NORTH COAST FISHERIES RENEWAL COUNCIL &
COMMUNITY FISHERIES DEVELOPMENT CENTRE (CFDC) PRINCE RUPERT

1999 NORTH COAST STREAM INVENTORY PROJECT (NCSIP)

FINAL WATERSHEDS REPORT

FOR SELECTED WATERSHEDS IN DFO AREAS 3, 4, 5, 6 & 7

Report Document Prepared by:
David Rolston, BSc., and
Bart Proctor, BSc.

Organization:

Community Fisheries Development Centre
Attn: Tasha Sutcliffe
253 Third Avenue West
Prince Rupert, BC
V8J 1L2
(250) 624-8566

Co-Funders:

FISHERIES RENEWAL BC

Habitat and Enhancement Branch
Pacific Region

Fisheries and Oceans Canada | Pêches et Océans Canada

EXECUTIVE SUMMARY

This report describes the results of a 1999 field assessment of fish and fish habitat in selected watersheds in DFO Areas 3, 4, 5, 6, & 7 by participants of the 1999 North Coast Stream Inventory Project (NCSIP), managed through the Community Fisheries Development Centre (CFDC).

The purpose of the 1999 assessment was build on the information obtained during the 1998 assessment, and to provide regional standardization within the North Coast Stream Inventory Project so that a regional approach towards long-term watershed planning could be developed.

For both years (1998 & 1999), site-specific juvenile coho densities were sampled and estimated using a mark and recapture protocol developed by Blair Holtby, DFO Nanaimo. The remainder of the methodology of the watershed assessments was developed the CFDC, and consisted of a modified 1:20,000 RIC Fish and Fish Habitat Assessment, relative fish abundances assessments, qualitative fisheries habitat assessments, and associated mapping procedures.

The fish habitat surveyed in 1999 was according to an abbreviated habitat assessment methodology, specified in Reconnaissance (1:20 000) Fish and Fish Habitat Inventory Standards and Procedures (RIC, 1998). The habitat was assessed so that stream reach and biophysical data could be utilized in tentative regional watershed planning and capability modelling.

Additionally, catch per unit effort (CPUE) methodology was used to estimate relative juvenile coho, and other fish species abundances between watersheds and sample sites. An intensive 1:20000 mapping exercise was additionally completed, noting and geo-referencing impacts, fish abundances, and adult holding and spawning and juvenile rearing habitats.

The anticipated resource benefits of watershed restoration activities completed in conjunction with strategic stock enhancement activities include potential increases in the survival of stream rearing salmonids, and in improving the status of endangered coho salmon stocks. The assessment work and associated rehabilitation measures for the impacted watersheds are expected to produce employment and retraining for displaced local fisheries and forestry workers.

This project was supported through the Habitat Restoration and Salmonid Enhancement Program of the Department of Fisheries and Oceans Canada (DFO) and Fisheries Renewal BC (FsRBC).

Table of Contents

INTRODUCTION

The *Habitat Restoration and Salmonid Enhancement Program* (HRSEP) of the Department of Fisheries and Oceans Canada (DFO) has been extended through the Pacific Salmon Fisheries Restructuring Program and complements the Pacific Salmon Revitalization Strategy. The focus is to increase the quality and quantity of salmon habitat and to conserve salmon stocks in British Columbia and the Yukon.

The goals of the HRSEP Program are:

1. ***Habitat Restoration:*** to improve or create freshwater and estuary habitat for salmon spawning and rearing;
2. ***Salmon Stock Rebuilding:*** to support stock enhancement projects that help bolster weak populations and assist stock assessment projects that gather vital fisheries information; and
3. ***Resource and Watershed Stewardship:*** to support community-based initiatives that promote sustainable salmon populations.

Fisheries Renewal BC (FsRBC) is a provincial Crown corporation which protects and restores fisheries resources and make strategic investments in British Columbians and in communities that rely on commercial or sports fishing. The goal is to achieve and maintain sustainable fisheries and help create new economic opportunities for the people and communities that depend on them.

FsRBC has a broad legislated mandate that includes:

- promoting the protection, conservation and enhancement of fish stocks and habitat;
- building a multi-skilled workforce in fishing communities by supporting employment, training and technological development;
- working with communities to develop strategic plans for job creation in the fisheries;
- developing local infrastructure that will encourage employment and investment in communities; and
- providing advice to the government of British Columbia on fisheries-related programs.

Proponent, Funding Source and Partners

In 1998 and 1999, the Community Fisheries Development Centre (CFDC) entered into an agreement with both DFO (HRSEP) and Fisheries Renewal BC (FsRBC) to complete a stream inventory project within DFO Areas 3, 4, 5, 6 & 7. 10 Field crew teams from Prince Rupert and adjacent coastal communities were trained in stream inventory methodology and employed through the Prince Rupert Community Fisheries Development Centre (CFDC) within the North Coast Stream Inventory Project (NCSIP).

There was 1 field crew employed from each of the following communities: Kincolith, Lax Kw'Alaams (Port Simpson), Metlakatla, Oona River, Kitkatla, Hartley Bay, and Kitasoo (Klemtu). Additionally 3 field crews were employed from Prince Rupert.

OVERALL PROJECT PURPOSE AND DESCRIPTION

The purpose of the North Coast Stream Inventory Project Project (NCSIP) was to build up stream profiles on the presence and density of juvenile salmonids, especially coho salmon. This program is important in establishing a baseline for determining what species are at risk in the watershed and the condition of the fish habitat. This program now covers a few years of consecutive data collection.

The focus of doing stream inventory studies is to be consistent over many years or at the very least, over one cycle of the coho life cycle. The establishment of a stream profile which includes juvenile salmonid density counts, scale analysis, genetic profile, mapping, and water quality data are all necessary ingredients to establish a proper baseline. The comparison of this baseline with coho adult enumeration counts will establish a correlation about juvenile salmonid mortality within a system and provide remedies to improve the output of a system if deemed necessary.

The information collected from this program is crucial in determining what watersheds may be in need of stock assistance and/or habitat rehabilitation, and the capacity of that assistance. Additionally, it may be possible to utilize the collected biophysical information in longer term watershed planning, when combined with future productivity and watershed classification projects.

For both years (1998 & 1999), site-specific juvenile coho densities were sampled and estimated using a mark and recapture protocol developed by Blair Holtby, DFO Nanaimo. The remainder of the methodology of the watershed assessments was developed the CFDC, and consisted of a modified 1:20,000 RIC Fish and Fish Habitat Assessment, relative fish abundances assessments, qualitative fisheries habitat assessments, and associated mapping procedures.

The fish habitat surveyed in 1999 was according to an abbreviated habitat assessment methodology, specified in Reconnaissance (1:20 000) Fish and Fish Habitat Inventory Standards and Procedures (RIC, 1998). The habitat was assessed so that stream reach and biophysical data could be utilized in tentative regional watershed planning and capability modelling.

Additionally, catch per unit effort (CPUE) methodology was used to estimate relative juvenile coho, and other fish species abundances between watersheds and sample sites. An intensive 1:20000 mapping exercise was additionally completed, noting and geo-referencing impacts, fish abundances, and adult holding and spawning and juvenile rearing habitats.

The anticipated resource benefits of watershed restoration activities completed in conjunction with strategic stock enhancement activities include potential increases in the survival of stream rearing salmonids, and in improving the status of endangered coho salmon stocks. The assessment work and associated rehabilitation measures for the impacted watersheds are expected to produce employment and retraining for of both First Nations and non-aboriginal displaced local fisheries and forestry workers.

THE 1999 NCSIP COHO ENUMERATION PROGRAM

INTRODUCTION

The focus of the 1999 ***North Coast Stream Inventory Program (NCSIP)*** was a continuation of the 1998 NCSIP program to collect data related to juvenile salmonids densities within selected systems from Area 3-Area 7. During the 1999 NCSIP program, we trained crews in mapping procedures to do overall assessments of the watershed and also on a reach by reach basis by filling out reach site cards. Our purpose for the mapping was to look at the potential of doing productivity models and also to begin the stage of using a GIS format by tagging systems with an external databases that incorporates the data we have collected over the last two years. The last part of the 1999 NCSIP program this year was done by using four of the crews to do an adult coho enumeration on 11 of the systems we have good juvenile data on in order to gather data about:

(1) The movement of adult coho into these systems (2-3 different site visits at 1 week- 2 week intervals
(2) Measurements of pools that are concerned both with adult holding pools and juvenile rearing areas
(3) To begin the process of putting a quantitative relationship or correlation between returning adults and starting a time series of predictions on juvenile numbers/returning adults.
(4) Looking at the potential of indicator river in Area 5

METHODS AND TRAINING MANUAL

Refer to the North Coast Fisheries Development Centre Watershed Enumeration and Pool Survey Manual

SYSTEMS ENUMERATED

Location is distance from the mouth of estuary (refer to maps)
Code: Live coho = LC Dead coho = DC Live Jack Coho = LJC Dead Jack Coho = DJC

PRUDHOMME CREEK FIS

The team of Brian Carpenter and Robyn Parks (Prince Rupert 3) did surveys for adult enumeration in the Prudhomme Creek on November 12th, November 16th and December 1st 1999. They also did a survey on November 12th in a side stream on the west side of the lake near a group of cabins. The surveys were done at a time of high water events as the time frame to do these enumeration corresponded to an unusually high amount of precipitation for the time period of early November to early December. The team did some limited measurements on pool area and depths due to the high water conditions (Refer to working map on Prudhomme)

Enumeration done on November 10 1999 (Prudhomme Creek) Inspected creek into Reach 4 about the 1920 meter mark

Location (m)	Coho Enumerated	Observations
848 - 878	2 LC 1LJC	Water Temperature is 4 C
1271	1 LC	Water Conditions above normal
1805 -1856	12 LC	Coho were spawning in this area
		Survey stopped at 1895 m

The team also did a 1/2 hour soak using 4 gee traps at Site # 2 and they tallied 14 fin clipped juvenile coho and 2 not clipped juvenile coho, 6 rainbows and 16 dolly varden.

Enumeration done on November 12 1999 (Small creek on west side of Prudhomme Lake about 1.5 km from the estuary of Prudhomme Creek and near brown cabin)

Location (m)	Coho Enumerated	Observations
	2	Observed small distance to lake entrance
		Water Conditions normal

Enumeration done on November 16 1999 (Prudhomme Creek) Inspected length of Creek to the bottom of falls 2185 meters

Location (m)	Coho Enumerated	Observations
878	9 LC	Located near LWD pile
1271	1 LC	Water temperature 5 C
1428	1 LC	Coho were spawning
1805	3 LC	Observed near large boulders
1895	2 LC	Water conditions above normal

Set 4 gee traps for 1/2 hour in two pools at the 1350 meter mark. The observed tally was 1 clipped juvenile coho, 36 unclipped juvenile coho, 20 rainbows and 19 dolly varden.

Enumeration done on Dec 1st 1999 (Prudhomme Creek) Inspected creek up to Site 2 about 1271 meter mark

Location (m)	Coho Enumerated	Observations
	1 LC	Saw fish at the lower end of the creek
		Water Conditions above normal

No gee trappings were done because of the heavy rainfalls on this day

DENISE CREEK

The team of Brian Carpenter and Robyn Parks (Prince Rupert 3) did Coho enumeration on Denise Creek on November 9th and November 15th 1999. On December 18th the team checked some of the creeks on the left-hand side of Denise Arm. The surveys were done in above normal water conditions.

Enumeration done on November 9th 1999 (Denise Creek) Inspected creek to the falls which is 2126 meters from the estuary.

Location (m)	Coho Enumerated	Observations
235	1 DC	1 Coho carcass on creek bank below Site 1
1186-1200	2 LC	Both were spawning below Reach 3-4 break
		Water conditions above normal

No Gee trapping done this day as there are very few juvenile coho found in this system and the high water events that are taking place.

Enumeration done on November 15th 1999 (Denise Creek) Inspected creek up to 1020 meters from the estuary

Location (m)	Coho Enumerated	Observations
472	2 LC 1LJC	Observed in side pool in Site #2
1020	1 LC	
		Water temperature 6 C
		Water Conditions above normal

Gee trapping for juvenile was done in 3 locations (1) In site 1 (235 meters) 4 traps for 1 hour soak and the tally was 2 juvenile coho, 6 sculpins (2) In site 2 (472 meters) 4 traps for 1 hour soak and the tally was 3 coho and 1 sculpin (3) (1020 meter) 4 traps for 1/2 hour 12 coho fry (4 are believed to be smolts), 1 steelhead

Enumeration done on November 18th 1999 (Creeks on the left side of Denise Arm)

The team did not fill out any stream inspection form but on the activity report they did not report any sightings of fish. Their comments about the condition of the creeks was that the creeks were in poor condition with low water flow and lots of wind falls and poor spawning conditions.

WOLF CREEK

The team of Brian Carpenter and Robyn Parks (Prince Rupert 3) did enumeration in Wolf Creek on November 8th, November 17th, November 29th and December 3rd 1999. The November 29th and December 3rd surveys can be discounted because of the heavy rainfalls and they reported no fish sighted on either occasions and in communications

with them they stated it would have been very difficult to see any signs due to the high water conditions.

Enumeration done on November 8th 1999. Inspected Wolf creek to the impassable falls at the top of the system

Location (m)	Coho Enumerated	Observations
0-1288	0	No sign of adult coho in system
		Water Conditions above normal

Enumeration done on November 17th 1999. Inspected the length of the system (1288 meters)

Location (m)	Coho Enumerated	Observations
0	1 DC	Coho skin and tail in tidal pool
287	1 LC	
355	4 LC	One coho quite silvery
593	1 DC	Dead coho jaw bone in Site #1
		Water temperature 5 C
		Water Conditions above normal

Gee traps were set in three locations to observe presence of juvenile coho (1) At 500 meter, 4 gee traps were set for 1/2 hour and the tally was 14 juvenile coho, 8 rainbows and 2 dolly varden (2) At 634 meters 4 gee traps were set for 1/2 hour and the tally was 9 juvenile coho, 3 rainbows, and 2 dolly vardens (3) At the bottom of the falls (1140 meters) the 4 gee traps were set for 1/2 hour and the tally was 0 juvenile coho, 10 rainbows and 3 dolly varden.

***** **The team made the comment that there was poor spawning habitat above Site 1 (593 meters and up)**

ANTIGONISH

The team of Brian Carpenter and Robyn Parks (Prince Rupert 3) did go into Antigonish on two different occasions: November 19th and December 2nd 1999. Personal communications with the group was that no adult coho presence was sighted on November 19th and that on December 2nd the snow was too heavy to proceed up the Work Channel road to gain access to Antigonish.

DIANA CREEK

The team of Bernie Scullion and Garry Brooks (Prince Rupert 2) enumerated Diana Creek on one occasion November 10th 1999. They were on their way to Valley Creek just off the Khyex river but they found that the tide was too low to use their skiff to get into that system so they defaulted to Diana Creek. On personal communications with Dan Wagner, local Department of Fisheries staff enumerate this system during this time so this will only add to their information.

Enumeration done on Diana Creek Nov 10 1999

Location (m)	Coho Enumerated	Observations
Campsite by bridge	1 LC	Coho observed at large pool down stream of bridge by road side picnic area
Just above bridge	7 LC	Coho sighted just up stream of bridge just off the Diana Creek trail
75 m up the Diana trail	15 LC	Sighted in a series of small pools and vegetated islands
		Water Conditions above normal

***** Of all coho sighted 6 were paired and coho appear to be holding**

KWINISTA

The team of Bernie Scullion and Garry Brooks (Prince Rupert 2) did adult coho enumeration on Kwinista Creek on November 11th 1999. The water level was moderate but swift and the color of the water was ice tea

Location (m)	Coho Enumerated	Observations
0	2 DC	Pre-spawn coho found at the bottom end of Site #2 Eaten by bear
	3 LC	1 male and female paired
		Water Temperature is 5 C

McNEIL RIVER

The team of Bernie Scullion and Garry Brooks (Prince Rupert 2) and after **Bernie Scullion and Bruce Hansen** visited the McNeil system on three different occasions November 9th , December 2nd and December 3rd 1999. On November 9th the team could not access the upper areas of McNeil due to a landslide that blocked the road. In personal communication with the group, they stated that the slide has caused no impedance to fish movement to the upper reaches of McNeil but it prevented them that day to get up and enumerate the upper reaches of McNeil. On December 2nd the team of Bernie Scullion and Bruce Hansen enumerated the upper McNeil river. On December 3rd they enumerated the lower McNeil River

Coho enumeration done on December 2nd 1999

Location (m)	Coho Enumerated	Observations
Upper McNeil	32 LC	Bottom corner Site 1 to beaver dam but there was no coho noted in the lake
		Snow on the ground

Coho enumeration done on the Lower McNeil on December 3rd 1999

Location (m)	Coho Enumerated	Observations
Lower McNeil	0	No coho sighted in Reach 1 and Reach 2
	1 dead Pink	Sighted near pool near trail to Site 1 and 2
		Weather is wet snow

ABERDEEN

Bruce Hansen and Bernie Scullion (Prince Rupert 2) made one visit to Aberdeen on **Nov 30th 1999** and walked the entire system to the impassable cascades. They observed no adult fish in the system. No Gee trapping was done on the system

INVER CREEK

Bruce Hansen and Bernie Scullion (Prince Rupert 2) made one visit to Inver Creek on December 1st 1999 and walked the system from the Skeena River to the impassable fall. They observed no adult fish in the system. No Gee Trapping was done on the system. They indicated that there was noticeable stream bank erosion throughout the streambed.

NORTH CREEK

The team of Bernie Scullion and Garry Brooks (Prince Rupert 2) made one visit to North Creek on November 12th 1999. They walked to the end of Reach 4 in North Creek and sighted no adult fish. The water conditions were very high that day. They spotted juvenile coho in the tributaries off the main stem of North Creek

SILVER CREEK

The team of Alvin Bolton and Cliff Ryan (Metlakatla) did pool assessments and adult enumeration on November 9th and November 11th in Silver Creek. They returned to do another adult enumeration on November 26th in which they walked the whole system.

The following is a summary of the adult enumeration and juvenile enumeration in Silver Creek on November 9th and 11th combined.

Location	Coho Enumerated	Observations
Reach 1	5 Dead Adults	Deteriorated too much to make ID
Reach 2	1 DC	
Reach 3	1 DC	Found a dead pink and the coho was spawned out
Reach 4	0	Water Conditions above normal

Gee Traps were set in the four reaches. (1) 4 Gee Traps were set down from the impassable waterfall (Reach 4) for 15 minutes. The tally was 3 juvenile coho . (2) Set 4 Gee traps were set in Reach 3 for 15 minutes and the tally was 0 juveniles (3) Set 4 Gee traps in Reach 2 for 15 minutes and the tally was 0 juveniles (4) Set 4 Gee traps in Reach 1 for 15 minutes and the tally was 2 sculpins.

Adult Coho enumeration on November 26th 1999 in Silver Creek

Location	Coho Enumerated	Observations
Reach 1	0	
Reach 2	3 LC	Coho sighted 20 meters below the logging bridge. Also walked a tributary and saw no signs of adults. Saw salmon eggs in the stream at the same sighting
Reach 3	0	Found a dead pink and the coho was spawned out
Reach 4	0	Water Conditions above normal

*** No Gee Trapping was done

AIRPORT DOCK CREEK 915-789000-55600

The team of Alvin Bolton and Cliff Ryan (Metlakatla) did adult enumeration and pool area measurement on November 17th, November 18th and November 20th 1999.

Combined adult enumeration on November 17th and Nov 18th in Airport Dock Creek to the end of the creek at the beaver dam (2560 meters)

Location	Coho Enumerated	Observations
Reach 1	0	
Reach 2	0	
Reach 3	9 LC 1LJC	All adults were sighted in Reach 3

4 Gee traps were set in each of the reaches but the soak time was not given. (1) Traps set at first pool below Beaver Dam at the top of Reach 3 and the tally was 113 juvenile coho, 6 sticklebacks, 5 cutthroats (2) Traps set at 390 meter mark from the beginning of the road to the Airport and the tally was 49 juvenile coho, 32 cutthroat (3) Set traps at the 872 meters and the tally was 20 juvenile coho and 1 cutthroat

Adult enumeration done on November 20th 1999 in Airport Dock Creek and on the heavy rainfalls made the water conditions high

The team stated that they had walked the entire length of the creek but did not see any adults. They talked to a local inhabitant from Crippen Cove who stated that he had seen 8 adult coho near Site #1 a short time ago. He also stated that this creek is connected to the creek in Delusion Bay by a series of small lakes

SCOTT INLET 910-813800

The team of Alvin Bolton and Cliff Ryan (Metlakatla) did an adult assessment in Scott Inlet creek but they did not see any adult fish. They also walked part of the second creek in Scott Inlet but they did not observe any adult fish.

MOORE COVE

The team of Farrel Noel and Ralph Letts (Oona River) did both adult enumeration and pool depth and area measurements. We directed the Oona River team to do more assessment work on Moore Cove because we want to explore the possibility that Moore River could be a functional indicator river similar to the LacMac river up in the Work Channel area. The team went into Moore Cove on November 5th and November 6th to do pool surveys in Reach 4 where the main body of adult coho spawn and also enumeration, and on November 13th of 1999 they did a repeat enumeration.

Adult enumeration combined November 5th and November 6th 1999 in Moore Cove

Area assessed (m)	Coho Enumerated	Observations
3000	150 LC	Assessment was done for 3000 m from the bridge at the logging road that goes from Kumeleon to Falls River
		1 bear was observed

Gee trapping was done by the crew in personal communications but I have yet to connect with the team where that data is located. I will include it when I establish contact with them.

Adult enumeration done on November 13th 1999 in Moore Cove

Location	Coho Enumerated	Observations
Reach 1	0	
Reach 2	0	
Reach 3	9 LC 1LJC	All adults were sighted in Reach 3

No Gee Trapping was done in the system on this occasion

ALPHA BAY 915-560200-61000 (KUPE)

The team of Farrel Noel and Ralph Letts did adult enumeration in Alpha Bay on two different occasions November 14th and November 20th 1999. Dave Lewis (Fisheries Charter vessel patrolman) was scheduled to do a visit in November into the Alpha Bay system.

Enumeration done on November 14th 1999 in Alpha Bay

Area surveyed	Coho Enumerated	Observations
1500 m	1 LC 1 DC	

Enumeration done on November 20th 1999 in Alpha Bay

Area Surveyed	Coho Enumerated	Observations
1500 m	0	

No Gee Trapping was done in the Alpha Bay system

SPILLER RIVER 915-765500-87000 (PORT)

The team of Farrell Noel and Ralph Letts (Oona River) did adult enumeration and pool depth and area measurements on 2 different occasions November 3rd and November 12th 1999.

Enumeration done on November 3rd 1999 at Spiller River

Area Surveyed	Coho Enumerated	Observations
2800 meters	10 LC 3 DC	The team surveyed 2800 meters up Spiller from the estuary

Enumeration done on November 12th 1999 at Spiller River

Area Surveyed	Coho Enumerated	Observations
2800 meters	10 LC 3 DC	The team surveyed 2800 meters up Spiller from the estuary

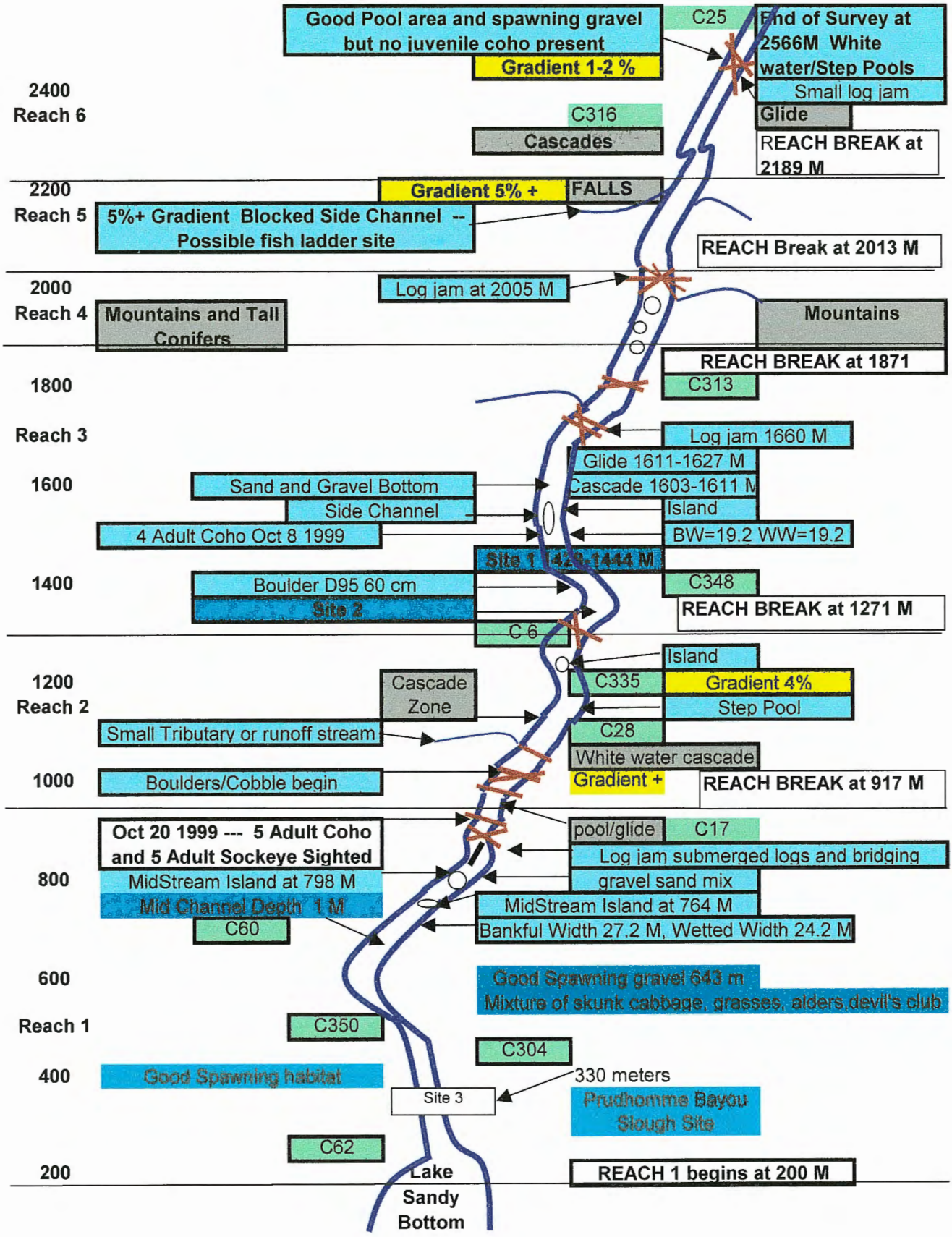
PORCHER CREEK 915-765500-2862 (Part 1)

Enumeration done on November 4th 1999

Area Surveyed	Coho Enumerated	Observations
1750 meters	20 LC	

Enumeration done on November 11th 1999

Area Surveyed	Coho Enumerated	Observations
1750 meters	18 LC	


Good Pool area and spawning gravel but no juvenile coho present
Gradient 1-2 %
C25
End of Survey at 2566M White water/Step Pools
Small log jam
Glide
REACH BREAK at 2189 M
2400
Reach 6
C316
Cascades
2200
Gradient 5% +
FALLS
Reach 5
5%+ Gradient Blocked Side Channel -- Possible fish ladder site
REACH Break at 2013 M
2000
Log jam at 2005 M
Reach 4
Mountains and Tall Conifers
Mountains
REACH BREAK at 1871
1800
C313
Reach 3
Log jam 1660 M
Glide 1611-1627 M
1600
Sand and Gravel Bottom
Cascade 1603-1611 M
Side Channel
Island
4 Adult Coho Oct 8 1999
BW=19.2 WW=19.2
Site 1 1428-1444 M
1400
Boulder D95 60 cm
C348
Site 2
REACH BREAK at 1271 M
C 6
Island
1200
Reach 2
Cascade Zone
C335
Gradient 4%
Step Pool
Small Tributary or runoff stream
C28
White water cascade
1000
Boulders/Cobble begin
Gradient +
REACH BREAK at 917 M
pool/glide
C17
Oct 20 1999 --- 5 Adult Coho and 5 Adult Sockeye Sighted
Log jam submerged logs and bridging
800
MidStream Island at 798 M
gravel sand mix
Mid Channel Depth 1 M
MidStream Island at 764 M
C60
Bankful Width 27.2 M, Wetted Width 24.2 M
600
Good Spawning gravel 643 m
Mixture of skunk cabbage, grasses, alders,devil's club
Reach 1
C350
C304
400
Good Spawning habitat
330 meters
Site 3
Prudhomme Bayou Slough Site
C62
200
REACH 1 begins at 200 M
Lake Sandy Bottom

KINCOLITH

APPROACHING KINCOLITH (GINGOLX) FROM ARRANDALE

1998 PROJECT MANAGER 1 : RAY AZAK
STREAM TECHNICIANS: FRASER DOOLAN, KIRBY STEVENS, JEFF STEVENS

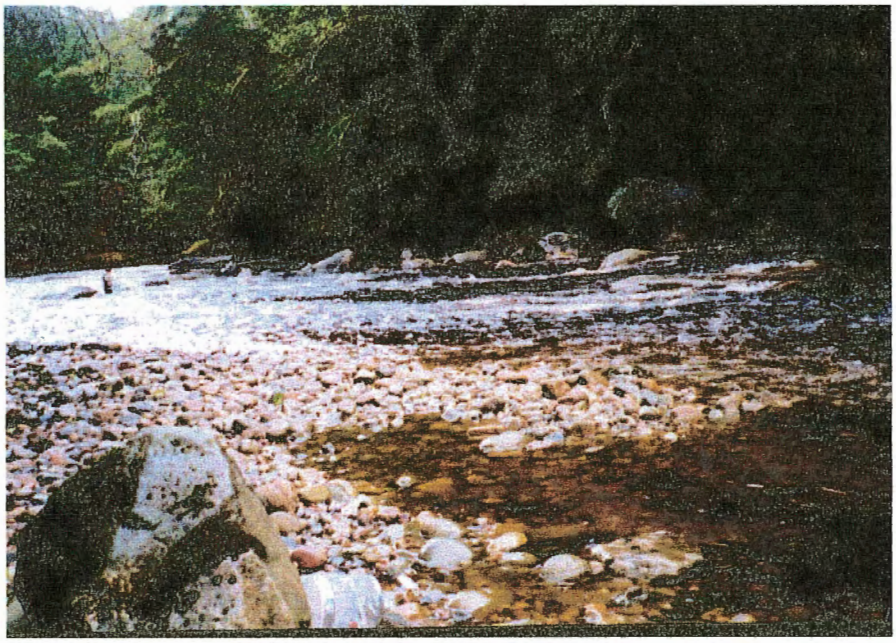
1998 PROJECT MANAGER 2: PERRY STEVENS
Stream Technicians: RUDY WATTS, KEN ALEXANDER, JEREMY OKABE

1998 PROJECT MANAGER 3: CARMELITA TRIMBLE
STREAM TECHNICIANS: NEIL SMYTHE, RAYMOND STEWART JR. and KEN ALEXANDER

1999 PROJECT MANAGER: RAY AZAK
STREAM TECHNICIANS: ROBERT STEVENS JR., KEN ALEXANDER

CHAMBERS CREEK

Location: Fisheries Statistical Area 3----Flows Northeast into Iceberg Bay where Portland Channel meets the Nass River (54 129 NW)
Watershed Code: NA 500-009000
Length of system observed: 5.0 km from mouth of creek
Historical records of adult salmonids presence: Chinook (Peak late July early August), Coho (Peak at middle of October), Chum (Peak late August early September) and Pink (Peak in middle to late August)
Other indigenous fish: Steelhead and Freshwater Sculpins
Adult Enumeration: No 1998 or 1999 data received on adult salmon enumeration
Comments: There were four sites that were used throughout Chambers Creek up to the 5 km mark of the system and below the falls. There does not seem to be a great deal of juvenile coho in this system.



CHAMBERS CREEK

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	95	38	0	0	42 juvenile steelhead caught in the first trapping. Traps were left in for the water for 48 hours for the second retrapping and possibly the fish escape. This site was 3.5 km from the mouth of the creek
1998	2	10	210	6	0	0	Site was located 1.5 km from the mouth of river. No mapping was done on this site
1998	3	10	90	13	0	0	Site was located 935 meters from the mouth of the creek. There was no map or data for mark recapture on snd trapping
1998	4	10	90	0	NA	NA	Site 5km from the mouth of creek and 50 meters before the falls 19 juvenile steelhead captured in the traps but no coho

1999	1	10	120	43	NA	NA	No other species were caught in the trapping.
1999	2	8	480	4	NA	NA	
1999	3	10	90	158	167	3	Survey location was 2435 meters from the mouth of the estuary. 1steelhead parr

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	5%	NA	3-5%	NA	NA	28.05	22.12	NA	Cobble 50 Gravel 50
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	40	5%	NA	0-5%	NA	NA	28.96	23.92	NA	Boulder 20 Cobble 50 Gravel 25 Sand 5

WILAUKS CREEK

Location: Fisheries Statistical Area 3----Flows into Alice Arm , West of mouth of Illiance River
Watershed Code: 9109299
Length of system observed: 5.0 km
Historical records of adult salmonids presence: Coho (Peak at middle of October), Chum (Peak late August early September) and Pink (Peak in middle to late August)
Other indigenous fish: Dolly Varden, Stickleback and Freshwater Sculpins
Adult Enumeration: Nov 04/98 70 adult coho and 2 dead coho observed. Started seeing coho about 1 1/2 km from mouth in evenly distributed pools
Comments: There were four sites that were used throughout Chambers Creek up to the 5 km mark of the system and below the falls. There does not seem to be a great deal of juvenile coho in this system.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	1020	74	0	0	Trapping 2 was not completed for the mark recapture in Site 1
1998	2	10	1170	32	0	0	Same as above but for Site 2
1998	3	10	120	0	NA	NA	No coho trapped in the first trapping in Site 3 and there was no mark recapture trapping
1998	4	10	90	0	NA	NA	Site 4 same as above
1998	5	10	90	0	NA	NA	No coho trapped in the initial trapping

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	0%	NA	0-3%	NA	NA	14.2	10.25	NA	Cobble 50 Gravel 30 Sand 20
2	40	50%	NA	10-15%	NA	NA	9.9	7.88	NA	Cobble 80

										Gravel 10 Mud 10
3	40	5%	NA	0-5%	NA	.60	20.42	20.42	NA	NA
4	40	5%	NA	5-10%	NA	.83	NA	NA	NA	Cobble 100%
5	40	0%	NA	0-5%	NA	.5	17.65	12.22	NA	Cobble 80 Sand 20

STAGOO (INDIAN RIVER)

Location: Fisheries Statistical Area 3----Flows into Observatory Inlet, Northeast of Dawkins Point
Watershed Code: 9109197
Length of system observed: 5.0 km from mouth of creek
Historical records of adult salmonids presence: Coho , Chum (Peak middle to late August) and Pink (Peak in late August to early September)
Other indigenous fish: Steelhead and Dolly Varden
Adult Enumeration: Oct 10/98 observed 85 coho and these fish were seen only in deep pools about 3/4 km from mouth of creek. Oct 22/98 observed approximately 85 coho in deep pools.
Comments:

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	90	15	NA	NA	Site 1 was 200 meters below the falls. No marked/recapture was done on Site 1
1998	2	10	120	35	0	0	Site 2 was 1km from the mouth to where the creek splits to Stagoo Creek -350 meters to site. No marked/recapture was done on Site 2
1998	3	10	95	6	0	0	Site 3 had no marked/recapture done on Site 3

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	5%	NA	1-5%	NA	.46	21.47	15.8	NA	Cobble 70 Gravel 20 Sand 5 Boulder 5
2	40	10%	NA	5%	NA	1.34	NA	NA	NA	NA
3	40	10%	NA	5-7%	NA	.60	32.54	29.68	NA	Sand 5 Cobble 95

DOGFISH CREEK

Location: Fisheries Statistical Area 3----Flows into Dogfish Bight, Portland Canal (56 130 SE)
Watershed Code: 9109715
Length of system observed: Canyons and rapids 4 km from mouth
Historical records of adult salmonids presence: Coho (Arrive in mid September), Chum (Peak middle August) and Pink (Peak in middle to late August)
Other indigenous fish: Steelhead, Freshwater Sculpin and Dolly Varden
Adult Enumeration: November 17/98 3-5 Coho Oct 19 1999 20 live coho

Comments:

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	60	192	68	104	The soak time for the first trapping was 60 minutes but the soak time for the second trapping was 1380 minutes
1998	2	10	1155	185	NA	NA	Site 2 had no remark/capture done
1998	3	10	1325	22	13	1	Hip chain out from 657 meters to mouth
1998	4	20	1150	54	2	2	Site 4 was 1000 meters from the mouth of the stream. The second trapping had a soak time of 1150 minutes
1998	5	20	90	127	71	35	Site 5 was 2850 from the mouth of Dogfish Creek
1999	1	15	1020	304	NA	NA	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	0%	NA	10%	NA	.54	21.05	18.45	NA	Cobble 70 Gravel 20 Sand 10
2	40	40%	NA	10%	NA	.36	16.98	12.54	NA	Cobble 50 Gravel 40 Sand 10
3	40	30%	NA	5%	NA	NA	16.2	9.45	NA	Cobble 80 Boulder 5 Gravel 15
4	51	NA	NA	0-5%	NA	NA	13.92	10.8	NA	NA
5	40	15%	NA	10-15%	NA	.32	19.01	15.31	NA	Sand 20 Gravel 50 Cobble 20 Boulder 10

SALMON COVE CREEK

Location: Fisheries Statistical Area 3----Flows Northeast into Observatory Inlet,
Watershed Code: 9109602
Length of system observed: 4.0 km from mouth of creek
Historical records of adult salmonids presence: Coho and Pink (Peak in late August to early September)
Other indigenous fish: Steelhead and Dolly Varden
Adult Enumeration:
Comments:

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	10	90	0	NA	NA	Site 1 was 2558 meters from the mouth of the creek -No juvenile coho in traps 5 steelhead
2	10	90	0	NA	NA	Site 2 No juvenile coho in traps
3	10	90	0	NA	NA	Site 3 No juvenile coho in traps -770 meters from mouth of creek

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	50%	NA	1-3%	NA	.NA	15.14	13.62	NA	Cobble 75 Boulder 25
2	40	85%	NA	5-10%	NA	.35	18.2	15.36	NA	Cobble 10 Sand 80 Boulder 10
3	40	20%	NA	2-5%	NA	.45	21.25	9.18	NA	Sand 10 Cobble 60 Gravel 10 Boulder 20

PERRY BAY

Location: Off the Alice Arm area . Flows into Perry Bay between Perry Peninsular and the Mainland
Watershed Code: 910924 ○○○
Length of system observed: 2.0 km
Historical records of adult salmonids presence: Coho and Chum
Other indigenous fish: Dolly Varden and Freshwater Sculpins
Adult Enumeration: No enumeration
Comments: There was no coho in the traps and therefore did not commit to any more sites within this system

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	5	60	19	1	4	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	80%	NA	15%	NA	.NA	5.86	4.84	NA	Cobble 90 Gravel 10

LIME CREEK

Location: Area 3
Watershed Code: NA 910929000
Length of system observed: 770 meters from the mouth
Historical records of adult salmonids presence: Coho
Other indigenous fish: Dolly Varden
Adult Enumeration: No coho observed on system
Comments: There was no juvenile coho found in the first trapping

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	1125	0	NA	NA	No coho fry in the straps

KITSAULT

Location: Area 3
Watershed Code: NA 910930200
Length of system observed: 770 meters from the mouth
Historical records of adult salmonids presence: Coho
Other indigenous fish: Dolly Varden Freshwater sculpin, Steelhead
Adult Enumeration:
Comments: This form is incomplete because the site maps were done poorly and the recorded information for the trapping was incomplete in regards to times, second retrapping and site location. There is no data box for the site characteristics

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1999	1	10	NA	2	NA	NA	1 Freshwater sculpin 2chum?
1999	2	10	NA	378	NA	NA	First trapping had 150 steelhead
1999	3	10	NA	97	NA	NA	First trapping 1 dolly varden, 6 sculpin, 1 steelhead

ILLIANCE

Location: Area 3
Watershed Code: NA 910929800
Length of system observed:
Historical records of adult salmonids presence: Coho
Other indigenous fish: Dolly Varden and Sculpin
Adult Enumeration: No coho observed on system
Comments: There was no retrapping of both Site 1 and Site 2. Very high water during time of assessment. Mapping of both sites had insufficient data to post in table.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1999	1	10	90	35	NA	NA	No second retrapping. First trapping there was 5 sculpin
1999	2	10	90	89	NA	NA	No second retrapping. First trapping 3 dolly varden and 17 sculpins

LAX KW'ALAAMS

1998 PROJECT MANAGER: CLIFF REECE

1998 STREAM TECHNICIANS: JIM TAIT, BRIAN JOHNSON, JAMES RYAN and VERNON JR. D.

1999 PROJECT MANAGER: ROD HENRY

1999 STREAM TECHNICIANS: VERNON DUODAWARD, RANDAL JOHNSON SR.

STUMAUN CREEK

Location: Fisheries Statistical Area 3----Flows into Stumaun Bay near Port Simpson
Watershed Code: 91082[illegible]500
Length of system observed: 6 km
Historical records of adult salmonids presence: Coho, Chum and Pink (Peak in early to mid September)
Other indigenous fish: Cutthroat, Freshwater Sculpin and Dolly Varden
Adult Enumeration: NA
Comments: This creek has a lot of windfalls and major log jams alongside many beaver dams. The potential for this system is good

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	14	NA	25	65	18	Information for soak time was not on the data sheet
1998	2	NA	NA	44	11	3	Same as above
1998	3	13	NA	NA	NA	NA	No data sheet
1998	4	13	480	29	0	3	First trapping the soak time was 480 minutes and they used 13 traps but the second trapping they used only 6 traps and the soak time was 50 minutes
1998	5	NA	NA	8	NA	NA	No data on mark/recapture, no of traps set out or soak time
1998	6	14	NA	3	3	0	
1998	7	14	510	3	4	0	
1999	1	19	90	13	20	3	
1999	2	20	90	9	9	2	First trapping 9 sculpins and 1 cutthroat. Second trapping 1 cutthroat
1999	3	20	90	16	8	4	Second trapping 2 cutthroay and 4 sculpin
1999	4	20	90	22	10	0	

1998 Sites

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	31	10%	NA	0-3%	NA	2?	14.4	8.65	NA	Cobble 30 Rock 5 Sand 65
2	40	60%	NA	5-10%	NA	..71	12.24	8.68	NA	Bottom Sandy
3	40	0%	NA	2-5%	NA	.55	13.6	6.72	NA	Cobble 90 Boulder 10
4	22	NA	NA	0-2%	NA	NA	12.17	5.7	NA	NA
5	40	50%	NA	10-15%	NA	.NA	11.42	6.14	NA	Sand 20 Gravel 20 Cobble 40
6	40	60%	NA	0%	NA	.63	6.3	4.98	NA	Cobble 40 Sand 30 Boulder 15 Rock 15

7	40	40%	NA	2-5%	NA	.21	13.24	8.74	NA	Cobble 20 Rock 50 Sand 15 Gravel 15

1999 Site Locations

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average channel depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	50 %	80 D	10-15	24.66	.29	6.75	5.3	3.96	80 fines
2	40	60%	75 D 25 C	5	24.22	.33	6.52	4.6	4.5	C 50 G 25 F 25
3	40	40-60	60 D 40 C	0-3	19.25	.2	7.3	4.05	1.86	NA
4	40	20-40	60 D 40 C	0-2%	47.35	1	8.67	7.3	NA	NA

LACHOO CREEK (PEARL HARBOUR)

Location: South of Port Simpson in the top part of Fisheries Statistical Area 4
Watershed code: NA
Length of System: NA
Historical records of adult salmonids present: Coho and Pink
Juvenile salmonids present: Coho
Adult Enumeration: Sept 1 1999 6848 live pinks and 200 dead pinks
Comments:

Lachoo Creek need major cleanup as it has many log jams that are the result of logging along the creek. This has resulted in many windfalls in and around this creek. The water flow in this creek is good and has the potential to be a good salmon-producing creek. There is one log jam about 10 meters high which needs to be removed. A crew with a chainsaw could be used to remove all the windfalls in this creek.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1999	1	20	120	61	47	12	First trapping caught 5 Dolly Varden and 80 cutthroat. Second Trapping caught 12 Dolly Varden and 88 Cutthroat Trout
1999	2	12	210	111	46	7	First trapping caught 13 Dolly Varden and 83 Cutthroat and the second trapping caught 8 dolly varden and 20 Cutthroat
1999	3	20	255	83	22	5	First trapping was 5 dolly varden, 19 cutthroat , and 24 sculpins . The second trapping was done 4 days later and the total was 1 sculpin
1999	4	17	1475	125	39	19	First trapping 1 unknown trout, 8 dolly varden, 5 cutthroat, 5 sculpin. Second trapping 3 sculpin. No times were given for the second retrapping
1999	5	14	120	28	172	4	First trapping 23 cutthroat, 1 dolly varden and the second trapping 22 cutthroat snf 23 dolly varden

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	NA	50 D 50 C	NA	46.5	.08	13.1	13	NA	NA
2	40	80%	NA	5%	14.53	.62	17	16	NA	Sand 33 Cobble 33 Gravel 33
3	40	40-60	100	10	18.82	..71	14.27	12.95	9.85	NA
4	40	NA	NA	5%	22.08	NA	14.37	9.5	7.25	Gravel Cobble Sand
5	40	NA	NA	0-2%	20.53	.41	4	3.7	2.1	Gravel 60 Fines 40

BIG BAY 910-821800 (WGR:)

Location: South of Port Simpson in the top part of Fisheries Statistical Area 4
Watershed code: NA ? Pt at Big Bay, NW of PR
Length of System: NA
Historical records of adult salmonids present: Coho and Pink
Juvenile salmonids present: Coho
Adult Enumeration:
Comments:

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1999	1	20	150	14	9	3	First trapping caught 5 Dolly Varden and 1 cutthroat and 4 steelhead. Second Trapping caught 1 Dolly Varden and 4 Steelhead Location of site was 234 meters west of Bill's Creek.
1999	2	20	195	96	21	5	First trapping caught 3 Dolly Varden and the second trapping caught 1 Stickleback
1999	3	20	255	22	21	10	First trapping was 1 dolly varden and 4 steelhead . The second trapping was 3 sculpins
1999	4	20	90	6	6	0	First trapping 6 sculpin. Second trapping 5 sculpin.

ite No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average depth (cm) of stream	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	70-90	100 C	2-5	40.9	.71	5.62	4.75	NA	Bed 80 Gravel 20
2	40	70-90	100 C	2	43.83	.21	10.27	8.83	NA	Bed 80 Gravel 20
3	40	50-70	100 C	2	31.33	.45	7.87	7.58	NA	Mostly bedrock
4	40	70-90	100 C	5%	25.47	.83	9.2	8.2	NA	NA

SANDY BAY CREEK

Location: Just East of Brundige Creek, Dundas Island (Area 3-1)
Watershed code: 9158235634 915-823500-63100
Length of System: 5.0 km
Historical records of adult salmonids present: Coho and Pink (Peak in late August and early September)
Juvenile salmonids present: Yes but very good sign of juvenile coho
Adult Enumeration: NA
Comments:

The crew walked the length of the creek and found a large number of windfalls and log jams. This creek has good water flow and very good salmon habitat but needs a major clean up. A crew with a chainsaw could be used to remove all the windfalls in this creek.

BRUNDIGE CREEK

Location: Northwest Dundas Island (Area 3-1)
Watershed code: 915823551 915-823500-51800
Length of System: 2.0 km
Historical records of adult salmonids present: Coho (Peak in mid to late October), Chum (Peak in late September to early October), and Pinks (Peak in late August to late September)
Juvenile salmonids present: Yes caught 3 juvenile coho in the Gee Traps
Adult Enumeration: NA
Comments:

This creek needs a major clean up as there are a lot of windfalls and log jams. Between the two creeks, Brundige and Sandy Bay creeks we caught only 3 coho fry. These two creeks are long overdue for a cleanup. Also this creek has a major log jam with a waterfall and dam. Also, it doesn't make sense working in these creeks when the seine fleet is fishing right outside these creek systems. With the knowledge we have on this selective seine fishery, it did not to to well because the fishers caught a large amount of coho that was bound for the mainland. It goes to show that in the past years the seine fleet fished up these two creeks.

HAIDA BAY CREEK

Location: NA
Watershed code: NA
Length of System: NA
Historical records of adult salmonids present: Coho and Pink
Juvenile salmonids present: NA
Adult Enumeration: NA
Comments:

Haida Bay Creek was once a very good coho creek. Although I personally did not see this stream in its heyday, my older brother saw this creek when it had a lot of coho bound for the Haida Bay creek system. Again the seine fleet fished out this creek back in the 1950's. Also this creek needs a major cleanup and there are major windfalls in the system and it hasn't been cleaned up in many years.

ENSHESHESE RIVER (SLIDE BAY)

Location: Flows Southwest into Work Channel
Watershed code: 9108631000
Length of System: 10-12 km
Historical records of adult salmonids present: Coho (Peak Late September early October), Chum (Peak late August to the Middle of September) and Pink (Peak late August to middle of September)
Juvenile salmonids present: NA
Adult Enumeration: Yes
Comments:

We arrived at this site on Oct 21st 1998 and the water flow was very strong and very high so we could not fish or take samples for DNA testing at this time. We walked into the stream and tried to find a suitable place to work but because of the swift water it was decided not to put the crews safety first and not attempt to work at this time at this location. However, we ran into the MV Tam-Mar-Rack, the DFO Charter Boat and the skipper informed us that he and his crew did the juvenile salmonids study already on this system and also the Quontoon Inlet creek system. The Tam-Mar_Rack crew conducted their tests about a week prior to our arrival. The skipper of the vessel said that he was pleased with the return of the 1998 coho return. All information on the system are available at the Department of Fisheries (DFO) in Prince Rupert. The skipper said he has put his report many times in the pas few years that the Quotoon Inlet creek needs a major clean up. The upper creek has a major log jam which is very high. The return in the creek for 1998 was fair.

ISLAND BAY CREEK AND LAKE

Comments:

We walked right up to the lake and fished the creek and did not catch any coho fry. However, this creek has good potential for coho. This creek need major clean up because of log jams and wind falls as the creek has not been cleaned up in years.

LAX KW' ALAAMS SALT LAKE STUMUAN BAY

Watershed code: 9108285000 Pt at McNichol Cr 910807900
Comments:

This lake once was a fair coho producer but once again the seine fleet fishing near the creek and this lake has put the coho run in dire straits. The seine fleet would catch the coho that were on route to this area. The Seine fleet fished at Bernie Island and Black Point. The people of Lax Kw' Alaams would harvest fish from the Stumaun Bay Creeks as well as the Salt Lake creeks up until the late 1950's. We have left this system alone because of the poor returns that were coming in. When we were up at the lake we did see coho that came back to spawn as there was a dozen of them jumping in the lake.

UNION BAY CREEK

Watershed code: 9108719
Comments:

Walked right to the end of this creek, also made two maps. We fished but did not catch any coho fry. This creek also needs a major cleanup as there are many windfalls and log jams. The upper creek has a high dam about 5 meters which would need a crew with some chainsaws to clean it up

CROW LAKE

Location: South of Port Simpson in the top part of Fisheries Statistical Area 4
Watershed code: 9108785
Length of System: NA
Historical records of adult salmonids present: Coho and Pink
Juvenile salmonids present: Yes
Adult Enumeration: NA
Comments:

Crow Lake creek is the best creek for trapping coho fry as we caught 121 fry. In spite of this good catch of fry this creek needs a cleanup. Down at the mouth of this creek, there is a major logjam and all the way up to the head there are many windfalls and jam ups. Water flow is very good but a crew with chainsaws would be needed to remove the debris from the creek systems. This creek could be an excellent home for coho fry in the future, also we made two maps of the area

KHUTZEYMATEEN (K' TZUN-A-DIIN) ESANSPANAKNOK CREEKS

Watershed code: 9108875
Comments:

Walked to the end of this creek, also fished but did not catch any coho fry. This creek has not been cleaned up in many years. Windfalls and logjams are in the system and the windfalls are fairly recent. The water flow is very good and will make an excellent coho creek in the near future. A crew with a chainsaw to remove debris from this system would be a good idea. Also, there is excellent LWD for the salmon to hide behind. Note: DFO has been in this system as we found old fish tags along the creek as the date or year is unknown.

BILLY CREEK (BIG BAY AREA)

Watershed code: 9108504
Comments:

There is a lake at the end of this creek where the old timers of Lax Kw' alaams once worked at Georgetown Saw Mills and they used to harvest fish at this site in their time. We walked up this creek but did not catch any fish. This creek needs a major clean up and also there are many beaver dams in this system which should be cleaned up so the salmon could get through to the lake.

