PALLANT CREEK STEELHEAD

TAGGING AND LIFE HISTORY INVESTIGATIONS

1987—88

by

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Fisheries Progress Report No. SK 59

January, 1989

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ABSTRACT

An annual steelhead tagging and life history study was initiated on Pallant Cr., Queen Charlotte Islands in 1981. This report documents results obtained during the 1987—88 winter fishery. Between Oct. 20 and May 15, 160 steelhead were tagged, of which 36 were recaptured once, while 5 and 1 were recaptured 2 and 3 times respectively. An additional 8 fish from previous study seasons were recaptured. Fifty nine percent of the catch was taken from the upper 1.1 km of the river during Dec. and March. Time between initial capture and recapture ranged from 1 to 121 days and averaged 42 days. Seventy—two percent of recaptures occurred within the zone of original capture. The likelihood of recapture was considerably greater for early season tagged fish. Steelhead recaptured in this study from previous seasons were taken close to their original tagging date 1 or 2 years earlier. The dominant age group was 3.3 (46.3%) followed by 4.3 (20.4%), 3.2 and 4.2 (11.1% each), 3.1S1 (3.7%) and 3.2S1 and 4.2S1 (1.9% each). Fresh water age was dominated by 3. (63%) and 4. (33%) while ocean ages 2 and 3 accounted for 25.9 and 70.4% respectively. The total population was estimated at 466 fish.

INTRODUCTION

A long term steelhead tagging study was initiated on Pallant Creek during the 1981—81 winter season by the B.C. Steelhead Society in collaboration with the Pallant Creek Hatchery staff (D.F.O.) and M.O.E. personnel. The study has been repeated annually and this report covers the 87—88 season. Objectives of the study were to:

1. describe steelhead run timing and movement.
2. describe life history characteristics.
3. estimate population size.

A description of the study area can be found in previous Pallant Creek reports (deLeeuw, 1985 a, 1986).

THE FISHERY

Angling effort for steelhead on Pallant Creek has increased dramatically since 1970, with highest numbers of angler days (510) having been recorded for the 1987—88 study season (Table 1). This increase has been the result of larger number of anglers fishing the Pallant rather than an increase in effort by individual anglers. Number of anglers fishing Pallant Creek has increased steadily over the past 15 years while individual angler effort has been variable. Increased effort has emphasized the need for improved information on which to base management decisions.

Estimated number of fish kept has varied over the recording period while the number of fish released has increased (Table 1). Greatest number of fish were released (1026) during this study period and was likely an over—estimation. A positive bias of up to 63% has been observed in the B.C. steelhead questionnaire catch estimates compared to on—site creel survey results (Billings, 1982). Over—estimation as a result of a disproportionate number of successful anglers returning their questionnaires was therefore a distinct possibility.

The total catch/angler day has been also varied over the recording period but remained fairly consistent over the last 8 years. Fish kept/angler day has decreased continually since 1970 (Table 1). Angler success on Pallant Creek has been consistently better than the average for the Charlottes as a whole.

Table 1. Pallant Creek Steelhead Harvest Analysis [1]results, 1970—71 to 1987—88.

Season	Days Fished	Anglers	Days Fished/ Angler	Kept	Released	Kept/ Day	Catch/ Day	Charlottes Catch/Day
70—71	8	4	2.0	8	20	1.00	3.50	.36
71—72	10	3	3.3	21	25	2.00	4.60	.52
72—73	89	12	7.4	45	86	.50	1.47	.31
73—74	26	3	8.7	26	34	1.00	2.22	.33
74—75	10	3	3.3	7	0	.67	.67	.27
75—76	73	30	2.4	23	40	.32	.86	.47
76—77	107	46	2.3	47	20	.45	.65	.37
77—78	74	30	2.5	48	92	.64	1.86	.48
78—79	177	42	4.2	35	26	.21	.38	.41
79—80	236	50	4.7	36	86	.16	.53	.48
80—81	382	53	7.2	59	709	.16	1.96	.79
81—82	227	66	3.4	41	190	.22	1.05	.93
82—83	293	50	5.9	17	511	.06	1.80	1.23
83—84	235	37	6.4	39	330	.17	1.57	.57
84—85	359	58	6.2	66	620	.18	1.92	1.32
85—86	137	41	3.3	14	185	.10	1.44	1.65
86—87	221	72	3.1	18	348	.11	1.65	1.52
87—88	510	66	7.7	38	1026	.07	2.07	1.28
Mean:	177	37	4.9	33	240	.43	1.68	.71

[1] Steelhead Harvest Analysis. B.C. Fish & Wildlife Branch annual reports.

METHODS

The river was partitioned into seven zones (Fig. 1). Adult steelhead were angled on conventional gear and tagged with orange, numbered, anchor (76 mm x 2 mm spaghetti) tags. Weights, where recorded, were generally estimated while fork lengths were measured. Sex, date of capture, tag number and colour as well as zone of capture were also recorded. After the removal of a few scales between the dorsal fin and lateral line, fish were released at the capture site. In—stream migration distances of recaptured fish were estimated by calculating the zone length between the mid points of original and recapture zones.

