West Fork Smith River
Salmonid Life Cycle Monitoring Project

Annual Report: 2010-2011

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Introduction

The Salmonid Life Cycle Monitoring Project of the Oregon Department of Fish and Wildlife (ODFW) has guided monitoring of juvenile and adult salmonid fishes (*Oncorhynchus spp*.) in the West Fork Smith River (Umpqua basin) since 1998. These activities are coordinated under the Oregon Plan for Salmon and Watersheds and are part of a broader effort to monitor populations of salmonids in select Oregon coastal streams. Two objectives of this program are to estimate the abundance of returning adult salmonids and downstream-migrating juvenile salmonids, and estimate the marine and freshwater survival rates for coho salmon.

This report summarizes monitoring activities within the West Fork Smith River basin, including population estimation for the 2010-11 run-year of returning adult fish and year 2011 out-migration of juvenile fish. A full description of sampling methods is provided in Solazzi et al. (2000) and Suring et al. (2009). These and other Life Cycle Monitoring Project reports are available on the ODFW Corvallis Research Lab website, http://nrimp.dfw.state.or.us/crl/

Adult Fish Trap Operation

Trap maintenance during summer 2010 included replacement of the cable that anchors the floating weir used as a passage barrier, and additional replacement of bolts that hold the trap head-dam to the bedrock river bottom.

The floating weir was installed September 15 and the first fish (both coho and Chinook salmon) were trapped on October 25. Most coho salmon were trapped in November corresponding with increased streamlows (Figure 1). A strong freshet occurred on November 18, causing the floating weir to submerge. Weir function was intermittent for the next several days because of heavy loads of suspended debris. Prior to mid-November, beginning late October, a large number of fish passed Smith Falls but did not ascend WF Smith River. Stream surveys conducted after weir failure indicated a large number of fish also bypassed the fish trap on November 18-20. After November 20 the weir was 100% effective, but few fish entered the trap.

Run timing of winter steelhead extended from mid-December to mid-April (Figure 1). Trap efficiency was 1.4% for coho salmon and 31.3% for steelhead. Number of fish trapped is summarized in Table 1.

The floating weir was removed from the river and the adult trap decommissioned on April 27.

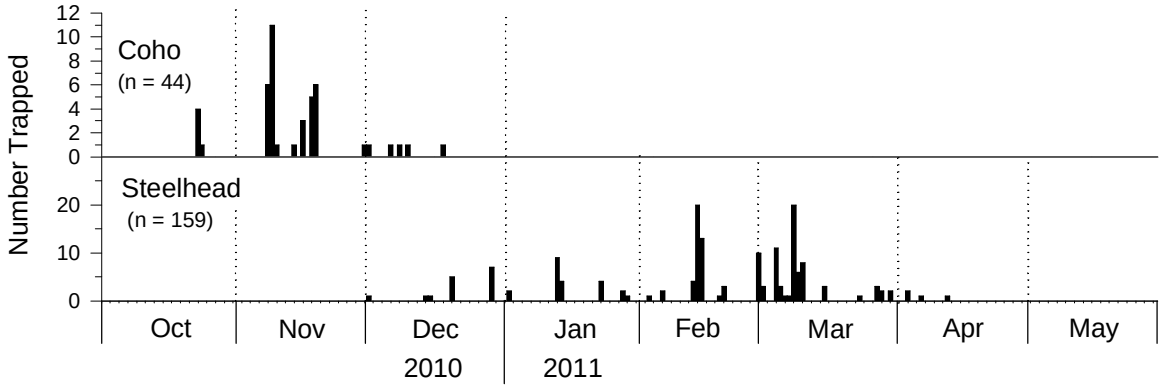

Figure 1. Timing of coho salmon and winter steelhead trapped in the West Fork Smith River during the 2010-11 run-year.

Table 1. Number of days the West Fork Smith River adult fish trap weir functioned as a passage barrier, and number of fish trapped during the 2010-11 run-year. Mortalities were fish that stranded on the floating weir after being passed above the trap or after they bypassed the trap during high streamflows.

			Wild			Hatchery			
Species	Month	Trap days	Female	Male	Jack	Female	Male	Jack	Mortalities
Coho	Oct	30	1	3	1				
	Nov	27	14	18	1				
	Dec	22	4	1					
Chinook	Oct	30	0	12	2			1	6
	Nov	27	2	11	1			1	6
	Dec	22		1					
Steelhead	Dec	22	4	9		1			
	Jan	24	3	17					
	Feb	28	20	21				1	
	Mar	27	42	24		1			
	Apr	20	3	1					

Spawning Ground Surveys

Surveys that provided data for estimation of spawner populations of coho salmon and winter steelhead were conducted at approximately seven day intervals from October 29, 2010 to May 17, 2011. These included the five principal tributaries and nine mainstem reaches. In addition, we were able to make frequent observations of post-spawned steelhead that tended to gather in the pool above the head dam at the adult trap. Spawning activity for Pacific lamprey and cutthroat trout was also recorded for all surveys conducted.

Coho salmon spawning activity was widespread throughout all major tributaries (Table 2 and Figure 3). Redds were also observed in mainstem survey reaches, but these were from both coho and Chinook salmon spawners. Winter steelhead redds were observed in all tributaries except upper Moore Creek, but the majority of spawning within survey reaches was found in the mainstem (73% of redds observed; Table 3 and Figure 4).

Table 3 also summarizes redd counts of cutthroat trout and Pacific lamprey. Few cutthroat or lamprey redds were seen, but this is likely due to the cessation of survey efforts before most spawning occurs.

Table 2. Peak live counts for coho salmon, redd counts for coho and Chinook salmon, and total coho spawners in survey reaches based on area-under-curve (AUC) calculation in the West Fork Smith River during the period October 2010 to January 2011.

	Survey	Section	Length (km)	Peak Live	Peak Redds	Total AUC
Tributaries						
	Coon Cr.		1.11	14	18	35
	Crane Cr.	1	1.15	17	13	40
	Crane Cr.	2	1.54	21	13	49
	Moore Cr.	1	1.33	34	23	101
	Moore Cr.	2	1.99	28	29	107
	Beaver Cr.	1	2.11	35	24	77
	Beaver Cr.	2	1.17	62	60	215
	Gold Cr.	1	1.16	29	21	87
	Gold Cr.	2	1.86	34	22	86
Mainstem						
	Trib. B to Crane Cr.		1.71	12	23	34
	Moore Cr to Trib. D		2.55	12	12	41
	Trib. D to Trib. E		0.64	0	1	0
	Road X-ing to Trib. F		0.51	10	13	34
	Trib. F to Beaver Cr.		1.56	110	18	174
	Beaver to Gold Cr.		0.84	173	18	276
	Gold Cr to left trib.		1.78	142	25	312
	Headwaters	3	1.12	42	23	87
	Headwaters	4	1.36	30	32	92
Total			26.0			1,847

Estimated Spawner Populations

In most years, estimates of spawners are made using an adjusted Peterson mark-recapture methodology, based on the number of fish tagged and passed at the adult trap, and number of tagged and untagged fish observed (live fish and spawned-out carcasses) on surveys (see Solazzi et al. 2000 and Suring et al. 2009 for methodology). In years when insufficient numbers of fish are tagged to use mark-recapture methodology, spawner populations are estimated using area-under-curve (AUC) calculation from survey counts.

