

# 2005 LITTLE APPLGATE RIVER SMOLT TRAPPING REPORT

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## INTRODUCTION

In 2005, a rotary screw trap was used in the Little Applegate River to estimate salmon and steelhead smolt production. Other project objectives were determining smolt migration timing and smolt sizes, and comparing annual variation in fish production estimates. Monitoring of this site began in 1999, and it has been monitored for seven consecutive years. Although other agencies contributed significant labor to this project in previous years, this year's project was staffed primarily by the Applegate River Watershed Council and Rogue River-Siskiyou National Forest. The Oregon Department of Fish and Wildlife (ODFW) and Medford District Bureau of Land Management (BLM) assisted by applying for permits, and by helping install, remove, and occasionally operate the trap. Fish collection and handling were covered under scientific take permit #OR2005-2226

## STUDY SITE

The Little Applegate River supports populations of fall Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), winter and summer steelhead (*O. mykiss*), coastal cutthroat trout (*O. clarki clarki*), Pacific lamprey (*Lampetra tridentata*), and reticulate sculpin (*Cottus perplexus*). Most, if not all, of the salmon production occurs below a waterfall at RiverMile (RM) 1.5. Steelhead can ascend the waterfall and there are about 33 miles of known spawning and rearing habitat for steelhead in the basin (Vogt 2004). The Little Applegate River is one of the most important tributaries for winter steelhead production in the Applegate River subbasin (Prevost et al. 1997).

Vogt (2004) reported the Little Applegate River drains about 72,200 acres and is the last major Applegate River tributary before fish passage is blocked at Applegate Reservoir. Over 70% of the watershed is owned by either the U.S. Forest Service (32.2%) or BLM (40%); the remaining lands are owned by individuals or corporations (27.4%) and the State of Oregon (0.4%, Vogt 2004). About 60% of the fish habitat in the watershed is located on private land although private ownership of the basin is less than 30% of the watershed area (USDI BLM and USDA FS 1995). The smolt trap was located at about RM 0.2 on private land.

## METHODS

A 5-foot diameter rotary screw trap (E. G. Solutions) was installed on 3 March, although trapping did not begin until 22 March due to a delay in receiving permits. Trapping ended

on 1 July 2005, and the trap was disabled for two weeks between 11 and 25 May due to high flows and broken equipment. Because of limited funding and personnel this trap was operated four days per week in 2005. Although this trap was operated seven days per week in previous years, some literature suggests reducing sampling intensity during outmigrant studies can still provide relatively precise population estimates (Irvine et al. 2003). The trap did not usually operate Friday afternoon through Monday morning and was usually checked Tuesday through Friday mornings.

The following description of the sampling methodology is adapted from Vogt (2004):

“Fish were collected daily, identified to species and life stage, and counted. Fork lengths were measured from a sample of up to 25 fish per week from each species and life stage. A subsample of all salmonids over 60 mm was marked daily with a caudal fin clip. A maximum of 25 fish of each species and life stage was marked each day unless fewer than 25 were captured. Marked fish were then transported upstream to a release point about 0.2 miles upstream of the trap site and released. Fish that were not marked or that were previously marked and recaptured were released below the trap site. All fish mortalities occurring during handling and release were recorded.

Marked fish recaptured at each trap were counted to provide an estimate of trapping efficiency. The sampling week used to calculate weekly trapping efficiencies was Monday through Friday. Weekly and seasonal trapping efficiencies were calculated with the following formula:

$$E = R/M$$

where  $E$  = trap efficiency,  $R$  = the number of marked fish recaptured, and  $M$  = the number of marked fish released.

The total number of migrants ( $N$ ) passing the trap site during a given period of time was estimated with the formula:

$$N=C/E$$

where  $C$  = the number of unmarked fish captured.”

To estimate the number of fish passing the trap on the days the trap was not operating, an adjusted  $N$  was calculated using an expansion where the weekly catch was multiplied by the number of days actually trapped that week and divided by 7. The same trap efficiency was assumed in calculating the expanded  $N$  as the actual  $N$ .

