1997 OUTMIGRANT TRAPPING, COHO RELOCATION AND SCULPIN PREDATION SURVEY OF THE SOUTH FORK TEN MILE RIVER

FOR
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ABSTRACT

Outmigrant traps were installed in the spring of 1997 in the South Fork Ten Mile River and two of its tributaries, Campbell and Smith Creek. The purpose of trapping was 1), enumerate outmigration of coho and steelhead trout, 2), relocate a portion of coho fry to headwater areas to reestablish runs, and 3) estimate trapping related fry mortality rates due to predatory sculpin. Trapping started in March and continued through the end of May. Traps were pulled when high flows were anticipated in order to reduce potential mortalities. Most steelhead trout were marked with a caudal fin clip and returned upstream to determine trap efficiency rates. About 12% of the coho fry captured in traps were taken to headwater areas and released. Other juvenile coho salmon and all other animals captured were released downstream without marks. Stomach samples were taken from a small portion (3.5%) of prickly sculpin captured to determine predation rates on salmonid fry. Two types of traps were installed in Smith Creek for the purpose of determining if fry mortality could be reduced. A 1/2 inch mesh trap, which allowed instantaneous escapement of fiy while holding larger trout and sculpin, was installed upstream of the trap holding fry.

The number and lengths of animals captured are reported by weekly intervals. Bi-weekly length and weights data for salmonids are provided. Campbell Creek, Smith Creek and the South Fork Ten Mile were estimated, based on counts and trap efficiency rates estimates, to have 5 12. 729, and 1726 coho smolts passing the three traps, respectively. Steelhead trout estimates were 2.367. 1,700, 3,172, respectively. Counts of coho fry were 205, 208. and 2, respectively while steelhead fry counts were 19.93 1, 17.62 1, and 4,3 13. For the first time since traps have been opeated in the Ten Mile, chinook salmon fry were captured. Over two thousand were observed in the South Fork trap. The chinook salmon in the Ten Mile originated from introductions of Eel River and other sources in the early 1980's Coho fry relocation was successful but limited by the low number of fry captured. No losses were observed and fry remained at release site for several days and were observed actively feeding. Trapped prickly sculpin were found to average 4.2 fry/stomach . The largest sculpin (<1 10mm) were responsible for most of the mortality, with 40 fry being found in one 128mm sculpin. Mortality rate in trap which allowed instantaneous release of fry (1/2 mesh) was 1/3 that of trap which withheld fry. The overall mortality of fry in traps holding fry, even with screens designed to allow separation of fry from larger fish, was estimated at 25%. The population of sculpin in Smith Creek. estimated to be around 2,000, could have ingested over 150,000 in a three month period of 1997 if the fry/stomach ratio found in 1/2 inch mesh trap is indicative of rate found throughout the stream. The 1997 results are compared to both 1995 and 1996 salmon spawning survey and outmigrant trapping studies for the South Fork Ten Mile basin. The 1997 coho outmigrant population was up from 1996 by between 8 and 15 times for the individual areas and up about 25 times from 1995. For Age 1+ steelhead trout , 1997 estimates were down over 1996 in Smith Creek and the South Fork while remaining steady in Campbell Creek. Compared to 1995, the South Fork juvenile steelhead estimate was up 2.6 times in 1997.

TABLE OF CONTENTS

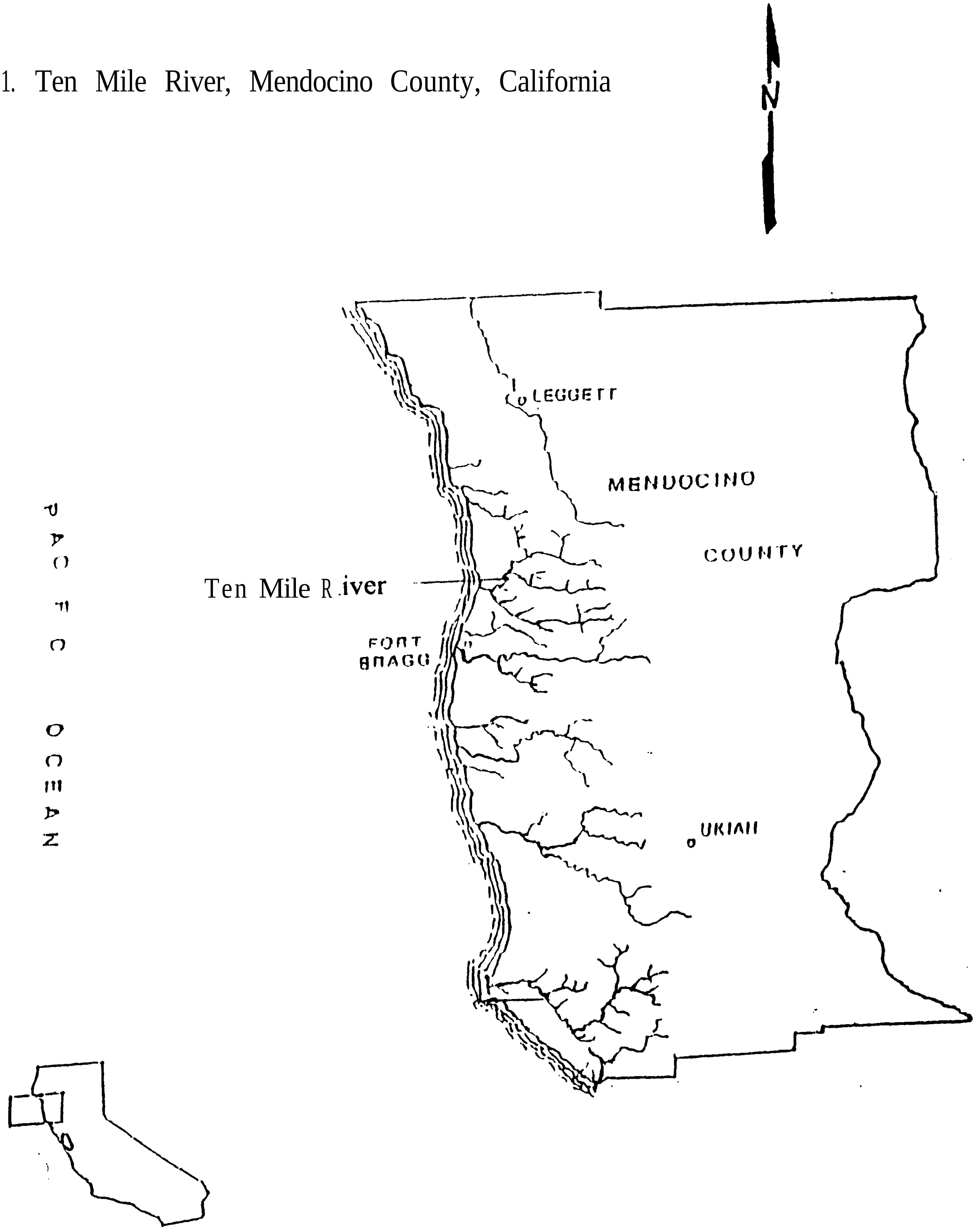
INTRODUCTION

This study was conducted by Salmon Trollers Marketing Association (STMA) as part of the Northwest Emergency Assistance Program (NEAP) to employ commercial fisherman effected by recent fishery closures due to low stock abundance. In this study, outmigrant traps were placed in the Ten Mile River (Figure 1). This project adds a third consecutive year an evaluation of outmigrant salmon and steelhead trout *(0. mykiss)* has been conducted within the South Fork Ten Mile River basin.

Besides the collection of data relevant to the population status of a critical stock of coho salmon (Oncorhynchus *kisutch)*, this year's activities included an evaluation of trapping induced mortalities on salmonid fry by predatory sculpin. Outmigrate traps can offer predators with improved feeding opportunity by concentrating fry. In normal trap operation, mortality of fish can is assessed only from the number of dead fish which are observed in a trap. But for fry, mortality due to predation is likely the major cause of death unless the fish have been subjected to high velocities for extended periods. Unless stomach contents are examined, losses due to predation will go undocumented. Outmigrate traps are commonly fitted with screens to allow smaller fish to swim to back of trap while excluding larger predators. But trap operators have in the past observed obvious signs of predation, such as extended stomachs of sculpin which were "full" of fry, even with these screens in place.

In order to help evaluate the effect outmigrant trapping operations have on young salmon and steelhead populations, STMA proposed to sample sculpin stomachs to determine the degree of predatory impacts. While yearling coho and steelhead are also likely to feed upon recently emerged fry, sculpin were believed to be the major predator. Other animals such as frogs, salamanders and aquatic snakes may also utilize fry as a food source during and soon after fry emergence. Besides attempting to estimate fry mortality, an alternative trap design was developed and installed which reduced opportunity for predation to occur.

Figure 1. Ten Mile River, Mendocino County, California



One final objective for this study was to utilize emigrating coho fry to reestablishing coho populations where they are no longer present in the basin. Outmigrating coho fry offer an opportunity for reintroduction of a native stock which does not utilize any hatchery type operation nor does it pose a significant risk to populations from which fish are collected. In this program a portion of the coho salmon fry caught in outmigrant traps were transported to headwater areas where adult spawners have been absent for many years due to migration barriers. Since outmigrant traps are located in the lower portion of the basin, a short distance from tidal influence, there is little habitat available for these coho fry to rear below trapping sites and few are expected to survive to become adults. A year in freshwater is considered necessary for survival in the marine environment (Shapovalov, 1954; Conte et al. 1966; Crone and Bond 1976; Hartman et al; 1982). Salmonid fry which are leaving the natal streams shortly after emergence are likely doing so due to aggressive territorial behavior by dominant fish or their inability to find suitable rearing habitat or adequate food resources for survival. (Mason and Chapman 1965; Chapman 1962). By introducing these fry into upper areas of the basin which offer prime rearing habitat and little competition, there survival is expected to be greatly enhanced

As well as reporting on numbers of juvenile salmon and steelhead trapped, sculpin induced mortalities, and coho relocation efforts, this report details the catch of all fish and other animals found in outmigrant traps. It compares the findings from this years trapping operation with those from the previous two years as well as findings from a salmon and steelhead trout spawning survey conducted in both Campbell and Smith Creek earlier this year.

