**The paleolimnology of
Haynes Lake, and Teapot Lake, Ontario:
documenting anthropogenic disturbances within
Canada's largest city**

By

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in partial fulfillment of the requirements for the degree of

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Chapter 1. General Introduction

At Carleton University, students are encouraged to publish the results of their research. Therefore, a thesis can be formatted as a manuscript at the outset, to ease the process of submission to a scientific journal. As a result, this thesis has been formatted so that two journal articles can be extracted and published. The first, a study of Haynes Lake, Ontario (Chapter 2), will be submitted to "Environmental Geology" and the second, a study of Teapot Lake, Ontario (Chapter 3) will be submitted to "Hydrobiologia".

The human ecological footprint is a method of measuring anthropogenic impacts to ecosystems. The Greater Toronto Area (GTA) has been drastically changed since humans have settled in the area, and, therefore this area scores very high on the human influence index. Haynes Lake (43° 57'57"N; 79° 24'42"W) and Teapot Lake (43°45'14"N; 79°48'14"W) were the focus of this research given their location within the GTA, and their close proximity to Swan Lake (43° 57'00"N; 79° 24'51"W), Ontario, and the subject of my undergraduate research project. Haynes Lake, like Swan Lake, is located on the Oak Ridges Moraine (ORM), an area recognized for containing an important source of ground water for the Greater Toronto Area (GTA), and also one that is biologically diverse. The purpose of this research is to study anthropogenic and natural stressors on Haynes Lake, and evaluate the degree of change that may have occurred with the movement of the human species into the region, using diatoms and thecamoebians extracted from lake sediments as the biological proxy. Further, I

evaluated if similar anthropogenic changes to the landscape clearly evident in the Swan Lake aquatic ecosystem were also evident in Haynes Lake.

Although Teapot Lake is not located on the ORM, it is also located within the GTA. Visual inspection of water property data from Teapot Lake indicated the lake may be meromictic, and might therefore provide a detailed record of the history of the lake. The land surrounding Teapot Lake, except for a small, thick screen of forest, has been subjected to clearance first for agriculture and housing for European settlers, and, more recently, for many highways and housing to accommodate explosive population growth in the area. Therefore, Teapot Lake was studied to determine if anthropogenic changes to the landscape, confirmed through palynology, could be detected in the aquatic ecosystem, also using diatoms as the biological proxy, and if so, were these changes similar to changes observed in Haynes Lake and in Swan Lake.

The results of these studies indicate that Haynes Lake showed evidence of similar impacts to the aquatic ecosystem as were observed in the Swan Lake study. Both lakes indicated that anthropogenic alterations of the landscape had an impact on the aquatic ecosystem. Conversely, the results of the Teapot Lake study did not show significant changes in the aquatic ecosystem using diatoms as the biological proxy even though it was shown that the lake is meromictic, and therefore the sediments should provide an accurate record of changes to the lake concomitant with anthropogenic stresses. It is hypothesized that either the

sediments have been disturbed when the massive roadways were constructed or repaired nearby, or phosphorus is not biologically available for diatom growth due to the meromictic nature of the lake.

Table of Contents

Acknowledgements and Contributions.....	1
Chapter 1. General Introduction	3
List of Figures and Tables.....	8
Chapter 2. The paleolimnology of Haynes Lake, Oak Ridges Moraine, Ontario: documenting 700 years of anthropogenic disturbance	9
Abstract.....	10
Introduction	11
Materials and methods.....	15
Study area.....	15
Sediment Core Details and Chronology	17
Diatom Preparation and Enumeration	19
Thecamoebian Preparation and Enumeration.....	21
Data Analysis	21
Results.....	23
Sediment Core Details and Chronology	23
Fossil Diatom Assemblages	27
Diatom-inferred pH (DI-pH) and Total Phosphorus (DI-TP).....	28
Fossil Thecamoebian Assemblages.....	31
Cluster Analysis	32
Discussion	36
Conclusions	41
References	42
Chapter 3. A paleolimnological study of meromictic Teapot Lake, Ontario	50
Abstract.....	51
Introduction	52
Materials and methods.....	54
Study area.....	54
Sedimentology and sediment core details.....	57
Chronology.....	57
Pollen Preparation and Enumeration.....	58
Pollen Data Analysis	59
Diatom Preparation and Enumeration	60
Diatom Data Analysis.....	61
Water Property Measurements	62
Results.....	63
Sedimentology	63
Palynology.....	66
Chronology.....	69
Water Properties and Physical Characteristics of Teapot Lake.....	73
Fossil Diatom Assemblages	80
Diatom-inferred pH and Total Phosphorus (DI-pH and DI-TP)	83
Discussion	85
Conclusions	90
References	92

Appendix 1. Diatom percent abundance data: Haynes Lake, Ontario	98
Appendix 2. Haynes Lake Diatom Subsampling Data	104
Appendix 3. Thecamoebian percent abundance data: Haynes Lake, Ontario..	105
Appendix 4. Haynes Lake ²¹⁰ Pb data	106
Appendix 5. Haynes Lake Water Chemistry Data	107
Appendix 6. Common diatom species images: Haynes Lake, Ontario	108
Appendix 7. Sediment core x-ray images: Haynes Lake, Ontario	112
Appendix 8. Diatom percent abundance data: Teapot Lake, Ontario	114
Appendix 9. Teapot Lake Diatom Subsampling Data	126
Appendix 10. Pollen percent abundance data: Teapot Lake, Ontario	128
Appendix 11. Teapot Lake ²¹⁰ Pb data	136
Appendix 12. Common diatom species images: Teapot Lake, Ontario	137
Appendix 13. Sediment core x-ray images: Teapot Lake, Ontario	141

List of Figures and Tables

Chapter 2 Figures and Tables

Fig. 1. Site Map of Haynes Lake, Ontario, Canada.	16
Fig. 2A. Haynes Lake Core x-ray: ~ 0 - 20 cm depth from core HYC1-1.....	24
Fig. 2B. Haynes Lake Core x-ray: ~ 14 - 34 cm depth from core HYC1-1.....	24
Fig. 2C. Haynes Lake Core x-ray: ~ 54 - 74 cm depth from Core HYC1-1.....	24
Fig. 2D. Haynes Lake Core x-ray: ~ 114 - 134 cm depth from core HYC1-2.....	25
Fig. 2E. Haynes Lake Core x-ray: ~ 134 - 154 cm depth from core HYC1-2.....	25
Fig. 3. Graph of Haynes Lake sediment age.	26
Fig. 4. Diatom percent abundance, DI-TP, and DI-pH from Haynes Lake, Ontario.	30
Fig. 5. Thecamoebian percent abundance from Haynes Lake, Ontario.	33
Fig. 6. Cluster analysis of diatom species percent abundance from Haynes Lake, Ontario.....	34
Fig. 7. Cluster analysis of thecamoebian species percent abundance from Haynes Lake, Ontario.....	35

Chapter 3 Figures and Tables

Fig. 1. Site map of Teapot Lake, Ontario, Canada.	56
Fig. 2A. Teapot Lake Core x-ray: ~ 20 - 40 cm depth from core TPLC2-1.	64
Fig. 2B. Teapot Lake core x-ray: ~ 130 - 150 cm depth from core TPLC2-2.	64
Fig. 2C. Teapot Lake Core x-ray: ~ 180 - 206 cm depth from core TPLC2-2.	64
Fig. 2D. Teapot Lake Core x-ray: ~ 285 - 305 cm depth from core TPLC2-3.	65
Fig. 2E. Teapot Lake Core x-ray: ~ 335 - 355 cm depth from core TPLC2-4.	65
Fig. 2F. Teapot Lake core x-ray: ~ 375 - 395 cm depth from core TPLC2-4.	65
Fig. 3. Teapot Lake Palynology.	68
Table 1. Teapot Lake Sediment and Wood Fragment ¹⁴ C Dating Results	70
Fig. 4A. Graph of Teapot Lake sediment age using ²¹⁰ Pb dating methods.	71
Fig. 4B. Graph of Teapot Lake sediment age using ²¹⁰ Pb and palynology.....	72
Table 2. Teapot Lake Water Property Profile, August 17, 2005.	77
Table 3. Teapot Lake Water Property Values.....	77
Fig. 5. Graph of Teapot Lake Water Temperatures from April 21, 2006 to March 16, 2007.	78
Fig. 6. Sub-bottom profiles of Teapot Lake, Ontario.....	79
Fig. 7. Diatom percent abundance, DI-TP, and DI-pH from Teapot Lake, Ontario.	81
Fig. 8. Cluster analysis of diatom species percent abundance from Teapot Lake, Ontario.....	84

Chapter 2. The paleolimnology of Haynes Lake, Oak Ridges Moraine, Ontario: documenting 700 years of anthropogenic disturbance

Abstract

Haynes Lake is a small kettle lake located on the Oak Ridges Moraine (ORM), Ontario, and is within the Greater Toronto Area (GTA); Canada's most populous region. The ORM is an important recharge and discharge area for ground water and drinking water in the GTA, and is a natural habitat for a diverse array of plant and animal species. Diatoms and thecamoebians extracted from Haynes Lake sediment cores were used as biological proxies to quantify changes in water chemistry through time, and thus infer changes in the limnology and ecosystem biology. High-resolution details of the sedimentary history of the lake were determined through x-ray analysis of the sediment cores. There were three periods of disturbance to the Haynes Lake ecosystem from *ca* A.D. 656 through to *ca* A.D. 2003 which were significant enough to cause major changes in lake sedimentation, the diatom flora, and thecamoebian fauna. The first disturbance was concomitant with Iroquoian population expansion in the area during the period from A.D. 1300 to A.D. 1550. The second period of disturbance occurred between *ca*. A.D. 1670 - 1750 following the first appearance of European settlers in the area. The most severe disturbance to the ecosystem, however, occurred *ca* A.D. 1890 due to increased erosion caused by a growing population of European settlers in the vicinity who cleared land for agriculture, housing and built a road adjacent to the lake.

Introduction

The global human footprint is expressed as the sum total of all ecological footprints of the human population (human influence index (HII)), and has been estimated to cover 83 % of the earth's landmass (Sanderson et al. 2002). Scoring ~ 60 % on the HII, it would be expected that heavily populated and industrialized southern Ontario, including the Toronto area, Canada's most populous region, has been significantly influenced by anthropogenic activity (Sanderson et al. 2002; Statistics Canada 2007a). The ultimate impact of anthropogenic disturbances through land use change and population growth on both short term and long term ecosystem stability is a subject of much debate (Burden et al. 1986b; Ekdahl et al. 2007; Patterson et al. 2002; Trombulak and Frissell 2000; Watchorn et al. 2008; Whitelaw and Eagles 2007). Measuring the impact of these disturbances can be an important first step in long-term conservation planning, which may help ensure that at least parts of Canada remain as the "last of the wild", and that developed areas containing small islands of biogeographical diversity do not lose the biological diversity that remains (Sanderson et al. 2002).

Early in the 17th century, European explorers arrived in the Great Lakes area to find already well-traveled trails leading from one body of water to another (Guillet 1933; Smith 1989). There is evidence that indigenous peoples inhabited Southern Ontario as early as A.D. 500, although it was not until some time between A.D. 1250 and A.D. 1420 that the Amerindian population of the area is estimated to have increased from ~11,000 to 29,000 individuals; a remarkable 1.07% per annum growth rate (Warrick 2000). Archaeological evidence of this

population increase has been found in the form of the remains of many native villages dating from this time, located in upland locations away from traditional settlement areas near major rivers and lakes, and separated from each other by only 20 - 30 km (Warrick 2000). This increase in population resulted in changes to the landscape as land was cleared for agriculture and settlements, and as deer became less significant in local diets (Kapches 1981). An excellent example of indirect paleolimnological evidence of anthropogenic disturbances has been observed in cores from Crawford Lake, Ontario, which was adjacent to a known Amerindian (Iroquoian) village, using diatoms and pollen as biological proxies of this pre-European settlement land use change (Ekdahl et al. 2007; McAndrews and Turton 2007). High population growth (ca A.D. 1300), combined with finite availability of food (maize, fish, game), necessitated the relocation of many Iroquoian communities as well as the founding of new ones (Warrick 2000). Migrating Iroquoian communities generally did not locate on the Oak Ridges Moraine region with its poorer soils, as compared to the sand plains found surrounding Lake Ontario. However, archaeological studies have found the remains of at least one Iroquoian settlement on the Oak Ridges Moraine dating from this period of population increase and migration. The Wilcox Lake Iroquoian settlement, the Esox site (see Fig. 1), was a 1.2 ha village (early A.D. 1300's) located on the eastern end of the Oak Ridges Moraine, and was within 2 km of Haynes Lake (Austin 1994). The Iroquoians subsequently left the Oak Ridges Moraine area by the year 1550 A.D., as the physical and geographical constraints of food resources around Lake Ontario encouraged relocation to the

north, particularly to the rich hunting grounds of the Lake Simcoe area (Warrick 2000; Stamp 1991).

Prior to A.D. 1825, Ontario was sparsely populated by Europeans, with only three communities having populations larger than 1000, with Toronto, then known as York, being one of them. In 1795, the Governor of Upper Canada, John Graves Simcoe, planned to build the first highway in the area, which was to follow existing Amerindian trails. This highway became known as Yonge Street, and was to be built over 25 years to open a route between Lake Ontario and Lake Huron. The first portion of the road, which extended to Lake Simcoe, was completed in a year, and opened the area to settlement (Stamp 1991). To counter American expansionism from the south, the British military further encouraged settlement by clearing land for agriculture and for more roads in this area between A.D. 1825 - 1851. As a direct result, Ontario experienced rapid population growth as settlers poured in to establish farms on the fertile soils of the province (Gentilcore and Wood 1978). As Ontario's population swelled, roads were extended north to the Precambrian Shield between A.D. 1861 and 1891. By A.D. 1878, the land immediately surrounding Haynes Lake had been cleared and was being farmed by several landowners including George Spraxton, Quetton St. George, Peter Baker and Christopher Smith (Canniff 1869; McGill University 2001). Evidence of significant anthropogenic disturbances to lake ecosystems as a result of this rapid 19th century population growth and associated land clearance have been seen in many lakes in Ontario. For example, studies

variously using diatoms, palynology and thecamoebians as biological proxies, in analysis of sediments from Grignac, Second, Swan and Crawford lakes have recorded significant impact to lake water quality as a result of disturbances to the landscape related to deforestation activities as the new settlements grew (Burden et al. 1986a; Patterson et al. 2002; Ekdahl et al. 2007; McAndrews and Turton 2007; Watchorn et al. 2008)

Previous research has indicated that it is possible to predict past water quality variables using a model based on the relationship between diatoms extracted from surface sediments and current water quality variables (Anderson 1995; Dixit et al. 2002; Enache and Prairie 2002; Hall and Smol 1996; Reavie and Smol 2001; Siver 1999; Watchorn et al. 2008). Similarly, many thecamoebian taxa have been shown to have preferences for particular environmental variables and, as such, analysis of changes in their populations provide important paleolimnological information (Kumar and Patterson 2000; Patterson and Kumar 2002; Patterson et al. 2002). The purpose of this study is to utilize both diatoms and thecamoebians to assess temporal changes in biological diversity in Haynes Lake, to determine whether both Medieval Iroquoian and 19th century European settlement activities have had a long lasting impact on lake water quality and ecosystem stability, and to compare results of this study with results of a study of Swan Lake, Ontario (Watchorn et al. 2008), located < 1 km to the southwest.

Materials and methods

Study area

Haynes Lake is a kettle lake located on the ORM (Fig. 1). The ORM area extends 160 km from the Trent River in the east to the Niagara Escarpment in the west. It is a >100 m-thick, till-glaciofluvial-glaciolacustrine sediment complex deposited as an inter-lobate moraine between about 13,000 and 15,000 years BP (Karrow 1989; Sharpe et al. 2004). This moraine acts as a recharge and discharge area for groundwater, supporting some 65 watercourses, and is a drinking water source for local communities (Gerber and Howard 2002; Whitelaw and Eagles 2007). The ORM also provides natural habitat for a large number of plant and animal species (Whitelaw and Eagles 2007). The ORM, with a population of approximately 100,000 residents, is situated within the Greater Toronto Area (GTA), which has a population of approximately 5.2 million people (2006 Census, Statistics Canada 2007b; Whitelaw and Eagles 2007).

Fig. 1. Site Map of Haynes Lake, Ontario, Canada.

Note the location of Swan Lake Ontario, <1 km to the west, and the Iroquoian settlement, Esos Site, 300 m to the east of Wilcox Lake, indicated with an arrow (DMTI Spatial Inc. 2003; Google Earth™ Mapping Service 2007; Natural Resources Canada 2002; Stamp 1991; Statistics Canada 2001).

Haynes Lake (43° 57'57"N; 79° 24'42"W) is one of many kettle depressions in the moraine (Fig. 1). It is a small lake, at 0.4 km long by 0.13 km wide, with a maximum depth of 16 m, and is at about 255 m above sea level. The surrounding land is level with the lake to the east and the south, while land on the north side lies about 20 m above water level, and land from mid-way between Wilcox Lake and Haynes Lake on the west side slopes gently towards the lake. There is a road (Regional Road 12) located immediately adjacent to the lake and well within the floodplain of Haynes Lake. When lake levels are high, particularly in the spring, a portion of the highway is often submerged. One house is situated on the north side of Haynes Lake, and there is a golf course just to the north of the house. The rest of the lake is surrounded by mixed deciduous and coniferous forest, with roads, farmland, and residential areas beyond. There were Common Cattails (*Typha latifolia* L.), Eurasian Water Milfoil (*Myriophyllum spicatum* L.), and zebra mussels (*Dreissena polymorpha* Pallas) observed in the water. Populations of Canada Geese (*Branta canadensis* L.) were also observed on the lake during spring and fall.

Sediment Core Details and Chronology

Sediment cores were extracted from the bottom of Haynes Lake (43° 57'55"N; 79° 24'48"W) using a Livingstone corer (Deevey 1965) on August 20, 2005 at 16 m water depth. One sediment core, Haynes HYC1, was collected in three sections measuring 94.5 cm, 96.0 cm, and 81.0 cm respectively, for a total of 269.5 cm. Two other cores, Haynes HYC2 and Haynes HYC3, were collected

from the same location to provide material for dating, and for study utilizing other proxies.

The three sections of the core used in this study (HYC1-1, HYC1-2, and HYC1-3) were x-rayed to identify distinct layers with a Kevex x-ray machine at 40 kV, and 27 - 44 mA, with exposure times ranging from 90 - 180 seconds. The images were captured on erasable phosphor plates and digitally recovered using an OREX scanner with VideoRen® software (version 1.0).

One sediment sample (1000 mg) from Haynes Core HYC1-3-22-23 (211 cm core depth) was sent to IsoTrace Radiocarbon Laboratory (University of Toronto) for bulk dating analysis. Two separate analyses (normal precision) were conducted, correcting for natural and sputtering isotope fractionation. Results were measured using the $^{13}\text{C}/^{12}\text{C}$ ratio, with sample age quoted as an uncalibrated conventional radiocarbon date in years before present, using the Libby ^{14}C mean life of 8033 years. The error represents the 68.3% confidence limit.

Thirteen samples from Haynes Core HYC3, taken from 0 – 36.5 cm core depth, were sent to the Science Museum of Minnesota for ^{210}Pb dating analysis. Dates and sedimentation rates were determined according to the c.r.s. (constant rate of supply) model (Appleby et al. 1986; Appleby and Oldfield 1978) with confidence intervals calculated by first-order error analysis of counting uncertainty (Binford 1990).

Diatom Preparation and Enumeration

Diatoms were used as a biological proxy in this study to infer changes in water chemistry through time. Diatoms deposited in Haynes Lake sediment were analyzed by extracting them from twenty 1 cm thick subsamples from Core HYC1, corresponding to a range of sample depths from 1 cm to 188.5 cm.

Approximately 1 cc of wet sediment was extracted, weighed and freeze-dried from each of the subsamples. The subsamples were then prepared for diatom analysis by weighing out 0.032 g - 0.058 g of dry sediment. A 10 ml solution of 50:50 nitric/sulfuric acid was added to each sediment sample and heated for approximately 20 minutes to remove organic material. The acid mixture was then diluted with distilled water and sonicated to disaggregate the diatom frustules into single valves. Subsequently, the acid was removed from the samples through centrifugation and a series of at least five distilled water dilutions. Finally, washed samples were stored for further processing in 45 ml of distilled water.

Aliquots of 0.5 ml from the washed diatom solution were pipetted onto 18 mm x 18 mm coverglasses and allowed to air-dry. The coverglasses were fixed onto microscope slides with Naphrax[®] mountant. Two microscope slides were prepared for each sample; one for analysis with a Leica DMR[®] light microscope with phase contrast optics, and the others as reserve slides for cross-reference and verification. Prior to diatom counting, two scanning electron microscope stubs was prepared from two samples to identify small diatoms using an FEI XL

Environmental Scanning Electron Microscope (ESEM). All of the quantified prepared microscope slides, the remaining subsample material, associated notes and photomicrographs are archived in the National Collection at the Canadian Museum of Nature, in Ottawa.

At least 600 diatoms were counted at 1600X magnification from each slide using a transect counting protocol (Pappas and Stoermer 1996; Watchorn et al. 2008). The number of valves per gram dry weight (total valves g⁻¹ dwt) and percent abundance were subsequently calculated for each taxon. Flux rates were subsequently determined using ²¹⁰Pb and sediment accumulation measures. The diatoms were identified using standard taxonomic references (e.g. Camburn and Charles 2000; Fallu et al. 2000; Germain 1981; Jahn et al. 2001; Krammer 1997a, b, 2000, 2002, 2003; Krammer and Lange-Bertalot 1986, 1988, 1991a, 1991b; Lange-Bertalot 2001; Lange-Bertalot and Krammer 1989; Lange-Bertalot et al. 1996; Meltzeltin et al. 2005; Patrick and Reimer 1966, 1975; Reavie and Smol 1998; Reichardt 1999; Round et al. 1990; Siver et al. 2005; Van de Vijver et al. 2004; Werum and Lange-Bertalot 2004).

Thecamoebian Preparation and Enumeration

Twenty samples for thecamoebian analysis were obtained from the same Haynes Lake subsamples as were used for diatom analysis. Each 1 cc sample prepared for thecamoebian study was screened with a 43 μm sieve to retain thecamoebians and to remove silts and clays. Wet aliquots were then examined under an Olympus binocular stereomicroscope at 40 - 80X magnification. Taxa identification followed Kumar and Dalby (1998). Each entire 1 cc sample was counted for thecamoebians. Relative fractional abundance was subsequently calculated for each taxonomic unit.