Scales were viewed using a dissecting microscope. The two best examples from the sample were cleaned and mounted on gummed cards. Impressions of the scales were made on acetate cards by applying heat (85 to 95°C) and pressure (100 ft lbs) for 60 seconds. A Leitz Prado projector was then used to examine each scale for freshwater and ocean age (Narver and Withler, 1984). Population size was determined using the Schnabel, Schumacher and Schnabel—Chapman adjusted multiple census techniques (Ricker, 1975). The formulae were:

Schnabel:
$$N = \frac{\text{sum } (Ct\ Mt)}{R}$$

Schumacher:
$$\frac{1}{N} = \frac{\text{sum } (Mt\ Rt)}{\text{sum } (Ct\ Mt^2)}$$

Schnabel,Chapman revised:
$$N = \frac{\text{sum } (Ct\ Mt)}{R + 1}$$

Where:
- t = 5—day time period
- Ct = total catch during time t
- Mt = total fish tagged and released during time t
- M = sum of Mt
- Rt = total recapture during time t
- R = sum of Rt

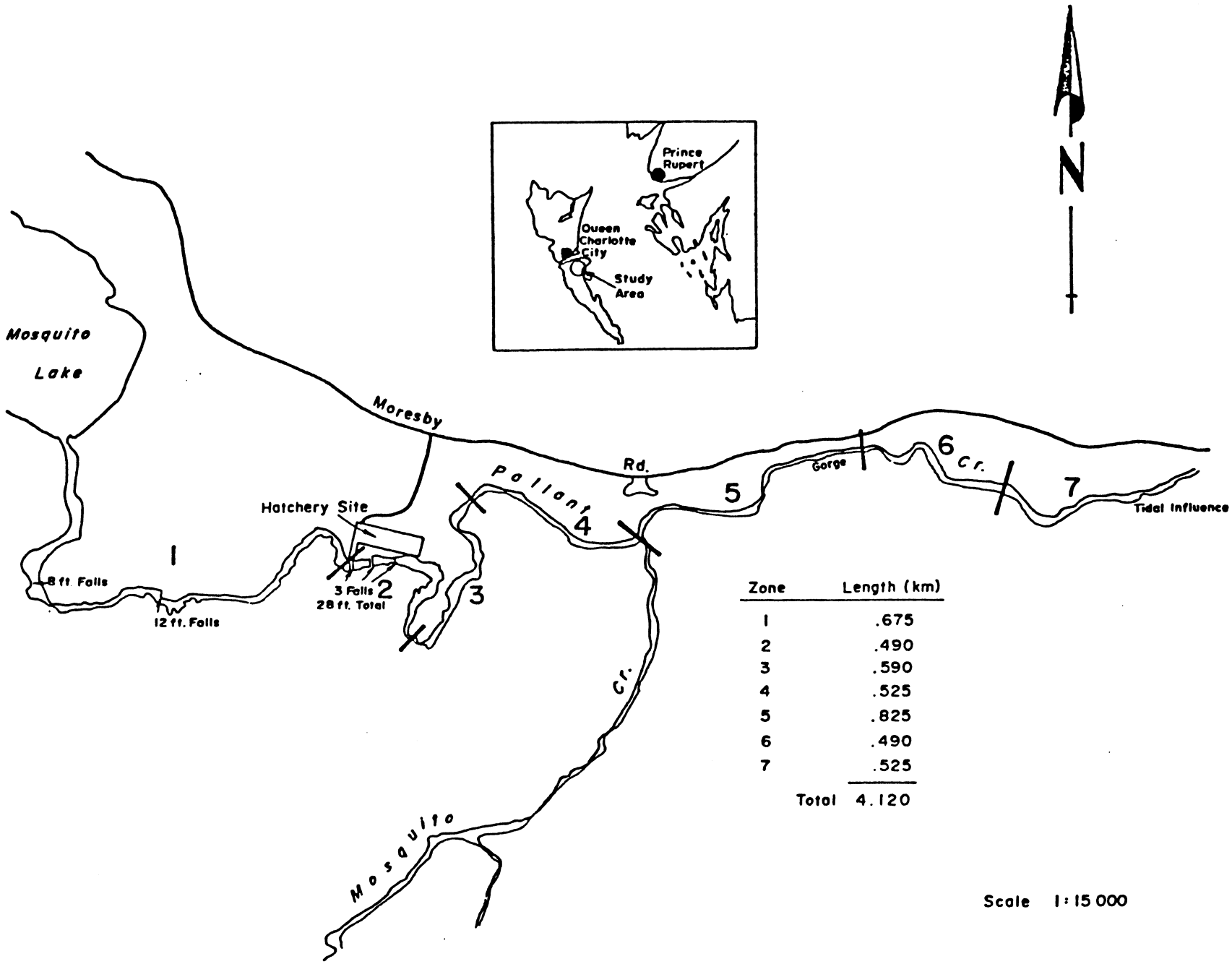

Fig. 1 Pallant Creek Angling Zones During The 1987–88 Steelhead Tagging Study

Table 2. Pallant Creek steelhead tagged during the 1984—85 to 87—88 winter seasons by zone.

	Steelhead tagged (%)				
Zone	1984-85	1985-86	1986-87	1987-88	Total
1	0(0)	1(1)	3(2)	9(6)	13(2)
2	27(22)	16(11)	40(24)	46(34)	129(22)
3	13(11)	29(20)	50(29)	49(25)	141(24)
4	34(28)	13(9)	32(19)	18(11)	97(16)
5	2(1)	14(10)	26(15)	19(12)	61(10)
6	17(14)	60(42)	18(11)	18(11)	113(19)
7	11(9)	10(7)	1(1)	1(1)	23(4)
Not recorded	19(15)	----	---	---	19(3)
Total	123(100)	143(100)	170(100)	160(100)	596(100)

Although steelhead were tagged as early as Oct. 20, and as late as May 15, the majority were taken during December through March with no discernable run trend. Unlike other years the best catch within any 10 day period occurred in mid February when 21 fish were tagged (Table 3). In the three previous study periods, highest catches occurred in Dec., March and April. When all catches grouped in 10 day periods were combined over the last 4 tagging seasons, a minor peak occurred during the Dec., Jan. period, while the majority were taken in March and April.

