**APPLICATION OF MULTIVARIATE STATISTICAL AND
ANALYTICAL TECHNIQUES IN THE EXAMINATION OF LACUSTRINE
ARCELLACEAN DATA FROM SOUTHWESTERN NEW BRUNSWICK**

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

Ottawa-Carleton Geoscience Centre
and
The Department of Earth Sciences

Carleton University

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Lacustrine Arcellacean Data from Southwestern New Brunswick

Submitted by

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ABSTRACT

Paleoenvironmental applications of arcellaceans (thecamoebians) have been examined quantitatively using Q-mode clustering methods for at least the last ten years. This dissertation presents a comparative survey of these and several other multivariate statistical and analytical techniques in order to develop new tools and to refine those already in use. Several lakes ranging considerably in area and trophic state were selected from southwestern New Brunswick for study in order to build a large arcellacean database. Many sediment-water interface (SWI) and sediment core samples were collected as well as environmental data for each SWI sample. In addition, SWI samples were recovered for Total Organic Carbon analysis.

The examination of various multivariate statistical techniques includes: R- and Q-mode clustering, multicollinearity diagnostic tests, data normalization procedures, principal components analysis, canonical correlation analysis, and finally multiple regression analysis. Based on these investigations, it was determined that arcellacean data sets required: 1. the removal of any variables whose associated errors were greater than their abundances more than 60% of the time; 2. the transformation of arcellacean fractional abundance data so that their distribution was rendered statistically normal; 3. the correction of multicollinear pairs or groups of variables which fall below the Variable Inflation Factor cut-off of 10 by combining them.

Stepwise multiple regression analysis proved to be a useful method in the generation of predictive transfer functions. Functions were developed for Total Organic Carbon, specimen density, dissolved oxygen, temperature, and depth. The different strengths of each function indicated the relative influence on arcellacean assemblages by each environmental parameter. This information proved very useful for subsequent interpretation.

The different statistical tests and transformations that were developed for multiple regression analysis were applied to the data used for Q-mode cluster analysis. This resulted in clusters that were more easily correlated with the environmental parametric ranges of data recorded within the geographic boundary of each cluster. Using these same techniques from arcellacean records, the Frog and Greenhill lakes cores were found to be useful in the paleoenvironmental reconstruction of the Holocene. This was especially so for the last 150 years of recorded European settlement history as the arcellacean record was able to resolve distinct stages within this time.

ACKNOWLEDGEMENTS

I would like to thank Dr. R.T. Patterson for his supervision, his insights, his enthusiasm, and for giving me the many opportunities to explore different places and possibilities under the auspices of research to see where they would lead. I would also like to acknowledge his financial support for this research from NSERC Research Grant OGP0041665.

I would also like to thank Dr. Jerry Choate of the New Brunswick Department of the Environment who provided insights into the study area helping me to select the best lakes to study and for supplying me with literally hundreds of printouts of environmental data.

No project like this could be possible without assistance in the field. I thank my field assistants for the 1998 season: Arun Kumar, Bob Boudreau, and Sarah Vandervlugt; for the 2001 season: Alice Chang, Bob Boudreau, and Leslie Taylor. I would like to extend special thanks the Roy and Jeanne Patterson for their kind hospitality and their knowledge of the area as they were especially helpful in procuring historic records of European settlement and land clearing that was vital to my work.

I would like to thank all those other people who went beyond what was expected of them whose little favours weren't so little to me. I thank Audrey Dallimore for advising me on the use of radiocarbon dating as well as the use of sediment core X-rays. I thank Mary Ellen Petrunewich at Merivale Medical Imaging who took time from her busy schedule to help me X-ray my core samples and showing great interest in my work. I would also like to thanks Lewis Ling and Peter Jones at the Carleton University Research Facility for Electron Microscopy (CURFEM) for the electron microscopy of my specimens.

And finally, I must thank Yota Cosmopoulos for so many things, for introducing me to other multivariate statistical techniques that were important for this work, and much more than that. I thank you for your support in all times good and bad and for embodying all those qualities that I hold in the highest regard.

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ORIGINAL CONTRIBUTION

All samples and data were collected in the field by Andrew Dalby under the supervision of Dr. R.T. Patterson and with the assistance of Arun Kumar, Bob Boudreau, Alice Chang, Sarah Vandervlugt, Leslie Taylor, and Roy Patterson. Subsampling, sample processing, and specimen counting under the light microscope were all conducted by Andrew Dalby. Radiocarbon dating was conducted by Alice Leung at Isotrace, at the University of Toronto. Total Organic Sample analysis was done by Greg Clarkin at Areco Canada in Ottawa. ^{210}Pb analysis was performed by Bassam Ghaleb at GEOTOP at the Université de Québec à Montréal and the ^{210}Pb dates were calculated by Andrew Dalby. Lewis Ling and Peter Jones at the Carleton University Research Facility for Electron Microscopy (CURFEM) performed the scanning electron microscopy of selected arcellacean specimens.

All other work was conceived and completed by Andrew Dalby in consultation with Dr. R.T. Patterson.

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CHAPTER 1

INTRODUCTION

This dissertation is divided into three main parts, each examining the usage of arcellaceans (thecamoebians) as environmental and paleoenvironmental indicators using multivariate statistical tools. Part One (Chapters 4 and 5) is a comparative study of the different multivariate statistical tools available to the researcher. Part Two (Chapters 6 and 7) examines modern arcellacean faunas at the sediment-water interface (SWI), their ecological tolerances, and the applicability and refinement of the tools developed in Part One. Part Three (Chapters 8 and 9) evaluates the usefulness of arcellaceans in reconstructing the postglacial record, again using the tools from Part One and their refinements from Part Two.

Research over the last decade and a half has shown great promise for the utility of arcellaceans (thecamoebians) as paleoenvironmental indicators (see Chapter 2). Indeed, this study aims to enhance our understanding of these freshwater amoeboid testate protozoans by examining a large number of arcellacean bearing samples from a suite of different lakes (ranging from oligotrophic to eutrophic) from southern New Brunswick. Specimen data recovered from sediment-water interface and core samples were examined to expand and refine their applicability using, in part, different multivariate statistical analyses. These are possible because of the modern availability of sophisticated computers and software previously unavailable to researchers in diverse fields where

quantification is possible and desirable (Hair et al., 1998). Paleoenvironmental interpretation based on arcellaceans has been somewhat impeded by a lack of baseline data, but research over the last twenty years, and especially in the last seven, has started to change this. This has been improved upon as more and more work has been of a quantitative nature.

Recent arcellacean research has been driven partly by an interest to find new environmental monitors, especially as concerns about the environment and the impact of climate change exist in society today. In this regard, science has a responsibility to provide useful and accurate information in order to differentiate anthropogenic and natural causes of climatic variation (Patterson and Kumar, 2002). This is especially important as decisions are being made at the highest levels intended to reduce any deleterious effect that human activity has on the environment and these must be based on verifiable and substantiated information in order to be effective.

Arcellaceans were selected for this purpose because they are ubiquitous in lacustrine environments and have rapid generation times, making them ideal proxies to record short-lived environmental changes (Schönborn 1981; Medioli and Scott, 1983). The examination of the core samples in Part Three tends to confirm this as the arcellacean record was able to detect short-lived phenomena that did not appear in the palynological record. Arcellaceans have other advantages as well, such as the relative ease of micropaleontological processing over palynology, for example (see Chapter 3).

Arcellaceans are an asexually reproducing group of testate amoeboid protozoans of the Order Arcellinida Kent 1880, and are often referred to as thecamoebians, an artificial polyphyletic group which includes arcellaceans as well as some other groups (Loeblich and Tappan, 1964; Mediolli and Scott, 1983; Patterson and Kumar, 2002). They comprise an amoeboid body and produce a test whose composition and morphology varies in different species. The test is sac-like in appearance can be produced autogenously in some species, or comprised of agglutinated grains (xenogenous) cemented together with an organic compound usually composed of mucopolysaccharide, which is highly resistant to most biological and chemical destructive agents, enhancing their preservation potential in the fossil record (Patterson and Kumar, 2002). Arcellacean systematics and the problems associated with this are discussed in greater detail in Chapters 2 and 11.

In order to carry out this research, several lakes from southwestern New Brunswick were selected for this study: Frog, George, Greenhill, McAdam, Oromocto, Utopia, and Yoho (Figure 1.1). They ranged considerably in area from 22-5000 Ha and trophic state from oligotrophic to extremely eutrophic. Those lakes with high organic-content substrates, namely Frog (Figure 1.2) and Greenhill (Figure 1.3), were by far the most useful for this research as this sediment is found to harbor abundant arcellacean populations. Oromocto (Figure 1.4) and Yoho lakes (Figure 1.5) yielded samples with lower abundances than the first two, nevertheless arcellaceans were found in statistically significant numbers. McAdam Lake (Figure 1.6) was found to have a fairly rocky bottom thus only seven samples were recovered from a few restricted bays. Finally, George and

Utopia lakes (Figure 1.1) did not supply any usable samples for this study as George Lake had a predominantly sandy bottom with few organics, and Lake Utopia was too deep to sample effectively with the equipment used.

Figure 1.1

Regional map of southern New Brunswick showing the locations of the lakes examined in the study.

Figure 1.1

Figure 1.2

Sample locality map of Frog Lake. The shallow bottom (<3m) made the presentation of bathymetric data unnecessary.

Figure 1.2

Figure 1.3

Sample locality and bathymetry map of Greenhill Lake.

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Sample locality and bathymetry map of Yoho Lake.

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Figure 1.6

Sample locality and bathymetry map of McAdam Lake.

Figure 1.6

CHAPTER 2

PREVIOUS WORK ON ARCELLACEANS

Arcellaceans have been described in the literature as far back as 1816 (Lamarck, 1816; Leclerc, 1816) with important taxonomic pioneering work performed throughout the nineteenth and early twentieth centuries (e.g. Archer, 1866a,b, 1867; Ehrenberg 1830, 1832a,b, 1838, 1843, 1848, 1856, 1872; Leidy, 1874a-c, 1876, 1878, 1879; Penard, 1890, 1893, 1899, 1902, 1905, 1911; Perty 1849a,b, 1852). While lacustrine taxonomic studies dominated the literature until 1930, research shifted its emphasis toward arcellacean faunas found in soil and peat environments (Medioli and Scott, 1983).

Research up until very recently has focused almost exclusively on species descriptions with little regard for taxonomic consistency (Medioli and Scott 1983; Patterson and Kumar 2002). Rising to the challenge to standardize this taxonomy, Ogden and Hedley (1980) produced a comprehensive atlas of freshwater testate amoebae which, unfortunately, describes far too many infrasubspecific forms as individual species. It must be pointed out that they were attempting to pull together a vast collection of research without the benefit of any unifying standards so this work should be viewed as a positive contribution despite its limitations.

The contributions of Medioli, Scott and others have significantly advanced arcellacean research in laying the groundwork for future efforts. The seminal work on

Holocene arcellaceans from eastern Canada (Medioli and Scott, 1983) investigated the taxonomic problems and presented efforts to solve them. Work on interclonal variability of amoeboid protozoans brought into question the very definition of species and the difficulties in the assignment of such (Medioli et al., 1987). Medioli and Scott (1988) and Medioli et al. (1990) then began to investigate the potential of arcellaceans for paleolimnological interpretation, and this present work represents part of that unbroken continuum.

Q-mode clustering techniques were investigated for their interpretive potential and eventually adopted in the following works: McCarthy et al. (1995), Asioli et al. (1996), Patterson et al. (1996, 2002), and Reinhardt et al. (1998), among others. Some of these found that arcellaceans were helpful in identifying the effects of mining activity on the environment and providing suggestions for remediation (Asioli et al., 1996; Patterson et al., 1996, 2002; Reinhardt et al., 1998; Kumar and Patterson 2000; and Patterson and Kumar, 2000).

While taxonomic inconsistency was still an issue, Kumar and Dalby (2000) presented an illustrated key of lacustrine arcellaceans to help clarify some of this confusion. R-mode cluster analysis, used in many of the same works listed above, helped significantly to statistically isolate those species and infrasubspecific strains in order to remove the arbitrariness of taxonomic designations. This is a necessary foundation for the effective use of arcellaceans for paleolimnological interpretation.

CHAPTER 3

METHODOLOGY

Seven lakes from southwestern New Brunswick were selected for this study; Frog, George, Greenhill, McAdam, Oromocto, Utopia, and Yoho (Figures 1.1-1.6). They ranged considerably in area (22-5000 Ha) and trophic state from oligotrophic to extremely eutrophic (Table 3.1). Data collection was carried out over two field seasons (1998 and 2001).

3.1 Field work

In each lake, attempts were made to collect at least 20 sediment-water interface (SWI) samples and one long Livingstone core during the 1998 field season (Table 3.1). While both objectives were successful in Greenhill and Oromocto lakes, only a long core was collected from Frog lake as extensive algal mats and other aquatic vegetation prevented the collection of all but two SWI samples.

Cores were attempted in McAdam and Yoho lakes but the thin sediment layer overlying the bedrock made coring impossible, so only SWI samples were recovered. Lake Utopia presented a unique challenge as its steep sides and deep waters prevented recovery of any cores or SWI samples due to limitations of the equipment used. While

SWI and core samples were recovered from Lake George, the generally sandy bottom substrate resulted in low or barren arcellacean counts, rendering them inadequate for further interpretation (Kumar and Patterson, 2000).

A Livingstone corer (Livingstone, 1955) was used successfully to recover long cores from Frog (709cm), Greenhill (478cm), and Oromocto lakes (44cm; 137cm; and 171cm). The sediment in each core barrel was split longitudinally into two equal halves, one of which was wrapped and stored as archive material. The other portion was subsampled into 1cm slices at various intervals, depending on sediment type and core length. Where the sediment appeared to be unchanged, the sampling interval was 10cm or less for shorter cores and 20 cm for the longer cores. In sections where there appeared to be rapid sedimentation changes, additional samples were taken just above and below each horizon to identify any faunal changes.

An Eckman box grab sampler was used to recover the SWI samples. The top 2-3 mm of sediment was carefully removed from each sample for micropaleontological analysis. As arcellaceans are epifaunal in nature, specimens from this topmost sediment layer are considered to represent current lacustrine conditions (Kumar and Patterson, 2000). A commercial sonar device (fish finder) with a bottom hardness indicator was used to identify sediment type at sampling sites. Muddy sediments were preferred for recovery as they tend to contain abundant arcellacean communities, whereas sandy or rocky substrates usually have impoverished or barren populations (Kumar and Patterson, 2000).

An additional 30 subsamples for total organic content (TOC) analysis were taken from several SWI and core samples (Table 3.2). All samples were refrigerated during transport and while in laboratory storage, and all (except those for TOC and radiocarbon analysis) were treated with isopropyl alcohol to inhibit decay.

Physical characteristics, including water depth, temperature (surface and at depth), dissolved oxygen, pH and salinity, were recorded for each SWI sample station. A global positioning system receiver was used to record the geographic position of the SWI and coring sample stations. The relative positions of prominent shore features were also used to verify sampling station localities.

A short freeze core was retrieved from Frog Lake during the 2001 field season to supplement the 1998 Livingstone core. The top metre of sediment from that Livingstone core was an unusable disturbed slurry that lacked stratigraphic integrity, and thus could not be subsampled. The freeze core material was subsampled and stored in the same manner as all other samples.

A Knudsen 320B/P echosounder was used during the 2001 field season for subbottom sonar profiling of Frog, Greenhill, Oromocto, and Yoho lakes (Appendix A). This is a more powerful and versatile tool than the fish finder as it can be used to profile the subsurface lake stratigraphy with a range of dual frequencies from 3.5 to 250kHz (Knudson Engineering Limited, 1999).

The apparatus is powered by a 12 volt battery and consists of three components: the transducer, the central case, and a laptop computer. As its operation requires the use of the laptop computer to operate and to monitor the equipment, the subbottom profile data can be stored electronically, increasing its utility.

3.2 Laboratory Work

3.2.1 Micropaleontological Processing

Those samples with high amounts of gyttja were treated with $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ to loosen the organic material for easy removal during the sieving process (see section 3.2.3). All samples (SWI, Livingstone cores, and freeze core) were then screened with a 1000 μm sieve to remove coarse particles and then with a 43 μm sieve to retain arcellacean specimens. Most samples were then subdivided into sextets using a wet splitter (Scott and Hermelin, 1993). The Frog Lake freeze core subsamples did not contain sufficient material to warrant wet splitting, yet fortunately they contained enough specimens for analysis. The target was to count a minimum of 300 specimens for each sample, using as many complete sextet splits as needed, in order to attain significant numbers for further statistical analysis (Patterson and Fishbein, 1989; Appendix B).

3.2.2 $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ Treatment

Samples with a high organic content (gyttja) were treated with sodium carbonate monohydrate ($\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$) in a water solution to break down the organic particles which obscure the viewing and counting of arcellacean specimens under a light microscope (B.C. Jaiprakash, pers. comm.). Several experiments were performed in order to assess the efficacy of this procedure and also to ensure that the solution did not adversely affect the arcellacean tests.

Three SWI samples were selected to test the procedure. Each sample was split into two halves; the first halves to be treated with $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ and the other three to be kept as controls. Arcellacean specimen counts were then recorded for all three pairs of samples prior to $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$ treatment. Each treated half was monitored visually under a binocular light microscope while the sodium carbonate and water solution was added. Bubbles were observed forming around the organic gyttja particles while the arcellacean tests were unaffected. The samples were then left overnight and observed again the next afternoon, a week later, then two weeks later. In each case, none of the arcellacean tests was affected, but the organic material had partially broken up with the remnants becoming slightly discoloured, changing from green to greenish brown.

The three treated and three untreated samples were then screened with a $43\mu\text{m}$ sieve under a stream of cold water for ten minutes. Some of the material from the untreated samples was observed percolating out of the sieve for less than two minutes, which was found to be the case with previous arcellacean work (Reinhardt et al., 1998;

Dalby et al., 2000; Patterson et al., 2002). On the other hand, material from the treated samples was observed slowly percolating for more than ten minutes.

The arcellacean specimens in the treated and sieved samples were recounted for comparison with the previous results and this confirmed that none of the tests was affected by the treatment as the numbers were the same. This is not surprising as the cement that binds the agglutinated particles in most thecamoebian tests is composed of a mucopolysaccharide which is highly resistant to most biological and chemical destructive agents (Medioli and Scott, 1983; Patterson and Kumar, 2002).

While not all gyttja particles were fragmented to below the 43 μ m size threshold, this remaining organic fraction was nevertheless sufficiently weakened by the Na₂CO₃·H₂O treatment to dissociate under a gentle, sustained stream of water during the sieving process. Although it was difficult to see, careful observation of the water draining from the sieve revealed a faint greenish brown hue for some 10 to 20 minutes confirming that material was indeed being mechanically broken up by water action.

The partial removal of gyttja particles from a sample greatly facilitated accurate and unhindered counting of arcellacean tests. With such highly organic material, it was necessary in the past to split a sample beyond the six aliquot standard, requiring much more time at the microscope than with other samples. The Na₂CO₃·H₂O treatment was found to be effective at speeding up quantitative analysis.

3.2.3 Other Laboratory Work

In addition to arcellacean processing and counting, other work was performed on the collected material. This included scanning electron microscopy of collected arcellacean tests, total organic carbon (TOC) analysis, X-ray photography of a cross section of core samples, and radiometric dating of selected core samples (^{14}C and ^{210}Pb).

Scanning electron micrographs were acquired using a JEOL 6400 scanning electron microscope at the Carleton University Research Facility for Electron Microscopy (CURFEM). Wherever possible, at least one image of each taxon (species and strain) from each lake was obtained. Each image was collected electronically and on video prints for reference. Plates were assembled from the electronic specimen images which were prepared using Adobe Photoshop 6 by placing black backgrounds and resizing them to scale where necessary (Plates 1-6).

Selected samples from each lake (SWI and core) were analysed for total organic carbon (TOC) by Areco Canada Inc., of Ottawa (Table 3.2) using a LECO TC/IC capable of analyzing TOC in solid samples (i.e. sediments). This is a more accurate methodology than the “loss on ignition at 550°C” technique which cannot distinguish between organic and inorganic carbon (G. Clarkin, pers. comm.).

Patterson et al. (submitted) found that mammography X-raying of a thin slice of core was better at detecting structures not easily seen with the human eye. The Greenhill

Lake and two Oromocto Lake cores were x-rayed at Merivale Medical Imaging in Ottawa. One cm thick slices were removed from the archived (non-sampled) halves of the cores and were wrapped in standard kitchen plastic wrap to avoid desiccation. Mammography film was used as its image resolution is greater than standard x-ray film techniques. The core images (Appendix C) were taken at 50 kV at 50 ms, small focus at 140 mA power. While structure was captured for the primarily inorganic postglacial sediments, the portions of the cores with high organic content (gyttja), where most arcellaceans were recovered, did not exhibit any kind of structure.

Five radiocarbon dates were obtained for the Greenhill (3) and Frog (2) Lake long cores near arcellacean first occurrence horizons (Table 3.3). These were performed at Isotrace at the University of Toronto using accelerator mass spectrometry (AMS). ^{210}Pb dates from near the tops of each core were also obtained (Table 3.4), using the constant rate of supply (CRS) model (Appleby et al., 1995; Binford, 1990; Binford et al., 1993; Sorgente et al., 1999) from GEOTOP at the Université de Québec à Montréal. Figure 3.1 (Frog Lake only) shows the ^{210}Pb disintegrations per minute per gram are plotted against the core data on the decay curve beside the background (supported) ^{210}Pb fraction. Unfortunately, the topmost record for Greenhill Lake appeared to be unavailable based on the faunal record and ambiguous ^{210}Pb data (see Chapter 9 for discussion).

3.3 Multivariate Statistical Analyses

Multivariate statistical analysis consisted of several steps: 1. Q- and R-mode cluster analysis; 2. canonical correlation; 3. tests for normal distribution of data (skewness and kurtosis) and multicollinearity; 4. principal components factor analysis, and; 5. stepwise multiple regression. The ultimate goal was to develop a set of transfer functions to be able to quantitatively relate the environmental parameters (total organic carbon, specimen density, dissolved oxygen, temperature, and depth) with the proxy data (arcellacean fractional abundances).

In addition to multivariate techniques, the Shannon Diversity Index (SDI) was also calculated for each sample using the following formula (Appendix D):

$$SDI = - \sum_{i=1}^N x_i \cdot \ln x_i$$

(Equation 1)

where x_i is the fractional abundance of each taxon in a sample. The SDI is a rough measure of faunal diversity and is used to indicate the relative health of the community from which the sample was taken. Stressed or unfavourable environments will generally yield a low SDI (< 1.0) whereas a healthy, diverse assemblage will have an SDI of 2 or greater (Dalby et al., 2000; Patterson et al., 2002). As the SDI is an expression of abundance and diversity of arcellaceans in a sample, it was included as a proxy variable in addition to individual taxonomic fractional abundances in the various multivariate statistical analyses below.

3.3.1 Cluster analysis

Recent work in the assessment of arcellaceans as paleoenvironmental indicators has commonly used Q- and R-mode cluster analysis dendrograms to graphically illustrate the underlying structure of the data in order to facilitate interpretation (eg. Asioli et al., 1996; McCarthy et al., 1995; Patterson et al., 1996; 2002; Reinhardt et al., 1998).

Cluster analysis includes several multivariate techniques that group suites of variables based on measurable metrical characteristics (Hair et al., 1998) such as arcellacean fractional taxonomic abundances. The generated clusters contain groups of samples that are more similar to each other than to samples in other groups. More precisely, a group should exhibit relative internal homogeneity and external heterogeneity. Arcellacean taxonomic abundance data were examined using SPSS 10, a statistical software package.

R-mode analysis was used to group taxa whose covariance was nearly identical in all or most samples (Appendix E). To clarify, covariant pairs exhibit mutual variability about their common mean (Davis, 1986). This was performed for all southern New Brunswick SWI samples used in this study, as well as for individual lakes (Greenhill, Oromocto, and Yoho). Those taxa that were found to be consistently covariant, a condition known as multicollinearity, were grouped together for further statistical analyses.

Q-mode analysis was used to group samples as opposed to taxa in order to recognize any underlying structure in the data that might indicate significant relationships

(Appendix F). Ward's clustering method was used as it closely emulates biological systems in a statistically significant "error-weighted maximum likelihood" manner described by Fishbein and Patterson (1993). The assumption is "that samples from similar environments... are [normally distributed] around a centroid" (Fishbein and Patterson, 1993), meaning that they are compositionally similar because the assemblage is determined by the surrounding environmental conditions.

While these are powerful aids for interpretation, cluster analysis is nevertheless limited as it does not establish causal relationships between proxy data and environmental parameters, but simply shows whatever structure appears to exist in the data. In this way it has been described as a descriptive, atheoretical, and noninferential technique (Hair et al., 1998). Moreover, this has one significant drawback as the technique will preferentially generate clusters regardless of the existence of any true or significant structure and will not always generate unique solutions (Hair et al., 1998). Therefore other methodologies were also employed in this research to recognize relationships.

3.3.2 Canonical correlation analysis

Canonical correlation (CC) is used to quantify the number and nature of mutually independent relationships between two sets of variables (Stevens, 1996), which in this study were the proxy data (taxonomic fractional abundances) and the environmental parameters (total organic carbon, specimen density, dissolved oxygen, temperature, and depth). While SPSS 10 did not have a native CC application within it, it could still be

performed with this software using a command line script in conjunction with an imported application source code (Appendix G). CC was performed on all SWI data as a group from all southern New Brunswick lakes in this study (Greenhill, McAdam, Oromocto, and Yoho). It was also performed for individual lakes for which there were enough sediment-water interface samples (>20; Greenhill, Oromocto, and Yoho).

While this method is considered “weak” by many researchers because it has the least number of preparatory constraints of any multivariate technique (Hair et al., 1998), it is still useful in determining whether a significant covariant relationship exists between the proxy and parametric data. The preparatory constraints of other methods usually consist of correcting and transforming data for normality and to remove outliers (Tabachnick and Fidell 1996; Hair et al., 1998)

One of the other drawbacks is that too large a sample size will sometimes infer a statistical relationship where one probably does not exist, a condition known as overfitting. The decision to perform CC for both individual lakes and all samples combined was intended to minimize this effect.

3.3.3 Principal Components Factor Analysis

Principal Components Factor Analysis (PCA) is a multivariate technique used for data reduction. Specifically, it is used to reduce the number of variables in the arcellacean proxy data sets in order to more easily accomplish subsequent multivariate

techniques and to minimize multicollinearity. This methodology examines the underlying structure in a data matrix to define a set of common underlying dimensions (also called factors), thus reducing the number of variables (Hair et al., 1998). These factors represent linear relationships in multidimensional space which are orthogonal to each other (i.e. at right angles).

PCA was performed on the data in this study using SPSS 10. This approach generated six components (Table 3.5; Appendix H) which act as new variables that are subsequently used in a multiple regression. The PCA data were calculated with the following formula:

$$PC_n = \sum_{i=1}^N \beta_i \cdot x_i$$

(Equation 2)

where:

- PC_n is the value of the n^{th} component (1-6) for a given sample (Results in Appendix H)
- β_i represents the i^{th} coefficient generated by PCA
- x_i represents the fractional abundance of the i^{th} taxa in the summation (Appendix J)

There are limitations in using this method because there is a loss of information whenever there is a reduction in the dimensionality of the data (Hair et al., 1998). This could be information that would otherwise aid in establishing a covariant relationship between

arcellacean proxies and environmental data. Because of this, some researchers debate the appropriateness of this technique for predictive procedures, deeming it useful only for exploratory, descriptive purposes not unlike the results obtained by cluster analysis. However, PCA differs from cluster analysis in an important aspect – it only defines factors if there is *significant* structure present in the data, whereas cluster analysis will define groups even if structure is absent (Hair et al., 1998).

3.3.4 Multiple regression

Similar to canonical correlation, this is a technique which identifies and quantifies covariant relationships between proxy and parametric variables. It differs from CC in that it examines mathematical relationships between the group of proxies and only one parameter instead of all parameters together as with canonical correlation. It then generates transfer functions that predict the single environmental parameter based solely on the proxy data, which is useful if one only has the latter (eg. a core sample).

Stepwise multiple regression was used in SPSS 10 to generate transfer functions for the following environmental parameters: total organic carbon, specimen density, dissolved oxygen, temperature, and depth. Although pH and salinity data were also collected in the field, all samples had a pH of 6.9 to 7.1 and no salinity was detected so these data were not used. For each parameter, transfer functions were generated for each lake with a significant number of samples (>20; Greenhill, Oromocto, and Yoho) and for all SWI samples combined.

Multiple regression is considered one of the more robust techniques because it has more constraints on the data used (Hair et al., 1998). Several tests and corrections required before using the multiple regression procedure were for: multicollinearity, normality (skewness and kurtosis), linearity, and homoscedasticity (Hair et al., 1998; Jobson, 1991).

Multicollinearity is the state in which there are large correlations between explanatory variables (Jobson, 1991), in this case the arcellacean proxies. While R-mode cluster analysis can detect this, the best way to quantitatively identify multicollinear pairs or groups is to generate a correlation matrix, which can be done in SPSS 10 (Appendix I). This was performed with the multiple regression function by setting one proxy as the independent variable and all others as dependent variables and then running the regression. This must be done with each proxy variable versus all others in order to construct the matrix.

When the fractional abundances of a pair of variables have a high two-way correlation (R^2 approaching 1), then the pair is said to have a low tolerance ($= 1 - R^2$), which is the standard expression for multicollinearity. It must be stressed that this high correlation must be two-way to be considered multicollinear, in other words proxy A must covary by the same amount as proxy B, as well as the other way around. One variable could very well be present in only a handful of samples and covary closely with another which is present in all samples, but this second ubiquitous variable will not

covary with the first over the entire breadth of its distribution. This latter case is not a true collinear pair.

Tests for normality are conducted by examining the skewness and kurtosis of the distributions of all data. Skewness is the measure of how off-centre the highest point of the distribution curve is found to be. This can be corrected by employing a natural logarithm (ln) or exponent function of the data. Kurtosis is the amplitude of the highest part of the distribution histogram and can also be corrected using the same techniques. While a perfect normal distribution is not a firm requirement for multiple regression, it does facilitate a more parsimonious regression result. The assumption of a linear relationship between proxies and parameters is also an important consideration as the multiple regression methodology assumes this in its calculations. If this is not the case, they can be corrected with either natural logarithm or exponent functions (Hair et al., 1998; Jobsen, 1991).

If error variance is relatively equal over the range of the values in a set of data, it is said to exhibit homoscedasticity. This is desirable as it will improve the efficacy of multiple regression calculations. Unfortunately, areas of high error variance over the distribution (heteroscedasticity) cannot be corrected as they are products of the sample size fraction. The calculation used to assess the associated error for a 95% confidence interval is shown below (Patterson and Fishbein, 1989) and the results are found in Appendix J:

$$e_{x_i} = 1.96 \cdot \sqrt{\frac{x_i \cdot (1 - x_i)}{N}}$$

(Equation 3)

where:

- N is the total number of counts per sample
- x_i is the fractional abundance of the i^{th} taxon

Transfer functions were generated for each environmental parameter for all SWI data combined as well as for Greenhill, Oromocto, and Yoho lakes individually. As well, each of these procedures was done for three types of data: 1. fractional abundance data that had two taxa grouped (*Diffflugia oblonga* “glans” and *D. oblonga* “spinosa”) based on comparative R-mode cluster analysis; 2. fractional abundance data that had five taxa grouped based on multicollinearity calculations (*Diffflugia oblonga* “glans”, *D. oblonga* “spinosa”, *D. oblonga* “linearis”, *D. protaeiformis* “claviformis”, and *Centropyxis constricta*); and 3. principal components. The results of all three approaches were compared and examined.

Figure 3.1

Dates derived from the decay curve of ^{210}Pb (half-life=22.26 years). The Constant Rate of Supply (CRS) of ^{210}Pb input was assumed.

Figure 3.1

Table 3.1

Localities and sampling types. SWI = sediment-water interface sample. TOC = total organic carbon analysis samples. All TOC samples were taken from selected SWI samples.

Table 3.1

Lake	Area (Ha)	Productivity	SWI	Livingstone cores ¹	Freeze core ¹	TOC SWI	TOC Cores
Frog	22.02	v. eutrophic	2	1 (note ² /23)	1 (22/0)	-	2
Greenhill	25.78	v. eutrophic	24	1 (21/28)	-	4	5
McAdam	354.4	oligotrophic	7	-	-	2	
Oromocto	4759	oligotrophic	33	OR2 (6/4) OR3 (8/26) OR4 (2/29)		10	1
Yoho	108.1	eutrophic	29			6	

¹ numbers in parentheses indicates number of core subsamples (arcellaceans present/barren)

² faunally-rich top portion unusable; supplemented with the freeze core

Table 3.2

Total organic content (TOC) analysis results expressed as a percentage of dry weight.

TOC analysis was performed at Areco Canada using a LECO TC/IC analyzer which distinguishes between the organic and inorganic carbon fraction.

Table 3.2

Sample	%TOC	Sample	%TOC
FRC20	13.8	ORS12	4.72
FRC120	14.5	ORS15	0.47
GRC40	15	ORS20	6.29
GRC130	14.8	ORS22	2.07
GRC140	8.4	ORS24	3.16
GRC170	14.3	ORS27	1.36
GRC180	12	ORS29	5.6
GRS3	12.4	ORS31	6
GRS5	17.6	ORS35	4.99
GRS15	16.8	YO12	2.22
GRS22	13.6	YO15	7.36
ML1	28.9	YO21	6.15
ML3	22.5	YO24	0.84
OR3-124	1.4	YO27	3.82
ORS8	2.31	YO8	6.61

Method detection limit=0.02

Table 3.3

Calibrated radiocarbon dates. AMS ^{14}C dating was performed at Isotrace at the University of Toronto.

Table 3.3

Lake	Depth	Sample	Lab	Date	error
		Identification	Number		
Frog	119	FRZ119	TO-9832	4900	± 50
Frog	225	FRC225	TO-9697	8490	± 80
Greenhill	91	GRC91	TO-9833	4380	± 50
Greenhill	238	GRC238	TO-9695	7300	± 70
Greenhill	310	GRC310	TO-9696	10990	± 90

Table 3.4

^{210}Pb data used in calculating dates for the more recent 100 years of the sedimentary record. Analysis was performed at GEOTOP at the Université de Québec à Montréal.

Table 3.4

	²¹⁰ Pb dpm/g	±
FRsurface	7.213	0.146
FRZ1	4.5024	0.099
FRZ7	4.6351	0.0979
FRZ13	3.2279	0.0866

	²¹⁰ Pb dpm/g	±
GRsurface	7.1416	0.1416
GR10	10.8706	0.211
GR30	1.7269	0.0564
GR50	1.444	0.051

CHAPTER 4

COMPARATIVE MULTIVARIATE ANALYSIS RESULTS

Investigations into the usage of multivariate statistical analysis techniques in the present study has yielded promising results in relating arcellacean assemblages to environmental parameters. I have previously used the Shannon Diversity Index (SDI) as well as Q- and R-mode clustering as interpretive aids (Dalby et al., 2000; Patterson et al., 2002). Examination of other methodologies such as canonical correlation, principal components analysis, and multiple regression analysis have also proven to be useful, provided that their limitations are properly understood.

Ultimately, stepwise multiple regression used in conjunction with the requisite tests and assumptions led to the generation of transfer functions relating environmental parameters with arcellacean proxy data. Many of these data have undergone transformations for various reasons as discussed below. These new data sets are referred by the acronyms UNCORR, RM, MULTI, and PCA (Table 4.1). In many cases, more than one data set representing different transformation models was used with different techniques in order to test their usefulness and validity.

4.1 Removal of taxa with high fractional abundance errors

Some taxa were removed from the data set prior to multivariate analyses because their associated standard errors were often higher than their actual abundances, rendering their values meaningless. The following taxa were not used in any multivariate technique: *Arcella discoides*; *Centropyxis constricta* "greenhillensis"; *Diffugia bidens*; *D. oblonga* "gigantica", *D. oblonga* "lanceolata", *D. oblonga* "tenuis", and *D. oblonga* "triangularis"; *D. urceolata*; and *D. urens*. The percentages of all samples for each taxon that had meaningless amounts (associated error $\geq$ abundance) were recorded for each taxon and given in Table 4.2. Those samples that did not contain any specimens of a particular taxon were not included in this percentage calculation. Those taxa which had meaningless fractional abundance values (associated error $\geq$ abundance) in 60% or more of the samples in which they were found were removed from further analysis. This cutoff was determined by the distribution graph (Figure 4.1) which shows a distributional distinction between: 1. the group of taxa whose associated errors were *greater than* their fractional abundances in each sample for more than 60% of the samples, and 2. the group of taxa whose associated errors were *less than* their fractional abundances in each sample for more than 60% of the samples. Multiple regressions and Q-mode cluster analysis were performed using only the latter group.

4.2 Shannon Diversity Index (SDI)

The SDI was not used exclusively as a rough guide of diversity as in previous work (Dalby et al. 2000, Patterson et al., 2002), but as a separate proxy variable. This was found to be a justifiable usage because canonical correlation analysis (section 4.6)

showed a significant relationship between SDI and other environmental parameters. Additionally, SDI was often chosen as an explanatory variable in transfer functions by multiple regression analyses (section 4.7) which only include those variables that have strong explanatory properties.

A potential problem exists with the taxonomic fractional abundance data transformations (Table 4.1). As the SDI is calculated based on these (Equation 1), its values would naturally change if certain proxy data are combined, as the lumping of taxa results in a lower diversity score. Different SDI scores were calculated for the UNCORR, RM, and MULTI data sets (Appendix D) and their distributions are shown in Figure 4.2. All three score sets followed the same distributional pattern even if some values were slightly different at the upper end of the scale. Experiments using only one SDI calculation with the different transformational data sets found that there was a negligible difference for those transfer functions that utilized SDI as an explanatory variable.

4.3 Cluster analysis

R-mode cluster analysis results (Appendix E) revealed that the differentiation of some morphologically diverse taxa into distinct strains was valid as strains from the same species would not cluster together, with the exception of *Diffugia oblonga* "glans" and *Diffugia oblonga* "spinosa", which were subsequently combined. These relationships are expressed graphically with the use of dendrograms (Appendix E, Part 1) and with

numerical data from proximity matrices (Appendix E, Part 2). While Q-mode cluster analysis was also performed for all the above, these results (Appendix F) are presented and discussed in Chapters 6 and 7 as they are examined in more detail there.

R-mode cluster dendrograms and proximity matrices were generated for the following data sets: all samples combined; sediment-water interface (SWI) samples for each individual lake; all core subsamples for each lake; and for all samples (SWI and cores) for each individual lake. Visual examination of all the dendrograms revealed that some of the arbitrary taxonomic strains would sometimes cluster together, while in other cases they would not.

A comparison of the Euclidean distances at which two taxa split (branching points) was useful in determining which ones should be combined in further analyses (Appendix E, Part 3). In every dendrogram, *Diffflugia oblonga* "glans" and *D. oblonga* "spinosa" clustered together having a negligible (≤ 1) Euclidean distance. This was further supported by the low standard deviation of all Euclidean distances of the branching points for the pair. Thus, a new data set of taxonomic fractional abundances, labeled RM, (Table 4.1) was created that combines the two taxa (subsequently referred to as *D. oblonga* "glans-spinosa"). This was then used in subsequent analyses alongside the uncorrected (UNCORR), multicollinear combined (MULTI-see below) and principal components (PCA) data sets.

4.4 Principal components analysis (PCA)

PCA generated six new components that acted as new variables in the data set labeled PCA. The PCA values were calculated from the summed products of the taxonomic abundance data and the coefficients supplied by the principal components analysis (Equation 3; Appendix H). Table 4.3 lists the various abbreviated codes for different arcellacean taxa, which are frequently used as variable subscripts in these and subsequent equations, as well as abbreviated forms of the taxa in other tables and figures.

4.5 Data examination, preparation, and transformation for multiple regression

Multiple regression, and to a lesser extent canonical correlation, require assumptions of normally distributed data and the minimizing of multicollinearity wherever possible (Hair et al., 1998). However, real data are rarely normally distributed in the sense that they are discrete and bounded, so in practice what is required is that the data approximates a normal distribution (Jobsen 1991).

The standard measurements for a normal distribution, skewness and kurtosis, were calculated along with their Z scores (Equations 4 and 5; Table 4.4a). The Z scores, which are standard expressions of these properties, transform skewness and kurtosis data into more easily interpreted information and are given below:

$$z_{\text{skewness}} = \frac{\text{skewness}}{\sqrt{\frac{6}{N}}}$$

(Equation 4)

$$z_{\text{kurtosis}} = \frac{\text{kurtosis}}{\sqrt{\frac{24}{N}}}$$

(Equation 5)

where:

- N is the total number of samples containing the taxon being measured

Ideally, a normal distribution should have a z_{skewness} and z_{kurtosis} of zero, and large deviations from these indicate non-normality. In practical terms, acceptable z_{skewness} and z_{kurtosis} values should lie between 2.5 and -2.5 for small sample sizes (Hair et al., 1998). While ten or fewer observations per sample constitutes a small sample size according to Tabachnick and Fidell (1996) and Hair et al. (1998), all the samples in this study had far more than this, therefore having a Z score fall within the ± 2.5 range is not a strict requirement (Table 4.4; Appendix B).

As normality is an important assumption when attempting to mathematically establish linear relationships as with multiple regression analysis (Hair et al., 1998), the distributions of all taxonomic fractional abundances, SDI scores, and parametric data were examined for this property. Among the environmental parameters, only specimen density (S) exhibited a non-normal distribution, as well as a nonlinear relationship to

taxonomic groupings, both of which were corrected using a natural log transformation. Because the natural log of specimen density achieved much better results with multiple regression analysis in all instances, $\ln(S)$ is used hereafter as the expression for specimen density.

The taxonomic data were then tested for normality and most had Z values outside the ± 2.5 normality zone. While skewness and kurtosis Z scores are an exact method for the determination of normality, a quicker way is simply to sort the values for each variable from lowest to highest, to plot them on a graph, and then to examine their distribution visually. Simplified distribution graphs are presented in Figure 4.3: Figure 4.3a shows a linear distribution (normal) that requires no transformation; Figure 4.3b shows a non-normal distribution that requires an exponential function (exp) transformation converting it to the graph from Figure 4.3a; Figure 4.3c shows another non-normal distribution that should be transformed using a natural log function ($\ln$).

As most taxa had Z values outside the ± 2.5 normality zone, the appropriate transformations were executed using the graphical method outlined above. *Centropyxis aculeata* had a distribution resembling Figure 4.3b, so was modified accordingly. Its Z scores for both the uncorrected and transformed nevertheless fell within the ± 2.5 threshold. *Pontigulasia compressa* and *Diffflugia oblonga* "oblonga" required no transformation as their distributions resembled that shown in Figure 4.3a. All other taxa had non-normal distributions resembling Figure 4.3c, so they underwent a natural log transformation. Skewness and kurtosis values were then recalculated along with their Z

scores for all transformed taxa to confirm their normality (Table 4.4b). While some still lay outside the ± 2.5 threshold, their Z values were much closer to zero after the transformation. As these data are not considered "small sample sizes" as explained above, this was not considered overly problematic. Nevertheless, their distributions were rendered more normal. The excluded taxa described in Section 4.1 did have large deviations from normality and this can be explained by their low occurrences and low abundances. This was not a concern as they were excluded from further statistical procedures.

Finally, results from multicollinearity diagnostics suggested the combination of several taxa into a new group subsequently labeled "MULTI" (Table 4.1; Appendix I). While a Variable Inflation Factor (VIF) of 10 is generally used as standard cutoff value (see Appendix I) denoting multicollinearity, it is not a strict boundary as researchers in different fields will often experiment with different values (Hair et al., 1998). A VIF cutoff of 10, however, did not reveal any collinear pairs or groupings in the arcellacean data beyond those identified using R-mode cluster analysis (*Diffflugia oblonga* "glans-spinosa"). After manipulating the VIF, it was found that pairs started to converge at a value of around 6. While few pairs emerged at 6, about a quarter of the taxa clustered together at a value of 5. A VIF of 5.5 was eventually chosen which grouped *Centropyxis constricta* "constricta", *C. kahli*, *Diffflugia protaeiformis* "claviformis", and *D. oblonga* strains "glans", "linearis", and "spinosa". This new artificial variable combining these taxa was then included in a new data set labeled MULTI and used in subsequent

techniques alongside the RM and PCA sets in order to compare their usefulness (Table 4.1).

4.6 Canonical correlation

Canonical correlation analysis was used to detect significant mathematical relationships between the environmental parameters and the proxy data and was performed for the RM, MULTI, and PCA data sets. High correlations for all three sets were found (Table 4.5; Appendix K), implying that multiple regression procedures can therefore proceed.

While canonical correlation coefficient data can be used in generating predictive transfer functions, this is not recommended because their reliability is questionable and often is a result of overfitting (Hair et al., 1998). Nevertheless, this procedure was tested with the data from the present study, resulting in functions with very high correlations between arcellacean proxy data and environmental data, suggesting overfitting. These correlations (best fit expressions) are similar to the R^2 values generated by multiple regression analysis (see below). Therefore, canonical correlation was only used here to establish that there were sufficient correlations to proceed to other, more robust, techniques.

4.7 Stepwise multiple regression

Stepwise multiple regression was performed for the regular and normalized UNCRR, RM, and MULTI data as well as for the PCA data sets attempting to relate them to the environmental parameters. Data generated by this method included the R, R² (measure of goodness of fit) and R'² (adjusted measure of goodness of fit) scores, and the coefficients used in transfer function equations. The adjusted goodness of fit expression (R'²) was particularly useful as it takes into account the number of explanatory values, a greater number of which can lead to overfitting (Jobson 1991). All transfer function equations follow this standard format:

$$P_{\text{group}}^{\text{model}} = \beta_0 + \sum_{i=1}^N \beta_i \cdot x_i$$

(Equation 6)

where:

- **P** represents the environmental parameter predicted by the function (see Table 4.6 for a list of parametric variables, superscripts, and subscripts)
- the model superscript refers to the manner in which the data have been manipulated (normalized; taxa combined, etc.; Table 4.6)
- the group subscript refers to the group of samples for which the function applies (a function for a single lake, all lakes combined, etc.; Table 4.6)
- β_0 represents the constant generated by the multiple regression
- β_i represents the i^{th} coefficient generated by the multiple regression
- x_i represents the fractional abundance of the i^{th} taxa in the summation

Multiple regression transfer functions were generated for all possible combinations of data set models, groups, and regression models (stepwise and backward elimination). These data set models include regular and normalized data of the UNCRR, RM, MULTI, and PCA data sets and were done for the following groups of samples: all lake samples combined, individual lakes, and specimen density groupings. The specimen density groupings were created because $\ln(S)$ appeared to be a stronger factor than dissolved oxygen, temperature, and depth, so to minimize its "signal", three new groups of data were created, S_{high} , S_{med} , and S_{low} (Table 4.6). The S_{low} group did not reveal any significant relationships with dissolved oxygen, temperature, or depth. The S_{high} , S_{med} did reveal significant relationships, but their R^2 values were not as high as those for individual lakes encompassing all $\ln(S)$ groups.

Two different multiple regression procedures were performed on all of the above: stepwise and backward. Stepwise multiple regression selects the variable with the best predictive correlation with the parameter being examined. It then adds the next best predictor as long as it increases the combined explanatory power and that the partial correlation coefficients are statistically significant (Hair et al., 1998). Backward multiple regression, or backward elimination, starts with all variables and then eliminates those with little explanatory power one at a time.

All multiple regression results for all data sets, models, and methods (normalized and uncorrected) are given in Appendix L. These include all the constants and coefficients for the transfer functions (β_0 and β_i), R , R^2 , and R'^2 , their tests for

significance and standard errors. Each transfer function has been numbered for ease of referral hereafter.

Figure 4.1

Distribution curve showing the percentages of samples for each taxon whose associated errors per sample were less than their fractional abundances (associated standard error $\geq$ abundance). The taxa are plotted along the x-axis from left to right are: *Centropyxis aculeata*, *Pontigulasia compressa*, *Diffflugia oblonga* "oblonga", *Centropyxis constricta* "constricta", *Lagenodiffflugia vas*, *Cucurbitella tricusps*, *D. protaeiformis* "claviformis", *D. oblonga* "spinosa", *Nebella galeata*, *D. oblonga* "linearis", *Lesquereusia modesta*, *D. oblonga* "glans", *Diffflugia corona*, *Centropyxis kahli*, *D. protaeiformis* "amphoralis", *Diffflugia urens*, *D. oblonga* "tenuis", *D. urceolata*, *Arcella discoides*, *D. oblonga* "triangularis", *D. oblonga* "gigantica", *Diffflugia bidens*, *Centropyxis constricta* "greenhillensis", *D. oblonga* "lanceolata".

Figure 4.1

Figure 4.2

Shannon Diversity Index (SDI) distribution comparisons. SDI values generated from the UNCORR, RM, and MULTI data sets showed only minor visible differences for the highest values.

Figure 4.3

Simplified distribution graph models for taxonomic fractional abundances from lowest to highest. These are used to determine what kind of transformation is required to achieve normality. 4.3a linear distribution (normal) requiring no transformation. 4.3b non-normal distribution requiring an exponential function (exp) transformation. 4.3c non-normal distribution requiring a natural log function (ln) transformation.

Figure 4.3

Table 4.1

List of acronyms used to describe the different data set transformations.

Table 4.1

Model	Explanation
UNCORR	Uncorrected taxonomic fractional abundance data
RM	Corrected for R-mode clustering, combining <i>Diffflugia oblonga</i> "glans" and "spinosa"
MULTI	Corrected for multicollinearity, combining <i>Centropyxis constricta</i> "constricta", <i>Centropyxis kahli</i> , <i>Diffflugia protaeiformis</i> "claviformis", and <i>Diffflugia oblonga</i> "glans", "spinosa", and "linearis"
PC	data generated by principal components analysis

Table 4.2

Percentage calculations of samples per taxa that had meaningless fractional abundance values (associated standard error $\geq$ abundance).

Table 4.2

Taxon	% of samples error<abun.
<i>Centropyxis aculeata</i>	100
<i>Pontigulasia compressa</i>	85.71
<i>D. oblonga</i> "oblonga"	81.82
<i>Centropyxis constricta</i> "constricta"	78.08
<i>Lagenodifflugia vas</i>	77.78
<i>Cucurbitella tricuspidis</i>	74.70
<i>D. protaeiformis</i> "claviformis"	73.85
<i>D. oblonga</i> "spinosa"	69.86
<i>Nebella galeata</i>	68.75
<i>D. oblonga</i> "linearis"	68.18
<i>Lesquereusia modesta</i>	66.20
<i>D. oblonga</i> "glans"	63.64
<i>Diffugia corona</i>	57.75
<i>Centropyxis kahli</i>	52.50
<i>D. protaeiformis</i> "amphoralis"	41.67
<i>Diffugia urens</i>	36.36
<i>D. oblonga</i> "tenuis"	33.33
<i>D. urceolata</i>	33.33
<i>Arcella discoides</i>	32.14
<i>D. oblonga</i> "triangularis"	27.78
<i>D. oblonga</i> "gigantica"	27.27
<i>Diffugia bidens</i>	25.00
<i>Centropyxis constricta</i> "greenhillensis"	0
<i>D. oblonga</i> "lanceolata"	0

Table 4.3

Simplified taxonomic codes used in transfer function equation subscripts and elsewhere.

Table 4.3

Adis	=	<i>Arcella discoides</i>
Ca	=	<i>Centropyxis aculeata</i>
Ccg	=	<i>C. constricta</i> "greenhillensis"
Ccc	=	<i>C. constricta</i> "constricta"
Ctri	=	<i>Cucurbitella tricuspis</i>
Ckal	=	<i>Centropyxis kahli</i>
Dbid	=	<i>Diffugia bidens</i>
Dcor	=	<i>Diffugia corona</i>
Dogig	=	<i>Diffugia oblonga</i> "gigantica"
Dogl	=	<i>D. oblonga</i> "glans"
Dola	=	<i>D. oblonga</i> "lanceolata"
Doli	=	<i>D. oblonga</i> "linearis"
Doo	=	<i>D. oblonga</i> "oblonga"
Dos	=	<i>D. oblonga</i> "spinosa"
Doten	=	<i>D. oblonga</i> "tenuis"
Dotri	=	<i>D. oblonga</i> "triangularis"
Dpam	=	<i>D. protaeiformis</i> "amphoralis"
Dpc	=	<i>D. protaeiformis</i> "claviformis"
Durn	=	<i>Diffugia urens</i>
Durc	=	<i>D. urceolata</i> "urceolata"
Lvas	=	<i>Lagenodiffugia vas</i>
Lmod	=	<i>Lesquereusia modesta</i>
Ngal	=	<i>Nebella galeata</i>
Pcomp	=	<i>Pontigulasia compressa</i>
Dogs	=	combines Dogl and Dos
Multi	=	combines Ccc, Ckal, Dogl, Doli, Dos, and Dpc
sdi	=	normalized SDI

Table 4.4

Skewness, z_{skewness} , kurtosis, and z_{kurtosis} values used to determine degree of normality. 4.4a
before transformation. 4.4b after transformation.

Table 4.4

A. Before Transformation

N	Ca	Ctri	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Ngal	Pcomp	Dogl	Dogs	Ccc	Ckal	Doli	Dpc	multi
	91	51	47	65	42	10	62	58	14	79	34	52	41	24	16	37	68
Skewness	-0.363	1.709	1.869	1.735	1.617	5.896	1.158	4.93	6.246	1.066	3.158	1.964	2.093	4.799	3.42	2.145	1.555
±	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253
Z skewness	-1.4137	4.9825	5.231	5.7106	4.2782	7.6117	3.7224	15.328	9.5409	3.8681	7.5175	5.7819	5.4712	9.598	5.5848	5.3266	5.2349
±	0.9853	0.7376	0.7081	0.8327	0.6694	0.3266	0.8133	0.7866	0.3865	0.918	0.6023	0.7448	0.6614	0.506	0.4131	0.6283	0.6517
within ±2.5?	yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kurtosis	-0.627	2.527	2.747	4.178	2.199	36.226	0.301	29.899	43.529	0.212	10.946	4.169	4.546	29.345	11.954	4.413	1.953
±	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Z kurtosis	-1.2209	3.6837	3.8442	6.8757	2.909	23.384	0.4838	46.48	33.246	0.3846	13.028	6.1366	5.9418	29.345	9.7604	5.4794	3.2874
±	0.9736	0.7289	0.6997	0.8229	0.6614	0.3227	0.8036	0.7773	0.3819	0.9071	0.5951	0.736	0.6535	0.5	0.4082	0.6208	0.8416
within ±2.5?	yes	-	-	-	-	-	yes	-	-	yes	-	-	-	-	-	-	-

B. After Transformation

N	Ca	Ctri	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Ngal	Pcomp	Dogl	Dogs	Ccc	Ckal	Doli	Dpc	multi
	91	51	47	65	42	10	62	58	14	79	34	52	41	24	16	37	68
Skewness	0.011	0.158	0.431	-0.535	0.489	4.064	-0.243	0.298	2.466	-1.006	1.019	0.161	0.51	1.624	2.188	0.713	-0.528
±	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253	0.253
Z skewness	0.0428	0.4606	1.2063	-1.7609	1.2938	5.2466	-0.7811	0.9265	3.7669	-3.6504	2.4257	0.474	1.3332	3.248	3.573	1.7706	-1.7775
±	0.9853	0.7376	0.7081	0.8327	0.6694	0.3266	0.8133	0.7866	0.3865	0.918	0.6023	0.7448	0.6614	0.506	0.4131	0.6283	0.6517
within ±2.5?	yes	yes	yes	yes	yes	-	yes	yes	-	-	yes	yes	yes	-	-	yes	yes
Kurtosis	-0.738	-1.669	-1.399	-1.344	-1.498	15.992	-1.564	-1.2	5.093	-0.164	-0.43	-1.587	-1.471	1.228	3.295	-1.212	-1.153
±	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Z kurtosis	-1.437	-2.433	-1.9578	-2.2118	-1.9817	10.323	-2.5138	-1.8655	3.8896	-0.2975	-0.5118	-2.336	-1.9226	1.228	2.6904	-1.5049	-1.9408
±	0.9736	0.7289	0.6997	0.8229	0.6614	0.3227	0.8036	0.7773	0.3819	0.9071	0.5951	0.736	0.6535	0.5	0.4082	0.6208	0.8416
within ±2.5?	yes	yes	yes	yes	yes	-	yes	yes	-	yes	yes	yes	yes	yes	-	yes	yes

Table 4.5

Canonical correlation results for the different data sets. The CC score is similar to the goodness of fit calculation (R^2) for multiple regression analysis. The correlation numbers represent individual canonical variates (eigenvalues).

Table 4.5

UNCORR		unnormalized
Correlation	CC score	Significance ¹
1	0.872	0
2	0.704	0
3	0.504	0.069
4	0.432	0.225

UNCORR		normalized
Correlation	CC score	Significance ¹
1	0.901	0
2	0.663	0
3	0.563	0.013
4	0.44	0.195

RM		unnormalized
Correlation	CC score	Significance ¹
1	0.869	0
2	0.7	0
3	0.497	0.05
4	0.427	0.186

RM		normalized
Correlation	CC score	Significance ¹
1	0.895	0
2	0.665	0
3	0.563	0.007
4	0.431	0.172

MULTI		unnormalized
Correlation	CC score	Significance ¹
1	0.866	0
2	0.645	0
3	0.443	0.027
4	0.387	0.101

MULTI		normalized
Correlation	CC score	Significance ¹
1	0.887	0
2	0.563	0
3	0.447	0.019
4	0.401	0.073

PCA		unnormalized
Correlation	CC score	Significance ¹
1	0.848	0
2	0.463	0
3	0.291	0.028
4	0.194	0.071

PCA		normalized
Correlation	CC score	Significance ¹
1	0.848	0
2	0.531	0
3	0.329	0.017
4	0.162	0.131

¹ test for remaining correlations being zero

Table 4.6

List of acronyms. 4.6a environmental parameters. 4.6b different sample groupings.

Table 4.6

<u>Parameters</u>	
TOC	- Total Organic Carbon
S	- specimen density (specimens/cm ³)
ln(S)	- natural log of S
O	- dissolved oxygen (mg/L)
T	- temperature (°C)
D	- depth (m)
<u>Group</u>	
GR	- all Greenhill Lake SWI samples
GRML	- Greenhill and McAdam lake SWI samples
OR	- all Oromocto Lake SWI samples
YO	- all Yoho Lake SWI samples
NBall	- all SWI samples in this study (Appendix J)
S _{high}	- all SWI samples in the high specimen density group ($\ln(S) > 3.5$)
S _{med}	- all SWI samples in the medium specimen density group ($1.5 < \ln(S) < 3.5$)
S _{low}	- all SWI samples in the low specimen density group ($\ln(S) < 1.5$)

CHAPTER 5

COMPARATIVE MULTIVARIATE ANALYSIS DISCUSSION

Modern computers have provided many new opportunities for processing large amounts of data in significant ways. Arcellacean, and in a broader sense, micropaleontological research began as purely descriptive, qualitative field. Recent decades have seen more and more quantification in these areas as the tools became more available. Exploration of the data available for this project using several multivariate statistical techniques produced significant results, and more importantly allowed the development of new and useful interpretive tools for arcellacean research.

5.1 Stepwise multiple regression versus backward elimination

Because stepwise multiple regression starts with one variable (the one with the best predictive correlation) and then only adds subsequent variables that increase the combined explanatory power of the set, generally fewer variables are added to the transfer function than with backward elimination (Hair et al., 1998). There is an important advantage from using stepwise over backward elimination and this deals with the problem of overfitting (Hair et al., 1998). Backward elimination will often include many more explanatory variables than with the former method, but many of those partial correlations may be partly coincidental, especially if they are not large. Multiple

regression analysis will attempt to balance an equation with the parameter in question on one side, and with a set of proxy variables with their coefficients and constants on the other. If a large number of variables with relatively low partial correlations (with the parameter) are used, the procedure may produce a better combined correlation than actually exists in reality. This is because this method is attempting to balance the equation in order to produce the best results (Hair et al., 1998). This problem is minimized when fewer variables are used.

Backward elimination often produced suspiciously high R^2 values, or best fit expressions. Such high values are suspect because a transfer function is based on proxy data which are affected not only by the parameter being examined, but by many others as well. As a result, a given assemblage of proxies will never explain 100% of the relationship between the assemblage and a single parameter, unless through the unlikely circumstance that only that parameter is affecting it.

