CHAPTER 8 SPECIES AND HABITAT: AQUATIC

Characterization

This chapter provides an overview of available information regarding the status of aquatic species and habitat within the Gordon Creek Watershed. Much of the information presented here has been extracted from analyses and reports that have been performed for neighboring watersheds within the Sandy River Basin. There is little information documented by the Oregon Department of Fish and Wildlife (ODFW), or other sources, regarding the status of fish in Gordon Creek specifically. Information related to the life history of migratory and resident fish species is presented, supplemented by population trends in nearby rivers, including Bull Run and the upper Sandy River.

The second section of this chapter discusses the condition of the habitat features present in and along Gordon Creek that are important to fish and other aquatic species. Information is presented from ODFW aquatic habitat surveys conducted in Gordon Creek in 1993. A large flood event occurred in 1996, however, and the degree to which conditions have changed since the surveys were conducted is unknown.

Current Conditions

Threatened, Endangered, and Sensitive Species

Populations of several fish species found in the Gordon Creek Watershed are protected by the federal Endangered Species Act (ESA). In addition, the State of Oregon maintains a list of state threatened and endangered species, and the Oregon Natural Heritage Information Center (ONHIC) tracks listings and includes additional categories of concern. Finally, the Bureau of Land Management (BLM) categorizes species as "bureau sensitive" and "bureau tracking", which receive additional management consideration.

Spring and fall chinook salmon, coho salmon and winter steelhead trout are all listed as threatened under the ESA. Coho salmon are also listed as endangered by the state of Oregon. Pacific lamprey are considered a federal species of concern. The ESA listed species are monitored and regulated by state and federal agencies to prevent additional decline in their populations.

Summary information regarding the status of these species, as well as other species found in the Sandy River Basin, is shown in Table 8-1.

Table 8-1. Special status fish species in the Gordon Creek Watershed.

Common Name	Scientific Name	Federal Status	ODFW Status	ORNHIC List	BLM Status
Fall chinook salmon (Lower Columbia River)	*Oncorhynchus tshawytscha*	LT	SC	1	
Spring chinook salmon (Lower Columbia River)	*Oncorhynchus tshawytscha*	LT	SC	1	BA
Winter steelhead (Lower Columbia River ESU)	*Oncorhynchus mykiss*	LT	SC	1	
Bull trout (Columbia River population)	*Salvelinus confluentus*	LT	SC	1	
Coho salmon (Lower Columbia River)	*Oncorhynchus kisutch*	LT	LE	1	
Pacific lamprey	*Lampetra tridentata*	SOC	SV	4	BT

Federal: LT = Listed as Threatened Species, SOC = Species of Concern

ODFW: SC = Critical, LE = Listed as Endangered Species, SV = Vulnerable

ORNHIC: 1 = Threatened or endangered throughout range, 4 = Taxa of conservation concern, are rare but secure, or declining in numbers but still too common for T and E status

BLM: BA = Bureau Assessment, BT = Bureau Tracking

Anadromous Fish

Few data exist regarding the numbers of anadromous fish that historically or currently use the Gordon Creek Watershed. Information in this document often refers to the Sandy River Basin or the neighboring Bull Run Watershed. A summary of the primary anadromous fish stocks in the Gordon Creek Watershed is provided in Table 8-2.

