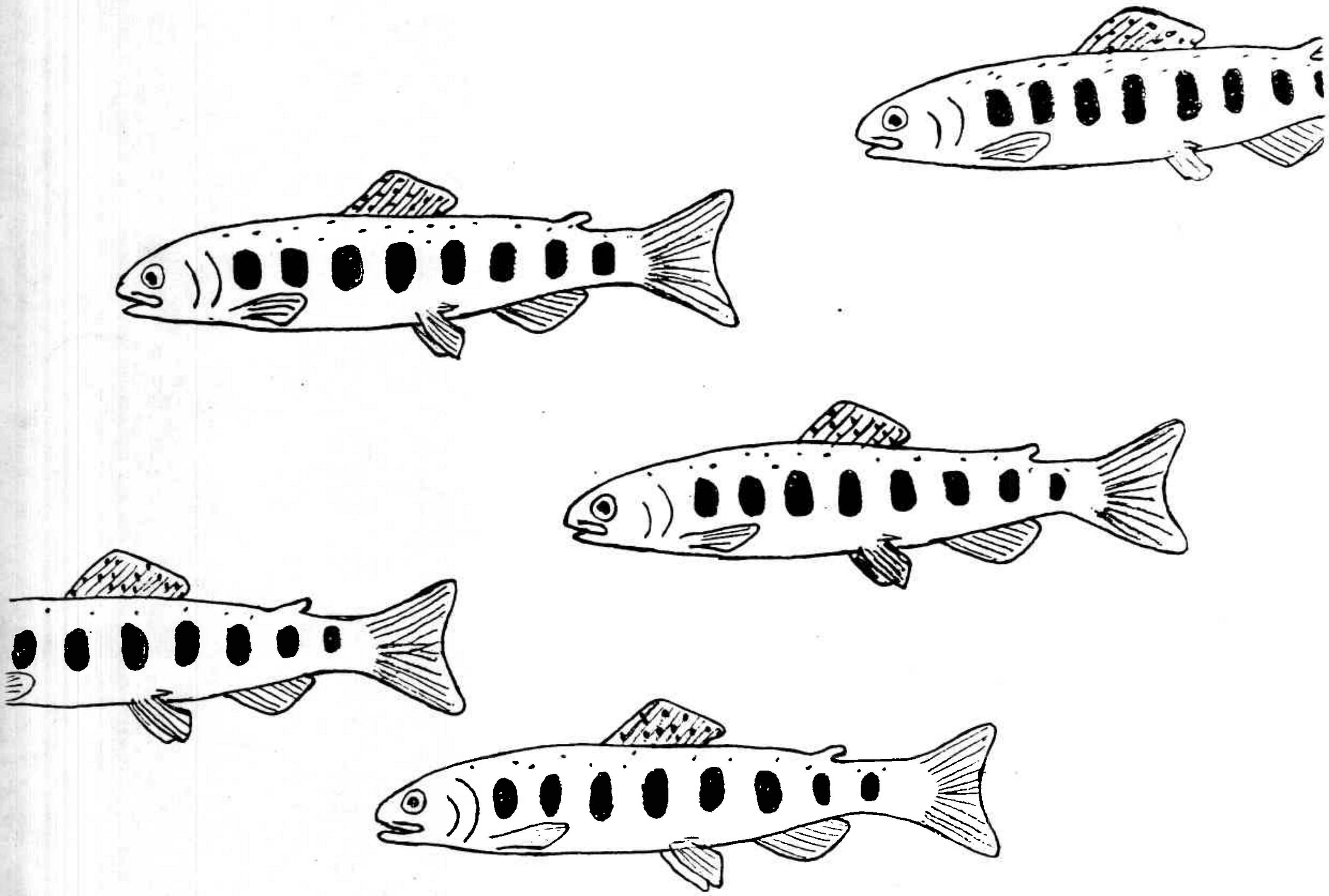
Tell - sorry this has been delayed - hope you can still use it. - Wendy

1991 and 1992 Calf Creek Migrant Trapping Results and Juvenile Steelhead (Oncorhynchus mykiss) Emigration Estimate.



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ACKNOWLEDGEMENTS

With the completion of this paper a number of special thanks are due. First great thanks are due for Dan Gale, who babysat and nursed the trap and the trap site through the 1991 trapping season. Second, thanks goes out to Jeff Dambacher who supplied the insight into the Steamboat Creek system and set up the database used to analyze the data. Thanks also goes out to Scott Lightcap for his editing help and moral support during our work on this project. Thanks to Robbie Watson for assistance in designing the rigging system for the trap. Thanks also to Jeff Dose, Barb Fontaine, Jerry Harryman, Mike Widmann, David Fix, Darrel Myers, and Jim Ward for assistance in assembling and/or maneuvering the trap at various times throughout the effort. Finally our appreciation goes out to Calf Creek, for sharing its secrets.

Respectfully,

Glenn R. Harkleroad

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EXECUTIVE SUMMARY

The Calf Creek watershed located on the North Umpqua Ranger District was monitored for emigrant juvenile steelhead in the spring of 1991 and 1992. This was done in order to comply with monitoring item CF1/NFWF 11 of the Umpqua National Forest Land Management Plan. The information that follows should prove useful in decision making for forest resource managers.

During the 1991 trapping season (3/8/92 - 7/4/92) an estimate of 3590 juvenile steelhead emigrated from the Calf Creek basin. In 1991 70% of the emigrants were age 1+ parr and 29% were age 2+ juveniles, with the final 1% consisting of age 3+ emigrants. (An age 1+ fish is one year plus an undetermined period of time less than one year of age. A parr is a juvenile salmonid not undergoing the physiological change of smoltification or preparing for ocean life.) The 1992 trapping season results were similar, with the majority of the 2161 emigrants being age 1+. During 1992 1+ made up 70% of the emigrants, while the 2+ represented 26% and 3+ contributed 4% of the total emigrants.

The emigrants left Calf Creek with the onset of rising temperatures and receding flows. It was determined that these juveniles were moving out of Calf Creek to continue their freshwater residence elsewhere in the North Umpqua River basin. The fact that the majority of the Calf Creek outmigrants are age 1+ parr is significant. Most juvenile steelhead leaving the North Umpqua River do so as age 2+ or age 3+ smolts. This has been determined to be the case by Oregon Dept. of Fish and Wildlife's trapping efforts at Winchester Dam. This means that the age 1+ parr leaving Calf Creek rear elsewhere in the system, possibly in the main stem North Umpqua River, for at least another year before they truly outmigrate to the ocean. This type of rearing strategy, as it relates to Calf Creek steelhead, is known as **partial rearing**. The partial rearing of North Umpqua River system steelhead was originally addressed by Jeff Dambacher in 1991, with his study of steelhead life history on Steamboat Creek. Along with Dambacher's study on Steamboat Creek, Oregon Dept. of Fish and Wildlife's documentation of the movement of steelhead smolts through the Winchester hydropower project also supports the idea that the emigrants are using another portion of the North Umpqua basin for continued rearing.

The partial rearing of Calf Creek steelhead in the North Umpqua River is an important factor for local resource decisions. Since Calf Creek steelhead do not rely solely on their natal stream to complete their freshwater residence, their management becomes much more involved. Due to the fact that Calf Creek juveniles may use the North Umpqua for partial rearing, resource managers have a unique challenge before them. Not only must they be concerned with Calf Creek itself, but they must also be concerned with the influence of cumulative watershed effects in the North Umpqua River. Protecting fish habitat in Calf Creek will not necessarily insure the survivability of Calf Creek's races of summer and winter steelhead. The effects of land management activities throughout the North Umpqua River drainage have potential to impact the steelhead native to Calf Creek.

In relation to the monitoring of the Forest Smolt Production Validation established in the 1990 Umpqua National Forest Land and Resource Management Plan, the trapping efforts on Calf Creek show very little actual smolt production from Calf Creek. Due to the complex juvenile life histories of steelhead in Calf Creek, Steamboat Creek, and perhaps many other North Umpqua River tributaries, this monitoring item would best be accomplished through outmigrant trapping efforts at the down river Forest boundary.

INTRODUCTION

The monitoring of juvenile steelhead (Oncorhynchus mykiss) emigration from Calf Creek watershed commenced in March of 1991. This project was undertaken in order to comply with the 1990 Umpqua National Forest Land and Resource Management Plan's monitoring plan. The monitoring plan (Chapter V, pgs. 16-17) states that "annually 20% of the class I streams" on the forest will be monitored for smolt production in order to "validate smolt output estimates" and to "determine if changes in habitat quality are occurring."

Emigration of juvenile steelhead was monitored on Calf Creek for the 1991 and 1992 spring emigration period. In the Pacific Northwest juvenile anadromous salmonids undergo a spring emigration, which is often associated with increasing water temperatures and receding flows in their natal streams (Dambacher 1991., Moring 1975.). In many river systems this emigration is also associated with smoltification of the juvenile salmonids and subsequent migration to the ocean. This behavior allows for the monitoring of a large percentage of the basin's anadromous juvenile salmonid production by the trapping of downstream migrants. Downstream migrant trapping gives a general idea of Calf Creek steelhead life history and overall basin health.

In addition to being a monitoring plan objective, the gathering of this information will help establish a database for forest resource managers. The monitoring of downstream migrants provides insights into the beneficial uses of water in Calf Creek and ultimately the North Umpqua River. This insight will allow managers to make better informed decisions as to the potential impacts of management activities and could result in more effective resource management.

BASIN DESCRIPTION AND HISTORY

Calf Creek is a third order stream located within a 12,260 acre watershed in the North Umpqua River drainage in southwestern Oregon (Figure 1). It contains approximately four miles of anadromous salmonid spawning and rearing habitat as well as eleven miles of resident salmonid (rainbow trout (O. mykiss) and cutthroat trout (O. clarki) habitat. The four miles of anadromous fish habitat are utilized almost solely by steelhead. Coho salmon (O. kisutch) have been known to use the basin but are confined to the lower 0.4 miles by a falls which appears to serve as a barrier to their passage. Spring chinook salmon (O. tshawytscha) occasionally use the lower portion of this basin as well.

Aside from the previously mentioned salmonids, Calf Creek also provides habitat for longnose dace (Rhinichthys evermanni), speckled dace (R.osculus), pacific lamprey (Lampetra tridentata), and at least one species of sculpin (Cottus spp.). Other salmonids known to use the basin include brown trout (Salmo trutta), which are thought to enter Calf Creek from the North Umpqua River; and brook trout (Salvelinus fontinalis), which in the past have been stocked in Twin Lakes. Twin Lakes are located in the upper portion of the Calf Creek watershed.

The watershed can be divided into three distinct sections. The lower most section, from the mouth up 2 river miles, has been subjected to a wide range of management practices. These management practices include timber harvest, rock quarry activities, and fire salvage as recent as 1988. The stream itself has also been extensively managed, with the construction of 176 habitat enhancement structures from 1984 to 1989. These habitat structures include blast pools, rootwads, boulder clusters and wing deflectors. The need for these improvement projects was likely created by the sluicing of the main channel that occurred during the 1964 flood. This lower section of the main stem of Calf Creek has also been the focus of steelhead spawning ground surveys in 1991 and 1992, and of stream habitat inventory surveys in 1989, 1990, and 1991.

The middle section of the basin, from river mile 2 to river mile 6, is currently being managed as a roadless area. Up to this point there has been no timber harvest activity in this section of the basin.

The upper most section of the Calf Creek (above river mile 6) basin has been managed extensively for timber harvest since the mid 1950's, with re-entry into the basin in the early 1960's and the late 70's and 80's. Although no sales have taken place thus far in the 1990's, there are two sales currently proposed for this basin. Combined, these sales consist of 89 acres which are to be clearcut and another 599 acres which are to be shelterwood cut.

MATERIALS AND METHODS

TRAPPING

Downstream migrating juvenile steelhead were trapped using a 5' diameter rotary screw migrant trap (Fig. 2). The trap was located 0.2 miles above the mouth of Calf Creek and was fished in a scour pool where the channel bottlenecked down to a width of approximately eight feet. This site was chosen for two reasons: 1) the constriction of flow provided optimum conditions for trapping and 2) the flow constriction also helped direct the migrants into the drum by increasing the percentage of the flow being effectively trapped. The trap was held in place and maneuvered in order to adjust to flow conditions using a series of pulleys and a tether line of half inch diameter cable.