A 95% confidence interval around each population estimate was calculated with the aid of the BootN program developed by Michael Murphy from the Auke Bay Laboratory in Alaska. A sample variance for each species was calculated using bootstrapping after 1,000 iterations and the confidence intervals around each population estimate were calculated by  $95\% \text{ CI} = 1.96 \sqrt{V}$ , where  $V$  = sample variance.

## RESULTS AND DISCUSSION

### Smolt Production Estimates

The actual steelhead production estimate of 9,280 smolts in 2005 (Table 1) was greater than any estimates from the previous six years (Vogt 2004). When the 2005 estimate was expanded to include days when the trap was not operating, the adjusted estimate was 15,528 steelhead smolts (Table 2). This could still be an underestimate of the actual number of smolts produced in the watershed because of high spring flows that disabled the trap in mid-May when some steelhead smolts are still emigrating (Fig. 1). The next highest population estimate of steelhead occurred in 2004 with 7,431 smolts, and the 2005 estimate continues a positive trend in steelhead population sizes in the Little Applegate River (Fig. 2), although at a much steeper incline. The increased number of steelhead smolts in 2005 might have been partially attributable to the removal of the Buck and Jones diversion dam at RM 3 in fall 2003, which blocked about 30 miles of habitat during late spring and summer and prevented passage of spawning winter steelhead into the middle and upper watershed (pers. comm., Chris Vogel, Applegate River Watershed Council). However, assuming most emigrating steelhead smolts are age 2 or 3, increased production related to dam removal would not likely be observed until the 2006 or 2007 trapping seasons. Using Vogt's (2004) estimate of 33 miles of available steelhead habitat in the Little Applegate River, there were about 281 (actual) or 470 (adjusted) smolts per mile produced in 2005.

Only two coho salmon smolts were captured in 2005 and therefore a population estimate could not be calculated. Coho salmon smolt production estimates have not been calculated from other trapping seasons and coho salmon smolts are rarely captured at this site (Vogt 2004). Because some coho salmon fry are collected in this trap (Vogt 2004; Table 3) it is possible poor parr to smolt survival is occurring due to deficiencies in oversummering or overwintering habitats. However, there is little available salmon habitat in the watershed because of the barrier falls at RM 1.5, and large numbers of coho salmon fry have not been trapped previously at his site.

The 2005 Chinook salmon production estimate of 608 smolts (916 adjusted) was about half of those from previous years at this site (Vogt 2004), although the trap was disabled during two weeks of potentially high emigration. As with coho salmon, the number of Chinook salmon smolts produced in this watershed is extremely low suggesting the amount of salmon habitat in the Little Applegate River is restricted by the waterfall at RM 1.5.

Table 1. Trap catches and population estimates.

Species	# of smolts captured	# of smolts marked	# of smolts recaptured	Trapping efficiency	Population estimate	95% confidence interval
Steelhead	696	292	22	8%	9,280	4,909—13,651
Coho	2	2	0	N/A	N/A	N/A
Chinook	73	25	3	12%	608	-366—1,582

Table 2. Adjusted trap catches and population estimates. The adjusted confidence intervals assume the same trap efficiency as the actual catches in Table 1.

Species	# of smolts captured	Adjusted # of smolts	Population estimate	Adjusted population estimate	Adjusted 95% confidence interval
Steelhead	696	1,165	9,280	15,528	10,350—20,706
Coho	2	4	N/A	N/A	N/A
Chinook	73	110	608	916	-105—1,937

