

**Fishery Data Series No. 92-46**

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# **Peterson Creek and Lake System Steelhead Evaluation, 1991**

by

**Roger Harding  
and  
Doug Jones**

November 1992

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Alaska Department of Fish and Game

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## ABSTRACT

Peterson Creek, located 40 km north of Juneau, supports the only recreational fishery for steelhead *Oncorhynchus mykiss* on the Juneau road system. Because of the small size of the stock and its popularity with anglers, efforts to enhance and/or monitor this fishery date to 1961. This study includes more detailed work of the study begun in 1989 to count the escapement and collect life history information needed to develop a fishery management plan.

In 1991 a weir was constructed near the creek mouth, and an escapement of 218 fish was counted from April 21 to June 5. This escapement was 39 fish (18%) more than the 1990 escapement of 179 and similar to the 1989 count of 222. The peak or midpoint of the immigration occurred on May 16, 1991. Forty-nine percent of the escapement were female and 51% were male. First-time spawners (age 3.2) constituted 65% of the escapement. Of 13 different age classes of repeat spawners, ages 3.2S1 and 4.2S1 accounted for 58%. Females averaged 760 millimeters fork length (SE = 7 millimeters) and males 694 millimeters (SE = 10). A total of 91 steelhead kelts passed downstream through the weir at Peterson Creek by June 12, 1991.

An experiment designed to estimate the number of juvenile steelhead/rainbow which rear above the Peterson Creek barrier falls and pass downstream over the falls to supplement the steelhead production in lower Peterson Creek was also conducted. There was no evidence of supplementary production from above the barrier falls.

KEY WORDS: Peterson Creek, steelhead, *Oncorhynchus mykiss*, escapement, weir, Dolly Varden, *Salvelinus malma*, cutthroat trout, *Oncorhynchus clarki*, creel survey, Juneau, Southeast Alaska, AWL, age-weight-length, rainbow trout, harvest.

## INTRODUCTION

The Peterson Creek and Lake system (Figure 1) presently supports the most heavily fished steelhead *Oncorhynchus mykiss* and resident rainbow trout *O. mykiss* fishery on the Juneau road system (Schwan 1990). Peterson Lake is located 8 km upstream of the mouth and is inaccessible to migrating steelhead due to a barrier falls 4 km upstream. To improve production of steelhead, the lake was treated in 1961 with rotenone to eliminate the resident population of Dolly Varden *Salvelinus malma* and stocked with 18,915 steelhead fry from Eva Lake. From 1962 through 1968 the lake was stocked with steelhead fry from a variety of sources (Table 1). The lake was stocked in the belief that juvenile steelhead/rainbow smolt would leave the lake, drop over the barrier falls and return as adult steelhead to lower Peterson Creek. The rotenone treatment was deemed a partial success in 1964 when Dolly Varden comprised 50% of fish samples obtained in Peterson Lake (Record of Lake Rehabilitation, Region I Catalog and Inventory Files, Douglas, Alaska). Peterson Creek was later used as a source of steelhead eggs for the Snettisham Hatchery from 1983 to 1987 (Table 2), but no fry were subsequently returned to Peterson Creek.

Management of the Peterson Creek steelhead fishery has been based on the assumption that juvenile steelhead/rainbow trout that rear above the barrier falls migrate downstream and supplement the steelhead population. Because of this assumption, harvest restrictions beyond the Southeast-wide regulations have not been deemed necessary, despite the small run size. The occurrence and extent of this supplementation has never been demonstrated.

A U.S. Forest Service recreational cabin has been constructed at Peterson Lake and is accessible via a recently improved 6.4-km-long trail. Also, the State of Alaska has acquired land at the mouth of Peterson Creek to improve access for anglers. These improvements are expected to increase the effort and harvest of Peterson Creek steelhead.

This project was motivated by concern that increasing effort and/or low estimates of stock size could deplete this stock. Consequently, in 1989, ADF&G built a bipod and picket weir near the outlet of the drainage and counted 222 steelhead immigrants with 165 kelts between May 2 and June 4. During 1989, anglers spent an estimated 2,121 angler-hours to harvest 22 steelhead and to catch and release an additional 17 (Harding and Jones 1990). The 1990 steelhead escapement was 179, with 114 kelts passed downstream. Anglers spent an estimated 2,865 angler-hours in 1990 to harvest 18 steelhead and to catch and release another 16 (Harding and Jones 1991).

The objectives of the 1991 research efforts were to:

1. count the escapement of steelhead into Peterson Creek between April 8 and June 12, 1991;
2. estimate the age and length composition of the adult steelhead returning to Peterson Creek between April 8 and June 12, 1991; and
3. determine whether rainbow trout smolt or juveniles which rear upstream of the barrier falls migrate downstream of the falls, thereby potentially contributing to Peterson Creek steelhead smolt production.

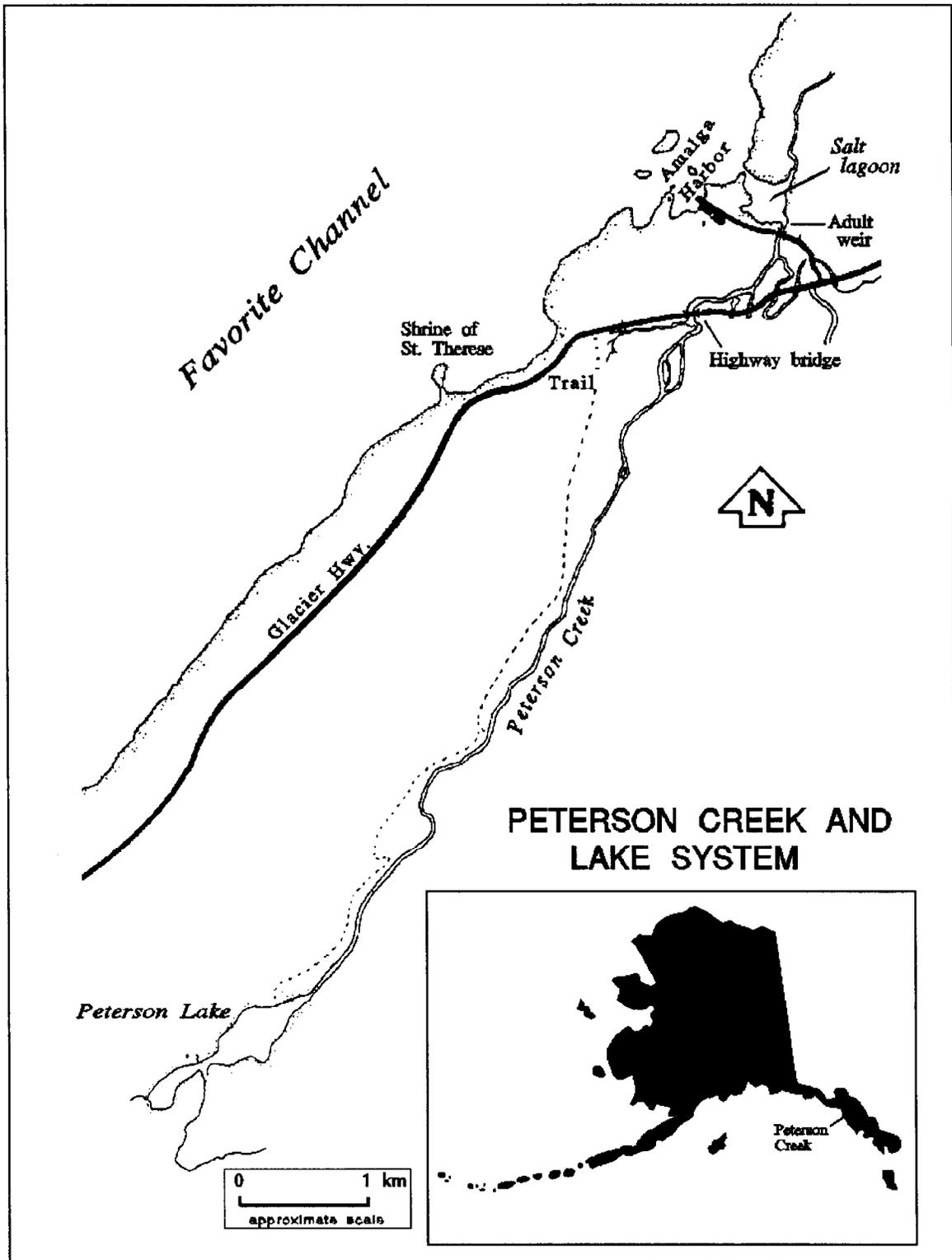


Figure 1. The Peterson Creek and Lake system near Juneau, Alaska.

Table 1. Numbers of fish stocked into the Peterson Creek/Lake system.<sup>a</sup>

Date	Species	Number	Size/Stage	Source
1919	pink salmon	3,300,000	eyed eggs	NA <sup>b</sup>
6/17/41	steelhead	8,600	eyed eggs	Ward Lake
6/17/41	steelhead	10,000	eyed eggs	Ward Lake
1960-62	grayling	NA	eyed eggs	NA
8/10/61	steelhead	14,300	fry	Lake Eva
8/12/61	steelhead	4,615	fry	Lake Eva
8/08/62	steelhead	16,500 <sup>c</sup>	1,100/1b	NA
7/30/63	steelhead	21,028	1,865/1b	NA
8/07/64	steelhead	17,388	700/1b	Pleasant Bay
8/??/65 <sup>d</sup>	steelhead	17,000	1,200/1b	NA
8/??/66	steelhead	17,000	700/1b	NA
8/??/67	steelhead	12,000	800/1b	NA
1968	steelhead	15,000 <sup>e</sup>	NA	NA

<sup>a</sup> Source: unpublished data in ADF&G Division of Sport Fish Region I catalog and inventory files, Juneau, Alaska.

<sup>b</sup> Not available.

<sup>c</sup> Incorrectly reported as 6,500 in Harding and Jones (1990).

<sup>d</sup> Incorrectly reported as 8/??/66 in Harding and Jones (1990).

<sup>e</sup> Incorrectly reported as 12,000 in Harding and Jones (1990).