5.2 Proxies and parameters

Before proceeding further, it would be useful to examine the proxy and parametric variables used. Arcellacean taxonomic fractional abundance (proxy) data were used not only to further support the initial assumption that assemblage composition is a direct and indirect result of environmental parametric forcing factors, but to assess if these relationships could be expressed statistically, thus increasing their utility. That

significant relationships were discriminated by multiple regression analysis supports this initial assumption.

The Shannon Diversity Index (SDI), previously used only as a rough measure of diversity (Dalby et al., 2000; Patterson et al., 2002), was included as a unique variable in taxonomic data sets to see what would occur in multiple regression analysis.

Serendipitously, SDI was found to be one of the more powerful explanatory variables.

What this result suggests is that taxonomic diversity itself is a result of different environmental parameters and just as useful, if not more so, than any individual taxon.

Consequently, SDI, in part, can be used to mathematically predict certain environmental factors.

The SDI is calculated based on all the taxonomic fractional abundances for a sample. This includes data not only for abundant taxa, but also for those present in small or even negligible numbers. These would include the taxa which were excluded from further statistical analyses, as described in Chapter 4, Section 4.1. A taxon with a calculated error greater than itself theoretically implies that specimens of that taxon may not have been found at all if another aliquot of the same sample had been selected for data collection. A further implication of this is that specimens of other taxa which may well have been present in the particular sample may not have been detected because none were present in the subsample arbitrarily chosen for analysis (see Chapter 3). Thus, the *number* of taxa detected with insignificant populations may very well be consistent. In other words, the taxonomic identifications of low-occurrence taxa may vary somewhat

depending on the aliquot selected, but the *number* of insignificant species found may be constant, and this number may contribute to the expression of diversity detected by the SDI.

Specimen density and its natural logarithm $\ln(S)$ were treated as environmental parameters for two purposes. The first was to examine if and how the density of specimens per unit of sediment affected the arcellacean assemblages. A significant relationship was indeed found to exist between the assemblages and $\ln(S)$ as demonstrated by transfer functions TF126, TF135, and TF3 (Appendix L). This could also mean that $\ln(S)$ is an effect of the nature of the assemblage as well as a factor partially controlling it, as different species may outcompete each other in a densely populated area. The most likely conclusion is that assemblage composition and $\ln(S)$ influence each other concurrently and in this light $\ln(S)$ can be considered both a forcing factor and an effect.

The second reason for treating $\ln(S)$ as a parameter is that it appears to be a rough reflection of total organic carbon (TOC). Figure 5.1 shows a plot of TOC versus $\ln(S)$, showing a linear relationship between the two. This is not surprising as arcellaceans are found preferentially in high organic content sediments such as algal gyttja (Reinhardt et al., 1998). Ideally, TOC data should be collected as well, because it had higher correlations with arcellacean assemblages than $\ln(S)$ as shown with transfer functions TF286, TF279, and TF282. Unfortunately, only 30 samples were available for analysis because all but those 30 were treated with alcohol to inhibit decay. Nevertheless,

multiple regression analysis provided a solution to this as the transfer functions derived for TOC were then used to calculate predicted TOC values for those samples for which TOC analysis was not performed. These new values were used in other parts of this study in particular for the interpretation of Q-mode clusters described in Chapters 6-9.

5.3 Data transformations

There were two main varieties of data transformations examined in this study: 1. the different modes of combining taxa (UNCORR, RM, MULTI and PCA); and 2. the non-normalized and normalized data sets.

Principal components developed by PCA were used to generate transfer functions for all parameters. In every case, PCA R^2 and R'^2 (best fit) values were consistently less than those performed with regular transformed taxonomic data (UNCORR, RM and MULTI). This is not surprising as there is a loss of information whenever data are reduced in this manner (Hair et al., 1998). For this reason, the transfer functions developed with principal components were not used hereafter. Because of this lack of utility, at least for the group being studied here, some researchers debate the appropriateness of this technique for further predictive procedures, deeming it useful only for exploratory and descriptive purposes (Hair et al., 1998). While PCA was an interesting exercise, other methods produced better results, so PCA transfer functions (TF291-TF394; Appendix L) were not used for further interpretation.

Comparison of the UNCRR, RM, and MULTI data sets suggested the subsequent use of the RM results for further interpretation. R^2 (best fit) values were for the most part higher for RM modified transfer functions, although in many cases they were only slightly higher than those on the UNCRR data set. The MULTI data set-based transfer functions consistently achieved lower values of R^2 and thus were not used in subsequent interpretations. This is not surprising as the Variable Inflation Factor (VIF) needed to be as low as 5.5 before any taxa were combined beyond those detected by R-mode clustering techniques. These results support the suggestion by many researchers that a VIF cutoff no lower than 10 be used in multicollinearity diagnostics (Hair et al., 1998).

5.4 Relationships between proxies and parameters using multiple regression analysis

Stepwise multiple regression analysis results suggest that TOC is the strongest forcing factor in the makeup of arcellacean assemblages in this study, followed by $\ln(S)$, dissolved oxygen and temperature for those lakes which are thermally stratified (Greenhill and McAdam), and then depth. These relationships are expressed graphically in Figures 5.2-5.6, where predicted versus actual amounts are plotted against each other. Ideally, this should result in a straight line at a 45 degree angle on the graph, as predicted amounts of a parameter should vary in the same manner as the actual amount. The transfer functions shown in Figures 5.2-5.6 represent those generated by stepwise multiple regression with the highest adjusted best fit expressions (R^2) for each parameter, in other words having the strongest explanatory power, as well as those with the next few

highest R^2 values for comparison. Figure 5.2a-c shows, as expected, predicted TOC versus actual TOC plotting more or less in a straight 45° line, while $\ln(S)$ has a thicker zone perpendicular to its trend, indicating a greater error (Figure 5.3). This may very well be the result of only having 30 samples for TOC calculations and 91 for $\ln(S)$.

Figures 5.4 and 5.5 (dissolved oxygen and temperature) show parametric values for most samples, predicted and actual, of high levels (surficial water values) of the parameter in question. This reflects the distribution of samples as they were collected in the field, as most were recovered from sediment found above the oxy-thermocline. Nevertheless, significant relationships between some taxa and these parameters existed above and below the oxy-thermocline, enabling the creation of predictive transfer functions for these values. Transfer functions that were developed for depth were not very useful as their R^2 values were low (Figure 5.6). This is most likely a product of the effects of the temperature and dissolved oxygen differentials in stratified lakes. These vary with depth and have stronger correlations with the arcellacean assemblages, and are probably overpowering any effect that depth by itself has on the assemblages. In fact, Figure 5.6b shows the transfer function developed for Oromocto Lake (TF199), which is unstratified, and it only achieved an R^2 value of 0.5, indicating that water depth is not a strong environmental factor. The higher R^2 value for the Greenhill Lake depth transfer function (TF161; Figure 5.6a) may well be a result of parametric collinearity among depth, dissolved oxygen, and temperature.

There are implications for paleoenvironmental reconstruction based on the different strengths of these relationships. TOC and $\ln(S)$ affect the assemblages most strongly, and this may mask other relationships that one may wish to use in assessing past climate change. Unfortunately, these relationships seem to work best when calculated based on data from individual lakes. This suggests that unless transfer functions are based on a much larger data set covering many different environments in different climatic zones, they aren't very useful beyond the individual lake.

In previous work, certain taxa have been identified as indicator species for certain environmental conditions (for example: Collins et al., 1990; Kumar and Patterson, 2000). In fact, certain taxa were found to be used consistently as explanatory variables for the same parameter using different multiple regression techniques, and these are given in Table 5.1. Although it is often useful in environmental interpretations to identify individual indicator species, the fact remains that groups of differently weighted taxa were used to create each transfer function. Any interpretation based on an individual taxon is not as strong as examining it within the context of an assemblage, as the assemblage is the true manifestation of environmental effects and this is supported by the different transfer functions that have been developed here. The taxa listed in Table 5.1 are presented simply to show that many of the same individual taxa are invoked in transfer functions regardless of the data transformation model used. This implies that each taxon is indeed being affected individually by each particular parameter.

Based on the examination of the transfer function results above, the best approach was found to be the following: 1. to use stepwise multiple regression; 2. to transform the taxonomic and parametric data, where appropriate, into normalized values; 3. to use the RM data set that includes the combined taxa (*Diffflugia oblonga* "glans" and *D. oblonga* "spinosa") based on R-mode clustering and multicollinearity diagnostics and using the latter with a Variable Inflation Factor (VIF) cutoff of 10; and 4. to avoid using Principal Components Analysis (PCA) as it was found to have less predictive power in multiple regressions than using taxonomic data that was not reduced in this manner.

Figure 5.1

Plot of TOC values versus specimen density, $\ln(S)$. TOC here is the actual measured data and not those which were inferred via transfer functions. The linear trend illustrates a correlation between the two when the two outliers (empty circles) are disregarded.

Figure 5.1

Figure 5.2

Actual versus inferred TOC for the three strongest transfer functions. Based on selected samples from all lakes in the study.

Figure 5.2

A TOC transfer function 282

B TOC transfer function 279

C TOC transfer function 286

Figure 5.3

Actual versus inferred specimen density, $\ln(S)$, for the three strongest transfer functions.

Based on SWI samples from all lakes in the study.

Figure 5.3

Figure 5.4

Actual versus inferred dissolved oxygen values for the three strongest transfer functions. Transfer Function 159 based on Greenhill Lake samples; Transfer Function 95 based on the high specimen density sample group (S_{high}); Transfer Function 115 based on the medium specimen density sample group (S_{med}). Note that these relationships are poor beyond the first transfer function, and the subsequent graphs are shown for comparison.

Figure 5.4

Figure 5.5

Actual versus inferred temperature values for the four strongest transfer functions. All transfer functions are based on Greenhill Lake samples. Note that these relationships are poor beyond the first transfer function, and the subsequent graphs are shown for comparison.

Figure 5.5

Figure 5.6

Actual versus inferred depth readings for the two strongest transfer functions. Transfer Function 161 based on Greenhill Lake samples; Transfer Function 199 based on Oromocto Lake samples.

A. D transfer function 161

B. transfer function 191

Figure 5.6

Table 5.1

Some of the common indicators invoked as explanatory variables in those transfer functions developed using stepwise multiple regression with significant best fit scores (R^2). Note the presence of *Lesquereusia modesta* indicating shallow water in one lake, but deeper water in another lake. One possible explanation for this discrepancy could be that the transfer functions developed for depth did not have high R^2 values, especially for Oromocto Lake (0.5), and thus are unreliable. It must be stressed, however, that the assemblage is the true expression of a parametric effect.

Table 5.1

Total Organic Carbon (TOC)

<u>High</u>	<u>Low</u>
<i>Diffugia protaeiformis</i> "amphoralis"	<i>Pontigulasia compressa</i>
SDI	

Specimen Density [ln(S)]

<u>High</u>	<u>Low</u>
<i>Centropyxis aculeata</i>	<i>Pontigulasia compressa</i>
SDI	

Dissolved Oxygen

<u>Normal</u>	<u>Disoxic</u>
<i>Diffugia oblonga</i> "glans"	<i>Diffugia protaeiformis</i> "amphoralis"
SDI	<i>Diffugia protaeiformis</i> "claviformis"

Temperature

<u>Normal</u>	<u>Low</u>
<i>Centropyxis aculeata</i>	none
<i>Diffugia oblonga</i> "glans"	
SDI	

Depth

Stratified lake (Greenhill)

<u>Shallow</u>	<u>Deep</u>
<i>Diffugia oblonga</i> "spinosa"	<i>Lesquereusia modesta</i>
<i>Diffugia oblonga</i> "glans"	

Depth

Unstratified Lake (Oromocto)

<u>Shallow</u>	<u>Deep</u>
<i>Lesquereusia modesta</i>	SDI
<i>Pontigulasia compressa</i>	

CHAPTER 6

SEDIMENT-WATER INTERFACE Q-MODE CLUSTER ANALYSIS RESULTS

In addition to the other multivariate techniques performed on sediment-water interface (SWI) samples for Greenhill, Oromocto, and Yoho lakes described in Chapters 4 and 5, Q-mode cluster analysis was also performed. Various Q-mode dendrograms were produced in order to determine the most useful clustering model (Appendix F). To that end, the following comparative approaches were carried out:

1. using normalized and non-normalized taxonomic fractional abundance data for Q-mode dendrogram generation
2. using several different "cutoff" lines for each dendrogram delimiting individual clusters (Appendix F)
3. listing of parametric ranges for each cluster (Tables 6.1-6.4)
4. listing the defining taxa for each cluster (Tables 6.1-6.4)

In previous work, only taxonomic fractional abundance data had been used for cluster analysis (Asioli et al., 1996; Patterson et al., 1996; Reinhardt et al., 1998; Patterson et al., 2002). In addition to this, the normalized taxonomic data generated for multiple regression analyses from Chapters 4 and 5 were also used for Q-mode cluster analysis for comparison in order to assess the usefulness of further data transformation.

One principal difference between the data used for generating Q-mode dendrograms in this study and previous work (Asioli et al., 1996; Patterson et al., 1996; Reinhardt et al., 1998; Patterson et al., 2002) is the number of excluded taxa. In previous work a conservative approach was used in eliminating those taxa whose standard errors were greater than actual fractional abundances *for most samples*. In this study many more were excluded based on approaches used for multiple regression analysis in Chapters 4 and 5. Nine taxa in this study had 60% or more instances of error greater than fractional abundances and were eliminated. These were: *Arcella discoides*; *Centropyxis constricta* "greenhillensis"; *Diffflugia bidens*; *D. oblonga* "gigantica", *D. oblonga* "lanceolata", *D. oblonga* "tenuis", and *D. oblonga* "triangularis"; *D. urceolata*; and *D. urens*. This resulted in slightly lower R^2 scores when using the data sets that excluded the nine taxa in multiple regression analysis, however the excluded taxa had low partial correlations and thus their omission likely reduced overfitting. Additionally, Q-mode dendrograms generated from both types of data (few excluded variables; more excluded variables) showed marked differences in assemblage distribution. One critical difference between the two is that the methodology used in this study generated clusters that correlated much more parsimoniously with the ranges of parametric data, thus confirming that this approach was justified.

The different cut-off lines for each dendrogram delimit distinct clusters to the left of each cutoff (Appendix F). These can be placed at different positions on the dendrogram, changing the number of cutoff clusters. To determine the best placement,

results from up to three cluster models were selected for each dendrogram for comparison.

As taxonomic fractional abundance data were used to generate the dendrograms, the defining taxa and Shannon Diversity Indices (SDI) for each cluster were easily identified from the data presented in Tables 6.1-6.3 (Greenhill, Oromocto, and Yoho lakes) which list the means, standard deviations, and maxima and minima for each taxon, SDI, and environmental parameter. Those defining taxa and descriptive parameters used to distinguish each cluster for all models are presented in Tables 6.4-6.6 (Greenhill, Oromocto, and Yoho lakes). It is important to note that a "high" value of a particular taxon/parameter refers to its relative value within its own range for one particular lake. For example, a relatively high level of *Pontigulasia compressa* in one cluster means that the samples within this cluster have *consistently* high amounts of this taxon compared to other groups of samples (clusters) in the same lake. These "high" amounts may not necessarily correspond to the same designated "high" amounts in another lake, but are used as a relative comparison. It is also important to reiterate that only consistently elevated levels of a particular taxon were noted. Those clusters that have a range of zero to high levels of a particular taxon were not included because even though some samples in that cluster may have high levels, this would not be descriptive of the entire group. To clarify, if all samples of a cluster contained 40-50% *Pontigulasia compressa* this would be a meaningful value, whereas a cluster having 0-60% of the same taxon would not be helpful for interpretation.

Most clusters were found to encompass discrete parametric, taxonomic, and Shannon Diversity Index (SDI) ranges which validates the initial assumption that environmental factors influence taxonomic assemblage composition. These taxonomic and parametric ranges were used to label each cluster (Tables 6.2-6.4). Again, the names of the clusters do not necessarily represent the highest ranges of different taxa or characteristics, but only those that help to distinguish them from the other clusters for the same lake and transformation model.

Table 6.1

Taxonomic and parametric ranges, means, and standard deviations for each Greenhill Lake Q-mode generated cluster. 6.1a using untransformed data. 6.1b using normalized data.

Table 6.1a

Greenhill Lake, no data transformation

		3-4 and 5-cluster model, cluster 1																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.8945	0.0034	0.0073	0.0194	0.0061	0.0087	0.0174	0.0037	0.0024	0.5159	0.0034	0.0095	0.0092	0.0022	0.0039	0.0113	0.0361	59.111	3.9927	4.9329	3.4286	19.079	10.343	
standard deviation	0.0511	0.0073	0.0041	0.0211	0.0082	0.022	0.0263	0.0071	0.0044	0.2182	0.0041	0.0094	0.0083	0.0037	0.0071	0.013	0.0294	24.568	0.4694	3.5684	2.5131	5.0697	11.025	
minimum value	0.824	0	0.0037	0	0	0	0	0	0	0.2235	0	0	0	0	0	0	0	0	28.444	3.348	0.5	0.8	11.1	4.8138
maximum value	0.9618	0.0198	0.014	0.0549	0.0147	0.0586	0.0747	0.0195	0.0121	0.8567	0.0103	0.022	0.0183	0.0081	0.0196	0.0391	0.0905	90.889	4.5086	7.91	6.6	22.9	35.116	

		3-4 and 5-cluster model, cluster 2																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.6921	0.0471	0.0158	0.0552	0.0114	0.0175	0.0275	0.0057	0.0157	1.2422	0.0031	0.0145	0.0397	0.0004	0.0153	0.0399	0.1088	92.167	4.2543	5.4767	3.1333	21.393	19.37	
standard deviation	0.0412	0.0259	0.0208	0.0412	0.0154	0.0283	0.023	0.0031	0.0111	0.1629	0.0037	0.0174	0.017	0.001	0.0245	0.0411	0.0477	77.929	0.7896	3.2504	1.8801	3.5317	13.067	
minimum value	0.6505	0.0064	0	0.0181	0	0	0	0	0.0024	0.0036	0.9527	0	0	0.017	0	0.0075	0.0571	30.667	3.4232	0.55	1	15.06	8.1636	
maximum value	0.7645	0.073	0.0563	0.1338	0.0361	0.073	0.0594	0.0109	0.0364	1.4106	0.0089	0.0403	0.0622	0.0024	0.0622	0.1141	0.1675	236.89	5.4676	7.91	5.6	24.8	45.037	

		3-cluster model, cluster 3																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.4697	0.0551	0.0296	0.118	0.0299	0.0024	0.0547	0.0102	0.0357	1.8368	0.0225	0.0524	0.0711	0.0032	0.0381	0.0346	0.1994	109.48	4.5645	7.2136	2.1909	22.945	17.295	
standard deviation	0.1107	0.0432	0.0168	0.0416	0.0154	0.0064	0.036	0.011	0.0225	0.2468	0.0216	0.0278	0.0344	0.0079	0.0347	0.0179	0.0681	55.097	0.5647	1.2878	0.9894	0.8371	5.1666	
minimum value	0.2121	0.0079	0.0067	0.0704	0.0046	0	0.0089	0	0.0029	1.4497	0	0.0208	0.0068	0	0	0.0096	0.1092	37.444	3.6229	3.43	1	21.2	12.4	
maximum value	0.6034	0.1379	0.0654	0.1886	0.0616	0.0214	0.1074	0.0352	0.0695	2.3264	0.0808	0.1229	0.1344	0.0267	0.1027	0.0593	0.3552	216.67	5.3784	7.9	4	24.9	31.118	

		4 and 5-cluster model, cluster 3a																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.319	0.0362	0.0171	0.1699	0.0384	0.0012	0.0853	0.005	0.0477	2.1634	0.0419	0.0803	0.0823	0.002	0.0667	0.0397	0.271	116.81	4.7565	7.72	1.7667	22.9	17.929	
standard deviation	0.0981	0.0123	0.0108	0.0253	0.0086	0.0011	0.0192	0.0028	0.0189	0.1514	0.034	0.0371	0.0275	0.002	0.0407	0.0135	0.0732	13.162	0.1095	0.3032	1.0796	0.1732	2.5356	
minimum value	0.2121	0.0223	0.0067	0.1411	0.0286	0	0.0634	0.002	0.0364	2.0272	0.0182	0.0552	0.0506	0	0.0225	0.0304	0.2227	108.67	4.8893	7.37	1	22.7	15.255	
maximum value	0.4049	0.0455	0.0283	0.1886	0.0445	0.002	0.0993	0.0067	0.0695	2.3264	0.0808	0.1229	0.1002	0.004	0.1027	0.0552	0.3552	132	4.8928	7.9	3	23	20.299	

		4-cluster model, cluster 3b																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.5262	0.0622	0.0343	0.0985	0.0268	0.0028	0.0433	0.0122	0.0312	1.7143	0.0152	0.0419	0.0669	0.0037	0.0273	0.0327	0.1725	106.74	4.4925	7.0238	2.35	22.963	17.057	
standard deviation	0.0373	0.0491	0.0167	0.0265	0.0168	0.0075	0.0346	0.0124	0.0232	0.1326	0.0106	0.0158	0.0375	0.0094	0.0277	0.0198	0.0454	65.235	0.656	1.4805	0.9783	0.9956	6.005	
minimum value	0.4672	0.0079	0.0128	0.0704	0.0046	0	0.0089	0	0.0029	1.4497	0	0.0208	0.0068	0	0	0.0096	0.1092	37.444	3.6229	3.43	1	21.2	12.4	
maximum value	0.6034	0.1379	0.0654	0.1398	0.0616	0.0214	0.1074	0.0352	0.0695	1.8674	0.0308	0.0685	0.1344	0.0267	0.0625	0.0593	0.2626	216.67	5.3784	7.9	4	24.9	31.118	

		5-cluster model, cluster 3b1																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.5517	0.1022	0.0431	0.0807	0.0167	0.0053	0.0202	0.0168	0.022	1.6323	0.0138	0.0304	0.0647	0.0073	0.0022	0.0469	0.1515	87.361	4.2558	6.3375	2.95	23.025	18.608	
standard deviation	0.0367	0.0356	0.0152	0.0088	0.0081	0.0107	0.0177	0.0148	0.0258	0.1412	0.0124	0.0093	0.0186	0.013	0.0028	0.0181	0.0337	65.638	0.7538	1.9468	0.7594	1.5108	8.6634	
minimum value	0.5233	0.069	0.0316	0.0704	0.0046	0	0.0089	0	0.0029	1.4497	0	0.0208	0.0431	0	0	0.0201	0.1092	37.444	3.6229	3.43	2.3	21.2	12.4	
maximum value	0.6034	0.1379	0.0654	0.092	0.0214	0.0214	0.0465	0.0352	0.0598	1.7896	0.0253	0.0431	0.0851	0.0267	0.0059	0.0593	0.1869	176.67	5.1743	7.49	4	24.9	31.118	

		5-cluster model, cluster 3b2																						
taxon/parameter	Ca	CrI	Dcor	Doo	Dos	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dogs	Ccc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.5007	0.0222	0.0254	0.1163	0.0368	0.0003	0.0663	0.0075	0.0405	1.7963	0.0167	0.0535	0.0691	0	0.0525	0.0184	0.1935	126.11	4.7291	7.71	1.75	22.9	15.505	
standard deviation	0.0128	0.0095	0.0148	0.0269	0.0176	0.0005	0.0328	0.0091	0.019	0.0564	0.0101	0.0118	0.054	0	0.0097	0.0068	0.05	67.973	0.5353	0.2617	0.8347	0.1414	1.6323	
minimum value	0.4872	0.0079	0.0128	0.0841	0.024	0	0.0342	0	0.0264	1.7308	0.0068	0.0401	0.0068	0	0.0396	0.0096	0.1507	64.889	4.1727	7.34	1	22.7	13.6	
maximum value	0.5172	0.0277	0.0445	0.1398	0.0616	0.001	0.1074	0.0205	0.0695	1.8674	0.0308	0.0685	0.1344	0	0.0625	0.024	0.2626	216.67	5.3784	7.9	2.9	23	17.334	

Table 6.1b

Greenhill Lake, normalized data

3.4.5-cluster model, cluster 1		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.3408	0.0877	0.048	0.1266	0.003	0.1377	0.0802	0.0403	1.8857	0.0702	0.0572	0.1207	0.7313	0.1339	0.0138	0.0863	0.1153	119.36	4.7239	7.7388	1.6875	22.913	16.008
standard deviation		0.1221	0.0207	0.0153	0.0499	0.0052	0.018	0.0668	0.0189	0.2789	0.0267	0.0189	0.025	0.0499	0.0418	0.039	0.0117	0.0234	45.956	0.3588	0.2458	0.8184	0.1356	2.5916
minimum value		0.1375	0.0425	0.0229	0.0378	0	0.1082	0	0.0178	1.4106	0.0355	0.0143	0.0677	0.6736	0.0381	0	0.0634	0.0729	64.889	4.1727	7.34	1	22.7	12.256
maximum value		0.549	0.111	0.0715	0.1886	0.0129	0.1587	0.2012	0.0695	2.3264	0.1205	0.0782	0.1559	0.8215	0.1722	0.1103	0.1027	0.1525	216.67	5.3784	7.91	3	23	20.299

3.4.5-cluster model, cluster 2		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.861	0	0.0201	0.0203	0	0.0581	0.0137	0.0029	0.4847	0.0209	0.0196	0.0462	0.3932	0.044	0.0841	0.0069	0.0593	58.889	4.0182	5.216	3.4	19.85	5.6309
standard deviation		0.0711	0	0.0141	0.0228	0	0.0597	0.0211	0.0052	0.1932	0.0223	0.0189	0.043	0.086	0.0375	0.1155	0.0095	0.028	20.439	0.3987	3.4637	2.4135	5.0361	0.8729
minimum value		0.7844	0	0.0072	0	0	0	0	0	0.2235	0	0	0.2788	0	0	0	0	0.013	29.111	3.3711	0.5	0.8	11.1	4.8138
maximum value		0.9408	0	0.0418	0.0549	0	0.1427	0.0479	0.0121	0.6899	0.0496	0.0424	0.0875	0.4878	0.0824	0.2216	0.019	0.0834	86.222	4.4569	7.91	6.6	22.9	6.9867

3-cluster model, cluster 3		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.5685	0.1077	0.0442	0.0592	0.0277	0.0666	0.1059	0.0152	1.26	0.0216	0.0294	0.0618	0.5639	0.106	0.0433	0.0179	0.1179	83.798	4.1638	5.3409	3.3091	21.16	20.24
standard deviation		0.1437	0.0458	0.0296	0.0379	0.0302	0.0401	0.0882	0.0179	0.397	0.0309	0.0263	0.0504	0.1984	0.0425	0.1239	0.0248	0.0535	68.273	0.7413	3.0196	1.741	3.8955	11.727
minimum value		0.4001	0.0149	0	0	0	0	0	0	0.4313	0	0	0	0	0	0	0	0	28.444	3.348	0.55	0.8	12.8	8.1636
maximum value		0.8528	0.1545	0.0814	0.1338	0.073	0.1326	0.248	0.0599	1.7886	0.0805	0.0636	0.1143	0.7108	0.1516	0.4149	0.0627	0.1856	236.89	5.4676	7.9	6.2	24.9	45.037

3.5-cluster model, cluster 3a		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.4766	0.1195	0.0659	0.0869	0.0172	0.0828	0.1279	0.0186	1.5143	0.0397	0.0476	0.1015	0.6317	0.1234	0.0747	0.0124	0.1188	115.17	4.5236	6.7183	2.55	23.317	18.067
standard deviation		0.0801	0.0441	0.0148	0.0248	0.0266	0.0352	0.0808	0.0207	0.2132	0.0324	0.0167	0.0105	0.0691	0.0266	0.1672	0.0158	0.0401	78.689	0.7614	1.6409	0.9772	1.3776	6.7743
minimum value		0.4001	0.034	0.0393	0.0647	0	0.0486	0	0.0029	1.2709	0	0.0151	0.0853	0.5416	0.079	0	0	0.0617	37.444	3.6229	3.43	1	21.2	12.4
maximum value		0.5898	0.1545	0.0814	0.1338	0.0524	0.1326	0.248	0.0598	1.7886	0.0805	0.0636	0.1143	0.7108	0.1516	0.4149	0.035	0.1558	236.89	5.4676	7.9	4	24.9	31.118

4-cluster model, cluster 3b		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.6789	0.0935	0.0182	0.0259	0.0403	0.0472	0.0795	0.011	0.9548	0	0.0076	0.0143	0.4825	0.0851	0.0055	0.0245	0.1168	46.156	3.732	3.688	4.22	18.572	22.849
standard deviation		0.1253	0.0495	0.0192	0.0167	0.0321	0.0401	0.0889	0.015	0.3518	0	0.017	0.032	0.278	0.0513	0.0124	0.0336	0.0718	25.881	0.471	3.6288	2.1171	4.4963	16.457
minimum value		0.5334	0.0149	0	0	0	0	0	0	0.4313	0	0	0	0	0	0	0	0	28.444	3.348	0.55	0.8	12.8	8.1636
maximum value		0.8528	0.1298	0.0392	0.0388	0.073	0.0881	0.1988	0.0364	1.358	0	0.0381	0.0715	0.6919	0.1314	0.0277	0.0627	0.1856	90.889	4.5096	7.9	6.2	22.9	45.037

5-cluster model, cluster 3b1		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.6487	0.1077	0.0049	0.0304	0.0197	0.0746	0.0539	0.0142	1.0558	0	0.0127	0.0238	0.6353	0.1034	0.0092	0.0408	0.16	55.778	3.9189	5.2433	3.4	20.153	11.363
standard deviation		0.107	0.0258	0.0084	0.0109	0.0217	0.0191	0.0801	0.0193	0.2661	0	0.022	0.0413	0.0534	0.0263	0.016	0.0354	0.0245	31.332	0.5494	4.0764	2.4249	4.4155	4.7327
minimum value		0.5334	0.078	0	0.0181	0	0.0527	0	0.0024	0.8567	0	0	0	0.5857	0.0794	0	0	0.1368	30.667	3.4232	0.55	0.8	15.06	8.1636
maximum value		0.7446	0.1229	0.0146	0.0388	0.0429	0.0881	0.1459	0.0364	1.358	0	0.0381	0.0715	0.6919	0.1314	0.0277	0.0627	0.1856	90.889	4.5096	7.9	5.6	22.9	16.8

5-cluster model, cluster 3b2		Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dool	Dos	Dogs	Multi	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
taxon/parameter	mean	0.7242	0.0722	0.0382	0.019	0.0712	0.0661	0.1179	0.0063	0.8034	0	0	0	0.2532	0.0577	0	0	0.052	31.722	3.4517	1.355	5.45	16.2	40.077
standard deviation		0.1819	0.0611	0.0015	0.0289	0.0026	0.0086	0.1115	0.009	0.5263	0	0	0	0.3591	0.0816	0	0	0.0736	4.6355	0.1487	1.1384	1.0607	4.8063	7.0152
minimum value		0.5956	0.0149	0.0371	0	0.0693	0	0.0391	0	0.4313	0	0	0	0	0	0	0	0	28.444	3.348	0.55	4.7	12.8	35.116
maximum value		0.8528	0.1298	0.0392	0.0381	0.073	0.0122	0.1988	0.0127	1.1756	0	0	0	0.5064	0.1154	0	0	0.1041	35	3.5553	2.16	6.2	19.6	45.037

Table 6.2

Taxonomic and parametric ranges, means, and standard deviations for each Oromocto Lake Q-mode generated cluster. 6.2a using untransformed data. 6.2b using normalized data.

Table 6.2a

Oromocto Lake, no data transformation

4.5.7-cluster model, cluster 1																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.7236	0.0194	0.0031	0.0025	0	0.0081	0	0.2408	0.6899	0	0	0	0	0	0	0	0	5.5432	1.6765	8.47	2.7333	21.3	0.3444
standard deviation	0.0196	0.0336	0.0053	0.0043	0	0.014	0	0.0245	0.1175	0	0	0	0	0	0	0	0	1.8653	0.3247	0.1852	2.0526	0.1	0.5885
minimum value	0.7039	0	0	0	0	0	0	0.2136	0.6093	0	0	0	0	0	0	0	0	4.037	1.3955	8.33	1	21.2	0
maximum value	0.7431	0.0583	0.0092	0.0075	0	0.0243	0	0.2612	0.8327	0	0	0	0	0	0	0	0	7.6286	2.032	8.68	5	21.4	1.0331

4.5.7-cluster model, cluster 2																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.6654	0	0	0	0	0.2058	0.0833	0.0455	0.843	0	0	0	0	0	0	0	0	1.6852	0.4996	8.35	1.7	21.35	2.2145
standard deviation	0.0411	0	0	0	0	0.0846	0.1179	0.0643	0.024	0	0	0	0	0	0	0	0	0.4976	0.2997	0.1414	0.2828	0.0707	1.2084
minimum value	0.6364	0	0	0	0	0.1389	0	0	0.828	0	0	0	0	0	0	0	0	1.3333	0.2877	8.25	1.5	21.3	1.36
maximum value	0.6944	0	0	0	0	0.2727	0.1667	0.0909	0.86	0	0	0	0	0	0	0	0	2.037	0.7115	8.45	1.9	21.4	3.069

4-cluster model, cluster 3																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.7835	0.0154	0.0047	0.045	0.0174	0.0163	0.0068	0.0806	0.813	0.0039	0.0046	0.0085	0.0039	0.0128	0.0034	0.0287	12.518	2.2989	8.3	3.7333	21.256	4.128	
standard deviation	0.0764	0.0247	0.0163	0.0383	0.0276	0.0176	0.011	0.0313	0.2669	0.0081	0.0096	0.0115	0.009	0.019	0.0102	0.0246	7.9834	0.7501	0.0676	1.5718	0.0616	3.1083	
minimum value	0.6514	0	0	0	0	0	0	0	0.2443	0	0	0	0	0	0	0	0	1.5185	0.4177	8.14	1.7	21.2	0.47
maximum value	0.9457	0.0909	0.0695	0.1207	0.0819	0.0543	0.0286	0.122	1.3151	0.0322	0.0395	0.0385	0.0336	0.0549	0.0421	0.0801	28.148	3.3375	8.37	6	21.4	14.384	

4.5-cluster model, cluster 4																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.4837	0.0344	0.0154	0.0459	0.1019	0.0353	0.0006	0.2438	1.3824	0.0123	0.0012	0.0135	0	0.0177	0.0049	0.0361	18.609	2.6342	8.297	2.44	21.32	4.1383	
standard deviation	0.0752	0.046	0.0167	0.0511	0.0655	0.0257	0.0018	0.0795	0.2147	0.0123	0.0039	0.0151	0	0.0409	0.0156	0.0397	13.132	0.8964	0.1042	0.8922	0.0422	2.9362	
minimum value	0.3603	0	0	0	0	0	0	0.1331	0.9628	0	0	0	0	0	0	0	0	2.037	0.7115	8.14	1.3	21.3	0
maximum value	0.5913	0.1444	0.0554	0.1549	0.1821	0.076	0.0056	0.3737	1.8283	0.0341	0.0124	0.0464	0	0.132	0.0493	0.132	42.333	3.7456	8.48	3.8	21.4	9.366	

5.7-cluster model, cluster 3a																						
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC
mean	0.9091	0	0	0.0032	0.0075	0.0061	0.0025	0.036	0.4036	0.0012	0.0185	0.0207	0.0021	0.0118	0	0.0346	10.252	2.2862	8.3033	3.6667	21.267	4.0852
standard deviation	0.0323	0	0	0.0056	0.013	0.0106	0.0042	0.035	0.1464	0.0021	0.0176	0.016	0.0037	0.0204	0	0.0397	3.5293	0.3558	0.0462	1.5275	0.0577	2.2418
minimum value	0.8846	0	0	0	0	0	0	0	0.2443	0	0.0037	0.0074	0	0	0	0.0074	6.8148	1.9191	8.25	2	21.2	2.3682
maximum value	0.9457	0	0	0.0096	0.0224	0.0184	0.0074	0.0699	0.5323	0.0037	0.0395	0.0385	0.0084	0.0353	0	0.0801	13.867	2.8295	8.33	5	21.3	6.6261

5-cluster model, cluster 3b																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.7584	0.0185	0.0056	0.0533	0.0194	0.0184	0.0077	0.0885	0.8649	0.0045	0.0016	0.0061	0.0042	0.013	0.0041	0.0275	12.972	2.3027	8.2893	3.7467	21.253	4.1365	
standard deviation	0.0537	0.026	0.0178	0.0365	0.0296	0.0183	0.0118	0.0225	0.2008	0.0087	0.0033	0.0092	0.0097	0.0194	0.0111	0.0224	8.6193	0.8155	0.0724	1.6326	0.064	3.3187	
minimum value	0.6514	0	0	0	0	0	0	0.0579	0.6081	0	0	0	0	0	0	0	0	1.5185	0.4177	8.14	1.7	21.2	0.47
maximum value	0.844	0.0909	0.0695	0.1207	0.0819	0.0543	0.0286	0.122	1.3151	0.0322	0.0093	0.0322	0.0336	0.0549	0.0421	0.0665	28.148	3.3375	8.37	6	21.4	14.384	

7-cluster model, cluster 3b1																						
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC
mean	0.6768	0.0537	0.026	0.0959	0.0123	0.0191	0.0178	0.0829	1.1543	0.0019	0.0031	0.005	0.0038	0	0.0067	0.0155	13.475	2.5223	8.2667	4.5333	21.233	7.6435
standard deviation	0.0387	0.0349	0.0379	0.0318	0.0168	0.0305	0.0155	0.0214	0.1643	0.0033	0.0054	0.0047	0.0066	0	0.0058	0.0042	5.7963	0.5134	0.1097	2.3692	0.0577	5.8544
minimum value	0.6514	0.0217	0	0.06	0	0	0	0.0588	0.9867	0	0	0	0	0	0	0.0107	6.8259	1.9353	8.14	1.8	21.2	3.8266
maximum value	0.7214	0.0909	0.0695	0.1207	0.0314	0.0543	0.0286	0.1	1.3151	0.0057	0.0093	0.0093	0.0114	0	0.0107	0.0186	17.944	2.8873	8.33	6	21.3	14.384

7-cluster model, cluster 3b2																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.7788	0.0097	0.0005	0.0427	0.0212	0.0182	0.0052	0.0911	0.8301	0.0051	0.0012	0.0063	0.0043	0.0163	0.0035	0.0305	12.846	2.2477	8.3075	3.55	21.258	3.2598	
standard deviation	0.0337	0.0148	0.0011	0.0299	0.0323	0.016	0.01	0.0234	0.1532	0.0096	0.0029	0.0102	0.0106	0.0206	0.0122	0.0242	9.3999	0.8844	0.0641	1.47	0.0669	1.8955	
minimum value	0.7285	0	0	0	0	0	0	0.0579	0.6081	0	0	0	0	0	0	0	0	1.5185	0.4177	8.14	1.7	21.2	0.47
maximum value	0.844	0.0395	0.0029	0.0859	0.0819	0.0462	0.0284	0.122	1.627	0.0322	0.0093	0.0322	0.0336	0.0549	0.0421	0.0665	28.148	3.3375	8.37	5.8	21.4	6.29	

7-cluster model, cluster 4a																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.5431	0.0417	0.0023	0.0184	0.1448	0.0247	0	0.1901	1.2917	0.0161	0.0031	0.0192	0	0.0018	0.0123	0.0332	13.292	2.2682	8.2675	2.6	21.3	1.7979	
standard deviation	0.0511	0.0688	0.0046	0.0225	0.0206	0.0215	0	0.0695	0.2355	0.0144	0.0062	0.0199	0	0.0035	0.0246	0.0294	9.0166	1.0864	0.0954	0.9092	0	1.4396	
minimum value	0.4718	0	0	0	0.1162	0	0	0.1331	0.9628	0	0	0	0	0	0	0	0	2.037	0.7115	8.14	1.8	21.3	0
maximum value	0.5913	0.1444	0.0093	0.0458	0.1641	0.0523	0	0.2909	1.5123	0.0341	0.0124	0.0464	0	0.007	0.0493	0.0669	22.667	3.1209	8.35	3.8	21.3	3.4954	

7-cluster model, cluster 4b																							
taxon/parameter	Ca	Cri	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dos	Doel	Dogs	Coc	Ckal	Dpc	Multi	S	In(S)	Oxygen	Depth	Temp	TOC	
mean	0.4441	0.0295	0.0242	0.0642	0.0732	0.0425	0.0009	0.2795	1.4429	0.0097	0	0.0097	0	0.0283	0	0.0381	22.154	2.8781	8.3167	2.3333	21.333	5.6985	
standard deviation	0.0625	0.03	0.0161	0.0583	0.0708	0.0275	0.0023	0.069	0.1967	0.0114	0	0.0114	0	0.0516	0	0.048	14.864	0.7481	0.1138	0.9501	0.0516	2.6404	
minimum value	0.3603	0	0.0112	0	0	0	0	0.2178	1.0768	0	0	0	0	0	0	0	0	7.2963	1.9874	8.14	1.3	21.3	29.619
maximum value	0.5171	0.0774	0.0554	0.1549	0.1821	0.076	0.0056	0.3737	1.8283	0.0304	0	0.0304	0	0.132	0	0.132	42.333	3.7456	8.48	3.8	21.4	9.366	

Table 6.2b

Oromocto Lake, normalized data

		4.5-7-cluster model, cluster 1																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.5804	0.016	0.0184	0.0556	0.0042	0.1549	0	0.1634	0.9639	0.0053	0.0108	0.0243	0.4791	0	0.4914	0	16.025	2.2965	8.355	2.9	21.3	4.0084	
standard deviation		0.1558	0.0378	0.0281	0.0579	0.0103	0.1221	0	0.1031	0.2494	0.013	0.0169	0.0278	0.1015	0	0.1113	0	15.353	1.1803	0.0742	1.5153	0.0632	2.6142	
minimum value		0.3703	0	0	0	0	0	0	0.0864	0.6692	0	0	0	0.3723	0	0.3545	0	1.5185	0.4177	8.25	1.3	21.2	0.47	
maximum value		0.7196	0.0932	0.057	0.1549	0.0252	0.2717	0	0.3503	1.3896	0.0319	0.0368	0.062	0.6508	0	0.673	0	42.333	3.7456	8.48	5.7	21.4	8.1356	
		4.5-cluster model, cluster 2																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.6895	0.0244	0.0026	0.0319	0.0032	0.1432	0.0364	0.1157	0.6837	0.0104	0.0008	0.0144	0.063	0	0.0053	0.0059	7.5046	1.7665	8.3392	3.0167	21.292	1.8973	
standard deviation		0.1156	0.0407	0.0089	0.0425	0.0111	0.1568	0.0545	0.0819	0.2026	0.0219	0.0028	0.027	0.1197	0	0.0183	0.0208	5.502	0.7687	0.1335	1.6797	0.0793	1.3452	
minimum value		0.5177	0	0	0	0	0	0	0	0.2443	0	0	0	0	0	0	0	1.3333	0.2877	8.14	1	21.2	0	
maximum value		0.9163	0.1207	0.0308	0.1207	0.0385	0.4257	0.1667	0.2612	0.9867	0.0653	0.0098	0.0757	0.3127	0	0.0635	0.0714	18.333	2.9087	8.68	6	21.4	4.72	
		4.5-cluster model, cluster 3																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.5218	0.0444	0.0123	0.0268	0.1538	0.1557	0.0131	0.1487	1.1394	0.0214	0.037	0.0784	0.3877	0.0161	0.1572	0	15.218	2.493	8.3278	3.6222	21.267	3.9009	
standard deviation		0.1845	0.0478	0.0188	0.0285	0.0293	0.1283	0.0297	0.1013	0.3581	0.0349	0.0245	0.0375	0.1593	0.037	0.1928	0	8.6182	0.8347	0.0307	1.2478	0.05	2.3758	
minimum value		0.279	0	0	0	0.0895	0	0	0	0.5323	0	0	0	0	0	0	0	2.037	0.7115	8.25	2	21.2	0	
maximum value		0.8276	0.1143	0.0438	0.0784	0.1821	0.3149	0.0878	0.2909	1.6283	0.0949	0.0622	0.1172	0.5647	0.1097	0.4598	0	26.444	3.275	8.35	5.8	21.3	6.6261	
		4-cluster model, cluster 4																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.4506	0.1212	0.0393	0.0531	0.1105	0.2155	0.016	0.1657	1.3337	0	0.0128	0.0216	0.2814	0.024	0.0333	0.0609	18.043	2.7258	8.2217	2.8333	21.283	6.537	
standard deviation		0.1534	0.0264	0.0363	0.0441	0.0479	0.1116	0.0391	0.1221	0.2119	0	0.0149	0.0251	0.2134	0.0378	0.0815	0.071	11.529	0.6304	0.0941	1.7546	0.0753	4.4715	
minimum value		0.2524	0.0817	0	0	0.026	0	0	0.0679	1.0102	0	0	0	0	0	0	0	6.9259	1.3953	8.14	1.6	21.2	3.16	
maximum value		0.6831	0.1563	0.0829	0.107	0.1822	0.2988	0.0958	0.3737	1.5284	0	0.0347	0.0584	0.5336	0.0827	0.1997	0.1474	36.111	3.5866	8.33	5.8	21.4	14.384	
		5.7-cluster model, cluster 4a																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.507	0.1309	0	0.0132	0.1315	0.2153	0	0.117	1.2613	0	0.0173	0.0292	0.525	0.0413	0.0898	0.1438	19.333	2.8453	8.235	3	21.25	4.2427	
standard deviation		0.2208	0.0359	0	0.0186	0.0435	0.0024	0	0.0836	0.3551	0	0.0245	0.0413	0.0122	0.0585	0.1412	0.0051	12.466	0.886	0.1344	1.6971	0.0707	1.0568	
minimum value		0.3509	0.1055	0	0	0.1007	0.2136	0	0.0579	1.0102	0	0	0	0	0.5164	0	0	10.519	2.3531	8.14	1.8	21.2	3.4954	
maximum value		0.6631	0.1563	0	0.0263	0.1822	0.217	0	0.1761	1.5123	0	0.0347	0.0584	0.5336	0.0827	0.1997	0.1474	28.148	3.3375	8.33	4.2	21.3	4.99	
		5.7-cluster model, cluster 4b																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.4224	0.1163	0.0589	0.073	0.0999	0.2156	0.024	0.1901	1.3699	0	0.0105	0.0177	0.1596	0.0153	0	0.0194	17.398	2.866	8.215	2.75	21.3	7.6841	
standard deviation		0.1406	0.0253	0.0255	0.0391	0.0524	0.1441	0.0479	0.142	0.1661	0	0.0122	0.0205	0.1286	0.0306	0	0.0389	12.964	0.8975	0.0926	2.0355	0.0816	5.2619	
minimum value		0.2524	0.0817	0.0291	0.0236	0.026	0	0	0.0588	1.1611	0	0	0	0	0	0	0	6.9259	1.3953	8.14	1.6	21.2	3.16	
maximum value		0.5415	0.1382	0.0829	0.107	0.148	0.2988	0.0958	0.3737	1.5284	0	0.0219	0.037	0.2988	0.0612	0	0.0778	36.111	3.5866	8.33	5.8	21.4	14.384	
		7-cluster model, cluster 2a																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.734	0.0117	0.0044	0.0351	0.0055	0.0326	0.0324	0.1281	0.5933	0.0179	0.0014	0.0247	0.108	0	0	0.0102	7.9974	1.9574	8.3686	3.8714	21.257	2.1102	
standard deviation		0.1176	0.031	0.0116	0.0473	0.0146	0.0714	0.0439	0.0892	0.2282	0.0269	0.0037	0.0322	0.1436	0	0	0.027	4.9027	0.5043	0.1405	1.7557	0.0787	1.5412	
minimum value		0.6153	0	0	0	0	0	0	0.038	0.2443	0	0	0	0	0	0	0	4.037	1.3955	8.25	1	21.2	0	
maximum value		0.9163	0.082	0.0308	0.1207	0.0385	0.1916	0.0955	0.2612	0.9867	0.0653	0.0098	0.0757	0.3127	0	0	0.0714	17.944	2.8973	8.68	6	21.4	4.72	
		7-cluster model, cluster 2b																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.6201	0.0421	0	0.0275	0	0.2979	0.0421	0.0983	0.8102	0	0	0	0	0	0.0127	0	6.8148	1.4992	8.298	1.82	21.34	1.5994	
standard deviation		0.0806	0.0494	0	0.0396	0	0.0929	0.0722	0.0767	0.0434	0	0	0	0	0	0.0284	0	6.9014	1.0443	0.1256	0.2588	0.0548	1.1059	
minimum value		0.5177	0	0	0	0	0.2157	0	0	0.7514	0	0	0	0	0	0	0	1.3333	0.2877	8.14	1.5	21.3	0	
maximum value		0.7054	0.1207	0	0.0859	0	0.4257	0.1667	0.2136	0.86	0	0	0	0	0	0.0835	0	18.333	2.9087	8.45	2.2	21.4	3.069	
		7-cluster model, cluster 3a																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.5674	0	0	0.0235	0.155	0	0	0.1757	0.9973	0	0.012	0.0202	0.223	0.0548	0	0	3.7778	1.2098	8.29	3.9	21.25	1.992	
standard deviation		0.1794	0	0	0.0332	0.0242	0	0	0.163	0.0926	0	0.0169	0.0286	0.3154	0.0776	0	0	2.4618	0.7047	0.0566	2.687	0.0707	2.8171	
minimum value		0.4406	0	0	0	0.1379	0	0	0.0604	0.8318	0	0	0	0	0	0	0	2.037	0.7115	8.25	2	21.2	0	
maximum value		0.6943	0	0	0.047	0.1721	0	0	0.2909	0.9628	0	0.024	0.0404	0.4461	0.1097	0	0	5.5185	1.7081	8.33	5.8	21.3	3.984	
		7-cluster model, cluster 3b																						
taxon/parameter		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dogl	Dos	Dogs	Multi	Coc	Kcal	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean		0.5088	0.0571	0.0158	0.0277	0.1534	0.2002	0.0169	0.1411	1.2086	0.0275	0.0441	0.095	0.4348	0.005	0.2021	0	18.486	2.8596	8.3386	3.5429	21.271	4.4463	
standard deviation		0.1978	0.0469	0.0201	0.0273	0.0324	0.1075	0.0332	0.0946	0.3801	0.0378	0.022	0.0171	0.0751	0.0133	0.1971	0	6.4756	0.3749	0.0107	0.9163	0.0488	2.1545	
minimum value		0.279	0	0	0	0.0895	0	0	0	0.5323	0	0	0.0696	0.322	0	0	0	9.7407	2.2765	8.33	2.5	21.2	1.826	
maximum value		0.8276	0.1143	0.0438	0.0784	0.1821	0.3149	0.0878	0.2814	1.6283	0.0949	0.0622	0.1172	0.5647	0.0351	0.4598	0	26.444	3.275	8.35	5	21.3	6.6261	

Table 6.3

Taxonomic and parametric ranges, means, and standard deviations for each Yoho Lake Q-mode generated cluster. 6.3a using untransformed data. 6.3b using normalized data.

Table 6.3a

Yoho Lake, no data transformation

		3.4-cluster model, cluster 1																						
taxon/parameter	Ca	CrI	Door	Doo	Dos	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dogs	Coc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.9599	0.0013	0.0023	0.0089	0.0013	0.0083	0.0004	0	0.0048	0.1859	0.0013	0.0026	0.0013	0.0025	0	0	0.0064	5.5926	1.0368	8.06	2.1833	21.767	3.6802	
standard deviation	0.047	0.0031	0.0057	0.0218	0.0033	0.0143	0.0011	0	0.0117	0.2163	0.0031	0.004	0.0031	0.0062	0	0	0.0122	7.6061	1.3186	0.1287	0.6178	0.0516	1.049	
minimum value	0.8931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4074	-0.8979	7.95	1.5	21.7	2.6562	
maximum value	1	0.0076	0.0141	0.0534	0.008	0.0348	0.0027	0	0.0286	0.4968	0.0076	0.008	0.0076	0.0153	0	0	0.0305	20.778	3.0339	8.3	3	21.8	5.4374	
		3.4-cluster model, cluster 2																						
taxon/parameter	Ca	CrI	Door	Doo	Dos	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dogs	Coc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.7387	0.0071	0.0024	0.0265	0.0046	0.0404	0.0116	0.0062	0.1453	0.8501	0.0009	0.0055	0.0101	0	0	0.0058	0.0214	6.4444	1.5574	7.976	3.85	21.62	2.129	
standard deviation	0.0474	0.0155	0.0059	0.0291	0.0099	0.0301	0.0206	0.0108	0.0656	0.1493	0.0029	0.0098	0.0208	0	0	0.0183	0.0296	4.2573	0.9495	0.1864	3.0435	0.3011	2.138	
minimum value	0.6891	0	0	0	0	0	0	0	0.0334	0.5869	0	0	0	0	0	0	0	0.8148	-0.2048	7.68	0.9	21	0	
maximum value	0.8211	0.0494	0.0183	0.0729	0.0263	0.0841	0.055	0.0294	0.2867	1.0148	0.0091	0.0263	0.065	0	0	0.0578	0.0921	12.926	2.5592	8.29	10.5	21.9	6.61	
		3-cluster model, cluster 3																						
taxon/parameter	Ca	CrI	Door	Doo	Dos	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dogs	Coc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.4028	0.0119	0.0194	0.0848	0.012	0.0581	0.0901	0.0103	0.2345	1.4332	0.0211	0.033	0.034	0.004	0.0024	0.0073	0.0807	7.1811	1.5538	7.9727	4.1545	21.564	6.6649	
standard deviation	0.1313	0.0204	0.0302	0.0989	0.0222	0.0728	0.141	0.0292	0.1304	0.3607	0.0343	0.0418	0.0509	0.0092	0.008	0.0123	0.0926	7.0339	1.0087	0.215	2.7598	0.3042	5.7521	
minimum value	0.2222	0	0	0	0	0	0	0	0	0.6918	0	0	0	0	0	0	0	0.7037	-0.3514	7.7	0.7	21.1	0	
maximum value	0.5855	0.0652	0.0894	0.3192	0.0654	0.1707	0.4737	0.0972	0.3784	1.9383	0.0892	0.1209	0.1298	0.0277	0.0265	0.0338	0.3009	25.111	3.2233	8.33	8	21.9	17.05	
		4-cluster model, cluster 3a																						
taxon/parameter	Ca	CrI	Door	Doo	Dos	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dogs	Coc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.2851	0.0036	0.0149	0.1391	0.0186	0.0639	0.0648	0.0194	0.3279	1.5357	0.0178	0.0365	0.0271	0.0032	0	0.0068	0.0735	4.8074	1.4659	7.982	3.78	21.54	3.914	
standard deviation	0.0646	0.0059	0.0206	0.127	0.0288	0.0801	0.0778	0.0435	0.0462	0.2022	0.0399	0.0398	0.0532	0.0071	0	0.0151	0.0572	2.3126	0.5256	0.2722	3.6383	0.4037	3.1033	
minimum value	0.2222	0	0	0	0	0	0	0	0.2639	1.3373	0	0	0	0	0	0	0.0159	2.3333	0.8473	7.7	0.7	21.1	0	
maximum value	0.3595	0.0135	0.0417	0.3192	0.0854	0.1528	0.1587	0.0972	0.3784	1.8662	0.0892	0.0892	0.1216	0.0159	0	0.0338	0.1554	7.8889	2.0655	8.33	8	21.9	7.36	
		4-cluster model, cluster 3b																						
taxon/parameter	Ca	CrI	Door	Doo	Dos	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dogs	Coc	Ckal	Doli	Dpc	Multi	S	ln(S)	Oxygen	Depth	Temp	TOC	
mean	0.5009	0.0188	0.0231	0.0395	0.0064	0.0534	0.1112	0.0026	0.1568	1.3478	0.0237	0.0301	0.0398	0.0046	0.0044	0.0078	0.0866	9.1593	1.627	7.965	4.4667	21.583	8.9574	
standard deviation	0.0759	0.026	0.038	0.0355	0.0157	0.0734	0.1898	0.0065	0.1278	0.4564	0.0326	0.047	0.0532	0.0113	0.0108	0.0109	0.1201	9.1839	1.3415	0.1817	2.0944	0.2317	6.678	
minimum value	0.3687	0	0	0	0	0	0	0	0	0.6918	0	0	0	0	0	0	0	0.7037	-0.3514	7.71	1.1	21.2	0	
maximum value	0.5855	0.0652	0.0894	0.0789	0.0393	0.1707	0.4737	0.0158	0.3696	1.9383	0.0826	0.1209	0.1298	0.0277	0.0265	0.0236	0.3009	25.111	3.2233	8.25	7.4	21.9	17.05	

Table 6.3b

Yoho Lake, normalized data

3.4-cluster model, cluster 1		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.7479	0.02	0.003	0.0153	0.0599	0.0155	0.0111	0.1138	0.5546	0.0028	0.0056	0.0126	0.1253	0.0194	0.0232	0	0	5.4603	1.1772	7.975	3.8071	21.614	2.2705
standard deviation		0.1898	0.0437	0.0112	0.0247	0.0643	0.0515	0.0293	0.1163	0.3758	0.0105	0.0148	0.0265	0.189	0.0429	0.0868	0	0	5.7282	1.1228	0.1877	2.7979	0.2797	1.7447
minimum value		0.4202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4074	-0.8979	7.68	0.9	21	0
maximum value		1	0.1251	0.0419	0.0654	0.1479	0.193	0.097	0.3696	0.9915	0.0392	0.0498	0.0839	0.5288	0.1395	0.3246	0	0	20.778	3.0339	8.3	10.5	21.9	5.4374

3.4.5-cluster model, cluster 2		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.3718	0.0549	0	0.096	0.0992	0.08	0.018	0.1814	1.4951	0.0612	0.0163	0.0746	0.8773	0.1396	0.1052	0.0169	0.1281	13.037	2.4156	7.9025	4.925	21.5	7.4468
standard deviation		0.2262	0.0403	0	0.0787	0.0519	0.1074	0.038	0.1482	0.4164	0.0513	0.0325	0.0653	0.0917	0.0451	0.2103	0.0339	0.0215	8.5057	0.6328	0.1305	1.9432	0.2708	5.2873
minimum value		0.1553	0	0	0.0277	0.0364	0	0	0.0334	0.9371	0	0	0.5689	0.074	0	0	0	0.1057	5.4815	1.7014	7.71	2.8	21.1	2.22
maximum value		0.6775	0.0968	0	0.2095	0.1629	0.2271	0.072	0.3784	1.9383	0.1212	0.065	0.1553	0.7829	0.1706	0.4207	0.0677	0.1546	25.111	3.2233	8	7.5	21.7	14.806

3-cluster model, cluster 3		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.367	0.0157	0.0402	0.0726	0.0862	0.2874	0.0254	0.1936	1.2931	0.0241	0.0212	0.0636	0.3028	0.0199	0.0368	0	0.0027	5.3778	1.4159	8.0622	2.7	21.711	6.1235
standard deviation		0.1892	0.0265	0.0362	0.1002	0.0803	0.1348	0.0527	0.1293	0.3732	0.0484	0.0324	0.0623	0.2478	0.0407	0.1103	0	0.008	3.8117	0.8564	0.1945	2.487	0.2619	5.4525
minimum value		0.1448	0	0	0	0	0	0	0	0.8918	0	0	0	0	0	0	0	0	0.7037	-0.3514	7.7	0.7	21.1	0
maximum value		0.7064	0.0707	0.0994	0.3192	0.1792	0.4737	0.145	0.3651	1.8662	0.1239	0.0776	0.1432	0.6085	0.1088	0.3309	0	0.0241	13.511	2.6035	8.33	8	21.9	17.05

4.5-cluster model, cluster 3a		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.3289	0.0298	0.0678	0.0281	0.1673	0.3084	0.0363	0.205	1.4993	0	0.0338	0.0569	0.2279	0	0	0	0	4.2315	1.4068	8.2175	1.075	21.875	7.9987
standard deviation		0.1836	0.0356	0.0169	0.0325	0.0171	0.0687	0.0725	0.1127	0.3542	0	0.0398	0.0672	0.27	0	0	0	0	1.2452	0.3188	0.0871	0.283	0.05	6.7121
minimum value		0.1448	0	0.0487	0	0.1419	0.2221	0	0.0732	1.0148	0	0	0	0	0	0	0	0	2.8667	0.9808	8.1	0.7	21.8	0.84
maximum value		0.5761	0.0707	0.0894	0.0569	0.1792	0.3872	0.145	0.3288	1.8662	0	0.0776	0.1308	0.5296	0	0	0	0	5.8667	1.7346	8.33	1.3	21.9	17.05

4.5-cluster model, cluster 3b		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.3875	0.0044	0.0181	0.1082	0.0214	0.2698	0.0167	0.1846	1.1281	0.0433	0.0112	0.069	0.3628	0.0359	0.0662	0	0.0048	6.2948	1.4232	7.938	4	21.58	4.6233
standard deviation		0.209	0.0069	0.0321	0.1255	0.0293	0.1786	0.0374	0.1539	0.3285	0.0603	0.0251	0.0655	0.2409	0.0509	0.148	0	0.0108	5.0527	1.1795	0.1587	2.7505	0.295	4.3878
minimum value		0.1715	0	0	0	0	0	0	0	0.8918	0	0	0	0	0	0	0	0	0.7037	-0.3514	7.7	1.4	21.1	0
maximum value		0.7064	0.0221	0.0741	0.3192	0.056	0.4737	0.0835	0.3651	1.421	0.1239	0.0562	0.1432	0.6085	0.1088	0.3309	0	0.0241	13.511	2.6035	8.07	8	21.8	11.917

5-cluster model, cluster 1a		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.8774	0	0.007	0.0056	0	0	0	0.0682	0.251	0	0	0	0.0881	0.0233	0	0	0	2.2654	0.5382	8.085	2.2167	21.767	3.0906
standard deviation		0.1717	0	0.0171	0.0136	0	0	0	0.1068	0.3164	0	0	0	0.2159	0.057	0	0	0	1.6039	0.8863	0.1692	0.828	0.0816	1.8298
minimum value		0.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4074	-0.8979	7.95	0.9	21.7	0
maximum value		1	0	0.0419	0.0333	0	0	0	0.2667	0.7155	0	0	0	0.5288	0.1395	0	0	0	4.5556	1.5163	8.3	3	21.9	5.4374

5-cluster model, cluster 1b		Ca	Chl	Door	Doo	Lvas	Lmod	Ngal	Pcomp	SDI	Dool	Dos	Dogs	Mult	Coc	Ckal	Doli	Dpc	S	ln(S)	Oxygen	Depth	Temp	TOC
mean		0.6508	0.0351	0	0.0226	0.1048	0.0271	0.0195	0.1481	0.7822	0.0049	0.0097	0.0221	0.1533	0.0164	0.0406	0	0	7.8565	1.6564	7.8925	5	21.5	1.6555
standard deviation		0.1439	0.0542	0	0.0292	0.0478	0.0676	0.0375	0.1177	0.2293	0.0139	0.0189	0.0326	0.1759	0.0328	0.1148	0	0	6.8172	1.0748	0.1639	3.2022	0.3251	1.5009
minimum value		0.4202	0	0	0	0	0	0	0	0.4149	0	0	0	0	0	0	0	0	0.8149	-0.2048	7.68	1.5	21	0
maximum value		0.8625	0.1251	0	0.0654	0.1479	0.193	0.097	0.3696	0.9915	0.0392	0.0498	0.0839	0.3984	0.0886	0.3246	0	0	20.778	3.0339	8.07	10.5	21.8	4.4245

Table 6.4

Q-mode clusters listing significant descriptive taxonomic and parametric ranges for Greenhill Lake. 6.4a using untransformed data. 6.4b using normalized data.

