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Bulkley River Watershed
Overwintering Study
2006-2007

prepared by

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Executive Summary

An overwintering study was conducted from November 2006 to April 2007 in the Bulkley River watershed in north-central British Columbia. The study area includes Byman, McQuarrie, Barren and Richfield Creeks, located in the lower portion of the Upper Bulkley watershed upstream of the confluence of the Morice and Bulkley rivers near Houston, B.C. The study area also includes McKinnon Creek, a groundwater channel and an Unnamed Creek, which is a tributary of McKinnon Creek near the town of Smithers, B.C., and Waterfalls Creek (a tributary to Mission Creek), located at the Village of New Hazelton, B.C. This study focused on monitoring species composition and fish condition at sites that were index sites during the Bulkley/Morice Watershed Overwintering Studies conducted from 1998 – 2001. The McKinnon Creek site is a habitat enhancement project conducted by Fisheries and Oceans and the overwintering monitoring was conducted to determine relative success of the project at providing over-wintering habitat. This over-wintering monitoring was conducted to provide background data to assist Habitat Management staff and Resource Restoration staff in liaising with various agencies and proponents when work is to be conducted in areas of the Upper Bulkley, McKinnon Creek and Mission Creek watershed study areas.

Species composition, fork length and weight data were collected when possible. Catch per unit effort (CPUE) data and condition of fish was collected over the winter at each site. Winter and spring habitat assessments were also completed at each site over the winter.

This report focuses primarily on the reporting of data collected during this study (2006/2007), although some comparisons have been made to the previous year's study (2005/06). The following is a summary of the data collected in 2006/07.

Upper Bulkley Sites

Winter habitat assessments found the Byman and Richfield sites to have sufficient water depth and dissolved oxygen (DO) throughout the winter. The water velocity at the Richfield site was too high in March to set traps. The limiting factors at the Barren site varied, from insufficient DO, water flow, and at times water depth. The high snow pack at the McQuarrie site made it inaccessible in the mid- and late- winter sampling periods.

Overall, species composition at the Upper Bulkley sites consisted of coho salmon (*Onchorhynchus kisutch)* and Rainbow trout (RBT)/steelhead (sthd) (*Onchorhynchus mykiss)*. Byman was the only site consistently sampled during the study, of which total catch consisted primarily of RBT/sthd, with a small proportion of coho. A fairly even proportion of RBT/sthd and coho were captured at the Richfield site. The McQuarrie site had the highest total catch of all the sites sampled in November, with a relatively even proportion of coho and RBT/sthd. No sampling was conducted beyond November at McQuarrie due to snow plowed from the highway onto the site. No fish were captured during the two sampling times at the Barren site.

Coho and RBT/sthd captured at the Upper Bulkley sites were in both the less than and greater than 80 mm length categories. It was not possible to analyze mean condition factor (FCC) of

coho salmon from the beginning to end of winter since the numbers captured were low. The mean condition factor of the greater than 80 mm length RBT/sthd at Byman was 0.96 at the beginning and 0.98 at the end of winter, which suggests this site provides good overwintering habitat for RBT/sthd. It was not possible to analyze the mean FCC at the other sites from beginning to end of winter since they were not consistently sampled throughout the winter.

The catch per unit effort (CPUE) for coho salmon at the beginning of winter differed among the four sites in the Upper Bulkley watershed. The highest CPUE for coho at the beginning of winter was at McQuarrie where as the lowest was at Barren. The CPUE for coho at Barren was also among the lowest at the end of winter (0 coho/trap). The CPUE for coho peaked in Jan. at the Byman site; however, beginning and end of winter CPUE for coho was very low to none. The CPUE for coho at Richfield decreased from beginning to middle of winter. The CPUE for RBT/sthd increased at Byman from the beginning to end of winter. The Barren site had no RBT/sthd captured at beginning or end of winter. At Richfield, the CPUE decreased from the beginning to middle of winter. McQuarrie had the highest CPUE for RBT/sthd at the beginning of winter of all the sites.

McKinnon Creek and Groundwater Channel Sites

Habitat assessments found the water depths to be too low to sample for fish at sites 1 and 2 of McKinnon Creek throughout the winter. In addition, the water depth at the Hydropole 12 site was only sufficient to sample at the end of winter in March. The water depth at the groundwater channel was greater than 20 cm throughout the winter, providing continuous overwintering habitat. The DO at the groundwater site was less than 10 ppm at the beginning and middle of winter; however, the coho captured appeared to be in good condition.

Species composition at the groundwater channel site consisted of coho salmon. Species composition at Hydropole 12 site at the end of winter consisted of coho salmon and Cutthroat trout (*Oncorhynchus clarki).*

The majority of coho captured at the groundwater channel site were in the less than or equal to 80 mm length category. The frequency of coho remained fairly constant from the beginning to end of winter, which could indicate low mortality over the winter since migration out of the glide was limited. The mean FCC for coho in the less than or equal to 80 mm length category decreased from 1.06 at beginning to 1.01 at the end of winter. It appears that this site provides good overwintering habitat since the mean FCC was consistently above 1.0 throughout the winter.

The CPUE for coho at the groundwater channel site increased overall from the beginning (24 coho/trap) to end of winter (36 coho/trap). There appeared to be a healthy population of overwintering coho at the groundwater site. The water depth decreased overall from the beginning to end of winter, and the potential for migration out of the channel was low throughout the winter, which may have contributed to the higher catch near the end of winter.

Waterfalls Creek Sites

Habitat assessments found all four sites to have sufficient water depth, DO and potential for migration throughout the winter.

Three species were captured at the Waterfalls Creek sites, including coho salmon, Dolly Varden char (*Salvelinus malma*) and cutthroat trout. High numbers of coho were captured at all four sites, potentially due to adult and fry stocking enhancement in the system. On the whole, there were much fewer Dolly Varden captured at the Waterfalls Creek sites during this study, as compared to the 2005/06 study.

A large proportion of coho captured at site 1 were less than or equal to 80 mm long, where 35 were captured in Dec. and 28 in March. The greater than 80 mm category coho also decreased over the winter. Over half of the coho captured at site 2 were less than or equal to 80 mm. Both category coho remained constant over the winter. At site 3, there was a slight decrease in numbers over the winter in the less than or equal to 80 mm category. On the contrary, there was a slight increase in the greater than 80 mm category coho from Dec. to March. At site 4, coho captured in the less than or equal to 80 mm category decreased slightly from Dec. to March. The greater than 80 mm category coho remained the same in Dec. and March.

At site 1, the mean FCC increased over the winter, from 1.06 in Dec. to 1.1 in March for the less than or equal to 80 mm coho. The mean FCC for the greater than 80 mm coho decreased from 1.01 in Dec. to 0.96 in March. At site 2, the mean FCC for the less than or equal to 80 mm coho increased from 1.02 (Dec.) to 1.14 (March). The mean FCC decreased for the coho in the greater than 80 mm category, where it was 1.04 in Dec. and 0.96 in March. At site 3, the mean FCC increased for both the less than or equal to 80 mm coho and greater than 80 mm coho, where coho increased slightly from 1.0 (Dec.) to 1.03 (March), and from 0.98 (Dec.) to 1 (March), respectively. Site 4 had a decrease in mean FCC for both category coho from March and Dec.

All Dolly Varden captured at site 1 were greater than 80 mm long, where there was a decrease in numbers over the winter. All DV captured at site 2 were greater than 80 mm long, with an overall decrease in numbers from beginning to end of winter. All DV captured at site 3 were of the greater than 80 mm length category, and there was a dramatic increase in DV over the winter where only 1 DV was captured in Dec. and 30 DV in March. All DV captured at site 4 were of the greater than 80 mm category, with a slight decrease noted over the winter.

The only site where mean FCC for DV could be calculated was at Waterfalls site 3, where the greater than 80 mm length category was only 0.89 in March.

At Waterfalls Creek, the CPUE for coho salmon decreased overall from beginning to end of winter at sites 1-3, whereas a slight increase in CPUE for coho occurred at site 4. The CPUE for coho was highest at site 1 and lowest overall at site 4 over the winter. The CPUE for DV at site 3 of Waterfalls Creek increased the most over the winter of the 4 sites sampled. Overall, the CPUE for DV was greatest at the end of winter, as compared to beginning of winter, at sites 3 and 4. Sites 1 and 2 showed a slight decrease in CPUE for DV over the winter. In conclusion, the CPUE for DV was much lower in 2006/07 than in 2005/06 at all the sites.

Table of Contents

List of Figures

List of Tables

List of Appendices

Acknowledgements

The overwintering study of 2006/2007 was conducted by the Department of Fisheries and Oceans Canada (DFO), Smithers, B.C. Brenda Donas designed the project, based on previous years of overwintering sampling conducted by Ms. Donas (DFO) in conjunction with SKR Consultants Ltd. Brenda Donas, Kevin Koch, Gavin Grub, and Natalie Newman conducted field sampling. Data was entered by Brenda Donas, Kevin Koch and Natalie Newman. Data analysis and reporting was conducted by Kevin Koch, Brenda Donas and Natalie Newman.

1.0 INTRODUCTION

The 2006/2007 overwintering program was used to monitor species composition and fish condition within the study area (i.e., Byman, Barren, McQuarrie, Richfield, McKinnon, and Waterfalls Creek, one unnamed creek, and a groundwater channel) located in the Bulkley River watershed. Culvert pools, as well as other pools and a groundwater channel in the Upper Bulkley and McKinnon watersheds were areas of focus. The Waterfalls Creek monitoring sites were the same index sites monitored during the 1998 – 2001 overwintering study (Donas and Saimoto. 2001b). Two additional sites were monitored during the 2006/2007 program, namely the Richfield Cr. site in the Upper Bulkley watershed and a groundwater channel site in the Middle Bulkley Watershed. The rationale for sampling additional sites was due to the inability to minnow trap at some of the sites sampled in 2005/2006 due to low water levels.

The Bulkley River watershed is utilized by several species of pacific salmon (coho, Chinook, sockeye, pink salmon) and steelhead, which have been in decline (Houston Chapter of the Steelhead Society of B.C. 1990, BCCF 1997, 1998, Holtby and Finnegan 1998). Declines in salmon stocks are generally attributed to over-exploitation of the stocks, decreased ocean or freshwater survival or a combination of these (Hillborn and Walters 1992, Walters 1995, Slaney *et al.* 1996, Slaney and Zaldokas 1997, Bradford and Irvine 2000). Decreased survival of juveniles in freshwater is often attributed to habitat degradation (National Research Council 1992, Johnston and Slaney 1996, Slaney and Zaldokas 1997, BCCF 1998). Winter survival has been considered to be one potential bottleneck in salmonid production in several systems (Bustard and Narver 1975, Swales *et al.* 1986, Dolloff 1987, Koning and Keeley 1997) since winter is generally a more stressful time for fish with resultant starvation, energy loss, declines in fish health and survival (Bustard and Narver 1975, Dolloff 1987, Cagnelli and Gross 1997) (Donas and Saimoto 2001a).

The long-term objectives of the Bulkley overwintering studies are to:

- determine changes in species abundance during the winter,
- document changes in weight, length and condition of species at sites examined,
- document changes in habitat such as reduction in available habitat over the course of the winter,
- document any changes to the quality of overwintering habitat due to low water levels as compared to previous years measurements at the same sites.

This report documents the results of the overwintering study from November 2006 to April 2007. Measurements at each site were taken during the beginning (either Nov. or Dec.), middle (either Jan. or Feb.) and end (March) months of winter during this study. It was felt that data collected at the beginning, middle and end of winter would provide sufficient information to monitor the conditions of habitat and fish throughout the winter. Previous overwintering study measurements were conducted during each month of winter in the 1998-2001, and 2005-2006 studies.

2.0 STUDY AREA

The Bulkley River is a major tributary to the Skeena River, located in north-central British Columbia. The Bulkley River drains into the Skeena River near the Village of Hazelton, B.C. The study area includes Byman, McQuarrie, Barren and Richfield Creeks, located in the Upper Bulkley watershed upstream of the confluence of the Morice and Bulkley rivers near Houston, B.C. (Figure 1). The study area also includes McKinnon Creek, an unnamed creek and a groundwater channel near the town of Smithers, B.C. (Figure 2). In addition, the study area includes Waterfalls Creek, a tributary to Mission Creek, at the Village of New Hazelton, B.C. Waterfalls Creek is located in the lower Bulkley River Watershed (Figure 3).

Figure 1. Locations of sites sampled in the Upper Bulkley Watershed.

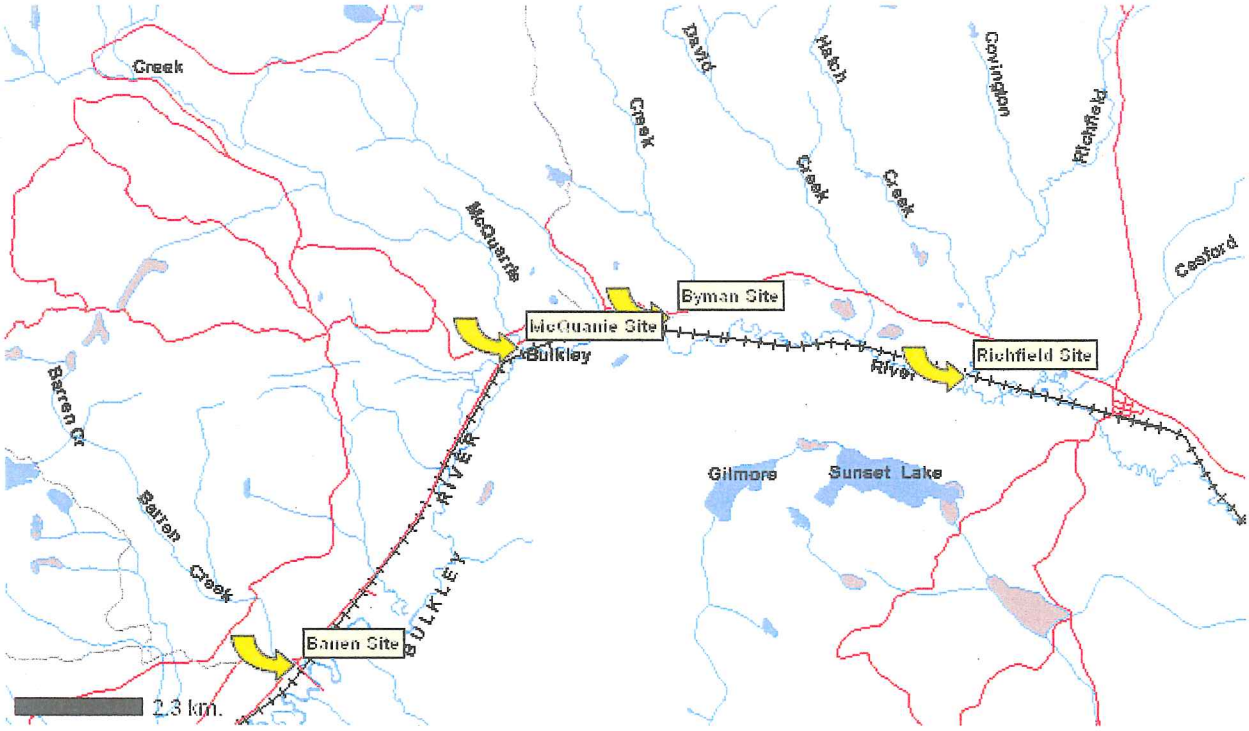


Figure 2. Location of sites sampled in the Middle Bulkley Watershed.

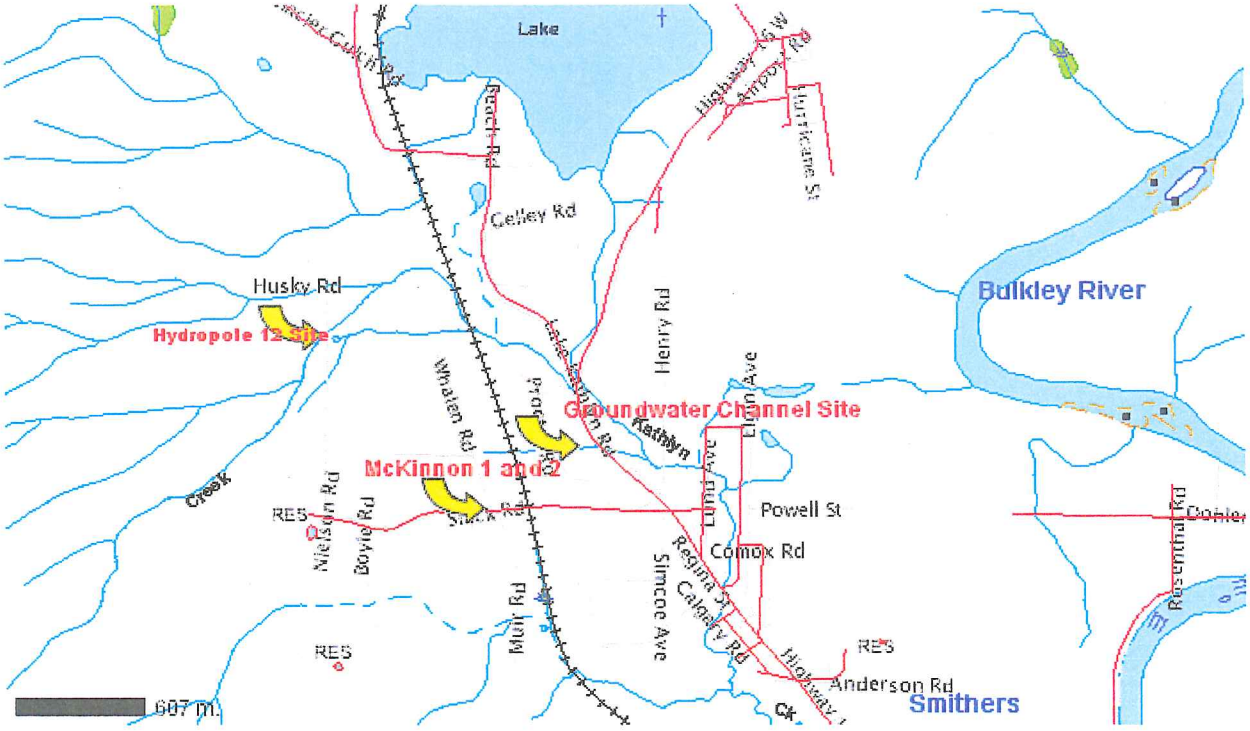
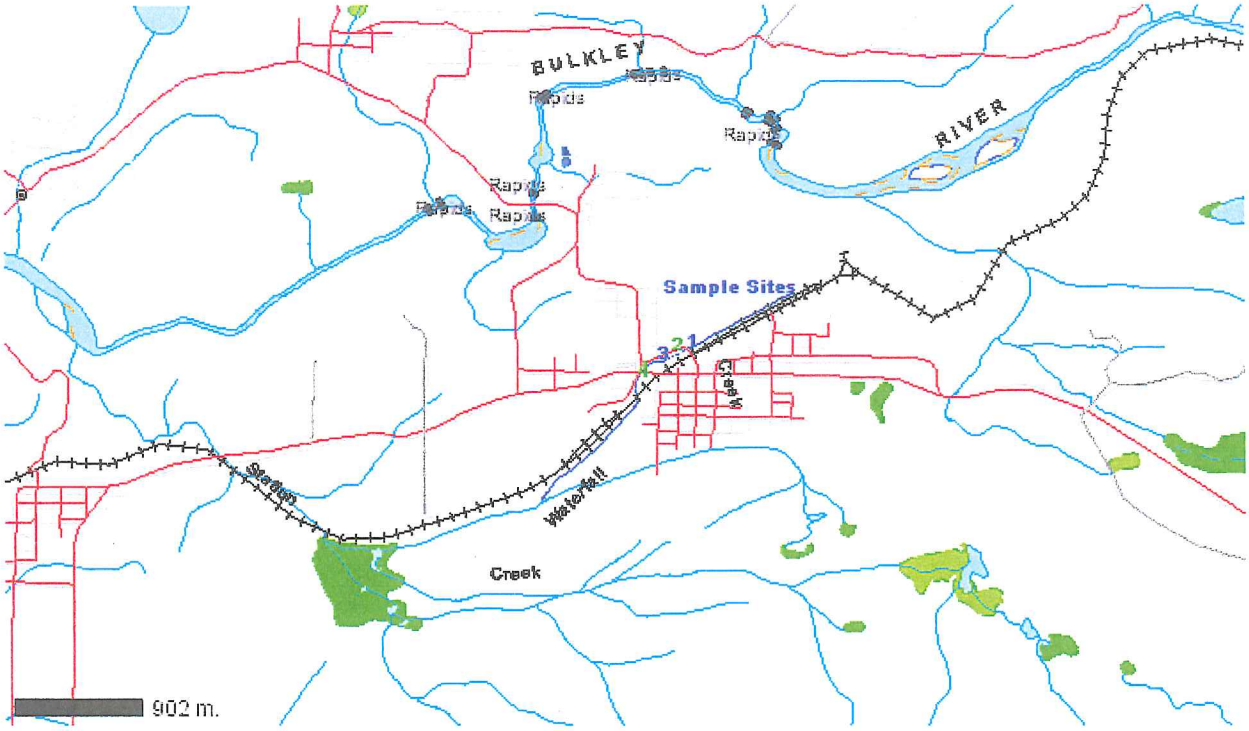


Figure 3. Locations of sites sampled in the Lower Bulkley Watershed (Waterfalls Creek).



3.0 MATERIALS AND METHODS

3.1 Habitat Assessment

Sites were selected based on accessibility of sites to salmonids and ease of access during winter sampling. Many of the sites were at culvert pools at road crossings. Sample site locations are illustrated in Figures 1, 2 and 3. All sites located on Barren, Byman, McQuarrie and Richfield Creek are drained by the Upper Bulkley River watershed, and are found within the portion of the watershed accessible to salmonids (downstream of falls). Most of these sites were either located upstream or downstream of culverts situated along the Highway 16 corridor and one site was located under a railway bridge. The site on McKinnon Creek was at a habitat enhancement project at the McKinnon Creek Whalen Road culvert crossing. This project involved construction of pool habitat on the upstream and downstream sides of the Whalen Road culvert. In addition, a site located at a culvert pool of an unnamed creek that is part of the McKinnon Creek watershed, as well as a groundwater channel site were also included in this study. The Waterfalls Creek sites in New Hazelton are located in the Lower Bulkley River watershed, and were sampled for continuity with the previous years of sampling (Donas and Saimoto 1999, 2000, 2001).

3.1.1 Winter Assessments

Changes in physical and chemical parameters (Table 1) were recorded monthly for each sample site using a data form designed for overwintering sampling (Appendix 1). Monthly physical and chemical data were collected by removing ice from the limnological/trapping station by hand with an axe.

These data include air temperature, pH, water temperature, ice thickness, snow depth, dissolved oxygen, and water depth.

Table 1. Physical and chemical parameters recorded on a monthly basis for each site during the overwintering study.

	Parameter	Unit/Categories	Method
General site description			
	Air temperature	Celsius	truck thermometer
	Ice Cover	percent	visual estimate
	Stream Flow	None, Low, Moderate, High	visual estimate
	Potential for fish migration	None, Low, Moderate, High	visual estimate
Limnological station	water depth	centimeters	meter stick
	ice thickness	centimeters	meter stick
	clarity of ice	None, Low, Moderate, High	visual estimate
	snow depth	centimeters	meter stick
	water temperature	Celsius	OxyGuard D. O. Meter
	turbidity	None, Low, Moderate, High	visual estimate
	Dissolved Oxygen	ppm	Oxyguard
	pH	pH units	Hanna H 19812

3.2.2 Spring Assessments

Spring assessments included an evaluation of physical characteristics at each site. These assessments were conducted near the middle of April 2007, using an updated data form designed for the project (Appendix 2). The data form was updated from the spring assessment form used in the 2005/06 overwintering study, in order to be more consistent with the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnson_NT1996.pdf). Habitat measurements were documented for all sites (Table 2).

Table 2. Physical parameters recorded in the field for each site sampled in April 2007, immediately after ice thaw.

	Parameter	Unit/Categories	Methods
pool, glide or riffle	Length of habitat unit	meter	hipchain
	Wetted width	meter	hipchain
	Bankfull width	meter	hipchain
	Max. wetted depth (at deepest point)	centimeter	Meter stick
	Depth at trap cluster location	centimeter	Meter stick
	Depth at riffle crest (at pool outlet)	centimeter	Meter stick
	Residual pool depth	centimeter	N/A
	Total % of wetted area covered	percent	Visual estimate
	Cover % breakdown (adds to 100%)		
	Cobble proportion of site	percent	Visual estimate
	Boulder proportion of site	percent	Visual estimate
	SWD (<10cm diameter)	percent	Visual estimate
	LWD (>10cm diameter)	percent	Visual estimate
	Undercut Banks	percent	Visual estimate
	Instream Vegetation	percent	Visual estimate
	Overhanging Vegetation	percent	Visual estimate

	Parameter	Unit/Categories	Methods
	Deep Pools	percent	Visual estimate
	Bed Material (adds to 100%)		
	% fines (< 2mm)	percent	Visual estimate
	% gravel (2-64 mm)	percent	Visual estimate
	% cobble (64-256 mm)	percent	Visual estimate
	% boulder (>256mm)	percent	Visual estimate
	% bedrock	percent	Visual estimate
	Description of other habitat features, impacts or restoration opportunities.	N/A	N/A

3.2 Fish Sampling

Low water temperatures and thick ice cover precluded the use of electrofishers, since electrofishing at water temperatures below 4°C can be harmful to salmonids. Fish sampling was conducted by setting minnow traps baited with roe in nylon bags at each of the sample sites during each sampling period (beginning, middle and end of winter). The minnow traps were left for 24 hours. Fish were recovered from the traps, anesthetized with Alka Seltzer and baking soda, identified to species, measured (fork length ± 1.0 mm), weighed (± 0.1 g using an Acculab V1200 electronic balance) and released back into the habitat. Due to difficulties encountered with estimates of population size in the winter of 1998/1999 (Donas and Saimoto 1999), no mark-recapture estimates were conducted in the winter of 2006/2007. Attempts were made to standardize the trapping intensity by considering the surface area of the site (a cluster of three traps/ 50 m^2 surface area). Difficulties in setting traps under the ice resulted in a reduction in trapping intensity at most sites to a cluster of three traps / 150 m^2 surface area. Trapping intensity at each site changed through the winter, in some cases, due to decreased pool depth in the latter portion of winter. Total catch and particularly catch per unit effort (i.e. catch per trap) was used as an indicator of fish abundance, as suggested in previous studies (Swales *et al.* 1986).

3.3 Fish Fork Length, Size and Condition

Fulton's condition factor was calculated for sampling dates where both length and weight of the fish were recorded. Fulton's condition factor (equation 4) is useful where growth is isometric, and/or if the fish to be compared are of approximately the same length (Ricker 1975, Bagenal 1978). Fulton's condition factor provides a measure of fatness of the fish, which is expected to reflect a fish's health.

Equation 4: $$K = 10^5 (w / l^3)$$

where: K = Fulton's condition factor
w = weight (g)
l = length (mm)

4.0 RESULTS

4.1 Habitat Assessment

Sites chosen in 2006 were at pools associated with road culvert crossings and other pools or glides that were expected to be suitable for overwintering habitat. Most of the sites were also monitored during the 2005/06 study; however, site on Richfield Creek and a site on groundwater channel were added to the 2006/07 study. Four sites on tributaries to the Upper Bulkley watershed, four sites in the McKinnon Creek watershed and four sites in the Waterfalls Creek mainstem (a tributary to Mission Creek) were sampled. The distribution of sites among general habitat types is summarized in Table 3. Spring and winter habitat assessment forms are located in Appendices 1 and 2, respectively.

4.1.1 Spring Assessments

Spring assessments were conducted at all twelve sites in April 2006, immediately after ice-off. All sites can be characterized as fluvial or groundwater habitat, where six of the twelve sites were glide-type habitat, one of the twelve sites was riffle-type habitat, and the remainder was pool-type habitat. Two of the twelve sites were rehabilitation pools associated with culvert crossings (i.e., McKinnon Cr. – Site 1 and Barren Cr.) in 2005/06. The habitat at both of these rehabilitation sites have changed during this study, where the McKinnon Cr. – Site 1 changed from pool to riffle, and the Barren site changed from a deep pool to degraded pool/riffle. The surface area, width and depth of all sites are summarized in Table 4.

4.1.1.1 Surface Area, Width and Depth

A total of twelve sites were sampled in April 2007. Sites ranged in surface area from 7.2 to 423.5 m^2. Site 2 of McKinnon Creek had the smallest surface area (7.2m^2), located in the middle Bulkley watershed. One of the Waterfalls Creek sites, site 2, had the largest surface area (423.5 m^2). The average surface area of the Upper Bulkley sites was 138 m^2 (SD=72.3). The average surface area of the middle Bulkley sites was 33.44 m^2 (SD=44.5). The average surface area of the Waterfalls Creek sites was 222.68 m^2 (SD=179.7). It should be noted that sites 1 and 2 of Waterfalls Creek were situated in the same 110 meter long glide, where site 1 was situated at the upper end of the glide and site 2 was situated at the lower end of the glide. Half of the total length of the glide (i.e., 55 meters) was used to calculate each surface area for sites 1 and 2. Of the sites sampled, only two had a surface area less than 15 m^2.

Wetted width of all the sites ranged from 2.2 to 11.8 meters. Wetted width averaged 8.3 m (SD=2.8) at the Upper Bulkley sites, 2.4 m (SD=0.2) at the middle Bulkley sites and 6.7 m (SD=1.9) at the Waterfalls Creek sites. Maximum depths of all the sites ranged from 20 to 150 centimeters. The maximum depths averaged 93 cm (SD=46 cm) at the Upper Bulkley sites, 30.5 cm (SD=9.5) at the middle Bulkley sites, and 90.5 cm (SD=11 cm) at the Waterfalls Creek sites. Of the sites sampled, five had a maximum wetted depth shallower than 0.50 m.

4.1.1.2 Habitat, Substrate and Cover

The majority of the habitat sampled consisted of glides (n=6), whereas the remainder consisted of pools (n=5) and riffles (n=6). Sites sampled had estimated gradients ranging between 0-1 percent. The dominant substrate type at 60% of the sites was fines, and the others were dominated by either gravels (30%) or cobble (10%). It should be noted that substrate was measured at 10 of the 12 sites only since the water was silty to visually estimate substrate composition at Richfield and Byman sites in mid-April 2007. The highest proportion of boulders was found at Waterfalls Creek site 4, primarily due to rip-rap along the banks that dislodged to the channel bed. The glide- or pool- type habitat of Sites 1-4 of Waterfalls Creek, as well as the groundwater channel site and McQuarrie site consisted predominately of fines. Aggradation of bed material was evident at sites 1 and 2 of McKinnon Creek, where the substrate was dominated by gravels at both these sites. Hydropole 12 was the only site that contained cobbles as the dominant substrate.

Cover was provided primarily by deep pools, cobbles, and boulders. Small woody debris was present at some of the sites, including Richfield (1%), McKinnon-Site 2 (10%), Hydropole 12 (5%), Groundwater site (30%), and Waterfalls-Sites 1-4 (2-5%). Cover provided by LWD was present in a small amount (~2-5%) at Byman, Hydropole 12, McKinnon-Site 2, and Waterfalls-Site 4. Cover was provided in smaller amounts by instream vegetation and overhanging vegetation at some of the sites; however, this cover would not be present during the winter.

Table 3. Site description and sampling times during the Bulkley River overwintering study, November 2006 to March 2007.

	Site # or Name	Location	Habitat	Surface Area (m^2)	Dates (06/07)
Upper Bulkley River Trib's	McQuarrie*	just downstream of highway 16, upstream of CNR crossing	Culvert pool, cobble	95	Nov., Jan., March
	Byman*	downstream side of highway 16 crossing	Culvert pool, cobble	184	Nov., Jan., March
	Barren*	upstream side of highway 16 crossing. This pool was dredged in September 2005 and September 2006.	Dredged pool, gravels/fines	60	Nov., Jan., March
	Richfield	Pool underneath the CNR bridge, located about 200 m upstream of the confluence with the Upper Bulkley.	Glide, not able to measure substrate (water too silty)	213	Nov., Jan., March
Middle Bulkley River Trib's	McKinnon Site 1+	upstream side of Whalen Rd. culvert	Riffle, gravels/cobble (Aggraded). Rehabilitation pool with cobble/fines existed during 2005/06 study.	16	December - March
	McKinnon Site 2+	downstream side of Whalen Rd. culvert	Glide, gravel/cobble (Culvert pool, fines/cobble in 2005/06).	7.2	December - March
	Unnamed+ (Hydropole12)	downstream side of Neilson Rd. culvert	Culvert pool, fines/cobble	10.56	December- March
	Groundwater	Pool located 5 m upstream of the Slack Road Creek confluence (Access off of Proctor Road).	Glide, fines	100	Dec., Feb., March.
Waterfalls Creek (Lower Bulkley)	Site 1*	Located approx. 1 km upstream of Highway 16 culvert, just downstream of a beaver dam. This is the uppermost site sampled, and is located adjacent to railway tracks.	Glide, fines	324.5	Dec., Jan. March
	Site 2*	Located approx. 800 m upstream of Highway 16 culvert, just upstream of a beaver dam. This site is also located adjacent to railway tracks.	Glide, fines	423.5	Dec., Jan. March
	Site 3*	Located approx. 500 m upstream of Highway 16 culvert, just upstream of a riffle. Site located adjacent to road.	Pool, fines/cobble/boulder	85.5	Dec., Jan. March
	Site 4*	Located just downstream of culvert crossing of road to landing. This site is located approximately 200 m downstream of Highway 16 culvert.	Culvert pool, cobble.	57.2	Dec., Jan. March

([1] also see Figure 1, 2 and 3 for site locations
* indicates sites also sampled in the winter of 1999 – 2001, and 2005-2006
+ indicates sites also sampled in 2005-2006)

Table 4. Surface Area, Wetted Width and Maximum Depth of all sites sampled in April 2007.

	Barren	Byman	McQuarrie	Richfield	McKinnon Site 1 (u/s)	McKinnon Site 2 (d/s)	Hydropole 12	G. Water	Waterfalls Site 1	Waterfalls Site 2	Waterfalls Site 3	Waterfalls Site 4
Wetted Width (m)	5.1	11.8	7.8	8.4	2.7	2.25	2.2	2.5	5.9	7.7	4.5	8.8
Max. Depth (cm)	38	150	95	90	25	23	44	30	~100	~100	82	80
Surface Area (m^2)	60	184	95	213	16	7.2	10.56	100	324.5	423.5	85.5	57.2

4.1.2 Winter Assessments

Some variability in air and water temperature, dissolved oxygen, pH, water depth, ice cover and thickness, and snow depth were observed among the sites sampled during the winter. Turbidity remained clear throughout the winter at all sites. Quantitative data recorded during the winter sampling at the sites are summarized in Table 5. Ranges, means and variability of conditions recorded during the winter assessments at all the sites are also provided in Table 5. Refer to Appendix 1 for detailed information.

Air temperature throughout the study ranged from a low of -12° C to a high of +2° C making it possible to individually sample juveniles on all sample dates. Water temperature ranged from 0.1°C to 3.6°C, with the highest water temperatures recorded at the groundwater channel site.

The recorded pH across all sites was within safe limits for salmonids and ranged from 6.9 to 8.1 with a mean of 7.5. Dissolved oxygen (DO) levels were also within safe limits for salmonids and were greater than 10 ppm for most sites throughout the sample period. There were only two sites with DO levels less than 10 ppm and they were at Barren Creek on January 16, 2007 (2.7ppm) and at the groundwater channel on Dec. 19, 2006 and Feb. 20, 2007 (4.7 and 9.4 ppm). Minimal flow at the groundwater channel and Barren Creek may have contributed to low DO levels. Minimum water depths (0 cm – 4.5 cm) were recorded at the McKinnon Creeks sites 1 and 2. It should be noted that water depths did not exceed 4.5 cm at sites 1 and 2 on the sampling dates (Dec. 12, Jan. 18, Feb. 20). Maximum water depth (90 cm) was recorded at Byman Creek on November 22, 2006.

