning streams or in the first eight miles of the McKenzie River below the confluence of the two spawning streams. Adults over-winter and forage in the mid to lower sections of the McKenzie River, some migrating as far as the McKenzie River's confluence with the Willamette River.

The ODFW and USFS have estimated juvenile bull trout abundance in Anderson Creek from data collected annually over the last decade by a downstream migrant fish trap (Table E1). The trap is located just below Highway 126, and thus the estimates exclude bull trout fry and juveniles that may result from spawning in the reach downstream from Highway 126.

Table E1. Number of Bull Trout Fry and Juveniles Captured in the Downstream Migrant Trap in Anderson Creek, 1994 through 2006, Julian weeks 6 through 22.

	Number of fry age 1 or less		Number equal to or greater than age 1	
Date	**Captured**	**Estimated [1]**	**Captured**	**Estimated[1]**
1994	1,745	5,827	183	753
1995	1,849	6,097	255	773
1996	1,995	5,700	178	475
1997	7,260	21,607	63	205
1998	7,869	23,053	124	417
1999	7,406	21,698	81	255
2000	6,127	17,750	152	455
2001[2]	3,247	9,853	82	238
2002	508	1,453	131	397
2003	3,142	8,460	167	500
2004	1,591	4,655	177	552
2005	281	1,642	107	628
2006	837	4,907	93	533

1 Estimated number of bull trout captured if the trap ran continuously and captured fish at a 60 percent rate of efficiency.
2 2001 was not a complete sample year for age 1+ bull trout due to trap repairs.

The trap is generally operated four days a week, from early February until the first week in June. In the decade since monitoring began, juvenile abundance peaked during the years 1997 through 2000, and dropped to the lowest count on record in 2002 (Table E1).

In 1999, densities of juvenile bull trout were estimated in 2.6 kilometers (1.62 miles) of Anderson Creek using a modified Hankin and Reeves protocol (Hankin and Reeves 1988). An average of 1.8 juvenile (age 1 year or more) bull trout per unit were observed in 60 habitat units sampled. Pocket units had the highest observed densities (9.7 per 100 m^2), while the lowest densities were observed in fast-water units (0.8 per 100 m^2) (Taylor and Reasoner 2000).

South Fork McKenzie Local Population above Cougar Dam

The local population of bull trout in the South Fork McKenzie River occurs upstream of Cougar Dam to approximately the Three Sisters Wilderness boundary and also the lower portions of French Pete Creek and Roaring River – a total of 29.3 kilometers (18.2 miles) of stream habitat. Spawning and juvenile rearing occurs in approximately five kilometers (three miles) of Roaring River, a large, spring-fed tributary of the South Fork McKenzie River (Ziller and Taylor 2000). Additional juvenile rearing has been documented in the South Fork McKenzie River downstream from the Roaring River confluence (ODFW 2003).

Intensive monitoring of the South Fork McKenzie River local population by ODFW, in association with the U.S. Army Corps of Engineers (USACE) Cougar Dam Water Temperature Control Project, began in 2001. Monitoring of this local population is being conducted by use of radio-telemetry and passive integrated transponder (PIT) tags, use of video and electronic fish counters, redd counts, snorkeling, and sampling by use of minnow traps and downstream migrant fish traps. Data collected to date, in conjunction with information from previous studies of bull trout in the South Fork McKenzie River, indicate Cougar Reservoir is utilized by adult and sub-adult bull trout for foraging from late fall through early spring. Adult and sub-adult bull trout move into the South Fork McKenzie River upstream from Cougar Reservoir in April and May, remaining in the South Fork until migrating into Roaring River to spawn in late-August through early-October (ODFW 2003).

Monitoring the timing and numbers of adult bull trout ascending and descending Roaring River has been accomplished by use of a remote passive integrated transponder tag antenna, radio telemetry, an electronic fish counter, redd counts, and in 2004, a video camera. Fry and juvenile out-migrations are monitored using a downstream migrant fish trap. Together these methods have provided an abundance of information not available for the other two local populations in the McKenzie River Subbasin.

In 2001 and 2002, a downstream migrant trap was operated in Roaring River about 550 feet above its confluence with the South Fork McKenzie River. Peak out-migration of bull trout fry occurred in March and April, and peak out-migration of age 1 and older juvenile bull trout occurred from May through July (ODFW 2003).

The number of redds counted in Roaring River steadily increased from 1998 to 2001, peaking at 34 in 2001. In 2002, total redd counts dipped to 25, but then climbed to 27 in 2003, and 32 in 2004, and 35 in 2005 (USFS 2004). The electronic fish counter utilized in Roaring River in 2003 and 2004,

combined with PIT tag monitoring, and trapping of downstream migrating, post-spawning bull trout, has allowed for precise estimations of spawner abundance in the South Fork McKenzie River local population. The number of adult bull trout that entered Roaring River in 2003 was approximately 37. The following year, 38 unique spawners were detected entering Roaring River. Trapping of downstream migrating (post spawning) adults revealed that 23 were female and 15 were male. The 32 redds observed in 2004, compared with the known number of spawning individuals, results in a ratio of redds to female bull trout of 1.4:1. There could be several explanations for more redds counted than females spawning: female bull trout deposit eggs in more than one redd, females dig without depositing eggs, and features are sometimes counted as redds that were not constructed by bull trout (ODFW 2003, 2004).

Current abundance of the South Fork McKenzie River local population may be adversely affected by the entrainment of bull trout through Cougar Dam. Entrainment through the dam may cause injury or mortality. Individuals that survive entrainment through the project may be lost to the local population above. The 38 bull trout spawning in Roaring River in 2004 included nine fish (eight female and one male) that had been entrained through Cougar Dam and subsequently captured below the dam in the spring of 2003 and 2004, and released back in Cougar Reservoir (ODFW 2004).

Upper McKenzie River Local Population above Trail Bridge Dam

This bull trout local population occurs in Trail Bridge Reservoir, Sweetwater Creek (a direct tributary to Trail Bridge Reservoir), the McKenzie River above Trail Bridge Reservoir to Tamolitch Falls, and Smith River upstream to Smith Dam. There is no information to suggest bull trout historically occupied the McKenzie River above Tamolich Falls, which is a natural barrier to upstream fish migration. However, bull trout historically utilized habitat in Smith River above Smith Dam, because individuals were observed in Smith Reservoir following completion of Smith Dam in 1963.

The Upper McKenzie River local population spawns in two locations: 1) the McKenzie River upstream of Trail Bridge Reservoir which provides approximately 1.1 kilometers (0.68 miles) of available spawning and rearing habitat and 2) Sweetwater Creek, which following a 1992 culvert project that restored passage, provides 2.4 kilometers (1.49 miles) of spawning and rearing habitat (Ziller and Taylor 2000). A program to transfer fry from Anderson Creek to Sweetwater Creek to reestablish spawning was implemented from 1993 to 1999, with the annual number of fry transferred ranging from 308 to 1,889 (6,384 fry in total from 1993 to 1999). The first adult bull trout to be documented ascending Sweetwater Creek occurred in 1999, when five adults were video-recorded moving through the culvert. In 2000 and 2001, two redds were counted, and in 2002, one redd was observed. In 2003 and 2004, four and nine redds were observed, respectively.

Counting bull trout redds in the McKenzie River upstream of Trail Bridge Reservoir is complicated by the presence of redds created by spawning Chinook salmon out-planted above Trail Bridge Dam. Biologists confirmed less than 10 redds annually in spawning surveys spanning a 10-year period beginning in 1994. However, in 2004, intensive spawning surveys occurred in the McKenzie River above Trail Bridge Reservoir in association with Eugene Water and Electric Boards' relicensing of the Carmen-Smith Hydroelectric Project. These surveys, which combined direct fish observations with redd counts, resulted in the verification of 16 bull trout redds, as compared to nine redds observed the previous year (USFS 2004).

