West Fork Smith River
Salmonid Life Cycle Monitoring Project

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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 2007-08 run-year of returning adult fish and year 2008 out-migration of juvenile fish. A full description of sampling methods is provided in Solazzi et al. (2000) and Jepsen et al. (2006). 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

The floating weir at the adult fish trap was installed September 19 and began to function on October 23 corresponding to the first increase in streamflow. The first coho salmon entered the trap on November 15. Streamflows increased significantly in mid-November and the floating weir was submerged for seven days, allowing most of the early run of fish to bypass the trap. The weir was subsequently submerged for 15 days in December, 11 days in January, seven days in February, three days in March and one day in April. The 2007-08 adult trapping season extended 201 days until mid-May, during which the trap fished optimally for 157 days (78% of season). The first winter steelhead was trapped on December 19 and the last steelhead was caught on May 5. The floating weir was removed and the trap was decommissioned on May 15. In early June the trap was vandalized, requiring replacement of the blocking weir at the upstream end of the trap.

Trapped coho salmon and winter steelhead were tagged with two yellow Floy tags. Fall Chinook salmon were passed upstream without being tagged, but length and sex were recorded. All spawned out fish found in the trap were passed downstream. No hatchery fish were trapped in 2007-08.

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 November 20, 2007 to May 14, 2008. These included the five principal tributaries and several mainstem reaches (nine reaches for coho salmon and ten reaches for winter steelhead). 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. In May, we added a survey reach in the lower 900m of Tributary H, 3.6 km upstream from Gold Creek. Tributary H was surveyed on three occasions to record western brook lamprey spawning activity. Spawning activity for Pacific lamprey and cutthroat trout was also recorded for all surveys conducted. In March, a gill net was found stretched across the river between Beaver and Gold creeks. Surveyors removed the net and notified authorities.

Coho salmon spawning activity was widespread throughout all major tributaries and most reaches of the mainstem (Table 1). Winter steelhead spawners were observed in most tributary reaches, but the majority of spawning occurred in the mainstem (86.5% of redds observed, Table 2). Table 2 also summarizes redd counts of cutthroat trout and Pacific lamprey. Only two fall Chinook spawners were observed, both in the mainstem. We counted only six live brook lamprey spawners and six lamprey redds in Tributary H, but this species typically spawns later than the May survey period.

Table 1. Peak live counts and redd counts for coho salmon, and total coho salmon spawners (based on area-under-curve calculations from survey counts) in the West Fork Smith River during the period November 2007 to January 2008. Survey lengths for Crane Creek / Tributary A and mainstem reach nominally designated road crossing to tributary F have not been measured.

	Survey	Section	Length (km)	Peak Live	Peak Redds	Total AUC
Tributaries						
	Coon Cr.		1.11	4	4	8.2
	Crane Cr.	1	1.15	6	6	11.7
	Crane Cr.	2	1.54	4	6	5.0
	Crane, Trib. A		na	0	0	0
	Moore Cr.	1	1.33	4	5	4.3
	Moore Cr.	2	1.99	3	5	4.1
	Beaver Cr.	1	2.11	7	7	10.9
	Beaver Cr.	2	1.17	8	5	11.5
	Beaver Cr.	3		16	9	12.3
	Gold Cr.	1	1.16	3	4	4.9
	Gold Cr.	2	1.86	2	2	1.8
Mainstem						
	Trib. B to Crane Cr.		1.71	10	4	19.9
	Moore Cr to Trib. D		2.55	17	1	23.3
	Trib. D to Trib. E		1.40	0	1	0.0
	Road x-ing to Trib. F		na	15	3	28.0
	Trib. F to Beaver Cr.		1.56	8	2	15.9
	Beaver to Gold Cr.		0.84	16	6	33.2
	Gold Cr to left trib.		1.78	13	7	26.1
	Headwaters	3	1.12	2	6	4.1
	Headwaters	4	1.36	7	8	19.5
Total						244.6

