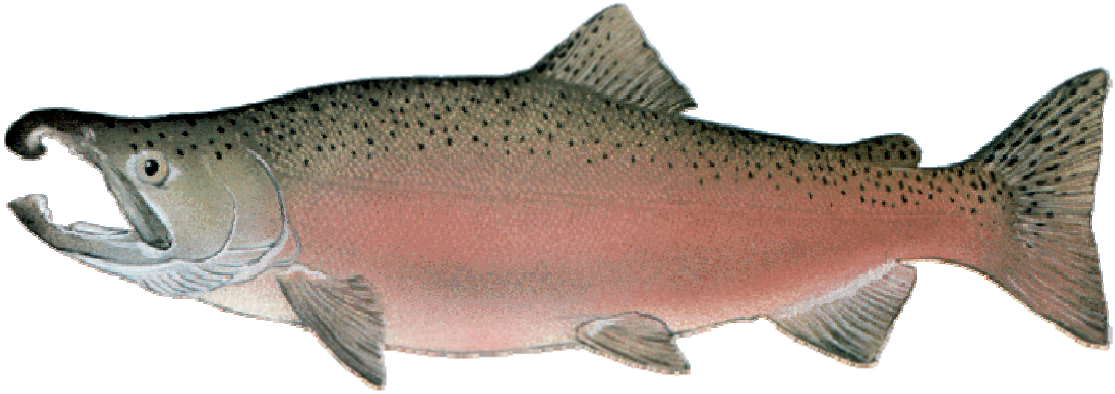
West Fork Smith River
Salmonid Life-Cycle Monitoring

Final Report: 2001-2002

FY 2001 Allocation
BLM Contract Number: HAC991021



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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 2001-2002 run year of returning adult fish and year 2002 out-migration of juvenile fish in the West Fork Smith River. A five-year summary of results for the period 1998-2002 is also provided. A full description of sampling methods is provided in Solazzi et al. (2000).

Adult Fish Trap Operation

The adult fish trap was operated continuously from September 17, 2001 to May 14, 2002. Several modifications were made to the trap during summer 2001 to increase flow through the trap during low-flow conditions and the period of leaf-fall. Modifications included excavation of a deeper entrance channel to the trap, excavation of a deeper jump pool at the base of the V-fyke through which fish enter the trap, removal of the false floor inside the trap box, and installation of a modified blocking weir and V-fyke designed to minimize collection of suspended leaves and debris. The floating weir panels were also repaired.

Precipitation and sufficient stream flow for fish to ascend the fish ladder and falls on the main stem of Smith River occurred in mid October. Fish first entered the trap in the West Fork Smith River on October 25. The floating weir was frequently submerged during high stream flows, including 4 days in November, 11 days in December, 7 days in January, and 3 days in February. Most adult fish by-passed the trap during periods of high flow. A flood event in late January caused significant damage to the floating weir and required replacement or repair of 30 percent of the weir pickets.

Total numbers of adult salmonids trapped in the West Fork Smith River are shown in Table 1. All wild fish were tagged with two yellow Floy tags and passed above the trap. In addition, eight coho of hatchery origin (including four females) were tagged and passed. Additional hatchery coho caught in the trap were hauled to the main stem of Smith River and released upstream from the West Fork.

Stranding of fish on the floating weir during low stream flows was a problem, as in previous years. Most stranded fish were those that bypassed the weir during high stream flows, then returned downstream as flows dropped. This problem was minimized by weighting and submerging portions of the weir to allow downstream passage over the weir.

Run timing generally corresponded with timing of freshet events and increased stream flow. Most hatchery coho were captured during the first portion of the run (Figure 1).

Table 1. Number of fish trapped at the West Fork Smith River adult fish trap, October 2001 through May 2002.

	Wild			Hatchery		
Species	Female	Male	Jack	Female	Male	Mortalities
Coho	48	57	6	8	11	6 adult male, 1 jack [a]
Chinook	5	33	3		1	9 adult male, 1 jack [b]
Steelhead	116	92			1	4 male [c]

[a] one fish gilled in V-fyke; six fish stranded on floating weir
[b] all fish stranded on floating weir
[c] one fish stranded on floating weir; two fish impinged on blocking weir; one fish gilled in V-fyke