Table E2. Summary of Bull Trout Redd Counts in the McKenzie River from Spawning Surveys by the Oregon Department of Fish and Wildlife, Stillwater Sciences and the U.S. Forest Service; 1989-2005.

Year	Mainstem McKenzie River Local Population									Upper McKenzie River Local Population			South Fork McKenzie River Local Population
	Anderson Creek				Olallie Creek								
	Below Culvert	USFS Index Reach	Above Culvert	Total Stream	Below Culvert	Above Culvert	Total Stream	McKenzie River Below Trail Bridge Dam	Total Mainstem McKenzie River Local Population	McKenzie River above Trail Bridge Dam	Sweetwater Creek	Total Upper McKenzie River Local Population	Roaring River Total South Fork River McKenzie Local Population
1989	-	7	-	7	-	-	-	-	7	-	-	-	-
1990	-	9	-	9	-	-	-	-	9	-	-	-	-
1991	0	8	8	8	-	-	-	-	8	-	-	-	-
1992	4	13	9	13	-	-	-	-	13	-	-	-	-
1993	4	15	11	15	-	-	-	-	15	-	-	-	1
1994	7	22	23	30	3	-	3	-	33	0	0	0	1
1995	3	30	70	73	1	9	10	-	83	7	0	7	2
1996	1	26	81	82	0	7	7	-	89	7	0	7	0
1997	-	18	-	85	0	9	9	-	94	3	0	3	0
1998	4	29	75	79	0	7	7	-	86	2	0	2	6
1999	13	47	64	77	0	6	6	-	83	0	0	0	13
2000	15	44	68	83	0	9	9	-	92	0	2	2	25
2001	6	23	66	72	2	4	6	-	78	1	2	3	34
2002	9	31	51	60	5	5	10	-	70	3	1	4	25
2003	6	23	50	56	7	10	17	0	73	9	4	13	27
2004	6	24	43	49	7	5	12	1	62	16	9	25*	32
2005	7	24	40	47	7	5	12	2	61	10	9	19	35
2006	-	-	-	59	-	-	8	1	68	12	21	33	33
2007	-	-	-	58	-	-	15	4	77	15	22	37	54

*The number of redds counted in 2004 may be disproportionately high compared to prior year counts in part because of an intensive survey effort that occurred in 2004, associated with the relicensing of the Carmen Smith Hydroelectric Project. See Stillwater Sciences 2006, pg. 67 for additional abundance estimates.

Middle Fork Willamette River Bull Trout Rehabilitation Program

A plan to rehabilitate the small or perhaps extirpated bull trout in the upper Middle Fork Willamette River was completed by the Willamette Basin Bull Trout Working Group in 1997 (ODFW and USFS 1998). Beginning in 1997 and continuing through 2005, bull trout fry from Anderson Creek in the McKenzie River Subbasin were reintroduced by ODFW and USFS to four coldwater springs and four creeks above Hills Creek Reservoir as part of the rehabilitation plan (ODFW and USFS 1998) (Table E3). Information on survival and dispersal of the 10,408 fry is limited, although distribution in 2001, was documented to be at least 5.5 miles in the Middle Fork Willamette River from approximately Chuckle Springs downstream to Sacandaga Campground (ODFW 2001a). ODFW and USFS personnel observed 28 bull trout and sampled approximately 25 percent of available habitat in the survey reach.

Table E3. Bull Trout Fry Transferred from Anderson Creek, a McKenzie River Tributary, to the Middle Fork Willamette River Basin above Hills Creek Reservoir.

	Coldwater Springs				Creeks						
Year	Chuckle	Iko	Indigo	Shadow	Bear	Upper Swift	Swift Side	Found	Skunk	Echo	Totals
1997	96		26						56		178
1998	411	938		150							1,499
1999	302	1,000		148			526				1,978
2000	349	1,075	204	53		522	300	285			2,788
2001	269	418			673	96					1,456
2002	177	75			38						290
2003	365	439	242		388					28	1,462
2004	149	129	109		75	155					617
2005		81	61								142
2006	----------None----------										0
Totals	**2,018**	**4,155**	**642**	**351**	**1,174**	**773**	**826**	**285**	**56**	**28**	**10,408**

Assuming an observation probability of 50 percent for night snorkeling, an estimate was made of approximately 230 bull trout present in the survey reach. Of these 230 estimated individuals, it is further estimated that 40 were greater than 10 inches (25 cm) in length. For the second consecutive year, juvenile bull trout were observed eating young-of-the-year Chinook salmon during snorkel surveys, underscoring the importance of this historic and recently reintroduced prey base for bull trout (ODFW 2001a).

A single sub-adult bull trout was captured by an angler in the Middle Fork Willamette River below Hills Creek Dam in June 2000. The origin of this fish is unknown, although it is possible it originated from the fry releases to the coldwater springs and creeks that are tributaries to the Middle Fork Willamette River above Hills Creek Reservoir during the first few years of the rehabilitation program. If this individual sub-adult bull trout originated from the rehabilitation program that began in 1997, it most likely migrated downstream through Hills Creek Reservoir and was entrained through the dam.

Additional evidence suggests introduced bull trout fry are surviving to sub-adult age and moving downstream to rearing habitat in Hills Creek Reservoir. In the spring of 2003, four sub-adult bull trout were reportedly caught and released by anglers in Hills Creek Reservoir, one of which was photographed and measured by USFS personnel (Dave Bickford, U. S. Forest Service, personal communication, 2003). In 2005, 11 post-spawning adult bull trout were captured in a screw trap in the Middle Fork Willamette River above Hills Creek Reservoir. Their precise spawning locations are unknown but in the summer of 2006, bull trout fry were observed in Iko Spring. The observation of fry represented the first known reproduction in the Middle Fork Willamette River since the rehabilitation program began in 1997 (Mark Wade, Oregon Department of Fish and Wildlife, personal communication, August 2006).

None of the four USACE dams in the Middle Fork Willamette River Subbasin are designed to minimize fish mortality; therefore, fish survival through the turbines and regulating outlets, especially for larger sized fish, is expected to be low. However, data collected from ODFW's radio-tagging studies in the South Fork McKenzie River Subbasin above Cougar Dam have provided evidence that adult bull trout can survive entrainment through these large dams.

The current abundance of adult and sub-adult bull trout in the Middle Fork Willamette River is believed to be approximately 20 to 30 fish. Spawning and successful reproduction was first documented by ODFW and the USFS in 2005 and again in 2006. PIT tag monitoring and trapping of adult bull trout documented at least 12 adults spawning in 2005 and 2006 (ODFW 2007). The bull trout carrying capacity of the Middle Fork Willamette River is not known, but local biologists believe the potential is similar to that of the South Fork McKenzie River (ODFW and USFS 1998).

Bull Trout in the Deschutes River Basin

Two core areas are identified in the Deschutes River Basin: Lower Deschutes River and Upper Deschutes River. The Lower Deschutes River Core Area contains current and historic bull trout habitat from Big Falls downstream to the mouth where it enters the Columbia River. The Deschutes River population of bull trout within the Lower Deschutes River Core Area, among the healthiest in Oregon, is approaching recovery status as set forth in the Deschutes Chapter of the Draft Bull Trout Recovery Plan (USFWS 2002). This population's increase in abundance over the last two decades is attributed largely to changes in angling regulations combined with an abundance of forage (kokanee) in Lake Billy Chinook. In contrast, bull trout in the Upper Deschutes River Core Area have been extirpated since the 1950s due to increased water temperatures, altered stream flow regimes, inundation of some juvenile rearing areas, blockage of passage to adult spawning areas, fisheries management, competition with nonnative trout, and overharvest (USFWS 2002).

