ASSESSMENT OF STEELHEAD ENHANCEMENT OPPORTUNITIES IN THE MORICE RIVER SYSTEM. PROGRESS IN 1981.

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ABSTRACT

A second consecutive year of juvenile steelhead life history data was collected on the Morice River system in August 1981. Sampling was conducted at 33 sites throughout the Morice system, with emphasis on Owen and Lamprey Creeks. Estimated standing crop (total biomass) of juvenile steelhead in Lamprey Creek was similar in 1980 and 1981, while estimated population number (0+, 1+ and 2+ age groups) was much higher in 1981. Owen Creek standing crop and estimated population were both much higher in 1981. Estimated survival from 1980 fry to 1981 yearlings was 68% in Lamprey Creek and 81% in Owen Creek. Data from other areas in the Morice system, including Houston Tommy Creek, Gosnell Creek, Shea Creek, Thautil River and the Morice River is also reported.

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1.0 INTRODUCTION

Assessment of steelhead enhancement opportunities in the Morice River system by the Fish Habitat Improvement Section began in 1980 at the request of Skeena Region fisheries management staff. At that time efforts were concentrated on two known important steelhead spawning tributaries, Owen and Lamprey Creeks, with limited effort in other parts of the Morice system. The 1980 assessment suggested that Owen and Lamprey Creeks were very important as spawning and early rearing tributaries for steelhead, as expected (Tredger, 1981). Age distribution of juvenile steelhead (primarily 0+ and 1+) suggested that these two streams were of importance for production of yearling and 2 year parr migrants for rearing to smolt stage in the mainstem Morice River. Recommendations from the 1980 assessment included 1) enhancement through a fry stocking program, based on annual fry recruitment monitoring at selected index sites, and 2) that further analysis of the entire Morice system be conducted to obtain a more comprehensive understanding of Morice River steelhead production and enhancement opportunities.

Objectives of the 1981 assessment program were basically: 1) to test the 1980 assessment conclusions in Owen and Lamprey Creeks through collection of a second year of data, 2) to monitor fry recruitment at several index sites for assessment of opportunities for a steelhead fry stocking program, and 3) to expand the 1980 analysis to include more of the Morice system. The 1981 assessment included reconnaissance of Houston Tommy Creek, the Gosnell Creek - Thautil River system and Morice River mainstem and side channel areas as well as Owen and Lamprey Creeks (Fig. 1). The assessment was conducted August 24 to 28, 1981.

2.0 METHODS

Fish population estimates by electrofishing and habitat sampling by the "habitat unit" methodology were carried out following standard F.H.I.S. methodology (de Leeuw 1981, Stuart 1981). Additional

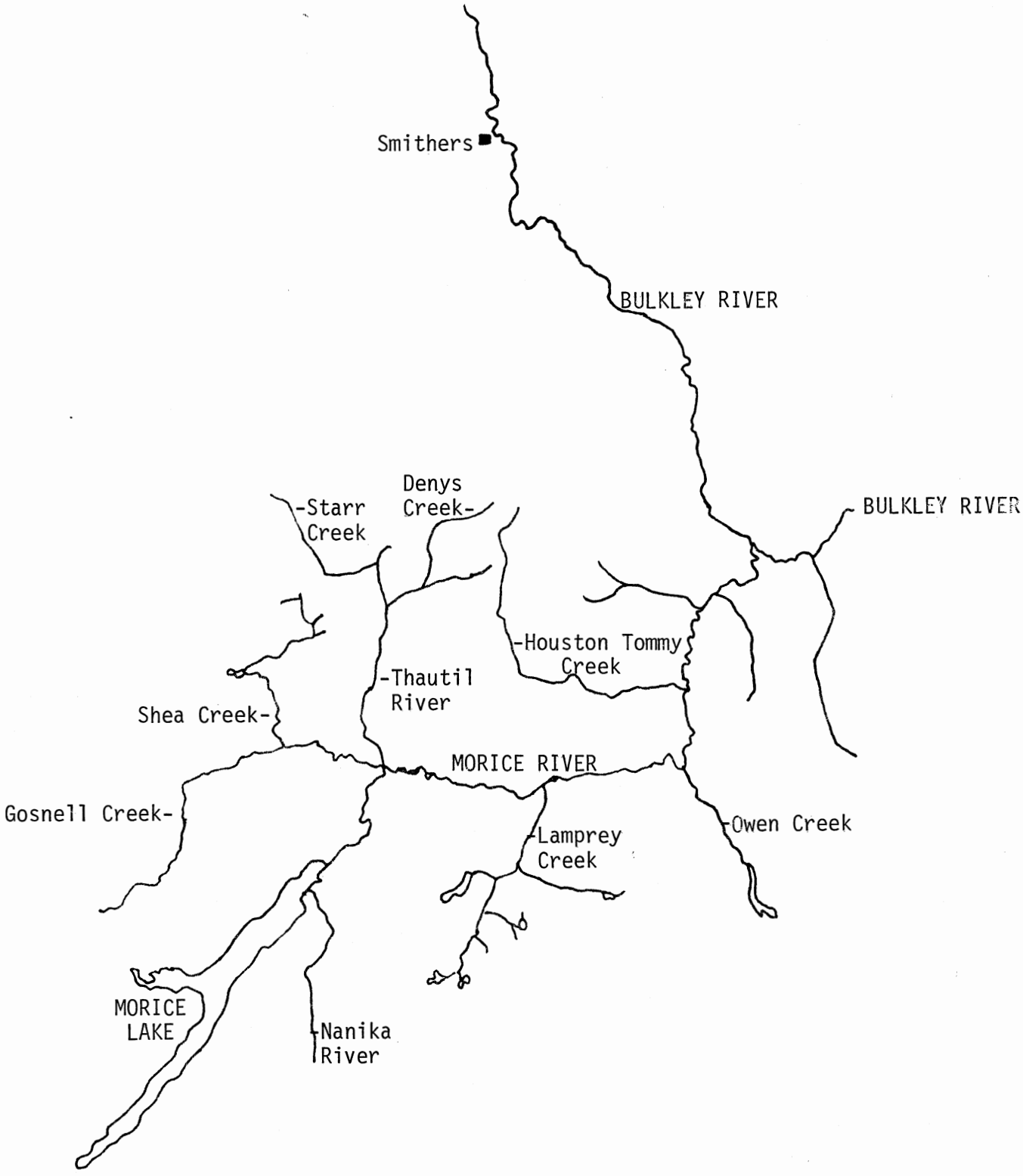

FIGURE 1 The Morice River System (Scale 1:600,000).

habitat information was obtained from available mapping (1:50,000) and air photos, and relevant regional and other agency reports. Sampling was conducted at thirty-three sites including Owen Creek (5), Lamprey Creek (6), Gosnell Creek (4), Shea (Cox) Creek (1), Thautil River (2), Denys Creek (1), Loljuh Creek (1), Starr Creek (1), Houston Tommy Creek (2), the Morice River mainstem edge (6) and Morice River sidechannels (4). Where possible attempts to sample 1980 sites were made.

3.0 RESULTS

Results are presented and discussed on a stream by stream basis. Where 2 years data are available a comparison of habitat and fish populations in 1980 and 1981 is made.

3.1 Lamprey Creek

3.1.1 Habitat

A discussion of habitat characteristics in Lamprey Creek on a reach basis is given in the 1980 report (Tredger, 1981). A summary is appended (Appendix 1). Reach breaks and sample site locations are given in Fig. 2. Comparison of 1980 and 1981 stream habitat follows.

Estimated discharge was significantly lower in Reaches 1 and 2 of Lamprey Creek in 1981 (Table 1). The 1981 discharge was estimated at less than 10% of the 1980 discharge (0.38 - 0.25 m^3/s in 1980; 0.025 - 0.023 in 1980). In the upper reaches discharge was 40% lower in 1981 (0.05 m^3/s in 1980; 0.02 m^3/s in 1981), although in both years was quite low. A major component of discharge in 1980 was Pimpernel Creek, entering Lamprey Creek near the break point of Reach 2 - 3. This was not the case in 1981 as discharge was only slightly higher in Reaches 1 and 2 compared to Reach 5.

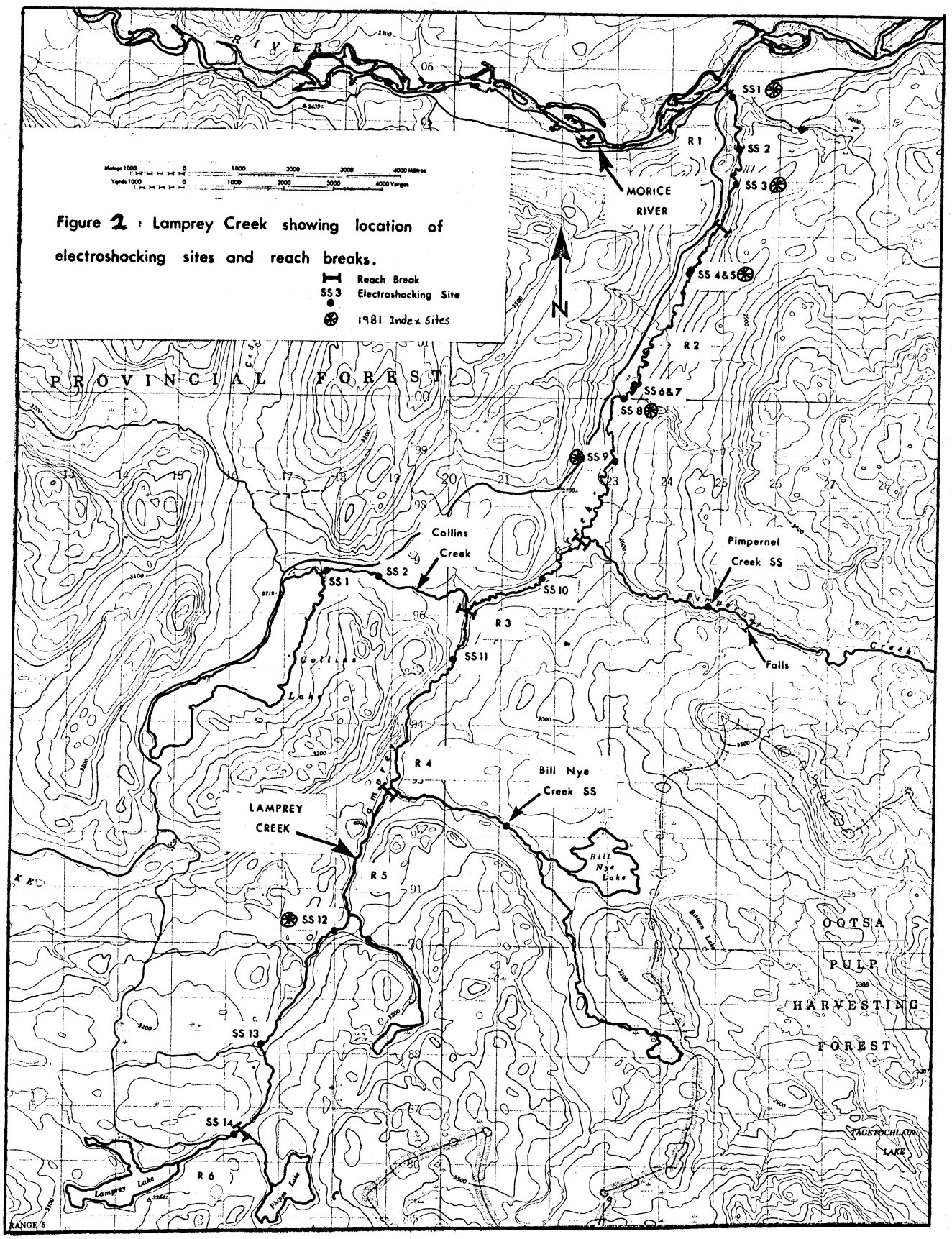

Figure 1 : Lamprey Creek showing location of electroshocking sites and reach breaks.

Reach Break
SS 3 Electroshocking Site
1981 Index Sites

Table 1. Estimated discharge in Lamprey Creek during 1980 and 1981 sampling periods (late August).

REACH/TRIBUTARY	ESTIMATED DISCHARGE (m^3/s)	
	1980	1981
Lamprey Reach 1	0.38	0.025
2	0.25	0.023
3	(0.04)	--
4	0.04	--
5	0.05	0.020
6	0.05	--
Tributary 1	<0.01	--
Pimpernel	0.13	--
Collins	<0.01	--
Bill Nye	<0.01	--
Tributary 5	<0.01	--
Phipps	<0.01	--

Changes in Lamprey Creek fish habitat were analyzed by comparing 1980 and 1981 habitat unit measurements in the reaches sampled (Table 2). Parameters assessed included stream (reach) area, percent hydraulic type, mean depth and percent total cover. In 1981 stream area decreased by 40% and 15% in Reaches 1 and 5 respectively, while Reach 2 showed an increase of 82%.

The validity of area decreases in Reaches 1 and 2 is intuitively reasonable as lower discharge should be reflected as less stream area. The increase in area of Reach 2 may be attributable to an increase in beaver activity, forming areas of beaver ponds and sloughs. The increase in beaver activity is difficult to quantify, and the 82% increase in area for 1981 is not considered reliable. In an area with beaverdams, roughly equal area from year to year is expected unless drastic changes in beaver activity were apparent. As many sample sites were inundated, a changed distribution and modest area increase is assumed.

Table 2. Summary of changes in Lamprey Creek habitat as sampled in August 1980 and August 1981.

REACH	YEAR	AREA (m^2)	POOL			RIFFLE			GLIDE		
			%	MEAN DEPTH	% COVER	%	MEAN DEPTH	% COVER	%	MEAN DEPTH	% COVER
1	1981	17,621	17	88	13	55	10	18	28	26	5
	1980	29,642	6	40	14	58	20	7	36	21	8
		-12,021	+11	+48	-1	-3	-10	+11	-8	+5	-3
2	1981	79,616	89	62	7	4	5	6	7	32	10
	1980	48,856	75	59	17	14	8	11	11	26	9
		+35,760	+14	+3	-10	-10	-3	-5	-4	+6	+1
5	1981	18,935	94	30	18	1	3	100	5	1	73
	1980	22,575	93	40	48	6	13	100	1	23	67
		+3,460	+1	-10	-30	-5	-10	0	+4	-22	+6

In terms of habitat type changes, all reaches showed an increase in pool percentage, and a decrease in riffle percentage. Glide percentage decreased in Reaches 1 and 2, and increased in Reach 5. Mean depth of riffles decreased in all reaches.

3.1.2 Fish Population

Fish sampling was conducted at six sites in Lamprey Creek, corresponding to 1980 Sites 1 and 3 in Reach 1, Sites 4, 8 and 9 in Reach 2, and Site 12 in Reach 5. An attempt to sample identical or at least similar sites to 1980 was made. Because of discharge differences and increased beaver ponding, identical sampling was only done at Site 12. Other samples were viewed as similar in both years based primarily on pool/riffle/glide ratios. Site 4 of 1981 was seen as a combination of 1980 Sites 4 and 5.

Population estimate results are summarized in Table 3 with complete details in Appendix 1.

Table 3. Summary of sportfish population densities (no/m^2) at 6 sample sites in Lamprey Creek, August 24 - 29, 1981.

REACH	SITE	RAINBOW			COHO	CHINOOK	DOLLY VARDEN	CUTTHROAT		WHITEFISH
		0+	1+	2+	0+	0+	Σ	0+	≥ 1+	0+
1	1	.18	.01	.01	.87	.01	.02	0	0	.01
	3	.35	.32	0	0	0	0	0	0	0
	$\bar{x}$	.27	.165	.005	.44	.005	.01	0	0	.005
2	4/5	.92	.26	.04	.07	0	.04	0	0	.09
	8	.82	.06	.01	0	0	.01	0	0	.16
	9	.82	.06	.01	0	0	.01	0	0	.01
	$\bar{x}$	.75	.21	.02	.023	0	.017	0	0	.087
5	12	0	0	0	0	0	.37	.30	.45	0

Sportfish captured in 1981 included rainbow (steelhead) and cutthroat trout, chinook and coho salmon, mountain whitefish and Dolly Varden char. Coarse fish included longnose dace, longnose suckers, and sculpins. Species distributions were very similar to 1980 sampling, where coho were present up to the lower portion of Reach 2, rainbow (steelhead) present up to Reach 4, and cutthroat present in Reach 5. One major difference was the presence of mountain whitefish in 1981; none were present in 1980. As in 1980, all juvenile rainbow were 0+, 1+ and 2+; no 3+ or older were captured.

A comparison of 1980 and 1981 coho and rainbow (steelhead) population densities at five sample sites is summarized in Table 4.

Table 4. Summary of juvenile rainbow and coho densities (no/m^2) in August 1980 and August 1981 at 5 sample sites in Lamprey Creek.

SITE	RAINBOW						COHO	
	0+		1+		2+		Σ (0+, 1+)	
	1980	1981	1980	1981	1980	1981	1980	1981
1	.32	.18	.10	.01	0	.01	.58	.87
3	.28	.35	.13	.32	.01	0	.01	0
4/5	.50	.92	.22	.26	.02	.04	.26	.07
8	.49	.51	.11	.32	.01	.01	0	0
9	.43	.82	.04	.06	0	.01	0	0
$\bar{x}$	.40	.56	.12	.19	.008	.014	.28	.31

Average steelhead fry density was higher (+.16/m^2) in 1981 compared to 1980. Sites 4/5 and 9 were significantly higher while Site 1 was lower. Yearling density was also higher in 1981 (+.07/m^2), significantly so at Sites 3 and 8. Site 1 was again lower. Density of 2+ steelhead was slightly higher in 1981. Average coho density was roughly equal in the two years, however, 1981 density was higher at Site 1 and lower at Site 4/5.

Steelhead

A summary of Lamprey Creek steelhead population estimates, length and weight estimates and total biomass estimates is given in Table 5. Calculations are included in Appendix 1. These estimates indicate an increase in fry, 1+ and 2+ parr populations in 1981 as compared to 1980. All population estimate comparisons were based on linear density rather than area density to correct for annual changes in stream area. Mean size of fry and 1+ parr was significantly smaller in 1981. In terms of total standing crop, 1981 was 13% higher than 1980. This standing crop figure illustrates the concept of carrying capacity, as although higher numbers of juvenile steelhead were present, stream conditions were such that growth was limited and standing crop was similar.