Steelhead Trout *(Onchorynchus mykiss)*

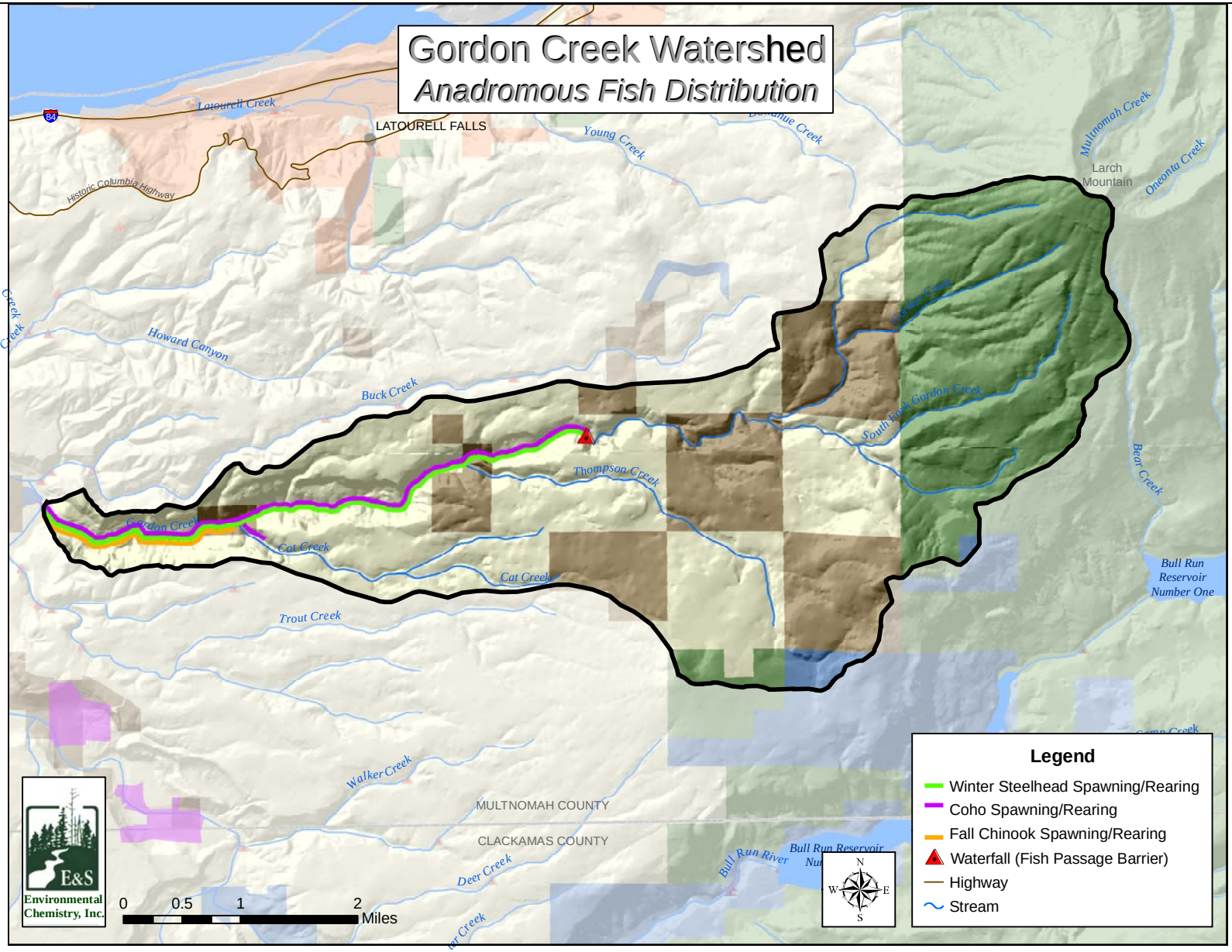
Steelhead trout express an array of life histories, including a variety of freshwater and saltwater rearing strategies, and adult spawning and migration strategies. Juvenile steelhead may rear one to four years in fresh water prior to their first migration to salt water. Saltwater residency may last one to three years. Adult steelhead may enter fresh water on spawning migrations year round if habitat is available for them, but generally spawn in the winter and spring. Steelhead may spawn more than once, returning to salt water between spawning runs. Resident forms that do not migrate to the ocean are referred to as rainbow trout.

Winter steelhead enter the Sandy River Basin from November through May (Map 8-1). A native late-winter steelhead run begins entering the Sandy River in February, although most of the run arrives in April and May. Historically, native fish spawned throughout the watershed, but today most of the spawning occurs in the upper Sandy River Basin. An introduced hatchery run from Big Creek stock enters the Sandy River between November and May. The hatchery fish now account for 70 to 80 percent of winter steelhead in the subbasin. Most of the fish bypass Gordon Creek and ascend past Marmot Dam to spawn in the Salmon River and upper Sandy River tributaries, although some spawning and rearing occurs in Gordon Creek (USFS 1997).

Table 8-2. Fish Stock Summary.

Species/Run	Origin/Hatchery Stock	Typical Spawning and Rearing Habitat	Spawning Time	Freshwater Rearing
Fall Chinook	Native Wild spawning from previous hatchery stocking	Low-gradient mainstem spawners (LWD* and pools)	Fall/winter	3-6 months
Spring Chinook	Native Hatchery-Willamette	Low-gradient mainstem spawners (LWD and pools)	Late summer Early fall	Up to 1 year
Coho	Native Hatchery - Sandy	Low-gradient, small to medium-sized streams and side channels. LWD	Late fall	1 year +
Winter Steelhead	Native Hatchery – Big Creek	Riffles, glides	Late winter, spring	1-4 years
Resident Cutthroat	Native Genetically unique population upper Bull Run River and Bull Run Lake	First- to third-order tributaries. Juveniles use pools and large channels with LWD.	Spring	N/A
Sea-run Cutthroat	Native	Small tributaries. Juveniles use pools and large channels with LWD.	Winter/early spring	1-6 years
Rainbow Trout	Native	Tributaries, margins of mainstems, and side channels	Spring	N/A
Pacific Lamprey	Native	Clear gravel riffles and runs	Spring/early summer	3-8 years

* LWD = Large Woody Debris



Map 8-1. Anadromous salmonid distribution in the Gordon Creek Watershed.

In order to protect the late-run native population, ODFW has a goal of limiting hatchery winter steelhead stray rates to less than 10 percent of the naturally-spawning run in the Upper Sandy Basin. Mixed counts of winter steelhead (including both native and hatchery stocks) are recorded annually at Marmot Dam, located 30 miles up the Sandy River from Gordon Creek (Figure 8-1). Only unmarked (wild) fish are passed above Marmot Dam. Marmot Dam counts show a decreasing trend in winter steelhead returns in the Sandy River Basin since 1965.