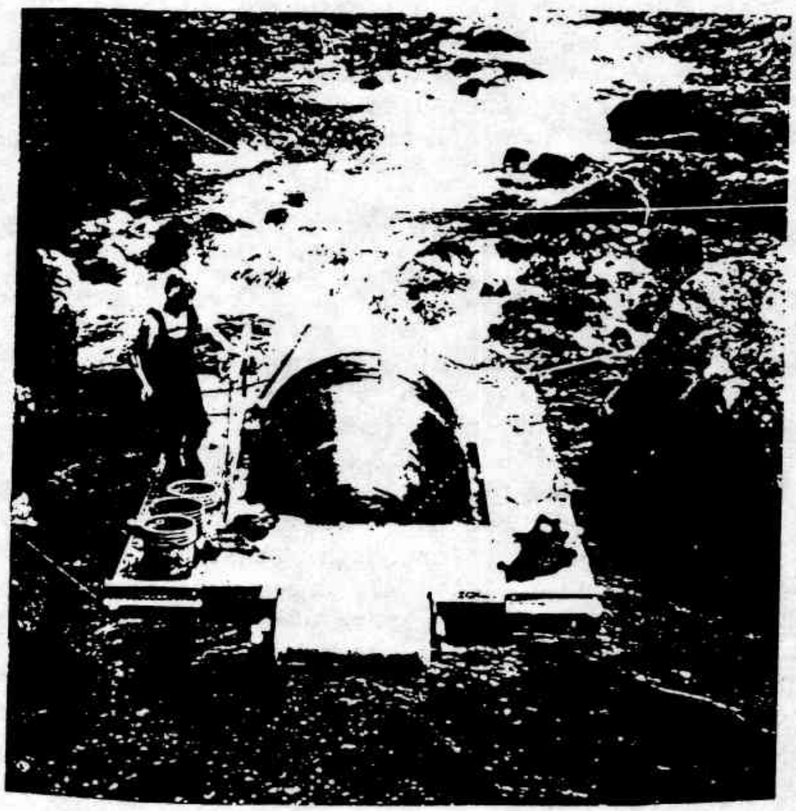

Fig 2. Rotary screw migrant trap in Calf Creek.

Under high flow conditions the trap was moved to the back of the pool area in order to keep it from being damaged by the flow and/or debris. When flows reached levels where it was judged that the trap could not be safely fished, the trap was pulled out of the main channel into a cove created by a bedrock outcrop until flows receded and it could be re-installed.

During low flow conditions (i.e. approaching summer base flow conditions) trap site modification was necessary. When the flow neared these levels we were forced to excavate substrate from below the drum in order to keep it turning freely. Along with this, approximately 50 meters of channel immediately above the trap site was modified to maximize the flow of the water into the drum and reduce possible migration routes around the drum. This was accomplished through the building of rock berms to channel the water and clearing of the streambed down to bedrock. Once these berms were established they were more or less maintained throughout the rest of the trapping period, except when destroyed by high flows.

The trap was fished twenty-four hours a day from the day it started fishing in March until it was pulled at the end of each trapping season (7/4/91 and 5/28/92). The exceptions to this included when the trap was unable to be fished due to high flows, when it stopped turning due to low flows, and when time constraints didn't allow for the trap to be checked on a daily basis. When the trap was fishing it was checked once daily, usually in the morning before the water temperature began to increase.

DATA COLLECTION

Data measurements, including water temperature and staff gauge height were recorded on a daily basis. The temperature was taken at the trap site, and the staff gauge height was recorded at its location 1.5 miles above the mouth. After the fish were removed from the livebox, they were sedated using MS-222 in order to ease the stress of handling. MS-222 (Tricaine Methanesulfonate) is a water soluble anesthesia used for the sedation of fishes and other cold-blooded animals. Once sedated, the fish were identified by species and measured by fork length. The fork length measurement is defined as: the linear distance from the fish's snout to the inside fork of the tail when the caudal lobes are held apart. In addition, an age class estimate was recorded for the juvenile steelhead trapped. In order to verify these age class estimates, scale samples were taken from fish over a wide range of fork length classes.

AGE CLASSES

Emigrants were divided into four different age class: 0+, 1+, 2+, or 3+. These ages are associated with the amount of time they have resided in fresh water. For example: An age 1+ fish would have been in freshwater for 1 year plus another undetermined amount of time, not more than one year. When using scale samples to age these fish the growth annuli often show one year's growth plus some continued growth before the fish was trapped. 0+ refers to a fish which hatched during the year of data collection and had not resided in freshwater for a full year. Therefore, basically 1+ are one year old, 2+ are two years old, etc.

TRAPPING EFFICIENCY

A mark/recapture method was used to determine trapping efficiency. A series of six different fin clips was established to be used on consecutive days. Each day, when new migrants entered the trap they were given a fin clip correlating to that day. On the seventh day the series would start over.

After all the fish had been worked up each day, the newly marked fish were taken 0.35 miles upstream and released. The assumption was that these released juveniles resumed their migration and passed through the trap site that evening, thus having the potential to be trapped again. This procedure allowed a trapping efficiency to be established. The trapping efficiency was determined by the percentage of released emigrants recaptured that evening (i.e. if 10 fish were released and 3 of those were recaptured, then the trapping efficiency would be 30%). Efficiencies were calculated for several different fork length classes based on 10mm increments between classes.

The fish which were recaptured on a daily basis, along with all other non-salmonids, were transported to and released at the mouth of Calf Creek. This was to assure that there would be little chance of them re-entering the sample population.

SCALE SAMPLES

Scale samples were taken from fish over a range of fork length classes to help determine the division in size categories between the various age classes. These scale samples were removed from the sedated juveniles and placed in scale envelopes. Date, location, species, and fork length were recorded. In the office, these scales were transferred to a microscope slide and read using a microfiche machine, which magnified the scales allowing the annuli to be easily viewed. Each scale sample was read by three district fisheries biologists and an age consensus was reached. In order to facilitate objectivity the scale samples were read without the reader having any knowledge (i.e. length or sample date) about the fish from which it was taken.

DEVELOPMENTAL STAGES

Using the classification scheme of Dambacher (1991), Calf Creek juveniles were divided into three developmental stage categories. The first of these categories was **parr**, defined as a juvenile which still has distinct parr marks and is showing no signs of smoltification. **Intermediate smolt** was the second category, meaning that the juvenile had begun to take on smolt characteristics. These characteristics included a slightly silvery appearance and fading of the parr marks. The third category was **smolt**. This meant that the emigrant no longer had visible parr marks, was silvery in appearance and had a distinct black line around the border of the caudal fin. These determinations were made on sight and recorded in the field.

DATA ANALYSIS

At the end of the 1992 trapping season all of the 1991 and 1992 data was entered into a database. After all the data was entered, information on trapping efficiencies and population estimates was queried. From this a comparison of timing of emigration, factors influencing emigration and overall population sizes could be made between years. Harvard Graphics was used to illustrate the results of the data analysis.

Estimates of total numbers of outmigrants were made for different trapping periods in each season. For both 1991 and 1992 the trapping periods were broken down into time blocks correlating to variations in hydraulic conditions. These variations include when the channel was simplified above the trap site and after major storm events (Table 1). The population estimates were handled this way because it was felt that trapping conditions were altered to such a degree between flow regimes, that it would have measurable influence on trapping efficiencies. For each trapping period, outmigrant estimates were made based on the combined mark/recapture data for the different length classes.

Date	1991	Date	1992
3/8-4/5	Trap installed - storm event.	3/24-4/1	Trap installed - trap site modification.
4/6-4/17	Storm event - trap site modification.	4/2-4/8	Trap site modification - storm event.
4/18-5/7	Trap site modification - peak flow staff gauge (2.4')	4/9-5/7	Trap reinstalled - trap site modification
5/8-5/16	Receding flow after peak - peak flow. staff gauge (2.6')	5/-5/28	Trap site modification cessation of trapping.
5/17-6/9	Peak flow (2.6') - trap site modification.		
6/10-7/4	Trap site modification - cessation of trapping.		

Table 1. Time blocks and circumstances used to determine trapping efficiencies during different hydrologic conditions.

RESULTS and DISCUSSION

AGING OF EMIGRANTS

The scale samples taken were used, as they were in the Alsea Watershed Study (Moring 1975), to age the emigrants by various length classes. The emigrants were divided into age 1+, 2+, and 3+ fish. In order to determine an age/length correlation, the total number of age 1+ and 2+ in each length category were compared (Table 2). Table 2 shows that the main area of overlap between age 1+ and 2+ falls within the 114-117 range. Using this comparison the decision was made that all fish under 115mm would be considered 1+, and all juveniles greater than 114mm would be either 2+ or 3+. Moring found that the break between 1+ and 2+ age emigrants in the Alsea system appeared to fall some where within the range of 90 mm to 100 mm. Through scale sample analysis the 3+ age fish were estimated to be at a minimum 170mm in length and so all emigrants measuring greater than 169mm were labeled as such. All scales sampled from fish within this length class were aged as 3+. Moring (1975) also found that scales sampled from Deer Creek fish were aged as 3+ at lengths as small as 161mm. Due to the low number of juveniles trapped in this range there was no reason to believe that this size/class designation would have a significant effect on the total estimated numbers of age 2+ or 3+ juveniles.

Fork Length(mm)	1+	2+	3+
110-113	4	1	0
114-117	6	6	0
118-121	2	2	0
122-125	0	6	0
126-169	0	9	0
>170	0	1	9

Table 2. Scale/age class comparisons from Calf Creek emigrants during the 1991 and 1992 trapping seasons.

This age/length classification was used until June 1, after which it was determined that age 1+ emigrants would have obtained a fork length greater than 115mm. After the first of June the break between 1+ and 2+ was changed to 120mm. This only effects the 1991 trapping season emigration estimate, since the 1992 trapping period was terminated before this date.

EMIGRATION ESTIMATES BY AGE CLASSES - 1991

0+ AGE CLASS

Emigration estimates were not made for the number of age 0+ juvenile steelhead leaving the Calf Creek basin. Since so few individuals were sampled and fin clipping was not a viable method for tracking, only actual numbers were reported. The first age 0+ steelhead for 1991 was trapped on May 27th. From this point on, age 0+ fish continued to be trapped until the trap was pulled on July 4th. During the trapping season 153 0+ fish were captured, ranging in size from 32mm to 60mm, with an average length of 43mm.

1+ AGE CLASS

The total estimated number of age 1+ steelhead leaving Calf Creek during the 1991 trapping season was 2552 individuals (Table 3). In order to display how the emigration correlated to temperature and flow, an emigration estimate by two week periods, such as used by Everest (1988), was used. By comparing the number of 1+ emigrants per two week time period with the daily temperature it can be seen that emigration increased with increased temperature. The emigration peaked in early June and began to decline by mid- June (Figure 3). When comparing the 1+ emigration with the staff gauge height record it was easy to see that the peak of emigration also coincided with a steady and relatively rapid decline in the flow level (Figure 4).

Date	Marked	Recaps.	Trapping eff.	Estimated numbers
3/8 - 4/5	24	8	33%	73
4/6 - 4/17	52	10	19%	274
4/18 - 5/7	244	129	53%	460
5/8 - 5/16	125	64	51%	245
5/17 - 6/9	280	99	35%	800
6/10 - 7/4	336	157	48%	700
			Total:	2552

Table 3. Emigration of 1+ steelhead from Calf Creek from 3/8/91 to 7/4/91, broken down by periods of similar hydraulic conditions at the trap site.

2+ AGE CLASS

A total of approximately 996 age 2+ juvenile steelhead emigrated from Calf Creek in 1991 (Table 4). Focusing on this emigration, it appears that the 2+ emigrants were more sensitive to environmental changes than the 1+. The 2+ emigration peaked earlier than the 1+, leaving the system as environmental changes were just beginning to set in. Comparing their emigration to temperature it appears that as the temperatures first began to rise the 2+ were already emigrating. Then by the time a significant increase in temperature was occurring, the 2+ emigration was peaking (Fig. 3). The same was true for the 1991 flow conditions. As the flows began to recede from the last substantial spring storm event the 2+ were already at the peak of their emigration. After this peak, emigration underwent a slight decrease and then leveled off until the cessation of trapping on July 4th (Fig 4).

Date	Marked	Recaps.	Trapping eff.	Estimated numbers.
3/8 - 4/5	13	4	31%	42
4/6 - 4/17	29	7	24%	121
4/18 - 5/7	84	32	38%	221
5/8 - 5/16	23	9	39%	59
5/17 - 6/9	50	9	18%	278
6/10 - 7/4	57	10	18%	317
			Sub-total:	1038
			minus 3+:	42
			Total:	996

Table 4. Emigration of 2+ steelhead from Calf Creek from 3/8/91 to 7/4/91, broken down by periods of similar hydraulic conditions at the trap site.

3+ AGE CLASS

During the 1991 trapping season an estimated 42 age 3+ juvenile steelhead emigrated from Calf Creek, ranging in size from 170mm to 190mm. Since the number of 3+ emigrants was so low, no attempt to estimate trends in migrational patterns was made.