Estimated Spawner Populations

Coho Salmon

In previous years, coho salmon spawners were estimated using mark and recapture methodology, but in 2007-08, too few fish were trapped and marked to use this method. As an alternative, spawners were estimated using area-under-curve (AUC) calculations for individual survey reaches. Season total AUC was calculated for "standard" reaches that are surveyed annually, including the five principal tributaries and seven reaches of the mainstem. For the run-years 2001-

02 through 2006-07, total AUC estimates for the standard surveys represented a mean of 48.4% of the total basin spawner estimates that were calculated using mark/recapture methodology. For the 2007-08 run-year, total AUC for standard surveys conducted up to mid-December was 204 spawners. This calculated AUC was divided by 0.484 for an estimate of 421 fish. We were unable to survey in late December due to high streamflows, but in early January we counted a total of five coho spawners on the standard survey reaches. These late spawning fish were also expanded for the entire basin (5 / 0.484 = 11 fish) for a total estimate of 432 coho salmon spawners.

Winter Steelhead

The estimate of winter steelhead spawners is 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. Estimates of spawners were made using the adjusted Peterson mark-recapture methodology:

$$N = \frac{(M(1-p^2) + 1)(C+1)}{(R + 1)}$$

where:

N = estimated population above the West Fork Smith River adult trap
M = the number of fish marked with two Floy tags
C = the number of fish observed for presence of tags on spawning surveys (live fish observations plus carcass recoveries), excluding fish for which presence of tag could not be determined
R = the number of tagged fish observed
p^2 = the probability that a fish lost both tags before being observed

The probability that a fish lost one of the two tags implanted was estimated by the formula:

$$p = n_1 / (2n_2 + n_1)$$

where:

n_1 = the number of observations of fish with one tag
n_2 = the number of observations of fish with two tags

The steelhead estimate includes a further adjustment to account for repeat spawners. Fish that were tagged prior to the current run-year but that bypass the trap become part of the marked population observed for tags. In 2008, tagged repeat spawners comprised 3.4% of fish that entered the trap. The number tagged (M) was adjusted by assuming that 3.4% of fish that bypassed the trap (an estimated 68.7% of total spawners) were previously tagged. This adjustment increased the “M” variable, the tagged population, by nine fish.

Timing of trap catch for the 2007-08 run-year generally corresponded with timing of high streamflow events (Figure 1). Most fish bypassed the trap during high streamflows when the floating weir was submerged, thus timing of trap catch was only an approximation of run timing.

The annual trap catch and estimated spawner populations of coho salmon and winter steelhead are shown in Table 3. There is no hatchery program in the Smith Basin; hatchery coho salmon were likely strays from the North Umpqua River, and hatchery steelhead were likely strays from the Siuslaw River.

Confidence intervals (95%) for coho salmon and winter steelhead total spawner estimates are shown in Table 4. Confidence intervals for winter steelhead were calculated using a bootstrap analysis (Thedinga et al. 1994, 1000 iterations).

Table 2. 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 2008.

	Survey	Section	Length (km)	Steelhead	Cutthroat	Pacific Lamprey
Tributaries						
	Coon Cr.		1.11	2	0	0
	Crane Cr.	1	1.15	2	0	0
	Crane Cr.	2	1.54	0	0	0
	Moore Cr.	1	1.33	7	4	2
	Moore Cr.	2	1.99	0	3	0
	Beaver Cr.	1	2.11	1	7	1
	Beaver Cr.	2	1.17	2	2	2
	Gold Cr.	1	1.16	4	1	1
	Gold Cr.	2	1.86	7	2	0
Mainstem						
	Trib. B to Crane Cr.		1.71	14	0	2
	Moore Cr to Trib. D		2.55	17	0	0
	Road x-ing to Trib F		1.40	21	0	0
	Trib. F to Beaver Cr.		1.56	24	0	0
	Beaver to Gold Cr.		0.84	16	0	1
	Gold Cr to left trib.		1.78	18	1	1
	Headwaters	3	1.12	21	1	0
	Headwaters	4	1.36	20	1	0
	Headwaters	5	na	9	0	0