Data Analysis

A diatom-water quality transfer function for Haynes Lake was developed following the format of Watchorn et al. (2008) using the program C2 version 1.5 (Juggins 2005). Fifty lakes from the Reavie and Smol (2001) calibration set that had complete data for spring growing conditions, including pH, and total phosphorus (TP), were used as the calibration model to infer past water chemistry values in Haynes Lake. Lakes used in the calibration set are located <275 km to the east of Haynes Lake and are situated on bedrock formations of limestone (Trenton and Beekmantown formations), granitic (Precambrian Shield) rock, or a mixture of the two (Chapman and Putnam 1966). Reconstruction of past water chemistry values for Haynes Lake were generated using 85 taxa from the fossil assemblage that were also found in the Reavie and Smol (2001) calibration set. The species relative abundance data was square-root transformed for weighted

averaging (WA) analyses to reduce the effect of dominant taxa, as previously described in Reavie and Smol (2001).

MVSP version 3.13p software was used for cluster analysis to determine associations between core depth and diatom and thecamoebian species in Haynes Lake. The diatom and thecamoebian species percent abundance data was first square-root transformed to normalize the data, and then the Squared Euclidean (minimum variance) method of Cluster Analysis was used to determine the relationships.

Results

Sediment Core Details and Chronology

X-ray analysis indicated distinctive laminations and changes in sedimentology in Haynes Lake sediments through time (Fig. 2A, 2B, 2C, 2D, 2E). The top 30 cm of the core was composed of very dense, finely layered clay. In order to capture a clear x-ray image of this very dense section, the top 30 cm of the core was subjected to the longest exposure times and highest amperages of any section of the core. There was a distinctive change in sedimentology at 30 cm core depth, with layers higher in organic material (appearing as dark areas on the x-ray images) alternating with layers higher in clay content below this core depth. A thick, distinctive region of high organic content was observed at approximately 70 cm, with frequent changes in bedding orientation beginning at this horizon and continuing to about 140 cm depth, where bedding orientation returned to a horizontal orientation, as was observed in the top 70 cm of sediments.

Radiocarbon and ^{210}Pb dating methods indicate that the sediments recovered in the examined core span *ca* A.D. 656 (211.5 cm) to *ca* A.D. 2003 (1 cm), with a margin of error ranging from 2 to 47 years. Interpolation of these data using a second order polynomial curve ($R^2 = 0.998$) provided estimates for the ages of intervening sediment samples (Fig. 3).

Fig. 2A. Haynes Lake Core x-ray: ~ 0 - 20 cm depth from core HYC1-1.
The top direction is to the left.

Fig. 2B. Haynes Lake Core x-ray: ~ 14 - 34 cm depth from core HYC1-1.
The top direction is to the left.

Fig. 2C. Haynes Lake Core x-ray: ~ 54 - 74 cm depth from Core HYC1-1.
The top direction is to the left.

Fig. 2D. Haynes Lake Core x-ray: ~ 114 - 134 cm depth from core HYC1-2.
The top direction is to the left.

Fig. 2E. Haynes Lake Core x-ray: ~ 134 - 154 cm depth from core HYC1-2.
The top direction is to the left.

Fig. 3. Graph of Haynes Lake sediment age. Sediment age determined from ^{14}C and ^{210}Pb dating methods. A second order polynomial curve was fitted to interpolate dates between dated samples.

Fossil Diatom Assemblages

Ninety-six different taxa were identified from twenty-five genera in the Haynes Lake sediment core. Of these taxa, sixteen were present at >5% abundance in at least one sample and were deemed present in statistically significant enough amounts for subsequent analysis (Patterson and Fishbein, 1989). Species assemblages changed as sediment depth decreased, with particularly distinct changes noted through the top 30 cm and below 130 cm in the core (Fig. 4).

At the base of the core (188.5 - 140 cm), the dominant species were *Cyclotella comensis* Grunow 1882, *Cyclotella michiganiana* Skvortzow 1937, and *Cyclotella pseudostelligera* Hustedt 1939 (Fig. 4). Other prominent species included *Encyonema silesiacum* Bleisch 1861, *Nitzschia amphibia* Grunow 1862, *Fragilaria capucina* Desmazieres 1825 sensu lato and *Navicula cryptotenella* Krammer & Lange-Bertalot 1985. The diatom community changed dramatically at 130 cm core depth (ca. A.D. 1325), with *Fragilaria nanana* Lange-Bertalot 1993 temporarily increasing in abundance along with *Navicula cryptotenella*, *Encyonema silesiacum*, *Achnantheidium minutissimum* (Kützing) Czarnecki 1994, and *Fragilaria capucina* sensu lato. From 130 to ~ 30 cm (ca. A.D. 1325 - ca. A.D. 1890), there was a general decline in *Encyonema silesiacum* and *Nitzschia amphibia*, with successional increases in *C. pseudostelligera* (120 cm), *C. comensis* (100 cm), *Cyclotella bodanica* Grunow 1878 sensu lato (75 cm) and *C. michiganiana* (60 cm). From 30 - 2 cm, a clay layer was present with a successional shift in the diatom flora from *Fragilaria capucina*, *Navicula cryptotenella* and *Nitzschia amphibia* to *C. pseudostelligera* (30 cm), *Fragilaria*

nanana (15 cm), *Cyclotella michiganiana* (11 cm), and *Achnanthisidium minutissimum* (5 cm). At the top of the core (<5cm) *Asterionella formosa* Hassall 1850 and *Stephanodiscus medius* Håkansson, 1986, became more prominent in conjunction with a decline in the relative abundance of *A. minutissimum*. *Asterionella formosa* was absent down-core, but at the top of the core represented the third most dominant species, at 14.5% abundance. *Stephanodiscus medius* was also absent below 25 cm, but in the top 5 cm composed 12.9% of the assemblage.

Diatom-inferred pH (DI-pH) and Total Phosphorus (DI-TP)

There were distinct changes in spring diatom-inferred pH (Fig. 4) recognized throughout the Haynes Lake sediment core. The inferred pH ranged from 7.9 - 8.3 in the deepest part of the core (188.5 cm - 110 cm). The highest DI-pH (8.7) occurred at 100 cm core depth, and fluctuated between 7.9 and 8.5 from 80 cm core depth to 40 cm. At 30 cm core depth, the DI-pH dropped to 7.7 and remained near these levels to 1 cm depth, where it rose to 8.0. The lowest DI-pH was documented at 15 cm depth (7.6). Direct measurements of pH from Haynes Lake water samples provided values of 7.97 (August 2005), and 8.13 (September 2007), closely correlating with the diatom inferred pH value obtained in the top cm of the core.

Diatom-inferred total phosphorus (DI-TP) was subject to large error, and changes through time were not significant (Fig. 4). Interestingly, however, DI-TP at 1 cm core depth was determined to be 0.011 mg L^{-1} , while instrument measured TP

was nearly identical, ranging from 0.011 - 0.012 mg L⁻¹. The highest DI-TP values corresponded to 45 cm core depth at 0.013 mg L⁻¹, while the lowest values were observed at 110 - 120 cm and 30 cm core depth (~0.008 mg L⁻¹).

Fig. 4. Diatom percent abundance, DI-TP, and DI-pH from Haynes Lake, Ontario.

Taxa are represented if they are present in >5 % abundance in at least one sample. Diatom-inferred spring pH (DI-pH), and diatom-inferred spring total phosphorus (DI-TP) are also presented, with samples recovered from Core HYC1-1 and HYC1-2.

Fossil Thecamoebian Assemblages

Sixteen taxa were identified in the Haynes Lake core. Of these taxa, seven were present in at least 5% abundance in at least one sample (Fig. 5). In the lowermost core section (188.5 - 140 cm), the dominant species were *Arcella vulgaris* (Ehrenberg, 1830) and *Centropyxis aculeata* "discoides" (Ehrenberg, 1832). At 130 cm core depth, *A. vulgaris* remained the dominant thecamoebian. However a change in species composition was noted at this horizon, with *Cucurbitella tricuspis* (Carter, 1856) becoming the second most dominant species at 18 % abundance. *Arcella vulgaris* remained the dominant species until 30 cm core depth, when it dropped to 2 % abundance, and rose in abundance to 7 % abundance at 1 cm core depth. At 60 cm core depth, the assemblage was almost entirely comprised of *C. tricuspis* and *A. vulgaris* (ca. 1750 A.D.). Above this core depth, *Centropyxis aculeata* "aculeata" (Ehrenberg, 1832) increased in abundance (at 50 cm) generally making up >20 % of the assemblage to the top of the core. *C. triscuspis* temporarily decreased in abundance above 50 cm, increasing to at ~ 40% at 30 cm. *Cucurbitella tricuspis* abundance remained at >28 % above this horizon, becoming the dominant species at 1 cm depth (62 % abundance).

Cluster Analysis

Cluster analysis of the diatom data resulted in recognition of three main clusters, with the most distinctive cluster comprising the samples from the top 30 cm of the core (Fig. 6). This cluster was separated from the next closest cluster by about 2.5 times the squared Euclidean distance, while a distance of approximately 5.5 times the squared Euclidean distance separated the third cluster. Cluster analysis of the thecamoebian data (Fig. 7) also resulted in recognition of three main clusters, with the most obvious cluster also comprising samples from the top 30 cm.

Fig. 5. Thecamoebian percent abundance from Haynes Lake, Ontario. Taxa are represented if they are present in >5% abundance in at least one sample. Samples were recovered from sediment cores HYC1-1 and HYC1-2.

Fig. 6. Cluster analysis of diatom species percent abundance from Haynes Lake, Ontario. Samples analyzed are indicated by M-1, M-5...M-189, with the number following the M being the core depth of the sample, measured in cm. Samples were recovered from Core HYC1-1 and HYC1-2.

Fig. 7. Cluster analysis of thecamoebian species percent abundance from Haynes Lake, Ontario. The numbers on the right side indicate the core depth (in cm) of the samples analyzed. Samples were recovered from Core HYC1-1 and HYC1-2

Discussion

Interpretation of the microfossil and sedimentary record from a core collected from Haynes Lake, ORM, Ontario, spanning the period from *ca.* A.D. 656 to the present indicates that there were three periods of significant disturbance to the lake ecosystem through this interval. These disturbances, all associated with major changes in sedimentology, diatom flora assemblages and thecamoebian fauna assemblages, can all be linked to human-induced alteration of the surrounding landscape.

Frequent changes in bedding orientation of the sediments commencing above 140 cm core depth, as observed through x-ray analysis (Figs. 2D, 2E), provide the earliest record that the lake was altered. A major change in the diatom flora at 130 cm core depth (*ca.* A.D. 1325 A.D.) is also indicative of a significant change to the lake ecosystem. For example, *Fragilaria capucina* sensu lato, *Fragilaria nanana* and *Achnantheidium minutissimum*, an epiphytic species that can tolerate a broad range of disturbance conditions (Beaver 1981; Potapova and Hamilton 2008), were found to increase in abundance at this horizon.

Cyclotella bodanica also decreased in abundance in comparison to assemblages found in older sediments in the core. These changes in the core record correlate well with increases in the rate of Iroquoian population growth, which has been linked to increased rates of land clearance for maize agriculture in Southern Ontario (Warrick 2000), suggesting a link between anthropogenic activities and changes in the lake ecosystem. The limnological changes observed in Haynes

Lake are similar to lake ecosystem modifications observed at Crawford Lake ~ 70 km to the west, on the Niagara Escarpment, which has also been linked to Iroquoian agricultural land clearance. As observed at Haynes Lake, *A. minutissimum* increased in abundance in sediments deposited in Crawford Lake following Iroquoian settlement of the area (Ekdahl et al. 2007). Similarly, *C. bodanica* decreased in abundance in Crawford Lake through this interval, as also observed at Haynes Lake (Ekdahl et al. 2007).

Significant changes in the thecamoebian fauna also occurred at the 130 cm horizon in Haynes Lake, when *Cucurbitella tricuspis*, a species that has been correlated with eutrophic conditions (Patterson et al. 2002), dramatically increased in abundance. These results also correlate well with the results of a paleolimnological study at nearby Swan Lake, where an ecologically destabilized assemblage of thecamoebians indicated there was a period of deforestation spanning the interval from ca. A.D. 1350 - A.D. 1700 (Patterson et al. 2002). These observations provide corroborative evidence that there was a significant widespread environmental impact on lake ecosystems caused by the higher rate of land clearance for maize agriculture, that was required to support the expanding Iroquoian populations, and increased number of native villages in the 14th and 15th centuries. Indeed, the close proximity (<2 km) of the Wilcox Lake archaeological site (Esox Site; Fig. 1) to Haynes Lake presents even stronger evidence for direct links between land clearance for maize agriculture there, and

its impact on local water quality and lake biodiversity (Austin 1994; Stamp 1991; Warrick, 2000).

Analysis of the 75 - 60 cm interval of the Haynes Lake core provides evidence of a second period of disturbance as indicated by changes in sedimentology, and diatom and thecamoebian assemblages. This interval was deposited *ca.* A.D. 1670 - 1750 and correlates with the first contact between the Iroquoians and Europeans who arrived from France and began initial settlement of the area by building forts in Toronto and Niagara, and then later by clearing and burning the virgin forest to make way for housing and agricultural activities (Guillet 1946; Smith 1989; Mitchell 1952). X-rayed images of the core reveal that changing sedimentation patterns that characterized the 140 - 70 cm interval in the core differed from the horizontal, laminar style of sedimentation above 70 cm (Fig. 2C). A major change in the diatom assemblage through the 75 - 60 cm interval provides biological evidence of the changing land-use patterns, with *C. michiganiana*, a meso-eutrophic planktonic species (Ek Dahl et al. 2007), becoming the dominant species by 60 cm core depth. *Cyclotella pseudostelligera* decreased in importance at 75 cm depth, while *Cyclotella bodanica*, also a meso-eutrophic species (Reavie et al. 1995), appeared in the assemblage in significant numbers for the first time at the 75 cm horizon. Above the 60 cm core horizon (*ca.* 1750 A.D.), the thecamoebian assemblage in the Haynes Lake sediment core are almost entirely composed of the alkaliphilic species *C. tricuspis* and *A. vulgaris*, a stressed environment indicator (Patterson

and Kumar 2001), providing further evidence of significant land-use change in the area around the lake.

The top 30 cm of the Haynes Lake sediment core, which encompasses the interval from *ca.* AD 1890 to the present day, correlates with the flood of European settlers that came to the area at that time (Canniff 1869). More precisely, clearance of the land immediately to the west of Haynes Lake probably began soon after parcels were granted to two settlers; William Bond, (Concession II, Lot 7, Whitchurch Township) in 1798 (Archives of Ontario 1979), who developed his land into a nursery and fruit farm (Guillet 1946), and William Wilcocks (Concession II, Lot 6, Whitchurch Township), in 1802. This portion of the core, with its high clay content, would have been deposited as a result of anthropogenic resuspended sediment, which was introduced as a consequence of erosion due to deforestation for housing and agriculture, and with the construction of Regional Road 12 along the edge of the lake (Gentilcore and Wood 1978; Langman 1971).

At 30 cm core depth (*ca.* A.D. 1890), changes in diatom species assemblage were also noted when *Cyclotella comensis*, *Navicula cryptotenella*, and *Nitzschia amphibia* all decreased in abundance. Also, *C. comensis*, a species associated with oligotrophic conditions (Sorvari and Korhola 1998), and *N. amphibia* did not appear in the assemblage above this core depth. The DI-pH ratio declined to 7.7 at 30 cm depth, and further declined to 7.6 at 15 cm depth, the lowest DI-pH ratio

of the samples that were analyzed, indicative of the clastic deposition of clay as shown by the x-ray results. Similar changes in diatom floral makeup have been observed with road construction and resultant clay input in other lakes (e.g. Third Sister Lake, Michigan; Hammer and Stoermer 1997).

The changes in the diatom species assemblage in Haynes Lake in the post-European settlement phase were not as significant as those noted to have occurred in Swan Lake during this same time period. At Swan Lake, the highest DI-TP levels were inferred to have occurred during the European settlement period, indicating a high degree of erosion due to deforestation (Watchorn et al., 2008), whereas changes in DI-TP across the European settlement horizon in Haynes Lake were much more equivocal, with large error estimates. The DI-pH ratio (Fig. 4), however, does provide a good way to explain temporal changes in the diatom species assemblages in Haynes Lake.

Thecamoebian data from the top 30 cm of the Haynes Lake sediment core agree with results observed in the diatom flora obtained from the same sample depths. Cluster analysis of both diatom and thecamoebian data indicate that this portion of the core is distinctly different from the rest of the core (Figs. 6, 7). Although *C. tricuspidis* continued as a dominant taxa above 30 cm, significant changes in thecamoebian assemblage are indicated by the emergence of *C. aculeata* "aculeata", another stressed environment indicator, as a dominant taxa through the top 30 cm, and by a large reduction in the proportion of *A. vulgaris* through

this interval. Changes in assemblage were also noted in nearby Swan Lake from the European settlement period, with *C. aculeata* and *A. vulgaris* present in higher proportions than that observed in older sediments (Patterson et al. 2002). This provides further evidence of the disturbed ecosystems that exist in many modern lakes as a direct result of anthropogenic disturbances to the landscape, such as erosion due to deforestation and road building, that occurred during the European settlement period (Hall and Smol 1996; Hammer and Stoermer 1997; Patterson et al. 2002; Reavie and Smol 2001; Watchorn et al. 2008).

Conclusions

This multiproxy dataset indicates varying degrees of disturbance occurred in the Haynes Lake ecosystem through the period from *ca.* A.D. 656 to *ca.* A.D. 2003. Both Iroquoian inhabitation and European settlement had an impact on lake water quality and sedimentation in Haynes Lake, with the most severe disturbance indicated by the diatom flora, the thecamoebian fauna, and sedimentology comprising the period from *ca.* A.D. 1890 to the present. Although the predicted changes in water quality (limnological impact) were not as significant as that observed in nearby Swan Lake, or in Crawford Lake, the same anthropogenic-induced alterations of the landscape caused a disturbance to the aquatic ecosystem in Haynes Lake, and these effects remain evident in the modern lake habitat.

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Chapter 3. A paleolimnological study of meromictic Teapot Lake, Ontario

Abstract

Teapot Lake (43°45'14"N; 79°48'14"W) is a small lake located within the Greater Toronto Area (GTA). Study of the water column indicated it is meromictic, therefore analysis of the sediment should provide an accurate record of past water conditions. Pollen and diatoms extracted from the sediment dated from *ca.* 5600 YBP to the present indicate only slight changes in the aquatic ecosystem concomitant with anthropogenic changes to the landscape for agriculture and housing by both Iroquoian inhabitants (*ca.* 500 A.D. to 1500 A.D.) and by European settlers (*ca.* A.D. 1850). Furthermore, changes in diatom-inferred pH and total phosphorus were not significant and subject to large error. This is contrary to many other published studies, indicating either the sediment record of Teapot Lake has been disturbed, or that excess phosphorus in the aquatic ecosystem is not available for diatom growth. It is possible that much of the available phosphorus doesn't circulate into the epilimnion due to the meromictic nature of Teapot Lake, and remains in the hypolimnion. Excess phosphorus becomes bound with iron and manganese observed in high concentrations below the thermocline to produce either iron-phosphates or manganese-phosphates.

Introduction

Meromictic lakes are noted for archiving detailed, undisturbed sediment records that are useful for studying lake histories since anoxic bottom waters preclude the presence of bioturbators (Cohen 2003; Ekdahl et al. 2007; Rybak and Dickman 1988; Smol et al. 1983). Biological proxies such as diatoms respond rapidly to any changes in lake ecosystems and will thus provide a detailed record of limnological change, particularly in the undisturbed sediments of meromictic lakes. Models developed based on observed diatom assemblages have been shown to be able to predict past water quality variables based on current optima (Anderson 1995; Hall and Smol 1996; Hall and Smol 1999; Patrick and Reimer 1966; Reavie and Smol 2001; Watchorn et al. 2008).

Palynology has also been proven to be a useful paleolimnological tool for determining past changes in the landscape, and for providing estimates for ages of sediment deposited in lakes (Allison et al. 1986; Bennett and Fuller 2002; Bhiry and Fillion 1996; Boucherle et al. 1986; Burden et al. 1986; Chalcote 2003). If used together, pollen and diatoms can provide a multiproxy paleolimnological lake history, and can be used to determine if there was a correlation between changes in the terrestrial ecosystem and changes in the aquatic ecosystem (Boucherle et al. 1986; St. Jacques et al. 2000; Watchorn et al. 2008)

Previous qualitative assessments and limited water property data collection from Teapot Lake, Heart Lake Conservation Area, Brampton, Ontario suggested that

the lake may be meromictic, since it is very small, deep and surrounded by a 100 m wide wind-blocking forest screen (Don Ford, Toronto and Region Conservation Authority (TRCA), personal communication 2005). Determination that the lake is meromictic would be very useful, as interpretation of the contained sedimentary record might provide an accurate record of changes to the aquatic ecosystem as a result of anthropogenic changes to the landscape in the Greater Toronto Area (GTA), a region that has changed drastically as a result of settlement and massive population growth, particularly in the adjacent Brampton area (Canniff 1869; Statistics Canada 2007).

The purpose of this study was to collect water property data from Teapot Lake over an extended period of time to determine whether the lake was, in fact, meromictic, and to determine if diatoms and pollen extracted from a Holocene sediment core could detect changes in the aquatic ecosystem concomitant with anthropogenic disturbances to the adjacent landscape.

Materials and methods

Study area

Teapot Lake is located in the Etobicoke Creek Watershed within the Heart Lake Conservation Area. The lake is 8 km north of the city of Brampton and on the Brampton Esker (Fig. 1). The Brampton Esker is about 8 km long and 1.8 km wide and formed during the retreat of the Lake Ontario ice lobe from the Brampton area ca. 13,300 YBP (Karrow et al. 1977; Motz and Morgan 2001). The esker is composed of coarse glaciofluvial sands and gravels, and is capped by a layer of clay till. The esker is an important aquifer and source of groundwater, with the sands and gravels holding and purifying water as it percolates downwards. The esker has been, and continues to be, an important source of aggregate for construction and road building in the Brampton area. The Heart Lake Conservation Area contains 43.5 hectares of deciduous, coniferous and mixed forest. This is the largest block of forest in a highly fragmented landscape (Karrow et al. 1977; Motz and Morgan 2001; TRCA 1998).

