

Englishman River Invertebrate Assessment

2019

Summary Report



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Front Cover Photo: Riverside sample station at “Top Bridge Park Community Park”, where volunteers are sorting the benthic invertebrates that were captured from the adjacent riffle.

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Introduction

Members of the Mid Vancouver Island Habitat Enhancement Society (MVIHES) have been interested in the biological health of the Englishman River for many years. Some of the activities MVIHES volunteers have participated in include:

- From 2003 to 2012, working with Federal and Provincial Agencies in delivery of the Englishman River Recovery Plan, focused on the restoration of fish and fish habitat (D.R. Clough, 2013).
- Participating in the Regional District of Nanaimo's Community Water Monitoring program to assess water quality throughout the watershed (R. Barlak 2012).
- Working under direction of Department of Fisheries and Oceans to monitor Coho smolt output of Shelly Creek (2012-2020).
- Capturing bi-weekly water quality samples for Environment and Climate Change Canada as part of the (Federal and Provincial) Pacific Water Quality Monitoring Program.

In the Englishman River Habitat Status Report (2013), Clough identified a number of projects that volunteer streamkeepers (like MVIHES) should implement to monitor the future health of the watershed over the long term. In response, MVIHES developed a program entitled "Watershed Health and You" that aimed to engage our local community in recognizing the importance of the watershed and become involved in monitoring the bio-physical health of the systems natural features (<https://www.mvihes.bc.ca/current-initiatives/community-engagement-and-field-work>).

Long term monitoring of benthic invertebrates has been identified as a method to assess pollution in British Columbia streams (Taccogna et al 1995). Benthic macroinvertebrates are the larval forms of flying insects that spend part, if not all their life cycle, in fresh water (Carter et al., 2012). There are over 4,000 species of benthic macroinvertebrates found in freshwater lakes and streams in Canada, each able to live in varying habitats and tolerate various levels of pollution, contaminants and water quality parameters (Carter et al., 2012). As benthic invertebrates feed on organic matter in streams, their role is vital to the circulation of nutrients in riverine ecosystems, thus playing an important role in sustaining the food chain of fish as well as other vertebrates, such as amphibians and birds. Studies of juvenile Cutthroat Trout and Coho Salmon show a large percentage of chironomid larvae/pupae and adult insects followed by trichopteran in their diet (Glova, 1972).

The Streamkeepers Handbook, (Module 4,) suggests that sampling invertebrate populations in different parts of a river system will allow for comparisons that can help determine whether a stream is healthy or has chronic or periodic water quality problems (Taccogna et al 1995).

In the spring of 2019, MVIHES partnered with Island Waters Flyfishers to implement an invertebrate monitoring project on the river with the following objectives:

1. To assess the benthic invertebrate community for abundance and pollution tolerances throughout the lower Englishman river and tributaries
2. To involve as many interested volunteers in all aspects of the project, from field collection to analysis.
3. To test the application of the Streamkeepers Module 4 as a field sampling method to answer the following questions:
 - Do volunteers require extensive training in benthic invertebrates?
 - Is the method simple to implement in the field?
 - Can the data be easily summarized to provide a snapshot of watershed health?

Methods

In a recent report completed by Vancouver Island University, a benthic invertebrate sampling project was completed by students over a seven-year time frame on the Englishman River (E. Demers 2016). In June 2019, the authors met to discuss the logistics and methods of benthic sampling used by the students with the author. Dr. Demers felt the Streamkeepers Module 4 was an effective sample protocol, and he encouraged us to use it, which we did.

Study Areas within the Englishman River Watershed

Sites selected for benthic sampling needed to meet the following criteria:

- Ease of access for volunteers, with sampling equipment and counting tables/chairs
- Presence of suitable cobble substrates creating preferred riffle conditions which are preferred by benthic insects.

For this project, we decided that field sampling should focus on the lower watershed (reaches 2 and 3 of the river), and the tributaries below the falls. The reason we decided to focus our efforts in the lower watershed was based on the frequency of human influences to water quality conditions that could impact benthic communities (Plewes 2018). A total of four areas were selected for benthic sampling and are located within watershed (Fig. 1).

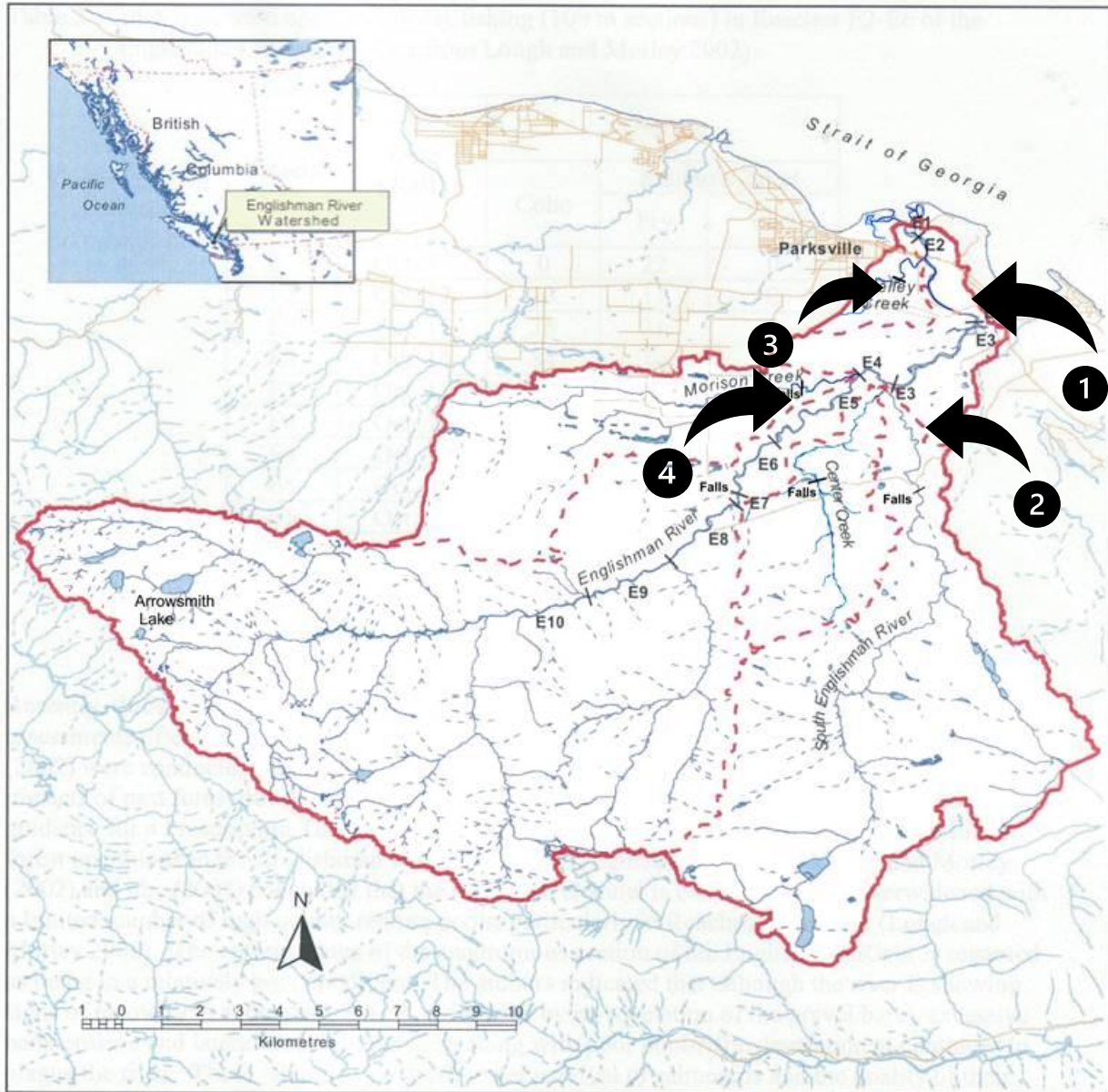


Figure 1. Englishman River Watershed, showing general sample areas: Area 1. Lower River; Area 2. South Englishman; Area 3. Shelly Creek; Area 4. Morison Creek.