In 2010, we used mark and recapture methodology to estimate coho salmon spawners but used only data collected from carcass recoveries (N = 477). The low number of fish tagged, all within a short time frame, provided a limited opportunity to observe live fish for presence of tags. Carcasses persist in the system longer than live fish, providing a longer opportunity to determine the percentage of tagged fish in the spawner population. We estimate a total of 2,909 coho spawners in 2010 (Table 4).

As an alternative method of estimating coho salmon spawners, we used regression analysis based on the relationship of AUC counts of spawners within standard survey reaches (five principal tributaries plus seven mainstem reaches) to the estimates of total spawners for years when mark-recapture was used (Figure 2). Based on total AUC counts of 1,813 fish on standard reaches in 2010, the regression relationship inferred a total of 3,105 spawners, differing from our mark-recapture estimate by only 6.7%.

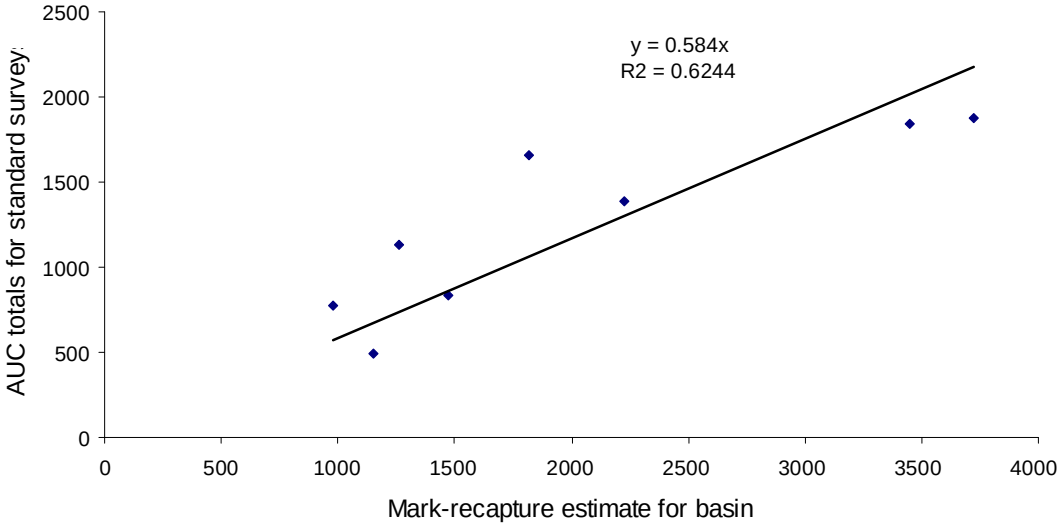

Figure 2. Relationship of area-under-curve estimates of total coho salmon spawners on standard survey reaches and point estimates of total spawners based on Peterson mark-recapture methodology in the West Fork Smith River

We made a total of 229 observations of winter steelhead spawners, of which 31.3% were tagged. We used mark/recapture to estimate a steelhead spawner population of 467 fish. Spawner estimates with confidence intervals are shown in Table 4.