EMIGRATION VS. TEMPERATURE
CALF CREEK 1991

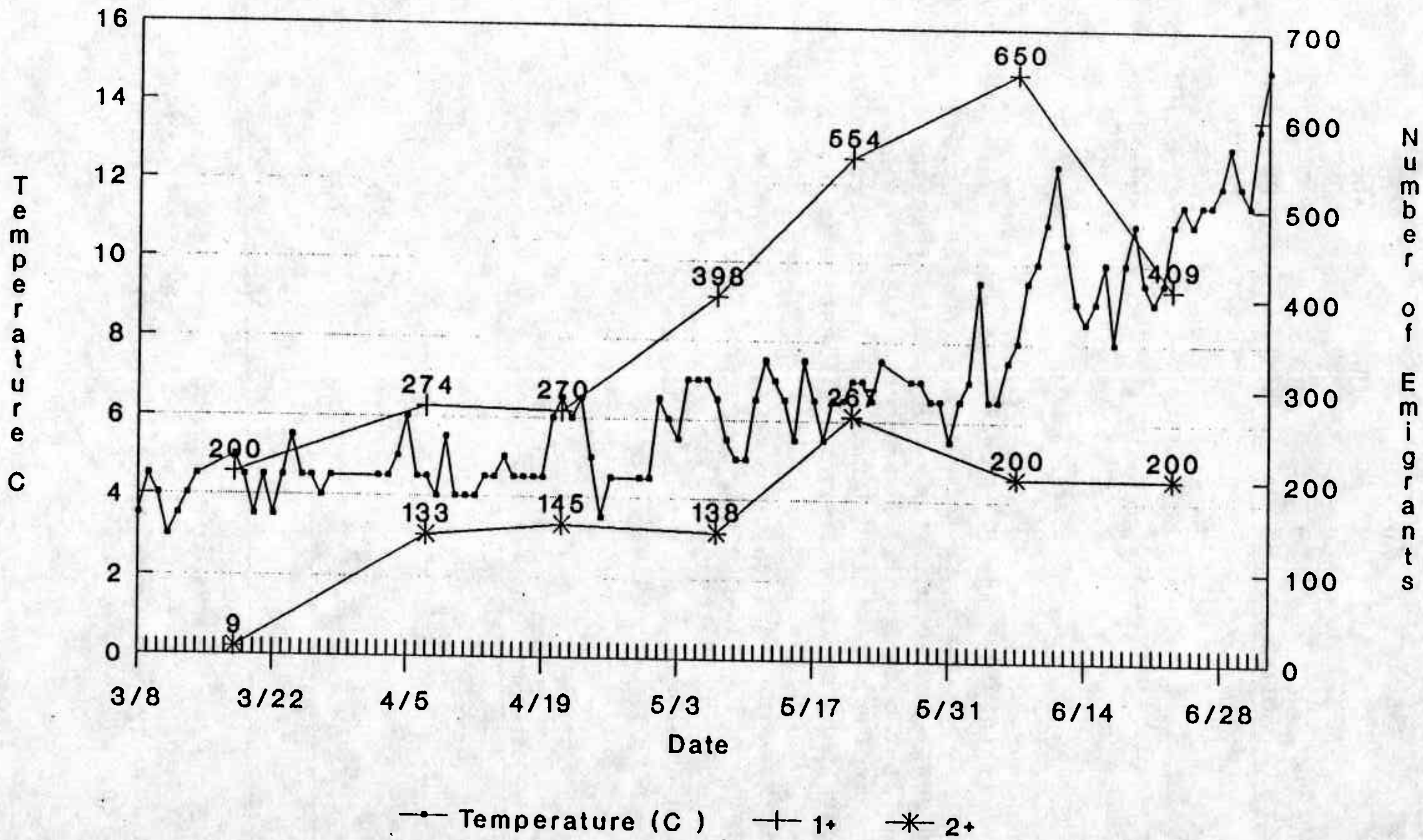

Fig. 3 Bi- weekly estimates of juvenile steelhead emigration vs. water temp. during 1991 outmigrant trapping.

EMIGRATION VS. DAILY STAFF GAUGE READING
CALF CREEK 1991

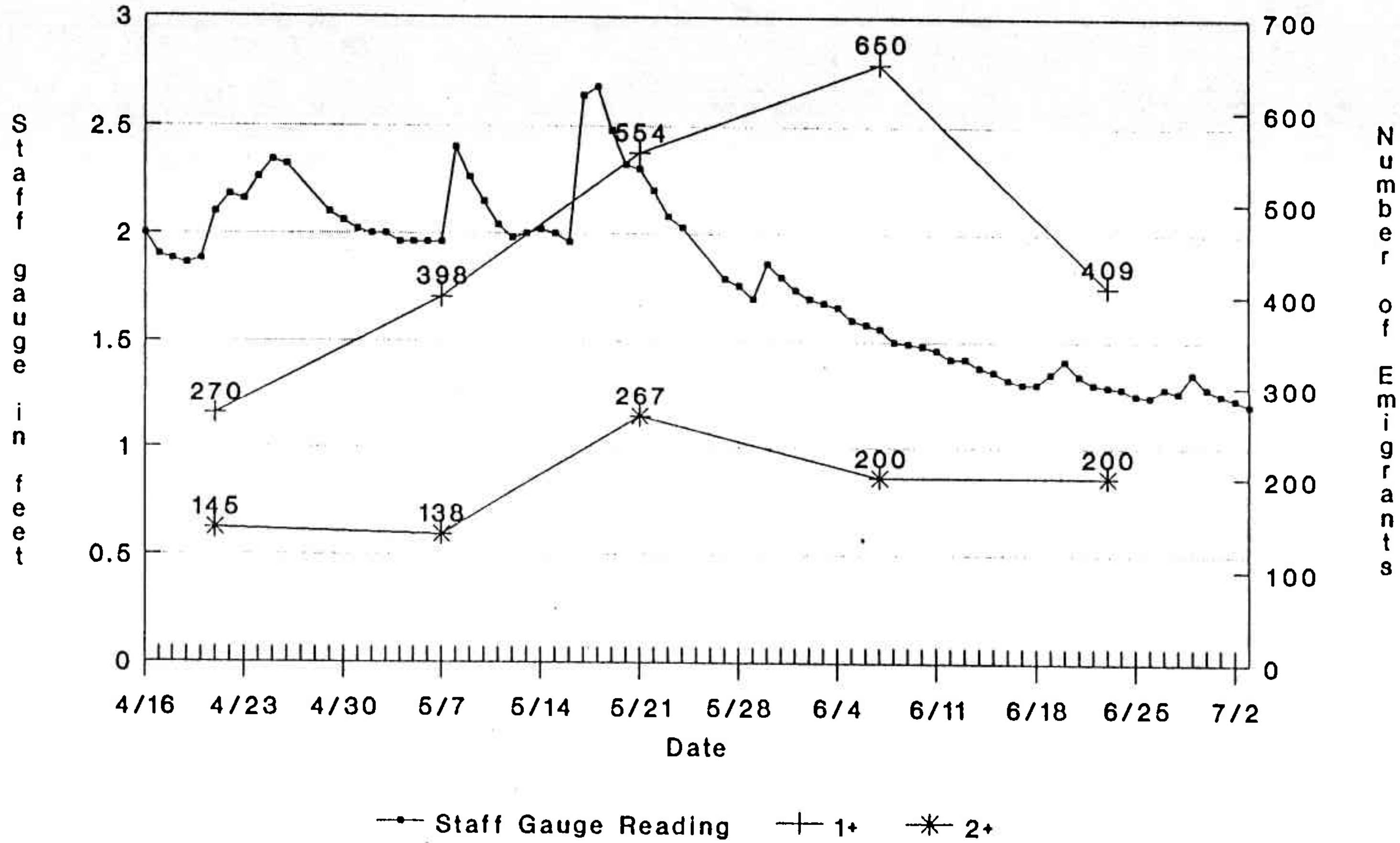

Fig. 4 Bi- weekly estimates of juvenile steelhead emigration vs. staff gauge height during 1991 outmigrant trapping.

EMIGRATION ESTIMATES BY AGE CLASSES - 1992

0+ AGE CLASS

During the 1992 trapping season a total of 431 0+ fish were trapped. The first 0+ of 1992 was caught on May 6th, a full three weeks before the first 0+ of 1991 was trapped. This was most likely a function of the early onset of summer-like flow conditions. The 0+ measured for 1992 were on average smaller than the previous year, with a range in size from 28mm to 52mm and a mean length of 37mm. During the 1992 season the 0+ also continued to migrate from the time they first were trapped until the trap was pulled on May 28.

Dambacher, in 1991, found that 0+ steelhead emigrants that exited the Steamboat Creek basin did so with the onset of base flow conditions. Calf Creek 0+ appeared to exhibit the same type of behavior. Prior to the trapping of the first 0+, small schools of them were seen in the shallows above the trap. As the water levels began to drop these shallow margin habitats decreased in size, forcing some of the fish to seek living space elsewhere. In this search for suitable habitat a large number of 0+ emigrated from Calf Creek. Calf Creek 0+, like those in Steamboat Creek, appeared to move out of their natal streams in order to find suitable habitat in the main river.

1+ AGE CLASS

By the end of the 1992 trapping season 1514 age 1+ steelhead juveniles left Calf Creek (Table 5). As with the 1991 estimates, established time blocks based on trap site hydraulic conditions were used to estimate the total number of emigrants. In order to conduct comparisons with temperature and staff gauge height emigration was again broken into two week time blocks. For the interpretation of bi-weekly emigration the entire trapping period was broken into two week blocks except for the first week which stood alone in the original data (Figure 5). More 1+ moved during the first week than during any of the two week periods during the entire trapping season. This would suggest that the peak of 1+ emigration was occurring at the time the trap was installed.

Date	Marked	Recaps.	Trapping eff.	Estimated numbers
3/24 - 4/1	145	41	28%	518
4/2 - 4/8	158	115	73%	216
4/9 - 5/7	137	41	30%	457
5/8 - 5/28	161	81	50%	323
			Total:	1514

Table 5. Emigration of 1+ steelhead from Calf Creek from 3/24/92 to 5/28/92, broken down by periods of similar hydraulic conditions at the trap site.

In an effort to extrapolate the outmigration to estimate the timing of the actual peak, the number of emigrants for the first week was doubled, so as to simulate two weeks of data (Figure 6). This eliminates what is likely a false peak from 4/1 to 4/14 suggested in figure 5. In order to do this the assumption must be made that the same number of 1+ were emigrating the week prior to the first week of data collection.

Comparing the adjusted data in figure 6 to the daily temperature record it can be seen that there was no obvious correlation between the emigration of the 1+ juveniles and temperature (Figure 7). As stated earlier it appears that the peak of emigration was occurring or had occurred prior to trap installation. For the two month period that was trapped a steadily decreasing number of 1+ continued to leave the basin, with no apparent relation to temperature conditions. To get the full idea of what occurred during the 1992 emigration relative to the water temperature it would have been necessary to have temperature data from before March 25th.

The same problem existed when looking at the staff gauge height data (Figure 8). It appears that the emigration was in full swing before trapping commenced. Staff gauge readings appeared to be low during the peak emigration period, but actual conditions before trapping commenced were unknown. In order to get an idea of the flow conditions before trapping started, flow data from near the mouth of Steamboat Creek was obtained. Steamboat Creek flow data dating back to a month before trapping started shows that flows were abnormally low during March (Figure 9). Comparing this to the 1991 trapping data it appears that abnormally low flow conditions had set in significantly early during 1992, prompting an early emigration.

2+ AGE CLASS

The 563 age 2+ steelhead juveniles which emigrated in 1992 displayed a bi-modal peak in emigration (Table 6 & Figure 6). Again, as with the 1+, the first week of trapping was doubled as to illustrate the significance of the early emigration (Figure 6). Due to the late start in trapping, again it was difficult to say much about how the early migration was tied into temperature. The second peak in early May seemed to be correlated with an increase in temperature, but dropped off rapidly as temperatures continued to increase (Figure 7). This suggests that the majority of the 2+ emigrants for the 1992 spring emigration had left the basin during the previous low flow conditions in March.

When this bi-modal peak was viewed in relation to the staff gauge levels for 1992 it was apparent that both peaks were associated with low flows (Figure 8). Using the Steamboat Creek data for reference, once again it showed that there was an extended period of receding flows before trapping commenced (Figure. 9). As discussed with the 1+ this may indicate that an early emigration took place.

Date	Marked	Recaps.	Trapping eff.	Estimated numbers
3/24 - 4/1	49	15	31%	158
4/2 - 4/8	52	18	35%	149
4/9 - 5/7	49	5	10%	490
5/8 - 5/28	47	14	30%	157
			sub-total:	647
			minus 3+:	84
			Total:	563

Table 6. Emigration of 2+ steelhead from Calf Creek from 3/24/92 to 5/28/92, broken down by periods of similar hydraulic conditions at the trap site.

3+ AGE CLASS

In 1992 approximately 84 age 3+ emigrants with a size range of 170mm to 290mm left the Calf Creek watershed. This represents double the number of 3+ emigrants in half of the trapping time, as compared to 1991. This may have been a function of the early onset of low flows and higher temperatures. As with 1991 no attempt to estimate emigration trends for this relatively small number of emigrants was made.

