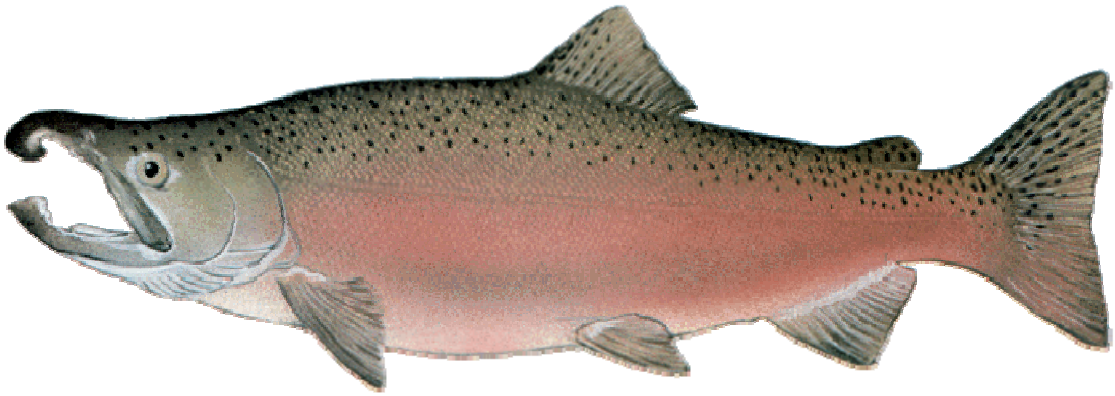
# West Fork Smith River
# Salmonid Life-Cycle Monitoring

## Final Report: 2002-2003

**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 2002-2003 run year of returning adult fish and year 2003 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 of 2002 the floating weir that functions as a passage barrier at the adult fish trap was redesigned and rebuilt. All PVC pickets were replaced. The resistance boards that provide lift at the downstream edge of the weir were re-engineered by changing the manner in which the boards attach and hinge. The transverse spacers used to maintain picket spacing were made more rigid by gluing PVC sleeves over the pickets on the upstream and downstream faces of each spacer. These changes subsequently reduced chronic points of failure following high stream flow events. The floating weir was installed and the adult fish trap made operational on September 16, 2002.

Stream flows remained very low through October. A small freshet occurred in mid-November, allowing some returning coho and fall chinook salmon to enter the West Fork Smith River. During this freshet the floating weir submerged briefly, allowing a portion of returning fish to bypass the adult trap. Whereas fish could enter the West Fork Smith River in mid-November, flows in the tributaries remained low and spawning fish were only observed in the lower reaches of the main stem, below Moore Creek. Stream flows subsequently dropped during November and remained low until mid December. After mid December, high stream flows caused the weir to submerge for a total of 14 days in December, seven days in January, two days in February, nine days in March, and three days in early April.

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. Three coho of hatchery origin entered the trap but were not passed. In previous years, a portion of fall chinook that were tagged and passed at the West Fork Smith trap subsequently returned downstream. This behavior made it impossible to ascertain the number of tagged fish in the spawning population above the trap, precluding estimation of total spawners. In 2002, fall chinook were identified by sex but were passed without further handling.

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).

Table 1. Number of fish trapped at the West Fork Smith River adult fish trap, October 2002 through May 2003. All mortalities were fish stranded on the floating weir.

| | Wild | | | Hatchery | | |
|---|---|---|---|---|---|---|
| Species | Female | Male | Jack | Female | Male | Mortalities |
| Coho | 100 | 171 | 14 | 3 | | 2 adult male, 1 female, 1jack |
| Chinook | 2 | 12 | | | | 1 adult male |
| Steelhead | 46 | 73 | | | | 2 male, 1 female |

