Skeena Region

British Columbia Fish & Wildlife Branch

A FISHERIES INVENTORY OF SOME STREAMS WITHIN THE MORRISON LAKE - HATCHERY ARM PORTION OF BABINE LAKE

by

S. P. HATLEVIK

Skeena Fisheries Report No. 80 - 5

April, 1981

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B.C. Fish and Wildlife Branch

Smithers, B.C.

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SUMMARY

In August 1980 the Fish and Wildlife Branch and Northwood Pulp and Timber Limited jointly participated in a fisheries inventory of 11 streams within the Morrison Lake - Hatchery Arm region of Babine Lake. It was found that 8 of the 9 small streams surveyed provided good-to-excellent rearing habitat for either coho salmon and/or rainbow trout. One of the streams was being utilized by spawning sockeye salmon. The two larger streams - Morrison River and Tahlo Creek - provided excellent spawning habitat for sockeyes, cohos, pinks and rainbows. Additionally they offered good sport fishing for rainbow trout. The Morrison Lake system is unique to the Babine Lake watershed because of its remoteness, lack of easy road access and because it is still relatively undeveloped. For the planned development it is hoped that stringent guidelines will be followed in order to preserve and protect the integrity of the presently high fishery values of the study area.

INTRODUCTION

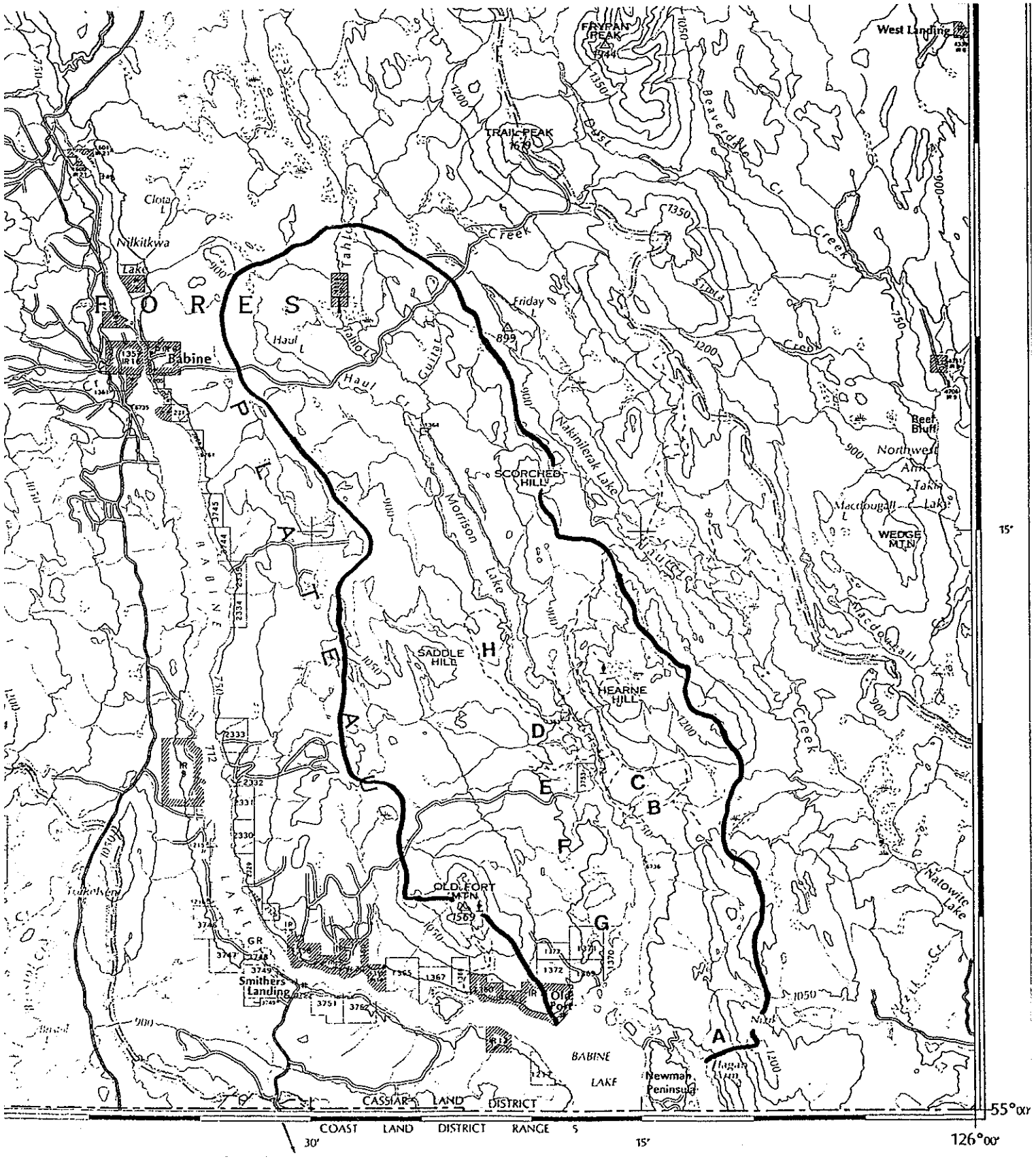
In January 1980, biologists representing Northwood Pulp and Timber Ltd. and the Fish and Wildlife Branch discussed some of Northwood's long term harvesting plans. One of the areas reviewed was the Morrison Lake - Hatchery Arm portion of Babine Lake (Fig. 1). At the time, the Branch had very limited fisheries information upon which to base protection guidelines for this watershed. This along, with Northwood's increasing concern for harvesting with minimum environmental damage, led to the formation of a plan to jointly participate in a fisheries inventory of the area. Northwood offered to finance helicopter time and, if needed, to provide accomodations and meals at one of their field camps located near the study area. The Branch agreed to supply the inventory crew along with related equipment and to provide Northwood with copies of the resultant maps and report.

The survey was tentatively scheduled for the late summer of 1980, with the following objectives:

1. Provide a source upon which Habitat Protection section of Fish and Wildlife Branch could base protection guidelines.
2. Provide Northwood with an assessment of fishery values and related habitat which would be incoporated into their harvesting and road-building plans.
3. Evaluate the system for the feasibility of potential habitat enhancement projects under the Salmonid Enhancement Program.
4. Generally increase the sum total of fisheries knowledge pertaining to the Morrison Lake - Hatchery Arm watershed.

The data resulting from this study have been presented in three forms:

Figure 1. The location of the study area (scale 4 miles = 1 inch).



1. This report.
2. A topographic map composite (scale 1:50,000) showing sample point sites, numbers and species of fish sampled and some physical features such as beaver dams, canyons and proposed road and bridge locations.
3. A mylar overlay (scale 1:50,000) depicting fishery values of the streams and lakes within the study area.

BACKGROUND HISTORY

Starting about the turn of the century, the Dominion Department of Fisheries operated a sockeye hatchery at the southern end of Morrison Lake (Meyers, 1980). This was closed down in 1938. In 1945, the Fisheries Research Board began studies on Morrison Lake as part of an overall investigation of lakes within the Skeena watershed (McMahon). Their objective was to gather information pertaining to natural sockeye salmon recruitment and to determine limiting factors. They had hoped to develop methods to increase the efficiency of natural propogation. Since about 1930 the Department of Fisheries and Oceans maintained records of annual salmon escapement into Morrison Creek and both Upper and Lower Tahlo Creeks. Figures recorded since 1951 are presented in Appendix A. Fish and Wildlife Branch records indicate a licensed hunting guide has operated in the Morrison Lake area since the mid-sixties, primarily for moose.

