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PALLANT CREEK STEELHEAD:
TAGGING AND LIFE HISTORY
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PALLANT CREEK STEELHEAD
TAGGING AND LIFE HISTORY INVESTIGATIONS

1988-89

by

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INTRODUCTION

A long term steelhead tagging study was initiated on Pallant Creek during the 1980-81 winter season by the Queen Charlotte Islands Chapter of the Steelhead Society of B.C. in collaboration with the Pallant Creek Hatchery staff, Department of Fisheries and Oceans (D.F.O.) and Ministry of Environment (M.O.E.) personnel. Objectives of the study were to:

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

This report describes the fishery and results of the 1988-89 study season. A description of the study area can be found in previous Pallant Creek reports (deLeeuw, 1985 a, 1986).

THE FISHERY

Angling for steelhead on the Pallant has increased continuously since 1970, primarily as a result of larger number of fishermen rather than an increase in effort by individual anglers (Table 1). Individual effort has been variable with no consistent pattern. Increased total effort on Pallant and other Queen Charlotte Islands streams has emphasized the need for improved information on which to base management decision.

Fish kept although variable has been decreasing since 1970 while the number released has increased (Table 1). Greatest number of fish (1026) were released during the 87-88 season 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 primarily successful anglers returning their questionnaires was therefore a distinct possibility.

Total catch/angler day has varied during the recording period but remained fairly stable over the last 8 years. Angler success on the Pallant has been consistently better than the Charlottes average as a whole.

Of the 21 recaptured fish (includes one from the previous study) 15 (71%) were taken in the zone of original capture (Table 4). Of the 6 migrators, 5 were recaptured upstream of their tagging location, while 1 was taken downstream. Like the previous years observations, adult Pallant Creek steelhead appear to migrate very little once in their natal stream.

Duration between original and recapture dates ranged from two to 121 days and averaged 36 days. Of the 21 recaptures, 10 (50%) were taken within 20 days of first capture. Two fish were recaptured 4 months after first tagging. Fifty percent of all fish tagged in Nov., Dec., and Jan. were recaptured, while only 13, 16, and 0 percent of those tagged in Feb., Mar and Apr respectively were recaptured (Table 5). This increased probability of recapture of early tagged fish was also observed in the previous studies.

Eight fish were recaptured from previous study seasons. Four of these were originally tagged two years previous. Of these eight fish, four were recaptured this season in their original zone of capture while another four were taken in the same month. One fish originally tagged in late February was recaptured in July over one year later. Excepting this last fish, the tagging information suggests that repeat spawners return to their natal stream at similar times between years. Five (63%) of the previous years recaptures were females.

Table 1. Pallant Creek steelhead harvest analysis¹, 1970-71 to 1988-89.

Season Fished	Days Fished	Anglers	Angler	Kept	<u>Number of Steelhead</u>			
					Kept	Released	Day	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	.30	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
88-89	<u>351</u>	<u>72</u>	<u>4.9</u>	<u>14</u>	<u>534</u>	<u>.04</u>	<u>1.56</u>	<u>1.41</u>
Mean:	186	39	4.9	32	255	.41	1.67	.74

¹Steelhead 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 coloured, numbered anchor (7.62 cm 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. Migration distance of recaptured fish was estimated by calculating the stream length between mid points of original and recapture zones.

Scales were first viewed using a dissecting microscope. The two best examples from the sample were cleaned, mounted on gummed cards and impressions 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 (Picker, 1975). The formulae were:

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

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

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

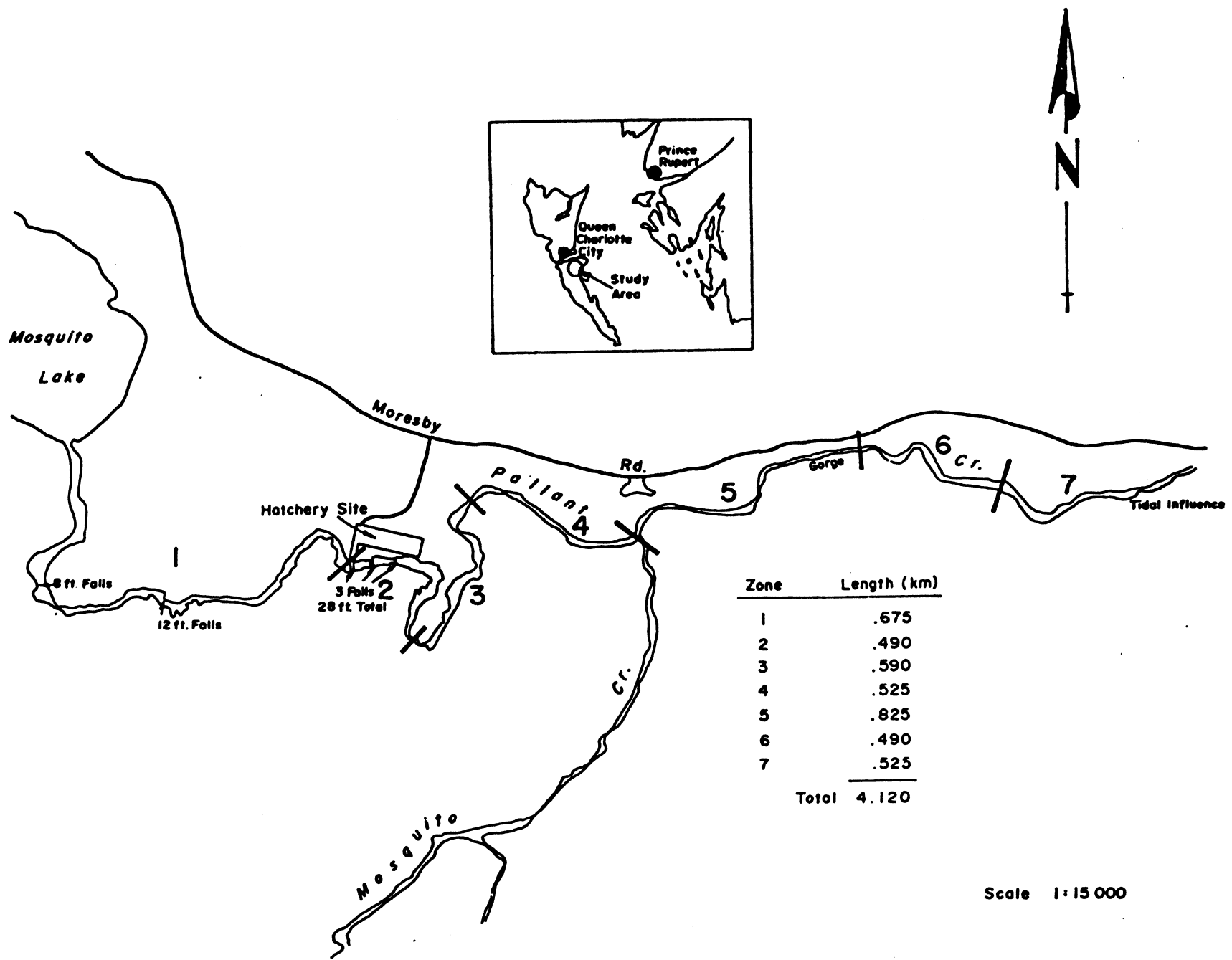


Fig. 1 Pallant Creek Angling Zones During The 1988-89 Steelhead Tagging Study

RESULTS AND DISCUSSION

Eighty-seven adult steelhead were tagged from Nov. 2/88 to Apr. 19/89. Among these 20 were recaptured once, 4 twice and one fish was recaptured 3 times. Eight additional fish were recaptured from previous study seasons one of which was taken twice, for a total catch of 121. The last fish was recaptured July 10, 1989. The 1988-89 catch, excluding all recaptures, was only 58% of the average of four previous study seasons.