The Pelton Round Butte Hydroelectric Project (Project) is owned by PGE, and is located just below the confluence of the Deschutes, Metolius, and Crooked rivers. Although there are a small number of bull trout that migrate downstream through the Project, the three dams associated with the Project do not currently provide fish passage and thus functionally split the bull trout population in the Lower Deschutes River Core Area into two groups with five local populations:

1. the Metolius River Subbasin above the Project (includes three local populations), and

2. Shitike Creek and Warm Springs River below the Project (includes two local populations).

The five local populations within the Lower Deschutes River Core Area are:

1. Whitewater River (Metolius River Subbasin above the Project)

2. Jefferson, Candle, and Abbot River Complex (Metolius River Subbasin above the Project)

3. Canyon, Jack, Heising, and Mainstem Metolius River Complex (Metolius River Subbasin above the Project)

4. Shitike Creek (Shitike Creek and Warm Springs River below the Project)

5. Warm Springs River (Shitike Creek and Warms Springs River below the Project)

Bull trout residing above the Project are primarily adfluvial, spawning and rearing in the Metolius River Subbasin, with sub-adult and adult rearing, overwintering, and foraging in Lake Billy Chinook. There are also resident bull trout in the Metolius River but they comprise a small component of the overall population. Bull trout below the Project spawn and rear in Shitike Creek and Warm Springs River, and use the lower Deschutes River for foraging.

There is an abundance of data over a long time series for bull trout in the Deschutes River Basin due primarily to studies initiated in the 1980s by PGE, in cooperation with the Confederated Tribes of the Warm Springs Reservation and ODFW. Bull trout in the Metolius River have been monitored for approximately 20 years, while bull trout in Shitike Creek and the Warm Springs River have been monitored since 1998. Data on bull trout in the Whitewater River, a Metolius tributary, cannot be collected consistently because of its remoteness and the presence of turbid glacially-influenced water most years (Brun and Dodson 2002). All five local populations in the Deschutes River Basin appear to be stable or increasing over the period from 1998 to 2005 (USFWS 2002).

Bull trout in the Metolius River Subbasin are grouped into three local populations that interact and form spawning complexes based on geography and other limited data. As stated above, these include the Whitewater River complex, Jefferson/Candle/Abbot Creek complex, and Canyon/Jack/Heising/mainstem Metolius River complex. Life history studies have shown that there is considerable straying between the latter two local populations (Ratliff et al. 1996). A comprehensive genetic analysis of Metolius River bull trout is underway with results expected from the USFWS in late 2007. The analysis will provide information on the relatedness of bull trout from the various spawning tributaries of the Metolius River. Since regular monitoring began in the 1980s, redd counts in the Metolius River Subbasin have risen steadily from 27 in 1986 to a high of over a 1,000 in 2004 (Figures. E1a and E1b). Figures E1a and E1b do not include counts from Whitewater River on the Warm Springs Reservation. Current redd counts suggest an adult population of over 2,000 individuals in the Metolius River Subbasin.

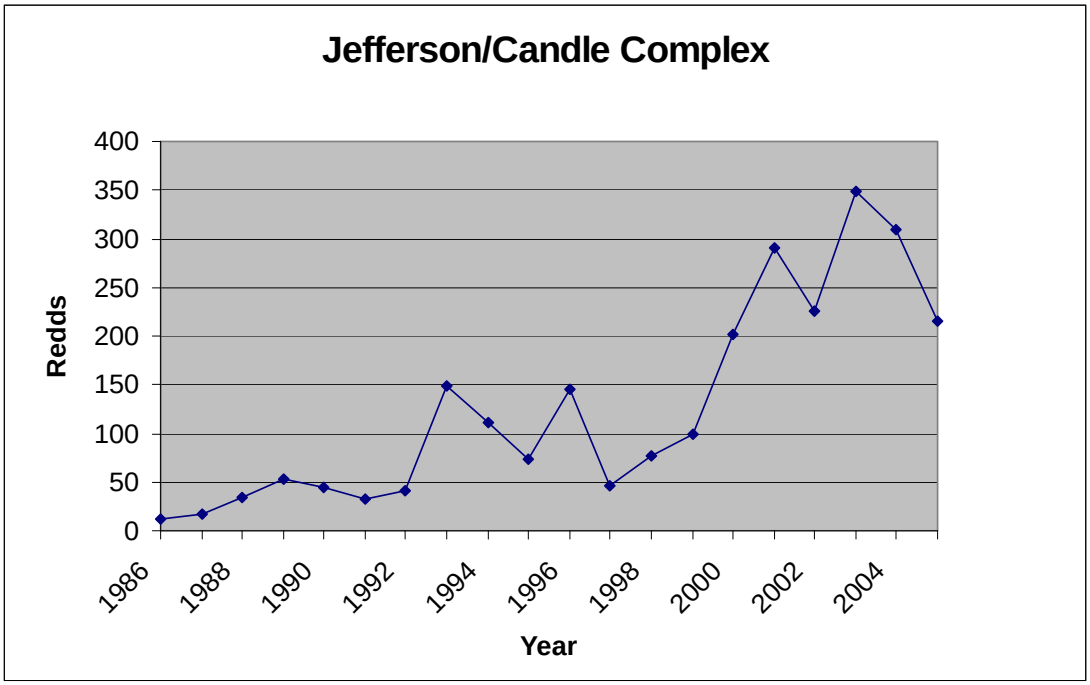

Figure E1a. Redd counts from the Metolius River Subbasin, 1986 – 2005: Jefferson/Candle Complex.

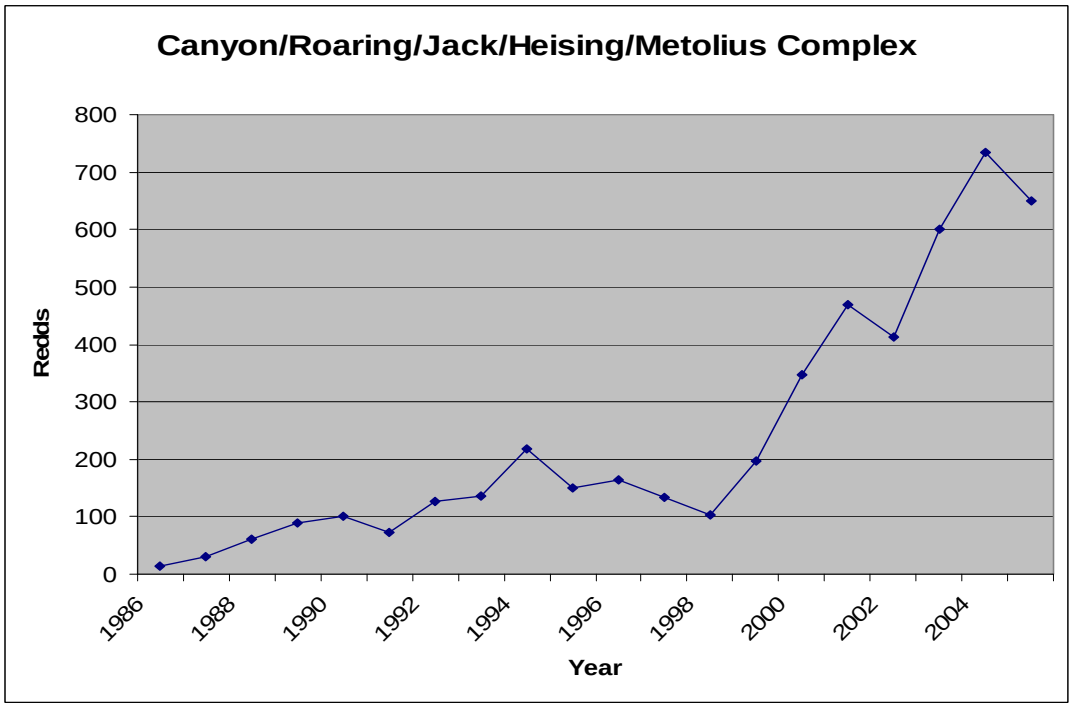

Figure E1b. Redd counts from the Metolius River Subbasin, 1986 – 2005: Canyon/Roaring/Jack/Heising/Metolius Complex.