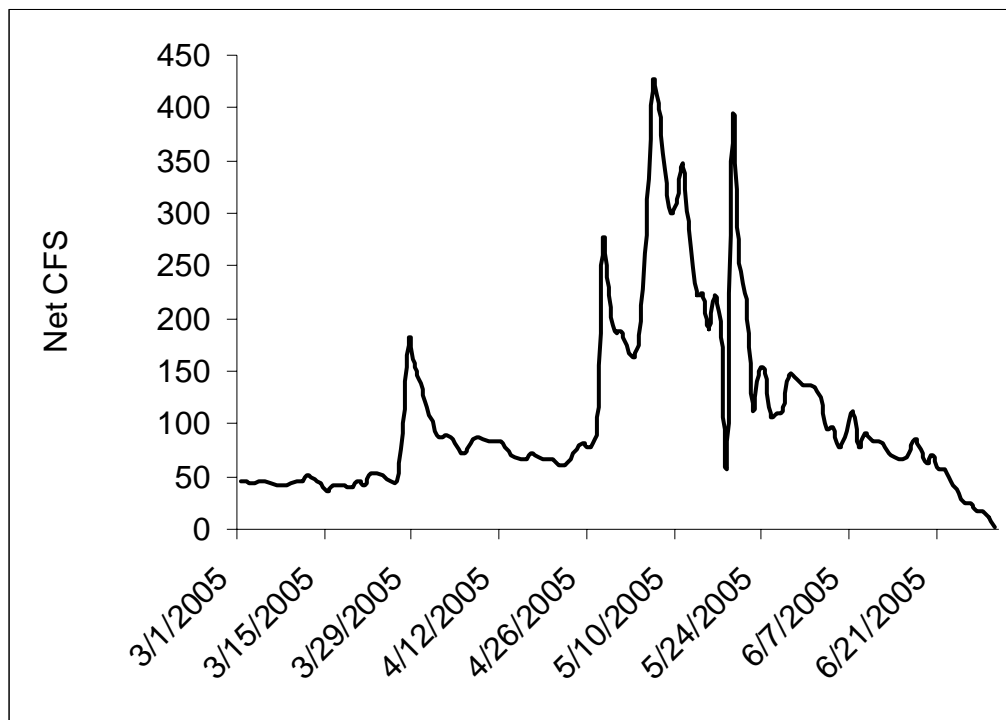


Figure 1. Conceptual model of tributary discharge in cubic feet per second (cfs) in the upper Applegate River in spring 2005. Data graphed are mean daily Applegate River flows at the town of Applegate gauge subtracted from the mean daily river flows at the Copper gauge, which represent releases from Applegate Dam. Source data were obtained from USGS, <http://waterdata.usgs.gov/or/nwis/rt>. The trap was disabled during the two-week period of peak flows in May.

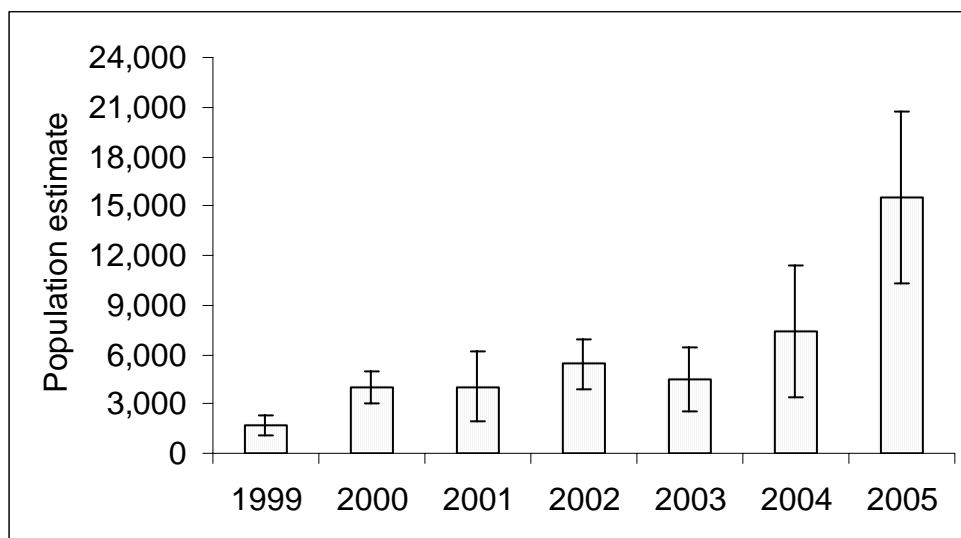


Figure 2. Population estimates and 95% confidence intervals of steelhead smolts collected in the Little Applegate River smolt trap, 1999-2005. The population estimate shown for 2005 was the expanded estimate of 15,528 smolts; the estimate calculated using the actual number of fish captured was 9,280 smolts.

