

*Specializing in  
Aquatic Impact  
Assessment and  
Monitoring*

February 22, 2007

Ms Karilyn Long & Mr. Ryan Benson  
Okanagan Nation Alliance  
3255 C Shannon Lake Road  
Westbank, BC V4T 1V4

Dear Ms.Long and Mr. Benson:

Re: Okanagan Metric Analysis for 7 streams sampled in 2006

Please find enclosed the results of the data analyses you requested on your 2007 invertebrate data collected from Okanagan-area streams. Metrics were calculated and summarized for all sites sampled in 2007. Okanagan B-IBI scores were then calculated for all sites using the 5-metric benthic invertebrate – index of biotic integrity (OK B-IBI) developed by Jensen (2006). A brief description of the methods is presented in this letter along with a summary of the results.

Methods used to calculate metrics from the supplied invertebrate data followed those used for Skeena Region Forest Science Project (FSP) (Bennett *et al.* 2003) and Okanagan B-IBI (Jensen 2006). Before calculating any metrics, all adults were eliminated from the raw data. Several taxa that were determined to be non-aquatic were removed from the raw data including the Family Carabidae (Order Coleoptera) and Homoptera individuals. In addition, several zooplankton taxa were removed from the raw data. Any invertebrates that were not identified to at least the family level were ignored during metric calculations except where noted in the metric definitions.

Consistent with methods used by Jensen (2006), metrics were calculated and defined for insects identified to the genus level except chironomids which were keyed to family, and non-insects keyed to the order or family level. Twenty-five metrics were calculated for each stream sites and are summarized in the attached excel spreadsheet (ONA\_benthic\_2006.xls) and in Table 1. Definitions of the metrics are attached.

Table 1: Metric Results for Okanagan Streams sampled in 2007

Site Name	Inkameep Creek	Okanagan River - States	Okanagan River-Oliver	Omak Creek	Penticton Channel	Salmon Creek	Shuttleworth Creek
Year	2006	2006	2006	2006	2006	2006	2006
Total # of Individuals per sample	366	298	283	368	67	391	195
# of Individuals per sample (w/o order)	366.0	298.0	283.0	368.0	67.0	391.0	195.0
# of Taxa	23.0	15.0	10.0	22.0	12.0	16.0	12.0
# Ephemeroptera Taxa	6	4	1	7	2	4	2
# Plecoptera Taxa	5	2	2	4	2	4	2
# Trichoptera Taxa	3	3	2	3	2	2	2
# Intolerant Taxa	0	0	0	0	0	0	0
% Tolerant Individuals	23.5	40.6	14.9	15.1	9.2	2.8	83.0
# Clinger Taxa	12	5	5	12	4	8	4
% Predators	17.2	10.7	2.5	5.2	11.9	7.7	0.5
% Dominance (3 taxa)	53.0	71.5	89.8	61.1	70.1	80.6	82.1
# Long-lived Taxa (only 100%)	5	4	3	4	2	3	2
% Sediment Tolerant	1.1	0.0	0.0	0.8	1.5	1.8	75.9
% Sediment Intolerant	4.1	24.2	75.3	15.5	44.8	20.7	3.6
% Mayflies	38.5	7.7	5.3	27.4	9.0	59.6	1.5
% Oligochaetes	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Diptera and non-insect	3.6	13.4	1.1	3.3	23.9	10.7	84.6
% Clingers	68.6	80.5	92.9	47.0	68.7	35.8	8.7
# Diptera taxa	7	3	2	4	4	4	2
% Dipterans	3.6	13.4	1.1	3.3	23.9	10.5	8.7
% Non-insects	0.0	0.0	0.0	0.0	0.0	0.3	75.9
% Long-lived	38.5	49.7	17.7	21.5	6.0	6.1	4.6
Simpson's Diversity	0.87	0.81	0.69	0.84	0.75	0.67	0.47
Evenness	0.05	0.08	0.15	0.05	0.11	0.09	0.18
% Collector-Filterers	4.4	24.8	33.2	16.3	62.7	28.4	3.6
% Shredders	0.8	0.0	0.0	29.3	0.0	0.3	5.6
Hilsenhoff Biotic Index	3.24	3.8	2.75	3.13	4.31	4.5	6.99

As shown in Table 2, the OK B-IBI scores ranged from 7 (very poor stream condition) at three sites, Okanagan River – Oliver, Penticton Channel and Shuttleworth Creek to 19 (good stream condition) at two sites, Inkameep Creek and Omak Creek.

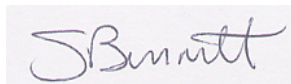
Table 2: Okanagan B-IBI Score and Stream Condition for each of the sites sampled in 2007.

Site Name	# of Taxa	Score	# E Taxa	Score	# P Taxa	Score	# Intol Taxa	Score	# Clinger Taxa	Score	B-IBI Score	Okanagan B-IBI Stream Condition
Inkameep Creek	23.0	3.0	6	5	5	5	0	1	12	5	19.0	Good
Okanagan River - State	15.0	3.0	4	3	2	3	0	1	5	1	11.0	Poor
Okanagan River-Oliver	10.0	1.0	1	1	2	3	0	1	5	1	7.0	Very Poor
Omak Creek	22.0	3.0	7	5	4	5	0	1	12	5	19.0	Good
Penticton Channel	12.0	1.0	2	1	2	3	0	1	4	1	7.0	Very Poor
Salmon Creek	16.0	3.0	4	3	4	5	0	1	8	3	15.0	Fair
Shuttleworth Creek	12.0	1.0	2	1	2	3	0	1	4	1	7.0	Very Poor

2/22/2007

Thank you for the opportunity to work with you on this project. If there are any changes or additional data analyses required, please do not hesitate to contact me at 250-635-3584 or [Shauna.Bennett@telus.net](mailto:Shauna.Bennett@telus.net). An invoice for the work (2007-2) is attached.

