JUVENILE STEELHEAD POPULATIONS IN THE MORICE RIVER SYSTEM, 1980 TO 1982

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Abstract.--Results of three consecutive years (1980 to 1982) of juvenile steelhead population monitoring in the Morice River system is presented in this report. Results are focussed on late summer fish habitat description, fish population estimates and annual survival rates within individual streams.

Emphasis was placed on Owen and Lamprey Creeks, with lesser effort on other tributaries and mainstem areas. Estimated steelhead fry populations in Lamprey Creek ranged from 45,000 to 70,000. The 1+ population ranged from 17,000 to 30,000 while the 2+ population ranged from 1,100 to 5,400. Three year old parr were only found in 1982. Estimated survival rates range from 25 to 68 percent fry to 1+, and 6.6 to 18 percent 1+ to 2+. Total steelhead biomass was relatively constant, ranging from 214 to 239 kg. Estimates of Owen Creek steelhead population ranged from 38,000 to 100,000 fry, 19,000 to 31,000 yearlings and 3,000 to 6,300 two year olds. No 3+ parr were found. Survival rates ranged from 29.6 to 81 percent fry to 1+, and 9.6 to 33.7 percent 1+ to 2+ parr. Total biomass ranged from 287 to 581 kg.

Limited (less complete) results are presented for other tributaries and the mainstem. Very rough steelhead parr capacity estimates using a preliminary steelhead smolt model are presented. Headwater fry stocking opportunities are briefly discussed. No discussion of overall Morice River steelhead life history and population dynamics is presented at this time.

INTRODUCTION

Juvenile steelhead populations in the Morice River system have been studied by the Fish Habitat Improvement Section (F.H.I.S.) since 1980. Sampling has been conducted over three consecutive years (1980, 1981 and 1982), concentrating on late summer (August) population estimates. Original sampling in 1980 concentrated on Owen and Lamprey Creeks in an attempt to outline enhancement techniques applicable to these streams. Recommendations from the 1980 program included an expansion of sampling effort to include the entire Morice River system and to put specifically Owen and Lamprey Creek production into an overall system perspective. The sampling program was expanded to include the

entire Morice system in 1981, and continued as index site sampling 1982.

This report basically outlines the results of 1980 to 1982 Morice River steelhead assessment conducted by F.H.I.S. Emphasis is placed on annual variation in habitat parameters and fish populations. Interpretation of the 1980 to 1982 results in terms of smolt yield capacity and potential enhancement will not be included. Important data in this regard was collected in 1983, and will be discussed with 1983 results. Some discussion of enhancement options directly assessed in 1982, specifically fry stocking options in headwater areas, will be included. However, this should be considered preliminary to the more complete reporting to follow.

METHODS

Sample Site Locations By Year

Initial involvement by F.H.I.S. in the Morice River system in 1980 concentrated efforts in gaining detailed assessments of Owen and Lamprey Creeks (Fig. 1). Sampling was conducted at eighteen sites in Lamprey Creek and ten sites in Owen Creek. Two other areas were sampled, Gosnell Creek (three sites) and Morice River sidechannels (seven sites).

In 1981 index sampling was conducted in Owen (five sites) and Lamprey (six sites) Creeks. The sampling program was expanded to include the Thautil River system (two sites in the Thautil River plus one site in each of Starr, Denys and Loljuh Creeks), the Gosnell Creek system (four sites), Houston Tommy Creek (two sites) and the mainstem Morice River (six mainstem edge and four sidechannel sites). The objective of the expanded sampling program was to evaluate relative importance of all areas within the system.

In 1982 index sampling was continued in Owen (five sites), Lamprey (six sites), and Gosnell Creeks (three sites), and the mainstem Morice River (five sites). More intensive investigation of four potential headwater stocking areas was conducted in Upper Gosnell, Shea (Gosnell system), Upper Pimpernel (Lamprey system) and Houston Tommy Creeks.

Sampling Methods

Assessment of juvenile fish populations in the Morice River system concentrated on late summer population estimates. All pertinent methodology is outlined in de Leeuw (1981).

LAMPREY CREEK

Biophysical sampling was conducted at 6 sites in Lamprey Creek and 2 sites in a tributary, Pimpernel Creek. Sites corresponded to original 1980 site numbers 1, 3, 5, 8, 9 and 11, in Lamprey Creek, and 1 in Pimpernel Creek (Fig. 2). An additional site above the falls on Pimpernel was sampled to assess fry stocking opportunities.

Habitat Assessment

A description of Lamprey Creek habitat by reach was completed by Tredger (1981), and is included in this report as reference data (Table 1). Results presented in this section will describe differences in the 3 years of data.

Stream discharge

Discharge estimates by reach in 1980 to 1982 are summarized in Table 2. In general, Lamprey Creek had the lowest flow in 1981 while 1980 and 1982 values were similar. It appears that Reach 2 had highest discharge in 1982, a result of abundance of beaverponds and possible "gradual release" from these. In 1980 the major flow originated in Pimpernel Creek. This was not the case in 1982, as Pimpernel had low discharge.

Stream area and habitat type

Stream area fluctuations in sampled reaches of Lamprey Creek are summarized in Table 3. In comparison with 1980 values, 1982 areas were reduced in Reaches 1 and 4 of Lamprey Creek and Reach 1 of Pimpernel Creek. Reach 2 of Lamprey Creek was higher in both 1981 and 1982. In general, stream area in

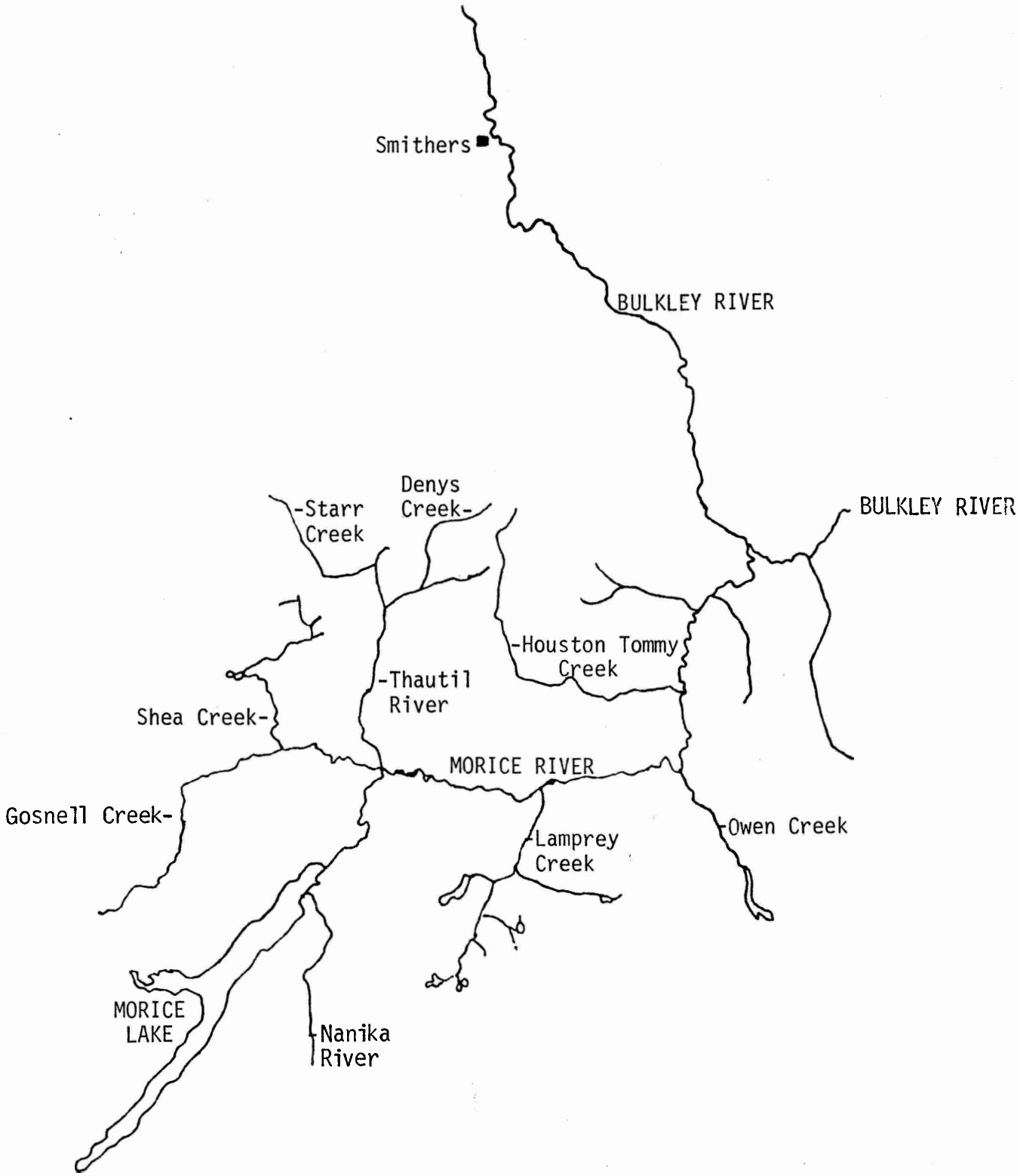

FIGURE 1 The Morice River System (Scale 1:600,000).

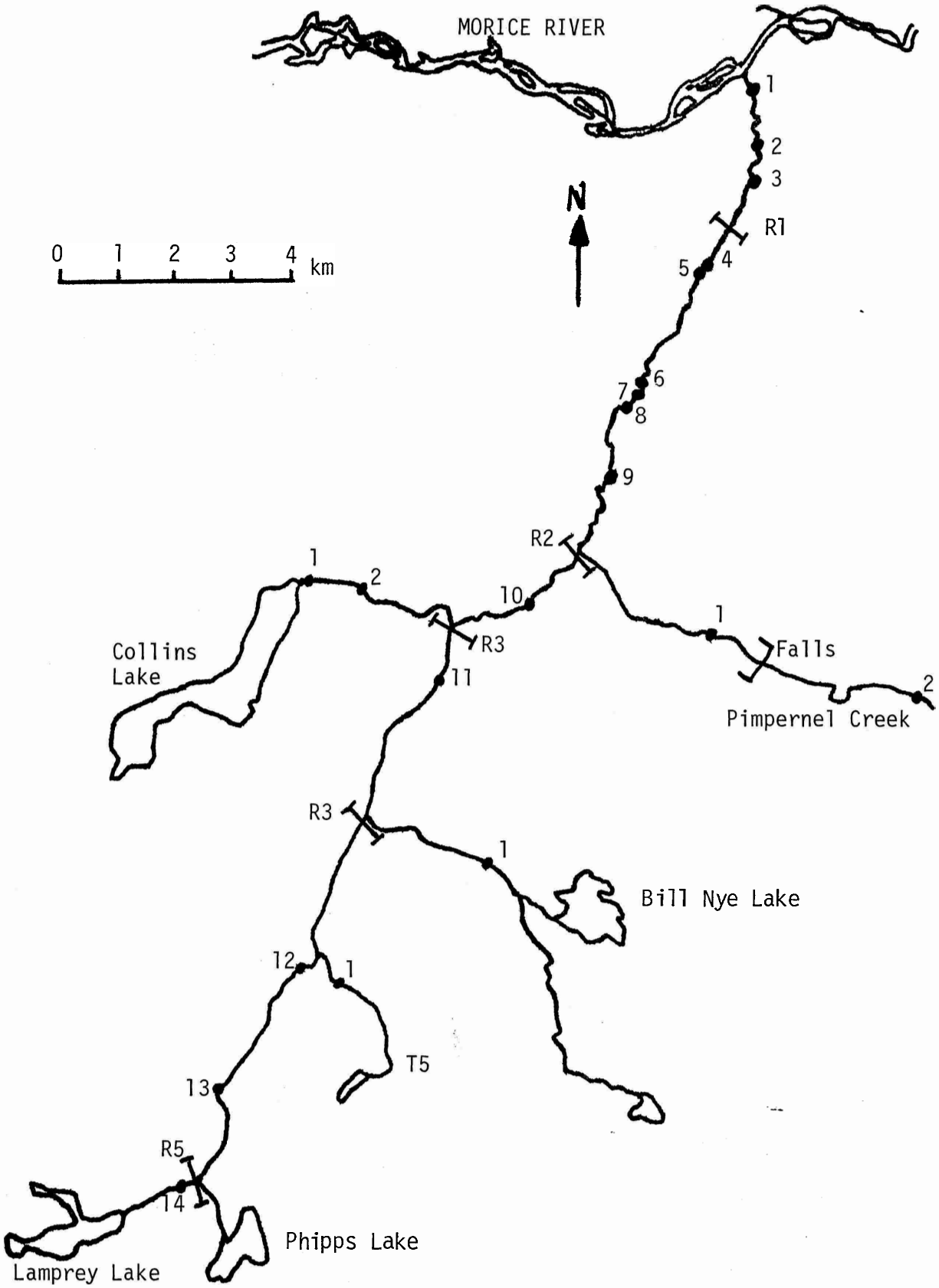

Figure 2. Lamprey Creek electroshocking sites and reach breaks.

TABLE 1 Lamprey Creek reach breaks and tributary data.

REACH	APPROX. LENGTH (km)	APPROX. GRADIENT[a]	SAMPLE SITES	HABITAT TYPE % POOL	% GLIDE	% RIFFLE	MAJOR SUBSTRATES	ESTIMATED DISCHARGE (m^3/s)	COVER TYPE	MEAN WIDTH (m)	TOTAL AREA (m^2)
Lamprey Creek											
1. Morice - 29.5 mile	3.25	0.9% (0.5-3.0; $\bar{x}$=1.7)	1, 2, 3	6	39	55 (canyon like)	C, B, LG	.38	B, L	9.1	29,600
2. mile 29.5 - Pimpernel	8.3	0.5% (0 -1.5; $\bar{x}$=0.7)	4, 5, 6, 7, 8, 9	74	18	8 (some beaverdams)	SG, F, LG	.25 in lower .04 in upper	L, IV	5.3	43,800
3. Pimpernel - Collins	3.15	0.5% (0.3)	10	91	6	3 (beaverdams)	F, LG, SG	-	OV, L, C	7.8	24,700
4. Collins - Bill Nye	4.15	1.3% (2.0)	11	31	57	12	SG, LG, F	.04	L, C	2.8	11,800
5. Bill Nye - Phipps	7.6	1.8% (0.5)	12, 13	92	2	6 (some beaverdams)	F, C, LG	.05	OV, IV, C	3.0	22,600
6. Phipps - Lamprey Lake	2.7	1.4% (1-2; $\bar{x}$=1.5)	14	48	0	52	SG, F, LG	.05	OV, L	1.5	4,000
Tributaries											
T1 to lake	2.3	4.6% (5)	T1	58	13	29	LG, C, B	<.01	OV, C	0.9	2,100
Pimpernel to falls	4.0	3.2% (2.5)	1		65	35	LG, SG, C	.13	L, B, C	4.4	17,800
Collins to lake	3.25	2.2% (0.5-2; $\bar{x}$=1.1)	1, 2	90	2	35 (some isolated pools)	SG, F, LG	<.01	OV, L	1.8	5,950
Bill Nye to fork	3.15	1.4% (0.5)	1	98	0	2	F, SG, LG	<.01	L, C, IV	4.9	15,600
T5 to lake	2.85	3.9% (5.5)	1	64	10	26	SG, LG, F	<.01	OV, L	1.2	3,450
Phipps to lake	1.2	4.3%		(isolated pools)							

[a] map measured; sampled in brackets

Table 2. Estimated instantaneous discharge in Lamprey Creek and tributaries during 1980 to 1982 sampling periods (late August).

Reach/Tributary	Estimated Discharge (m^3/s)		
	1980	1981	1982
Lamprey 1	0.38	0.025	0.14
2	0.25	0.023	0.39
3	(0.04)	-	-
4	0.04	-	0.043
5	0.05	0.020	-
6	0.05	-	-
T1	<0.01	-	-
Pimpernel	0.13	-	0.045
Collins	<0.01	-	-
Bill Nye	<0.01	-	-
T S	<0.01	-	-
Phipps	<0.01	-	-

Table 3. Estimated stream area in sampled reaches of Lamprey Creek, August 1980 to 1982.

Reach/Tributary	Estimated Stream Area (m^2)			% change (1982 vs. 1980)
	1980	1981	1982	
Lamprey 1	29,600	17,620	26,280	-11
2	43,800	79,620	68,592	+40
3	24,700	-	-	-
4	11,800	-	10,070	-15
5	22,600	18,940	-	-
6	4,000	-	-	-
T1	2,100	-	-	-
Pimpernel 1	17,800	-	9,100	-49
Collins	5,950	-	-	-
Bill Nye	15,600	-	-	-
T5	3,450	-	-	-

reaches with "confined" channel types appeared sensitive to discharge fluctuations (Reaches 1 and 4, and Pimpernel), while less confined reaches (those with beaverdams and ponds) appeared more independent of discharge (Reach 2). Total area in the latter may be more a function of beaver activity.

Habitat type, in terms of pool, glide and riffle, is summarized in Table 4. Mean values represent the best estimate. There was variation between years, related to discharge differences, but is very likely masked by sampling error.

Fish Population Assessment

1982 population estimates

Results of the 1982 population estimates are summarized in Table 5, with details in Appendix 1. Species captured included rainbow trout (0+ to 3+), cutthroat trout (0+ and 1+), Dolly Varden char (0+ and 1+), coho salmon (0+), chinook salmon (0+), mountain whitefish (0+ and 1+?), longnose dace, sculpins and suckers. All rainbow trout captured at these sampling locations are assumed anadromous (Tredger, 1981).

Steelhead

Comparison of juvenile densities

Table 6 summarizes juvenile steelhead densities at the individual sample sites (index sites). The 1982 fry densities were generally lower in Reaches 1 and 2 in comparison to previous sampling, while Reach 4 and Pimpernel Creek had higher 1982 fry density. Yearling populations were lower in 1982 at all sites with the exception of Site 9. Two year old parr density was notably higher at 2 locations, Sites 4/5 and 9, while density remained low or zero elsewhere. Of most interest was the presence of 3+ parr in 1982. Although densities were low, 3+ parr were found at 4 of 7 sites, while they were not found in Lamprey Creek in previous sampling.

Age--fork length comparison

Length-frequency analysis of fish captures in Lamprey Creek is included in Appendix 1. Mean fork length and weight of juvenile steelhead captured in August in 1980 to 1982 is summarized in Table 7. Mean fry size was much lower in 1981 and 1982 compared to 1980. Mean yearling size was similarly lower in 1981 and 1982 compared to 1980. Size of 2+ steelhead was much lower in 1982 compared to previous sampling, while 3+ were not found prior to 1982. The fact that 3+ were only found in 1982 suggest the possibility that scale interpretation may have some slight errors. Combining the 1982 2+ and 3+ age groups (which should mask any errors) still results in a smaller mean length for 1982. Maximum size captured was similar in all 3 years (140 mm).

Condition factor

Condition factor was calculated by length-weight regression analysis from 1980 and 1982 Lamprey and Owen Creek data (Appendix 1). Calculated values for use in the emperical formula $wt(g) = a \times l(mm)^3$ were similar in both years:

1980	$a = 1.065 \times 10^{-5}$
1982	$a = 1.085 \times 10^{-5}$
average	$a = 1.075 \times 10^{-5}$

The average value was used to calculate all mean weight estimates in Table 7.

Standing crop estimates and annual survival rates

Standing crop estimates are derived in Appendix 1 and summarized in Table 8. Annual survival rates are also indicated. The 1982 fry population was equal in numbers to the 1980 population, which were both much lower than the 1981 population. In terms of biomass, the 1982 standing crop was less than 1981, which was less than 1980. Referring to Reach specific calculations (Appendix 1), it appears that fry population density in 1982 was lower in Reach 1 and lower Reach 2, and higher in upper Reach 2 to Reach 4.

The 1982 yearling (1+) population was equal to the 1980 population, but was much lower than the 1981 population. Biomass of 1+ was roughly equal in 1980 and 1981, but was

Table 4. Summary of stream habitat type (% pool, riffle, glide) in Lamprey Creek, August 1980 to 1982.

Reach	Discharge Rank[1]	1980			1981			1982			Mean		
		P	R	G	P	R	G	P	R	G	P	R	G
1	80,82,81	6	55	39	17	55	28	0	53	47	8	54	38
2	82,80,81	74	8	18	89	4	7	67	8	25	77	7	16
3	80	91	3	6	———			———			91	3	6
4	equal	31	12	57	———			49	35	16	40	23	37
5	80,81	92	62	2	94	5	1	———			93	6	1
6	80	48	52	0	———			———			48	52	0
Pimpernel	80,82	0	35	65	———			18	18	64	9	26	65

[1] rank from highest to lowest.

Table 5. Summary of fish population densities (No/m^2) at eight sample sites in the Lamprey Creek system, August 23 to 26, 1982.

Reach	Site	Rainbow				Coho	Chinook	Other Species[1]
		0+	1+	2+	3+	0+	0+	
1	1	.08	.04	.02	.04	.33	.28	MW .02, LnD .27, SC .04, Su .04
	3	.12	.07	.01	.01	.14	.07	LnD .59
2	4/5	.29	.11	.07	.02	.07	.14	DV .02, MW .14, LnD .43
	8	.24	.01	.01	0	0	0	DV .04, MW .11, LnD .11
	9	.48	.22	.07	.01	0	0	Ct .01, MW .07, LnD .56, Su .04
4	11	1.30	.08	0	0	0	0	Ct .42, DV .04
Pimpernel	1	.97	.04	0	0	0	0	DV .04
	2	0	0	0	0	0	0	Su-abundant

[1] MW--mountain whitefish, LnD--longnose dace, SC--sculpin species, SU--sucker species, DV--Dolly Varden, Ct--cutthroat trout.

Table 6. Comparison of juvenile steelhead densities (No/m^2) at sample sites in in Lamprey Creek, August 1980 to 1982.

Reach	Site	0+			1+			2+			3+		
		1980	1981	1982	1980	1981	1982	1980	1981	1982	1980	1981	1982
1	1	.32	.18	.08	.10	.01	.04	0	.01	.02	0	0	.04
	3	.28	.35	.12	.13	.32	.07	.01	0	.01	0	0	.01
	x	.30	.265	.10	.125	.165	.055	.005	.005	.015	0	0	.025
2	4/5	.50	.92	.29	.22	.26	.11	.02	.04	.07	0	0	.02
	8	.49	.51	.24	.11	.32	.01	.01	.01	.01	0	0	0
	9	.43	.82	.48	.04	.06	.22	0	.01	.07	0	0	.01
	x	.47	.75	.34	.12	.21	.11	.01	.02	.05	0	0	.01
4	11	.12	-	1.30	.17	-	.08	0	-	0	0	-	0
Pimpernel	1	.51	-	.97	.19	-	.04	0	-	0	0	-	0

Table 7. Mean fork length (mm) and weight (g) of juvenile steelhead captures in Lamprey Creek, August 1980 to 1982.

Age Group	1980		1981		1982	
	Length	Weight	Length	Weight	Length	Weight
0+	47.8 (30-63)	1.17	39.0 (29-60)	0.64	41.1 (29-58)	0.75
1+	87.5 (65-115)	7.20	78.4 (63-118)	5.18	75.4 (60-93)	4.61
2+	122.7 (110-138)	19.86	124.4 (117-140)	20.70	105.4 (85-118)	12.59
3+	-		-		133.3 (122-144)	25.46
Combined 2+/3+	-		-		112.3 (83-194)	

Table 8. Standing crop estimates (fish number and biomass) and annual survival rates for juvenile steelhead in Lamprey Creek, August 1980, 1981 and 1982.

Age Group	Estimated Standing Crop--Numbers and Biomass (kg)					
	1980		1981		1982	
0+	44,794 (52.4)	68%	69,950 (44.6)	25%	45,473 (33.9)	
1+	19,320 (139.1)	6.6%	30,550 (158.3)	18%	17,297 (79.7)	
2+	1,116 (22.2)		1,276 (26.4)		5,400 (68.0)	
3+	0		0		2,250 (57.3)	
Total Weight(kg)	(213.7)		(229.3)		(238.9)	

much lower in 1982. The 2+ parr population was much higher in 1982 compared to either 1980 or 1981, in terms of numbers and biomass.

Total biomass of juvenile steelhead in Lamprey Creek was roughly consistent through 1980, 1981 and 1982. Despite large fluctuations in numbers of fish, total biomass was "buffered" by compensation in terms of fish size. Examples include relatively few, large fish (fry and parr) in 1980, abundant, small fry and 1+ parr in 1981, and abundant 2+ and 3+ parr with relatively few, small fry and 1+ in 1982.

Survival rates for consecutive years were not consistent. Fry to 1+ survival ranged from 68% from 1980 to 1981, to 25% from 1981 to 1982. For 1+ to 2+ survival it ranged from 6.6% to 18%, and 3+ parr were only found in 1982. The high survival of 1+ to 2+ in 1982, and the relatively large population of 2+ (and 3+) parr in 1982, may be related to small fish size. There may be outmigration of parr to the mainstem Morice, which could be size dependent. If this "critical" size was not achieved by much of the population, then many more fish would remain in Lamprey Creek, thus showing increased apparent survival. Because of outmigrations the actual 1+ to 2+ survival may normally be higher than that reported for Lamprey Creek alone.

Fry Stocking Potential--Pimpernel Creek

Upper Pimpernel Creek, above the falls, was briefly assessed for potential fry stocking opportunities. Quite simply this area was found to have very little potential as a steelhead fry rearing area. Any steelhead fry stocking in the Lamprey Creek system should be considered only for upper Lamprey, basically "extending the range" of present rearing populations.

OWEN CREEK

Biophysical sampling was conducted at five sites in Owen Creek in 1982, corresponding to 1980 site numbers 1, 3, 6, 7 and 9 (Fig. 3).

Habitat Assessment

A description of Owen Creek habitat by reach is given in Table 9 (Tredger 1981). A discussion of habitat changes relative to 1980 and 1981 is presented in this section.

Stream discharge

Discharge estimates by reach in August 1980 to 1982 sampling periods are summarized in Table 10. In 1980 a large amount of flow originated from Puport Creek (top of Reach 5), creating relatively high discharge throughout Reaches 1 to 5 of Owen Creek. In 1981 discharge was low throughout, with some slight increase in the lower reaches perhaps due to beaverdam storage (release). In 1982 discharge from Owen Lake was relatively high, while flows in the lower reaches were relatively low (beaverdam retention?).

Stream area and habitat type

Stream area estimates from Owen Creek sampling (Table 11) indicates large fluctuations over the 3 sampling years. These results may not be valid because of the variability in beaverponding and habitat type sampled. Anomalies include Reaches 1 and 4, where larger area corresponded to lower discharge, and Reach 5, where less area correspond to higher discharge.

Habitat type in Owen Creek sample areas varied in all reaches between years (Table 12). Differences are related to stream discharge, sampling variability and gross habitat changes (eg. beaverponding).

Fish Population Assessment

1982 population estimates

Results of 1982 fish population estimates at five sites in Owen Creek are summarized in Table 13, with detailed results included in Appendix 2. Species captured included rainbow trout (0+ to 3+), coho (0+), Dolly Varden (0+ to 3+), mountain whitefish (0+), redside shiners, longnose dace, sculpins and suckers. Juvenile rainbow population in Owen Creek is assumed to be resident and anadromous. The

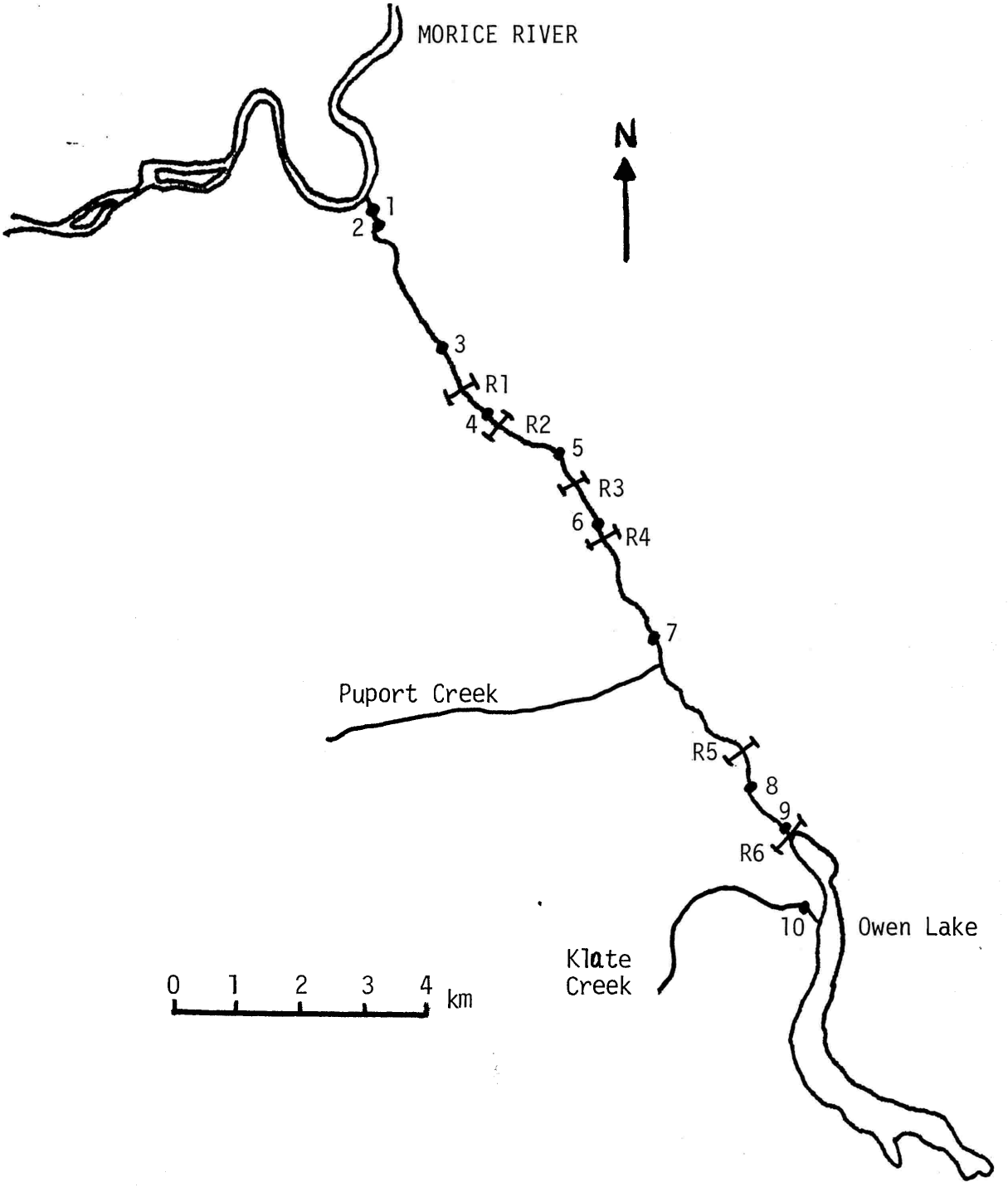

Figure 3. Owen Creek electroshocking sites and reach breaks.