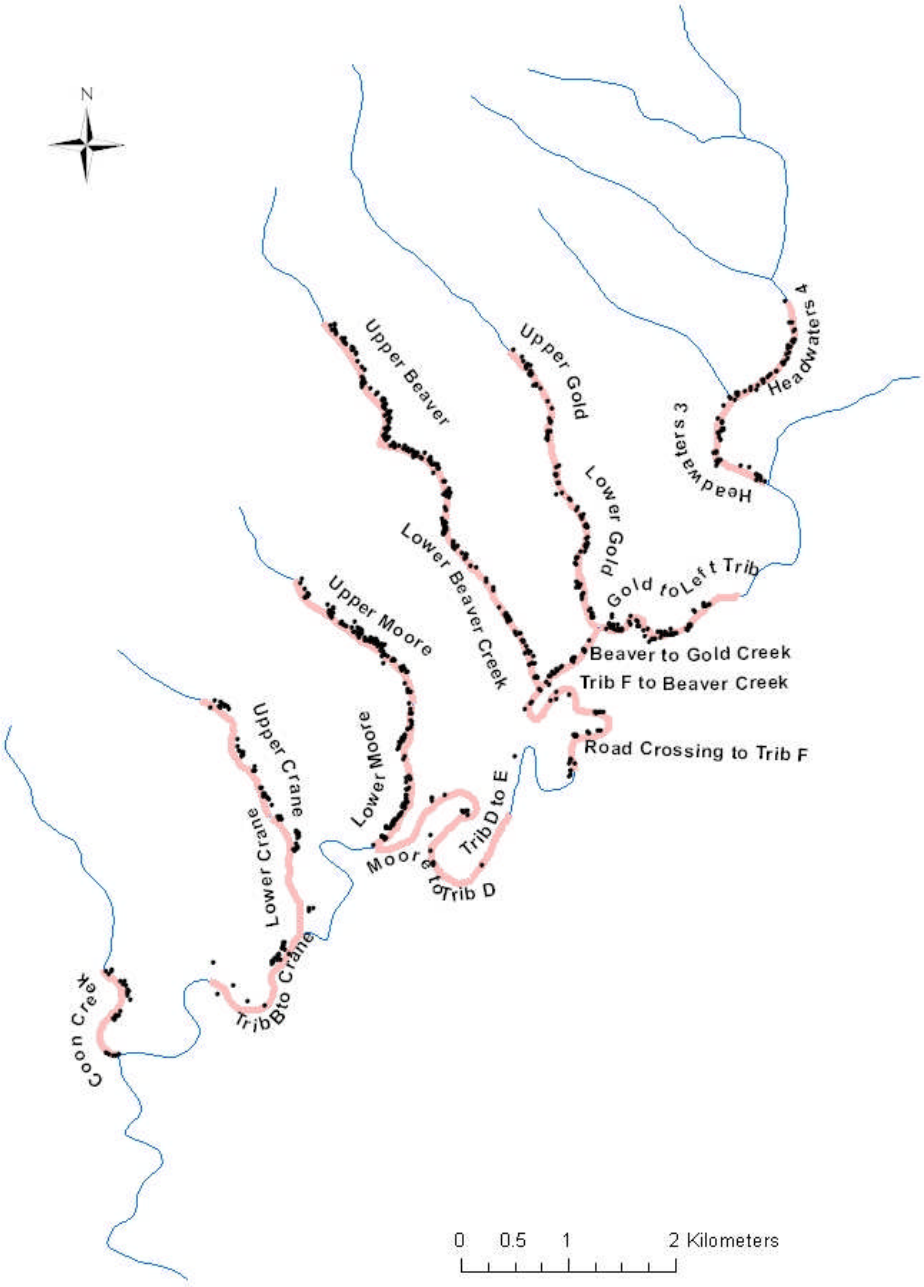

Figure 3. Redd distribution for coho and Chinook salmon within survey reaches in West Fork Smith River during the 2010 run-year. Shaded sections denote survey reaches.

Table 3. Total number of winter steelhead, cutthroat trout and Pacific lamprey redds counted on survey reaches in the West Fork Smith River for the period January to May 2011.

	Survey	Section	Length (km)	Steelhead	Cutthroat	Pacific lamprey
Tributaries						
	Coon Cr.		1.11	6	1	0
	Crane Cr.	1	1.15	3	0	0
	Crane Cr.	2	1.54	4	1	0
	Moore Cr.	1	1.33	3	0	0
	Moore Cr.	2	1.99	0	0	0
	Beaver Cr.	1	2.11	12	0	0
	Gold Cr.	1	1.16	12	0	0
	Gold Cr.	2	1.86	18	0	0
Mainstem						
	Trib. B to Crane Cr.		1.71	16	1	1
	Moore Cr to Trib. D		2.55	28	0	4
	Trib. D to Trib. E		0.64	2	0	0
	Road X-ing to Trib. F		0.51	15	0	3
	Trib. F to Beaver Cr.		1.56	23	1	1
	Beaver to Gold Cr.		0.84	18	0	5
	Gold Cr to left trib.		1.78	23	0	4
	Headwaters	3	1.12	12	0	3
	Headwaters	4	1.36	19	1	1

Table 4. Total spawner returns and confidence intervals (CI) for coho salmon and winter steelhead in the West Fork Smith River for run-years 1998-99 through 2010-11. Calculated trap efficiency represents the percentage of total estimated spawners that were trapped.

Return Year	Coho (95% CI)		Trap Effic. (%)	Steelhead (95% CI)		Trap Effic. (%)
98-99	155[a]	na	na	352	(± 128)	na
99-00	295	(238-372)	32.0	453	(± 21)	89.3
00-01	553	(465-657)	18.3	330	(± 17)	91.2
01-02	1,441	(1,216-1,794)	7.5	834	(± 216)	28.2
02-03	3,447	(3,122-3,927)	7.9	378	(± 114)	33.0
03-04	3,730	(3,220-4,441)	4.5	533	(± 111)	38.8
04-05	978	(787-1,233)	6.3	243	(± 36)	66.4
05-06	1,818	(1,458-2,392)	2.8	404	(± 158)	28.8
06-07	1,152	(831-1,658)	3.5	383	(± 103)	35.4
07-08	335[a]	na	na	310	(±122)	31.3
08-09	1,260	(1,000-1,653)	3.1	424	(±179)	24.3
09-10	2,230	(1,990-2,483)	11.1	378	(±41)	69.6
10-11	2,909[b]	(1,259-5,830)	1.8	467	(±133)	31.3

[a] based on AUC estimation from spawner survey data; confidence intervals were not calculated.

[b] based on percentage of marked fish within the carcass population only (live fish observations excluded)