Two years of data enable us to follow year classes (age groups) through to estimate survival. One major assumption which may not be fulfilled is the requirement that no immigration or emmigration takes place between sampling dates. Survival estimates are summarized in Table 6. The 1980 fry to yearling survival rate was estimated at

Table 6. Age group survival estimates for juvenile steelhead in Lamprey Creek, August 1980 to August 1981.

1980		1981		Survival
0+	44,794	0+	69,950	
1+	19,320	1+	30,550	68%
2+	1,116	2+	1,276	6.6% - most outmigrated
		3+	0	0% - all outmigrated

68%, a seemingly very high value. Instantaneous rates for both years were 44%. The high survival may be justified by the high quality habitat type for overwintering. Abundant deep pool and beaverpond areas were present providing the deep overwinter habitat necessary in a cold winter climate area such as the Morice. Another factor to consider

Table 5. Steelhead population estimate and standing crop comparision in Lamprey Creek, August 1980 and 1981.

Age Group	Population Estimate		Mean Length (mm)		Mean Weight (g)		Biomass (kg)	
	1980	1981	1980	1981	1980	1981	1980	1981
0+	44,750	69,950	47.8	39.0	1.16	0.66	51.9	46.2
1+	19,320	30,550	87.5	78.4	7.13	5.46	137.8	166.8
2+	1,116	1,276	122.7	124.4	19.67	20.79	22.0	26.5
							211.6	239.5

is the error involved in standing crop calculations. The method of arriving at particularly the 1981 figures may be questionable because of the fewer number of sample sites conducted relative to 1980 (Appendix 1).

Coho

As in 1980 the juvenile coho population was restricted in range to Reach 1 and the lower portion of Reach 2. Mean density at the sites sampled was equal in both years although differences at sample sites were apparent. Coho fry numbers, based on linear densities and comparison with 1980 results were estimated at 12186 (Appendix 2), basically equal to the 12375 estimated in 1980. Standing crop was roughly 27 kg (2.23 g/coho fry), less than the 36.5 kg estimated in 1980. Mean size of coho was smaller in 1981; fry in 1980 were 60.2 mm compared to 55.5 mm in 1981, mean weight was 2.62 g in 1980 and 2.23 g in 1981.

3.1.3 Steelhead life history and enhancement considerations.

Life history of Morice River steelhead relative to the role of Lamprey Creek appears to center on the production of migrants to the Morice River mainstem for further rearing to smolt stage. Age distribution of 1980 and 1981 fish captures and population estimates in Lamprey Creek indicates that the vast majority outmigrate as very late season 1+ (ie. September - October) or as 2 year olds (April - early August). Rearing must then continue largely in the mainstem Morice - Bulkley system to smolt stage. Returning adult steelhead have been shown by scale analysis to spend two (0.2%), three (23.5%), four (69.9%) and five (6.4%) winters in freshwater before migrating seaward (Whately et al, 1978). In terms of enhancement of Morice River steelhead through Lamprey Creek, the objective should be to maximize production of migrants to the mainstem. A balance between actual numbers and expected survival differences due to size differences must be made (ie. is it better to produce a very large number of smaller fish and possibly reduce the survival rate to smolt stage or a smaller number of larger fish and ensure high survival).

3.2 Owen Creek

Sampling was conducted at 5 sites in Owen Creek in Reaches 1, 3, 5 and 6. Sample sites corresponded to site numbers 1, 3, 5, 7 and 9 of 1980 sampling (Fig. 3).

3.2.1 Habitat

A detailed description of Owen Creek fish habitat by reach is given in Tredger (1981) (Appendix 2). In this section only changes in late summer habitat relative to 1980 will be discussed. Discharge estimates in Owen Creek during the 1981 sampling period ranged from 0.19 m^3/s (6.6 cfs) in Reach 1 to 0.02 m^3/s (0.7 cfs) in Reach 6 below Owen Lake. This discharge was much lower than 1980 estimates when flows were roughly 0.6 to 0.8 m^3/s (21-30 cfs) in Reaches 1-5, and 0.1 m^3/s (3.5 cfs) in Reach 6 below Owen Lake. In 1980 a significant amount of water originated from Puport Creek.

A summary of habitat changes as sampled in 1980 and 1981 is given in Table 7. In Reach 1 stream area was estimated at 25,085 m^2, a slight decrease from 1980. An increase in pool percentage occurred, with a decrease in glide and riffle percent. Depth decreased in all habitats. In Reach 3 a very large decrease in area, from 127,500 m^2 to 9,500 m^2 was estimated. This result is not considered valid as obviously different habitat was sampled in 1980 and 1981. The 1980 sampling was in the edge of a beaverpond (slough); 1981 sampling was in the riffle between beaverponds. Reach 3 data will not be included in further habitat analysis.

Reach 5 showed a decrease in area (-9,503 m^2) in 1981 along with a decrease in pool percent and an increase in riffle percent. Depth was reduced in pools and glides, and was roughly equal in riffles. Cover was reduced very significantly in all habitats. Reach 6 showed an increase in area (+855 m^2), increase in pool (+33%) and riffle (+7%) areas, and a decrease in glide area (-40%). Mean depth decreased in all habitat types in Reach 6.

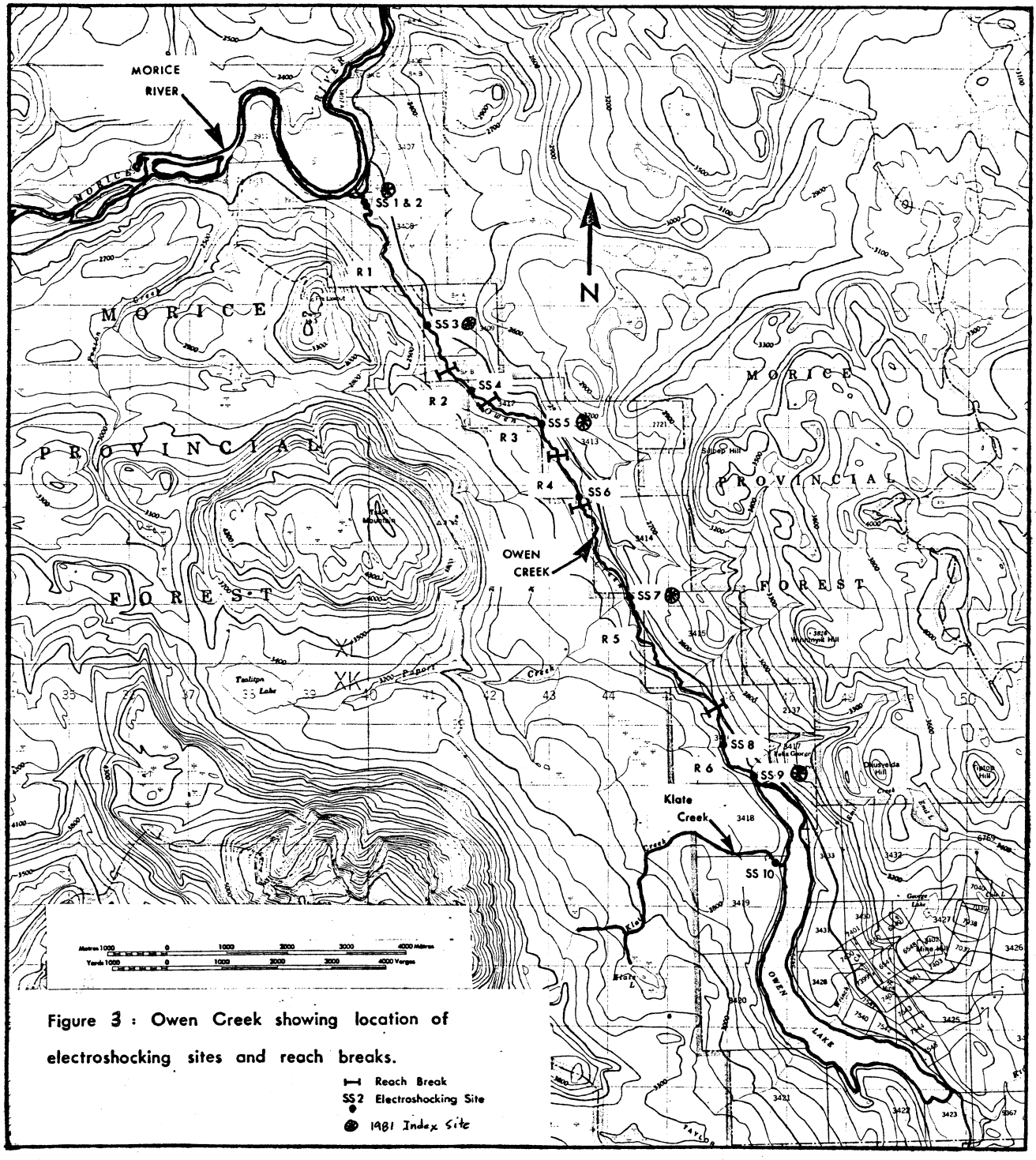

Figure 3 : Owen Creek showing location of electroshocking sites and reach breaks.

Table 7. Summary of changes in Owen Creek habitat as sampled in August 1980 and August 1981.

Reach		Area	Pool			Riffle			Glide		
			%	$\bar{D}$	%C	%	$\bar{D}$	%C	%	$\bar{D}$	%C
1	1981	25,085	45	52	11	11	10	1.8	44	20	2.5
	1980	27,320	7	88	6.6	26	13	6.6	67	40	4.5
		-2,235	+38	-36	+4.4	-15	-3	-4.8	-23	-20	-2.0
3	1981	9,500	64	100	26	4	10	31	32	40	11
	1980	127,500	100	120	50	0	0	0	0	0	0
		-118,000	-36	-20	-24	+4	+10	+31	+32	+40	+11
5	1981	31,026	18	80	0	35	20	1	46	33	0.4
	1980	40,529	39	120	10	15	19	12	46	46	20
		-9,503	-21	-40	-10	+20	+1	-11	0	-13	-19.6
6	1981	5,976	69	15	6.5	29	2	0.3	2	15	57
	1980	5,091	36	35	2	22	7	2	42	23	21
		+885	+33	-20	+4.5	+7	-5	-1.7	-40	-8	+36

3.2.2 Fish population

A summary of Owen Creek fish population estimates is given in Table 8; complete data are included in Appendix 2. Sportfish captured included juvenile rainbow (both steelhead and Owen Lake

Table 8. Summary of sportfish population densities (no/m^2) at 5 sample sites in Owen Creek, August 24-28, 1981.

REACH	SITE	RAINBOW				COHO	DOLLY VARDEN	MOUNTAIN WHITEFISH
		0+	1+	2+	3+	0+	Σ	Σ
1	1	1.73	0.20	0.03	0	0.22	0	0
	3	2.57	0.31	0.04	0.01	0.36	0.03	0.04
	$\bar{x}$	2.15	0.255	0.035	0.005	0.29	0.015	0.02
3	5	0.71	0.27	0.04	0	0.77	0.11	0
5	7	0.99	0.25	0.02	0	0.60	0.11	0.19
6	9	1.66	0.02	0	0		0	0.01

resident stock), coho, Dolly Varden and mountain whitefish. Coarse fish present included sculpins, redside shiner, and squawfish. Coarse fish were only captured at Site 9 immediately downstream of Owen Lake. The rainbow population at Site 9 near Owen Lake is assumed to be made up of steelhead and lake resident stock. Species presence and distribution was very similar to 1980 sampling. The major change was juvenile coho presence in Reach 5, Site 7. In 1980 coho were not found above Reach 3.

A comparison of 1980 and 1981 juvenile rainbow and coho population densities is summarized in Table 9. Sample site habitat was similar in all sample sites with the exception of Site 5. All 1981 sampling was conducted in glide/riffle/pool (ie. flowing) sequences; 1980 sampling included sloughs and swamps, of which Site 5 was one. Site 5 therefore cannot be included in comparison analysis.

Table 9. Summary of juvenile steelhead and coho densities (no./m^2) in August 1980 and August 1981 at 5 sample sites in Owen Creek.

SITE	RAINBOW [1]						COHO	
	0+		1+		2+		0+	
	1980	1981	1980	1981	1980	1981	1980	1981
1	0.78	1.73	0.18	0.20	0	0	0.25	0.22
3	0.78	2.57	0.11	0.31	0	0.01	0.08	0.36
5[2]	0	0.71	0.06	0.27	0.02	0	0.14	0.77
7	0.41	0.99	0.22	0.25	0.03	0	0	0.60
9	1.05	1.66	0.04	0.02	0	0	0	0
$\bar{x}$[3]	0.60	1.53	0.12	0.21	.01	.002	0.16	0.49

[1] 3+ population was insignificant in both years.

[2] 1980 and 1981 sample sites not comparable.

[3] mean coho density over distribution range.

Mean rainbow fry density was much higher in 1981 than in 1980. This was the case at all sample sites. Yearling density was also higher in 1981, largely due to Sites 3 and 5. Coho fry density was 3 times higher in 1981, and distribution appeared to cover more of the stream.

Steelhead

A summary of Owen Creek steelhead population estimates, length and weight estimates, and total biomass estimates is given in Table 10.

Table 10. Steelhead population estimate and standing crop comparison in Owen Creek, August 1980 and 1981.

AGE GROUP	POPULATION ESTIMATE		MEAN LENGTH (mm)		MEAN WEIGHT(g)		BIOMASS (kg)	
	1980	1981	1980	1981	1980	1981	1980	1981
0+	38,330	100,275	50.5	45.4	1.37	1.00	52.5	100.3
1+	18,715	31,029	92.0	91.7	8.29	8.21	155.1	254.7
2+	3,460	6,315	128.0	148.5	22.33	34.88	77.3	220.3
							284.9	575.3

All comparisons were calculated on a linear density basis to overcome stream area changes (Appendix 2).

The 1981 population estimates are quite significantly higher than 1980 for all age groups present. Total biomass increased 102% from 285 to 575 kg. Size of steelhead fry was smaller, while 1+ parr were the same size in both years. Two year olds were quite significantly larger in 1981.

Estimated 0+ to 1+ survival in Owen Creek was calculated at 81% (Table 11), an extremely high value in terms of generally accepted figures. The actual survival is undoubtedly high, as habitat quality in terms of overwinter habitat might suggest, however 81% is extremely high. Two problems may be acting; firstly there may be some problem with the population extrapolation process. Steelhead populations may have for some reason been concentrated at sample sites (eg. beaverdams restricting movements). A second reason may have been inmigrations from the Morice River mainstem. This is somewhat unlikely because of beaverdams and the fact that the major increase was in upper reaches.

Table 11. Age group survival estimates for juvenile steelhead in Owen Creek, August 1980 to August, 1981.

	1980	1981	SURVIVAL
0+	38,330	100,275	
1+	18,715	31,029	81%
2+	3,460	6,315	34%

Coho

Coho fry population was estimated at roughly 42,000 in Owen Creek in late August of 1981 (Appendix 2). This compares with

3,800 fry and 17,850 yearlings estimated present in August of 1980. The dramatic increase in fry population suggests that 1980 must have been very good for spawner access to the upper reaches of Owen Creek. Again, upstream migrations are thought of as possible, but unlikely to occur in great magnitude because of beaverdams. Size of coho fry was roughly equal in 1980 and 1981 (55.6 mm in 1980, 56.1 mm in 1981).

3.2.3 Steelhead life history and enhancement considerations

As was the case for Lamprey Creek, the role of Owen Creek relative to Morice River steelhead production largely lies in production of yearling and two year old migrants. However, the number of 2+ fish present was large relative to the Lamprey Creek population, indicating a significant number of 3 year old migrants either as smolts or for further rearing in the mainstem. The unusually high fall fry to fall 1+ survival rate (81%) is very likely an overestimate, however is indicative of high survival in a stable, deep water system such as Owen Creek.

3.3 Houston Tommy Creek

Houston Tommy Creek was sampled by F.H.I.S. for the first time in August 1981. Sampling was brief, conducted at 2 sites below an impassable falls (Fig. 4). The entire stream was observed by helicopter.

3.3.1 Habitat

Four reaches were identified in Houston Tommy Creek, three in the accessible portion below the falls, and one above the falls to the headwaters. The falls, located 17.6 km from the Morice confluence, present a definite barrier to upstream fish migrations. A summary of habitat characteristics is given in Table 12.

