Lower Bridge River Aquatic Monitoring
Year 2003 Data Report

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Report Summary

On 1 August 2000 a continuous flow regime was initiated from Terzaghi Dam, located at the eastern end of Carpenter Lake, to improve conditions of fish habitat in the Lower Bridge River. Questions concerning the effects of the increased flows on the river led to a baseline study designed to monitor physical conditions below Terzaghi Dam before and after the flow release. This monitoring program, which began in 1996, is scheduled to continue at a minimum until 2004, and has become part of a proposed 16-year long flow experiment under the Water Use Plan.

The main purpose of the monitoring program in 2003 was to examine the influence of the water release from Terzaghi Dam on fish resources and the aquatic environment in reaches 2, 3 and 4 of the Lower Bridge River. This report summarizes the results of data gathered from this program during 2003.

As part of the monitoring program, three general monitoring activities were conducted: 1) continuous monitoring of water stage, water temperature and light intensity; 2) seasonal sampling for assessment of water chemistry parameters, periphyton accrual, macroinvertebrate abundance, and juvenile salmonid growth; 3) a fall standing stock survey to estimate relative productivity of fish populations.

As reported in 2001 and 2002, data collected during 2003 indicate that the continuous flow release from Carpenter Reservoir has altered the physical habitat conditions of the Lower Bridge River by enlarging the wetted area of the channel, modifying the water temperature regime, and varying the river hydraulics. Since 1 August 2000, changes in hydraulic and physical conditions resulting from the flow release were most apparent in reaches 3 and 4 of the study area. Differences in channel morphology combined with the influence of the Yalakom River inflow buffered the effects in Reach 2.

Water chemistry parameters recorded in 2003 were within the guidelines established for the Province of British Columbia. Differences in most of the parameters between years could not be readily distinguished from natural variability. However, unusually high levels of Ammonium were recorded at sites in reaches 2 and 3 during September 2003. The cause of these elevated values was not determined. Another notable difference is the change in TP turbidity. The spatial gradient of TP turbidity values apparent prior to the flow release was inverted after the introduction of reservoir water. Since the release, higher levels have been recorded in reaches 3 and 4, than in Reach 2.

Analysis of fish growth data provided a comparison of mean fish sizes in each reach through the seasons, and enabled the assignment of age-classes to captured fish. In general, the mean forklength and weight of juvenile salmonids, particularly age-0+ chinook and age-0+ and age-1 rainbow trout, tends to be slightly greater in reaches 3 and 4 than in Reach 2, as noted in previous reports.

Fish density (standing stock) data collected in 2003 revealed both similarities and differences in the spatial distribution and relative abundance of fish when compared to data from previous study years. For the first time since initiation of the flow release, the highest mean biomass estimate was in Reach 4. As in most years, the mean biomass estimate in Reach 3 was higher than in Reach 2. The high estimate in Reach 4 indicates significant use of habitats made available since the flow release for spawning and rearing by salmonid species, as well as recolonization of this reach by larger fish (e.g., age-2 rainbow trout) from areas further downstream.

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1.0 INTRODUCTION

1.1 Background

The Bridge River below Terzaghi Dam supports populations of salmon and steelhead, and enters the Fraser River near Lillooet, BC. Following the construction of diversion tunnels in 1960, Bridge River water, stored in Carpenter Reservoir above the dam, was completely diverted through Mission Mountain to powerhouses in the Seton-Anderson watershed. As a result, a section of the river channel (approximately 4.2 km) immediately below the dam was dewatered, except during periodic spill events related to flood control. Downstream of this dewatered section, the contribution of tributary and groundwater sources resulted in river discharge that was 1% of mean annual discharge prior to regulation.

In response to concerns about impacts to the aquatic ecosystem related to the flow diversion, BC Hydro, Fisheries and Oceans Canada, and the Provincial Ministry of Environment engaged in discussions regarding appropriate flow regimes to provide fish habitat downstream from the base of the dam. Agreement on an interim mean annual water budget of 3 cubic meters per second (cms), ranging from a minimum of 2 cms to a maximum of 5 cms, was reached in 1998. On 31 July 2000, the Deputy Comptroller of Water Rights for British Columbia issued an Order to initiate the release of Carpenter Reservoir water into the Lower Bridge River (LBR); a continuous flow release began on 1 August 2000.

A condition of the Interim Flow Order was the continuation of environmental monitoring studies on the LBR. The purpose of this report is to describe methods used in the monitoring program, compile results from activities undertaken during the 2003 field season, and to demonstrate compliance with conditions of the Interim Flow Order. For more detailed description of the results from past monitoring studies refer to Riley et al. (1997, 1998), Higgins and Korman (2000), Longe and Higgins (2002), and Sneep and Higgins (2003).

1.2 Objectives

As in the 2000, 2001, and 2002 study years, the primary study objective in 2003 was to monitor impacts related to the release of hypolimnetic water from Carpenter Reservoir into the LBR channel. To meet this objective, the work was to include:

1) continuous monitoring of water temperature, light intensity, and river stage;
2) seasonal monitoring of water chemistry parameters, periphyton accrual, and relative abundance of aquatic invertebrates;
3) fish sampling to assess the growth, distribution, and relative abundance of juvenile salmonids, especially coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawytscha*), and rainbow trout (*Oncorhynchus mykiss*), within the study area.

