SUMMARY

Objectives for 2000

Project objectives were to: (1) transport migratory salmonids around Elk Creek Dam, (2) determine the proportion of wild adult anadromous salmonids that return to Elk Creek, and (3) determine if transported coho salmon spawn in widely distributed areas upstream of Elk Creek Dam.

Accomplishments in 2000

All objectives were accomplished.

Findings in 2000

Trap catches of mature salmonids in the 1999-2000 return year totaled 298 unmarked and 64 marked coho salmon (*Oncorhynchus kisutch*), 265 wild and 4 hatchery steelhead (*O. mykiss*), 20 unmarked chinook salmon (*O. tshawytscha*), and 51 wild cutthroat trout (*O. clarki*). A minimum of one adult salmonid died as a result of trap and transport.

Wild adults that returned to Elk Creek in 1999-2000 represented 20.3% of the wild coho salmon and 3.6% of the wild steelhead that passed the counting station at Gold Ray Dam. This finding suggested that steelhead production remains depressed because the Elk Creek Basin accounts for 9.5% of the area accessible to anadromous salmonids that pass Gold Ray Dam.

Coho salmon fry were observed at most sites near the upstream limits of areas that could be reached by spawners. Sensitivity analyses indicated that continued sampling should increase the precision of distribution estimates.

INTRODUCTION

Elk Creek enters the Rogue River at River Kilometer (RK) 244. Elk Creek Dam is located 2.6 km upstream from the creek mouth. The basin covers about 351 sq km, of which 343 sq km are upstream of Elk Creek Dam. Mean monthly flow is less than 10 cubic feet per second (cfs) in late summer and is 400-600 cfs in winter. Mean monthly flow in winter peaks between 1,000 and 1,800 cfs.

Coho salmon, steelhead, chinook salmon, and cutthroat trout spawn in the Elk Creek Basin. Coho salmon in southern Oregon and northern California have been listed as threatened by the National Marine Fisheries Service (NMFS) under the Endangered Species Act. Although NMFS decided not to list steelhead in the area, that decision is under judicial review. Small numbers of spring chinook salmon and fall chinook

salmon spawn in Elk Creek when flow increases enough in autumn to permit upstream migration. Adult cutthroat trout also migrate into Elk Creek, although these fish do not appear to be anadromous.

Elk Creek Dam is one of three dams authorized by the United States Congress and constructed by the United States Army Corps of Engineers (USACE) in the Rogue River Basin of southwestern Oregon. The other dams, Lost Creek and Applegate, are fully operational. A court order halted construction of Elk Creek Dam in 1987 after dam height reached 83 feet.

Blockage of spawning areas used by anadromous fish in the Elk Creek Basin was to be mitigated by the production of coho salmon and steelhead at Cole M. Rivers Hatchery. Mitigation was to begin when the dam was fully constructed. A diversion tunnel through the dam was altered after construction in an attempt to provide upstream passage for adult salmonids.

Spawning surveys and trap catches of juveniles suggested that few adult coho salmon or steelhead passed the dam during the 1991-92 run year even though Oregon Department of Fish and Wildlife (ODFW) staff observed hundreds of adult salmonids immediately downstream of the dam. These observations increased concern that adult salmonids were unable to pass Elk Creek Dam.

In response to that concern, a trap-and-haul operation began at Elk Creek Dam in autumn of 1992. Adult salmonids were trapped below the dam and were trucked and released upstream of the dam during the 1992-93 and 1993-94 run years. Trap catches totaled 38 coho salmon and 119 steelhead in 1992-93, and 86 coho salmon and 120 steelhead in 1993-94. Returns in both run years were very low compared with ODFW estimates of historic returns that averaged 1,560 coho salmon, 1,000 summer steelhead, and 2,000 winter steelhead (USACE 1980).

The USACE funded the Elk Creek Dam Fisheries Evaluation Project in the spring of 1995. The project goal was to develop strategies to restore the natural production of self-sustaining migratory salmonids to a level appropriate for the habitat available in the Elk Creek Basin. Findings from the first five years of work were reported by Satterthwaite et al. (1996a), Satterthwaite et al. (1996b), Satterthwaite and Leffler (1997), Satterthwaite (1998), and Satterthwaite (1999).