Table 6.4a

Lake: Greenhill	3-Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 Low abundance and diversity assemblage	Entire range of TOC; low to moderately high specimen density; moderate to high dissolved oxygen; entire temperature and depth ranges.	High <i>Centropyxis aculeata</i> Low SDI
2 moderate to high temperature assemblage	Entire range of TOC, specimen density, dissolved oxygen, and depth; moderate to high temperature.	High <i>Centropyxis aculeata</i> Moderate SDI
3 Shallow water high diversity assemblage	Moderate to high TOC; entire range of specimen density, dissolved oxygen; high (surficial) temperature; shallow to moderate depth.	High SDI, <i>Diffugia oblonga</i> "oblonga" Low <i>Centropyxis aculeata</i>

Lake: Greenhill	4-Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 Low abundance and diversity assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 moderate to high temperature assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a Shallow water high diversity assemblage	Moderate to high TOC; high specimen density; high (surficial) levels of dissolved oxygen and temperature; shallow depth.	High SDI Low <i>Centropyxis aculeata</i>
3b Shallow to moderate depth assemblage	Moderate to high TOC; entire range of specimen density; moderate to high (surficial) dissolved oxygen; high (surficial) temperature; shallow to medium depth.	High SDI Moderate <i>Centropyxis aculeata</i> , <i>Diffugia oblonga</i> "oblonga"

(continued)

Table 6.4a (continued)

Lake: Greenhill	5-Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 Low abundance and diversity assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 moderate to high temperature assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a Shallow water high diversity assemblage	(same as 4 cluster model, #3a)	(same as 4 cluster model, #3a)
3b ₁ High diversity assemblage	Moderate to high TOC; entire range of specimen density; moderate to high (surficial) levels of dissolved oxygen; high (surficial) temperature; shallow to medium depth.	High SDI Moderate <i>Diffflugia oblonga</i> "oblonga"
3b ₂ Shallow water high diversity assemblage	Moderate to high TOC; entire range of specimen density; high (surficial) levels of dissolved oxygen and temperature; shallow depth.	High SDI, <i>Diffflugia oblonga</i> "oblonga"

Table 6.4b

Lake: Greenhill	3 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 Shallow water high diversity assemblage	High TOC; medium to high specimen density; high (surficial) levels of dissolved oxygen and temperature; shallow depth.	High SDI Low <i>Centropyxis aculeata</i>
2 Low organic low diversity assemblage	Low TOC; low to medium specimen density; entire range of dissolved oxygen, temperature, and depth.	High <i>Centropyxis aculeata</i> Moderate "multi" (see Appendix I for explanation) Low SDI
3 Medium to high organic assemblage	Medium to high TOC; entire range of specimen density, dissolved oxygen, temperature, and depth.	High Lagenodifflugia vas Med-high <i>Centropyxis aculeata</i> Low-medium SDI

Lake: Greenhill	4 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 Shallow water high diversity assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 Low organic low diversity assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a Medium-high organic and diversity assemblage	Medium to high TOC; entire range of specimen density; moderate to high (surficial) levels of dissolved oxygen; high (surficial) temperature; shallow to medium depth.	High <i>Diffflugia corona</i> , <i>D. oblonga</i> "spinosa/glans", "multi" Medium SDI, <i>Centropyxis aculeata</i>
3b Medium-high organic assemblage	Medium to high TOC; low to medium specimen density; entire range of dissolved oxygen, temperature and depth.	Med-high SDI Low-medium <i>Centropyxis aculeata</i>

(continued)

Table 6.4b (continued)

Lake: Greenhill	5 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 Shallow water high diversity assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 Low organic and diversity assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a Medium-high organic and diversity assemblage	(same as 4 cluster model, #3a)	(same as 4 cluster model, #3a)
3b ₁ Medium organic low diversity assemblage	Medium TOC; low to medium specimen density; entire range of dissolved oxygen, temperature, and depth;	High <i>D. oblonga</i> "spinosa/glans", "multi" Medium-high <i>Centropyxis aculeata</i> Low-medium SDI
3b ₂ Disoxic deep water assemblage	High TOC; low specimen density; low (disoxic) levels of dissolved oxygen; entire range of temperature; deep water.	High <i>Diffflugia protaeiformis</i> "amphoralis", <i>Centropyxis aculeata</i> Low-medium SDI

Table 6.5

Q-mode clusters listing significant descriptive taxonomic and parametric ranges for Oromocto Lake. 6.5a using untransformed data. 6.5b using normalized data.

Table 6.5a

Lake: Oromocto	4 Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 <i>Pontigulasia compressa</i> low organic assemblage	Low TOC; low specimen density; entire range of depth.	High <i>Pontigulasia compressa</i> Medium-high <i>Centropyxis aculeata</i> Medium SDI
2 Shallow water, low organic and abundance assemblage	Low TOC; low specimen density; shallow depth.	Medium-high <i>Centropyxis aculeata</i> Medium SDI
3 Transitional assemblage	Entire range of TOC, specimen density, and depth.	Medium-high <i>Centropyxis aculeata</i>
4 <i>Pontigulasia compressa</i> high diversity assemblage	Low to medium TOC; entire range of specimen density; shallow to medium depth.	High SDI, <i>Pontigulasia compressa</i> Low <i>Centropyxis aculeata</i>

Lake: Oromocto	5 Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 <i>Pontigulasia compressa</i> low organic assemblage	(same as 4 cluster model, #1)	(same as 4 cluster model, #1)
2 Shallow water, low abundance assemblage	(same as 4 cluster model, #2)	(same as 4 cluster model, #2)
3a Low organic and diversity assemblage	Low TOC; low to medium specimen density; entire range of depth.	High <i>Centropyxis aculeata</i> Low SDI
3b Transitional assemblage	Entire range of TOC, specimen density, and depth.	Medium-high <i>Centropyxis aculeata</i> Medium SDI
4 <i>Pontigulasia compressa</i> high diversity assemblage	(same as 4 cluster model, #4)	(same as 4 cluster model, #4)

(continued)

Table 6.5a (continued)

Lake: Oromocto	7 Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 <i>Pontigulasia compressa</i> low organic assemblage	(same as 4 cluster model, #1)	(same as 4 cluster model, #1)
2 Shallow water, low abundance assemblage	(same as 4 cluster model, #2)	(same as 4 cluster model, #2)
3a Low organic and diversity assemblage	(same as 5 cluster model, #3a)	(same as 5 cluster model, #3a)
3b ₁ High diversity <i>Diffugia oblonga</i> assemblage	Entire range of TOC; low to medium specimen density; entire range of depth.	High SDI, <i>Diffugia oblonga</i> "oblonga"
3b ₂ <i>Centropyxis aculeata</i> low organic assemblage	Low TOC; entire range of specimen density and depth.	High <i>Centropyxis aculeata</i> Medium SDI
4a High diversity <i>Pontigulasia compressa</i> low organic, transitional assemblage	Low TOC; low to medium specimen density; shallow to medium depth.	High SDI, <i>Pontigulasia compressa</i> Medium <i>Centropyxis aculeata</i>
4b High diversity <i>Pontigulasia compressa</i> medium organic assemblage	Low to medium TOC; entire range of specimen density; shallow to medium depth.	High SDI, <i>Pontigulasia compressa</i> Low <i>Centropyxis aculeata</i>

Table 6.5b

Lake: Oromocto	4 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 <i>P. compressa</i> - <i>C. Kahli</i> assemblage	Low to medium TOC; entire range of specimen density and depth.	High <i>Pontigulasia compressa</i> , <i>Centropyxis kahli</i> , "multi"
2 Low organic assemblage	Low TOC; low to medium specimen density; entire range of depth.	Low-medium SDI
3 Low organic <i>Lagenodifflugia vas</i> assemblage	Low TOC; low to medium specimen density; entire range of depth.	High <i>Lagenodifflugia vas</i> , Medium-high SDI
4 High Diversity assemblage	Entire range of TOC, specimen density and depth.	High SDI, <i>Pontigulasia compressa</i> , <i>Cucurbitella tricusps</i>

Lake: Oromocto	5 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 <i>P. compressa</i> - <i>C. Kahli</i> assemblage	(same as 4 cluster model, #1)	(same as 4 cluster model, #1)
2 Low organic assemblage	(same as 4 cluster model, #2)	(same as 4 cluster model, #2)
3 Low organic <i>Lagenodifflugia vas</i> assemblage	(same as 4 cluster model, #3)	(same as 4 cluster model, #3)
4a High Diversity low organic assemblage	Low TOC; low to medium specimen density; shallow to medium depth.	High SDI, <i>Lagenodifflugia vas</i> , <i>Cucurbitella tricusps</i> , <i>Diffflugia protaeiformis</i> "claviformis", <i>Lesquereusia modesta</i> , "multi"
4b High Diversity assemblage	Entire range of TOC, specimen density and depth.	High SDI, <i>Pontigulasia compressa</i> , <i>Cucurbitella tricusps</i>

(continued)

Table 6.5b (continued)

Lake: Oromocto	7 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 <i>P. compressa</i> - <i>C. Kahli</i> assemblage	(same as 4 cluster model, #1)	(same as 4 cluster model, #1)
2a Low organic <i>C. aculeata</i> , <i>P. compressa</i> assemblage	Low TOC; low to medium specimen density; entire range of depth.	High <i>Centropyxis aculeata</i> , <i>Pontigulasia compressa</i> Low-medium SDI
2b Low organic shallow water assemblage	Low TOC; low to medium specimen density; shallow water.	High <i>Lesquereusia modesta</i> Medium SDI
3a Low organic <i>L. vas</i> , <i>P. compressa</i> assemblage	Low TOC and specimen density; entire range of depth.	High <i>Lagenodifflugia vas</i> , <i>Pontigulasia compressa</i> Medium SDI
3b Medium deep water assemblage	Entire range of TOC; low to medium specimen density; medium to deep water.	High <i>Lagenodifflugia vas</i> , <i>Difflugia oblonga</i> "spinosa/glans", "multi" Medium-high SDI
4a High Diversity low organic assemblage	(same as 5 cluster model, #4a)	(same as 5 cluster model, #4a)
4b High Diversity assemblage	(same as 5 cluster model, #4b)	(same as 5 cluster model, #4b)

Table 6.6

Q-mode clusters listing significant descriptive taxonomic and parametric ranges for Yoho Lake. 6.6a using untransformed data. 6.6b using normalized data.

Table 6.6a

Lake: Yoho	3 Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 Shallow water low diversity assemblage	Low TOC; entire range of specimen density; shallow water.	High <i>Centropyxis aculeata</i> Low SDI
2 Moderate diversity <i>P. compressa</i> - <i>C. aculeata</i> assemblage	Low to medium TOC; low to moderate specimen density; entire range of depth.	Medium-high SDI, <i>Pontigulasia compressa</i> Medium-high <i>Centropyxis aculeata</i> Low SDI
3 Transitional assemblage	Entire range of TOC, specimen density, and depth.	Medium-high SDI Low-medium <i>Centropyxis aculeata</i>

Lake: Yoho	4 Cluster Model	Data transformation: none
Cluster:	Parametric ranges:	Defining taxa:
1 Shallow water low diversity assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 Moderate diversity <i>P. compressa</i> - <i>C. aculeata</i> assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a Moderate diversity <i>Pontigulasia compressa</i> assemblage	Low to medium TOC; low specimen density; entire range of depth.	Medium-high SDI, <i>Pontigulasia compressa</i> , "multi" Low <i>Centropyxis aculeata</i>
3b Transitional assemblage	Entire range of TOC, specimen density, and depth.	Medium-high SDI Medium <i>Centropyxis aculeata</i>

Table 6.6b

Lake: Yoho	3 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 Low organic assemblage	Low TOC; entire range of specimen density and depth.	Medium-high CA Low-medium SDI
2 Moderate diversity assemblage	Entire range of TOC, specimen density, and depth.	High <i>Centropyxis constricta</i> , <i>Diffugia protaeiformis</i> "claviformis", <i>Pontigulasia compressa</i> Medium-high SDI
3 Transitional assemblage	Entire range of TOC and depth; low to medium specimen density;	Medium-high SDI

Lake: Yoho	4 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1 Low organic assemblage	(same as 3 cluster model, #1)	(same as 3 cluster model, #1)
2 Moderate diversity assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a <i>L. vas-L. modesta</i> shallow water assemblage	Entire range of TOC; low specimen density; shallow water.	High <i>Lagenodiffugia vas</i> , <i>Lesquereusia modesta</i> Medium-high SDI
3b Transitional assemblage	Low to medium TOC and specimen density; entire range of depth.	Medium SDI

Lake: Yoho	5 Cluster Model	Data transformation: normalized
Cluster:	Parametric ranges:	Defining taxa:
1a Low organic shallow water assemblage	Low TOC and specimen density; shallow water.	High <i>Centropyxis aculeata</i> Low SDI
1b Low organic assemblage	Low TOC; entire range of specimen density and depth.	Low-medium SDI Medium <i>Centropyxis aculeata</i>
2 Moderate diversity assemblage	(same as 3 cluster model, #2)	(same as 3 cluster model, #2)
3a <i>L. vas-L. modesta</i> shallow water assemblage	(same as 4 cluster model, #3a)	(same as 4 cluster model, #3a)
3b Transitional assemblage	(same as 4 cluster model, #3b)	(same as 4 cluster model, #3b)

CHAPTER 7

SEDIMENT-WATER INTERFACE (SWI) Q-MODE CLUSTER ANALYSIS DISCUSSION

Previous research has indicated that arcellacean assemblage composition is controlled by several limnological and climatic factors, including but not exclusive to: sediment organic levels, dissolved oxygen, water temperature, and depth (Scott and Medioli, 1983; Patterson et al., 1985; Collins et al., 1990; Medioli et al., 1990; Patterson et al., 1996, 2002; Reinhardt et al., 1998; Dalby et al., 2000; Kumar and Patterson, 2000; Patterson and Kumar, 2000, 2002). This study aims to expand the arcellacean database and to refine the quantitative tools used in arcellacean assemblage interpretation, as well as to further investigate the usefulness of this group as environmental indicators.

7.1 Controlling factors

Multiple regression analysis, described in Chapters 4 and 5, examined many relationships between arcellacean assemblages (proxy data) and each environmental parameter individually. Statistically significant relationships were found to exist in varying degrees for each parameter. The controlling factors (environmental parameters) from strongest to weakest are: total organic content (TOC), specimen density, dissolved oxygen, temperature, and then depth.

That TOC had the strongest influence on arcellacean assemblages implies that the trophic nature of a lake is a stronger control than climatic inputs on the faunal makeup of the sediment-water interface (SWI). This result is supported by the fact that several lakes with different trophic natures were found in the same area, all subject to the same climatic conditions. These ranged from oligotrophic (Oromocto) to eutrophic (Yoho) and extremely eutrophic (Greenhill).

Unfortunately, only 30 TOC samples were analyzed from lakes studied as the analysis of more samples in this study in this manner would have been prohibitively expensive. Additionally, only 30 samples were set aside untreated with alcohol as TOC analysis was not originally planned for this study. As alcohol is composed of organic carbon, TOC analysis would have been impractical. However, multiple regression analysis (see Chapters 4 and 5) provided transfer functions to infer values for those samples for which TOC analysis was not performed. As a transfer function is not a perfect expression of a proxy-parametric relationship, such inferred quantities must be accompanied with a strong caveat. While the R^2 was high indicating a strong controlling relationship, some calculated (inferred) values were unusually high, particularly for Greenhill Lake (Figure 1).

Figure 7.1a shows the TOC contour map for Greenhill Lake with intervals of 5%. Three samples, GRS4, GRS16, and GRS24, had inferred TOC values from 30-45%. As none of the actual measured TOC values exceeded 20%, these three values are likely

overestimated. Figure 7.1b lumps all values greater than 15% into the same contour interval, effectively eliminating this outlier effect. That map shows TOC to be elevated in the central basin and to the northwest where the inlet to the lake is found. This makes sense as this stream is a substantial source of organic input originating from a hog farm upstream. This effluent has been a major concern for the New Brunswick Department of the Environment. This department has conducted several fecal coliform surveys for Greenhill Lake which have indicated that the severe pollution problem from hog farming upstream had major ramifications for human health, particularly as there are numerous homes and a youth summer camp on the lake (Jerry Choate, New Brunswick Department of Municipal Affairs and Environment, pers. comm.). The inferred TOC values, even when disregarding the outliers, are plausible as they reflect the expected result of high organic input from the stream that after settling concentrates in the central-west part of the lake.

The most prominent feature of Oromocto and Yoho lakes is the extremely low actual and inferred TOC values over large areas (Figures 7.2 and 7.3). Unlike Greenhill Lake, there were no overly inflated inferred values, with the range of inferred TOC falling within the range of actual TOC. It was not surprising to find low TOC values as these lakes had rocky or winnowed sandy substrates over large areas of their bottoms, and the higher TOC values (inferred and actual) were only found in those areas, such as restricted bays, where such values would be expected.

In Oromocto Lake, the greatest concentration of elevated TOC was in the Harbour Bay area (Figures 1.5, 7.2), a shallow (<3m) restricted bay, about half way up the eastern side of the lake. A visual survey found a fair amount of bottom vegetation in this area that probably contributed to, or is an effect of, higher TOC. Much of the rest of the bottom substrate is dominated by sandy or silty sediments, in contrast with the dense algal gyttja found in Greenhill Lake. An underwater visual survey at the north end of Oromocto Lake indicated that sand-rich sediments extended along a shallow depth gradient for hundreds of meters. Some vegetation was also observed here, including occasional algal masses. Relatively elevated TOC values in Yoho Lake are generally found close to shore, in or near restricted bays (Figure 7.3). Improperly installed septic systems may be a cause of elevated TOC as the shoreline of Yoho Lake is densely circled with permanent homes and cottages.

Stratification of the water column in certain lakes also appears to be an important factor controlling the distribution of arcellaceans. The colder, oxygen deprived regions below the oxy-thermocline result in compositional differences in arcellacean assemblages based on multiple regression and Q-mode cluster results. Two of the lakes in the study area were stratified: Greenhill and McAdam. It was unfortunately not possible to compare the two lakes as only seven sediment samples were recovered from McAdam Lake because the lake bottom was characterized by rocky or winnowed sandy substrates. For this reason, the McAdam Lake samples were not examined using Q-mode clustering techniques. Nevertheless, significant relationships were found to exist between dissolved oxygen and temperature data in Greenhill Lake. Yoho and Oromocto lakes are

unstratified so any relationships between dissolved oxygen and temperature could not be discerned there as there were insignificant gradients of these parameters throughout the water column.

Relationships between water depth and arcellacean assemblages were difficult to determine for two reasons: 1. the R^2 (adjusted measure of goodness of fit) scores for depth were generally low, indicating that different assemblages were controlled to greater extents by other environmental parameters; and 2. the stronger dissolved oxygen and temperature relationships in stratified lakes tended to confound any possible relationships controlled by depth alone. In fact, only two statistically significant transfer functions were found (see Chapters 4 and 5), one each for Greenhill Lake (stratified) and Oromocto Lake (unstratified). As these lakes have different stratification regimens, this provided an opportunity to compare depth relationships in order to filter the effects of stratification. Unfortunately, the R^2 value for Oromocto Lake was only 0.5, meaning that fully half the effects of depth are not statistically explained by the arcellacean data, at least not through stepwise multiple regression analysis. Furthermore, Yoho Lake, unstratified like Oromocto Lake, did not exhibit any detectable relationship between depth and arcellacean assemblages through stepwise multiple regression analysis. All these results suggest that while depth is not an environmental control because it is a product of other factors such as dissolved oxygen and temperature.

7.2 Clustering models

Several clustering methods were presented in Chapter 6. Geographic and parametric comparisons of the different models suggest that the best approach is to use normalized data, corrected for multicollinearity, with the elimination of those taxa whose standard errors exceeded their actual abundances more than 60% of the time (see Chapter 4, section 4.1). These conclusions are based on two lines of evidence: 1. multiple regression analyses that examined statistically significant relationships between arcellacean proxies and environmental parameters worked best when using the above methodology; and 2. comparative Q-mode analysis results would seem to confirm this methodology, as clusters generated by this method were more easily defined based on both proxy and parametric ranges.

For Greenhill Lake, analysis of normalized data permitted the resolution of more easily defined clusters based on faunal and parametric ranges (Tables 6.4a and 6.4b). In fact, it was only possible to discriminate the Deep Water Disoxic Assemblage (3b₂) using this methodology. Additionally, the non-normalized data identified three indistinct high diversity assemblages, two of which were in shallow water (3a, 3b₁, and 3b₂), rendering them somewhat useless for interpretation. In Oromocto Lake, using normalized data in Q-mode analysis it was possible to resolve shallow and deep water clusters, whereas the non-normalized clusters only identified a shallow water cluster. Normalized data clusters were also useful for identifying five distinct clusters in Yoho Lake, whereas the non-normalized clusters could only identify four. The geographic distributions of the clusters based on normalized data are shown in Figures 7.4 to 7.6 and are described in Tables 6.4b (Greenhill), 6.5b (Oromocto), and 6.6b (Yoho).

7.3 Greenhill Lake Assemblages

The Shallow Water High Diversity Assemblage (1) is characterized by its close proximity to the shoreline and its location above the oxy-thermocline. The Low Organic and Diversity Assemblage (2) is not geographically contiguous and seems to be controlled by a lower TOC. It must be pointed out that inferred TOC values are used for this interpretation, and these were generated using calculations based on arcellacean data, as are the Q-mode clusters themselves. However, the relatively lower faunal diversity found here does seem to suggest an expected lower TOC value as well.

The Medium-High Organic and Diversity (3a) and Medium Organic Low Diversity (3b₁) assemblages gradually trend from relatively high to lower diversity and TOC as one moves into deeper water towards the center of the lake. This is not surprising as these clusters represent the transition across the oxy-thermocline boundary, below which the Disoxic Deep Water Assemblage (3b₂) is found.

7.4 Oromocto Lake Assemblages

Oligotrophic Oromocto Lake generally has substrates with relatively low organic content. It is therefore not surprising to find the lake characterized by four distinct low organic assemblages (2a, 2b, 3a, 4a). These were differentiated on the basis of water depth and dominant fauna. Interestingly, the High Diversity Low Organic Assemblage

(4a) is found adjacent to the inlet at the north end of the lake as well as the northernmost bay in The Basin (Figure 1.5). To find a high faunal diversity assemblage in a low organic milieu is unexpected, but this may be explained by the allochthonous transport of arcellacean specimens from the source stream.

The only relatively deep waters with appreciable arcellacean populations seem to be restricted to areas of Harbour Cove on both sides of the narrowing known locally as "The Jaws", and in one sample found in South Cove, also a restricted bay. These areas are identified by Q-mode cluster analysis as the Medium Deep Water Assemblage (3b). This assemblage differs from other deeper water areas in that it is found in geographically restricted areas with limited circulation as well as being found adjacent to other arcellacean populations identified in shallower water clusters. This seems to suggest the possibility of allochthonous specimen transport from nearby shallower areas to deeper water.

7.5 Yoho Lake Assemblages

Yoho Lake, like Oromocto Lake, also contains substrates with relatively low organic content, which limits the usefulness of arcellaceans as many samples had low faunal counts. Nevertheless, enough of them had sufficiently high numbers for the purposes of Q-mode cluster analysis. The *L. vas-L. modesta* Shallow Water Assemblage (3a) was found in geographically restricted bays and was also characterized by relatively higher faunal diversity. Oddly, the southwestern and west-central bays also had

populations that classified with the Low Organic Shallow Water Assemblage (1a), which were found adjacent to Assemblage 3a in the west-central bay. The assemblage was also adjacent to the Transitional Assemblage (3b) which is compositionally similar to 3a. Why this is so is unclear, but it would seem to suggest that there are microenvironmental differences over short distances in parts of the lake. One possible cause for this could be the relative placement of the septic systems of the residential properties that line the shore, but this is conjectural.

There is an interesting contrast between Q-mode cluster analysis and the multiple regression analyses performed in Chapters 4 and 5. Q-mode analysis seemed to be able to resolve shallow water assemblages in Yoho Lake, whereas multiple regression analysis found no statistically significant relationships between depth and arcellacean assemblages. This can be explained by the fact that compositionally different assemblages were found in shallower water, making it difficult if not impossible to produce a transfer function for depth based on a single suite of arcellacean fractional abundance variables.

The usefulness of Q-mode analysis for environmental interpretation is clear and these interpretations are enhanced by the identification of statistically significant relationships using multiple regression analysis. The reverse is also true. Q-mode cluster analysis can be used to identify complex relationships (eg. that of Yoho Lake described in the previous paragraph) that multiple regression analyses were unable to resolve. This

study has shown that while individual statistical techniques are helpful for interpretation, the usage of several techniques concurrently greatly enhances our interpretation as they are complementary, increasing our understanding of arcellacean assemblage dynamics.

Figure 7.1

Total Organic Carbon (TOC) contour map for Greenhill Lake. Based on actual and inferred data. Inferred TOC values are speculative and are presented to assess the validity of their usage. 7.1a Contour map using increments of 5%. 7.1b Contour map showing increments of 5% only for those values below 20% effectively eliminating possible outliers.

Figure 7.1

Figure 7.2

Total Organic Carbon (TOC) contour map for Oromocto Lake. Based on actual and inferred data. Inferred TOC values are speculative and are presented to assess the validity of their usage.

Figure 7.2

Figure 7.3

Total Organic Carbon (TOC) contour map for Yoho Lake. Based on actual and inferred data. Inferred TOC values are speculative and are presented to assess the validity of their usage.

Figure 7.3

Figure 7.4

Map of Greenhill Lake showing the geographic distribution of Q-mode generated clusters. Q-mode assemblage codes: 1 Shallow Water High Diversity Assemblage. 2 Low Organic Low Diversity Assemblage. 3 Medium to High Organic Assemblage: 3a Medium-High Organic and Diversity Assemblage; 3b Medium-High Organic Assemblage; 3b₁ Medium Organic Low Diversity Assemblage; 3b₂ Disoxic Deep Water Assemblage. Bathymetric contour interval for the inset map is 3 m.

Figure 7.4

Figure 7.5

Map of Oromocto Lake showing the geographic distribution of Q-mode generated clusters. Q-mode assemblage codes: 1 *P. compressa*-*C. Kahli* Assemblage. 2 Low Organic Assemblage: 2a Low Organic *C. aculeata*, *P. compressa* Assemblage; 2b Low Organic Shallow Water Assemblage. 3 Low Organic *Lagenodifflugia vas* Assemblage: 3a Low Organic *L. vas*, *P. compressa* Assemblage; 3b Medium Deep Water Assemblage. 4 High Diversity Assemblage: 4a High Diversity Low Organic Assemblage; 4b High Diversity Assemblage. Bathymetric contour interval for the inset map is 4 m.

Figure 7.5

Figure 7.6

Map of Yoho Lake showing the geographic distribution of Q-mode generated clusters.

Q-mode assemblage codes: 1 Low Organic Assemblage: 1a Low Organic Shallow Water

Assemblage; 1b Low Organic Assemblage. 2 Moderate Diversity Assemblage. 3

Transitional Assemblage: 3a *L. vas-L. modesta* Shallow Water Assemblage; 3b

Transitional Assemblage. Bathymetric contour interval for the inset map is 3 m.

Figure 7.6

CHAPTER 8

SEDIMENT CORE ANALYSIS RESULTS

The arcellacean fossil records from Frog and Greenhill lakes were examined using Q-mode clustering methods and these were used for the paleoenvironmental reconstruction of the arcellacean postglacial record. Figures 8.1 (Greenhill Lake core) and 8.2 (Frog Lake core) graphically present Q-mode clusters, the Shannon Diversity Index (SDI), and the pollen zones of Mott (1975) and Terasmae (1973), as well as core depth and radiometric dates. These data are supplemented by traditional fractional abundance data graphs also plotted along the cores (Figures 8.3 and 8.4)

Q-mode cluster analysis dendrograms (Appendix F) were generated using the methodology and refinements described in Chapters 6 and 7. Specifically, the arcellacean fractional abundance data used were normally transformed and did not include those taxa which had 60% or more instances of standard errors greater than actual fractional abundance (see Chapter 4, section 4.1). For each core at least two different dendrogram "cutoff" models were used for comparison (Appendix F). It was found that this was useful for interpreting the sediment-water interface sample dendrograms as described in Chapters 6 and 7 and this approach is again used here.

Q-mode clusters were then examined for which ranges of defining taxa and SDI values were intrinsic to each. These range data are presented in Tables 8.1 and 8.2 (Greenhill and Frog lakes), which list the means, standard deviations, and maxima and minima for each taxon, as well as the SDI. These data helped to distinguish each cluster, which are described in Tables 8.3 and 8.4 (Greenhill and Frog lakes).

Unlike the SWI Q-mode dendrograms, directly measured environmental parametric data were unavailable, especially in the case of dissolved oxygen, depth, and temperature. Predicted total organic carbon (TOC) and specimen density were calculated using transfer functions based on modern samples, but they did not correlate well with those directly measured values on core subsamples and were not used hereafter. It must be stressed that the TOC transfer functions were developed based on only 30 present-day sediment-water interface (SWI) samples described in Chapters 6 and 7. Their uncertain usefulness at inferring modern TOC levels for those samples for which TOC analysis was not performed was discussed in Chapter 7. In addition to this, they may not necessarily reflect the same relationships that existed in the fundamentally different environments found just after the last deglaciation. Downcore variations of the results from transfer function calculations may well represent environmental changes other than the present-day parameters upon which they are based.

SWI and core Q-mode dendrograms generated, for the most part, clusters with relatively equal numbers of samples. This is not surprising as this method preferentially creates clusters of relatively equal size (Hair et al., 1998). The Greenhill Lake core

cluster results were somewhat different, however. The two cutoff models made 3 or 5 regular sized clusters. In addition to this, three other single sample clusters were also discriminated (GRC00, GRC180, GRC200). The descriptions in Table 8.3 list the two different cutoff models as 3+3 and 5+3, the first number representing how many regular sized clusters, and the second digits representing the single-sample clusters.

Coring of Frog Lake presented some logistical problems. The top 1-2 metres of sediment from the Livingstone core was an unusable disturbed slurry that lacked stratigraphic integrity, and thus could not be subsampled. The arcellacean record began just before the unusable portion. To remedy this, a short freeze core was retrieved from the same area during a subsequent field season to supplement this. Subsequently, both the freeze and Livingstone cores are presented together on the same figures with a break between them. The stratigraphic positions of the subsamples (in cm) for the freeze core are accurate as the sediment-water interface (SWI) was clearly observed on the frozen sample. Unfortunately, it was difficult to determine the exact depth of the SWI from the Livingstone core as the thick algal growth in Frog Lake offered the same resistance as soft sediment when placing the core barrel into the bottom, making it difficult to find the bottom. Also, the disturbed slurry recovered from the core barrel offered no clue as to the position of the SWI. Because of this, the relative stratigraphic positions of the Livingstone and freeze cores may be up to half a meter out relative to one another.

Figure 8.1

Q-mode clusters, Shannon Diversity Indices, specimen density [$\ln(S)$], and pollen zones of Mott (1975) and Terasmae (1973) plotted against the Frog Lake core. Q-mode assemblage codes: 1 High Diversity Assemblage. 2 *C. aculeata*- *L. vas* Assemblage: 2a *Centropyxis aculeata* Assemblage; 2b *Lagenodifflugia vas* Assemblage. 3 Transitional Assemblage: 3a *Diffflugia protaeiformis* Transitional Assemblage; 3b *Lesquereusia modesta* Transitional Assemblage. 4 Low Diversity Assemblage.

Figure 8.1

Figure 8.2

Q-mode clusters, Shannon Diversity Indices, specimen density [$\ln(S)$], and pollen zones of Mott (1975) and Terasmae (1973) plotted against the Greenhill Lake core. Q-mode assemblage codes: (1) single sample: GRC-00. 2 High Abundance and Diversity Assemblage. 3 *D. protaeiformis*-*L. vas* Assemblage: 3a High Diversity *D. protaeiformis*-*L. vas* Assemblage; 3b *D. protaeiformis*-*L. vas* Assemblage. 4 Medium Abundance *Centropyxis aculeata* Assemblage. (5) single sample: GRC-180. (6) single sample: GRC-200.

Figure 8.2

Figure 8.3

Fractional abundance data graphs plotted against the Frog Lake core.

Figure 8.4

Fractional abundance data graphs plotted against the Greenhill Lake core.

Figure 8.4

Table 8.1

Taxonomic and parametric ranges, means, and standard deviations for each Frog Lake core Q-mode generated cluster.

Table 8.1

Frog Lake Core

4 and 6-cluster model, cluster 1																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.4496	0.6955	0.8164	0.0069	0.7973	0.3391	0.0382	1.6131	0.8559	0.6911	0.0628	0.0189	0.5537	18.264	16.719	4.6189	4.1071	7.7324	7.5815	1.8137	5.478	24.841	26.386	
standard deviation	0.2091	0.1798	0.0766	0.012	0.0811	0.0507	0.0168	0.5378	0.1253	0.1918	0.0653	0.0328	0.1728	5.4423	5.9954	0.2075	0.3841	1.0448	0.3157	0.6804	1.1629	7.8744	0.7486	
minimum value	0.2114	0.5086	0.729	0	0.7328	0.3003	0.0211	1.2588	0.7484	0.5066	0	0	0.3703	14.569	11.182	4.4543	3.7719	6.7532	7.2353	1.1007	4.6333	16.111	25.642	
maximum value	0.6033	0.8674	0.8718	0.0208	0.8884	0.3965	0.0547	2.2319	0.9935	0.8894	0.1304	0.0568	0.7135	24.514	23.073	4.852	4.5262	8.8324	7.8534	2.4559	6.8044	31.407	27.139	
4-cluster model, cluster 2																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.8596	0	0.0809	0.0012	0.6762	0.0167	0.0134	0.393	0.1868	0.0383	0.0187	0	0.064	3.7547	6.1702	4.4319	2.9159	4.8477	7.5585	3.6725	4.5794	13.034	18.173	
standard deviation	0.0852	0	0.1236	0.002	0.1627	0.0431	0.0178	0.1997	0.1873	0.1314	0.0487	0	0.1512	0.7285	0.9172	0.2491	0.1305	1.2003	0.224	0.7807	0.3551	1.9726	1.341	
minimum value	0.6876	0	0	0	0.3712	0	0	0.1217	0	-0.0822	0	0	0	2.5866	4.6795	3.9576	2.7181	3.462	7.0152	2.1885	4.095	10.043	14.179	
maximum value	0.9589	0	0.3767	0.0061	0.9559	0.1425	0.0507	0.8025	0.5201	0.3296	0.1629	0	0.4421	5.4768	7.5832	4.7735	3.1861	6.9698	7.9605	4.422	5.3216	16.822	18.422	
4-cluster model, cluster 3																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.7769	0.5284	0.5376	0.0082	0.6119	0.1555	0.0029	0.6971	0.2651	0.195	0.0392	0	0.1246	7.5392	9.0562	3.3726	3.3925	4.5612	7.4111	3.7729	4.6995	18.53	19.534	
standard deviation	0.0245	0.1459	0.1376	0.0077	0.1539	0.213	0.0028	0.0929	0.2231	0.2736	0.0877	0	0.21	1.188	1.1297	0.6035	0.1854	0.9435	0.2859	0.5857	0.9456	2.224	1.9671	
minimum value	0.7523	0.3697	0.311	0	0.3484	0	0	0.5558	0	0	0	0	0	5.6511	7.713	2.539	3.1818	3.462	6.901	3.0618	3.7158	15.924	17.465	
maximum value	0.8173	0.7558	0.6835	0.0191	0.724	0.395	0.0061	0.8158	0.8082	0.661	0.1961	0	0.4845	8.8269	10.618	3.9951	3.859	5.8009	7.561	4.422	5.4298	21.907	22.648	
4 and 6-cluster model, cluster 4																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.6706	0	0.0053	0	0	0	0	0.2425	0.004	0	0	0	0	4.1349	6.5885	1.4251	0.9721	4.2887	7.506	3.9083	4.4631	-15.064	0.586	
standard deviation	0.3045	0	0.0106	0	0	0	0	0.163	0.0079	0	0	0	0	2.1317	2.6009	2.3675	1.9873	1.6135	0	1.0273	0.3441	28.669	15.704	
minimum value	0.3775	0	0	0	0	0	0	0	0	0	0	0	0	3.069	5.296	-0.5754	-0.7598	3.462	7.506	2.3674	3.95	-40.53	-15.192	
maximum value	1	0	0.0212	0	0	0	0	0.35	0.0159	0	0	0	0	7.3325	10.498	4.2787	2.7449	6.6889	7.506	4.422	4.6933	10.48	14.863	
6-cluster model, cluster 2a																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.9149	0	0.1043	0.0012	0.5835	0.0093	0.0031	0.2623	0.073	-0.0092	0.0204	0	0.1006	3.8036	5.9762	4.3258	2.8823	3.9134	7.4676	4.1376	4.434	13.418	15.587	
standard deviation	0.0206	0	0.1385	0.0024	0.1093	0.0263	0.0042	0.0692	0.1028	0.026	0.0576	0	0.1874	0.8095	0.828	0.2283	0.1383	0.6258	0.1866	0.3941	0.145	2.0232	1.1177	
minimum value	0.898	0	0	0	0.3712	0	0	0.1217	0	-0.0737	0	0	0	3.069	5.2113	3.9576	2.7181	3.462	7.0152	3.6036	4.2075	10.708	14.179	
maximum value	0.9589	0	0.3767	0.0061	0.6891	0.0745	0.0122	0.3515	0.2339	0	0.1629	0	0.4421	5.4768	7.5832	4.7593	3.1861	4.7474	7.615	4.422	4.616	16.822	17.705	
6-cluster model, cluster 2b																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.771	0	0.0433	0.0012	0.8245	0.0285	0.0288	0.6021	0.3687	0.1144	0.0161	0	0.0054	3.6765	6.4806	4.8017	2.8685	5.8226	7.8888	2.9283	4.8121	12.42	17.109	
standard deviation	0.0715	0	0.0969	0.0016	0.1177	0.0637	0.0187	0.1497	0.1387	0.1971	0.0358	0	0.0121	0.6511	1.0622	0.1908	0.1087	0.9126	0.2203	0.5825	0.4811	1.9552	1.1941	
minimum value	0.6876	0	0	0	0.8988	0	0.0044	0.3906	0.2146	-0.0822	0	0	0	2.5866	4.6795	4.3263	2.7833	4.809	7.44	2.1885	4.095	10.043	15.3	
maximum value	0.873	0	0.2167	0.0029	0.9559	0.1425	0.0507	0.8025	0.5201	0.3296	0.0803	0	0.0271	4.1849	7.3861	4.7735	3.0548	6.9698	7.9605	3.5007	5.3216	14.659	18.422	
6-cluster model, cluster 3a																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.7653	0.4799	0.4205	0.0086	0.7043	0.3889	0.0042	0.7675	0.4576	0.1023	0	0	0.3115	6.6894	9.8754	3.2354	3.5639	4.8263	7.5439	3.8803	3.7889	20.328	21.351	
standard deviation	0.0184	0.0526	0.1548	0.0064	0.0279	0.0088	0.0002	0.0684	0.2101	0.1402	0	0	0.2448	1.4402	1.0499	0.9849	0.1345	1.3782	0.0018	0.8747	0.1034	2.2336	1.834	
minimum value	0.7523	0.4427	0.311	0.0041	0.6846	0.3827	0.0041	0.7191	0.3091	0.0032	0	0	0.1384	5.6511	9.1331	2.539	3.4687	3.9518	7.5426	3.0618	3.7158	18.748	20.054	
maximum value	0.7783	0.517	0.53	0.0131	0.724	0.395	0.0044	0.8158	0.8082	0.2014	0	0	0.4845	7.6878	10.618	3.9318	3.859	5.8009	7.5451	4.2888	3.8621	21.907	22.648	
6-cluster model, cluster 3b																								
taxon/parameter	Ca	Cr	Door	Doo	Lvas	Lmod	Pcomp	SDI	Dogs	Ccc	Ckal	Doli	Dpc	TOC282	TOC397	ln(S) _{ss}	ln(S) ₁₂₆	O ₁₅₉	O ₉₅	D ₁₆₁	D ₁₉₉	T ₂₇	T ₃₅	
mean	0.7847	0.5807	0.6157	0.0079	0.5503	0	0.002	0.6503	0.1398	0.2568	0.0654	0	0	8.1191	8.51	3.484	3.2782	4.3945	7.3227	3.8346	5.3065	17.332	18.323	
standard deviation	0.0283	0.1931	0.0548	0.01	0.181	0	0.0035	0.0818	0.1258	0.3543	0.1132	0	0	0.7244	0.9395	0.4804	0.1038	0.8446	0.3682	0.5376	0.2069	4.1813	0.7452	
minimum value	0.7671	0.3697	0.5558	0	0.3484	0	0	0.5558	0	0	0	0	0	7.3792	7.713	3.1781	3.1818	3.462	6.901	3.8684	5.0676	15.924	17.465	
maximum value	0.8173	0.7558	0.6835	0.0191	0.6979	0	0.0061	0.6992	0.2458	0.661	0.1961	0	0	8.8269	9.548	3.9951	3.3611	5.1199	7.561	4.422	5.4298	18.76	18.808	

Table 8.2

Taxonomic and parametric ranges, means, and standard deviations for each Greenhill
Lake core Q-mode generated cluster.

Table 8.2

Greenhill Lake Core

3x3 5x3-cluster model, single sample, cluster 1																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
single sample	0.5956	0.1296	0.0392	0.0381	0.073	0	0.0391	0.0127	1.1756	0	0.1154	0	0.1041	0.1678	15.942	14.58	3.5553	4.4686	7.7762	7.7414	1.6751	6.801	25.164	21.709	
3x3 5x3-cluster model, cluster 2																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.2043	0.7507	0.202	0.2102	0	0	0.0813	0.2098	1.8241	0.9775	0.6924	0.1004	0.4177	0.1987	8.7885	11.164	4.334	4.5307	8.9938	9.3866	0.4807	5.4466	13.715	16.295	
standard deviation	0.0744	0.1426	0.1954	0.0793	0	0	0.1115	0.0639	0.0839	0.0893	0.076	0.2245	0.2778	0.0478	3.2558	3.8475	0.391	0.4479	0.7529	0.5754	0.5082	0.4595	12.085	6.3713	
minimum value	0.0995	0.5471	0	0.1494	0	0	0	0.1365	1.7088	0.8408	0.8077	0	0	0.1246	4.2497	5.5901	3.9925	3.9958	8.9609	8.7297	-0.217	4.6984	1.003	8.8282	
maximum value	0.2714	0.895	0.4188	0.3368	0	0	0.2095	0.301	1.9324	1.0803	0.8064	0.502	0.7449	0.2456	12.85	14.498	4.8993	5.0813	10.748	10.205	0.9956	5.9422	26.879	24.435	
3x3-cluster model, cluster 3																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.2958	0.2377	0.0615	0.1603	0	0	0.3508	0.0214	0.2077	1.6742	0.8881	0.8051	0.0016	0.6473	0.1782	8.8356	9.7808	4.2669	4.3277	9.3664	8.3397	0.6759	5.4069	20.194	17.908
standard deviation	0.1321	0.2274	0.1242	0.0437	0	0	0.1634	0.0643	0.0683	0.2251	0.1586	0.184	0.0047	0.1312	0.0727	2.9845	2.8155	0.4232	0.3933	1.2684	1.549	0.823	0.4685	8.3629	3.2435
minimum value	0.1341	0	0	0.0774	0	0	0.1376	0	0.0851	1.1762	0.8051	0.3893	0	0.4959	0.0957	5.555	5.518	3.7317	3.7516	6.6887	5.0252	-0.212	4.7537	2.0918	13.909
maximum value	0.5866	0.4743	0.3235	0.2084	0	0.5421	0.1929	0.2954	1.9491	1.0791	0.8785	0.014	0.9322	0.3011	14.561	12.895	4.8928	4.8386	10.739	9.6996	2.4305	6.081	28.426	23.357	
3x3-cluster model, cluster 4																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.4989	0.6393	0.0039	0.0583	0.0648	0	0	0.0675	1.2843	0.772	0.2289	0.1749	0.8723	0.1778	8.89	13.634	3.0929	3.8607	8.6681	7.9507	1.1072	5.8182	22.853	21.104	
standard deviation	0.1839	0.1471	0.0078	0.0671	0.1295	0	0	0.054	0.3617	0.0955	0.1708	0.3499	0.297	0.1106	3.5607	6.8292	1.0561	1.791	0.8439	0.5072	0.4089	0.7327	3.8327	2.0582	
minimum value	0.3151	0.4983	0	0	0	0	0	0	0.8213	0.6784	0	0	0.4998	0.0727	5.8985	8.0645	1.6582	1.0061	8.037	7.506	0.7217	5.1308	19.83	19.06	
maximum value	0.7079	0.8201	0.0156	0.155	0.2591	0	0	0.1246	1.7951	0.8617	0.3795	0.6997	1.1603	0.2857	13.761	23.251	4.1608	4.8031	9.2735	8.4328	1.509	6.7937	28.201	23.802	
5x3-cluster model, cluster 3a																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.3622	0.4278	0.1105	0.1889	0	0	0.4453	0	0.2238	1.7966	0.9634	0.6384	0	0.5744	0.1988	8.4152	9.7252	4.4582	4.4521	9.9595	8.902	0.295	5.5814	19.293	18.53
standard deviation	0.182	0.333	0.1166	0.035	0	0	0.1394	0	0.0821	0.1411	0.1117	0.2157	0	0.0777	0.0881	3.9808	3.0806	0.4712	0.3987	0.7534	0.8017	0.4797	0.5122	3.6153	2.5619
minimum value	0.1341	0.3705	0	0.1354	0	0	0.206	0	0.1407	1.6405	0.8168	0.3893	0	0.4959	0.0888	5.555	0.7732	3.7317	4.0437	8.9705	0.9245	-0.212	4.7537	12.930	14.894
maximum value	0.3409	0.4743	0.3235	0.2084	0	0.5421	0	0.2954	1.9491	1.0791	0.8785	0	0.6738	0.3011	14.561	12.895	4.8928	4.8386	10.739	9.4589	0.9147	6.081	22.225	21.57	
5x3-cluster model, cluster 3b																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.3822	0.0002	0	0.1493	0	0	0.2326	0.0492	0.1879	1.5337	0.7939	0.5634	0.0035	0.7393	0.1527	7.8612	8.8604	4.0276	4.1721	8.6028	7.6388	1.1648	5.1888	21.332	17.125
standard deviation	0.1867	0.0004	0	0.0588	0	0	0.1083	0.0894	0.0797	0.2475	0.1657	0.1553	0.007	0.1345	0.0467	0.5673	2.9389	0.2103	0.3937	1.4834	2.1679	0.9625	0.3486	12.883	4.2318
minimum value	0.2319	0	0	0.0874	0	0	0.1376	0	0.0851	1.1762	0.8051	0.4211	0	0.8286	0.0957	7.1917	5.518	3.7841	3.7516	6.6887	5.0252	0.3077	4.8448	2.0918	13.909
maximum value	0.5866	0.0007	0	0.1903	0	0	0.3849	0.1929	0.2567	1.7382	0.9581	0.7838	0.014	0.9322	0.2024	9.5193	12.048	4.2503	4.8011	9.9237	8.6986	2.4305	5.6281	28.426	23.357
5x3-cluster model, cluster 4a																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.8515	0.5209	0	0.039	0.1295	0	0	0.0683	1.0202	0.6899	0.2899	0	0.6371	0.0827	6.2861	9.633	3.2783	4.3668	8.1144	7.976	1.4597	5.2679	24.016	22.65	
standard deviation	0.0797	0.032	0	0.0063	0.1832	0	0	0.0514	0.1399	0.0182	0.1268	0	0.1943	0.0142	0.831	2.1758	0.283	0.1861	0.1095	0.6451	0.0697	0.1941	5.9198	1.6296	
minimum value	0.5951	0.4983	0	0.0346	0	0	0	0.0519	0.8213	0.6794	0.2003	0	0.4998	0.0727	5.8985	8.0645	3.0782	4.2353	8.037	7.5191	1.4104	5.1306	19.83	21.487	
maximum value	0.7079	0.5436	0	0.0435	0.2591	0	0	0.1246	1.119	0.7013	0.3795	0	0.7745	0.0828	8.8737	11.172	3.4784	4.4884	8.1919	8.4328	1.509	5.4051	28.201	23.802	
5x3-cluster model, cluster 4b																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
mean	0.3463	0.7577	0.0078	0.0775	0	0	0	0.0468	1.5484	0.9541	0.1678	0.3499	1.1075	0.273	11.094	17.635	2.9055	2.9546	12.218	7.8254	0.7547	5.3684	21.89	19.558	
standard deviation	0.0441	0.0892	0.011	0.1096	0	0	0	0.0862	0.3085	0.0108	0.2373	0.4948	0.0747	0.019	3.7721	7.9416	1.7696	2.7558	0.0732	0.5931	0.0468	0.8014	0.1864	0.7037	
minimum value	0.3151	0.8964	0	0	0	0	0	0	1.3317	0.8484	0	0	0.1054	0.2902	8.4267	12.02	1.6582	1.0061	9.17	7.506	0.7217	5.9432	21.773	19.06	
maximum value	0.3775	0.8201	0.0156	0.155	0	0	0	0.0936	1.7951	0.8617	0.3795	0.6997	1.1603	0.2857	13.761	23.251	4.1608	4.8031	9.2735	8.4447	0.7876	6.7937	22.008	20.056	
3x3 5x3-cluster model, single sample, cluster 5																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
single sample	0.2147	1	0.8919	0.1741	0	0	0.6002	0.804	0.0819	2.0117	0.0888	-0.043	0	0.7469	0.0512	15.248	15.672	3.6007	4.3445	1.3733	6.0103	5.9492	4.7165	19.275	11.206
3x3 5x3-cluster model, single sample, cluster 6																									
taxon/parameter	Ca	Chl	Door	Doo	Dpam	Lvas	Lmod	Pcomp	SDI	Dogs	Coc	Doli	Dpc	multi	TOC282	TOC387	ln(S)	ln(S)	ln(S)	O 159	O 95	D 161	D 199	T 27	T 35
single sample	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3.089	5.298	0.1178	2.605	3.482	7.508	4.422	3.95	9.031	13.208	

Table 8.3

Q-mode clusters listing significant descriptive taxonomic and parametric ranges for Frog Lake.

Table 8.3

Frog Lake Core, 4-Cluster Model

Cluster:	Parametric ranges:	Defining taxa:
1 High diversity assemblage	High specimen density.	High SDI, many taxa in relatively appreciable quantities.
2 <i>C. aculeata</i> - <i>L. vas</i> assemblage	High specimen density.	Low-medium SDI, <i>Centropyxis aculeata</i> , <i>Lagenodifflugia vas</i>
3 Transitional assemblage	Medium specimen density.	Low-medium SDI, <i>Centropyxis aculeata</i> , <i>Cucurbitella tricusps</i> , <i>Lagenodifflugia vas</i>
4 Low diversity assemblage	Low specimen density.	Low SDI

Frog Lake Core, 6-Cluster Model

Cluster:	Parametric ranges:	Defining taxa:
1 High diversity assemblage	(same as 4-cluster model, #1)	(same as 4-cluster model, #1)
2a <i>Centropyxis aculeata</i> assemblage	High specimen density.	Low SDI, <i>Centropyxis aculeata</i> , <i>Lagenodifflugia vas</i>
2b <i>Lagenodifflugia vas</i> assemblage	High specimen density.	Low-medium SDI, <i>Lagenodifflugia vas</i> , <i>Diffflugia oblonga</i> "spinosa/glans"
3a <i>Diffflugia protaeiformis</i> transitional assemblage	Medium specimen density.	Medium SDI, <i>Centropyxis aculeata</i> , <i>Lagenodifflugia vas</i> , many taxa in relatively appreciable quantities.
3b <i>Lesquereusia Modesta</i> transitional assemblage	Medium specimen density.	Low-medium SDI, <i>Centropyxis aculeata</i> , <i>Lagenodifflugia va</i> , many taxa in relatively appreciable quantities.s
4 Low diversity assemblage	(same as 4-cluster model, #4)	(same as 4-cluster model, #4)

Table 8.4

Q-mode clusters listing significant descriptive taxonomic and parametric ranges for Greenhill Lake.

Table 8.4

Greenhill Lake Core, 3+3 Cluster Model

Cluster:	Parametric ranges:	Defining taxa:
(1) GRC-00	High specimen density.	Medium-high SDI
2 High abundance and diversity assemblage	High specimen density.	High SDI, many taxa in relatively appreciable quantities.
3 <i>D. protaeiformis</i> - <i>L. vas</i> assemblage	High specimen density.	<i>Diffflugia protaeiformis</i> "claviformis", <i>Lagenodifflugia vas</i> Medium-high SDI
4 Medium abundance <i>Centropyxis aculeata</i> assemblage	Low-medium specimen density.	<i>Centropyxis aculeata</i> Medium-high SDI
(5) GRC-180	Medium specimen density.	High SDI, many taxa in relatively appreciable quantities.
(6) GRC-200	Low specimen density.	SDI of zero (only one taxon present - <i>Centropyxis aculeata</i>).

(continued)

Table 8.4 (continued)

Greenhill Lake Core, 5+3 Cluster Model

Cluster:	Parametric ranges:	Defining taxa:
(1) GRC-00	(same as 3+3 cluster model, #1)	(same as 3+3 cluster model, #1)
2 High abundance and diversity assemblage	(same as 3+3 cluster model, #2)	(same as 3+3 cluster model, #2)
3a High diversity <i>D. protaeiformis</i> - <i>L. vas</i> assemblage	High specimen density.	High SDI, <i>Diffflugia protaeiformis</i> "claviformis", <i>Lagenodifflugia vas</i> , many taxa in relatively appreciable quantities.
3b <i>D. protaeiformis</i> - <i>L. vas</i> assemblage	High specimen density.	<i>Diffflugia protaeiformis</i> "claviformis", <i>Lagenodifflugia vas</i> , many taxa in relatively appreciable quantities. Medium-high SDI
4a <i>Centropyxis aculeata</i> assemblage	Medium specimen density.	<i>Centropyxis aculeata</i> Medium SDI
4b Medium abundance <i>Diffflugia protaeiformis</i> assemblage	Low-medium specimen density.	<i>Centropyxis aculeata</i> , <i>Diffflugia protaeiformis</i> "claviformis", "multi" Medium-high SDI
(5) GRC-180	(same as 3+3 cluster model, #5)	(same as 3+3 cluster model, #5)
(6) GRC-200	(same as 3+3 cluster model, #6)	(same as 3+3 cluster model, #6)

CHAPTER 9

SEDIMENT CORE ANALYSIS DISCUSSION

One of the most famous geological principles put forth by Hutton was that "the present is the key to the past", also known as uniformitarianism. When dealing with present arcellacean distributions and downcore data, however, this principle should be considered more a rough guideline than a hard and fast rule. McCarthy et al. (1995) suggested that the lack of baseline studies of modern arcellacean biogeography make downcore interpretations based on modern assemblages impossible. Only a single study by Collins et al. (1990) had attempted to add to our present knowledge by examining arcellacean populations along a longitudinal transect of lakes ranging from Baffin Island in the north down to Virginia. While they found distinct climatically and limnologically controlled trends, only generalized conclusions could be drawn regarding their ecological tolerances (Collins et al., 1990; McCarthy et al., 1995; Patterson and Kumar, 2002). In fact, Dallimore et al. (2000) found that arcellacean population dynamics in the Arctic were not significantly different from those in temperate environments, although a few species were found to be restricted to mid-temperate latitudes southward (Collins et al., 1990; McCarthy et al., 1995; Patterson and Kumar, 2002).

These limitations must be considered when interpreting the arcellacean core record. McCarthy et al. (1995) approached this problem by comparing their downcore arcellacean fauna with palynology, for which a well-calibrated record of paleoecological

events has been developed. A similar approach is taken here by comparing the faunal records of Frog and Greenhill lakes with the postglacial and palynological records of the New Brunswick region (Borns 1965, 1967, 1973; Dyck and Fyles, 1962, 1963; Gadd, 1970, 1973; Grant 1989; Lee 1959, 1962; Mott, 1975; Mott and Grant 1985; Warner et al, 1991).

In order to interpret arcellacean core assemblage results in their proper context, they will be described along with an overview for each of the five postglacial climatic and palynological stages. These are: 1. Glacial retreat; 2. the Early Holocene 3. the Hypsithermal; 4. the Middle to Late Holocene stable period; and 5. the Latest Holocene.

9.1 Glacial retreat

Deglaciation in the New Brunswick-Nova Scotia-Maine area may have started as early as 16500 yBP based on morainic systems found near the Passamaquoddy Bay area in Maine (^{14}C date: 16500 ± 370 yBP, GSC-1063, Gadd, 1973). These moraines likely extended out onto the shelf below present sea level, suggesting that an ice lobe existed at that time in what is now the Bay of Fundy (Mott, 1975). This mass had begun to retreat at about 12600 yBP and it is after this time that the first lacustrine sediments are found for coastal lakes near St. Stephen, New Brunswick (Borns 1965, 1967, 1973; Gadd 1970; Mott, 1975; Mott and Grant 1985).