METHODS

The field work was done on August 19 and 20, 1980. A helicopter (Jet Ranger 206) chartered from Northern Mountain Ltd. was used to transport the survey crew from Houston to the Morrison Lake area; to fly the streams and to move the crew to the various point sample sites.

Sampling consisted of electroshocking (Smith-Root Electrofisher-type VIII) visual observation, and angling when feasible. Point sample notes were done on Resource Anaylsis Branch Point Sample Cards (Fig. 2). Appendix B contains a glossary of terms used on the Point Sample cards and throughout this report. It has been taken from "Aquatic System inventory and anaylsis" by the Resource analysis Branch, 1977.

A brief summary of the sample point information is included in this report, but for brevity, the cards will be kept on file in the Smithers Fish and Wildlife office and are available for examination. Other types of equipment used were: a Suunto clinometer for measuring stream gradient; an Eslom 30 m tape for measuring water flows, and a camera (Konica C35) for taking photographs.

POINT SAMPLE

CHANNEL		BANK	
FLOOD/SIDE	Nil L M H	% SLOPING	
THREAD	S M	HT. THALWEG (m)	
SLOPE (%)		MAT. TEXTURE	
WETTED WIDTH (m)		VEGETATION (20m).	%
ROOTED WIDTH (m)		CONIFEROUS	
FLOOD PLAIN WIDTH(m)		DECIDUOUS	
VEL	AVG DEPTH	SHRUBS	
FLOW CHARACTER	P S R B T	GRASSES	
TURB m cm		BARE	
TEMP. AIR WAT. DIEL		CROWN CLOSURE %	
pH	D.O.	OVERHANG CLOSURE %	
SUBSTRATE		DEBRIS	L M H
COMP. % F G R		STABILITY	U S
ANG. CLASS R Rs As A			
D90 (cm)	COMPACTION L M H		
AQUATIC VEGETATION			
DOM.			
CODOM.			
SAMPLE NUMBER			
ALGAE DENSITY	L M H		
INV. DOM.			
INV. CODOM.			

SYSTEM

SYSTEM NO

REACH NO POINT OF

PHOTO ACCESS

DATE INITIALS

yr mo doy time

POINT LOCATION

METHOD	SAMPLE	NO	SPECIES	SIZE RANGE

SAMPLE NUMBER | LENGTH SAMPLED (m)

SHOCKING TIME (sec) | DIFFICULTY L M H

COMMENTS (FISH HABITAT SUITABILITY, STABILITY ETC.)

Figure 2. Resource Analysis Branch Point Sample Card used for taking field notes.

RESULTS AND DISCUSSION

This section will be discussed generally as follows:

-brief stream description summarized from the Point Sample cards
-fish sampling results
-comments about fish habitat values
-photographic documentation

Table 1 presents a summarization of the fish sampling results (primarily electroshocking) and is included to provide a quick reference to fish species presence.

1. Unnamed Creek A - Point Sample 1

This small tributary to Hagen Arm had a wetted width of 2 meters, average depth of 12 centimeters and a gradient of 0.5%. It generally exhibited placid flow character. Algae density was high. There was a moderate amount of debris which was classified as stable.

Electroshocking over 150 meters produced 25 sculpins, mostly within 50 meters of the lake. Further upstream, 8 coho and 1 rainbow (all juveniles) were sampled.

This creek had good rearing habitat for juvenile fish, but due to its small size it probably could not accomodate appreciable numbers of adult spawners.

Table 1. Fish sampling results from the Morrison Lake - Hatchery Arm watershed, August, 19 & 20, 1980.

Point Sample #	Name of Creek	Length Sampled (meters)	Electro-shocking time (seconds)	Species Captured
1	Unnamed A	150	178	25 sculpins 8 coho 1 rainbow
2	Unnamed B	200	217	14 coho 10 sculpins 3 rainbows 8 sockeye carcasses observed
3	Unnamed C	180	224	25 coho
4	Morrison Creek	200	235	1 rainbow 1 long nose dace 1 peamouth chub 1 rainbow angled
5	Unnamed D	200	171	45 rainbows
6	Unnamed E	300	310	2 chinooks 1 coho
7	Unnamed F	20	46	NIL
8	Unnamed G	150	335	50 sculpins 8 coho 2 rainbows
9	Tahlo Creek	100	330	6 long nose dace 4 sculpins 1 squawfish 17 rainbows angled about 10 sockeye observed
10	Guitar Creek	50	40	5 coho 5 rainbows
11	Unnamed H	60	116	43 rainbows 1 squawfish

Photo 1. Lower section of Unnamed Creek A. Most of the sculpins were sampled here.

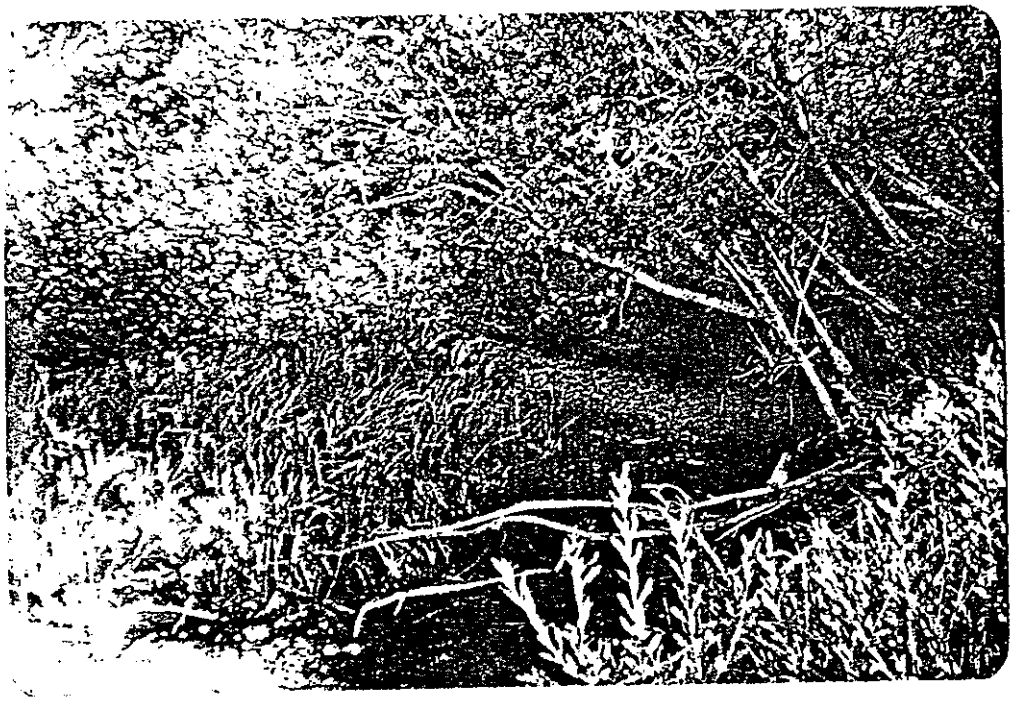


Photo 2. Unnamed Creek A, further upstream. Better rearing habitat here with more diverse habitat types and abundant vegetative cover.