METHODS

Trapping Operations

Traps were placed in three sites, South Fork Ten Mile, Campbell Creek- and Smith Creek (Figure 2.), to capture outmigrating or downstream moving juvenile salmonids. Traps consisted of funnel shaped nets (fyke nets) which emptied in to a livecar fish holding box at the downstream end of the net (See Appendix 1). The livecars (with the exception of a special livecar for use in Smith Creek, see below) were constructed out of a plastic pipe frame to which a rectangular shaped 1/8 inch nylon mesh container was connected. This livecar had a zipper opening utilized to scope out fish and debris that accumulated in the livecar. The fyke net was held in the stream by connecting it to metal fence posts that were pounded into the stream bed. Ropes were strung from the upstream end of the net to trees or any other sturdy structure on the bank to prevent loss of the trap during high water events. The lower portion of fyke net and livecar consisted of l/4" mesh. The upper portion of fyke net was l/2 inch mesh. Quarter inch wire mesh wing-wails were strung out from the fyke net to edge of bank where necessary. Various materials were used to secure the edges of wing-wall such as sand bags and rocks to help prevent fish from escaping around the trap. During periods of increasing flows and rain, a portion of the flow was allowed to by-pass the trap in order allow passage of any adult steelhead which might be traveling upstream to spawn.

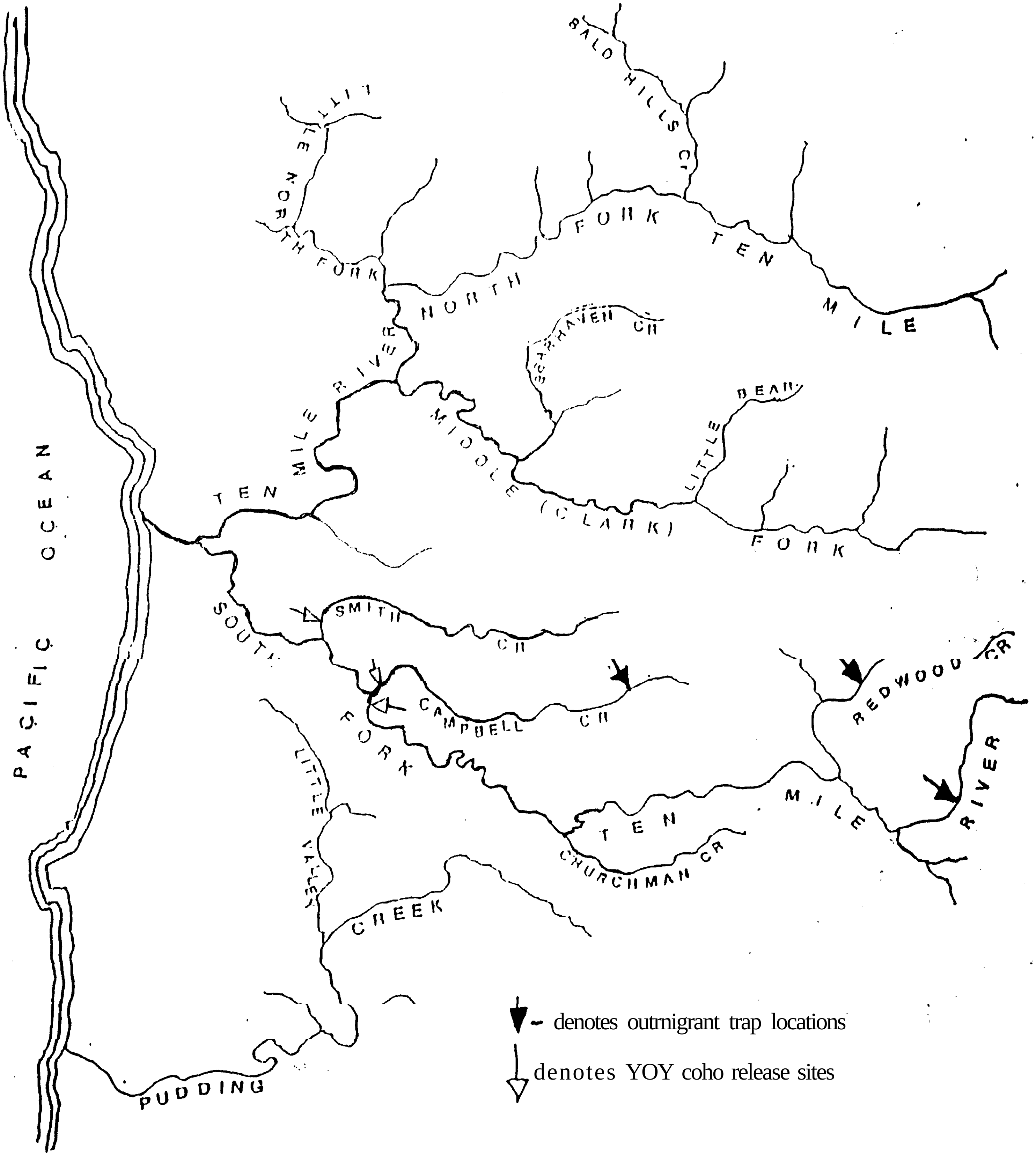
Where the small end of the fyke net was connected to the livecar there was a section of plastic pipe to which the net and livecar was held together with hose clamps. This pipe (8 inch dia.) was extended into the livecar approximately 3 to 6 inches and a stove pipe elbow was inserted into he lower end of the plastic pipe to discourage fish from exiting the live car and swimming back upstream. This elbow was normally pointed down towards the bottom of livecar but turned upward when the trap was being checked.

Wire mesh separators were installed in livecars to allow smaller fish to go into lower end of livecar where larger fish would be excluded. This was done to protect smaller fish from being eaten by the larger fish or other aquatic animals. Other material such as large boulders, twigs and branches were added to livecar to give added cover for trapped fish.

An exception to the above described livecar was utilized in Smith Creek. This livecar and fyke net trap was installed with the purpose of allowing instantaneous escapement of all fry while retaining larger salmonids and sculpin. This livecar consisted of a l/2 inch wire mesh cage and hinged lid constructed over rectangular plastic pipe frame. This second trap was installed about 250 feet upstream of the original trap and trapped the entire flow with the goal of capturing all of the larger fish migrating downstream. This trap was designed to reduce mortalities on fry and also served to help establish information on background levels of scuipin predation.

In order to reduce high flow related impacts to trapped fish, two side-by-side fyke nets and livecars were installed. This double trap arrangement worked very well in reducing impacts due to high flow conditions. Another additional precautionary action was taken to reduce flow related mortalities. Whenever forecasts suggested that significant amounts of rain were expected, traps were pulled and reset when threat ended or flows dropped. Later in the year one of the side-by-side traps was removed from Campbell Creek for use in the South Fork when that trap was installed. Also, the side-by-side trap configuration used in Smith Creek was abandoned when the l/2" mesh trap was installed there. The side-by-side trap configuration was used consistently on the South Fork.

Figure 2. Location of outmigrant traps in Campbell Creek, Smith Creek and South Fork Ten Mile River and location of YOY coho salmon released into headwater areas.



The three traps were ran once per day by two trap operators. Fish were scooped out of the livecar and placed in buckets. Fish were measured to nearest mm fork length and a subset weighted by water displacement in a graduated cylinder where one ml was equal to one gram. Occasionally fish were anesthetized utilizing Alka Seltzer but normally fish were measured without its use. Non-salmonids were not weighed.

Most steelhead smolts were marked with a clip off the posterior portion of the caudal fin and released upstream to determine trap efficiency rates. Coho smolts were not marked but instead were released below traps as were all other fish encountered .

Sculpin Predation

The Department of Fish & Game allowed STMA to sacrifice 50 sculpin, 10 per week for five weeks, to determine predation impacts on fry due to trapping operations. Up to 10 prickly sculpin were randomly selected per week (this was usually done on a single day each week unless less that 10 sculpin were available that day) and gut contents examined on site to determine number of YOY salmonids present. Each sculpin sampled was measured for length and weighed. All samples were taken in Smith Creek and samples were taken from both 1/2" mesh and normal livecars.

Coho Relocation

Some coho fry were relocated from outmigrant traps to headwater areas within the South Fork Ten Mile River basin (Figure 2.). Relocated coho were placed in five gallon plastic buckets filled with water and sealed with tight fitting lids. Zip sealed bag with ice were added the buckets to keep temperatures from rising during transportation. As many as 30 fry were held in a single bucket. Buckets were placed in vehicles in a manner to prevent spillage during transportation and out of direct sunlight to reduce temperature elevation. When destination was reached, fish were transferred to zip sealed gallon bags and placed into a backpack for the final leg of trip which took between 2 and 12 minutes. About 7 to 8 fry were placed into each bag. Before releasing fish, bags were placed into stream where, slowly, stream water was added to bags until temperature in bags were within a degree or two from the stream temperature.

RESULTS

The number and type of fish and other animals trapped in Campbell Creek, Smith Creek and the South Fork Ten Mile, and are shown on Tables 1 through 3. The significance of these numbers are discussed in detail in following sections. The lower portion of tables have been expanded for days where traps were not in operation. To estimate the number of fish that would have been trapped on days traps weren't operational, the average daily catch for a week where data is missing is multiplied by the fraction of the days in that week that were trapped. If only a single day or no of data was available, the daily average from the previous and following week were averaged to make the estimate for the missing time period. On Tables 4-10 are given the length frequency distribution for coho salmon and steelhead trout sampled during this study.

Shown on Table 11 is the number of steelhead parr and smolts which were marked or recaptured in Campbell Creek, Smith Creek and the South Fork. No coho were marked for recapture during this project. The recapture rates for marked fish were about 50 percent at both Smith and Campbell Creek and about half that at the South Fork trap. The overall low rates of recovery were influenced, in part, to portions of the channel remaining open during higher flow periods to allow adult steelhead passage. They were also affected by the periods traps were pulled altogether during high flow periods.

In Appendix 2 are given weight at length data and in Appendix 3 isinformation on the various physical parameter measurements such as temperature, weather and flow estimates. In Appendix 4 are given length frequency distributions for some of the non-salmonids encountered during study.

Trapping Operations

The Campbell Creek trap was set on March 6th. The trap was located about 50 feet below its 1996 location and about 650 feet above the mouth. It was pulled due to an approaching storm on March 16 but was reinstalled on the 17th when it became apparent flows were not going to increase significantly. Rain and increasing flows resulted in traps being pulled on April 18th. Traps remained out of the water until the 25th of April. From this time forward, until the end of May when the trap was removed, the trap remained operational. Campbell Creek trap operated a total of 77 days.

There were 230 yearling coho trapped this year compared to 864 yearling or older (Age 1+) steelhead trout. Coho fry numbered 205 while steelhead fry numbered 19,931. No yearling coho moralities occurred although there was one fry observed dead. A mortality rate of about 1 percent was observed for Age 1+ steelhead while about 4 tenths of one percent was the observed mortality rate for steelhead fry. There were other losses due to predation in traps which are discussed below. There were also 8 adult steelhead trapped. Two salmonids were identified as either rainbow or cutthroat trout. One of these fish measured 2 12 mm fork length while the other was at least 300 mm. The second fish was placed by in trap while surveyors left to get a camera. When they returned the fish had escaped back upstream and was not recovered.

