460-00000-0000-0000-000-000-CS7

RECONNAISSANCE REPORT

(Fish Habitat Improvement)

PROJECT: Upper Bulkley River Steelhead Population Monitoring

REGION: 6

LOCATION: Bulkley River upstream of Morice River Confluence near Houston

MANAGEMENT UNIT: 6-8, 6-9

AIR PHOTO REFERENCE NO:

MAP REFERENCE NO: 93L

DATE SURVEYED: Aug. 16 & 17, 1983

REPORT DATE: May 14, 1984

PERSONS PRESENT: G. Schultze, R. Tetreau, M. O'Neill

REPORT PREPARED BY: D. Tredger

PURPOSE: To monitor juvenile rainbow trout (steelhead) densities in the upper Bulkley River watershed.

OBSERVATIONS: See attached

PROPOSED ACTION: See attached

PHOTOGRAPHS ATTACHED: YES X NO___ AVAILABLE: YES___ NO___

CIRCULATE TO: M. Whately, M. Lough

SUGGESTED CONTACTS:

COMMENTS BY:

SEE ATTACHED SHEETS: YES X NO___

INTRODUCTION

The upper Bulkley River system, near Houston, was first assessed by the Fish Habitat Improvement Section in 1981 (Tredger 1982). The initial assessment identified probable areas of importance for steelhead recruitment and juvenile rearing. In 1982 an index sampling program was initiated to monitor steelhead recruitment on an annual basis. Results of the 1982 assessment are outlined in Tredger (1983). The index sampling program was continued in 1983. The purpose of this report is to outline results of the 1983 steelhead fry recruitment monitoring program in the upper Bulkley system.

METHODS

The upper Bulkley River was sampled by Region 6 Fisheries staff on August 16 and 17, 1983. A total of 5 index sites were sampled in areas of known (or suspected) importance as steelhead recruitment sites (Fig. 1). Areas sampled included Buck Creek (3 sites), McQuarrie Creek (1 site) and the mainstem upper Bulkley (1 site). All sampling was conducted following the standard F.H.I.S. methodology of fish population estimates (electrofishing) and habitat sampling (de Leeuw, 1981).

RESULTS

Stream Discharge and Physical Habitat

Estimated stream discharge and physical habitat characteristics of upper Bulkley River "index streams" are summarized in Table 1 (data included in Appendix 1). Results are presented as a 3 year comparison. Stream discharge was much higher at all sites in 1983 compared to 1981 or 1982. This generally translated into increased wetted width and mean depth. Buck Creek, Reach 2 was not consistent with this pattern. Pool/riffle/glide ratio changes were also inconsistent in terms of any pattern. These inconsistencies suggest lack of sensitivity in the sample technique (i.e. insufficient sample size).

