

Figure 1. Location of sampling sites in the Lake Huron-Lake Erie Corridor, July-August, 2004 (three zones: St. Clair River, Lake St. Clair (include St. Clair Delta) and Detroit River) and in the Walpole Island, August 2005. Map was made by Alice Grgicak-Mannion in Univeristy of Windsor

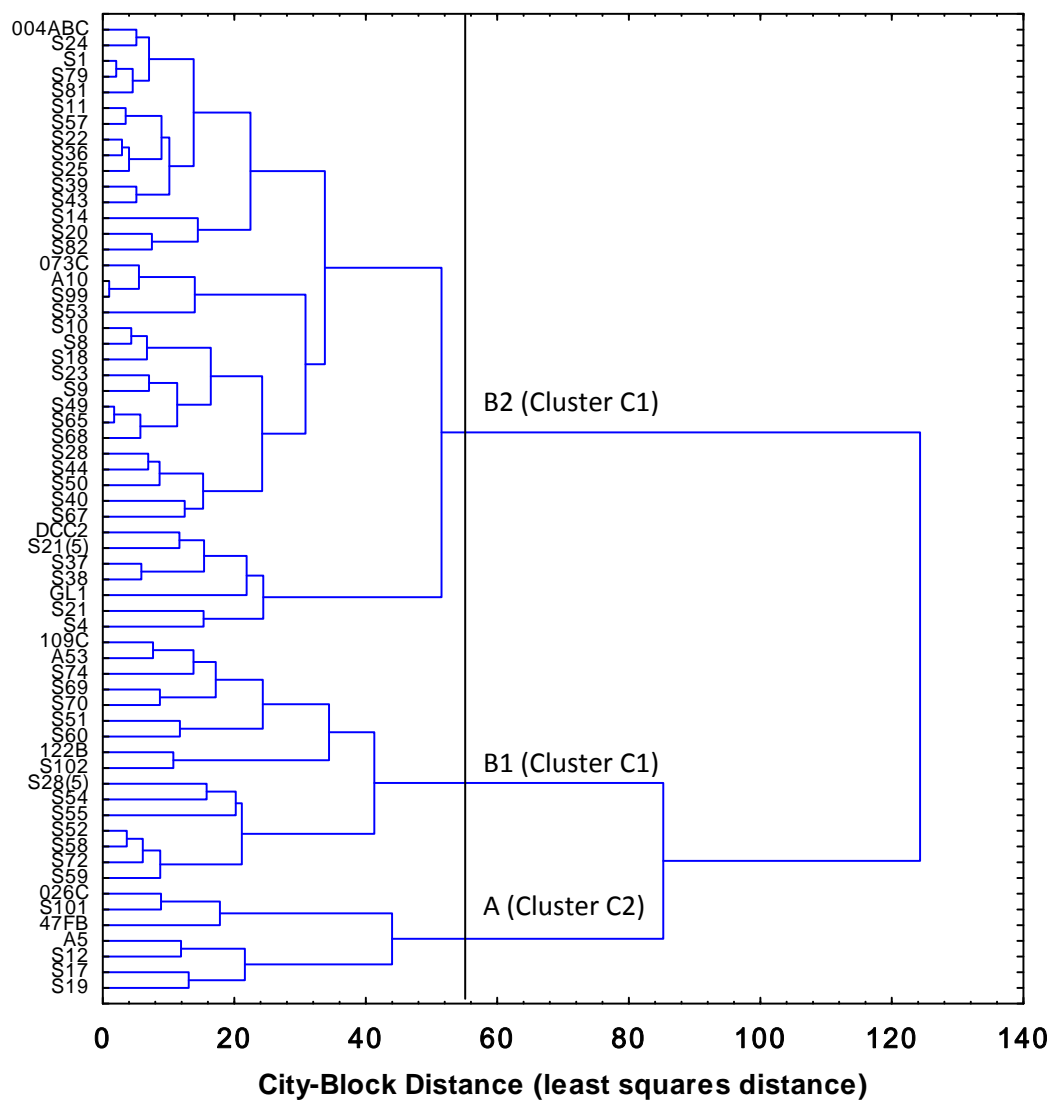


Figure 2 Dendrogram of REF sites (n = 62) grouped according to similar zoobenthic community composition in the 1991, 1999 and 2004/5 Lake Huron-Lake Erie Corridor analysis (Ward's method clustering city-block distances of octave-transformed relative abundances of zoobenthic taxa).