Prickly and coastrange sculpin *(Cottus asper and C. aluticus)* numbers were 593 and 3 18, respectively. The other common fish observed was threespine stickleback *(Gasterosteus aculeatus)* which numbered 140. Other animals observed were 36 yellow -legged frogs (*Rana boylei)*, 10 red-legged frogs *(Rana aurora)*, and 4 1 giant pacific salamanders *(Dicamptodon ensatus)*. Others include the red-bellied newt *(Taricha rivularis)*, rough-skinned newt *(Taricha granulosa)* and California Newt *(Taricha torosa)*.

The first yearling coho was captured on the first day of trapping, March 7th and the last was on May 23, 9 days before trap was removed. The peak emigration period occurred in the first week of May. The first coho fiy was trapped on March 25 and numbers peaked on March 28 where 67 were captured on that day. Number dropped to no more than two per day by March 3 1. The peak in emigration of Age 1+ steelhead occurred the first week in May, similar to coho The first steelhead fry was observed on March 18th, prior to any coho fry being captured. Their numbers peaked in late April through early May. Prickly sculpin numbers were high throughout the mid-March through April period while coastrange sculpin peaked in mid to late April. Stickleback numbers were generally higher in the later half of the survey period.

The Smith Creek trap was first set on March 6. As in Campbell, the trap was pulled on March 16th and reset he next day. It was pulled again on April 14th, reset April 28, and then operated continuously through May 3 1. Trap was in operation a total of 76 days. The trap was located approximately 1500 feet above the mouth.

There were 350 coho yearlings trapped compared to 667 Age l+ steelhead. There were 208 coho fiy and 17,621 steelhead fry captured in Smith Creek trap. There was one coho yearling and one Age l+ steelhead mortality. No coho fry mortalities were observed and . the observed mortality rate for steelhead fry was 0.3 1 percent Five adult steelhead were also captured and released.

Table 1 Weekly Summaries of the Number of Fish and Other Animals Trapped in the Campbell Creek Outmigran Trap in 1997, Number of Days a Week Trap was in operation, and Percent Mortaility Observed and Expansion for days where trap was not in operation

	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 7-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31	Total	Mortality
Coho YOY	0	0	0	175	25	2	0	0	2	0	0	1	0	205	0.49%
Coho Y+	3	3	8	13	1	21	43	1	38	78	14	4	3	230	0.00%
Steelhead YOY	0	0	12	2	850	6450	4244	821	6379	292	495	79	307	19931	0.40%
Steelhead Y+	16	30	70	83	56	92	112	6	76	150	104	56	13	864	0.93%
Prickly Sculpin	16	74	94	84	48	43	94	6	44	28	22	21	19	593	0.00%
Coastrange Sculpin	5	13	13	24	25	22	80	8	27	39	16	27	19	318	0.00%
Stickleback	3	6	7	20	7	2	8	1	24	12	6	23	21	140	0.00%
Juv. Lampery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Adult Lampery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
GP Salamander	1	3	1	2	4	6	3	0	6	3	1	2	1	33	0.00%
Frog	0	2	5	11	3	5	10	0	6	1	1	1	1	46	0.00%
Newts	0	2	1	9	4	6	4	0	2	0	0	0	0	28	0.00%
Steelhead	2	0	1	0	4	0	0	0	0	0	0	0	1	8	0.00%
Snake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Days Operated	2	7	6	7	7	7	6	1	7	7	7	7	7	78	
									Expansions for "full" week of Trapping						
Coho YOY	0	0	0	175	25	2	0	1	2	0	0	1	0	206	
CohoY+	10	3	9	13	1	21	50	39	38	91	14	4	3	297	
Steelhead YOY	0	0	14	2	850	6450	4952	5677	6379	341	495	79	307	25546	
Steelhead Y+	56	30	82	83	56	92	131	95	76	175	104	56	13	1048	
Prickly Sculpin	56	74	110	84	48	43	110	72	44	33	22	21	19	735	
Coastrange Sculpin	17	13	15	24	25	22	93	60	27	46	16	27	19	404	
Stickleback	10	6	8	20	7	2	9	15	24	14	6	23	21	166	
Juv. Lampery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Adult Lampery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
GP Salamander	3	3	1	*2*	4	6	4	4	6	4	1	2	1	41	
Frog	0	2	6	11	3	5	12	8	6	1	1	1	1	56	
Newts	0	2	1	9	4	6	5	3	2	0	0	0	0	32	
Adult Steelhead	7	0	1	0	4	0	0	0	0	0	0	0	1	13	
Snake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 2

1997 Weekly Summaries of the Number of Fish and Other Animals Trapped in the Smith Creek Outmigrant Trap, Number of Days a Week Trap was in operation, and Percent Mortality Observed

	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 7-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31	Total	Mortality
CohoYOY	0	0	45	95	58	3	2	0	1	3	0	1	0	208	0.00%
CohoY*	2	5	14	4	10	21	50	0	73	125	36	5	5	350	0.29%
Steelhead YOY	0	57	1304	458	56	769	3370	0	4652	5965	870	50	70	17621	0.31%
Steelhead Y+	13	33	80	40	22	42	134	0	74	132	51	24	22	667	0.15%
Pric Sculpin	51	156	316	113	124	125	49	0	40	44	22	11	26	1077	0.00%
Coast Sculpin	15	32	88	31	67	61	28	0	23	45	18	12	28	448	0.00%
Stickleback	0	1	1	1	0	1	7	0	13	7	5	3	3	42	2.38%
Lamprey	0	1	1	2	2	0	0	0	1	0	0	0	0	7	0.00%
Adutt Lampery	0	2	0	0	1	0	0	0	0	0	0	0	0	3	0.00%
GP Salamander	0	0	2	1	3	4	0	0	2	4	2	4	1	23	0.00%
Frog	1	0	1	4	0	3	12	0	6	2	1	0	0	30	0.00%
Newts	0	1	2	1	1	1	0	0	0	2	0	3	1	12	0.00%
Steelhead	0	0	2	0	2	0	1	0	0	0	0	0	0	5	0.00%
Snake	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.00%
Days Operated	3	7	7	7	7	7	6	0	5	6	7	7	7	76	
Coho YOY	0	0	45	95	58	3	2	2	1	3	0	1	0	210	
CohoY+	5	5	14	4	10	21	58	62	102	125	36	5	5	452	
Steelhead YOY	0	57	1304	458	56	769	3932	4011	6515	5965	870	50	70	24058	
Steelhead Y+	30	33	80	40	22	42	156	104	104	132	51	24	22	840	
Prickly Sculpin	119	156	316	113	124	125	57	45	56	44	22	11	26	1213	
Coastrange Sculpin	35	32	88	31	67	61	33	26	32	45	18	12	28	507	
Stickleback	0	1	1	1	0	1	8	10	18	7	5	3	3	58	
Juv. Lamprey	0	1	1	2	2	0	0	1	1	0	0	0	0	8	
Adult Lampery	0	2	0	0	1	0	0	0	0	0	0	0	0	3	
GP Salamander	0	0	2	1	3	4	0	1	3	4	2	4	1	25	
Frog	2	0	1	4	0	3	14	9	8	2	1	0	0	45	
Newts	0	1	2	1	1	1	0	0	0	2	0	3	1	12	
Adult Steelhead	0	0	2	0	2	0	1	1	0	0	0	0	0	6	
Snake	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
Painted Ensatina	0	2	1	0	0	0	0	0	0	0	0	0	0	3	
Otter	0	0	1	0	0	0	0	0	0	0	0	0	0	1	

Table 3 Weekly Summaries of the number of Fish and Other Animals Trapped in the South Fork Outmigrani Trap in 1997, Number of Days a Week Trap was in operation, Percent Mortality Observed and Expansions for Days where Trap was not in Operation

	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31	Total	Mortality
Chinook YOY	15	67	26	7	0	215	402	489	476	429	2126	0.24%
Coho YOY	0	2	0	0	0	0	0	0	0	0	2	0.00%
CohoY+	0	0	5	13	0	30	86	87	148	42	41 1	0.24%
Steelhead YOY	3	0	29	34	0	696	1448	1052	204	847	4313	0.36%
Steelhead Y+	8	58	66	81	0	39	101	114	108	26	601	0.00%
Adult Steelhead	0	3	1	0	0	0	0	0	0	0	4	0.00%
Pric Sculpin	188	198	187	136	0	53	80	86	42	56	1026	0.00%
Coast Sculpin	26	142	122	110	0	37	78	84	50	41	690	0.00%
Stickleback	6	21	29	29	0	40	72	43	60	93	393	0.00%
Lamprey	2	6	1	0	0	1	15	13	6	4	50	0.00%
Adult Lampery	0	1	6	0	0	1	5	4	3	0	20	0.00%
GP Salamander	0	1	0	0	0	0	0	0	0	0	1	0.00%
Frog	0	0	3	4	0	0	3	2	2	3	17	0.00%
Newts	0	16	12	11	0	0	0	1	1	2	43	0.00%
Turtle	0	0	1	0	0	0	1	0	1	0	3	0.00%
Days Operated	2	6	7	6	0	3	7	7	7	7	52	
Expansions for "Full" week of Trapping												
Chinook YOY	52	78	26	8	255	502	402	489	476	429	2718	
Coho YOY	0	2	0	0	0	0	0	0	0	0	2	
Coho Y+	0	0	5	15	43	70	86	87	148	42	496	
Steelhead YOY	10	0	29	40	833	1626	1448	1052	204	847	6089	
Steelhead Y+	28	68	66	95	93	91	101	114	108	26	789	
Adult Steelhead	0	4	1	0	0	0	0	0	0	0	5	
Prickly Sculpin	657	231	187	159	141	124	80	86	42	56	1763	
Coastrange Sculpin	91	166	122	128	107	86	78	84	50	41	954	
Stickleback	21	25	29	34	64	93	72	43	60	93	533	
Juv. Lamprey	7	9	1	0	1	2	15	13	6	4	59	
Adult Lampery	0	1	6	0	1	2	5	4	3	0	23	
GP Salamander	0	1	0	0	0	0	0	0	0	0	1	
Frog	0	0	3	5	2	0	3	2	2	3	20	

Newts	0	19	12	13	6	0	0	1	1	2	54
Turtle	0	0	1	0	0	0	1	0	1	0	3

Table 4	Length Frequency Distribution of Juvenile Coho Salmon Trapped in Campbell Creek, Ten Mile River Basin in 1997, By Week												
Fork	March	March	March	March	April	April	April	April	April-May	May	May	May	May-July
Length	2-8	9-15	16-22	23-29	30-5	6-12	13-19	20-26	27-3	4-10	11-17	18-24	25-31
23-25													
26-28													
29-31				18	3								
32-34				70	8	1							
35-37													
38-40													
41-43													
44-46													
47-49													
50-52													
53-55													
56-58													
59-61												1	
62-64													
65-67													
68-70													
71-73													
74-76													
77-79				1									
80-82		1	1			1	1		1				
83-85			1	2		4	1			2			
86-88			1	3		2	7			7	1		
89-91	1	2	2	1		2	2		2	5		1	
92-94			1			2	9		6	9	3	2	2
95-97			1	4		2	7		4	12	3		
98-100					1	3	7		7	8	2		
101-103				2		2	5		7	15	1	1	
104-106						2			2	9	4		1
107-109							2		4	8			
110-112							1		3	2			
113-115									2	1			
116-118							1			1			
119-121													
122-124													
125-127													
128-130													
131-131													
134-136													
137-139													
140-142													
143-145													
146-148													
149-151													
152-154													
155-157													
158-160													
161-163													
164-166													
167-169													
170-172													
173-175													
176-178													
179-181													
182-184													
185-187													
188-190													
191-193													
194-196													
197-199													
200-202													
203-205													
206-208													
SUM Y+	1	3	7	13	1	20	43	0	38	79	14	4	3
AVE LEN	89	90.0	88.7	92.8	108.0	96.1	97.8		103.6	103.7	104.1	96.8	97.0
SUM YOY	0	0	0	88	11	1	0	0	0	0	0	1	0
AVE LEN				32.4	32.2	33.0						60	

Table 5 Length Frequency Distribution of Juvenile Steelhead Trapped in Campbell Creek, Ten Mile River Basin in 1997, By Week.

Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31
23-25													
26-28			2	1	28	15	6		34				6
29-31			8		92	81	15		72			7	37
32-34			1		5	10	9		19			10	19
35-37						1			11			3	6
38-40		1							11			3	11
41-43									2			5	17
44-46												7	13
47-49												4	11
50-52												1	8
53-55			1	1								3	7
56-58												2	6
59-61									1			2	3
62-64									1				2
65-67		1	2				1			1			
68-70			3	1			1			1	3		
71-73			1	5	2	3	3		8		4	1	1
74-76			5	3	3	4	7		6	4	1	2	
77-79		2	3	6	3	5	6		6	9	4	2	
80-82		1	3	5	5	6	12		4	11	12	4	1
83-85		2	5	10	5	11	12		12	22	12	8	1
86-88	2	4	3	6	1	10	12		7	21	11	2	
89-91	1	2	6	4	3	12	11		10	14	11	7	
92-94		1	5	2	1	7	13		6	17	10	3	1
95-97		2	6	5	3	4	7		2	8	9	5	2
98-100		1	6	3	4	3	1		2	10	3	6	
101-103		1	6	5	2	5	4		3	7	5	5	
104-106	1		4	7		3	2		2	6	4	2	
107-109	1	1	3	1	3	4	4		2	6	6	1	1
110-112				3	1	2				2	5		1
113-115		2		2	2	1	1			2	2		2
116-118		1	3	3	1		1						
119-121		2	1	1		1			1	2	1	2	
122-124			1			2	1		2	1			
125-127			3			1				1		1	
128-130			2				1			1			
131-133	1	2	2				1			2	1		1
134-136							1			1	1		
137-139		1	1		1					1			
140-142						1			1		1	1	
143-145				1	1		1						
146-148		1	3				1						
149-151			1		3	1					1		
152-154	1				1	1					1	2	
155-157			1	1		1	2						
158-160	1												
161-163				1			1		1				
164-166		1	3		2								
167-169		1											
170-172			2	2	2								
173-175					1	1	1						
176-178						1							
179-181				1	1								
182-184				1									
185-187					1								
188-190		1											
191-193										1			
194-196					2								
197-199				1									
200-202			1										
203-205			1										
206-208					1								
209-211													
SUM Y+	8	30	87	81	55	90	108	0	75	151	108	54	11
AVE LEN	115.1	108.3	105.2	99.0	113.5	95.9	93.3		88.8	93.3	93.4	95.8	100.1
SUM YOY	0	1	11	1	125	107	30	0	149	0	0	47	146
AVE LEN		39.0	29.7	27.0	29.4	29.9	30.3		31.0			41.0	39.8

Table 6		Length Frequency Distribution of Juvenile Coho Salmon Trapped in Smith Creek, Ten Mile River Basin in 1997, By Week.											
Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31
23-25													
26-28													
29-31			10	25	14								
32-34				39	44	2	2						
35-37													
38-40									1				
41-43													
44-46													
47-49													
50-52													
53-55													
56-58												1	
59-61													
62-64													
65-67													
68-70													
71-73													
74-76			1	1	1					1			
77-79				1		1	1			1			
80-82	1	2	1		1	2	1			2			
83-85		1	2	1			1		4	6			
86-88		1	1		2	2	7		5	9	1		1
89-91	1					4	3		12	10	4		3
92-94			1	1	1	4	16		9	13	6		1
95-97					3	6	8		9	23	6		1
98-100		1			1		1		12	27	9		
101-103			1		1	2	5		8	12	1	1	1
104-106							4		6	7	6	2	
107-109									3	8	2	1	
110-112						1			3	2			
113-115										3	1		
116-118							1						
119-121													
122-124													
125-127													
128-130													
131-133													
134-136													
137-139													
140-142													
143-145													
146-148													
149-151													
152-154													
155-157													
158-160													
161-163													
164-166													
167-169													
170-172													
173-175													
176-178													
179-181													
182-184													
185-187													
SUM Y+	2	5	7	4	10	22	48	0	71	124	36	4	7
AVE LEN	85.5	86.4	88.5	85.0	93.0	92.6	94.3		98.4	96.8	98.2	105.0	92.6
SUM YOY	0	0	11	65	59	2	2	0	1	1	0	1	0
AVE LEN			34.1	32.5	33.0		33.0		39.0			57.0	

Table 7	Length Frequency Distribution of Juvenile Steelhead Trapped in Smith Creek, Ten Mile River Basin in 1997, By Week.												
Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31
23-25		1											
26-28		49	56	20	7	47	18		10			8	1
29-31		8	86	125	34	102	37		37			22	5
32-34				3	9	3	3		8			2	4
35-37					1							1	1
38-40												1	1
41-43						2						2	1
44-46							1		4			2	
47-49													3
50-52													1
53-55												2	2
56-58													1
59-61			1										
62-64	1												
65-67			1							1			1
68-70	1	1		2			2		2		1		1
71-73			1	1					1	3	1		
74-76			4	2					1	3	6		1
77-79		2	3	3		4	5		7	9	1	1	1
80-82		1	2		1	1	8		9	6	3	1	
83-85		1	1	1		2	7		8	6	7	2	1
86-88		1	4	3	1	1	22		4	14	2	3	1
89-91	1		2	1	1	4	8		5	15	4	3	
92-94		1	2	2	3	6	9		7	15	1	1	2
95-97		1	5	1	2	1	15		4	10	3	2	
98-100		1	2	3	1	2	11		8	10	4	1	
101-103		4	3	2	2	4	5		1	7	4	1	2
104-106				1		1	7		2	3	9		
107-109	1	1	1	1		1	1		3	7	3	1	1
110-112		1	1			1	5		2	6	3	1	
113-115			1		2		6		4	4		2	
116-118		2		2		3	1			2	1	1	
119-121		1	1		1		1		1	2	1	1	1
122-124			2							3	1	1	
125-127		1				1	2						
128-130			1	1			1			1			
131-133		1	1	1			1		1	1			
134-136	1						1		1				
137-139		1		1			1			2			
140-142		1	1				1			1			
143-145			1	1			1						
146-148		1	1	2			1						
149-151			2		1	1							
152-154		1			1		2						
155-157	2	1		1		3	1						
158-160			2						1				
161-163		1	1		1		1		1	2			
164-166	2	1	1			1							
167-169				1	1	1	2					1	
170-172					1	1							
173-175		1		1									
176-178	2			1									
179-181					1	1							
182-184	1		1	1			1						
185-187					2								
188-190													
191-193		1											
194-196													
197-199		1				1							
200-202													
203-205													
206-208	1												
216			1										
222		1											
SUM Y+	13	31	50	36	22	41	129	0	73	133	55	23	12
AVE LEN	142.4	124.3	108.2	106.0	124.4	111.4	100.4		94.2	96.7	94.2	100.8	89.8
SUM YOY	0	58	142	148	51	154	59	0	59	0	40	40	20
AVE LEN		27.4	28.8	29.7	30.2		29.5		30.9			32.5	39.3

Table 8 Length Frequency Distribution of Juvenile Coho Salmon Trapped in the South Fork Ten Mile River in 1997, By Week.

Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31
23-25													
26-28													
29-31													
32-34					2								
35-37													
38-40													
41-43													
44-46													
47-49													
50-52													
53-55													
56-58													
59-61													
62-64													
65-67													
68-70													
71-73													
74-76													
77-79									1				
80-82						1				4	1	2	
83-85						1	1		2	3	1	2	1
86-88									3	10	10	8	
89-91						1	1		1	8	11	9	6
92-94							2		3	6	14	21	6
95-97						1	4		4	11	16	29	13
98-100							2		4	13	12	27	4
101-103						1			2	16	11	19	5
104-106							1		5	6	7	15	4
107-109										7	3	8	3
110-112							1		4			5	
113-115									1	1		1	
116-118										1			
119-121													
122-124													
125-127													
128-130													
131-133													
134-136													
137-139													
140-142													
143-145													
146-148													
149-151													
152-154													
155-157													
158-160													
161-163													
164-166													
167-169													
170-172													
173-175													
176-178													
179-181													
182-184													
185-187													
188-190													
191-193													
194-196													
197-199													
200-202													
203-205													
206-208													
SUM Y+	0	0	0	0	0	5	12	0	30	86	86	146	42
AVE LEN						90.6	96.5		98.1	96.7	95.7	97.9	97.1
SUM YOY	0	0	0	0	2	0	0	0	0	0	0	0	0
AVE LEN					33.0								

Table 9 Length Frequency Distribution of Juvenile Steelhead Trapped in the South Fork Ten Mile River Basin in 1997, By Week.

Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May 25-31
23-25													
26-28					1	7	1						3
29-31				1	1	19	28						10
32-34							3						7
35-37													3
38-40													
41-43													
44-46													2
47-49													
50-52													
53-55													
56-58													
59-61										1			
62-64													
65-67							3						
68-70					1		1			1	2	3	
71-73						1	2		2	3	7	1	
74-76					1	4	2		8	4	5	10	
77-79					1	3	5		1	9	6	7	3
80-82						4	2		7	4	14	8	3
83-85					1	5	8		4	15	12	9	3
86-88					1	7	9		3	9	16	12	1
89-91					1	1	7		4	10	7	9	3
92-94					4	4	3		2	4	9	12	3
95-97						2	4		3	1	11	10	1
98-100				1		2	1		3	6	3	5	1
101-103						2	3		1	4	4	3	
104-106				1		2	2			3	1	4	3
107-109						2			1	2	1	1	1
110-112						1	2			1		1	
113-115				1	1		2			2		2	2
116-118				2	2		1		1			3	1
119-121						1			1		2		1
122-124									1			3	
125-127					1							1	
128-130					2								
131-133					2	1							
134-136						1	1				1	1	
137-139					1		1						
140-142					4	1	2			1		1	
143-145					1	2	2						
146-148					3	6	5						
149-151					2	3	1						
152-154					1	1	1						
155-157					3	4	3						
158-160					6	1	2						
161-163					1		1			1			
164-166					2	2	1						
167-169					5	1	1						
170-172					1	1	1						
173-175					2								
176-178					1	1							
179-181					1								
182-184													
185-187													
188-190													
191-193													
194-196													
197-199													
200-202													
203-205					1								
206-208													
SUM Y+	0	0	0	5	53	68	79	0	40	81	101	108	26
AVE LEN				110.4	140.1	113.4	108.0		88.4	89.6	87.5	91.5	94.2
SUM YOY	0	0	0	1	2	26	32	0	0	0	0	0	25
AVE LEN				30.0	28.5	29.2	30.2						32.4

Table 10 Length Frequency Distribution of Juvenile Chinook Salmon Trapped in the South Fork Ten Mile River Basin in 1997, By Week.

Fork Length	March 2-8	March 9-15	March 16-22	March 23-29	April 30-5	April 6-12	April 13-19	April 20-26	April-May 27-3	May 4-10	May 11-17	May 18-24	May-July 25-31
23-25													
26-28													
29-31					3								
32-34					2	1							
35-37				1	26				3				
38-40				2	31	14	1		1	2			
41-43				1	4	4	4		9	8	1		
44-46						2	2		2	14	2	1	
47-49						5			11	15	3	2	2
50-52									9	11	4	5	4
53-55									7	20	9	4	6
56-58									6	14	18	4	5
59-61									6	12	8	10	2
62-64									3	13	10	3	2
65-67									1	5	4	2	4
68-70										5		1	2
71-73											1		1
74-76													1
77-79													1
80-82													
83-85													
86-88													
89-91													
92-94													
95-97													
98-100													
SUM	0	0	0	4	66	26	7	0	58	119	60	32	30
AVE LEN				39.0	37.4	41.4	42.4		50.6	53.9	57.3	57.2	59.4

Prickly and coastrange sculpin numbers were 1,077 and 448 respectively. Smith Creek unlike Campbell, had pacific lamprey *(Lampetra tridentata* present Both the adults and juvenile were observed. One aquatic garter snake *(Thumnophis couchii,* one red-legged frog, 2 Pacific treefrogs (Hyla regilla), one bull frog *(Rana cutesbeiunnu)* and yellow-legged frogs were also trapped. Three unusual salamanders, painted ensatinas *(Ensatina eschscholzi picta),* were also captured in Smith Creek trap.

The first yearling coho was captured on March 8 and the last on the last day of trap operation, May 31. Numbers peaked the first week of May. Steelhead trout peaked between the 13th and 18th of April with a secondary peak in early May coinciding with the yearling coho peak. The first coho fry were observed on March 19 and peaked in late March. Steelhead fry were first captured on March 9th and peaked in late April and early May. Prickly sculpin numbers peaked in mid-March while coastrange sculpin peaked in late April to early May.

The South Fork trap was first set on March 27th. The trap was pulled March 30 for a day and reinstalled the next. The trap was again pulled on the 18th of April and reset on April 30th. Trap was in operation a total of 52 days. The trap was located approximately 200 yards above the mouth of Campbell Creek. There were 2,126 chinook *(Oncorhynchus tschawytscha)* fry captured this year. This is the first out of three years of trapping that chinook have been found in SF Ten Mile outmigrant traps. 411 yearling coho were captured as well as 601 yearling steelhead. Coho fry totaled only 2 fish while steelhead fry numbered 4,3 13. One dead coho smolt was observed in trap. This, a 85 mm fish, had been eaten by a large sculpin and was found with its tail sticking out of the sculpins mouth. No yearling or older steelhead mortalities were observed. The mortality rate for chinook fry was 0.24 percent and for steelhead fry, the observed mortality rate was 0.36 percent.

Prickly sculpin numbered 1,026 while coastrange sculpin numbered 690. The number of three-spine stickleback were 393. Twenty adult and 50 juvenile Pacific Lamprey were captured as well as three western pond turtles *(Clemmys marmorata).* All frogs captured were yellow-legged frogs. Only a singe giant Pacific salamander was captured. Both red-bellied and rough skinned newts were observed with red bellied salamanders being observed mainly in the early portion of trapping and rough skinned salamanders occurring later.

Salmonid Length Frequency Distributions

The weekly length frequency distributions of trapped salmonids are given on Tables 4-10. Weekly mean lengths are summarized at the bottom of each table for both Young-of the-Year (YOY) and yearling or older fish. During the data entry process it became apparent that one sampler consistently had fish that weighed less than other samplers. Upon examination of the data. it was determined. and substantiated by the sampler, that total lengths had been taken instead of fork length. To adjust for this, his coho and steelhead average lengths were compared to other samplers by monthly periods for each trap independently. For "other" samplers, fork length measurements were generally about 92 percent of total length measurements. All yearling coho data taken by this sampler was adjusted for this difference and these lengths incorporated into the length frequency distribution tables. For steelhead trout, the fork length average generally about 97 percent of total length. The more pronounced fork in the caudal fin of coho smolts was responsible for the difference between the two species. Also, a smaller percentage of steelhead were in smolt condition overall and parr generally have a smaller difference between total and fork length. Fish measured in total length were not part of the data set shown in Appendix 2, showing length/weight comparisons.

Weekly average lengths for coho and steelhead trout are shown in Figures 3 & 4, respectively. Coho averaged slightly larger in Campbell Creek. The smaller average size of steelhead in late April and May, compared to the earlier period, appears to result from the older age (Age 2 or older fish) having already emigrated out of the stream. During the early period, there appears to be a surprisingly similar change from week to week in the average length in steelhead (Figure 4) for the 3 streams and a similar but less pronounced change for coho the same week. This perhaps could have been influenced by the New Moon which occurred on April 7th or quick drop in stream temperatures which started on March 3 1. Elevated levels of outmigration have been associated more with a drop in temperature than lunar phase in other studies (McMahon and Holtby, 1992). The length frequency distribution (Table 9) for juvenile steelhead in the South Fork seems to show a more defined age 2 component than in Campbell or Smith Creek. These data indicate, that for the South Fork, there is an age/length separation between Age 1 and Age 2 at about 122 mm in the late March to mid-April period and the average length of Age 1 steelhead is around 90 mm while for Age 2 fish, the average is about 150 mm.

Figure 3. Weekly length of coho salmon yearlings in Campbell Creek, Smith Creek and the South Fork Ten Mile River in 1997.

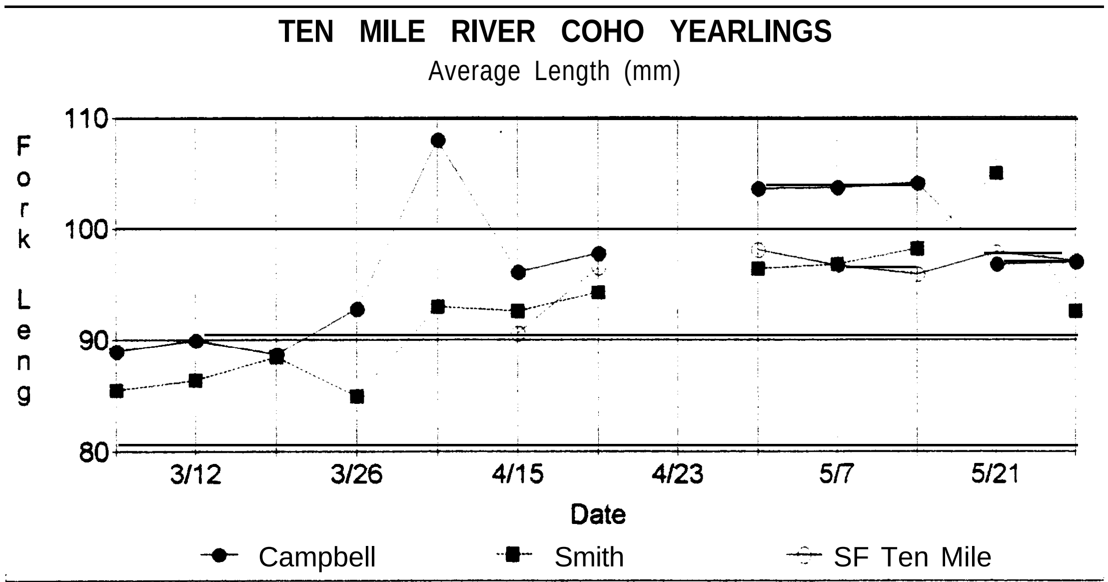
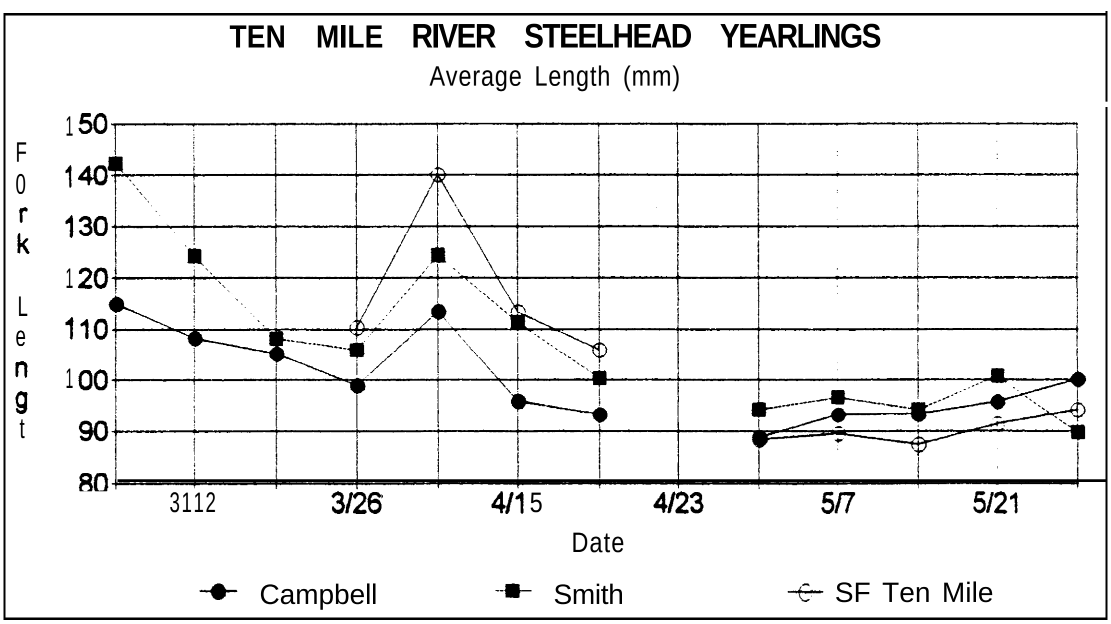


Figure 4. Weekly average lengths of Age 1+ steelhead trout in Campbell Creek, Smith Creek and the South Fork Ten Mile River in 1997.