Area 1 refers to four sample sites on the mainstem of the lower river (Fig. 2)

- **Site 1.** Riffle 200 meters downstream of the Orange Bridge (access off Plumber Road). Waypoint- 49°19'02.21"N 124°17'05.42"W
- **Site 2.** Riffle adjacent to the Scout Hall (accessed off the end of Despard Road off Martindale Road). Waypoint - 49°18'33.64"N 124°17'01.73"W.
- **Site 3.** Riffle at the tail-out to the last pool in the Top Bridge Park Canyon (accessed from Top Bridge Community Park). Waypoint - 49°17'57.61"N 124°16'03.85"W.
- **Site 4.** Riffle site 100 meters above the BC Hydro Transmission Line Crossing (access from the Englishman River Regional Park). Waypoint - 49°17'07.77"N 124°16'56.99"W

We also selected four sites in tributaries to the lower river for benthic sampling.

Area 2 refers to two sites located in the **South Englishman River**, entering the river from the southeast (Fig. 3).

- **Site: South Englishman River** - riffle 50 m upstream of the Center Creek confluence. This is the CWM water monitoring site (accessed off 155 Main -). Waypoint - 49°16'34.69"N 124°17'46.93"W
- **Site: Center Creek** – riffle 30 meters upstream confluence with the South Englishman River. Waypoint - 49°16'35.42"N 124°17'51.42"W

Area 3 refers to Shelly Creek, a small tributary entering the lower river from the west (Fig. 4).

- **Site: Shelly Creek Park** – Trail access off Hamilton Road, proceed 200 meters upstream to small bridge crossing. Waypoint: 49°18'23.42"N 124°18'14.00"W

Area 4 refers to Morison Creek, a large tributary entering river from the west (Fig. 5).

- **Site: Morison Creek** trail off the road end @ Sierra Road - take left fork and proceed 200 meters to the creek. Waypoint - 49°16'35.42"N 124°19'22.88'W.

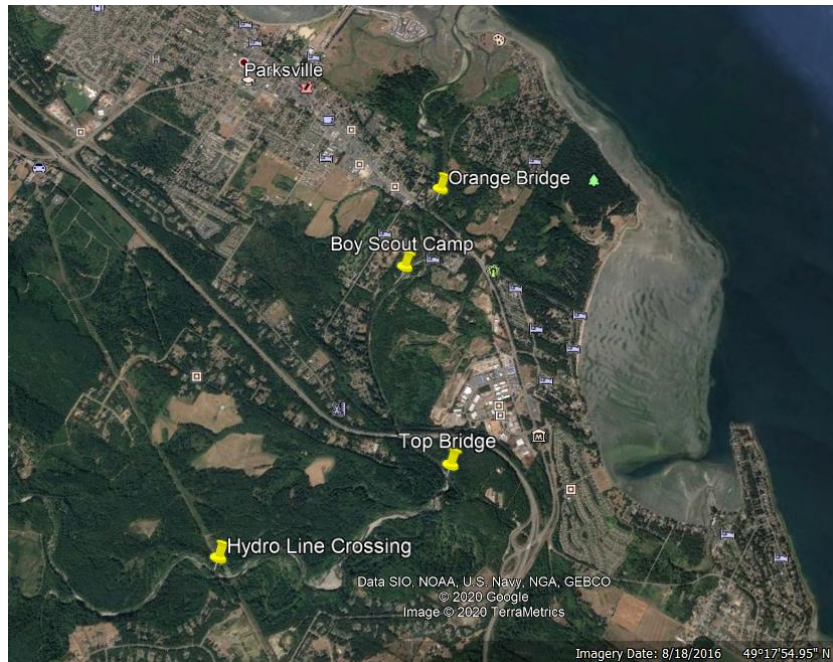


Figure 2. Lower River Sample Sites: Orange Bridge- 200 meters below Hwy. 19A; Boy Scout Camp (off Martindale Road at Despard Road); Top Bridge – outlet of lower pool in Top Bridge Community Park; Hydro Line Crossing (in the Englishman River Regional Park).

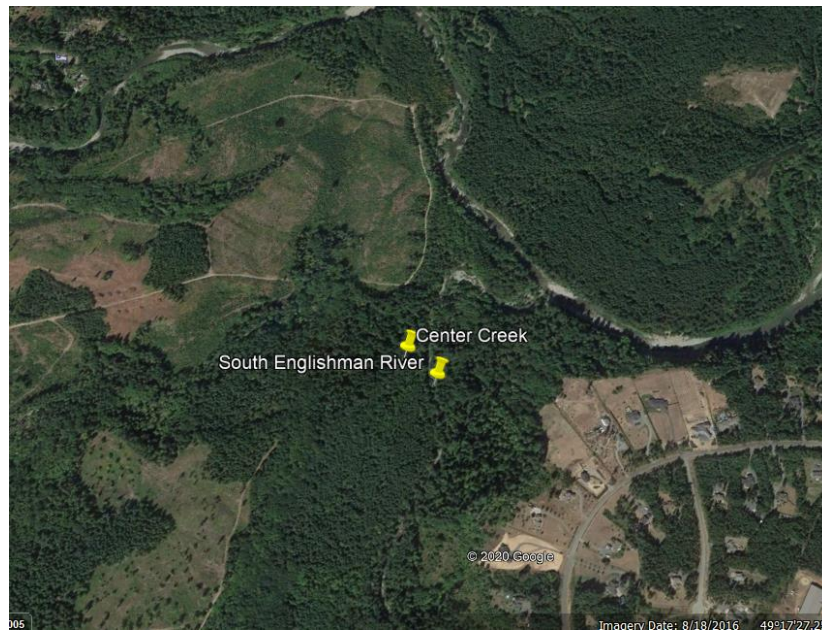


Figure 3. South Englishman River Sample Sites: South Englishman, 200 meters upstream from confluence with mainstem; Center Creek, 100 meters upstream from confluence with Englishman River.

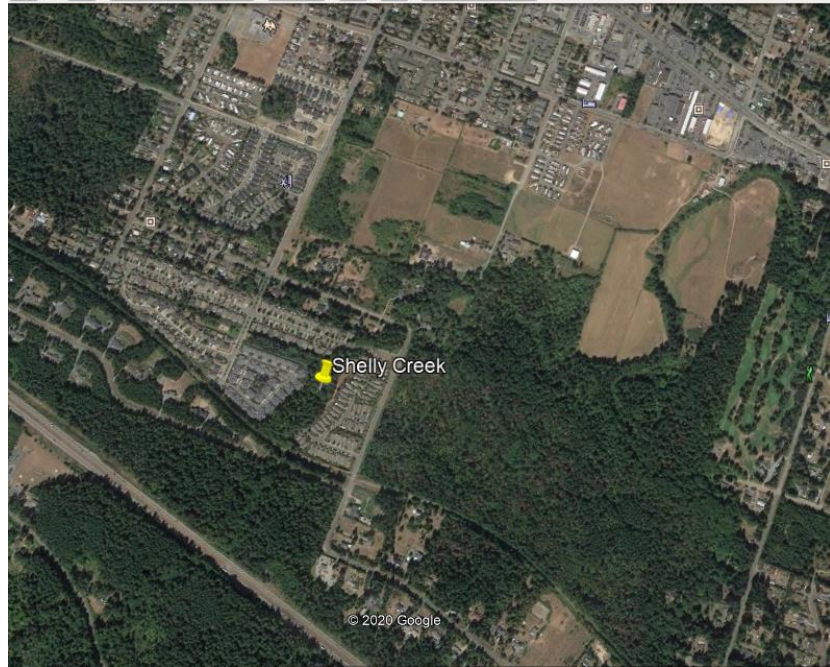


Figure 4. Shelly Creek Sample Site. Located in North Shelly Creek Park, 200 meters above Hamilton Road.