Reach 1, covering 7 km from the Morice confluence to below a large slide area, flows through a steep sided valley (canyon in lower

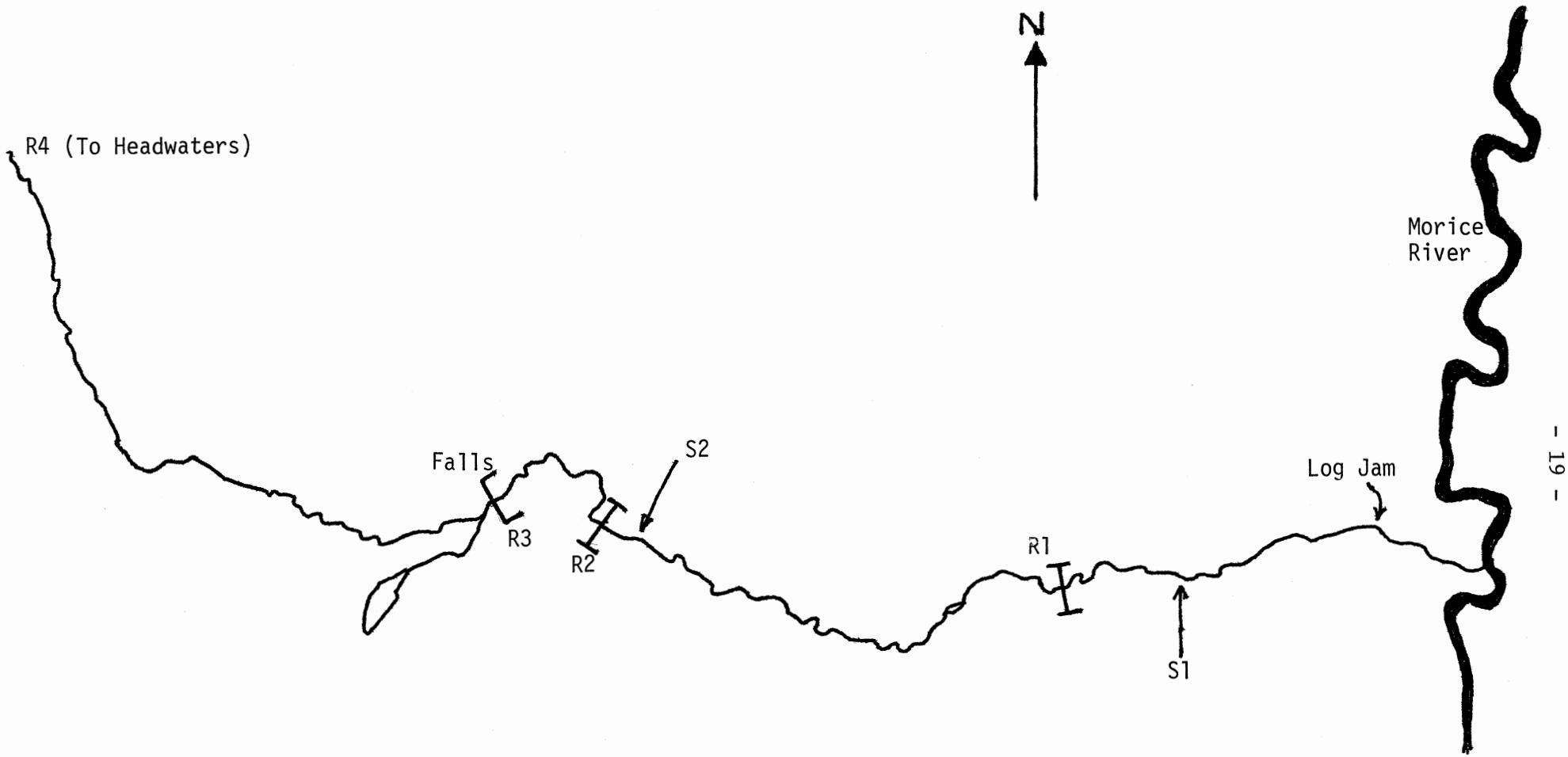

FIGURE 4 Houston Tommy Creek (Scale - 1:77,000).

Table 12. Summary of Houston Tommy Creek habitat characteristics, August 1981.

REACH	APPROX. LENGTH (km)	APPROX. GRADIENT	SAMPLE SITES	HABITAT TYPE			MAJOR SUBSTRATES	EST. DISCHARGE (m^3/s)	COVER TYPE	MEAN WIDTH (m)	TOTAL AREA (m^2)
				% POOL	% GLIDE	% RIFFLE					
1	7.0	1.25%	1	0	13	87	LG,C,B	2.0	B,OV,L	16.1	112,750
2	7.9	1.0 %	2	0	68	32	C,LG	2.0	L,OV	9.1	71,800
3	2.7	(1.25%)	--	assume similar to Reach 1						(9.1)	(24,570)
Falls	located at top of Reach 3 (17.6 km); definite barrier										209,120
4	28	habitat similar to Reach 2								Approx.	200,000

2 km). Habitat in August 1981 was generally riffle-glide in a cobble and boulder substrate. Steelhead rearing capability looked very good. A very large log jam was present roughly 2.0 km upstream of the Morice confluence. Reach 2, extending for roughly 7.9 km, was slightly lower in gradient than Reach 1, and was generally glide riffle over cobble and large gravel substrates. Some sections were braided with numerous side channels. Very little pool habitat was observed. Reach 3, covering 2.7 km to the falls, was again steep sided canyon type habitat similar to Reach 1.

The falls is a definite fish barrier. A close-up look was not possible, however 4 separate falls from chutes to 10 m vertical drops were observed from the helicopter. Modification of the falls to provide fish passage can almost certainly be ruled out.

Above the falls (Reach 4) to the headwaters habitat was very similar to that of Reach 2, comprised of long glides and riffles in cobble-gravel substrates. Reach 4 covered roughly 28 km of which 20 km was below the 4,000 foot contour.

3.3.2 Fish population

Population estimates were conducted at 2 sites in Houston Tommy Creek in Reaches 1 and 2 below the falls (Fig. 4). Species present included rainbow trout, coho salmon and Dolly Varden char (Table 13). Juvenile rainbow were found only at Site 1, in riffle habitat with abundant boulder cover. All rainbow captured were parr, ranging in size from 75 mm (1+) to 157 mm (≈3+). No fry were sampled. Sampling at Site 2, a sidechannel in the upper portion of Reach 2, revealed coho fry and Dolly fry and yearlings; no rainbow.

The low density and absence of year classes of rainbow indicates that the population was not at saturation. Further evidence lies in rough smolt yield estimates prepared by Tredger (1982).

Table 13. Summary of fish population densities (no/m^2) at 2 sample sites in Houston Tommy Creek, August 27, 1981.

REACH	SITE	RAINBOW			COHO	DOLLY VARDEN
		0+	1+	$\geq$ 2+	0+	Σ
1	1a	0	0	0.08	0	0
2	2	0	0	0	0.10	0.19

a. presence/absence sampling near Site 1 found yearling rainbow (1) and Dolly Varden (1).

The estimated smolt yield for Houston Tommy Creek was 6,660 based on rough habitat area and a smolt yield model. Assuming a 30% parr to smolt survival rate, the parr population required to produce this smolt yield is roughly 22,000. Averaged over the whole stream area (209,000 m^2, 17.6 km) a mean density of 0.10 parr/m^2 (1.25 parr/linear m) is calculated. Although the above calculations are rough, the very low sampled parr density indicates that Houston Tommy Creek is not currently producing at this level.

3.3.3 Steelhead enhancement

Fish sampling indicated that Houston Tommy Creek was under-seeded for all salmonid species. A major limiting factor was seen as the large log jam roughly 2 km from the mouth creating difficult access for spawners. This jam may be more of a barrier at high spring flows, as while coho fry were present, no steelhead fry were found in a year when steelhead fry populations were generally very high (in adjacent areas). Removal of the jam (by blasting) should provide access for steelhead and coho up to the falls (17.6 km). Some "impetus" to speed fish colonization (ie. stocking) may be required. Some juvenile salmonids may also migrate up Houston Tommy for rearing purposes. Projected benefits from log jam removal relate to annually saturating Houston Tommy Creek with steelhead fry. The actual saturation density is unknown at this time, but assuming the average will be near 0.10 parr/m^2

then benefits amount to an annual smolt yield of roughly 6,660 and an adult steelhead escapement of 250 to 500 (at 3:1 and 1:1 C:E respectively).

Some 28 km of stream is present above the falls, 20 km of which is located below the 4,000 foot contour. Habitat as seen by helicopter overflight was much like Reach 2, basically a glide-riffle environment with a fairly wide active channel width and limited deep water (pool) habitat. Bypassing the falls is not considered possible at this time. Headwater stocking may be a possible enhancement technique applicable to this area. Before headwater stocking is considered two things should be investigated: 1) probable success of juvenile steelhead in migrating downstream over the falls, and 2) parr/smolt production from Reach 2 under full recruitment. Favorable findings in these areas would then allow consideration of headwater stocking.

3.4 Gosnell Creek

The Gosnell Creek system was sampled by the F.H.I.S. in both 1980 and 1981. Due to poor access (helicopter only) sampling was not intense, conducted at 3 sites in 1980 and 5 sites in 1981.

3.4.1 Habitat

Gosnell Creek was divided into 6 reaches from the Morice/Thautil confluence to the headwaters (Fig. 5, Table 14). Shea Creek (or Cox Creek, Gosnell north fork), the major tributary, was divided into 2 reaches covering 9 km to a falls. Habitat summaries (Table 14) include data from 1980 and 1981 where possible. Data from A.S.B. files provided much of the information on Gosnell habitat generalities (Appendix 4).

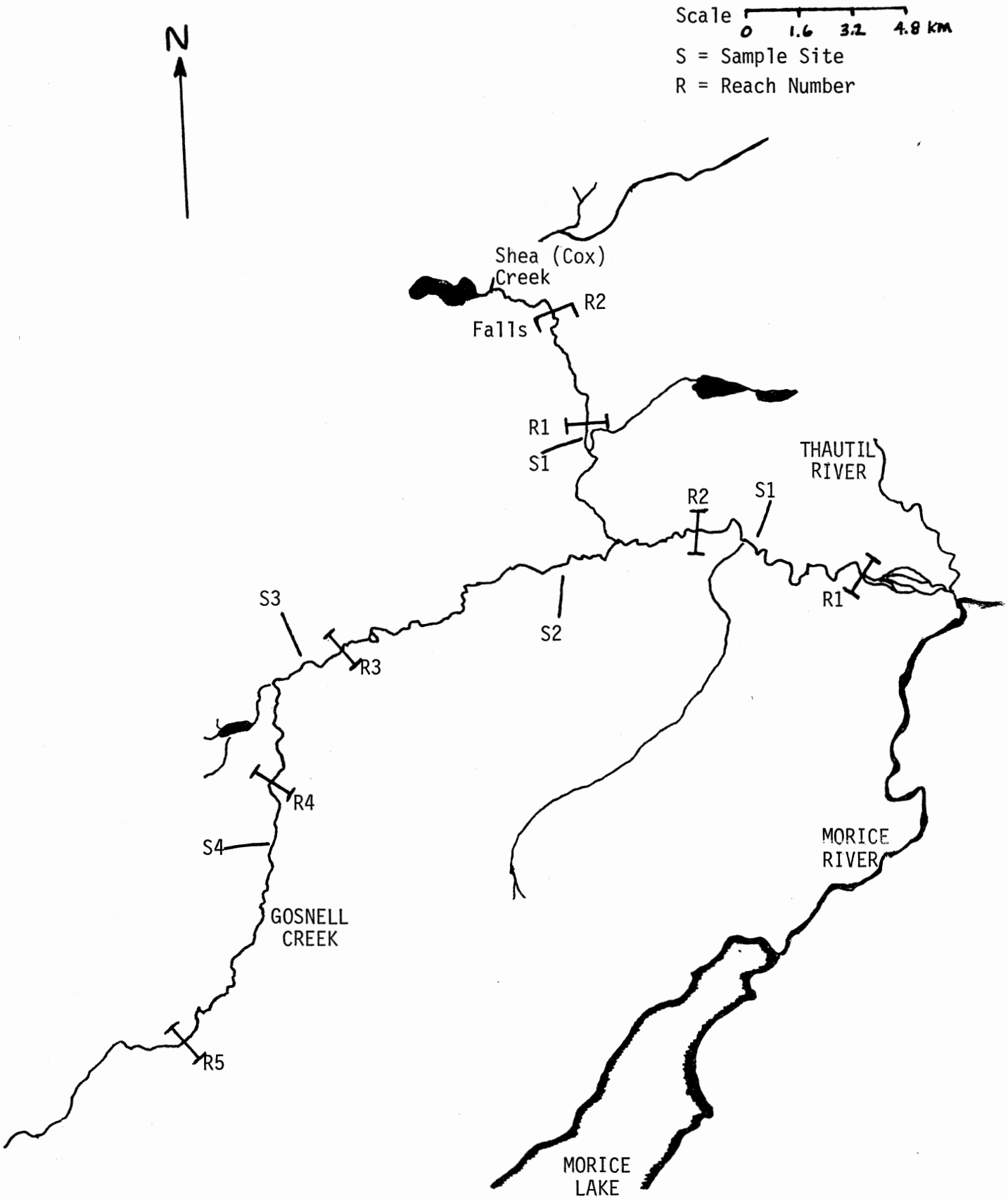

FIGURE 5. The Gosnell Creek system.

Table 14. Summary of Gosnell Creek/Cox Creek reach habitat parameters.

REACH	APPROX. LENGTH (km)	GRADIENT MAP	GRADIENT FIELD	SAMPLE SITES	HABITAT TYPE % POOL	% GLIDE	% RIFFLE	MAJOR SUBSTRATES	COVER TYPE	MEAN WIDTH (m)	TOTAL AREA (m^2)
Gosnell Crk.											
1	3.0	0.2	--	--	not sampled			(F,SG)	--	(16)	(48,000)
2	8.0	0.4	0.7-0.85	1(1980), 1(1981)	0	85	15	LG,SG,C	L,OV	16	127,000
3	15.0	0.2	0.85-1.25	2(1980), 2(1981)	>1	78	22	SG,LG	OV,L	20	294,200
4	6.0	1.0	0.5	3	4	67	29	SG,F,LG	OV,L	6.8	39,700
5	10.0	1.2	2.2	4	31	32	37	C,LG	L,OV,C	6.6	65,000
6	6.5	1.0	--	--	not sampled					(4.0)	26,000
	48.5										598,100
Shea Creek											
1	5.0	0.8	1.0	1(1980), 1(1981)	0	79	21	LG,SG,C	B,L,OV	7.0	29,882
2	4.0	1.1	--	--	not sampled					(7.0)	(28,000)
	9.0 (to falls)										58,000

3.4.2 Fish sampling

Five population estimates were conducted in the Gosnell Creek system in 1981. A summary of data from 1980 and 1981 is given in Table 15. Juvenile rainbow, coho and Dolly Varden were captured in

Table 15. Summary of fish population estimate results in the Gosnell Creek system, 1980 and 1981.

REACH	SITE	RAINBOW			COHO	DOLLY VARDEN	OTHER
		0+	1+	≥2+	Σ	Σ	SPECIES
1981							
Gosnell							
2	1	0	0.06	0	0.31	0	--
3	2	0.02	0	0	0.21[a]	0.02	--
4	3	0	0	0	0	0.11	--
5	4	0	0	0	0.02	0.22	--
Shea Cr.1	1	0.05	0.06	0.02	0.10	0.02	--
1980							
2	1	0.18	0.11	0	0	0.04	MW,LND
3	2	0.02	0	0	0.03	0.07	--
Shea Cr.1	1	0.06	0.02	0	0.31[b]	0.01	--

[a] 0+ and 1+ coho

[b] Longnose Dace, Mountain Whitefish

1981, with the addition of mountain whitefish and longnose dace in 1980. What appeared to be chinook redds were found in 1980, but no chinook fry were identified in 1981.

Steelhead

It appears the major "pathway" for steelhead in the Gosnell Creek system is up Shea Creek to the falls. Juvenile steelhead were not found in upper Gosnell (eg. Reach 4, 5), although some were found in Reach 3 above Shea Creek. Steelhead densities were low in all sites with the exception of Site 1, Reach 2 1980 and Shea Creek in 1981.

Discussion of present and potential steelhead smolt yield will be left for the 1982 data analysis. At this time projected maximum smolt yield from accessible reaches of the Gosnell system amount to roughly 3,000 (Tredger, 1982). This figure is based on a rough habitat model and is subject to change.

Coho

Coho juveniles were found throughout the Gosnell Creek system. Coho have been identified in the headwaters (Reach 6) and in 4 tributary streams (Carswell, 1978). Highest coho densities were found in Reach 2 and 3 sites in 1981, and in Shea Creek in 1980. In both years 0+ and 1+ coho were found.

Dolly Varden

Dolly Varden juveniles were present throughout the Gosnell Creek sampling area. Highest density was found in the uppermost sample site in Reach 5. Age groups present in sampling included 0+, 1+ and 2+.

3.4.3 Future work

Shea Creek

In 1980 and 1981 Shea Creek has been sampled below the falls (at 9.0 km). It appears that Shea Creek is the major "route" for steelhead in the Gosnell system at the present time. This could be expected given the lake headed nature of this stream. The potential of Shea Creek above the falls should be investigated in 1982.

Gosnell Creek

Stream assessment work in Gosnell Creek above the Shea Creek confluence indicates steelhead rearing habitat is available. The major problem may be a good spawning area (such as Shea Creek) to seed the area. Investigations in 1982 should include a small lake headed system tributary to Reach 3. As lake headed areas are known to be of major importance to Skeena steelhead, the potential of this stream for spawning should be examined.

3.5 Thautil River

The Thautil River system was sampled by F.H.I.S. for the first time in 1981. Sampling was not intense, conducted at 5 sites only (Fig. 6). Data presented here shall include only a summary of fish sampling. Habitat description will not be attempted at this time.

3.5.1 Fish sampling

A summary of fish population estimate results is given in Table 16. Rainbow (steelhead), coho and Dolly Varden juveniles were captured.

Table 16. Summary of 1981 fish population estimate results in the Thautil River system.

SITE	FISH DENSITY (no/m^2)				
	RAINBOW			DOLLY VARDEN	COHO
	0+	1+	$\geq$ 2+	Σ	Σ
Thautil R. 1.	0.04	0	0	0	0.13
Thautil R. 2.	0.12	0.03	0.02	0.02	0
Denys Cr.	0	0	0	0.14	0
Loljuh Cr.	0	0	0	0.78	0
Starr Cr.	0	0.02	0	0.02	0

Dolly Varden

Dolly Varden were found in all upper sample sites conducted in the Thautil River system. Maximum density recorded, 0.78 fish/m^2, was in Loljuh Creek, a small tributary of Denys Creek.