In autumn of 1995, the USACE announced plans to remove a portion of, or all of, the spillway of Elk Creek Dam to provide unobstructed passage for juvenile and adult salmonids. As a consequence of this decision, ODFW reduced the scope of the Elk Creek Dam Fisheries Evaluation Project. Revised project objectives since 1997 are to: (1) transport migratory salmonids around Elk Creek Dam, (2) determine the proportion of wild adult anadromous salmonids that return to Elk Creek, and (3) determine if transported coho salmon spawn in widely distributed areas upstream of Elk Creek Dam.

METHODS

Collection and Transport of Salmonids

The fish collection facility operated continuously from 5 October 1999 through 17 May 2000 and was checked a minimum of once daily. Samplers recorded the species, fin marks or tags, and classified the fish based on estimated fork length. Samplers classified chinook salmon less than 60 cm as jacks, coho salmon less than 50 cm as jacks, and steelhead less than 41 cm as half-pounders. Project staff transported and released all fish, except coho salmon of hatchery origin, in Elk Creek about one km upstream from the dam. Coho salmon of hatchery origin were killed in accordance with the National Marine Fisheries Service handling permit issued to ODFW. Coho salmon were classified as hatchery fish if a fin clip was present.

Proportion of Fish that Returned to Elk Creek

I estimated the Elk Creek contribution to runs of wild adult coho salmon and steelhead in the upper portion of the Rogue River by dividing the number of fish that returned to Elk Creek by the number of counterparts that passed the fish counting station at Gold Ray Dam on the Rogue River at RK 204. Estimates of the number of wild fish that passed Gold Ray Dam were obtained from Michael Evenson, ODFW, Central Point.

I assumed that trap catches reflected the number of fish that attempted to return to the Elk Creek Basin. I also assumed that all steelhead of hatchery origin were marked with fin clips. This assumption seemed reasonable because cohorts were all marked before release from Cole M. Rivers Hatchery. Different estimation procedures were needed to estimate the number of wild and hatchery coho salmon that returned to Elk Creek because some hatchery fish were not marked with fin clips.

Collection records from the hatchery and interpretations of coded-wire tags found in non-clipped fish indicated that clipped fish accounted for 85.1% of the jacks, and 86.3% of the adults, for coho salmon of hatchery origin that returned to Cole M. Rivers Hatchery in 1999-2000. I used these estimates, and the number of clipped fish captured in the trap, to estimate the number of non-clipped coho salmon of hatchery origin trapped in Elk Creek.

Spawning Distribution of Coho Salmon

Upstream limits of coho salmon spawning were estimated from the distribution of subyearling coho salmon. On 26-27 July, samplers snorkeled the larger streams where fry were found in

1996-99. Surveys began at the upstream limits where coho salmon fry were observed in previous years. Samplers attempted to determine the upstream limits of fry to the nearest 0.1 km and sampled at least 0.2 km upstream of sites that appeared to be the upstream limit of fry distribution.

RESULTS AND DISCUSSION

Collection and Transport of Salmonids

Trap catches of adult salmonids at the collection facility in the 1999-2000 return year totaled 298 unmarked and 64 marked coho salmon, 265 wild and 4 hatchery steelhead, 20 unmarked chinook salmon, and 51 wild cutthroat trout. Weekly trap catches are presented in Table 1 and in Table 2.

Project staff observed that a minimum of one adult salmonid died as a result of trap and transport. A wild adult steelhead, for unknown reasons, while being transported on 15 December. No coho salmon died immediately as a result of trap and transport. Four wild adult coho salmon were found dead on the upstream side of the weir. It was not possible to determine if these fish had spawned because all were male. In addition, it was not possible to determine if these fish had been transported upstream of Elk Creek Dam because transported fish were not marked in 1999-2000.

Table 1. Number of mature coho salmon, steelhead, and cutthroat trout trapped at the fish collection facility on Elk Creek, 1999-2000 return year. Coho salmon jacks were less than 50 cm long and half-pounders were less than 41 cm long. All cutthroat trout were longer than 30 cm and none exhibited hatchery marks. Data may include fish transported multiple times. All fish were released upstream of Elk Creek Dam except that coho salmon known to be of hatchery origin were killed rather than released.