Stream flow ranged from low to moderate at all sites. The potential for fish migrating in and out of the pools at the upper Bulkley sites ranged anywhere from low to high, with the highest overall potential for migration recorded at the Byman Creek site. The potential for migration at the McKinnon Creek sites was low to none, low to moderate at the Groundwater site, and low to high at the Hydropole 12 creek site. The potential for fish migrating in or out of glides or pools at sites 1-4 of Waterfalls Cr. was moderate to high throughout the winter. The potential for migration consistently seemed to be lowest at all sites during the mid-winter months of January or February.

Ice cover throughout the winter at the Upper Bulkley sites, other than Barren, ranged from 85-100%. Ice cover at the Barren site ranged from 40-100%. Ice thickness appeared to be greatest at McQuarrie Cr. (46.5 cm), although it was only recorded on Nov. 22/06. Overall ice thickness was lowest at Barren (0.5-13cm), possibly due to ditch water flowing in on the right bank side of the pool. Ice cover at the Middle Bulkley sites varied throughout the winter, with the highest ice cover and thickness recorded at the McKinnon Creek and Hydropole 12 sites (98-100%; 11-43cm) from December to February. The groundwater channel, due to warmer water temperatures, had the lowest recorded ice cover (50-80%) and lowest ice thickness (7-20 cm) from December to February. It should be noted the Hydropole 12 creek and groundwater channel sites both

had 0% ice cover on March 27. Lastly the ice cover and thickness at the Waterfall creek sites ranged from 90-100% and 9-55 cm during the December and January sampling dates. In March, the ice cover and thickness was greatest at sites 1 and 2 of Waterfalls Creek (50-95%; 8-9cm) and lowest at Waterfalls site 3 and 4 (10%, 0.1cm). Snow depth at all the sites ranged from 0 – 35 cm.

Table 5. Summary of winter assessment results at all sites sampled from November 2006 to March 2007.

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Air Temperature	34	-12^{0}C	2^{0}C	-3.1^{0}C	4.5
Water Temperature	26	0.1^{0}C	3.6^{0}C	0.8^{0}C	1.0
Dissolved Oxygen	25	4.7ppm	13.4ppm	11.4ppm	2.6
pH	29	6.9	8.1	7.5	0.3
Water Depth (cm)	33	0 cm	90 cm	40 cm	20.8
Ice Thickness (cm)	32	0 cm	55 cm	22.5 cm	17
Ice Cover (%)	33	0%	1%	83%	30
Snow Depth (cm)	33	0 cm	35 cm	7.3	8.1

N=Number of times the variable was recorded over the course of the winter study.

4.1.3 Changes in Habitat During the Winter

The change in habitat at sites in the Upper, Middle and Lower Bulkley tributaries are presented in the following sections for comparison purposes. Temporal trends in water depth, ice thickness and dissolved oxygen were graphed for each site (Figures 4, 5 and 6). Trends in percent ice cover, snow depth and pH are not discussed in these sections since it was found that these variables remained relatively consistent throughout the winter. Air temperature varied throughout the winter since some sites were sampled during warm or cold spells, and no trends were evident. Only minor decreases in water temperatures occurred at all sites throughout the winter (Refer to data sheets in Appendix 2 for more detailed information).

4.1.3.1 Upper Bulkley tributary Sites

Water depths at Byman and Richfield decreased overall throughout the winter (Figure 4). Water depth at Barren decreased from November to January, but increased in March to a similar depth found at the beginning of winter. The dissolved oxygen (DO) was most constant at the Richfield site, whereas DO increased between the January and March sampling dates at Byman and Barren, especially at the latter. The DO level of 2.7 ppm at Barren in January was considered to be at lethal levels for fish. From January to March, ice thickness remained fairly constant at Byman and Richfield, where as the thickness of ice decreased at Barren in March to beginning of winter conditions.

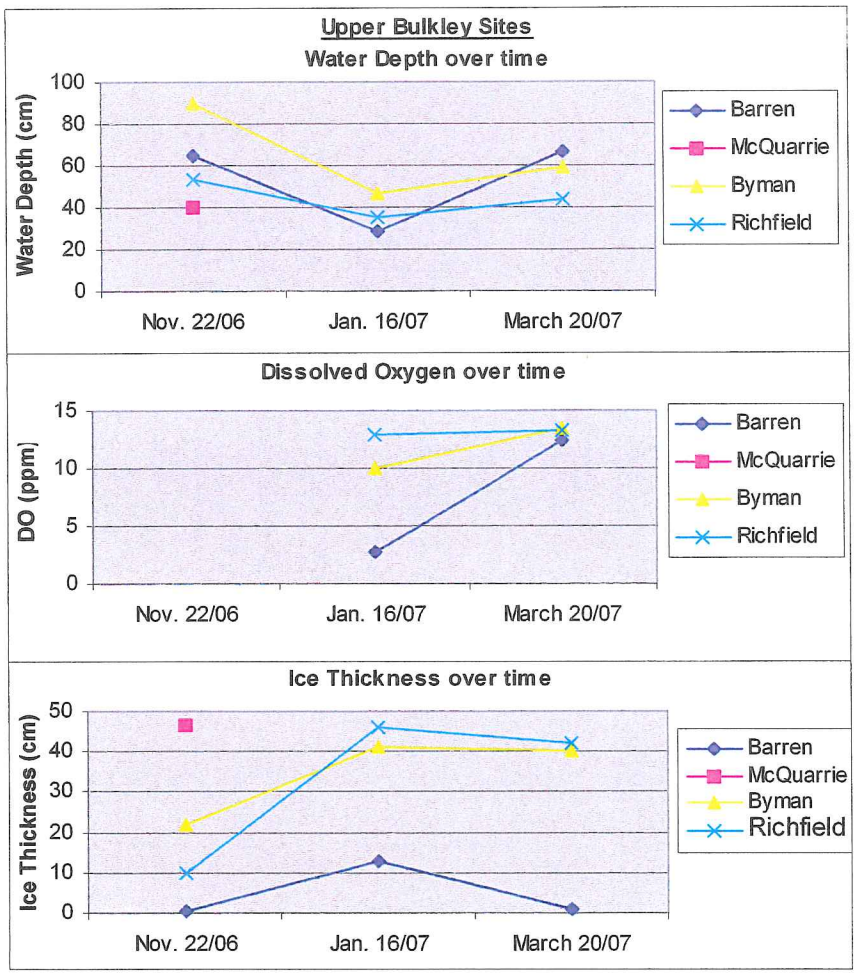


Figure 4. Water Depth, Dissolved Oxygen and Ice Thickness over time for the Upper Bulkley Tributaries (2006/07).

4.1.3.2 Middle Bulkley tributary Sites

Water depth at the McKinnon Creek sites was very low over the winter (Figure 5); therefore, fish sampling was not possible and these sites would not provide overwintering fish habitat. Water depth decreased over the winter at the Hydropole 12 site and the groundwater site. The most marked decrease in water depth occurred from December 19th to January 18th at the groundwater site, although overwintering habitat was continuous throughout the winter. Dissolved oxygen at the groundwater site increased over the winter from 4.7 to 11.4 ppm. Only one DO measurement was taken at the McKinnon sites where it was over 13 ppm. Dissolved oxygen at Hydropole 12 increased slightly over the winter from 10.5 to 12.6 ppm. Ice thickness steadily decreased at all the sites throughout the winter, with the most noticeable decrease recorded at Hydropole 12.

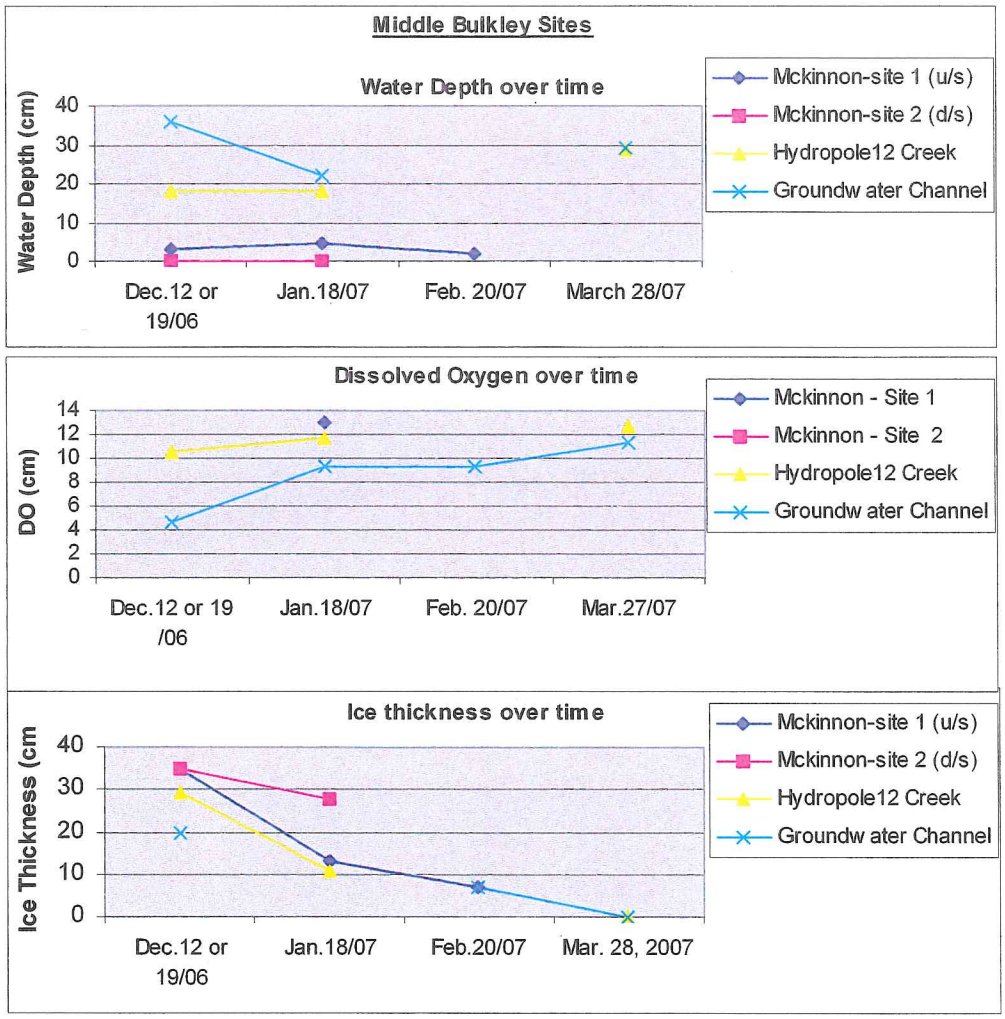


Figure 5. Water Depth, Dissolved Oxygen and Ice Thickness over time for the Middle Bulkley Tributaries (2006/07).

4.1.3.3 Lower Bulkley tributary sites

Water depths at all four sites of Waterfalls Creek increased slightly throughout the winter (Figure 6). Sites 1-4 had water depths greater than 30 cm throughout the winter. The dissolved oxygen of all four sites remained fairly constant throughout the winter with no levels less than 10.5 ppm. Ice thickness steadily decreased at sites 2-4 throughout the winter. The ice thickness decreased overall at site 1; however, an increase occurred from Dec. 12 to Jan. 18.

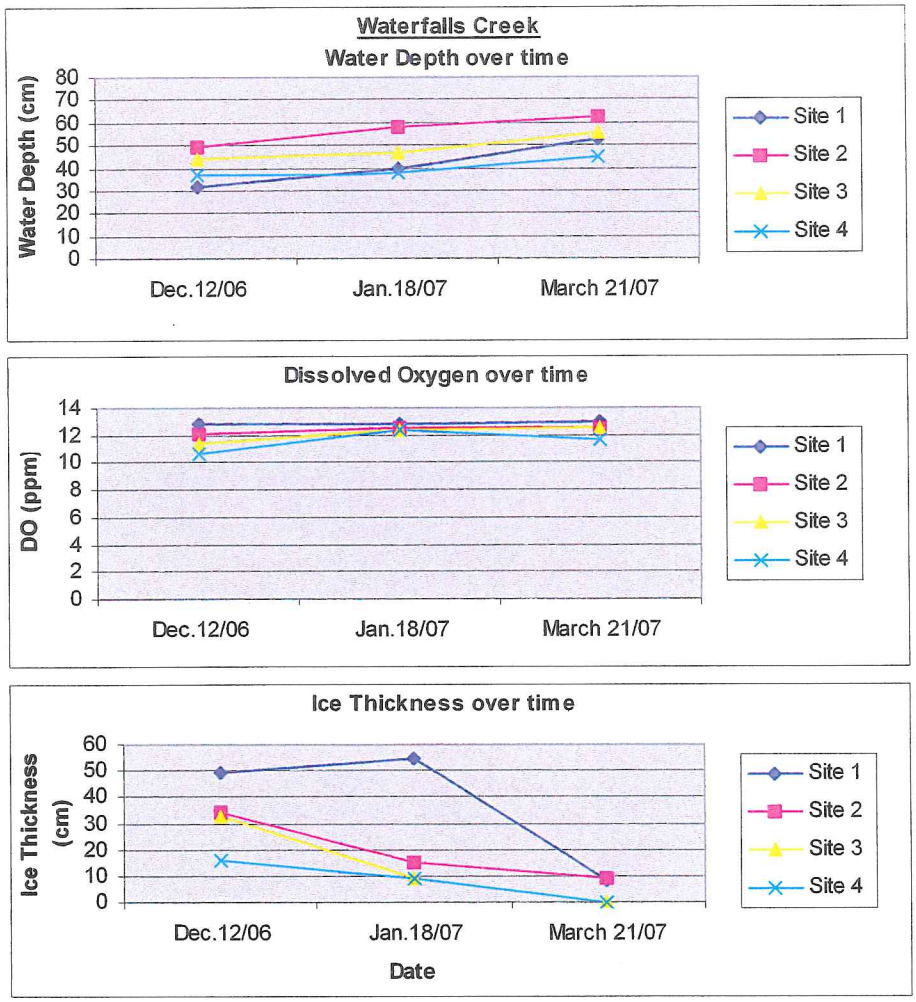


Figure 6. Water Depth, Dissolved Oxygen and Ice Thickness over time for the Lower Bulkley Tributary sites (2006/07).

4.2 *Fish Sampling*

Coho, rainbow trout (RBT)/steelhead (sthd), Dolly Varden char and cutthroat trout were captured during the overwintering study. The following sections present fish sampling results for the Upper, Middle and Lower Bulkley tributary sites sampled between November 2006 and March 2007.

4.2.1 Upper Bulkley Tributary Sites

Coho and RBT/sthd were captured during the overwintering study conducted at the Upper Bulkley tributary sites between November 2006 and March 2007. The species composition, as well as fish fork length frequencies and condition will be discussed. Appendix 3 contains all the fish capture data for each site throughout the winter sampling program.

4.2.1.1 Species composition

The species composition varied between the four sites and dates sampled at the Upper Bulkley tributary sites (refer to Figures 7 to 9). Due to various circumstances, Byman was the only site of the four in the Upper Bulkley that was continuously sampled throughout the winter. Byman contained a fairly high proportion of Rainbow Trout/sthd, as compared to coho (Figure 7). A total of 10 fish were captured at Byman in November, where the majority was rainbow trout/sthd (9, 90%), and the remainder consisted of coho (1, 10%). The total number of fish captured at Byman increased slightly from 10 in November to 12 in March, where 100% of the fish captured were rainbow.

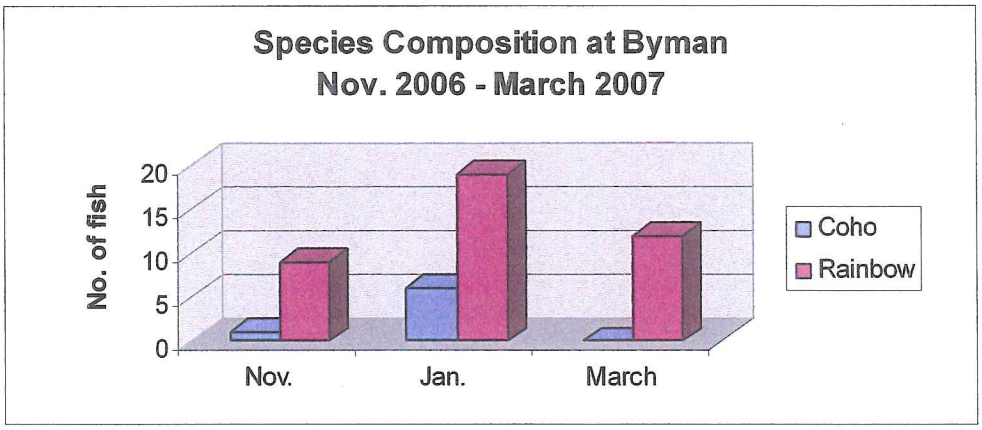


Figure 7. Monthly Species Composition at Byman.

Fish were not captured at the Barren site during the two sampling times in Nov. and March. Barren Creek was extensively dredged upstream and downstream of the highway culvert in late summer 2006 as part of a Ministry of Transportation Culvert Maintenance Program, which appeared to have contributed to a loss of habitat at the Barren site.

The McQuarrie site was sampled in November only, due to snow plowed off the highway onto the site in January and March making the site inaccessible for trapping. A total of 30 fish were captured at McQuarrie Creek in November, where 17 were RBT/sthd (57%) and 13 were coho (43%) (Figure 8).

The Richfield site was sampled at the beginning and middle of winter. Sampling was not possible at the end of winter in March due to water flowing too high and fast to set traps. Richfield contained a fairly even proportion of RBT/sthd and coho (Figure 9). A total of 19 fish were captured at Richfield in November, where there was 9 RBT/sthd (47%) and 10 coho captured (53%). The total number of fish captured at Richfield decreased from 19 in November to only 1 RBT/sthd in January. The low number of fish captured in January may have been attributed to losing half of the second trap that may have had fish.

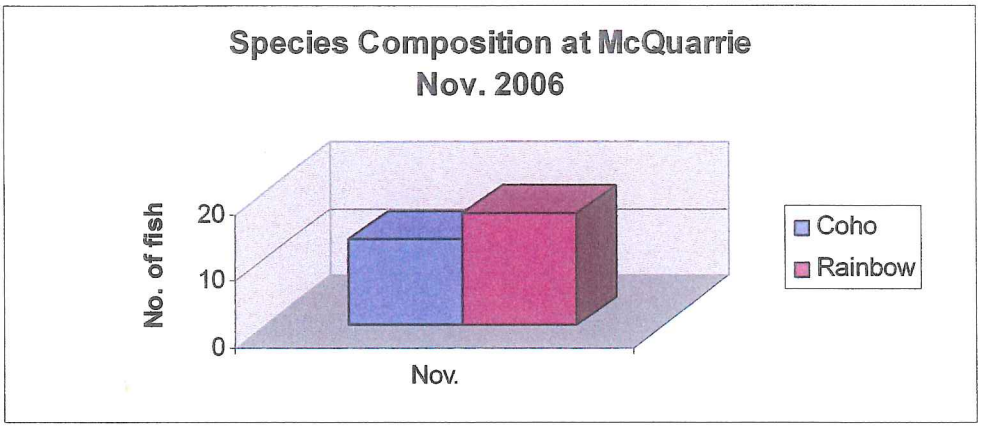


Figure 8. Monthly Species Composition at McQuarrie.

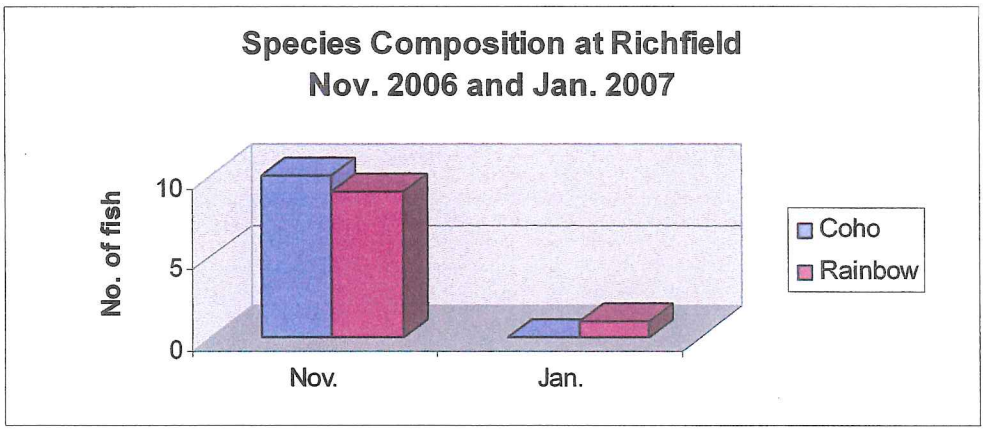


Figure 9. Monthly Species composition at Richfield Creek.

4.2.1.2 Fork Length and Condition Comparisons

Fork length and weight data were collected for salmonids throughout the overwintering study. A total of 30 coho and 66 RBT/sthd trout were measured at the upper Bulkley tributary sites over the winter. Length, weight and condition data are summarized in the following sections. Coho has been presented in two categories estimated from fork length distributions attained from fish captured at sites at the Upper Bulkley tributary sites in 2005/06 and 2006/07. Based on length frequency distributions of coho, two fork length categories have been created for 80 mm or less coho, and coho greater than 80 mm. It is assumed that RBT/sthd trout have similar fork length categories as coho.

4.2.1.2.1 Coho

Fork length and weight data were collected for all of the coho captured (30) during the study. Length, weight and condition factor data for sites sampled are provided in Appendix 3. The fork length comparisons for coho salmon have been presented by month in two fork length categories (i.e., $\leq$ 80 mm and > 80 mm) for the Byman site.

Figure 10 depicts coho salmon fork length frequency by month for the Byman site since it was the only site in the Upper Bulkley that was continuously monitored throughout the winter. There was a slightly higher number of coho captured at the Byman site that were greater than 80 mm, with the highest frequency of coho (n=3) captured on Jan. 17/07. There were only 3 coho less than 80 mm captured in total, of which all were captured on Jan. 17/07. Overall, there was a slight decline in coho numbers from beginning to end of winter at the Byman site.

There were insufficient numbers of coho captured to analyze the mean Fulton's condition factor (FCC) by month and fork length (FL) category at all the sites, including the Byman site where only 7 coho were captured throughout the winter.

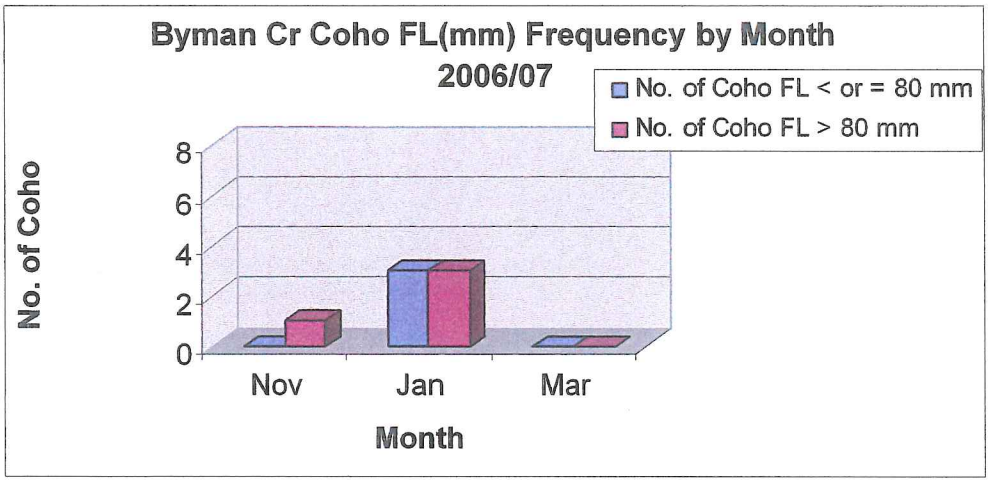


Figure 10. Coho Fork Length (FL) Frequency by month, at the Byman Site (2006/07).

4.2.1.2.2 Rainbow Trout/Steelhead

Fork length was collected for all the RBT/sthd captured (66) and weight data were collected for 64 of the 66 (97%) RBT/sthd captured during the study. Length, weight and condition factor data for sites sampled are provided in Appendix 3. The fork length comparisons and Fulton's condition factor (FCC) data for RBT/sthd has been presented by month in two fork length categories (i.e., less than 80 mm and greater than 80 mm) for the Byman site. Most of the RBT/sthd captured at the Byman site was greater than 80 mm in length.

Figure 11 depicts RBT/sthd fork length frequency by month for the Byman site. At the Byman Creek site, there were no apparent trends in RBT/sthd frequency distributions from beginning to end of winter. The most notable result was the increase in greater than 80 mm RBT/sthd recorded on Jan. 17/07.

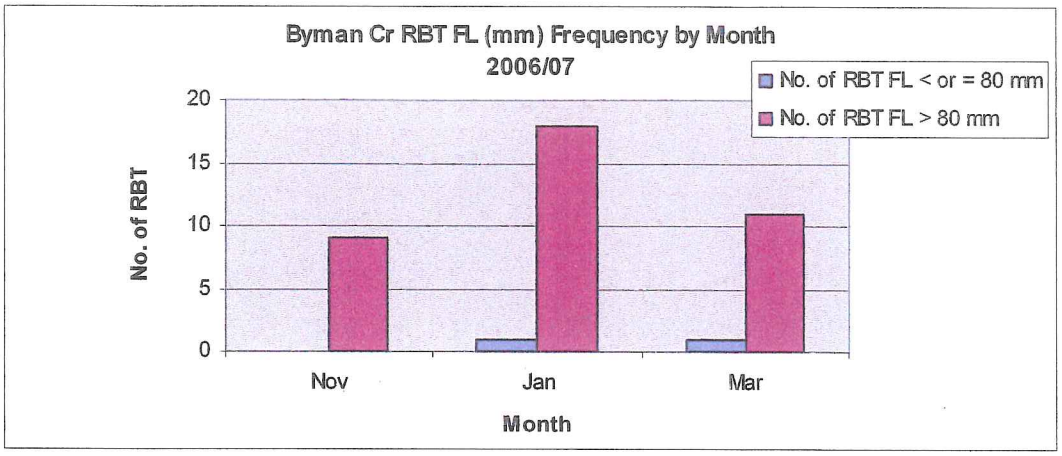


Figure 11. Rainbow Trout Fork Length (FL) Frequency by month, for the Byman site (2006/07).

Figure 12 depicts RBT/sthd mean Fulton's condition factor (FCC) by month and fork length (FL) category for Byman site. RBT/sthd in the less than 80 mm fork length category were absent during Nov. and only 1 coho was captured in each of the Jan. and March sampling dates; therefore, there was insufficient data to analyze mean FCC for ≤ 80 mm category. The mean FCC for RBT/sthd in the greater than 80 mm fork length category increased slightly from 0.96 in Nov. to 0.98 in March.

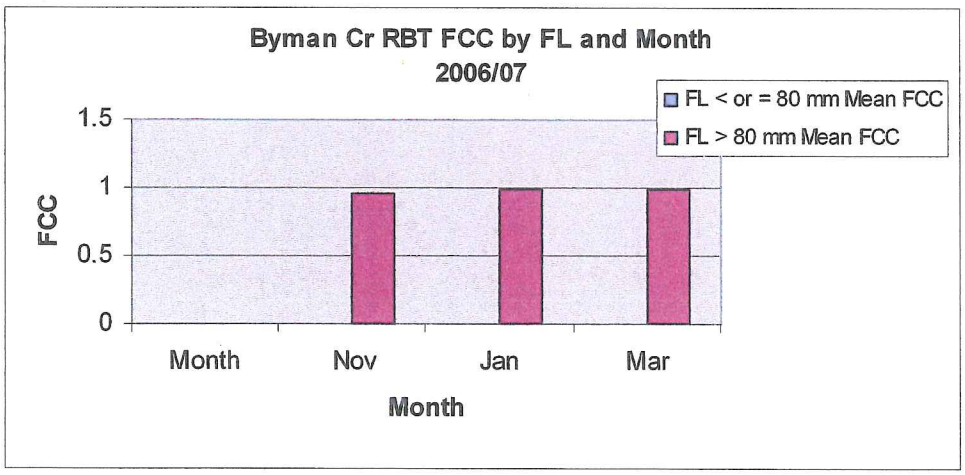


Figure 12. Rainbow Trout Mean Fulton's Condition Factor (FCC) by Fork Length (FL in mm) and month, for the Byman site.

The summary of the condition factor data is provided in Table 6. The condition of RBT/sthd trout appeared to be greater at the end than beginning of winter.

Table 6. Mean Fulton's Condition Factor for Rainbow Trout/Steelhead at Byman, November 2006 and March 2007.

Site	Species	Fork Length Category	FCC-Mean Nov-06	FCC-Mean Mar-07
Byman	RBT/sthd	≤ 80mm	na	na
		>80 mm	0.96	0.98

4.2.2 Middle Bulkley Tributary Sites

Coho and cutthroat trout were captured during the overwintering study conducted at the middle Bulkley tributary sites between December 2006 and March 2007. It should be noted that due to extremely low water levels at McKinnon Creek sites 1 and 2, fish sampling was not possible throughout the winter. The species composition, as well as fish fork length frequency and condition comparisons will be discussed for two or the four sites sampled in the McKinnon Creek watershed, including the groundwater channel and Hydropole 12 sites.

4.2.2.1 Species composition

Coho was the only species present at the Groundwater channel site. The unnamed creek (i.e., Hydro pole 12 site) contained cutthroat trout and coho at the end of winter in March 2007. The Hydro pole 12 site was not sampled in Dec. or Feb. due to shallow water conditions; therefore, no beginning or middle of winter data exists for the Hydro pole 12 site in 2006/07.

A total of 48 coho were captured at the groundwater site in December 2006. The amount of coho captured at the groundwater site decreased slightly from 48 in Dec. 2006 to 38 in February 2007. The amount of coho captured at the end of winter in March 2007 increased to 72 coho; however, it should be noted that 3 traps were set where as only 2 traps were set in Dec. and February.

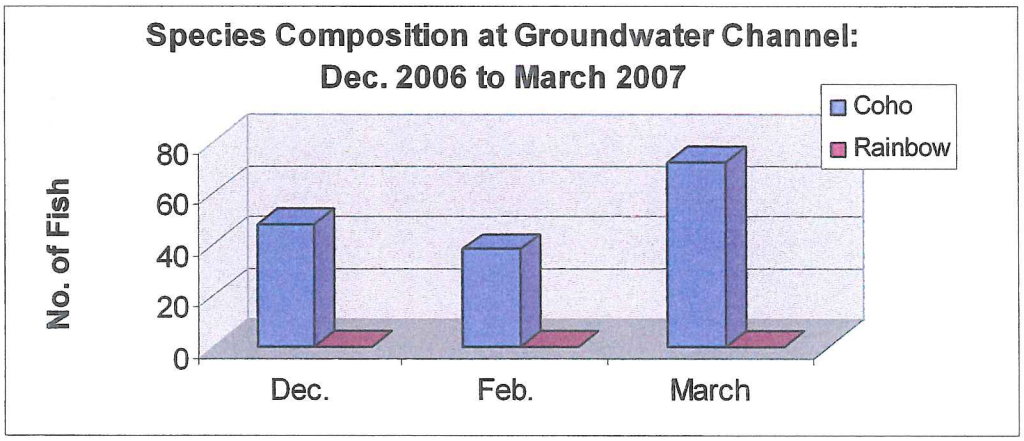


Figure 13. Monthly Species Composition at the Groundwater channel site.

A total of 5 fish were captured at the Hydro pole 12 site in March 2007, which included 4 cutthroat trout (80%) and 1 coho (20%). As mentioned there is no beginning or end of winter data for the Hydro pole 12 site due to low water levels that were not conducive to sampling.

4.2.2.2 Fork Length and Condition Comparisons

Fork length and weight data were collected for salmonids throughout the overwintering study. A total of 117 coho and 4 cutthroat trout were measured at the middle Bulkley tributary sites during the overwintering study. Length, weight and condition data for coho are summarized in the following sections. A summary of fish length and condition for cutthroat trout has not been provided due to their low numbers captured the Hydro pole 12 site only. Coho has been presented in two categories estimated from fork length distributions attained from fish captured at sites at the McKinnon Creek sites in 2005/06 and 2005/07. Based on length frequency distributions of coho, two fork length categories have been created for 80 mm or less coho, and coho greater than 80 mm.

4.2.2.2.1 Coho

Fork length data was collected for 110 of the 159 coho captured (69%) and weight data was collected for 72 of the 159 (45%) during the study of the middle Bulkley sites. Length, weight and condition factor data for sites sampled are provided in Appendix 3. The fork length comparisons and Fulton's condition factor (FCC) data for coho salmon has been presented by month in two fork length categories (i.e., $\leq$ 80 mm and > 80 mm) for each site.

Figure 14 depicts coho salmon fork length frequency by month at the groundwater site. The majority of coho captured were $\leq$ 80 mm long, with only 2 coho captured that were > 80 mm long on Dec.20. It appears on Figure 14 that the frequency of coho decreased from the beginning to end of winter; however, since only 30 of the 72 coho were measured in March, the graph could be mis-leading. The total numbers of coho captured on each date (refer to Appendix 3) indicate an actual increase in the amount of coho captured from beginning to end of winter.

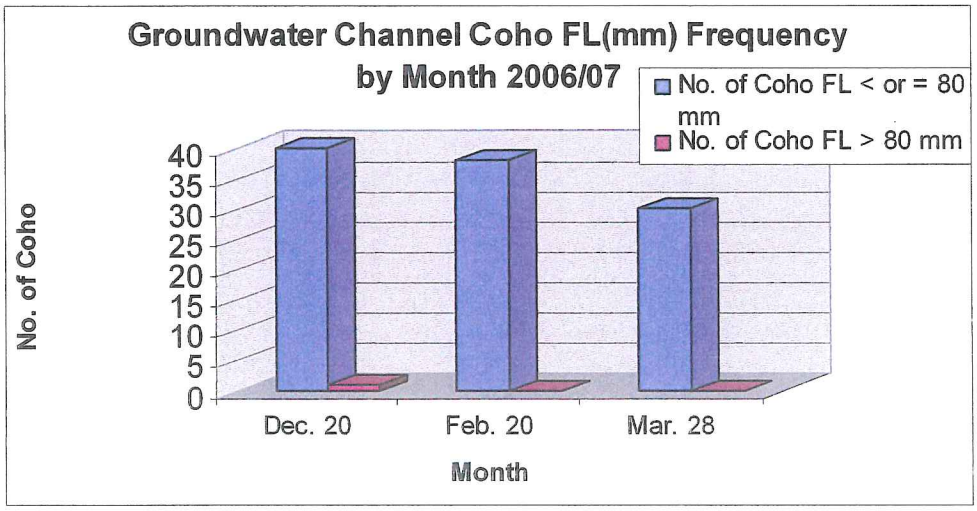


Figure 14. Groundwater channel Coho Fork Length (FL) Frequency by Month.

Figure 15 depicts coho salmon mean Fulton's condition factor (FCC) by month and fork length (FL) category for the groundwater channel. The mean FCC for coho in the less than or equal to 80 mm fork length category decreased from 1.06 in Dec. to 1.01 in March. The mean FCC for the greater than 80 mm coho is not applicable since only 2 coho in this category were captured throughout the winter.