METLAKATLA

1998 PROJECT MANAGER: ALVIN BOLTON JR.

1998 STREAM TECHINICIANS: BRAD LEIGHTON LLOYD ETZERZA CLIFFORD RYAN

1999 PROJECT MANAGER: CLIFFORD RYAN

1999 STREAM TECHNICIANS: LLOYD ETZERA BRAD LEIGHTON

SWAMP ISLAND CREEK 910-817100 (WORC)

Location: The creek is inside Swamp Island just north of Ryan Point
Watershed Code: NA
Length of system observed: NA Pp
Historical records of adult salmonids presence: Coho and Pinks
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: Oct 5th 1998 there was 68 live coho,1 dead coho and 1 jack coho sighted and 6 live pinks
Comments: They did an initial reconnaissance of Swamp Island Creek and caugth 149 coho fry. At the time of the site surveys the creek was high due to high water conditions

ALVIN BOLTON AND BRAD LEIGHTON TAKING STREAM MEASUREMENTS IN SWAMP ISLAND CREEK DURING 1998 NCSIP

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	20	90	47	36	3	Site locations was a creek inside Swamp Island just north of Ryan Point Light
2	20	90	21	91	0	Stream is lower on the recapture and the result is more fish trapped. Saw some adult coho swimming in the creek but no carcass

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	31	20%	10% desc 90% conf	0-5%	NA	.35	16	NA	NA	Sand 80 Gravel 20

2	40	30%	100% conf	5-10%	NA	NA	11.9	11.9	NA	Sand 40 Gravel 60

SLIPPERY ROCK LIGHT

North of Swamp Island 910-8/8200

Location: The creek is directly inside Slippery Rock Light on the west side of the Tshmshian Peninsula
Watershed Code: NA
Length of system observed: NA
Historical records of adult salmonids presence: NA
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: There is no evidence of this creek being surveyed before as there is no indication of any historical records in any Fisheries Stream Survey Manuals

DEPTH MEASUREMENTS IN SLIPPERY ROCK CREEK

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	21	8	3	The creek was low and it was sunny conditions
1998	2	20	90	9	10	0	The creek was low and it was sunny conditions
1999	1	20	90	44	NA	NA	First trapping had 6 dolly varden and 12 sculpins –no data sheet available for second trapping
1999	2	20	105	77	3	5	First trapping 10 dolly varden, 4 cutthroat, and 9 sculpins. Second trapping had 4 sculpins. The second retrapping was done done 4 days later
1999	3	20	100	36	9	1	First trapping 7 dolly varden, 2cutthroat,7 sculpins and the second trapping 5 dolly varden and 20 sculpins
1999	4	20	150	43	20	12	First trapping10 dolly vardens,1cutthroat,16 sculpins, 1 steelhead Second trapping 2 dolly varden 13 sculpins

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average depth of site (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	30	40%	5% desc 95% conf	10%	NA	.16	4.98	NA	NA	Sand 60 Gravel 40
2	51	60%	100% conf	5%	NA	NA	4.6	NA	NA	Sand 50 Gravel 50
3	38	NA	95 % conf 5% desc	5-10	20	.2	5.33	5.33	NA	Sand 40 Gravel 60
4	41	40%	100% conf	5%	32.04	.24	6.01	6.01	NA	Rock 50 Sand 50

SCOTT INLET CREEK 910 - 813800

Location: East of the Public Dock at Metlakatla. Scott Inlet creek flows south into Venn Pass
Watershed Code: NA
Length of system observed: NA Pt at 910812100
Historical records of adult salmonids presence: NA
Other indigenous fish: Cutthroat Trout and Dolly Vardens
Adult Enumeration: No Adult coho observed
Comments: There is no evidence of this creek being surveyed before as there is no indication of any historical records in any Fisheries Stream Survey Manuals

SCOTT CREEK

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	33	6	6	The creek was very low on the recapture
1998	2	20	90	32	26	14	The creek was low and it was sunny conditions
1998	3	15	90	10	17	5	
1999	1	20	110	42	11	9	First trapping 5 dolly varden, 15 cutthroat. Second trapping 10 dolly varden 12 cutthroat trout
1999	2	20	90	30	20	15	First trapping 11 dolly varden 15 cutthroat and second trapping 8 dolly varden and 6 cutthroat
1999	3	20	60	17	10	8	First trapping 13 dolly varden and 15 cutthroat and the second trapping 12 dolly varden and10 cutthroat
1999	4	20	120	13	10	5	First trapping 7 dolly varden and 2 cutthroat and second trapping 7 dolly varden and 7 cutthroat

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average stream depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	38	60%	20% desc 80% conf	2-5%	NA	.NA	5.6	5.6	NA	Sand 80 Gravel 20
2	39	60%	20% desc 80% conf	5%	NA	.55	4..64	4.64	NA	Sand 50 Gravel 50
3	18	90%	10% desc 90%c onf	10%	NA	NA	3.5	NA	NA	Sand 90 Gravel 10
4	40	49%	100% conf	2-5%	27.29	.52	3.34	3.34	NA	Sand 50 Gravel 30 Cobble 20

SCOTT CREEK 2

Location: East of the Public Dock at Metlakatla. Scott Inlet creek flows south into Venn Pass . Scott Creek 2 is the snd Creek in Scott Inlet on the upstream
Watershed Code: NA
Length of system observed: NA
Historical records of adult salmonids presence: NA
Other indigenous fish: Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: There is no evidence of this creek being surveyed before as there is no indication of any historical records in any Fisheries Stream Survey Manuals

Ptat 910812100

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	20	90	104	55	22	The creek was low and it was sunny conditions

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	38	20%	100% conf	0-3%	38.75	.13	4.98	NA	NA	Sand 30 Gravel 70

AIRPORT DOCK CREEK 915-789000-55600

Location: The creek is located next to the Airport Dock in Venn Passage
Watershed Code: NA
Length of system observed: NA Pt at 91081380 0
Historical records of adult salmonids presence: NA
Other indigenous fish: Cutthroat Trout , Freshwater Sculpins, Stickleback and Dolly Varden
Adult Enumeration: No Adult coho observed in 1998. 27 live Coho observed on Oct 4th 1999
Comments: There is no evidence of this creek being surveyed before as there is no indication of any historical records in any Fisheries Stream Survey Manuals

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	202	108	46	The creek was low and it was sunny conditions
1998	2	20	90	101	63	31	The creek was low and it was sunny conditions
1999	1	10	120	105	28	23	First trapping 3 cutthroat trout, 8 sculpins, 3 sticklebacks. Second trapping 8 doly vardens and 3 sticklebacks
1999	2	10	250	49	9	8	First trapping 6 sculpins, 5 sticklebacks. Second trapping 8 sculpins, 5 sticlebacks
1999	3	10	180	27	24	12	First trapping 6 sculpins, 7 sticklebacks. Second trappings 2 cutthroat 7 sculpins

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	20%	10% desc 90% conf	0-5%	NA	.1	6.08	5.18	NA	Sand 50 Gravel 50
2	31	30%	100% conf	5%	NA	.07	5.13	5.13	NA	NA
3	40	20	100% conf	0-5%	86.2	.4	4.95	4.95	NA	Fine 60 Gravel 40

PRINCE RUPERT GROUP 1

1998 PROJECT MANAGER: BART PROCTOR

1998 STREAM TECHNICIANS: LORN QUICK, JENNY HENDERSON and FRANK ROBINSON

1999 PROJECT MANAGER: LORN QUICK

1999 STREAM TECHNICIANS: JENNY HENDERSON, ROBYN PARKS, DAVID HANSON

DIANA CREEK

Location: Mouth of Prudhomme Lake about 13 miles west of Prince Rupert (See attached map)
Watershed Code: 9107919234 910-791900-23400
Length of system: 4.8 km
Historical records of adult salmonids presence: Sockeye, Chinook, Coho, Chum, Pink
Other indigenous fish: Dolly Varden, Freshwater Sculpins, Rainbow trout
Adult Enumeration: Seen evidence of coho and chinook swimming into the mouth of the creek
Comments: Good juvenile coho densities in this area but Diana Creek has been assisted by past enhancement in this area

Fig 1 Training the three project managers from Kincolith

Diana Creek had four sites that were used in determining presence and densities of juvenile salmonids and indigenous fish. The sites that were chosen were named Site1, Site2, Site 3 (100 meters above the bridge on Highway 16) and Site 4 (below the bridge)

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 Coho mrked	Trap3 previous coho	Trap4 unmrked coho	Trap mrked coho	Comments
1998	1	20	90	40	17	3	52	*	17	3	*No marks from previous trapping in Summer
1998	2	20	90	122	36	14	55	*	50	1	* refer to previous comment
1998	3	10	30	*95	176	4					*marked 95 but the no. trapped was 180
1998	4	10	30	72	153	5					
1999	1	20	90	161	182	22					Sculpin25 Stickle 1 Rainbow4
1999	2	20	90	63	155	15					Dolly 1

											Sculpin 9 Rainbow5
1999	3	10	90	118	448	9					Estuary trapping

(1) **First and Second trapping in Site 1 and Site 2 the bottom lobe of the caudal fin was marked
(2) **Third and Fourth trapping the upper lobe of the caudal fin was marked in Site 3 and 4 and in the first and second trappings in Site 3 and Site 4

(In 1998 Site 1 and Site 2 were used to do the initial trapping and recapture plus another series of trapping that was done six weeks later. Site 1 and Site 2 were mapped (look at sample map in the Appendix) but Site 3 and Site 4 was in the estuary area where Diana flows into Prudhomme lake. These sites were not mapped as the area is not defined enough to properly map these area in the prescribed methods that were outlined in the Methods Section. These sites were selected to see if the juvenile coho moved down to these lower areas in the fall and winter when the main Diana Creek has high water levels due to the predominant high rainfalls that occur in the Fall. However, as indicated in the table above, there was no recapture of previously marked fish from the upper sites.)

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	53	40%	5% desc 95% con	10%	50.1	1.05	14.28	13.97	12.03	Gravel 10 Cobble 90
2	29	40%	50% desc 50% con	15%	82.6	.38	18.86	17.62	16.05	Sand 25 Gravel 25 Cobble 50

KLOIYA RIVER

Location: Flows N.W. into Kloiya Bay, Morse Basin. It is situated about 10 miles west of Prince Rupert (See attached map)
Watershed Code: 910791900 910-791900
Length of system: 3 km
Historical records of adult salmonids presence: Chinook, Coho, Chum, Pink, Steelhead
Other indigenous fish: Dolly Varden, Freshwater Sculpins, Rainbow trout and Stickleback
Adult Enumeration: Observed Chinook and Coho in the system in the Fall
Comments: Kloiya River is the main entrance for any migrating salmon that enter into the Kloiya River, Prudhomme Creek and Diana Lake watersheds. The Kloiya River has a fish ladder that is at the upper end of Kloiya River as the migrating fish enter the Prudhomme Lake system. The estuarine area may be under the influence of the effluence of the Watson Island pulp mill.

Only one study site was determined suitable in Kloiya river for the mapping and the determination of juvenile salmonids densities within this system. We walked the length of the whole system looking for sites by doing initial trapping in various parts of the river. However, Kloiya River is a river that does not have many defined areas that have the classic pool riffle areas that are created by Largy Woody Debris (LWD) emplacement in the system. It is also filled with many canyons and long running glides. One other site that looked suitable only had the presence of sculpins in large number with minimal salmonid or trout presence. We have encountered sculpins in many of the study areas of this program, which has resulted in the reduction of soak time of the Gee Traps in order to prevent juvenile coho mortality by sculpins in the traps.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap 3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998 **	1	20	90	146	113	17	*	146	101	13	* No marked coho were observed in the third trapping
1999	1	20	90								

(1) **First and Second trapping the bottom lobe of the caudal fin was marked
(2) **Third and Fourth trapping the upper lobe of the caudal fin was marked

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	50	10	50% desc 50% con	10%	51.8	.83	29.1	27.5	27.01	Gravel 90 Cobble 10

PRUDHOMME CREEK

Location: Northwest part of Prudhomme Lake about 20 kilometers west of Prince Rupert (See attached map)
Watershed code: 9107919271 910-791900-27100
Length of system: 3 kilometers of possible spawning areas until you meet a high canyon area.
Historical records of adult salmonids presence: Sockeye, Coho
Other indigenous fish: Dolly Varden, Rainbow trout and Stickleback
Adult Enumeration: Seen evidence of sockeye and coho swimming into the mouth of the creek Observed around 300 sockeye spawners in late August and a few dead coho in November
Comments: Good juvenile coho densities in the creek and in the estuary area where the creek meets Prudhomme lake. However, did not see that many returning coho spawners this year

Prudhomme Creek had three sites that were used in determining presence and densities of juvenile salmonids and indigenous fish. The sites that were chosen were named Site1, Site2, Site 3 (area that was at the mouth of the creek as it flows into Prudhomme Lake. Site 3 resembles a bayou (see Fig 2) with many still standing trees that are surrounded by water and is an excellent rearing habitat for the juvenile salmonids. It was created when the Kloiya dam was put in to provide a power supply for the pulp mill and thus the water levels of the lake were raised accordingly. No mapping or physical measurements of Site 3 were taken due to the difficulty of defining a site within this area.

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap 1	Trap2 unmrked coho	Trap2 mrked coho	Trap3 Previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	1	20	90	73	101	33		55	28	*24	* In this trapping- 4 marked bottom caudal fin observed
1998	2	20	90	168	75	67		102	29	*23	* In this trapping- 1 marked bottom caudal fin

											observed
1998	3	10	30	172	184	41					Note the short soak times and the high density of fry trapped

(1) First and Second trapping the bottom lobe of the caudal fin was marked in Site 1 , Site 2
(2) Third and Fourth trapping the upper lobe of the caudal fin was marked in Site 1 and Site2 and the First and Second trapping of Site 3

The Prudhomme Creek system has good spawning and rearing habitat both in the creek part of the system and the lake estuary. The water flows within the system are substantial even in low water conditions. The system resembles Diana Creek as they both feed into Prudhomme Lake and have an estuary area at the mouth that provides good rearing habitat for the juvenile salmonids when water conditions become high within the creek.

Fig 2 Prudhomme Creek as it enters into Prudhomme Lake

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	33	40	80 % desc 20% conf	25%	69.87	.66	14.54	14.54	14.36	Sand 80 Lrock 10 Cobble 10
2	33	55	70% desc 30% conf	5-10%	68.75	Not taken	15.37	15.25	15.17	Sand 45 Gravel 45 Cobble 10

DENISE CREEK

Location: Flows southwest into Denise Inlet, which is adjacent to Kloiya Bay about 18 kilometers northeast of Prince Rupert
Watershed Code: 9107937 910-793700
Length of system: 4.8 km
Historical records of adult salmonids presence: Coho Chum and Pink
Other indigenous fish: Freshwater Sculpins and Rainbow trout
Adult Enumeration: Observed 1998 one dead chum and one live chum, no sign of coho, and some pink. On Sept 10 1999 observed 65 live pins and 4 live chum
Comments: This system has low presence of both adult and juvenile salmonids within this system. However, the system has good spawning substrate and many areas have good LWD placement and the resultant pool and riffle habitat units.

Denise Creek had three sites that were used in determining presence and densities of juvenile salmonids and indigenous fish. The sites that were chosen were named Site1, Site2, Site 3 (estuarine area where Denise Creek flows into Denise Inlet and Morice Basin.

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap 3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	1	20	90	31	26	8		11	*		* did not do recapture due to insufficent catch Trap3
1998	2	20	90	40	17	3		14	*		* did not do recapture due to insufficent catch Trap3
1998	3	11	40	23	*						* did not do recapture as this was an exploratory trapping
1999	1	20	90	29	27	5					First trap 36 Sculpin Snd trap 66 Sculpin 2 rainbows
1999	2	20	90	46	42	7					First trap86 Sculpin 2cutthroat 1 dolly. Second trap 179 sculpin 2 cutthroat

(1) First and Second trapping in Site 1 and Site 2 the bottom lobe of the caudal fin was marked
(2) Third trapping the upper lobe of the caudal fin was marked in Site 1and 2 and in the first and s trapping in Site 3.

Denise Creek is a system that has very low population numbers of both adult and juvenile salmonids. In Site 2 we found it difficult to do further trapping because of the number of sculpins that were in the test site. Denise is a system that should be studied for doing some stock assistance within the system. There are plans to do helicopter logging in the area next year and Denise Inlet will be used as a log storage area. The effluent from the pulp mill may have a direct bearing on the productivity of the system by its influence on the estuarine area of Denise Inlet.

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	30	45	75 % desc 25% conf	5%	N/A	.41	13.94	12.32	12.32	Sand 30 Cobble 70
2	42	40	90% desc 10% conf	5-10%	83.25	.45	19.7	15.27	14.7	Sand 25 Cobble 75

SILVER CREEK

Location: Flows southwest into Prince Rupert harbour at Tuck Narrows (See attached map)
Watershed code: 9108013
Length of system: 3.0 km
Historical records of adult salmonids presence: Coho, Chum, Pink
Other indigenous fish: Freshwater Sculpins,
Adult Enumeration: Seen a strong show of pinks throughout the system in September 1998, 2or 3 chum and no evidence of coho within the system. On Aug 30 1999 30 pinks observed with some of them paired.
Comments: Though Silver Creek had a strong showing of pinks there is little evidence of coho and chum. There is a barrier a waterfall at the top of the system with a huge blowdown area just before it. We walked the entire stream both in August and in late October and early November.

Silver Creek had three sites that were used in determining presence and densities of juvenile salmonids and indigenous fish. The sites that were chosen were named Site1, Site2, Site 3 (estuarine area where Silver Creek meets Laurier Cove/Tuck Inlet.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	1	20	90	37	32	5					* ran out of time to do the next series of trapping
1998	2	20	90	17	*		4 * these juveniles had bottom caudal mark	13			* no second recapture was done here due to the amount of sculpins
1998	3	13	45	12							* exploratory trapping in the estuary
1999	1	20	90	74	50	23					First trap 12 sculpins 2 dolly 2rainbow Second trap 25 sculpin 7 rainbow
1999	2	20	90	12	29	0					First Trap 46 Sculpin 2 rainbow Second trap 17 sculpin

											1 rainbow

(1) First and Second Trapping in Site 1 and Site 2 had the bottom lobe of the caudal fin was marked
(2) The Third Trapping in Site 2 and the First Trapping in Site 3 had the upper lobe of the caudal fin clipped as a mark

Silver Creek is a system that is a candidate for stock assistance, as there are many areas that would provide good spawning and rearing areas for coho and chum. This area was logged thirty years and it is very evident by the amount of deciduous trees (see Fig 3) within the riparian zone. One thing to note is the amount of garnet that is in the cobbles that form the majority of substrate of the stream. However, when water levels are low, the stream does not have deep established pools and there is a lack of LWD in the system.

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	39	60	99% desc 1% conf	15%	55.5	.67	14.77	12.33	N/A	Lrock 10 Sand 30 Gravel 10 Cobble 60
2	30	20	99% desc 1% conf	5-10%	80	.37	18.12	11.17	10.95	Sand 50 Cobble50

Fig 3. Deciduous trees such as alders blown down alongside Silver Creek

HUMPBACK CREEK

Location: Flows North into Humpback Bay which is located on the North side of Porcher Island (See attached map)
Watershed Code: 9157655826 915-765500-82600
Length of system: 4.0 km
Historical records of adult salmonids presence: Coho and Pink
Other Indigenous Fish: Sculpins, Rainbows and Dolly Varden
Adult Enumeration: Seen evidence of spawning coho (19) and carcasses (5) in November. An early reconnaissance on September 30th observed 30 adult pinks in the lower reaches but this was past the peak

of migration due to the number of carcasses found in the first 2 kms and many had washed down to the estuarine area.
Comments: This system was logged in the late sixties and there is evidence of this by the amount of alders within the Riparian zones and the many blowdown alder trees in the upper part of the stream. Water levels in this system rise and fall very quickly. The level of water in the creek can rise by a foot or two in an hour. The system does not have a lot of LWD but there are many deep pools throughout the system. Like most of the streams on Porcher Island, the streams meander in a sinusoidal pattern throughout the watershed.

The study area for Humpback had one site called Site 1 that were used in determining presence and densities of juvenile salmonids and indigenous fish. One of the local people that live in the community walked the creek with one of the stream technicians to look for study sites but the amount of rainfall in the previous days made it extremely difficult to judge suitable sites.

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	1	20	90	74	32	21					* The study was done in last part of October and Nov.

(1) First and Second trapping in Site 1 the bottom lobe of the caudal fin was marked

An early reconnaissance of Humpback Creek was done on September 30th to do some selective trapping throughout the system. This was done after the peak of the pink run which makes it difficult for trapping juvenile coho in these systems. The combination of carcasses in the system and the movement of spawning pinks lessen the opportunity to trap these juvenile salmonids.

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	42	45	90% desc 10% conf	5-10%	100 +	.32	14.98	9.76	9.76	Sand 50 Cobble 50

HUNT CREEK AND SMALL CREEK IN SOUTHWEST PART OF HUNT'S INLET

Hunt Inlet Cr.
915-765500-76800

Location: Hunt Creek and the small creek in the Southwest part of Hunt's Inlet flows north into Hunt's Inlet which is located on the North side of Porcher Island (See attached map)
Watershed Code: 9157655768
Length of system: 3.0 km in Hunt Creek and a beaver dam at the top part of the system. Unknown length for the southwest creek in Hunt's Inlet.
Historical records of adult salmonids presence: Coho and Pink
Other Indigenous Fish: Sculpins, Rainbows and Dolly Varden
Adult Enumeration: Observed no spawning coho and 1 coho carcass in November within any of the systems of Hunt's Inlet. Pink migration into the systems would have been late August and early September
Comments: The stream systems in Hunt Creek and the other small streams are quite narrow in breadth and like most of the streams on Porcher Island, meander in a sinusoidal pattern throughout the watershed. There was no evidence of logging activity within the riparian portion of the system and therefore there is a lot of LWD placement within the system because of the coniferous trees. The system on the whole has excellent potential for further stock assistance, as there are good areas for spawning and lots of pools. The canopy cover is quite extensive which might have a factor on the productivity of the system.

The study area for Hunt Creek had two sites called Site 1 and Site 2 that were used in determining presence and densities of juvenile salmonids and indigenous fish. An exploratory trip was done in late September to determine site suitability. Unfortunately, another system was mistaken for Hunt Creek and so there was no reconnaissance for pink enumeration. The system that was looked at was a system on the southwest side of Hunt's Inlet which can be described as a ditch system as it is a narrow (1-3 meters) but runs for many kilometers. An initial trapping was done throughout the system to determine presence and the catches were sporadic. In November, we measured off a 70-meter section of this system and put 20 Gee Traps at 3 meter intervals. In Hunt Inlet we did some initial trapping in November to find suitable sites but though it is wider than the ditch system, the meandering of the stream makes it impossible to find 30-50 meter sites that would have a series of habitat units within its boundaries. We used two smaller sites and used 10 Gee Traps for each site.

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	Ditch Site 70 m. long	20	90	5							* site had Gee Traps at 3.0 meter apart
1998	Hunt Creek 1	10	90	18	* 6	* 3					* Soak time was 16 hrs Recapture the next day
1998	Hunt Creek 2	10	90	13	*11	*8					* Same as above

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
2	21	90	100% conf	10%	46	.27	2.83	2.8	N/A	Gravel 50 Sand 25 Clay25

LITTLE USELESS CREEK

Location: Flows Northwest into Useless Bay, Edye Passage which is located on the North side of Porcher Island (See attached map)
Watershed code: 915765569 915-765500-69000
Length of system: Did not walk the entire system
Historical records of adult salmonids presence: Coho and Pink
Other Indigenous Fish: Sculpins, Dolly Varden and Sticklebacks
Adult Enumeration: Observed 1 coho carcass in November. No reconnaissance was done earlier to observe pink migration into the system.
Comments: This system is typical of Porcher Island streams that are narrow in breadth and meander in a sinuosity fashion. We trapped in many areas of the system to observe presence but we found that there is sporadic presence of juvenile fish combined with low numbers. This system is in need of stock assistance as the stream has good potential, as there is both good spawning areas and rearing habitat throughout the system

A study area for Little Useless could not be determined due to lack of juvenile coho within the system and time constraints. We trapped throughout the system to observe presence and to obtain scale and DNA samples. This is an interesting area because of the different drainage systems at the top of Porcher Island which involve Little Useless, Big Useless and the small systems that are located around Porcher Inlet. The general consensus from the trapping is that present densities within this system are very low but we only trapped within the first two kilometers of the system. Time constraints prevented walking the entire system and doing further trappings.

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
*1	20	90	20							* One site we used had 16 traps and 4 others were used in key pool areas

(1) All juvenile fish were marked by the removal of a small piece on the bottom caudal lobe

****** No mapping or stream characteristics were taken in Little Useless**

McNICHOL CREEK

Location: Flows south into Melville Arm Prince Rupert Harbour
Length of system: Stream walked only the first 3-4 km (see attached Map) 910807900
Historical records of adult salmonids presence: Coho and Pink
Other indigenous fish: Dolly Varden, Freshwater Sculpins, Rainbow trout
Adult Enumeration: Many pinks within the system during September of 1998 but only observed 2 migrating coho On Sept 17 1999 observed 811 live pinks and 150 dead pinks.
Comments: Good juvenile coho densities in the area as we found juvenile presence in many parts of the first 3-4 km as there are many pools and lots of LWD placement for pool formation and cover for the juvenile coho. However, the lack of adult coho in the system this year will attest to whether the coho enumeration are adequate because all indications is that recruitment for fry output should be poor next year.

McNichol Creek had 2 study sites known as Site 1 and Site 2. Trapping was not done at the estuary area. Site 1 was an interesting site because many coho that had marked in mid September were caught in the early November trappings. This site had the most recaptures when the duration between the trappings was 6-8 weeks. Site 2 did not have a 4th trapping due to the weather and the end of the project.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Trap3 previous marked coho	Trap3 coho	Trap4 unmrked coho	Trap4 mrked coho	Comments
1998	1	20	90	104	41	43	**24	64	*		* no mark recap due to end of project and weather ** these marks were from the 1st and 2nd trap
1998	2	20	90	56	20	7		27	26	5	
1999	1	20	90	98	92	58					First set 6 Dolly 17

											rainbows Second set 4 Dolly 4 cutthroat 3 rainbow
1999	2	20	90	59	51	13					First set Dolly 18 1 Cutthroat 4 Rainbow Second set 6 Dolly 7 cutthroat 1 Rainbow

(1) First and Second trappings bottom lobe of the caudal fin marked
(2) Third and Fourth trappings top lobe of the caudal fin marked

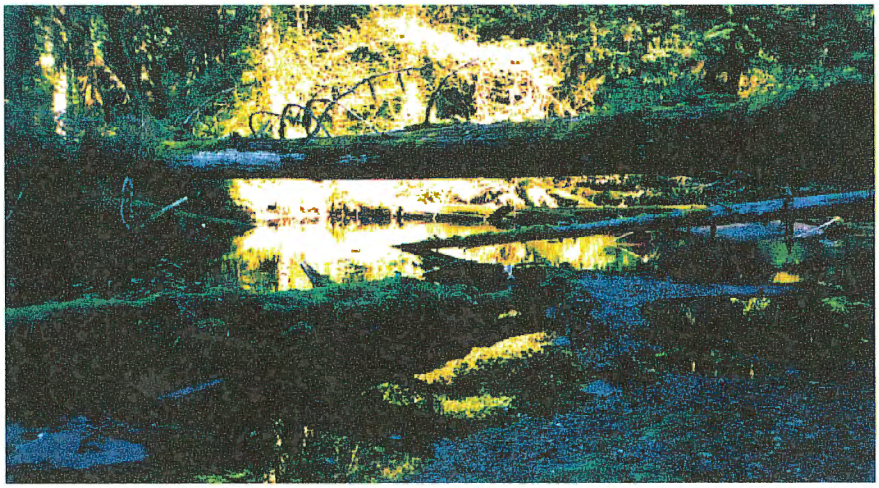


Fig 4. Site 2 in McNichol Creek with extensive LWD in the stream

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	33	65	50% desc 50% desc	10%	69	.19	18.95	13.68	13.2	Sand 50 Gravel 50
2	32	15	50% desc 50% conf	10-20%	65.8	.15	28.16	11.6	N/A	Sand 85 Gravel 15

DISCUSSION

The summarization of the data is shown in the Appendix which includes parameters such as the Population Estimate (N), the Catch Per Unit Effort (CPUE), and the Density of fry within the site in a square meter. Also in the Appendix is a breakdown of the average weight per length class for the majority of the sites that were done during this project. A comparison was done looking at the Average Length/Weight with Juvenile Coho length

Population Estimate of the individual sites

Population estimation of the sites was done using a revised estimation of the Petersen Method in using a mark-recapture method (see methods). The calculations were based on the formula below:

$$\textit{Population estimation of site (N)} = \frac{(C+1) * (S+1)}{(R+1)}$$

where **C** = Total Catch of Juvenile Coho Fry in the Initial Trapping using Gee Traps
S = Total Catch of Juvenile Coho Fry in the Second Trapping
R = Total of Marked Juvenile Coho Fry within the Second Trapping

Population estimation of the sites is shown in Appendix under the Summary of Data Sheet and the range was from a low of 47.5 fry/site to a high of 1069.83 fry/site. Some of the sites done in Diana, Kloiya, and Prudhomme were sampled a second time so that there was two months between sampling.

Density Estimate of Selected Sites within the different systems

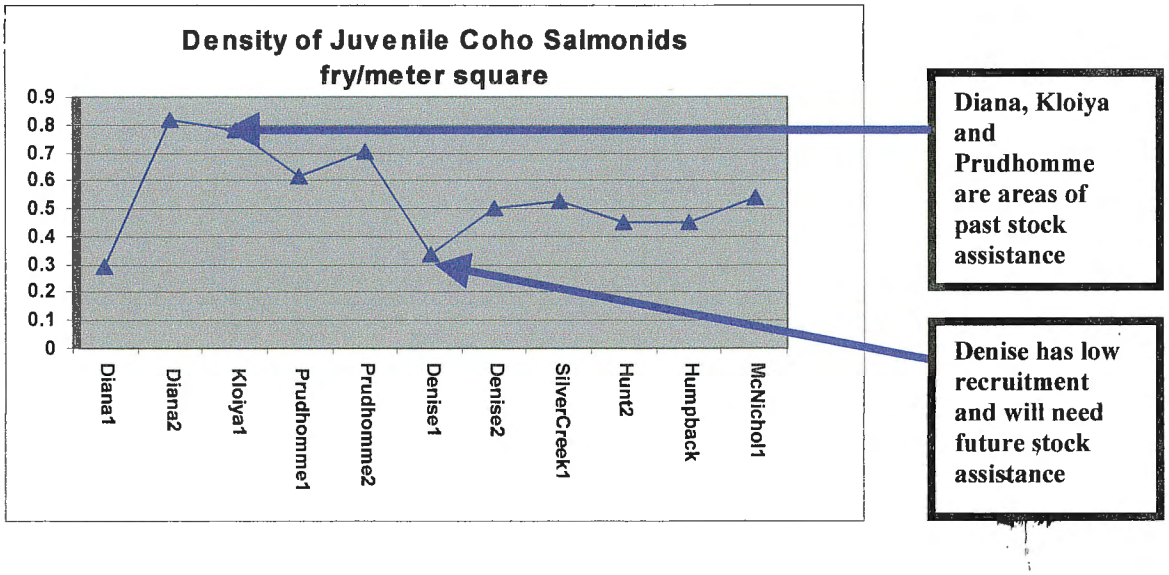
Density Estimate were done on the sites by using the Population Estimate and the Square Area of the Site using the average wetted width and the length of the site.

Area = Average Wetted Width X Length of the Site

Average Wetted Width = Average of five or six measurement of wetted width within the site

$$\textbf{Density} = \frac{\textbf{Population (N)}}{\textbf{Area (square meters)}}$$

The density of fry per square meter is shown in the Summary of Data Sheet in the Appendix. Fig 5 is a graph showing the densities of juvenile coho fry within selected sites within the different systems



In the figure the highest density levels are shown to be in Diana Creek , Kloiya Creek and Prudhomme Creek. These system are components within the Diana Lake and Prudhomme Lake System. These systems have received stock assistance in the past through enhancement work done by volunteers at the Oldfield hatchery in Prince Rupert. Systems like Denise Creek had low recruitment for juvenile coho in 1998 and threre was little evidence of adult recruitment for any of the salmon species this summer and fall. Presently, there is a helicopter logging operation being done in February and March of 1999 where they are using Denise Inlet as a log storage area. Island systems such as Humpback Creek, Hunt Inlet, and Little Useless all are located at the top of Porcher Island received low recruitment of juvenile and adult coho. Humpback Creek is still suffering from the effects of past logging operation because the riparian area is mainly deciduous trees and there are many of these alders have blown down within the system. There will be very little recruitment of Large Woody Debris (LWD) in this system in the future. Systems like Little Useless are basically devoid of juvenile and adult coho recruitment even though there is no evidence of logging activity. Little Useless would be a good candidate to research whether the system is void of fish due to productivity and low nutrient levels or because of high levels of harvesting of adult coho within the Eddy Pass area.

Catch per Unit Effort (CPUE)

The CPUE derived from the different sites is shown in the Summary of Data Sheet in the Appendix. The range of the CPUE was a high of .573 fry/trap/min to a low of .002 fry/trap/min. The CPUE is derived by:

$$CPUE = F/T/M$$

Where **F** = The total number of fry in all of the traps
T = The total number of Gee Traps
M = Total time of the traps in the water

In Fig 6 the graph show the relationship between the CPUE of the different sites within the Area 4 SIP

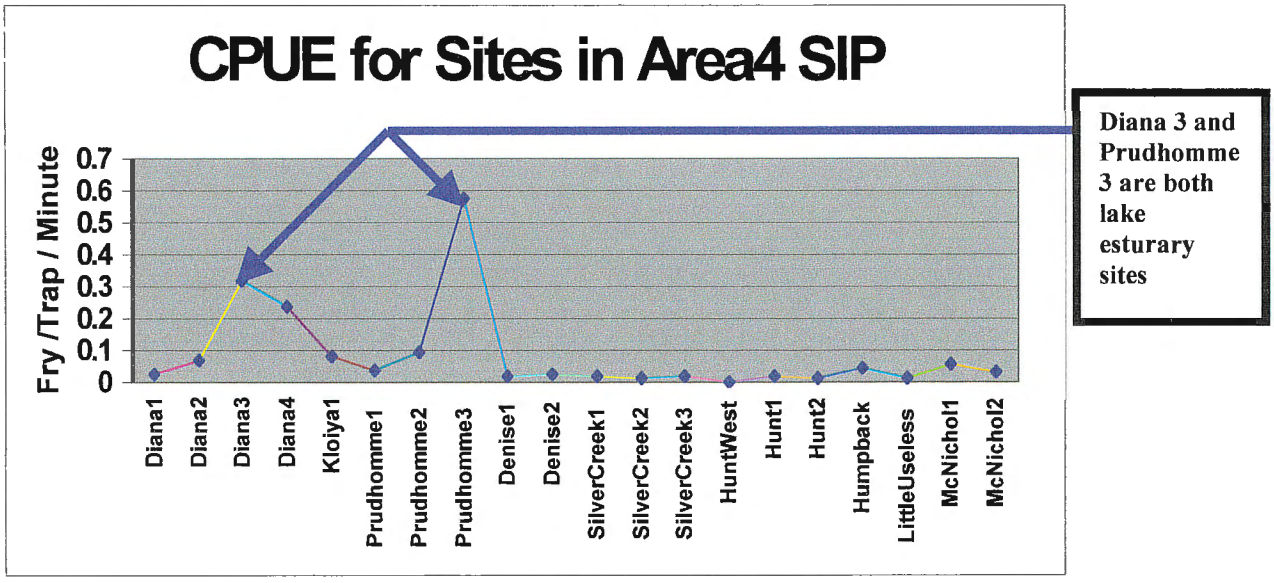


Fig 6 The CPUE for the different sites within the Area 4 SIP project

Project. The graph shows the marked differences between the sites that are part of the Diana and Prudhomme Lake System with the sites in the other systems. The high peaks in the graph are both sites that are at the terminal end of the creek as it flows into the lake. These sites were sampled in late October after an extensive time of continous rainfall and thus high water levels in the creeks. This indicates that the high water levels force the juvenile coho down into the lake estuarine area during high water events.

However, we made the mistake of not trapping in this area during the low water events of the summer and early fall so we having nothing to compare to this observation.

CPUE and density variations between sites within the same system is expected as it is hard to determine in a general study what type of density dependent or density independent mechanisms are going on in a specific site to make it more productive. However, if you look at the different systems there will always a general trend in relative density comparisons between sites of one system with the differences of sites in a different system. For example from Fig 7 , if we sampled many more sites in the Diana Creek and Denise Creek systems we would expect a relative higher density count in the sites from Diana. I f we used Diana as a baseline for juvenile coho productivity within these systems then except for Kloiya, Pruhomme and possibly McNichol, the rest of the systems sampled would be considered in extremely poor condition.

Average Juvenile Coho Length/Weight Ratio versus Juvenile Coho Length

To understand the dynamics of growth within the various systems an index was derived by taking an average of the weights at the different length class of each site and dividing it by its respective length. The average weight/length ratio of each length class was then pooled between the different sites and an overall average weight/length ratio was generated that represented all the sites. This average ratio at each length class can be used as the baseline for comparing an individual measurement within in each length class of the different site. For example in the Average Length/Weight data form in the Appendix, Denise1 has a length/weight ratio of 34.37 in the 55mm class and this ratio shows it is larger than the 32.75 average length/ratio for all the sites. However, the limitation in this data summary is that more weights for each length class would have to be taken in order to put confidence in the index. Also, the weight measurements would have to be taken for all the sites at the same time or some type of weight correction factor would have to be implemented to compensate for the different times in measurements.

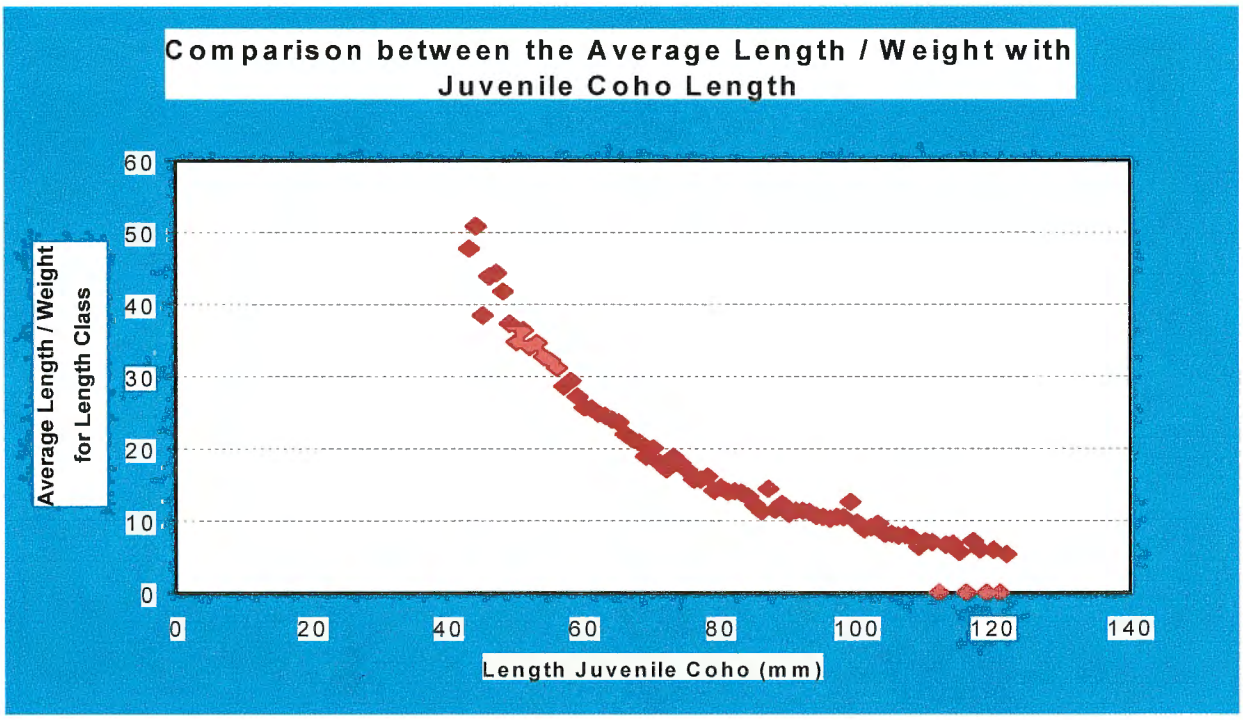


Fig 7 Relationship between the average Length/Weight Ratio plotted against Juvenile Coho Length

INVENTORY AND TRAINING

During the first week of September, the CFDC staff in Prince Rupert backed by Fisheries Renewal funding was able to initiate stream inventory projects for six more groups. The project managers of these groups would be trained by us and Brian Spilstadt of DFO in site selection, mapping of sites, placement of Gee Traps, sampling methods and data entry. In late September, 3 more groups from Kincolith were added to the overall Stream Inventory project on the North Coast and they received training by us in the Prince Rupert area. The groups comprised of one project manager and three stream technicians and the stream inventory projects would be conducted in their respective areas. The groups involved in the project were:

(1) Kincolith Group 1 (Area 3)
(2) Kincolith Group 2 (Area 3)
(3) Kincolith Group 3 (Area 3)
(4) Port Simpson (Area 4)
(5) Metlakatla (Area 4)
(6) Prince Rupert Salmon Enhancement Society (Area 4)
(7) Prince Rupert group (Area 4)
(8) Kitkatla (Area 5)
(9) Hartley Bay (Upper Area 6)
(10) Klemtu (Lower Area 6)

Fig 8 First training session in early September

Our group helped in the acquisition of equipment (see equipment list) for the 9 other groups so that they could start immediately. Individual members of our group worked with some of the new groups in their study area for a period of time to ensure proper data collection.

Fig 9 Taking the juvenile salmonids out of the trap for sampling

Fig 10 Taking channel depth measurements in training session

CONCLUSIONS

The Stream Inventory Program began its inaugural year on the North Coast and will provide the baseline on how to streamline data collection methods for next year. The program was immense because it encompassed areas from Observatory Inlet (Area 3) down to Laredo Channel (lower Area 6). There are many aspects of the program that can be improved upon such as a standardization of data collection, training of data collectors in GIS, better coordination of the program with DFO, Ministry of Land and Environment and Parks (MoELPH) and Ministry of Forestry (MoF). The program will have to be run many years to extract any meaningful data in regards to juvenile salmonid densities within these systems. Also, the program has provided the opportunity to do adult coho enumeration in the various systems and to correlate adult presence in relationship to the following year's fry output.

RECOMMENDATIONS

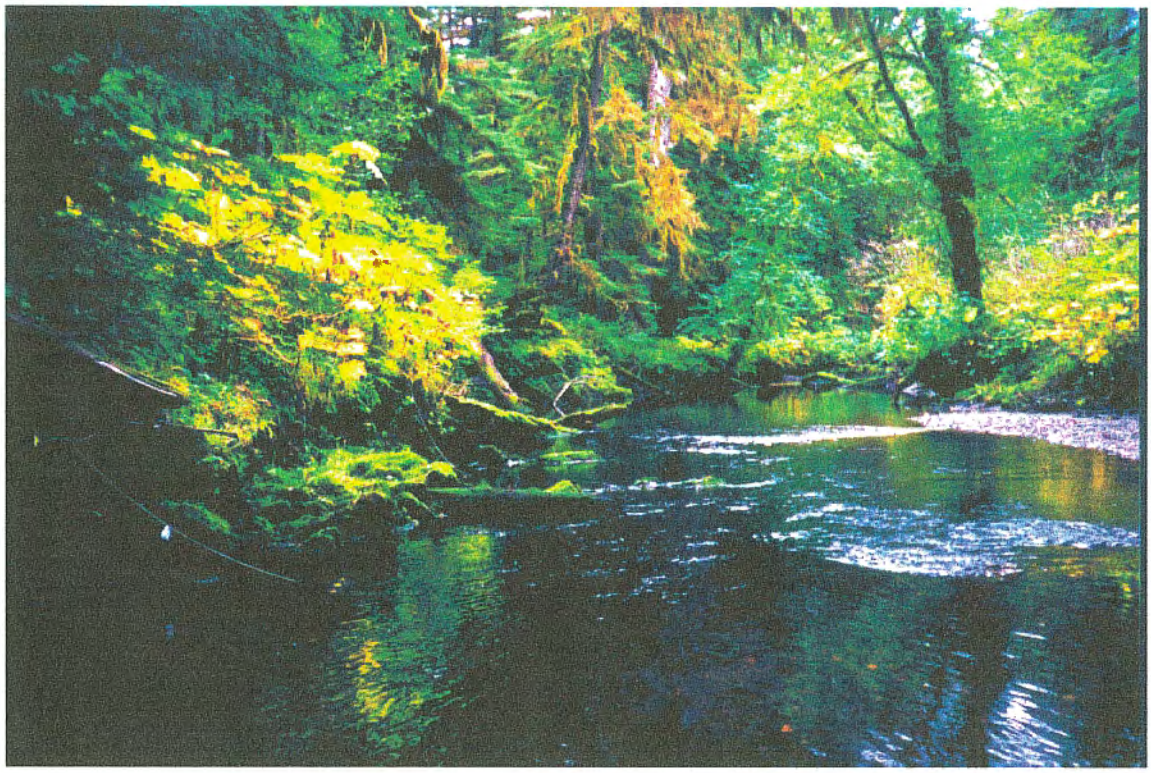
(1) To work closer with the different governmental agencies in order to streamline the data collection methods so that it will provide better cost/benefit ratios by using the stream technicians to extract different types of data beneficial to other agencies.

(2) To work with the Habitat Branch of Department of Fisheries and Stock Assessment Branches of Department of Fisheries in using data collection methodology in the field that will be standardized throughout the region and the province

(3) Train people in using GIS (Arcview) which will be beneficial to the process of standardizing data collection and processing.

(4) Developing a strategy for adaptive management in which small actions as limited stock assistance alongside the stream assessments should be performed to monitor its progress within a system.

PRINCE RUPERT GROUP 2



1998 PROJECT MANAGER: BARRY DREISS

STREAM TECHNICIANS: BRIAN CARPENTER
GARRY BROOKS
KEITH ISHERWOOD

1999 PROJECT MANAGER: SHAWN DAVIES AND BRIAN CARPENTER

1999 STREAM TECHNICIANS: BRIAN CARPENTER AND GARRY BROOKS

LOST CREEK 910-791900-31300 (WORC)

Location: 125 meters west of the Prudhomme Lake Campground Site on Highway 16
Watershed Code: 96-250-20 Pt at 910-791900-27100
Length of system observed:
Historical records of adult salmonids presence: Not available
Other indigenous fish: Stickleback, Rainbow trout and Dolly Varden
Adult Enumeration: Observed adult coho swimming near site by the lake
Comments:

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	10	200	281	249	166	
2	10	240	74	17	51	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	27	70%	90% con 10% desci	5%	NA	..69	3.4	2.6	2.4	Mud and Sand bottom
2	29	100%	100% conf	2-5%	NA	.12	5.43	4.53	NA	Gravel Sand and Clay

HAYS CREEK

Location: Flows NE into Prince Rupert Harbour, from old Prince Rupert Dump Area on Kaien Island
Watershed Code: 915789127 915-789100-27000
Length of system observed: 200 m downstream from Hydro Line crossing stream at ski hill where there is a waterfall at Wantage Road
Historical records of adult salmonids presence: Coho and Pinks
Other indigenous fish: Cutthroat and Dolly Varden
Adult Enumeration: No Adult salmonids observed
Comments:

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	205	107	37	19	
1999	1	20	90	128	53	51	First trapping 102 dolly varden and 31 cutthroat. Second trapping 63 dolly varden and 15 cutthroat

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	NA	NA	5%	NA	.NA	5.9	4.8	3.9	Sand and Gravel

URIAH CREEK

Location: Golf Course at #10 Fairway about 47 m upstream from driving range bridge on the left bank
Watershed Code: 96-0200-060-1 Pt at Hays Cr. 915-789100-27000-32700
Length of system observed: NA
Historical records of adult salmonids presence: Not available
Other indigenous fish: Freshwater Sculpins, Rainbow trout and Dolly Varden
Adult Enumeration: No
Comments: The measurements and trapping on Uriah was not done in a specific site but trapping was done over 430 meters with traps put out at different points along the stream.

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	20	195	35	35	5	Top of Site 1 2030 meters from Railway Bridge on the edge of the Skeena River

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	435	20-50	Desc 50% Bush 50%	NA	NA	..34	Approx 1.5 m	Approx 1.5 m	Approx 1.5 m	Sand and Gravel 10 Bedrock 60 and 30 Boulder

COHO FRY TAKEN FROM THE BELLY OF A FRESHWATER SCULPIN

ABERDEEN

Location: Flows south into right bank Skeena River across from Hotspring Point
Watershed Code: ~~4000611.~~ 400-025100
Length of system observed: Not Available Site selected was 242 -282 meters upstream from base of Railway Bridge near the Skeena River
Historical records of adult salmonids presence: Not available but spawning has been observed up to .5 km upstream in Aberdeen
Other indigenous fish: Freshwater Sculpins, Rainbow trout and Dolly Varden
Adult Enumeration: No Adult salmonid observed
Comments:

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	135	135	16	40	
1998	2	20	90	23	5	5	
1999	1	20	90	325	224	130	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	10%	95% desc 5% con	2-5%	NA	.60	13.7	12.9	12.0	Sand and Gravel Boulder + cobble
2	40	1%	20% desc 80% con	2-5%	NA	.15	9.93	7.73	5.06	Boulder Cobble Gravel

MORESBY CREEK Morse Cr. 915-789100-20400

Location: Flows into Prince Rupert harbour and is located under the 2nd Ave Bridge
Watershed Code: ~~9508522.~~
Length of system observed: NA
Historical records of adult salmonids presence: Coho
Other indigenous fish: Cutthroat trout and Dolly Varden
Adult Enumeration: Spawning has occurred Nov 9/98 at 150 meters upstream
Comments:

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	210	84	93	19	The traps were set over a span of 600 meters but one specific site was mapped
1999	1	20	90	50	11	36	First trapping 24 dolly varden, 14 cutthroat, 3 sculpins 2 steelhead and the second retrapping 13 dolly varden, 15 cutthroat, 1

							sculpin and 3 steelhead

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	50%	90% desc 10% con	2-5%	NA	.27	4.93	3.13	NA	Cobble and Gravel

EKUMSEECUM

Ekumsekum Cr.

Location: Flows Southwest into Skeena River across from Windsor Point
Watershed Code: 40-0176 400-032800
Length of system observed: Approximately 1200 meters upstream to new Beaver Dam
Historical records of adult salmonids presence: Not available
Other indigenous fish: Freshwater Sculpins, StickleBack and Dolly Varden
Adult Enumeration: No Adult coho observed but Adult Steelhead observed in the system
Comments: Some past logging done in the area. Quite a few juvenile coho fish from 55 mm to 75 mm with curvature of the spine. ** It was observed that somebody else has been doing some clipping of the juvenile fry in this area previously.

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	20	90	556	243	213	Site is 273 meters from base of CNR trestle to 763 meter upstream. About a 1% gradient

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	490	50-70	10% desc 90% con	NA	NA	.37	9.83	5.3	4.42	Mostly mud in tidal area with no gravel

MARIGONISH

Location: Flows south into Skeena River right bank
Watershed Code: 40-0173 400-032600
Length of system observed: 23 meters upstream from Railway Bridge and ends at 241 meters
Historical records of adult salmonids presence: Not available
Other indigenous fish: Stickleback
Adult Enumeration:
Comments: ** Previously marked fish by others

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	10	180	147	158	99	The 10 traps were set at intervals throughout the creek to 514 meters upstream

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	514	25	10% desc 90% con	NA	NA	.18	8.42	5.54	5.38	Mostly mud in tidal area with no gravel

WOLF CREEK

Location: Flows into Wainwright Basin behind the Pulp mill on Watson island
Watershed Code: 9107895○○
Length of system observed: 2030 meters from the railway track on the banks of the Skeena River
Historical records of adult salmonids presence: Records indicate unknown for all species
Other indigenous fish: Cutthroat Trout and Dolly Varden
Adult Enumeration: No Adult coho observed
Comments: Prince Rupert 1 did one of the sites on Wolf Creek and Prince Rupert 2 did the other site. These sites were used as a training area by the two groups in the beginning of their individual stream inventory projects. The system is prone to washout due to flash rain events.

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	19	45	8	7	5	Site was used as training with Prince Rupert 2 as that group did the other site on Wolf Creek

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	30	20%	20% descd 80% conf	0-5%	NA	.67	16.1	14.2	13.73	Gravel and Cobble

SETTING THE GEE TRAPS WITHIN THE STREAM

ANTIGONISH

Location: Flows south into right bank Skeena river, from LacMach river divide
Watershed Code: 4000324
Length of system observed: 2116 meters upstream from CNR trestl near mouth located near Skeena River
Historical records of adult salmonids presence: NA
Other indigenous fish: Cutthroat Trout and Dolly Varden, Freshwater Sculpins, Steelhead
Adult Enumeration: No Adult coho observed in visit in 1998. On September 15 1999 16 Coho and 1 Pink were seen in Antigonish
Comments: First site marker at 2116 meters upstream from CN Bridge, the second site marker at 2158 meters upstream from CN Bridge

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	94	NA	NA	No data sheets for the mark recapture trapping
1998	2	20	105	80	56	22	
1999	1	20	90	56	190	14	First trapping had 1 dolly varden and 9 freshwater sculpin. Second trapping had 69 sculpins
1999	2	20	90	113	77	43	First trapping had 1 dolly varden, 3 cutthroat trout, 3 sculpins, 5 rainbows. Second trapping saw 3 cutthroat trout, 1 sculpin and 1 rainbow
1999	3	20	90	325	224	130	First trapping saw 3 dolly varden, 5 cutthroat, 4 sculpins, 4 stickleback and 3 rainbows. Second retrapping saw 4 dolly varden 1 cutthroat and 1 sculpin

							sculpin and 3 steelhead

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	50%	90% desc 10% con	2-5%	NA	.27	4.93	3.13	NA	Cobble and Gravel

EKUMSEECUM

Location: Flows Southwest into Skeena River across from Windsor Point
Watershed Code: 40-0176
Length of system observed: Approximately 1200 meters upstream to new Beaver Dam
Historical records of adult salmonids presence: Not available
Other indigenous fish: Freshwater Sculpins, StickleBack and Dolly Varden
Adult Enumeration: No Adult coho observed but Adult Steelhead observed in the system
Comments: Some past logging done in the area. Quite a few juvenile coho fish from 55 mm to 75 mm with curvature of the spine. ** It was observed that somebody else has been doing some clipping of the juvenile fry in this area previously.

Site No.	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1	20	90	556	243	213	Site is 273 meters from base of CNR trestle to 763 meter upstream. About a 1% gradient

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	490	50-70	10% desc 90% con	NA	NA	.37	9.83	5.3	4.42	Mostly mud in tidal area with no gravel

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average stream depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	1%	10% desci 90% conif	10%	28.2	.52	14	7.36	6.57	Cobble and Gravel
2	28	NA	100% conif	0-5%	NA	.59	9.1	6.81	NA	Cobble 70 Gravel 30
3	29	NA	100% conf	0-5%	21.66	.65	16.02	13.1	NA	Cobble 70 Gravel 30

PRINCE RUPERT GROUP 3

1998 PROJECT MANAGER: BRUCE HANSEN

1998 STREAM TECHNICANS: NORM McGEE, TOM TIMMS, BERNIE SCULLION

1999 PROJECT MANAGER: BERNIE SCULLION

1999 STREAM TECHNICIANS: JENNIFER BAILEY BARRY DREES NORM McGEE

Kwinitsa

KWINISTA CREEK

Location: Flows into the Skeena River about 35 km east of Prince Rupert. Highway 16 at 75 km from Prince Rupert.
Watershed Code: ~~40006611~~ 400-066100
Length of system observed: 2030 meters from the railway track on the banks of the Skeena River
Historical records of adult salmonids presence: Not available
Other indigenous fish: Freshwater Sculpins, Rainbow trout and Dolly Varden
Adult Enumeration: No Adult coho observed but Adult Steelhead observed in the system. On Sept 9 1999 1575 live pinks and 300 dead pinks observed, 2 chums and 1 chinook
Comments: Wide shallow river and difficult to assess spawning area due to high water conditions Kwinista Crek is fairly long but very wide and shallow. There are many slow moving deep pools within the system and substantial areas of spawning gravel.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	19	5	5	Top of Site 1 2030 meters from Railway Bridge on the edge of the Skeena River
1998	2	20	90	15	6	1	Top of Site 2 1720 meters from Railway Bridge on the edge of the Skeena River
1999	1	17	90	108	80	49	First trapping 76 sculpins, 4 steelhead. Second trapping 7 cutthroat, 70 sculpins, 8 steelhead
1999	2	20	90	84	96	3	Second trapping 3 sculpins

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	10%	10% desc 90% con	5%	NA	.38	21	16.73	NA	Sand and Gravel 10 Bedrock 60 and 30 Boulder
2	41	10%	20% desc 80% con	5%	NA	.15	20.25	13.83	10.5	NA

INVER CREEK

Location: Flows SE into the Right Bank Skeena River just East of Aberdeen Point . Highway 16 at 69 km from Prince Rupert
Watershed Code: ~~40006611~~ 400-031400
Site Location: Top of Site 1 is 597 meters and Site 2 is 431 meters from Railway Bridge near the opening into the Skeena River
Historical records of adult salmonids presence: Not available
Other indigenous fish: Dolly Varden, Freshwater Scuplin
Adult Enumeration: 4 bright Adult coho observed entering the creek near the railway bridge on Oct 13 1998

Comments: Fish located behind beaver dam and creek has changed direction due to a slide. Good spawning area within the vicinity of Site 2. Inver Creek is a short and rocky system. There is limited spawning gravel in lower reaches.