Teapot Lake (43°45'14"N; 79°48'14"W) is a very small but deep lake, measuring approximately 125 m wide and 125 m across, with a maximum depth of 12 m, and is located about 255 m above mean sea-level (AMSL). It is surrounded on all sides by an approximately 100 m wide band of thick forest cover consisting of a mixture of birch (*Betula* spp.), spruce (*Picea* spp.), pine (*Pinus* spp.), maple (*Acer* spp.), alder (*Alnus* spp.), poplar (*Populus* spp.), ash (*Fraxinus* spp.), tamarack (*Larix* spp.), highbush cranberry (*Vaccinium* spp.), and willow (*Salix* spp.).

Beyond the forested area, there is a mixture of farm, residential and commercial land uses supported by a substantial road network.

Fig. 1. Site map of Teapot Lake, Ontario, Canada.

(DMTI Spatial Inc. 2003; Google Earth™ Mapping Service 2007; Natural Resources Canada 2002; Statistics Canada 2001)

Sedimentology and sediment core details

One sediment core was collected in five sections measuring 109.0 cm (TPLC2-1), 97.0 cm (TPLC2-2), 108.0 cm (TPLC2-3), 107.5 cm (TPLC2-4), and 75.0 cm (TPLC2-5), for a total of 496.5 cm. The core was extracted from the center of Teapot Lake (43° 45' 147" N; 79° 48' 136 " W) on August 17, 2005 at a water depth of 12 m, using a Livingstone corer (Deevey 1965). Five other sediment cores were collected from Teapot Lake to provide material for dating, and for separate studies utilizing other proxies.

The five sections of the core were x-rayed to identify any subtle sedimentary features, and to recognize in particular, any laminar structure, with a Kevex x-ray machine at 40 kV, and 27 mA, with exposure times ranging from 90 - 180 seconds. The images were captured on erasable phosphor plates and digitally recovered using an OREX scanner with VideoRen® software (version 1.0).

Chronology

Thirteen samples from Teapot Lake Core TPLC1-1, from 0 - 18.9 cm core depth, were sent to the Science Museum of Minnesota for ^{210}Pb dating analysis. Core TPLC1-1 was taken from the same location as core TPLC2 (sections 1 through 5), which is the core that was used for diatom analysis. Dates and sedimentation rates were determined according to the c.r.s. (constant rate of supply) model (Appleby et al. 1986; Appleby and Oldfield 1978) with confidence intervals calculated by first-order error analysis of counting uncertainty (Binford 1990).

Several samples (TPLC2-3-35 [bulk sediment; 750 mg]; TPLC2-4-80 [bulk sediment; 634 mg]; TPLC4-3-4-5 [bulk sediment; 106 mg]; TPLC4-8-2-3 [bulk sediment; 876 mg]; TPLC1-5A 1-2 [wood fragment]) from Teapot Lake were sent to IsoTrace Radiocarbon Laboratory (University of Toronto) for ^{14}C -dating analysis. Two or four separate analyses (normal precision) were conducted on each sample, correcting for natural and sputtering isotope fractionation. Results were measured using the $^{13}\text{C}/^{12}\text{C}$ ratio, with sample age quoted as an uncalibrated conventional radiocarbon date in years before present (YBP), using the Libby ^{14}C mean life of 8033 years. The error represents the 68.3% confidence limit.

Due to the difficulties associated with obtaining reliable ^{14}C dates from Teapot Lake, palynology was used as an important tool for not only gaining information about the Holocene ecology of the area surrounding the lake, but to also chronologically constrain the Holocene history of the core.

Pollen Preparation and Enumeration

Pollen preparation followed methods described by Fægri and Iversen (1989).

Forty-two 50 mm³ aliquots of wet sediment from Teapot Lake sediment cores TPLC2-1, TPLC2-2, TPLC2-3, TPLC2-4, and TPLC2-5 were subjected to hot treatments of 10% hydrochloric acid and 10% potassium hydroxide followed by acetolysis. Sieving and hydrofluoric acid treatments were omitted. Slurries were stained with safranin, dehydrated sequentially with alcohol, and stored in silicone oil. One tablet containing a known quantity of *Lycopodium clavatum* spores was

added to the majority of samples prior to processing in order to calculate pollen concentrations (batch No. 938 934, $n=10,679 \pm 953$ std. error spores/tablet; Benninghoff 1962; Stockmarr 1971). There was, unfortunately, an insufficient quantity of spores to spike each sample. Pollen and spores were identified and counted at 500x magnification with an Olympus BX50 transmitted light microscope. Total terrestrial pollen and spores counted per slide were consistently above 300, and more frequently above 400, except at one horizon (131 cm) where 257 grains and spores were enumerated.

Pollen keys by McAndrews et al. (1988), Fægri and Iversen (1989), and Kapp et al. (2000) aided pollen identification. *Pinus* pollen was identified as diploxylon-type, haploxylon-type, or was classified as undifferentiated (Fægri and Iversen 1989). *Juniperus* and *Thuja occidentalis* pollen were grouped together as Cupressaceae since their pollen is difficult to differentiate using light microscopy. Pteropsida (monolete) spores include all monolete members of the class Pteridophyta.

Pollen Data Analysis

The main pollen sum includes all total terrestrial pollen and spores, including fern spores since this group constitutes an important component of the modern vegetation of Ontario. The frequency of aquatic taxa, fungal spores, Nymphaea hairs, *Pediastrum*, sponge spicules, and microscopic charcoal was calculated from the total pollen sum. Calculation of absolute pollen abundance followed Stockmarr (1971). Percentage and concentration pollen data were graphed using

Tilia version 2.0 (Grimm 1993). The CONISS program for stratigraphically constrained cluster analysis using a square root data transformation was applied to aid pollen diagram zonation (Gordon and Birks 1976; Grimm 1987; Fægri and Iversen 1989).

Diatom Preparation and Enumeration

Diatoms were used as a biological proxy in this study to infer changes in lake water properties through time. Diatoms deposited in Teapot Lake sediment were analyzed by extracting them from forty-two subsamples distributed from 1-410 cm throughout four sections of Core TPLC2 (TPLC2-1, TPLC2-2, TPLC2-3, TPLC2-4).

Approximately 1 cc of wet sediment was extracted, weighed and freeze-dried from each subsample. The subsamples were then prepared for diatom analysis by weighing out 0.0200 g - 0.0516 g of dry sediment. A 10 ml solution of 50:50 nitric/sulfuric acids was added to each sediment sample and heated for approximately 20 minutes to remove organic material. The acid mixture was then diluted with distilled water and sonicated to disaggregate the diatom frustules into single valves. Subsequently, the acid was removed from the samples through centrifugation and a series of at least five distilled water dilutions. Finally, washed samples were stored for further processing in 45 ml of distilled water.

Aliquots of 0.5 ml from the washed diatom solution were pipetted onto 18 mm x 18 mm coverglasses and allowed to air-dry. The coverglasses were fixed onto

microscope slides with Naphrax[®] mountant. Two microscope slides were prepared for each sample; one for analysis with a Leica DMR[®] light microscope with phase contrast optics, and the others as reserve slides for cross-reference and verification. Prior to diatom counting, six scanning electron microscope stubs were prepared from six core horizons to identify small diatoms using an FEI XL Environmental Scanning Electron Microscope (ESEM). All of the quantified prepared microscope slides, the remaining subsample material, associated notes and photomicrographs are archived in the National Collection at the Canadian Museum of Nature, in Ottawa.

At least 600 diatoms were counted at 1600X magnification from each slide using a transect counting protocol (Pappas and Stoermer 1996; Watchorn et al. 2008). The number of valves per gram dry weight (total valves g⁻¹ dwt) and percent abundance were subsequently calculated for each taxon. Flux rates were subsequently determined using ²¹⁰Pb and sediment accumulation measures. The diatoms were identified using standard taxonomic references (e.g. Krammer 2003, 2002, 2000, 1997a, 1997b; Krammer and Lange-Bertalot 1988, 1986, 1991a, 1991b; Lange-Bertalot 2001; Patrick and Reimer 1966; Potapova and Hamilton 2007; Siver and Kling 1997).

Diatom Data Analysis

A diatom-water quality transfer function for Teapot Lake was developed following the format of Watchorn et al. (2008) using the program C2 version 1.5 (Juggins 2005). Fifty lakes from the Reavie and Smol (2001) calibration set that had

complete data for spring growing conditions, including pH, and total phosphorus (TP), were used as the calibration model to infer past water chemistry values in Teapot Lake. Lakes used in the calibration set are located < 300 km to the east of Teapot Lake and are situated on bedrock formations of limestone (Trenton and Beekmantown formations), granitic (Precambrian Shield) rock, or a mixture of the two (Chapman and Putnam 1966). Reconstruction of past water chemistry values for Teapot Lake were generated using 29 taxa from the fossil assemblage that were also found in the Reavie and Smol (2001) calibration set. The species relative abundance data was square-root transformed for weighted averaging (WA) analyses to reduce the effect of dominant taxa, as previously described in Reavie and Smol (2001).

Water Property Measurements

A profile through the lake water column of water property variables including temperature, dissolved oxygen, depth, conductance, pH and redox were measured using a Hydrolab Surveyor 3 on August 17, 2005, and on April 13, 2006. Samples of Teapot Lake water were also collected in plastic bottles for laboratory analysis at the Ottawa-Carleton Water Quality Laboratory for variables such as pH and TP on August 17 and 18, 2005, and on April 14, 2006.

Three Minilog-T temperature data loggers were moored from a permanent raft anchored at the center of Teapot Lake (43° 45' 147" N; 79° 48' 136 " W) at 1m (ID # 1056E), 3m (ID # 1055E), and 8m (ID # 1044E) water depth on April 13, 2006. These data loggers were set to record hourly water temperatures from

April 21, 2006 to March 16, 2007 for the purpose of determining whether the lake is truly meromictic.

Sub-bottom profiles of Teapot Lake were also collected in August 2005 using a Knudsen Engineering 320BP portable echosounder to determine the nature and shape of the bottom.

Results

Sedimentology

Visual inspection of the core indicated that the top 100 cm were primarily composed of gyttja, with no distinctive laminations observed. Digital x-ray analysis confirmed that Teapot Lake sediments from this core were not laminated through the top 100 cm (Fig. 2A), but that there were finely layered, planar laminations from about 100 cm depth to approximately 200 cm depth (Fig. 2B). Laminations were again absent from 200 cm to about 260 cm (Fig. 2C), while planar laminations were observed from 260 cm to about 315 cm (Fig. 2D). Sediments changed orientation frequently, and were, at times, sloped at a steep angle through the 315 - 350 cm (Fig. 2E) interval of the core. From 350 cm to the bottom of the analyzed portion of the core (410 cm) (Fig. 2F), finely-layered, flat-lying laminations were again observed.

Fig. 2A. Teapot Lake Core x-ray: ~ 20 - 40 cm depth from core TPLC2-1.
The top direction is to the left.

Fig. 2B. Teapot Lake core x-ray: ~ 130 - 150 cm depth from core TPLC2-2.
The top direction is to the left.

Fig. 2C. Teapot Lake Core x-ray: ~ 180 - 206 cm depth from core TPLC2-2.
The top direction is to the left.

Fig. 2D. Teapot Lake Core x-ray: ~ 285 - 305 cm depth from core TPLC2-3.
The top direction is to the left.

Fig. 2E. Teapot Lake Core x-ray: ~ 335 - 355 cm depth from core TPLC2-4.
The top direction is to the left.

Fig. 2F. Teapot Lake core x-ray: ~ 375 - 395 cm depth from core TPLC2-4.
The top direction is to the left.

Palynology

Fifty-two pollen and spore taxa were identified from forty-two horizons in the Teapot Lake sediment core TPLC2-1 through TPLC2-5 (Fig. 3). Four pollen assemblage zones were recognized based on CONISS and visual inspection.

Zone TPZ-1 (500-420 cm)

Picea was the dominant pollen type in this basal zone, reaching over 30 % abundance mid-zone (470 cm core depth), before declining. *Quercus* and *Larix* pollen were also relatively abundant in this zone. *Tsuga canadensis* began to increase mid-zone, following the decline in *Picea* pollen, and reached 20 % abundance by the end of Zone TPZ-1.

Zone TPZ-2 (420-270 cm)

Tsuga canadensis pollen continued to increase at the onset of this zone, and peaked at 25 % abundance at 413 cm core depth, before declining to ~ 3 % at 399 cm depth. A biostratigraphic age of ca. 5400 calendar YBP has been applied to this decline (Fuller 1998; Bennett and Fuller 2002; Calcotte 2003). *Fagus* pollen increased abruptly at the beginning of this zone, and sustained a relative abundance from 10 % to 20 % throughout Zone TPZ-2. *Tsuga canadensis* pollen recovered at 320 cm, and rose to 28 % abundance at 277 cm core depth. A biostratigraphic age of ca. 3450 calendar YBP has been applied to the event at 320 cm core depth (Fuller 1998). Sponge spicules were also noted to increase in abundance through this zone, and fluctuated from <1 % to 10 %.

Zone TPZ-3 (270-110 cm)

Tsuga canadensis pollen declined at the beginning of this zone, concomitant with a slight increase in *Fagus* pollen, succeeded by a marginal rise in *Betula* pollen. Following the initial decline, *T. canadensis* pollen peaked to a core maximum of ~40 % at 187 cm depth. At 180 cm sediment depth, *T. canadensis* declined steeply to 6 % abundance, but throughout the remainder of the zone, this pollen type fluctuated between 11 % and 22 % abundance. Trends in the relative abundance of *T. canadensis* were inversely mirrored by fluctuations in the frequency of microscopic charcoal, with a peak in abundance of 31 % observed at 180 cm sediment depth.

Fig. 3. Teapot Lake Palynology.

Samples were obtained from Teapot Lake sediment core TPLC2-1, TPLC2-2, TPLC2-3, TPLC2-4, TPLC2-5.

Zone TPZ-4 (110-0 cm)

Tsuga canadensis pollen continued to increase steadily throughout this zone, to reach 35 % abundance near the top of the sediment core, at 8 cm depth. *Fagus* pollen also increased in Zone TPZ-4, and reached a core maximum of 30 % abundance from 64 cm to 43 cm depth, before declining slightly to 21 % abundance at 8 cm depth. Microscopic charcoal increased at the start of this zone to reach a peak abundance of 26 % at 107 cm depth, then declined through to the top of the core. Sponge spicules were relatively abundant following near-absence in the previous zone.

Chronology

Radiocarbon dating of four bulk sediment samples and one wood fragment sample did not provide any conclusive results (Paul Gammon, personal communication 2007). Two separate analyses of samples TPLC2-3-35 (241 cm depth) and TPLC2-4-80 (400 cm depth), taken from core TPLC2, which was obtained from the center of Teapot Lake, indicated there was not enough material to indicate the age of the samples (Table 1). Analysis of a wood fragment from TPLC1-5A - 1-2 (474 cm core depth), taken from core TPLC1, also extracted from the center of Teapot Lake, indicated the fragment was less than 50 years of age, which is obviously erroneous. Two more bulk sediment samples were dated, this time from core TPLC4, which was taken from a second sampling location, closer to the shore. Four separate analyses of sample TPLC4-3-4-5 (88 cm core depth) indicated sediment age to be 1790 +/- 50 YBP while four separate analyses of sample TPLC4-8-2-3 (582 cm depth), indicated sediment

age to be 770 +/- 40 YBP. These results were deemed to be highly inaccurate as younger sediments cannot accumulate on top of older sediments.

Table 1. Teapot Lake Sediment and Wood Fragment ¹⁴ C Dating Results					
Sample ID	Location	Sediment Depth (cm)	Sample Description	Sample Weight (mg)	Age (YBP)
TPLC2-3-35	center	241	sediment	750	no result
TPLC2-4-80	center	400	sediment	634	no result
TPLC1-5A-1-2	center	474	wood fragment	--	< 50
TPLC4-3-4-5	near shore	88	sediment	106	1790 +/- 50
TPLC4-8-2-3	near shore	582	sediment	876	770 +/- 40

Since the lower portion of the core could not be reliably dated using ¹⁴C methods, palynology was used to chronologically constrain the portions of the core below where ²¹⁰Pb dating was effective. The pollen derived age estimates and ²¹⁰Pb dating indicated that the sediments recovered from the portion of the core examined for diatom assemblages span *ca.* 5600 YBP (410 cm) to *ca.* A.D. 2001 (1 cm), with a margin of error ranging from 1 to 25 years for the ²¹⁰Pb data (from 1 cm to 18.9 cm). Interpolation of these data using second order polynomial curves provided estimates for the ages of intervening sediment samples. Separate curves were used, with one curve used to interpolate dates in the top 30 cm using the ²¹⁰Pb data ($R^2 = 0.9873$) and the second curve ($R^2 = 0.9993$) used all of the data to interpolate approximate dates derived from palynological analysis for the rest of the core (Fig. 4A, 4B).

Fig. 4A. Graph of Teapot Lake sediment age using ^{210}Pb dating methods. A second order polynomial curve was fitted to interpolate dates between dated samples. Samples were taken from core TPLC1-1.

Fig. 4B. Graph of Teapot Lake sediment age using ^{210}Pb and palynology. A second order polynomial curve was fitted to interpolate dates between ^{210}Pb dated samples and estimated ages derived from the palynology results. Samples were taken from core TPLC1-1 and TPLC2-1 through TPLC2-5.

Water Properties and Physical Characteristics of Teapot Lake

Teapot Lake is very small in size relative to its depth (12m), and is surrounded by thick forest cover, which impedes wind-driven water circulation, resulting in continuous stratification. Water property data measurements collected from Teapot Lake on August 17, 2005 (Table 2) indicated that the water was stratified with a distinct thermocline; the top 2.5 m being distinctly different from the rest of the water column. Between 2.5 m and 3.0 m depth, water temperature decreased by 4.4 °C, and from 23.70 °C at the surface to 9.85 °C at 3.0 m depth. The water column temperature declined progressively beneath 3 m to 5.1 °C at the lake bottom (12 m). Similarly, dissolved oxygen decreased from 18.2 mgL⁻¹ at 2 m water depth to 0.82 mgL⁻¹ by 3 m water depth. Dissolved oxygen content in the water progressively decreased from this horizon to the lake bottom where a value of 0.32 mgL⁻¹ was observed (Table 2). The water column in Teapot Lake was sampled again on April 13, 2006, when similar results and trends were observed.

Total phosphorus (TP) measurements indicated concentrations ranged from 0.19 - 0.20 mgL⁻¹ from 0.5 - 1.0 m depth in August 2005 (Table 3). Measurements taken the following spring indicated little change in TP, with a value of 0.22 mgL⁻¹ observed at 0.5 m water depth. TP concentrations were observed to increase with increasing water depth, with a value of 1.53 mgL⁻¹ measured at 9 m water depth. Similarly, concentrations of iron and manganese increased with increasing water depth (Table 3).

Analysis of a 12-month temperature data logger record indicated the thermocline observed in Teapot Lake in August 2005 remained undisturbed year-round, with the exception of an 11-hour period. At each of 1m, 3m, and 8m water depths, where the temperature loggers were deployed, there were a total of 8064 temperature measurements recorded in Teapot Lake between April 15, 2006 and March 17, 2007. Mean recorded temperatures were 13.0 ± 8.4 °C (1m), 8.7 ± 4.8 °C (3m), and 4.4 ± 0.3 °C (8m). There was also a range in temperature of 26.8 °C at 1 m depth, 13.6 °C at 3 m depth, and only 1.1 °C at 8 m water depth. There was an eleven-hour period, on December 2, 2006, when at all three water depths the same temperature (4.9°C) was recorded. Measurements for the rest of the study period indicated that water temperatures were otherwise always different at these water depths (Fig. 5). There is also no evidence that any significant fall turnover occurred during the short interval in which the lake was the same temperature at 1m, 3m, and 8m, as oxygen profiles measured in the lake before and after this date were always characterized by anoxic conditions at the lake bottom.

From the surface of the water, down to 3.75 m water depth, algae had grown on the chain holding the temperature data loggers in place during the 18-month period that it was submerged. Below that depth, there was no growth of any kind observed, a further indication of anoxic bottom waters. Algae had also grown on the top two data loggers (1 m and 3 m water depth), while a freshwater sponge had grown on the data logger located at 1 m depth. The data logger located at 8

m water depth had no overgrowths whatsoever providing further qualitative evidence of the anoxic conditions existing at depth in Teapot Lake.

A sub-bottom profile of Teapot Lake (Fig. 6) indicated that the lake bottom in Teapot Lake is characterized by a series of abruptly dropping off terraced benches on all sides and at several depths (Fig. 6). These distinct features, which can be traced laterally around Teapot Lake suggest that the water body may have been characterized by several different water depths through its history, probably related to paleoclimate. The variation in the size and depth of Teapot Lake related to these changes could have had a significant impact on diatom community composition (Reavie and Smol 2001). Unfortunately, it is impossible to date these terraces with the available data so their possible relationship to observed diatom assemblage changes cannot be ascertained.

During a site visit on September 22, 2007, a number of very large bottom mats, varying in size, but measuring up to 80 m in length and 1 m in depth, appeared to have floated to the surface of the lake. They were composed of thick masses of moss, plant roots and gyttja, with Canada Goose (*Branta canadensis*) droppings and feathers noted on top of some of the mats. A Great Blue Heron (*Ardea herodias*) was also observed standing on the largest bottom mat for an extended period of time. These bottom mats were not present during other visits to Teapot Lake in August 2005, or in April 2006, and TRCA authority personnel had no recollection of ever seeing any at other times in the past (Don Ford, personal

communication 2007). The mats may have been dislodged and floated to the surface as a result of explosives related seismic activity related to the massive new Highway 410 extension construction project occurring <1 km to the north-east in 2007. Confirmation of the unique nature of this event was provided by examination of cores taken at water depths beneath the thermocline where no vegetation is found. No evidence of previous floating mats is found at any horizon through these cores. In addition, the ^{210}Pb chronology obtained was uninterrupted indicating that no allochthonous sediment was present in the upper 20 cm of the core.