Bull trout local populations in Shitike Creek and the Warm Springs River averaged 232 and 202 spawners, respectively between 1998 and 2001 (Brun and Dodson 2001). Redd counts peaked in Shitike Creek in 2002 and in Warm Springs River in 2003, and have declined since (Figures. E2a and E2b).

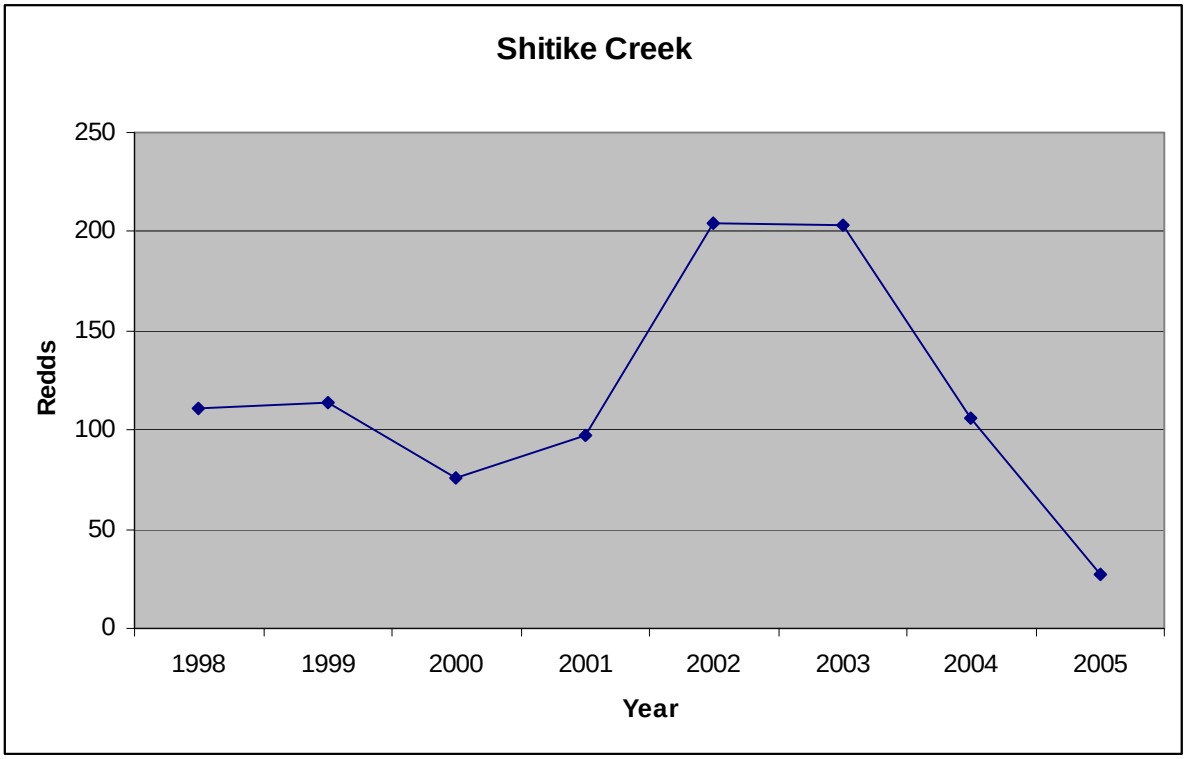

Figure E2b. Redd counts in Shitike Creek, 1998 – 2005 (adapted from Burchell and Brun 2005).

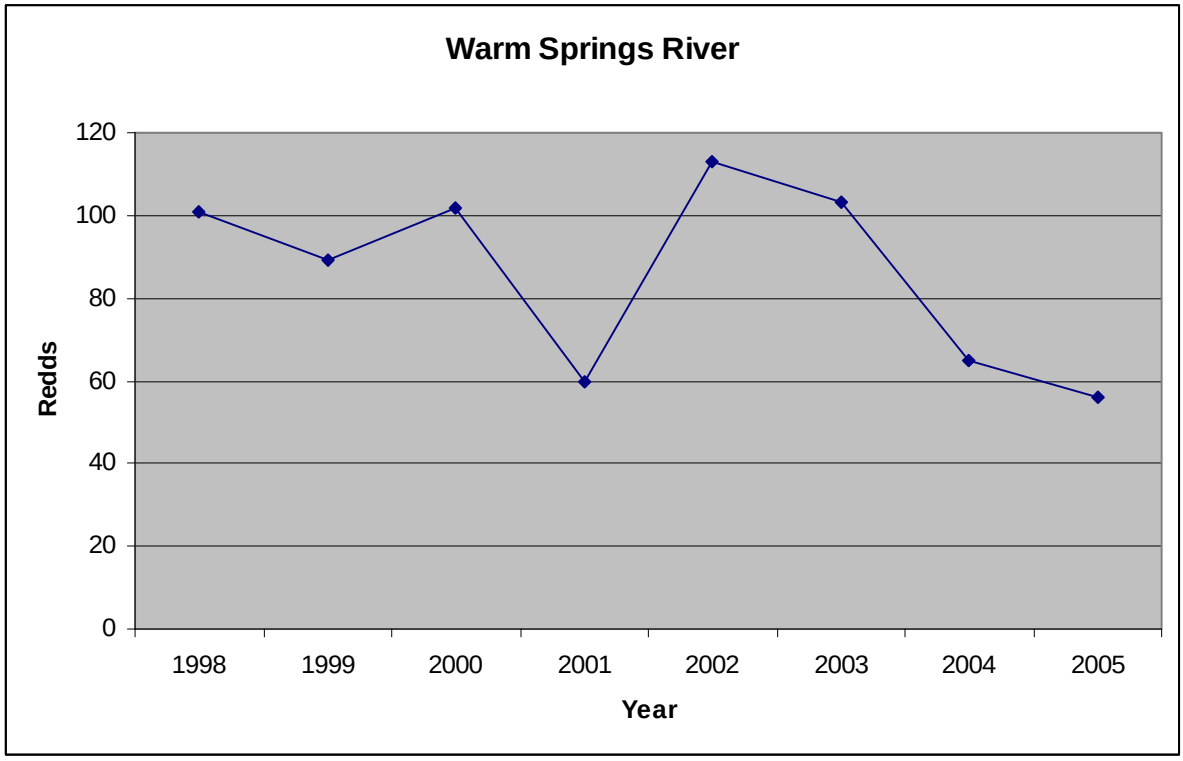

Figure E2b. Redd counts in Warm Springs River, 1998 – 2005 (adapted from Burchell and Brun 2005).

The reason for the recent decline in redd counts in Shitike Creek and Warm Springs River is unknown, but could be related to warmer than average water conditions during the fall of 2005, an increase in the numbers of seasonal passage barriers created by recreational swimmers, or a shift in spawning distribution to areas outside index reaches (Burchell and Brun 2005).

In the Metolius River, most bull trout spawning occurs between August 15 and October 1. However, spawning has been observed as early as July 13 and as late as mid-October (Ratliff et al. 1996). In Shitike Creek, spawning was observed from August 20 through early November, when water temperature averaged 6.1 degrees Celsius (43 degrees Fahrenheit) between RM 18 to 27 [note: this was the mean 7-day average from thermographs]. In the Warm Springs River, temperatures averaged 6.6 degrees Celsius (44 degrees Fahrenheit) between RM 31 to 35 during the late-August to early November spawning period (Brun 1999).

