Salmo River Watershed Water Quality Monitoring Report 2007 – 2013

A Columbia Basin Water Quality Monitoring Project

C. Nichols and G. Nellestijn
Salmo Watershed Streamkeepers Society
2014

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The Water Quality Monitoring Project is part of the Columbia Basin Watershed Network. The Columbia Basin Watershed Network Database is located at: www.cbwn.ca

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Cover photo of the Salmo River at Hidden Creek, taken by: Gerry Nellestijn.

Project Highlights

- Habitat assessment and benthic macro-invertebrate sampling following CABIN protocols, continuous temperature monitoring, and water quality analysis occurred at three sites on the Salmo River from 2007 to 2012. Site NESLM01 is downstream of the Village of Salmo. NESLM02 is downstream of the community of Ymir and upstream of the Village of Salmo. Site NESLM03 is near the headwaters of the Salmo River.

- CABIN monitoring protocols, including benthic macro-invertebrate sampling, occurred at each site annually in the fall. Non-metal water quality analysis was conducted at each site at this time. Metals in the water were analysed in 2007, 2008, and 2009 at NESLM02. Metals in the sediment were analysed in 2010, 2011, and 2012 at NESLM02. Non-metal water quality analysis was also conducted monthly from 2009 to 2013 at NESLM02. Continuous temperature monitoring occurred at each site with varied annual monitoring dates.

- CABIN BEAST Analysis found the NESLM01 and NESLM02 fluctuated between potentially stressed and stressed during 2007 to 2012 while NESLM03 was severely stressed in 2007, fluctuated between potentially stressed and stressed from 2008 to 2011, and was unstressed in 2012.

- Benthic macro-invertebrate metrics showed that all three sites had fairly stable abundance and diversity measures (with the exception of a high outlier at NESLM03 in 2007). Site NESLM01 had the highest Chironomidae taxa and the lowest EPT numbers. NESLM02 had the lowest Chironomidae taxa and the highest EPT taxa. Site NESLM03 had higher numbers of Chironomidae taxa in 2007 with the number decreasing and the EPT numbers increasing to 2012.

- Non-metal water quality analysis showed some low exceedances in values of dissolved oxygen during cold winter months at NESLM02 and also pH values lower than guidelines in the latter half of 2012 and beginning of 2013. Total phosphorus spikes were found in 2009 at NESLM02 and NESLM03.

- Metal water quality data collected at NESLM02 had three parameters (total cadmium, total copper, total zinc) exceeding the guideline for the protection of aquatic life. Total cadmium values were approximately 10 times higher than the CCME guideline in all years.

- Sediment quality data collected at NESLM02 revealed that out of the 27 parameters having guidelines for the protection of aquatic life, 7 exceeded the guidelines in one or all years of sampling. These included arsenic, cadmium, iron, lead, nickel, silver, and zinc. These results revealed that the lower effect guidelines were exceeded by arsenic, iron, and nickel sediment values and that cadmium, lead, and zinc values exceeded the higher effect CCME PEL guidelines at least one year sampled. These elements are thus of greater potential concern.

- Maximum stream temperatures ranged from 14.22 ºC at NESLM03 in 2011 to 20.65 ºC at NESLM01 in 2008 (Table 10). The highest temperatures each year were at NESLM01 while the lowest were at NESLM03. Both sites had average summer temperatures (July to early September) that exceeded BC optimum temperature guidelines for adult Bull Trout (*Salvelinus confluentus*) of 6.0-14.0 ºC.

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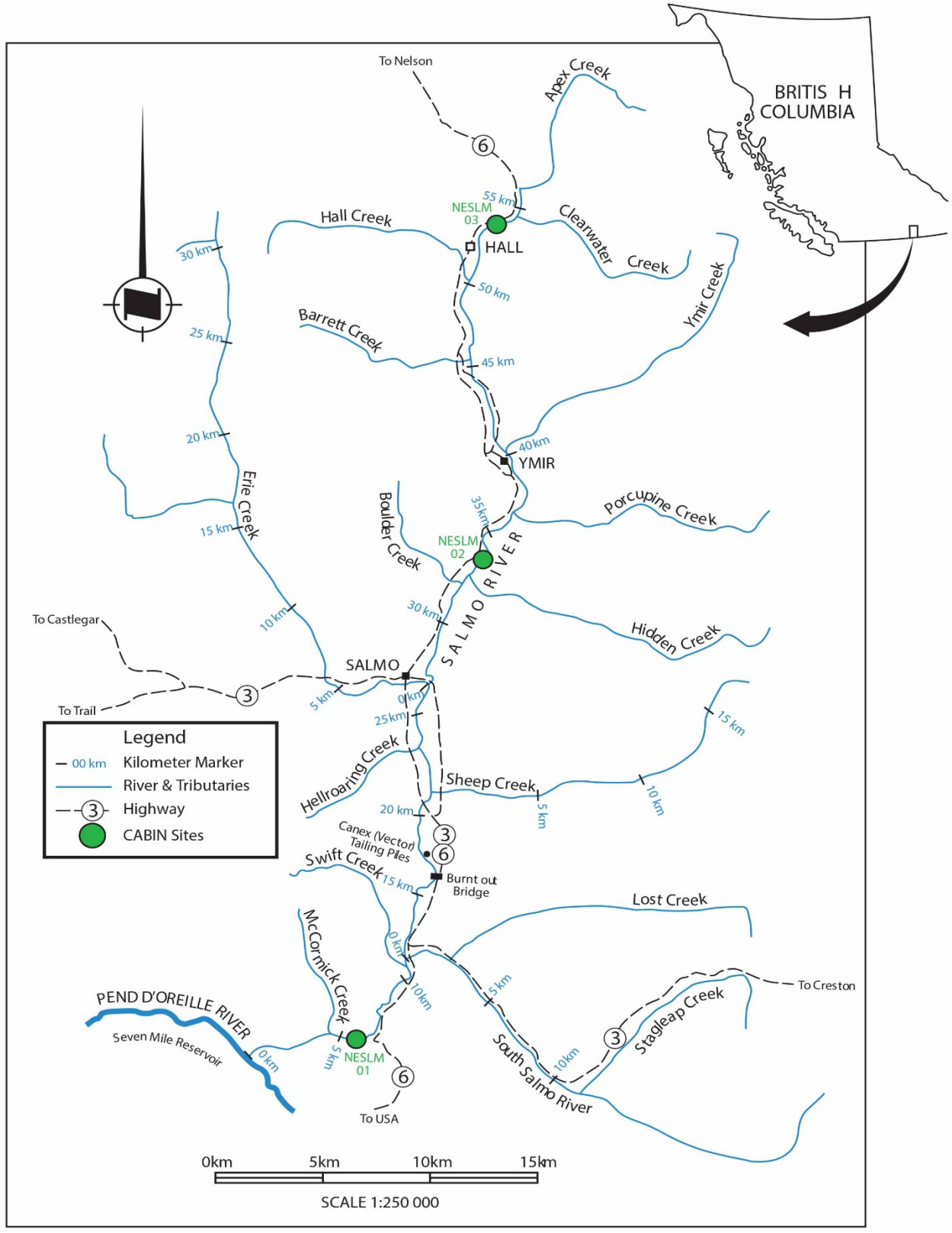

Figure 1: A map of the Salmo River Watershed showing the locations of CBWQMP CABIN sites NESLM01, NESLM02, and NESLM03.

Introduction

Community-based water quality management in the Columbia River basin plays an important role in preserving watershed function for sustainable communities and ecosystems. It is imperative that current and future water quality and quantity concerns be assessed in the Columbia River basin as environmental change poses substantial risk to ecosystem and societal health. Changes in land use and climate pose the greatest threat to both water quality and water quantity in the Columbia River basin. Current and future reductions in snow accumulation (Barnett *et al*. 2008) and glacial ice (Jost *et al*. 2012) have been shown to result in reduced water supply in the Columbia basin, particularly for the low flow summer periods (Burger *et al*. 2011). Lower streamflow leads to a reduced ability for streams to dilute pollution, potentially resulting in substantial water quality issues. In addition to climate change, the diverse land uses of the Columbia River basin, including: recreational and industrial development, streamflow regulation, municipal and industrial waste water, and non-point source pollution present a challenge for community-based water quality management.

A first step in addressing present and future water quality and quantity issues is developing community awareness and involvement. The Columbia Basin Watershed Network (CBWN) is an environmental stewardship project funded by the Columbia Basin Trust (CBWN 2012). The CBWN provides support to organizations, individuals and local water stewardship groups that undertake activities to conserve and monitor rivers and lakes throughout the Canadian Columbia River Basin (CBWN 2012). In response to local support, the CBWN has developed a long-term Water Quality Monitoring Project (WQMP), with the following goals (CBWN 2012):

1. Develop a science-based model for community-based water quality monitoring;
2. Establish online accessibility to water quality data; and,
3. Link the monitoring project with community awareness activities.

In order to meet these goals the Salmo Watershed Streamkeepers Society (SWSS) have been conducting water quality monitoring in the Salmo River Watershed from 2007 to 2013. Monitoring has included benthic macro-invertebrate assessment, water and sediment quality assessment and continual temperature monitoring.

1.1 Study location and background

The Salmo River rises from the Selkirk Mountains 12km southeast of Nelson, BC and progresses in a southerly direction for approximately 60km from its origin to its confluence with the Pend d'Oreille River at the Seven Mile Dam Reservoir (Figure 1). The system is a 5th order stream and has a total drainage basin area of roughly 123,000ha (Baxter & Nellestijn, 2000).

Elevation in the basin ranges from 564m above sea level at its confluence and rises to 2,343m at the headwaters near Ymir Mountain. Within this range, the system comprises two biogeoclimatic zones: Interior Cedar Hemlock (ICH) zones in valley bottoms at lower elevations and Englemann Spruce-Subalpine Fir (ESSF) zones at higher elevations. There are eight 2nd and 3rd order tributaries to the Salmo River (Apex, Clearwater, Hall, Barrett, Ymir (Wildhorse), Porcupine, Hidden, and Erie Creeks) and two 4th order tributaries (Sheep Creek and the South

Salmo River) (Baxter & Nellestijn, 2000). There are no major lakes or reservoirs in the river system to attenuate flood flows. There are several small headwater lakes in the watershed including Barrett, Lost, Panther, Curtis, Rosebud, and Waldie (Wulf) and mid-size Erie Lake with a surface area of 32.4ha (BC Lake Stewardship Society, 2012) which flows into Erie Creek approximately 4km west of Salmo on Hwy #3. Basic physical information is provided in Table 1 (Westslope Fisheries, 2003).

Fish species found in the Salmo River Watershed include: largescale sucker (*Catostomus catastomus*), longnose sucker (*Catostomus macrocheilus*), slimy sculpin (*Cottus cognatus*), rainbow trout (*Oncorhynchus mykiss*), mountain whitefish (*Prosopium williamsoni*), northern pikeminnow (*Ptychocheilus oregonensis*), longnose dace (*Rhinicthys cataractae*), redside shiner (*Richardsonius balteatus*), bull trout (*Salvelinus confluentus*), and eastern brook trout (*Salvelinus fontinalis*) (Nellestijn, 2013). Bull trout are a blue listed species of concern in the Province of BC and have been designated as a high conservation concern in the Salmo River Watershed (Hagen, 2008).

Table 1. Summary of Geographic Information for the Salmo River Watershed (Westslope Fisheries, 2003).

Geographic Information	
Stream Order	Fifth Order
Gazetteer Name	Salmo River
Watershed Code	330-092600
Water Body Identifier	00000LARL
MWLAP Region	4
DFO District	Habitat and Enhancement Branch, Columbia River Section
Approximate Distance to Nearest Town	12 km from Nelson; flows through Salmo, B.C.
Ministry of Forests Region	Nelson
Ministry of Forests District	Arrow
Number of tributaries	2nd and 3rd order - 8 4th order – 2
Water Quality Stations	None identified
Water Survey of Canada Stations	08NE074 (Salmo); 1949-2002

	08NE044 (Waneta); 1936-1946
Management Objectives – Inland River	1. Angler Use 2. Wild
Drainage Area	1230 km^2
Stream Length (mainstem)	60 km
Mean annual discharge	31.5 m^3/s
NTS Map Sheets	082F/3, 082F/6
UTM (confluence)	471999E 5430261N

The Salmo River Watershed is heavily impacted by human activities. Prior to the early 1800s, the Salmo(n) River was a draw to local First Nations for its abundance of berries and annual salmon runs (chinook, sockeye, and coho) that have been calculated at over 70,000lbs (Ellis & Nellestijn, 2008). Between 1807 and 1811, the upper Columbia River Basin was explored by David Thompson who was quickly followed by the Hudson's Bay Company fur traders, placer/lode miners, and timber harvesters. Mining and timber harvesting in the Salmo River Watershed accelerated into the 19th Century bringing construction of railways, roads, and communities with them. The construction of downstream dams on the Pend d'Oreille and Columbia Rivers for flood control and hydro-electric production significantly alter upstream flow patterns and the Grand Coulee Dam in Washington State permanently blocked salmon runs with its completion in 1942. Dam construction, mining and forestry activities, and land development for transportation and urbanization are the most visible human influences on the state of the watershed both historically and currently. Impacts from human land use in the Salmo River Watershed are itemized in Table 2.

Table 2. List of impacts associated with various land use activities as they relate to historical and current impacts seen in the Salmo River Watershed.

Activity	Impacts
Dam Construction	Loss of Salmon Upstream flow patterns altered (creation of reservoirs) Loss of habitat connectivity for other fish species (Bull Trout) Upstream water temperatures altered Habitat loss due to flow pattern changes Stream nutrient levels altered due to loss of salmon.
Road/Railway Construction	Loss/alteration of riparian/wetland/floodplain areas/habitat Habitat loss/alteration/disturbance Sedimentation of streams/lakes Bank erosion Stream temperature increase due to removal of overhead vegetation

	Channelization and culverts
Mining	Uncontrolled burns to access bedrock Tailings piles alongside or in streams Toxins from production allowed to run into streams and/or leach from tailings ponds Loss/alteration of riparian areas Stream habitat loss/alteration Erosion from exposed hillsides/mine workings Groundwater contamination Altered surface/subsurface drainage and overland flow
Timber Harvest	Loss/alteration of riparian/wetland areas/habitat Sedimentation of streams due to road building and bank erosion Increase in stream temperature (lack of shade) Loss of large cedar and hemlock forest Road construction to access remote areas Habitat loss/alteration/disturbance
Urbanization	Loss/alteration of riparian/wetland/floodplain areas/habitat Bank channelization and dyking for flood control Contamination of surface and groundwater (human waste, household and industrial chemicals) Construction of pipelines, roads, highways Sedimentation from construction, transportation, and recreation activities Agricultural run-off Altered surface water flows and drainage (increase in stormwater waste, decrease in groundwater recharge) Domestic/Agricultural water withdrawals

The program sites were selected primarily by the availability of access points and to represent areas that experience some or all of the impacts present within the watershed (Figure 1). NESLM01 (Table 3) is located upstream of the confluence of the Salmo and Pend d'Oreille Rivers, above the Shenango Canyon section. Although this site is characterized by mostly recreational land use, its location downstream of the Village of Salmo, is expected to bear the heaviest impacts from urbanization, industrial land use, mining, and timber harvest. Located upstream of the site are two heavily mined tributary streams, Erie and Sheep Creeks. These valleys hosted large communities of their own during the mining heydays of the late 1800 to early 1900s (Heinbuch & Nellestijn, 2000). Many of these old mine sites have large tailings piles or ponds close to streams. NELSM02 (Table 3) is located just upstream of the confluence with Hidden Creek. Land use in this area is rural residential and industrial. The location is in close proximity to the highway, old railway bed, and Porcupine Sawmill. Upstream of this site is the unincorporated community of Ymir which has no public sewage system and has been heavily reliant on timber harvesting and mining. Some of the largest mines in the Kootenays were located in the Ymir vicinity and there are many tailings ponds and piles alongside or in the River (Heinbuch & Nellestijn, 2000). NESLM03 (Table 3) is located near the headwaters of the Salmo River, just downstream of the confluence of Apex and Clearwater Creeks. Clearwater Creek and the upper Salmo River mainstem are known bull trout spawning areas (Nellestijn, 2013). This site is the least impacted with some historical logging and proximity to old railway tracks and the highway. There may have been some placer mining but no large mines. There is some current logging nearby but the largest current impact would be upstream recreation use at Whitewater Ski Resort and shore use by anglers and others.

Table 3. Summary of sites monitored in 2007-2012.

Site Code	Site Name	Development Pressures	Year Monitored		
			CABIN	Water / sediment quality	Temperature (partial year, hourly)
NESLM01	Lower Salmo River	Historical mining impacts and tailings, forestry, recreation, downstream of the Village of Salmo.	2007-2012	Annual: 2007-2012	2007-2013
NESLM02	Mid Salmo River	Historical mining impacts and tailings, forestry, recreation, rural residential.	2007-2012	Monthly: 2007-2013 Annual Metals in Water: 2007-2009 Annual Metals in Sediment: 2010-2012	2007-2013
NESLM03	Upper Salmo River	Historical mining impacts and tailings, forestry, recreation.	2007-2012		2007-2013

1.2 Objectives

The objectives of this water quality monitoring report are as follows:

1. Present CABIN, sediment and water quality and continual temperature data collected to date in a format that can be used for analysis and ongoing assessment.
2. Analyse biological monitoring data (CABIN). Complete the analysis using the analytical tools in the CABIN database by classifying benthic invertebrate community stress at sampling sites according the Reference Condition Approach and calculating invertebrate community metrics.
3. Analyse water and sediment quality data to identify if there were any parameters of potential concern in the study area. Complete this review by comparing monitoring results to applicable federal and provincial guidelines for the protection of aquatic life and drinking water, where available.
4. Analyse temperature data obtained from the continual data logger(s).
5. Relate biological results to water/sediment quality and temperature findings.
6. Provide recommendations for future stream health data collection including applicable data to be collected, locations to be sampled and procedures.

Methods

1.3 General data collection

Canadian Aquatic Biomonitoring Network (CABIN) techniques were used to collect data on benthic macro-invertebrates, habitat and water quality. Data were collected following the CABIN Field Procedures for Wadeable Streams (Environment Canada 2012a) and the CBWQMP Operating Procedures (CBWQMP 2012). CABIN sampling was conducted once a year in the fall at sites indicated in (Table 3). Invertebrate samples were analysed by EcoAnalysts Inc. (Moscow, ID) following CABIN laboratory methods (Environment Canada 2012b). All data were entered into the online CABIN database which was used to analyse findings and provide site reports.

In addition to water quality sampling collected during annual CABIN data collection, water quality data was also collected monthly at the site NESLM02 following CBWQMP Operating Procedures (CBWQMP 2012). Water quality parameters measured in the field (*in situ*) included turbidity, pH, specific conductivity, and dissolved oxygen. Parameters analysed in the laboratory included inorganics, nutrients and metals. Sediment chemistry sampling (i.e., metals) was conducted at NESLM02 in 2010, 2011 and 2012. Maxxam Analytics Ltd. (Burnaby, BC) completed laboratory water and sediment quality analysis.

Continual stream temperature was collected at all three sites using Onset HOBO Water Temperature Pro v2 Data Loggers. The data loggers were encased in custom made (by SWSS), galvanized steel covers that allowed for data offloading without removal. The covered loggers were secured on location using steel cables and clamps, ensuring that the loggers would remain underwater during the lowest expected stream flows. Data offloading was done in the field with Onset's HOBO base station and a laptop computer.

1.4 General data analysis

The Reference Condition Approach (RCA) in CABIN was used to determine the condition of the benthic invertebrate community at the test sites by comparing each test site to a group of reference sites with similar environmental characteristics.

Using the Analytical Tools in the CABIN database, three analyses were used to review invertebrate test site data (Steps 1a – 1c in Figure 2): BEnthic Assessment of SedimenT (BEAST), River Invertebrate Prediction and Classification System (RIVPACS), and metrics. Water quality (Step 2) and stream temperature (Step 3) analyses followed to provide an overall understanding of stream condition.

The reference model used in the RCA analysis was the Preliminary Okanagan-Columbia Reference Model (2010) provided in the online CABIN database. Because the model was still considered preliminary, with some potential data gaps, caution was exercised when interpreting RCA results (obtained from Steps 1a to 1c). Furthermore, it was important that all subsequent analyses (Steps 2, and 3) were conducted.

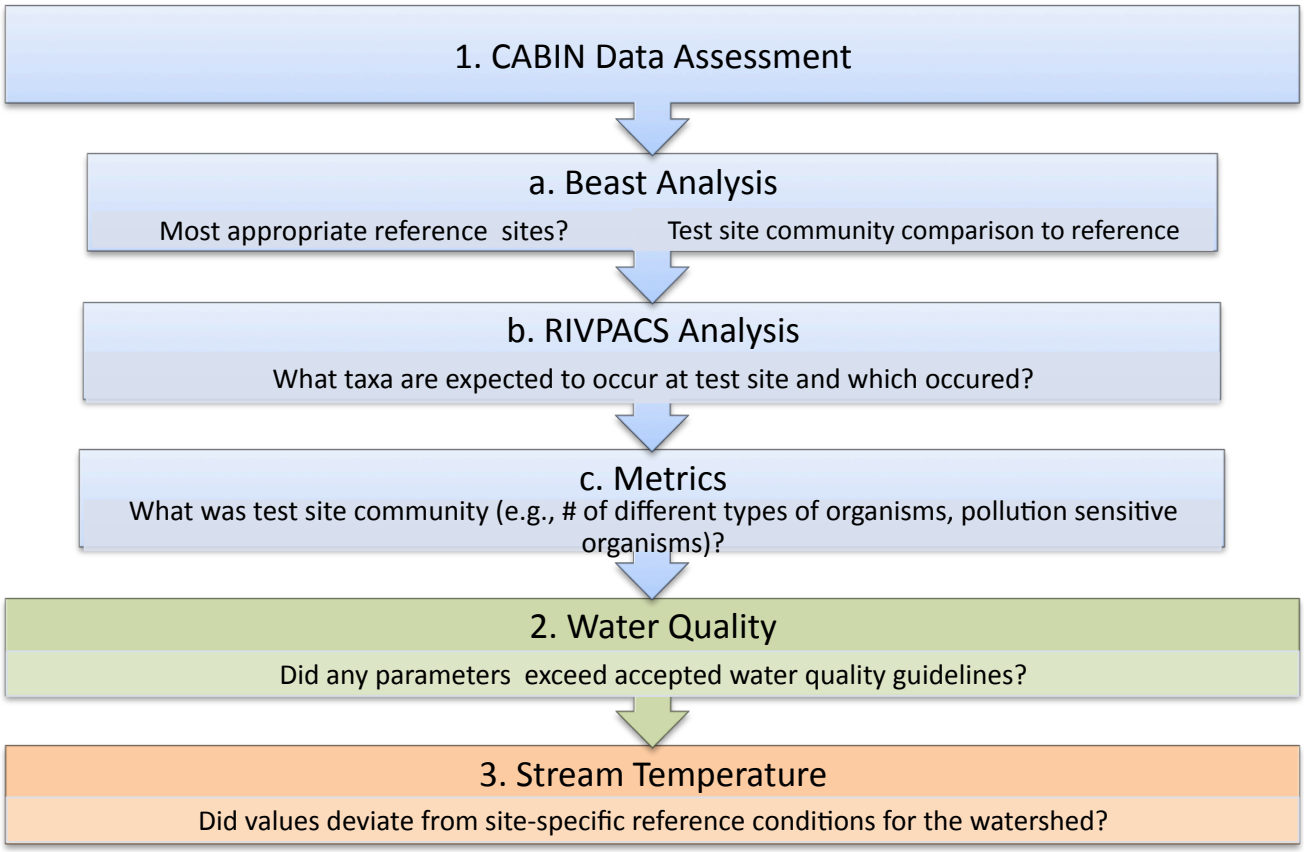

Figure 2. Stream condition analyses - Steps 1a to c review CABIN data using the reference condition approach and Steps 2 and 3 review water quality and continual stream temperature data collected

1.5 CABIN data analysis

1.5.1 Reference Condition Approach: BEAST analysis and site assessment

BEAST analysis was used to predict test sites to a reference group from the preliminary Okanagan-Columbia reference model provided by Environment Canada through the CABIN database. BEAST uses a classification analysis that determines the probability of test site membership to a reference group based on habitat variables (Rosenberg *et al.* 1999). Habitat variables used to predict group membership in the Okanagan-Columbia reference model include latitude, longitude, percent area of watershed with a gradient <30%, percent area of watershed with permanent ice cover and average channel depth.

CABIN model hybrid multi-dimensional scaling ordination assessment was then used to evaluate benthic community stress based on divergence from reference condition. This analysis placed test sites into assessment bands corresponding to a stress level ranging from unstressed to severely stressed. In the ordination assessment, sites that are unstressed fall within the 90% confidence ellipse around the cloud of reference sites which means that their communities are similar or equivalent to reference (Rosenberg *et al.* 1999). Potentially stressed, stressed and severely stressed sites fall outside of the 90%, 99% and 99.9% confidence ellipses and indicate mild divergence, divergence, or high divergence of the benthic community from reference condition (Rosenberg *et al.* 1999).

1.5.2 RIVPACS analysis

RIVPACS ratios were calculated in the Analytical tools section of the CABIN database. RIVPACS analysis relies on presence/absence data for individual taxa. The RIVPACS ratio determines the ratio of observed taxa at test sites to taxa expected to be present at the test site based on their presence at reference sites. A RIVPACS ratio close to 1.00 indicates that a site is in good condition as all taxa expected to be present were found at the test site. A RIVPACS ratio >1.00 can indicate community enrichment while a ratio <1.00 can indicate that a benthic community is in poor condition.

1.5.3 Community composition metrics

Benthic community composition metrics were calculated in the CABIN database using the Metrics section of the Analytical Tools menu. A collection of relevant measures of community richness, abundance, diversity and composition were selected to describe the test site communities. Using metrics, indicator attributes were used to interpret the response to environmental disturbances. Metrics are complimentary to an RCA analysis.

1.6 Water quality data analysis

1.6.1 Water quality QA/QC

Raw data were first subjected to a quality control evaluation to assess the accuracy and precision of the laboratory and field methods. For all sediment and water samples analysed, the

laboratory assessed accuracy through the use of matrix spike, spiked blank, and method blank samples. As well, the laboratory measured precision through duplicate sample analysis. As per standard practice, all laboratory quality control results were reviewed and confirmed to meet standard criteria prior to proceeding with processing of field samples (Maxxam 2012).

Field duplicates were submitted to the laboratory to measure both field sampling error plus local environmental variance. Duplicate review was based on relative percent difference (RPD) as determined by Equation 1. For duplicate values at or greater than five times the Method Detection Limit (MDL), a RPD values >20% indicates a possible problem, and > 50% indicates a definite problem, most likely either contamination or lack of sample representativeness (BC MoE 2003). An RPD value greater than or equal to 30% was considered an alert level (Horvath pers. comm.). Where RPD values were greater than 30%, the source of the problem was determined, and the impact upon the sample data ascertained (BC MoE 2003). If data were found to be within acceptable ranges, subsequent analyses included only the first of the duplicate samples.