Table 9. Summary of Owen Creek reach habitat characteristics.

REACH	APPROX. LENGTH (km)	APPROX. GRADIENT (MEASURED)	SAMPLE SITES	HABITAT TYPE			MAJOR SUBSTRATES	ESTIMATED DISCHARGE (m^3/s)	COVER TYPE	MEAN WIDTH (m)	TOTAL AREA (m^2)
				% POOL	% GLIDE	% RIFFLE					
1. Morice R.	3.95	1.2%	1, 2, 3	7	67	26	SG, F, LG	0.75	L, C, OV	6.9	27,320
2.	0.85	1.5%	4	0	82	18	LG, C, SG	0.8	L, OV, B	10.0	8,490
3.	1.70	≈0.0%	5	100 (beaver activity)	0	0	F (slough)	0.6	IV, OV, L	75	127,500
4.	1.0	0.5%	6	19	64	17	F, SG, LG	0.6	L, C, OV	9.2	9,248
5.	4.65	1.0%	7	39 (beaver activity)	46	15	SG, F, LG	0.7	OV, L; C	8.7	40,529
6. to Owen Lake	1.6	>0.5%	8, 9	36	42	22	LG, SG, F (angular gravels)	0.1	OV, L, C	3.2	5,091
Klate Creek	4.06	2.5%	10	4	37	59	SG, F, LG	0.02	OV, L	2.2	8,864

Table 10. Estimated stream discharge in Owen Creek during August 1980 to 1982 sampling periods.

Reach	Estimated Discharge (m^3/s)		
	1980	1981	1982
1	0.75	0.19	0.12
2	0.80	-	-
3	0.60	0.06	-
4	0.60	-	0.09
5	0.70	0.06	0.20
6	0.01	0.02	0.23

Table 11. Estimated stream area in sampled reaches of Owen Creek, August 1980 to 1982.

	Estimated Stream Area (m^2)			%Change (1982 vs 1980)
	1980	1981	1982	
1	27,320	25,085	46,964	+72
2	8,490	-	-	-
3	127,500	9,500	-	-
4	9,248	-	13,000	+40
5	40,529	31,026	24,581	-39
6	5,091	5,976	8,570	+40

Table 12. Summary of stream habitat type (% pool, riffle, glide) in Owen Creek, August 1980 to 1982.

Reach	Discharge Rank	1980			1981			1982			Mean		
		P	R	G	P	R	G	P	R	G	P	R	G
1	80, 81, 82	7	26	67	45	11	44	78	13	9	43	17	40
2	80	0	82	18	———			———			0	82	18
3	80, 81	64	4	32	100	0	0	———			82	2	16
4	80, 82	19	64	17	———			100	0	0	59	32	9
5	80, 82, 81	39	15	46	18	35	46	70	11	19	43	20	37
6	82, 81, 80	36	22	42	69	29	2	44	10	46	50	20	30

Table 13. Summary of fish population density (No/m^2) at five sample sites in Owen Creek, August 24 to 25, 1982.

Reach	Site	Rainbow				Coho	Other species[1]
		0+	1+	2+	3+	0+	
1	1	1.14	0.40	0.01	0	0.03	DV 0.13
	3	2.18	0.16	0.01	0	0	DV 0.10, MW 0.07
4	6	0.14	0.14	0	0	0.08	DV 0.16, MW 0.02, RsS 0.12
5	7	0.57	0.35	0.01	0.02	0	DV 0.69, RsS 0.02, LnD 0.01
6	9	0.31	0.05	0.05	0	0	MW 0.05, RsS 3.18, Su 0.16, Sc 0.47

[1] DV Dolly Varden, MW mountain whitefish, RsS redside shiner, LnD longnose dace, Sc sculpin species, Su sucker species.

resident population was arbitrarily set at half the Reach 6 and upper Reach 5 population, with anadromous fish prevailing throughout the remainder (Tredger 1981).

Steelhead

Comparison of juvenile densities

A comparison of juvenile steelhead densities at Owen Creek sample sites is given in Table 14. Because of habitat type changes at some access points, some sample sites are not comparable between years. Fry density in 1982 was medium in the sampled range in Reaches 1 and 5, and was lower in Reach 6. Reaches 3 and 4 were not comparable. Highest fry densities generally occurred in 1981, with lowest in 1980. Yearling (1+) densities were generally higher throughout Owen Creek in 1982, with 1980 having lowest densities. The 2+ and 3+ parr densities were very low in all three years sampled.

Age--fork length comparisons

Length-frequency analysis of 1982 Owen Creek fish captures is included in Appendix 2. Mean fork length and weight of juvenile steelhead captures in August 1980 to 1982 is summarized in Table 15. Average fry fork length ranged from 45.4 mm in 1981 to 50.5 mm in 1980, with 1982 being in the middle at 47 mm. The average yearling size was much smaller in 1982 (80.1 mm) compared to 1980 or 1981 (92 mm). The 2+ parr were also smaller in 1982, although sample size was small for 2+ in all years.

Standing crop estimates and annual survival rates

Standing crop estimates are derived in Appendix 1 and summarized in Table 16. The 1982 fry population number and biomass was slightly greater than the midway point of the three year range. The 1982 yearling population was roughly equal in number to the 1981 population, while biomass was much lower due to smaller fish size. Yearling biomass was roughly equal in 1980 and 1982 despite the greater number present in 1982. Greatest biomass and numbers of yearlings occurred in 1981. Age 2+ parr number and biomass was greatest in 1981, followed by 1980 and 1982.

Total steelhead biomass was much greater in 1981 than other years. Largest estimated populations and biomass of all age groups was found in 1981. Total biomass was roughly equal in 1980 and 1982. Fry and yearlings density was greater in 1982, with definite size compensation occurring in yearlings (i.e. biomass equal).

Survival rates for consecutive years (August to August) are indicated on Table 16. Fry to yearling survival ranged from 81% for 1980 to 1981, to 29.6% for 1981 to 1982. Yearling to 2 year old survival ranged from 33.7% for 1980 to 1981, to 9.6% for 1981 to 1982.

HOUSTON TOMMY CREEK

Houston Tommy Creek was first sampled by F.H.I.S. in 1981. Two sites were sampled, in Reaches 1 and 2 below the falls (Fig. 4). In 1982 three sites were sampled, covering Reaches 1 and 2, and Reach 4 above the falls.

Habitat Assessment

A very brief description of Houston Tommy Creek was included in the 1981 analysis (Tredger, 1983). As more data was collected in 1982 a combined analysis was done (Table 17). Stream discharge was similar in 1981 and 1982 (2.0 m^3/s and 1.6 m^3/s respectively) in Reach 1.

Houston Tommy Creek is basically a moderate gradient cobble-gravel-boulder stream. It originates in mountainous terrain, flowing south from the southern slope of the Telkwa Range with headwaters alpine but not glacial. T.D.S. is estimated at 50-60 mg/ℓ. The stream may have high spring flows (i.e. channel width of 50-100 m in Reach 2), and may have occasional high turbidity due to unstable valley walls. The stream was clear June 13, 1982 (M. Lough, pers.comm). Houston Tommy Creek is accessible for 17 km from the Morice River. At 17 km a large falls presents a definite barrier to upstream fish migration.

Table 14. Comparison of juvenile steelhead densities (No/m^2) at sample sites in Owen Creek, August 1980 to 1982.

Reach	Site	0+			1+			2+			3+		
		1980	1981	1982	1980	1981	1982	1980	1981	1982	1980	1981	1982
1	1	0.78	1.73	1.14	0.18	0.20	0.40	0	0	0.01	0	0	0
	3	0.78	2.57	2.18	0.11	0.31	0.16	0	0.01	0.01	0	.01	0
	x	0.78	2.15	1.66	0.14	0.26	0.28	0	0.005	0.01	0	.005	0
3(4)[1]	5(6)	0	-	(0.14)	0.06	-	(0.14)	0.02	-	(0)	0	-	(0)
4(3)[1]	6(5)	0.16	(0.71)	-	0.09	(0.27)	-	0	(0.04)	-	0	(0)	-
5	7	0.41	0.99	0.57	0.22	0.25	0.35	0.03	0.02	0.01	0	0	0.02
6	9	1.05	1.66	0.31	0.04	0.02	0.05	0	0	0.05	0	0	0

[1] sample site habitat changed at these access points. Slough habitat present at Site 5 in 1980 and Site 6 in 1982. Riffle-glide habitat present at Site 6 in 1980 and Site 5 in 1981.

Table 15. Mean fork length (mm) and weight (g) of juvenile steelhead captured in Owen Creek, August 1980 to 1982.

Age Group	1980		1981		1982	
	Length	Weight	Length	Weight	Length	Weight
0+	50.5 (32-71)	1.38	45.4 (29-66)	1.01	47.0 (34-63)	1.12
1+	92.0 (66-121)	8.37	91.7 (70-132)	8.29	80.1 (63-111)	5.53
2+	128.0 (119-151)	22.5	148.5 (115-172)	35.2	120.7 (114-124)	18.9
3+	-		193 -	77.3	152.3 (146-160)	38.0
Combined 2+/3+	-		-		136.5 (114-160)	27.3

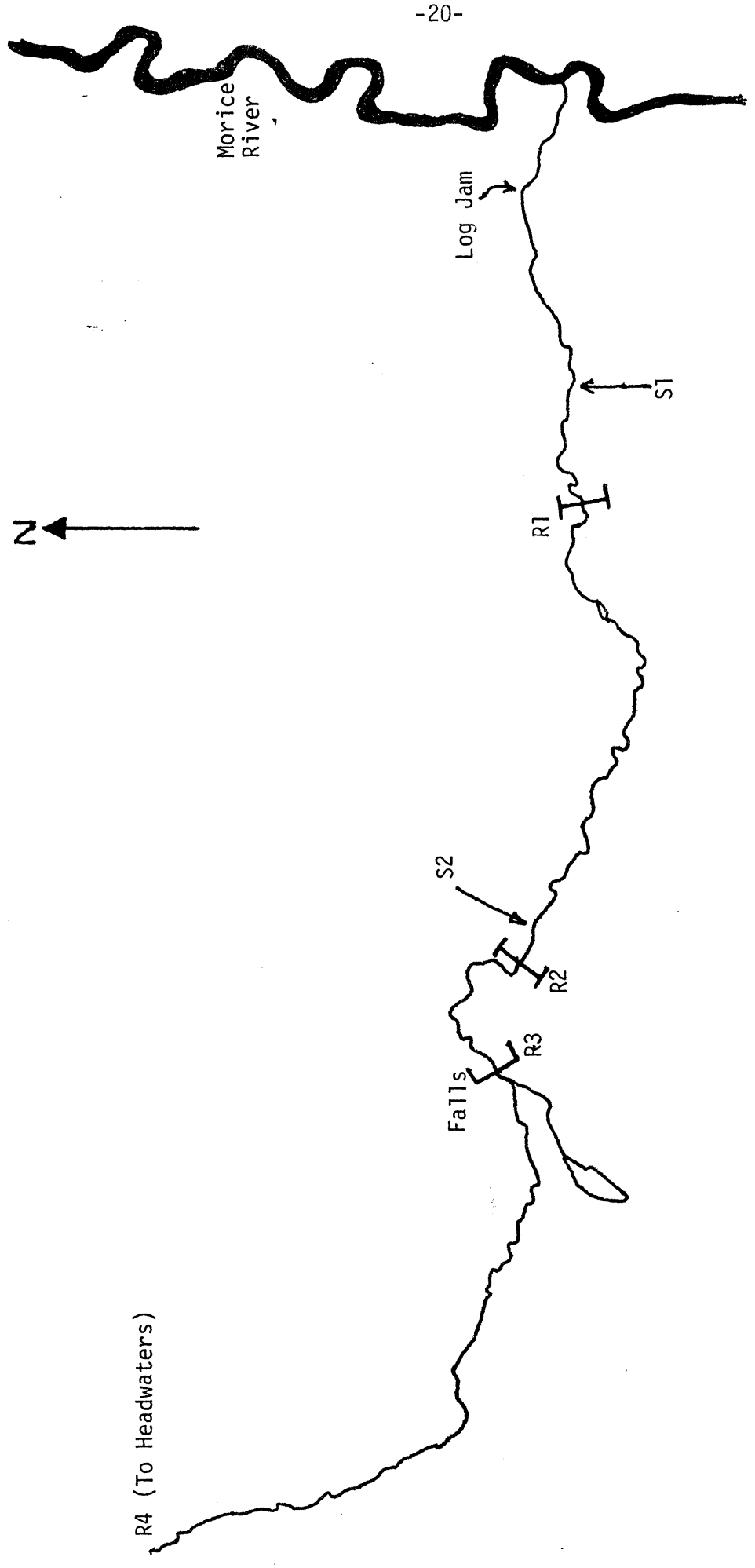

FIGURE 4 Houston Tommy Creek (Scale - 1:77,000).

Table 16. Standing crop estimates (fish number and biomass) and annual survival rates for juvenile steelhead in Owen Creek, August 1980, 1981 and 1982.

Age Group	Estimated Standing Crop--Numbers and Biomass (kg)		
	1980	1981	1982
0+	38,330 (52.9)	100,275 (101.3)	75,214 (84.2)
	81%	29.6%	
1+	18,715 (156.6)	31,029 (257.2)	29,650 (164.0)
	33.7%	9.6%	
2+	3,460 (77.9)	6,315 (222.3)	2,966 (56.1)
Total Weight (kg)	(287.4)	(580.8)	(304.3)

Table 17. Reach habitat characteristics of Houston Tommy Creek based on 1981 and 1982 habitat sampling data.

Reach	Length (km)	Gradient (1:50,000)	Habitat type (%)			Wetted Width (m)	Major Substrates	Cover Type	Total Area(m^2)
			Pool	Glide	Riffle				
1	6.5	1.4%	0	30	70	10.1	C,LG,B	B,DV	65,870
2									
mainstem	7.25	1.1%	5	68	27	10.3	LG,C,SG	DV,L	74,936
sidechannel	.36	-	0	72	28	5.9	LG,C,SG	DV,L	2,180
									77,116
3	3.25	1.5%	-	-	-	(8)	———	——	(26,000)
Total to Falls	17.0	-							168,986
4	approx.20	2.0%	0	56	44	10.9	C,LG,SG	B	219,000

Table 18. Summary of fish population densities (No/m^2) at three sample sites in Houston Tommy Creek, August 26, 1982.

Reach	Site	Rainbow				Coho	Chinook	Dolly Varden		
		0+	1+	2+	3+	0+	0+	0+	1+	2+
1	1	0.02	0.01	0	0	0.03	0.01	0.01	0	0
2	2	0	0	0	0	0	0	0.01	0.05	0.03
4 (above falls)	3	0	0.06	0.05	0.02	0	0	0	0	0

Three reaches were identified below the falls.

Reach 1, covering the initial 6.5 km from the Morice, flows through a steep-sided valley (canyon in lowest 2 km). The stream was basically a single channel (wetted width 10 m, channel width 15-25 m) with occasional bars. Habitat type was riffle-glide in a moderate gradient cobble-gravel-boulder substrate. Rearing habitat quality in August was basically good. Note that the large log jam present in 1981 was not present in 1982.

Reach 2, covering 7.25 km, was slightly lower gradient with an irregularly meandering channel confined between valley walls. Some sidechannels were present (~5% of length) at low summer flow. Substrates were generally cobble and large gravel. Valley wall failure (i.e. landslides) was quite apparent throughout Reach 2, and may cause turbidity problems.

Reach 3, to the falls, was a single channel stream entrenched in a deep canyon. Some valley wall slumps were evident. Gradient was roughly 1.5%. This reach was not sampled, but habitat may be similar to Reach 1. The falls are a definite barrier to upstream fish migration. A close-up look was not possible, but observations from a helicopter indicated a series of chutes and vertical drops (5 m maximum) over a 100 m horizontal distance (M. Lough, pers.comm.).

Above the falls one reach was identified. Reach 4 covered approximately 20 km, from the falls to the point where gradient increases rapidly. Overall gradient is 2.0%. Reach 4 appears relatively stable, with a single channel (some sidechannels) flowing between close-in valley walls. Habitat sampling indicated glide-riffle habitat with cobble-large gravel and small gravel substrate.

Fish Population Assessment

1982 population estimates

Results of 1982 population estimates at three Houston Tommy Creek sample sites are summarized in Table 18. Anadromous species (steelhead, chinook and coho) were found only at Site 1, and at low densities. Dolly Varden were found at both sample sites conducted below the falls (Sites 1 and 2). Above the falls (Site 3, Reach 4), only native rainbow were found.

Steelhead

Juvenile steelhead were not abundant in 1980 or 1981 sampling in Houston Tommy Creek. In 1980, 1+ and 2+ parr were present in low density at Site 1 only. In 1981, fry and 1+ parr were present in low density again at Site 1 only. Juvenile steelhead were not found in Reach 2 in either year.

Steelhead standing crop estimates, based on linear density at Site 1 and applied over Reach 1, indicate populations of roughly 1,260 fry and 630 yearlings in 1982, and 1,600 2+ parr (with 1,600 1+?) in 1981. No confidence should be placed in these estimates; indicate that current populations are low. Whether these juveniles represent steelhead or native stock may be in question as well.

The presence of equal or greater numbers of parr compared to fry suggests that parr might migrate in to Houston Tommy for summer rearing purposes. This is quite likely the case. The scarcity of fry suggests either, 1) poor spawning conditions, 2) poor access for spawners, or 3) low potential spawning population. The log jam identified in 1981 was not in place in August 1982, therefore alleviating access problems. Houston Tommy may not be a "preferred" spawning tributary (compared to Owen and Lamprey) due to spring runoff conditions (i.e. not lake-headed, low stream temperatures, possible turbidity from slides, etc.).

Steelhead Fry Stocking Potential

The fact that poor juvenile steelhead populations were present in Houston Tommy Creek in 1981 and 1982 brings up the question of habitat quality; is Houston Tommy Creek suitable for steelhead spawning and rearing? Actual spawning habitat in terms of depth, velocity and substrates, should be abundant. Overall substrate sizes and the presence of sidechannels suggest this to be the case. The

magnitude and quality of spring runoff as it affects spawning in Houston Tommy is unclear at this time (although habitat appeared good in June, 1983). Summer rearing habitat appears good throughout. Reaches 1 and 3 appear particularly good because of moderate gradient (1.4-1.5%) and abundance of large (boulder, cobble) substrates. Reach 2 may be somewhat less suitable in terms of rearing capacity due to smaller substrates (gravels, cobble), but the presence sidechannels may compensate somewhat for this. Above the falls, in Reach 4, rearing conditions should be similar to Reach 2, although gradient was somewhat higher.

The major limiting factor in juvenile production throughout Houston Tommy may be overwinter survival. Pool areas are not very common. High survival often associated with streams like Owen and Lamprey (with significant beaverponding) will not occur in Houston Tommy.

Smolt production capacity

Theoretical steelhead smolt yield capacity, based on late summer habitat parameters, was estimated using the Keogh River preliminary smolt model (Slaney 1981, Appendix 3). Note that application to the Morice system is uncertain at this time. Results by reach are summarized in Table 19. Below the falls theoretical smolt yield was 1,345 or 0.008 smolts/m^2. Above the falls an estimated 1,636 smolts could be produced, for a system total of 2,980 smolts.

Fry seeding rates

Fry stocking rates must be related to maximum smolt production capability. Estimated stocking rates are summarized in Table 20. These estimates assume that smolt yield estimates are valid. Parr to smolt survival was taken as 30% as was used in the model. Fry to parr survival was given as a range from worst case (10%) to best case (24%).

The above stocking rates should serve as a guide to fry requirements for Houston Tommy. As far as need and practicality of stocking these areas, the following should be considered.

1. Below the falls is currently accessible to adult steelhead, but very little spawning (as evidenced by lack of fry) occurs. As rearing potential appears good, annual or bi-annual stocking may be required to offset poor spawning conditions.
2. Fry stocked above the falls will eventually have to pass over the falls, bringing up the possibility of mortality. Studies on the subject of mortality in passing over falls are rare, but those available suggest no serious mortality[1]. This, of course, depends on falls configuration (height, plunge pool depth, etc.).

GOSNELL CREEK

The Gosnell Creek system was sampled in 1980, 1981 and 1982 (Fig. 5). The original 1980 sampling was conducted at two sites in Gosnell Creek and one in Shea (Cox) Creek. In 1981 sampling was expanded slightly to include four sites in Gosnell Creek and one in Shea Creek. Sampling in 1982 concentrated on index sites and further investigation of two headwater areas (including Shea Creek and upper Gosnell Tributary "L") relative to fry stocking.

Habitat Assessment

Stream habitat characteristics of the Gosnell Creek system are summarized in Table 21. As habitat assessment was not intensive in any year detailed analysis was not possible.

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1 Hamilton and Goodland, 1956. Effect of Horsefly River falls on downstream migrant sockeye fry. IPSFC.
S. Billings, pers.comm. Indicating survival of fish stocked in headwaters (above 10 m falls) as seen at counting fence on Keogh R.

Table 19. Estimated steelhead smolt yield from Houston Tommy Creek based on the Keogh preliminary model.

Reach	Length (m)	Width (m)	Area (m^2)	Smolt Density(No/m^2)	Total Smolt Yield
1	6,500	10.1	65,650	.0099	651
2	7,250	10.3	76,799	.0057	436
3	3,250	8.0	26,000	.0072	258
Below Falls	17,000	-	168,449	.0080	1,345
4	20,000	10.9	218,000	.0075	1,636
Stream Total	37,000		386,449	.0077	2,980

Table 20. Estimated steelhead fry populations required to produce maximum smolt yield in Houston Tommy Creek.

	Below Falls	Above Falls	Total
Est. Smolt Yield	1,345	1,636	2,980
Parr population @ 30% parr to smolt survival	4,483	5,453	9,933
Fry population			
@ 10% fry to parr	44,830	54,530	99,330
@ 17% fry to parr	26,370	32,076	58,429
@ 24% fry to parr	18,680	22,720	41,388

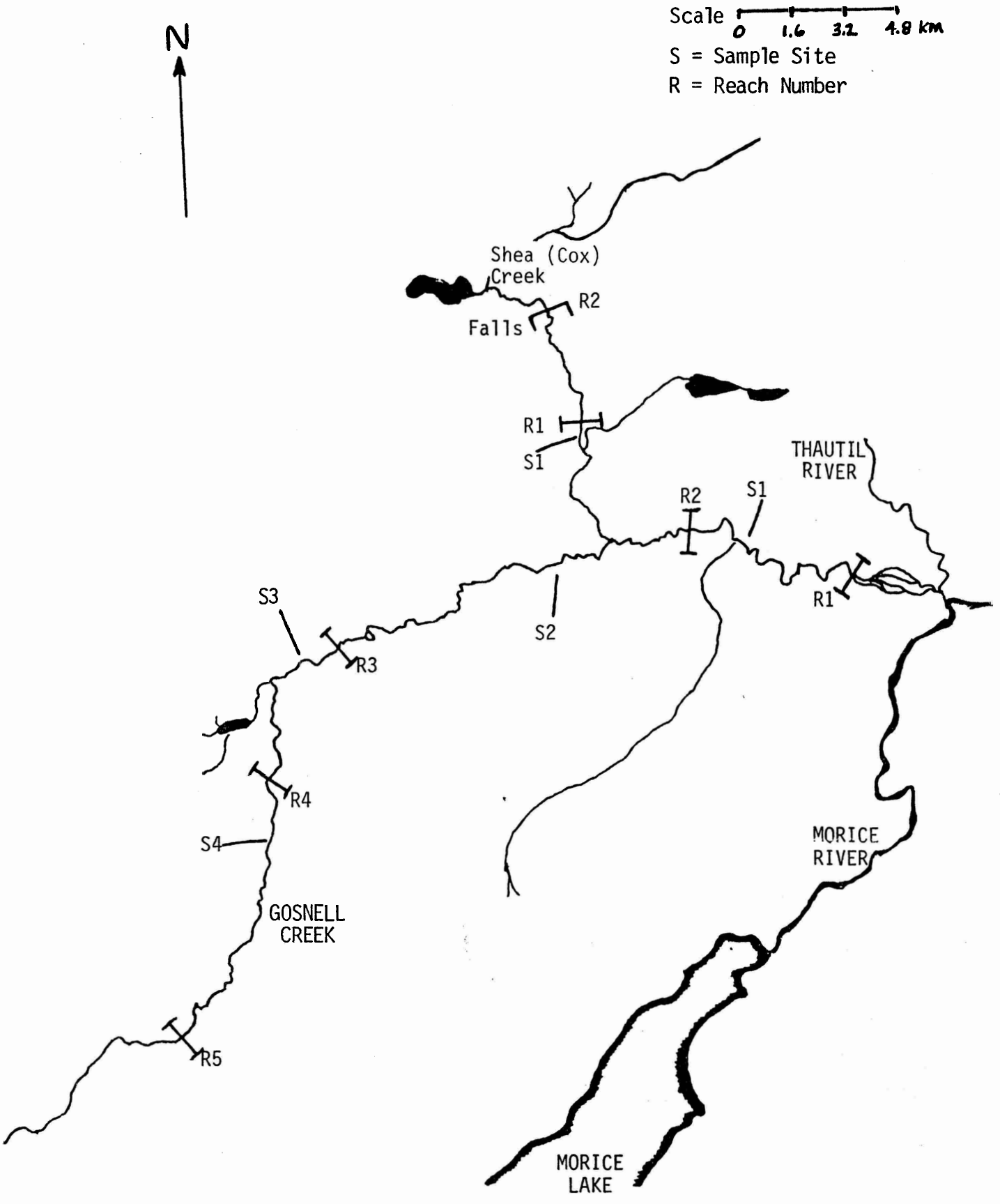

FIGURE 5. The Gosnell Creek system.

Table 21. Summary of habitat characteristics of the Gosnell Creek system.

Reach	Length (km)	Gradient (%)	Habitat Type (%) Pool	Glide	Riffle	Wetted Width	Major Substrates	Cover Type	Total Area
Gosnell									
1	3.0	0.2	--	--	--	(16)	(F,SG)	-	48,000
2 mstm.	8.0	0.4	0	88	12	17.5	LG,SG,C	L,DV	139,000
sidech.	0.8	-	0	54	46	10.3	LG,C,SG	L,DV	8,200
3 mstm.	15.0	0.2	2	76	22	17.0	SG,LG	L,DV	254,802
sidech.	0.3		0	57	43	2.8	F,SG	L	834
4	6.0	1.0	4	67	29	6.8	SG,F,LG	DV,L	39,700
5	10.0	1.2	31	32	37	6.6	C,LG	L,DV,C	65,000
6	6.5	1.0	--	--	--	(4.0)	--	--	26,000
	48.5	(mstm only)							582,368
Trib. "L"									
1	2.5	0.5	55	17	28	5.2	F,SG	IV,L,C	13,080
2	3.5	3.0	(riffle-glide)			3	--	--	10,500
	6.0								23,580
Shea									
1	5.0	0.8	0	76	24	6.5	SG,LG,C	B,L	32,470
2	4.0	1.1	not sampled			(6.5)	--	--	(26,000)
Falls									
3	3.0	0.4	4	87	9	7.5	SG,F	L,DV	22,620
4	10.0	0.9	20	57	23	3.2	SG,LG,F	L,DV	32,582
	22.0								55,202

Gosnell Creek

Gosnell Creek mainstem habitat was divided into six reaches from the Morice confluence to the headwaters. Basically, the Gosnell is a moderate gradient stream, with a single, irregularly meandering channel pattern and gravel (small and large) substrates. Cobble substrate was somewhat more abundant in Reach 2.