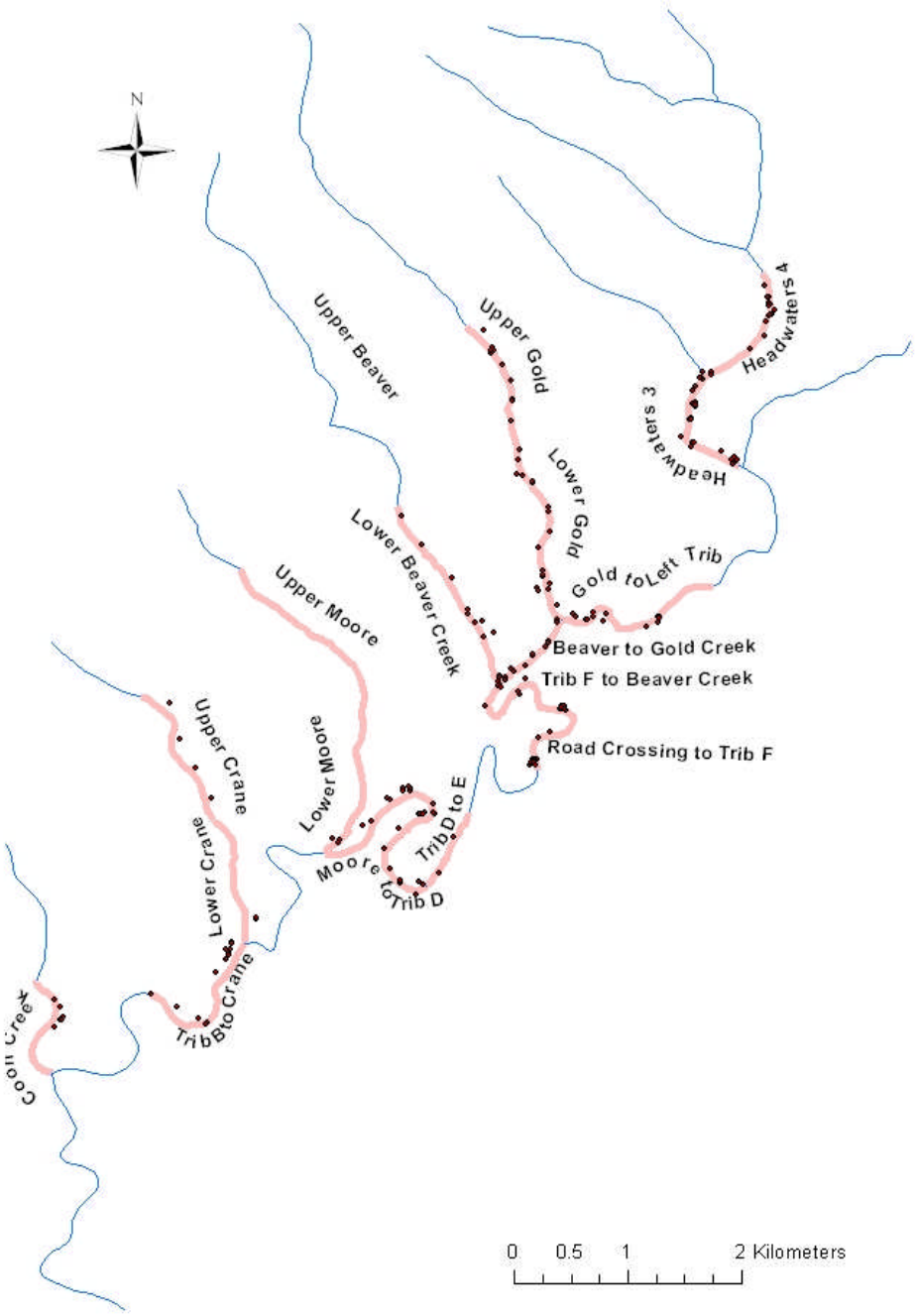

Figure 4. Redd distribution for winter steelhead within survey reaches in West Fork Smith River during the 2010-11 run-year. Shaded sections denote survey reaches.

Juvenile Out-Migrant Trap Operation

The juvenile out-migrant trap on the West Fork Smith River was installed on February 2 and operated until June 7. The trap functioned continuously except for nine days in February and March when it was inoperable due to high stream flows.

Estimated numbers of out-migrants for each species and size class are shown in Table 5. A single trap malfunction (log jammed in trap cone) accounted for most of the coho fry handling mortalities in 2011.

Table 5. Estimated out-migrants, calculated trap efficiencies and handling mortalities measured at the juvenile migrant trap on the West Fork Smith River from January 31 to June 12, 2011. Adult cutthroat trout (> 250mm) were not estimated using mark-recapture methodology; for this and other categories with insufficient mark recoveries, number in parentheses denotes actual catch.

Species	Age (salmon) or size-class (FL, mm)	Estimated total migrants	Trap efficiency	Handling mortalities
Coho	smolts (age 1+)	31,128	0.35	10
	fry (age 0)	52,527	0.09	353
Chinook fry	age-0	1,195	0.26	7
Trout fry	< 60	(17)		10
Steelhead	> 120	6,871	0.05	1
	90 – 119	1,071	0.16	0
	< 60 – 89	144	0.29	4
Cutthroat	≥ 250	(26)		0
	160 – 249	3,323	0.07	1
	120 – 159	2,208	0.12	0
	90 – 119	(7)		1
	60 – 89	(1)		

West Fork Smith River Monitoring Summary: 1998-2011

Coho Salmon

Trap catch of coho and Chinook salmon, and estimated spawning populations of coho salmon are summarized in Table 6. Calculated freshwater and marine survival rates are summarized in Table 7, and trends in these parameters are shown in Figure 5.

Table 8 summarizes data collected on juvenile coho salmon sampled at the fish trap. Figure 6 displays juvenile production in the basin, specifically the relationship of the number of fry and smolt migrants to size of spawner stock, and the relationship of fry and smolt migrants produced per female to total female spawners. The latter relationship (Figure 6b) suggests smolt production is density dependent and that carrying capacity for the basin is approached in most years. The upward trend in smolt production shown in Figure 5c (during which spawner stock varied widely) suggests carrying

capacity may be increasing; mean smolt population size has almost doubled from 17,783 for the period 1998-2004 to 32,461 for the period 2005-2011 (st. dev.=4,376 and 7,656, resp.).

Table 6. The number of female (F), male (M) and jack (J) coho and chinook salmon captured at the West Fork Smith River adult trap and the estimated spawning population above the trap during the return years 1998-1999 through 2010-2011. Numbers of wild female and male spawners were based on percent representation in spawned-out carcasses recovered on surveys and the adult trap weir. Coho salmon jacks are fish ≤510mm, and Chinook salmon jacks are fish ≤600mm.

	Trap Catch						Estimated Spawning Population					
	Wild			Hatchery			Wild			Hatchery		
Return Year	F	M	J	F	M	J	F	M	J	F	M	J
Coho												
98-99							72	73	na	0	0	na
99-00	38	58	1	0	0	0	130	163	na	0	0	na
00-01	46	56	23	0	0	0	271	279	na	0	0	na
01-02	49	57	6	8	11	0	707	729	189	15	20	na
02-03	100	173	12	3	0	0	1,520	1,924	114	4	3	na
03-04	56	110	2	0	0	0	1,787	1,940	101	0	0	na
04-05	30	32	0	0	0	0	417	561	na	0	0	na
05-06	17	34	0	0	0	0	723	1,095	na	0	0	na
06-07	17	16	0	2	1	0	464	688	na	2	1	na
07-08	7	6	0	0	0	0	137	198	na	0	0	na
08-09	16	23	5	0	0	0	501	759	na	0	0	na
09-10	124	127	1	0	1	0	1,094	1,131	na	0	0	na
10-11	19	23	2	0	1	0	1,583	1,326	na	0	1	na
Fall Chinook												
98-99	0	13	0	0	0	0						
99-00	3	13	0	0	0	0						
00-01	1	32	3	0	0	0						
01-02	5	34	2	0	1	0						
02-03	2	10	0	0	0	0						
03-04	2	20	2	0	0	0						
04-05	8	20	2	6	21	1						
05-06	2	9	4	1	4	0						
06-07	0	1	0	0	0	0						
07-08	2	7	0	0	0	0						
08-09	2	18	2	0	0	0						
09-10	8	47	7	0	0	2						
10-11	2	24	3	0	0	2						

Table 7. Estimated number of female spawners, egg deposition, fry and smolt production, number of wild returning adults, and freshwater and marine survival rates (females) for coho salmon in the WF Smith River.

Brood	Female Spawners					Returning Adults		Percent Survival	
Year	Wild	Hatchery	Egg Deposition[a]	Fry	Smolts	Female	Male	FW	Marine
1996					22,412	131	164		1.2
1997				2,527	10,866	273	280		5.0
1998	72	0	205,405	3,014	14,851	707	734	7.1	9.6
1999	130	0	376,545	3,605	20,091	1,521	1,926	5.3	15.3
2000	271	0	721,450	13,550	17,358	1,790	1,940	2.4	20.9
2001	704	15	2,044,536	35,851	15,849	417	561	0.8	5.3
2002	1,520	4	4,853,940	80,876	23,054	723	1,095	0.5	6.3
2003	1,787	0	5,130,275	104,402	39,576	464	688	0.8	2.4
2004	417	0	1,184,220	27,598	23,242	137	198	2.0	1.2
2005	723	0	2,222,612	36,621	22,504	501	759	1.0	4.5
2006	464	0	1,376,200	30,471	31,017	1,096	1,134	2.3	7.1
2007	137	0	352,316	1,448	38,605	1,583	1,326	10.9	8.2
2008	501	0	1,511,052	3,169	41,142			2.7	
2009	1,094	0	2,706,553	30,516	31,138			1.2	
2010	1,583	0	4,830,255	52,527					

[a] the number of eggs deposited by each female was estimated using the formula: $\sum$ 7.96 * (fork length of female in mm) – 2854. This formula is based on the relationship between length of female coho salmon and fecundity developed from hatchery fish returning to Fall Creek hatchery in the Alsea basin (Johnson 1988).