#### Relative abundances of other fishes trapped

Other fishes were trapped but not marked because of their small sizes, spawning characteristics, or potential resident life histories. Therefore population sizes could not be estimated for these fishes. Data from 2005 continue to support existing information that the Little Applegate River is used by Pacific lamprey and has extremely low densities of coastal cutthroat trout in the mainstem (Table 3). I assumed all of the juvenile lampreys captured in 2005 were Pacific lamprey as this was the only species identified in a fish morphology laboratory during the 2001 trapping season (pers. comm. Doug Markle, Oregon State University; Jeannine Rossa, Medford BLM). The notable absence of exotic fishes captured in the trap is a positive sign for native fish conservation in this watershed.

#### Trapping efficiencies

Total trapping efficiency of steelhead smolts was comparable to or higher than several previous years (Table 4), despite expending less than half the previous sampling effort in 2005. This finding supports Irvine et al. 2003, who suggested during smolt emigration studies it may be possible to sample less, thereby reducing project costs, while still providing relatively accurate population estimates. Trap efficiency of Chinook salmon smolts was also comparable to previous years (Table 4), even though only 25 smolts were marked throughout the trapping season because most were less than 60 mm long.

Table 3. Fishes trapped without calculating population estimates.

Species and lifestage	Actual #	Adjusted #
Coho salmon fry	141	201
Trout fry*	78	137
Steelhead (60-89 mm)	315	525
Steelhead (90-119 mm)	556	908
Cutthroat trout (60-89 mm)	1	2
Cutthroat trout (90-119 mm)	1	2
Cutthroat trout (120-159 mm)	1	2
Cutthroat trout ( $\geq 160$ mm)	0	0
Steelhead (adult)	5	9
Pacific lamprey (adult)	1	2
Lamprey (macropthalmia)	1	2
Lamprey (ammocetes)	64	93

\* These fish were too small to determine if they were cutthroat trout or steelhead

Table 4. Sampling effort and total trap efficiency for Chinook salmon and steelhead smolts. Data from 1999 to 2004 from Vogt 1999, 2000, 2001, 2002, 2003, 2004. Population estimates were not calculated for Chinook salmon smolts in 1999-2001.

Year	# of days trapped	Steelhead trapping efficiency (%)	Chinook trapping efficiency (%)
2005	52	8	12
2004*	113	5	12
2003*	113	8	11
2002	122	10	28
2001	116	7	--
2000	109	13	--
1999	112	15	--

\*Trap was disabled one or more days due to high flows or debris.

### Smolt emigration timing

Peak steelhead smolt emigration occurred the week of 29 March through 4 April. This was about one month earlier than the median week during 1998 through 2004 (Vogt 2004), and coincided with the first high flow event of the spring (Fig. 1). About 90% of the 2005 steelhead smolt emigration occurred between 29 March and 2 May (Fig. 3); although the trap was disabled between 10 and 23 May and significant emigration might also have occurred during this period. For example, 10% of the 2004 steelhead population estimate occurred during this two-week period (Fig. 4). Another noteworthy observation is 18% of the 2004 steelhead smolt emigration occurred before the week of 22 March. Because the trap did not operate until the week of 22 March in 2005, it is likely a substantial proportion of the population was not sampled and the adjusted population size of 15,528 steelhead smolts is again likely an underestimate. Overall

steelhead catches in 2004 were much more evenly distributed (Fig. 4) than in 2005 where almost 60% of the total catch occurred in one week of trapping (Fig. 3).

Chinook salmon smolts were still emigrating when the trapping stopped although catches appeared to be decreasing (Fig. 5). Substantial numbers of Chinook smolts were also still emigrating in 2004 when the trap was removed (Vogt. unpub. data). In 2005, peak Chinook salmon emigration was the third week of June, which was about two to three weeks later than the average peak (Vogt 2004).

Peak lamprey ammocete migration occurred during the week of 3 May (Fig. 6). Weekly catches were fairly consistent excluding the period when the trap was disabled. Lamprey ammocetes, like Chinook salmon smolts, appeared to still be emigrating when the trap was removed at the beginning of July.

