

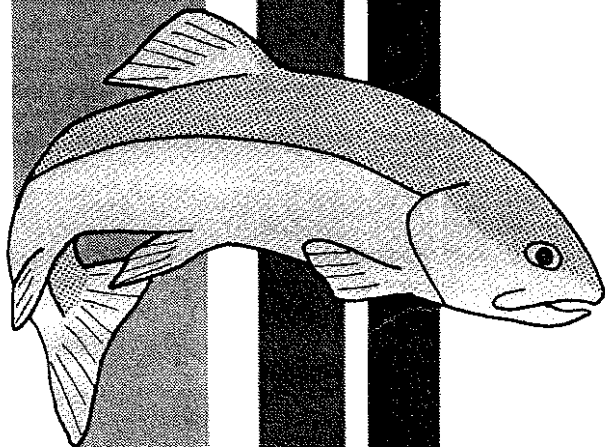


# Skeena Fisheries

Pallant Creek Steelhead  
1983-84

*by*

*A. D. de Leeuw*



B.C. Ministry of Environment  
Fisheries Branch  
Smithers, B.C.

Fisheries Progress Report No. SK-51

October 1985

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ABSTRACT

de Leeuw, A.D. 1985. Pallant Creek steelhead: 1983-84. Fisheries Progress Report No. SK-51.

During the 1983-84 winter season, a steelhead tagging study was undertaken on Pallant Creek, Queen Charlotte Islands. Fifty-eight steelhead were tagged and 10.3% were subsequently recaptured. Run size was calculated with multiple capture techniques and was estimated to be 266 fish. Confidence limits ranged from 125 to 1599 steelhead. Duration between recaptures averaged 45 days and ranged from 1 to 89 days. The majority of steelhead were taken in the upper river, approximately 3 km from tidal influence. The dominant age group was 3.3 (47.1%) followed by 3.2 (23.9%) and 2.2 (6.5%). Repeat spawners comprised 9% of the sample. Results are discussed relative to the sports fishery and other Charlotte streams.

## INTRODUCTION

This report describes a steelhead trout tagging project carried out on Pallant Creek, Queen Charlotte Islands, during the winter of 1983-84. A similar study was conducted during the winter of 1981-82 (de Leeuw, (1985a).