Deschutes River Basin bull trout exhibit both fluvial and adfluvial life histories. Fluvial bull trout migrate from their smaller natal stream to a larger river to rear, and then back to their natal stream to spawn. Adfluvial bull trout migrate from their smaller natal stream eventually entering a lake or reservoir to rear. After several years of growth, and with the onset of maturity, adfluvial bull trout retrace their earlier migration back to their natal stream to spawn. In one recent study conducted by Brun and Dodson (2000), radio-tagged adults began their migration in mid-May. They initially made short migrations into and out of spawning streams. Later, one individual moved upstream 73 kilometers (44 miles) in Shitike Creek to reach spawning areas and then moved quickly downstream after spawning. Other tagged fish showed similar behavior. In the Metolius River, maturing bull trout migrating from Lake Billy Chinook were captured from May through August. Peak upstream movement occurred between August 20 and September 15.

All bull trout local populations in the Lower Deschutes River Basin contain the migratory life history form as observed by radio-tag studies (Brun 2000; Brun and Dodson 2001); and upstream migrant traps (Ratliff et al. 1996, Brun and Dodson 2001, Brun and Dodson 2002). However, the three local populations in the Metolius River Subbasin are currently separated by the Project from the two local populations downstream in Shitike Creek and the Warm Springs River. The Project does not have operational fish passage facilities at this time. However, PGE has proposed renewing passage thru trap and haul as a major mitigation goal during the new Federal license term (Ratliff et al. 2001). Renewed passage is planned to commence within the next ten years. Having successful passage through or around the Project is considered important to the recovery of the bull trout in the Deschutes River Basin (USFWS 2002).

Bull Trout in the Lewis River Basin

The Lewis River Basin is located on the western flanks of the Cascade Mountains in southwest Washington. The Lewis River is segregated by three dams (Merwin, Yale, and Swift), none of which have upstream passage. Limited downstream passage via spill over these dams is assumed and explains bull trout adults observed in the most downstream reservoir (Merwin). The Lewis River Basin is one of two core areas identified in the Lower Columbia River Recovery Unit and it contains three local populations (USFWS 2002): Pine Creek, Rush Creek, and Cougar Creek. The first two local populations, Pine Creek and Rush Creek, occur highest in the basin above Swift Dam. The Cougar Creek Local Population occurs above Yale Dam, a tributary to Yale Lake. Fish passage on the Lewis River is blocked approximately 10 miles above Swift Reservoir by a series of three natural barrier waterfalls. Fluvial bull trout entrained through or spilled over the three dams could migrate to and use the Columbia River, but whether they do is currently unknown. Bull trout in the Lewis River where once fluvial but now are adfluvial due to the existence of reservoirs. Anecdotal records indicate that the Lewis River may have had anadromous bull trout prior to the construction of Merwin Dam. “Dollies” were reportedly routinely netted in Woodland, Washington prior to the construction of Merwin Dam. There have also been several records of silvery bull trout captured in the fish trap at the base of Merwin Dam and at the Lewis River Hatchery (Jim Byrne, Biologist,Washington Department of Fish and Wildlife, personal communication, 2007).

Only two verified bull trout sightings have occurred below Merwin Dam, and their presence is likely a result of water spilled over Yale Dam. No known spawning areas exist in Lake Merwin. Bull trout have been observed in the Yale Dam tailrace apparently attempting to migrate upstream. The one local population of bull trout in Yale Lake spawns and rears in Cougar Creek. Spawning bull trout have been observed in Cougar Creek since 1979, and the local population spawner abundance has ranged from zero to 40 individuals. Spawning adfluvial bull trout in Yale Lake migrate into Cougar Creek from the middle of August through early September. Spawning occurs from late September through early October. In 2001, the count of adult spawners in Cougar Creek was nine adults.

Swift Dam was constructed in 1958. The reservoir formed by the dam is approximately 18.5 km (11.5 miles) long with a surface area of approximately 1, 895 hectares (4,680 acres) at full pool. The two local populations occurring within Swift Reservoir occur in Pine and Rush creeks. These two local populations are assumed to interact with one another and the adults are enumerated together in abundance estimates made for bull trout spawners above Swift Dam. Surveys of adult spawners have been conducted since 1994. Bull trout spawners above Swift Dam have steadily increased from 101 spawners estimated in 1994 to 1,181 spawners estimated in 2005. In the spring of 2001, the Washington Department of Fisheries and Wildlife (WDFW) operated a screw trap in the Lewis River just above Swift Reservoir. Juvenile bull trout caught in the trap ranged in size from 120 millimeters to just over 200 millimeters (PacifiCorp 2002).

The WDFW, USFS, and PacifiCorp have been cooperatively conducting bull trout research on the Lewis River since 1989. Spawner abundance above Swift Dam is estimated utilizing a modified Peterson's mark-recapture population estimate for bull trout over 360 mm long. Table E4 below indicates bull trout netted for the marking portion of the adult spawner estimate from 1995 through 2004. There has been an increasing trend, and over 100 fish have been captured during the last four years.

Table E4. Swift Reservoir Bull Trout Net Captures, 1995 – 2004.

Year	Timeframe	No. Tagged	No. Captured	No. Recaptured	No. Mortalities
2004	May 19- July 14	128	141	19	0
2003	May 14- July 9	85	100	17	1
2002	May 30-July 24	100	114	13	0
2001	May 24-July 12	88	126	28	0
2000	May 18-July 13	69	87	16	1
1999	May 27-July 15	32	36	3	0
1998	May 7-June 11	58	67	14	0
1997	May 8-June 26	75	56	20	1
1996	May 10-June 18	15	18	2	1
1995	May 9-May 25	46	48	2	0

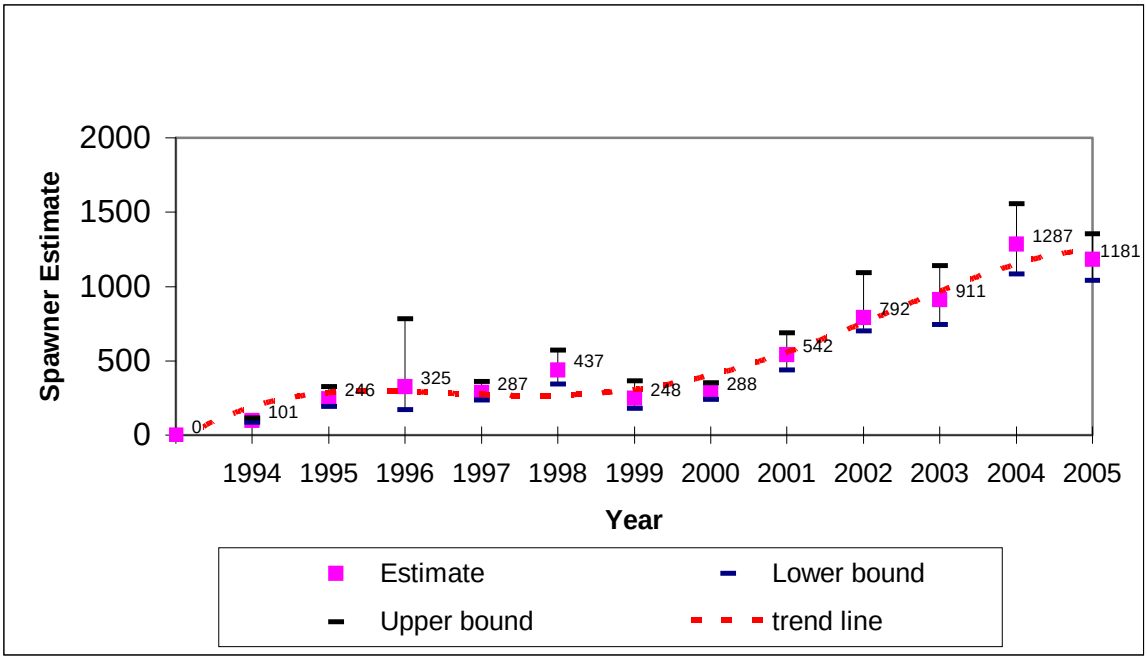

Figure E3. Swift Reservoir Bull Trout Adult (greater than 360 mm) Estimates, 1994-2005. Upper and lower bounds are indicated at the 95 percent confidence levels.