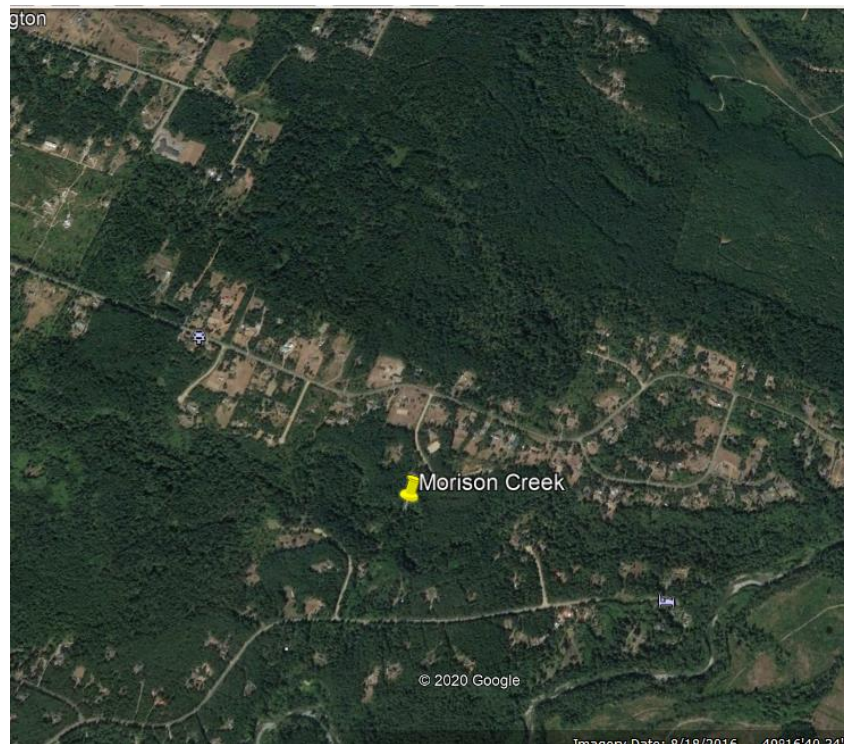


Figure 5. Morison Creek Sample Site: Trail from Sierra Road leading to a location 100 meters below falls.

Sampling Procedures

Upon arrival at a sample site, the following procedure was followed with equipment used:

1. **Setting up riverside “sample site”:** Two portable tables (4'X8') along with chairs (for each volunteer) were brought to a riverside location near the sample site. During rain events, a large 20'x20' tent was set-up to protect the volunteers and sample trays from getting wet.
2. **To acquire representative sample bugs from the river/creek substrate, we followed the following process:**
 - a. Following the recommendation of Module 4, we choose to sample a shallow riffle with rocks 5cm to 25cm in size.
 - b. A “Hess Sampler” was used at the Orange Bridge site. This device is a 34-cm diameter galvanized metal drum hand pressed into the substrate to isolate a circular 0.09m² sampling area (see Appendix II). All stones and debris within the sample drum were gently agitated to loosen any benthic invertebrates. The contents of the collecting net were then transferred to a 20- liter bucket and taken to the field station.

At the remaining seven sample sites, we used a 30 cm wide “D” net w/500 micron mesh size. Each site was approached from downstream. The D net required us to measure a 30 cm X 30 cm area upstream of the net, where all stones >5 cm were brushed into the net. We placed the resulting catch in a 20-liter bucket and took it to the field station.

- c. To filter out the invertebrates we passed the sample in the bucket through a series of sieves (4mm, 2mm and 500 micron) to separate wood debris and small stones from invertebrates.
3. **The process of identifying and counting invertebrates was as follows:** The filtered sample was poured into a white tray (10”x12”) where volunteers sat at a portable table and used a hand magnifying lens to identify bugs. Individual bugs were removed from the trays using tweezers/ pipettes/ eye droppers or white plastic spoons and placed in a plastic ice cube tray. Each compartment of the tray allowed for the sorting of organisms. Bruce Murray was the primary invertebrate identifier. Bruce is familiar with organizing invertebrates as he has an Entomology background. For the project, he would identify bugs to the major taxa or groups (classes orders, families) but not species. Bruce used a head- mounted jewelers magnifying device to identify and count organisms. A laminated field key was also used to help identify organisms (Adams 2003). Bugs that were not easily identified in the field were stored in a small (100ml) plastic bottles using 99% isopropyl alcohol for later identification at home.

4. **Data Capture:** The results were compiled using Streamkeepers Module 4 Invertebrate Survey Field Data Sheet (Appendix I). Photos were taken using an I-Phone S6 model or Samsung Galaxy 5.

Results and Discussion:

The results of the 2019 invertebrate survey with field notes for all eight sample sites are found in Appendix III. Each sample site includes a “Site Interpretation” rating using Streamkeepers Module 4.

Benthic Invertebrate Densities and Pollution Tolerances Observed at a Watershed Scale.

When looking at the density of invertebrates sampled in 2019, we separated the data into “river sites only” (area 1) and “tributaries only” (areas 2,3 and 4). The reason for doing this was in recognition that the river sample sites were physically larger and influenced by augmented summer flows (from Arrowsmith Lake).

When combining the counts from all the river sample sites, we see that the total benthic invertebrate density is 2,703 animals/m² (Fig 6). The proportion of benthic invertebrates made up of “pollution sensitive” (category 1) taxa was 50%. Members of the insect groups Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, caddisflies, or EPT) are grouped together because they all require clean water (Taccogna 1995).