Equation 1: Duplicate sample quality control

Relative Percent Difference = (Absolute difference of duplicate 1 and 2/average of duplicate 1 and 2)*100

$$\left(\frac{\text{Duplicate 1} - \text{Duplicate 2}}{(\text{Duplicate 1}+\text{Duplicate 2})/2} \right)$$

Field blank data were collected to monitor possible contamination prior to receipt at the laboratory. Field blanks were compared using Equation 2. Field blank values that were 2 times greater than the reportable detection limit were considered levels of alert (Maxxam 2012, Horvath pers. comm.). Field blank values that exceeded the alert level were reviewed in more detail to identify the potential source(s) for contamination; as well other data on that day were compared to historical data to identify if there were anomalies possibly related to contamination.

Equation 2: Field Blank sample quality control

$$\frac{\text{Field Blank Value}}{\text{Reportable Detection Limit (RDL)}}$$

1.6.2 Guideline review

A guideline is a maximum and/or a minimum value for a characteristic of water, sediment or biota, which in order to prevent specified detrimental effects from occurring, should not be exceeded (Nagpal 2001). Water quality results were compared to the applicable provincial and federal guidelines for the protection of aquatic life and drinking water (Table 4). Sediment quality results were also compared to the applicable British Columbia and Canadian guidelines for the protection of aquatic life.

Table 4. Provincial and federal guidelines applicable to the protection of aquatic life (sediment and water quality) and drinking water (water quality only).

Document	Sediment Quality – Aquatic Life	Water Quality – Aquatic Life	Water Quality – Drinking Water
Federal			
Canadian Water Quality Guidelines (CCME 1999a)		X	
Guideline for Canadian Drinking water quality (Health Canada 2012)			X
Canadian Sediment Quality Guidelines (CCME 1999b)	X		
Provincial			
Approved Water Quality Guidelines (Government of BC 2013)	X	X	X
Working Water Quality Guidelines for BC (Nagpal et al. 2006)	X	X	X

* CCME - Canadian Council of Ministers of the Environment

When both long-term and short-term exposure guidelines were available, the long-term guideline was used in the review, since sampling was assumed to have occurred under 'normal' conditions. As well, to characterize water and sediment quality, all guideline thresholds were considered in this review. An exceedance of any of the thresholds was flagged to provide an understanding of the potential risks to aquatic organisms.

The transpose add-in tool created by GranDuke Geomatics (2013a) was used to automate the addition of new water quality data from Maxxam into existing CBWN datasets. Using Visual Basic for Applications (VBA) users opened MS Excel files from Maxxam and chose which MS Excel file to append the new data into. The add-in matches parameter names between files and converts units (e.g., between µm and mg) flagging the data cells that were successfully transferred. The Automated Guideline Assessment Tool for High-speed Analysis (AGATHA), also developed by GranDuke Geomatics (2013b) was then used to compare measured water and sediment quality values to the applicable published guidelines. The interface to AGATHA for the CBWQMP was provided through Microsoft Excel. AGATHA highlighted values that were above or below published guidelines and provided links to guidelines where further information could be attained. AGATHA automatically monitors the national and provincial guidelines for changes, ensuring guideline checks are up-to-date into the future.

1.7 Stream temperature analysis

HOBOware was used to process the data and Microsoft Excel was used for the stream temperature analysis. Stream temperature data were analyzed using descriptive statistics (average, maximum, minimum, and standard deviation) for each year and each site.

Results

1.8 CABIN results

1.8.1 Reference Condition Approach: BEAST analysis and site assessment

For sites sampled on the Salmo River, CABIN BEAST analysis determined the highest probability of reference group membership for all sites in all years was to group 4 (probabilities found in Table 5). Therefore, all sites were predicted to and compared with reference group 4 which includes 18 streams predominantly located in the Columbia Mountains and Highlands and Western Continental Range eco-regions. The mean average channel depth of reference group 4 is 29.3 cm and is within the test sites' average depth range of 18.6-67.0 cm. A comparison of individual test site habitat attributes with the reference model means is included in the Site Assessment Reports in Appendix A. CABIN models assessed NESLM01 as potentially stressed over the period from 2008-2009 (Table 5) and stressed in all other sampling years. Community stress at NESLM02 increased from an assessment of potentially stressed from 2007-2009 to stressed in 2010, then returned to potentially stressed in 2011 and 2012. NESLM03 was severely stressed in 2007, showing the largest divergence from reference condition of all sites. The site was only assessed as stressed or potentially stressed in the following sampling years and was assessed as unstressed in 2012, showing the largest change in assessments of all three sites. Site assessment ordination plots are included in the Site Assessment Reports in Appendix A.

Table 5. CABIN model assessment of test sites against reference condition as defined by the preliminary Okanagan-Columbia reference model; assessment, prediction of reference group and probability of group membership.

Site Code	2007	2008	2009	2010	2011	2012
NESLM01	**Stressed** Group 4; 63.9%	**Potentially Stressed** Group 4; 54.2%	**Potentially Stressed** Group 4; 74.4%	**Stressed** Group 4; 53.3%	**Stressed** Group 4; 68.0%	**Stressed** Group 4; 68.4%
NESLM02	**Potentially Stressed** Group 4; 74.7%	**Potentially Stressed** Group 4; 75.7%	**Potentially Stressed** Group 4; 78.2%	**Stressed** Group 4; 79.0%	**Potentially Stressed** Group 4; 75.8%	**Potentially Stressed** Group 4; 77.1%
NESLM03	**Severely stressed** Group 4; 81.1%	**Potentially Stressed** Group 4; 80.4%	**Stressed** Group 4; 80.3%	**Potentially Stressed** Group 4; 81.0%	**Potentially Stressed** Group 4; 80.0%	**Unstressed** Group 4; 80.2%

Sites along the Salmo River were consistently classified as divergent from reference condition except for NESLM03 in 2012. The level of divergence varied from year to year at all sites, with sites mostly fluctuating between potentially stressed and stressed. These assessments suggest that there may be water quality impacts in the Salmo River watershed that are causing the benthic community to diverge from reference condition, but that the level of impact changes

temporally. In order to determine what types of environmental and water quality variations influence the level of stress in the benthic community it is necessary to investigate the benthic community composition metrics, habitat attributes and water chemistry variables collected at these sites.

1.8.2 RIVPACS analysis

RIVPACS Observed:Expected (O:E) ratios for test sites are summarized in Table 6 and lists of the Frequency and Probability of Taxa Occurrence are included in the Site Assessment Reports for each location and sampling year in Appendix A. The RIVPACS ratios were below 0.80 in NESLM01 2009 and 2012, NESLM02 2007 and 2012, and NESLM03 2007 and 2010 (Table 6) but were higher in all other years at each site. The ratios exceeded 0.95 at NESLM02 in 2009 and 2010, and at NESLM03 in 2011 and 2012. Overall the ratios do not seem to correspond to CABIN model conditions as we see that NESLM03 in 2007 has a severely stressed condition but not the lowest RIVPAC ratio (Table 6). The highest ratios are 0.97 at NESLM02 in 2009 and 2010 but one site is potentially stressed and the other is stressed and both are higher than the unstressed NESLM03 in 2012.

Taxa that were expected (based on a probability of >70% occurrence at reference sites) but that were not observed were of the orders Plecoptera (Capniidae, Chloroperlidae, Nemouridae, Perlidae, Perlodidae, and Taeniopterygidae) and Trichoptera (Hydropsychidae and Rhyacophilidae) only. Absence of EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa can be an important indicator as they are typically the most sensitive to poor stream health, habitat disturbance, and pollutants. The sites with the lowest RIVPACS ratios corresponded to those years with the most taxa not observed (Table 6) although they did not necessarily correspond to those of the most stressed CABIN model condition.

Table 6. RIVPACS Observed:Expected Ratios of taxa at test sites. Taxa* were listed that had a probability of occurrence >70% at reference sites but were not observed at the test site. CABIN model conditions are indicated as shaded background.**

Site	2007	2008	2009	2010	2011	2012
NESLM01	0.82 PERLI, RHYA, TAEN	0.85 CAPN, TAEN	0.62 CAPN, NEMO, PERLI, RHYA, TAEN	0.85 RHYA, TAEN	0.90 CAPN, TAEN	0.72 NEMO, PERLO, RHYA, TAEN
NESLM02	0.62 NEMO, PERLI, PERLO, RHYA, TAEN	0.89 CAPN, PERLO	0.97 CAPN	0.97 CAPN	0.88 CAPN, PERLO	0.79 CAPN, HYDR, TAEN
NESLM03	0.70 CAPN, CHLO, PERLI, PERLO	0.88 HYRD, PERLI	0.88 PERLI, TAEN	0.79 CAPN, HYDR, PERLI	0.96 PERLI	0.96 HYDR

*Macroinvertebrate family abbreviations:
Order Plecoptera: CAPN-Capniidae, CHLO-Chloroperlidae, NEMO-Nemouridae, PERLI-Perlidae, PERLO-Perlodidae, and TAEN-Taeniopterygidae **Order Trichoptera:** HYDR-Hydropsychidae, RHYA-Rhyacophilidae
**CABIN model condition: unstressed, potentially stressed, stressed, severely stressed.

1.8.3 Community composition metrics

Macroinvertebrate community composition, complexity, and abundance are strong indicators of stream health and are commonly reported in various measurements (metrics) that can be compared across time for one site or between sites. Several common benthic community metrics are summarized in Table B-1 for each site in each year and definitions of the metrics can be found in Appendix B. In general, the metrics across the years for each site show variability but no significant trends.

Total number of distinct taxa indicates the biodiversity of a benthic community and usually declines with a decrease in stream health along with a decrease in intolerant (EPT) taxa (Table B-2). The total number of taxa present in each sample was relatively consistent across the samples (ranging from 19 to 29) with no significant fluctuations between years at any site. Similarly, the number of EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa ranged from 10 to 18 through the years with little fluctuation at any one site indicating relative stability in the diversity of site communities.

Total abundance is an estimate of the total number of individual organisms present in a sample and can be influenced by many different factors at a particular site and can be organism specific. Through the sample years on the Salmo River, the total abundance has varied somewhat at each site but not in any great amount except at NESLM02 where total abundance reached 9100 in 2010 and at NESLM03 where in 2007 the total abundance was 36400 (Figure 3). This value at NESLM03 is significantly higher than the range of abundance in other years at this site. It is possible that this outlier may be a result of a transcription error in reporting but we have been unable to determine if that is indeed the case at the time of this report. It is also possible that the abundance value is not the result of reporting error and represents a decrease of 33,000 benthic individuals at this site between 2007 and 2008.

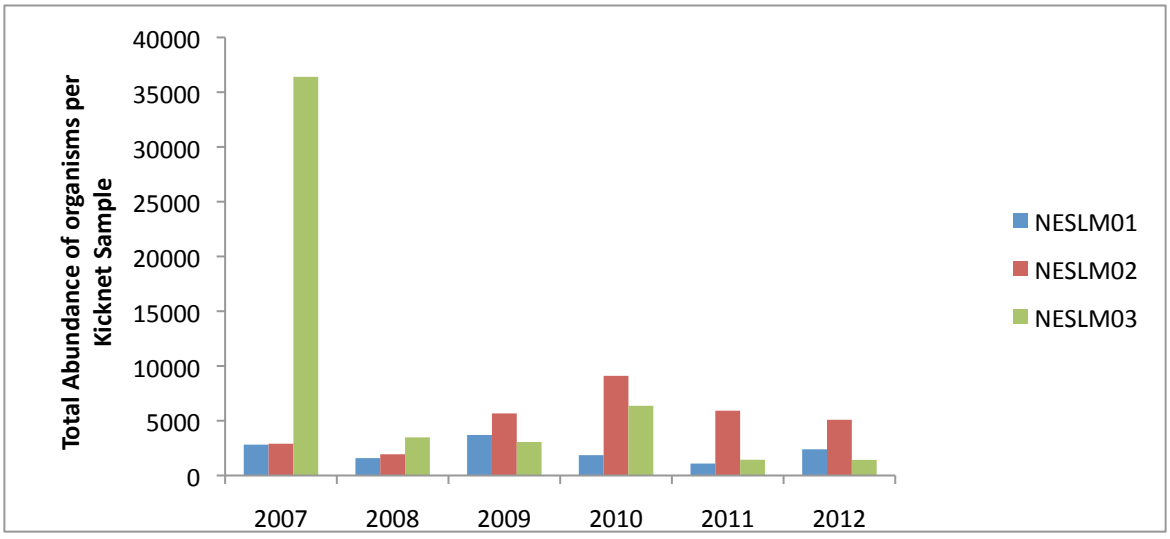

Figure 3. Total Abundance of organisms estimated from kicknet samples at NESLM01, NESLM02, and NESLM03 for 2007 to 2012.

Relative abundance of specific organisms is often used as a percentage to express the composition of a community. Specifically when looking at the comparative abundance of EPT and Diptera orders in comparison to others and in particular, when looking at the percentage of a population that is sensitive to habitat disturbances (EPT) and how that population changes over time or between locations. In the Salmo River, there was little variation over time at each site however, NESLM03 did show a decrease in Chironomidae (order Diptera) and Plecoptera and an increase in Ephemeroptera from 2010 to 2012 (Figure 6) as the site became less stressed through those years. Site NESLM01 had the highest percentages of Chironomidae and NELSM02 had the highest percentages of Ephemeroptera on average (Figures 4, 5, and 6).

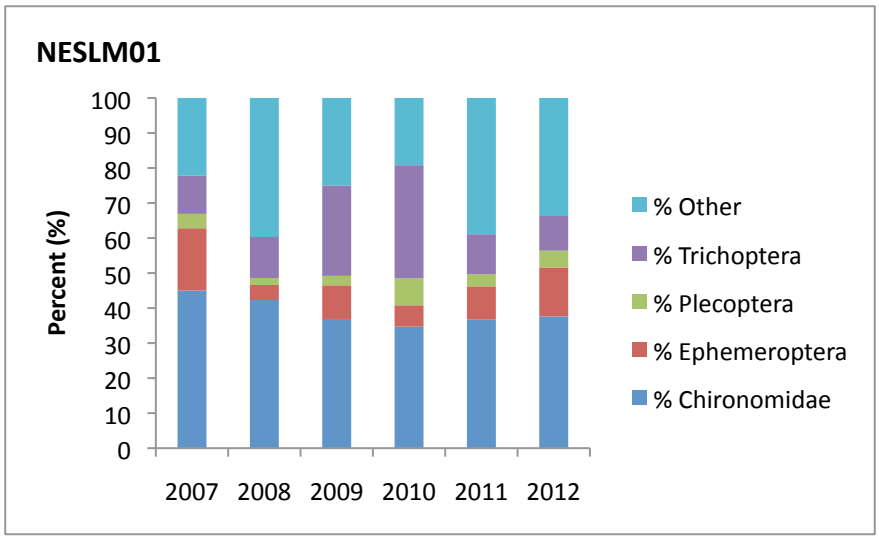

Figure 4. Community composition by percentage for years 2007 to 2012 at NESLM01.

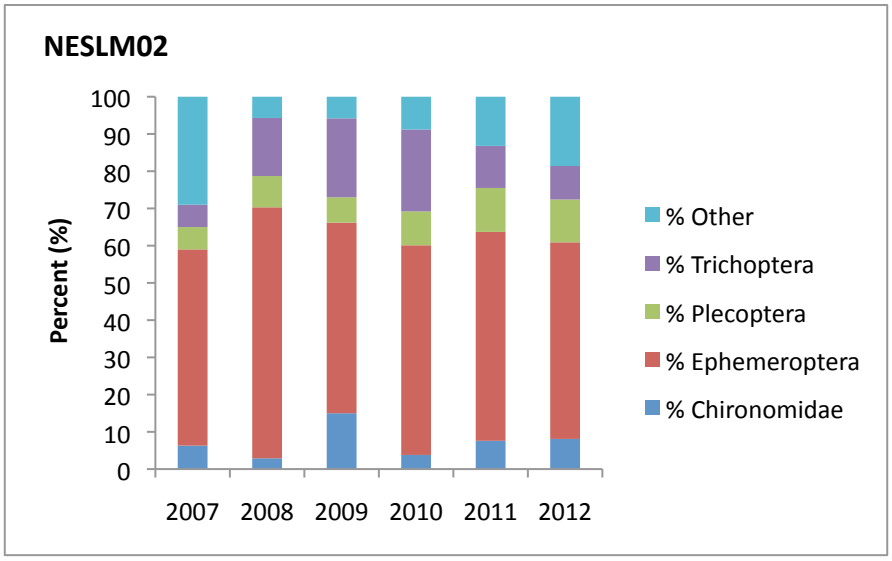

Figure 5. Community composition by percentage for years 2007 to 2012 at NESLM02.

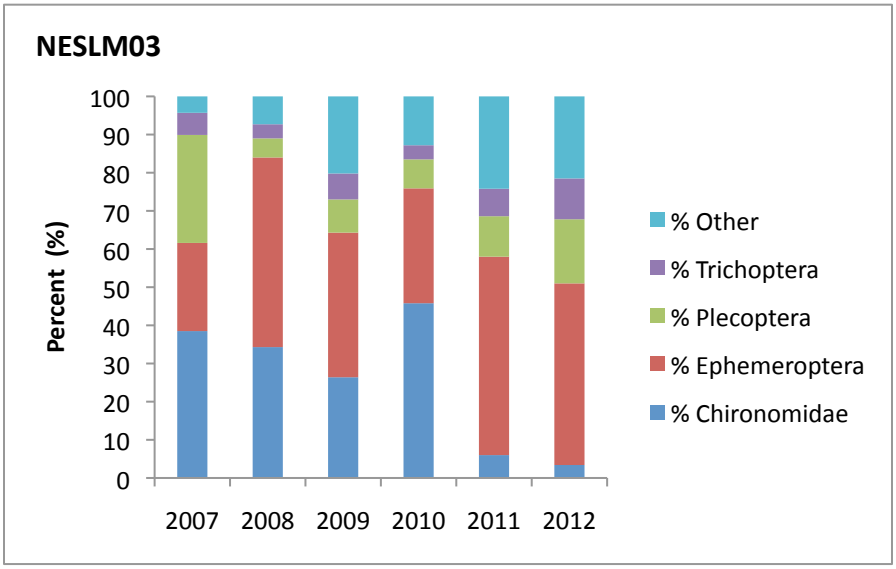

Figure 6. Community composition by percentage for years 2007 to 2012 at NESLM03.

1.9 Water quality results

1.9.1 Water quality QA/QC

All laboratory quality control results were reviewed and confirmed to meet standard criteria (Maxxam 2012) prior to proceeding with processing of field samples (T. Rudkin Pers. Comm.). Field duplicates and field blanks of water samples were submitted to the laboratory for sites each site annually (Appendix C-1). RPD values from field duplicate samples comparison indicated no values exceeding the Alert Criteria of 30%. The quality control review of field blank data revealed that all but the blank ran on June 3, 2010 and the blank value for bicarbonate from July 19, 2011 were within acceptable ranges. These results indicated potential contamination/influence in the blank samples. A review of the regular data for these parameters/days, indicated that field values were not elevated relative to other days sampled. All subsequent water quality analyses included only the first of the duplicate samples, typed as "Regular". All values that had been flagged as being analysed past recommended hold times were considered to be acceptable since they were within the normal range for the parameter in the sampling area.

1.9.2 Non-metal water quality data

Non-metal water quality data were collected at three sites on the Salmo River at various frequencies between 2007 and June, 2013 (Appendix B. Water Quality Data-2). Of the non-metal parameters reviewed, dissolved oxygen, pH, and total phosphorus were found to be the only non-metal parameters outside of the guidelines, and this occurred only periodically (Table 7).

Dissolved oxygen values were lower than that required for the protection of aquatic life (Government of BC 2006) in December and January 2012, and January 2013 at NESLM02 and October 2007 at NESLM03. Low concentrations of dissolved oxygen in the winter can be a limiting factor for fish survival.

The pH values were found to be outside of the acceptable range of 6.5-9.0 for the protection of aquatic life (Government of BC 2013 and CCME 2004) at all three sites in the latter half of 2012 and the first half of 2013. At NESLM02 the pH value spiked to a high of 9.09 in February of 2012. Values at NESLM01 (September 2012), NESLM02 (August - November 2012, January - June 2013), and NESLM03 (September 2012) were below the acceptable low end of the parameter (6.5). The guidelines for pH values recognize that natural pH values can drop below 6.5 but specify that decreases in pH caused by human impact are not permitted (McKean and Nagpal 1991).

The phosphorus guideline for the protection of aquatic life follows a framework-based approach were concentrations should not (i) exceed predefined 'trigger ranges'; and (ii) increase more than 50% over the baseline (reference) levels (CCME 1999a, 2004). The trigger ranges are based on the range of phosphorus concentrations in water that define the reference productivity

or trophic status[1] for a site (CCME 2004). Based on existing data, the baseline range for total phosphorus in the Salmo River was determined to be 4-10 µg/L, representing oligotrophic conditions. This is typical of unimpacted areas and generally supports diverse and abundant aquatic life and is self-sustaining (CCME 2004). Using the CCME approach, data were evaluated against the site specific guideline, calculated as 1.5x the upper end of the baseline range, which is equivalent to 15 µg/L. The total phosphorus guideline values were exceeded at NESLM02 and NESLM03 in May and October 2009 respectively. These exceedances represented substantive spikes of 76 µg/L and 150 µg/L from that normally present. These phosphorus values also exceeded the drinking water guideline of 10 µg/L (Health Canada 2012).

In 2010, a transition was made to analyse orthophosphate instead of total phosphorus. Orthophosphate is the most significant form of inorganic phosphorus, and is the only form of soluble inorganic phosphorus directly utilized by aquatic biota (CCME 2004). Orthophosphate values were generally very low, below detectable levels. However, a spike was noted at NESLM02 in January 2012, with levels increasing to 6.1 µg/L.

1.9.3 Metal water quality data

Metal water quality data were collected in 2007, 2008, and 2009 at NESLM02 with three parameters (total cadmium, total copper, total zinc) exceeding the guideline for the protection of aquatic life (Table C-3, Table 7). Total cadmium values were approximately 10 times higher than the CCME guideline (1999a) in all years. In 2008, the sample value exceeded the calculated Total Copper guideline (CCME 2004) of 2.0 µg/L by 0.1 µg/L (2.1 µg/L). The total zinc value in 2008 was two times higher than the BC Approved Guideline (2006).

1.9.4 Sediment quality data

Sediment quality data collected at NESLM02 in 2010, 2011, and 2012 revealed that out of the 27 parameters having guidelines for the protection of aquatic life, 7 exceeded the guidelines in one or all years of sampling (Table C-4, Table 7). These included arsenic, cadmium, iron, lead, nickel, silver, and zinc. The factor that each of the exceedances was higher relative to the guidelines was calculated (Table 8). These results reveal that the lower effect guidelines were exceeded by arsenic, iron, and nickel sediment values (e.g. CCME ISQG and BC Working low effect). The CCME ISQG refers to the Interim Sediment Quality Guideline which is the concentration below which adverse biological effects are expected to rarely occur (i.e. fewer than 25% adverse effects occur below this level) (CCME 2001). Cadmium, lead, and zinc values exceeded the higher effect CCME PEL guidelines at least one year sampled. These elements are thus of greater potential concern. The CCME PEL refers to the probable effect level which is the level above which adverse effects are expected to occur frequently (i.e. >50% adverse effects occur above the PEL) (CCME 2001).

[1] Trophic status refers to the productivity of a waterbody, with eutrophic systems having high productivity and oligotrophic having low. Nutrient addition, primarily phosphorus, contributes to eutrophication, which is when the waterbody's productivity is accelerated from natural (Wetzel, 2001).

Table 7. Summary of guideline exceedances for water and sediment quality data for the protection of aquatic life (aq. life).

Site	Years assessed*	Exceedance (intent, source**): date
Water, non-metals		
NESLM01	2007, 2008, 2009, 2010, 2011, 2012	**pH** (Aq. Life, BC Appr. And CCME): 2012
NESLM02	2007, 2008, 2009 (9X), 2010 (11X), 2011 (11X), 2012 (12X), 2013 (6X)	**Dissolved Oxygen** (Aq. Life, CCME): Dec 2012, Jan 2013 **Dissolved Oxygen** Aq. Life, BC Appr.): Jan 2012 **pH** (Aq. Life, BC Appr. And CCME): Feb, Aug, Sept, Oct, Nov 2012; Jan, Feb, Mar, Apr, May, June 2013 **Total Phosphorus** (Drinking, HC): May 2009 **Total Phosphorus** (Aq. Life, CCME): May 2009
NESLM03	2007, 2008, 2009, 2010, 2011, 2012	**Dissolved Oxygen** (Aq. Life, CCME): 2007 **pH** (Aq. Life, BC Appr. And CCME): 2012 **Total Phosphorus** (Drinking, HC): Oct 2009 **Total Phosphorus** (Aq. Life, CCME): Oct 2009
Water, metals		
NESLM02	2007, 2008, 2009	**Total Cadmium** (Aq. Life, CCME): 2007, 2008, 2009 **Total Copper** (Aq. Life, CCME): 2008 **Total Zinc** (Aq. Life, BC Appr.): 2007
Sediment, metals		
NESLM02	2010, 2011, 2012	**Total Arsenic** (Aq. Life, BC Work and CCME PEL): 2010, 2011 **Total Cadmium** (Aq. Life, BC Work and CCME ISQG): 2010, 2012 **Total Cadmium** (Aq. Life, CCME PEL): 2012 **Total Iron** (Aq. Life, BC Work): 2011 **Total Lead** (Aq. Life, BC Work and CCME ISQG): 2010, 2012 **Total Lead** (Aq. Life, CCME PEL): 2011 **Total Nickel** (Aq. Life, BC Work): 2010, 2011, 2012 **Total Silver** (Aq. Life, BC Work): 2011 **Total Zinc** (Aq. Life, BC Work and CCME ISQC): 2010, 2012 **Total Zinc** (Aq. Life, CCME PEL): 2011

Legend:
*Data collected 1 time per year unless otherwise indicated.
**Source:
BC Appr. = BC Approved Water Quality Guidelines (Government of BC 2006)
BC Work = BC Working Water Quality Guidelines (Nagpal et al. 2006)
CCME (ISQG or PEL) = Canadian Sediment Quality Guidelines (CCME 1999b)
CCME = Canadian Water Quality Guidelines (CCME 1999a)
HC = Drinking Water Quality Guidelines (Health Canada 2012)

Table 8. Sediment quality exceedances at NESLM02 and the factor greater that each of the exceedances was relative to the guidelines.