Throughout this report, juvenile *O. mykiss* are referred to as rainbow trout, although a large proportion of these fish in the LBR are anadromous steelhead.

1.3 Study Area

The LBR between Terzaghi Dam and the confluence with the Fraser River was divided into four reaches by Matthews and Stewart (1985). Their reach break designations are defined in Table 1.1.

Table 1.1 Reach break designations and descriptions for the Bridge River below Terzaghi Dam.

Reach	Boundary (Rkm)		Description
	Downstream	Upstream	
1	0.0	20.0	Fraser River Confluence to Camoo Creek
2	20.0	25.4	Camoo Creek to Yalakom River confluence
3	25.4	36.7	Yalakom R. confluence to upper extent of groundwater inflow
4	36.7	40.9	Upper extent of groundwater inflow to Terzaghi Dam

Data collection for the LBR Monitoring Program conforms to these reach break designations and has been focused on the 20.9 km section of river between the mouth of Camoo Creek and Terzaghi Dam (Figure 1.1). The sampled tributaries include Mission Creek, Yankee Creek, Russell Springs, Hell Creek, Michelmoon Creek, Yalakom River, Antoine Creek, and Camoo Creek.

1.4 Study Period

The majority of field sampling was completed during six eight-day sample periods. The sessions were conducted from 8 to 15 May, 4 to 13 July, 21 to 28 August, 18 to 25 September, 13 to 20 November, and 12 to 19 December 2003. The LBR standing stock assessment was conducted from 2 to 11 September 2003. Physical parameters such as water temperature, light intensity, and river stage were continuously monitored throughout the year. This report summarizes the data collected from each of these activities.

