Assessing Ecological Disease Through Macroinvertebrates as Stream Health Indicators

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BIOL 4502

Thesis

Water temperature

- Dissolved Oxygen

Effect of macroinvertebrates

- Diversity
- Functional feeding groups
- Stream health affecting species

Introduction

Live in the water for all or most of their life

- Life cycles often longer than one year

Stay in areas suitable for their survival

- Limited mobility

Easy to collect and identify

Differ in their tolerance to amount and types of pollution

- Indicators of environmental condition

Paller et al. 2006

- Collected species
- Examined 27 sites
- Measured
  - Canopy cover on shoreline
  - Sand predominate substrate
  - Few riffles

Paller et al. 2006

Species richness in temperate streams

Taxa richness and stream size correlations

Compared undisturbed and disturbed sites

Findings – Diversity on next slide

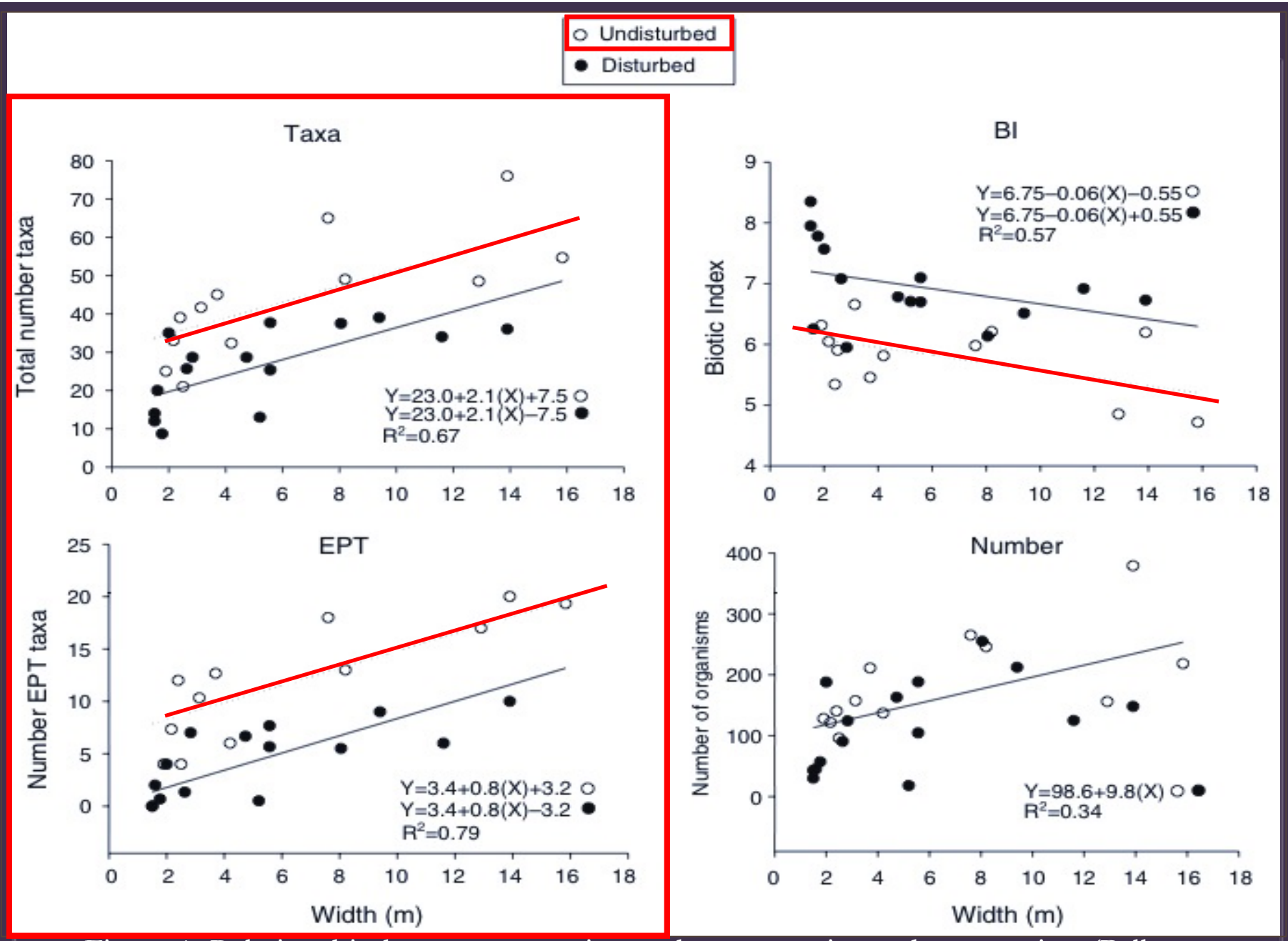


Figure 1. Relationship between macroinvertebrates metrics and stream size. (Paller et al. 2006)

Dobrin and Gilberson

Examined EPT's in a spring-fed stream

Answered previous hypotheses about thermally stable habitats

Water temperature variation

- <3°C minimum to maximum on a weekly basis
- Compared to non-spring fed streams varying ≥25°C annually