The summary of the condition factor data is also provided in Table 7. Fulton's condition factor for coho at the groundwater channel site was greater at the beginning of winter

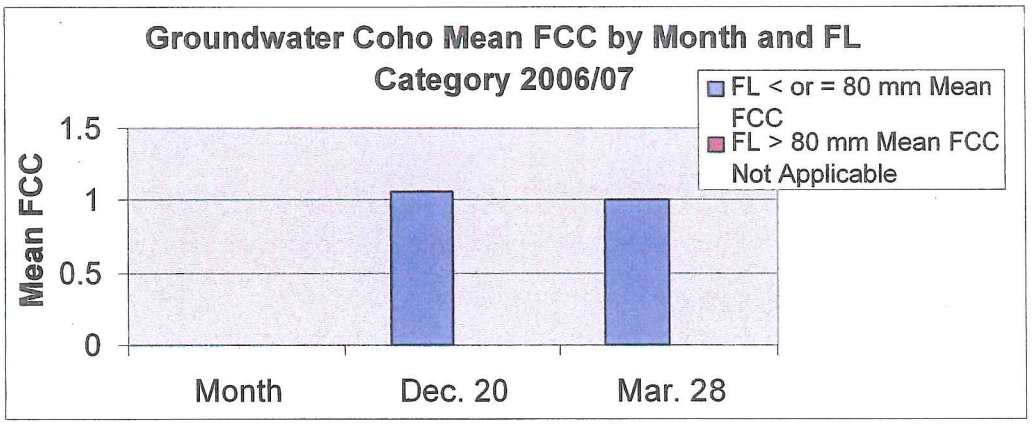


Figure 15. Mean FCC by Fork Length (FL) Category and Month for Coho at the Groundwater site (2006/07).

Table 7. Mean Fulton's Condition Factor for coho at the Groundwater site in December 2006 and March 2007.

Site	Species	Fork Length Category	FCC-Mean Dec-06	FCC-Mean Mar-07
Groundwater site	Coho	≤ 80mm	1.06	1.01
		>80 mm	na	na

4.2.3 Lower Bulkley Tributary Sites

Coho, Dolly Varden and Cutthroat trout were captured at Waterfalls Creek between December 2006 and March 2007. The species composition, as well as fish fork length frequency and condition will be discussed for all four sites sampled at Waterfalls Creek.

4.2.3.1 Species Composition

The species composition varied between the four sites and dates sampled at Waterfalls Creek (refer to Figures 16-19). Overall, site 2 contained the highest number of fish in December 2006 and site 1 contained the highest number of fish in March 2007, of all the sites sampled in Waterfalls Creek. Site 4 contained the lowest number of fish in both December 2005 and March 2006, which may or may not be a function of Site 4 having the smallest volume of all the Waterfalls Creek sites since potential for migration was

moderate to high throughout the winter. On the whole, there were much fewer Dolly Varden captured at the Waterfalls Creek sites during this study, as compared to the 2005/06 study.

A total of 179 fish were captured at site 1 in December 2006, where the majority were coho (169, 94.4%), and a minor proportion consisted of Dolly Varden (9, 5.1%) and Cutthroat tout (1, 0.5%). The total number of fish captured at site 1 decreased slightly from 179 in Dec. to 155 in March. The species composition in March was comprised solely of coho salmon.

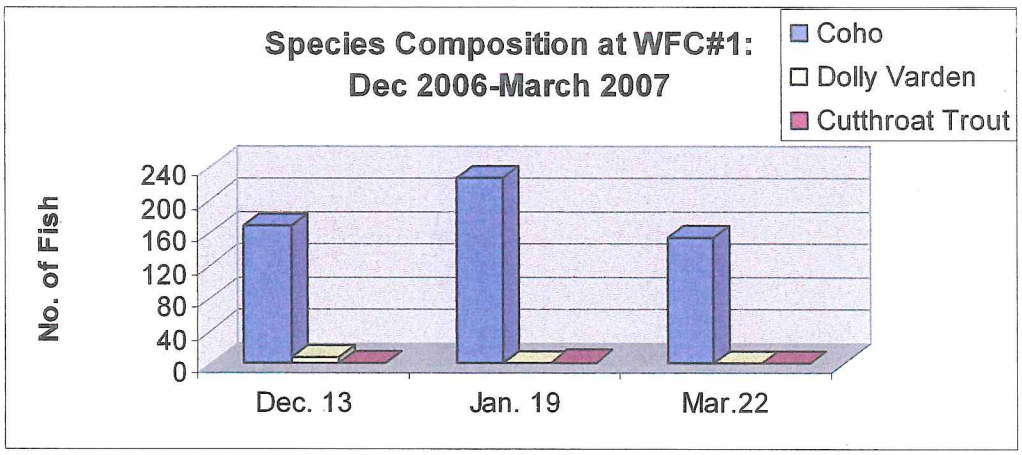


Figure 16. Monthly Species Composition at Waterfalls Creek – Site 1 (2006/07).

A total of 228 fish were captured at site 2 in December 2006, where the majority was coho (221, 96.9%), and the remainder consisted of Dolly Varden (6, 2.6%) and Cutthroat trout (1, 0.5%) The total number of fish captured at site 2 decreased from December to March, where only 90 fish were captured in March. The species composition remained fairly similar in March and December where the majority was coho (85, 94%) and the remainder consisted of Dolly Varden (5, 6%).

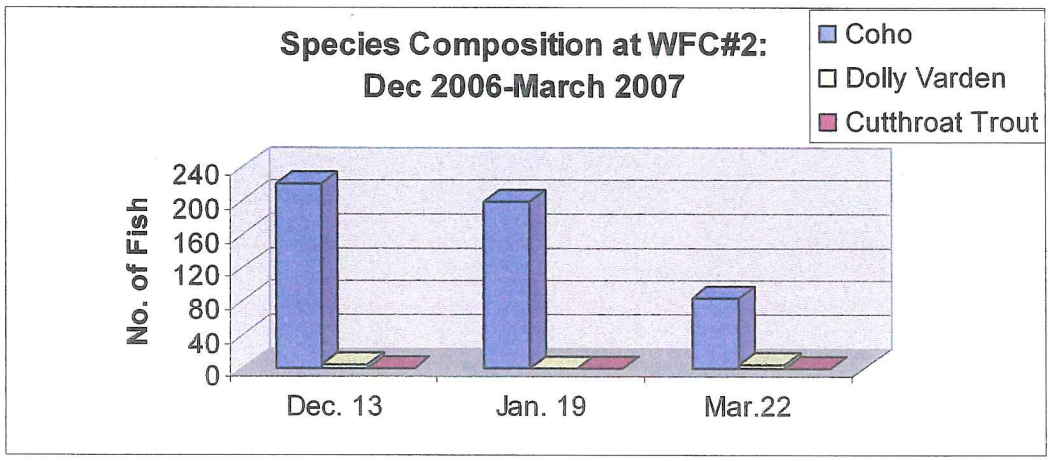


Figure 17. Monthly Species Composition at Waterfalls Creek – Site 2 (2006/07).

A total of 94 fish were captured at site 3 in December 2006, where the amount of coho (93, 99%) was much greater than Dolly Varden (1, 1%). The total number of fish captured at site 3 in March 2006 was 80, where the majority captured was Dolly Varden (45, 55%) and the remainder were coho (36, 45%), which was a shift in species composition from Dec. where the majority of fish were coho. On the whole, site 3 had the greatest number of Dolly Varden captured over the winter, of all the sites sampled at Waterfalls Creek.

A total of 41 fish were captured at site 4 in December 2006, consisting solely of coho. A total of 77 fish was captured in March 2007, where the majority consisted of coho (74, 96%) and the remainder consisted of Dolly Varden (3, 4%). The proportion of Dolly Varden and coho remained fairly constant in Dec. and March; however, the total amount of fish captured in March was much greater than in Dec.

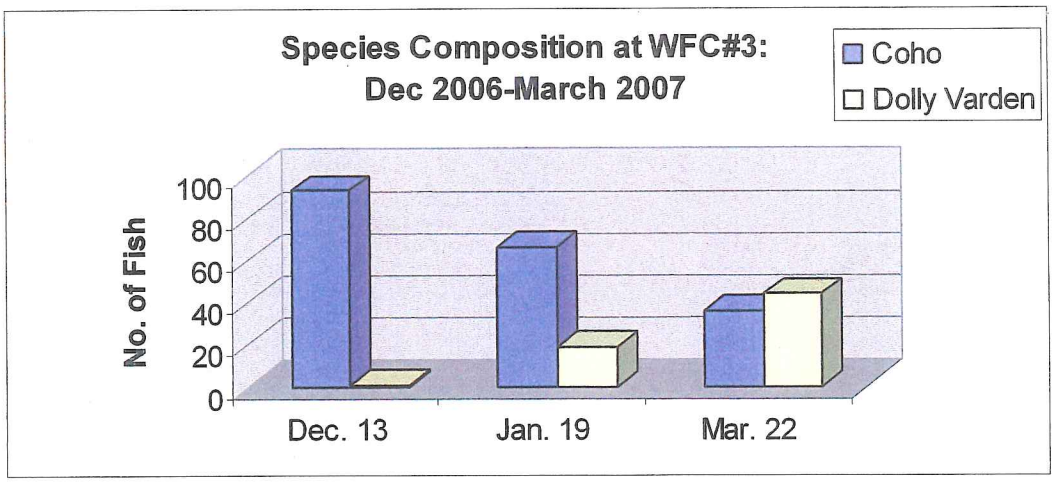


Figure 18. Monthly Species Composition at Waterfalls Creek – Site 3 (2006/07).

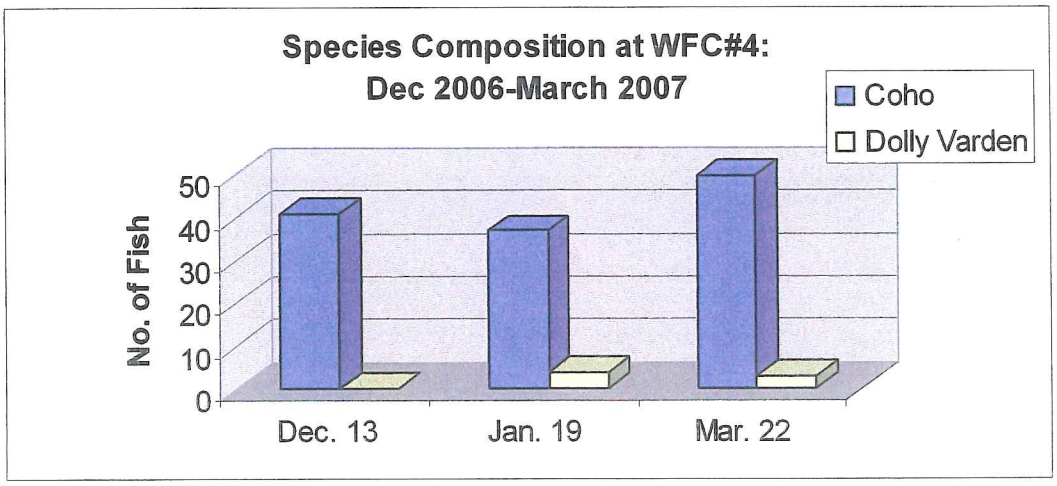


Figure 19. Monthly Species Composition at Waterfalls Creek – Site 4 (2006/07).

4.2.3.2 Fork Length and Condition Comparisons

Fork length and weight data were collected for salmonids throughout the overwintering study. A total of 1403 coho and 92 Dolly Varden were captured at the Waterfalls Creek sites during the overwintering study. The total catch of coho was much greater during this study than in 2005/06, whereas the total catch of Dolly Varden was much less in 2006/07 than in 2005/06. Length, weight and condition data for coho and Dolly Varden are summarized in the following sections. Coho have been presented in two categories estimated from fork length distributions attained from fish captured at sites at the Waterfalls Creek sites from 2005-2007. Based on length frequency distributions of coho, two fork length categories have been created for 80 mm or less coho, and coho greater than 80 mm. It is assumed that Dolly Varden has similar fork length categories as coho.

4.2.3.2.1 Coho

Fork length and weight data was collected for under half of the coho captured at the Waterfalls Creek sites since the total catch was so high (n=1403). Length, weight and condition factor data for sites sampled are provided in Appendix 3. The fork length comparisons and Fulton's condition factor (FCC) data for coho salmon has been presented by month in two fork length categories (i.e., less than or equal to 80 mm and greater than 80 mm) for each site.

Figure 20 depicts coho salmon fork length frequency by month for sites 1-4 of Waterfalls Creek. A large proportion of coho captured at the site 1 were less than or equal to 80 mm, where 35 were captured in Dec. and 28 in March. The greater than 80 mm category coho also decreased over the winter from 9 in Dec. to 2 in March. Over half of the coho captured at site 2 were less than or equal to 80 mm, where 20 were captured in both Dec. and March. The greater than 80 mm category coho also remained constant over the winter at 10 fish captured in both Dec. and March. At site 3, there was a slight decrease in numbers over the winter in the less than or equal to 80 mm category from 21 in Dec. to 18 in March. On the contrary, there was a slight increase in the greater than 80 mm category coho from 11 in Dec. to 12 in March. At site 4, coho captured in the less than or equal to 80 mm category decreased slightly from 19 in Dec. to 18 in March. The greater than 80 mm category coho remained the same in Dec. and March at 12 coho.

Figure 21 presents mean Fulton's condition factor (FCC) for coho salmon by month and fork length (FL) category for sites 1-4. At site 1, the mean FCC increased overall over the winter, from 1.06 (Dec.) to 1.1 (March) for less than or equal to 80 mm coho. On the contrary, the mean FCC for greater than 80 mm coho decreased from 1.01 in Dec. to 0.96 in March. At site 2, the mean FCC for the less than or equal to 80 mm coho increased from 1.02 (Dec.) to 1.14 (March). The mean FCC decreased for the coho in the greater than 80 mm category, where it was 1.04 in Dec. and 0.96 in March. At site 3, the mean FCC increased for both the less than or equal to 80 mm coho and greater than 80 mm coho, where coho increased slightly from 1.0 (Dec.) to 1.03 (March), and from 0.98

(Dec.) to 1 (March), respectively. The culvert pool of site 4 had a decrease in mean FCC for both category coho from March and Dec. (refer to Table 8).

The summary of the condition factor data is also provided in Table 8.

Table 8. Mean Fulton's Condition Factor for coho at Waterfalls Creek in December 2006 and March 2007.

Site	Species	Fork Length Category	FCC-Mean Dec-06	FCC-Mean Mar-07
1	Coho	≤ 80mm	1.06	1.11
		>80 mm	1.01	0.96
2	Coho	≤ 80mm	1.02	1.14
		>80 mm	1.04	0.96
3	Coho	≤ 80mm	1.00	1.03
		>80 mm	0.98	1.00
4	Coho	≤ 80mm	1.05	0.99
		>80 mm	1.03	0.91

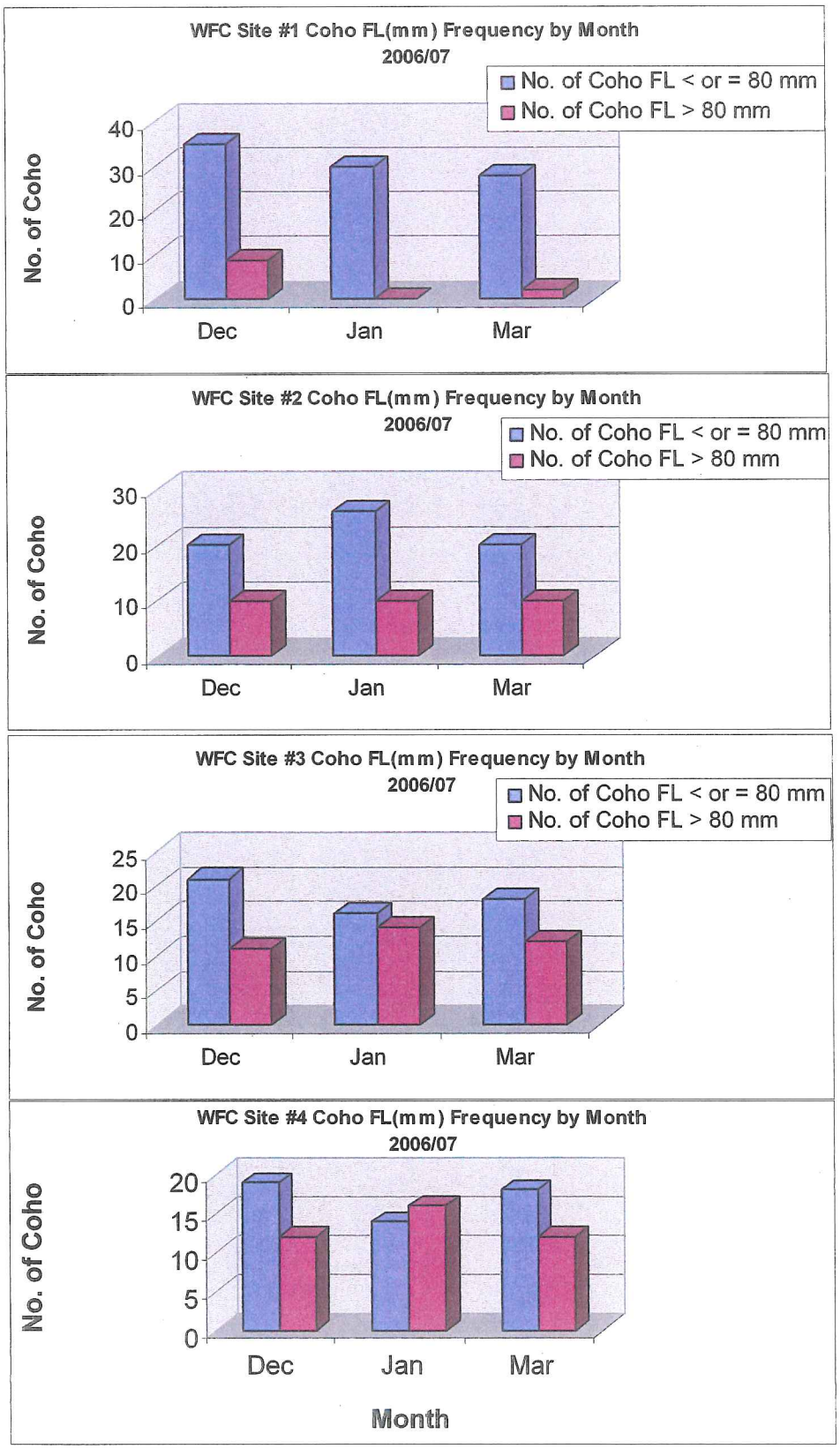


Figure 20. Coho Fork Length Frequency by month for Waterfalls Creek Sites 1-4.

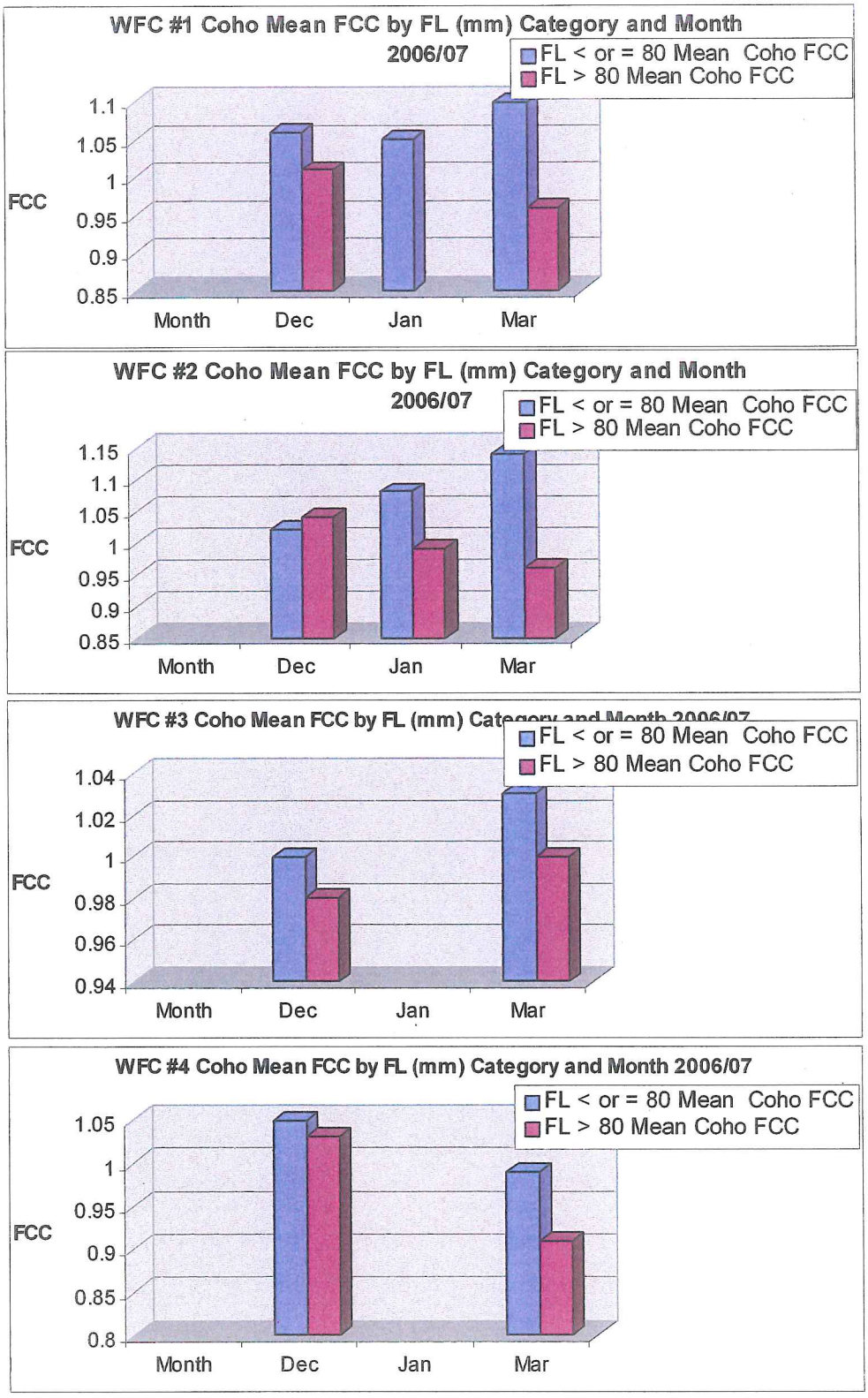


Figure 21. Mean FCC by Fork Length (FL) Category and by month for Coho at Waterfalls Creek Sites 1-4 (2006/07).

4.2.3.2.2 Dolly Varden

Fork length and weight data was collected for the majority of the Dolly Varden (DV) captured during the study of the Waterfalls Creek sites. Length, weight and condition factor data for sites sampled are provided in Appendix 3. The fork length comparisons and Fulton's condition factor (FCC) data for Dolly Varden has been presented by month in two fork length categories (i.e., less than or equal to 80 mm and greater than 80 mm) for each site.

Figure 22 depicts Dolly Varden (DV) fork length frequency by month for sites 1-4 of Waterfalls Creek. All DV captured at site 1 were greater than 80 mm, where 9 were captured in Dec. and 0 in March. All DV captured at site 2 were greater than 80 mm, with an overall decrease in numbers from beginning to end of winter where 6 were captured in Dec. and 5 in March. All DV captured at site 3 were of the greater than 80 mm category, and there was a dramatic increase in DV over the winter where only 1 DV was captured in Dec. and 30 DV in March. All DV captured at site 4 were of the greater than 80 mm category, with a decrease from 4 in Dec. to 3 in March.

Figure 23 presents DV mean Fulton's condition factor (FCC) by month and fork length (FL) category for sites 3 only since DV were low in number at the other sites. The mean FCC for the greater than 80 mm DV was only 0.89 in March.

The summary of the condition factor data for site 3 is also provided in Table 9.

Table 9. Mean Fulton's Condition Factor for DV at Waterfalls Creek in December 2006 and March 2007.

Site	Species	Fork Length Category	FCC-Mean Dec-06	FCC-Mean Mar-07
3	DV	≤ 80mm	na	na
		>80 mm	na	0.89

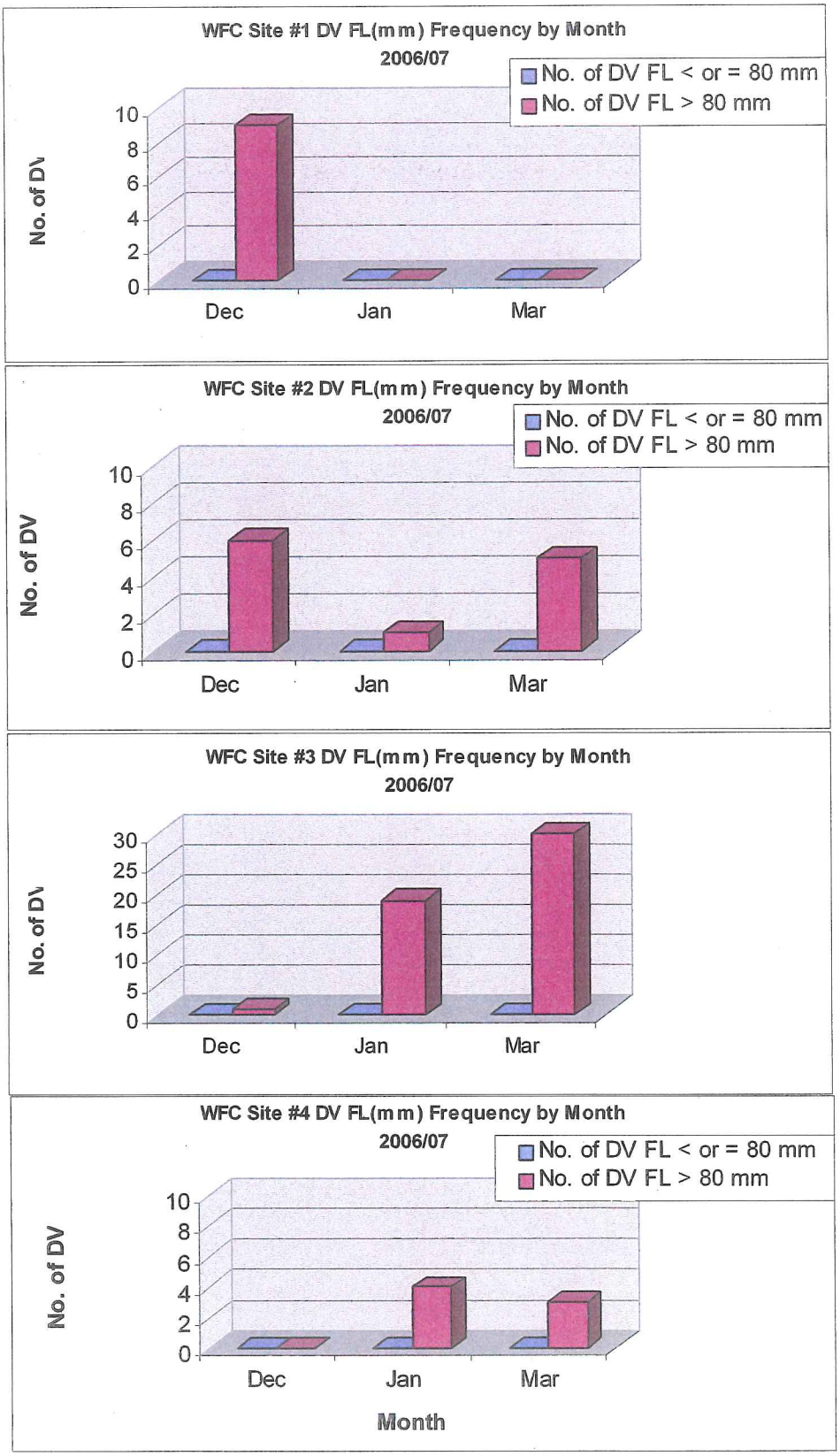


Figure 22. Fork Length (FL) Frequency by Month for Dolly Varden at Waterfalls Creek Sites 1-4 (2006/07).

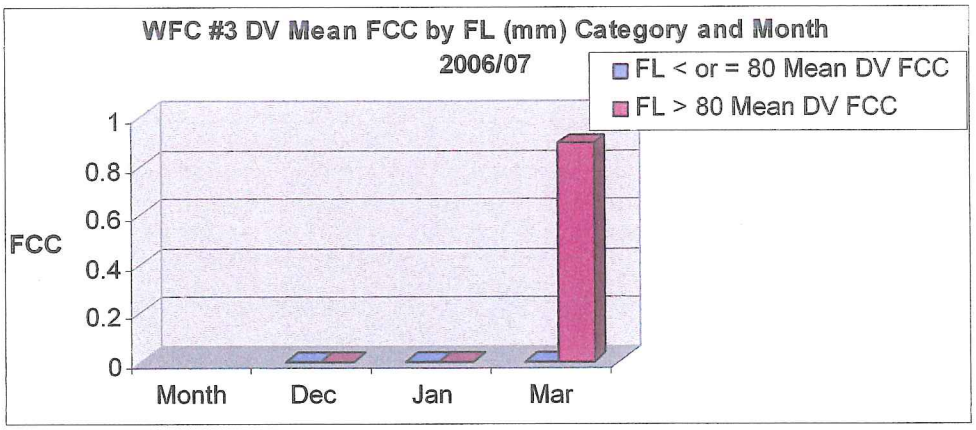


Figure 23. Mean Fulton's Condition Factor by Fork Length (FL) Category for Dolly Varden at Waterfalls Creek Site 3 (2006/07).

4.3 Density Indices (CPUE)

Fish capture data was used to calculate catch per unit effort (CPUE). Total catch and CPUE during the overwintering study (Nov.-March) are summarized for each of the sites in Table 10. It should be noted that CPUE for McKinnon Creek (Site 1 and 2) was not calculated since trapping was not possible due to low water levels.

Total catch and CPUE was highest at Waterfalls Cr. (Site 1) and lowest at the Barren site. Total catch over the winter was greater than 45 fish at six of the ten sites sampled for fish (60%). These sites included Byman and the Groundwater channel, and sites 1-4 of Waterfalls Cr. Coho salmon comprised greater than or equal to 50% of the total catch at the Richfield and groundwater sites, and sites 1-4 of Waterfalls Cr. Greater than 50% of the total fish captured at Byman and McQuarrie were RBT/sthd. Dolly Varden was not as abundant at the Waterfalls sites as they were during last years study. Overall, the CPUE was greater than 5 fish/trap at seven of the ten sites sampled for fish (refer to Table 8).

Table 10. Summary of traps catches of juvenile salmonids at each site sampled during the overwintering study (2006/07).

	Site	# Traps Set	Coho Salmon			Rainbow trout/ steelhead			Cutthroat trout			Dolly Varden			All Species	
			C	%	CPUE	C	%	CPUE	C	%	CPUE	C	%	CPUE	C	CPUE
Upper Bulkley Tributaries	Barren	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	McQuarrie	3	13	43	4.3	17	56.7	5.7	0	0	0	0	0	0	30	10
	Byman	9	7	14.9	0.8	40	85.1	4.4	0	0	0	0	0	0	47	5.2
	Richfield	5	10	50	2	10	50	2	0	0	0	0	0	0	20	4
Middle Bulkley Tributaries	Hydropole 12	2	1	20	0.5	0	0	0	4	80	2	0	0	0	5	2.5
	Ground-water site	7	158	100	22.6	0	0	0	0	0	0	0	0	0	158	22.6
	McKinnon Sites 1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	McKinnon Site 2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waterfalls Creek	Site 1	9	550	97.9	61.1	0	0	0	3	0.5	0.3	9	1.6	1	562	62.4
	Site 2	9	506	97.5	56.2	0	0	0	1	0.2	0.1	12	2.3	1.3	519	57.6
	Site 3	9	195	75.3	21.7	0	0	0	0	0	0	64	24.7	7.1	259	28.8
	Site 4	9	152	95.6	16.9	0	0	0	0	0	0	7	4.4	0.8	159	17.7

C=total catch, %=proportion of the total catch, CPUE=mean catch of each species using monthly CPUE data.

The following figures present CPUE data over time as well as between sites and by species. The CPUE for coho salmon for all the sites sampled for fish are presented in Figures 24-26. The CPUE for Rainbow Trout/sthd are presented for the Upper Bulkley sites in Figure 27. CPUE for Dolly Varden are presented for the Waterfalls Creek sites in Figure 28.

4.3.1 CPUE for Coho

The CPUE for coho salmon at the beginning of winter differed among the four sites in the upper Bulkley watershed. The highest CPUE for coho at the beginning of winter was at McQuarrie (4.3 coho/trap), where as the lowest was at Barren (0 coho/trap). CPUE for coho at Barren was also among the lowest at the end of winter (0 coho/trap). Middle and end of winter CPUE is absent for McQuarrie due to inaccessibility of the site for trapping caused by highway snow being plowed into the creek. The CPUE for coho peaked in Jan. at the Byman site (2 coho/trap); however, beginning and end of winter CPUE for coho was very low to none. CPUE for coho at Richfield decreased from beginning to middle of winter (Figure 24).

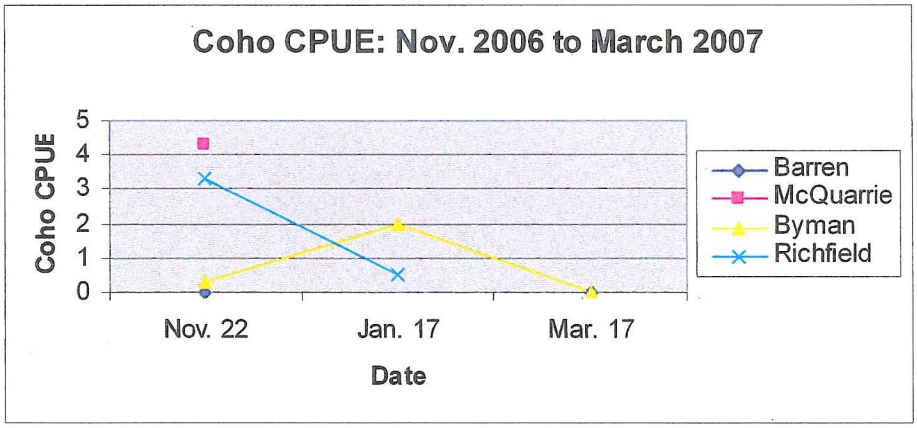


Figure 24. Catch per Unit Effort (CPUE) by month for Coho at Barren, McQuarrie Byman and Richfield sites.

The CPUE for coho salmon at the Middle Bulkley sites has been presented solely for the groundwater channel since it was the only site continuously sampled for fish over the winter. CPUE for coho increased overall from the beginning (24 coho/trap) to end of winter (36 coho/trap). There appeared to be a healthy population of overwintering coho at the groundwater site (Figure 24).

At Waterfalls Creek, the CPUE for coho salmon decreased overall from beginning to end of winter at sites 1-3, whereas a slight increase in CPUE for coho occurred at site 4 (Figure 25). The CPUE for coho was highest at site 1 and lowest overall at site 4 over the winter. On the whole the CPUE for coho in 2006/07at all 4 sites far exceeded the CPUE for DV, which was not always the case in 2005/06.

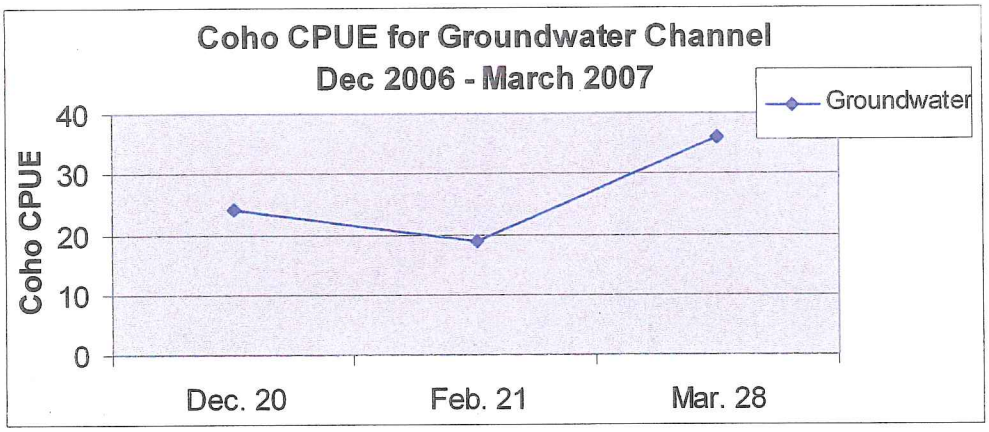


Figure 24. Catch per Unit Effort (CPUE) for Coho by month at the Groundwater Channel site.