Run timing and therefore the catch undoubtedly vary from year to year depending on stream discharge, temperature and other environmental factors.

Thirty four (31%) fish of the total tagged in this study season were recaptured once. Of these, four (2.5%) were recaptured a second time. An additional two fish tagged during the previous seasons were treated as this year's original captures since these were recaptured twice during the present study. A total of 36 fish were therefore recaptured once, five twice and a single fish was recaptured three times for a total of 42 recaptures during the 1987—88 tagging period. Eight fish were recaptured from earlier seasons.

Table 3. Number of steelhead tagged during the 1984–85 to 1987–88 winter seasons grouped in 10 day periods.

Date	1984–85	1985–86	1986–87	1987–88			Total
				M	F	Total	
10/01–10	0	0	0	0	0	0	0
11–20	0	0	0	0	3	3	3
21–30	0	0	0	0	0	0	0
11/01–10	0	0	0	0	0	0	0
11–20	0	0	2	0	0	0	2
21–30	0	0	0	2	3	5	5
12/01–10	0	0	12	0	1	1	13
11–20	3	10	16	4	11	15	44
21–30	1	13	6	4	6	10	30
01/01–10	1	13	14	3	5	8	36
11–20	3	4	6	5	8	13	26
21–30	7	4	24	3	13	16	51
O2/01–10	4	4	11	5	5	10	29
11–20	3	7	8	8	13	21	39
21–30	17	6	8	5	3	8	39
03/01–10	4	18	9	6	10	16	47
11–20	20	23	12	5	4	9	64
21–30	18	26	6	3	4	7	57
04/01–10	41	7	3	5	2	7	58
11–20	0	7	22	6	4	10	39
21–30	0	1	8	0	0	0	9
05/01–10	1	1	3	0	0	0	5
11–20	0	0	0	1	0	1	1
Total	123	143	170	65 (41%)	95 (59%)	160	596

Only ten (28%) of the recaptured fish had travelled out of their zone of original capture. Of these six had migrated upstream while the remaining four were recaptured downstream of their tagging zone (Table 4). Six of the migrators were recaptured in an adjacent zone while the remaining four were recaptured two (2 fish) and three zones (2 fish) removed from their original tagging site. If recaptures were indicative of migration patterns, adult Pallant Creek steelhead appeared to migrate very little once in their natal stream. This observation was similar to previous studies.

Time between this season's original and recapture dates ranged from one to 121 days and averaged 42 days. Unlike the earlier Pallant Creek studies no fish were recaptured on the day of initial tagging. Of the 42 recaptures, 16 (38%) were taken within 20 days of first capture. The remaining 26 fish (62%) spent from one to four months in the stream. Average stream residency of steelhead during this study was somewhat longer than in previous seasons. Sex ratio of recaptured females (60%) was similar to the entire tagged population (59%).

Steelhead tagged early in the season had a higher probability of being recaptured than did later run fish. Over half (16 or 62%) of all fish tagged in December (26) were captured a second time while none of those tagged in March and April (49) were recaptured (Table 5). Similar results were obtained in the 1986—87 and 1985—86 seasons.

Only three of the eight steelhead tagged in previous seasons were recaptured in their original capture zone, while five were recaptured near their original tagging date one or two years earlier. One fish originally tagged on Dec. 12, 1985 was recaptured on Dec. 6, 1987 and two fish tagged in mid March (1987 and 86) were recaptured in early April during this study. These data suggested that repeat spawning steelhead return to their natal stream at similar times between years. Earlier Pallant Creek data corroborated this conclusion. Of the eight recaptures from previous years' tagging programs, six were females.

Table 4. Migration distance (km) and time duration (days) between captures of recaptured steelhead in Pallant Creek, 1987–88.

TOTAL

Tag #	Sex	Original capture Zone	Original capture Date	First recapture Zone	First recapture Date	Second recapture Zone	Second recapture Date	Distance Km.	Time Days (1^{st} recap)
280	F	3	Dec.12	3	Dec.27			0	15
1358	M	2	Dec.27	2	Jan.10	2	Jan.15		31
						(2	Jan.27)	0	(14)
1363	F	6	Dec.31	3	Jan.15			+1.91	15
1268	F	2	Dec.21	2	Jan.18	2	Mar.9	0	78(28)
1357	M	2	Dec.27	2	Jan.26			0	30
1367	F	2	Dec.13	2	Jan.31			0	49
1352	F	2	Dec.11	2	Feb.3			0	54
1350	F	2	Jan.29	2	Feb.8			0	10
285	F	2	Jan.10	2	Feb.12			0	33
1285	F	4	Jan.15	4	Feb.13	3	Mar.16	+.56	60(29)
1270	F	2	Dec.13	2	Feb.14			0	63
1265	M	2	Jan.16	2	Feb.14			0	29
1339	F	2	Feb.10	2	Feb.15			0	5
1345	F	6	Feb.12	6	Feb.15	5	Feb.21	+.67	9(3)
1275	F	1	Dec.13	1	Feb.19			0	68
1290	F	2	Jan.29	3	Feb.19			-.54	21
1253	F	1	Oct.20	1	Feb.19			0	121
1370	F	2	Feb.15	4	Feb.21			-1.1	6
1320	M	6	Feb.6	4	Feb.21			+1.35	15
1360	M	2	Jan.10	2	Feb.23			0	44
1356	F	2	Dec.21	2	Feb.24			0	65
1302	M	4	Feb.14	5	Mar.5			+.68	19
1375	M	2	Feb.25	2	Mar.5			0	8
1834*	F	5	Feb.4	5	Mar.4			0	28
2821*	M	2	Feb.22	2	Feb.23	2	Mar.3	0	9(1)
1353	M	2	Dec.11	2	Mar.7			0	86
1280	F	3	Jan.9	3	Mar.9			0	59
1373	M	2	Feb.23	2	Mar.9			0	14
1327	F	2	Feb.11	2	Mar.13			0	30
1369	F	3	Feb.18	3	Mar.14			0	24
1361	F	4	Dec.13	3	Mar.14			+.56	91
1295	M	4	Jan.17	5	Mar.24			-.68	66
288	M	2	Jan.10	5	Mar.28			-1.78	77
1354	M	2	Dec.11	2	Apr.3			0	113
1304	F	3	Feb.5	3	Apr.10			0	64
1390	M	2	May 15	2	May 16			0	1
F = 22									
M = 14									
			Total = 36					5(1)	ave = 42