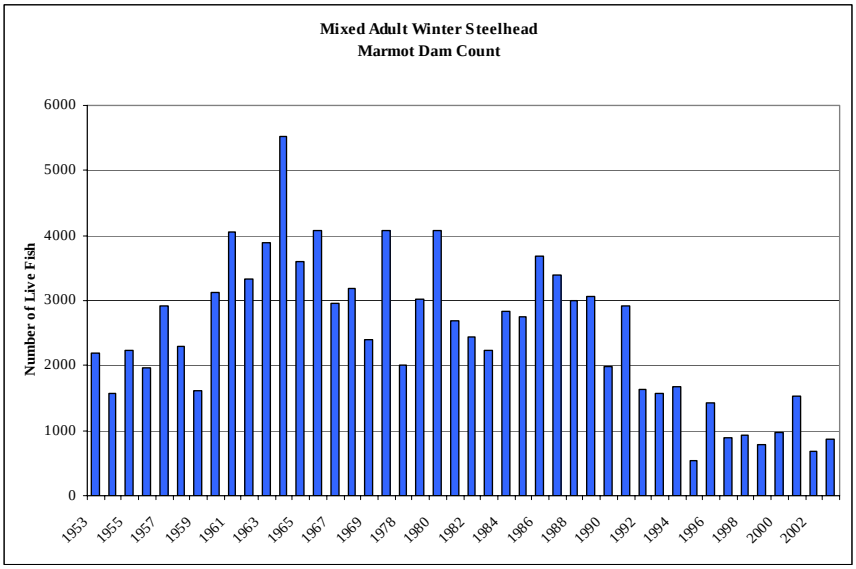


Figure 8-1. Winter steelhead counts at Marmot Dam.

Summer steelhead begin migrating into the Sandy River in late February. The run peaks in June. Summer steelhead spend the summer, fall, and early winter in holding pools before spawning, generally in February. The summer steelhead run (Skamania stock) was introduced in 1975 from eggs originally collected in the Washougal River, and propagated at the South Santiam Hatchery. At the time of introduction, it was believed that natural reproduction or competition with native stocks would not occur, but natural reproduction has since been confirmed (USFS 1996). There has also been some speculation that there may have once been a small native run of summer steelhead (USFS 1997).

Chinook Salmon *(Oncorhynchus tshawytscha)*

Fall Chinook

Two distinct stocks of fall chinook are native to the Sandy River Basin: the early-maturing "tule" stock and the dominant late-maturing fall stock (NPPC 2002). The early-maturing stock enters the Sandy River in August and spawns from late September to mid-October, and is believed to be a mix of wild and hatchery fish. The late-maturing fall stock enters the subbasin in October and spawns from late October through December and is an indigenous run (USFS 1996). A second group returns from December through early

February, and has been referred to as the "winter run." However, this population has been declining in numbers and may have died out in Gordon Creek. Although fall chinook counts in Gordon Creek in the early 1950s were as high as 115, only 2 fish were recorded during the most recent count in 1997. ODFW no longer conducts regular counts of "winter" chinook (NPPC 2002).

Fall chinook spawning is concentrated in the lower Sandy River, near Oxbow Park, and in the nearby tributary streams, including Gordon Creek (ODFW 1997). Fall chinook that spawn in the tributary streams of the Sandy River, such as Gordon Creek, generally emigrate to the Columbia River earlier than those from the mainstem of the Sandy River, leaving during the late summer and fall of their first year. They generally return to spawn after two to five years in the ocean.

Spring Chinook

Spring chinook enter the Sandy River Basin as early as February with peak returns to the lower portion of the Sandy River in April and May (USFS 1996). It is unknown whether spring chinook also enter Gordon Creek. The current spring run in the Sandy River Basin is predominantly the result of Willamette stock from the Clackamas hatchery. A large native run once existed, but may now be extinct.

Figure 8-2 shows the annual trend in spring chinook passage over Marmot Dam. Hatchery releases to the Sandy River began in the early 1900s. Passage at the dam typically occurs from May until October (USFS 1996). Trend information specific to Gordon Creek was unavailable, but the general pattern of increasing spring chinook in the Sandy River Basin is likely to be mirrored in the Gordon Creek Watershed.