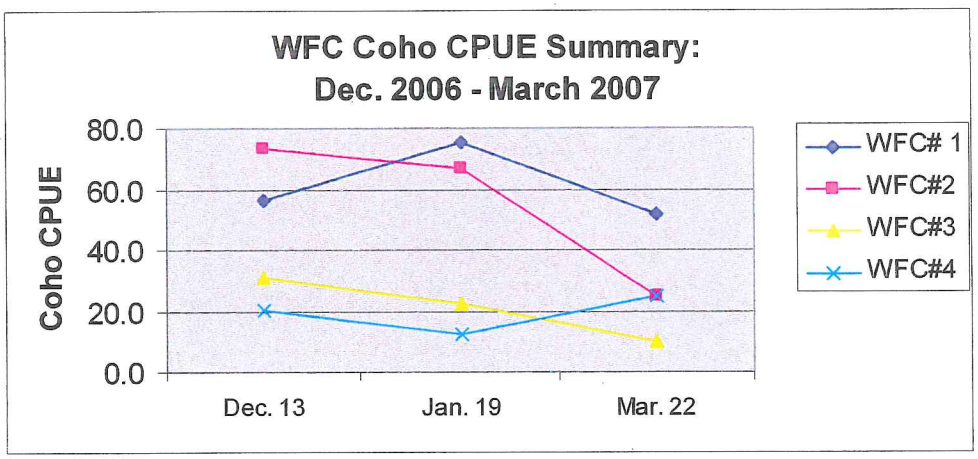


Figure 25. Catch per Unit Effort (CPUE) by month for Coho at the Waterfalls Creek sites.

4.3.2 CUPE for Rainbow Trout (RBT)/Steelhead(STHD)

The CPUE for RBT/STHD increased at Byman from 3 at the beginning of winter to 6 at the end of winter. The Barren site had no RBT/STHD captured at beginning or end of winter. At Richfield, the CPUE decreased from 3/trap at the beginning to 0/trap at the middle of winter. McQuarrie had the highest CPUE (5.7/trap) for RBT/STHD at the beginning of winter of all the sites (Figure 26). As mentioned, trapping was not possible in Jan. and March at McQuarrie due to snow plowed from the highway onto the site.

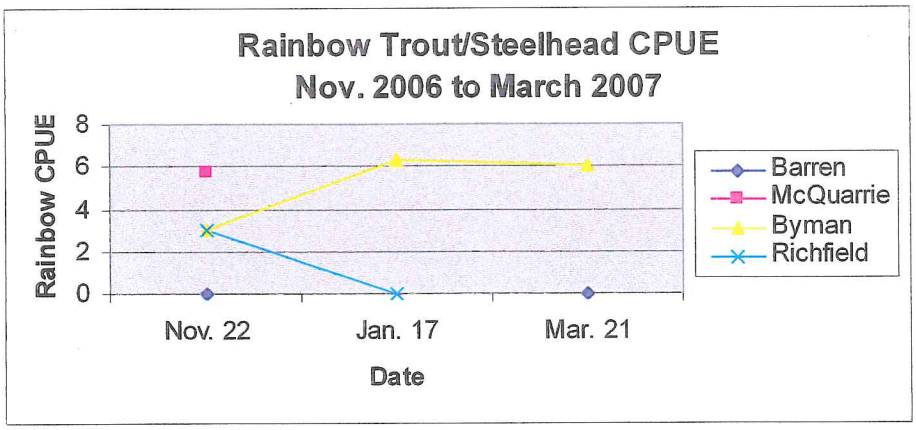


Figure 26. Catch per Unit Effort (CPUE) by month for Rainbow Trout/Steelhead at the Upper Bulkley Sites.

4.3.3 CUPE for Dolly Varden (DV)

The CPUE at site 3 of Waterfalls Creek increased the most over the winter of the 4 sites sampled, where it ranged from 0.3 to 9.7 DV/trap. Overall, the CPUE for DV was greatest at the end of winter, as compared to beginning of winter, at sites 3 and 4. Sites 1 and 2 showed a slight decrease in CPUE for DV over the winter (Figure 27).

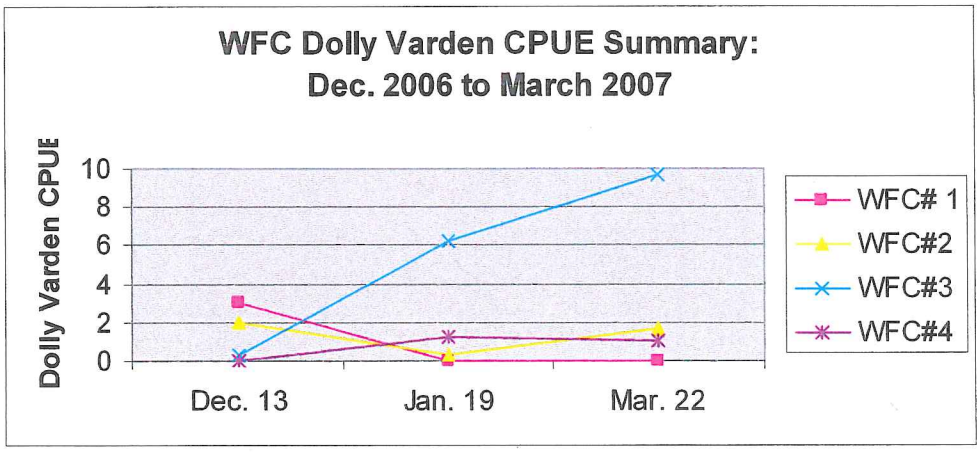


Figure 27. Catch per Unit Effort (CPUE) by month for Dolly Varden at the Waterfalls Creek sites 1-4.

5.0 DISCUSSION & COMPARISON TO 2005/06 STUDY

As noted in previous overwintering studies (Donas and Saimoto 2001a, 2001b; Donas and Newman 2006), watershed characteristics, as well as habitat types sampled are expected to influence species composition, fish size and condition, and fish densities such as CPUE. Therefore, it can be expected for results to vary as they have between sites of this study. Winter has been documented to be a critical time in the life history of

salmonids (Bustard and Narver 1975), since this season can affect fish health and survival (Bustard and Narver 1975, Dolloff 1987). Many habitat types, such as beaver ponds, lakes, mainstems and tributaries have been identified as important overwintering habitat for salmonids (Bustard and Narver 1975, Swales et al. 1986). Within these habitat types, the importance of cobble substrate, deep pools and organic cover have been documented (Bustard and Narver 1975, Swales et al. 1986, Dolloff 1987). Differences in species composition, densities and fish size are expected to occur as a result of habitat composition at the different sample sites. As used in previous overwintering studies (Donas and Saimoto 1999-2001; Donas and Newman 2006), the two main indicators of habitat suitability in this study were species density indices (CPUE) and fish size (fork length, weight and condition).

5.1 Winter and Spring Habitat Assessments

Overall, there seemed to be a greater number of fish captured at sites with water depths greater than approximately 50 centimeters or in areas influenced by groundwater (i.e., the groundwater site in the McKinnon Watershed). One of the most notable results was the low water depths and absence of overwintering habitat at the McKinnon sites 1 and 2, as well as the lack of overwintering habitat from the beginning to middle of winter at Hydro pole 12 (Figures 28 and 29). Spring habitat assessments conducted in April 2007 confirmed the loss of deep pool habitat that was noted at the McKinnon sites during the winter study of 2005/06. The low pool depth at McKinnon Site 2 and Hydro pole 12 may have been attributed to lower than normal flows; however, the loss of overwintering habitat at McKinnon site 1 appeared to be due to a build up of sediment causing the pool the fill in and become a riffle prior to the winter.

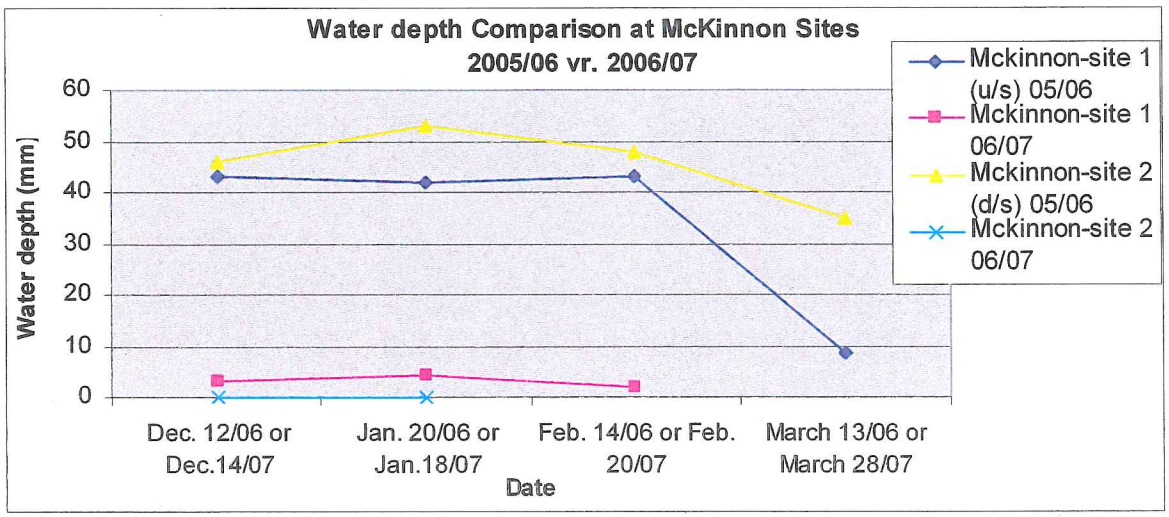


Figure 28. Water Depth Comparison at McKinnon Sites 1 and 2 (2005/06 vr. 2006/07).

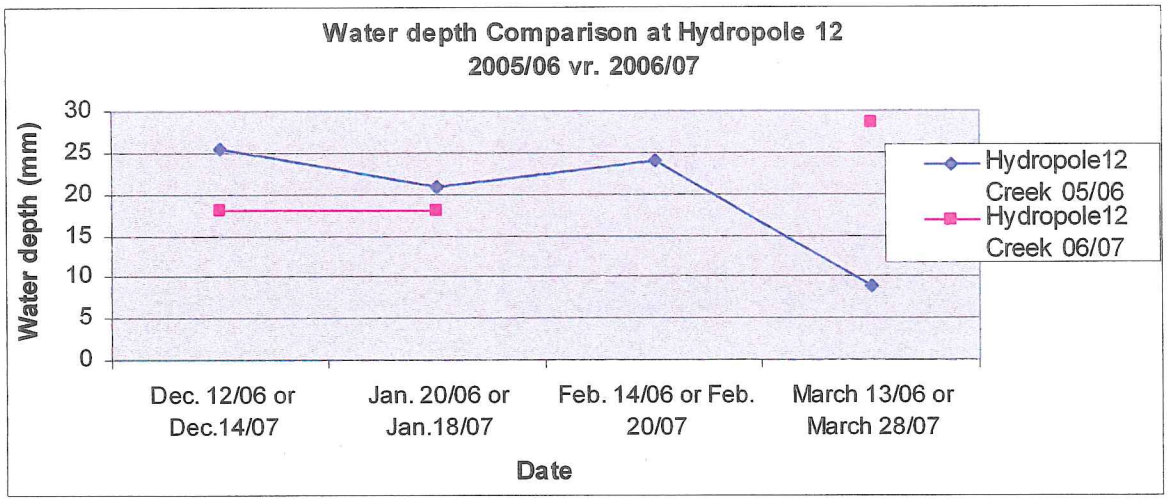


Figure 29. Water Depth Comparison at Hydro pole 12 (2005/06 vr. 2006/07).

Habitat assessments found the Byman and Richfield sites in the Upper Bulkley to have sufficient water depth and dissolved oxygen throughout the winter. Flow at the Richfield site was too fast in late March, however, making it impossible to set traps. Water depths at Byman in 2005/06 and 2006/07 were comparable. Water depth was only measured at McQuarrie at the beginning of winter in 2006/07 (40cm), which was much lower than the depth measured at the beginning of winter in 2005/06 (125cm). Habitat assessments found low water depths and dissolved oxygen levels, as well as lack of cobble substrate, at the Barren site in 2006/07. In 2005/06, the Barren site had water depths greater than 60 cm over the winter, and also had primarily cobble substrate. The decrease in quality of overwintering habitat at Barren in 2006/07 appeared to be due to the Ministry of Transportation culvert maintenance program, where the pool habitat was dredged both upstream and downstream of the highway crossing in late winter 2006. Lower than normal flows before ice-up may also have been a contributing factor. A comparison of water depths over time at Barren is depicted on Figure 30.

Habitat assessments at Waterfalls Creek found sites 1-4 to have sufficient water depth and dissolved oxygen throughout the winter. Even though the water depths were sufficient in 2006/07, they were on the whole lower than measured in 2005/06. The water depths at site 4, however, were higher in 2006/07 than in 2005/06, especially near the end of the winter. Figure 31 provides a comparison in water depths over time at the Waterfalls Creek sites.

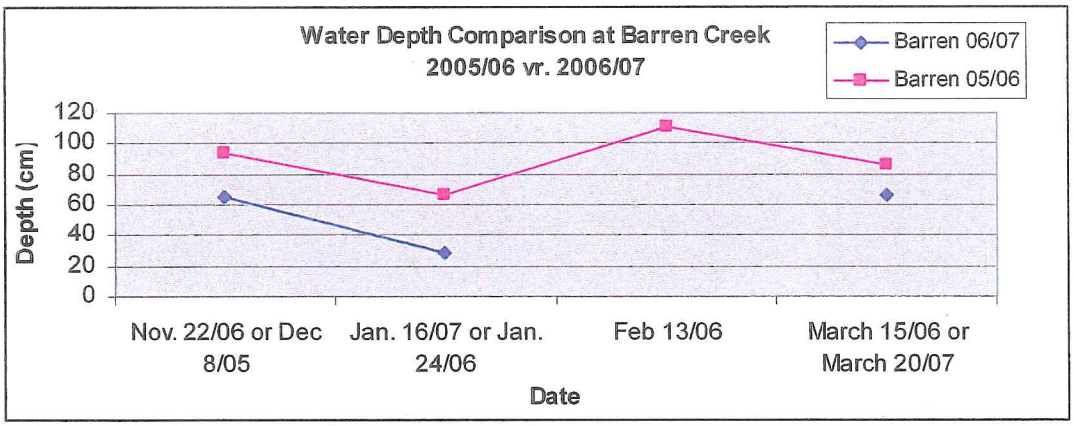


Figure 30. Water Depth Comparison at Barren Creek (2005/06 vr. 2006/07).

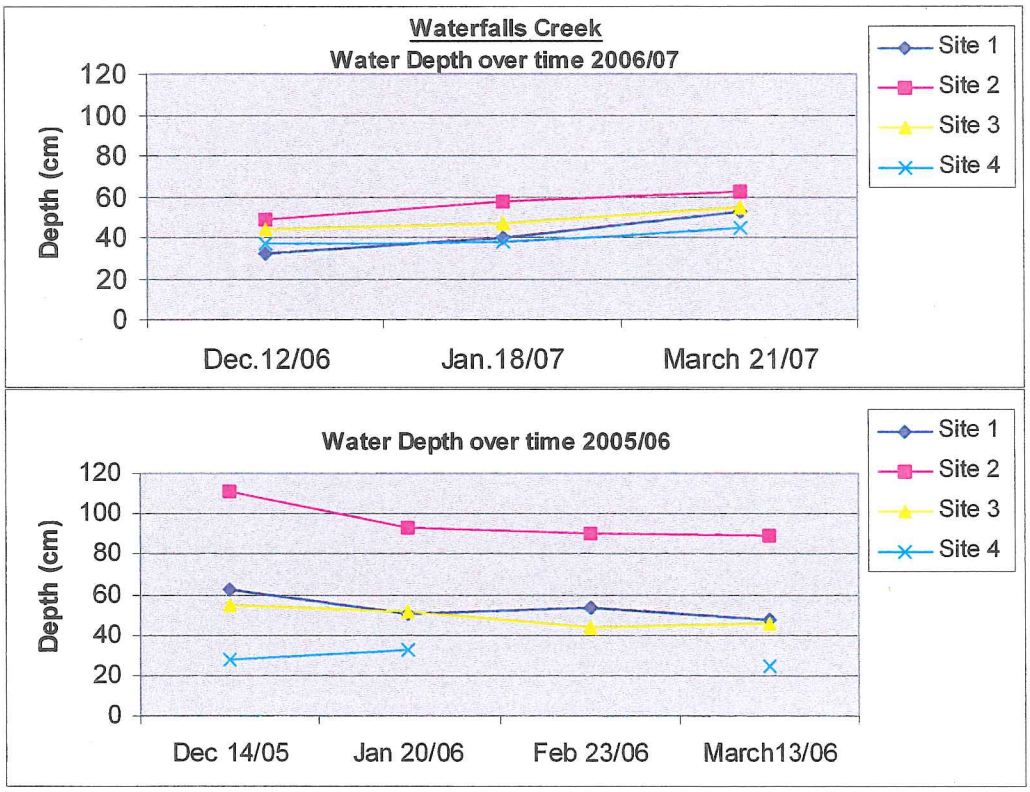


Figure 31. Water Depth Comparison at Waterfalls Site 1-4 (2005/06 vr. 2006/07).

5.2 Species Composition and Diversity

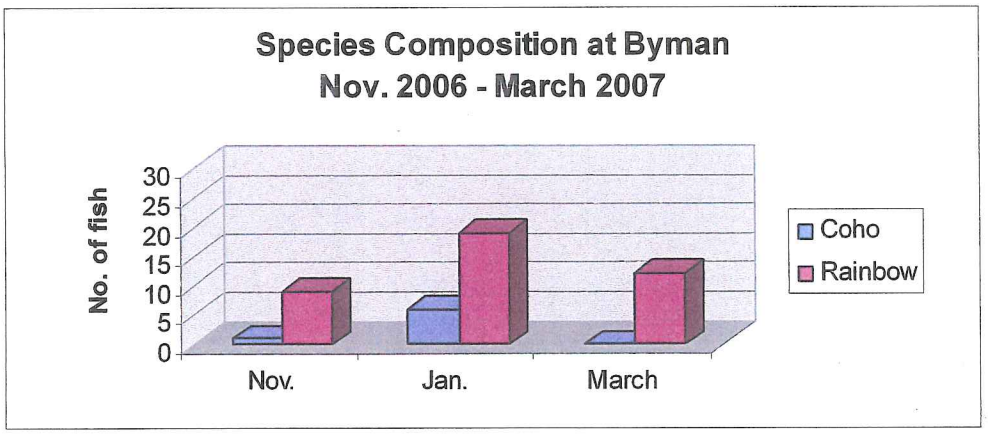
Coho salmon and RBT/sthd were documented at the Upper Bulkley sites throughout the study. It should be noted that Chinook salmon was also documented at the Byman Creek site during the 2000/2001 overwintering study (Donas and Saimoto 2001a).

Fish were not captured at the Barren site in 2006/07. Barren Creek was extensively dredged upstream and downstream of the highway culvert in late summer 2006 as part of

a Ministry of Transportation (MoT) Culvert Maintenance Program, which appeared to have contributed to a loss of habitat at the Barren site. It should be noted that the Barren site was found to provide good overwintering habitat and contained the highest number of fish, of the three sites sampled in the Upper Bulkley during the 2005/06 winter sampling program, even though dredging occurred upstream of the culvert in September 2005.

The McQuarrie site contained the highest number of fish at the beginning of winter (Nov 2006) as compared to Byman and Richfield. Seventeen RBT/STHD and 13 coho were captured at McQuarrie, where as at Byman, 9 RBT/STHD were captured and 1 coho. No RBT/STHD and 10 coho were captured at the beginning of winter at Richfield. McQuarrie was not sampled during the middle or end of winter in 2006/07.

There was consistently more RBT/STHD than coho captured at the Byman site during each of the winter months sampled in 2006/07. Fish captured at Byman in 2005/06 were also comprised more of RBT/STHD than coho. The numbers of RBT/STHD and coho were on the whole higher in 2005/06 compared to 2006/07, with the exception of March. The low water depths prior to ice-up 2006 may have contributed to the fewer numbers of fish at Byman at beginning and middle of winter in 2006/07. The figure below depicts a comparison of the number of fish and composition between 2005/06 and 2006/07(Figure 32).



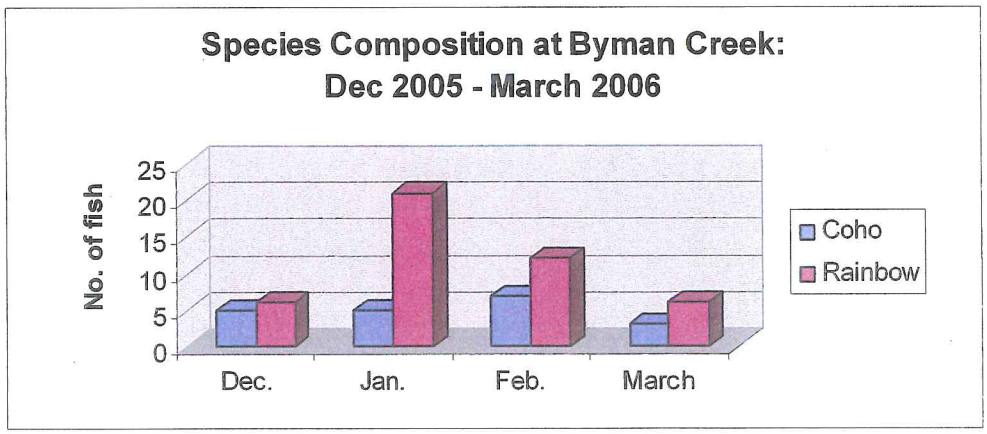


Figure 32. Species Composition at Byman Creek (2005/06 vr. 2006/07).

As mentioned in section 5.1, fish sampling was not conducted at sites 1 and 2 of McKinnon Creek. There was sampling conducted at Hydro pole 12, but only at the end of winter in March 2007 where only 1 coho and 4 CT were captured. Fish at the groundwater channel site, in the middle Bulkley Watershed, were comprised solely of coho, with fairly large numbers captured throughout the winter months sampled. The groundwater channel had minimal flow and lower dissolved oxygen than other sites measured in the McKinnon Watershed, which may have caused the absence of RBT/STHD in this groundwater sourced overwintering habitat.

Three species were documented at the Waterfalls Creek sites in both 2006/07 and 2005/06, including coho salmon, Dolly Varden char and cutthroat trout. High numbers of coho were captured in Waterfalls Creek in both studies, potentially due to adult and fry stocking enhancement in the system. On whole, the proportion of Dolly Varden compared to coho at all the sites was much less in 2006/07 than in 2005/06. The reason for fewer Dolly Varden is not known.

It is difficult to use species composition and diversity as an indicator of overwintering habitat at the sites studied from 2005-07. Additional overwintering sampling at these sites would be beneficial in using species composition/diversity as an indicator in the future.

5.3 Fork Length and Condition Comparisons

The frequency of larger fork length fish is expected to be more prevalent near the end of winter than the smaller less competitive fish since smaller fish are assumed to have less energy reserves (Dolloff 1987). Fulton's condition factor (FCC) is expected to change over the winter, and differ between sites, since the amount of energy loss during the winter is expected to vary between sites (Donas and Saimoto 2001b).

5.3.1 Coho – Upper Bulkley Tributaries

As previously mentioned, there were no fish captured at the Barren site during the 2006/07 study. In 2005/06, a good number of coho greater than 80 mm were captured, and a consistent FCC of greater than 1.0 indicated that the Barren site provided good overwintering habitat for coho.

At the McQuarrie site, fish sampling was conducted only in November during the 2006/07 study. It should be mentioned that more coho were captured in November 2006 (n=12 in the $\leq$ 80 mm category, n=1 in the > 80 mm category), than the entire winter sampling period in 2005/06 (n=6 in the $\leq$ 80 mm category). The FCC for the less than or equal to 80 mm category coho was 1.03 in November 2006.

At the Richfield site, fish sampling was conducted in November 2006 and January 2007. Ten coho in the less than or equal to 80 mm category were captured in November, and

mean FCC was 1.15, indicating a healthy population of coho at the beginning of the winter. Coho were not captured in January. The Richfield site was not sampled in 2005/06; therefore, a comparison of fork length frequency and FCC has not been made to 2006/07.

At the Byman site in 2006/07, there was a slightly higher number of coho captured than were in the greater than 80 mm long category, with the highest frequency of coho (n=3) captured on Jan. 17/07. There were only 3 coho less than 80 mm long captured in total, all of which were captured on Jan. 17/07. Overall, there was a slight decline in coho numbers from beginning to end of winter at the Byman site (Figure 33). There were more coho captured at the Byman site in 2005/06 than in 2006/07; however, they were all greater than 80 mm long. There was also a slight decline in coho numbers from beginning to end of winter at Byman in 2005/06 (Figure 33). Overall, the frequency of coho decreased from the beginning to end of winter, which could indicate there was a net migration of coho out of the Byman pool, or some mortality over the winter.

There were insufficient numbers of coho (total=7) captured at the Byman site in 2006/07 to analyze the mean Fulton's condition factor (FCC) by month, or to make a comparison to 2005/06.

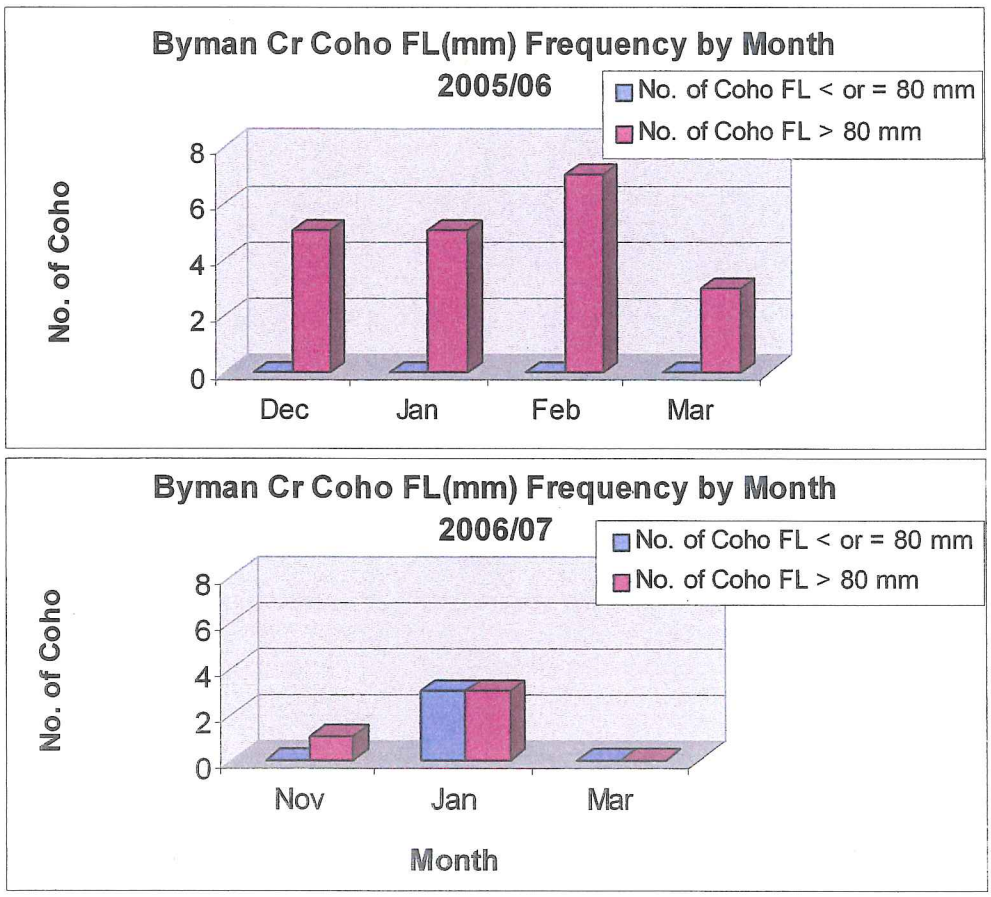


Figure 33. Fork Length Comparisons of Coho at the Byman (2005/06 vr. 2006/07).

5.3.2 Coho – McKinnon Creek

As discussed in Section 5.1, there was no fish sampling conducted at McKinnon sites 1 and 2 in 2006/07 due to very low water in combination with loss of pool habitat. Sampling was conducted at Hydropole 12, but only at the end of winter in March 2007 where only 1 coho and 4 CT were captured; therefore, it is not possible to make comparisons to 2005/06.

At the groundwater channel site, a large amount of coho, primarily in the ≤ 80 mm long category, were captured throughout the winter of 2006/07. The frequency of coho remained fairly constant throughout the winter, which indicates that this site offers good overwintering habitat. Mortality of coho appeared to be low since the numbers remained fairly constant over the winter and the potential for migration of coho out of the groundwater channel into the stream nearby was low to none. The mean FCC for coho in the less than or equal to 80 mm fork length category was consistently above 1.0 which also indicates that the groundwater channel site provides good overwintering habitat for coho.

5.3.3 Coho – Waterfalls Creek

A large proportion of coho captured at site 1 in both 2005/06 and 2006/07 of Waterfalls Creek were less than or equal to 80 mm, where there numbers declined slightly over the winter. The greater than 80 mm category coho remained fairly constant throughout the winter in 2005/06, whereas a decline in this category was noted in 2006/07 (Figure 34). These results indicate that site 1 provides fairly stable habitat, with the decline in numbers possibly due to net migration out of the glide in March, although some studies have noted a lack of movement of salmonids during winter (Dolloff 1987, Swales et al. 1986, Giannico and Healey 1998). Due to warmer water temperatures in March younger coho may have migrated to other habitat in the system however, mortality of coho is also a possibility.

Most of the coho captured at the site 2 in 2005/06 were greater than 80 mm, with an overall decline in numbers over the winter with a peak noted in January (Figure 35). Many more coho in the less than or equal to 80 mm category, and less coho in the greater than 80 mm category were captured in 2006/07, than in 2005/06. The coho in both categories remained constant from beginning to end of winter in 2006/07 (Figure 35).

At site 3 in 2005/06, there appeared to be a decline in numbers over the winter however, both fork length categories peaked in January. The peak in numbers in January at sites 2 and 3 in 2005/06 may have been due to net migration of coho to these sites, contrary to studies that indicate salmonids such as coho tend not to move in the winter (Dolloff 1987, Swales et al. 1986, Giannico and Healey 1998). The overall decline of coho over the winter at sites 2 and 3 in 2005/06 may have been due to mortality or migration of coho

out of the pools. In 2006/07, the coho numbers in both categories remained fairly constant throughout the winter, with a relatively even distribution of both fork length categories of coho (Figure 36). It is uncertain why coho numbers remained more constant in 2006/07 than in 2005/06, since the potential for migration was moderate to high throughout both winter study periods. It should be mentioned, however, that there were much less Dolly Varden captured in the traps in 2006/07 which may have contributed to coho numbers remaining relatively constant in 2006/07 due to more access to the traps.

All coho captured at site 4 in 2005/06 were of the less than or equal to 80 mm category, with a decrease in numbers from Dec. to Feb. Since potential for migration at site 4 was only moderate in Feb., mortality may explain the decline in coho numbers. There were many more coho captured in both categories in 2006/07 than in 2005/06.

It should be noted that at sites where an overall decline in coho was noted it may have been partly due to these fish being less active and feeding less throughout the winter, in which case some coho may not have entered the traps.

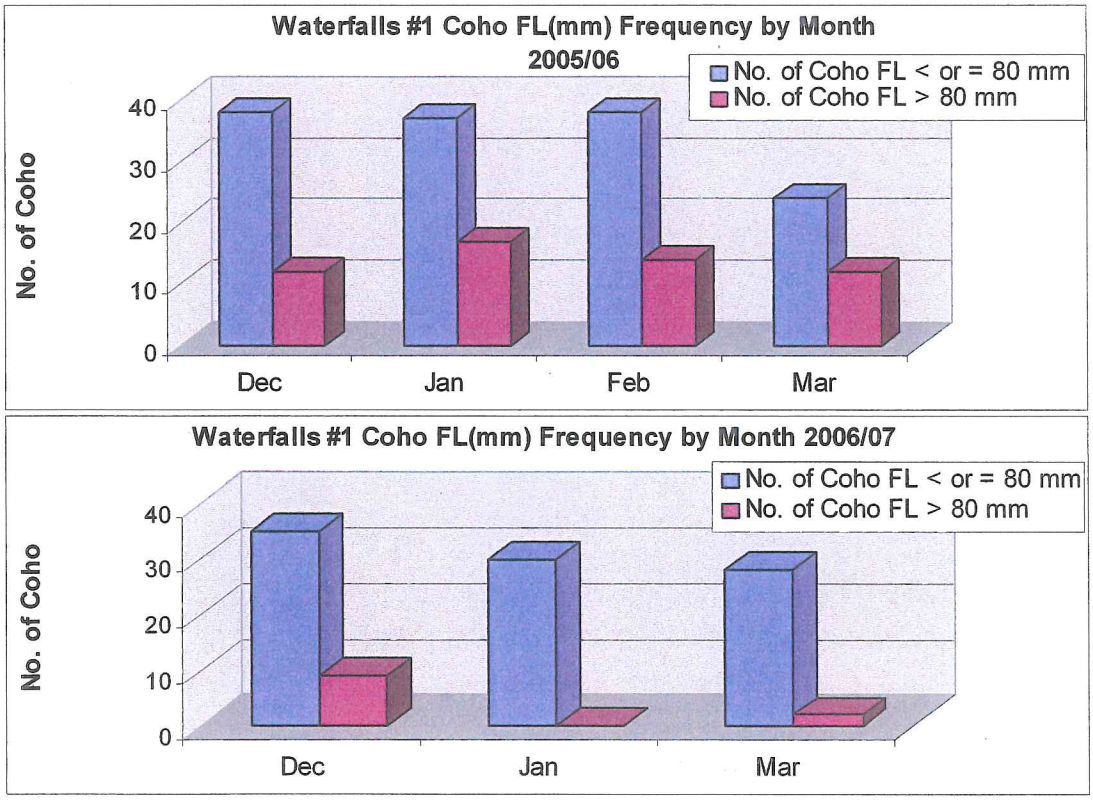


Figure 34. Fork Length Comparisons for Coho at Waterfalls Site#1 (2005/06 vr. 2006/07).

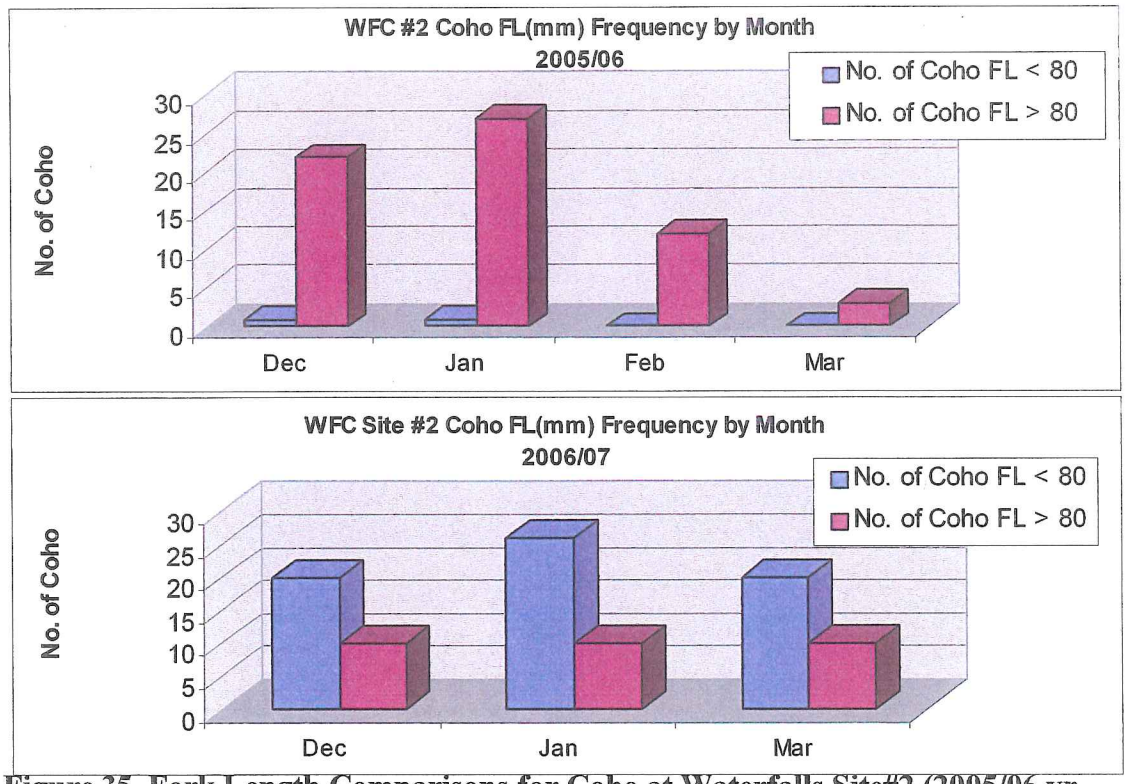


Figure 35. Fork Length Comparisons for Coho at Waterfalls Site#2 (2005/06 vr. 2006/07).