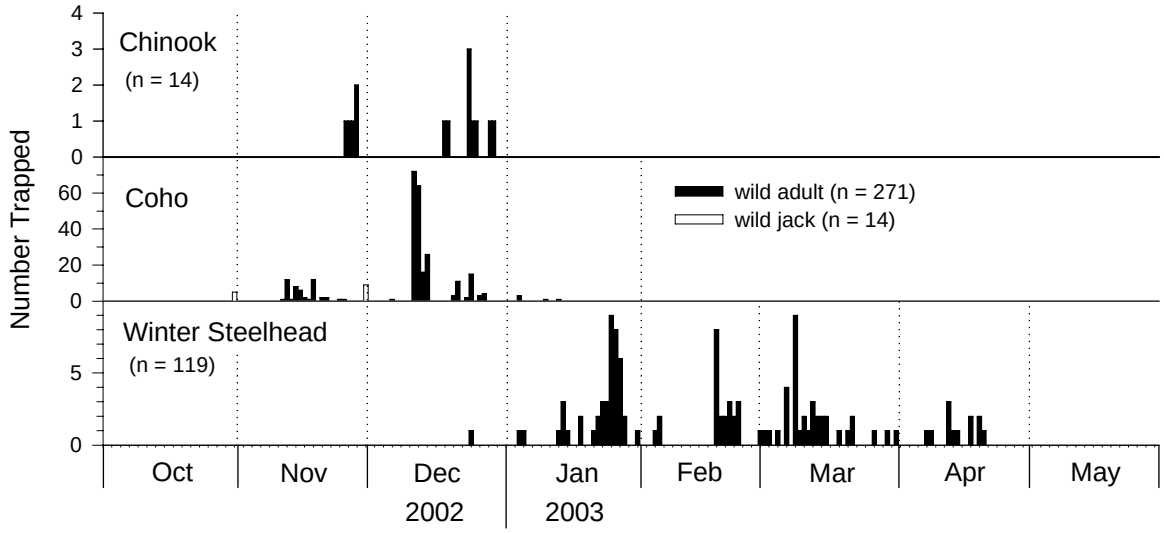


Figure 1. Timing of fall chinook salmon, coho salmon and winter steelhead trapped in the West Fork Smith River during the 2002-2003 run year.

**Spawning Ground Surveys**

Only two fall chinook were observed on spawning ground surveys. The low counts of both spawners and trapped adults suggest low spawning escapement of fall chinook in the West Fork Smith River during 2002.

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

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

Table 2. Peak counts of live coho salmon and redds, 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 2002 to May 2003.

| Survey reach | Length (km) | Coho | | | Steelhead |
|---|---|---|---|---|---|
| | | Peak live | Peak redds | Total AUC | Total redds |
| Tributaries | | | | | |
| Coon Cr. | 1.12 | 89 | 29 | 89 | 4 |
| Crane Cr., lower | 1.28 | 31 | 18 | 40 | 7 |
| Crane Cr, upper | 1.44 | 66 | 30 | 81 | 2 |
| Moore Cr, lower | 1.12 | 84 | 24 | 141 | 14 |
| Moore Cr, upper | 2.08 | 160 | 79 | 247 | 12 |
| Beaver Cr, lower | 2.08 | 55 | 22 | 82 | 12 |
| Beaver Cr, upper | 2.40 | 80 | 30 | 102 | 4 |
| Gold Cr, lower | 1.28 | 55 | 35 | 82 | 10 |
| Gold Cr, upper | 1.76 | 81 | 36 | 136 | 12 |
| Main stem | | | | | |
| Trap to Coon Cr [a] | 0.80 | -- | -- | -- | 1 |
| Trib. B to Crane Cr. | 1.76 | 24 | 18 | 39 | 22 |
| Moore Cr to Trib. D | 1.92 | 34 | 8 | 50 | 33 |
| Trib. D to Trib. E | 1.28 | 2 | 1 | 2 | 1 |
| Trib. F to Beaver Cr. | 1.12 | 35 | 12 | 47 | 33 |
| Beaver to Gold Cr. | 0.78 | 30 | 28 | 43 | 22 |
| Gold Cr. to left tributary | 1.60 | 64 | 28 | 73 | 26 |
| Above bridge, Section 3 | 1.76 | 49 | 27 | 49 | 18 |
| Above bridge, Section 4 | 1.12 | 65 | 26 | 77 | 12 |
| Above bridge, Section 5 [a] | -- | -- | -- | -- | 3 |

