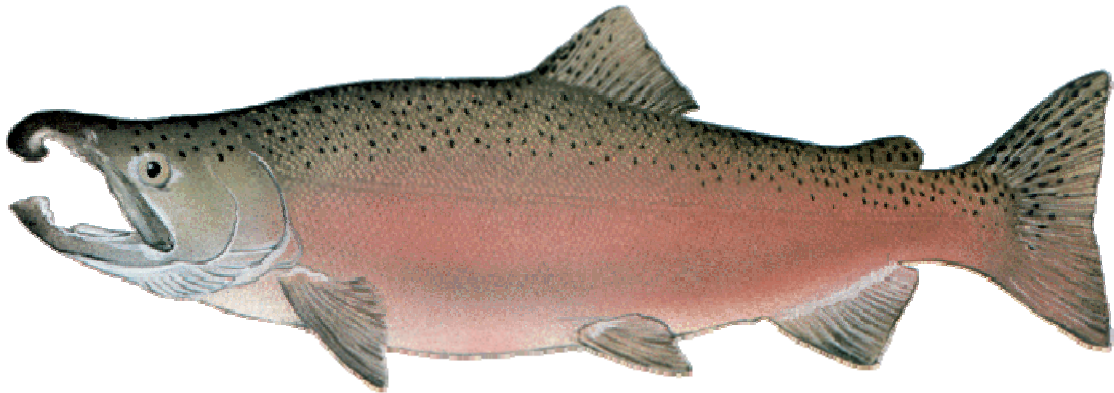


**West Fork Smith River
Salmonid Life-Cycle Monitoring**

Final Report: 2003-2004

**FY 2003 Allocation
BLM Contract Number: HAC991021**



Prepared by:
Bruce A. Miller ¹
Oregon Department of Fish and Wildlife
Western Oregon Research and Monitoring Program

¹ Oregon Department of Fish and Wildlife / Charleston, Oregon (bruce.a.miller@state.or.us)

Introduction

The Salmonid Life-Cycle Monitoring Project of the Oregon Department of Fish and Wildlife 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 for the 2003-2004 run year of returning adult fish and year 2004 out-migration of juvenile fish in the West Fork Smith River. A full description of sampling methods is provided in Solazzi et al. (2000).

Adult Fish Trap Operation

During summer 2003 repairs were made to the adult fish trap and floating weir. The floating weir was installed and the trap made operational on September 17, 2003.

Stream flows remained low through October. Precipitation and stream flows increased in early November, but fish did not enter the trap until November 16. During a high stream flow event on November 29 a large tree became caught on the floating weir and kept the weir submerged for 48 hours, permitting a large number of upstream-migrating coho salmon to bypass the trap. During the trapping period, the weir was submerged for a total of six days in November, 11 days in December, 12 days in January, eight days in February, three days in March and two days in April. The last fish (winter steelhead) entered the trap on May 1, and on May 5 the weir was removed and the trap decommissioned.

Total numbers of adult salmonids trapped in the West Fork Smith River are shown in Table 1. All wild coho salmon and winter steelhead were tagged with two yellow Floy tags and passed above the trap.

Run timing generally corresponded with timing of freshet events and increased stream flow. Most fish bypassed the trap during high stream flows when the floating weir was submerged, thus timing of fish that entered the adult trap was only an approximation of run timing (Figure 1).

Spawning Ground Surveys

No fall Chinook salmon were observed on spawning ground surveys, although nine spawned-out Chinook were recovered on the adult trap weir. The low number of recovered spawners and trapped adults suggests a low total number of fall Chinook spawners in the West Fork Smith River during 2003.

Coho salmon spawned throughout the basin. Among the major tributaries, Moore and Beaver creeks received the most spawning activity, while in the main stem, most spawning was observed between Beaver and Gold creeks, and in the reach upstream from Gold Creek (Table 2).

Spawning activity of winter steelhead was also widespread throughout the main stem and in all major tributaries (Table 2).