Bull trout residing in Swift Reservoir migrate into tributary streams from late May through early August, and spawn from early August through the middle of September. Emigration of juveniles from the tributaries to Swift Reservoir and Yale Lake is believed to occur from the middle of May through June.

Lack of passage at Lewis River hydroelectric facilities has fragmented the bull trout population and prevented migration into the lower Lewis and Columbia rivers. By adopting an adfluvial life history, bull trout persist at relatively moderate numbers in the Lewis River. The Lower Columbia Recovery Team considers upstream and downstream passage at Yale Dam and Swift Dam to be essential for recovery. An additional concern is the low instream flow levels in the Swift bypass reach which may affect potential spawning and rearing habitat for bull trout present in Yale Lake. Additional entrainment studies are necessary to evaluate the impacts of current operations at Yale and Swift dams on bull trout. Upstream passage for salmon at Merwin Dam currently exists in the form of trap and haul. Studies designed to assess whether or not bull trout from the upper watershed would benefit from volitional or trap and haul passage at Merwin Dam need to be conducted.

Kokanee were introduced into the reservoirs in the late 1950s and early 1960s and now spawn in tributaries of Lake Merwin and Yale Lake. Nonnative brook trout have been stocked in the upper Lewis River Basin and in some tributaries of Pine Creek.

Bull trout in the Lewis River persist at moderate numbers in fragmented local populations. Adult abundance estimates for bull trout above Swift Dam (Pine and Rush creeks combined) ranged from 101 in 1994 to 1,181 in 2005, peaking in 2004 at an estimated 1,287 adults (Figure E3). In recent years, the majority of spawning has shifted from Rush Creek to Pine Creek. Based on guidance in Rieman and Allendorf (2001), bull trout in Rush and Pine creeks are not at risk from inbreeding depression. Conversely, the local population in Cougar Creek is significantly below 100 individuals and is considered at risk.

Bull Trout in the Hood River Basin

Bull trout in the Hood River Basin are split into two local populations due to the presence of Clear Branch Dam: the Clear Branch Local Population and the Hood River Local Population. There is little connectivity between the two local populations above and below the dam because it has no operational upstream passage. Downstream passage can only occur when water is spilled over the dam during high water events. Although both local populations are very small, the Clear Branch Local Population above the dam appears to have higher numbers of adult spawners compared to the Hood River Local Population below the dam.

Information on bull trout distribution and abundance in the Hood River Basin is from a variety of sources, and includes a number of sampling methods. Fish trap data are available from fish collections at the Powerdale Dam trap, a trap on the Punchbowl Falls fish ladder (discontinued following the 1964 flood), floating screw traps at several locations throughout the basin, and a trap at the base of Clear Branch Dam. Other information includes individual observations, snorkel, and electrofishing surveys (Pribyl et al. 1996).

Current bull trout distribution in the Hood River Basin occurs in three major areas: mainstem Hood River, Middle Fork Hood River, and Clear Branch of Hood River (USFWS 2002). Bull trout distribution in the East and West Forks of Hood River are based on isolated, infrequent sightings. Historical distribution is believed to approximate current distribution based on existing knowledge. A comprehensive population assessment is not available. Buchanan et al. (1997) reported the total number of adult bull trout in the recovery unit is believed to be less than 300 individuals. Recent spawning surveys for bull trout upstream of Clear Branch Dam, where the majority of bull trout occur within the recovery unit, indicate an adult abundance less than 50 individuals.

Clear Branch Local Population

Table E5 shows annual high counts of bull trout above Clear Branch Dam. Snorkel surveys conducted in a portion of the habitat in Clear Branch above the dam found a total of 51 to 200 bull trout (all life stages) between 1996 and 2003, while surveys below the dam found a total of zero to three bull trout between 1996 and 2003. Figure E4 displays the same data graphically. Abundance studies conducted by the USFS and ODFW in 2005 and 2006 estimated the total local population (primarily juveniles) in Clear Branch above the dam to range between 233 to 849 individuals (2005 estimate) and 200 to 826 individuals (2006 estimate) (USFS 2006).

Table E5. Annual High Count of Adult and Juvenile Bull Trout in Clear Branch Above Laurance Lake from 1996-2003. All counts were made by snorkeling at night in established monitoring reaches that make up approximately 30 percent of the total available habitat above the lake (USFS 2003).

Year	Adults	Juveniles	Total
1996	23	64	87
1997	44	52	96
1998	16	53	69
1999	20	114	134
2000	9	42	51
2001	16	94	110
2002	29	171	200
2003	26	135	161

[**Note on Table E5 above:** Counts for 2001-2003 do not include the newly opened "old growth" channel that adds approximately 0.3 miles of habitat. Beginning in 1996 the USFS snorkeled the same subreaches at least two times per year. High counts in any given year vary but usually fall within the month of August.]

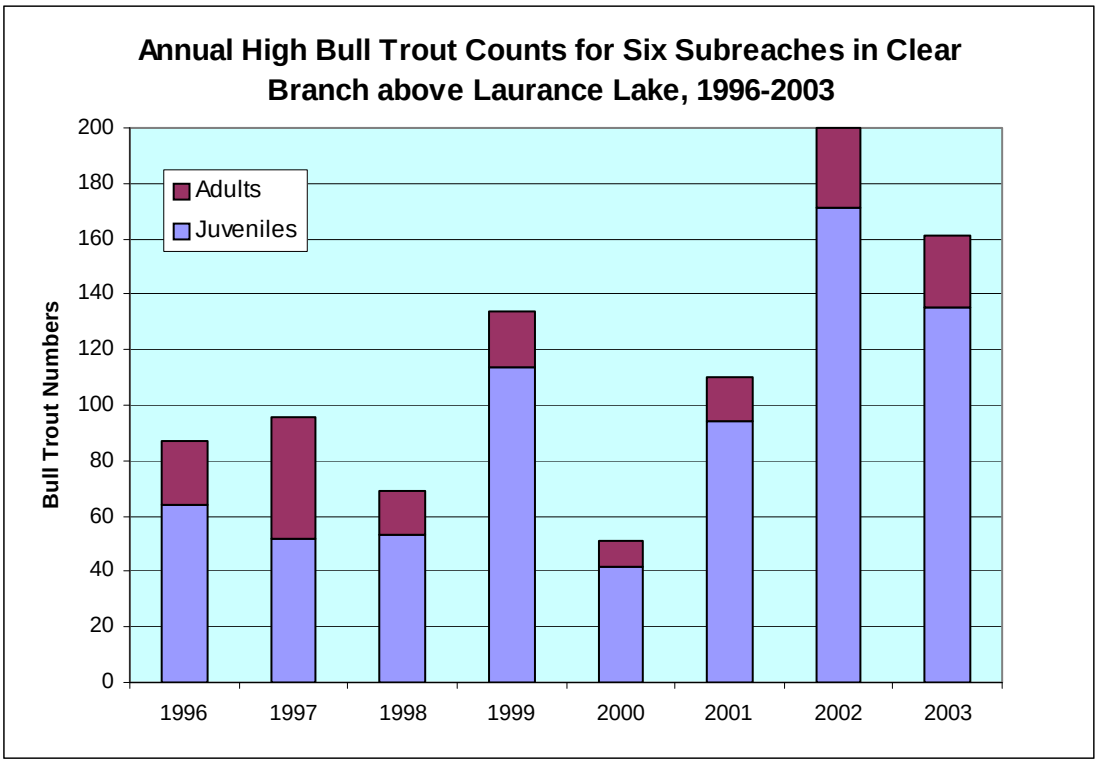

Figure E4. Annual High Counts 1996 to 2003 of Bull Trout Above Clear Branch Dam.