Element	Year	Factor higher than guideline*				
		CCME ISQG**	CCME PEL***	BC Work low effect	BC Work high effect	BC Work General
Arsenic	2010	1.6	-	-	-	-
	2011	1.8	-	-	-	-
Cadmium	2010	3.3	-	-	-	-
	2011	-	2.3	-	-	-
	2012	2.4	-	-	-	-
Iron	2011	-	-	1.1	-	-
Lead	2010	2.15	-	-	-	-
	2011	-	1.5	-	-	-
	2012	1.7	-	-	-	-
Nickel	2010	-	-	1.3	-	-
	2011	-	-	1.4	-	-
	2012	-	-	1.0	-	-
Silver	2011	-	-	-	-	1.02
Zinc	2010	1.9	-	-	-	-
	2011	-	1.3	-	-	-
	2012	1.6	-	-	-	-

***See Table 7 for guideline source definitions and references**

****CCME ISQG (Interim Sediment Quality Guideline Concentration): below which adverse biological effects are expected to rarely occur (i.e. fewer than 25% adverse effects occur below this level)**

*****CCME PEL (Probable Effect Level): level above which adverse effects are expected to occur frequently (i.e. >50% adverse effects occur above the PEL).**

1.10 Stream temperature results

Continuous stream temperature monitoring was conducted between 2007 and 2012 at three locations (NESLM01, NESLM02, and NESLM03) on the Salmo River. Dates monitored varied by year (Table 9). Maximum stream temperatures ranged from 14.22 ºC at NESLM03 in 2011 to 20.65 ºC at NESLM01 in 2008 (Table 10). In 2007, sampling did not begin until September and did not capture the maximum stream temperatures typically seen in July and August. On average, the highest temperatures each year were at NESLM01 while the lowest were at NESLM03 which is consistent with expected results. NESLM03 is a higher gradient, faster moving stream with more overhanging vegetation while NESLM01 is wider, slower moving with little shade (Appendix A). Figures 7, 8, and 9 illustrate the similarities in temperature profile between years at each site.

Both NESLM01 and NESLM02 had average summer temperatures (July to early September) that exceeded BC optimum temperature guidelines for adult Bull Trout (*Salvelinus confluentus*) of 6.0-14.0 ºC (Oliver and Fidler 2001). Bull Trout are a blue-listed species of concern in the Province of BC and have been designated a high conservation concern in the Salmo River Watershed (Hagen 2008).

Table 9. Temperature sampling dates for all sites and years.

	Dates Monitored					
Site	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
NESLM01	September to November	July to October	June to October	May to October	August to September	July to September
NESLM02	September to November	July to October	June to October	May to October	August to September	July to September
NESLM03	September to November	July to October	June to October	May to October	August to September	July to September

Table 10. Maximum stream temperatures recorded at each site during each sampling year from 2007 to 2012.

	Maximum Stream Temperature (ºC)					
Site	**2007***	**2008**	**2009**	**2010**	**2011**	**2012**
NESLM01	15.06	20.65	20.34	19.34	17.46	17.80
NESLM02	15.49	18.56	18.53	17.80	16.42	17.37
NESLM03	12.63	16.23	16.08	-	14.22	15.46

*2007 sampling began in September and did not likely capture the highest temperatures that year.

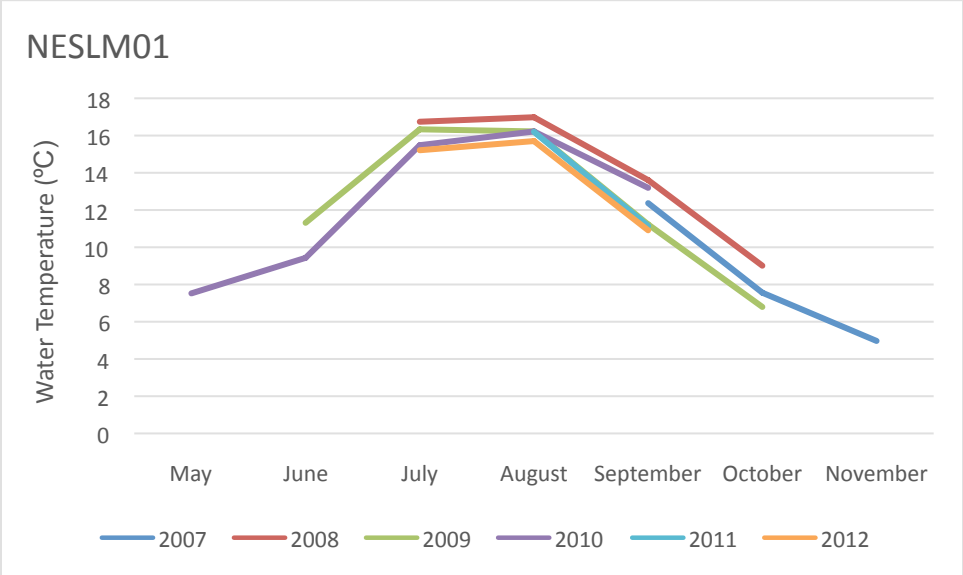

Figure 7. Monthly average maximum daily stream temperature for May to November from 2007 to 2012 at NESLM01. Note that sampling dates varied between years.

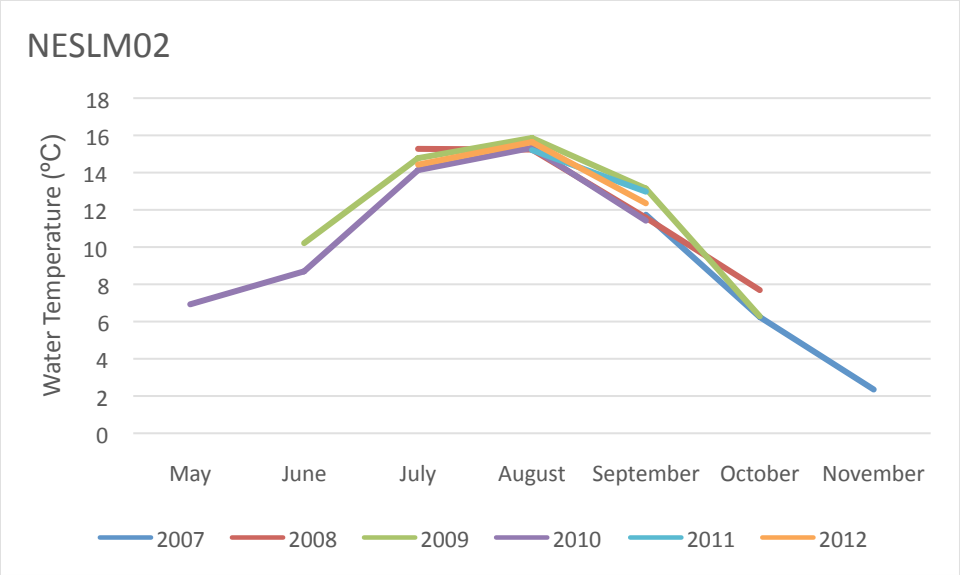

Figure 8. Monthly average maximum daily stream temperature for May to November from 2007 to 2012 at NESLM02. Note that sampling dates varied between years.

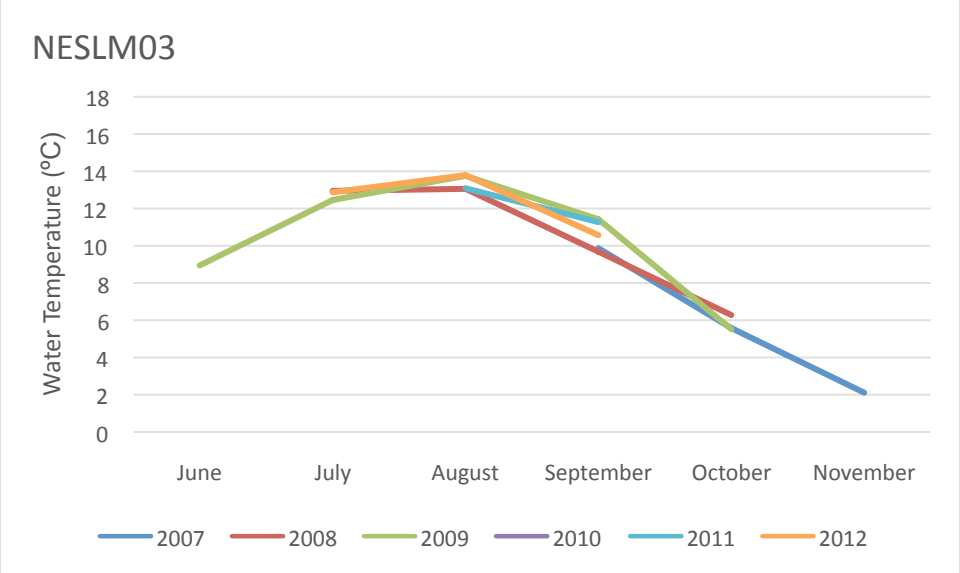

Figure 9. Monthly average maximum daily stream temperature for June to November from 2007 to 2012 at NESLM03. Note that sampling dates varied between years.

Discussion

Six years (2007-2012) of CABIN sampling, water quality analysis, and temperature monitoring at our site locations on the Salmo River has provided some baseline data for the mainstem of the system. There are, however, significant gaps in this data. As a pilot project, the monitoring program was altered over the years as some test parameters were removed as unnecessary and others were added. Procedures, equipment, and reporting mechanisms also changed throughout the time period as member group capacity and funding were increased.

NESLM01 is located at the downstream end of the stream system, just upstream from where the Salmo River flows into the Pend d'Oreille River. CABIN BEAST Analysis found this site to be potentially stressed in 2008 and 2009 and stressed in 2007, 2010, 2011, and 2012 compared to the reference condition model (Table 5). The benthic community metrics show a low RIVPACS ratio in 2009 but higher ratios in the following three years with several Plecoptera and Trichoptera (EPT) taxa not observed (Table 6). NESLM01 shows the highest level of Chironomidae of the three sites which may correspond to the stressed model condition Figure 4). The abundance and diversity of EPT individuals generally decrease and the number of less intolerant (Chironomidae) taxa increase as stream habitat becomes degraded.

Stream and sediment metals were not measured in the water quality analysis at NESLM01 and non-metal analysis did not show any indicators of a degraded system. However, this data, collected only once per year, is insufficient for further discussion into water quality.

The temperature profile at NESLM01 (collected in inconsistent annual monitoring periods (Figure 7)) shows that this site had the highest maximum temperatures each year and the warmest temperatures overall. Stream temperatures can have an effect on benthic macro-invertebrate and fish habitat availability and may be a limiting factor at this site for the Salmo River Bull Trout population.

NESLM02 is located midway between the headwaters and the confluence of the Salmo River and the Pend d'Oreille River and approximately halfway between the unincorporated community of Ymir and the Village of Salmo. CABIN BEAST Analysis found this site to be potentially stressed in all years except 2010, when the site was found to be stressed (Table 5). The RIVPACS ratios were high except for in 2007 which corresponded to the year that there were the most unobserved taxa that were expected to be present at >70%. As at NESLM01, these unobserved taxa were Plecoptera and Trichoptera (EPT) (Table 6). NESLM02 had the highest abundance of the three sites (excluding the outlier at NESLM03 in 2007) (Figure 3) with a high percentage of EPT taxa and the smallest percentage of the more tolerant Chironomidae taxa (Figure 5) suggesting a healthy benthic macro-invertebrate community.

Water quality monitoring was conducted more regularly (monthly from 2009-2013) at NESLM02 (Appendix B) and included annual metal testing in the water (2007–2009) and in the sediment (2010-2012). Non-metal analysis indicated low level exceedances of dissolved oxygen in the coldest winter months as temperatures dropped to 0 ºC. Total phosphorus exceeded guidelines in a spike of 76 µg/L during 2009 that could be anthropogenic in nature or naturally occurring. NESLM03 also had a spike of 150 µg/L in 2009. These are the only two total phosphorus values

to exceed the guidelines. PH values outside of the accepted ranges were found at NESLM02 in the latter half of 2012 and into 2013 however none of these parameters correspond with the stressed condition of 2010 which may indicate that they lie within normal fluctuations for this stream. Further monitoring would be required to complete an analysis.

Metals in water and sediment testing found several parameters that exceeded the guidelines including cadmium, copper and lead in the water and arsenic, cadmium, iron, lead, nickel, silver and zinc in the sediment. Only cadmium was found in the water for all three years and only arsenic, cadmium, lead, and zinc exceeded high level guidelines in the sediment. More information is needed to study the effects of these particular metals.

The temperature profile at NESLM02 (collected in inconsistent annual monitoring periods (Figure 8)) was similar to that of NESLM01 although the temperatures were consistently slightly lower. Maximum daily temperatures during the summer months still exceeded the optimum range for Bull Trout and may be a limiting factor at this site for the Salmo River Bull Trout population.

NESLM03 is located near the headwaters of the Salmo River, just downstream of the confluence of Clearwater and Apex Creeks. CABIN BEAST Analysis found this site to be severely stressed in 2007 stressed 2009, potentially stressed in 2008, 2010, and 2011, and unstressed in 2012 compared to the reference condition model (Table 5). The benthic community metrics show the lowest RIVPACS ratio in 2007 corresponding to the severely stressed condition but higher ratios in the following years. As at the other sites, several Plecoptera and Trichoptera (EPT) taxa not were not observed but were expected to be present (Table 6). NESLM03 shows the most variation in the percent of Chironomidae and EPT individuals of the three sites. Chironomidae numbers decreased as EPT numbers increased which corresponds to the change from severely stressed in 2007 to unstressed condition in 2012 (Figure 6). Abundance metrics showed an outlier in 2007 that exceeded the other years at NESLM03 by approximately 33,000 individuals. It is possible that this value is the result of a data processing error however that has not been confirmed at this point. It is also possible that this is a natural value and that there were other factors, either anthropogenic or natural, involved in the decrease in individuals between 2007 and 2008.

Stream and sediment metals were not measured in the water quality analysis at NESLM03 and non-metal analysis did not show any indicators, other than the total phosphorus in 2009 as discussed above, of a degraded system. However, this data, collected only once per year, is insufficient for further discussion into water quality.

The temperature profile at NESLM03 (collected in inconsistent annual monitoring periods (Figure 9)) shows that this site had the lowest maximum temperatures each year and the coolest average temperatures of the three sites with maximum daily values falling within the optimal range for Bull Trout at <14 ºC.

Conclusions and Recommendations

The Salmo River Watershed is a heavily impacted watershed, home to several species of concern and characterized by high gradient tributary streams.

SWSS conducts research, monitoring, and restoration activities in the Salmo River Watershed guided by our Watershed Planning Team (WPT) and by the provincially and federally endorsed Salmo River Watershed-Based Fish Sustainability Plan (WFSP) (Green, Nellestijn, & Field, 2006). Conservation of the Bull Trout population is a priority recognized within the plan.

Data collection to date illustrates that the Salmo River mainstem sites (NESLM01, NESLM02, and NESLM03) are divergent from the reference stream in the CABIN models and have not, in general, differed greatly from year to year in benthic community metrics, measured water quality parameters, or thermal regime. This baseline data is valuable but not inclusive of the entire system.

As such, CBWQMP related data collection in the Salmo River Watershed should align with assessed needs as outlined in the WFSP and aid in defining limiting factors of the bull trout population. To that end, SWSS suggests that CBWQMP operating procedures engage in a watershed approach and reflect high level values where they have been identified. In the Salmo River Watershed additional sites should be selected on tributary streams that represent known bull trout spawning areas, such as Clearwater Creek, Sheep Creek, and the South Salmo River (Nellestijn, 2013).

The SWSS recognizes that all monitoring in this cold water system provides a guide that increases our ability to make this Place more ecologically responsive for all species.

Within the Salmo River Watershed the SWSS recommends expanding the CBWQMP to:

- Integrate it with existing planning, restoration, conservation, and monitoring efforts in this watershed.
- Develop a comprehensive watershed-based temperature monitoring program specifically targeting Bull Trout spawning areas or other areas of interest as identified in the WFSP.
- Maintain the CBWQMP temperature loggers located at NESLM01, NESLM02, and NESLM03 sites.
- Maintain the monthly water quality monitoring program in order to secure a long-term record within the Salmo River System.
- Add monthly water quality monitoring sites in areas that have been identified as areas of concern.
- Adapt the monthly program to reflect community needs.
- Increase the community-oriented WQMP to include a comprehensive communications element beyond the Village Council Report and the Earth Day Poster we already do.

- Expand the Program to characterize flow regimes within tributary watersheds of identified importance.

Within the Columbia River Watershed the SWSS recommends expanding the CBWQMP to:

- Ensure that water quality monitoring is species oriented as well as reflecting human needs.
- Create a contingency fund for each watershed group as an available resource to assess emergency water quality concerns or any emerging water quality concern, point source or other.
- Expand the Program to include the Columbia River mainstem and a selection of Columbia River tributaries.
- Develop a Columbia River Watershed 'State of the Basin Water Quality Report'.
- Develop partnerships within existing agency and industry water quality monitoring programs to ensure a community-based element.
- Develop criteria for a WQMP flow-monitoring element.
- Provide training only for the recognition and reporting process to applicable groups for other elements that may determine or have an effect on water quality.
- Consider monitoring fish populations.
- Most importantly, actively support ecosystem-based management, Watershed planning, and a guaranteed implementation approach to increased environmental, social and economic health.

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Personal Communications

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Rudkin, Tabitha. Project Manager, Maxxam Analytics, Burnaby BC.

Appendix A. CABIN data

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Oct 28 2007
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03335 N, 117.30012 W
Altitude	1850
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	20.9%	7.8%	6.6%	63.9%	0.9%
CABIN Assessment of NESLM01 on Oct 28, 2007	Divergent				

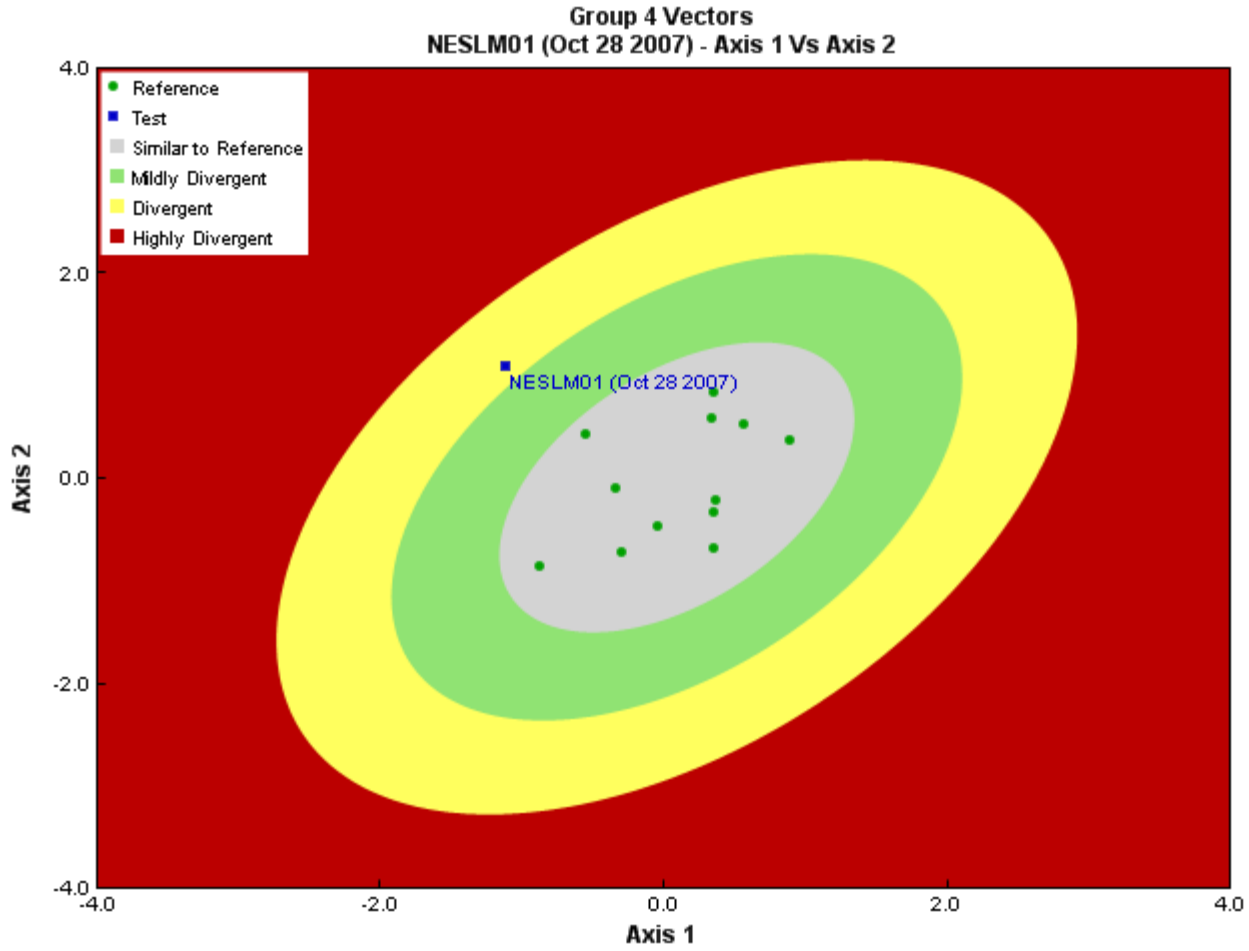

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	October 28, 2007
Subsampling Device	Marchant Box
Proportion Subsampled	12/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.79	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	45.0	7.4 ± 6.4
% Ephemeroptera	17.8	51.7 ± 18.7
% Ephemeroptera that are Baetidae	26.7	40.6 ± 30.0
% EPT Individuals	32.8	87.7 ± 7.3
% of 2 dominant taxa	60.9	57.9 ± 14.2
% of dominant taxa	45.0	39.8 ± 14.9
% Plecoptera	4.1	31.4 ± 15.4
% Tricoptera	10.9	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.4	0.9 ± 0.1
Total Abundance	2816.6	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	11.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	20.0	19.1 ± 3.6
Trichoptera taxa	2.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.94
Ephemerellidae	78%	100%	100%	100%	100%	0.95
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.74
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.75
Perlodidae	78%	78%	89%	92%	81%	0.87
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.88

RIVPACS : Expected taxa P>0.50	13.89
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	0.94
RIVPACS : Expected taxa P>0.70	10.96
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.82

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	62.8	23.6 ± 11.1
Depth-Max (cm)	76.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	1.12	0.48 ± 0.22
Velocity-Max (m/s)	1.66	0.76 ± 0.36
Width-Bankfull (m)	51.0	13.4 ± 9.9
Width-Wetted (m)	31.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	8	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	5	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	14.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.6	7.9 ± 0.4

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Oct 19 2008
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03335 N, 117.30012 W
Altitude	1791
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	33.6%	6.0%	5.4%	54.2%	0.7%
CABIN Assessment of NESLM01 on Oct 19, 2008	Mildly Divergent				

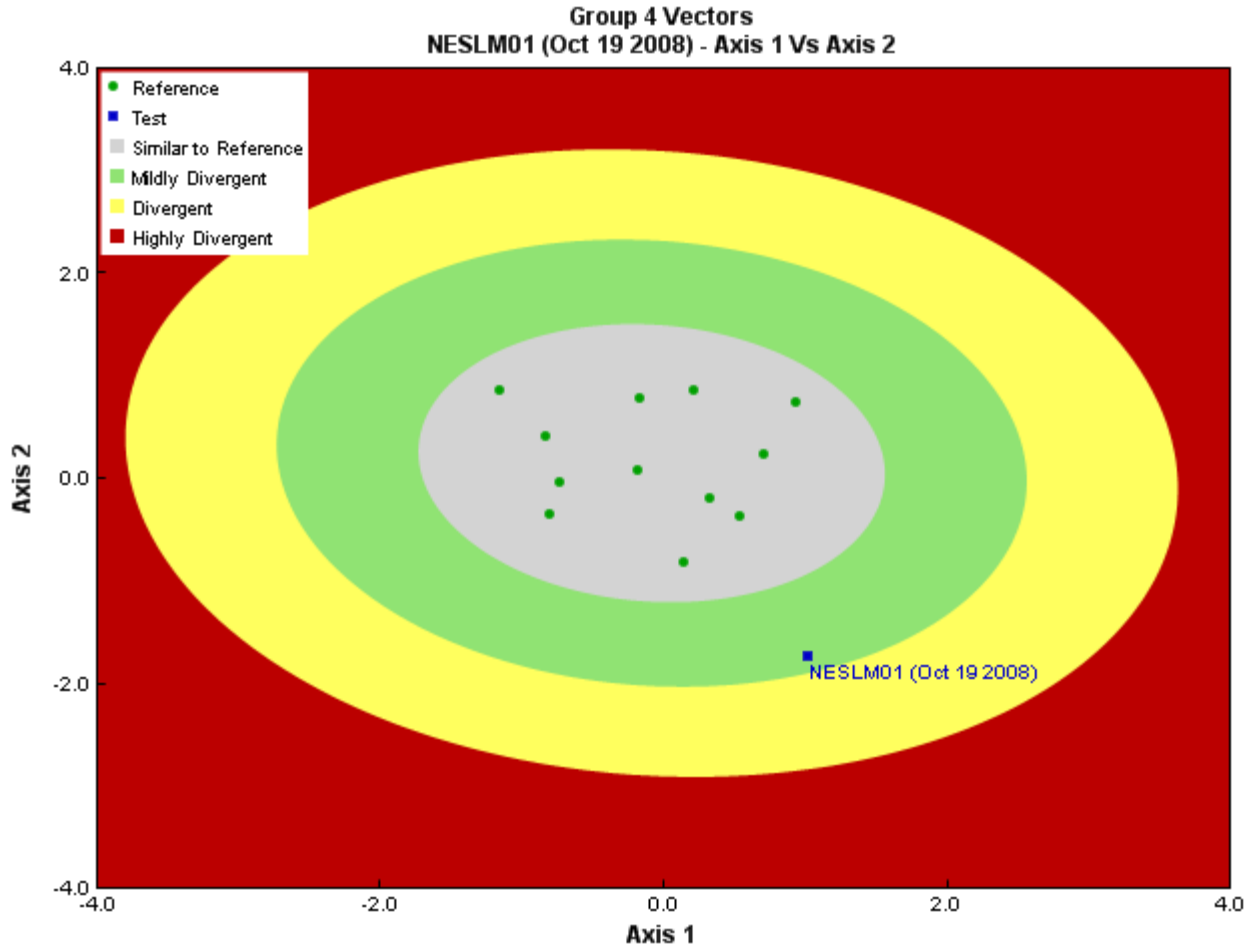

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	October 19, 2008
Subsampling Device	Visual Estimate
Proportion Subsampled	18.9/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.9	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	42.3	7.4 ± 6.4
% Ephemeroptera	4.3	51.7 ± 18.7
% Ephemeroptera that are Baetidae	23.1	40.6 ± 30.0
% EPT Individuals	18.0	87.7 ± 7.3
% of 2 dominant taxa	66.7	57.9 ± 14.2
% of dominant taxa	42.3	39.8 ± 14.9
% Plecoptera	2.0	31.4 ± 15.4
% Tricoptera	11.7	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.3	0.9 ± 0.1
Total Abundance	1587.2	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	13.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	1.8	1.9 ± 0.4
Simpson's Diversity	0.7	0.8 ± 0.1
Total No. of Taxa	23.0	19.1 ± 3.6
Trichoptera taxa	5.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.82
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.91
Ephemerellidae	78%	100%	100%	100%	100%	0.93
Heptageniidae	100%	100%	100%	100%	100%	1.00
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlodidae	78%	78%	89%	92%	81%	0.86
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.89

RIVPACS : Expected taxa P>0.50	13.64
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	1.03
RIVPACS : Expected taxa P>0.70	9.40
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.85