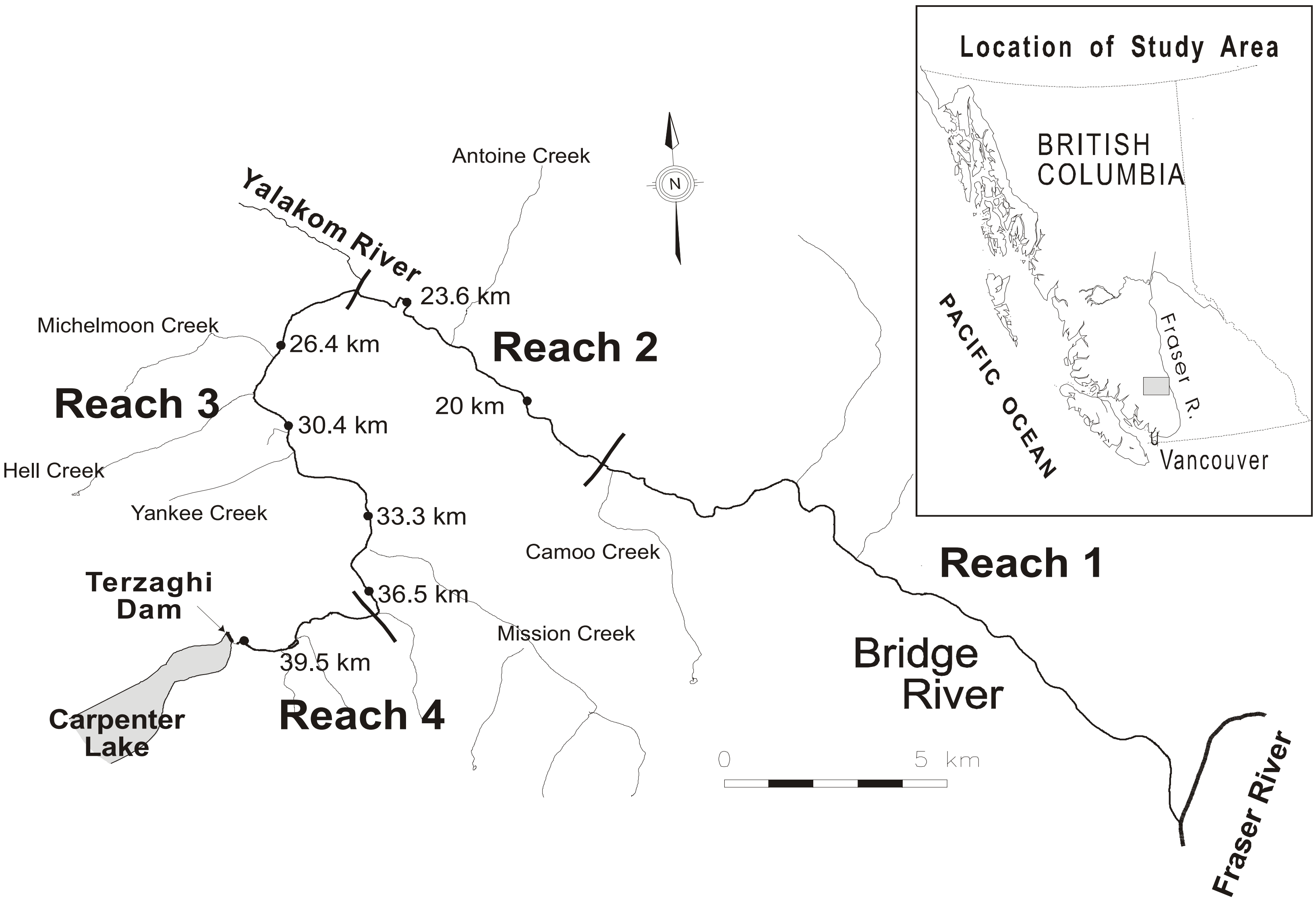

Figure 1.1 The Lower Bridge River Aquatic Monitoring Program study area, including reach breaks, index sample site locations, and tributaries.

2.0 METHODS

2.1 The Aquatic Monitoring Program

Sampling for the Aquatic Monitoring Program was conducted at seven indexed sites located at approximate three kilometer intervals downstream of the dam (River Kilometer 20.0, 23.6, 26.4, 30.4, 33.3, 36.5, and 39.9) Six of these sites have been monitored since before the initiation of continuous flow (1 August 2000); the seventh site (located in the previously dewatered reach at Rkm 39.9) was added after 1 August 2000. Protocol for studies in 2003 followed methods developed in 1996, which were also employed for Bridge River monitoring activities in 1997, 1998, 1999, 2000, 2001, and 2002.

2.2 Water Temperature, Light and Stage

Water temperature and light intensity were recorded once every hour at each of the index sites using data loggers. Onset Computer Corporation manufactured both the Stowaway Light Intensity Loggers (HL1) and Stowaway Temperature Loggers (XT I08 and STIB08) used on this project. The relative stage of the river was monitored at three stations (Rkm 20.0, 26.2, and 36.8) using a PS9000 submersible pressure transducer (Instrumentation Northwest, Inc.) coupled to a Lakewood 310-UL-16 data recorder.

2.3 Water Chemistry, Periphyton and Invertebrates

Water chemistry data were gathered during each of the six sample periods. Water samples analyzed for nutrients and other chemical parameters were collected at each site and from all tributaries within the study area (listed in Section 1.3). The methodology employed for water sampling, as well as techniques used for laboratory analysis of nutrients, are described by Riley et al. (1997). Supplementary water quality parameters (i.e., conductivity, pH, and spot water temperature) also were measured at each site using a WTW handheld field meter.

Periphyton accrual, and benthic invertebrate abundance data were collected at all seven sampling locations, during three approximate six- to eight-week monitoring series. At each site, three permanent stations located approximately 20 meters apart provided sample replication for periphyton and invertebrate data. Results from the sampling program were used to characterize seasonal changes in conditions for primary and secondary productivity and were compared among reaches for spatial contrasts. The spring series ran from 9 May to 9 July, the summer series from 9 July to 22 August, and the fall series from 19 September to 14 November 2003.

Periphyton accrual in the LBR was measured using replicate 30 × 30 × 1 cm open cell Styrofoam sheets (obtained from D.L Jones Supply, Vancouver, B.C.). Rubber bands were used to attach the Styrofoam to 1 cm thick pieces of plywood, bolted to 30 x 30 x 10 cm concrete blocks. Three periphyton samplers were placed at each site in areas of similar depth and velocity. Samples of accumulated Chlorophyll a (Chl a) were collected by removing a core of Styrofoam using the open end of a 7-dram plastic vial (8.5 cm^2 core area) every five to seven days during each series. Samples were also taken from the periphyton samplers at the completion of each series, such that the species composition of the attached algae could be classified.

Relative abundance of benthic macro-invertebrates was assessed using standardized metal baskets filled with small cobble substrate gathered from the streambed. The baskets were placed on the substrate, in areas of similar depth and velocity, at three stations for each site. The location of each station was proximal to those selected for the periphyton colonization samplers. At the end of each series, the baskets were carefully removed from the streambed and placed in a bucket. Each of the small cobbles contained within the baskets was gently scrubbed by hand to remove any attached material, including invertebrates. All of this material was filtered through a fine mesh sieve, then preserved and stored in a sample jar containing a 10% formalin solution. These samples were subsequently submitted to a laboratory for sorting, identification (to the lowest possible taxonomic level), and enumeration of the collected invertebrates.

Drift sampling for invertebrates was conducted using six drift samplers similar in design to those described by Mundie (1964). Samples were collected at two sites, located at Rkm 23.6 and 30.4, during each sample session. At each site, the catch was processed every four hours for a 24-hour period. Invertebrates were preserved in 10% formalin and submitted for the same analyses as the benthic samples. Water depth and flow velocity through each sampler's aperture were measured at the start and end of each four-hour sampling interval, such that the volume of water flowing through the drift samplers could be calculated.