* These 2 fish were recaptured from previous tagging seasons, but were treated as this season's original tagging since they were captured twice during the present study.

Table 5. Pallant Creek steelhead original capture and recapture dates grouped by month within the 87—88 winter season.

Month of capture	Tagged population	Number and percent ( ) of tagged population recaptured in successive months. Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Totals
Oct.	8					1(13)				1(13)
Nov.	5									
Dec.	26			1(4)	7(27)	4(15)	3(12)	1(4)		16(62)
Jan.	37					6(16)	4(11)			10(27)
Feb.	39					6(15)	7(18)	1(3)		14(36)
Mar.	32									
Apr.	17									
May	1								1(100)	1(100)
Total	160			1 (1).	7 (4).	17 (11).	14 (9).	2 (1).	1 (1).	42 (26).

* percent of total tagged

AGE AND SIZE

Scales were obtained from 56 steelhead. Fresh water age was not readable in two of these. Eight different total age groups were represented, of which 3.3 was the most common (46.3%), followed by 4.3 (20.4%), 3.2 and 4.2 (11.1% each), 5. and 3.1S1 (3.7% each) and
3.2S1 and 4.2S1 at 1.9% each (Table 6). The two fish aged 5. were both males with little or no marine growth. These were probably residualized or precocious males.

Table 6. Steelhead trout age groups from Pallant Creek, 1987—88 N = 56.

Age Groups	Males	Females	Total (%)
5.	2	0	2(3.7)
3.2	3	3	6(11.1)
3.3	9	16	25(46.3)
4.2	2	4	6(11.1)
4.3	1	10	11(20.4)
3.1S1	0	2	2(3.7)
3.2S1	0	1	1(1.9)
4.2S1	0	1	1(1.9)
Total	17	37	54
R*.3	1	1	2

R* = Central area of scale is resorbed, fresh water age not readable.

Table 7. Number and percentage of male and female Pallant Creek Steelhead of different fresh water ages, 1987—88, N=54.

Fresh Water Age	Males	Females	Total (%)
3	12	22	34(63)
4	3	15	18(33)
5	2	0	2(4)
Total	17	37	54

Table 8. Number and percentage of male and female Pallant Creek Steelhead of different ocean ages, 1987—88, N=54.

Ocean Age	Males	Females	Total(%)
1	0	2	2(3.7)
2	5	9	14(25.9)
3	10	28	38(70.4)
Total	15	39	54

All multiple spawners (7.4%), were on their second spawning migration.

Sixty three percent of the sample had spent 3 years in the stream prior to ocean migration, followed by four (33%) and five (4%) years of juvenile stream residency (Table 7). Ocean age .3 dominated the sampled population (70.4%), followed by .2 (25.9%) and .1 (3.7%, Table 8).

The dominance of 3 years fresh water growth has been prevalent in Pallant Creek since study initiation in 1981. The degree of dominance however has varied markedly. In some years up to 90% of the example (eg. 1986—87) was comprised of the 3 year stream residents while in 1985—86 it was only 60%. Similarly ocean residency varied from year to year. In 1981—82 age .3 comprised 81% of the sample while in 1985—86 it was only 43.5%. Age class structure of Pallant Creek steelhead fluctuates considerably from year to year, likely in close association with variations in freshwater survival and smolt abundance.

Among maiden fish, size was directly related to ocean age. The average 2—ocean male was 66.6 cm, while 3—ocean fish averaged 80.7 cm. A 2—ocean female was 70.9 cm, slightly larger than a male of similar age, while a 3—ocean female was 75.0 cm, considerably smaller than males of that ocean age (Table 9).

Table 9. Fork lengths (cm) of male and female Pallant Creek Steelhead of different ocean ages. 1987—88.

Ocean age	Males			Females		
	N	$\bar{X}$	Range	N	$\bar{X}$	Range
.2	5	66.6	58.0—75.0	7	70.0	66.0—76.2
.3	11	80.7	71.1—89.0	26	75.0	68.6—83.8

Males on the average gained about 14 cm F.L. between age .2 and .3, while females gained only 4 cm F.L. Pre spawning fish tagged during the 1985—86 season and recaptured 2 years later in the present study had increased 14 cm in fork length while steelhead with 1 year between captures were only 1.3 cm larger (Table 10). All recaptured fish which were originally tagged 2 years earlier were relatively small at the time of first capture i.e. around 66 cm. Growth of these small fish was therefore considerable. Larger first spawners on the other hand appeared to grow less between spawnings. Variable marine growing conditions could also account for this difference. Data were inconclusive however due to the small sample size.