Table 2. Teapot Lake Water Property Profile, August 17, 2005. (Hydrolab Surveyor 3)						
Depth (m)	Temperature (°C)	Dissolved Oxygen (mgL ⁻¹)	Conductance (µS cm ⁻¹)	pH	Redox	% Dissolved Oxygen
0.5	23.70	6.82	320	8.23	578	83.5
1.0	23.53	6.80	319	8.13	570	81.7
1.5	22.12	9.92	332	7.88	578	116.7
2.0	18.12	18.20	334	9.16	358	198.2
2.5	14.29	1.29	345	7.32	535	13.7
3.0	9.85	0.82	348	6.85	60	7.1
3.5	7.24	0.70	347	6.68	32	5.7
4.0	5.90	0.62	348	6.57	-4	5.0
4.5	4.92	0.53	354	6.47	-39	4.1
5.0	4.41	0.46	358	6.41	-54	3.6
5.5	4.15	0.39	368	6.30	-64	2.9
6.0	3.98	0.34	378	6.22	-69	2.6
6.5	3.95	0.31	387	6.15	-70	2.4
7.0	3.96	0.27	399	6.07	-68	2.0
7.5	4.04	0.26	440	5.96	-65	2.0
8.0	4.17	0.23	488	5.84	-48	1.8
8.5	4.30	0.20	535	5.76	-53	1.6
9.0	4.42	0.21	592	5.70	-55	1.6
9.5	4.60	0.19	680	5.63	-55	1.5
10.0	4.71	0.20	793	5.59	-55	1.6
10.5	4.89	0.35	946	5.56	-63	2.9
11.0	5.00	0.35	1132	5.56	-55	2.8
11.5	5.11	0.34	1241	5.56	-61	2.7
12.0	5.13	0.32	1237	5.57	-52	2.7

Table 3. Teapot Lake Water Property Values. (Ottawa-Carleton Water Quality Laboratory)						
Date Collected	Water Depth (m)	Conductivity (µS/cm)	TP (mgL ⁻¹)	pH	Fe (mg/L)	Mn (mg/L)
17-Aug-05	0.5	310	0.020	7.8	0.020	0.0166
14-Apr-06	0.5	270	0.022	7.63	0.077	0.046
18-Aug-05	1.0	310	0.019	7.72	0.022	0.021
17-Aug-05	5.0	350	0.060	7.17	0.630	0.460
18-Aug-05	6.0	370	0.050	6.97	0.780	0.420
18-Aug-05	9.0	500	1.53	6.92	4.90	0.670

Fig. 5. Graph of Teapot Lake Water Temperatures from April 21, 2006 to March 16, 2007.

Fig. 6. Sub-bottom profiles of Teapot Lake, Ontario.

Fossil Diatom Assemblages

One hundred and twenty-five taxa were identified from twenty-four genera in the Teapot Lake sediment core. Of these taxa, eighteen were present at >5 % abundance, in at least one sample, and thus deemed to be present in statistically significant number (Patterson and Fishbein 1989) (Fig. 7).

The results obtained for the stratigraphically lowermost sample analyzed, at 410 cm depth (ca. 5600 YBP), was significantly different from the rest of the samples examined, as indicated by cluster analysis of the diatom data (Fig. 8), and based on sedimentology (Fig. 2F). The most abundant species at this core depth was *Fragilaria nanana* Lange-Bertalot 1993 at 26 % abundance, with *Cyclotella comensis* Grunow 1882 (20 % abundance), *Fragilaria tenera* Lange-Bertalot 1980 (15 % abundance), and *Cyclotella michiganiana* Skvortzow 1937 (13 % abundance) being the second, third and fourth most abundant species, respectively. *Fragilaria nanana* temporarily disappeared from the assemblage above this depth, however *C. comensis*, and *C. michiganiana* never reached >1% of the assemblage in any of the other samples analyzed.

Fig. 7. Diatom percent abundance, DI-TP, and DI-pH from Teapot Lake, Ontario.

Taxa are represented if they were present in >5 % abundance in at least one sample. Diatom-inferred spring pH (DI-pH), and diatom-inferred spring total phosphorus (DI-TP) are also presented, with samples recovered from Core TPLC2-1, TPLC2-2, TPLC2-3, and TPLC2-4.

There were no drastic changes in diatom species assemblages observed in sediment samples from 368 to 40 cm core depth, and all samples clustered relatively closely. Throughout this interval, *Fragilaria tenera* comprised at least 14 % of the assemblage, was never ranked lower than third in total abundance, and reached a peak abundance of 60 % at 95 cm core depth. There were slight changes in species assemblages noted through this interval though, which were concomitant with changes in sedimentation patterns. From 260 cm to 200 cm, there were no laminations observed, while distinct, fine laminations were observed through x-ray analysis from 200 cm to 100 cm sediment depth. At about 204 cm depth (ca. 510 A.D.), *Achananthidium minutissimum* (Kützing) Czarnecki 1994, which had varied from 12 % to 19 % abundance from 277 cm to 216 cm depth, decreased abruptly to only 1 % abundance, and did not increase again to >5 % abundance until 40 cm depth. At this same interval, *F. tenera* doubled in abundance and *Eunotia flexuosa* (Brebisson in Kützing) Kützing 1849, *Eunotia intermedia* (Krasske ex Hustedt) Nörpel & Lange-Bertalot in Lange-Bertalot 1993, and *Fragilaria capucina* Desmazières 1925 all increased in abundance, and remained in the assemblage to the top of the core. A change in sedimentology was again noted at 100 cm depth (ca. 1575 A.D.), with no laminar pattern being observed from 100 cm depth to the top of the core. Just before the change in sedimentation pattern (at 105 cm sediment depth), *E. flexuosa* underwent a sharp decrease in abundance to 5 % from a >15 % abundance in the 110 - 148 cm core interval. *E. flexuosa* did not increase to >10 % abundance again until the 70 cm core horizon. Similarly, at the 105 cm core depth, *Fragilaria*

capucina increased to 18 % abundance from a <9 % abundance in the 110 - 154 cm core interval.

Cluster analysis of diatom percent abundance indicated that the top 30 cm of the core was distinctly different from the rest of the core (Fig. 8). Based on extrapolation using the polynomial equation calculated with the ^{210}Pb data, this core interval encompassed the period from ca. A.D. 1620 to present. This section of the core was characterized by an abundance of *F. tenera* (ranging from 14 % - 43 % abundance), with a notable spike in abundance (10 % of the assemblage) of *Nitzschia palea* (Kützing) W. Smith 1856 at 25 cm depth, and an evenly distributed assemblage of *Achnantheidium minutissimum*, *Encyonema minutum* (Hilse) Mann in Round et al. 1990, *Eunotia flexuosa*, *Eunotia intermedia*, *Fragilaria capucina*, and *Navicula radiosa* Kützing 1844 comprising the rest of the assemblage in this interval.

Diatom-inferred pH and Total Phosphorus (DI-pH and DI-TP)

Diatom-inferred total phosphorus (DI-TP) for this core was subject to large error, and changes through time were not significant (Fig. 7). DI-TP ranged from 0.008 - 0.013 mgL^{-1} while measured values from 0.5 m water depth ranged from 0.020 - 0.022 mgL^{-1} . DI-pH ranged from 7.8 to 8.2 (Fig. 7), indicating there was very little change inferred in the pH of Teapot Lake from ca. 5600 YBP to the present day. The calculated DI-pH of 8.0 determined for 1 cm sediment depth closely corresponds with water chemistry measurements taken in August 2005, and in April 2006, which provided a pH value of 7.63 – 7.8 for the lake - bottom sediment –water interface.

Fig. 8. Cluster analysis of diatom species percent abundance from Teapot Lake, Ontario.

The numbers on the right side indicate the core depth (in cm) of the samples analyzed. Samples were recovered from Core TPLC2-1, TPLC2-2, TPLC2-3, and TPLC2-4.

Discussion

The results of the temperature logger study indicate there is a distinctive thermocline and chemocline in Teapot Lake, and that there is no vertical mixing of the water column through the year. The lake is therefore meromictic (Cohen 2003; McNeely 1973), despite the lack of laminated sediments in the upper portion of the core. Diatom assemblages recovered from downcore should therefore provide a high-resolution paleolimnological record of conditions in the lake (Cohen 2003; Hall and Smol, 1999; Reavie and Smol, 2001).

Cluster analysis of the diatom data indicated that the sample from 410 cm core depth is significantly different from the flora recovered from any other samples collected up core. Palynological evidence of a disturbance in the terrestrial ecosystem is observed just above this core depth, at 400 cm depth, as indicated by the rapid decline of *Tsuga canadensis* (Eastern Hemlock), a decline in *Picea* (Spruce), and an increase in abundance of the successional species *Fagus* (Beech). The change in Eastern Hemlock abundance in this region has previously been dated at ca. 5400 YBP (Bennett and Fuller 2002; Chalcote 2003; Fuller 1998; Davis 1981) and may be related to an insect outbreak (Allison et al. 1986; Bhiry and Fillion 1996) linked to warming during the hypsithermal warm period in the present-day Brampton area (Edwards and Fritz 1986) and elsewhere (Lamb 1977). Other studies show that this change to the regional forest ecosystem also had a significant impact in many Ontario lake ecosystems (e.g. Little Round Lake, Sunfish Lake, MacKay Lake, Flower Round Lake, Long

Lake, Singleton Lake, and van Nostrand Lake; Boucherle et al. 1986; Hall and Smol 1993; St. Jacques et al. 2000). A peak in estimated hypsithermal DI-TP values in van Nostrand, Long and Singleton Lakes provide indirect evidence of this eutrophication (Hall and Smol 1993; St. Jacques et al. 2000). There is no corresponding peak in DI-TP dating from sediments deposited during the hypsithermal in Teapot Lake, although the inference is subject to large error. There is however, an associated diatom floral response observed in Teapot Lake as indicated by the presence of the meso-eutrophic planktonic species *Cyclotella michiganiana* (Ekdahl et al. 2007), and *Cyclotella comensis* which, together, comprised >33 % of the assemblage at 410 cm sediment depth. Above 410 cm depth, neither of these two species were present in the assemblage above 1 % abundance in any other sample.

Frequent changes in sediment bedding orientation observed through x-ray analysis from 350 cm - 315 cm are indicative of the adjustments to sedimentary inputs that the lake underwent through this time period. The pollen data indicates the return of Eastern Hemlock to the area at 325 cm, which has been observed elsewhere in the region to occur at ca. 3450 YBP (Fuller 1998). The increased abundance of the diatom taxa *Navicula radiosa*, and *Eunotia flexuosa* indicate that nutrient conditions were changing (Enache and Prairie 2002) through this interval.

The next notable change in the diatom species assemblage occurred at 204 cm sediment depth (ca. A.D. 510) and is accompanied by another change in sedimentology. *Achanantheidium minutissimum*, an epiphytic species that can tolerate a broad range of nutrient and disturbance conditions (Beaver 1981; Potapova and Hamilton 2008), decreased abruptly in relative abundance at this horizon, and did not reappear in the assemblage to any great degree until 40 cm sediment depth. Also at 204 cm depth, the tychoplanktonic taxa *Fragilaria tenera* doubled in abundance and other taxa such as *Eunotia flexuosa*, *Eunotia intermedia*, and *Fragilaria capucina* also increased in abundance, an indication that there was a change in nutrient conditions in the lake. The palynological results indicate that there were changes occurring in the landscape that could have affected lake water, with increases in *Picea* observed at 214 cm sediment depth, while abundance of *Tsuga canadensis* remained low.

At 105 cm depth (ca. A.D. 1540) there is another change in the diatom assemblage, again accompanied by a change in sedimentology, which correlates with a spike in abundance of microscopic charcoal. *Eunotia flexuosa* underwent a sharp decrease in abundance to 5% and did not increase to >10 % abundance again until the 70 cm core horizon. *Fragilaria capucina* also increased in abundance at 105 cm providing a further indication of a disturbance to the ecosystem. Although the changes in sedimentology and observed levels of microscopic charcoal correlated with changes in the diatom species assemblages, the changes are not significant enough to impact either the

inferred DI-TP or DI-pH, suggesting that the lake was largely sheltered from terrestrial influences during this period. These changes could be related to natural forest fires or even possible induced fire disturbance resulting from Iroquoian habitation (ca A.D. 500-1500) in the region (Warrick 2000). However, the changes to the Teapot Lake ecosystem through this interval are minor compared to the more considerable changes observed in other Ontario lake ecosystems (e.g. Crawford Lake, Swan Lake, and Wilcox Lake), which have been linked with Iroquoian land clearance for agriculture and housing (Ekdahl et al. 2007, Patterson et. al. 2002; Warrick 2000).

The top 30 cm of sediment collected from Teapot Lake are deposited from *ca.* A.D. 1620 to the present. Cluster analysis of the diatom percent abundance data indicate these samples are the most similar compared with the other samples (Fig. 8). *Fragilaria tenera* is the most abundant diatom through this section of the core, and *Nitzschia palea* reached its peak abundance in the core, at 25 cm core depth. There were no other major changes in the floral assemblage noted through this section, nor were there significant inferred changes in DI-pH or DI-TP documented.

Results of previous studies from other lakes in the region (e.g. Swan Lake, Crawford Lake, Little Round Lake, Grignac Lake, and Second Lake) have been characterized by significant changes in diatom assemblages that provide a clear correlation with deforestation associated with European settlement and

agriculture (beginning ca. A.D.1850), as well as more recent increases in population growth (ca. A.D.1965 to present) (Burden et al. 1986; Ekdahl et al. 2007; Patterson et al. 2002; Watchorn et al. 2008). In Teapot Lake, recognition of this signal associated with settlement related land use changes is not evident from either the observed diatom assemblages or the inferred DI-TP or DI-pH values. As Teapot Lake is meromictic, and not subject to bioturbation related “assemblage averaging” as would have occurred in the other studied lakes, the sedimentary record should provide a complete, undisturbed historic record of the lake, with sharp changes in diatom assemblages occurring when anthropogenic land use change occurred. As such assemblage changes are not noted in Teapot Lake, the lake must have been somehow protected from the impact of land use change in the area, or this lake has other properties that compensate for these anthropogenic effects.

A possible clue for the lack of evidence of recognizable anthropogenic influence may be related to the unique water chemistry of Teapot Lake. Concentrations of TP, iron and manganese all increase with increasing water depth (Table 3). In lakes with high concentrations of Fe and Mn, which is the case with Teapot Lake, phosphorus sorbs with the Fe or Mn (Cohen 2003) and is deposited as vivianite or other iron or manganese phosphates on the lake bottom (Gammon, personal communication 2007). Since Teapot Lake is meromictic, the phosphorus deposited as vivianite at the bottom of the lake does not circulate to the upper part of the water column, and is therefore unavailable for diatom growth.

Conclusions

Teapot Lake is a meromictic lake, which should contain an accurate sediment record due to lack of bioturbation. Analysis of diatom and pollen assemblages extracted from a sediment core dated from *ca.* 5600 YBP to present indicated there were minor adjustments in the aquatic ecosystem associated with disturbances to the landscape. The first disturbance was observed with a unique diatom assemblage from sediments dated at *ca.* 5600 YBP when Eastern Hemlock nearly disappeared due to an insect outbreak brought on by the hypsithermal warm period. Changes in sedimentology, and diatom assemblage, as well as increases in microscopic charcoal were observed in sediments dated from the period *ca.* A.D. 500 to 1500 which could be related to natural forest fires or to Iroquoian land clearance for agriculture and housing, although much more significant impacts have been observed in other lakes. The top 30 cm of the sediment core (*ca.* 1620 A.D. to present) grouped together in cluster analysis, and there should have been significant changes in diatom assemblage, DI-TP, DI-pH and palynology through this section given the fact that European settlers moved into the area en masse during this period. However, this was not the case, and other changes observed indicated there was no significant correlation between diatom paleo-assemblages, or in diatom-inferred total phosphorus or pH that can be related to anthropogenic changes to the landscape. The most likely explanation is related to the unique geochemistry of the lake. Phosphorus entering the system, natural or anthropogenically produced, sorbs to Fe and Mn, which are present at very high concentrations, to form vivianite and various other minerals that are deposited and thus sequestered on the lake bottom due to the

meromictic nature of Teapot Lake. Thus, there is no paleolimnological evidence of the eutrophism, using diatoms as the biological proxy, associated with 19th century land clearance and settlement, which characterizes all other examined lakes in the area.

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Appendix 1. Diatom percent abundance data: Haynes Lake, Ontario

Diatom percent abundance: Haynes Lake, Ontario							
Taxon	Core Depth						
	1cm	5cm	11cm	15cm	20cm	25cm	30cm
Ach. lanc. lanceolata	0.576	0.000	0.000	0.143	0.000	0.000	0.000
A. minutissimum total	4.317	22.760	6.892	12.751	7.532	2.718	5.894
Amphora capulata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brachysira brebissonii	0.000	0.000	0.000	0.000	0.000	0.143	0.000
Asterionella formosa	14.532	0.000	0.000	0.287	0.000	0.000	0.000
Cymb. amphicephala	0.144	0.000	0.000	0.000	0.000	0.000	0.000
Cymbella cesatii	0.000	0.000	0.000	0.000	0.000	0.000	0.999
Cymbella subcistula	0.000	0.179	0.363	0.000	0.000	0.000	1.299
Cymbella falaisensis	0.000	0.000	0.000	0.000	0.000	0.000	0.500
Encyonema minuta	0.288	0.179	0.363	0.000	0.000	0.572	0.699
Encyonema silesiacum	0.000	0.000	0.000	0.000	0.000	0.000	0.200
Cocconeis euglyta	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cyclotella bodanica	1.151	0.000	0.605	0.000	0.000	0.000	0.000
Cyclotella comensis	1.727	0.000	0.000	0.000	0.000	0.000	0.100
Cyclo. michiganiana	16.691	10.753	43.047	3.725	12.597	6.724	6.194
Cyclotella stelligera	15.827	26.344	22.128	40.688	60.390	71.388	72.927
Eunotia praeupta	0.000	0.000	0.000	0.000	0.000	0.000	0.300
Fragilaria biceps	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fragilaria brevistriata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fragilaria cap. v. gracilis	0.576	0.000	0.121	0.000	0.000	0.286	0.500
Staurosira construens	0.144	0.179	0.000	0.000	0.000	0.000	0.000
Fragilaria cyclosum	0.000	1.075	0.000	0.573	0.000	0.143	0.200
Frag. delicatissima	2.446	3.047	1.451	5.874	2.597	1.574	1.099
Fragilaria leptostauron	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F. nanana Total	3.453	4.659	3.990	16.046	7.662	6.724	4.396
Fragilaria pinnata	0.863	0.358	0.605	0.000	0.130	0.000	0.000
Fragilaria tenera	0.000	0.000	0.000	0.000	0.000	0.286	0.100
Gomp. acuminatum	0.000	0.000	0.242	0.000	0.000	0.000	0.100
Gomp angustatum	0.000	0.000	0.000	0.000	0.000	0.000	0.000
G. cap and truncatum TOT	0.000	0.358	0.000	0.287	0.130	0.000	0.000
Navicula gastrum	0.288	0.000	0.121	0.000	0.000	0.000	0.000
Nav. cryptocephala	0.288	0.000	0.726	0.000	0.130	0.143	0.000
cf. Nav. cryptotonnella	0.000	1.971	0.967	0.000	0.000	0.000	0.300
Eolimna minima	0.719	1.613	0.726	1.433	0.000	0.000	0.000
Navicula pseudoventralis	0.432	0.000	0.000	0.430	0.000	0.000	0.000
Sellaphora pupula	1.007	0.358	0.000	0.000	0.000	0.286	0.200
Navicula radiosa	0.000	0.000	0.000	0.860	0.000	0.000	0.000
Navicula seminulum	0.000	0.358	0.000	0.000	0.000	0.000	0.000
Navicula tuscula	0.000	0.000	0.000	0.000	0.000	0.000	0.100
Navicula veneta	0.144	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia angustata	0.000	0.358	0.000	0.000	0.000	0.000	0.000
Nitzschia dissipata	0.576	0.179	0.121	0.287	0.260	0.000	0.000
Nitzschia flexoides	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia fonticola	1.727	2.509	1.935	1.003	0.519	0.143	0.000
Nitzschia gracilis	2.158	0.358	0.363	0.000	0.649	0.286	0.000
Nitzschia palea	0.000	0.000	0.121	0.430	0.519	0.858	0.000
Rhopalodia gibba	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Staur. anceps v. gracilis	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stephano. medius	12.950	0.000	3.990	0.143	0.260	0.286	0.000
Tabellaria quadrisepata	0.863	0.717	0.000	0.000	0.000	0.000	0.000
A. exigua v. heterovalvata	0.000	0.000	0.121	0.000	0.000	0.000	0.000
Achnanthes holsatica	0.288	0.538	0.121	0.287	0.130	0.000	0.000
Ach. jackii form 1	0.000	0.000	0.000	1.433	0.519	0.143	0.000