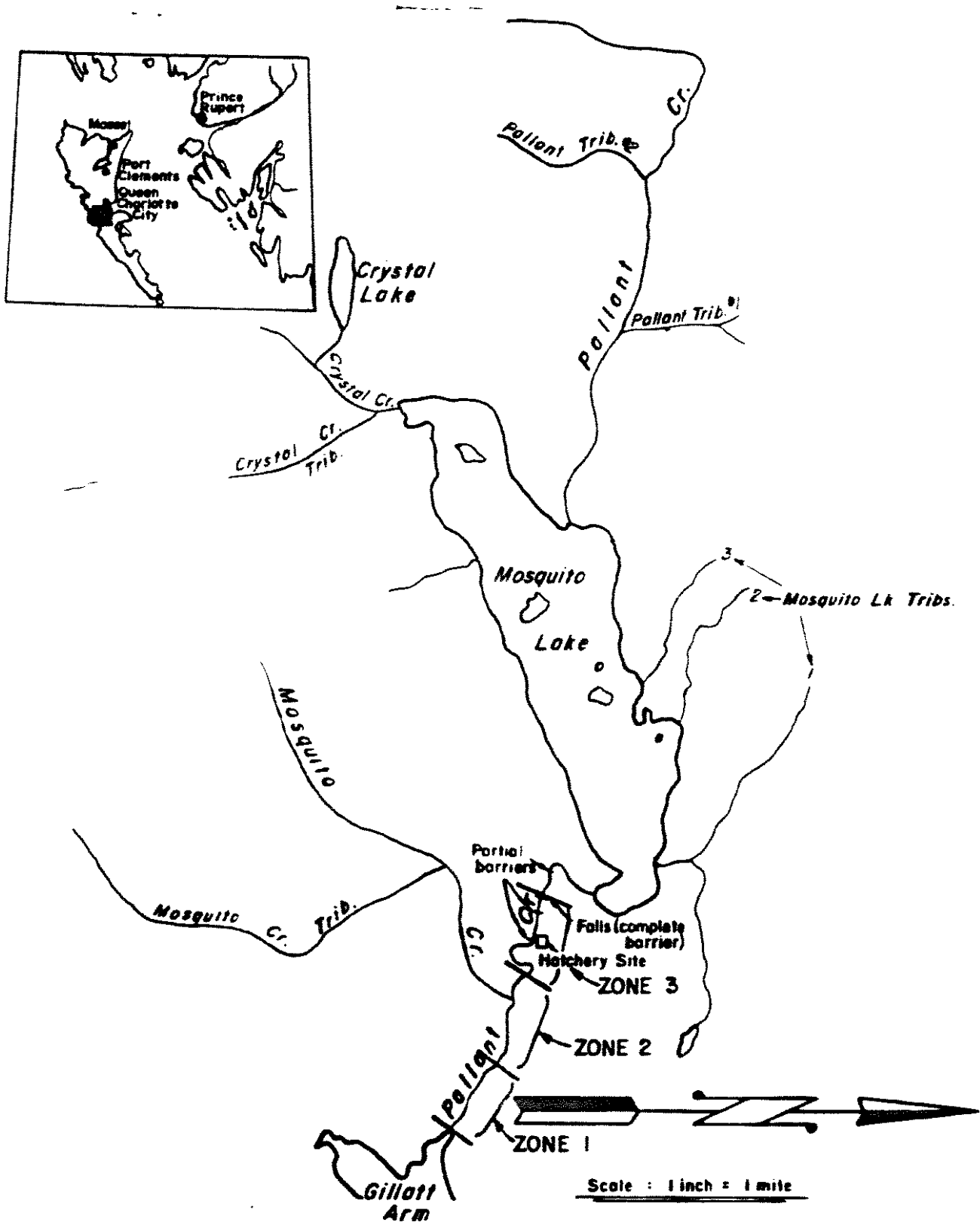
In an attempt to document steelhead population changes over the long term, it is hoped steelhead tagging will be continued for several years, thus establishing Pallant Creek as an adult steelhead index stream for the Queen Charlotte Islands. The small drainage basin area, the angler accessibility, and the continued commitment of the Pallant Creek Hatchery staff and the Queen Charlotte Island Chapter of the B.C. Steelhead Society, all contribute to make Pallant Creek highly suitable for long term investigations of steelhead.

The objectives of the 1983-84 study are to :

1. Describe steelhead run timing and movement;
2. Describe life history characteristics;
3. Estimate population size.

## DESCRIPTION OF THE STUDY AREA AND FISHERY

Located on northern Moresby Island (Figure 1), Pallant Creek drains an area of 8495 hectares and flows in an easterly direction into Gillatt Arm of Cumshewa Inlet. Distribution of anadromous species is



**Fig. 1 PALLANT CREEK AND MOSQUITO LAKE SYSTEM**

limited by an impassable falls to the lower 3.5 km. Other than steelhead (Salmo gairdneri) the following species are also found in the lower Pallant: sockeye salmon (Oncorhynchus nerka), coho salmon (O. kisutch), chum salmon (O. keta), pink salmon (O. gorbuscha), Dolly Varden char (Salvelinus malma), and prickly sculpin (Cottus asper).

Like many Charlotte streams, run-off patterns for Pallant Creek vary tremendously as a function of precipitation, primarily rainfall, despite the large lake at its headwaters. Discharges range from .223 to 125 m<sup>3</sup>/s, with an average annual flow of 15.2 m<sup>3</sup>/s (Environment Canada, 1982). Temperatures vary from .5 to 19.0°C, and total dissolved solids (T.D.S.) in July are <30 ppm.

Additional information on the Pallant Creek system is available from: Caw, 1978; Marshall, et al, 1978; Shepherd, 1978, 1982; and de Leeuw, 1984. For results of the 1981-82 Pallant Creek steelhead tagging study, note de Leeuw, 1985a.