Table 2. Number and sex of steelhead removed from Peterson Creek to be used as a brood source for Snettisham Hatchery, 1983-1987.<sup>a</sup>

Sex	Year				
	1983	1984	1985	1986	1987 <sup>b</sup>
Male	3	4	10	121	8
Female	5	4	10	11	8
Total	8	8	20	22	16

<sup>a</sup> Source: unpublished data in ADF&G Division of Sport Fish Region I catalog and inventory files, Juneau, Alaska.

<sup>b</sup> All but one male were live spawned in 1987.

## METHODS

### Adult Escapement

Adult steelhead were caught in a trap as they passed upstream through an aluminum channel and picket weir erected 100 m above a saltwater lagoon at the mouth of Peterson Creek (Figure 1). Steelhead were sampled for length and scales (ages). Each steelhead sampled was measured to the nearest 5 mm of fork length (tip of snout to fork of tail), and scales were extracted for age analysis. Date, time of passage through weir, sample number, sex (if possible), condition, and comments, were also recorded. Eight scales were collected, four from each side of the fish, from an area two scale rows above the lateral line on a diagonal line from the posterior end of the dorsal fin to the anterior end of the anal fin. Scale samples were mounted on gum cards, and triacetate impressions of the scales (7,000 kg/cm<sup>2</sup> pressure at a temperature of 97°C for 30 seconds) were prepared for use in determining age. Water temperature and depth were measured 5 m downstream from the weir each morning. Water depth was recorded to the nearest 0.5 cm and water temperature to the nearest °C.

Steelhead scales were aged using methods described by Narver and Withler (1977). Repeat spawners are classified with an "S" after the ocean age to denote a successful spawning and survival. For example, a steelhead aged as 3.2S1 was 6 years old: it spent 3 years (winters) in fresh water before emigration as a smolt, and 2 years (winters) in salt water, then returned to fresh water as an adult, spawned ("S"), and survived another year in salt water before returning to fresh water on its second spawning run. First-time spawning steelhead are fish without an "S" in their total age designation.

The mean and standard error for the length estimates were calculated using standard procedures for normal variates (SAS 1985).

### Juvenile Studies

To determine if juvenile steelhead/rainbow from above the barrier falls could supplement the production of steelhead in lower Peterson Creek, we conducted a mark-recapture experiment to estimate the number of "above barrier" fish leaving Peterson Creek. Fish were captured above the falls and given a mark. Later, emigrants were captured with a fyke net near the falls and the total number of marked fish going over the falls was estimated from the proportion of marked to unmarked fish in the fyke net catch. Finally, the number of "above barrier" fish leaving the drainage was estimated from the number of marked fish counted at the weir expanded by the proportion of marked to unmarked fish in the fyke net.

A marking event was conducted between the barrier falls in Peterson Creek and Peterson Lake from April 22 to April 26. Juvenile rainbow/steelhead were captured by using baited minnow traps and a backpack electro-shocker. Fish were marked with a small upper caudal clip. All fish captured were measured to the nearest 1 mm fork length and weighed to the nearest gram. Scales were collected and placed between clear plastic sheets, stored in coin envelopes, and the ages determined by examination of the scales. Fish were physically examined for signs of smolting (color and ease of scale removal) and for sexual maturity (dripping eggs or milt).

On May 6-8 and May 21-22, marking events were conducted at the outlet of Peterson Lake. A combination of small minnow traps, large minnow traps, and a fyke net

were set near the outlet of Peterson Lake. All Dolly Varden caught were counted and all steelhead/rainbow trout captured were sampled as described above. These trout were also given upper caudal clips.

The barrier falls fyke net was operational from April 17 through June 15 and was fished continuously except for short periods of high water. The fyke net was not designed to capture every downstream moving fish but spanned approximately 35% of the stream and funnelled half of the stream water. A trapping event to look for marked fish that may have escaped the barrier falls net was conducted immediately downstream of the barrier falls on May 30-31 and June 5.

After the adult weir was installed, a downstream fyke net was placed in the weir to capture emigrant juvenile fish. The weir was made "smolt-tight" with 1-cm by 1-cm mesh vexar netting stretched across the face of the weir. Salmonids  $\geq 50$  mm moving downstream were captured and identified, and all juvenile steelhead/rainbow trout were examined for fin clips and sampled as described above. Fish  $< 50$  mm could generally pass downstream through the vexar netting.

An estimate of the abundance of juvenile rainbow/steelhead passing over the barrier falls can be calculated as the number of marked fish captured in the weir divided by the proportion of smolt (or juvenile fish) that were captured in the upstream fyke net (sampling just above the barrier falls) that were marked:

$$\hat{N}_u = \frac{M}{\hat{p}} \quad (1)$$

where  $\hat{N}_u$  = total number of smolt captured at the weir from above the falls;

M = total number of marked smolt counted at the weir which were marked above the falls; and

$\hat{p}$  = proportion of the smolt captured ( $m/n$ , where  $m$  is the number of marked smolt captured among  $n$  captures) in the fyke net just above the barrier falls which are marked.

The variance of  $\hat{N}_u$  is estimated by employing the Delta Method (Seber 1982):

$$V[\hat{N}_u] = M^2 \left( \frac{1}{\hat{p}} \right)^4 V[\hat{p}] \quad (2)$$

where  $V[\hat{p}] = \left( 1 - \frac{n}{N_u} \right) \left( \frac{p(1-p)}{(n-1)} \right)$ .

## RESULTS

### Adult Escapement

The adult steelhead weir was fish-tight on April 15, 1991. A snorkel survey of the stream above the weir, conducted on April 16, found one steelhead 300 m above the weir. Between April 21 and June 5, 218 steelhead were counted upstream through the weir, with the peak or midpoint of the escapement occurring on May 16 (Figure 2 and Appendix A1).

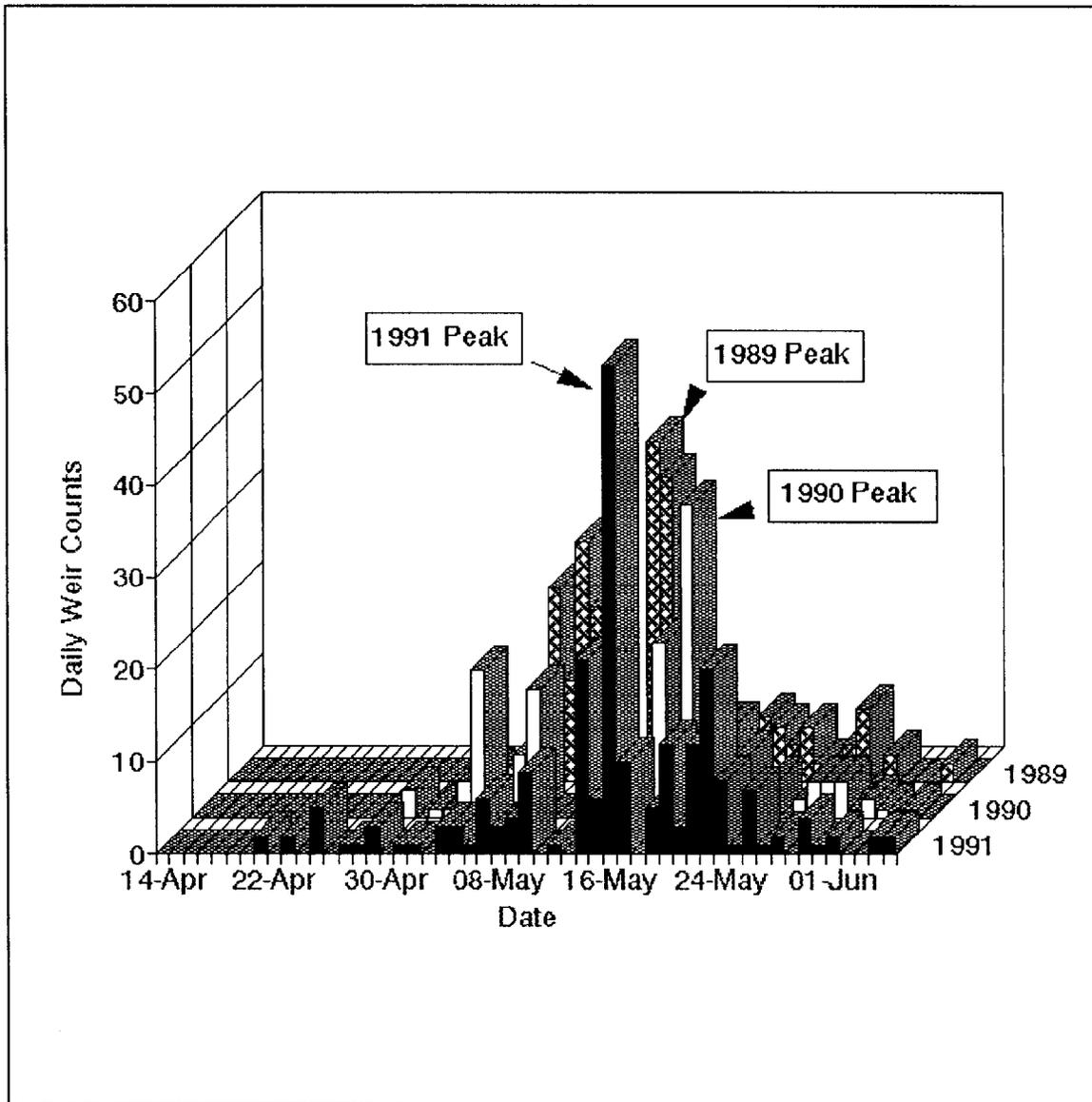


Figure 2. Escapement timing for steelhead at the Peterson Creek weir, 1989, 1990 and 1991.

Ninety-one steelhead kelts were counted moving downstream through the weir after spawning (Appendix A1). The first three fish passed through the weir on May 24, and the peak of downstream migration occurred on June 6, when 38 fish were counted (Figure 3). The downstream count was 42% of the upstream count, but steelhead were still leaving the system when the weir was removed on June 12.

Water temperatures ranged from 2.0°C on April 21 to 8.5°C on June 5. Stream water levels ranged from a high of 89 cm on May 11 to a low of 21 cm on June 4 (Appendix A1).