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	66.7	23.6 ± 11.1
Depth-Max (cm)	79.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.30	0.48 ± 0.22
Velocity-Max (m/s)	0.49	0.76 ± 0.36
Width-Bankfull (m)	47.0	13.4 ± 9.9
Width-Wetted (m)	29.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	7	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
SurroundingMaterial (Category(0-9))	5	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	60.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	12.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.4	7.9 ± 0.4
General-SpCond (uS/cm)	147.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Oct 15 2009
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03335 N, 117.30012 W
Altitude	1850
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	4.7%	11.4%	8.2%	74.4%	1.1%
CABIN Assessment of NESLM01 on Oct 15, 2009	Mildly Divergent				

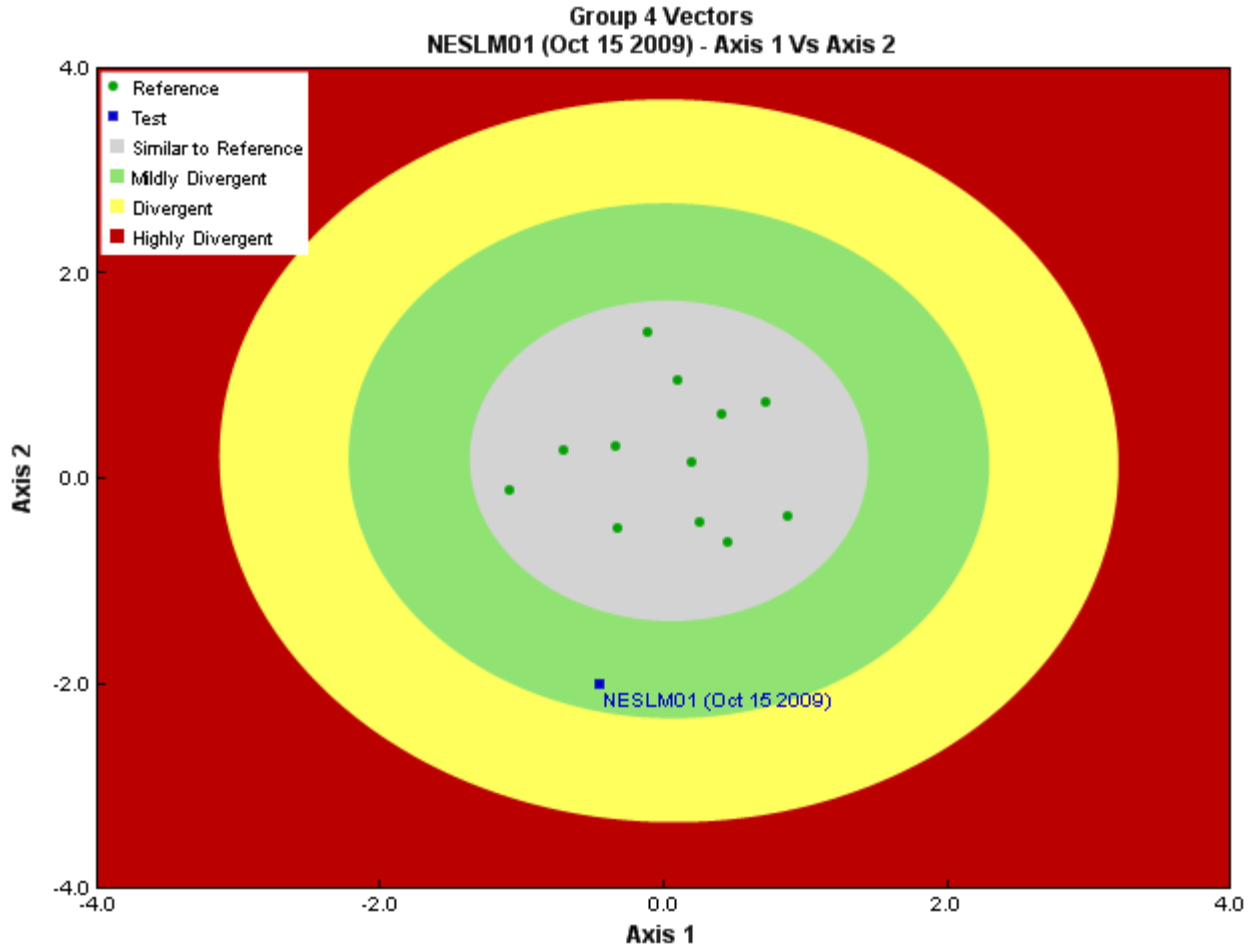

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 26, 2010
Subsampling Device	Marchant Box
Proportion Subsampled	9/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.89	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	36.9	7.4 ± 6.4
% Ephemeroptera	9.6	51.7 ± 18.7
% Ephemeroptera that are Baetidae	6.2	40.6 ± 30.0
% EPT Individuals	38.1	87.7 ± 7.3
% of 2 dominant taxa	61.9	57.9 ± 14.2
% of dominant taxa	36.9	39.8 ± 14.9
% Plecoptera	2.7	31.4 ± 15.4
% Tricoptera	25.8	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.5	0.9 ± 0.1
Total Abundance	3699.9	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	10.0	13.3 ± 2.7
Plecoptera taxa	2.0	6.3 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	19.0	19.1 ± 3.6
Trichoptera taxa	3.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.97
Ephemerellidae	78%	100%	100%	100%	100%	0.99
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.87
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.87
Perlodidae	78%	78%	89%	92%	81%	0.89
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.87

RIVPACS : Expected taxa P>0.50	14.24
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.77
RIVPACS : Expected taxa P>0.70	11.28
RIVPACS : Observed taxa P>0.70	7.00
RIVPACS : O:E (p > 0.7)	0.62

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	52.8	23.6 ± 11.1
Depth-Max (cm)	94.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.36	0.48 ± 0.22
Velocity-Max (m/s)	0.62	0.76 ± 0.36
Width-Bankfull (m)	47.0	13.4 ± 9.9
Width-Wetted (m)	30.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	5	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	68.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.7	7.9 ± 0.4
General-SpCond (uS/cm)	162.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Oct 01 2010
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03335 N, 117.30012 W
Altitude	1791
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	34.8%	5.9%	5.3%	53.3%	0.7%
CABIN Assessment of NESLM01 on Oct 01, 2010	Divergent				

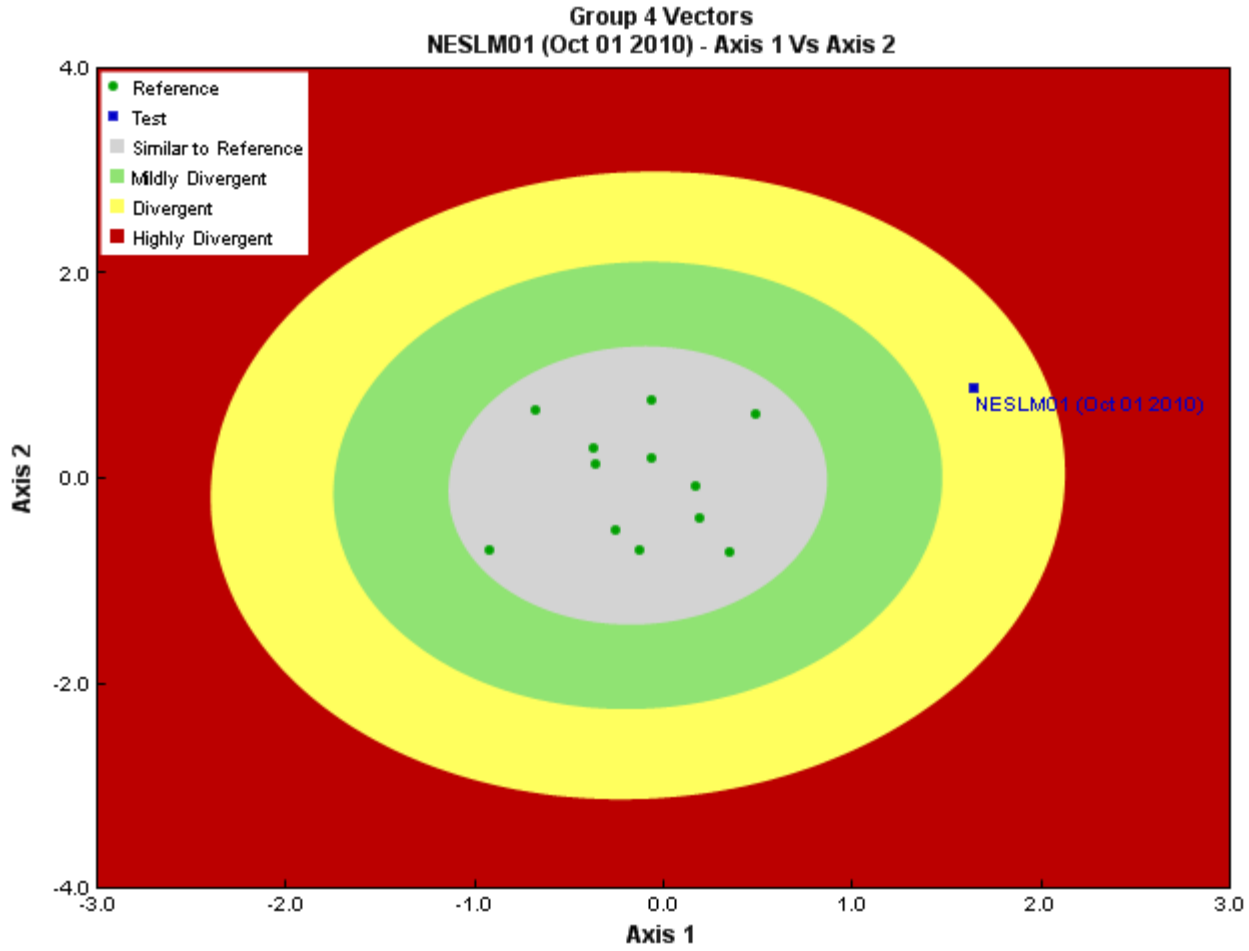

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	March 09, 2011
Subsampling Device	Marchant Box
Proportion Subsampled	16/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.88	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	34.7	7.4 ± 6.4
% Ephemeroptera	6.1	51.7 ± 18.7
% Ephemeroptera that are Baetidae	5.6	40.6 ± 30.0
% EPT Individuals	46.1	87.7 ± 7.3
% of 2 dominant taxa	62.0	57.9 ± 14.2
% of dominant taxa	34.7	39.8 ± 14.9
% Plecoptera	7.7	31.4 ± 15.4
% Tricoptera	32.3	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1
Total Abundance	1856.3	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	13.0	13.3 ± 2.7
Plecoptera taxa	5.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	24.0	19.1 ± 3.6
Trichoptera taxa	4.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.82
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.91
Ephemerellidae	78%	100%	100%	100%	100%	0.92
Heptageniidae	100%	100%	100%	100%	100%	1.00
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlodidae	78%	78%	89%	92%	81%	0.86
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.89

RIVPACS : Expected taxa P>0.50	13.62
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	0.95
RIVPACS : Expected taxa P>0.70	9.40
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.85

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	67.0	23.6 ± 11.1
Depth-Max (cm)	85.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.39	0.48 ± 0.22
Velocity-Max (m/s)	0.57	0.76 ± 0.36
Width-Bankfull (m)	44.0	13.4 ± 9.9
Width-Wetted (m)	30.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	8	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	2	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.3	7.9 ± 0.4
General-Turbidity (NTU)	0.3600000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Sep 22 2011
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03335 N, 117.30012 W
Altitude	1735
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	15.2%	8.7%	7.1%	68.0%	1.0%
CABIN Assessment of NESLM01 on Sep 22, 2011	Divergent				

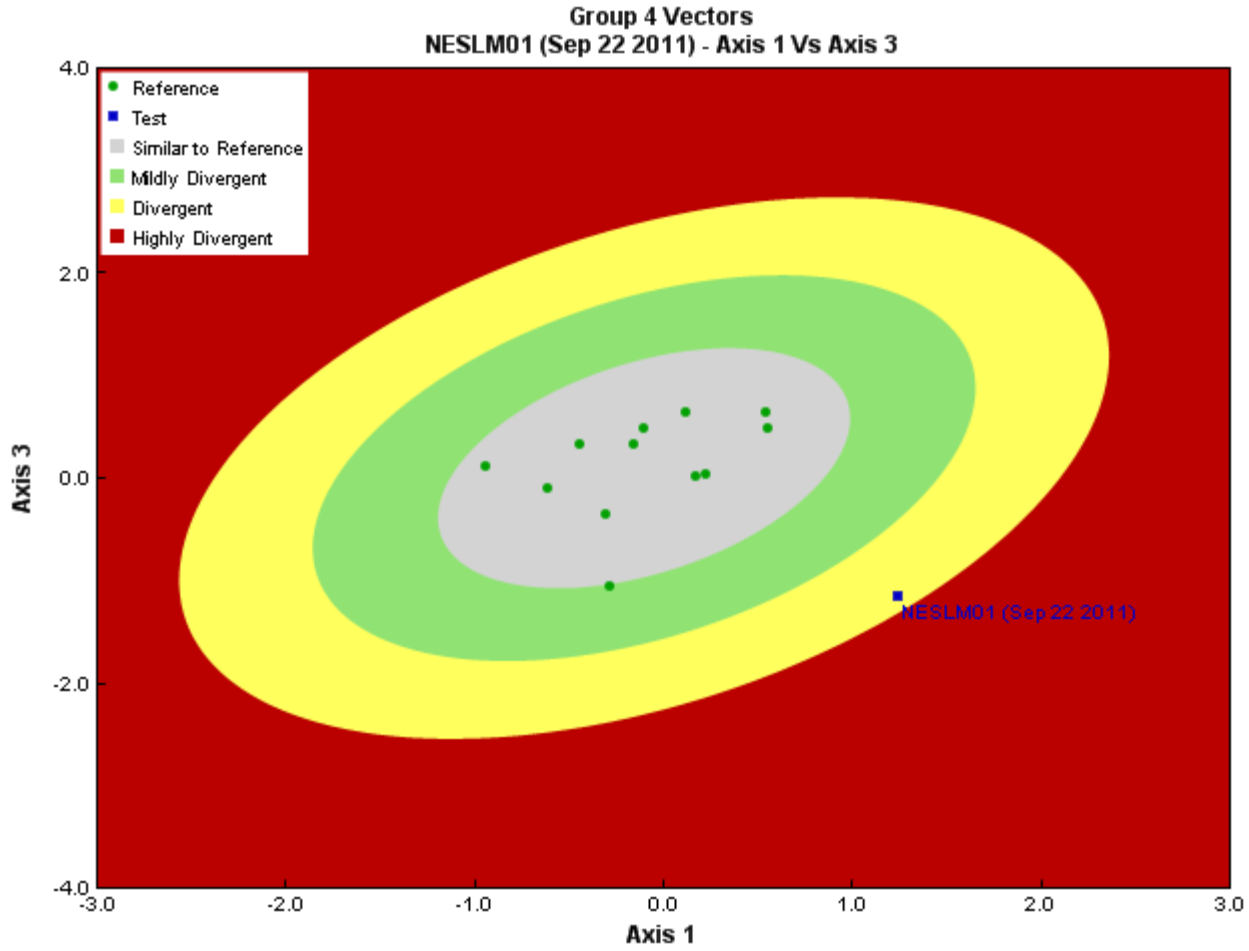

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	January 27, 2012
Subsampling Device	Marchant Box
Proportion Subsampled	29/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.81	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	36.7	7.4 ± 6.4
% Ephemeroptera	9.5	51.7 ± 18.7
% Ephemeroptera that are Baetidae	3.3	40.6 ± 30.0
% EPT Individuals	24.4	87.7 ± 7.3
% of 2 dominant taxa	58.2	57.9 ± 14.2
% of dominant taxa	36.7	39.8 ± 14.9
% Plecoptera	3.5	31.4 ± 15.4
% Tricoptera	11.4	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.4	0.9 ± 0.1
Total Abundance	1089.5	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	11.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	23.0	19.1 ± 3.6
Trichoptera taxa	3.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.95
Ephemerellidae	78%	100%	100%	100%	100%	0.97
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.78
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.79
Perlodidae	78%	78%	89%	92%	81%	0.88
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.88

RIVPACS : Expected taxa P>0.50	13.50
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	0.96
RIVPACS : Expected taxa P>0.70	11.08
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.90

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	60.5	23.6 ± 11.1
Depth-Max (cm)	99.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.36	0.48 ± 0.22
Velocity-Max (m/s)	0.53	0.76 ± 0.36
Width-Bankfull (m)	44.0	13.4 ± 9.9
Width-Wetted (m)	27.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
SurroundingMaterial (Category(0-9))	4	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	45.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	12.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.6	7.9 ± 0.4
General-SpCond (uS/cm)	158.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.3600000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM01
Sampling Date	Sep 25 2012
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.03440 N, 117.30749 W
Altitude	1735
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	14.6%	8.9%	7.1%	68.4%	1.0%
CABIN Assessment of NESLM01 on Sep 25, 2012	Divergent				

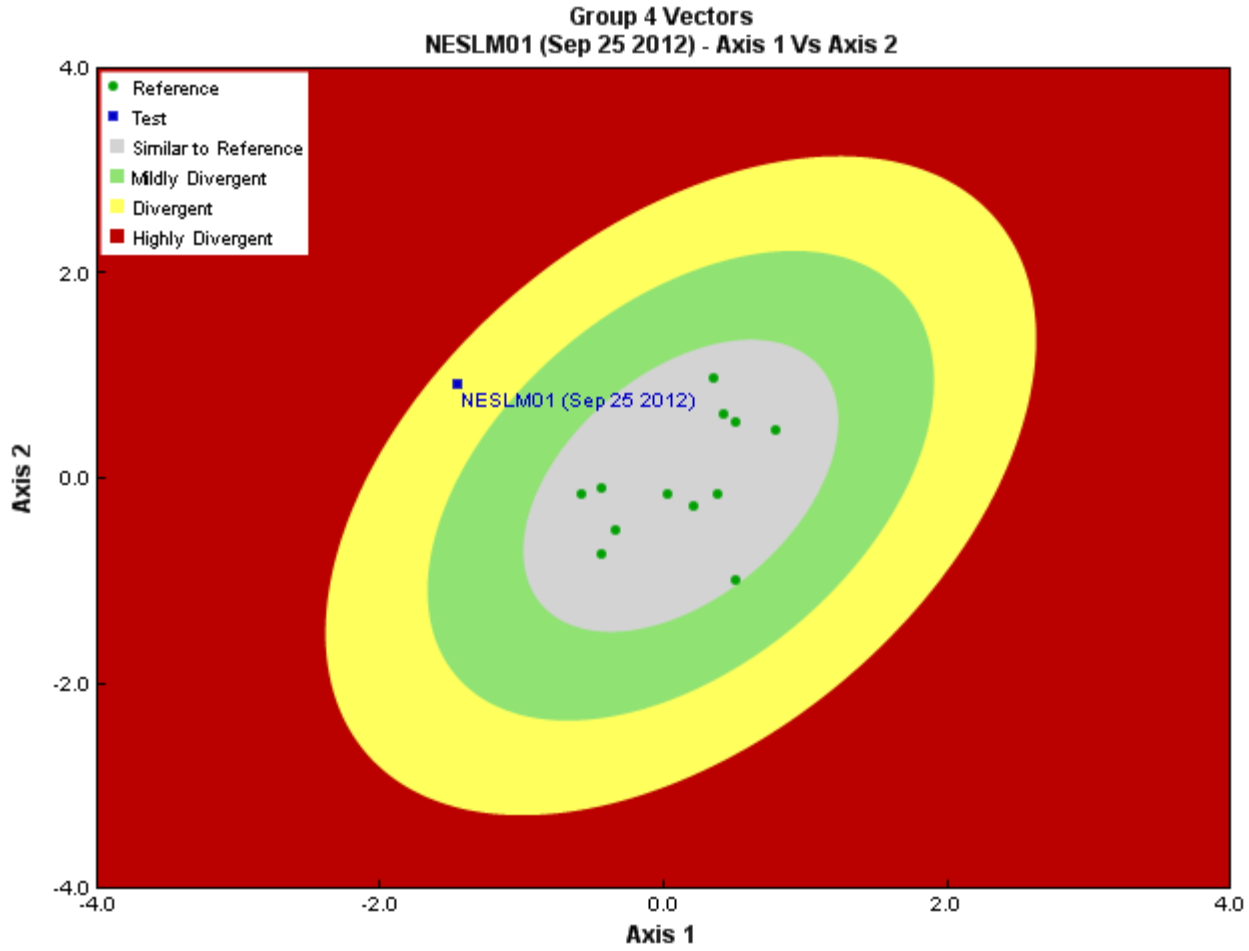

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 12, 2013
Subsampling Device	Marchant Box
Proportion Subsampled	14/100

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.81	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	37.6	7.4 ± 6.4
% Ephemeroptera	14.0	51.7 ± 18.7
% Ephemeroptera that are Baetidae	21.3	40.6 ± 30.0
% EPT Individuals	28.7	87.7 ± 7.3
% of 2 dominant taxa	58.8	57.9 ± 14.2
% of dominant taxa	37.6	39.8 ± 14.9
% Plecoptera	4.8	31.4 ± 15.4
% Tricoptera	9.9	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.4	0.9 ± 0.1
Total Abundance	2392.7	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM01	Predicted Group Reference Mean ±SD
EPT taxa (no)	13.0	13.3 ± 2.7
Plecoptera taxa	3.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.2	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	25.0	19.1 ± 3.6
Trichoptera taxa	6.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM01
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.95
Ephemerellidae	78%	100%	100%	100%	100%	0.97
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.79
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.80
Perlodidae	78%	78%	89%	92%	81%	0.88
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.88

RIVPACS : Expected taxa P>0.50	13.52
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.81
RIVPACS : Expected taxa P>0.70	11.09
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.72

D. Habitat Description

Variable	NESLM01	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	60.2	23.6 ± 11.1
Depth-Max (cm)	85.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.34	0.48 ± 0.22
Velocity-Max (m/s)	0.54	0.76 ± 0.36
Width-Bankfull (m)	44.0	13.4 ± 9.9
Width-Wetted (m)	28.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
SurroundingMaterial (Category(0-9))	4	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	6.5	7.9 ± 0.4
General-SpCond (uS/cm)	170.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.5300000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Oct 25 2007
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.23348 N, 117.23335 W
Altitude	2319
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.0%	11.7%	10.7%	74.7%	2.9%
CABIN Assessment of NESLM02 on Oct 25, 2007	Mildly Divergent				

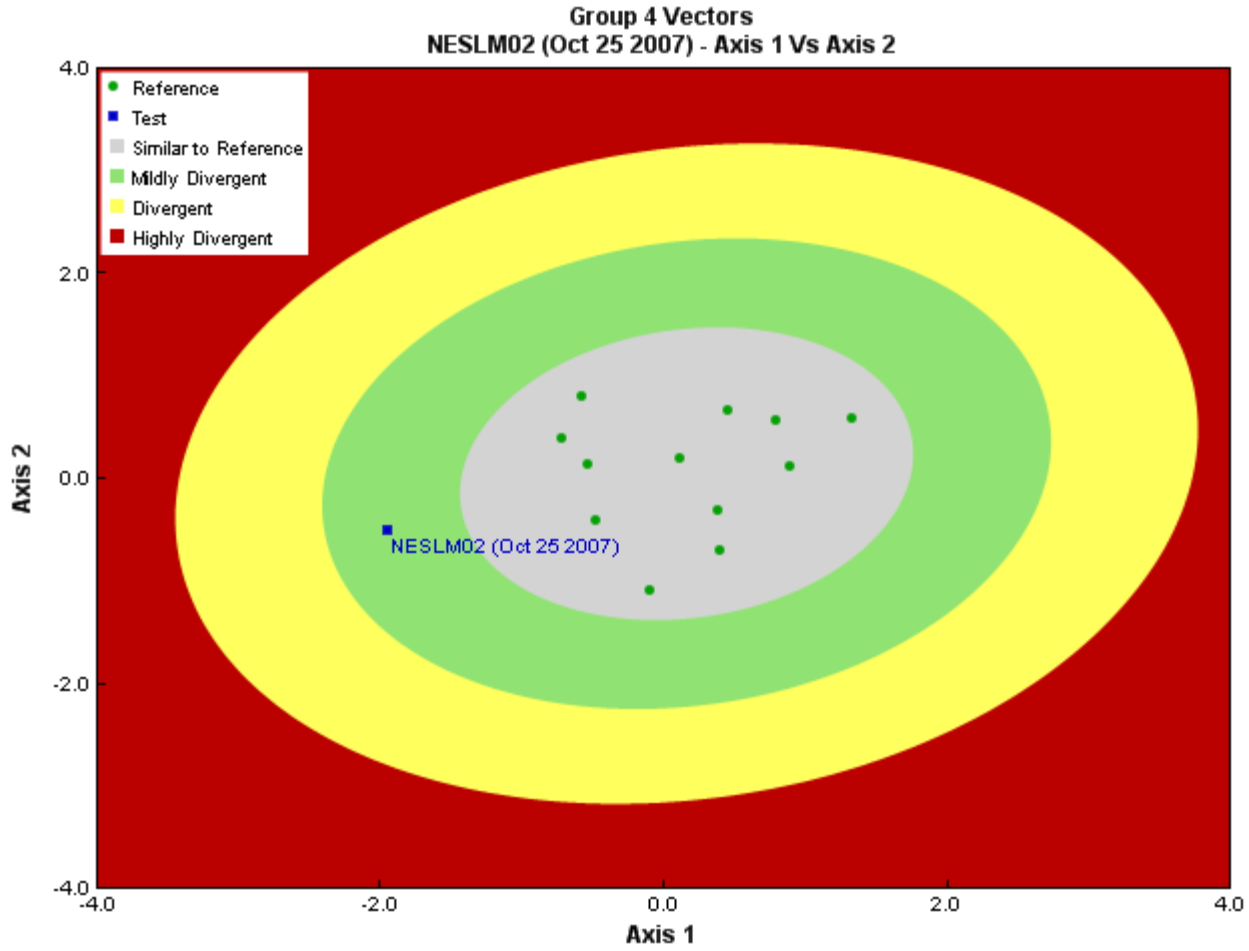

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	October 27, 2007
Subsampling Device	Marchant Box
Proportion Subsampled	11/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.86	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	6.3	7.4 ± 6.4
% Ephemeroptera	52.7	51.7 ± 18.7
% Ephemeroptera that are Baetidae	1.8	40.6 ± 30.0
% EPT Individuals	64.6	87.7 ± 7.3
% of 2 dominant taxa	58.0	57.9 ± 14.2
% of dominant taxa	32.6	39.8 ± 14.9
% Plecoptera	6.0	31.4 ± 15.4
% Tricoptera	6.0	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	2900.0	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	12.0	13.3 ± 2.7
Plecoptera taxa	3.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.0	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	19.0	19.1 ± 3.6
Trichoptera taxa	4.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.82
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.98
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.89
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.88

RIVPACS : Expected taxa P>0.50	14.29
RIVPACS : Observed taxa P>0.50	10.00
RIVPACS : O:E (p > 0.5)	0.70
RIVPACS : Expected taxa P>0.70	11.34
RIVPACS : Observed taxa P>0.70	7.00
RIVPACS : O:E (p > 0.7)	0.62