Diatom percent abundance: Haynes Lake, Ontario							
Taxon	Core Depth						
	1cm	5cm	11cm	15cm	20cm	25cm	30cm
Ach. jackii form2	0.144	0.358	0.121	0.000	0.000	0.000	0.000
Ach. lanceolata v. dubia	0.000	0.000	0.121	0.000	0.000	0.000	0.000
Achnanthes saprophila	1.439	9.140	4.111	3.438	0.909	1.574	0.200
Brach. microcephala	0.000	0.538	0.121	0.716	0.390	1.001	0.699
Cyclotella glomerata	1.295	0.000	0.242	0.000	0.000	0.000	0.000
Cymatopleura elliptica	0.144	0.000	0.000	0.143	0.000	0.000	0.000
Cymbella sp1	0.000	0.000	0.000	0.000	0.000	0.000	0.100
cf. Cymbella parva	0.576	0.717	0.121	0.430	0.130	1.717	0.000
Encyo. microcephala	3.022	3.405	1.572	1.146	1.299	0.572	0.000
Denticula subtilis	0.000	0.000	0.000	0.000	0.000	0.000	0.300
Eolimna sp1	0.863	0.000	0.242	1.433	0.000	0.000	0.000
Eolimna sp2	0.000	0.717	0.121	0.573	0.519	0.000	0.000
Eolimna sp4	0.432	0.896	0.242	0.143	0.000	0.000	0.000
Eolimna minima2	0.000	0.000	0.000	0.143	0.000	0.143	0.000
Eunotia flexuosa	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fragilaria sp1	0.000	0.000	0.242	0.000	0.000	0.000	0.000
Frag. Pinn. v. lanceolat	0.000	0.538	0.242	0.430	0.000	0.000	0.000
Frag. ulna v. danica	1.583	0.000	0.000	0.000	0.000	0.000	0.000
Gomphonema sp2	0.000	0.358	0.000	0.000	0.000	0.000	0.100
Gomphonema sp3	0.000	0.000	0.242	0.000	0.000	0.143	0.000
Gomphonema sp4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gomphonema cf. intricatum	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hantzschia amphioxys	0.000	0.000	0.121	0.000	0.000	0.000	0.000
Navicula sp1	0.000	0.179	0.000	0.000	0.000	0.000	0.000
Navicula sp2	1.007	0.000	0.000	0.287	0.519	0.143	0.000
Navicula sp3	0.288	0.538	0.000	0.000	0.000	0.429	0.000
Navicula sp6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula chiarae	0.863	0.896	0.484	0.716	0.260	1.288	0.400
Nav. cryptocephala ?	0.000	0.000	0.121	0.000	0.000	0.000	0.000
Neidium bisulcatum	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sp1	0.576	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sp5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia agnita	3.022	2.509	1.693	3.582	1.818	0.000	1.499
Nitzschia amphibia	0.000	0.000	0.000	0.000	0.000	0.143	0.599
Nitzschia Fragilaria	0.144	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sigmoidea	0.432	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sinuata	0.000	0.000	0.605	0.143	0.000	0.000	0.000
cf. Pinnularia anglica	0.000	0.000	0.121	0.000	0.000	0.000	0.000
Pinnularia sp1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stauroneis intricans	0.000	0.358	0.000	0.000	0.130	0.143	0.000
Teapot Frag sp3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Epithemia sp1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eunotia monodon v. monod.	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cymboplectra cuspidata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula bryophila	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula abiskoensis	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp96	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp96-004	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Diatom percent abundance: Haynes Lake, Ontario							
Taxon	Core Depth						
	40 cm	45 cm	50 cm	60 cm	75 cm	80 cm	100 cm
Ach. lanc. lanceolata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A. minutissimum total	0.627	4.729	0.221	0.565	0.331	0.484	0.491
Amphora capulata	0.000	0.231	0.000	0.000	0.331	0.000	0.000
Brachysira brebissonii	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Asterionella formosa	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cymb. amphicephala	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cymbella cesatii	2.038	4.383	0.663	2.197	2.152	1.290	3.601
Cymbella subcistula	1.724	1.615	0.442	0.565	1.821	0.323	1.637
Cymbella falaisensis	0.784	4.268	0.221	0.377	0.828	0.968	2.128
Encyonema minuta	1.567	0.692	0.110	0.565	0.000	0.000	0.000
Encyonema silesiacum	0.000	2.076	0.884	0.565	2.649	0.968	1.146
Cocconeis euglyta	0.000	0.231	0.000	0.000	0.000	0.000	0.000
Cyclotella bodanica	0.000	0.000	0.000	0.000	22.351	0.000	0.000
Cycotella comensis	32.915	11.995	13.370	30.948	25.993	29.677	62.848
Cyclo. michiganiana	9.404	5.190	16.796	47.960	21.026	31.613	12.930
Cyclotella stelligera	0.000	0.115	58.453	1.444	0.000	27.903	0.000
Eunotia praerupta	0.000	0.461	0.110	0.377	0.497	0.000	0.327
Fragilaria biceps	0.000	0.807	0.000	0.314	0.000	0.161	0.164
Fragilaria brevistriata	0.000	0.000	0.221	0.000	0.331	0.161	0.000
Fragilaria cap. v. gracilis	5.172	0.461	0.000	0.188	0.662	0.161	0.164
Staurosira construens	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fragilaria cyclopus	0.157	0.000	0.000	0.000	0.000	0.000	0.000
Frag. delicatissima	3.605	5.306	0.221	0.502	0.166	0.000	0.655
Fragilaria leptostauron	0.000	0.346	0.663	0.188	0.331	0.000	0.000
F. nanana Total	4.075	7.728	0.000	0.000	0.000	0.000	0.000
Fragilaria pinnata	0.000	0.000	0.663	0.063	0.000	0.000	0.000
Fragilaria tenera	4.389	1.615	0.221	0.126	0.000	0.000	0.000
Gomp. acuminatum	0.157	0.231	0.000	0.063	0.000	0.000	0.327
Gomp angustatum	0.157	0.000	0.000	0.000	0.000	0.000	0.000
G. cap and G. truncatum TOT	0.940	0.346	0.000	0.063	0.000	0.161	0.000
Navicula gastrum	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nav. cryptocephala	0.313	0.000	0.000	0.000	0.662	0.000	0.000
cf. Nav. cryptotonna	0.940	6.228	0.773	2.197	4.305	1.129	1.473
Eolimna minima	0.157	0.346	0.110	0.000	0.000	0.161	0.000
Navicula pseudoventralis	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sellaphora pupula	0.627	0.923	0.552	0.439	0.497	0.000	0.000
Navicula radiosa	0.784	0.807	0.000	0.063	0.166	0.000	0.655
Navicula seminulum	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula tuscula	2.194	3.230	0.663	0.502	1.821	0.323	0.655
Navicula veneta	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia angustata	0.157	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia dissipata	0.313	0.000	0.000	0.126	0.000	0.000	0.000
Nitzschia flexoides	0.313	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia fonticola	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia gracilis	1.567	0.346	0.000	0.000	0.000	0.000	0.000
Nitzschia palea	0.000	0.231	0.000	0.000	0.000	0.000	0.000
Rhopalodia gibba	1.724	3.345	0.663	0.000	1.656	0.000	0.327
Stauroneis anceps v. gracilis	0.000	0.000	0.000	0.188	0.000	0.000	0.000
Stephano. medius	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tabellaria quadrisepata	0.000	0.000	0.000	0.063	0.331	0.000	0.000
Ach. exigua v. heterovalvata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Achnanthes holstata	0.000	0.115	0.331	0.000	0.000	0.000	0.000
Ach. jackii form 1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ach. jackii form2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ach. lanceolata v. dubia	0.000	0.231	0.000	0.000	0.000	0.000	0.000
Achnanthes saprophila	4.389	2.768	0.000	0.628	0.166	0.323	0.982
Brach. microcephala	0.157	0.231	0.221	0.439	1.656	0.000	0.327
Cyclotella glomerata	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Diatom percent abundance: Haynes Lake, Ontario							
Taxon	Core Depth						
	40 cm	45 cm	50 cm	60 cm	75 cm	80 cm	100 cm
Cymatopleura elliptica	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cymbella sp1	2.194	1.269	0.221	0.628	1.656	0.000	0.491
cf. Cymbella parva	0.470	0.000	0.000	0.188	0.331	0.161	0.164
Encyo. microcephala	3.918	3.922	0.110	1.193	0.166	1.129	2.619
Denticula subtilis	0.000	4.268	0.663	0.000	0.497	0.323	1.309
Eolimna sp1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna sp2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna sp4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna minima2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eunotia flexuosa	0.157	0.115	0.000	0.126	0.166	0.000	0.327
Fragilaria sp1	0.157	0.000	0.000	0.000	0.000	0.000	0.000
Frag. Pinn. v. lanceolat	0.157	0.000	0.000	0.063	0.331	0.000	0.000
Frag. ulna v. danica	1.411	2.076	0.110	0.251	0.000	0.000	0.327
Gomphonema sp2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gomphonema sp3	0.313	0.000	0.000	0.000	0.662	0.000	0.000
Gomphonema sp4	0.470	2.537	0.773	1.569	1.159	0.484	0.982
Gomphonema cf. intricatum	0.000	1.269	0.442	0.000	0.662	0.000	0.164
Hantzschia amphioxys	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula sp1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula sp2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula sp3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula sp6	0.940	0.346	0.000	1.067	0.000	0.323	0.327
Navicula chiarae	4.545	0.923	0.000	1.130	0.331	0.161	1.637
Nav. cryptocephala ?	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Neidium bisulcatum	0.000	0.231	0.221	0.126	0.000	0.000	0.000
Nitzschia sp1	0.157	0.000	0.000	0.000	0.000	0.000	0.164
Nitzschia sp5	1.881	1.384	0.000	0.251	0.000	0.323	0.000
Nitzschia agnita	0.784	2.537	0.000	0.000	0.000	0.000	0.000
Nitzschia amphibia	0.313	6.228	0.884	1.569	2.980	1.290	0.491
Nitzschia Fragilaria	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sigmoidea	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sinuata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
cf. Pinnularia anglica	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pinnularia sp1	0.000	0.923	0.000	0.126	0.000	0.000	0.164
Stauroneis intricans	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Teapot Frag sp3	0.784	0.000	0.000	0.000	0.000	0.000	0.000
Epithemia sp1	0.000	0.346	0.000	0.000	0.000	0.000	0.000
Eunotia monodon v. monod.	0.000	0.000	0.000	0.000	0.331	0.000	0.000
Cymbopleura cuspidata	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula bryophila	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Navicula abiskoensis	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp96	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp96-004	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Diatom percent abundance: Haynes Lake, Ontario						
Taxon	Core Depth					
	110 cm	120 cm	130 cm	140 cm	160 cm	188.5 cm
Ach. lanc. lanceolata	0.000	0.000	0.000	0.000	0.000	0.000
A. minutissimum total	0.606	0.433	3.361	0.988	1.059	0.123
Amphora capulata	0.076	0.000	0.000	0.000	0.000	0.000
Brachysira brebissonii	0.000	0.000	0.000	0.000	0.106	1.472
Asterionella formosa	0.000	0.000	0.000	0.000	0.000	0.000
Cymb. amphicephala	0.000	0.000	0.000	0.000	0.000	0.000
Cymbella cesatii	0.379	2.091	5.042	1.153	1.801	2.699
Cymbella subcistula	0.114	0.505	1.541	0.165	0.530	2.331
Cymbella falaisensis	1.061	0.865	0.700	0.494	1.271	0.368
Encyonema minuta	0.455	0.216	0.420	0.000	0.000	0.613
Encyonema silesiacum	0.227	1.586	3.221	1.153	4.767	5.644
Cocconeis euglyta	0.000	0.000	0.000	0.165	0.000	0.000
Cyclotella bodanica	0.417	5.191	0.000	1.318	5.932	0.613
Cycotella comensis	6.404	14.564	13.866	28.501	18.962	25.031
Cyclo. michiganiana	7.503	20.692	20.028	25.535	26.271	7.117
Cyclotella stelligera	76.279	37.635	5.462	0.494	26.695	13.620
Eunotia praeurupta	0.076	0.288	0.000	0.165	0.000	0.491
Fragilaria biceps	0.038	0.072	0.140	0.329	0.106	0.000
Fragilaria brevistriata	0.000	0.072	0.000	0.000	0.000	0.245
Fragilaria cap. v. gracilis	0.303	0.793	2.661	1.153	0.318	1.472
Staurosira construens	0.000	0.000	0.000	0.000	0.000	0.000
Fragilaria cyclopum	0.000	0.216	0.000	0.165	0.000	0.000
Frag. delicatissima	0.796	2.668	10.224	5.931	0.318	0.491
Fragilaria leptostauron	0.038	0.000	0.560	0.000	0.000	0.245
F. nanana Total	0.531	0.577	6.583	2.801	0.106	0.245
Fragilaria pinnata	0.076	0.000	0.000	0.000	0.106	0.000
Fragilaria tenera	0.189	0.144	2.101	0.000	0.000	0.123
Gomp. acuminatum	0.000	0.000	0.000	0.000	0.000	0.123
Gomp angustatum	0.000	0.000	0.000	0.000	0.000	0.000
G. cap and G. truncatum TOT	0.000	0.000	0.000	0.000	0.000	0.123
Navicula gastrum	0.000	0.000	0.000	0.000	0.000	0.368
Nav. cryptocephala	0.114	0.000	0.000	0.000	0.000	0.491
cf. Nav. cryptotonna	0.455	1.514	3.641	3.789	1.589	1.840
Eolimna minima	0.000	0.000	0.000	0.165	0.106	0.000
Navicula pseudoventralis	0.000	0.000	0.000	0.000	0.000	0.000
Sellaphora pupula	0.000	0.721	0.000	0.000	0.530	0.613
Navicula radiosa	0.000	0.433	1.261	0.659	0.424	1.350
Navicula seminulum	0.000	0.000	0.000	0.000	0.000	0.000
Navicula tuscula	0.341	0.793	1.821	1.977	0.106	9.448
Navicula veneta	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia angustata	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia dissipata	0.000	0.000	0.000	0.329	0.000	0.245
Nitzschia flexoides	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia fonticola	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia gracilis	0.000	0.000	0.000	0.329	0.000	0.245
Nitzschia palea	0.000	0.000	0.000	0.000	0.000	0.000
Rhopalodia gibba	0.076	0.000	0.560	1.153	0.530	0.859
Stauroneis anceps v. gracilis	0.000	0.000	0.000	0.000	0.000	0.000
Stephano. medius	0.114	0.000	0.000	0.000	0.000	0.000
Tabellaria quadrisepata	0.000	0.000	0.140	0.000	0.000	0.000
Ach. exigua v. heterovalvata	0.000	0.000	0.000	0.000	0.212	0.000
Achnanthes holsatica	0.000	0.072	0.000	0.000	0.000	0.000
Ach. jackii form 1	0.000	0.144	0.280	1.318	0.000	0.000
Ach. jackii form2	0.000	0.000	0.000	0.000	0.000	0.000
Ach. lanceolata v. dubia	0.000	0.000	0.000	0.000	0.000	0.000
Achnanthes saprophila	0.682	0.793	1.541	0.988	1.483	0.245
Brach. microcephala	0.114	0.288	1.821	1.318	0.212	2.331
Cyclotella glomerata	0.000	0.000	0.000	0.000	0.000	0.000

Diatom percent abundance: Haynes Lake, Ontario						
Taxon	Core Depth					
	110 cm	120 cm	130 cm	140 cm	160 cm	188.5 cm
Cymatopleura elliptica	0.000	0.000	0.000	0.000	0.000	0.000
Cymbella sp1	0.265	0.793	1.401	0.165	0.530	0.123
cf. Cymbella parva	0.000	0.000	0.000	0.000	0.000	3.067
Encyo. microcephala	0.872	1.730	3.361	2.471	0.212	0.245
Denticula subtilis	0.114	0.793	0.700	1.318	0.530	3.190
Eolimna sp1	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna sp2	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna sp4	0.000	0.000	0.000	0.000	0.000	0.000
Eolimna minima2	0.000	0.000	0.000	0.000	0.000	0.000
Eunotia flexuosa	0.000	0.144	0.000	0.000	0.212	0.000
Fragilaria sp1	0.000	0.000	0.000	0.165	0.000	0.000
Frag. Pinn. v. lanceolat	0.000	0.000	0.140	0.000	0.000	0.000
Frag. ulna v. danica	0.076	0.649	1.261	3.460	0.318	0.123
Gomphonema sp2	0.076	0.000	0.000	0.000	0.000	0.000
Gomphonema sp3	0.000	0.000	0.000	0.329	0.318	1.840
Gomphonema sp4	0.114	0.288	0.420	0.165	1.483	1.104
Gomphonema cf. intricatum	0.076	0.216	1.120	0.494	0.106	0.982
Hantzschia amphioxys	0.000	0.000	0.000	0.000	0.000	0.123
Navicula sp1	0.000	0.000	0.000	0.000	0.000	0.000
Navicula sp2	0.114	0.000	0.560	0.000	0.000	0.000
Navicula sp3	0.000	0.000	0.000	0.000	0.000	0.245
Navicula sp6	0.000	0.433	0.000	0.988	0.000	0.000
Navicula chiarae	0.303	0.360	0.840	1.318	0.318	0.245
Nav. cryptocephala ?	0.000	0.000	0.000	0.000	0.000	0.000
Neidium bisulcatum	0.000	0.000	0.140	0.000	0.106	0.000
Nitzschia sp1	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sp5	0.114	0.144	0.840	2.142	0.212	0.368
Nitzschia agnita	0.227	0.360	1.120	0.659	0.318	1.104
Nitzschia amphibia	0.076	0.649	0.700	3.295	1.271	5.644
Nitzschia Fragilaria	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sigmoidea	0.000	0.000	0.000	0.000	0.000	0.000
Nitzschia sinuata	0.000	0.000	0.000	0.000	0.000	0.000
cf. Pinnularia anglica	0.000	0.000	0.000	0.000	0.000	0.000
Pinnularia sp1	0.000	0.072	0.140	0.494	0.212	0.000
Stauroneis intricans	0.000	0.000	0.000	0.000	0.000	0.000
Teapot Frag sp3	0.000	0.000	0.000	0.000	0.000	0.000
Epithemia sp1	0.114	0.000	0.280	0.000	0.000	0.000
Eunotia monodon v. monod.	0.000	0.000	0.000	0.000	0.000	0.000
Cymboplectra cuspidata	0.000	0.000	0.000	0.000	0.106	0.000
Navicula bryophila	0.000	0.000	0.000	0.000	0.106	0.000
Navicula abiskoensis	0.000	0.000	0.000	0.000	0.106	0.000
sp96	0.000	0.000	0.000	0.000	0.000	0.245
sp96-004	0.000	0.000	0.000	0.000	0.000	0.123

Appendix 2. Haynes Lake Diatom Subsampling Data

Sample Depth (cm)	Total Wet Weight (g)	Total Dry Weight (g)	Water Weight (g)	Subsample Weight (g)
1.0	1.0079	0.3944	0.6135	0.0579
5.0	1.0471	0.3340	0.7131	0.0464
11.0	1.1683	0.5521	0.6162	0.0573
15.0	1.4903	0.8708	0.6195	0.0517
20.0	1.2691	0.6603	0.6088	0.0456
25.0	1.2798	0.7238	0.5560	0.0462
30.0	1.4837	0.7930	0.6907	0.0468
40.0	1.1656	0.3200	0.8456	0.0446
45.0	1.1095	0.2485	0.8610	0.0399
50.0	0.9606	0.1106	0.8500	0.0342
60.0	1.1012	0.2190	0.8822	0.0467
75.0	1.0277	0.0705	0.9572	0.0323
80.0	0.9739	0.0972	0.8767	0.0449
100.0	0.8481	0.0755	0.7726	0.0472
110.0	0.9175	0.1789	0.7386	0.0346
120.0	0.9504	0.1601	0.7903	0.0543
130.0	0.9108	0.1681	0.7427	0.0335
140.0	1.1469	0.1012	1.0457	0.0450
160.0	0.8548	0.0784	0.7764	0.0334
188.5	0.8238	0.0778	0.7460	0.0330

Appendix 3. Thecamoebian percent abundance data: Haynes Lake, Ontario

Thecamoebian Percent Abundance: Haynes Lake								
Core Depth (cm)	Taxon							
	Curcurbitella tricuspidis	Arcella vulgaris	Centropyxis aculeata "aculeata"	Centropyxis aculeata "discooides"	Centropyxis constricta "aerophila"	Centropyxis constricta "constricta"	Diffflugia oblonga "oblonga"	Diffflugia oblonga "bryophila"
1	62.73	7.45	19.88	2.48	0.62	0.62	4.35	0.00
5	25.32	1.27	35.76	5.70	0.32	0.00	16.46	1.58
11	76.03	2.74	3.42	2.05	0.00	0.00	0.00	0.00
15	28.16	1.94	47.57	8.74	0.00	0.00	1.94	0.00
20	30.77	7.69	49.23	7.69	0.00	1.54	3.08	0.00
25	31.18	1.08	53.76	7.53	1.08	0.00	2.15	0.00
30	39.83	1.69	44.92	8.47	0.85	0.00	1.69	0.00
40	5.00	12.00	73.00	1.00	0.00	0.00	1.00	0.00
45	2.67	18.22	64.00	5.78	0.89	0.89	0.89	0.00
50	4.23	38.03	53.52	0.70	0.70	0.70	0.00	0.00
60	47.06	49.02	0.00	0.00	0.00	0.00	3.92	0.00
75	11.32	71.70	1.89	15.09	0.00	0.00	0.00	0.00
80	10.94	66.04	1.13	10.57	0.00	0.38	10.94	0.00
100	23.17	59.76	0.00	13.41	0.00	0.00	3.05	0.00
110	31.08	62.84	4.05	0.00	0.00	0.00	0.00	0.00
120	34.91	35.38	7.08	2.36	0.00	0.00	18.40	0.00
130	18.10	72.38	0.00	9.52	0.00	0.00	0.00	0.00
140	2.92	77.19	0.00	19.30	0.00	0.00	0.00	0.00
160	8.61	78.15	0.00	13.25	0.00	0.00	0.00	0.00
188.5	0.00	67.16	12.69	18.66	0.00	1.49	0.00	0.00

Thecamoebian Percent Abundance: Haynes Lake								
Core Depth (cm)	Taxon							
	Diffflugia oblonga "glans"	Diffflugia urceolata "elongata"	Diffflugia urceolata "urceolata"	Diffflugia corona	Diffflugia bidens	Diffflugia protaeioformes "acuminata"	Diffflugia protaeioformes "amphoralis"	Lesquereusia spiralis
1	0.00	0.00	0.00	1.24	0.00	0.62	0.00	0.00
5	2.22	0.32	0.95	5.38	0.32	3.48	0.32	0.63
11	0.00	13.01	0.00	2.05	0.00	0.00	0.00	0.68
15	0.00	0.00	0.00	11.65	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	3.23	0.00	0.00
30	0.00	0.00	0.00	1.69	0.00	0.00	0.00	0.85
40	0.00	6.00	0.00	0.00	0.00	0.00	0.00	2.00
45	0.00	5.78	0.00	0.89	0.00	0.00	0.00	0.00
50	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.70
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03
120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89
130	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
140	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00
160	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 4. Haynes Lake ²¹⁰Pb data

Location: Science Museum of Minnesota												
Top of Interval	Base of Interval	Cum. Dry Mass	Unsup. Activity	Error of Unsup. Act.	Cum. Act. below Int.	Age of Int.	Error of Age	Date A.D.	Sediment Accum.	Error of Sed. Accum.		
(cm)	(cm)	(g/cm2)	(pCi/g)	(±s.d.)	(pCi/cm2)	(yr)	(±s.d.)		(g/cm2 yr)	(±s.d.)		
0	1	0.3162	6.1092	0.2546	21.4159	2.77	4.84	2002.9	0.1140	0.01295		
2	3	1.0394	5.0377	0.2068	17.5951	9.08	5.42	1996.6	0.1145	0.01532		
4.1	5.1	1.8131	3.9495	0.0645	14.3286	15.68	6.22	1990.0	0.1186	0.01871		
8.1	9.1	3.9189	0.9885	0.0710	10.5703	25.45	3.59	1980.2	0.3426	0.02845		
12.2	13.2	6.0808	1.0956	0.0712	8.2937	33.24	3.75	1972.4	0.2430	0.02035		
16.2	17.2	7.7122	1.4047	0.0776	6.2041	42.56	3.94	1963.1	0.1432	0.01206		
19.2	20.3	9.3700	0.6567	0.0560	4.7786	50.94	3.58	1954.7	0.2369	0.02186		
22.3	24.3	11.4968	0.7989	0.0627	3.1708	64.11	3.76	1941.5	0.1387	0.01210		
24.3	26.3	12.5156	1.0757	0.0704	2.0749	77.73	4.19	1927.9	0.0748	0.00636		
26.3	28.4	13.8896	0.4348	0.0313	1.4775	88.64	4.82	1917.0	0.1260	0.01408		
28.4	30.4	14.7292	0.9252	0.0598	0.7007	112.59	7.83	1893.0	0.0350	0.00569		
30.4	32.4	16.1420	0.1861	0.0317	0.4378	127.70	11.38	1877.9	0.0935	0.02832		
34.4	36.5	18.2372	0.1546	0.0348	0.0957	176.53	47.29	1829.1	0.0317	0.03076		

Supported Pb-210: 0.8409 ± 0.0163 pCi/g
Number of Supported Samples: 3

Cum. Unsup. Pb-210: 23.3476 pCi/cm2
Unsup. Pb-210 Flux: 0.7786 pCi/cm2 yr

Appendix 5. Haynes Lake Water Chemistry Data

Date: Aug. 20/05

Atmospheric Pressure: 98.1 kPa

Location: Site 1 Haynes Lake 43°57.548N; 79°24.481W

Water Samples (3) Collected Approx. 1m depth : DC878

Equipment: YSI Instrument

Depth (m)	Temperature (°C)	Dissolved Oxygen (mg/L)	Conductance $\mu\text{S}/\text{cm}$	Conductance (corr. to 25°C)	Dissolved Oxygen (%)	pH
0.5	23.3	5.89	784	811	67.0	7.97
1.0	23.3	5.80	780	809	66.9	
2.0	23.2	5.50	780	808	66.9	
3.0	23.2	5.60	779	807	62.0	
4.0	23.0	5.50	778	808	65.0	
5.0	19.1	5.50	795	895	59.0	
6.0	14.8	2.70	729	911	27.0	
7.0	11.5	0.87	681	922	8.0	
8.0	9.4	0.13	656	936	1.1	
9.0	7.7	0.07	640	957	0.6	
10.0	6.7	0.16	635	977	1.3	
11.0	6.0	0.07	644	1010	0.6	
12.0	5.5	0.06	670	1067	0.5	
13.0	5.2	0.06	715	1149	0.5	
14.0	5.1	0.06	731	1178	0.4	
15.0	5.1	0.03	750	1210	0.3	
16.0	5.1	0.02	749	1208	0.2	7.36

Analysis by: Ottawa-Carleton Water Quality Laboratory

Subsample Date	pH	Total Phosphorus (mg/L)	Conductivity ($\mu\text{S}/\text{cm}$)
Aug. 18/05	8.03	0.012	800

Appendix 6. Common diatom species images: Haynes Lake, Ontario

These images, as well as subsample material and microscope slides, are archived at the Canadian Museum of Nature, Research Division, Ottawa, Ontario.