B. Unnamed Creek B - Point Sample 2

This creek was larger than "A", with a wetted width of 3 meters, average depth of 20 centimeters and a gradient of 1%. The flow character was swirling and algae density low. There was good spawning habitat with the substrate comprised of 60% gravels and low compaction. A good percentage of undercut banks, adequate overhanging vegetation, and stable instream debris with accompanying root wads combined to offer good juvenile rearing habitat.

Electroshocking for 200 meters produced 14 coho (lengths 3 to 7 cm), 3 rainbows (5 to 10 cm) and 10 sculpins. In addition, 8 sockeye carcasses were found along the banks as well as a great deal of bear sign.

Photo 3. Unnamed Creek B. Note the good rearing habitat provided by instream debris, (creating pools) and over-hanging vegetation providing cover.

This is an important creek for fish. It offers good rearing habitat for coho and rainbow. It is positively identified as a sockeye spawning stream. Additionally, it is probably utilized by spawning coho and rainbow trout.

3. Unnamed Creek C - Point Sample 3

The first 80 meters of this stream was very slow flowing with a predominantly muck substrate, which in places, was somewhat like quicksand. Recent beaver activity had resulted in the deposition of a lot of instream debris. Average wetted width was 2 meters, depth 20 centimeters and gradient less than 0.5%. Further upstream, the physical characterstics changed markedly. The gradient increased along with a resultant increase in water velocity; and the substrate contained a much higher percentage of gravels.

Electroshocking within the first 80 meters produced no fish. Better fish habitat was found further upstream, and 25 coho juveniles were obtained within a 100 meter stretch.

The first 80 meters of this stream provide very poor fish habitat due to the beaver activities resulting in extreme substrate siltation. However, beyond this area, the fish habitat improves greatly, and overall, this stream affords excellent rearing habitat for coho salmon.

Photo 4. Unnamed Creek C. Looking upstream into the section containing excellent rearing habitat for coho salmon.

4. Morrison Creek - Point Sample 4

Morrison Creek measured 10 meters wide, average depth was 45 centimeters, and stream velocity measured 0.63 meters/second. The stream gradient was 1% and the surface flow character broken. A very noticeable feature was the great abundance of fresh water clams. Abundant spawning gravels were evident throughout the area sampled.

Electroshocking a length of stream 200 meters produced 1 rainbow trout (20 cm), 1 longnose dace and 1 peamouth chub. Angling yielded 1 rainbow (13 cm).

Morrison Creek can be considered vital to the Morrison Lake - Hatchery

Arm system for the following reasons:

1. Because of stable flows, ideal stream velocities, and the great abundance of spawning gravels, it is extremely important as a spawning stream for sockeye, coho, pinks, rainbows, and possible even a few chinooks.

2. It is also important as a river "highway" providing fish access to other good spawning grounds further upstream in the watershed (i.e. Tahlo Creek).

There are records indicating that at times, Morrison Creek is plagued by beaver dams and debris jams and that there is some bear and bird predation (Graham, et al, 1976).

The point sample was done at the proposed Northwood bridge crossing site. As there appeared to be a great abundance of spawning gravels in this vicinity there could be a potential conflict between forestry and fisheries interests.

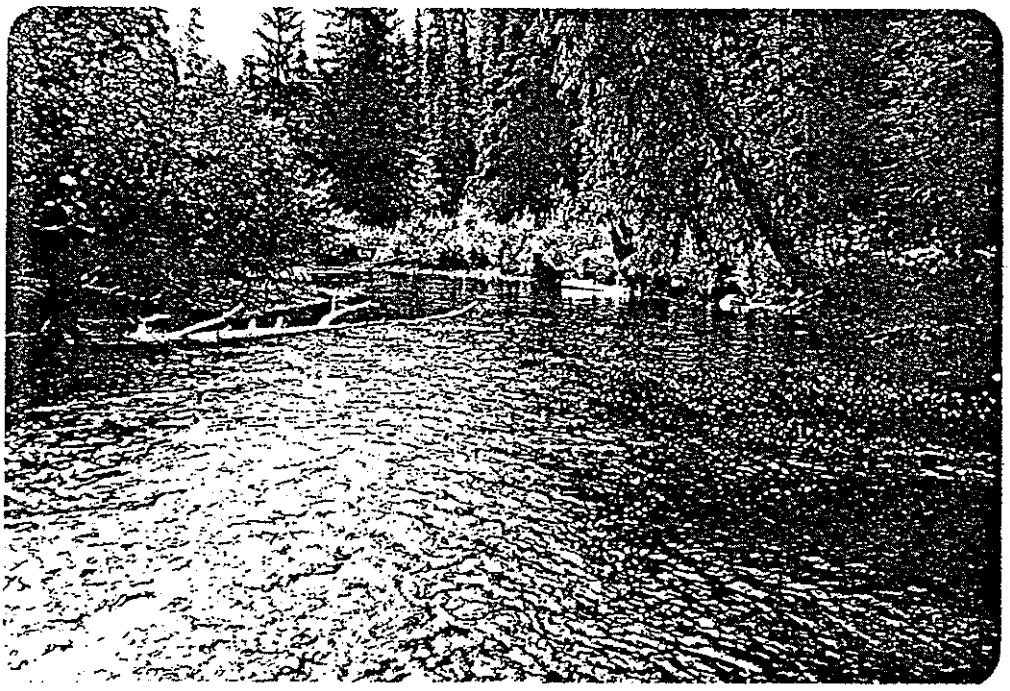


Photo 5. Morrison Creek near the vicinity of Northwood's proposed bridge crossing site. Note the abundance of spawning gravels.

5. Unnamed Creek D - Point Sample 5

Wetted width of this creek was 3 meters, average depth 15 centimeters and gradient less than 0.5%. The amount of instream debris was judged to be high and stable. A small beaver dam was noted near the mouth of this stream. During lower flows, it may be a barrier to upstream fish movement. The stream had many pools and riffles, and the substrate was comprised of about 50% large rocks (greater than 10% diameter).

Rainbow trout are often found in streams of this nature and this one proved to be extremely productive. Electroshocking over 200 meters produced 45 rainbows (3 to 16cm length) - but no other species.

This stream is a very important producer of rainbow trout and every

Photo 6. Unnamed Creek D. This stream provided extremely productive rearing habitat for rainbow trout.

means possible should be taken to ensure protection. The fact that no other species of fish (especially coho) were sampled suggests that the beaver dam at the mouth may already have been a barrier.

6. Unnamed Creek E - Point Sample 6

Many small debris jams, which could be barriers during lower flows, were evident in this creek. Wetted width measured 2 meters, average depth 15 centimeters and stream gradient was 0.5%. Flow character was primarily placid. The substrate was comprised of 50% gravels; instream debris was moderate and stable.

This creek was one of the least productive of those sampled. It yielded only 1 coho and surprisingly, 2 chinooks over 300 meters of electroshocking. The presence of chinooks is interesting because historical fisheries escapement records indicate chinooks only very occasionally enter the Morrison drainage. As they are "mainstem" spawners, it is suspected they spawned somewhere in Morrison Creek and some of the resultant fry dropped downstream to Creek E to rear.

7. Unnamed Creek F - Sample Point 7

The point sample was done on the edge of a swamp because the helicopter could not land anywhere else (due to the closed tree canopy). As this section had very poor fishery habitat, it should not necessarily be considered representative of the entire stream.