Populations of Outmigrants

Outmigrant traps were not set up to capture all outmigrant salmonids. Side channels were kept open during elevated flow periods in order not to inhibit adult fish from being able to migrant upstream. Secondly, trap design could not prevent fish once they entered livecar, from exiting again and searching for other means to bypass trap. Also, traps were removed occasionally during high flows to prevent flow related mortalities. In order to estimate trap efficiency, juvenile steelhead were marked with a caudal fin clip and released upstream. No coho were marked in an attempt to reduce any handling stress on the species since it was "listed" as a species threatened with extinction.

On the lower portions of Tables l-3, are given "expanded" numbers of trapped animals. This accounting for days which traps were not operated is necessary to estimate the total number of organisms which have moved past the trap site. Generally, species counts are 20 to 25 percent higher when accounting for days when traps were not operational. In Table 10 is shown the recovery rate for marked steelhead in each of the three streams. Data is broken down into recovery rates for both steelhead parr and smolts. The recovery rates for the entire period are shown at the bottom of Table 10. Smolt recovery rates are higher at both Smith and Campbell Creek than they are for parr. The opposite situation is found on the South Fork.

Recovery rates of marked fish are used here to estimate the number of fish that passed the traps unobserved. The average recovery rate for steelhead smolts is utilized to estimate coho smolt trapping efficiency. Combined smolt and parr recovery is utilized to estimate juvenile steelhead trapping efficiency. Table 11 below gives estimates of the total number of coho and steelhead moving downstream past the trap sites in the period between when the traps were first set though the end of May. In both 1995 and 1996 (Maahs 1995; Maahs 1996b), the number of juvenile steelhead trapped in June was a significant portion of the total numbers of outmigrants. To estimate the number of fish which would have migrated in June of this year, the average number of steelhead trapped per day in 1996 was compared between the two months. The ratio of May and June catch rates from 1996 and the number of fish trapped in May of 1997 were used. to estimate what number of fish would have been trapped in June of 1997 if traps had been in operation. Estimates of the total number of yearling coho and Age 1+ steelhead moving downstream past the trap sites are shown in parentheses at the right hand side of Table 12.

Coho Relocation

A portion (up to 50 %) of coho fry in this program were to be utilized as a means of restocking the headwaters of the South Fork Ten Mile River basin. When coho fry began showing up in traps STMA began transporting some to headwater areas. Few coho were actually moved due to the low number of fry and short duration of the downmigration period. In Campbell Creek, out of the total of 205 coho fry trapped, 96 percent were found between March 26 and March 3 1. On Smith Creek, out of 208, 64 percent were trapped between these two dates. By the time the transportation operation was set up and running, the numbers had dropped to too low a level to make the transportation effort worthwhile.

There were 33 coho fry transferred to the upper SF, 15 to upper Redwood Creek and 2 Campbell Creek fry were transferred to upper Campbell Creek (see Figure 2). Most fry transferred originated from Smith Creek due to the longer period of availability. The relocation period extended only from March 30 to April 1. Only three Campbell Creek fish were relocated, 2 to upper Campbell Creek and one to the upper South Fork. All other coho released into Redwood Creek and the South Fork originated from Smith Creek. Lengths of relocated coho fry were between 29 and 33 mm fork length. No mortalities were observed and all fish appeared healthy at release. The trip by vehicle took about 60-70 minutes to reach the upper South Fork and Redwood Creek and about 12 minutes to reach upper Campbell Creek.

On the first trip, 15 coho fry were brought in a 5 gallon bucket from Smith to Campbell Creek where fish were picked up by a separate transportation crew. Fresh water was added to bucket from Campbell Creek and water temperature checked (1 1°C). The bucket was sealed with tight lid and placed in floor board of pick-up truck to prevent spillage. Midway (about 30 minutes later) temperatures were checked. Temperature in bucket had risen 1° C and fresh water was added to bucket. Freshwater was again mixed into bucket 20 minutes later at the road crossing on Redwood Creek and water temp brought down to 10 degrees for remaining portion of vehicle trip which consisted of about 10 minute vehicle ride over rough 4 wheel drive terrain. Finally, the fish were transferred to gallon sized zip sealed plastic bags (4 or 5 fish per bag), placed into backpack lined with insulation, and carried down into Redwood Creek about an 8- 10 minute trip. Water temperature in bags were 11 degrees when completing trip. Redwood

Creek temperature at the time was 10 degrees. Fish were slowly released in quite water just above pool with a considerable amount of woody debris. No salmonids were observed in the area.

For transportation to the upper South Fork, the procedure was similar except a zip sealed bag of ice was inserted into bucket to keep temperatures from rising. The vehicle trip took about 1 hour and 10 minutes. Fresh water was added once during trip. The backpack trip took only about 3 minutes. Water temperature in bags was 12 degrees both times fish were brought to this site. Stream temps were 10 degrees on March 30 and 8 degrees on April 1st. Each time plastic bags were placed in the stream to decrease temperatures and slowly stream water was mixed into bags before release. No salmonids of any kind were observed in area although there was a fresh redd immediately upstream of release site. There was also a partial salmonid (steelhead presumably) carcass in an adjacent pool. Gravel quality appeared quite good with few fines and good quantities of large and small woody debris were present. A few juvenile Giant Pacific Salamanders were also present

Table 12. Estimated population of coho and steelhead migrating downstream past trap sites on Campbell Creek and Smith Creek from March 2 through May 3 land the South Fork from March 23 through May 3 1.

Stream	Species	Number Trapped *	Trap Efficiency Estimate	Population Estimate**
Campbell	Coho	297	58%	512 (512)
	Steelhead	1048	47%	2230 (2367)
Smith	Coho	452	62%	739 (729)
	Steelhead	840	54%	1555 (1700)
South Fork	Coho	411	24%	1713 (1726)
	Steelhead	601	27%	2226 (3 172)

* These numbers expanded for full week of trapping (see Tables l-3)

** Number in ( )'s include June estimates of outmigrants extrapolated based on monthly ratios of past trapping seasons

On the second trip (April 1) to release coho fry in this area, about 10 fry were observed in the area where initial release occurred and just downstream a bit. No fry were observed above the riffle immediately upstream or for another 450 feet upstream; although two other redds were observed in this area. While it could not be confirmed that the observed fry were coho, it would appear that many of the coho fry released had stayed in the area where they had been released two days earlier. These fry were observed to be feeding at the surface as well as around the decomposing carcass.

One trip to release coho fry into upper Campbell Creek was made. Only two fish were available for transport of that day. The vehicle trip took about 12 minutes and about another 12 minutes for the backpack trip. Stream temperature was 10 degrees while water temperature in bags were 12 degrees. Stream was low gradient with considerable canopy from a very dense conifer forest. No salmonids were observed in area. Juvenile giant Pacific salamanders were present. The lack of salmonids probably indicated a barrier to migration downstream as the stream appeared to be very suitable rearing habitat.

Sculpin Predation

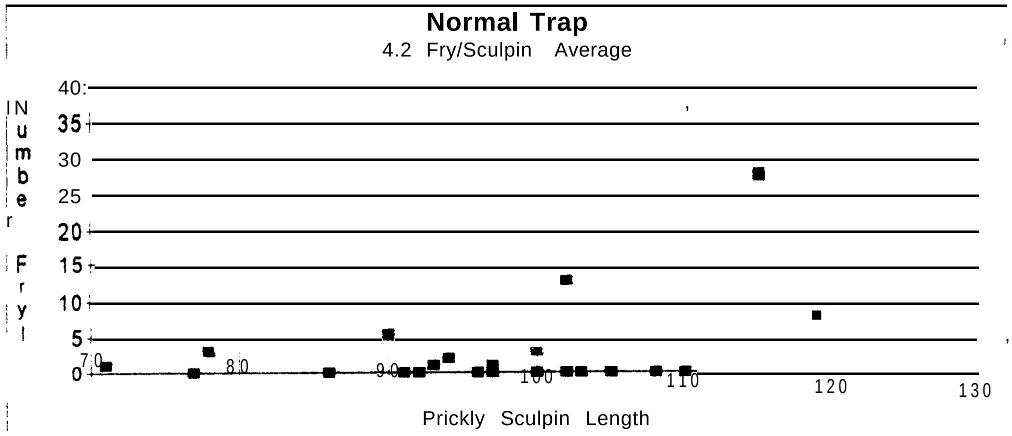
In all, STMA was allowed to sacrifice ten sculpins per week, a total of 50 sculpins for stomach content examination. Due to the fact that predation impacts are likely affected by size of sculpin, number of fry present, water visibility and other factors, results of stomach sampling efforts could not be well documented in this study. In this study, only prickly sculpin were sampled and only in Smith Creek. The sampling period is divided into two intervals. The first is where the “normal” trap was in operation. The second period is where the “sculpin” trap (l/2 inch mesh livecar) was installed in front of the normal trap which from here on will be referred to as the “fry” trap as it was designed to capture the fry which were able to pass directly through the sculpin trap located immediately upstream. The sculpin trap retained all but the smallest trout and sculpin which were able to pass through the l/2 inch mesh along with the fry. Figure 5 shows the number of fry found in sculpin stomachs for the three trap types by sculpin length. The top graph shows results for the normal trap, which operated in Smith Creek up until April 9th. Here, a 4.2 fry/stomach average resulted. It can be seen that the largest sculpin were primarily responsible for overall mortality. The two lower graphs shows the results found during the period that the sculpin and fry trap were being operated (from April 10 through May 3 1). For sculpin sampled in the sculpin trap, there was an averaged of 0.9 fry/stomach. In the fry trap, 2.8 fry/stomach were found. The general indication is that the losses in the sculpin trap were about l/3 the rate compared with the normal trap. There is a background level of natural predation on fry in the stream which has not been assessed in this study. Due to the fact that the yearling trap offers immediate escape for fry the rate of predation in this trap may be indicative of what is typical for this stream, although, because of the sculpin’s inability to pursue its prey past the trap mesh, its normal success rate in capturing prey may actually be inhibited.