Fish habitat as related to instream cover was more abundant in Reach 2 (cobble habitat). Much of the stream was composed of glide and riffle hydraulic types. In upper Gosnell (Reaches 3 and 4 at least) small substrate and moderate to high water velocity (as suggested by glide habitat and gradient) rendered much of the stream "un-useable" for salmonid rearing. Good habitat was present only in relation to log debris. In Reach 2 much more area of cover was present in glides and riffles due to larger substrates.

Tributary "L"

Tributary "L", located in the upper Gosnell system, was investigated because of its lake-headed nature and the known importance of lake-headed tributaries for Skeena steelhead. Tributary "L" originated from a small lake (1 km long x 1/2 km wide) located at the 920 m (3,000 foot) elevation on the Morice-Zymoetz divide. Two reaches were identified (Table 21). Reach 1 was a low gradient area with beaverponds and swamp. Substrates were very "mushy", composed of fines and small gravel. Reach 2, a moderate to high gradient area stream, was not sampled. Aerial observations indicated good spawning and rearing capability.

Shea Creek

Shea Creek is the major tributary to the Gosnell Creek system in terms of available habitat and steelhead distribution. Four reaches were identified (Table 21); 2 in the lower 9.0 km up to an impassable falls, and 2 above the falls covering roughly 13 km (Fig. 5).

The stream below the falls (Reaches 1 and 2) is good juvenile steelhead rearing area. Habitat when sampled was basically glide-riffle with abundant instream boulder (and cobble) cover. The falls is currently a barrier to anadromous fish migration, but does have potential for modification to allow fish passage (M. Lough, pers. comm.). Upstream of the falls is approximately 13 km of moderate to low gradient habitat. Three small adjacent lakes are present. Reach 3 covers 3 km, from the falls to slightly above the small lake outlet. Habitat was primarily glide, with small gravel and fines substrate. Reach 4 covers roughly 10 km to an arbitrary break off point at the onset of high gradient. Habitat was composed of a glide-riffle-pool complex with abundant instream log debris. Substrates were small and large gravels with fines. Qualitatively, rearing habitat looked good.

Fish Population Assessment

1982 population estimates

Results of 1982 fish population estimates in the Gosnell Creek system are summarized in Table 22. Salmonid populations in the Gosnell Creek system include rainbow (steelhead) and cutthroat trout, chinook and coho salmon, Dolly Varden char and mountain whitefish. Juvenile steelhead were found at 3 sites, including Gosnell Reaches 2 and 3 and Shea Reach 1. Cutthroat trout were found in Gosnell Reach 3 and upper Shea Creek, while Dolly Varden were present throughout. Chinook and coho fry were found in Gosnell Reach 3, with coho also present in the Shea Reach 1. Mountain whitefish were found in Gosnell Reaches 2 and 3 only.

Steelhead

Three years (1980, 1981 and 1982) of low intensity sampling in the Gosnell Creek system suggest that the major "route" for steelhead spawning (and rearing) includes Gosnell Creek into Reach 3 (beyond Shea Creek) and Shea Creek to the falls. Juvenile steelhead density in all years was relatively low (Table 23), with the exception of Shea Creek Reach 1 in 1982. This reach (site) had the highest steelhead fry density (0.74 fry/m^2), over 3 times the previous Gosnell system high and over 10 times the previous recordings at this

Table 22. Summary of fish density (No/m^2) estimates in the Gosnell Creek system, 1982.

Stream/ Reach	Site	Rainbow			Cutthroat			Dolly Varden			Other Species	
		0+	1+	⩽2+	0+	1+	⩽2+	0+	1+	⩽2+		
Gosnell/2	1	0.13	0.04	0.04	0	0	0	0	0	0.02	MW	0.08
											Cottid	0.04
Gosnell/3	2	0	0.08	0	0	0	0.04	0.08	0.16	0.04	Chinook	0.24
											Coho	0.16
											MW	0.16
Shea/1	1	0.74	0.21	0.02	0	0	0	0.05	0	0	Coho	0.33
Shea/3	2	0	0	0	0.03	0.02	0	0.17	0	0		
Shea/4	3	0	0	0	0.24	0.08	0	0	0.12	0		
Trib."L"/1	1	0	0	0	0	0	0	0.30	0.02	0		

Table 23. Juvenile steelhead density (No/m^2) in the Gosnell Creek system, 1980 to 1982.

Stream/Reach			Steelhead Density (No/m^2)		
			0+	1+	⩽2+
Gosnell	2	1980	0.18	0.11	0
		1981	0	0.16	0
		1982	0.13	0.04	0.04
	3	1980	0.02	0	0
		1981	0.02	0	0
		1982	0	0.08	0
Shea	1	1980	0.06	0.02	0
		1981	0.05	0.06	0.02
		1982	0.74	0.21	0.02

site. Parr density (0.23/m^2) was also highest at this site, roughly double the previously recorded high.

Only very rough standing crop estimates will be attempted at this time; the purpose being to identify Gosnell Creek production relative to other tributary systems. For the purposes of extrapolation steelhead (and coho) density from Reach 2 will be applied to Reach 3 as suggested by distribution patterns. Results are summarized in Table 24, with details in Appendix 4.

In terms of fry recruitment, the estimated population ranged from a low of 3,500 in 1981 to a high of 39,000 in 1982. The fry population was concentrated in Shea Creek in 1981 and 1982, while Gosnell Creek below Shea held most of the 1980 fry.

The steelhead parr population ranged from a low of 9,000 in 1981 to a high of 18,600 in 1982. Parr numbers were roughly equal in Shea Creek and Gosnell Creek in 1981 and 1982 (therefore much higher density in Shea), while 1980 parr were more plentiful in Gosnell. The majority of parr were age 1+, with some 2+ and very occasional 3+ (Appendix 4). Fry to parr comparisons are therefore not applicable as survival rates. Note that consecutive year data does not make sense in some cases (i.e. 3,650 total 1981 fry produced 18,570 total 1982 parr). This illustrates the constraints of sampling and extrapolation at low sample densities, and emphasizes the relative nature of the analysis.

Steelhead Fry Stocking Potential

Two areas of the Gosnell Creek system were more intensively studied relative to enhancement (fry stocking) potential.

Upper Gosnell

The Gosnell Creek system above Shea Creek (including Tributary "L") was assessed for fry stocking potential. As the main steelhead "route" travels up Shea Creek, the upper Gosnell system generally lacks fry recruitment. Tributary "L" aroused special interest because of its lake-headed nature and potential as a stable steelhead spawning area.

The upper Gosnell cannot be classed as prime steelhead rearing habitat. Small substrates and relatively high water velocity basically restrict potential rearing habitat to pools and deep glides with associated log debris. Overall rearing density (or rearing capacity) should therefore be relatively low. The presence of Dolly Varden suggests a fed fry release might be more appropriate.

Some potential steelhead spawning habitat is present in Tributary "L", especially near the Reach 1-Reach 2 break area. Spring conditions are not known, but can be assumed acceptable because of the small lake presence. Beaverdams in Reach 1 may limit access somewhat. Fry planting in this area is recommended, as rearing habitat is available and the potential to produce a small spawning population is there.

Shea Creek

An impassable falls located 9 km up Shea Creek presently excludes anadromous salmonids from approximately 13 km of spawning and rearing habitat. As stream assessment has indicated Shea Creek to be among the most significant areas in terms of habitat quality and present steelhead production levels, enhancement should be a priority. Modification of the falls to allow access for spawning steelhead is feasible (M. Lough, pers.comm.) and should be done. In the interim, and until natural recruitment is proved sufficient, fry stocking should be conducted.

Parr capacity and fry stocking requirements

Rough estimates of parr capacity were calculated using the Slaney smolt model (Appendix 4), and fry stocking requirements were projected (Table 25). Note that these fry requirements do not represent parr capacity, they represent the average requirement to achieve the estimated parr capacity. Total number for the Gosnell system is estimated at 32,000 with 21,300 in upper Gosnell (including Tributary "L") and 10,700

Table 24. Summary of Gosnell Creek juvenile steelhead standing crop estimates, August 1980, 1981 and 1982.

		1980	1981	1982	Average
Gosnell	0+	21,870	230	12,690	11,600
	Parr	14,720	3,980	9,930	9,540
Shea	0+	1,980	3,330	26,730	10,680
	Parr	810	4,950	8,640	4,800
Total	0+	23,850	3,560	39,420	22,280
	Parr	15,530	8,930	18,570	14,340

Table 25. Gosnell Creek steelhead parr capacity and fry stocking estimates based on habitat parameters and smolt yield modelling.

Reach	Length (m)	Area (m^2)	Estimated Parr Capacity	Estimated Fry Requirement	Fry Density No/m	Fry Density No/m^2
Gosnell						
3(above Shea)	11,500	78,000	2,000	11,760	1.0	0.15
4	6,000	40,000	960	5,650	0.9	0.14
Trib "L"						
1	2,500	13,000	400	2,340	0.9	0.18
2	3,500	10,500	270	1,570	0.4	0.15
Gosnell Total				21,320		
Shea						
3 (falls to lake)	3,000	22,500	700	4,120	1.4	0.18
4 (above lake)	10,000	32,000	1,127	6,630	0.7	0.21
Shea Total				10,750		
Gosnell System Total				32,070		

in upper Shea. A higher seeding rate for upper Shea would be acceptable in anticipation of downstream seeding (eg. lower Shea, Gosnell). A suggested maximum level would be 0.4 fry/m^2, roughly double the "parr capacity" level (total roughly 21,000 fry).

THAUTIL RIVER

The Thautil River system (Fig. 6) has not been intensively sampled by F.H.I.S. Initial survey in 1981 included the Thautil River (2 sites) and Starr, Denys and Loljuh Creeks. In 1982 only Thautil River Sites 1 and 2 were sampled. Much of the habitat information was therefore taken from other sources (eg. Aquatic Studies Branch files).

Habitat Assessment

A summary of stream habitat characteristics by reach is given in Table 26. Note that low sample density makes some tabulated values (particularly % habitat type and wetted width) rather questionable. The mainstem Thautil River (Reach 1), which constitutes the major stream area, had a relatively wide channel width indicative of relatively high freshet flows. Sidechannels within the active channel were moderately abundant (at summer flows). The gravel-cobble substrate, presence of boulder cover and wide active channel indicate fair steelhead rearing habitat in Reach 1.

Reach 2 of the Thautil River, above the Starr Creek confluence, is of little apparent value as steelhead rearing habitat. Much of the reach was marshy, with an indistinct channel (Carswell, 1979).

Significant tributaries to the Thautil River include Starr, Denys and Gabriel Creeks. Starr Creek, in Reach 1, was moderate to high gradient riffle-glide habitat with boulder and cobble substrate. Reach 2 was not sampled by F.H.I.S., however, Carswell (1979) found a relatively unstable, gravel channel with gravel bars and swirling flow character. One marshy tributary was also present.

Denys Creek in Reach 1 and Loljuh Creek, a tributary, were sampled by F.H.I.S. Denys Creek was riffle-glide habitat with gravel and cobble substrates. Cover was primarily afforded by cobble and boulder substrates. Habitat quality is best described as fair for steelhead rearing. Loljuh Creek was a fairly small stream, composed of riffle-glide habitat and gravel-cobble substrates. Habitat appeared good for summer rearing, however, winter conditions may be rather severe.

Gabriel Creek was sampled by Carswell (1979). This stream was characterized by swirling flow and abundant instream debris and deadfall. Rearing habitat was good, particularly for coho.

Fish Population Assessment

1982 population estimates

Fish population estimates were conducted only in the mainstem Thautil River in 1982 (Table 27). Rainbow, coho, Dolly Varden and mountain whitefish were present in the 2 sample sites. Densities were low for all species, with the exception of rainbow parr at Site 2 (0.18/m^2).

As much of the Thautil River system was not sampled in 1982, a brief summary of fish presence in the rest of the system as outlined in Tredger (1983) will be included. Reach 2 of the Thautil River had rainbow and Dolly Varden present. Gabriel Creek had rainbow, coho and Dolly Varden. Starr Creek had rainbow and Dolly Varden in Reach 1, and mountain whitefish and Dolly Varden in Reach 2. Denys and Loljuh Creeks had only Dolly Varden.

Steelhead

Two years of fish sampling in the Thautil River system indicated juvenile steelhead rearing in the mainstem Thautil River (Reaches 1 and 2), Starr Creek (Reach 1) and Gabriel Creek. Rearing densities are only available for Thautil River Reach 1 and Starr Creek Reach 1 (Table 28). These data indicate generally low densities of steelhead fry and parr throughout the system. The 1982 parr densities at Site 2 of the Thautil River were

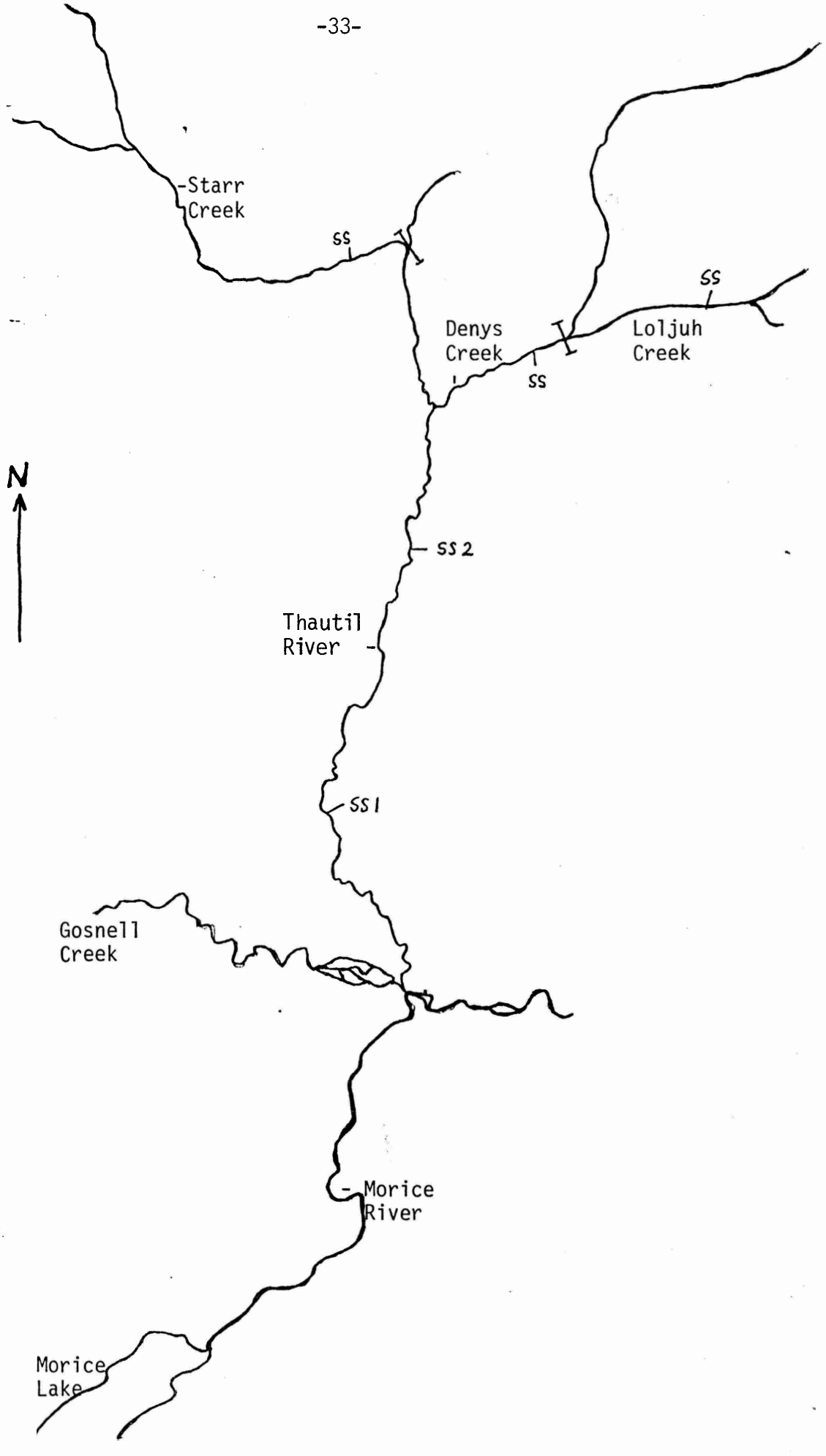

FIGURE 6. The Thautil River system. Scale 1:200,000

Table 26. Summary of habitat characteristics of streams in the Thautil River system.

Stream/Reach	Length (km)	Gradient	Habitat Type(%) P	R	G	Wetted Width	Major Substrate	Cover Type	Total Area
Thautil 1 mstm	25	0.9	55	21	24	9.5	LG,C	B,L	235,360
1 sidech	5	(0.9)	4	53	43	15.7	C,LG	L,B	78,720
2	4.5	2.0	marshy, swirling flow			(4)	G,F	N/A	(18,000)
Gabriel 1	2.0	3.0	sinuous, swirling flow			(1.5)	F,G	L	(3,000)
Denys 1	4.5	1.9	0	61	39	10.1	LG,C	B,DV	45,670
2	9.5	2.0	-	-	-	(10.1)	-	-	(95,900)
Loljuh 1	5.0	2.3	0	43	57	3.4	LG,C	B,DV	17,220
Starr 1	2.0	2.3	0	53	47	7.5	B,C	B	14,920
2	9.0	2.0	-	-	-	(7.5)	(G)	-	(67,580)

Table 27. Summary of 1982 fish density (No/m^2) estimates in Thautil River sample sites, August 1982.

Stream/Reach	Rainbow				Coho	Dolly Varden		Other Species
	0+	1+	2+	3+	0+	0+	1+	
Thautil 1 1	.20	.03	0	0	.03	.07	0	-
Thautil 1 2	0	.08	.05	.05	0	0	0	M.Whitefish .03

Table 28. Summary of juvenile steelhead density (No/m^2) in the Thautil River system, August 1981 and 1982.

Stream/Reach/Site	Year	Steelhead Density (No/m^2)			
		0+	1+	2+	3+
Thautil 1-1	1981	0.04	0	0	0
	1982	0.20	0.03	0	0
Thautil 1-2	1981	0.12	0.03	0.02	0
	1982	0	0.08	0.05	0.05
Thautil 1 -mean	1981/82	0.09	0.035	0.018	0.013
Starr 1-1	1981	0	0.02	0	0

the only exception. Because data is sparse, no standing crop estimates will be attempted at this time.

Steelhead Fry Stocking Potential

As the Thautil River system appears under-utilized by steelhead (based on low densities), fry stocking appears to have some potential as an enhancement technique. As no barrier to migration exists the question of habitat quality must be addressed.

Habitat quality

Late summer rearing habitat in the mainstem Thautil River (Reach 1). Starr Creek, Denys Creek and Loljuh Creek appears good. Potential constraints on fish production may occur in these areas due to poor overwinter conditions (Loljuh and perhaps upper Denys Creeks) poor spring runoff conditions (Thautil River and Starr Creek),or the general low productivity of the systems. The Thautil system may not be a "preferred" spawning area because of spring runoff causing high and dirty water conditions. The fact that fry were present indicates that some spawning does occur in the Thautil River.

Parr capacity and fry stocking requirements

Rough estimates of parr capacity were calculated using the Slaney smolt model (Appendix 5) and fry stocking requirements were projected (Table 29). Total requirements for the Thautil system are roughly 33,000 covering Thautil River Reach 1, Starr Creek Reaches 1 and 2, and Denys Creek Reach 1. Because fry populations were present, and parr population was fairly good in the mainstem Thautil River, it is recommended that only upper areas (Starr, Denys) be seeded at this time (total fry = 7,500). As with Gosnell Creek, these estimates are very rough.

MORICE RIVER MAINSTEM AND SIDECHANNELS

The Morice River mainstem and sidechannels have been sampled by F.H.I.S. in 1980, 1981 and 1982. Fish sampling has been more on a "hit and miss" basis, attempting to sample the range of habitat types over the length of Morice River. Habitat assessment has not been conducted by F.H.I.S. Instead, detailed sampling by ENVIROCON Ltd., has been referenced. Any F.H.I.S. observations were incorporated.

Habitat Assessment

The Morice River, above the Bulkley confluence (Fig. 7), was partitioned into 4 reaches (ENVIROCON 1981). A summary of some very general reach characteristics is given in Table 30.

Sidechannels are a very signficant aspect of Morice River habitat. Sidechannel development (or channel complexity), the ratio of total channel length to main channel length, ranged from a low of 1.2 in Reach 3 (27.8 mainstem length x 1.2 = 33.1 km total channel length) to a high of 4.7 in Reach 2 (33.8 mainstem length x 4.7 = 159.5 km total channel length).

Different types of sidechannel are present, offering differing habitat types. Some have wide, open gravel banks while others are confined with overhanging vegetation and stable appearance. Still others are very slow moving, low gradient backchannels. The sidechannel development referred to above represents combined side and backchannels. Recent investigations have indicated a 1.5:1 ratio of backchannels to sidechannels (D. Bustard, pers.comm.). F.H.I.S. observations indicate many channels are a combination, with a sidechannel beginning with high gradient and gradually "flattening out" into a backchannel.

1982 Fish Sampling

Fish sampling in the Morice River mainstem was conducted at 5 sites in 1982 (Fig. 7). Results are summarized in Table 31. Species captured included rainbow (0+ and 1+), chinook (0+), coho (0+), Dolly Varden (2+), mountain whitefish (0+), longnose dace and sculpins. Highest density was found at Aspen camp for rainbow fry ($0.43/m^2$) and parr ($0.21/m^2$), chinook fry ($0.77/m^2$) and coho fry ($0.26/m^2$). Other sites had relatively low

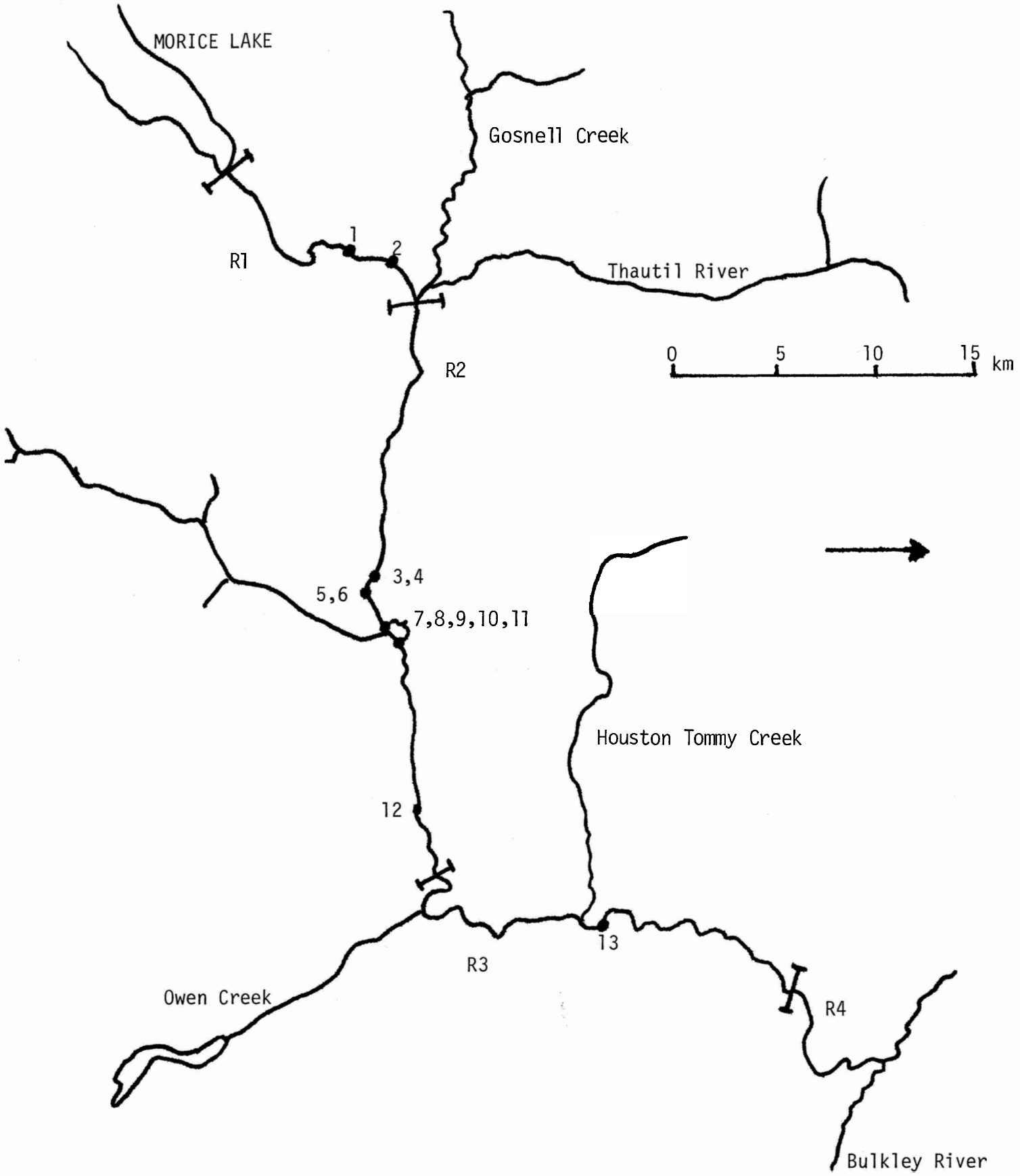

Figure 7. Morice River electroshocking sites and reach breaks.

Table 29. Thautil River steelhead parr capacity and fry stocking estimates based on habitat parameters and smolt yield modelling.

Stream/Reach		Length (m)	Area (m^2)	Estimated Parr Capacity	Estimated Fry Requirement	Fry Density	
						No/m	No/m^2
Thautil	1	22,000	220,000	4,186	(24,600)	1.12	0.11
Starr	1	2,000	17,600	273	1,600	0.80	0.09
	2	4,500	36,000	533	3,130	0.70	0.87
Denys	1	4,000	40,000	470	2,760	0.69	0.07
Total (excluding Thautil)					7,490		
(including Thautil)					(32,090)		

Table 30. Summary of general reach characteristics of the Morice River (data from ENVIROCON 1981).

Reach		Length (km)	Gradient (m/km)	Side Channel[1] Development	Substrate	Log Cover and Debris
1	Morice Lake to Gosnell Creek	15.4	3.2	1.7 (10.2)	cobble with some gravel	moderate
2	Gosnell Creek to Fenton Creek	33.8	1.9	4.7 (125.7)	gravel with cobble	high
3	Fenton Creek to Peacock Creek	27.8	2.7	1.2 (5.3)	variable. Silt to boulder and bedrock	low
4	Peacock Creek to Bulkley River[2]	10.0	1.3	2.0 (10.0)	gravel and cobble	moderate

[1] Sidechannel development (or channel complexity) - proportion of total channel length during late summer. Sidechannel length in brackets.
[2] Reach 4 extends into the Bulkley River, for a total length of 18.1 km.

Table 31. Results of fish density estimates (No/m^2) in the Morice River, August 23-26, 1982.

Site	Habitat	Rainbow		Chinook	Coho	Other Species
		0+	1+	$\sum$	$\sum$	
Aspen	cobble edge	0.43	0.21	0.77	0.26	DV 2+ - 0.02 MW - 0.02 LND - 0.06
21 Mile	open sidechannel	0.14	0.06	0.12	0	MW - 0.03 LND - 0.20 Sc - 0.01
Lamprey edge	gravel edge	0.08	0.02	0.02	0	MW - 0.01 LND - 0.14
32 Mile	sidechannel riffle-glide	0.05	0.04	0.05	0.01	MW - 0.12 LND - 0.15
Morice West	glide edge	0.08	0	0.19	0	Sc - 0.02

salmonid densities.

Juvenile steelhead--1980 to 1982

Sampling of fish in the Morice River mainstem and sidechannels has not been standardized. Basically a "random" assortment of sample sites are available. A detailed summary of steelhead densities by site, habitat and year is included in Appendix 6, with highlights in Table 32.

Average sampled fry density ranged from a low of 0.136 fry/m^2 in 1980 to a high of 0.294 fry/m^2 in 1981. A low density of 0.156 fry/m^2 was sampled in 1982. In terms of consecutive years sampling at individual sites, most followed the pattern of low in 1980 to high in 1981 (2 of 3 sites) and high in 1981 to low in 1982 (4 of 5 sites).

Average sampled parr density ranged from a low of 0.008 parr/m^2 in 1981, to 0.02 parr/m^2 in 1980, to a high of 0.07 parr/m^2 in 1982. Consecutive year sampling and individual sites indicates moderate density in 1980 to low 1981 density (3 of 3 sites), and low 1981 density to high 1982 density (4 of 5 sites).

Age and growth

The majority of juvenile steelhead captured in the Morice mainstem were fry and 1+ parr. Very few 2+ or older parr were captured. A summary of captures and mean fork length by age group is given in Table 33. Mean fry size dropped from 42 mm in 1980 to 36 mm in 1981 and 35 mm in 1982. This could be partially due to earlier sampling dates. Yearling steelhead parr were of roughly equal size in 1981 and 1982, while they were much smaller in 1982. This smaller size could be due to higher 1982 parr density.

Population estimates

Very rough estimates of steelhead fry and parr in the Morice River are summarized in Table 34. These estimates were calculated using mean sampled density (per linear meter) times habitat length (Appendix 6). Rough judgements of habitat quality were made by applying mean density to "good" habitat (1/2 of mainstem edge and sidechannels) and 0 density to "poor" habitat (1/2 of mainstem edge and backchannels). The main reason for doing this was to adjust for bias in selecting sample sites in good habitat. Obviously the accuracy of these estimates is highly questionable, and numbers generated should be viewed with caution.