The substrate was 100% sand and muck, which was extremely soft, and

made electroshocking very difficult. The stream had no disarmable flow. The channel was braided, vegetative cover was low, and old beaver activity was readily apparent.

Further upstream, above the swamp, the stream channel as observed from the helicopter appeared to be nearly dry.

Sampling by electroshocking and angling produced no fish; nor were any observed.

On the map, this creek seems to have a relatively large waterhsed. When road access is eventually provided, the creek should be examined in other locations prior to a final assessment of its overall fishery values.

Photo 7. Unnamed Creek F, showing representative portion of the swamp where the point sample was done.

8. Unnamed Creek G - Sample Point 8

The wetted width of this creek was 3 meters, average depth was 25 centimeters and the slope was 0.5%. The substrate was estimated to be 60% fines; flow character was placid, and the amount of instream debris was judged moderate and stable.

Sampling over 150 meters yielded 8 coho, 2 rainbows and 50 sculpins. This stream was considered to have good rearing habitat for coho salmon.

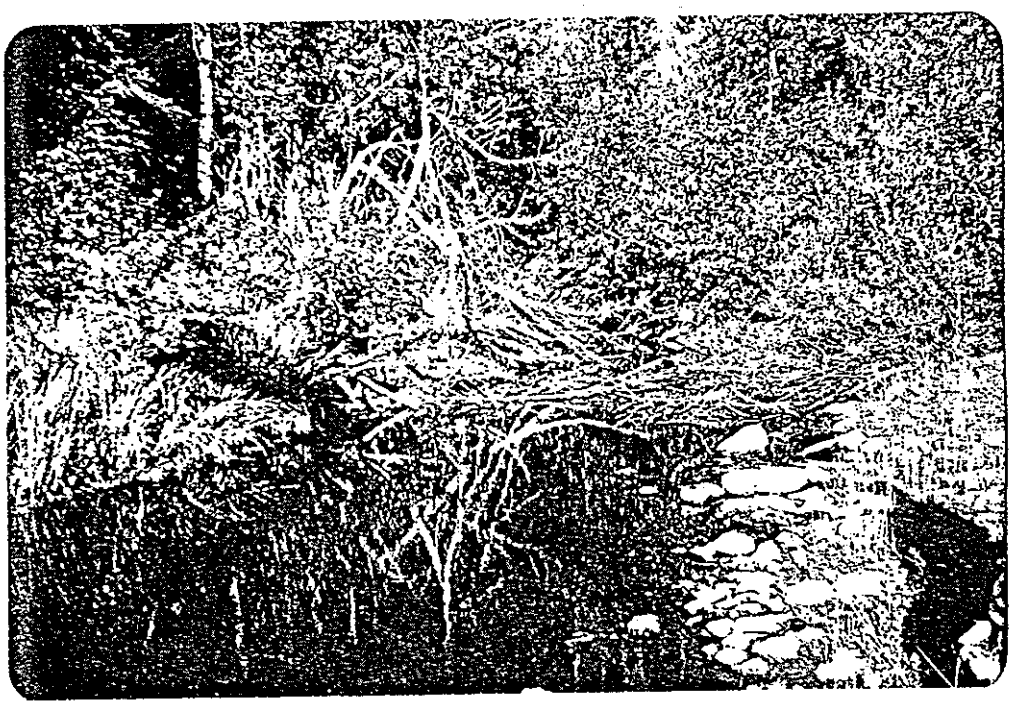


Photo 8. Unnamed Creek G, looking upstream at sample point.

9. Tahlo Creek - Point Sample 9

Tahlo Creek can be divided into two sections:

a. Lower Tahlo - from Morrison Lake upstream to Tahlo Lake.
b. Upper Tahlo - upstream from Tahlo Lake.

a. Lower Tahlo Creek

Lower Tahlo Creek is much larger than the previously described unnamed creeks. Wetted width was 9 meters, average depth 30 centimeters and stream gradient nearly 1%. The stream velocity measured 0.3 meters/second while calculated stream flow was 0.85 meters^3/second. Algae density was high, substrate was about 60% gravels and moderately compacted.

Electroshocking over 100 meters yielded 6 long nose dace, 4 sculpins and 1 squawfish. Angling produced 17 rainbows ranging from 20 cm to 36 cm. About 10 sockeyes were seen rolling, splashing, etc in 2 pools.

The importance of Tahlo Creek as a sockeye spawning stream has been documented by the Dept. of Fisheries and Oceans since 1930. Estimates of sockeye escapements have ranged from a low of 400 in 1952 to a high of 24,600 in 1963. The upper 3 miles are considered to be the most productive for spawning as well as the two canyon areas which "support appreciable numbers of spawning sockeye" (Anon, 1980). The central section of the stream is "slough-like and unproductive" (anon, 1980). Sometimes "beaver dams are partial or complete barriers during periods of low water flow" (Anon, 1980).

Although not reported, it is suspected coho also spawn in lower Tahlo Creek due to the presence of coho juveniles in a tributary stream - Guitar Creek.

b. Upper Tahlo Creek

The Dept. of Fisheries and Oceans reports that only the lower

600 feet is utilized by spawning sockeyes and that during periods of low water flow beaver dams can be partial or complete barriers.

Photo 9. Lower Tahlo Creek, at point sample 9 located just upstream from Guitar Creek confluence.

10. Guitar Creek - Sample Point 10

This very small tributary to Tahlo Creek had a wetted width of 1 meter, average depth of only 8 centimeters, and a gradient of 0.5%. Vegetative overhang closure was estimated at 80%. This provides good cover, which is so important for rearing juveniles. Ample quantities of instream debris and undercut banks provided good rearing habitat.

Electroshocking over 50 meters yielded 5 coho and 5 rainbows (all juveniles).

Due to the small size of this stream it is doubtful if adult coho or rainbows would utilize it for spawning. However, it is considered to be important because it provides excellent rearing habitat for coho and rainbow spawning in Tahlo Creek.

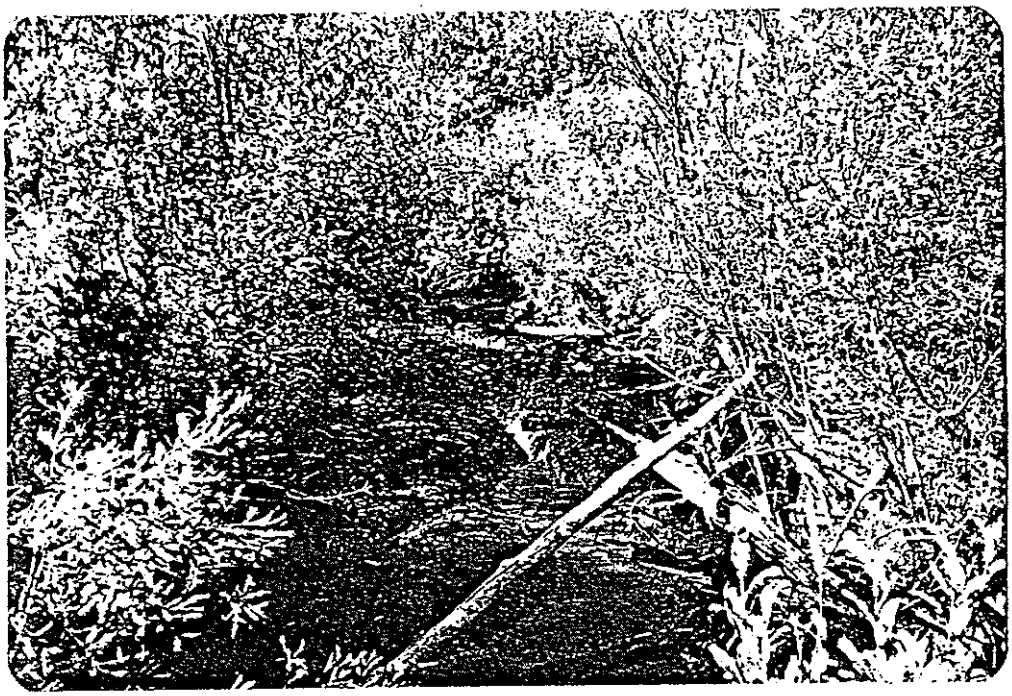


Photo 10. Guitar Creek. Ample vegetative cover and a diversity of habitat types produces good rearing habitat for both coho and rainbows.