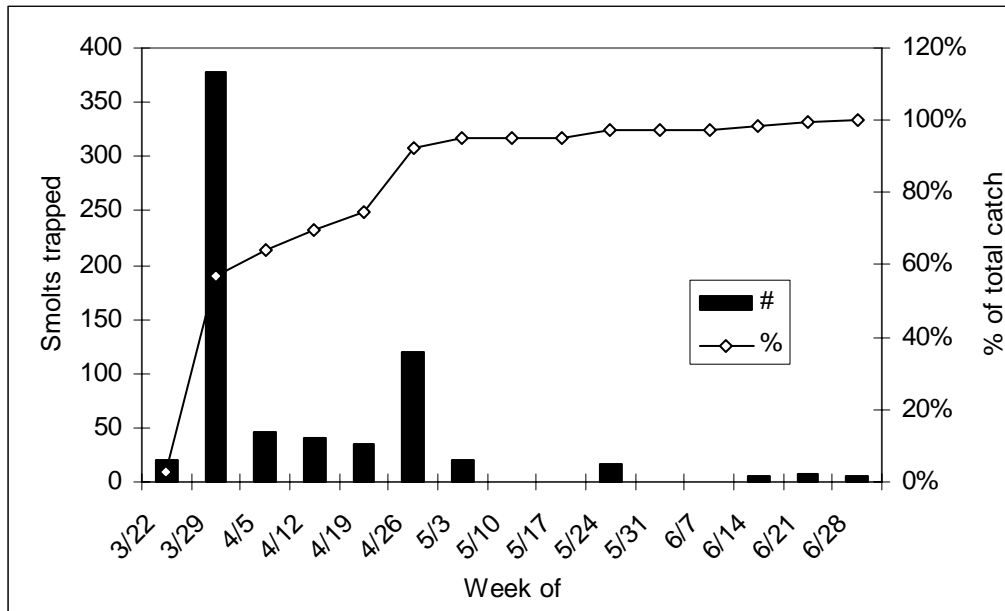


Figure 3. 2005 Steelhead smolt catches. The trap was disabled between 10 and 23 May.

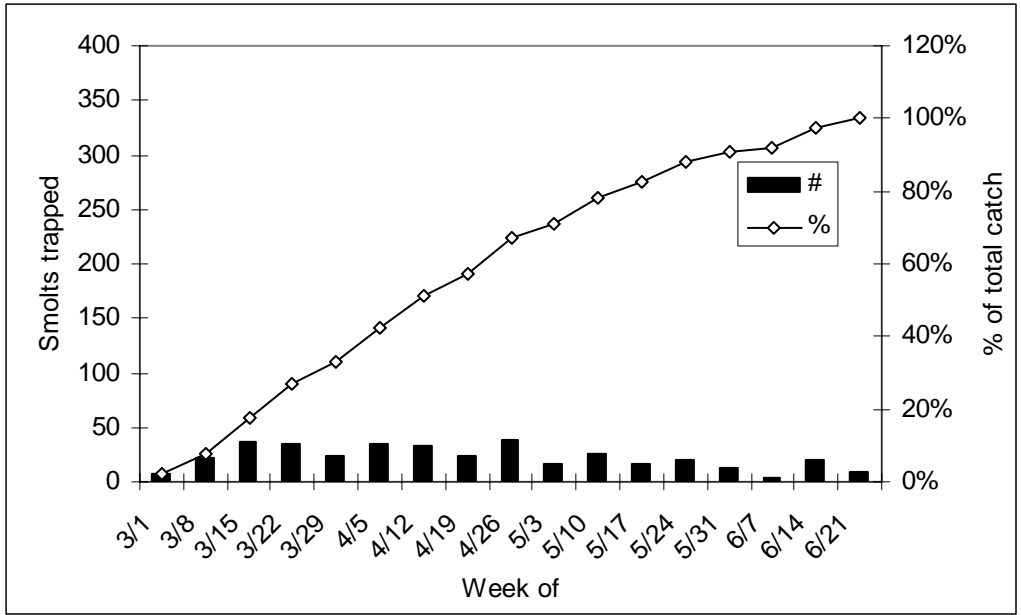


Figure 4. 2004 Steelhead smolt catches.