A further source of error in fry population estimates is sampling time as related to emergence time. Fry emergence studies in 1982 (ENVIROCON, in prep.) indicate emergence occurred throughout August, peaking in mid-August and virtually complete by September 1. F.H.I.S. sampling was conducted September 6-7 in 1980, August 26-28 in 1981, and August 23 to 26 in 1982. Only in 1982 would emergence have been completed. This invalidates the assumption of equal recruitment over the sample area (mainstem Morice), certainly in 1981 and 1982, as fry dispersal may not have seeded all areas equally.

Application of F.H.I.S. Sampling

Population estimates for steelhead fry and parr in the Morice River mainstem may be of questionable accuracy as previously discussed. Comparable data produced by ENVIROCON (in prep.) is not "in hand" at the present time. When available, the reliability of F.H.I.S. estimates can be checked.

F.H.I.S. sampling of the mainstem is not sufficient to get a complete "picture" of Morice River steelhead production. Only summer population estimate data has been collected. This is not sufficient because:

1. Most juvenile steelhead sampled were 0+ and 1+. As juvenile steelhead generally spend 3 or 4 years in freshwater prior to smolting, sampling clearly did not cover all age groups.
2. Limitations on juvenile steelhead survival may be more significant over the winter low flow period. These and possibly other problems will be addressed in 1983 sampling and reporting.

Table 32. Summary of 1980-1982 juvenile steelhead density (No/m^2) in the Morice River mainstem and sidechannel.

Site	Habitat	1980		1981		1982	
		0+	Parr	0+	Parr	0+	Parr
Reach 1							
1. Islands above Gosnell	mainstem edge	—		0.67	0	—	
2. Morice West Bridge	mainstem edge	—		0.15	0	0.08	0
Reach 2							
3. 33 Mile	sidechannel	0.18	0.02	—		—	
4. 33 Mile	mainstem edge	0.09	0	—		—	
5. 32 Mile sidechannel 1	sidechannel	0.11	0.01	0.39	0	0.05	0.05
6. 32 Mile sidechannel 2	sidechannel	0.24	0.03	0.11	0	dry	
7.Lamprey confluence	mainstem edge	—		0.28	0.01	0.08	0.02
8.Lamprey sidechannel 1	sidechannel	—		0.20	0.02	—	
9.Lamprey sidechannel 2	sidechannel	0.11	0.05	—		—	
10. Lamprey sidechannel 3	sidechannel	0.11	0	—		—	
11.Lamprey sidechannel 4	sidechannel	—		0.29	0.03	—	
12. 21 Mile	sidechannel	0.11	0.03	0.15	0.01	0.14	0.06
Reach 3							
13. Aspen camp	mainstem edge	—		0.41	0	0.43	0.21
Mean all sites		0.136	0.020	0.294	0.008	0.156	0.07

Table 33. Summary of mean fork length by age group of juvenile steelhead captured in the Morice River mainstem, August 1980 to 1982.

Age Group	1980 N	1980 Mean Length	1980 Range	1981 N	1981 Mean Length	1981 Range	1982 N	1982 Mean Length	1982 Range
0+	139	42.0	30-62	225	36.1	29-52	73	35.1	29-47
1+	16	83.8	63-99	8	84.6	65-90	30	75.0	62-90
2+	3	110.0	101-118	1	118	118	0	-	-
Sample Date		Sept. 6-7			Aug. 26-28			Aug. 23-26	

Table 34. Juvenile steelhead population estimates in the mainstem Morice River, 1980 to 1982.

Age Group	Estimated Population		
	1980	1981	1983
0+	180,000	224,000	140,000
1+	21,500	6,700	63,000
2+[1]	N/A	N/A	N/A

[1] 2+ parr insignificant in F.H.I.S. sampling.

FURTHER DATA AND REPORTING REQUIREMENT

The current report outlines the results of three years of sampling in the Morice River system. Major emphasis was placed on Owen and Lamprey Creeks, with lesser effort on other tributaries and mainstem areas. Sampling thus far has given us good information on the availability of habitat, the range of recruitment and juvenile (younger) densities, and relative "importance" of system areas for steelhead production purposes. What we do not have is information on older age groups of steelhead parr, particularly in the mainstem Morice and Bulkley Rivers. Emphasis will be (was) placed on this for 1983 sampling.

Once 1983 parr data is available, hopefully the entire Morice system can be put into perspective regarding smolt yield and limiting factors in smolt yield. This is the projected focus of 1983 data reporting.

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APPENDIX 1. Lamprey Creek biophysical sampling data and analysis - 1982.

a. Habitat description
b. Fish population estimates
c. Fish capture length-frequency analysis
d. Length-weight data (condition factor)
e. Standing crop estimates

• Habitat characteristics of Lamprey Creek Reach 1

HABITAT TYPE
REACH LENGTH (m) 3250 Total Area = 26280 m²

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	0		6		6	
Average length (m)			20.5		17.9	
Average wetted width (m)			8.1		8.2	
Average channel width (m)			13.2		12.9	
Average depth (cm)			10		23	
Average area (m^2)			165		146	
Total no. of units in reach			84.5		84.5	
Total area of units in reach (m^2)			13943.53		12337.47	
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge 0.14 m^3/s
Average velocity

Morse

LAMPREY CREEK

REACH 1

Habitat Class	R	G	R	G	R	G	G	R	G	R	G	R	Average for Reach: POOLS x̄	POOLS %	GLIDES x̄	GLIDES %	RIFFLES x̄	RIFFLES %
Length	8	32	34	9	47	27	14.3	10	18	4	7	20	–		Σ107.30 x̄7.9	36.6	Σ123 x̄20.5	59.4
Wetted width	7	9.5	10.5	7	9	8	8	5	8	6	5	4	–		8.2		8.1	
Channel width	13	12	16	13	14	16	12	8	11	10	12	16	–		12.9		13.2	
Area	56	304	357	63	423	216	114.4	50	144	24	35	80	–		Σ876.4 x̄146.1	47	Σ990 x̄165	53
Mean depth	.11	.3	.09	.20	.09	.15	.2	.2	.3	.1	.1	.1	–		.13		0.10	
Velocity	.6	–	–	–	–	–	.1	.1	–	–	–	–	–		~.1		~.25	
Log cover	0	0	0	0	0	0	0	.5	.5	0	.5	0	–		.17		Σ.5 x̄.08	
Boulder cover	8.7	7	7	.5	3	2.5	8	3	2	25	.5	7	–		Σ20.4 x̄3.4		Σ.752 x̄9.2	
Instream veg.	0	0	0	0	0	0	1	4	1	.5	.5	4	–		Σ2.5 x̄.42		Σ8.5 x̄1.9	
Overstream veg.	0	0	0	0	0	0	2	.5	2	1	1	3	–		Σ5 x̄.83		Σ4.5 x̄.75	
Cutbanks	0	0	0	0	0	0	0	0	0	0	0	0	=		0		0	
Total cover	2.7	7	7	.5	3	2.5	11	8	5.5	9	2.5	14	–		Σ29 x̄4.8	3.3	Σ38.70 x̄6.95	2.9
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	–		clr		clr	
Gradient	–	–	–	–	–	–	.5	.5	–	–	–	–	=		–		–	
Fines	5	10	5	5	5	5	5	10	20	5	5	5	–		9.2		5.3	
Small gravel	5	10	20	10	5	10	10	15	5	15	10	10	–		9.2		11.6	
Large gravel	15	15	20	30	25	25	25	20	20	30	30	30	–		21.3		22.8	
Cobble	50	45	35	45	50	50	40	30	40	30	40	40	–		44.4		42.3	
Boulder	25	20	20	10	15	10	20	25	15	20	15	15	=		15.8		18.	
Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	–		0		0	
Compaction	low	low	low	low	low	low	low	low	low	low	low	low	–		low		low	

Richness = 6

x̄Q n .14 m³/s 4.9 cfs

• Habitat characteristics of Lamprey Creek Reach 2

HABITAT TYPE
REACH LENGTH (m) 8300 Area = 68592 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	6		8		9	
Average length (m)	44.5		5.1		17.4	
Average wetted width (m)	9.5		7.9		6.2	
Average channel width (m)	15.7		19.8		12.3	
Average depth (cm)	77		5		30	
Average area (m²)	424.5		40.2		108.3	
Total no. of units in reach	107		143		161	
Total area of units in reach (m²)	45422	67	5750	8	17420	25
Average area log debris cover (m²)						
Average area boulder cover (m²)						
Average area instream vegetation (m²)						
Average area overstream vegetation (m²)						
Average area cutbanks (m²)						
Average area total cover (m²)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge 0.39 m³/s
Average velocity

Morice — page 1 of 2

LAMPREY CREEK

REACH 2

Habitat Class	G	R	G	G	R	G	P (above beaver dam)	R (below dam)	G	R	G	R	P	P	G	P	G	R
Length	7.1	2.5	11.4	20	4	15	35	3	18	4	7	6	9	20	20	12	50	5
Wetted width	5.7	6	1.9	6	1	4	4	1	3	4	8.8	8.9	8.5	5	4.5	9	9.5	5
Channel width	10	10	10	10	12	12	10	10	10	10	9.0	11	12	13	10	10	11	15
Area	40.5	15	21.7	180	4	60	140	3	54	16	61.6	34	34	150	90	108	475	85
Mean depth	.25	.01	.20	.3	.1	.2	.4	.1	.2	.1	.25	.10	.4	1.0	.3	.45	.35	.1
Velocity	.2	1	.6	.1	1.3	.5	<.1	1.5	.5	1.5	.2	.5	–	–	.2	–	.25	.5
Log cover	.5	.5	1.5	1	.5	4	5	.3	2	0	0	.2	0	2	1	1	3	.25
Boulder cover	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	.1	0	0
Instream veg.	1	0	0	.5	0	0	1	0	0	0	.1	.5	0	.3	0	.3	0	0
Overstream veg.	1	0	.5	5	0	4	6	0	2	3	.3	0	0	.3	2	5	2.5	0
Cutbanks	.5	0	1	0	0	0	1	1	0	0	0	0	.3	3	4	2	.5	0
Total cover	3	.5	3	65	.5	8	15	1.3	4	3	.4	.7	.3	5.6	7	8.4	6	.25
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr
Gradient	0	3	.5	0	2	0	0	2	.5	2	–	–	–	–	–	–	–	–
Fines	50	10	40	85	20	70	75	30	75	10	40	30	70	80	60	60	60	30
Small gravel	30	20	30	10	60	20	10	20	15	20	30	20	20	10	20	30	20	40
Large gravel	20	30	20	5	20	5	5	40	5	30	20	30	10	5	10	7	10	20
Cobble	10	40	10	0	0	5	5	20	5	40	10	10	0	5	10	3	10	10
Boulder	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low	low

Marice

page 2 of 2

LAMPREY CREEK

REACH 2

Beaver Dam

Habitat Class	R	P	G	R	G	D	P						Average for Reach POOLS x̄	%	GLIDES x̄	%	RIFFLES x̄	%
													P		G		R	
Length	11	26	4	5	11	.5	160						Σ467 x̄ 44.5	55.5	Σ178.5 x̄ 17.9	26.1	Σ90.5 x̄ 5.1	8.4
Wetted width	15	7.5	3	8	8	8.5	12						9.5		6.2		7.9	
Channel width	22	8.8	28	33	33	34	16						15.7		12.3		19.8	
Area	165	195	12	40	88	4.25	1920						Σ2597 x̄ 424.5	64.5	Σ1082 x̄ 1083	27.4	Σ320.4 x̄ 40.2	8.1
Mean depth	.03	.35	.15	.05	.08	.4	.85						.77		.30		.05	
Velocity	—	—	.75	—	.2	—	—						—		~.36		~.05	
Log cover	.8	1.3	0	0	0	4.25	5.5						Σ14.8 x̄ 2.5		Σ13 x̄ 1.3		Σ1.95 x̄ .24	
Boulder cover	0	0	0	0	0	0	0						Σ2.1 x̄ .35		0		0	
Instream veg.	.1	.3	0	.1	0	0	40						Σ41.90 x̄ 6.9		Σ1.6 x̄ .16		Σ.70 R .09	
Overstream veg.	.2	4	.25	.2	0	0	55						Σ70.30 x̄ 11.7		Σ1765 x̄ 1.76		Σ3.9 x̄ .93	
Cutbanks	0	3	.1	0	0	0	45						Σ54.3 x̄ 9.1		Σ6.1 x̄ .61		Σ1.0 x̄ .13	
Total cover	.5	8.6	.35	.3	0	0	140						Σ177.9 x̄ 29.7	7	Σ3225 x̄ 3.88	3.5	Σ7.05 x̄ .88	2.2
Turbidity	clr	clr	clr	clr	clr	clr	clr						clr		clr		clr	
Gradient	—	—	—	—	—	—	—						~0		~.2		~2	
Fines	15	35	15	20	15	50	35						40.6		59.4		18.9	
Small gravel	55	40	40	55	63	25	25						29.6		22.6		46	
Large gravel	28	33	45	25	20	25	33						28.4		11.1		27.5	
Cobble	2	2	0	0	2	0	7						6.1		6.9		7.5	
Boulder	0	0	0	0	0	0	0						0.3		0		0	
Bedrock	0	0	0	0	0	0	0						0		0		0	
Compaction	low	low	low	low	low	low	low						low		low		low	

Roughness .7

x̄ Q n .39 m³/s 13.8 cfs

• Habitat characteristics of Lamprey Creek Reach 4

HABITAT TYPE
REACH LENGTH (m) 4150 Area = 10070 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	2		3		1	
Average length (m)	12		7		11	
Average wetted width (m)	2.8		2.2		2	
Averagechannel width (m)	8.7		8		8	
Average depth (cm)	32		4		10	
Average area (m^2)	33.6		15.6		22	
Total no. of units in reach	148		222		74	
Total area of units in reach (m^2)	4980	49	3463	34	1628	17
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge .043 m^3/s
Average velocity

Morice
LAMPREY CREEK
REACH 4

														Average for Reach					
														POOLS		GLIDES		RIFFLES	
														$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	R	R	P	R	P								P		G		R	
Length	11	21	16	16	3	8								$\frac{\Sigma 24}{\bar{x} 12}$		11		$\frac{\Sigma 21.1}{\bar{x} 7}$	
Wetted width	2	3.7	1.5	2.7	5	3								2.8		2		2.2	
Channel width	8	8	8	8	8	10								8.7		8		8	
Area	22	7.8	24	43.2	15	24								$\frac{\Sigma 67.2}{\bar{x} 13.6}$	49.4	22	16.2	$\frac{\Sigma 46.8}{\bar{x} 5.6}$	34.4
Mean depth	20	.05	.05	.25	.03	.45								.32		.2		.09	
Velocity	.3	.20	—	—	—	—								—		—		—	
Log cover	0	0	0	.2	.05	.30								$\frac{\Sigma .5}{\bar{x} .25}$		0		$\frac{\Sigma .05}{\bar{x} .02}$	
Boulder cover	.1	.1	.6	.6	0	0								$\frac{\Sigma .6}{\bar{x} .3}$		.1		$\frac{\Sigma .7}{\bar{x} .23}$	
Instream veg.	.2	0	0	0	0	0								0		.2		0	
Overstream veg.	.2	0	0	.1	0	.1								$\frac{\Sigma .2}{\bar{x} .1}$		.2		0	
Cutbanks	.15	0	0	0	0	.2								$\frac{\Sigma .2}{\bar{x} .1}$		.15		0	
Total cover	.65	.1	.6	.9	.05	.6								$\frac{\Sigma 1.5}{\bar{x} .75}$		.65		$\frac{\Sigma .75}{\bar{x} .25}$	
Turbidity	clr	clr	clr	clr	clr	clr								clr		clr		clr	
Gradient	—	—	—	—	—	—								—		—		—	
Fines	25	15	20	5	5	50								21.1		25		14.4	
Small gravel	10	20	20	20	20	30								23.6		10		20	
Large gravel	40	20	20	35	35	10								26.1		40		26.5	
Cobble	20	20	20	35	35	10								26.1		20		26.5	
Boulder	5	5	20	5	5	0								3.1		5		12.6	
Bedrock	0	0	0	0	0	0								0		0		0	
Compaction	low	low	low	low	low	low								low		low		low	

• Habitat characteristics of Pimpernel Creek Reach 1 (below falls)

HABITAT TYPE
REACH LENGTH (m) 4000 Area = 9100

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	1		3		3	
Average length (m)	4		3.3		8.3	
Average wetted width (m)	4		1.6		2.3	
Average channel width (m)	25		25		25	
Average depth (cm)	30		6		15	
Average area (m^2)	16		5.4		18.7	
Total no. of units in reach	103		309		309	
Total area of units in reach (m^2)	1650	18	1670	18	5783	64
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge 0.045 m^3/s
Average velocity

Morice
Lamprey Creek- PEMPERNEL CREEK
Below falls

													Average for Reach					
													POOLS		GLIDES		RIFFLES	
													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	R	G	R	G	R	P						P		G		R	
Length	10.5	0.8	4.5	6	10	3	4						4	10.3	≤25 $\bar{x}$ 8.3	64.4	≤9.8 $\bar{x}$ 3.3	25.3
Wetted width	1.7	1.3	1.8	2	3	1	4						4		2.3		1.6	
Channel width	25	25	25	25	25	25	25						25		25		25	
Area	17.9	1.04	8.1	12	30	3	16						16	18.2	≤56 $\bar{x}$ 18.7	18.6	≤16.09 $\bar{x}$ 5.4	18.2
Mean depth	.25	.1	.25	.05	.15	.1	.3						.3		.15		.06	
Velocity	.2	.5	.2	.5	.2	.7	0						0		~.2		~.57	
Log cover	0	0	.5	.1	1	0	5						5		≤1.5 $\bar{x}$ .5		≤.1 $\bar{x}$ .03	
Boulder cover	0	0	0	0	0	0	0						0		0		0	
Instream veg.	0	0	0	0	0	0	0						0		0		0	
Overstream veg.	1	0	1	1	4	0	2						2		≤6 $\bar{x}$ 2		≤1 $\bar{x}$ .3	
Cutbanks	1	0	.1	1	1	0	1						1		≤2.1 $\bar{x}$ .7		≤1.0 $\bar{x}$ .3	
Total cover	2	0	1.6	2.1	6	0	8						8	50	≤9.6 $\bar{x}$ 3.2	17.1	≤2.1 $\bar{x}$ .7	13
Turbidity	clr	clr	clr	clr	clr	clr	clr						clr		clr		clr	
Gradient	.5	1	0	1.5	0	1	0						0		.17		1.2	
Fines	30	10	30	20	30	10	60						60		30		17.5	
Small gravel	40	40	40	40	50	40	30						30		45.4		40	
Large gravel	20	40	20	30	20	30	10						10		20		30.7	
Cobble	10	10	10	10	0	20	0						0		4.6		11.8	
Boulder	0	0	0	0	0	0	0						0		0		0	
Bedrock	0	0	0	0	0	0	0						0		0		0	
Compaction	low	low	low	low	low	low	low						low		low		low	

roughness .7
$\bar{x}Q = .045\ m^3/s$ 1.6 cfs

• Habitat characteristics of Pimpernel Creek Reach 2 (above falls)

HABITAT TYPE
REACH LENGTH (m) 2000 (approx) Area = 3630 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	2		3		1	
Average length (m)	4.25		4		9	
Average wetted width (m)	2		1.9		1.5	
Average channel width (m)	4		3.8		8	
Average depth (cm)	15		7		15	
Average area (m^2)	8.5		7.7		13.5	
Total no. of units in reach	136		203		68	
Total area of units in reach (m^2)	1150	32	1566	43	915	25
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble.						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge 0.01 m^3/s

Average velocity

Marice

Lamprey Creek - PIMPERNEL CREEK TRIB

Above falls

													Average for Reach					
													POOLS		GLIDES		RIFFLES	
													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	P	R	G	R	P	R							P		G		R	
Length	6	3	9	7	2.5	2							Σ8.5 $\bar{x}$4.25	28.8	9	30.5	Σ13 $\bar{x}$9	40.7
Wetted width	2	1.2	1.5	2.5	2	1							2		1.5		1.9	
Channel width	4	5	8	3.5	4	3							4		8		3.8	
Area	12	3.6	13.5	17.5	5	2							Σ17 $\bar{x}$8.5	21.7	13.5	25.2	Σ23.10 $\bar{x}$7.7	43.1
Mean depth	.15	.05	.15	.07	.15	.10							.15		.15		.07	
Velocity	0	–	.05	–	–	–									.05			
Log cover	.5	0	.5	0	.5	.1							Σ1 $\bar{x}$.5		.5		Σ.1 $\bar{x}$.03	
Boulder cover	0	1	1	2	0	.1							0		1		Σ3.1 $\bar{x}$1.03	
Instream veg.	.5	0	.5	0	.1	0							Σ1.6 $\bar{x}$.3		.5		0	
Overstream veg.	1	0	1	0	2	0							Σ3 $\bar{x}$1.5		1		0	
Cutbanks	.5	0	0	0	.5	.1							Σ1 $\bar{x}$.5		0		Σ.1 $\bar{x}$.03	
Total cover	2.5	1	3	2	3.1	.3							Σ56 $\bar{x}$25.5	30	3	22	Σ3.3 $\bar{x}$1.1	
Turbidity	clr	clr	clr	clr	clr	clr							clr		clr		clr	
Gradient	–	–	–	–	–	–							–		–		–	
Fines	25	0	30	5	10	5							20.6		30		4.2	
Small gravel	25	20	20	25	25	40							27.8		20		25.5	
Large gravel	40	20	30	45	45	40							41.6		30		40.7	
Cobble	10	30	10	20	10	15							10		10		21.1	
Boulder	0	30	10	5	0	0							0		10		8.5	
Bedrock	0	0	0	0	0	0							0		0			
Compaction	low	low	low	low	low	low							low		low			

roughness = .7

$\bar{x}$ Qm .01 .35 cfs

Morice-LAMPREY CREEK REACH 1 DATE Aug 23/82 AREA 103 m^2 SITE # 1-Bridge Site
LENGTH 14.7 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	29-50	37.71	0.63	7	0.8	8.75	5.50	0.08	0.05	0.60
	1+	79-89	84.00	6.48	3	0.8	3.75	24.29	0.04	0.24	0.26
	2+	110-120	115.0	16.60	2	0.8	2.50	41.49	0.02	0.40	0.17
	3+	125-193	138.0	25.82	3	0.8	3.75	94.59	0.04	0.98	0.26
								165.87	0.18	1.61	1.29
Coho	0+	42-70	55.81	2.22	27	0.8	33.75	74.79	0.33	0.73	2.30
Chk	0+	50-78	64.17	3.02	23	0.8	28.75	87.16	0.25	0.85	1.96
Mw	≤	48-62	55.00	2.36	2	0.8	2.50	5.89	0.02	0.06	0.17
LNP	≤	29-141	56.05	3.50	22	0.8	27.50	96.13	0.27	0.93	1.87
Cottid	≤	65-138	109.33	14.11	3	0.8	3.75	52.98	0.04	0.51	0.26
Sucker sp	≤	79-97	86.67	9.73	3	0.8	3.75	36.48	0.04	0.35	0.26

HABITAT DESCRIPTION: Riffle / Glide habitat in reach 1

Discharge Q ~.6 m^3/s 21 cfs **Gradient** N/R

Temperature (°C) 16°C **Turbidity** Clear

Hydraulic Type	Pool	Glide	Riffle
% area		72.5	27.5
mean width		7.4	6.15
mean depth		.3	.11
% cover		6.5	2.6
cover type[1]		B	B
substrate[2]		F10, SG10, LG 15 C45, B20	F 5, SG 5, LG 15, C 50, B 25,

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice-Lamprey Creek Reach 1 DATE Aug 24/82 AREA 114.9 m^2 SITE # 3
LENGTH 19.3 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_0	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	37-51	46.90	1.14	10	0.75	13.33	15.27	0.12	0.13	0.98
	1+	89-95	88.67	7.61	6	0.75	8.00	60.90	007	0.53	056
	2+	118-	118.00	17.83	1	0.75	1.33	23.77	0.01	0.21	0.09
	3+	139.0	139.00	29.14	1	0.75	1.33	38.85	0.01	0.34	0.09
								138.79	0.21	1.21	1.67
Coho	0+	56-8C	66.58	9.64	12	0.75	16.00	58.19	0.14	0.51	1.12
Chk	0+	51-6C	60.33	2.46	6	0.75	8.00	19.68	0.07	0.17	0.56
LnD	Σ	93-115	64.76	3.45	51	0.75	68.00	234.86	0.59	2.05	4.76

HABITAT DESCRIPTION: Glide habitat reach 1

Discharge Qav.1 3.5 cfs Gradient 0.5
Temperature (°C) 12° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		8.0	
mean depth		.2	
% cover		9.6	
cover type[1]		B, IV, OV	
substrate[2]		F5, SG 10, LG 25 C 40, B 20	

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice-Lamprey Creek Reach 2 DATE Aug 23/82 AREA 74.3 m^2 SITE # 5
LENGTH 11.6 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/m^2 DENSITY	BIOMASS DENSITY	No / linear meter
Rbt	0+	33-50	38.88	0.67	16	0.75	21.33	14.28	0.29	0.19	1.84
	1+	64-81	78.33	4.38	6	0.75	8.00	35.05	0.11	0.47	0.69
	2+	98-115	106.5	13.24	4	0.75	5.33	70.59	0.07	0.95	0.46
	3+	144	144.0	32.90	1	0.75	1.33	43.80	0.02	0.58	0.11
								163.12	0.49	2.19	3.10
Coho	0+	59-70	64.50	3.26	4	0.75	5.33	17.37	0.07	0.23	0.46
Chk	0+	54-78	66.25	3.31	8	0.75	10.67	35.34	0.14	0.48	0.92
Dv	0+	50	50.00	1.25	1	0.75	1.33	1.67	0.02	0.02	0.11
Mw	≥	98-109	70.75	6.29	8	0.75	10.67	67.11	0.14	0.90	0.92
LwD	≥	95-88	166.58	3.62	24	0.75	32.00	115.73	0.43	1.56	2.76

HABITAT DESCRIPTION: Glide/Riffle/Glide habitat near beaver dam

Discharge Qr .2 m^3/s 7 cfs Gradient .5-3%
Temperature (°C) N/R Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		79.8	20.2
mean width		4.9	6
mean depth		.23	.01
% cover		6.9	.70
cover type[1]		L,IV,OV,C	L
substrate[2]		F 47, SG 23, LG 20	F10, SG20 LG30
		C 10	C40

COMMENTS: Upstream from this point habitat is almost entirely glide

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Marine- LAMPREY CREEK Reach 2 DATE Aug 23/82 AREA 133.6 m^2 SITE # 8
LENGTH 13.5 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{P}$	$\bar{n}$	TOTAL BIOMASS	No /m^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	29-45	36.77	0.56	26	0.80	32.50	18.18	0.24	0.14	2.41
	1+	77	77.0	4.95	1	0.80	1.25	6.19	0.01	0.05	0.09
	2+	98	98.0	10.21	1	0.80	1.25	12.76	0.01	0.10	0.09
								37.13	0.26	0.29	2.59
Dv	0+	38-40	39.33	0.61	3	0.80	3.75	2.29	0.02	0.02	0.28
	1+	65	65.0	2.75	1	0.80	1.25	3.43	0.01	0.03	0.09
								5.72	0.04	0.05	0.37
Mw	≤	48-63	54.75	2.25	12	0.80	15.00	33.77	0.11	0.25	1.11
Lwd	≤	11-74	39.17	1.03	12	0.80	15.00	15.49	0.11	0.12	1.11

HABITAT DESCRIPTION: Complex site Glide/riffle/pool

Discharge Q N.3 m^3/s 10.5 cfs Gradient N/R

Temperature (°C) 12° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area	25	36	39
mean width	8.6	8.8	8.85
mean depth	0.40	0.25	0.10
% cover	0.2	0.30	0.50
cover type[1]	C.	IV OV	L, IV
substrate[2]	F70, SG20, LG10	F40, SG30, LG20 C10	F 30, SG 30, LG 30 C10,

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice- LAMPREY CREEK Reach 2 DATE Aug 23/82 AREA 183.9 m^2 SITE # 9
LENGTH 21.3 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_s	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M^2 DENSITY	BIOMASS DENSITY	No / linear meter
Rbt	0+	31-50	40.61	0.75	66	0.75	8800	66.24	0.48	0.36	4.13
	1+	63-86	75.03	4.66	33	0.8	41.25	192.28	0.22	1.05	1.94
	2+	99-114	104.20	12.33	10	0.8	12.50	154.09	0.07	0.84	0.59
	3+	122-132	126.00	21.85	2	0.8	2.50	54.63	0.01	0.30	0.12
								467.67	0.78	2.54	6.77
Ct	2+	113	113.00	15.87	1	0.8	1.25	19.89	0.01	0.11	0.06
Mw	≤	50-150	66.64	6.63	11	0.8	13.75	91.18	0.07	0.50	0.65
LnD	≤	22-88	50.13	1.79	82	0.8	102.50	178.02	0.56	0.97	4.81
Sucker sp	≤	77-126	107.61	18.72	6	0.8	7.50	140.43	0.04	0.76	0.35

HABITAT DESCRIPTION: Riffle/Pool habitat

Discharge	—	Gradient	0
Temperature (°C)	11° C	Turbidity	Clear

Hydraulic Type	Pool	Glide	Riffle
% area	57.5		42.5
mean width	8.9		5.9
mean depth	.35		.03
% cover	4.7		0.3
cover type[1]	L, IV, OV, C		L, IV, OV, C
substrate[2]	F25, SG40, LG33, C2		F15, SG55, LG28 C2

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice LAMPREY CREEK Reach 4 DATE Aug 26/82 AREA 29.1 m² SITE# 11
LENGTH 15 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{P}$	$\bar{n}$	TOTAL BIOMASS	No /M² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	33-99	3956	0.69	34	0.90	37.78	26.14	1.30	0.90	2.52
	1+	69-72	7050	3.81	2	0.90	2.22	8.46	0.08	0.29	0.15
								34.60	1.38	1.19	8.67
Ct	0+	43-47	45.00	1.01	2	0.90	2.22	8.24	0.08	0.08	0.15
	1+	60-99	7689	5.32	9	0.90	10.00	52.22	0.34	1.83	0.67
								55.46	0.48	1.91	0.82
Dv	0+	99	99.00	1.18	1	0.90	1.11	1.31	0.09	0.09	0.07

HABITAT DESCRIPTION: Glide /riffle habitat

Discharge Q ≈ .2m³/s 7.1cfs Gradient IV/R

Temperature (°C) 14° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		74	26
mean width		1.9	2.05
mean depth		0.20	0.05
% cover		2.2	0.3
cover type[1]		B,IV,OV,C	B
substrate[2]		F25,SG10,LG 40 C20, B5	F 15,SG20,LG30, C30B5

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstr eam ve ge tation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice PIMPERNEL #1 DATE Aug26/82 AREA 27.09 M² SITE # 1-Below falls
LENGTH 15.8 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_n	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear meter
Rbt	0+	38-61	51.99	1.59	25	.95	26.32	40.45	0.97	1.50	1.67
	1+	108	108.0	13.67	1	0.95	1.05	14.39	0.04	0.53	0.07
								54.84	1.01	2.03	1.74
Dv	1+	90	90.0	7.29	1	0.95	1.05	7.67	0.04	0.28	0.07

HABITAT DESCRIPTION: Glide/riffle/Glide.