	Coho salmon					Steelhead		
	Jacks		Adults		Half-pounders			
Week of capture	Unmarked	Marked	Unmarked	Marked	Wild	Hatchery	Wild	Cutthroat trout
10/22-10/28	0	0	2	0	0	0	2	0
10/29-11/04	0	0	1	0	0	0	0	1
Adults Hatchery[a]								0

11/05-11/11	0	0	0	0	0	0	0
0	0						
11/12-11/18	3	1	14	8	0	0	0
0	0						
11/19-11/25	4	3	35	9	0	0	0
0	0						
11/26-12/02	4	2	119	16	0	0	10
0	1						
12/03-12/09	2	4	37	8	0	0	2
0	1						
12/10-12/16	9	0	33	7	0	0	5
0	1						
12/17-12/23	2	0	13	4	0	0	8
0	6						
12/24-12/31	0	0	2	0	0	0	0
0	0						
01/01-01/07	0	1	9	1	0	0	0
0	0						
01/08-01/14	0	0	9	0	0	0	48
0	8						
01/15-01/21	0	0	0	0	1	0	23
0	16						
01/22-01/28	0	0	0	0	1	0	12
0	3						
01/29-02/04	0	0	0	0	0	0	4
0	1						
02/05-02/11	0	0	0	0	0	0	6
0	0						
02/12-02/18	0	0	0	0	1	0	20
0	3						
02/19-02/25	0	0	0	0	0	0	16
1	0						
02/26-03/04	0	0	0	0	2	0	11
0	1						
03/05-03/11	0	0	0	0	0	0	8
0	0						
03/12-03/18	0	0	0	0	0	0	7
0	0						
03/19-03/25	0	0	0	0	0	0	15
0	0						
03/26-04/01	0	0	0	0	0	0	6
0	0						
04/02-04/08	0	0	0	0	0	0	27
1	3						
04/09-04/15	0	0	0	0	0	0	10
0	6						
04/16-04/22	0	0	0	0	1	0	11
1	0						
04/23-04/29	0	0	0	0	0	0	3
0	0						
04/30-05/06	0	0	0	0	0	0	3
0	0						
05/07-05/13	0	0	0	0	0	0	2
0	0						

05/14-05/20	0	0	0	0	0	0	1	0	0
Annual total	24	11	274	53	5	0	260	4	51

[a] *May include some fish released downstream in the Rogue River after capture at Cole M. Rivers Hatchery.*

Table 2. Number of mature chinook salmon trapped at the fish collection facility on Elk Creek, 1999-2000 return year. Jacks were less than 60 cm long. Data may include fish transported multiple times.

Week of capture	Jacks		Adults	
	Marked	Unmarked	Marked	Unmarked
10/22-10/28	0	0	0	5
10/29-11/04	0	8	0	1
11/05-11/11	0	2	0	1
11/12-11/18	0	0	0	1
11/19-11/25	0	0	0	1
11/26-12/02	0	1	0	0
Annual total	0	11	0	9

Proportion of Fish that Returned to Elk Creek

I estimated that hatchery fish accounted for 13 of the jacks, and 61 of the adults, for adult coho salmon trapped in Elk Creek during 1999-2000. Returns of wild adult coho salmon to the collection facility on Elk Creek accounted for 20.3% of the wild adult coho salmon that passed the fish counting station at Gold Ray Dam in 1999-2000 (Table 3). Returns of wild adult steelhead to the collection facility on Elk Creek accounted for 3.6% of the wild adult steelhead that passed Gold Ray Dam in 1999-2000 (Table 3).

In comparison to steelhead, greater proportions of coho salmon have returned to Elk Creek in each year of trapping. I estimated that returns to Elk Creek accounted for 7-31% of the wild coho salmon that annually passed Gold Ray Dam (Table 3). In contrast, only 1-4% of the wild steelhead that

annually passed Gold Ray Dam returned to Elk Creek (Table 3). Steelhead production in Elk Creek may be on the increase. The percentage of wild fish that returned to Elk Creek in 1999-2000 (3.6%) was more than two-fold greater than the percentage return in 1994-95 (1.6%).