SPATIAL AND TEMPORAL DISTRIBUTION OF TAGGED STEELHEAD

Fifty one and 25 per cent of all steelhead were tagged in zones 2 and 3 respectively (Table 2). Zone 2 catch was the highest seasonal percentage for any zone during all study years. Over 50% of the cumulative total of all fish tagged in all study years (683) were captured in zones 1 and 2. These two zones are closest to the hatchery (Fig. 1) where access is readily available.

Steelhead were tagged from late November to mid April, with

Table 2. Steelhead tagged in Pallant Creek during the 1984-85 to 88-89 winter season, grouped by zone.

Zone	Steelhead Tagged					total
	(% Annual Total)					
	1984-85	1985-86	1986-87	1987-88	1988-89	
1	0(0)	1(1)	3(2)	9(6)	0(0)	13(2)
2	27(22)	16(11)	40(24)	46(34)	44(51)	173(26)
3	13(11)	29(20)	50(26)	49(25)	22(25)	163(25)
4	34(28)	13(9)	32(19)	18(11)	1(1)	98(14)
5	2(1)	14(10)	26(15)	19(12)	11(13)	72(11)
6	17(14)	60(42)	18(11)	18(11)	9(10)	122(17)
7	11(9)	10(7)	1(1)	1(1)	0(0)	23(3)
Not recorded	<u>19(15)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	123(100)	143(100)	170(100)	160(100)	87(100)	683(100)

the majority of the catch occurring after late February. This was similar to other study years (Table 3). Although the larger component of the Pallant Creek steelhead run enters in the latter part of the season, peaks in run timing have been variable from year to year depending on stream discharge, temperature.

Twenty (23%) of the 87 fish tagged were recaptured once. Of these 4(5%) and 1 (1%) were recaptured a second and third time respectively (Table 4). Eight fish were recaptured from previous years. One of these was recaptured twice.

Table 3. Number of steelhead tagged during the 1984-85 to 1988-89 winter seasons grouped in 10 day periods.

Date	1984-85	1985-86	1986-87	1987-88	1988-89	Total
10/01-10	0	0	0	0	0	0
11-20	0	0	0	3	0	3
21-30	0	0	0	0	0	0
11/01-10	0	0	0	0	0	0
11-20	0	0	2	0	0	2
21-30	0	0	0	5	4	9
12/01-10	0	0	12	1	4	17
11-20	3	10	16	15	6	50
21-30	1	13	6	10	3	33
01/01-10	1	13	14	8	4	40
11-20	3	4	6	13	2	28
21-30	7	4	24	16	4	55
02/01-10	4	4	11	10	2	31
11-20	3	7	8	21	4	43
21-30	17	6	8	8	10	49
03/01-10	4	18	9	16	11	58
11-20	20	23	12	9	6	70
21-30	18	26	6	7	15	72
04/01-10	41	7	3	7	10	68
11-20	0	7	22	10	2	41
21-30	0	1	8	0	0	9

Table 3. (cont'd)

Date	1984-85	1985-86	1986-87	1987-88	1988-89	Total
05/01-10	1	0	3	0	0	4
11-20	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total	123	143	170	160	87	683

Table 4. Migration distance (km) and time duration (days) between captures of recaptured steelhead tagged in Pallant Creek, 1988-89.