Year	Site No.	No. of Gee Traps	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	10	90	42	17	18	Water conditions low and the weather is overcast
1998	2	10	90	90	41	27	Water conditions low and high overcast
1999	1	10	90	62	106	33	First trapping 52 dolly varden and second trapping 63 dolly varden
1999	2	10	90	98	134	48	First trapping 27 dolly varden, 1 sculpin. Second trapping 67 dolly varden and 2 sculpin

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	25	45%	25% desc 75% con	0-5%	NA	.9	6.2	3.9	3.16	Sand and Gravel 10 Bedrock 60 and 30 Boulder
2	40	10%	20% desc 80% con	5%	NA	.15	20.25	13.83	10.5	NA

INVER CREEK SITE 2 LOOKING UPSTREAM

VALLEY CREEK

Location: First Creek on left of the mainstream Khyex River just north of bridge
Watershed Code: 40-0200-010 400-036100-11100
Length of system observed: 3.2 km
Historical records of adult salmonids presence: Not available
Other indigenous fish: Freshwater Sculpins, Rainbow trout and Dolly Varden
Adult Enumeration: NA
Comments: This system is an example of a healthy system as there has been no evidence of logging and there was a good showing of juvenile coho within the stream

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	223	187	106	Top of Site 1 1177 meters from where the Valley Creek meets the Khyex River
1999	1	20	90	347	327	155	First trapping 24 sulpins, 3 dolly varden. Second trapping 25 sculpins 3 dolly varden
1999	2	20	90	379	316	83	First trapping 33 scuplins. Second Trapping 18 scuplins

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	5%	90% desc 10% con	5-10%	NA	.35	17.6	12.93	10.35	Sand 25 Cobble 25 Gravel 20 Boulder 30

NORTH CREEK (BREMNER LAKE)

Location: Located in Osland (Smith Island) in the Skeena River Slough just off main boardwalk where there is a trail off (Vacher house) 627 meters to North Creek
Watershed Code: 9157840821 915-784000-82100
Length of system observed: From tidewater to Bremner lake is 1880 meters long
Historical records of adult salmonids presence: Not available
Other indigenous fish: Stickleback, Rainbow trout and Dolly Varden
Adult Enumeration: No Adult coho observed (Nov 11/98) but reports from local people of large numbers of coho at earlier dates
Comments: The adult coho are in the lake and the main spawning areas are on the creek systems on the other side of the lake.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrke d coho	Trap2 mrked coho	Comments
1998	1	20	90	90	NA	NA	Top of Site 1 590 meters from Trail
1998	2	20	90	21	25	6	Site 2 was 627 meters off main boardwalk (Vacher House) up trail to creek
1999	1	20	90	90	NA	NA	High water events prevented recapture
1999	2	20	90	222	71	52	Retraps done after 6 days due to heavy rain. First trapping 2 dolly varden 1 stickleback. Second retrapping 1 dolly varden, 1 stickleback

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	8%	10% desc 90% con	5%	NA	.33	16.55	9.9	9.9	Mud 35 Boulder 30 Cobble 35
2	41	10%	5% desc 95% con	10%	NA	.15	8.3	4.9	NA	Sand 30 Cobble 30 Boulder 40

VILLAGE OF OSLAND WHERE NORTH CREEK FLOWS THROUGH FROM BREMNER LAKE

WOLF CREEK

Location: Flows into Wainwright Basin behind the Pulp mill on Watson island
Watershed Code: 9107895
Length of system observed: 2030 meters from the railway track on the banks of the Skeena River
Historical records of adult salmonids presence: Records indicate unknown for all species
Other indigenous fish: Cutthroat Trout and Dolly Varden
Adult Enumeration: No Adult coho observed (Refer to 1999 Adult Coho Enumeration Report)

Comments: Prince Rupert 1 did one of the sites on Wolf Creek and Prince Rupert 2 did the other site. These sites were used as a training area by the two groups in the beginning of their individual stream inventory projects. The system is prone to washout due to flash rain events.

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	37	NA	NA	Site was used as training with Prince Rupert 1 as that group did the other site on Wolf Creek
1999	1	10	90	33	15	2	First trapping 4 dolly varden and 5 rainbows and the second trapping 7 dolly varden and 7 rainbows
1999	2	10	90	14	13	4	First trapping 26 rainbows and 1 dolly varden

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Descid ous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	15%	NA	NA	NA	NA	NA	NA	NA	NA

McNEIL RIVER (GREEN RIVER)

Location: Flows into the Skeena River about 35 km east of Prince Rupert
Watershed Code: ~~9106735337~~ 400-015200
Length of system observed: 6.7 km
Historical records of adult salmonids presence: Adult coho and Pink
Other indigenous fish: Freshwater Sculpins, StickleBack, Rainbow trout, Cutthroat and Dolly Varden
Adult Enumeration: Oct 29/98 there was 25 Adult Coho and 7 Jack Coho observed in the system. Several pairs at mouth of River with the majority at the 200 meter in the old Beaver Site. The area observed was from Jewel Lake upstream 600 meters. One adult carcass found Nov6/98 in the Lower McNeil River.
Comments: Impassable Rapids at above 5 km above Lake

Year	Site No.	No. of Gee Trap	Soak Time (min)	Trap 1 coho	Trap2 unmrked coho	Trap2 mrked coho	Comments
1998	1	20	90	275	236	46	Lower McNeil River about 3.5 km from Highway on Green River Forestry Road down to River about 100 meters and then 233 meters to the top of Site 1 upstream
1998	2	20	90	155	96	33	Lower McNeil River about3.5 km from Highway on Green River Forestry Road down to River 100 meters then downstream 224 meters to top of Site 2
1998	3	20	90	200	114	38	6.7 Kilometers from Highway on Green River Forestry Road down to River 300 meters and then 157 meters to top of Site 3
1998	4	20	90	198	86	67	6.7 Kilometers from Highway on Green River Forestry Road down to River 300 meters then 707 meteres down river to the top of Site 4
1999	1	20	90	227	164	41	First recapture 4 dolly varden, 4 cutthroat, 5 sculpins and second recapture 3 dolly varden, 1 sculpin, 1 stickleback, and 1 steelhead
1999	2	20	90	204	179	62	First trapping 2 dolly varden, 3 sculpin and second trapping 6 dolly varden, 2 sculpin and 4 steelhead
1999	3	20	90	346	204	66	First trapping 5 dolly varden, 8cutthroat, 13 stickleback and 3 steelhead. Second trapping 7 dolly varden, 3 cutthroat, and 12 stickleback

1999	4	20	90	61	192	36	First trapping 7 dolly varden, 3 cutthroat, 4 stickleback. Second retrapping 5 dolly varden, 5 cutthroat and 20 stickleback

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	10%	NA	10%	NA	.08	17.0	14.13	NA	Sand 100
2	40	10%	Berry bush	5%	NA	.11	23.56	20.33	NA	Gravel 50 Sand 40 Rocks 10
3	40	15	Berry Bush	5%	NA	.17	8.83	8	NA	Sand 20 Gravel 15 Cobble 15 Boulder 50
4	40	0	NA	1%	NA	.15	15	7.63	7.63	NA

SUMMARY OF McNEIL RIVER FROM MOUTH AS RECORDED IN 1998

Meter	Observations
0	Highway Bridge
100	Trail comes to River
170	Slough enters from right bank
240	Power line
322	Slough entering from right bank
520	2 Sloughs entering from right bank
736	Slough right side
793	Deep narrow ravine
935	Slough right bank
1000	Old windfall overhanging river
1072	Deep Slough left bank
1457	Slough left bank
1524	Slough left bank
1800	Mouth of creek

OTHER SYSTEMS OBSERVED

Alias Clearwater Cr.

Date	Name of system or stream	Adult salmonid	Juvenile salmonids	Comments
Nov 13/98	**Sparkling Creek**--40 km upstream on Ecstall River on the right bank	No 400-016500-39800	No	Section inspected was from tidewater upstream to 300 meters
Oct 15/98	**Snowbound Creek**	No	No	Section observed was from railway bridge to impassable falls at 134
Oct 19/98	**Snowbound Creek**	No	Yes --11 juvenile coho trapped at 183 meters	Section inspected was from railway bridge to impassable falls 500 m
Oct 28/98	**Boneyard Creek**	No	No	Section inspected was

400-006400

				from Railway bridge to 500 meters upstream. At 305 m there is the old Dam site. There are large boulders and granite tock throughout the system
Nov 10/98 400-018200-28600	**Gamble Creek**	No	Yes 15 juvenile coho in traps at 400 and 430 meters from tidewater	Tributary McNeil River about 2000 meters upstream from the McNeil River Highway Bridge on left then upstream to 714 m to impassable falls
Nov 13/98 400-016500-141100	**Hayward Creek**	No	No	Section inspected was across from Brown's mill on the Ecstall River 16 km upstream
Nov 13/98 400-016500	**Ecstall River**	Yes Badly decomposed chum observed above 35 km	No	From mouth to 44 km upstream of Skeena River

NORTH COAST FISHERIES RENEWAL COUNCIL & COMMUNITY FISHERIES DEVELOPMENT CENTRE (CFDC)
PRINCE RUPERT
1999 NORTH COAST STREAM INVENTORY PROJECT (NCSIP)

FINAL WATERSHEDS REPORT

FOR SELECTED WATERSHEDS IN DFO AREAS 4 (SOUTH) & 5 (NORTH)
PREVIOUSLY SURVEYED BY THE COMMUNITY OF OONA RIVER

Report Document
Prepared by David Rolston, BSc..

Organizations:

Oona River Community Association
Attn: Jan Lemon
Box 93, Oona River, BC
V0V 1E0
(250) 624-1789

Community Fisheries Development Centre
Attn: Tasha Sutcliffe
253 Third Avenue West
Prince Rupert, BC
V8J 1L2
(250) 624-8566

Co-Funders:

EXECUTIVE SUMMARY

This report describes the results of both a 1998 field assessment of fish and fish habitat in selected watersheds in DFO Areas 4 (South) and 5 (North) by the Oona River Community Association (ORCA), and a 1999 field assessment of fish and fish habitat in the same watersheds by the Community Fisheries Development Centre (CFDC).

A companion report, titled "*Final Report Summary*", contains the detailed introduction and 1998 methodology, and summarizes and compares the findings between the watersheds and provides detailed watershed rehabilitation prescriptions for impacted watersheds.

Selected watersheds and their associated salmon populations have been subjected to numerous past and current impacts, including:

1. extensive historical commercial fishing,
2. logged riparian zones, which in large part cause;
   - lack of instream large woody debris (LWD) and resulting decreased habitat complexity;
   - mass wasting and logging-induced landslide activity and erosion;
   - degraded fish spawning habitat from increased surface erosion, sediment delivery, and excessive bedload movement; and
   - increased beaver damming activity due to the enhanced food supply from deciduous regeneration in logged riparian areas, and associated problems with fish access issues, and
3. an increase in ocean water temperatures, which may be responsible for a dramatic reduction in the smolt-to-adult survival rates for coho salmon (*Oncorhynchus kisutch*).

The purpose of the 1998 assessment was to determine the cause and the extent of the numerous (freshwater) impacts on watersheds adjacent to Oona River and their associated fish populations, and utilize this information for future strategic stock enhancement and watershed rehabilitation projects.

The purpose of the 1999 assessment was build on the information obtained during the 1998 assessment, and to provide regional standardization within the North Coast Stream Inventory Project so that a regional approach towards long-term watershed planning could be developed.

For both years (1998 & 1999), site-specific juvenile coho densities were sampled and estimated using a mark and recapture protocol developed by Blair Holtby, DFO Nanaimo. The remainder of the methodology of the watershed assessments was developed by ORCA and the CFDC, and consisted of habitat, relative fish abundances assessments and associated mapping procedures.

The fish habitat surveyed in 1998 was according to an abbreviated habitat assessment methodology, specified in Watershed Restoration Technical Circular #8 - Fish Habitat Assessment Procedures (Johnston and Slaney, 1996). The habitat was assessed so that comparisons could be made between reaches and watersheds that are either impacted or in need of limited strategic stock enhancement.

The fish habitat surveyed in 1999 was according to an abbreviated habitat assessment methodology, specified in Reconnaissance (1:20 000) Fish and Fish Habitat Inventory Standards and Procedures (RIC, 1998). The habitat was assessed so that stream reach and biophysical data could be utilized in tentative regional watershed planning and capability modelling.

Additionally, catch per unit effort (CPUE) methodology was used to estimate relative juvenile coho, and other fish species abundances between watersheds and sample sites. An intensive 1:20000 mapping exercise was additionally completed, noting and geo-referencing impacts, fish abundances, and adult holding and spawning and juvenile rearing habitats.

The anticipated resource benefits of watershed restoration activities completed in conjunction with strategic stock enhancement activities include potential increases in the survival of stream rearing salmonids, and in improving the status of endangered coho salmon stocks. The assessment work and associated rehabilitation measures for the impacted watersheds are expected to produce employment and retraining for displaced local fisheries and forestry workers.

This project was supported through the Habitat Restoration and Salmonid Enhancement Program of the Department of Fisheries and Oceans Canada (DFO) and Fisheries Renewal BC (FsRBC).

Table of Contents

List of Tables

List of Figures

1. INTRODUCTION

The *Habitat Restoration and Salmonid Enhancement Program* (HRSEP) of the Department of Fisheries and Oceans Canada (DFO) has been extended through the Pacific Salmon Fisheries Restructuring Program and complements the Pacific Salmon Revitalization Strategy. The focus is to increase the quality and quantity of salmon habitat and to conserve salmon stocks in British Columbia and the Yukon.

The goals of the HRSEP Program are:

1. ***Habitat Restoration:*** to improve or create freshwater and estuary habitat for salmon spawning and rearing;
2. ***Salmon Stock Rebuilding:*** to support stock enhancement projects that help bolster weak populations and assist stock assessment projects that gather vital fisheries information; and
3. ***Resource and Watershed Stewardship:*** to support community-based initiatives that promote sustainable salmon populations.

Fisheries Renewal BC (FsRBC) is a provincial Crown corporation which protects and restores fisheries resources and make strategic investments in British Columbians and in communities that rely on commercial or sports fishing. The goal is to achieve and maintain sustainable fisheries and help create new economic opportunities for the people and communities that depend on them.

FsRBC has a broad legislated mandate that includes:

- promoting the protection, conservation and enhancement of fish stocks and habitat;
- building a multi-skilled workforce in fishing communities by supporting employment, training and technological development;
- working with communities to develop strategic plans for job creation in the fisheries;
- developing local infrastructure that will encourage employment and investment in communities; and
- providing advice to the government of British Columbia on fisheries-related programs.

1.1 Proponent, Funding Source and Partners

In 1998, the Oona River Community Association (ORCA) entered into an agreement with DFO (HRSEP) to complete a Resource and Watershed Stewardship Project within DFO Area 4 (South) & 5 (North). This project was to consist of stream inventory for the purposes of watershed restoration and salmon stock rebuilding in and around Porcher Island.

In 1999, HRSEP also co-funded the North Coast Stream Inventory Project (NCSIP) in conjunction with FsRBC, which was carried-out through the Prince Rupert Community Fisheries Development Centre (CFDC), where the 1998 field crew participants from Oona River were re-employed in resampling the same watersheds visited in 1998 by ORCA .

2. Overall Project Description

The purpose of the Oona River Stream Inventory Project (ORSIP) was to build up stream profiles on the presence and density of juvenile salmonids, especially coho salmon. This program is important in establishing a baseline for determining what species are at risk in the watershed and the condition of the fish habitat. It is anticipated that this program will be extended to cover a few years of consecutive data collection.

The focus of doing stream inventory studies is to be consistent over many years or at the very least, over one cycle of the coho life cycle. The establishment of a stream profile which includes juvenile salmonid density counts, scale analysis, genetic profile, mapping, and water quality data are all necessary ingredients to establish a proper baseline. The comparison of this baseline with coho adult enumeration counts will establish a correlation about juvenile salmonid mortality within a system and provide remedies to improve the output of a system if deemed necessary. The information collected from this program is crucial in determining what watersheds may be in need of stock assistance and/or habitat rehabilitation, and the capacity of that assistance.

The project, when combined with hatcheries in Hartley Bay, Kincolith and Oona River, involves the following:

- Resource & watershed habitat restoration, where appropriate.
- Stock rebuilding and enhancement, where appropriate, and under the guidance of DFO.
- Inventory & mapping.
- Public awareness through use of our hatchery building.
- Stock assessment utilizing visual enumeration and coho fry density methodology.
- Local community stewardship.
- Habitat restoration, where appropriate.

3. Results and Discussion - Chismore Creek (South Tributary) Watershed

3.1 Background Review

3.1.1 General Watershed Description 915-765500-86900

Chismore Creek (DFO Watershed Code 97-9300-060), located on the northeast of Porcher Island, flows west to Chismore Passage (Figure 2). It is a third order stream, ~3.3 km in length, draining an area of 6.5 km^2. For the first 1.4 km upstream of the mouth, Chismore Creek has a fairly low gradient (4 %), which increases to 15 % towards the end. Chismore Creek was not sampled due to an inaccessible waterfall, 600m above the mouth.

A South Tributary flows into Chismore Creek, 300 m upstream of the mouth of Chismore Creek. This tributary is a second order stream draining an area of 1.8 km^2. For the first 1.2 km upstream of the mouth, the South Tributary of Chismore Creek has an overall gradient of ~5½%, which then increases to ~20% (Figure 1) to its' termination at ~2.4 km.

There is a large debris jam at the confluence of Chismore Creek and the South Tributary. The debris jam had caused the braiding of the channel, and the build-up of a large mid-channel bar/island downstream of the debris jam. The westernmost channel may be an old logging road, as it is straight and is of nearly equal depths (Figure 2).

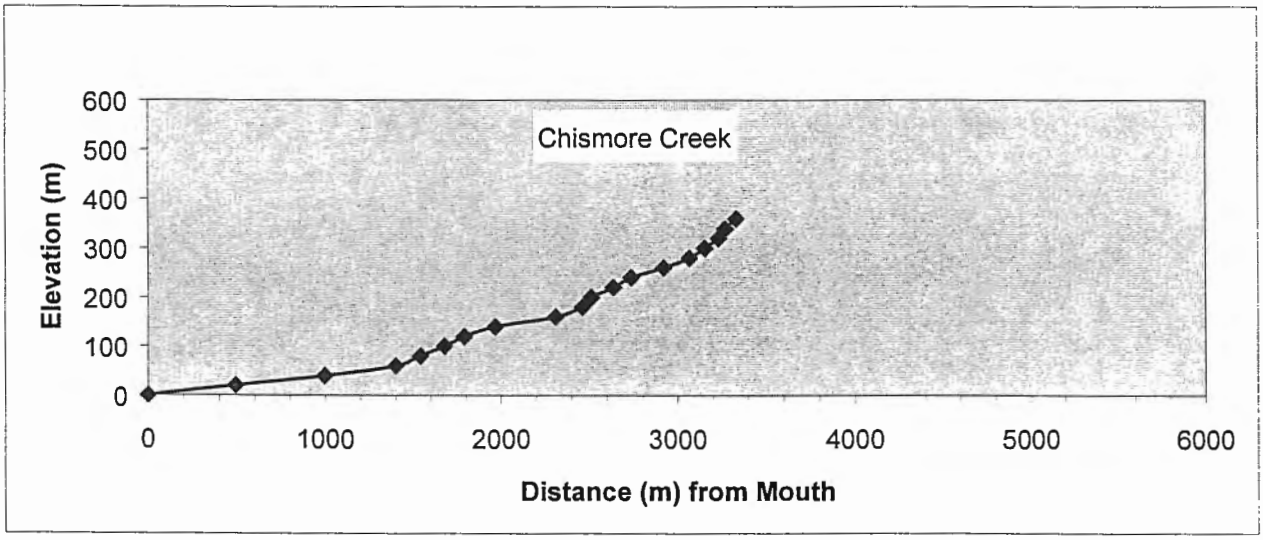


Figure 1 - Gradient Profile for South Tributary of Chismore Creek

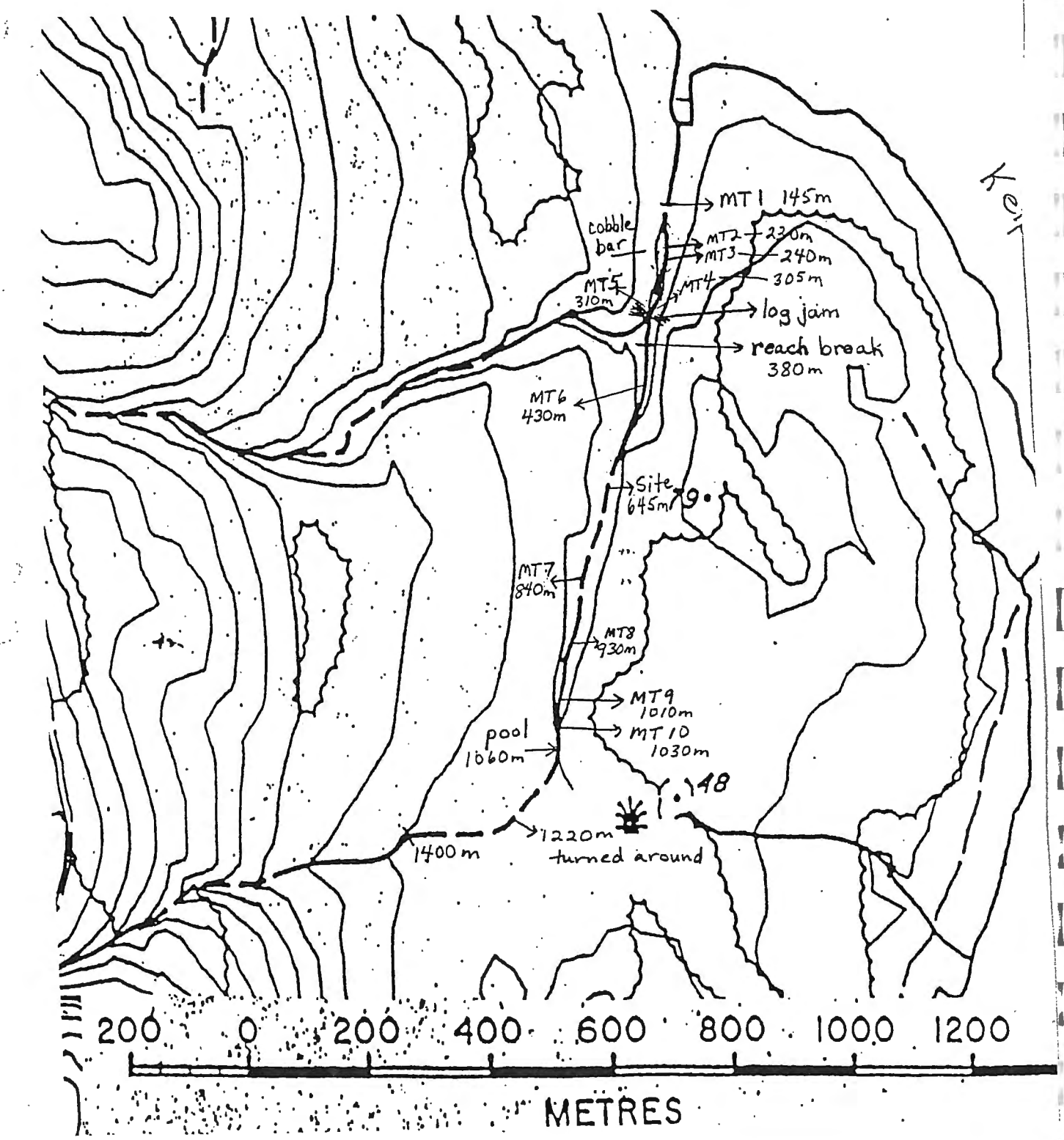


Figure 2 - Overview Map of Chismore Creek and South Tributary

3.1.2 Historical Fisheries Data

According to the Stream Information Summary System (SISS, 1991), the Chismore Creek watershed contains pink salmon, with pink salmon (*Oncorhynchus gorbuscha*) having been observed spawning in the lower 1.2 km of Chismore Creek. No information exists for Chismore Creek in the Stream Escapement Catalogue (Hancock et al., 1983) or the FISS database (1997).

However, minnow trapping and visual observations indicate that coho salmon (*Oncorhynchus kisutch*), resident cutthroat trout (*Oncorhynchus clarki* clarki*)*, rainbow trout (*Oncorhynchus mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are present in Chismore Creek (Table 7).

Adult coho salmon also utilize some of the lower, deeper pools associated with massive LWD jam at the confluence of the South Tributary and Chismore Creek, as well as the larger pools associated with log jams along the South Tributary of Chismore Creek (SISS 1991, and 1997 personal observations).

Chismore Creek does not support a strong run of pink salmon. Data are only available from 1982 to the present. From 1982 to 1996, the returns range from 100 (1994) to 4,100 (1996), with a mean escapement of 1,010 fish. There is no data for coho salmon escapement.

Select comments from Streamwalkers data are summarized in Table 1.

Table 1 - Summary of Condensed Selected Historical Streamwalkers Comments - Chismore Creek

Year	Impacts/Comments
1980	Fish observed above fork in mainstem.
1981	Lower creek riparian area logged up to forks. Wide gravel area with windfalls at fork. Large log jam in mainstem, 0.4 km upstream from mouth. Logging road crosses right hand fork. Fish observed below forks, only.
1982	Slopes logged by Whonnock Industries.
1983	Some silting. Water levels fluctuate. Log jam approximately 0.8 km upstream from mouth. Spawning fish distributed evenly up mainstem and both forks.
1984	Low water levels, with freezing in early November.
1985	Silting caused by logging in upper watershed.
1986	Low water levels in August.
1987	Spawning fish to 1.6 km upstream from mouth. Flood event, September 29 to October 1.
1989	Spawning fish need high tide in order to enter stream. No fish passage approximately 1.25 km from mouth. Low water levels in mid-September, with high water temperatures of 15°C. Pre-spawn mortality of approximately 150 pink salmon.
1991	Creek channel changes due to log jams and associated landslides and scouring. Fish spawning in lower section below large log jam, only.
1997	Large sediment wedge and debris jam at 390-420m upstream from mouth. Possible fish passage.

Reviewing the logging history of Chismore Creek in Triton's (1998) Porcher Island report, it states that:

- most of the slopes surrounding Chismore Creek were harvested in 1981-1984; and
- approximately 2.5 km^2 or 38% of the Chismore Creek watershed area was logged from 1981-84, with a buffer strip maintained along the stream.

3.2 Overview Level Watershed Survey

The physical characteristics of the first reach of Chismore Creek and the South Tributary, including channel morphology, gradient, widths and substrate composition are presented in Table 2 and Table 3. Habitat parameters (*i.e.* 1997 results) for these reaches are from Triton's 1998 report, and these parameters are presented in Table 4. Since smaller side-pools were omitted from the 1998 sampling protocol; 1998 results are not shown in order to avoid erroneous comparisons.

At 600 m upstream (Reach 1/2 break) in Chismore Creek, a waterfall (10 m in height) is present. This is a barrier to anadromous fish. Additionally, there is a section of small waterfalls and cascades several hundred metres above the waterfall. Therefore, the two reaches above this barrier were not considered for habitat restoration and not sampled.

Similarly due to time and logistical restraints, Reach 2 in the South Tributary of Chismore Creek was not sampled. It was not considered to be a high priority due to low fish habitat values, high gradient (22 %) and the waterfall at approximately 1450 m (JEC, 1997).

The reach descriptions from Triton (1998) for Chismore Creek and the South Tributary were reviewed, updated, and included in this report.

Table 2 - Physical Characteristics for Reaches in Chismore Creek and the South Tributary - Triton Environmental 1997

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean widths +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
Chismore Creek 1 (0-600)	Riffle/Riffle-Pool	3-5	14.0±4.4	8.3±1.3	Cobble	Large Gravel
S. Trib. Chismore 1 (0-1300)	Riffle-Pool	3-4	8.0±2.2	6.3±1.8	Large Gravel	Cobble

Table 3 - Habitat Parameters for Reaches in Chismore Creek and the South Tributary - Triton Environmental 1997

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
Chismore Creek 1 (0-600)	N/A	N/A	2.4	F	2.5	G	1	0	71.4	28.6
S. Trib. Chismore 1 (0-1300)	N/A	N/A	1.5	G	3.9	G	3.4	10.5	51.2	38.3

Notes: Due to time constraints, pool area was not measured in Chismore watershed
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Table 4 - Habitat Parameters for Reaches in Chismore Creek and the South Tributary - Triton Environmental 1997

Reach Number (instream distance, m)	Offchannel Habitat		Adult Holding Pools (number per km)		Average Cover in Pools (estimated % by area)			Spawning Gravel Quality		
	Value	Rating	Value	Rating	Wood	O'head	Rating	Dominant	Subdom	Rating
Chismore Creek 1 (0-600)	L	P	3	P	20	50	F	Cobble	Gravel	P
S. Trib. Chismore 1 (0-1300)	H	G	9	P	20	30	F	Large Gravel	Small Cobble	F

Notes: Abbreviations: H - high, L - low
Overhead cover comprised of LWD, cutbank, overstream vegetation and instream vegetation
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1 Chismore Creek

Reach 1 of Chismore Creek had substrate composed of cobble and large gravels, with minor amounts of fines (Table 2 and Table 4). Reach 1 had a fairly wide channel width (14 m) due to the accumulation of bedload from the debris jam, initiating from the road failures/debris torrents in the upslope areas (Triton, 1998). This reach has a low availability of pool habitat, including adult holding pools and rearing and overwintering pools for juveniles. Some spawning habitat was present, but the cobble substrate was somewhat unstable. Some spawning habitat for pink salmon is found adjacent to the side channel at 185 to 390 m. The morphology of the side channel, from 185 to 390 m upstream, is composed of one long riffle, with the substrate being mostly cobble. The riparian vegetation in Reach 1 has been impacted from past forest harvesting (*i.e.* reduced coniferous vegetation, increased alder growth), which results in a decline of large LWD recruitment to the stream.

The frequency of pools is rated '*fair*' with a pool every 2.4 channel widths (Table 3), as '*good*' salmonid habitat is present in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of only 0.57 m with '*fair*' cover overall (Table 4). From these calculations, it is apparent that Reach 1 is somewhat deficient in the pool habitat available for salmonids.

LWD provides structure and stability to the stream, as well as creating habitat and providing cover. In Reach 1, there were 2.5 pieces of LWD per channel width (Table 3), considered '*good*', as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). However, the classification of LWD per channel width may not be an appropriate measure for this reach, as this section of stream is aggraded, with the channel being significantly widened and flattened due to bedload accumulation (Triton, 1998).

The size of the LWD also greatly affects stream habitat morphology. In this reach, 28.6% of the total LWD pieces are over 50 cm in diameter. However, much of the instream large LWD in Chismore Creek are buried beneath massive bedload accumulation. Although the large LWD are slowing down the downstream migration of the massive inputs of scoured bedload, the LWD are generally not able to function as a critical part of the hydraulics of the stream, scouring out and damming large holding, rearing and spawning pools. Calculations for LWD parameters indicate that this reach has only 1 functioning piece of LWD per channel width (Table 3).

The riparian vegetation in Reach 1 of Chismore Creek is mainly maturing hemlock and spruce. A stand of young alders is present on the midchannel bar area at the location where the channel splits. Past logging practices were evident from the presence of old stumps and the side channel may have been an old logging road.

Reach 1 South Tributary

The substrate in this reach was primarily gravels and cobbles, with minor amounts of fines. Adequate numbers of functioning large instream LWD were present in this reach. There were a number of smaller LWD-induced pools at the downstream side of small debris jams, but overall there was not a substantial number of adult holding pools. The presence of shallower pools may be due to the fact that there was some infilling of the deep pools with minor amounts of bedload materials. There was adequate juvenile rearing habitat, and some spawning habitat. At high flows, adult coho can migrate upstream of the debris jam, to access the uppermost reach (personal observations). Summer low flows may inhibit adult pink passage and spawning. A waterfall, 20 m in height, may be present near the beginning of reach 2 at 1450 m (JEC, 1997). A small 1m cascade is situated 490m above the Chismore Creek confluence and a small, 1m LWD falls is situated 535m above the confluence. Fish passage is possible over both obstructions.

The streamside vegetation in this reach has not been logged and therefore natural amounts of LWD would enter the stream. Furthermore, this reach is upstream of the confluence with Chismore Creek mainstem, which has been debris torrented.

In this reach, pools were more abundant than in the heavily impacted Reach 1 of Chismore Creek. The number of pools per channel width was 1.5, rated as '*good*' according to the WRTC #8 (Table 3). However, the pools depths in this reach are slightly less, with maximum and residual pool depths of 0.74 m and 0.46 m, respectively.

The South Tributary has 3.9 LWD pieces per channel width, with 38.4% of the LWD being greater than 50 cm in diameter. The greater abundance of large LWD is likely correlated with the pool frequency in this reach. This reach also has greater than 3 times the functional LWD per channel width than Reach 1 of Chismore Creek (Table 3). As previously mentioned, extensive bedload accumulation has occurred in Reach 1 of Chismore Creek, affecting instream habitat by infilling pools and burying LWD.

The riparian species in this reach are hemlock and spruce (unlogged) from the mouth of the South Tributary to 600 m upstream. In this reach, there was adequate recruitment of streamside vegetation into instream structural components. From 600 to 800 m upstream, the forest cover map shows a bog, composed of western red cedar and lodgepole pine. From 800 m upstream to the reach break at 1300m, the riparian species composition is western red cedar and hemlock (Interfor, 1997). The South Tributary of Chismore Creek is not highly impacted by past forest harvesting.

Table 5 - Reach Descriptions and Impacts - Chismore Creek and South Tributary - Triton Environmental 1997

Reach #	Distance (m) from Mouth	Watershed Impacts/Comments
		Chismore Creek
1	0-600	Reach 1, 3.7% gradient, severely impacted by aggradation, and debris jam.
1	185-390	Side channel.
1	390-420	Large sediment wedge and debris jam. Possible fish passage.
1	600	10m waterfall. End of anadromous fish use.
2	600-1400	Reach 2, 3.5% gradient, moderately impacted reach, non ground checked.
3	600-3330	Reach 3, 15.5% gradient, highly torrented reach, bedload inputs from slides, suspected non-fish reach, non ground checked.
		South Tributary of Chismore Creek
1	0-1300	Reach 1, 5.6% gradient, moderately impacted.
1	0-90	Large sediment wedge and debris jam. Probable fish passage.
1	90-1300	Lightly impacted reach.
2	1300-2400	Reach 2, 22.4% high gradient, lightly impacted reach, suspected non-fish reach, non ground checked.

3.3 Minnow-trapping Data

Minnow trapping data for the Chismore Creek watershed are summarized in Table 6 and Table 7. Due to the low numbers of fish captured in this system, length-frequency distributions are not presented, as they would not provide meaningful information about the fish populations.

3.3.1 Overview Catch per Unit Effort (CPUE)

It is interesting to compare watershed CPUE results between years (Table 6 and Table 7). The South Tributary of Chismore Creek 1998 CPUE values were from 15.8 (coho CPUE) to 22.0 (Total CPUE) times higher than 1997 CPUE values. This trend is not mirrored in the Chismore Creek CPUE results, however. Although the 1998 coho CPUE results did increase slightly over the 1997 results, the Total CPUE results remained more-or-less constant for reach 1 of Chismore Creek.

This nearly constant Total CPUE rate may indicate that the impacted reach 1 of Chismore Creek might already be at the maximum of its' limited rearing capacity; where the South Tributary of Chismore Creek has underutilized potential rearing habitat that could be utilized if there was adequate juvenile recruitment.

3.3.2 Site-Specific Catch per Unit Effort (CPUE)

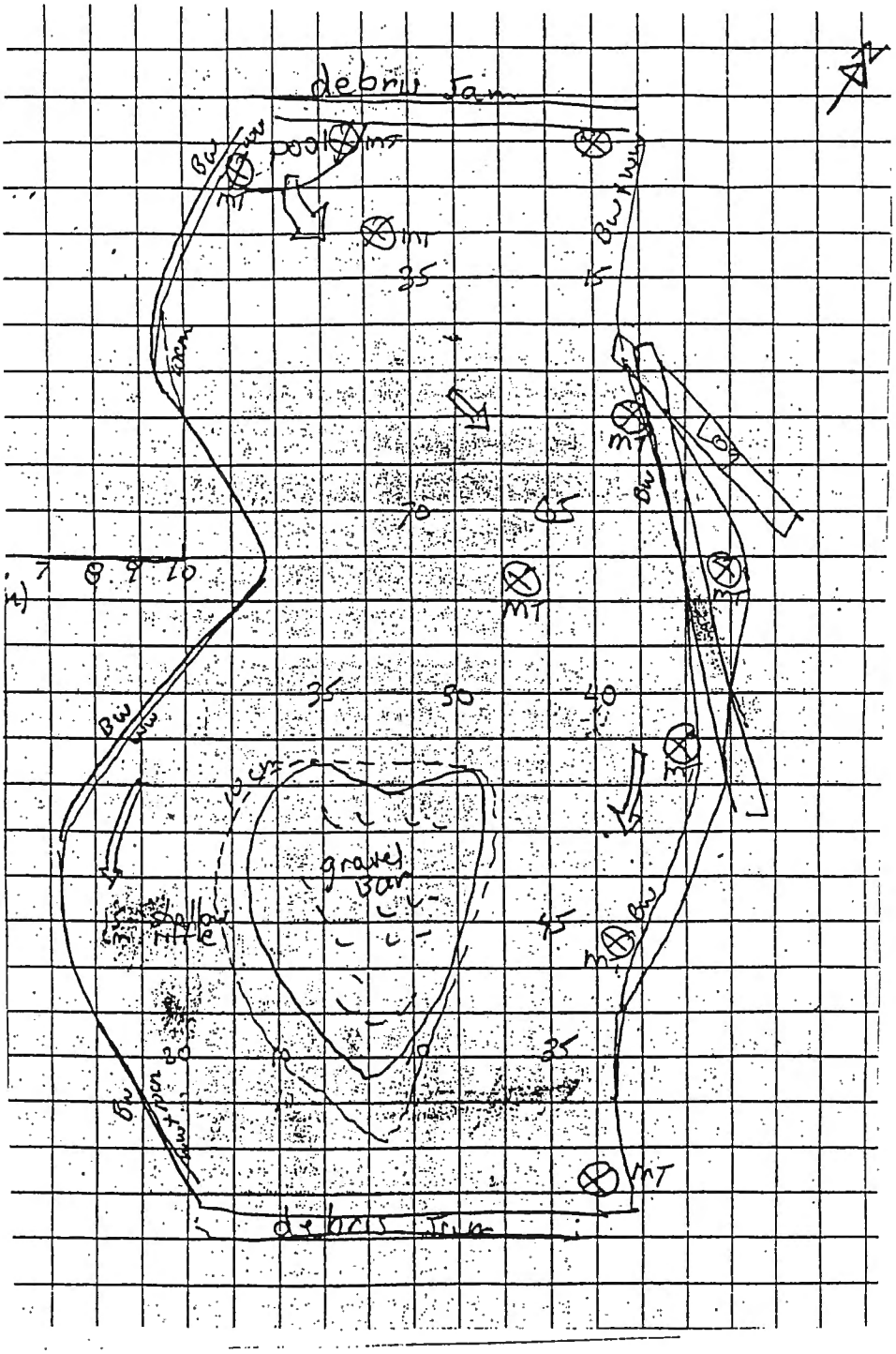
The pool site chosen was had much poorer juvenile coho rearing habitat than the remainder of the reach, and slightly better juvenile coho rearing habitat than the remainder of the watershed. The site ranked 21st/22nd (coho CPUE) and 20th/27th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): South Tributary of Chismore Creek reach 1 ranked 5th (coho CPUE) and 5th (Total CPUE), where Chismore Creek reach 1 CPUE values ranked 42nd (coho CPUE) and 46th (Total CPUE), of 49 overview CPUE values.

Table 6 - Overview Catch per Unit Effort Results - Chismore Creek - Triton Environmental 1997

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)								
Trap	Times			Habitat			Species							Species								
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	97/10/06 9:30	97/10/06 14:10	4:40	0m	1	Mainstem, 1st deep pool edge marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	97/10/06 10:00	97/10/06 13:45	3:45	222m	1	Mainstem, scour pool	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	97/10/06 10:15	97/10/06 13:30	3:15	490m	1	Mainstem, debris jam pool	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	97/10/06 11:00	97/10/06 12:55	1:55	100m	1	S. Trib., pool	2	0	0	0	0	0	2	1.04	0	0	0	0	0	1.04	
	Total Watershed Catch Effort		13:35			Total Watershed # Capture	2	0	0	0	0	0	2	0.15	0	0	0	0	0	0.15	Total CPUE
	Reach 1 Chismore		11:40			Reach 1 Chismore Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	3.41	Reach 1 Chis.
	Reach 1 South Tributary		1:55			Reach 1 South Tributary	2	0	0	0	0	0	2	1.04	0	0	0	0	0	1.04	Reach 1 S. Trib

Table 7 - Overview Catch per Unit Effort Results - Chismore Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)								
Trap	Times			Habitat			Species							Species								
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	10/15/98 10:22	10/15/98 14:00	3:38	145	1C	Main channel, in shallow pool near LWD.	24	0	0	3	5	0	32	6.61	0	0	0.83	1.38	0	8.81	
2	10/15/98 10:35	10/15/98 13:50	3:15	230	1C	Main channel, south side channel, in riffle/glide.		0	0	0	1	0	1	0	0	0	0	0.31	0	0.31	
3	10/15/98 10:40	10/15/98 13:45	3:05	240	1C	Main channel, south side channel, in riffle/glide.	4	0	0	0	4	0	8	1.30	0	0	0	1.30	0	2.59	
4	10/15/98 10:42	10/15/98 13:40	2:58	305	1C	Main channel, in shallow, dammed pool.	4	0	0	0	0	0	4	1.35	0	0	0	0	0	1.35	
5	10/15/98 10:45	10/15/98 13:35	2:50	310	1C	Main channel, in shallow, dammed pool.		0	1	1	0	0	2	0	0	0.35	0.35	0	0	0.71	
6	10/15/98 11:20	10/15/98 13:30	2:10	50	1ST	South tributary, in shallow pool.	2	0	1	0	10	0	13	0.92	0	0.46	0	4.62	0	6.00	
7	10/15/98 12:00	10/15/98 13:00	1:00	460	1ST	South tributary, in bedrock pool.	1	0	1	1	2	0	5	1.00	0	1.00	1.00	2.00	0	5.00	
8	10/15/98 12:10	10/15/98 12:50	0:40	550	1ST	South tributary, in bedrock pool.	1	0	0	3	0	0	4	1.50	0	0	4.50	0	0	6.00	
9	10/15/98 12:15	10/15/98 12:45	0:30	630	1ST	South tributary, in small pool.	72	1	7	1	0	0	81	144.0	2.00	14.00	2.00	0	0	162.0	
10	10/15/98 12:20	10/15/98 12:40	0:20	650	1ST	South tributary, in small pool.	1	3	0	0	0	0	4	3.00	9.00	0	0	0	0	12.00	
	Total Watershed Catch Effort		20:26			Total Watershed # Capture	109	4	10	9	22	0	154	5.33	0.20	0.49	0.44	1.08	0	7.54	Total CPUE
	Reach 1 Chismore		15:46			Reach 1 Chismore Creek	32	0	1	4	0	0	47	2.03	0	0.06	0.25	0.63	0	2.98	Reach 1 Chis.
	Reach 1 South Tributary		4:40			Reach 1 South Tributary	77	4	9	5	0	0	107	16.50	0.86	1.93	1.07	2.57	0	22.94	Reach 1 S. Trib



SITE 1----CHISMORE CREEK (South Tributary)
Moderate flow----October 16, 1998
Area > 10 cm.= ~89m^2
Scale—1:156 Depths in cm.
⊗ MT —Minnow trap locations

Figure 3 - Detailed Drawing - Site 1 - South Tributary of Chismore Creek

3.3.3 Site-Specific Juvenile Coho Fry Densities

Site 1, South Tributary of Chismore Creek (Figure 3), was calculated to have a density of 0.36 (+/- 0.14) coho fry per m^2 of pool area (Table 10 *Summary Report*). This was one of the lowest estimated densities of our sampled watersheds, and is substantially below the expected North Coast coho fry densities of 1-2 fry per m^2 of pool area (Holtby, B., Pers. Comm.). The pool site chosen was, however, a poorer site selection when comparing overview watershed (Table 7 *Summary Report*) CPUEs.

3.3.4 Fork Lengths

Age-size distribution graph for Chismore creek was not constructed due to the lack of numbers of sampled fry (n = 14).

3.3.5 Weights

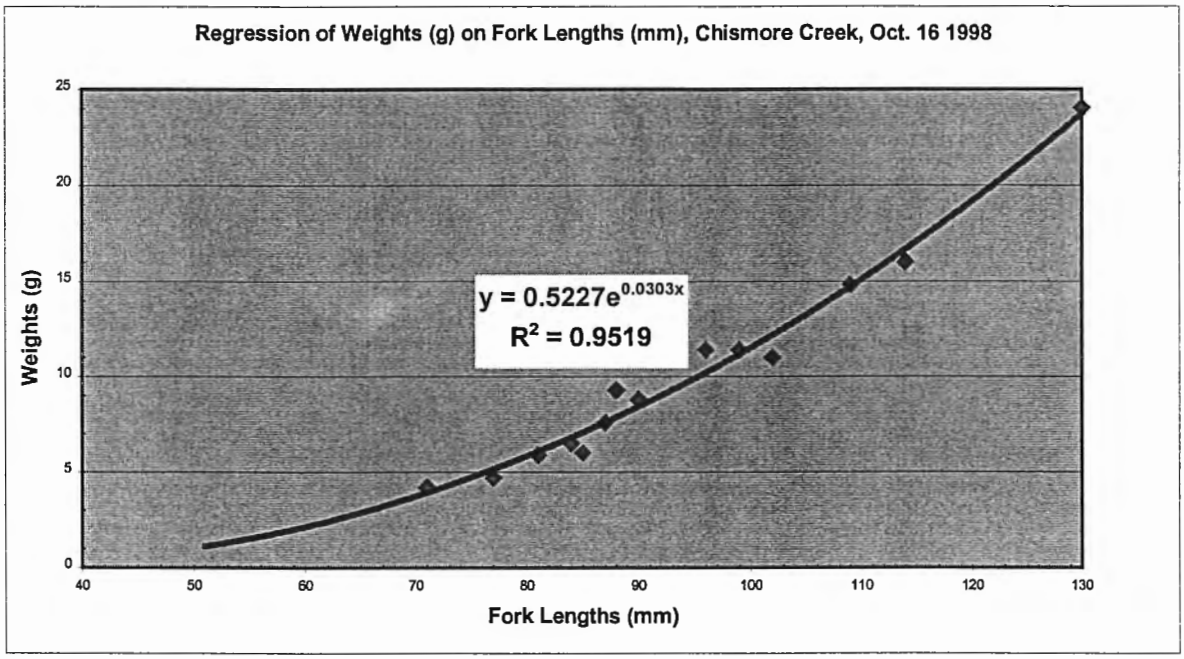


Figure 4 - Regression of Coho Fry Weights on Fork Lengths - Chismore Creek

Coho fry weights were recorded on October 16, 1998 and then were plotted against fork lengths (Figure 4). This information was then used to calculate fish condition factors.

3.3.6 Fish Condition Factors

The overview average watershed fish condition factor was calculated to be 1.14 (+/- 0.10) on October 16, 1998 (Table 14 and Figure 13 *Summary Report*).

4. RESULTS AND DISCUSSION - FOOTE CREEK WATERSHED

4.1 Background Review

4.1.1 General Watershed Description 915-765500-21200

Foote Creek (DFO Watershed Code 97-9300-430), located on the north of Porcher Island, flows southeast to Salt Lagoon (Figure 6). It is a third order stream, 5.7 km in length, draining an area of 9.2 km^2. Foote Creek is a low gradient stream with an overall gradient of approximately 0.5% for the first 3.5 km, and an overall gradient of 1.5% to its' termination at 5.7 km (Figure 5). There is a short, higher gradient section between 3.5 and 3.9 km of ~5%, the next section between 3.9 and 5.0 km having a gradient of 2%, and the uppermost section between 5.0 and 5.7 km having a gradient of 2.5%.

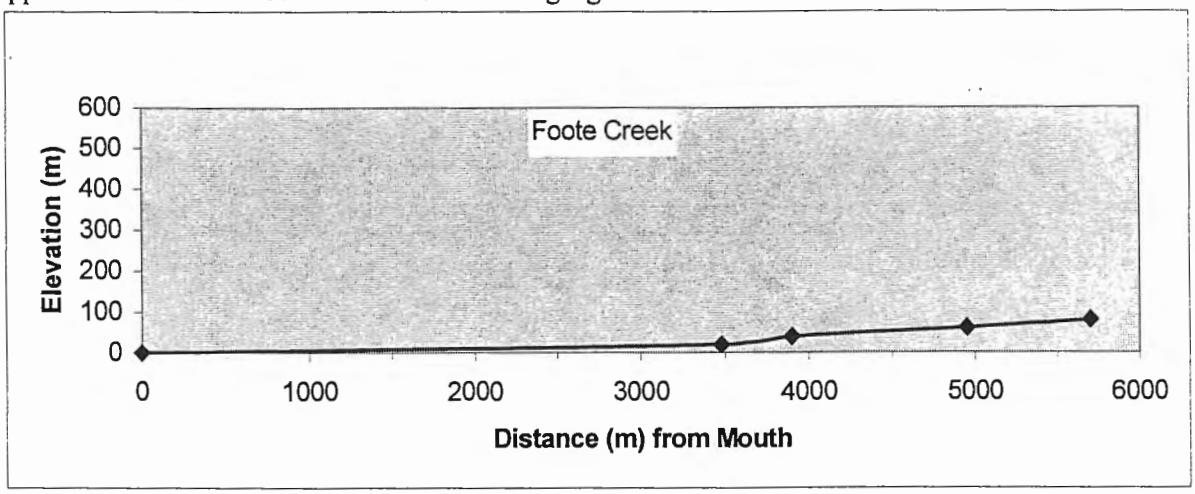


Figure 5 - Gradient Profile for Foote Creek

4.1.2 Historical Fisheries Data

The Foote Creek watershed historically contained three species of Pacific salmon, coho (*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*), and pink salmon (*Oncorhynchus gorbuscha*) (SISS, FISS). All species have been observed spawning in the lower 2 km, with coho spawning up to the headwaters (SISS). Resident cutthroat trout (*Oncorhynchus clarki* clarki*)*, Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present (Table 12).

It is interesting to note that the two largest watersheds in Salt Lagoon, Foote and Salt Lagoon Creeks, both contain chum salmon. This situation is somewhat unusual, as most similar-sized, smaller coastal streams do not contain chum salmon.

It is possible that the fact that both watersheds border Salt Lagoon may help provide the ability for these two watersheds to support chum salmon stocks, as chum (and to a lesser extent, pink) juveniles require an extended estuarine rearing phase in their life-cycles. Salt Lagoon may provide this extensive, sheltered, saline estuarine chum fry rearing habitat that other smaller coastal streams do not possess, due to the fact that the smaller, coastal streams do not normally contain extensive estuarine habitats.

The combination of low gradient rearing habitat and sufficient chum and pink salmon fry prey, may in turn, help support the above average coho fry densities and hence the larger than average numbers of adult coho spawners historically found in Foote Creek.

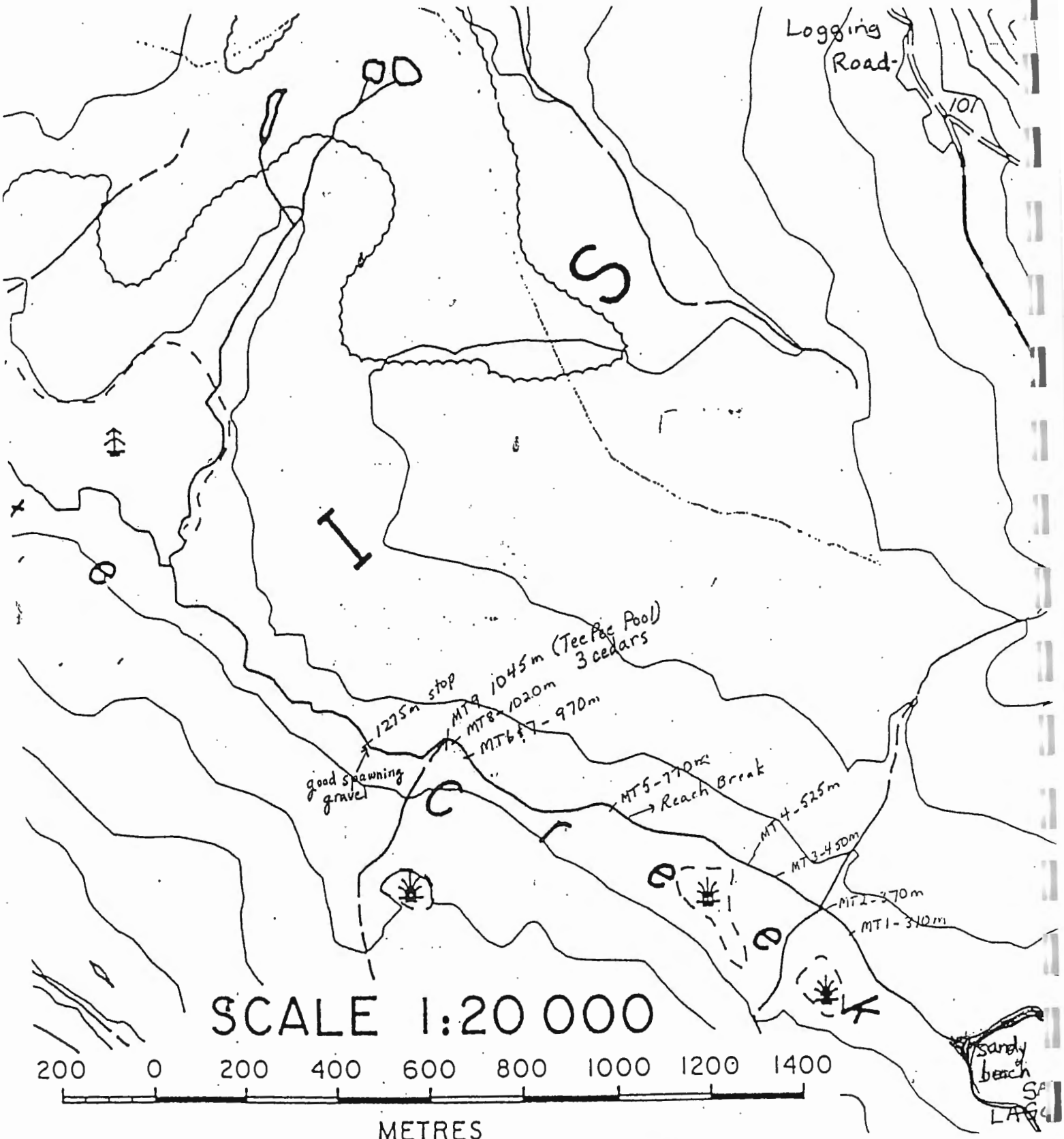


Figure 6 - Overview Map of Foote Creek

Select comments from Streamwalkers data are summarized in Table 8.

Table 8 - Summary of Condensed Selected Historical Streamwalkers Comments - Foote Creek

Year	Impacts/Comments
1958	Low water levels late August.
1961	Low water levels late August.
1963-64	Low water levels late August.
1964	Lower watershed logged.
1968	Low water levels late August, logging debris in stream.
1970	Porcher Inlet opened for fishing for 3 days at end of August.
1973-74	Large amount of bark noted at mouth of stream.
1974	Low water levels late August.
1981	Low water levels late August.
1985	Low water levels late August.
1993	Low water levels late August.