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	18.6	23.6 ± 11.1
Depth-Max (cm)	26.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.65	0.48 ± 0.22
Velocity-Max (m/s)	0.91	0.76 ± 0.36
Width-Bankfull (m)	46.0	13.4 ± 9.9
Width-Wetted (m)	19.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	5	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	2	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	14.0000000	11.4175000 ± 0.7986708
General-pH (pH)	7.6	7.9 ± 0.4

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Oct 13 2008
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.23361 N, 117.23333 W
Altitude	2319
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	8.9%	5.1%	8.3%	75.7%	2.0%
CABIN Assessment of NESLM02 on Oct 13, 2008	Mildly Divergent				

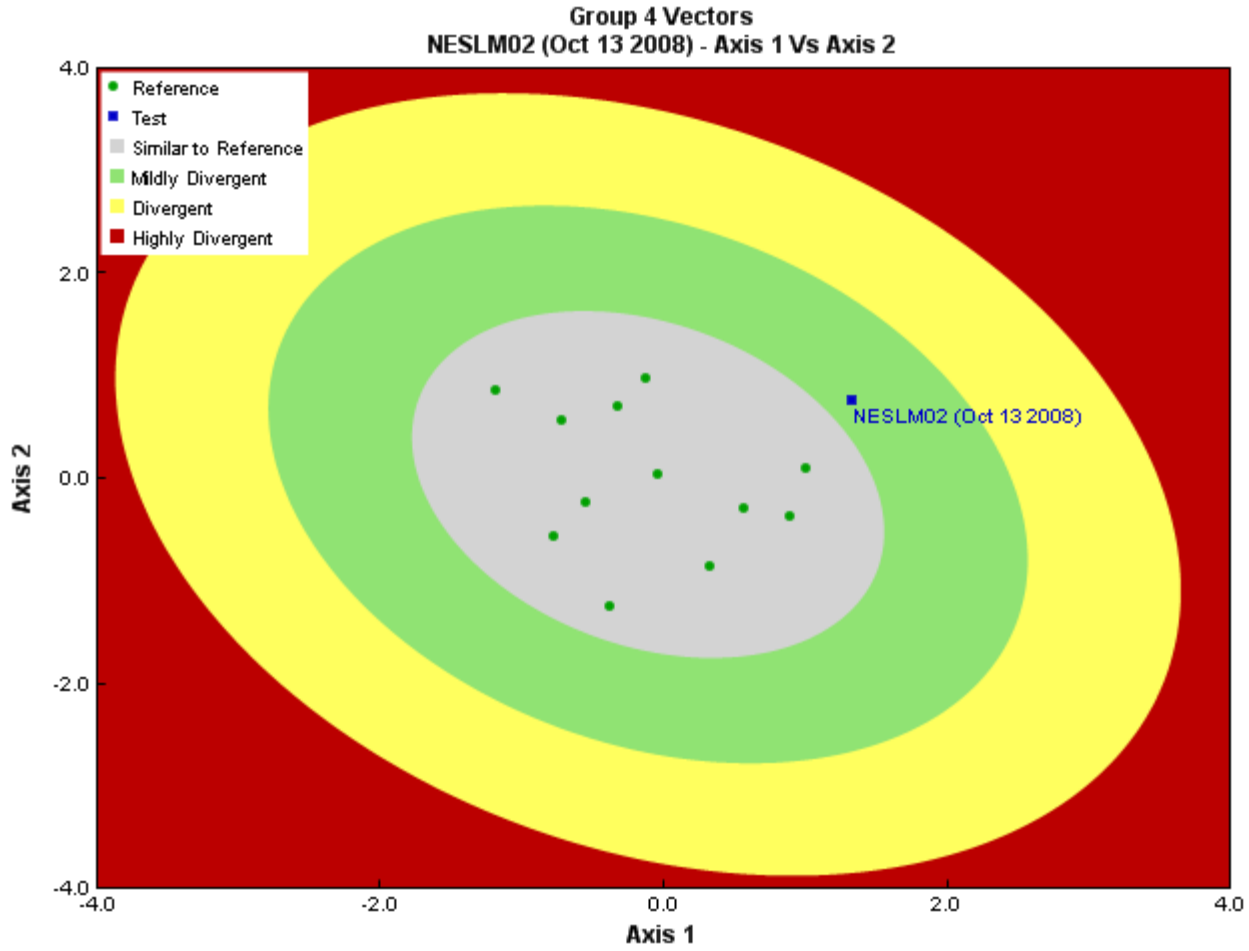

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	-
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	October 19, 2008
Subsampling Device	Visual Estimate
Proportion Subsampled	17.9/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.69	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	2.9	7.4 ± 6.4
% Ephemeroptera	67.4	51.7 ± 18.7
% Ephemeroptera that are Baetidae	6.0	40.6 ± 30.0
% EPT Individuals	91.4	87.7 ± 7.3
% of 2 dominant taxa	63.1	57.9 ± 14.2
% of dominant taxa	42.9	39.8 ± 14.9
% Plecoptera	8.4	31.4 ± 15.4
% Tricoptera	15.6	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	1.0	0.9 ± 0.1
Total Abundance	1938.4	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	15.0	13.3 ± 2.7
Plecoptera taxa	5.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.0	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	23.0	19.1 ± 3.6
Trichoptera taxa	6.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.97
Ephemerellidae	78%	100%	100%	100%	100%	0.98
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.83
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.84
Perlodidae	78%	78%	89%	92%	81%	0.89
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.90

RIVPACS : Expected taxa P>0.50	13.69
RIVPACS : Observed taxa P>0.50	13.00
RIVPACS : O:E (p > 0.5)	0.95
RIVPACS : Expected taxa P>0.70	11.25
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.89

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	54.5	23.6 ± 11.1
Depth-Max (cm)	82.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.32	0.48 ± 0.22
Velocity-Max (m/s)	0.40	0.76 ± 0.36
Width-Bankfull (m)	44.0	13.4 ± 9.9
Width-Wetted (m)	18.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	5	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
SurroundingMaterial (Category(0-9))	4	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	53.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	14.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.0	7.9 ± 0.4
General-SpCond (uS/cm)	120.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Oct 15 2009
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.23348 N, 117.23335 W
Altitude	2319
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.2%	8.8%	10.1%	78.2%	2.6%
CABIN Assessment of NESLM02 on Oct 15, 2009	Mildly Divergent				

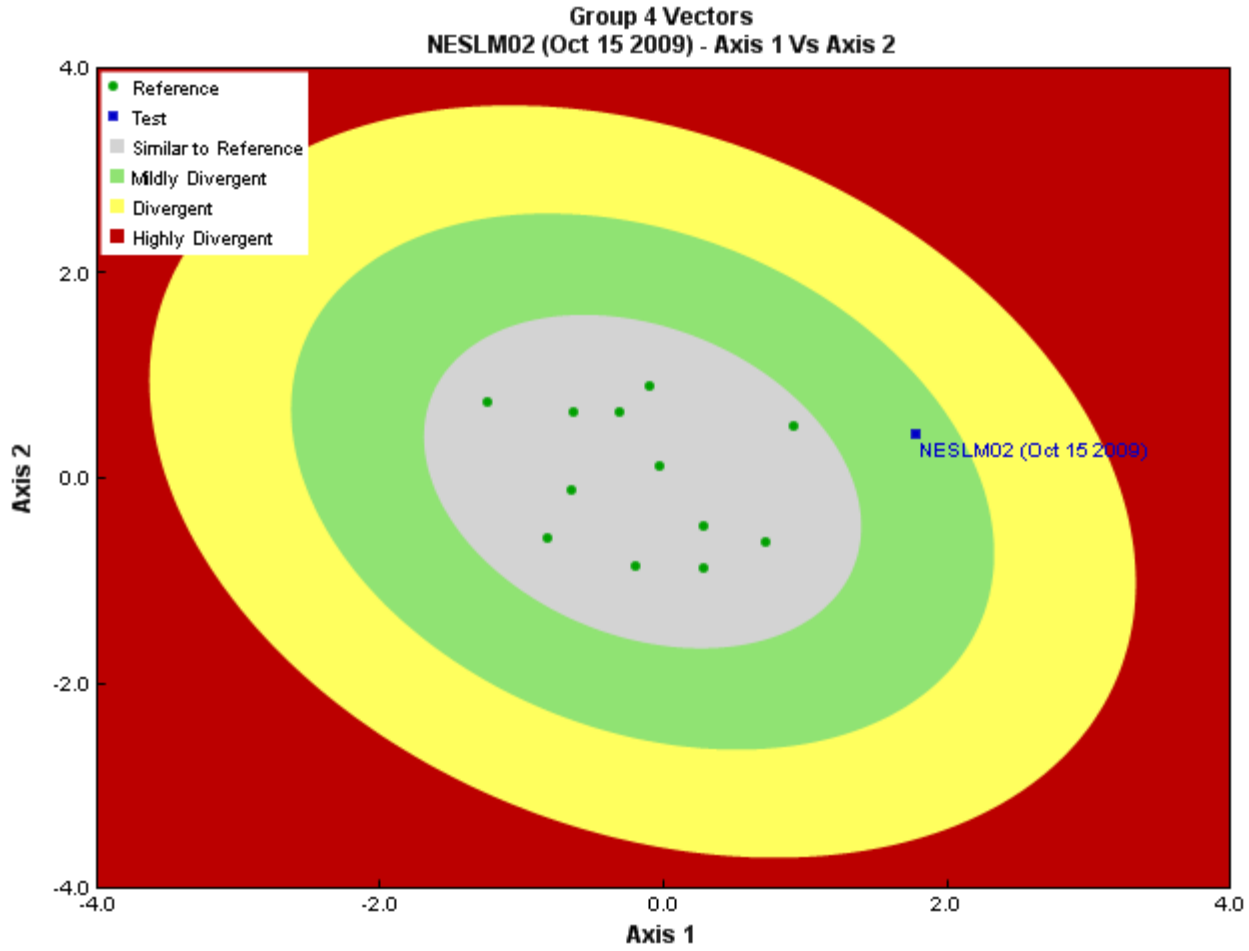

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 26, 2010
Subsampling Device	Marchant Box
Proportion Subsampled	6/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.87	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	15.0	7.4 ± 6.4
% Ephemeroptera	51.2	51.7 ± 18.7
% Ephemeroptera that are Baetidae	2.3	40.6 ± 30.0
% EPT Individuals	79.1	87.7 ± 7.3
% of 2 dominant taxa	55.3	57.9 ± 14.2
% of dominant taxa	40.3	39.8 ± 14.9
% Plecoptera	6.8	31.4 ± 15.4
% Tricoptera	21.2	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.8	0.9 ± 0.1
Total Abundance	5666.6	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	15.0	13.3 ± 2.7
Plecoptera taxa	5.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	24.0	19.1 ± 3.6
Trichoptera taxa	6.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.84
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.98
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.89
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.89

RIVPACS : Expected taxa P>0.50	14.34
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	0.98
RIVPACS : Expected taxa P>0.70	11.38
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	0.97

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	32.5	23.6 ± 11.1
Depth-Max (cm)	45.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.43	0.48 ± 0.22
Velocity-Max (m/s)	0.68	0.76 ± 0.36
Width-Bankfull (m)	44.0	13.4 ± 9.9
Width-Wetted (m)	15.9	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	5	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	48.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	13.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.3	7.9 ± 0.4
General-SpCond (uS/cm)	132.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Oct 01 2010
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.23348 N, 117.23335 W
Altitude	2319
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.5%	8.0%	9.9%	79.0%	2.5%
CABIN Assessment of NESLM02 on Oct 01, 2010	Divergent				

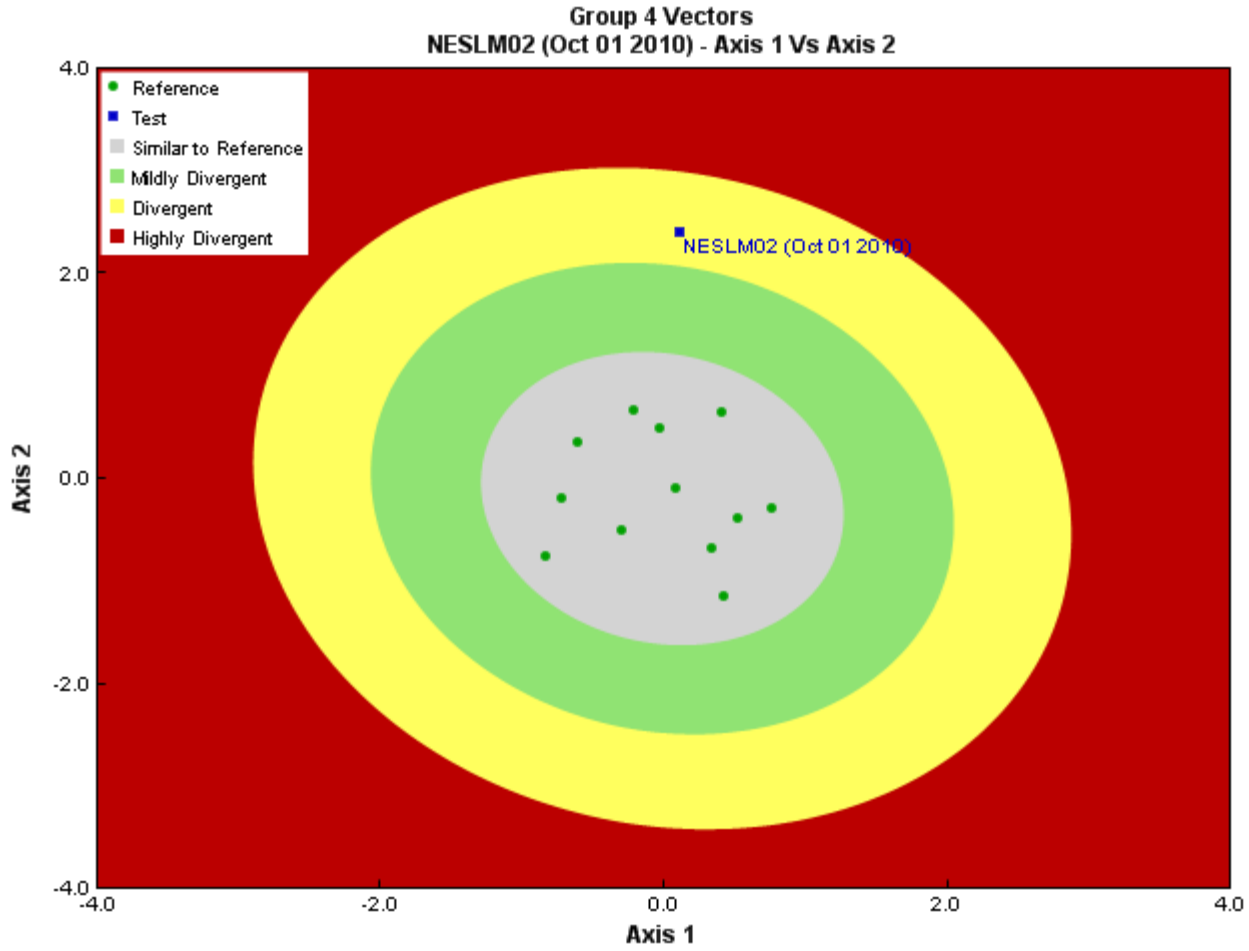

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	March 09, 2011
Subsampling Device	Marchant Box
Proportion Subsampled	4/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.92	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	3.8	7.4 ± 6.4
% Ephemeroptera	56.3	51.7 ± 18.7
% Ephemeroptera that are Baetidae	1.0	40.6 ± 30.0
% EPT Individuals	87.4	87.7 ± 7.3
% of 2 dominant taxa	60.4	57.9 ± 14.2
% of dominant taxa	45.3	39.8 ± 14.9
% Plecoptera	9.1	31.4 ± 15.4
% Tricoptera	22.0	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	1.0	0.9 ± 0.1
Total Abundance	9100.0	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	15.0	13.3 ± 2.7
Plecoptera taxa	6.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.0	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	24.0	19.1 ± 3.6
Trichoptera taxa	5.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.84
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.98
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.89
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.89

RIVPACS : Expected taxa P>0.50	14.35
RIVPACS : Observed taxa P>0.50	15.00
RIVPACS : O:E (p > 0.5)	1.05
RIVPACS : Expected taxa P>0.70	11.39
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	0.97

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	36.8	23.6 ± 11.1
Depth-Max (cm)	53.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.43	0.48 ± 0.22
Velocity-Max (m/s)	0.73	0.76 ± 0.36
Width-Bankfull (m)	54.0	13.4 ± 9.9
Width-Wetted (m)	18.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	5	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	2	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.5	7.9 ± 0.4
General-Turbidity (NTU)	0.3300000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Sep 22 2011
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.23348 N, 117.23335 W
Altitude	2286
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.0%	10.8%	10.5%	75.8%	2.8%
CABIN Assessment of NESLM02 on Sep 22, 2011	Mildly Divergent				

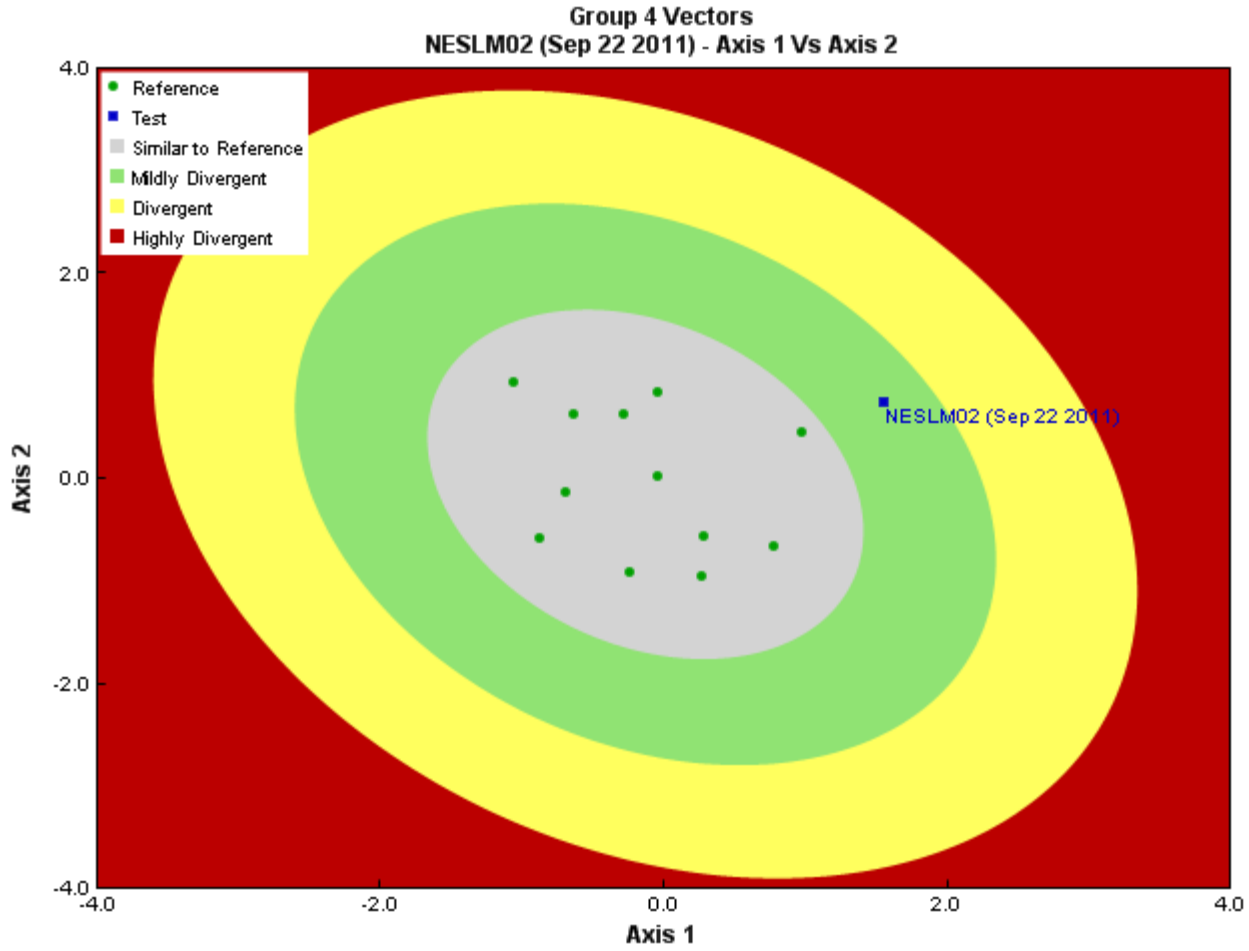

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	January 27, 2012
Subsampling Device	Marchant Box
Proportion Subsampled	6/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.86	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	7.6	7.4 ± 6.4
% Ephemeroptera	56.1	51.7 ± 18.7
% Ephemeroptera that are Baetidae	7.0	40.6 ± 30.0
% EPT Individuals	79.2	87.7 ± 7.3
% of 2 dominant taxa	50.4	57.9 ± 14.2
% of dominant taxa	40.3	39.8 ± 14.9
% Plecoptera	11.8	31.4 ± 15.4
% Tricoptera	11.3	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	5916.6	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	13.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.3	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	24.0	19.1 ± 3.6
Trichoptera taxa	5.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.98
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.88

RIVPACS : Expected taxa P>0.50	14.30
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : O:E (p > 0.5)	0.84
RIVPACS : Expected taxa P>0.70	11.36
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.88

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	22.7	23.6 ± 11.1
Depth-Max (cm)	38.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.38	0.48 ± 0.22
Velocity-Max (m/s)	0.68	0.76 ± 0.36
Width-Bankfull (m)	54.0	13.4 ± 9.9
Width-Wetted (m)	17.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	5	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	3	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	59.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	12.0000000	11.4175000 ± 0.7986708
General-pH (pH)	9.0	7.9 ± 0.4
General-SpCond (uS/cm)	121.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.2300000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM02
Sampling Date	Sep 25 2012
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Selkirk-Bitterroot Foothills Ecoregion
Coordinates (decimal degrees)	49.24207 N, 117.23455 W
Altitude	2286
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	9.6%	10.4%	77.1%	2.8%
CABIN Assessment of NESLM02 on Sep 25, 2012	Mildly Divergent				

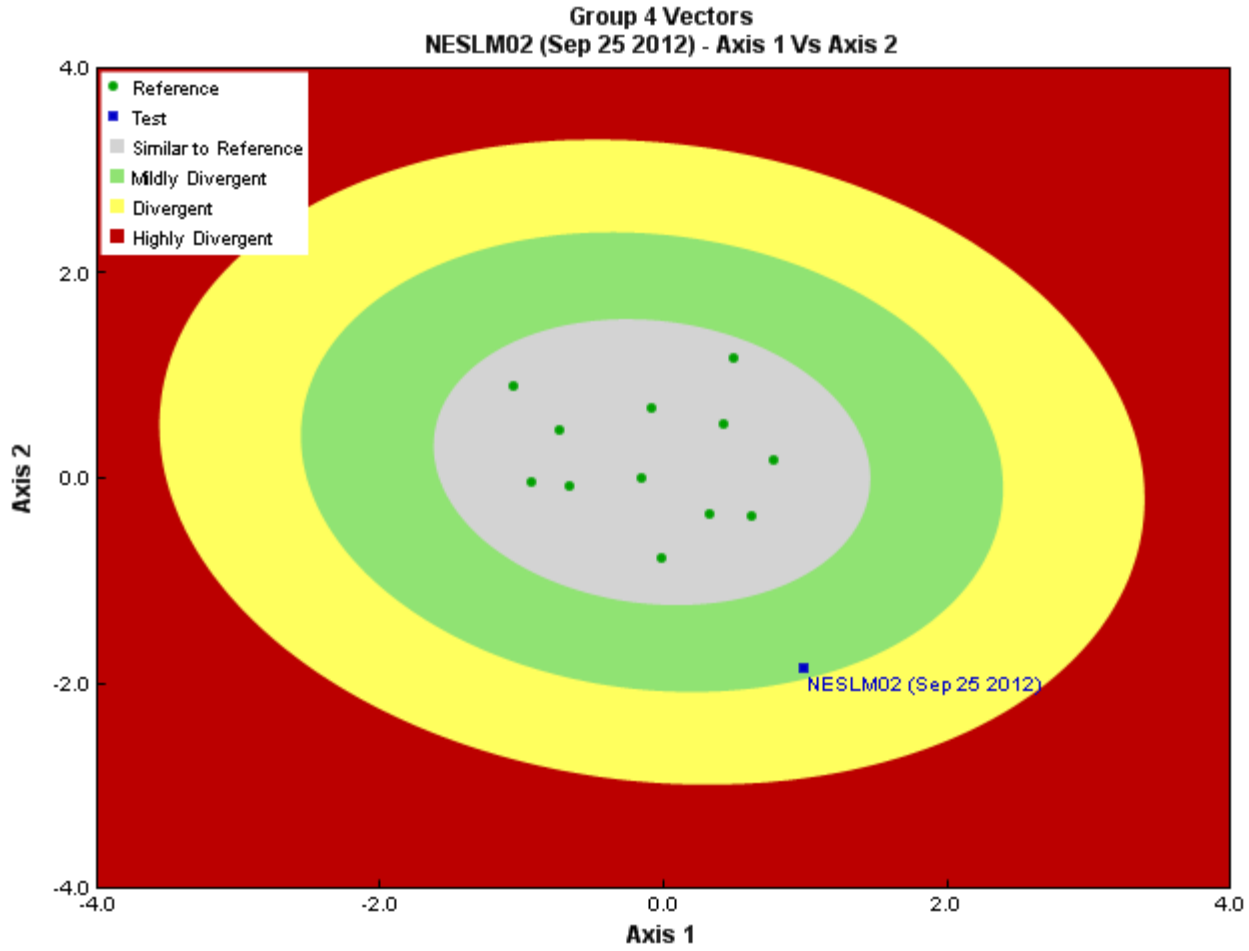

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 13, 2013
Subsampling Device	Marchant Box
Proportion Subsampled	7/100

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.89	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	8.1	7.4 ± 6.4
% Ephemeroptera	52.8	51.7 ± 18.7
% Ephemeroptera that are Baetidae	1.6	40.6 ± 30.0
% EPT Individuals	73.3	87.7 ± 7.3
% of 2 dominant taxa	53.4	57.9 ± 14.2
% of dominant taxa	45.2	39.8 ± 14.9
% Plecoptera	11.5	31.4 ± 15.4
% Tricoptera	9.0	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	5085.6	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM02	Predicted Group Reference Mean ±SD
EPT taxa (no)	12.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.1	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	22.0	19.1 ± 3.6
Trichoptera taxa	4.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM02
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.83
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.98
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.89
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.89

RIVPACS : Expected taxa P>0.50	14.32
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.77
RIVPACS : Expected taxa P>0.70	11.37
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.79