Deglaciation in the Point Escuminac area, on the northeastern coast near Moncton, N.B., was reported to have occurred after 13500 yBP (Rampton et al. 1984; Grant 1989) and prior to 12000 yBP when the area was inundated by marine waters (Warner et al. 1991). The first freshwater sediments were deposited around 10900 ± 130 yBP (Hel-2081b), although pollen was found underlying the marine sediments most likely from long-distance transport from further inland by flora that had already begun to colonize the reclaimed land (Warner et al. 1991).

Glacial retreat proceeded steadily up the St. John River Valley area, where many of the lakes in this study are located, until it reached the Grand Falls region in northwestern New Brunswick, where a number of small advances and retreats occurred (Lee, 1959, 1962; Gadd, 1973; Mott, 1975). This last series of events in the Grand Falls area has generated radiocarbon dates between 9820 and 10140 yBP on glacial Lake Madawaska sediments, indicating that the ice had left the present study area prior to this time (9820 ± 130 yBP, GSC-18, Dyck and Fyles, 1962; 9830 ± 160 yBP, GSC-56, Dyck and Fyles, 1963; 10140 ± 150 yBP, GSC-5, Dyck and Fyles, 1962).

Radiocarbon dates for the beginning of deglaciation in the southern Maritime provinces of Canada often gave anomalously old dates of up to $16\,500 \pm 370$ (GSC-1063). These were considered to be caused by a mixture of unweathered carbonate sediments in the samples, or the “old carbon effect” (Mott, 1975; Mott and Grant 1985). Karrow and Anderson (1975) acknowledge that this is a problem and agree that these older dates are suspect. They also concluded that unweathered and exposed carbonates following

deglaciation contribute to this. Nevertheless, as vegetation colonizes the land and as lacustrine sediments begin to form a "cap" over the bedrock, this problem is considerably lessened over time (Karrow and Anderson, 1975). While the reliability of older dates from lacustrine and morainic sediments are a concern in areas with carbonate bedrock, the lakes in the present study area are not affected in this way as they mainly overlie sandstone and other noncarbonate rocks.

The environment for the early part of the latest Pleistocene (15000-12000 yBP) has been described as cooler with herb pollen characteristic of modern tundra-like conditions (Davis, 1967). However, the presence of thermophilous tree pollen in these assemblages would suggest that no modern environmental analogues exist, although the tree pollen may have been transported over large distances from areas where colonizing forests had already established themselves (Mott, 1975). The St. John River Valley and southwestern New Brunswick pollen records are dominated early on by grasses such as *Salix*, Gramineae, Cyperaceae, and *Artemisia* (willow, grasses, sedges, and sagebrush) as well as tree pollen from 12000-10000 yBP onward, mainly taxa indicative of open woodland environments like *Picea*, *Betula*, *Abies*, and *Populus* (spruce, birch, fir, and poplar). The latest Pleistocene encompasses Pollen zones 6-9 of Mott (1975 – southwestern NB) and Zones Vb-IX of Terasmae (1973 – St. John River Valley).

9.2 The Early Holocene

The pollen record for the Early Holocene (10000-7000 yBP) in the south-central New Brunswick area is dominated by *Pinus*, *Quercus*, *Picea*, and *Betula* (pine, oak, spruce, and birch). This interval marked the transition from open woodland to a closed forest as pollen frequency increased dramatically (Mott, 1975 – Pollen zones 5-6; Terasmae, 1973 – Pollen zones IV-Va).

As described above, lacustrine deposits have been dated as far back as 10900±130 yBP (Hel-2081b) in Point Escuminac (Warner et al., 1991). The oldest date from this study is 10990±90 yBP (TO-9696) on a gyttja sample 310cm down the Greenhill Lake core, although this gyttja extended down to 400cm where at an abrupt boundary deposits of fine-grained silt devoid of organics begin, which are interpreted here as glacial outwash. The last meter of the lacustrine sediments, although devoid of arcellaceans, was found to contain large numbers of diatoms. The first appearance of arcellaceans here, recorded at 200cm downcore, dates after 7300±70 yBP (TO-9695; gyttja sample at 238cm). The arcellacean record began a little earlier in Frog Lake (220cm) just after 8490±80 yBP (TO-9697; gyttja sample at 225cm). Sharp increases in organic content observed to have occurred around 10000 yBP in lacustrine deposits have also been reported elsewhere in Atlantic Canada by Mott et al. (1986) and by McCarthy et al. (1995), indicating accelerated climatic warming at this time.

Centropyxis aculeata was found to be the first colonizing species in Frog and Greenhill lakes, which corresponds to the results of other studies (Patterson et al., 1985; Honig and Scott, 1987; McCarthy et al., 1995). This is not unexpected, as *C. aculeata* is

considered to be a generalist able to tolerate a wide range of habitats from tropical to Arctic, brackish to freshwater, oligotrophic to eutrophic, and even lakes polluted by mine tailings (Decloître, 1953, 1956; Scott and Medioli, 1980; Medioli and Scott, 1983, 1988; Schönborn, 1984; Patterson et al., 1985; Honig and Scott, 1987; Guilbault et al., 1995; Guilbault et al., 1996; Patterson et al., 1996; Reinhardt et al., 1998; Hutchinson et al., 1998; Dalby et al., 2000; Dallimore et al., 2000; Boudreau et al., 2001; Patterson and Kumar, 2002).

The different colonization times for different lakes supports the fact that *C. aculeata* is a primary colonizer regardless of climatic effects, as arcellacean first appearances have ranged from the latest Pleistocene to well into the Early Holocene (this study; McCarthy et al., 1995). The vectors of chance colonization may vary from lake to lake. For example, Boudreau et al. (2001) postulated that foraminifera found in a brackish part of Lake Winnipegosis in Manitoba far from the sea colonized the lake on the feet of birds traveling between marine regions and freshwater habitats.

9.3 The Hypsithermal

The Hypsithermal (~7000-5000 yBP) record for both Frog and Greenhill lake cores is marked by a dramatic increase in arcellacean diversity (SDI) and abundance as shown in Figures 8.1 to 8.4 (mid-Hypsithermal, Ogden, 1987; Hypsithermal, McCarthy et al., 1995). Q-mode clustering identified the Transitional Assemblage (3) in Frog Lake as well as a variety of rapidly changing assemblages in Greenhill Lake for this period

(Figures 8.1 and 8.2; Tables 8.4 and 8.4). There are two possible explanations for the undefined (Frog) and chaotic natures (Greenhill) of assemblage patterns during the Hypsithermal. First, this is a period of warming where arcellacean assemblages as well as lacustrine conditions were probably adapting to changes in climate. Also, the colonizing episodes occurred just prior to the Hypsithermal, suggesting that assemblage compositions were an effect of both climate change and influx of new species.

Pinus and *Tsuga* (pine and hemlock) dominated the pollen record at this time, the latter increasing greatly at the beginning of the Hypsithermal and remaining in relatively appreciable quantities until about 5120 yBP (Mott, 1975). In general, this time also saw greater floral diversity representing the establishment of a mixed forest (Mott, 1975 – Pollen Zone 4; Terasmae, 1973 – Pollen zones II-III).

9.4 The Middle to Late Holocene stable period

While most of the period following the Hypsithermal (5000–~200 yBP) is characterized by generally stable conditions, there is a short episode of instability in the arcellacean record for both cores at the very beginning of the period. Both core records show a dramatic short-lived reduction in diversity and abundance. This instability is recorded by the low Shannon Diversity Index (SDI) and specimen density values as well as by Q-mode cluster analysis dendrograms (Low Diversity Assemblage (4) – Frog Lake; Low Organic *Centropyxis aculeata* Assemblage (4a) – Greenhill Lake).

After this short unstable period, the arcellacean record revealed stable conditions that proceeded unchanged over the next three to four millennia. The Frog Lake core revealed little change in faunal composition as evidenced by the SDI and specimen density as well as the Q-mode clusters Low Organic *Lagenodifflugia* *vas* (2a)/*Centropyxis aculeata* (2b) assemblages, which are compositionally similar (Figure 8.1; Tables 8.1 and 8.3). This is mirrored in Greenhill Lake, which is characterized by higher diversity than in Frog Lake, but again here the SDI and specimen density are relatively stable. Q-mode clustering identified the compositionally related High Diversity *D. protaeiformis*-*L. vas* (3a) and the *D. protaeiformis*-*L. vas* (3b) assemblages which dominate unchanged over this long period (Figure 8.2; Tables 8.2 and 8.4). Both lakes exhibit differences in faunal diversity, abundance, and composition, but they nevertheless show the same trends. This implies that while lacustrine conditions vary from lake to lake, arcellaceans record the same environmental changes, a characteristic which is useful for paleoenvironmental reconstruction.

The pollen record also reflects this post-Hypsithermal stabilization as characterized by a diverse mixed forest where there is an increase in hardwoods and a dramatic relative decrease in pine and conifers in general (Mott, 1975; Pollen zones 1-3). Interestingly, the pollen record did not identify the short-lived transitional period of instability that is clearly recognized in the arcellacean record. One possible explanation for this phenomenon is the presence of a drought which affected species diversity shown by the SDI and specimen abundance (Figures 8.1-8.2).

9.5 The Latest Holocene

The transformation of the surrounding environment from forest to farmland is recorded in the arcellacean record of Frog Lake. The SDI for Frog Lake saw an increase, then a dramatic reduction upcore. Specimen density also dips slightly near the top of the core (Figure 8.1). Lead 210 (^{210}Pb) dating was performed in order to establish dates for the top part of both the Frog and Greenhill lake cores using the Constant Rate of Supply (CRS) model (Appleby et al., 1995; Binford, 1990; Binford et al., 1993; Sorgente et al., 1999). There were problems with ^{210}Pb data recovered from the top part of Greenhill Lake as ^{210}Pb seemed to increase dramatically at 10cm downcore then dropping to lower, possibly background levels below that, rendering them unusable (Table 3.4). Fortunately, reliable ^{210}Pb dates were obtained for Frog Lake (Figure 3.1).

The Frog Lake arcellacean record for the last 150 years correlates well with recorded settlement history. *Cucurbitella tricuspis*, an important indicator of eutrophication due to surrounding land use changes (Patterson et al., 2002), reappears around 50 cm downcore. Based on an estimated sedimentation rate of 0.3mm/year that was calculated from ^{210}Pb dates from 1900 to the present it was calculated that the margins of the lake were cleared in about 1863. This estimate correlates well with the deeding and subsequent clearance of 100 acres of land adjacent to the lake for farming by John B. Nesbitt in 1851 (Halfpenny, 1878). Subsequent to this first clearance of land Nesbitt and several other later arrivals cleared several hundred more acres by 1906, with most parcels of land being taken up in the late 1880s. With the technology of the time, it

would have taken a number of years to clear the land, so the 1863 estimate for deforestation of the lake shore is reasonable.

The Q-mode cluster analysis of the arcellacean record clearly shows that Frog Lake underwent rapid limnological changes starting around 1900 as agriculture began in earnest in the area. These changes are represented by the appearance of the Transitional Assemblages (3a and 3b) just after 1900, followed by the *Centropyxis aculeata* Assemblage (2a) around 1950. The final fifty years of the sedimentary record are represented by the High Diversity Assemblage (1) which is characterized by dramatic increases of many taxa (Figures 8.1, 8.3; Tables 8.1, 8.3). The dense algal blooms observed today in this shallow lake are undoubtedly caused by fertilizer-rich runoff from adjacent farms which was in use in the area from 1946 on (Ruth Kerr, personal communication 2002). Inferred TOC starts to increase after 1900, then after a short decrease, increases rapidly after 1950. It must again be emphasized that the inferred TOC record is highly speculative. Nevertheless these results are interesting as they correlate well with actual historic events.

The arcellacean record was not only able to record the advent of European settlement in the Frog Lake area, but its distinctive stages as well. This ability to resolve recent land use events at such a high resolution has also been reported elsewhere. In Swan Lake, near Toronto, Ontario, the clearing of the area for agriculture and settlement was also documented in the arcellacean and palynological records based on a lake sediment core (Patterson et al., 2002). The same trends are observed there as found in

Frog Lake, including an increase in the algalphilic *Cucurbitella tricuspidis* after the advent of farming, with a dramatic increase around 1950 when chemical fertilizers became readily available. Both these studies when viewed together confirm that arcellacean proxies are excellent indicators of human induced land-use changes.

The latest record for Greenhill Lake was difficult to discern due to problems with the ^{210}Pb data as well as the arcellacean record. The rapid faunal changes observed at the top of the Frog Lake core are not as clear in the Greenhill Lake core, although there is marked compositional difference between the two uppermost samples (GRC00 and GRC10) which cover the top 10cm. Q-mode clustering identified a single sample cluster for this topmost sample (GRC00). The arcellacean record and the nonsensical ^{210}Pb data suggests that the uppermost sedimentary record has been lost or disturbed in some way. This is unfortunate as the study of the hog farm runoff pollution problems described in Chapter 7 would have greatly benefited from a more complete recent record. The disturbance of the topmost part of the Greenhill Lake core could have been caused by the use of the Livingstone core when the barrel was lowered into the substrate. Because of the soft nature of the sediments, it was difficult to judge when the core barrel had actually penetrated them. The experience at Frog Lake offers a solution, though. Because a freeze core was used, the sediment-water interface was easily observable and thus recorded. In order to obtain a complete record, it is recommended that in future lake sediment cores be recovered with a Livingstone core supplemented by a freeze core for the first two metres or so.

CHAPTER 10

CONCLUSIONS

The initial concept behind this dissertation was to further investigate the application of arcellacean assemblage proxies for the purposes of paleoenvironmental and paleolimnological research. One of the outcomes of this approach was the refinement of Q-mode cluster analysis as well as the investigation, comparison, and eventual development of other multivariate statistical techniques. While canonical correlation and principal components analysis were of limited use, stepwise multiple regression provided new insights into the relationships between arcellacean assemblage data and the environmental and limnological parameters that control their makeup.

Paleoenvironmental reconstruction based on microfossils such as arcellaceans and foraminifera is nothing new. An obvious and reasonable approach is to single out those species which are determined to be indicators for whatever parameters are being studied. In recent work as well as in this study, however, it is now possible to accurately quantify arcellacean *assemblages* rather than a disparate group of individual species. Environmental and paleoenvironmental interpretations are greatly facilitated using this approach. In fact, this study found that interpretations based on an individual taxon are not as strong as examining an assemblage, as the assemblage is a more likely manifestation of environmental effects.

The transfer functions developed in Part One were helpful not only for the calculation of inferred parametric values based on arcellacean assemblages, but also for identifying the relative strengths of those parameters in how they influence arcellacean faunal makeup. Also, the statistical tests and transformations required for stepwise multiple regression were then applied to Q-mode cluster analysis, improving the results over the way it had been conducted in previous work. Specifically, results benefitted greatly from the normalization of arcellacean data coupled with the elimination of many more taxa than had been purged in previous work.

Multiple regression and Q-mode cluster analysis on sediment-water interface samples established that great differences exist in limnological makeup from lake to lake even if they are in the same area subject to the same climatic conditions. Patterns of surrounding land use, oxy-thermal stratification, lake size, and trophic nature all contributed to these wide variations. These limnological differences, however, did not hamper the usage of arcellacean assemblage data in the reconstruction of the postglacial record. While different cores had different faunas, many of the same climatic and environmental events were recorded by them. In fact, they were able to do so with greater precision than with traditional palynological techniques, for example allowing the identification of the short-lived post-Hypsithermal drought preceding the more stable Middle to Late Holocene episode. It must be stressed however that the pollen record was very useful in identifying broad environmental changes. It is therefore recommended that both records be used together to achieve the greatest interpretive potential.

It is strongly recommended that lake sediment cores be recovered using both a Livingstone corer for the entire sedimentary record as well as a freeze corer for the top metre in order to obtain the most recent record. It would appear that it is difficult to accurately judge the position of the sediment-water interface when placing the sturdy Livingstone core barrel into the soft topmost sediments.

CHAPTER 11

SYSTEMATICS

Research over the last one and a half decades has demonstrated the utility of arcellaceans as paleoenvironmental indicators (see Ch. 2 – Previous Work). This usefulness, however, requires taxonomic consistency among researchers in order to be effective. This is particularly important when employing complex multivariate statistical analysis techniques which also require that any potential error in the original data be kept to a minimum.

To this end, attempts have been made to reduce the considerable taxonomic confusion inherent in this group (Patterson and Kumar, 2002). Most research on arcellaceans during the last 150 years work has been of a descriptive nature with few attempts until recently at practical applications, so there has been little motivation to standardize taxonomy. Quite often, regionalism has prevailed with many new species being described in an area with little or no regard for similar work done elsewhere (Patterson and Kumar, 2002). Details of these taxonomic challenges include the over-splitting of taxa in some quarters and reduction (lumping) of species by others have been discussed and described in great detail by Ogden and Hedley (1980), Medioli and Scott (1983), and Medioli et al. (1987, 1990).

In order to produce a coherent, realistic, and useful systematic taxonomy, the approach taken here is to first split those taxa with considerable internal morphological diversity into strains (see Asioli et al., 1996; Patterson et al., 1996; and Reinhardt et al., 1998). These are then examined statistically using R-mode cluster analysis to see which morphologically based strains were real, specifically those which exhibited different ecological requirements. The present study took this approach a step further by using a multicollinearity diagnostic to accomplish the same goal more accurately (see Ch. 4 – Multivariate Analysis Results).

One of the main problems challenging systematists is the species concept with regards to primarily clonal organisms like arcellaceans (Medioli and Scott, 1983; Medioli et al., 1987; Patterson et al., 1996; Reinhardt et al., 1998; Kumar and Dalby, 1998; Patterson and Kumar, 2002). Although arcellaceans have been known to reproduce sexually this phenomenon has only rarely been observed (Valkanov, 1962a,b, 1966; Mignot and Raikov, 1992; Patterson and Kumar, 2002). Certain well-established definitions of species, such as the ability to produce viable offspring, are irrelevant for such organisms.

The nature of the genotype must therefore be relied upon to define individual species. As *phenotypic* variation (morphology) is a well established criteria for representing genotypic expressions (Medioli and Scott, 1983), the arcellacean species concept must be based primarily on physical characteristics. These include: 1. the cell itself, 2. the nature of its pseudopodia, and 3. test morphology (Deflandre, 1953; Loeblich

and Tappan, 1961, 1964; Ogden and Hedley, 1980). It is difficult to use the first two characteristics if they are not easily discriminated under the light microscope where most specimen identifications are done. This is especially complicated when different types of pseudopodia (lobose, filose, and granuloreticulose) may have arisen many times convergently (Medioli and Scott, 1983). While these are challenges for the biologist, they are rendered useless altogether for the paleontologist who only has tests to work with.

To facilitate arcellacean identification, Kumar and Dalby (1998) produced a key for lacustrine thecamoebians species and strains and their approach is followed here. Although the International Code of Zoological Nomenclature (ICZN) does not recognize strains as valid taxonomic units, they have been found to be useful and statistically significant. Moreover, the principal of priority regulated by the ICZN is followed in naming strains for the sake of consistency.

Subphylum SARCODINA Schmarda 1871

Class RHIZOPODEA von Siebold 1845

Subclass LOBOSA Carpenter 1861

Order ARCELLINIDA Kent 1880

Superfamily ARCELLACEA Ehrenberg 1830

Family ARCELLIDAE Ehrenberg 1830

Genus *Arcella* Ehrenberg 1830

Arcella dicoides Ehrenberg 1843

(not figured)

Arcella dicoides EHRENBURG 1843

Arcella dicoides Ehrenberg 1843 OGDEN and HEDLEY 1980, p36-37 pl. 7 a-d

Test round, hyaline, autogenous, with a tapering edge with small, central, invaginated aperture. Tapering, angular edge distinguishes *A. discoides* from *A. vulgaris*, which has a more rounded edge. Not figured as recovered specimens collapsed when mounted on the scanning electron microscope plug.

Family CENTROPYXIDIDAE Deflandre 1953

Genus *Centropyxis* Stein 1859

Centropyxis aculeata (Ehrenberg 1832)

(Plate 2, figs. 1-5)

Arcella aculeata EHRENBURG 1832, p.91

Centropyxis aculeata (Ehrenberg 1832) OH80 p46-47 pl. 12 a-d

Centropyxis spinosa Cash 1905 OGDEN and HEDLEY 1980, p.62-63 pl. 20 a-d

Centropyxis aculeata (Ehrenberg 1832) MEDIOLI and SCOTT 1983, p.39-41, pl. 7 figs.

10-19

Centropyxis aculeata (Ehrenberg 1832) PATTERSON et al. 1985, p.134, pl. 4, figs. 1-7

Centropyxis aculeata (Ehrenberg 1832) SCOTT et al. 1991, p.384, pl. 1, figs. 7-9

Centropyxis aculeata (Ehrenberg 1832) ASIOLI et al. 1996, p.252, pl. 1, figs. 7-8

Centropyxis aculeata (Ehrenberg 1832) "aculeata" REINHARDT et al. 1998, p.140, pl. 1,

figs. 1a-c

Centropyxis aculeata (Ehrenberg 1832) "discoides" REINHARDT et al. 1998, p.140, pl.

1, fig. 2

Centropyxis aculeata (Ehrenberg 1832) "aculeata" DALBY et al. 2000, p.140, pl. 1, figs.

6a-e

Centropyxis aculeata (Ehrenberg 1832) "discoides" DALBY et al. 2000, p.140, pl. 1, fig.

5a

Centropyxis aculeata (Ehrenberg 1832) "aculeata" PATTERSON and KUMAR 2000,

p.320, pl. 2, fig. 12

Centropyxis aculeata (Ehrenberg 1832) "discoides" PATTERSON and KUMAR 2000,

p.319-320, pl. 1, figs. 6, 17, pl. 2, fig. 10

Centropyxis aculeata (Ehrenberg 1832) "aculeata" PATTERSON et al. 2002, *in press*,

figs 7.1

Centropyxis aculeata (Ehrenberg 1832) "discoides" PATTERSON et al. 2002, *in press*,

figs 7.2a-b

Test depressed, circular often with 1- 8 spines in postero-lateral margin. Aperture central to off-centre, invaginated. Fundus length less than half the width of the apertural face.

Previous workers have split *Centropyxis aculeata* into strains "aculeata" and "discoides" based on the presence and absence of spines, respectively (Reinhardt et al. 1998), but this approach is not taken here.

R-mode and multicollinearity tests were not performed for *C. aculeata* "discoïdes", *C. constricta* "aerophila" nor *C. constricta* "spinosa" as their numbers were low, often below the error threshold which precludes these statistical tests. Also, there is a morphological gradation between *C. aculeata* and *C. constricta* (Medioli and Scott, 1983). Different researchers could arbitrarily put the same specimen into more than one strain, introducing taxonomic confusion.

Also, there are practical problems associated with these designations, particularly when spines have been broken off from an "aculeata" specimen which may appear to be a "discoïdes". While spine "stubs" can be identified using scanning electron microscopy, it is often difficult to do so under the light microscope.

For all these reasons, both strains are treated as one in this work to minimize arbitrariness which would render results from multivariate statistical techniques questionable.

Centropyxis constricta (Ehrenberg 1843)

Strain: *Centropyxis constricta* "constricta"

(Plate 2, figs. 7-10)

Arcella constricta EHRENBURG 1843, p.410, pl. 4, fig. 35, pl. 5, fig. 1

Centropyxis constricta (Ehrenberg 1843) OGDEN and HEDLEY 1980, p.52-53 pl. 15 a-e

Centropyxis constricta (Ehrenberg 1843) MEDIOLI and SCOTT 1983, p.41-43, pl. 7

figs. 1-9

Centropyxis constricta (Ehrenberg 1843) PATTERSON et al. 1985, p.134, pl. 4, figs. 8-14

Centropyxis constricta (Ehrenberg 1843) SCOTT et al. 1991, p.384, pl. 1, fig. 4

Centropyxis constricta (Ehrenberg 1843) ASIOLI et al. 1996, p.252, pl. 1, fig. 9

Centropyxis constricta (Ehrenberg 1843) "constricta" REINHARDT et al. 1998, p.140, pl. 1, figs. 4a-b, 6a-b

Centropyxis constricta (Ehrenberg 1843) "aerophila" DALBY et al. 2000, p.140, pl. 1, figs. 2a-b

Centropyxis constricta (Ehrenberg 1843) "aerophila" PATTERSON and KUMAR 2000, p. 320, pl. 2, fig. 4

Centropyxis constricta (Ehrenberg 1843) "constricta" PATTERSON and KUMAR 2000, p. 320, pl. 2, fig. 3

Centropyxis constricta (Ehrenberg 1843) "constricta" PATTERSON et al. 2002, *in press*, figs 7.3a-c

Test shape varies from subspherical to elongated. Apertural lip thickened and at an angle of 45-60 degree with respect to the longitudinal axis of the test. Spines may or may not be present as they are often broken during micropaleontological processing. Fundus length 1.5 to 3 times the width of the apertural face. As with *Centropyxis aculeata* (see above), *Centropyxis constricta* had been split into strains "constricta" and "aerophila" again based on the presence and absence of spines, respectively (Reinhardt et al., 1998). The same difficulties were encountered as in the previous example, so they are considered the same strain here.

Strain: *Centropyxis constricta* "greenhillensis", new strain

(Plate 2, figs. 15-16)

Test length greater than or equal to the apertural diameter, as in *Centropyxis constricta* "constricta", but apertural face does not lie at an angle of 45 to 60 degrees with respect to the longitudinal axis of the test, but at a right angle. The apertural lip is thickened and distended with a diameter greater than that of the rest of the fundus, also not seen in *Centropyxis constricta* "constricta". The new strain is named after the type locality, Greenhill Lake.

Centropyxis kahli Deflandre 1929

(Plate 1, figs. 1a-d)

Centropyxis kahli Deflandre 1929

Cyclopyxis kahli (Deflandre 1929) OGDEN and HEDLEY 1980, p70-71, pl. 24 a-e

Test tiny with very little variation in size ($100 \pm 20\mu\text{m}$), round, sub-hemispherical in lateral cross-section, small aperture invaginated. Fundus length is a little over half the width of the apertural face. Medioli and Scott (1983) described the problems associated with species designations for the range of morphologies in the *C. aculeata* (more *Arcella* sp. type) to *C. constricta* (more *Diffflugia* sp. type) spectrum. In the southwestern New Brunswick lakes however, *C. kahli* was not found to have much morphological variability, so its distinctive designation is appropriate.

Family DIFFLUGIIDAE Stein 1859

Genus *Diffugia* Leclerc in Lamarck 1816

Diffugia bidens Penard 1902

(not figured)

Diffugia bidens PENARD 1902, p.264, figs. 1-8

Diffugia bidens Penard 1902 MEDIOLI and SCOTT 1983, p.21-22, pl. 1, figs. 1-5

Diffugia bidens Penard 1902 PATTERSON et al. 1985, p.134, pl. 2, figs. 13-14

Diffugia bidens Penard 1902 PATTERSON et al. 2002, *in press*, fig. 7.7

Test laterally compressed with 2 to 3 short spines; aperture round and simple. Not figured as only a few specimens were recovered and they collapsed when mounted on the scanning electron microscope plug.

Diffugia corona Wallich 1864

(Plate 2; figs. 11-14)

Diffugia protaeiformis (sic) Ehrenberg subsp. *D. globularis* (Dujardin) var. *D. corona*

WALLICH 1864, p.244, pl. 15, fig. 4a-c, pl. 16, figs. 19, 20

Diffugia corona Wallich 1864 ARCHER 1866, p.186

Diffugia corona Wallich 1864 OGDEN and HEDLEY 1980, p.128-129 pl. 53 a-d

Diffugia corona Wallich 1864 MEDIOLI and SCOTT 1983, p.22, pl. 1, figs. 6-14

Diffugia corona Wallich 1864 PATTERSON et al. 1985, p.134, pl. 2, figs. 1-6

Cucurbitella corona (Wallich 1864) ASIOLI et al. 1996, p.257, pl. 3, figs. 7a-b

Diffugia corona Wallich 1864 REINHARDT et al. 1998, p.140, pl. 2, figs. 1a-b

Diffugia corona Wallich 1864 PATTERSON and KUMAR 2000, p.319-320, pl. 1, figs.

3, 4, 7, pl. 2, fig. 1

Diffugia corona Wallich 1864 PATTERSON et al. 2002, *in press*, figs. 8.1a-c

Test spherical with 1 to 10 short aboral spines, aperture circular with prominent crenulations (6 – 20) forming a thin collar.

Diffugia oblonga Ehrenberg 1832

Strain: *Diffugia oblonga* "gigantica", new strain

(Plate 4, fig. 10)

Diffugia oblonga Ehrenberg PATTERSON et al. 1985, p.134, pl. 1, fig. 8

Very large pyriform test, laterally compressed, composed of large mineral grains, round simple aperture. Differs from *Diffugia oblonga* "triangularis" by having a smooth aboral end and a thinner apertural neck.

Strain: *Diffugia oblonga* "glans"

(Plate 5, figs. 1-5)

Diffugia glans PENARD 1902

Diffugia oblonga Ehrenberg 1832 MEDIOLI and SCOTT 1983, p.25-28, pl. 2 1-4, 13

Diffugia oblonga Ehrenberg 1832 PATTERSON et al. 1985, p.134, pl. 1, figs. 6, 7

Diffugia oblonga Ehrenberg 1832 ASIOLI et al. 1996, p.257, pl. 3, figs. 4a-b

Diffugia oblonga Ehrenberg 1832 "glans" REINHARDT et al. 1998, p.140, pl. 2, figs.

7a-b

Diffugia oblonga Ehrenberg 1832 "glans" DALBY et al. 2000, p.140, pl. 1, fig. 4

Diffugia oblonga Ehrenberg 1832 "glans" PATTERSON and KUMAR 2000, p.319, pl.

1, figs. 8, 11, 13, 19

Diffugia oblonga Ehrenberg 1832 "glans" PATTERSON et al. 2002, *in press*, figs. 8.7a-

b

Test oval to ovoid, slightly elongated, fundus rounded, neck absent, aperture circular with smooth lip, test made of fine sand particles but often incorporating a few very large grains.

Strain: *Diffugia oblonga* "lanceolata"

(Plate 1, figs. 3a-b)

Diffugia lanceolata PENARD 1890, p.145, pl. 4, figs. 59-60

Diffugia lanceolata Penard 1890 OGDEN and HEDLEY 1980, p.140-1, pl. 59, figs. a-d

Diffugia oblonga Ehrenberg 1832 MEDIOLI and SCOTT 1983, p.25-28, pl. 2 fig. 10

Diffugia oblonga Ehrenberg 1832 "lanceolata" REINHARDT et al. 1998, p.140, pl. 2,

fig. 6

Test elongate, pyriform and smooth, fundus rounded, neck long, aperture circular without lip.

Strain: *Diffugia oblonga* "linearis"

(Plate 3, figs. 10-11)

Diffugia pyriformis var. *linearis* PENARD 1890, p.137, pl. 3, figs. 42-44

Diffugia oblonga Ehrenberg 1832 "linearis" REINHARDT et al. 1998, p.140, pl. 2, figs.

8a-b

Test flask shaped, fundus rounded, neck long and constricted, aperture very narrow and circular, test made of fine to coarse sand grains.

Strain: *Diffugia oblonga* "oblonga"

(Plate 4, figs. 1-9)

Diffugia oblonga EHRENBURG 1832, p.90

Diffugia oblonga Ehrenberg 1832 OGDEN and HEDLEY 1980, p.148-149, pl. 63, figs.

a-c

Diffugia oblonga Ehrenberg 1832 HAMAN 1982, p.367, Pl. 3, Figs. 19-25

Diffugia oblonga Ehrenberg 1832 MEDIOLI and SCOTT 1983, p.25-28, pl. 2 figs. 5-6

Diffugia oblonga Ehrenberg 1832 SCOTT and MEDIOLI 1983, p.818, figs. 9a-b

Diffugia oblonga Ehrenberg 1832 PATTERSON et al. 1985, p.134, pl. 1, figs. 11-12

Diffugia oblonga Ehrenberg 1832 ASIOLI et al. 1996, p.252, pl. 1, figs. 1a-b, 2a-b

Diffugia oblonga Ehrenberg 1832 "oblonga" REINHARDT et al. 1998, p.140, pl. 2, figs.

10a-b

Diffugia oblonga Ehrenberg 1832 "bryophila" PATTERSON and KUMAR 2000, p.319,

pl. 1, fig. 14

Diffugia oblonga Ehrenberg 1832 "oblonga" PATTERSON and KUMAR 2000, p.319,

pl. 1, figs. 2, 5

Diffugia oblonga Ehrenberg 1832 "oblonga" PATTERSON et al. 2002, *in press*, figs.

8.2a-d

Test pyriform, elongated to oblong, fundus rounded, neck long, aperture circular without lip, test made of generally fine sand grains.

Strain: *Diffugia oblonga* "spinosa"

(Plate 4, figs. 11-14)

Diffugia claviformis Penard 1899 OGDEN and HEDLEY 1980, 126-7 pl. 52 a-e

Diffugia oblonga Ehrenberg 1832 MEDIOLI and SCOTT 1983, p.25-28, pl. 2 figs. 7-8

Diffugia oblonga Ehrenberg 1832 PATTERSON et al. 1985, p.134, pl. 1, figs. 4, 10

Diffugia oblonga Ehrenberg 1832 "spinosa" REINHARDT et al. 1998, p.140, pl. 2, figs.

11a-b

Diffugia protaeiformis Lamarck 1816 "claviformis" PATTERSON and KUMAR 2000,

p.319-320, pl. 1, fig. 9, pl. 2, fig. 8

Diffugia oblonga Ehrenberg 1832 "spinosa" PATTERSON et al. 2002, *in press*, figs.

8.3a-b

Test pyriform, elongated, fundus large and with a distinct lobate spine, neck short and constricted, aperture narrow, circular without lip, test made of fine sand grains. This strain may appear superficially similar to *Diffugia protaeiformis* "amphoralis", but differs in being much larger (see Plate 6 for size comparisons) and having a thicker wall.

Strain: *Diffugia oblonga* "tenuis"

(not figured)

Diffugia pyriformis var. *tenuis* PENARD 1890, p.138, pl. 3, figs. 47-49

Diffugia oblonga Ehrenberg 1832 "tenuis" REINHARDT et al. 1998, p.140, pl. 2, figs.

12a-b

Test elongated, ovoid almost bean shaped, fundus subrounded to subacute, neck indistinct or absent, aperture narrow and circular, test made of generally medium to fine sand grains. Not figured as only a few specimens were recovered and they were broken when mounted on the scanning electron microscope plug.

Strain: *Diffugia oblonga* "triangularis"

(Plate 5, figs. 6-8)

Diffugia oblonga Ehrenberg 1832 MEDIOLI and SCOTT 1983, p.25-28, pl. 2 fig. 26

Diffugia oblonga Ehrenberg 1832 PATTERSON et al. 1985, p.134, pl. 1, figs. 5, 9

Diffugia oblonga Ehrenberg 1832 "triangularis" PATTERSON et al. 2002, *in press*, figs.

8.4a-b

Test pyriform, elongated to oblong, fundus rounded with two or three protrusions resembling fins, neck indistinct or absent, aperture narrow and circular, test made of generally medium to fine sand grains

Diffugia protaeiformis Lamarck 1816

Strain: *Diffugia protaeiformis* "amphoralis"

(Plate 1, fig. 2)

Diffugia protaeiformis LAMARCK 1816, p.95 (reference to material in a manuscript by Leclerc, 1816)

Diffugia amphoralis HOPKINSON in CASH and HOPKINSON 1909, p.43, pl. 21, fig.

13

Diffugia elegans Penard 1890 OGDEN and HEDLEY 1980, p.132-133 pl. 55 a-c

Diffugia protaeiformis Lamarck 1816 ASIOLI et al. 1996, p.254, pl. 2, figs. 3, 5

Diffugia protaeiformis Lamarck 1816 "amphoralis" REINHARDT et al. 1998, p.142, pl.

2, fig. 4

Diffugia protaeiformis Lamarck 1816 "amphoralis" PATTERSON and KUMAR 2000,

p.320, pl. 2, figs. 14-15, 17

Diffugia protaeiformis Lamarck 1816 "amphoralis" PATTERSON et al. 2002, *in press*,

figs. 8.6a-b

Test almost biconical and tapering to form an aboral spine. Test wall much thinner and less robust than that of *D. oblonga*. Aperture simple and round. Fundus length 1 to 1.5 times apertural diameter.

Strain: *Diffugia protaeiformis* "claviformis"

(Plate 1, figs. 4-5)

Diffugia protaeiformis LAMARCK 1816, p.95 (reference to material in a manuscript by Leclerc, 1816)

Diffugia acuminata EHRENBURG 1838, p.95

Diffugia pyriformis var. *claviformis* PENARD 1899, p.25, pl. 2, figs. 12-14

Diffugia acuminata Ehrenberg 1838 OGDEN and HEDLEY 1980, p.118, pl. 48, figs. a-c

Diffugia protaeiformis Lamarck 1816 MEDIOLI and SCOTT 1983, p.17-20, pl. 1, figs. 15-20

Diffugia acuminata Ehrenberg 1838 SCOTT and MEDIOLI 1983, p.818, fig. 9d

Diffugia protaeiformis Lamarck 1816 PATTERSON et al. 1985, p.134, pl. 3, figs. 3-4

Diffugia protaeiformis Lamarck 1816 "protaeiformis" ASIOLI et al. 1996, p.254, pl. 2, figs. 1-2, 4

Diffugia protaeiformis Lamarck 1816 "claviformis" REINHARDT et al. 1998, p.142, pl. 2, fig. 3

Diffugia protaeiformis Lamarck 1816 "acuminata" REINHARDT et al. 1998, p.142, pl. 2, figs. 3, 5

Diffugia protaeiformis Lamarck 1816 "claviformis" DALBY et al. 2000, p.140, pl. 1, fig. 3

Diffugia protaeiformis Lamarck 1816 "claviformis" PATTERSON and KUMAR 2000, p.320, pl. 2, fig. 6

Diffugia protaeiformis Lamarck 1816 "claviformis" PATTERSON et al. 2002, *in press*, figs. 8.5a-b

Test elongate, cylindrical, and tapering to form an aboral spine. Test wall much thinner and less robust than that of *D. oblonga*. Aperture simple and round. Fundus length 3 or more times apertural diameter.

Diffugia urens Patterson et al., 1985

(Plate 2, figs. 6a-b)

Diffugia urens PATTERSON et al. 1985, p.135, pl. 3, figs. 5-14

Test subspherical, with narrow circular aperture with slightly raised irregular apertural lip. Distinguished from *Diffugia urceolata* in having a much smaller aperture to test diameter.

Diffugia urceolata "urceolata" Carter 1864

(Plate 3, figs. 1-2)

Diffugia urceolata CARTER 1864, p.27, pl. 1, fig. 7

Diffugia urceolata Carter 1864 OGDEN and HEDLEY 1980, p.158-159 pl. 68 a-d

Diffugia urceolata Carter 1864 MEDIOLI and SCOTT 1983, p.31-33, pl. 3, figs. 1-14

Diffugia urceolata Carter 1864 PATTERSON et al. 1985, p.134, pl. 2, figs. 11-12

Diffugia urceolata Carter 1864 ASIOLI et al. 1996, p.257, pl. 3, figs. 1a-b, 3a-b

Diffugia urceolata Carter 1864 REINHARDT et al. 1998, p.142, pl. 2, figs. 2a-b

Diffugia urceolata Carter 1864 "urceolata" PATTERSON and KUMAR 2000, p.319, pl.

1, figs. 10-16

Diffugia urceolata Carter 1864 “urceolata” PATTERSON et al. 2002, *in press*, fig. 7.8

Test spherical to ovoidal; aperture a distinct hanged collar. Test wall thinner and less robust than that of *D. oblonga*.

Genus *Lagenodiffugia* Medioli and Scott 1983

Lagenodiffugia vas (Leidy 1874)

(Plate 5, figs. 9-14)

Diffugia vas LEIDY 1874, p.155

Pontigulasia elisa (Penard 1893) OGDEN and HEDLEY 1980, p.164-165 pl. 71 a-d

Lagenodiffugia vas (Leidy 1874) MEDIOLI AND SCOTT 1983, p.33, pl. 2, figs. 18-23,
27, 28

Lagenodiffugia vas (Leidy 1874) PATTERSON et al. 1985, p.135, pl. 1, figs. 13-16

Lagenodiffugia vas (Leidy 1874) REINHARDT et al. 1998, p.142, pl. 1, figs. 8a-b

Lagenodiffugia vas (Leidy 1874) PATTERSON and KUMAR 2000, p.320, pl. 2, fig. 11

Lagenodiffugia vas (Leidy 1874) PATTERSON et al. 2002, *in press*, figs. 7.6a-d

Test elongate, pyriform, fundus bulbous and wide, neck arising from its narrow end with a prominent constriction at its base.

Genus *Pontigulasia* Rhumbler 1895

Pontigulasia compressa (Carter 1864)

(Plate 3, figs. 3-9)

Diffugia compressa CARTER 1864, p.22, pl. 2, figs. 5-6

Pontigulasia compressa (Carter 1864) OGDEN and HEDLEY 1980, p.162-163 pl. 70 a-d

Pontigulasia compressa (Carter 1864) MEDIOLI and SCOTT 1983, p.35-36, pl. 6, figs.

5-7

Pontigulasia compressa (Carter 1864) ASIOLI et al. 1996, p.252, pl. 1, figs. 3a-b

Pontigulasia compressa (Carter 1864) PATTERSON et al. 1985, p.135, pl. 2, figs. 7-8

Pontigulasia compressa (Carter 1864) PATTERSON et al. 2002, *in press*, fig. 7.9

Test ovoid to pyriform, laterally compressed, with a distinct "V" shaped constriction at the base of the neck. Aperture simple and ovoid.

Family HYALOSPHEENIIDAE Schulze 1877

Genus *Cucurbitella* Penard 1902

Cucurbitella tricuspis (Carter 1856)

(Plate 1, figs. 6-7)

Diffugia tricuspis CARTER 1856, p.221, pl. 7, fig. 80

Diffugia oviformis Cash 1909 OGDEN and HEDLEY 1980, p.150-151 pl. 64 a-d

Diffugia tricuspis Carter 1859 MEDIOLI and SCOTT 1983, p.28-31, pl. 4 figs. 5-19

Diffugia tricuspis Carter 1859 PATTERSON et al. 1985, p.134, pl. 2, figs. 15-16

Cucurbitella tricuspis (Carter 1859) ASIOLI et al. 1996, p.252, pl. 1, fig. 6

Cucurbitella tricuspis (Carter 1859) REINHARDT et al. 1998, p.142, pl. 1, figs. 7a-f

Cucurbitella tricuspis (Carter 1859) PATTERSON and KUMAR 2000, p.319-320, pl. 1,
figs. 1, 12, pl. 2, figs. 7, 9

Cucurbitella tricuspis (Carter 1859) PATTERSON et al. 2002, *in press*, figs. 7.5a-d

Test subspherical to ovoid, autogenous. Aperture with variable number of crenulations or lobes. This species has a seasonally irregularly shaped test, being larger and spherical during the benthic phase, and smaller and more pyriform during the planktic phase. The crenulated aperture has a variable number of lobes ranging from three to twenty.

Genus *Lesquereusia* Schlumberger 1845

Lesquereusia modesta Rhumbler 1895

(Plate 1, figs. 8-10)

Lesquereusia modesta Rhumbler 1895 OGDEN and HEDLEY 1980, p.84-85, pl. 31 fig a-
d

Lesquereusia spiralis (Ehrenberg 1840) REINHARDT et al. 1998, p.144, pl. 1, fig. 9a-b

Spherical test with asymmetrical neck composed of mixture of clasts and silicious rods. Its spherical test distinguishes it from *L. spiralis* Ehrenberg 1840, which is more flattened. Apertural neck curved, spiraling away from the centre of the test.

Genus *Nebela* Leidy 1875

Nebela galeata Penard 1890

(not figured)

Nebela galeata Penard 1890 OGDEN and HEDLEY 1980, p100-101, pl. 39 fig a-d

Pyriform test laterally compressed composed of flat ovoid siliceous plates, and tapers to a thick lateral margin. Not figured as only a few specimens were recovered and they collapsed when mounted on the scanning electron microscope plug.

PLATE 1

- 1a-d.** *Centropyxis kahli* Deflandre 1929. 1a. oblique view. b. same figure with aperture electronically shaded based on optical microscopy observations; glue that was used for mounting the specimen on the scanning electron microscopy plug had formed a thin covering over the aperture. c. apertural view. d. aperture electronically shaded as in b. Specimen from OR3-120.
- 2.** *Diffflugia protaeiformis* Lamarck 1816 "amphoralis". Specimen from GRS4.
- 3a-b.** *Diffflugia oblonga* Ehrenberg 1832 "lanceolata". a. side and b. oblique views of a specimen from ORS4
- 4-5.** *Diffflugia protaeiformis* Lamarck 1816 "claviformis". 4a and b. side and oblique views of a specimen from GRC60. 5. SWI specimen from Lake Utopia.
- 6-7.** *Cucurbitella tricuspis* (Carter 1856). 6a and b side and oblique views of a specimen from Lake Utopia. 7a and b side and oblique views of a specimen from GRC60.
- 8-10.** *Lesquereusia modesta* Rhumbler 1895. 8 from ORS4. 9a-b. side and oblique views of an SWI specimen from Lake Utopia. 10a-b. side and oblique views of a specimen from GRC10.

All figures are at the same scale. SWI=sediment-water interface sample; Core sample locality codes: GRC=Greenhill Lake core; OR3=Oromocto Lake core 3. SWI sample locality codes: GRS=Greenhill Lake; ORS=Oromocto Lake.

PLATE 2

- 1-5.** *Centropyxis aculeata* (Ehrenberg 1832). 1a. and b. apertural and edge views of a specimen from FRS1; 2. from ORS4; 3. from GRC60; 4. from OR2-3; 5. from YO4.
- 6a-b.** *Diffflugia urens* Patterson et al., 1985. 6a. and b. side and apertural views of a specimen from ORS29.
- 7-10.** *Centropyxis constricta* (Ehrenberg 1843) "constricta". 7a and b side and edge views of a specimen from GRC60; 8-9. both from FRS1; 10. from OR2-3.
- 11-14.** *Diffflugia corona* Wallich 1864. 11a and b side and apertural views of a specimen from ORS4; 12. and 14. from FRS1; 13. from Lake Utopia.
- 15-16.** *Centropyxis constricta* (Ehrenberg 1843) "greenhillensis". 15a and b apertural and side views of a specimens from GRS26; 16a, b, and c side, oblique, and apertural views of a specimen from GRS9.

All figures are at the same scale. SWI=sediment-water interface sample; Core sample locality codes: GRC=Greenhill Lake core; OR2=Oromocto Lake core 2. SWI sample locality codes: FRS=Frog Lake; GRS=Greenhill Lake; ORS=Oromocto Lake; YO=Yoho Lake.

PLATE 3

1-2. *Diffflugia urceolata* "urceolata" Carter 1864. 1a and b side and oblique views of a specimen from GRC10; 2 from ML5.

3-9. *Pontigulasia compressa* (Carter 1864). 3a, b, and c side, oblique, and edge views of a specimen from ORS28; 4a and b from Lake Utopia; 5 from ORS4; 6a and b from YO4; 7. from FRS1; 8a and b from GRC60; 9a and b from YO11.

10-11. *Diffflugia oblonga* Ehrenberg 1832 "linearis". 10a and b from GRS7; 11a and b from YO15.

All figures are at the same scale. SWI=sediment-water interface sample; Core sample

locality codes: GRC=Greenhill Lake core; OR2, OR3=Oromocto Lake cores.

SWI sample locality codes: FRS=Frog Lake; GRS=Greenhill Lake;

ML=McAdam Lake; ORS=Oromocto Lake; YO=Yoho Lake.

PLATE 4

1-9. *Diffflugia oblonga* Ehrenberg 1832 "oblonga". 1a and b side and oblique views of a specimen from ORS4; 2 and 3a,b both from YO4; 4 from GRC60; 5a and b from Lake Utopia; 6a and b from GRC60; 7 from ORS4; 8a and b from GRC60; 9 FR200.

10. *Diffflugia oblonga* Ehrenberg 1832 "gigantica". Specimen from GRS22.

11-14. *Diffflugia oblonga* Ehrenberg 1832 "spinosa". 11 from ORS4; 12 from ML6; 13a and b from FRS1; 14a and b from YO11.

All figures are at the same scale. SWI=sediment-water interface sample; Core sample locality codes: FR=Frog Lake core; GRC=Greenhill Lake core. SWI sample locality codes: FRS=Frog Lake; GRS=Greenhill Lake; ML=McAdam Lake; ORS=Oromocto Lake; YO=Yoho Lake.

PLATE 5

1-5. *Diffflugia oblonga* Ehrenberg 1832 "glans". 1a and b side and oblique views of a specimen from OR2-3; 2a and b from OR2-3; 3a and b from GRC30; 4 from GRC60; 5 from YO4.

6-8. *Diffflugia oblonga* Ehrenberg 1832 "triangularis". 6a and b from YO2; 7a and b from GRS3; 8a and b from ORS30.

9-14. *Lagenodiffflugia vas* (Leidy 1874). 9a and b from ML4; 10a and b from ORS30; 11 from YO4; 12 and 13 from FR220; 14 from GRS5.

All figures are at the same scale. SWI=sediment-water interface sample; Core sample locality codes: FR=Frog Lake core; GRC=Greenhill Lake core; OR2=Oromocto Lake core 2. SWI sample locality codes: GRS=Greenhill Lake; ML=McAdam Lake; ORS=Oromocto Lake; YO=Yoho Lake.

1a

1b

6a

6b

2a

2b

7a

7b

3a

3b

4

5

8a

8b

9a

9b

10a

10b

11

12

13

14

0 100 200 300 400 500 μm

PLATE 6

Plates 1-5 presented at the same scale for size comparison of illustrated specimens.

0 500um

Plate 1

Plate 2

Plate 3

Plate 5

Plate 4

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APPENDICES

0m

2m

4m

6m

8m

10m

12m

14m

16m

18m

20m

APPENDIX B - continued...

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FROG LAKE Freeze core (continued)																				YOHO LAKE SWI						
	FRZ024	FRZ030	FRZ036	FRZ042	FRZ048	FRZ054	FRZ060	FRZ066	FRZ072	FRZ078	FRZ084	FRZ090	FRZ096	FRZ102	FRZ108	FRZ114	FRZ120	FRZ126	YO1	YO2	YO3	YO4	YO5	YO6	YO7	
Arceia discoides	2	0	0	0	1	1	0	1	1	0	3	2	0	0	0	0	3	9	0	15	0	0	0	0	0	
Centropyx aculeata	208	190	132	237	273	184	206	302	274	248	309	208	153	37	70	68	143	182	117	340	70	125	97	178	22	
C. consuetudo "constricta"	0	2	8	0	5	3	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	44	0	10	0	
C. consuetudo "greenhillensis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Cucurbitella tricuspidis	4	5	4	0	1	0	0	0	0	0	0	0	0	0	0	0	2	12	1	0	0	0	0	0		
Centropyx kahli	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0		
Difflugia bidens	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Difflugia corona	2	4	3	0	0	0	1	0	2	1	2	0	0	0	0	0	4	6	0	0	1	0	0	15		
Difflugia oblonga "gigantica"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0		
D. oblonga "plans"	0	2	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	28	0	11		
D. oblonga "tanceolata"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D. oblonga "linearis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0		
D. oblonga "oblonga"	1	3	3	0	0	0	0	1	1	1	2	0	0	0	0	0	0	1	7	0	0	25	0	24		
D. oblonga "spinosa"	2	4	0	0	5	4	0	0	1	2	0	0	0	0	0	0	0	1	3	0	0	13	0	0		
D. oblonga "tenuis"	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0		
D. oblonga "triangularis"	1	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D. proteiformis "amphiformis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D. proteiformis "claytoniformis"	4	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	8	0	1	0		
Difflugia urens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D. urceolata "urceolata"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0		
Lesquerella modesta	15	12	6	8	49	14	11	30	62	14	5	12	0	1	4	3	9	3	2	13	0	40	0	0		
Nebelia galeata	4	4	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	2	0	9		
Ponticulatella compressa	1	1	0	0	0	0	1	18	6	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0		
TOTAL	245	229	157	248	350	214	220	355	340	265	329	227	153	38	75	72	163	216	131	374	71	339	97	304		
Specimen density (spec/cc)	81.667	76.333	52.333	82.667	116.67	71.333	73.333	118.33	113.33	88.333	109.67	76.667	51	12.667	25	24	54.333	72	4.8519	20.778	2.8296	25.111	3.5826	13.511		
Dissolved oxygen (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.06	8.03	7.95	8	7.95		
Depth (m)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.5	3	4.5			
Temperature (C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.8	21.8	21.7	21.6			

YOHO LAKE SWI (continued...)																						McADAM LAKE SWI				
	YO8	YO9	YO10	YO11	YO12	YO13	YO14	YO15	YO16	YO17	YO18	YO19	YO20	YO21	YO22	YO23	YO24	YO27	YO28	YO29	ML1	ML2	ML3	ML4	ML5	
Arceia discoides	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
Centropyx aculeata	35	55	151	55	16	25	11	131	17	74	253	169	57	75	21	101	10	254	173	34	75	83	161	139	107	
C. consuetudo "constricta"	18	3	0	0	0	0	0	19	0	0	0	5	0	0	0	0	8	5	0	0	61	27	15	4	19	
C. consuetudo "greenhillensis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cucurbitella tricuspidis	2	1	0	0	0	3	0	8	0	0	0	0	2	1	0	0	0	4	12	0	22	35	47	7	11	
Centropyx kahli	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	
Difflugia bidens	0	0	0	1	5	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	
Difflugia corona	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	28	26	2	23	
Difflugia oblonga "gigantica"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. oblonga "gigas"	0	19	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	3	0	0	9	11	14	0	1	
D. oblonga "tanceolata"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. oblonga "linearis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. oblonga "oblonga"	31	68	6	0	4	0	0	7	0	7	3	0	0	7	0	1	0	0	24	13	63	14	0	0	32	
D. oblonga "spinosa"	0	0	5	10	2	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	14	10	8	0	0	
D. oblonga "tenuis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. oblonga "triangularis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. proteoformis "amphiformis"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	
D. proteoformis "claviformis"	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	25	37	21	0	34	
Difflugia urens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D. ureceolata "urceolata"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	1	
Lesquerodifflugia vas	1	2	23	11	10	0	0	8	1	9	19	13	21	8	0	0	0	8	14	0	12	43	25	15	49	
Lesquerureusia modesta	0	0	8	4	10	0	0	7	0	2	0	4	16	6	0	0	9	0	0	0	1	8	26	0	2	
Nebelia galeata	0	0	4	0	7	0	0	0	4	0	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ponticulatella compressa	58	65	13	50	12	17	0	51	4	15	63	44	9	17	8	14	0	11	31	1	15	22	12	18	38	
TOTAL	148	213	190	153	72	46	11	253	22	107	349	238	123	109	30	123	19	329	243	35	326	318	359	183	312	
Specimen density (spec/cc)	5.4815	7.8889	7.037	5.6867	2.6867	1.7037	0.4074	9.3704	0.8148	3.3963	12.926	8.8148	4.5585	4.057	1.1111	4.5586	0.7037	12.785	9	1.2963	18.111	14.733	39.889	6.778	11.595	
Dissolved oxygen (mg/L)	7.71	7.7	8.04	8.1	8.33	7.71	8.07	7.95	7.68	7.96	7.73	7.9	8.25	8.19	8.29	7.95	8.03	7.95	8.07	8.3	7.1	7.348	8	5.93	7.44	
Depth (m)	7.5	8	1.7	1.3	0.7	7.4	1.9	4.9	10.5	4.2	7.2	5.2	1.1	1.2	0.9	2.8	3.5	2.8	2	1.8	2.5	4.5	2.5	3.1	1.4	
Temperature (C)	21.1	21.1	21.8	21.8	21.9	21.2	21.8	21.6	21	21.7	21.2	21.5	21.9	21.9	21.7	21.7	21.7	21.7	21.8	21.8	26.4	21.2	24.7	22.7	23.7	

APPENDIX C - GREENHILL CORE XRAY

NOTE: The only structure shown in the X-ray was below ~300cm downcore as gyttja was invisible to this method.