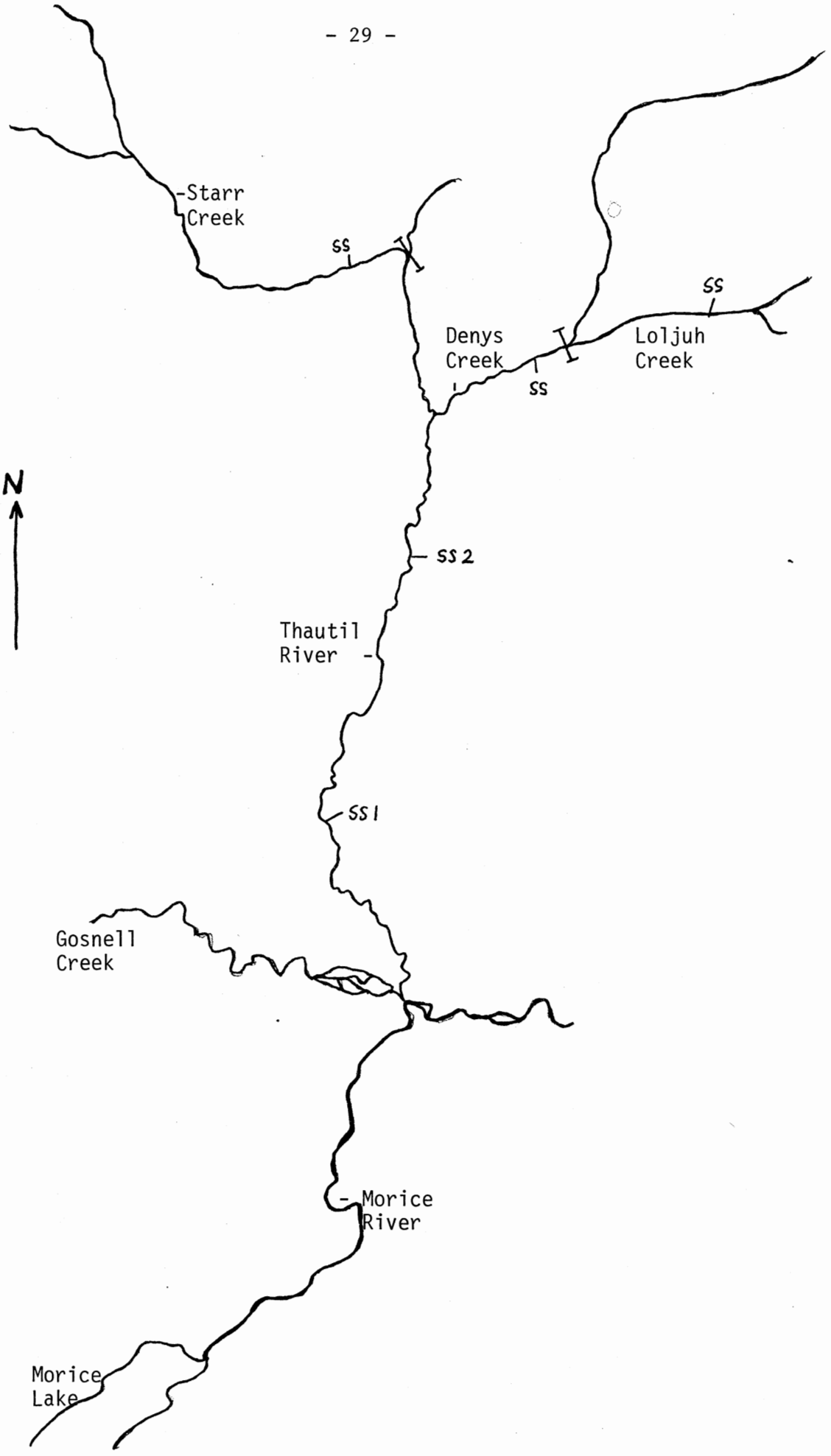

FIGURE 6. The Thautil River system. Scale 1:200,000

Coho

Juvenile coho were found only at Site 1 on the Thautil River. This site included a small backchannel in a gravel bar where all the coho were found. A.S.B. data indicates coho presence in the Thautil River and in a tributary, Gabriel Creek (Carswell, 1978).

Steelhead

Juvenile steelhead were captured in both Thautil River sites and in Starr Creek. Densities were quite low in all sites, with the maximum occurring at Thautil Site 2, a sidechannel. No rainbow were found in the Denys Creek system. The distribution is consistent with A.S.B. data (Carswell, 1978).

Potential steelhead smolt yield has been very roughly estimated by Tredger (1982) at 2,000 from the Thautil River system. An attempt to fine tune this estimate will be made with further data collection.

3.5.2 Future work

At this time the Thautil River is not well known to the F.H.I.S. Because of poor access, data collection will in 1982 be restricted to index sample sites in areas of known juvenile rainbow presence (eg. Thautil mainstem, Starr Creek).

3.6 Morice Mainstem

The mainstem Morice River was sampled at 10 sites in 1981; 4 in edge habitat and 6 in sidechannel areas. Only 5 sites were similar to 1980 sampling. A discussion of Morice River habitat will not be presented at this time. This discussion will basically be a summary of fish sampling data.

3.6.1 Fish sampling

A summary of mainstem population estimates is included in Table 17. Detailed results are included in Appendix 6. Sportfish captured included rainbow (steelhead), chinook, coho and mountain whitefish. Coho were present in 8 of 10 samples, with a mean density of 0.16/m^2 of sample site. Chinook fry were found at 6 of 10 sample sites, with a mean density of 0.03/m^2. All sites had rainbow fry, varying from 0.11 to 0.67 fry/m^2 with a mean of 0.29 fry/m^2. Rainbow parr were present at only 4 of 10 sites.

Table 17. Summary of Morice River mainstem fish population estimates. Density expressed as no/m^2.

SITE	HABITAT	RAINBOW		COHO	CHINOOK	OTHER
		0+	PARR[2]	Σ	Σ	SPECIES[1]
1	mainstem edge-good fry area	0.41	0	0.14	0.12	MW,LND
2	sidechannel-open,wide	0.15	0.01	0	0.01	MW,LND
3	mainstem edge-no cover	0.25	0.01	0.06	0.01	MW,LND
4	sidechannel-some cover	0.20	0.02	0.06	0.04	MW,LND
5	mainstem edge-no cover	0.31	0	0	0.12	MW,LND
6	sidechannel-open,some cover	0.29	0.03	0.28	0	MW,LND
7	sidechannel-open shallow riffle	0.39	0	0.01	0	MW,LND
8	sidechannel-small with cover	0.11	0	0.54	0	LND
9	mainstem edge-fast glide	0.15	0	0.20	0.02	SC
10	braided channel-good fry riffle	0.67	0	0.32	0	SC
MEAN		0.29	<0.01	0.16	0.03	--

[1] LND = longnose dace, MW = mountain whitefish, SC = sculpin.

[2] all parr were age 1+, except one 2+ fish at Site 4.

Steelhead fry density comparison - 1980 and 1981

A comparison of steelhead fry density at mainstem Morice River sample sites is given in Table 18. Overall mean sampled density in terms of numbers of fry per m^2 in 1981 was roughly twice the 1980 level.

Table 18. Summary of steelhead fry density at mainstem Morice River sample sites, 1980 and 1981.

SITE	STEELHEAD FRY DENSITY (no./m(no./m^2))	
	1980	1981
1. Aspen campground	--	2.67 (0.41)
2. Mile 21 sidechannel	1.72 (0.11)	2.35 (0.15)
3. Lamprey mainstem edge	--	1.01 (0.25)
4. Lamprey sidechannel	0.74 (0.11)	0.96 (0.20)
5. Lamprey mainstem edge	--	1.07 (0.31)
6. Lamprey sidechannel	1.10 (0.11)	1.15 (0.29)
7. 32 mile sidechannel	3.00 (0.11)	2.67 (0.39)
8. 32 mile sidechannel	1.27 (0.24)	0.63 (0.11)
- 33 mile mainstem edge	0.71 (0.09)	--
- 33 mile sidechannel	0.93 (0.18)	--
9. Morice West Rd. bridge	--	0.37 (0.15)
10. Islands above Gosnell	--	3.31 (0.67)
Mean all sites	1.35 (0.14)	1.62 (0.29)

In terms of numbers per linear meter, the 1981 density was only slightly higher.

Chinook and Coho

A summary of 1980 and 1981 chinook and coho densities is given in Table 19. These data indicate that chinook density was the same in 1980 and 1981 in terms of numbers per m^2, however linear density was slightly lower. Coho density was roughly doubled in 1981 both in terms of linear and area density. Both chinook and coho results may show different trends if similar sample sites were compared in the two sample years. This will not be attempted at this time.

Table 19. Summary of juvenile chinook and coho density (no/m(no/m^2)) in mainstem Morice River sample sites, 1980 and 1981.

SITE	CHINOOK				COHO			
	1980		1981		1980		1981	
1.		--	0.81	(0.12)		--	0.93	(0.14)
2.	0.69	(0.04)	0.10	(0.01)	0.15	(0.01)	0	(0)
3.		--	0.06	(0.01)		--	0.24	(0.06)
4.	1.20	(0.17)	0.17	(0.04)	0.83	(0.12)	0.31	(0.06)
5.		--	0.43	(0.12)		--	0	(0)
6.	0.11	(0.01)	0	(0)	0.32	(0.03)	1.11	(0.28)
7.	0.10	(0.01)	0	(0)	0	(0)	0.10	(0.01)
8.	0	(0)	0	(0)	1.48	(0.28)	2.95	(0.54)
	0	(0)		--	0.34	(0.06		--
	0	(0)		--	0	(0)		--
9.		--	0.06	(0.02)		--	0.50	(0.20)
10.		--	0	(0)		--	1.56	(0.32)
Mean all sites	0.30	(0.03)	0.22	(0.03)	0.45	(0.07)	0.77	(0.16)

3.6.2 Future work

The following will be attempted in the 1982 assessment:

1. continued monitoring of steelhead fry densities in Morice River mainstem sites. The objectives will be to build up a bank of data from which a proper "indexing" system can be made.

2. quantification of habitat in the mainstem Morice River, from Morice Lake to the Bulkley confluence. This will largely be done by air photo analysis with the inclusion of 1980 to 1982 habitat sampling data.

3. analysis will attempt to quantify fish populations and estimate the relative importance of various tributaries and mainstem areas.

4.0 DISCUSSION

Results of a second year (1981) of Morice River system sampling basically agreed with initial (1980) study conclusions. Owen and Lamprey Creeks were of primary importance as production areas for fry and yearling steelhead. The presence of 2 year old parr was greater in 1981 (at least in Owen Creek) perhaps suggesting a larger role in direct smolt production. Other tributaries sampled revealed a similar age distribution.

Steelhead fry recruitment monitoring in 1981 indicated a substantial increase over 1980 fry numbers in all areas sampled (tributaries and mainstem). Yearling populations in Owen and Lamprey Creeks were also estimated as being much higher in 1981. Despite increased numbers of steelhead juveniles in Lamprey Creek, total standing crop (biomass) was estimated as roughly equal in both years. This may be an indication that the stream was near capacity in both years.

"Survival" rates from 1980 fry to 1981 yearlings were estimated at 68% in Lamprey Creek and 81% in Owen Creek. These values are very high when compared to generally accepted rates, however are considered a reflection of the good habitat quality in both streams. Deep overwintering habitat is abundant in both streams. One other possible influence on high apparent survival is upstream parr migrations.

Data from other locations in the Morice system has not been collected or analyzed in the same detail as either Owen or Lamprey Creeks. Further collection of data in these locations will basically serve as an index to fry recruitment, and a means to put production from mainstem and tributary streams into some "perspective".

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APPENDIX I Lamprey Creek sampling data and standing crop estimates.

a) Habitat characteristics
b) Fish population estimates
c) Standing crop estimates

LAMPREY CREEK HABITAT SUMMARY - 1980 (TREDGER 1981)

TABLE 1 Lamprey Creek reach breaks and tributary data. Complete data in Appendix 1.

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 (canyon like)	39	55	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 (some beaverdams)	18	8	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 (beaverdams)	6	3	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 (some beaverdams)	2	6	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 (some isolated pools)	2	35	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

• Habitat characteristics of Lamprey Creek Reach 1

HABITAT TYPE
REACH LENGTH (m) 3250 Area = 17621 m^2

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	2		5		5	
Average length (m)	20		50.5		19.6	
Average wetted width (m)	9		5.9		6	
Average channel width (m)	11.5		8.6		10.4	
Average depth (cm)	88		10		26.	
Average area (m^2)	180		233		120	
Total no. of units in reach	16.7		41.6		41.6	
Total area of units in reach (m^2)	3006	17	9693	55	4922	28
Average area log debris cover (m^2)	2.5		.8		.5	
Average area boulder cover (m^2)	12		37.2		3.9	
Average area instream vegetation (m^2)	.75		0		.3	
Average area overstream vegetation (m^2)	8.5		4.4		1.4	
Average area cutbanks (m^2)	0		0		0	
Average area total cover (m^2)	23.8	13	42.4	18	6.1	5
Average % substrate fines		35		4		8
Average % substrate small gravel		7.5		6		8
Average % substrate large gravel		12.5		20		14
Average % substrate cobble		10		47		51
Average % substrate boulder		30		23		19
Average % substrate bedrock		5		0		0

• Habitat characteristics of Lamprey Creek Reach 2

HABITAT TYPE
REACH LENGTH (m) 8300 Area = 79616 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	5		7		3	
Average length (m)	92.4		9.3		23.3	
Average wetted width (m)	8.7		3.3		6	
Average channel width (m)	15.2		17.4		15.3	
Average depth (cm)	62		5		32	
Average area (m²)	1016		32.1		141	
Total no. of units in reach	69.5		97.3		41.7	
Total area of units in reach (m²)	70612	89	3123	4	5881	7
Average area log debris cover (m²)	30.6		0.9		6.3	
Average area boulder cover (m²)	0		0		0	
Average area instream vegetation (m²)	16		0.4		1	
Average area overstream vegetation (m²)	18.6		0.5		5.7	
Average area cutbanks (m²)	10		0		1	
Average area total cover (m²)	75.2	7	1.8	6	14	10
Average % substrate fines		60		11.4		31.7
Average % substrate small gravel		18		47.1		61.7
Average % substrate large gravel		17		39.3		7.5
Average % substrate cobble		5		2.2		0
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

• Habitat characteristics of Lamprey Creek Reach 5

HABITAT TYPE
REACH LENGTH (m) 7600 Area = 18935 m^2

Habitat unit	POOL		RIFFLE		GLIDE	
	Value	%	Value	%	Value	%
No. of units sampled	3		2		1	
Average length (m)	41.67	90	2.25	3	9	6
Average wetted width (m)	1.6	73.3	.9	38.5	2	.7
Average channel width (m)	2		2.5		3	
Average depth (cm)	30		3		1	
Average area (m^2)	107.7		2		18	
Total no. of units in reach	164.6		109.7		54.9	
Total area of units in reach (m^2)	17728	94	219	1	988	5
Average area log debris cover (m^2)	6.3	6	1.5	73	5	28
Average area boulder cover (m^2)	0	0	0	0	0	0
Average area instream vegetation (m^2)	.83	1	.1.	.05	1	6
Average area overstream vegetation (m^2)	6	6	1.25	61	4	22
Average area cutbanks (m^2)	5.7	5	.5	24	3	17
Average area total cover (m^2)	18.8	18	3.35	158	13	73
Average % substrate fines		46.7		30		50
Average % substrate small gravel		16.7		65		25
Average % substrate large gravel		16.7		5		0
Average % substrate cobbles		3.3		0		0
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

LAMPREY CR. DATE 24 AUG 81 AREA 129 M^2 SITE # 1
LENGTH 20 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+	32-52	38.53	0.65	19	.8	23.75	15.55	0.18	0.12	1.19
	1+		79	5.25	1	.8	1.25	6.56	0.01	0.05	0.06
	2+		123	19.82	1	.8	1.25	24.77	0.01	0.19	0.06
	Σ							46.88	0.20	0.36	1.31
COHO	Σ	40-84	55.53	2.23	90	.8	112.50	250.65	0.87	1.94	5.63
Ch	Σ	67	67	3.31	1	.8	1.25	4.14	0.01	0.03	0.06
D.V.	Σ	68-156	112	20.55	2	.8	2.50	51.39	0.02	0.40	0.13
M.W.F.	Σ	55	55	2.25	1	.8	1.25	2.81	0.01	0.02	0.06
Σ salmonid								388.88	1.14	3.01	7.38
C.N SUCKER		78	78	11.86	1	.8	1.25	14.83	0.01	0.11	0.06
C.N.D.		35-72	50.79	1.65	39	.8	48.75	80.20	0.38	0.62	2.44
CoHid		74-138	112.3	16.62	3	.8	3.75	62.33	0.03	0.48	0.19

HABITAT DESCRIPTION: glide - riffle

Discharge 0.04 m^3/s (1.25 cfs) Gradient 1.75

Temperature (°C) 13 Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		65	35
mean width		7	6
mean depth		.35	.1
% cover		4	11
cover type[1]		B, L	B
substrate[2]		C60, B20, LG10 SG5, F5	C50, B30, LG15 SG5

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

LAMPREY CR. DATE 24 AUG 81 AREA 46 M^2 SITE # 3
LENGTH 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 meter
RBT	0+	43-60	49.92	1.35	12	.75	16	21.66	0.35	0.47	2.29
	1+	76-118	89	7.97	11	.75	14.67	116.83	0.32	2.54	2.10
	Σ							138.49	0.67	3.01	4.39
L.N.D	Σ	50-79	60.95	2.77	20	.75	26.67	73.91	0.58	1.61	3.81

HABITAT DESCRIPTION: riffle

Discharge 0.01 m^3/s (0.5 cfs) Gradient 1.5

Temperature (°C) 13 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			3
mean depth			0.1
% cover			35
cover type[1]			B, L
substrate[2]			C40, B20, LG20 SG10, F10

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

LAMPREY CR. DATE 24 AUG 81 AREA 61 M^2 SITE # 4
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+	34-54	40.95	0.75	42	.75	56.00	42.14	0.92	0.69	2.43
	1+	67-97	77.08	5.04	12	.75	16.00	80.57	0.26	1.32	0.70
	2+	117-140	128.5	23.14	2	.75	2.67	61.71	0.04	1.01	0.12
	Σ							184.42	1.22	3.02	3.25
COHO	Σ	50-68	57	2.35	3	.75	4.0	9.41	0.07	0.15	0.17
D.V	Σ	42-43	42.5	0.77	2	.75	2.67	2.05	0.04	0.03	0.12
M.W.F.	Σ	52-57	54.25	2.16	4	.75	5.33	11.53	0.09	0.19	0.23
Σ salmonid								207.41	1.42	3.39	3.77
L.N.D.	Σ	34-59	43.73	1.04	15	.75	20	20.87	0.33	0.34	0.87