tag #	c ¹	Original								km	days
		Capture		1 recap.		2 recap.		3 recap.			
		zone	day	zone	day	zone	day	zone	day		
1246	B	2	12/04	2	12/13					0	9
1241	B	3	12/06	3	12/15					0	9
1384	B	2	12/09	2	12/18					0	9
1872	0*	2	12/18	2	04/19					0	121
1242	B	2	11/28	2	01/01					0	34
1396	B	5	12/31	5	01/11					0	11
1506	Y	2	01/08	2	01/17	2	01/29			0	21
1391	B	2	01/01	2	01/29	2	02/26			0	56
1504	Y	2	01/02	2	01/29					0	27
1505	Y	2	01/08	2	01/29					0	21
1509	Y	4	01/12	2	01/16					+1.1	35
1502	Y	3	02/19	2	02/27	2	03/02	2	03/11	+0.54	20
1239	B	2	12/05	2	02/27					0	84
281	G	2	03/01	2	03/17					0	16
1226	B	2	11/21	2	03/21					0	120
1538	Y	2	03/08	2	03/21					0	13
1530	Y	6	03/17	5	03/28					+0.66	11
1394	B	2	12/17	4	03/28					-1.1	91
1544	Y	3	03/27	2	03/29					+0.54	2
1233	B	2	03/26	2	04/02	2	04/06			0	11
1516	Y	6	02/21	3	04/07					+1.88	45

1, C = colour: B blue, 0 = orange, y = yellow, g = green.

*, this fish was originally tagged Jan. 6, 1987, but treated here as an original capture in 1988.

Table 5. Pallant Creek steelhead tagging and first recapture dates grouped by month within the 88-89 winter season.

Month of Capture	Tagged population	Number and Percent () of Tagged Population Recaptured in Successive Months						
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Nov.	4			1 (25)		1 (25)		2 (50)
Dec.*	14		3 (21)	1 (7)	1 (7)	1 (7)	1 (7)	7 (50)
Jan.	10			4 (40)	1 (10)			5 (50)
Feb.	16				1 (7)		1 (7)	2 (13)
Mar.	32					4 (13)	1 (3)	5 (16)
Apr.	<u>12</u>		<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u> (0)
Total	88*		3	6	3	6	3	21

* Includes one fish treated as this years' first capture but tagged in the year previous.

AGE AND SIZE

Thirty three fish were scale sampled with only 7 age groups represented. Freshwater age was not readable in 9 sets (27%) due to resorption of the central area (Table 6). The most common age group was 3.3 (30%) followed by 3.2 (27%). The remaining 5 age groups were determined from only one fish each. Three fish were repeat spawners (9%) and one was on its third spawning migration.

Three years of juvenile stream growth dominated the small sample (92%, N=24) while 3 and 2 years of ocean residency comprised 50 and 41% respectively of all saltwater ages. Although the degree of age class dominance has fluctuated markedly from year to year, age 3.3 fish have consistently been the most abundant.

Two and 3 year ocean males averaged 66.8 and 84.4 cm respectively while females of similar ages averaged 75 and 78.1 cm (Table 7). This difference in length between .2 and .3 males (17.6 cm) and similar aged females (3.1 cm) was also documented in the earlier studies. Two .4 females were 82.6 and 83.0 cm. Average growth of both sexes during the year prior to spawning (ie. the difference in length from .2 to .3 fish) was about 10 cm. Repeat spawners tagged 1 and 2 years earlier were only 4.7 and 8.1 cm larger respectively (Table 8).

Table 6. Steelhead trout age groups from Pallant Creek, 1988-89,
 N=33.

Age Groups	Number of Males	Number of Females	Total (%)
3.2	4	5	9 (27)
3.3	3	7	10 (30)
4.3		1	1 (3)
2.SS1	1		1 (3)
3.1s1		1	1 (3)
3.2s1	<u>1</u>	<u>1</u>	<u>1 (3)</u>
	9	14	23
R*		1	1 (3)
R.2	2	1	3 (9)
R.3	<u>2</u>	<u>3</u>	<u>5 (15)</u>
	<u>13</u>	<u>20</u>	<u>32 9</u>
Total	13	20	32 9
3.4	4	83.2 / 5	32

*, R = central area of scale is resorbed and freshwater age is not readable.

Table 7. Fork lengths (cm) of male and female Pallant Creek Steelhead of different ocean ages 1988-89, N=27.