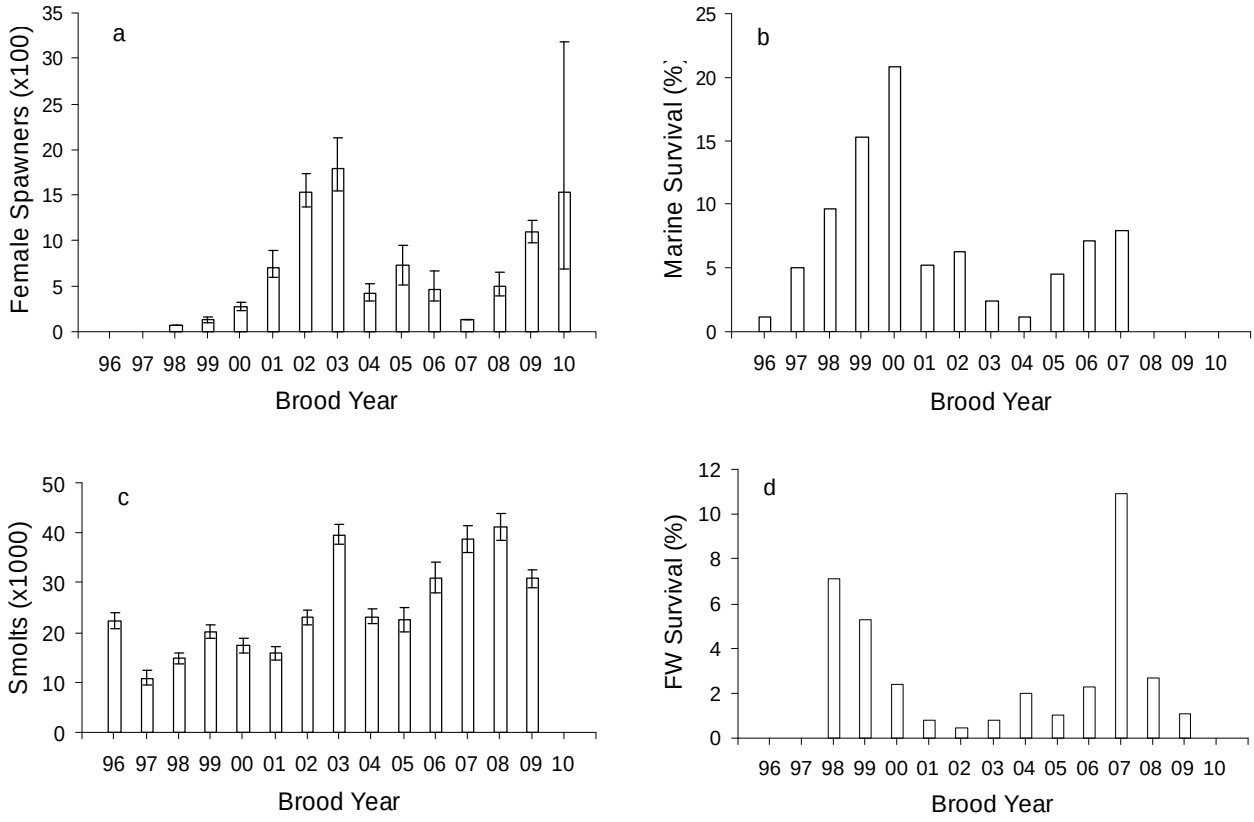

Figure 5. Trends in (a) estimated number of female spawners, (b) percent marine survival, (c) smolts, and (d) percent freshwater survival for coho salmon in the West Fork Smith River. Error bars show the 95% confidence interval. Marine survival estimates are for the total wild adults returning to spawn from smolts produced from the corresponding brood year. Calendar year of smolt out-migration is brood year +2 years. Calendar year of adult return for marine survival estimate is brood year +3 years. Freshwater survival (egg to smolt) is based on the estimated number of eggs deposited from the parent spawner population. The 1998 and 2007 brood years of returning adults were estimated using area-under-curve calculations; confidence intervals were not calculated. The 2010 brood year adult return was calculated based on carcass recoveries only.

Table 8. Estimated number of coho salmon smolt and fry migrants, week of peak migration for smolts, and mean fork length of smolts during week of peak migration in the West Fork Smith River. Data for smolts represents fish sampled in the second year following egg deposition (eg. fish sampled in 1998 were the 1996 brood year). Data for fry represents fish sampled the first year following egg deposition. Ninety five percent confidence intervals (CI) are shown.

Sample Year	Smolts ± CI			Fry ± CI			Peak Week	Mean FL (mm) ± CI		
1998	22,412	±	1,582	2,527	±	1,224	4/20-4/26	105	±	4.2
1999	10,866	±	1,420	3,014	±	641	5/17-5/23	113	±	3.5
2000	14,851	±	1,063	3,605	±	755	4/10-4/16	103	±	4.4
2001	20,091	±	1,325	13,550	±	3,626	4/23-4/29	112	±	4.3
2002	17,358	±	1,418	35,851	±	5,526	5/06-5/12	113	±	2.8
2003	15,849	±	1,166	80,876	±	9,319	5/05-5/11	109	±	4.1
2004	23,054	±	1,516	104,402	±	7,974	4/12-4/18	105	±	3.8
2005	39,576	±	2,038	27,598	±	3,515	5/02-5/08	110	±	4.8
2006	23,242	±	1,550	36,621	±	5,551	5/01-5/07	107	±	4.2
2007	22,504	±	2,375	30,471	±	13,585	4/23-4/29	112	±	3.0
2008	31,017	±	2,996	1,448	±	728	4/14-4/20	110	±	4.8
2009	38,605	±	2,664	3,169	±	2,149	4/27-5/3	106	±	1.9
2010	41,142	±	2,682	30,516	±	19,402	5/10-5/16	105	±	2.5
2011	31,138	±	1,870	52,527	±	13,093	5/9-5/15	110	±	3.2