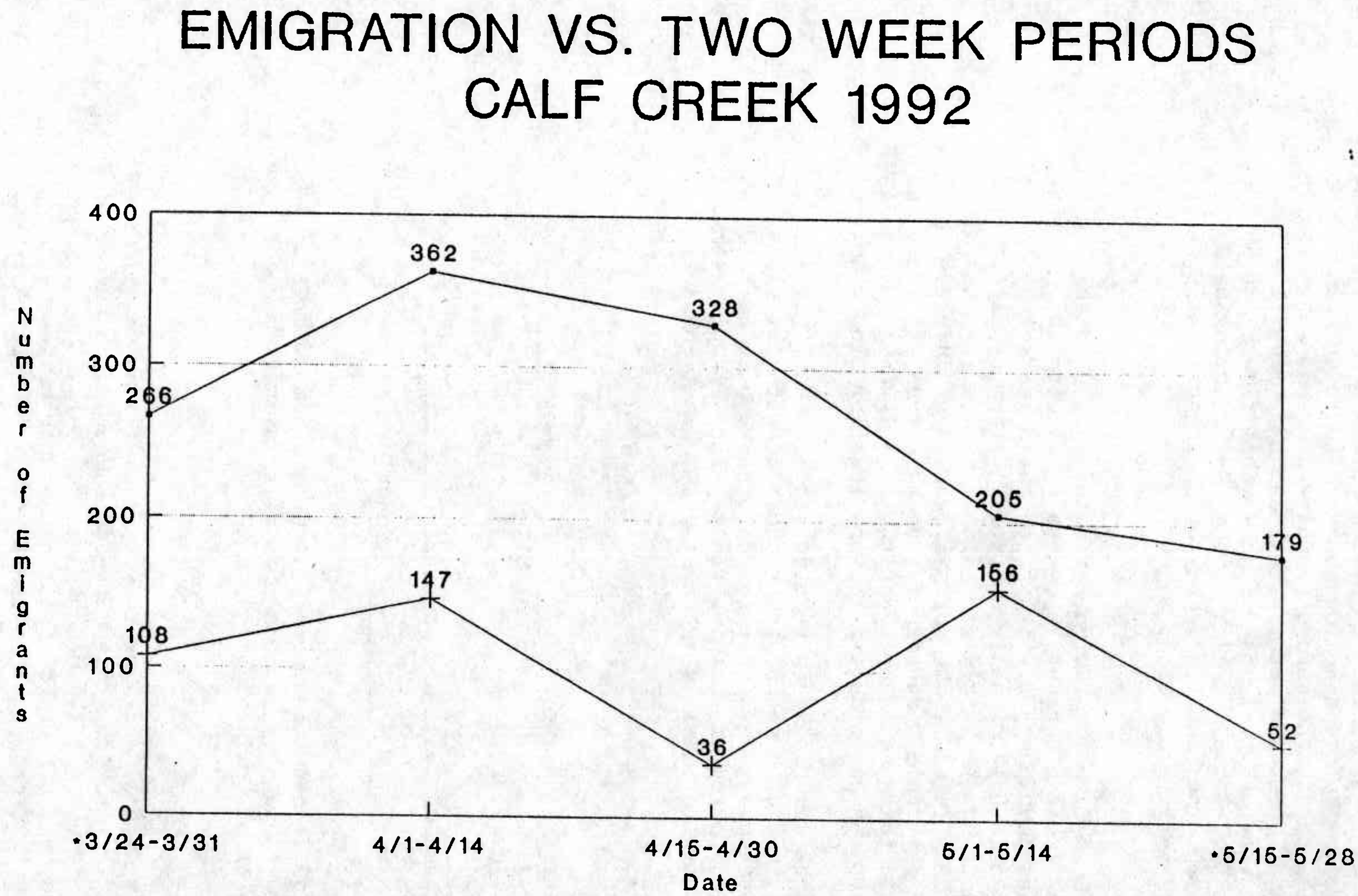

Fig. 5 Bi-weekly estimates of juvenile steelhead emigration from Calf Creek during 1992 spring outmigrant trapping.

EMIGRATION VS. TWO WEEK PERIODS
MODIFIED CALF CREEK 1992

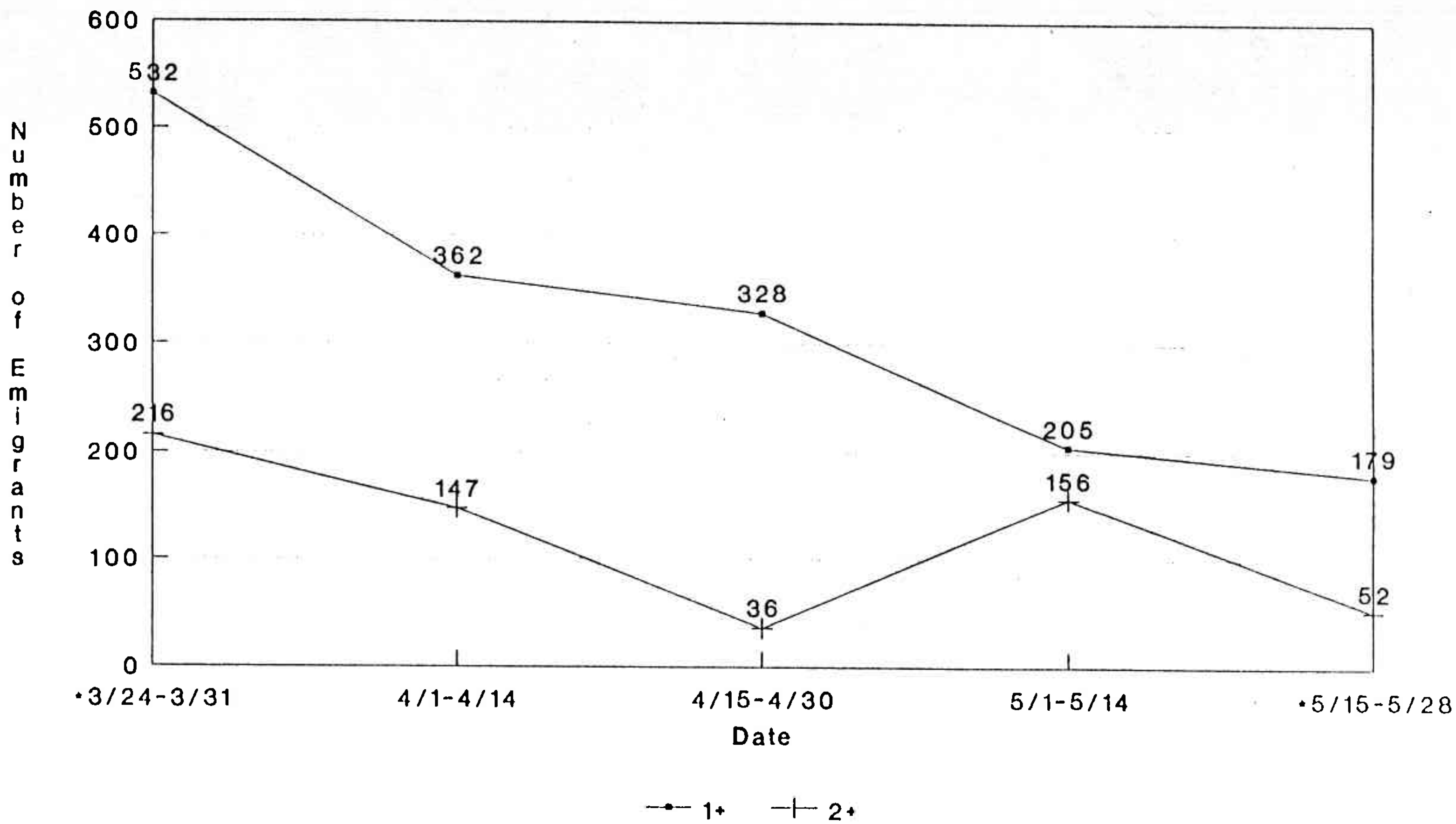

Fig. 6 Modified bi- weekly estimate of juv. steelhead movement from Calf Creek during 1992 spring outmigrant trapping.

EMIGRATION VS. TEMPERATURE CALF CREEK 1992

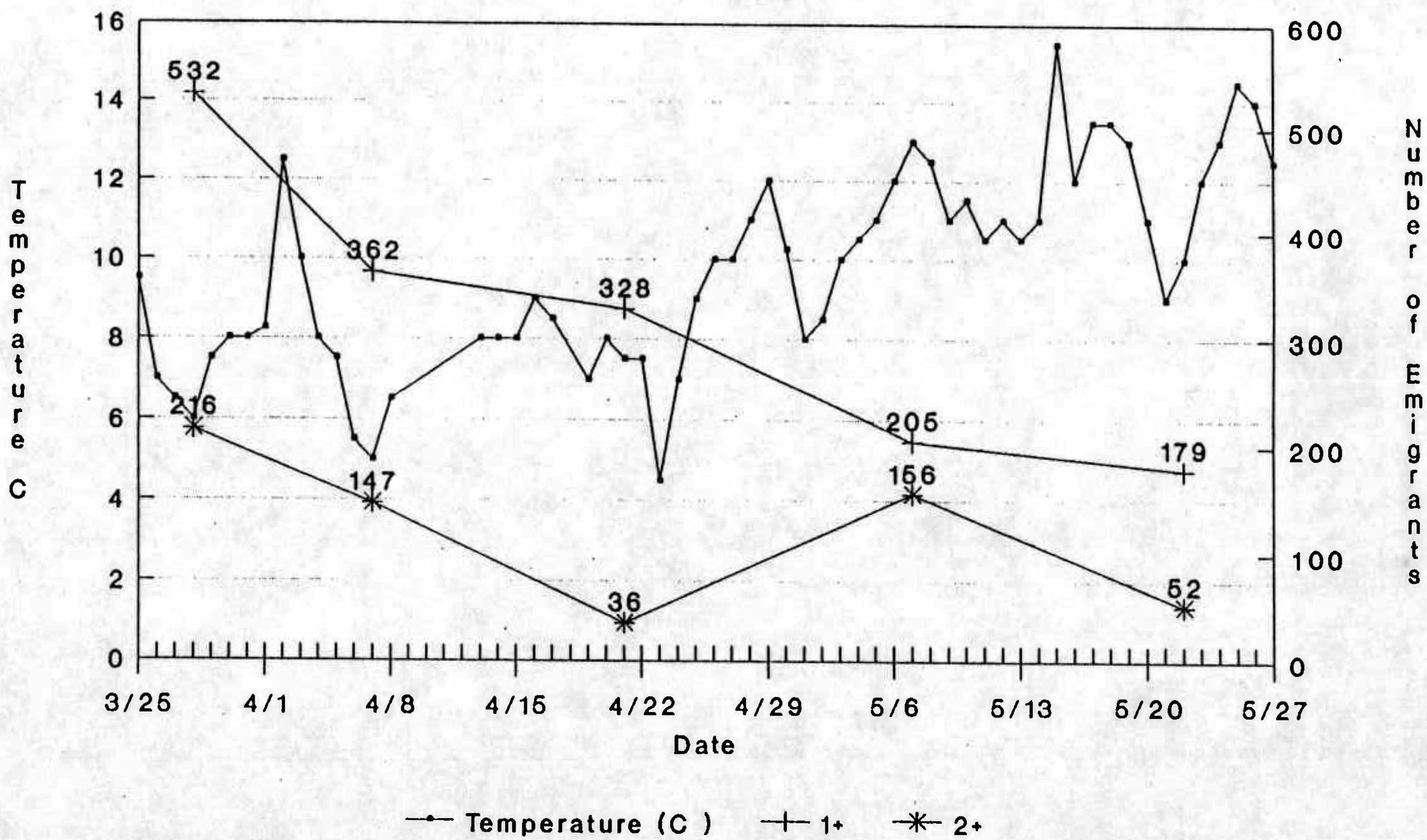

Fig. 7 Bi- weekly estimates of juvenile steelhead emigration vs. water temp. during 1992 outmigrant tapping.