Dobrin and Gilberson, 2003

Mean channel width and depth

pH/conductivity meter

Macroinvertebrates were collected using a modified Hess sampler (mesh size 200μm, area 0.07m^2)

Three samples per date on a monthly basis spring-summer-fall and a single sample in the winter

Dobrin and Gilberson, 2003

Macroinvertebrates preserved in 4% formalin

Stored in 70% ethanol

Specimens sorted from debris using microscope

EPT taxa separate and identified

Percent Dissolved Oxgyen Saturation

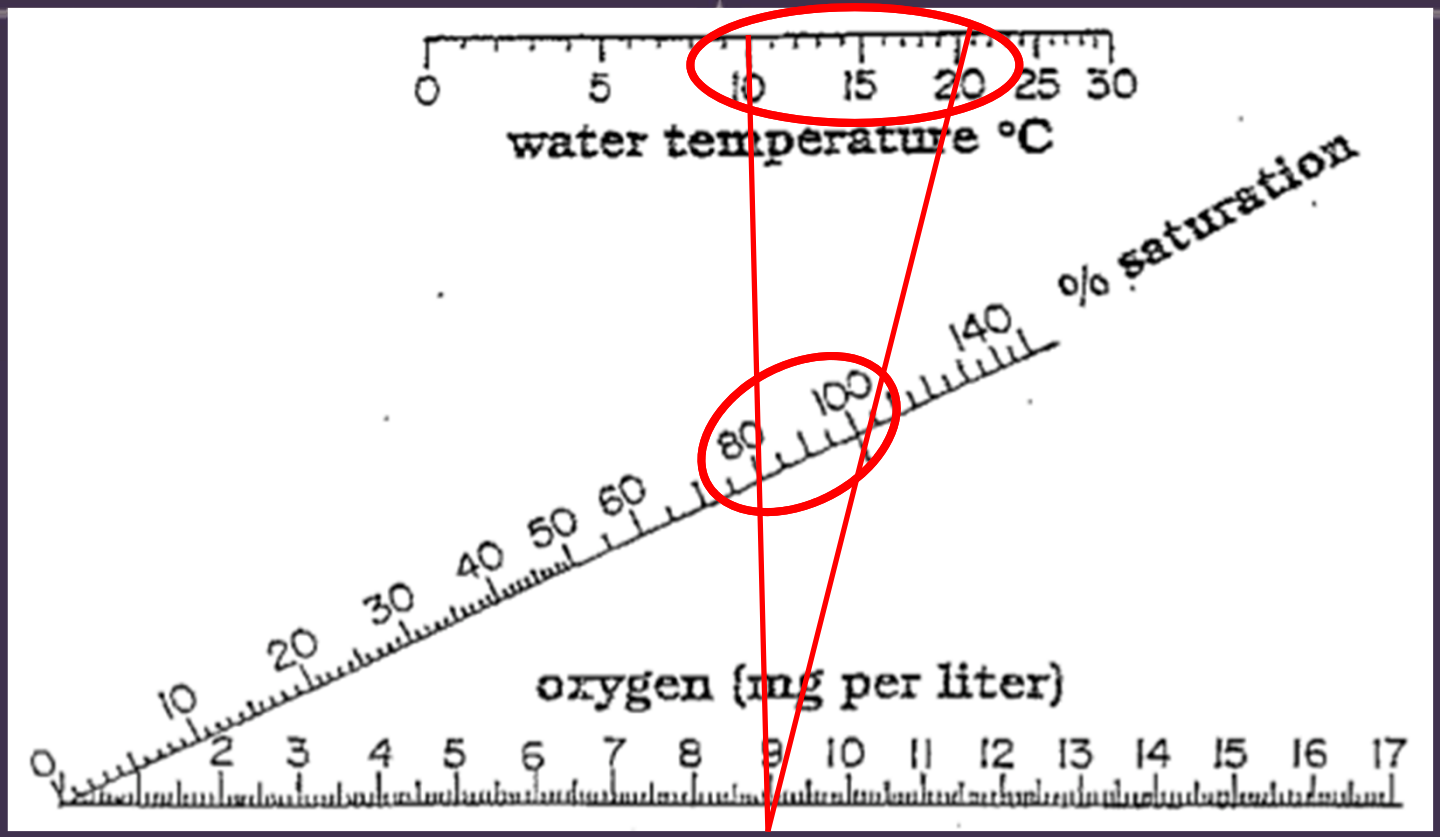


Figure 1. Water Temperature and Dissolved Oxygen scale that determines % Saturation. (Landon and Glover 2012)

Table 1. Relative abundance, % of total individuals of each species in each EPT order and total numbers of invertebrates. (Dobrin and Giberson 2003)

