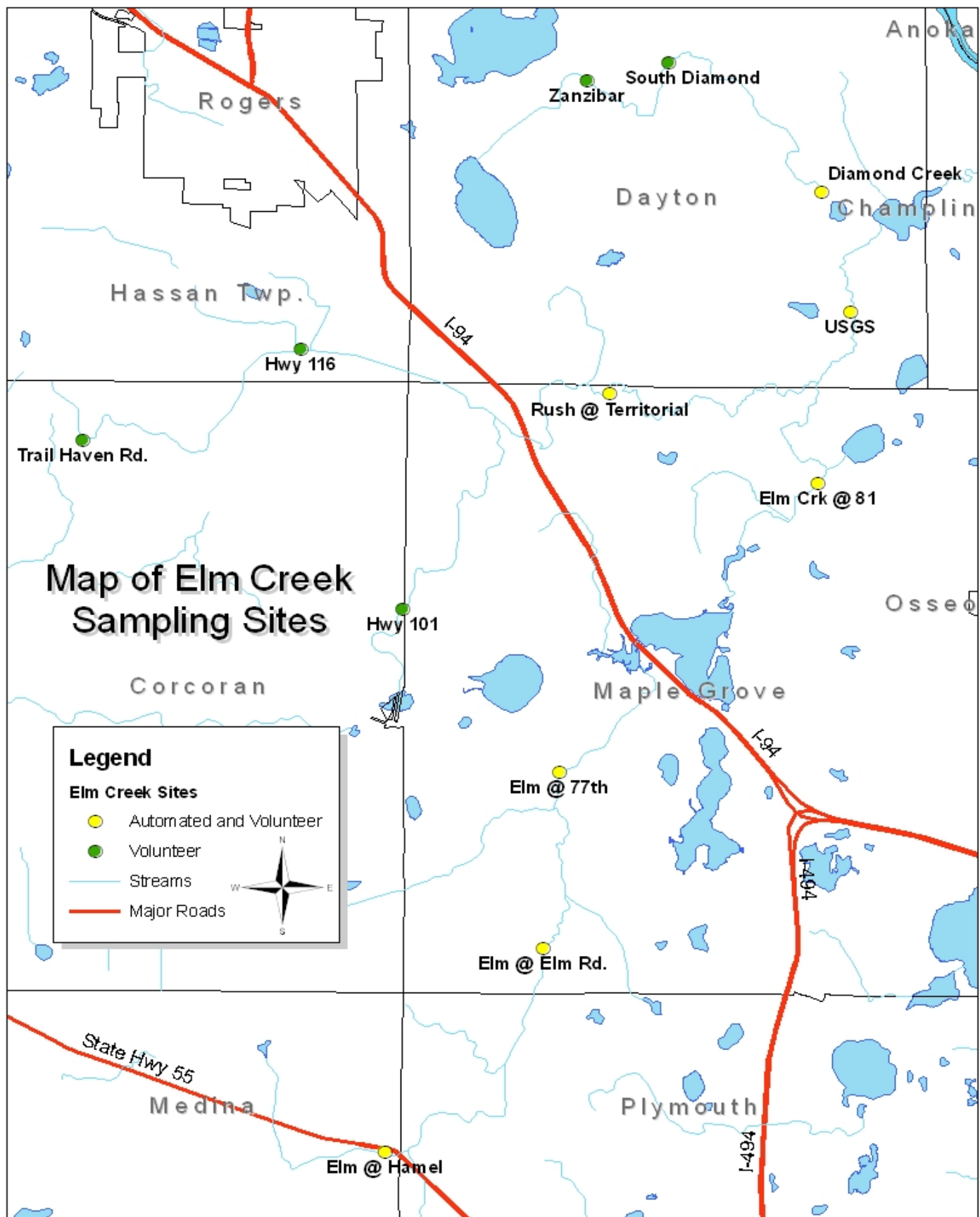




Stream Health Evaluation Program Elm Creek 2009







INTRODUCTION

In 2008, Hennepin County Environmental Services (HCES) partnered with the Elm Creek Watershed Management Commission to initiate a new stream monitoring program. Hennepin County Environmental Services has been coordinating successful monitoring programs for several years. River Watch focuses on stream monitoring using High School students in their classroom setting to gather data. The Wetland Health Evaluation Program (WHEP) recruits adult volunteers to monitor biological health of wetlands throughout the County. Using the same parameters as WHEP, the Stream Health Evaluation Program (SHEP) started monitoring streams in the fall of 2008. The pilot program consisted of one team of adult volunteers monitoring seven sites in the Elm Creek Watershed.