Table 10 Pallant Creek steelhead originally tagged in 1985–86 and 1986–87, recaptured in 1987–88.

Tag #	Sex	Original Capture		Recapture			
		Date	Fork Length(cm)	Date	Fork Length(cm)	Years	Growth(cm)
3945	F	Dec.12,85	68.6	Dec.6,87	76.2	2	7.6
1889	F	Jan.4,87	81.3	Jan.10,88	82.6	1	1.3
1834	F	Mar.18,87	80.0	Feb.4, 88	81.3	1	1.3
1834	F	Mar.18,87	80.0	Mar.4,88	81.3	1	1.3
2821	M	Dec.21,85	71.1	Feb.22,88	83.8	2	12.7
2821	M	Dec.21,85	71.1	Feb.23,88	83.8	2	12.7
2821	M	Dec.21,85	71.1	Mar.3,88	83.8	2	12.7
2669	F	Apr.10,87	76.2	Feb.23,88	77.5	1	1.3
3940	F	Jan.1,86	61.0	Feb.23,88	80.0	2	19.0
1848	M	Mar.15,87	66.0	Apr.1,88	----		
2258	F	Mar.12,86	63.5	Apr.1,88	81.3	2	17.8

POPULATION ESTIMATION

Three multiple capture population estimates calculated 459, 489 and 449 steelhead in Pallant Creek during the 1987—88 study period (Table 11). Confidence limits were fairly narrow due to the 42 (26%) recaptures. The estimates therefore likely approximated the actual population. Post tagging mortality, tag loss, emigration, non—reporting of tag recaptures, and catchability influences were not accounted for. Despite these factors, however, the estimates were still considered reasonable. Even if the no recruitment and mortality conditions required by the method were only approximately satisfied the multiple census technique employed in this study was still useful (Ricker, 1975). Both tag loss and post tagging mortalities would decrease recaptures resulting in a positive bias. Since the estimated steelhead catch (kill, Table 1) was only 38 fish, the fishery was not considered a conservation concern.

Table 11. Pallant Creek steelhead population estimates during the 1987—88 winter season.

Method	Estimate	95% confidence limits	
		Poison distribution	Normal distribution
Schnabel	459	340—637	349—670
Schumacher	489	392—651	
Chapman	449	333—620	344—645
Mean	466		

SUMMARY

1. One hundred and sixty steelhead were tagged on Pallant Creek, Queen Charlotte Islands between Oct. 20 and May 15 of the 1987—88 winter season. Thirty six were recaptured once, while 5 and 1 were recaptured 2 and 3 times respectively. Eight fish were recaptured from the 1985—86 (4) and 1986—87 (4) Pallant Creek studies.

2. The majority of fish were taken from the upper river during December through March. Of the 42 recaptures, 72% were taken in their original tagging zone. Average time to recapture was 42 days and ranged from 1 to 121 days. Sixty two percent of the recaptures were taken 1 to 4 months after original tagging.

3. Like the previous Pallant Creek studies, probability of recapture was influenced by original capture date. Fish tagged early in the season (Oct—Dec) were considerably more likely to be recaptured than those tagged late (March + April).

4. Five of the 8 steelhead which were tagged 1 and 2 seasons earlier were recaptured during this study close to their original tagging dates. These recaptures suggest that repeat spawning steelhead return to their natal stream at similar times within the season from year to year.

5. The dominant total age group was 3.3 (46.3%) followed by 4.3 (20.4%), 3.2 and 4.2 (11.1% each), 3.1S1 (3.7%) and 3.2S1 and 4.2S1 (1.9% each). Three and 4 years of fresh water residency accounted for 63 and 33% respectively of the total sample (N=54). Ocean ages .2 and .3 accounted for 25.9 and 70.4% respectively of the population sampled.

6. The Pallant Creek steelhead population during the 1987—88 study was estimated at 466 fish. Since 26% of the tagged sample were recaptured, confidence limits were fairly narrow and ranged from 333 to 670 fish.

7. The recreational fishery was not considered to impact significantly on the 1987—88 Pallant Creek steelhead population.

ACKNOWLEDGEMENTS

This project like previous Pallant Creek steelhead studies, was largely the result of volunteer work by the Queen Charlotte Islands Chapter of the B.C. Steelhead Society with the enthusiastic participation of the Pallant Creek Hatchery staff. Their assistance in this project was invaluable and greatly appreciated. Organization of field—collected data was supervised by Tom Rutherford, Community Advisor, Department of Fisheries and Oceans. Scale interpretations were provided by R. Tetreau. G. Schultz calculated the population estimates. Editorial comments were provided by R. Hooton and the report was typed by Pat. Neeve. The study was funded as a Public Involvement project by the Salmonid Enhancement Program.

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APPENDICES

APPENDIX I. Original steelhead captures from Pallant Creek, 1987—88 winter season.