Angler effort on the Pallant has increased steadily from 1970 to the 1983-84 season, both in terms of days fished and number of anglers (Table 1). The number of steelhead killed per angler day has decreased, but the total killed annually has increased during the early period of record and then stabilized. The catch/angler day (a combination of both fish kept and released) has declined somewhat over the past 10 years, probably as a function of increased angling pressure on a relatively finite steelhead population. Catch/angler day on the Pallant is better than it is for the Charlottes as a whole. The large

number of steelhead released during the 1980-81 (709) and 1982-83 (511) seasons is most likely an over-estimation as a result of primarily successful anglers returning the questionnaires. The two tagging seasons (1981-82 and 1983-84) appear to have had little effect on the reported questionnaire results (Table 1).

Table 1. Pallant Creek steelhead harvest analysis<sup>1</sup>, 1970-71 to 1984-85

Season	Days Fished	No. of Anglers	Kept	Released	Kept/Day	Catch/Day	Charlottes Catch/Day
70-71	8	4	8	20	1.00	3.50	.36
71-72	10	3	21	25	2.00	4.60	.52
72-73	89	12	45	86	.50	1.47	.31
73-74	26	3	26	34	1.00	2.22	.33
74-75	10	3	7	0	.67	.67	.27
75-76	73	30	23	40	.32	.86	.47
76-77	107	46	47	20	.45	.65	.37
77-78	74	30	48	92	.64	1.86	.48
78-79	177	42	35	26	.21	.38	.41
79-80	236	50	36	86	.16	.53	.48
80-81	382	53	59	709	.16	1.96	.79
81-82	227	66	41	190	.22	1.05	.93
82-83	293	50	17	511	.06	1.80	1.23
83-84	235	37	39	330	.17	1.57	.57
Mean:	139	31	32	155	.54	1.65	.54

<sup>1</sup>Steelhead Harvest Analysis, B.C. Fish and Wildlife Branch annual reports.



## METHODS

The river was roughly partitioned into three (3) zones (Figure 1). Adult steelhead were angled and tagged with orange, numbered anchor (spaghetti) tags. Weights were generally estimated while fork lengths were measured. Gender, date of capture, tag number and colour as well as location of capture were noted. After the removal of a few scales, fish were released at the capture site.

Scales were viewed using a dissecting microscope, and the two best examples from the sample selected were cleaned and mounted on gummed cards. Impressions of the scales were made on acetate cards by applying heat and pressure. A Leitz Prado projector was then used to examine each scale for freshwater and ocean age (Narver and Withler, 1974).

Population size was determined using the Schnabel, Schumacher and Schnabel-Chapman adjusted multiple census techniques (Ricker, 1958).

The formulae were:

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

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

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

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

## RESULTS

During the 1983-84 winter season, 59 steelhead were captured of which 58 were tagged. Of these, only 6 were recaptured (Appendix 1 and 11).

### SPATIAL AND TEMPORAL DISTRIBUTION

Although steelhead were taken throughout the accessible portion of Pallant Creek, the greatest portion of the catch came from the upper river or Zone 3 (Table 2). The largest catches were made during January, February and March (Table 3). Of the 59 steelhead captured, 33 or 56% were males, of which the greatest number were taken later in the season (Table 3). In March, 17 males were captured and released, while only 4 females were taken. Migration was difficult to assess, since only 3.5 km of the stream is accessible and few fish were recaptured. Only 2 fish taken in the middle area (Zone 2) were again taken further upstream in Zone 3. The remaining 4 fish were captured twice in the same general area (Table 4). Time duration between original tagging and repeat captures was extremely variable and ranged from 1 to 89 days (Table 4), with an overall average of 45 days. One fish was taken as a kelt (spawned fish) early in the season and recaptured in the same area 89 days later.

Table 2. Pallant Creek steelhead catch by zone.

Zone	Zone Length (Km)	Catch	Catch/Km
1 (Lower River)	1.16	4	3.5
2 (Middle River)	1.16	17	14.7
3 (Upper River)	1.16	20	17.2
Not recorded	---	18	---
Total	3.5	59	

Table 3. Number of steelhead captured during the 1983-84 tagging study on Pallant Creek. Catch grouped by 10-day periods.