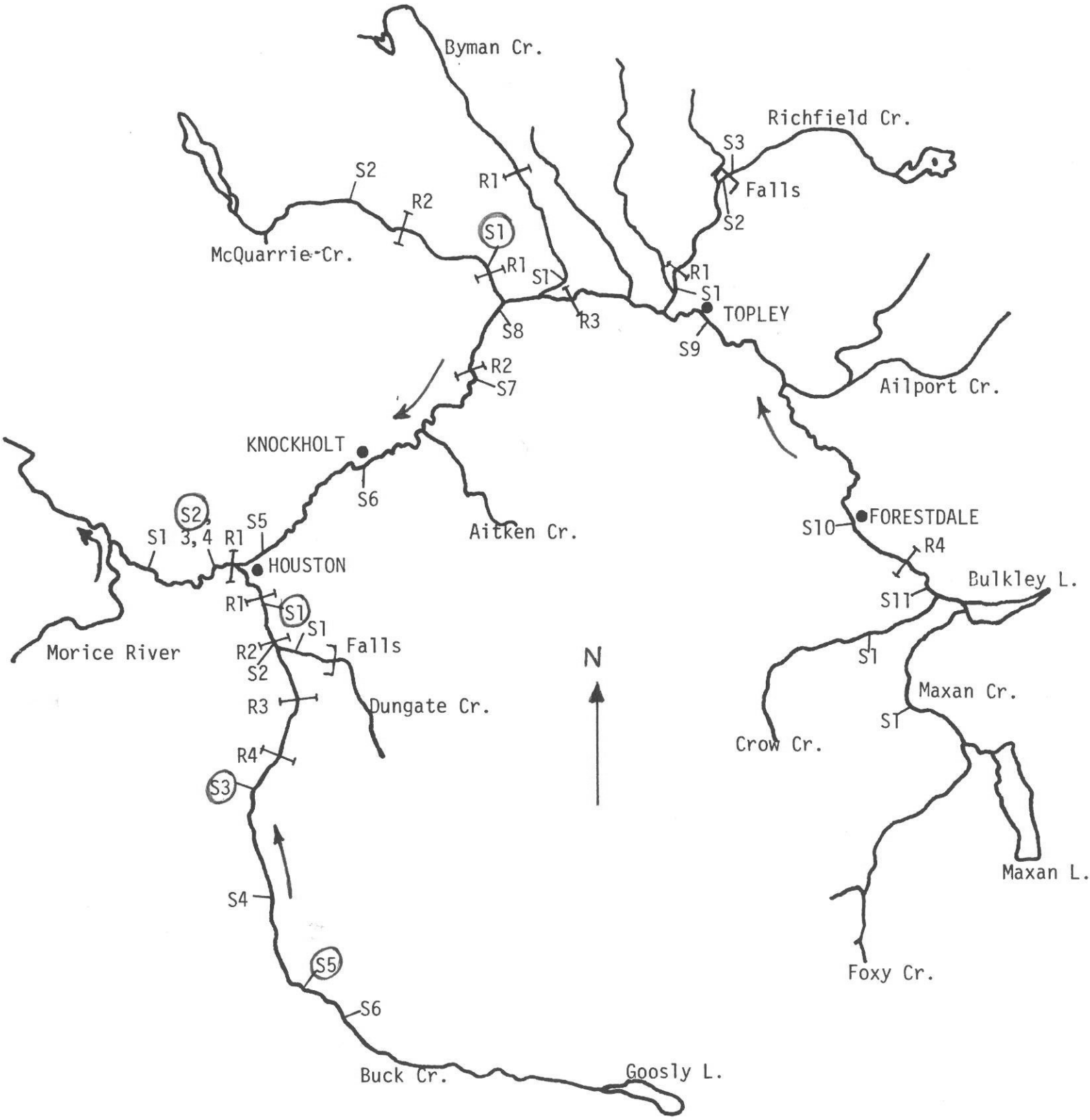

FIGURE 1. The Upper Bulkley River system, indicating reach breaks (R1) and sample sites (S1). 1983 index sites circled.

Table 1. Summary of upper Bulkley "index stream" habitat characteristics from 1981 to 1983.

Stream and Reach		Year	Discharge (m^3/s)	Wetted Width (m)	Pool/Riffle/ Glide Ratio	Mean Depth (cm)
Upper Bulkley	Reach 1	1981	1.60	16	35/ 9/56	62
		1982	1.60	12.8	6/ 3/91	67
		1983	5.1	16.4	22/34/39	80
Buck Creek	Reach 2	1981	0.46	10.8	21/ 0/79	28
		1982	0.40	14.5	16/76/ 8	41
		1983	1.33	14.4	0/65/35	26
Buck Creek	Reach 5	1981	0.25	9.4	15/18/67	37
		1982	0.30	6.7	5/53/41	23
		1983	1.12	9.1	11/25/64	12
McQuarrie Cr.	Reach 2	1981	0.075	2.3	18/34/48	12
		1982	0.20	6.2	18/57/25	14
		1983	0.74	6.15	9/39/52	28

Fish Population Estimates

Results of 1983 fish population estimates in the upper Bulkley system are included in Appendix 2. As the purpose of this program was steelhead population monitoring only steelhead will be discussed.

Rainbow (steelhead) fry

A comparison of 1981 to 1983 rainbow fry density (No/m^2 and No/m) at upper Bulkley index sites is given in Table 2. A 3 year mean was calculated for all sites, on which comparisons were made. In terms of number/m^2, 1983 mean value (0.44 fry/m^2) was equal to the 3 year mean (0.43 fry/m^2). The highest value was found in 1981 (0.55 fry/m^2), while the low value was found in 1982 (0.29 fry/m^2). In terms of individual site trends, higher than mean density was observed in upper Bulkley 2, Buck 1 and Buck 5. McQuarrie and Buck 3 had densities less than the 3 year mean. McQuarrie Creek remained the site with highest fry density.

Comparison of fry population on the basis of fry per linear meter may be more appropriate given the dramatic increase in discharge observed in 1983. Actual number of fry present in a stream section should be independent of discharge, while density per m^2 may be partially dependent on discharge (i.e. does lower density/m^2 mean fewer fish present, or simply more available habitat). Comparison on a linear meter basis (Table 2) indicates 1983 as having the largest population rather than 1981 which had highest fry density.