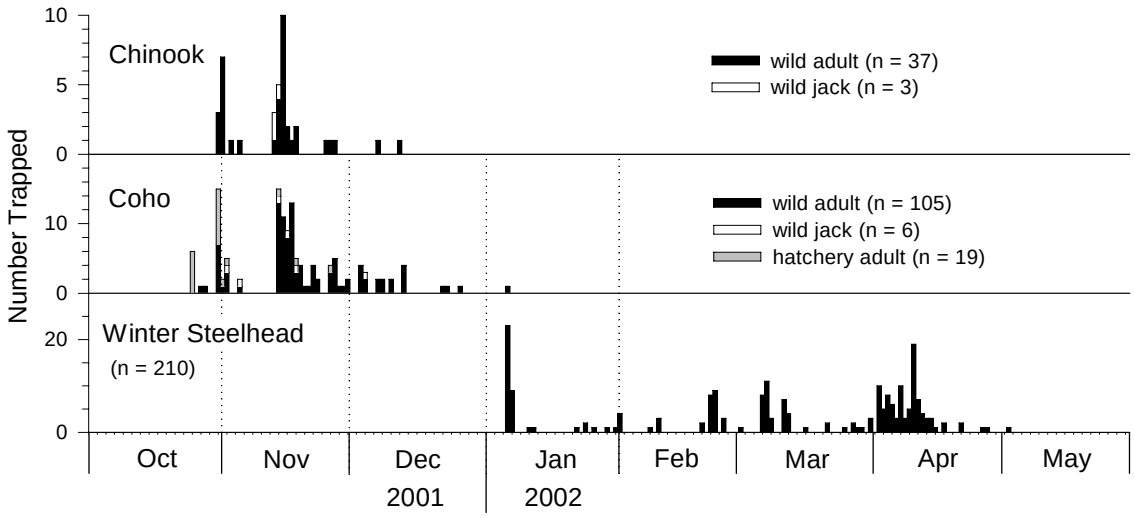

Figure 1. Timing of chinook salmon, coho salmon, and winter steelhead trapped in the West Fork Smith River during the 2001-2002 run year.

Spawning Ground Surveys

A total of 26 live fall chinook and one carcass were observed on spawning ground surveys, but none were yellow-tagged. Moore Creek was the only tributary where live chinook were found (n = 7); most spawning activity occurred in the main stem of the West Fork, primarily between the trap and Crane Creek, and the reach downstream from Beaver Creek. In addition, 19 chinook redds and a peak count of 36 live chinook were recorded downstream from the trap, in the 1.6 km reach between the trap and the mouth of the West Fork.

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 above Beaver Creek (Table 2).

Winter steelhead also spawned throughout the basin. Steelhead redds were individually flagged, permitting identification of new redds and calculation of season-total redds for each survey reach. Moore and Gold creeks received most spawning activity among the tributaries, but steelhead spawners were widely distributed throughout the main stem (Table 2).

Table 2. Total coho spawners observed in each survey reach (based on area-under-curve calculations from survey counts), peak coho redd counts, and season-total steelhead redd counts in the West Fork Smith River for the period November 2001 to May 2002.

		Coho		Steelhead
Survey reach	Length (km)	Total AUC	Peak redds	Total redds
Tributaries				
Coon Cr.	1.12	31	9	6
Crane Cr.	1.28	26	12	5
Moore Cr, lower	1.12	36	26	18
Moore Cr, upper	2.08	82	30	12
Beaver Cr, lower	2.08	47	24	7
Beaver Cr, upper	2.40	48	29	1
Gold Cr, lower	1.28	24	11	13
Gold Cr, upper	1.76	39	16	29
Mainstem				
Trap to Coon Cr.	1.28	not surveyed		13
Trib. B to Crane Cr.	1.76	39	16	24
Moore Cr to Trib. D	1.92	9[a]	--	65
Trib. D to Trib. E	1.28	4[a]	--	12
Trib. F to Beaver Cr.	1.12	9[a]	--	33
Beaver to Gold Cr.	0.78	33	14	25
Gold Cr. to left tributary	1.60	80	23	52
Above bridge, Section 3	1.76	53	13	26
Above bridge, Section 4	1.12	46	10	21
Above bridge, Section 5	1.92	not surveyed		8
Total		606		352

[a] represents counts made prior to December 12 only; survey discontinued after that date

Estimation of Spawner Escapement

Chinook salmon

Few fall chinook were observed on spawning surveys, and none were yellow-tagged. The high incidence of stranded chinook on the floating weir suggests that many fish (either those tagged and passed or those that bypassed the trap) tended to move back downstream below the trap. As a consequence, the number of yellow-tagged chinook that remained above the trap was uncertain. No estimate of chinook spawners was made.