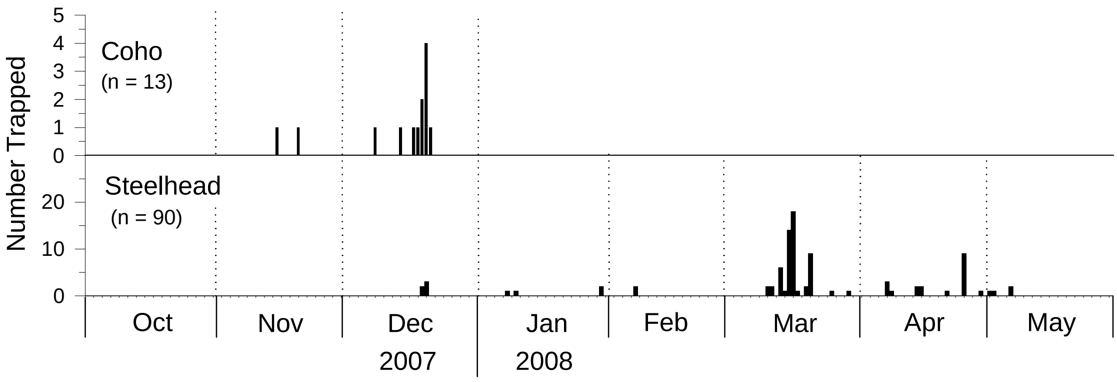

Figure 1. Timing of coho salmon and winter steelhead trapped in the West Fork Smith River during the 2007-08 run-year.

Table 3. The number of female (F), male (M) and jack (J) salmonids captured at the West Fork Smith River adult trap and the estimated spawning population above the trap during the return years 1998-99 through 2007-08. For coho salmon, 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 and winter steelhead jacks are fish ≤510mm, and Chinook salmon jacks are fish ≤600mm.

	Trap Catch						Estimated Spawning Population					
Return	Wild			Hatchery			Wild			Hatchery		
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	734	1,111	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	194	238	na	0	0	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						
Steelhead												
98-99	54	48	4	3	2	0	179	173		10	7	
99-00	244	158	0	1	1	0	275	177		1	1	
00-01	141	118	7	1	2	0	175	155		1	2	
01-02	116	86	2	0	1	0	472	362		2	2	
02-03	45	72	0	0	0	0	145	233		0	0	
03-04	104	92	1	0	1	0	281	252		2	1	
04-05	78	79	2	1	3	0	122	121		2	5	
05-06	56	43	0	4	1	0	229	176		16	4	
06-07	58	74	2	0	1	0	164	210		0	3	
07-08	31	57	2	0	0	0	108	200		0	0	

Table 4. Total estimated spawner populations of coho salmon and winter steelhead in the West Fork Smith River for run-years 1998-99 through 2007-08. The adult coho spawner population in 1998-99 and 2007-08 was based on area-under-curve estimation from spawner survey data; confidence interval was not calculated. Calculated trap efficiency was based on the percentage of total estimated spawners that were trapped. Repeat steelhead spawners were determined from the percentage of fish that entered the adult trap with tags implanted prior to the current run-year.

Return Year	Coho (95% CI)		Trap Effic. (%)	Steelhead (95% CI)		Trap Effic. (%)	Repeat Spawner (%)
98-99	145	na	na	366	(± 128)	na	na
99-00	293	(238-372)	32.0	453	(± 21)	89.3	na
00-01	550	(465-657)	18.3	334	(± 15)	91.2	0.7
01-02	1,471	(1,216-1,794)	7.5	834	(± 205)	28.2	12.3
02-03	3,451	(3,122-3,927)	7.9	375	(± 108)	33.0	4.8
03-04	3,727	(3,220-4,441)	4.5	536	(± 111)	38.8	2.0
04-05	978	(787-1,233)	6.3	247	(± 12)	66.4	1.8
05-06	1,845	(1,458-2,392)	2.7	425	(± 141)	28.8	5.8
06-07	1,154	(831-1,658)	3.4	377	(± 103)	35.4	0.8
07-08	432	na	3.5	308	(±122)	31.3	3.4

Juvenile Out-Migrant Trap Operation

The juvenile out-migrant trap on the West Fork Smith River was installed on February 6 and operated until June 9 when catch of salmonid fishes reached low levels. The trap functioned continuously except for nine days when it was inoperable due to high stream flows or trap malfunction.