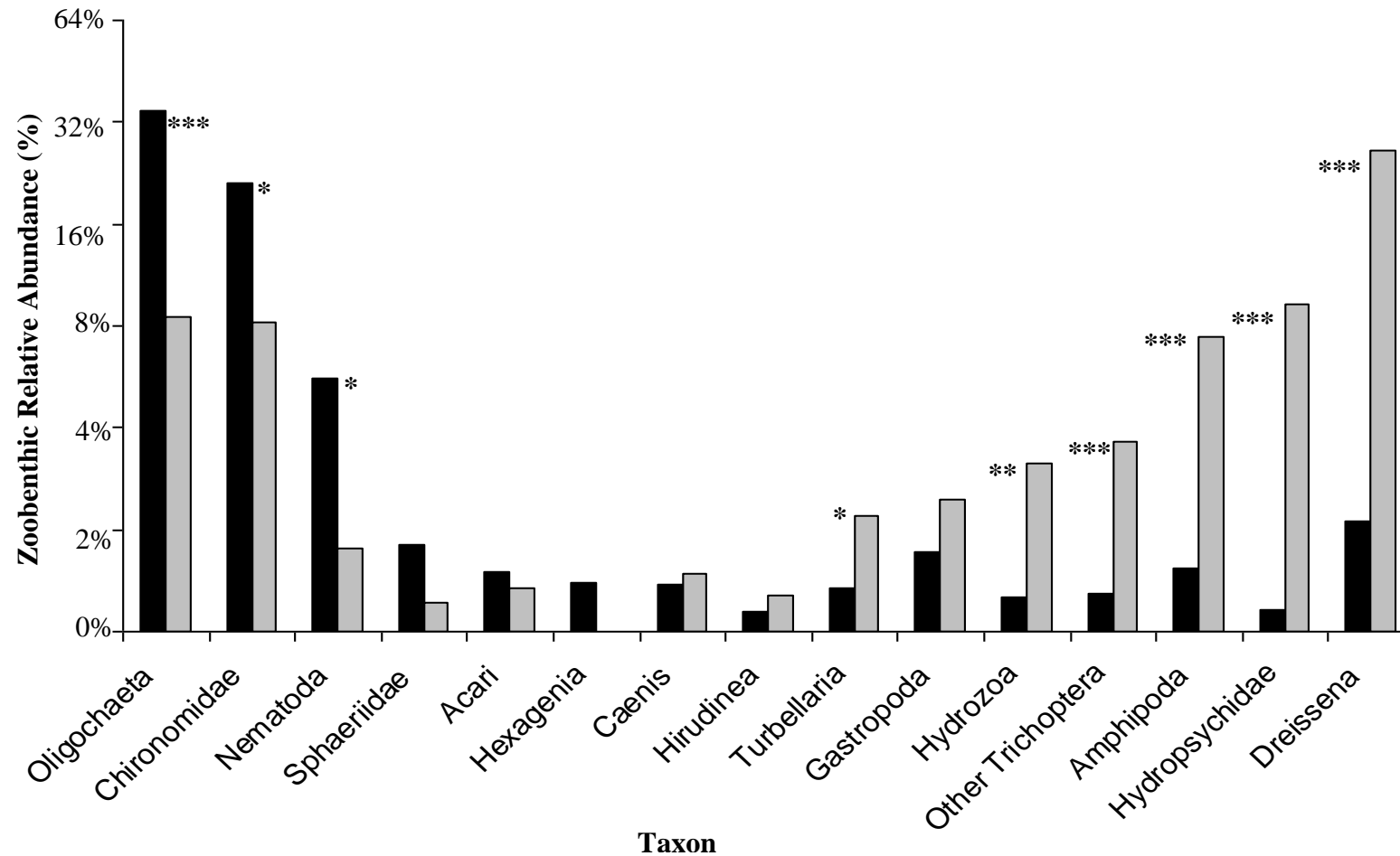


Figure 2.7. Mean value of taxa relative abundance (%) for two clusters of zoobenthic communities found in the Lake Huron-Lake Erie Corridor. Black bars indicate cluster C1 (depositional group), grey bars indicate cluster C2 (erosional group). Asterisk (*) indicates significance level: *** highly different; ** moderately different; * marginally different