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Sample		GR50	GR55	GR60	GR70	GR80	GR90	GR100	GR110	GR120	GR130	GR140	GR150	GR160	GR170	GR180	GR190	GR200	GR210	GR220	GR230	GR240	GR250	GR260	GR270	GR280	GR290	GR300	GR310	GR320	GR330	GR340	GR350	GR360	GR370	GR380	GR390	GR400	GR410	GR420	GR430	GR440	GR450	GR460	GR470	GR480	GR490	GR500	GR510	GR520	GR530	GR540	GR550	GR560	GR570	GR580	GR590	GR600	GR610	GR620	GR630	GR640	GR650	GR660	GR670	GR680	GR690	GR700	GR710	GR720	GR730	GR740	GR750	GR760	GR770	GR780	GR790	GR800	GR810	GR820	GR830	GR840	GR850	GR860	GR870	GR880	GR890	GR900	GR910	GR920	GR930	GR940	GR950	GR960	GR970	GR980	GR990	GR1000	GR1010	GR1020	GR1030	GR1040	GR1050	GR1060	GR1070	GR1080	GR1090	GR1100	GR1110	GR1120	GR1130	GR1140	GR1150	GR1160	GR1170	GR1180	GR1190	GR1200	GR1210	GR1220	GR1230	GR1240	GR1250	GR1260	GR1270	GR1280	GR1290	GR1300	GR1310	GR1320	GR1330	GR1340	GR1350	GR1360	GR1370	GR1380	GR1390	GR1400	GR1410	GR1420	GR1430	GR1440	GR1450	GR1460	GR1470	GR1480	GR1490	GR1500	GR1510	GR1520	GR1530	GR1540	GR1550	GR1560	GR1570	GR1580	GR1590	GR1600	GR1610	GR1620	GR1630	GR1640	GR1650	GR1660	GR1670	GR1680	GR1690	GR1700	GR1710	GR1720	GR1730	GR1740	GR1750	GR1760	GR1770	GR1780	GR1790	GR1800	GR1810	GR1820	GR1830	GR1840	GR1850	GR1860	GR1870	GR1880	GR1890	GR1900	GR1910	GR1920	GR1930	GR1940	GR1950	GR1960	GR1970	GR1980	GR1990	GR2000	GR2010	GR2020	GR2030	GR2040	GR2050	GR2060	GR2070	GR2080	GR2090	GR2100	GR2110	GR2120	GR2130	GR2140	GR2150	GR2160	GR2170	GR2180	GR2190	GR2200	GR2210	GR2220	GR2230	GR2240	GR2250	GR2260	GR2270	GR2280	GR2290	GR2300	GR2310	GR2320	GR2330	GR2340	GR2350	GR2360	GR2370	GR2380	GR2390	GR2400	GR2410	GR2420	GR2430	GR2440	GR2450	GR2460	GR2470	GR2480	GR2490	GR2500	GR2510	GR2520	GR2530	GR2540	GR2550	GR2560	GR2570	GR2580	GR2590	GR2600	GR2610	GR2620	GR2630	GR2640	GR2650	GR2660	GR2670	GR2680	GR2690	GR2700	GR2710	GR2720	GR2730	GR2740	GR2750	GR2760	GR2770	GR2780	GR2790	GR2800	GR2810	GR2820	GR2830	GR2840	GR2850	GR2860	GR2870	GR2880	GR2890	GR2900	GR2910	GR2920	GR2930	GR2940	GR2950	GR2960	GR2970	GR2980	GR2990	GR3000	GR3010	GR3020	GR3030	GR3040	GR3050	GR3060	GR3070	GR3080	GR3090	GR3100	GR3110	GR3120	GR3130	GR3140	GR3150	GR3160	GR3170	GR3180	GR3190	GR3200	GR3210	GR3220	GR3230	GR3240	GR3250	GR3260	GR3270	GR3280	GR3290	GR3300	GR3310	GR3320	GR3330	GR3340	GR3350	GR3360	GR3370	GR3380	GR3390	GR3400	GR3410	GR3420	GR3430	GR3440	GR3450	GR3460	GR3470	GR3480	GR3490	GR3500	GR3510	GR3520	GR3530	GR3540	GR3550	GR3560	GR3570	GR3580	GR3590	GR3600	GR3610	GR3620	GR3630	GR3640	GR3650	GR3660	GR3670	GR3680	GR3690	GR3700	GR3710	GR3720	GR3730	GR3740	GR3750	GR3760	GR3770	GR3780	GR3790	GR3800	GR3810	GR3820	GR3830	GR3840	GR3850	GR3860	GR3870	GR3880	GR3890	GR3900	GR3910	GR3920	GR3930	GR3940	GR3950	GR3960	GR3970	GR3980	GR3990	GR4000	GR4010	GR4020	GR4030	GR4040	GR4050	GR4060	GR4070	GR4080	GR4090	GR4100	GR4110	GR4120	GR4130	GR4140	GR4150	GR4160	GR4170	GR4180	GR4190	GR4200	GR4210	GR4220	GR4230	GR4240	GR4250	GR4260	GR4270	GR4280	GR4290	GR4300	GR4310	GR4320	GR4330	GR4340	GR4350	GR4360	GR4370	GR4380	GR4390	GR4400	GR4410	GR4420	GR4430	GR4440	GR4450	GR4460	GR4470	GR4480	GR4490	GR4500	GR4510	GR4520	GR4530	GR4540	GR4550	GR4560	GR4570	GR4580	GR4590	GR4600	GR4610	GR4620	GR4630	GR4640	GR4650	GR4660	GR4670	GR4680	GR4690	GR4700	GR4710	GR4720	GR4730	GR4740	GR4750	GR4760	GR4770	GR4780	GR4790	GR4800	GR4810	GR4820	GR4830	GR4840	GR4850	GR4860	GR4870	GR4880	GR4890	GR4900	GR4910	GR4920	GR4930	GR4940	GR4950	GR4960	GR4970	GR4980	GR4990	GR5000	GR5010	GR5020	GR5030	GR5040	GR5050	GR5060	GR5070	GR5080	GR5090	GR5100	GR5110	GR5120	GR5130	GR5140	GR5150	GR5160	GR5170	GR5180	GR5190	GR5200	GR5210	GR5220	GR5230	GR5240	GR5250	GR5260	GR5270	GR5280	GR5290	GR5300	GR5310	GR5320	GR5330	GR5340	GR5350	GR5360	GR5370	GR5380	GR5390	GR5400	GR5410	GR5420	GR5430	GR5440	GR5450	GR5460	GR5470	GR5480	GR5490	GR5500	GR5510	GR5520	GR5530	GR5540	GR5550	GR5560	GR5570	GR5580	GR5590	GR5600	GR5610	GR5620	GR5630	GR5640	GR5650	GR5660	GR5670	GR5680	GR5690	GR5700	GR5710	GR5720	GR5730	GR5740	GR5750	GR5760	GR5770	GR5780	GR5790	GR5800	GR5810	GR5820	GR5830	GR5840	GR5850	GR5860	GR5870	GR5880	GR5890	GR5900	GR5910	GR5920	GR5930	GR5940	GR5950	GR5960	GR5970	GR5980	GR5990	GR6000	GR6010	GR6020	GR6030	GR6040	GR6050	GR6060	GR6070	GR6080	GR6090	GR6100	GR6110	GR6120	GR6130	GR6140	GR6150	GR6160	GR6170	GR6180	GR6190	GR6200	GR6210	GR6220	GR6230	GR6240	GR6250	GR6260	GR6270	GR6280	GR6290	GR6300	GR6310	GR6320	GR6330	GR6340	GR6350	GR6360	GR6370	GR6380	GR6390	GR6400	GR6410	GR6420	GR6430	GR6440	GR6450	GR6460	GR6470	GR6480	GR6490	GR6500	GR6510	GR6520	GR6530	GR6540	GR6550	GR6560	GR6570	GR6580	GR6590	GR6600	GR6610	GR6620	GR6630	GR6640	GR6650	GR6660	GR6670	GR6680	GR6690	GR6700	GR6710	GR6720	GR6730	GR6740	GR6750	GR6760	GR6770	GR6780	GR6790	GR6800	GR6810	GR6820	GR6830	GR6840	GR6850	GR6860	GR6870	GR6880	GR6890	GR6900	GR6910	GR6920	GR6930	GR6940	GR6950	GR6960	GR6970	GR6980	GR6990	GR7000	GR7010	GR7020	GR7030	GR7040	GR7050	GR7060	GR7070	GR7080	GR7090	GR7100	GR7110	GR7120	GR7130	GR7140	GR7150	GR7160	GR7170	GR7180	GR7190	GR7200	GR7210	GR7220	GR7230	GR7240	GR7250	GR7260	GR7270	GR7280	GR7290	GR7300	GR731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[illegible]

1. Consult Table 4.1 for explanations of the different models. 2. REG combines *D. oblonga* "glans" and "spinosus" based on R-mode comparisons. 3. MULLI combines of *C. constricta* "constricta", *C. kahl*, *Diffugia oblonga* "lenticis", "glans", and "spinosus", and *D. proteiformis* "claviformis".

[illegible][illegible]

APPENDIX E1 - Proximity matrices for all R-mode analyses

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NEall - All samples from all lakes (SWI and cores)

	Adis	Ca	Ccc	Chl	Chel	Deor	Doglg	Dogll	Doll	Doo	Dos	Dotrl	Dpam	Dpc	Durn	Durc	Lwas	Lmod	Ngal	Pcomp
Adis	8.409	0.517	0.474	1.725	0.308	0.185	0.354	0.254	1.063	0.286	0.188	0.2	0.345	0.18	0.19	0.716	0.678	0.278	1.721	
Ca	8.409	8.298	8.258	8.5	8.356	8.458	8.369	8.429	8.063	8.362	8.455	8.446	8.332	8.452	8.455	8.108	8.308	8.429	7.792	
Ccc	0.517	8.298	0.499	1.786	0.398	0.508	0.369	0.461	0.865	0.406	0.5	0.511	0.466	0.495	0.481	0.688	0.799	0.542	1.612	
Chl	0.474	8.258	0.499	1.771	0.398	0.506	0.505	0.498	0.968	0.46	0.502	1.716	0.359	0.415	0.408	0.703	0.662	0.629	1.553	
Chel	1.725	8.5	1.786	1.771	1.732	1.716	1.751	1.726	2.016	1.734	1.716	1.719	1.784	1.716	1.716	1.853	1.831	1.727	2.299	
Deor	0.308	8.356	0.455	0.398	1.732	0.276	0.395	0.304	0.304	0.257	0.252	0.283	0.285	0.268	0.275	0.612	0.649	0.335	1.685	
Doglg	0.185	8.458	0.508	1.716	0.276	0.395	0.364	0.185	1.094	0.299	0.293	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	
Dogll	0.354	8.369	0.369	1.751	0.395	0.364	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	0.363	
Doll	0.254	8.429	0.461	1.726	0.304	0.185	0.363	0.254	1.041	0.257	0.106	1.093	0.939	0.979	1.075	1.077	1.091	1.19	1.098	
Doo	1.063	8.063	0.865	1.734	1.018	1.094	0.891	1.041	0.939	0.941	0.941	0.941	0.941	0.941	0.941	0.941	0.941	0.941	0.941	
Dos	0.286	8.362	0.406	1.734	0.299	0.257	0.257	0.257	0.257	0.252	0.252	0.252	0.252	0.252	0.252	0.252	0.252	0.252	0.252	
Dotrl	0.188	8.455	0.5	1.716	0.272	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	
Dpam	0.2	8.446	0.511	1.719	0.285	0.103	0.377	0.209	1.093	0.278	0.106	0.422	0.422	0.408	0.41	0.703	0.666	0.23	1.747	
Dpc	0.345	8.332	0.466	0.423	1.764	0.394	0.421	0.414	0.979	0.4	0.415	0.422	0.408	0.41	0.703	0.662	0.468	0.23	1.747	
Durn	0.18	8.452	0.495	0.498	1.716	0.275	0.348	0.169	1.075	0.252	0.052	0.11	0.408	0.06	0.06	0.707	0.652	0.213	1.766	
Durc	0.19	8.455	0.481	0.494	1.716	0.268	0.35	0.169	1.077	0.248	0.055	0.109	0.41	0.06	0.06	0.706	0.662	0.213	1.793	
Lwas	0.716	8.108	0.688	0.691	1.853	0.612	0.707	0.684	1.091	0.624	0.703	0.719	0.703	0.703	0.703	0.703	0.703	0.703	0.703	
Lmod	0.678	8.308	0.799	0.752	1.831	0.649	0.66	0.731	1.19	0.677	0.662	0.666	0.666	0.662	0.662	0.662	0.662	0.662	0.662	
Ngal	0.278	8.429	0.542	0.541	1.727	0.335	0.21	0.411	1.098	0.319	0.212	0.23	0.468	0.213	0.213	0.213	0.213	0.213	0.213	
Pcomp	1.721	7.792	1.631	1.631	2.299	1.685	1.739	1.613	1.738	1.377	1.638	1.742	1.747	1.689	1.736	1.739	1.553	1.691	1.727	

FR - Frog Lake (all)

	Adis	Ca	Ccc	Chl	Chel	Deor	Doglg	Dogll	Doll	Doo	Dos	Dotrl	Dpam	Dpc	Durc	Lwas	Lmod	Pcomp
Adis	4.206	0.153	0.107	0.053	0.089	0.107	0.052	0.058	0.111	0.053	0.053	0.053	0.07	0.054	0.312	0.056	0.109	
Ca	4.206	4.192	4.191	4.225	4.183	4.207	4.232	4.22	4.191	4.228	4.228	4.232	4.214	4.232	3.988	4.219	4.182	
Ccc	0.153	4.192	0.077	0.146	0.093	0.073	0.147	0.125	0.135	0.136	0.136	0.136	0.108	0.142	0.274	0.133	0.108	
Chl	0.107	4.191	0.077	0.118	0.064	0.068	0.12	0.1	0.121	0.111	0.111	0.111	0.086	0.116	0.285	0.104	0.105	
Chel	0.053	4.225	0.146	0.118	0.094	0.097	0.021	0.037	0.103	0.094	0.109	0.102	0.054	0.023	0.322	0.039	0.104	
Deor	0.089	4.183	0.093	0.064	0.064	0.064	0.1	0.086	0.109	0.089	0.11	0.089	0.057	0.093	0.282	0.083	0.081	
Doglg	0.107	4.207	0.073	0.068	0.097	0.064	0.097	0.085	0.104	0.085	0.11	0.089	0.057	0.093	0.29	0.081	0.081	
Dogll	0.052	4.232	0.147	0.12	0.1	0.064	0.021	0.037	0.103	0.094	0.104	0.105	0.044	0.029	0.311	0.034	0.105	
Doll	0.058	4.22	0.125	0.1	0.037	0.086	0.085	0.085	0.096	0.096	0.097	0.105	0.042	0.101	0.316	0.037	0.111	
Doo	0.111	4.191	0.135	0.121	0.103	0.109	0.11	0.104	0.105	0.097	0.097	0.105	0.042	0.101	0.316	0.037	0.111	
Dos	0.053	4.228	0.136	0.111	0.025	0.093	0.057	0.052	0.094	0.094	0.101	0.101	0.047	0.047	0.3	0.039	0.083	
Dotrl	0.053	4.232	0.148	0.121	0.102	0.098	0.057	0.052	0.094	0.094	0.101	0.101	0.047	0.047	0.3	0.039	0.083	
Dpam	0.07	4.214	0.108	0.086	0.054	0.073	0.057	0.052	0.094	0.094	0.101	0.101	0.047	0.047	0.3	0.039	0.083	
Dpc	0.054	4.232	0.142	0.116	0.023	0.098	0.057	0.052	0.094	0.094	0.101	0.101	0.047	0.047	0.3	0.039	0.083	
Durc	0.312	3.988	0.274	0.285	0.322	0.282	0.29	0.325	0.311	0.288	0.316	0.316	0.323	0.323	0.311	0.311	0.311	
Lwas	0.055	4.219	0.133	0.104	0.039	0.083	0.081	0.081	0.097	0.097	0.101	0.101	0.047	0.047	0.3	0.039	0.083	
Lmod	0.109	4.182	0.108	0.105	0.096	0.081	0.105	0.096	0.111	0.094	0.105	0.105	0.083	0.101	0.252	0.095	0.095	
Pcomp	0.109	4.182	0.108	0.105	0.096	0.081	0.105	0.096	0.111	0.094	0.105	0.105	0.083	0.101	0.252	0.095	0.095	

APPENDIX E1 - continued...

GRail - Greenhill Lake SWI and Core samples

	Adis	Ca	Ccc	Crit	Chal	Deor	Doglg	Dogll	Doll	Deo	Dos	Dotri	Dpam	Dpc	Durn	Dure	Lvas	Lmod	Pcomp
Adis	3.782	3.638	0.367	0.313	0.17	0.198	0.169	0.283	0.241	0.824	0.23	0.172	0.184	0.251	0.164	0.17	0.28	0.168	0.814
Ca	3.782	3.638	0.367	0.313	0.17	0.198	0.169	0.283	0.241	0.824	0.23	0.172	0.184	0.251	0.164	0.17	0.28	0.168	0.814
Ccc	0.367	0.368	0.326	0.326	0.359	0.317	0.36	0.251	0.302	0.635	0.36	0.353	0.365	0.345	0.342	0.346	0.274	0.349	0.811
Crit	0.313	0.3654	0.326	0.326	0.345	0.27	0.353	0.36	0.302	0.635	0.36	0.353	0.365	0.345	0.342	0.346	0.274	0.349	0.811
Chal	0.17	0.3839	0.359	0.345	0.345	0.137	0.032	0.305	0.184	0.864	0.204	0.141	0.102	0.166	0.11	0.338	0.347	0.337	0.837
Deor	0.198	0.3839	0.359	0.345	0.137	0.137	0.032	0.305	0.184	0.864	0.204	0.141	0.102	0.166	0.11	0.338	0.347	0.337	0.837
Doglg	0.169	0.3845	0.36	0.353	0.032	0.141	0.032	0.303	0.18	0.865	0.204	0.041	0.099	0.352	0.049	0.026	0.248	0.846	0.846
Dogll	0.283	0.3733	0.251	0.36	0.305	0.307	0.303	0.303	0.307	0.799	0.198	0.162	0.207	0.347	0.105	0.354	0.347	0.347	0.844
Doll	0.241	0.3781	0.302	0.347	0.184	0.187	0.18	0.307	0.307	0.799	0.198	0.162	0.207	0.347	0.105	0.354	0.347	0.347	0.844
Doo	0.824	0.342	0.256	0.308	0.204	0.807	0.865	0.657	0.799	0.682	0.682	0.193	0.222	0.324	0.189	0.192	0.22	0.22	0.702
Dos	0.23	0.3733	0.353	0.35	0.046	0.134	0.041	0.299	0.162	0.882	0.193	0.105	0.105	0.347	0.049	0.038	0.228	0.083	0.844
Dotri	0.172	0.3838	0.353	0.35	0.046	0.134	0.041	0.299	0.162	0.882	0.193	0.105	0.105	0.347	0.049	0.038	0.228	0.083	0.844
Dpam	0.184	0.3812	0.365	0.345	0.102	0.154	0.099	0.318	0.207	0.863	0.324	0.347	0.354	0.354	0.338	0.349	0.356	0.337	0.772
Dpc	0.251	0.3651	0.373	0.344	0.348	0.33	0.362	0.394	0.342	0.748	0.324	0.347	0.354	0.354	0.338	0.349	0.356	0.337	0.772
Durn	0.164	0.3826	0.341	0.342	0.057	0.134	0.049	0.283	0.166	0.84	0.189	0.049	0.11	0.338	0.347	0.337	0.337	0.337	0.825
Dure	0.17	0.3836	0.346	0.344	0.041	0.137	0.026	0.293	0.164	0.852	0.192	0.038	0.102	0.349	0.047	0.236	0.236	0.232	0.837
Lvas	0.168	0.3713	0.274	0.347	0.251	0.212	0.248	0.314	0.158	0.841	0.2	0.083	0.106	0.337	0.075	0.078	0.232	0.232	0.811
Lmod	0.168	0.3713	0.274	0.347	0.251	0.212	0.248	0.314	0.158	0.841	0.2	0.083	0.106	0.337	0.075	0.078	0.232	0.232	0.811
Pcomp	0.814	0.556	0.668	0.772	0.846	0.827	0.846	0.623	0.834	0.478	0.702	0.844	0.85	0.772	0.825	0.837	0.811	0.837	0.837

ORS - Oromocto Lake SWI

	Adis	Ca	Ccc	Crit	Chal	Deor	Doglg	Dogll	Doo	Dos	Dotri	Dpc	Lvas	Lmod	Ngal	Pcomp
Adis	3.994	3.987	0.048	0.221	0.159	0.096	0.027	0.052	0.322	0.065	0.026	0.071	0.401	0.347	0.177	0.979
Ca	3.994	3.987	0.048	0.221	0.159	0.096	0.027	0.052	0.322	0.065	0.026	0.071	0.401	0.347	0.177	0.979
Ccc	0.048	0.048	0.219	0.219	0.169	0.106	0.041	0.057	0.319	0.073	0.041	0.067	0.395	0.35	0.178	0.981
Crit	0.221	0.3908	0.219	0.219	0.169	0.106	0.041	0.057	0.319	0.073	0.041	0.067	0.395	0.35	0.178	0.981
Chal	0.159	0.3936	0.169	0.267	0.169	0.106	0.041	0.057	0.319	0.073	0.041	0.067	0.395	0.35	0.178	0.981
Deor	0.096	0.3967	0.106	0.194	0.169	0.099	0.099	0.108	0.279	0.168	0.1	0.113	0.388	0.345	0.2	0.939
Doglg	0.027	0.3997	0.041	0.219	0.165	0.044	0.044	0.325	0.061	0.061	0.011	0.067	0.397	0.348	0.175	0.981
Dogll	0.052	0.3981	0.057	0.224	0.162	0.108	0.044	0.322	0.073	0.073	0.0325	0.322	0.423	0.407	0.35	0.952
Doo	0.322	0.3799	0.319	0.314	0.333	0.279	0.061	0.073	0.312	0.065	0.065	0.067	0.389	0.35	0.186	0.973
Dos	0.065	0.3972	0.073	0.205	0.168	0.105	0.061	0.073	0.312	0.065	0.065	0.067	0.389	0.35	0.186	0.973
Dotri	0.026	0.3998	0.041	0.221	0.165	0.1	0.011	0.047	0.325	0.067	0.067	0.067	0.389	0.35	0.186	0.973
Dpc	0.071	0.3983	0.067	0.183	0.176	0.113	0.067	0.08	0.322	0.067	0.067	0.067	0.389	0.35	0.186	0.973
Lvas	0.401	0.3833	0.395	0.356	0.417	0.388	0.397	0.395	0.423	0.352	0.4	0.389	0.443	0.443	0.428	0.792
Lmod	0.347	0.3845	0.35	0.359	0.371	0.345	0.348	0.351	0.407	0.337	0.35	0.389	0.443	0.443	0.428	0.792
Ngal	0.177	0.3951	0.178	0.271	0.299	0.2	0.175	0.18	0.35	0.181	0.175	0.186	0.428	0.32	0.32	0.986
Pcomp	0.979	0.357	0.981	0.886	0.918	0.939	0.981	0.98	0.852	0.955	0.982	0.973	0.792	0.896	0.988	0.988

APPENDIX E1 - continued...

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ORail - Oremco Lake SWI and core samples

Adis	Ca	Ccc	Chl	Chal	Deor	Doglg	Dogl	Doo	Dos	Dorl	Dpc	Duc	Lvas	Lmod	Ngai	Pcomp
Adis	4.723	0.117	0.23	1.714	0.105	0.027	0.107	0.443	0.076	0.026	0.071	0.026	0.405	0.354	0.18	1.118
Ca	4.723	4.711	4.634	4.824	4.692	4.726	4.703	4.49	4.702	4.726	4.713	4.727	4.578	4.594	4.683	4.188
Ccc	0.117	0.246	0.246	1.717	0.156	0.114	0.063	0.419	0.099	0.114	0.126	0.114	0.398	0.352	0.192	1.11
Chl	0.23	4.634	1.717	1.715	0.203	0.228	0.246	0.423	0.215	0.23	0.229	1.714	1.757	1.747	1.722	1.036
Chal	1.714	4.824	1.717	1.715	1.713	1.714	1.715	1.754	1.715	1.714	1.715	1.714	1.757	1.747	1.722	1.036
Deor	0.105	4.692	0.156	0.203	0.156	0.114	0.063	0.419	0.099	0.114	0.126	0.114	0.398	0.352	0.192	1.11
Doglg	0.027	4.726	0.114	0.228	0.203	0.107	0.103	0.445	0.072	0.011	0.067	0.012	0.402	0.355	0.179	1.12
Dogl	0.107	4.703	0.063	0.246	0.145	0.103	0.103	0.421	0.092	0.105	0.105	0.105	0.397	0.353	0.19	1.12
Doo	0.443	4.49	0.419	0.423	0.401	0.445	0.421	0.425	0.076	0.076	0.067	0.067	0.406	0.357	0.18	1.12
Dos	0.026	4.702	0.099	0.215	0.12	0.072	0.092	0.425	0.076	0.076	0.067	0.067	0.406	0.357	0.18	1.12
Dorl	0.026	4.726	0.114	1.715	0.108	0.072	0.105	0.446	0.076	0.076	0.067	0.067	0.406	0.357	0.18	1.12
Dpc	0.071	4.713	0.126	1.715	0.12	0.067	0.123	0.443	0.096	0.067	0.067	0.067	0.406	0.357	0.18	1.12
Duc	0.026	4.727	0.114	1.714	0.105	0.012	0.105	0.443	0.077	0.012	0.067	0.067	0.406	0.357	0.18	1.12
Lvas	0.405	4.578	0.398	1.757	0.394	0.402	0.397	0.506	0.354	0.405	0.394	0.406	0.444	0.444	0.43	1.039
Lmod	0.354	4.594	0.352	1.747	0.354	0.355	0.353	0.494	0.338	0.357	0.357	0.357	0.444	0.444	0.43	1.039
Ngai	0.18	4.683	0.192	1.722	0.206	0.179	0.19	0.452	0.182	0.179	0.189	0.178	0.43	0.322	0.322	1.122
Pcomp	1.118	4.188	1.11	1.877	1.081	1.12	1.11	0.998	1.093	1.12	1.113	1.122	0.951	1.039	1.122	1.122

YO - Yoho Lake SWI

Adis	Ca	Ccc	Chl	Chal	Deor	Doglg	Dogl	Dool	Doo	Dos	Dpc	Duc	Lvas	Lmod	Ngai	Pcomp
Adis	3.587	0.214	0.088	0.059	0.123	0.043	0.138	0.054	0.443	0.087	0.086	0.049	0.334	0.543	0.116	1.002
Ca	3.587	3.545	3.569	3.593	3.57	3.598	3.576	3.477	3.579	3.582	3.601	3.458	3.495	3.582	3.148	1.002
Ccc	0.214	0.208	0.208	0.201	0.233	0.209	0.173	0.193	0.383	0.203	0.172	0.201	0.345	0.574	0.226	0.935
Chl	0.088	0.088	0.088	0.088	0.138	0.096	0.15	0.096	0.427	0.127	0.102	0.093	0.33	0.543	0.136	0.97
Chal	0.059	3.593	0.201	0.233	0.123	0.044	0.128	0.044	0.435	0.094	0.075	0.037	0.339	0.537	0.107	1.002
Deor	0.123	3.57	0.233	0.138	0.123	0.113	0.164	0.12	0.43	0.121	0.138	0.118	0.328	0.515	0.129	0.979
Doglg	0.043	3.598	0.209	0.096	0.113	0.113	0.13	0.036	0.441	0.068	0.078	0.028	0.328	0.541	0.109	1.004
Dogl	0.138	3.576	0.173	0.15	0.164	0.13	0.115	0.115	0.365	0.135	0.127	0.122	0.331	0.553	0.165	0.973
Dool	0.054	3.599	0.193	0.096	0.12	0.036	0.115	0.437	0.437	0.08	0.07	0.015	0.332	0.542	0.109	1.01
Doo	0.443	3.477	0.383	0.427	0.43	0.441	0.365	0.437	0.437	0.106	0.071	0.083	0.289	0.536	0.109	0.978
Dos	0.087	3.579	0.203	0.127	0.121	0.068	0.135	0.08	0.437	0.106	0.071	0.071	0.337	0.547	0.106	0.994
Dpc	0.086	3.582	0.172	0.102	0.138	0.078	0.122	0.07	0.415	0.083	0.083	0.083	0.337	0.547	0.106	1.012
Duc	0.049	3.601	0.201	0.093	0.118	0.028	0.122	0.015	0.439	0.083	0.071	0.071	0.337	0.547	0.106	1.012
Lvas	0.334	3.458	0.345	0.33	0.339	0.328	0.331	0.332	0.471	0.289	0.334	0.337	0.547	0.547	0.303	0.876
Lmod	0.543	3.495	0.574	0.537	0.515	0.541	0.553	0.542	0.64	0.336	0.545	0.542	0.547	0.547	0.303	0.876
Ngai	0.116	3.582	0.226	0.136	0.107	0.129	0.165	0.109	0.439	0.109	0.126	0.106	0.303	0.524	0.524	1.021
Pcomp	1.002	3.148	0.935	0.97	0.979	1.004	0.973	1.01	0.793	0.978	0.994	1.012	0.876	1.021	0.981	0.981

APPENDIX E2 R-mode Dendrograms (Page 2 of 2)

GRS

GRC

GRa11

YO

APPENDIX F - Q-mode Dendrograms (Page 1 of 3)

Greenhill Lake surface (uncorrected)

Greenhill Lake surface (normalized)

Yoho Lake surface (uncorrected)

Yoho Lake surface (normalized)

APPENDIX F - Q-mode Dendrograms (Page 2 of 3)

Oromocto Lake surface (uncorrected)

Oromocto Lake surface (normalized)

APPENDIX F - Q-mode Dendrograms (Page 3 of 3)

Greenhill Lake Core

Frog Lake Core

APPENDIX G – Canonical correlation script and function code

1. Canonical correlation command script used in SPSS 10 syntax window:

```
INCLUDE 'canonical correlation.sps'.

CANCORR      SET1=proxy1 proxy2 proxy3... proxyN/
              SET2=parameter1 parameter2/.
```

2. Canonical correlation function program used by the preceding script, shown below, must be present as a text file in the same folder as the SPSS 10 application program.

```
preserve.
set printback=off.
define cancorr (set1 =!charend('/')
                /set2 =!charend('/')
                /debug =!charend('/')
!DEFAULT ('N')
                /KEEPSC=!charend('/')
!DEFAULT ('Y')
                /PRCOR =!charend('/')
!DEFAULT (25) ).
preserve.
!IF ( !DEBUG !EQ 'N') !THEN
set printback=off mprint off.
!ELSE
set printback on mprint on.
!IFEND .

*-----
*-----
* Save the original file for later retrieval.
*-----
*-----
!IF (!DEBUG !EQ 'N') !THEN
SET RESULTS ON.
DO IF $CASENUM=1.
PRINT / "NOTE: ALL OUTPUT
INCLUDING ERROR MESSAGES
HAVE BEEN TEMPORARILY"
/ "SUPPRESSED. IF YOU
EXPERIENCE UNUSUAL
BEHAVIOR THEN RERUN THIS"
```

```
/ "MACRO WITH AN
ADDITIONAL ARGUMENT
/DEBUG='Y'."
/ "BEFORE DOING THIS YOU
SHOULD RESTORE YOUR DATA
FILE."
/ "THIS WILL FACILITATE
FURTHER DIAGNOSTICS OF ANY
PROBLEMS".
END IF.
!IFEND .
save outfile='cc__tmp1.sav'.

*-----
*-----
* Compute the correlation matrix and
pass information to MATRIX.
*-----
*-----
* DEFAULT: SET RESULTS AND
ERRORS OFF TO SUPPRESS
CORRELATION PIVOT TABLE *.
!IF (!DEBUG='N') !THEN
set results off errors off.
!IFEND
corr variables=!set1 !set2
/missing=listwise/matrix out(*).
set errors on results listing.

*-----
*-----
```

```
* Get correlations and compute basic
quantities needed for analysis.
```

```
*-----
-----.
```

```
* SET command placed to prevent
exceeding MXLOOPS 40 default *.
```

```
SET MXLOOPS=199 MITERATE 199.
matrix.
```

```
get r /variables=!set1/file=*
```

```
compute p1=ncol(r).
```

```
get r /file=*
```

```
/names=varname/variables=!set1 !set2.
```

```
compute p2=ncol(r)-p1.
```

```
compute nx1=varname(1:p1).
```

```
compute nv=p1+p2.
```

```
compute nx2=varname((p1+1):nv).
```

```
compute rr=r(4:(nv+3),1:nv).
```

```
compute ns=r(3,1).
```

```
compute r11=rr(1:p1,1:p1).
```

```
compute r22=rr((p1+1):nv,(p1+1):nv).
```

```
compute r12=rr(1:p1,(p1+1):nv).
```

```
compute d1=r(2,1:p1).
```

```
compute d2=r(2,(p1+1):nv).
```

```
compute d1=mdia(d1).
```

```
compute d2=mdia(d2).
```

```
compute s1=d1*r11*d1.
```

```
compute s12=d1*r12*d2.
```

```
compute s2=d2*r22*d2.
```

```
compute d1=inv(d1).
```

```
compute d2=inv(d2).
```

```
*-----
-----.
```

```
* Print correlations.
```

```
*-----
-----.
```

```
do if (p1 <= !PRCOR and p2 <=
!PRCOR ).
```

```
print r11 /format "f7.4"/title
```

```
'Correlations for Set-1'
```

```
    /space 2 /rnames=nx1
```

```
/cnames=nx1.
```

```
print r22 /format "f7.4"/title
```

```
'Correlations for Set-2'
```

```
    /space 2 /rnames=nx2
```

```
/cnames=nx2.
```

```
print r12 /format "f7.4"/title
```

```
'Correlations Between Set-1 and Set-2'
```

```
    /space 2 /rnames=nx1
```

```
/cnames=nx2.
```

```
end if.
```

```
*-----
-----.
```

```
* R1 and r2 are cholesky decomp of r11
and r22.
```

```
*-----
-----.
```

```
compute r1=chol(r11).
```

```
compute r2=chol(r22).
```

```
*-----
-----.
```

```
* R1_inv and r2_inv are inverse of r1
and r2.
```

```
*-----
-----.
```

```
compute r1_inv=inv(r1).
```

```
compute r2_inv=inv(r2).
```

```
*-----
-----.
```

```
* compute omega matrix.
```

```
*-----
-----.
```

```
do if (p1 le p2).
```

```
compute omega=t(r1_inv)*r12*r2_inv.
```

```
else.
```

```
compute
```

```
omega=t(r2_inv)*t(r12)*r1_inv.
```

```
end if.
```

```
*-----
-----.
```

```
* SVD computes the singular value
decomposition of omega.
```

```

*-----
-----
call svd(omega,u,lambda,v).

*-----
-----
* Create a list of names for use later in
labels .
*-----
-----

!LET !@='!NULL !LET !@1='!NULL
!LET !@2='!NULL
!DO !N= 1 !TO 199
!LET
!@='!CONCAT(!@,!QUOTE(!N),",")
!LET
!@1='!CONCAT(!@1,!QUOTE(!CONC
AT('CV1-',!N)),",")
!LET
!@2='!CONCAT(!@2,!QUOTE(!CONC
AT('CV2-',!N)),",")
!DOEND
!LET
!@='!CONCAT(!@,!QUOTE(@@))
!LET
!@1='!CONCAT(!@1,!QUOTE(@@))
!LET
!@2='!CONCAT(!@2,!QUOTE(@@)).
Compute num={!@}.

*-----
-----
* Lambda stores the canonical
correlations. Print them now.
*-----
-----

print diag(lambda)/format "f8.3"/title
'Canonical Correlations'
/space 2/rnames=num.

compute dlam=diag(lambda).

```

```

*-----
-----
* Compute the eigenvalues and test of
remaining canonical correlations.
*-----
-----

compute eign=(1 &/ (1-dlam &**2)) - 1.
compute wlam=1 &/ (1+eign).
compute n=nrow(wlam).
compute wilk=wlam.
compute df=wlam.
compute sig=wlam.
compute bart2=wlam.
compute tem=1.
loop #l=1 to n.
+ compute tem=tem*wlam(n-#l+1).
+ compute df(n-#l+1)=(p1-n+#l)*(p2-
n+#l).
+ compute dof=df(n-#l+1).
+ compute bart2(n-#l+1)=-(ns-
0.5*(p1+p2+3))*ln(tem).
+ compute chi=bart2(n-#l+1).
+ compute sig(n-#l+1)=1-
chicdf(chi,dof).
+ compute wilk(n-#l+1)=tem.
end loop.
compute test={wilk,bart2,df,sig}.
print test /format "f8.3"/title 'Test that
remaining correlations are zero:'
/space 2/rnames=num
/cnames={"Wilk's ", "Chi-SQ", " DF
", " Sig."}.

*-----
-----
* Compute and print the standardized
canonical coefficients for set-1.
*-----
-----

do if (p1 le p2).
compute a=r1_inv*u.
else.
compute a=r1_inv*v.
end if.

```

```

do if (p2 lt p1).
compute a=a(:,1:p2).
end if.
print a/format "f8.3"/title 'Standardized
Canonical Coefficients for Set-1'
    /space 2/rnames=nx1/cnames=num.

*-----
-----
* Compute and print the unstandardized
canonical coefficients for set-1.
*-----
-----

compute a1=d1*a.
print a1/format "f8.3"/title 'Raw
Canonical Coefficients for Set-1'
    /space 2/rnames=nx1/cnames=num.

*-----
-----
* Compute and print the standardized
canonical coefficients for set-2.
*-----
-----

do if (p1 le p2).
compute b=r2_inv*v.
else.
compute b=r2_inv*u.
end if.
do if (p1 le p2).
compute b=b(:,1:p1).
end if.
print b /format "f8.3"/title 'Standardized
Canonical Coefficients for Set-2'
    /space 2/rnames=nx2/cnames=num.

*-----
-----
* Compute and print the unstandardized
canonical coefficients for set-2.
*-----
-----

compute b1=d2*b.

```

```

print b1/format "f8.3"/title 'Raw
Canonical Coefficients for Set-2'
    /space 2/rnames=nx2/cnames=num.

*-----
-----
* Compute and print the canonical
loadings for set-1.
*-----
-----

compute tem=d1*s1*a1.
print tem /format "f8.3"/title 'Canonical
Loadings for Set-1'
    /space 2/rnames=nx1/cnames=num.

*-----
-----
* Compute the redundancy index as the
proportion of variance in set-1
* explained by its own canonical
variates.
*-----
-----

compute fl=cassq(tem)/p1.
compute fl=t(fl).

*-----
-----
* Compute and print cross loadings for
set-1.
*-----
-----

compute tem=d1*s12*b1.
print tem /format "f8.3"/title 'Cross
Loadings for Set-1'
    /space 2/rnames=nx1/cnames=num.

*-----
-----
* Compute the redundancy index as the
proportion of variance in set-1
* explained by the set-2 canonical
variates.

```

```
*-----
-----.
```

```
compute cs3=cssq(tem)/p1.
compute cs3=t(cs3).
```

```
*-----
-----.
```

```
* Compute and print cross loadings for
set-2.
```

```
*-----
-----.
```

```
compute tem=d2*s2*b1.
print tem /format "f8.3"/title 'Canonical
Loadings for Set-2'
    /space 2/rnames=nx2/cnames=num.
```

```
*-----
-----.
```

```
* Compute the redundancy index as the
proportion of variance in set-2
```

```
* explained by its own canonical
variates.
```

```
*-----
-----.
```

```
compute f2=cssq(tem)/p2.
compute f2=t(f2).
```

```
*-----
-----.
```

```
* Compute and print cross loadings for
set-2.
```

```
*-----
-----.
```

```
compute tem=d2*t(s12)*a1.
print tem /format "f8.3"/title 'Cross
Loadings for Set-2'
    /space 2/rnames=nx2/cnames=num.
```

```
*-----
-----.
```

```
* Compute the redundancy index as the
proportion of variance in set-2
```

```
* explained by the set-1 canonical
variates.
```

```
*-----
-----.
```

```
compute cs4=cssq(tem)/p2.
compute cs4=t(cs4).
```

```
*-----
-----.
```

```
* Print redundancy analysis results.
```

```
*-----
-----.
```

```
compute c1={!@1}.
compute c2={!@2}.
```

```
print /title '      Redundancy
Analysis:' /space 2.
```

```
print f1/format "f15.3"
    /title 'Proportion of Variance of Set-1
Explained by Its Own Can. Var.'
```

```
    /space 2/rnames=c1/cnames= {"Prop
Var"}.
```

```
print cs3/format "f15.3"
    /title 'Proportion of Variance of Set-1
Explained by Opposite Can. Var.'
```

```
    /space 2/rnames=c2/cnames= {"Prop
Var"}.
```

```
print f2/format "f15.3"
    /title 'Proportion of Variance of Set-2
Explained by Its Own Can. Var.'
```

```
    /space 2/rnames=c2/cnames= {"Prop
Var"}.
```

```
print cs4/format "f15.3"
    /title 'Proportion of Variance of Set-2
Explained by Opposite Can. Var.'
```

```
    /space 2/rnames=c1/cnames= {"Prop
Var"}.
```

```
*-----
-----.
```

```
* Create files for use in calculation of
canonical scores.
```

```
*-----
-----.
```



```

SAVE {P1,P2} / OUTFILE
'CC__SIZE.SAV'.
SAVE {T(A1),T(B)} / OUTFILE
'CC__AB.SAV' .
END MATRIX.
*-----
-----
* Create a file with variable names and
set number variable
*-----
-----

SET MESSAGES OFF RESULTS OFF.
SELECT IF $CASENUM=1.
DO REPEAT V=!SET1.
COMPUTE V=1.
END REPEAT.
DO REPEAT V=!SET2.
COMPUTE V=2.
END REPEAT.
STRING VARNAME (A8).
COMPUTE VARNAME='SET_NUM'.
FLIP VARIABLES !SET1 !SET2 /
NEWNAMES=VARNAME .
COMPUTE VARSEQ=1.
SPLIT FILE BY SET_NUM.
CREATE VARSEQ=CSUM(VARSEQ).
SAVE OUTFILE 'CC_NAMES.SAV'.
GET FILE 'CC__SIZE.SAV' .

*-----
-----
* Set up required information to create
compute statements for scoring.
*-----
-----

WRITE OUTFILE 'CC__AB.INC'
/'STRING @NMA001 TO
@NMA',COL1 (N3), ' (A8)'
/' @NMB001 TO @NMB',COL2
(N3), ' (A8)'
/'VECTOR @NMA= @NMA001 TO
@NMA',COL1 (N3)

```

```

/' @NMB= @NMB001 TO
@NMB',COL2 (N3)
/'COMPUTE N_A='COL1 (N3)
/'COMPUTE N_B='COL2 (N3)
/'IF (SET_NUM=1)
@NMA(VARSEQ)=CASE_LBL'
/'IF (SET_NUM=2)
@NMB(VARSEQ)=CASE_LBL'
/'COMPUTE @=1'
/'AGGREGATE OUTFILE
"CC__SPRD.SAV" / BREAK @'
/' / N_A=MAX(N_A) /
N_B=MAX(N_B)'
/' / @NMA001 TO @NMA',COL1
(N3) '=MAX (@NMA001 TO
@NMA',COL1 (N3),)'
/' / @NMB001 TO @NMB',COL2
(N3) '=MAX (@NMB001 TO
@NMB',COL2 (N3),)'
/'GET FILE "CC__AB.SAV"'
/'COMPUTE @=1'
/'MATCH FILES FILE * / TABLE
"CC__SPRD.SAV"/BY @'
/'VECTOR @NMA= @NMA001 TO
@NMA',COL1 (N3)
/' @NMB= @NMB001 TO
@NMB',COL2 (N3)
/' COEF= COL1 TO @'.
EXECUTE.

```

```

GET FILE 'CC_NAMES.SAV'.
INCLUDE FILE 'CC__AB.INC'.
SET PRINTBACK OFF.

```

```

*-----
-----
* Write out the compute statements for
scoring.
*-----
-----

```

```

STRING @SCNM@ (A8).
STRING @OLDNM@ (A8).
COMPUTE
@SCNM@=CONCAT('S1_CV',STRIN
G($CASENUM,N3)).

```

```

WRITE OUTFILE 'CC__.INC'
/'COMPUTE ',@SCNM@,'=' 0'.
LOOP CC@@@ = 1 TO N_A.
COMPUTE
@OLDNM@=@NMA(CC@@@).
COMPUTE @COEF@
=COEF(CC@@@).
WRITE OUTFILE 'CC__.INC' /'
+',@COEF@ (F20.16),' * ',@OLDNM@
.
END LOOP.
COMPUTE
@SCNM@=CONCAT('S2_CV',STRIN
G($CASENUM,N3)).
WRITE OUTFILE 'CC__.INC'
/'COMPUTE ',@SCNM@,'=' 0'.
LOOP CC@@@=1 TO N_B.
COMPUTE
@OLDNM@=@NMB(CC@@@).
COMPUTE @COEF@
=COEF(CC@@@+N_A).
WRITE OUTFILE 'CC__.INC' /'
+',@COEF@ (F20.16),' * ',@OLDNM@
.
END LOOP.
EXECUTE.

```

```

*-----
-----
* Get the original data and run the
scoring program.
*-----
-----

```

```

GET FILE 'cc__tmp1.sav'.
INCLUDE FILE 'CC__.INC' .
ERASE FILE 'CC__SIZE.SAV' .
ERASE FILE 'CC__AB.INC'.
ERASE FILE 'CC__NAMES.SAV'.
ERASE FILE 'CC__AB.SAV'.
ERASE FILE "CC__SPRD.SAV"
!IF (!KEEPSC ='N') !THEN
ERASE FILE 'CC__.INC'.
!ELSE

```

```

DO IF ($CASENUM=1).

```

```

SET RESULTS ON.
PRINT /'The canonical scores have been
written to the active file.'
/'Also, a file containing an SPSS
Scoring program has been written'
/'To use this file GET a system file
with the SAME variables'
/'Which were used in the present
analysis. Then use an INCLUDE
command'
/'to run the scoring program.'
/'For example :'/
/'GET FILE anotherfilename'
/'INCLUDE FILE "CC__.INC".'
/'EXECUTE.'.
END IF.
EXECUTE.

!IFEND.
RESTORE.
!enddefine.
RESTORE.

```

APPENDIX H - Principal components analysis results

Sample	PC1	PC2	PC3	PC4	PC5	PC6
GRS3	0.159482563	0.076755393	-0.036326788	-0.116741446	-0.129951115	0.039112516
GRS4	-0.14437658	-0.065342883	-0.147106882	-0.192965027	-0.123292808	0.172788274
GRS5	-0.073617777	0.027619586	-0.088470198	-0.159716565	-0.119257155	0.066763027
GRS6	-0.431870911	-0.138547186	-0.174058155	-0.245993593	-0.122578613	0.109578569
GRS7	-0.322512383	-0.093647604	-0.183587023	-0.249711408	-0.153627101	0.114605133
GRS8	-0.406008868	-0.118793033	-0.20074032	-0.250724615	-0.150489106	0.114941357
GRS9	0.469158942	0.301043905	0.102970169	-0.053796989	-0.107781298	-0.038713278
GRS10	0.202655807	0.164863222	0.012549282	-0.116243553	-0.117698695	0.001825126
GRS11	0.212625639	0.066798145	-0.057593145	-0.136327277	-0.127330482	0.067720703
GRS12	-0.569378874	-0.198534704	-0.256967631	-0.270260242	-0.155638143	0.138779535
GRS13	0.379753734	0.212703741	0.068877248	-0.060482604	-0.117045738	-0.022480519
GRS14	-0.023176288	0.025016834	-0.059837556	-0.19412682	-0.132016452	0.062760729
GRS15	-0.01562444	0.011918061	-0.080545043	-0.175187012	-0.139719055	0.082902172
GRS16	-0.557020491	-0.210517221	-0.259499792	-0.27344746	-0.120170663	0.184147795
GRS17	0.684077948	0.377066136	0.167034333	-0.058570092	-0.131874775	-0.079419664
GRS18	-0.662306318	-0.239053789	-0.28218094	-0.303401492	-0.156190006	0.156213257
GRS19	0.216568852	0.127926165	0.000378322	-0.074600416	-0.099495866	0.003697107
GRS20	0.095478346	0.011860693	-0.095988871	-0.174498413	-0.115248826	0.081196822
GRS21	-0.216855167	-0.07683893	-0.151379963	-0.239145826	-0.138944033	0.108083664
GRS22	0.240091859	0.145297414	0.054189688	-0.118813659	-0.1099906	0.001365213
GRS23	-0.590904873	-0.211783109	-0.26544815	-0.287095384	-0.151997703	0.145893748
GRS24	0.213754836	0.071297542	-0.014044899	-0.133347569	-0.079009984	0.061121466
GRS25	-0.075829735	-0.031103615	-0.12146556	-0.188838959	-0.122724876	0.087146367
GRS26	0.2745087	0.165448174	0.036892963	-0.138906937	-0.14263838	0.005911147
YO1	-0.506736001	-0.167013502	-0.244142559	-0.250767885	-0.150660021	0.123624412
YO2	-0.570879578	-0.202312374	-0.21968276	-0.272568143	-0.141742121	0.166106297
YO3	-0.735933427	-0.27183631	-0.313538058	-0.316426693	-0.158578123	0.160119197
YO4	0.396581519	0.219616644	0.150757288	-0.043179221	-0.105123182	-0.051913892
YO5	-0.783	-0.285	-0.327	-0.325	-0.164	0.163
YO6	-0.014556863	-0.006113524	-0.03264718	0.001183209	-0.069453834	0.015137951
YO7	0.125481734	0.019135558	0.085194492	0.268658627	0.089327136	-0.067833214
YO8	0.392359413	0.184118877	0.146888991	0.264528277	-0.071799319	-0.123828104
YO9	0.3731175	0.21417424	0.096705541	0.227474481	-0.086020152	-0.126282925
YO10	-0.350401134	-0.124591421	-0.159152244	-0.164658228	-0.073413403	0.087525138
YO11	0.203708699	0.034447759	0.226835462	0.187650213	0.018886902	-0.043418344
YO12	0.361810264	0.099055566	0.231100526	0.201287467	0.197606288	-0.089797301
YO13	-0.108789749	-0.112519431	0.01400418	0.158348438	-0.049992648	0.026111305
YO14	-0.783	-0.285	-0.327	-0.325	-0.164	0.163
YO15	0.081618604	0.021483391	0.027361965	0.040183029	-0.054329903	0.004443296
YO16	-0.394533537	-0.165503534	-0.10776539	-0.070406938	-0.088746231	0.070144518
YO17	-0.218032684	-0.076838102	-0.054793309	-0.055316093	-0.064538463	0.041437289
YO18	-0.291562598	-0.120658021	-0.070696111	-0.053558647	-0.075833168	0.053505393
YO19	-0.278973084	-0.118668462	-0.061740507	-0.0476881	-0.059106856	0.04962973
YO20	0.159282226	0.022490008	0.087668276	-0.022992764	0.081840261	0.011434338
YO21	-0.223550446	-0.114024022	-0.046749459	-0.04963507	-0.024043157	0.05631439
YO22	-0.317338149	-0.138255475	-0.085794024	0.027907568	-0.084523959	0.037472419
YO23	-0.424909219	-0.155395994	-0.17075463	-0.163339702	-0.132679361	0.093068079
YO24	-0.187464854	-0.112683184	-0.105328853	-0.113346861	0.280850705	0.065575204
YO27	-0.255078367	-0.061709741	-0.14825032	-0.195389169	-0.141647385	0.081667194
YO28	-0.218451124	-0.098775422	-0.088652464	-0.08088899	-0.089900101	0.065818402
YO29	-0.714511746	-0.263315611	-0.294470572	-0.284109569	-0.153513176	0.149603587

APPENDIX H (continued)

ML1	0.671611174	0.323771869	0.113071894	-0.063954407	-0.146632643	-0.068491953
ML2	0.613689908	0.205656107	0.176701064	-0.046888158	-0.053063465	-0.02029844
ML3	0.32012599	0.060975901	0.037283742	-0.109814051	-0.031079414	0.051957783
ML4	-0.278905191	-0.126325478	-0.095863897	-0.144624736	-0.092073581	0.088250907
ML5	0.430552177	0.17327755	0.156161442	-0.005078683	-0.053654747	-0.038943949
ML6	-0.045221043	-0.026326044	-0.058071206	-0.175889471	-0.069637675	0.082939793
ML7	-0.359097737	-0.127744869	-0.173885799	-0.104097807	-0.093523535	0.084666904
ORS04	0.048845684	0.020149679	-0.017970687	0.092184142	-0.061256881	-0.008011492
ORS05	-0.376813182	-0.140718267	-0.167440112	-0.122244215	-0.091974153	0.083800992
ORS06	-0.320349501	-0.127814293	-0.141438576	-0.07946325	-0.081839314	0.102141776
ORS07	-0.427256362	-0.162522847	-0.179584109	-0.092999033	-0.121919071	0.090288529
ORS08	-0.31891248	-0.106703031	-0.15995469	-0.083920197	-0.103972984	0.071321305
ORS10	-0.317392453	-0.09896489	-0.124356884	-0.170904613	-0.114954343	0.0785332
ORS11	-0.419585629	-0.142652265	-0.183713479	-0.131438326	-0.125306227	0.081016833
ORS12	-0.223357482	-0.059112786	-0.142227287	-0.110389579	-0.103535328	0.05628232
ORS13	-0.361163651	-0.154766628	-0.09648584	0.010103461	-0.084744407	0.04961391
ORS14	-0.460579733	-0.162314728	-0.196440487	-0.175942828	-0.10618838	0.096670884
ORS15	-0.353714952	-0.11900811	-0.1723128	-0.119454849	-0.101647831	0.08066608
ORS16	-0.123666786	-0.080671805	0.079848429	0.096209174	-0.020857909	-0.004358881
ORS17	-0.64796803	-0.236840544	-0.269782371	-0.266343209	-0.150856551	0.1397003
ORS18	-0.353424272	-0.11657078	-0.176826889	-0.142840925	-0.09547365	0.080151765
ORS19	-0.085901053	-0.083654503	0.004104263	0.254715688	-0.056017536	-0.004174877
ORS20	-0.242759155	-0.104956775	-0.090717997	-0.148772199	-0.072726393	0.084347117
ORS21	-0.498077296	-0.168577324	-0.226351191	-0.247102313	-0.151681254	0.127293701
ORS22	-0.034749179	-0.017131263	0.054050163	-0.039044728	-0.033348778	0.019019345
ORS23	-0.385428651	-0.173770749	-0.109129629	-0.010549047	-0.087737129	0.058205755
ORS24	0.188910432	-0.014977961	0.148862694	0.239649486	0.051566038	-0.03962862
ORS25	0.166187842	-0.013335376	0.071300727	0.020885905	-0.027016601	0.031764632
ORS26	0.103848723	0.013396351	0.042905364	0.095977463	-0.009878454	-0.005419211
ORS27	-0.247583174	-0.126340804	-0.104027644	-0.078140249	0.123458364	0.065761824
ORS28	0.193582469	0.017076892	0.154174892	0.154831713	0.048113687	-0.030449615
ORS29	-0.249122209	-0.109320569	-0.073844258	-0.086773884	-0.070714412	0.069945792
ORS30	0.006589333	-0.006947376	0.070979628	0.01126413	0.000955715	0.006686578
ORS31	0.151284407	0.047927548	0.150081251	0.128432778	0.024735065	-0.043764826
ORS32	-0.052432962	-0.049814283	-0.12309718	-0.11929552	-0.10625477	0.077721927
ORS33	-0.27203233	-0.152549394	-0.09940844	-0.021189656	-0.067551822	0.069007094
ORS34	-0.561361546	-0.212260488	-0.228346101	-0.212210262	-0.114825249	0.121610027
ORS35	-0.244672018	-0.093785083	-0.130747118	-0.171071	-0.102100888	0.089343352
ORS36	-0.102618491	-0.054049055	-0.07379447	-0.077901819	-0.029133137	0.054848929
ORS37	-0.326085343	-0.126384198	-0.157327432	-0.196397402	0.119068743	0.078670753

VIF	pairs	composition
10	none	n/a
7	none	n/a
6		2 (Dpc with Ccc; Doll with Dogs)
5.5		1 (Dpc, Ccc, Ckai, Doll, Dogs)
5		1 (Ccc, Ckai, Ckai, Deer, Dogs, Doll, Doo, Dpc, Ngai)

Avul	=	<i>Ancella vulgaris</i>	Doll	=	<i>D. oblonga</i> "linearis"
Ca	=	<i>Centropxytis aculeata</i>	Doo	=	<i>D. oblonga</i> "oblonga"
Ccg	=	<i>C. constriata</i> "greenhillsensis"	Dos	=	<i>D. oblonga</i> "spinosa"
Ccc	=	<i>C. constriata</i> "constriata"	Doten	=	<i>D. oblonga</i> "tenus"
Ciri	≠	<i>Cucurbitiella tricuspsis</i>	Dotri	=	<i>D. oblonga</i> "triangularis"
Kkal	=	<i>Centropxytis rahli</i>	Dpam	=	<i>D. prolaeiformis</i> "amphion"
Kbid	=	<i>Diftiugla bidens</i>	Dpnc	=	<i>D. prolaeiformis</i> "clavitor"
Dcor	=	<i>Diftiugla corona</i>	Durn	=	<i>Diftiugla urens</i>
Ddogr	=	<i>Diftiugla oblonga</i> "gigantica"	Durc	=	<i>D. urceolata</i> "urceolata"
Dogl	=	<i>D. oblonga</i> "glans"	Lvas	=	<i>Lagenodiftiugla</i> var.
Dogs	≠	<i>D. oblonga</i> "glans" and "spinosa"	Lmod	=	<i>Lesquerula modesta</i>
Dola	=	<i>D. oblonga</i> "larcoceolata"	Ngal	=	<i>Nebula galata</i>
			Pcomp	=	<i>Pontigulata compressa</i>

PEARSON CORRELATION

	Avul	Ca	Ccc	Cfil	Ckal	Deor	Doglg	Dogs	Doll	Doo	Dolen	Dofit	Dpam	Dpc	Dum	Durc	lyas	Lmod	Ngal	Poomp
Avul																				
Ca	0.0758																			
Ccc	-0.0061	-0.4951																		
Cfil	0.0775	-0.3709	0.3318																	
Ckal	0.0141	0.0032	-0.1234	0.0032																
Deor	-0.0499	-0.4716	0.2994	-0.1031	-0.0494															
Doglg	0.2236	-0.1961	0.0878	-0.0531	-0.059	0.0777														
Dogs	-0.0211	-0.5612	0.5629	0.1972	-0.115	0.2884	0.2923													
Doo	0.0508	-0.3182	0.4478	0.0512	-0.1014	0.0583	0.1175	0.5592												
Doll	-0.085	-0.5747	0.463	0.0982	-0.0974	0.2454	-0.0764	0.514	0.3898											
Dolen	0.0206	-0.2112	0.1878	-0.0475	-0.0375	0.0693	-0.0132	0.3254	0.4617	0.277										
Dofit	0.0257	-0.2894	0.2115	-0.0055	-0.0754	0.094	-0.0496	0.3865	0.6332	0.4012	0.811									
Dpam	0.2858	0.0833	0.0234	0.1078	-0.0694	0.0361	-0.0211	-0.0687	-0.0292	-0.032	-0.0156	-0.0063								
Dpc	0.0718	-0.373	0.3671	0.588	-0.116	0.4265	-0.0763	0.2778	0.1823	0.2383	0.0756	0.1441	0.0817							
Dum	0.0499	-0.2835	0.363	0.0377	-0.0979	0.0542	0.0456	0.5313	0.8531	0.4042	0.4372	0.6727	-0.0209	0.154						
Durc	-0.0271	-0.3675	0.7194	0.1472	-0.1016	0.2208	0.097	0.5372	0.4889	0.3864	0.2304	0.2277	-0.0436	0.2868	0.3607					
lyas	-0.0904	-0.5377	0.1306	0.1316	-0.181	0.3245	0.3032	0.3676	0.1895	0.0578	0.1654	0.1612	-0.1104	0.1904	0.1694	0.1342				
Lmod	-0.1091	-0.2255	-0.1789	-0.0608	-0.0391	0.0454	-0.0071	-0.1172	-0.1202	-0.1303	-0.0679	-0.0976	-0.0545	-0.1216	-0.1149	0.1048	0.0328			
Ngal	-0.1047	-0.0493	-0.1183	-0.1229	-0.0646	-0.0507	-0.0626	-0.0693	-0.0847	-0.0958	-0.0408	-0.0669	-0.0518	-0.128	-0.0785	-0.075	0.0198	0.2297		
Poomp	-0.1021	-0.4785	-0.1655	-0.1007	0.1865	-0.0714	0.1586	-0.0848	-0.22	0.0889	-0.0914	-0.1197	-0.1891	-0.2822	-0.2135	-0.1838	0.1823	0.0364	-0.0051	

APPENDIX I - continued...