SITE SELECTION

Staff from HCES partnered with Three Rivers Parks District staff to choose sites for monitoring within the Elm Creek Watershed. The sites chosen were at one time part of the River Watch program and also within the Park district boundaries. Seven sites total were monitored by the SHEP team.

PROTOCOL

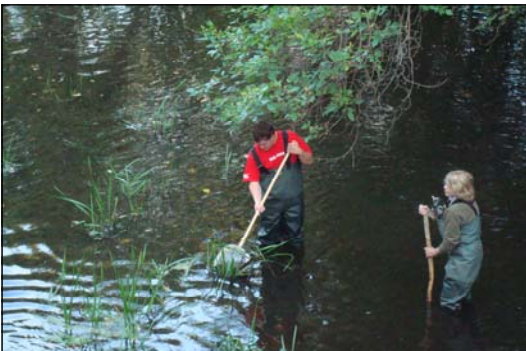
The protocol used in SHEP was the ‘multi-habitat’ method which has been adapted for volunteer use by the United States Environmental Protection Agency. To download the manual visit:

www.epa.gov/volunteer/stream

All samples are collected by the SHEP team and processed using EPA methods. Identification was to the Family level and 100% of the samples are checked by Hennepin County Environmental Services staff for accuracy. Data is entered into an excel spreadsheet and appropriate indices are calculated. Evaluation is performed using the multi-metric approach.

“NEW” PROTOCOL

The Hennepin County SHEP team also participated in using a new protocol for volunteers monitoring the cast skins of Chironomidae. Along with the traditional macroinvertebrate sample, the team used a technique developed by UM Entomologist Dr. Len Ferrington. Dr. Ferrington spent an afternoon with the team training them on sampling protocols. The samples were preserved and analysis will be performed in conjunction with Dr. Ferrington’s lab. HCDES plans to develop with Dr. Ferrington an identification key for volunteer use to identify these samples to the Genus/Species level for a finer assessment of water quality.





Stream Grading Scale					
Family Biotic Index	Grade	EPT	Grade	Number of Families	Grade
0.00 – 4.00	A	9-12	A	12 - 15	A
4.01 – 5.75	B	6.0 - 8.9	B	9.1 - 11.9	B
5.76 – 6.50	C	3 - 5.9	C	6 - 9	C
> 6.50	D	< 3	D	< 6	D

Letter Grading Scale	
3.83 - 4.00	A
3.50 - 3.82	A-
3.17 - 3.49	B+
2.83 - 3.16	B
2.50 - 2.82	B-
2.17 - 2.49	C+
1.83 - 2.16	C
1.50 - 1.82	C-
1.17 - 1.49	D+
0.83 - 1.16	D
0.50 - 0.82	D-
0.00 - 0.49	F

The grading scale used in SHEP takes into account three major biotic indices used routinely in biological monitoring programs. The first component is the Family Biotic Index which measures the overall community of invertebrates and their tolerance to pollution levels. The scale ranges from 0 to 10 with the lower values indicating high sensitivity and good water quality if present.

EPT stands for Ephemeroptera, Plecoptera, and Trichoptera or mayflies, stoneflies, and caddisflies. These three families include the most sensitive individuals and is looked at for indications of presence or absence. Higher scores indicate better water quality.

Finally, number of families measures the overall abundance of families or total diversity of family units. Again, with this index, the higher the number the better.



Elm Creek Results 2009				
Site	Total Number of organisms	Number of Families	EPT	FBI
EC#1 Elm Creek at Territorial	241	11	0	7.8
EC#2 Elm Creek at Hayden Lake Road	243	13	1	6.3
EC#3 Diamond Creek at Zanzi- bar	113	5	0	6.5
EC#4 Rush Creek at 116				
EC#5 Rush Creek at Territorial	315	13	1	6.9
EC#6 Elm Creek at 77th Avenue	175	11	1	7.2



Elm Creek Grading 2009		
Site	Grade in 2008	Grade in 2009
EC#1 Elm Creek at Territorial	D+	C-
EC#2 Elm Creek at Hayden Lake Road	C	C+
EC#3 Diamond Creek at Zanzi- bar	No sample taken; no water	D+
EC#4 Rush Creek at 116	C+	
EC#5 Rush Creek at Territorial	C-	C
EC#6 Elm Creek at 77th Avenue	C+	C-

Results of Citizen Volunteer Collections of Surface-Floating Pupal Exuviae of Chironomidae 2009

Dr. Leonard Ferrington, Jr.

Collections of surface-floating pupal exuviae (SFPE) were taken by Citizen Volunteers at six sample sites in 2009. This report summarizes the results of the sampling effort. All taxa were identified to genus and a series of metrics were calculated. Results are provided in tabular form, and a discussion of their significance is provided. Recommendations are included for consideration as plans for future biological monitoring activities are developed.