Table 1. Number of fish trapped at West Fork Smith adult fish trap during the period November 2003 to May 2004. All mortalities were fish stranded on the floating weir and are not part of number of fish trapped.

Species	Month	Wild			Hatchery			Mortalities
		Female	Male	Jack	Female	Male	Jack	
Coho	Nov	38	89	0				1 female
	Dec	18	20	2				2 female
	Jan	0	1	0				
	Total	56	110	2				
Chinook	Nov	2	17	2				3 male (1 wild, 2 hatch.) 2 female (1 wild, 1 hatch.)
	Dec	0	3	0				
	Total	2	20	2				
Steelhead	Jan	29	34					
	Feb	24	30					
	Mar	35	18					
	Apr	14	12			1		
	May	2	0					
	Total	104	93			1		

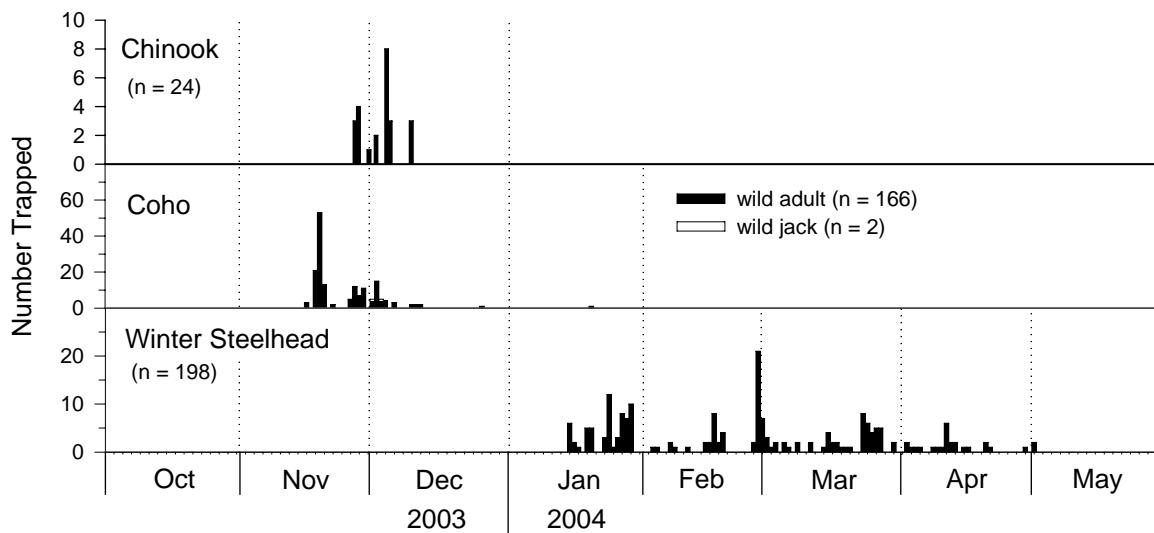


Figure 1. Timing of fall Chinook salmon, coho salmon and winter steelhead trapped in the West Fork Smith River during the 2003-2004 run year.

Table 2. Peak live counts and redd counts for coho salmon, total coho spawners (based on area-under-curve calculations from survey counts), and season-total counts of winter steelhead redds on survey reaches in the West Fork Smith River during the period November 2003 to May 2004.