Capture efficiency of traps was normally evaluated daily for each species and age/size class by marking up to 25 fish from each category with a small clip on the caudal fin, then releasing upstream of the trap. Subsequent recaptures of marked fish were recorded and weekly estimates of out-migrants were made by expanding trap catches using the following equations:

$$N_m = c / e_m$$

and

$$e_m = r / m,$$

where:

N_m = weekly estimated out-migrants
c = number of fish captured
e_m = measured weekly trap efficiency
r = number of recaptured marked fish
m = number of marked fish released

Weekly estimates were summed for season totals. When recaptures were infrequent (< five recaptures/week), totals for an equal number of previous and following weeks were pooled to obtain at least five recaptures. Population estimates were generally not calculated if fewer than five marked fish of a particular category were recaptured over the season, in which case number caught is reported.

Beginning in 2005, a weighted value for trap efficiency was used to calculate confidence intervals. Each weekly estimate of trap efficiency was weighted based on the proportion of total estimated migrants that each weekly estimate of migrants represented, using the equation:

$$e_w = e_m * (N_m / N_t),$$

where e_w = weighted weekly trap efficiency, e_m = measured weekly trap efficiency, N_m = weekly estimated migrants, and N_t = season total migrants. The sum of the weighted trap efficiencies was used in the confidence interval calculations.

Estimated numbers of out-migrants for each species and size class are shown in Table 5.

Table 5. Estimated out-migrants, calculated trap efficiencies and handling mortalities measured at the juvenile migrant trap on the West Fork Smith River from February 6 to June 9, 2008. 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+)	31,017	0.22	13
	fry (age 0)	1,448	0.11	1
Chinook fry	age-0	4,608	0.17	14
Trout fry	< 60	(50)		
Steelhead	> 120	3,876	0.07	1
	90 – 119	1,789	0.13	0
	< 60 – 89	319	0.21	0
Cutthroat	≥ 250	(12)		0
	160 – 249	904	0.08	0
	120 – 159	1,455	0.10	0
	90 – 119	(14)		0
	60 – 89	0		0

West Fork Smith River Monitoring Summary: 1998-2008

Coho Salmon

The 1998 brood year was the first brood for which the size of the parent stock and number of eggs deposited was estimated, and thus represents the first brood for which freshwater survival rate could be calculated. Adult coho salmon that returned to the West Fork Smith River in fall 1999 (1996 brood year) represent the first spawners for which the number of smolts that produced these adults was estimated, providing the first opportunity to calculate marine survival rate for this stock. For this and subsequent broods, calculated freshwater and marine survival rates are summarized in Table 6, and trends in these parameters are shown in Figure 2.

Table 6. Estimated number of female spawners, egg deposition, fry and smolt production, number of wild returning adults, and freshwater and marine survival rates for coho salmon in the WF Smith River.

Brood	Female Spawners		Egg			Returning Adults		Percent Survival	
Year	Wild	Hatchery	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	7.2	9.6
1999	130	0	376,545	3,605	20,091	1,521	1,926	5.5	15.3
2000	271	0	721,450	13,550	17,358	1,790	1,940	2.4	20.9
2001	707	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	465	690	0.8	2.4
2004	417	0	1,169,503	27,590	23,242	151	184	2.0	1.4
2005	723	0	1,814,160	36,621	22,504			1.2	
2006	465	0	1,292,703	30,471	31,017			2.4	
2007	170	0	472,662	1,448					

[a] the number of eggs deposited by each female was estimated using the formula: $\sum 7.96 * (\text{fork length of female in mm}) - 2854$. 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).