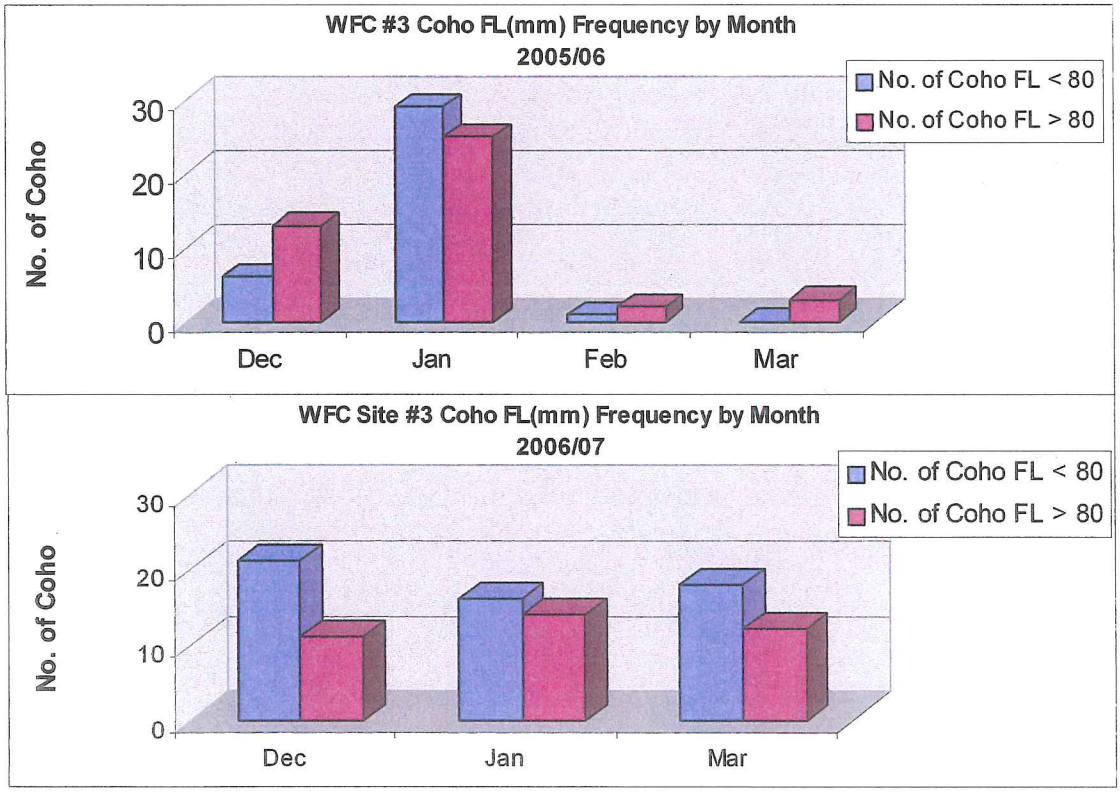


Figure 36. Fork Length Comparisons for Coho at Waterfalls Site#3.

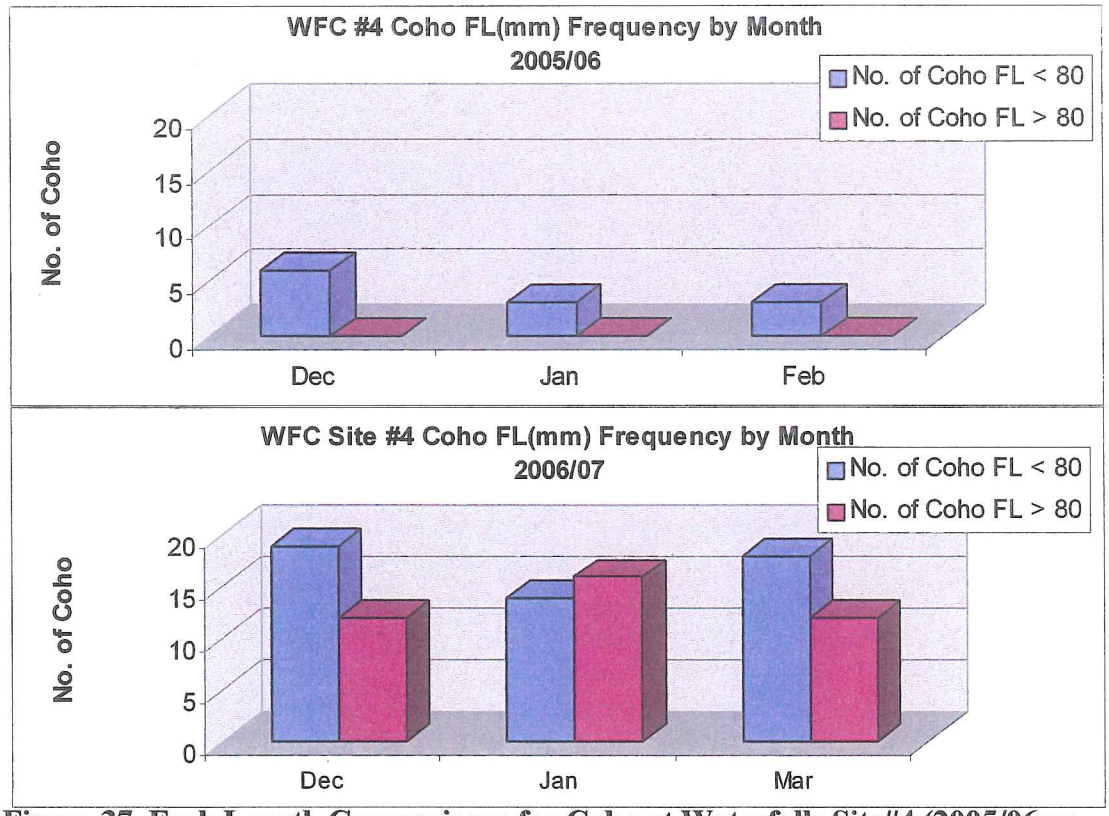


Figure 37. Fork Length Comparisons for Coho at Waterfalls Site#4 (2005/06 vr. 2006/07).

In 2005/06, the mean FCC for coho in both categories steadily decreased over the winter at all four sites, with some declines in FCC being more pronounced than others (Figures 38-41). The decline in condition is to be expected since fish utilize their stored energy reserves to survive the stressful season (Dolloff 1987). It should be noted that a previous overwintering study of Waterfalls Creek showed an increase in condition of coho in March which was attributed to increases in water temperature and improved environmental condition for feeding and growth (Donas and Saimoto 2001b). The air and water temperature recorded in March 2006 was slightly warmer than the other winter months; however, it is assumed the slight increase in these variables did not produce the similar effect as speculated in the previous study since condition of coho declined in March.

In 2006/07, the mean FCC at sites 1 and 2 increased over the winter for coho less than or equal to 80 mm long, whereas the mean FCC at sites 1 and 2 for coho greater than 80 mm long decreased (Figures 38 and 39). The mean FCC at site 3 increased slightly over the winter for both category coho. The mean FCC at site 3 in 2005/06 was much higher for both category coho at the beginning of winter than in 2006/07 (Figure 40). At site 4, the mean FCC decreased for both category coho over the winter (Figure 41). Overall, both increases and decreases in mean FCC was noted over the winter in 2006/07.

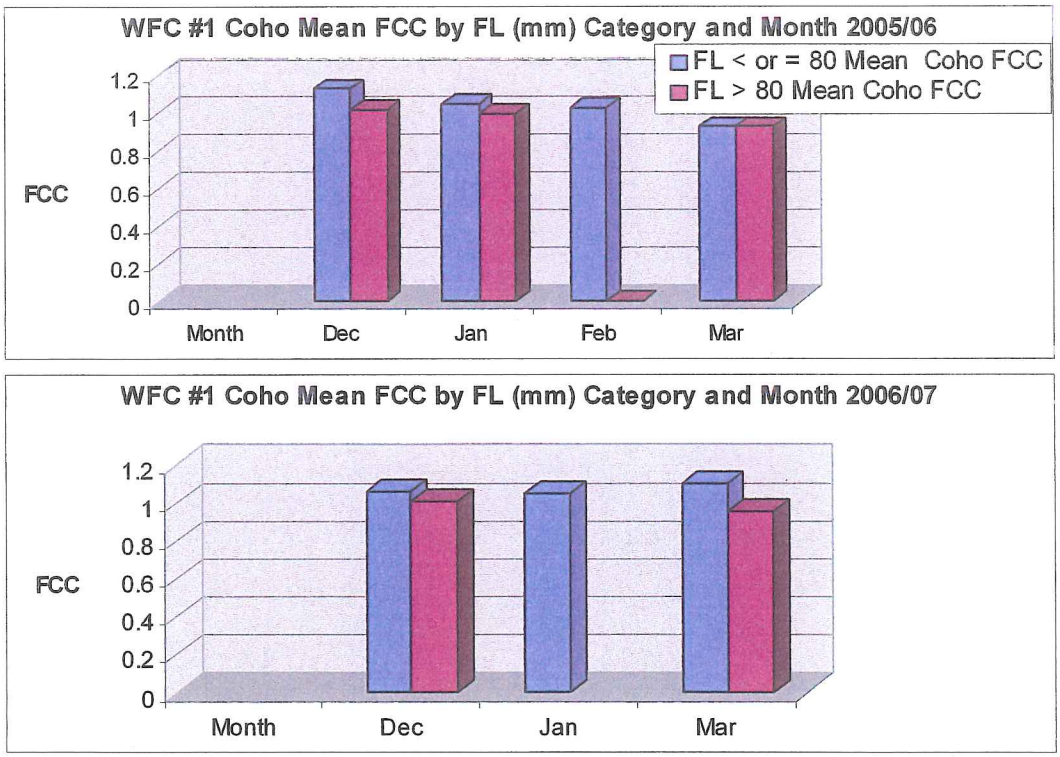


Figure 38. Mean FCC Comparisons at Waterfalls Site#1 (2005/06 vr. 2006/07).

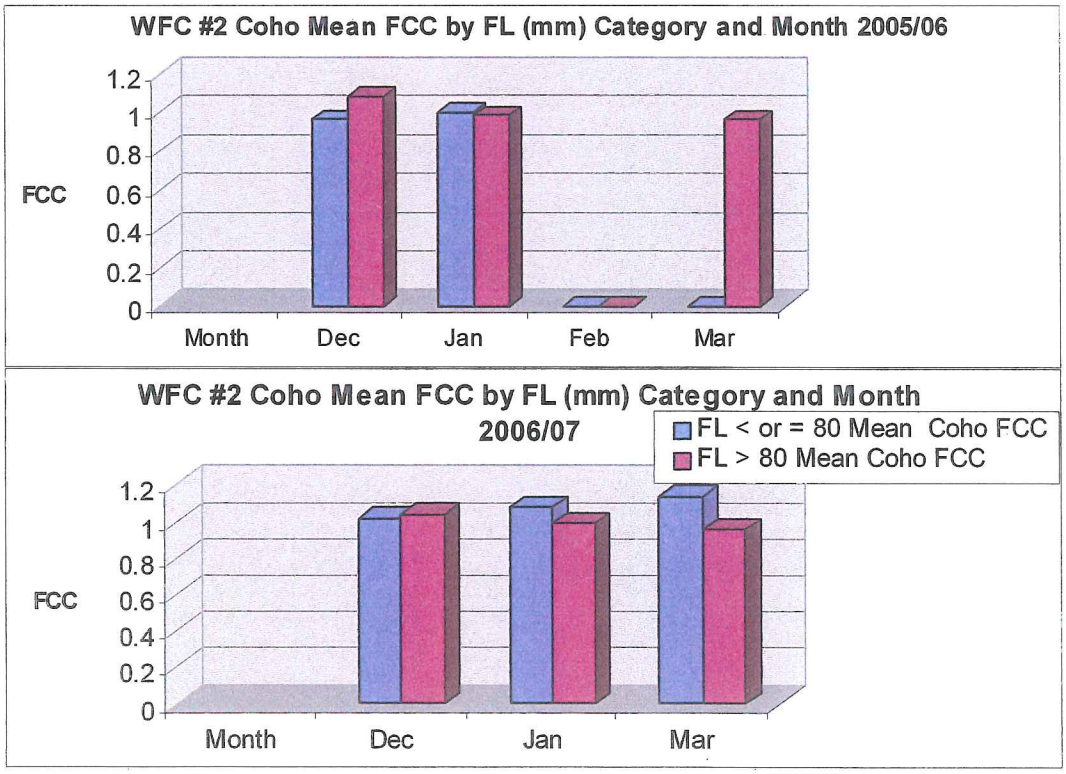


Figure 39. Mean FCC Comparisons at Waterfalls Site#2 (2005/06 vr. 2006/07).

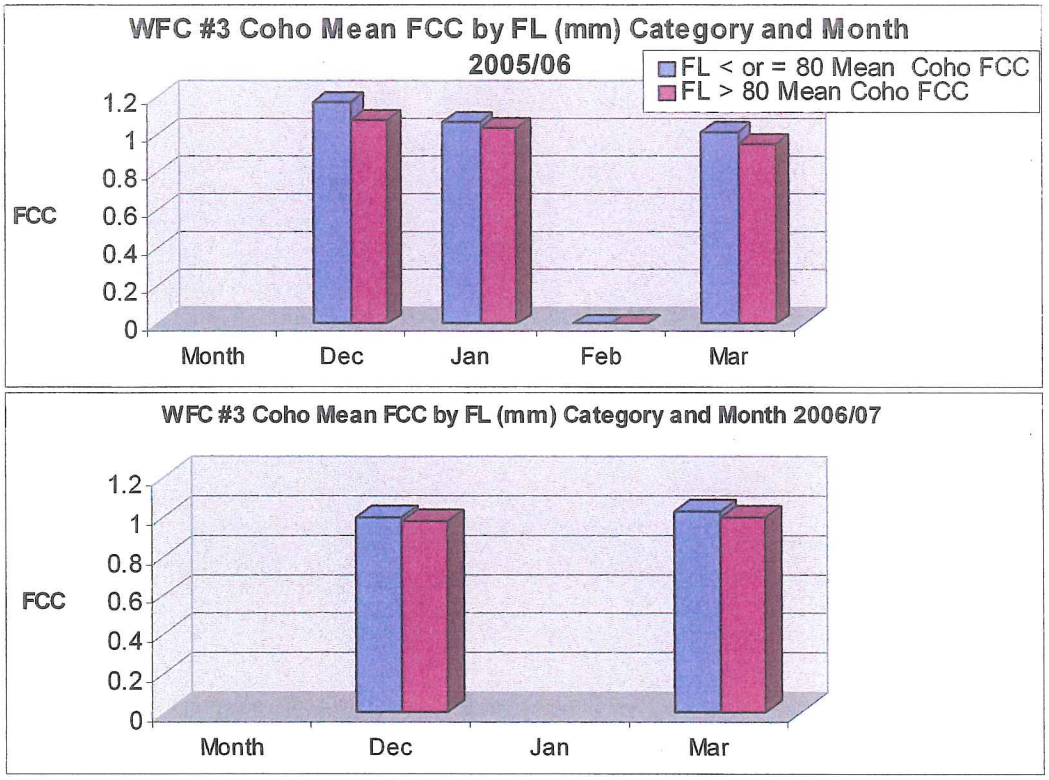


Figure 40. Mean FCC Comparisons at Waterfalls Site#3 (2005/06 vr. 2006/07).

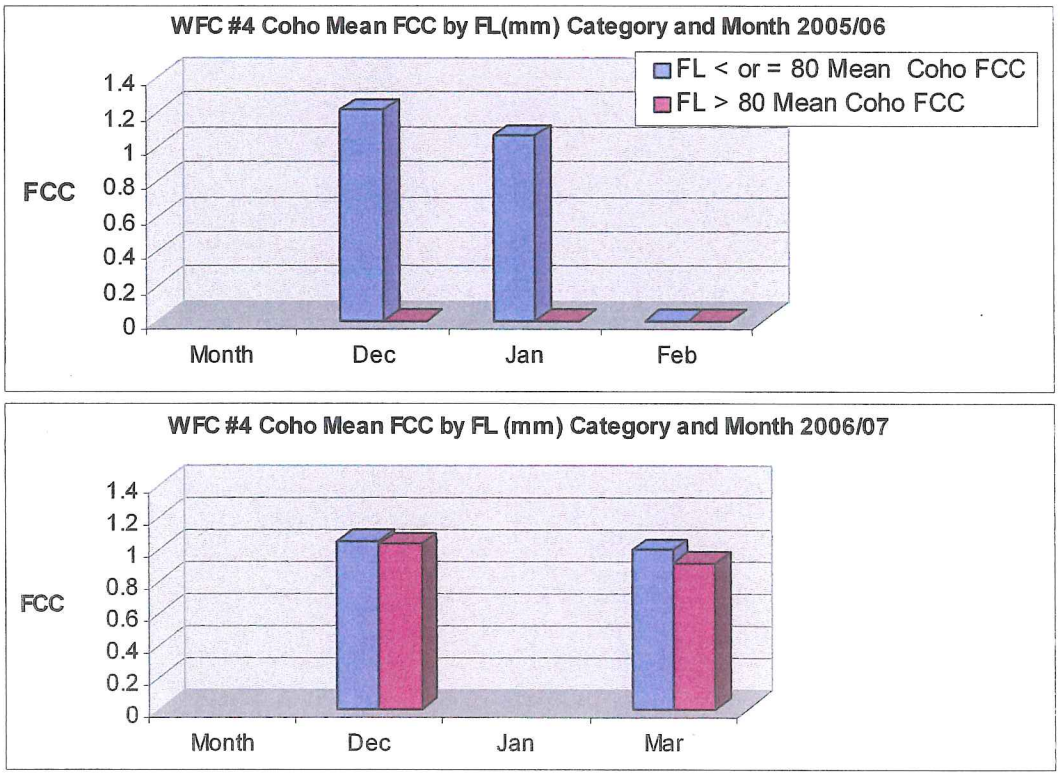


Figure 41. Mean FCC Comparisons at Waterfalls Site#4 (2005/06 vr. 2006/07).

5.3.4 Rainbow Trout/Steelhead – Upper Bulkley Tributaries

At the Byman site in 2005/06, there were no apparent trends in RBT/STHD frequency distributions from beginning to end of winter. Potential for migration was high at this site, which could be a factor in the variations from month to month. RBT/sthd have been known to move to different habitat prior to or during the winter (Bustard and Narver 1975, Swales et al. 1986). In both 2006/07 and 2005/06, there were more RBT captured in the > 80 mm category and the numbers peaked in January (Figure 42). The increase in RBT/STHD numbers in Jan. 2007 may have been due to the low/moderate potential for migration out of the pool.

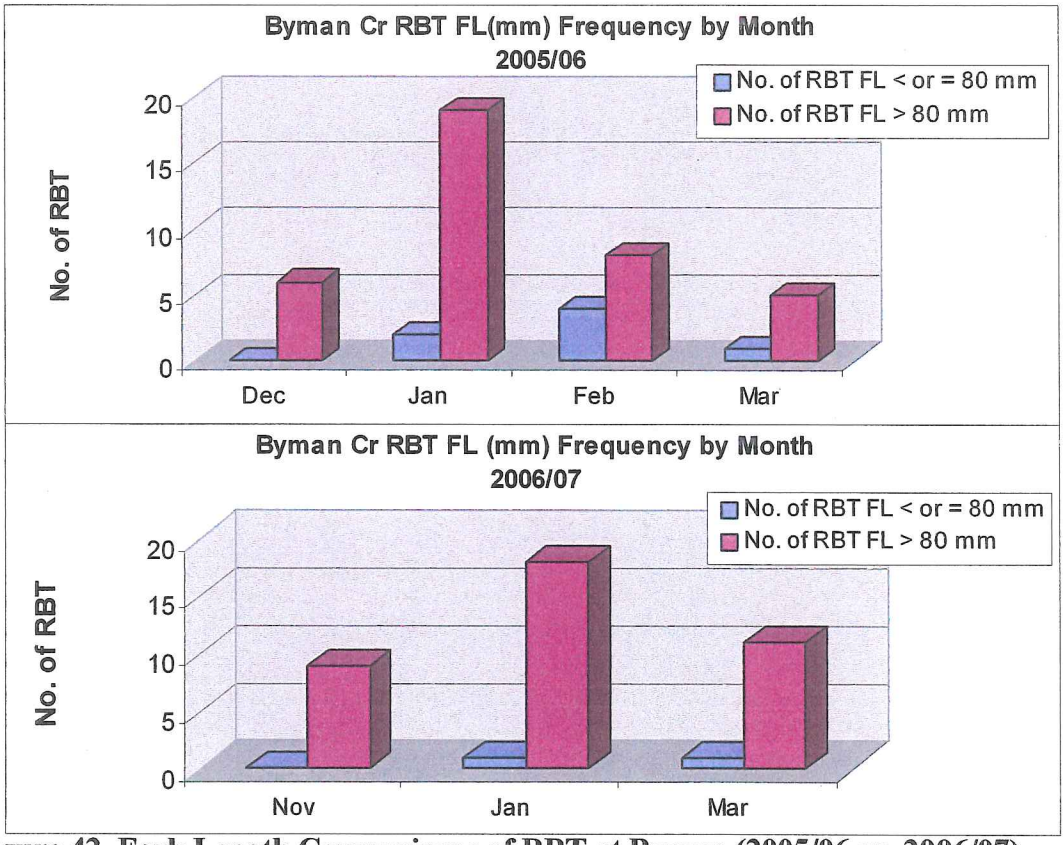
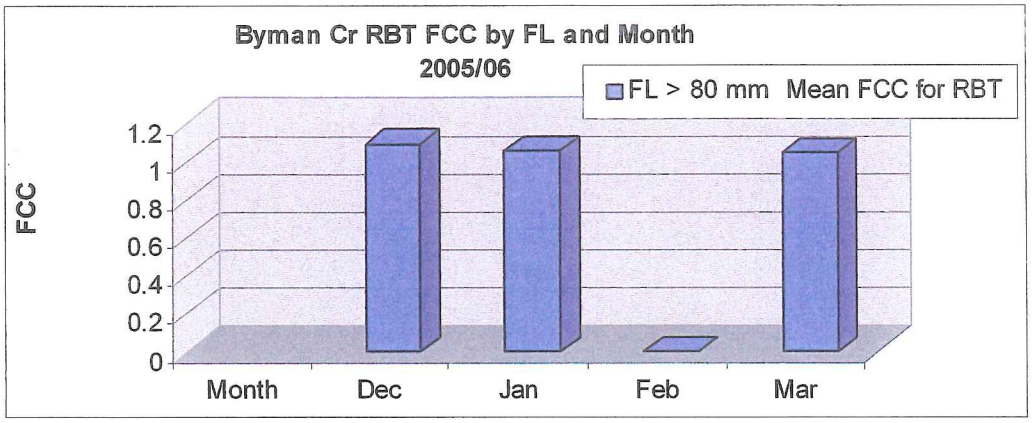


Figure 42. Fork Length Comparisons of RBT at Byman (2005/06 vr. 2006/07).

Due to low numbers of RBT/sthd captured in 2005/06 and 2006/07, the mean FCC for RBT/sthd in the less than or equal to 80 mm category has not been analyzed. In 2005/06, the mean FCC for RBT/sthd in the > 80 mm fork length category decreased slightly from 1.09 in Dec. to 1.04 in March. A fairly substantial decline in condition of the smaller RBT/sthd is to be expected since younger fish are assumed to have less energy reserves to survive adverse conditions than larger, more competitive fish (Cargnelli and Gross 1997). Therefore, the decline in condition is not necessarily an indication that Byman was limiting for overwintering salmonids in 2005/06. In 2006/07, the mean FCC for RBT/sthd in the > 80 mm fork length category increased only slightly from 0.96 in Nov. to 0.98 in March. It should be noted that the overall condition of RBT/STHD was lower

in 2006/07 than in 2005/06, which could be an early indicator of RBT/sthd being stressed due to lower water flows and levels prior to ice-up in 2006.



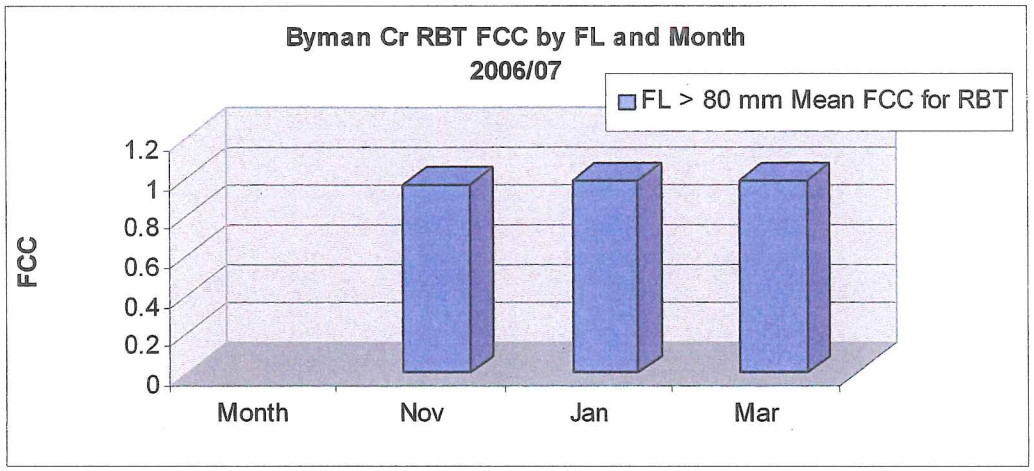


Figure 43. Mean FCC Comparisons for RBT/STHD at Byman (2005/06 vr. 2006/07).

5.3.5 Dolly Varden – Waterfalls Creek

In 2005/06, almost all DV captured at site 1 were greater than 80 mm category, where they increased from beginning to end of winter, although only 2 DV were captured in January. The increase in DV overall may have been due to net immigration to this glide since potential for migration was noted to be high at site 1. In 2006/07, the number of DV captured was substantially less than in 2005/06, where only 9 DV were captured at the beginning of winter (Figure 45).

In 2005/06, all of the DV captured at site 2 were greater than 80 mm long, with an overall decrease in numbers from beginning to end of winter however, the numbers increased in January and February. Migration to and from this glide could explain differences in numbers for each month since a high potential for migration was noted. In addition, some mortality may have occurred near the end of winter. All the DV captured in 2006/07 were also greater than 80 mm long, with an overall decrease in numbers over the

winter. The number of DV captured in 2006/07 was substantially less than what was captured in 2005/06 (Figure 46).

In 2005/06, there was an overall increase in the number of DV at site 3 over the winter and both fork length categories peaked in January. Migration to and from this glide due to high potential for migration at this site may have contributed to a peak in January. There was also an increase in the number of DV over the winter in 2006/07, where the number of DV at the end of winter was similar to 2005/06 (Figure 47). The total number of DV captured at site 3 was the highest of all the sites in both 2005/06 and 2006/07. It should be noted however that the number of DV captured in 2006/07 was substantially less than what was captured in 2005/06.

In 2005/06, DV captured at site 4 were of the greater than 80 mm category, with a decrease noted over the winter. Net migration out of the pool or mortality may have contributed to the decline in DV at site 4 since it had only a moderate potential for migration in Feb. A likely net migration out of the pool occurred in January due to high potential for migration noted during this month. In 2006/07, DV captured at site 4 were also of the greater than 80 mm category, with an increase noted over the winter. As noted at the other sites, the number of DV captured in 2006/07 was substantially less than what was captured in 2005/06 (Figure 48). It is not certain why the number of DV captured in 2006/07 was substantially less at all the sites, compared to 2005/06.

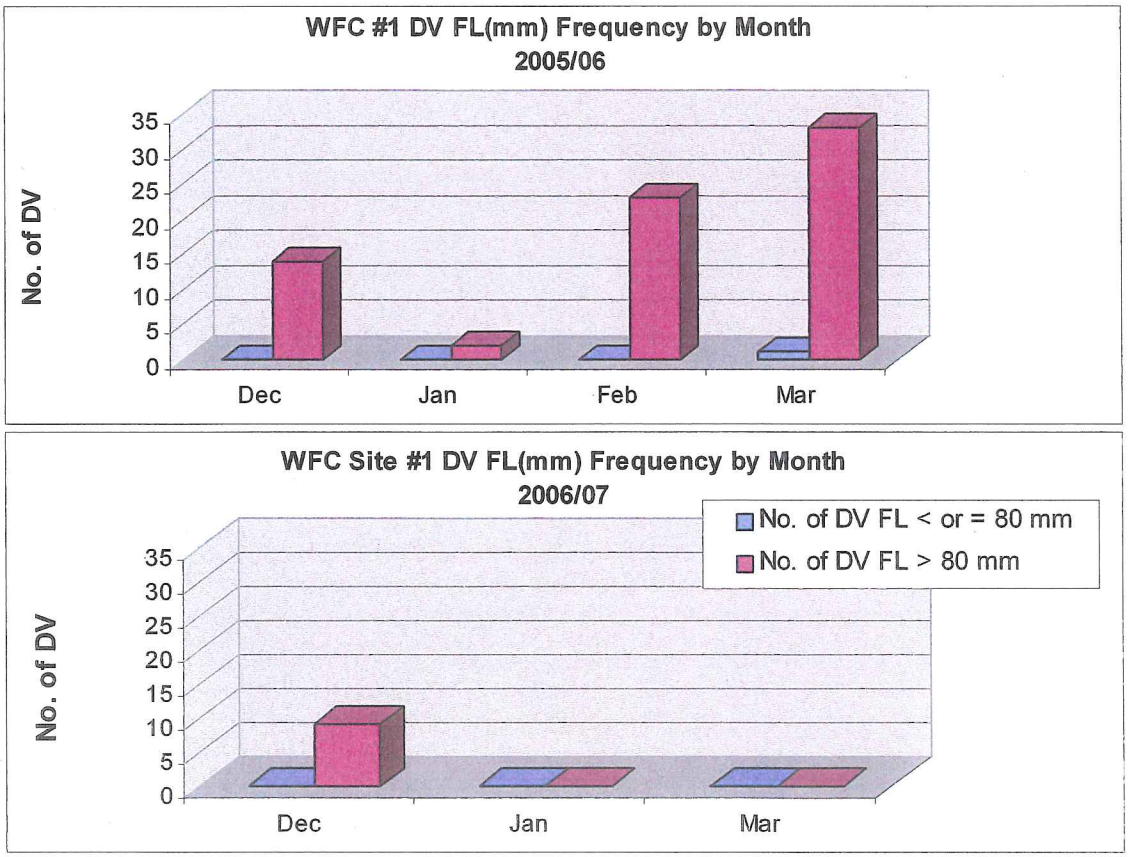


Figure 45. Fork Length Comparisons of DV at Waterfalls#1 (2005/06 vr. 2006/07).

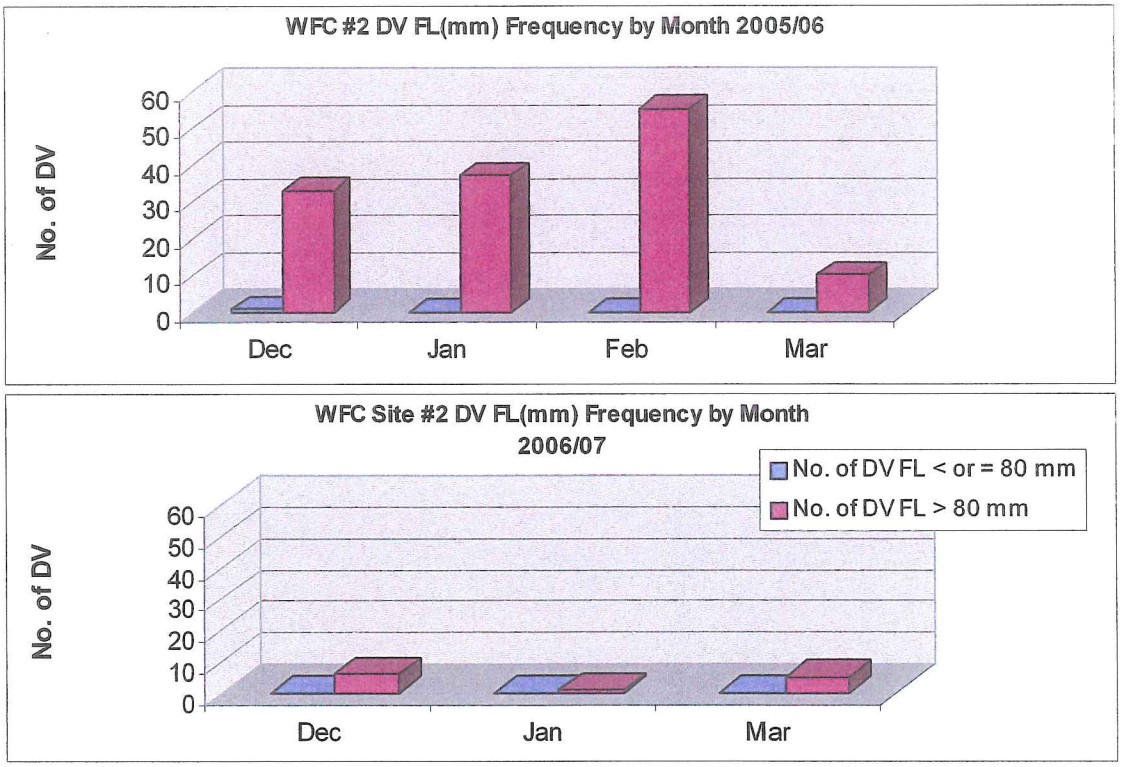


Figure 46. Fork Length Comparisons of DV at Waterfalls#2 (2005/06 vr. 2006/07).