Survey reach	Length (km)	Coho			Steelhead
		Peak live	Peak redds	Total AUC	Total redds
Tributaries					
Coon Cr.	1.11	64	27	72	7
Crane Cr., lower	1.15	21	20	32	7
Crane Cr, upper	1.54	21	17	32	0
Moore Cr, lower	1.33	75	49	141	8
Moore Cr, upper	1.99	64	40	112	6
Beaver Cr, lower	2.11	44	29	96	11
Beaver Cr, upper	1.17	73	41	126	7
Beaver Cr, headwaters ^a	0.30	d	d	d	4
Gold Cr, lower	1.28	50	47	87	20
Gold Cr, upper	1.76	63	48	90	25
Gold Cr, headwaters ^a	0.80	d	d	d	0
Church Cr ^b	1.90	24	17	42	e
Main stem					
Trap to Coon Cr ^a	0.80	d	d	d	2
Coon to Trib B	1.54	d	d	d	12
Trib. B to Crane Cr.	1.71	52	19	92	14
Crane Cr to flasher 143 ^a	0.40	d	d	d	0
Flasher B6 to Moore Cr ^a	0.40	d	d	d	15
Moore Cr to Trib. D	2.50	36	16	69	41
Trib. F to Beaver Cr.	1.56	57	21	73	34
Beaver to Gold Cr.	0.84	54	21	92	24
Gold Cr. to left tributary	1.78	96	44	142	45
Above bridge, Section 3	1.12	42	32	74	42
Above bridge, Section 4	1.36	50	23	74	31
Above bridge, Section 5	c	d	d	d	12
Total					367

^a surveyed by US Forest Service

^b surveyed by US Environmental Protection Agency

^c length not measured

^d not surveyed for coho spawners

^e not surveyed for steelhead spawners

Estimation of Spawner Escapement

Coho salmon

The estimated number of coho salmon spawners was based on the number of fish that were tagged and passed at the West Fork Smith trap, and number of tagged and untagged fish observed (live fish and spawned-out carcasses) on surveys. An estimate of adult coho spawners was made using the adjusted Peterson mark-recapture methodology:

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

where:

M = (165) the number of adult coho marked with two yellow Floy tags

C = (2967) the number of adult coho observed for presence of yellow tags on spawning surveys (live fish plus carcass recoveries), excluding fish for which presence of tag could not be determined

R = (131) the number of yellow-tagged fish observed (live fish plus carcass recoveries)

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 = (9) the number of fish observed with one yellow tag

n_2 = (122) the number of fish observed with two tags

Using this methodology and adjusting for tag loss, the total spawning escapement of coho salmon was 3728 fish (bootstrap 95% C.I. = 5210). This estimate represents a trap efficiency (proportion of total estimated run that was trapped) of 0.045. This estimate includes 1787 females, based on the sex ratio of fish recovered on spawning surveys and as spawned-out fish recovered on the trap weir. The total estimated return of wild females (including pre-spawn mortalities) was 1790 fish. Based on the estimated number of coho smolts that migrated from West Fork Smith River during spring 2002 (17,164), the 2003 return represents a marine survival rate of 20.9 percent for coho females.

Winter Steelhead

An estimate of winter steelhead spawners was made using the same methodology, where:

M = (198) the number of fish yellow-tagged and passed above the trap

C = (250) the number of fish observed (live counts + carcass recoveries) for tags

R = (97) the number of fish with yellow tags

p^2 = the probability that a fish lost both tags before being observed

n_1 = (3) the number of fish observed with one yellow tag

n_2 = (94) the number of fish observed with two tags

Using this methodology, the estimated number of steelhead spawners (N) was 510 (bootstrap 95% C.I. = 109). This total estimate of steelhead spawners included one hatchery fish. Based on the sex ratio of steelhead trapped at the West Fork Smith trap, 269 females (all wild) were calculated to have spawned above the trap. Using this estimate of total spawners, trap efficiency for steelhead was 0.388, and the ratio of total number of counted redds to the estimated number of female spawners was 1.29.

Juvenile Out-Migrant Trap Operation

The juvenile out-migrant trap was installed in the West Fork Smith River on February 11 and removed on June 3 when low stream-flows precluded further operation. The trap sampled continuously except for three occasions when the trap was pulled to the bank or the drum was raised to prevent damage during high stream flows (one day in February, one day in March, and two days in April). After mid-May, stream flows were very low and four intermediate drive vanes were installed to increase torque on the main drum.

Estimated numbers of out-migrants for each species and size class are shown in Table 3.