Achnantheidium minutissimum
Core Depth: 1 cm
Length: 9.83 μm ; Width: 2.9 μm

Asterionella formosa
Core Depth: 1 cm
Length: 59.4 μm ; Width: 2.48 μm

Cycotella comensis
Core Depth: 1 cm
Length: 9.32 μm; Width: 10.1 μm

Cyclotella bodanica
Core Depth: 1 cm
Length: 23.5 μm; Width: 25.5 μm

Cyclotella michiganiana
Core Depth: 1 cm
Length: 10.2 μm ; Width: 10.7 μm

Cyclotella stelligera
Core Depth: 25 cm
Length: 4.58 μm ; Width: 4.93 μm

Stephanodiscus medius
 Core Depth: 1 cm
 Length: 14.3 μm ; Width: 14.6 μm

Fragilaria nanana
 Core Depth: 1 cm
 Length: 69.8 μm ; Width: 2.36 μm

Appendix 7. Sediment core x-ray images: Haynes Lake, Ontario

Note: The images below are those not included within the text. The top direction is all of these images is to the left.

Haynes Lake Core HYC1-1: ~ 34 cm - 54 cm depth

Haynes Lake Core HYC1-1: ~ 74 cm - 94 cm depth

Haynes Lake Core 1-2: 95 cm – 114 cm core depth

Haynes Lake Core HYC1-2: ~ 153 – 173 cm core depth

Haynes Lake Core HYC1-2: ~ 173 cm – 188.5 cm

Appendix 8. Diatom percent abundance data: Teapot Lake, Ontario

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	1cm	2cm	5cm	7cm	8cm	10cm	12cm
Achnanthes minutissimum	1.5692	3.2653	5.5021	5.0824	2.4355	6.8831	4.5205
Achnanthes petersenii	0.0000	2.9314	0.4910	0.0000	5.4565	2.2183	0.0000
Aulacoseira ambigua	0.2853	0.4082	1.3755	1.6484	1.4327	0.0000	2.1918
Encyonema cesatii	0.0000	0.0000	0.0000	0.2747	0.0000	0.0000	0.0000
Cymbella cistula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	5.5635	2.1769	1.5131	2.3352	3.4384	2.3377	3.1507
Encyonema silesiacum	3.4237	1.2245	4.2641	2.1978	2.4355	1.4286	1.7808
Cocconeis euglyta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.1427	0.1361	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella comensis	0.2853	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C. michiganiana	0.5706	0.4082	0.1376	0.5495	0.4298	0.2597	0.0000
Cyclotella stelligera	0.7133	0.2721	0.1376	0.0000	0.0000	0.0000	0.0000
Eunotia flexuosa	7.2753	12.7891	6.4649	8.9286	7.4499	5.1948	4.2466
E. intermedia	6.8474	9.1156	6.3274	5.3571	3.4384	3.6364	4.2466
E. praerupta form 1	0.1427	0.4082	0.2751	0.6868	1.5759	0.2597	1.3699
Eunotia diadema	0.5706	0.8163	1.2380	1.7857	2.2923	0.7792	0.6849
Fragilaria brevistriata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Frag. cap. var. cap.	2.4251	0.6803	2.7510	5.4945	2.2923	12.7273	8.6301
Frag. cap. var. mesolepta	0.1427	0.2721	0.5502	0.6868	0.8596	0.0000	0.8219
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.1376	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.0000	0.0000	0.0000	0.5495	0.1433	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.4121	0.0000	0.0000	0.0000
Fragilaria nanana	0.4280	0.8163	1.3755	1.0989	1.1461	0.0000	1.6438
Fragilaria pinnata	0.0000	0.0000	0.2751	0.1374	0.0000	0.0000	0.0000
Fragilaria tenera	29.5292	24.6259	17.3315	18.6813	20.3438	14.0260	19.7260
F. ulna and arcus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. G. acuminatum	0.0000	0.1361	0.1376	0.4121	0.8596	0.6494	0.5479
Gomphonema micropus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema augur	0.0000	0.0000	0.0000	0.1374	0.4298	0.2597	0.1370
G. angustatumgracileaffine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp6	0.0000	0.1361	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion circulare Fm1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp3	0.0000	0.0000	0.0000	0.1374	0.0000	0.0000	0.0000
Naviculacryptocephala	0.1427	1.2245	1.2380	1.5110	0.5731	0.2597	0.5479
Navicula cryptotonella	0.8559	0.2721	0.1376	0.4121	0.4298	0.0000	0.6849
Cf. Eolimna minima	2.5678	2.4490	4.4017	4.5330	5.8739	3.3766	6.1644
Navicula pseudoventralis	0.0000	0.0000	0.4127	0.0000	0.4298	0.0000	0.0000
Sellaphora pupula	0.1427	0.1361	0.1376	0.0000	0.0000	0.1299	0.0000
Navicula radiosa	4.1369	4.4898	2.4759	1.3736	3.1519	2.8571	1.2329
Nitzschia sp4	1.7118	1.9048	2.0633	3.8462	2.0057	1.5584	1.0959
Nitzschia gracilis	0.9986	0.0000	0.1376	0.0000	3.2951	4.6753	4.9315
Pinnularia subanglica	1.2839	0.4082	0.6878	0.0000	0.5731	0.3896	0.2740
Pinnularia sp4	0.0000	0.0000	0.0000	0.1374	0.2865	0.0000	0.0000
Pinnularia viridis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis gracilis	0.1427	0.1361	0.0000	0.0000	0.8596	0.0000	0.0000
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.2747	0.0000	0.0000	0.1370
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T. flocculosa v.4	1.5692	2.3129	4.9519	2.6099	3.1519	2.8571	3.6986
Tabellaria fenestrata	0.1427	0.6803	0.1376	0.9615	0.4298	0.6494	0.4110
Achnanthes sp	0.0000	2.0690	0.0000	0.0000	9.2534	8.9123	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	1cm	2cm	5cm	7cm	8cm	10cm	12cm
A. exigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A. minut. v. scotica	0.1427	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aulacoseira islandica	1.2839	1.3605	1.6506	0.6868	1.1461	4.4156	0.4110
Eunotia sp1	0.1427	0.4082	0.0000	0.0000	0.0000	0.7792	0.0000
Eunotia sp2	0.1427	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia incisa	4.8502	3.6735	3.7139	1.5110	6.3037	3.6364	4.5205
E. monodon total	0.0000	0.3559	0.7117	0.0000	7.1007	3.5296	0.0000
E. paludosa	1.1412	1.9048	1.1004	1.0989	0.1433	1.1688	0.5479
Fragilaria sp1	0.7133	0.0000	0.2751	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.7792	0.1370
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.1433	0.0000	0.0000
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.1427	0.2721	0.6878	0.9615	0.0000	0.1299	0.4110
Gomphonema sp3	0.2853	0.5442	0.2751	0.1374	0.0000	0.0000	0.0000
Gomphonema sp4	0.4280	0.5442	0.5502	0.1374	0.2865	0.5195	0.2740
Cf. G. acum. v. Turris	0.1427	0.0000	0.0000	0.0000	0.8596	0.0000	0.0000
G. cymbelliclinum	0.4280	0.8163	0.0000	0.8242	0.5731	0.7792	0.5479
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.1427	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.2597	0.0000
Neidium affine	0.0000	0.4082	0.9629	0.5495	0.5731	0.3896	0.4110
Nitzschia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp2	0.2853	0.0000	0.1376	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	0.0000	0.0000	0.5502	2.1978	2.0057	0.5195	1.9178
Nitzschia perminuta	2.1398	2.7211	5.0894	3.5714	1.0029	2.9870	0.2740
Nupela neotropica	0.7133	0.6803	0.8253	1.2363	0.2865	2.3377	2.6027
Pinnularia macilenta	0.0000	0.1361	0.2751	0.0000	0.0000	0.2597	0.0000
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis krieri	0.0000	0.0000	1.2380	0.8242	0.1433	0.2597	0.4110
Stenopterobia intermedia	1.1412	0.5442	0.4127	0.5495	0.0000	0.2597	0.2740
Nitzschia agnita	1.4265	1.2245	3.8514	0.9615	0.0000	0.0000	0.0000
Nitzschia sp5	0.0000	0.0000	0.0000	0.0000	0.4298	0.0000	0.0000
Pinnularia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes lanc.lanc.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes saprophila	0.1427	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp4	0.0000	0.1361	0.1376	0.0000	0.0000	0.0000	0.0000
Pinnularia sp2	0.0000	0.0000	0.1376	0.5495	0.0000	0.0000	0.0000
Pinnularia sp3	0.0000	0.0000	0.1376	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.0000	0.0000	0.1376	0.0000	0.0000	0.0000	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.0000	0.1433	0.0000	0.2740
Nitzschia sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9178
Stephanodiscus sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2740
Brachysira microcephala	0.0000	0.0000	0.0000	0.0000	0.7163	0.0000	0.0000
Pinnularia sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cymbella sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula chiarae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Denticula sp1	0.0000	0.0000	0.0000	0.0000	1.1461	0.0000	0.5479
Gomphonema sp8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1370
Navicula sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	15cm	20cm	25cm	30cm	40cm	50cm	60cm
Achnanthes minutissimum	1.8692	2.1333	3.2967	4.4190	5.3333	0.0000	0.1570
Achnanthes petersenii	0.3273	0.0000	0.0000	0.0000	13.0290	6.8652	1.0141
Aulacoseira ambigua	1.0903	2.1333	1.7857	1.1457	0.0000	0.0000	0.1570
Encyonema cesatii	0.0000	0.0000	0.0000	0.4910	0.0000	0.0000	0.0000
Cymbella cistula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	4.5171	4.5333	3.9835	1.4730	1.5000	5.8531	4.2386
Encyonema silesiacum	3.1153	0.5333	1.2363	0.9820	1.6667	0.2491	1.5699
Cocconeis euglyta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.1558	0.0000	0.0000	0.3273	0.0000	0.1245	0.0000
Cyclotella comensis	0.0000	0.1333	0.0000	0.0000	0.0000	0.1245	0.0000
C. michiganiana	0.1558	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella stelligera	0.3115	0.0000	0.0000	0.0000	0.1667	0.0000	0.1570
Eunotia flexuosa	15.4206	6.5333	6.3187	6.7103	4.6667	9.3400	16.6405
E. intermedia	8.4112	3.8667	2.6099	4.2553	3.3333	5.8531	6.7504
E. praerupta form 1	0.4673	0.8000	0.6868	0.3273	0.1667	0.3736	0.4710
Eunotia diadema	0.9346	0.5333	0.1374	0.0000	0.0000	0.0000	0.0000
Fragilaria brevistriata	0.0000	0.0000	0.0000	0.0000	0.1667	0.0000	0.0000
Frag. cap. var. cap.	4.6729	8.2667	5.3571	1.9640	3.0000	13.5741	3.7677
Frag. cap. var. mesolepta	0.1558	0.0000	0.2747	0.4910	0.3333	0.1245	0.0000
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.3115	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria nanana	0.6231	0.8000	1.2363	1.1457	12.3333	0.0000	0.1570
Fragilaria pinnata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria tenera	21.1838	39.2000	31.5934	43.3715	34.3333	33.8730	28.7284
F. ulna and arcus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. G. acuminatum	0.7788	0.2667	1.3736	0.6547	0.0000	0.0000	0.1570
Gomphonema micropus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema augur	0.3115	0.0000	0.0000	0.0000	0.0000	0.0000	0.3140
G. angustatumgracileaffine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp6	0.0000	0.0000	0.2747	0.0000	0.0000	0.0000	0.1570
Meridion circulare Fm1	0.0000	0.0000	0.0000	0.0000	0.0000	0.4981	0.0000
Navicula sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1570
Naviculacryptocephala	0.9346	1.6000	1.0989	0.3273	0.0000	0.0000	4.7096
Navicula cryptotonella	0.3115	0.2667	0.0000	0.3273	0.6667	0.0000	1.2559
Cf. Eolimna minima	1.2461	2.4000	1.6484	1.8003	1.0000	0.1245	0.4710
Navicula pseudoventralis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sellaphora pupula	0.0000	0.0000	0.2747	0.0000	0.0000	0.0000	0.0000
Navicula radiosa	3.5826	0.4000	2.7473	2.2913	2.5000	10.3362	7.3783
Nitzschia sp4	0.0000	1.0667	0.6868	1.9640	8.6667	0.0000	0.9419
Nitzschia gracilis	0.0000	0.8000	0.0000	0.0000	1.3333	0.9963	0.0000
Pinnularia subanglica	1.4019	0.5333	0.2747	1.8003	0.0000	0.0000	0.0000
Pinnularia sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia viridis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis gracilis	0.0000	0.0000	0.2747	0.0000	0.3333	0.0000	0.1570
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T. flocculosa v.4	0.4673	0.4000	0.8242	1.1457	1.0000	0.3736	0.1570
Tabellaria fenestrata	0.4673	0.4000	0.2747	0.3273	0.8333	0.3736	0.7849
Achnanthes sp	0.2787	0.2853	1.1163	1.1229	26.5294	22.2904	0.8259
A. exigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1570
A. minut. v. scotica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aulacoseira islandica	2.0249	1.0667	0.2747	0.3273	0.1667	0.1245	0.0000
Eunotia sp1	0.1558	0.0000	0.1374	0.0000	0.0000	0.0000	0.0000
Eunotia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.2491	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	15cm	20cm	25cm	30cm	40cm	50cm	60cm
Eunotia incisa	3.4268	2.2667	2.6099	3.1097	1.3333	3.3624	0.7849
E. monodon total	0.0000	0.0000	0.0000	0.0000	25.9109	2.2220	1.4235
E. paludosa	1.5576	0.6667	1.2363	0.9820	0.1667	2.1171	1.7268
Fragilaria sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.1245	0.0000
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.2491	0.0000
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.7788	0.0000	0.1374	0.0000	0.0000	0.0000	0.0000
Gomphonema sp3	0.3115	0.1333	0.5495	0.0000	0.0000	0.0000	0.7849
Gomphonema sp4	0.0000	0.0000	0.2747	0.6547	0.0000	0.2491	0.7849
Cf. G. acum. v. Turris	0.4673	0.0000	0.1374	0.0000	0.0000	0.2491	0.0000
G. cymbelliclinum	0.3115	0.9333	0.5495	0.0000	0.0000	0.2491	0.0000
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.1333	0.0000	0.1637	0.0000	0.0000	0.0000
Neidium affine	0.9346	0.2667	0.4121	0.0000	0.0000	0.0000	0.1570
Nitzschia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	0.4673	2.2667	2.6099	2.1277	0.6667	0.0000	0.3140
Nitzschia perminuta	2.9595	3.8667	10.3022	4.4190	3.3333	0.2491	2.6688
Nupela neotropica	0.6231	0.0000	0.8242	0.3273	0.1667	0.0000	0.3140
Pinnularia macilenta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3140
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis krieri	0.1558	0.0000	0.1374	0.0000	0.1667	0.0000	0.0000
Stenopterobia intermedia	0.0000	0.2667	0.4121	0.1637	0.0000	0.3736	0.1570
Nitzschia agnita	2.3364	1.8667	1.5110	1.1457	0.3333	0.0000	0.3140
Nitzschia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes lanc.lanc.	0.0000	0.0000	0.0000	0.3273	0.0000	0.0000	0.0000
Meridion sp1	0.0000	0.0000	0.2747	0.0000	0.1667	0.0000	0.0000
Gomphonema sp5	0.0000	0.0000	0.0000	0.0000	0.3333	0.0000	0.0000
Achnanthes saprophila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp4	0.0000	0.0000	0.0000	0.1637	0.0000	0.0000	0.1570
Pinnularia sp2	0.1558	0.1333	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp3	0.0000	0.0000	0.1374	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.1637	0.0000	0.0000	0.0000
Nitzschia sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira microcephala	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cymbella sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula chiarae	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Denticula sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	70cm	75cm	85cm	90cm	95cm	100cm	105cm
Achnanthes minutissimum	0.0000	1.9704	1.2912	1.3223	1.4950	3.8333	2.1823
Achnanthes petersenii	0.1374	0.0000	7.3211	0.7657	0.0000	0.0000	0.0000
Aulacoseira ambigua	0.0000	0.0000	0.8608	0.0000	0.0000	0.0000	0.0000
Encyonema cesatii	0.0000	0.0000	0.0000	0.0000	0.0000	0.6667	0.0000
Cymbella cistula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	3.6977	4.1051	2.4390	2.8099	1.4950	0.6667	2.1823
Encyonema silesiacum	1.1254	3.7767	1.2912	0.8264	0.3322	3.3333	1.4121
Cocconeis euglyta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1284
Cyclotella comensis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2567
C. michiganiana	0.1608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella stelligera	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia flexuosa	10.7717	6.0755	8.0344	5.2893	6.1462	6.8333	5.2632
E. intermedia	5.4662	4.7619	3.8737	1.6529	1.8272	2.3333	2.5674
E. praeurpta form 1	0.3215	0.0000	0.1435	0.0000	0.4983	0.1667	0.0000
Eunotia diadema	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria brevistriata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Frag. cap. var. cap.	3.3762	7.3892	1.0043	16.0331	5.3156	14.1667	18.2285
Frag. cap. var. mesolepta	0.6431	0.1642	1.5782	0.4959	0.8306	0.6667	0.0000
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.1435	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria nanana	2.0900	2.6273	2.5825	1.6529	2.1595	3.0000	7.1887
Fragilaria pinnata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria tenera	23.7942	26.6010	36.5854	34.7107	60.4651	31.5000	36.7137
F. ulna and arcus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. G. acuminatum	1.1254	0.3284	0.5739	0.3306	0.1661	0.3333	0.0000
Gomphonema micropus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema augur	0.0000	0.1642	0.0000	0.0000	0.0000	0.1667	0.0000
G. angustatumgracileaffine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1284
Meridion circulare Fm1	0.1608	0.0000	0.1435	0.0000	0.0000	0.0000	0.0000
Navicula sp3	0.1608	0.1642	0.0000	0.0000	0.0000	0.0000	0.0000
Naviculacryptocephala	0.6431	2.2989	1.0043	2.1488	1.9934	2.6667	1.9255
Navicula cryptotonella	2.0900	0.0000	0.7174	0.4959	0.6645	1.3333	0.7702
Cf. Eolimna minima	0.6431	1.3136	2.5825	2.6446	0.6645	3.3333	0.2567
Navicula pseudoventralis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sellaphora pupula	0.1608	0.4926	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula radiosa	8.3601	5.7471	3.2999	1.6529	2.1595	4.0000	1.9255
Nitzschia sp4	3.5370	1.3136	1.1478	2.1488	0.0000	0.6667	0.8986
Nitzschia gracilis	3.2154	0.6568	5.0215	0.3306	1.6611	2.6667	1.0270
Pinnularia subanglica	0.0000	0.3284	0.2869	0.0000	0.0000	0.0000	0.0000
Pinnularia sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia viridis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis gracilis	0.1608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T. flocculosa v.4	0.1608	0.0000	1.0043	0.4959	0.8306	2.0000	1.0270
Taballaria fenestrata	0.8039	0.0000	0.2869	0.0000	0.0000	0.1667	0.1284
Achnanthes sp	2.6249	0.0000	5.8564	0.9650	0.0000	0.1376	0.0000
A. exigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A. minut. v. scotica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aulacoseira islandica	0.0000	0.3284	0.2869	0.0000	0.0000	0.0000	0.0000
Eunotia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	70cm	75cm	85cm	90cm	95cm	100cm	105cm
Eunotia incisa	0.8039	0.3284	0.7174	0.1653	0.1661	1.0000	1.1553
E. monodon total	0.0000	0.0000	5.4080	0.0000	0.0000	0.0000	0.0000
E. paludosa	0.9646	1.6420	0.2869	0.4959	0.4983	0.0000	0.0000
Fragilaria sp1	0.0000	0.9852	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.0000	0.4926	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp3	0.1608	0.6568	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp4	0.0000	0.0000	0.1435	0.0000	0.3322	0.1667	0.0000
Cf. G. acum. v. Turris	0.0000	0.3284	0.0000	0.0000	0.6645	0.0000	0.0000
G. cymbelliclinum	0.0000	0.6568	0.0000	0.3306	0.0000	0.0000	0.0000
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.4823	0.0000	0.0000	0.0000	0.3322	0.0000	0.0000
Neidium sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium affine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	0.1608	0.0000	0.2869	0.8264	0.3322	3.3333	0.5135
Nitzschia perminuta	1.4469	4.2693	2.8694	5.9504	0.3322	1.8333	1.2837
Nupela neotropica	0.1608	0.8210	0.2869	0.0000	1.3289	1.6667	0.7702
Pinnularia macilenta	0.0000	0.0000	0.0000	0.3306	0.0000	0.0000	0.1284
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis krieri	0.4823	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stenopterobia intermedia	0.4823	1.1494	0.0000	0.3306	0.1661	0.3333	0.2567
Nitzschia agnita	0.0000	1.8062	0.0000	0.8264	0.0000	0.0000	0.0000
Nitzschia sp5	0.0000	0.8210	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp1	0.0000	0.3284	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes lanc.lanc.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000	0.2567
Achnanthes saprophila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp2	0.1608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp7	1.9293	0.0000	2.2956	3.3058	0.6645	0.6667	0.5135
Stephanodiscus sp1	0.0000	0.0000	0.0000	0.0000	0.1661	0.0000	1.1553
Brachysira microcephala	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2567
Pinnularia sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cymbella sp1	0.0000	0.0000	0.0000	0.0000	0.1661	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula chiarae	0.1608	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Denticula sp1	1.4469	0.0000	0.1435	0.0000	0.1661	0.0000	0.0000
Gomphonema sp8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira sp1	0.0000	0.0000	1.0043	0.0000	0.1661	0.0000	0.0000