Rainbow (steelhead) parr

A comparison of parr density (No/m^2, No/m) from 1981 to 1983 at index sample sites is given in Table 3. In terms of parr per linear meter, data suggests 1983 density was near average in terms of 1+ population (1983 = 1.30 1+ parr/m, average = 1.22 1+ parr/m). The low year was 1982 (0.86 1+ parr/m) while the high year was 1981 (1.49 1+ parr/m). The 2+ parr population was less than average in 1983 (1983 = 0.13 2+ parr/m, average = 0.22 2+ parr/m) and was in fact the lowest value recorded. The high value occurred in 1981 (0.31 2+ parr/m).

Table 2. Comparison of rainbow (steelhead) fry density (No/m^2 and No/m) at 5 index sites in the upper Bulkley River system, 1981 to 1983. Bracketed values represent difference from 3 year mean.

Site		3 Year Mean	1981	1982	1983
A. Density in No/m^2					
Upper Bulkley	2	.05	0 (-.05)	.08 (+.03)	.06 (+.01)
Buck	1	.19	.13 (-.06)	.17 (-.02)	.26 (+.07)
	3	.37	.63 (+.26)	.14 (-.23)	.35 (-.02)
	5	.29	.09 (-.20)	.18 (-.11)	.61 (+.32)
McQuarrie	1	1.24	1.89 (+.65)	.89 (-.35)	.94 (-.30)
Mean		.43	.55 (+.12)	.29 (-.14)	.44 (+.01)
B. Density in No/linear m					
Upper Bulkley	2	.54	0 (- .54)	.74 (+ .20)	.89 (+ .33)
Buck	1	2.25	.98 (-1.27)	2.17 (- .08)	3.60 (+1.35)
	3	2.16	3.80 (+1.64)	.59 (-1.57)	2.08 (- .08)
	5	1.73	.79 (- .94)	.77 (- .96)	3.64 (+1.91)
McQuarrie	1	9.63	10.49 (+ .86)	5.41 (-4.22)	12.99 (+3.36)
Mean		3.26	3.21 (+ .05)	1.94 (-1.32)	4.64 (+1.38)

Table 3. Comparison of rainbow (steelhead) parr density (No/m^2 and No/m) at 5 index sites in the upper Bulkley River system, 1981 to 1983. Bracketed values represent difference from 3 year mean.

Site	1+ Parr				≥2+ Parr			
	3 Year Mean	1981	1982	1983	3 Year Mean	1981	1982	1983
A. Density in No/m^2 (to nearest .01)								
Upper Bulkley 2	.10	.16 (+.06)	.13 (+.03)	0 (-.10)	.02	.01 (-.01)	.04 (+.02)	0 (-.02)
Buck 1	.06	.06 (=)	.07 (+.01)	.01 (=)	.01	.01 (=)	.02 (+.01)	.01 (=)
3	.03	.03 (=)	.05 (+.02)	.02 (-.01)	.01	.01 (=)	.01 (=)	.01 (=)
5	.19	.25 (+.06)	.11 (-.08)	.22 (+.03)	.06	.11 (+.05)	0 (+.06)	.06 (=)
McQuarrie	.37	.54 (+.17)	.26 (-.11)	.31 (-.06)	.04	.06 (+.02)	.06 (+.02)	.01 (-.03)
Mean	.15	.20 (+.05)	.12 (-.03)	.12 (-.03)	.03	.04 (+.01)	.03 (=)	.02 (-.01)
B. Density in No/m								
Upper Bulkley 2	.92	1.60 (+.68)	1.17 (+.25)	0 (-.92)	.17	.13 (-.04)	.37 (+.20)	0 (-.17)
Buck 1	.71	.45 (-.26)	.89 (+.17)	.79 (+.08)	.17	.09 (-.08)	.30 (+.13)	.11 (-.06)
3	.18	.19 (+.01)	.20 (+.02)	.15 (-.03)	.05	.06 (+.01)	.05 (=)	.05 (=)
5	1.31	2.12 (+.81)	.48 (-.83)	1.33 (+.02)	.43	.93 (+.50)	0 (-.43)	.35 (-.08)
McQuarrie	2.96	3.08 (+.12)	1.58 (-1.38)	4.22 (+1.26)	.29	.36 (+.07)	.34 (+.05)	.16 (-.13)
Mean	1.22	1.49 (+.27)	.86 (-.36)	1.30 (+.08)	.22	.31 (+.09)	.21 (-.01)	.13 (-.09)

Juvenile rainbow size

A summary of juvenile rainbow size (fork length) in 1981 to 1983 sampling is given in Table 4. Fry and 1+ parr size was similar in all years (43.5 to 46.4 mm range in mean fry size, 82.9 to 85.3 mm range in mean 1+ size). The 2+ parr were largest in 1981 (121.4 mm average) and 1983 (122.7 mm average), and smallest in 1982 (113.9 mm average). However, sample size in older (2+ and 3+) age groups was quite small.