Ocean Age	Males			Females		
	N	X	Range	N	X	Range
.2	5	66.8	66.0-71.1	5	75.0	65.0 - 80.0
.3	5	84.4	83.8-86.4	10	78.1	71.1 - 83.8
.4						

Table 8. Pallant Creek steelhead originally tagged in 1986-87 and 1987-88, recaptured in 1988-89.

Tag #	Sex	Original Capture		Recapture		Years	Growth (cm)
		Date	Fork Length(cm)	Date	Fork Length(cm)		
01872	M	Jan 6/87	61.0	Dec 18/89	79.4	2	18.4
1286	F	Jan 28/88	68.6	Jan 9/89	71.4	1	2.5
1377	F	Feb 29/88	47.6	Feb 20/89	53.3	1	5.7
1877	M	Feb 01/87	76.2	Feb 27/89	80.0	2	3.8
1808	F	Jan 14/87	76.2	Mar 28/89	81.3	2	5.1
1825	F	Jan 21/87	76.2	Mar 31/89	81.3	2	5.1
1220	M	Apr 1/88	67.3	Apr 20/89	74.3	1	7.0
1376	F	Feb 26/88	<u>47.0</u>	Jul 10/89	<u>50.8</u>	1	<u>3.8</u>
	Average		65.0		71.4		1 yr=4.7 2 yr=8.1

POPULATION ESTIMATION

The average of 3 multiple capture population estimates calculated 266 steelhead in Pallant Creek during the 1988-89 study period (Table 9). Narrow confidence limits resulted from high numbers of recaptures (27 or 31%). The estimate therefore likely approximated actual population abundance. Post tagging mortality, tag loss, emigration, non-reporting of tag recaptures, and catchability influences were not accounted for. Despite these factors, however, the estimate was still considered reasonable. Even if the no recruitment and mortality conditions required by the method are only approximately satisfied the multiple census technique employed in this study was still useful (Picker, 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 14 fish, the fishery was not considered a conservation concern.

Table 9. Pallant Creek steelhead population estimates during the 1988-89 winter season.

Method	Estimate	95% confidence limits	
		Poison distribution	Normal Distribution
Schnabel	245	166-378	173-415
Schumacher	318	106-688	
Chapman	<u>235</u>	161-359	170-384
Mean	266		

SUMMARY

1. Eighty seven steelhead were angled and tagged on Pallant Creek, Queen Charlotte Islands between Nov. 2 and Apr 19 of the 1988-89 winter season. Twenty were recaptured once, while 4 and 1 were recaptured 2 and 3 times respectively. Eight fish were recaptured from the 1986-87 (4) and 1987-88 (4) Pallant Creek studies, one of which was taken twice.
2. The majority of fish (75%) were taken from the upper river during late February through mid April. Of the 21 recaptures (one tagged the year previous) 71% were taken in their original tagging zone. Average time to recapture was 36 days and ranged from 2 to 121 days. Fourty three 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 tagging date. Fish tagged early in the season (Nov-Dec) were more likely to be recaptured than those tagged late (March + April).
4. Four of the 8 steelhead which were tagged 1 and 2 seasons earlier were recaptured during this study close to their original tagging dates. Like the previous studies 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 (30%) followed by 3.2 (27%). Three years of freshwater residency accounted for 92% of the total sample (N=24). Ocean ages .2 and .3 accounted for 41 and 50% respectively of the population sampled.
6. The Pallant Creek steelhead population during the 1988-89 study was estimated at 266 fish. Since 31% of the tagged sample were recaptured, confidence limits were fairly narrow and ranged from 161 to 688 fish.
7. The recreational fishery was not considered to impact significantly on the 1988-89 Pallant Creek steelhead population.

ACKNOWLEDGEMENTS

Like the previous Pallant Creek steelhead studies, this project 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 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. Mark Beere calculated the population estimates. Editorial comments were provided by B. Hooton and the report was typed by Pat. Neeve. The study was funded as a Public Involvement project by the Salmonid Enhancement Program.