Date	Males	Females	Total
11/21-30	1	0	1
12/1-10	0	0	0
12/11-20	0	2	2
12/21-30	0	0	0
01/1-10	0	0	0
01/11-20	7	10	17
01/21-30	0	0	0
02/1-10	4	6	10
02/11-20	1	0	1
02/21-30	1	0	1
03/1-10	1	1	2
03/11-20	4	0	4
03/21-30	12	3	15
04/1-10	0	0	0
04/1-20	2	4	6
04/21-30	0	0	0
Total	33 (56%)	26 (44%)	59

Table 4. Movement and residency of recaptured steelhead in Pallant Creek, 1983-84.

Tag #	Original Capture			Zone	Recapture		No. Days
	Zone	Date	Condition		Date	Condition	
orange 2867	2	Jan 12	Bright	3	Feb 1	Bright	21
orange 2701	3	Dec 14	Bright	3	Mar 3	Coloured	80
orange 2716	3	Mar 3	Dark	3	Mar 14	Coloured	12
orange 2704	3	Jan 12	Spawning	3	Mar 19	Coloured	67
orange 2881	2	Mar 28	Coloured	3	Mar 29	Coloured	1
orange 2873	3	Jan 14	Kelt	3	Apr 14	Kelt	89

$\bar{X} = 45$

#### AGE AND SIZE

Of 59 scale samples, total ages were discernable for 34 fish.

From the samples where total age was discernable, steelhead which had spent 3 years in the stream and 3 years in the marine environment (3.3) were the dominant age group (47.1% of the total). The next most common ages were 3.2 (32.4%) and 2.2 (8.8%) (Table 5). In terms of juvenile age, 85.3% had spent 3 years in the stream prior to ocean migration (3.). The remaining 14.7% spent 2 (2.) years in the stream (Table 6).

Three years of marine residency (.3) accounted for 47.8% of all scales sampled, and was the dominant ocean age. The remaining ocean ages were: two (39.1%), one (10.9%) and four (2.2%) (Table 7).

Only 4 fish (9%) of the 46 sampled had spawned previously. Three fish had spawned once and were on their second spawning migration (.1S1), while one fish was on its fourth spawning run (.1SSS1). All repeat spawners had spent one year in the ocean prior to spawning and were distributed equally between the sexes (Table 8).

Table 5. Steelhead trout age groups from Pallant Creek, 1983-84,

Age groups	Males	Females	Total	% of Total (n = 34)
2.2	2	1	3	8.8
2.3	0	2	2	5.9
3.2	6	5	11	32.4
3.3	7	9	16	47.1
3.4	0	1	1	2.9
3.2S1	1	0	1	2.9
Total	<u>16</u>	<u>18</u>	<u>34</u>	
R.1	1	0	1	
R.2	2	1	3	
R.3	3	1	4	
R.1S1	1	2	3	
R.1SSS1	1	0	1	
Total (all samples)	<u>24</u>	<u>22</u>	<u>46</u>	

R = Central area of scale is reabsorbed and freshwater age cannot be determined.

Table 6. Number and percentage of male and female Pallant Creek steelhead of different fresh water ages, 1983-84, n = 34.

Fresh water age	Males	Females	Total	% of Total
2	2	3	5	14.7
3	14	15	29	85.3
Total	<u>16</u>	<u>18</u>	<u>34</u>	

Table 7. Number and percentage of male and female Pallant Creek steelhead of different ocean ages, 1983-84, (n = 46).

Ocean age	Males	Females	Total	% of Total
.1	2	3	5	10.9
.2	11	7	18	39.1
.3	10	12	22	47.8
.4	0	1	1	2.2
Total	<u>23</u>	<u>23</u>	<u>46</u>	

Table 8. Ocean ages of repeat spawning Pallant Creek steelhead captured during the 1983-84 season (n = 4).

	Ocean age	Males	Females	Total
	.1S1	1	2	3
	.1SSS1	$\frac{1}{2}$	$\frac{0}{2}$	$\frac{1}{4}$
Total				

Table 9. Fork lengths (cm) of male and female Pallant Creek steelhead of different ocean ages, 1983-84.