DISCUSSION

In terms of fry population monitoring in the upper Bulkley system, the conclusion from the 1983 index sampling program is that a larger fry population existed than in 1981 or 1982. Actual numbers of steelhead fry (in relation to resident rainbow fry) cannot be estimated as no "reference data" is available. Nor can they be related to steelhead escapement. As indicated in Tredger (1983), this data will serve as valuable background information when further knowledge of adult steelhead utilization of the upper Bulkley is gained. These data will be put into the context of the entire Bulkley River system when further stream population monitoring results (eg. Morice) become available.

An assessment of adult steelhead in the upper Bulkley remains the most important data requirement in this system. Buck and McQuarrie Creeks in particular have been identified as having tremendous potential steelhead production capabilities. The report of approximately 40 adult steelhead in lower McQuarrie Creek in the spring of 1983 is evidence of this.

Table 4. Summary of juvenile rainbow trout fork length (mean and range) sampled in the upper Bulkley River, 1981 to 1983.

Age Group	Year	N	Fork Length(mm)	
			Mean	Range
0+	1981	505	46.4	28-69
	1982	167	43.5	30-57
	1983	217	44.5	30-57
1+	1981	242	85.3	66-112
	1982	73	83.2	61-103
	1983	55	82.9	63-110
2+	1981	59	121.4	104-157
	1982	26	113.9	97-128
	1983	7	122.7	109-131
3+	1981	7	148	134-165
	1982	1	169	
	1983	1	138	

ACKNOWLEDGEMENTS

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Tredger, C.D. 1982. Upper Bulkley River reconnaissance with reference to juvenile steelhead carrying capacity. Unpubl. MS., Fish and Wildlife Branch, Ministry of Environment, Victoria, B.C.

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APPENDIX 1. Upper Bulkley River system habitat assessment data, August 16 and 17, 1983.

UPPER BULKLEY RIVER REACH 1

AUG. 16, 1983 DISCHARGE = 5.1 m^3/s (180 cfs)

Habitat Class	R	P	G	R	G	R	P (N=1)		R (N=3)		G (N=2)		Mean
Length	45	12	19	12	25	12	12		23		18.5		
Wetted width	15	16	18	16	18	14	16		15		18		16.4
Channel width	30	25	28	28	26	24	25		27		27		
Area	675	192	242	192	450	168	192		345		346		
Mean depth	.35	1.20	.80	.60	.80	.80	120		.58		.80		.80
Velocity	1.5	.3	.5	.7	.5	.8	.3		1.0		.5		
Log cover	0	2	1	0	0	0	2		0		.5		
Boulder cover	2	3	2	1	.5	1	3		1.33		1.25		
Instream veg.	1	1	3	0	1	2	1		1		2		
Overstream veg.	0	1	2	1	0	0	1		.33		1		
Cutbanks	0	1	0	0	0	0	1		0		0		
Total cover	3	8	8	2	1.5	3	8	4%	2.66	1%	4.75	1%	
Turbidity	CLEAR →												
Gradient													
Fines	20	70	50	40	50	30	70		30		50		
Small gravel	20	20	15	20	20	20	20		20		17		
Large gravel	40	5	20	20	20	20	5		27		20		
Cobble	10	4	20	15	5	25	4		17		13		
Boulder	10	1	5	5	5	5	1		6		5		
Bedrock	0	0	0	0	0	0	0		0		0		
Compaction	0	0	0	0	0	0	0		0		0		
____ total in reach													
area in reach													
%							22		39		39		

Reach length = _____

Total area = _____

McQUARRIE CREEK REACH 2

AUG. 16, 1983 DISCHARGE = 0.74 m³/s (26 cfs)