Table 3. Estimated number of out-migrants, recoveries of PIT-tagged fish, and calculated trap efficiency determined at the juvenile migrant trap at river kilometer 1.6 on the West Fork Smith River for the period February 11 to June 3, 2004. Numbers in parentheses denote unexpanded catch when fewer than five marked fish were recaptured to determine trap efficiency.

Species / Size or Age Class	Estimated total migrants	Number scanned	Number PIT-tagged ^a	Trap efficiency	Mortalities
Coho smolts (age 1+)	23,054	6,921	318	0.34	15 ^b
fry (age 0)	104,402			0.25	77
Chinook fry (age 0)	13,095			0.20	15
Trout fry (< 60mm)	(642)				3
Steelhead					
> 120mm	2,916	210	4	0.08	0
90 – 119mm	1,138	185	1	0.17	0
< 60 - 89mm	236	70	0	0.20	0
Cutthroat					
> 160mm	713	87	4	0.09	0
120 – 159mm	135	35	0	0.23	0
90 - 119mm	(2)	2	0		0
60 - 89mm	(7)	5	0		0

^a recoveries of fish PIT-tagged by US Environmental Protection Agency

^b handling mortalities only; an additional 40 fish were sacrificed for US EPA for isotope analysis and parasite identification

Summary of Findings: 1998 to 2004

The 1999 brood year of coho was the first brood for which the size of the parent stock and number of eggs deposited was estimated in the West Fork Smith River, and thus represents the first brood for which freshwater survival rate could be calculated. Adult coho that returned to West Fork Smith River in fall 1999 (1996 brood year) represent the first coho 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 these and subsequent broods

sampled in West Fork Smith River, calculated freshwater and marine survival rates are shown in Table 4.

Table 4. Estimated freshwater survival (egg to smolt) of coho salmon for the 1999-2002 brood years (BY) and marine survival (smolt to returning adult) for the 1996 to 2000 BY in the West Fork Smith River. The number of returning adult females used to calculate egg deposition was adjusted to account for pre-spawn trap mortalities, and calculated number of eggs deposited was adjusted by the fecundity/length relationship of females sampled at the trap. Adult returns and calculated marine survival rates do not include jacks (fish that return the same year as smolt emigration) for each brood.

BY	Eggs deposited	Smolts	FW surv. (%)	Return year	Adult returns ^a		Marine surv. (%)	
					Male	Female	Total	Female
1996	--	22,412	--	1999	164	131	1.32	1.17
1997	--	10,866	--	2000	279	273	5.08	5.02
1998	--	14,851	--	2001	734	707	9.71	9.52
1999	367,545	20,091	5.47	2002	1,926	1,521	17.16	15.14
2000	721,450	17,358	2.41	2003	1,941	1,790	21.49	20.62
2001	2,044,536	16,019	0.78					
2002	4,853,940	23,054	0.47					
2003	5,130,275	--	--					

^a Numbers of returning females and eggs deposited in this table may differ from figures posted in previous reports due to a change in the manner in which sex is apportioned from total returns. Number of females in previous reports included fish sampled in the adult fish trap plus post-spawn carcasses. Number of females in this report is based exclusively on sex ratio of post-spawn carcasses.

Returns of winter steelhead spawners have been determined annually since the 1999-2000 run year and are shown in Table 5.

Table 5. Estimated number of returning adult winter steelhead spawners in the West Fork Smith River.

Return Year	Total spawners	Female spawners	Trap efficiency
1999-00	453	274	0.894
2000-01	307	162	0.867
2001-02	731	405	0.292
2002-03	348	139	0.336
2003-04	501	264	0.394

Total number of downstream-migrating juvenile coho, steelhead and Chinook smolts for the seven year period 1998–2004 is shown in Figure 2, and the trend in mean length of coho and steelhead smolts during the two-week period of peak migration is shown in Figure 3. Migration timing of juvenile coho and steelhead is shown in Figure 4.