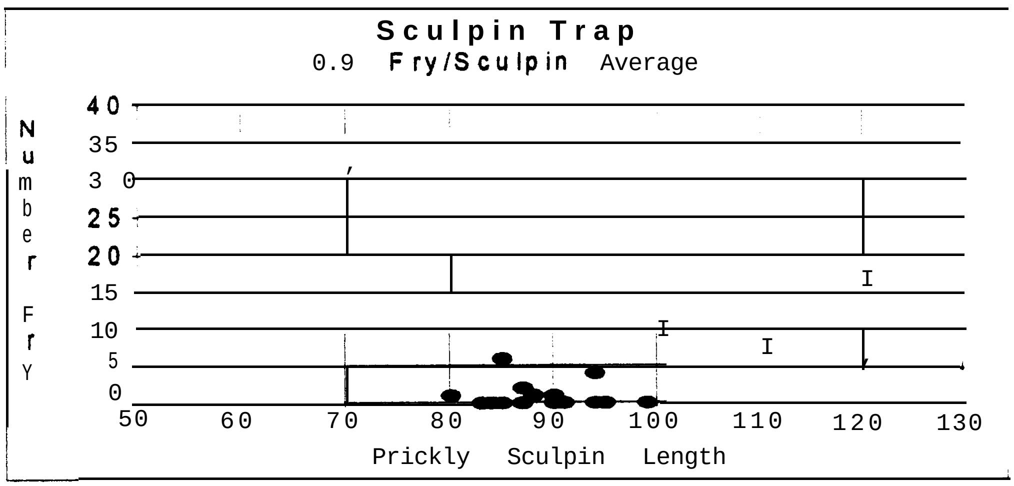
Utilizing the length frequency distribution for Smith Creek (see Appendix 3) prickly sculpin and rough estimates for fry predation by size, an estimate of fry loss due to sculpin predation in traps can be made. The average number of fry per stomach for sculpin 1OO mm or less was 1.6 in the normal trap operation. For sculpin between 100 and 110 there were 2.9 fry per stomach. For fish over 110, the average was 25 fry per stomach. Data for the this largest group was very limited with only three samples taken.

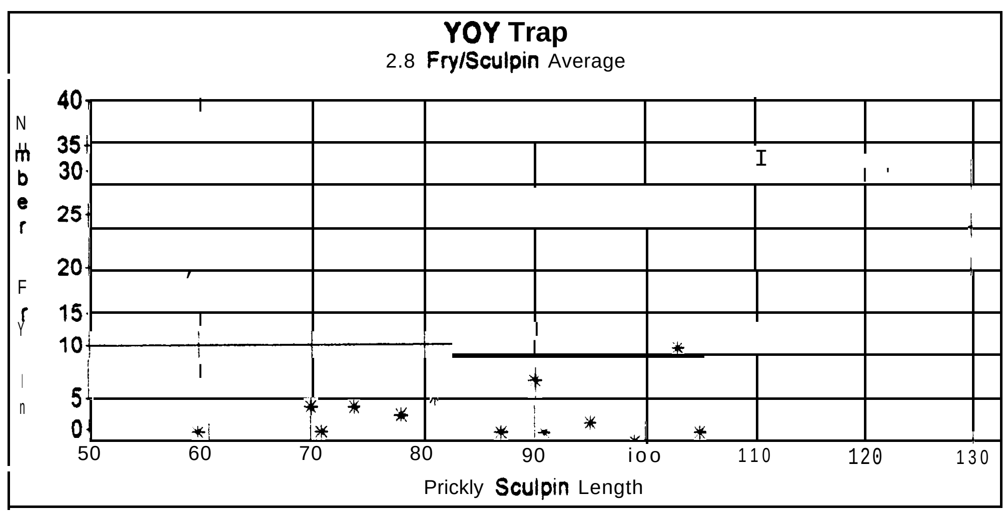
Utilizing the number of sculpin trapped (Table 2) and their length frequency distribution to construct the length distribution for the entire trapped population results in 775 prickly sculpin 1 00 mm or less, 200 from 10 1 to 11 Omm, and 103 greater than 1l0 mm in length trapped in Smith Creek this season. From this, it is estimated that there were 1240, 560 and 2,575 fry eaten in each of the three size groups, respectively, for a total of about 4,400. Assuming similar predation rates for coastal sculpin, there could be an additional 1,500 fry eaten, or nearly 6,000 overall- if a normal trap had been operation throughout the trapping period. This estimate should be considered very rough due to so few fish being sampled (only about 3.5 percent of the prickly sculpin were sampled and no coastal sculpin) and estimates take no accounting for the number of fry present during particular days that were selected for sampling. Assuming for the moment that the estimate of 6,000 fry ingested in traps is reasonably accurate, with the total number of fry counted in trap this year being 17, 621, about 1/4 of total population entering the trap may have been eaten by sculpin. A trap that allows all fry to escape appears to offer a significant reduction in the losses compared to a trap which retains fry.

The information clearly indicates that sculpin predation in normal traps, even with wire mesh separators, can result in a notable loss to the YOY population. The significance of this level of predation to the potential population of rearing salmonids needs to be considered while looking at the overall effect of predation in the stream. While this study did not determine what the natural levels of predation were, some indication of the potential losses due to sculpin predation are possible. Assuming that the ingestion rate of 0.9 fry per day as found in the in the trap with 1/2 mesh is indicative of the natural background level of predation, the loss of fry to sculpin can be estimated. Based on the expanded number of prickly and coastal sculpin in Smith Creek from Table 2 being over 1,700, and assuming some portion of sculpin pass traps uncounted, the population of sculpin in Smith Creek is likely to be at least 2,000 this year. While there is no information available to indicate what portion of the sculpin population actually moves downstream and leaves the tributary during their spawning migration, it is assumed here that the entire adult population does migrate. At a feeding rate of 0.9 fry per day (which assumes that the 0.9 fry per stomach is the same thing as a daily ration- a likely underestimate), and if the sculpin population has three months of access to fry (the duration of this years trapping period) the natural losses of fry over this time frame could be as high as 160,000. Whether or not this number accurately reflects reality, the significance of predation upon fry can not be dismissed. Considering the absence of the larger (>l 1 Omm) sculpin in traps during the period where the sculpin and fry traps were operating, the inability of sculpin to persue their prey beyond the trap wall, the assumption that gut contents are equal to daily rations, the impacts of other predators

Figure 5 Number of salmonid fry observed in sculpin stomachs by length for each of three trapping scenarios. Normal trap was operated earlier in year than other two types which were sampled concurrently







such as frogs, salamanders, and coho and steelhead smolts, and the remainder of the year where predation impacts could occur, one would expect overall losses to be much greater than estimated above.

DISCUSSION

Besides this years operations, outmigrant traps have been operated the prior two years in the South Fork Ten Mile River (Maahs 1995; Maahs 19963) and last year in both Campbell and Smith Creek. Spawning surveys were also conducted in Smith and Campbell in 1996-97 (Maahs 1997) and throughout the South Fork basin in 1995-96 (Maahs 1996a). Below is a discussion of this year's trapping results at each of the three trap locations compared to those of past years. Also, those results are discussed in relation to results of spawning surveys as well as other information relating to summer rearing densities obtained from other sampling efforts.

Campbell Creek

In 1996, the estimated number of Y+ coho in Campbell Creek was 34 (Maahs 19963). That compares to 5 12 this year, about a 15 fold increase. Steelhead estimates in 1996 were 2,379 which is nearly identical to this year estimate of 2,367. For coho fry, there was a dramatic decrease this year where only 205 were trapped compared to 1996, where 4,493 were counted. Fairly comparable numbers of steelhead fry, in the range of 20,000, were trapped each year. The number of frogs was higher this past year (46 compared to 25 in 1996) and included 10 red-legged frogs where none were trapped the prior year even with a total of 27 less days of trap operation. The lack of any lamprey this year was consistent with the 1996 data.

Smith Creek

The coho estimate in 1996 was 89 while this year 729 have been estimated. In 1996, the estimated number of yearling steelhead outmigrating past the trap was 3,954 where this season the estimate is 1,700. It appears that coho numbers have increased 8 fold while steelhead numbers are down to less than half of what they were in 1996. The number of coho and steelhead fry are also down. Only 208 coho fry were counted this year compared to about 2,500 last year. Last year about 40,000 steelhead fry were estimated while only 24,000 are estimated this year. Sculpin numbers were up this year. With , fewer days of operation, about 1,500 sculpin were counted which compares to 900 last year. Three-spine stickleback numbers were down to a third of last year's count. The number of frogs were up in Smith Creek this year also; a count this year of 46 compares to 7 in 1996.

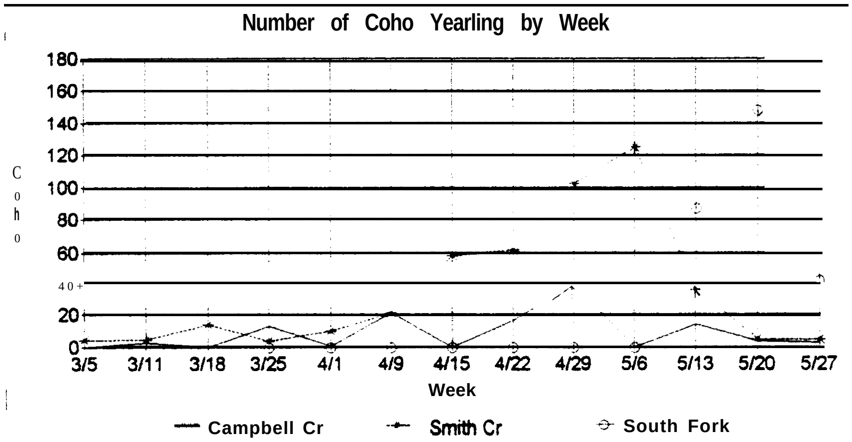
South Fork Ten Mile

In 1995 an outmigrant trap was operated in the South Fork about a half mile downstream of Campbell Creek. It was estimated that 21 coho smolts migrated downstream from May 19 to June 30 (Maahs 1995). From May 19 to May 3 1 of 1997, there were 158 coho smolts trapped from which almost 490 would be estimated based on trap efficiency rate. There is also an estimate of another 54 coho smolts moving downstream in June. For a fair comparison, a few additional coho from Campbell Creek should be included which would bring the estimate to around 559 coho smolts in 1997 for the same period. The 1995 estimate is only 3.7 percent of the 1997 estimate for the same time period. This year's estimate for the total coho smolt population in the South Fork is 1,726. At 3.7 percent, the 1995 estimate would be at 64 coho smolts.

In 1996, the outmigrant trap in the South Fork was located in the same vicinity as this year's. In 1996, the trap did not begin operation until early May but extended through June. In 1997, the trap was set in late March and operated through the end of May only. Comparing data only from the month of May 1996, the average catch of coho per day was 1.27. In 1997, the catch was 12.7 per day, about a 10 fold increase. At one tenth of 1997, the 1996 estimate of the outmigrant population would be about 170 Y+ coho.