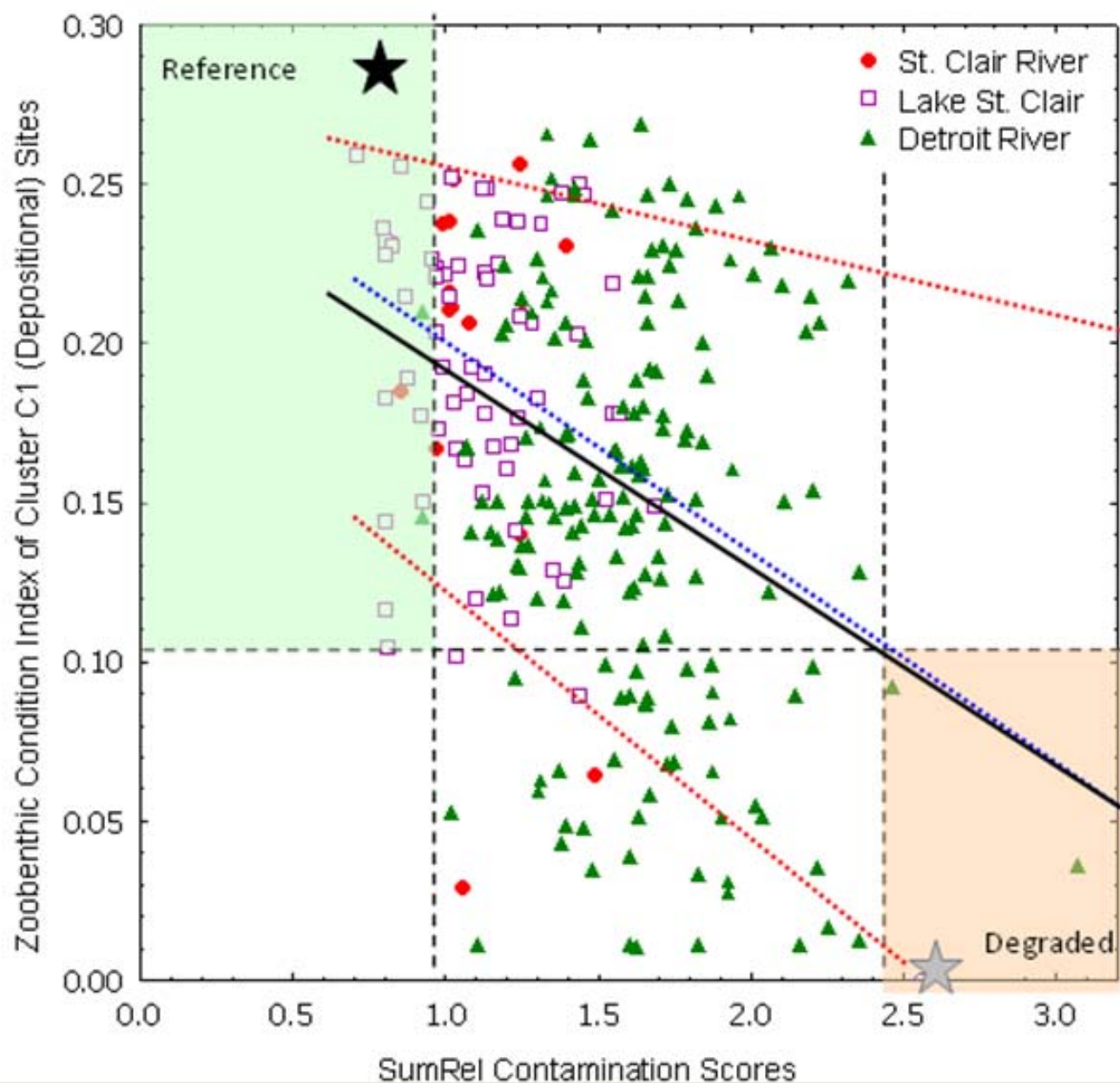


Figure 3 Relationship between Zoobenthic Condition Index (ZCI; Bray-Curtis zoobenthic relative abundance ordination scores) and the sediment contamination score (SumRel) for sites in cluster C1. $n = 255$ sites. The site with black star indicates the REF endpoint (high ordination score together with low SumRel); the site with grey star indicates the DEG endpoint (low ordination score together with high SumRel). Solid line indicates the least square fit line; dashed lines indicate 0.9, median and 0.1 quantile linear regression lines, respectively. The horizontal and vertical lines separate the samples into sectors as would be identified by piecewise quantile regression. All sites with SumRel scores < 1.0 have a ZCI score of 0.10 or greater. All sites with SumRel scores > 2.4 have a ZCI score of < 0.10 . Accordingly, depositional (C1) sites with ZCI scores > 0.10 cannot be said to be degraded