	Benthos		Adults	
	% of order	% of total	% of order	% of total
Ephemeroptera (total no.)	13 541		246	
Baetis tricaudatus	61.34	8.62	58.54	0.62
Cinygumula subaequalis	32.12	4.51	4.88	0.05
Epeorus (Iron) spp.	5.42	0.76	23.17	0.25
Paraleptophlebia debilis	0.44	0.06	13.41	0.14
Paraleptophlebia volitans	0.68	0.10	a	a
Plecoptera (total no.)	7 924		1 042	
*Paracapnia angulata**	28.66	2.36	a	a
*Leuctra ferruginea**	38.26	3.15	59.60	2.69
*Paraleuctra sara**	1.15	0.09	0.29	r
Nemoura trispinosa	24.87	2.04	8.34	0.38
Amphinemura nigritta	6.21	0.51	31.38	1.42
Sweltsa naica	0.85	0.07	0.29	r
Trichoptera (total no.)	777		132	
Rhyacophila brunnea	69.11	0.56	18.05	0.10
*Parapsyche apicalis**	28.70	0.23	3.76	r
*Frenesia missa**	a	a	0.75	r
*Hesperophylax designatus**	a	a	1.50	r
*Hydatophylax argus**	a	a	1.50	r
*Limnephilus rhombicus**	a	a	0.75	r
*Onocosmoecus unicolor**	0.13	r	6.03	r
*Psychoglypha subborealis**	a	a	65.41	0.38
*Pycnopsyche gentilis**	a	a	0.75	r
Lype diversa	a	a	0.75	r
*Neophylax aniqua**	2.06	r	0.75	r
Overall total	96 404		23 102	

E

P

T

Table 2. Summary of secondary production for EPT. (Dobrin and Giberson 2003)

	Functional feeding group[a]
Ephemeroptera	
Baetis tricaudatus	Collector/gatherer, scraper
Cinygmula subaequalis	Scraper, collector/gatherer
Epeorus (I.) pleuralis	Collector/gatherer, scraper
Epeorus (I.) fragilis	Collector/gatherer, scraper
Total	
Plecoptera	
Paracapnia angulata	Shredder
Leuctra ferruginea	Shredder
Amphinemura nigritta	Shredder
Nemoura trispinosa	Shredder
Swetsa naica	Predator
Total	
Trichoptera	
Parapsyche apicalis	Collector/filterer
Rhyacophila brunnea	Predator
Total	
Total EPT	

Campbell Creek

Test and metrics

- D.O., pH, nitrite, nitrate, orthophosphate and ammonia
- Chloride

Campbell Creek

- Macroinvertebrates collection
  - Summer and Winter
  - Kick-net
  - Downstream → upstream
  - Preserved in ethanol
- Macroinvertebrate subsampling
  - Rigorous protocol
  - Sent for speciation

Percent D.O. Saturation

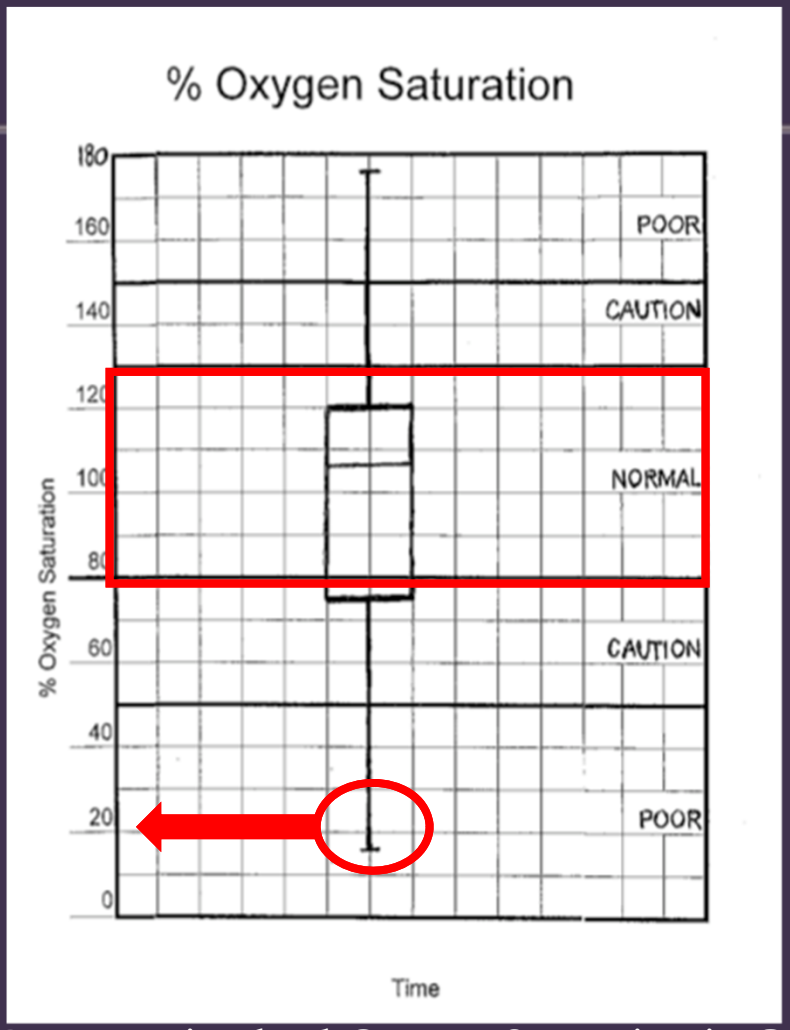


Figure 2. Percent Dissolved Oxygen Saturation in Campbell Creek. Data collected from winter 2006-winter 2012. (Landon and Glover 2012)