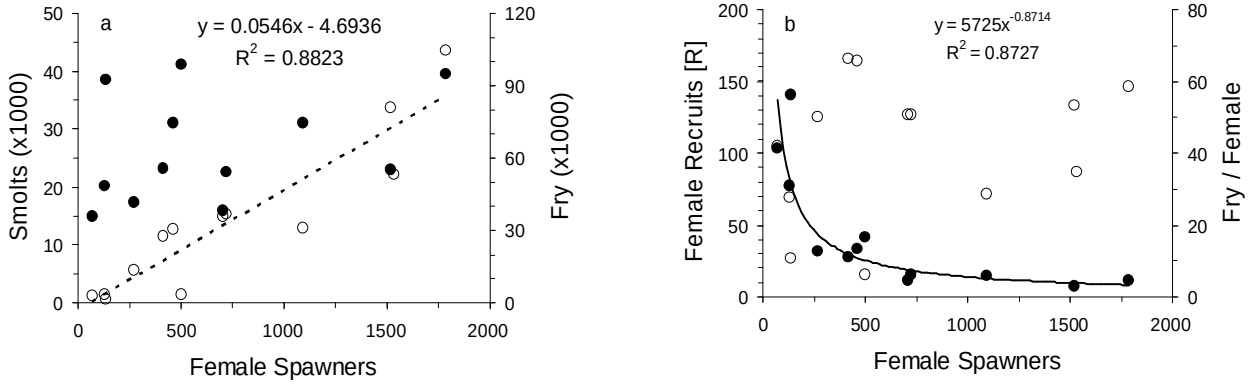

Figure 6. Relationship of number of fry and smolt migrants to size of spawner stock; (a) total smolt (solid symbol) and fry (clear symbol and dotted regression line; formula shown) migrants produced, to total female spawners; and (b) numbers of female smolts (solid symbol and regression line, formula shown) and total fry (clear symbol) migrants produced per female, to total female spawners.

Winter Steelhead

Trap catch and estimated spawning populations of winter steelhead are shown in Table 9. Estimated numbers of juvenile steelhead migrants are summarized by size class in Table 10.

Table 9. The number of female (F), male (M) and jack (J) winter steelhead captured at the West Fork Smith River adult trap and the estimated spawning population above the trap during the return years 1998-99 through 2010-11. Steelhead jacks are fish ≤510mm.

	Trap Catch						Estimated Spawning Population					
	Wild			Hatchery			Wild			Hatchery		
Return Year	F	M	J	F	M	J	F	M	J	F	M	J
98-99	54	48	4	3	2	0	178	172	na	10	7	na
99-00	244	158	0	1	1	0	273	177	na	1	1	na
00-01	141	118	7	1	2	0	175	155	na	1	2	na
01-02	116	86	2	0	1	0	472	358	na	2	2	na
02-03	45	72	0	0	0	0	144	231	na	0	0	na
03-04	104	92	1	0	1	0	281	252	na	2	1	na
04-05	78	79	2	1	3	0	120	121	na	2	5	na
05-06	56	43	0	4	1	0	229	176	na	16	4	na
06-07	58	74	2	0	1	0	168	214	na	0	3	na
07-08	31	57	2	0	0	0	109	200	na	0	0	na
08-09	50	45	0	0	1	0	223	200	na	2	2	na
09-10	147	114	1	0	0	0	211	164	na	0	0	na
10-11	72	72	0	2	0	1	229	233	na	6	0	1

Table 10. Estimated number of juvenile winter steelhead smolts (≥ 120mm fork length), week of peak smolt migration, mean fork length at peak week, and number of parr migrants (90-119mm and 60-89mm) in the West Fork Smith River. Number of fish caught is reported in parentheses when trap efficiency could not be determined for a particular category. Ninety five percent confidence intervals are shown.

Sample Year	Smolts ± CI	Peak week	Mean FL (mm) ± CI	Parr 90-119mm ± CI	Parr 60-89mm ± CI
1998	6,438 ± 1,286	4/20-4/26	169 ± 8	761 ± 225	27 ± 26
1999	2,688 ± 846	5/03-5/09	161 ± 7	66 ± 86	(10)
2000	2,836 ± 593	5/01-5/07	153 ± 4	1,675 ± 49	1,675 ± 1,030
2001	7,678 ± 1,338	3/26-4/01	148 ± 7	3,883 ± 507	620 ± 131
2002	4,681 ± 3,558	4/08-4/14	149 ± 8	769 ± 513	(10)
2003	2,448 ± 4,306	4/21-4/27	158 ± 10	227	159 ± 111
2004	2,916 ± 1,847	4/12-4/18	154 ± 8	1,138 ± 410	236 ± 158
2005	4,333 ± 1,382	3/21-3/27	145 ± 7	752 ± 227	73 ± 68
2006	3,840 ± 1,504	4/10-4/16	160 ± 8	582 ± 213	96 ± 163
2007	6,324 ± 5,258	4/09-4/15	160 ± 8	861 ± 316	(28)
2008	3,876 ± 2,680	4/28-5/4	154 ± 8	1,789 ± 696	319 ± 201
2009	4,433 ± 3,800	4/27-5/3	162 ± 9	1,475 ± 374	278 ± 104
2010	5,652 ± 7,706	4/12-4/18	153 ± 7	1,247 ± 448	279 ± 218
2011	6,872 ± 4,298	4/25-5/1	168 ± 7	1,071 ± 454	144 ± 105

Cutthroat Trout

Picket spacing in the floating weir and adult trap in the West Fork Smith River is too wide to effectively retain adult cutthroat trout. Live adults and cutthroat trout redds are counted on spawner surveys, but counts are generally too low to make population estimates using area-under-the-curve calculation. Estimated numbers of juvenile cutthroat trout migrants are summarized by size class in Table 11. The predominant size classes are fish 120-159 mm and 160-249 mm fork length, although there is considerable variation between years in each size class.

Table 11. Estimated number of cutthroat trout downstream migrants by size class (± 95% CI) in the West Fork Smith River. Number of fish caught is reported in parentheses when trap efficiency could not be determined for a particular category. No estimates were made in 1998 and 1999 when cutthroat trout in the Umpqua basin were listed as a threatened species under federal 4(d) rules.