EMIGRATION VS. DAILY STAFF GAUGE READING
CALF CREEK 1992

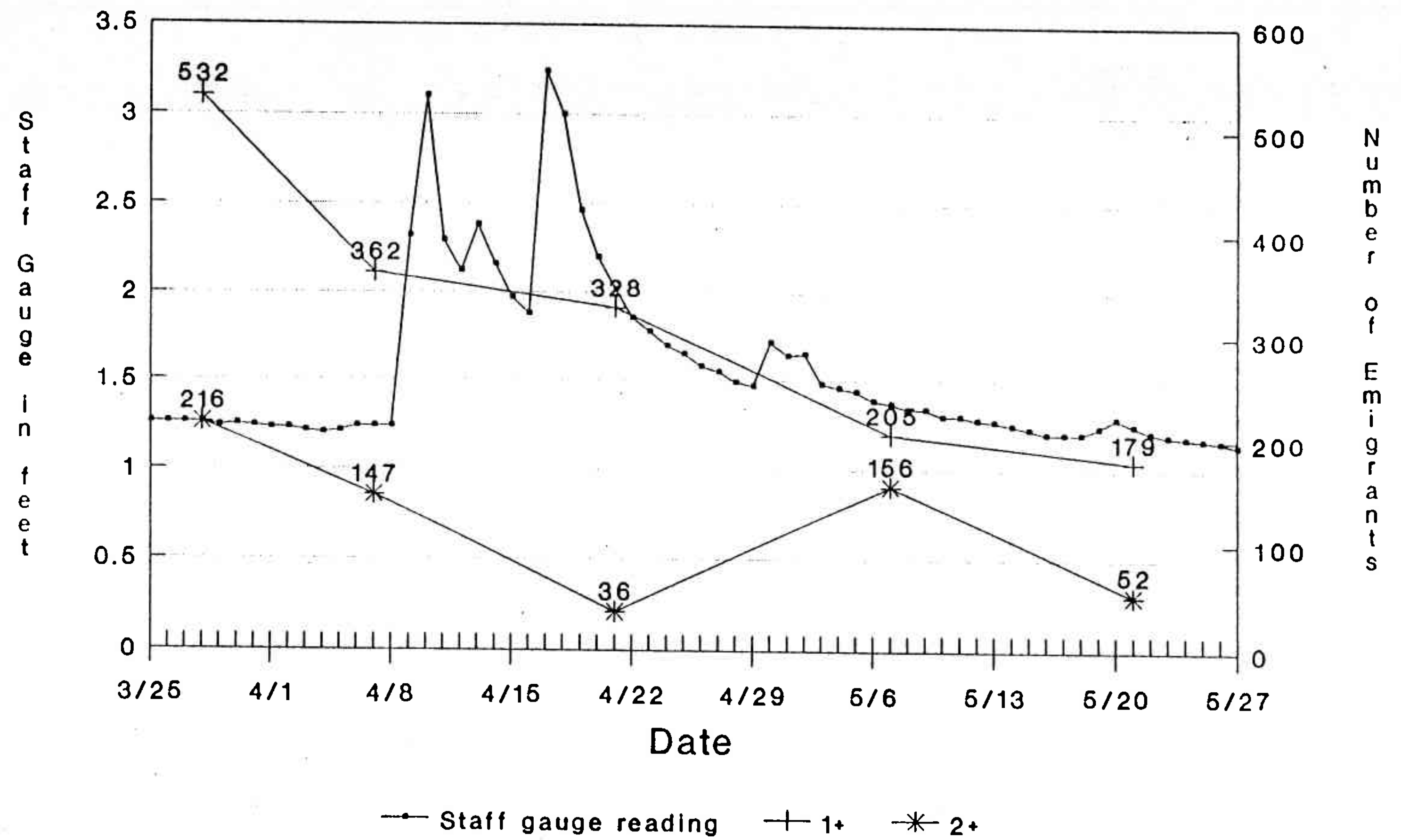

Fig. 8 Bi- weekly estimates of juvenile steelhead emigration vs. staff gauge height during 1992 outmigrant trapping.

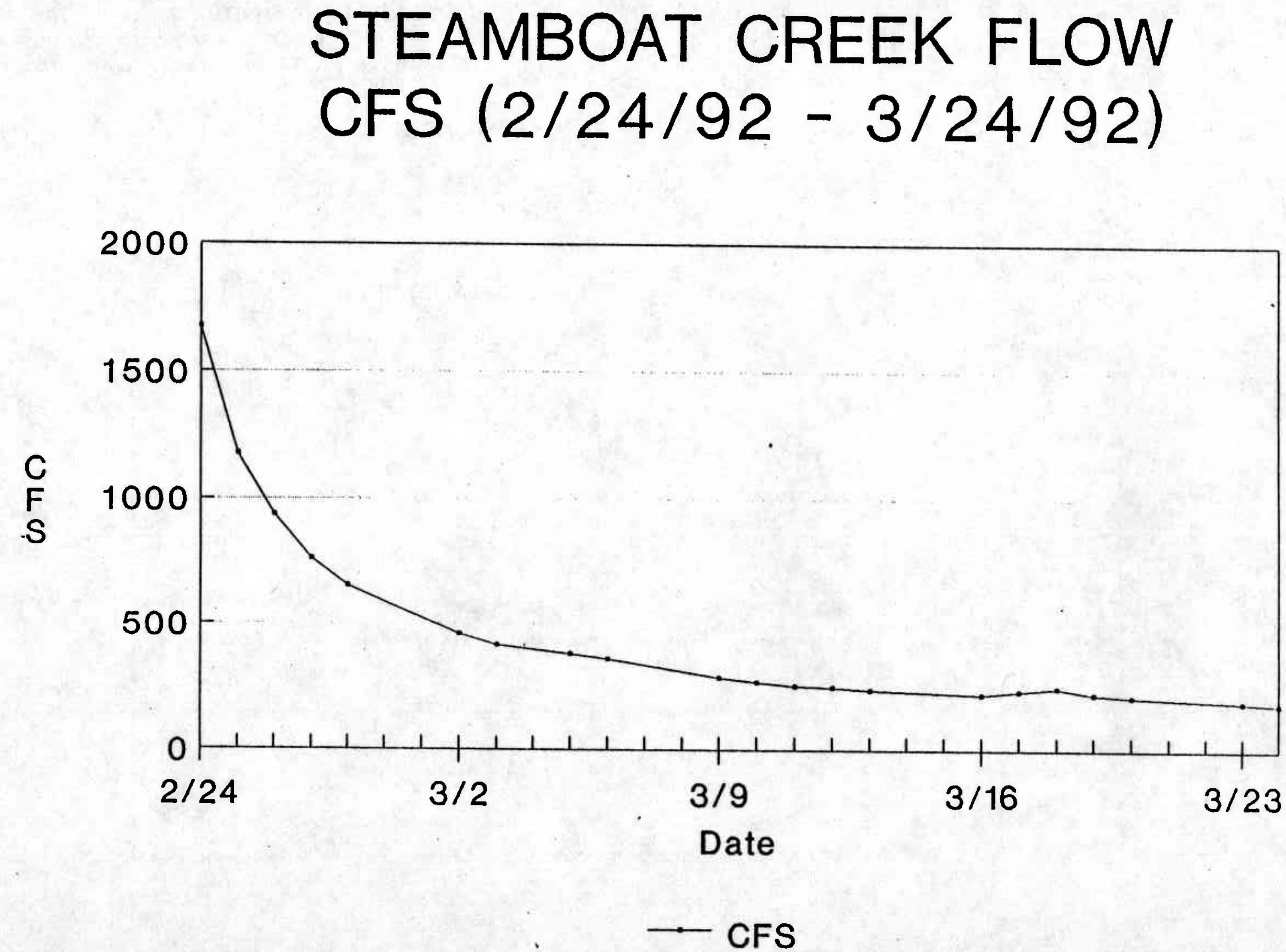

Fig. 9 Flow readings in Steamboat Creek measured in cubic feet per second.

TOTALS

In summary, the total estimated number of emigrants for each year, excluding 0+, is as follows:

1991 - 3590 juvenile steelhead left Calf Creek between 3/6/91 and 7/4/91.

Calf Creek - Total Numbers of Emigrants by Age Class. (1991)

Age Class	# of Emigrants
1+	2552
2+	996
3+	42
	Total: 3590

1992 - 2161 juvenile steelhead emigrated from Calf Creek from 3/25/92 to 5/28/92.

Calf Creek - Total Number of Emigrants by Age Class. (1992)

Age Class	# of Emigrants
1+	1514
2+	563
3+	84
	Total: 2161

By breaking down these totals into percentages by age class (Figure 10), we can see that for both years age 1+ juveniles composed 70% of the emigrants. The age 2+ and 3+ emigrants also composed nearly equal percentages of the population for both years, with 2+ composing 29% and 26% and 3+ equaling 1% and 4% during 1991 and 1992 respectively (Figure 10).

For Calf Creek, the majority of emigrants were 1+ juveniles. In the Alsea watershed study, Moring found that 56.2% of all juvenile steelhead emigrants from Deer Creek were 1+, and that 2+ composed 34.7% while 3+ composed a total of 9.1% of the emigrants. This was significantly different than what was found by Everest et al. (1988) in the Fish Creek studies. On Fish Creek the majority of emigrants were age 2+ juveniles, with no mention as to the number of 1+ and 3+.

In order to compare Calf Creek age class percentages with Dambacher's findings on Steamboat Creek, it was necessary to overlay the Calf Creek 1+/2+ age class break onto the Steamboat Creek data. Doing this we found that from 4/11/88 to 7/3/88, 1+ emigrants comprised 79% and age 2+ emigrants 21% of all emigrants leaving Steamboat Creek. This is comparable to the results found in Calf Creek with 70% of the emigrants being 1+ and 26%-29% of them being 2+. Unlike Calf Creek, no emigrants larger than 170mm (3+) were recorded leaving Steamboat Creek during spring emigration.

In contrast age 1+ and 2+ juvenile steelhead on the South Umpqua River and Jackson Creek emigrated in near equal proportion to each other (Scarnecchia and Roper 1992). Based on raw data (no extrapolation based on trapping efficiencies) emigrants sampled from Jackson Creek numbered 73 (46%) 1+ and 85 (54%) 2+ from 5/1/91 to 7/25/91. On the South Umpqua River steelhead emigrants were recorded as 163 age 1+ juveniles and 160 age 2+. This represents a virtual 50/50 split between the 1+ and 2+. Rotary screw traps were used on both of these streams. Comparing this with the 1991 raw data from Calf Creek, (3/8/91 to 7/4/91) 81% (1061) of the trapped migrants emigrated as 1+ and 18% (245) did so as 2+. The raw data for each age class in 1992 (3/24/92) are comparable with 76% (601) and 23% (186) emigrating as 1+ and 2+ respectively. For both 1991 and 1992, 3+ contributed approximately 1% of the total numbers of

COMPARISON OF EMIGRANTS BY AGE CLASS ESTIMATED EMIGRATION FOR 1991 AND 1992

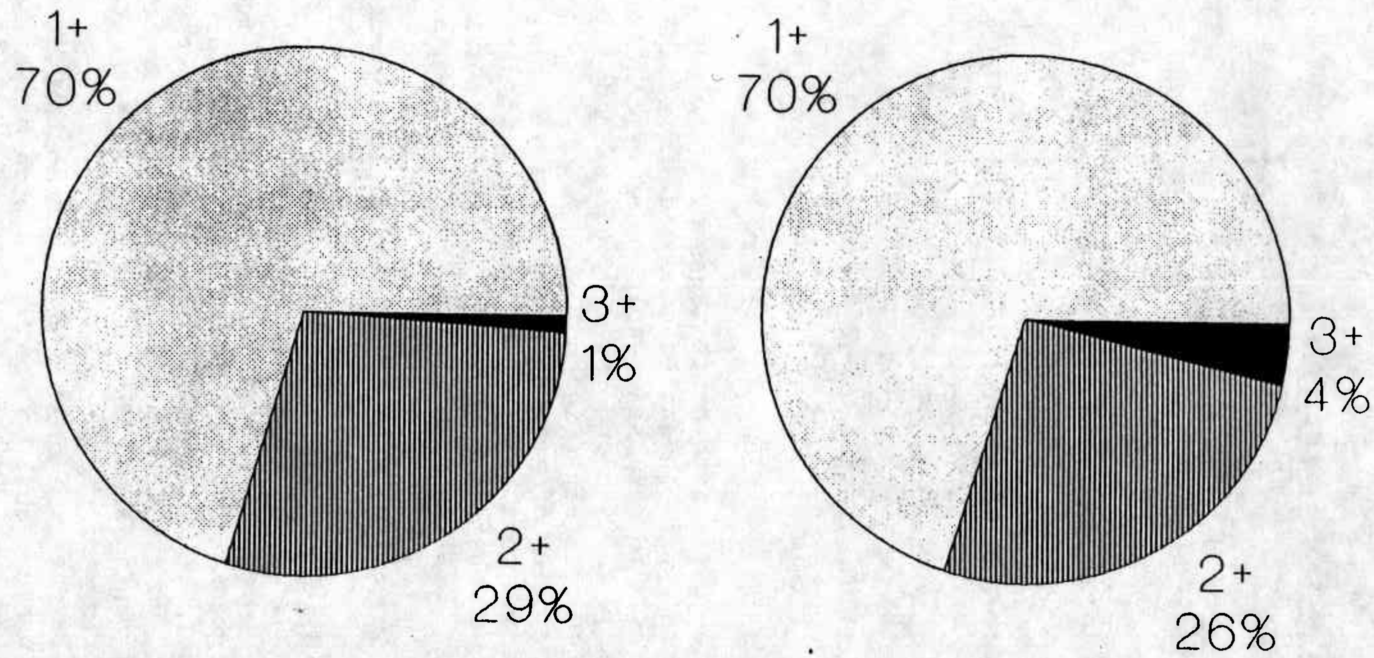

Fig. 10 Age class comparison of juvenile steelhead emigrating from Calf Creek for the 1991 and 1992 spring outmigrations.

fish actually collected in the trap. It is obvious that North Umpqua River steelhead have a substantially different emigration pattern than South Umpqua River fish. This is likely to be a function of conditions encountered in their natal streams and available habitat in downstream main stem areas.

DEVELOPMENTAL STAGES

As discussed earlier Calf Creek emigrants were broken down into three distinct developmental stages: parr, intermediate smolt, and smolt. The majority of emigrants in both 1991 and 1992 were classified as parr, with 3529 of 1991's emigrants and 2055 of 1992's emigrants being parr. Compared to the number of parr, there were relatively few intermediate smolts and even fewer smolts. Only 40 juveniles in 1991 and 76 juveniles in 1992 were classified as intermediate smolts, and only 21 and 30 juveniles were classified as smolts in 1991 and 1992 respectively (Tables 9 and 10).