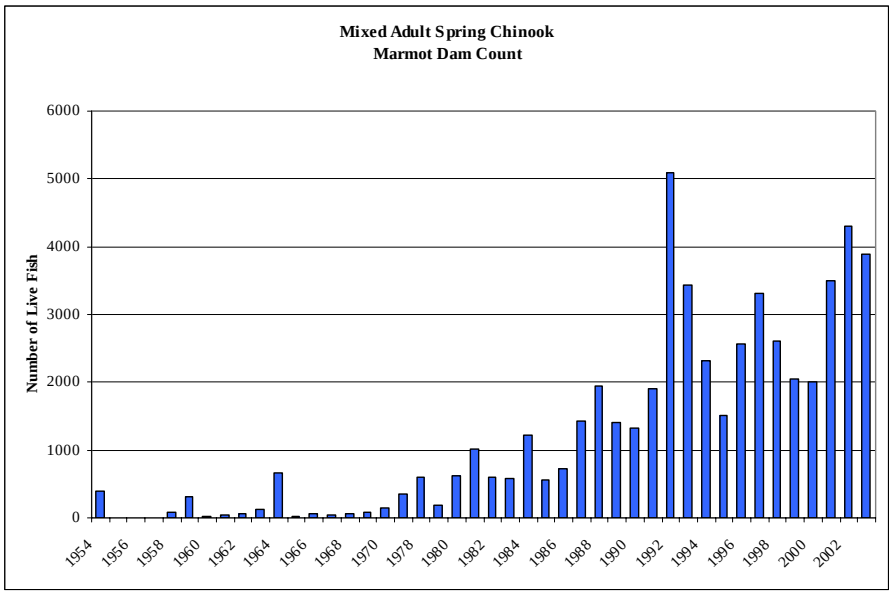


Figure 8-2. Spring chinook counts at Marmot Dam.

Some native spring chinook may remain in present-day runs, though the current population is dominated by the introduced Willamette stock. The decline of the native stock has been attributed to the installation of Marmot Dam on the Sandy River, influence from hatchery fish, timber harvest, and high levels of commercial and recreational fishing (USFS 1997). An unscreened diversion canal at Marmot Dam, operated by Portland General Electric (PGE) between 1912 and 1951, is also believed to have caused high mortality of smolts (USFS 1997). The Bull Run Hydroelectic Project is now scheduled for removal, however, beginning with Marmot Dam in 2007.

Coho Salmon *(Oncorhynchus kisutch)*

Coho salmon are native to Gordon Creek. They enter the Sandy River Basin between September and January, with peak returns in October. Coho generally spawn shortly after arrival on the spawning grounds. All adults die within two weeks after spawning. Juveniles will typically spend one summer and one winter in freshwater before migrating to the ocean in the spring, one year after emergence, as silvery smolts about four to five inches long. Most adults mature at three years of age (ODFW 1995).

Gordon Creek is one of the primary tributary streams that supports coho salmon in the lower Sandy River (NPPC 2002). There is both a hatchery stock early run and a native late run. Adult coho counts were performed in Gordon Creek between October and January in 2002/2003, with a total of three surveys made during this period. Thirty-nine coho salmon per mile were counted in lower Gordon Creek. In surveys conducted in 2004/2005, 15.5 fish per mile were counted (SRBWG 2006).

Table 8-3 shows data from the years in which adult and jack coho salmon peak count surveys were conducted. This non-continuous dataset was recorded for years between 1951 and 2002. The highest peak count was 19 coho salmon in 1952. The second highest count occurred in 1957 with 14 fish. These surveys began on October 1st of their respective years. Since peak return of coho salmon in the Sandy River Basin is estimated to occur in October, it is likely that these 1950s counts were observed during this month. Fish counts at Marmot Dam on the Sandy River show a decline during the 1990s, but have rebounded in recent years (Figure 8-3). Improvements in ocean conditions and stream habitat quality are generally cited as the reasons for the increase in coho returns.

Other Fish Species

There are several other fish species that are found in the Sandy River Basin. These species include cutthroat trout, rainbow trout, bull trout, brook trout, mountain whitefish, and Pacific lamprey (USFS 1997).

There is little documentation of these other fish species in Gordon Creek specifically. However, cutthroat trout and rainbow trout are known to use Gordon Creek (USFS 1997). The BLM has conducted one electroshocking

Table 8-3. Coho salmon returns in Gordon Creek, 1951 through 2002.

Survey Begin Date	Survey End Date	Year	Number of Fish
10/1/1951	1/31/1952	1951	2
10/1/1952	1/31/1953	1952	19
10/1/1953	1/31/1954	1953	2
10/1/1956	1/31/1957	1956	0
10/1/1957	1/31/1958	1957	14
12/1/1971	1/31/1972	1971	0
12/1/1972	1/31/1973	1972	0
12/1/1973	1/31/1974	1973	0
12/1/1974	1/31/1975	1974	3
12/1/1975	1/31/1976	1975	0
12/1/1976	1/31/1977	1976	11
12/1/1977	1/31/1978	1977	0
12/1/1978	1/31/1979	1978	4
12/1/1979	1/31/1980	1979	5
12/1/1980	1/31/1981	1980	2
12/1/1981	1/31/1982	1981	0
12/1/1982	1/31/1983	1982	1
12/1/1983	1/31/1984	1983	0
12/1/1984	1/31/1985	1984	3
12/1/1985	1/31/1986	1985	1
12/1/1986	1/31/1987	1986	3
12/1/1987	1/31/1988	1987	2
1/1/1989	12/31/1989	1989	0
12/1/1989	1/31/1990	1989	0
12/1/1991	1/31/1992	1991	0
12/1/1992	1/31/1993	1992	6
12/1/1993	1/31/1994	1993	3
12/1/1994	1/31/1995	1994	0
12/1/1995	1/31/1996	1995	0
12/1/1996	1/31/1997	1996	0
12/1/1997	1/31/1998	1997	1
12/1/1998	1/31/1999	1998	0
12/1/1999	1/31/2000	1999	0
12/7/2000	1/5/2001	2000	1
12/4/2001	1/10/2002	2001	3