REFERENCES

- de Leeuw, A.D. 1985a. Pallant Creek steelhead: some aspects of their life history, population size and sport fishery, 1981-82. Fisheries Progress Report No. SK-50. Ministry of Environment, Smithers, B.C.
- de Leeuw, A.D. 1985b. Pallant Creek steelhead: 1983-84. Fisheries Progress Report No. SK-51. Ministry of Environment, Smithers, B.C.
- de Leeuw, A.D. 1985c. Pallant Creek steelhead: 1984-85. Fisheries Progress Report No. SK-52. Ministry of Environment, Smithers, B.C.
- de Leeuw, A.D. 1987a. Pallant Creek Steelhead: 1985-86. Fisheries Progress Report No. SK-56. Ministry of Environment, Smithers, B.C.
- de Leeuw, A.D. 1987b. Pallant Creek steelhead: 1986-87. Fisheries Progress Report No. SK-5 . Ministry of Environment, Smithers, B.C.
- Narver, D.W. and F.S. Withler. 1974. Steelhead of the Nanaimo River, aspects of their biology and the fishery from three years of anglers' catches. Fisheries and Marine Services, Nanaimo, B.C., Cir. No. 99, 25 pp.
- Picker, W.E. 1975. Handbook of computations for biological statistics of fish populations. Bulletin #119. Fisheries Research Brd., Canada.
- Steelhead Harvest Analysis. 1970-71 through 1988-89, Fish and Wildlife Branch, Victoria, B.C.

APPENDICES

1. Original steelhead captures from Pallant Creek, 1988-89 winter season.
11. Steelhead recaptures from Pallant Creek, 1988-89 winter season.

APPENDIX 1. original steelhead captures from Pallant Creek, 1988-89 winter season.

Fish no.	Date	Sex	Length (cm)	Tag no. and Color	Zone	Remarks	Age
1	Nov21/88	M	83.8	01226 blue	2	darkening, red stripe	
2	Nov21/88	F	81.3	01243 blue	2	darkening, red stripe	
3	Nov28/88	M	86.4	01242 blue	2	red stripe, fungus on nose	
4	Nov28/88	F	73.7	01240 blue	2	bright, fresh	
5	Dec04/88	F	78.7	01246 blue	2	darkening	
6	Dec05/89	M	71.1	01239 blue	2	bright, fresh	
7	Dec06/88	M	95.3	01241 blue	3	bright, red stripe	3.2S1
8	Dec09/88	F	82.6	01384 blue	2	bright, wound on top of head	4.3
9	Dec14/88	M	82.6	01392 blue	3	coloured, jumper	
10	Dec16/88	F	76.2	01245 blue	2	bright	R.3
11	Dec16/88	F	74.9	01250 blue	3	bright, hook in mouth	3.2
12	Dec16/88	F	76.8	01249 blue	3	bright	R.3
13	Dec17/88	F	74.9	03702 orange	3	bright	
14	Dec17/88	M	83.8	01248 blue	3	bright	3.3
15	Dec27/88	F	77.5	01394 blue	2	bright	
16	Dec31/88	F	79.4	01394 blue	2	bright	R.3
17	Dec31/88	F	83.8	01396 blue	5	bright	3.3
18	Jan01/89	M	83.8	01391 blue	2	coloured, strong	3.3
19	Jan02/89	F	76.2	01504 yellow	2	getting coloured	3.3
20	Jan08/89	F	83.2	01505 yellow	2	getting coloured, belly soft	3.4

APPENDIX 1. (cont'd)