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
1	Oct20/87	F	71.5	1251 blue	1	thin, dark	3.3
2	Oct20/87	F	76.3	1252 blue	1	thin, dark	4.3
3	Oct20/87	F	73.0	1253 blue	1	thin, dark	3.3
4	Nov2l/87	M	44.5	289 green	3	Bright,red stripe resident?	5.0
5	Nov24/87	F	74.3	286 green	3	semi—bright,thin	4.3
6	Nov26/87	F	78.7	1254 blue	3	Bright	
7	Nov26/87	M	76.2	1258 blue	4	Bright	
8	Nov26/87	F	71.1	1255 blue	2	red stripe,fungus on head	
9	Dec05/87	F	74.9	280 green	3	Getting coloured,bare spot on nose	4.
10	Decll/87	F	78.8	1352 blue	2	Bright	
11	Decl1/87	M	70.5	1351 blue	2	Bright	
12	Decll/87	M	83.2	1353 blue	2	Getting coloured	
13	Decll/87	F	77.5	1354 blue	2	Bright	
14	Decll/87	F	76.2	1259 blue	2	Bright	
15	Decll/87	M	48.3	284 green	3	red strlpe,resident?	
16	Decl3/87	F	71.1	1275 blue	1		3.3
17	Decl3/87	M	81.3	1278 blue	1	Coloured	R.3
18	Decl3/87	F	71.1	1270 blue	2	Slight colour	4.2
19	Decl3/87	F	68.6	1269 blue	1	Slight colour	3.3
20	Dec13/87	F	68.6	1361 blue	4	Bright	3.3
21	Dec13/87	F	73.7	1367 blue	2	Bright	3.3
22	Decl3/87	F	71.1	1368 blue	2	Bright	3.3
23	Decl8/87	F	73.7	1279 blue	2	Bright	
24	Dec18/87	F	68.6	1277 blue	3	Bright	
25	Dec21/87	F	77.5	1268 blue	2	Bright,faint red stripe	4.3
26	Dec21/87	F	72.4	1356 blue	2	Bright	
27	Dec27/87	F	72.4	1355 blue	3	Bright	3.3
28	Dec27/87	M	58.4	1357 blue	2	dark	3.3
29	Dec27/87	M	78.7	1358 blue	2	Bright	4.2
30	Dec28/87	M	58.4	1274 blue	2	Bright,red stripe	3.2
31	Dec28/87	F	76.2	1271 blue	3	Bright	3+.3
32	Dec31/87	F	73.0	1276 blue	2	Darkening	4.3
33	Dec3l/87	F	76.2	1363 blue	6	Bright	R.3
34	Dec31/87	M	84.5	1364 blue	6	Bright,slight red stripe	3.3
35	Jan09/88	F	79.4	287 green	2	Coloured	
36	Jan09/88	F	76.2	1280 blue	3	Bright,strong	4.2S1
37	Janl0/88	F	61.6	285 green	2	Bright red,stripe	
38	Janl0/88	M	82.6	288 green	2	Coloured	3+.3
39	Janl0/88	M	81.3	1365 blue	1	Dark	
40	Janl0/88	F	72.4	1359 blue	1	Darkening,fungus on head	

APPENDIX I. (Cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
41	Jan10/88	F	68.6	1362 blue —	1	fair,belly getting Soft	
42	Jan10/88	M	81.3	1360 blue	2	Bright,slight red stripe	
43	Jan14/88	F	71.1	1264 blue	6	Bright,sea lice	4.3
44	Jan14/88	M	68.6	1267 blue	6	Bright,fresh wound left side	4.3
45	Jan15/88	M	73.7	1281 blue	2	Slight colour	3.3
46	Jan15/88	F	81.3	1266 blue	3	Slight colour	3.3
47	Jan15/88	M	68.6	1299 blue	6	Bright	
48	Jan15/88	F	77.5	1285 blue	4	Rainbow	
49	Jan15/87	F	80.0	1293 blue	4	Bright	
50	Jan15/87	M	67.3	1296 blue	4	Bright	
51	Jan15/88	F	71.1	1284 blue	2	Coloured	
52	Jan16/88	M	81.9	1265 blue	2	Coloured	3.3
53	Jan16/88	F	74.9	1335 blue	2	Slight colour	3.3
54	Jan17/88	F	76.2	1282 blue	4	Bright	
55	Jan17/88	M	73.7	1295 blue	4	red stripe, red cheeks	
56	Jan23/88	M	95.3	1323 blue	2	Getting red,powerful +20 lb.	
57	Jan24/88	F	76.2	1310 blue	4	Bright	
58	Jan25/88	F	71.8	1321 blue	2	red stripe	
59	Jan26/88	F	81.3	1313 blue	3	Bright,strong	4.3
60	Jan27/88	F	66.0	1300 blue	3	Coloured	
61	Jan28/88	F	83.2	1298 blue	5	Bright	
62	Jan28/88	F	68.6	1288 blue	2	Bright	
63	Jan28/88	F	68.6	1286 blue	4	Bright	4.2
64	Jan28/88	F	71.1	1283 blue	4	Bright	
65	Jan28/88	M	67.3	1287 blue	3	Bright	
66	Jan29/88	F	80.0	1350 blue	2	red stripe,getting soft	
67	Jan29/88	F	75.6	1290 blue	2	Bright	4.2
68	Jan29/88	F	81.3	1292 blue	2	Bright	4.3
69	Jan29/88	M	83.8	1334 blue	3	Coloured,strong	3+.3
70	Jan30/88	F	79.4	1297 blue	2	red stripe,getting soft	
71	Jan31/88	F	78.7	1338 blue	2	Coloured, fry in mouth	
72	Feb01/88	F	62.2	1294 blue	6	Bright,bad shape, fresh wounds	
73	Feb01/88	M	75.6	1291 blue	6	Bright,fresh wounds on penduncle	
74	Feb05/88	F	78.7	1304 blue	3	Bright	
75	Feb05/88	F	74.3	1319 blue	3	Bright	
76	Feb05/88	M	69.2	1348 blue	6	fresh,red stripe	