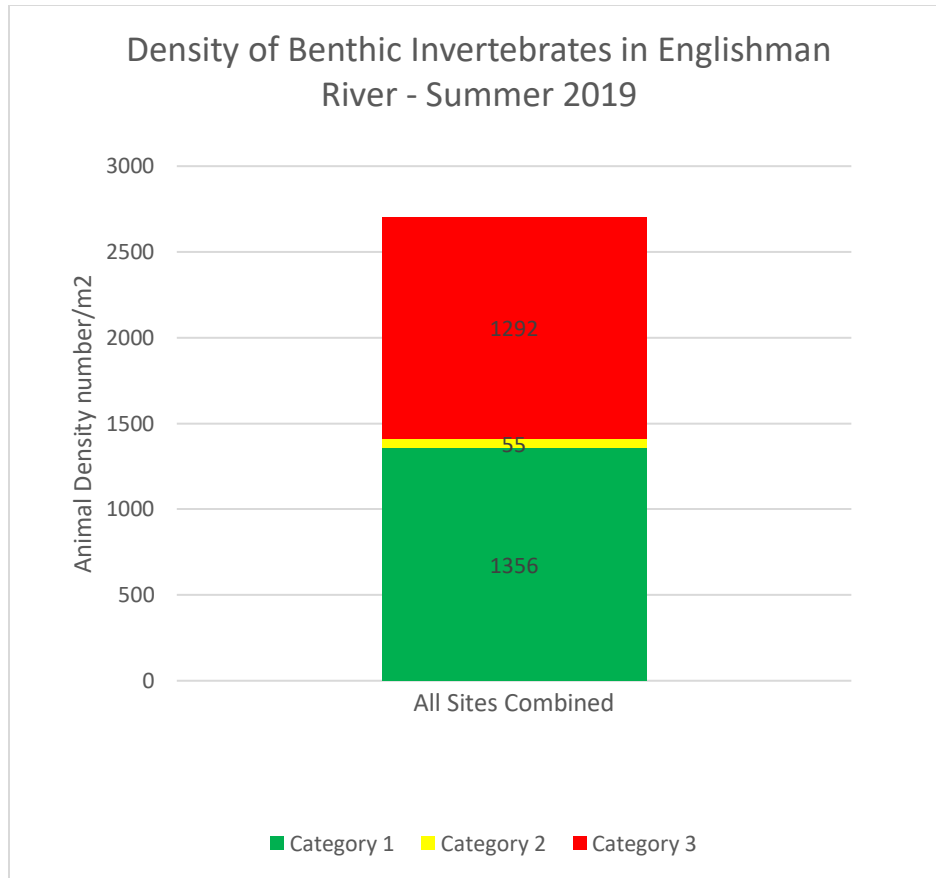


Figure 6. Density of Benthic Invertebrates of the Lower Englishman River watershed sample sites in the summer 2019. Colours represent “pollution sensitive” taxa (green: category 1), “somewhat pollution tolerant (yellow: category 2), and pollution tolerant (red. Category 3).

In comparing our 2019 results with a previous invertebrate study done by VIU (Demers 2016), we see that on average, total densities are comparable to samples taken over the eight- year VIU study. What is concerning is the drop in 2019 of the proportion of category 1 taxa to 50%, from those sampled between 2008 and 2015 where category 1 taxa ranged from 58% to 90% of the density of organisms.

The sample sites located on the tributaries were much more productive for benthicinsects with nearly 2x the density (4,473 animals/m²) of river sites. The proportion of category 1 invertebrates is nearly 90%, indicating water quality is very good (Fig. 7).

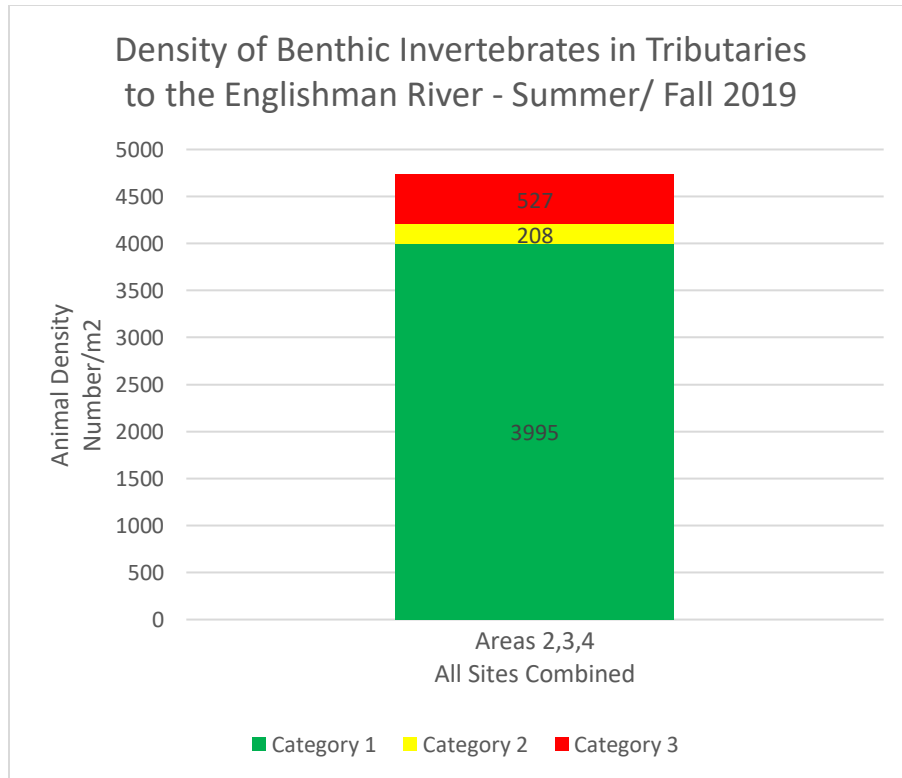
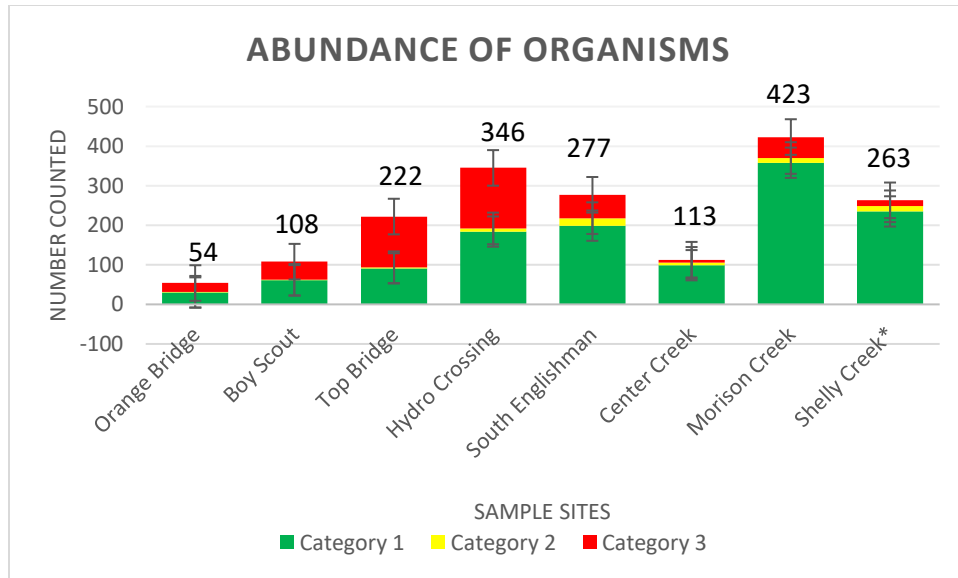


Figure 7. Density of Benthic Invertebrates found in Tributaries of the Englishman River in 2019. Colours represent "pollution sensitive" taxa

Abundance of Organisms and Pollution Tolerances

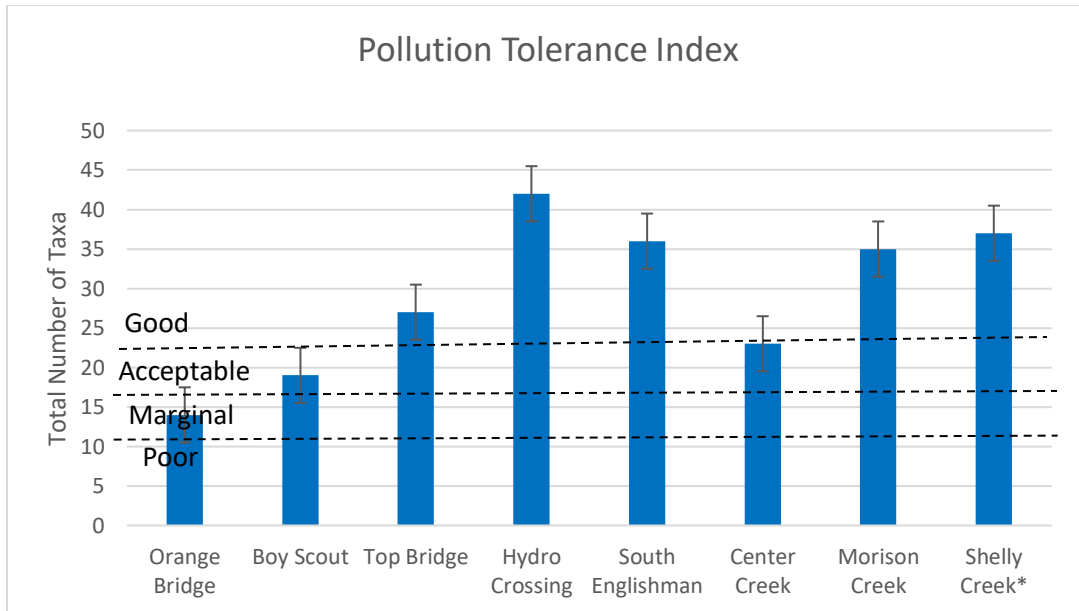
A combined total of 1806 invertebrates were captured at the all sample sites in 2019. Using the number of organisms captured and the pollution sensitivity taxa tallied at each site, there was an interesting trend based on where in the watershed the sample site was located (Fig. 8). The site with the lowest number of organisms was at the Orange Bridge (lowest point in the river sampled). As we moved up the main stem of the river, the total count of organisms multiplied by site 2X at each site. The river site with the highest abundance and diversity of organisms was the hydro crossing, while the tributary with the highest abundance and diversity of organisms was Morison Creek.