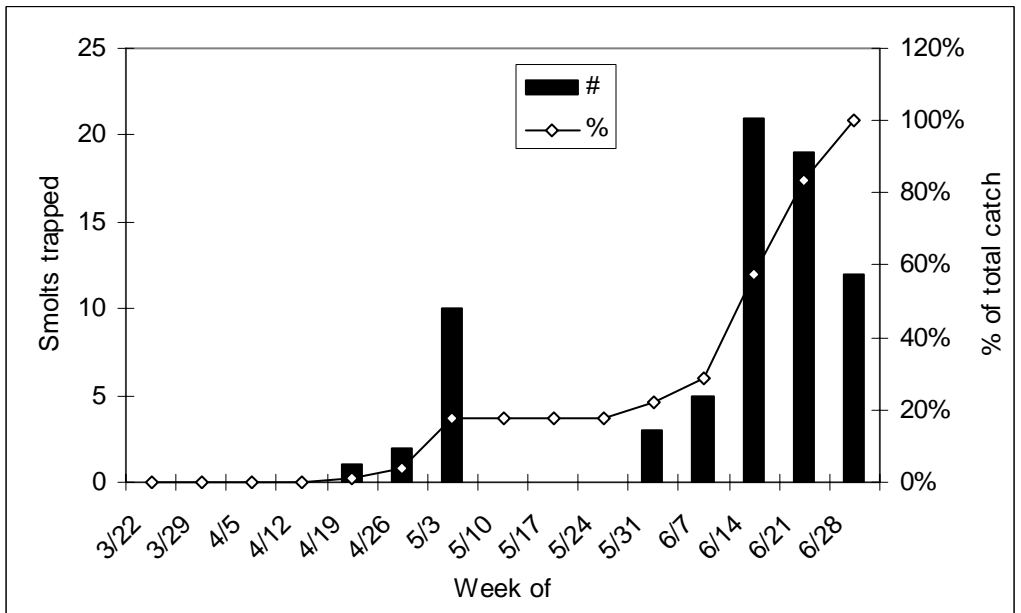


Figure 5. 2005 Chinook salmon smolt catches. The trap was disabled between 10 and 23 May.

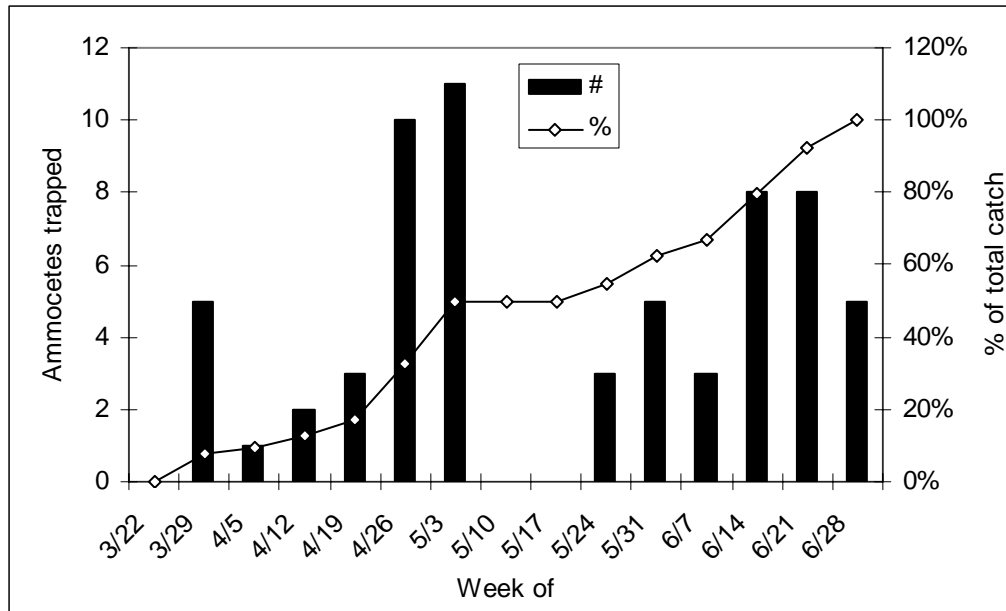


Figure 6. 2005 Lamprey ammocete catches. The trap was disabled between 10 and 23 May.