HABITAT DESCRIPTION: glide - riffle

Discharge 0.1 m^3/s (0.5 cfs) Gradient —

Temperature (°C) 14 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		74	26
mean width		3	2
mean depth		.25	.05
% cover		3	22
cover type[1]		L, IV, OV, C	L
substrate[2]		SG 95, FS	SG 90, F10

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

LAMPREY CR. DATE 24 AUG 81 AREA 156 M^2 SITE # 8
LENGTH 22 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+	30-59	39.88	0.72	56	.7	80.0	57.48	0.51	0.37	3.64
	1+	63-99	75.60	4.80	35	.7	50.0	240.14	0.32	1.54	2.27
	2+	125	125	20.80	1	.7	1.43	29.72	0.01	0.19	0.06
	Σ							327.34	0.84	2.10	5.97
M.W.F	Σ	50-103	58.94	3.12	18	.7	25.71	80.28	0.16	0.51	1.17
L.N.D.	Σ	21-80	48.30	1.49	27	.7	38.57	57.45	0.25	0.37	1.75
L.N. SUCKER	Σ	115	115	38.02	1	.7	1.43	54.32	0.01	0.35	0.06
Σ salmonid								407.62	1.0	2.61	7.14

HABITAT DESCRIPTION: glide - riffle

Discharge 0.03 m^3/s (1.2 cfs) Gradient 0.75

Temperature (°C) 14 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		92	8
mean width		9	2
mean depth		.30	.05
% cover		3	0
cover type[1]		L	—
substrate[2]		SG60, F30, LG5, C5	SG60, LG40

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

LAMPREY CR. DATE 24 AUG 81 AREA 238 M^2 SITE # 9
LENGTH 28 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+	29-48	37.28	0.57	156	.8	195	112.01	0.82	0.47	6.96
	1+	65-110	78.25	5.56	8	.6	13.3	74.11	0.06	0.31	0.48
	2+	117	117	17.06	1	.6	1.67	28.43	0.01	0.12	0.06
	Σ							214.55	0.89	0.90	7.50
D.V.	Σ	46-49	47.50	1.07	2	.8	2.50	2.69	0.011	0.011	0.09
M.W.F.	Σ	50-56	53	2.03	2	.8	2.50	5.07	0.011	0.021	0.01
Σ salmonid								222.31	0.912	0.934	7.6
L.N.D.	Σ	25-78	53.10	1.89	102	.8	127.5	241.22	0.54	1.01	4.55
SUCKER	Σ	142	142	71.58	1	.8	1.25	89.48	0.01	0.38	0.04

HABITAT DESCRIPTION:

Discharge 0.03 m^3/s (1.2 cfs) Gradient –

Temperature (°C) 13 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area	52		48
mean width	8		6.5
mean depth	0.50		0.05
% cover	3		1
cover type[1]	OV, L, IV, C		OV
substrate[2]	F65, LG25, SG5		LG50, SG30
	C5		F10, 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

LAMPREY CR. DATE 24 AUG. 81 AREA 58 M^2 SITE # 12
LENGTH 21 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
C.T.	0+	28-40	33.25	0.41	12	.7	17.14	6.96	0.30	0.12	0.82
	1+	64-85	74.58	4.51	12	.7	17.14	77.39	0.30	1.33	0.82
	2+	103-137	116.67	17.60	6	.7	8.57	150.85	0.15	2.60	0.41
	Σ							235.20	0.75	4.05	2.05
D.V.	Σ	65-149	96.33	10.55	15	.7	21.43	225.97	0.37	3.90	1.02
Σ Salmonid								461.17	1.11	7.96	3.06
Lamprey				present							

HABITAT DESCRIPTION:

Discharge 0.01 m^3/s (0.4 cfs) Gradient 0.5

Temperature (°C) 12 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area	65	31	4
mean width	3	2	1
mean depth	.40	.10	.03
% cover	16	72	100
cover type[1]	L, OV, C, IV	L, OV, C, IV	L, OV, C, IV
substrate[2]	F30, SG30, LG30, C10	F50, SG25 LG25	SG 60, F30 LG 10

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

c) standing crop calculations - Lamprey Creek.

All estimates based on 1980 and 1981 linear fish density estimates and estimated 1980 standing crop.

(i) Steelhead fry:

REACH	SITES	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	2.39	1.19	--	--
	3	2.82	2.29	--	--
	$\bar{x}$	2.61	1.74	5,417	3,611
2	4/5	2.74	2.43	--	--
	8	2.50	3.64	--	--
	9	1.90	6.96	--	--
	$\bar{x}$	2.38	4.34	18,571	33,864
				23,988	37,475
Stream Total				44,794	69,950

1981 standing crop = 1980 standing crop x $\frac{\text{(1981 mean density)}}{\text{(1980 mean density)}}$

stream total standing crop = 1980 total standing crop x

$$\frac{\text{(1981 Reach 1 \& 2 standing crop)}}{\text{(1980 Reach 1 \& 2 standing crop)}}$$

major assumptions:
1. sample sites representative of reach habitat to the same degree in 1980 and 1981
2. steelhead distribution similar in 1980 and 1981

(ii) 1+ Parr

REACH	SITES	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	0.74	0.06	--	--
	3	1.27	2.10	--	--
	$\bar{x}$	1.01	1.08	2,182	2,333
2	4/5	1.27	0.70	--	--
	8	0.55	2.27	--	--
	9	0.19	0.48	--	--
	$\bar{x}$	0.67	1.15	8,263	14,183
				10,445	16,516
Stream Total				19,320	30,550

(iii) 2+ Parr

REACH	SITES	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	0	.06	--	--
	3	.09	0	--	--
	$\bar{x}$	.045	.03	107	71
2	4/5	.15	.12	--	--
	8	.05	.06	--	--
	9	.0	.06		
	$\bar{x}$	.067	.08	1,009	1,205
				1,116	1,276
Stream Total				1,116	1,276

(iv) Coho fry

REACH	SITE	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	4.29	5.63	--	--
	3	0.09	0	--	--
2	4/5	1.50	0.17	--	--
	$\bar{x}$	1.96	1.93	12,375	12,186

APPENDIX 2 Owen Creek sampling data and standing crop estimates.

a) Habitat characteristics
b) Fish population estimates
c) Standing crop estimates

OWEN CREEK HABITAT DATA - 1980 (TREDGER 1981)

Table 3 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

• Habitat characteristics of OWEN CK. REACH 1

HABITAT TYPE
REACH LENGTH (m) 3950 25085 m^2

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	3		4		5	
Average length (m)	18.3		7.5		16.2	
Average wetted width (m)	8.3		4.25		4.8	
Average channel width (m)	17.3		14.5		12.0	
Average depth (cm)	52		10		20	
Average area (m^2)	158.3		29		93.2	
Total no. of units in reach	71		95		119	
Total area of units in reach (m^2)	11240	45	2755	11	11090	44
Average area log debris cover (m^2)	14	9	0.13	0.4	1.2	1
Average area boulder cover (m^2)	0	0	0	0	0.1	0.1
Average area instream vegetation (m^2)	0	0	0	0	0	0
Average area overstream vegetation (m^2)	2.7	2	0.25	1	0.8	1
Average area cutbanks (m^2)	1.3	1	0.13	0.4	0.4	0.4
Average area total cover (m^2)	18	11	0.5	1.8	2.5	2.5
Average % substrate fines		41.7		10		24
Average % substrate small gravel		26.7		46.3		43
Average % substrate large gravel		28.3		40		33
Average % substrate cobbles		3.3		3.7		0
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

• Habitat characteristics of OWEN CR. REACH 3 25 AUG '81

HABITAT TYPE
REACH LENGTH (m) 1700 9500 m²

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	1		3		2	
Average length (m)	28	44	3	14	13	42
Average wetted width (m)	8	89	5.3	49	8.5	74.5
Average channel width (m)	9		10.5		11.5	
Average depth (cm)	100		10		40	
Average area (m²)	224	45	16	10	112	45
Total no. of units in reach	27		81		54	
Total area of units in reach (m²)	6044	64	432	4	3022	32
Average area log debris cover (m²)	46	21	5	31	7	6
Average area boulder cover (m²)	0	0	0	0	0	0
Average area instream vegetation (m²)	0	0	0	0	0	0
Average area overstream vegetation (m²)	7	3	0	0	1	1
Average area cutbanks (m²)	5	2	0	0	4	4
Average area total cover (m²)	58	26	5	31	12	11
Average % substrate fines		70		20		65
Average % substrate small gravel		25		63.3		25
Average % substrate large gravel		5		16.7		10
Average % substrate cobbles		0		0		0
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

$\bar{x}$ velocity - .06 m/s
$\bar{x}$ gradient - .75%

• Habitat characteristics of OWEN CR. REACH 5 25 AUG 81

HABITAT TYPE
REACH LENGTH (m) 4650 31026 m^2

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	1		3		2	
Average length (m)	20	25	8	30	18.5	45
Average wetted width (m)	5	45	8.7	85	6.5	65.5
Average channel width (m)	11		10.3		11	
Average depth (cm)	80		20		33	
Average area (m^2)	100	18	64	35	124.5	47
Total no. of units in reach	57		172		115	
Total area of units in reach (m^2)	5700	18	11008	35	14318	46
Average area log debris cover (m^2)	19	19	3	5	3	2
Average area boulder cover (m^2)	0	0	0	0	0	0
Average area instream vegetation (m^2)	0	0	0	0	0	0
Average area overstream vegetation (m^2)	2	2	1.7	3	2.5	2
Average area cutbanks (m^2)	0	0	.3	1	.5	.4
Average area total cover (m^2)	21	21	5	8	6	4.4
Average % substrate fines		40		5		30
Average % substrate small gravel		35		8.3		35
Average % substrate large gravel		25		70		27.5
Average % substrate cobbles		0		16.7		7.5
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

$\bar{x}$ velocity - .06 m/s

$\bar{x}$ gradient - —

• Habitat characteristics of OWEN CR. REACH 6 25 AUG 81

HABITAT TYPE
REACH LENGTH (m) 1600 5976 m^2

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	3		3		1	
Average length (m)	12	58	7.7	37	3	5
Average wetted width (m)	4.16	29.3	3.2	23.6	1.5	11
Average channel width (m)	14		13.5		13	
Average depth (cm)	15		2		15	
Average area (m^2)	53.3	68.6	22.8	29.4	4.5	100
Total no. of units in reach	77		77		26	
Total area of units in reach (m^2)	4104	69	1755	29	117	2
Average area log debris cover (m^2)	1.5	2.8	.07	.29	2	44
Average area boulder cover (m^2)	0	0	0	0	.0	0
Average area instream vegetation (m^2)	.2	.38	0	0	.5	11
Average area overstream vegetation (m^2)	1.8	3.4	0	0	0	0
Average area cutbanks (m^2)	0	0	0	0	.1	2.2
Average area total cover (m^2)	3.5	6.58	.07	.29	2.6	57.2
Average % substrate fines		28.3		13.3		35
Average % substrate small gravel		45		41.6		40
Average % substrate large gravel		23.3		35		25
Average % substrate cobbles		3.3		8.3		0
Average % substrate boulder		0		1.7		0
Average % substrate bedrock		0		0		0

$\bar{x}$ velocity - .1 m/s

$\bar{x}$ gradient - 1%

OWEN CR. DATE 25 AUG 81 AREA 44 M² SITE # 1
LENGTH 16 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
RBT	0+	35-63	44.97	1.03	61	.8	76.25	78.54	1.73	1.79	4.77
	1+	70-105	84.72	6.83	7	.8	8.75	59.76	0.20	1.36	0.55
	2+	127	127	21.82	1	.8	1.25	27.27	0.03	0.61	0.08
	Σ							165.15	1.92	3.68	5.39
COHO	0+	48-70	60.13	2.70	8	.8	10	27	.22	.60	.63
Σ salmonid								192.15	2.14	4.28	6.02

HABITAT DESCRIPTION: glide - riffle (main stream)

Discharge 0.05 m³/s (1.7 cfs) Gradient 0.25 %

Temperature (°C) 14 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		67	33
mean width		3.0	3.25
mean depth		0.3	0.15
% cover		12	0
cover type[1]		L, OV, C	—
substrate[2]		SG 60, LG 30 F 10	SG 60, LG 35 F 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

OWEN CR. DATE AUG 81 AREA 127 M^2 SITE # 3
LENGTH 31 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+	32-63	45.99	1.10	277	.85	325.88	358.52	2.57	2.82	10.51
	1+	73-132	92.70	9.26	33	.85	38.82	359.48	0.31	2.83	1.25
	2+	151-172	163	46.57	4	.85	4.71	219.14	0.04	1.73	0.15
	3+	193	193	76.56	1	.85	1.18	90.07	0.01	0.71	0.04
	Σ							1027.21	2.93	8.09	11.95
COHO	Σ	43-78	56.15	2.25	39	.85	45.88	103.38	0.36	0.81	1.48
D.V.	Σ	50-57	54.33	1.62	3	.85	3.53	5.72	0.03	0.05	0.11
M.W.F	Σ	68-80	73.50	5.42	4	.85	4.71	25.48	0.04	0.20	0.15
Σ salmonid								1161.59	3.36	9.15	1.74

HABITAT DESCRIPTION: glide - riffle

Discharge 0.19 m^3/s (6.6 cfs) Gradient —

Temperature (°C) 12 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		83	17
mean width		6	8
mean depth		0.15	0.03
% cover		7	0
cover type[1]		L, OV, C	—
substrate[2]		SG60, LG20 F20	SG40, LG40 F20

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

OWEN CR. DATE 25 AUG 81 AREA 99 M^2 SITE # 5

LENGTH 15 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+	37-63	49.43	1.36	53	.75	70.67	95.88	0.71	0.97	4.71
	1+	79-99	90.3	7.95	20	.75	26.67	212.08	0.27	2.14	1.78
	2+	115-131	126.3	21.83	3	.75	4.0	87.32	0.04	0.88	0.27
	Σ							395.28	1.02	3.99	6.76
COHO	Σ	40-66	54.16	1.98	57	.75	76.0	150.2	0.77	1.52	5.07
D.V.	Σ	55-88	68.50	3.56	8	.75	10.67	37.98	0.11	0.38	0.71
Σ salmonid								583.46	1.90	5.89	12.54

HABITAT DESCRIPTION: glide - riffle

Discharge	0.06 m^3/s (2 cfs)	Gradient	.75%
Temperature (°C)	13	Turbidity	clear
Hydraulic Type	Pool	Glide	Riffle
% area		85	15
mean width		7	5
mean depth		.35	.10
% cover		12	53
cover type[1]		L, OV, C	L
substrate[2]		F60, SG 30 LG 10	F30, SG60 LG 10

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

OWEN CR. DATE 25 AUG 81 AREA 126 M² SITE # 7
LENGTH 16 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
RBT	0+	37-66	48.31	1.28	94	.75	125.33	160.46	0.99	1.27	7.83
	1+	73-125	92.21	8.84	24	.75	32.0	282.98	0.25	2.25	2.0
	2+	155-172	163.5	46.93	2	.75	2.67	125.13	0.02	.99	0.17
	Σ							496.55	0.82	3.94	6.5
CoHo	Σ	42-75	57.49	2.34	57	.75	76	177.85	0.60	1.41	4.75
D.V.	Σ	45-95	66.0	3.60	10	.75	13.33	47.96	0.11	0.38	0.83
M.W.F.	Σ	60-74	66.0	3.94	18	.75	24.0	94.46	0.19	0.75	1.50
Σ salmonid								816.82	1.72	6.48	13.58

HABITAT DESCRIPTION: riffle - glide

Discharge 0.06m³/s (2 cfs) Gradient —

Temperature (°C) 12 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		48	52
mean width		6	11
mean depth		.35	.20
% cover		7	17
cover type[1]		L, OV, C	L, OV, C
substrate[2]		F40, SG30 LG25, C5	LG60, C25 SG10, F5

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

OWEN CR. DATE 25 AUG 81 AREA 98 M^2 SITE # 9
LENGTH 32 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+	29-60	40.93	0.79	138	.85	162.35	127.49	1.66	1.30	5.07
	1+	102-112	107.0	13.13	2	.85	2.35	30.90	0.02	0.32	0.07
	Σ							158.39	1.68	1.62	5.14
M.W	Σ	64	64	3.54	1	.85	1.18	4.16	0.01	0.04	0.04
Σ salmonid								162.55	1.69	1.66	5.18
Cottid	Σ	48-118	69.17	4.54	6	.6	10	45.37	0.10	0.46	0.31
R.S. SHINER	Σ	20-41	27.92	0.11	24	.85	28.24	3.11	0.29	0.03	0.88
N. SQAWFISH	Σ	159	159	345.69	1	.85	1.18	406.70	0.01	4.15	0.04

HABITAT DESCRIPTION: pool - riffle

Discharge 0.02 m^3/s (0.7 cfs) Gradient 1%

Temperature (°C) 15 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area	88		12
mean width	5		2
mean depth	.30		.02
% cover	1		0
cover type[1]	L, OV		—
substrate[2]	SG 60, F20 LG 20		LG 60, SG 20 C 10, F 10

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

c) Standing Crop Calculations - Owen Creek

(i) Steelhead fry

REACH	SITES	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	2.94	4.77	--	--
	3	4.68	10.51	--	--
	$\bar{x}$	3.81	7.64	18,410	36,916
3	5	0	4.71	not applicable	
5'	7	1.58	5.87	12,360	45,920
6'	9	2.08	2.54	1,676	2,046
Reach 1, 5 and 6 total				32,446	84,882
Stream total				38,330	100,275

1. steelhead fry in reach 6 and upper half of reach 5 assumed to be 50% of total rainbow fry capture.

(ii) 1+ Parr

REACH	SITES	FISH DENSITY (no/m)		STANDING CROP	
		1980	1981	1980	1981
1	1	0.69	0.55	--	--
	3	0.65	1.25	--	--
	$\bar{x}$	0.67	0.90	2,024	2,719
3[1]	5	0.31	1.78	not applicable	
5[2]	7	0.84	1.48	6,960	12,263
6[2]	9	0.07	0.035	75	38
Reach 1, 5 and 6 total				9,059	15,020
Stream total				18,715	31,029

1. not applicable because of habitat differences.
2. steelhead yearlings in reach 6 and upper half of reach 5 assumed to be 50% of total rainbow yearling population.