Ocean Age	N	Males			Females			Total	
		$\bar{X}$	Range cm	N	$\bar{X}$	Range cm	N	$\bar{X}$	Range
.1	2	65.4	61.5-69.2	0	--	--	2	65.4	61.5-69.2
.2	11	65.0	53.8-74.4	8	65.2	56.0-76.9	19	65.1	53.8-76.9
.3	11	79.2	69.0-87.0	11	76.6	69.2-83.0	22	77.9	69.0-87.0
.4	0	--	--	1	79.5	79.5	1	79.5	79.5
Total	24	72.1	53.8-87.0	20	72.2	56.0-83.0	44	72.1	53.8-87.0

POPULATION ESTIMATION

According to the three different estimators, the 1983-84 Pallant Creek steelhead population was between 235 and 288 fish (Table 10). Wide confidence limits are likely due to few repeat captures.

Table 10. Pallant Creek steelhead population estimates during the winter of 1983-84.

Method (Ricker, 1958)	Estimate	95% Confidence Limits	
		Poisson distribution	Normal distribution
N Schnable	274	125 - 747	150 - 1599
N Schumacher	288	212 - 450	
N Chapman	<u>235</u>	114 - 587	142 - 668
$\bar{X} = 266$			

## DISCUSSION

The large catch of steelhead in Zones 2 and 3 is likely the result of better access, proximity to the hatchery and therefore greater angler activity, and rapid steelhead migration through the lower reaches. During the 1981-82 season, a similar distribution of the catch was encountered. The large catches throughout January, February and March are typical of many Charlotte streams, although the large number of males relative to the females taken in March has not been noted in other streams. This relative abundance of males was reflected in the catch as a whole, where the sex ratio favoured males (56%) over females (44%). During the 1981-82 study, however, Pallant Creek steelhead sex ratio was comparable to other Charlotte streams and favoured females 62%.

The extended time duration between capture and recapture (up to 89 days with an average of 45 days) is perhaps a function of steelhead migrating into and out of Pallant Creek during the season. In Goldstream River on southern Vancouver Island, radio tagged steelhead migrated into the stream during high flows and back to the estuary again during reduced discharges (Witt, et al. 1980). Given the variable flow regimes of small coastal streams, Pallant Creek steelhead likely migrate in a similar pattern. Further work is required on this aspect of steelhead behaviour.

Age structure of 1983-84 Pallant Creek steelhead is comparable to other Charlotte streams. On the Yakoun River (de Leeuw, 1983) and Copper River (Chudyk, 1982) the dominant ages were 3.3 (60.5%) and 3.2 (42.5%) respectively. On Pallant Creek during the 1981-82 season, the most common age was also 3.3 (50%). Three years of fresh water residency prior to ocean migration accounted for nearly 90% of all steelhead in the above three streams.

The relative contribution of the age groups, however, can vary from year to year. This was the case on the Pallant, where length of ocean residency prior to their first spawning changed radically from the 1981-82 to the 1983-84 study periods (Table 11). In the 1981-82 season, 2 and 3 ocean fish comprised 19 and 81% respectively of the total run while no 1 or 4 ocean fish were found. During the 1983-84 season, however, 1, 2, 3 and 4 ocean fish comprised 10.9, 39.1, 47.8 and 2.2% of the total respectively. Fresh water ages were almost identical in the two study periods.

Table 11. The percent contribution of different fresh water and marine residency age groups of Pallant Creek steelhead.

Study Year	Fresh Water Age					N	Ocean Age			
	N	1.	2.	3.	4.		.1	.2	.3	.4
1981-82	18	0%	17%	83%	0%	-	0%	19%	81%	0%
1983-84	34	0%	14.7%	85.3%	0%	46	10.9%	39.1%	47.8%	2.2%



Repeat spawners comprised only 9% of fish sampled in this study, while during the 1981-82 season 19% had spawned previously. The average of the two study periods is 14%. The number of multiple spawners in any given steelhead run can be variable, dependent largely on survival and the magnitude of the previous year's run. The low repeat spawner rate in the 1983-84 season could therefore be the result of a reduced 1982-83 run. Since the 1983-84 steelhead run was estimated to contain roughly 260 fish, the previous season's adult steelhead population was likely considerably less, possibly between 100-200 fish.

The average size of steelhead during this study period was similar to previous results. In the 1981-82 season, 2 and 3 ocean fish averaged 62.7 and 74 cm respectively, while during the 1983-84 study these ocean ages were 65.1 and 77.9 cm. On the Yakoun River, fish averaged somewhat larger, with 2 and 3 ocean fish being 69 and 83 cm.