The escapement data for coho salmon in Foote Creek are presented in Figure 7. Yearly escapement data is discontinuous as access to this creek through 3 sets of tidal rapids, is difficult. These data indicate that the historic coho returns to Foote Creek were fairly substantial, given the small size of this stream.

Between 1953 and 1966, it appears that approximately 3500 adult coho returned annually to spawn in Foote Creek. From 1967 onwards, the escapement numbers dropped drastically to below 800 adults.

Porcher Inlet, including Foote Creek, is included in the Department of Fisheries and Oceans (DFO) Area 5. Escapement data for Area 5 (Figure 6 *Summary Report*) and the Porcher Inlet Subarea (Figure 8 *Summary Report*) similarly show high returns from the mid-1950's to 1968. It appears that the 1968 returns were less in Foote Creek and Porcher Inlet, than Area 5 Total. Additionally, during the mid-1970's, Area 5 Total reported moderate returns, which were again not mirrored by Foote Creek and Porcher Inlet escapement numbers.

It appears that logging took place in the watershed starting from 1964 (Table 8). Logging debris was noted in the creek in 1968, and in 1973, bark was noted at the creek mouth. Logging operations may have been detrimental to coho stocks in Foote Creek.

Additionally, an old gill net was found abandoned in the woods near the stream mouth during our stream inventory. Poaching may have also been a factor in the drop in escapement numbers.

1966 was a peak year for coho returns for all areas (Figure 7, and Figures 4-9 *Summary Report*) and was the last year reporting large escapement numbers in Foote Creek.

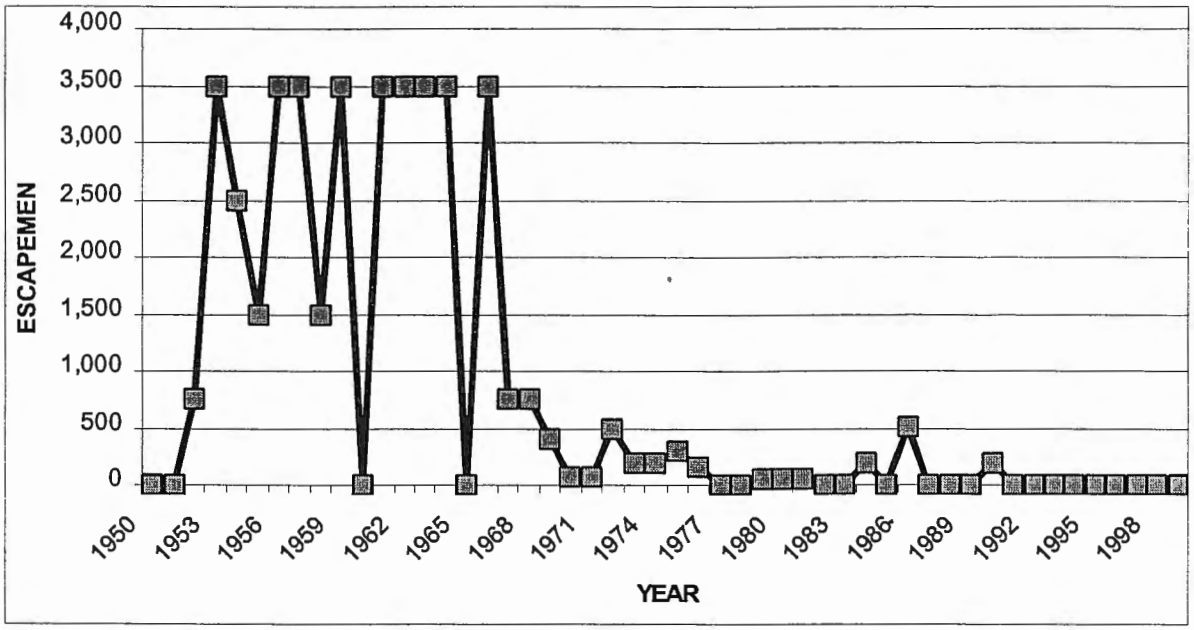


Figure 7 - Historical Coho Escapement - Foote Creek

4.2 Overview Level Watershed Survey

The physical characteristics of the 2 reaches of Foote Creek, including channel morphology, gradient, widths and substrate composition are presented in Table 9. Habitat parameters (1997) for Reach 1 of Foote Creek, were calculated and these parameters are presented in Table 10. The survey of reach 2 was not entirely completed, due to time constraints, and the habitat parameters were therefore not calculated. Following these tables is a brief description of the fish habitat available in each reach of Foote Creek and a summary.

Table 9 - Physical Characteristics for Reaches in Foote Creek 1998

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-700)	Backflooded Run	0.5	10.6±1.0	9.8±1.2	Mud	Sand
2 (750-1250+)	Riffle-Pool	1-2	7.3±1.0	6.5±1.2	Small Gravels	Cobble

Table 10 - Habitat Parameters for Reaches in Foote Creek Calculated from Overview Habitat Survey Data 1998

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
1 (0-700)	17.5	P	11.1	P	0.4	P	0.4	19.2	50.0	30.8

Notes: Reach 2 not entirely surveyed and not included.
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Foote Creek had a "backflooded run" morphology with the substrate mainly composed of fines (mud, silt) with minor amounts of sands. A qualitative assessment of the reach indicated that spawning habitat was very limited, but there was adequate juvenile rearing and overwintering habitat, although there was limited LWD cover. Cutbanks were the predominant instream cover type.

The percent of pools by channel area was 17.5%, indicating that this reach is rated as '*poor*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Foote Creek (2-5% gradient and <15m width) require over 40% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*poor*' with a pool every 11.1 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of only 0.75 m with '*poor*' cover overall.

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were only 0.4 pieces of LWD per channel width (Table 10), a '*poor*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). In this reach, only 30.8% of the total LWD pieces are greater than 50 cm in diameter.

Reach 2

Reach 2 was not entirely surveyed, due to time constraints, and the habitat parameters were therefore not calculated. However, adequate juvenile rearing and overwintering and adult spawning habitat is present. The substrate was primarily gravels and cobbles. Reach 2 has a riparian species composition of hemlock, spruce and western red cedar, in that order. Most of the riparian vegetation is older, mature trees, with a regenerating, coniferous understory of younger trees.

Summary

Table 11 summarizes the habitat and impacts for the first 2 reaches of Foote Creek. The largest impacts to Foote Creek may have occurred as a result of historical logging near the stream mouth. There is an amount of debris accumulation of wood at the mouth, and this debris may have helped to build-up fine materials at the stream mouth, thereby backflooding the reach (*i.e.* reach 1). Additionally, past beaver activity may have also helped to alter the fisheries habitat within this reach by slowing the water flow, thereby allowing more fines to drop out of suspension. It is also likely that some skidding of logs occurred in this reach, as there is almost no instream wood, and the channel is deep. Reach 2, in comparison, appears to have adequate habitat structure, including spawning gravels.

Table 11 - Reach Descriptions and Impacts - Foote Creek

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-700	Reach 1, backflooded run with fine bed materials. Evidence of old beaver dams. Good rearing habitat, very poor spawning habitat.
2	700-1275+	Reach 2, riffle-run morphology.

4.3 Minnow-trapping Data

4.3.1 Overview Catch per Unit Effort (CPUE)

Table 12 - Overview Catch per Unit Effort Results - Foote Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)								
Trap	Times			Habitat			Species							Species								
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/2/98 12:15	9/2/98 16:39	4:24	310	1	Main channel, in deep LWD pool, gentle flow near cutbank.	34					1	35	7.73	0.00	0.00	0.00	0.00	0.23	7.95	
2	9/2/98 12:25	9/2/98 16:10	3:45	370	1	Main channel, in deep (2m) cutbank pool.	1				1		2	0.27	0.00	0.00	0.00	0.27	0.00	0.53	
3	9/2/98 12:15	9/2/98 15:30	3:15	450	1	Main channel, in 1m cutbank pool.	5	1		3	6		15	1.54	0.31	0.00	0.92	1.85	0.00	4.62	
4	9/2/98 12:40	9/2/98 14:59	2:19	525	1	Trib entering at 525m, set in 30 cm shallow pool.	13	3		4	2		22	5.61	1.29	0.00	1.73	0.86	0.00	9.50	
5	9/2/98 13:00	9/2/98 14:30	1:30	770	2	Main channel, 80 cm deep pool.	6	2		3			11	4.00	1.33	0.00	2.00	0.00	0.00	7.33	
6	9/2/98 14:00	9/2/98 14:35	0:35	970	2	Main channel, in 30 cm tail-out of pool below "teepee pool".	2						2	3.43	0.00	0.00	0.00	0.00	0.00	3.43	
7	9/2/98 14:00	9/2/98 14:35	0:35	970	2	Main channel, in 1m deep "teepee pool", near cutbank and LWD.	9	2		5			16	15.43	3.43	0.00	8.57	0.00	0.00	27.43	
8	9/2/98 14:05	9/2/98 14:35	0:30	1020	2	Main channel, above "teepee pool", at mouth of trib in 30 cm water.	13			1			14	26.00	0.00	0.00	2.00	0.00	0.00	28.00	
9	9/2/98 14:05	9/2/98 14:35	0:30	1045	2	Trib entering at 1045 m, in shallow pool.	2	1					3	4.00	2.00	0.00	0.00	0.00	0.00	6.00	
	Total Watershed Catch Effort		17:23			Total Watershed # Capture	85	9	0	16	9	1	120	4.89	0.52	0.00	0.92	0.52	0.06	6.90	Total CPUE
	Reach 1 Catch Effort		13:43			Reach 1 # Capture	53	4	0	7	9	1	74	3.86	0.29	0.00	0.51	0.66	0.07	5.39	Reach 1 CPUE
	Reach 2 Catch Effort		3:40			Reach 2 # Capture	32	5	0	9	0	0	46	8.73	1.36	0.00	2.45	0.00	0.00	12.55	Reach 2 CPUE

Overview CPUEs are presented in Table 12. The Total and Coho CPUEs are both higher in reach 2, than in reach 1. Foote Creek had comparable or even slightly better CPUE values, when comparing reach and watershed CPUEs against other watersheds (Table 7 *Summary Report*).

4.3.2 Site-Specific Catch per Unit Effort (CPUE)

No pool site was yet chosen for this watershed, due to time constraints.

4.3.3 Site-Specific Juvenile Coho Fry Densities

No estimates of site-specific juvenile coho fry pool densities were completed on this watershed.

4.3.4 Fork Lengths

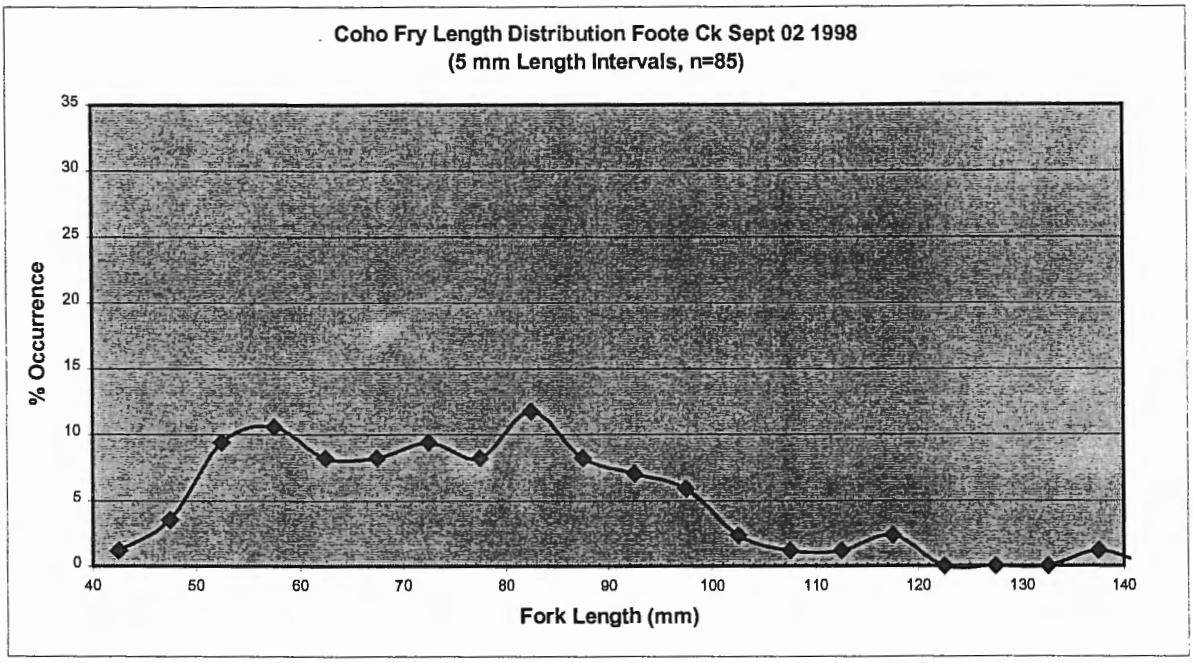


Figure 8 - Age-size Distributions - Foote Creek

There appeared to be less of a demarcation between 1st and 2nd year classes, and more 2nd year old coho juveniles than other watersheds' age-size distribution graphs (Figure 8). Due to the indistinct demarcation between 1st and 2nd year classes, percentages of 1st year old coho fry in the population was not calculated. The peak fork length of 1st year old coho fry was 55mm, and 82.5mm for 2nd year old coho fry. There even appeared to be 3rd, and possibly 4th year old coho fry in the population.

4.3.5 Weights

Coho fry weights were not recorded, and therefore fish condition factors and biomass calculations are not available.

4.3.6 Fish Condition Factors

Not calculated.

5. RESULTS AND DISCUSSION - HEAD CREEK WATERSHED

5.1 Background Review

915-765500-18600

5.1.1 General Watershed Description

Head Creek (DFO Watershed Code 97-9300-3760), located in Porcher Inlet on Porcher Island, flows northwest to the head of Porcher Inlet (Figure 10). It is a third order stream, 5.0 km in length, draining an area of 6.6 km^2. Head Creek is a higher gradient stream with an overall gradient of approximately 4% for the first 1.5 km, rising to approximately 7.5% for the next 1.4 km, and then rising past 25% after 3.9 km (Figure 9).

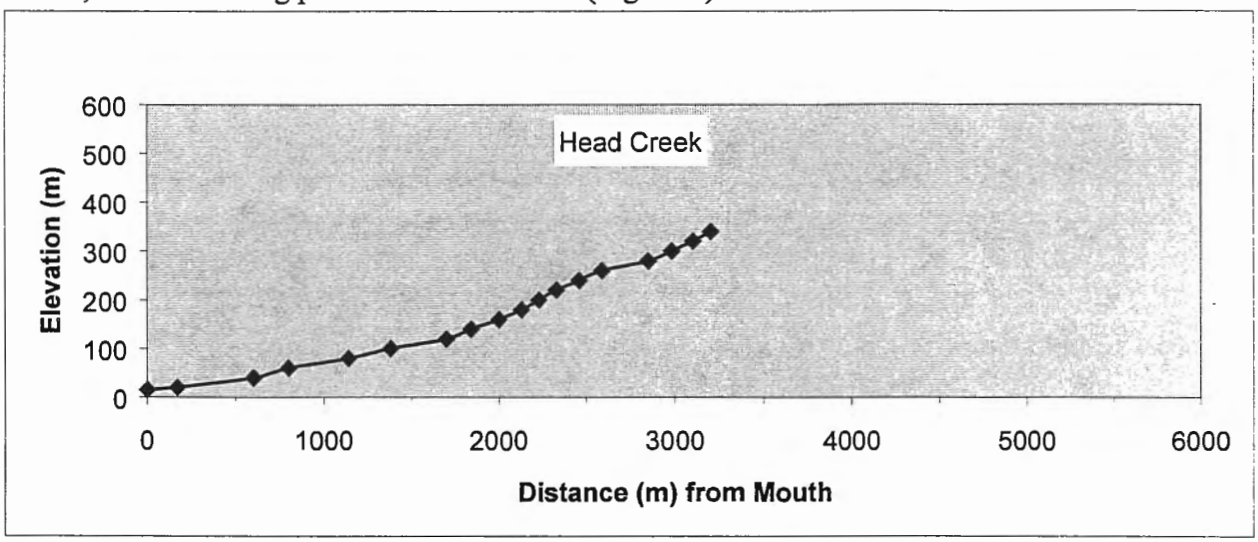


Figure 9 - Gradient Profile for Head Creek

5.1.2 Historical Fisheries Data

The Head Creek watershed contains three species of Pacific salmon, coho (*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*) and pink salmon (*Oncorhynchus gorbuscha*) (SISS, FISS). All species have been observed spawning in the lower 1.0 km, with quite substantial numbers of pink spawners (SISS, 1991). Resident cutthroat trout (*Oncorhynchus clarki* clarki), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present (Table 17).

Historical streamwalkers comments and observations are summarized in Table 13. Logging was completed in 1950, and there has been numerous logging-related impacts (*e.g.* scouring, etc.) since that time.

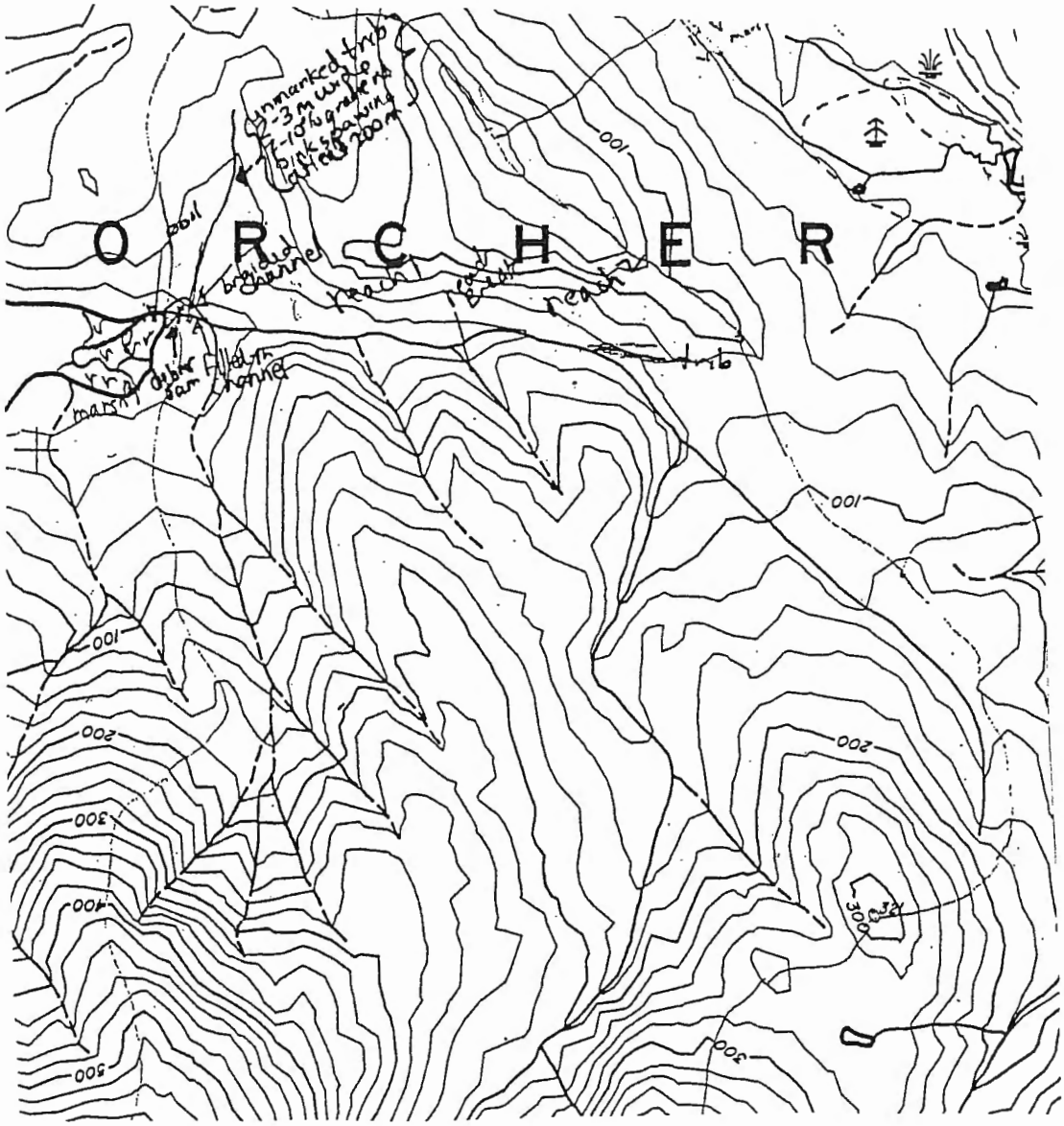


Figure 10 - Overview Map of Head Creek

Table 13 - Summary of Condensed Selected Historical Streamwalkers Comments - Head Creek

Year	Impacts/Comments
1950	Logging completed in watershed.
1951	Low water late August, log jams formed on mainstem.
1955	Low water late August, log jams formed on mainstem.
1958	Low water late August, log jams formed on mainstem.
1961-64	Low water levels late August.
1966-67	Low water levels late August, windfall trees in creek.
1970	Heavy seine fishing in area for 3 days.
1971	Windfall trees in creek.
1972	Low water levels in August, heavy seine fishing in area, very heavy pink returns.
1974	Low water levels in August, fishing closed Sept. 03.
1975	Fishing closed Sept. 01
1976-77	Low water late August, log jams formed on mainstem.
1978	Windfall trees in creek.
1979	Low water late August.
1980	Porcher Inlet commercial catch is 50,000 pink with 24 seines + 8 gillnets. Inlet closed.
1981	Low water levels late August, windfall trees in creek.
1982	Windfall trees in creek.
1983	Bank erosion noticeable.
1984	Low water late August and in winter.
1985-87	Low water late August.
1988	Streambed scouring.
1989	Low water late August, log jams formed on mainstem.
1990	Low water late August.
1992	Low water late August, early September.
1993	Low water whole season.

The escapement data for coho salmon in Head Creek are presented in Figure 11. These data indicate that the coho returns to Head Creek are fairly small, although escapement data is discontinuous and possibly unreliable. Escapement data is only available for the following years: 1958, 1967-68, 1975, 1978-80, 1984, 1986-88, 1991, 1993, and 1996.

It is difficult to make any realistic correlations or assumptions pertaining to Head Creek escapement data, given the lack of recorded data. 1958, 1968, 1975, 1978, and 1986 were years that had above average numbers of adult coho returns to Head Creek, but there are very few other years with recorded escapement data.

Porcher Inlet, including Head Creek, is included in the Department of Fisheries and Oceans (DFO) Area 5. Escapement data for Area 5 (Figure 6 *Summary Report*) and the Porcher Inlet Subarea (Figure 8 *Summary Report*) show high returns from the mid-1950's to 1968.

1966 was a peak year for coho returns for all areas (Figure 11, Figures 4-9 *Summary Report*).

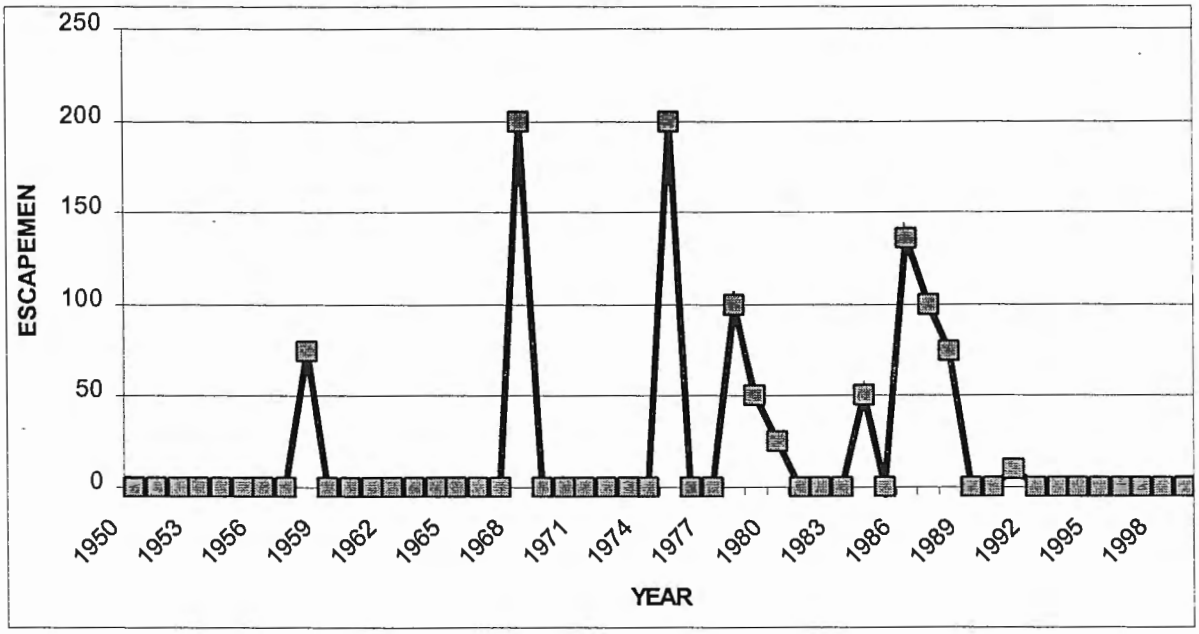


Figure 11 - Historical Coho Escapement - Head Creek

5.2 Overview Level Watershed Survey

The physical characteristics of the three reaches of Head Creek, including channel morphology, gradient, widths and substrate composition are presented in Table 14. Habitat parameters for Reach 1 of Head Creek, were calculated and these parameters are presented in Table 15.

Table 14 - Physical Characteristics for Reaches in Head Creek 1998

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-980)	Riffle-Run	~4	9.7±3.1	5.2±1.1	Cobble	Gravel

Table 15 - Habitat Parameters for Reaches in Head Creek Calculated from Overview Habitat Survey 1998

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	>50
1 (0-980)	31.3	F	6.6	P	1.3	F	1.1	17.7	56.6	25.7

Notes: Reach 2 not yet entirely surveyed and not included.

Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Head Creek had riffle-run morphology with the substrate mainly composed of large gravels and small cobbles, with minor amounts of fines (mostly sand). A qualitative assessment of the reach indicated that adult holding and juvenile overwintering habitat was somewhat limited. Juvenile summer rearing habitat was available in the lower part of this reach, but overwintering habitat was limited. Coho spawning habitat was present, especially in the upper part of the reach, while pink spawning habitat predominated in the lower part of the reach. Overall, there was a low availability of adult holding and juvenile overwintering pools except for LWD-induced pools at the downstream side of small debris jams. There is a moderate infilling of the deepest pools by inputs of bedload.

Additionally, there is evidence of shifting of the historic channel at 355 m where bedload built-up behind a debris jam, causing the channel to reroute to the north around the debris pile (Figure 10).

The lower end of Head Creek was extensively logged for 870 m above the mouth, possibly from the pre-1950 logging operations (Table 13). There has been considerable streambed and streambank erosion in the lower end of this creek, and the erosion also extends into the estuary where old cut stumps are still visible in the intertidal grass flats. The estuary may have since expanded up into the lower 180 m of the stream after the lower streambed eroded from past logging effects. Old cut stumps are visible along the bank, and in the channel where the channel has shifted downstream of the debris jam at 355 m.

The lowest 600 m of this watershed consists of LWD jams, extensive riffles, extensive channel braiding, and frequent sediment wedges. The channel is largely unconfined, but the streambanks become steeper and confine the channel at the upper end of the reach. Adult pink and coho salmon were found throughout the system, but the pink salmon numbers were the highest near the stream mouth, and were even 200 m up a small, high gradient tributary (unmarked) north of and near the mouth of Head Creek.

The percent of pools by channel area was 31.3% (Table 15), indicating that this reach is rated as '*fair*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Head Creek (2-5% gradient and <15m width) require over 40% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*poor*' with a pool every 6.6 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of only 0.68m.

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were only 1.3 pieces of LWD per channel width (Table 15), a '*fair*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, only 25.7% of the total LWD pieces are greater than 50 cm in diameter.

Reach 1 has a riparian species composition of hemlock, spruce and western red cedar, in that order. Most of the riparian vegetation of the upper part of the reach is older, mature trees, with a regenerating, coniferous understory of younger trees, where the lower part of the reach has younger, mainly coniferous growth with a dense understory of deciduous bushes.

Table 16 summarizes the impacts for reach 1 of Head Creek.

Table 16 - Reach Descriptions and Impacts - Head Creek

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-980	Reach 1: frequent LWD jams and sediment wedges, extensive riffles and channel braiding.
1	355	Old channel infilled with bedload.

5.3 Minnow-trapping Data

5.3.1 Overview Catch per Unit Effort (CPUE)

Comparing overview catch per unit effort results (Table 17) between reaches: reach 2 had nearly 10 times the coho CPUE values of reach 1, and nearly 6 times the total CPUE values of reach 1. These results would be expected, given the impacted and infilled pool habitat in reach 1.

5.3.2 Site-Specific Catch per Unit Effort (CPUE)

The pool site chosen was had roughly equivalent juvenile coho rearing habitat as reach 1, although reach 2 of the watershed had slightly better juvenile rearing habitat than the site. The pool site chosen ranked 7th (coho CPUE) and 14th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 1 ranked 15th (Coho CPUE) and 17th (Total CPUE), where reach 2 ranked 4th (both Coho and Total CPUE) of 49 overview CPUE values.

5.3.3 Site-Specific Juvenile Coho Fry Densities

We were unable to find a single large pool to perform juvenile coho fry density estimation in the section of the watershed surveyed to date. Instead, several small pools were concurrently surveyed, and the results combined in order to estimate juvenile coho fry densities.

Site 1 (summary of sites 1A, 1B and 1C) Head Creek (Figure 12), was calculated to have a density of 0.84 ($^{+}$/- 0.12) coho fry per m^2 of pool area (Table 10 *Summary Report*). This was an average estimated density compared to other sampled watersheds, but it is still below the expected density of 1-2 coho fry per m^2 of pool area.

Table 17 - Overview Catch per Unit Effort Results - Head Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/3/98 10:00	9/3/98 16:50	6:50	395	1	Main channel, in shallow LWD pool.	4				9		13	0.59	0.00	0.00	0.00	1.32	0.00	1.90	
2	9/3/98 10:10	9/3/98 16:45	6:35	430	1	Main channel, in deep LWD pool.	1				37		38	0.15	0.00	0.00	0.00	5.62	0.00	5.77	
3	9/3/98 10:20	9/3/98 16:40	6:20	510	1	Main channel, in 70 cm deep cutbank/LWD pool.	6						6	0.95	0.00	0.00	0.00	0.00	0.00	0.95	
4	9/3/98 10:35	9/3/98 16:30	5:55	525	1	Main channel, in deep LWD pool.					11		11	0.00	0.00	0.00	0.00	1.86	0.00	1.86	
5	9/3/98 10:35	9/3/98 16:30	5:55	540	1	Off main channel, in shallow LWD pool, low flow.	23				12		35	3.89	0.00	0.00	0.00	2.03	0.00	5.92	
6	9/3/98 11:00	9/3/98 16:00	5:00	610	1	Main channel, in shallow wetted area.	25	1					26	5.00	0.20	0.00	0.00	0.00	0.00	5.20	
7	9/3/98 12:00	9/3/98 15:00	3:00	925	1	Off main channel, in shallow LWD side pool.	21	3		7			31	7.00	1.00	0.00	2.33	0.00	0.00	10.33	
8	9/3/98 12:00	9/3/98 15:00	3:00	925	1	Off main channel, in shallow LWD side pool.	23						23	7.67	0.00	0.00	0.00	0.00	0.00	7.67	
9	9/3/98 13:20	9/3/98 13:40	0:20	1310	2	Main channel, in shallow cutbank/LWD pool.	4			1			5	12.00	0.00	0.00	3.00	0.00	0.00	15.00	
10	9/3/98 13:20	9/3/98 13:40	0:20	1310	2	Main channel, in shallow cutbank/LWD pool.	11	1					12	33.00	3.00	0.00	0.00	0.00	0.00	36.00	
	Total Watershed Catch Effort		43:15			Total Watershed # Capture	118	5	0	8	69	0	200	2.73	0.12	0.00	0.18	1.60	0.00	4.62	Total CPUE
	Reach 1 Catch Effort		42:35			Reach 1 # Capture	103	4	0	7	69	0	183	2.42	0.09	0.00	0.16	1.62	0.00	4.30	Reach 1 CPUE
	Reach 2 Catch Effort		0:40			Reach 2 # Capture	15	1	0	1	0	0	17	22.50	1.50	0.00	1.50	0.00	0.00	25.50	Reach 2 CPUE

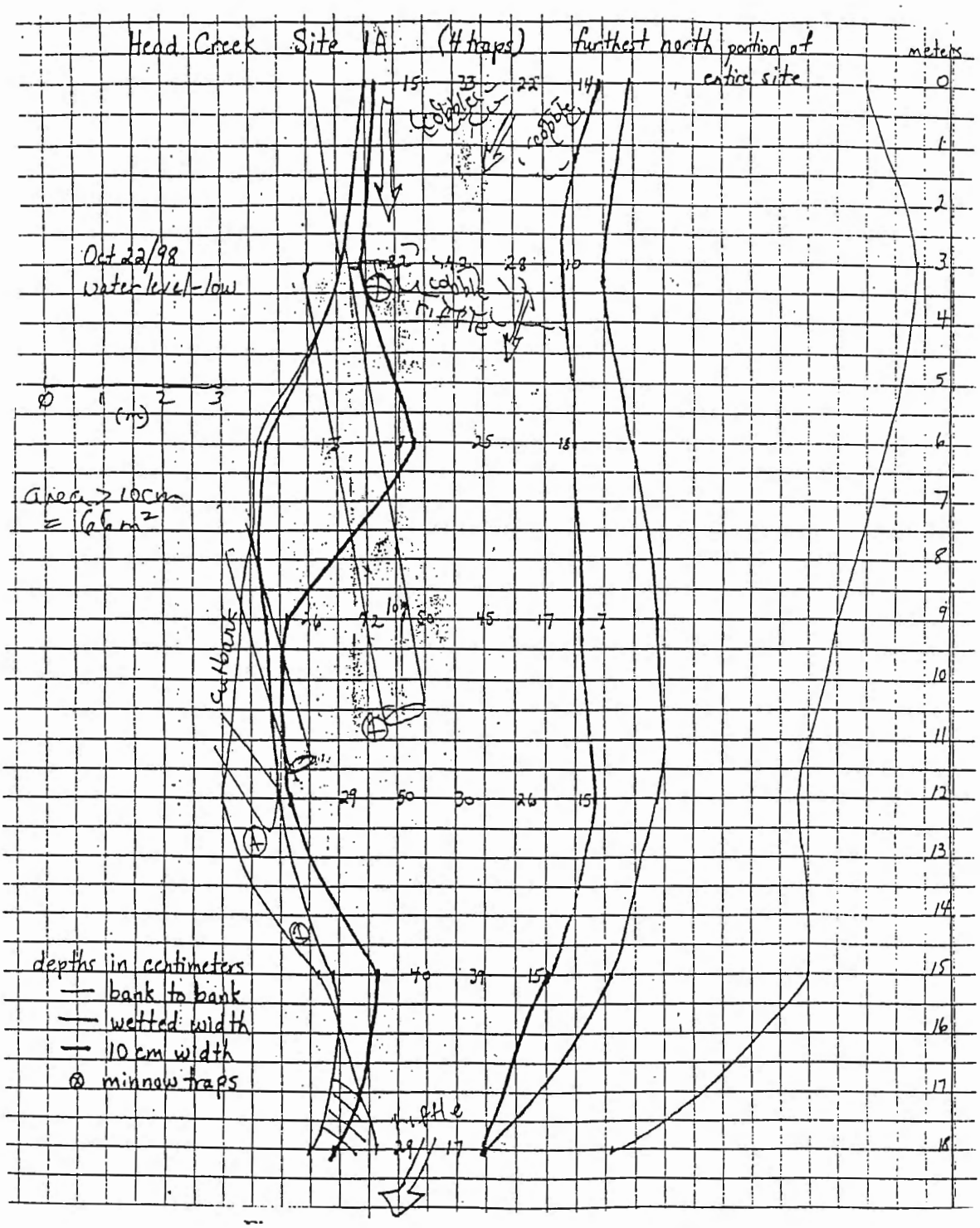


Figure 12 - Detailed Drawing - Site 1A - Head Creek

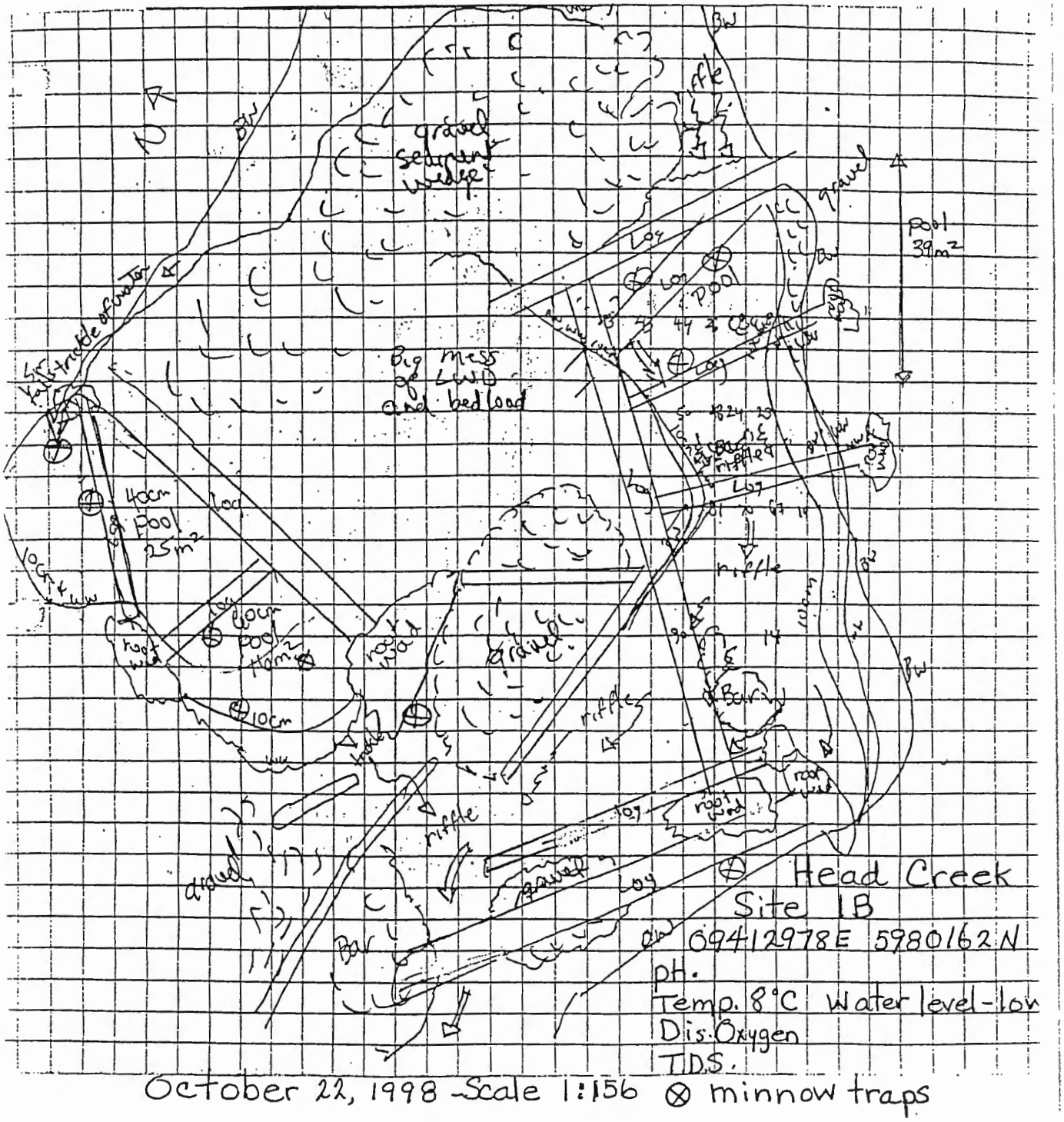


Figure 13 - Detailed Drawing - Site 1B - Head Creek

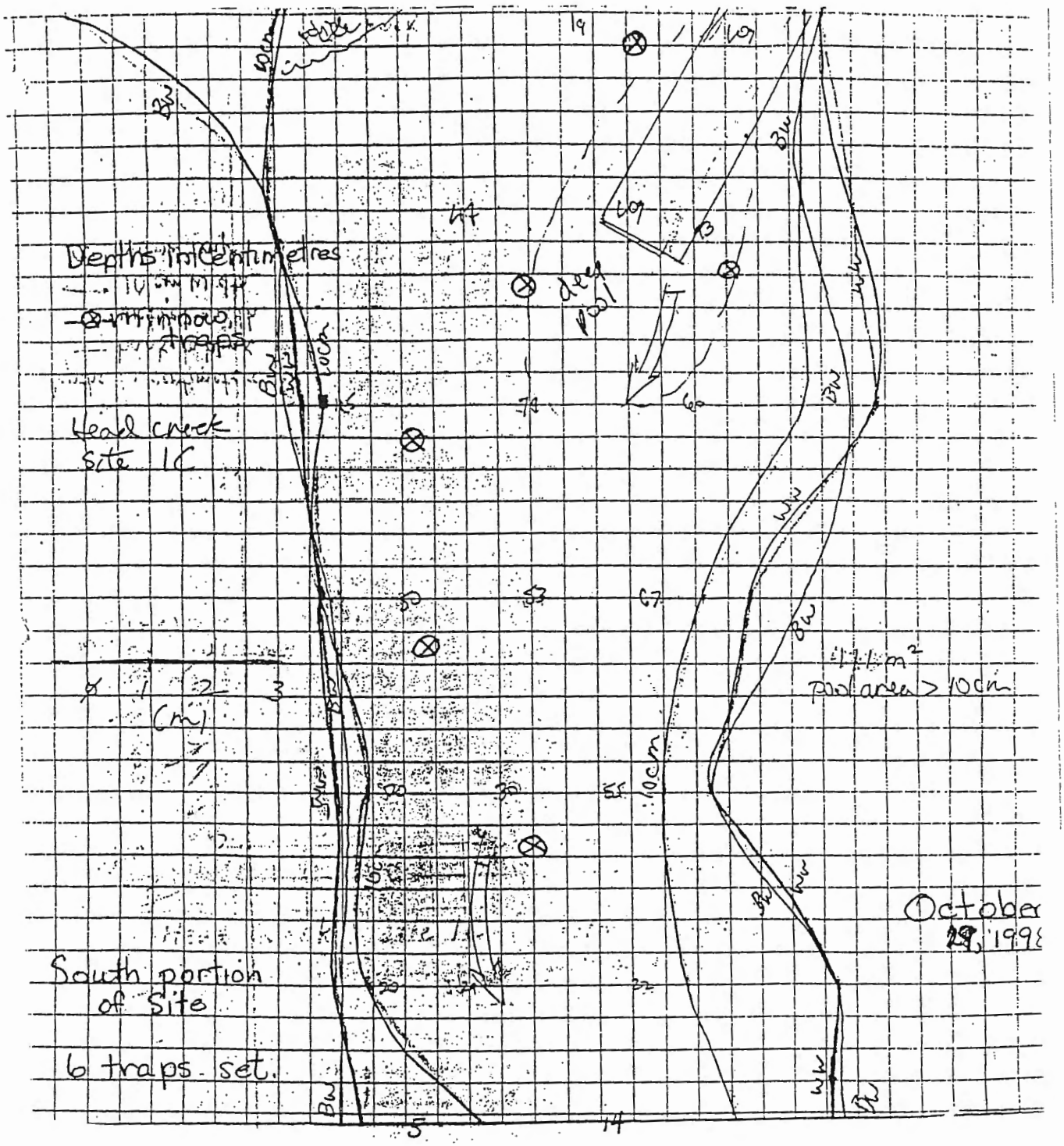


Figure 14 - Detailed Drawing - Site 1C - Head Creek

5.3.4 Fork Lengths

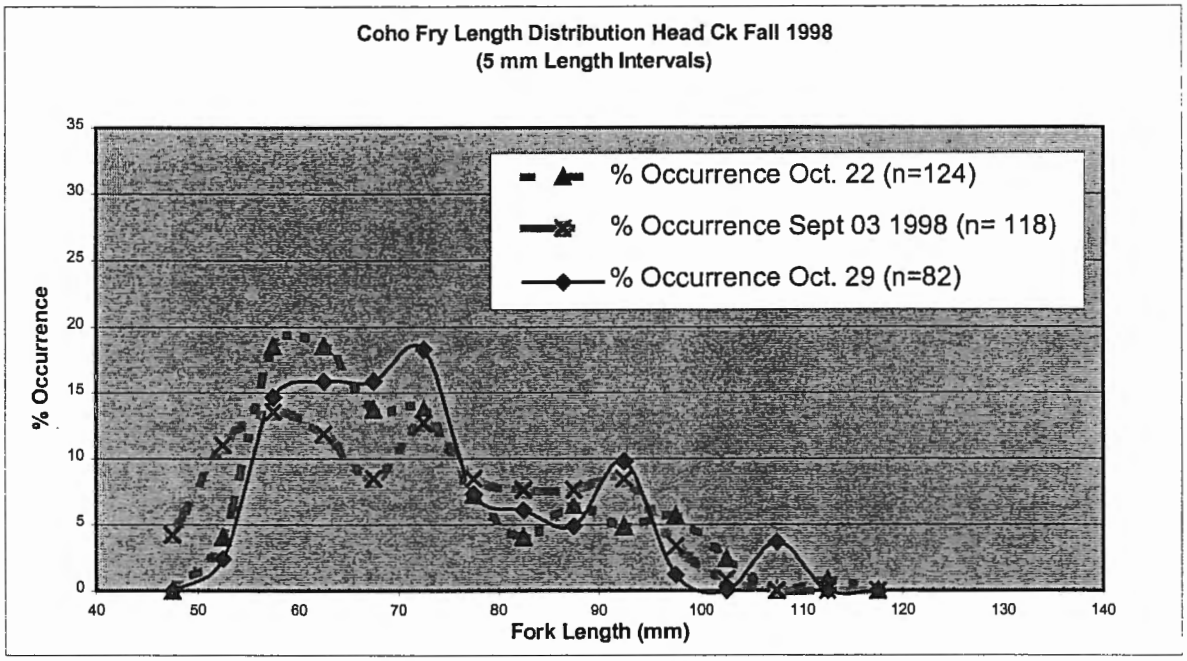


Figure 15 - Age-size Distributions - Head Creek

Foote Creek age-size distribution patterns (Figure 15); similar to Kumealon, Porcher, and Wolf Creeks, and Oona and Pa-aat Rivers age-size distribution patterns, exhibit very strong bimodal peaks for each age-class. This pattern of bimodal peaks for coho fry age-classes is probably due to the staged recruitment from the distinct early and late runs of adult coho spawners in these systems.

It is difficult to assess if low early fall water flows have an impact on the separation between early and late runs of returning coho adults; but all of the sampled watersheds in Porcher Inlet, which are chronically subject to low flow conditions (Table 3 *Summary Report*), strongly exhibit this phenomenon of bimodal coho fry distributions.

5.3.5 Weights

Coho fry weights were recorded on October 22, and then were plotted against fork lengths (Figure 15). This information was then used to calculate fish condition factors.

As well, this information was used in order to estimate current biomass as a percentage of expected carrying capacity of the pool site. Head Creek site 1 was found to have the current estimated pool biomass as 67.0% of the expected coho carrying capacity (Table 13 *Summary Report*).

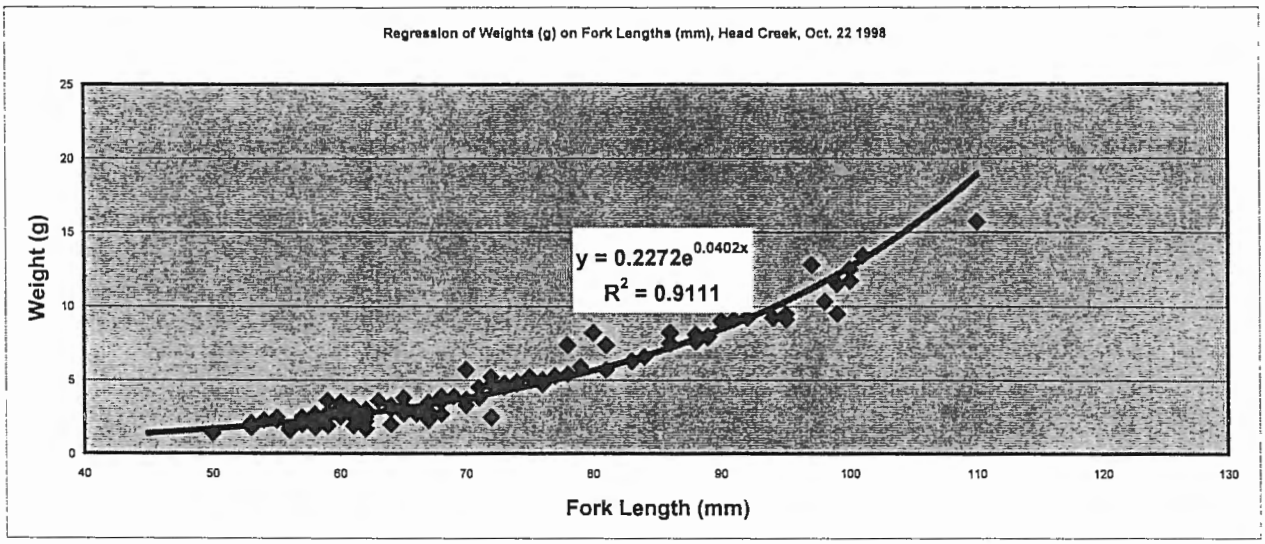


Figure 16 - Regression of Coho Fry Weights on Fork Lengths - Head Creek

5.3.6 Fish Condition Factors

The overall average watershed fish condition factor was calculated to be 1.18 (+/- 0.20) on October 22, 1998 (Table 14 and Figure 13 *Summary Report*).

6. RESULTS AND DISCUSSION - MOORE COVE CREEK WATERSHED

6.1 Background Review

910-779100

6.1.1 General Watershed Description

Moore Cove Creek (DFO Watershed Code 91-9895-200), located in Telegraph Passage between the north end of Grenville Channel and the Skeena River, flows northwest to the head of Porcher Inlet (Figure 19). It is a fourth order stream, 12.5 km in length, draining an area of 36.5 km^2.

Moore Cove Creek has a short 300 m section at the mouth with 7% gradient, an overall gradient of ~0.5% for the next 4.0 km, a higher gradient section of 4% for the next 1.7 km, a short high gradient section of ~27% at ~6.1 km, a lower gradient section of ~1% between 6.1 and 10.8 km containing a lake, ending with a high gradient of ~33% to its' termination at 12.5 km (Figure 17).

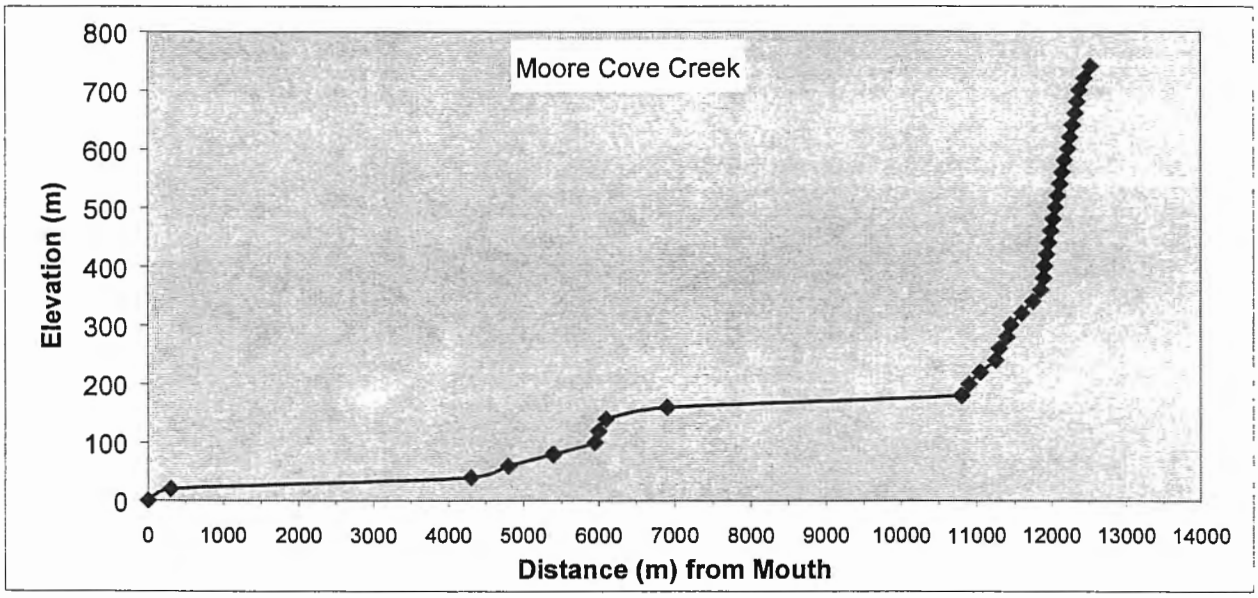


Figure 17 - Gradient Profile for Moore Cove Creek

Moore Cove Creek has a large, high gradient tributary, John Campbell Creek, which joins at 5.2 km. John Campbell Creek (Figure 18) has a gradient of 4.5% for the first 1300 m, then has a gradient of 17.5% for the next 1 km, and has an overall gradient of 15% until its' termination at 4.6 km. John Campbell Creek drains an area of 7.4 km^2.