Coho salmon

The estimated number of coho spawners was based on the number of fish yellow-tagged and passed at the West Fork Smith trap, and number of tagged fish observed (live fish and carcasses) on spawning surveys. All yellow-tagged fish observed on surveys were double-tagged, thus no adjustment was made for tag loss.

A modified Peterson estimate was made using the formula:

$$N = \frac{(M + 1)(C+1)}{(R + 1)}$$

where:

N = estimated population above the West Fork Smith trap
M = (113) the number of adult fish yellow-tagged and passed above the trap
C = (1,181) the number of fish observed for tags (live counts plus carcass recoveries)
R = (88) the number of fish observed with yellow tags

Using this method, a total of 1514 coho (bootstrap 95% confidence interval = 1490) spawned in the West Fork Smith River during the 2001-2002 run-year. This estimate includes both wild and hatchery-origin spawners. Based on recoveries of tagged and untagged hatchery fish, an estimated 15 spawners were of hatchery origin. A calculated 715 wild females plus six hatchery females spawned above the trap, based on the sex ratio of fish that entered the adult trap plus non-yellow-tagged carcasses recovered. Trap efficiency for coho was 0.076.

Winter Steelhead

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

M = (205) the number of fish yellow-tagged and passed above the trap
C = (304) the number of fish observed (live counts + carcass recoveries) for tags
R = (85) the number of fish with yellow tags
p^2 = the probability that a fish lost both yellow 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 = (1) the number of fish observed with one yellow tag
n_2 = (84) the number of fish observed with two tags

Using this methodology, the estimated number of steelhead spawners (N) was 731 (bootstrap 95% confidence interval = 165). Based on the sex ratio of steelhead trapped at the West Fork Smith trap, 405 females were calculated to have spawned above the trap. Using this estimate of total escapement, trap efficiency for steelhead was 0.292, and the ratio of total number of counted redds to the estimated number of female spawners was 1.152.

Juvenile Out-Migrant Trap Operation

The juvenile out-migrant trap was installed in the West Fork Smith River on February 4 and removed on May 28 when low stream-flows precluded further operation. The trap sampled continuously except for two occasions in February and April when the trap was pulled from the main current to avoid damage during strong freshets. On one occasion, the trap box filled with floating debris during a storm event and caused significant mortality of trapped fish.

Estimated numbers of out-migrants for each species and size class are shown in Table 4. In 2002, the downstream-migrating populations of speckled dace and longnose dace were also monitored in the West Fork Smith River. An estimated population of over five thousand speckled dace moved past the migrant trap, primarily during April and May (Table 4; Figure 2). Several age classes of this species were apparent in the trap catch (Figure 3). Although smaller in number, the downstream-migrating population of longnose dace also appeared to be represented by several age classes (Table 4; Figure 3). Several individuals of both species of dace were recovered as mortalities in the trap box and examined for gonad development. All larger individuals of both species were sexually mature and this downstream movement may have represented a spawning migration.

Table 4. Estimated number of out-migrants 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 4 to May 28, 2002. Numbers in parentheses denote unexpanded catch when too few marked fish were recaptured to determine trap efficiency.

Species / size or age class		Estimated total migrants	Trap efficiency	Mortalities
Coho	smolts (age 1+)	17,358	0.31	194
	fry (age 0)	35,851	0.16	302
Chinook fry (age 0)		18,726	0.29	88
Trout fry (< 60mm)		(37)		1
Steelhead				
	> 120mm	4,681	0.05	36
	90 – 119mm	769	0.15	9
	< 60 - 89mm	(10)		1
Cutthroat				
	> 160mm	2,417	0.13	8
	120 – 159mm	2,748	0.13	12
	90 - 119mm	(3)		0
	60 - 89mm	(1)		0
Speckled dace		5,165	0.45	23
Longnose dace		100	0.44	1

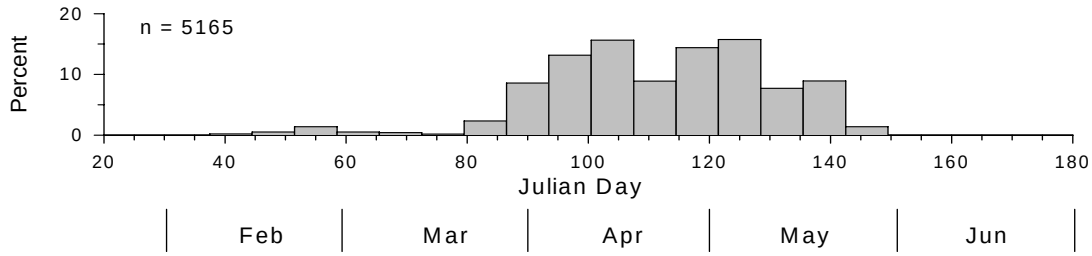

Figure 2. Migration timing of speckled dace measured at river kilometer 1.6 in the West Fork Smith River, Oregon, in 2002.