Only 10.3% of the original steelhead captures were recaptured. The degree of accuracy of the population estimate is therefore questionable. This is reflected in the wide confidence limits which range from 125 to 1599 around an average population estimate of 266. Steelhead abundance during the 1981-82 season was similar to this study, and was estimated to be 224 fish. Wide confidence limits were also associated with the earlier study and ranged from 77 to 1614 fish. Low repeat capture rate of adult Pallant Creek steelhead in both study years is likely a function of short stream residency and/or repeated entry and exodus during one season. Both scenarios would result in a decreased probability of recapture.

SUMMARY

1. During the 1983-84 steelhead season, 58 steelhead were tagged in Pallant Creek, of which 6 or 10.3% were recaptured. Low repeat capture rate was attributed to possible rapid and frequent migration into and out of the stream.
2. The number of days between recaptures ranged from 1 to 89 days and averaged 45 days.
3. The greatest number of steelhead were taken from the upper river, approximately 3 km from tide water during January, February and March.
4. The overall dominant age class of 1983-84 Pallant Creek steelhead was 3.3 (47.1%) followed by 3.2 (23.9%) and 2.2 (6.5%). Eighty-five percent of all fish sampled had spent 3 years in fresh water prior to ocean migration. Repeat spawners comprised 9% of the sampled population.
5. Average length of Pallant Creek steelhead during the 1983-84 season was 72.1 cm and ranged from 53.8 to 87.0 cm. One, two, three and four year ocean fish were 65.4, 65.1, 77.9 and 79.5 cm respectively. Males appeared slightly larger than females.
6. Population abundance of the 1983-84 Pallant Creek steelhead run was estimated. Three results were calculated using multiple sample techniques. These were: 235, 274 and 288 fish. Wide confidence limits ranged from 125 to 1599 fish and are assumed to result from few repeat captures.

ACKNOWLEDGEMENTS

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APPENDICES

- I. Original steelhead captures from Pallant Creek, 1983-84 winter season.
- II. Steelhead recaptures from Pallant Creek, 1983-84 winter season.

APPENDIX I. Original steelhead captures from Pallant Creek, 1983-84 winter season.