APPENDIX I (Cont'-d)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
77	Feb03/88	F	58.4	1312 blue	3	Bright	
78	Feb06/88	M	70.5	1331 blue	6	Bright	3.
79	Feb06/88	M	68.6	1320 blue	6	Bright	
80	Feb07/88	M	62.9	1322 blue	7	Bright,red stripe	
81	Feb10/88	F	74.3	1339 blue	2	Coloured,belly soft	
82	Feb11/88	M	81.9	1306 blue	2	Coloured	
83	Feb11/88	F	71.1	1327 blue	2	Coloured	
84	Feb12/88	F	76.2	1345 blue	6	Bright	
85	Feb13/88	F	68.6	1309 blue	6	Bright,strong	4.
86	Feb13/88	M	71.1	1314 blue	3	Bright,fresh	
87	Feb13/88	M	89.5	1325 blue	3	Bright,red stripe, hook in mouth	3.
88	Feb13/88	F	71.1	1305 blue	3	Bright, red stripe, getting soft	4.
89	Feb14/88	M	71.1	1301 blue	4	Bright,fresh	
90	Feb15/88	F	76.2	1333 blue	2	Slightly coloured	3.
91	Feb16/88	M	66.0	1336 blue	3	Getting coloured, scars on body	
92	Feb17/88	F	76.2	1301 blue	4	Bright,fresh	
93	Feb19/88	F	77.5	1372 blue	5	Bright,fresh	
94	Feb18/88	M	78.7	1371 blue	5	red stripe	
95	Feb18/88	F	74.9	1369 blue	3	kelt	3+.
96	Feb18/88	M	81.3	1311 blue	2	red stripe,darkening	
97	Feb18/88	F	78.7	1370 blue	2	Bright,fresh	
98	Feb18/88	M	77.5	1328 blue	3	red stripe,darkening	
99	Feb19/88	F	71.1	1341 blue	2	coloured, ripe	
100	Feb19/88	F	81.3	1330 blue	3	kelt,good shape	
101	Feb19/88	F	80.0	1315 blue	3	kelt,good shape,hook in eye	
102	Feb20/88	F	78.7	1346 blue	3	Bright	3+.
103	Feb22/88	M	68.6	1326 blue	6	Bright	
104	Feb23/88	M	72.4	1373 blue	2	Coloured,scrappy	3.
105	Feb24/88	F	83.8	1349 blue	5	Fresh	3.
106	Feb25/88	F	63.5	1201 blue	2	Kelt	
107	Feb25/88	M	74.9	1375 blue	3	dark,milt running	4.
108	Feb26/88	F	47.0	1376 blue	3	red stripe,resident?	
109	Feb29/88	M	47.6	1377 blue	3	dark,spawning,resident?	
110	Feb29/88	M	71.1	1378 blue	4	red stripe	
111	Mar02/88	M	71.1	1381 blue	6	Bright,fresh,bleeding from bill	
112	Mar02/88	F	76.2	13240 blue	5	Bright,fresh	
113	Mar03/88	F	76.8	1344 blue	6	Bright,fresh	
114	Mar03/88	F	68.6	1303 blue	6	Bright,fresh	
115	Mar03/88	M	83.8	1308 blue	2	red stripe,darkening	
116	Mar03/88	M	50.8	1342 blue	3	dark,milt,very deep fish	

APPENDIX I (cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
117	Mar04/88	F	77.5	1307 blue	5	Bright,fresh	
118	Mar04/88	F	62.9	1324 blue	5	Bright,fresh,eye bleeding	
119	Mar05/88	F	76.2	1382 blue	5	Chromer,wound right side	
120	Mar05/88	F	78.7	1379 blue	3	Kelt,good shape	3+.3
121	Mar06/88	F	71.1	1380 blue	2	Kelt	
122	Mar07/88	F	73.7	1332 blue	4	Bright,fresh	
123	Mar07/88	M	63.5	1329 blue	5	Darkening	
124	Mar08/88	M	61.0	1317 blue	4	Darkening	
125	Mar08/88	F	89.5	1202 blue	5	Bright,fresh	
126	Mar09/88	M	71.1	1318 blue	2	Bright,fresh	
127	Marl2/88	F	66.0	1398 blue	5	Bright,fresh	3.2
128	Marl2/88	F	66.0	1399 blue	4	Bright,fresh	3.2
129	Marl2/88	M	71.1	1400 blue	4	Coloured	3.3
130	Marl3/88	M	74.9	1316 blue	3	Coloured	
131	Marl6/88	M	78.7	1389 blue	3	Dark	4.3
132	Marl7/88	F	74.9	1214 blue	6	Bright,fresh	
133	Marl7/88	F	82.6	1206 blue	5	Bright,fresh	
134	Marl7/88	M	69.9	1213 blue	5	Bright,fresh	
135	Marl7/88	M	69.9	1223 blue	5	Bright,fresh	
136	Mar22/88	M	69.9	1203 blue	3	Darkening	
137	Mar22/88	F	64.8	1208 blue	3	Bright,fresh	
138	Mar24/88	M	70.5	1343 blue	4	Bright,fresh	
139	Mar24/88	M	68.6	1209 blue	3	Bright,fresh	
140	Mar24/88	F	82.6	1212 blue	3	Kelt,excellent shape	
141	Mar24/88	F	71.1	1206 blue	3	Kelt,good shape	
142	Mar3l/88	F	73.0	1388 blue	3	Kelt,excellent shape	
143	Apr0l/88	M	68.6	1207 blue	2	Bright,fresh	
144	Apr0l/88	F	77.5	1222 blue	3	Bright,fresh	
145	Apr0l/88	F	81.3	1204 blue	2	Kelt,a little rough	
146	Apr0l/88	M	66.0	1224 blue	2	Bronze	
147	Apr0l/88	M	67.3	1220 blue	2	Bright,red stripe	
148	Apr08/88	M	80.0	1226 blue	2	Dark	
149	Aprl0/88	M	74.9	1383 blue	2	Bright,fresh	
150	Aprl2/88	M	69.9	1210 blue	2	Dark	
151	Aprl2/88	M	71.1	1218 blue	3	Dark	
152	Aprl5/88	M	71.1	1216 blue	5	Semi—bright	
153	Aprl5/88	F	64.8	1227 blue	5	Bright,fresh	
154	Aprl5/88	F	83.8	1229 blue	5	Kelt,excellent shape	
155	Aprl7/88	M	71.1	1228 blue	2	Bright,bleeding from gill	
156	Aprl7/88	M	70.5	1374 blue	3	Semi—bright	
157	Aprl7/88	F	80.0	1221 blue	6	Kelt,bright beauty	
158	Apr17/88	F	67.3	1230 blue	6	Bright,fresh	