2.4 Fish Growth and Standing Stock Assessment

Salmonids were collected during each sample session at each index site to monitor spatial and temporal patterns of fish growth. The intent was to capture approximately 25 to 30 fish from each age-class for the salmonid species available at the time of the surveys. Backpack electrofishing was the sole fish sampling method employed to accomplish this objective. Captured fish were anaesthetized with clove oil, identified to species, measured (forklength to the nearest millimeter), and weighed (to the nearest gram). Subsequent to processing, all fish were released at or near their collection point.

In addition to monthly growth data, a fall standing stock assessment was completed from 2 to 11 September 2003 in order to estimate the abundance and density of chinook salmon, coho salmon, and rainbow trout in Reaches 2, 3, and 4. Sampling was conducted at 50 sites, located between Rkm 20.0 and 40.5. At each site, a three-person crew completed three to four electrofishing passes using a Smith-Root backpack electrofisher operating at 200-400 volts DC.

Sites in the standing stock survey were enclosed with three ¼ inch mesh stop nets, covering an area of 50 to 150 m^2. Two shorter panels were used for upstream and downstream stop nets, oriented perpendicular to the bank, and a longer net was used for the offshore side, which ran parallel to the bank. The net placement procedure was standardized among crews; the downstream net was secured first, followed by the upstream net, and lastly the side net. Care was taken not to walk in, or disturb the site until it was fully enclosed. The stop nets were hung on bipods and secured with 10 lb anchors and ropes fixed to the shore. To seal the bottom of each net to the substrate and minimize the potential for fish escaping the enclosure, rocks were placed along the entire lead line of each net.

At some sites prior to the 2000 flow release, nets could be extended from bank to bank due to lower discharge in the LBR. However, increased depth and velocities in the river since initiation of the flow release have reduced the availability of suitable electrofishing sites and necessitated the use of smaller three-sided enclosures. For this reason, the sample locations do not represent a random selection of run, riffle, and pool-type habitats. Whenever possible, three-sided sites were positioned on the bank where the stream-wide sites had been located in previous years. In cases where adjacent positioning was not feasible, the site was moved to the nearest upstream location where sampling could be safely carried out.

Following each electrofishing pass during the standing stock survey, captured fish were processed according to the procedure described for the seasonal growth sampling. The fish were kept in a live basket in the stream until all passes were completed, when they were released near their point of capture.

After completion of the fish sampling, physical parameters were recorded at each sampling site. Three length measurements (i.e., offshore, mid, and inshore) and three width measurements (i.e., upstream, mid, and downstream) were taken to calculate the area sampled. Water depths and flow velocities were recorded from three transects (i.e., upstream, mid, and downstream) after the nets had been dismantled. At each transect, five depths and five velocities were measured at equal intervals from bank to the offshore extent of the sampled area. Velocities were measured using a Swoffer model 2100 current meter at 0.6 of depth. Maximum depth and maximum velocity were also noted for each site.

Other recorded data included site location, habitat type, sampling effort, date, water temperature, D90, as well as percent composition and mean particle size of streambed and bank substrates. Site location included river kilometer and bank association. Sampling effort was recorded as the number of seconds electrofished. Water temperature was taken as a spot measurement using a handheld mercury thermometer. Dominant habitat type, D90, substrate composition, and mean particle size were all qualitatively assessed by the field crews.

3.0 RESULTS

3.1 Physical Conditions

Lower Bridge River discharge is regulated by Terzaghi Dam, which is located approximately 40.9 km upstream of the confluence with the Fraser River. Since 1 August 2000, a mean annual discharge of 3 cms has been released from the dam. Currently, this flow release can range from a minimum of approximately 2 cms to a maximum of approximately 5 cms. Several tributaries also contribute flow within the study area.

3.1.1 River Stage

Mean daily river level (relative stage) data, recorded at three sites (Rkm 20.0, 25.5, and 36.8) on the LBR, are presented in Figure 3.1. Comparisons of river level data at these sites from 1996 to 2003 are presented in Appendix A, Figure A1.

Prior to the initiation of the flow release, the river stage level in Reach 3 was relatively stable (i.e., did not fluctuate significantly on a daily or even seasonal basis) since flow volume in this reach was predominantly comprised of groundwater discharge and the influence of small tributaries. The relative stage in Reach 2, however, tended to exhibit greater fluctuations due to the influence of the Yalakom River, which contributes a fairly significant proportion of flow at the upstream end of this reach. Since the flow release began, these general patterns have not notably changed, although the overall river level has increased. The most significant increase has been observed at Site 36.8 (the first stage-monitoring site downstream of the dam). River level at this site increased by approximately 0.55 m, relative to pre-release levels. An intermediate response was observed at Site 25.5 where stage increased by approximately 0.35 m. Changes in stage at Site 20.0 were not as obvious, which may be due to a potential buffering effect of the Yalakom River inflow combined with differences in channel morphology at this location relative to the monitoring stations upstream. These conclusions were also supported by the stage data recorded during 2001 and 2002.