Ninety-nine percent (215 fish) of the 218 steelhead escapement passing the weir were sampled for age, length, and sex (Appendix A2). Of these, 110 were males and 108 were females. Two of the (110) males sampled were not scale sampled, yielding a sample of 108 males and 107 females (or 215 fish) for age analysis. Nine of these 215 scale samples (3 from males and 6 from females) could not be aged. Of the 206 remaining scale samples, saltwater age was not determined for 2 fish and freshwater age was not determined for 31 fish (Table 3). Sixty-five percent of the sampled fish were first-time spawners; 45% were age 3.2, 36% were age 4.2, and 24% were age 3.3 (Table 3, Figure 4). Of 13 different age classes of repeat spawners, ages 3.2S1 and 4.2S1 accounted for 58%. Females averaged 761 mm (SE = 7 mm) long and males averaged 694 mm (SE = 10 mm) long.

#### Juvenile Studies

Forty-three juvenile steelhead/rainbow trout were captured between the barrier falls and Peterson Lake and marked with upper caudal clips between April 22 and April 26, 1991 (Table 4). Of these 43 fish, 34 were captured with minnow traps and 9 with a backpack electro-shocker. The fish marked above the falls ranged in length from 60 mm to 158 mm with a mean length of 116 mm (SE = 3.0) (Table 4). The age composition of the 43 fish marked included: 1 (2.6 %) age 1, 12 (31.6 %) age 2, 15 (39.5 %) age 3, 9 (23.7 %) age 4, and 1 (2.6 %) age 5. Scales from five of the fish were unreadable. Twenty of the 43 fish caught above the barrier falls were ripe males, with 22 additional fish categorized as "resident" on the basis of their visual appearance; one fish was not categorized (Table 5). Only one steelhead/rainbow trout previously marked with an upper caudal clip was recaptured during this marking period.

No steelhead/rainbow trout were captured during the first marking event (May 6-8, 1991) in Peterson Lake (though 161 Dolly Varden were caught). Two steelhead/rainbow trout were caught on the second trip (May 21 and May 22) along with 550 Dolly Varden. Both of the steelhead/rainbow captured were visually classified as "resident." The largest steelhead/rainbow trout was 4 years old and was 139 mm long, while the smaller fish was 2 years old and 127 mm long (Table 4).

The downstream fyke net located above the barrier falls was fished from April 17 until June 15. No downstream migrating steelhead/rainbow trout or any Dolly Varden were caught.

On April 17, 1991 the fyke net at the adult weir was operational. On the first full day of operation (April 18), the net caught 47 emigrating juvenile steelhead/rainbow trout (Figure 5, Table 6, and Appendix A2). The fyke net was periodically shut down during floods, but otherwise was operated continuously until June 12. One hundred twenty-three (123) emigrants were captured in the fyke net at the weir; of these, 3 died (Table 6). The midpoint of emigrants

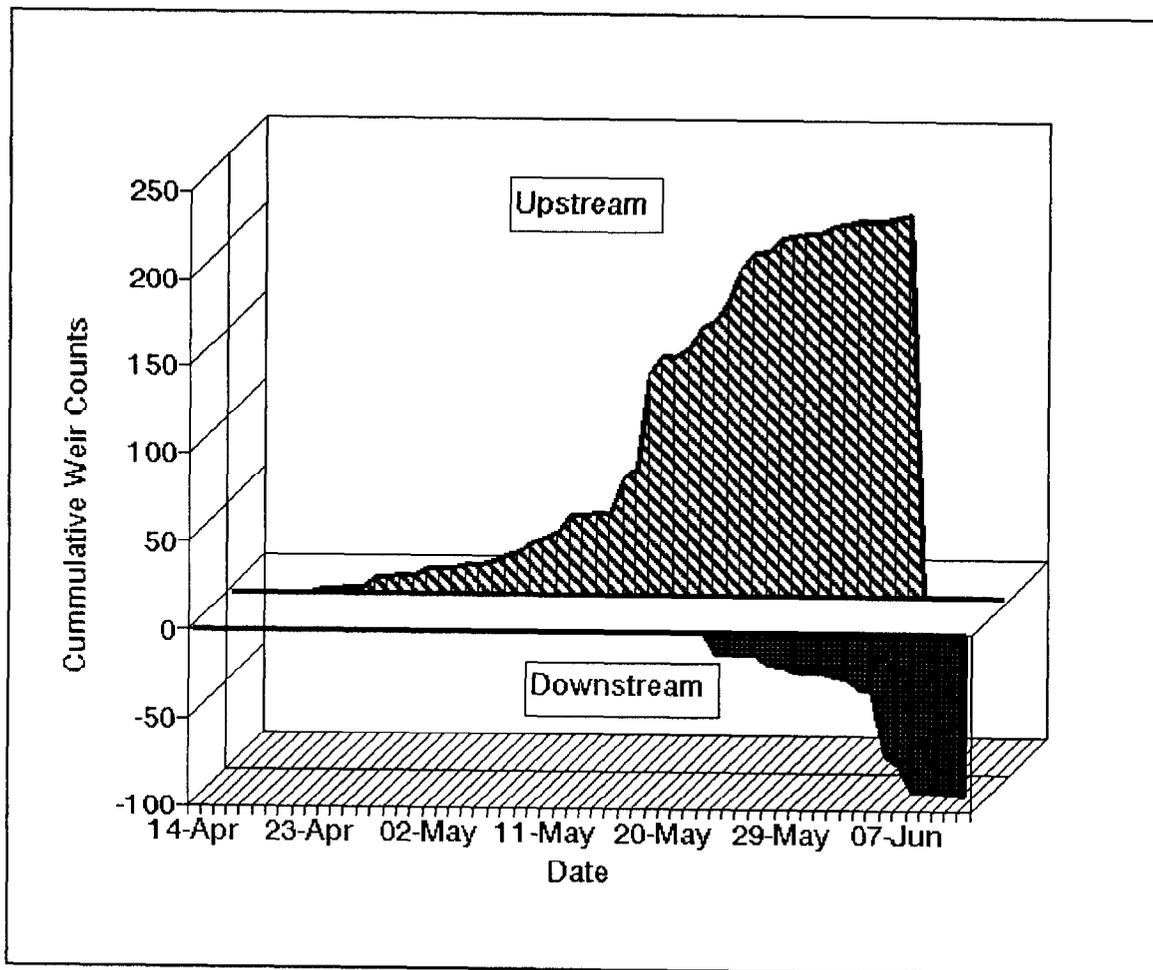


Figure 3. Cumulative upstream and downstream counts of adult steel-head at the Peterson Creek weir, 1991.

Table 3. Estimated age composition and mean length at age of the steelhead escapement at Peterson Creek, 1991.

Age Class	Female			Male			Combined
	n	Length	SE	n	Length	SE	n
2.2S1				1	900		1
2.3				1	820		1
2.3S1	2	799	29.0				2
3.2	4	639	19.9	32	620	8.1	36
3.2S1	9	783	20.4	9	766	17.5	18
3.2S1S1	1	810		2	793	27.5	3
3.3	16	794	7.5	6	831	12.8	22
3.3S1	5	818	15.4	3	862	11.7	8
3.3S1S1	1	915					1
3.X	1	768					1
4.1				1	457		1
4.1S1S1	1	785					1
4.1S2	1	620					1
4.2	8	630	6.3	24	663	9.3	32
4.2S1	9	751	13.6	4	778	64.6	13
4.2S1S1	3	796	25.6	1	915		4
4.3	13	766	8.8	3	811	49.5	16
4.3S1	3	800	30.6				3
4.3S1S1	1	925					1
4.X	1	840					1
5.2	3	610	17.8	4	718	12.3	7
5.2S1	1	685		1	800		2
? .2S1				1	740		1
? .3	2	805	10.0				2
R.2	3	718	66.7	7	645	14.4	10
R.2S1	3	756	8.3	2	740	65.0	5
R.2S1S1	1	778		1	695		2
R.2S1S1S1	3	828	20.9				3
R.3	5	778	20.5	2	778	97.5	7
R.3S1	1	825					1
UNREADABLE	6	764	30.9	3	682	38.4	9
Total	107			108			215

? = Scales regenerated; freshwater ages undetermined.

X = Unable to determine saltwater age.