Sample year	Fork Length 160-249mm	120-159mm	90-119mm	60-89mm
1998	(192)	(4)	0	0
1999	--	--	--	--
2000	947 ± 581	1,148 ± 439	(11)	(1)
2001	901 ± 251	1,633 ± 377	472 ± 406	(31)
2002	2,417 ± 982	2,748 ± 985	(3)	(1)
2003	1,235 ± 2,177	(70)	(4)	(5)
2004	713 ± 815	135 ± 136	(2)	(7)
2005	898 ± 646	724 ± 454	(2)	0
2006	2,304 ± 1,118	1,587 ± 471	(8)	(1)
2007	(64)	945 ± 1,615	(5)	(3)
2008	904 ± 1,519	1,455 ± 950	(14)	0
2009	1,845 ± 1,140	1,636 ± 566	587 ± 890	0
2010	3,930 ± 5,916	2,787 ± 3,207	(21)	0
2011	3,323 ± 1,938	2,208 ± 887	(9)	(1)

Other Species

Total number of select non-salmonid fishes trapped is shown in Table 12.

Table 12. Number of Pacifc and brook lamprey, speckled dace, Umpqua dace, redside shiner, largescale sucker and pikeminnow captured at the West Fork Smith River fish trap, river kilometer 1.6. Numbers represent actual catch; trap efficiency was not measured for these species. Eyed juvenile lamprey are Pacific lamprey that have completed metamorphosis to the life-history stage that is migrating seaward; eyed juveniles were not distinguished from ammoecoetes in 1998 and 1999. Western brook lamprey and eyed Pacific lamprey juveniles were not distinguished prior to 2003. Umpqua dace were not distinguished from speckled dace for the period 1998 through 2001.

	Pacific lamprey			Brook	Speck.	Umpq.	R.S.	L.S.	Pike-
Year	Adult	Amm.	Eyed	lamprey	dace	dace	shiner	sucker	minnow
1998	--	585[a]	--	22[b]	7,637[c]	--	913	100	2
1999	1	327[a]	--	--	2,975[c]	--	265	97	0
2000	--	648	--	42[b]	2,440[c]	--	322	85	0
2001	8	144	--	114[a]	5,194[c]	--	271	167	0
2002	4	300	--	17[a]	2,298	45	379	50	4
2003	0	216	7	45	2,830	52	200	10	4
2004	4	309	8	93	4,292	71	974	35	1
2005	7	749	81	74	4,879	103	1,117	21	2
2006	4	405	3	69	5,193	141	1,576	59	0
2007	1	219	0	142	5,133	65	517	71	0
2008	1	58	0	14	2,718	231	354	49	2
2009	2	36	0	7	4,265	70	1,297	128	0
2010	2	31	0	1	2,847	38	649	56	1
2011	2	78	0	0	3,677	52	1,204	45	0

[a] may include eyed lamprey juveniles
[b] may include adult Pacific lamprey
[c] may include Umpqua dace

Scale Analysis

We continued analysis of scales for age composition of out-migrating steelhead smolts and returning adult spawners (Table 13). Smolt-age data for both juveniles and adults were used to apportion each into specific brood years, enabling calculation of smolt to adult (marine) survival (see West Fork Smith River Life Cycle Monitoring Annual Report, 2009-2010 for methodology). Figure 7 shows marine survival by brood year. An alternative view of marine survival is to consider survival of all smolts in a particular out-migration year, irrespective of smolt age. Because all smolts each year face similar ocean conditions, this view provides a measure of how variable ocean conditions may be as a factor influencing early survival. Marine survival by out-migration year is shown in Figure 8. The use of brood year or out-migration year as the numerator in calculation of marine survival results in somewhat different patterns, but values that depart furthest from the long-term mean are similar because one age-class (age-2 smolt + 2-ocean years) predominates (mean = 67.6%) in spawner populations. For example, the high values of 20.0% for 1998, calculated using BY, and 22.2% for 2000, calculated using OMY, are similar because a strong return of 834 adults in 2002 were produced primarily from a low number of age-2 smolts of the 1998 brood year (2,187 smolts) and a low number of total out-migrants in 2000 (2,823 smolts). While the patterns between methods differ, the

long-term means are almost identical (mean = 8.8% using BY, mean = 8.9% by OMY; st dev. = 4.1 and 5.2, resp.)

Table 13. Age composition of juvenile and adult winter steelhead in West Fork Smith River. (OMY denotes out-migration year).

	Juveniles					Adults					
							Percent				
OMY	N	Smolt age	Percent		Smolt age	Ocean years	2009	2010	2011	Mean	S.D
2008	50	1	18.0		1	1					
		2	80.0			2	3.5	4.1	7.0	4.9	1.9
		3	2.0			3	0	1.2	1.6	0.9	0.8
						4	0	0.8	0.8	0.5	0.5
2009	145	1	13.8			5				0.0	
		2	82.1								
		3	4.1		2	1	1.2	0.4	0.0	0.5	0.6
						2	75.3	64.4	60.5	66.7	7.7
2010	110	1	28.2			3	11.8	20.7	20.9	17.8	5.2
		2	65.5			4	3.5	1.2	4.7	3.1	1.8
		3	6.4			5	1.2	0.8	0.0	0.7	0.6
2011	159	1	13.2		3	1				0.0	
		2	82.4			2	2.4	2.8	0.0	1.7	1.5
		3	4.4			3	2.4	3.2	2.3	2.6	0.5
						4	0	0.4	2.3	0.9	1.2
			Mean	S.D.		5				0	
		1	18.3	6.9							
		2	77.5	8.1							
		3	4.2	1.8		n =	85	247	129		

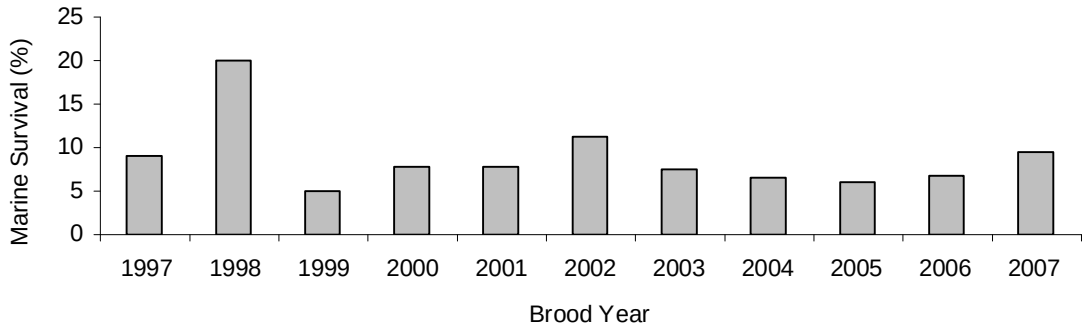

Figure 7. Calculated marine survival (smolt to maiden adult) by brood year for winter steelhead in West Fork Smith River. The value for 2007 includes only age-3 and age-4 adults that returned in 2011, which accounts for 73.0% of the spawner population (mean value for 2009-2011). Fish that return after 2011 would be predominantly repeat spawners (64.8% of age-5, 100% of fish >age-5).