Human Influence

- Vegetation
  - Cover affecting water temperature
  - Growth affecting oxygen concentrations
- Roads
  - Construction
  - Salting
- Mining/drilling
  - Brine flushing – possible spike at beginning of chemical water analyses

Campbell Creek

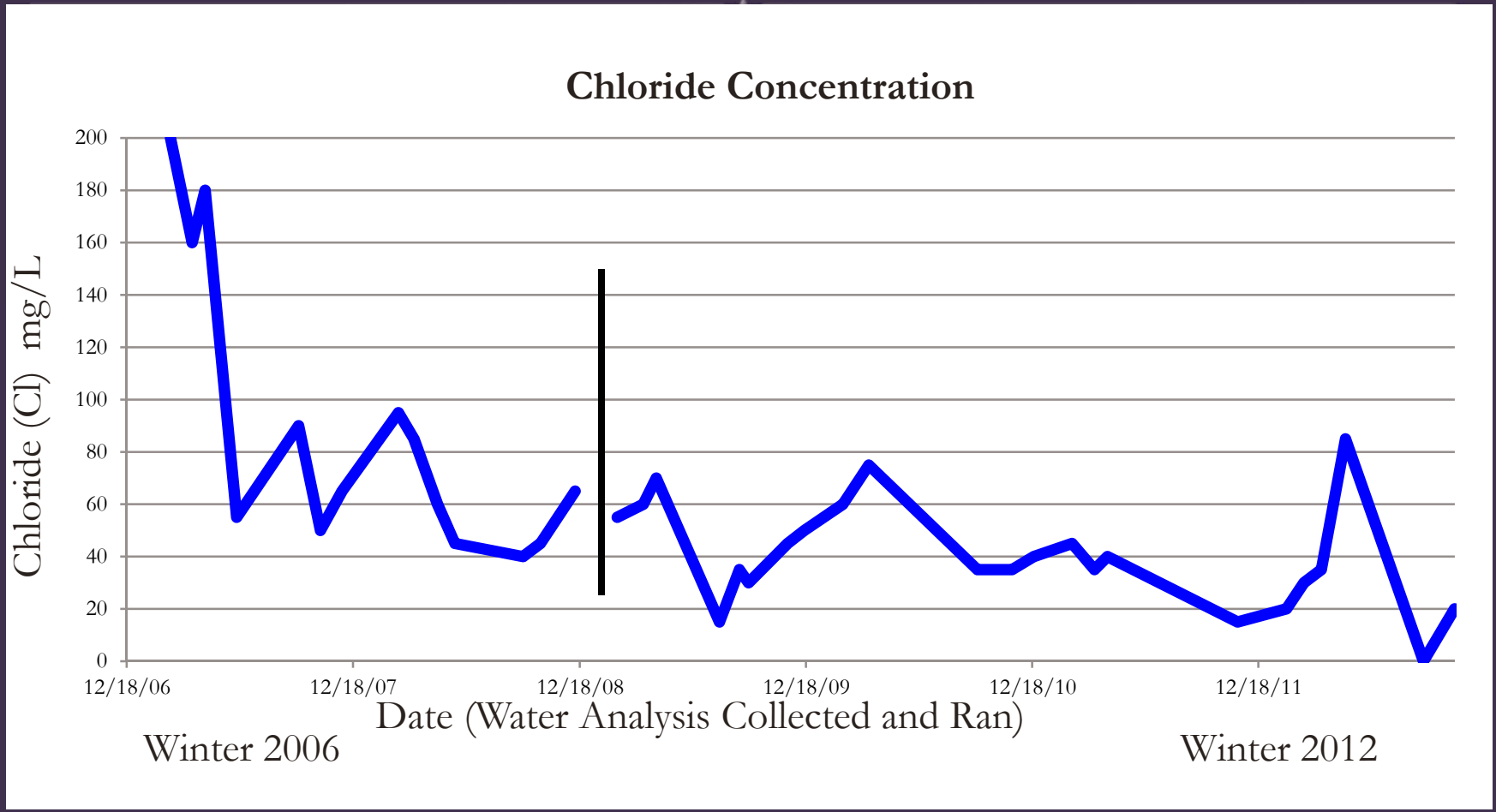


Figure 4. Chloride Levels in Campbell Creek. (Landon and Glover 2012)

Campbell Creek

- Macroinvertebrates collection
  - Summer and Winter
    - Kick-net
    - Downstream → upstream
  - Preserved
    - Randomized
    - Sent for speciation

Table 4. Trends of EPT and Chironomidae species compared. (Landon and Glover 2012)