TOLERANCE (approaching zero indicates high collinearity)

	Avul	Ca	Ccc	Chl	Chal	Deor	Dogig	Dogs	Doil	Doo	Dden	Ddri	Ddam	Dde	Durn	Durc	Lvas	Lmod	Ngal	Peomp
Avul	0.00077	0.7874	0.74571	0.72983	0.68776	0.74405	0.10072	0.73421	0.54201	0.7776	0.7674	0.78616	0.47192	0.668	0.79051	0.1548	0.78608	0.78927	0.74294	0.78616
Ca	0.02136	0.26731	0.00809	0.01657	0.00649	0.00726	0.00014	0.00612	0.00174	0.0394	0	0	0.00216	0.00691	0	0.00019	0.03758	0.0857	0.00983	0.17346
Ccc	0.02358	0.55006	0.1932	0.17117	0.11592	0.11992	0.00413	0.08053	0.04144	0.19342	0.26896	0.27086	0.04833	0.07631	0.26731	0.0048	0.24062	0.25445	0.13757	0.24229
Chl	0.08923	0.86505	0.52521	0.17126	0.13045	0.00482	0.13108	0.05142	0.45537	0.55066	0.55066	0.06043	0.11767	0.55006	0.00635	0.41102	0.46512	0.21683	0.46512	0.76453
Chal	0.06121	0.61312	0.34459	0.33212	0.25893	0.40833	0.01909	0.39002	0.17892	0.83403	0.8673	0.66655	0.22604	0.42772	0.86505	0.02484	0.87566	0.82713	0.55494	0.62383
Deor	0.40096	0.58309	0.57405	0.59382	0.58548	0.55648	0.00745	0.5144	0.5144	0.59701	0.58411	0.58309	0.55188	0.58241	0.59666	0.35855	0.56915	0.58207	0.58617	0.5767
Dogig	0.04234	0.36219	0.18225	0.23381	0.17325	0.19354	0.00174	0.0156	0.16168	0.20704	0.21524	0.21825	0.12132	0.17322	0.35714	0.0189	0.20121	0.21048	0.18352	0.21636
Dogs	0.06544	0.21515	0.1747	0.19209	0.16847	0.19095	0.00174	0.05121	0.0199	0.29718	0.47259	0.48283	0.024	0.06704	0.47037	0.00227	0.293	0.3358	0.09531	0.21636
Doil	0.00902	0.46926	0.07836	0.16348	0.07457	0.06401	0.00174	0.29478	0.29163	0.29163	0.28868	0.29718	0.29246	0.29842	0.31656	0.24219	0.29403	0.29568	0.29499	0.29638
Doen	0.27917	0.29595	0.29214	0.29647	0.29248	0.2956	0.24728	0.29163	0.18389	0.16849	0.18123	0.45208	0.17627	0.17809	0.21542	0.13984	0.18471	0.18433	0.18305	0.18372
Ddri	0.16964	0.18423	0.18657	0.18416	0.18376	0.17992	0.12073	0.18389	0.38986	0.80257	0.85911	0.85985	0.17627	0.17809	0.21542	0.13984	0.18471	0.18433	0.18305	0.18372
Ddam	0.18308	0.85911	0.65488	0.72569	0.67568	0.6402	0.0538	0.668	0.38986	0.80257	0.85911	0.85985	0.17627	0.17809	0.21542	0.13984	0.18471	0.18433	0.18305	0.18372
Dde	0.03725	0.39557	0.15246	0.203	0.18376	0.18265	0.00816	0.20877	0.07999	0.32216	0.39904	0.40084	0.10094	0.39698	0.85985	0.01132	0.28969	0.37106	0.24073	0.42535
Durn	0.18786	0.20492	0.20362	0.2045	0.20325	0.20483	0.18031	0.19755	0.16756	0.204	0.21915	0.23964	0.20222	0.20555	0.40368	0.00303	0.39283	0.39463	0.39078	0.3992
Durc	0.31182	0.39651	0.33761	0.39588	0.38551	0.37722	0.18139	0.36751	0.31526	0.39339	0.39783	0.39809	0.37286	0.08068	0.60168	0.00303	0.39283	0.39463	0.39078	0.3992
Lvas	0.01239	0.59916	0.1305	0.19747	0.10483	0.08114	0.00222	0.0721	0.02588	0.39216	0.60459	0.6006	0.03286	0.08068	0.60168	0.00303	0.39283	0.39463	0.39078	0.3992
Lmod	0.00801	0.89366	0.09023	0.14613	0.06474	0.08568	0.00149	0.08023	0.0177	0.28394	0.89366	0.89445	0.02209	0.06758	0.89366	0.00189	0.70077	0.73206	0.08066	0.8726
Ngal	0.08632	0.90909	0.4417	0.6169	0.39324	0.39063	0.01354	0.33933	0.13974	0.75529	0.90909	0.90909	0.16932	0.39688	0.90992	0.01784	0.70077	0.73206	0.08066	0.8726
Peomp	0.00281	0.63854	0.03032	0.05143	0.02106	0.02709	0.00052	0.02288	0.00641	0.09391	0.63857	0.63857	0.00909	0.02727	0.64226	0.00071	0.09056	0.2076	0.03392	

VIF (Variable Inflation Factor) (10 or greater indicates high collinearity)

	Avul	Ca	Ccc	Chl	Chal	Deor	Dogig	Dogs	Doil	Doo	Dden	Ddri	Ddam	Dde	Durn	Durc	Lvas	Lmod	Ngal	Peomp
Avul		1.27	1.341	1.37	1.454	1.344	9.929	1.362	1.845	1.286	1.27	1.272	2.119	1.497	1.265	6.46	1.253	1.267	1.346	1.272
Ca	1306.28		109.994	60.343	154.009	137.787	7009.03	163.405	576.209	26.382	high	high	463.661	144.692	high	52.15.19	26.612	11.688	103.808	5.765
Ccc	46.824	3.741		5.842	8.627	8.339	242.233	11.046	24.133	5.17	3.718	3.692	20.693	12.77	3.741	208.343	4.156	3.93	7.289	4.117
Chl	42.402	1.818	5.176		5.839	7.666	207.464	7.629	19.448	2.196	1.816	1.817	16.549	8.498	1.818	157.387	2.433	2.15	4.612	2.15
Chal	11.207	1.156	1.904	1.454		2.449	62.396	2.564	5.589	1.199	1.153	1.154	4.424	2.338	1.156	40.254	1.142	1.209	1.802	1.308
Deor	16.338	1.631	2.902	3.011	3.862		86.936	3.62	7.685	2.203	1.63	1.624	7.365	3.71	1.629	64.899	2.326	1.879	2.851	1.603
Dogig	2.494	1.715	1.742	1.684	1.708	1.797		1.944	1.944	1.675	1.712	1.715	1.812	1.717	1.676	2.789	1.757	1.718	1.706	1.734
Dogs	23.621	2.761	5.487	4.277	5.772	5.167	134.225			3.93	2.749	2.754	10.077	4.632	2.671	95.084	3.736	2.925	4.7	2.71
Doil	15.281	4.648	5.724	5.206	6.007	5.237	64.083	6.185		4.83	4.646	4.582	8.243	5.773	2.8	52.921	4.97	4.751	5.449	4.622
Doo	110.878	2.131	12.761	6.117	13.41	15.622	574.739	19.528	50.261		2.116	2.072	41.67	14.917	2.126	441.352	3.413	2.978	10.492	3.28
Dden	3.582	3.379	3.423	3.373	3.419	3.383	4.044	3.429	3.464	3.365		1.377	3.419	3.351	3.159	4.129	3.401	3.382	3.39	3.374
Ddri	5.895	5.428	5.36	5.43	5.442	5.558	8.283	5.435	5.935	5.518	2.212		5.673	5.615	4.642	7.151	5.414	5.425	5.463	5.443
Ddam	5.462	1.164	1.527	1.378	1.48	1.562	18.589	1.497	2.565	1.246	1.164	1.163		1.423	1.163	13.682	1.218	1.185	1.399	1.138
Dde	28.843	2.528	6.559	4.926	5.442	5.475	122.6	4.79	12.501	3.104	2.506	2.496	9.907		2.519	88.372	3.452	2.695	4.154	2.351
Durn	5.323	4.86	4.911	4.489	4.92	4.882	5.546	5.062	5.968	4.902	4.563	4.173	4.945	4.865		5.35	4.907	4.883	4.89	4.867
Durc	3.207	2.522	2.962	2.526	2.594	2.651	5.513	2.721	3.172	2.542	2.513	2.512	2.636	2.446	2.476		2.545	2.534	2.559	2.505
Lvas	80.698	1.689	7.863	5.064	9.539	12.325	450.374	13.87	38.641	2.55	1.654	1.655	30.433	12.394	1.662	330.092		2.409	8.449	2.542
Lmod	124.769	1.119	11.083	6.843	15.447	15.225	673.388	16.603	56.483	3.402	1.119	1.118	45.274	14.797	1.119	502.669	3.684		12.367	1.695
Ngal	14.637	1.1	2.264	1.621	2.543	2.56	73.98	2.947	7.156	1.324	1.1	1.1	5.906	2.519	1.099	56.052	1.427	1.366		1.146
Peomp	355.769	1.571	32.985	19.443	47.483	36.913	1931.44	43.711	156.123	10.648	1.566	1.566	123.57	36.673	1.557	1411.57	11.043	4.817	29.483	

APPENDIX I - continued...

VIFs GREATER THAN:
(* indicates yes, 0 = no) 5.5

	Avul	Ca	Ccc	Ciri	Kchal	Deor	Doglg	Dogs	Doil	Doo	Dolen	Doiri	Dpam	Dpc	Dum	Durc	Lvas	Lmod	Ngal	Pcomp
Avul	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Ca	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ccc	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ciri	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Kchal	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Deor	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Doglg	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dogs	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Doil	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Doo	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Dolen	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Doiri	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Dpam	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Dpc	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Dum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Durc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Lvas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Lmod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Ngal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pcomp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

TRANSPPOSED VIF

	Avul	Ca	Ccc	Ciri	Kchal	Deor	Doglg	Dogs	Doil	Doo	Dolen	Doiri	Dpam	Dpc	Dum	Durc	Lvas	Lmod	Ngal	Pcomp
Avul	1.27	1306.28	46.824	42.402	11.207	16.338	2.494	23.621	15.281	110.878	3.582	5.895	5.462	26.843	5.323	3.207	80.696	124.789	14.637	355.789
Ca	1.341	108.994	3.741	1.818	1.156	1.631	1.715	2.761	4.648	2.131	3.379	5.428	1.164	2.528	4.88	2.522	1.689	1.119	1.1	1.571
Ccc	1.37	60.343	5.842	5.176	1.904	2.902	1.742	5.487	5.724	12.761	3.423	5.36	1.527	6.559	4.911	2.962	7.663	11.083	2.264	32.985
Ciri	1.454	154.009	8.627	5.839	3.011	1.684	1.708	4.277	5.206	6.117	3.373	5.43	1.378	4.926	4.89	2.526	5.064	6.843	1.621	19.443
Kchal	1.344	137.787	8.339	7.666	2.449	3.862	1.797	5.167	5.237	15.622	3.383	5.558	1.562	5.475	4.882	2.651	12.325	15.225	2.56	47.483
Deor	9.929	7009.03	242.233	207.464	52.396	86.936	1.944	134.225	64.083	574.739	4.044	8.283	18.589	122.6	5.546	5.513	450.374	673.368	73.88	1931.44
Doglg	1.362	163.405	11.046	7.629	2.564	3.62	1.944	12.954	6.185	19.528	3.429	5.435	1.497	4.79	5.062	2.721	13.87	16.603	2.947	43.711
Dogs	1.845	576.209	24.133	19.448	5.589	7.685	1.944	5.83	50.261	3.464	3.464	5.935	1.246	3.104	4.902	2.542	38.641	56.493	7.156	156.123
Doil	1.286	25.382	5.17	2.196	1.199	2.203	1.712	3.83	4.63	2.116	3.365	5.212	1.164	2.506	4.563	2.513	1.654	1.119	1.1	1.566
Doo	1.27 high	3.718	1.816	1.816	1.153	1.63	1.715	2.749	4.646	2.072	1.377	2.212	1.163	2.496	4.173	2.512	1.665	1.118	1.1	1.566
Dolen	1.272 high	3.692	1.817	1.817	1.154	1.624	1.715	2.754	4.582	2.072	1.377	2.212	1.163	2.496	4.173	2.512	1.665	1.118	1.1	1.566
Doiri	2.119	463.661	20.683	16.549	4.424	7.365	1.812	10.077	8.243	4.167	3.419	5.673	1.423	9.907	4.946	2.636	30.433	45.274	5.906	123.57
Dpam	1.497	144.692	12.77	8.498	2.338	3.71	1.717	4.632	5.773	14.917	3.351	5.615	1.63	8.372	5.35	2.545	12.394	14.797	2.519	36.673
Dpc	1.265 high	3.741	1.816	1.816	1.156	1.629	1.676	2.671	2.8	2.126	3.159	4.642	1.163	2.519	4.865	2.476	1.662	1.119	1.089	1.557
Dum	8.46	5215.19	206.343	157.387	40.254	64.899	2.789	96.084	52.921	441.352	4.129	7.151	13.682	88.372	5.35	2.545	330.092	502.689	56.052	1411.57
Durc	1.253	28.612	4.156	2.433	1.142	2.326	1.757	3.736	4.97	3.413	3.401	5.414	1.216	3.452	4.907	2.545	2.409	3.684	1.427	11.043
Lvas	1.267	11.668	3.83	2.15	1.209	1.879	1.718	2.925	4.751	2.978	3.382	5.425	1.185	2.695	4.883	2.534	2.409	3.684	1.427	11.043
Lmod	1.346	103.808	7.269	4.612	1.802	2.861	1.706	4.7	5.449	10.492	3.39	5.463	1.399	4.154	4.89	2.559	8.449	12.367	1.366	4.817
Ngal	1.272	5.765	4.117	2.15	1.308	1.603	1.734	2.71	4.622	3.28	3.374	5.443	1.138	2.351	4.867	2.505	2.542	1.695	1.146	29.463
Pcomp	1.272	5.765	4.117	2.15	1.308	1.603	1.734	2.71	4.622	3.28	3.374	5.443	1.138	2.351	4.867	2.505	2.542	1.695	1.146	29.463

APPENDIX I - continued...

TRANSPOSED VIFs GREATER THAN: 5.5

("1" indicates yes, "0" no)

[illegible]

RESULTS of two-way collinearity

("X" indicates collinear pairs)

[illegible]

APPENDIX J - Taxonomic Abundances and error calculations

[illegible]

APPENDIX J - continued...

LAKE (cont' from above)			GREENHILL Livingstone core																[... continued next page]									
Sample	GRS24	GRS25	GRS26	GH10	GH20	GH30	GH40	GH50	GH60	GH70	GH80	GH90	GH100	GH110	GH120	GH130	GH140	GH150	GH160	GH170	GH180							
Ancella discoides	-	0.0019	0.0031	0.0032	0.0148	0.0022	0.0035	0.0035	0.0037	0.0057	0.0211	-	0.0142	0.0116	0.0203	0.0449	0.0132	0.0117	0.0062	0.0173	0.0478							
Centropyx aculeata	+	0.0026	0.0035	0.0082	0.0129	0.0161	0.0069	0.0068	0.0073	0.0079	0.0155	-	0.0138	0.0113	0.0149	0.0222	0.0115	0.0114	0.0065	0.015	0.0244							
Centropyx aculeata	+	0.5233	0.6998	0.4872	0.3778	0.3828	0.239	0.1579	0.3287	0.2985	0.2074	0.3353	0.3636	0.7057	0.7043	0.487	0.4611	0.3879	0.4327	0.3692	0.7938							
Centropyx aculeata	+	0.0347	0.0275	0.0314	0.0535	0.0519	0.0469	0.0423	0.0542	0.0548	0.0424	0.0509	0.0488	0.0532	0.0482	0.0527	0.0535	0.0491	0.0525	0.0465	0.0531							
C. constancia "constancia"	+	0.0565	0.0338	0.1344	0.0603	0.089	0.0472	0.0596	0.0415	0.097	0.1165	0.0816	0.0321	0.0284	0.0087	0.0203	0.018	0.0237	0.0146	0.0462	0.0173							
C. constancia "constancia"	+	0.0161	0.0108	0.0214	0.0263	0.0304	0.0233	0.0275	0.023	0.0354	0.0335	0.0295	0.0179	0.0194	0.0098	0.0149	0.0142	0.0153	0.0127	0.0228	0.015							
C. constancia "greenhillensis"	+	-	-	0.0021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Cucurbitella tricusps	+	0.0742	0.0563	0.0277	0.0921	0.0396	0.066	0.0246	0.083	0.0149	0.0142	-	0.0027	-	0.0203	0.0029	0.018	0.0165	0.0439	0.0123	0.0242							
Cucurbitella tricusps	+	0.0182	0.0139	0.0103	0.0319	0.0206	0.0273	0.018	0.0318	0.0145	0.0124	-	0.0052	-	0.0149	0.0057	0.0142	0.0136	0.0217	0.012	0.0177							
Centropyx kahli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Centropyx kahli	+	0.0035	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Diffugia bidenis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Diffugia corona	+	0.0654	0.0563	0.0154	0.0063	0.0119	0.0094	-	-	-	-	-	-	-	-	-	-	0.0029	0.0062	-	0.0614							
Diffugia oblonga "gigantica"	+	0.0172	0.0139	0.0077	0.0088	0.0116	0.0106	-	-	0.0096	-	-	-	-	-	-	-	0.0057	0.0085	-	0.0275							
Diffugia oblonga "gigantica"	+	0.0043	0.0018	0.0063	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. oblonga "gigas"	+	0.0063	0.0056	0.0308	0.0444	0.0095	0.0081	0.0312	0.0242	0.1045	0.1392	0.0302	0.0936	0.0106	0.0116	0.0232	0.015	0.0633	0.0322	0.0492	0.0034							
D. oblonga "gigas"	+	0.0055	0.0045	0.0108	0.0228	0.0313	0.0311	0.0334	0.0177	0.0366	0.0362	0.0184	0.0295	0.012	0.0113	0.0159	0.013	0.0245	0.0187	0.0235	0.0177							
D. oblonga "lanceolata"	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. oblonga "linearis"	+	-	0.0075	0.0564	-	-	-	-	-	0.0173	-	-	0.003	-	-	-	-	-	0.0351	-	-							
D. oblonga "linearis"	+	-	0.0052	0.0145	-	-	-	-	-	0.015	-	-	0.0059	-	-	-	-	-	0.0195	-	-							
D. oblonga "oblonga"	+	0.0704	0.0647	0.0841	0.1673	0.1484	0.2296	0.3368	0.1488	0.1455	0.1534	0.1903	0.1791	0.0674	0.0435	0.1565	0.2066	0.2084	0.155	0.1354	0.0346							
D. oblonga "oblonga"	+	0.0178	0.0148	0.0174	0.0431	0.039	0.0462	0.0549	0.041	0.0422	0.0376	0.0423	0.0389	0.0293	0.0215	0.0393	0.0434	0.0409	0.0384	0.0372	0.0211							
D. oblonga "spinosa"	+	0.0214	0.0283	0.0246	0.0571	0.0356	0.0346	0.0772	0.0415	0.0448	0.0284	0.0544	0.0107	0.0284	0.0232	0.0029	0.0449	0.0564	0.0351	0.0277	0.0138							
D. oblonga "spinosa"	+	0.0101	0.0094	0.0097	0.0256	0.0198	0.0201	0.031	0.023	0.0248	0.0174	0.0244	0.0104	0.0194	0.0159	0.0057	0.0222	0.023	0.0195	0.0178	0.0135							
D. oblonga "tenuis"	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. oblonga "triangularis"	+	-	0.0009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. proteiformis "amphoralis"	+	-	0.0018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. proteiformis "amphoralis"	+	0.0214	0.0009	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
D. proteiformis "claviformis"	+	0.0101	0.0018	0.002	0.0563	0.0075	0.0184	0.019	0.0089	0.044	0.0175	-	0.0336	0.017	0.0332	0.0401	0.0284	0.0433	0.0899	0.021	0.029							
D. proteiformis "claviformis"	+	0.0553	0.0075	0.0184	0.0151	0.01	0.0225	0.0152	-	0.0216	0.0135	0.0193	0.0199	0.0194	0.0228	0.0302	0.0154	0.0189	0.0371	0.0146	0.015							
Diffugia urens	+	-	0.0009	0.0082	-	-	-	-	-	0.0126	0.0124	-	0.0053	0.0248	-	0.0174	0.003	-	0.0062	0.0035	0.0171							
Diffugia urens	+	-	0.0018	0.0057	-	-	-	-	-	0.0126	0.0124	-	0.0074	0.0182	-	0.0138	0.0059	-	0.0085	0.0088	0.0148							
D. urceolata "urceolata"	+	0.0013	0.0047	0.0133	0.0095	0.003	-	0.0035	0.0104	-	0.0028	-	0.0028	-	-	-	-	-	-	-	-							
D. urceolata "urceolata"	+	0.0025	0.0041	0.0072	0.0107	0.0058	-	0.0089	0.0117	-	0.0056	-	0.0299	0.0199	0.006	0.016	0.0071	-	0.0087	0.0269	0.0079							
Lagenodiffugia vas	+	0.0465	0.0131	0.0472	-	0.003	-	-	-	0.0299	0.0199	0.006	0.016	0.0071	-	0.0087	0.0269	0.0079	-	0.0277	-							
Lagenodiffugia vas	+	0.0146	0.0098	0.0133	-	0.0058	-	-	-	0.0204	0.0146	0.0083	0.0127	0.0098	-	0.0098	0.0174	0.0089	-	0.0178	-							
Lesquerensia modesta	+	0.0352	0.0085	0.0031	0.0063	0.0059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Lesquerensia modesta	+	0.0128	0.0048	0.0035	0.0088	0.0082	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Nebelia galeata	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
Pontigulasma compressa	+	0.0164	0.0131	0.0349	0.1365	0.1632	0.2201	0.2281	0.301	0.2164	0.2727	0.2447	0.2667	0.0851	0.1246	0.1682	0.1407	0.1928	0.0936	0.2954	0.0519							
Pontigulasma compressa	+	0.0088	0.0088	0.0115	0.0379	0.0395	0.0465	0.0487	0.0529	0.0483	0.0465	0.0463	0.0443	0.0326	0.0349	0.0392	0.0373	0.0397	0.0309	0.0496	0.0256							

APPENDIX J - continued...

LAKE	Sample	GR190	GR200	FR01	FR02	FR03	FR04	FR05	FR06	FR07	FR08	FR09	FR10	FR11	FR12	FR13	FR14	FR15	FR16	FR17	FR18	FR19	FR20	FR21	FR22	FR23	FR24	FR25	FR26	FR27	FR28	FR29	FR30	FR31	FR32	FR33	FR34	FR35	FR36	FR37	FR38	FR39	FR40	FR41	FR42	FR43	FR44	FR45	FR46	FR47	FR48	FR49	FR50	FR51	FR52	FR53	FR54	FR55	FR56	FR57	FR58	FR59	FR60	FR61	FR62	FR63	FR64	FR65	FR66	FR67	FR68	FR69	FR70	FR71	FR72	FR73	FR74	FR75	FR76	FR77	FR78	FR79	FR80	FR81	FR82	FR83	FR84	FR85	FR86	FR87	FR88	FR89	FR90	FR91	FR92	FR93	FR94	FR95	FR96	FR97	FR98	FR99	FR100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Acoelia discoides	0.1429	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX J - continued...

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LAKE YOHO LAKE SWI (continued...)																					
Sample	Y017	Y018	Y019	Y020	Y021	Y022	Y023	Y024	Y027	Y028	Y029	MADAM LAKE SWI						UTOP/NOH L. SWI			
												M1	M2	M3	M4	M5	M6	M7	UT1	CHS04	CHS05
Arceia discoides	-	-	-	-	-	-	-	-	0.003	-	-	-	-	-	-	-	0.0084	-	-	0.0026	-
Centropyxis aculeata	0.6916	0.7249	0.7101	0.4634	0.6881	0.7	0.8211	0.5263	0.772	0.7119	0.9714	0.2301	0.261	0.4485	0.7586	0.3429	0.554	0.7778	0.7178	0.5171	0.7939
+	0.0875	0.0469	0.0576	0.0881	0.087	0.164	0.0677	0.2245	0.0453	0.0569	0.0562	0.0457	0.0483	0.0514	0.0619	0.0527	0.0506	0.0639	0.0621	0.0502	0.0436
C. constriata "constriata"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	0.0182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. constriata "greenhillsensis"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cucurbitella tricuspis	-	-	-	0.0163	0.0092	-	-	-	0.0122	0.0494	-	0.0675	0.1101	0.1309	0.0383	0.0383	0.0717	-	0.1188	0.0288	0.0091
+	-	-	-	0.0224	0.0179	-	-	-	0.0118	0.0272	-	0.0272	0.0344	0.0349	0.0278	0.0205	0.0329	-	0.0446	0.0168	0.0102
Centropyxis kahli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0094	-	-	-	0.0458	0.0099	0.0184	0.003
Diffugia bidens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0331	0.0137	0.0135
Diffugia corona	-	-	-	0.0894	0.0163	-	-	-	-	-	-	0.0552	0.0681	0.0724	0.0109	0.0737	0.0042	-	0.0149	0.021	-
+	-	-	-	0.0504	0.0252	-	-	-	-	-	-	0.0248	0.0311	0.0268	0.0151	0.029	0.0083	-	0.0167	0.0144	-
Diffugia oblonga "gigantica"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. oblonga "glans"	-	-	-	-	-	-	-	-	0.0091	-	-	0.0276	0.0346	0.039	-	0.0032	-	-	-	-	-
+	-	-	-	-	-	-	-	-	0.0103	-	-	0.0178	0.0201	0.02	-	0.0063	-	-	-	-	-
D. oblonga "lanceolata"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. oblonga "linearis"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. oblonga "oblonga"	0.0654	0.0086	-	0.0569	-	0.0333	-	-	0.0729	0.0535	-	0.1933	0.044	-	-	0.1026	0.0253	0.0523	0.0446	0.1549	0.0515
+	0.0469	0.0097	-	0.0409	-	0.0642	-	-	0.0261	0.0263	-	0.0429	0.0225	-	-	0.0337	0.02	0.0353	0.0285	0.0363	0.0238
D. oblonga "sphaea"	-	0.0201	-	-	-	-	-	-	-	-	-	0.0429	0.0314	0.0223	-	0.0084	-	-	-	0.0079	-
+	-	0.0147	-	-	-	-	-	-	-	-	-	0.022	0.0192	0.0153	-	0.0116	-	-	-	0.0089	-
D. oblonga "tenuis"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. oblonga "triangularis"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. protaeiformis "amphoralis"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. protaeiformis "claviformis"	-	-	-	-	-	-	-	-	-	-	-	0.0578	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	0.0259	0.0352	0.0243	-	0.0346	0.0329	-	0.0097	-	-
Diffugia urens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. urcediata "urcediata"	-	-	-	-	-	-	-	-	-	-	-	0.0337	-	0.0028	-	0.0032	-	-	-	-	-
+	-	-	-	-	-	-	-	-	-	-	-	0.0196	-	0.0055	-	0.0053	-	-	-	-	-
Lagenodiffugia vas	0.0841	0.0544	0.0546	0.1707	0.0734	-	-	-	0.0243	0.0576	-	0.0368	0.1352	0.0696	0.082	0.1571	0.0802	-	-	0.0052	-
+	0.0526	0.0238	0.0289	0.0685	0.049	-	-	-	0.0166	0.0293	-	0.0204	0.0376	0.0263	0.0397	0.0404	0.0346	-	-	0.0073	-
Lesquerius modesta	0.0187	-	-	0.1301	0.055	-	-	-	0.4737	-	-	0.0031	0.0252	0.0724	-	0.0064	0.0506	0.0382	0.005	0.0236	0.0333
+	0.0257	-	-	0.0594	0.0428	-	-	-	0.2245	-	-	0.006	0.0172	0.0269	-	0.0089	0.0279	0.0308	0.0097	0.0152	0.0194
Nebelia galathea	-	0.0115	0.0294	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+	-	0.0112	0.0215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pontigulastrea compressa	0.1402	0.1805	0.1849	0.0732	0.156	0.2867	0.1138	-	0.0334	0.1276	0.0286	0.046	0.0682	0.0334	0.0874	0.1058	0.0127	0.085	0.0198	0.2178	0.1091
+	0.0658	0.0404	0.0493	0.046	0.0691	0.1582	0.0561	-	0.0194	0.0419	0.0552	0.0227	0.0279	0.0186	0.0409	0.0341	0.0142	0.0442	0.0192	0.0414	0.0336

APPENDIX K - Canonical correlation results

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1 - UNCRR unnormalized

Correlations Between Set-1 and Set-2

	ln(S)	OXYGEN	DEPTH	TEMP
CA	-0.184	-0.1095	0.092	-0.3179
CTRI	0.3169	-0.259	0.0074	0.152
DCOR	0.2857	-0.1137	-0.1811	0.2493
DOO	0.3576	0.0855	0.0422	0.2931
DOS	0.4701	0.0305	-0.2263	0.318
DPAM	0.1917	-0.4979	0.1391	-0.3054
LVAS	0.1499	0.0792	-0.1752	0.1564
LMOD	-0.3191	0.102	-0.1657	0.0126
NGAL	-0.2141	0.1139	-0.0921	-0.0134
PCOMP	-0.372	0.3183	0.1132	-0.0015
SDI	0.4772	0.0301	-0.1614	0.387
DOGL	0.3022	0.0415	0.1007	0.2042
CCC	0.4397	-0.1793	0.0021	0.2835
CKAL	-0.0562	0.1034	-0.0543	0.0098
DOLI	0.5021	0.0439	-0.2488	0.2122
DPC	0.3655	-0.34	0.0235	0.1987

Canonical Correlations

1	0.872
2	0.704
3	0.504
4	0.432

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.073	207.907	64	0
2	0.306	94.211	45	0
3	0.606	39.778	28	0.069
4	0.813	16.457	13	0.225

2 - UNCRR normalized

Correlations Between Set-1 and Set-2

	ln(S)	OXYGEN	DEPTH	TEMP
CA	-0.197	-0.1245	0.0924	-0.3285
CTRI	0.4453	-0.2077	-0.0478	0.1895
DCOR	0.4139	-0.1717	-0.2428	0.2215
DOO	0.3576	0.0855	0.0422	0.2931
DPAM	0.2953	-0.4162	0.0792	-0.1759
LVAS	0.331	0.039	-0.1283	0.2154
LMOD	-0.0931	0.0538	-0.2682	-0.0089
NGAL	-0.1772	0.1517	0.0072	-0.0289
PCOMP	-0.372	0.3183	0.1132	-0.0015
SDI	0.4772	0.0301	-0.1614	0.387
DOS	0.5628	0.0344	-0.2475	0.3366
DOGL	0.4354	0.0586	0.0127	0.3072
CCC	0.5569	-0.2905	0.0353	0.2366
CKAL	-0.016	0.0906	-0.0213	0.0192
DOLI	0.5695	0.0135	-0.2354	0.2323
DPC	0.5628	-0.3574	0.0191	0.2011

Canonical Correlations

1	0.901
2	0.663
3	0.563
4	0.44

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.058	225.788	64	0
2	0.309	93.357	45	0
3	0.551	47.352	28	0.013
4	0.807	17.088	13	0.195

3 - RM unnormalized

Correlations Between Set-1 and Set-2

	ln(S)	OXYGEN	DEPTH	TEMP
CA	-0.184	-0.1095	0.092	-0.3179
CTRI	0.3169	-0.259	0.0074	0.152
DCOR	0.2857	-0.1137	-0.1811	0.2493
DOO	0.3576	0.0855	0.0422	0.2931
DPAM	0.1917	-0.4979	0.1391	-0.3054
LVAS	0.1499	0.0792	-0.1752	0.1564
LMOD	-0.3191	0.102	-0.1657	0.0126
NGAL	-0.2141	0.1139	-0.0921	-0.0134
PCOMP	-0.372	0.3183	0.1132	-0.0015
SDI	0.4772	0.0301	-0.1614	0.387
DOGS	0.467	0.0446	-0.0637	0.3157
CCC	0.4397	-0.1793	0.0021	0.2835
CKAL	-0.0562	0.1034	-0.0543	0.0098
DOLI	0.5021	0.0439	-0.2488	0.2122
DPC	0.3655	-0.34	0.0235	0.1987

Canonical Correlations

1	0.869
2	0.7
3	0.497
4	0.427

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.077	205.236	60	0
2	0.314	92.636	42	0
3	0.615	38.845	26	0.05
4	0.817	16.123	12	0.186

4 - RM normalized

Correlations Between Set-1 and Set-2

	ln(S)	OXYGEN	DEPTH	TEMP
CA	-0.197	-0.1245	0.0924	-0.3285
CTRI	0.4453	-0.2077	-0.0478	0.1895
DCOR	0.4139	-0.1717	-0.2428	0.2215

DOO	0.3576	0.0855	0.0422	0.2931
DPAM	0.2953	-0.4162	0.0792	-0.1759
LVAS	0.331	0.039	-0.1283	0.2154
LMOD	-0.0931	0.0538	-0.2682	-0.0089
NGAL	-0.1772	0.1517	0.0072	-0.0289
PCOMP	-0.372	0.3183	0.1132	-0.0015
SDI	0.4772	0.0301	-0.1614	0.387
DOGS	0.5867	0.0836	-0.1198	0.3686
CCC	0.5569	-0.2905	0.0353	0.2366
CKAL	-0.016	0.0906	-0.0213	0.0192
DOLI	0.5695	0.0135	-0.2354	0.2323
DPC	0.5628	-0.3574	0.0191	0.2011

Canonical Correlations

1	0.895
2	0.665
3	0.563
4	0.431

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.062	222.675	60	0
2	0.31	93.657	42	0
3	0.556	46.898	26	0.007
4	0.814	16.444	12	0.172

5 - MT unnormalized

Correlations Between Set-1 and Set-2

	ln(S)	OXYGEN	DEPTH	TEMP
CA	-0.184	-0.1095	0.092	-0.3179
CTRI	0.3169	-0.259	0.0074	0.152
DCOR	0.2857	-0.1137	-0.1811	0.2493
DOO	0.3576	0.0855	0.0422	0.2931
DPAM	0.1917	-0.4979	0.1391	-0.3054
LVAS	0.1499	0.0792	-0.1752	0.1564
LMOD	-0.3191	0.102	-0.1657	0.0126
NGAL	-0.2141	0.1139	-0.0921	-0.0134
PCOMP	-0.372	0.3183	0.1132	-0.0015
SDI	0.4772	0.0301	-0.1614	0.387
MULTI	0.5593	-0.144	-0.0773	0.3387

Canonical Correlations

1	0.866
2	0.645
3	0.443
4	0.387

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.1	188.906	44	0
2	0.399	75.239	30	0
3	0.683	31.212	18	0.027
4	0.85	13.32	8	0.101

6 - MT normalized**Correlations Between Set-1 and Set-2**

	ln(S)	OXYGEN	DEPTH	TEMP	
CA	-0.197	-0.1245	0.0924	-0.3285	
CTRI	0.4453	-0.2077	-0.0478	0.1895	
DCOR	0.4139	-0.1717	-0.2428	0.2215	
DOO	0.3576	0.0855	0.0422	0.2931	
DPAM	0.2953	-0.4162	0.0792	-0.1759	
LVAS	0.331	0.039	-0.1283	0.2154	
LMOD	-0.0931	0.0538	-0.2682	-0.0089	
NGAL	-0.1772	0.1517	0.0072	-0.0289	
PCOMP	-0.372	0.3183	0.1132	-0.0015	
SDI	0.4772	0.0301	-0.1614	0.387	
MULTI	0.6533	-0.1679	-0.0109	0.2821	

Canonical Correlations

1	0.887
2	0.563
3	0.447
4	0.401

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.	
1	0.098	190.846	44	0	
2	0.459	63.877	30	0	
3	0.672	32.617	18	0.019	
4	0.839	14.363	8	0.073	

7 - PCA unnormalized**Correlations Between Set-1 and Set-2**

	ln(S)	OXYGEN	DEPTH	TEMP	
NSRM1	0.4618	0.035	-0.1369	0.3875	
NSRM2	0.4332	0.0088	-0.1395	0.3761	
NSRM3	0.1767	0.1808	-0.0926	0.3144	
NSRM4	0.1798	0.1215	-0.2057	0.3136	

Canonical Correlations

1	0.848
2	0.463
3	0.291
4	0.194

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.	
1	0.194	140.262	16	0	
2	0.692	31.485	9	0	
3	0.881	10.845	4	0.028	
4	0.963	3.263	1	0.071	

8 - PCA normalized**Correlations Between Set-1 and Set-2**

	ln(S)	OXYGEN	DEPTH	TEMP	
LSRM1	0.5496	-0.021	-0.1303	0.3975	

LSRM2	0.5036	-0.0579	-0.1577	0.3591	277
LSRM3	0.2816	0.1275	-0.1206	0.3433	
LSRM4	0.2406	0.109	-0.2409	0.2795	

Canonical Correlations

1	0.848
2	0.531
3	0.329
4	0.162

Test that remaining correlations are zero:

	Wilk's	Chi-SQ	DF	Sig.
1	0.175	148.804	16	0
2	0.624	40.382	9	0
3	0.868	12.067	4	0.017
4	0.974	2.283	1	0.131

APPENDIX L - All Transfer Functions

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TF#	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
1	NBall	none	UN RM	stepwise	S (Constant)	27.233	6.048		4.503	0	
	R	R squared	adj. R squ.	±	DOLI	1375.656	203.27	0.542	6.768	0	
		0.686	0.471	0.453	34.32574333	DCOR	468.782	164.11	0.224	2.857	0.005
					PCOMP	-99.62	35.003	-0.228	-2.846	0.006	
2	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN RM	backward	S (Constant)	9.348	8.75		1.068	0.288	
	R	R squared	adj. R squ.	±	LVAS	-160.976	84.145	-0.177	-1.913	0.059	
		0.727	0.529	0.495	32.97621787	LMOD	-125.218	57.891	-0.17	-2.163	0.033
					PCOMP	-184.126	41.573	-0.421	-4.429	0	
					SDI	48.423	11.84	0.564	4.09	0	
					DOLI	763.424	248.26	0.301	3.075	0.003	
					DPC	-368.286	183.05	-0.213	-2.012	0.047	
3	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN RM	stepwise	ln(S) (Constant)	-3.577	2.18		-1.641	0.104	
	R	R squared	adj. R squ.	±	LMOD	-3.532	1.878	-0.158	-1.881	0.063	
		0.787	0.62	0.598	0.890605701	PCOMP	-2.732	1.511	-0.207	-1.809	0.074
					SDI	3.358	0.66	1.294	5.091	0	
					CA	5.846	2.017	0.847	2.899	0.005	
					NGAL	-9.72	4.611	-0.145	-2.108	0.038	
4	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN RM	backward	ln(S) (Constant)	2.302	0.247		9.302	0	
	R	R squared	adj. R squ.	±	CTRI	-6.573	3.927	-0.165	-1.674	0.098	
		0.807	0.651	0.612	0.874438683	DOO	-4.176	2.439	-0.175	-1.713	0.091
					LVAS	-8.219	2.8	-0.298	-2.936	0.004	
					LMOD	-8.831	1.641	-0.396	-5.382	0	
					NGAL	-14.267	4.688	-0.213	-3.043	0.003	
					PCOMP	-8.107	1.044	-0.613	-7.768	0	
					SDI	3.094	0.474	1.192	6.525	0	
					CCC	-7.851	3.906	-0.21	-2.01	0.048	
					DPC	-9.444	5.111	-0.181	-1.848	0.068	
5	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN RM	step+back	O (Constant)	7.172	0.35		20.509	0	
	R	R2	adj R2	±	1.4083	DPAM	-81.264	14.621	-0.466	-5.558	0
		0.626	0.392	0.371		DPC	-29.438	6.507	-0.446	-4.524	0
						SDI	0.842	0.323	0.257	2.609	0.011
6	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN	stepwise	D (Constant)	3.406	0.242		14.071	0	
	R	R squared	adj. R squ.	±	1.838	DOLI	-38.548	11.746	-0.358	-3.282	0.001
		0.392	0.154	0.124		DOGL	32.036	12.501	0.282	2.563	0.012
					DCOR	-17.662	8.839	-0.199	-1.998	0.049	
7	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN	backward	D (Constant)	-2.087	1.378		-1.515	0.133	
	R	R squared	adj. R squ.	±	1.833	CA	5.473	1.543	0.567	3.546	0.001
		0.421	0.177	0.129		DPAM	37.556	19.423	0.195	1.934	0.056
						PCOMP	9.551	2.666	0.516	3.582	0.001
						DOGL	36.711	13.272	0.323	2.766	0.007
						DPC	20.914	9.293	0.286	2.251	0.027
8	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	UN RM MT	step+back	T (Constant)	20.202	0.41		49.244	0	
	R	R squared	adj. R squ.	±	1.71	SDI	1.372	0.333	0.382	4.114	0
		0.489	0.24	0.222		DPAM	-57.024	17.698	-0.3	-3.222	0.002
9	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	RM	stepwise	D (Constant)	3.345	0.212		15.787	0	
	R	R squared	adj. R squ.	±	1.913	DOLI	-26.756	11.039	-0.249	-2.424	0.017
10	GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
	NBall	none	RM	backward	D (Constant)	-1.947	1.523		-1.279	0.204	
	R	R squared	adj. R squ.	±	1.871	CA	5.259	1.671	0.545	3.147	0.002
	0.378	0.143	0.092		DOO	8.488	4.275	0.255	1.986	0.05	

DPAM	32.972	19.723	0.171	1.672	0.098
PCOMP	8.426	2.653	0.455	3.176	0.002
DPC	20.079	9.488	0.275	2.116	0.037

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
11 NBall	none	MT	stepwise	S (Constant)	-162.047	71.429		-2.269	0.026	
R	R squared	adj. R squ.	±	PCOMP	-102.57	54.849	-0.235	-1.87	0.065	
	0.635	0.403	0.382	36.46698925	SDI	92.557	22.393	1.079	4.133	0
				CA	158.574	66.593	0.695	2.381	0.019	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
12 NBall	none	MT	backward	S	(Constant)	4.23	9.117	0.464	0.644	
R	R squared	adj. R squ.	±		CTRI	-260.029	129.96	-0.198	-2.001	0.049
	0.666	0.443	0.411	35.61602196	LVAS	-195.443	91.397	-0.215	-2.138	0.035
					LMOD	-145.806	60.031	-0.198	-2.429	0.017
					PCOMP	-207.168	37.063	-0.474	-5.59	0
					SDI	62.259	10.135	0.726	6.143	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
13 NBall	none	MT	stepwise	ln(S)	(Constant)	-7.808	1.14	-6.849	0
R	R squared	adj. R squ.	±		SDI	4.269	0.411	1.645	10.377
	0.792	0.627	0.61	0.876730152	CA	9.812	1.097	1.421	8.947
					DOO	5.028	1.962	0.211	2.562
					NGAL	-8.978	4.483	-0.134	-2.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
14 NBall	none	MT	backward	ln(S)	(Constant)	2.059	0.269	7.656	0	
R	R squared	adj. R squ.	±		CTRI	-10.392	3.858	-0.261	-2.694	0.009
	0.811	0.657	0.619	0.866103868	DCOR	-9.974	5.425	-0.157	-1.839	0.07
					DOO	-5.286	2.477	-0.222	-2.134	0.036
					LVAS	-9.837	2.911	-0.357	-3.38	0.001
					LMOD	-9.752	1.726	-0.438	-5.65	0
					NGAL	-16.859	4.815	-0.251	-3.501	0.001
					PCOMP	-9.167	1.194	-0.693	-7.678	0
					SDI	3.988	0.634	1.537	6.293	0
					MULTI	-7.987	2.466	-0.477	-3.239	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
15 NBall	none	MT	stepwise	O (Constant)	7.49	0.258		29.057	0	
R	R squared	adj. R squ.	±	DPAM	-76.033	15.571	-0.436	-4.883	0	
	0.579	0.335	0.313	1.4717	PCOMP	3.622	1.493	0.217	2.425	0.017
					CTRI	-9.561	4.435	-0.19	-2.156	0.034

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
16 NBall	none	MT	backward	O	(Constant)	6.959	0.383	18.151	0	
R	R squared	adj. R squ.	±		CTRI	-14.544	5.03	-0.289	0.005	
	0.609	0.371	0.342	1.4399	DPAM	-80.923	15.034	-0.464	-5.382	0
					SDI	1.432	0.447	0.436	3.204	0.002
					MULTI	-7.641	2.699	-0.361	-2.831	0.006

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
17 NBall	none	MT	stepwise	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
18 NBall	none	MT	backward	D	(Constant)	3.895	0.478	8.147	0	
R	R squared	adj. R squ.	±		CTRI	13.748	7.022	0.247	1.958	0.053
	0.34	0.116	0.075	1.889	DOO	9.394	4.329	0.282	2.17	0.033
					PCOMP	3.8	1.973	0.205	1.926	0.057
					SDI	-1.773	0.564	-0.488	-3.144	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
19 GR	none	UN RM	stepwise	S	(Constant)	39.895	14.758	2.703	0.014	
R	R squared	adj. R squ.	±	CCC	968.962	239.24	0.616	4.05	0.001	
	0.777	0.603	0.544	38.62440564	DCOR	1915.948	506.28	0.598	3.784	0.001
				CTRI	-806.597	248.98	-0.546	-3.24	0.004	

GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
20	GR	none	UN	backward	S	(Constant)	-1109.967	389.22	-2.852	0.015	
	R	R squared	adj. R squ.	±	CA	1093.422	371.37	3.852	2.944	0.012	
		0.92	0.846	0.705	31.05751068	DCOR	3126.327	730.2	0.976	4.281	0.001
						DOO	-1076.513	577.4	-1.059	-1.864	0.087

DOS	4369.97	1438.5	1.296	3.038	0.01
DPAM	1401.4	554.57	0.463	2.527	0.027
LVAS	1526.714	395.96	0.905	3.856	0.002
LMOD	-3264.594	1272.1	-0.499	-2.566	0.025
SDI	196.173	104.76	2.088	1.873	0.086
DOGL	3186.652	872.58	0.973	3.652	0.003
CCC	1302.072	498.7	0.827	2.611	0.023
DPC	1067.703	533.36	0.491	2.002	0.068

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
21 GR	none	UN RM MT	stepwise	ln(S)	(Constant)	4.552	0.182	25.038	0
R	R squared	adj. R squ.	±		LVAS	10.632	2.912	0.574	3.651 0.001
	0.693	0.48	0.431	0.473499278	DCOR	13.878	5.531	0.395	2.509 0.02

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
22 GR	none	UN	backward	ln(S)	(Constant)	-9.082	3.148	-2.885	0.01
R	R squared	adj. R squ.	±		CA	12.899	2.973	4.14	4.339 0
	0.896	0.803	0.748	0.315096881	CTRI	-9.272	1.991	-0.571	-4.657 0
					DCOR	14.413	4.676	0.41	3.082 0.006
					SDI	4.333	0.914	4.202	4.741 0
					DOGL	28.955	6.985	0.805	4.145 0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
23 GR	none	UN MT	stepwise	O	(Constant)	4.136	0.791	5.23	0
R	R squared	adj. R squ.	±		DOO	26.9	8.608	0.554	3.125 0.005
	0.554	0.307	0.276	2.3223					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
24 GR	none	UN	backward	O	(Constant)	-71.616	14.165	-5.066	0
R	R squared	adj. R squ.	±		CA	70.954	13.326	5.238	5.324 0
	0.907	0.823	0.761	1.3349	CTRI	-15.61	8.307	-0.221	-1.879 0.077
					DPAM	-41.839	15.576	-0.29	-2.686 0.016
					SDI	25.32	4.187	5.646	6.047 0
					DOGL	146.698	32.717	0.938	4.484 0
					CCC	-48.198	12.943	-0.642	-3.724 0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
25 GR	none	UN RM MT	stepwise	D	(Constant)	3.906	0.455	8.59	0
R	R squared	adj. R squ.	±		LVAS	-30.227	9.147	-0.576	-3.305 0.003
	0.576	0.332	0.301	1.488					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
26 GR	none	UN	backward	D	(Constant)	52.438	9.12	5.75	0
R	R squared	adj. R squ.	±		CA	-45.061	8.583	-5.101	-5.25 0
	0.921	0.848	0.767	0.859	CTRI	14.864	6.066	0.323	2.45 0.027
					DPAM	19.351	10.268	0.205	1.885 0.079
					LMOD	43.607	24.872	0.214	1.753 0.1
					PCOMP	35.51	12.685	0.432	2.8 0.013
					SDI	-16.994	2.723	-5.812	-6.242 0
					DOGL	-90.141	21.112	-0.884	-4.27 0.001
					CCC	23.471	8.62	0.479	2.723 0.016

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
27 GR	none	UN	stepwise	T	(Constant)	-137.52	20.311	-6.771	0
R	R squared	adj. R squ.	±		SDI	45.473	5.734	7.827	7.93 0
	0.93	0.864	0.805	1.56	CA	146.551	19.248	8.35	7.614 0
					DOO	79.546	22.244	1.266	3.576 0.003
					DOGL	253.229	45.052	1.25	5.621 0
					CKAL	281.995	70.584	0.454	3.995 0.001
					CCC	-64.993	20.117	-0.668	-3.231 0.005
					DOS	-111.526	49.563	-0.535	-2.25 0.039

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
28 GR	none	UN	backward	T	(Constant)	-125.032	19.805	-6.313	0
R	R squared	adj. R squ.	±		CA	132.592	18.609	7.554	7.125 0
	0.932	0.869	0.799	1.58	CTRI	-38.754	13.033	-0.424	-2.974 0.009
					DCOR	-49.43	26.081	-0.25	-1.895 0.077
					SDI	48.834	6.09	8.406	8.018 0
					DOGL	293.451	46.899	1.449	6.257 0
					CCC	-83.65	17.129	-0.86	-4.883 0
					CKAL	341.266	77.754	0.549	4.389 0.001
					DOLI	-59.624	22.049	-0.507	-2.704 0.016

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
29 GR	none	RM	backward	S (Constant)	-984.785	350.03		-2.813	0.012
R	R squared	adj. R squ.	±	CA	985.962	331.65	3.473	2.973	0.009
	0.84	0.706	0.602	36.08784221	DCOR	1535.219	567.89	0.479	2.703
					LVAS	790.69	340.12	0.469	2.325
					SDI	215.724	101.59	2.296	2.123
					CCC	1073.015	337.85	0.682	3.176
					DOGS	1525.685	571.42	0.78	2.67

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
30 GR	none	RM	backward	ln(S) (Constant)	-11.312	3.484		-3.247	0.006
R	R squared	adj. R squ.	±	CA	15.269	3.306	4.901	4.618	0
	0.923	0.853	0.758	0.308775142	DCOR	28.47	7.134	0.81	3.991
					DPAM	11.173	5.147	0.336	2.171
					LVAS	16.681	3.797	0.901	4.393
					LMOD	-24.795	10.157	-0.345	-2.441
					SDI	2.777	0.884	2.693	3.143
					CCC	13.09	3.494	0.758	3.746
					DPC	12.021	4.974	0.504	2.417
					DOGS	31.913	7.791	1.486	4.096

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
31 GR	none	RM	stepwise	O (Constant)	4.516	0.688		6.567	0
R	R squared	adj. R squ.	±	DOGS	52.523	16.467	0.562	3.19	0.004
	0.562	0.316	0.285	2.3075					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
32 GR	none	RM	backward	O (Constant)	1.044	1.376		0.759	0.46
R	R squared	adj. R squ.	±	CTRI	-39.006	17.108	-0.553	-2.28	0.038
	0.838	0.701	0.542	1.8465	DOO	-93.645	34.217	-1.93	-2.737
					DPAM	-49.99	22.691	-0.346	-2.203
					LMOD	-156.712	65.71	-0.502	-2.385
					SDI	12.604	3.451	2.811	3.653
					DOGS	105.404	43.94	1.129	2.399
					CCC	-68.908	22.957	-0.918	-3.002
					DOLI	-70.167	29.556	-0.773	-2.374

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
33 GR	none	RM	backward	S (Constant)	1.044	1.376		0.759	0.46
R	R squared	adj. R squ.	±	CTRI	-39.006	17.108	-0.553	-2.28	0.038
	0.838	0.701	0.542	1.8465	DOO	-93.645	34.217	-1.93	-2.737
					DPAM	-49.99	22.691	-0.346	-2.203
					LMOD	-156.712	65.71	-0.502	-2.385
					SDI	12.604	3.451	2.811	3.653
					CCC	-68.908	22.957	-0.918	-3.002
					DOLI	-70.167	29.556	-0.773	-2.374
					DOGS	105.404	43.94	1.129	2.399

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
34 GR	none	RM	backward	D (Constant)	46.825	9.518		4.92	0
R	R squared	adj. R squ.	±	CA	-40.182	9.004	-4.549	-4.462	0
	0.858	0.736	0.662	1.034	LMOD	73.852	26.14	0.363	2.825
					PCOMP	28.077	14.587	0.341	1.925
					SDI	-13.085	2.678	-4.475	-4.886
					DOGS	-66.443	15.465	-1.091	-4.296

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
35 GR	none	RM	stepwise	T (Constant)	-60.122	22.177		-2.711	0.013
R	R squared	adj. R squ.	±	SDI	23.851	6.132	4.105	3.89	0.001
	0.771	0.594	0.533	2.42	CA	73.328	20.987	4.178	3.494
					DOGS	94.36	35.986	0.78	2.622

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
36 GR	none	RM	backward	T (Constant)	-61.941	21.173		-2.925	0.009
R	R squared	adj. R squ.	±	CA	75.235	20.043	4.286	3.754	0.001
	0.806	0.649	0.576	2.3	LMOD	-98.47	56.892	-0.243	-1.731
					SDI	24.931	5.88	4.291	4.24
					DOGS	90.357	34.393	0.747	2.627

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
37 GR	none	MT	stepwise	S (Constant)	31.083	25.098		1.238	0.229

R	R squared	adj. R squ.	±	SDI	45.576	17.518	0.485	2.602	0.016
	0.485	0.235	0.201	51.13424163					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
38 GR	none	MT	backward	S (Constant)	-384.291	167.68		-2.292	0.034
R	R squared	adj. R squ.	±	CA	423.762	170.99	1.493	2.478	0.023
	0.743	0.552	0.458	42.10519575	DCOR	2633.577	715.28	0.822	3.682
					LVAS	1078.594	390.39	0.64	2.763
					MULTI	836.141	321.71	1.294	2.599
									0.018
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
39 GR	none	MT	backward	ln(S) (Constant)	-13.329	4.649		-2.867	0.011
R	R squared	adj. R squ.	±	CA	17.444	4.507	5.599	3.87	0.001
	0.871	0.758	0.652	0.370083966	DCOR	31.885	8.413	0.907	3.79
					DOO	11.824	4.836	1.06	2.445
					DPAM	12.635	6.673	0.38	1.894
					LVAS	15.024	3.826	0.812	3.927
					SDI	2.165	0.925	2.1	2.341
					MULTI	17.405	5.011	2.454	3.473
									0.003
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
40 GR	none	MT	backward	O (Constant)	-35.476	15.883		-2.234	0.038
R	R squared	adj. R squ.	±	CA	37.425	14.958	2.763	2.502	0.022
	0.759	0.577	0.487	1.9539	DOO	33.773	17.075	0.696	1.978
					DPAM	-46.803	22.361	-0.324	-2.093
					SDI	11.655	4.419	2.599	2.637
									0.016
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
41 GR	none	MT	backward	D (Constant)	45.391	12.724		3.567	0.002
R	R squared	adj. R squ.	±	CA	-39.401	12.25	-4.46	-3.216	0.005
	0.774	0.598	0.487	1.275	DOO	-26.823	13.33	-0.848	-2.012
					LVAS	-22.23	11.554	-0.424	-1.924
					SDI	-9.358	2.993	-3.2	-3.126
					MULTI	-15.771	9.057	-0.784	-1.741
									0.099
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
42 GR	none	MT	step+back	T (Constant)	-45.341	20.148		-2.25	0.036
R	R squared	adj. R squ.	±	SDI	18.891	5.624	3.252	3.359	0.003
	0.754	0.568	0.504	2.49	CA	59.389	19.003	3.384	3.125
					DOO	48.978	21.339	0.779	2.295
									0.033
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
43 OR	none	UN RM MT	stepwise	S (Constant)	-70.668	24.03		-2.941	0.006
R	R squared	adj. R squ.	±	SDI	40.292	9.539	1.393	4.224	0
	0.656	0.431	0.393	8.014727682	CA	65.247	22.355	0.963	2.919
									0.007
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
44 OR	none	UN RM MT	backward	S (Constant)	-8.234	4.946		-1.665	0.108
R	R squared	adj. R squ.	±	CTRI	-124.929	52.89	-0.401	-2.362	0.026
	0.711	0.506	0.415	7.868528733	LVAS	-59.789	33.107	-0.336	-1.806
					LMOD	-68.361	28.756	-0.347	-2.377
					PCOMP	-38.784	17.051	-0.364	-2.275
					SDI	34.864	7.103	1.206	4.909
									0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
45 OR	none	UN	stepwise	ln(S) (Constant)	-12.202	3.018		-4.043	0
R	R squared	adj. R squ.	±	SDI	5.62	0.926	2.229	6.069	0
	0.789	0.622	0.568	0.589074395	CA	12.988	2.808	2.198	4.626
					PCOMP	6.42	2.155	0.691	2.98
					DOGL	33.521	15.018	0.283	2.232
									0.034
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
46 OR	none	UN RM MT	backward	ln(S) (Constant)	2.164	0.355		6.101	0
R	R squared	adj. R squ.	±	LMOD	-5.203	2.483	-0.303	-2.095	0.045
	0.713	0.508	0.438	0.672324491	NGAL	-9.774	4.498	-0.323	-2.173
					PCOMP	-4.027	1.511	-0.434	-2.665
					SDI	1.844	0.399	0.731	4.625
									0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
47 OR	none	UN RM MT	stepwise	O (Constant)	8.341	0.02		412.18	0
R	R squared	adj. R squ.	±	CTRI	-1.158	0.526	-0.368	-2.202	0.035

0.368 0.135 0.107 0.09819

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
48 OR	none	UN	backward	O (Constant)	8.318	0.018		459.77	0
R	R squared	adj. R squ.	±						
	0	0	0	0.1039					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
49 OR	none	UN RM MT	step+back	D (Constant)	4.45	0.435		10.241	0
R	R squared	adj. R squ.	±						
	0.573	0.329	0.284	1.28	LMOD	-12.453	4.353	-0.429	-2.86 0.008
					PCOMP	-6.418	2.353	-0.409	-2.727 0.011

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
50 OR	none	UN RM MT	step+back	T (Constant)	21.23	0.021		1025.7	0
R	R squared	adj. R squ.	±						
	0.502	0.252	0.202	0.05958	NGAL	0.837	0.377	0.372	2.218 0.034
					PCOMP	0.335	0.116	0.485	2.893 0.007

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
51 OR	none	RM MT	stepwise	ln(S) (Constant)	-11.593	3.205		-3.617	0.001
R	R squared	adj. R squ.	±						
	0.745	0.555	0.509	0.628217342	SDI	5.408	0.982	2.145	5.505 0
					CA	12.724	2.992	2.154	4.253 0
					PCOMP	5.533	2.258	0.596	2.45 0.021

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
52 OR	none	RM	backward	O (Constant)	8.362	0.025		338.07	0
R	R squared	adj. R squ.	±						
	0.494	0.244	0.166	0.09492	CTRI	-1.456	0.543	-0.463	-2.682 0.012
					DCOR	2.155	1.26	0.329	1.71 0.098
					DOO	-0.792	0.448	-0.321	-1.77 0.087

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
53 OR	none	MT	backward	O (Constant)	8.653	0.15		57.522	0
R	R squared	adj. R squ.	±						
	0.555	0.308	0.18	0.09411	CA	-0.325	0.177	-0.474	-1.835 0.078
					CTRI	-1.52	0.581	-0.483	-2.614 0.014
					DOO	-0.827	0.429	-0.335	-1.926 0.065
					LVAS	-0.719	0.397	-0.4	-1.811 0.081
					LMOD	-0.689	0.36	-0.346	-1.915 0.066

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
54 GRML	none	UN RM	stepwise	S (Constant)	55.805	11.332		4.925	0
R	R squared	adj. R squ.	±						
	0.476	0.227	0.2	53.39156325	DOLI	1016.055	348.3	0.476	2.917 0.007

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
55 GRML	none	UN	backward	S (Constant)	-1254.61	181.98		-6.894	0
R	R squared	adj. R squ.	±						
	0.862	0.744	0.68	33.7811534	CA	1224.375	170.66	4.408	7.174 0
					CTRI	-870.63	192.83	-0.599	-4.515 0
					DCOR	1112.973	364.39	0.466	3.054 0.005
					SDI	389.72	53.853	3.945	7.237 0
					DOGL	1938.767	526.46	0.562	3.683 0.001
					CCC	586.723	222.4	0.424	2.638 0.014

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
56 GRML	none	UN RM	stepwise	ln(S) (Constant)	4.919	0.21		23.427	0
R	R squared	adj. R squ.	±						
	0.672	0.451	0.412	0.762343203	DOLI	19.464	4.997	0.548	3.895 0.001
					PCOMP	-14.779	4.673	-0.445	-3.163 0.004

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
57 GRML	none	UN	backward	ln(S) (Constant)	-12.618	1.922		-6.564	0
R	R squared	adj. R squ.	±						
	0.955	0.911	0.884	0.337906628	CA	16.104	1.802	3.482	8.939 0
					CTRI	-11.472	2.151	-0.474	-5.335 0
					DCOR	18.374	3.688	0.462	4.982 0
					LMOD	-20.661	4.335	-0.353	-4.766 0
					PCOMP	-14.818	2.768	-0.446	-5.353 0
					SDI	5.739	0.556	3.489	10.325 0
					DOGL	32.938	5.548	0.573	5.936 0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
58 GRML	none	UN RM MT	stepwise	O (Constant)	5.177	0.649		7.98	0
R	R squared	adj. R squ.	±						
	0.593	0.351	0.305	2.1326	DOO	18.345	6.784	0.418	2.704 0.012
					DPAM	-53.182	23.437	-0.351	-2.269 0.031