Discharge Qv.05 1.8 cfs	Gradient 0-1%	
Temperature (°C) 14°	Turbidity Clear	
Hydraulic Type	Pool	Glide	Riffle
% area		96.2	3.8
mean width		1.75	1.3
mean depth		0.25	.10
% cover		7.4	0.
cover type[1]		OV, C	—
substrate[2]		F30, SG 90, LG 20, C10	F10, SG 90, LG 40 C10

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, Ccutbanks

[2] Ffines, SG small gravel, LG large gravel, C cobbles, B boulders, Brbedrock

Monica - PIMPERNEL #2 DATE Aug 26/82 AREA 15.6 M² SITE # 3
LENGTH 9 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear meter
Sucker sp only											

HABITAT DESCRIPTION: Pool/Riffle habitat

Discharge — Gradient ~0

Temperature (°C) Turbidity Clear

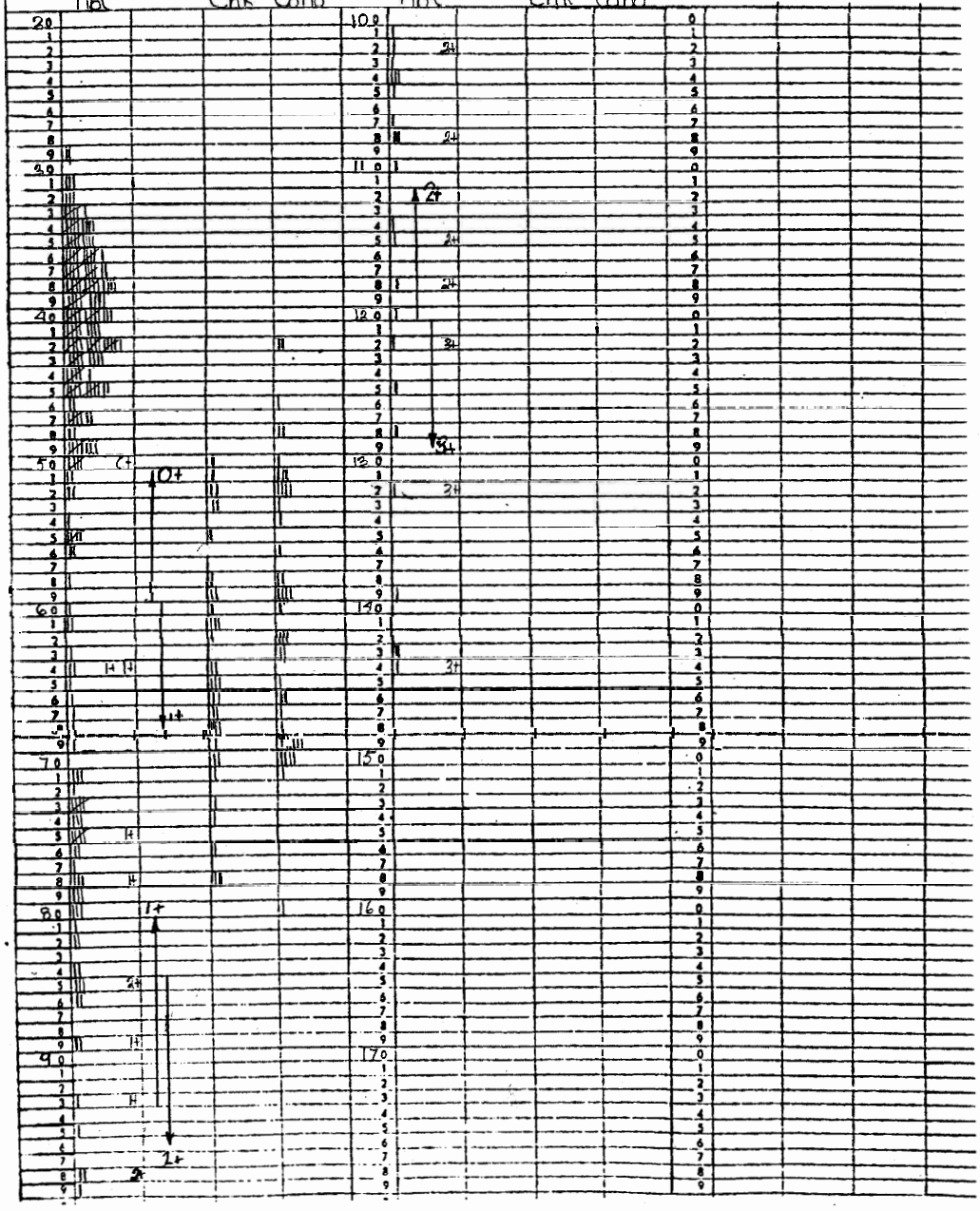
Hydraulic Type	Pool	Glide	Riffle
% area	77		33
mean width	2.0		1.2
mean depth	0.15		0.05
% cover	16.0		1.6.
cover type[1]	L, IV, OV, C		B.
substrate[2]	F25, SG25, LG40 C10		F0, SG20, LG20 C30, B30.

COMMENTS: Anaylar Substrate
Hundreds of sucker fry seen and caught 15-30mm.

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Cumulative Length-frequency Data - Rainbow trout, Chinook, Coho
Location: Morice - LAMPREY CR
Date: August 23 to 26 1988



Rainbow Length-Weight Data - Morice System

1. Owen Creek - Site 1

n = 21 r^2 = 0.96
a = 0.77
b = 1.0352×10^{-5}

2. Owen Creek - Site 7

n = 12 r^2 = 0.99
a = 1.18
b = 1.045×10^{-5}

3. Lamprey Creek - Site 3

n = 13 r^2 = 0.99
a = 0.17
b = 1.203×10^{-5}

4. Combined

n = 46 r^2 = 0.99
a = 0.71
b = 1.085×10^{-5}

Empirical formula:

$$wt(g) = 1.085 \times 10^{-5}(\ell)^3$$

k-values used for Morice River System

Rainbow	1.085×10^{-5}	ℓ^3
Coho	1.2×10^{-5}	ℓ^3
Chinook	1.1×10^{-5}	ℓ^3
Dolly Varden	1.0×10^{-5}	ℓ^3
Cutthroat	1.1×10^{-5}	ℓ^3
Mountain Whitefish	1.35×10^{-5}	ℓ^3
Longnose Dace	1.15×10^{-5}	ℓ^3
Redsided shiner	4.0×10^{-6}	$\ell^{3.3}$
Sucker sp	2.5×10^{-5}	$\ell^{2.38}$
Cottid	1.0×10^{-5}	ℓ^3

Steelhead fry--Lamprey Creek

Reach	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	2.39	1.19	0.60	-	-	-
	3	2.82	2.29	0.93	-	-	-
	x	2.61	1.74	0.77	5,417	3.611	1,598
2	4/5	2.74	2.43	1.84	-	-	-
	8	2.50	3.64	2.41	-	-	-
	9	1.90	6.96	4.13	-	-	-
	x	2.38	4.34	2.79	18,571	33,864	21,770
4	11	0.50	-	2.52	1,414	-	4,276
Pimpernel	1	2.06	-	1.67	9,076	-	7,357
Sampled reach total (R1, 2)					23,998	37,475	-
(R1, 2, 4 and Pimpernel)					34,478	-	35,001
Estimated stream total					44,794	69,950	45,473

Site 11 representative of glide/riffle habitat only. As Reach 4 has 50% pool habitat, apply factor of .6 to 1982/1980 ratio to form an appropriate estimate (i.e. (2.52/.50) x 1414 = 7126 x .6 = 4,276).

Steelhead 1+ parr--Lamprey Creek

Reach[1]	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	0.74	0.06	0.26	-	-	-
	3	1.27	2.10	0.56	-	-	-
	x	1.01	1.08	0.41	2,182	2,333	885
2	4/5	1.27	0.70	0.69	-	-	-
	8	0.55	2.27	0.09	-	-	-
	9	0.19	0.48	1.94	-	-	-
	x	0.67	1.15	0.91	8,263	14,183	11,182
Pimpernel	1	0.76	-	0.07	3,381	-	311
Sampled reach total (R1, 2)					10,445	16,516	-
(R1, 2, and Pimpernel)					13,826	-	12,378
Estimated stream total					19,320	30,550	17,297

[1] Site 11 representative of glide/riffle habitat only in 1982. As parr habitat associated more with pool environments this site was not used for extrapolation purposes.

Steelhead 2+/3+ parr--Lamprey Creek

Reach	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	0	0.06	0.43	-	-	-
	3	0.09	0	0.18	-	-	-
	x	0.045	0.03	0.305	107	71	725
2	4/5	0.15	0.12	0.57	-	-	-
	8	0.05	0.06	0.09	-	-	-
	9	0	0.06	0.71	-	-	-
	x	0.067	0.08	0.46	1,009	1,205	6,927
Sampled reach total					1,116	1,276	7,652
Estimated stream total					1,116	1,276	7,652

Reach 4 (Site 11) not applicable

2+/3+ ratio was roughly 2.4/1, therefore standing crop of
2+ = 7,652 x 2.4/ x 2.4/3.4 = 5,400
3+ = 7,652 x 1/ x 3.4 = 2,250

APPENDIX 2. Owen Creek biophysical sampling data and analysis - 1982

a. Habitat description
b. Fish population estimates
c. Fish capture length-frequency analysis
d. Standing crop estimates

• Habitat characteristics of Owen Creek Reach 1

HABITAT TYPE
REACH LENGTH (m) 3950

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	5		4		4	
Average length (m)	26.4		12.3		12.8	
Average wetted width (m)	16.4		7.2		9.8	
Average channel width (m)	21.9		25.8		22.4	
Average depth (cm)						
Average area (m^2)	432.2		88.9		61.5	
Total no. of units in reach	85		68		68	
Total area of units in reach (m^2)	36 737		6045		4182	46,964
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge
Average velocity

Morice

Page 1 of 2

OWEN CREEK

REACH 1

Dam sdechan.rd

Habitat Class	P	R	P	G	P	P	G	R	R	G	P	D	R	G				
Length	45	3	5	6	20	20	2	8	22	10	42	2	18	31				
Wetted width	7	5	2	5	7	5	4	4.5	6	8.5	38	14	3.5	7.5				
Channel width	10	10	10	15	20	20	20	15	14	14	38	24	38	26				
Area	315	15	10	30	140	100	8	36	132	85	1596	28	63	8225				
Mean depth	.25	.05	.60	.10	1.0	.50	.15	.05	.08	.09	.9	1	.1	.2				
Velocity	.1	.25	—	.3	0	0	—	—	.8	—	—	—	—	—				
Log cover	3	.1	3	0	4	.5	0	0	0	.2	22	28	.2	.8				
Boulder cover	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Instream veg.	0	0	0	0	0	0	0	0	0	.3	5	0	0	.1				
Overstream veg.	4	0	1	0	2	0	0	0	0	0	12	0	0	1				
Cutbanks	1	.35	0	0	1	0	0	0	0	.1	9	0	0	3				
Total cover	8	.35	4	0	7	0	0	0	0	.6	48	0	.2	4.3				
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	lm	—	clr	clr				
Gradient	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Fines	75	10	10	10	95	90	20	5	15	20	40	100	15	25				
Small gravel	20	80	60	63	0	10	50	50	55	60	48	0	80	70				
Large gravel	5	10	30	30	5	0	30	45	29	20	10	0	13	5				
Cobble	0	0	0	0	0	0	0	0	2	0	2	0	20	0				
Boulder	0	0	0	0	0	0	0	0	0	0	0	0	8	0				
Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Compaction	low	low	low	low	low	low	low	low	low	low	low	low	low	low				

							Side Channel						Average for Reach					
							POOLS		GLIDES		RIFFLES		POOLS		GLIDES		RIFFLES	
							$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class							P	—	G	—	R		P		G		R	
Length											18		Σ132 $\bar{x}$26.4	56.9	Σ49 $\bar{x}$12.3	21.1	Σ51 $\bar{x}$12.9	22
Wetted width											3.5		16.4		7.2		4.8	
Channel width											38		21.9		25.8		22.4	
Area											62		Σ2161 $\bar{x}$432.2	78.2	Σ355.5 $\bar{x}$[illegible]	12.9	Σ246.0 $\bar{x}$61.5	8.9
Mean depth											.1		.79		.16		.08	
Velocity											—		.1		.5		[illegible]	
Log cover											.2		Σ32.5 $\bar{x}$6.5		Σ.4 $\bar{x}$.1		Σ.3 $\bar{x}$.08	
Boulder cover											0		0		0		0	
Instream veg.											0		Σ5 $\bar{x}$1		Σ.4 $\bar{x}$.1		0	
Overstream veg.											0		Σ19 $\bar{x}$3.8		Σ1 $\bar{x}$.25		0	
Cutbanks											0		Σ11 $\bar{x}$2.2		Σ3.1 $\bar{x}$.78		Σ.25	
Total cover											.2	.3	Σ67 $\bar{x}$13.4	3.1	Σ4.9 $\bar{x}$1.3	1.5	Σ.55 $\bar{x}$.14	.2
Turbidity											Clr		clr		clr		Clr	
Gradient											—		—		—		—	
Fines											15		50.8		22.3		13.2	
Small gravel											20		39.1		66.5		46.8	
Large gravel											43		8.6		11.2		33.2	
Cobble											20		1.5		0		6.2	
Boulder											2		0		0		0.6	
Bedrock											0		0		0		0	
Compaction											low		low		low		low	

$\bar{x}$ Q = .12 m^3/s

• Habitat characteristics of Owen Creek Reach 4

HABITAT TYPE
REACH LENGTH (m) 1000

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	1					
Average length (m)	25m					
Average wetted width (m)	13					
Average channel width (m)						
Average depth (cm)						
Average area (m^2)	325					
Total no. of units in reach	1					
Total area of units in reach (m^2)	13000					
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge
Average velocity

Morice

OWEN CREEK — slough-like pools caused by beaver dam

REACH 4 — Sample site: 25m section of Bowron

Habitat, Class	SP	SP
Length	6.5	25
Wetted width	11	13
Channel width	18	19
Area	71.5	325
Mean depth	1	1.5
Velocity	0	0
Log cover	2	0
Boulder cover	0	2
Instream veg.	1	0
Overstream veg.	2	25
Cutbanks	1	25
Total cover	7	52
Turbidity	clr	clr
Gradient	0	0
Fines	95	100
Small gravel	5	0
Large gravel	0	0
Cobble	0	0
Boulder	0	0
Bedrock	0	0
Compaction	—	—

• Habitat characteristics of Owen Creek Reach 5

HABITAT TYPE
REACH LENGTH (m) 4650

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%	
No. of units sampled	4		3		5		
Average length (m)	19.5		6.7		6		
Average wetted width (m)	6		3		4.5		
Average channel width (m)							
Average depth (cm)							
Average area (m^2)	116.8		25.3		27		
Total no. of units in reach	145		109		181		
Total area of units in reach (m^2)	16936		2758		4887		24581
Average area log debris cover (m^2)							
Average area boulder cover (m^2)							
Average area instream vegetation (m^2)							
Average area overstream vegetation (m^2)							
Average area cutbanks (m^2)							
Average area total cover (m^2)							
Average % substrate fines							
Average % substrate small gravel							
Average % substrate large gravel							
Average % substrate cobble							
Average % substrate boulder							
Average % substrate bedrock							

Estimated discharge

Average velocity

Forge													Average for Reach					
Owen Creek													POOLS		GLIDES		RIFFLES	
Reach 5													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	P	G	P	R	R	G	P	G	G	R	G	P	P		6		R	
Length	27	8	25	8	4	6	20	7	5	8	4	6	R 78 $\bar{x}$ 19.5	60.9	R 30 $\bar{x}$ 6	23.4	R 20 $\bar{x}$ 6.7	15.6
Wetted width	5	4	6	4	3	5	7	4	5	4	5	7	6		4.5		3.8	
Channel width	10	10	10	15	15	15	15	12	10	10	15	15	11.7		12.1		13	
Area	135	32	150	32	12	130	140	28	25	32	20	42	R 461 $\bar{x}$ 116.9	67.9	R 135 $\bar{x}$ 27	19.9	R 76 $\bar{x}$ 25.33	11.2
Mean depth	.2	.3	.6	.05	.1	.3	.5	.6	.3	.1	.2	.8	.47		.35		.08	
Velocity	.2	.3	.1	.3	.3	.1	.05	.1	.2	.4	.1	.1	~.11		~.17		~.33	
Log cover	1	0	4	0	.5	.1	<1	.5	0	.5	.5	4	R 13 $\bar{x}$ 3.3		R 2.8 $\bar{x}$ .16		R 1 $\bar{x}$ .33	
Boulder cover	0	1	0	0	0	0	0	0	0	0	0	0	0		R 1 $\bar{x}$ .2		0	
Instream veg.	2	0	2	0	0	0	2	0	0	0	0	0	R 6 $\bar{x}$ 1.5		0		0	
Overstream veg.	6	0	2	0	8	0	4	1	1	.5	.5	0	R 13 $\bar{x}$ 3		R 2.5 $\bar{x}$ .5		R 85 $\bar{x}$ 29.8	
Cutbanks	4	0	0	0	0	0	1	0	0	0	0	3	R 8 $\bar{x}$ 2		0		0	
Total cover	13	1	8	0	8.5	.1	11	1.5	1	1	.7	7	R 39 $\bar{x}$ 9.8	8.4	R 4.3 $\bar{x}$ .86	3.2	R 93 $\bar{x}$ 32	12.6
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr		clr		clr	
Gradient	1	1	.5	3	2	1	.5	1	1	2	1	.5	~.5		1		~2	
Fines	15	10	20	5	10	30	20	10	20	15	80	30	19.5		28.5		10	
Small gravel	10	10	10	20	20	40	20	30	15	15	20	20	13.9		23.2		17.9	
Large gravel	40	30	30	30	40	30	30	40	25	40	0	40	29.8		26.7		35.7	
Cobble	35	40	30	45	30	0	30	20	30	30	0	10	29.7		19.2		36.4	
Boulder	0	10	10	0	0	0	0	0	0	0	0	0	3.1		2.4		0	
Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0		0		0	
Compaction	low	low	low	low	low	low	low	low	low	low	low	low	low		low		low	

roughness = .7

$\bar{x}$ Q = .16 m^3/s 5.6 cfs

• Habitat characteristics of Owen Creek Reach 6

HABITAT TYPE
REACH LENGTH (m) 1600

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	1		3		4	
Average length (m)	25		4.9		11	
Average wetted width (m)	8		3		4.7	
Average channel width (m)						
Average depth (cm)						
Average area (m^2)	200		14.5		51.9	
Total no. of units in reach	19		57		76	
Total area of units in reach (m^2)	3800		826		3944	8570
Average area log debris cover (m^2)						
Average area boulder cover (m^2)						
Average area instream vegetation (m^2)						
Average area overstream vegetation (m^2)						
Average area cutbanks (m^2)						
Average area total cover (m^2)						
Average % substrate fines						
Average % substrate small gravel						
Average % substrate large gravel						
Average % substrate cobble						
Average % substrate boulder						
Average % substrate bedrock						

Estimated discharge
Average velocity

Morice OWEN CREEK REACH 6													Average for Reach					
													POOLS		GLIDES		RIFFLES	
													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	R	G	R	G	R	G	P	G					P		G		R	
Length	2.8	3.9	8	5	4	15	25	20					25	29.9	Σ28.9 $\bar{x}$11	52.4	Σ19.8 $\bar{x}$4.9	17.7
Wetted width	1.1	3.2	2	3	4	4	8	6					8		4.7		3	
Channel width	12	12	12	12	12	12	8	8					8		10.2		12	
Area	11.5	12.5	16	15	16	60	200	120					200	44.3	Σ203.5 $\bar{x}$51.9	46	Σ43.5 $\bar{x}$19.5	9.7
Mean depth	.1	.4	.1	.15	.15	.2	1	.5					1		.38		.12	
Velocity	1	.4	1	.8	1	.8	0	.1					0		.58		.1	
Log cover	.2	.3	0	2	4	.1	7	10					7		Σ12.9 $\bar{x}$3.1		Σ4.2 $\bar{x}$1.9	
Boulder cover	0	0	0	0	0	0	0	.1					0		Σ.1 $\bar{x}$.03		0	
Instream veg.	0	0	0	0	0	5	0	1					0		Σ6 $\bar{x}$1.5		0	
Overstream veg.	0	.5	0	.3	.2	0	4	3					4		Σ3.8 $\bar{x}$.95		Σ.2 $\bar{x}$.06	
Cutbanks	0	.1	0	0	.1	0	8	4					8		Σ4.2 $\bar{x}$1.1		Σ.1 $\bar{x}$.03	
Total cover	.2	.9	0	2.3	4.3	5.1	19	18.1					19	9.5	Σ26.4 $\bar{x}$6.6	12.7	Σ4.6 $\bar{x}$1.5	10.3
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr					clr		clr		clr	
Gradient	1	.5	2	1	1.5	.5	0	0					0		.5		1.5	
Fines	10	20	10	12.5	10	30	20	40					20		33.9		10	
Small gravel	40	30	20	32.5	20	30	120	30					20		30.2		25.3	
Large gravel	40	40	60	42.5	40	30	40	20					40		25.7		47.3	
Cobble	10	10	10	12.5	30	10	20	10					20		10.2		17.9	
Boulder	0	0	0	0	0	0	0	0					0		0		0	
Bedrock	0	0	0	0	0	0	0	0					0		0		0	
Compaction	low	low	low	low	low	low	low	low					low		low		low	

roughness = .7

$\bar{x}Q$ in .5 m^3/s 17.5 cfs

Nonis - Owen Creek DATE Aug 29/82 AREA 138.75 m² SITE # 1
Reach 1 LENGTH 51 m

SPECIES	AGE	ft-RANGE	$\bar{f}i$	MEAN WEIGHT	C_s	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	35-58	47.06	1.16	135	0.85	158.82	184.25	1.19	1.33	3.11
	1+	61-102	73.66	4.55	47	0.85	55.29	251.37	0.40	1.81	1.08
	2+	119	119.0	16.07	1	0.85	1.18	18.91	0.01	0.14	0.02
								454.53	1.55	3.28	4.21
Coho	0+	77-88	84.00	7.19	3	0.85	3.53	25.36	0.03	0.18	0.07
Dv	0+	46-98	45.00	0.92	2	0.85	2.35	2.17	0.02	0.02	0.05
	1+	85-89	87.00	6.60	2	0.85	2.35	15.52	0.02	0.11	0.05
								17.69	0.04	0.13	0.10

HABITAT DESCRIPTION: Complex site Pool/Riffle/Glide

Discharge — Gradient N/R.

Temperature (°C) 18° @ 1500 HRS Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area	42.4	21.6	36
mean width	3.0	2.3	2.25
mean depth	.36	.18	.075
% cover	7.3	1.8	4.4
cover type[1]	L,OV,C.	L,OV,C.	L,OV,C.
substrate[2]	F 72, SG 10 LG 18,	F 62, SG 21 LG 17	F 6, SG 77, LG 17

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Mbrice - Owen Creek Reach 1 DATE Aug 24/82 AREA 89.1 m^2 SITE # 3
LENGTH 13.8 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	35-60	45.61	1.06	148	0.8	185.00	196.27	2.18	2.32	13.41
	1+	73-88	79.09	5.48	11	0.8	12.75	74.61	0.16	0.88	1.00
	2+	129	124.0	20.69	1	0.8	1.25	25.86	0.01	0.31	0.09
								296.74	2.35	3.51	14.60
Dv	0+	36-53	43.93	0.88	7	0.8	8.75	7.70	0.10	0.09	0.63
Mw	≤	63-69	66.60	4.00	5	0.8	6.25	25.01	0.07	0.30	0.45

HABITAT DESCRIPTION: Riffle / glide.

Discharge Q = .72 m^3/s 25.4 cfs Gradient ≈ 19.5

Temperature (°C) 16° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		25.4	74.6
mean width		7.9	5.8
mean depth		.09	.08
% cover		0.7	0
cover type[1]		L, IV, C	—
substrate[2]		F 20, SG 60	F 15, SG 55, LG 28
		LG 20	C 2

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] Ffines, SG small gravel, LG large gravel, Ccobbles, Bboulders, Brbedrock

Morice - Owen Creek Reach 4 DATE Aug 25/82 AREA 71.5 M^2 SITE # 6
LENGTH 11 M

SPECIES	AGE	FL-RANGE	$\bar{fl}$	MEAN WEIGHT	C_0	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	43-58	50.86	1.46	7	0.7	10.00	14.58	0.14	0.20	0.91
	1+	78-103	89.93	8.00	7	0.7	10.00	79.98	0.14	1.12	0.91
								94.56	0.28	1.32	1.82
Coho	0+	81-96	87.25	8.07	4	0.7	5.71	46.12	0.08	0.65	0.52
Dv	0+	48-56	51.29	1.36	7	0.7	10.00	13.68	0.14	0.19	0.91
	1+	115	115.0	15.81	1	0.7	1.43	21.73	0.02	0.30	0.13
								35.36	0.16	0.49	1.04
Mw	≤	76	76.0	5.98	1	0.7	1.43	8.47	0.02	0.12	0.13
RsS	≤	46-68	58.17	2.03	6	0.7	8.57	17.41	0.12	0.24	0.78

HABITAT DESCRIPTION: Slough/Pool near beaver dam, just above old bridge site.

Discharge Q ~ >.09 m^3/s 3.2 cfs **Gradient** 0

Temperature (°C) 14° @ 1030 HRS **Turbidity** Clear

Hydraulic Type	slough/Pool	Glide	Riffle
% area	100		
mean width	6.5		
mean depth	1.0		
%cover	8.4		
cover type[1]	L, IV, OV, C		
substrate[2]	F95, SG5		

COMMENTS: - excellent overwintering area
- section sampled may have been somewhat shallower than the rest of the area
- lots of fish feeding in the deep pool area

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice- Owen Creek Reach 5 DATE Aug 24/82 AREA 119 m^2 SITE # 7
LENGTH 23 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No/ linear mete
Rbt	0+	37-60	48.80	1.34	46	.68	67.65	90.70	0.57	0.76	2.94
	1+	67-111	87.43	7.59	28	.68	41.18	312.60	0.35	2.63	1.79
	2+	124	124.0	30.69	1	.68	1.47	30.42	0.01	0.26	0.06
	3+	151-160	155.5	40.90	2	.68	2.94	120.29	0.02	1.01	0.13
								553.01	0.95	4.66	4.92
Dv	0+	39-61	51.62	1.43	29	.4	72.50	103.38	0.61	0.87	3.15
	1+	78-88	81.33	5.49	3	.4	7.50	40.76	0.06	0.34	0.33
	2+	153	153.0	35.82	1	.4	2.50	89.54	0.02	0.75	0.11
								233.68	0.69	1.96	3.59
LnD	≤	100	100.0	11.50	1	.9	1.11	12.78	0.01	0.11	0.05
RsS	≤	70	70.0	4.91	.2	.9	2.22	10.91	0.02	0.09	0.10

HABITAT DESCRIPTION: Glide/Riffle/Pool Complex site

Discharge Qn .2m³/s 7.1cfs Gradient .5-2.%
Temperature (°C) 15° @ 1600HRS Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area	35	38	27
mean width	7	5.0	4
mean depth	.8	.25	.10
% cover	5.9	1.4	0.84
cover type[1]	L, C,	L, OV	L, OV
substrate[2]	F30, SG20 LG40 C10	F43 SG 17 LG 23 C 17	F15, SG15, LG40 C30

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice - Owen Creek Reach 6 DATE Aug 24/83 AREA 24 M^2 SITE# 9
LENGTH 8 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_s	$\bar{P}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	34-52	45.83	1.10	6	0.8	7.50	8.28	0.31	0.34	0.94
	1+	80	80.00	5.56	1	0.8	1.25	6.94	0.05	0.29	0.16
	2+	146	146.0	38.77	1	0.8	1.25	42.21	0.05	1.76	0.16
								57.23	0.41	2.39	1.26
Mw	≤	68	68.0	4.24	1	0.8	1.25	5.31	0.05	0.22	0.16
Rs	≤	17-70	41.59	1.10	61	0.8	76.25	83.71	3.18	3.49	9.53
Sculpin sp	≤	46-78	66.67	5.03	3	0.8	3.75	18.87	0.16	0.79	0.47
Cottid sp	≤	51-146	73.44	6.30	9	0.8	11.25	70.86	0.47	2.95	1.41

HABITAT DESCRIPTION: Owen Creek near lake outlet Riffle/Glide.