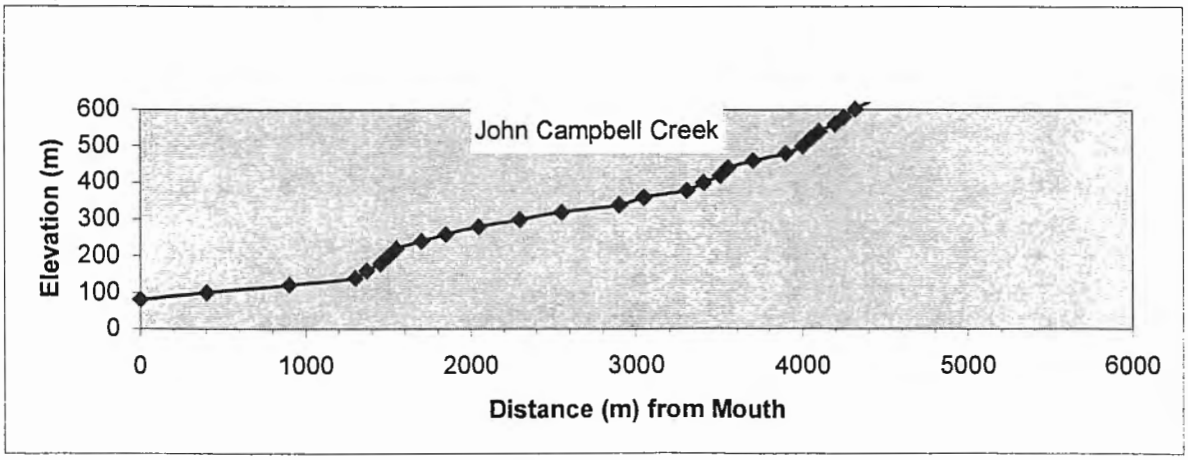


Figure 18 - Gradient Profile for John Campbell Creek

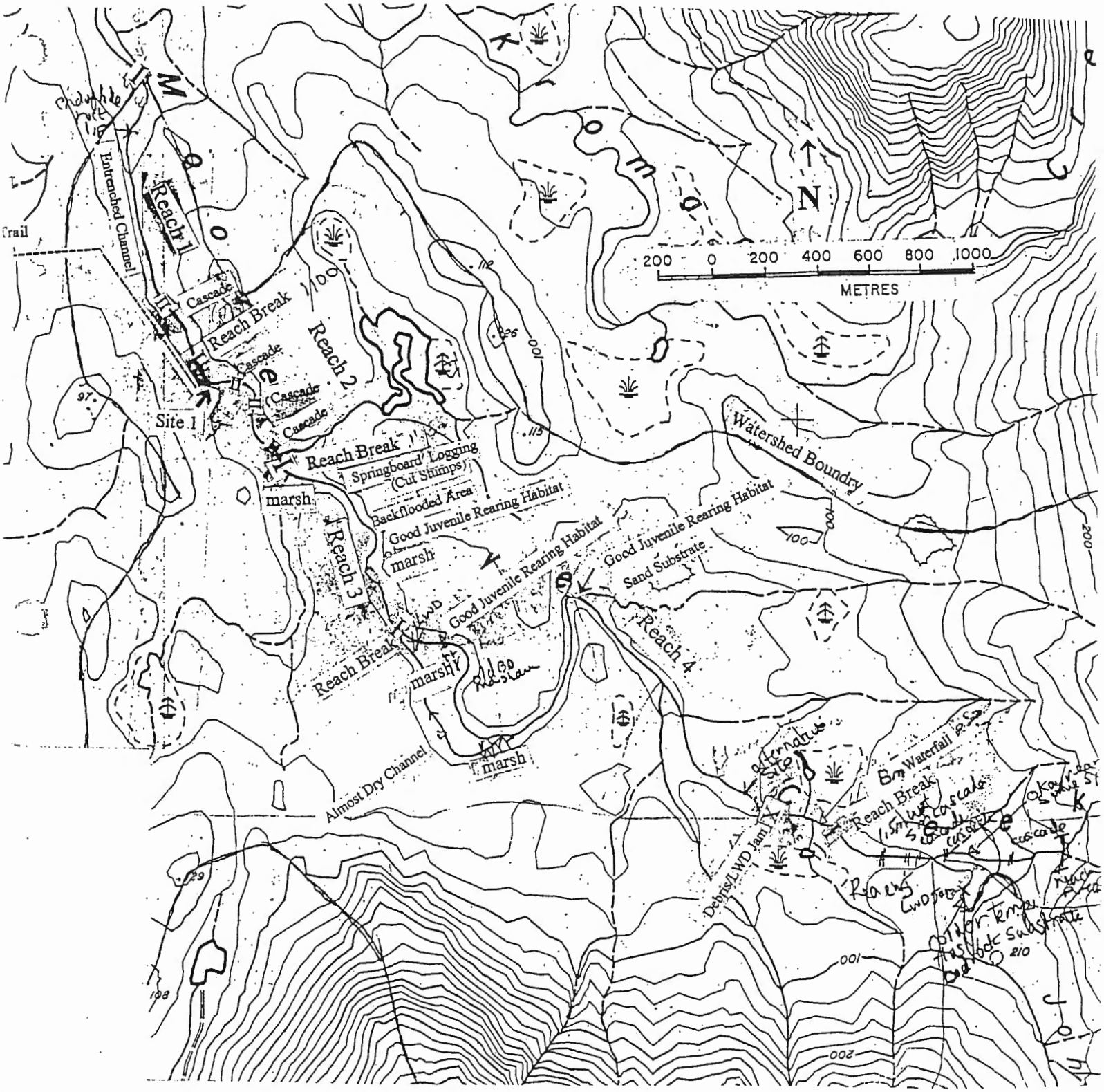


Figure 19 - Overview Map of Moore Cove Creek

6.1.2 Historical Fisheries Data

The Moore Cove Creek watershed contains three species of Pacific salmon, coho (*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*) and pink salmon (*Oncorhynchus gorbuscha*) (SISS, FISS). Resident cutthroat trout (*Oncorhynchus clarki* clarki) and rainbow trout (*Oncorhynchus mykiss*) are also present (Table 22 and Table 23). Anadromous salmonids can access only the lowest 4.8 km of this watershed, as there is an impassable 8 m waterfall at ~4.2 km. Resident cutthroat trout (*Oncorhynchus clarki* clarki) were found in John Campbell Creek and above the waterfall on Moore Cove Creek. Trout juveniles were noted at the current Interfor road crossing on the large tributary to the west of John Campbell Creek.

Historical streamwalkers comments and observations are summarized in Table 18.

Table 18 - Summary of Condensed Selected Historical Streamwalkers Comments - Moore Cove Creek

Year	Impacts/Comments
1949	Wooden fish ladder installed at lowest falls.
1956	Obstructions on both forks (Moore Cove and Kromann Creeks) largely eliminated.
1957	Low water late August.
1961	Some loss of early run fish due to low water levels.
1963	Low water until early September. Some prespawn die-off.
1964	Low water late August, early September. Prespawn pink die-off
1965	Low water September. Guardian transported 3600 fish over falls.
1967	Logging to within ¼ mile of stream.
1968	Blasted falls at mouth.
1973	Low pink returns.
1974	Low water August, high water October.
1975	Cascades in lower 3.2 km of river blasted.
1976	Low water late August. High flows and turbid water impaired escapement estimation.
1978	High water in November with streambed scouring.
1981	Abundance of coho fry during summer inspection.
1983	Removed guardian cabin.
1984	Low water and freezing early November.
1986	Low water late August, ~6000 prespawn pink die-off.
1992	Low water and freezing early November.

The escapement data for coho salmon in Moore Cove Creek are presented in Figure 20. These data indicate that the coho returns to Moore Cove Creek are fairly substantial, when reported, although escapement data is discontinuous and possibly unreliable. Escapement data is only available for the following years: 1950, 1951, 1955, 1961, 1966-74, 1987, and 1990.

It is difficult to make any realistic correlations or assumptions pertaining to Moore Cove Creek escapement data, given the lack of recorded data. 1961, 1966, and 1968/69 were years that had above average numbers of adult coho returns to Moore Cove Creek, but there are very few other years with recorded escapement data. It appears that this watershed can support adult spawner returns of above 7000 coho, although the past few years probably had less than 400 adult coho spawners return.

Moore Cove Creek, is included in the Department of Fisheries and Oceans (DFO) Area 4 (Figure 4 *Summary Report*) and the Coastal Subarea (Figure 5 *Summary Report*). Escapement data for Area 4 show high returns from the mid-1950's to 1968, with a decline in escapement numbers from 1968 to 1983, a period of high variability from 1983 to 1995, and another steep decline in escapement numbers to the present. Escapement data for Coastal Subarea 4 show lower escapement numbers during the mid-1950's to 1968, but are similar to Area 4 escapement numbers for the remainder of the escapement data.

1966 was a peak year for coho returns for all areas (Figure 20, and Figures 4-9 Summary Report).

Moore cove Creek can support large runs of pink salmon of over 120,000 spawners.

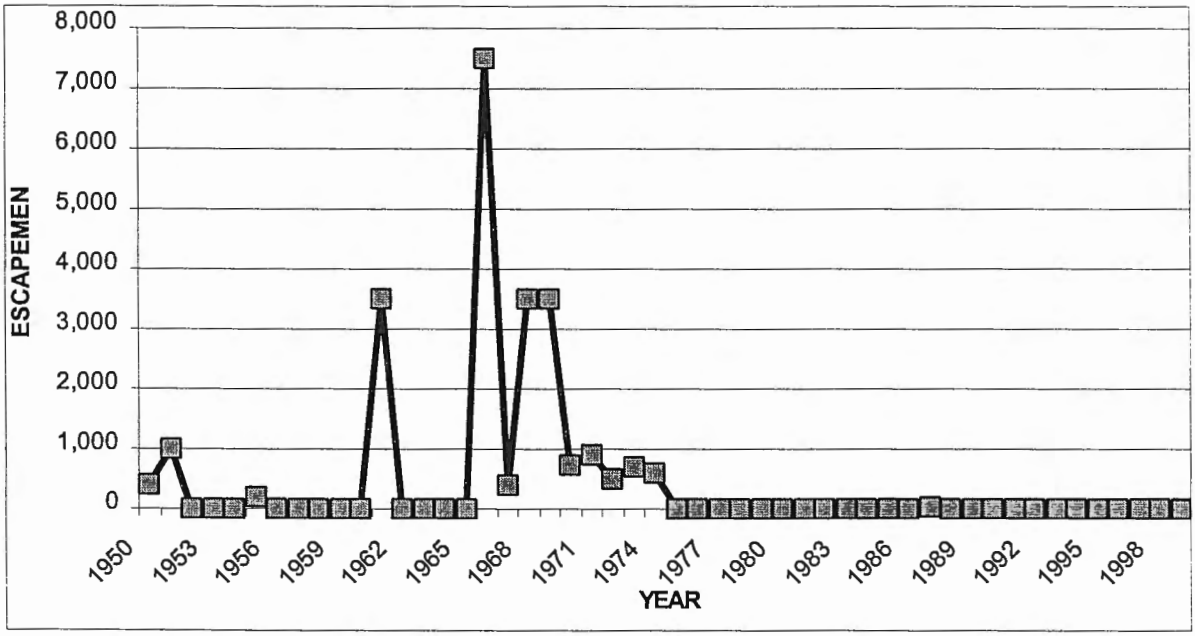


Figure 20 - Historical Coho Escapement - Moore Cove Creek

6.2 Overview Level Watershed Survey

The physical characteristics of five reaches of Moore Cove Creek, including channel morphology, gradient, widths and substrate composition are presented in Table 19. Habitat parameters for Reaches 2 and 5 of Moore Cove Creek were calculated and these parameters are presented in Table 20.

Table 19 - Physical Characteristics for Reaches in Moore Cove Creek 1998

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-1100)	Step-Pool/Chutes	5-7	UK	UK	Bedrock	Boulder
2 (1100-1600)	Riffle-Pool	1-2	17.0±4.2	16.5±4.4	Sand	Gravel
3 (1600-2300)	Riffle-Pool	0.5	UK	UK	Mud	Sand
4 (2300-4200)	Riffle-Pool	2-3	UK	UK	Gravel	Sand
5 (4200-5050)	Cascade-Pool	3-4	10.5±2.3	8.7±2.8	Bedrock	Gravel

Table 20 - Habitat Parameters for Reaches in Moore Cove Creek Calculated from Overview Habitat Survey 1998

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
2	28.5	P	6.2	P	0.7	P	0.7	8.3	66.7	25
5	9.1	P	20.6	P	0.4	P	0.4	11.1	89.9	0

Notes: Reaches 1, 3 & 4 not yet surveyed.
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Moore Cove Creek had step-pool morphology with the substrate mainly composed of bedrock and boulders (Table 19). There were short sections of cascades and chutes interspersed with step-pools. There was evidence that during high water flood events that the water level rises by as much as 3 m, by observing the height of permanent moss and brush cover. The channel is entrenched. It would be expected that the few, sparse LWD jams would persist only over the low flow period, as there would be considerable hydraulic forces that would scour this reach in high flood periods. There is a natural rock barrier at the end of the reach that delineates the level of the high tide, which may have been blasted to improve fish passage in the past.

A qualitative assessment of the reach indicated that the habitat in this reach would be seasonably suitable for marginal trout and char rearing only. There would be considerable hydraulic forces in this reach during flood events that would be expected to dislodge fish populations.

Reach 2

Reach 2 of Moore Cove Creek had riffle-pool morphology with the substrate mainly composed of sand and gravel (Table 19). Reach 2 had good fish habitat, providing excellent juvenile rearing habitat and good spawning habitat. Large numbers of pink salmon spawn in the riffles and some coho salmon also spawn in the tail-outs of the large pools. It is likely that trout and char utilize the smaller gravels in the pools for spawning, also. There were also adequate adult holding pools, although it was noted that black bears congregate at the cascades, taking salmon migrating upstream of the cascades. The substrate was largely sands and gravels (Table 19), and the banks appeared stable with adequate amounts of large coniferous riparian trees.

In this reach, pools were moderately abundant, with a percentage of pools per channel area of 28.5%, however; this is still considered '*poor*'. The number of pools per channel width was poor at 6.2 (Table 20). The maximum and residual pool depths were deep at 2.7 m and 2.2 m, respectively. The abundance of bedrock outcrops in Reach 2 has likely played a role in creating these larger and deeper pools as there was not a large quantity of LWD, possibly due to the expected high water flows during flood events. Only 0.7 pieces of LWD per channel width are present in Reach 2, with 25% of this being greater than 50 cm in diameter.

Reach 3

Reach 3 of Moore Cove Creek had riffle-pool morphology (back-flooded) with the substrate mainly composed of mud and sand (Table 19). Reach 3 had the best juvenile overwintering habitat found in the watershed and excellent adult holding habitat, due to the depth of water and adequate LWD and cutbank cover. It would be expected that it would provide only fair rearing habitat, as it would be expected that there is considerable competition from resident cutthroat trout. Reach 3 would also be very poor spawning habitat due to the accumulation of fine substrate. Pondweeds (*Potomogeten* spp.) and sedges (*Carex* spp.) were noted. There was evidence of low-intensity springboard logging on the East bank, as old cut stumps were noted. There was also evidence of beaver activity.

Reach 4

Reach 4 of Moore Cove Creek had riffle-pool morphology with the substrate mainly composed of gravel and sand (Table 19). Reach 4 had numerous LWD jams, and multi-channels throughout the reach. The lower end of reach 4 was similar to reach 3 (back-flooded overwintering habitat), except for the numerous LWD jams and channel avulsions and braiding. Reach 4 gradually changed from a backflooded overwintering habitat to a riffle-pool habitat containing smaller pools with extensive gravel riffles and sediment wedges, and unstable banks and ending in a confined channel. There appeared to be adequate juvenile rearing habitat, especially at the mouths of the numerous tributaries. There was poor spawning habitat at the start of the reach, which graded into excellent spawning habitat towards the end of the reach. Large numbers of pink salmon were noted spawning in the extensive gravel riffles at the downstream side of LWD jams, while coho salmon were noticed holding and spawning in the pools. There is an impassable 8 m waterfall at the end of this reach at ~4.2 km.

Reach 5

Reach 5 of Moore Cove Creek had cascade-pool morphology with the substrate mainly composed of bedrock and gravel (Table 19). Reach 5 had numerous cascades and waterfalls, with steep and undercut banks throughout the reach. There appeared to be adequate trout and char rearing and spawning habitat, especially at upper end of the reach. Since there is an impassable 8 m waterfall at the start of this reach at ~4.2 km, this reach is not utilized by anadromous salmon, and only cutthroat trout were found to be present. The mainstem (which drains the lake) was found to have warmer water than John Campbell Creek, although trout were found in all tributaries.

The percent of pools by channel area was 9.1%, indicating that this reach is rated as '*poor*' for this habitat parameter. According to Johnston and Slaney (1996), streams with >5% gradient and <15m width require over 20% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*poor*' with a pool every 20.6 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Given the cascade-pool morphology and higher gradient of this reach, it would not be expected to be prime fish habitat with large, frequent pools.

LWD provides structure and stability to the stream as well as creating habitat and providing cover, especially in lower gradient streams. In Reach 1, there were only 0.4 pieces of LWD per channel width (Table 20), a '*poor*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, none (0%) of the total LWD pieces were greater than 50 cm in diameter. Again, it would be expected that given the cascade-pool morphology and higher gradient of this reach, LWD would not substantially function within the stream.

Table 21 summarizes the descriptions for the reaches of Moore Cove Creek. Moore Cove Creek is largely not impacted by past logging, although there was some evidence of springboard logging in reach 3. It may be that the combination of difficult access to this watershed via a long tidal estuary, and difficulty transporting cut logs either over the hills at the mouth or through the narrow gorge of reach 1, may have made past logging operations less attractive for this watershed.

Table 21 - Reach Descriptions - Moore Cove Creek

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-1100	Step-Pool/Chutes: poor salmon habitat overall: entrenched, short sections of cascades and chutes interspersed with step-pools.
2	1100-1600	Riffle-Pool: excellent juvenile rearing habitat, good spawning habitat, and adequate adult holding pools.
3	1600-2300	Riffle-Pool: excellent juvenile overwintering and adult holding habitat, fair rearing habitat, very poor spawning habitat.
4	2300-4200	Riffle-Pool: adequate juvenile rearing and adult spawning habitat: extensive riffles, channel braiding and avulsions, and frequent sediment wedges and LWD jams, unstable banks.
5	4200-5050	Cascade-Pool: trout habitat only: numerous cascades and waterfalls, with steep and undercut banks.

6.3 Minnow-trapping Data

6.3.1 Overview Catch per Unit Effort (CPUE)

Comparing overview catch per unit effort results (Table 22 and Table 23) between reaches: reach 2 had nearly 32.8 times the Total CPUE values of reaches 4 and 5, and a Coho CPUE value 14 times larger than reach 4, while no coho were captured in reach 5 due to the inaccessible waterfall at the reach 4/5 barrier. Even the cutthroat (CT) CPUE of reach 2 was 10.9 times larger than the CT CPUE value for reach 5, again indicating the better overall habitat in reach 2.

Table 22 - Overview Catch per Unit Effort Results - Reach 2 - Moore Cove Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in side pool, 70 cm depth.	8		2				10	19.20	0.00	4.80	0.00	0.00	0.00	24.00	
2	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in side pool, 80 cm depth.	19	1	1				21	45.60	2.40	2.40	0.00	0.00	0.00	50.40	
3	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in small bedrock scour pool beneath cascade/falls, 60 cm depth.	3						3	7.20	0.00	0.00	0.00	0.00	0.00	7.20	
4	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in large pool underneath log, 60 cm depth.	30	9	8				47	72.00	21.60	19.20	0.00	0.00	0.00	112.80	
5	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in cutbank above cascade/falls, 50 cm depth.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in cutbank above cascade/falls, 50 cm depth.	13	12	3	1			29	31.20	28.80	7.20	2.40	0.00	0.00	69.60	
7	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in cutbank above cascade/falls, 50 cm depth.	2	2	2				6	4.80	4.80	4.80	0.00	0.00	0.00	14.40	
8	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in cutbank below cascade/falls, 50 cm depth.	40	18	5	3			66	96.00	43.20	12.00	7.20	0.00	0.00	158.40	
9	9/11/98 11:00	9/11/98 11:25	0:25	633	2	Main channel, in large pool, 100 cm depth.	9	3	6	3			21	21.60	7.20	14.40	7.20	0.00	0.00	50.40	
	Reach 2 Catch Effort		3:45			Reach 2	124	45	27	7	0	0	203	33.07	12.00	7.20	1.87	0.00	0.00	54.13	Reach 2 CPUE

Table 23 - Overview Catch per Unit Effort Results - Reaches 4 & 5 - Moore Cove Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/23/98 10:15	9/23/98 16:00	5:45	Bridge	5	Tyke Lake Creek at Bridge		3					3	0.00	0.52	0.00	0.00	0.00	0.00	0.52	
2	9/23/98 10:30	9/23/98 15:50	5:20	Bridge	5	High Gradient Trib. At bridge		2					2	0.00	0.38	0.00	0.00	0.00	0.00	0.38	
3	9/23/98 10:35	9/23/98 15:35	5:00	Bridge	5	High Gradient Trib. At bridge		16					16	0.00	3.20	0.00	0.00	0.00	0.00	3.20	
4	9/23/98 10:35	9/23/98 15:30	4:55	445	5	Junction with Tyke Lake trib.		7					7	0.00	1.42	0.00	0.00	0.00	0.00	1.42	
5	9/23/98 10:45	9/23/98 15:25	4:40	535	5	Main channel, bedrock pool above upper falls		12					12	0.00	2.57	0.00	0.00	0.00	0.00	2.57	
6	9/23/98 11:15	9/23/98 14:55	3:40	610	5	Main channel, bedrock pool, below cascades.		1					1	0.00	0.27	0.00	0.00	0.00	0.00	0.27	
7	9/23/98 11:40	9/23/98 14:50	3:10	790	4	Main channel, bedrock pool, below lower falls.	5	1					6	1.58	0.32	0.00	0.00	0.00	0.00	1.89	
8	9/23/98 11:45	9/23/98 14:35	2:50	1275	4	Main channel, bedrock pool.	1						1	0.35	0.00	0.00	0.00	0.00	0.00	0.35	
9	9/23/98 12:40	9/23/98 14:25	1:45	1457	4	Main channel, bedrock pool.	12						12	6.86	0.00	0.00	0.00	0.00	0.00	6.86	
10	9/23/98 13:00	9/23/98 14:10	1:10	1658	4	Main channel, bedrock pool.	3						3	2.57	0.00	0.00	0.00	0.00	0.00	2.57	
	Total Watershed Catch Effort		38:15			Total Watershed # Capture	21	42	0	0	0	0	63	0.55	1.10	0.00	0.00	0.00	0.00	1.65	Total Watershed
	Reach 5 Catch Effort		29:20			Reach 5 # Capture	0	41	0	0	0	0	41	0.00	1.40	0.00	0.00	0.00	0.00	1.40	Reach 5 CPUE
	Reach 4 Catch Effort		8:55			Reach 4 # Capture	21	1	0	0	0	0	22	2.36	0.11	0.00	0.00	0.00	0.00	2.47	Reach 4 CPUE

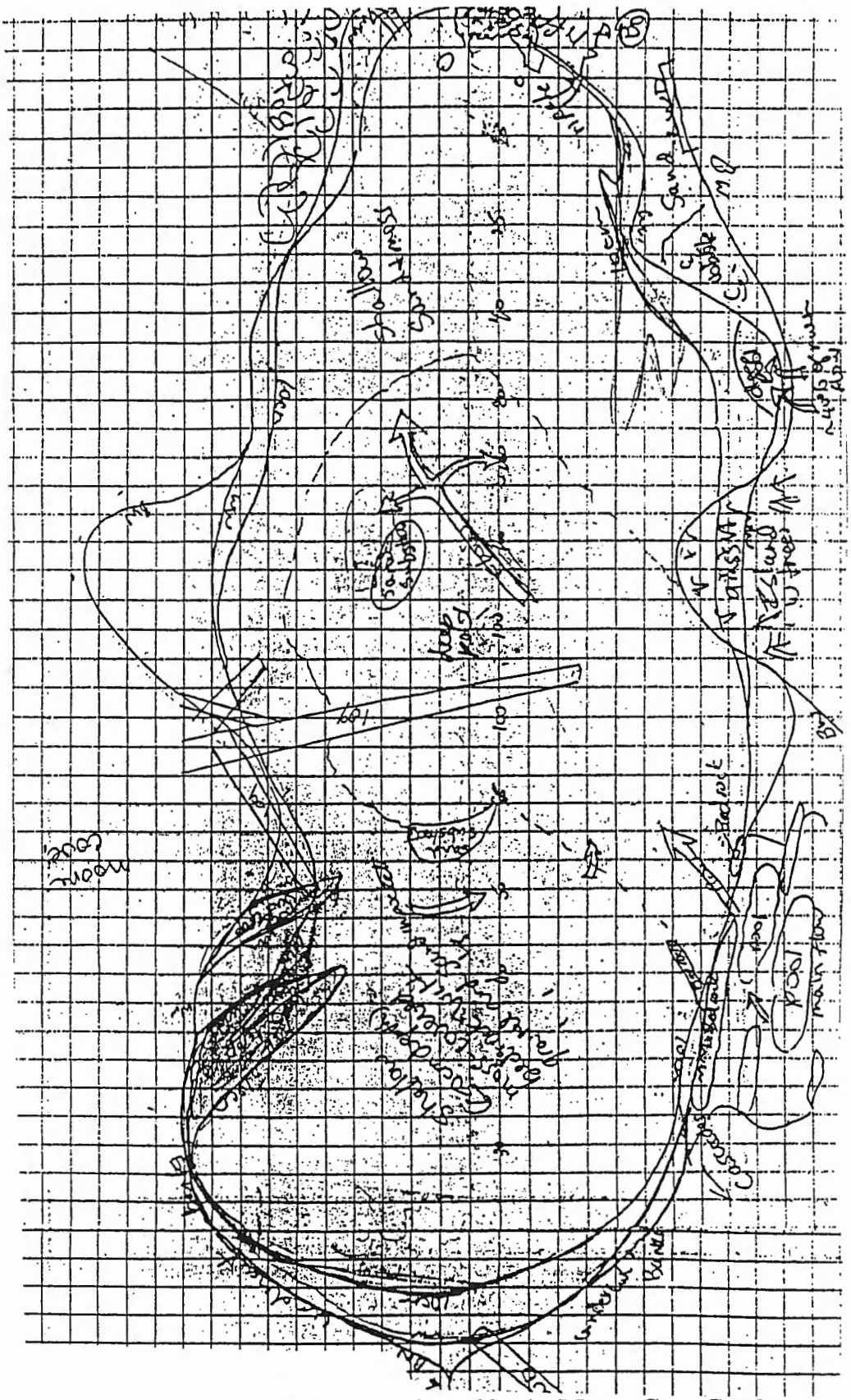


Figure 21 - Detailed Drawing - Site 1 - Moore Cove Creek

6.3.2 Site-Specific Catch per Unit Effort (CPUE)

The pool site chosen was had somewhat poorer juvenile coho rearing habitat than the remainder of reach 2, which should be taken into consideration when comparing juvenile coho fry densities. The pool site chosen ranked 17th (both coho and Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 2 ranked 2nd (both coho and Total CPUE) of 49 overview CPUE values.

6.3.3 Site-Specific Juvenile Coho Fry Densities

Site 1, Moore Cove Creek (Figure 21), was calculated to have a density of 0.70 (+/- 0.71) coho fry per m^2 of pool area in 1998 and 1.04 (+/- .18) in 1999 (Table 10 *Summary Report*). Site 2 was calculated to have a density of 2.16 (+/- 0.37) coho fry per m^2 of pool area in 1999.

The 1998 results were slightly below the expected density of 1-2 coho fry per m^2 of pool area, but are an average estimated density compared to other sampled watersheds. There is a disproportionate amount of variability associated with this estimate (0.71 coho fry per m^2 of pool area), which is due to the fact that only a small percentage (*i.e.* 18%) of the population was sampled.

The 1999 results show an improvement in juvenile coho density estimates over 1998 results, and are average (site 1) to slightly above average (site 2) results.

6.3.4 Fork Lengths

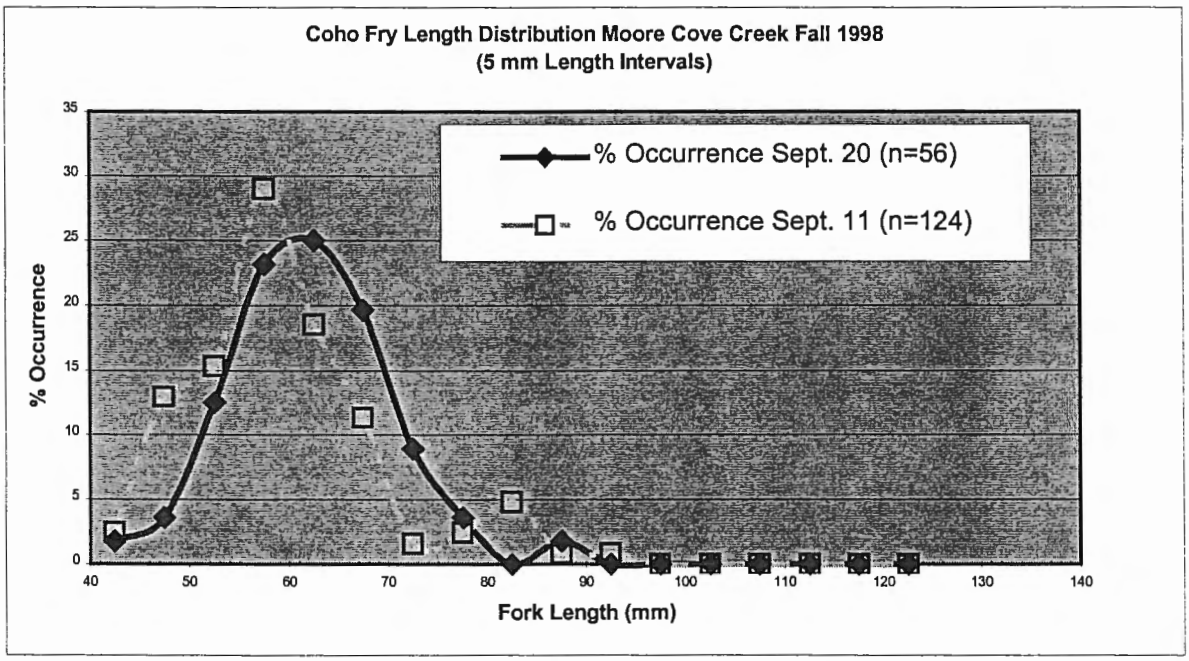


Figure 22 – 1998 Age-size Distributions – Site 1 - Moore Cove Creek

Reviewing the age-size distribution graph for Moore Cove Creek (Figure 22), it is apparent that there is a high proportion (98.2 %, Table 12 "*Summary Report*") of 1st year coho fry in the population. This reach has the highest percentage of 1st year fry in any of the sampled

watershed populations (Table 11 "*Summary Report*"). Additionally, this reach has the highest CPUE results of the sampled watersheds (Table 7 "*Summary Report*").

As described in the "*Overview Catch per Unit Effort*" section in the "*Summary Report*": Moore Cove Creek (reach 2), had juvenile rearing habitat positioned the lowest in the watershed, before the chute section (reach 1) at the mouth. It would be expected that the smaller, less-dominant 1st year coho juveniles may be flushed from upstream habitats during freshets, ending-up taking advantage of this last suitable habitat. This may be the reason for the high percentage of 1st year coho fry in the population, and the CPUE results (Table 7 "*Summary Report*") tend to confirm this hypothesis.

Additionally, the 1999 fry trapping (Figure 23) confirms that there is a difference between sites in age-size distribution results between site 1 and site 2. 1999 results for site 1 indicate that the percentage of first year old coho juveniles in the population were 88.8% on September 10th, and 96.2% on September 15th. By comparison, 70.0% of the population were composed of first year old coho juveniles in site 2 on September 16th, and 58.3% on September 26th.

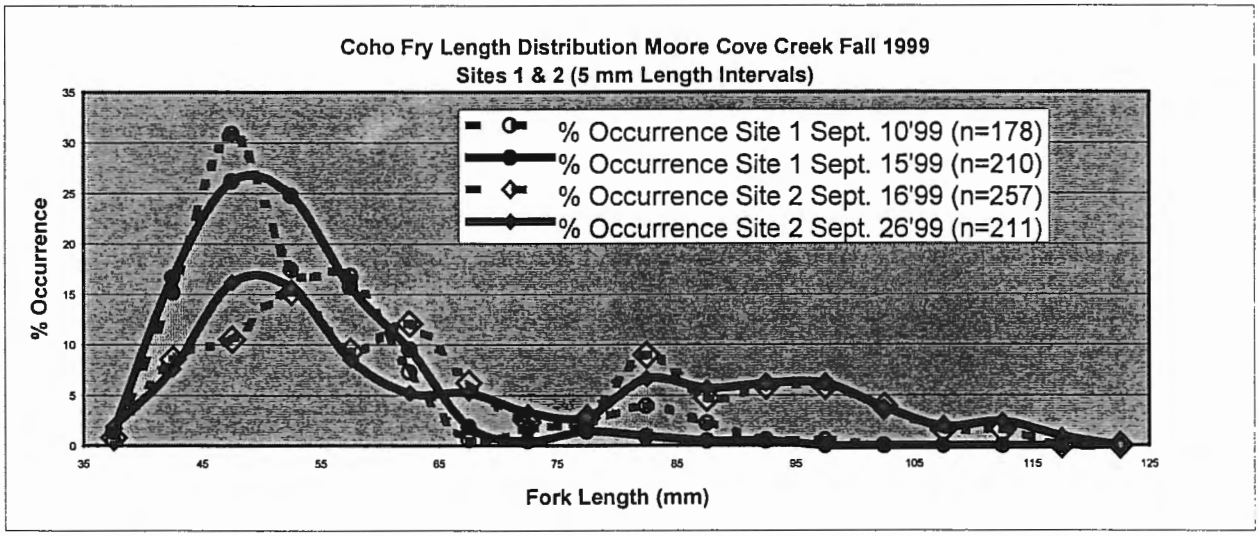


Figure 23 – 1999 Age-size Distributions - Sites 1 & 2 – Moore Cove Creek

It is also apparent that there has been some growth of the sample population between the sampling dates of September 11 and September 20, 1998 (Figure 22) on site 1, and also between the 1999 sampling dates (Figure 23). This growth can be best illustrated when comparing the fork length cut-off between 1st and 2nd year old size classes (*e.g.* 1999 data - 69mm Sept. 10, 72mm Sept. 15, 75mm Sept. 16, and 77mm Sept. 26).

However, it is difficult to ascertain with absolute certainty the extent of this growth, as the fork lengths of the size-classes that make-up these 2 graphs were arbitrarily chosen, and the advancement of the lengths of the medians and cut-offs of the age-classes will reflect this pre-chosen length intervals.

It is also interesting to compare size-at-age between years (Figure 24). Although the sampling was completed at nearly the same dates for both years, it is apparent that the median of the 1st year juvenile coho age class for 1999 (50mm on Sept. 15th 1999) is much shorter than the 1998 results (62mm on Sept. 20th, 1998). This effect probably has nothing to do with food availability, as the regressions of weight on length (Figure 25) are identical between years. Rather, it is highly likely that this effect was caused by lowered winter stream water temperatures.

This means that there has been a substantial decrease in the 1st year old juvenile growth over the 1998/1999 winter period as compared to the 1997/1998 winter period. This may be related to the El Nino/La Nina climatic effects, and may have effects on both juvenile mortality and smolt size, and consequently may then have an effect on smolt ocean survival rates.

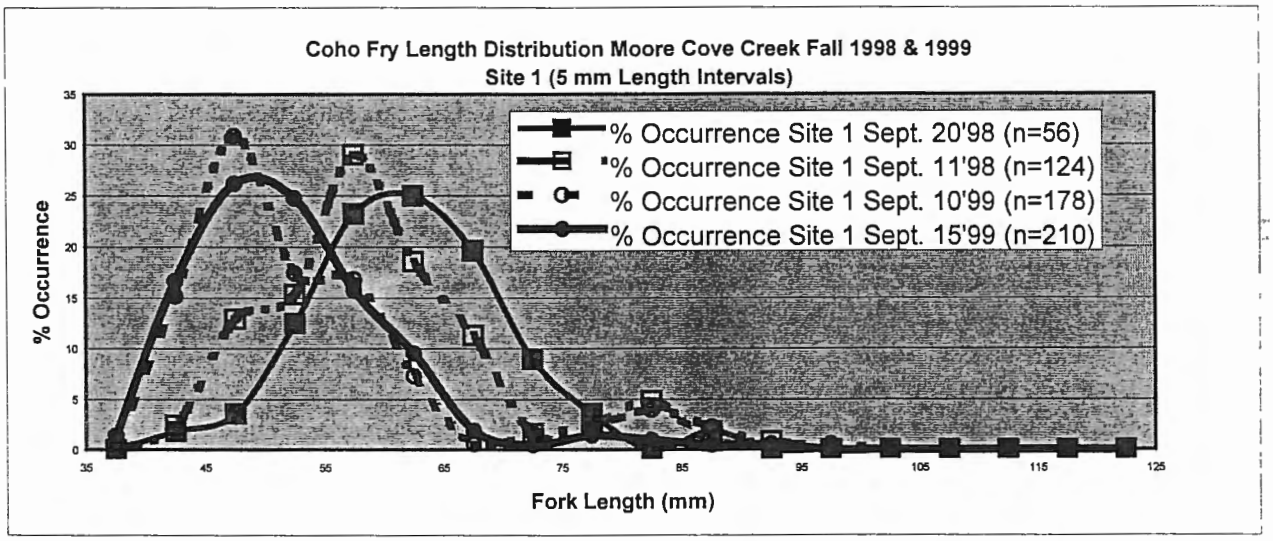


Figure 24 - Comparison of Age-size Distributions Between Years 1998 and 1999 - Site 1 - Moore Cove Creek

6.3.5 Weights

Coho fry weights were recorded on September 20th 1998 and September 10th 1999, and then were plotted against fork lengths (Figure 25). This information was then used to calculate fish condition factors.

As well, this information was used in order to estimate current biomass as a percentage of expected carrying capacity of the pool site. Moore Cove Creek site 1 was found to have the current estimated pool biomass as 35.5% of the expected coho carrying capacity (Table 13 *Summary Report*).

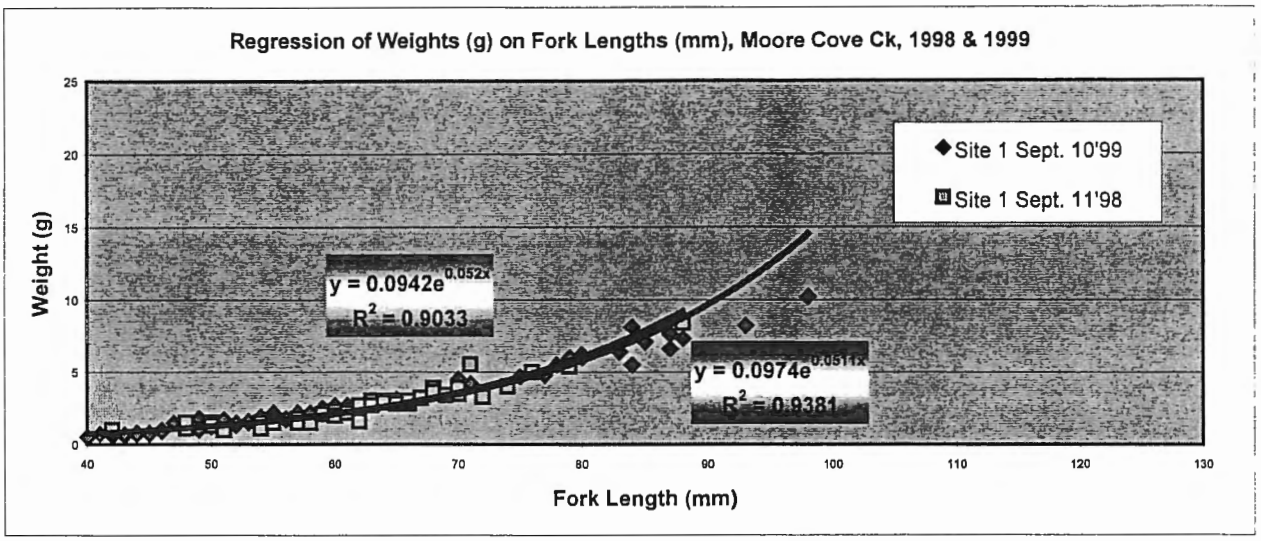


Figure 25 - Regression of Coho Fry Weights on Fork Lengths - Moore Cove Creek

When comparing weight on length relationships between similar-sized watersheds (Figure 25), the smaller size-classes (*i.e.* lengths) of sampled Moore Cove Creek coho fry had significantly lighter weights than Kumealon Creek and Pa-aat River. At 50 mm in fork length, Moore Cove Creek coho fry were 70 and 64% lighter than Kumealon Creek and Pa-aat River coho fry, respectively. However, at 80 mm fork length, Moore Cove Creek coho fry were 8 and 6% heavier than Kumealon Creek and Pa-aat River coho fry, respectively.

This difference in weight between similar-sized (*i.e.* lengths) coho fry may be due to the high percentage of 1st year coho fry in the sampled Moore Cove Creek population, as compared to the other sampled populations. There was only approximately 10 days difference between the sampling dates of Moore Cove Creek and Kumealon Creek and Pa-aat River, so this would not be expected to be the major factor in the weight difference, and additionally only the smaller size-classes were affected.

It is possible that there is some intraspecific competition within the 1st year coho fry age-class that decreases the density-dependent food availability. It may be that there is an overabundance of 1st year coho fry in our site pool, which means that this age-class is lighter due to increased competition for food. Examining fish condition factors tends to support this hypothesis.

6.3.6 Fish Condition Factors

The overall average watershed fish condition factor was calculated to be 1.04 (+/- 0.17) on September 20, 1998 (Table 14 and Figure 13 *Summary Report*). The average 1st year fish condition factor was also calculated to be 1.04 (+/- 0.17), which can then be compared to the Kumealon Creek average 1st year fish condition factor at 1.34 (+/- 0.19). This means that the 1st year old fish in our sample site are lighter at size (*i.e.* length) than Kumealon Creek coho fry.

7. RESULTS AND DISCUSSION - OONA RIVER WATERSHED

7.1 Background Review

915-765500-92300

7.1.1 General Watershed Description

Oona River (DFO Watershed Code 97-9300-130), located on the east of Porcher Island, flows southeast to the north of Ogden Channel, where it meets Grenville Channel. It is a fourth order stream, 3.5 km in length, draining an area of 11.9 km^2. Oona River is a low gradient stream with an overall gradient of approximately 1% throughout its' length (Figure 26).

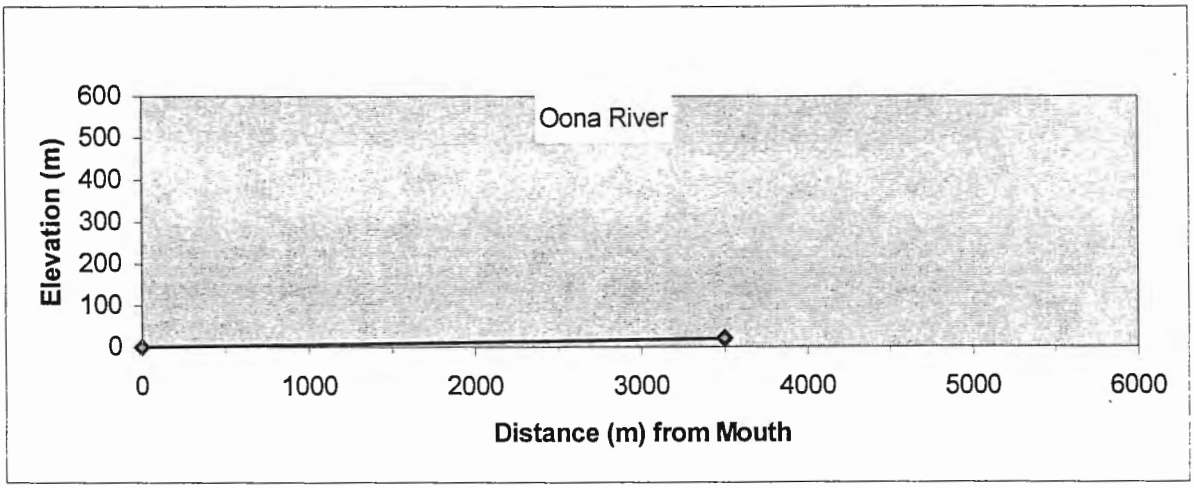


Figure 26 - Gradient Profile for Oona River

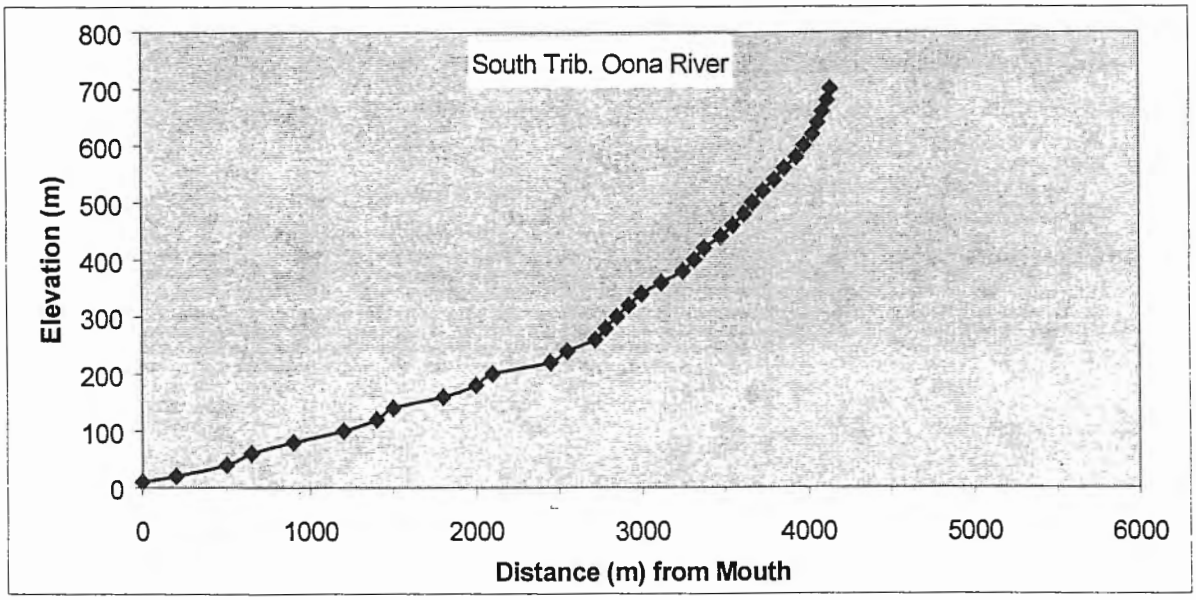


Figure 27 - Gradient Profile for the South Tributary of Oona River

Oona River has two similar, large higher gradient tributaries, to both the north and the south of Oona River. The "*South Tributary of Oona River*", 4.1 km in length drains an area of 3.8

km^2, and has a gradient of 5.5% for the first 500 m, which then gradually increases in gradient (Figure 27). There is an impassable waterfall at 500m.

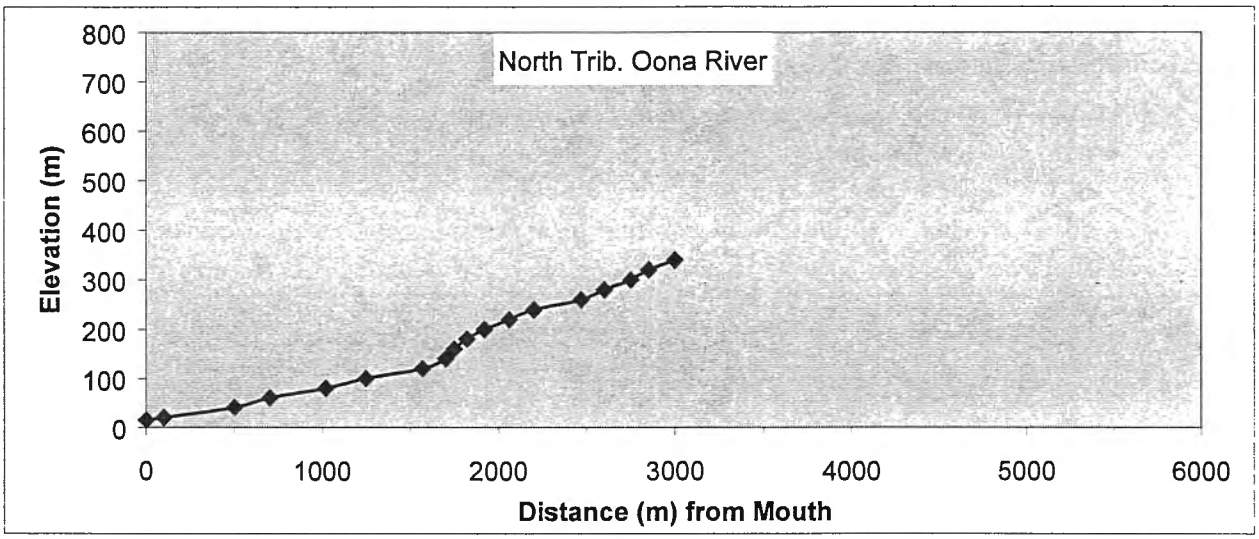


Figure 28 - Gradient Profile for the North Tributary of Oona River

The "*North Tributary of Oona River*" drains an area of 3.5 km^2, and has a gradient of <10% for the first 1.57 km, which then gradually increases in gradient, similar to the South Tributary (Figure 28).

There is also a smaller tributary, Oscar Creek, 110m from the mouth of Oona River and to the South of Oona River. Oscar Creek is a 3-5m wide creek, and drains an area of 1 km^2.

7.1.2 Historical Fisheries Data

The Oona River watershed contains two species of Pacific salmon, coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*) (SISS, FISS, Hancock et al., 1983). Resident cutthroat trout (*Oncorhynchus clarki* clarki*)*, rainbow trout (*Oncorhynchus mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present.

Select comments from Streamwalkers data are summarized in Table 24.

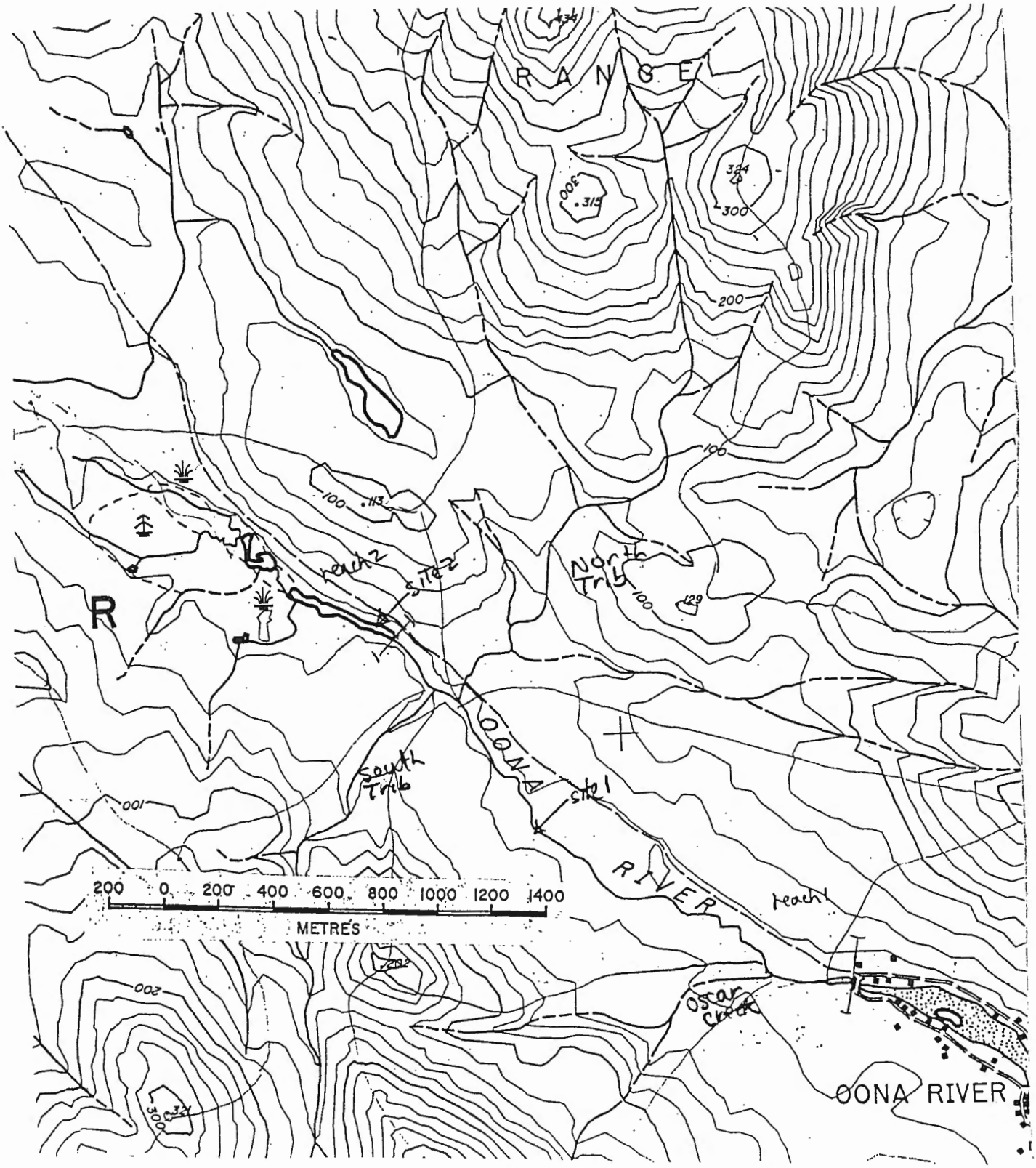


Figure 29 - Overview Map of Oona River

Table 24 - Summary of Condensed Selected Historical Streamwalkers Comments - Oona River

Year	Impacts/Comments
1930	Heavy rains in Sept.
1958	Low-moderate steelhead returns.
1961	Some loss of early run fish due to low water levels.
1964	Very low water late August, early September.
1965	Low water in August.
1972-80	Series of passable log jams and beaver dams kept open by minor hand work.
1972	Low water in August. Some overspawning at peak of run.
1974	Low water in August, high water in October.
1978	High water in late Sept. and early Nov., which may have scoured some pink redds.
1980	Dead pinks found unscarred and unspawned at upper limit of tidal area, cause of death unknown. Same occurrence as in Spiller River and Chismore Creek.
1981	Low water in August.
1982-83	15,000 coho eggs placed in incubation box.
1984	Low water in August/Sept., and low water with freezing in November.
1985	Low water late August/early Sept.
1986	Low water late August/early Sept. Good pink return. Upper Ogden and Lr. Telegraph Passage closed to commercial fishing.
1987	Low water August.
1988	Local sawmill dumps sawdust and wood in lower Oona River.
1990	Local hatchery released 30,000 coho fry, 45,000 coho eggs taken for incubation.
1991	Local hatchery released 30,000 coho fry, 40,000 coho and 12,000 pink eggs taken for incubation. Low water late August. Numerous LWD obstructions in stream.
1992	High water September/October. Low water with freezing in January.
1993	40,000 coho eggs taken for incubation. Low water August/September.
1994	41,000 coho eggs taken for incubation
1995	Low water late August/early September. Numerous beaver dams on mainstem. Oona River hatchery release of 42,000 coho fry.
1996	44,000 to 45,000 coho eggs taken for incubation.
1997	15,000 to 17,000 coho eggs taken for incubation.

The escapement data for coho salmon in Oona River are presented in Figure 30. These data indicate that the coho run to Oona River is substantial. Years with incomplete data include 1950-54, 1956, 1959-60, 1962-65, 1970, 1986, and 1995-97. As previously mentioned, there are inherent inaccuracies in streamwalkers data, but they do provide a general indication of the numbers of fish present in the system.

The east side of Porcher Island, including Oona River, is included in the Department of Fisheries and Oceans (DFO) Coastal Subarea of Area 4. Escapement data for the Coastal Subarea (Figure 5 *Summary Report*) also show very high returns in the late 1960's, with a peak of 40,225 fish in 1966 and a mean of 16,400 (1966-1969). These data also indicate that the present numbers of coho returning to the subarea, although variable, are similar to those observed in the past. For example, between 1950 and 1965, the mean return was 2,910 coho and between 1970 and 1996, 3,840 coho.

1966 was a peak year for coho returns for all areas (Figure 30, and Figures 4-9 *Summary Report*).