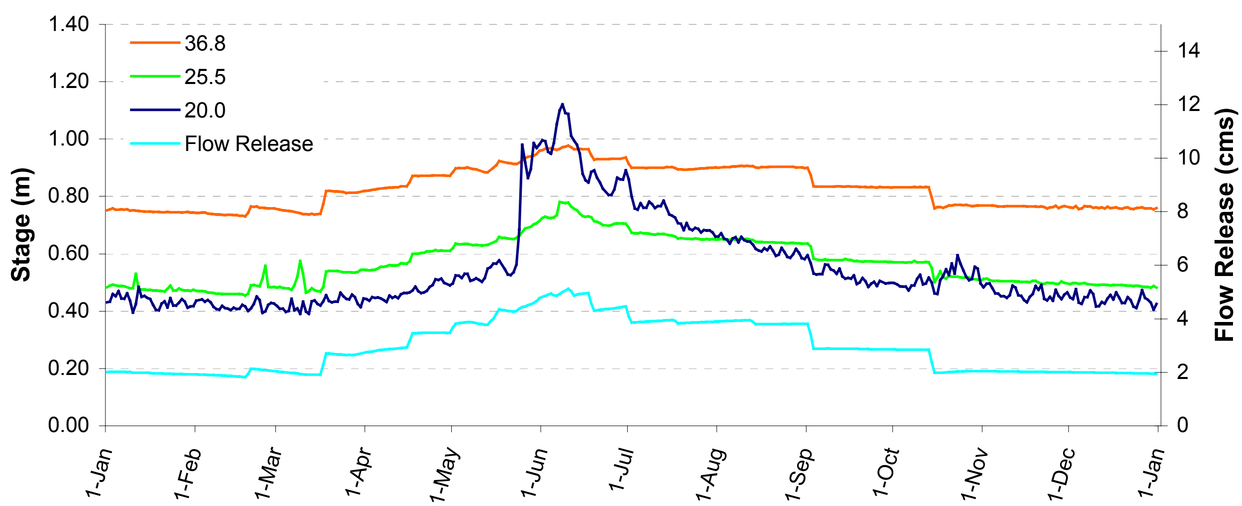

Figure 3.1 Relative river stage levels at three locations on the Lower Bridge River and daily mean flow releases from Terzaghi Dam during 2003. Station numbers refer to river kilometer upstream of the Bridge River confluence with the Fraser River.

3.1.2 Water Temperature

Mean daily temperatures from each of the study reaches on the LBR are presented in Figure 3.2. Comparisons of water temperature data for each reach from 1996 to 2003 are illustrated in Appendix A, Figures A2 and A3.

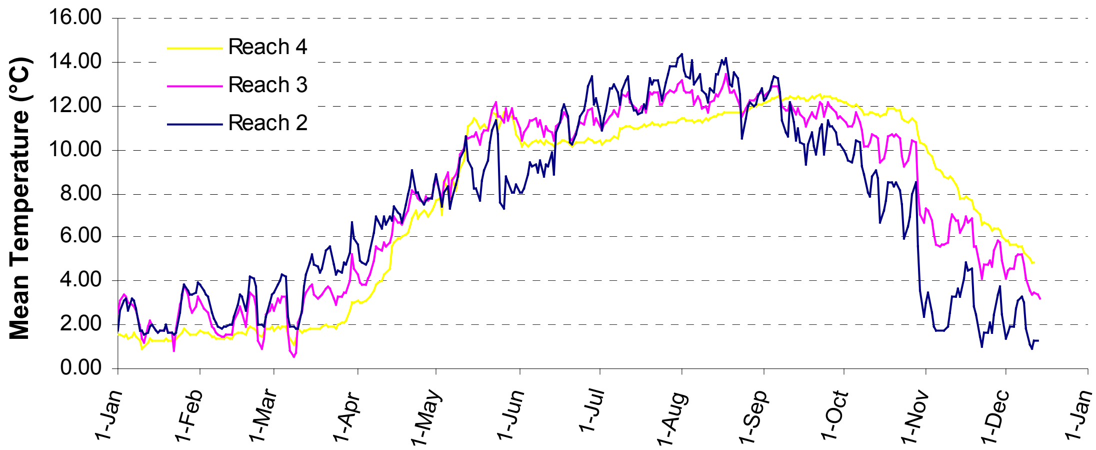

Figure 3.2 Mean daily water temperatures recorded in the Lower Bridge River, 1 January to 13 December 2003.

Water temperatures recorded in the LBR and Yalakom River follow the fairly typical seasonal patterns of coastal systems. Base values are generally recorded from December to February, steadily increase from March to May, peak during the summer months (June to August), and decline again in the fall. Though these general trends are still exhibited, the introduction of hypolimnetic flow releases from Carpenter Reservoir in August 2000 moderately altered the temperature regime of the LBR.

As with the stage data, the most significant impacts were reflected by data from Reach 3. Prior to the flow release, water temperatures at the upstream-most site in Reach 3 exhibited the least amount of variation between seasons due to the predominance of groundwater in this portion of the reach. The influence of the groundwater resulted in temperatures a few degrees warmer during the winter and a few degrees cooler during the summer relative to sites downstream. The groundwater input also influenced the seasonal temperature gradient between the sites located in Reach 3. During fall and winter, temperatures at the upper portion of the reach were generally warmer than downstream; however, during spring and summer this pattern inverted, such that temperatures in the upper portion of the reach were generally cooler than downstream. Since initiation of the flow release, these season-associated temperature gradient patterns have not changed. However, the temperature regimes have become much more similar between the sites in Reach 3, and are generally cooler in winter and warmer in summer, which is particularly significant in the upstream portion of the reach. Also, the decrease in temperature during fall appears to occur more gradually, resulting in mean daily temperatures approximately 2 to 4°C higher than previously recorded for this season.