Habitat Class	R	P	G	G	R	P	P (N=2)		R (N=2)		G (N=2)		MEAN
Length	36	6	8	54	22	8	7		29		31		
Wetted width	6	6	6.5	7	5	5	5.5		5.5		6.75		6.15
Channel width	28	21	23	21	25	30	25.5		26.5		22		
Area	216	36	52	378	110	40	38		163		215		
Mean depth	.25	.40	.30	.28	.20	.50	.45		.22		.29		.28
Velocity	.7	–	–	–	–	–	–		–		–		
Log cover	0	.5	0	0	0	.5	.5		0		0		
Boulder cover	3.5	.5	0	3	2	0	.25		2.75		1.5		
Instream veg.	0	0	.4	0	0	0	0		0		.2		
Overstream veg.	0	0	0	1.5	0	.5	.25		0		.75		
Cutbanks	0	.5	0	0	.75	0	.25		.40		0		
Total cover	3.5	1.5	.4	4.5	2.75	1.0	1.25	3%	3.15	2%	2.45	1%	
Turbidity	CLEAR	→	→	→	→								
Gradient													
Fines	10	30	10	10	5	15	22		7		10		
Small gravel	15	10	35	20	5	40	25		10		28		
Large gravel	20	10	30	45	35	25	18		28		37		
Cobble	30	30	25	20	40	15	22		35		22		
Boulder	25	20	0	5	15	5	13		20		3		
Bedrock	0	0	0	0	0	0	0		0		0		
Compaction	0	0	0	0	0	0	0		0		0		
							___ total in reach						
							area in reach						
							%		9		39		52

Reach length = _____

Total area = _____

BUCK CREEK — REACH 2

AUG. 16, 1983 — DISCHARGE = 1.33 m^3/s (47 cfs)

Habitat Class	R	G	R	G	R	R	P (N=0)	R (N=4)		G (N=2)		Mean
Length	11.1	24	48	12	40	20		30		18		
Wetted width	13.7	14	15	15	15	14		14.4		14.5		14.4
Channel width	15	20	18	17	17	18		17		18.5		
Area	150	280	720	180	600	200		418		230		
Mean depth	.25	.33	.25	.25	.25	.25		.25		.29		.26
Velocity	.5							.				
Log cover	0	.25	1.0	1	2	.5		.88		.63		
Boulder cover	1.5	.5	14.0	3	15	4.0		8.6		1.75		
Instream veg.	0	0	.5	.25	0	0		.1		.12		
Overstream veg.	.5	.5	10	5	20	7		9.4		2.75		
Cutbanks	0	1.0	0	0	0	0		0		.5		
Total cover	2.0	2.25	25.5	9.25	37	11.5		19	4.5%	5.75	2.5%	
Turbidity	CLEAR	→										
Gradient	1%	→										
Fines	10	5	5	5	5	5		6		5		
Small gravel	15	15	10	10	10	5		10		12		
Large gravel	25	20	15	15	20	20		20		18		
Cobble	25	35	30	40	30	30		29		37		
Boulder	25	25	40	30	35	40		35		28		
Bedrock	0	0	0	0	0	0		0		0		
Compaction	0	0	0	0	0	0		0		0		
____ total in reach												
area in reach												
%							0	65		35		

Reach length = _____

Total area = _____

BUCK CREEK — REACH 5

AUG. 16, 1983 — DISCHARGE = 1.12 m^3/s (40cfs)

Habitat Class	R	G	G	P	R	G	G	R	G	P			P(N=2)		R(N=3)		G(N=5)		mean
Length	12	22	12	40	6	18	36	23	55	15			22.5		13.7		29		
Wetted width	7	6	7	10	6	10	11	11	15	5			7.5		8		9.8		9.1
Channel width	9	12	12	10	15	12	14	21	17	30			20		15		13.4		
Area	84	132	84	40	36	180	418	253	825	75			57.5		124		328		
Mean depth	.2	.5	1.5	1.8	.2	.4	.75	.3	.45	1.2			1.5		.23		.72		.68
Velocity	.6	.5	.3	.1	.6	.4	–	.63	–	–									
Log cover	0	0	0	16	0	0	.5	0	1	61			38.5		0		.3		
Boulder cover	2	5	2	4	.5	0	.3	0	0	0			2		.83		1.5		
Instream veg.	0	0	0	0	0	0	0	1	0	0			0		.33		.0		
Overstream veg.	3	0	0	12	0	20	1	0	0	1			6.5		1		4.2		
Cutbanks	0	0	0	4	0	0	0	0	0	9			6.5		0		0		
Total cover	5	5	2	36	.5	20	1.8	1	1	71			53.5	93%	.72	1%	8	2.4%	
Turbidity	CLEAR																		
Gradient																			
Fines	30	30	45	60	20	25	20	5	35	15			37		18		31		
Small gravel	20	15	10	10	15	10	30	15	35	60			35		17		20		
Large gravel	20	25	20	10	30	30	25	45	20	20			15		32		24		
Cobble	25	25	20	15	30	35	5	30	10	5			10		28		19		
Boulder	5	5	5	5	5	0	5	5	0	0			3		5		3		
Bedrock	0	0	0	0	0	0	15	0	0	0			0		0		3		
Compaction	1	1	1	0	1	1	0	0	0	0			0		0		0		
													total in reach						
													area in reach						
													%		11		25		64