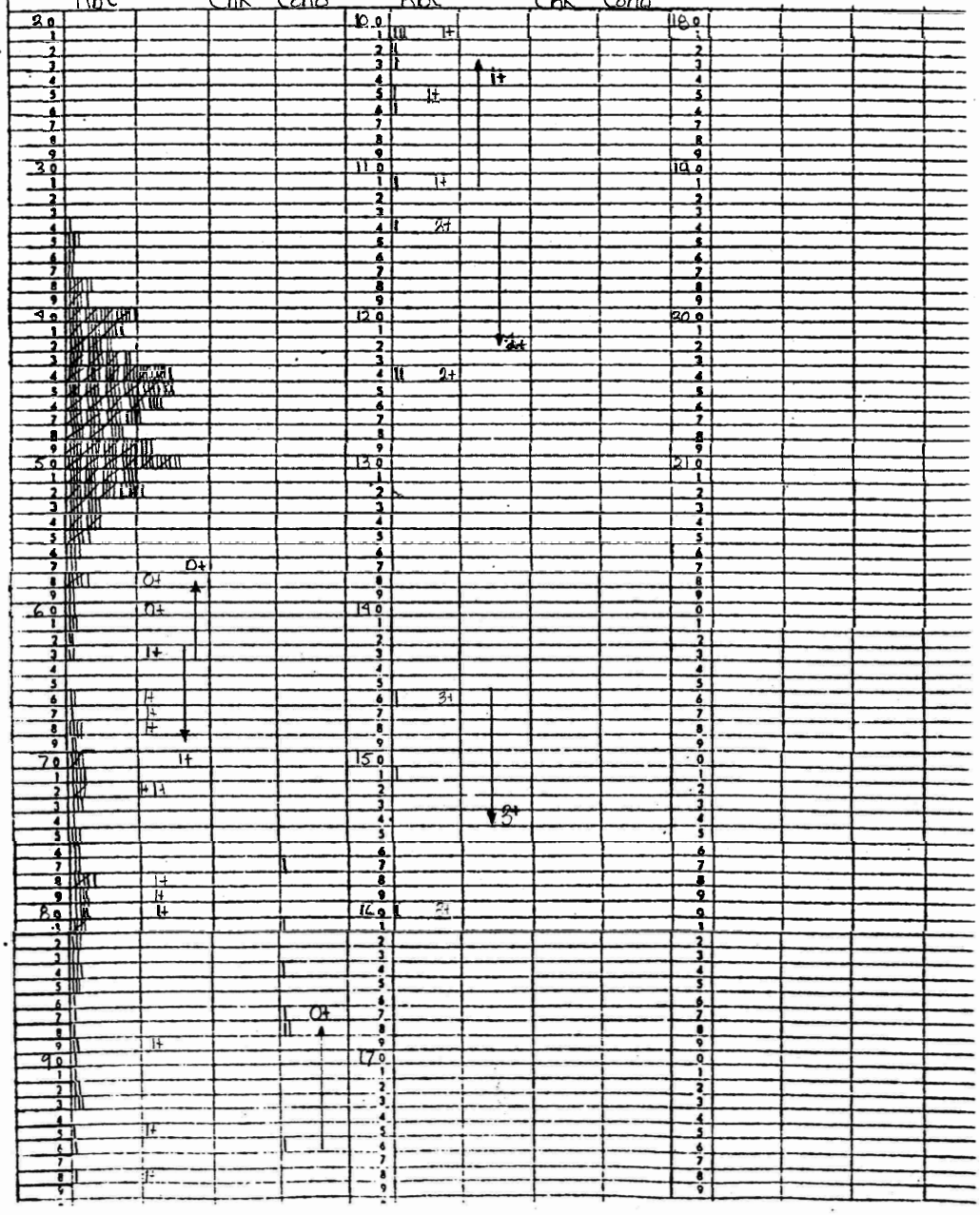
Discharge Q~ .23 m^3/s 8.1 cfs Gradient .5-1%
Temperature (°C) N/R Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		52	48
mean width		3.9	2.8
mean depth		.25	.1
% cover		3.8	.8
cover type[1]		L, OV, C	L
substrate[2]		F20 SG30 LG40 C10,	F10 SG20 LG60 C10

COMMENTS: Large numbers of red-sided shiners seen fry -> 150mm
Redds throughout the area, probably resident rbt (Owen Lake)

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks
[2] Ffines, SG small gravel, LG large gravel, Ccobbles, Bboulders, Br bedrock

Cumulative Length-frequency Data - Rainbow, Coho, Chinook
Location: Morice - Owen Cr
Date: August 22 to 26 1982



Steelhead fry--Owen Creek

Reach	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	2.94	4.77	3.11	-	-	-
	3	4.68	10.51	13.41	-	-	-
	x	3.815	7.64	8.265	18,410	36,916	39,912
3	5(6)	0	-	(0.91)	not applicable		
4	6(5)	0.31	(4.71)	-	not applicable		
5[1]	7	1.58	5.87	2.94	12,360	45,920	22,999
6[1]	9	2.08	2.54	0.94	1,676	2,046	757
Sampled Reach Total					32,446	84,882	63,668
Estimated Population					38,330	100,275	75,214

Steelhead 1+--Owen Creek

Reach	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	0.69	0.55	1.08	-	-	-
	3	0.65	1.25	1.00	-	-	-
	x	0.67	0.90	1.04	2.024	2.719	3,142
3	5(6)	0.31	-	(0.91)	not applicable		
4	6(5)	1.13	(1.78)	-	not applicable		
5[1]	7	1.12	2.0	1.79	6,960	12,263	11,124
6[1]	9	0.14	0.07	0.16	75	38	86
Sampled reach total					9,059	15,020	14,352
Estimated population					18,715	31,029	29,650

Steelhead 2+--Owen Creek

Reach	Sites	Fish Density(No/m)			Standing Crop (No)		
		1980	1981	1982	1980	1981	1982
1	1	0	.08	.02	-	-	-
	3	0	.15	.09	-	-	-
	x	0	.12	.06	0	474	237
3	5(6)	.10	-	0	not applicable		
4	6(5)	0	(.27)	-	not applicable		
5	7	0.13	0.17	0.06	900	1,177	415
6	9[1]	0	0	0.16	10	10	128
Sampled reach total					910	1,651	780
Estimated population					3,460	6,315	2,966

[1] linear density (0.16) x 50% anadromous x reach length (1.6 km) = Reach 6 standing crop.

APPENDIX 3. Houston Tommy Creek biophysical sampling data and analysis - 1982.

a. Habitat description
b. Fish population estimates
c. Fish capture length - frequency analysis
d. Smolt yield modelling

Houston Tommy Creek 1980, 1981 & 1982
Reach 1

Habitat Class	G	R	G	R	G	R	R	G	R	Average for Reach: POOLS x̄	POOLS %	GLIDES x̄	GLIDES %	RIFFLES x̄	RIFFLES %
										N = 0		N = 4		N = 5	
Length	19	30	28	35	25	34	60	50	60			30.5	36	43.8	64
Wetted width	7.7	16	10	13	10	9	20	7	30			8.7		15.6	
Channel width	25	28	25	25	23	27	25	18	28			25.3		26.6	
Area	1466	480	280	455	250	336	1200	350	1200			254.1	30	488	70
Mean depth	.3	.2	.4	.2	.4	.2	.35	.5	.25			.4		.24	
Velocity	1	–	–	–	–	–	–	–	.7	–		–		–	
Log cover	1.5	0	2	0	1	0	3	7	4			2.9		1.4	
Boulder cover	1.5	5	3	12	4	5	9	6	12			3.6		8.6	1.8
Instream veg.	0	0	0	0	0	0	0	0	0			0		0	
Overstream veg.	8.5	2	2	0	3	.5	8	15	7			5.6		3.5	
Cutbanks	.5	0	0	0	4	0	0	0	0			1.1		0	
Total cover	6	7	7	12	12	55	20	28	23			13.2	5	13.5	3
Turbidity	clr	clr	clr	clr	clr	clr	–	–	–			clr		clr	
Gradient	1	2	..	–	–	–	–	1.5	–			1.25		2	
Fines	10	5	10	5	10	0	10	10	15			10		7	
Small gravel	15	10	10	10	25	10	10	20	15			17.5		11	
Large gravel	30	25	30	20	30	35	20	30	40			30		28	
Cobble	30	40	40	25	20	30	35	30	20			30		30	
Boulder	15	20	10	25	15	25	25	10	10			12.5		21	
Bedrock	0	0	0	15	0	0	0	0	0			0		3	
Compaction	low	low	low	low	low	low	0	0	0			low		low	

Reach length 6500 m
Total area 65,870 m²

	POOLS	GLIDES	RIFFLES
total in Reach	0	76	95
area in Reach	0	19,510	46,360
%	0	30	70

Houston Tommy Creek 1981 & 1982
Reach 2 mainstem habitat

Habitat Class	G	P	R	G	G	R	G						P(N=1)	R(N=2)	G(N=4)
Length	7	12	22	66	18	43	27						12	32	29.5
Wetted width	7	8	13	11.5	9	6	15						8	9.5	10.6
Channel width	100	100	78	48	40	30	30						100	54	54.5
Area	49	96	286	759	162	258	405						96	272	344
Mean depth	25	1.2	.10	.11	.3	.3	.4						1.2	.2	.27
Velocity	—	—	—	.5	—	—	—						—	—	—
Log cover	2	4.6	3	0	1	1	16						4.6	2	4.8
Boulder cover	0	0	0	0	2	0	3						0	0	1.2
Instream veg.	0	0	0	0	0	0	0						0	0	0
Overstream veg.	0	1	5	25	0	6	8						1	5.5	8.2
Cutbanks	.1	.2	0	0	0	2	1						.2	1	.3
Total cover	2.1	5.8	8	25	3	9	28						5.8	8.5	14.5
Turbidity	clr	—	—	—	—	—	—								
Gradient	—	—	—	—	—	—	—								
Fines	5	35	2	5	0	0	5						35	1	4
Small gravel	25	15	20	20	0	5	5						15	13	12
Large gravel	68	50	58	50	20	30	25						50	44	41
Cobble	2	0	20	25	65	60	60						0	40	38
Boulder	0	0	0	0	15	5	5						0	2	5
Bedrock	0	0	0	0									0	0	0
Compaction	low	—	—	—											
												total in reach	37	74	149
												area in reach	355.2	20,128	51,256
												%	5	27	68

Reach length= 7250m
Total area= 74,936 m^2

Houston Tommy Creek 1981 & 1982
Reach 2 side channel habitat

Habitat Class	G	R	R	G	Average for Reach: POOLS x̄	POOLS %	GLIDES x̄	GLIDES %	RIFFLES x̄	RIFFLES %
					N= 0		N= 2		N= 2	
Length	38	22	8	7			22		15	
Wetted width	8	5	1.5	1.5			4.8		3.3	
Channel width	45	47	–	–			–		–	
Area	304	110	12	10.5			157		61	
Mean depth	.3	.12	.1	.2			.25		.11	
Velocity	–	–	.06?	–			–		–	
Log cover	.7	0	.5	1			.85		.25	
Boulder cover	.5	.1	0	0			.25		.05	
Instream veg.	0	0	0	0			0		0	
Overstream veg.	0	3	0	.5			.25		1.5	
Cutbanks	0	2.2	0	0			0		1.1	
Total cover	1.2	5.3	.5	1.5			1.35		2.9	
Turbidity	clr	clr	clr	clr						
Gradient	–	–	1.2	–						
Fines	5	5	0	30			17.5		2.5	
Small gravel	20	10	10	20			20		10	
Large gravel	45	70	30	30			37.5		50	
Cobble	25	12	55	20			22.5		33.5	
Boulder	5	3	5	0			2.5		4	
Bedrock	0	0	0	0			0		0	
Compaction	low	low	0	0						

Reach length 362 m
Total area 2,180 m²

total in reach	0	10	10
area in reach	0	1570	610
%	0	72	28

HOUSTON Tommy Creek 1982
Reach 4 (Above falls)

														Average for Reach					
														POOLS		GLIDES		RIFFLES	
														$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	G	R	G										N=	0	N=	3	N=	1
Length	15	30	40	15										—		≤60 x 20	60	40	40
Wetted width	9	12	18	8										—		10.3		12	
Channel width	30	20	20	20										—		22.5		20	
Area	135	360	720	120										—		≤610 x 205	562	480	43.8
Mean depth	.7	.3	.3	.5										—		.43		.3	
Velocity	.4	.4	.5	.3										—		.37		.3	
Log cover	3	0	0	0										—		≤3 x 1		0	
Boulder cover	1	2	80	2										—		≤5 x 6.7		20	4.2
Instream veg.	0	0	0	0										—		0		0	
Overstream veg.	.5	1	0	0										—		≤1.5 x .5		0	
Cutbanks	0	0	0	0										—		0		0	
Total cover	4.5	3	20	2										—	—	≤9.5 x 3.2	1.6	20	4.2
Turbidity	clr	clr	clr	clr										—		clr		clr	
Gradient	1	1	1.5	1										—		1		1.5	
Fines	10	15	10	10										—		12.9		10	
Small gravel	20	15	10	20										—		17.1		10	
Large gravel	40	40	30	20										—		36.1		30	
Cobble	20	20	40	40										—		22.9		40	
Boulder	10	10	10	10										—		10		10	
Bedrock	0	0	0	0										—		0		0	
Compaction	low	low	low	low										—		low		low	

Reach length 20,000m
Total area 219,000m²

total in reach	0	600	200
area in reach	0	123,000	96,000
%	0	56	44

Morice - Houston Tommy Reach 1 DATE Aug 26/82 AREA 146.6 M² SITE # 1
LENGTH 19 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_s	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	37-39	38.00	0.60	2	0.6	3.33	1.99	0.02	0.01	0.18
	1+	76	76.00	4.76	1	0.6	1.67	7.94	0.01	0.05	0.09
								9.93	0.03	0.06	0.27
Coho	0+	58-79	67.00	3.80	3	0.6	5.00	19.01	0.03	0.13	0.86
ChK	0+	67	67.00	3.31	1	0.6	1.67	5.51	0.01	0.09	0.09
Dv	0+	55	55.00	1.66	1	0.6	1.67	2.77	0.01	0.02	0.09

HABITAT DESCRIPTION: Glide

Discharge 1.6 m³/s (57 cfs) Gradient 1%
Temperature (°C) 14.5 Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		100%	
mean width		7.7	
mean depth		0.3	
% cover		4.1	
cover type[1]		L, B, OV, C	
substrate[2]		F10, SG15, LG30 C30, B015	

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice-Houston Tommy — DATE Aug 26/82 — AREA 96.73 M² — SITE # 2
Reach 2 — LENGTH 17.5 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_s	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M² DENSITY	BIOMASS DENSITY	No/ linear mete
Dv.	0+	59	59.00	1.57	1	0.8	1.25	1.97	0.01	0.02	0.07
	1+	92-109	99.75	10.09	4	0.8	5.00	50.45	0.05	0.52	0.29
	2+	120-121	120.50	17.50	2	0.8	2.50	43.74	0.03	0.45	0.14
								105.16	0.09	0.99	0.50

HABITAT DESCRIPTION: Side channel Riffle/Glide.

Discharge — Gradient N/R

Temperature (°C) 12.5° — Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		68.4	31.6
mean width		5.75	5.1
mean depth		.30	.12
% cover		1.2	5.5
cover type[1]		L,B	B,OV,C
substrate[2]		F5,SG20,LG45	F5,SG10,LG70
		C25,B5	C12,B3

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] Ffines, SG smallgravel, LG large gravel, C cobbles, Bboulders, Br bedrock

Meriddau STD N TOM MY — DATE Aug 26/82 — AREA 135 M² — SITE # 3
Reach 3 — LENGTH 15 M — Above falls

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear mete
Native Rbt	1+	74-100	90.00	8.08	7	.80	8.75	70.78	0.06	0.52	0.58
	2+	113-130	117.90	17.71	5	.80	6.25	110.71	0.05	0.82	0.42
	3+	150-206	178.00	65.73	2	.80	2.50	164.33	0.02	1.22	0.17
								345.76	0.13	2.56	1.17

HABITAT DESCRIPTION: Glide

Discharge 1.22 m³/s (43.4 cfs) — Gradient 1%
Temperature (°C) 11° @ 1300 HRS — Turbidity Clear

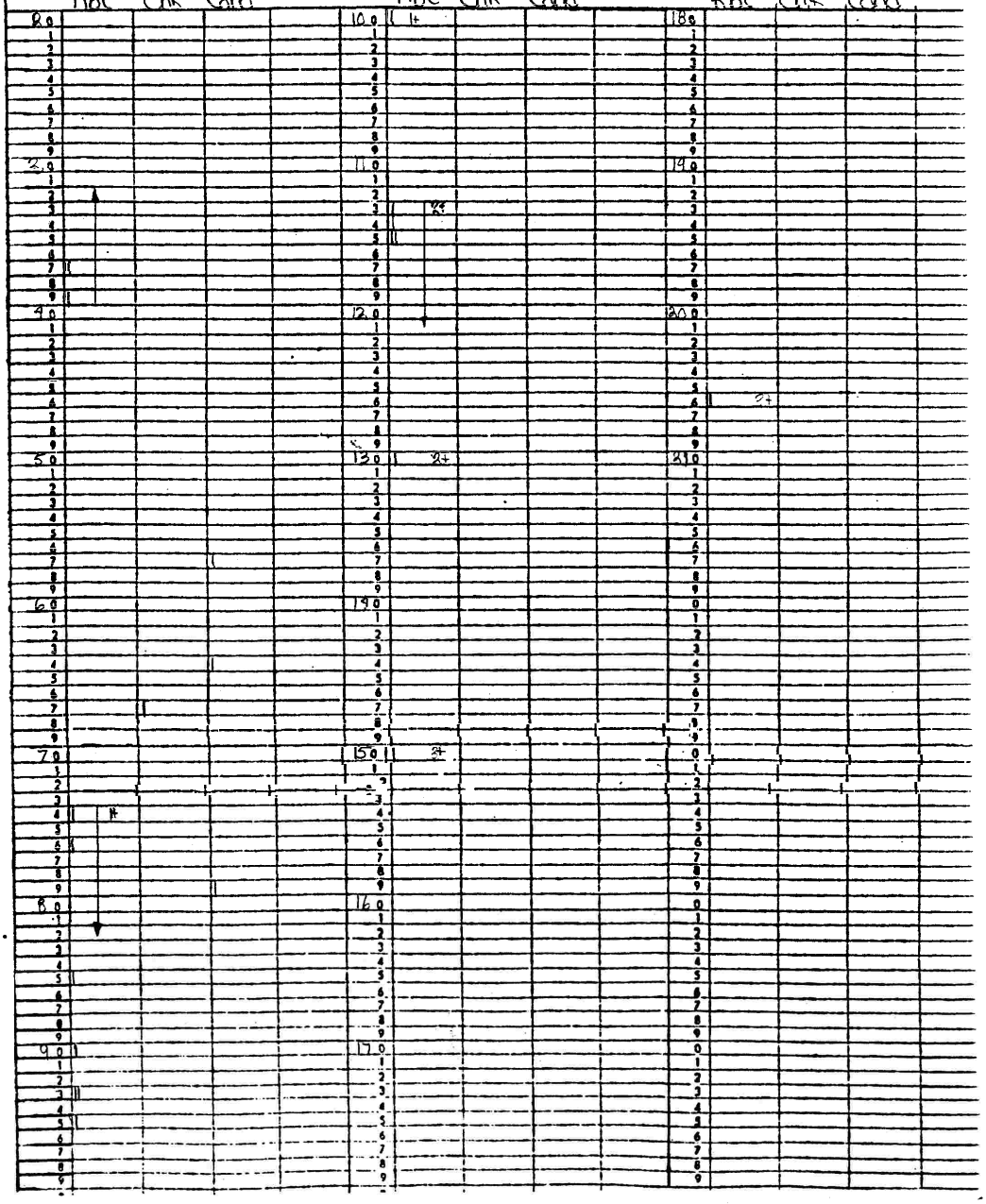
Hydraulic Type	Pool	Glide	Riffle
% area		100%	
mean width		9.0	
mean depth		0.7	
% cover		3.3	
cover type[1]		L, B, OV	
substrate[2]		F10, SG20, LG 40 C20, B10	

COMMENTS: Nice pool but no fry
Rainbow were native - distinctive spotting

[1] L log, B boulder, IV instreamvegetation, OV overstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Cumulative Length-frequency Data Rainbow, Chinook, Coho
Location: Morice - Houston Tommy Cr
Date: August 3 to 26 1982



Houston Tommy Creek - Smolt Yield Modelling

! HOUSTON TOMMY CREEK - SMOLT YIELD MODELLING

STREAM	REACH	LENGTH	WETTED .WIDTH	TOTAL AREA	RIFFLE AREA	RUN AREA	FLAT AREA	POOL AREA	% BOULDER	M.A.T.	TDS	P RIFF	P RUN	P FLAT	P POOL	TOTAL P	H	N	SMOLT DENSITY	SMOLT YIELD
HOUSTON TOMMY	1	6500	10.1	65650	.7	.2	.1	0	10	4.2	55	.0175	.027	.0017	0	.0462	.01386	.03065	.00991221	650.73659
	MSTM 2	7250	10.3	74675	.27	.1	.58	.05	0	4.2	55	0	135	.00086	.0032	.02656	.007968	.03065	.00569845	425.53160
	SC 2	360	5.9	2124	.28	.1	.62	0	.8	4.2	55	0	.0135	.01054	0	.02404	.007212	.03065	.00515778	10.955129
	3	3250	8	26000	.7	.2	.1	0	10	4.2	55	.0175	.027	.0017	0	.0462	.01386	.03065	.00991221	257.71746
	BEL.FALLS	17360		168449																1344.9408
	AB.FALLS 4	20000	10.9	218000	.44	.2	.36	0	4.2	4	55	.0035992	.027	.00612	0	.0367192	.01101576	.03065	.00750296	1635.6445
	STREAM TOTAL																			2980.5853

model used - Keogh River preliminary model (Slaney, 1981)

- adjustments made: - minimum Priff value of 0
  - % Boulder in Reaches 1 and 3 increased to 10% because canyon area was not sampled.
  - parr to smolt survival of 0.3 rather than 0.4

APPENDIX 4. Gosnell Creek and tributaries biophysical sampling data and analysis - 1982

a. Habitat description
b. Fish population estimates
c. Fish capture length - frequency analysis
d. Standing crop estimates - 1980 to 1982
e. Smolt yield modelling

Morice - Gosnell Creek 1980/81/82

Reach 2 (pg. 1 of 2)

											side channel							
Habitat Class	R	R	G	R	G	R	G	G	R	G	G	G	R	G	R			
Length	20	20	47	35	75	3	300	200	14	50	11	30	25	42	16			
Wetted width	19	2	16.5	27	18	18	28	18	12	12	4.5	15	18	15	16			
Channel width	30	30	35	45	35	35	30	80	40	40	--	50	40	74	60			
Area	380	40	775	945	1350	54	8400	3600	168	600	495	450	450	630	256			
Mean depth	.25	.10	.35	.15	.4	.2	.5	.7	.2	.6	.25	1.2	.3	1.0	.3			
Velocity	1.0	-	-	-	-	-	.5	-	-	-	.3	.3	1.7	1.0	1.2			
Log cover	1	0	3	.5	3	0	10	20	1	9	3	10	5	15	3			
Boulder cover	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0			
Instream veg.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0			
Overstream veg.	1	0	13	1	3	0	30	10	0	1	2	8	3	20	3			
Cutbanks	0	0	0	0	2	0	10	5	0	1	0	0	0	8	0			
Total cover	2	0	16	3.5	8	0	50	35	2	11	6	18	8	43	6			
Turbidity	clr.	—	—	—	—	—	—	—	—	→		—	—	—	—			
Gradient	0.7	—	—	—	—	—	—	—	—	→	.5	—	1.2	—	—			
Fines	0	10	15	5	20	0	10	30	0	35	60	50	10	10	0			
Small gravel	30	60	35	25	20	20	40	30	10	45	20	30	10	10	10			
Large gravel	50	30	35	45	40	50	30	20	40	15	15	30	40	50	50			
Cobble	20	0	10	20	15	20	15	20	40	5	5	10	40	30	35			
Boulder	0	0	5	5	5	10	5	0	10	0	0	0	0	0	5			
Bedrock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Compaction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

Marice - Gosnell Creek 1980/81/82

Reach 1-2 pg. 2 of 2

	side channel						Side Channel						Average for Reach					
							POOLS		GLIDES		RIFFLES		POOLS		GLIDES		RIFFLES	
							$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	R	R	G	R	G	N= 0		N=	5	N=	4	N= 0		N=	6	N=	6
Length	4	8	50	20	30	60	-		Σ107 x̄21.4	49	Σ113 x̄28.3	51	-		122	36	Σ122 x̄20.3	14
Wetted width	6	6	6	5	15	15	-		9.1		11.5		-		17.9		15.5	
Channel width	12	13	10	18	40	20	-		38.5		30.75		-		40		36.7	
Area	24	48	300	100	450	900	-		Σ1253.5 x̄350.7	54	Σ1054 x̄263.5	46	-		2183		314	
Mean depth	.20	.10	.10	.30	.15	.30	-		0.6		0.2		-		.48		.18	
Velocity	—	.30	.30	.18	.45	.24	-		0.43		0.88		-		.37		.73	
Log cover	0	0	.5	.3	.10	0	-		5.7		2.1		-		7.5		.43	
Boulder cover	0	0	.1	0	.10	.5	-		0		.03		-		.08		.02	
Instream veg.	0	0	0	0	0	0	-		0		0		-		.17		0	
Overstream veg.	.10	0	.3	.2	0	.10	-		6.26		1.6		-		9.5		.33	
Cutbanks	0	0	2.0	0	.5	0	-		1.6		0.5		-		2.67		.08	
Total cover	.10	0	2.9	.5	.7	.60	-		13.56	5	4.23	2	-		19.9	10	.86	.3
Turbidity	Clr	clr	clr	clr	clr	clr	-		Clr		clr		-		clr		clr	
Gradient	NR	NR	NR	NR	NR	NR	-		.5		1.2		-		-		0.7	
Fines	20	10	10	15	2	5	-		22.5		7.5		-		19.2		2.8	
Small gravel	20	20	20	20	10	15	-		20		15		-		30.8		25.8	
Large gravel	40	30	40	40	30	25	-		35		40		-		27.5		40.8	
Cobble	15	40	20	20	40	40	-		16		33.75		-		17.5		23.3	
Boulder	5	0	10	5	18	15	-		2		3.75		-		5		7.3	
Bedrock	0	0	0	0	0	0	-		0		0		-		0		0	
Compaction	low	low	low	low	low	low	-		low		low		-		low		low	
Reach Length(m) = 8000							Total in Reach		0		18		14		0		56		56	
Total Area (m^2) = 148,032							Area in Reach		0		4,512		3689		0		122,248		17,584	
							%		0						0		88		12	

Morce - Grasnell Creek 1980/1981/1982

Reach 3 pg 1 of 2

Habitat Class	G	R	G	R	P	G	R	G	R	G								
Length	104	92	250	55	11	50	15	100	35	50								
Wetted width	22	26	36	15	4	15	14	20	12	12								
Channel width	44	50	36	44	20	40	17	20	15	22								
Area	2288	2392	9000	825	44	750	210	2000	420	600								
Mean depth	1.0	.45	.75	.35	.4	.8	.3	.3	.4	.5								
Velocity	-	-	-	-	.5	1.0	2.0	1.0	1.5	1.0								
Log cover	200	18	40	80	4	10	1.0	6.0	2.0	12								
Boulder cover	0	0	0	0	0	0	0	0	0	0								
Instream veg.	0	0	0	0	0	0	0	0	0	0								
Overstream veg.	0	24	500	0	0	5	2	12	5	5								
Cutbanks	60	36	60	20	.8	4	0	.5	0	1								
Total cover	260	78	600	100	48	19	3	185	7	18								
Turbidity	clr	→	→	→	→	→	→	→	→	→								
Gradient %	.5	→	→	→	0	-	1.5	1.0	1.5	1.0								
Fines	20	10	10	5	80	30	0	10	10	30								
Small gravel	40	40	30	30	20	20	80	60	50	50								
Large gravel	40	50	50	60	0	10	20	30	40	20								
Cobble	0	0	10	5	0	0	0	0	0	0								
Boulder	0	0	0	0	0	0	0	0	0	0								
Bedrock	0	0	0	0	0	0	0	0	0	0								
Compaction					0	0	0	0	0	0								