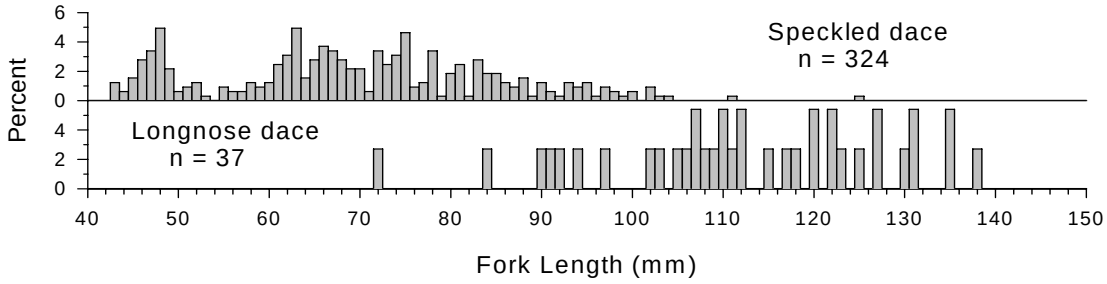

Figure 3. Length-frequency of downstream-migrating speckled dace and longnose dace measured at measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period March 25 to May 28, 2002.

Summary of Findings: 1998 to 2002

Migration timing of juvenile coho and winter steelhead for the five-year period 1998–2002 is shown in Figure 4.

Since 1998, numbers of coho smolts have ranged from 10,866 to 22,412, with a mean of 17,115, while numbers of steelhead smolts (> 120mm) have ranged from 2,688 to 7,678, with a mean of 4,854 (Figure 5). The numbers of coho fry moving past the trap have displayed an increasing trend (Figure 5). Whereas the number of coho fry ranged between 2,527 and 3,605 between 1998 and 2000, an estimated 13,550 coho fry in 2001 and 35,851 fry in 2002 migrated from the West Fork Smith. These higher numbers of coho fry migrants may reflect higher spawning escapement of the parent broods (an estimated 1,517 coho spawners in 2001, 538 spawners in 2000, and 264 spawners in 1999; no estimates were made for earlier adult returns).

Chinook fry migrants have ranged from 127,726 measured in 1998 to a low of 937 in 2001 (Figure 5). The number of chinook fry counted in 2002 (18,726) was the second highest recorded in the past five years. Although chinook production is linked, to some degree, to number of spawners, an additional factor that may influence production in the West Fork Smith may be the hydrological characteristics of the basin. Steep headwall areas, narrow valley bottoms and low groundwater storage and recharge capacity cause extreme fluctuations in stream flow during storm events (USDI 1997). Chinook spawning activity

appears to be confined to the main stem, where high stream flows may re-distribute spawning gravels and potentially influence egg survival. Particularly high stream flow events occurred during the 1999-2000 and 2000-2001 run years, which may have contributed to the low numbers of chinook fry observed during the respective spring migration periods.