Bull trout forage and overwinter in the reservoir and spawn in the tributaries. Spawning has been confirmed in Pinnacle Creek and Clear Branch above the reservoir. Bull trout observations in Pinnacle Creek include three juveniles and one adult from 1996 to 1998, one adult and one juvenile in 1999 (USFS 1999), four adults and two juveniles in 2001, one adult and 12 juveniles in 2002 and two adults and eight juveniles in 2003 (USFS 2003). See Table E6 for annual counts of adult and juvenile bull trout in Pinnacle Creek 2002 and 2003, and see Table E7 for annual total counts of bull trout redds in Clear Branch and Pinnacle Creek, 2001-2005 (USFS 2003).

Table E6. Annual High Count of Adult and Juvenile Bull Trout in Pinnacle Creek in 2002 and 2003. All counts were made by snorkeling at night in established monitoring reaches that make up approximately 13 percent of the total available habitat. (USFS 2003).

Year	Adults	Juveniles	Total
2002	1	12	13
2003	2	8	10

Table E7. Annual Total Counts of Bull Trout Redds in Clear Branch, Pinnacle Creek, and Compass Creek 2001 to 2005. Clear Branch has two separate channels (reaches 2 and 5) that flow into Laurance Lake, thus both reaches start at RM 1.5. (USFS 2003 and 2005).

Stream and Reach No.	River Mile	Distance (RM)	Redds Counted				
			2001	2002	2003	2004	2005
Clear Branch							
Reach 1	0.0 – 0.6	0.6	0	1	2	0	0
Reach 2	1.5 – 2.2	0.7	6	1	5	6	13
Reach 3	2.2 – 3.0	0.8	8	5	7	4	7
Reach 4	3.0 – 3.5	0.5	NS	4	2	NS	0
Reach 5	1.5 – 1.85	0.35	NS	0	0	NS	0
Pinnacle Creek							
Reach 1	0.0 – 1.25	1.25	1	2	4	3	11
Compass Creek							
Reach 1	0.0 – 1.00	1.00	NS	NS	NS	NS	0
Total Redds			15	13	20	13	31

NS = Not Surveyed

Hood River Local Population

The distribution of the Hood River local population includes: Clear Branch downstream of the Clear Branch Dam; Bear, Coe, Compass, and Tony creeks; Eliot Branch; mainstem and Middle Fork of the Hood River; and perhaps Evans Creek and the East Fork Hood River. Bull trout captures in the Columbia River suggest that the Columbia River is used as foraging habitat for Hood River bull trout (Buchanan et al. 1997). Records from the Powerdale Dam upstream fish trap provide some adult bull trout abundance data for two time periods: from 1963 to 1971 and from 1992 to present. Adult bull trout counts were not made from 1972 to 1991. During the first time period (1963 to 1971), trap counts at Powerdale Dam were not consistent due to counting at only one of the two ladders or the ladders themselves being inoperable (USFS 1996a). Numbers of bull trout counted during this time period range from a high of 12 in 1967, to a low of zero in 1970, and average five fish annually over the nine year period (USFS 1996a). Bull trout have been trapped at the Powerdale Dam fish trap continuously since 1992. Adult bull trout counts range from a high of 28 fish in 1999 to two fish in 1993. Figure E5 displays the adult bull trout counts at the Powerdale Dam fish trap for both time periods.

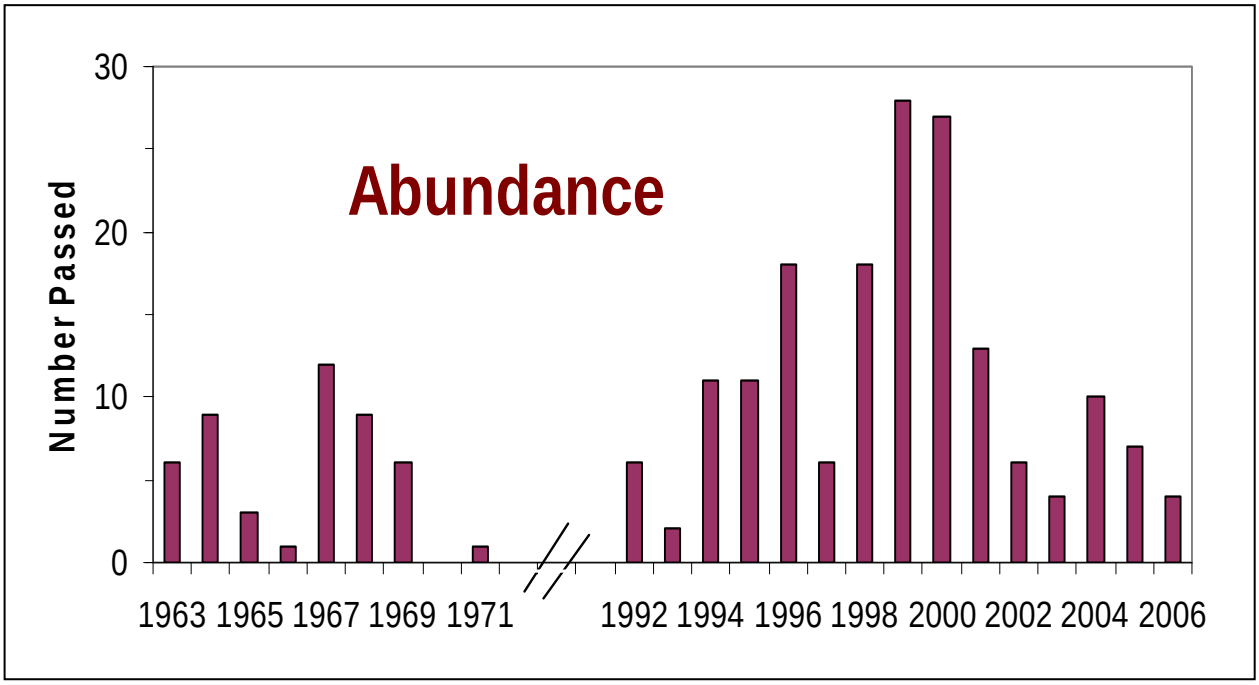

Figure E5. Adult Bull Trout Counts at the Powerdale Dam Fish Trap, 1963 - 2006.

As shown in Figure E6 below, bull trout migrate upstream in the Hood River from the Columbia River through the trap from early May to early October. The primary movement period appears to be from mid-May to mid-July.

The mainstem Hood River is formed by the confluence of the Middle Fork and the East Fork of the Hood River. At present, the mainstem Hood River, is believed to be used primarily for foraging, migration, and overwintering by bull trout. Migrations include journeys into the Columbia River of unknown extent, however, at least two bull trout tagged at the Powerdale Dam trap have been recovered in 1994 and 2000, at or near Drano Lake on the opposite side of the Columbia River in Washington State (Pribyl et al. 1996, ODFW 2001b). Another fish tagged in 1994 was recaptured in 1995, 6.8 miles downstream of the confluence of the Hood and Columbia rivers (Buchanan et al. 1997). Overwintering in the mainstem Hood River is suspected because untagged adult bull trout have been observed at several locations within the Hood River Basin (USFS 1996a) indicating they have not crossed the Powerdale Dam and upstream trap. There are no confirmed spawning locations on the mainstem Hood River, and information on bull trout use of the mainstem is mostly from trap data collected at Powerdale Dam.