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
59 GRML	none	UN	backward	O (Constant)	-14.54	9.133		-1.592	0.123	
R	R squared	adj. R squ.	±	CA	17.301	8.342	1.454	2.074	0.048	
	0.694	0.481	0.401	1.9794	CTRI	-23.502	10.238	-0.377	-2.296	0.03
				DPAM	-52.256	21.968	-0.345	-2.379	0.025	
				SDI	8.336	3.008	1.97	2.771	0.01	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
60 GRML	none	UN RM MT	stepwise	D (Constant)	3.874	0.432		8.962	0	
R	R squared	adj. R squ.	±	DOO	-14.342	4.759	-0.488	-3.013	0.005	
	0.488	0.238	0.212	1.521						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
61 GRML	none	UN RM	backward	D (Constant)	4.128	0.629		6.559	0	
R	R squared	adj. R squ.	±	CTRI	12.833	7.399	0.307	1.734	0.095	
	0.695	0.484	0.404	1.323	DPAM	28.799	14.727	0.284	1.956	0.061
				SDI	-1.989	0.502	-0.702	-3.963	0.001	
				DPC	19.551	9.116	0.389	2.145	0.041	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
62 GRML	none	UN RM MT	step+back	T (Constant)	17.702	1.265		13.99	0	
R	R squared	adj. R squ.	±	SDI	3.053	0.848	0.556	3.599	0.001	
	0.556	0.309	0.285	2.81						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
63 GRML	none	RM	backward	S (Constant)	-1225.672	227.76		-5.382	0	
R	R squared	adj. R squ.	±	CA	1225.447	215.25	4.411	5.693	0	
	0.85	0.723	0.622	36.71309879	DCOR	1295.927	465.95	0.543	2.781	0.011
				DOO	411.42	210.12	0.402	1.958	0.063	
				LVAS	446.174	249	0.317	1.792	0.087	
				SDI	278.994	61.779	2.824	4.516	0	
				CCC	896.893	265.94	0.648	3.373	0.003	
				DOLI	805.609	412.71	0.378	1.952	0.064	
				DOGS	821.985	439.82	0.41	1.869	0.075	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
64 GRML	none	RM	backward	ln(S) (Constant)	-21.352	3.271		-6.528	0	
R	R squared	adj. R squ.	±	CA	25.071	3.134	5.42	8	0	
	0.927	0.859	0.788	0.457208104	DCOR	24.826	6.002	0.625	4.136	0.001
				DOO	11.226	2.885	0.659	3.891	0.001	
				DPAM	13.512	5.606	0.23	2.41	0.026	
				LVAS	8.394	3.328	0.358	2.522	0.02	
				SDI	4.731	0.774	2.876	6.111	0	
				CCC	16.054	3.476	0.696	4.619	0	
				DOLI	18.412	5.392	0.518	3.415	0.003	
				DPC	12.628	4.503	0.433	2.804	0.011	
				DOGS	27.63	6.253	0.827	4.419	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
65 GRML	none	RM	backward	O (Constant)	-24.532	10.332		-2.374	0.026	
R	R squared	adj. R squ.	±	CA	27.274	9.567	2.292	2.851	0.009	
	0.706	0.498	0.397	1.9858	DPAM	-39.743	23.043	-0.262	-1.725	0.097
				PCOMP	35.19	16.602	0.412	2.12	0.044	
				SDI	8.578	3.064	2.027	2.8	0.01	
				DOGS	44.442	21.696	0.517	2.048	0.051	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
66 GRML	none	MT	stepwise	S	NO RELATION					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
67 GRML	none	MT	backward	S (Constant)	-646.048	207.79		-3.109	0.005	
R	R squared	adj. R squ.	±	CA	623.103	189.87	2.243	3.282	0.003	
	0.75	0.563	0.496	42.39230427	CTRI	-724.589	223.81	-0.498	-3.237	0.003
				PCOMP	-696.833	323.25	-0.349	-2.156	0.041	
				SDI	284.809	65.79	2.883	4.329	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
68 GRML	none	MT	stepwise	ln(S) (Constant)	4.759	0.25		19.042	0	
R	R squared	adj. R squ.	±	PCOMP	-18.352	5.199	-0.552	-3.53	0.001	
	0.619	0.383	0.339	0.808007684	DOO	8.612	2.667	0.505	3.23	0.003
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	

69	GRML	none	MT	backward	ln(S)	(Constant)	-7.283	2.647		-2.751	0.011
	R	R squared	adj. R squ.	±		CA	10.758	2.431	2.326	4.426	0
		0.881	0.776	0.72	0.526387981	CTRI	-11.739	3.349	-0.485	-3.505	0.002
						DCOR	11.656	5.468	0.293	2.132	0.043
						LMOD	-16.715	6.673	-0.285	-2.505	0.019
						PCOMP	-19.827	4.107	-0.597	-4.828	0
						SDI	4.755	0.826	2.891	5.754	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
70 GRML	none	MT	backward	O	(Constant)	3.091	1.041		2.969	0.006
R	R squared	adj. R squ.	±		CTRI	-31.902	10.798	-0.512	-2.954	0.007
	0.724	0.525	0.43	1.9317	DPAM	-71.626	23.031	-0.473	-3.11	0.005
					LVAS	-21.543	11.705	-0.357	-1.84	0.078
					SDI	6.556	1.793	1.549	3.657	0.001
					MULTI	-22.589	9.699	-0.828	-2.329	0.028

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
71	GRML	MT	backward	D (Constant)	4.443	0.654		6.799	0
	R	R squared	adj. R squ.	±	CTRI	20.189	7.439	0.484	2.714 0.011
	0.576	0.332	0.284	1.45	SDI	-1.804	0.505	-0.636	-3.57 0.001

										t	sig.
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
72 YO	none	UN RM	stepwise	S	(Constant)	5.842	0.96		6.082	0	
R	R squared	adj. R squ.	±		DOLI	725.818	187.98	0.611	3.861	0.001	
	0.611	0.374	0.349	4.89726693							

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
73	YO	UN	backward	S	(Constant)	261.798	77.447		3.38	0.005	
	R	R squared	adj. R squ.		CA	-260.113	77.692	-10.403	-3.348	0.006	
		0.92	0.847	0.669	3.49241843	CTRI	-341.259	105	-0.911	-3.25	0.007
					DCOR	-335.335	88.057	-1.161	-3.808	0.002	
					DOO	-269.52	75.309	-3.217	-3.579	0.004	
					DOS	-362.587	136.56	-0.937	-2.655	0.021	
					LVAS	-337.533	89.408	-2.922	-3.775	0.003	
					LMOD	-293.736	78.973	-4.726	-3.719	0.003	
					NGAL	-264.889	75.84	-0.857	-3.493	0.004	
					PCOMP	-309.945	79.923	-6.452	-3.878	0.002	
					SDI	20.765	5.699	1.887	3.643	0.003	
					DOGL	-301.939	110.37	-1.175	-2.736	0.018	
					CCC	-290.193	87.185	-1.752	-3.328	0.006	
					CKAL	-454.176	145.39	-0.492	-3.124	0.009	
					DPC	-318.231	113.47	-0.707	-2.804	0.016	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
74	YO	UN	stepwise	ln(S)	(Constant)	-5.623	1.676		-3.356	0.003
	R	R squared	adj. R squ.	±	SDI	3.284	0.648	1.738	5.072	0
	0.749	0.562	0.504	0.733674324	CA	7.052	1.621	1.642	4.35	0
					DOO	6.099	2.552	0.424	2.39	0.025

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
75	YO	UN RM	backward	ln(S)	(Constant)	1.71	0.288		5.927	0	
	R	R squared	adj. R squ.	±		LMOD	-5.569	1.55	-0.522	-3.593	0.002
		0.743	0.553	0.494	0.741149805	PCOMP	-4.724	1.526	-0.572	-3.096	0.005
						SDI	1.668	0.352	0.882	4.739	0

<u>GROUP</u>	<u>TRANS</u>	<u>DATATYPE</u>	<u>METHOD</u>	<u>PARAMETER</u>	
76 YO	none	UN RM MT	stepwise	O	<i>NO RELATION</i>

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
77	YO	UN	backward	O (Constant)	7.964	0.037		214.25	0	
	R	R squared	adj. R squ.	±	DCOR	3.195	1.644	0.362	1.943	0.063
	0.362	0.131	0.096	0.1761						

<u>GROUP</u>	<u>TRANS</u>	<u>DATATYPE</u>	<u>METHOD</u>	<u>PARAMETER</u>	
78 YO	none	UN RM MT	stepwise	D	<i>NO RELATION</i>

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
79	YO	none	UN RM MT	backward	D	(Constant)	2.485	0.752	3.302	0.003	
	R	R squared	adj. R squ.	±		PCOMP	7.439	3.86	0.36	1.927	0.065
		0.36	0.129	0.095	2.49						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
80 YO	none	UN RM MT	stepwise	T (Constant)	21.77	0.075		288.61	0
R	R squared	adj. R squ.	±	+RM back PCOMP	-0.936	0.387	-0.435	-2.418	0.023
	0.435	0.19	0.157	0.249					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
81 YO	none	UN	backward	T (Constant)	21.669	0.09		240.26	0
R	R squared	adj. R squ.	±	PCOMP	-1.474	0.467	-0.686	-3.157	0.004
	0.611	0.373	0.291	0.229	SDI	0.244	0.118	0.496	2.062
					DOGL	-5.117	2.169	-0.445	-2.359
									0.027

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
82 YO	none	RM	backward	S (Constant)	249.893	73.313		3.409	0.005
R	R squared	adj. R squ.	±	CA	-248.231	73.569	-9.927	-3.374	0.005
	0.918	0.842	0.684	3.409977251	CTRI	-320.052	97.066	-0.855	-3.297
					DCOR	-324.155	84.199	-1.122	-3.85
					DOO	-252.565	68.632	-3.015	-3.68
					LVAS	-332.394	86.93	-2.878	-3.824
					LMOD	-282.729	75.181	-4.549	-3.761
					NGAL	-258.825	73.446	-0.837	-3.524
					PCOMP	-301.433	76.904	-6.275	-3.92
					SDI	21.395	5.478	1.944	3.906
					DOGS	-311.28	106.78	-1.553	-2.915
					CCC	-275.841	82.143	-1.666	-3.358
					CKAL	-443.819	141.04	-0.481	-3.147
					DPC	-319.05	110.79	-0.709	-2.88
									0.013

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
83 YO	none	RM	stepwise	ln(S) (Constant)	2.069	0.203		10.176	0
R	R squared	adj. R squ.	±	DOGS	16.726	6.02	0.486	2.778	0.01
	0.486	0.236	0.205	0.928991123					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER
84 YO	none	RM	backward	O NO RELATION

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
85 YO	none	MT	stepwise	S (Constant)	4.207	1.092		3.852	0.001
R	R squared	adj. R squ.	±	MULTI	55.605	13.732	0.629	4.049	0
	0.629	0.396	0.372	4.808458451					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
86 YO	none	MT	backward	S (Constant)	243.229	66.108		3.679	0.002
R	R squared	adj. R squ.	±	CA	-241.146	66.34	-9.644	-3.635	0.002
	0.895	0.8	0.675	3.456516857	CTRI	-309.576	85.848	-0.827	-3.606
					DCOR	-310.24	80.078	-1.074	-3.874
					DOO	-246.791	64.661	-2.946	-3.817
					LVAS	-301.931	79.826	-2.614	-3.782
					LMOD	-271.256	67.395	-4.364	-4.025
					NGAL	-256.583	69.903	-0.83	-3.671
					PCOMP	-289.307	69.701	-6.023	-4.151
					SDI	17.539	5	1.594	3.507
					MULTI	-257.646	74.42	-2.916	-3.462
									0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
87 YO	none	MT	stepwise	ln(S) (Constant)	1.994	0.204		9.794	0
R	R squared	adj. R squ.	±	MULTI	8.154	2.56	0.537	3.186	0.004
	0.537	0.289	0.26	0.896315149					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
88 YO	none	MT	backward	ln(S) (Constant)	31.183	13.445		2.319	0.034
R	R squared	adj. R squ.	±	CA	-29.864	13.492	-6.954	-2.213	0.042
	0.849	0.72	0.545	0.702986954	CTRI	-39.621	17.46	-0.616	-2.269
					DCOR	-39.856	16.286	-0.803	-2.447
					DOO	-29.77	13.151	-2.069	-2.264
					LVAS	-41.519	16.235	-2.093	-2.557
					LMOD	-37.179	13.707	-3.482	-2.712
					NGAL	-32.666	14.217	-0.615	-2.298
					PCOMP	-38.455	14.176	-4.661	-2.713
					SDI	3.667	1.017	1.94	3.606
					MULTI	-37.542	15.136	-2.474	-2.48
									0.025

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
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89	YO	none	MT	backward	O	(Constant)	8.008	0.055		145.27	0
	R	R squared	adj. R squ.	±		LVAS	1.408	0.636	0.399	2.212	0.037
		0.481	0.232	0.168	0.169	PCOMP	-0.479	0.265	-0.326	-1.808	0.083

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
90	YO	none	MT	backward	T	(Constant)	21.664	0.093	233.33	0	
	R	R squared	adj. R squ.	±		PCOMP	-1.508	0.482	-0.702	-3.128	0.005
		0.59	0.348	0.263	0.233	SDI	0.286	0.135	0.581	2.128	0.044
						MULTI	-1.816	0.859	-0.459	-2.113	0.046

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
91	Shigh	none	UN RM	stepwise	S	(Constant)	56.805	15.793	3.597	0.002	
	R	R squared	adj. R squ.	±		CCC	791.555	277.74	0.519	2.85	0.009
		0.519	0.27	0.236	48.83107967						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
92	Shigh	none	UN RM	backward	S	(Constant)	-322.768	117.16	-2.755	0.013	
	R	R squared	adj. R squ.	±		CA	394.048	123.04	1.303	3.203	0.005
		0.748	0.56	0.437	41.9196237	DCOR	1909.132	632.34	0.716	3.019	0.007
						DOO	647.205	289.21	0.636	2.238	0.038
						CCC	1241.182	337.62	0.814	3.676	0.002
						DOLI	958.076	443.48	0.515	2.16	0.044

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
93	Shigh	none	UN RM	stepwise	ln(S)	(Constant)	5.065	0.153	33.045	0	
	R	R squared	adj. R squ.	±		CCC	10.45	2.151	0.664	4.858	0
		0.83	0.689	0.624	0.353685663	CTRI	-11.22	2.288	-0.808	-4.903	0
						DCOR	14.107	4.498	0.513	3.137	0.005
						PCOMP	-3.525	1.347	-0.365	-2.618	0.017

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
94	Shigh	none	UN RM	backward	ln(S)	(Constant)	0.183	1.097	0.167	0.87	
	R	R squared	adj. R squ.	±		CA	4.89	1.145	1.567	4.271	0.001
		0.824	0.68	0.567	0.379582449	DCOR	17.806	5.727	0.647	3.109	0.006
						DOO	7.968	2.622	0.759	3.039	0.007
						LVAS	6.848	3.296	0.4	2.078	0.053
						CCC	12.922	3.071	0.821	4.207	0.001
						DOLI	7.951	4.374	0.414	1.818	0.087

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
95	Shigh	none	UN RM	stepwise	O	(Constant)	7.506	0.331	22.652	0	
	R	R squared	adj. R squ.	±		DPAM	-65.7	16.023	-0.591	-4.1	0.001
		0.775	0.601	0.542	1.1723	CKAL	-130.675	38.024	-0.499	-3.437	0.003
						PCOMP	8.964	4.218	0.309	2.125	0.046

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
96	Shigh	none	UN	backward	O	(Constant)	-36.605	9.863	-3.711	0.003	
	R	R squared	adj. R squ.	±		CA	38.314	8.915	4.09	4.298	0.001
		0.904	0.817	0.677	0.984	CTRI	-21.44	8.181	-0.514	-2.621	0.021
						DCOR	-37.64	18.078	-0.456	-2.082	0.058
						DOS	-77.283	23.633	-0.71	-3.27	0.006
						DPAM	-79.061	15.589	-0.711	-5.071	0
						SDI	19.182	3.955	5.859	4.851	0
						DOGL	78.287	20.69	0.818	3.784	0.002
						CCC	-60.747	12.997	-1.286	-4.674	0
						DOLI	-32.743	13.984	-0.568	-2.341	0.036
						DPC	-23.38	11.29	-0.357	-2.071	0.059

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
97	Shigh	none	UN RM MT	stepwise	D	(Constant)	3.123	0.344	9.089	0	
	R	R squared	adj. R squ.	±		LVAS	-19.822	6.563	-0.541	-3.02	0.006
		0.541	0.293	0.261	1.06						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
98	Shigh	none	UN RM	backward	D	(Constant)	1.753	0.23	7.606	0	
	R	R squared	adj. R squ.	±		DPAM	40.37	12.648	0.509	3.192	0.004
		0.69	0.477	0.427	0.933	CKAL	102.275	29.793	0.548	3.433	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER
99	Shigh	none	UN MT	stepwise
				T

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
100 Shigh R	none	UN	backward	T	(Constant)	-12.566	5.891		-2.133	0.05
	R squared	adj. R squ.	±	CA	30.873	5.346	4.182	5.775	0	
				CTRI	-12.515	5.754	-0.381	-2.175	0.046	
				DCOR	-24.235	12.555	-0.372	-1.93	0.073	
				DPAM	-38.547	11.485	-0.44	-3.356	0.004	
				SDI	13.385	2.178	5.187	6.146	0	
				DOGL	71.293	14.93	0.945	4.775	0	
				CCC	-28.139	8.013	-0.756	-3.512	0.003	
				DOLI	-41.787	10.617	-0.92	-3.936	0.001	
0.891	0.794	0.685	0.77							
101 Shigh R	none	RM	backward	O	(Constant)	6.396	0.736		8.688	0
	R squared	adj. R squ.	±	DPAM	-69.071	15.549	-0.621	-4.442	0	
				SDI	1.532	0.595	0.468	2.573	0.019	
				CCC	-16.772	8.605	-0.355	-1.949	0.066	
				CKAL	-119.884	36.643	-0.457	-3.272	0.004	
				1.1438						
0.8	0.64	0.564								
102 Shigh R	none	RM	stepwise	T	(Constant)	21.854	0.393		55.672	0
	R squared	adj. R squ.	±	DOGS	22.66	8.995	0.473	2.519	0.02	
				0.473	0.224	0.189	1.23			
103 Shigh R	none	RM	backward	T	(Constant)	5.64	5.986		0.942	0.359
	R squared	adj. R squ.	±	CA	14.687	5.49	1.989	2.675	0.015	
				DPAM	-30.158	14.876	-0.344	-2.027	0.058	
				SDI	5.43	1.931	2.104	2.813	0.012	
				DOLI	-20.494	10.056	-0.451	-2.038	0.057	
				DOGS	29.636	12.719	0.619	2.33	0.032	
				1.04						
0.739	0.546	0.419								
104 Shigh	none	MT	stepwise	S	NO RELATION					
105 Shigh R	none	MT	backward	S	(Constant)	46.797	19.389		2.414	0.026
	R squared	adj. R squ.	±	DCOR	2017.922	713.76	0.757	2.827	0.01	
				LVAS	640.174	288.62	0.386	2.218	0.038	
				LMOD	-2651.664	844.6	-0.845	-3.14	0.005	
				46.1893522						
0.637	0.406	0.317								
106 Shigh R	none	MT	stepwise	ln(S)	(Constant)	5.044	0.189		26.669	0
	R squared	adj. R squ.	±	MULTI	3.638	1.167	0.554	3.118	0.005	
				CTRI	-6.31	2.467	-0.454	-2.557	0.018	
				0.323	0.474415428					
0.618	0.382									
107 Shigh R	none	MT	backward	ln(S)	(Constant)	-6.568	2.838		-2.315	0.034
	R squared	adj. R squ.	±	CA	11.536	2.837	3.697	4.066	0.001	
				DCOR	31.034	8.25	1.128	3.762	0.002	
				DOO	12.006	3.189	1.143	3.765	0.002	
				DPAM	15.395	7.486	0.415	2.056	0.056	
				LVAS	13.148	3.878	0.768	3.39	0.004	
				PCOMP	8.738	3.6	0.904	2.427	0.027	
				MULTI	16.234	4.047	2.473	4.012	0.001	
				0.393530501						
0.822	0.676	0.534								
108 Shigh R	none	MT	step+back	O	(Constant)	7.423	0.318		23.374	0
	R squared	adj. R squ.	±	DPAM	-62.83	19.576	-0.565	-3.21	0.004	
				0.565	0.319	0.288	1.461			
109 Shigh R	none	MT	backward	D	(Constant)	2.128	0.248		8.59	0
	R squared	adj. R squ.	±	DPAM	33.908	15.268	0.428	2.221	0.037	
				0.428	0.183	0.146	1.14			
110 Shigh R	none	MT	backward	T	(Constant)	21.249	0.78		27.231	0
	R squared	adj. R squ.	±	SDI	0.951	0.511	0.369	1.86	0.076	
				0.369	0.136	0.097	1.3			
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	

111	Smed	none	UN RM MT	stepwise	S	(Constant)	15.81	1.696		9.323	0
	R	R squared	adj. R squ.	±		PCOMP	-23.127	10.639	-0.299	-2.174	0.035
		0.299	0.09	0.071	7.526579452						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
112	Smed	none	UN RM MT	backward	S	(Constant)	41.876	8.623	4.856	0	
	R	R squared	adj. R squ.	±		CA	-29.499	9.485	-0.773	-3.11	0.003
		0.555	0.308	0.229	6.854378555						
						DCOR	-145.461	56.108	-0.441	-2.593	0.013
						DOO	-33.747	19.492	-0.263	-1.731	0.09
						DPAM	254.143	120.83	0.27	2.103	0.041
						PCOMP	-52.764	14.681	-0.683	-3.594	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
113	Smed	none	UN RM MT	stepwise	ln(S)	NO RELATION			

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
114	Smed	none	UN	backward	ln(S)	(Constant)	5.579	0.674	8.281	0	
	R	R squared	adj. R squ.	±		CA	-2.321	0.739	-0.807	-3.141	0.003
		0.489	0.239	0.172	0.535681956						
						DCOR	-10.588	4.377	-0.426	-2.419	0.02
						DOO	-2.782	1.523	-0.288	-1.827	0.074
						PCOMP	-4.111	1.146	-0.706	-3.588	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
115	Smed	none	UN RM	step+back	O	(Constant)	6.717	0.581	11.563	0	
	R	R squared	adj. R squ.	±		DPAM	-115.249	26.453	-0.47	-4.357	0
		0.696	0.485	0.451	1.5038						
						DPC	-41.982	8.988	-0.595	-4.671	0
						SDI	1.36	0.556	0.316	2.443	0.018

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
116	Smed	none	UN RM MT	stepwise	D	(Constant)	3.811	0.37	10.306	0	
	R	R squared	adj. R squ.	±		LMOD	-27.898	9.424	-0.379	-2.96	0.005
		0.488	0.238	0.206	1.669						
						DOO	8.293	3.942	0.269	2.104	0.041

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
117	Smed	none	UN	backward	D	(Constant)	-3.166	2.423	-1.307	0.198	
	R	R squared	adj. R squ.	±		CA	6.822	2.592	0.745	2.632	0.012
		0.553	0.306	0.209	1.666						
						DOO	10.911	5.017	0.354	2.175	0.035
						DPAM	54.775	29.412	0.242	1.862	0.069
						PCOMP	8.975	4.355	0.484	2.061	0.045
						DOGL	36.179	15.447	0.365	2.342	0.024
						DPC	24.271	12.718	0.373	1.908	0.063

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
118	Smed	none	UN RM MT	step+back	T	(Constant)	19.658	0.674	29.174	0	
	R	R squared	adj. R squ.	±		DPAM	-128.07	32.753	-0.463	-3.91	0
		0.604	0.365	0.338	1.864						
						SDI	1.499	0.575	0.309	2.609	0.012

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
119	Smed	none	RM MT	backward	ln(S)	(Constant)	2.934	0.204	14.377	0	
	R	R squared	adj. R squ.	±		DCOR	-9.822	4.029	-0.395	-2.438	0.019
		0.526	0.277	0.213	0.522252058						
						DPAM	19.067	9.288	0.268	2.053	0.046
						PCOMP	-2.563	0.845	-0.44	-3.034	0.004
						SDI	0.719	0.222	0.577	3.24	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
120	Smed	none	RM	backward	D	(Constant)	-4.973	2.881	-1.727	0.091	
	R	R squared	adj. R squ.	±		CA	8.664	3.055	0.946	2.836	0.007
		0.539	0.29	0.191	1.685						
						DOO	15.082	4.762	0.49	3.167	0.003
						DPAM	57.269	29.782	0.253	1.923	0.061
						PCOMP	10.641	4.734	0.574	2.248	0.03
						DPC	28.271	13.453	0.434	2.101	0.041
						DOGS	25.896	12.301	0.359	2.105	0.041

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
121	Smed	none	MT	stepwise	O	(Constant)	7.236	0.418	17.301	0	
	R	R squared	adj. R squ.	±		DPAM	-113.09	29.067	-0.462	-3.891	0
		0.614	0.377	0.337	1.6537						
						PCOMP	5.604	2.375	0.279	2.36	0.023
						CTRI	-15.242	7.179	-0.248	-2.123	0.039

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
122	Smed	none	MT	backward	O	(Constant)	6.685	0.648	10.317	0	
	R	R squared	adj. R squ.	±		CTRI	-22.074	8.095	-0.359	-2.727	0.009

0.646	0.418	0.366	1.6168	DPAM	-117.789	28.425	-0.481	-4.144	0
				SDI	1.978	0.755	0.46	2.62	0.012
				MULTI	-11.758	4.191	-0.439	-2.806	0.007

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
123 Smed	none	MT	backward	D	(Constant)	-14.856	6.955	-2.136	0.039
R	R squared	adj. R squ.	±	CA	18.55	7.077	2.026	2.621	0.012
0.541	0.293	0.175	1.702	CTRI	19.776	11.474	0.349	1.724	0.092
				DOO	28.682	8.761	0.932	3.274	0.002
				DPAM	71.039	31.233	0.314	2.274	0.028
				LVAS	19.952	10.653	0.606	1.873	0.068
				PCOMP	18.295	7.405	0.987	2.471	0.018
				MULTI	20.042	7.898	0.811	2.538	0.015

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
124 NBall	normalized	UN	stepwise	S	(Constant)	18.051	5.956	3.031	0.003
R	R squared	adj. R squ.	±	DOLI	954.447	131.27	0.551	7.271	0
0.748	0.56	0.539	31.50158527	DCOR	374.862	114.13	0.242	3.284	0.001
				PCOMP	-73.73	33.266	-0.169	-2.216	0.029
				DPAM	525.853	253.24	0.154	2.077	0.041

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
125 NBall	normalized	UN	backward	S	(Constant)	-29.6	13.034	-2.271	0.026
R	R squared	adj. R squ.	±	CA	48.044	17.71	0.231	2.713	0.008
0.779	0.606	0.578	30.13394938	DCOR	320.677	129.68	0.207	2.473	0.015
				DPAM	528.632	240.39	0.155	2.199	0.031
				DOS	409.069	154.56	0.231	2.647	0.01
				CCC	157.393	64.453	0.211	2.442	0.017
				DOLI	781.1	149.53	0.451	5.224	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
126 NBall	normalized	UN	stepwise	ln(S)	(Constant)	-5.522	1.105	-4.995	0
R	R squared	adj. R squ.	±	DOS	0.898	0.364	0.216	2.466	0.016
0.818	0.67	0.646	0.835345456	DPAM	1.064	0.49	0.141	2.173	0.033
				CA	8.127	1.098	1.292	7.398	0
				SDI	3.673	0.529	1.415	6.949	0
				DOO	4.21	1.857	0.177	2.267	0.026
				NGAL	-0.9	0.448	-0.128	-2.009	0.048

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
127 NBall	normalized	UN	backward	ln(S)	(Constant)	-3.498	1.186	-2.949	0.004
R	R squared	adj. R squ.	±	CA	5.42	1.21	0.862	4.478	0
0.841	0.707	0.662	0.815943879	CTRI	6.787	2.013	0.267	3.372	0.001
				DCOR	8.981	3.7	0.192	2.427	0.018
				DOO	7.947	2.158	0.334	3.683	0
				DPAM	20.16	6.677	0.195	3.019	0.003
				LVAS	4.438	1.861	0.211	2.385	0.02
				LMOD	1.905	0.986	0.177	1.932	0.057
				PCOMP	3.473	1.659	0.263	2.093	0.04
				DOS	17.977	4.789	0.335	3.753	0
				CCC	7.428	2.298	0.328	3.232	0.002
				CKAL	1.455	0.551	0.171	2.64	0.01
				DOLI	16.3	4.338	0.311	3.757	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
128 NBall	normalized	UN RM	stepwise	O	(Constant)	6.949	0.37	18.774	0
R	R squared	adj. R squ.	±	DPAM	-40.491	11.811	-0.31	-3.428	0.001
0.588	0.345	0.315	1.4691	DPC	-12.728	3.027	-0.461	-4.205	0
				SDI	1.465	0.408	0.446	3.589	0.001
				DCOR	-13.249	6.483	-0.224	-2.044	0.044

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
129 NBall	normalized	UN RM	backward	O	(Constant)	6.952	0.364	19.089	0
R	R squared	adj. R squ.	±	DCOR	-13.165	6.348	-0.223	-2.074	0.041
0.622	0.387	0.343	1.4383	DPAM	-39.802	11.567	-0.305	-3.441	0.001
				LMOD	-2.844	1.409	-0.209	-2.018	0.047
				SDI	2.044	0.468	0.623	4.363	0
				CCC	-8.24	4.245	-0.288	-1.941	0.056
				DPC	-10.131	3.843	-0.367	-2.636	0.01

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
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130	NBall	normalized	UN RM	stepwise	D	(Constant)	4.011	0.29		13.834	0
	R	R squared	adj. R squ.	±		LMOD	-4.748	1.497	-0.316	-3.173	0.002
		0.39	0.152	0.133	1.829	DOLI	-21.08	7.294	-0.288	-2.89	0.005
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
131	NBall	normalized	UN	backward	D	(Constant)	3.961	0.317		12.478	0
	R	R squared	adj. R squ.	±		DCOR	-13.53	7.031	-0.207	-1.924	0.058
		0.45	0.203	0.166	1.794	LMOD	-3.939	1.518	-0.262	-2.595	0.011
						DOLI	-24.331	7.995	-0.332	-3.043	0.003
						DPC	6.616	3.505	0.216	1.888	0.062
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
132	NBall	normalized	UN RM MT	step+back	T	(Constant)	20.12	0.422		47.665	0
	R	R squared	adj. R squ.	±		SDI	1.43	0.345	0.399	4.146	0
		0.435	0.189	0.171	1.77	DPAM	-28.419	13.722	-0.199	-2.071	0.041
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
133	NBall	normalized	RM	stepwise	S	(Constant)	12.7	6.337		2.004	0.048
	R	R squared	adj. R squ.	±		DOLI	831.255	140.64	0.48	5.911	0
		0.763	0.582	0.558	30.85069172	DCOR	286.677	119	0.185	2.409	0.018
						PCOMP	-69.424	32.639	-0.159	-2.127	0.036
						DPAM	588.755	249.71	0.172	2.358	0.021
						DOGS	164.171	75.992	0.182	2.16	0.034
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
134	NBall	normalized	RM	backward	S	(Constant)	-29.541	13.188		-2.24	0.028
	R	R squared	adj. R squ.	±		CA	46.35	17.703	0.223	2.618	0.01
		0.776	0.602	0.574	30.28275684	DCOR	357.521	127.59	0.231	2.802	0.006
						DPAM	583.476	242.83	0.171	2.403	0.018
						CCC	120.094	66.025	0.161	1.819	0.072
						DOLI	826.053	145.51	0.477	5.677	0
						DOGS	194.821	78.8	0.216	2.472	0.015
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
135	NBall	normalized	RM	stepwise	ln(S)	(Constant)	-4.419	1.204		-3.672	0
	R	R squared	adj. R squ.	±		DOGS	0.986	0.38	0.232	2.595	0.011
		0.812	0.659	0.639	0.84323455	DPAM	1.331	0.498	0.176	2.675	0.009
						DOLI	0.897	0.436	0.162	2.055	0.043
						CA	6.924	1.189	1.101	5.824	0
						SDI	3.256	0.579	1.254	5.624	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
136	NBall	normalized	RM	backward	ln(S)	(Constant)	-3.441	1.176		-2.925	0.005
	R	R squared	adj. R squ.	±		CA	5.274	1.197	0.839	4.407	0
		0.843	0.711	0.666	0.811086575	CTRI	7.207	2.014	0.284	3.579	0.001
						DCOR	9.932	3.639	0.212	2.73	0.008
						DOO	6.513	2.178	0.273	2.991	0.004
						DPAM	22.665	6.67	0.219	3.398	0.001
						LVAS	4.727	1.817	0.225	2.601	0.011
						LMOD	1.974	0.98	0.184	2.014	0.047
						PCOMP	3.454	1.646	0.261	2.098	0.039
						CCC	5.793	2.276	0.256	2.545	0.013
						CKAL	1.296	0.553	0.152	2.344	0.022
						DOLI	18.29	4.196	0.349	4.359	0
						DOGS	9.284	2.382	0.341	3.898	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
137	NBall	normalized	RM	backward	D	(Constant)	3.874	0.329		11.773	0
	R	R squared	adj. R squ.	±		DCOR	-14.078	7.04	-0.215	-2	0.049
		0.456	0.208	0.171	1.788	LMOD	-3.559	1.543	-0.237	-2.307	0.023
						CCC	7.805	3.82	0.247	2.043	0.044
						DOLI	-26.064	8.228	-0.356	-3.168	0.002
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
138	NBall	normalized	MT	stepwise	S	(Constant)	10.091	9.023		1.118	0.267
	R	R squared	adj. R squ.	±		PCOMP	-191.046	36.618	-0.437	-5.217	0
		0.644	0.415	0.395	36.09201168	SDI	47.953	7.472	0.559	6.417	0
						LMOD	-84.561	30.661	-0.238	-2.758	0.007
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
139	NBall	normalized	MT	backward	S	(Constant)	-123.029	74.35		-1.655	0.102
	R	R squared	adj. R squ.	±		CA	130.52	72.372	0.628	1.803	0.075

0.661	0.436	0.41	35.63368334	LMOD	-68.781	31.511	-0.194	-2.183	0.032
				PCOMP	-103.995	60.307	-0.238	-1.724	0.088
				SDI	92.969	26.029	1.084	3.572	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
140 NBall	normalized	MT	stepwise	In(S)	(Constant)	1.571	0.223	7.031	0
R	R squared	adj. R squ.	±		MULTI	2.711	0.406	0.525	6.682
	0.744	0.553	0.533	0.959638768	PCOMP	-2.903	0.997	-0.22	-2.913
					DCOR	8.995	3.633	0.192	2.476
					DPAM	17.22	7.714	0.167	2.232

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
141 NBall	normalized	MT	backward	In(S)	(Constant)	-6.248	1.152	-5.422	0
R	R squared	adj. R squ.	±		CA	7.691	1.181	1.223	6.514
	0.811	0.658	0.638	0.844388202	DOO	3.348	1.884	0.141	1.777
					DPAM	14.977	6.731	0.145	2.225
					SDI	3.488	0.566	1.344	6.166
					MULTI	1.304	0.502	0.253	2.598

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
142 NBall	normalized	MT	stepwise	O	(Constant)	7.232	0.251	28.864	0
R	R squared	adj. R squ.	±		DPAM	-47.252	12.604	-0.362	-3.749
	0.474	0.225	0.207	1.5803	PCOMP	3.913	1.613	0.234	2.425

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
143 NBall	normalized	MT	backward	O	(Constant)	7.212	0.377	19.122	0
R	R squared	adj. R squ.	±		CTRI	-8.23	3.726	-0.256	-2.209
	0.55	0.303	0.262	1.5251	DCOR	-13.229	6.788	-0.224	-1.949
					DPAM	-45.495	12.099	-0.348	-3.76
					SDI	1.755	0.501	0.535	3.506
					MULTI	-1.952	0.786	-0.299	-2.484

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
144 NBall	normalized	MT	stepwise	D	(Constant)	3.691	0.279	13.237	0
R	R squared	adj. R squ.	±		LMOD	-4.034	1.536	-0.268	-2.626
	0.268	0.072	0.061	1.903					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
145 NBall	normalized	MT	backward	D	(Constant)	8.396	2.279	3.684	0
R	R squared	adj. R squ.	±		CA	-4.501	2.284	-0.512	-1.971
	0.344	0.118	0.088	1.876	LMOD	-4.38	1.633	-0.291	-2.683
					SDI	-1.97	0.92	-0.543	-2.141

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
146 GR	normalized	UN	step+back	S	(Constant)	49.102	17.546	2.798	0.01
R	R squared	adj. R squ.	±		DOS	1129.389	390.6	0.525	2.891
	0.525	0.275	0.242	49.77562183					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
147 GR	normalized	UN	stepwise	In(S)	(Constant)	3.67	0.206	17.778	0
R	R squared	adj. R squ.	±		LVAS	7.383	2.027	0.613	3.643
	0.613	0.376	0.348	0.506841244					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
148 GR	normalized	UN	backward	In(S)	(Constant)	-7.546	2.785	-2.709	0.019
R	R squared	adj. R squ.	±		CA	10.387	2.621	3.73	3.964
	0.903	0.815	0.646	0.37348877	CTRI	9.92	4.228	0.839	2.346
					DCOR	9.733	4.378	0.381	2.223
					DPAM	23.367	6.855	0.896	3.409
					LVAS	13.844	4.012	1.15	3.451
					PCOMP	19.933	7.398	0.687	2.694
					DOGL	17.673	5.647	1.004	3.13
					DOS	20.385	6.25	0.863	3.262
					CCC	10.643	3.186	0.874	3.341
					CKAL	3.069	1.432	0.492	2.143
					DOLI	9.221	3.439	0.576	2.681

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
149 GR	normalized	UN	stepwise	O	(Constant)	3.613	0.735	4.918	0
R	R squared	adj. R squ.	±		DOS	68.288	16.357	0.665	4.175
	0.665	0.442	0.417	2.0844					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
150 GR	normalized	UN	backward	O (Constant)	-80.616	18.607		-4.332	0
R	R squared	adj. R squ.	±	CA	82.322	18.034	6.799	4.565	0
	0.885	0.783	0.723	1.4357	LMOD	-9.063	4.17	-0.259	0.043
				SDI	33.106	6.708	7.383	4.935	0
				DOGL	43.526	12.484	0.569	3.487	0.003
				CCC	-28.347	9.211	-0.535	-3.078	0.006
151 GR	normalized	UN	stepwise	D (Constant)	3.928	0.494		7.956	0
R	R squared	adj. R squ.	±	DOS	-47.568	10.207	-0.71	-4.66	0
	0.727	0.529	0.484	1.278	LMOD	7.693	3.475	0.337	0.038
152 GR	normalized	UN	backward	D (Constant)	61.739	11.684		5.284	0
R	R squared	adj. R squ.	±	CA	-55.63	11.311	-7.045	-4.918	0
	0.902	0.814	0.749	0.892	LMOD	8.134	2.684	0.357	0.008
				PCOMP	46.816	13.612	0.569	3.439	0.003
				SDI	-23.27	4.299	-7.958	-5.413	0
				DOGL	-31.18	7.793	-0.625	-4.001	0.001
				CCC	16.754	6.154	0.485	2.722	0.014
153 GR	normalized	UN	stepwise	T (Constant)	18.406	0.999		18.417	0
R	R squared	adj. R squ.	±	DOS	82.573	22.248	0.621	3.711	0.001
	0.621	0.385	0.357	2.84					
154 GR	normalized	UN	backward	T (Constant)	-79.594	34.742		-2.291	0.033
R	R squared	adj. R squ.	±	CA	94.547	33.809	6.027	2.797	0.011
	0.734	0.538	0.469	2.58	DOO	39.619	20.952	0.63	1.891
				SDI	35.134	11.928	6.048	2.945	0.008
155 GR	normalized	RM	stepwise	S (Constant)	39.974	18.165		2.201	0.039
R	R squared	adj. R squ.	±	DOGS	645.664	195.88	0.575	3.296	0.003
	0.575	0.331	0.3	47.84096882					
156 GR	normalized	RM	backward	S (Constant)	-1824.494	451.32		-4.043	0.001
R	R squared	adj. R squ.	±	CA	1823.552	437.23	7.187	4.171	0
	0.809	0.654	0.602	36.0898196	SDI	747.573	163.51	7.956	4.572
				DPC	-652.978	203.37	-0.525	-3.211	0.004
157 GR	normalized	RM	stepwise	ln(S) (Constant)	3.657	0.177		20.69	0
R	R squared	adj. R squ.	±	DOGS	8.485	1.906	0.688	4.452	0
	0.688	0.474	0.45	0.465472922					
158 GR	normalized	RM	backward	ln(S) (Constant)	-16.259	4.438		-3.664	0.002
R	R squared	adj. R squ.	±	CA	19.563	4.298	7.025	4.552	0
	0.858	0.736	0.681	0.35458422	LMOD	-1.771	0.984	-0.22	-1.8
				SDI	8.151	1.607	7.903	5.073	0
				DPC	-6.966	2.007	-0.511	-3.47	0.003
159 GR	normalized	RM	stepwise	O (Constant)	3.462	0.68		5.094	0
R	R squared	adj. R squ.	±	DOGS	6.744	1.044	0.807	6.46	0
	0.822	0.676	0.645	1.6257	LMOD	-4.428	2.07	-0.267	-2.139
									0.044
160 GR	normalized	RM	backward	O (Constant)	-58.179	17.367		-3.35	0.003
R	R squared	adj. R squ.	±	CA	59.789	16.809	4.938	3.557	0.002
	0.89	0.792	0.748	1.3694	DCOR	-36.784	13.918	-0.331	-2.643
				SDI	22.257	6.338	4.964	3.512	0.002
				DOGS	47.165	8.562	0.88	5.509	0
161 GR	normalized	RM	stepwise	D (Constant)	4.422	0.457		9.681	0
R	R squared	adj. R squ.	±	DOGS	-4.294	0.702	-0.788	-6.119	0

		0.81	0.656	0.623	1.093	LMOD	3.146	1.391	0.291	2.261	0.034
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
162 GR	normalized	RM	backward	D	(Constant)	4.813	0.437	11.006	0		
R	R squared	adj. R squ.	±	DOO	18.677	6.99	0.59	2.672	0.015		
	0.876	0.767	0.718	0.945	LVAS	-12.263	5.564	-0.359	-2.204	0.04	
					LMOD	6.683	2.545	0.293	2.626	0.017	
					DOGS	-36.322	7.505	-1.039	-4.84	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
163 GR	normalized	RM	stepwise	T	(Constant)	17.508	0.949	18.443	0		
R	R squared	adj. R squ.	±	DOGS	7.819	1.596	0.722	4.9	0		
	0.722	0.522	0.5	2.5							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
164 GR	normalized	RM	backward	T	(Constant)	-6.184	8.85	-0.699	0.495		
R	R squared	adj. R squ.	±	CA	21.803	8.366	1.39	2.606	0.02		
	0.87	0.756	0.626	2.16	CTRI	58.44	19.112	0.878	3.058	0.008	
					DPAM	63.452	26.11	0.432	2.43	0.028	
					LVAS	36.929	19.442	0.545	1.899	0.077	
					LMOD	-18.875	6.837	-0.417	-2.761	0.015	
					PCOMP	61.807	35.062	0.378	1.763	0.098	
					CKAL	12.341	6.062	0.351	2.036	0.06	
					DOGS	82.983	18.081	1.195	4.589	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
165 GR	normalized	MT	stepwise	S	(Constant)	43.231	20.775	2.081	0.049		
R	R squared	adj. R squ.	±	LVAS	535.966	203.99	0.489	2.627	0.015		
	0.489	0.239	0.204	51.01463978							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
166 GR	normalized	MT	backward	S	(Constant)	-1632.844	537.44	-3.038	0.006		
R	R squared	adj. R squ.	±	CA	1608.301	519.07	6.339	3.098	0.005		
	0.689	0.475	0.425	43.35701902	SDI	639.395	192.23	6.805	3.326	0.003	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
167 GR	normalized	MT	stepwise	ln(S)	(Constant)	3.67	0.206	17.778	0		
R	R squared	adj. R squ.	±	LVAS	7.383	2.027	0.613	3.643	0.001		
	0.613	0.376	0.348	0.506841244							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
168 GR	normalized	MT	backward	ln(S)	(Constant)	-14.331	5.035	-2.846	0.01		
R	R squared	adj. R squ.	±	CA	17.258	4.864	6.197	3.548	0.002		
	0.798	0.636	0.581	0.406072011	LVAS	5.148	2.229	0.428	2.31	0.032	
					SDI	6.635	1.81	6.434	3.665	0.002	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
169 GR	normalized	MT	stepwise	O	(Constant)	3.314	0.903	3.67	0.001		
R	R squared	adj. R squ.	±	LVAS	31.778	8.866	0.607	3.584	0.002		
	0.607	0.369	0.34	2.2172							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
170 GR	normalized	MT	backward	O	(Constant)	-84.333	25.985	-3.245	0.004		
R	R squared	adj. R squ.	±	CA	85.617	25.287	7.071	3.386	0.003		
	0.753	0.566	0.501	1.9274	DOO	40.072	15.671	0.826	2.557	0.019	
					SDI	30.784	8.922	6.865	3.451	0.003	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
171 GR	normalized	MT	stepwise	D	(Constant)	4.724	0.567	8.33	0		
R	R squared	adj. R squ.	±	LVAS	-21.971	5.568	-0.644	-3.946	0.001		
	0.644	0.414	0.388	1.392							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
172 GR	normalized	MT	backward	D	(Constant)	61.066	17.628	3.464	0.002		
R	R squared	adj. R squ.	±	CA	-55.205	17.154	-6.992	-3.218	0.004		
	0.728	0.531	0.46	1.308	DOO	-24.974	10.631	-0.789	-2.349	0.029	
					SDI	-19.867	6.052	-6.794	-3.283	0.004	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
173 GR	normalized	MT	stepwise	T	(Constant)	14.06	1.845	7.621	0		
R	R squared	adj. R squ.	±	MULTI	12.616	3.015	0.666	4.185	0		
	0.666	0.443	0.418	2.7							

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
174 GR	normalized	MT	backward	T	(Constant)	-79.594	34.742		-2.291 0.033
R	R squared	adj. R squ.	±	CA	94.547	33.809	6.027	2.797	0.011
	0.734	0.538	0.469	2.58	DOO	39.619	20.952	0.63	1.891 0.073
					SDI	35.134	11.928	6.048	2.945 0.008

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
175 GRML	normalized	UN RM	stepwise	S	(Constant)	48.988	11.863		4.129 0
R	R squared	adj. R squ.	±	DOLI	822.227	248.28	0.524	3.312	0.002
	0.524	0.274	0.249	51.72415962					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
176 GRML	normalized	UN RM	backward	S	(Constant)	-1403.481	232.5		-6.036 0
R	R squared	adj. R squ.	±	CA	1396.462	223.49	5.428	6.249	0
	0.832	0.692	0.644	35.61922413	SDI	567.215	88.499	5.742	6.409 0
					CCC	371.391	204.55	0.329	1.816 0.081
					DPC	-559.782	162.35	-0.522	-3.448 0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
177 GRML	normalized	UN RM	stepwise	ln(S)	(Constant)	3.494	0.25		13.999 0
R	R squared	adj. R squ.	±	DOLI	16.062	3.186	0.615	5.041	0
	0.775	0.601	0.557	0.661648512	PCOMP	-17.694	4.268	-0.533	-4.146 0
					DCOR	10.924	4.539	0.308	2.407 0.023

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
178 GRML	normalized	UN	backward	ln(S)	(Constant)	-22.9	2.737		-8.367 0
R	R squared	adj. R squ.	±	CA	25.692	2.632	5.997	9.763	0
	0.933	0.87	0.831	0.409209236	DCOR	6.583	3.454	0.186	1.906 0.069
					DOO	5.966	2.209	0.35	2.701 0.013
					DPAM	6.319	3.685	0.139	1.715 0.1
					LMOD	-1.951	0.922	-0.19	-2.115 0.045
					SDI	9.15	1.013	5.563	9.031 0
					DOGL	10.537	2.995	0.399	3.518 0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
179 GRML	normalized	UN	stepwise	O	(Constant)	4.869	0.585		8.325 0
R	R squared	adj. R squ.	±	DOGL	33.255	10.989	0.49	3.026	0.005
	0.49	0.24	0.214	2.268					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
180 GRML	normalized	UN	backward	O	(Constant)	-37.891	14.919		-2.54 0.018
R	R squared	adj. R squ.	±	CA	41.183	14.385	3.736	2.863	0.008
	0.714	0.51	0.412	1.9613	DOO	18.652	9.209	0.425	2.025 0.054
					PCOMP	45.614	16.273	0.534	2.803 0.01
					SDI	13.82	5.297	3.265	2.609 0.015
					DOGL	28.511	13.699	0.42	2.081 0.048

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
181 GRML	normalized	UN RM MT	stepwise	D	(Constant)	3.874	0.432		8.962 0
R	R squared	adj. R squ.	±	DOO	-14.342	4.759	-0.488	-3.013	0.005
	0.488	0.238	0.212	1.521					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
182 GRML	normalized	UN RM	backward	D	(Constant)	3.716	0.659		5.636 0
R	R squared	adj. R squ.	±	LMOD	6.261	2.702	0.354	2.317	0.028
	0.637	0.406	0.34	1.392	SDI	-2.238	0.565	-0.789	-3.959 0
					DPC	14.6	6.044	0.475	2.416 0.023

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
183 GRML	normalized	UN RM	step+back	T	(Constant)	17.702	1.265		13.99 0
R	R squared	adj. R squ.	±	SDI	3.053	0.848	0.556	3.599	0.001
	0.556	0.309	0.285	2.81					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
184 GRML	normalized	RM MT	backward	ln(S)	(Constant)	-19.015	3.403		-5.587 0
R	R squared	adj. R squ.	±	CA	21.708	3.27	5.067	6.639	0
	0.915	0.838	0.797	0.447602591	CTRI	-6.147	2.267	-0.33	-2.711 0.012
					DCOR	6.659	3.76	0.188	1.771 0.089
					LMOD	-2.869	0.917	-0.279	-3.127 0.005
					PCOMP	-10.25	3.666	-0.309	-2.796 0.01

SDI 9.144 1.211 5.559 7.55 0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
185 GRML	normalized	RM MT	stepwise	O (Constant)	4.652	0.648		7.179	0
R	R squared	adj. R squ.	±	DOO	21.112	7.135	0.482	2.959	0.006
	0.482	0.232	0.205	2.28					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
186 GRML	normalized	RM	backward	O (Constant)	-20.738	13.122		-1.58	0.127
R	R squared	adj. R squ.	±	CA	24.841	12.638	2.253	1.966	0.061
	0.702	0.492	0.391	1.9967	DPAM	-32.961	17.059	-0.282	-1.932 0.065
				LMOD	-10.224	4.222	-0.387	-2.421	0.023
				SDI	13.703	4.998	3.238	2.742	0.011
				CCC	-32.594	11.948	-0.674	-2.728	0.011

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	NO RELATION				
187 GRML	normalized	MT	stepwise	S					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
188 GRML	normalized	MT	backward	S (Constant)	-1415.246	271.51		-5.212	0
R	R squared	adj. R squ.	±	CA	1397.557	260.67	5.432	5.361	0
	0.737	0.543	0.51	41.79762256	SDI	558.976	100.09	5.658	5.585 0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
189 GRML	normalized	MT	stepwise	In(S) (Constant)	3.861	0.25		15.449	0
R	R squared	adj. R squ.	±	PCOMP	-18.352	5.199	-0.552	-3.53	0.001
	0.619	0.383	0.339	0.808007684	DOO	8.612	2.667	0.505	3.23 0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
190 GRML	normalized	MT	backward	O (Constant)	-37.701	15.846		-2.379	0.025
R	R squared	adj. R squ.	±	CA	40.431	15.274	3.668	2.647	0.014
	0.652	0.425	0.337	2.0832	DOO	20.331	9.744	0.464	2.087 0.047
				PCOMP	39.666	17.016	0.464	2.331	0.028
				SDI	14.807	5.604	3.498	2.642	0.014

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
191 GRML	normalized	MT	backward	D (Constant)	4.375	0.667		6.555	0
R	R squared	adj. R squ.	±	CTRI	17.099	7.044	0.533	2.427	0.022
	0.55	0.303	0.253	1.481	SDI	-2.171	0.622	-0.766	-3.487 0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
192 GRML	normalized	MT	step+back	T (Constant)	15.203	1.667		9.12	0
R	R squared	adj. R squ.	±	MULTI	11.249	2.691	0.613	4.18	0
	0.613	0.376	0.354	2.67					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
193 OR	normalized	UN RM MT	stepwise	S (Constant)	-64.019	20.88		-3.066	0.005
R	R squared	adj. R squ.	±	+MT back	42.11	9.727	1.456	4.329	0
	0.665	0.442	0.405	7.934552941	CA	62.039	20.342	1.026	3.05 0.005

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
194 OR	normalized	UN	backward	S (Constant)	4.955	2.074		2.389	0.023
R	R squared	adj. R squ.	±	DOO	117.852	32.363	0.482	3.642	0.001
	0.688	0.474	0.439	7.705851879	DOS	242.923	64.402	0.5	3.772 0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
195 OR	normalized	UN	stepwise	In(S) (Constant)	1.567	0.186		8.405	0
R	R squared	adj. R squ.	±	DOS	22.259	5.791	0.525	3.844	0.001
	0.663	0.44	0.403	0.69292924	DOO	8.84	2.91	0.415	3.038 0.005

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
196 OR	normalized	UN	backward	In(S) (Constant)	-5.607	1.707		-3.285	0.003
R	R squared	adj. R squ.	±	CA	7.713	1.884	1.463	4.094	0
	0.843	0.711	0.599	0.568128609	DCOR	12.038	6.072	0.333	1.982 0.06
				DOO	11.84	2.907	0.556	4.073	0
				LVAS	5.096	2.447	0.416	2.083	0.049
				LMOD	3.961	1.165	0.585	3.398	0.002
				PCOMP	8.076	2.314	0.87	3.489	0.002
				DOS	22.66	7.444	0.535	3.044	0.006
				CKAL	1.066	0.512	0.251	2.084	0.048
				DPC	10.431	3.139	0.445	3.323	0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER								
197 OR	normalized	UN RM MT	stepwise	O	NO RELATION							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
198 OR	normalized	UN	backward	O	(Constant)	-64.019	20.88		-3.066	0.005		
R	R squared	adj. R squ.	±	SDI		42.11	9.727	1.456	4.329	0		
	0.607	0.368	0.251	0.08994								
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
199 OR	normalized	UN RM MT	step+back	D	(Constant)	3.95	0.514		7.682	0		
R	R squared	adj. R squ.	±	LMD		-4.487	0.764	-0.827	-5.874	0		
	0.781	0.61	0.57	0.99	PCOMP	-9.525	2.194	-0.607	-4.341	0		
				SDI		2.116	0.69	0.496	3.066	0.005		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
200 OR	normalized	UN RM MT	stepwise	T	(Constant)	21.213	0.021		1004	0		
R	R squared	adj. R squ.	±	LMD		0.231	0.075	4.58E-01	3.088	0.004		
	0.583	0.34	0.296	0.056	PCOMP	0.241	0.103	3.49E-01	2.352	0.025		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
201 OR	normalized	UN RM MT	backward	T	(Constant)	21.279	0.029		734.45	0		
R	R squared	adj. R squ.	±	DCOR		1.094	0.479	0.407	2.283	0.03		
	0.711	0.506	0.435	0.05014	LMD	0.382	0.085	0.758	4.493	0		
				PCOMP		0.32	0.113	0.463	2.839	0.008		
				SDI		-0.12	0.041	-0.642	-2.945	0.006		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
202 OR	normalized	RM	backward	S	(Constant)	1.492	2.711		0.55	0.586		
R	R squared	adj. R squ.	±	DOO		120.367	32.716	0.493	3.679	0.001		
	0.695	0.483	0.429	7.769161265	LMD	19.556	10.452	0.252	1.871	0.071		
				DOGS		107.627	35.037	0.414	3.072	0.005		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
203 OR	normalized	RM	stepwise	ln(S)	(Constant)	1.311	0.196		6.691	0		
R	R squared	adj. R squ.	±	DOGS		11.26	2.915	0.497	3.863	0.001		
	0.732	0.536	0.488	0.641605789	DOO	8.031	2.77	0.377	2.899	0.007		
				CTRI		4.803	2.195	0.287	2.188	0.037		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
204 OR	normalized	RM	backward	ln(S)	(Constant)	-11.447	2.529		-4.526	0		
R	R squared	adj. R squ.	±	CA		12.347	2.476	2.342	4.986	0		
	0.782	0.611	0.571	0.587385052	PCOMP	5.797	2.034	0.624	2.851	0.008		
				SDI		5.836	0.929	2.315	6.285	0		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
205 OR	normalized	RM MT	backward	O	(Constant)	8.36	0.028		302.58	0		
R	R squared	adj. R squ.	±	LMD		-0.261	0.133	-0.333	-1.967	0.058		
	0.333	0.111	0.082	0.09956								
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
206 OR	normalized	MT	step+back	ln(S)	(Constant)	-11.447	2.529		-4.526	0		
R	R squared	adj. R squ.	±	SDI		5.836	0.929	2.32E+00	6.285	0		
	0.782	0.611	0.571	5.87E-01	CA	12.347	2.476	2.34E+00	4.986	0		
				PCOMP		5.797	2.034	6.24E-01	2.851	0.008		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
207 YO	normalized	UN	stepwise	S	(Constant)	5.842	0.96		6.082	0		
R	R squared	adj. R squ.	±	DOLI		284.623	73.714	6.11E-01	3.861	0.001		
	0.611	0.374	0.349	4.90E+00								
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
208 YO	normalized	UN	backward	S	(Constant)	-15.276	9.231		-1.655	0.112		
R	R squared	adj. R squ.	±	CA		19.714	9.027	0.873	2.184	0.04		
	0.756	0.571	0.493	4.319243202	SDI	8.859	4.904	0.805	1.806	0.085		
				DOGL		75.225	25.748	0.481	2.922	0.008		
				DOS		78.048	39.763	0.318	1.963	0.062		
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.			
209 YO	normalized	UN	stepwise	ln(S)	(Constant)	0.592	0.252		2.346	0.028		

R	R squared	adj. R squ.	±	CCC	8.69	2.642	0.497	3.289	0.003
0.673	0.452	0.407	0.802693999	LVAS	7.024	2.317	0.458	3.031	0.006
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
210 YO	normalized	UN	backward	In(S)	(Constant)	-5.7	1.577	-3.615	0.001
R	R squared	adj. R squ.	±	CA	6.476	1.577	1.67	4.106	0
0.734	0.539	0.479	0.752415272	DOO	4.837	2.504	0.336	1.932	0.066
				SDI	3.463	0.721	1.832	4.806	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
211 YO	normalized	UN RM MT	stepwise	O	(Constant)	7.937	0.042	190.63	0
R	R squared	adj. R squ.	±	LMOD	0.491	0.218	0.411	2.255	0.033
0.411	0.169	0.136	0.1722						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
212 YO	normalized	UN	backward	O	(Constant)	7.956	0.038	207.82	0
R	R squared	adj. R squ.	±	DCOR	2.464	1.215	0.376	2.027	0.053
0.376	0.141	0.107	0.1751						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	NO RELATION				
213 YO	normalized	UN RM MT	stepwise	D					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
214 YO	normalized	UN	backward	D	(Constant)	13.872	5.95	2.331	0.03
R	R squared	adj. R squ.	±	CA	-10.922	5.938	-1.124	-1.839	0.081
0.704	0.495	0.343	2.12	LVAS	24.889	10.642	0.647	2.339	0.03
				PCOMP	13.709	5.569	0.663	2.462	0.023
				SDI	-9.974	3.434	-2.105	-2.905	0.009
				DOGL	34.565	15.502	0.513	2.23	0.037
				CCC	19.35	9.81	0.441	1.973	0.063
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
215 YO	normalized	UN RM MT	stepwise	T	(Constant)	21.695	0.072	300.19	0
R	R squared	adj. R squ.	±	PCOMP	-1.036	0.346	-0.482	-2.998	0.006
0.622	0.386	0.335	0.221	LMOD	0.781	0.281	0.446	2.775	0.011
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
216 YO	normalized	UN	backward	T	(Constant)	20.507	0.584	35.094	0
R	R squared	adj. R squ.	±	CA	1.198	0.583	1.186	2.054	0.053
0.741	0.549	0.414	0.208	LVAS	-2.456	1.045	-0.615	-2.35	0.029
				PCOMP	-1.586	0.547	-0.738	-2.9	0.009
				SDI	1.068	0.337	2.17	3.168	0.005
				DOGL	-3.311	1.522	-0.473	-2.175	0.042
				CCC	-2.017	0.963	-0.443	-2.094	0.049
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
217 YO	normalized	RM	stepwise	S	(Constant)	4.209	1.065	3.953	0.001
R	R squared	adj. R squ.	±	DOLI	199.731	73.8	0.429	2.706	0.012
0.716	0.513	0.473	4.406395519	DOGS	47.528	18.119	0.416	2.623	0.015
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
218 YO	normalized	RM	backward	S	(Constant)	-25.635	8.858	-2.894	0.009
R	R squared	adj. R squ.	±	CA	29.395	8.698	1.302	3.379	0.003
0.795	0.632	0.544	4.096398196	DCOR	-86.023	32.959	-0.4	-2.61	0.016
				SDI	16.518	4.886	1.501	3.381	0.003
				CKAL	-12.837	7.439	-0.245	-1.726	0.099
				DOGS	47.561	19.611	0.416	2.425	0.024
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
219 YO	normalized	RM	stepwise	In(S)	(Constant)	0.996	0.207	4.804	0
R	R squared	adj. R squ.	±	DOGS	11.437	3.193	0.582	3.582	0.001
0.582	0.339	0.313	0.863935574						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
220 YO	normalized	RM	backward	In(S)	(Constant)	-3.686	1.588	-2.321	0.03
R	R squared	adj. R squ.	±	CA	4.465	1.561	1.152	2.861	0.009
0.725	0.526	0.464	0.762956898	SDI	2.509	0.837	1.327	2.996	0.006
				DOGS	6.292	3.634	0.32	1.731	0.097
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
221 YO	normalized	RM	backward	O	(Constant)	8	0.064	125.78	0