D. Habitat Description

Variable	NESLM02	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	28.2	23.6 ± 11.1
Depth-Max (cm)	39.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.45	0.48 ± 0.22
Velocity-Max (m/s)	0.57	0.76 ± 0.36
Width-Bankfull (m)	54.0	13.4 ± 9.9
Width-Wetted (m)	17.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	5	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	3	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	10.0000000	11.4175000 ± 0.7986708
General-pH (pH)	6.4	7.9 ± 0.4
General-SpCond (uS/cm)	138.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.3700000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Oct 27 2007
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.38346 N, 117.20018 W
Altitude	2759
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.2%	4.6%	9.7%	81.1%	4.4%
CABIN Assessment of NESLM03 on Oct 27, 2007	Highly Divergent				

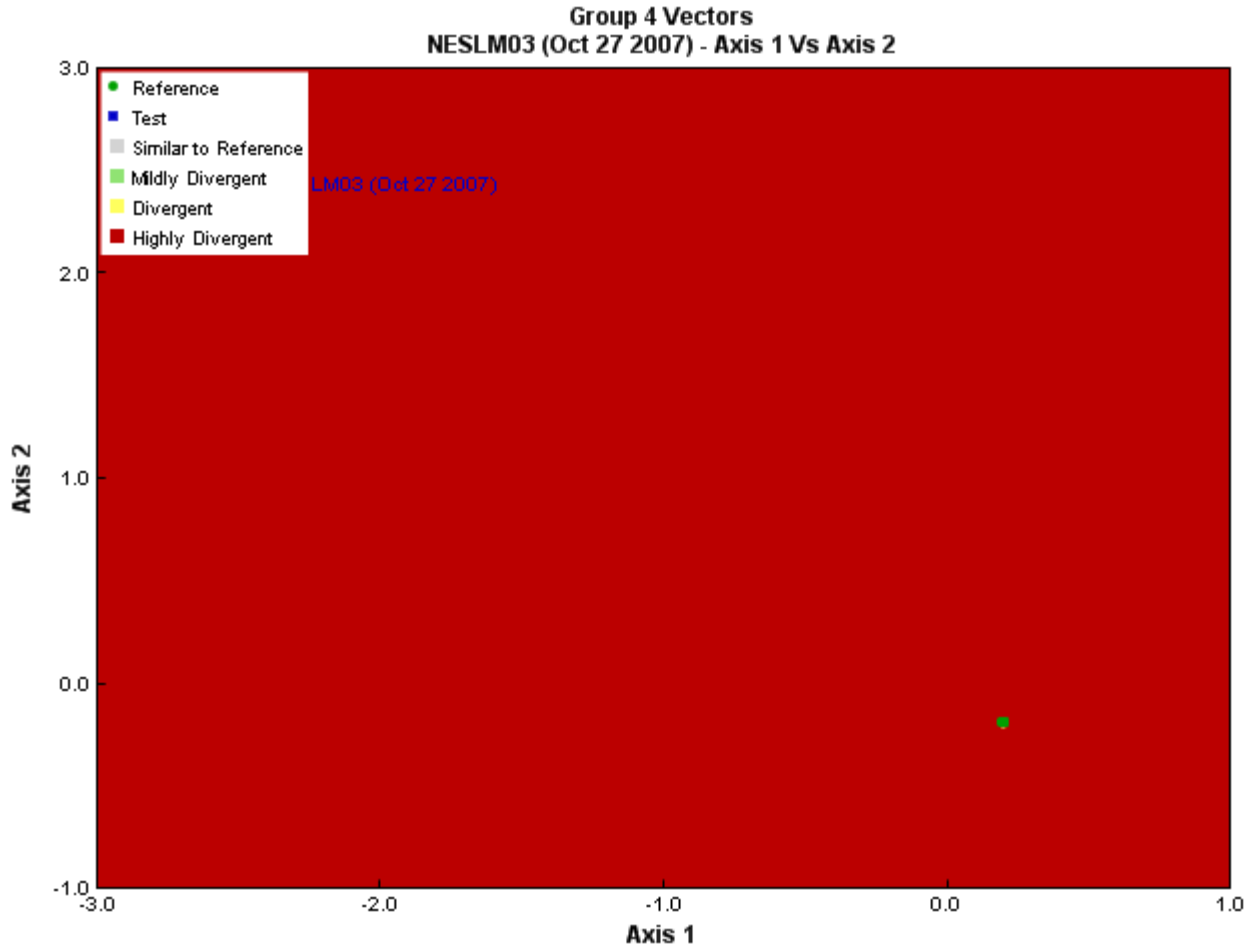

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	October 27, 2007
Subsampling Device	Marchant Box
Proportion Subsampled	1/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.98	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	38.5	7.4 ± 6.4
% Ephemeroptera	23.1	51.7 ± 18.7
% Ephemeroptera that are Baetidae	17.9	40.6 ± 30.0
% EPT Individuals	57.1	87.7 ± 7.3
% of 2 dominant taxa	61.8	57.9 ± 14.2
% of dominant taxa	38.5	39.8 ± 14.9
% Plecoptera	28.3	31.4 ± 15.4
% Tricoptera	5.8	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1
Total Abundance	36400.0	587.2 ± 299.2
Richness		
Ephemeroptera taxa	4.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	15.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	21.0	19.1 ± 3.6
Trichoptera taxa	7.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.91

RIVPACS : Expected taxa P>0.50	13.86
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.79
RIVPACS : Expected taxa P>0.70	11.42
RIVPACS : Observed taxa P>0.70	8.00
RIVPACS : O:E (p > 0.7)	0.70

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	29.0	23.6 ± 11.1
Depth-Max (cm)	32.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.60	0.48 ± 0.22
Velocity-Max (m/s)	0.68	0.76 ± 0.36
Width-Bankfull (m)	38.0	13.4 ± 9.9
Width-Wetted (m)	11.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	8	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Embeddedness (Category(1-5))	4	5 ± 1
SurroundingMaterial (Category(0-9))	4	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	4.3900000	11.4175000 ± 0.7986708
General-pH (pH)	7.7	7.9 ± 0.4

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Oct 19 2008
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.38346 N, 117.20018 W
Altitude	2759
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	5.1%	9.9%	80.4%	4.5%
CABIN Assessment of NESLM03 on Oct 19, 2008	Mildly Divergent				

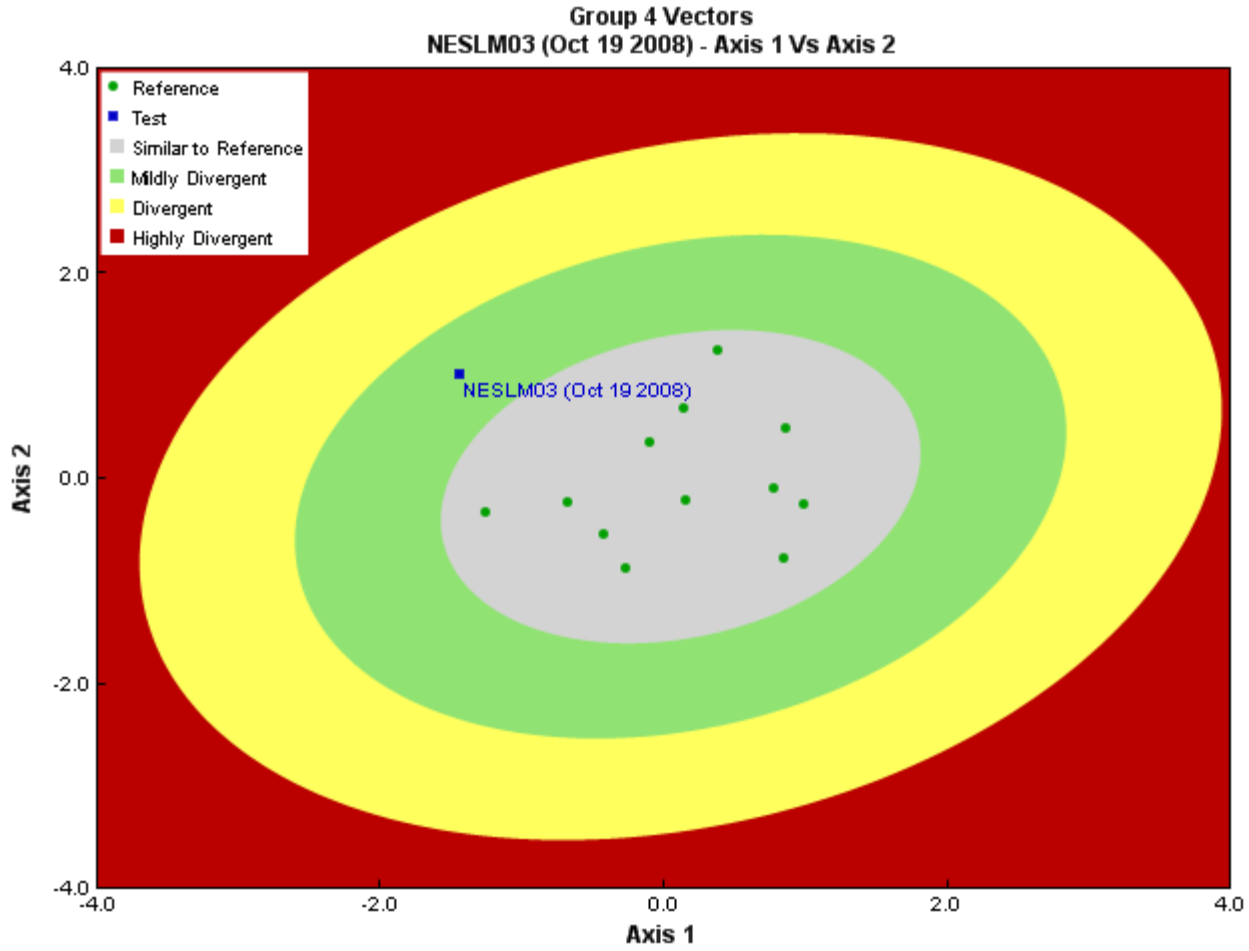

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	October 19, 2008
Subsampling Device	Visual Estimate
Proportion Subsampled	8.62/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.8	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	34.3	7.4 ± 6.4
% Ephemeroptera	49.7	51.7 ± 18.7
% Ephemeroptera that are Baetidae	34.2	40.6 ± 30.0
% EPT Individuals	58.3	87.7 ± 7.3
% of 2 dominant taxa	61.0	57.9 ± 14.2
% of dominant taxa	34.3	39.8 ± 14.9
% Plecoptera	5.0	31.4 ± 15.4
% Tricoptera	3.7	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.6	0.9 ± 0.1
Total Abundance	3480.2	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	16.0	13.3 ± 2.7
Plecoptera taxa	5.0	6.3 ± 1.1
Shannon-Wiener Diversity	1.9	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	21.0	19.1 ± 3.6
Trichoptera taxa	6.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.91

RIVPACS : Expected taxa P>0.50	13.84
RIVPACS : Observed taxa P>0.50	12.00
RIVPACS : O:E (p > 0.5)	0.87
RIVPACS : Expected taxa P>0.70	11.41
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.88

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	24.8	23.6 ± 11.1
Depth-Max (cm)	36.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.33	0.48 ± 0.22
Velocity-Max (m/s)	0.62	0.76 ± 0.36
Width-Bankfull (m)	21.0	13.4 ± 9.9
Width-Wetted (m)	13.0	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	5	7 ± 1
Embeddedness (Category(1-5))	3	5 ± 1
SurroundingMaterial (Category(0-9))	5	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	38.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	13.0000000	11.4175000 ± 0.7986708
General-pH (pH)	7.9	7.9 ± 0.4
General-SpCond (uS/cm)	92.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Oct 18 2009
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.38346 N, 117.20018 W
Altitude	2759
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	5.1%	9.9%	80.3%	4.5%
CABIN Assessment of NESLM03 on Oct 18, 2009	Divergent				

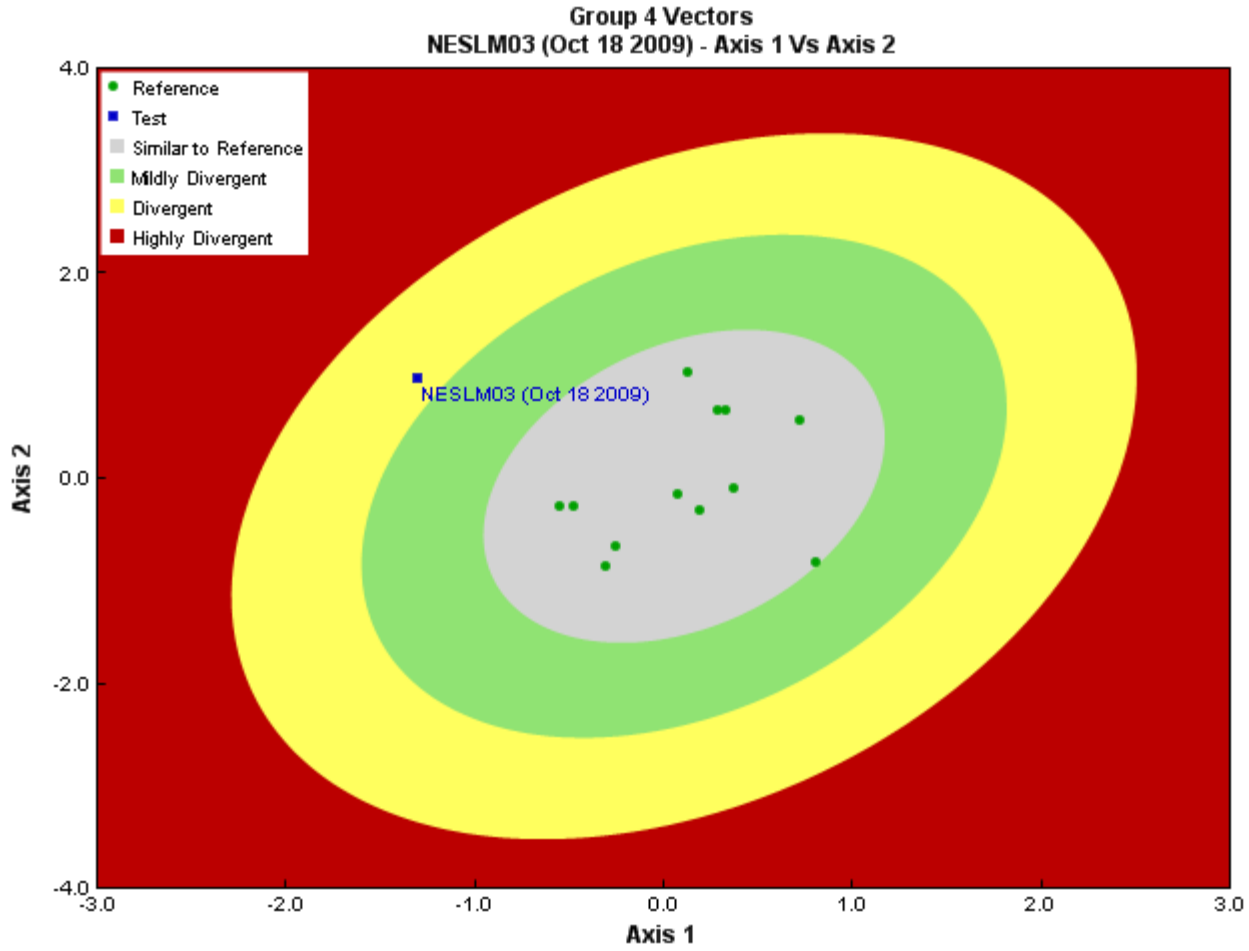

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 26, 2010
Subsampling Device	Marchant Box
Proportion Subsampled	12/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.78	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	26.4	7.4 ± 6.4
% Ephemeroptera	37.9	51.7 ± 18.7
% Ephemeroptera that are Baetidae	25.9	40.6 ± 30.0
% EPT Individuals	53.4	87.7 ± 7.3
% of 2 dominant taxa	42.8	57.9 ± 14.2
% of dominant taxa	26.4	39.8 ± 14.9
% Plecoptera	8.7	31.4 ± 15.4
% Tricoptera	6.8	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.7	0.9 ± 0.1
Total Abundance	3058.2	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	17.0	13.3 ± 2.7
Plecoptera taxa	5.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.5	1.9 ± 0.4
Simpson's Diversity	0.9	0.8 ± 0.1
Total No. of Taxa	29.0	19.1 ± 3.6
Trichoptera taxa	7.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.91

RIVPACS : Expected taxa P>0.50	13.84
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	1.01
RIVPACS : Expected taxa P>0.70	11.41
RIVPACS : Observed taxa P>0.70	10.00
RIVPACS : O:E (p > 0.7)	0.88

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	24.3	23.6 ± 11.1
Depth-Max (cm)	29.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.31	0.48 ± 0.22
Velocity-Max (m/s)	0.43	0.76 ± 0.36
Width-Bankfull (m)	21.0	13.4 ± 9.9
Width-Wetted (m)	10.3	8.5 ± 5.8
Landcover		
Sediment Chemistry		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	5	7 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	31.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	12.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.0	7.9 ± 0.4
General-SpCond (uS/cm)	68.0000000	168.9833333 ± 123.7858182

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Oct 01 2010
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.38346 N, 117.20018 W
Altitude	2759
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.2%	4.8%	9.7%	81.0%	4.4%
CABIN Assessment of NESLM03 on Oct 01, 2010	Mildly Divergent				

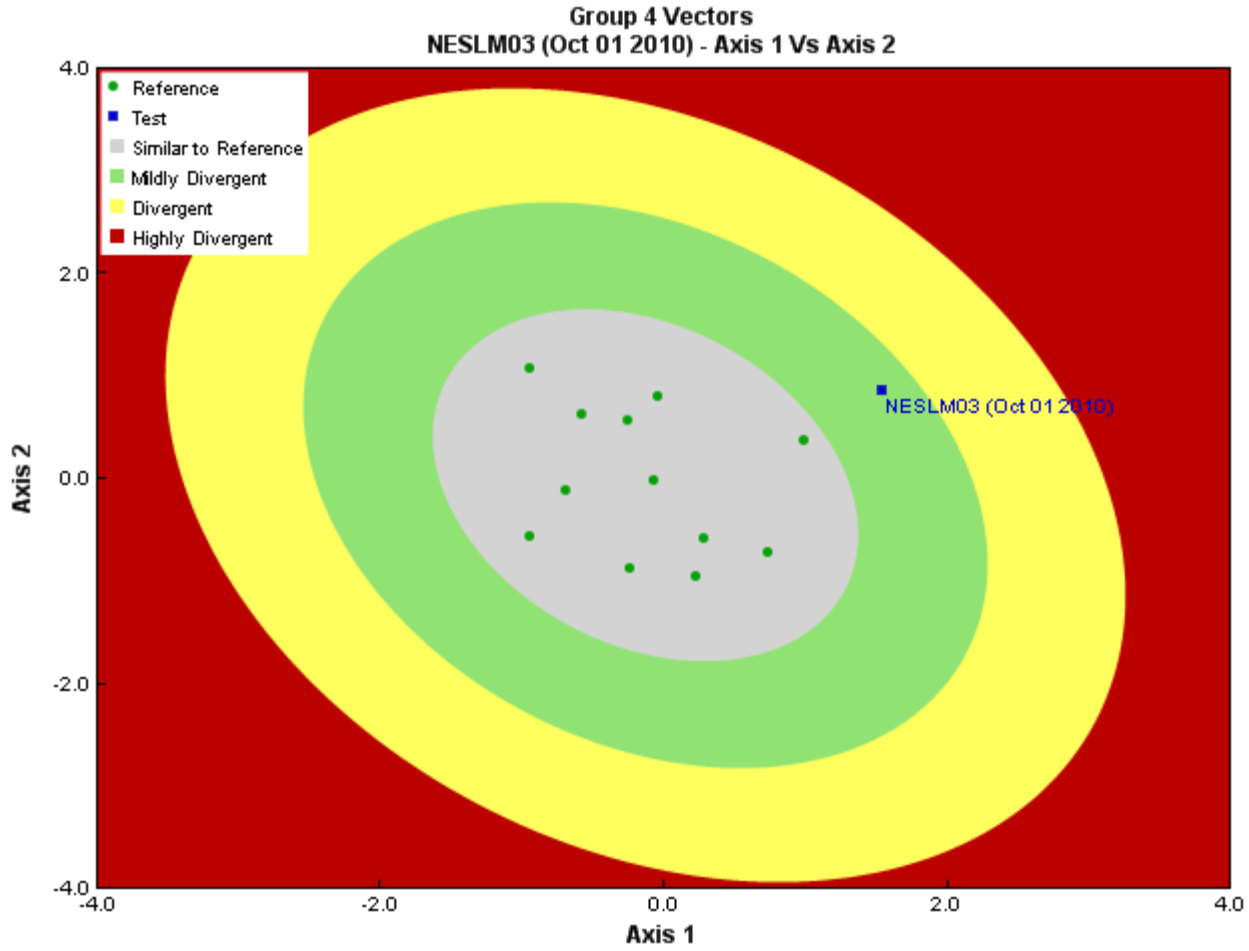

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Gary Lester, Ecoanalysts Inc.
Identification Date	March 09, 2011
Subsampling Device	Marchant Box
Proportion Subsampled	6/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.88	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	45.8	7.4 ± 6.4
% Ephemeroptera	30.1	51.7 ± 18.7
% Ephemeroptera that are Baetidae	37.4	40.6 ± 30.0
% EPT Individuals	41.4	87.7 ± 7.3
% of 2 dominant taxa	57.1	57.9 ± 14.2
% of dominant taxa	45.8	39.8 ± 14.9
% Plecoptera	7.6	31.4 ± 15.4
% Tricoptera	3.7	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.5	0.9 ± 0.1
Total Abundance	6366.6	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	14.0	13.3 ± 2.7
Plecoptera taxa	4.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.0	1.9 ± 0.4
Simpson's Diversity	0.8	0.8 ± 0.1
Total No. of Taxa	23.0	19.1 ± 3.6
Trichoptera taxa	5.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.91

RIVPACS : Expected taxa P>0.50	13.85
RIVPACS : Observed taxa P>0.50	11.00
RIVPACS : O:E (p > 0.5)	0.79
RIVPACS : Expected taxa P>0.70	11.42
RIVPACS : Observed taxa P>0.70	9.00
RIVPACS : O:E (p > 0.7)	0.79

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	28.0	23.6 ± 11.1
Depth-Max (cm)	33.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.39	0.48 ± 0.22
Velocity-Max (m/s)	0.56	0.76 ± 0.36
Width-Bankfull (m)	21.0	13.4 ± 9.9
Width-Wetted (m)	9.3	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	2	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.1	7.9 ± 0.4
General-Turbidity (NTU)	0.3800000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Sep 22 2011
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.38346 N, 117.20018 W
Altitude	2979
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	5.3%	10.0%	80.0%	4.6%
CABIN Assessment of NESLM03 on Sep 22, 2011	Mildly Divergent				

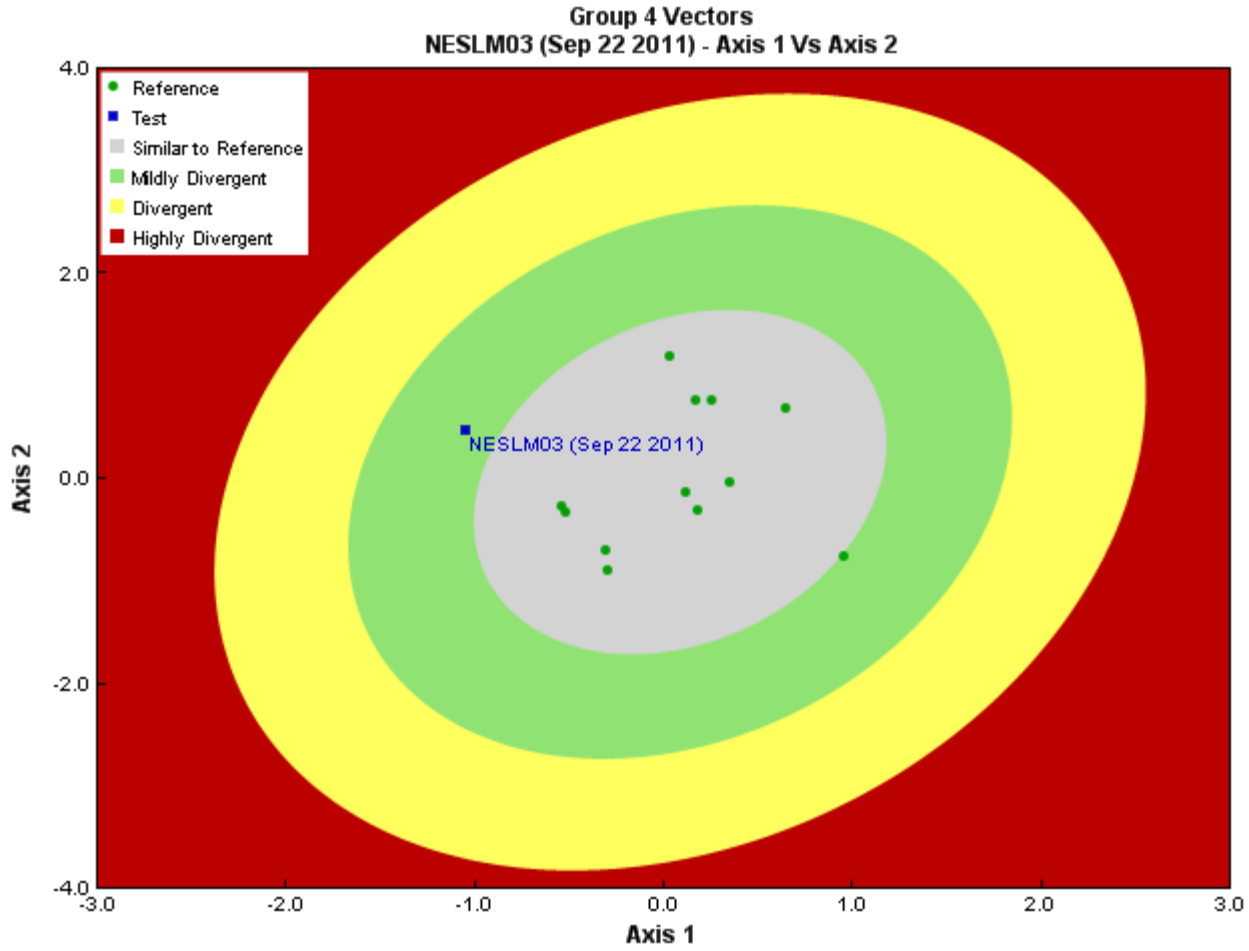

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	January 27, 2012
Subsampling Device	Marchant Box
Proportion Subsampled	23/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.58	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	6.0	7.4 ± 6.4
% Ephemeroptera	52.0	51.7 ± 18.7
% Ephemeroptera that are Baetidae	33.1	40.6 ± 30.0
% EPT Individuals	69.8	87.7 ± 7.3
% of 2 dominant taxa	32.6	57.9 ± 14.2
% of dominant taxa	17.2	39.8 ± 14.9
% Plecoptera	10.6	31.4 ± 15.4
% Tricoptera	7.2	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	0.9	0.9 ± 0.1
Total Abundance	1439.0	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	16.0	13.3 ± 2.7
Plecoptera taxa	6.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.6	1.9 ± 0.4
Simpson's Diversity	0.9	0.8 ± 0.1
Total No. of Taxa	26.0	19.1 ± 3.6
Trichoptera taxa	5.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.84
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.90