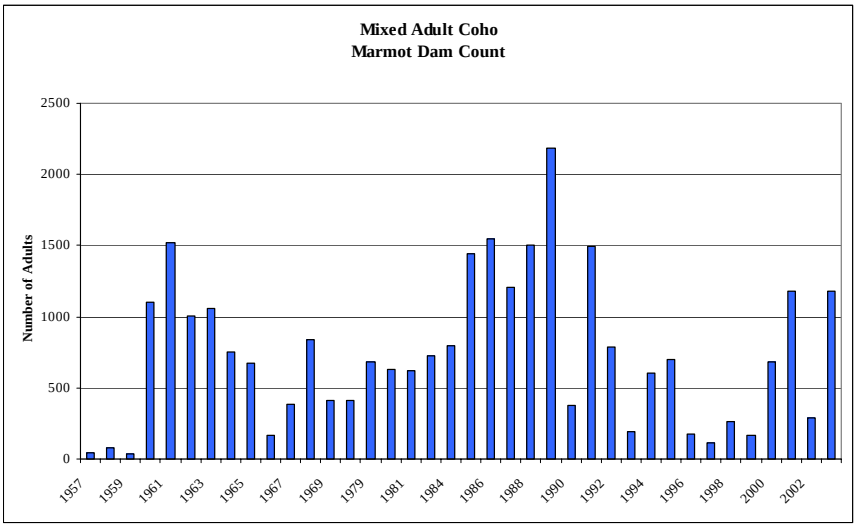


Figure 8-3. Counts of coho salmon returns at Marmot Dam, 1957 through 2003.

survey near the mouth of Cat Creek, which did not reveal any non-salmonid fish species.

Resident Cutthroat Trout (*Oncorhynchus clarki*)

Cutthroat trout are native to Gordon Creek. The majority of the cutthroat trout exhibit a resident life history, but some may be migratory, either anadromous or adfluvial. Cutthroat trout can often be found in association with longnose dace (*Rhinichthys cataractae*), torrent (*Cheimarrichthys fosteri),* and shortnose sculpin (*Cottus spp.*) (USFS 1997), although they are commonly the only fish species found in headwater tributaries in the Gordon Creek Watershed.

Rainbow Trout (*Oncorhynchus mykiss*)

Rainbow trout are native to the Gordon Creek Watershed. They are present above waterfalls in some upper reaches and tributaries of Gordon Creek (NPPC 2002). Although once identified as a unique species, rainbow trout are now believed to be a resident form of steelhead trout that spend their entire life cycle in freshwater streams and reservoirs (USFS 1997). Hatchery stocks of rainbow trout were released in the Sandy River Basin until 1995 (PGE 1998).

Mountain Whitefish (*Prosopium williamsoni*)

Mountain whitefish are found in the lower mainstem of the Sandy River, and are likely to be found in Gordon Creek (D. Roberts, BLM, pers. comm.). They are indigenous to the Sandy River Basin and their populations appear to

be healthy. Mountain whitefish spawn in the fall and can grow up to 12 inches (PGE 1998).

Pacific Lamprey (*Lampetra tridentata*)

The Pacific lamprey is a native anadromous fish that is found in the Sandy River and is likely to be present in Gordon Creek (D. Roberts, BLM, pers. comm.). As an adult, this fish is parasitic on other fish (USFS 1997). Lamprey spawn and bury their eggs in streambed sediment. Hatched larvae can spend between three to eight years in gravelly to fine sediments located in shallow backwaters. Consequently, de-watering below dams is a large contributor to larval mortality (USFS 1997).

Fish Passage Barriers

One natural obstacle to upstream fish passage has been identified in the Gordon Creek Watershed. A 13-foot waterfall located 5.4 miles upriver from the mouth of Gordon Creek prevents fish from migrating upstream beyond this point (Map 8-1). We are unaware of any culverts or other artificial barriers to anadromous fish passage in the Gordon Creek Watershed. A debris jam a half-mile upstream from the mouth of Gordon Creek may partially block upstream fish passage, but the current condition of this obstacle is unknown. Table 8-4 shows the length of stream that is used by coho, spring chinook, and winter steelhead for spawning and rearing in Gordon Creek. Winter steelhead and possibly coho salmon use the entire portion of the river up to the barrier falls. Fall chinook use is believed to extend up to the confluence with Cat Creek.

Table 8-4. Length of stream in Gordon Creek used by coho, spring chinook, and winter steelhead for spawning and rearing.

Anadromous Fish Species	Stream Name	Miles of Stream Use
Coho	Cat Creek	0.3
	Gordon Creek	5.4
Total Coho Miles		5.8
Spring Chinook	Gordon Creek	1.8
Winter Steelhead	Gordon Creek	5.4

Aquatic Habitat

Splash Dams and Stream Cleaning

Splash dams were used on the Sandy River to transport timber downstream to sawmills in the late 1800s and early 1900s. No information was available regarding the use of splash dams in the Gordon Creek Watershed. Most of

the BLM lands were railroad and tractor logged, and the stream channels do not appear scoured. Stream channels that have been observed appear to be in excellent condition with adequate structure and large wood (P. Hawe, BLM, pers. comm.).