Reach length = _____

Total area = _____

APPENDIX 2. Upper Bulkley River index site fish population estimate results, August 16 and 17, 1983.

Upper Bulkley - Nadina Rd

DATE Aug 16/83 AREA 375 M² SITE # 2

LENGTH 25 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
Rb	0+	39-51	45.38	0.79	13.00	.6	21.67	17.22	0.06	0.05	0.87
LND		34-88	50.73	1.92	15.00	.6	25.00	47.96	0.07	0.13	1.00
Sucker		82	82.00	8.12	1.00	.6	1.67	13.54	.004	.04	0.07
Sculp		101-104	102.5	10.78	2.00	.6	3.33	35.92	0.01	0.10	0.13

HABITAT DESCRIPTION: Riffle - Glide - Pool

Discharge 5.1 m³/s (180 cfs) Gradient .5%-2% ($\bar{x}$ = 1.2%)

Temperature (°C) 14°C @ 1100 hrs Turbidity clear

Hydraulic Type	Pool 192 m²	Glide 692 m²	Riffle 843 m²
% area	11	40	49
mean width	16 m	15 m	18 m
mean depth	1.2 m	0.8 m	0.55 m
mean velocity	0.3 m/s	0.5 m/s	1.0 m/s
cover type[1]	L B IV OV C	L B IV OV	B IV OV
% cover	1 2 0.5 0.5 0.5	0.1 0.4 0.6 0.3	0.5 2.5 0.1
substrate[2]	F SG LG C B	F SG LG C B	F SG LG C B
	70 20 5 4 1	50 18 20 17 5	30 20 27 16 7

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

Bulkley River Buck Creek at Powerline

DATE Aug 16/83 AREA 152.07 M^2 SITE # 1

LENGTH 11.1 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
Rb	0+	34-55	45.38	0.80	32	.8	40.00	32.06	0.26	0.21	3.60
	1+	84-110	95.00	7.36	7	.8	8.75	64.44	0.06	0.42	0.79
	2+	124	124.00	15.98	1	.8	1.25	19.97	0.01	0.13	0.11
DACE		48-101	66.18	3.86	22	.8	27.50	106.05	0.18	0.70	2.48
MW		78+	78.00	6.41	1	.8	1.25	8.01	0.01	0.05	0.11
CHW		69-78	73.75	4.44	4	.8	5.00	22.19	0.03	0.15	0.45

HABITAT DESCRIPTION: Riffle - Glide

Discharge	1.20 m^3/s (43 cfs)		Gradient	1%
Temperature (°C)	15.5°C		Turbidity	clear
Hydraulic Type	Pool 0	Glide 460		Riffle 1490
% area	0	24		76
mean width		18.5		17
mean depth		0.29		0.25
mean velocity		0.63		0.88
cover type[1]		L B IV OV C		L B IV OV C
% cover		0.27 0.8 0.05 1.2 0.2		0.2 2.3 0.03 2.8
substrate[2]		F SG LG C B		F SG LG C B
		5 13 17 37 28		5 10 20 30 35

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

Bulkley River - Buck Creek below first bridge

DATE Aug 16/83 AREA 152.04 M^2 SITE # 3

LENGTH 25.2 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
						.8					
Rb	0+	34-53	44.83	0.79	42	.8	52.50	41.36	0.35	0.27	2.08
	1+	79-99	88.33	5.93	3	.8	3.75	22.23	0.02	0.15	0.15
	2+	129	129.00	17.99	1	.8	1.25	22.49	0.01	0.15	0.05
DACE		30	30.00	0.31	3	.8	3.75	1.16	0.02	0.01	0.15
MW		64-67	65.33	3.77	3	.8	3.75	14.13	0.02	0.09	0.15