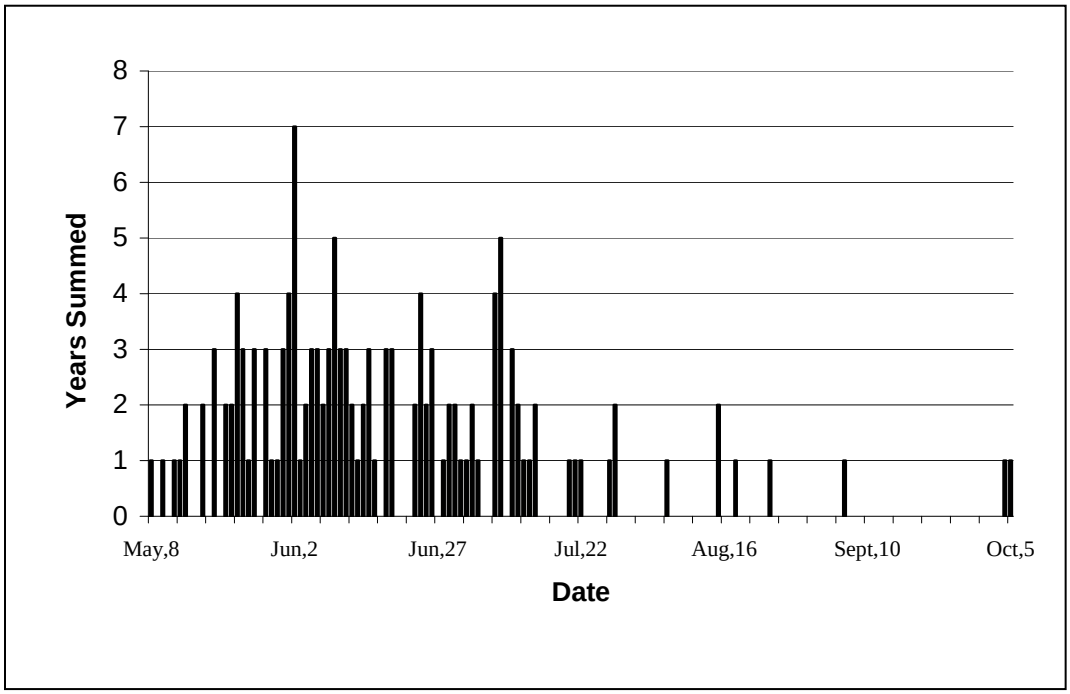

Figure E6. Frequency of Bull Trout Trapped in the Upstream Fish Trap at the Powerdale Dam, May – October, all years summed.

Two redds were detected in Bear Creek in 1999, by personnel from the USFS (USFS 1999). These redds were located approximately 325 feet upstream of the confluence with the Middle Fork Hood River. This suggested that rearing bull trout occur in the vicinity, including the Middle Fork Hood River, which was later verified by surveys (USFS 1999). A radio-tagged bull trout was tracked into Tony Creek, a Middle Fork Hood River tributary in 1998. Rearing bull trout were observed in 1995, in Coe Branch and Compass Creek by ODFW personnel (Buchanan et al. 1997), and one redd was found in Coe Branch in 1999. At the Coe Branch diversion, six adult bull trout were passed manually above the diversion in 1995 (Pribyl et al. 1996), and two adults that were tagged at Powerdale Dam in 2005 were observed at the Coe Branch diversion later that year. Bull trout have also been observed in Eliot Branch, where river conditions inhibit sampling above this diversion (USFS 1999).

No abundance estimates are available for the Middle Fork Hood River and tributaries. Surveys in 1995, found 19 bull trout (all life stages) in Compass Creek (Buchanan et al. 1997). Snorkel surveys conducted in Compass Creek from 1995 through 1998, detected a high of 19 fish in 1995, two fish in 1996, zero fish in 1997, and one fish in 1998 (USFS 1999), however these surveys were presence/absence surveys, not abundance estimates.

ODFW has operated rotary-screw traps (i.e., migrant traps) to capture downstream migrant anadromous salmonids in the Hood River Basin since 1992. The traps are located in the West (RM 4.0), Middle (RM 1.3), and East (RM 1.0) forks of the Hood River; and in Lake Branch (RM 0.1), which is a tributary to the West Fork of the Hood River. Sampling periods for all traps is generally from late March to July 31 annually. The traps are operated to monitor steelhead, coho, and Chinook salmon outmigration, however bull trout were also found in the traps, particularly in the Middle Fork trap, and results are summarized in Table E8 (Olsen 2004; Steve Starcevich, Oregon Department of Fish and Wildlife, personal communication, 2006).

Table E8. Bull Trout Captures in Screw Traps Operated in all Three Forks of the Hood River from 1992 to 2006.

Trap location	Number of Bull Trout Captured	Mean Fork Length (mm)
West Fork	0	NA
Lake Branch (West Fork)	1	>300
East Fork	1	375
Middle Fork	63	169

The number of bull trout observations for the West Fork of Hood River is limited. However, bull trout would not have been precluded from using the West Fork Hood River historically, at least on a seasonal basis. There are two records of bull trout occurrences in the West Fork of Hood River. The earliest available documentation is a single fish capture in 1963 at the fish trap at Punchbowl Falls fish ladder (USFS 1996b, Buchanan et al. 1997). Another bull trout was captured at the mouth of Lake Branch, a tributary to the West Fork of Hood River, in the fall of 1997 by the ODFW. Based on temperature data collected by USFS fish biologists (USFS1996b) suitable bull trout habitat is present in the West Fork Hood River mainstem and tributaries. Bull trout use of the West Fork Hood River is thought to be primarily for foraging, migration, and overwintering.

Although bull trout may have occurred in the East Fork Hood River historically (USFS 1996a), confirmation is lacking. According to Buchanan et al. (1997), William Stanley from the Middle Fork Irrigation District observed a bull trout in Evans Creek, a tributary to the East Fork Hood River, in the early 1990s. A subsequent survey of the area by a fisheries biologist did not yield any further detections (Buchanan et al. 1997). The bull trout in Evans Creek likely ended up there via the Eliot Branch irrigation ditch or moved in from downstream because it was attracted to Eliot Branch water. One bull trout was seen in the mouth of Wisehart Creek (USFS 1996a). However, due to the lack of bull trout observations during snorkeling and electrofishing surveys and the current water quality and habitat conditions, it was determined that use of the East Fork Hood River by bull trout is limited. An analysis of East Fork Hood River tributary stream temperatures indicate that Cold and Crystal Spring creeks, and some headwater East Fork Hood River stream segments may be suitable for bull trout, however, compared to the West Fork Hood River, the habitat is limited (Gary Asbridge, U. S. Forest Service, personal communication, 2003). Recovery efforts may also be directed to include the East Fork Hood River as habitat for an additional local population if information gathered in future efforts indicate that bull trout are occupying the East Fork Hood River or the habitat has the potential to support a bull trout local population.

At the time of listing, the USFWS considered bull trout in the Hood River Basin to be threatened by isolation (from dams and seasonally impaired water quality) and impacts to stream systems from past and ongoing forest management and agricultural activities. Bull trout above Laurance Lake in the Clear Branch of Hood River are considered to be at high risk of a random extinction event due to low numbers, isolation, and restriction to a single confirmed spawning area (USFWS 1998b, Buchanan et al. 1997).