(iii) 2+ Parr

REACH	SITES	FISH DENSITY (no/m) 1980	FISH DENSITY (no/m) 1981	STANDING CROP 1980	STANDING CROP 1981
1	1	0	.08	--	--
	3	0	.15	--	--
	$\bar{x}$	0	.12	0	474
3	5	.10	.27	not applicable	
5	7	.13	.17	900	1,177
6	9	0	0	10	10
Reach 1, 5 and 6 total				910	1,661
Stream total				3,460	6,315

(iv) Coho fry

REACH	REACH LENGTH	SITE	FISH DENSITY (no/m)	STANDING CROP
1		1	0.63	--
		3	1.48	--
	3,950	$\bar{x}$	1.05	4,148
2	850		(3.06)	2,601
3	1,700	5	5.07	8,619
4	1,000		(4.91)	4,910
5	4,600	7	4.75	21,850
6	1,600	9	0	0
				42,128

1981 estimates were based on linear density only; no reference to 1980 standing crop was made because of distribution differences.

APPENDIX 3 Houston Tommy Creek sampling data and standing crop estimates.

a) Habitat characteristics
b) Fish population estimates

• Habitat characteristics of HOUSTON TOMMY CR REACH 1 27 AUG 81

HABITAT TYPE mainstem
REACH LENGTH (m) 1000 m Area = 112750 m²

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	0		2		1	
Average length (m)			60	70	50	30
Average wetted width (m)			20	75	7	39
Average channel width (m)			26.5		18	
Average depth (cm)			.30		.50	
Average area (m²)			1200	87	350	13
Total no. of units in reach			82		41	
Total area of units in reach (m²)			98400	87	14350	13
Average area log debris cover (m²)			3.5	.29	7	2
Average area boulder cover (m²)			10.5	.88	6	1.7
Average area instream vegetation (m²)			0.	0	0	0
Average area overstream vegetation (m²)			7.5	.63	15	4.3
Average area cutbanks (m²)			0	0	0	0
Average area total cover (m²)			21.5	1.80	28	8
Average % substrate fines				12.5		10
Average % substrate small gravel				12.5		20
Average % substrate large gravel				30		30
Average % substrate cobbles				27.5		30
Average % substrate boulder				17.5		10
Average % substrate bedrock				0		0

$\bar{x}$ velocity - .7 m/s.

$\bar{x}$ gradient - 1.5%

discharge - 2 m³/s (70 cfs)

• Habitat characteristics of HOUSTON TOMMY REACH 2

HABITAT TYPE mainstem
REACH LENGTH (m) 7900m Area = 71800 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled			1		2	
Average length (m)			43		22.5	
Average wetted width (m)			6		12	
Average channel width (m)			30		35	
Average depth (cm)			30		35	
Average area (m²)			258		270	
Total no. of units in reach			90		180	
Total area of units in reach (m²)			23220	32	48600	68
Average area log debris cover (m²)			1		8.5	
Average area boulder cover (m²)			0		2.5	
Average area instream vegetation (m²)			0		0	
Average area overstream vegetation (m²)			6		7	
Average area cutbanks (m²)			2		1.5	
Average area total cover (m²)			9	3.4	19.5	7.2
Average % substrate fines			0		2.5	
Average % substrate small gravel			5		2.5	
Average % substrate large gravel			30		22.5	
Average % substrate cobble			60		62.5	
Average % substrate boulder			5		10.0	
Average % substrate bedrock			0		0	

gradient : 1.2%

HOUSTON TOMMY CR DATE 27 AUG. 81 AREA 33 M^2 SITE # 1
LENGTH 11 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	Σ	127-159	143	32.31	2	.8	2.50	80.78	0.08	2.45	0.23

HABITAT DESCRIPTION: riffle

Discharge 2 m^3/s (1000) Gradient 1.5%

Temperature (°C) 10 Turbidity

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			20
mean depth			
% cover			1.6
cover type[1]			B C L
substrate[2]			F SG LG C B Br

COMMENTS: sampled near site and found 1 YC - 75mm and 1 DV - 110 mm.

[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

HOUSTON TOMMY CR. DATE 27 AUG 81 AREA 23 M² SITE # 2
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 meter
COHO	Σ	47-48	47.5	1.29	2	.9	2.22	2.86	0.10	0.12	0.15
D.V.	Σ	44-78	63.25	2.80	4	.9	4.44	12.47	0.19	0.54	0.30

HABITAT DESCRIPTION: riffle-glide in side channel

Discharge 0.06 m³/s (2.2 cfs) Gradient 1.2 %

Temperature (°C) 5°C @ confluence Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		47	53
mean width		1.5	1.5
mean depth		.20	.10
% cover		14	4
cover type[1]		L, OV	L
substrate[2]		F3C, SG10, LG30	SG10, LG30
		C30	C55, B5

COMMENTS: Discharge in side channel only

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

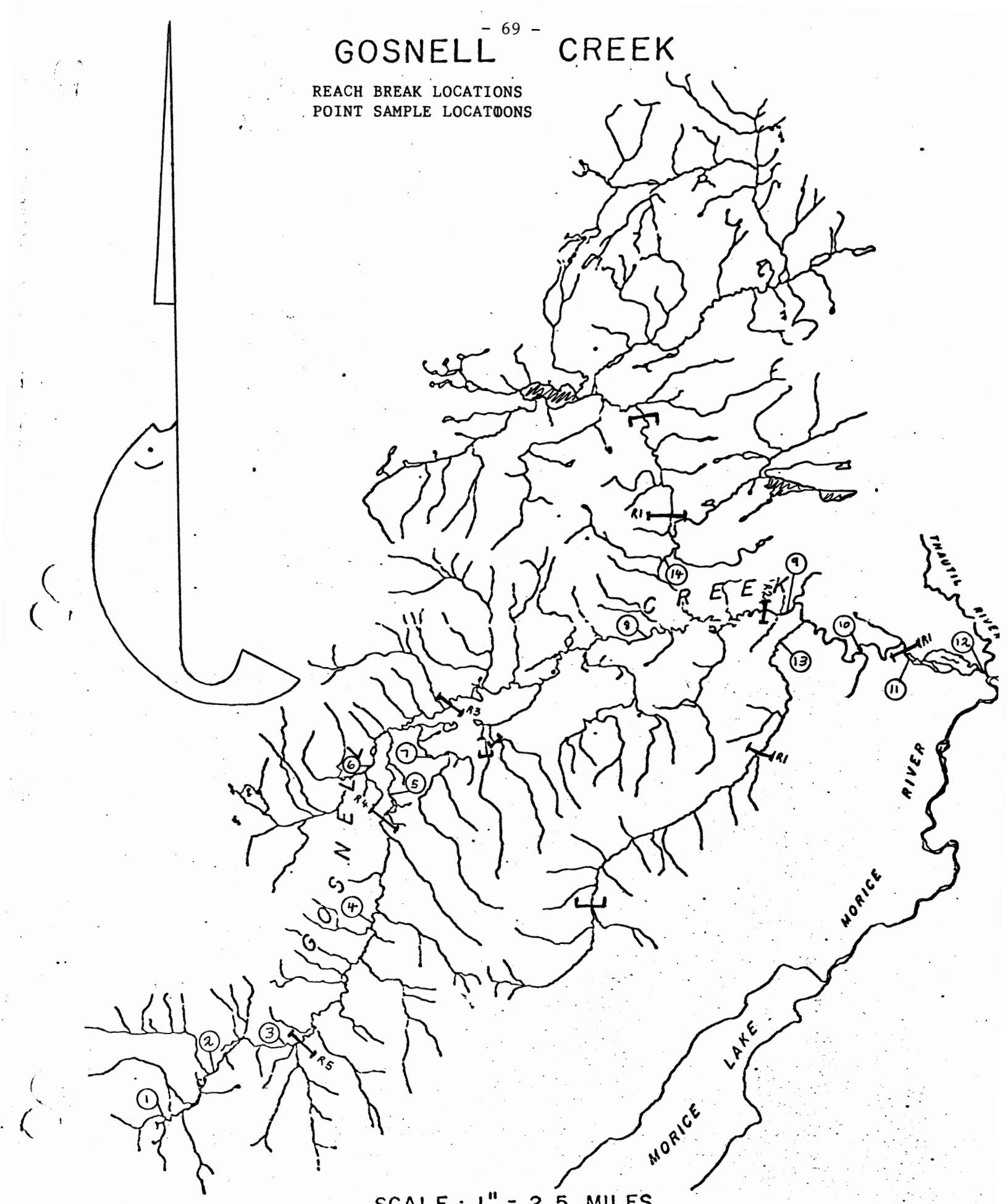
[2] F fines, SG small gravel, LG large gravel, C cobbles, B boulders, Br bedrock

APPENDIX 4 Gosnell Creek sampling data.

a) Aquatic Studies Branch data
b) Habitat characteristics
c) Fish population estimates

GOSNELL CREEK

REACH BREAK LOCATIONS
POINT SAMPLE LOCATIONS



SCALE : 1" = 2.5 MILES

APPENDIX 1: Summary of Stream Reach Inventory Data for Gosnell Creek

STREAM REACH FEATURE	1	2	3	4	5	6
BED MATERIAL						
Fines (clay, silt, sand)	20	35	45	15	30	100
Gravel (2-64mm)	80	55	55	75	60	-
Large (64mm+)	0	10	0	10	10	-
Bedrock	0	0	0	0	0	-
CHANNEL WIDTH (m)	20	25	20	30	30	25
CHANNEL DESCRIPTION						
Stage	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Flow Character	Placid/Swirling	Placid	Rolling/Swirling	Placid/Swirling	Swirling	Placid/Swirling
Valley:channel ratio	10+	10+	10+	10+	10+	5/10
Confinement	Unconfined	Confined	Unconfined	Unconfined	Unconfined	Unconfined
Pattern	Irregular	Regular	Irregular	Irregular	Irregular	Irregular
Vertical Stability	Aggrading	Stable	Stable	Stable	Stable	?
Side Channel	Low	Low	Moderate	Moderate	Moderate	Low
Channel Debris	High	Low	Moderate	Low	Low	Low
Floodplain Debris	High	Low	Moderate	Moderate	Moderate	Moderate
BAR PRESENCE						
Side/point	High	Moderate	High	High	High	Moderate
Mid Channel	High	Low	Moderate	Moderate	High	Low
Transverse	Low	Nil	Low	Low	Moderate	Low
Junction	Moderate	Nil	Low	Low	Low	Low
Diamond/braiding	Moderate	Low	Low	Low	Moderate	Low
Islands	Moderate	Low	Low	Moderate	Moderate	Nil
LATERAL CHANNEL MOVEMENT						
Apparently stable	No	Yes	No	No	No	No
Bar Vegetation progressions	Moderate	Low	High	Moderate	Moderate	Low
Cut-offs/oxbows	High	Low	High	Moderate	Moderate	Low-Nil
Meander scars	High	Low	High	Moderate	Moderate	Low
Avulsions	High	Low	Low	Moderate	Nil	Low
Terraces	High	Low	Low	Low	Nil	Low
Constrictions	Low	Nil	Nil	Nil	Low	Low
% Unstable Banks	5	5	5	5	5	-
ACTIVE VALLEY WALL PROCESS						
Rock/soil falls	Nil	Low	Nil	Nil	Nil	Low
Mud/snow flows	Nil	Nil	Nil	Nil	Nil	Low
Slumps/glides	Nil	Nil	Low	Nil	Low	Low
Slides	Nil	Nil	Nil	Nil	Low	Moderate
STREAM FEATURES	-inundated area -stream bed undefined -standing deadfall	-stable banks -deep, straight channel	-many side point bars -gravelly bottom			-mostly organic in stream bed
FISH PRESENT	Co, Sh, DV	Co, Sh, DV	DV	DV	DV	Co
FIELD PHOTOGRAPHS	Yes	Yes	Yes	Yes	Yes	Yes
AIR PHOTOGRAPHS & NUMBER	BC 5302-172 -126	BC 5302-172 -126	BC 5309-088	BC	BC	BC
POINT SAMPLE DATA CARD NUMBER	11,12	9,10	8	5	4	1,2,3
FISH SAMPLE DATA CARD NUMBER	11,12	9,10	5	5	4	
NTS MAP	93 L 3	93 L 3	93 L 4	93 L 4	93 L 4	93 L 4
COMMENTS	-appears to be a good coho spawn area -good SH holding water					

APPENDIX 2: Summary of Stream Reach Inventory Data for Gosnell Creek Tributaries

Cox

STREAM FEATURE / REACH	TRIB #1 REACH #1	TRIB #2 REACH #1	TRIB #3	TRIB #4
BED MATERIAL				
Fines (clay, silt, sand)	40	45	100	100
Gravel (2-64mm)	45	40	-	-
Large (64mm+)	5	5	-	-
Bedrock	0	0	-	-
CHANNEL WIDTH (m)	15	15	7	4.0
CHANNEL DESCRIPTION				
Stage	Moderate	Moderate	High	Moderate
Flow Character	Broken-Tumbling	Broken	Placid	Placid
Valley:channel ratio	2/5	10+	10+	10+
Confinement	Unconfined	Unconfined	Unconfined	Unconfined
Pattern	Irregular	Irregular	Irregular	Irregular
Vertical Stability	Aggrading	Aggrading	Aggrading	Aggrading
Side Channel	Moderate	High	Low	Moderate
Channel Debris	Low	Low	Low	Low
Floodplain Debris	Moderate	Moderate	Low	Moderate
BAR PRESENCE				
Side/point	High	High	Low	Low-Nil
Mid Channel	Moderate	High	Low	Low
Transverse	High	High	Low	Low
Junction	Moderate	Moderate	Low	Nil
Diamond/braiding	Moderate	Moderate	Low	Nil
Islands	Moderate	High	Low	Nil
LATERAL CHANNEL MOVEMENT				
Apparently stable	No	No	No	No
Bar Vegetation progressions	High	Moderate	High	Nil
Cut-offs/oxbows	High	High	High	Moderate
Meander scars	Moderate	High	High	Low
Avulsions	Low	Moderate	Low	Low
Terraces	Low	Moderate	Low	Nil
Constrictions	Low	Low-Moderate	Low	Low
% Unstable Banks	5-10	5	10	5
ACTIVE VALLEY WALL PROCESS				
Rock/soil falls	Low	Low	Nil	Nil
Mud/snow flows	Low-Nil	Low	Nil	Nil
Slumps/glides	Low	Low	Low	Nil
Slides	Low	Low	Nil	Nil
STREAM FEATURES	-lower end -multiple channel	-broken channel good spawning gravel steelhead, coho -good fry holding water	-mostly organics (60%) on streambed	-swampy, marshy flats -heavy debris fall
FISH PRESENT	Co, (DV)	Co, (DV), (SH)	Co	Co, DV
FIELD PHOTOGRAPHS	Yes	Yes	Yes	Yes
AIR PHOTOGRAPHS & NUMBER	BC 5302-126	BC 5309-088	BC	BC
POINT SAMPLE DATA CARD NUMBER	13	14	6	7
FISH SAMPLE DATA CARD NUMBER	13	14	6	
NTS MAP	93 L 3	93 L 6	93 L 4	93 L 4
COMMENTS				-high streambed organics

• Habitat characteristics of Gosnell Creek Reach 2
(combined 1980 and 1981 data)

HABITAT TYPE
REACH LENGTH (m) 8000 Area = 127,152 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled			7		8	
Average length (m)			19		94	
Average wetted width (m)			16		16	
Average channel width (m)			40		49	
Average depth (cm)			21		62	
Average area (m^2)			304		1500	
Total no. of units in reach			63		72	
Total area of units in reach (m^2)			19152	15	108000	85
Average area log debris cover (m^2)			10,5		9	
Average area boulder cover (m^2)			3		0	
Average area instream vegetation (m^2)			0		0.1	
Average area overstream vegetation (m^2)			8		11	
Average area cutbanks (m^2)			0		3.2	
Average area total cover (m^2)			21.5	7.1	23.3	1.5
Average % substrate fines			3.5		26	
Average % substrate small gravel			23.5		29	
Average % substrate large gravel			43.5		29	
Average % substrate cobble			25.0		14	
Average % substrate boulder			4.5		2	
Average % substrate bedrock			0		0	

• Habitat characteristics of Gosnell Creek Reach 3
(combined 1980 and 1981 data)

HABITAT TYPE
REACH LENGTH (m) 15000 Area = 294,192 m^2

Habitat unit	POOL Value	POOL %	RIFFLE Value	RIFFLE %	GLIDE Value	GLIDE %
No. of units sampled	1		4		5	
Average length (m)	11		49		110	
Average wetted width (m)	4		16.7		21	
Average channel width (m)	20		31.5		32	
Average depth (cm)	40		38		67	
Average area (m^2)	44		818		2310	
Total no. of units in reach	20		79		99	
Total area of units in reach (m^2)	880	<1	64622	22	228,690	78
Average area log debris cover (m^2)	4		2.5		54	
Average area boulder cover (m^2)	0		0		0	
Average area instream vegetation (m^2)	0		0		0	
Average area overstream vegetation (m^2)	0		7.8		104	
Average area cutbanks (m^2)	0.8		14		25	
Average area total cover (m^2)	4.8	10.9	46.8	5.7	183	7.9
Average % substrate fines		80		6		20
Average % substrate small gravel		20		50		48
Average % substrate large gravel		0		42		30
Average % substrate cobbles		0		2		2
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

Average gradient = 0.85% (0.5-1.5)