HABITAT DESCRIPTION: Glide - Riffle - Pool

Discharge 1.46 m^3/s (52 cfs) Gradient N/A

Temperature (°C) 14.5 Turbidity N/A

Hydraulic Type	Pool 75 m^2	Glide 1,327.	Riffle 353 m^2
% area	4	76	20
mean width	5	10.8	8
mean depth	1.2	0.5	.23
mean velocity	N/A	N/A	N/A
cover type[1]	L OV C	L B C	L IV OV C
% cover	81 1.3 12	0.1 0.02 0.03	0.09 0.3 0.3 0.8
substrate[2]	F SG LG C	F SG LG C B Br	F SG LG C B
	15 60 20 5	35 36 17 5 2 5	15 35 33 15 2

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

Bulkley - Buck Creek at Sarvis Fire

DATE Aug 17/83 AREA 132 M² SITE # 5

LENGTH 22 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
Rb.	0+	27-57	42.88	0.70	52	.65	80.00	56.37	0.61	0.43	3.64
	1+	70-95	81.16	4.56	19	.65	29.23	133.30	0.22	1.01	1.33
	2+	109-131	119.50	14.52	4	.65	6.15	89.36	0.05	0.68	0.28
	3+	138	138.00	22.02	1	.65	1.54	33.88	0.01	0.26	0.07
Dace		43-82	62.00	3.00	23	.65	35.38	106.33	0.27	0.81	1.61
Sucker		112-127	118.00	23.36	3	.65	4.62	107.83	0.03	0.82	0.21

HABITAT DESCRIPTION: Glide - Riffle - Pool

Discharge 1.12 m³/s (40 cfs) Gradient 0.5 - 1.5% ($\bar{x}$ = 1%)

Temperature (°C) 13°C @ 0900 hrs Turbidity 1m

Hydraulic Type	Pool 40 m²	Glide 396 m²	Riffle 120 m²
% area	7	71	22
mean width	10 m	8 m	6.5 m
mean depth	1.8 m	0.4 m	0.2 m
mean velocity	0.1 m/s	0.3 m/s	0.6 m/s
cover type[1]	L B OV C	B OV	B OV
% cover	40 10 30 10	2 5	2 2.5
substrate[2]	F SG LG C B	F SG LG C B	F SG LG C B
	60 10 10 15 5	33 12 25 27 3	25 18 25 27 5

COMMENTS: low temperature

[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

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Bulkley R. - McQuanie Creek

DATE Aug 16/83 AREA 106.5 M^2 SITE # 1

LENGTH 7.7 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
Rb	0+	30-55	45.08	0.80	80	0.8	100	80.37	0.94	0.75	12.99
	1+	63-105	80.23	4.57	26	0.8	32.5	148.51	0.31	1.39	4.22
	2+	128	128	17.57	1	0.8	1.25	21.97	0.01	0.21	0.16
LND		51-100	69.21	4.14	38	0.8	47.50	196.44	0.45	1.84	6.17

HABITAT DESCRIPTION: Riffle Pool Glide

Discharge 0.74 m^3/s (26 cfs) Gradient

Temperature (°C) 12 Turbidity

Hydraulic Type	Pool 76	Glide 430	Riffle 326
% area	9	52	39
mean width	5.5	6.8	5.5
mean depth	0.45	0.29	0.23
mean velocity	N/A	N/A	N/A
cover type[1]	L B OV C	B IV OV	B C
% cover	1.3 0.7 0.7 0.7	0.7 0.1 0.3	1.7 0.2
substrate[2]	F SG LG C B	F SG LG C B	F SG LG C B
	23 22 25 23 7	10 27 38 22 3	8 10 27 35 20

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

Length/Weight Relationships

1.	McQuarrie Creek	$r^2 = 0.95$ $a = 1.01$ $b = 8.26 \times 10^{-6}$
2.	Upper Buck Creek 2nd Bridge Crossing	$r^2 = 0.97$ $a = 2.78$ $b = 8.04 \times 10^{-6}$
3.	Combined data	$r^2 = 0.97$ $a = 1.56$ $b = 8.38 \times 10^{-6}$