Navicula sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	110cm	116cm	123cm	129cm	135cm	141cm	148cm
Achnanthes minutissimum	0.8026	0.6006	3.5370	0.7485	1.2966	0.6431	0.1597
Achnanthes petersenii	0.0000	2.3819	0.0000	0.2994	74.9649	0.0000	2.0283
Aulacoseira ambigua	0.1605	0.0000	0.0000	0.1497	0.3241	0.0000	0.0000
Encyonema cesatii	0.1605	0.0000	0.8039	0.0000	0.1621	0.0000	0.0000
Cymbella cistula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	4.3339	6.0060	4.0193	6.8862	3.5656	4.5016	1.5974
Encyonema silesiacum	0.4815	0.6006	1.1254	0.0000	0.6483	0.3215	0.6390
Cocconeis euglyta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella comensis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C. michiganiana	0.0000	0.0000	0.0000	0.1497	0.0000	0.0000	0.0000
Cyclotella stelligera	0.0000	0.0000	0.0000	0.0000	0.3241	0.0000	0.0000
Eunotia flexuosa	20.0642	16.3664	14.7910	17.8144	23.0146	19.9357	16.2939
E. intermedia	7.3836	3.4535	3.8585	2.2455	2.7553	3.5370	2.8754
E. praerupta form 1	0.4815	1.2012	0.9646	0.4491	0.3241	0.1608	0.3195
Eunotia diadema	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria brevistriata	0.0000	0.0000	0.4823	0.2994	0.0000	0.0000	0.0000
Frag. cap. var. cap.	1.7657	0.0000	7.5563	0.0000	5.1864	0.1608	9.2652
Frag. cap. var. mesolepta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.2994	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.0000	0.0000	0.0000	0.2994	0.0000	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria nanana	9.1493	4.6547	8.6817	1.1976	4.3760	0.9646	0.6390
Fragilaria pinnata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria tenera	25.2006	31.2312	21.2219	37.8743	19.7731	52.4116	38.8179
F. ulna and arcus	0.0000	0.0000	0.0000	1.1976	0.0000	0.0000	0.0000
Cf. G. acuminatum	0.0000	0.0000	0.0000	0.5988	0.4862	0.0000	0.0000
Gomphonema micropus	0.0000	0.0000	0.0000	2.0958	0.0000	0.0000	0.0000
Gomphonema augur	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. angustatumgracileaffine	0.0000	0.0000	0.0000	8.0838	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.7485	0.0000	0.0000	0.0000
Nitzschia sp6	0.0000	0.3003	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion circulare Fm1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp3	0.0000	0.0000	0.0000	0.0000	0.3241	0.0000	0.1597
Naviculacryptocephala	0.4815	0.7508	0.9646	0.2994	4.0519	0.3215	0.3195
Navicula cryptotonella	0.4815	1.2012	0.6431	4.3413	1.1345	1.6077	0.9585
Cf. Eolimna minima	0.0000	0.3003	0.3215	0.4491	0.1621	0.0000	0.0000
Navicula pseudoventralis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sellaphora pupula	0.0000	6.7568	1.9293	0.5988	0.9724	0.0000	0.1597
Navicula radiosa	4.4944	6.0060	4.3408	6.1377	6.4830	2.0900	3.5144
Nitzschia sp4	0.0000	0.0000	1.4469	0.0000	0.9724	0.0000	0.0000
Nitzschia gracilis	2.4077	1.3514	2.5723	0.7485	1.7828	0.0000	0.0000
Pinnularia subanglica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.3215	0.0000
Pinnularia viridis	0.0000	0.1502	0.0000	0.0000	0.1621	0.0000	0.0000
Stauroneis gracilis	0.0000	0.1502	0.0000	0.0000	0.4862	0.0000	0.4792
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T. flocculosa v.4	0.4815	0.0000	0.3215	0.0000	0.1621	0.0000	0.0000
Tabellaria fenestrata	1.4446	0.3003	0.1608	0.0000	0.6483	0.0000	0.0000
Achnanthes sp	0.0000	2.6198	0.2751	0.1497	71.4866	0.0000	0.2736
A. exigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A. minut. v. scotica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aulacoseira islandica	0.0000	0.1502	0.0000	0.2994	0.0000	0.0000	0.0000
Eunotia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	110cm	116cm	123cm	129cm	135cm	141cm	148cm
Eunotia incisa	3.2103	0.4505	1.6077	0.7485	0.6483	0.3215	0.7987
E. monodon total	0.0000	15.7865	0.0000	0.4491	52.7955	0.0000	0.7117
E. paludosa	0.9631	2.2523	0.4823	0.4491	0.1621	1.9293	0.0000
Fragilaria sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.1497	0.0000	0.0000	0.3195
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.1605	0.1502	0.1608	0.0000	0.3241	0.1608	0.3195
Gomphonema sp3	0.6421	0.6006	0.6431	0.4491	0.4862	0.1608	0.0000
Gomphonema sp4	0.0000	0.0000	0.1608	0.1497	0.9724	0.0000	0.0000
Cf. G. acum. v. Turris	0.0000	0.3003	0.0000	0.0000	0.0000	0.0000	0.0000
G. cymbelliclinum	1.1236	0.1502	0.3215	0.4491	0.8104	0.4823	0.1597
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp1	0.1605	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium affine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	1.6051	0.0000	0.9646	0.1497	0.6483	0.0000	0.0000
Nitzschia perminuta	0.6421	0.0000	0.0000	0.0000	0.9724	0.0000	0.3195
Nupela neotropica	0.0000	0.0000	0.1608	0.0000	0.1621	0.0000	0.1597
Pinnularia macilenta	0.1605	0.3003	0.0000	0.0000	0.3241	0.1608	0.0000
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis kriereri	0.0000	0.0000	0.0000	0.0000	0.1621	0.0000	0.0000
Stenopterobiaintermedia	0.3210	0.0000	0.3215	0.5988	0.9724	0.1608	0.3195
Nitzschia agnita	0.0000	0.0000	0.3215	0.0000	1.6207	0.0000	0.4792
Nitzschia sp5	0.0000	0.0000	0.3215	0.0000	0.0000	0.0000	0.0000
Pinnularia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes lanc.lanc.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion sp1	0.6421	0.0000	0.1608	0.0000	0.3241	0.0000	0.1597
Gomphonema sp5	0.3210	0.3003	0.3215	0.5988	0.3241	0.0000	0.0000
Achnanthes saprophila	0.0000	0.0000	0.0000	0.0000	0.3241	0.0000	0.0000
Fragilaria sp4	0.0000	0.0000	0.1608	0.1497	0.0000	0.0000	0.0000
Pinnularia sp2	0.0000	0.0000	0.8039	0.1497	0.0000	0.0000	0.3195
Pinnularia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp7	0.6421	0.0000	1.2862	0.0000	0.3241	0.0000	0.0000
Stephanodiscus sp1	0.0000	0.4505	1.2862	0.0000	0.1621	0.0000	0.0000
Brachysira microcephala	0.0000	0.1502	0.3215	0.0000	0.0000	0.0000	0.0000
Pinnularia sp6	0.0000	0.0000	0.0000	0.0000	0.1621	0.3215	0.0000
Cymbella sp1	0.0000	0.4505	0.0000	0.0000	0.1621	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula chiarae	0.0000	0.0000	0.0000	0.8922	0.0000	0.0000	0.0000
Denticula sp1	0.0000	1.0511	0.0000	0.1497	0.0000	0.4823	0.0000
Gomphonema sp8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	154cm	160cm	166cm	173cm	179cm	185cm	198cm
Achnanthes minutissimum	1.4493	1.4068	2.6604	1.1076	3.2028	0.0000	1.4157
Achnanthes petersenii	0.0000	0.0000	0.0000	0.0000	0.2747	0.0000	0.0000
Aulacoseira ambigua	0.0000	0.0000	0.1565	0.4747	0.3559	0.0000	0.9009
Encyonema cesatii	0.0000	0.1172	0.0000	0.0000	0.7117	0.0000	0.0000
Cymbella cistula	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	2.2297	3.1653	4.3818	9.8101	4.2705	2.8302	2.9601
Encyonema silesiacum	0.7804	0.9379	1.8779	0.1582	1.9573	1.5723	0.7722
Cocconeis euglyta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cyclotella comensis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C. michiganiana	0.0000	0.0000	0.0000	0.3165	0.0000	0.0000	0.0000
Cyclotella stelligera	0.0000	0.2345	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia flexuosa	2.3411	3.8687	8.7637	16.2975	7.8292	18.0818	12.7413
E. intermedia	0.1115	1.4068	2.6604	1.4241	0.1779	2.0440	1.1583
E. praerupta form 1	0.0000	0.0000	0.3130	0.4747	1.4235	0.0000	0.2574
Eunotia diadema	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria brevistriata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1287
Frag. cap. var. cap.	0.0000	11.7233	3.9124	3.4810	0.5338	4.8742	0.2574
Frag. cap. var. mesolepta	0.0000	0.0000	0.1565	0.0000	0.0000	0.0000	0.9009
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.0000	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.3165	0.0000	0.0000	0.0000
Fragilaria nanana	21.2932	3.7515	16.9014	5.3797	14.0569	1.7296	16.6023
Fragilaria pinnata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria tenera	53.9576	49.5897	16.5884	16.4557	30.7829	22.0126	22.5225
F. ulna and arcus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. G. acuminatum	0.1115	0.1172	0.1565	0.9494	0.7117	0.0000	0.0000
Gomphonema micropus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema augur	0.6689	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. angustatumgracileaffine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp6	0.1115	0.0000	0.1565	0.0000	0.0000	0.0000	0.0000
Meridion circulare Fm1	0.1115	0.0000	0.4695	0.0000	0.1779	0.0000	0.0000
Navicula sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Naviculacryptocephala	2.4526	0.9379	2.5039	0.7911	2.6690	0.4717	0.7722
Navicula cryptotonella	0.7804	0.0000	0.7825	0.6329	0.3559	1.5723	1.1583
Cf. Eolimna minima	0.5574	1.5240	2.1909	1.2658	1.4235	0.3145	0.9009
Navicula pseudoventralis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sellaphora pupula	0.0000	0.2345	0.3130	0.3165	0.0000	0.6289	0.0000
Navicula radiosa	1.3378	1.7585	2.1909	6.6456	4.0925	2.5157	4.8906
Nitzschia sp4	0.0000	0.0000	2.6604	0.0000	0.0000	0.0000	0.0000
Nitzschia gracilis	1.6722	0.8206	1.2520	0.1582	0.7117	0.0000	2.1879
Pinnularia subanglica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp4	0.0000	0.0000	0.0000	0.1582	0.0000	0.0000	0.0000
Pinnularia viridis	0.0000	0.0000	0.1565	0.0000	0.0000	0.1572	0.1287
Stauroneis gracilis	0.0000	0.0000	0.3130	0.0000	0.3559	0.0000	0.1287
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T. flocculosa v.4	0.0000	0.0000	0.6260	0.0000	0.0000	0.0000	0.0000
Tabellaria fenestrata	0.0000	0.0000	0.1565	0.0000	0.0000	0.0000	0.5148
Achnanthes sp	0.0000	0.0000	0.0000	0.0000	0.1361	0.0000	0.0000
A. exigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
A. minut. v. scotica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aulacoseira islandica	0.0000	0.1172	0.0000	0.3165	0.1779	0.0000	0.1287
Eunotia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	154cm	160cm	166cm	173cm	179cm	185cm	198cm
Eunotia incisa	0.0000	0.2345	0.0000	0.0000	0.8897	0.7862	0.1287
E. monodon total	0.0000	0.0000	0.0000	0.0000	0.0000	0.1779	0.0000
E. paludosa	0.0000	0.2345	0.0000	0.6329	0.1779	0.0000	0.0000
Fragilaria sp1	0.0000	0.4689	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3861
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1287
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.0000	0.3517	0.0000	0.3165	0.0000	0.3145	0.0000
Gomphonema sp3	0.0000	0.0000	0.1565	0.0000	0.0000	1.8868	0.0000
Gomphonema sp4	0.0000	0.0000	0.1565	0.0000	0.0000	0.4717	0.0000
Cf. G. acum. v. Turris	0.0000	0.0000	0.0000	0.4747	0.0000	0.1572	0.0000
G. cymbelliclinum	0.0000	0.0000	0.1565	0.7911	0.3559	0.0000	0.7722
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium affine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp1	0.0000	0.0000	0.0000	0.3165	0.0000	0.0000	0.0000
Nitzschia sp2	0.0000	0.0000	0.1565	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	0.4459	0.0000	0.3130	1.7405	0.0000	0.0000	0.0000
Nitzschia perminuta	0.5574	0.7034	3.1299	1.8987	2.4911	0.0000	4.7619
Nupela neotropica	0.0000	0.0000	0.3130	0.0000	0.1779	0.0000	0.0000
Pinnularia macilenta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis kriereri	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3861
Stenopterobiaintermedia	0.3344	0.0000	0.3130	0.0000	0.3559	0.0000	0.3861
Nitzschia agnita	0.0000	0.0000	0.0000	1.2658	0.0000	0.0000	0.0000
Nitzschia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes lanc.lanc.	0.0000	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000
Meridion sp1	1.1148	0.5862	0.6260	1.5823	0.3559	0.0000	1.4157
Gomphonema sp5	0.0000	0.2345	0.3130	0.0000	0.0000	0.0000	0.3861
Achnanthes saprophila	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2574
Pinnularia sp2	0.0000	0.0000	0.1565	0.0000	0.0000	0.0000	0.0000
Pinnularia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.1115	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp7	0.0000	0.0000	0.3130	0.6329	0.0000	0.0000	0.7722
Stephanodiscus sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira microcephala	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cymbella sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula chiarae	0.0000	0.0000	0.3130	0.1582	0.0000	0.0000	0.0000
Denticula sp1	0.0000	0.0000	0.3130	0.6329	0.0000	0.0000	0.3861
Gomphonema sp8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1287
Brachysira sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	204cm	216cm	226cm	277cm	325cm	368cm	410cm
Achnanthes minutissimum	1.3216	12.5152	18.7935	11.7735	0.2915	3.0945	4.7805
Achnanthes petersenii	1.4262	0.3273	3.4487	0.0000	0.2747	5.0386	2.6508
Aulacoseira ambigua	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema cesatii	0.0000	1.7011	1.5081	0.8942	0.2915	0.0000	0.9756
Cymbella cistula	0.0000	0.3645	0.0000	0.0000	0.0000	0.0000	0.0000
Encyonema minuta	3.9648	0.3645	1.9722	3.7258	6.5598	4.0717	0.8780
Encyonema silesiacum	1.0279	0.0000	0.0000	2.3845	0.8746	0.4886	0.0976
Cocconeis euglyta	0.0000	0.0000	0.1160	0.0000	0.0000	0.0000	0.0000
Cyclotella atomus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6829
Cyclotella comensis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	20.0976
C. michiganiana	0.0000	0.0000	0.1160	0.0000	0.0000	0.0000	13.2683
Cyclotella stelligera	0.0000	0.0000	0.2320	0.0000	0.0000	0.0000	0.0000
Eunotia flexuosa	13.5095	3.2807	3.2483	7.4516	21.1370	9.2834	3.1220
E. intermedia	0.5874	0.2430	0.0000	0.8942	0.8746	1.1401	0.0976
E. praeurpta form 1	0.2937	0.2430	0.1160	1.4903	0.4373	0.0000	0.1951
Eunotia diadema	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria brevistriata	0.1468	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Frag. cap. var. cap.	1.0279	0.1215	0.0000	0.0000	1.0204	0.6515	2.8293
Frag. cap. var. mesolepta	0.0000	0.0000	0.1160	0.2981	0.0000	0.3257	0.0000
Frag. capucina v. rumpens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Staurosira construens	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S. construens v. venter	0.0000	0.0000	0.0000	0.1490	0.0000	0.0000	0.0000
Fragilaria leptostauron	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria nanana	6.3142	24.1798	15.6613	8.7928	3.3528	0.4886	26.0488
Fragilaria pinnata	0.0000	0.0000	0.0000	0.0000	0.0000	1.9544	0.0000
Fragilaria tenera	47.1366	23.5723	18.5615	25.3353	26.8222	18.4039	15.4146
F. ulna and arcus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. G. acuminatum	0.5874	0.3645	0.0000	0.4471	0.2915	0.1629	0.5854
Gomphonema micropus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema augur	0.0000	0.0000	0.0000	0.0000	0.0000	0.1629	0.1951
G. angustatumgracileaffine	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G. truncatumcapitatum+sp7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp6	0.0000	0.0000	0.0000	0.0000	0.2915	0.1629	0.0000
Meridion circulare Fm1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Navicula sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Naviculacryptocephala	1.7621	5.4678	3.5963	0.5961	1.1662	7.3290	0.6829
Navicula cryptotonella	0.4405	0.1215	0.0000	0.4471	0.2915	0.1629	0.0000
Cf. Eolimna minima	0.1468	1.9441	3.0162	0.0000	0.4373	2.1173	0.3902
Navicula pseudoventralis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sellaphora pupula	0.0000	0.2430	0.8121	0.4471	0.5831	3.7459	0.0976
Navicula radiosa	3.3774	0.9721	1.8561	1.7884	8.4548	4.2345	0.3902
Nitzschia sp4	0.0000	0.6075	6.3805	0.0000	0.0000	0.0000	0.2927
Nitzschia gracilis	0.0000	2.9162	2.6682	3.1297	0.1458	3.0945	0.0000
Pinnularia subanglica	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pinnularia sp4	0.0000	0.0000	0.0000	0.0000	0.1458	0.1629	0.0000
Pinnularia viridis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis gracilis	0.1468	0.0000	0.3480	0.2981	0.0000	1.3029	0.0000
Stauroneis sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.8143	0.0000
Stephanodiscus medius	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Surirella linearis	0.0000	0.0000	0.0000	0.0000	0.0000	0.3257	0.0000
T. flocculosa v.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tabellaria fenestrata	0.7342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes sp	2.6051	1.2656	9.4184	0.4127	0.4163	11.1027	5.6799
A. exigua	0.0000	0.1215	0.0000	0.1490	0.0000	1.3029	0.0000
A. minut. v. scotica	0.0000	0.0000	0.8121	0.4471	0.0000	0.0000	0.4878
Aulacoseira islandica	0.0000	0.0000	0.0000	0.0000	0.0000	2.1173	0.0000
Eunotia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Eunotia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Diatom percent abundance: Teapot Lake, Ontario							
Taxon	Core Depth						
	204cm	216cm	226cm	277cm	325cm	368cm	410cm
Eunotia incisa	1.4684	0.2430	0.0000	1.4903	1.3120	1.3029	0.0000
E. monodon total	3.1407	1.9282	1.7380	0.0000	0.6289	6.6082	0.0000
E. paludosa	0.2937	0.0000	0.0000	0.0000	0.1458	0.0000	0.0000
Fragilaria sp1	0.7342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fragilaria sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cf. Frag. neoproducta	0.0000	0.0000	0.0000	0.1490	0.0000	0.4886	0.0000
Fragilaria senedra	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp2	0.1468	0.0000	0.1160	0.0000	0.1458	0.0000	0.0000
Gomphonema sp3	0.2937	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp4	0.0000	0.0000	0.0000	0.0000	0.1458	0.0000	0.0000
Cf. G. acum. v. Turris	0.1468	0.2430	0.0000	0.0000	0.0000	0.0000	0.0000
G. cymbelliclinum	0.0000	0.0000	0.0000	0.4471	0.0000	0.9772	0.0000
Gomphonema gracile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gparvparv.f.saprophilum	0.2937	0.2430	0.2320	0.0000	0.0000	0.4886	0.0000
Neidium sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Neidium affine	0.0000	0.0000	0.0000	0.0000	0.0000	1.1401	0.0000
Nitzschia sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia perminuta SM	0.0000	0.3645	1.2761	0.0000	0.0000	0.0000	1.1707
Nitzschia perminuta	0.4405	2.1871	2.7842	3.2787	2.4781	0.8143	1.3659
Nupela neotropica	0.0000	0.0000	0.0000	0.0000	0.0000	0.1629	0.0000
Pinnularia macilenta	0.0000	0.0000	0.0000	0.0000	0.0000	0.6515	0.0000
P. nodosa v. robusta	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Stauroneis krieri	0.0000	0.2430	0.2320	0.0000	0.0000	0.4886	0.0000
Stenopterobiaintermedia	0.0000	0.0000	0.0000	0.1490	0.4373	0.9772	0.0976
Nitzschia agnita	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp5	0.0000	0.2430	2.5522	0.0000	0.0000	0.0000	0.0000
Pinnularia sp1	0.0000	0.2430	0.0000	0.0000	0.0000	0.1629	0.0000
Achnanthes lanc.lanc.	0.0000	0.0000	0.2320	0.0000	0.0000	0.0000	0.0000
Meridion sp1	0.2937	0.0000	0.3480	0.0000	2.6239	0.1629	0.0000
Gomphonema sp5	0.7342	0.7290	0.4640	0.8942	1.0204	0.0000	0.7805
Achnanthes saprophila	0.0000	1.2151	0.4640	0.1490	0.0000	0.0000	0.3902
Fragilaria sp4	0.2937	0.0000	0.0000	0.0000	0.2915	0.0000	0.0000
Pinnularia sp2	0.0000	0.0000	0.0000	0.1490	0.0000	0.0000	0.0000
Pinnularia sp3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Achnanthes holsatica	0.0000	0.0000	0.0000	0.0000	0.0000	0.9772	0.0000
Pinnularia sp5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Nitzschia sp7	0.0000	0.4860	0.0000	0.5961	0.0000	0.0000	0.1951
Stephanodiscus sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brachysira microcephala	0.0000	0.0000	0.3480	4.0238	0.0000	0.0000	0.2927
Pinnularia sp6	0.0000	0.1215	0.0000	0.0000	0.0000	0.0000	0.0000
Cymbella sp1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gomphonema sp6	0.0000	0.0000	0.0000	0.0000	0.0000	0.1629	0.2927
Navicula chiarae	0.0000	0.0000	1.8561	0.1490	0.4373	0.1629	0.1951
Denticula sp1	0.0000	0.0000	0.4640	0.0000	0.0000	0.0000	0.1951
Gomphonema sp8	0.0000	0.2430	0.0000	1.0432	0.0000	0.0000	0.0000
Brachysira sp1	0.2937	0.1215	0.1160	0.0000	0.0000	0.0000	0.0000
Navicula sp4	0.0000	0.0000	0.0000	0.2981	0.0000	0.9772	0.0000