In Maahs (1996b), an estimated population of 493 Y+ coho was derived for the South Fork Ten Mile. It was assumed that the South Fork had a outmigration timing similar to Campbell and Smith Creek. Since the South Fork trap was not installed until May 3rd, the proportion of fish trapped at Smith and Campbell before that date was used to estimate the number of early outmigrants in the South Fork Based on this years results, that assumption appears faulty. Figure 6 shows the weekly numbers (expanded for non-operational days) of coho counted at the three streams. Clearly, the peak outmigration occurred later in the South Fork than either Smith or Campbell Creek which indicates that the 1996 estimate was likely inflated.

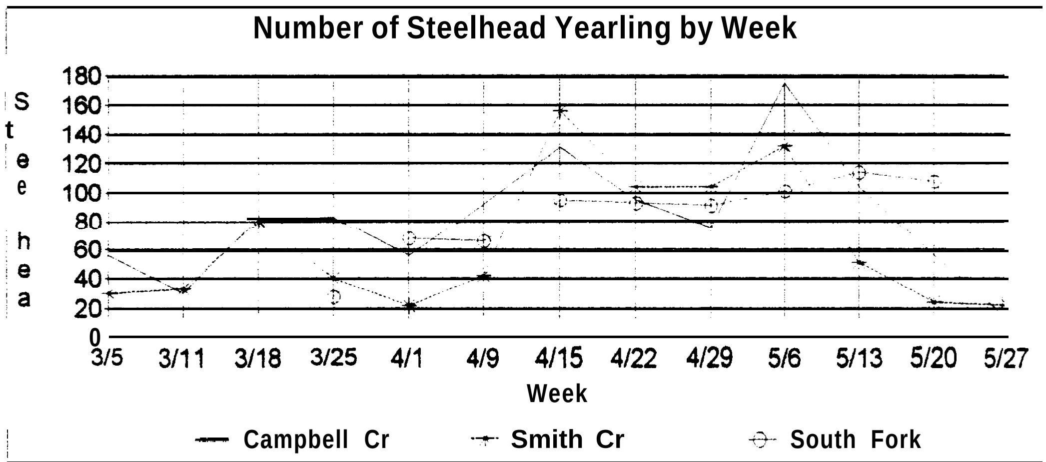
Figure 6. Expanded number of coho trapped per week in Campbell Creek Smith Creek and South Fork Ten Mile in 1997.



For a comparison of the numbers of steelhead trapped in the South Fork in 1995, 1996 and 1997, only data for the Month of May is compared since no trapping was conducted in 1997 in June and none prior to the last two days of April in 1995. In 1995 for 19 days of operation in May, there were 92 Age l+ steelhead trapped, or 4.8 per day. In 1996 for 22 days of operation, there were 9 14 Age 1+ steelhead trapped, or 4 1.5 per day. And in 1997, there was for 3 1 days, 388 trapped, or 12.5 per day.

The 1996 estimate of the number of Age l+ steelhead migrating downstream in the South Fork (Maahs 1996b) also was based in part on the assumption that the outmigration timing in the South Fork was similar to Campbell and Smith Creek. Figure 7 shows the number of steelhead trapped per week in the South Fork this year. Here, timing between the three streams are similar but with a somewhat later peak occurring in the South Fork in the mid May period. This same peak timing occurred in 1996 which also came about two weeks later than either Smith or Campbell Creek. This indicates that there was also an overestimate of the steelhead population in 1996. Using this years estimate of 3,172 Age 1+ steelhead as a starting point, the populations for 1995 and 1996 can be estimated utilizing the May average catch/day rates. With the 1996 average of 4 1.5/day being 3.3 times the 1997 estimate, the 1996 population of steelhead moving downstream past the trap site would be about 10,500. This is considering that the recapture rate was same for steelhead both years. In 1995, the rate was about half the later two years. With this consideration, the 1995 population would be estimated at roughly 2,400.

Figure 7. Expanded number of Age 1+ steelhead trapped per week in Campbell Creek Smith Creek and South Fork Ten Mile in 1997.



The chinook salmon trapped this year were the first that have been observed in the Ten Mile River. Chinook spawners have been observed in Ten Mile in 1989-90, 1991-92, and 1995-96 and likely originated with introductions of Eel River and other chinooks stocks made in the early 1980's (Maahs and Gilleard 1994).

Salmonid Lengths

Juvenile coho tended to have similar lengths in 1996 & 1997 in Campbell Creek with typical lengths being around 102-108 mm by late April or May. Smith Creek coho were smaller this year with lengths typically averaging around 96mm in length whereas in 1996 they tended to average around 110 mm. Coho yearlings in the South Fork were similar this year to those in Smith Creek with weekly averages around 97mm. Coho lengths this year in the South Fork are much less than those in 1996 where most coho were between 134 and 160 mm. In late May and early June of 1995, coho in the South Fork averaged around 105 mm. Two clearly separate length groups were evident in the South Fork basin in 1996 (Maahs 1996b), one of which was not present in either 1995 or 1997. These fish were quite large and were primarily found in the South Fork but several individuals were also found in Smith Creek and one in Campbell Creek, very large coho at 207 mm. It is presumed that these are the progeny of a exceptionally early portion of the spawning run which spawned in the South Fork in the fall of 1994. Based on the length frequency of coho in 1995 and 1997, this component of the outmigration was not present either of these two years.

Based on length frequency distributions (Table 5, 7, & 9), the larger, presumably older juvenile steelhead, are migrating downstream earlier than the smaller younger fish. By late April and May, most all outmigrant appear to be yearling steelhead which average just under 100 mm in length with little difference in lengths between the three streams. The age 2 component is most clearly separable in the South Fork data where in late March and April fish in this larger group ranged in length from around 130mm to 180 mm. In both Campbell and Smith, a wide range in the lengths of steelhead trout occur in this older group with no normally distributed age group apparent. Campbell Creek and Smith Creek steelhead tended to be slightly larger in 1997 than in 1996 throughout the trapping period.

Compared to 1996 length data, Campbell Creek steelhead trout were larger in 1997 during the early portion of the trapping period and it appears that there were relatively more fish in the older age group in 1997. Lengths in May were quite comparable. In Smith Creek, lengths were similar both years. In 1996, there was no data taken prior to May in the South Fork. May steelhead were generally 20mm shorter in length in 1996 than in 1997. In 1995, steelhead lengths averaged around 90mm throughout the period of late April through the end of June, similar to lengths in 1997.

Numbers versus Lengths

In Campbell Creek, with a 15 fold increase in the number of coho, there was no difference in the average length of yearling coho. In Smith Creek, coho were considerably shorter in 1997 as the population increased about 8 fold. A 10 fold increase in South Fork coho population resulted in a population 1/3 shorter than in 1996. This change may be influenced by the time of spawning instead density dependent factors. In 1995, South Fork coho averaged about 105 mm, slightly greater than in 1997 where the population was about 36 times as great.

Juvenile steelhead populations appeared to be similar in Campbell in both 1996 and 1997 with lengths slightly longer in 1997. For Smith Creek, steelhead numbers were down over 40 percent compared to 1996 while average lengths increased slightly. In South Fork, average May lengths were up 20 mm where the population dropped to only about 30 percent of that in 1996.

The high numbers of fry in Campbell Creek in 1996 resulted in higher levels of similar sized coho yearlings than in past. This, in years where steelhead number were the same, gives the impression that there could have been still higher numbers of coho salmon produced from this basin, in a comparable water year, without reaching density dependent induced limitations. Both 1996 and 1997 were years with well above average rainfall. Due to the fact that well over 5,000 coho migrated out of the system as fry, the limitation to production may be due to either inadequate fry rearing conditions or possibly high mortality due to predation and not lack of adult spawning or egg to fry survival rates.

Summer Rearing Densities

Summer rearing density information has been collected in many parts of the Ten Mile River for several years and from these data and habitat inventory information, population estimates for different areas of the basin have been made for both coho and steelhead trout (David Hines, Georgia Pacific West Corp. personnel communication). Outmigrant trapping estimates for Campbell and Smith Creek, for both coho and steelhead trout, are roughly about 10 percent of density based estimates. For the South Fork, the steelhead trout estimate is only about 1 percent of that based on summer rearing densities, while for coho, the outmigrant trapping estimates are about 50 percent of density based estimates. Of all estimates, the most unreasonable appears to be the outmigrant estimate for steelhead trout in the South Fork. There are about 47 miles of class I stream in the South Fork and its tributaries above Campbell Creek. This compares to less than 6 miles in Campbell Creek (Georgia-Pacific West. Inc. 1997). The estimates for steelhead based on outmigrant trapping are similar for both these basins but, based on summer densities, there are about 9 times more in the South Fork than Campbell Creek . It does not seem likely that some error in estimating the outmigrant population of steelhead in the South Fork resulted in an underestimate, since, unlike for Campbell and Smith Creek, the estimated population of coho in the basin is quite close for both estimation procedures. Without doubt, the entire population of steelhead in the upper basin did not outmigrate and pass the trapping site and there is certainly a large portion of the population which would stayed behind to rear for another year in fresh water. But this does not explain the above discrepancies. One explanation is that in the South Fork, a large proportion of the steelhead population leaves the basin during the winter period, prior to trapping, and that the same motive for emigration is not present in either Smith or Campbell Creek. Significant over-winter mortality rates for steelhead in the South Fork could also explain the low number of steelhead trapped.

Spawner Survey Data in Ten Mile in 1996-97

Only two areas in the Ten Mile River had spawning surveys in 1996-97. These two areas were Campbell and Smith Creek (Maahs 1997). Low numbers of coho spawners were estimated in both Smith and Campbell. Perhaps only 2 to 6 pair were estimated to have spawned in Campbell and 2 to 8 pair in Smith Creek. These numbers are down, about 20 to 40 percent of that in 1996 (Maahs 1996a). This low number of spawners is further documented by the dramatic decrease in the number of coho fry trapped this year. In Campbell Creek, this year coho fry are only about 3.5 percent of 1996 number, and in Smith, numbers are only about 5 percent of 1996. The timing of spawning both years is quite similar with fish first showing up on spawning grounds the first week of January.

For steelhead, the 1997 spawning survey (Maahs 1997) indicated that steelhead spawning activity was up dramatically in Smith this year compared to 1995-96 and to a lesser extent in Campbell Creek as well. The number of steelhead fry counted did not follow spawning survey indication of increased spawning. The numbers of fry trapped this season are down in Smith while remaining similar to last year in Campbell Creek.

The low number of coho spawners in the South Fork Ten Mile in 1996-1997, as evidenced by both the low number of spawners in Smith and Campbell Creek and the limited number of YOY coho trapped, are the returns from the 1994-95 spawning year. In this estimated in this report that only 64 smolts were produced from the South Fork basin above Smith Creek from that brood. It would appear, even at very low numbers, those smolts did survive at a high enough rate to allow for a continuation of the coho run since coho fry were trapped in both Campbell Creek and the South Fork this season. Further work to document summer rearing densities or number of smolts outmigrating in the 1997-98 would be needed to determine whether or not this brood has been able to maintain itself.

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