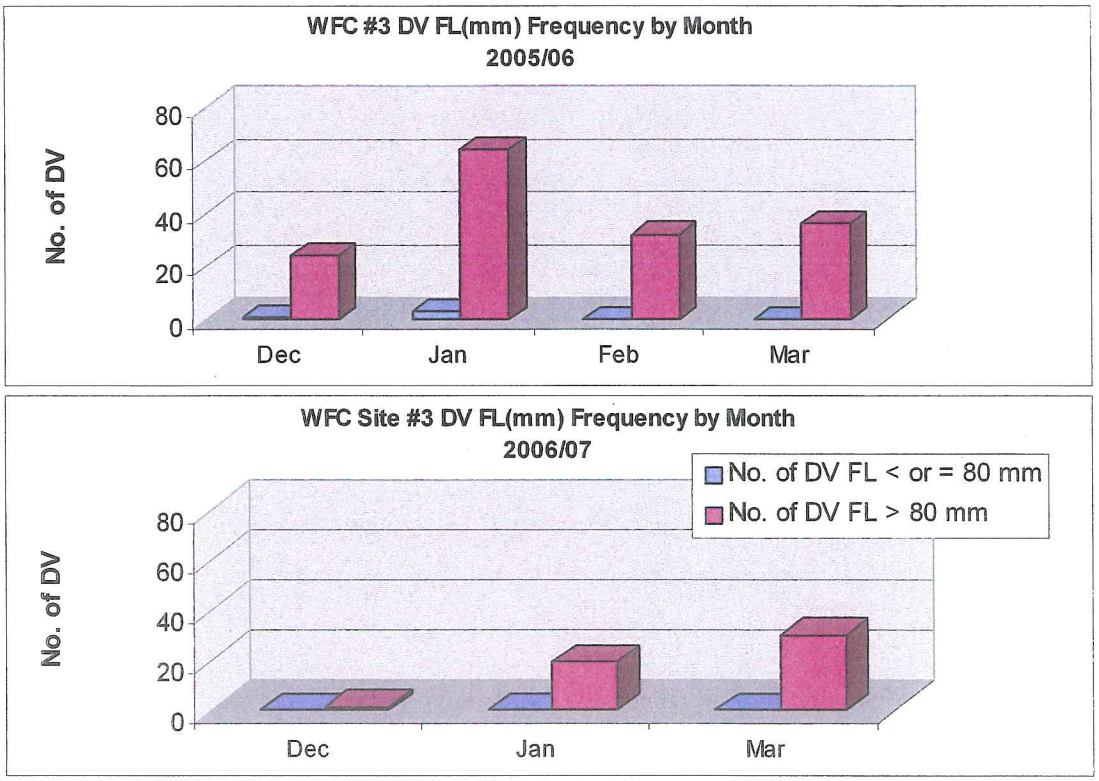


Figure 47. Fork Length Comparisons of DV at Waterfalls#3 (2005/06 vr. 2006/07).

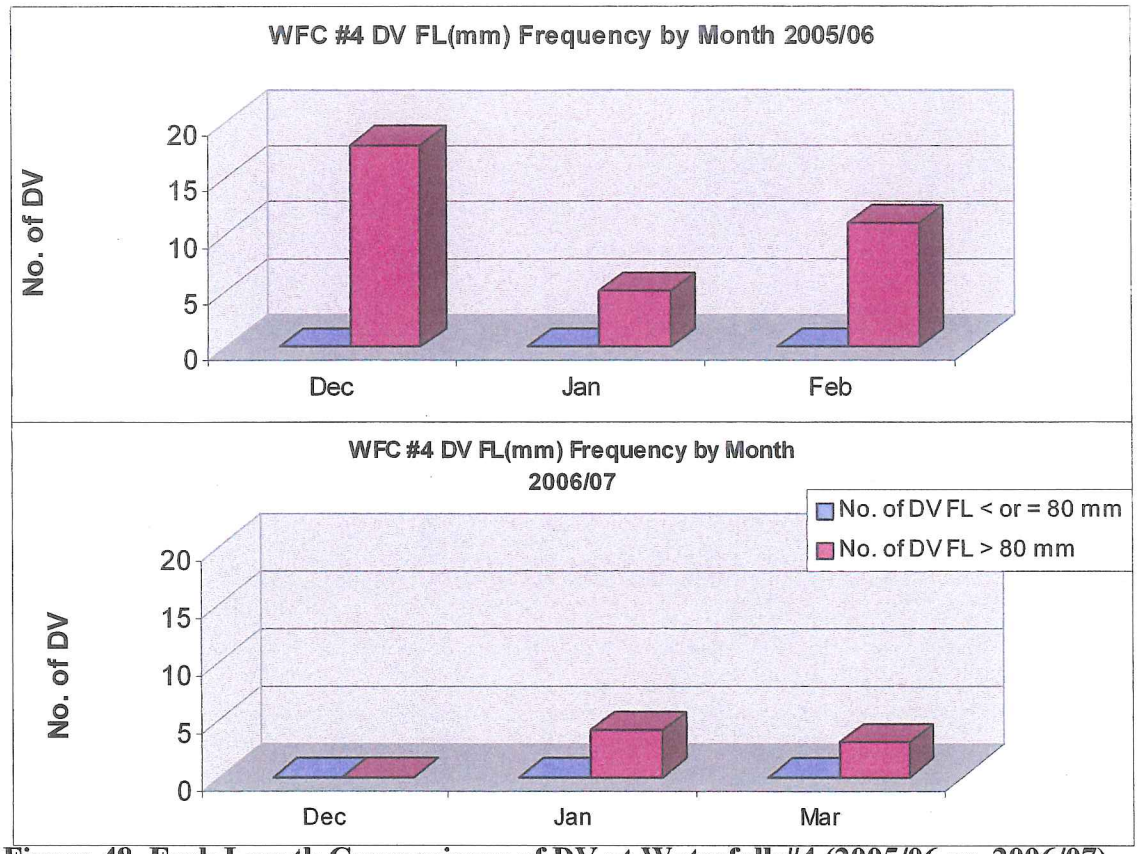


Figure 48. Fork Length Comparisons of DV at Waterfalls#4 (2005/06 vr. 2006/07).

In 2005/06, the mean FCC for DV decreased from the beginning to end of winter for all four sites (Figure 49). The decrease in FCC indicates that winter is difficult for the DV in the system, which is to be expected for all salmonids. Due to low numbers of DV captured at Sites 1, 2 and 4 in 2006/07, it was not possible to calculate the monthly mean FCC for DV. At site 3, the mean DV was calculated for the end of winter only where it was 0.89, which was slightly lower than what was found in 2005/06 where the mean FCC was 0.92 (Figure 49).

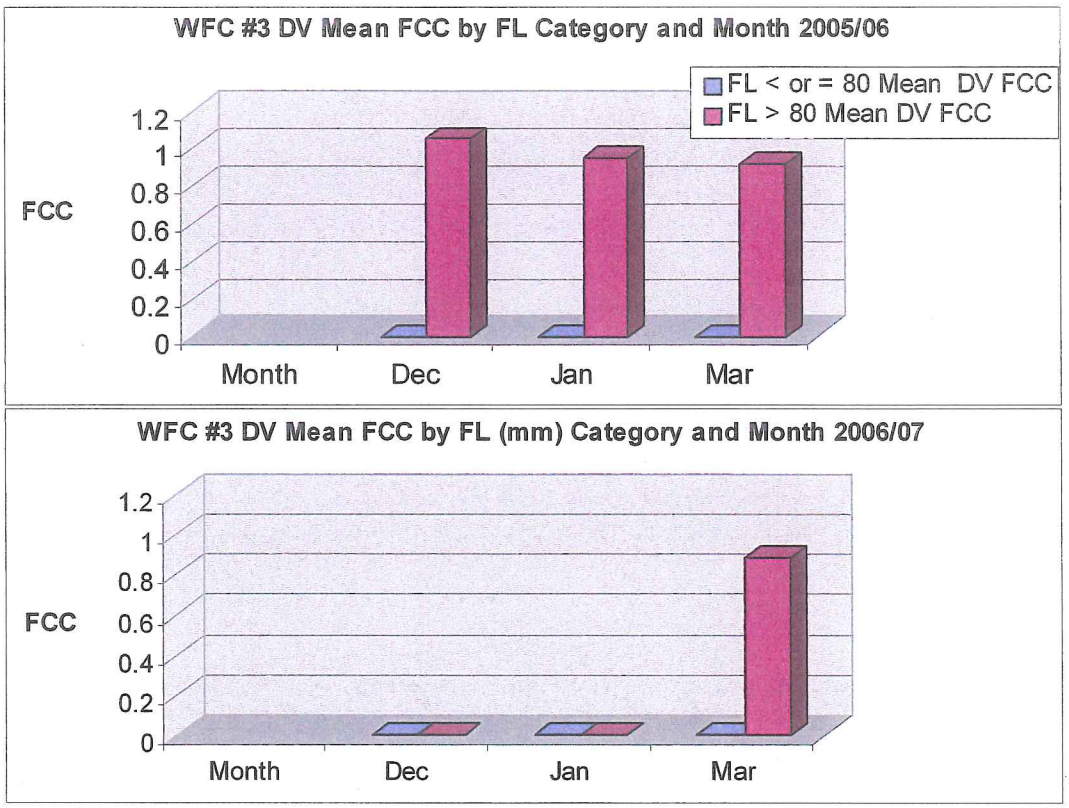


Figure 49. Mean FCC for DV at Waterfalls#3 (2005/06 vr. 2006/07).

5.4 *Density (CPUE)*

5.4.1 CPUE for Coho

In 2006/07, the highest CPUE for coho in the Upper Bulkley sites at the beginning of winter was at McQuarrie (4.3 coho/trap). The CPUE for coho at McQuarrie at the beginning of winter in 2005/06 was 0 coho trap. Middle and end of winter CPUE is absent for McQuarrie due to inaccessibility of the site for trapping (high snow levels). The CPUE at Barren at the beginning and end of winter in 2006/07 was the lowest of all the sites (0 coho/trap). The CPUE for coho at Barren in 2005/06 was much higher, where it ranged anywhere from 8 to 22 coho/trap over the winter. In 2006/07, the CPUE for coho peaked in Jan. at the Byman site (2 coho/trap); however, beginning and end of winter CPUE for coho was very low to none. The CPUE for coho at Byman in 2005/06 was slightly higher than 2006/07, with the exception of January (Figure 50). Finally, CPUE for coho at Richfield decreased from beginning to middle of winter in 2006/07.

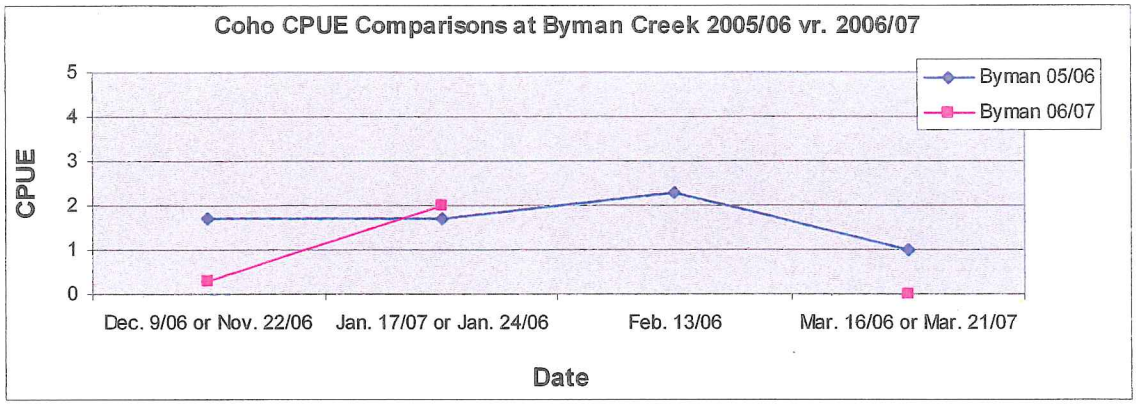


Figure 50. Coho CPUE Comparisons at Byman Creek (2005/06 vr. 2006/07).

In 2006/07, CPUE for coho at the groundwater channel site increased overall from the beginning (24 coho/trap) to end of winter (36 coho/trap). There appeared to be a healthy population of overwintering coho at the groundwater site. The water depth decreased overall from the beginning to end of winter, and the potential for migration out of the channel was low throughout the winter, which may have contributed to the higher catch near the end of winter. The groundwater channel was not monitored in 2005/06.

At Waterfalls Creek in 2006/07, the CPUE for coho salmon decreased overall from beginning to end of winter at sites 1-3, whereas a slight increase in CPUE for coho occurred at site 4. The CPUE for coho was highest at site 1 and lowest overall at site 4 over the winter. On the whole the CPUE for coho in 2006/07 at all 4 sites throughout the winter exceeded the CPUE for coho in 2005/06 (Figures 51 to 54). The higher numbers of coho in 2006/07 may have been due to the low CPUE of DV at the sites. In 2005/06, CPUE for coho at sites 1 and 2 decreased from the onset to end of winter, which also occurred in 2006/07 (Figures 51 and 52). This could have been due to a high potential for migration at sites 1 and 2, which were located in pool/glide habitat with a total length of about 300m. On the whole, the CPUE at site 3 was fairly consistent at the beginning and end of winter in 2005/06, with a noticeable decrease in Feb. 2006 (Figure 53). The CPUE at Waterfalls Creek Site 4 in 2005/06 for coho remained fairly constant, possibly due to potential for migration being much less at this site. In contrast, the CPUE for coho at site 4 in 2006/07 was not as constant throughout the winter (Figure 54).

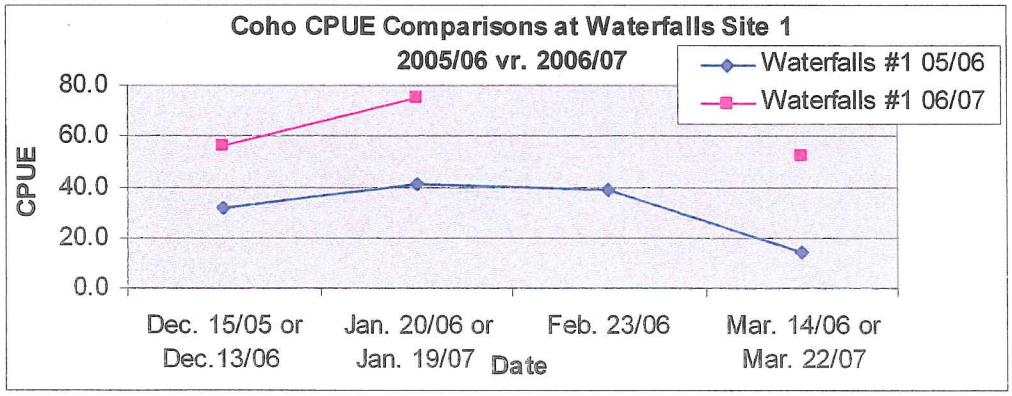


Figure 51. Coho CPUE Comparisons at Waterfalls Site 1 (2005/06 vr. 2006/07).

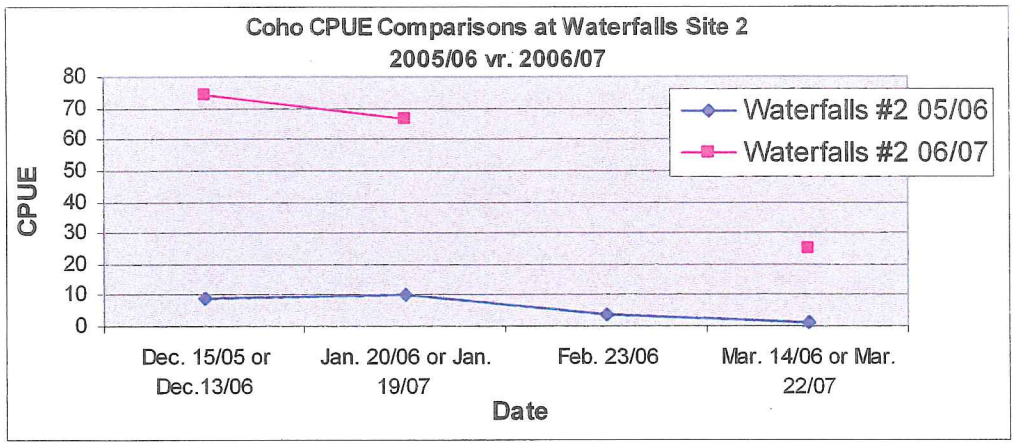


Figure 52. Coho CPUE Comparisons at Waterfalls Site 2 (2005/06 vr. 2006/07).

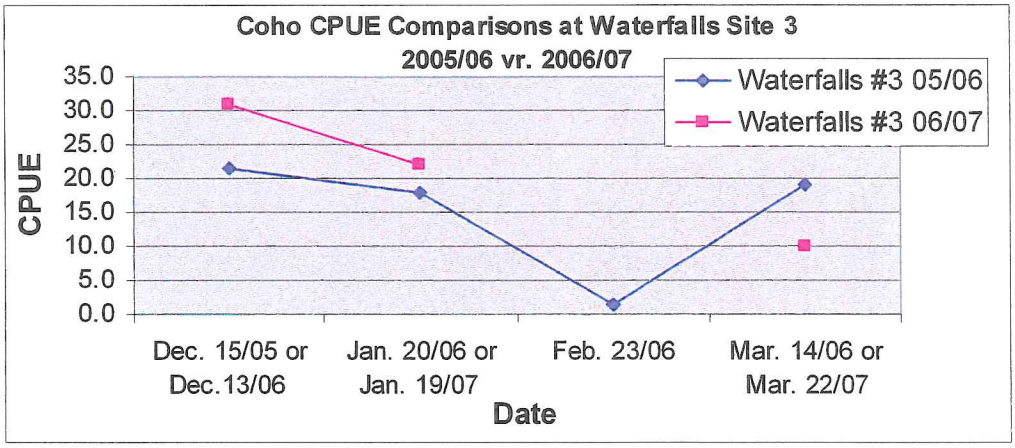


Figure 53. Coho CPUE Comparisons at Waterfalls Site 3 (2005/06 vr. 2006/07).

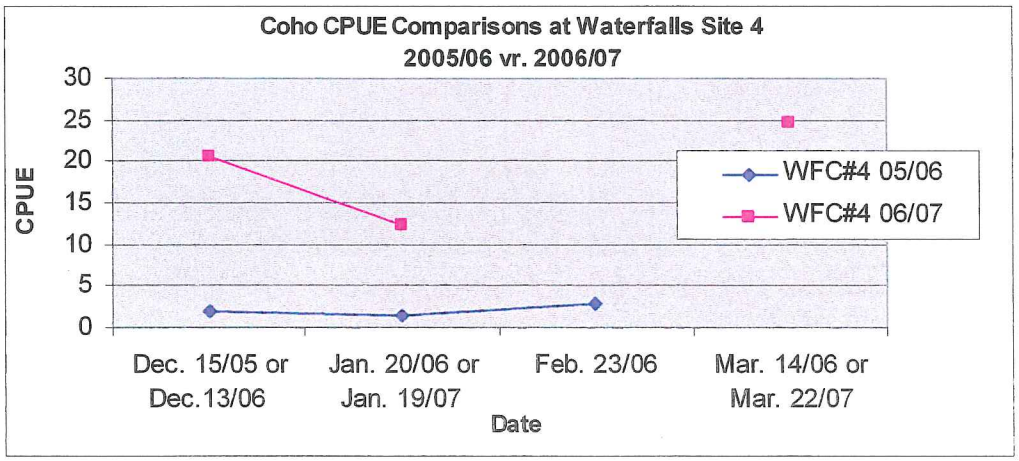


Figure 54. Coho CPUE Comparisons at Waterfalls Site 4 (2005/06 vr. 2006/07).

5.4.2 CPUE for Rainbow Trout/Steelhead

The Barren site had no RBT/STHD captured at beginning or end of winter in 2006/07. In 2005/06, CPUE at the Barren site was the most consistent of the three sites (1.3-4.3/trap), which could be attributed to Barren Creek having the lowest potential for migration of the 3 sites. In 2006/07, McQuarrie had the highest CPUE for RBT/STHD (5.7/trap) at the beginning of winter of all the sites. In 2005/06, the CPUE for RBT/STHD at the beginning of winter at McQuarrie was 9.0/trap, which was also the highest of all sites sampled in 2005/06. At Richfield, the CPUE for RBT/sthd decreased from 3/trap at the beginning to 0/trap at the middle of winter. In 2006/07, the CPUE for RBT/STHD increased at Byman from 3 at the beginning of winter to 6 at the end of winter. As a comparison of RBT/sthd CPUE at Byman between 2005/06 and 2006/07, CPUE was similar in Dec. and Jan.; however, CPUE at the end of winter was higher in 2006/07 than in 2005/06 (Figure 55).

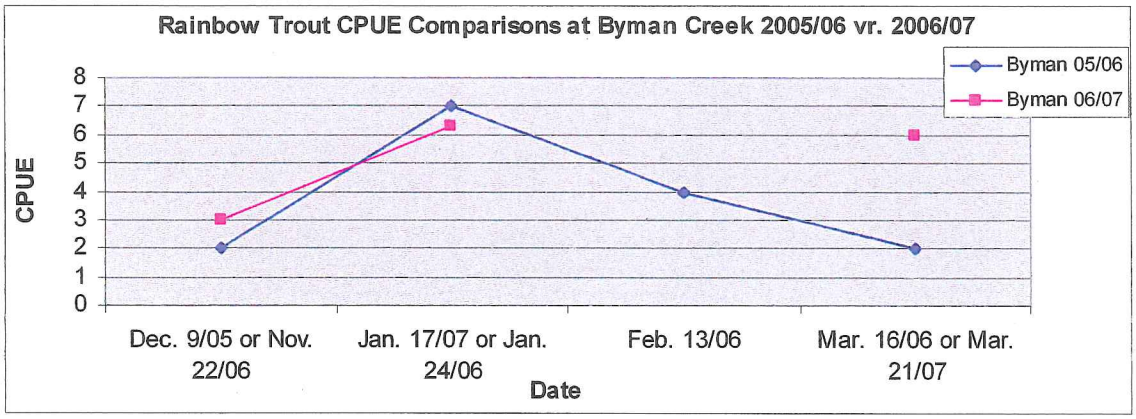


Figure 55. RBT/Sthd CPUE Comparisons at Byman (2005/06 vr. 2006/07).

5.4.3 CPUE for Dolly Varden

In 2005/06, the CPUE for DV at the Waterfalls Creek sites varied over the duration of winter sampling with site 3 having the most consistent CPUE over all sampling dates. High potential for migration most likely affected CPUE for DV. In 2006/07, the CPUE at site 3 of Waterfalls Creek increased the most over the winter of the 4 sites sampled. Overall, the CPUE for DV was greatest at the end of winter, as compared to beginning of winter, at sites 3 and 4. Sites 1 and 2 showed a slight decrease in CPUE for DV over the winter. In conclusion, the CPUE for DV was much lower in 2006/07 than in 2005/06 at all the sites (Figures 56 to 59). It is not certain why the CPUE for DV was so much lower in 2006/07.

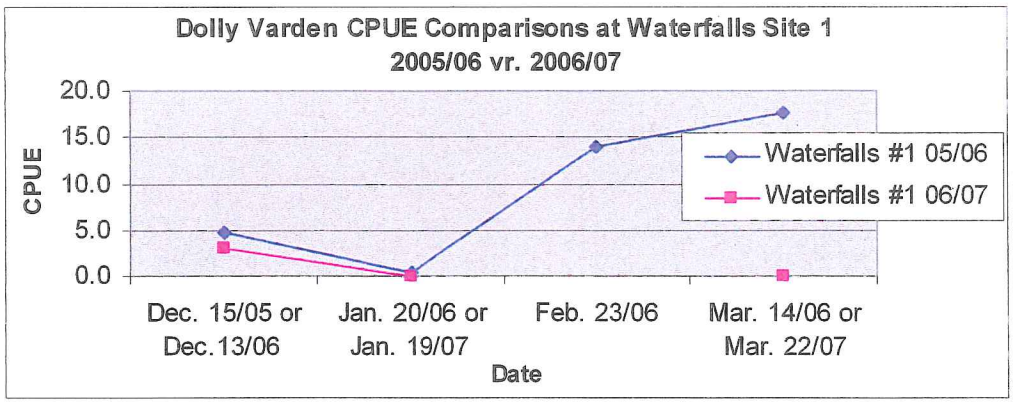


Figure 56. DV CPUE Comparisons at Waterfalls Site 1 (2005/06 vr. 2006/07).

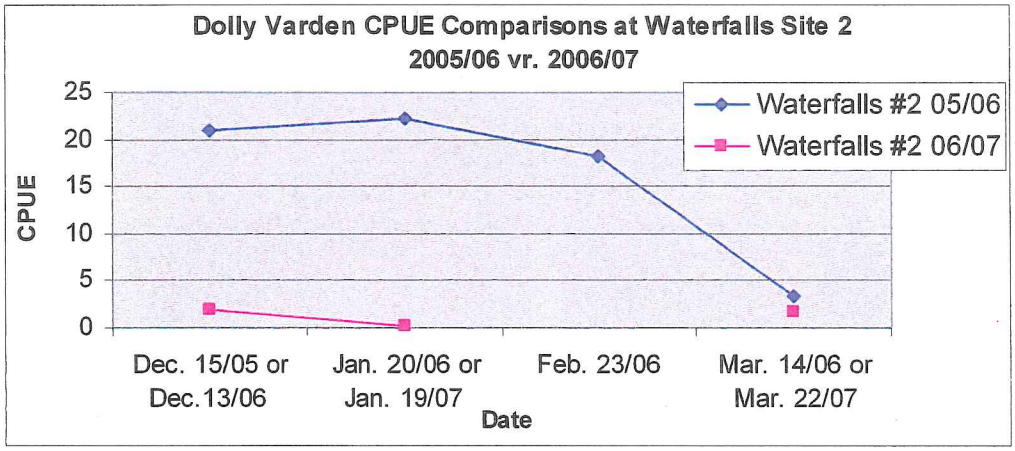


Figure 57. DV CPUE Comparisons at Waterfalls Site 2 (2005/06 vr. 2006/07).

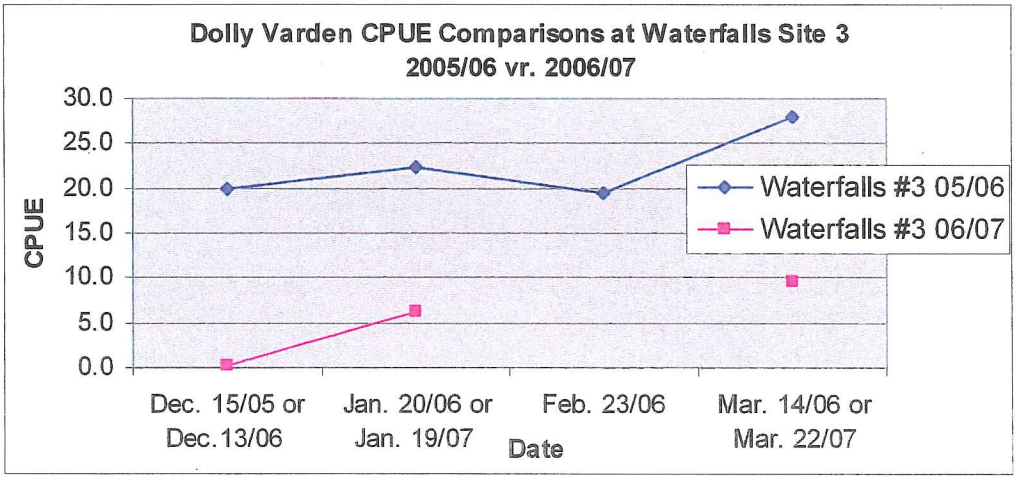


Figure 58. DV CPUE Comparisons at Waterfalls Site 3 (2005/06 vr. 2006/07).

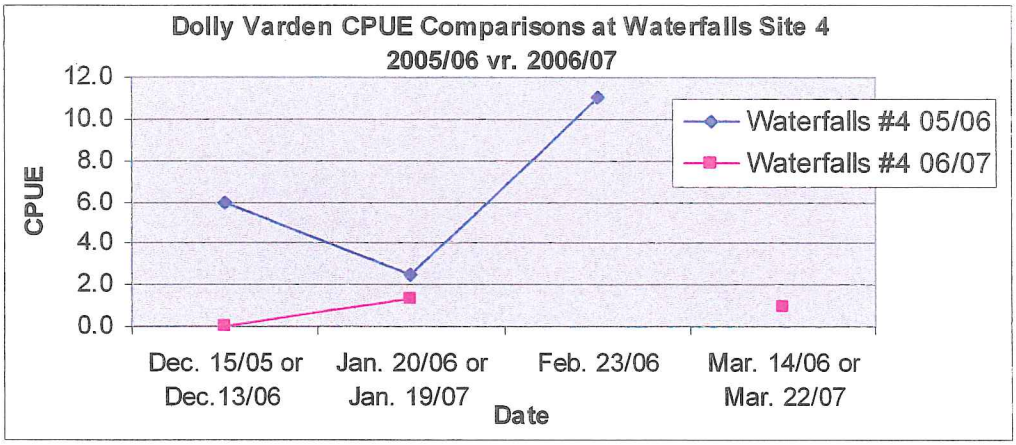


Figure 59. DV CPUE Comparisons at Waterfalls Site 4 (2005/06 vr. 2006/07).

6.0 CONCLUSIONS AND RECOMMENDATIONS

1. Further monitoring, including habitat assessments and overwintering trapping, of all twelve sites sampled during this study is recommended to compare CPUE, and fish size and condition with 2005/06 and 2006/07 results.
2. Find, flag, GPS and record habitat conditions at other pools in the Byman, Barren, McQuarrie and Richfield systems to start winter sampling on them in 2007/08.
3. Find a new system, other than Waterfalls Creek (Sites 1-4) that has potentially been impacted by the railway and sample in 2007/08 to raise awareness and gain more information.
4. Further habitat rehabilitation at McKinnon Cr. is required. Water levels were too low at both Site 1 (upstream) and Site 2 (downstream) of the culvert, and infilling of the pool with sediment (aggradation) had also occurred in spring/summer of 2006 at Site 1. Minnow trapping was not possible at these sites in 2006 due to low water levels. It should also be noted that water levels were also too low near the end of winter at site 1 in 2005. Possible replacement of the existing culvert with a larger embedded culvert would be a long term solution to decrease the potential for sediment build-up upstream of the culvert at Site 1.
5. The groundwater channel sustained a healthy population of coho juveniles over the 2006/07 sampling season. The water level at this groundwater channel was suitable for trapping throughout the winter (22 – 36 cm deep), whereas the water levels were too low for trapping at the McKinnon and Hydro pole sites, which could be an indication that groundwater channels provide critical overwintering habitat. Enhancement of groundwater areas may be an option for rehabilitation work in the future.
6. The maintenance program (i.e. dredging) of the Barren Creek site (just upstream of the highway culvert) in the fall of 2005 appeared to be beneficial since the densities of coho were highest at Barren Creek compared to the other two Upper Bulkley sites during the overwintering study of 2005/06. Monitoring in 2006/07

found that further dredging upstream and downstream of the highway culvert in late summer 2006 decreased the value of overwintering habitat at the Barren Creek site (i.e., the cobbles were covered by fines, water levels decreased and DO was very low during the middle of winter).

7.0 LITERATURE CITED

Bagenal, T. 1978. Methods for assessment of fish production in fresh waters. (3rd. ed). IBP Handbook No. 3. Blackwell Scientific Publications, Oxford, London.

British Columbia Conservation Foundation. 1997. Mid-Bulkley overview fish and fish habitat assessment for watershed restoration. Unpublished report prepared for Nadina Community Futures Development Corporation, Houston, B.C..

British Columbia Conservation Foundation. 1998. Mid-Bulkley detailed fish habitat/riparian/channel assessment for watershed restoration. Unpublished report prepared for Nadina Community Futures Development Corporation, Houston, B.C.

Bustard, D.R. and D.W. Narver. 1975. Aspects of the winter ecology of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). J. Fish Res. Board Can. 31: 667-680.

Cargnelli, L.M. and M.R. Gross. Fish energetics: larger individuals emerge from winter in better condition. Trans. Am. Fish. Soc. 126: 153-156.

Davis, J. C. 1975. Minimal dissolved Oxygen requirements of aquatic life with emphasis on Canadian species: a review. J. Fish. Res. Bd. Can. Vol. 32(12): 2295-2232.

Dolloff, C.A. 1987. Seasonal population characteristics and habitat use by juvenile coho salmon in a small Alaska stream. Trans. Am. Fish. Soc. 116: 828-829.

Donas, B. and R.K. Saimoto. 1999. Upper Bulkley River overwintering study 1998-2000 Interim Report. Unpublished report prepared for Fisheries Renewal B.C., Smithers, B.C.

Donas, B. and R.K. Saimoto. 2000. Upper Bulkley River overwintering study 1999-2000 Interim Report. Unpublished report prepared for Fisheries Renewal B.C., Smithers, B.C.

Donas, B. and R.K. Saimoto. 2001a. Upper Bulkley River and Toboggan Creek Overwintering Study 2000-2001. Prepared for Fisheries Renewal B.C., Smithers, B.C.

Donas, B. and R.K. Saimoto. 2001b. Mission Creek Overwintering Study 2000-2001. Prepared for Fisheries Renewal B.C., Smithers, B.C.

Donas, B. and N. Newman. 2006. Bulkley River Watershed Overwintering Study 2005-2006. Prepared by DFO, Smithers, B.C.

Giannico, G. R. and M.C. Healey. 1998. Effect of flow and food on winter movements of juvenile coho salmon. Trans. Am. Fish. Soc. 127: 645-651.

Johnston, N.T. and P.A. Slaney. 1996. Fish habitat assessment procedures. Watershed restoration technical circular No. 8. Watershed Restoration Program, Vancouver, B.C.

Slaney, P.A. and D. Zoldakos (eds.). 1997. Fish habitat rehabilitation procedures. Watershed Restoration Technical Circular No. 9. Watershed Restoration Program, Vancouver, B.C.

Swales, S. and C.D. Levings. 1989. Role of off-channel ponds in the life cycle of coho salmon (*Oncorhynchus kisutch*) and other juvenile salmonids in the Coldwater River, BC. Can. J. Fish. Aquat. Sci. 46: 232-242.

Appendix 1
Winter Habitat Assessment Data

Site Identification	Barren Creek
Sampling Date	Nov 22,06

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-9
Ice Cover	40%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	65
Ice thickness (cm)	0.5
Clarity of Ice	semi-clear
Snow Depth (cm)	0
Water Temp ©	measure tomorrow
Turbidity	clear
DO	n/a
pH	7.2
Flow (m/s)	n/a

Number of traps set	3	**Set Locations**	Culvert inlet pool (just upstream of culvert)
Set duration	overnight		

Comments

More fines and less cobble in this pool compared to last year.
Photos 194 and 195 of Barren pool.
DO meter and flow meter frozen and not working.
Check this site at the end of winter only.

Site Identification	Barren Creek
Sampling Date	Jan16,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-12
Ice Cover	100%
Stream Flow	low
Potential for Migration	low

Water Depth (cm)	29
Ice thickness (cm)	13
Clarity of Ice	none
Snow Depth (cm)	10
Water Temp ©	0.1
Turbidity	clear
DO	2.7
pH	7.7
Flow (m/s)	n/a

Number of traps set	0
Set duration	n/a

Set Locations

no traps set

Comments

Dissolved oxygen too low to set traps.

Site Identification	Barren Creek
Sampling Date	20-Mar-07

Atmospheric and Water Conditions

Air Temp (deg Celsius)	1
Ice Cover	60%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	67	
Ice thickness (cm)	1	
Clarity of Ice	none	
Snow Depth (cm)	10	snow on ice crust
Water Temp ©	0.2	
Turbidity	clear	
DO	12.5	
pH	7.6	
Flow (m/s)	n/a	

Number of traps set	3
Set duration	24hrs

Set Locations

upstream Hwy. 16 culvert

Comments

Photos taken
No fish captured.