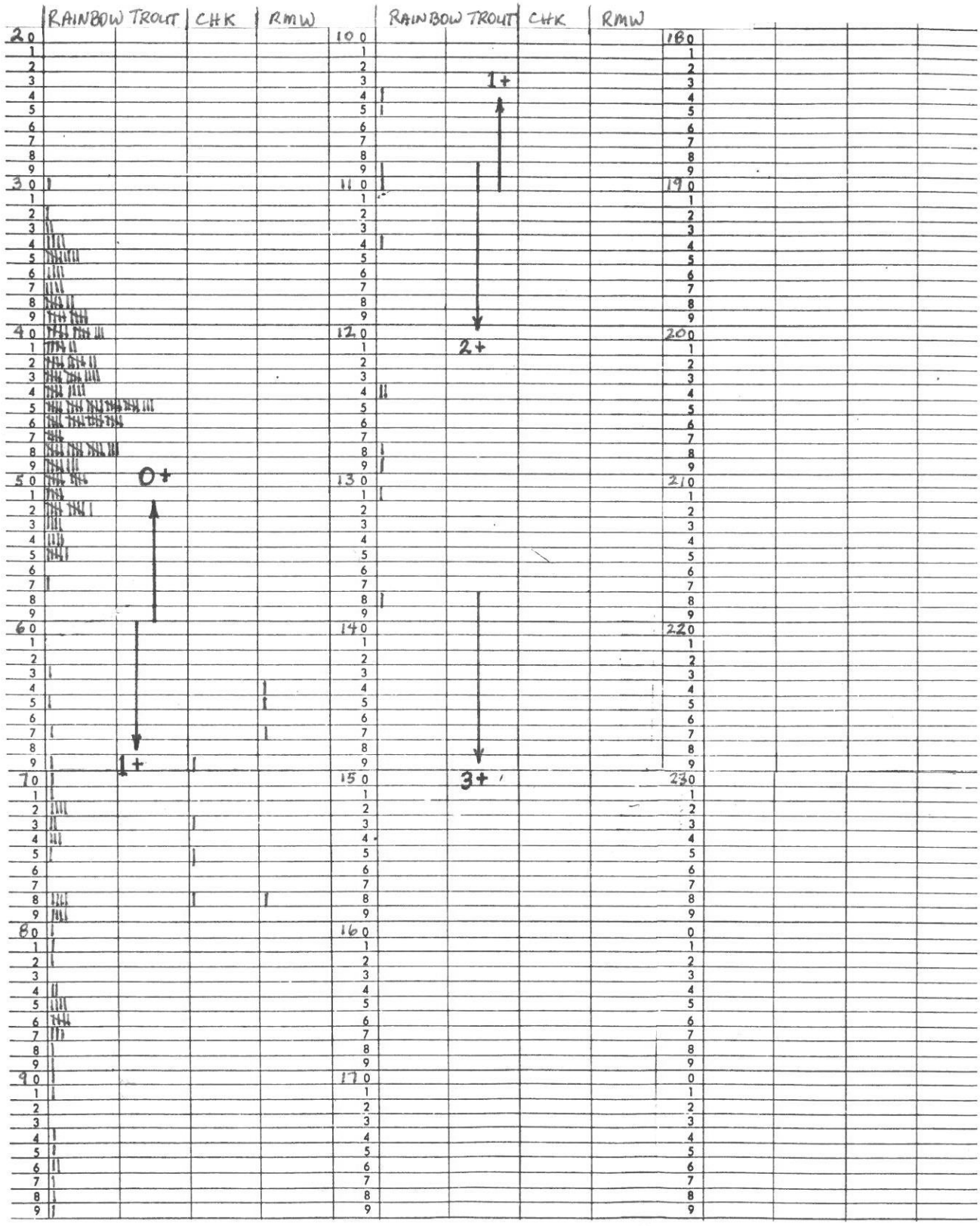
Empirical formula $wt = 8.38 \times 10^{-6} \ \ell^3$

K-values used for Upper Bulkley 1982 population estimates

Rainbow trout	8.38×10^{-6}	ℓ^3
Coho	1.2×10^{-5}	ℓ^3
Chinook	1.1×10^{-5}	ℓ^3
Mountain whitefish	1.35×10^{-5}	ℓ^3
Sculpin	1.0×10^{-5}	ℓ^3
Dace	1.15×10^{-5}	ℓ^3

Cumulative length-frequency data : Upper Bulkley system 1983

Aug. 16 + 17, 1983



Rbt	Mean length (mm)			
		0+	44.5	(N = 217)
		1+	82.9	(N = 55)
		2+	122.7	(N = 7)
		3+	138	(N = 1)

Buck Creek (Site 3) below first bridge crossing on Buck Flats Road.

Upper Bulkley River near Houston (Site 2).

Buck Creek (Site 5) at Swiss fire. This site corresponds to the Ferris property site of 1981 and 1982.