Fish #	Date	Sex	Length (cm)	Weight (kg)	Tag # and Colour	Area	Remarks	Age
1	Nov 23	M	59.0	2.0	orange 3180	Hatchery	Dark	2.2
2	Dec 14	F	64.0	2.7	orange 2701	Upper River	Slight color	R.2
3	Dec 14	F	56.4	1.5	orange 2703	Lower River	Bright	3.2
4	Jan 12	M	53.8	1.5	orange 2704	Upper River	Spawning	3.2
5	Jan 12	M	69.0	3.2	orange 2705	Upper River	Spawning	3.3
6	Jan 12	M	79.5	4.5	orange 2706	Hatchery	Spawning	3.3
7	Jan 12	F	71.8	3.6	orange 2708	Middle	Bright	3.3
8	Jan 12	M	69.2	3.2	orange 2711	Upper River	Bright	2.2
9	Jan 12	F	61.5	2.0	orange 2867	Middle	Bright	2.2
10	Jan 12	F	76.9	4.5	orange 2866	Upper River	Bright	R.1S1
11	Jan 14	F	76.9	4.5	orange 2719	Not recorded	Bright	3.3
12	Jan 14	M	84.6	5.6	orange 2721	Not recorded	Coloured	R.3
13	Jan 14	M	61.5	2.0	orange 2826	Not recorded	Coloured	3.2
14	Jan 14	M	74.4	4.4	orange 2827	Not recorded	Coloured	3.3
15	Jan 15	F	69.2	3.6	orange 2868	Upper River	Coloured	3.3
16	Jan 15	F	74.4	--	orange 2869	Middle River	Bright	3.3
17	Jan 15	F	79.5	4.1	orange 2870	Upper River	Bright	3.4
18	Jan 15	F	76.9	4.5	orange 2871	Upper River	Bright	--
19	Jan 15	F	61.5	--	orange 2872	Middle River	Dark	3.2
20	Jan 15	F	64.1	2.7	orange 2873	Upper River	Kelt	--
21	Feb 1	M	69.2	--	orange 2877	Middle River	Coloured	R.1S1
22	Feb 4	M	84.6	5.4	orange 2724	Upper River	Coloured	R.3
23	Feb 4	F	82.1	4.5	orange 2722	Middle River	Kelt	3.3
24	Feb 8	M	84.6	--	white X00202	Lower River	Bright	3.3
25	Feb 8	F	--	--	orange 06934	Upper River	--	2.3
26	Feb 8	F	74.4	--	orange 03168	Not recorded	Kelt	3.3
27	Feb 8	F	71.8	--	orange 03169	Upper River	Bright	3.2
28	Feb 8	F	83.0	--	orange 02892	Middle River	--	3.3
29	Feb 8	M	87.0	--	orange 02896	Middle River	--	3.2S1
30	Feb 8	F	83.0	--	orange 02887	Middle River	--	R.3
31	Feb 18	M	82.0	--	orange 02723	Middle River	Coloured	--
32	Mar 3	M	61.5	--	orange 02716	Upper River	Dark	3.3
33	Mar 3	F	--	--	orange 02725	Upper River	Dark	R.1S1
34	Mar 15	M	71.8	--	orange 02714	Lower River	Bright	3.2
35	Feb 22	M	82.1	5.4	orange 02875	Not recorded	Coloured	3.3
36	Mar 22	M	69.2	--	orange 2710	Middle River	Dark	R.1
37	Mar 22	M	79.5	--	orange 3651	Middle River	Dark	3.3
38	Mar 25	M	74.4	--	orange 3652	Not recorded	Kelt	R.2
39	Mar 25	F	66.7	--	orange 3653	Upper River	Bright	3.2
40	Mar 27	M	64.1	2.3	orange 2878	Not recorded	Coloured	3.2
41	Mar 27	M	64.1	--	orange 2879	Not recorded	Bright	--
42	Mar 28	M	79.5	--	orange 2880	Not recorded	Kelt	--
43	Mar 28	F	71.8	--	orange 2881	Middle River	Coloured	--
44	Mar 30	M	61.5	--	orange 2717	Middle River	Coloured	3.2

APPENDIX I. continued. Original steelhead captures from Pallant Creek,  
1983-84 winter season.

Fish #	Date	Sex	Length (cm)	Weight (kg)	Tag # and Colour	Area	Remarks	Age
45	Mar 30	M	84.6	--	orange 2889	Middle River	Dark	R.3
46	Mar 19	M	66.7	--	orange 3121	Not recorded	--	--
47	Mar 20	M	71.8	--	orange 3122	Not recorded	--	--
48	Mar 20	M	69.2	--	orange 3123	Not recorded	--	--
49	Mar 21	M	64.1	--	orange 3103	Not recorded	--	--
50	Mar 29	M	71.8	--	orange 2883	Upper River	Very dark	--
51	Mar 29	M	64.1	2.3	orange 2884	Middle River	Bright	3.2
52	Mar 31	M	64.1	--	orange 3104	Not recorded	Dark	--
53	Apr 12	F	74.4	3.2	orange 2727	Upper River	Kelt	3.3
54	Apr 12	F	79.5	4.5	orange 2728	Upper River	Coloured	3.3
55	Apr 12	M	61.5	1.5	orange 2729	Not recorded	Spawning	R.1SSS1
56	Apr 12	F	74.4	3.6	orange 2730	Middle River	Spawning	2.3
57	Apr 12	M	66.7	2.3	orange 2885	Lower River	Spawning	R.2
58	Apr 12	F	89.7	--	orange 2726	Not recorded	Spawning	--
59	Mar 29	F	63.5	2.3	Not tagged	Not recorded	--	3.2



APPENDIX II. Steelhead recaptures from Pallant Creek, 1983-84 winter season

Fish #	Date	Sex	Length (cm)	Weight (kg)	Tag # and Colour	Area	Remarks	Age
1	Feb 1				orange 2867	Upper River	Bright	
2	Mar 3				orange 2701	Upper River	Coloured	
3	Mar 14				orange 2716	Hatchery	--	
4	Mar 19				orange 2704	Hatchery	--	
5	Mar 29				orange 2881	Upper River	--	
6	Apr 14				orange 2873	--	--	