[a] not surveyed for coho spawners

**Estimation of Spawner Escapement**

*Coho salmon*

The estimated number of coho spawners was based on the number of fish that were yellow-tagged and passed at the West Fork Smith trap, and number of tagged fish observed (live fish and carcasses) on spawning 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 = (271) the number of adult coho marked with two yellow Floy tags
C = (2,200) 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 = (172) the number of yellow tagged fish observed (live fish plus carcass recoveries)
$p^2$ = 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:

$n_1$ = (6) the number of fish observed with one yellow tag
$n_2$ = (166) the number of fish observed with two tags

Using this methodology and adjusting for tag loss, the total spawning escapement of adult coho in the West Fork Smith River was 3,459 fish during the 2002-2003 run year. This estimate includes 1,423 females, based on the sex ratio of fish that entered the adult trap and non-yellow tagged carcasses recovered on spawning surveys. Based on this estimate of total escapement, trap efficiency for adult coho was 0.078.

*Winter Steelhead*

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

M = (115) the number of fish yellow-tagged and passed above the trap
C = (167) the number of fish observed (live counts + carcass recoveries) for tags
R = (55) the number of fish with yellow tags
$n_1$ = (2) the number of fish observed with one yellow tag
$n_2$ = (53) the number of fish observed with two tags

Using this methodology, the estimated number of steelhead spawners was 348. Based on the sex ratio of steelhead trapped at the West Fork Smith trap plus untagged carcass recoveries, 139 females were calculated to have spawned above the trap. Using this estimate of total escapement, trap efficiency for steelhead was 0.336, and the ratio of total number of counted redds to the estimated number of female spawners was 1.78.

**Juvenile Out-Migrant Trap Operation**

The juvenile out-migrant trap was installed in the West Fork Smith River on February 6 and removed on June 5 when low stream-flows precluded further operation. The trap sampled continuously except for several occasions when the trap was submerged due to high stream flows, or pulled over to the bank to prevent damage during high flows (one day in February, seven days 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. The trash drum was also disconnected to minimize resistance on the main drum. Because the trash drum was disabled, significant amounts of floating debris collected in the live-box each 24 hour period and resulted in some mortality of age-0 fry in early June.

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

Table 3. 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 6 to June 5, 2003. 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 | Trap efficiency | Mortalities |
|---|---|---|---|---|
| Coho | smolts (age 1+) | 16,019 | 0.31 | 22 |
| | fry (age 0) | 80,876 | 0.25 | 176 |
| Chinook fry (age 0) | | 933 | 0.28 | 6 |
| Trout fry (< 60mm) | | (225) | | 3 |
| Steelhead | | | | |
| | > 120mm | 2,448 | 0.05 | 1 |
| | 90 – 119mm | (75) | | 0 |
| | < 60 - 89mm | 159 | 0.26 | 0 |
| Cutthroat | | | | |
| | > 160mm | 1,235 | 0.08 | 0 |
| | 120 – 159mm | (70) | | 0 |
| | 90 - 119mm | (4) | | 0 |
| | 60 - 89mm | (5) | | 0 |
| Speckled dace | | 8,276 | 0.34 | 21 |
| Longnose dace | | 152 | 0.31 | 0 |

In 2002, the US Environmental Protection Agency (EPA) implemented a research project in West Fork Smith River to investigate factors influencing abundance, distribution, growth, and freshwater survival of juvenile coho. Specific research goals and objectives are presented in Wigington et al.(2002). As part of this research, EPA implanted Passive Integrated Transponder (PIT) tags in 4280 age-0 coho (2001 brood) between August 19 and December 22. Fish were sampled from the lower reaches of the three largest tributaries (Moore, Beaver, Gold creeks) and reaches of the main stem adjacent to the mouths of these creeks. Concurrently, the US Forest Service began a study in West Fork Smith River to evaluate passage of juvenile salmonids at road culverts. Within the same tributaries and main stem reaches as those sampled by EPA, groups of juvenile steelhead and cutthroat trout were PIT-tagged.

One of the recovery sites for tagged fish was the juvenile downstream-migrant trap operated by Oregon Department of Fish and Wildlife. All coho, steelhead and cutthroat trout captured at the migrant trap were tested for the presence of tags. A total of 152 tagged coho were detected, representing 3.7% of total coho smolts sampled. Additionally, four tagged steelhead and three tagged cutthroat trout were detected at the trap.