Fish No.	Date	Sex	Length (cm)	Tag no. and color	Zone	Remarks	Age
21	Jan08/89	F	79.1	01506 yellow	2	getting coloured	3.3
22	Jan12/89	M	83.8	01509 yellow	4	slight colour	R.3
23	Jan18/89	F	71.1	01511 yellow	2	red stripe	3.3
24	Jan25/89	M	68.6	01502 yellow	2	getting coloured	R.2
25	Jan29/89	M	71.1	01244 blue	3	bright	R.2
26	Jan29/89	F	78.7	01247 blue	3	bright	3.3
27	Jan30/89	?	40.6	01503 yellow	3	rainbow??	
28	Feb07/89	F	73.7	01507 yellow	2	semi-bright	3.1S1
29	Feb07/89	M	84.5	01508 yellow	2	coloured	3.3
30	Feb19/89	F	68.6	01502 yellow	3	coloured	
31	Feb19/89	F	73.7	01523 yellow	3	bright	
32	Feb19/89	M	72.4	01524 yellow	3	coloured	
33	Feb19/89	M	68.6	01525 yellow	3	bright	
34	Feb21/89	M	73.7	01515 yellow	5	bright	
35	Feb21/89	F	72.4	01516 yellow	5	bright	
36	Feb21/89	F	74.9	01517 yellow	5	bright	
37	Feb21/89	F	71.1	01518 yellow	6	Kelt, good shape	
38	Feb22/89	F	73.7	01519 yellow	5	bright, scarred	
39	Feb22/89	M	71.1	01520 yellow	5	bright	
40	Feb22/89	F	77.5	01521 yellow	3	bright	

APPENDIX 1. (Cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
41	Feb22/89	M	82.6	01522 yellow	6	coloured	
42	Feb22/89	M	84.5	01532 yellow	3	coloured	
43	Feb27/89	F	78.7	00320 green	2	coloured	
44	Mar01/89	M	81.3	00281 green	2	coloured	
45	Mar01/89	M	86.4	00365 green	2	coloured	
46	Mar01/89	F	69.9	01533 yellow	2	semi-coloured	
47	Mar03/89	M	50.8	01534 yellow	2	coloured	2.SS1
48	Mar03/89	F	80.0	01535 yellow	2	coloured	3+.3
49	Mar04/89	F	65.4	01536 yellow	2	coloured	R.2
50	Mar08/89	F	80.0	01537 yellow	2	coloured, soft	R.2
51	Mar08/89	F	81.3	01538 yellow	2	coloured, soft	
52	Mar10/89	F	81.3	01539 yellow	2	semi-coloured	3.3
53	Mar10/89	M	63.5	01540 yellow	2	coloured	
54	Mar10/89	M	86.3	01541 yellow	2	coloured, strong	R.3
55	Mar17/89	M	78.7	01527 yellow	6	bright	
56	Mar17/89	F	66.0	01528 yellow	6	bright, fresh	
57	Mar17/89	M	77.5	01529 yellow	6	bright	
58	Mar17/89	M	68.6	01530 yellow	6	bright, scratches tail to stomach	

APPENDIX 1. (cont'd)

Fish no.	Date	Sex	Length (cm)	Tag no. and colour	Zone	Remarks	Age
59	Mar17/89	F	81.3	01531 yellow	6	coloured, soft	
60	Mar18/89	F	0	01526 yellow	6	coloured, soft	
61	Mar26/89	F	80.0	01542 yellow	2	kelt, good shape	3.2S
62	Mar26/89	M	80.0	01233 blue	2	bright, super strong	
63	Mar26/89	M	71.1	01231 blue	3	bright	
64	Mar27/89	M	73.0	01544 yellow	3	coloured, strong	
65	Mar28/89	M	71.1	01545 yellow	6	bright	
66	Mar28/89	F	81.3	01546 yellow	5	bright	
67	Mar28/89	M	88.9	01547 yellow	5	red stripe, fresh	
68	Mar28/89	M	71.1	01548 yellow	5	bright, fresh	
69	Mar28/89	F	86.4	01549 yellow	5	bright, fresh	
70	Mar28/89	F	76.2	01550 yellow	5	kelt, good shape	
71	Mar29/89	F	76.2	01551 yellow	2	kelt, good shape	3.2S
72	Mar29/89	F	76.2	01560 yellow	2	kelt, fair shape	3.2S
73	Mar29/89	M	63.5	01559 yellow	3	coloured	
74	Mar31/89	M	71.8	01232 blue	2	bright	3.2
75	Mar31/89	M	76.2	01556 yellow	2	bright	
76	Apr02/89	M	81.3	01235 blue	2	dark, strong	