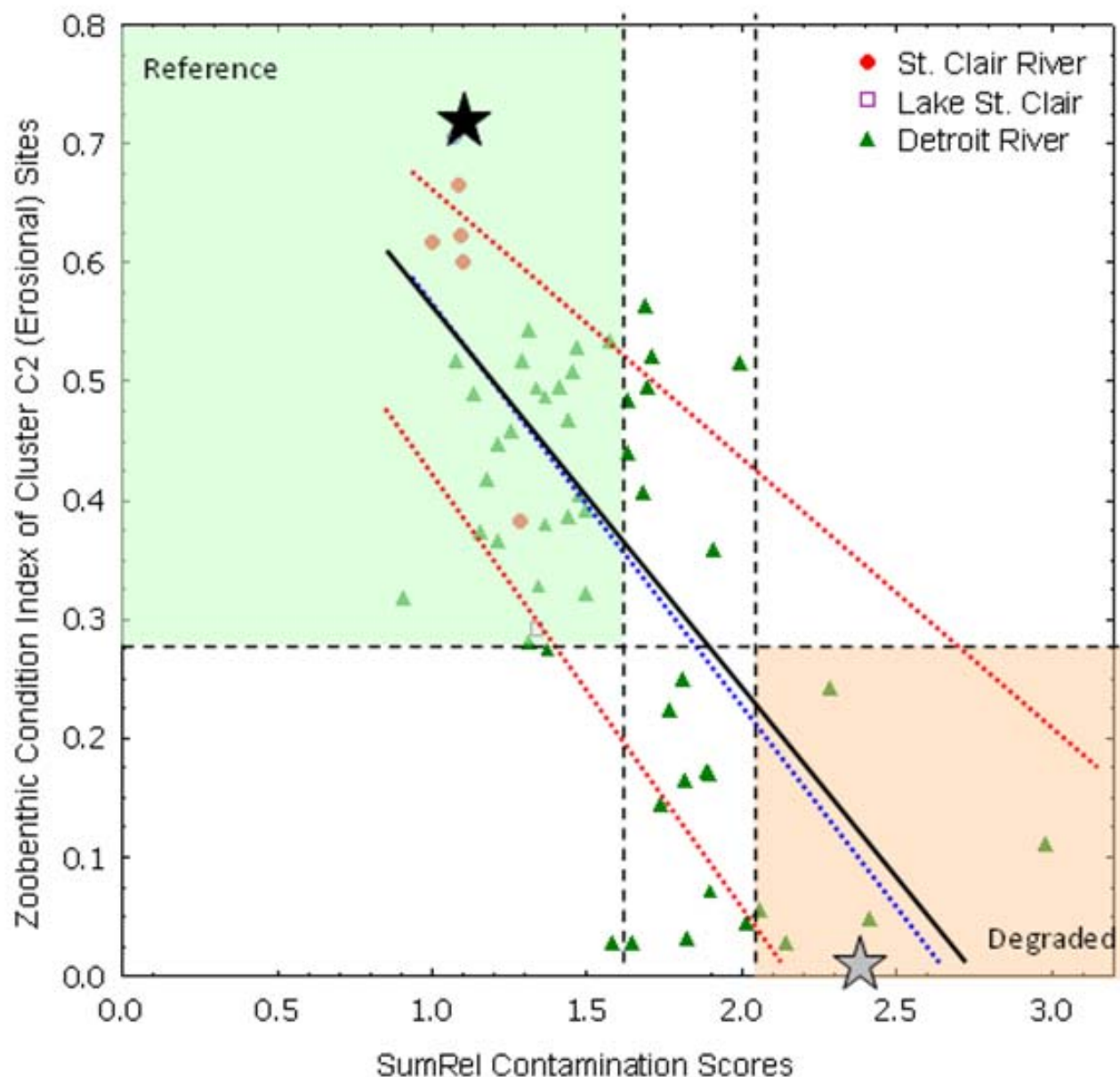


Figure 4 Relationship between Zoobenthic Condition Index (ZCI; Bray-Curtis zoobenthic relative abundance ordination scores) and the sediment contamination score (SumRel) for sites in cluster C2. $n = 56$ sites. The site with black star indicates the REF endpoint (high ordination score together with low SumRel); the site with grey star indicates the DEG endpoint (low ordination score together with high SumRel). Solid line indicates the least square fit line; dashed lines indicate 0.9, median and 0.1 quantile linear regression lines, respectively. The horizontal and vertical lines separate the samples into sectors as would be identified by piecewise quantile regression. All sites with SumRel scores < 1.55 have a ZCI score of 0.27 or greater. All sites with SumRel scores > 2.0 have a ZCI score of < 0.27 . Accordingly, erosional (C2) sites with ZCI scores > 0.27 cannot be said to be degraded

Table1 Correlation (factor loading) between values of 16 chemical variables measured at 311 Lake Huron-Lake Erie Corridor sites and 5 principal component factors. Variables combined in 5 factors are shown in bold face