Age Class	# of Parr	# of Int. Smolts	# of Smolts
1+	2547	5	0
2+	951	35	10
3+	31	0	11

Table 9. A comparison of developmental stages vs. age class for Calf Creek emigrants during the 1991 trapping season.

Age Class	# of Parr	# of Int. Smolts	# of Smolts
1+	1499	15	0
2+	506	34	23
3+	50	27	7

Table 10. A comparison of developmental stages vs. age class for Calf Creek emigrants during the 1992 trapping season.

These tables show that the majority of 1+ juveniles left the basin as parr, and very few left as intermediate smolts. These tables also illustrate that the 2+ migrated primarily as parr with a small percentage of the remainder moving as intermediate smolts and smolts. For the 3+ there is a difference between years. In 1991 they emigrated either as parr or smolts (Table 9). The next year, 1992, there were 3+ emigrants in all three developmental stage categories (Table 10). However, even if some of the outmigrants were smoltifying, it would be logical to assume that they would not yet develop smolt characteristics so early in the outmigration.

Calf Creek is not alone in having the majority of its emigrants leave as parr. Dambacher (1991) found that 94% of the emigrants from Steamboat Creek left as parr and, Loch (1988) working on Gobar Creek determined that 86.1% of the emigrants from that system were classified as parr. In his thesis Dambacher proposed that the parr leaving Steamboat Creek were not destined immediately for the ocean, but instead would be utilizing the main stem North Umpqua River for continued rearing.

PARTIAL REARING

The idea that juvenile salmonids leave their natal stream in favor of a larger river system for continued freshwater residence is called partial rearing. The juvenile steelhead from Calf Creek appeared to display a partial rearing life history. The majority of the emigrants leaving the basin were 1+ parr which were showing no signs of smolting, and therefore did not appear to be headed immediately to the ocean. These juveniles, like the majority of the emigrants from Steamboat Creek in Dambacher's study (1991), are believed to have moved out of Calf Creek and taken up residence in the main stem North Umpqua River.

This theory is substantiated by looking at the movement of juvenile steelhead through the Winchester hydropower project fish passage facility on the lower North Umpqua River. During Oregon Department of Fish and Wildlife's 1985 downstream migrant assessment at the hydropower project site, 287 steelhead smolts were sampled between 5/6/85 and 8/15/92. In another category classified as "advanced juvenile rainbow trout," 51 individuals were sampled. The report states that a portion of those 51 individuals may have been non-smolted juvenile steelhead. This would indicate that the majority of steelhead juveniles were passing through Winchester Dam as smolts. This would lend to the theory that the parr emigrants are using the North Umpqua River for partial rearing.

SPRING EMIGRATION

Dambacher proposed that a spring emigration is a function of habitat quality and spatial limitation in the natal stream, and the presence of good quality habitat downstream. The emigration of parr from Calf Creek was in response to the recession of flow levels. As the flows dropped, available space in Calf Creek became limited and fish were likely forced to leave the basin in search of suitable habitat. This theory is supported by the fact that during summer low flows the overall combined densities of age 1+ and age 2+ juveniles/sq. meter in Calf Creek are relatively high. During a 1989 stream inventory study on Calf Creek the fish densities in the anadromous portion of the basin were estimated at .053 fish/sq. meter. This is higher than Dambacher found in any of the Steamboat Creek tributaries. The highest 1+ densities in any of the Steamboat segments was 0.044 fish/ sq. meter, in lower main stem Steamboat Creek. Therefore, steelhead juveniles in Calf Creek would appear to be spatially limited, not limited by the quality of the habitat. The motivation for leaving Calf Creek would simply be because there was no available space for the emigrants in existing habitat.

The availability of good rearing habitat downstream in the main stem North Umpqua probably also plays a role in the emigration of parr from the Calf Creek watershed. As Dambacher pointed out in his study of Steamboat Creek, the North Umpqua River provides favorable living conditions for parr emigrants. In the main stem the emigrants are able to take advantage of cooler water temperatures, more available habitat, and greater food production than found in their natal streams.

TRAPPING EFFICIENCIES

For the estimated number of emigrants in both 1991 and 1992, trapping efficiencies were calculated by time blocks reflecting changes in hydraulic conditions at the trap site. As discussed before these changes in conditions included such alterations as increased flows due to storm events and trap site modification to deal with low flows. There was a wide range in trapping efficiencies during these time periods, ranging from 18% to 53% in 1991 and from 10% to 73% in 1992.

In order to get an idea of how trapping efficiency related to fork length, a comparison of the mark/recaptured individuals was performed by fork length for the 1991 and 1992 trapping data (Tables 11 & 12 and Figures 11 & 12). Juveniles in the 90mm - 99mm length category were most effectively trapped, ranging from 54- 55% for both years. Emigrants in the <90mm length class were also effectively trapped having a 42% efficiency rating annually. For juveniles >99mm, a comparable range of 28% to 41% was observed over the two trapping seasons.

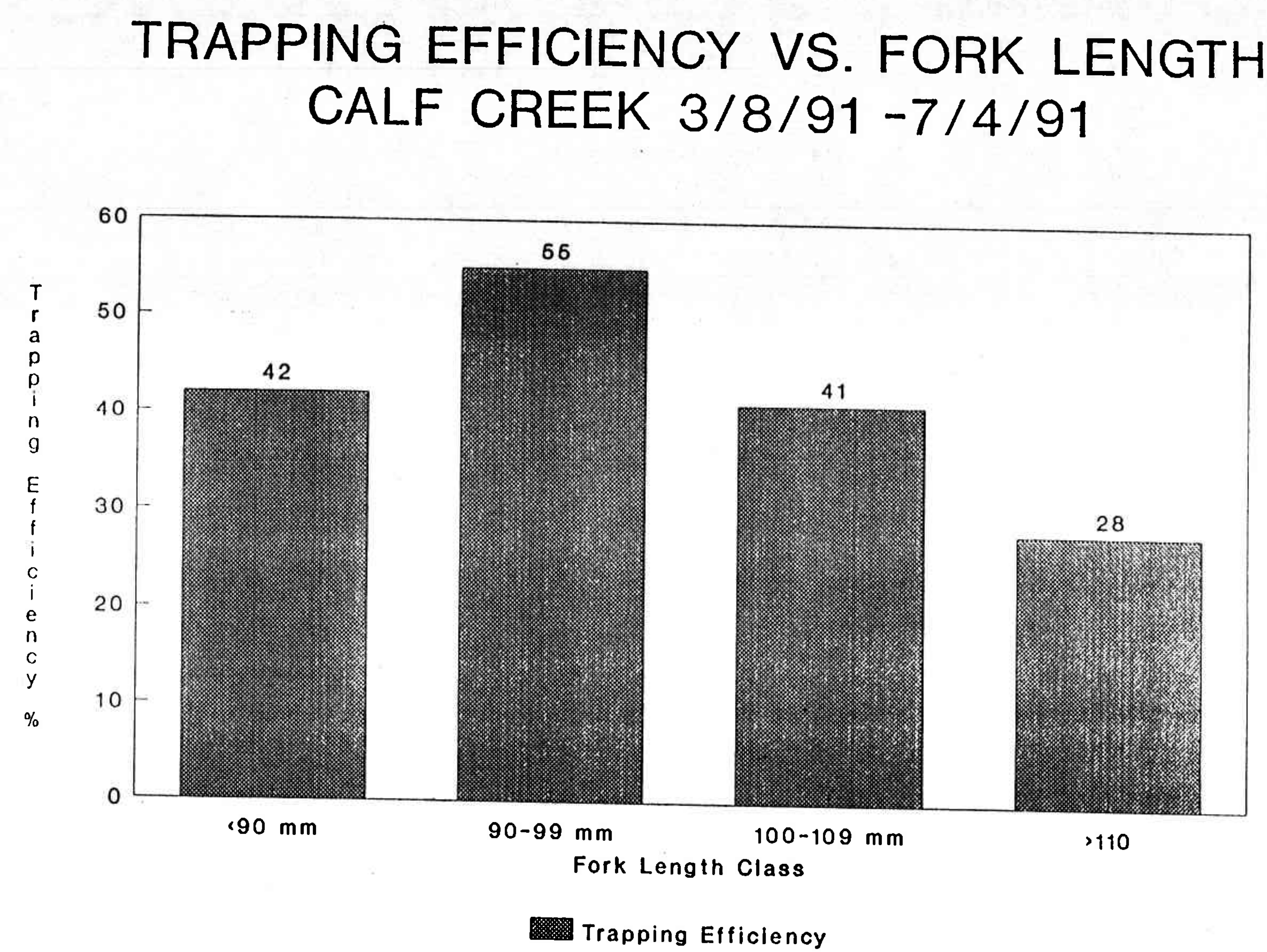

Fig. 11 Trapping efficiency for juvenile steelhead during 1991 spring outmigrant trapping period using rotary screw trap.

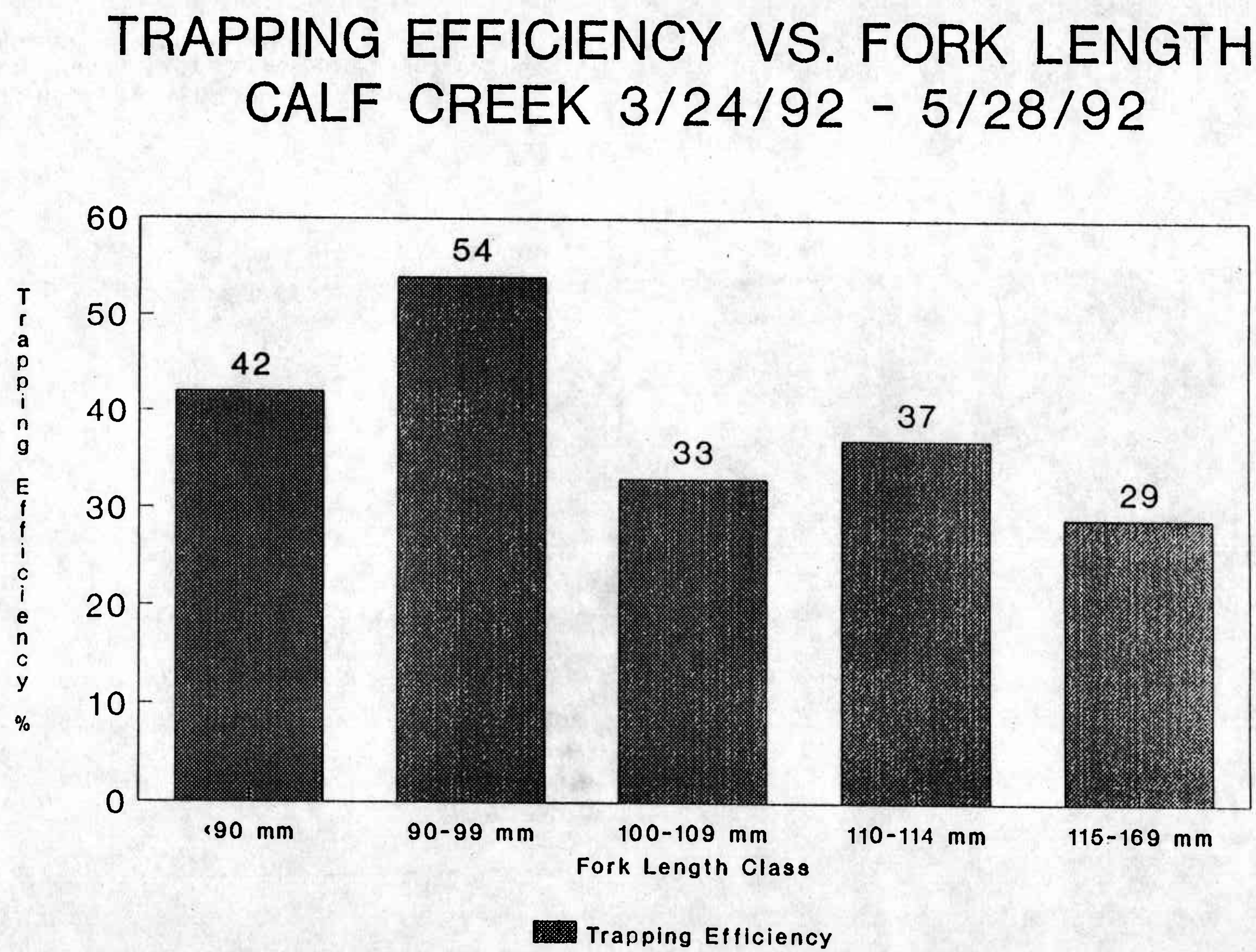

Fig. 12 Trapping efficiency for juvenile steelhead during 1992 spring outmigrant trapping period using rotary screw trap.

Fork Length	Marked	Recaps.	Trapping eff.
<90	284	118	42%
90 - 99	371	203	55%
100 - 109	259	106	41%
>110	403	111	28%

Table 11. A comparison of trapping efficiency vs. fork length for Calf Creek emigrants during the 1991 trapping season.