**Summary of Findings: 1998 to 2003**

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 of coho salmon (egg to smolt) for the 1999-2001 brood years (BY) and marine survival (smolt to returning adult) rates for the 1996 to 1999 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.

| | | | | | 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 | 2002 | 2,036 | 1,423 | 17.2 | 14.2 |
| 2000 | 642,747 | 17,358 | 2.7 | | | | | |
| 2001 | 2,099,982 | 16,019 | 0.8 | | | | | |
| 2002 | 4,542,580 | -- | | | | | | |

The number of returning winter steelhead spawners was first estimated during the 1999-2000 run-year, and this effort has continued through the 2002-2003 run-year. Estimates of returning steelhead spawners are shown in Table 5.

Table 5. Estimated number of returning adult winter steelhead spawners in the West Fork Smith River for the 1999-2000 through 2002-2003 return years.

| 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 |

Total number of downstream-migrating juvenile coho, steelhead and chinook smolts for the six-year period 1998–2003 is shown in Figure 2, and migration timing of these species is

shown in Figure 3. The trend in mean length of coho and steelhead smolts during the two-week period of peak migration is shown in Figure 4.

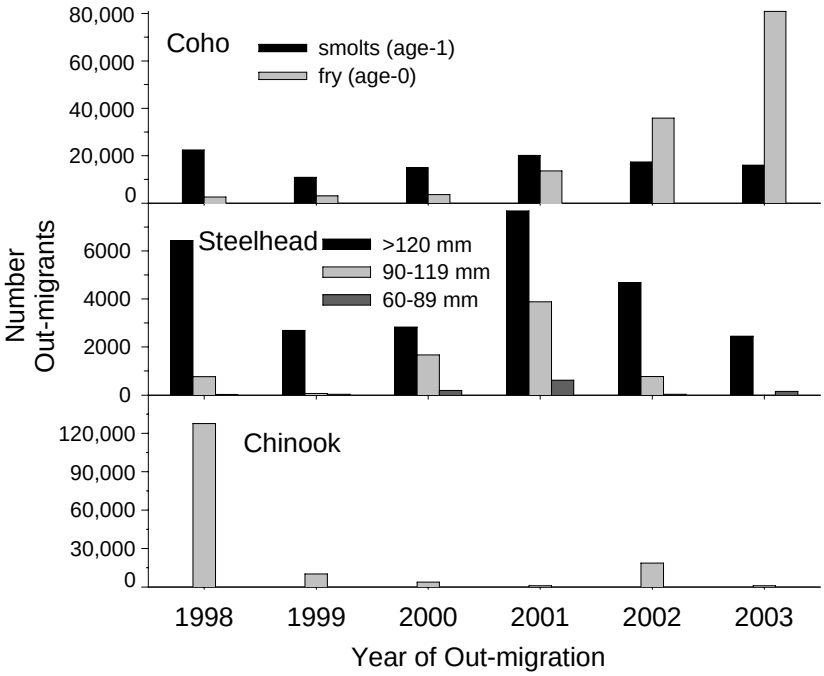


Figure 2. Number of downstream-migrating juvenile coho salmon, winter steelhead, and chinook salmon measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2003.

The most abundant non-salmonid species captured in the juvenile migrant trap each year is speckled dace *Rhinichthys osculus*. The number of downstream-migrating speckled dace, and the congeneric longnose dace *R. cataractae*, were estimated at the juvenile trap in 2002 and 2003. Larger individuals of both species were sexually mature when captured and it is presumed the downstream movement of these species is associated with spawning behavior. Migration timing for these species is shown in Figure 5 and length frequency histograms are shown in Figure 6.

Other non-salmonid species captured at the juvenile trap are enumerated, but trap efficiencies and estimates of total migrants are not made. Table 6 summarizes total catch of these other species.