Table 7 summarizes data collected on downstream-migrating populations of juvenile coho salmon at the juvenile fish trap. Peak migration generally occurred between mid-April and mid-May, and was likely strongly influenced by patterns of stream flow and water temperature.

Figure 3a shows the relationship of number of coho fry and smolt migrants to size of spawner stock. The relationship of fry migrants to spawners displays a close linear correlation, with increased spawner levels corresponding to proportionate increases in fry migrants. The correlation of smolt production to female spawners is less clear. In addition to seeding levels and egg to fry survival rates, smolt production is influenced by variables that determine survival of parr during summer and winter. These variables include summer water temperatures, winter stream flows, density of parr and competition between cohorts and other species, and level of parasite infestation. Survival of a cohort is influenced by each variable to greater or lesser degrees each year, thus a close relationship would not be expected. Despite the lack of a clear linear correlation, Figure 3a shows that smolt production varied little over a broad range of number of spawners. A better descriptor of the relationship between smolts produced and spawners may be found in the close non-linear correlation of smolts produced per female and size of spawner stock (Figure 3b). Highest production rates were found at low spawner densities. This suggests survival of one or more life-history stages may be density dependent, and by inference, habitats essential to specific life-history stages may be limited.

Figure 3b also shows the correlation of fry migrants per parent and spawner stock. There is little variation in this parameter, with the exception of years with very low spawner levels. This suggests that a proportion of fry produced from each female tends to move downstream, irrespective of seeding level.