• Habitat characteristics of GOSNELL REACH 4 27 AUG 81

HABITAT TYPE
REACH LENGTH (m) 6000 Area = 39,680 m^2

Habitat unit	POOL		RIFFLE		GLIDE	
	Value	%	Value	%	Value	%
No. of units sampled	1		2		3	
Average length (m)	6	7	10	24	19.3	69
Average wetted width (m)	4	7	8	23	6.5	20
Average channel width (m)	60		39		38	
Average depth (cm)	1		.13		.35	
Average area (m^2)	24	4	80	29	124	67
Total no. of units in reach	71		143		214	
Total area of units in reach (m^2)	1704	4	11440	29	26536	67
Average area log debris cover (m^2)	1	4	1.5	2	1.3	1
Average area boulder cover (m^2)	0	0	0	0	0	0
Average area instream vegetation (m^2)	0	0	0	0	0	0
Average area overstream vegetation (m^2)	2	8	.5	1	2.3	2
Average area cutbanks (m^2)	1	4	.25	.3	1	1
Average area total cover (m^2)	4	16	2.25	3.3	4.6	4
Average % substrate fines		15		7.5		28.3
Average % substrate small gravel		70		60		50
Average % substrate large gravel		15		32.5		21.7
Average % substrate cobles		0		0		0
Average % substrate boulder		0		0		0
Average % substrate bedrock		0		0		0

$\bar{x}$ velocity —
$\bar{x}$ gradient .5%

• Habitat characteristics of GOSNELL REACH 5 27 AUG 81

HABITAT TYPE
REACH LENGTH (m) 10000 Area = 64,974 m^2

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	2		1		1	
Average length (m)	17	35	34	35	30	30
Average wetted width (m)	6	75	7	10	6.5	9
Average channel width (m)	80		73		75	
Average depth (cm)	.8		.25		.3	
Average area (m^2)	102	32	238	37	195	31
Total no. of units in reach	204		102		102	
Total area of units in reach (m^2)	20,808	31	24,276	37	19,890	32
Average area log debris cover (m^2)	8	8	2	.4	7	4
Average area boulder cover (m^2)	0	0	0	0	0	0
Average area instream vegetation (m^2)	0	0	0	0	0	0
Average area overstream vegetation (m^2)	1.5	1	4	2	0	0
Average area cutbanks (m^2)	2.25	2	0	0	2	1
Average area total cover (m^2)	11.75	11	6	6	9	5
Average % substrate fines		15		0		0
Average % substrate small gravel		7.5		5		5
Average % substrate large gravel		30		25		30
Average % substrate cobbles		37.5		55		50
Average % substrate boulder		5		10		10
Average % substrate bedrock		0		0		0

$\bar{x}$ velocity —

$\bar{x}$ gradient 2.2%

• Habitat characteristics of Shea CREEK REACH 1 27 AUG. 81

HABITAT TYPE
REACH LENGTH (m) 5000 m Area = 29882 m²

Habitat unit	POOL Value	%	RIFFLE Value	%	GLIDE Value	%
No. of units sampled	0		2		4	
Average length (m)			16.5	24	25.5	76
Average wetted width (m)			5	7	7.5	8
Average channel width (m)			75		75	
Average depth (cm)			.15		.26	
Average area (m²)			85.5	21	159	79
Total no. of units in reach			74		148	
Total area of units in reach (m²)			6327	21	23555	79
Average area log debris cover (m²)			0	0	1.5	1
Average area boulder cover (m²)			1	1	.25	.15
Average area instream vegetation (m²)			0	0	.25	.15
Average area overstream vegetation (m²)			0	0	.75	.5
Average area cutbanks (m²)			0	0	0	0
Average area total cover (m²)			1	1	2.75	6.3
Average % substrate fines			5		15	
Average % substrate small gravel			27.5		36.25	
Average % substrate large gravel			35		25	
Average % substrate cobbles			27.5		20	
Average % substrate boulder			5		6.25	
Average % substrate bedrock			0		0	

$\bar{x}$ velocity –

$\bar{x}$ gradient 1%

note: 1980 data not included as only side channel habitat was sampled.

GOSNELL CR DATE 27 AUG 81 AREA 50 M^2 SITE # 1
LENGTH 11 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	Σ	117-125	121	18.93	2	.7	2.86	54.08	0.06	1.08	0.26
COHO	Σ	38-75	51.09	1.79	11	.7	15.71	28.15	0.31	0.56	1.43
Salmonid								82.23	0.37	1.64	1.69

HABITAT DESCRIPTION: side channel of Gosnell

Discharge Gradient 0.5 %

Temperature (°C) 11 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		4.5	
mean depth		.25	
% cover		12	
cover type[1]		L, OV	
substrate[2]		F60, SG20, LG15, C5	

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 CR DATE 27 AUG 81 AREA 60 M² SITE # 2
LENGTH 10 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
RBT	0+	45	45	0.97	1	.7	1.43	1.39	0.02	0.02	0.14
COHO	Σ	41-106	61	3.75	9	.7	12.86	48.18	0.21	0.80	1.29
D.V.	1+	72	72	3.73	1	.7	1.43	5.33	0.02	0.09	0.14
Salmonid								54.9	0.25	0.91	1.57

HABITAT DESCRIPTION: side pool / log jam site

Discharge Gradient

Temperature (°C) Turbidity

Hydraulic Type	Pool	Glide	Riffle
% area	100		
mean width	6.0		
mean depth	.40		
% cover	8		
cover type[1]	L, C		
substrate[2]	F80, SG20		

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

COSNELL CR DATE 27 AUG 81 AREA 40 M^2 SITE # 3
LENGTH 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 meter
D.V:	Σ	48-95	64.67	3.67	3	.7	4.29	15.72	0.11	0.39	0.54

HABITAT DESCRIPTION: pool and tail (glide)

Discharge 1.0 m^3/s (35 cfs) Gradient

Temperature (°C) 9 @ 1500 hrs Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area	60	40	
mean width	4	8	
mean depth	1.0	.35	
% cover	17	18	
cover type[1]	OV, C, L	OV, C, L	
substrate[2]	F15, SG70, LG15	F40, SG50, LG10	

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 CR. DATE 27 AUG. 81 AREA 65 M² SITE # 4
LENGTH 10 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
COHO	Σ	88	88	8.18	1	.7	1.43	11.68	0.02	0.18	0.14
D.V.	Σ	46-132	103.4	13.42	10	.7	14.29	191.69	0.22	2.95	1.43
Epalmonid								203.37	0.24	3.13	1.57

HABITAT DESCRIPTION: Pool - glide

Discharge Gradient

Temperature (°C) 10 Turbidity

Hydraulic Type	Pool	Glide	Riffle
% area	65	35	
mean width	7.2	5.4	
mean depth	1.0		
% cover	12		
cover type[1]	L, OV, C		

substrate[2] F30, SG10
LG30, C25, B5

COMMENTS: pool description pertains to pool and pool tail (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

Shea (Cox) CR. DATE 27 AUG 81 AREA 161 M^2 SITE # 1
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+	49-52	51.17	1.43	6	.7	8.57	12.25	0.05	0.08	0.37
	1+	79-120	88	7.80	7	.7	10.0	78.01	0.06	0.48	0.43
	2+	135-136	135.5	26.50	2	.7	2.86	75.70	0.02	0.47	0.12
	Σ							155.96	0.13	1.03	0.92
COHO	Σ	41-51	47.36	1.29	11	.7	15.71	20.28	0.10	0.13	0.68
D.V.	Σ	53-70	61.50	2.46	2	.7	2.86	7.03	0.02	0.04	0.12
Σ salmonid								183.27	0.25	1.2	1.72

HABITAT DESCRIPTION: riffle with cobble - boulder cover

Discharge 0.25 m^3/s (9 cfs) Gradient

Temperature (°C) 12 @ 1330 hrs Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			7
mean depth			.15
% cover			1.5
cover type[1]			B
substrate[2]			FS, SG 15, LG 30 C 40, B 10

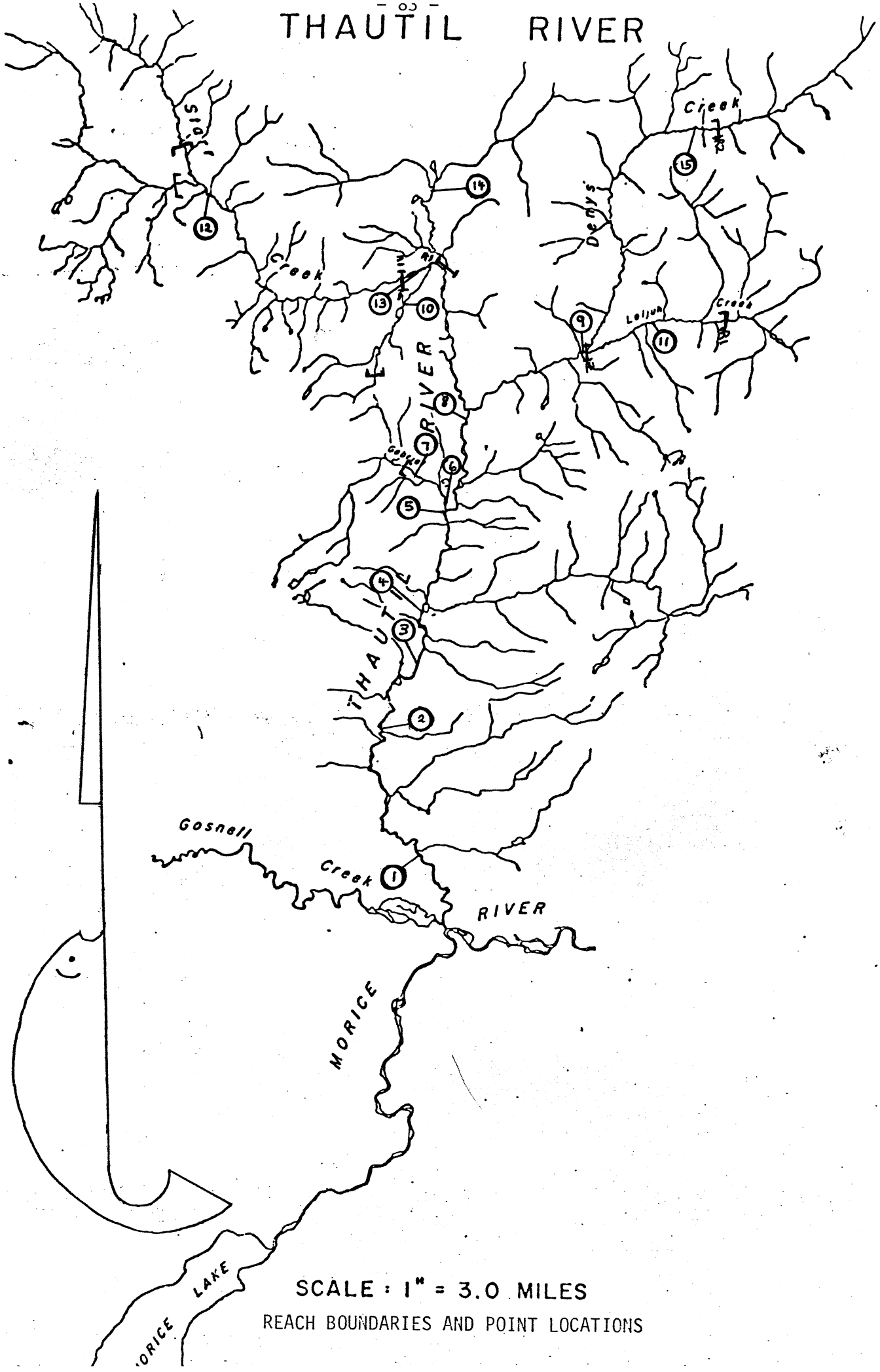
COMMENTS:

[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

APPENDIX 5 Thautil River sampling data.

a) A.S.B. data
b) Fish population estimates


THAUTIL RIVER
Creek
Denys
Creek
Lajun
Creek
RIVER
THAUTIL
Gosnell
Creek
RIVER
MORICE
LAKE
SCALE : 1" = 3.0 MILES
REACH BOUNDARIES AND POINT LOCATIONS

APPENDIX 1 A Summary of Stream Reach Inventory Data for THAUTIL RIVER and TRIBUTARIES

STREAM REACH / FEATURE	THAUTIL RIVER REACH 1	THAUTIL RIVER REACH 2	STARR CREEK REACH 1	STARR CREEK REACH 2	STARR CREEK TRIBUTARY 1	GABRIEL CREEK REACH 1	LOLJUH CREEK REACH 1	DENY'S CREEK REACH 1	DENY'S CREEK REACH 2
BED MATERIAL									
Fines (clay, silt, sand)	20	30	20	30	20	40	20	25	10
Gravel (2-64mm	75	50	30	50	20	30	40	25	50
Large (64mm+)	5	20	50	20	60	30	40	50	30
Bedrock	0	0	0	0	0	0	0	0	10
CHANNEL WIDTH (m)	18	4	30	10	1.3	1-2	6	10	8
CHANNEL DESCRITION									
Stage	M	M	M	M	M	M	M	M	M
Flow Character	R-Broken	Swirling	R-Broken	Swirling	Placid	Swirling	S-Rolling	S-Rolling	R-Broken
Valley:channel ratio	2/5	2/5	2/5	2/5	10+	2/5	2/5	5/10	2/5
Confinement	occasionally confined	occasionally confined	N/A	occasionally confined	unconfined	confined	confined	occasionally confined	unconfined
Pattern	regular meander	meandering	sinuous	sinuous	regular	sinuous	regular meander	irregular	regular
Vertical Stability	stable	unstable	unstable	unstable	degrading	unstable	stable	stable	stable
Side Channel	M	L	M	L	M	M	L	L	L
Channel Debris	M	L	L	L	L	L	M	M	M
Floodplain Debris	M	L	M	L	L	M	M	M	M
BAR PRESENCE									
Side/point	M	L	L	L	L	M	L	M	M
Mid channel	M	L	M-H	L	L	M	M	L	M
Transverse	M	L	L	L	Nil	M	M	L	M
Junction	M	L	L	M	Nil	L	M	L	M
Diamond/braiding	L	L	L	M	Nil	L	M	M	L
Islands	N	L	M-H	M	L	L	L	L	M
LATERAL CHANNEL MOVEMENT									
Apparently stable	No	No	No	No	No	No	No	Yes	Yes
Bar Vegetation progressions	H	H	M	L	L	M	M	M	L
Cut-offs/oxbows	L	M	M	L	M	M	L	L	L
Meander scars	H	M	L-M	H	M	M	L	L	L
Avulsions	M	M	L-M	M	L	L	L	L	L
Terraces	M	L	M	M	L	L	L	L	L
Constrictions	L	L	Nil	L	L	L	L	L	L
% unstable banks	10	0	N/A	5%	60	L	L	L	L
ACTIVE VALLEY WALL PROCESS									
Rock/soil falls	L	L	Nil	L	L	L	L	L	L
Mud/snow flows	L	Nil	Nil	L	L	L	L	L	L
Slumps/glides	L	L	L	L	L	L	L	L	L
Slides	L	Nil	Nil	L	Nil	L	L	L	L
STREAM FEATURES & GENERAL CHARACTERISTICS	-wide flat gravel bars -several meanders -wide stream channel	-marshy -indistinct channel -saturated water table	-wide gravel bars reddish tinge -wide creek channel	-gravel bars -lateral channel movement	-swampy -wide valley flat	-in channel debris & deadfall	-regularly meandering -moderate flows	-regular meanders -confined lower end	-confined -torturous meanders
FISH PRESENT	Co, Rb, Dv	Rb DV	Rb	NW DV	*(Co)	Rb, DV Co	DV	DV	DV
FIELD PHOTOGRAPHS	yes	yes	yes	yes	yes	yes	yes	yes	yes
AIR PHOTOGRAPHS & NUMBER	BC 5302 #'s 170, 172, 168, 194, 197, 258, 165	BC 5302 -#165	BC 5302 #165	BC 5302 #134	BC 5302 #165	BC 5302 #168	BC 5302 #197 #198	BC 5302 #197 #258	BC 5302 #197
POINT SAMPLE DATA CARD NUMBER	1,2,3,4,5,8	14	13	12	10	6,7	11	9	15
NTS MAP	93L3	93L6	93L6	93L6	93L6	93L6	93L6	93L6	93L6
COMMENTS	-long reach -good Rainbow/ Steelhead rearing				*no fish sampled -coho presence suspected				

APPENDIX 1 B Thautil River - Deny's Creek Inventory***

DATE	STREAM	STATION	O_2(ppm)	pH	TEMP. (^oF)	TEMP. (^oC)	CLARITY	T.D.S.	FLOW (cfs)	SUBSTRATE	FISH SPECIES
22 Aug 68	Deny's Ck.	A	11	6.7	44.5	6.9	clear	52	15*	2.5cm - 30cm	D.V.
22 Aug 68	Thautil R.	B	9	7.2	52	11.1	clear	55	51.7	2.5cm - 45cm	D.V., Coho, R.
22 Aug 68	"	C	9	7.5	53	11.6	clear	55	78.3		D.V., Coho, R.
22 Aug 68	"	D	9	7.8	55	12.8	clear	67	90**		Coho, R.M.W.

* Loljuh Creek approximately 10 cfs as Deny's Creek near exit to Thautil 26.6 cfs.

** Visual estimate, Gosnell Creek appears to be a larger flow.

*** Data from August 1968 survey of Thautil River-Denys Creek done by G. D. Taylor, Regional Fisheries Biologist and R. W. Seredick, Conservation Officer, Smithers, B. C.