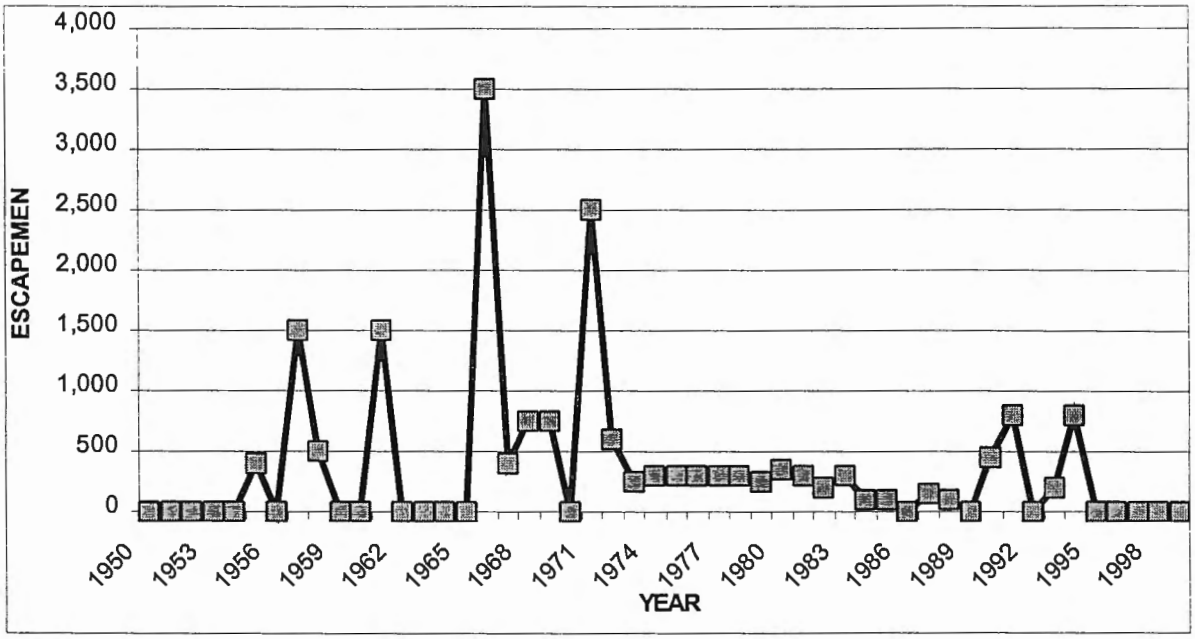


Figure 30 - Historical Coho Escapement - Oona River

7.2 Overview Level Watershed Survey

The physical characteristics of the reaches and tributaries of Oona River, including channel morphology, gradient, widths and substrate composition are presented in Table 25. Habitat parameters for Reaches 1 of Oona River are provided in Table 26. A brief description of the fish habitat available in each reach and tributary of Oona River and a summary are also provided.

The mainstem of Oona River, unlike many other coastal streams, has no discrete reach breaks (except for the bog/beaver dam complex at the headwaters). Instead of discrete reaches, the low gradient mainstem of Oona River has short (20-80m) sections of riffle, pool or glide habitat units, which typically grade into another habitat type and can further be dissected into secondary habitat units. The main change in habitat along the river is in riparian vegetation and bank stability. There are two sections (340-920m and 1600-1900m from the mouth) along the mainstem of Oona River where past springboard logging has exasperated the bank instability. Except for the addition of fine sediment from eroding banks onto spawning gravels, the changes in bank stability have been somewhat beneficial, creating more rearing habitat and increasing decidious leaf litter inputs into the river.

The North and South Tributaries of Oona River are similar in size, gradient and habitat, expect that anadromous fish use in the South Tributary is halted at 500m, due to the impassable waterfall. Both tributaries become largely unsuitable for fish habitat past 1.5 to 1.7 km, due to increases in gradients. Oscar Creek has substantial pink spawning habitat near it's junction with Oona River.

Table 25- Physical Characteristics for Reaches and Tributaries in Oona River

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-2150)	Riffle-Pool	~1	13.2±2.0	9.5±3.1	Large Gravel	Fines
2 (2150-3500)	Beaver Dams	0-.5	N/A	N/A	Fines	Small Gravels
North Tributary (0-400)	Riffle-Pool	2-3	4-8m	3-6m	Cobble	Gravel
South Tributary (0-500)	Riffle-Pool	1-2	Braided	Braided	Gravel	Cobble
Oscar's Creek (0-500)	Riffle-Pool	~2	3-5m	2-5m	Gravel	Fines

Table 26 - Habitat Parameters for Reach 1 in Oona River

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	>50
1 (0-2150)	59.2	G	3.7	F	2.0	G	2.0	12.6	52.9	34.5

Notes: Reach 2 (beaver pond section) not surveyed according to Form 4 methodology
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Oona River had riffle-pool morphology with the substrate mainly composed of gravels and fines, with minor amounts of boulders. A qualitative assessment of the reach indicated that there was substantial adult holding and overwintering habitats, and adequate juvenile rearing and spawning habitats.

The percent of pools by channel area was 59.2%, indicating that this reach is rated as '*good*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Oona River (2% gradient and <15m width) require over 55% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*fair*' with a pool every 3.7 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of 0.44 m with adequate cover (LWD and cutbanks).

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were 2.0 pieces of LWD per channel width (Table 26), a '*fair*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, 34.5% of the total LWD pieces are greater than 50 cm in diameter.

Reach 2

Reach 2 was not sampled using WRPTC #8 methodology (Johnston and Slaney, 1996) for LWD or pools because it is basically a large bog/beaver dam complex with beaver ponds present upstream.

Adequate juvenile rearing habitat is present, especially at the mouths of the small streams that empty into the beaver pond. No spawning would occur within the beaver dam complex, due to lack of spawning gravels, but it is possible that resident trout would utilize the small gravels present at the tributary mouths to spawn. This habitat would be expected to be utilized primarily as overwintering habitat.

South Tributary

The lower end of the South Tributary is heavily impacted by past logging practices, especially in the first 400m from the mouth. There is substantial spawning habitat (especially for pink salmon), however there are numerous LWD/debris jams and channel braiding which would make access difficult for adult salmon. Coho salmon have been able to transverse the numerous LWD/debris jams and have been seen spawning just below the waterfall at 500m. There is substantial juvenile rearing habitat. There are few adult holding and juvenile overwintering pools. The substrate was largely gravels and small cobbles, with minor amounts of sand and fines.

North Tributary

The lower 300m of the North Tributary is a succession of small beaver dams, which would provide fair rearing and adequate overwintering habitat. There would be little spawning habitat, except for small pockets of spawning gravels above the beaver dams. It would be difficult, but not impossible, for pink salmon to transverse these beaver dams. Above the beaver dams, the gradient gradually rises, and small cascades become more numerous, eventually becoming a succession of small waterfalls above 600m. There would be fair rearing habitat, and juvenile coho salmon have been noted below 600m.

Table 27 summarizes the habitat in the reaches and tributaries of Oona River

Table 27 – Summary of Reach Descriptions - Oona River

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-2150	Reach 1: substantial adult holding and overwintering habitats, and adequate juvenile rearing and spawning habitats.
2	2150-3500	Reach 2: Beaver dams, excellent overwintering habitat, fair rearing habitat, limited spawning habitat.
North Trib.	0-600	Substantial overwintering habitat in beaver dams, and adequate juvenile rearing and spawning habitats, poor adult holding habitat.
South Trib.	0-500	Substantial spawning habitat, and adequate juvenile rearing and poor overwintering habitats. Difficulty with access over debris jams.
Oscar Creek	0-300	Excellent pink spawning near mouth.

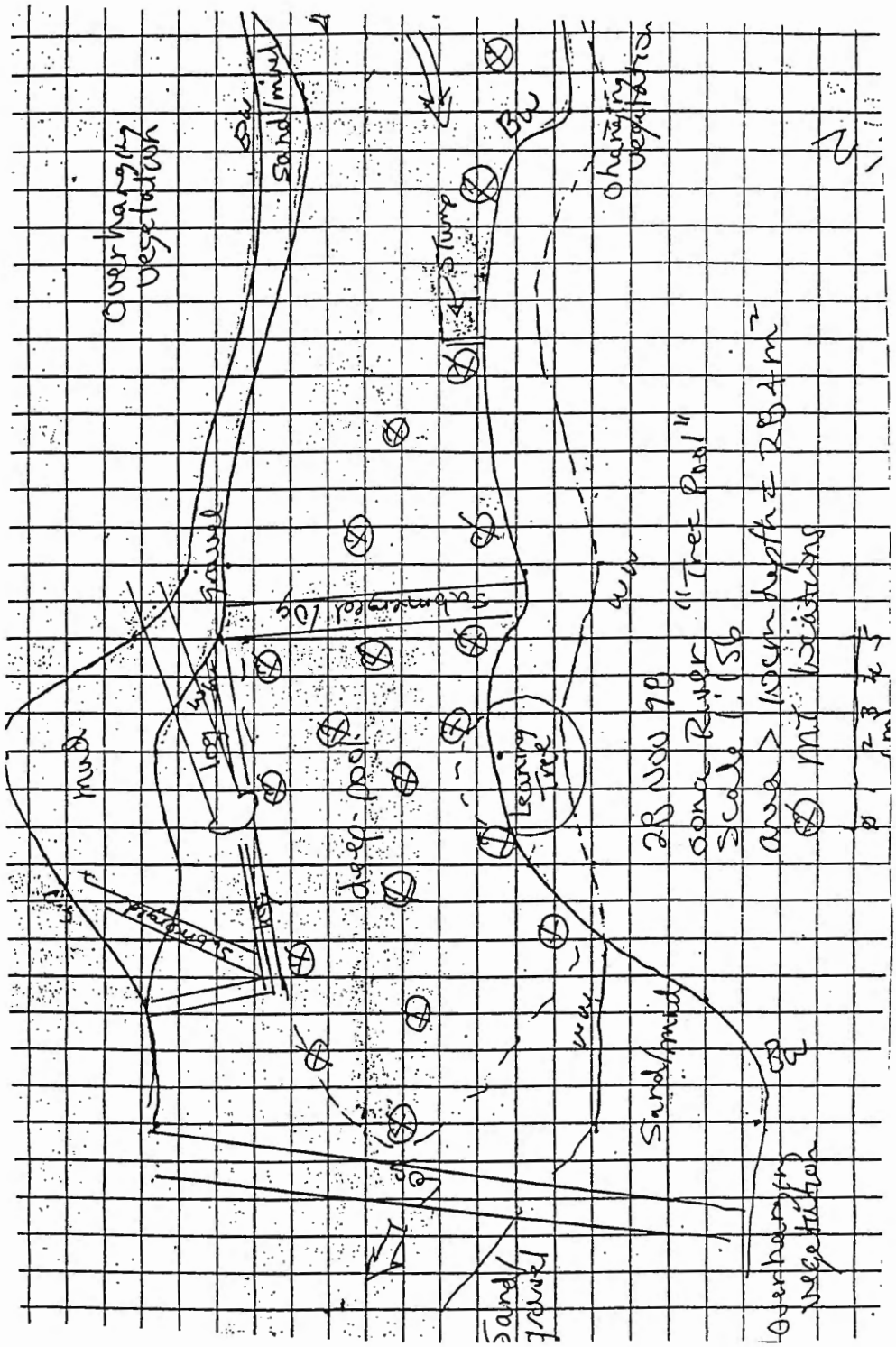


Figure 31 - Detailed Drawing - Site 1 - Oona River

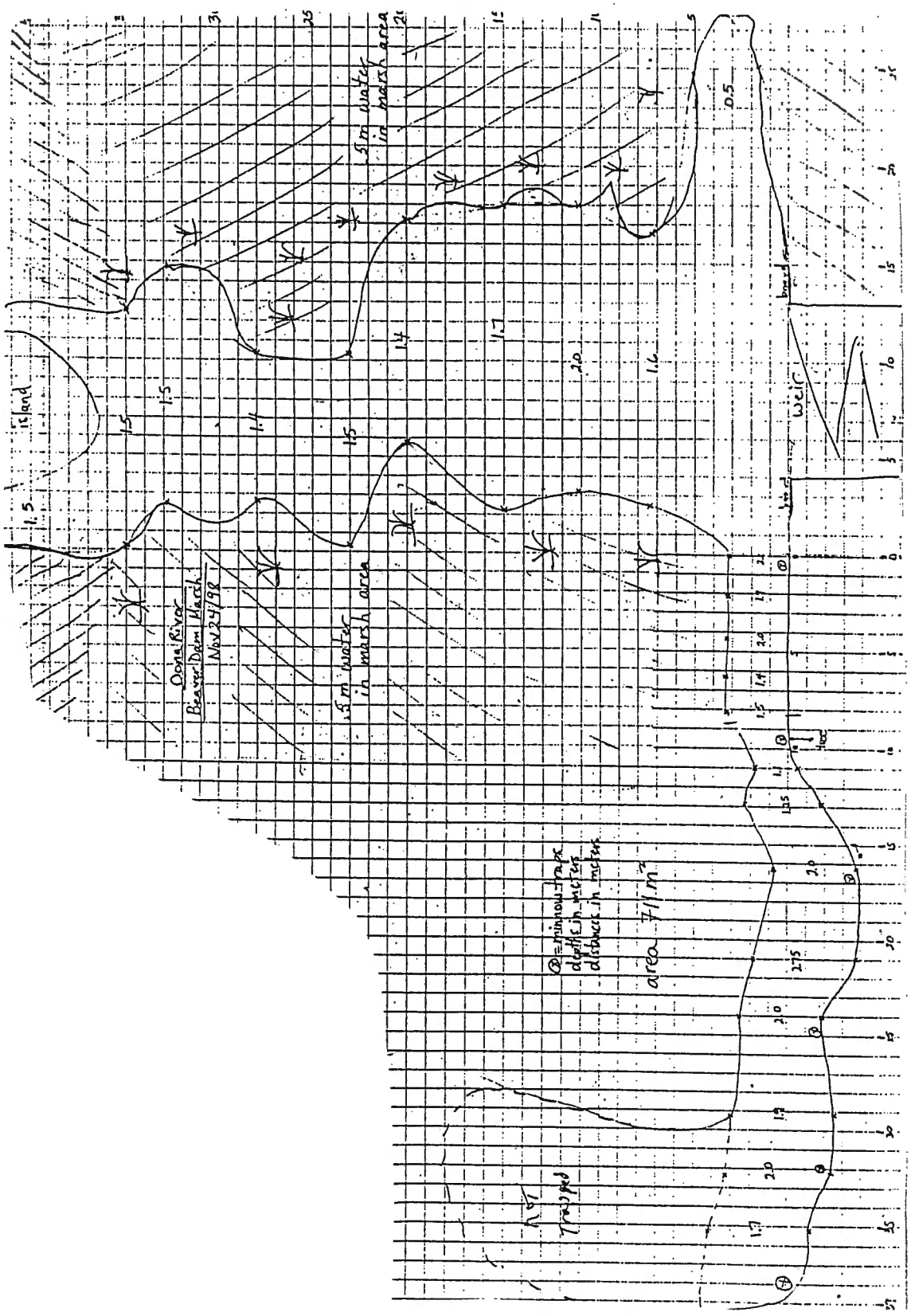


Figure 32 - Detailed Drawing - Site 2 (Beaver Dam) - Oona River

7.3 Minnow-trapping Data

7.3.1 Overview Catch per Unit Effort (CPUE)

No overview minnow-trapping was completed on Oona River.

7.3.2 Site-Specific Catch per Unit Effort (CPUE)

Since Oona River was not overview minnow-trapped, it is impossible to compare relative habitat values between sites and reaches. However, site CPUE can be compared, and site 2 has better overwintering habitat than site 1.

Site 1 ranked 3rd and 6th (coho CPUE) and 4th and 7th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). Site 2 ranked 18th and 26th (coho CPUE) and 22nd and 31st (Total CPUE) of 31 site-specific CPUE values.

7.3.3 Site-Specific Juvenile Coho Fry Densities

Site 2, Oona River (Figure 31), was calculated to have a density of 1.27 (+/- 0.58) coho fry per m^2 of pool area (Table 10 *Summary Report*). This was the highest estimated density of all of our sampled watersheds. There has been limited stock enhancement on Oona River for 18 years, and this factor may be largely responsible for this above average coho fry density.

7.3.4 Fork Lengths

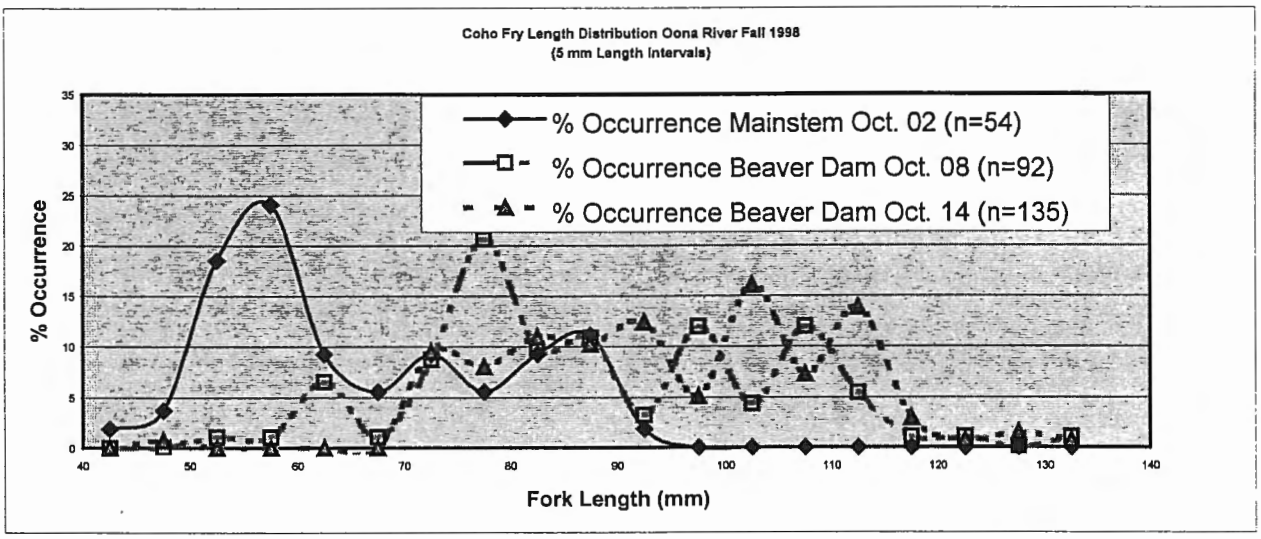


Figure 33 - Age-size Distributions - Oona River

It is interesting to compare the age-size distributions between sampling dates and locations (Table 32). It is obvious that there was a larger percentage of 1st year old coho fry in the mainstem of Oona River on October 02, 1999 (63.0% 1st years) as compared to the beaver dam on October 08, 1999 (9.8% 1st years). It is likely that the coho fry had migrated to suitable overwintering habitat as the water temperatures dropped. It is also likely that the larger, more dominant 2nd year old coho maintained their dominance in the prime overwintering habitat (in this case – the beaver dam), pushing the 1st year old coho fry to less desirable overwintering habitat, such as the mainstem.

7.3.5 Weights

Coho fry weights were recorded on October 02 and 08, and then were plotted against fork lengths (Figure 34). This information was then used to calculate fish condition factors.

As well, this information was used in order to estimate current biomass as a percentage of expected carrying capacity of the pool site. Oona River site 2 was found to have the current estimated pool biomass as 233.2% of the expected coho carrying capacity (Table 13 *Summary Report*). This was the highest biomass recorded, and may be due to a combination of past stock enhancement efforts and fry migrating to overwintering habitat.

It is interesting to note that the Oona River coho fry were 20% heavier than the Salt Lagoon Creek coho fry at 60mm fork length (Figure 34 and Figure 41). Additionally, the mainstem had smaller, lighter fry than the beaver dam (Figure 34).

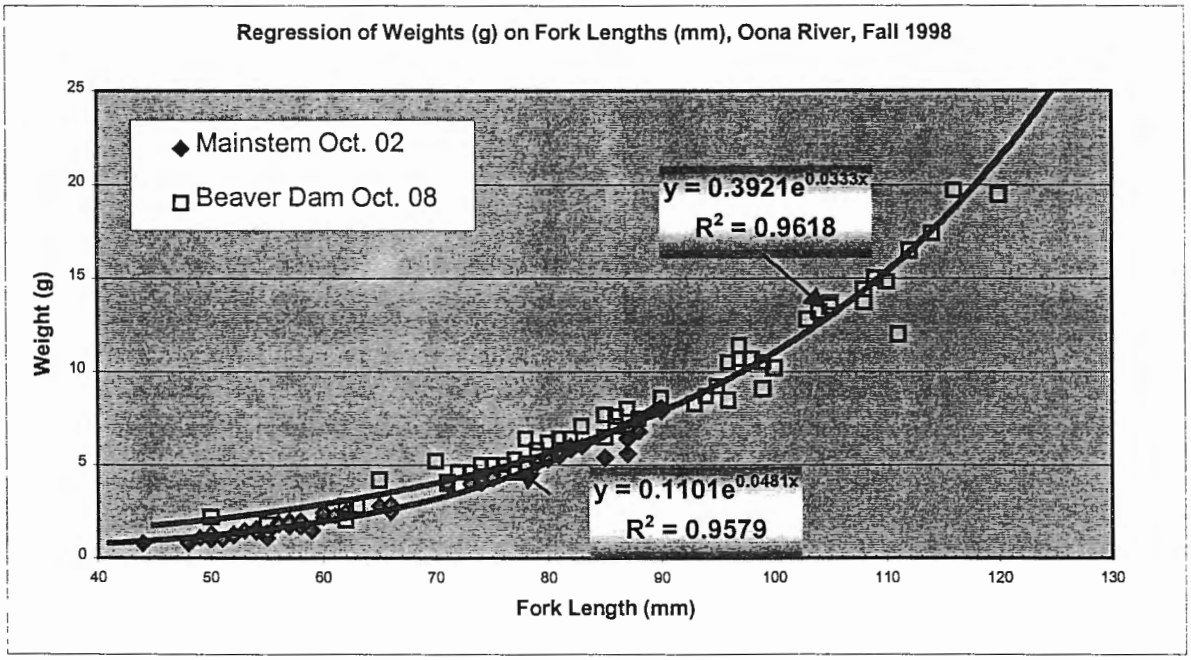


Figure 34 - Regression of Coho Fry Weights on Fork Lengths - Oona River

7.3.6 Fish Condition Factors

The overall average watershed fish condition factor varied from 0.98 (+/- 0.11) on October 02, 1998 to 1.22 (+/- 0.18) on March 06, 1999 (Table 14 and Figure 13 *Summary Report*).

8. RESULTS AND DISCUSSION - PORCHER CREEK WATERSHED

8.1 Background Review

915-765500-28600

8.1.1 General Watershed Description

Porcher Creek (DFO Watershed Code 97-9300-480), located in Porcher Inlet on Porcher Island, flows southeast to Porcher Inlet (Figure 44). It is a third order stream, 9.6 km in length, draining an area of 16.3 km^2.

Porcher Creek has a 3.3% gradient for the first 1200 m, a 1.5% gradient for the next 2.8 km, a short higher gradient section with 6.3% gradient between 4.0 and 4.35 km, a 2.5% gradient to 8.5 km, and a gradually increasing gradient which becomes unsuitable for fish habitat (as the gradient increases above 20%) past 9.3 km (Figure 42).

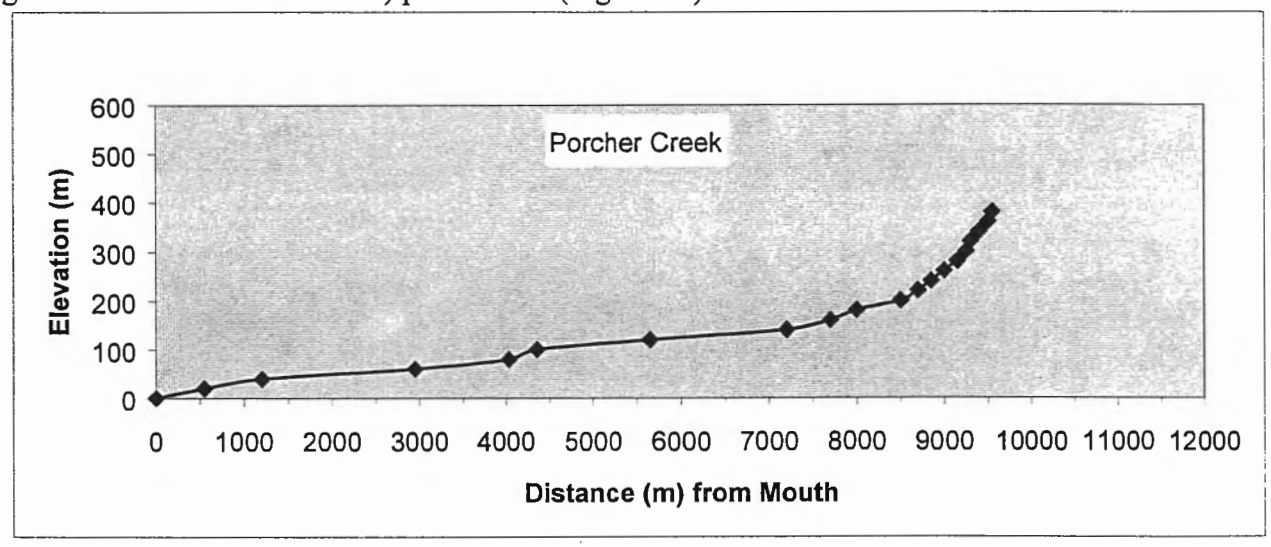


Figure 35 - Gradient Profile for Porcher Creek

8.1.2 Historical Fisheries Data

The Porcher Creek watershed contains two species of Pacific salmon, coho (*Oncorhynchus kisutch*) and pink (*Oncorhynchus gorbuscha*) salmon, and there has been a record of a few sightings of chum (*Oncorhynchus keta*) salmon (SISS, FISS, Hancock et al., 1983). Pink and chum salmon species have been observed spawning below the falls at 1.7 km, while coho have been observed past the falls to 2.4 km (SISS, 1991). Resident cutthroat trout (*Oncorhynchus clarki* clarki), rainbow trout (*Oncorhynchus mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present (Table 38).

Select comments from Streamwalkers data are summarized in Table 34. The stream was logged in 1985. There have been numerous logging-related impacts to this stream since 1985, although there is also evidence of pre-logging slope instability (*e.g.* 1971, 1973 and 1983).

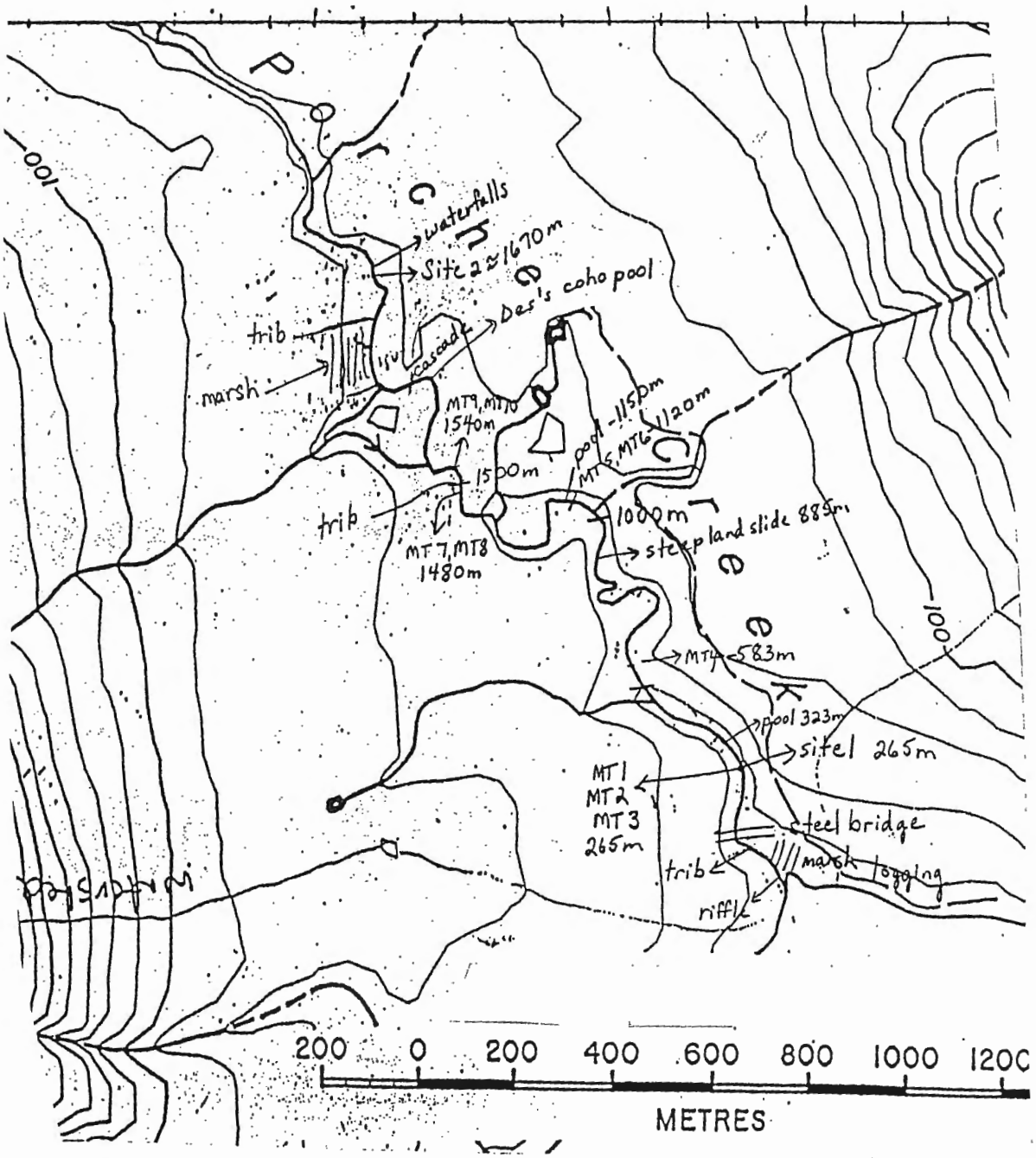


Figure 36 - Overview Map of Porcher Creek

Table 28 - Summary of Condensed Selected Historical Streamwalkers Comments - Porcher Creek

Year	Impacts/Comments
1949	North arm closed for fishing.
1951	Low water levels late August.
1952	Low water late August, log jams formed on mainstem.
1958	Low water levels late August.
1959	Log jams on mainstem.
1960	Log jams on mainstem.
1961-65	Low water levels late August.
1967	Log jams on mainstem.
1968	Low water levels late August.
1970	Coho noted in upper reaches. Heavy seine in area for 3 days fishing, reported in Head and Wolf creek notes.
1971	Windfall trees in creek.
1972	Low water levels late August. Heavy seine fishing in area, very heavy pink returns, reported in Head and Wolf creek notes.
1973	Windfall trees in creek.
1974	Low water levels late August.
1978	Log jams on mainstem.
1979	Low water late August.
1980	Coho noted in upper reaches. Porcher Inlet commercial catch is 50,000 pink with 24 seines + 8 gillnets, reported in Head and Wolf creek notes. Inlet closed.
1981	Low water levels late August.
1983	Slide into creek.
1984	Low water late August and in winter.
1985	Stream logged. Low water late August.
1986	Low water late August.
1987	Low water late August, log jams formed on mainstem.
1988	Streambed scouring and log jams.
1989	Slides caused by logging, low water late August, log jams formed on mainstem.
1991	Log jams.
1992	Log jams, windfall trees in creek.
1993	Low water levels late August, windfall trees in creek.
1994	Logging debris in mainstem.
1995	Logging debris in mainstem. Oona River hatchery release of 14,000 coho fry from incubated Porcher Creek eggs.

The escapement data for coho salmon in Porcher Creek are presented in Figure 45. These data indicate that the coho returns to Porcher Creek have been fairly substantial for the size of the stream (~1500 maximum adult coho escapement numbers), although escapement data is discontinuous and possibly unreliable. Escapement data is only available for the following years: 1950-58, 1960-61, 1963-73, 1979-80, and 1983-88. The remainder of the years either have no data, or no coho were observed.

It is therefore difficult to make any realistic correlations or assumptions pertaining to Porcher Creek escapement data, given the lack of recorded data.

It should also be noted that the Oona River Hatchery stocked 14,000 coho fry, hatched from incubated Porcher Creek eggs, into Porcher Creek in 1995 (Table 34). This would mean that above average adult escapement numbers might be expected in 1998-99. Indeed, the 1998 adult enumeration results were 224 adult coho observed. This is the highest recorded return since 1968.

During fall 1999, there were only 38 adult coho seen from the waterfall to the mouth in Porcher Creek. This low number of returning adults is unsettling, as Porcher Creek had

approximately 280 returning adult coho in total in 1998. The high numbers of returning coho in 1998 may be in large part due to the stock assistance provided by the Oona River hatchery that released 15,000 coho fry in the system in 1995.

Porcher Inlet, including Porcher Creek, is included in the Department of Fisheries and Oceans (DFO) Area 5. Escapement data for Area 5 (Figure 6 *Summary Report*) and the Porcher Inlet Subarea (Figure 8 *Summary Report*) similarly show high returns from the mid-1950's to 1968. Additionally, during the mid-1970's, Area 5 Total reported moderate returns, which were again not mirrored by Porcher Creek and Porcher Inlet escapement numbers. 1966 was a peak year for coho returns for all areas (Figure 45, and Figures 4-9 *Summary Report*). From 1970 to 1980, there was also heavy fishing pressure recorded in Porcher Inlet (Table 34).

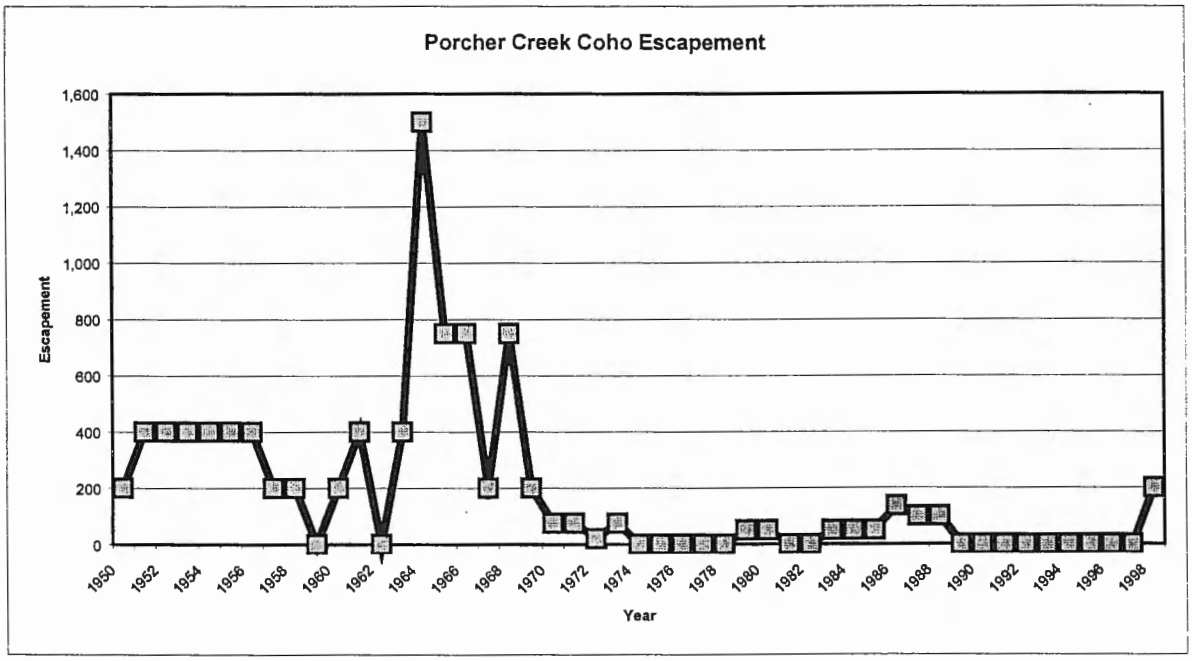


Figure 37 - Historical Coho Escapement - Porcher Creek

8.2 Overview Level Watershed Survey

The physical characteristics of the two surveyed reaches of Porcher Creek, including channel morphology, gradient, widths and substrate composition are presented in Table 35. Habitat parameters (1997) for Reach 1 of Porcher Creek, were calculated and these parameters are presented in Table 36. Reach 2 was not entirely surveyed, and therefore the results are not included. Following these tables is a brief description of the fish habitat available in each reach of Porcher Creek and a summary.

Table 29 - Physical Characteristics for Reaches in Porcher Creek

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-710)	Riffle-Pool	2-4	17.2±2.6	10.1±3.4	Cobble	Large Gravel
2 (710-1750)	Riffle-Pool	1-3	N/A	N/A	Large Gravel	Cobble

Table 30 - Habitat Parameters for Reach 1 in Porcher Creek

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
1 (0-750)	20.5	P	3.5	P	8.9	F	7.6	9.9	53.4	36.7

Notes: Reach 2 not entirely surveyed and not therefore included

Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Porcher Creek had riffle-run morphology with the substrate mainly composed of cobble and large gravels, with minor amounts of boulders. The channel was largely confined, but not quite entrenched, as the streambanks become steeper and entrench the channel at the upper end of the reach. There are extensive LWD jams, riffles, and channel braiding, and frequent sediment wedges.

A qualitative assessment of the reach indicated that juvenile overwintering habitat was somewhat limited due to the presence of riffles and shallow pools, although there are a few larger, deeper pools. There is adequate juvenile rearing habitat and excellent pink salmon spawning habitat. Coho spawning habitat and adult holding pools were limited, although there was some spawning and holding habitats available in the larger LWD-induced pools.

The percent of pools by channel area was 20.5% (Table 36), indicating that this reach is rated as '*poor*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Porcher Creek (2-5% gradient and <15m width) require over 30% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*poor*' with a pool every 3.5 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of only 0.30 m with '*good*' cover overall, generally in the form of LWD. From these calculations, it is apparent that Reach 1 is deficient in the pool habitat available for salmonids.

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were 8.9 pieces of LWD per channel (Table 36), a '*good*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, 36.7% of the total LWD pieces are greater than 50 cm in diameter.

Although excessive, the amount of LWD in the form of debris jams in this reach may be holding large amounts of bedload from moving downstream and further infilling pool habitat.

Reach 1 has a riparian species composition of alder with an understory of regenerating hemlock, spruce and western red cedar. The channel braiding and bank instability can be expected to increase for the next few decades, as where the alders that are currently maintaining what little bank stability that remains, decay and rot. There will be a substantial period of time where there is no coniferous LWD to replace rotting instream LWD, or even large root systems to provide bank stability. Riparian planting of conifers should therefore be considered for this reach.

Reach 2

Reach 2 of Porcher Creek had riffle-run morphology with the substrate mainly composed of large gravels and cobble, with minor amounts of boulders. The channel was entrenched. Similar to reach 1, there are a number of LWD debris jams with the associated channel braiding. However, unlike reach 1, there are also a number of cascades with the associated large bedrock pools. There are also a few landslides along the steep and high banks.

A qualitative assessment of the reach indicated that there was adequate to excellent juvenile overwintering habitat, and adult coho spawning and holding pools. All cascades were passable to coho, and probably passable to pink salmon.

Historic fisheries data indicates that adult coho are able to navigate the ~3 m waterfalls at 1750 m during high water flows only. Installation of a fish ladder by blasting, or secondarily by installation of a wooden fish ladder, would provide access to an additional 6.8 km of prime fish habitat (estimation by gradient < 10%). Currently, anadromous species are only able to utilize the lowest 1750 m, or only 21% of the stream length with fish habitat potential at low water flows.

Summary

Table 37 summarizes the impacts both reaches of Porcher Creek. There has been significant post-logging impacts to Porcher Creek, most impacts are related to slope and bank instability. Reach 1 has frequent LWD jams and channel braiding, while reach 2 is more affected by bank failure and landslides. There may have been bank instability before logging occurred, but logging probably exasperated the problem.

Reach 1 has adequate juvenile rearing and pink spawning habitat, while reach 2 has adequate coho spawning and juvenile overwintering habitat.

Table 31 - Reach Descriptions and Impacts - Porcher Creek

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-710	Reach 1: Excellent pink spawning habitat, good juvenile rearing habitat, poor overwintering and coho spawning habitat; numerous LWD debris jams, riffles and sediment wedges and frequent channel braiding.
2	130, 165, 195, 230, 242, 265, 300, 360-460	Large LWD jams.
2	710-1750	Reach 2: Good coho spawning and juvenile overwintering habitat; numerous landslides, cascades, and large bedrock pools.
2	770, 885, 1000, 1540	Landslides into creek.
2	1170, 1500, 1730	Cascades with downstream bedrock pools.

8.3 Minnow-trapping Data

8.3.1 Overview Catch per Unit Effort (CPUE)

Table 32 - Overview Catch per Unit Effort Results - Porcher Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/1/98 10:20	9/1/98 16:50	6:30	265	1	Main channel, at future site 1.	3	3			15		21	0.46	0.46	0.00	0.00	2.31	0.00	3.23	
2	9/1/98 10:20	9/1/98 16:50	6:30	265	1	Main channel, at future site 1.	3	3			15		21	0.46	0.46	0.00	0.00	2.31	0.00	3.23	
3	9/1/98 10:20	9/1/98 16:50	6:30	265	1	Main channel, at future site 1.	26				1		27	4.00	0.00	0.00	0.00	0.15	0.00	4.15	
4	9/1/98 11:40	9/1/98 16:30	4:50	583	1	Main channel, in shallow LWD pool.	5	1			11		17	1.03	0.21	0.00	0.00	2.28	0.00	3.52	
5	9/1/98 13:30	9/1/98 15:50	2:20	1120	2	Main channel, in deep bedrock pool (Mark's coho pool).	5	4		2	10		21	2.14	1.71	0.00	0.86	4.29	0.00	9.00	
6	9/1/98 13:30	9/1/98 15:50	2:20	1120	2	Main channel, in deep bedrock pool (Mark's coho pool).	4	4	1	2	10		21	1.71	1.71	0.43	0.86	4.29	0.00	9.00	
7	9/1/98 14:20	9/1/98 15:30	1:10	1480	2	Main channel, at NE side.	11	15		5			31	9.43	12.86	0.00	4.29	0.00	0.00	26.57	
8	9/1/98 14:20	9/1/98 15:15	0:55	1480	2	Main channel, in deep bedrock pool (Des's coho pool).	22	12		1			35	24.00	13.09	0.00	1.09	0.00	0.00	38.18	
9	9/1/98 14:40	9/1/98 15:00	0:20	1540	2	Main channel, in deep bedrock pool below waterfall.	9	3		1			13	27.00	9.00	0.00	3.00	0.00	0.00	39.00	
10	9/1/98 14:40	9/1/98 15:00	0:20	1540	2	Main channel, in deep bedrock pool below waterfall.	4	6					10	12.00	18.00	0.00	0.00	0.00	0.00	30.00	
Total Watershed Catch Effort			**31:45**			Total Watershed # Capture	92	51	1	11	62	0	**217**	**2.90**	1.61	0.03	0.35	1.95	0.00	**6.83**	Total CPUE
Reach 1 Catch Effort			**24:20**			Reach 1 # Capture	37	7	0	0	42	0	**86**	**1.52**	0.29	0.00	0.00	1.73	0.00	**3.53**	Reach 1 CPUE
Reach 2 Catch Effort			**12:15**			Reach 2 # Capture	60	45	1	11	31	0	**148**	**4.90**	3.67	0.08	0.90	2.53	0.00	**12.08**	Reach 2 CPUE

Comparing overview catch per unit effort results (Table 38) between reaches: reach 2 had nearly 3.2 times the coho CPUE values of reach 1, and 3.4 times the total CPUE values of reach 1. These results mean that reach 2 has roughly 3 times the fisheries values of reach 1. These results might be expected, given the impacted and infilled pool habitat in reach 1.

However, given the availability of juvenile rearing habitat in reach 1, it also might be expected that coho CPUE values would be higher in reach 1 than the current CPUE values. It may be that sculpins are having a significant impact on the survival of coho fry that attempt to rear in the shallow pools and riffles in this reach.

In the "*Summary Report*", a significant and serious sculpin/coho interaction was described from interpretation of CPUE results from all watersheds. It was hypothesized that in impacted and infilled pool habitat, sculpins would have much higher success in capturing and eating younger coho fry.

Since there are significant sculpin CPUE values in this watershed (Table 38), reach 1 may be an example of an impacted watershed where sculpins may have greatly improved success in capturing younger coho fry.

8.3.2 Site-Specific Catch per Unit Effort (CPUE)

Site 1 (Figure 38) had roughly equivalent juvenile coho rearing habitat as reach 1. The pool site chosen ranked 14th and 15th (coho CPUE), and 15th and 18th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 1 ranked 23rd (Coho CPUE) and 18th (Total CPUE) of 49 overview CPUE values.

Site 2 (Figure 39) had poorer juvenile coho rearing habitat than reach 2. The pool site chosen ranked 9th and 11th (coho CPUE), and 2nd and 13th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 2 ranked 9th (Coho CPUE) and 7th (Total CPUE) of 49 overview CPUE values.

8.3.3 Site-Specific Juvenile Coho Fry Densities

Site 1, Porcher Creek (Figure 38), was calculated to have a density of 0.80 (+/- 0.19) coho fry per m^2 of pool area (Table 10 *Summary Report*). Site 2, Porcher Creek (Figure 39), was calculated to have a density of 0.52 (+/- 0.08) coho fry per m^2 of pool area (Table 10 *Summary Report*). Both of these density estimations are below the expected North Coast coho fry densities of 1-2 fry per m^2 of pool area (Holtby, B., Pers. Comm.).

It would also be expected that juvenile 1st year old coho numbers would be increased in 1999, due to the increase in returning adult coho spawners in 1998. Strangely, this phenomenon was not observed – instead juvenile coho numbers were reduced from last year's results (Table 33).

Table 33 – 1999 and 1998 Coho Juvenile Trapping Results From Porcher Creek

Site #	1999 Coho Density	1998 Coho Density	1999 Ave. CPUE	1998 Ave. CPUE
Porcher Site 1	0.20 coho m^{-2} *	0.80 coho m^{-2}	0.12	1.61
Porcher Site 2	0.35 coho m^{-2}	0.52 coho m^{-2}	0.36	1.93

Note: * Coho Density estimated from CPUE/Density regression.

Since spawning habitat downstream of the waterfall in Porcher Creek is severely limited, it is likely that late-run spawning coho disturbed redds made by earlier spawners. Ensuring access to the upper reaches of this watershed would definitely increase spawning habitat availability, as there is spawning habitat above the falls. There is also juvenile rearing capability in the bog lakes area near the upper termination of this watershed.

An egg take was carried-out on Porcher Creek for coho during the fall 1999, and Oona River Hatchery is being utilized to incubate the eggs. The 1999 density estimations of coho juvenile range from 3 to 10 times lower (**Error! Reference source not found.**) than the expected densities of 1-2 fish m^{-2} (Pers. Comm. Blair Holtby).

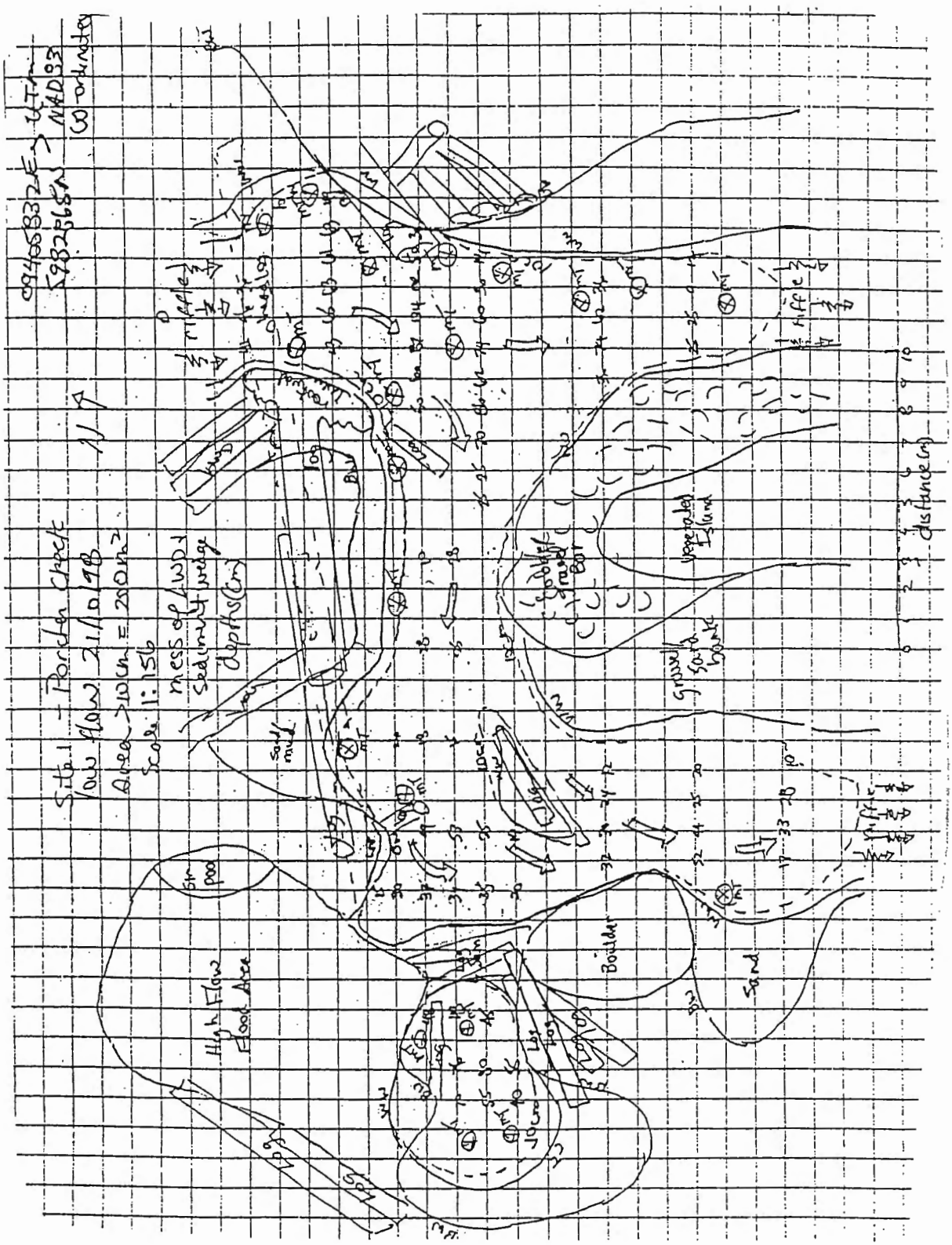


Figure 38 - Detailed Drawing - Site 1 - Porcher Creek

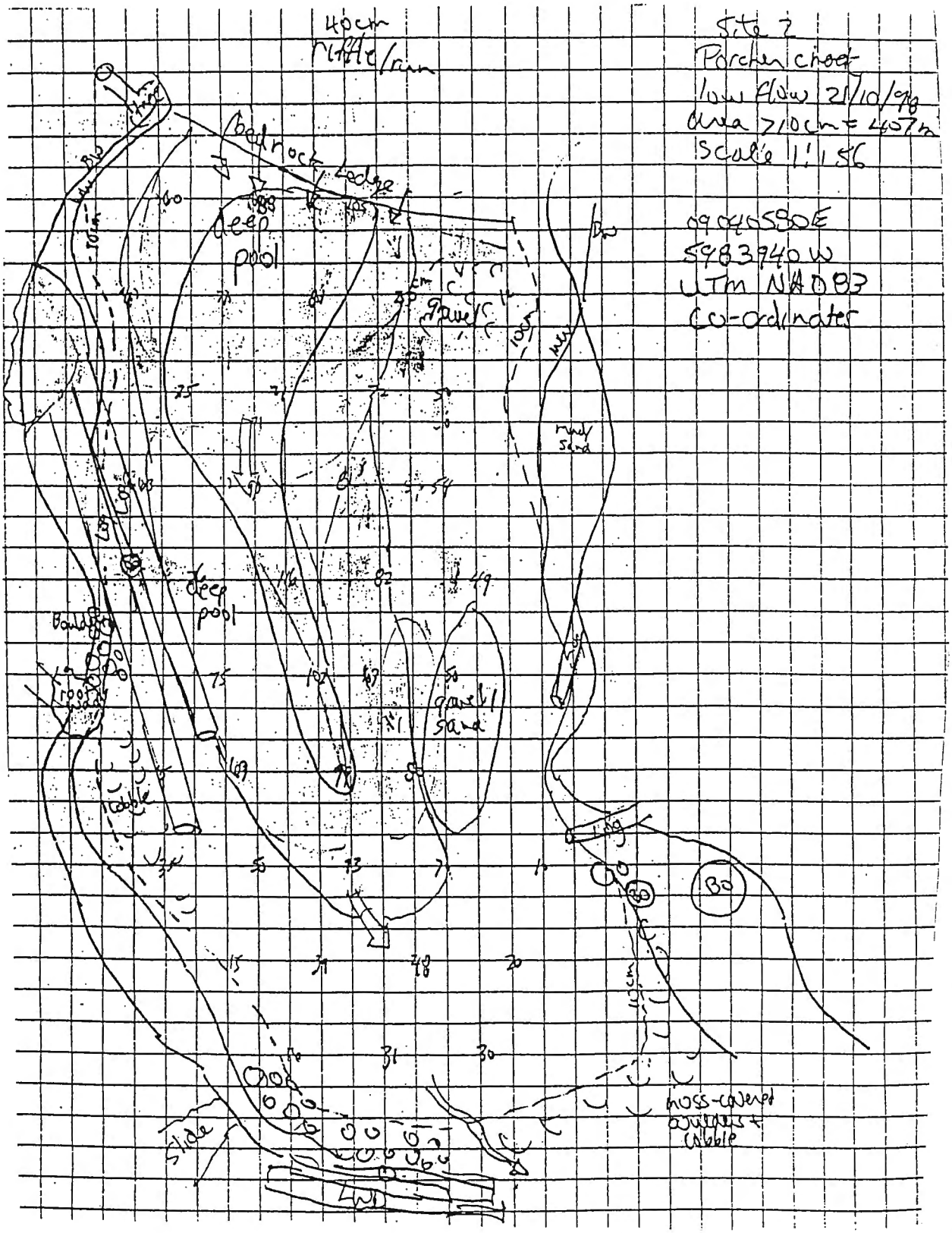


Figure 39 - Detailed Drawing - Site 2 - Porcher Creek

8.3.4 Fork Lengths

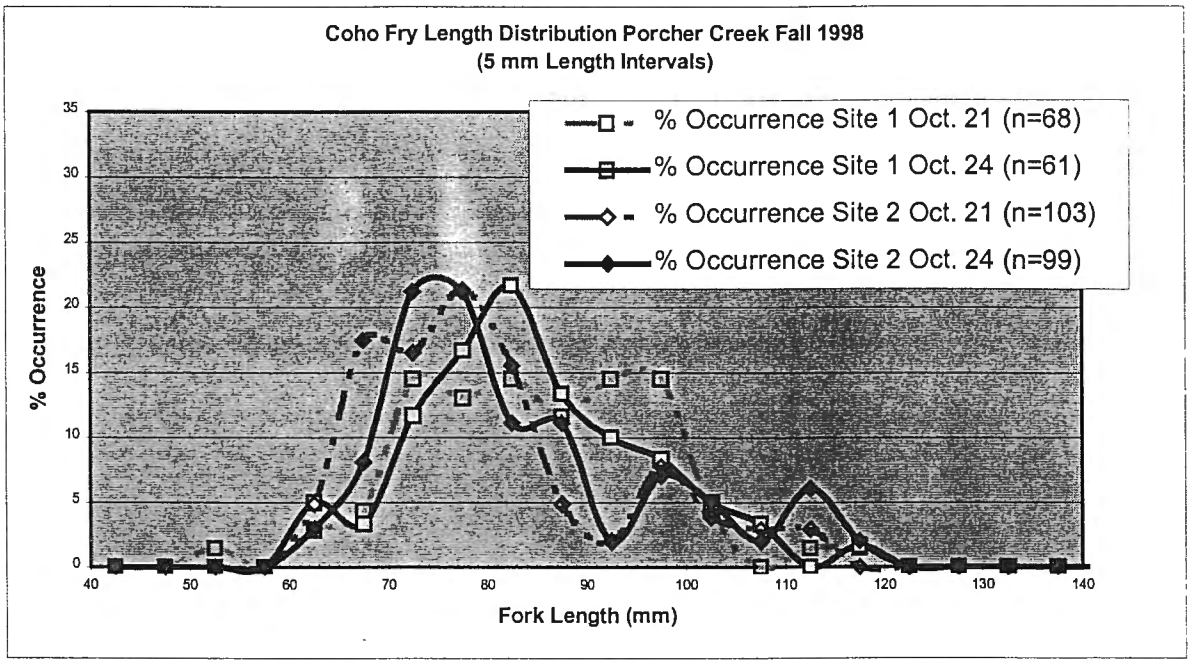


Figure 40 - Age-size Distributions - Porcher Creek

It is difficult to make definite assumptions about the age-size distribution of coho fry in the sampled sites on Porcher Creek, due to the complicated and confusing age-size distributions (Figure 40). 1999 age-size distributions were not plotted due to the limited sample size.