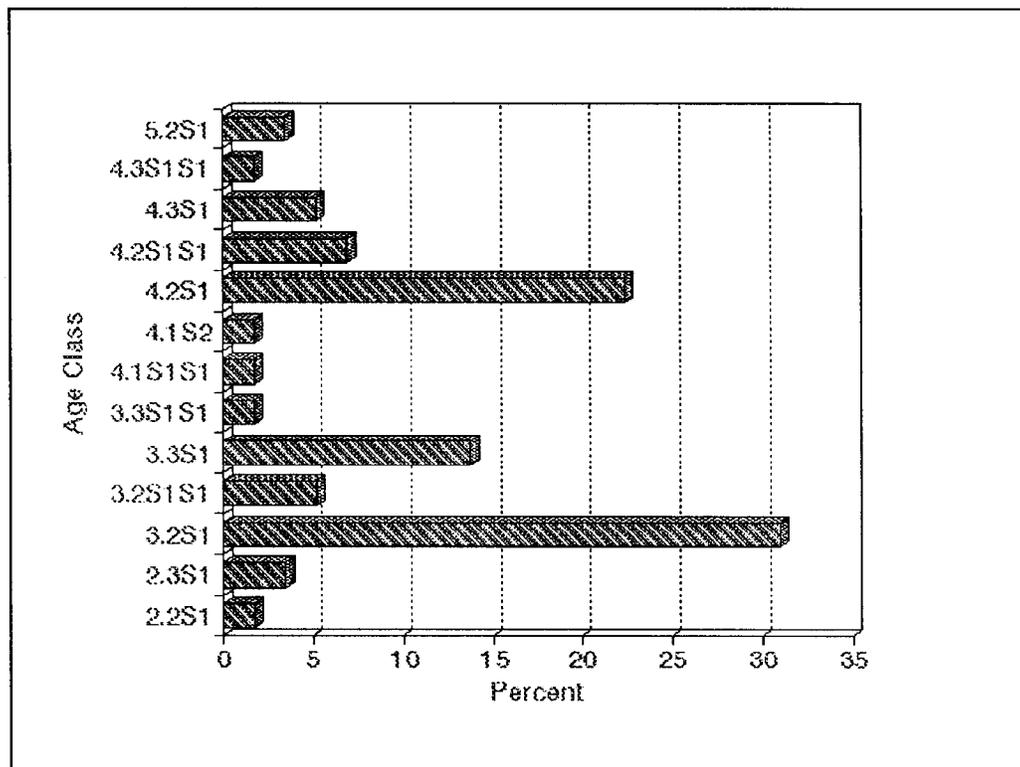
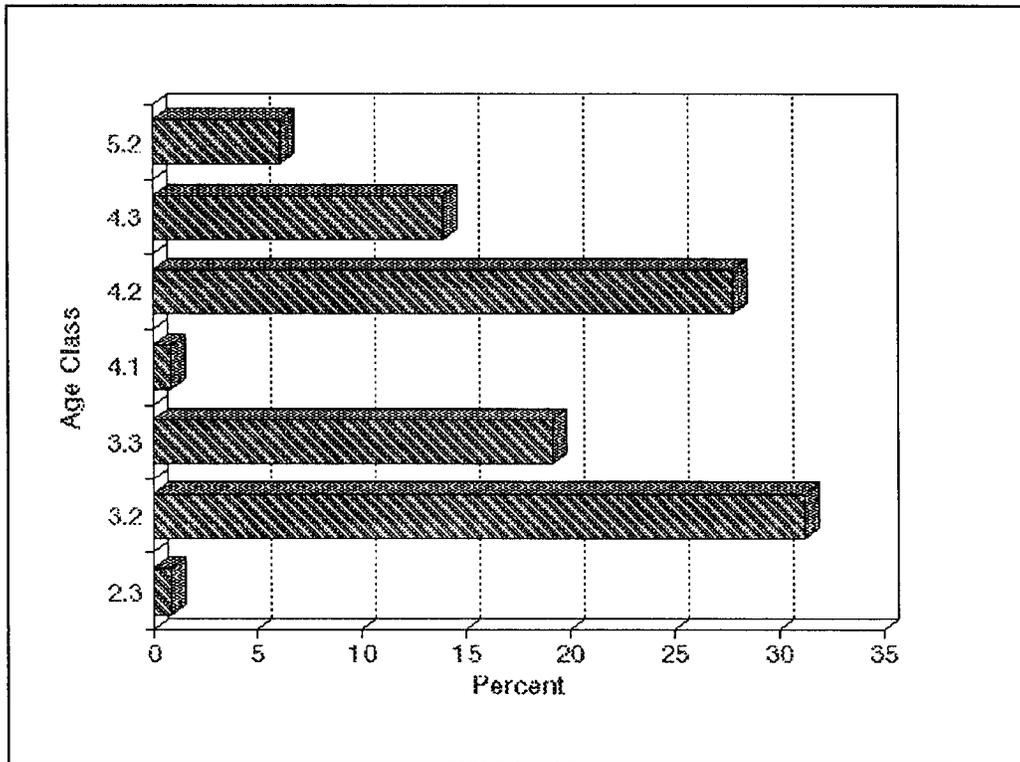


Figure 4. Age composition of first-time (above) and repeat (below) spawning steelhead in Peterson Creek, 1991. Only completely determined age classes are shown.

Table 4. Ages of juvenile steelhead/rainbow captured upstream of the barrier falls (above falls), at Peterson Lake (Pet. Lake), and just downstream of the barrier falls (below falls) during 1991.

Area	Age class	Mean length (mm)	SE	Min length (mm)	Max length (mm)	n
Below falls	?	68.2	3.9	52	83	9
Below falls	1	63.7	1.7	52	78	18
Below falls	2	74.2	2.1	61	112	28
Below falls	3	123.8	3.8	110	142	8
	<u>Mean</u>	76.6	2.7	52	142	63
Pet. Lake	2	127.0	0.0	127	127	1
Pet. Lake	4	139.0	0.0	139	139	1
	<u>Mean</u>	133.0	6.0	127	139	2
Above falls	1	60.0	0.0	60	60	1
Above falls	2	97.4	2.2	87	115	12
Above falls	3	119.2	2.6	101	138	15
Above falls	4	127.7	4.3	114	157	9
Above falls	5	155.0	0.0	155	155	1
Above falls	?	134.6	6.2	122	158	5
	<u>Mean</u>	116.1	3.0	60	158	43
Overall		93.4	2.7	52	158	108

Table 5. Summary of juvenile steelhead/rainbow lengths by maturity index for fish captured above the barrier falls (above falls), at Peterson Lake (Pet. Lake), and just below the barrier falls (below falls) at Peterson Creek, 1991.

Area	Maturity index	Sex	Mean length (mm)	SE	Min length (mm)	Max length (mm)	n
Below falls	resident	?	69.8	1.5	52	112	55
Below falls	presmolt	?	123.8	3.8	110	142	8
Pet. Lake	resident	?	133.0	6.0	127	139	2
Above falls		?	95.0	0.0	95	95	1
Above falls	resident	?	111.1	4.8	60	157	21
Above falls	resident	F	155.0	0.0	155	155	1
Above falls	mature/res.	M	120.6	3.1	94	158	20
Overall			93.4	2.7	52	158	108

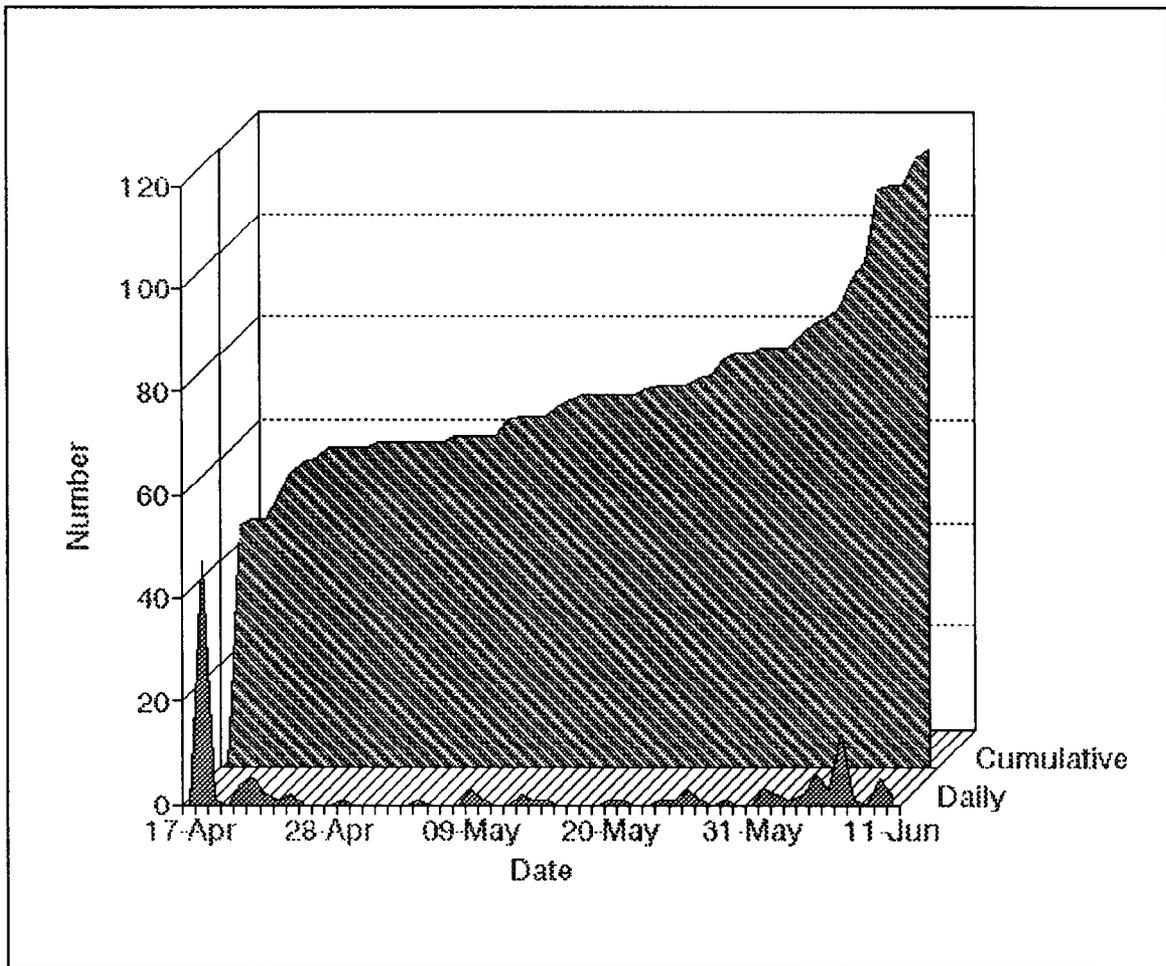


Figure 5. Daily and cumulative counts of downstream migrating juvenile steelhead/rainbow at Peterson Creek, 1991.

Table 6. Daily and cumulative (cum.) counts of downstream migrating steelhead smolt, cutthroat trout, Dolly Varden, and juvenile coho salmon in Peterson Creek, 1991.