Aquatic Habitat Survey

To assess current in-stream habitat conditions within the Gordon Creek Watershed, fish habitat survey data, collected according to ODFW protocols (Moore et al. 1997), were compiled and are presented in this section. ODFW has established statewide benchmark values as guidelines to interpret the habitat survey data for an initial evaluation of habitat quality (Table 8-5). The benchmarks rate habitat conditions as "good", "fair", or "poor" in relation to the assumed natural regime of the stream reach.

Table 8-5. Stream channel habitat benchmarks. (Source: WPN 1999)

Parameter	Subfactor	Units	Good	Fair	Poor
Area		% of channel area	>35	>10 and <35	<10
Pool frequency		# of channel widths	>8	> 8 and <20	<20
Pool depth	gradient <3% or <7m (23 ft) wide	meters	>0.5	>0.2 and <0.5	<0.2
	gradient >3% or >7m (23 ft) wide	meters	>1.0	>0.5 and <1.0	<0.5
Gravel available		% of area	>35	>15 and <35	<15
LWD density[a]		# pieces/100m (328 ft)	>20	>10 and <20	<10
LWD volume		cubic m/100m (328 ft)	>30	>20 and <30	<20
Key LWD[b] density		# pieces/100m (328 ft)	>3	>1 and <3	<1

[a] LWD is defined as >50 cm (20 in) diameter and longer than the width of the 'active' channel.
[b] Pieces that are at least 0.6 m (2 ft) in. diameter and 10 m (32.8 ft) long.

ODFW's survey divided Gordon Creek into four separate reaches. Each of the four reaches exhibited identical general conditions for each of the habitat types (Table 8-6). The riparian zone along the creek is in fair condition, but overall aquatic habitat conditions in Gordon Creek are considered poor, specifically in relation to pool frequency and depth, riffle habitat, and the amount of large woody debris found in the stream.

Table 8-6. Gordon Creek stream habitat conditions

Stream	Reach	Pools	Riffles	Riparian Area	Large Wood
Gordon Creek	1	●	●	●●	●
Gordon Creek	2	●	●	●●	●
Gordon Creek	3	●	●	●●	●
Gordon Creek	4	●	●	●●	●

● Poor ●● Fair ●●● Good

This stream habitat survey extended from the confluence of Gordon Creek with the Sandy River to where the river splits into North and South Fork Gordon Creek, covering a stream length of 7.5 miles (39,800 feet). Detailed descriptions of these four stream reaches, as described in the Watershed Assessment for the Sandy River Basin (SRBWC 1999), are provided below.

Reach 1 begins at the confluence and extends 1.6 miles (8,500 feet) to Cat Creek. The valley is mostly narrow with a steep v-shape. The channel is constrained by hillslopes. Primary habitat types are rapids (52 percent) with cobble (38 percent), gravel (31 percent), and sand (17 percent) substrates; and cascades (42 percent) having cobble (33 percent), gravel (31 percent), boulders (11 percent), and sand (16 percent) substrates. Woody debris is absent or very low, with no habitat complexity or cover created. Riparian vegetation is a mix of young conifers, hardwoods, and shrubs. About 90 percent of stream banks are stabilized by vegetation and there is no active erosion. Land use is second-growth timber.

Reach 2 begins at Cat Creek and extends 2.4 miles (12,923 feet) to Thompson Creek. The valley is narrow with a steep v-shape. The channel is constrained by hillslopes. Primary habitat type is cascades (85 percent) with various amounts of cobble, gravel, sand, and boulder substrates. Woody debris is very low with no habitat complexity or cover created. Riparian vegetation is a mix of young conifers, hardwoods, and shrubs. About 97 percent of stream banks are stabilized by vegetation; 1.2 percent are actively eroding. Land use is large timber.

Reach 3 begins at Thompson Creek and extends 3.3 miles (17,549 feet). The valley is narrow with a moderate to steep v-shape. The channel is constrained by hillslopes. The primary habitat type is cascades (91.5 percent) with various amounts of cobble, gravel, sand, and boulder substrates. Woody debris is very low with no habitat complexity or cover created. Riparian vegetation is a mix of young conifers and hardwoods, and shrubs. About 89 percent of stream banks are stabilized by vegetation and none are actively eroding. Land use is large timber.

Reach 4 extends 0.2 miles (827 feet) to the North Fork/South Fork split. The valley is broad and the channel unconstrained. The primary habitat type is rapids (90 percent) with primarily cobble (33 percent), gravel (33 percent), and sand (14 percent) substrates. Woody debris is very low with no habitat complexity or cover created. Riparian vegetation is young deciduous trees and shrubs. About 92.5 percent of stream banks are stabilized by vegetation; 7.5 percent are actively eroding. Land use is second-growth timber.

Sandy Basin Partnership

Beginning in 1999, a consortium of federal, state, and local agencies and non-governmental organizations signed an agreement to "…work together on recovery of listed fish species in the Sandy River Basin." These species

include steelhead, chinook and coho salmon. The partners are taking a basin-wide approach. As part of this agreement, termed the Sandy River Basin Agreement, a basin-wide analysis was completed using the Ecosystem Diagnosis and Treatment Model (EDT) developed by Mobrand Biometrics, Inc. A description of the EDT process and methodology can be found on the Mobrand Biometrics website (http://www.mobrand.com/edt.htm).