APPENDIX I (Cont 'd)

Fish No.	Date	Sex	Length (cm)	Tag no. and Color	Zone	Remarks	Age
77	Apr02/89	F	73.7	01386 blue	2	bright	
78	Apr04/89	M	73.7	01543 yellow	2	bright, fresh	
79	Apr04/89	F	86.4	01557 yellow	2	bright, fresh	
80	Apr05/89	M	83.8	01567 yellow	3	strong, coloured	
81	Apr06/89	M	71.1	01554 yellow	2	semi-bright	
82	Apr07/89	M	66.0	01571 yellow	2	coloured	3.2
83	Apr09/89	M	66.7	01562 yellow	2	coloured	3.2
84	Apr09/89	M	84.5	01563 yellow	2	semi-bright, strong	
85	Apr09/89	M	76.2	01553 yellow	3	red stripe, fresh	
86	Apr11/89	M	81.3	01564 yellow	3	dark	
87	Apr19/89	F	78.7	01565 yellow	1	kelt, good shape	3.2s

APPENDIX 11 Steelhead recaptures from Pallant Creek, 1988-89

Fish No.	Date	Sex	Length (cm)	Tag no. and Color	Zone	Remarks
2	Dec15/88	M	95.3	01241	3	red stripe
3	Dec18/88	F	82.6	01384	2	slight colour
***4	Dec18/89	M	79.4	01872	2	slight colour
5	Jan01/89	M	86.4	01242	2	coloured
***6	Jan09/89	F	71.1	01286	3	
7	Jan11/89	F	82.6	01396	5	
8	Jan17/89	F	78.1	01506	2	red stripe
9	Jan29/89	M	83.8	01391	2	
10	Jan29/89	F	76.2	01504	2	
11	Jan29/89	F	83.2	01505	2	
*12	Jan29/89	F	79.1	01506	2	
13	Feb16/89	M	83.8	01509	2	
***14	Feb20/89	F	53.3	01377	3	coloured
*15	Feb26/89	M	83.8	01391	2	killed
***16	Feb27/89	M	80.0	01877	2	coloured
17	Feb27/89	F	68.6	01502	2	coloured
18	Feb27/89	M	71.1	01239	2	coloured
*19	Mar02/89	F	68.6	01502	2	coloured

APPENDIX II (Cont'd)

Fish No.	Date	Sex	Length (cm)	Tag no. and Color	Zone	Remarks
**20	Mar11/89	F	68.6	01502 yellow	2	coloured
21	Mar17/89	M	81.3	00281 green	2	coloured
22	Mar21/89	M	83.8	01226 blue	2	coloured
23	Mar21/89	F	81.3	05138 yellow	2	coloured
24	Mar28/89	F	68.6	01330 yellow	5	bright
25	Mar28/89	F	77.5	01394 blue	4	kelt, rough shape
***26	Mar28/89	F	81.3	01808 orange	S	kelt, good shape
27	Mar29/89	M	73.0	01544 yellow	2	spawning, good shape
***28	Mar31/89	F	81.3	01825 orange	4	semi-bright
29	Apr02/89	M	80.0	01233 blue	2	bright
30	Apr07/89	F	72.4	01516 yellow	3	kelt
*31	Apr06/89	M	80.0	01233 blue	2	bright
* ***32	Apr19/89	M	79.4	01872 orange	2	
***33	Apr20/89	M	74.3	01220 blue	2	coloured
***34	Jul10/89	F	50.8	01376 blue	3	killed, bright

* second time recaptured

** third time recaptured

*** recapture from another tag year