Fork Length	Marked	Recaps.	Trapping eff.
<90	215	90	42%
90 - 99	213	114	54%
100 - 109	127	57	33%
110 - 114	46	17	37%
115 - 169	172	50	29%

Table 12. A comparison of trapping efficiency vs. fork length for Calf Creek emigrants during the 1992 trapping season.

Using the 1991 data a comparison of trapping efficiency vs. flow by age class was also performed. From this we can see that for age 1+ juveniles the efficiencies were in the 40 to 50 percent, and that for age 2+ the efficiencies were in the 20 to 30 percent range (Table 13 and Figure 13). This efficiency by age class data compliments the efficiency vs. fork length data.

	1+			2+		
Staff Gauge	Marked	Recaps.	Trapping eff.	Marked	Recaps.	Trapping eff.
<1.50'	350	154	44%	60	14	23%
1.50 - 1.99'	290	144	50%	63	21	33%
>2.00'	352	151	43%	115	36	31%

Table 13. A comparison of trapping efficiency vs. flow for Calf Creek emigrants during the 1991 trapping season.

PERIODS OF NO TRAPPING

During the 1991 trapping season there were occasions when the trap was unable to be fished due to time constraints. From 3/8/91 to 4/5/91, a total of seven days were not trapped for this reason. These missed trapping days are felt to have little effect on the estimated total number of emigrants during that time. This is because during this time few fish were moving, as to include seven days when the trap was functional and no fish were trapped. Also on 4/27/91 and 4/28/91 the trap was not fished. Before the trap was pulled there were relatively few fish moving, and after it was reinstalled the fish numbers began to increase only slightly. No estimate of juvenile emigration during the non-trapping period was made. The final time that the trap was unable to be fished during the 1991 trapping season, significant fish movement was occurring. On 5/25/91 and 5/26/91 the migrant trap was unable to be fished. Because of the significant numbers of emigrants moving before and after this time an estimate of the missed number of emigrants was made. By taking the average estimated number of emigrants per day (44 "1+" and 15 "2+"), and multiplying it by the number of days not trapped, it was determined that an estimated number of 88 age 1+ and 30 age 2+ juveniles are unaccounted for during this time period. During the total of eleven missed trapping days

TRAPPING EFFICIENCY VS. STAFF GAUGE CALF CREEK 4/16/91 - 7/3/91

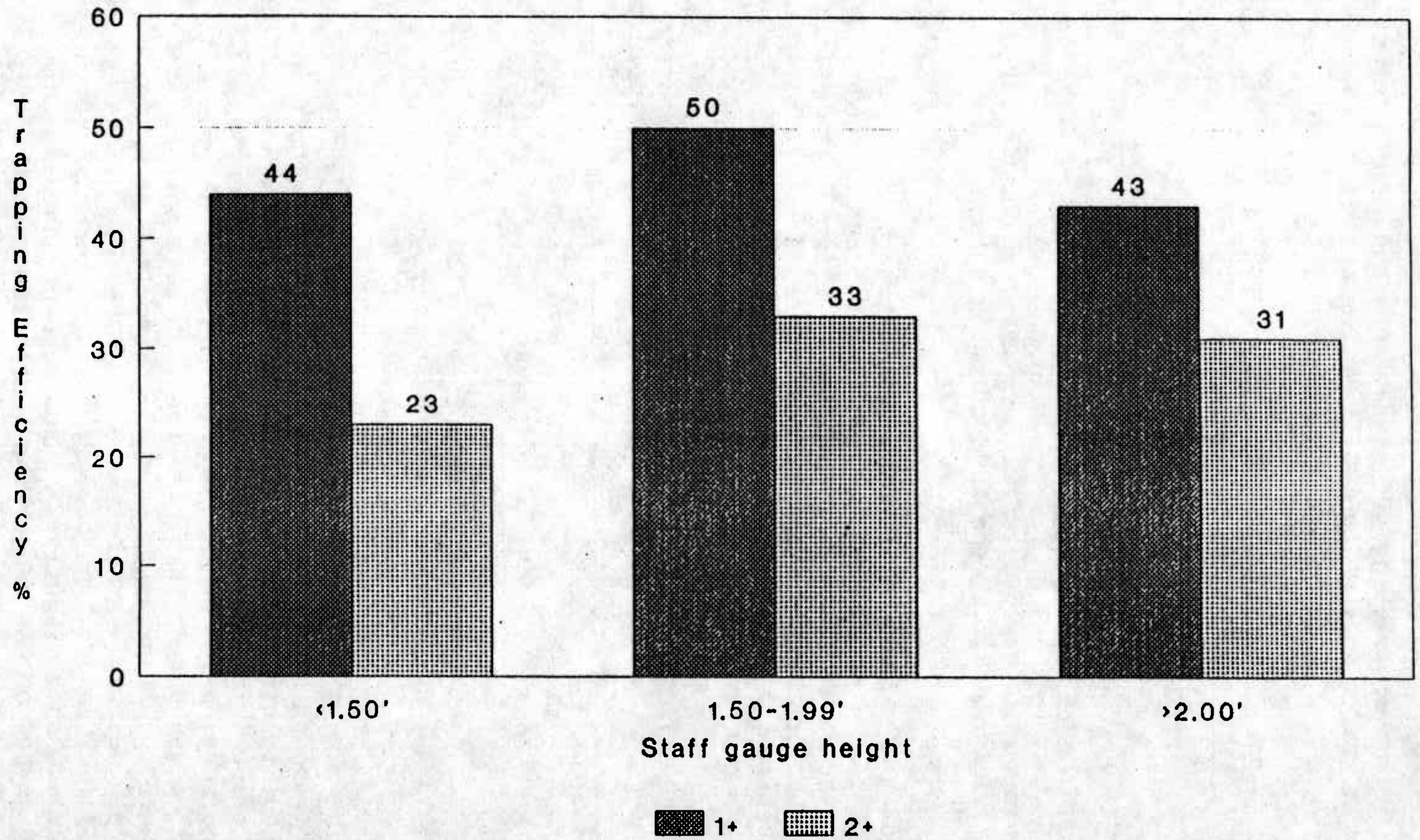

Fig.13 Trapping efficiencies for various flow class on Calf Creek during the 1991 spring outmigrant trapping period.

throughout the 1991 trapping season it is doubtful that more than 100 age 1+ and 40 age 2+ juveniles are unaccounted for in the total emigration estimate. Since the number of fish that actually moved on these days cannot be confirmed these estimates of unsampled emigrants are not included in the overall emigration estimate.

During the 1992 trapping season a total of four trapping days were missed because of unsafe trapping conditions. These included three days from 4/9/92 to 4/11/92 , and also 4/17/92. The trap was pulled on these days because of high flows, which made operating the trap unsafe. Dambacher (1991) documented in his Steamboat Creek Study, that juvenile steelhead tended not to emigrate during these times of high and turbid flow conditions. Because of this, it is felt that the number of emigrants moving during these conditions of high flow was negligible as compared to the estimated total number of emigrants. Therefore the missing of these few days during the trapping period is assumed to have little effect on the estimated total number of outmigrants for 1992.

MORTALITY

Mortality is always a major concern when handling fish. When using a chemical such as MS-222 there is the possibility of causing mortality, either at the time of administration or subsequent delayed mortality. During the 1991 and 1992 trapping periods there were no deaths during the administration of MS-222 and any delayed mortality could not be confirmed.

Throughout the 1991 trapping season only four mortalities were recorded. Two of these mortalities were the direct result of handling during removal from the trap. The causes of the other mortalities were unknown, as the fish were found dead in the trap upon arrival. Speculation is that either the mortality occurred for some unknown reason in the trap, or that the deceased simply washed downstream and were caught in the trap.

On April 2 of the 1992 trapping season there was a total of eleven confirmed mortalities. On this day the trap was not able to be checked until the late afternoon, by which time the water temperature had risen to 12.5 °C. Upon arrival at the trap, it was found to contain 101 steelhead juveniles and a 732mm adult female steelhead. While approaching the trap the female was heard trying to escape by attempting to swim back out through the rotating drum. In her attempts to escape the female had killed five juveniles. This, along with warmer water conditions, caused the rest of the juveniles in the livebox to become stressed. By the the time the female was removed from the trap and the juveniles were worked up six more juveniles had died.

The next day only 9 of 68 released emigrants were recaptured. Since after this day the trapping efficiencies were high and remained so, it was believed that either there was considerable delayed stress mortality or the stress suffered by the juveniles had interrupted their migration pattern. This may have caused a slight overestimate of the number of emigrants for the 4/2/92 - 4/8/92 trapping period. Other than this event, no other mortalities were recorded during the 1992 spring emigration trapping.

DAYS TO RECAPTURE

During the 1991 and 1992 trapping season 90% and 91%, respectively, of recaptured emigrants were trapped the night after being released (Figures 14). Since trapping efficiency was determined by comparing the percentage of emigrants released above the trap with the number of those which were recaptured that evening, the high percentage of one-day recaptures supports our estimated trapping efficiencies. With an average 90.5% one-day recaptures between both years, the theory that emigrants resume their migration that evening was substantiated. The juveniles which did not resume their migration the evening after their release were usually trapped within another 2 to 3 days after release, and all recaptures occurred within 6 days of release. These results are comparable with Dambacher's (1991) Steamboat Creek findings, in which nearly 90% of all emigrants were trapped the first night after release

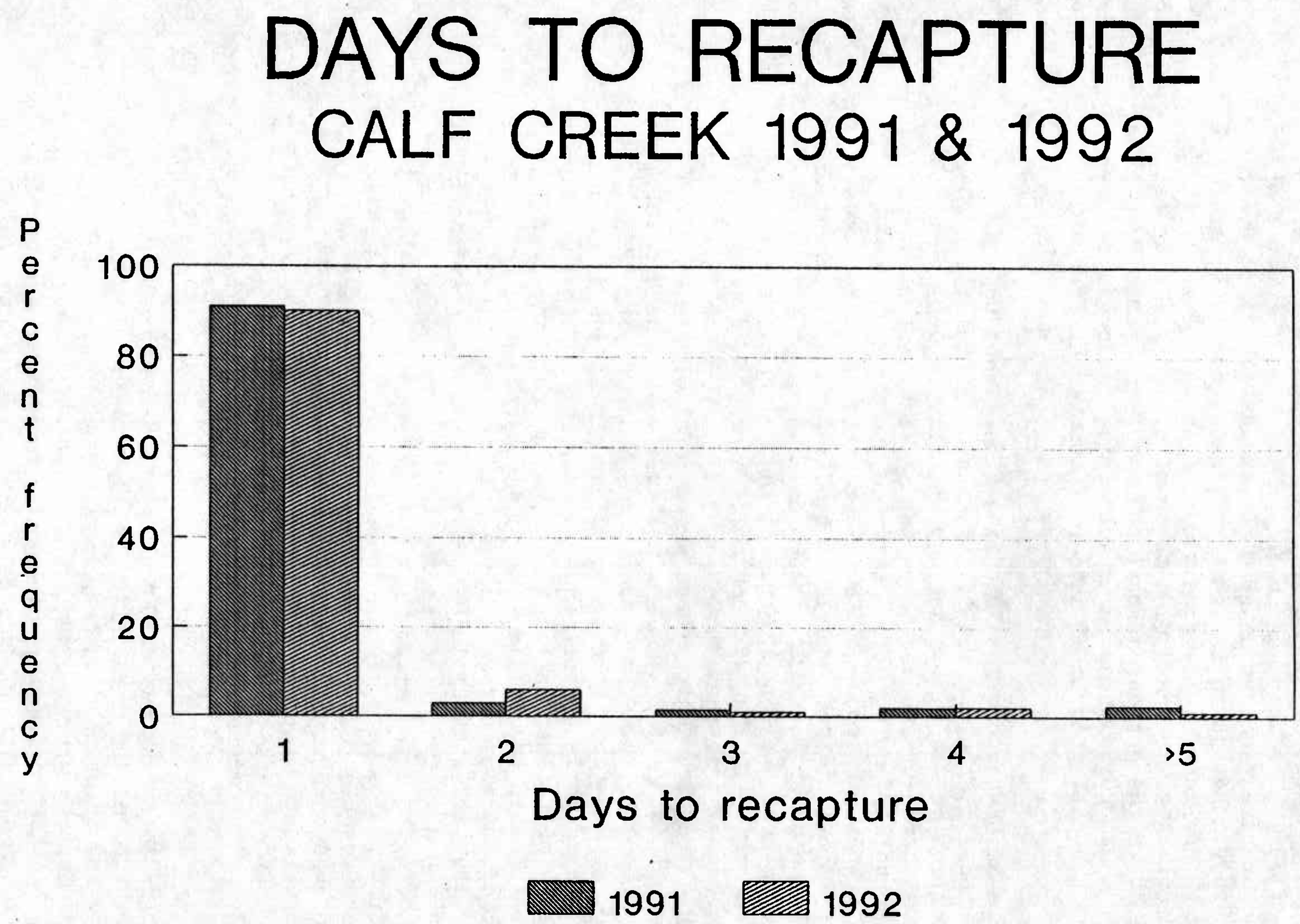

Fig.14 Number of days to recapture for juvenile steelhead emigrants on Calf Creek for 1991 and 1992.

and the majority of the remaining recaptures occurred with in the following three days.