However, it is apparent that there is a definite bimodal age-size distribution; similar to Kumealon, Head, and Wolf Creeks, and Oona and Pa-aat Rivers age-size distribution patterns. This pattern of bimodal peaks for coho fry age-classes is probably due to the staged recruitment from the distinct early and late runs of adult coho spawners in these systems.

It is difficult to assess if low early fall water flows have an impact on the separation between early and late runs of returning coho adults; but all of the sampled watersheds in Porcher Inlet, which are chronically subject to low flow conditions (Table 3 *Summary Report*), strongly exhibit this phenomenon of bimodal coho fry distributions.

It also appears that 1st year coho fry in site 2 are slightly smaller in fork length than site 1 coho fry. This may be due to the fact that reach 1 generally has better rearing habitat, and even though sculpin predation levels may be increased in reach 1; growth rates are similarly increased.

8.3.5 Weights

Coho fry weights were recorded on October 21, 1998, and then were plotted against fork lengths (Figure 41). This information was then used to calculate fish condition factors.

As well, this information was used in order to estimate current biomass as a percentage of expected carrying capacity of site 2. Due to the complicated age-size distribution patterns; the percentage of 1st year coho fry in the population of both sites was not estimated, and therefore the estimation of current biomass as a percentage of expected carrying capacity was also not calculated.

However, the current biomass as a percentage of potential annual smolt output was calculated (Table 13 *Summary Report*). Site 1 and site 2 were estimated to have 67.7% and 119.0%, respectively, of the potential annual smolt output as current estimated biomass in these pools.

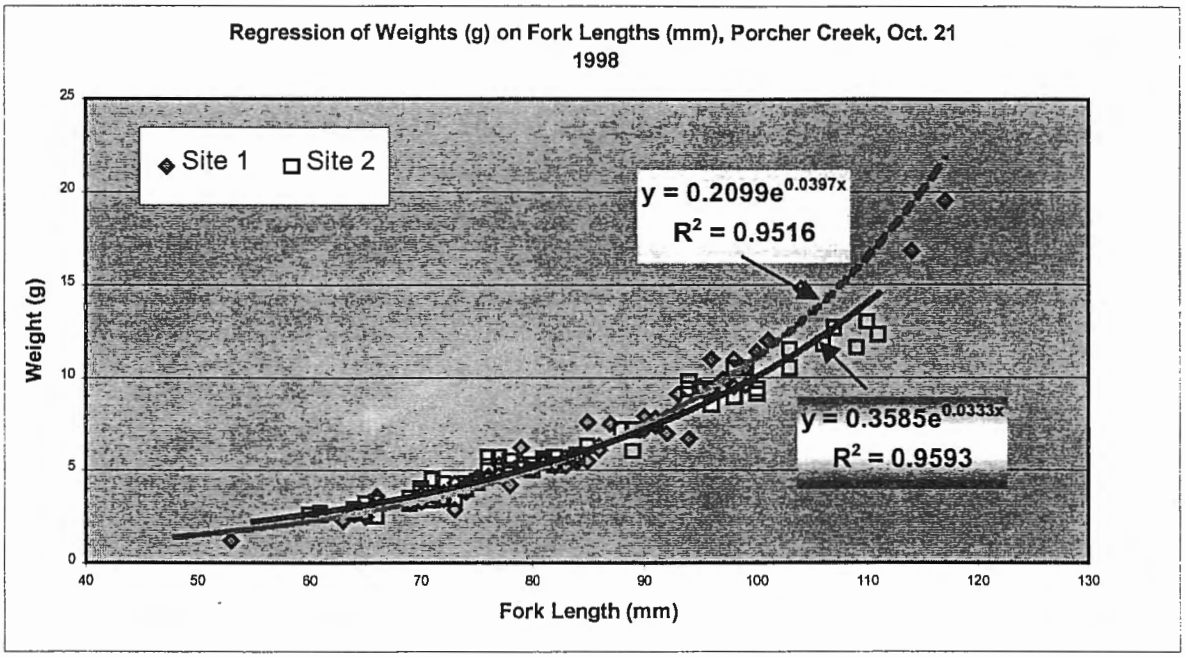


Figure 41 - Regression of Coho Fry Weights on Fork Lengths - Porcher Creek

The weights were plotted against fork lengths for both sites, and a regression equation was developed to describe these relationships (Figure 41). It is interesting to note that the larger (*i.e.* longer fork length, 100+ mm) coho fry in site 1 were ~15% heavier than site 2 coho fry for the same fork length. Again, this may be due to the fact that reach 1 has better rearing habitat, and there would be increased interspecific competition from resident trout as the coho fry increase in length.

8.3.6 Fish Condition Factors

The overall average watershed fish condition factors for site 1 and site 2 were calculated to be 1.03 (+/- 0.12) and 1.05 (+/- 0.10), respectively, on October 21, 1998 (Table 14 and Figure 13 *Summary Report*).

9. Results and Discussion - Shaw Creek Watershed

9.1 Background Review

915-742200-87800

9.1.1 General Watershed Description

Shaw Creek (DFO Watershed Code 97-8700-230), located in Petrel Channel on the east side of McCauley Island, flows east to Petrel Channel (Figure 44). It is a third order stream, 8.6 km in length, draining an area of 26.0 km^2.

Shaw Creek is a low gradient stream throughout its' length. Shaw Creek has a 5.5% gradient for the first 350 m, a 1.0% gradient for the next 2.9 km, a 2.0% gradient for the next 0.9 km, a 0.5% gradient for the next 3.8 km, a short 200 m higher gradient section with 10.0% gradient, and a 4.0% gradient to its' termination at 8.6 km (Figure 42).

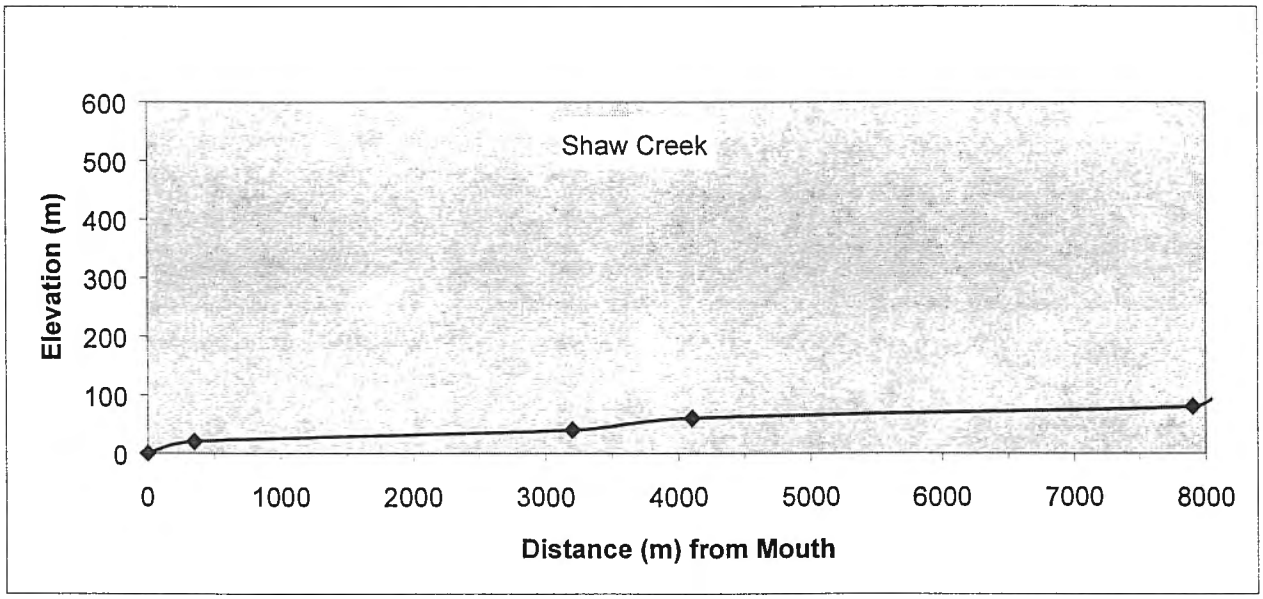


Figure 42 - Gradient Profile for Shaw Creek

Shaw Creek also has a major tributary that empties from the North into Shaw Creek, 80 m from the mouth of Shaw Creek. This "*North Tributary of Shaw Creek*" is a 2nd order stream, 3.3 km in length, and drains an area of 6.0 km^2. The North Tributary is a slightly higher gradient than Shaw Creek, having a gradient of 3-5% throughout its' length (Figure 43).

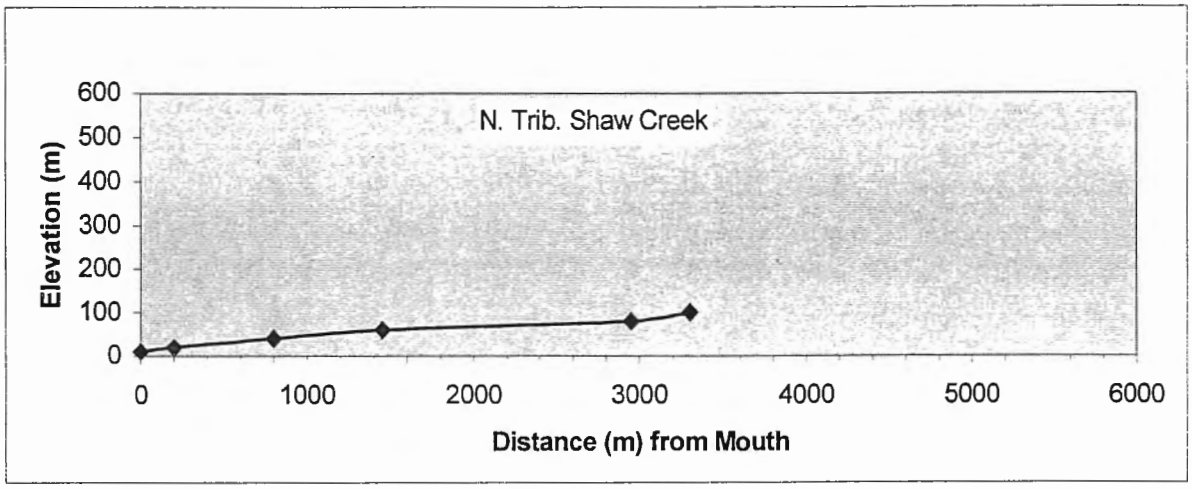


Figure 43 - Gradient Profile for the North Tributary of Shaw Creek

9.1.2 Historical Fisheries Data

The Shaw Creek watershed contains three species of Pacific salmon: coho (*Oncorhynchus kisutch*), pink (*Oncorhynchus gorbuscha*), and chum (*Oncorhynchus keta*) salmon (SISS, FISS, Hancock et al., 1983). Pink and chum salmon species have been observed spawning below the falls at 0.4 km and in the North Tributary, while coho have been observed past the falls in Shaw Creek (SISS, 1991). Resident cutthroat trout (*Oncorhynchus clarki* clarki*)*, rainbow trout (*Oncorhynchus mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present (Table 38).

Select comments from Streamwalkers data are summarized in Table 34.

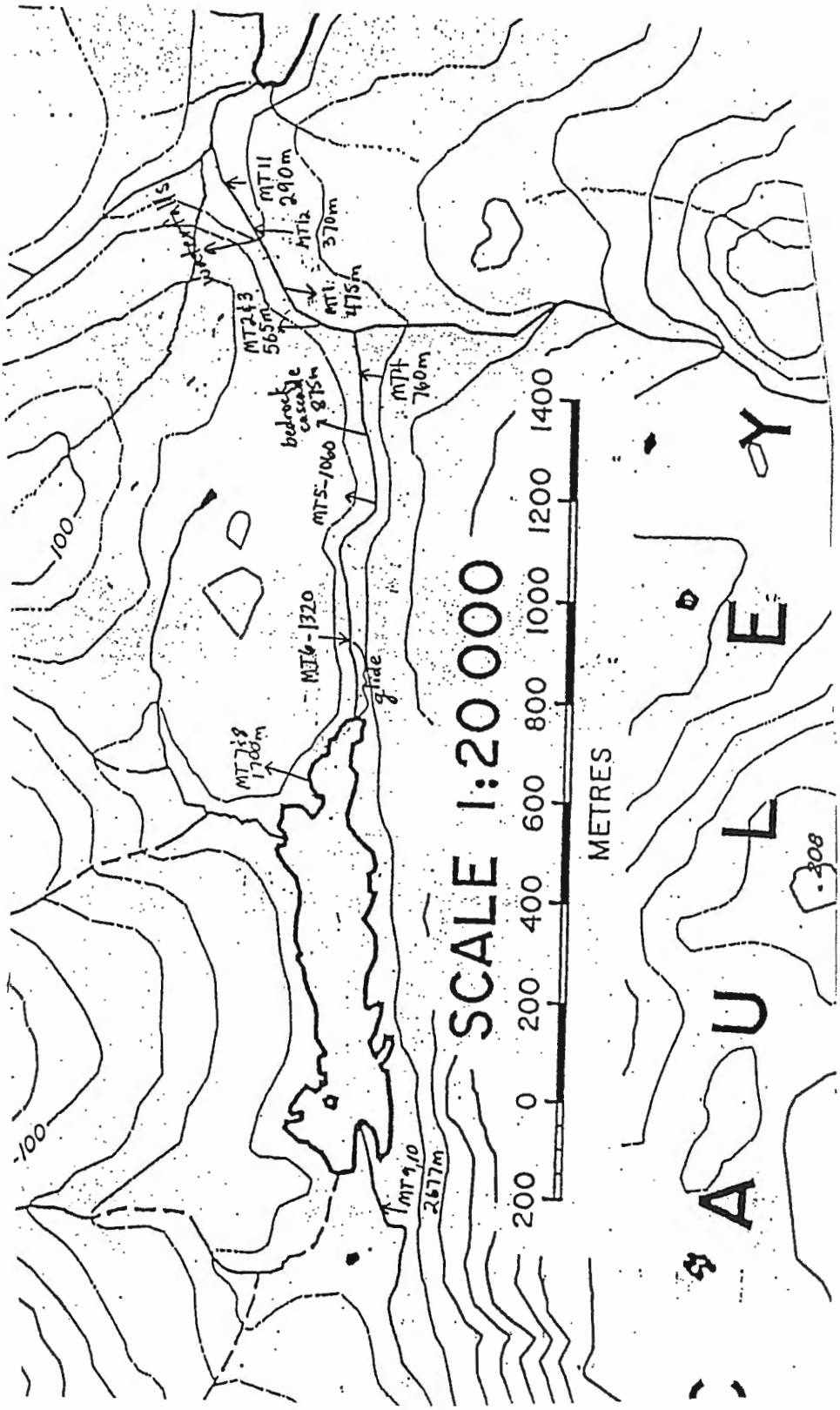


Figure 44 - Overview Map of Shaw Creek

Table 34 - Summary of Condensed Selected Historical Streamwalkers Comments - Shaw Creek

Year	Impacts/Comments
1952	Low flows delayed pink spawning runs.
1961	Low water levels late August.
1963	Low water levels late August.
1965	Low water levels June, July, August, and September. All species runs delayed.
1967	Low water levels late August.
1968	Low water levels late August.
1969	Coho noted in both streams.
1970	Coho stocks low due to trolling in Petrel Channel.
1974	Low water levels late August, coho above falls.
1976	No coho above falls, fish unable to pass. Little blasting done on falls.
1977	Low water levels late August, pinks not above falls.
1978	Pinks not above falls.
1979	Coho above falls.
1980	Coho above forks.
1981	Low water levels late August, coho above forks.
1984	Low water levels in winter.
1985	Low water late August and in winter.
1986	Low water late August, prespawn die-off early September.
1987	Low water levels in winter.
1989	Coho in both forks.
1990	Coho in both forks, pinks more in left fork.
1992	Low water levels late August, coho below falls.
1993	Low water levels late August, log jam in Northwest fork.
1994	Log jam.
1995	Removed log jam.

The escapement data for coho salmon in Shaw Creek are presented in Figure 45. These data indicate that the coho returns to Shaw Creek are fairly substantial for the size of the stream (~1500 maximum adult coho escapement numbers). There is also a substantial run of chum salmon (~1800 maximum adult coho escapement numbers).

The escapement data for coho salmon in this watershed is mostly complete, with the exception of the years 1978, 1981, 1989, and 1995-96.

It appears that during the years 1950 to 1968, there were good coho returns in Shaw Creek, a sharp decrease in escapement numbers from 1969 to 1984, and a return to higher escapement numbers from 1985 to 1995.

Shaw Creek is included in the Department of Fisheries and Oceans (DFO) Area 5. Escapement data for Area 5 (Figure 6 *Summary Report*) similarly shows high returns from the mid-1950's to 1968. Additionally, during the mid-1970's, Area 5 Total reported moderate returns, which were not mirrored by Shaw Creek escapement numbers.

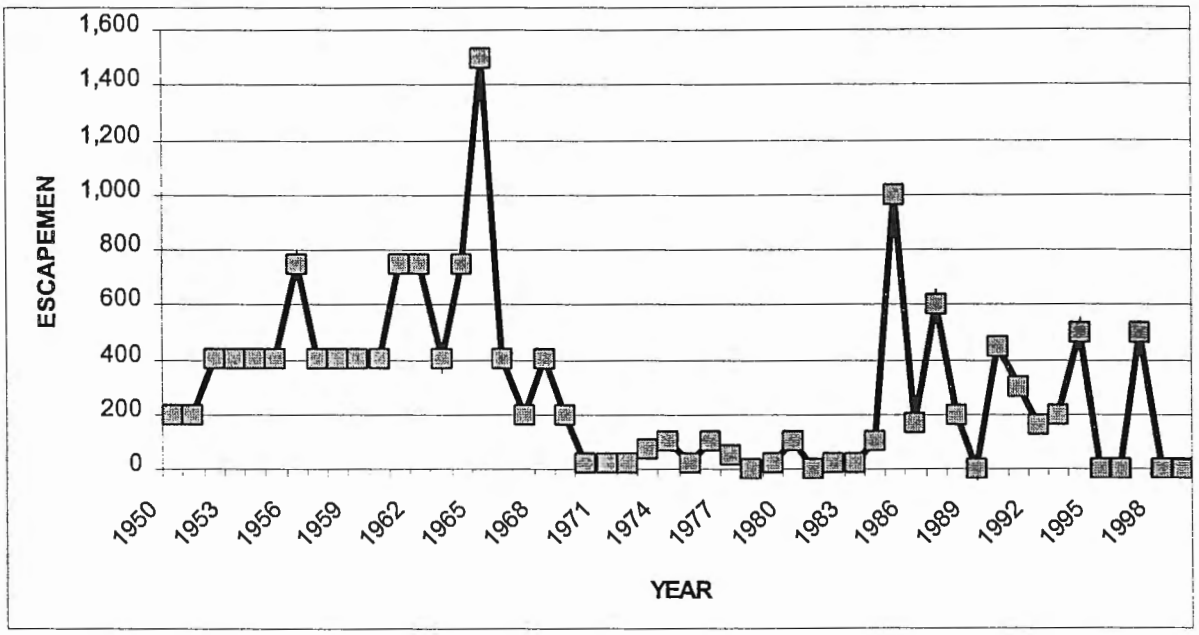


Figure 45 - Historical Coho Escapement - Shaw Creek

9.2 Overview Level Watershed Survey

The physical characteristics of the two surveyed reaches of Shaw Creek, including channel morphology, gradient, widths and substrate composition are presented in Table 35. Habitat parameters (1997) for reach 2 of Shaw Creek, were calculated and these parameters are presented in Table 36. Reaches 1, 3 and 5 were not entirely surveyed, and therefore the results are not included. Reach 4 is a lake, and the habitat parameters are not applicable to this type of habitat. Following these tables is a brief description of the fish habitat available in each reach of Shaw Creek and a summary.

Table 35 - Physical Characteristics for Reaches in Shaw Creek

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-380)	Cascade-Pool	5-6	N/A	N/A	Cobble	Large Gravel
2 (380-1130)	Cascade-Pool	1-4	12.0±1.4	10.0±1.4	Large Gravel	Cobble
3 (1130-1440)	Backflooded Run	0.5-1	N/A	N/A	Sand	Mud
4 (1440-2300)	Lake	0	N/A	N/A	Mud	Sand
5 (2300+)	Backflooded Run	0.5-1	N/A	N/A	Mud	Sand
1 North Trib. (0-1600+)	Cascade-Pool	3-4	3-4	6-8	Cobble	Large Gravel

Table 36 - Habitat Parameters for Reach 1 in Shaw Creek

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
2 (380-1130)	5.5	P	14.8	P	0.2	F	0.2	20	70	10

Notes: Reaches 1, 3, 5 not entirely surveyed and therefore not included. Reach 4 is a lake and therefore also not included. Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Shaw Creek had cascade-pool morphology with the substrate mainly composed of cobble and large gravels, with minor amounts of boulders. This is a short reach (~380 m) that terminates at a 3m falls, which are passable at higher water flows to adult coho. There is a large pool at the base of the falls which is transversely dissected by a bar of boulders, and several smaller pools at the upper end of the reach.

A qualitative assessment of the reach indicated that juvenile overwintering habitat was very limited except for the larger pool near the waterfall, and juvenile rearing habitat was similarly limited. This reach, especially the large pools beneath the waterfalls, has nearly the only dependable adult coho holding and spawning habitats on this watershed. In years of low water flow, it is felt that many coho holding in the pools downstream of the waterfalls die from gas supersaturation when water temperatures rise.

Shaw Creek was initially visited on 15 Sept. 1998, and we found ~380 adult coho holding in the pool below the falls, with ~80 preyed-on (wolf and eagle) dead coho, and found very few juvenile coho throughout the system (Table 38 and Table 39). The water temperature was 13^{0}C, and DO (dissolved oxygen) was 9.5 mgl^{-1} (~92% saturation), with a low water discharge of ~31m^{3}min^{-1}.

Approximately 1 week later, the DFO streamwalker (Kent Whyles) informed us that he has just visited Shaw Creek and found some 380 dead adult (non-spawned) coho. This week was very warm, and no rains fell. We responded immediately, and found some 250 adults remaining in the pool, and using dip nets and pack sacks, we manually lifted 127 adults over the small waterfall. Dead fish displayed enlarged kidneys, and distended air bladders. Additionally, many live fish displayed "popeye".

It is very likely that the adult had suffered from gas supersaturation as it would be expected that the water temperatures would have warmed-up in the previous week. Fall rains were late, and this may be due to a warming trend or El Niño, and would explain the paucity of juvenile coho in the system (this die-off may have happened to some degree in the last year or two also). A fish ladder could be installed to alleviate this problem. Stock enhancement may be necessary for a few years to ensure survival of the stock since adult returns would be

expected to be very low for the next year or two, since very few coho juveniles were found throughout the system.

Historic fisheries data indicates that adult coho are able to navigate the ~3 m waterfalls at 380 m during high water flows only (Table 34). Installation of a fish ladder by blasting, or secondarily by installation of a wooden fish ladder, would provide access to an additional 8.2 km of prime fish habitat (estimation by gradient < 10%). Currently, anadromous species are only able to utilize the lowest 380 m, or only 5% of the stream length with fish habitat potential at low water flows.

Reach 2

Reach 2 of Shaw Creek had cascade-pool morphology with the substrate mainly composed of cobble and large gravels, with minor amounts of boulders. The channel was confined. There are also 3 sets of cascades with the associated bedrock pools. All cascades were passable to coho, and probably passable to pink salmon.

A qualitative assessment of the reach indicated that there was marginal juvenile overwintering habitat, fair juvenile rearing habitat, and adequate adult coho spawning and holding pools.

The percent of pools by channel area was only 5.5% (Table 36), indicating that this reach is rated as '*poor*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Shaw Creek (>5% gradient and <15m width) require over 30% of percent pools by area to provide good salmonid habitat. However, given the somewhat higher gradient for this reach, it would not be expected to contain a large percentage of pool habitat. As well, pool frequency is also '*poor*' with a pool every 14.8 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996).

Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of 1.20 m with '*good*' cover overall, generally in the form of boulders. From these calculations, it is apparent that Reach 1 is deficient in the pool habitat available for salmonids, but the few available pools are excellent adult holding and good juvenile overwintering habitat..

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were only 0.2 pieces of LWD per channel (Table 36), a '*poor*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). It is felt that the high water flows scour available LWD from this reach. Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, only 10.0% of the total LWD pieces are greater than 50 cm in diameter. It is apparent that LWD plays a minor role in creating habitat in this reach.

Reach 3

Reach 3 of Shaw Creek had a morphology of a shallow back-flooded run, with the substrate mainly composed of sand and mud, with minor amounts of gravels. There was also substantial amounts of both instream and riparian cover. The instream vegetation consisted of mosses and grasses, and the riparian cover was mainly shrubs.

A qualitative assessment of the reach indicated that there was excellent juvenile rearing habitat, fair adult holding habitat, marginal juvenile overwintering habitat, and no adequate adult coho spawning and holding pools.

Reach 4

Reach 4 of Shaw Creek was a shallow lake, with the substrate mainly composed of mud and sand. There were also substantial amounts of riparian cover, and marshy areas. The instream vegetation consisted of grasses, and the riparian cover was mainly shrubs.

A qualitative assessment of the reach indicated that there was fair juvenile rearing habitat, although larger resident cutthroat trout would be expected to prey on smaller coho fry. There was also good adult holding and juvenile overwintering habitats.

Reach 5

Reach 5 of Shaw Creek had virtually the same habitat as reach 3, except that the depths were greater, and mud was the primary substrate. Reach 5 had a morphology of a shallow back-flooded run, with the substrate mainly composed of mud. There were also substantial amounts of both instream and riparian cover. The instream vegetation consisted grasses, and the riparian cover was mainly shrubs.

A qualitative assessment of the reach indicated that there was good juvenile rearing and adult holding habitats, adequate juvenile overwintering habitat, and no adequate adult coho spawning habitat. This reach was surveyed to 2677 m, only.

Reach 1 North Tributary

Reach 1 of the North Tributary of Shaw Creek had cascade-pool morphology with the substrate mainly composed of cobble and large gravels, with minor amounts of boulders and sands. The average low water flow allows LWD to build-up in this reach, unlike reach 2 of Shaw Creek where high flows appear to scour LWD from the reach. LWD plays a critical function in creating pool habitat in this reach, holding and retaining bedload. Besides numerous LWD jams, there are also numerous bedrock cascades with the associated bedrock pools at the downstream side of the cascade. The largest cascade/pool complex is at 985 m, and would also be suitable chum spawning habitat.

A qualitative assessment of the reach indicated that juvenile overwintering habitat was somewhat limited except for the larger LWD and bedrock. Juvenile rearing habitat was fair to adequate. There was excellent pink spawning habitat, and fair to adequate coho spawning habitat in the larger pools. However, it would be expected that adult coho would have difficulties in reaching these pools during low flow conditions.

Summary

Table 37 summarizes the reaches of Shaw Creek, and reach 1 of the North Tributary.

Table 37 - Reach Descriptions - Shaw Creek

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-380	Reach 1: Adequate adult holding and spawning habitats, limited juvenile rearing and overwintering habitats. 3 m waterfalls at upper end of reach, impassable at low flows.
½	380	3 m waterfall, passable to adult coho at higher flows only.
2	380-1130	Reach 2: Marginal juvenile overwintering habitat, fair juvenile rearing habitat, and adequate adult coho spawning and holding pools.
2	575, 875, 920 m	Cascades, passable for adult coho.
3	1130-1440	Reach 3: Excellent juvenile rearing habitat, fair adult holding habitat, marginal juvenile overwintering habitat, and no adequate adult coho spawning and holding pools.
4	1440-2300	Reach 4: Lake. Fair juvenile rearing habitat, good adult holding and juvenile overwintering habitats.
5	2300+?	Reach 5: Good juvenile rearing and adult holding habitats, adequate juvenile overwintering habitat, and no adequate adult coho spawning habitat.
1 N. Trib.	0-1600+	Reach 1: Excellent pink spawning habitat, fair coho spawning habitat in the few larger pools. Poor juvenile rearing and adult holding habitats, very poor juvenile overwintering habitat. Frequent LWD jams, sediment wedges, and cascades.
1 N. Trib.	130, 200, 270, 430, 580, 640, 770, 985	Bedrock cascades with pools.
1 N. Trib.	340, 370, 410, 600, 680, 985-1040, 1310	LWD jams with sediment wedges.

9.3 Minnow-trapping Data

9.3.1 Overview Catch per Unit Effort (CPUE)

Comparing overview catch per unit effort results (Table 38) between reaches: reach 1 was the only reach on Shaw Creek that coho juveniles were captured. It is therefore obvious that adult coho were not able to traverse the 3 m waterfalls in the past 2 years.

Additionally, few coho juveniles were found in the North Tributary of Shaw Creek (Table 39), and there were also significant sculpin CPUE values in the reach.

In the "*Summary Report*", a significant and serious sculpin/coho interaction was described from interpretation of CPUE results from all watersheds. It was hypothesized that in impacted and infilled pool habitat, sculpins would have much higher success in capturing and eating younger coho fry.

Since there are significant sculpin CPUE values in the North Tributary (Table 39), reach 1 may be an example of an impacted watershed where sculpins may have greatly improved success in capturing younger coho fry.

9.3.2 Site-Specific Catch per Unit Effort (CPUE)

Site 1 (Figure 46) had poorer juvenile coho rearing habitat than reach 1. The pool site chosen ranked 28th and 29th (coho CPUE), and 19th and 25th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 1 ranked 12th (Coho CPUE) and 8th (Total CPUE) of 49 overview CPUE values.

9.3.3 Site-Specific Juvenile Coho Fry Densities

The site-specific Juvenile coho fry density for Shaw Creek is not available, due to the fact that no marked fish were recaptured.

9.3.4 Fork Lengths

Age-size distributions were not completed on Shaw creek due to the fact that there was too small of a sample size (n=7).

9.3.5 Weights

Coho fry weights were recorded on October 18/19, 1998, and were not plotted against fork lengths due to the fact that there was too small of a sample size (n=7).

9.3.6 Fish Condition Factors

Fish condition factors were not calculated due to the fact that there was too small of a sample size (n=7).

Table 38 - Overview Catch per Unit Effort Results - Shaw Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
11	9/15/98 19:20	9/15/98 19:45	0:25	290	1	Main channel, in bedrock and boulder pool.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12	9/15/98 19:40	9/15/98 19:52	0:12	370	1	Main channel, in deep bedrock scour pool below waterfall.	2				3		5	10.00	0.00	0.00	0.00	15.00	0.00	25.00	
1	9/15/98 12:40	9/15/98 16:40	4:00	475	2	Main channel, in shallow bedrock pool.		2					2	0.00	0.50	0.00	0.00	0.00	0.00	0.50	
2	9/15/98 12:50	9/15/98 16:35	3:45	565	2	Main channel, in shallow bedrock pool.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3	9/15/98 13:00	9/15/98 16:30	3:30	565	2	Main channel, in bedrock scour pool.		2			1		3	0.00	0.57	0.00	0.00	0.29	0.00	0.86	
4	9/15/98 13:10	9/15/98 16:10	3:00	760	2	Main channel, in shallow bedrock pool.		10		1			11	0.00	3.33	0.00	0.33	0.00	0.00	3.67	
5	9/15/98 13:37	9/15/98 15:50	2:13	1060	2	Off main channel, in scour pool,with cut bank.		3			2		5	0.00	1.35	0.00	0.00	0.90	0.00	2.26	
6	9/15/98 14:00	9/15/98 15:30	1:30	1320	3	Main channel, at bottom of glide.		5	1	1	2	2	11	0.00	3.33	0.67	0.67	1.33	1.33	7.33	
7	9/15/98 14:50	9/15/98 15:10	0:20	1700	4	In lake, north side.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8	9/15/98 14:50	9/15/98 15:10	0:20	1700	4	In lake, north side.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9	9/15/98 15:20	9/15/98 15:50	0:30	2677	5	Above lake, in back-flooded channel area with grass.						3	3	0.00	0.00	0.00	0.00	0.00	6.00	6.00	
10	9/15/98 15:20	9/15/98 15:50	0:30	2677	5	Above lake, in back-flooded channel area with grass.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total Watershed Catch Effort		20:15			Total Watershed # Capture	2	22	1	2	8	5	40	0.10	1.09	0.05	0.10	0.40	0.25	1.98	Total CPUE
	Reach 1 Catch Effort		0:37			Reach 1 # Capture	2	0	0	0	3	0	5	3.24	0.00	0.00	0.00	4.86	0.00	8.11	Reach 1 CPUE
	Reach 2 Catch Effort		16:28			Reach 2 # Capture	2	2	0	0	3	0	7	0.12	0.12	0.00	0.00	0.18	0.00	0.43	Reach 2 CPUE
	Reach 3 Catch Effort		1:30			Reach 3 # Capture	0	5	1	1	2	2	11	0.00	3.33	0.67	0.67	1.33	1.33	7.33	Reach 3 CPUE
	Reach 4 Catch Effort		0:40			Reach 4 # Capture	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Reach 4 CPUE
	Reach 5 Catch Effort		1:00			Reach 5 # Capture	0	0	0	0	0	3	3	0.00	0.00	0.00	0.00	0.00	3.00	3.00	Reach 5 CPUE

Table 39 - Overview Catch per Unit Effort Results – North Tributary of Shaw Creek 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)							
Trap	Times			Habitat			Species							Species							
	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
13	9/16/98 19:10	9/16/98 19:30	0:20	200	1	Shallow pool.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
14	9/17/98 10:15	9/17/98 13:20	3:05	340	1	Shallow LWD pool.					9		9	0.00	0.00	0.00	0.00	2.92	0.00	2.92	
15	9/17/98 10:22	9/17/98 13:15	2:53	400	1	Shallow side pool.	3						3	1.04	0.00	0.00	0.00	0.00	0.00	1.04	
16	9/17/98 11:25	9/17/98 12:50	1:25	980	1	Deep pink and coho spawning pool at bottom of small cascade.				3			3	0.00	0.00	0.00	2.12	0.00	0.00	2.12	
17	9/17/98 11:25	9/17/98 12:50	1:25	980	1	Deep pink and coho spawning pool at bottom of small cascade.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
18	9/17/98 12:15	9/17/98 12:35	0:20	1530	1	Side channel riffle.							0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total Watershed Catch Effort		9:28			Total Watershed # Capture	3	0	0	3	9	0	15	0.32	0.00	0.00	0.32	0.95	0.00	1.58	Total CPUE

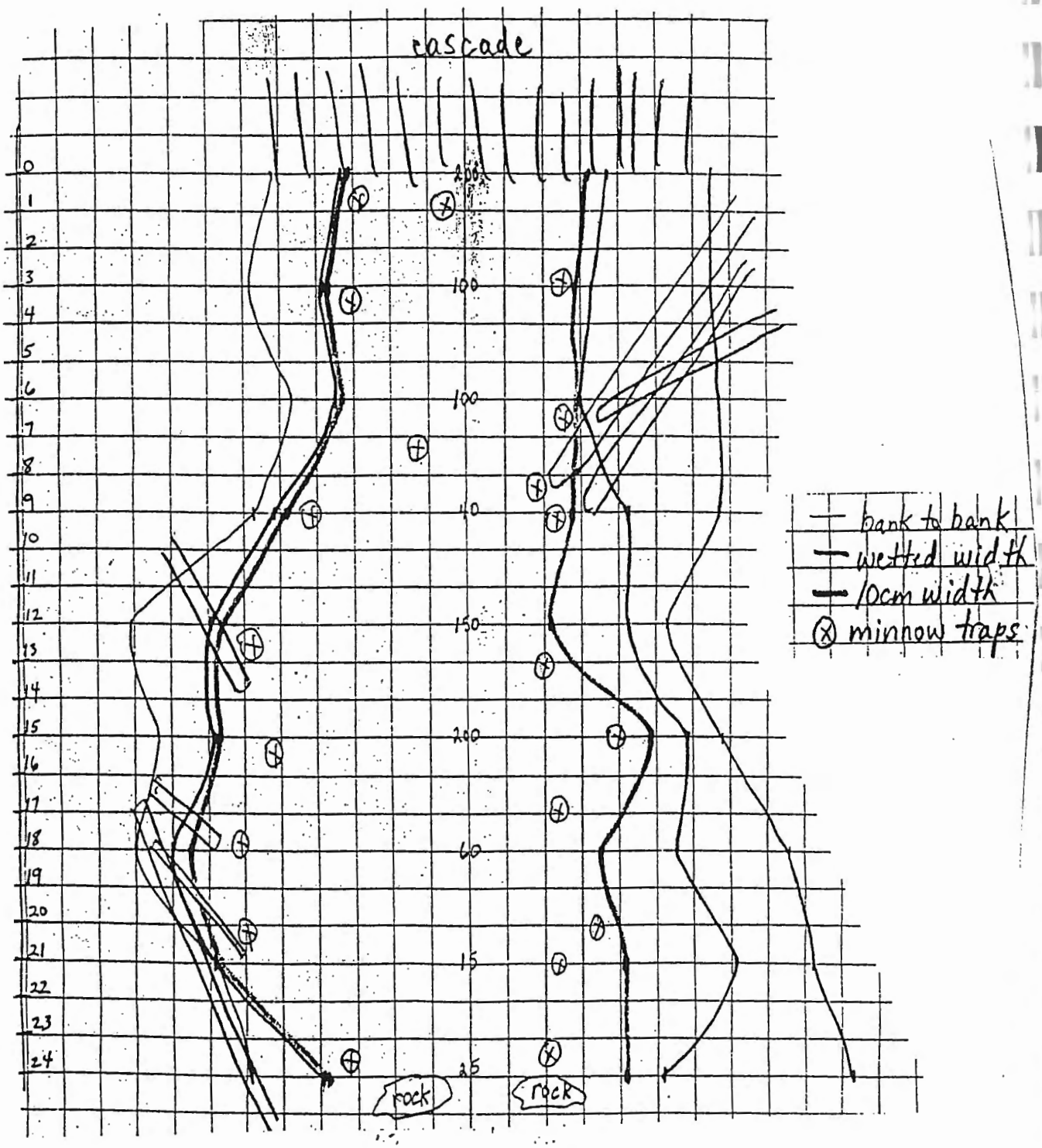


Figure 46 - Detailed Drawing - Site 1 - Shaw Creek

10. RESULTS AND DISCUSSION - SPILLER RIVER WATERSHED

10.1 Background Review

915-7655500-87800

10.1.1 General Watershed Description

Spiller River (DFO Watershed Code 97-9300-080), located on the northeast of Porcher Island, flows northwest to Chismore Passage (Figure 48). It is a third order stream, 2.9 km in length, draining an area of 5.8 km^2. Spiller River is a low gradient stream with an overall gradient of approximately 2% throughout its' length (Figure 47).

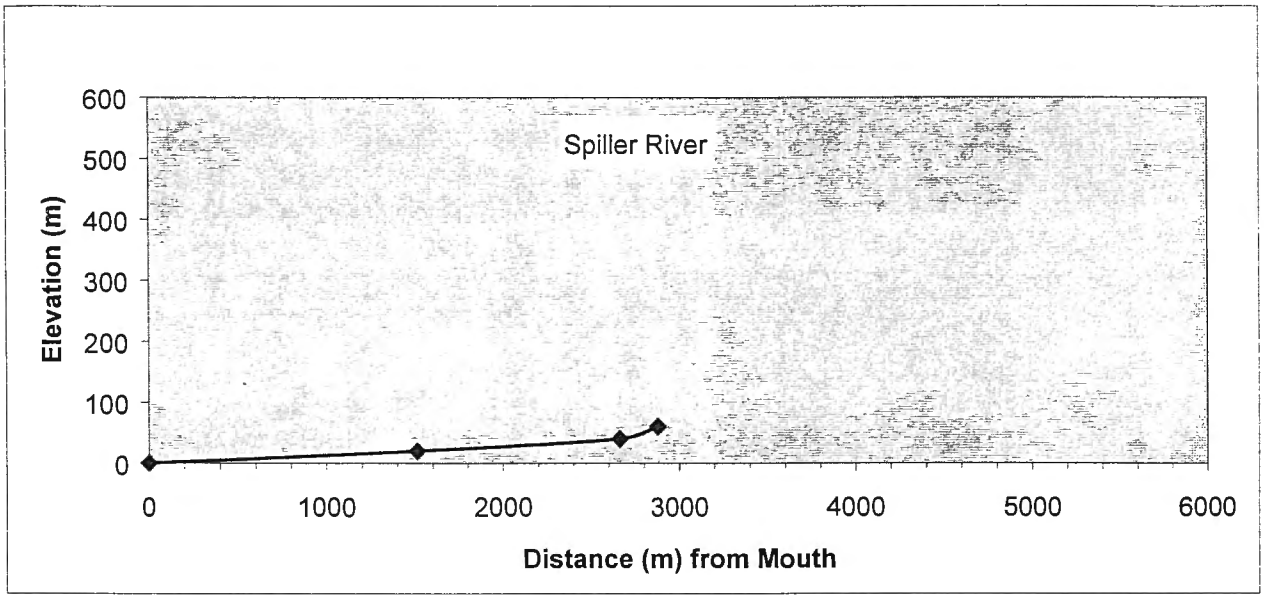


Figure 47 - Gradient Profile for Spiller River

10.1.2 Historical Fisheries Data

The Spiller River watershed contains two species of Pacific salmon, coho salmon (*Oncorhynchus kisutch*) and pink salmon (*Oncorhynchus gorbuscha*) (SISS, FISS, Hancock et al., 1983). Both species have been observed spawning in the lower 1.8 km, with quite substantial numbers of pink spawners (SISS, 1991). Resident cutthroat trout (*Oncorhynchus clarki* clarki), rainbow trout (*Oncorhynchus mykiss*), Dolly Varden char (*Salvelinus malma*) and sculpins (*Cottus* spp.) are also present.

Spiller River is said to have good rearing habitat in side channels and small tributaries, with good spawning gravel beds in slough-like marshy grassland near the mouth, with the tidal influence extending to 0.8 km upstream (FISS, 1997). Pink and coho salmon have been observed spawning in the lower 1.8 km of Spiller River, with substantial numbers of pink spawners (SISS, 1991). However, both species traditionally utilized the entire 4.0 km upstream from the mouth of Spiller River (Hancock et al., 1983). Select comments from Streamwalkers data are summarized in Table 40.

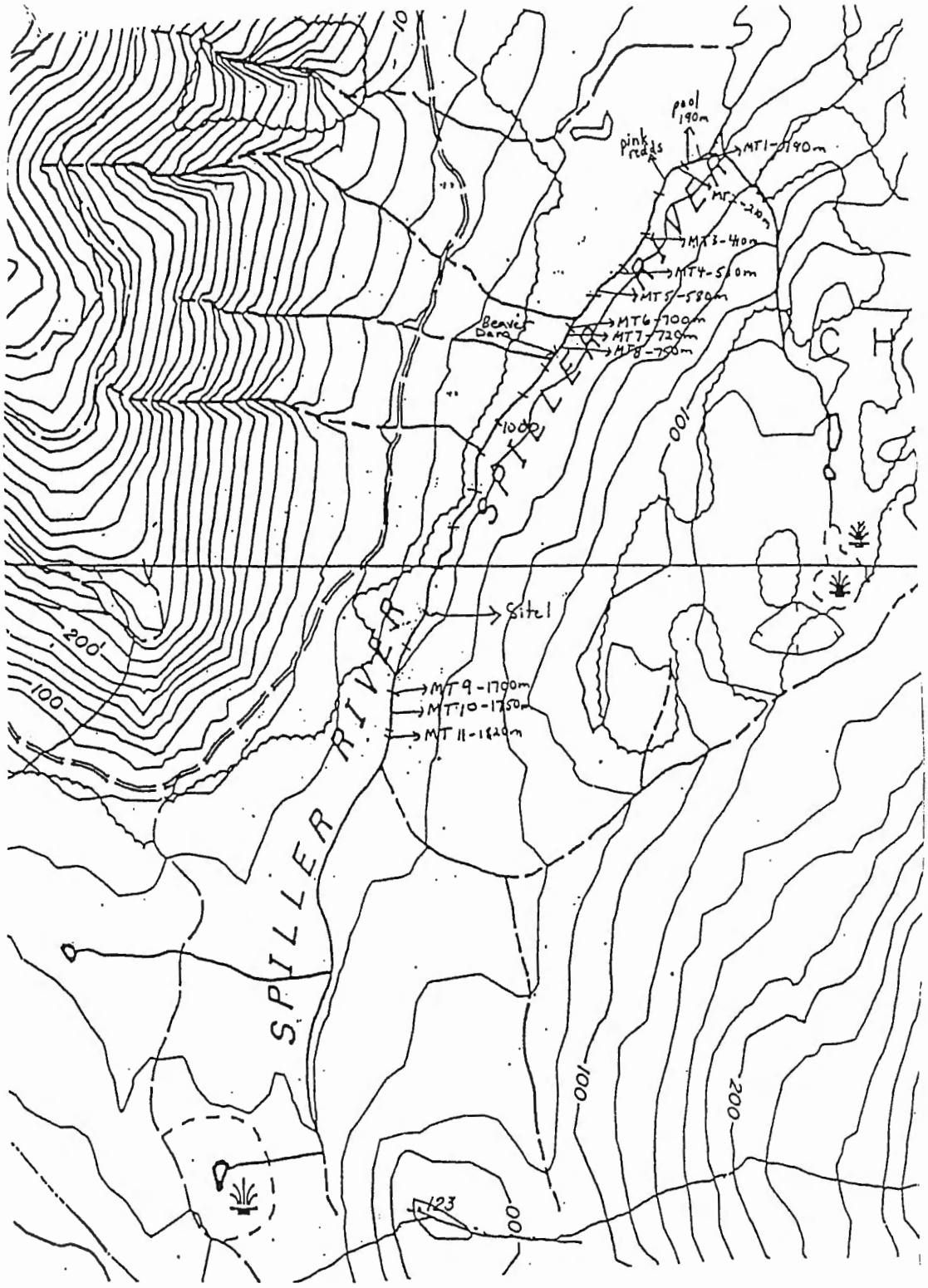


Figure 48 - Overview Map of Spiller River

Table 40 - Summary of Condensed Selected Historical Streamwalkers Comments - Spiller River

Year	Impacts/Comments
1950	Fish spawn along entire length of stream, from bridge at mouth to approximately 3.3 km upstream.
1953	Preponderance of female pinks observed.
1957	Spawning fish to 0.8 km upstream from mouth.
1961	Prespawn die-off due to low water on September 1, satisfactory water levels for remainder of run.
1963	As above, fish die-off early September.
1965	Low water delayed upstream migration.
1967-80	Minor silting noted most years.
1971	Slight scour and erosion. Spawning fish to 1.7 km upstream from mouth.
1972	Evidence of overspawning of pinks.
1974	Low water levels late August.
1978	Heavy November rains may have scoured some redds.
1981	Streambed stable. Good coho rearing in side channel, and small tributaries. No obstructions to fish passage.
1983-84	Majority of upslopes logged by Whonnock Industries.
1983	Beaver dam built around log jam, 1.7 km upstream from mouth. Some erosion.
1984	DFO blasted beaver dam August 9, at approximately 1.25 km upstream from mouth. Freezing low water in early November.
1985-86	Lowest riparian areas logged by Whonnock Industries.
1985	Silting caused by logging. Low water levels. Beavers rebuilding dams.
1987	Low water levels in August.
1991	Beavers build dams behind log jams.
1997	Log jam at 750-900m. Braided thalweg. Possible fish passage. 1.5 m falls.

The escapement data for coho salmon in Spiller River are presented in Figure 49. These data indicate that the coho run to Spiller River is fairly small. Between 1950 and 1965, no coho were enumerated spawning in Spiller River. Coho returns were highest in the late 1960's, with a peak of 1,500 fish in 1966 and a mean of 117 fish between 1967 and 1969. Since 1969, counts were nil, no coho were observed or the stream was not inspected. However, in 1989, coho were present, but they were not enumerated. As previously mentioned, there are inherent inaccuracies in streamwalkers data, but they do provide a general indication of the numbers of fish present in the system.

The east side of Porcher Island, including Chismore Passage, is included in the Department of Fisheries and Oceans (DFO) Coastal Subarea of Area 4. Escapement data for the Coastal Subarea (Figure 5 *Summary Report*) also show very high returns in the late 1960's, with a peak of 40,225 fish in 1966 and a mean of 16,400 (1966-1969). These data also indicate that the present numbers of coho returning to the subarea, although variable, are similar to those observed in the past. For example, between 1950 and 1965, the mean return was 2,910 coho and between 1970 and 1996, 3,840 coho.

1966 was a peak year for coho returns for all areas (Figure 49, and Figures 4-9 *Summary Report*).

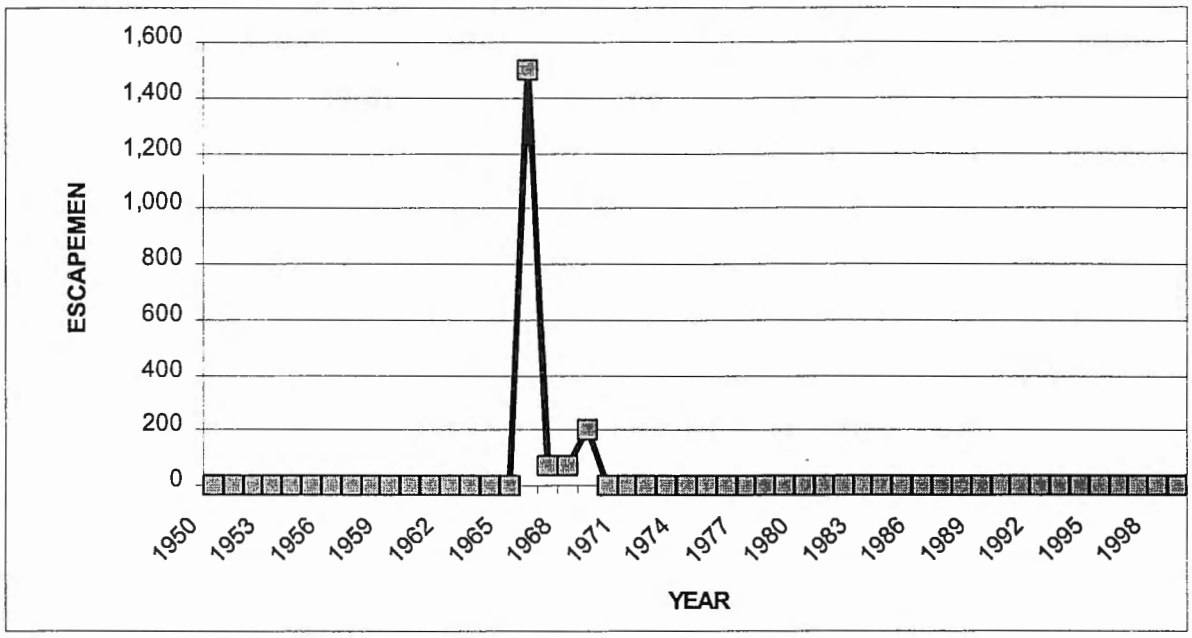


Figure 49 - Historical Coho Escapement - Spiller River

Reviewing the logging history of Spiller River in Triton's (1998) Porcher Island report, it states that:

- most of the slopes north of Spiller River were harvested in 1983-84 and most of the lower river drainage north of Spiller River were harvested in 1985-86;
- 1.7 km^2 or approximately 30% of the Spiller River watershed has been logged, the majority being a large clearcut on the south face of the Spiller Range, adjacent to the north bank in reaches 2 and 3; and
- the riparian zone on the north side of the river was logged in 1985-86, extending from 750 m to 1400 m upstream of the mouth.

A narrow buffer strip of streamside vegetation was left on the north side of the river, however, due to back-flooding of the beaver dams in Reach 2: there is no remaining streamside vegetation on the north side of Spiller River except for coniferous revegetation (Triton, 1998).

10.2 Overview Level Watershed Survey

The physical characteristics of the three reaches of Spiller River, including channel morphology, gradient, widths and substrate composition are presented in Table 41. Habitat parameters (1997) for Reaches 1 and 3 of Spiller River, from Triton's 1998 report, were calculated and these parameters are presented in Table 42 and Table 43. Following these tables is a brief description of the fish habitat available in each reach of Spiller River and a summary. Since smaller side-pools were omitted from the 1998 sampling protocol; 1998 results are not shown in order to avoid erroneous comparisons.

The reach descriptions from Triton (1998) for Spiller River were reviewed, updated, and included in our report.

Table 41 - Physical Characteristics for Reaches in Spiller River -Triton Environmental 1997

Reach Number (instream distance, m)	Channel morphology	Gradient (%)	Widths (m) (mean +/- standard deviation).		Substrate Composition	
			Channel	Wetted	Dominant	Subdominant
1 (0-750)	Riffle-Pool	~2	8.4±1.1	6.8±1.7	Large Gravel	Fines
2 (750-1450)	Beaver Dams	0-2	N/A	N/A	Fines	Small Gravels
3 (1450-2880)	Riffle-Pool	~2	8.6±2.0	6.8±2.0	Gravel	Fines

Table 42 - Habitat Parameters for Reaches in Spiller River - Triton Environmental 1997

Reach Number (instream distance, m)	Percent Pools (by area)		Pool Frequency (channel widths / pool)		Total LWD Pieces / Channel Width		Functional LWD Pieces / Channel Width	Functional LWD as a Percentage of Total LWD by Size Class (cm)		
	Value	Rating	Value	Rating	Value	Rating		10-20	20-50	> 50
1 (0-750)	9.6	P	4.8	P	1.4	F	1.1	12.0	80.0	8.0
3 (1450-2880)	24.6	P	2.3	F	1.7	F	2.1	6.4	51.6	42.0

Notes: Reach 2 (beaver pond section) not surveyed according to Form 4 methodology
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Table 43 - Habitat Parameters for Reaches in Spiller River -Triton Environmental 1997

Reach Number (instream distance, m)	Offchannel Habitat		Adult Holding Pools (number per km)		Average Cover in Pools (estimated % by area)			Spawning Gravel Quality		
	Value	Rating	Value	Rating	Wood	Over-head	Rating	Dominant	Subdom	Rating
1 (0-750)	L	P	2	P	20	5	P	Gravel	Fines	P
3 (1450-2880)	L	F	7	F	30	5	F	Gravel	Small Cobble	F

Notes: Reach 2 (beaver pond section) not surveyed according to Form 4 methodology
Abbreviations: H - high, L - low
Overhead cover comprised of LWD, cutbank, overstream vegetation and instream vegetation
Ratings: P - Poor, F - Fair, G - Good; according to Diagnostic Table 5, (pages 56-57 in Johnston and Slaney, 1996)

Reach 1

Reach 1 of Spiller River had riffle-run morphology with the substrate mainly composed of large gravels and small cobbles, with minor amounts of fines. A qualitative assessment of the reach indicated that juvenile rearing habitat was somewhat limited. Some spawning habitat was present, but for the most part, the substrate was compacted and infilled with fine sediment. Overall, there was a low availability of adult holding pools except for LWD-induced pools at the downstream side of small debris jams.