Site Identification

Byman
at culvert pool

Sampling Date

Nov 22/06
1:05 PM

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-9
Ice Cover	90%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	90
Ice thickness (cm)	22
Clarity of Ice	none
Snow Depth (cm)	5
Water Temp ©	not working
Turbidity	clear
DO	not working
pH	7.5
Flow (m/s)	n/a

Number of traps set	3

Set duration	overnight

Set Locations

Culvert outlet pool (same as last year)

Comments

Photo 192: downstream
Photo 193: upstream
**need to set traps at the mouth of Byman in the Upper Bulkley River
DO meter not working properly/flow meter frozen and not working

Site Identification

Byman
at culvert pool

Sampling Date

Jan16,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-12
Ice Cover	100%
Stream Flow	mod
Potential for Migration	low-mod

Water Depth (cm)	47
Ice thickness (cm)	41
Clarity of Ice	opaque
Snow Depth (cm)	18
Water Temp ©	0.1
Turbidity	clear
DO	10.0
pH	7.9
Flow (m/s)	n/a

Number of traps set	3

Set duration	24 hr

Set Locations

Comments

water flowing under culvert

Site Identification	Byman at culvert pool
Sampling Date	March20,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	1
Ice Cover	90%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	59
Ice thickness (cm)	40
Clarity of Ice	none
Snow Depth (cm)	9
Water Temp ©	0.3
Turbidity	clear
DO	13.4
pH	7.7
Flow (m/s)	n/a

Number of traps set	3
Set duration	24 hr

Set Locations

d/s of Highway 16 culvert

Comments

water flowing under culvert

Site Identification	McQuarrie Creek
Sampling Date	Nov 22,06 2:10 PM

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-9
Ice Cover	100%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	40
Ice thickness (cm)	46.5
Clarity of Ice	none
Snow Depth (cm)	4
Water Temp ©	measure tomorrow
Turbidity	clear
DO	n/a
pH	7.7
Flow (m/s)	n/a

Number of traps set	3	**Set Locations**	Culvert outlet pool (downstream side of hwy 16)
Set duration	overnight		

Comments	DO meter and flow meter frozen and not working.

Site Identification	McQuarrie Creek
Sampling Date	Jan16,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-12
Ice Cover	100%
Stream Flow	n/a
Potential for Migration	low

Water Depth (cm)	
Ice thickness (cm)	
Clarity of Ice	
Snow Depth (cm)	
Water Temp ©	
Turbidity	
DO	
pH	
Flow (m/s)	

Number of traps set	0

Set duration	

Set Locations

Comments

Due to highway's plowing snow into the creek we were unable to access the site (snow too high).

Site Identification	Richfield 1 (under CN bridge)
Sampling Date	Nov 22/06 12:05pm

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-9
Ice Cover	85%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	53
Ice thickness (cm)	10
Clarity of Ice	none
Snow Depth (cm)	1
Water Temp ©	0.4
Turbidity	Clear
DO	n/a
pH	7.9
Flow (m/s)	n/a

Number of traps set	3	**Set Locations**	In pool under CN bridge
Set duration	overnight		

Comments	New site since we are not able to trap at UBR1. Small patch of open water at the location where we set the traps. Photo 190 (close-up of trap hole) Photo 191 (Upstream view) Flow meter not working (frozen) DO meter not working properly

Site Identification Richfield 1 (under CN bridge)

Sampling Date Jan16,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-9
Ice Cover	100%
Stream Flow	low
Potential for Migration	low

Water Depth (cm)	35
Ice thickness (cm)	46
Clarity of Ice	opaque
Snow Depth (cm)	4
Water Temp ©	0.1
Turbidity	clear
DO	13.0
pH	7.8
Flow (m/s)	low

Number of traps set	3

Set duration	overnight

Set Locations

Comments

Site Identification Richfield 1 (under CN bridge)

Sampling Date March 20,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	0.5
Ice Cover	100%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	44
Ice thickness (cm)	42
Clarity of Ice	none
Snow Depth (cm)	35
Water Temp ©	0.6
Turbidity	clear
DO	13.3
pH	7.5
Flow (m/s)	low

Number of traps set	0
Set duration	

Set Locations

Comments No traps set due to an increase in flow- too high, might kill fish

Site Identification	Groundwater Channel
Sampling Date	Dec 19,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	0
Ice Cover	80%
Stream Flow	Low
Potential for Migration	Low

Water Depth (cm)	36
Ice thickness (cm)	20
Clarity of Ice	Clear to none
Snow Depth (cm)	0
Water Temp ©	2.6
Turbidity	Semi-clear
DO	4.7
pH	7.70
Flow (m/s)	none

Number of traps set	3
Set duration	overnight

Set Locations

Set next to berm, off of Proctor Road. We walked about 200 m off road.

Comments

Photos- None
Traps set in GW channel fairly close to the confluence with the creek, but connectivity to the creek appears to be very minimal.

Site Identification Groundwater Channel

Sampling Date Feb 20,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	1.9
Ice Cover	50%
Stream Flow	Low
Potential for Migration	Low

Water Depth (cm)	22
Ice thickness (cm)	7
Clarity of Ice	None
Snow Depth (cm)	19
Water Temp ©	3.6
Turbidity	Clear
DO	9.4
pH	7.40
Flow (m/s)	Low

Number of traps set	2

Set duration	overnight

Set Locations

Comments

Site Identification	Groundwater Channel
Sampling Date	27-Mar-07

Atmospheric and Water Conditions

Air Temp (deg Celsius)	0
Ice Cover	0%
Stream Flow	Low
Potential for Migration	Low

Water Depth (cm)	29	
Ice thickness (cm)	0.1	Skiff of Ice that is clear
Clarity of Ice	Clear	
Snow Depth (cm)	No snow on ice/ 30 cm snow depth on the land	
Water Temp ©	3.4	
Turbidity	Clear	
DO	11.4	
pH	7.15	
Flow (m/s)		

Number of traps set	3
Set duration	overnight

Set Locations

~ 6 meters upstream from confluence with main creek.

Comments

Fry can be seen from confluence of G.W. channel and main creek about 40 m upstream of confluence. Fry are quite active.
Note: need to walk adjoining creeks to look for more G.W. channels for future development.

Site Identification	Hydropole #12 (downstream of culvert)
Sampling Date	Dec12,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-3
Ice Cover	100%
Stream Flow	low
Potential for Migration	mod

Water Depth (cm)	18	
Ice thickness (cm)	29	
Clarity of Ice	opaque	
Snow Depth (cm)	4	
Water Temp ©	1.3	
Turbidity	clear	
DO	10.5	
pH	8.1	
Flow (m/s)	n/a	some flow

Number of traps set	0	**Set Locations**	None set.
Set duration	n/a		

Comments	Water level too low to set traps. Abundant orange/red algae and smells like H_2S.

Site Identification	Hydropole #12 (downstream of culvert)
Sampling Date	Jan18,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-1
Ice Cover	100%
Stream Flow	low
Potential for Migration	low

Water Depth (cm)	18
Ice thickness (cm)	11
Clarity of Ice	none
Snow Depth (cm)	5
Water Temp ©	0.1
Turbidity	clear
DO	11.6
pH	7.0
Flow (m/s)	n/a

Number of traps set	n/a
Set duration	n/a

Set Locations

Comments

Water too low to set traps.

Site Identification	Hydropole 12
Sampling Date	27-Mar-07

Atmospheric and Water Conditions

Air Temp (deg Celsius)	0
Ice Cover	0
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	28.5
Ice thickness (cm)	0
Clarity of Ice	0
Snow Depth (cm)	0
Water Temp ©	0.8
Turbidity	mod
DO	12.6
pH	7.1
Flow (m/s)	NA

Number of traps set	2	**Set Locations**	D/S side of culvert
Set duration	24 hrs		

Comments

Site Identification McKinnon Creek #1 & #2

Sampling Date Dec12,2006

Atmospheric and Water Conditions

	Site #1	Site #2
Air Temp (deg Celsius)	-2	-2
Ice Cover	100%	100%
Stream Flow	none	none
Potential for Migration	none	none

Water Depth (cm)	~3	0
Ice thickness (cm)	30-40	30-40
Clarity of Ice	none	none
Snow Depth (cm)	10	10
Water Temp ©	n/a	n/a
Turbidity	n/a	n/a
DO	n/a	n/a
pH	n/a	n/a
Flow (m/s)	n/a	n/a

Number of traps set	n/a
Set duration	n/a

Set Locations none set

Comments Water level too low for trapping.
Will check this site at the end of winter.

Site Identification McKinnon Creek #1 (U/S) & #2 (D/S)

Sampling Date Jan18,2007

Atmospheric and Water Conditions

	Site #1	Site #2
Air Temp (deg Celsius)	-1	-1
Ice Cover	98%	100%
Stream Flow	low	none
Potential for Migration	low	none

Water Depth (cm)	4.5	0
Ice thickness (cm)	13	28
Clarity of Ice	opaque	opaque
Snow Depth (cm)	18	18
Water Temp ©	1	n/a
Turbidity	clear	n/a
DO	13.0	n/a
pH	7.4	n/a
Flow (m/s)	n/a	n/a

Number of traps set	n/a	n/a
Set duration	n/a	n/a

Set Locations Some flowing water at the site.

Comments No traps set; water too low or no water.

Site Identification	McKinnon Creek #1(U/S)
Sampling Date	Feb. 20/2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)		1.9
Ice Cover		100%
Stream Flow	Mod	
Potential for Migration	None	

Water Depth (cm)		2
Ice thickness (cm)		43
Clarity of Ice	None	
Snow Depth (cm)		18
Water Temp ©	NA	Water too shallow for measurement
Turbidity	Mod	
DO	NA	Water too shallow for measurement
pH	NA	Water too shallow for measurement
Flow (m/s)	NA	Water too shallow for measurement

Number of traps set	**Set Locations**	No traps set
Set duration		

Comments

Site Identification	McKinnon Creek #1(U/S)
Sampling Date	March 27/07

Atmospheric and Water Conditions

Air Temp (deg Celsius)		No measurements taken, snow plowed into creek.
Ice Cover		No overwintering habitat available.
Stream Flow		
Potential for Migration		

Water Depth (cm)	
Ice thickness (cm)	
Clarity of Ice	
Snow Depth (cm)	
Water Temp ©	
Turbidity	
DO	
pH	
Flow (m/s)	

Number of traps set	**Set Locations**	No traps set
Set duration		

Comments

Site Identification	Waterfalls #1
Sampling Date	Dec 12,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-3
Ice Cover	100%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	32
Ice thickness (cm)	49
Clarity of Ice	opaque
Snow Depth (cm)	0
Water Temp ©	1.4
Turbidity	clear
DO	12.8
pH	7.65
Flow (m/s)	none

Number of traps set	3
Set duration	overnight

Set Locations

3 traps set just downstream of beaver dam

Comments

4 photos: 1 looking upstream; 2&3 of ice hole; 4 looking downstream

SiteID	Waterfalls #1
Sampling Date	Jan. 18, 2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)		-6
Ice Cover		100%
Stream Flow		Low
Potential for Migration		Mod

Water Depth (cm)		40
Ice thickness (cm)		55
Clarity of Ice		None
Snow Depth (cm)		10
Water Temp ©		0.7
Turbidity		Clear
DO		12.8
pH		7.5
Flow (m/s)		NA

Number of traps set	3

Set duration		Overnight

Set Locations

Just downstream of BD, in exact location as Dec. 2006 sample time.

Comments

Site Identification Waterfalls #1

Sampling Date March 21,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	2
Ice Cover	95%
Stream Flow	low
Potential for Migration	mod

Water Depth (cm)	52.5
Ice thickness (cm)	8
Clarity of Ice	none
Snow Depth (cm)	0.5
Water Temp ©	0.9
Turbidity	clear
DO	13.0
pH	7.4
Flow (m/s)	n/a

Number of traps set	3

Set duration	24 hrs

Set Locations just below beaver dam

Comments very little snow left in New Hazelton

Site Identification Waterfalls #2

Sampling Date Dec12,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-3
Ice Cover	100%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	49
Ice thickness (cm)	34.5
Clarity of Ice	opaque
Snow Depth (cm)	0
Water Temp ©	0.1
Turbidity	clear
DO	12.1
pH	7.3
Flow (m/s)	n/a

Number of traps set	3

Set duration	overnight

Set Locations Just upstream of dam

Comments Photo 5 (Gavin chopping ice); 6 (close-up of ice hole); 7 (downstream view)

Site Identification Waterfalls #2

Sampling Date Jan. 18/07

Atmospheric and Water Conditions

Air Temp (deg Celsius)		-6
Ice Cover		100%
Stream Flow		Low
Potential for Migration		Mod

Water Depth (cm)		58
Ice thickness (cm)		15
Clarity of Ice		None
Snow Depth (cm)		10
Water Temp ©		0.1
Turbidity		Clear
DO		12.6
pH		7.6
Flow (m/s)		NA

Number of traps set	3

Set duration		Overnight

Set Locations Just u/s of BD

Comments

Site Identification Waterfalls #2

Sampling Date March21,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	2
Ice Cover	50%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	62
Ice thickness (cm)	9
Clarity of Ice	none
Snow Depth (cm)	0.5
Water Temp ©	0.9
Turbidity	clear
DO	12.5
pH	7.2
Flow (m/s)	n/a

Number of traps set	3

Set duration	24 hrs

Set Locations Just upstream of beaver dam that has recently breached.

Comments

Site Identification Waterfalls #3

Sampling Date Dec12,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-3
Ice Cover	100%
Stream Flow	mod
Potential for Migration	high

Water Depth (cm)	44
Ice thickness (cm)	32.5
Clarity of Ice	semi-clear
Snow Depth (cm)	0
Water Temp ©	0.4
Turbidity	clear
DO	11.4
pH	7.3
Flow (m/s)	n/a

Number of traps set	3

Set duration	overnight

Set Locations instream area close to road

Comments Seems to be more beaver dam activity; water is higher this year
Photo 8 (downstream view); 9 (close-up of hole)

Site Identification	Waterfalls 3
Sampling Date	Jan. 19, 2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)		-3
Ice Cover		100%
Stream Flow		Low
Potential for Migration		Mod

Water Depth (cm)		47
Ice thickness (cm)		9
Clarity of Ice		None
Snow Depth (cm)		10
Water Temp ©		0.1
Turbidity		Clear
DO		12.4
pH		7.3
Flow (m/s)		NA

Number of traps set		3
Set duration		Overnight

Set Locations

Same Location as Dec. 2006

Comments

Site Identification Waterfalls #3

Sampling Date March21,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	2	
Ice Cover	10%	edge ice only
Stream Flow	mod	
Potential for Migration	high	

Water Depth (cm)	55
Ice thickness (cm)	0
Clarity of Ice	n/a
Snow Depth (cm)	none
Water Temp ©	0.6
Turbidity	clear
DO	12.5
pH	6.9
Flow (m/s)	n/a

Number of traps set	3

Set Locations

Set duration	24 hrs

Comments

Site Identification Waterfalls #4

Sampling Date Dec12,2006

Atmospheric and Water Conditions

Air Temp (deg Celsius)	-3
Ice Cover	100%
Stream Flow	mod
Potential for Migration	mod

Water Depth (cm)	37	
Ice thickness (cm)	16	
Clarity of Ice	semi-clear	
Snow Depth (cm)	1	
Water Temp ©	0.1	
Turbidity	clear	
DO	10.6	
pH	7.4	
Flow (m/s)	n/a	good flow

Number of traps set	2
Set duration	overnight

Set Locations Downstream of double culverts (1 trap set in culvert, 1 just downstream of culvert).

Comments Photos 10 & 11 (close-up of ice hole)

Site Identification Waterfalls#4

Sampling Date Jan. 18/2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)		-3
Ice Cover		90%
Stream Flow		Low
Potential for Migration		Mod
Water Depth (cm)		38
Ice thickness (cm)		9
Clarity of Ice		None
Snow Depth (cm)		10
Water Temp ©		0.1
Turbidity		Clear
DO		12.4
pH		7.3
Flow (m/s)		NA

Number of traps set	3
Set duration	Overnight

Set Locations

Same site as Dec.
1 of the traps was set just inside the culvert

Comments

Site Identification Waterfalls #4

Sampling Date March21,2007

Atmospheric and Water Conditions

Air Temp (deg Celsius)	2	
Ice Cover	10%	edge ice only
Stream Flow	mod	
Potential for Migration	high	

Water Depth (cm)	45	
Ice thickness (cm)	n/a	
Clarity of Ice	none	no clarity at edge ice; middle of pool has no ice
Snow Depth (cm)	0.5	
Water Temp ©	0.3	
Turbidity	clear	
DO	11.6	
pH	7.0	
Flow (m/s)	n/a	

Number of traps set	3
Set duration	24

Set Locations just downstream of the 2 culverts

Comments

Appendix 2
Spring Habitat Assessment Data

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 19/ 07	**Photos:** 485-Lk U/S from culvert 486-Lk X R to L 487-Lk D/S	488-Lk u/s of step pools u/s of riffle
Surveyors Initials	NN, GG		
Location	McKinnon #1 U/S of culvert		

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	6	
Habitat Unit Type *(i.e. pool, riffle or glide)*	riffle	note: No longer a pool. Step pool habitat u/s. (riffle continues into culvert [not measured])
Wetted Width (m)	2.7	two channels with an island in between
Bankfull Width (m)	5	measured in middle of hab. unit where it is the widest
Max. Depth (at deepest point) (cm) (estimate if necessary)	25	
Depth at trap cluster location (cm) (estimate if necessary)	N/A	
Depth of riffle crest (at pool outlet) (if applicable)	N/A	
Residual Pool Depth (Max. depth minus depth at riffle crest)	N/A	
Total % of wetted area covered	5	
Cover % breakdown (adds to 100%)		
Cobble	20	
Boulder	80	
Small Woody Debris (<10cm diam)	0	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	0	
Deep Pools	0	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	5	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	70	
% cobble (64-256 mm) *btwn tennisball and basketball*	15	
% boulder (> 256 mm) *bigger than a basketball*	10	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities

Needs more riparian veg. and cover. Gradient needs to be reduced to slow the flow so that a pool can be maintained.
referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 19/07	**Photos:** 489-d/s view 490-x-view (LB to RB) 491-u/s view
Surveyors Initials	NN, GG	
Location	McKinnon #2	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	3.2	Did not include glide habitat in the culvert.
Habitat Unit Type *(i.e. pool, riffle or glide)*	Glide	A pool in 2005/06 overwintering study
Wetted Width (m)	2.25	
Bankfull Width (m)	2.45	
Max. Depth (at deepest point) (cm) (estimate if necessary)	23	
Depth at trap cluster location (cm) (estimate if necessary)	N/A	
Depth of riffle crest (at pool outlet) (if applicable)	N/A	
Residual Pool Depth (Max. depth minus depth at riffle crest)	N/A	
Total % of wetted area covered	10%	
Cover % breakdown (adds to 100%)		
Cobble	5	
Boulder	80	Rip-rap on left bank offering cover.
Small Woody Debris (<10cm diam)	10	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	5	
Deep Pools	0	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	20	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	70	
% cobble (64-256 mm) *btwn tennisball and basketball*	8	
% boulder (> 256 mm) *bigger than a basketball*	2	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Possibility of rock weirs to back-water and create pool habitat.

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 19/ 07	**Photos:**	
Surveyors Initials	NN, GG	492-Lk D/S 493-Lk X (LB to RB) 494-Lk U/S	495+496-u/s of 40m section where water becomes shallow
Location	Groundwater channel		

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	40	measured from confluence U/S to the second stake U/S of 2nd stake water is shallow and heavily vegetated
Habitat Unit Type *(i.e. pool, riffle or glide)*	glide	
Wetted Width (m)	2.5	est. too muddy to walk in channel
Bankfull Width (m)	2.5	est. too muddy to walk in channel
Max. Depth (at deepest point) (cm) (estimate if necessary)	30	
Depth at trap cluster location (cm) (estimate if necessary)	30	
Depth of riffle crest (at pool outlet) (if applicable)	N/A	
Residual Pool Depth (Max. depth minus depth at riffle crest)	N/A	
Total % of wetted area covered	50	
Cover % breakdown (adds to 100%)		
Cobble	0	
Boulder	0	
Small Woody Debris (<10cm diam)	30	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	3	
Instream Vegetation	35	
Overhanging Vegetation	30	
Deep Pools	2	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	100	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	0	
% cobble (64-256 mm) *btwn tennisball and basketball*	0	
% boulder (> 256 mm) *bigger than a basketball*	0	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities

Major potential for GW channel enhancement
Some fish observed U/S of the 40m but water is very shallow

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	19-Apr-07	Photos: 482- looking d/s from culvert 483-looking X (Left to right bank) - Pool 1 482-looking u/s from Left bank at Pool 2
Surveyors Initials	NN, GG	
Location	Hydropole 12	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	Pool 1: 2.3 m Pool 2: 2.5 m est.	In March, 1 trap set in Pool 1 and 1 trap set in Pool 2. Pool 1=culvert pool, Pool 2: first pool downstream of P1
Habitat Unit Type *(i.e. pool, riffle or glide)*	Pool	
Wetted Width (m)	Pool 1: 2.2 m Pool 2: 2.2 m	2 pools measured since 1 trap set in each pool in March 2007.
Bankfull Width (m)	Pool 1 Pool 2: 2.2 m	"
Max. Depth (at deepest point) (cm) (estimate if necessary)	Pool 1: 37 Pool 2: 44	"
Depth at trap cluster location (cm) (estimate if necessary)	Pool 1: 37 Pool 2: 44	"
Depth of riffle crest (at pool outlet) (if applicable)	Pool 1: 13 Pool 2: 10	"
Residual Pool Depth (Max. depth minus depth at riffle crest)	Pool 1 : 24 Pool 2: 34	"
Total % of wetted area covered	60	
Cover % breakdown (adds to 100%)		
Cobble	5	
Boulder	0	
Small Woody Debris (<10cm diam)	5	
Large Woody Debris (>10cm diam)	2	
Undercut Banks	18	
Instream Vegetation	0	
Overhanging Vegetation	40	
Deep Pools	30	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	30	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	30	
% cobble (64-256 mm) *btwn tennisball and basketball*	40	
% boulder (> 256 mm) *bigger than a basketball*	0	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Slight odour to water, recommend water testing.

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 18/ 07	**Photos:** 2880-Lk U/S and down from culvert
Surveyors Initials	KK,GG	2881-Lk U/S from culvert 2882-Lk X (LB to RB) 2883-Lk D/S from end of habitat
Location	Barren Creek U/S of culvert	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	11.7 23.7	without the inclusion of the culvert in the habitat unit inclusion of culvert
Habitat Unit Type *(i.e. pool, riffle or glide)*	riffle/pool	
Wetted Width (m)	5.1	
Bankfull Width (m)	7.6	est. due to lack of veg.
Max. Depth (at deepest point) (cm) (estimate if necessary)	38	
Depth at trap cluster location (cm) (estimate if necessary)	5	Water is much shallower then last trap date
Depth of riffle crest (at pool outlet) (if applicable)	20	
Residual Pool Depth (Max. depth minus depth at riffle crest)	18	
Total % of wetted area covered	10	
Cover % breakdown (adds to 100%)		
Cobble	1	
Boulder	1	
Small Woody Debris (<10cm diam)	0	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	0	
Deep Pools	98	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	28	very soft and unstable substrate
% gravel (2-64 mm) *btwn grain of sand and tennisball*	70	
% cobble (64-256 mm) *btwn tennisball and basketball*	1	
% boulder (> 256 mm) *bigger than a basketball*	1	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Flow is moderate
Banks are extremely unstable and in need of riparian veg. both up and down from highway. Rip rap could also be used.

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 18/ 07	**Photos:** 0475-Lk down from culvert 0476-Lk U/S from L bank D/S of riffle 0477-Lk X (R to L) / 0478-Lk X (L to R)
Surveyors Initials	KK, GG	
Location	Byman Creek d/s of highway 16 culvert	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	15.6	
Habitat Unit Type *(i.e. pool, riffle or glide)*	pool	
Wetted Width (m)	11.8	
Bankfull Width (m)	13.7	
Max. Depth (at deepest point) (cm) (estimate if necessary)	1.5	est. too deep
Depth at trap cluster location (cm) (estimate if necessary)	70	
Depth of riffle crest (at pool outlet) (if applicable)	15	
Residual Pool Depth (Max. depth minus depth at riffle crest)	1.35	est. too deep
Total % of wetted area covered	65	
Cover % breakdown (adds to 100%)		
Cobble	5	
Boulder	20	
Small Woody Debris (<10cm diam)	1	
Large Woody Debris (>10cm diam)	2	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	10	
Deep Pools	62	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	N/A	Water to silty to see substrate- not able to estimate.
% gravel (2-64 mm) *btwn grain of sand and tennisball*	N/A	
% cobble (64-256 mm) *btwn tennisball and basketball*	N/A	
% boulder (> 256 mm) *bigger than a basketball*	N/A	
% bedrock	N/A	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Could definitely use LWD to enhance cover for both juvenile and adult salmon and could be easily anchored to rip rap on R bank
Flow is moderate and it would be worth while to come back when water is clear to see substrate

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 18/ 07	**Photos:**	2878-Lk X (R bank to L)
		2875-Lk D/S from culvert	2879-Lk X (R bank to d/s)
Surveyors Initials	KK, GG	2876-Lk R bank to L	
		2877-Lk U/S from riffle	
Location	McQuarrie D/S culvert		

Site Measurements		**Comments**
Length of habitat unit (m)	12.2	from riffle to edge of culvert
e.g. riffle crest-crest, dam-dam, etc.	27.2	includes length of culvert
Habitat Unit Type *(i.e. pool, riffle or glide)*	pool	
Wetted Width (m)	7.8	
Bankfull Width (m)	8.8	
Max. Depth (at deepest point) (cm) (estimate if necessary)	95	
Depth at trap cluster location (cm) (estimate if necessary)	95	
Depth of riffle crest (at pool outlet) (if applicable)	25	
Residual Pool Depth (Max. depth minus depth at riffle crest)	70	
Total % of wetted area covered	40	
Cover % breakdown (adds to 100%)		
Cobble	28	
Boulder	2	
Small Woody Debris (<10cm diam)	0	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	2	
Deep Pools	70	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	50	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	28	
% cobble (64-256 mm) *btwn tennisball and basketball*	20	
% boulder (> 256 mm) *bigger than a basketball*	2	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Water is much clearer than the other sites and the flow is moderate
Photos 2878 and 2879 are of the Bulkley confluence with McQuarrie creek

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 18/ 07	**Photos:** 0479-Lk X L to R 0480-Lk D/S from L bank 0481-Lk U/S from L bank
Surveyors Initials	KK,GG	
Location	Richfield Creek under CN train bridge	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	25.4	drops into a pool on the D/S end blue ribbon on D/S boundary
Habitat Unit Type *(i.e. pool, riffle or glide)*	glide	
Wetted Width (m)	8.4	
Bankfull Width (m)	9.1	
Max. Depth (at deepest point) (cm) (estimate if necessary)	90	
Depth at trap cluster location (cm) (estimate if necessary)	90	
Depth of riffle crest (at pool outlet) (if applicable)	50	
Residual Pool Depth (Max. depth minus depth at riffle crest)	40	
Total % of wetted area covered	40	note: this was based on the entire habitat unit
Cover % breakdown (adds to 100%)		
Cobble	5	
Boulder	15	
Small Woody Debris (<10cm diam)	0	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	5	currently ice is providing additional cover
Instream Vegetation	0	
Overhanging Vegetation	5	
Deep Pools	70	not deep pool but deep glide
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	N/A	too silty, cannot estimate
% gravel (2-64 mm) *btwn grain of sand and tennisball*	N/A	
% cobble (64-256 mm) *btwn tennisball and basketball*	N/A	
% boulder (> 256 mm) *bigger than a basketball*	N/A	
% bedrock	N/A	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Bridge is providing overhead cover here and the flow is moderate

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 12/ 07	**Photos:** taken at U/S end of site where traps set in winter #0463- Looking U/S #0464- Looking D/S #0465- Looking X R to L
Surveyors Initials	NN, KK	
Location	Waterfalls Creek site #1	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	110*	beaver dam to beaver dam
Habitat Unit Type *(i.e. pool, riffle or glide)*	glide	toward D/S end of site it is much deeper
Wetted Width (m)	5.9	Measured at beaver dam
Bankfull Width (m)	5.9	
Max. Depth (at deepest point) (cm) (estimate if necessary)	100	at far D/S end of site just U/S of next dam
Depth at trap cluster location (cm) (estimate if necessary)	60	
Depth of riffle crest (at pool outlet) (if applicable)	N/A	
Residual Pool Depth (Max. depth minus depth at riffle crest)	N/A	
Total % of wetted area covered	90	
Cover % breakdown (adds to 100%)		
Cobble	0	
Boulder	0	
Small Woody Debris (<10cm diam)	5	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	5	
Instream Vegetation	0	
Overhanging Vegetation	10	
Deep Pools	80	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	100	highly organic
% gravel (2-64 mm) *btwn grain of sand and tennisball*		less than 1% of gravel just U/S of lower dam
% cobble (64-256 mm) *btwn tennisball and basketball*		
% boulder (> 256 mm) *bigger than a basketball*		
% bedrock		

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Flow level is moderate (full to banks and not overtopping beaver dams)
Blue ribbon hung to mark site location (left bank willow)
Blue ribbon also hung on tree near road (other side of D-sign) incase ribbon near stream is missing due to beavers
*Habitat unit length measured differently than last yr. This yr. the entire length b/t beaver dams was length of habitat unit.
referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 12/ 07	**Photos:** 0466- Looking U/S from beaver dam 0467- Looking X R to L from beaver dam 0468- Looking D/S from 10m U/S of dam
Surveyors Initials	NN, KK	
Location	Waterfalls Creek site #2	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	110	part of same haitat unit as site #1
Habitat Unit Type *(i.e. pool, riffle or glide)*	glide	
Wetted Width (m)	7.7	Measured just upstream of BD.
Bankfull Width (m)	7.7	
Max. Depth (at deepest point) (cm) (estimate if necessary)	100	
Depth at trap cluster location (cm) (estimate if necessary)	77	
Depth of riffle crest (at pool outlet) (if applicable)	N/A	
Residual Pool Depth (Max. depth minus depth at riffle crest)	N/A	
Total % of wetted area covered	90	
Cover % breakdown (adds to 100%)		
Cobble	0	
Boulder	0	
Small Woody Debris (<10cm diam)	5	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	5	
Instream Vegetation	0	
Overhanging Vegetation	10	
Deep Pools	80	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	100	
% gravel (2-64 mm) *btwn grain of sand and tennisball*		less than 1% gravel, just u/s of dam
% cobble (64-256 mm) *btwn tennisball and basketball*		
% boulder (> 256 mm) *bigger than a basketball*		
% bedrock		

Description of other habitat features, impacts or restoration opportunities

i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Both sites #1 and #2 are part of the same habitat unit which consists of a long glide dominated by beaver dams w/ deeper areas found on the U/S side of the dams

Beaver dam is breached. Some alluvials (gravels) are present just u/s of dam

Hung 2 blue ribbons on bank side to mark site and 1 ribbon near rd. in case others go missing due to beavers

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 12/ 07	**Photos:** 0469-Lk U/S from riffle at beaver dam (D/S end of pool) 0470-Lk X (R to L) near trap location 0471-Lk D/S from U/S end of pool (where 2 channels)
Surveyors Initials	NN, KK	
Location	Waterfalls Creek site #3	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	19	
Habitat Unit Type *(i.e. pool, riffle or glide)*	pool	D/S end at riffle to the point where the channel splits into two U/S
Wetted Width (m)	4.5	
Bankfull Width (m)	4.5	
Max. Depth (at deepest point) (cm) (estimate if necessary)	82	
Depth at trap cluster location (cm) (estimate if necessary)	82	
Depth of riffle crest (at pool outlet) (if applicable)	24	
Residual Pool Depth (Max. depth minus depth at riffle crest)	58	
Total % of wetted area covered	70	
Cover % breakdown (adds to 100%)		
Cobble	20	majority near R bank
Boulder	25	rip rap along R bank has fallen into channel
Small Woody Debris (<10cm diam)	3	
Large Woody Debris (>10cm diam)	0	
Undercut Banks	2	
Instream Vegetation	5	
Overhanging Vegetation	5	
Deep Pools	40	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	60	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	5	
% cobble (64-256 mm) *btwn tennisball and basketball*	15	
% boulder (> 256 mm) *bigger than a basketball*	20	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Blue ribbon hung on R bank willow to mark site
Good cover provided by boulder/ cobble along R bank

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

2006/2007 Overwintering Monitoring - Habitat Description Data

Date	April 12/ 07	**Photos:** 0472-Lk D/S from Rd. 0473-Lk X (R to L) 0474-Lk X and U/S from L bank
Surveyors Initials	NN, KK	
Location	Waterfalls Creek site #4	

Site Measurements		**Comments**
Length of habitat unit (m) *e.g. riffle crest-crest, dam-dam, etc.*	6.5	
Habitat Unit Type *(i.e. pool, riffle or glide)*	pool	
Wetted Width (m)	8.8	
Bankfull Width (m)	8.8	
Max. Depth (at deepest point) (cm) (estimate if necessary)	80	near L bank
Depth at trap cluster location (cm) (estimate if necessary)	78 58	(near L bank) trap location in March ' 07 (D/S of R culvert) trap location in Dec ' 06 and Feb ' 07
Depth of riffle crest (at pool outlet) (if applicable)	46	
Residual Pool Depth (Max. depth minus depth at riffle crest)	32	
Total % of wetted area covered	80	
Cover % breakdown (adds to 100%)		
Cobble	10	
Boulder	33	appears to be rip rap in the middle of the channel
Small Woody Debris (<10cm diam)	2	
Large Woody Debris (>10cm diam)	5	
Undercut Banks	0	
Instream Vegetation	0	
Overhanging Vegetation	15	
Deep Pools	35	
Bed Material (adds to 100%)		
% fines (< 2 mm) *grain of sand and smaller*	45	
% gravel (2-64 mm) *btwn grain of sand and tennisball*	5	
% cobble (64-256 mm) *btwn tennisball and basketball*	10	
% boulder (> 256 mm) *bigger than a basketball*	30	
% bedrock	0	

Description of other habitat features, impacts or restoration opportunities
i.e. beaver dams present, rap-rap present, needs LWD added, banks unstable, etc.

Rip rap in channel is providing cover
Hung blue ribbon to mark site (photo 0474 was also taken from this location)

referenced the Fish Habitat Assessment Procedure (http://www.for.gov.bc.ca/hfd/library/ffip/Johnston_NT1996.pdf)

Appendix 3
Fish Capture Data

Juvenile Capture and Sampling Summary

Location Barren Creek culvert (upstream sid
Date Nov 23,06
10:00am

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
	0		

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC

Comments: No fish in any of the traps.

Juvenile Capture and Sampling Summary

Location Barren Creek culvert (u/s side)
Date March 20,07

Species	No. Caugh	Min Ln (mm)	Max Ln (mm)
NFC	0		

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
							#DIV/0!
							#DIV/0!
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Comments: No fish in any of the traps.

Juvenile Capture and Sampling Summary

Location Byman Creek d/s culvert pool
Date Nov 23/06
10:55am

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	1	100	100
RB	9	83	128

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	RB	106	10.9		0.915185
MT	1	1	RB	119	14.6		0.866387
MT	1	1	RB	83	5.1		0.891941
MT	1	1	CO	100	10.6		1.06
MT	1	1	RB	114	13.9		0.93821
MT	1	1	RB	125	19.5		0.9984
MT	1	2	RB	115	13.4		0.881072
MT	1	2	RB	123	18.2		0.978039
MT	1	2	RB	128	22.7		1.08242
MT	1	3	RB	110	14.9		1.119459

Note: Fish look to be in good shape (ie. Fins look good).

Juvenile Capture and Sampling Summary

Location Byman Creek d/s culvert pool
Date Jan17,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	6	60	101
RB	19	80	129

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	60	1.8		0.833333
MT	1	2	CO	92	7.9		1.014527
MT	1	2	RB	80	5.5		1.074219
MT	1	2	RB	113	13.3		0.921757
MT	1	2	RB	85	6		0.977
MT	1	2	RB	123	19.5		1.047899
MT	1	2	RB	115	16.5		1.084902
MT	1	2	RB	120	14.7		0.850694
MT	1	2	CO	101	9.2		0.892943
MT	1	2	RB	121	18.4		1.038632
MT	1	2	RB	95	8.7		1.014725
MT	1	2	CO	89	5.8		0.822731
MT	1	2	RB	127	19.4		0.947089
MT	1	2	RB	123	23		1.235983
MT	1	2	RB	84	5.3		0.894207
MT	1	2	CO	80	5.6		1.09375
MT	1	2	RB	87	6.4		0.971901
MT	1	2	RB	129	20.5		0.954959
MT	1	2	RB	115	14.6		0.959974
MT	1	2	RB	115	13.7		0.900797
MT	1	2	RB	85	5.5		0.895583
MT	1	3	RB	94	8.7		1.047456
MT	1	3	CO	67	3.2		1.063961
MT	1	3	RB	121	15.1		0.852356
MT	1	3	RB	107	12.1		0.98772

Comment: Coho have scale loss and eroded fins.