Date	Steelhead		Cutthroat		Dolly Varden		Coho	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
17 Apr	0	0	0	0	0	0	0	0
18 Apr	47	47	2	2	8	8	14	14
19 Apr	1	48	0	2	0	8	2	16
20 Apr	0	48	0	2	0	8	0	16
21 Apr	4	52	1	3	20	28	26	42
22 Apr	5	57	1	4	11	39	34	76
23 Apr	2	59	1	5	5	44	21	97
24 Apr	1	60	0	5	10	54	24	121
25 Apr	2	62	0	5	18	72	17	138
26 Apr	0	62	1	6	9	81	7	145
27 Apr	0	62	0	6	5	86	6	151
28 Apr	0	62	0	6	8	94	0	151
29 Apr	1	63	0	6	5	99	2	153
30 Apr	0	63	0	6	0	99	3	156
01 May	0	63	0	6	0	99	0	156
02 May	0	63	0	6	0	99	5	161
03 May	0	63	0	6	2	101	0	161
04 May	0	63	0	6	4	105	0	161
05 May	1	64	0	6	4	109	8	169
06 May	0	64	2	8	4	113	1	170
07 May	0	64	0	8	3	116	4	174
08 May	0	64	0	8	2	118	2	176
09 May	3	67	0	8	9	127	4	180
10 May	1	68	0	8	2	129	4	184
11 May	0	68	0	8	0	129	0	184
12 May	0	68	0	8	0	129	0	184
13 May	2	70	0	8	7	136	13	197
14 May	1	71	1	9	7	143	23	220
15 May	1	72	0	9	7	150	20	240
16 May	0	72	1	10	6	156	20	260
17 May	0	72	0	10	16	172	28	288
18 May	0	72	1	11	13	185	79	367
19 May	0	72	0	11	32	217	184	551
20 May	1	73	0	11	21	238	46	597
21 May	1	74	1	12	40	278	90	687
22 May	0	74	0	12	26	304	200	887
23 May	0	74	3	15	47	351	147	1034
24 May	1	75	0	15	48	399	193	1227
25 May	1	76	0	15	35	434	147	1374
26 May	3	79	0	15	25	459	211	1585
27 May	1	80	0	15	1	460	230	1815
28 May	0	80	1	16	0	460	139	1954
29 May	1	81	0	16	18	478	447	2401
30 May	0	81	0	16	9	487	244	2645
31 May	0	81	0	16	2	489	476	3121
01 Jun	3	84	0	16	6	495	235	3356
02 Jun	2	86	0	16	4	499	81	3437
03 Jun	1	87	0	16	3	502	25	3462
04 Jun	2	89	0	16	2	504	77	3539
05 Jun	6	95	1	17	6	510	142	3681
06 Jun	3	98	0	17	1	511	0	3681
07 Jun	14	112	0	17	3	514	71	3752
08 Jun	1	113	1	18	3	517	32	3784
09 Jun	0	113	0	18	0	517	0	3784
10 Jun	5	118	0	18	5	522	31	3815
11 Jun	2	120	1	19	1	523	0	3815
Totals	120		19		523		3815	

occurred on April 25, 1991 (Figure 5). In addition to steelhead/rainbow, 3,815 juvenile coho, 523 Dolly Varden, and 19 cutthroat trout emigrants were counted (Table 6). No marked fish were caught.

Ninety-eight of the surviving 120 juvenile steelhead captured in the main weir fyke net were scale sampled. The predominant ages for captured smolt were age 3 (49%) and age 4 (30%) (Table 7). Only six of the downstream migrants were visually categorized as "resident" on the basis of their visual appearance (i.e. dark color, parr marks, and/or ease of scale removal); the remainder were categorized as either smolt or pre-smolt. The mean length of the 123 steelhead smolt captured was 181 mm (SE = 2).

On May 30-31 and June 5, sampling events were conducted immediately downstream of the barrier falls to look for marked fish that may have escaped the barrier falls fyke net. A total of 63 juvenile steelhead/rainbow were captured, sampled, and examined for marks. None of the fish examined were marked. All fish were captured using small minnow traps; backpack electro-shockers were not used because of the presence of adult steelhead. The 63 steelhead/rainbow captured had a mean length of 124 mm (SE = 4.0); 18 (29%) were age 1, 28 (44%) were age 2, 8 (13%) were age 3, and 9 (14%) could not be aged (Table 4). Fifty-five (87%) of these fish were visually classified as resident and 8 (13%) were classified as presmolt.

#### DISCUSSION

In 1990 we operated a smolt weir above the barrier falls to count emigrating steelhead/rainbow from May 16 to June 17 and sporadically from June 18 through August 5 (severe water fluctuations prevented continuous operation). One marked steelhead/rainbow was caught on August 2; however, this fish was known to reside at the weir site (uniquely marked). In 1991 we fished a fyke net 20 m downstream of the 1990 weir site and caught no fish. If there were many emigrants moving downstream some would have been captured. Furthermore, no marked steelhead/rainbow trout were captured in the fyke net at the adult weir or in minnow trapping below the falls in 1991. This strongly suggests that supplementation of steelhead production in the lower river is negligible or non-existent.

It is possible that some smolt left prior to the April 17 installation of the fyke net at the adult weir, as the smolt count appeared to peak on April 25. However, at Petersburg Creek, near Petersburg, Alaska, steelhead smolt emigration rates peak in June (Jones 1975; Jones *Unpublished*). Based on this, we suspect that our observed peak in April was not the true peak of migration (it may have been a surge in emigration rates possibly related to environmental conditions). Consequently, it is our judgment that few fish were missed.

The 1991 upstream movement of steelhead began earlier than in 1989 (Harding and Jones 1990) or 1990 (Harding and Jones 1991) with the first fish through the weir on April 21. A dive survey on April 16 revealed the presence of one adult steelhead (bright silver) approximately 300 m above the weir, indicating an even earlier entrance into Peterson Creek this year. The 1991 return of 218 was 17.9% above the 1990 count of 179 and nearly identical to the 222 count in 1989. The harvest of adult steelhead in Peterson Creek was 18 in 1990 and 22 in 1989; no creel census was conducted in 1991. Thus, the exploitation rate by recreational anglers is about 10% of the observed return.

In 1989 and 1990 we noted that most angling effort in Peterson Creek occurred prior to the arrival of the fish: an estimated 1,344 angler hours (52% of the total 1990 angler effort) occurred before the passage of the fifth steelhead through the weir. Should this amount of effort shift to when fish are present in the stream, more fish would be harvested. It would take only a minor shift in timing of angler effort to significantly impact the Peterson Creek steelhead. It is also likely that angler effort at Peterson Creek will increase in the future. The catch rate (CPUE) of 0.01-0.02 for Peterson Creek steelhead is lower than the 0.11-0.36 fish CPUE for other streams sampled in southeast Alaska (Table 8).

Managers have wrongly assumed that the production of Peterson Creek steelhead was supplemented by smolt from the upper drainage and that this buffered the stock from any harmful effects of harvest. Our data show that smolt are not derived from the upper drainage but most likely from recruitment below the falls. We conclude that the population has been reduced from historical levels, and we are concerned that sustained or increased effort will over-exploit this stock. We recommend that the stock be managed for catch and release.

#### ACKNOWLEDGMENTS

We thank local property owners Walter E. Butts, Jr., and Mrs. Jeannie B. Moulds, who allowed us to place part of our weir on their property. We also thank the City and Borough of Juneau for allowing us to locate part of our weir and a tent camp on their property. Invaluable assistance was provided by project technicians Kurt Kondzela, Brad Gruening, and Andy Starostka.

Table 7. Ages of downstream migrating steelhead/rainbow smolt captured in a stream type fyke net installed in the outlet weir at Peterson Creek, 1991.

Age class	Mean length (mm)	SE	Min. length (mm)	Max. length (mm)	n
2	81.5	6.5	75	88	2
3	163.7	2.5	113	203	48
4	194.0	2.6	165	222	29
5	205.0	4.0	171	225	15
?	173.8	17.8	124	201	4
Overall	177.7	2.8	75	225	98

Table 8. Steelhead catch rates (kept + released ÷ effort) in selected Alaska streams, 1982-1991.

Year	Location	Effort	Steelhead		CPUE	Ratio released to kept
			Kept	Released		
1982 <sup>a</sup>	Anchor	29,079	375	667	0.04	1.8
1985 <sup>b</sup>	Situk	10,434	362	2,695	0.29	7.4
1986 <sup>c</sup>	Situk	12,283	287	2,094	0.19	7.3
1987 <sup>d</sup>	Situk	10,542	391	3,797	0.40	9.7
1988 <sup>e</sup>	Situk	16,379	423	4,991	0.33	11.8
1989 <sup>f</sup>	Situk	10,988	361	2,055	0.22	5.7
1990 <sup>g</sup>	Situk	14,907	392	1,317	0.11	3.4
1991 <sup>h</sup>	Situk	4,618	NA <sup>i</sup>	1,055	0.23	3.4
1988 <sup>j</sup>	Thorne	2,331	67	93	0.07	1.4
1990 <sup>k</sup>	Thorne	3,070	111	142	0.08	1.3
1988 <sup>l</sup>	Ward	3,638	359	971	0.37	2.7
1989 <sup>m</sup>	Ward	4,778	384	293	0.14	0.8
1989 <sup>n</sup>	Karta	1,568	50	124	0.11	2.5
1989 <sup>o</sup>	Peterson	2,121	22	17	0.02	0.8
1990 <sup>p</sup>	Peterson	2,865	18	16	0.01	0.9
1990 <sup>q</sup>	Sitkoh	1,205	35	243	0.23	6.9
1991 <sup>r</sup>	Sitkoh	848	19	297	0.36	15.6

<sup>a</sup> Wallis and Balland (1984).

<sup>b</sup> Mecum and Suchanek (1986). Survey missed the early part of the run. Informal surveys indicated that at least 2,230 hours of effort were expended to harvest 66 steelhead and release another 1,889 steelhead between April 15 and April 29 (Bob Johnson, ADF&G, Division of Sport Fish, Yakutat, Alaska).

<sup>c</sup> Mecum and Suchanek (1987).

<sup>d</sup> Bingham et al. (1988).

<sup>e</sup> Suchanek and Bingham (1989).

<sup>f</sup> Johnson and Marshall (1990).

<sup>g</sup> Bob Johnson, ADF&G, Division of Sport Fish, Yakutat, Alaska, personal communication.

<sup>h</sup> Glynn (1992). Survey is for peak of season (April 8-June 2) only.

<sup>i</sup> Harvest of steelhead prohibited by emergency order.

<sup>j</sup> Freeman and Hoffman (1990). September 26, 1988 through June 4, 1989.

<sup>k</sup> Freeman and Hoffman (1991). October 23 1989 through June 3, 1990.

<sup>l</sup> Hubartt (1989). February 29, 1988 through June 19, 1988.

<sup>m</sup> Hubartt (1990). October 10, 1988 through May 21, 1989.

<sup>n</sup> Hoffman et al. (1990).

<sup>o</sup> Harding and Jones (1990).

<sup>p</sup> Harding and Jones (1991).

<sup>q</sup> Jones, Harding, and Schmidt (1991).