RESULTS: Surface-floating pupal exuviae were contained in all samples. The range of specimens varied from 24 specimens per sample to 67 specimens per sample. A total of 262 specimens were present in all six samples.

The taxonomic composition and abundances of genera are given in Table 1. A total of 14 genera were encountered across all sample sites. The number of genera detected at individual sites was less, and ranged from six to eight genera per site. This pattern of variation across sample sites is common, and is measured by calculating coefficients of similarity for all pairs of samples.

TABLE 1: Results for Citizen Volunteer Monitoring							
Sampling Coordinated by Mary Karius							
Samples collected in 2009							
	Sample	Sample	Sample	Sample	Sample	Sample	
	Site	Site	Site	Site	Site	Site	Project
Taxon	EC-1	EC-2	EC-3	EC-4	EC-5	EC-6	Totals
Orthoclaadiinae							
<i>Corynoneura</i>	0	1	2	1	2	1	7
<i>Cricotopus</i>	21	4	18	27	15	33	118
<i>Limnophyes</i>	0	2	0	0	0	0	2
<i>Nanocladius</i>	1	3	3	4	0	0	11
<i>Parakiefferiella</i>	1	0	0	0	0	0	1
<i>Parametriocnemus</i>	1	0	1	0	2	2	6
<i>Thienemanniella</i>	0	0	0	0	1	1	2
<i>Tvetenia</i>	0	0	0	0	1	0	1
Chironomini							
<i>Parachironomus</i>	1	1	0	1	0	0	3
<i>Polypedilum</i>	0	0	0	5	0	0	5
Tanytarsini							
<i>Micropsectra</i>	9	4	6	0	0	3	22
<i>Paratanytarsus</i>	14	3	1	0	0	0	18
<i>Tanytarsus</i>	19	41	1	1	3	0	65
Tanypodinae							
<i>Procladius</i>	0	0	0	0	0	1	1
Total Specimens	67	59	32	39	24	41	262
Total Taxa	8	8	7	6	6	6	14

The genera detected at the sample sites are common and widespread in streams in the metro area, and all are moderately to strongly tolerant to organic enrichment and/or reduced concentrations of dissolved oxygen. Generic richness is low compared to values obtained at sample sites in past studies of Minnehaha Creek. There is a conspicuous absence of species that are intolerant to organic enrichment and lowered dissolved oxygen. There is also a lack of genera that are common in riffle areas of faster flowing streams. Consequently, it appears that sample sites may not have well-developed and/or extensive riffle habitat, which could result in natural levels of reduced dissolved oxygen. If well-developed riffles are present at the sites, then the lack of these genera would most likely indicate some form of stress that is contributing to low dissolved oxygen, which could possibly be elevated levels of organic enrichment.

Table 2 summarizes the similarities of for all combinations of the six sample sites based on Jaccard's Coefficient of Similarity. This coefficient is one of the most commonly reported similarity value in the scientific literature. With six sample sites the number of two-sample comparisons is 15. In the table the diagonal is indicated by ----. The 15 values below the diagonal are the calculated similarities converted to percents. The values above the diagonal represent the rankings of the similarities, where 1 represents the two most similar sites.

TABLE 2: Similarities based on Jaccard's Coefficient of Similarity (Ties indicated with *)						
Sampling Coordinated by Mary Karius						
Samples Collected in 2009						
Sample Sites Compared	Sample Site EC-1	Sample Site EC-2	Sample Site EC-3	Sample Site EC-4	Sample Site EC-5	Sample Site EC-6
Sample Site EC-1	----	2	1*	6	8*	8*
Sample Site EC-2	60%	----	1*	3	8*	8*
Sample Site EC-3	66.7%	66.7%	----	5*	5*	5*
Sample Site EC-4	40%	55.6%	44.4%	----	7	9
Sample Site EC-5	27.3%	27.3%	44.4%	33.3%	----	4
Sample Site EC-6	27.3%	27.3%	44.4%	20%	50%	----

Based on Jaccard's coefficient of Similarity, sample sites EC-1, EC-2 and EC-3 are most similar. These values are approximately in the range of what we normally obtain for samples from sites that are close to each other and not experiencing substantial changes in habitat conditions, water quality or other type of stresses. Sample sites EC-4 and EC-5, and EC-4 and EC-6 have similarities that are unusually low for sites adjacent to each other, or close to each other but located on the same stream. A complete list of similarity indices and the resulting calculations for all site combinations is provided as an appendix table at the end of this report.