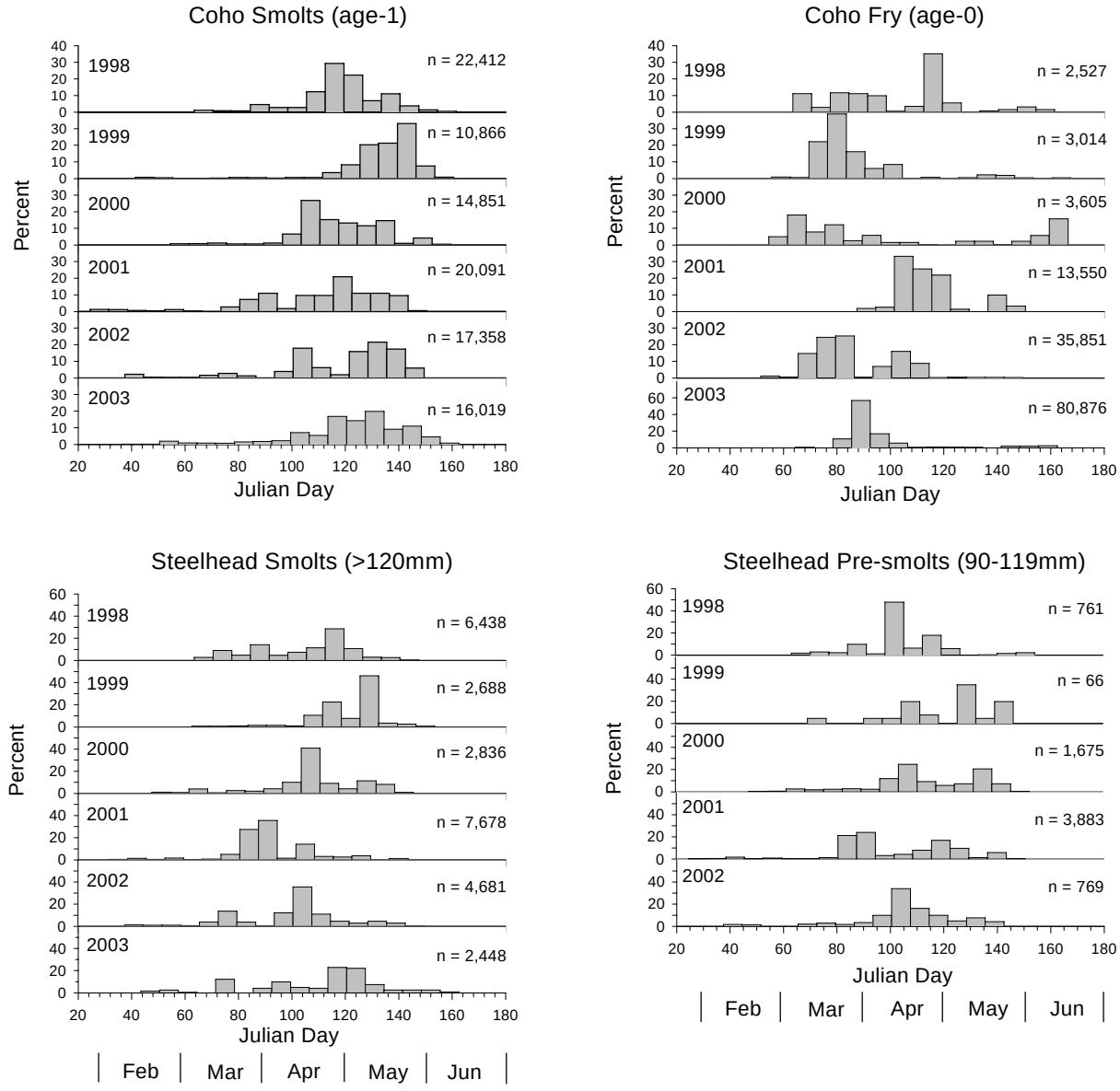


Figure 3. Migration timing of juvenile coho salmon and winter steelhead measured at river kilometer 1.6 in the West Fork Smith River, Oregon, for the period 1998 through 2002. No estimate of steelhead pre-smolts was made in 2003.