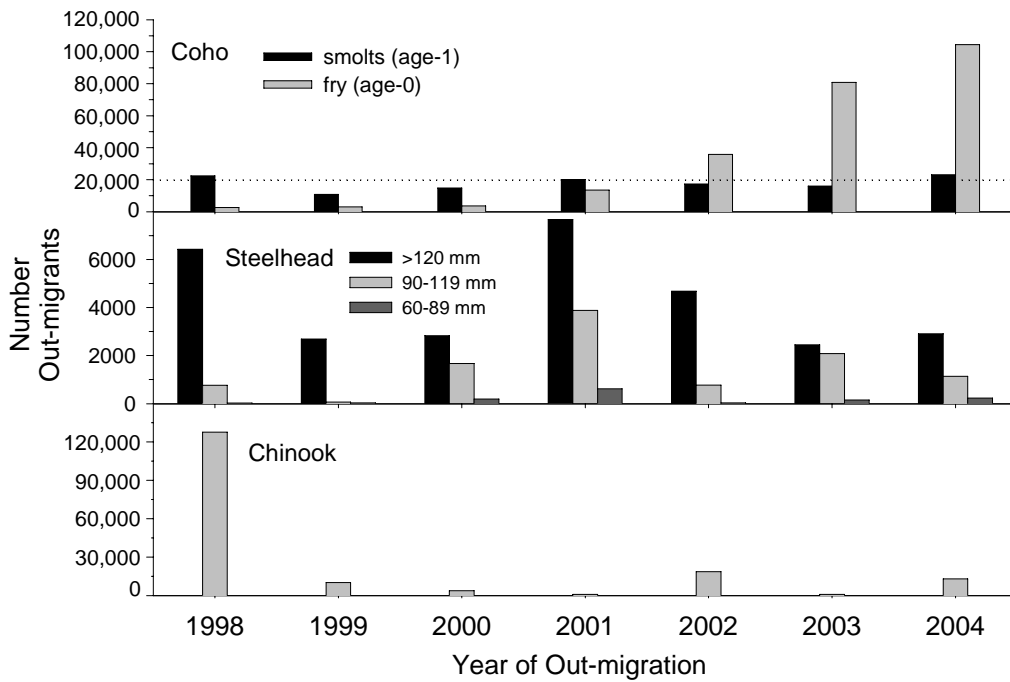


Figure 2. Number of downstream-migrating juvenile coho salmon, winter steelhead, and Chinook salmon measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2004.

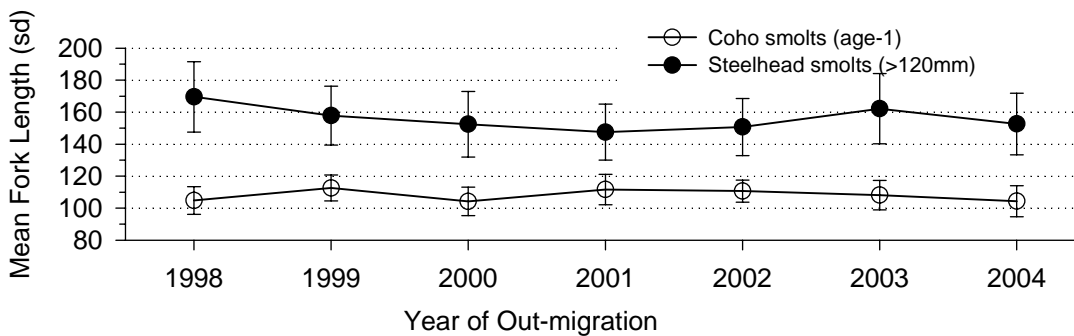


Figure 3. Mean fork length (\pm stand dev) of coho and steelhead smolts during the two-week period of peak out-migration in the West Fork Smith River for the period 1998 to 2004.