Two different approaches were taken to calculate Hilsenhoff's Biotic Index. The first method is to treat the results as presence/absence data and calculate the average tolerance value (see Table 3). The second approach is to calculate a weighted value based on the abundances of specimens for each genus that is present in the sample (see Table 4). The second approach is most commonly reported in the scientific literature. However, because of the low numbers of specimens, the first approach also provides informative results.

TABLE 3: Results for Citizen Volunteer Monitoring						
Hilsenhoff Biotic Index Calculations						
Based on Presence/Absence Data						
	Sample	Sample	Sample	Sample	Sample	Sample
	Site	Site	Site	Site	Site	Site
Taxon	EC-1	EC-2	EC-3	EC-4	EC-5	EC-6
Orthoclaadiinae						
<i>Corynoneura</i>	0	7	7	7	7	7
<i>Cricotopus</i>	7	7	7	7	7	7
<i>Limnophyes</i>	0	3.1	0	0	0	0
<i>Nanocladius</i>	3	3	3	3	0	0
<i>Parakiefferiella</i>	4.8	0	0	0	0	0
<i>Parametriocnemus</i>	5	0	5	0	5	5
<i>Thienemanniella</i>	0	0	0	0	6	6
<i>Tvetenia</i>	0	0	0	0	5	0
Chironomini						
<i>Parachironomus</i>	10	10	10	10	0	0
<i>Polypedilum</i>	0	0	0	3.1	0	0
Tanytarsini						
<i>Micropsectra</i>	7	7	7	0	0	7
<i>Paratanytarsus</i>	6	6	6	0	0	0
<i>Tanytarsus</i>	6	6	6	6	6	0
Tanypodinae						
<i>Procladius</i>	0	0	0	0	0	9
Biotic Index	6.1	6.1	7.3	6.0	6.0	6.8
Total Taxa	8	8	7	6	6	6

The Biotic Index values based on the presence/absence approach range between 6.0 and 7.3. Based on criteria provided by Hilsenhoff for interpreting the value, all sites would be judged as having fair to fairly poor water quality, with fairly significant to significant organic pollution.

TABLE 4: Results for Citizen Volunteer Monitoring						
Hilsenhoff Biotic Index Calculations						
Based on Specimen Abundance Data						
	Sample	Sam- ple	Sam- ple	Sample	Sample	Sample
	Site	Site	Site	Site	Site	Site
Taxon	EC-1	EC-2	EC-3	EC-4	EC-5	EC-6
Orthocladiinae						
<i>Corynoneura</i>	0	7	14	7	14	7
<i>Cricotopus</i>	147	28	126	189	105	231
<i>Limnophyes</i>	0	6.2	0	0	0	0
<i>Nanocladius</i>	3	9	9	12	0	0
<i>Parakiefferiella</i>	4.8	0	0	0	0	0
<i>Parametrioctenus</i>	5	0	5	0	10	10
<i>Thienemanniella</i>	0	0	0	0	6	6
<i>Tvetenia</i>	0	0	0	0	5	0
Chironomini						
<i>Parachironomus</i>	10	10	0	10	0	0
<i>Polypedilum</i>	0	0	0	15.5	0	0
Tanytarsini						
<i>Micropsectra</i>	63	28	42	0	0	21
<i>Paratanytarsus</i>	84	18	6	0	0	0
<i>Tanytarsus</i>	114	246	6	6	18	0
Tanypodinae						
<i>Procladius</i>	0	0	0	0	0	1
Sum (Specimens * Tolerance)	430.8	352.2	208	239.5	158	276
Total Taxa	8	8	7	6	6	6
Biotic Index	6.4	6.0	6.5	6.1	6.6	6.7

The Biotic Index values based on the weighting by specimen abundance approach range between 6.1 and 6.7. Based on criteria provided by Hilsenhoff for interpreting the value, all sites would again be judged as having water quality that is fair to fairly poor, with fairly significant to significant organic pollution.

RECOMMENDATIONS: The number of specimens per sample was below target levels that are considered ideal for biological monitoring with SFPE. Target figures in the literature range from 100 specimens per sample to 300 per sample. Occasionally samples that are collected may have many more specimens, even ranging to more than 1000 specimens per sample. If samples are large, then subsampling to 300 specimens is recommended. In order to reach the recommended number of specimens per sample it is recommended that the time spent sampling and the area sampled at each sample site be increased. Care should be taken to expend the same amount of effort at each sample site. If large numbers of specimens are collected in samples, they can effectively be subsampled.