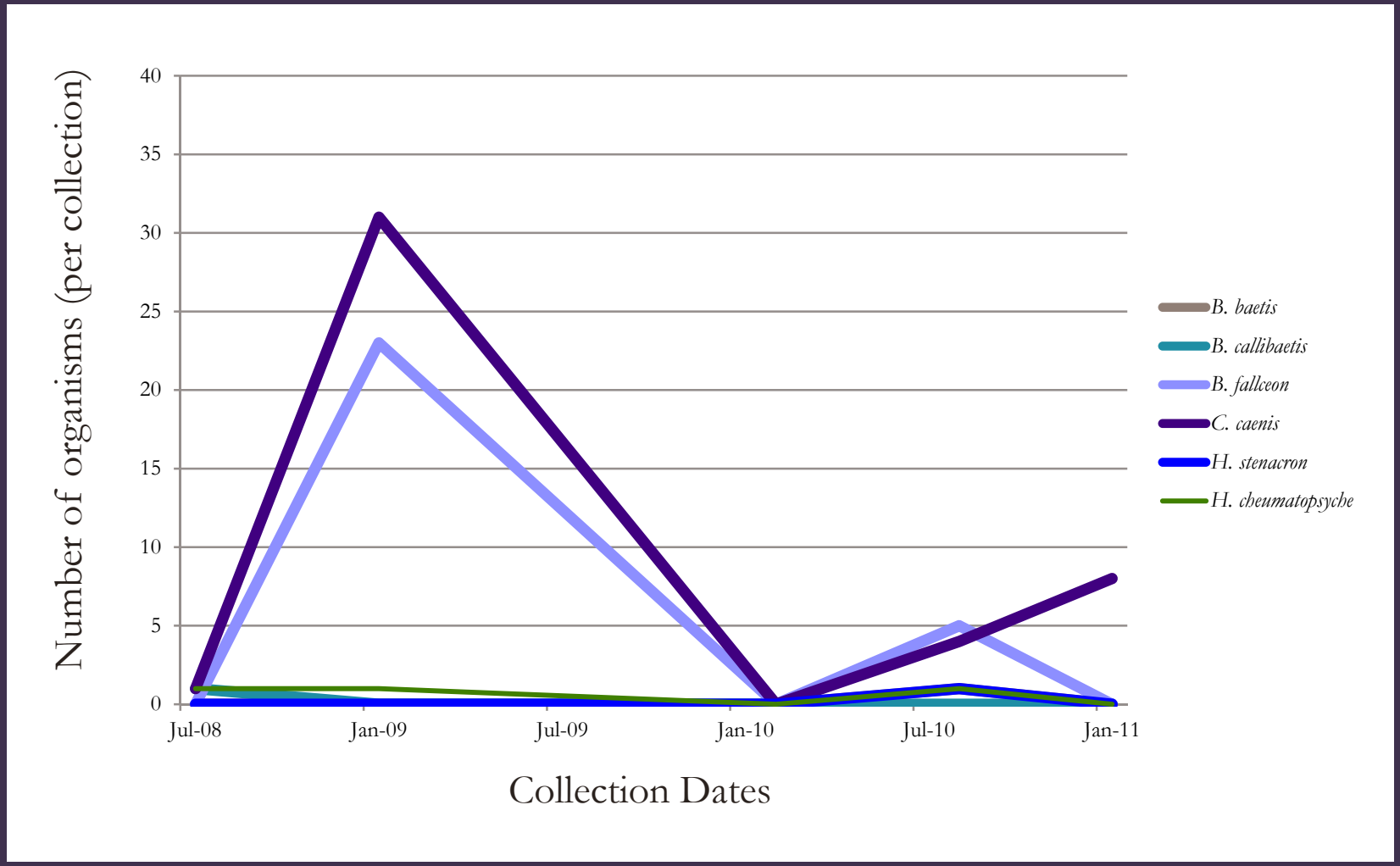
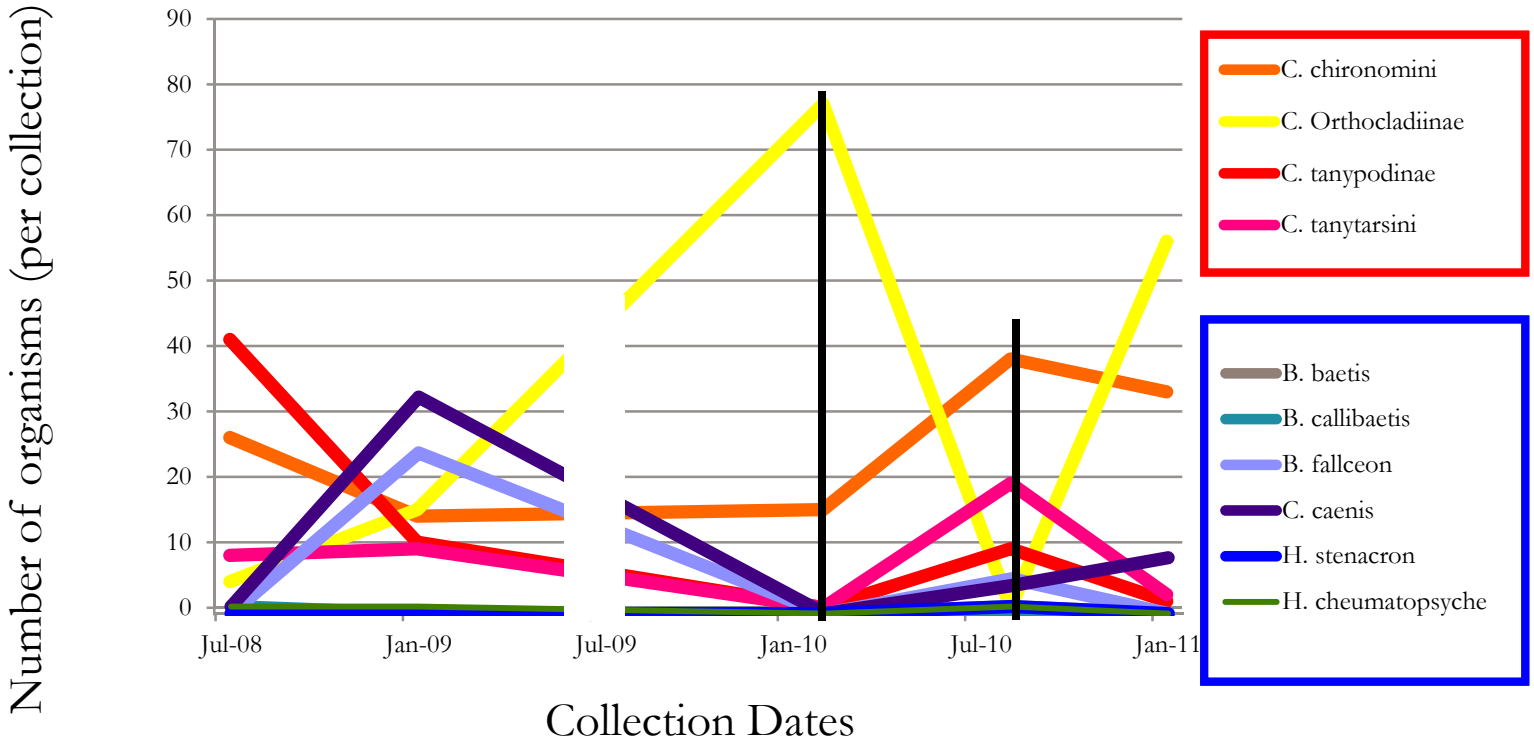