Some of these changes were also evident in Reach 2; however, the influence of the Yalakom River inflow seems to moderate their significance relative to Reach 3. Overall peak and minimum water temperatures do not appear to have changed within the study area.

3.1.3 *Light Intensity*

As in previous study years, hourly measurements of light intensity were recorded at each sampling site during 2003. Impacts on relative light conditions were not expected to result from the new flow regime. With some year-to-year variation, data collected in 2003 was generally consistent with results from previous years. The light data is not presented in this report, but is available upon request.

3.1.4 *Water Chemistry*

Water chemistry samples were collected from the LBR, Carpenter Reservoir, and tributaries within the study area during each sample session. The results of analyses conducted by the Fisheries and Oceans Canada (DFO) laboratory at Cultus Lake are divided into mainstem and tributary locations, and are presented in Appendix A, Tables A1 and A2, respectively. Graphical comparisons of mean values for each water chemistry parameter before and after the flow release are provided in Figure A4.

In general, trends in the levels of water chemistry parameters recorded for the LBR did not change significantly from the analysis reported in 2002. One exception, however, was the concentration of Ammonium. In September 2003, the levels of Ammonium recorded in reaches 2 and 3 (mean = 213.50 and 133.56 µg/L, respectively) were significantly higher than the typical levels for this parameter (mean = ca. 2 to 7 µg/L). An increase in this parameter was also noted for Reach 2 in September 2001 (mean = 70.32 µg/L); however, the reason for these increases is not known.

Total phosphorus (as well as total dissolved-, and soluble reactive phosphorus) levels in reaches 2 and 3 of the LBR were highest in 2003 since the initiation of the flow release; the levels in Reach 4 were down slightly from the peak levels recorded for this reach in 2002, likely resulting from the lower values recorded for these parameters in the reservoir during 2003. Total Nitrogen and alkalinity levels have been fairly consistent since the flow release. Higher values for both parameters are typically recorded in the tributaries relative to the mainstem sites; however, mainstem alkalinity levels tended to increase from Reach 4 to Reach 2, whereas total nitrogen did not exhibit a spatial gradient.

Since the introduction of Carpenter Reservoir water into the lower river, TP turbidity levels have been higher in mainstem reaches than the tributaries, and exhibit an upstream to downstream gradient in the LBR. TP turbidity levels in 2003 were down from the post-flow release peak levels recorded during 2002. pH levels decreased very slightly from 2000 to 2002, but remained fairly consistent between 2002 and 2003. Overall, the water chemistry parameters tested were within the guidelines established for the Province of British Columbia (Pommen, Nagpal and Swain 1995).

As reported in 2002, differences in water chemistry parameters in the LBR prior to, and since the flow release appear to be relatively moderate. As such, these differences cannot be easily distinguished from natural variations. Significant changes to phosphorus levels were not readily apparent. Average post-release values of total nitrogen were lower than pre-release values in Reach 3, whereas average values for this nutrient were slightly higher in Reach 2 since the release. The spatial gradient of TP turbidity values apparent prior to the flow release was inverted after the introduction of reservoir water. Previously, higher levels were consistently recorded in Reach 2 than Reach 3, likely due to inputs from the Yalakom River inflow. Since the release, however, higher levels have been recorded in reaches 3 and 4. Average alkalinity and pH levels have decreased slightly in the mainstem reaches, but the differences do not appear significant.

3.2 Periphyton and Aquatic Invertebrates

Periphyton accrual data collected during the 2003 spring, summer, and fall series sampling are presented in Figure 3.3. Composition of periphyton found on the sampling plates, and a complete analysis of periphyton species collected during the 2003 monitoring program, are presented in Appendix B, Figure B1 and Tables B1 to B3, respectively. At the time of writing, enumeration of benthic invertebrates and drift sampling was not complete and results could not be included in this report.

During the spring and summer series, periphyton accrual (measured as cumulative density of Chlorophyll a (Chl a)) was highest in Reach 4, and lowest in Reach 2. In the fall series, the greatest accrual occurred in Reach 3, despite high initial values recorded for Reach 2; Reach 4 had the lowest accrual during fall. Also, cumulative periphyton growth in Reach 4 decreased from spring to fall, whereas the opposite was true in Reach 2. Total accrual for Reach 3 was highest in fall and lowest in summer.

Similar to the 2003 data, periphyton accrual during most of the previous study years has typically been higher in Reach 3 than in Reach 2. During the 2001 study year, however, this pattern was reversed: higher mean values were recorded for Reach 2 than Reach 3. These results suggest that changes to spatial patterns of periphyton growth related to potential impacts of the flow release could be difficult to discern due to the influence of natural variation.