The percent of pools by channel area was 9.6%, indicating that this reach is rated as '*poor*' for this habitat parameter. According to Johnston and Slaney, 1996, streams such as Spiller River (2-5% gradient and <15m width) require over 40% of percent pools by area to provide good salmonid habitat. As well, pool frequency is also '*poor*' with a pool every 4.8 channel widths, as good salmonid habitat is found in streams with less than 2 channel widths between pools (Johnston and Slaney, 1996). Furthermore, large deep pools (residual depths of >1m) with ample cover (>20%) are important as adult holding pools. Pools in Reach 1 have a mean residual depth of only 0.30 m with '*poor*' cover overall (Table 43). From these calculations, it is apparent that Reach 1 is deficient in the pool habitat available for salmonids.

LWD provides structure and stability to the stream as well as creating habitat and providing cover. In Reach 1, there were only 1.4 pieces of LWD per channel width (Table 42), a '*fair*' rating as >2 pieces of total LWD per channel width are considered good for salmonid habitat (Johnston and Slaney, 1996). Not only is the number of LWD pieces important, but the size of the functioning LWD greatly affects stream habitat morphology. In this reach, only 8% of the total LWD pieces are greater than 50 cm in diameter.

Reach 1 has a riparian species composition of hemlock, spruce and western red cedar, in that order. Most of the riparian vegetation is older, mature trees, with a regenerating, coniferous understory of younger trees.

Reach 2

Although Reach 2 is the most impacted reach in Spiller River, it was not sampled using WRPTC #8 methodology (Johnston and Slaney, 1996) for LWD or pools because it is basically a very large debris jam/beaver dam complex with beaver ponds present upstream.

Good juvenile rearing habitat is present, both within the debris jam and within the beaver dam complex. The substrate was primarily fines. Some gravel, originating from the landslides on the north slopes, was present at the tributary mouths. No spawning would occur within the beaver dam complex, due to lack of spawning gravels, but it is possible that coho may utilize some of the small sections of spawning habitat within the debris jam, downstream of the beaver dams.

The riparian vegetation in Reach 2 is similar to reach 1, except on the north side of the river where there is a regenerating clear cut. The riparian zone on the north side of the river was logged adjacent to 650 m of streambank, from 750 to 1400 m in 1985-86. No remaining streamside vegetation exists on the north bank from 950 to 1400 m, due to back-flooding from the beaver dams. The Forest Development Map (Interfor, 1997) shows this north side as being mainly composed of immature Sitka spruce (previously planted), with some western hemlock and very minor amounts of red cedar and balsam, between 10 and 13 years old. The forest vegetation immediately beyond the riparian zone on the south side of the river on both reach 1 and 2, is mostly bog, composed of mainly western red cedar and lodgepole pine.

Reach 3

Reach 3 had the best fish habitat of Spiller River, providing excellent spawning habitat and juvenile rearing habitat. There were also adequate adult holding pools, although the lowest section nearest the beaver dams had shallower pools, due to past bedload inputs. Reach 3 had a slightly larger channel and wetted widths, than reach 1, along with more large pools. The substrate was largely gravels and small cobbles, with minor amounts of sand (Table 41).

In this reach, pools were more abundant than in Reach 1, with a percentage of pools per channel area of 24.6%, however; this is still considered '*poor*'. The number of pools per channel width was fair at 2.3 (Table 42). The pool depths are also greater than Reach 1, with maximum and residual pool depths of 0.66 m and 0.46 m, respectively. The abundance of large LWD in Reach 3 has likely played a role in creating these larger and deeper pools. 1.7 pieces of LWD per channel width are present in Reach 3, with 42% of this being greater than 50 cm in diameter.

Historic fisheries data indicates that before the beaver dams and debris jam were present in Spiller River, coho and pink salmon were able to access spawning habitat up to the headwaters of Spiller River. Currently, anadromous species are only able to utilize the lowest 750 m, or only 30 % of the historic stream length.

From 1450 m to 1850 m (at the junction with the south tributary), the riparian species are hemlock, spruce and western red cedar. In this reach, there appears to be adequate recruitment of coniferous riparian vegetation to the stream to become functional LWD. There are adequate pools and rearing habitat up to this confluence. There is less water flow from the South Tributary, and it has a lower gradient with low marsh-like banks.

From 1850 m to approximately 2500 m upstream from the mouth, at the headwaters of Spiller River, the riparian area is shown on the forest cover map as bog, composed of western red cedar and lodgepole pine, with minor amounts of yellow cedar (Interfor, 1997). JEC (1987) indicated that blown-down riparian vegetation was present in the lower section of Reach 3, but this was not observed during this field assessment. However, he may have been referring to the regenerating clear-cut on the north side of the river, in Reach 2, as it was noted that the beaver dams were also incorrectly geo-referenced.

There is very little water flow during low flow conditions in the East branch above 1850m, and it would be of little benefit for overwintering juveniles, although it could be utilized for summer rearing by coho juveniles. It would be of marginal spawning habitat if the low flows continued throughout the winter.

Summary

The most significant impact present in Spiller River is the debris jam/beaver dam in Reach 2, between 750 and 900 m upstream of the mouth. The beaver dams limit upstream fish migration, as there are series of small falls (2 m falls at 935 m and 1 m falls at 1100 and 1300 m).

The presence of the large landslide at 830 m indicates that this slope failure/landslide/debris torrent may have been the initiator of the debris jam. The landslide appears to still contribute minor loads of fine materials to the main channel.

Upstream between 750 to 1450 m, there is a fairly large slide at 1040 m and two smaller slides, all draining from the north slope. The larger slide at 1040 m continues to contribute fine sediment to the mainstem, but the sediment appears to be retained within the beaver dam complex and therefore not impacting the river. The landslide at 1350 m contributes coarser materials. These gravel areas within the beaver dam complex may be used by resident trout for spawning. Spiller River, being a low gradient river (~2%), does not have the ability to flush out the inputs of bedload and fine materials from these landslides on the north slope.

Reach 3, above 1450 m, is not directly impacted, but the beaver dams downstream limit the migration of adult salmon into this reach which provides good to excellent fish habitat. There is a moderate infilling of the deepest pools by past inputs of bedload, especially closest to the beaver dam complex.

Table 44 summarizes the impacts for all three reaches of Spiller River. The largest impacts to Spiller River occurred as a result of debris slides originating from old logging roads in the regenerating clearcuts north of the river. A massive accumulation of wood and bedload is present from 750 to 900 m upstream of the mouth caused by either a single slide or a combination of repeat debris torrenting. Beavers have since built dams in behind this debris jam, causing a barrier to salmon migration.

In the lower 750 m of the river, the spawning gravels are compacted, with increased accumulation of fine materials into the spaces between the gravels. When the substrate is excessively compacted, adult salmon are unable to excavate spawning redds and increased percolation of fine sediment into the interstices of the substrate decreases the oxygen to the developing embryo which may cause suffocation.

Table 44 - Reach Descriptions and Impacts - Spiller River - Triton Environmental 1997

Reach #	Distance (m) from Mouth	Impacts/Comments
1	0-750	Reach 1, compacted spawning gravel.
1	750	Old landslide into creek.
2	750-900	Old log jam. Braided thalweg. Improbable fish passage. 2 m fall.
2	750-1450	Reach 2, severely impacted by debris jams and beaver dams.
2	935	Beaver dam.
2	1100	2nd beaver dam.
2	1300	3rd beaver dam.
3	1450-2880	Reach 3, moderately impacted reach.

10.3 Minnow-trapping Data

10.3.1 Overview Catch per Unit Effort (CPUE)

It is interesting to compare watershed CPUE results between years (Table 45 and Table 46). Similar to Chismore Creek results, 1998 watershed CPUE values were from 6.0 (coho CPUE) to 14.7 (Total CPUE) times higher than 1997 CPUE values. Reach 3 had the largest increase in coho CPUE values, 13.1 times larger than 1997 values; while reach 1 increased 9.3 times over 1997 values.

No minnow-trapping was carried-out in reach 2 in 1998. Minnow trapping in Reach 2 captured four juvenile coho, with a CPUE of 0.33 fish·hr^{-1} in 1997 (Triton, 1998). As well, a number of juvenile salmonids were observed at the mouths of small streams flowing into the beaver dam.

Some juveniles may prefer to remain close to the mouths of the feeder streams (except in low flow and winter conditions) instead of the beaver ponds, to avoid lower oxygen levels, higher water temperatures in summer, higher predation by adult cutthroat trout and the possibility of food items being swept downstream. As water levels drop or freezing occurs, these juveniles would likely retreat to deeper sections of the beaver ponds.

No adults were observed spawning in reach 3 either year, and it is unlikely that adult coho can migrate past the series of debris jams, beaver dams and small falls (1 - 1.5 m in height) in Reach 2. However, juvenile coho may be able to access Reach 3 at high flow events, by utilizing small trickles of water falling around the beaver dams.

Table 45 - Overview Catch per Unit Effort Results - Spiller River - Triton Environmental 1997

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)								
	Times			Habitat			Species							Species								
Trap	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	97/10/07 9:35	97/10/07 17:30	7:55	80m	1	Mainstem, 1st deep pool	1	0	0	0	0	0	1	0.13	0	0	0	0	0	0.13	
2	97/10/07 9:55	97/10/07 18:45	8:50	420m	1	Mainstem, scour pool	0	1	0	0	0	0	1	0	0.11	0	0	0	0	0.11	
3	97/10/07 10:40	97/10/07 15:55	5:15	835m	2	Mainstem, log jam pool	4	0	0	0	0	0	4	0.76	0	0	0	0	0	0.76	
4	97/10/07 11:20	97/10/07 14:50	3:30	1200m	2	Mainstem, beaver pond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	97/10/07 11:40	97/10/07 14:55	3:15	1350m	2	Mainstem, beaver pond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	97/10/07 12:10	97/10/07 13:50	1:40	1490m	3	Mainstem, LWD plunge pool	3	0	0	0	0	0	3	1.80	0	0	0	0	0	1.80	
	Total Watershed Catch Effort		30:25			Total Watershed # Capture	8	1	0	0	0	0	9	0.26	0.03	0	0	0	0	0.30	Total Watershed CPUE
	Reach 1 Catch Effort		16:45			Reach 1 # Capture	1	1	0	0	0	0	2	0.06	0.06	0	0	0	0	0.12	Reach 1 CPUE
	Reach 2 Catch Effort		12:00			Reach 2 # Capture	4	0	0	0	0	0	4	0.33	0	0	0	0	0	0.33	Reach 2 CPUE
	Reach 3 Catch Effort		1:40			Reach 3 # Capture	3	0	0	0	0	0	3	1.80	0	0	0	0	0	1.80	Reach 3 CPUE

Table 46 - Overview Catch per Unit Effort Results - Spiller River 1998

Catch Effort Data				Catch Data										Catch Per Unit Effort (# Fish/Hr.)								
	Times			Habitat			Species							Species								
Trap	Time In	Time Out	Soak Time hr:mm	Distance Upstream (m)	Reach #	Location/Habitat Description	CO	CT	RB	DV	SC	TSB	Total	CO	CT	RB	DV	SC	TSB	Total	Comments
1	9/8/98 10:00	9/8/98 15:00	5:00	190	1	Main channel, in LWD pool near mouth.	2	0	0	0	44	0	46	0.40	0	0	0	8.80	0	9.20	
2	9/8/98 10:00	9/8/98 14:55	4:55	210	1	Main channel, in LWD pool near mouth.	1	0	0	0	3	0	4	0.20	0	0	0	0.61	0	0.81	
3	9/8/98 10:30	9/8/98 14:35	4:05	410	1	Main channel, in shallow LWD pool with log.	5	0	0	0	13	0	18	1.22	0	0	0	3.18	0	4.41	
4	9/8/98 10:40	9/8/98 14:30	3:50	510	1	Main channel, in shallow side pool with rootwad.		0	0	0	26	0	26	0	0	0	0	6.78	0	6.78	
5	9/8/98 11:00	9/8/98 14:24	3:24	580	1	Main channel, in shallow LWD pool.	5	0	0	0	0	0	5	1.47	0	0	0	0	0	1.47	
6	9/8/98 11:10	9/8/98 14:17	3:07	700	1	Main channel, in shallow LWD pool.		0	0	0	0	0	0	0	0	0	0	0	0	0	
7	9/8/98 11:15	9/8/98 14:15	3:00	720	1	Main channel, in shallow LWD pool.	3	0	0	0	0	0	3	1.00	0	0	0	0	0	1.00	
8	9/8/98 11:20	9/8/98 14:10	2:50	750	1	Main channel, in shallow LWD pool.	1	0	0	0	0	0	1	0.35	0	0	0	0	0	0.35	
9	9/8/98 12:48	9/8/98 13:15	0:27	1700	3	Main channel, in shallow LWD pool.		0	0	0	0	0	0	0	0	0	0	0	0	0	
10	9/8/98 12:48	9/8/98 13:15	0:27	1750	3	Main channel, in shallow LWD pool.	12	0	0	0	0	0	12	26.67	0	0	0	0	0	26.67	
11	9/8/98 12:48	9/8/98 13:15	0:27	1820	3	Main channel, in LWD pool.	20	2	2	0	0	0	24	44.44	4.44	4.44	0	0	0	53.33	
	Total Watershed Catch Effort		31:32			Total Watershed # Capture	49	2	2	0	86	0	139	1.55	0.06	0.06	0	2.73	0	4.41	Total CPUE
	Reach 1 Catch Effort		30:11			Reach 1 # Capture	17	0	0	0	86	0	103	0.56	0	0	0	2.85	0	3.41	Reach 1 CPUE
	Reach 3 Catch Effort		1:21			Reach 3 # Capture	32	2	2	0	0	0	36	23.70	1.48	1.48	0	0	0	26.67	Reach 3 CPUE

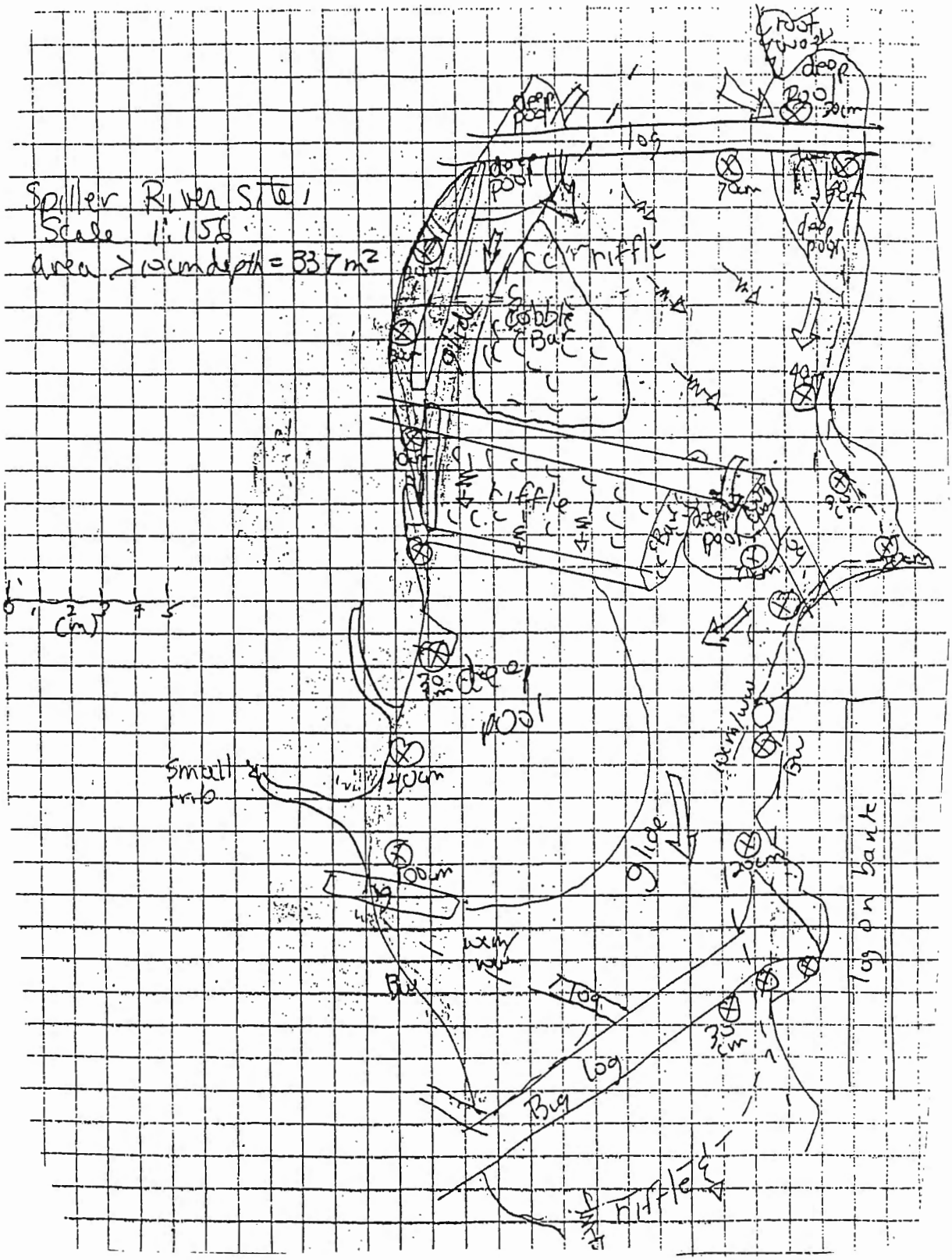


Figure 50 - Detailed Drawing - Site 1 - Spiller River

10.3.2 Site-Specific Catch per Unit Effort (CPUE)

The pool site chosen was had much better juvenile coho rearing habitat than the reach 1, and slightly poorer juvenile rearing habitat than reach 3 of the watershed. The pool site chosen ranked 13th (coho CPUE) and 5th (Total CPUE) of 31 site-specific CPUE values (Table 9 *Summary Report*). When this site-specific CPUE ranking is compared overview watershed CPUE rankings (Table 7 *Summary Report*): reach 1 ranked 37th (Coho CPUE) and 41th (Total CPUE), where reach 3 ranked 3rd (both Coho and Total CPUE) of 49 overview CPUE values.

10.3.3 Site-Specific Juvenile Coho Fry Densities

Site 1, Spiller River (Figure 50), was calculated to have a density of 1.11 (+/- 0.29) coho fry per m^2 of pool area in 1998 (Table 10 *Summary Report*). This was one of the highest estimated densities of our sampled watersheds, but it is felt that a high water flood event may have flushed some of the marked coho fry from the pool, as examination of the age-size distribution (Figure 51) shows that there appears to be an influx of 1st year old coho fry from the initial sampling September 09 to the return recapture event September 15 1998.

This influx of 1st year coho fry can also be illustrated by comparing the rise in the percentage of 1st year coho fry in the population from 37.5 to 51.9% (Table 13 *Summary Report*) between the sampling dates.

If only 30 fry were lost from the site during the high water event, so that recovery of these marked fry was impossible; this event would alter the calculated density from approximately 0.54 fry per m^2 to its' current value of 1.11 fry per m^2.

Additional confirmation for this assumption can be illustrated by comparing 1999 results, where the juvenile coho density estimation for site 1 was 0.52 (+/- 0.28) fry per m^2.

10.3.4 Fork Lengths

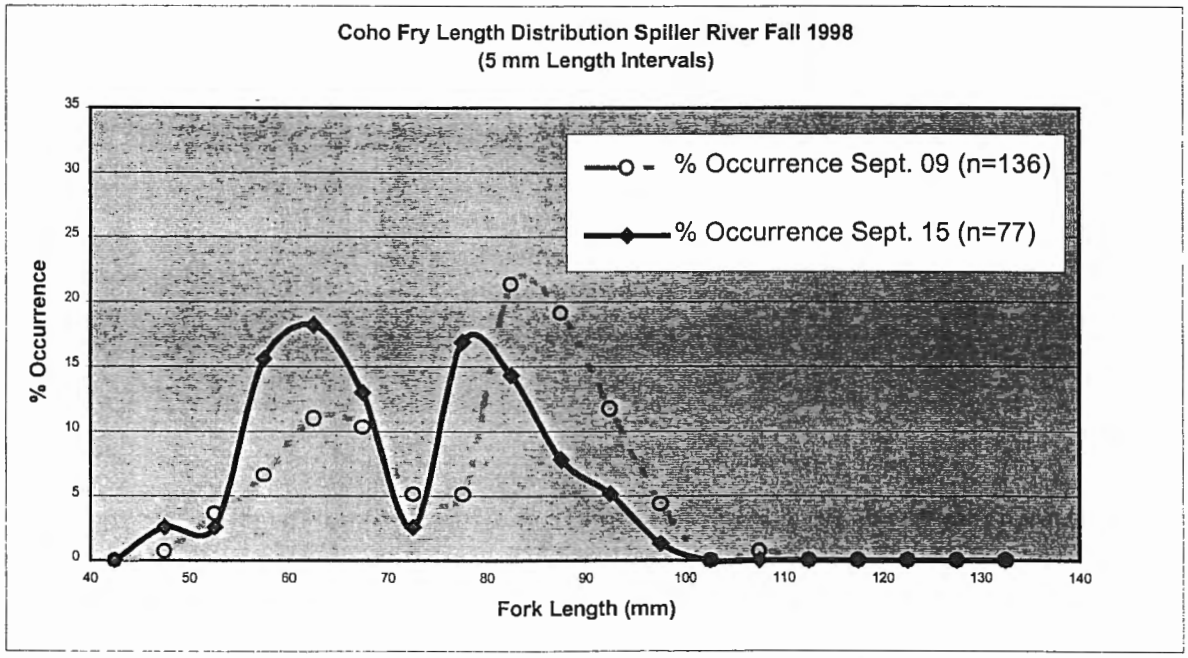


Figure 51 - Age-size Distributions - Spiller River

11. REFERENCES

Anonymous, 1995. Lake and stream inventory standards and procedures, BC Ministry of Environment, Lands and Parks, Fisheries Branch, Victoria, BC.

Finnigan, R.J. and D.E.L. Marshal. 1997. Fish Habitat Rehabilitation Procedures. Watershed Restoration Technical Circular No. 9. Ministry of Environment, Lands and Parks, Watershed Restoration Program. pp. 15-1 to 15-11.

Fish Habitat Inventory and Information Program. 1991. Stream Summary Catalogue. Subdistrict 4A Lower Skeena, Department of Fisheries and Oceans, Vancouver, B.C.

Fisheries Information Summary System. 1997. http://habitat.pac.dfo.ca/cfdocs/fiss/gate01.cfm. Department of Fisheries & Oceans, Habitat & Enhancement Branch, Vancouver, B.C.

Groot, C., and Margolis, L. [*Editors*] 1991. Pacific salmon life histories. UBC Press, Vancouver.

Hancock, M.J., A.J. Leaney-East and D.E. Marshall. 1983. Catalogue of Salmon Streams and Spawning Escapements of Statistical Area 4 (Lower Skeena River) Including Coastal Streams. Can. Dep. Rep. Fish. Aquat. Sci. 395: xxi + 422p.

Johnston, N.T. and P.A. Slaney. 1996. Fish Habitat Assessment Procedures, Watershed Restoration Circular No. 8. British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C. 97p.

Jyrkkanen Environmental Consulting. 1997. Interfor Watershed Restoration Program - Overview Fisheries Assessment. 157p. + Appendices.

Marshall, D.E., and Britton, E.W. 1990. Carrying capacity of coho salmon streams. Can. MS Rep. Fish. Aquat. Sci. 2058:32p.

Meidinger, D. and Pojar, J. 1991. Ecosystems of British Columbia. Special Report Series 6. Ministry of Forests.

Ministry of Forests. 1988. Biogeoclimatic and Ecoregion Units of the Prince Rupert Forest Region (Map). British Columbia Ministry of Forests, Research Branch, Victoria, B.C.

Moyle, P.B, and Cech Jr., J. 1988. Fishes: An introduction to icthyology. Prentice-Hall, Englewood Cliffs, New Jersey, USA. pp. 564

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 191:382p.

Simpson, K.S. 1991. Preparatory stream reconnaissance, smolt trapping and habitat utilization surveys for a coho salmon research program in Northern British Columbia. Can. Manuscr. Rep. Fish. Aquat. Sci. No. 2116:28 p.

Slaney, P.A. and D. Zaldokas (eds.). 1997. Fish Habitat Rehabilitation Procedures. British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Watershed Restoration Program, Technical Circular No. 9.

Triton Environmental Consultants Ltd. 1998a. Level II Fish Habitat Assessment of Kumealon Lagoon Watersheds: Kumealon and North Kumealon Creeks, MoELP Region 6 (Skeena), Coastal Area.

Triton Environmental Consultants Ltd. 1998b. Level II Fish Habitat Assessment for Porcher Island Watersheds: Spiller River, Chismore, and Humpback Creeks, MoELP Region 6 (Skeena), Coastal Area.

KITKATLA

1998 LEAD HAND: RANDY VICKERS

STREAM TECHNICIANS: EDDY McKAY, ARNOLD VICKERS, WILLIARD ASTOR

1999 LEAD HAND: ARNOLD VICKERS

STREAM TECHNICIANS: MARVIN ROBINSON, EDDY McKAY JR.

BILLY CREEK

Location: Located on the south end of Porcher Island and flow south into Kitkatla Inlet in the Gasboat Passage (Area 5)
Watershed Code: MELP Watershed Code **915-7655-060** DFO SISS/RAB Code **97-9300-260**
Length of system observed: 5.0 km
Historical records of adult salmonids presence: Coho and Pinks where the pink of the run for Coho is in the middle of October and the peak of the run for Pink is in the middle of September
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: The data collection is incomplete on this system

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	10	1080	NA	NA	NA	There was nothing on the data sheets to indicate what the result of the trapping were
2	1998	10	1080	NA	NA	NA	Same as above
1	1999	20	90	45	20	9	Caught 87 sculpins & 13 Dolly Vardens during both trappings
2	1999	24	95	84	55	19	Caught 133 sculpins during both trappings

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	NA	NA	NA	NA	NA	NA.	NA	NA	NA	NA
2	34	30%	70% conf	0-5%	NA	.71	5.4	4.5	NA	Rock 50 Boulder 50

ENDHILL CREEK

Location: Located on the north-east end of Banks Island and flows north-east into Principe Channel (Area 5)
Watershed Code: MELP Watershed Code **915-5600-629** DFO SISS/RAB Code **97-8500-040**
Length of system observed: 1.0 km
Historical records of adult salmonids presence: Coho, Chum. Sockeye, and Pink. The peak of the Coho run is in October , peak of the Chum run is early September, the peak of the sockeye run is mid September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout, Dolly Varden, and Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: The data collection is incomplete on this system

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	60	3	8	0	Caught 6 sticklebacks during both trappings

HANKIN CREEK (KA-ALB CREEK)

Location: Flows west into Browning Entrance, from the north-west side of McCauley Island
Watershed Code: MELP Watershed Code **915-7422-433** DFO SISS/RAB Code **97-8700-805**
Length of system observed: NA
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: The trapping was done on Hankin Creek but the mapping was not available at the time of the survey as the water level was too high. No other maps were sent in to complete the mapping part of the survey

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	2	1110	67	132	3	The survey incomplete as there was no mapping component to the survey

KITKATLA CREEK

Location: South end of Porcher Island and it flows southwest into Kitkatla Inlet. The entrance is directly across from Gurd Point on Gurd Island
Watershed Code: MELP Watershed Code 915-7655-370 DFO SISS/RAB Code **97-9300-570**
Length of system observed: 6.5 km
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout, Rainbow and Freshwater Sculpins
Adult Enumeration: Oct 28th there were 14 adult coho carcasses enumerated. On Nov 11/98, 101 Adult coho were enumerated.
Comments: Reach 1 and 2 have a lot of fish bones from spawned out coho and Reach 2 has good spawning beds. Reach 3 and 4 (about 1000 meters from the entrance into Kitkatla Creek have a good presence of juvenile coho and trout. Also there were juvenile chinook found in the traps

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	9	120	10	48	0	No Map for Site 1
2	1998	9	120	15	47	0	No real site map for Site 2

PHOENIX

Location: Flows south into Kitkatla Inlet from the south end of Porcher Island and west of the entrance into Porcher Inlet (Area 5)
Watershed Code: MELP Watershed Code **915-7655-335** DFO SISS/RAB Code **97-9300-535**
Length of system observed: 5.0 km
Historical records of adult salmonids presence: Coho and Pinks
Other indigenous fish: Freshwater Sculpins and small Perch
Adult Enumeration: November 11/98 between 0-1038 meters there was 100 live adult coho sighted and 25 adult coho carcasses
Comments: One channel stream just by 998 m mark about 1-2 meters wide and 40-50 cm deep and has coho fry habitat with undercut banks and woody debris but the length of the this stream is unknown. About 100 meters in is a beaver dam and there were 1-2 adult pre-spawn deaths The enumeration of the adult salmonids only accounts for about one-quarter of the Phoenix system. At the 800 meters to 1200 meter, there is good spawning beds but there is very little Riparian zone and offers little protection from birds

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	10	120	25	70	2	#1 stream on the right side going upstream
2	1998	10	90	18	NA	NA	No data sheet for the Second Trapping
1	1999	20	165	188	NA	NA	No data sheet for the Second Trapping. Caught 112 sticklebacks and 12 sculpins during 1st trapping

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	15%	NA	0-5%	NA	.23	11.13	10.7	NA	Cobble 50 Sand 50
2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

SKENE COVE CREEK

Location: Located on the south-east end of Porcher Island and flows south-east into Ogden Channel (Area 5)
Watershed Code: MELP Watershed Code **915-7655-986** DFO SISS/RAB Code **97-9300-200**
Length of system observed: 1.5 km
Historical records of adult salmonids presence: Coho and Pinks where the pink of the run for Coho is in the middle of October and the peak of the run for Pink is in the middle of September
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: Observed 200 coho in estuary and 600 pink on 20/09/99
Comments: Productive system with good habitat, overall consolidated coho juvenile density estimation for all habitat types is 0.29 $fishm^{-2}$, estimated 2300 fry in system, to LWD jam at 1282m.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	90	99	92	60	Caught 1 sculpin, 7 cutthroat & 1 Dolly Varden during both trappings
2	1999	20	90	178	57	13	Caught 13 cutthroat & 39 Dolly Varden during both trappings

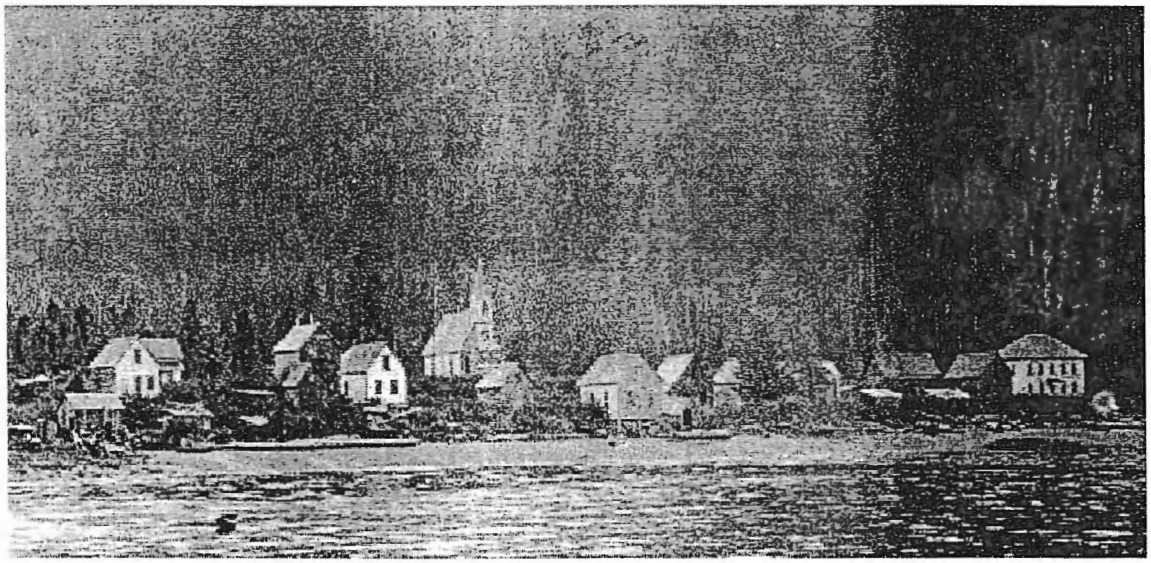
Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	49	40%	100% conf	NA	75	NA.	7.0	6.5	NA	NA
2	35	45%	100% conf	0-5%	50	NA.	6.5	6.5	NA	NA

TABLE BAY CREEK

Location: Flows west into Principe Channel, from the west side of McCauley Island (Area 5)
Watershed Code: MELP Watershed Code **915-7422-305** DFO SISS/RAB Code **97-8700-660**
Length of system observed: 1.0 km
Historical records of adult salmonids presence: Coho, Chum and Pink. The peak of the Coho run is in October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout, Dolly Varden, and Freshwater Sculpins
Adult Enumeration: No Adult coho observed
Comments: The data collection is incomplete on this system

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	105	52	153	3	Caught 236 sticklebacks, 2 cutthroat & 1 Dolly Varden during both trappings
2	1999	20	120	98	36	24	Caught 13 cutthroat & 39 Dolly Varden during both trappings

HARTLEY BAY



1998 LEAD HAND 1: S. CLIFTON

STREAM TECHNICIANS: F. RIDLEY, J. RIDLEY, F. LEASK

1998 LEAD HAND 2: CLYDE RIDLEY

STREAM TECHNICIANS: WAYNE ROBINSON, COLIN RIDLEY, HARVEY RIDLEY, BILL STARR, ROBIN ROBINSON

1999 LEAD HAND: F. LEASK

STREAM TECHNICIANS: A. ROBINSON, HARVEY RIDLEY

KEESIL Cr.

Location: 10 km north of Hartley Bay flowing east to Douglas Channel
Watershed Code: MELP Watershed Code **910-7271-000** DFO SISS/RAB Code **91-9495-000**
Length of system observed: 1.5 –2
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is mid-September
Other indigenous fish: Steelhead and Freshwater Sculpins
Adult Enumeration: October 27th 1998 50-100 Adult coho and 6 coho carcasses
Comments: There was only 5 traps used in the 1998 survey and little information about the location of the sites on the Keesil system

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	5	60	19	1	4	
2	1998	5	60	21	7	2	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	30	40%	90% decid 10% conf	0-5%	NC	.71	1.36	NC	NC	NC
2	40	60%	90% decid	0-5%	NC	.55	NC	NC	NC	Clay and Gravel

KISHKOSH Kiskosh Cr.

Location: The system flows southeast into Douglas Channel about 15 kilometers north of Hartley Bay
Watershed Code: : MELP Watershed Code **910-7216-000** DFO SISS/RAB Code **91-9451-000**
Length of system observed: 4-5 km
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is mid-September
Other indigenous fish: Cuttthroat, Steelhead, Freshwater Sculpins and Sticklebacks
Adult Enumeration: Information was handed into the Department of Fisheries for the 1998 results. Enumerated 2 sockeye, 150 pink, and 50 chum adults on 1/10/99.
Comments: 2nd trapping not completed on sites.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	10	60	153	42	17	
2	1998	8	45	194	23	11	The site was originally done with 8 traps and the recapture was done with 4 traps and the length of trapping was different
1	1999	10	1440	105	NC	NC	2nd trapping not completed
2	1999	10	1530	67	NC	NC	2nd trapping not completed

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	35	NC	75% conf	0-5%	NC	NC	25.5	22.1	NC	Sand Gravel
2	37	10%	75% conf	0-3%	NC	NC	25.9	21.9	NC	80% Sand 8% cobble 2% rock

MALSEY CREEK

Location: Runs east into Malsey Bay inside of Hartley Bay
Watershed Code: MELP Watershed Code **910-7288-000** DFO SISS/RAB Code **91-9500-000**
Length of system observed: 2 km
Historical records of adult salmonids presence: Coho, Chum, Pink and sockeye. The peak of the Coho run is in mid-October , peak of the Chum run is early September, the peak of the Pink run is mid-September, and the peak of the sockeye run is mid-September.
Other indigenous fish: Rainbows
Adult Enumeration: Nov 2/98 there was 12-20 adult coho observed in the Malsey Creek system, and 200 pink on 26/08/99.
Comments:

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	5	150	21	67	0	The site was trapped with 5 traps on the initial trapping and then they used 10 traps on the recapture
2	1998	5	120	10	54	0	Same as above (1500 meters upstream from ocean)
1	1999	10	90	130	89	32	
2	1999	10	90	122	58	13	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	48	60%	Most old growth	0-2%	NC	..55	9.0	NC	NC	Sand 50 Gravel 50
2	40	70%	50% conf 50% alder	0-2%	NC	.2	15.3	NC	NC	Sand 80 Gravel 20

910-713-700

QUAAL R.

Location: 12 km north of Hartley Bay flows east into Douglas Channel
Watershed Code: MELP Watershed Code **910-7139-036** DFO SISS/RAB Code **91-9400-000**
Length of system observed: 16 km
Historical records of adult salmonids presence: Coho, Chum, Pink and sockeye. The peak of the Coho run is in mid-October , peak of the Chum run is early September, the peak of the Pink run is mid-September, and the peak of the sockeye run is mid-September.
Other indigenous fish: Cutthroat Trout And Rainbow
Adult Enumeration: Data was handed into the Department of Fisheries for 1998 enumeration. Enumerated 600,000 pink, 800 chum, and 500 coho on 14/09/99.
Comments:

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1998	10	360	21	8	3	
2	1998	NC	NC	55	NC	NC	The data sheet contains no data on the number of traps used and on the recapture for Trap 2
1	1999	10	90	98	55	61	
2	1999	10	90	55	30	4	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	10%	NC	0-5%	NC	.48	27	NC	NC	Sand Gravel
2	30	0%	NC	0%	NC	.62	25.3	NC	NC	Sand 50 Gravel 50

RIORDIN Cr.

Location: East side of Gribbell Island flowing east to Ursula Channel
Watershed Code: MELP Watershed Code ~~**915-5665-724-**~~ DFO SISS/RAB Code **97-6950-180**
Length of system observed: 8 km 915-566500-58300
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is mid-September
Other indigenous fish: Cutthroat Trout And Rainbow
Adult Enumeration: Enumerated 10 coho and 5000 pink on 03/09/99.
Comments:

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	10	90	75	94	4	
2	1999	10	70	98	95	6	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	40	10%	NC	0-5%	NC	.48	27	NC	NC	Sand Gravel
2	30	0%	NC	0%	NC	.62	25.3	NC	NC	Sand 50 Gravel 50

COHO ENUMERATIONS BY HARTLEY BAY GROUP 2

The coho enumeration forms were handed into the Department of Fisheries for 1998.

Name of System	Watershed code	Distance observed
Kitkiata ~~(Old Town)~~ Cr.	9107133 00	10 km
Kishkosh	91072160 0	8 km
Goat Harbour Cr. (Alice) Goat R.	9105657	6 km
Keesil	9107271	3 km
Quaal	9107139	1 1/2 km
Malsey Creek	91-9500	2 km
Red Bluff	915560284	1.5 km
Union Pass	915560287	2.0 km
Bishop Bay	NC	3 km

915-560200-84700

915-560200-87000

KITASOO

1998 LEAD HAND: WILLIAM HALL

1998 STREAM TECHNICIANS: EARL HOPKINS, LOUIE MASON, FRED NEASLOSS and ANTHONY ROBINSON

1999 LEAD HAND: CLARKE ROBINSON

1999 STREAM TECHNICIANS: CHRIS McKNIGHT and ARCHIE ROBINSON

BOTTLENECK CREEK

Location: Located on the west end of Roderick Island and flows west into Finlayson Channel (Area 7)
Watershed Code: MELP Watershed Code **915-4865-306** DFO SISS/RAB Code **97-4400-736**
Length of system observed: 1.2 km
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: 10 adult coho, 80 adult pink and 35 chum counted 22/09/99, 21 adult coho, 135 adult pink and 85 chum counted 12/09/99.
Comments: The data collection is incomplete on this system, 2nd trapping not completed, site parameters incomplete. Beaver dams creating possible pink salmon obstruction at low flows at 367m, and impassable falls at 1052m.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	90	19	NC	NC	Caught 86 sculpins 1 cutthroat trout & 2 Dolly Vardens during initial trapping.
2	1999	24	90	4	NC	NC	Caught 3 sculpins & 1 stickleback during initial trapping.
3	1999	24	90	49	NC	NC	

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	NC	NC	NC	NC	NC	NC.	NC	NC	NC	NC
2	NC	NC	NC	NC	NA	0.6	NC	NC	NA	Sand 60%, gravel 30%, cobble 10%
3	34	30%	70% conf	0-5%	NA	.71	5.4	4.5	NA	Sand 20%, gravel 10%, cobble 20% Boulders5%

DUTHIE CREEK

Location: Located on the north end of Pooley Island and flows north into Sheep Passage (Area 7)
Watershed Code: MELP Watershed Code **915-4880-343** DFO SISS/RAB Code **97-????-???**
Length of system observed: 2.5 km
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: 12 adult coho, 10 adult pink counted 12/10/99.
Comments: The data collection is incomplete on this system, no minnow-trapping data, site parameters incomplete. Source of silt from bridge at1600m, impassable 15m falls at 2450m.

KWAKWA CREEK

Location: Flows west into Kitasu Bay and Laredo Sound, from the west side of Swindle Island (Area 6).
Watershed Code: MELP Watershed Code **915-4820-599** DFO SISS/RAB Code **97-4200-765**
Length of system observed: 2.8 km
Historical records of adult salmonids presence: Coho, Chum. Sockeye, and Pink. The peak of the Coho run is in late October , peak of the Chum run is mid September, the peak of the sockeye run is mid September, and the peak of the Pink run is late September

Other indigenous fish: Cutthroat Trout and Freshwater Sculpins
Adult Enumeration: counted 30 pink and 10 chum on 20/09/99 and 325 sockeye, 10 pink and 5 chum on 04/10/99 Adult coho observed
Comments: Site data incomplete.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	90	5	NC	NC	2nd trapping not completed
2	1999	20	90	0	NC	NC	Caught no fish during initial trapping.

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	100	20%	NC	NC	NC	NC.	NC	NC	NC	Sand 10%, gravel 40%, cobble 10% Boulder 5%
2	NC	20%	NC	NC	NA	0.6	NC	NC	NA	Sand 50%, gravel 10%, cobble 5% Boulder 30%

MARY'S COVE CREEK

Location Located on the west end of Roderick Island and flows west into Finlayson Channel (Area 7)
Watershed Code: MELP Watershed Code 915-4865-0680 DFO SISS/RAB Code **97-????-???**
Length of system observed: 2.1 km
Historical records of adult salmonids presence: Coho, Chum. Sockeye, and Pink. The peak of the Coho run is in late October , peak of the Chum run is late September, the peak of the sockeye run is early October, and the peak of the Pink run is late September
Other indigenous fish: Cutthroat Trout, Rainbow and Freshwater Sculpins
Adult Enumeration: There were 50 adult coho enumerated on 14/09/99, 30 coho, 252 pink and 20 chum were enumerated on 17/09/99, and 10 adult pink and 5 chum enumerated on 24/09/99.
Comments: Site data incomplete.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	90	5	0	0	
2	1999	20	90	11	0	0	Caught 110 sculpins & 1 stickleback during initial trapping.
3	1999	10	90	1	0	0	Caught 17 sculpins & 2 cutthroat during initial trapping.
4	1999	10	90	2	0	0	Caught 56 sculpins during initial trapping.
5	1999	20	90	14	47	0	Caught 79 sculpins during initial trapping.

Site No.	Length of Site (M)	Percent Canopy over Site	Percent Deciduous or Conifer	Percent LWD of the site	Average pool depth (cm)	Average Velocity (m/s)	Average Bankfull Width (M)	Average Wetted Width (M)	Average 10 cm depth Width (M)	Substrate composition percentage
1	22	NC	NC	NC	NC	NC.	NC	NC	NC	NC
2	NC	NC	NC	NC	NC	NC.	NC	15.6	NC	Sand 5%, gravel 40%, cobble 10% Boulder 75%
3	50	NC	NC	NC	NC	0.6	NC	NC	NC	NC
4	52.3	NC	NC	NC	NC	NC.	15.5	13.2	NC	NC
5	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

SALMON BAY CREEK

Location: Flows west into Mathieson Channel (Area 7)
Watershed Code: MELP Watershed Code **910-4839-000** DFO SISS/RAB Code **97-????-???**
Length of system observed: 3.1 km
Historical records of adult salmonids presence: Coho, Chum. and Pink. The peak of the Coho run is in mid-October , peak of the Chum run is early September, and the peak of the Pink run is late September
Other indigenous fish: Freshwater Sculpins and small Perch
Adult Enumeration: There were 323 pink and 409 chum were enumerated on 13/09/99, and 225 adult pink and 300 chum enumerated on 24/09/99.
Comments: Site data incomplete.

Site No.	Year	No. of Gee Traps	Soak Time (min)	Trap1 coho	Trap2 unmarked coho	Trap2 marked coho	Comments
1	1999	20	90	1	0	0	Caught 3 sculpins 3 rainbow trout & 1 stickleback during initial trapping.
2	1999	20	90	11	NC	NC	No data sheet for the Second Trapping

REPORT

to

NORTH COAST FISHERIES RENEWAL COUNCIL

For:

Fall 1998 Salmon Stock Assessment for

Southern Statistical Area 6

By:

Kitasoo Band Council
Community of Klemtu, B.C.

January 29, 1999

INTRODUCTION:

The community of Klemtu consists of 350 on reserve members of the Kitasoo Indian Band. The community is situated in the remote central coast region. Only a few years ago the fishing industry accounted for 80% of the entire economy. The fall down effect of salmon fishing in Klemtu has been particularly difficult since both the harvesting and processing sector have been affected. The Kitasoo processing plant has not processed any salmon for 2 years. The creation of the FRBC funding to assist displaced fishery workers is timely and welcomed in Klemtu.

The Kitasoo community has operated the Kitasoo Fisheries Program since the introduction of AFS in 1991. The program has developed significant capacity in fisheries management, stock assessment and enhancement over the years but has been constrained due to stagnant funding. This project utilized William Hall and other highly skilled Kitasoo Fisheries program members to lead the new FsRBC crew.

This report outlines the activities proposed for the 1998 fall FsRBC survey and the results obtained as a result of the contact.

PROPOSED ACTIVITIES:

The proposed activities for this project were as follows:

1. **Salmon enumeration** (live and dead) by species utilizing the DFO stream inspection log formats for creek walk observations. Enumeration data will be inputted daily into the DFO inspection log/BC 16 program created for MICROSOFT ACCESS software. Data will be E-Mailed to the DFO Fisheries Management office in Prince Rupert on a weekly basis.

2. **Salmon carcass sampling** – A random sampling of 100 carcasses of each species will be conducted on each stream. Scales will be collected for chum and coho and otoliths and scales collected from sockeye. Books and otolith kits are available in Klemtu.

3. **Hydrologic monitoring** – Permanent staff gauges will be installed in all creeks with a permanent benchmark placed in an entrenched area with a bedrock face nearby. The site will be at the lowest possible stream reach above influence of high water. The staff gauges will be utilized to monitor stream levels in order to validate/standardize countability of the stream on each visit and determine the cutoff point at which walking is not worthwhile. Over time a flow height curve can be established to determine stream flows at each level.

4. **Turnover rate** – On one or two creeks, pink and chum salmon will be subject to an intensive dead pitch requiring carcasses to be cut in half to avoid recounting. The cumulative time series counts of carcasses will be plotted

against the live observations to determine the actual turnover rate (residence time) for these two species. This data is critical to the Area Under the Curve calculations now being used by DFO to determine escapement.

5. **Habitat Observations** – Due to the time high water flows are typical therefore no specific habitat work will be prescribed. However observations on habitat needs assessment such as Bank erosion, slides, bed load movement, beaver dams etc. will be recorded for future study.

6. **Trail clearance** – Trails will be cut through areas to access streams or to navigate around obstructions (canyons, windfalls etc.)

7. **Harbour/high water days** - The Kitasoo community also has a salmonid enhancement facility contracted by the Department of Fisheries and Oceans. This facility will provide an opportunity for the crew to assist in hatchery egg take activities on harbour and high water days. The hatchery has scaled up production to 1.55 million eggs in 1998 and the additional assistance will be welcomed.

STUDY AREAS:

The following 8 creeks have been selected for these surveys:

1. Browns Cove (Mckay creek) - Turnover rate experiment
2. Kwa Kwa creek
3. Price creek
4. Green River
5. Soda creek
6. Powles creek– Possible turnover rate experiment
7. Quigley creek
8. Trahey creek

STUDY PERIOD: September 21- November 6, 1998 (7 weeks)

TRAINING:

Over and above any training offered in Prince Rupert by the North Coast Fisheries Renewal Council the Kitasoo Fisheries Program will provide additional training such as.

1. **Bear awareness**
2. **Swift Water rescue** –
3. **Survival First Aid** -.
4. **Stock Assessment Training**

RESULTS:

Managers Report:

Overall the operation of the 1998 FSRBC program was challenging due to the persistent high rainfalls and high river water levels which did not permit safe or worthwhile inspections of the creeks during most of the study period. A window of opportunity was afforded during the third week of October when the creek water levels dropped to near normal levels and allowed the crews to collect some valuable field data. These data included adult escapement information in area 6 and area 7 rivers. Due to the persistent high water the project was shortened to only 4 weeks (October)in the hope of conducting the habitat and juvenile coho surveys some time during the winter. To date less than 50% of the approved funding has been spent on the project.

As a result of the persistent high water no specific habitat data was collected or even attempted during the study period. Several other of the proposed outcomes were not possible due to the short duration of the program and the water conditions. The high water levels were anticipated and therefore habitat activities were not scheduled in our original proposal.

While high water conditions reduced the opportunity to collect quality instream data the participants time was spent productively on skill development and other activities. Several training sessions were conducted and the crews spent 8 days assisting the local SEP and AFS crew in the collection of chum and sockeye broodstock and resulting eggs takes.

Specific results are as follows:

Adult enumeration: During the survey period a total of 16 creek walks were conducted in area 6 and 7 creeks. Results are provided in stream inspection logs in the appendix. Stream inspection logs were completed for only 10 of the walks of which only 2 are from the originally targeted creeks. Several attempts were made to survey all the area 6 study creeks however due to persistent high water the only useful data was collected on McKay creek. All completed surveys were E-Mailed to DFO in Bella Coola and were used in the annual BC 16 summaries of escapement for these creeks. In general, escapements for the region were good to excellent for chum and pink, improved over past years and considered fair for coho but generally poor for sockeye.

Salmon carcass sampling : High water plagued the ability to collect carcasses for sampling in the majority of the creeks as most were washed out of the system.

Hydrologic monitoring: Due to high water permanent staff guages were not installed on the creeks during the survey period. This activity was proposed for later in the winter or spring when the rivers settled into winter low flows.

Turnover rate: Persistent high water during the survey period reduced the number of recoverable carcasses. Also the lack of live observed spawning adults during the three weeks of peak spawning provided too few data points to calculate turnover rate with the degree of confidence required. It was also discovered that the crew did not cut all carcasses in half thus increasing the likelihood of multiple counting over several surveys.

Examples of the turnover rate graphs using the limited data is shown in the appendix. The turnover rates were calculated at 28.1 days for chum and 13.3 days for pink. The expected turnover rate for the area is approximately 10 days for chum and 14 – 25 days for pink. A Kitasoo AFS tagging study of chum at Kitasoo creek in 1992 recorded 9.2 days for chum with a range of 7 – 11 days. A good estimate of pink turnover for the area has not yet been determined.

Habitat Observations: This component of the fall surveys was to record any unusual occurrences (beaver dams, slides, etc.) which would effect salmonid production on the selected streams. Other than high water there were no observed habitat disturbances encountered on any of the streams. High water events were not considered sufficient to scour gravel or effect survival. A mild winter thus far is also ensuring good flows and limited freezing of redds.

Trail Clearance: No trail clearance was required for the fall survey.

Harbour days: While attempts were made to visit all the targeted river systems, this was not possible due to poor weather and high water. Several creeks were visited but proved unwalkable due to high water flows. Other activities were accomplished during these periods. These activities are as follows:

- 4 days during first week of October assisting Kitasoo SEP on chum adult broodstock collection and eggtakes of 1.5 million eggs.

- 3 days during second week of October assisting Kitasoo AFS crew on remote eggtake and broodstock collection of 40,000 sockeye eggs at Lagoon creek.

Training: During the first two weeks of October the crew were provided specific training on several topics, these included:

1. bear encounter safety. This training utilized in class training, a video, and a final exam.

2. Basic non-certifiable instruction was provided on safety and first aid.

3. Hands-on non-certifiable field training was provided on swift water rescue, firearms safety, and stock assessment activities including:
    - Adult salmon counting (creek walks)
    - Adult salmon identification
    - Adult salmon sampling techniques

RECOMMENDATIONS:

1. Kitasoo suspended the program early due to poor conditions and to save money and complete the project at a later date. We recommend that the unused funding be allocated to Kitasoo to complete the program prior to March 31, 1999 or have the funding and habitat based activities advanced to the next fiscal year.

2. Kitasoo requests that any funding provided by FsRBC be continued on a contractual basis so we may manipulate wage rates commensurate with other programming and the individuals experience.

ADULT SALMONID ENUMERATION IN THE KITASOO AREA

Date	Name of system	Watershed Code	Adult Salmonid	Historical Records	Comments
10/19/98	Bottleneck	97-4400-736	No	Coho Pink and Chum	Flows NW into Head of Bottleneck Inlet, Roderick Island, Finalyson Channel
10/13/98	Windy Bay	97-4600-878	2 Jack Coho 2 live Chum 7 dead Chum	Coho Pink and Chum	Flows NW into head of Windy bay, Dooley Is., Sheep Passage
10/22/98	Windy Bay	97-4600-878	28 dead Chum	Coho Pink and Chum	Bears and birds causing mortality
10/14/98	Duthie	97-4600-807	2 Pink- TTD in stream is 3729 95 dead Chum TTD in stream 13472 Coho TTD 50	Coho Pink and Chum	Located on Pooley Is. and flows N into S Side of Sheep Passage, W of Windy Bay
10/21/98	Geish	97-4600-620	No	Coho Pink Chum	No fish in creek walked trail to a small lake and then walked creek down
10/01/98	Gorilla	97-4400-122	3 Pinks 1270 Live chum 650 Dead chum	Coho Pink Chum	Flows NE and NW into small bay, west sode pf Griffin Passage
10/13/98	Gorilla	97-4400-122	7 live chum 750 dead chum	Coho Pink Chum	Bears and Wolves seen in the system
10/22/98	Carter	91-7000	Yes 3 Pinks	Sockeye Coho Chum Pink	Flows SW into head of Carter Bay at North end of Finlayson Channel
10/15/98	Browns Cove	NA	40 coho 325 live chum	NA	Area 7 Log jams in this sysem
10/23/98	Browns Cove	NA	45 live coho 50 live chum 560 dead chum	NA	Area 7