<sup>r</sup> Schmidt (1992).

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APPENDIX A



Appendix A1. Daily and cumulative weir counts for upstream- and downstream-migrating adult steelhead at Peterson Creek, 1991.

Date	Upstream				Downstream		Daily Water	
	Female	Male	Total	Cum.	Total	Cum.	Temp	Level
14-Apr	0	0	0	0	0	0	NA	NA
15-Apr	0	0	0	0	0	0	NA	NA
16-Apr	0	0	0	0	0	0	3.7	29.0
17-Apr	0	0	0	0	0	0	3.8	30.0
18-Apr	0	0	0	0	0	0	3.1	35.0
19-Apr	0	0	0	0	0	0	3.5	51.0
20-Apr	0	0	0	0	0	0	2.5	46.0
21-Apr	1	1	2	2	0	0	2.0	39.0
22-Apr	0	0	0	2	0	0	3.1	40.0
23-Apr	1	1	2	4	0	0	2.2	42.5
24-Apr	0	0	0	4	0	0	2.0	41.0
25-Apr	1	4	5	9	0	0	2.5	46.5
26-Apr	0	0	0	9	0	0	2.0	37.0
27-Apr	0	1	1	10	0	0	2.2	44.0
28-Apr	0	1	1	11	0	0	2.2	37.0
29-Apr	1	2	3	14	0	0	3.0	45.5
30-Apr	0	0	0	14	0	0	2.0	35.0
01-May	0	1	1	15	0	0	2.5	47.0
02-May	0	1	1	16	0	0	2.5	38.5
03-May	0	0	0	16	0	0	2.0	37.0
04-May	1	2	3	19	0	0	3.0	44.5
05-May	1	2	3	22	0	0	3.0	49.0
06-May	0	1	1	23	0	0	3.2	43.0
07-May	2	4	6	29	0	0	3.2	47.5
08-May	2	1	3	32	0	0	3.0	40.0
09-May	2	2	4	36	0	0	3.0	39.0
10-May	1	8	9	45	0	0	3.0	70.0
11-May	0	0	0	45	0	0	3.0	89.0
12-May	0	1	1	46	0	0	2.0	39.0
13-May	0	0	0	46	0	0	2.0	29.5
14-May	6	15	21	67	0	0	3.2	44.0
15-May	2	4	6	73	0	0	3.0	45.5
16-May	26	27	53	126	0	0	3.5	44.5
17-May	4	6	10	136	0	0	5.0	45.0
18-May	0	0	0	136	0	0	4.0	36.5
19-May	4	1	5	141	0	0	5.0	34.5
20-May	9	3	12	153	0	0	5.1	32.0
21-May	3	0	3	156	0	0	4.8	32.0
22-May	8	4	12	168	0	0	5.1	24.5
23-May	12	8	20	188	0	0	5.5	33.0
24-May	4	4	8	196	12	12	6.0	33.5
25-May	1	0	1	197	0	12	6.0	33.5
26-May	7	0	7	204	0	12	6.5	31.0
27-May	1	0	1	205	0	12	6.0	26.5
28-May	1	1	2	207	6	18	6.5	61.0
29-May	0	0	0	207	1	19	7.0	37.5
30-May	2	2	4	211	3	22	6.0	37.0
31-May	1	0	1	212	0	22	6.0	36.0
01-Jun	2	0	2	214	0	22	5.5	35.0
02-Jun	0	0	0	214	2	24	6.0	35.0
03-Jun	0	0	0	214	1	25	6.0	25.0
04-Jun	1	1	2	216	6	31	8.0	21.0
05-Jun	1	1	2	218	0	31	8.5	19.0
06-Jun	0	0	0	0	38	69	7.0	46.0
07-Jun	0	0	0	0	5	74	7.0	31.0
08-Jun	0	0	0	0	15	89	7.0	33.0
09-Jun	0	0	0	0	0	89	7.0	23.0
10-Jun	0	0	0	0	0	89	7.5	55.0
11-Jun	0	0	0	0	1	90	6.5	45.5
12-Jun	0	0	0	0	1	91	7.5	27.5
Total	108	110	218	218	91	91		

Appendix A2. Length, age, and sex of adult steelhead sampled at Peterson Creek weir, 1991.

Date	Length (mm)	Age class	Sex	Comments
21-Apr	540	3.2	M	SEMI BRIGHT
21-Apr	810	3.3	F	BRIGHT
23-Apr	780	R.2	F	VERY BRIGHT
23-Apr	835		M	SEMI BRIGHT RIPE SCALES UNREADABLE
25-Apr	408		M	SEMI BRIGHT RIPE SCALES REGENERATED
25-Apr	675	4.2	M	SEMI BRIGHT RIPE
25-Apr	895	3.2S1	F	BRIGHT RIPE
25-Apr	675	R.2S1	M	SEMI BRIGHT RIPE
25-Apr	710	3.2	M	SEMI BRIGHT RIPE
27-Apr	735	4.2	M	CAUGHT IN SALTWATER AT MOUTH OF PETERSON (BRIGHT)
28-Apr	765	3.2S1S1	M	SEMI BRIGHT RIPE
29-Apr	865	3.3	M	DARK RIPE
29-Apr	620	3.2	M	BRIGHT RIPE
29-Apr	810	R.2S1S1S1	F	BRIGHT FIRM
01-May	813	3.3	M	SEMI BRIGHT RIPE; SPORT CAUGHT IN SALTWATER
02-May	900	2.2S1	M	VERY DARK RIPE; SPORT CAUGHT OFF POINT BEHIND WEIR
04-May	820	3.2S1S1	M	RIPE DARK
04-May	770	3.2S1	M	RIPE SEMI BRIGHT
04-May	805	R.2S1S1S1	F	RIPE DRIPPING EGGS; GILL NET MARKS ON FRONT HALF OF BODY
05-May	770	4.2S1	M	DARK
05-May	585	3.2	M	SEMI DARK RIPE
05-May	790	R.2	F	BRIGHT TIGHT- NOT RIPE
06-May	605	R.2	M	SEMI BRIGHT RIPE
07-May	800	3.3	F	SEMI BRIGHT RIPE; NET MARKED
07-May	848		F	SEMI BRIGHT NOT RIPE SCALES UNREADABLE
07-May	631	3.2	M	SEMI BRIGHT RIPE
07-May	645	3.2	M	SEMI BRIGHT RIPE
07-May	756	4.3	M	SEMI DARK; RIPE
07-May	725	3.2S1	M	SEMI DARK; RIPE
08-May	690	3.2	F	BRIGHT RIPE
08-May	870	R.2S1S1S1	F	BRIGHT, NOT RIPE
08-May	615	4.2S1	M	SEMI DARK RIPE
09-May	604	3.2	M	SEMI DARK; RIPE
09-May	630	R.2	M	SEMI BRIGHT RIPE
09-May	780	3.3	F	BRIGHT RIPE; NET MARKED
09-May	830	UNREADABLE	F	BRIGHT; NOT RIPE; NET MARKS
10-May	810	3.3	F	BRIGHT NOT RIPE
10-May	457	4.1	M	BRIGHT RIPE
10-May	646	3.2	M	SEMI BRIGHT RIPE
10-May	595	3.2	M	SEMI BRIGHT RIPE
10-May	800	3.2S1	M	SEMI DARK RIPE
10-May	695	R.2S1S1	M	SEMI DARK RIPE
10-May	675	4.2	M	SEMI DARK RIPE
10-May	910	4.3	M	SEMI BRIGHT RIPE

-continued-

Date	Length (mm)	Age class	Sex	Comments
10-May	610	3.2	M	BRIGHT RIPE
12-May	795	4.2S1	M	SEMI DARK NOT RIPE
14-May	635	3.2	M	SEMI DARK RIPE
14-May	656	3.2	M	SEMI DARK RIPE
14-May	614	4.2	M	SEMI DARK RIPE
14-May	725	R.3	F	BRIGHT NOT RIPE
14-May	805	3.2S1	F	BRIGHT RIPE
14-May	805	R.2S1	M	SEMI DARK RIPE
14-May	665	UNREADABLE	M	RIPE SEMI DARK
14-May	850	3.3S1	M	RIPE SEMI DARK
14-May	758	3.2	M	RIPE SEMI DARK
14-May	650	4.2	M	NOT RIPE SEMI DARK; HOOK SCAR
14-May	624	3.2	M	RIPE SEMI DARK
14-May	875	R.3	M	RIPE SEMI DARK
14-May	768	R.2S1	F	RIPE SEMI BRIGHT
14-May	670	4.2	M	NOT RIPE SEMI BRIGHT
14-May	720	4.2	M	RIPE SEMI BRIGHT
14-May	670	3.2	M	RIPE SEMI BRIGHT
14-May	768	4.3	M	RIPE SEMI DARK
14-May	795	4.2S1	F	RIPE SEMI DARK; NET MARKS
14-May	740	4.2	M	RIPE SEMI DARK
14-May	775	3.3	F	RIPE SEMI BRIGHT
14-May	790	4.3	F	RIPE BRIGHT
15-May	845	3.3	M	SEMI DARK NOT RIPE
15-May	746	3.2S1	F	SEMI DARK RIPE
15-May	820	2.3	M	SEMI DARK; RIPE
15-May	620	4.2	M	SEMI DARK; RIPE
15-May	615	3.2	M	SEMI BRIGHT; NOT RIPE
15-May	620	4.2	F	BRIGHT; FIRM
16-May	805	3.2S1	F	BRIGHT; NOT RIPE
16-May	775	3.3	F	BRIGHT; NOT RIPE
16-May	575	4.2	M	SEMI BRIGHT
16-May	595	3.2	M	SEMI BRIGHT
16-May	645	4.2	M	DARK RIPE
16-May	585	R.2	F	BRIGHT NOT RIPE
16-May	825	R.3S1	F	SEMI BRIGHT; NOT RIPE
16-May	595	3.2	M	SEMI DARK; RIPE
16-May	615	3.2	M	SEMI DARK; RIPE
16-May	775	3.2S1	F	BRIGHT; NOT RIPE
16-May	770	2.3S1	F	BRIGHT; NOT RIPE
16-May	770	3.2S1	M	RIPE DARK
16-May	775	3.3	F	NOT RIPE; BRIGHT
16-May	765	3.2S1	M	RIPE; DARK
16-May	735	3.2S1	F	NOT RIPE BRIGHT
16-May	745	4.2S1S1	F	NOT RIPE BRIGHT
16-May	775	3.3S1	F	RIPE BRIGHT
16-May	750	4.2S1	F	NOT RIPE BRIGHT
16-May	755	3.3	F	NOT RIPE SEMI BRIGHT
16-May	685	4.2	M	RIPE SEMI DARK
16-May	790	3.3	F	NOT RIPE BRIGHT