APPENDIX TABLES

Data set: SFPE Citizen Volunteer Samples 2009					
First Sample Compared:	EC-1	EC-1	EC-1	EC-1	EC-1
Second Sample Compared	EC-2	EC-3	EC-4	EC-5	EC-6
Double 0 matches included.					
Simple Matching Coefficient	0.714	0.786	0.571	0.429	0.429
Jaccard's Coefficient	0.6	0.667	0.4	0.273	0.273
Sorensen's Coefficient	0.75	0.8	0.571	0.429	0.429
Ochiai's Coefficient	0.75	0.802	0.577	0.433	0.433
Kendall's Coefficient of Association	0.417	0.577	0.167	0.125	0.125
Whittaker's Percentage Similarity	0.5	0.54	0.369	0.453	0.402
Bray Curtis Similarity	0.508	0.566	0.453	0.418	0.463
Bray Curtis Distance	0.492	0.434	0.547	0.582	0.537
Pinkham & Pearson's Index	0.189	0.213	0.149	0.098	0.105
Weighted	0.051	0.085	0.085	0.073	0.082
Coefficient of Divergence	0.622	0.589	0.716	0.787	0.775
Euclidean Distance	30.49	22.82	25.96	24.06	27.27
	6	5	2	2	6
Average	8.15	6.1	6.939	6.431	7.29
Squared	930	521	674	579	744
Squared Average	66.42	37.21	48.14	41.35	53.14
	9	4	3	7	3
Morisita's Index	0.664	0.759	0.624	0.74	0.598
Horn's Index	0.781	0.775	0.584	0.669	0.624

APPENDIX TABLES (continued)

Data set: SFPE Citizen Volunteer Samples 2009				
First Sample Compared:	EC-2	EC-2	EC-2	EC-2
Second Sample Compared	EC-3	EC-4	EC-5	EC-6
Double 0 matches included.				
Simple Matching Coefficient	0.786	0.714	0.429	0.429
Jaccard's Coefficient	0.667	0.556	0.273	0.273
Sorensen's Coefficient	0.8	0.714	0.429	0.429
Ochiai's Coefficient	0.802	0.722	0.433	0.433
Kendall's Coefficient of Association	0.577	0.458	0.125	0.125
Whittaker's Percentage Similarity	0.266	0.178	0.21	0.153
Bray Curtis Similarity	0.308	0.204	0.193	0.16
Bray Curtis Distance	0.692	0.796	0.807	0.84
Pinkham & Pearson's Index	0.196	0.209	0.06	0.134
Weighted	0.012	0.006	0.009	0.005
Coefficient of Divergence	0.58	0.626	0.81	0.785
Euclidean Distance	42.556	46.73 3	40.137	50.517
Average	11.374	12.49	10.727	13.501
Squared	1811	2184	1611	2552
Squared Average	129.35 7	156	115.07 1	182.28 6
Morisita's Index	0.191	0.144	0.294	0.105
Horn's Index	0.512	0.367	0.454	0.278

APPENDIX TABLES (continued)

Data set: SFPE Citizen Volunteer Samples 2009						
First Sample Compared:	EC-3	EC-3	EC-3	EC-4	EC-4	EC-5
Second Sample Compared	EC-4	EC-5	EC-6	EC-5	EC-6	EC-6
Double 0 matches included.						
Simple Matching Coefficient	0.643	0.643	0.643	0.571	0.429	0.714
Jaccard's Coefficient	0.444	0.444	0.444	0.333	0.2	0.5
Sorensen's Coefficient	0.615	0.615	0.615	0.5	0.333	0.667
Ochiai's Coefficient	0.617	0.617	0.617	0.5	0.333	0.667
Kendall's Coefficient of Association	0.289	0.289	0.289	0.125	0.167	0.417
Whittaker's Percentage Similarity	0.708	0.688	0.691	0.676	0.717	0.723
Bray Curtis Similarity	0.648	0.679	0.63	0.54	0.7	0.585
Bray Curtis Distance	0.352	0.321	0.37	0.46	0.3	0.415
Pinkham & Pearson's Index	0.208	0.19	0.146	0.099	0.13	0.211
Weighted	0.134	0.15	0.128	0.121	0.228	0.117
Coefficient of Divergence	0.608	0.619	0.622	0.678	0.756	0.551
Euclidean Distance	12.124	7.874	15.78	14.03 6	9.695	18.57 4
Average	3.24	2.104	4.217	3.751	2.591	4.964
Squared	147	62	249	197	94	345
Squared Average	10.5	4.429	17.78 6	14.07 1	6.714	24.64 3
Morisita's Index	0.953	0.975	0.943	0.98	0.975	0.974
Horn's Index	0.785	0.776	0.852	0.753	0.77	0.838