Stressor variables	PC1	PC2	PC3	PC4	PC5
Co	0.91	0.18	0.16	0.12	0.04
Al	0.90	-0.04	0.02	0.08	0.19
Ni	0.82	0.50	0.13	0.14	0.06
Mn	0.74	0.38	0.16	0.15	0.36
Fe	0.72	0.41	0.10	0.15	0.11
Cr	0.71	0.62	0.10	0.13	0.03
Cu	0.65	0.64	0.03	0.14	0.02
Hg	-0.03	0.81	0.08	-0.07	0.17
Pb	0.42	0.80	0.07	0.17	0.02
Zn	0.55	0.71	0.07	-0.02	0.06
SumPCBs	0.27	0.65	0.44	0.18	-0.21
Cd	0.34	0.58	0.18	0.55	0.04
OCS	0.05	0.02	0.86	0.00	0.30
p,p'-DDE	0.31	0.34	0.66	0.07	-0.35
As	0.13	0.05	0.00	0.96	0.03
Ca	0.34	0.09	0.12	0.06	0.84
Explained Variance	5.18	4.10	1.52	1.42	1.18
Proportion of total variance	0.32	0.26	0.09	0.09	0.07
Cum. Proportion	0.32	0.58	0.67	0.76	0.84

Table 2 Analysis of Variance (one-way ANOVA) results of two clusters of zoobenthos in 62 REF sites in the Lake Huron-Lake Erie Corridor. The zoobenthic taxa most important in distinguishing hierarchical clusters of sites has highest F value. Asterisk (*) indicates significance level: *** highly different; ** moderately different; * marginally different