THAUTIL R. DATE 27 AUG '81 AREA 110 M^2 SITE # 1
LENGTH 31 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+	38-39	38.50	0.61	2	.5	4.0	2.43	0.04	0.02	0.13
COHO	Σ	38-51	46.60	1.23	10	.7	14.29	17.63	0.13	0.16	0.46

HABITAT DESCRIPTION: riffle edge (6m) plus backchannel

Discharge 1.6 m^3/s (58 cfs) Gradient —

Temperature (°C) 10 °C Turbidity clear

Hydraulic Type	Pool (Backchannel)	Glide	Riffle
% area	18		82
mean width	1.25		39
mean depth	0.20		0.30
% cover	0		1
cover type[1]	—		B
velocity (mean)	0		0.14 m/s
substrate[2]	F50, LG40, C10		C45, B20, LG20 SG10, F5

COMMENTS: all coho in backchannel

[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

THAUTIL R. DATE 27 AUG. 81 AREA 81 M^2 SITE # 2
LENGTH 24 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+	34-78	56.57	2.47	7	.75	9.33	23.07	0.12	0.28	0.39
	1+	84-99	91.5	8.32	2	.75	2.67	22.19	0.03	0.27	0.11
	2+	131	131	23.94	1	.75	1.33	31.92	0.02	0.39	0.06
	Σ										
D.V.	Σ	40	40	.64	1	.75	1.33	0.85	0.02	0.01	0.06

HABITAT DESCRIPTION: side channel to mainstem

Discharge 0.2 m^3/s (7.5 cfs) Gradient —

Temperature (°C) 9° Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		75	25
mean width		3.5	3
mean depth		.30	.15
% cover		12.5%	12%
cover type[1]		L, OV, C	L, C
substrate[2]		C55, B15, LG15, SG10, FS	C60, B15 LG15, SG5, FS

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

DENYS CR. DATE 27 AUG. 81 AREA 44 M^2 SITE # —
LENGTH 11 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
D.V.	Σ	37-75	47.80	1.40	5	0.8	6.25	8.76	0.14	0.20	0.57

HABITAT DESCRIPTION: edge of riffle - glide

Discharge 1.4 m^3/s (50 cfs) Gradient —

Temperature (°C) 7 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			4 (13.5)
mean depth			0.15 (0.2 - 0.3)
% cover			2
cover type[1]			B, OV
substrate[2]			LG45, C27, B5 SG13, F10

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

LOLJUH CR DATE 27 AUG 81 AREA 29 M^2 SITE # ___
LENGTH 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
D.V.	Σ	27-127	76.53	586	17	.75	22.67	132.82	0.78	4.58	3.78

HABITAT DESCRIPTION:

Discharge 0.11 m^3/s (4 cfs) Gradient 1.5%
Temperature (°C) 6° Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		3.5	
mean depth		0.20	
% cover		30	
cover type[1]		OV, C, L, B	
substrate[2]		LG 40, C 20 SG 30, B 5, F 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

STARR CR. DATE 27 AUG 81 AREA 52 M^2 SITE # —
LENGTH 13 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	1+	108	108	13.42	1	0.9	1.11	14.91	0.02	0.29	0.09
D.V.	Σ	43	43	.80	1	0.9	1.11	0.88	0.02	0.02	0.09

HABITAT DESCRIPTION: riffle-glide

Discharge	N/A	Gradient	1%
Temperature (°C)	9°C	Turbidity	clear
Hydraulic Type	Pool	Glide	Riffle
% area		77	23
mean width		4	4
mean depth		.35	.30
% cover		7.5	17
cover type[1]		B	B
substrate[2]		B35, C25 LG20, SG10, FS	B35, C30 LG20, SG10, FS

COMMENTS:

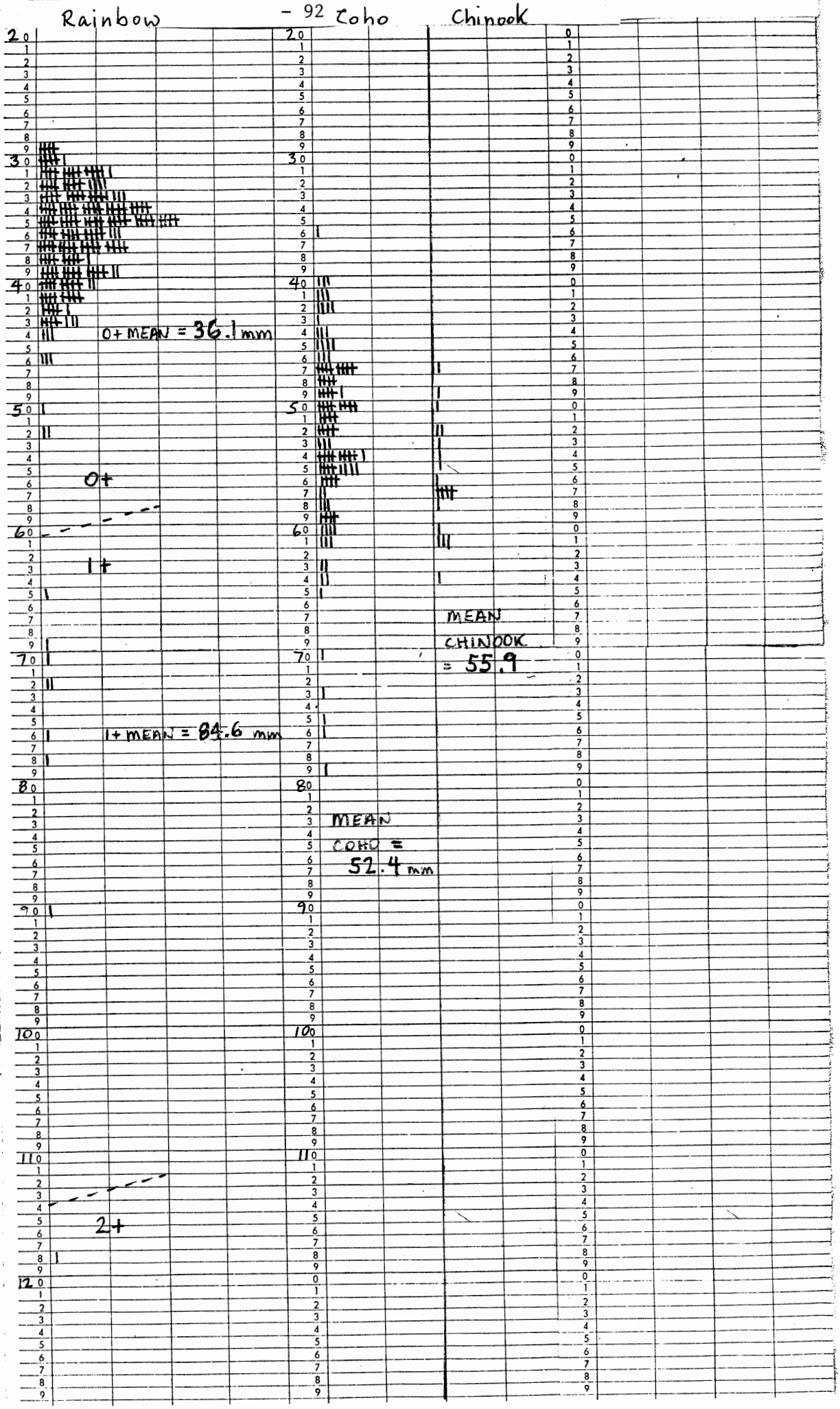
[1] L log, B boulder, IV instream vegetation, OV overstream vegetation, C cutbanks

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

APPENDIX 6 Morice River mainstem population estimate results.

MORICE RIVER - MAINSTEM 1981

Rainbow - 92 Coho Chinook



MORICE R at Aspen Campground. DATE 28 AUG-81 AREA 75 M² SITE # 1
LENGTH 11.5 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
RBT	0+	30-44	36.52	0.53	23	.75	30.67	16.27	0.41	0.22	2.67
COHO	Σ	46-64	53.63	1.90	8	.75	10.67	20.29	0.14	0.27	0.93
Ch	Σ	49-61	56.71	2.04	7	.75	9.33	19.02	0.12	0.25	0.81
M.W	Σ	38-52	44.25	1.23	4	.75	5.33	6.54	0.07	0.09	0.46
Σ Salmonid								62.12	0.74	0.83	4.87
L.N.D.	Σ	50-122	68.17	4.66	6	.75	8.0	37.29	0.11	0.50	0.70

HABITAT DESCRIPTION: mainstem edge - edge of glide on a cobble boulder bar

Discharge — Gradient —

Temperature (°C) 13 Turbidity Clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		6.5 (stream = 70)	
mean depth		0.2	
% cover		4	
cover type[1]		B, C	
substrate[2]		C40, LG30, B15	

COMMENTS: - excellent fry habitat; perhaps maximum expected D.
- average fry habitat width = 3 m.

[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 R. at MILE 21 SIDECHANNEL — DATE 28 AUG 81 — AREA 217 M^2 — LENGTH 14 M — SITE # 2

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+	32-52	38.35	0.63	23	.7	32.86	20.80	0.15	0.10	2.35
	1+	69-72	70.50	3.74	2	.7	2.86	10.68	0.01	0.05	0.20
								31.48	0.16	0.15	2.55
Ch	Σ	57	57	2.04	1	.7	1.43	2.91	0.01	0.01	0.10
M.W.F.	Σ	44-53	48.33	1.55	3	.7	4.29	6.65	0.02	0.03	0.31
Σ salmonid								41.04	0.19	0.19	2.96
L.N.D.	Σ	34-68	48.65	1.27	23	.7	32.86	41.65	0.15	0.19	2.35

HABITAT DESCRIPTION: MILE 21 SIDECHANNEL - "OPEN" (ie. wide gravel) channel

Discharge — Gradient 1.0%

Temperature (°C) — Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		46	54
mean width		20	13
mean depth		.20	.10
% cover		0	0
cover type[1]		—	—
velocity		0.5 m/s	1 m/s
substrate[2]		SG 20, LG 50	SG 40, LG 40
		C 30	C 15, F 15

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 R. at Lamprey Creek — DATE 26 AUG 81 — AREA 96 M² — SITE # 3 — LENGTH 24 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
RBT	0+	30-65	36.76	0.62	17	.7	24.29	14.97	0.25	0.16	1.01
	1+	90	90	7.76	1	.7	1.43	11.09	0.01	0.12	0.06
	Σ							26.06	0.26	0.28	1.07
COHO	Σ	51-61	54.25	1.95	4	.7	5.71	11.14	0.06	0.12	0.24
CH	Σ	57	57	2.22	1	.7	1.43	3.17	0.01	0.03	0.06
M.W.F	Σ	44-48	46	1.32	2	.7	2.86	3.78	0.03	0.04	0.12
Σ salmonid								44.15	0.36	0.47	1.49
L.N.D.	Σ	27-78	48.33	1.45	33	.7	47.14	68.31	0.49	0.71	1.96

HABITAT DESCRIPTION: mainstem edge - glide

Discharge — Gradient —

Temperature (°C) — Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		4 (90 wetted channel)	
mean depth		0.2	
% cover		0	
cover type[1]		—	
substrate[2]		C 45, LG 40 SG 5, F 10	

COMMENTS: edge of glide on wide gravel bar
depth from 0 to 0.4 m at edge of sample

[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 R. DATE 26 AUG. '81 AREA 128 M^2 SITE # 4
Side channel above Lamprey creek LENGTH 27 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+	29-50	35.45	0.50	22	.85	25.88	12.97	0.20	0.10	0.96
	1+	76-118	97	11.09	2	.85	2.35	26.09	0.02	0.20	0.09
	Σ							39.06	0.22	0.30	1.05
COHO	Σ	40-59	47	1.32	7	.85	8.24	10.87	0.06	0.08	0.31
Ch	Σ	50-64	58	2.20	4	.85	4.71	10.34	0.04	0.08	0.17
M.W.F.	Σ	42	42	1.0	1	.85	1.18	1.18	0.01	0.01	0.04
Σ salmonid								61.45	0.33	0.47	1.57
L.N.D.	Σ	45-80	59.77	2.62	13	.85	15.29	40.05	0.12	0.31	0.57

HABITAT DESCRIPTION: small side channel of larger open side channel

Discharge 0.44 m^3/s (16 cfs) Gradient —

Temperature (°C) 13.5 °C Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		57	43
mean width		4.5	5
mean depth		0.25	0.20
% cover		7	2
cover type[1]		L, OV, C	L
velocity		0.6 m/s	0.8 m/s
substrate[2]		SG 70, LG 25 FS	LG 60, SG 40

COMMENTS: side channel borders on active channel edge

[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 R above Lamprey Creek — DATE 28 AUG 81 — AREA 70 M² — LENGTH 20 M — SITE # 5

SPECIES	AGE	fl-RANGE	$\bar{fl}$	MEAN WEIGHT	C_1	$\bar{p}$	$\bar{n}$	TOTAL BIOMASS	No/M² DENSITY	BIOMASS DENSITY	No / linear meter
RBT	0+	32-39	35.67	0.49	15	.7	21.43	10.49	0.31	0.15	1.07
Ch	Σ	47-57	52.83	1.64	6	.7	8.57	14.06	0.12	0.20	0.43
M.W.F.	Σ	43	43	1.07	1	.7	1.43	1.53	0.02	0.02	0.07
Σ Salmonid								26.08	0.45	0.37	1.57
L.N.D.	Σ	43-60	52.13	1.68	15	.7	21.43	36.02	0.31	0.51	1.07

HABITAT DESCRIPTION: mainstem edge - glide

Discharge — Gradient —

Temperature (°C) 15° — Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		3.5 (channel ≅ 90)	
mean depth		0.25	
% cover		0	
cover type[1]		—	
substrate[2]		LG 60, SG 30 C 5, F 5	

COMMENTS: same gravel bar as site no. 3

[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 R. DATE 26 AUG 81 AREA 148 M^2 SITE # 6

SIDECHANNEL NEAR LAMPREY CREEK LENGTH 37 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+	29-43	35.32	0.48	34	.8	42.50	20.55	0.29	0.14	1.15
	1+	70-78	73.33	4.23	3	.8	3.75	15.85	0.03	0.11	0.10
	Σ							35.40	0.32	0.25	1.25
COHO	Σ	40-63	52.33	1.78	33	.8	41.25	73.57	0.28	0.50	1.11
M.W.F	Σ	40-47	43.50	1.12	4	.8	5.0	5.61	0.03	0.04	0.14
Σ salmonid								114.58	0.63	0.79	2.50
L.N.D.	Σ	24-58	46.83	1.34	12	.8	15	20.14	0.10	0.14	0.41

HABITAT DESCRIPTION: SIDECHANNEL WITH LOG COVER ("OPEN" CHANNEL)

Discharge 0.8 m^3/s (28 cfs) Gradient 0.75 %

Temperature (°C) — Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area		60	40
mean width		4	4
mean depth		0.3	0.2
% cover		6	6
cover type[1]		L, OV	L
substrate[2]		SG40, LG30, F30	SG70, F20, LG10
velocity		1 m/s	2 m/s

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 R. DATE 26 AUG 81 AREA 96 M² SITE # 7
32 MILE SIDECHANNEL LENGTH 14 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
RBT	0+	29-43	35.50	0.49	28	.75	37.33	18.41	0.39	0.19	2.67
COHO	Σ	48	48	1.33	1	.75	1.33	1.77	0.01	0.02	0.10
M.W.F.	Σ	50-65	53.33	2.11	6	.75	8.0	16.89	0.08	0.18	0.57
Σ Salmonid								37.07	0.48	0.39	3.34
L.N.D.	Σ	43-68	53.79	1.75	29	.75	38.67	67.52	0.40	0.70	2.76

HABITAT DESCRIPTION: COBBLED RIFFLE IN 32 MILE SIDECHANNEL - OPEN CHANNEL

Discharge — Gradient 1.5%

Temperature (°C) 14.5 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width	(channel = 100 to 180 m; riffle = 25m)		6.8 sampled
mean depth			0.3
% cover			0
cover type[1]			—
substrate[2]			F10, SG20, LG30, C35, B5

COMMENTS: excellent fry habitat

[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 R.
SIDECHANNEL AT 32 MILE

DATE 26 AUG. 81 AREA 77 M^2 SITE # 8
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+	31-41	35.86	0.51	7	.8	8.75	4.42	0.11	0.06	0.63
COHO	Σ	36-65	50.70	1.63	33	.8	41.25	67.42	0.54	0.88	2.95
Σ salmonid								71.84	0.65	0.94	3.58
L.N.D.	Σ	58	58	2.24	1	.8	1.25	2.80	0.02	0.04	0.09

HABITAT DESCRIPTION: small side channel - top end with debris

Discharge	—	Gradient	< 0.5 %
Temperature (°C)	14.5°	Turbidity	clear

Hydraulic Type	Pool	Glide	Riffle
% area		79	21
mean width	(side channel w = 6m)	5.5	3
mean depth		0.25	0.07
% cover		15	5
cover type[1]		L, OV	L
substrate[2]		F60, SG20 LG10, C10	F10, SG50 LG35, C5

COMMENTS: - sample was at top end of long side channel
- water control was log jam
- bottom end slough - many coho fry

[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 R. DATE 26 AUG. 81 AREA 48 M² SITE # 9
LENGTH 19 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
RBT	0+	34-52	40	0.73	6	.85	7.06	5.15	0.15	0.11	0.37
CoHo	Σ	55-79	68.5	4.03	8	.85	9.41	37.90	0.20	0.79	0.50
Ch	Σ	58	58	2.15	1	.85	1.18	2.52	0.02	0.05	0.06
Σ Salmonid								45.57	0.37	0.95	0.43
Cottus	Σ	54-109	75	6.13	4	.85	4.71	28.85	0.10	0.60	0.25

HABITAT DESCRIPTION: glide edge

Discharge — Gradient

Temperature (°C) Turbidity

Hydraulic Type	Pool	Glide	Riffle
% area		100	
mean width		sampled 2.5 (channel = 50 m)	
mean depth		0.5 (0-1.0)	
% cover		—	
cover type[1]		B, OV	
substrate[2]		F15, SG5, LG20 C30, B30	

COMMENTS: - edge of very fast (representative) mainstem glide
- habitat restricted to edge for fry

[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 R. DATE 27 AUG 81 AREA 108 M^2 SITE # 10
LENGTH 22 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+	29-46	36.57	0.54	51	.7	72.86	39.05	0.67	0.36	3.31
COHO	Σ	40-64	50.58	1.62	24	.7	34.29	55.39	0.32	0.51	1.56
Σ salmonid								94.44	0.99	0.87	4.87
Cottid	Σ	58	58	2.24	1	.7	1.43	3.21	0.01	0.03	0.06

HABITAT DESCRIPTION: shallow riffle-glide ; part of braided channel

Discharge — Gradient —

Temperature (°C) 15.5 Turbidity clear

Hydraulic Type	Pool	Glide	Riffle
% area			100
mean width			4.9m
mean depth			.15
% cover			0
cover type[1]			—
substrate[2]			F10, SG 50, LG 30, C 10
velocity			0.5 m/s

COMMENTS: adjacent mainstem = fast riffle

[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