APPENDIX I (cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
159	Apr19/88	M	62.2	1217 blue	5	Bright,fresh	
160	May15/88	M	76.2	1390 blue	2	Spawned,excellent shape	

APPENDIX II Steelhead recaptures from Pallant Creek, 1987—88 winter season.

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Ag
+1	Dec06/87	F	76.2	3945 orange	3	killed,bright	3+.2
2	Dec27/87	F	69.9	280 green	3	quite bright, fungus on nose	
+3	Jan10/88	F	82.6	1889 orange	6	bright,fresh	
4	Jan10/88	M	58.4	1358 blue	2	coloured	
*5	Jan15/88	M	58.4	1358 blue	2	coloured	
6	Jan15/88	F	76.2	1363 blue	3	bright	
7	Jan18/88	F	76.2	1268 blue	2	coloured	
8	Jan26/88	M	76.2	1357 blue	2	coloured,fiesty	
**9	Jan27/88	M	58.4	1358 blue	2	coloured	
10	Jan31/88	F	71.1	1367 blue	2	dark	
11	Feb03/88	F	70.5	1352 blue	2	dark,spawning, fungus by tag	
+12	Feb04/88	F	81.3	1834 orange	5	bright	3.2
13	Feb08/88	F	80.0	1350 blue	2	coloured,getting soft belly	
14	Feb12/88	F	61.6	285 green	2	still bright	
16	Feb15/88	F	77.5	1285 blue	4		
16	Feb14/88	F	71.1	1270 blue	2	coloured,belly a little soft	
17	Feb14/88	M	81.9	1265 blue	2	coloured, a brute	
18	Feb15/88	F	74.3	1339 blue	2	coloured	
19	Feb15/88	F	76.2	1345 blue	6		
20	Feb19/88	F	71.1	1275 blue	1		
21	Feb19/88	F	75.6	1290 blue	3		
22	Feb19/88	F	74.3	1253 blue	1	kelt,coloured	
23	Feb21/88	F	78.7	1370 blue	4		
24	Feb21/88	M	68.6	1320 blue	4		
*25	Feb21/88	F	76.2	1345 blue	5		
+26	Feb22/88	M	83.8	2821 orange	2	coloured	
27	Feb23/88	M	81.3	1360 blue	2	coloured	
+28	Feb23/88	F	77.5	2669 orange	5	bright	
+29	Feb23/88	F	80.0	3940 orange	2	semi—bright,strong	3.1
*30	Feb23/88	M	83.8	2821 orange	2	coloured,strong	3.3
31	Feb24/88	F	72.4	1356 blue	2	coloured,soft belly	
**32	Mar03/88	M	83.8	2821 orange	2	dark	
*+33	Mar04/88	F	83.9	1834 orange	5	kelt,good shape	
34	Mar05/88	M	71.1	1302 blue	5	red stripe,good shape	
35	Mar05/88	M	74.9	1375 blue	2	coloured	
36	Mar07/88	M	83.2	1353 blue	2	dark	
37	Mar09/88	F	76.2	1280 blue	3	kelt,good shape	
*38	Mar09/88	F	76.2	1268 blue	2	kelt,dark	
39	Mar09/88	M	77.5	1373 blue	2	dark,strong	
40	Mar13/88	F	71.1	1327 blue	2	kelt	
41	Mar14/88	F	74.9	1369 blue	3	kelt,good shape	

APPENDIX II (Cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Ag
42	Mar14/88	F	68.6	1361 blue	3	kelt, good shape	
*43	Mar16/88	F	77.5	1285 blue	3	kelt, good shape	
44	Mar24/88	M	73.7	1295 blue	5	dark, bad shape	
45	Mar28/88	M	82.6	288 green	5	dark	
+46	Apr01/88	M	0	1848 orange	6	dark	
+47	Apr01/88	F	81.3	2258 orange	2	kelt,good shape	
48	Apr03/88	M	77.5	1354 blue	2	ratbag	
49	Apr10/88	F	78.7	1304 blue	3	kelt,good shape	
50	May16/88	M	76.2	1390 blue	2	spawned,excellent shape	

* second recapture
** third recapture
\+ recaptured from a previous year
? this fish was on its third spawning run, yet showed no spawning marks on its scales.