### Smolt sizes

Steelhead smolt mean length during the peak week of emigration (29 March) was 157 mm. Although peak migration occurred about a month earlier than average, the 2005 smolt size was about 10 mm larger than the six-year mean of about 147 mm (Vogt 2004). However, Vogt (2002) reported there was not a clear relation between steelhead smolt size and emigration timing, as he observed in Chinook and coho salmon. In 2005, Chinook salmon smolt mean length during the peak week of emigration (14 June) was 59 mm. This measurement was comparable to the three-year mean of 61 mm (Vogt 2004).

## CONCLUSIONS

The Little Applegate River is a productive wild steelhead stream with populations that have increased over the last seven years. The steelhead population estimate calculated this year was the highest in seven consecutive years of sampling this site, although it likely underestimated total production. Despite a larger population in 2005, the lack of a perceived density-dependent effect on smolt growth in the form of smaller smolts suggests steelhead rearing habitat in the watershed is still not overseeded. The correspondence between an early spring freshet and the majority of steelhead emigration implies localized disturbances such as chemical spills or landslides, even if very short term, could have profound impacts on steelhead production in this watershed.

Although all of the Chinook salmon production was not captured because the trap was removed while Chinook were still emigrating, data collected to that point support prior observations this stream is fairly insignificant in terms of salmon and coastal cutthroat

trout production. While steelhead peak emigration occurred earlier than average, Chinook salmon emigrated later than average.

## RECOMMENDATIONS

This smolt trapping project represents an important reference monitoring site in the Applegate River sub-basin. Long-term data sets can enable the use of population dynamics modeling such as sensitivity analyses and the ability to detect significant trends in population change over time. Further, this project allows for monitoring the effects of several proposed restoration and management activities in the watershed including the Little Applegate Stream Habitat Enhancement Project (LASHEP), diversion dam removal or modifications, instream large wood placement, and timber harvest on private and public lands. For example, biologists have recently observed significant deposition of granitic sand in steelhead spawning habitats throughout the watershed; this smolt trap would determine if these habitat changes could be detected in the future at the population level.

Because of the benefits to aiding land management decisions and evaluating restoration projects, this smolt trapping project should be continued as a way to track habitat changes and responses in fish production throughout the watershed. Results from the 2005 season show it is possible to sample less intensively at this site and still obtain relatively high trap efficiency. Another alternative to operating the trap every day throughout the season would be to sample the peak season intensively (e.g. seven days per week for two or three months) then reduce sampling frequency during the shoulder seasons. Creative options to continue funding and staffing this monitoring project should be explored.

## ACKNOWLEDGEMENTS

Thanks to owner Ben Gerwick and caretaker Fred Thomas for providing access to the project site on private land. This project would not have occurred in 2005 without the tireless efforts of the Applegate River Watershed Council; particularly Chris Vogel who operated the trap alone much of the season. Daniel Newberry and Kevin O'Brien from the watershed council also assisted in data collection and logistical support. Barbara Mumblo from the Rogue River-Siskiyou National Forest assisted in trap operation. Chris Volpe, Jim Andrews, and Gricelda Meraz, from Medford BLM assisted in trap installation, removal, and occasionally operation. Southern Oregon University (SOU) students Jeremy Stahler and Janelle Krause, and James Vial—an American Fisheries Society Hutton Scholar from South Medford High School—also assisted in trap operation. David Tippet, an SOU intern, entered and validated the trapping data. Dan VanDyke and Jay Doino from ODFW obtained collection permits or assisted in trap operation. Jerry Vogt from Oregon Department of Transportation provided statistical software and assistance. Susan Maiyo from the Rogue River-Siskiyou National Forest and Chris Vogel reviewed an earlier version of this report.

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