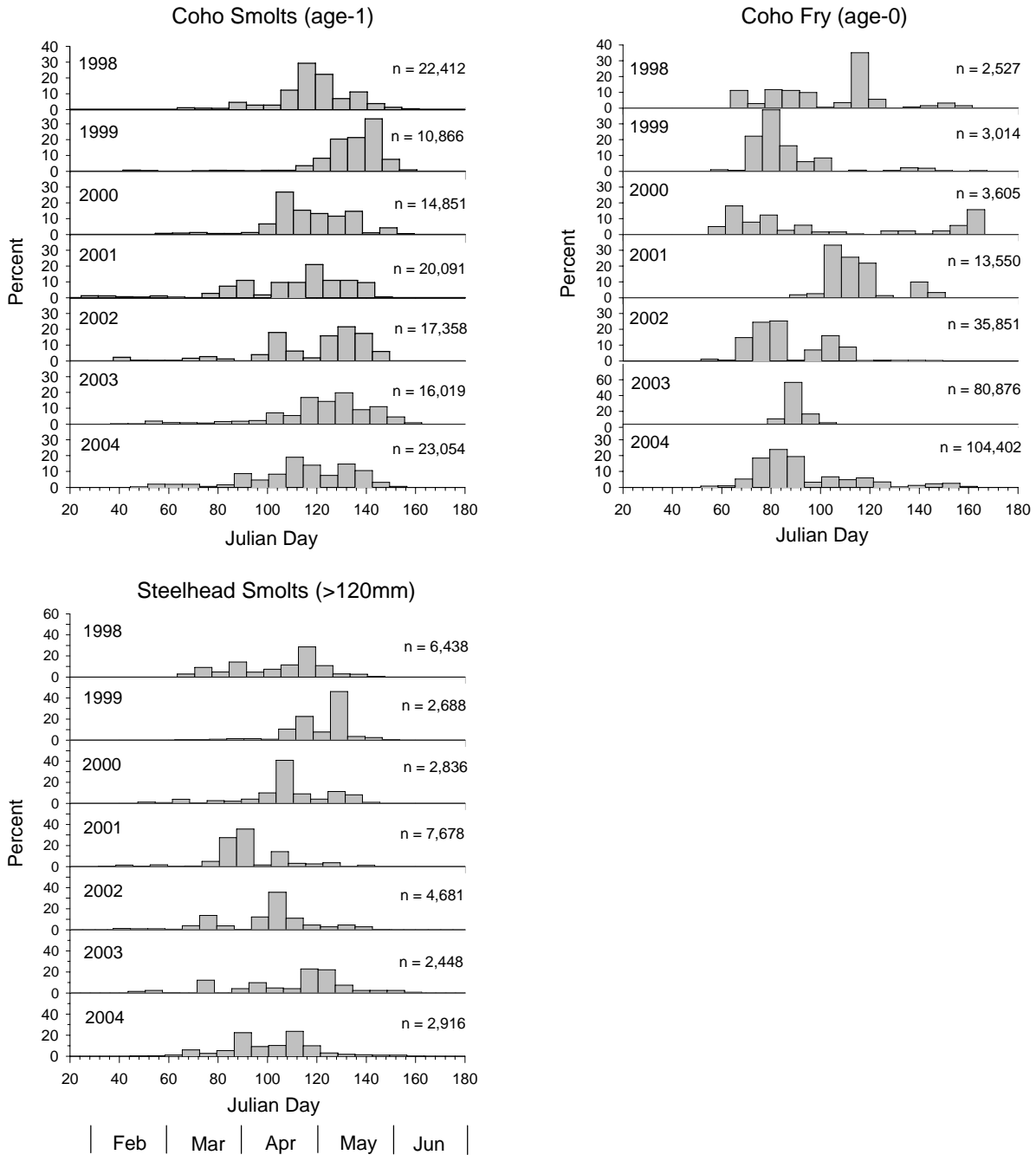


Figure 4. Migration timing of juvenile coho salmon and winter steelhead smolts measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2004.

Literature Cited

Solazzi, M.F., S.L. Johnson, B. Miller, T. Dalton 2000. Salmonid Life-Cycle Monitoring Project 1998 and 1999. Monitoring Program Report Number OPSW-ODFW-2000-3, Oregon Department of Fish and Wildlife, Portland, Oregon.