11. Unnamed Creek H - Point Sample 11

Numerous undercut banks; plentiful overhanging vegetative cover; and a high amount of instream debris typified this stream. Wetted width was 3 meters, average depth was 18 centimeters and stream gradient measured 0.5%.

Electroshocking over a short distance of 60 meters produced 43 rainbows (2 to 10 cm length and 1 squawfish).

This creek contains excellent rearing habitat for rainbow trout and is undoubtedly one of the most important of all the streams surveyed. Every means possible should be used to assure its continued productivity.

Photo 11. Unnamed Creek H. This creek was extremely productive for rainbow trout.

POTENTIAL FOR HABITAT IMPROVEMENT PROJECTS

Generally, the Branch policy favours rehabilitating aquatic systems which tend to meet the following criteria:

1. The system supports a known and fairly intensive sport fishery. (for rainbow, cutthroat or steelhead).
2. Fish populations have declined.
3. Man's activities have resulted in fish habitat losses or deteriorations.

Because there is presently no easy road access into the Morrison drainage, the sport fishery is not well developed. Deterioration or loss of fish habitat as a result of man's activities has been negligible. This makes the Morrison Lake area unique to the Babine Lake watershed: simply that it has not yet undergone any major industrial developments. Consequently, the Branch view presently is not so much a consideration of improving the fish habitat but of simply maintaining present fishery values.

CONCLUSIONS

Nearly all of the small streams surveyed provided good-to-excellent rearing habitat for rainbow trout and coho salmon. Unnamed Creeks D and H had exceptional productivity for rainbows while good coho habitat was found in Creeks A, B, C and G. Guitar Creek, a tributary to Tahlo Creek provided good rearing habitat for both rainbows and coho. Surprisingly, Creek E contained juvenile chinook salmon - a rare species for the Morrison watershed. Creek B supported sockeye spawning, Tahlo Creek and Morrison Creek have previously been studied by The Dept. of Fisheries and Oceans and their importance as spawning streams for sockeye and coho salmon is well

known. In addition, they are probably also important spawning and rearing streams for rainbow trout.

Morrison Creek and lower Tahlo Creek were the only streams surveyed which were large enough to provide opportunities for sport fishing. Lower Tahlo Creek especially, seemed to offer excellent angling for rainbow trout.

RECCOMENDATIONS

1. Watercourses within the study area should be stringently protected to maintain the presently high fishery values. Road crossings on all the streams surveyed should allow for fish passage.

2. The proposed bridge site on Morrison Creek should be further evaluated to clarify if a potential fisheries problem exists. If there is a possible conflict due to the bridge being located in the vicinity of good spawning gravels, perhaps a more suitable site could be found further upstream where spawning is not as prolific.

3. This study did not include work on any of the lakes. Because roads will eventually be contructed in fairly close proximity to about a dozen lakes, they should be surveyed to determine their fisheries values. It would be desireable to assess these lakes prior to road construction. The Branch may wish to protect some of the lakes by recommending a re-location of roads.

4. It is not positively known if steelhead utilize the Morrison drainage. Because other anadromous species do, it has often been speculated that steelhead could be present as well. It would be interesting to do a study in the late spring (when steelhead are spawning) to clarify this issue.

REFERENCES

Anon. 1980. Annual salmon escapement records. Department of Fisheries and Oceans. Unpubl. M.S. Smithers, B.C.

Burns, J. and D. Tredger, 1975. Lake Survey Data reports for Tahlo and Haul Lakes. Unpubl. M.S. Fish and Wildlife Branch, Victoria, B.C.

Graham, C.C. R.A. McIndue and D.N. Meyers, 1976. Biophysical Stream Survey of several streams in the Babine-Nitlkitkwa area. Data Report Series PAC/0-76-3. Environment Canada. Fisheries and Marine Service.

McMahon, V.H._____Lakes of the Skeena River Drainage. VII Morrison Lakes. Progress report. Pacific Biological Station. Nanaimo.

Meyers, D. 1980. pers. com.

Turnbull, T. 1980. pers. com.

ACKNOWLEDGMENTS

M. O'Neil collected field data and helped compile the two complementary maps. B. Allan made recommendations regarding map format and provided a review. T. Turnbull and D. Meyers provided information. Northwood Pulp and Timber Ltd. provided financial assistance to make the study possible. Special thanks are extended to Northwood biologist, G. Hazelwood who helped initiate the project. M. Whately reviewed this report and the maps. Colleen Mushta typed the report.

APPENDIX A

Annual Salmon Escapement Records
for Morrison Creek and Tahlo Creek
Dept. of Fisheries and Oceans

CONSERVATION DISTRICT: 8 STATISTICAL AREA: 4

LOCATION OF MOUTH: Flows south into Morrison arm of Babine Lake

POSITION:

LENGTH: 3.5 MI. WIDTH: 25 FT. DRAINAGE: 160 SQ. MI.

COMPOSITION: BEDROCK: BOULDER: COARSE: FINE:

SILT & SAND: UNCLASSIFIED:

GRADIENT:

FALL IN FT/000	
0.0 - 2.5	
2.5 - 5.0	
5.0 - 7.5	
7.5 - 10.0	
> 10.0	

WETTED AREA: SQ. YD. SPAWNING AREA: SQ. YD.

DISCHARGE: 315 CFS MAX: 600 CFS MIN: 29.5 CFS

TEMPERATURE:

BARRIERS OR POINTS OF DIFFICULT ASCENT:

SPAWNING DISTRIBUTION:

SPECIES	SECTION OF STREAM USED
SOCKEYE	throughout
CHINOOK	
COHO	throughout
CHUM	
PINK (ODD YR)	
PINK (EVEN YR)	
STEELHEAD	

POTENTIAL OF INACCESSIBLE PORTION OF STREAM:

GENERAL REMARKS:

-During low water levels beaver dams can be an obstruction to the salmon. (1952, 1959-63, 1967-69, 1973-74 BC 16, F381)

-Log jams from 1 to 2.5 miles delay the fish (1948-49, 1959, 1971 BC 16, F381)

-Bird and bear predation is heavy (1948,1963,1973-76 BC 16, F381)

SPAWNING ESCAPEMENT RECORD FOR: MORRISON CREEK (G) (Hatchery Creek)

YEAR	SOCKEYE	CHINOOK	COHO	CHUM	PINK	STEELHEAD
1947						
48						
49						
50						
51	2200		100			
52	400		400			
53	16000		400			
54	12000		400			
55	600		200			
56	18000					
57	20000					
58	9000		800			
59	22000		250			
60	6000		400			
61	18000		250			
62	9000		200			
63	32500		250			
64	16000		200			
65	50000					
66	9000					
67	14000		150			
68	35000		300			
69	12250		100			
70	7200		100			
71	6000		200			
72	8000		N.R.			
73	17200		N.R.			
74	13755		N.R.			
75	16000		N.R.			
76	3600		N.R.			
77	9000		N.R.			
78	1,500		50			
79	11,200		N.R.			
80	4,000		N.O.			
81						
82						
83						
84						
85						
Arrival						
Start	Aug 10		Oct. 1			
Peak	Aug 30		Oct. 15			
End	Sept 15		Oct. 30			

REMARKS:

CONSERVATION DISTRICT: 8 STATISTICAL AREA: 4

LOCATION OF MOUTH: Flows south into Morrison Lake from Tahlo Lake

POSITION: 55-17 N, 126-25 W.