R	R squared	adj. R squ.	±		PCOMP	-0.739	0.331	-0.504	-2.236	0.035
0.552	0.305	0.214	0.1642		SDI	0.171	0.082	0.509	2.078	0.049
					CCG	-1.507	0.602	-0.485	-2.503	0.02
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
222 YO	normalized	RM	backward	D	(Constant)	2.485	0.752	...	3.302	0.003
R	R squared	adj. R squ.	±		PCOMP	7.439	3.86	0.36	1.927	0.065
	0.36	0.129	0.095	2.49						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
223 YO	normalized	RM	backward	T	(Constant)	21.701	0.09		240.48	0
R	R squared	adj. R squ.	±		PCOMP	-1.365	0.469	-0.635	-2.909	0.008
	0.59	0.349	0.264	0.233	SDI	0.214	0.117	0.434	1.831	0.08
					CCC	-1.81	0.854	-0.397	-2.119	0.045
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
224 YO	normalized	MT	stepwise	S	(Constant)	3.247	1.389		2.337	0.028
R	R squared	adj. R squ.	±		MULTI	12.425	3.673	0.56	3.383	0.002
	0.56	0.314	0.287	5.124941756						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
225 YO	normalized	MT	backward	S	(Constant)	3.294	1.675		1.966	0.061
R	R squared	adj. R squ.	±		LMOD	-23.12	6.52	-0.591	-3.546	0.002
	0.741	0.55	0.491	4.328905422	PCOMP	-36.055	9.047	-0.751	-3.985	0.001
					SDI	12.084	2.349	1.098	5.144	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
226 YO	normalized	MT	stepwise	ln(S)	(Constant)	0.452	0.245		1.848	0.077
R	R squared	adj. R squ.	±		MULTI	2.191	0.543	0.575	4.035	0
	0.726	0.527	0.487	0.746271835	LVAS	5.427	2.187	0.354	2.481	0.02
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
227 YO	normalized	MT	backward	ln(S)	(Constant)	-3.73	1.435		-2.599	0.016
R	R squared	adj. R squ.	±		CA	4.458	1.42	1.15	3.139	0.005
	0.766	0.587	0.533	0.712000933	SDI	2.328	0.759	1.232	3.068	0.005
					MULTI	1.735	0.663	0.455	2.618	0.015
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
228 YO	normalized	MT	backward	O	(Constant)	7.749	0.099		78.23	0
R	R squared	adj. R squ.	±		CA	0.281	0.137	0.408	2.057	0.051
	0.542	0.294	0.235	0.1621	LMOD	0.735	0.237	0.616	3.105	0.005
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
229 YO	normalized	MT	backward	D	(Constant)	7.707	1.358		5.674	0
R	R squared	adj. R squ.	±		CA	-5.136	1.874	-0.528	-2.741	0.011
	0.576	0.332	0.277	2.22	LMOD	-10.378	3.248	-0.616	-3.195	0.004
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
230 YO	normalized	MT	backward	T	(Constant)	21.143	0.13		162.13	0
R	R squared	adj. R squ.	±		CA	0.61	0.18	0.604	3.393	0.002
	0.656	0.43	0.382	0.213	LMOD	1.223	0.312	0.699	3.923	0.001
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
231 Shigh	normalized	UN RM	stepwise	S	(Constant)	45.419	22.3		2.037	0.054
R	R squared	adj. R squ.	±		CCC	462.537	196.92	0.448	2.349	0.028
	0.448	0.2	0.164	51.09033154						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
232 Shigh	normalized	UN RM	backward	S	(Constant)	-1410.233	281.74		-5.005	0
R	R squared	adj. R squ.	±		CA	1442.964	276.93	5.246	5.211	0
	0.785	0.616	0.558	37.1553736	SDI	612.662	111.95	5.798	5.473	0
					DPC	-914.986	229.95	-0.819	-3.979	0.001
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
233 Shigh	normalized	UN	stepwise	ln(S)	(Constant)	3.87	0.225		17.182	0
R	R squared	adj. R squ.	±		LVAS	5.17	2.107	0.463	2.453	0.023
	0.463	0.215	0.179	0.522494375						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
234 Shigh	normalized	UN RM	backward	ln(S)	(Constant)	-11.551	2.863		-4.035	0.001
R	R squared	adj. R squ.	±		CA	15.286	2.814	5.386	5.432	0

0.792	0.627	0.571	0.377534311	SDI	6.434	1.137	5.9	5.656	0
				DPC	-8.928	2.336	-0.774	-3.821	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
235 Shigh	normalized	UN RM MT	stepwise	O	(Constant)	5.245	0.622	8.435	0
R	R squared	adj. R squ.	±	LVAS	19.419	5.818	0.58	3.338	0.003
	0.58	0.336	0.306	1.4424					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
236 Shigh	normalized	UN	backward	O	(Constant)	-10.218	3.462	-2.951	0.009
R	R squared	adj. R squ.	±	CA	15.43	3.44	1.811	4.486	0
	0.88	0.775	0.677	0.9845	CTRI	33.986	9.991	0.976	0.004
				LVAS	31.432	7.252	0.938	4.334	0.001
				LMOD	-8.645	3.3	-0.487	-2.62	0.019
				PCOMP	36.619	6.823	1.261	5.367	0
				DOGL	23.963	8.51	0.506	2.816	0.012
				DOS	51.01	14.494	0.682	3.519	0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
237 Shigh	normalized	UN RM MT	step (+MTback)	D	(Constant)	3.753	0.418	8.983	0
R	R squared	adj. R squ.	±	LVAS	-15.258	3.909	-0.64	-3.903	0.001
	0.64	0.409	0.382	0.969					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
238 Shigh	normalized	UN	backward	D	(Constant)	3.349	0.529	6.325	0
R	R squared	adj. R squ.	±	CTRI	-19.683	9.334	-0.793	-2.109	0.05
	0.793	0.628	0.497	0.874	LVAS	-27.064	6.669	-1.135	0.001
				LMOD	7.312	3.022	0.578	2.42	0.027
				PCOMP	-10.847	4.724	-0.525	-2.296	0.035
				SDI	2.909	1.117	1.248	2.605	0.019
				DOS	-30.016	13.077	-0.563	-2.295	0.035

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
239 Shigh	normalized	UN	stepwise	T	(Constant)	21.734	0.36	60.385	0
R	R squared	adj. R squ.	±	DOGL	21.145	6.552	0.567	3.227	0.004
	0.567	0.321	0.29	1.15					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
240 Shigh	normalized	UN	backward	T	(Constant)	14.078	2.631	5.35	0
R	R squared	adj. R squ.	±	CA	6.264	2.485	0.933	2.521	0.022
	0.774	0.599	0.458	1	LVAS	11.224	5.996	0.425	1.872
				PCOMP	15.405	7.067	0.673	2.18	0.044
				DOGL	19.172	8.736	0.514	2.195	0.042
				DOS	24.485	13.072	0.415	1.873	0.078
				DPC	19.04	6.852	0.698	2.779	0.013

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
241 Shigh	normalized	RM	stepwise	In(S)	(Constant)	3.87	0.225	17.182	0
R	R squared	adj. R squ.	±	LVAS	5.17	2.107	0.463	2.453	0.023
	0.619	0.383	0.325	0.473919189					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
242 Shigh	normalized	RM	backward	O	(Constant)	5.36	0.59	9.091	0
R	R squared	adj. R squ.	±	CTRI	32.956	9.571	0.946	3.443	0.003
	0.889	0.79	0.698	0.9522	LVAS	30.901	7.14	0.923	4.328
				LMOD	-6.353	3.203	-0.358	-1.984	0.065
				PCOMP	27.533	5.166	0.948	5.33	0
				SDI	-5.731	1.285	-1.75	-4.46	0
				DOLI	13.154	7.455	0.298	1.764	0.097
				DOGS	36.41	7.798	0.926	4.669	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
243 Shigh	normalized	RM	backward	D	(Constant)	3.411	0.497	6.869	0
R	R squared	adj. R squ.	±	CTRI	-13.444	6.922	-0.542	-1.942	0.07
	0.848	0.719	0.596	0.784	LVAS	-22.773	5.731	-0.955	-3.973
				PCOMP	-16.682	5.515	-0.807	-3.025	0.008
				SDI	4.521	1.236	1.939	3.659	0.002
				CCC	-12.286	6.286	-0.539	-1.955	0.068
				DOLI	-13.218	5.873	-0.421	-2.251	0.039
				DOGS	-21.371	6.496	-0.763	-3.29	0.005

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
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244	Shigh	normalized	RM	stepwise	T	(Constant)	20.803	0.475		43.79	0
	R	R squared	adj. R squ.	$\pm$		DOGS	20.814	4.891	0.672	4.255	0
		0.672	0.451	0.427	1.03						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
245	Shigh	normalized	RM	backward	T	(Constant)	20.025	0.577	34.692	0	
	R	R squared	adj. R squ.	$\pm$		CTRI	12.084	6.468	0.44	1.868	0.079
		0.855	0.731	0.636	0.82	LVAS	17.497	5.917	0.663	2.957	0.009
						PCOMP	13.423	4.873	0.587	2.754	0.014
						SDI	-3.527	0.983	-1.367	-3.587	0.002
						DPC	18.373	5.815	0.673	3.159	0.006
						DOGS	29.141	6.574	0.941	4.433	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.
246	Shigh	normalized	MT	stepwise	S	NO RELATION			

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.	
247	Shigh	normalized	MT	backward	S	(Constant)	-688.441	281.61	-2.445	0.023
	R	R squared	adj. R squ.	$\pm$		CA	708.931	269.8	2.578	0.016
		0.558	0.311	0.246	48.53510896	SDI	298.455	103.65	2.824	0.009

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
248	Shigh	normalized	MT	stepwise	In(S)	(Constant)	3.87	0.225	17.182	0	
	R	R squared	adj. R squ.	$\pm$		LVAS	5.17	2.107	0.463	2.453	0.023
		0.463	0.215	0.179	0.522494375						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
249	Shigh	normalized	MT	backward	In(S)	(Constant)	-6.974	2.84	-2.455	0.023	
	R	R squared	adj. R squ.	$\pm$		CA	10.6	2.743	3.734	0.001	
		0.69	0.476	0.397	0.447677644	DOO	5.539	2.58	0.527	2.146	0.044
						SDI	3.907	0.989	3.583	3.953	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
250	Shigh	normalized	MT	backward	O	(Constant)	-5.091	4.365	-1.166	0.258	
	R	R squared	adj. R squ.	$\pm$		CA	8.077	3.364	0.948	2.401	0.027
		0.745	0.555	0.462	1.2703	LVAS	28.83	6.916	0.861	4.169	0.001
						PCOMP	28.116	9.721	0.968	2.892	0.009
						MULTI	7.207	3.642	0.69	1.979	0.062

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
251	Shigh	normalized	MT	backward	D	(Constant)	3.753	0.418	8.983	0	
	R	R squared	adj. R squ.	$\pm$		LVAS	-15.258	3.909	-0.64	-3.903	0.001
		0.64	0.409	0.382	0.969						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
252	Shigh	normalized	MT	step+back	T	(Constant)	21.265	0.505	42.115	0	
	R	R squared	adj. R squ.	$\pm$		LVAS	14.342	4.724	0.543	3.036	0.006
		0.543	0.295	0.263	1.17						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
253	Smed	normalized	UN	stepwise	S	(Constant)	13.583	1.738	7.817	0	
	R	R squared	adj. R squ.	$\pm$		PCOMP	-21.396	10.075	-0.277	-2.124	0.039
		0.495	0.245	0.196	7.001163894	DOS	98.68	40.139	0.317	2.458	0.018
						DPAM	214.365	104.05	0.269	2.06	0.045

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
254	Smed	normalized	UN	backward	S	(Constant)	2.987	3.781	0.79	0.434	
	R	R squared	adj. R squ.	$\pm$		CA	10.667	5.396	0.299	1.977	0.054
		0.534	0.286	0.222	6.886358389	DPAM	235.987	102.3	0.296	2.307	0.026
						DOS	120.444	42.952	0.387	2.804	0.007
						DPC	40.973	16.826	0.335	2.435	0.019

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
255	Smed	normalized	UN	stepwise	In(S)	(Constant)	2.459	0.131	18.73	0	
	R	R squared	adj. R squ.	$\pm$		DOS	7.822	3.113	0.333	2.512	0.015
		0.421	0.177	0.142	0.545139752	PCOMP	-1.66	0.773	-0.285	-2.147	0.037

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	$\pm$	stand. beta	t	sig.		
256	Smed	normalized	UN	backward	In(S)	(Constant)	2.148	0.102	21.007	0	
	R	R squared	adj. R squ.	$\pm$		DPAM	17.303	7.826	0.288	2.211	0.032
		0.48	0.231	0.181	0.532789229	DOS	7.424	3.059	0.316	2.427	0.019

DPC 2.33 1.203 0.252 1.938 0.059

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
257 Smed	normalized	UN RM	stepwise	O (Constant)	6.979	0.571		12.216	0
R	R squared	adj. R squ.	±	DPAM	-100.265	22.607	-0.484	-4.435	0
	0.687	0.472	0.438	1.5219	DPC	-18.034	4.011	-0.566	0
				SDI	1.209	0.55	0.281	2.201	0.033

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
258 Smed	normalized	UN RM	backward	O (Constant)	6.454	0.574		11.25	0
R	R squared	adj. R squ.	±	DCOR	-19.192	8.737	-0.277	-2.197	0.034
	0.763	0.582	0.513	1.4173	DPAM	-83.937	22.148	-0.405	0
				LVAS	-7.011	3.742	-0.237	-1.874	0.068
				LMOD	-3.757	2.097	-0.223	-1.791	0.08
				SDI	3.367	0.836	0.783	4.026	0
				CCC	-9.982	5.086	-0.293	-1.963	0.056
				DPC	-16.331	4.464	-0.513	-3.658	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
259 Smed	normalized	UN RM MT	stepwise	D (Constant)	4.518	0.366		12.347	0
R	R squared	adj. R squ.	±	LMOD	-6.503	2.036	-0.419	-3.194	0.002
	0.419	0.175	0.158	1.719					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
260 Smed	normalized	UN	backward	D (Constant)	3.996	0.599		6.673	0
R	R squared	adj. R squ.	±	DOO	12.461	4.669	0.405	2.669	0.011
	0.66	0.436	0.326	1.538	DPAM	53.164	23.286	0.278	0.028
				LVAS	9.329	4.798	0.342	1.944	0.059
				NGAL	12.82	6.988	0.221	1.835	0.074
				PCOMP	7.854	2.967	0.424	2.647	0.011
				SDI	-3.698	0.982	-0.933	-3.766	0.001
				DOGL	16.832	7.118	0.324	2.365	0.023
				DPC	16.292	4.823	0.554	3.378	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
261 Smed	normalized	UN RM MT	step(+MT back)	T (Constant)	19.658	0.674		29.174	0
R	R squared	adj. R squ.	±	DPAM	-108.243	27.683	-0.463	-3.91	0
	0.604	0.365	0.338	1.864	SDI	1.499	0.575	0.309	0.012

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
262 Smed	normalized	UN	backward	T (Constant)	19.291	0.678		28.44	0
R	R squared	adj. R squ.	±	DPAM	-107.193	26.84	-0.459	-3.994	0
	0.645	0.416	0.378	1.807	SDI	2.181	0.653	0.45	0.002
				DPC	-9.545	4.762	-0.266	-2.004	0.051

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
263 Smed	normalized	RM	stepwise	S (Constant)	15.81	1.696		9.323	0
R	R squared	adj. R squ.	±	PCOMP	-23.127	10.639	-0.299	-2.174	0.035
	0.299	0.09	0.071	7.526579452					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
264 Smed	normalized	RM	backward	S (Constant)	11.426	1.231		9.284	0
R	R squared	adj. R squ.	±	DPAM	245.489	107.73	0.308	2.279	0.027
	0.382	0.146	0.11	7.366331179	DPC	31.104	16.569	0.254	0.067

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
265 Smed	normalized	RM MT	stepwise	ln(S)	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
266 Smed	normalized	RM	backward	ln(S) (Constant)	2.126	0.115		18.456	0
R	R squared	adj. R squ.	±	DPAM	17.622	7.995	0.294	2.204	0.033
	0.451	0.204	0.152	0.542174041	DPC	2.295	1.227	0.249	0.068
				DOGS	3.237	1.597	0.271	2.027	0.048

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
267 Smed	normalized	RM	backward	D (Constant)	4.203	0.601		6.991	0
R	R squared	adj. R squ.	±	DOO	11.323	4.127	0.368	2.744	0.009
	0.603	0.363	0.275	1.596	DPAM	47.075	23.96	0.246	1.965
				PCOMP	6.09	2.947	0.329	2.067	0.045
				SDI	-2.938	0.831	-0.741	-3.537	0.001
				DPC	15.842	5.024	0.539	3.153	0.003
				DOGS	12.819	5.533	0.337	2.317	0.025

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
268 Smed	normalized	RM	backward	T	(Constant)	10.239	4.508	2.271	0.028
R	R squared	adj. R squ.	±	CA	8.589	4.259	0.819	2.017	0.05
0.703	0.494	0.424	1.739	DPAM	-101.439	26.244	-0.434	-3.865	0
				LVAS	-8.691	4.858	-0.26	-1.789	0.081
				LMOD	-4.816	2.571	-0.254	-1.873	0.068
				SDI	7.704	2.455	1.588	3.138	0.003
				DPC	-17.35	5.604	-0.483	-3.096	0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
269 Smed	normalized	MT	stepwise	S	(Constant)	15.81	1.696	9.323	0
R	R squared	adj. R squ.	±	PCOMP	-23.127	10.639	-0.299	-2.174	0.035
0.299	0.09	0.071	7.526579452						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
270 Smed	normalized	MT	backward	S	(Constant)	15.81	1.696	9.323	0
R	R squared	adj. R squ.	±	PCOMP	-23.127	10.639	-0.299	-2.174	0.035
0.455	0.207	0.155	7.177400114						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
271 Smed	normalized	MT	backward	ln(S)	(Constant)	-0.902	1.097	-0.822	0.415
R	R squared	adj. R squ.	±	CA	2.958	1.054	1.098	2.806	0.007
0.469	0.22	0.169	0.536577464	DPAM	15.502	7.973	0.258	1.944	0.058
				SDI	1.512	0.488	1.213	3.099	0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
272 Smed	normalized	MT	stepwise	O	(Constant)	6.876	0.396	17.346	0
R	R squared	adj. R squ.	±	DPAM	-91.254	25.38	-0.441	-3.596	0.001
0.562	0.316	0.287	1.7143	PCOMP	5.62	2.462	0.28	2.283	0.027

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
273 Smed	normalized	MT	backward	O	(Constant)	-11.883	9.066	-1.311	0.197
R	R squared	adj. R squ.	±	CA	18.613	8.616	2.004	2.16	0.037
0.691	0.477	0.39	1.5861	CTRI	-10.119	5.36	-0.27	-1.888	0.066
				DOO	9.367	5.338	0.281	1.755	0.087
				DPAM	-93.747	24.761	-0.453	-3.786	0
				PCOMP	16.808	6.511	0.837	2.581	0.013
				SDI	7.44	3.181	1.731	2.339	0.024
				MULTI	-2.45	1.223	-0.292	-2.004	0.052

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
274 Smed	normalized	MT	backward	D	(Constant)	3.986	0.418	9.54	0
R	R squared	adj. R squ.	±	DOO	8.343	3.884	0.271	2.148	0.037
0.546	0.298	0.252	1.62	DPAM	49.127	23.795	0.257	2.065	0.045
				LMOD	-6.057	1.952	-0.39	-3.103	0.003

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
275 TOC NBall	none	UN	stepwise	TOC	(Constant)	1.031	0.991	1.041	0.312
R	R squared	adj. R squ.	±	DCOR	106.267	42.521	0.287	2.499	0.022
0.92	0.846	0.82	3.205	DPC	135.715	23.447	0.572	5.788	0
				DOS	223.265	55.264	0.44	4.04	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
276 TOC NBall	none	UN	backward	TOC	(Constant)	331.499	76.295	4.345	0.003
R	R squared	adj. R squ.	±	CA	-332.65	76.33	-8.083	-4.358	0.003
0.991	0.981	0.944	1.788	CTRI	-241.999	77.908	-1.086	-3.106	0.017
				DCOR	-308.294	96.765	-0.831	-3.186	0.015
				DOO	-308.565	79.986	-2.504	-3.858	0.006
				DOS	-318.864	134.44	-0.628	-2.372	0.049
				LVAS	-304.28	72.925	-2.25	-4.173	0.004
				LMOD	-321.098	76.403	-4.726	-4.203	0.004
				NGAL	-288.903	71.145	-0.817	-4.061	0.005
				PCOMP	-348.568	77.138	-4.998	-4.519	0.003
				DOGL	-282.396	98.071	-0.424	-2.88	0.024
				CCC	-324.561	76.987	-2.15	-4.216	0.004
				CKAL	-244.865	86.479	-0.366	-2.831	0.025
				DOLI	-360.965	103.48	-0.664	-3.488	0.01
				DPC	-296.257	91.487	-1.249	-3.238	0.014

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
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GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
277 TOC NBall	none	UN	stepwise	ln(TOC)	(Constant)	-0.378	0.459	-0.823	0.421
R	R squared	adj. R squ.	±	SDI	2.009	0.347	0.774	5.795	0
	0.825	0.681	0.648	0.62632105	PCOMP	-5.173	1.3	-0.531	-3.978

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
278 TOC NBall	none	UN	backward	ln(TOC)	(Constant)	14.038	3.031	4.631	0
R	R squared	adj. R squ.	±	CA	-14.09	3.372	-2.453	-4.179	0.001
	0.887	0.787	0.681	0.596166195	DCOR	-26.562	12.407	-0.513	-2.141
				DOO	-8.357	3.851	-0.486	-2.17	0.048
				LVAS	-8.897	4.426	-0.471	-2.01	0.064
				LMOD	-11.547	2.884	-1.218	-4.004	0.001
				PCOMP	-15.828	3.064	-1.626	-5.167	0
				CCC	-16.455	7.137	-0.781	-2.305	0.037

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
279 TOC NBall	none	RM	stepwise	TOC	(Constant)	0.811	0.839	0.966	0.347
R	R squared	adj. R squ.	±	DOGS	163.001	39.558	0.463	4.121	0.001
	0.948	0.898	0.874	2.678	DPC	98.688	20.607	0.416	4.789
				DPAM	392.324	135.44	0.245	2.897	0.01
				DCOR	93.361	43.524	0.252	2.145	0.047

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
280 TOC NBall	none	RM	backward	TOC	(Constant)	315.21	59.026	5.34	0.001
R	R squared	adj. R squ.	±	CA	-316.248	58.865	-7.685	-5.372	0.001
	0.99	0.981	0.95	1.689	CTRI	-226.44	62.095	-1.016	-3.647
				DCOR	-285.694	71.158	-0.77	-4.015	0.004
				DOO	-292.981	64.371	-2.378	-4.551	0.002
				LVAS	-291.124	60.247	-2.153	-4.832	0.001
				LMOD	-305.008	59.501	-4.489	-5.126	0.001
				NGAL	-276.15	58.893	-0.781	-4.689	0.002
				PCOMP	-331.793	59.127	-4.758	-5.612	0.001
				CCC	-307.782	58.944	-2.039	-5.222	0.001
				CKAL	-226.106	66.372	-0.338	-3.407	0.009
				DOLI	-338.776	79.891	-0.623	-4.24	0.003
				DPC	-277.349	71.864	-1.169	-3.859	0.005
				DOGS	-284.576	92.474	-0.808	-3.077	0.015

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
281 TOC NBall	none	RM	step+back	ln(TOC)	(Constant)	-0.378	0.459	-0.823	0.421
R	R squared	adj. R squ.	±	SDI	2.009	0.347	0.774	5.795	0
	0.825	0.681	0.648	0.62632105	PCOMP	-5.173	1.3	-0.531	-3.978

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
282 TOC NBall	none	MT	stepwise	TOC	(Constant)	3.069	0.965	3.18	0.005
R	R squared	adj. R squ.	±	MULTI	44.392	6.651	0.505	6.675	0
	0.965	0.931	0.915	2.209	DCOR	168.156	27.612	0.453	6.09
				DPAM	513.307	107.55	0.321	4.773	0
				PCOMP	-14.447	4.723	-0.207	-3.059	0.007

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
283 TOC NBall	none	MT	backward	TOC	(Constant)	301.616	60.101	5.018	0
R	R squared	adj. R squ.	±	CA	-300.398	60.016	-7.3	-5.005	0
	0.983	0.965	0.939	1.861	CTRI	-220.009	68.125	-0.987	-3.229
				DCOR	-244.339	67.566	-0.659	-3.616	0.004
				DOO	-286.244	66.59	-2.323	-4.299	0.001
				LVAS	-284.048	64.157	-2.101	-4.427	0.001
				LMOD	-294.676	60.697	-4.337	-4.855	0
				NGAL	-260.755	63.357	-0.738	-4.116	0.001
				PCOMP	-316.412	57.206	-4.537	-5.531	0
				MULTI	-282.842	63.004	-3.217	-4.489	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
284 TOC NBall	none	MT	stepwise	ln(TOC)	(Constant)	0.947	0.242	3.92	0.001
R	R squared	adj. R squ.	±	MULTI	8.169	2.047	0.666	3.991	0.001
	0.666	0.443	0.415	0.806560071					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
285 TOC NBall	none	MT	backward	ln(TOC)	(Constant)	-0.465	0.438	-1.061	0.303
R	R squared	adj. R squ.	±	DPAM	50.818	28.733	0.227	1.769	0.094
	0.853	0.728	0.683	0.593941637	PCOMP	-4.5	1.29	-0.462	-3.487
				SDI	1.96	0.33	0.755	5.938	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
286	TOC NBall	UN RM MT	stepwise	TOC	(Constant)	-7.659	2.052	-3.733	0.002	
R	normalized	adj. R squ.	±	SDI	15.184	1.545	0.816	9.825	0	
	0.94	0.884	0.865	2.78	PCOMP	-39.104	6.045	-0.561	-6.469	0
				DPAM	122.155	46.041	0.223	2.653	0.016	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
287	TOC NBall	UN RM	backward	TOC	(Constant)	2.432	5.767	0.422	0.679	
R	normalized	adj. R squ.	±	CA	-11.088	5.847	-0.265	-1.896	0.077	
	0.969	0.939	0.914	2.218	CTRI	32.92	11.709	0.225	2.812	0.013
				DPAM	152.228	38.108	0.278	3.995	0.001	
				PCOMP	-44.916	5.83	-0.644	-7.704	0	
				SDI	10.389	2.608	0.559	3.984	0.001	
				DOLI	-51.077	23.975	-0.154	-2.13	0.05	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
288	TOC NBall	UN RM MT	stepwise	ln(TOC)	(Constant)	-0.378	0.459	-0.823	0.421	
R	normalized	adj. R squ.	±	SDI	2.009	0.347	0.774	5.795	0	
	0.825	0.681	0.648	0.62632105	PCOMP	-5.173	1.3	-0.531	-3.978	0.001
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
289	TOC NBall	UN RM MT	backward	ln(TOC)	(Constant)	3.064	0.555	5.517	0	
R	normalized	adj. R squ.	±	CA	-3.435	0.801	-0.587	-4.29	0.001	
	0.893	0.798	0.734	0.543674433	CTRI	9.242	2.383	0.452	3.878	0.001
				DPAM	23.243	9.006	0.304	2.581	0.02	
				NGAL	6.147	3.043	0.237	2.02	0.06	
				PCOMP	-5.779	1.372	-0.594	-4.213	0.001	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
290	TOC NBall	MT	backward	TOC	(Constant)	-11.213	2.359	-4.754	0	
R	normalized	adj. R squ.	±	CTRI	52.313	15.372	0.357	3.403	0.004	
	0.968	0.938	0.913	2.232	DOO	43.731	15.152	0.355	2.886	0.011
				DPAM	140.978	39.326	0.257	3.585	0.003	
				LMOD	16.732	6.875	0.316	2.434	0.028	
				PCOMP	-39.107	5.042	-0.561	-7.757	0	
				SDI	10.726	1.757	0.577	6.104	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
291	NBall	PC UN S	step+back	S	(Constant)	-5.96	6.121	-0.97	0.333	
R	none	adj. R squ.	±	NSUN1	125.516	16.26	1.293	7.718	0	
	0.64	0.41	0.397	36.0347714	NSUN4	-174.828	28.62	-1.024	-6.11	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
292	NBall	PC UN S	step+back	ln(S)	(Constant)	1.003	0.19	5.287	0	
R	none	adj. R squ.	±	NSUN1	4.523	0.45	1.541	10.05	0	
	0.74	0.548	0.532	0.96021466	NSUN4	-3.96	0.902	-0.766	-4.39	0
				NSUN5	-5.421	1.607	-0.504	-3.37	0.001	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	NO RELATION					
293	NBall	PC UN S	stepwise	O						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
294	NBall	PC UN S	backward	O	(Constant)	7.997	0.336	23.83	0	
R	none	adj. R squ.	±	NSUN2	-7.285	2.426	-1.854	-3	0.003	
	0.436	0.19	0.162	1.6245	NSUN3	6.965	3.486	1.476	1.998	0.049
				NSUN4	2.985	1.65	0.457	1.809	0.074	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	NO RELATION					
295	NBall	PC UN S	step+back	D						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
296	NBall	PC UN S	step+back	T	(Constant)	21.021	0.236	88.96	0	
R	none	adj. R squ.	±	NSUN1	1.578	0.396	0.389	3.983	0	
	0.389	0.151	0.142	1.8						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
297	NBall	PC RM S	stepwise	S	(Constant)	-9.464	6.38	-1.48	0.142	
R	none	adj. R squ.	±	NSRM1	126.186	16.2	1.452	7.789	0	
	0.648	0.42	0.406	35.7481711	NSRM3	-171.485	27.37	-1.168	-6.27	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
298 NBall	none	PC RM S	backward	S (Constant)	-6.371	6.499		-0.98	0.33
R	R squared	adj. R squ.	±	NSRM1	223.186	53.8	2.569	4.149	0
	0.665	0.442	0.423	NSRM2	-107.566	56.97	-1.188	-1.89	0.062
			35.2382852	NSRM3	-161.511	27.5	-1.1	-5.87	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
299 NBall	none	PC RM S	step+back	ln(S) (Constant)	1.05	0.178		5.894	0
R	R squared	adj. R squ.	±	NSRM1	4.619	0.459	1.757	10.06	0
	0.744	0.553	0.538	NSRM3	-4.426	0.847	-0.997	-5.23	0
			0.95453753	NSRM4	-4.442	1.623	-0.459	-2.74	0.008
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
300 NBall	none	PC RM S	stepwise	O NO RELATION					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
301 NBall	none	PC RM S	backward	O (Constant)	8.311	0.299		27.76	0
R	R squared	adj. R squ.	±	NSRM1	4.393	2.478	1.322	1.773	0.08
	0.438	0.192	0.164	NSRM2	-7.354	2.624	-2.122	-2.8	0.006
			1.6232	NSRM3	5.102	1.267	0.908	4.028	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
302 NBall	none	PC RM S	step+back	D NO RELATION					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
303 NBall	none	PC RM S	step+back	T (Constant)	20.978	0.243		86.2	0
R	R squared	adj. R squ.	±	NSRM1	1.407	0.355	0.388	3.966	0
	0.388	0.15	0.141						
			1.8						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
304 NBall	none	PC MT S	step+back	S (Constant)	-63.375	13.43		-4.72	0
R	R squared	adj. R squ.	±	NSMT3	-0.02771	0.004	-0.942	-7.4	0
	0.619	0.384	0.37	NSMT2	174.357	31.1	0.714	5.607	0
			36.8351209						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
305 NBall	none	PC MT S	step+back	ln(S) (Constant)	-3.512	1.352		-2.6	0.011
R	R squared	adj. R squ.	±	NSMT3	-0.00249	0.001	-2.796	-3.44	0.001
	0.729	0.532	0.516	NSMT2	4.546	1.055	0.615	4.309	0
			0.97683278	NSMT1	-3.29	1.545	-1.866	-2.13	0.036
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
306 NBall	none	PC MT S	stepwise	O (Constant)	8.332	0.321		25.94	0
R	R squared	adj. R squ.	±	NSMT2	-5.867	1.51	-0.628	-3.89	0
	0.384	0.148	0.128	NSMT1	-1.029	0.36	-0.461	-2.86	0.005
			1.6574						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
307 NBall	none	PC MT S	backward	O (Constant)	4.265	2.265		1.883	0.063
R	R squared	adj. R squ.	±	NSMT1	-5.678	2.588	-2.546	-2.19	0.031
	0.423	0.179	0.15	NSMT2	-7.588	1.767	-0.812	-4.29	0
			1.6363	NSMT3	-0.0022	0.001	-1.95	-1.81	0.073
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
308 NBall	none	PC MT S	step+back	D NO RELATION					
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
309 NBall	none	PC MT S	step+back	T (Constant)	20.063	0.429		46.77	0
R	R squared	adj. R squ.	±	NSMT3	-0.00048	0	-0.387	-3.96	0
	0.387	0.15	0.14						
			1.8						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
310 NBall	none	PC UN	step+back	S (Constant)	52.222	7.397		7.06	0
R	R squared	adj. R squ.	±	NNUN1	211.916	30.16	0.788	7.027	0
	0.606	0.368	0.353	NNUN4	-158.962	28.37	-0.628	-5.6	0
			37.3141042						
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
311 NBall	none	PC UN	step+back	ln(S) (Constant)	2.906	0.236		12.32	0

R	R squared	adj. R squ.	±	NNUN1	5.015	1.194	0.616	4.202	0
0.694	0.482	0.458	1.03388328	NNUN4	-4.531	1.015	-0.592	-4.46	0
				NNUN5	-5.773	1.811	-0.347	-3.19	0.002
				NNUN3	4.681	2.074	0.405	2.256	0.027

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
312 NBall	none	PC UN	stepwise	O	(Constant)	7.472	0.33	22.63	0
R	R squared	adj. R squ.	±	NNUN4	5.358	1.233	0.553	4.347	0
0.425	0.181	0.162	1.6249	NNUN2	-5.056	1.499	-0.429	-3.37	0.001

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
313 NBall	none	PC UN	backward	O	(Constant)	7.513	0.328	22.92	0
R	R squared	adj. R squ.	±	NNUN1	4.073	2.444	0.396	1.667	0.099
0.454	0.206	0.179	1.6088	NNUN2	-8.993	2.79	-0.764	-3.22	0.002
				NNUN4	4.962	1.243	0.512	3.992	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
314 NBall	none	PC UN	step+back	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
315 NBall	none	PC UN	step+back	T	(Constant)	22.719	0.354	64.2	0
R	R squared	adj. R squ.	±	NNUN1	4.187	1.107	0.372	3.783	0
0.372	0.139	0.129	1.81						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
316 NBall	none	PC RM	step+back	S	(Constant)	-26.427	18.46	-1.43	0.156
R	R squared	adj. R squ.	±	NNRM1	334.005	51.06	1.293	6.542	0
0.589	0.347	0.332	37.9254342	NNRM4	-1.034	0.206	-0.993	-5.03	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
317 NBall	none	PC RM	stepwise	ln(S)	(Constant)	-0.07664	0.596	-0.13	0.898
R	R squared	adj. R squ.	±	NNRM1	8.962	1.682	1.146	5.327	0
0.671	0.45	0.431	1.05846358	NNRM4	-0.04569	0.007	-1.45	-6.11	0
				NNRM2	5.38	2.277	0.642	2.362	0.02

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
318 NBall	none	PC RM	backward	ln(S)	(Constant)	-0.396	0.617	-0.64	0.523
R	R squared	adj. R squ.	±	NNRM1	9.427	1.686	1.206	5.592	0
0.685	0.469	0.444	1.04678098	NNRM2	5.928	2.275	0.707	2.606	0.011
				NNRM3	0.02801	0.016	0.142	1.718	0.089
				NNRM4	-0.04941	0.008	-1.568	-6.41	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
319 NBall	none	PC RM	stepwise	O	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
320 NBall	none	PC RM	backward	O	(Constant)	11.091	0.881	12.59	0
R	R squared	adj. R squ.	±	NNRM2	-13.056	2.939	-1.231	-4.44	0
0.439	0.193	0.175	1.6126	NNRM4	0.05041	0.011	1.265	4.565	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
321 NBall	none	PC RM	step+back	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
322 NBall	none	PC RM	step+back	T	(Constant)	22.671	0.34	66.69	0
R	R squared	adj. R squ.	±	NNRM1	4.064	1.061	0.376	3.831	0
0.376	0.142	0.132	1.81						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
323 NBall	none	PC MT	step+back	S	(Constant)	42.148	8.555	4.927	0
R	R squared	adj. R squ.	±	NNMT3	-117.729	55.79	-0.206	-2.11	0.038
0.596	0.355	0.332	37.9098623	NNMT1	120.27	24.94	0.694	4.823	0
				NNMT2	159.165	39.1	0.584	4.07	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
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324	NBall	none	PC MT	step+back	In(S)	(Constant)	2.8	0.233		12.03	0
	R	R squared	adj. R squ.	±	NNMT3		-5.7	1.518	-0.33	-3.76	0
		0.691	0.478	0.46	1.03146845	NNMT1	3.681	0.678	0.702	5.425	0
					NNMT2		4.724	1.064	0.573	4.44	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
325	NBall	none	PC MT	step+back	O	(Constant)	7.632	0.322	23.71	0	
	R	R squared	adj. R squ.	±	NNMT2		-6.147	1.52	-0.589	-4.04	0
		0.397	0.158	0.138	1.6477	NNMT1	-2.688	0.967	-0.405	-2.78	0.007

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
326	NBall	none	PC RM	step+back	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
327	NBall	none	PC MT	step+back	T	(Constant)	22.678	0.355	63.87	0	
	R	R squared	adj. R squ.	±	NNMT1		2.607	0.717	0.36	3.636	0
		0.36	0.129	0.12	1.82						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
328	NBall	normalized	PC UN S	step+back	S	(Constant)	-4.026	5.738	-0.7	0.485	
	R	R squared	adj. R squ.	±	LSUN1		123.469	16.04	1.261	7.698	0
		0.661	0.437	0.424	35.2137449	LSUN3	-76.528	14.57	-0.861	-5.25	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
329	NBall	normalized	PC UN S	stepwise	In(S)	(Constant)	1.387	0.161	8.611	0	
	R	R squared	adj. R squ.	±	LSUN1		3.975	0.45	1.342	8.825	0
		0.718	0.515	0.504	0.98882101	LSUN3	-2.363	0.409	-0.878	-5.78	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
330	NBall	normalized	PC UN S	backward	In(S)	(Constant)	1.198	0.188	6.372	0	
	R	R squared	adj. R squ.	±	LSUN1		4.271	0.471	1.442	9.063	0
		0.731	0.534	0.518	0.97493888	LSUN3	-2.701	0.442	-1.004	-6.12	0
					LSUN5		1.205	0.642	0.151	1.877	0.064

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
331	NBall	normalized	PC UN S	stepwise	O	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
332	NBall	normalized	PC UN S	backward	O	(Constant)	7.862	0.332	23.72	0	
	R	R squared	adj. R squ.	±	LSUN1		5.195	1.744	1.387	2.979	0.004
		0.536	0.288	0.255	1.5326	LSUN2	-12.947	2.814	-3.091	-4.6	0
					LSUN3		1.792	1.068	0.527	1.678	0.097
					LSUN4		5.603	2.064	1.261	2.714	0.008

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
333	NBall	normalized	PC UN S	step+back	D	NO RELATION				
	R	R squared	adj. R squ.	±						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
334	NBall	normalized	PC UN S	step+back	T	(Constant)	20.788	0.27	77.03	0	
	R	R squared	adj. R squ.	±	LSUN1		1.639	0.398	0.4	4.123	0
		0.4	0.16	0.151	1.79						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
335	NBall	normalized	PC RM S	step+back	S	(Constant)	-8.754	6.097	-1.44	0.155	
	R	R squared	adj. R squ.	±	LSRM1		115.22	14.63	1.427	7.875	0
		0.666	0.444	0.432	34.9827435	LSRM3	-93.651	16.11	-1.054	-5.81	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
336	NBall	normalized	PC RM S	stepwise	In(S)	(Constant)	1.217	0.168	7.229	0	
	R	R squared	adj. R squ.	±	LSRM1		3.767	0.404	1.542	9.319	0
		0.733	0.537	0.526	0.96638849	LSRM3	-2.97	0.445	-1.104	-6.67	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
337	NBall	normalized	PC RM S	backward	In(S)	(Constant)	1.035	0.192	5.399	0

R	R squared	adj. R squ.	±	LSRM1	4.03	0.422	1.65	9.554	0
0.745	0.555	0.54	0.95240858	LSRM3	-3.275	0.467	-1.218	-7.01	0
				LSRM5	1.182	0.623	0.145	1.898	0.061

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	
338 NBall	normalized	PC RM S	stepwise	O	NO RELATION

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
339 NBall	normalized	PC RM S	backward	O	(Constant)	7.78	0.343		22.66	0
R	R squared	adj. R squ.	±	LSRM1	5.207	1.773	1.686	2.938	0.004	
0.531	0.281	0.248	1.5392	LSRM2	-11.776	2.624	-2.846	-4.49	0	
				LSRM3	2.235	0.981	0.657	2.279	0.025	
				LSRM4	4.835	1.971	0.628	2.454	0.016	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	
340 NBall	normalized	PC RM S	step+back	D	NO RELATION

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
341 NBall	normalized	PC RM S	step+back	T	(Constant)	20.765	0.275		75.39	0
R	R squared	adj. R squ.	±	LSRM1	1.341	0.328	0.397	4.086	0	
0.397	0.158	0.149	1.79							

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
342 NBall	normalized	PC MT S	step+back	S	(Constant)	-19.647	7.881		-2.49	0.015
R	R squared	adj. R squ.	±	LSMT1	41.859	5.653	0.834	7.404	0	
0.623	0.388	0.374	36.7090647	LSMT2	142.546	25.01	0.642	5.7	0	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
343 NBall	normalized	PC MT S	step+back	In(S)	(Constant)	0.694	0.201		3.456	0.001
R	R squared	adj. R squ.	±	LSMT1	1.531	0.144	1.008	10.63	0	
0.752	0.566	0.556	0.93552886	LSMT2	5.173	0.637	0.77	8.117	0	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
344 NBall	normalized	PC MT S	step+back	O	(Constant)	8.42	0.355		23.7	0
R	R squared	adj. R squ.	±	LSMT2	-4.445	1.127	-0.523	-3.94	0	
0.388	0.15	0.131	1.6548	LSMT1	-0.662	0.255	-0.345	-2.6	0.011	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	
345 NBall	normalized	PC MT S	step+back	D	NO RELATION

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
346 NBall	normalized	PC MT S	step+back	T	(Constant)	20.778	0.284		73.27	0
R	R squared	adj. R squ.	±	LSMT1	0.791	0.206	0.377	3.844	0	
0.377	0.142	0.133	1.81							

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
347 NBall	normalized	PC UN	stepwise	S	(Constant)	32.915	5.294		6.217	0
R	R squared	adj. R squ.	±	LNUN1	152.485	19.49	0.71	7.824	0	
0.641	0.41	0.397	36.0296356	LNUN4	-53.017	16.57	-0.29	-3.2	0.002	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
348 NBall	normalized	PC UN	backward	S	(Constant)	28.973	5.747		5.042	0
R	R squared	adj. R squ.	±	LNUN1	146.641	19.61	0.683	7.479	0	
0.655	0.429	0.409	35.6671797	LNUN3	57.27	34.24	0.223	1.673	0.098	
				LNUN4	-82.926	24.26	-0.454	-3.42	0.001	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
349 NBall	normalized	PC UN	step+back	In(S)	(Constant)	2.36	0.17		13.92	0
R	R squared	adj. R squ.	±	LNUN1	5.172	0.589	0.796	8.783	0	
0.723	0.523	0.501	0.99195163	LNUN4	-3.078	0.691	-0.557	-4.45	0	
				LNUN3	2.242	0.952	0.289	2.354	0.021	
				LNUN5	1.479	0.667	0.181	2.216	0.029	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
350 NBall	normalized	PC UN	stepwise	O	(Constant)	8.071	0.24		33.58	0

R	R squared	adj. R squ.	±	LNUN4	3.602	0.827	0.516	4.353	0
0.455	0.207	0.189	1.5989	LNUN2	-4.763	1.134	-0.498	-4.2	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
351 NBall	normalized	PC UN	backward	O (Constant)	8.07	0.248		32.48	0
R	R squared	adj. R squ.	±	LNUN1	5.302	1.829	0.645	2.898	0.005
0.535	0.286	0.253	1.534	LNUN2	-12.81	2.824	-1.338	-4.54	0
				LNUN3	5.564	2.145	0.567	2.593	0.011
				LNUN4	2.056	1.07	0.294	1.922	0.058

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
352 NBall	normalized	PC UN	step+back	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
353 NBall	normalized	PC UN	step+back	T (Constant)	21.905	0.207		105.7	0
R	R squared	adj. R squ.	±	LNUN1	3.348	0.883	0.373	3.79	0
0.373	0.139	0.129	1.81						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
354 NBall	normalized	PC RM	step+back	S (Constant)	29.355	5.151		5.699	0
R	R squared	adj. R squ.	±	LNRM1	150.858	18.5	0.757	8.153	0
0.656	0.43	0.417	35.4162772	LNRM3	-68.208	16.77	-0.377	-4.07	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
355 NBall	normalized	PC RM	step+back	ln(S) (Constant)	2.384	0.154		15.5	0
R	R squared	adj. R squ.	±	LNRM1	5.42	0.55	0.899	9.861	0
0.73	0.534	0.517	0.97512449	LNRM3	-2.441	0.483	-0.446	-5.05	0
				LNRM5	1.513	0.649	0.185	2.33	0.022

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
356 NBall	normalized	PC RM	stepwise	O (Constant)	8.103	0.239		33.89	0
R	R squared	adj. R squ.	±	LNRM3	3.984	0.877	0.576	4.545	0
0.454	0.206	0.188	1.5998	LNRM2	-4.563	1.111	-0.521	-4.11	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
357 NBall	normalized	PC RM	backward	O (Constant)	7.934	0.255		31.11	0
R	R squared	adj. R squ.	±	LNRM1	5.361	1.885	0.703	2.844	0.006
0.532	0.283	0.249	1.5379	LNRM2	-11.24	2.513	-1.282	-4.47	0
				LNRM3	3.081	0.962	0.446	3.204	0.002
				LNRM4	5.799	2.168	0.436	2.675	0.009

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
358 NBall	normalized	PC RM	step+back	D	NO RELATION				

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
359 NBall	normalized	PC RM	step+back	T (Constant)	21.895	0.204		107.4	0
R	R squared	adj. R squ.	±	LNRM1	3.219	0.815	0.386	3.95	0
0.386	0.149	0.14	1.8						

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
360 NBall	normalized	PC MT	step+back	S (Constant)	5.87	6.483		0.905	0.368
R	R squared	adj. R squ.	±	LNMT1	73.315	11.15	0.63	6.577	0
0.602	0.362	0.348	37.4691645	LNMT2	133.98	25.19	0.509	5.32	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
361 NBall	normalized	PC MT	step+back	ln(S) (Constant)	1.636	0.165		9.914	0
R	R squared	adj. R squ.	±	LNMT1	2.76	0.284	0.783	9.728	0
0.741	0.549	0.539	0.95354127	LNMT2	4.862	0.641	0.611	7.586	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
362 NBall	normalized	PC MT	step+back	O (Constant)	8.371	0.286		29.25	0
R	R squared	adj. R squ.	±	LNMT2	-4.385	1.112	-0.436	-3.94	0
0.388	0.151	0.132	1.6542	LNMT1	-1.016	0.492	-0.228	-2.06	0.042

GROUP	TRANS	DATATYPE	METHOD	PARAMETER
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363	NBall	normalized	PC MT	step+back	D	NO RELATION					
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
364	NBall	normalized	PC RM	step+back	T (Constant)	21.647	0.192		112.9	0	
	R	R squared	adj. R squ.	±	LNMT1	1.735	0.482	0.356	3.598	0.001	
		0.356	0.127	0.117	1.82						
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
365	TOC NBall	none	PC UN S	step+back	TOC (Constant)	-5.097	1.229		-4.15	0.001	
	R	R squared	adj. R squ.	±	NSUN2	32.271	2.711	1.531	11.9	0	
		0.941	0.886	0.874	2.683	NSUN4	-33.594	4.179	-1.034	-8.04	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
366	TOC NBall	none	PC UN S	step+back	ln(TOC) (Constant)	0.005475	0.283		0.019	0.985	
	R	R squared	adj. R squ.	±	NSUN2	3.932	0.625	1.337	6.29	0	
		0.83	0.689	0.656	0.61862346	NSUN4	-3.922	0.964	-0.865	-4.07	0.001
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
367	TOC NBall	none	PC RM S	step+back	TOC (Constant)	-4.85	1.237		-3.92	0.001	
	R	R squared	adj. R squ.	±	NSRM2	31.814	2.751	1.708	11.57	0	
		0.939	0.882	0.87	2.727	NSRM3	-34.467	4.191	-1.214	-8.22	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
368	TOC NBall	none	PC RM S	step+back	ln(TOC) (Constant)	0.03544	0.283		0.125	0.902	
	R	R squared	adj. R squ.	±	NSRM2	3.851	0.63	1.481	6.115	0	
		0.827	0.683	0.65	0.6243221	NSRM3	-3.998	0.959	-1.009	-4.17	0.001
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
369	TOC NBall	none	PC MT S	step+back	TOC (Constant)	-5.554	1.306		-4.25	0	
	R	R squared	adj. R squ.	±	NSMT2	41.916	4.947	0.969	8.474	0	
		0.937	0.878	0.865	2.774	NSMT1	16.125	1.379	1.338	11.7	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
370	TOC NBall	none	PC MT S	stepwise	ln(TOC) (Constant)	-1.809	0.585		-3.09	0.006	
	R	R squared	adj. R squ.	±	NSMT3	-0.00094	0	-1.053	-6.04	0	
		0.811	0.658	0.622	0.64865213	NSMT2	3.861	1.052	0.64	3.67	0.002
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
371	TOC NBall	none	PC MT S	backward	ln(TOC) (Constant)	-0.03892	0.298		-0.13	0.898	
	R	R squared	adj. R squ.	±	NSMT1	1.97	0.315	1.171	6.261	0	
		0.821	0.674	0.64	0.63337608	NSMT2	4.851	1.129	0.803	4.295	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
372	TOC NBall	none	PC UN	step+back	TOC (Constant)	14.25	1.114		12.79	0	
	R	R squared	adj. R squ.	±	NNUN2	62.343	5.83	1.135	10.69	0	
		0.927	0.859	0.844	2.983	NNUN4	-32.815	4.534	-0.768	-7.24	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
373	TOC NBall	none	PC UN	step+back	ln(TOC) (Constant)	2.391	0.257		9.291	0	
	R	R squared	adj. R squ.	±	NNUN2	7.381	1.346	0.963	5.483	0	
		0.784	0.614	0.574	0.68870745	NNUN4	-3.74	1.047	-0.627	-3.57	0.002
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
374	TOC NBall	none	PC RM	step+back	TOC (Constant)	-4.709	3.765		-1.25	0.226	
	R	R squared	adj. R squ.	±	NNRM2	97.588	12.75	1.95	7.655	0	
		0.886	0.784	0.762	3.691	NNRM4	-0.268	0.048	-1.427	-5.6	0
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
375	TOC NBall	none	PC RM	step+back	ln(TOC) (Constant)	0.248	0.744		0.333	0.743	
	R	R squared	adj. R squ.	±	NNRM2	11.382	2.521	1.63	4.515	0	
		0.753	0.567	0.521	0.72982002	NNRM4	-3.04E-02	0.009	-1.16	-3.22	0.005
GROUP		TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.	
376	TOC NBall	none	PC MT	step+back	TOC (Constant)	14.316	####		14.06	0	
	R	R squared	adj. R squ.	±	NNMT1	41.631	3.589	1.298	11.6	0	

		0.937	0.878	0.865	2.775	NNMT2	46.413	5.058	1.027	9.176	0
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
377	TOC NBall	none	PC MT	step+back	In(TOC)	(Constant)	2.402	0.25	9.613	0	
R	R squared	adj. R squ.	±	NNMT1	4.916	0.881	1.098	5.58	0		
	0.789	0.623	0.583	0.68102102	NNMT2	5.281	1.242	0.837	4.254	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
378	TOC NBall	normalized	PC UN S	step+back	TOC	(Constant)	-5.063	1.666	-3.04	0.007	
R	R squared	adj. R squ.	±	LSUN3	-16.13	3.507	-0.86	-4.6	0		
	0.9	0.811	0.791	3.455	LSUN2	35.219	4.383	1.502	8.035	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
379	TOC NBall	normalized	PC UN S	stepwise	In(TOC)	(Constant)	0.398	0.294	1.356	0.19	
R	R squared	adj. R squ.	±	LSUN1	1.94	0.394	0.74	4.919	0		
	0.74	0.547	0.525	0.72716367							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
380	TOC NBall	normalized	PC UN S	backward	In(TOC)	(Constant)	-0.186	0.374	-0.5	0.626	
R	R squared	adj. R squ.	±	LSUN1	2.815	0.527	1.074	5.339	0		
	0.843	0.71	0.662	0.61334339	LSUN3	-2.8	0.891	-1.069	-3.14	0.006	
					LSUN4	2.502	1.111	0.692	2.252	0.037	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
381	TOC NBall	normalized	PC RM S	step+back	TOC	(Constant)	-5.612	1.759	-3.19	0.005	
R	R squared	adj. R squ.	±	LSRM3	-17.313	3.634	-0.92	-4.76	0		
	0.897	0.804	0.783	3.519	LSRM2	36.452	4.58	1.537	7.96	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
382	TOC NBall	normalized	PC RM S	step+back	In(TOC)	(Constant)	0.231	0.274	0.842	0.41	
R	R squared	adj. R squ.	±	LSRM1	2.872	0.51	1.266	5.632	0		
	0.823	0.678	0.644	0.62961727	LSRM3	-1.728	0.59	-0.658	-2.93	0.009	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
383	TOC NBall	normalized	PC MT S	step+back	TOC	(Constant)	-7.713	2.136	-3.61	0.002	
R	R squared	adj. R squ.	±	LSMT1	11.423	1.434	1.039	7.964	0		
	0.878	0.771	0.747	3.798	LSMT2	25.886	5.156	0.655	5.02	0	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
384	TOC NBall	normalized	PC MT S	step+back	In(TOC)	(Constant)	-0.443	0.351	-1.26	0.222	
R	R squared	adj. R squ.	±	LSMT1	1.503	0.236	0.979	6.377	0		
	0.827	0.683	0.65	0.62432927	LSMT2	3.308	0.847	0.599	3.903	0.001	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
385	TOC NBall	normalized	PC UN	stepwise	TOC	(Constant)	6.096	1.12	5.442	0	
R	R squared	adj. R squ.	±	LNUN2	46.71	6.538	0.94	7.144	0		
	0.854	0.729	0.701	4.133	LNUN4	-11.896	4.534	-0.345	-2.62	0.017	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
386	TOC NBall	normalized	PC UN	backward	TOC	(Constant)	6.491	1.193	5.442	0	
R	R squared	adj. R squ.	±	LNUN1	32.298	4.016	0.93	8.043	0		
	0.888	0.788	0.753	3.757	LNUN3	26.389	7.606	0.538	3.469	0.003	
					LNUN4	-18.697	5.504	-0.543	-3.4	0.003	
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
387	TOC NBall	normalized	PC UN	stepwise	In(TOC)	(Constant)	1.824	0.162	11.28	0	
R	R squared	adj. R squ.	±	LNUN1	3.561	0.736	0.734	4.84	0		
	0.734	0.539	0.516	0.7335785							
GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.		
388	TOC NBall	normalized	PC UN	backward	In(TOC)	(Constant)	1.405	0.197	7.147	0	
R	R squared	adj. R squ.	±	LNUN1	4.22	0.662	0.87	6.374	0		
	0.839	0.705	0.655	0.61931554	LNUN3	3.806	1.254	0.556	3.035	0.007	
					LNUN4	-2.554	0.907	-0.531	-2.82	0.011	

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
389 TOC NBall	normalized	PC RM	stepwise	TOC (Constant)	9.094	0.993		9.16	0
R	R squared	adj. R squ.	±	LNRM1	27.971	4.585	0.807	6.101	0
	0.807	0.65	0.633	4.579					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
390 TOC NBall	normalized	PC RM	backward	TOC (Constant)	5.139	1.261		4.075	0.001
R	R squared	adj. R squ.	±	LNRM1	18.618	6.505	0.537	2.862	0.011
	0.906	0.822	0.78	3.547					
				LNRM2	31.758	10.3	0.646	3.084	0.007
				LNRM3	-15.587	4.303	-0.459	-3.62	0.002
				LNRM5	9.987	5.048	0.243	1.978	0.064

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
391 TOC NBall	normalized	PC RM	stepwise	ln(TOC) (Constant)	1.772	0.15		11.84	0
R	R squared	adj. R squ.	±	LNRM1	3.725	0.691	0.77	5.389	0
	0.77	0.592	0.572	0.69032618					

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
392 TOC NBall	normalized	PC RM	backward	ln(TOC) (Constant)	1.305	0.202		6.476	0
R	R squared	adj. R squ.	±	LNRM1	5.072	0.748	1.048	6.782	0
	0.854	0.729	0.683	0.59358914					
				LNRM3	-2.312	0.802	-0.488	-2.88	0.01
				LNRM4	3.198	1.261	0.434	2.536	0.021

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
393 TOC NBall	normalized	PC MT	step+back	TOC (Constant)	0.977	1.414		0.691	0.498
R	R squared	adj. R squ.	±	LNMT1	22.447	3.241	0.867	6.927	0
	0.858	0.736	0.708	4.081					
				LNMT2	24.411	5.473	0.559	4.461	0

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
394 TOC NBall	normalized	PC MT	step+back	ln(TOC) (Constant)	0.71	0.222		3.2	0.005
R	R squared	adj. R squ.	±	LNMT1	3.009	0.509	0.833	5.917	0
	0.816	0.667	0.631	0.64039669					
				LNMT2	3.115	0.859	0.511	3.627	0.002

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
395 TOC All	none	LN	stepwise	TOC (Constant)	5.296	1.307		4.053	0
R	R squared	adj. R squ.	±	DPC	97.493	26.9	0.389	3.625	0.001
	0.867	0.752	0.712	3.783					
				DOS	159.063	34.77	0.464	4.575	0
				DOOR	126.488	36.57	0.366	3.459	0.002
				PCOMP	-20.996	7.042	-0.308	-2.98	0.006

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
396 TOC All	none	RM	stepwise	TOC (Constant)	5.636	1.361		4.142	0
R	R squared	adj. R squ.	±	DPC	87.006	28.55	0.347	3.047	0.005
	0.852	0.725	0.681	3.98					
				DOGS	80.12	19.72	0.438	4.062	0
				DOOR	130.195	38.43	0.377	3.388	0.002
				PCOMP	-21.252	7.434	-0.311	-2.86	0.008

GROUP	TRANS	DATATYPE	METHOD	PARAMETER	B	±	stand. beta	t	sig.
397 TOC All	none	MT	stepwise	TOC (Constant)	4.067	1.411		2.882	0.008
R	R squared	adj. R squ.	±	DOOR	184.881	47.76	0.535	3.871	0.001
	0.718	0.515	0.459	5.182					
				DPAM	589.539	237.2	0.34	2.486	0.02
				MULTI	19.589	9.058	0.298	2.163	0.04