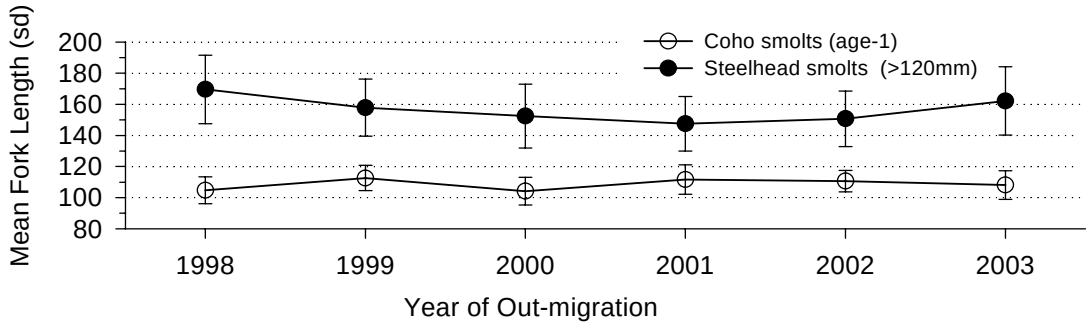


Figure 4. Mean fork length (± stand dev) of coho and steelhead smolts during the two-week period of peak out-migration in the West Fork Smith River for the period 1998 to 2003.

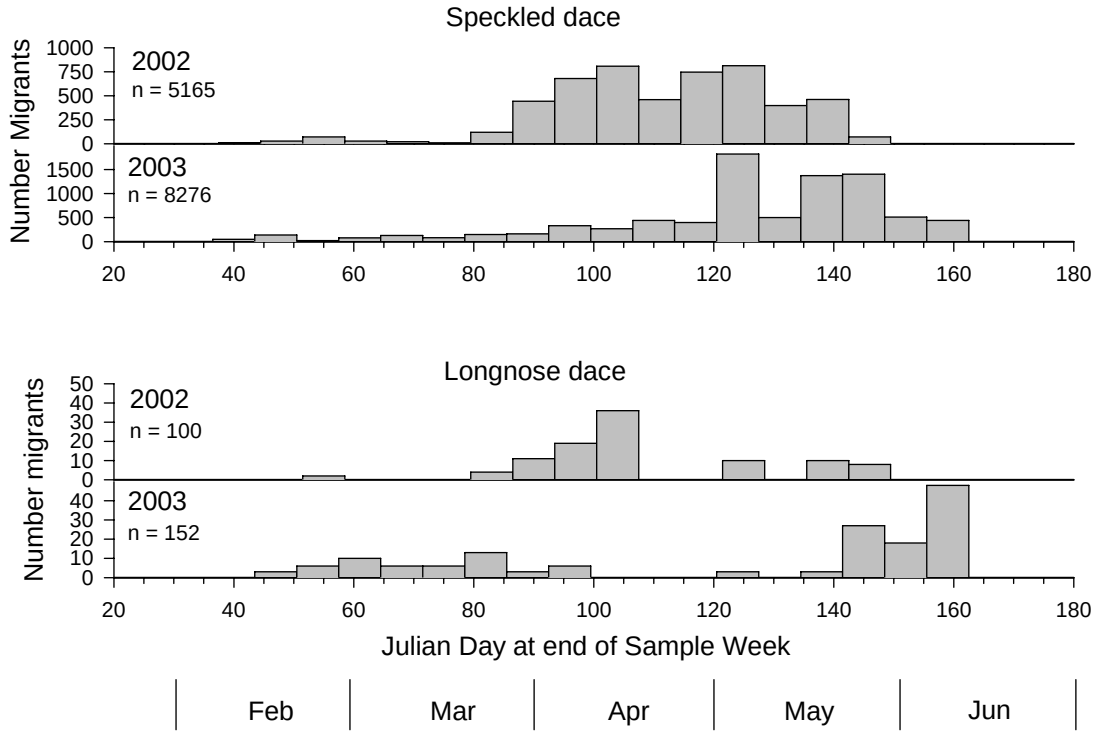


Figure 5. Migration timing of speckled dace and longnose dace measured at river kilometer 1.6 in the West Fork Smith River in 2002 and 2003.