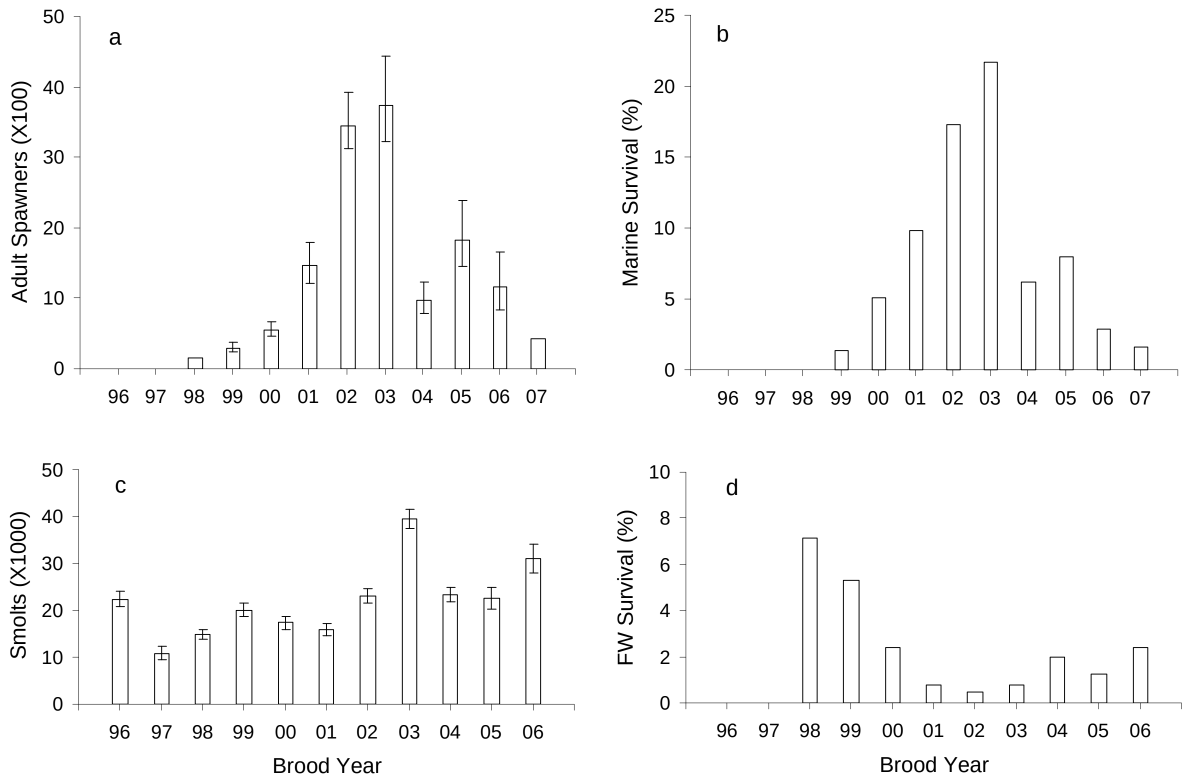

Figure 2. Trends in (a) estimated number of adult spawners, (b) percent marine survival, (c) smolts, and (d) percent freshwater survival for coho salmon in the West Fork Smith River. Error bars show the 95% confidence interval. Marine survival estimates are for the total wild adults returning to spawn 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. For sample years 1998 and 2007 the populations estimate was calculated using area under the curve calculations and 95% confidence intervals were not calculated.

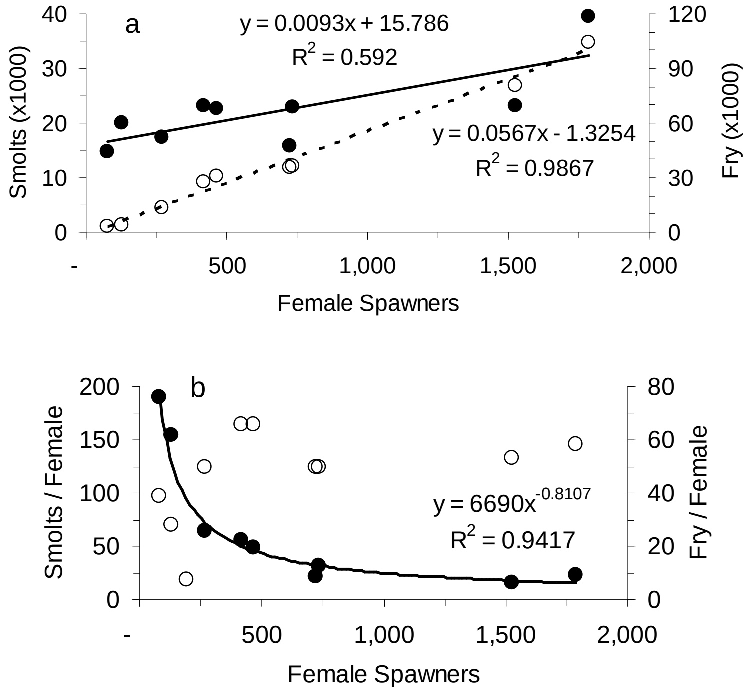

Figure 3 . Relationship of number of fry and smolt migrants to size of spawner stock; (a) total smolt (solid symbol and regression line; formula shown above line) and fry (clear symbol and dotted regression line; formula show below line) migrants produced, to total female spawners; and (b) numbers of smolt (solid symbol and regression line) and fry (clear symbol) migrants produced per female, to total female spawners.

Table 7. 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 ± 1,584	2,527 ± 1,224	4/20-4/26	104.6 ± 4.2
1999	10,866 ± 1,465	3,014 ± 658	5/17-5/23	113.0 ± 3.5
2000	14,851 ± 1,088	3,605 ± 752	4/10-4/16	103.0 ± 4.4
2001	20,091 ± 1,337	13,550 ± 3,557	4/23-4/29	112.1 ± 4.3
2002	17,358 ± 1,460	35,851 ± 5,628	5/06-5/12	112.5 ± 2.8
2003	15,849 ± 1,239	80,876 ± 11,360	5/05-5/11	109.2 ± 4.1
2004	23,054 ± 1,523	104,402 ± 7,963	4/12-4/18	105.4 ± 3.8
2005	39,576 ± 2,038	27,598 ± 3,515	5/02-5/08	110.0 ± 5.0
2006	23,242 ± 1,550	36,621 ± 5,551	5/01-5/07	107.0 ± 4.0
2007	22,504 ± 2,375	30,471 ± 13,585	4/23-4/29	112.0 ± 3.0
2008	31,017 ± 2,996	1,448 ± 728	4/12-4/18	110.0 ± 4.0

Winter Steelhead

Marine survival estimates are not calculated for winter steelhead because the spawning population is composed of multiple ages, including fish that may be on a second spawning migration. In addition, the steelhead smolt population in any year is comprised of different brood years. Estimated numbers of juvenile steelhead migrants are summarized by size class in Table 8.