Morice - Gosnell Creek 1980/81/82								Side Channel						Average for Reach					
Reach 3 pg 2 of 2								POOLS		GLIDES		RIFFLES		POOLS		GLIDES		RIFFLES	
	Side Channel							$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	R	G	P	G	P	G	N= 0		N= 1		N= 1		N= 3		N= 8		N= 4	
Length	7.1	7.1	12	12	10	10	70	-		7.1		7.1		11		81		49	
Wetted width	3	2.4	15	10	10	12	10	-		3		2.4		8.67		17.5		16.75	
Channel width	20	20	20	15	15	20	15	-		20		20		18.3		26.5		31.5	
Area	21.3	17.0	180	120	100	120	700	-		21.3		17.0		95		141.7		821	
Mean depth	.15	.15	0.5	1.2	.6	.5	.5	-		.15		.15		.7		.62		.38	
Velocity	-	-	.25	.2	-	-	-	-		-		-		.35		.8		1.75	
Log cover	1	1	.3	5	2	2	2	-		1		1		3.7		34		25.25	
Boulder cover	0	0	0	0	0	.5	2	-		0		0		.2		.25		0	
Instream veg.	0	0	0	0	0	0	0	-		0		0		0		0		0	
Overstream veg.	.1	.1	0	0	.3	.3	.3	-		.1		.1		.1		65.3		7.75	
Cutbanks	0	0	.1	0	0	.5	0	-		0		0		.4		15.7		14	
Total cover	1.1	1.1	.4	5	2.3	3.3	4.3	-		1.1		1.1		4.4	5	115.25	6	47	5
Turbidity	clr	clr	clr	clr	clr	clr	clr	-		clr		clr		clr		clr		clr	
Gradient	nr	nr	nr	nr	nr	nr	nr	-		nr		nr		-		0.8		1.5	
Fines	70	70	60	60	20	40	20	-		70		70		60		25		6.25	
Small gravel	25	25	25	25	60	30	30	-		25		25		25		44.4		50	
Large gravel	5	5	12	10	15	20	20	-		5		5		10.7		24.6		43.5	
Cobble	0	0	3	3	5	8	40	-		0		0		3.7		6.0		1.25	
Boulder	0	0	0	0	0	2	10	-		0		0		0.6		0		1.25	
Bedrock	0	0	0	0	0	0	0	-		0		0		0		0		0	
Compaction	-	-	-	-	-	-	-	-		-		-		-		-		-	
Total in Reach								0		21		21		51		137		68	
Area in Reach								0		477		357		4,845		194,129		55,828	
%								0		57		43		2		76		22	

Reach Length 15000m

Total Area 255,636 m^2

GOSNELL CREEK TRIBUTARY "L" 1982

REACH 1

Q = .15 m³/s (5.4 cfs)

	G	R	P	G									Average for Reach					
													POOLS		GLIDES		RIFFLES	
													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	G	R	P	G									N= 1		N= 2		N= 1	
Length	15	20	60	10									60	64.9	12.5	13.5	20	21.6
Wetted width	2	7.5	5	6.5									5		3.8		7.5	
Channel width	8	8	7	7.5									7		7.8		8	
Area	30	150	300	65									300	55	47.5	17.4	150	27.6
Mean depth	.35	.07	1.0	.15									1		.21		.07	
Velocity	.6	.1	.01	—									~.01		~.6		~.1	
Log cover	1	1	4	1									4		1		1	
Boulder cover	0	0	0	0									0		0		0	
Instream veg.	3	0	10	4									10		3.5		0	
Overstream veg.	.1	.5	5	0									5		.05		.5	
Cutbanks	1.5	.5	3	0									3		.75		.5	
Total cover	5.6	2	22	5									22	7.3	5.3	11.1	2	1.3
Turbidity	clr	clr	clr	clr									clr		clr		clr	
Gradient	<.5	<.5	<5	<.5									<5		<.5		<.5	
Fines	70	30	100	50									100		56.3		30	
Small gravel	30	70	0	50									0		43.7		70	
Large gravel	0	0	0	0									0		0		0	
Cobble	0	0	0	0									0		0		0	
Boulder	0	0	0	0									0		0		0	
Bedrock	0	0	0	0									0		0		0	
Compaction	soft mucky like bottom																	
Total in Reach													24		48		24	
Area in Reach (m²)													7,200		2,280		3,600	
%													55		17		28	

Reach Length = 2500 m
Total Area = 13,080 m²

SHEA CREEK 1981/1982

REACH 1

													Average for Reach					
													POOLS		GLIDES		RIFFLES	
													$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	R	G	R	G	G	R	G	G	R	G			N=	0	N=	5	N=	4
Length	14	20	10	40	40	23	12	20	10	30			–		27	74	14.3	26
Wetted width	4	7	8	9	8	7	3	8	3	4			–		6.5		5.5	
Channel width	30	25	40	25	60	70	80	80	80	80			–		58.3		55	
Area	52	140	80	360	320	14[illegible]	3[illegible]	160	30	120			–		189	79	76	21
Mean depth	.2	.4	.2	.3	.35	.15	.15	.25	.15	.30			–		.3		.18	
Velocity	.5	.1	.8	.2	—	—	—	—	—	—			–		.15		.4	
Log cover	0	0	0	0	2	0	0	3	0	1			–		1		0	
Boulder cover	1	1	.2	2	0	2	0	0	0	1			–		0.7		0.8	
Instream veg.	0	0	0	0	0	0	0	0	0	1			–		0.2		0	
Overstream veg.	0	0	0	1	1	0	0	0	0	2			–		0.7		0	
Cutbanks	0	0	0	0	0	0	0	0	0	0			–		0		0	
Total cover	1	1	.2	3	3	2	0	3	0	5			–		2.6	1.0	0.8	1.0
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr			–		clr		clr	
Gradient	1.5	1	1.5	1	–	–	–	–	–	1			–		1		1.5	
Fines	10	60	10	20	10	5	10	20	5	20			–		23.3		7.5	
Small gravel	15	20	40	30	10	15	50	40	40	45			–		32.5		27.5	
Large gravel	25	10	20	25	40	30	20	20	40	20			–		22.5		28.8	
Cobble	35	5	25	20	30	40	25	15	15	10			–		17.5		28.8	
Boulder	15	5	5	5	10	10	5	5	0	5			–		5.8		7.5	
Bedrock	0	0	0	0	0	0	0	0	0	0			–		0		0	
Compaction	low	low	low	low	1	braided							–		low		low	

REACH LENGTH 5000 m — TOTAL IN REACH 0 130 104

TOTAL AREA 32,470 m — AREA IN REACH 24,570 7900

% 76 24

SHEA CREEK 1982

REACH 3 (Falls to Lake area)

Q= 0.4m³/s

Habitat Class	R	G	P	G	R	G	Average for Reach: POOLS x̄	POOLS %	GLIDES x̄	GLIDES %	RIFFLES x̄	RIFFLES %
							N=	1	N=	3	N=	2
Length	3	16	9	6	12	98	9	16.5	38	69.7	7.5	13.8
Wetted width	9	8.5	5	6	5.5	8	5		8		6.2	
Channel width	18	18	22	19	21	15	22		15.6		20.4	
Area	27	136	45	36	66	736	45	4.3	302	86.8	46.5	8.9
Mean depth	.02	.18	.8	.2	.06	.4	.8		.36		.05	
Velocity	.4	.4	—	.3	—	—	—		.35		.4	
Log cover	0	.1	2.1	0	.1	15	2.1		5.8		.05	
Boulder cover	0	0	0	0	0	0	0		0		0	
Instream veg.	.75	.1	1.8	1.4	1	4.5	1.8		2		.88	
Overstream veg.	0	.1	.8	0	0	9.5	.8		3.2		0	
Cutbanks	0	.2	3.3	0	0	2.5	3.3		.9		0	
Total cover	.75	.5	8.6	1.4	1.1	31.5	8.6	19.1	11.9	3.8	.93	2.
Turbidity	clr	clr	clr	clr	clr	clr	clr		clr		clr	
Gradient	Nr	Nr	Nr	Nr	Nr	Nr	Nr		Nr		Nr	
Fines	5	10	15	5	8	60	15		50.3		7.1	
Small gravel	85	75	80	90	90	35	80		43.2		88.6	
Large gravel	10	15	5	5	2	5	5		6.5		4.3	
Cobble	0	0	0	0	0	0	0		0		0	
Boulder	0	0	0	0	0	0	0		0		0	
Bedrock	0	0	0	0	0	0	0		0		0	
Compaction	low	low	low	low	low	low	low		low		low	

REACH LENGTH 3000m

TOTAL AREA 22,620 m²

TOTAL IN REACH	22	65	43
AREA IN REACH	990	19,630	2,000
%	4	87	9

SHEA CREEK													1982	Average for Reach					
REACH 4 (above Lake)														POOLS		GLIDES		RIFFLES	
														$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	R	P	R	G	R	G								N=	1	N	=2	N=	3
Length	7	7	6	10	5	7								7	33.6	8.5	39.5	6	87.9
Wetted width	2	4	2	5	1	4								4		4.6		1.7	
Channel width	15	19	10	15	5	6								19		11.3		10.6	
Area	14	28	12	50	5	28								28	20.4	39	56.9	10.3	88.6
Mean depth	.2	.5	.1	.4	.2	.3								.5		.36		.16	
Velocity	—	.2	—	—	—	—								.12		—		—	
Log cover	2	.75	.1	4	.5	1								.75		2.5		.87	
Boulder cover	0	0	0	0	.25	0								0		0		.08	
Instream veg.	0	0	0	.5	0	0								0		.25		0	
Overstream veg.	.5	.25	0	1	.5	1								.25		1		.3	
Cutbanks	2	0	0	0	.5	1								0		.5		.87	
Total cover	4.5	1	.1	5.5	1.75	3								1	3.6	4.25	10.9	2.1	20.9
Turbidity	clr	clr	clr	clr	clr	clr								clr		clr		clr	
Gradient	—	.5	—	—	—	—								.5		—		—	
Fines	25	20	10	40	10	35								20		38.2		16.8	
Small gravel	40	45	45	30	20	30								45		30		38.7	
Large gravel	35	35	45	20	40	30								35		23.6		29.7	
Cobble	0	0	0	10	20	5								0		8.2		3.2	
Boulder	0	0	0	0	10	0								0		0		1.6	
Bedrock	0	0	0	0	0	0								0		0		0	
Compaction	low	low	low	low	low	low								low		low		low	
REACH LENGTH 10,000m													TOTAL IN REACH	238		476		714	
TOTAL AREA 32,582 m^2													AREA IN REACH	6,664		18,564		7,354	
													%	20		57		23	

GOSNELL CREEK Reach 2 DATE Aug 26/82 AREA 75.8 m² SITE # 1
LENGTH 12 m

SPECIES	AGE	II-RANGE	$\bar{ll}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/m² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	36-92	38.0	0.60	7	0.70	10.00	6.00	0.13	0.08	0.83
	1+	91-99	95.0	9.35	2	0.70	2.86	26.72	0.04	0.35	0.24
	2+	126	126.00	21.70	1	0.70	1.43	31.01	0.02	0.41	0.12
	3+	146	146.0	33.77	1	0.70	1.43	48.24	0.02	0.64	0.12
								111.97	0.21	1.48	1.31
Dv	3+	160	160.0	40.96	1	0.70	1.43	58.51	0.02	0.77	0.12
Mw	≤	50-56	53.0	2.03	2	0.70	2.86	5.80	0.04	0.08	0.24
Cottid.	≤	102-148	125.0	21.52	2	0.70	2.86	61.47	0.04	0.81	0.24

HABITAT DESCRIPTION: Sidechannel Glide/Riffle

Discharge ~~0.2.4~~ 17.3 cfs Gradient N/R

Temperature (°C) 14° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		38	62
mean width		7.3	5.9
mean depth		0.10	0.20
% cover		0.2	0.
cover type[1]		L, C	—
substrate[2]		F20, SG20, LG10	F 10, SG 20, LG 30,
		C15, B5	C40

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Gosnell Creek Reach 3 — DATE Aug 26/82 — AREA 38.3 M² — SITE # 2 — LENGTH 19.2 M

SPECIES	AGE	II-RANGE	$\bar{II}$	MEAN WEIGHT	C_i	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	1+	68-78	72.00	4.28	2	0.65	3.08	13.17	0.08	0.34	0.22
Coho	0+	55-66	58.75	2.47	4	0.65	6.15	15.22	0.16	0.40	0.43
Chk	0+	56-100	79.67	6.17	6	0.65	9.23	56.97	0.24	1.49	0.65
Cut	2+	120	120.0	19.01	1	0.65	1.54	29.24	0.04	0.76	0.11
Dv	0+	41-51	46.00	1.01	2	0.65	3.08	3.10	0.08	0.08	0.22
	1+	72-84	78.00	4.79	4	0.65	6.15	29.46	0.16	0.77	0.48
	8+	115	115.0	15.21	1	0.65	1.54	23.40	0.04	0.61	0.11
								55.96	0.28	1.46	0.76
Mw	Σ	45-51	48.75	1.57	4	0.65	6.15	9.69	0.16	0.25	0.43

HABITAT DESCRIPTION: Side channel Riffle/Glide

Discharge —

Gradient N/R

Temperature (°C) 12°

Turbidity

Hydraulic Type	Pool	Glide	Riffle
% area		50	50
mean width		3	2.4
mean depth		0.15	
% cover		5.7	
cover type[1]		L, OV	
substrate[2]		F 70, SG 25, LG 5	

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

SHEA CREEK REACH 1 DATE Aug 26/82 AREA 56 M^2 SITE # 1
LENGTH 14 M

SPECIES	AGE	FL-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear meter
Rbt	0+	39-51	40.74	0.76	27	0.65	41.54	31.61	0.74	0.56	2.97
	1+	74-96	82.44	6.20	9	0.75	12.00	74.35	0.21	1.33	0.86
	2+	115	115.0	16.50	1	0.75	1.33	22.00	0.02	0.39	0.10
								127.96	0.97	2.28	3.93
Cotb	0+	41-57	49.56	1.51	12	0.65	18.46	27.89	0.33	0.50	1.32
Dv	0+	49	49.00	1.18	2	0.65	3.08	3.62	0.05	0.06	0.22

HABITAT DESCRIPTION: Riffle habitat

Discharge 0 ~ .8 cms 9.8 cfs Gradient 1.5

Temperature (°C) 14° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			4
mean depth			0.20
% cover			1.8
cover type[1]			B
substrate[2]			F10, SG 15, LG 25 C 35, B 15

COMMENTS: Same site as 1981, flow much lower
Dead adult lamprey present

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

SHEA CREEK REACH 3 DATE Aug 26/82 AREA 60.4 m^2 SITE # 2
LENGTH 11.7 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{P}$	$\bar{n}$	TOTAL BIOMASS	No/m^2 DENSITY	BIOMASS DENSITY	No / linear mete
Cut	0+	26	26.00	0.19	1	0.60	1.67	0.38	0.08	0.01	0.14
	1+	75	75.00	4.69	1	0.80	1.25	5.80	0.02	0.10	0.11
								6.12	0.05	0.11	0.25
Dv	C+	36-48	41.67	0.75	6	0.60	10.00	7.46	0.17	0.12	0.85

HABITAT DESCRIPTION: Riffle/Glide habitat

Discharge C a. 30 cfs 10.6 cfs Gradient N/R

Temperature (°C) 11° Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		84.9	15.1
mean width		5.8	6.8
mean depth		0.18	0.02
% cover		0.8	1.2
cover type[1]		L, IV, OV, C	IV
substrate[2]		F10, SG75, LG15	F5, SG85, LG10

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fine s, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

SHEA CREEK REACH 4 DATE Aug 26/82 AREA 52 M^2 SITE # 3
LENGTH 19 M

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Cut.	0+	26-35	31.50	0.35	6	0.6	10.00	3.47	0.24	0.08	0.71
	1+	59-62	60.50	2.41	2	0.6	3.33	8.02	0.08	0.19	0.24
								11.49	0.32	0.27	0.95
Dv.	1+	77-79	78.00	4.75	3	0.6	5.00	23.74	0.12	0.57	0.36

HABITAT DESCRIPTION: Riffle/Pool habitat

Discharge On.11 3.9cfs Gradient ~.5

Temperature (°C) 12.5 Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area	66		34
mean width	4.0		2.0
mean depth	0.50		0.20
% cover	2.4		10.7
cover type[1]	L, OV		L, OV, C.
substrate[2]	F20, SG 45, LG35		F 25, SG 40 LG35

COMMENTS: Creek generally good looking habitat

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

GOSNELL TRIB "L" DATE Aug 26/82 AREA 75 M^2 SITE # 1
LENGTH 81 M

SPECIES	AGE	II-RANGE	$\bar{l}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Dv	0+	40-55	47.37	1.09	19	.85	22.35	24.31	0.30	0.32	1.06
	1+	86	86.00	6.36	1	.85	1.18	7.48	0.02	0.10	0.06
							23.53	31.79	0.32	0.42	1.12

HABITAT DESCRIPTION: Glide head/Riffle habitat in swamp

Discharge Qn .2 m^3/s 7.1 cfs Gradient < 0.5 %
Temperature (°C) 9° @ 1030 HRS Turbidity Clear

Hydraulic Type	Pool	Glide head	Riffle
% area		90	60
mean width		2.0	7.5
mean depth		0.35	0.07
% cover		8.7	2.8.
cover type[1]		L, IV, OV, C	L, OV, C.
substrate[2]		F 70, SG 30	F 30 SG 70

COMMENTS: Confined channel, good looking gravel, accessible to lake.

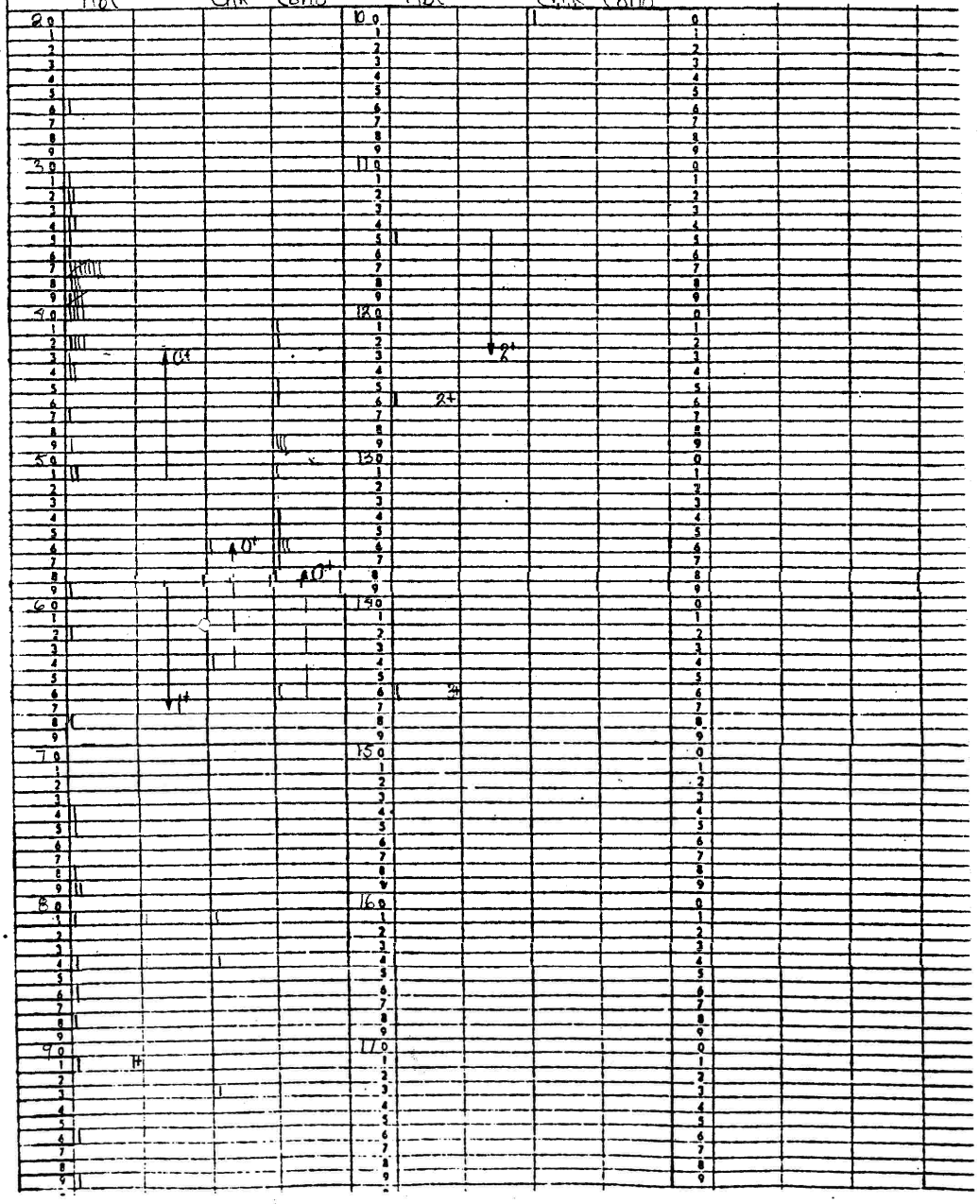
[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fine s, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Cumulative Length-frequency Data - Rainbow trout, Coho, Chinook

Location: Morice Gosnell Cr

Date: August 23 + 026 1982



Standing crop estimates of juvenile steelhead in the Gosnell Creek system, 1980 to 1982.

Reach		Length	Extrapolation Site	Fish Density(No/m)			Standing Crop		
				Rb 0+	Rb parr	Coho	Rb 0+	Rb parr	Coho
1981									
Gosnell	1	3,000	(1)	0	0.26	1.43	0	780	4,290
	2	8,800	1	0	0.26	1.43	0	2,290	12,580
	3	3,500	1	0	0.26	1.43	0	910	5,000
	3a	11,800	2	0.02	0	1.29	230	0	15,220
	4	6,000	3	0	0	0	20	0	0
	5	10,000	4	0	0	0.14	0	0	1,400
	6	6,500	3/4	0	0	0.07	0	0	450
Shea	1	5,000	1	0.37	0.55	0.68	1,850	2,750	3,400
	2	4,000	(1)	0.37	0.55	0.68	1,480	2,200	2,720
Σ							3,560	8,930	45,060
1982									
Gosnell	1		(1)	0.83	0.48	0	2,490	1,440	0
	2		1	0.83	0.48	0	7,300	4,220	0
	3		1	0.83	0.48	0	2,900	1,680	0
	3a		2	0	0.22	0.43	0	2,590	5,070
	4		(3)	0	0	0	0	0	0
	5		(4)	0	0	0	0	0	0
	6		(3/4)	0	0	0	0	0	0
Shea	1		1	2.97	0.96	1.32	14,850	4,800	6,600
	2		(1)	2.97	0.96	1.32	11,880	3,840	5,280
Σ							39,420	18,570	16,950
1980									
Gosnell	1		(1)	1.43	0.87	0	4,290	2,610	0
	2		1	1.43	0.87	0	12,580	7,660	0
	3		1	1.43	0.87	0	5,000	3,040	0
	3a		2	0	0.12	0.19	0	1,410	2,240
	4		(3)	0	0	0	0	0	0
	5		(4)	0	0	0	0	0	0
	6		(3/4)	0	0	0	0	0	0
Shea	1		1	0.22	0.09	1.12	1,100	450	5,600
	2		(1)	0.22	0.09	2.23	880	360	4,480
Σ							23,850	15,530	12,320

!GOSNELL CREEK SYSTEM -- SMOLT YIELD ESTIMATES USING ORIGINAL SLANEY MODEL

STREAM	REACH	LENGTH	WETTED WIDTH	TOTAL AREA	RIFFLE AREA	RUN AREA	FLAT AREA	POOL AREA	%BOULDER	M.A.T.	T.D.S.	P RIFF	P RUN	P FLAT	P POOL	TOTAL P	H	N	SMOLT DENSITY	TOT SMOLT YIELD
SHEA	3	3000	7.5	22500	.09	.17	.7	.04	0	4.5	60	0	.02295	.0119	.00256	.03741	.011223	.0331	.00928703	208.95823
	4	10000	3.2	32000	.23	.17	.4	.2	0	4.5	60	0	.02295	.0068	.0128	.04255	.012765	.0331	.01056304	338.0172
GOSNELL	3	11500	6.8	78200	.22	.16	.6	.02	0	4.2	60	0	.0216	.0102	.00128	.03308	.009924	.0331	.00766464	599.37454
	4	6000	6.8	40800	.29	.17	.6	.04	0	4.2	50	0	.02295	.0102	.00256	.03571	.010713	.0282	.00704915	287.60548
TRIB L	1	2500	5.2	13000	.28	.07	.1	.55	0	4.2	50	0	.00945	.0017	.0352	.04635	.013905	.0282	.00914949	118.94337
	2	3500	3	10500	.3	.2	.5	0	5	4.2	50	.00315	.027	.0085	0	.03865	.011595	.0282	.00762951	80.109855

APPENDIX 5. Thautil River and tributaries biophysical sampling and analysis - 1982

a. Habitat description
b. Fish population estimates
c. Fish capture length - frequency analysis
d. Smolt yield modelling

Morice			1981/1982				Side Channel						Average for Reach					
Thautil River			Page 2 of 2.				POOLS		GLIDES		RIFFLES		POOLS		GLIDES		RIFFLES	
Reach 1	sidechannel						$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%	$\bar{x}$	%
Habitat Class	R	G	R	G	R	G	N = 1		6		16		1		5		5	
Length	42	46	19	39	7	17	24		Σ343.1 x̄ 57.2		Σ389.4 x̄ 64.9		100		Σ124. x̄ 20.7		Σ193.4 x̄ 38.6	
Wetted width	12	15	12	13	5	5.5	20		14.9		16.2		18		7.6		6.6	
Channel width	56	42	62	58	—	—	120		69		64.6		20		36.6		33.8	
Area	504	690	228	507	21	59.5	480		852		1051		1800		157.4		136.4	
Mean depth	.3	.6	.25	.15	.15	.35	1.2		.4		.23		1.5		.91		.26	
Velocity	—	—	—	—	.6	.3	—		.4		.65		.1		0.67		1.2	
Log cover	4	23	0	24	2	3	0		10.8		1.		.5		.8		.12	
Boulder cover	2	0	0	0	0	0	0.4		0.33		2.3		.3		.1		2.6	
Instream veg.	0	0	0	0	0	0	0		0.03		0.05		0		.05		.03	
Overstream veg.	0	0	0	9	0	3	0		2.5		0		0		.3		.3	
Cutbanks	0	0	0	9	.5	1.5	0		1.75		0.08		0		0		0	
Total cover	3	23	0	42	2.5	4.5	0.4	0	15.4	1.8	3.4	0.3	.9	.09	2.2	1.4	2.9	2.1
Turbidity	clr	→	→	→	→	→	clr		clr		clr		clr		clr		clr	
Gradient	—			—	—	—	—		1		2		0		<1		~2	
Fines	0	0	0	5	5	5	20		10		7.5		60		15.7		8.9	
Small gravel	5	5	0	5	5	10	5		14.8		10.8		10		29.3		16.8	
Large gravel	20	30	20	25	15	15	10		25		20		10		21		26.3	
Cobble	60	50	60	50	60	55	54		40.8		47.5		10		19.8		32.7	
Boulder	15	15	20	15	15	15	5		9.1		14.1		10		16.3		11.8	
Bedrock	0	0	0	0	0	0	1		0.17		0.17		0		8.9		0	
Compaction	0	0	0	0	0	0	0		low		low		low		low		low	
Reach Length(m) = 25000			Total in Reach				6.6		39.7		39.7		72		360		360	
Side channel (m) = 5000			Area in Reach				3170		33,820		41,720		129,600		56,660		49,100	
			%				4		43		53		55.		24.		21.	