Emigrational pattern changes were observed during both the 1991 and 1992 trapping seasons. At one point during the 1991 trapping season, it was observed that the frequency of two-day and three-day recaptures had significantly increased. At this time emigrants were being released into a large pool at the release site. During high flow conditions the pool was quite turbulent and was not conducive to juvenile salmonid holding. As flow receded the pool habitat became calm and may have provided hospitable habitat for released emigrants. This is believed to have delayed the departure of released emigrants from the release site. In order to reduce the chances of having the juveniles delay departure from the release site, the juveniles were released in a glide habitat immediately below the pool. This appeared to rectify the problem, as the percentage of emigrants caught two or more days after release decreased significantly.

During 1992 there were two instances which appeared to effect the emigrational patterns of the juvenile steelhead leaving Calf Creek. The first event which appeared to effect the migration of the juveniles occurred on April 2nd. On this day, as discussed earlier, the juveniles in the livebox were subject to a high level of stress because of the presence of a large, unhappy, female steelhead in the livebox, warm water temperatures and handling. This high level of stress was known to produce some mortalities and was believed to have altered the juveniles emigrational pattern. This is supported by an increase in two-day and three-day recaptures following the event. Also in 1992 a similar event to what happened in 1991 occurred. In 1992 the juveniles were being released in the glide as discussed previously. During the 1992 season the water levels became so low that it appeared that the juveniles were holding in the now slow moving glide habitat, like they were believed to be doing in the pool during 1991. Since the water levels were unusually low the juveniles may have found the glide to be hospitable habitat unlike during 1991. In an effort to reduce the possibility of juveniles holding at the release site, they began to be released in the riffle habitat immediately below the glide. This appeared to solve the problem, as daily trapping efficiencies began to increase after this change.

OTHER FISH

Along with the emigrating juvenile steelhead, a number of other fishes were also trapped. In 1991 from 3/14 to 6/20 the migrant trap intercepted a total of eleven adult male steelhead, ranging in size from 390mm to 830mm. The majority of these fish were runbacks, that is they had spawned and were heading back down river. Other salmonids trapped included four cutthroat trout (O. clarki), six resident rainbow trout (O. mykiss), and two brown trout (Salmo trutta). Also a single 0+ chinook salmon (O. tshawytscha) and a 1+ coho salmon (O. kisutch) parr were trapped.

During the 1992 trapping season only two adult steelhead were trapped. One was a 762mm female who ended up being trapped twice, once on her way up stream to spawn and then again as she was leaving the system. The other adult was a 737mm adult winter steelhead female, who was trapped in mid March. She was very dark in color and had not spawned. Other salmonids trapped included one cutthroat trout, one resident rainbow trout, and five brown trout. The only other salmonid sampled was a 56mm 0+ coho salmon which was trapped on 5/26/92.

There was a steady movement of dace during both trapping seasons. This included both longnose dace (Rhinichthys evermanni) and speckled dace (Rhinichthys osculus). The migration of dace was documented from the start to the cessation of trapping during both years, with a peak of movement in mid June during the 1991 trapping season. Many of the male dace trapped had bright red fins associated with spawning coloration and a high percentage of the females sampled appeared to be gravid. This would seem to indicate that they were undergoing a spawning migration, although not enough is known about local dace life history patterns to confirm this.

Aside from the afore mentioned species, in 1991 a single largescale sucker (Catostomus macrocheilus) was trapped. In 1992 a number of sculpin (Cottus spp.) were sampled, but none were identified to species. Along with the fish a pair of Pacific giant salamanders (Dicamptyodon ensatus) were also trapped.

INDEPENDENT TRAP DAYS

The main focus of the migrant trapping was on the 1991 and 1992 spring emigrations. The periods which were effectively trapped with these goals in mind were 3/6/91 through 7/4/91 and from 3/26/92 to 5/28/92. Aside from these dates there were a few scattered days after storm events, when trapping was done. These were just brief periods of time that were trapped out of interest, with no goal other than to determine whether fish were moving.

In October 1991 three days of trapping were done from 10/28 to 10/30. During this time five 1+ ranging in size from 119mm to 143mm were trapped and five 2+ to 3+ range fish were trapped, measuring from 162mm to 222mm in length. These age class designations were estimates since no scale samples were taken to verify actual age/length comparisons. Also during this period one 34mm age 0+ steelhead was trapped.

The next brief trapping period occurred on November 7th and 8th, 1991. At this point adult summer steelhead were migrating into Calf Creek, and seven of them found their way into the trap. Seven 1+ juveniles also were trapped with length measurements from 108mm to 141mm. Four 2+ trapped during this period were from 156mm to 188mm in length. Ninety-one age 0+ emigrants were also trapped during this time.

During the Steamboat Creek study, Dambacher (1991) also did some trapping in the month of November (7-20, 1988). Age 0+ emigrants and juveniles ranging from 105mm to 164mm constituted the majority of the emigrants. Dambacher also showed that fish in the 165mm to 220mm size were emigrating. At no other time during the Steamboat Creek study did fish in this size range emigrate. This may suggest that these fish, which are in the 3+ range as defined in this report, emigrate primarily during the winter. The limited amount of winter trapping data available for Calf Creek does not allow for a similar conclusion to be drawn about its emigrants habits.

With such limited winter trapping data available from Calf Creek it is difficult to draw any conclusions about emigration patterns during the winter months. For Steamboat Creek the winter emigration is greatly reduced as compared to the spring emigration.

SMOLT PRODUCTION

In the 1990 ~~North~~ Umpqua National Forest Land and Resource Management Plan (LRMP) Final Environmental Impact Statement (FEIS) it states that the Umpqua National Forest contains 350 miles of anadromous salmonid spawning and rearing habitat. Approximately 100 miles of which is located on the North Umpqua Ranger District. The 350 miles of anadromous habitat located on the Forest has been estimated to produce an annual average of 178,900 steelhead smolts, as outlined in the Umpqua National Forest LRMP FEIS - appendix B (pg.78). The estimate was made by Forest Fisheries Biologist, Jeff Dose, utilizing adult spawner escapement numbers from 1987 and 1988. By back calculating, using smolt to adult survivability estimates, the estimated number of smolts necessary to produce those years adult spawner escapements was obtained.

In looking at the smolt production from Calf Creek during 1991 and 1992 it can be seen that smolt production is considerably lower than would be expected. In 1991 only an estimated 61 steelhead in the intermediate smolt and smolt stages were produced, and 1992 yielded an estimated 108 juvenile steelhead in these categories. Also in looking at Dambacher's (1991) results from Steamboat Creek the total estimated number of smolts produced (4,100) is suprisingly low for the fifty-five miles of anadromous habitat sampled. If we assume that the smolt production for Steamboat Creek during Dambacher's study was an "average" year's production and use the two year average on Calf Creek, we can estimate that in a given year approximately 4183 smolts are produced between the two drainages. These drainages represent 59% of the 100 miles of anadromous habitat located on the North Umpqua Ranger District. This would suggest that 59% of the anadromous habitat on the district is producing an estimated annual average of 4183 juvenile steelhead smolts. This is far below what would be expected in order to produce the estimated smolt output, as outlined in the Umpqua National Forest LRMP FEIS - appendix B (pg. 78).

Estimated smolt output from the entire North Umpqua Ranger District is a difficult estimate to make from just trapping the tributaries of the North Umpqua River. This is especially true because of the partial rearing life history strategy of the steelhead which use the basin. Outmigrant trapping of the tributaries of the North Umpqua River is a needed and valuable management tool for monitoring general basin health and in helping "determine if changes in habitat quality are occurring" as called for in the 1990 Umpqua National Forest LRMP. But, in order to get a more accurate picture of the number of smolts and/or intermediate smolts produced on the district, other methods of monitoring smolt production in the North Umpqua River will need to be used. The most accurate means of estimating smolt production from the Forest in the North Umpqua River drainage would be to conduct trapping at the down river Forest boundary.

MANAGEMENT IMPLICATIONS

The most important factor in the management of Calf Creek steelhead is their partial rearing life history. This life history strategy adapted by Calf Creek fish makes their management considerably more involved than if they reared in their natal stream until smoltification. Resource managers, in order to assure the survivability of the summer and winter races of steelhead in Calf Creek, must be aware of the pressures put upon the steelhead by land management activities. This means that resource managers must not only be aware of potential impacts put upon them by management activities within the Calf Creek basin, but they must also be aware of factors influencing water quality and fish habitat in the North Umpqua River where the fish may reside for an important developmental portion of their lives. Therefore, management for Calf Creek steelhead includes management of potential cumulative watershed effects of land management activities in the North Umpqua River basin above and below Calf Creek.

Although it is apparent that Calf Creek steelhead use the North Umpqua River for partial rearing, it is unknown exactly which areas of the river they use and for what lengths of time. It is probable that they use the portion of the river directly below Calf Creek for another one to two years of rearing before emigrating to the ocean, but this has not been confirmed. This again will cause the management of Calf Creek steelhead in the North Umpqua River to be more complex. Until further study as to the utilization of the North Umpqua River by juvenile steelhead has taken place, the potential exists for Calf Creek steelhead populations to be impacted by cumulative watershed effects in the North Umpqua River which may emanate from the Calf Creek watershed.

The best current option for the management of Calf Creek steelhead at this time would be to continue outmigrant trapping on Calf Creek. This should be done in order to monitor any changes in juvenile steelhead outmigrant age structure and/or emigration pattern. Trapping efforts should also be under taken year round, in order to get a complete picture of juvenile steelhead movement out of the Calf Creek basin. Another key to more effective management of Calf Creek steelhead, and steelhead from other North Umpqua tributaries, would be to begin trying to determine how the North Umpqua River is being utilized by the partially rearing juvenile steelhead.

In order to comply with the Umpqua National Forest's LRMP monitoring plan item CF1/NFWF11, Forest Smolt Production Validation, the outmigrant trapping efforts need to be expanded to the North Umpqua River. To get an idea of the smolt production of the North Umpqua Ranger District, smolt trapping efforts should be undertaken in the North Umpqua River at the Forest boundary. This would give an accurate picture of the number of smolts leaving the Forest, and would have the potential to provide insight as to the use of the North Umpqua River by steelhead which have adopted the partial rearing life history strategy.

GLOSSARY

Anadromous - A fish life cycle which includes being born in freshwater, migrating to the ocean where they spend the majority of their lives and returning to freshwater to spawn.

Class I Stream - A stream which facilitates spawning and rearing of anadromous salmonids.

Emigration - A mass movement of individuals from one location to another.

Gravid - The condition of bearing eggs, before spawning.

Parr - A juvenile salmonid which still has its parr mark coloration, associated with freshwater residence.

Salmonid - A fish belonging to the family Salmonidae, including salmon and trout.

Smolt - A juvenile Salmonid which has under gone changes associated with migration to the ocean, including fading of parr marks and silvering of the body.

Smoltification - The physiological transformation from parr to smolt.

Spawn - The deposition and fertilization of eggs.

REFERENCES

Dambacher, J.M. 1991. Distribution, abundance, and emigration of juvenile steelhead, and analysis of stream habitat in the Steamboat Creek basin, Oregon. Masters Thesis, Oregon State University. Corvallis, Oregon.

Dose, Jeff. 1992. Personal communication. Forest Fisheries Biologist, Umpqua National Forest. Roseburg, Oregon.

Everest, F.H., G.H. Reeves, and J.R. Sedell. 1988. Changes in habitat and populations of steelhead trout, coho salmon, and chinook salmon in Fish Creek, Oregon, 1983-1987, as related to habitat improvement. Pacific Northwest Forest and Range Experiment Station. Foerst Sciences Lab. Corvallis, Oregon.

Leider, S.A., M.W. Chilcote, and J.J. Loch. 1986. Movement and survival of presmolt steelhead in a tributary and the main stem of a Washington river. North American Journal of Fisheries Management. 6: 526-531

Loch, J.J., S.A. Leider, M.W. Chilcote, R. Cooper, and T.H. Johnson. 1988. Differences in yield, emigration-timing, size, and age structure of juvenile steelhead from two small western Washington streams. Calif Fish and Game 74(2): 106 - 118.

Moring, J.R. and R.L. Lantz. 1975. The Alsea watershed study: Effects of logging on the aquatic resources of three headwater streams of the Alsea River, Oregon. Part I - biological studies. Fisheries Research Report #9. Oregon Dept. of Fish and Wildlife. Corvallis, Oregon.

Scarnecchia, D.L. and B.B Roper. 1992. South Umpqua spring chinook salmon project data summary 1991 field season. Dept. of Fish and Wildlife Resources. University of Idaho. Moscow, Idaho.

Williams, Ron. 1985. Oregon Dept. of Fish and Wildlife - Progress Report. pgs.9-10. Roseburg, Oregon.

Williams, Ron. 1992. Personal communication. Oregon Dept. of Fish and Wildlife.