-continued-

Date	Length (mm)	Age class	Sex	Comments
16-May	930	4.2S1	M	RIPE DARK
16-May	795	4.3	F	NOT RIPE BRIGHT
16-May	745	5.2	M	RIPE SEMI DARK
16-May	725	4.2	M	RIPE SEMI DARK
16-May	640	R.2	M	SEMI BRIGHT; NOT RIPE
16-May	710	R.2	M	SEMI BRIGHT; RIPE
16-May	635	4.2	F	BRIGHT; NOT RIPE
16-May	595	3.2	F	RIPE BRIGHT
16-May	850	3.3S1	M	NOT RIPE; SEMI BRIGHT
16-May	680	R.3	M	RIPE; SEMI DARK
16-May	720	5.2	M	RIPE; SEMI BRIGHT
16-May	625	4.2	M	RIPE; DARK
16-May	630	4.2	M	RIPE; SEMI BRIGHT
16-May	625	R.2	M	RIPE; SEMI BRIGHT
16-May	750	4.2S1	F	NOT RIPE; SEMI DARK
16-May	655	3.2	M	RIPE DARK
16-May	625	3.2	M	RIPE DARK
16-May	750	4.2S1	F	NOT RIPE; BRIGHT
16-May	620	5.2	F	NOT RIPE; BRIGHT
16-May	830	4.2S1	F	NOT RIPE; BRIGHT
16-May	740	4.3S1	F	NOT RIPE; BRIGHT
16-May	710	3.2S1	F	NOT RIPE; BRIGHT
16-May	795	? .3	F	RIPE; BRIGHT
16-May	640	4.2	M	RIPE DARK
16-May	555	3.2	M	NOT RIPE; SEMI DARK
16-May	685	5.2	M	RIPE; SEMI DARK
16-May	685	5.2S1	F	NOT RIPE; SEMI BRIGHT
16-May	710	4.3	F	NOT RIPE; BRIGHT
16-May	780	3.2S1	M	RIPE; SEMI DARK
16-May	615	3.2	M	RIPE; DARK
16-May	830	R.3	F	RIPE; SEMI BRIGHT
16-May	620	4.2	M	RIPE; DARK
17-May	820	4.3S1	F	NOT RIPE; BRIGHT
17-May	775	4.3	F	RIPE; BRIGHT
17-May	665	4.2	M	RIPE; SEMI DARK
17-May	720	5.2	M	RIPE; SEMI DARK
17-May	595	3.2	M	RIPE; SEMI DARK
17-May	635	4.2	M	RIPE; BRIGHT
17-May	555	3.2	M	RIPE; SEMI DARK
17-May	745	4.2S1	F	RIPE; BRIGHT
17-May	575	5.2	F	RIPE; BRIGHT; DEAD IN TRAP, OTOLITHS TAKEN
17-May	685	R.2	M	RIPE; BRIGHT
19-May	748	4.3	F	BRIGHT; NOT RIPE
19-May	718	4.2S1	F	BRIGHT; NOT RIPE
19-May	648	4.2	M	SEMI DARK; RIPE
19-May	828	2.3S1	F	SEMI BRIGHT; NOT RIPE
19-May	753	4.3	F	SEMI BRIGHT; NOT RIPE
20-May	815	? .3	F	BRIGHT; RIPE
20-May	815	3.3	M	DARK; RIPE

-continued-

## Appendix A2. (Page 4 of 5).

Date	Length (mm)	Age class	Sex	Comments
20-May	730	4.2S1	F	SEMI BRIGHT; NOT RIPE
20-May	770	3.3	F	BRIGHT; NOT RIPE
20-May	790	3.3S1	F	SEMI BRIGHT; NOT RIPE
20-May	610	3.2	M	SEMI BRIGHT; RIPE
20-May	610	4.2	F	BRIGHT; NOT RIPE
20-May	760	4.3	F	SEMI BRIGHT; NOT RIPE
20-May	800	5.2S1	M	SEMI DARK; RIPE
20-May	740	R.2S1	F	SEMI BRIGHT; NOT RIPE
20-May	790	4.3	F	BRIGHT; NOT RIPE
20-May	784	4.3	F	BRIGHT; NOT RIPE
21-May	816	R.3	F	BRIGHT; RIPE; SCARS ON LOWER TAIL
21-May	615	4.2	F	BRIGHT; RIPE; SCARS
21-May	634	5.2	F	SEMI BRIGHT; RIPE; SCARS
22-May	818	4.2S1S1	F	SEMI BRIGHT; NOT RIPE
22-May	725	4.2	M	SEMI DARK; RIPE
22-May	645	3.2	F	SEMI DARK; NOT RIPE
22-May	620	4.1S2	F	SEMI BRIGHT; NOT RIPE
22-May	740	? .2S1	M	DARK RIPE
22-May	725	4.2	M	DARK RIPE
22-May	860	3.2S1	M	DARK RIPE; 2 LARGE GASHES
22-May	825	3.3S1	F	SEMI BRIGHT; RIPE
22-May	740	R.3	F	BRIGHT; RIPE
22-May	760	R.2S1	F	BRIGHT RIPE
22-May	660	4.2	F	BRIGHT RIPE
22-May	820	3.3	F	BRIGHT RIPE
23-May	778	R.2S1S1	F	SEMI BRIGHT RIPE
23-May	665	3.2S1	M	DARK; NOT RIPE
23-May	692	4.2S1	F	BRIGHT RIPE; DRIPPING EGGS
23-May	825	4.2S1S1	F	BRIGHT RIPE; DRIPPING EGGS
23-May	915	3.3S1S1	F	SEMI BRIGHT RIPE; DRIPPING EGGS
23-May	850	3.3S1	F	BRIGHT NOT RIPE
23-May	860	3.3	M	SEMI DARK; RIPE
23-May	760	3.3	F	BRIGHT; NOT RIPE
23-May	764	4.3	F	BRIGHT; NOT RIPE
23-May	581	3.2	M	DARK RIPE
23-May	768	3.3	F	SEMI BRIGHT; NOT RIPE
23-May	730	3.2S1	F	SEMI BRIGHT; NOT RIPE
23-May	645	3.2	M	SEMI BRIGHT; RIPE
23-May	915	4.2S1S1	M	DARK; NOT RIPE
23-May	760	3.2S1	M	DARK; RIPE
23-May	925	4.3S1S1	F	SEMI BRIGHT; RIPE, DRIPPING EGGS
23-May	885	3.3S1	M	DARK RIPE
23-May	850	3.3S1	F	
23-May	685	3.2	M	DARK RIPE
23-May	640	4.2	F	BRIGHT, NOT RIPE
24-May	787	4.3	F	BRIGHT, RIPE
24-May	840	4.3S1	F	SEMI BRIGHT, NOT RIPE
24-May	644	4.2	M	BRIGHT, RIPE
24-May	846	3.3	F	BRIGHT, NOT RIPE
24-May	842	UNREADABLE	F	DARK RIPE

-continued-

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Date	Length (mm)	Age class	Sex	Comments
24-May	628	3.2	M	SEMI BRIGHT; NOT RIPE
24-May	546	3.2	M	BRIGHT, RIPE
24-May	785	3.3	M	SEMI BRIGHT; RIPE
25-May	615	4.2	F	BRIGHT RIPE; MASSIVE GILL NET (FRESH) MARKS
26-May	768	3.???	F	SEMI DARK RIPE
26-May	840	4.???	F	SEMI BRIGHT; RIPE
26-May	625	3.2	F	NOT RIPE; BRIGHT
26-May	800	4.3	F	NOT RIPE; BRIGHT
26-May	805	3.3	F	NOT RIPE; BRIGHT
26-May	780	R.3	F	RIPE; BRIGHT
26-May	630	UNREADABLE	F	RIPE; BRIGHT
27-May	760	UNREADABLE	F	RIPE; BRIGHT
28-May	770	UNREADABLE	F	NOT RIPE; SEMI BRIGHT
28-May	755	UNREADABLE	M	RIPE; BRIGHT
30-May	750	UNREADABLE	F	BRIGHT RIPE
30-May	625	UNREADABLE	M	SEMI DARK RIPE
30-May	600	3.2	M	SEMI DARK RIPE
30-May	645	4.2	F	BRIGHT NOT RIPE; SEA LICE
31-May	810	3.2S1S1	F	BRIGHT NOT RIPE; SEA LICE
01-Jun	785	4.1S1S1	F	BRIGHT NOT RIPE; FIRM
01-Jun	700	4.3	F	BRIGHT NOT RIPE; FIRM
04-Jun	620	4.2	M	BRIGHT RIPE
04-Jun	850	3.2S1	F	BRIGHT; SPAWNED OUT; SPORT CAUGHT, OTOLITH TAKEN
05-Jun	620	R.2	M	BRIGHT RIPE
05-Jun	860	3.3	F	BRIGHT RIPE

Appendix A3. Length, weight, age, and sex of juvenile steelhead/rainbow sampled at the adult weir downstream fyke net in Peterson Creek, 1991.