Morice 1981/1982 Page 1 of 2

Thautil River

Reach 1

							Side Channel							sidechannel				
Habitat Class	R	G	R	G	R	G	G	R	G	R	R	G	P	R	G	R	P	G
Length	9	7	15	40	27	48	3.1	9.4	12	3	60	80	100	255	60	57	24	178
Wetted width	6	4	6	7	4	5	3.4	2.45	18	18	8	10	18	39	28	28	20	27
Channel width	40	40	40	40	40	40	95	85	25	30	30	30	30	100	105	100	120	115
Area	54	28	90	280	108	240	10.5	58.4	216	54	480	800	1800	9945	1680	1596	480	4806
Mean depth	.3	.35	.10	.35	.25	.35	.2	.15	.5	.15	.3	.5	1.5	.3	.3	.25	1.2	.7
Velocity	—	—	—	—	—	—	.5	.7	.5	1.2	1.5	1.0	.1	—	—	—	—	—
Log cover	.5	0	0	1	0	3	1	.2	0	0	0	0	.5	0	14	0	0	0
Boulder cover	5	1	5	5	0	0	0	.2	0	.3	3	2	.3	10	0	1.8	0.4	2.0
Instream veg.	0	0	0	0	0	0	2	.3	0	0	0	0	0	0	0	0	0	0
Overstream veg.	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3.0
Cutbanks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total cover	5.5	1	5	4	8	5	1.2	1.7	0	.3	5	2	.8	10	14	1.8	0.4	5.0
Turbidity	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	clr	→				
Gradient	—	—	—	—	—	—	1	2	1	2	2	1.5	0	—	—	—	—	—
Fines	0	5	0	10	5	45	30	30	10	10	10	0	60	5	15	5	20	5
Small gravel	10	15	10	15	10	45	40	30	30	10	10	10	10	10	10	15	5	19
Large gravel	30	40	35	25	50	5	20	20	30	20	20	20	10	20	30	25	10	30
Cobble	40	30	50	15	30	5	10	10	30	40	30	20	10	45	45	50	54	35
Boulder	20	10	5	5	2	0	0	10	0	30	30	40	10	20	0	5	5	10
Bedrock	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Compaction	low	low	low	low	low	low	low	low	low	low	low	low	low	0	0	0	0	0

• Habitat characteristics of STARR CR. REACH 1 — 27 AUG 81

HABITAT TYPE
REACH LENGTH (m) 2000 — Total Area = 14,920 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	0		2		2	
Average length (m)			15	36	26.5	64
Average wetted width (m)			11	50	5.5	17
Average channel width (m)			36		42	
Average depth (cm)			.27		.4	
Average area (m^2)			165		146	
Total no. of units in reach	0		48		48	
Total area of units in reach (m^2)	0		7,920	53	7,000	47
Average area log debris cover (m^2)			0	0	0	0
Average area boulder cover (m^2)			12	5	9.5	6
Average area instream vegetation (m^2)			0	0	0	0
Average area overstream vegetation (m^2)			0	0	0	0
Average area cutbanks (m^2)			0	0	0	0
Average area total cover (m^2)			12	5	9.5	6
Average % substrate fines				2.5		25
Average % substrate small gravel				7.5		75
Average % substrate large gravel				25		27.5
Average % substrate cobbles				30		30
Average % substrate boulder				35		32.5
Average % substrate bedrock				0		0

$\bar{x}$ Velocity —

$\bar{x}$ gradient 1%

$\bar{x}$ width = 7.5m.

• Habitat characteristics of DENYS CR. 27 AUG 81

REACH 1

HABITAT TYPE
REACH LENGTH (m) 4500 Total Area = 45,670

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	0		3		2	
Average length (m)			18.3	62	16.5	38
Average wetted width (m)			10	66.3	10.5	59
Average channel width (m)			17.6		20.5	
Average depth (cm)			.2		.32	
Average area (m^2)			183		173	
Total no. of units in reach			153		102	
Total area of units in reach (m^2)			28,000	61	17,670	39
Average area log debris cover (m^2)			1	1	1	1
Average area boulder cover (m^2)			3	2	2	1
Average area instream vegetation (m^2)			0	0	0	0
Average area overstream vegetation (m^2)			7.7	5	4.5	3
Average area cutbanks (m^2)			0	0	.5	.3
Average area total cover (m^2)			11.7	8	8	5.3
Average % substrate fines				3.3		12.5
Average % substrate small gravel				10		12.5
Average % substrate large gravel				41.7		42.5
Average % substrate cobbles				36.7		27.5
Average % substrate boulder				8.3		5
Average % substrate bedrock				0		0

$\bar{x}$ velocity - 1
$\bar{x}$ gradient - 2
$\bar{x}$ width - 10.1m

• Habitat characteristics of L OTUH CR. 27 AUG '81

REACH 1

HABITAT TYPE
REACH LENGTH (m) 5000

Total Area = 17,220 m^2

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	0		3		3	
Average length (m)			9.67	47	11	53
Average wetted width (m)			4	69	3.7	51.7
Average channel width (m)			5.7		7.7	
Average depth (cm)			.15		.23	
Average area (m^2)			30.7	43	40.5	57
Total no. of units in reach			242		242	
Total area of units in reach (m^2)			7420	43	9800	57
Average area log debris cover (m^2)			.3	1	1	1
Average area boulder cover (m^2)			4	13	4.33	3
Average area instream vegetation (m^2)			0	0	0	0
Average area overstream vegetation (m^2)			1	3	5	12
Average area cutbanks (m^2)			0	0	0	0
Average area total cover (m^2)			5.3	17	7.3	16
Average % substrate fines				5		6.7
Average % substrate small gravel				13.3		23.3
Average % substrate large gravel				36.7		40
Average % substrate cobbles				31.7		21.7
Average % substrate boulder				13.3		8.3
Average % substrate bedrock				0		0

$\bar{x}$ velocity - —

$\bar{x}$ gradient - 1.5%

$\bar{x}$ width = 3.4 m

Morice - Thautil River
Reach 1

DATE Aug 26/82 AREA 48.82 m^2 SITE # 1
LENGTH 12.5 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	27-32	29.00	0.27	6	.7	8.57	2.29	0.20	0.05	0.69
	1+	102	102.00	11.51	1	.7	1.43	16.45	0.03	0.38	0.11
	≤							18.74	0.23	0.43	0.80
Coho	0+	95	95.00	1.09	1	.7	1.43	1.56	0.03	0.04	0.11
Dv	0+	43-45	44.00	0.85	2	.7	2.86	2.44	0.07	0.06	0.23

HABITAT DESCRIPTION: Glide/Riffle Sidechannel

Discharge Qn.26 m^3/s 9.2cfs Gradient 1-2 %
Temperature(°C) 15° @ 1200HRS Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		24.3	75.7
mean width		3.35	3.45
mean depth		.2	.15
% cover		2.8	4.0
cover type[1]		L, IV,	L, B, IV, OV
substrate[2]		F30, SG40 LG20 C10	F30, SG30, LG20 C10, B10

COMMENTS:

[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Morice- Thautil River — DATE Aug 26/82 — AREA 54 m² — SITE # 2
Reach 1 — LENGTH 9 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/m² DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	1+	82-89	85.67	6.13	3	0.7	4.29	56.28	0.08	0.49	0.48
	2+	102-111	106.5	13.18	2	0.7	2.86	37.65	0.05	0.70	0.22
	3+	132-166	146.00	34.70	2	0.7	2.86	99.14	0.05	1.84	0.32
								73.07	0.18	3.03	1.12
Mw	≥	273	273.0	[illegible]	1	0.7	1.43	398.90	0.03	7.27	0.16

HABITAT DESCRIPTION: Riffle

Discharge — Gradient ≈ >1%

Temperature (°C) 15° @ 1230 HRS Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			6
mean depth			.30
% cover			10.2
cover type[1]			L, B
substrate[2]			FC, SG 10, LG 30, C 40 B 20

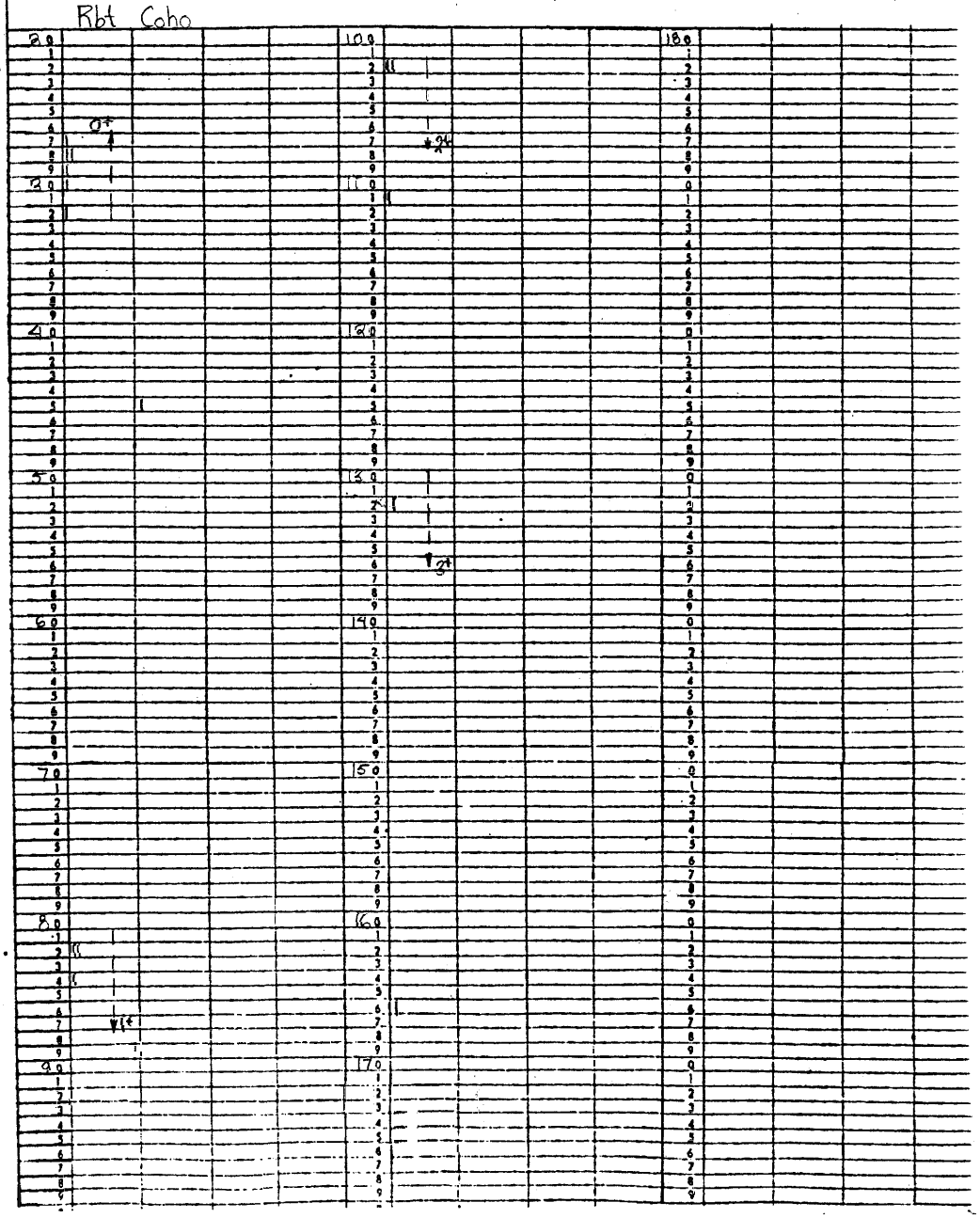
COMMENTS: - May be best parr habitat in river
- Side channels in area.
- Slightly higher gradient than surrounding areas

[1] L log, B boulder, IV instreamvegetation, OV overstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Cumulative Length-frequency Data
Location: Mouth - THUTIL RIVER
Date: August 23 to 26 1982

Rbt Coho



THAUTIL RIVER SYSTEM -- SMOLT YIELD ESTIMATES USING ORIGINAL SLANEY MODEL

STREAM	REACH	LENGTH	WETTED WIDTH	TOTAL AREA	RIFFLE AREA	RUN AREA	FLAT AREA	POOL AREA	%BOULDER	M.A.T.	T.D.S.	P RIFF	P RUN	P FLAT	P POOL	TOTAL P	H	N	SMOLT DENSITY	TOT SMOLT YIELD
THAUTIL	1	22000	10	220000	.45	.1	.4	.05	1	4.5	60	-.000495	.0135	.0068	.0032	.023005	.0069015	.0331	.00571099	1256.4181
STARR	1	2000	8.8	17600	.6	.1	.3	0	5	4	50	.0063	.0135	.0051	0	.0249	.00747	.0282	.00468120	82.389120
	2	4500	8	36000	.2	.1	.6		0	4	50	0	.0135	.0102	0	.0237	.00711	.0282	.00445560	160.40160
DENYS	1	4000	10	40000	.6	.1	.3	0	1.5	4	50	.00021	.0135	.0051	0	.01881	.005643	.0282	.00353628	141.45120
																				1640.6600

parr capacity = smolt yield ÷ 0.3

fry required = parr capacity ÷ 0.17

APPENDIX 6. Mainstem Morice River biophysical sampling and analysis - 1982.

a. Fish population estimates
b. Fish capture length - frequency analysis
c. Analysis of mainstem sampling - 1980 to 1982

Morice River Mainstem DATE Aug 23/82 AREA 85.5 m² LENGTH 28.5 m SITE # Morice West

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /M² DENSITY	BIOMASS DENSITY	No /linear metre
Rbt	0+	32-36	34.00	c.98	5	0.7	7.14	3.07	0.08	0.04	0.25
Chk	0+	50-68	61.90	2.66	10	0.6	16.67	44.28	0.19	0.52	0.58
Cottidae	≥	45	45.00	0.91	1	0.7	1.43	1.30	0.02	0.02	0.05

HABITAT DESCRIPTION: Glide edge sample

Discharge	—	Gradient	N/R
Temperature (°C)	N/R	Turbidity	Clear
Hydraulic Type	Pool	Glide edge	Riffle
% area		100	
mean width		40 (3 sampled)	
mean depth		.6 m.	
% cover		1.2	
cover type[1]		B	
substrate[2]		F30 SG10, LG10 C40 B10	

COMMENTS: Envirocon emergence trap here. Peak 1 week before fish 29-30mm, add one to 40mm.

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] Ffines, SG small gravel, LG large gravel, Ccobbles, B boulders, Br bedrock

Morice River Mainstem DATE Aug 23/82 AREA 281.2 m^2 SITE # 32 mile
LENGTH 23 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/m^2 DENSITY	BIOMASS DENSITY	No / linear meter
Rbt	0+	30-47	38.67	0.67	12	0.8	15.00	10.04	0.05	0.04	0.65
	1+	75-84	78.63	5.30	8	0.8	10.00	52.96	0.04	0.19	0.43
								63.00	0.09	0.23	1.08
Chk	0+	53-61	56.64	2.01	11	0.8	13.75	27.64	0.05	0.10	0.60
Coho	0+	54-72	61.33	2.90	3	0.8	3.75	10.89	0.01	0.04	0.16
Mw	≥	90-89	51.15	2.00	27	0.8	33.75	67.59	0.12	0.24	1.47
LnD	≥	48-93	65.31	3.48	35	0.8	43.75	152.42	0.15	0.54	1.90

HABITAT DESCRIPTION: Side channel Riffle / Glide head

Discharge — Gradient ≈ .5 - 2%

Temperature (°C) 15° @ 1900 HRS Turbidity clear

Hydraulic Type	Pool	Glide head	Riffle
% area		20.9	79.1
mean width		7.4	15
mean depth		.25	.07
% cover		—	—
cover type[1]		—	—
substrate[2]		F30, SG20, LG50	F5, SG30, LG60, C5

COMMENTS: Riffle and glide may have been a little fast for fry but edges should have been loaded

[1] L log, B boulder, IV instreamvegetation, OVoverstream vegetation, C cutbanks

[2] F fines, SG sndlgravel, LG large gravel, C cobbles, Bboulders, Br bedrock

Morice River Mainstem DATE Aug 23/82 AREA 295 m^2 SITE Lamprey confluence
LENGTH 35 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/m^2 DENSITY	BIOMASS DENSITY	No/ linear meter
Rbt	0+	29-47	33.13	0.42	15	0.8	18.75	7.82	0.08	0.03	0.54
	1+	67-85	77.33	5.16	3	0.8	3.75	19.35	0.02	0.08	0.11
								27.17	0.10	0.11	0.65
Chk	0+	50-54	51.75	1.53	4	0.8	5.00	7.64	0.02	0.03	0.14
Mw	≥	50	50.00	1.69	1	0.8	1.25	2.11	0.01	0.01	0.09
LnD	≥	28-71	47.56	1.48	27	0.8	33.75	49.97	0.14	0.20	0.96

HABITATDESCRIPTION: Glr leadge

Discharge	—	Gradient	1%
Temperature (°C)	16° @1600 HRS	Turbidity	Clear
Hydraulic Type	Pool	Glide	Riffle
% area		100%	
mean width		60 (7.0 sampled)	
mean depth		0.3	
% cover		0	
cover type[1]		—	
substrate[2]		F 5, SG, 10, LG 35, C 40, B 10	

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstreamvegetation, C cutbanks

[2] Ffines, SG smallgravel, LGlarge gravel, C cobbles, Bboulders, Brbedrock

Morice River Mainstem DATE Aug 21/82 AREA 156.4 M^2 SITE # 21 mile
LENGTH 19 M

SPECIES	AGE	II-RANGE	$\bar{ll}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M^2 DENSITY	BIOMASS DENSITY	No / linear mete
Rbt	0+	29-41	34.67	0.97	18	0.8	22.50	10.57	0.14	0.07	1.18
	1+	66-78	71.88	9.08	8	0.8	10.00	40.75	0.06	0.26	0.53
								51.32	0.20	0.33	1.71
Chk	0+	49-60	53.47	1.70	15	0.8	18.75	31.89	0.12	0.20	0.99
Mw	≥	40-55	38.25	0.79	4	0.8	5.00	3.97	0.03	0.03	0.26
LnD	≥	39-79	52.09	1.88	25	0.8	31.25	58.64	0.20	0.37	1.64
Cottidae	≥	69	69.00	2.62	1	0.8	1.25	3.28	0.01	0.02	0.07

HABITATDESCRIPTION: Sidech annel

Discharge —
Gradient N/R
Temperature (°C) 14°
Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area			100%
mean width			8.24
mean depth			.10
% cover			0
cover type[1]			—
substrate[2]			F5, SG30 LG40 C35

COMMENTS:

[1] L log, B boulder, IV instreamvegetation, OVoverstream vegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Monice mainstem DATE Aug 24/82 AREA 88.5 m^2 SITE # Aspen camp
LENGTH 14.5 m

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No /m^2 DENSITY	BIOMASS DENSITY	No /lin m site
Rbt	0+	29-96	35.04	0.50	23	0.6	38.33	19.19	0.48	0.22	2.64
	1+	62-90	73.91	4.59	11	0.6	18.33	84.18	0.21	0.95	1.26
								103.37	0.69	1.17	3.90
Coho	0+	40-60	48.79	1.43	19	0.6	28.33	33.45	0.26	0.38	1.61
ChK	0+	45-80	57.12	2.14	41	0.6	68.33	146.47	0.77	1.66	9.71
Dv	2+	152	152.00	35.12	1	0.6	1.67	58.53	0.02	0.66	0.11
Mw	≤	45	45.00	1.23	1	0.6	1.67	2.05	0.02	0.02	0.11
LnD	≤	50-105	69.00	5.46	3	0.6	5.00	27.28	0.06	0.31	0.34

HABITAT DESCRIPTION: Boulder/cobble mainstem edge. glide

Discharge — Gradient N/R

Temperature (°C) 16° Turbidity Clear

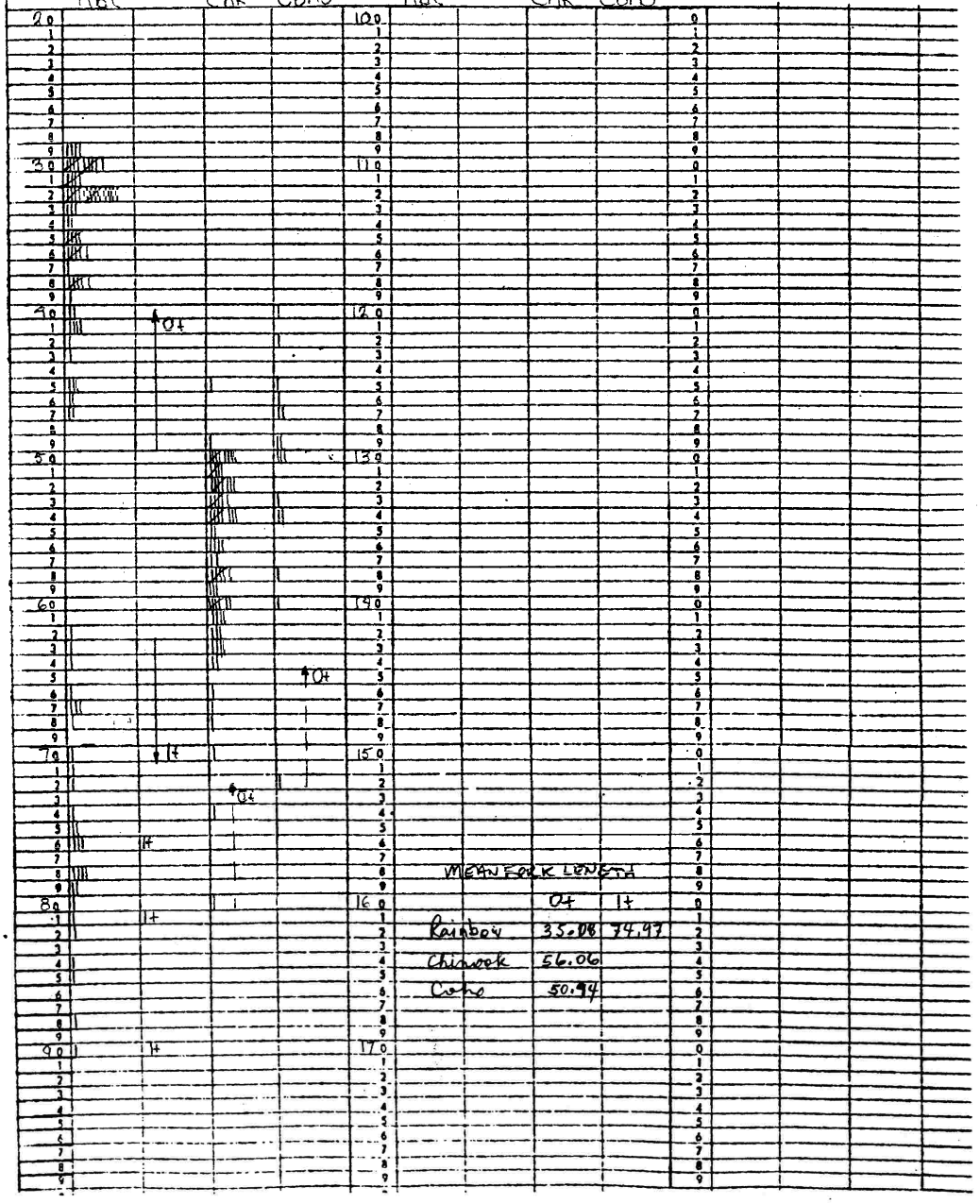
Hydraulic Type	Pool	Glide	Riffle
% area		100%	
mean width		6.1	
mean depth		.4	
% cover		≈10	
cover type[1]		B	
substrate[2]		F2, SG3, LG40 C40, B15	

COMMENTS: Site approx 40 below confluence of Monice R and "washout" creek.

[1] L log, B boulder, IV instreamvegetation, OV overstreamvegetation, C cutbanks

[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

Cumulative Length-frequency Data - Rainbow trout, Chinook, Coho
Location: Morice River - mainstem
Date: August 31 to 2 Sept 1982



APPENDIX Table 6-1. Summary of 1980 to 1982 juvenile steelhead density in No/m (No/m^2) in the Morice River.

Site	Habitat	Year	Steelhead Density		
			0+	1+	2+
Reach 1					
1. Islands above Gosnell	edge of fast riffle in braided channel; good gravel/cobble riffle glide	1981	3.31 (0.67)	0	0
2. Morice West Road bridge	edge of fast glide; cobble/boulder edge	1981	0.37 (0.15)	0	0
		1982	0.25 (0.08)	0	0
Reach 2					
3. 33 Mile sidechannel	riffle glide; mostly fines and small gravel	1980	0.93 (0.18)	0.05 (0.01)	0.05 (0.01)
4. 33 Mile mainstem edge	edge of glide; flat habitat with gravels and fines	1980	0.71 (0.09)	0	0
5. 32 Mile sidechannel	glide riffle in open cobble sidechannel	1980	3.00 (0.11)	0.31 (0.01)	0
		1981	2.67 (0.39)	0	0
		1982	0.65 (0.05)	0.43 (0.04)	0
6. 32 Mile sidechannel	top end of small channel; pool glide with debris	1980	1.27 (0.24)	0.13 (0.03)	0
		1981	0.63 (0.11)	0	0
		1982	dry at sample time		
7. Lamprey confluence	mainstem edge of glide; cobble/large gravel substrates	1981	1.01 (0.25)	0.06 (0.01)	0
		1981	1.07 (0.31)	0	0
		1982	0.54 (0.08)	0.11 (0.02)	0
8. Lamprey sidechannel 1	small sidechannel of larger open channel-glide/riffle	1981	0.96 (0.20)	0.09 (0.02)	0
9. Lamprey sidechannel 2	glide habitat in large, often deep channel	1980	0.74 (0.11)	0.29 (0.04)	0.09 (0.01)
10. Lamprey sidechannel 3	riffle-pool-side pool habitat	1980	1.10 (0.11)	0	0
11. Lamprey sidechannel 4	open channel with log cover--riffle/glide	1981	1.15 (0.29)	0.10 (0.03)	0
12. 21 Mile sidechannel	open channel-riffle/glide with gravel substrates	1980	1.72 (0.11)	0.34 (0.02)	0.05 (0.01)
		1981	2.35 (0.15)	0.20 (0.01)	0
		1982	1.18 (0.14)	0.53 (0.06)	0
Reach 3					
13. Aspen camp	cobbled edge of mainstem glide	1981	2.67 (0.41)	0	0
		1982	2.64 (0.43)	1.26 (0.21)	0

APPENDIX Table 6-2. Mainstem edge and sidechannel sites--fry population

Site	Density (No/m)		
	1980	1981	1982
1	-	3.31	-
2	-	0.37	0.25
3	0.93	-	-
4	0.71	-	-
5	3.00	2.67	0.65
6	1.27	0.63	-
7	-	0.63	0.54
8	-	0.96	-
9	0.74	-	-
10	1.10	-	-
11	-	1.15	-
12	1.72	2.35	1.18
13	-	2.67	2.64
Mean (all sites)	1.35	1.68	1.05
Reach 1	-	1.84	0.25
Reach 2	1.35	1.47	0.80
Reach 3	-	2.67	2.64

APPENDIX Table 6-3. Mainstem edge and sidechannel sites--1+ parr population

Site	Density (No/m)		
	1980	1981	1982
1	-	0	-
2	-	0	0
3	0.05	-	-
4	0	-	-
5	0.31	0	0.43
6	0.13	0	-
7	-	0.03	0.11
8	-	0.09	-
9	0.29	-	-
10	0	-	-
11	-	0.10	-
12	0.34	0.20	0.53
13	-	0	1.26
Mean (all sites)	0.16	0.05	0.47
Reach 1	-	0	0
Reach 2	0.16	0.075	0.36
Reach 3	-	0	1.26

APPENDIX Table 6-4. Mainstem vs. sidechannel fry populations.

Site	Mainstem edge	Sidechannel
	1980, 1981, 1982	1980, 1981, 1982
1	, 3.31,	
2	, 0.37, 0.25	
3		0.93,
4	0.71, ,	
5		3.00, 2,67, 0.65
6		1.27, 0.63,
7	, 1.04, 0.54	
8		, 0.96,
9		0.74, ,
10		1.10, ,
11		, 1.15,
12		1.72, 2.35, 1.18
13	, 2.67, 2,64	
χ	0.71, 1.85, 1.14	1.46, 1.55, 0.92
$\chi(x)$	1.44	1.41

- on a per linear meter basis mainstem edge and sidechannel fry density were equal for all sites.
- annually, mainstem edge had higher density in 2 of 3 years. This may be biased by 2 very good edge sites.

APPENDIX Table 6-5. Mainstem vs. sidechannel parr population.

Site	Mainstem edge	Sidechannel
	1980, 1981, 1982	1980, 1981, 1982
1	, 0 ,	
2	, 0 , 0	
3		.10, ,
4	0 , ,	
5		.31, 0 , .43
6		.13, 0 ,
7	, .03, .11	
8		, .09,
9		.29, ,
10		0 , ,
11		.10,
12		.34, .20, .53
13	, 0 , 1.26	
X	0 , .0075, 0.46	0.195, 0.078, .48
X(x)	0.175	0.194

- per linear meter basis no difference in mean parr density in mainstem or sidechannel sites.
- annually, no great difference noted--too few samples again.

APPENDIX Table 6-6. Morice River steelhead fry and parr population estimates - 1980 to 1982.

Reach	Habitat Type	Length (km)	0+		1+	
			No/m	Total No	No/m	Total No
1980						
1	Mainstem edge - good	15.4	1.35	20,790	0.16	2,464
	- poor	15.4	0	0	0	0
	Sidechannel	4.1	1.35	5,535	0.16	656
	Backchannel	6.1	0	0	0	0
				26,325		3,120
2	Mainstem edge - good	33.8	1.35	45,630	0.16	5,408
	- poor	33.8	0	0	0	0
	Sidechannel	50.3	1.35	67,905	0.16	8,048
	Backchannel	75.4	0	0	0	0
				113,535		13,456
3	Mainstem edge - good	27.8	1.35	37,530	0.16	4,448
	- poor	27.8	0	0	0	0
	Sidechannel	2.1	1.35	2,835	0.16	454
	Backchannel	3.2	0	0	0	0
				40,365		4,902
Total Reach 1-3				180,225		21,478

1981

0+ - mean density = 1.68/m
- fry population = 1.68/1.35 x 180,225 = 224,280
1+ - mean density = 0.05/m
- 1+ population = 0.05/0.16 x 21,478 = 6,172

1982

0+ - mean density = 1.05/m
- fry population = 1.05/1.35 x 180,225 = 140,175
1+ - mean density = 0.47/m
- 1+ population = 0.47/0.16 x 21,478 = 63,092