Taxon	Cluster C1 vs. Cluster C2						Mean (\pm 1SE) Relative Abundance of Zoobenthos	
	SS Between	df	SS Within	df	F	p	Cluster C1	Cluster C2
Hydropsychidae	55.70	1	46.73	60	71.53	p<0.001***	0.21 \pm 0.09	3.20 \pm 0.76
Dreissena	82.37	1	168.91	60	29.26	p<0.001***	1.09 \pm 0.23	4.73 \pm 0.38
Amphipoda	32.46	1	90.50	60	21.52	p<0.001***	0.61 \pm 0.17	2.90 \pm 0.58
Oligochaeta	25.52	1	74.90	60	20.44	p<0.001***	5.12 \pm 0.15	3.09 \pm 0.33
Other Trichoptera	13.82	1	68.74	60	12.06	p<0.001***	0.38 \pm 0.14	1.87 \pm 0.81
Hydrozoa	10.52	1	59.30	60	10.65	p<0.01**	0.34 \pm 0.11	1.64 \pm 0.70
Nematoda	17.56	1	163.67	60	6.44	p<0.05*	2.49 \pm 0.22	0.81 \pm 0.41
Chironomidae	11.56	1	136.37	60	5.08	p<0.05*	4.40 \pm 0.20	3.04 \pm 0.30
Turbellaria	3.15	1	45.28	60	4.17	p<0.05*	0.43 \pm 0.10	1.14 \pm 0.60
Hexagenia	1.38	1	49.32	60	1.68	p>0.05	0.47 \pm 0.12	0.00 \pm 0.34
Sphaeriidae	2.01	1	76.18	60	1.59	p>0.05	0.86 \pm 0.15	0.29 \pm 0.22
Gastropoda	1.67	1	106.72	60	0.94	p>0.05	0.78 \pm 0.18	1.29 \pm 0.50
Hirudinea	0.17	1	24.46	60	0.42	p>0.05	0.19 \pm 0.09	0.36 \pm 0.36
Acari	0.17	1	51.93	60	0.19	p>0.05	0.58 \pm 0.13	0.42 \pm 0.29
Caenis	0.07	1	52.71	60	0.08	p>0.05	0.46 \pm 0.12	0.56 \pm 0.37

Table 3 Habitat variables accepted into the DFA model describing discriminant functions and their mean (\pm 1SE) in the 62 REF sites. Variables with bold face were determined by DFA model as significant in classifying REF site cluster membership. Asterisk (*) indicates significance level: *** highly different; ** moderately different; * marginally different

Habitat variables	Significance level	Mean \pm 1SE	
		Cluster C1	Cluster C2
		Shallow water area with fine substrate and high DOC	Deep water area with coarse substrate and low DOC
Median Particle Size (Phi)	p < 0.001***	1.41 \pm 0.10	-0.39 \pm 0.28
Dissolved Oxygen Concentration (DOC)(mg/L)	p < 0.01**	9.50 \pm 0.01	8.92 \pm 0.03
Water Depth (m)	p < 0.05*	2.77 \pm 0.07	4.59 \pm 0.22
Total Organic Carbon (Loss On Ignition %)	p > 0.05	1.36 \pm 0.04	1.41 \pm 0.12
Water Temperature ($^{\circ}$ C)	p > 0.05	20.03 \pm 0.02	20.17 \pm 0.05
Lake or River	p > 0.05		
Latitude	p > 0.05		
Longitude	p > 0.05		

Table 4 Revised forward stepwise multiple regression of relative abundances of 2 taxa vs. ZCI scores for cluster C1 sites. $F_{[2,252]}=735.87$ $p<0.0001$ $R^2= 0.85$

	B ± 1SE	t	p	Partial R²
Intercept	0.136 ± 0.005	25.409	0.000	
Chironomidae	0.027 ± 0.001	35.410	0.000	0.717
Oligochaeta	-0.014 ± 0.001	-15.348	0.000	0.137
ZCI = 0.136 + 0.027*Chironomidae – 0.014*Oligochaeta				

Table 5 Revised forward stepwise multiple regression of relative abundances of 4 taxa vs. ZCI scores for cluster C2 sites. $F_{[4,51]}=101.43$ $p<0.0001$ $R^2=0.89$

	B ± 1SE	t	p	Partial R²
Intercept	0.295 ± 0.050	5.908	0.000	
Oligochaeta	-0.028 ± 0.007	-3.793	0.000	0.625
Hydropsychidae	0.039 ± 0.007	5.916	0.000	0.138
Chironomidae	0.034 ± 0.005	6.442	0.000	0.054
Dreissena	0.031 ± 0.005	5.714	0.000	0.071
ZCI = 0.295 - 0.028*Oligochaeta + 0.039*Hydropsychidae + 0.034*Chironomidae + 0.031*Dreissena				