Sincerely,

A handwritten signature in cursive script, reading "S Bennett", is displayed on a light gray rectangular background.

Shauna A. Bennett, R.P. Bio (1054)  
Aquatic Impact Assessment Biologist

Encl.

## Metric Definitions

As shown in the attached spreadsheet (ONA\_benthic\_2006.xls), functional feeding group, clinger behaviour, tolerance /intolerance to general pollution, tolerance / intolerance to sedimentation, long-lived designation and Hilsenhoff Biotic Index tolerance value are listed for each taxon. A list of clingers was prepared by Leska Fore and available on the Salmonweb internet site ([www.salmonweb.org](http://www.salmonweb.org)). Also available at the Salmonweb site was a list of long-lived (semi-voltine) and tolerant taxa prepared by Robert Wisseman. Classifications for taxa that were not listed in either of these sources were taken from Merritt and Cummins (1996) or CAMLnet (CADFG 2003).

- **Taxa richness metrics:** The number of distinct taxa counted in a sample for a given taxonomic level (e.g. Order Ephemeroptera). Individuals at higher taxonomic levels (e.g. family level) were only counted as a distinct taxon if there were no individuals at the lower level (e.g. genus level for that family). Taxa richness metrics included:
  - Total taxa richness
  - Ephemeroptera (mayfly) taxa
  - Plecoptera (stonefly) taxa
  - Trichoptera (caddisfly) taxa
  - Long-lived taxa (semi-voltine life cycle, reproduces once a year or once every few years) Semi-voltine taxa were defined by Robert Wisseman and provided on the Salmonweb internet site.
  - Intolerant taxa, and
  - Clinger taxa (invertebrates documented as exhibiting “clinging” as the primary behavior (Merritt and Cummins 1996))
- **% predators:** Predators are individuals belonging to the predator functional feeding group as described by Robert Wisseman (NuWissMaster98.xls) or by Merritt and Cummins (1996). The relative abundance of predators was calculated for each replicate and averaged for the site.
- **Dominance (3 taxa):** Percent dominance was calculated as the sum of individuals in the three most abundant taxa in that sample, divided by the total number of individuals (identified to family) and multiplied by 100.
- **% sediment tolerant individuals:** The relative abundance of sediment tolerant individuals. Sediment tolerant taxa were classified by Kleindl (1995) or by Zweig and Rabeni (2001) and included the following:
  - Oligochaetes
  - Gastropods
  - *Antocha*, *Dicronata* and *Hexatoma* sp. of the Tipulidae Family (Order Diptera)
  - *Procleon* sp. of the Family Baetidae
  - *Stictochironomus* sp. (Order Diptera)
  - *Nectopsyche* sp. (Order Trichoptera)
  - *Cladotanytarsus (Lenziella)* sp. (Order Diptera)
  - *Ephoron* sp. (Order Ephemeroptera)
  - *Pseudochironomus* sp. (Order Diptera)
- **% sediment intolerant individuals:** The relative abundance of sediment intolerant individuals. Sediment intolerant taxa were classified by Kleindl (1995) or by Zweig and Rabeni (2001) and included the following:

- *Glossosoma* and *Anagapetus* of the Glossosomatidae Family (Order Trichoptera)
  - *Wormaldia* of the Family Philopotamidae (Order Trichoptera)
  - *Cheumatopsyche*, *Hydropsyche*, *Parapsyche* and *Arctopsyche* of the Family Hydropsychidae (Order Trichoptera)
  - *Trichorythodes*, *Isonychia* and *Stenonema spp.* of the Order Ephemeroptera
  - *Caenis sp.* (Order Ephemeroptera)
  - *Cricotopus/ Orthocladius* (Order Diptera)
  - *Ectopria* (Order Coleoptera)
  - *Polypedium* (Order Diptera)
  - *Thienemanniella* (Order Diptera)
  - *Tvetenia* (Order Diptera)
- **Hilsenhoff biotic index:** The Hilsenhoff biotic index (HBI) is a value calculated by summing the number of individuals in each taxon weighted by the assigned tolerance value of each taxon to organic pollution (Resh *et al.* 1996). Hilsenhoff biotic index values were available in a USEPA document (Barbour *et al.* 1999) and in CAMLnet (CADFG 2003). HBI values can range from 0 to 10. The lower range represents better water quality, while numbers closer to 10 represent the poorest water quality as shown in Table 3. Note that the thresholds in the table were designed for Family-level data, and have been applied to genus-level data.

Table 3: Water Quality Based on Family Biotic Index Values (from Resh et al. 1996)

Family Biotic Index	Water Quality
0 – 3.75	Excellent
3.76 – 4.25	Very Good
4.26 – 5	Good
5.01 – 5.75	Fair
5.76 – 6.5	Fairly Poor
6.51 – 7.25	Poor
7.26 - 10	Very Poor

- **Simpson's Diversity Index (D):** A measure of the abundance and taxonomic richness of a community (Environment Canada 2002).  $D = 1 / \sum(p_i)^2$  where  $p_i$  is the proportion of individuals in each taxon.
- **Evenness:** A measure of the distribution and relative contribution of each taxon present to the overall community (Environment Canada 2002).  $Evenness = 1 / \sum(p_i)^2 / S$  where  $p_i$  is the proportion of the  $i$ th taxon at the station, and S is the total number of taxa at the station.
- **% Collector-Filters:** Percentage of individuals in a sample that use collecting -filtering as a primary feeding behaviour.
- **% Shredders:** Percentage of individuals in a sample that use shredding as a primary feeding behaviour.

## Literature Cited:

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