Table 8. Estimated number of juvenile winter steelhead smolts (≥ 120mm fork length), week of peak smolt migration, mean fork length at peak week, and number of pre-smolt 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.

Sample Year	Smolts ± CI			Peak week	Mean FL (mm) ± CI			Pre-smolts 90-119mm ± CI			Pre-smolts 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	193	±	49	1,675	±	1,030
2001	2,737	±	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	(75)			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

We completed an analysis of scales collected in four sample years from winter steelhead smolts (≥120mm fork length) to characterize smolt age structure in West Fork Smith River. We found considerable variation between years in the proportions of age-1, age-2, and age-3 smolts (Table 9).

Table 9. Age structure of winter steelhead smolts (≥ 120mm fork length) sampled at the West Fork Smith River juvenile fish trap in four sample years. Age was determined from scale analysis.

	1998		1999		2002		2008	
Age	N	%	N	%	N	%	N	%
1	81	60.9	35	35.0	12	15.6	21	42.0
2	55	41.4	60	60.0	59	76.6	29	58.0
3	0	0.0	5	5.0	6	7.8	0	0.0
Total	136		100		77		50	

We also analyzed the size structure of age-1 and age-2 steelhead smolts to determine the relationship of fork length to age at migration. Figure 4 shows that while larger smolts are predominantly age-2 and smaller smolts are predominantly age-1, the point at which most (shown as 75%) smolts shift from age-1 to age-2 has varied from 165-170mm in 1998 to 145-150mm in 2001.

Variation in steelhead smolt age and age-specific size at migration suggests a number of factors may influence age composition of a smolt population, including environmental variables such as water temperature and streamflow patterns experienced during the pre-smolt phase, and biological variable such as inter-and intra-specific competition. This variation indicates that attempts to calculate marine survival rates for individual brood years will require scale analysis and determination of age structure of both the smolt and returning adult phases. Additionally, the number of pre-smolt (< 120mm fork length) migrants has varied widely and in some years comprises a significant proportion of trapped fish (Table 8). It is not known whether some portion of steelhead migrants defined as "pre-smolts" at the trap should be included in the smolt population.