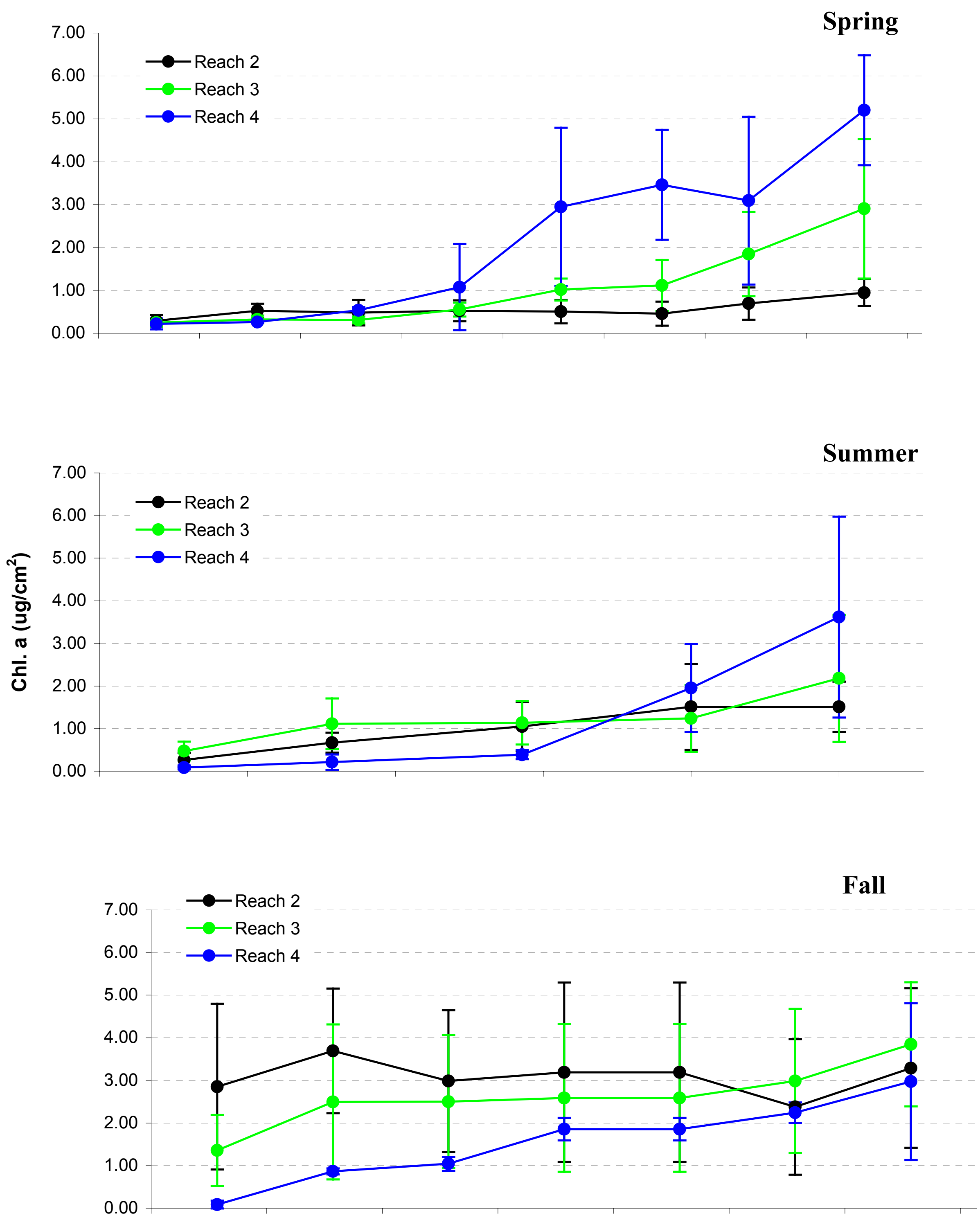

Figure 3.3 Mean periphyton accrual (measured as Chlorophyll a) on artificial substrates in the Lower Bridge River, during the spring, summer, and fall series sampling. Each point represents an average accrual for all stations within a reach.

3.3 Fish Sampling

In total, 4,324 fish were collected by backpack electrofishing during the annual standing stock survey (Reach 2, *n*=883; Reach 3, *n*=1754; Reach 4, *n*=1687), which was conducted from 2 to 11 September, 2003. A total of 50 sites were sampled, including 18 in Reach 2, 20 in Reach 3, and 12 in Reach 4. Sampling for growth data (lengths and weights) was conducted at the seven index monitoring sites during each sample session in 2003. Totals of 643 salmonids were captured in May, 682 in July, 744 in August, 624 in September, 554 in November, and 500 in December.

3.3.1 Fish Growth

The size ranges of each species and age-class sampled for growth data are presented in Table 3.1. Detailed data on mean weight during growth sampling and the standing stock survey are presented in Appendix C, Tables C1 and C2. During this study, the age-classes of each salmonid species were determined using length-frequency analysis for each sampling session.

Table 3.1 Size ranges (in mm) for each age-class of salmonids captured in the Lower Bridge River for growth sampling, May to December 2003.