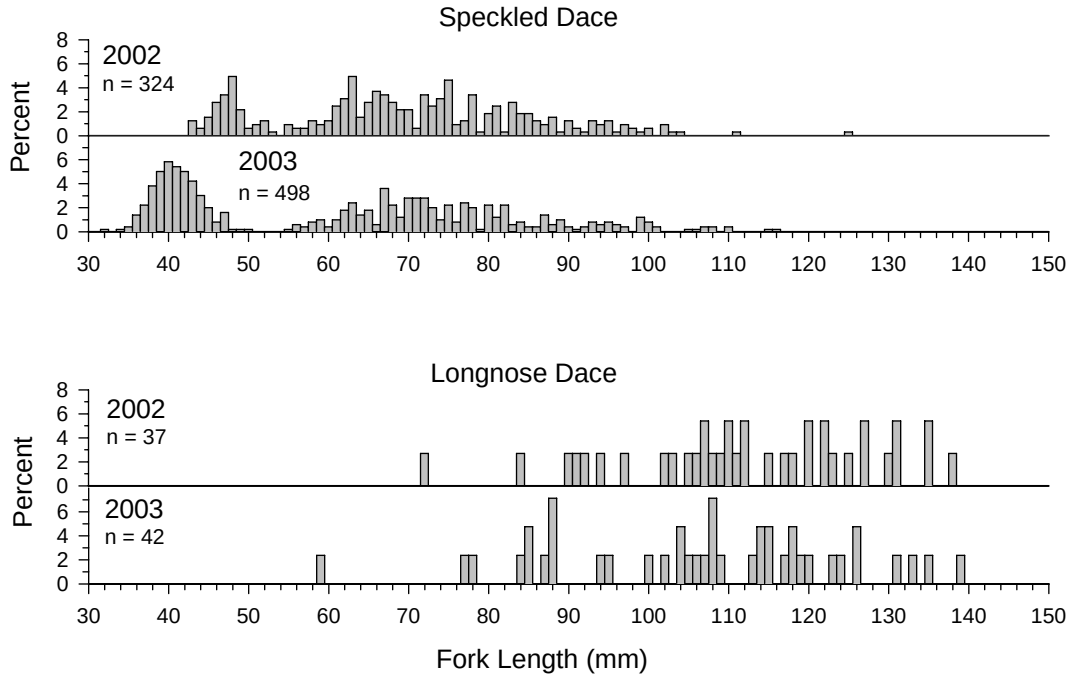


Figure 6. Length-frequency of downstream-migrating speckled dace and longnose dace captured at the West Fork Smith River juvenile fish trap in 2002 and 2003.

Table 6. Total catch of non-salmonid fishes and amphibians at the downstream-migrant trap on the West Fork Smith River for the period 1998-2003.

| Species | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|
| Redside shiner *Richardsonius balteatus* | 931 | 308 | 382 | 425 | 379 | 321 |
| Pikeminnow *Ptychocheilus oregonensis* | 2 | 0 | 0 | 0 | 6 | 4 |
| Largescale sucker *Catostomus macrocheilus* | 93 | 111 | 87 | 186 | 53 | 32 |
| Cottids | 40 | 24 | 31 | 17 | 29 | 20 |
| Lamprey ammocoetes | 597 | 334 | 697 | 130 | 348 | 238 |
| Pacific lamprey *Entosphenus tridentatusa* eyed juveniles [a] | 22 | -- | 61 | 283 | 17 | 7 |
| Brook lamprey *Lampetra richardsoni* adults [b] | -- | -- | -- | -- | -- | 129 |
| Speckled dace *Rhinichthys osculus* [c] | 7206 | 3680 | 2725 | 2924 | 2298 | 2830 |
| Longnose dace *R. cataractae* [d] | -- | -- | -- | -- | 45 | 52 |
| Pacific giant salamander *Dicamptodon tenebrosus* | 3 | 0 | 2 | 2 | 2 | 1 |

[a] not distinguished from ammocoetes in 1999
[b] not distinguished from ammocoetes or eyed juveniles prior to 2003
[c] combined dace species from 1998 to 2001 (counts may include some longnose dace)
[d] not distinguished separately from speckled dace until 2002

**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.

Wigington, P.J., Jr., Ebersole, J.L., Baker, J.P., Church, M.R., Compton, J.E., Leibowitz, S.G., White, D., and Cairns, M.A. 2002. Landscape and Watershed Influences on Wild Salmon and Fish Assemblages in Oregon Coastal Streams. EPA NHREEL Western Ecology Division Research Plan No. XXXX.