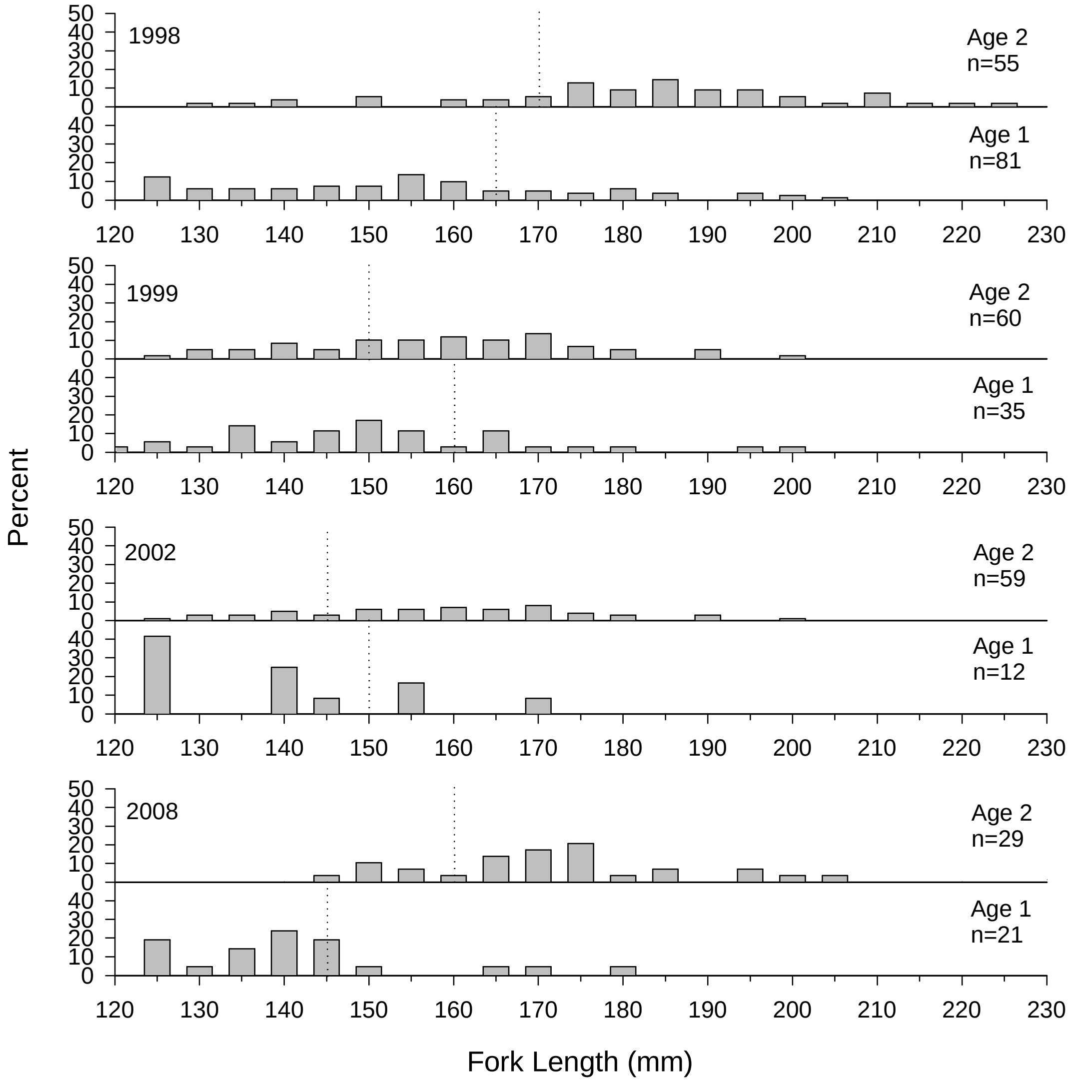

Figure 3. Length-frequency histograms of age-1 and age-2 winter steelhead smolts in the West Fork Smith River for sample years 1998, 1999, 2002 and 2008. The dotted lines in each plot represent the fork length at which 75% of smolts are characterized as larger (right of line for age-2 fish) or smaller (left of line for age-1 fish). Histograms display fork lengths in 5mm bins.

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 10. 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 10. 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

Other Species

Total number of select non-salmonid fishes trapped is shown in Table 11. Pacific lamprey captured included both pre- and post-spawned adults. Almost all western brook lamprey were post-spawned. Sculpin (*Cottus* spp.) were also caught in low numbers.

Table 11. 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 were not distinguished prior to 2003. Umpqua dace were not distinguished from speckled dace for the period 1998 through 2001.

	Pacific lamprey			Brook	Speck.	Ump.	R.S.	L.S.	Pike-
Year	Adult	Amm.	Eyed	lamprey	dace	dace	shiner	sucker	minnow
1998	22 [c]	585 [a]	--	--	7,637 [b]	--	913	100	2
1999	1	327 [a]	--	--	2,975 [b]	--	265	97	0
2000	42 [c]	648	32 [c]	--	2,440 [b]	--	322	85	0
2001	8	144	114 [c]	--	5,194 [b]	--	271	167	0
2002	4	300	17 [c]	--	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

[a] may include eyed lamprey juveniles
[b] may include Umpqua dace
[c] may include western brook lamprey

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