	May	July	August	September	November	December
Ch Age-0+	30 – 59	40 – 89	40 – 99	70 – 119	60 – 119	30 – 99
Ch Age-1	90 +	90 +	-[a]	-	-	-
Co Age-0+	20 – 59	30 – 69	40 – 89	50 – 99	50 – 109	50 – 109
Co Age-1	60 – 109	70 +	90 – 99	-	-	-
Rb Age-0+	Not yet out[b]	20 – 39	20 – 69	30 – 79	40 – 104	40 – 104
Rb Age-1	40 – 99	50 – 124	70 – 149	80 – 154	105 – 164	105 – 154
Rb Age-2	100 – 149	125 – 179	150 – 209	155 – 209	165 – 219	155 – 219
Rb Age-3	150 +	180 +	210 +	210 +	220 +	220 +

[a] Chinook and coho parr (age-1 fish) were not sampled after the July and August sessions, respectively.
[b] During the May sample session, rainbow trout fry (age-0+) had not yet emerged from the substrate.

A few trends were apparent from the results of the 2003 growth data analysis. Firstly, the average size of young-of-the-year chinook as well as young-of-the-year and age-1 rainbow trout were generally higher in reaches 3 and 4 than in Reach 2. This trend is consistent with the 2001 and 2002 data. Growth rates for young-of-the-year coho and age-2 rainbow trout were similar between reaches during the 2003 study period. Also, the habitat in Reach 4, made accessible by the flow release, continued to support salmonid spawning and rearing, which was confirmed by the presence of age-0+ coho, chinook, and rainbow trout in this section of the river. These trends are also supported by the 2003 stock assessment data.

3.3.2 Standing Stock Assessment

Estimated mean biomasses of the available age-classes of salmonid species are presented in Table 3.2. The relative biomass contribution of each species and age-class in each reach, as well as the spatial variation of estimated mean salmonid biomass within the study area are presented in Appendix C, Figures C1 and C2, respectively.

Table 3.2 Estimated mean biomass (g/100 m^2) of salmonids captured in the Lower Bridge River during the standing stock assessment, 2 to 11 September 2003.

Species	Age-Class	Reach 2	Reach 3	Reach 4
Chinook	0+	84.47	47.46	22.84
Coho	0+	75.08	101.88	186.39
	1			13.30
Rainbow Trout	0+	41.13	71.46	125.92
	1	64.69	141.07	399.85
	2	121.78	116.61	131.48
	3	271.33	286.32	
All Species[a]		**69.10**	**98.33**	**183.62**

[a] Mean biomass of all species and age classes for each reach.

During 2003, total estimated biomass was highest in Reach 4 and lowest in Reach 2. Rainbow trout, coho, and chinook, as well as most of the available age-classes for these species, were represented in each of the sampled reaches. However, age-3 rainbow trout were not captured in Reach 4, age-1 coho were not captured in reaches 2 and 3, and age-1 chinook were not captured in any of the sampled reaches during the 2003 stock assessment. The biomass estimates for age-0+ rainbow trout and coho were highest in Reach 4; the highest estimate for age-0+ chinook was in Reach 2. The mean biomass for age-1 rainbow trout in Reach 4 was the highest overall estimate, which likely indicates significant use of this reach for spawning and rearing by this species.

Analysis of the 2003 data also indicates a change in the total amount and distribution of salmonid biomass between regions of the river since 2000, as was suggested in the 2001 and 2002 reports. Reach 4, previously dewatered, was first sampled in the 2000 standing stock survey; the total biomass estimate for that year was 52.5 g/100m^2. From 2001 to 2003 the total biomass estimates for Reach 4 increased to 522.94, 859.54, and 879.78 g/100 m^2. These increases likely reflect the suitability of salmonid spawning and rearing habitats made available by the continuous flow release, as well as recolonization of this reach by larger fish (e.g., age-2 rainbow trout) from areas further downstream. The total biomass for Reach 2 (658.48 g/100 m^2) in 2003 was the highest estimate on record for this reach, augmented by the capture of several age-2 and –3 rainbow trout. The biomass estimate for Reach 3 was lower than the 2001 and 2002 estimates for this reach, but was within the range of estimates calculated in previous study years.

Total biomass estimates have been higher in Reach 3 than in Reach 2 since commencement of the annual stock assessment program in 1996. However, 2003 was the first sampling year that a higher estimate was reported for Reach 4 than Reach 3. Furthermore, analysis of spatial variation in biomass distribution for 2003 suggests that biomass values for individual sites in reaches 2 and 3 are generally lower with less variability compared to sites in Reach 4.

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APPENDIX A
RIVER STAGE, WATER TEMPERATURE, AND WATER CHEMISTRY DATA

(Note: The appendix tables and figures are contained in a separate file and can be obtained from BC Hydro upon request)

APPENDIX B
PERIPHYTON DATA

(Note: The appendix tables and figures are contained in a separate file and can be obtained from BC Hydro upon request)

APPENDIX C
FISH DATA SUMMARY

(Note: The appendix tables and figures are contained in a separate file and can be obtained from BC Hydro upon request)