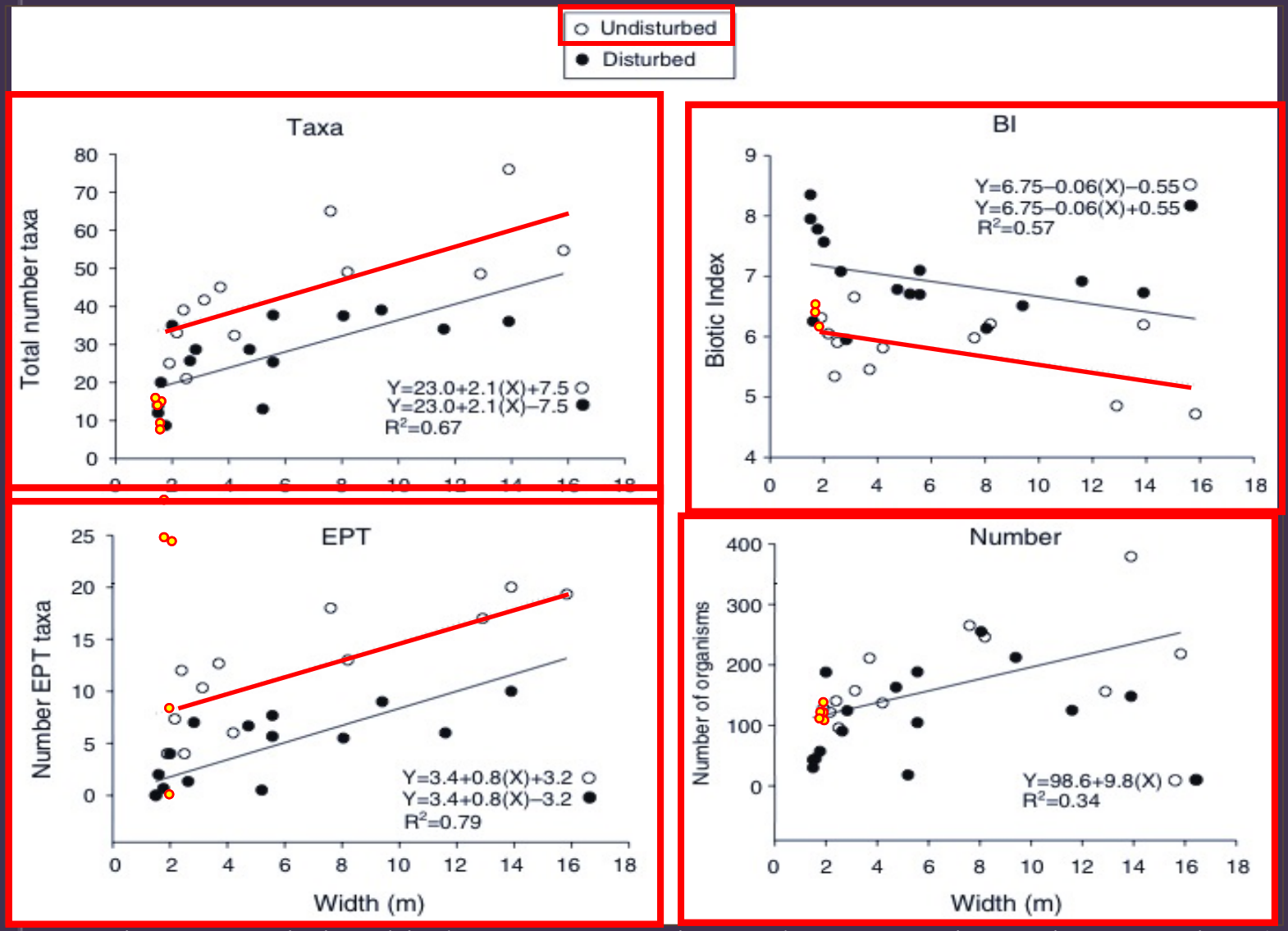