RIVPACS : Expected taxa P>0.50	13.84
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	1.01
RIVPACS : Expected taxa P>0.70	11.41
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	0.96

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	22.5	23.6 ± 11.1
Depth-Max (cm)	28.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.23	0.48 ± 0.22
Velocity-Max (m/s)	0.44	0.76 ± 0.36
Width-Bankfull (m)	21.0	13.4 ± 9.9
Width-Wetted (m)	12.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	6	7 ± 1
Dominant-2nd (Category(0-9))	7	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	6	4 ± 1
Topography		
Water Chemistry		
General-Alkalinity (mg/L)	74.0000000	71.7000000 ± 53.9231440
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	8.0	7.9 ± 0.4
General-SpCond (uS/cm)	96.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.4000000	0.2020000

Site Assessment Report

A. Site Description

CABIN Study Name	CBWN-Salmo River
CABIN Site Code	NESLM03
Sampling Date	Sep 25 2012
Know Your Watershed (KYW) Basin	Central Columbia
Province / Territory	British Columbia
Terrestrial Ecological Classification	Montane Cordillera Ecozone Columbia Mountains and Highlands Ecoregion
Coordinates (decimal degrees)	49.39086 N, 117.21055 W
Altitude	2979
Feature Name	Salmo River
Stream Order	6

B. CABIN Assessment Results

REFERENCE MODEL SUMMARY	
Model Name	Columbia-Okanagan Preliminary March 2010
Analysis Date	November 27, 2013
Taxanomic Level	Family
Predictor Variables	Depth-Avg Latitude Longitude Reg-Ice SlopeLT30%

Reference Groups	**1**	**2**	**3**	**4**	**5**
Number of Reference Sites	9	43	17	12	33
Group Error Rate	22.2%	24.5%	22.2%	25.0%	32.4%
Overall Model Error Rate	26.4%				
Probability of Group Membership	0.1%	5.2%	9.9%	80.2%	4.6%
CABIN Assessment of NESLM03 on Sep 25, 2012	Similar to Reference				

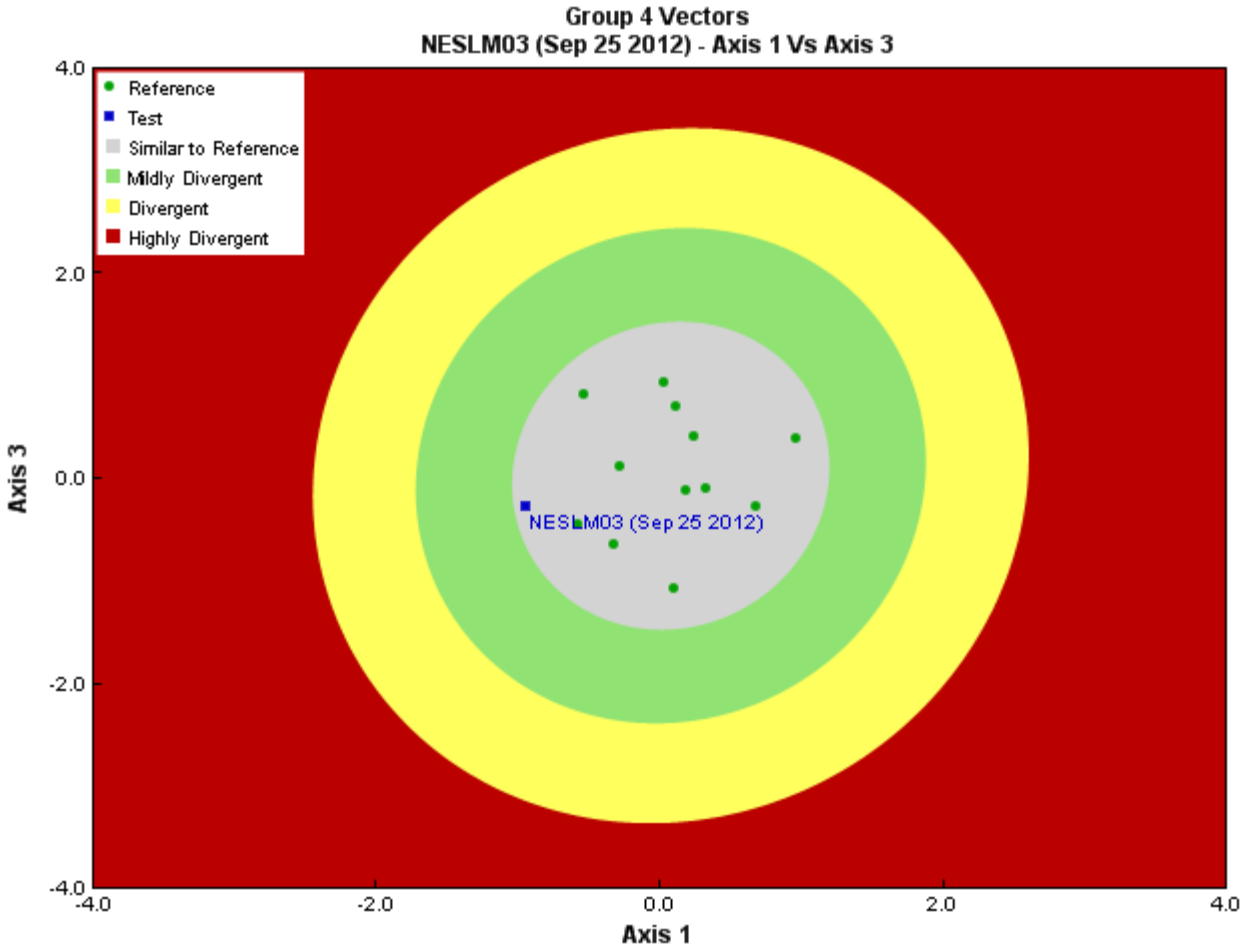

Figure 3. CABIN ordination assessment of the test site with the predicted group of reference sites. Each axis represents the relative abundance of the entire benthic invertebrate community with different organisms weighted differently on each axis.

Sample Information

Sampling Device	Kick Net
Mesh Size	400
Sampling Time	3
Taxonomist	Eco Analsyts, EcoAnalysts
Identification Date	February 13, 2013
Subsampling Device	Marchant Box
Proportion Subsampled	23/100

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
Bray-Curtis Distance	0.53	0.4 ± 0.1
Number Of Individuals		
% Chironomidae	3.4	7.4 ± 6.4
% Ephemeroptera	47.6	51.7 ± 18.7
% Ephemeroptera that are Baetidae	28.8	40.6 ± 30.0
% EPT Individuals	75.0	87.7 ± 7.3
% of 2 dominant taxa	31.4	57.9 ± 14.2
% of dominant taxa	17.7	39.8 ± 14.9
% Plecoptera	16.8	31.4 ± 15.4
% Tricoptera	10.7	4.5 ± 2.8
No. EPT individuals/Chironomids+EPT Individuals	1.0	0.9 ± 0.1
Total Abundance	1425.9	587.2 ± 299.2
Richness		
Ephemeroptera taxa	5.0	3.8 ± 0.8

Site Metrics

Metric Name	NESLM03	Predicted Group Reference Mean ±SD
EPT taxa (no)	18.0	13.3 ± 2.7
Plecoptera taxa	7.0	6.3 ± 1.1
Shannon-Wiener Diversity	2.7	1.9 ± 0.4
Simpson's Diversity	0.9	0.8 ± 0.1
Total No. of Taxa	28.0	19.1 ± 3.6
Trichoptera taxa	6.0	3.2 ± 1.4

Frequency and Probability of Taxa Occurence

Reference Model Taxa	Frequency of Occurence in Reference Sites					Probability Of Occurrence at NESLM03
	Group 1	Group 2	Group 3	Group 4	Group 5	
Baetidae	100%	100%	100%	100%	97%	1.00
Capniidae	78%	55%	50%	92%	68%	0.85
Chironomidae	100%	100%	100%	100%	95%	1.00
Chloroperlidae	78%	88%	94%	100%	100%	0.99
Ephemerellidae	78%	100%	100%	100%	100%	1.00
Heptageniidae	100%	100%	100%	100%	100%	1.00
Hydropsychidae	11%	92%	78%	92%	86%	0.90
Nemouridae	100%	100%	100%	100%	100%	1.00
Perlidae	11%	84%	33%	100%	3%	0.88
Perlodidae	78%	78%	89%	92%	81%	0.90
Rhyacophilidae	100%	92%	100%	100%	95%	0.99
Taeniopterygidae	89%	49%	100%	92%	97%	0.91

RIVPACS : Expected taxa P>0.50	13.84
RIVPACS : Observed taxa P>0.50	14.00
RIVPACS : O:E (p > 0.5)	1.01
RIVPACS : Expected taxa P>0.70	11.41
RIVPACS : Observed taxa P>0.70	11.00
RIVPACS : O:E (p > 0.7)	0.96

D. Habitat Description

Variable	NESLM03	Predicted Group Reference Mean ±SD
Channel		
Depth-Avg (cm)	24.2	23.6 ± 11.1
Depth-Max (cm)	39.0	34.6 ± 12.3
Reach-%CanopyCoverage (PercentRange)	1.00	1.33 ± 0.78
Velocity-Avg (m/s)	0.26	0.48 ± 0.22
Velocity-Max (m/s)	0.46	0.76 ± 0.36
Width-Bankfull (m)	21.0	13.4 ± 9.9
Width-Wetted (m)	11.0	8.5 ± 5.8
Landcover		
Substrate Data		
Dominant-1st (Category(0-9))	5	7 ± 1
Dominant-2nd (Category(0-9))	6	7 ± 1
Embeddedness (Category(1-5))	5	5 ± 1
SurroundingMaterial (Category(0-9))	6	4 ± 1
Topography		
Water Chemistry		
General-DO (mg/L)	11.0000000	11.4175000 ± 0.7986708
General-pH (pH)	6.2	7.9 ± 0.4
General-SpCond (uS/cm)	103.0000000	168.9833333 ± 123.7858182
General-Turbidity (NTU)	0.4800000	0.2020000

Appendix B. Community Composition Metrics

Table B-1. Benthic invertebrate community composition metrics measured in 3 minute kicknet samples taken at three locations (NESLM01, NESLM02, and NESLM03) on the Salmo River between 2007 and 2012. CABIN model conditions are indicated as shaded background.*

Metric	NESLM01						NESLM02						NESLM03					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
% Chironomidae	45.0	42.3	36.9	34.7	36.7	37.6	6.3	2.9	15	3.8	7.6	8.1	38.5	34.3	26.4	45.8	6	3.4
% Ephemeroptera	17.8	4.3	9.6	6.1	9.5	14	52.7	67.4	51.2	56.3	56.1	52.8	23.1	49.7	37.9	30.1	52	47.6
% Ephemeroptera that are Baetidae	26.7	23.1	6.2	5.6	3.3	21.3	1.8	6	2.3	1	7	1.6	17.9	34.2	25.9	37.4	33.1	28.8
% of 2 dominant taxa	60.9	66.7	61.9	62	58.2	58.8	58.0	63.1	55.3	60.4	50.4	53.4	61.8	61	42.8	57.1	32.6	31.4
% of dominant taxa	45.0	42.3	36.9	34.7	36.7	37.6	32.6	42.9	40.3	45.3	40.3	45.2	38.5	34.3	26.4	45.8	17.2	17.7
% Plecoptera	4.1	2	2.7	7.7	3.5	4.8	6	8.4	6.8	9.1	11.8	11.5	28.3	5	8.7	7.6	10.6	16.8
% Trichoptera	10.9	11.7	25.8	32.3	11.4	9.9	6	15.6	21.2	22	11.3	9	5.8	3.7	6.8	3.7	7.2	10.7
Ephemeroptera taxa	5	4	5	4	4	4	5	4	4	4	4	4	4	5	5	5	5	5
No. EPT taxa	11	13	10	13	11	13	12	15	15	15	13	12	15	16	17	14	16	18
# EPT / #Chironomids+ #EPT	0.4	0.3	0.5	0.6	0.4	0.4	0.9	1	0.8	1	0.9	0.9	0.6	0.6	0.7	0.5	0.9	1
Plecoptera taxa	4	4	2.0	5	4	3	3	5	5	6	4	4	4	5	5	4	6	7
Shannon-Wiener Diversity	1.9	1.8	1.9	2.1	2.1	2.2	2	2	2.1	2	2.3	2.1	1.9	1.9	2.5	2	2.6	2.7
Simpson's Diversity	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.9
Total Abundance	2816.6	1587.2	3699.9	1856.3	1089.5	2392.7	2900	1938.4	5666.6	9100	5916.6	5085.6	36400	3480.2	3058.2	6366.6	1439	1425.9
Total No. of Taxa	20	23	19	24	23	25	19	23	24	24	24	22	21	21	29	23	26	28
Trichoptera taxa	2	5	3	4	3	6	4	6	6	5	5	4	7	6	7	5	5	6

*CABIN model condition: unstressed, potentially stressed, stressed, severely stressed.

Table B-2. Definitions of Common Benthic Community Composition Metrics

Metric	Definitions*	Significance**	Response to disturbance**
Richness measures			
Total number of taxa	Total number of distinct taxa (considering all orders of insects) in the sample.	The biodiversity of a stream declines with disturbance. There is usually a decrease of intolerant taxa and an increase of tolerant taxa.	
No. EPT taxa	The estimated total number of individuals in the insect orders Ephemeroptera, Plecoptera and Trichoptera (EPT) in the sample.	High numbers of EPTs generally indicate good water quality. The absence of any one of the three EPT groups at a site is significant, as they are typically the most sensitive to habitat disturbance.	
No. Ephemeroptera taxa	Number of distinct taxa in the insect order Ephemeroptera.	Ephemoptera (mayflies) are often used as an indicator of good water quality because most are intolerant of pollution. Generally sensitive to low levels of oxygen.	
No. Trichoptera taxa	Number of distinct taxa in the insect order Trichoptera in the sample.	Trichoptera (caddisflies) are generally sensitive to moderately tolerant of pollution.	
Plecoptera taxa	Total number of distinct taxa in the insect order Plecoptera	Plecoptera (stoneflies) are commonly found in cool, clean, streams and rivers. Their presence indicates ample supply of oxygen.	
Abundance measures			
Total abundance	Estimated total number of invertebrates present in the sample.	Total abundance of organisms found at the test site can be influenced by many factors including type of stress and the organisms involved (Rosenberg and Resh 1984). Abundance may increase due to nutrient enrichment but decrease in response to toxic effects such as metals contamination or changes in pH, conductivity and dissolved oxygen.	
Community			

Metric	Definitions*	Significance**	Response to disturbance**
composition			
% Chironomidae	Relative abundance of all individuals in the insect family Chironomidae (Order = Diptera), expressed as a percent of the total number of individuals in the sample.	Chironomidae (non-biting midges) are moderately to highly tolerant of pollution.	
% Ephemeroptera	Relative abundance of all individuals in the insect order Ephemeroptera, expressed as a percent of the total number of individuals in the sample.	See above	
% Ephemeroptera that are Baetidae	Relative abundance of all individuals in the insect family Baetidae divided by the total Ephemeroptera abundance.	Baetidae tend to be more tolerant than other families of Ephemeroptera.	
% Plecoptera	Relative abundance of all individuals in the insect order Plecoptera, expressed as a percent of the total number of individuals in the sample.	See above	
% Tricoptera	Relative abundance of all individuals in the insect order Trichoptera, expressed as a percent of the total number of individuals in the sample.	See above	
# EPT / #Chironomids+ #EPT	Abundance of EPT taxa divided by the abundance of Chironomids and EPT taxa	The diversity of EPTs decline in response to most types of human activity. Chironomidae are more pollution tolerant than EPT taxa	
Dominance measures			

Metric	Definitions*	Significance**	Response to disturbance**
% of dominant taxa	Relative occurrence of the most abundant taxon expressed as a percent of the total number of individuals in the sample.	As diversity declines, a few taxa end up dominating the community. Opportunistic taxa that are less particular about where they live replace taxa that require special foods or particular types of physical habitat.	
% of 2 dominant taxa	Relative occurrence of the two most abundant taxon, expressed as a percent of the total number of individuals in the sample.	As above	
Diversity/evenness measures			
Shannon-Wiener diversity	Measures the likelihood that the next individual will be the same species as the previous sample. It combines species richness (the number of species in the community) and species evenness (how even are the numbers of individuals of each species). Values range from 0 (indicating low community complexity) to 4 (indicating high community complexity).	These diversity indices provide a summary of the distribution of the taxa. Diverse and equitable communities are indicators of good water quality.	
Simpson's diversity	An index of community evenness. Values range from 0 to 1.0, with higher values indicating a more even community.	See above	

Appendix C. Water Quality Data

Table C-1. Salmo River Watershed water quality QA/QC data for 2007 to 2012.

Stewardship Group	Sample Date (dd/mm/yy)	Site Code*	Site Name	Alkalinity (Total as CaCO3)	Alkalinity (PP as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)	Hydroxide (OH)	Nitrite (N)	Nitrate (N)	Orthophosphate (P)	Nitrate plus Nitrite (N)	Conductivity	pH	Turbidity
			Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**uS/cm**	**ph units**	**NTU**
			Detection Limit (RDL)	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.005**	**0.02**	**0.005**	**0.02**	**1**		**0.1**
SWSS	03-06-10	**NESLM02 REG**	Salmo R. Site 2	24	<0.5	30	<0.5	<0.5	<0.005	0.07	<0.005	0.07			
SWSS	03-06-10	**NESLM02 LAB**	Salmo R. Site 2	23	<0.5	28	<0.5	<0.5	<0.005	<0.02	<0.005	<0.02	49	7.6	13.5
SWSS		**Duplicate QC**	**Calculated RPD (%)**	4.3	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a
SWSS	03-06-10	**NESLM02 REP**	Salmo R. Site 2	25	<0.5	30	<0.5	<0.5	<0.005	0.07	<0.005	0.07	49	7.6	14.5
SWSS		**Duplicate QC**	**Calculated RPD (%)**	-4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a
SWSS	03-06-10	**NESLM02 BLK**	Salmo R. Site 2	1.2	<0.5	1.5	<0.5	<0.5	<0.005	0.07	<0.005	0.07	1	5.6	<0.1
SWSS		**Blank QC**	**X times > than RDL**	2.4	1.0	3.0	1.0	1.0	1.0	3.5	1.0	3.5	1.0	n/a	1.0
SWSS	19-07-11	**NESLM 02 REG**	Salmo R. Site 2	30	<0.5	36	<0.5	<0.5	<0.005	<0.02	<0.005	<0.02			
SWSS	19-07-11	**NESLM 02 REP**	Salmo R. Site 2	32	<0.5	39	<0.5	<0.5	<0.005	<0.02	<0.005	<0.02	65	7.45	0.2
SWSS		**Duplicate QC**	**Calculated RPD (%)**	-6.5	0.0	-8.0	0.0	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a
SWSS	19-07-11	**NESLM 02-BLK**	Salmo R. Site 2	1	<0.5	1.2	<0.5	<0.5	<0.005	<0.02	<0.005	<0.02	1	6.12	<0.1
SWSS		**Blank QC**	**X times > than RDL**	2.0	1.0	2.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	n/a	1.0
SWSS	19-06-12	**NESLM02 REG**	Salmo R. Site 2	23	<0.50	28	<0.50	<0.50	0.0050	0.024	0.0050	0.024			
SWSS	19-06-12	**NESLM02 REP**	Salmo R. Site 2	23.7	<0.50	28.9	<0.50	<0.50	0.0050	0.024	0.0050	0.024	51.7	7.65	2.07
SWSS		**Duplicate QC**	**Calculated RPD (%)**	-3.0	0.0	-3.2	0.0	0.0	0.0	0.0	0.0	0.0	n/a	n/a	n/a
SWSS	19-06-12	**NESLM02 BLK**	Salmo R. Site 2	0.79	<0.50	0.96	<0.50	<0.50	0.0050	<0.020	0.0050	<0.020	<1.0	5.81	0.86
SWSS		**Blank QC**	**X times > than RDL**	1.6	1.0	1.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	n/a	8.6

QA/QC Alert Crieria (Maxxam):

Duplicate (or REP for replicate) review based on relative percent difference (RPD) = Recommended alert if RPD ≥30% for general chemistry. Relative percent difference limit (RPD)= [(Result 2 - Result 1) / mean] * 100.

Field Blank (BLK), recommended alert = 2X reporting limit (RDL)

(1) Sample analysed past recommended hold time

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Site Name	Nitrite (N)	Nitrate (N)	Alkalinity (Total as CaCO3)	Alkalinity (PP as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)
		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		Guideline	CCME: 0.060. HC Drinking: 1	CCME: 3. HC Drinking: 10	No stream guideline	no guideline	no guideline	no guideline
28-10-07	NESLM01	Salmo R. Site 1			50.6	<0.5	61.7	<0.5
19-10-08	NESLM01	Salmo R. Site 1			60.0	<0.5	73.0	<0.5
22-09-09	NESLM01	Salmo R. Site 1			68.0	<0.5	83.0	<0.5
04-10-10	NESLM01	Salmo R. Site 1	<0.005	<0.02	65.0	<0.5	80.0	<0.5
26-09-11	NESLM01	Salmo R. Site 1	<0.005	0.03	45.0	<0.5	55.0	<0.5
25-09-12	NESLM01	Salmo R. Site 1	<0.0050	<0.020	76.9	<0.50	93.8	<0.50
28-10-07	NESLM02	Salmo R. Site 2			46.7	<0.5	57.0	<0.5
19-10-08	NESLM02	Salmo R. Site 2			53.0	<0.5	64.0	<0.5
19-02-09	NESLM02	Salmo R. Site 2			57.0	<0.5	69.0	<0.5
25-03-09	NESLM02	Salmo R. Site 2			59.0	<0.5	72.0	<0.5
23-04-09	NESLM02	Salmo R. Site 2			42.0	<0.5	52.0	<0.5
19-05-09	NESLM02	Salmo R. Site 2			30.0	<0.5	37.0	<0.5
18-06-09	NESLM02	Salmo R. Site 2			27.0	<0.5	33.0	<0.5
21-07-09	NESLM02	Salmo R. Site 2			31.0	<0.5	38.0	<0.5
19-08-09	NESLM02	Salmo R. Site 2			52.0	<0.5	63.0	<0.5
22-09-09	NESLM02	Salmo R. Site 2			60.0	<0.5	73.0	<0.5
18-10-09	NESLM02	Salmo R. Site 2			48.0	<0.5	58.0	<0.5
02-02-10	NESLM02	Salmo R. Site 2	<0.005	0.07	60.0	<0.5	74.0	<0.5
02-03-10	NESLM02	Salmo R. Site 2	<0.005	0.04	63.0	<0.5	76.0	<0.5
06-04-10	NESLM02	Salmo R. Site 2	<0.005	0.04	60.0	<0.5	73.0	<0.5
04-05-10	NESLM02	Salmo R. Site 2	<0.005	0.12	44.0	<0.5	53.0	<0.5
03-06-10	NESLM02	Salmo R. Site 2	<0.005	0.07	24.0	<0.5	30.0	<0.5
06-07-10	NESLM02	Salmo R. Site 2	<0.005	<0.02	37.0	<0.5	45.0	<0.5
04-08-10	NESLM02	Salmo R. Site 2	<0.005	<0.02	56.0	<0.5	68.0	<0.5
07-09-10	NESLM02	Salmo R. Site 2	<0.005	<0.02	59.0	<0.5	72.0	<0.5
04-10-10	NESLM02	Salmo R. Site 2	<0.005	<0.02	53.0	<0.5	64.0	<0.5
02-11-10	NESLM02	Salmo R. Site 2	<0.005	0.07	38.0	<0.5	46.0	<0.5
30-11-10	NESLM02	Salmo R. Site 2	<0.005	0.06	47.0	<0.5	57.0	<0.5
04-01-11	NESLM02	Salmo R. Site 2	<0.005	0.02	58.0	<0.5	71.0	<0.5
02-02-11	NESLM02	Salmo R. Site 2	<0.005	0.2	57.0	<0.5	70.0	<0.5
09-03-11	NESLM02	Salmo R. Site 2	<0.005	0.05	59.0	<0.5	72.0	<0.5
13-04-11	NESLM02	Salmo R. Site 2	<0.005	0.03	61.0	<0.5	74.0	<0.5
11-05-11	NESLM02	Salmo R. Site 2	<0.005	0.12	45.0	<0.5	55.0	<0.5
23-06-11	NESLM02	Salmo R. Site 2	<0.005	0.03	21.0	<0.5	26.0	<0.5
19-07-11	NESLM02	Salmo R. Site 2	<0.005	<0.02	30.0	<0.5	36.0	<0.5
16-08-11	NESLM02	Salmo R. Site 2	<0.005	<0.02	47.0	<0.5	58.0	<0.5
26-09-11	NESLM02	Salmo R. Site 2	<0.005	<0.02	59.0	<0.5	72.0	<0.5
01-11-11	NESLM02	Salmo R. Site 2	<0.005	<0.02	63.0	<0.5	76.0	<0.5
06-12-11	NESLM02	Salmo R. Site 2	<0.005	0.047	56.8	<0.50	69.3	<0.50
11-01-12	NESLM02	Salmo R. Site 2	<0.005	0.056	59.0	<0.50	72.0	<0.50
21-02-12	NESLM02	Salmo R. Site 2	<0.005	0.039	58.6	<0.50	71.5	<0.50

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Site Name	Nitrite (N)	Nitrate (N)	Alkalinity (Total as CaCO3)	Alkalinity (PP as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)
		Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
		Guideline	CCME: 0.060. HC Drinking: 1	CCME: 3. HC Drinking: 10	No stream guideline	no guideline	no guideline	no guideline
21-03-12	NESLM02	Salmo R. Site 2	<0.005	0.044	59.2	<0.50	72.3	<0.50
17-04-12	NESLM02	Salmo R. Site 2	<0.005	0.053	50.1	<0.50	61.1	<0.50
15-05-12	NESLM02	Salmo R. Site 2	0.0083	0.118	29.2	<0.50	35.6	<0.50
19-06-12	NESLM02	Salmo R. Site 2	<0.005	0.024	23.0	<0.50	28.0	<0.50
17-07-12	NESLM02	Salmo R. Site 2	<0.005	<0.020	33.1	<0.50	40.4	<0.50
22-08-12	NESLM02	Salmo R. Site 2	<0.0050	<0.020	53.8	<0.50	65.7	<0.50
25-09-12	NESLM02	Salmo R. Site 2	<0.0050	<0.020	58.8	<0.50	71.7	<0.50
24-10-12	NESLM02	Salmo R. Site 2	<0.0050	<0.020	52.9	<0.50	64.5	<0.50
20-11-12	NESLM02	Salmo R. Site 2	<0.0050	0.045	38.9	<0.50	47.5	<0.50
17-12-12	NESLM02	Salmo R. Site 2	<0.0050	0.044	46.9	<0.50	57.2	<0.50
22-01-13	NESLM02	Salmo R. Site 2	<0.0050	0.048	54.0	<0.50	65.8	<0.50
19-02-13	NESLM02	Salmo R. Site 2	<0.0050	0.025	55.0	<0.50	67.1	<0.50
26-03-13	NESLM02	Salmo R. Site 2	<0.0050	0.04	54.7	<0.50	66.8	<0.50
23-04-13	NESLM02	Salmo R. Site 2	<0.0050	0.057	49.5	<0.50	60.4	<0.50
29-05-13	NESLM02	Salmo R. Site 2	<0.0050	0.032	26.8	<0.50	32.7	<0.50
19-06-13	NESLM02	Salmo R. Site 2	<0.0050	<0.020	21.7	<0.50	26.5	<0.50
28-10-07	NESLM03	Salmo R. Site 3			33.7	<0.5	41.2	<0.5
19-10-08	NESLM03	Salmo R. Site 3			38.0	<0.5	46.0	<0.5
18-10-09	NESLM03	Salmo R. Site 3			31.0	<0.5	38.0	<0.5
14-10-10	NESLM03	Salmo R. Site 3	<0.005	0.030	38.0	<0.5	47.0	<0.5
26-09-11	NESLM03	Salmo R. Site 3	<0.005	<0.020	74.0	<0.5	90.0	<0.5
25-09-12	NESLM03	Salmo R. Site 3	<0.0050	0.034	46.0	<0.50	56.2	<0.50