Date	Length (mm)	Weight	Age	Sex	Maturity <sup>a</sup>	Comments
18-Apr	165	0	3		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	196	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	207	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	191	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	201	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	199	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	197	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	115	0	3		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	189	0	4		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	184	0	5		2	PINK STRIPE STILL VISIBLE; PARR MARKS SHOWING
18-Apr	225	0	5		3	SILVER BRIGHT
18-Apr	167	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	201	0	5		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	205	0	5		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	206	0	5		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	174	0	4		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	169	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	182	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	168	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	168	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	172	0	3		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	188	0	4		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	201	0	?		2	PARR MARKS; PINK COLOR STRIPE SCALE UNREADABLE
18-Apr	210	0	4		2	PARR MARKS; PINK COLOR STRIPE
18-Apr	162	0			2	PARR MARKS; PINK COLOR STRIPE SCALE SAMPLING STOPPED
18-Apr	192	0			3	PARR MARKS; PINK COLOR STRIPE
18-Apr	201	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	207	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	222	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	193	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	206	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	172	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	198	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	203	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	181	0			2	PARR MARKS; PINK COLOR STRIPE

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Date	Length (mm)	Weight	Age	Sex	Maturity <sup>a</sup>	Comments
18-Apr	175	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	193	0			2	NOTCH IN CAUDAL; BRIGHT RED COLORED FISH BUT DIDN'T REALLY LOOK LIKE RESIDENT
18-Apr	199	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	156	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	206	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	218	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	201	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	197	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	196	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	197	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	195	0			2	PARR MARKS; PINK COLOR STRIPE
18-Apr	161	0			2	PARR MARKS; PINK COLOR STRIPE
19-Apr	178	0			2	NOT SCALE SAMPLED
21-Apr	149	0	3		2	
21-Apr	210	0	4		2	
21-Apr	197	0	5		2	
21-Apr	192	0	4		2	
22-Apr	200	0	4		2	VERY ROBUST LOOKING FISH
22-Apr	197	0	4		2	VERY ROBUST LOOKING FISH
22-Apr	128	0	3		6	VERY ROBUST LOOKING FISH
22-Apr	159	0	3		6	VERY ROBUST LOOKING FISH
22-Apr	201	0	5		2	VERY ROBUST LOOKING FISH
23-Apr	176	0	3		2	
23-Apr	181	0	3		2	
26-Apr	181	0			2	
24-Apr	204	0	5		2	
25-Apr	171	0	3		2	
25-Apr	170	0	3		2	
29-Apr	195	79	4		3	
05-May	190	65	4		3	
09-May	172	53	?		2	POSSIBLE CUT SCALES UNREADABLE
09-May	163	39	3		2	POSSIBLE CUT
09-May	139	24	3		1	POSSIBLE CUT
10-May	136	23	3			POSSIBLE CUT
13-May	166	42	3			
13-May	124	26	?			SCALES UNREADABLE
14-May	165	42	3		1	
15-May	143	29	3		1	
20-May	212	98	5		3	
21-May	149	32	3		2	
24-May	156	38	3		2	
25-May	200	90	4		3	
26-May	153	34	3		2	
26-May	175	60	3		2	
26-May	192	66	4		2	
27-May	113	16	3		1	

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Date	Length (mm)	Weight	Age	Sex	Maturity <sup>a</sup>	Comments
29-May	167	51	3		2	
30-May	220	109	5	M	3	MORT; OTOLITH TAKEN
01-Jun	183	67	3		3	
01-Jun	225	107	5		3	
01-Jun	222	119	4		3	
02-Jun	218	105	4		3	
02-Jun	204	83	4		3	
03-Jun	178	61	3	M	3	MORT; NO OTOLITH TAKEN
04-Jun	188	74	3		3	
04-Jun	177	56	3		3	
05-Jun	170	49	3		3	
05-Jun	161	42	3		3	
05-Jun	215	100	5		3	
05-Jun	189	62	4		3	
05-Jun	199	81	4		3	
05-Jun	170	46	3		3	
06-Jun	197	79	4		3	
06-Jun	203	84	3		3	
06-Jun	166	43	3		3	
07-Jun	171	46	5		3	
07-Jun	219	97	5		3	
07-Jun	175	51	3		3	
07-Jun	198	74	?		3	SCALES UNREADABLE
07-Jun	195	59	4		3	
07-Jun	178	59	3		3	
07-Jun	178	63	3		3	
07-Jun	168	48	4		3	
07-Jun	185	65	3		3	
07-Jun	163	46	3		3	
07-Jun	171	56	3		3	
07-Jun	165	42	4		3	
07-Jun	159	40	3		3	
07-Jun	88	7	2		1	
08-Jun	159	41	3		2	
09-Jun	190	73	5		3	OTTER MORT; NO OTOLITH TAKEN, HEAD CRUSHED
10-Jun	75	3	2		1	
10-Jun	159	40	3		3	
10-Jun	170	43	4		3	
10-Jun	154	38	3		3	
10-Jun	163	44	3		3	
11-Jun	150	30	3		2	
11-Jun	171	45	4		3	

<sup>a</sup> 1 = resident; 2 = presmolt; 3 = smolt; 4 = mature/resident; 5 = other.

Appendix A4. Length, weight, age, sex, and maturity of juvenile steelhead captured just below the barrier falls (BF), above the barrier falls (UF) and at Peterson Lake (LK) during 1991.

Date	Area	Length	Weight	Age	Sex	Maturity <sup>a</sup>	Comments
22-Apr	UF	95	0	2			
22-Apr	UF	118	0	3	M	4	RIPE MALE, VERY DARK COLOR
22-Apr	UF	94	0	2	M	4	RIPE MALE
22-Apr	UF	133	0	3	M	4	RIPE MALE, PARR MARKS VISIBLE; NO SILVER AT ALL
23-Apr	UF	157	0	4		1	
23-Apr	UF	124	0	3		1	
23-Apr	UF	155	0	5	F	1	
23-Apr	UF	90	0	2		1	
23-Apr	UF	124	0	4		1	
23-Apr	UF	110	0	3		1	
23-Apr	UF	90	0	2		1	
23-Apr	UF	129	0	3		1	
23-Apr	UF	122	0	?	M	4	SCALES UNREADABLE
23-Apr	UF	123	0	3	M	4	
23-Apr	UF	121	0	4		1	
23-Apr	UF	108	0	3	M	4	
23-Apr	UF	103	0	2		1	
23-Apr	UF	138	0	3		1	
23-Apr	UF	109	0	3	M	4	
23-Apr	UF	60	0	1		1	JUVENILE
23-Apr	UF	101	0	2		1	
23-Apr	UF	132	0	?	M	4	??? CUT ??? SCALES UNREADABLE
23-Apr	UF	158	0	?	M	4	SCALES UNREADABLE
24-Apr	UF	117	18	3	M	4	TATTERED TAIL
24-Apr	UF	102	10	2		1	
24-Apr	UF	114	15	4	M	4	
24-Apr	UF	117	17	3		1	
24-Apr	UF	97	8	2		1	
24-Apr	UF	87	7	2		1	
24-Apr	UF	133	24	?	M	4	SCALES UNREADABLE
24-Apr	UF	97	9	2	M	4	
24-Apr	UF	114	15	3	M	4	
24-Apr	UF	123	18	4	M	4	
25-Apr	UF	120	18	4	M	4	RIPE
25-Apr	UF	125	19	4	M	4	RIPE
25-Apr	UF	98	10	2		1	
25-Apr	UF	140	24	4		1	BRIGHT
25-Apr	UF	128	21	?		1	SCALES UNREADABLE
25-Apr	UF	128	20	3	M	4	
25-Apr	UF	119	16	3	M	4	
25-Apr	UF	101	12	3		1	SEMI BRIGHT
26-Apr	UF	125	20	4	M	4	RIPE
26-Apr	UF	115	16	2		1	
21-May	LK	127	24	2		1	
21-May	LK	139	24	4		1	
30-May	BF	142	30	3		2	C
30-May	BF	69	4	2		1	
30-May	BF	72	4	2		1	
30-May	BF	94	13	2		1	
30-May	BF	69	6	2		1	
30-May	BF	127	23	3		2	

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Date	Area	Length	Weight	Age	Sex	Maturity <sup>a</sup>	Comments
30-May	BF	113	14	3		2	
30-May	BF	67	3	1		1	
30-May	BF	94	8	2		1	
30-May	BF	115	15	3		2	
30-May	BF	132	21	3		2	
30-May	BF	112	11	2		1	
30-May	BF	81	6	2		1	
30-May	BF	52	1	1		1	
30-May	BF	72	5	2		1	
30-May	BF	69	4	2		1	
30-May	BF	53	2			1	NO SCALES TAKEN
30-May	BF	78	5			1	NO SCALES TAKEN
30-May	BF	60	3			1	NO SCALES TAKEN
30-May	BF	72	5			1	NO SCALES TAKEN
30-May	BF	83	5			1	NO SCALES TAKEN
30-May	BF	52	2			1	NO SCALES TAKEN
30-May	BF	71	3			1	NO SCALES TAKEN
30-May	BF	64	3			1	NO SCALES TAKEN
31-May	BF	70	4	2		1	
31-May	BF	124	17	3		2	
31-May	BF	58	2	1		1	
31-May	BF	63	2	1		1	
31-May	BF	81	5	2		1	
31-May	BF	81	5			1	
31-May	BF	71	3	2		1	
31-May	BF	64	3	1		1	
31-May	BF	58	2	1		1	
31-May	BF	68	3	1		1	
31-May	BF	65	3	2		1	
31-May	BF	89	7	2		1	
31-May	BF	110	12	3		2	
31-May	BF	70	3	2		1	
31-May	BF	60	2	1		1	
31-May	BF	65	3	2		1	
31-May	BF	66	3	2		1	
31-May	BF	64	3	1		1	
05-Jun	BF	78	5	1		1	
05-Jun	BF	78	5	1		1	
05-Jun	BF	66	3	1		1	
05-Jun	BF	72	4	2		1	
05-Jun	BF	71	4	2		1	
05-Jun	BF	71	2	2		1	SNAKE LIKE
05-Jun	BF	75	6	2		1	
05-Jun	BF	127	20	3		2	
05-Jun	BF	69	3	1		1	
05-Jun	BF	75	4	2		1	
05-Jun	BF	55	3	1		1	
05-Jun	BF	61	2	2		1	
05-Jun	BF	74	5	2		1	
05-Jun	BF	64	2	1		1	
05-Jun	BF	54	2	1		1	
05-Jun	BF	68	5	2		1	
05-Jun	BF	71	3	2		1	
05-Jun	BF	64	4	1		1	
05-Jun	BF	66	5	2		1	
05-Jun	BF	65	3	2		1	
05-Jun	BF	65	4	1		1	