Table 3. Trends of EPT and Chironomidae species compared. (Student collections, 2008-2011)





Campbell Creek:
July 2008
Jan 2009
NONE
Feb 2010
Aug 2010
Jan 2011

Figure 4. Relationship between macroinvertebrates metrics and stream size. (Paller et al. 2006)

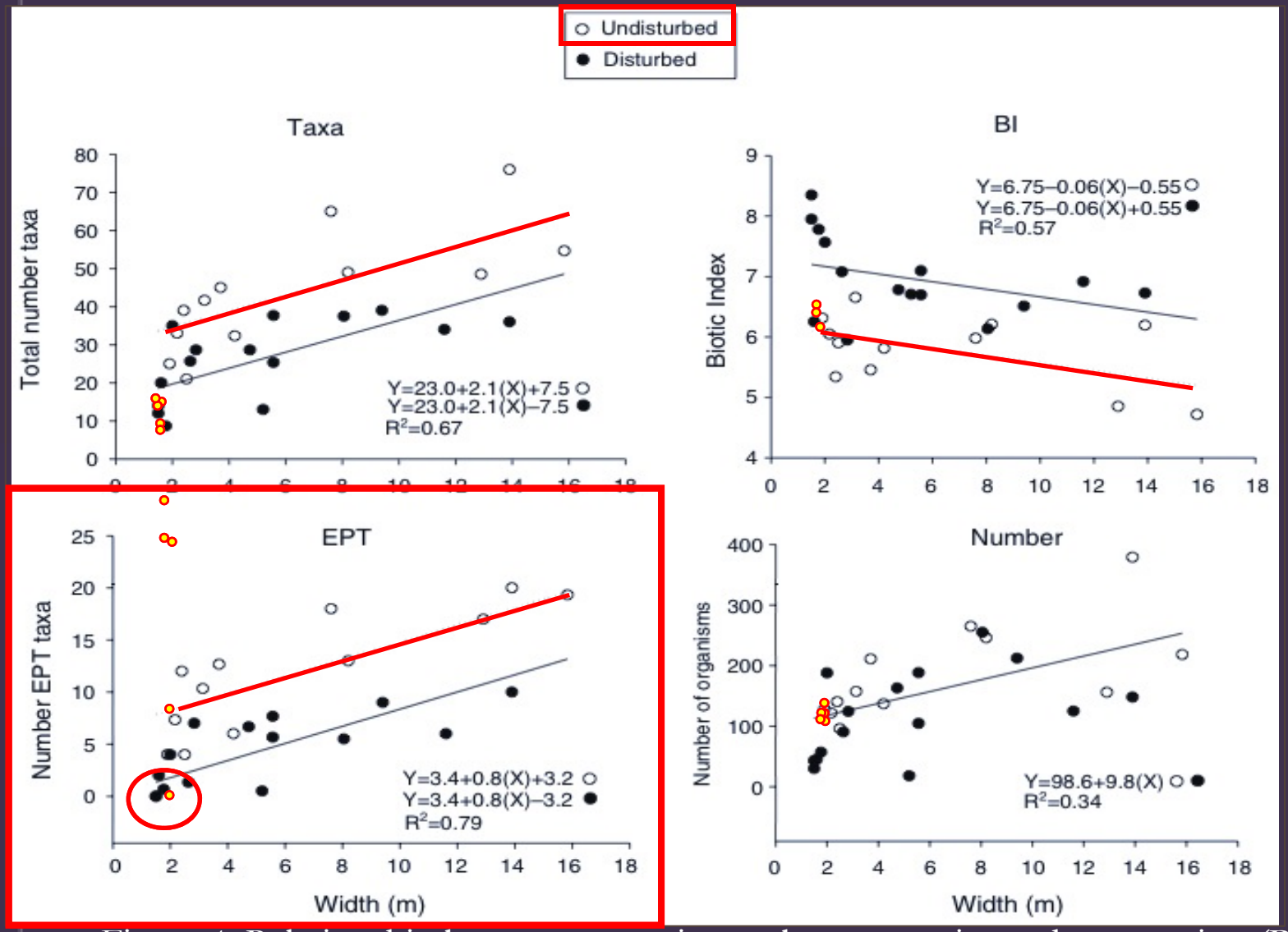


Figure 4. Relationship between macroinvertebrates metrics and stream size. (Paller et al. 2006)