*indicates that only 2 benthic samples were captured

Figure 8. Abundance of Benthic Organisms Counted at each site, grouped into Pollution Sensitivity Categories.

A pollution tolerance index was generated for each site, based upon the total number of broad taxonomic groups found in each pollution tolerance category. The resulting analysis shows that 5 of the 8 sample sites were rated as good, with the lower rated sites found in the lower mainstem of the river (Fig 9).

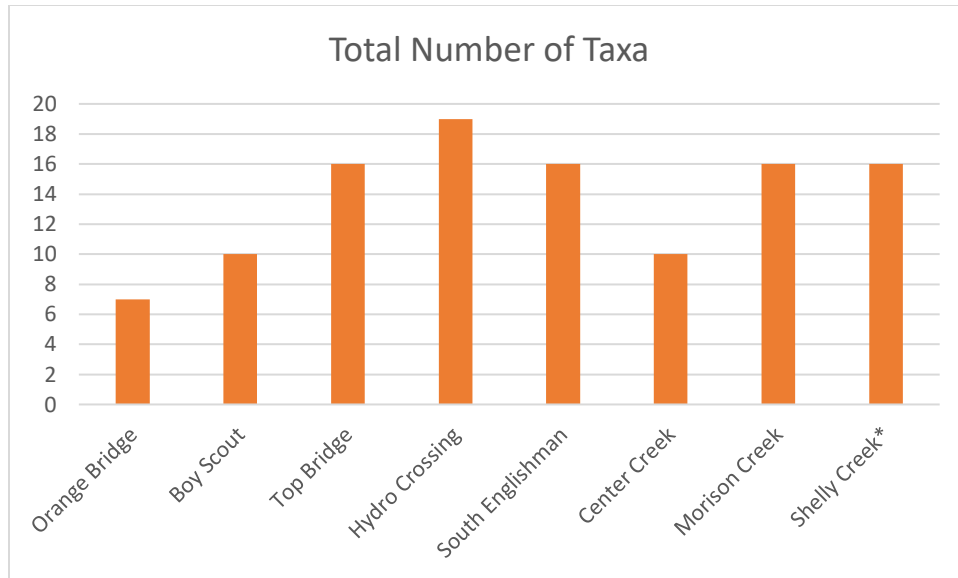


*indicates that only 2 benthic samples were captured

Figure 9. The Pollution Tolerance Index- Rating Water Quality at Sample Sites.

Benthic Diversity Assessment

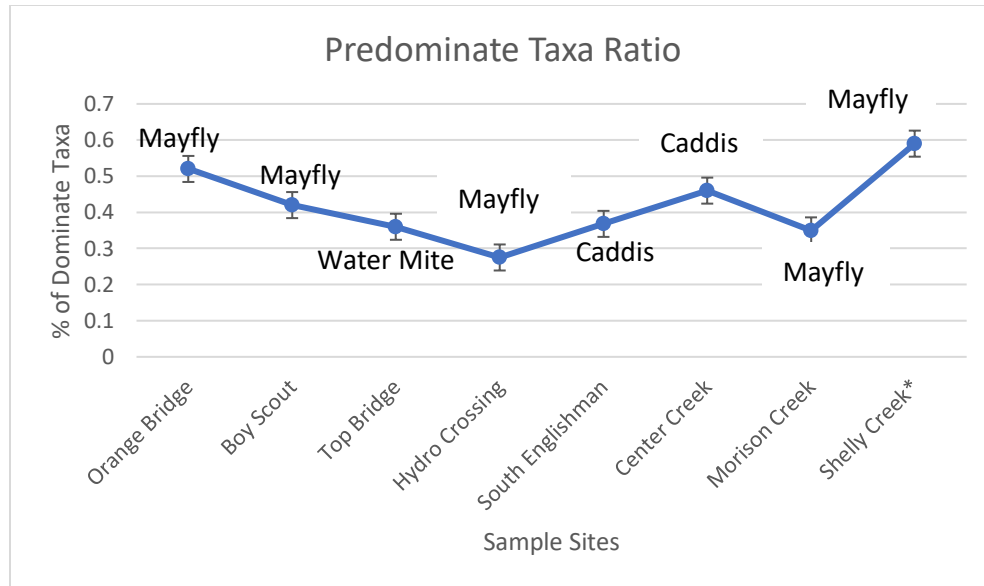
The sample sites selected in 2019 show some variability in the total number of taxa counted, from a low of 7 taxon to a high of 19 taxon (Fig. 10). Generally, streams with good habitat and water quality have high benthic diversity; therefore, many taxa (Taccogna 1995). When comparing diversity of sites in the river, we see that the lowest count starts in the lower river and rises at sites further up- river. The tributary sample sites appear to have highly diverse taxa, with the exception of Center Creek, where lower counts could be a result of very low summer flows.



*indicates that only 2 benthic samples were captured

Figure 10. Total Number of Individual Taxa Counted at each Sample Site

When assessing diversity of benthic invertebrates, a predominate taxa ratio of between 0.0 and 0.4 is rated as good, while 0.4 to 0.6 range as acceptable (Taccogna 1995). The taxa ratio measurements for sites sampled in 2019 ranged between 0.28 to 0.60 (Fig. 11). The predominate taxa for a majority of the sample sites were Mayflies. Water Mite, a pollution tolerant species dominated the Top Bridge sample site. This site is immediately downstream of a popular swimming/bathing location during the summer months.



*indicates that only 2 benthic samples were captured

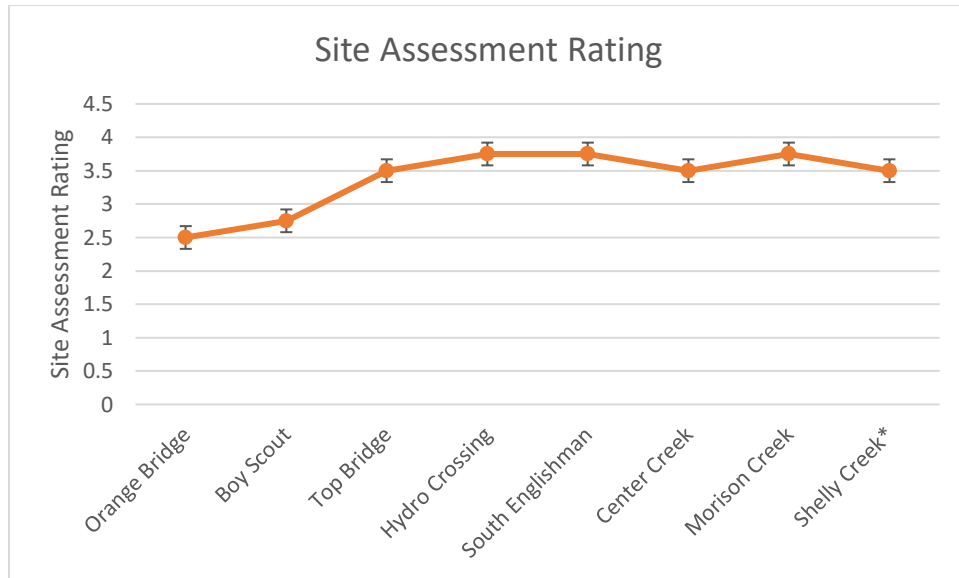
Figure 11. The Ratio of Predominate Taxa and Dominate Species at each Site.