The Sandy River Basin EDT analysis was populated with stream survey data from USFS Level 2 stream surveys, ODFW physical habitat surveys and BLM aquatic surveys. Initial analysis was completed by Mobrand Biometrics in 2002 and updated in 2004 for the entire Sandy River Basin. Biological rules were used for coho and chinook salmon and winter steelhead. The model produces estimates of current and historical anadromous salmonid production and the three most limiting factors on production based on a comparison of existing (Patient) and historical (Template) aquatic conditions. Historical conditions are those believed to have existed prior to European settlement (approximately 1850s). A list of habitat restoration and protection actions was developed based on the limiting factors identified in the EDT analysis.

Anchor Habitat Assessment

In January, 2004, the Sandy River Basin Working Group (SRBWG) was convened to develop a coordinated anadromous fish restoration strategy for the Sandy River Basin (SRBWG 2006). Participants included representatives from 14 entities including federal, state, and local governmental agencies, and non-profit organizations. The goal of the SRBWG was to identify anchor habitat, which was defined as "distinct stream reaches that currently harbor specific life history stages of salmon and steelhead to a greater extent than the stream at large." Anchor habitats were designated by evaluating empirical data, professional judgment data, and Ecosystem Diagnosis and Treatment (EDT) model data.

The lower reach of Gordon Creek was designated as anchor habitat for coho salmon, based on empirical data and professional judgment. Habitat quality was not sufficiently high for Gordon Creek to qualify as anchor habitat for spring chinook, fall chinook or winter steelhead (SRBWG 2006). Recommendations to improve habitat quality include enhancement of side channels, carcass enrichment, identify sediment sources (i.e. unstable road segments), and restore LWD conditions, if feasible (Table 8-7). Restoration actions include many of those identified in the EDT process as well as additional actions prioritized by action category (See Table 8-7). The restoration opportunities identified in Table 8-7 for the Gordon Creek watershed are mainly derived from the EDT process combined with the hierarchical approach utilized in the Sandy Basin Restoration Strategy, currently under development.

Reference Conditions

Information regarding reference conditions for aquatic species and habitats specific to the Gordon Creek Watershed is scarce. The most comprehensive study of historical salmon and steelhead populations was conducted in 1998 for the Sandy River Basin during PGE's hydroelectric dam relicensing effort (Taylor 1998). According to this study, declines in the abundance of salmon populations were first evident in the late 1800s, largely the result of commercial fishing pressure in the Pacific Ocean and in the Columbia River. The runs of anadromous salmonids were historically as high as 20,000 winter steelhead, 15,000 coho, 10,000 fall chinook, and 8,000 to 10,000 spring chinook in the Sandy River Basin (Mattson 1955). Spawning surveys suggest that current adult returns are only 10 to 25 percent of 1890 levels, which had already declined substantially compared with returns prior to Euro-American settlement (USFS 1996).

The first significant alteration to aquatic systems began with the fur trappers, who nearly extirpated beaver throughout much of Oregon beginning in the early 1800s. Early settlers removed beaver dams to drain lowland areas for agriculture. Rapid human population growth in the late 1800s led to extensive logging, especially in the lower Sandy River. Early logging and associated activities such as railroad construction, and removal of in-stream wood to facilitate log drives accelerated the process of aquatic habitat degradation. In the Gordon Creek Watershed specifically, logging dates back to the early 1900s, when the Bridal Veil Logging Company is known to have been active in the watershed. There may have been settlers in the mid-elevations of the watershed beginning in the late 1800s, although there is little evidence of human habitation in the watershed (for more information see Chapter 10, *Human Use*, of this analysis). The construction of dams, which began in the early 1900s, also contributed significantly to the decline in salmon populations (USFS 1996).

A natural waterfall limits upstream fish passage 5.4 miles from the mouth of Gordon Creek. Steelhead and possibly coho still spawn as far upstream as the barrier falls, so it is unlikely that the extent of spawning habitat has been reduced since historical times in this watershed. Declines in the salmonid populations in this watershed would most likely be attributed to increased stream temperatures and the lack of large wood and associated structural diversity.

Table 8-7. Restoration Opportunities in the Gordon Creek Watershed. (Source SRBWG 2006)

Hierarchical Restoration Strategy	Altered Watershed Process (from WA)	Corresponding Level 3 Survival Factors (from EDT)	EDT Reach	Restoration Actions (Known)	Restoration Actions (New)
1. Reconnection of Isolated Habitats	Isolated Side Channels along River	HQ	Gordon 2a/b	None	Gordon 2a/b Side Channel Enhancement
2. Restoration of Long Term Processes (Water Quality, Nutrient Levels, Roads, Infrastructure)	Loss of Marine Derived Nutrients	Fo	Gordon 1a/b, Gordon 2a/b	None	Gordon 1a/b and 2a/b Salmon Carcass Enrichment
	Increased fine sediment delivery, mass wasting, and hydrologic impacts relating to upper basin roads	SL, CS	Gordon 1a/b, Gordon 2a/b	None	Identify problem roads and other sources of sediment; develop and implement restoration actions
	Harassment and Poaching	H/P	Gordon 1a	None	Increase law enforcement in high likelihood poaching areas

Abbreviations of EDT Survival Factors for the Sandy River Basin:
CS = Channel Stability; Fo = Food; HD = Habitat Diversity; H/P = Harassment/Poaching; HQ = Key Habitat Quantity; SL = Sediment Load; T = Temperature; W = Withdrawals.