LENGTH: 5.0 MI. WIDTH: 15 FT. DRAINAGE: _____ SQ. MI.

COMPOSITION: BEDROCK: _____ BOULDER: _____ COARSE: _____ FINE: _____

SILT & SAND: _____ UNCLASSIFIED: _____

GRADIENT:

FALL IN FT/000	
0.0 - 2.5	
2.5 - 5.0	
5.0 - 7.5	
7.5 - 10.0	
> 10.0	

WETTED AREA: _____ SQ. YD. SPAWNING AREA: _____ SQ. YD.

DISCHARGE: _____ CFS MAX: _____ MIN: _____

TEMPERATURE: _____

BARRIERS OR POINTS OF DIFFICULT ASCENT: _____

SPAWNING DISTRIBUTION:

SPECIES	SECTION OF STREAM USED
SOCKEYE	Upper 3.0 miles
CHINOOK	
COHO	
CHUM	
PINK (ODD YR)	
PINK (EVEN YR)	
STEELHEAD	

POTENTIAL OF INACCESSIBLE PORTION OF STREAM: _____

GENERAL REMARKS:

-Central section of stream is slough-like & unproductive.
-Two narrow rocky canyons support appreciable numbers of spawning sockeye
-Beaver dams are partial or complete barriers during periods of low water flow (1952-1975 B.C. 16, F381)

SPAWNING ESCAPEMENT RECORD FOR: TAHLO CREEK (G)

YEAR	SOCKEYE	CHINOOK	COHO	CHUM	PINK	STEELHEAD
1947						
48						
49						
50						
51	1000					
52	400					
53	10000					
54	12000					
55	1200					
56	11000					
57	9000					
58	10000					
59	12500					
60	5000					
61	7000					
62	4500					
63	24600					
64	10000					
65	3500					
66	2500					
67	1500					
68	11000					
69	10200					
70						
71	2000					
72	600					
73	9000					
74	17200					
75	7000					
76	1400					
77	3600					
78	1500	1,000 KOKANEE				
79	6,600					
80	5,000					
81						
82						
83						
84						
85						
Arrival						
Start	Aug 5					
Peak	Aug 31					
End	Sept 15					

REMARKS:

NAME OF STREAM: TAHLO CREEK, UPPER LOCAL NAME: SALMON

CONSERVATION DISTRICT: 8 STATISTICAL AREA: 4

LOCATION OF MOUTH: Flows south into Tahlo Lake of the Morrison system

POSITION: 55-20 N,126-28W

LENGTH: 8 MI. WIDTH: 10' FT. DRAINAGE: SQ. MI.

COMPOSITION: BEDROCK: BOULDER: COARSE: FINE:

SILT & SAND: UNCLASSIFIED:

GRADIENT:

FALL IN FT/000	
0.0 - 2.5	
2.5 - 5.0	
5.0 - 7.5	
7.5 - 10.0	
> 10.0	

WETTED AREA: SQ. YD. SPAWNING AREA: SQ. YD.

DISCHARGE: CFS MAX: MIN:

TEMPERATURE:

BARRIERS OR POINTS OF DIFFICULT ASCENT:

SPAWNING DISTRIBUTION:

SPECIES	SECTION OF STREAM USED
SOCKEYE	lower 600 feet
CHINOOK	
COHO	
CHUM	
PINK (ODD YR)	
PINK (EVEN YR)	
STEELHEAD	

POTENTIAL OF INACCESSIBLE PORTION OF STREAM:

GENERAL REMARKS:

-Beaver dams are partial or complete barriers during periods of low water flow (1952-1975 B.C. 16, F381)

-Large burns have affected watershed (1967, F381)

SPAWNING ESCAPEMENT RECORD FOR: TAHLO CREEK (UPPER)

YEAR	SOCKEYE	CHINOOK	COHO	CHUM	PINK	STEELHEAD
1947						
48						
49						
50						
51	1200					
52	400					
53						
54						
55						
56						
57	1500					
58						
59	2500					
60						
61	2000					
62	25					
63	100					
64	1000					
65						
66						
67						
68						
69						
70						
71						
72						
73	100					
74	300					
75	N.R.					
76	1400	N.R.				
77	N.R.	N.R.				
78						
79	N.O.					
80	N.O.					
81						
82						
83						
84						
85						
Arrival						
Start	Aug					
Peak	Sept					
End	Sept					

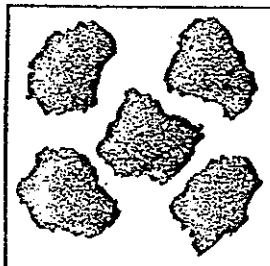
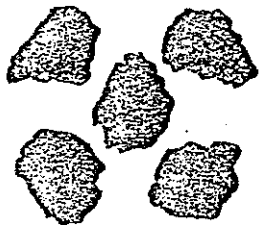
REMARKS:

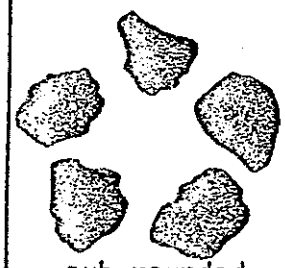
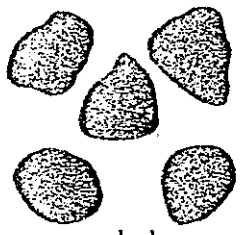
APPENDIX B

Glossary of Terms

The definitions of terms used in this glossary are from various sources: Arnette (1976) has been followed whenever possible; wetland classes indicated by * are provisional and dependent on the evolving Canada Wetland Classification; definitions of angularity class and texture are from the Terrain Classification System (1976); other terms follow standard texts or procedures.

angularity class - - The degree of roundness refers to the sharpness of edges and corners of a particle.

<table>
<tr><td> 
angular</td><td> 
sub-angular</td><td rowspan="2">A particle is angular and subangular if most of the edges and corners are sharp.