Site Assessment Ratings

Using the Streamkeepers Module 4, sites are rated by assigning a score of 1 (poor) to 4 (good) to each water quality and diversity index or ratio. The resulting average gives a general rating of stream health at the site (Taccogna 1995).

Sometimes individual indices or ratios may suggest contradictory stream conditions. The general site rating helps even out such results. For example, both species presence and water quality measurements may show good water quality conditions, while species diversity may be low because of physical problems.

Site assessment ratings ranged from 2.5 to 3.75 (Fig 12). The lowest site ratings are in the lower river with higher ratings attained at sites further up the river or in tributaries. The combined site rating for all sites in 2019 averaged 3.375. From this analysis we see that “acceptable” conditions exist in the lower Englishman watershed for benthic community abundance and diversity. This rating is similar to the results of the VIU study (Demers 2016).



*indicates that only 2 benthic samples were captured

Figure 12. Site Assessment Rating (1=Poor; 2=Marginal; 3=Acceptable; 4=Good).

Conclusions

The 2019 benthic invertebrate sampling project provided results that should help focus future activities:

- 1) The Streamkeepers Module 4 methodology provided a simple field protocol that was easy to complete at each sample station selected in 2019. Volunteer interest in the project remained high through the Summer/ Fall as everyone learned how to organize and set-up a field lab; how to sample bugs and how to learn from others. Some key aspects to making this project a success when working with inexperienced volunteers was:
 - a. Well organized – site access, equipment
 - b. A competent on- site entomologist to assist with bug identification
 - c. A person responsible for data management and compilation
- 2) The benthic invertebrate sampling program in 2019 shows that water quality in the lower Englishman River and tributaries is acceptable.
- 3) When comparing the sample results for each river station, we found that several metrics showed improvement as sites moved up the river from tidewater (Orange Bridge), indicating that water quality improves with distance upstream.

- 4) When comparing sample sites located on tributaries, we found that all but Center Creek had comparable metrics. Center Creek suffers from low flows, which may be a factor, but further investigation is needed.

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Appendix I: Streamkeepers Module 4- Invertebrate Survey Field Data Sheet

The Stewardship Series

send the data to: Streamkeepers Database

Invertebrate Survey Field Data Sheet

(use a new data sheet for each stream section surveyed)

Module 4

Stream Name			Date
Stream Segment # Stream Section #			Sampling location
sampler used, mesh size, total area sampled			# of 30cm x 30cm samples
COLUMN A Pollution Tolerance	COLUMN B Number Counted	COLUMN C Number of Taxa	COLUMN D Common Name
CATEGORY 1 (pollution intolerant)			Caddisfly Larva (EPT)
			Dobsonfly (hellgrammite)
			Gilled Snail
			Mayfly Nymph (EPT)
			Riffle Beetle
			Stonefly Nymph (EPT)
Sub-total			Water Penny
CATEGORY 2 (somewhat tolerant of pollution)			Alderfly Larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
			Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
Sub-total			Watersnipe Larva
CATEGORY 3 (pollution tolerant)			Aquatic Worm
			Blackfly Larva
			Leech
			Midge Larva (chironomid)
			Planarian
			Pouch and Pond Snails
			True Bug Adult
Sub-total			Water Mite
TOTAL			

The Stewardship Series

send the data to: Streamkeepers Database

Invertebrate Survey Interpretation Sheet

(use a new data sheet for each stream section surveyed)

Module 4

Stream Name	Date
Stream Segment # Stream Section #	Sampling location
sampler used, mesh size, total area sampled	# of 30cm x 30cm samples

A) ABUNDANCE AND DENSITY

ABUNDANCE: total number of organisms from **Column B**

=

DENSITY: invertebrate density per square meter

(total # counted) ÷ (# of 30cm x 30cm samples x 0.09m²)

=

_____ ÷ (_____) = _____

B) PREDOMINANT TAXON

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANCE INDEX: use the **total number of broad** taxonomic groups found in each tolerance category, from Field Data Sheet (**Column D**)

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
>22	22-17	16-11	<11

3 x (# of category 1)

+ 2 x (# of category 2)

+ (# of category 3)

=

EPT INDEX: total number of **EPT** taxa from **Column C**, Field Data Sheet

EPT INDEX			
Good	Acceptable	Marginal	Poor
>8	5-8	2-5	0-1

EPT are stonefly, caddisfly and mayfly

=

EPT TO TOTAL RATIO: total number of **EPT** organisms from **Column B**, Field Data Sheet divided by the total number of organisms

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.5 - 0.75	0.25 - 0.50	0 - 0.25

of **EPT** _____ ÷ total =

The Stewardship Series

send the data to: Streamkeepers Database

Invertebrate Survey Interpretation Sheet

(use a new data sheet for each stream section surveyed)

Module 4

Stream Name	Date
Stream segment # Stream section #	sampling location
sampler used, mesh size, total area sampled	# of 30cm x 30cm samples

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: from Column C, Field Data Sheet

PREDOMINANT TAXON RATIO: divide the number of invertebrate in the predominant taxon by the total number of invertebrates counted:

$$\frac{\text{predominant}}{\text{total}} = \text{_____}$$

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

E) SITE ASSESSMENT

RATING:

Assign a rating between 1 and 4 to each index or ratio, then average the results to produce a general site assessment.

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

General Comments -
Unknown Bugs

SITE ASSESSMENT RATING	
Index or Ratio	Rating
Pollution Tolerance Index	
EPT Index	
EPT to Total Ratio	
Predominant Taxon Ratio	
Total	
Average	

see page 13 and 14 of Module 4 for further information

Appendix II - Field Equipment Photos



D-Net Sampler



Hess Sampler in use



Washing trays to capture bugs in trays



Sample Trays that volunteers used to separate invertebrates from algae and debris.

Appendix III – Stream Invertebrate Survey - Field Notes and Module 4
Site Interpretation

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 17/06/2019 Orange Bridge riffle at Plumber Road- Waypoint- 49°19'02.21"N 124°17'05.42"W

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sampling Methods: Streamkeepers Module 4 using a Surber Sampler-w/500micron net,

Sampling Location: 3 sample sites on the riffle beside Plumber Road, 100 meters downstream of the Orange Bridge.

Flows measured at Water Survey of Canada (June 17, noon) - 1.06cms

A) Abundance and density

ABUNDANCE - 54

DENSITY: $54/0.27 = 200/ m^2$

B) Predominant Taxon - Mayfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 9

2 x (# of category 2) = 2

(# of category 3) = 3

= 14

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C = 3

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 0.55

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 7

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa = 28/54 = 0.52

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 2

EPT Index: 2

EPT to Total Ratio: 3

Predominant Taxon Ratio: 3

Total: 10

Average $10/4=2.5=2.5$ note no caddis flies but many in ds pool this day after cabin fire may have that effect or would be 3.0 or good.