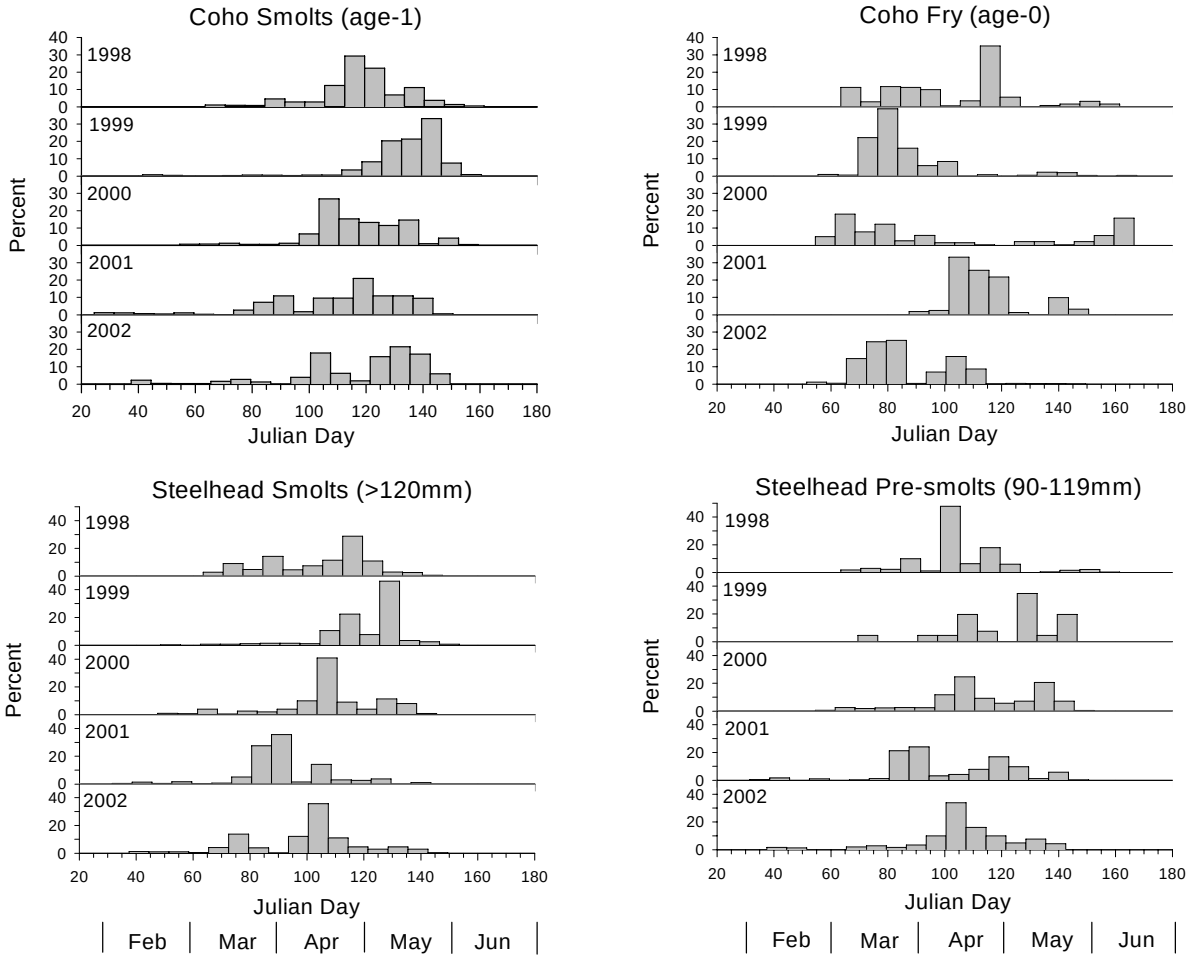

Figure 4. Migration timing of juvenile coho salmon and winter steelhead measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2002.

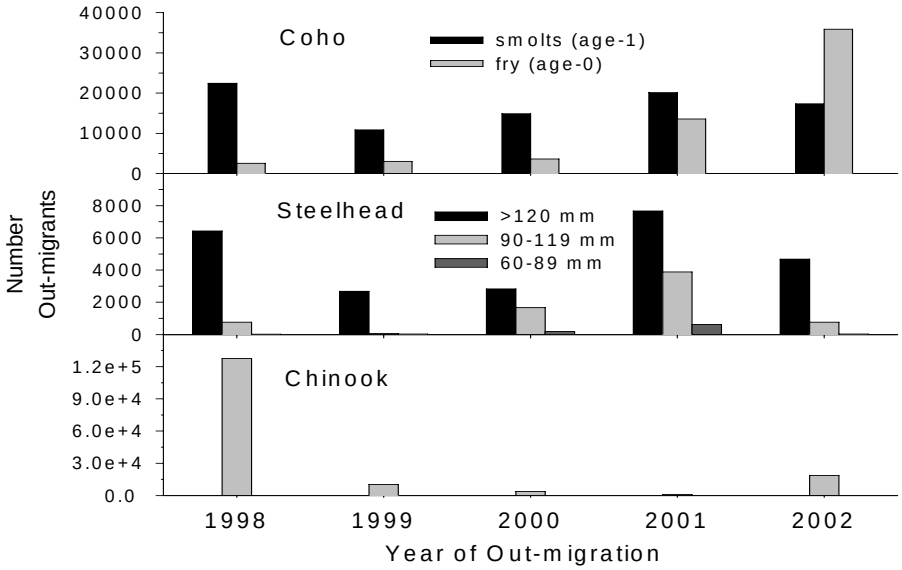

Figure 5. Number of downstream-migrating juvenile coho salmon, winter steelhead, and chinook salmon measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2002.