BC Approved Water Quality Guidelines (Government of BC 2006)

BC Working Water Quality Guidelines (Nagpal et al. 2006)

Canadian Water Quality Guidelines (CCME 1999a)

Value — Drinking water Guidelines (HC; Health Canada 2012 or BC Approved, BC Working as indicated)

*all values in **bold print** were measured in the field

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Hydroxide (OH)	Orthophosphate (P)	Nitrate plus Nitrite (N)	Dissolved Oxygen	Conductivity	pH	Turbidity	Water Temperature
		mg/L	µg/L	mg/L	mg/L	uS/cm	ph units	NTU	◦C
		no guideline	no guideline	no guideline	BC Approved: 8 (all other stages other than embryo) and 11 (buried embryo)	no guideline	BC App. And CCME:6.5-9.0	no mean guideline	Max. daily 19°C. Max. incubation (spring/fall) is 12 °C.
28-10-07	NESLM01	<0.5			**14**	**114**	**8.59**		**5.0**
19-10-08	NESLM01	<0.5			**12**	**147**	**8.39**		**7.0**
22-09-09	NESLM01	<0.5			**11**	**162**	**8.65**		**8.4**
04-10-10	NESLM01	<0.5	<5	<0.02	**11**	**138.6**	**8.29**	**0.36**	**12.3**
26-09-11	NESLM01	<0.5	<5	0.03	**12**	**158**	**8.58**	**0.36**	**10.6**
25-09-12	NESLM01	<0.50	<5	<0.020	**11**	**170**	**6.45**	**0.53**	**11.6**
28-10-07	NESLM02	<0.5			**14**	**88**	**7.64**		**6.5**
19-10-08	NESLM02	<0.5			**14**	**120**	**8.13**		**5.9**
19-02-09	NESLM02	<0.5					7.90		
25-03-09	NESLM02	<0.5					8.00		
23-04-09	NESLM02	<0.5					7.70		
19-05-09	NESLM02	<0.5					7.70		
18-06-09	NESLM02	<0.5					7.60		
21-07-09	NESLM02	<0.5					7.70		
19-08-09	NESLM02	<0.5					7.90		
22-09-09	NESLM02	<0.5					7.80		
18-10-09	NESLM02	<0.5			**13**	**132**	**8.33**		**5.7**
02-02-10	NESLM02	<0.5	<5	0.07	**14**	**143.2**	**8.49**	**0.30**	**2.7**
02-03-10	NESLM02	<0.5	<5	0.04	**14**	**149.9**	**8.40**	**0.10**	**3.2**
06-04-10	NESLM02	<0.5	<5	0.04	**13**	**140.0**	**8.49**	**0.40**	**4.3**
04-05-10	NESLM02	<0.5	<5	0.12	**13**	**97.8**	**8.36**	**1.10**	**4.6**
03-06-10	NESLM02	<0.5	<5	0.07	**13**	**48.5**	**8.40**	**18.70**	**8.5**
06-07-10	NESLM02	<0.5	<5	<0.02	**12**	**80.0**	**8.33**	**0.60**	**9.8**
04-08-10	NESLM02	<0.5	<5	<0.02	**10**	**119.7**	**8.48**	**0.54**	**13.3**
07-09-10	NESLM02	<0.5	<5	<0.02	**11**	**136.4**	**8.64**	**0.25**	**9.9**
04-10-10	NESLM02	<0.5	<5	<0.02	**11**	**116.4**	**8.53**	**0.33**	**7.5**
02-11-10	NESLM02	<0.5	<5	0.07	**10**	**93.5**	**8.38**	**4.90**	**5.6**
30-11-10	NESLM02	<0.5	<5	0.06	**9**	**61.0**	**8.55**	**1.20**	**0.5**
04-01-11	NESLM02	<0.5	<5	0.02	**12**	**69.8**	**8.54**	**0.31**	**-1.0**
02-02-11	NESLM02	<0.5	<5	0.2	**13**	**77.1**	**8.53**	**0.82**	**-0.1**
09-03-11	NESLM02	<0.5	<5	0.05	**9**	**78.9**	**8.94**	**0.23**	**1.2**
13-04-11	NESLM02	<0.5	<5	0.03	**11**	**100.3**	**8.59**	**0.42**	**4.9**
11-05-11	NESLM02	<0.5	<5	0.12	**13**	**63.5**	**8.57**	**2.86**	**7.1**
23-06-11	NESLM02	<0.5	<5	0.03	**11**	**35**	**8.50**	**5.71**	**9.0**
19-07-11	NESLM02	<0.5	<5	<0.02	**13**	**55**	**8.90**	**0.69**	**11.5**
16-08-11	NESLM02	<0.5	<5	<0.02	**11**	**94**	**8.85**	**0.33**	**11.5**
26-09-11	NESLM02	<0.5	<5	<0.02	**12**	**121**	**8.98**	**0.23**	**8.7**
01-11-11	NESLM02	<0.5	<5	<0.02	**12**	**116**	**8.65**	**0.19**	**2.3**
06-12-11	NESLM02	<0.50	<5	0.047	**6**	**125**	**8.96**	**0.33**	**0.0**
11-01-12	NESLM02	<0.50	6.1	0.056	**7**	**13.1**	**8.61**	**0.22**	**-2.0**
21-02-12	NESLM02	<0.50	<5	0.039	**13**	**125**	**9.09**	**0.54**	**2.0**

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Hydroxide (OH)	Orthophosphate (P)	Nitrate plus Nitrite (N)	Dissolved Oxygen	Conductivity	pH	Turbidity	Water Temperature
		mg/L	µg/L	mg/L	mg/L	uS/cm	ph units	NTU	◦C
		no guideline	no guideline	no guideline	BC Approved: 8 (all other stages other than embryo) and 11 (buried embryo)	no guideline	BC App. And CCME:6.5-9.0	no mean guideline	Max. daily 19°C. Max. incubation (spring/fall) is 12 °C.
21-03-12	NESLM02	<0.50	<5	0.044	**10**	**124**	**8.88**	**0.30**	**3.5**
17-04-12	NESLM02	<0.50	<5	0.053	**10**	**112**	**8.60**	**0.81**	**4.9**
15-05-12	NESLM02	<0.50	<5	0.126	**14**	**48**	**8.50**	**11.35**	**8.4**
19-06-12	NESLM02	<0.50	<5	0.024	**13**	**38**	**8.54**	**3.24**	**7.0**
17-07-12	NESLM02	<0.50	<5	<0.020	**11**	**60**	**8.52**	**0.87**	**13.4**
22-08-12	NESLM02	<0.50	<5	<0.020	**11**	**106**	**6.44**	**0.61**	**14.4**
25-09-12	NESLM02	<0.50	<5	<0.020	**10**	**138**	**6.36**	**0.37**	**11.0**
24-10-12	NESLM02	<0.50	<5	<0.020	**9**	**102**	**6.48**	**0.25**	**5.3**
20-11-12	NESLM02	<0.50	<5	0.045	**10**	**77**	**6.43**	**4.12**	**5.3**
17-12-12	NESLM02	<0.50	<5	0.044	**12**	**99**	**6.70**	**0.31**	**1.3**
22-01-13	NESLM02	<0.50	<5	0.048	**6**	**12**	**6.40**	**0.86**	**0.9**
19-02-13	NESLM02	<0.50	<5	0.025	**9**	**116**	**6.20**	**0.25**	**3.5**
26-03-13	NESLM02	<0.50	<5	0.04	**13**	**116**	**6.33**	**0.51**	**2.7**
23-04-13	NESLM02	<0.50	<5	0.057	**12**	**99**	**6.42**	**0.90**	**4.3**
29-05-13	NESLM02	<0.50	<5	0.032	**13**	**47**	**6.13**	**2.03**	**7.0**
19-06-13	NESLM02	<0.50	<5	<0.020	**12**	**33**	**6.30**	**4.00**	**7.0**
28-10-07	NESLM03	<0.5			**4.4**	**71**	**7.73**		**6.7**
19-10-08	NESLM03	<0.5			**13**	**92**	**7.96**		**3.2**
18-10-09	NESLM03	<0.5			**12**	**68**	**7.97**		**5.8**
14-10-10	NESLM03	<0.5	<5	0.03	**11**	**91.1**	**8.06**	**0.38**	**7.5**
26-09-11	NESLM03	<0.5	<5	<0.02	**11**	**96**	**8.01**	**0.40**	**7.0**
25-09-12	NESLM03	<0.50	<5	0.034	**11**	**103**	**6.20**	**0.48**	**9.8**

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Air Temperature	Total Phosphorus (P)	Notes	Total Hardness (CaCO3)	Dissolved Hardness (CaCO3)	Total Nitrogen (N)	Conductivity
		°C	µg/L		mg/L	mg/L	mg/L	uS/cm
		no guideline	CCME: 1.5X trophic range. HC Drinking = 10	CCME: trophic range (based on backgrd values for site).	no guideline	no guideline	no guideline	no guideline
28-10-07	NESLM01		<5	4-10 Oligotrophic		57.5	0.03	118
19-10-08	NESLM01		<5	4-10 Oligotrophic		70.7	0.03	150
22-09-09	NESLM01	**11.1**	10	4-10 Oligotrophic		69.8	0.11	154
04-10-10	NESLM01	**18.5**						
26-09-11	NESLM01	**14.9**						
25-09-12	NESLM01	**10.6**						
28-10-07	NESLM02		<5	4-10 Oligotrophic	51.8	52.6	0.04	107
19-10-08	NESLM02		<5	4-10 Oligotrophic	58.5	59.1	0.03	120
19-02-09	NESLM02		<5	4-10 Oligotrophic		60.6	0.09	130
25-03-09	NESLM02		<5	4-10 Oligotrophic		64.2	0.1	140
23-04-09	NESLM02		6	4-10 Oligotrophic		46.0	0.34	100
19-05-09	NESLM02		76	4-10 Oligotrophic		28.9	0.29	68
18-06-09	NESLM02		10	4-10 Oligotrophic		24.3	0.12	56
21-07-09	NESLM02		<5	4-10 Oligotrophic		28.6	0.08	66
19-08-09	NESLM02		<5	4-10 Oligotrophic		55.2	0.06	120
22-09-09	NESLM02		<5	4-10 Oligotrophic	63.1	63.0	0.09	134
18-10-09	NESLM02		8	4-10 Oligotrophic		50.7	0.08	112
02-02-10	NESLM02	**3.1**						
02-03-10	NESLM02	**4.6**						
06-04-10	NESLM02	**6.4**						
04-05-10	NESLM02	**7.2**						
03-06-10	NESLM02	**14.5**						
06-07-10	NESLM02	**20.2**						
04-08-10	NESLM02	**27.4**						
07-09-10	NESLM02	**17.6**						
04-10-10	NESLM02	**9.2**						
02-11-10	NESLM02	**9.1**						
30-11-10	NESLM02	**1.4**						
04-01-11	NESLM02	**-10**						
02-02-11	NESLM02	**-11**						
09-03-11	NESLM02	**1.5**						
13-04-11	NESLM02	**12**						
11-05-11	NESLM02	**22**						
23-06-11	NESLM02	**17.7**						
19-07-11	NESLM02	**28**						
16-08-11	NESLM02	**24.5**						
26-09-11	NESLM02	**9.7**						
01-11-11	NESLM02	**1.1**						
06-12-11	NESLM02	**-3.5**						
11-01-12	NESLM02	**-10**						
21-02-12	NESLM02	**4.1**						

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Air Temperature	Total Phosphorus (P)	Notes	Total Hardness (CaCO3)	Dissolved Hardness (CaCO3)	Total Nitrogen (N)	Conductivity
		°C	µg/L		mg/L	mg/L	mg/L	uS/cm
		no guideline	CCME: 1.5X trophic range. HC Drinking = 10	CCME: trophic range (based on backgrd values for site).	no guideline	no guideline	no guideline	no guideline
21-03-12	NESLM02	**5.5**						
17-04-12	NESLM02	**9.1**						
15-05-12	NESLM02	**29.2**						
19-06-12	NESLM02	**17.6**						
17-07-12	NESLM02	**36.5**						
22-08-12	NESLM02	**26**						
25-09-12	NESLM02	**17.2**						
24-10-12	NESLM02	**5.8**						
20-11-12	NESLM02	**5.8**						
17-12-12	NESLM02	**3**						
22-01-13	NESLM02	**0.5**						
19-02-13	NESLM02	**5.7**						
26-03-13	NESLM02	**12.2**						
23-04-13	NESLM02	**10.5**						
29-05-13	NESLM02	**23**						
19-06-13	NESLM02	**10.6**						
28-10-07	NESLM03		10	4-10 Oligotrophic		38.6	0.09	82
19-10-08	NESLM03		<5	4-10 Oligotrophic		41.3	0.06	91
18-10-09	NESLM03		150	4-10 Oligotrophic		34.2		0.006
14-10-10	NESLM03	**11**						
26-09-11	NESLM03	**13**						
25-09-12	NESLM03	**12.3**						

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Total Suspended Solids	Dissolved Calcium (Ca)	Dissolved Magnesium (Mg)
		mg/L	mg/L	mg/L
		No mean guideline	No stream guideline	no guideline
28-10-07	NESLM01	<4	19.1	2.41
19-10-08	NESLM01	<4	22.9	3.26
22-09-09	NESLM01	<4	22.5	3.28
04-10-10	NESLM01			
26-09-11	NESLM01			
25-09-12	NESLM01			
28-10-07	NESLM02	<4	18.6	1.48
19-10-08	NESLM02	<4	20.7	1.80
19-02-09	NESLM02	<4	21.3	1.80
25-03-09	NESLM02	16	22.6	1.85
23-04-09	NESLM02	<4	16.2	1.32
19-05-09	NESLM02	22	10.1	0.90
18-06-09	NESLM02	<4	8.57	0.69
21-07-09	NESLM02	<4	9.70	1.05
19-08-09	NESLM02	31	19.5	1.61
22-09-09	NESLM02	<4	22.1	1.88
18-10-09	NESLM02	<4	17.8	1.52
02-02-10	NESLM02			
02-03-10	NESLM02			
06-04-10	NESLM02			
04-05-10	NESLM02			
03-06-10	NESLM02			
06-07-10	NESLM02			
04-08-10	NESLM02			
07-09-10	NESLM02			
04-10-10	NESLM02			
02-11-10	NESLM02			
30-11-10	NESLM02			
04-01-11	NESLM02			
02-02-11	NESLM02			
09-03-11	NESLM02			
13-04-11	NESLM02			
11-05-11	NESLM02			
23-06-11	NESLM02			
19-07-11	NESLM02			
16-08-11	NESLM02			
26-09-11	NESLM02			
01-11-11	NESLM02			
06-12-11	NESLM02			
11-01-12	NESLM02			
21-02-12	NESLM02			

Table C-2. Water chemistry data (non-metal), with comparison to guidelines for the protection of aquatic life and drinking water, Salmo River watershed.

Sample Date (dd/mm/yy)	Site Code	Total Suspended Solids	Dissolved Calcium (Ca)	Dissolved Magnesium (Mg)
		mg/L	mg/L	mg/L
		No mean guideline	No stream guideline	no guideline
21-03-12	NESLM02			
17-04-12	NESLM02			
15-05-12	NESLM02			
19-06-12	NESLM02			
17-07-12	NESLM02			
22-08-12	NESLM02			
25-09-12	NESLM02			
24-10-12	NESLM02			
20-11-12	NESLM02			
17-12-12	NESLM02			
22-01-13	NESLM02			
19-02-13	NESLM02			
26-03-13	NESLM02			
23-04-13	NESLM02			
29-05-13	NESLM02			
19-06-13	NESLM02			
28-10-07	NESLM03	<4	14	0.92
19-10-08	NESLM03	<4	14.8	1.05
18-10-09	NESLM03	80		<4.00
14-10-10	NESLM03			
26-09-11	NESLM03			
25-09-12	NESLM03			

Table C-3. Water chemistry (metals) and comparison to guidelines for the protection of aquatic life and drinking water, Salmo River.

Sample Date (dd/mm/yy)	Site Code	Site Name	pH	Total Hardness (CaCO3)	Total Aluminum (Al)	Total Antimony (Sb)	Total Arsenic (As)	Total Barium (Ba)	Total Beryllium (Be)	Total Bismuth (Bi)
		Units	ph units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		Guideline	BC App. And CCME:6.5-9.0	no guideline	CCME: 100 when pH is > 6.5. HC: 100 (max)	BC Work: 20. HC: 6 (max)	BC App: 5. HC: 10 (max)	BC Work (mean) 1000. HC: 1000 (max)	BC Work: 5.3. BC Work: 4.0 (max)	no guideline
28-10-07	NESLM02	Salmo R. Site 2	*8.35*	51.8	13	<0.5	0.3	13	<0.1	<1
19-10-08	NESLM02	Salmo R. Site 2	*8.30*	58.5	11	<0.5	0.3	15	<0.1	<1
22-09-09	NESLMO2	Salmo R. Site 2	*8.30*	63.1	14	<0.5	0.3	16	<0.1	<1

BC Approved Water Quality Guidelines (Government of BC 2006)

BC Working Water Quality Guidelines (Nagpal et al. 2006)

Canadian Water Quality Guidelines (CCME 1999a)

Value — Drinking water Guidelines (HC; Health Canada 2012 or BC Approved, BC Working as indicated)

*Values in *red italic* font were input using results from other dates or sites (e.g., averages)

Table C-3. Water chemistry (metals) and comparison to guidelines for the protection of aquatic life and drinking water, Salmo River.

Sample Date (dd/mm/yy)	Site Code	Total Boron (B)	Total Cadmium (Cd)	Notes	Total Calcium (Ca)	Total Chromium (Cr)	Total Cobalt (Co)	Total Copper (Cu)	Total Iron (Fe)
		µg/L	µg/L		mg/L	µg/L	µg/L	µg/L	µg/L
		BC App: 1200. HC: 5000 (max)	CCME: (10^0.86[log10(Hardness)]-3.2). HC: 5 (max)	CCME Guideline Value and BC Working Guideline	no guideline	HC: 50 (max)	BC App: 4.0	BC App: 2.0 µg/L when hardness is ≤50 mg/L; and 0.04*hardness when hardness ≥50 mg/L.CCME-related to hardness. BC App: 500 (max)	CCME: 300. HC: 300 (aesthetic)
28-10-07	NESLM02	<5	0.19	0.02	18.4	<1	<0.5	<0.2	22
19-10-08	NESLM02	<50	0.21	0.02	20.5	<1	<0.5	2.1	18
22-09-09	NESLMO2	<50	0.25		22.2	<1	<0.5	0.3	18

Table C-3. Water chemistry (metals) and comparison to guidelines for the protection of aquatic life and drinking water, Salmo River.

Sample Date (dd/mm/yy)	Site Code	Total Lead (Pb)	Notes	Total Lithium (Li)	Total Magnesium (Mg)	Total Manganese (Mn)	Notes	Total Mercury (Hg)	Total Molybdenum (Mo)	Total Nickel (Ni)
		µg/L		µg/L	mg/L	µg/L		µg/L	µg/L	µg/L
		BC App. when hardness ≥8: (3.31 + e(1.273 ln [hardness] - 4.704). HC: 10 (max)	BC App. guideline calculation	BC Work: 14	no guideline	BC App. = (0.0044*hardness+0.605)*1000. HC: 50 (aesthetic)	BC App. guideline calculation	CCME: 0.026. HC: 1 (max)	BC App. 1000; CCME 73. BC App: 250 (max)	CCME: $e^{0.76[\ln(\text{hardness})]+1.06}$
28-10-07	NESLM02	<0.2	4.7	<5	1.46	1	832.9	<0.02	1	<1
19-10-08	NESLM02	0.4	4.9	<5	1.75	1	862.4	<0.02	1	<1
22-09-09	NESLMO2	<0.2		<5	1.9	1		<0.02	1	<1

Table C-3. Water chemistry (metals) and comparison to guidelines for the protection of aquatic life and drinking water, Salmo River.

Sample Date (dd/mm/yy)	Site Code	Total Phosphorus (P)	Total Potassium (K)	Total Selenium (Se)	Total Silicon (Si)	Total Silver (Ag)	Total Sodium (Na)	Total Strontium (Sr)	Total Sulphur (S)	Total Thallium (Tl)	Total Tin (Sn)
		µg/L	mg/L	µg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L
		BC App. 15. BC App: 10 (lake/max)	BC Work: 372-432 mg/L	BC App. 2.0. HC and BC App: 10 (max)	no guideline	BC App. 1.5 if hardness>100, 0.05 if hardness is <100. CCME 0.1.	HC: 200 (aesthetic)	no guideline	no guideline	CCME and BC Work: 0.8. BC Work: 2.0	no guideline
28-10-07	NESLM02		0.75	0.3	3590	<0.02	1.3	92	<3	<0.05	<5
19-10-08	NESLM02		0.85	0.4	3450	<0.02	1.46	105	<3	<0.05	<5
22-09-09	NESLMO2		0.9	0.4	3950	<0.02	1.59	109	<3	<0.05	<5

Table C-3. Water chemistry (metals) and comparison to guidelines for the protection of aquatic life and drinking water, Salmo River.

Sample Date (dd/mm/yy)	Site Code	Total Titanium (Ti)	Total Uranium (U)	Total Vanadium (V)	Total Zinc (Zn)	Notes	Total Zirconium (Zr)
		µg/L	µg/L	µg/L	µg/L		µg/L
		BC Work: 2000	CCME: 15. BC Work 300. HC: 20 (max)	BC Work: 6	BC App: 7.5 +0.75 * (hardness - 90). HC: 5000 (aesthetic)	BC App. calculated guideline	no guideline
28-10-07	NESLM02	<5	0.2	<5	15	7.5	<0.5
19-10-08	NESLM02	<5	0.2	<5	7	7.5	<0.5
22-09-09	NESLMO2	<5	0.2	<5	6		<0.5

Table C-4. Sediment quality and comparison to guidelines for the protection of aquatic life, Salmo River.

Sample Date (dd/mm/yy)	Site code	Site Name	Soluble (2:1) pH	Total Aluminum (Al)	Total Antimony (Sb)	Total Arsenic (As)	Total Barium (Ba)	Total Beryllium (Be)	Total Bismuth (Bi)	Total Cadmium (Cd)
		Units*	pH Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Guideline		no guideline	no guideline	no guideline	CCME and BC Working ISQG 5.9, PEL 17	no guideline	no guideline	no guideline	CCME and BC Working ISQG 0.6, PEL 3.5
04-10-10	NESLM02	Salmo R. Site 2	7.18	10300	0.5	9.4	60.8	0.3	<0.1	2.00
01-11-11	NESLM02	Salmo R. Site 2	7.5	11700	0.8	10.7	87.1	<0.4	0.4	8.06
25-09-12	NESLM02	Salmo R. Site 2	7.41	9390	0.4	5.73	48	<0.40	0.17	1.46

*1 mg/kg = 1 µg/g

Guideline exceedance legend for the protection of freshwater aquatic life:

- BC Approved Water Quality Guidelines (Government of BC 2006)
- BC Working Water Quality Guidelines, lowest effect (Nagpal et al. 2006)
- BC Working Water Quality Guidelines, severe effect (Nagpal et al. 2006)
- Canadian Sediment Quality Guidelines - ISQG (CCME 1999b)
- Canadian Sediment Quality Guidelines - PEL (CCME 1999b)

Table C-4. Sediment quality and comparison to guidelines for the protection of aquatic life, Salmo River.

Sample Date (dd/mm/yy)	Site code	Total Calcium (Ca)	Total Chromium (Cr)	Total Cobalt (Co)	Total Copper (Cu)	Total Iron (Fe)	Total Lead (Pb)	Total Lithium (Li)	Total Magnesium (Mg)	Total Manganese (Mn)	Total Mercury (Hg)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Guideline	no guideline	ISQG 37.3, PEL 90	no guideline	ISQG 35.7, PEL 197	BC Work: low 21,200, severe 43,766	CCME and BC Working ISQG 35, PEL 91.3	no guideline	no guideline	BC Work: low 460, severe 1100	ISQG 0.17, PEL 0.486
04-10-10	NESLM02	3690	25	8.5	23.5	20,600	75.4	16	6990	367	<0.05
01-11-11	NESLM02	6990	33	9.9	33.2	23,400	137	17	7330	390	0.07
25-09-12	NESLM02	3760	22.4	7.26	16.3	19,500	59.6	14.4	6570	294	<0.050

*1 mg/kg = 1 µg/g

Table C-4. Sediment quality and comparison to guidelines for the protection of aquatic life, Salmo River.

Sample Date (dd/mm/yy)	Site code	Total Molybdenum (Mo)	Total Nickel (Ni)	Total Phosphorus (P)	Total Potassium (K)	Total Selenium (Se)	Total Silver (Ag)	Total Sodium (Na)	Total Strontium (Sr)	Total Thallium (Tl)	Total Tin (Sn)	Total Titanium (Ti)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Guideline	no guideline	BC Work: low 16, severe 75	no guideline	no guideline	BC App. 2	BC Work 0.5	no guideline	no guideline	no guideline	no guideline	no guideline
04-10-10	NESLM02	1.1	21.3	861	1310	<0.5	0.38	157	28.0	0.12	0.2	588
01-11-11	NESLM02	1.4	23.3	1020	1580	1.8	0.51	189	49.6	0.15	0.5	756
25-09-12	NESLM02	1.2	16.7	803	1260	<0.50	0.262	125	29.6	0.114	0.15	556

*1 mg/kg = 1 µg/g

Table C-4. Sediment quality and comparison to guidelines for the protection of aquatic life, Salmo River.

Sample Date (dd/mm/yy)	Site code	Total Uranium (U)	Total Vanadium (V)	Total Zinc (Zn)	Total Zirconium (Zr)
		mg/kg	mg/kg	mg/kg	mg/kg
	Guideline	no guideline	no guideline	CCME and BC Working ISQG 123, PEL 315	no guideline
04-10-10	NESLM02	0.78	45	229	0.6
01-11-11	NESLM02	2.13	49	400	0.6
25-09-12	NESLM02	0.813	38.2	196	1

*1 mg/kg = 1 µg/g