The area upstream of Elk Creek Dam accounts for about 9.5% of the area accessible to anadromous salmonids that pass Gold Ray Dam. I believe that the basin should produce at least a comparable percentage of coho salmon and steelhead because both species spawn in tributaries rather than in the Rogue River (Rivers 1964). Given that the return to Elk Creek accounted for more than 20% of the wild coho salmon that passed Gold Ray Dam during 1997-98 through 1999-2000, the Elk Creek Basin appears to have the capability of producing a large proportion of the wild migratory salmonids produced in the upper portion of the Rogue River Basin.

I also believe that steelhead production should be greater in the Elk Creek Basin because (1) densities of juveniles were very low in 1995 (Satterthwaite et al. 1996a), (2) annual returns have accounted for less than 5% of the wild adults that passed Gold Ray Dam, and (3) annual returns have never come close to reaching mitigation levels identified in planning

Table 3. Returns of wild adult anadromous salmonids to Elk Creek as compared to those that passed Gold Ray Dam, 1992-93 through 1999-2000. Steelhead less than 41 cm (half-pounders) are not included. Passage estimates at Gold Ray Dam were received from Michael Evenson, ODFW, Central Point.

	Coho salmon			Steelhead		
Return year	Elk Creek	Gold Ray Dam	% return	Elk Creek	Gold Ray Dam	% return
1992-93	40	--	--	112	5,541	2.0
1993-94	76	756	10.1	105	8,022	1.3
1994-95	232	3,265	7.1	201	12,515	1.6
1995-96	349	3,345	10.4	283	12,344	2.3
1996-97	319	3,516	9.1	493	14,144	3.4
1997-98	982	4,566	21.5	224	5,018	4.4
1998-99	404[a]	1,310[a]	30.8[a]	351	9,232	3.8

1999-00	288	1,417	20.3	265	7,343
3.6					

[a] *Estimate revised from previous year.*

documents (USACE 1980). Consequently, I recommend continued sampling to estimate returns of wild fish to assess the success of transportation as a method to restore the natural production of migratory salmonids.

Spawning Distribution of Coho Salmon

Coho salmon spawned in widely distributed areas of the Elk Creek basin during 1996-2000. Fry in the West Branch of Elk Creek were distributed farther upstream in 2000 as compared to 1996-99. The upper distributions of fry in the other four streams were intermediate to those observed in earlier years (Table 5). Waterfalls located at RK 3.2 on Flat Creek and at RK 20.9 on Elk Creek appeared to be barriers to adult coho salmon that returned to freshwater in 1999.

Data from 1996-2000 suggested that fry surveys would be an effective method to determine whether adult coho salmon continue to spawn in widely distributed areas of the Elk Creek Basin. With five years of data, the 95% confidence intervals associated with the means of spawning limits ranged between 0.4 and 1.2 km (Table 5). Assuming no changes in the standard deviations associated with the means, I estimate that the 95% confidence intervals should range between 0.4 and 1.0 km if fry distributions are estimated for a total of six years.

Future changes to methods of fish transportation, or construction to modify or remove a portion of Elk Creek Dam, may result in some type of fisheries evaluation. Baseline data on the spawning distribution of coho salmon in the Elk Creek Basin is a low-cost method of evaluating the effects changed conditions for fish passage. Consequently, I recommend that sampling continue for at least one more year to increase the precision of the estimated mean location of upstream spawning by coho salmon in each stream.

Table 5. Upstream limits (RK) of coho salmon fry in five creeks within the Elk Creek Basin, 1996-99.

Year	West Branch	Flat	Sugarpine	Bitterlick	Elk

1996	3.5	3.2	8.9	4.0	23.0
1997	3.8	4.1	6.6	2.0	20.9
1998	4.1	5.5	9.2	3.1	20.9
1999	4.4	3.2	7.2	4.0	20.9
2000	4.6	3.2	6.6	3.8	20.9
Mean	4.1	3.8	7.7	3.4	21.3
±95% CI	0.4	1.0	1.2	0.8	0.9

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