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant			Caddisfly
			Dobsonfly
			Gilled Snail
	14,13,1=28	2	Mayfly
			Riffle Beetle
	2,0,0=2	1	Stonefly
Sub Total:	30	3	Water Penny
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	0,2,0=2	1	Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
Sub Total:	2	1	Watersnipe Larva
Category 3 - Pollution Tolerant			Aquatic Worm
	0,2,3=5	1	Blackfly Larva
			Leech
	0,2,7=9	1	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult
4,0,4=8	1	Water Mite	
Sub Total:	22	3	
Total:	54	7	

Module 4 Stream Invertebrate Survey Interpretation

- **Englishman River | Survey ID: 03/07/2019 Boy Scout Camp (river left) riffle Waypoint - 49°18'33.64"N 124°17'01.73"W.**

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sampling Methods: D Net sampler- w/500micron net,

Sampling Location: 3 sample sites on the riffle beside the Boy Scout Camp at the end of Despard Rd (off Martindale).

Flows measured at Water Survey of Canada (July 3, noon) - 1.4cms

A) Abundance and density

ABUNDANCE: / NUMBER OF SAMPLES =108

DENSITY: $108/0.27 = 400$ organisms/m²

B) Predominant Taxon – Mayfly at 45 individuals

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 12

2 x (# of category 2) = 2

(# of category 3) = 5

= 19

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C = 4

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 61/108= 0.56

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 10

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa = 0.42

SITE ASSESMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 3

EPT Index: 2

EPT to Total Ratio: 3

Predominant Taxon Ratio: 3

Total: 11

Average = $11/4=2.75$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	1,2,2=5	1	Caddisfly
			Dobsonfly
			Gilled Snail
	10,13,22=45	2	Mayfly
			Riffle Beetle
	3,2,6=11	1	Stonefly
		Water Penny	
Sub Total:	61	4	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
			Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
	1,0,0=1	1	Watersnipe Larva
Sub Total:	1	1	
Category 3 - Pollution Tolerant	2,0,4=6	1	Aquatic Worm
	3,2,3=8	1	Blackfly Larva
			Leech
	3,6,20=29	1	Midge Larva (chironomid)
			Planarian
			Pouch Snail
	1,0,0=1	1	Truebug Adult
0,0,2=2	1	Water Mite	
Sub Total:	46	5	
Total:	108	10	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 09/08/2019 Top Bridge Park - lower pool riffle outlet. Waypoint - 49°17'57.61"N 124°16'03.85"W.

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sampling Methods: Streamkeepers Module 4, using D Net- w/500micron net,

Sampling Location: 3 sample sites on the riffle on river left, at outlet of the lower pool of Top Bridge Park.

Flows measured at the Water Survey of Canada station (Orange Bridge) - 1.4cms

A) Abundance and density

ABUNDANCE: total number of organisms =222

DENSITY = 222/ (3x.09) = 822 organisms per sq. m

B) Predominant Taxon –Water Mite

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 18

2 x (# of category 2) = 4

(# of category 3) = 5

= 27

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C =8

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 88/222 =0.396

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 16

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa (81/222) = 0.36

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 4

EPT to Total Ratio: 2

Predominant Taxon Ratio: 4

Total: 14

Average $14/4 = 3.5$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	12/6/4 = 22	3/2/3=3	Caddisfly
			Dobsonfly
			Gilled Snail
	6/9/8=23	1/2/1=2	Mayfly
	1/1/1=3	1/1/1=1	Riffle Beetle
	8/24/11=43	1/3/3=3	Stonefly
			Water Penny
Sub Total:	91	9	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	0/0/2=2	0/0/1=1	Cranefly Larva
	1/0/0=1	1/0/0=1	Crayfish
			Damselfy Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
			Watersnipe Larva
Sub Total:	3	2	
Category 3 - Pollution Tolerant	16/0/13=29	1/0/1=1	Aquatic Worm
	2/0/5=7	1/1/1=1	Blackfly Larva
			Leech
	7/1/0=8	1/1/0=1	Midge Larva (chironomid)
			Planarian
			Pouch Snail
	1/0/2=3	1/0/1=1	Truebug Adult
	12/18/51=81	0/1/1=1	Water Mite
Sub Total:	128	5	
Total:	222	16	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 16/08/2019 -100 meters above Hydro line xing in Regional Park- Waypoint - 49°17'07.77"N 124°16'56.99"W

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sample Methods: Streamkeepers Module 4 using a D Net Sampler- w/500micron net, 3 sample sites on the riffle,

Field Sampling Location: 100m upstream of Hydro Transmission xing, accessed by Englishman River Park.

Flows estimated: 1.5cms WSC (note: DFO side channel takes ½ flow above this site)
Turbidity=000. H2O temp=15.1C. Spec. Cond=110.2us/cm. DO=10.23 (water quality using YSI)

Habitat measures: wetted width=14.7m; channel width=42.7m; mean depth of riffle=28cm.

A) Abundance and density

ABUNDANCE: total number of organisms =264

DENSITY = 264/ (3x.09) = 977 organisms per sq. m

B) Predominant Taxon –Mayfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 30

2 x (# of category 2) = 6

(# of category 3) = 6
= 42

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C =9

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 173/346 =0.50

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 19

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa (95/346) = 0.275

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 4

EPT to Total Ratio: 3

Predominant Taxon Ratio: 4

Total: 15

Average $15/4 = 3.75$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	18/21/6 = 45	4	Caddisfly
			Dobsonfly
			Gilled Snail
	46/8/41=95	4	Mayfly
	3/3/5=11	1	Riffle Beetle
	10/10/13=33	1	Stonefly
			Water Penny
Sub Total:	184	10	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
	0/1/1=2	1	Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	1/1/2=4	0/0/1=1	Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
	1/0/2=3	1	Watersnipe Larva
Sub Total:	9	3	
Category 3 - Pollution Tolerant	7/0/6=13	1/0/1=1	Aquatic Worm
	9/1/37=47	1/1/1=1	Blackfly Larva
	0/1/0 =1	1	Leech
	8/7/6=21	2	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult
	18/40/13=71	0/1/1=1	Water Mite

Sub Total:	153	6	
Total:	346	19	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 22/09/2019 South Englishman River 25 m upstream of confluence with Center Creek - Waypoint - 49°16'34.69"N 124°17'46.93"W

Participants:

Mid Vancouver Island Habitat Enhancement Society & Island Water Flyfishers:

Field Sampling Methods: Streamkeepers Module 4 using D nets- w/500micron net,

Sampling Location: 3 sample sites on the riffles upstream of Center Creek

Flows – low summer flow, but some rain events have bumped flows up marginally (1-1.5 cm. est.)

Habitat Measures: 18.3 meters channel width; 15.5 m wetted width; Mean riffle depth=115mm

A) Abundance and density

ABUNDANCE: = 277

DENSITY: $277 / (3 \cdot .09) = 1026 / \text{m}^2$

B) Predominant Taxon - Caddisfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 27

2 x (# of category 2) = 4

(# of category 3) = 5

Pollution Tolerance Index = 36

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C = 8

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = $196/277=0.72$

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 16

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa = $102/277 = 0.421$

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 4

EPT to Total Ratio: 3

Predominant Taxon Ratio: 4

Total: 15

Average $15/4=3.75$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	49,24,29 = 102	3	Caddisfly
			Dobsonfly
			Gilled Snail
	45,15,25 =85	3	Mayfly
	3,0,0=3	1	Riffle Beetle
	7,2,0=9	2	Stonefly
			Water Penny
Sub Total:	199	9	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	5,5,7=17	1	Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
	1,1,0=2	1	Watersnipe Larva
Sub Total:	19	2	
Category 3 - Pollution Tolerant	14,7,18 =39	1	Aquatic Worm
	10,0,1=11	1	Blackfly Larva
			Leech
	3,0,2=5	2	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult
	1,3,0=4	1	Water Mite
Sub Total:	59	5	
Total:	277	16	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 22/09/2019 Center Creek 50m above confluence w/South Englishman River - Waypoint - 49°16'35.42"N 124°17'51.42"W

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sampling Methods: D nets- w/500micron net,

Sampling Location: 50 meters upstream from confluence - 3 sample sites on the riffles in the area

Flows – low summer flow (20 liters/sec. est.)