Table 8-7. Continued.

Hierarchical Restoration Strategy	Altered Watershed Process (from WA)	Corresponding Level 3 Survival Factors (from EDT)	EDT Reach	Restoration Actions (Known)	Restoration Actions (New)
3. Restoration of Long Term Processes (Riparian Areas)	Elevated Stream Temperature	T	Gordon 1a	Project 26 – Gordon 1a/1b Riparian Enhancement (100 ft buffers) Project 27 – Gordon 1a/1b Riparian Improvement	
	Lack Riparian LWD Recruitment	HD, CS	Gordon 1a/1b, Gordon 2a/2b	Projects listed above addressing elevated stream temperature also address lack of riparian LWD recruitment.	
	Riparian Disturbance via Disp. CG's	HD, CS	Gordon 1a	None	Gordon 1a Dispersed Site Rehabilitation
	Invasion of Noxious Weeds	SL, HD	Gordon 1a/b, Gordon 2a/b	None	Continue ongoing surveys for new sites, implement treatments
4. Restoration of Short Term Processes (In-stream Projects)	Lack of in-stream LWD, Habitat simplification	HD, HQ, CS	Gordon 1a/b, Gordon 2a/b	Project 28 – Gordon LWD Placement	Investigate opportunity for LWD placement in Gordon 2a/2b, if feasible, design and implement LWD addition project

Abbreviations of EDT Survival Factors for the Sandy River Basin:
CS = Channel Stability; Fo = Food; HD = Habitat Diversity; H/P = Harassment/Poaching; HQ = Key Habitat Quantity; SL = Sediment Load; T = Temperature; W = Withdrawals.

Discussion

Fish Distribution and Trends

Information regarding distribution, abundance, and trends is unavailable for most fish species in the Gordon Creek Watershed. Historical angling records indicate that large numbers of salmon and steelhead entered and spawned in the neighboring Bull Run Watershed, and probably Gordon Creek (USFS 1997). Coho salmon is the only species that has been consistently monitored by ODFW in the watershed. The small coho run size makes it difficult to determine a trend, but establishes a consistent pattern of spawning use in Gordon Creek. Use of Gordon Creek by chinook salmon and steelhead trout is also well documented, although abundance information is lacking. Rainbow trout in upper Gordon Creek (above the waterfall) are considered an important isolated population in the Sandy River Basin (NPPC 2002).

Anadromous fish populations have declined significantly over the past 150 years throughout the Sandy River Basin. Negative impacts of human activities on anadromous salmonids in Gordon Creek include overharvest of the Columbia River stocks beginning in the 1800s, excessive quantity of fine sediments in spawning gravels, competition with introduced and hatchery fish, removal of large conifers in the riparian zone, and reduced streamflows, both historically and currently for municipal water diversions (USFS 1996). Elsewhere in the Sandy River Basin, blockage of upstream habitat by dam construction has been a significant factor. However, PGE is planning to remove the Bull Run Hydroelectric Project beginning in 2007, so some dam-related issues will no longer be a concern. New transitional issues related to dam removal, such as the effects of sediment release from the reservoir bottom, may present new challenges.

Aquatic Habitat Conditions

Although native stocks make up a minority of the populations of most salmonid species in the watershed, current management practices are designed to encourage the recovery of native stocks. In 2006, the Sandy River Basin Working Group has designed Gordon Creek s an anchor habitat for coho salmon. In addition, ODFW identified Gordon Creek as a potential steelhead habitat restoration area in the Draft Sandy Subbasin Summary (NPPC 2002). A stated goal in this report is to:

> Protect, restore, and improve fish habitat throughout the basin to improve healthy native fish populations that provide ecological function and diversity to the Sandy watershed, and greatly benefit people in the region.

Important elements of aquatic habitat include pools, riffles, large woody debris, and riparian vegetation conditions. Different habitat conditions are required for different species, and for various life stages of each species. Chinook salmon prefer larger streams with pools and LWD, while coho

salmon use low-velocity small to medium streams and side channels. Steelhead trout often are present in the heads of pools, in riffles with large boulders and wood in the summer. In the winter they prefer habitats that provide cover with LWD and boulders. Juvenile steelhead trout utilize higher velocity areas than coho or chinook salmon (USFS 1997). In the Gordon Creek Watershed, ODFW surveys found aquatic habitat conditions to be poor for pools and LWD, and fair for riparian vegetation. Improvement of in-stream habitat conditions in lower Gordon Creek could significantly enhance the condition of salmonid populations in the watershed.