0.976869

Juvenile Capture and Sampling Summary

Location Byman Creek d/s culvert pool
Date 21-Mar-07

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	0		
RB	12	71	121

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	RB	83	4.4		0.769517
MT	1	1	RB	81	6.4		1.204273
MT	1	1	RB	108	10.5		0.833524
MT	1	1	RB	88	6.8		0.99784
MT	1	1	RB	108	12.4		0.984352
MT	1	1	RB	81	5		0.940838
MT	1	1	RB	71	4		1.117596
MT	1	2	RB	121	18		1.016053
MT	1	2	RB	94	8.4		1.011337
MT	1	2	RB	92	7.8		1.001685
MT	1	2	RB	84	6.2		1.046053
MT	1	2	RB	114	15		1.012457
MT	1	3	NFC				
							0.983448

Comments: 1 RB from first trap had fungus on its adipose (white growth)
1 trap (#3) was out of current too much.

Juvenile Capture and Sampling Summary

Location McQuarrie culvert pool
Date Nov 23,06

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	13	48	120
RB	17	50	131

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	50	1.5		1.2
MT	1	1	CO	67	3.1		1.030712
MT	1	1	RB	92	8.2		1.053053
MT	1	1	CO	77	6.7		1.467583
MT	1	1	CO	58	2.1		1.076305
MT	1	1	RB	82	5.2		0.943109
MT	1	1	RB	97	8.2		0.89846
MT	1	1	RB	103	11.4		1.043261
MT	1	2	CO	48	1.5		1.356337
MT	1	2	RB	76	5.1		1.161795
MT	1	3	CO	71	3.4		0.949957
MT	1	3	CO	75	5.2		1.232593
MT	1	3	RB	69	4.3		1.308944
MT	1	3	CO	65	3.0		1.092399
MT	1	3	CO	120	17.9	scale dama	1.03588
MT	1	3	RB	72	3.8		1.01809
MT	1	3	RB	130	21.2		0.964952
MT	1	3	CO	65	2.7		0.983159
MT	1	3	RB	70	4.7		1.370262
MT	1	3	RB	131	21.7		0.965263
MT	1	3	RB	66	3.9		1.356541
MT	1	3	RB	77	6.2		1.358062
MT	1	3	CO	62	4.5		1.888154
MT	1	3	CO	72	4.9		1.3128
MT	1	3	CO	63	5.6		2.239579
MT	1	3	RB	88	11.6		1.702198
MT	1	3	RB	50	1.7		1.36
MT	1	3	RB	75	n/a		n/a
MT	1	3	RB	122	19.0		1.046343
MT	1	3	RB	77	5.7		1.248541

Comments: The trap which only captured 2 fish was damaged with a hole big enough that fish could have escaped.

1.319131 mean FCC coho <80 mm
1.272779 mean FCC RB <80 mm
1.07708 mean FCC RB >80 mm

Juvenile Capture and Sampling Summary

Location Richfield 1
Date Nov 23/06 11:30 am

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	10	58	75
RB	9	56	93

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	61	2.4		1.057357
MT	1	1	RB	79	5.1		1.034401
MT	1	1	CO	62	2.6		1.090934
MT	1	1	RB	70	3.7		1.078717
MT	1	1	CO	60	2.2		1.018519
MT	1	1	CO	75	4.8		1.137778
MT	1	2	CO	63	2.6		1.039805
MT	1	2	RB	81	5.6		1.053739
MT	1	2	RB	93	8.9		1.106474
MT	1	2	RB	78	5.6		1.18006
MT	1	2	CO	63	2.9		1.159782
MT	1	2	CO	64	2.6		0.991821
MT	1	2	CO	68	4.4		1.399349
MT	1	2	CO	73	4.5		1.156762
MT	1	2	RB	112	15.3		1.089024
MT	1	2	CO	58	2.9		1.486326
MT	1	2	RB	56	2		1.138848
MT	1	2	RB	84	6.6		1.113541
MT	1	2	RB	62	3.1		1.300728
MT	1	3	none				

1.153843

Juvenile Capture and Sampling Summary

Location Richfield 1 (under CN bridge)
Date Jan17,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	0		
RB	1	83	83

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	2	RB	83	n/a		
		3	NFC				

Comments: Lost half of trap 1 and no fish caught in trap 3.

Juvenile Capture and Sampling Summary

Location Groundwater Channel/Proctor Rd.
Date Dec19,2006

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	48	44	99

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	63	2.6		1.04
MT	1	1	CO	62	2.4		1.01
MT	1	1	CO	64	2.5		0.95
MT	1	1	CO	48	1.1		0.99
MT	1	1	CO	66	3.3		1.15
MT	1	1	CO	63	2.7		1.08
MT	1	1	CO	45	0.9		0.99
MT	1	1	CO	56	2.1		1.20
MT	1	1	CO	55	1.8		1.08
MT	1	1	CO	53	1.5		1.01
MT	1	1	CO	46	1.0		1.03
MT	1	1	CO	52	1.5		1.07
MT	1	1	CO	56	1.9		1.08
MT	1	1	CO	44	0.8		0.94
MT	1	1	CO	54	1.8		1.14
MT	1	1	CO	59	2.3		1.12
MT	1	1	CO	61	2.7		1.19
MT	1	1	CO	46	1.0		1.03
MT	1	1	CO	45	1.1		1.21
MT	1	1	CO	51	1.6		1.21
MT	1	1	CO	50	1.3		1.04
MT	1	1	CO	49	1.1		0.93
MT	1	1	CO	47	1.0		0.96
MT	1	1	CO	62	2.9		1.22
MT	1	1	CO	78	5.6		1.18
MT	1	1	CO	99	10.1		1.04
MT	1	1	CO	54	1.6		1.02
MT	1	1	CO	49	1.4		1.19
MT	1	1	CO	66	3.3		1.15
MT	1	1	CO	46	1.1		1.13
MT	1	1	CO	50	1.2		0.96
MT	1	1	CO	48	1.1		0.99
MT	1	1	CO	51	1.2		0.90
MT	1	1	CO	55	1.6		0.96
MT	1	1	CO	93	8.4		1.04
MT	1	1	CO	62	2.0		0.84
MT	1	1	CO	54	1.7		1.08
MT	1	1	CO	45	1.1		1.21
MT	1	1	CO	48	1.1		0.99
MT	1	1	CO	57	1.4		0.76
MT	1	2	CO	45	1.1		1.21
MT	1	3	NA				

1.06 Mean FCC
1.06 Mean FCC < 80 mm

Comments:

MT2: Fish may have escaped from this trap since the mesh was pulled back a little.
7 extra coho were captured in trap 1
MT3:This trap was frozen half above water level - hence no fish captured.

Juvenile Capture and Sampling Summary

Location Groundwater Channel Proctor Rd.
Date Feb.21,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	38	44	60

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	48			0.00
MT	1	1	CO	45			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	52			0.00
MT	1	1	CO	45			0.00
MT	1	1	CO	50			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	46			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	50			0.00
MT	1	1	CO	46			0.00
MT	1	1	CO	46			0.00
MT	1	1	CO	46			0.00
MT	1	1	CO	52			0.00
MT	1	1	CO	54			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	50			0.00
MT	1	1	CO	53			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	60			0.00
MT	1	1	CO	49			0.00
MT	1	1	CO	46			0.00
MT	1	1	CO	49			0.00
MT	1	1	CO	49			0.00
MT	1	1	CO	44			0.00
MT	1	1	CO	44			0.00
MT	1	1	CO	47			0.00
MT	1	1	CO	45			0.00
MT	1	1	CO	48			0.00
MT	1	1	CO	45			0.00
MT	1	1	CO	53			0.00
MT	1	1	CO	47			0.00
MT	1	2	CO	50			0.00

Comments: Balances not working

Juvenile Capture and Sampling Summary

Location Groundwater Channel Proctor Rd.
Date 28-Mar-07

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	72	42	80

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	50	1.5		1.20
MT	1	1	CO	59	1.9		0.93
MT	1	1	CO	58	1.5		0.77
MT	1	1	CO	65	3.2		1.17
MT	1	1	CO	49	1.1		0.93
MT	1	1	CO	60	2.3		1.06
MT	1	1	CO	50	1.0		0.80
MT	1	1	CO	46	1.1		1.13
MT	1	1	CO	48			0.00
MT	1	1	CO	48	1.3		1.18
MT	1	1	CO	48	1.1		0.99
MT	1	1	CO	46	1.0		1.03
MT	1	1	CO	68	3.7		1.18
MT	1	1	CO	63	1.9		0.76
MT	1	1	CO	50	1.3		1.04
MT	1	1	CO	42	0.9		1.21
MT	1	1	CO	49	1.1		0.93
MT	1	1	CO	53	1.1		0.74
MT	1	1	CO	48			0.00
MT	1	1	CO	50	1.4		1.12
MT	1	1	CO	60	2.5		1.16
MT	1	1	CO	55	2.0		1.20
MT	1	1	CO	80	5.5		1.07
MT	1	1	CO	52			0.00
MT	1	1	CO	56	1.5		0.85
MT	1	1	CO	53	1.6		1.07
MT	1	1	CO	56	2.0		1.14
MT	1	1	CO	49	1.3		1.10
MT	1	1	CO	54	1.9		1.21
MT	1	1	CO	52	0.9		0.64
MT	1	1	CO	59	2.0		0.97
MT	1	1	CO	53	1.6		1.07
MT	1	1	CO	43	1.3		1.64

1.01 Mean

Comments:
Trap 1: 11 coho not sampled
Trap 2: 11 coho not sampled
Trap 3: 20 coho not sampled

Juvenile Capture and Sampling Summary

Location Hydropole 12
Date 28-Mar-07

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CT	4	79	140
CO	1	69	69

Individual Sampling Data

Capture M	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CT	80	4.2		0.82
MT	1	2	CO	69	2.6		0.79
MT	1	2	CT	79	4		0.81
MT	1	2	CT	89	5.6		0.79
MT	1	2	CT	140	25		0.91

Juvenile Capture and Sampling Summary

Location Waterfalls #1
Date Dec13,2006

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	169	42	113
CT	1	126	126
DV	9	85	149

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	42	0.9		1.21
MT	1	1	CO	46	1.0		1.03
MT	1	1	CO	46	1.0		1.03
MT	1	1	CO	49	1.2		1.02
MT	1	1	CO	52	1.5		1.07
MT	1	1	CO	54	1.7		1.08
MT	1	1	CO	55	1.8		1.11
MT	1	1	CO	55	1.7		1.02
MT	1	1	CO	57	2.0		1.08
MT	1	1	CO	57	1.8		0.97
MT	1	1	CO	58	1.9		0.97
MT	1	1	CO	58	2.0		1.03
MT	1	1	CO	59	2.1		1.04
MT	1	1	CO	59	2.1		1.02
MT	1	1	CO	60	2.1		0.99
MT	1	1	CO	60	2.7		1.25
MT	1	1	CO	61	2.5		1.10
MT	1	1	CO	62	2.7		1.13
MT	1	1	CO	63	2.6		1.02
MT	1	1	CO	64	2.6		0.97
MT	1	1	CO	64	2.8		1.07
MT	1	1	CO	65	2.9		1.06
MT	1	1	CO	65	2.9		1.06
MT	1	1	CO	65	3.2		1.17
MT	1	1	CO	65	3.1		1.13
MT	1	1	CO	65	3.0		1.09
MT	1	1	CO	67	3.3		1.10
MT	1	1	CO	67	2.9		0.96
MT	1	1	CO	70	3.7		1.08
MT	1	1	CO	75	4.4		1.04
MT	1	1	CO	75	4.5		1.07
MT	1	1	CO	75	4.1		0.97
MT	1	1	CO	78	5.0		1.05
MT	1	1	CO	80	5.4		1.05
MT	1	1	CO	80	5.6		1.09
MT	1	1	CO	81	5.8		1.09
MT	1	1	CO	81	5.3		1.00
MT	1	1	CO	82	5.4		0.98

MT	1	1	CO	85	6.2		1.01
MT	1	1	CO	91	7.3		0.97
MT	1	1	CO	91	8.4		1.11
MT	1	1	CO	105	12.5		1.08
MT	1	1	CO	110	11.6		0.87
MT	1	1	CO	113	13.5		0.94
MT	1	2	CT	126	17.8		0.89
MT	1	2	DV	149	26.1		0.79
MT	1	2	DV	110	12.1		0.91
MT	1	2	DV	85	6.1		0.99
MT	1	2	DV	110	9.7		0.73
MT	1	2	DV	90	7.8		1.07
MT	1	2	DV	95	8.3		0.97
MT	1	3	DV	120	16.2		0.94
MT	1	3	DV	110	8.7		0.65
MT	1	3	DV	86	n/a		

Comments: 1 fish with shredded tail

Juvenile Capture and Sampling Summary

Location Waterfalls 1
Date Jan. 19/2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	226	42	73
CT	2	69	92

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC	
MT	1	1	CO	42	0.6		0.81	
MT	1	1	CO	42	0.9		1.21	
MT	1	1	CO	43	1		1.26	
MT	1	1	CO	43	0.8		1.01	
MT	1	1	CO	44	1		1.17	
MT	1	1	CO	46	0.8		0.82	
MT	1	1	CO	46	0.9		0.92	
MT	1	1	CO	46	1		1.03	
MT	1	1	CO	46	0.8		0.82	
MT	1	1	CO	47	1		0.96	
MT	1	1	CO	47	1.2		1.16	
MT	1	1	CO	47	1.1		1.06	
MT	1	1	CO	48	1.1		0.99	
MT	1	1	CO	48	1.2		1.09	
MT	1	1	CO	50	2		1.60	
MT	1	1	CO	50	1.4		1.12	
MT	1	1	CO	50	1.2		0.96	
MT	1	1	CO	50	1.5		1.20	
MT	1	1	CO	51	1.4		1.06	
MT	1	1	CO	51	1.4		1.06	
MT	1	1	CO	51	1.1		0.83	
MT	1	1	CO	54	1.5		0.95	
MT	1	1	CO	58	1.9		0.97	
MT	1	1	CO	62	2.3		0.97	
MT	1	1	CO	63	2.7		1.08	
MT	1	1	CO	63	2.5		1.00	
MT	1	1	CO	63	2.4		0.96	
MT	1	1	CO	67	3.7		1.23	
MT	1	1	CO	69	3.6		1.10	
MT	1	1	CO	73	3.9		1.00	1.05
MT	1	2	CT	69	2.9		0.88	
MT	1	3	CT	92	7.2		0.92	

Comments: Trap 1: 29 more coho
Trap 2: 75 more coho
Trap 3: 92 more coho

Juvenile Capture and Sampling Summary

Location Waterfalls #1
Date Mar22,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	155	43	83
RB	0		
DV	0		

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
GT	1	1	CO	43	1.0	n/a	1.26
GT	1	1	CO	45	1.2	n/a	1.32
GT	1	1	CO	46	1.3	n/a	1.34
GT	1	1	CO	46	1.3	n/a	1.34
GT	1	1	CO	47	0.9	n/a	0.87
GT	1	1	CO	47	1.2	n/a	1.16
GT	1	1	CO	48	1.2	n/a	1.09
GT	1	1	CO	49	2.0	n/a	1.70
GT	1	1	CO	50	1.5	n/a	1.20
GT	1	1	CO	50	1.3	n/a	1.04
GT	1	1	CO	51	1.3	n/a	0.98
GT	1	1	CO	52	1.5	n/a	1.07
GT	1	1	CO	53	1.4	n/a	0.94
GT	1	1	CO	54	1.6	n/a	1.02
GT	1	1	CO	55	1.8	n/a	1.08
GT	1	1	CO	59	2.1	n/a	1.02
GT	1	1	CO	59	2.3	n/a	1.12
GT	1	1	CO	59	2.2	n/a	1.07
GT	1	1	CO	62	2.9	n/a	1.22
GT	1	1	CO	62	2.5	n/a	1.05
GT	1	1	CO	64	2.7	n/a	1.03
GT	1	1	CO	65	2.5	n/a	0.91
GT	1	1	CO	67	3.3	n/a	1.10
GT	1	1	CO	67	2.9	n/a	0.96
GT	1	1	CO	69	3.5	n/a	1.07
GT	1	1	CO	70	3.3	n/a	0.96
GT	1	1	CO	71	3.6	n/a	1.01
GT	1	1	CO	75	4.4	n/a	1.04
GT	1	1	CO	81	5.1	n/a	0.96
GT	1	1	CO	83	5.5	n/a	0.96

Comments: some coho with eroded operculums; NO DV CAPTURED!!! 1.10
Trap 1: 18 coho not sampled
Trap 2: 50 coho not sampled 0.96
Trap 3: 57 coho not sampled.

Juvenile Capture and Sampling Summary

Location Waterfalls #2
Date Dec 13,2006

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	221	41	102
DV	6	112	157
CT	1	154	154

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	41	0.7		1.02
MT	1	1	CO	44	0.8		0.94
MT	1	1	CO	47	1.1		1.06
MT	1	1	CO	47	1.1		1.06
MT	1	1	CO	47	0.7		0.67
MT	1	1	CO	47	1.0		0.96
MT	1	1	CO	49	1.3		1.10
MT	1	1	CO	50	1.2		0.96
MT	1	1	CO	50	1.2		0.96
MT	1	1	CO	51	1.3		0.98
MT	1	1	CO	53	1.7		1.14
MT	1	1	CO	56	1.9		1.08
MT	1	1	CO	60	2.3		1.06
MT	1	1	CO	60	2.1		0.97
MT	1	1	CO	60	2.3		1.06
MT	1	1	CO	60	2.3		1.06
MT	1	1	CO	60	2.0		0.93
MT	1	1	CO	62	2.5		1.05
MT	1	1	CO	63	3.0		1.20
MT	1	1	CO	68	3.2		1.02
MT	1	1	CO	74	4.3		1.06
MT	1	1	CO	76	4.4		1.00
MT	1	1	CO	76	4.7		1.07
MT	1	1	CO	77	4.8		1.05
MT	1	1	CO	78	4.8		1.01
MT	1	1	CO	80	5.3		1.04
MT	1	1	CO	81	6.4		1.20
MT	1	1	CO	83	5.9		1.03
MT	1	1	CO	83	6.1		1.07
MT	1	1	CO	84	6.7		1.13
MT	1	1	CO	85	6.5		1.06
MT	1	1	CO	86	6.1		0.96
MT	1	1	CO	89	6.8		0.96
MT	1	1	CO	90	6.8		0.93
MT	1	2	CO	96	9.0		1.02
MT	1	1	CO	102	10.5		0.99
MT	1	1	DV	137	23.5		0.91
MT	1	1	DV	123	17.6		0.95

MT	1	1	DV	121	17.8		1.00
MT	1	1	DV	140	26.2		0.95
MT	1	2	DV	157	46.9		1.21
MT	1	2	DV	112	13.5		0.96
MT	1	1	CT	154	33.0		0.90

Juvenile Capture and Sampling Summary

Location Waterfalls 2
Date Jan. 19/07

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	200	41	102
DV	1	125	125

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	41	0.6		0.87
MT	1	1	CO	45	0.9		0.99
MT	1	1	CO	47	1.5		1.44
MT	1	1	CO	51	1.7		1.28
MT	1	1	CO	53	1.5		1.01
MT	1	1	CO	61	1.6		0.70
MT	1	1	CO	63	2.7		1.08
MT	1	1	CO	72	3.8		1.02
MT	1	1	CO	73	3.8		0.98
MT	1	1	CO	75	6.3		1.49
MT	1	1	CO	75	4.4		1.04
MT	1	1	CO	75	4.7		1.11
MT	1	1	CO	78	4.9		1.03
MT	1	1	CO	81	5.6		1.05
MT	1	1	CO	81	5.2		0.98
MT	1	1	CO	81	5.7		1.07
MT	1	1	CO	83	5.5		0.96
MT	1	1	CO	85	5.9		0.96
MT	1	1	CO	85	6.1		0.99
MT	1	1	CO	86	6.3		0.99
MT	1	1	CO	93	7.7		0.96
MT	1	1	CO	94	8.4		1.01
MT	1	1	CO	102	10.1		0.95
MT	1	1	CO	80	Scale Frozen		#REF!
MT	1	1	CO	56	Scale Frozen		#REF!
MT	1	1	CO	62	Scale Frozen		#REF!
MT	1	1	CO	81	Scale Frozen		#REF!
MT	1	1	CO	55	Scale Frozen		#REF!
MT	1	1	CO	49	Scale Frozen		#REF!
MT	1	1	CO	90	Scale Frozen		#REF!
MT	1	1	DV	125			0.00
MT	1	2	No Sampling Done				
MT	1	3	No Sampling Done				

Comments:

Trap 1: 21 more Coho 0.99
Trap 2: 63 more Coho 1.08
Trap 3: 86 more Coho

Juvenile Capture and Sampling Summary

Location Waterfalls #2
Date March22,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	85	40	94
DV	5	87	105

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
GT	1	1	CO	40	1.1	n/a	1.72
GT	1	1	CO	40	0.9	n/a	1.41
GT	1	1	CO	41	n/a	n/a	n/a
GT	1	1	CO	42	1.2	n/a	1.62
GT	1	1	CO	44	0.6	n/a	0.70
GT	1	1	CO	44	n/a	n/a	n/a
GT	1	1	CO	45	0.9	n/a	0.99
GT	1	1	CO	45	1.0	n/a	1.10
GT	1	1	CO	47	1.1	n/a	1.06
GT	1	1	CO	47	1.3	n/a	1.25
GT	1	1	CO	49	1.5	n/a	1.27
GT	1	1	CO	53	n/a	n/a	n/a
GT	1	1	CO	55	1.8	n/a	1.08
GT	1	1	CO	67	3.3	n/a	1.10
GT	1	1	CO	72	3.5	n/a	0.94
GT	1	1	CO	75	3.9	n/a	0.92
GT	1	1	CO	75	4.5	n/a	1.07
GT	1	1	CO	75	4.5	n/a	1.07
GT	1	1	CO	76	4.4	n/a	1.00
GT	1	1	CO	82	4.9	n/a	0.89
GT	1	1	CO	82	5.2	n/a	0.94
GT	1	1	CO	83	5.5	n/a	0.96
GT	1	1	CO	84	6.4	n/a	1.08
GT	1	1	CO	84	6.1	n/a	1.03
GT	1	1	CO	85	6.2	n/a	1.01
GT	1	1	CO	86	6.3	n/a	0.99
GT	1	1	CO	87	6.1	n/a	0.93
GT	1	1	CO	88	6.1	n/a	0.90
GT	1	1	CO	88	6.5	n/a	0.95
GT	1	1	CO	94	7.7	n/a	0.93
GT	1	2	DV	102	10.4	n/a	0.98
GT	1	2	DV	87	5.6	n/a	0.85
GT	1	3	DV	105	10.1	n/a	0.87
GT	1	3	DV	131	17.7	n/a	0.79
GT	1	3	DV	103	9.9	n/a	0.91

Comments: Trap #2 had 2 right maxillary clips; Trap #3 had 2 right maxillary clips
Trap 1: 13 coho not sampled
Trap 2: 22 coho not sampled
Trap 3: 20 coho not sampled

Juvenile Capture and Sampling Summary

Location Waterfalls Creek Site #3
Date Dec13,2006

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	93	50	110
DV	1	110	110

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	2	CO	50	1.5		1.20
MT	1	2	CO	50	1.4		1.12
MT	1	2	CO	53	1.4		0.94
MT	1	2	CO	55	1.6		0.96
MT	1	2	CO	62	2.3		0.97
MT	1	2	CO	63	2.4		0.96
MT	1	2	CO	68	3.2		1.02
MT	1	2	CO	70	3.4		0.99
MT	1	1	CO	72	3.7		0.99
MT	1	2	CO	74	4.0		0.99
MT	1	1	CO	75	4.2		1.00
MT	1	2	CO	75	4.0		0.95
MT	1	2	CO	75	3.9		0.92
MT	1	2	CO	75	4.3		1.02
MT	1	1	CO	79	4.8		0.97
MT	1	2	CO	79	4.7		0.95
MT	1	2	CO	80	4.9		0.96
MT	1	2	CO	80	4.8		0.94
MT	1	2	CO	80	5.0		0.98
MT	1	2	CO	80	5.0		0.98
MT	1	2	CO	80	5.7		1.11
MT	1	2	CO	82	5.4		0.98
MT	1	2	CO	83	5.4		0.94
MT	1	2	CO	84	6.1		1.03
MT	1	2	CO	84	6.0		1.01
MT	1	2	CO	87	6.3		0.96
MT	1	2	CO	90	8.1		1.11
MT	1	2	CO	92	8.5		1.09
MT	1	2	CO	104	10.4		0.92
MT	1	2	CO	105	11.0		0.95
MT	1	2	CO	105	12.2		1.05
MT	1	1	CO	110	10.1		0.76
MT	1	1	DV	110	13.1		0.98

Juvenile Capture and Sampling Summary

Location
Date

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	66	50	94
DV	19	87	160

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	73			
MT	1	1	CO	84			
MT	1	1	CO	83			
MT	1	1	CO	86			
MT	1	1	CO	75			
MT	1	1	CO	50			
MT	1	1	CO	72			
MT	1	1	CO	55			
MT	1	1	CO	84			
MT	1	1	DV	124			
MT	1	1	DV	130			
MT	1	2	CO	92			
MT	1	2	CO	75			
MT	1	2	CO	82			
MT	1	2	CO	57			
MT	1	2	CO	81			
MT	1	2	CO	72			
MT	1	2	CO	63			
MT	1	2	CO	68			
MT	1	2	CO	77			
MT	1	2	CO	82			
MT	1	2	CO	64			
MT	1	2	CO	76			
MT	1	2	CO	81			
MT	1	2	DV	148	Fish in Stomach		
MT	1	2	DV	124	chipped tail - fish in stomach		
MT	1	2	DV	136			
MT	1	2	DV	95			
MT	1	2	CO	78			
MT	1	2	CO	85			
MT	1	2	CO	94			
MT	1	2	CO	63			
MT	1	2	CO	70			
MT	1	2	CO	84			
MT	1	2	CO	90			
MT	1	2	CO	83			
MT	1	2	DV	127	Fish in Stomach		
MT	1	2	DV	147			

MT	1	2	DV	160	Fish in Stomach		
MT	1	2	DV	154			
MT	1	2	DV	150			
MT	1	2	DV	117			
MT	1	2	DV	117			
MT	1	2	DV	119			
MT	1	2	DV	120			
MT	1	2	DV	87			
MT	1	2	DV	106			
MT	1	3	DV	122			
MT	1	3	DV	93			

Comments: Scale not working
Coho in mouth of Dolly was 57 mm (the Dolly was 148 mm)
Trap 2: 3 more coho
Trap 3: 33 more coho

Juvenile Capture and Sampling Summary

Location Waterfalls #3
Date Mar22,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	36	48	96
DV	44	87	147

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
GT	1	2	CO	48	1.1	n/a	0.99
GT	1	1	CO	55	1.8	n/a	1.08
GT	1	2	CO	58	2.0	RMAX	1.03
GT	1	2	CO	59	2.3	n/a	1.12
GT	1	2	CO	61	2.5	RMAX	1.10
GT	1	2	CO	66	3.0	RMAX	1.04
GT	1	1	CO	69	3.0	RMAX	0.91
GT	1	3	CO	71	3.3	n/a	0.92
GT	1	2	CO	74	4.3	n/a	1.06
GT	1	3	CO	74	4.2	n/a	1.04
GT	1	3	CO	76	4.4	RMAX	1.00
GT	1	1	CO	77	5.4	n/a	1.18
GT	1	1	CO	78	4.8	n/a	1.01
GT	1	1	CO	78	4.2	RMAX	0.89
GT	1	2	CO	78	5.1	n/a	1.07
GT	1	3	CO	79	5.2	n/a	1.05
GT	1	1	CO	80	5.2	n/a	1.02
GT	1	3	CO	80	4.9	n/a	0.96
GT	1	1	CO	82	5.5	n/a	1.00
GT	1	2	CO	82		n/a	0.00
GT	1	2	CO	83	6.0	n/a	1.05
GT	1	3	CO	83	6.1	n/a	1.07
GT	1	1	CO	84	6.2	n/a	1.05
GT	1	2	CO	84	5.9	n/a	1.00
GT	1	2	CO	85		n/a	0.00
GT	1	1	CO	86	6.0	n/a	0.94
GT	1	2	CO	87	6.9	n/a	1.05
GT	1	3	CO	90	6.8	n/a	0.93
GT	1	1	CO	91	7.2	n/a	0.96
GT	1	2	CO	96	8.4	RMAX	0.95
GT	1	1	DV	120	16.0	n/a	0.93
GT	1	1	DV	146	26.8	n/a	0.86
GT	1	3	DV	131	19.9	n/a	0.89
GT	1	1	DV	122	16.5	n/a	0.91
GT	1	1	DV	147	27.5	n/a	0.87
GT	1	2	DV	100	8.7	n/a	0.87
GT	1	2	DV	106	10.5	n/a	0.88
GT	1	2	DV	137	20.5	n/a	0.80

GT	1	2	DV	94	8.2	n/a	0.99
GT	1	2	DV	135	20.0	n/a	0.81
GT	1	2	DV	121	14.9	n/a	0.84
GT	1	2	DV	125	17.0	n/a	0.87
GT	1	2	DV	125	17.2	n/a	0.88
GT	1	2	DV	110	12.6	n/a	0.95
GT	1	2	DV	95	8.1	n/a	0.94
GT	1	2	DV	97	8.7	n/a	0.95
GT	1	2	DV	116	13.3	n/a	0.85
GT	1	2	DV	87	5.9	n/a	0.90
GT	1	2	DV	123	15.0	n/a	0.81
GT	1	2	DV	108	12.1	n/a	0.96
GT	1	2	DV	123	15.4	n/a	0.83
GT	1	2	DV	96	8.9	n/a	1.01
GT	1	2	DV	90	7.0	n/a	0.96
GT	1	2	DV	114	13.2	n/a	0.89
GT	1	2	DV	137	22.8	n/a	0.89
GT	1	2	DV	105	10.5	n/a	0.91
GT	1	2	DV	102	9.9	n/a	0.93
GT	1	2	DV	128	20.3	n/a	0.97
GT	1	2	DV	142	23.8	n/a	0.83
GT	1	2	DV	135	19.6	n/a	0.80

Comment: DV at this site with CO inside of them.

Juvenile Capture and Sampling Summary

Location Waterfalls #4
Date Dec13,2006

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	41	55	98

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	55	1.7		1.02
MT	1	1	CO	56	1.8		1.02
MT	1	1	CO	57	2.1		1.13
MT	1	1	CO	60	2.5		1.16
MT	1	1	CO	61	2.5		1.10
MT	1	1	CO	61	2.5		1.10
MT	1	2	CO	61	2.5		1.10
MT	1	1	CO	63	2.7		1.08
MT	1	1	CO	63	2.7		1.08
MT	1	1	CO	64	2.7		1.03
MT	1	1	CO	65	2.9		1.06
MT	1	2	CO	65	2.8		1.02
MT	1	1	CO	67	3.2		1.06
MT	1	1	CO	67	3.3		1.10
MT	1	1	CO	69	3.4		1.03
MT	1	1	CO	72	3.8		1.02
MT	1	1	CO	77	4.8		1.05
MT	1	1	CO	78	4.7		0.99
MT	1	1	CO	79	5.1		1.03
MT	1	1	CO	80	4.5		0.88
MT	1	1	CO	81	5.4		1.02
MT	1	1	CO	84	6.1		1.03
MT	1	2	CO	87	6.8		1.03
MT	1	1	CO	88	6.9		1.01
MT	1	1	CO	88	7.0		1.03
MT	1	2	CO	89	7.6		1.08
MT	1	1	CO	90	7.6		1.04
MT	1	2	CO	91	7.4		0.98
MT	1	1	CO	92	8.6		1.10
MT	1	1	CO	94	8.5		1.02
MT	1	1	CO	97	9.6		1.05
MT	1	1	CO	98	9.6		1.02

Comments:
Trap 2: 9 extra coho captured.

Juvenile Capture and Sampling Summary

Location Waterfalls#4
Date Jan. 19/2007

Species	No. Caugh	Min Ln (mm)	Max Ln (mm)
CO	37	47	102
DV	4	117	178

Individual Sampling Data

Capture Meth	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
MT	1	1	CO	90			
MT	1	1	CO	58			
MT	1	1	CO	47			
MT	1	1	CO	61			
MT	1	1	CO	81			
MT	1	1	CO	99			
MT	1	1	CO	95			
MT	1	1	CO	80			
MT	1	1	CO	82			
MT	1	1	CO	102			
MT	1	1	CO	99			
MT	1	1	CO	81			
MT	1	1	CO	70			
MT	1	1	CO	61			
MT	1	1	CO	55			
MT	1	1	CO	61			
MT	1	1	CO	77			
MT	1	1	CO	84			
MT	1	1	CO	85			
MT	1	1	CO	51			
MT	1	1	CO	52			
MT	1	2	CO	81			
MT	1	2	CO	85			
MT	1	2	CO	85			
MT	1	3	CO	65			
MT	1	3	CO	67			
MT	1	3	CO	70			
MT	1	3	CO	97			
MT	1	3	CO	81			
MT	1	3	CO	101			
MT	1	3	DV	178	Fish in stomach		
MT	1	3	DV	171	Fish in stomach		
MT	1	3	DV	140			
MT	1	3	DV	117			

Comments: Scales not working
Trap 3: 7 Coho not sampled

Juvenile Capture and Sampling Summary

Location Waterfalls Creek #4
Date March 22,2007

Species	No. Caught	Min Ln (mm)	Max Ln (mm)
CO	74	48	105
DV	3	123	136

Individual Sampling Data

Capture Method	Cluster #	Trap #	Species	FL(mm)	Weight(g)	Mark type	FCC
GT	1	1	CO	48	0.9	n/a	0.81
GT	1	1	CO	54	2.0	n/a	1.27
GT	1	1	CO	56	1.6	n/a	0.91
GT	1	2	CO	58	2.1	n/a	1.08
GT	1	2	CO	61	2.2	n/a	0.97
GT	1	2	CO	61	2.1	n/a	0.93
GT	1	1	CO	62	1.5	n/a	0.63
GT	1	2	CO	62	2.6	n/a	1.09
GT	1	1	CO	65	2.3	n/a	0.84
GT	1	2	CO	66	2.8	n/a	0.97
GT	1	1	CO	67	3.7	n/a	1.23
GT	1	1	CO	70	2.9	n/a	0.85
GT	1	1	CO	71	3.3	n/a	0.92
GT	1	1	CO	74	5.1	n/a	1.26
GT	1	1	CO	76	5.4	n/a	1.23
GT	1	2	CO	76	4.9	n/a	1.12
GT	1	1	CO	80	4.6	n/a	0.90
GT	1	1	CO	80	4.6	n/a	0.90
GT	1	1	CO	84	5.6	n/a	0.94
GT	1	2	CO	84	5.2	n/a	0.88
GT	1	1	CO	85	5.6	n/a	0.91
GT	1	1	CO	85	5.4	n/a	0.88
GT	1	2	CO	85	6.0	n/a	0.98
GT	1	2	CO	85	5.9	n/a	0.96
GT	1	1	CO	90	6.5	n/a	0.89
GT	1	2	CO	92	8.3	n/a	1.07
GT	1	1	CO	94	7.0	n/a	0.84
GT	1	1	CO	96	7.9	n/a	0.89
GT	1	1	CO	97	7.0	n/a	0.77
GT	1	2	CO	105	10.1	n/a	0.87
GT	1	2	DV	123	15.1	n/a	0.81
GT	1	2	DV	136	22.2	n/a	0.88
GT	1	2	DV	128	16.9	n/a	0.81

Trap 2: 21 extra coho captured
Trap 3: 23 extra coho captured