Habitat Measures: 15.9 meters channel width; 4.8 m wetted width; Mean riffle depth=82mm

A) Abundance and density

ABUNDANCE: = 113

DENSITY: $113 / (3 \times .09) = 419 / \text{m}^2$

B) Predominant Taxon - Caddisfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 18

2 x (# of category 2) = 2

(# of category 3) = 3

= 23

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C = 6

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 99/113= 0.88

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 10

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa = 52/113 = 0.46

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 3

EPT to Total Ratio: 4

Predominant Taxon Ratio: 3

Total: 14

Average $14/4=3.5$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	23,11,18 = 52	3	Caddisfly
			Dobsonfly
			Gilled Snail
	15,12,9 =36	2	Mayfly
			Riffle Beetle
	5,1,5=11	1	Stonefly
Sub Total:	99	6	Water Penny
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
			Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	4,0,2=6	1	Cranefly Larva
			Crayfish
			Damselfly Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
Sub Total:	6	1	Watersnipe Larva
Category 3 - Pollution Tolerant	0,1,0 =1	1	Aquatic Worm
	5,0,1=6	1	Blackfly Larva
			Leech
	1,0,0=1	1	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult
Sub Total:	8	3	Water Mite
Total:	113	10	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 19/10/2019 Shelly Creek in Shelly Creek Park above Hamilton Road Waypoint: 49°18'23.42"N 124°18'14.00"W

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Methods: Streamkeepers Module 4, using D nets- w/500micron net,

Sampling Location: 2 sample sites on riffles in the Upper Shelly Park area upstream of Hamilton Road (note: heavy rain on sample day precluded samplers from completing a 3rd capture and count of bugs).

Flows – low summer flow, but some rain events have bumped flows up marginally (1.0 liter/sec.- est.)

Habitat Measures: 3.0m Channel Width; 0.7 meters wetted width of riffles, depth of riffle-10mm

A) Abundance and density

ABUNDANCE: = 263

DENSITY: $263 / (2 * .09) = 1461 / m^2$

B) Predominant Taxon - Mayfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 21

2 x (# of category 2) = 10

(# of category 3) = 6

= 37

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C = 6

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 0.89

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 18

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa = $156/263 = 0.593$

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 3

EPT to Total Ratio: 4

Predominant Taxon Ratio: 3

Total: 14

Average $14/4=3.5$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	2,14 = 16	2	Caddisfly
			Dobsonfly
			Gilled Snail
	133,23 =156	2	Mayfly
	0,1 = 1	1	Riffle Beetle
	34,28=62	2	Stonefly
			Water Penny
Sub Total:	235	7	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
	0,3=3	1	Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	4,0=4	1	Cranefly Larva
			Crayfish
	0,1 =1	1	Damselfly Larva
	0,1 =1	1	Dragonfly Larva
			Fishfly Larva
			Scud
1,3 =4	1	Watersnipe Larva	
Sub Total:	13	5	
Category 3 - Pollution Tolerant	1,4 =5	1	Aquatic Worm
	2,4=6	1	Blackfly Larva
	1,0 = 1	1	Leech
	1,1 =2	2	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult
	1,0 = 1	1	Water Mite
Sub Total:	15	6	
Total:	263	18	

Module 4 Stream Invertebrate Survey Interpretation

Englishman River | Survey ID: 23/08/2019 Morison Creek - trail access to 100 m Below Falls - Waypoint - 49°16'35.42"N 124°19'22.88"W.

Participants:

Mid Vancouver Island Habitat Enhancement Society and Island Water Flyfishers

Field Sampling Methods: Streamkeepers Module 4 using D Nets- w/500micron net,

Sampling Location: 3 sample sites on the riffle at end of trail which leads off of Sierra Road (note: take left fork of trail to go to site (downstream of falls)).

Flows estimate: 10/liters/sec. Turbidity=0.30. H2O temp=11.9C. Spec. Cond=110.4us/cm. DO=10.7 (water quality using YSI)

Habitat at Site: mean wetted width = 6.4m; mean channel width = 7.8m; mean riffle depth = 7.5cm

A) Abundance and density

ABUNDANCE: total number of organisms =423

DENSITY = 423/(3x.09) = 1,567 organisms per sq m

B) Predominant Taxon –Mayfly

C) WATER QUALITY ASSESSMENTS

POLLUTION TOLERANT INDEX			
Good	Acceptable	Marginal	Poor
greater than 22	22 - 17	16 - 11	less than 11

3 x (# of category 1) = 24

2 x (# of category 2) = 6

(# of category 3) = 5
= 35

EPT INDEX			
Good	Acceptable	Marginal	Poor
greater than 8	5 - 8	2 - 5	0 - 1

Total number of EPT taxa from Column C =7

EPT TO TOTAL RATIO			
Good	Acceptable	Marginal	Poor
0.75 - 1.00	0.50 - 0.75	0.25 - 0.50	0 - 0.25

of EPT / total = 335/423 =0.79

D) DIVERSITY ASSESSMENT

TOTAL NUMBER OF TAXA: 16

PREDOMINANT TAXON RATIO			
Good	Acceptable	Marginal	Poor
0 - 0.40	0.40 - 0.60	0.60 - 0.80	0.80 - 1.0

PREDOMINANT TAXON RATIO: Predominant Taxa (149/423) = 0.35

SITE ASSESSMENT RATING			
Good	Acceptable	Marginal	Poor
4	3	2	1

Pollution Tolerance Index: 4

EPT Index: 3

EPT to Total Ratio: 4

Predominant Taxon Ratio: 4

Total: 16

Average $15/4 = 3.75$

Field Data as Collected

Pollution Tolerance	Number Counted	Number of Taxa	Common Name
Category 1 - Pollution Intolerant	14/23/67 = 104	1/2/3=3	Caddisfly
			Dobsonfly
			Gilled Snail
	31/88/30=149	2/2/2=2	Mayfly
	2/15/6=23	1/1/1=1	Riffle Beetle
	20/37/25=82	1/2/1=2	Stonefly
			Water Penny
Sub Total:	358	8	
Category 2 - Somewhat Pollution Tolerant			Alderfly larva
	2/0/0	1	Aquatic Beetle
			Aquatic Sowbug
			Clam, Mussel
	0/4/3	0/0/1=1	Cranefly Larva
			Crayfish
			Damselfy Larva
			Dragonfly Larva
			Fishfly Larva
			Scud
	1/2/0	1	Watersnipe Larva
Sub Total:	12	3	
Category 3 - Pollution Tolerant	4/9/8=21	1/0/1=1	Aquatic Worm
	2/9/5=16	1/1/1=1	Blackfly Larva
	2/0/1 =3	1	Leech
	1/7/2=10	1/1/0=1	Midge Larva (chironomid)
			Planarian
			Pouch Snail
			Truebug Adult

	0/2/1=3	0/1/1=1	Water Mite
Sub Total:	53	5	
Total:	423	16	