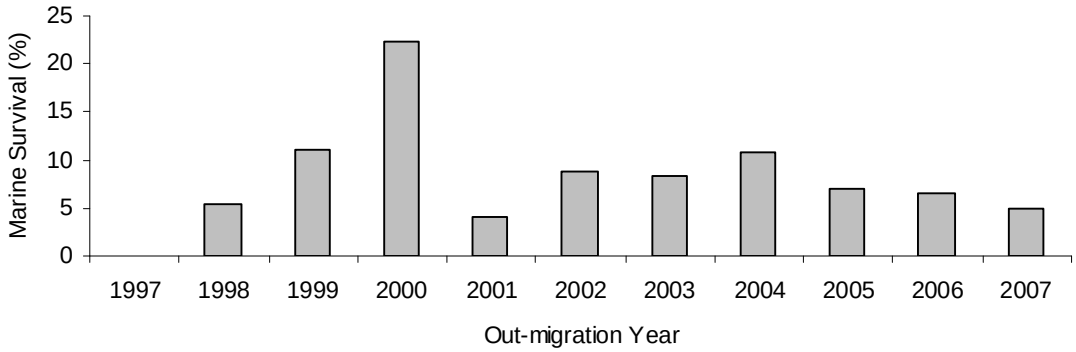

Figure 8. Calculated marine survival (smolt to maiden adult) by out-migration year for winter steelhead in West Fork Smith River. The value for 2007 includes only age-3 and age-4 adults that returned in 2011, which accounts for 73.0% of spawners (mean value for 2009-2011). Fish that return after 2011 would be predominantly repeat spawners (64.8% of age-5, 100% of fish >age-5).

The out-migrating coho salmon smolt population in West Fork Smith River includes a proportion of larger fish that differ appreciably from the mean size of their cohorts. In 2011, we collected a random set of scales from fish ≥ 120mm (range 120-147mm FL) to determine whether these larger fish may have remained in freshwater for an additional year and out-migrated at age-2. We limited scale collection and enumeration of fish ≥ 120mm to a five week period, March 28 to May 1, because an increasing percentage of age-1 smolts grow into this larger size group during May and June.

The size distribution of migrants during this time period (Figure 9a) shows that fish ≥ 120mm comprise a relatively small component of the total population. We analyzed scales collected from 32 fish within the ≥ 120mm sub-population and determined that 18.8% were age-2. For the period during which we enumerated fish ≥ 120mm, this larger sub-population represented 4.3% of total migrants sampled, among which 0.8% were presumed age-2. Assuming age-2 smolts out-migrate at similar rates as age-1 fish throughout the entire migration period, we estimate a total of 252 age-2 migrants in 2011. This number is small relative to the confidence interval for the total smolt estimate and would be insignificant as a factor in calculation of smolt (by brood year) to adult survival

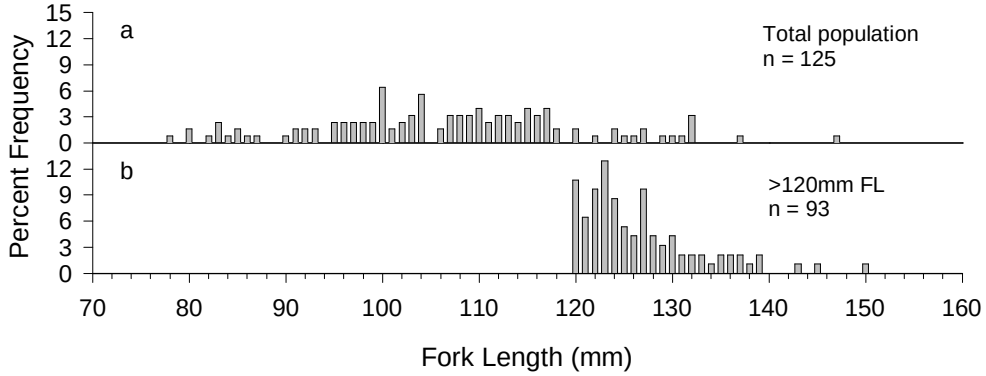

Figure 9. Size distribution of (a) randomly sampled coho salmon smolts, and (b) all coho smolts ≥ 120mm FL captured at the West Fork Smith River fish trap during the period March 28 to May1, 2011.

Water Temperature Monitoring

Ten thermistors were installed within the basin to expand spatial water temperature monitoring, Monitoring sites were established at the mouths of the Crane, Moore, Beaver and Gold creeks, and at six sites in mainstem reaches.

During summer 2010, water temperature in the lower mainstem of West Fork Smith River (river kilometer 1.6; Figure 10) frequently exceeded the 18C maximum temperature criteria established for the Umpqua Basin (Oregon Department of Environmental Quality). This pattern is similar to mid-summer temperatures recorded during the previous 13 year period in the basin (West Fork Smith River Life Cycle Monitoring Annual Report: 2008-2009).

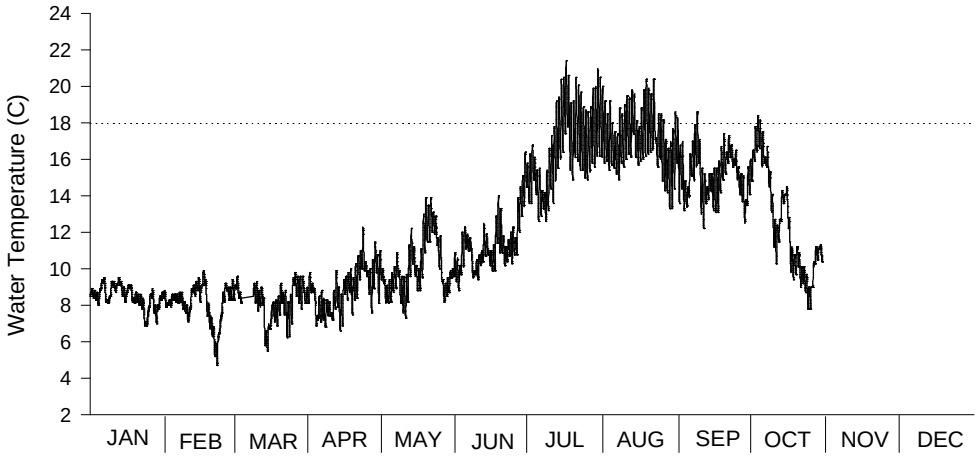

Figure 10. Water temperature in West Fork Smith River at river kilometer 1.6, 2010. Dotted line at 18C depicts maximum temperature criteria for salmon and trout rearing and migration (Lower Umpqua basin; Oregon Department of Environmental Quality). Data after October 25 not available.

Acknowledgements

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