Campbell Creek:
July 2008
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NONE
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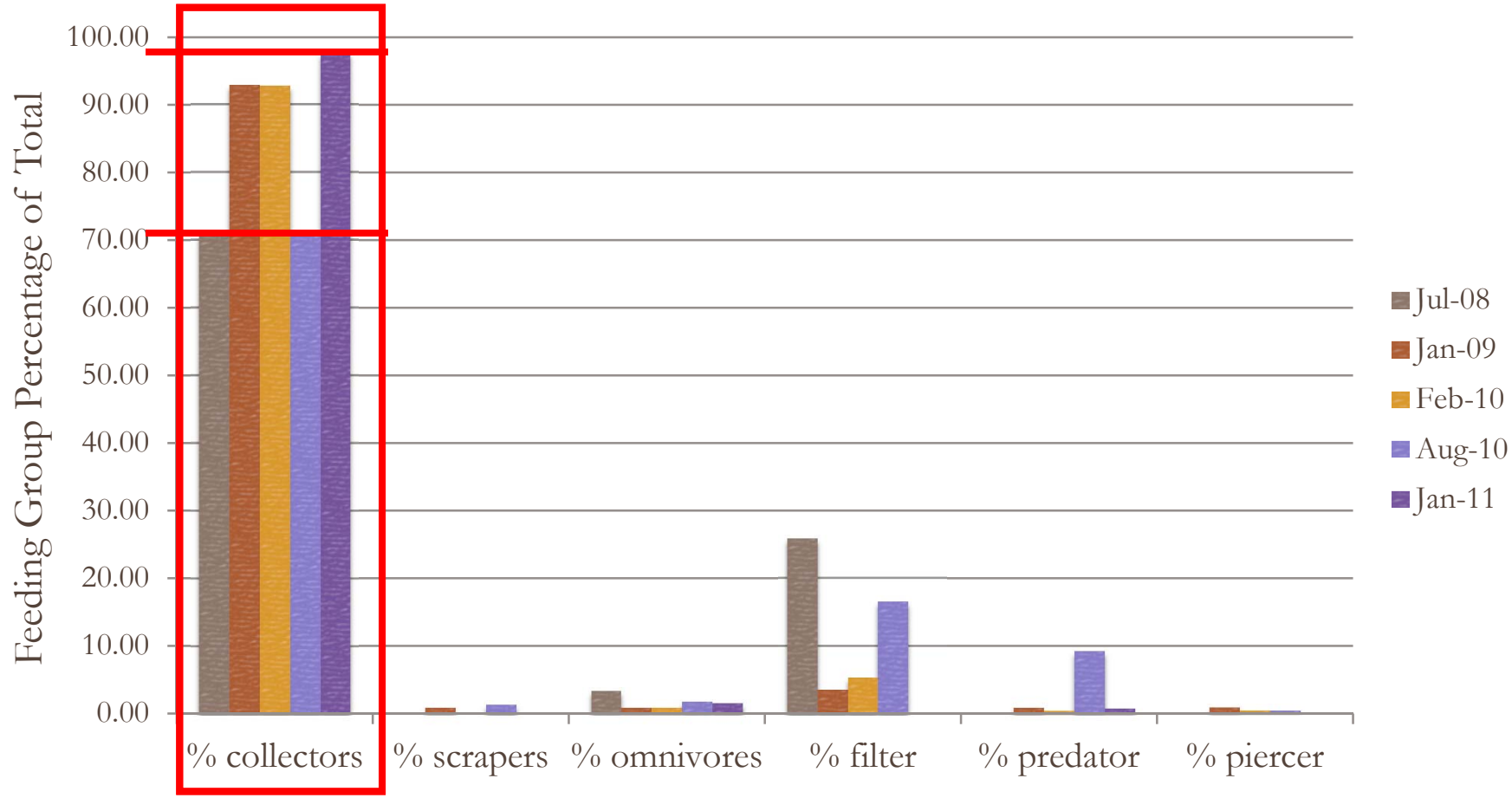
Table 6. Summary of functional feeding groups collected at Campbell Creek. Landon and Glover 2012



Overall implication of macroinvertebrates

Water temperature

Diversity of taxa

Feeding types

Human Influence

Habitat destruction

Urbanization

Run-off

Salting and brine

Acknowledgements

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Questions?

Literature Consulted

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