A particle is rounded and subrounded if most of the edges and corners are smooth.</td></tr>
<tr><td> 
sub-rounded</td><td> 
rounded</td></tr>
</table>

Note: Roundness should not be confused with sphericity; e.g. a nearly spherical particle may have sharp corners and be angular, while a flat pebble may not be spherical but still be well rounded as to its corners. See texture.

aquatic vegetation - - plant life growing in or on the water. Dominant (DOM) and co-dominant (CODOM) vegetation is identified by common name, species or genus.

average depth - - at a point cross-section, the average depth of water when multiplied by the width, equals the cross-sectional area. Measurements across the channel width should be made if access permits.

bank - - the rising ground bordering a stream channel below the level of rooted vegetation and above the normal streambed and designated as right or left facing downstream. See bank vegetation %, channel and texture.

bank vegetation % - - the percentages of ground coverage of each vegetation class found within 20 meters of the bank. Total may be greater than 100%. See overhang, and crown closure.

bank, % sloping - - the estimated length of banks that slope less than 45^{o} (100% slope) expressed as a percentage of total bank lengths.

barrier - - an obstruction to all fish movement at all flows. Species specific and flow dependent barriers are mapped as obstructions.

bed - - bottom of a watercourse. See bed % and channel.

bed % - - the percentages of substrate classes found on the bottom of stream at a point sample. See substrate, composition.

*bogs - - bogs are peat-covered areas or peat-filled depressions with a high water table and a surface carpet of mosses, chiefly Sphagnum. The water table is at or near the surface in the spring, and slightly below during the remainder of the year. The mosses often form raised hummocks, separated by low, wet interstices. The bog surface is often raised, or if flat or level with the surrounding wetlands, it is virtually isolated from mineral soil waters. Hence the surface bog waters and peat are strongly acid and upper peat layers are extremely deficient in mineral nutrients. Peat is usually formed in situ under closed drainage and oxygen saturation is very low. Although bogs are usually covered with Sphagnum, sedge may grow on them. They may be treed or treeless, and they are frequently characterized by a layer of Ericaceous shrubs.

cascade - - a series of small steps or falls. Total height and length are mapped when available.

channel - - a natural or artifical waterway of perceptible extent which periodically or continuously contains moving water. It has definite bed and banks which serve to confine the water in a single (S) or multiple (M) thread. Also see cross-section, form and entrenchment.

channel stability - - the relative amount of channel migration caused by cutoffs, diversions and meander development as determined from an analysis of sequential aerial photographs and ground observations. Channel stability indicators are mapped as reach characteristics at 1:20,000 scale only:

- s single channel; usually entrenched and stable
- m single channel; regular meandering on a marshy flat, stable
- p single channel, regular, meandering non-catastrophic instability (i.e. gradual downstream progression)
- c single channel; irregular meandering, catastrophic instability (channel shifts by cutoff of meanders or diversion)
- b multiple channel; braided, non-catastrophic instability (channel shifts continuously by minor progressive cutoff and diversion)
- d multiple channel; catastrophic instability (channel stable or migrating slightly for long periods; infrequently new channels are formed by cutoff or diversion process)
- v single channel; stabilized by vegetation.

chute - - a confined and inclined section of stream channel usually with bedrock substrate and high velocity, smooth flowing water. Total height and length (m) are mapped when available.

complex reach - - contains a repetitive sequence of two identifiable reach types. A Reach Tally card is completed for each type and the reach symbol is complexed (see text).

cross-section types - - the section of the stream channel taken perpendicular to the stream centerline. Using the 1:50,000 scale, three cross-sectional types are differentiated:

confined (c) : the channel is entrenched or lateral movement is controlled at high and regular flows by banks,

bounded (b) : channel movement or flooding is limited by valley walls near the edge of the floodplain,

unconfined (u): the channel is not bounded by valley walls and much lateral movement or flooding is possible at high flows.

Using the 1:20,000 scale, channel cross-section types are increased to the following:

confined (1:20,000)

- C Canyon; bedrock entrenched
- V Ravine; unconsolidated material or incompetent bedrock

unconfined (1:20,000)

- E Steep ephemeral; unconfined on a steep bedrock slope
- F Fluvial fan
- P Wide floodplain channel(s)
- S Slough; unconfined tributary channel on a valley flat

bounded (1:20,000)

- B Narrow floodplain constricted between terrace scarps or valley wall
- D Depression wetland other than a lake along the course of a channel.

crown closure - - the closure over a stream created by overstorey vegetation. It is expressed as a percentage of the channel area so covered.

debris - - allochthonous organic materials deposited within the floodplain. The abundance of debris is described as low, moderate or high. Debris that has been transported or is in the process of being moved is unstable (u). Anchored debris is considered stable (s). See obstructions.

D90 - - the diameter of substrate which is larger than 90% of the remainder.

entrenchment - - the degree of stream incision resulting from fluvial processes. See channel.

ephemeral stream - - a stream that wholly or partially disappears during dry periods.

*fens - - fens are peatlands characterized by surface layers of poorly to moderately decomposed peat, often with well-decomposed peat near the base. They are covered by a dominant component of sedges, although grasses and reeds may be associated in local pools. Sphagnum is usually subordinate or absent, with the more exacting mosses being common. Often there is much low to medium height shrub cover and sometimes a sparse layer of trees. The waters and peats are less acid than in bogs of the same area, and sometimes show somewhat alkaline reactions. Fens usually develop in restricted drainage situations where oxygen saturation is relatively low and mineral supply is restricted. Usually very slow internal drainage occurs through seepage down very low gradient slopes, although sheet surface flow may occur during spring melt or periods of heavy precipitation.

flood channel - - a channel that contains water at high flows. The channel may be connected to the main stream and is characterized by water of low velocity. Spatial occurrence is described as being nil, low (L), moderate (M) or high (H).

floodplain - - the flat land bordering a stream and subject to periodic flooding. It is constructed by the process of the present stream. See floodplain width.

floodplain width - - the width of the flat land bordering a stream that shows obvious signs of flooding and/or channel shift. See floodplain.

flow character - - the surface expression of the water that is determined by water velocity, volume and substrate. It is described at the time of survey as:

placid - tranquil, sluggish
swirling - eddies, boils, swirls,
rolling - unbroken standing waves
broken - riffles, rapids, jumps
tumbling - cascades, usually over large boulders or rock outcrops.

More than one term may be used to describe flow character.

form - - the appearance of the channel pattern within a reach. It is described as:

Straight (S) - little or no curving
Irregular (I) - no clear pattern of lateral movement
Meandering (M) - clear pattern of lateral movement identified by formation of oxbows or winding curves. Pattern ranges from tortuous to curving.

height thalweg - - the thalweg is a line connecting the deepest points in the stream channel; the height of the thalweg at a point is the vertical distance between the deepest point and the top of the stream bank.

invertebrates - - aquatic macro-invertebrates. Usually identified are insects by family and other arthropods, annelid worms and molluscs. Dominant (DOM) and next most common (CODOM) are noted.

karst - - a comprehensive term applied to limestone or dolomite areas that possess a topography peculiar to and dependent upon underground solution and the diversion of surface waters to underground routes.

mainstream azimuth - - the angular distance in the horizontal plane measured clockwise from true north to the stream outlet from the stream head.