The coho smolts sampled in 2001 and 2002 (1999 and 2000 brood years) represent the first broods for which numbers of parent spawners were estimated. Calculated freshwater survival rates for these broods are shown in Table 5. Returning coho spawners sampled in 2001 represent the third year for which the numbers of out-migrating smolts that produced these adults are known. Calculated marine survival rates for these broods are also shown in Table 5.

Water temperature has also been monitored at the out-migrant trap site in the West Fork Smith River. Temperature at this site has often exceeded 17C° during July and early August, and occasionally exceeded 20C° (Figure 6).

Table 5. Estimated freshwater survival (egg to smolt) and marine survival (smolt to returning adult) rates for coho salmon in the West Fork Smith River for the 1996-1999 brood years (BY). 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.

					Adult returns		Marine surv. (%)	
BY	Eggs deposited	Smolts	FW surv. (%)	Return year	Male	Female	Total	Female
1996	--	22,412		1999	160	104	1.2	0.9
1997	--	10,866		2000	295	243	5.0	4.5
1998	--	14,851		2001	787	715	10.2	9.8
1999	291,955	20,091	6.9					
2000	642,747	17,358	2.7					

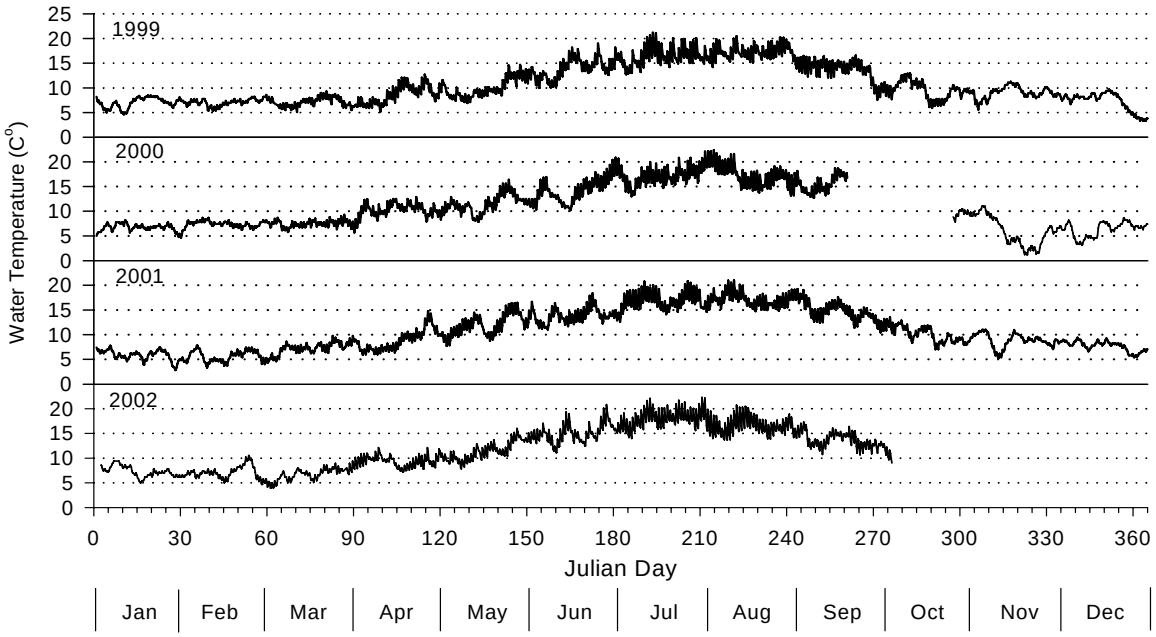

Figure 6. Water temperature recorded at river kilometer 1.6 in the West Fork Smith River for the period January 1, 1999 to October 3, 2002. Temperature was not recorded from September 17 to October 23, 2000.

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.

USDI Bureau of Land Management, Umpqua Resource Area 1997. West Fork Smith River Sub-watershed Analysis. Unpublished document on file at the Coos Bay BLM District Office, North Bend, OR.