*marshes - - marshes are grassy, herb dominated wet areas, periodically inundated up to a depth of 2 m or less with standing or slowly moving water. Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mud flats. Marshes are subject to a gravitational water table, but water remains within the rooting zone of plants during at least part of the growing season. The substratum usually consists of mineral or organic soils with a high mineral content, but there is little peat accumulation. Waters are usually circumneutral to alkaline, and there is a relatively high oxygen saturation. Marshes characteristically show zonal or mosaic surface patterns of vegetation, comprised of unconsolidated grass and sedge sods, frequently interspersed with channels or pools of open water. Marshes (may be bordered by) peripheral bands of trees and shrubs, but the predominant vegetation consists of a variety of emergent non-woody plants such as rushes, sees, reedgrasses and sedges. Where open water areas occur, a variety of submerged and floating aquatic plants flourish.

obstruction - - any object or formation that may impede, block, or hinder waterflow and/or fish migration. Types distinguished are falls, cascades/chutes, beaver dams, culverts, velocity and other barriers. Height (m) is mapped when available, (see text). See barrier.

overhang closure - - the closure over a stream created by understorey vegetation within 1 m of normal water surface. It is expressed as a percentage of the channel area.

point sample - - a spot sample on a stream. The point may be defined in any useful manner, such as a very short reach (area visible at a road crossing or helicopter landing site), a particular bank channel or a single bank (for water sample site, beach seining, etc.).

point number - - (Point__ of___) is a non-repetitive number within a coded watershed system. Numbers are accessed in the data file in combination with the system and reach number. Point numbers are placed on the map at the point.

*pond - - a body of still water, smaller than a lake.

pool control % - - the percentage of each factor which controls the occurrence of pools in a reach.

profile - - a description of the longitudinal profile of the stream channel. At a 1:50,000 scale, it will be stepped (s) which is a repetituous sequence of slopes or forms (such as pool-riffle, confined-unconfined), or regular (r), which is a continuous or homogeneous profile (such as all rapids). At a 1:20,000 scale, profile is assumed regular and not mapped.

reach - - the basic biophysical mapping unit for the Aquatic Systems Inventory. It is characterized by relatively homogeneous properties which will vary according to the scale of the survey. Properties are homogeneous within the reach and include slope, channel and/or biological parameters. See complex reach.

reach number - - is the distance in km from the system mouth to the lower reach boundary (see Digitizing). The distance is correlated with map and data file information. See reach sequence number.

reach tally card - - a tally of average values for a reach i.e. values represent estimates of substrate composition and descriptions of form, profile and cross-section etc. for the entire reach. See Table 2.1, text.

reach sequence number - - reaches are numbered sequentially upstream from the mouth (1, 2...n). These numbers are mapped at the upstream reach boundary symbol. It is correlated with data file information. See reach number.

riffle - - a shallow rapid in a stream, where the water surface is broken into waves by obstructions wholly or partially submerged. A riffle may be drowned out at high water.

rooted width - - the width of the stream channel between rooted vegetation on either bank.

*shallow open water - - shallow open water which is locally known as pond or slough, is relatively small, non-fluvial body of standing water occuping a transitional stage between lakes and marshes. In contrast to marshes, these waters impart a characteristic open aspect, with proportionately large expanses of permanent surface water that lack emergent cover, except for relatively narrow zones adjoining shorelines.

side channel - - a channel connected to the main stream at low and high water. It is characterized by low velocity flows. Spatial frequency is described as being Nil, low (L), moderate (M), or high (H).

sink - - the point at which a stream disappears into fluvial material.

slope - - a) Reach Slope

the length of reach divided by the change in elevation between the downstream and upstream ends of the reach. Derived from topographic maps, it is expressed to the nearest 0.1% between 0% and 3%, and to the nearest 1% above 3%.

b) Point Slope

the slope at a point as read from a clinometer to the nearest 0.5%.

slump - - active mass wasting of surfical material from banks or valley walls into stream channels. Length of the slump is mapped and digitized (see text).

substrate - - the material 20-30 cm deep that comprises the stream bed. See substrate composition.

substrate compaction - - the relative density or looseness of substrate caused by sedimentation, mineralization and/or imbrication. See substrate.

substrate composition - - three size ranges are identified at 1:50,000 and expressed as a percentage of total substrate:

fines (F) 0-2 mm
gravels (G) 2-100 mm
rock (R) bedrock

A fourth category, larges, is computed as a residual and is material larger than 100 mm but not bedrock: L=10-F-G-R. At 1:20,000 the D90 diameter is added to the reach symbol.

substrate stability - - flowing water causes the movement of the stream substrate. An indication of the mobility of the substrate is the presence of:

braiding (Brd.) - anastomosing stream flow,
bars (Bar) - deposits of sand and gravel which are built up and removed by stream flows,
islands (Is) - distinguished from bars by being composed of consolidated or unconsolidated material and supporting well-established vegetation.

*swamps - - are woody plant dominated where standing to gently flowing waters occur seasonally or persist for long periods at the surface. Frequently there is an abundance ofpools and channels indicating subsurface water flow. The substrate is usually continually water-logged. Waters are circumneutral to moderately acid in reaction, and show little deficiency in oxygen or in mineral nutrients. The substrate consists of mixtures of transported mineral and organic sediments or peat deposited in situ. The vegetation cover may consist of coniferous or deciduous trees, tall shrubs, herbs and mosses. In some regions, Sphagnum may be abundant.

texture - - the size, roundness and sorting of particles in unconsolidated clastic sediments.

1. Descriptive terminology

Specific Clastic Terms	Common Clastic Terms
b bouldery	a blocky
k cobbly	r rubbly
p pebbly	g gravelly
s sandy	f fines
ǵ silty	
c clayey	

2. Definition of Common Clastic Terms.

Blocky: An accumulation of angular particles greater than 256 mm in size.

Rubbly: An accumulation of angular particles with a size range of 2-256 mm, but may include interstitial sand.

Gravelly: An accumulation of two or more size ranges of rounded particles greater than 2 mm but may include interstitial sand.

Fines: A mixture of silt and clay; may also contain a minor fraction of fine sand.

3. Application of the Specific and Common Terms in the Textural Classification of Clastic Sediments.

ROUNDNESS \ SIZE (mm)		mm 256	64	2	.062	.0039
SPECIFIC	ROUNDED	BOULDERY	COBBLY	PEBBLY		
SPECIFIC	ROUND or ANGULAR			SANDY	SILTY	CLAYEY
COMMON	ROUNDED	GRAVELLEY				
COMMON					FINES	
COMMON	ANGULAR	BLOCKY	RUBBLY			

a. No more than two specific and/or common terms will be used together, e.g. pebbly rubble or sandy cobble.

b. A subordinate textural component will not generally be shown if it constitutes less than 25% of the total volume of the deposit.

thread - - a line created by the directional flow of a stream within the main channel(s). It is classified as single (s) or multiple (m). See channel.

total pool % - - the amount of pool area in a reach expressed as a percentage of the reach area. See pool control.

turbidity - - the clarity of the water as measured by the depth to which the bottom is still visible.

velocity - - the time of rate of motion; the distance travelled divided by the time taken to travel that distance. On the point sample card it is the chip or surface velocity unless a current meter is used. Method of measurement should be noted.

visibility - - the distance (m) which a swimmer with face mask can see underwater.

watershed - - the area drained by a particular stream or lake. If a watershed boundary is mapped, the watershed has a code number and associated information in the data file.

——— Major watershed boundary e.g. 23 Pine River; two digit watershed code.

- - - Sub-watershed boundary e.g. 23-0400 Sukunka River; tributary to Pine River. (Six digit watershed code).

----- Minor watershed boundary e.g. 23-0400=040 Burnt River; tributary to Sukunka. Also, 23-0400-040-010 Brazion Creek; tributary to Burnt River. See Appendix