Appendix 9. Teapot Lake Diatom Subsampling Data

Sample Depth (cm)	Total Wet Weight (g)	Total Dry Weight (g)	Water Weight (g)	Subsample Weight (g)
1.0	17.3557	16.6667	0.6890	0.0225
2.0	17.6788	16.7408	0.9380	0.0266
5.0	17.3383	16.5396	0.7987	0.0238
7.0	17.4617	16.5787	0.8830	0.0225
8.0	17.6097	16.6936	0.9161	0.0212
10.0	17.4191	16.6732	0.7459	0.0164
12.0	17.5717	16.7628	0.8089	0.0268
15.0	17.3898	16.6090	0.7808	0.0228
20.0	17.2731	16.7179	0.5552	0.0201
25.0	17.3363	16.7588	0.5775	0.0217
30.0	17.3014	16.6355	0.6659	0.0263
40.0	17.3321	16.7578	0.5743	0.0200
50.0	17.4301	16.5135	0.9166	0.0389
60.0	17.3677	16.5822	0.7855	0.0200
70.0	18.1764	17.2684	0.9080	0.0265
75.0	17.5852	16.8179	0.7673	0.0255
85.0	17.7960	16.7962	0.9998	0.0239
90.0	17.9518	16.6205	1.3313	0.0200
95.0	17.7402	16.7939	0.9463	0.0332
100.0	17.7240	16.6399	1.0841	0.0200
105.0	17.7276	16.7014	1.0262	0.0200
110.0	17.4091	16.5818	0.8273	0.0200
116.0	17.6424	16.7610	0.8814	0.0307
123.0	17.6953	16.9717	0.7236	0.0400
129.0	17.6902	16.7768	0.9134	0.0303
135.0	17.6033	16.7077	0.8956	0.0300
141.0	17.6843	16.7465	0.9378	0.0308
148.0	17.4416	16.5932	0.8484	0.0363
154.0	17.6882	16.7661	0.9221	0.0309
160.0	17.5672	16.6945	0.8727	0.0516
166.0	17.7512	16.8107	0.9405	0.0351
173.0	17.7545	16.8209	0.9336	0.0410
179.0	17.8211	16.9586	0.8625	0.0335
185.0	17.6271	16.6765	0.9506	0.0505
198.0	17.6598	16.566	1.0938	0.0351
204.0	17.6971	16.7699	0.9272	0.0383
216.0	17.5581	16.7733	0.7848	0.0401
226.0	17.7760	16.8767	0.8993	0.0400
236.0	17.7474	16.8877	0.8597	0.0356
277.0	17.6068	16.6990	0.9078	0.0200

Sample Depth (cm)	Total Wet Weight (g)	Total Dry Weight (g)	Water Weight (g)	Subsample Weight (g)
325.0	17.7131	16.8997	0.8134	0.0200
368.0	17.6655	16.7468	0.9187	0.0369
410.0	17.5370	16.6172	0.9198	0.0421

Appendix 10. Pollen percent abundance data: Teapot Lake, Ontario

Core Depth (cm)	Pollen Percent Abundance: Teapot Lake							
	Taxon							
	Tsuga canadensis	Picea	Abies	Pinus haploxylon	Pinus diploxylon	Undifferentiated Pinus	Undifferentiated Pinaceae	Cupressaceae
8.00	35.53	1.54	0.88	0.00	0.66	0.66	1.32	2.19
22.00	27.06	0.00	0.00	0.00	2.55	0.20	1.76	2.35
36.00	16.97	1.03	1.54	0.00	1.80	0.00	1.80	2.31
43.00	17.65	0.00	0.71	0.00	0.71	0.47	0.71	4.94
50.00	24.46	0.81	0.00	0.27	0.81	0.54	1.08	1.08
64.00	16.94	1.09	0.00	0.00	0.27	0.00	0.82	2.73
78.00	22.25	0.26	0.26	0.00	0.52	0.00	0.79	2.09
92.00	15.96	0.22	1.33	0.44	0.89	0.22	0.44	1.55
99.00	17.27	1.81	0.00	0.00	0.40	0.60	0.40	2.21
107.00	15.29	1.94	0.49	0.00	0.24	0.00	1.46	1.70
110.00	18.72	0.80	0.53	0.27	0.80	0.27	0.80	0.80
117.00	14.35	0.71	1.18	0.71	0.24	0.00	0.94	12.00
131.00	15.18	0.39	0.39	0.78	1.56	1.56	0.39	0.78
138.00	21.54	0.19	0.96	0.00	0.00	0.00	2.12	2.12
152.00	10.48	1.21	1.41	0.81	1.01	0.00	0.81	2.42
166.00	14.17	0.81	0.00	0.40	0.81	0.40	1.42	1.01
180.00	5.87	1.17	0.78	0.98	0.20	0.20	0.59	5.48
187.00	38.61	1.04	0.58	0.23	1.39	0.00	0.69	1.39
194.00	4.02	0.57	0.00	0.29	0.00	0.00	1.44	0.57
201.00	4.33	2.64	2.26	0.94	3.39	0.00	2.45	1.51
214.00	7.84	6.67	2.61	0.78	6.54	0.39	1.05	0.78
228.00	2.43	1.46	0.16	0.00	2.11	0.00	0.81	4.05
242.00	7.02	0.78	0.16	0.62	1.25	0.00	0.78	3.59
249.00	6.49	2.16	0.36	0.00	0.36	0.00	1.62	2.34
262.00	10.10	2.56	0.64	0.64	0.96	0.00	2.56	1.28
277.00	27.72	0.41	0.27	0.00	0.41	0.00	0.41	1.22
291.00	23.15	0.62	0.15	0.15	0.62	0.00	0.00	1.54
305.00	15.95	0.00	0.00	0.00	0.33	0.00	0.33	0.82
322.00	1.41	0.31	0.00	0.00	0.94	0.00	0.47	1.88
336.00	3.03	2.42	1.06	0.30	1.06	0.00	0.76	0.61
350.00	1.83	4.73	0.46	0.00	1.22	0.00	0.30	0.46
356.00	4.68	2.42	0.30	0.76	2.57	0.00	1.81	1.36
371.00	2.79	2.65	0.56	0.28	0.42	0.00	0.56	1.54
385.00	4.64	1.77	0.55	0.00	0.14	0.00	0.41	0.55
399.00	2.98	1.70	0.14	0.00	0.14	0.00	0.28	1.42
413.00	27.83	0.46	0.00	0.00	0.69	0.00	0.00	0.12
429.50	12.48	9.19	0.13	0.26	1.44	0.00	0.26	0.26
443.50	10.16	5.46	0.38	0.13	0.76	0.00	2.41	0.25
457.50	3.14	22.92	1.05	0.12	1.63	0.00	1.75	0.35
471.50	1.42	30.10	0.88	0.11	1.20	0.33	0.00	0.11
478.50	1.37	24.03	0.91	0.18	1.37	0.00	0.09	0.37
497.50	7.88	8.61	0.36	0.00	1.58	0.00	0.12	0.36

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Larix	Salix	Acer rubrum	Acer negundo	Acer saccharinum	Undifferentiated Acer	Quercus	Fraxinus
8.00	1.10	1.97	0.00	0.00	0.00	1.97	1.32	1.10
22.00	1.37	0.98	0.00	0.00	0.00	0.20	3.14	1.37
36.00	4.37	0.26	0.00	0.00	0.00	0.26	3.08	1.29
43.00	3.06	0.24	0.00	0.00	0.00	0.00	4.00	0.94
50.00	1.61	1.08	0.00	0.00	0.00	0.00	4.03	0.00
64.00	2.19	0.55	0.00	0.00	0.00	0.00	3.01	0.82
78.00	1.57	1.05	0.00	0.00	0.00	0.00	1.57	0.79
92.00	1.55	0.67	0.00	0.00	0.00	0.44	3.77	0.44
99.00	1.61	0.60	0.00	0.00	0.00	0.20	4.02	1.00
107.00	2.67	2.43	0.00	0.00	0.00	0.49	5.58	1.21
110.00	1.60	0.27	0.00	0.00	0.00	0.27	2.67	0.53
117.00	0.94	0.00	0.00	0.00	0.00	0.24	1.88	0.94
131.00	0.39	0.00	0.00	0.00	0.00	0.00	0.78	0.00
138.00	0.77	0.77	0.00	0.00	0.00	0.19	0.96	0.00
152.00	2.02	0.60	0.00	0.00	0.00	0.40	2.22	0.00
166.00	0.61	0.20	0.00	0.00	0.00	0.20	1.21	0.00
180.00	0.59	0.78	0.00	0.00	0.00	0.20	1.57	0.00
187.00	0.12	0.23	0.00	0.00	0.00	0.81	5.43	0.12
194.00	0.00	0.00	0.00	0.00	0.00	0.00	3.45	0.00
201.00	0.00	0.38	0.00	0.00	0.00	0.56	5.27	0.19
214.00	0.39	1.44	0.00	0.00	0.00	1.05	4.58	1.05
228.00	0.49	0.97	0.00	0.00	3.73	0.00	7.94	0.97
242.00	0.31	0.94	0.00	0.00	1.40	0.00	6.40	1.72
249.00	0.72	0.00	0.18	0.00	0.18	0.00	0.72	0.54
262.00	0.48	0.00	0.48	0.00	0.00	0.00	2.72	0.64
277.00	1.49	0.14	0.00	0.00	0.00	0.41	3.13	1.09
291.00	1.39	0.00	0.31	0.00	0.00	0.00	8.18	0.93
305.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.16
322.00	0.31	0.16	0.00	0.00	1.72	0.00	5.63	2.19
336.00	0.00	0.15	0.76	0.00	0.45	0.00	1.06	1.52
350.00	3.81	0.00	0.00	0.00	0.30	0.00	4.12	1.83
356.00	0.15	0.00	0.30	0.00	0.00	0.00	3.93	1.51
371.00	0.70	0.00	0.84	0.00	0.84	0.00	6.56	1.82
385.00	0.41	0.27	0.14	0.00	2.86	0.00	1.91	0.95
399.00	0.28	0.00	0.14	0.00	0.85	0.00	2.98	2.56
413.00	0.46	0.00	0.35	0.00	0.46	0.00	2.42	0.92
429.50	0.53	0.00	0.00	0.00	0.00	0.00	7.62	1.31
443.50	0.38	0.00	0.38	0.00	1.02	0.00	10.16	0.51
457.50	0.93	0.23	0.12	0.00	0.58	0.00	5.82	0.35
471.50	2.08	0.00	0.22	0.00	0.22	0.00	3.83	0.11
478.50	3.75	0.00	0.09	0.00	1.19	0.00	8.31	0.46
497.50	2.55	0.00	0.24	0.00	0.85	0.00	6.19	0.97

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Ulmus	Celtis	Fagus	Ostrya/ Carpinus	Tilia	Juglans	Carya	Populus
8.00	2.63	0.00	20.83	2.41	0.00	0.88	0.00	0.00
22.00	4.51	0.00	28.43	0.20	1.57	0.00	0.00	0.00
36.00	3.08	0.00	30.59	0.77	1.03	0.00	0.00	0.00
43.00	5.65	0.00	33.41	1.65	0.94	0.00	0.24	0.47
50.00	2.96	0.00	33.33	1.34	0.27	0.00	0.00	0.00
64.00	3.01	0.00	33.61	0.82	0.27	0.55	0.00	0.00
78.00	4.45	0.00	26.70	0.52	0.26	0.52	0.26	0.26
92.00	6.87	0.00	29.05	0.00	0.22	0.22	0.00	0.44
99.00	8.03	0.00	21.89	0.40	0.60	0.80	2.21	0.20
107.00	3.88	0.00	21.12	1.21	1.70	0.24	0.49	0.24
110.00	4.55	0.00	22.46	1.07	0.53	0.27	0.80	0.27
117.00	5.65	0.00	22.12	0.24	0.00	0.00	0.71	0.00
131.00	1.17	0.00	13.23	0.00	0.00	0.00	0.00	0.00
138.00	5.77	0.00	22.31	0.00	0.00	0.00	0.38	0.00
152.00	4.44	0.00	24.40	0.00	0.00	0.00	0.81	0.00
166.00	4.05	0.00	25.30	0.00	0.00	0.00	1.82	0.20
180.00	3.91	0.39	22.11	0.20	0.39	0.00	0.98	0.00
187.00	4.16	0.00	11.91	0.81	0.92	0.12	0.12	0.46
194.00	2.01	0.00	18.39	0.00	0.00	0.29	0.57	0.00
201.00	5.65	0.00	17.51	0.19	1.51	0.38	0.56	0.38
214.00	6.80	0.00	11.50	0.39	0.39	0.92	1.31	0.00
228.00	5.19	0.00	16.21	1.13	0.97	0.65	0.97	0.00
242.00	6.24	0.00	15.29	0.31	0.31	0.78	1.25	0.16
249.00	2.70	0.36	15.32	0.36	0.72	0.00	0.36	0.54
262.00	2.40	0.00	22.28	0.48	0.32	0.00	1.28	0.00
277.00	5.16	0.00	12.91	0.54	0.00	0.14	0.41	0.14
291.00	3.55	0.00	9.10	0.15	0.62	0.15	0.31	0.15
305.00	2.96	0.00	12.17	0.16	0.49	0.00	0.99	0.33
322.00	3.29	0.00	14.55	1.41	1.10	0.16	0.94	0.00
336.00	6.06	0.00	13.18	1.67	0.15	0.30	1.21	0.00
350.00	3.66	0.00	11.13	0.30	0.91	0.15	2.59	0.00
356.00	3.02	0.00	10.57	0.45	0.15	0.00	1.36	0.15
371.00	4.75	0.00	10.20	1.68	0.70	0.84	1.96	0.28
385.00	3.68	0.00	14.32	0.68	0.68	1.09	1.64	0.27
399.00	3.13	0.00	15.63	0.00	0.43	0.71	2.70	0.00
413.00	2.08	0.00	10.74	0.23	0.46	0.81	0.46	0.12
429.50	1.97	0.00	1.18	0.92	0.39	0.00	0.00	0.00
443.50	1.65	0.00	1.90	1.40	0.89	0.25	0.25	0.00
457.50	1.75	0.00	0.70	0.81	0.12	0.12	0.00	0.00
471.50	1.86	0.00	0.22	2.08	0.33	0.11	0.00	0.00
478.50	1.64	0.55	0.46	1.55	0.27	0.09	0.82	0.09
497.50	1.82	0.00	3.03	1.09	0.24	0.12	0.36	0.00

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Morus	Cornus	Betula	Alnus	Polygonom amphibian	Petalostemum	Rubus	Rumex
8.00	0.00	0.00	8.11	0.66	0.00	0.00	0.00	0.00
22.00	0.00	0.00	5.49	1.18	0.00	0.00	0.00	0.00
36.00	0.00	0.00	2.83	1.80	0.00	0.00	0.00	0.00
43.00	0.00	0.00	4.47	1.18	0.00	0.00	0.00	0.00
50.00	0.00	0.00	2.42	1.61	0.00	0.00	0.00	0.00
64.00	0.00	0.00	3.83	0.82	0.00	0.00	0.00	0.00
78.00	0.00	0.00	4.71	0.26	0.00	0.00	0.00	0.00
92.00	0.00	0.00	2.44	0.67	0.00	0.00	0.00	0.00
99.00	0.00	0.00	3.82	0.60	0.00	0.40	0.00	0.00
107.00	0.00	0.00	2.91	1.70	0.00	1.70	0.00	0.00
110.00	0.00	0.00	2.41	1.34	0.00	0.53	0.00	0.00
117.00	1.65	0.00	3.29	0.71	0.00	0.00	0.00	0.00
131.00	0.00	0.00	1.95	0.00	0.00	0.00	0.00	0.00
138.00	0.00	0.00	7.50	0.00	0.00	0.00	0.00	0.00
152.00	0.00	0.00	6.45	3.83	0.00	0.00	0.00	0.00
166.00	0.00	0.20	0.61	1.21	0.00	0.00	0.00	0.00
180.00	0.00	0.00	6.85	0.78	0.00	0.00	0.00	0.00
187.00	0.00	0.00	3.70	0.81	0.00	0.00	0.00	0.23
194.00	0.00	0.00	1.72	1.15	0.00	0.00	0.00	0.00
201.00	0.00	0.00	3.95	0.56	0.00	0.00	0.00	0.00
214.00	0.00	0.00	4.31	1.31	0.00	0.00	0.00	1.05
228.00	0.00	0.00	6.48	0.00	0.00	0.00	0.00	0.00
242.00	0.00	0.00	3.90	0.31	0.00	0.00	0.00	0.00
249.00	0.00	0.00	1.08	0.36	0.00	0.18	0.00	0.00
262.00	0.00	0.00	1.12	0.00	0.00	0.00	0.16	0.00
277.00	0.00	0.00	0.14	0.00	0.41	0.00	0.41	0.00
291.00	0.00	0.00	0.93	0.00	0.31	0.00	0.46	0.00
305.00	0.00	0.00	0.16	0.66	0.00	0.00	0.00	0.00
322.00	0.00	0.00	4.07	2.82	0.00	0.00	0.00	0.00
336.00	0.00	0.00	3.18	0.61	0.00	0.00	0.00	0.76
350.00	0.00	0.00	2.74	0.00	0.00	0.00	0.00	0.00
356.00	0.00	0.00	1.66	0.45	0.15	0.00	0.00	0.45
371.00	0.00	0.00	3.21	0.28	0.28	0.14	0.00	0.28
385.00	0.00	0.00	4.23	0.14	0.00	0.41	0.00	0.00
399.00	0.00	0.00	2.70	0.14	0.00	0.28	0.00	0.00
413.00	0.00	0.00	1.62	0.23	0.00	0.00	0.00	0.00
429.50	0.00	0.13	2.10	0.00	0.00	0.13	0.00	0.00
443.50	0.00	0.00	2.29	0.25	0.00	0.00	0.00	0.00
457.50	0.00	0.00	2.33	0.00	0.23	0.00	0.00	0.00
471.50	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00
478.50	0.00	0.00	4.29	0.00	0.00	0.00	0.00	0.82
497.50	0.00	0.00	1.21	0.12	0.00	0.00	0.00	0.00

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Chenopodiaceae	Plantago	Helianthus	Ambrosia	Artemisia	Portulaca	Andropogon	Zea
8.00	0.00	0.00	0.00	0.22	0.00	0.44	0.00	0.44
22.00	0.00	0.20	0.20	0.00	0.00	0.00	0.00	0.00
36.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00
50.00	0.00	0.00	0.00	0.27	0.27	0.00	0.00	0.00
64.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00
78.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00
92.00	0.44	0.00	0.00	1.11	0.00	0.00	0.00	0.00
99.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.00
107.00	0.49	0.00	0.00	0.24	0.00	0.00	0.00	0.00
110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
131.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00
138.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
152.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
166.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
180.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00
187.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
194.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
201.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
214.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00
228.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
242.00	0.00	0.00	0.00	0.00	0.31	0.00	0.16	0.00
249.00	0.00	0.18	0.00	0.18	0.36	0.00	0.00	0.00
262.00	0.00	0.00	0.00	0.00	0.32	0.48	0.00	0.00
277.00	0.00	0.14	0.00	0.14	0.54	0.00	0.27	0.00
291.00	0.00	0.00	0.00	0.15	0.00	0.15	0.00	0.00
305.00	0.00	0.33	0.00	0.00	0.33	0.00	0.00	0.00
322.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
336.00	0.15	0.00	0.00	0.15	0.00	0.00	0.00	0.00
350.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
356.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00
371.00	0.00	0.00	0.00	0.28	0.00	0.00	0.14	0.00
385.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00
399.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00
413.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.12
429.50	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
443.50	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00
457.50	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00
471.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
478.50	0.09	0.00	0.00	0.27	0.00	0.00	0.00	0.00
497.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Zizania aquatica	Undifferentiated Poaceae	Equisteum	Pteridium	Pteropsida	Ulota crispa	Lycopodium lucidulum	Lycopodium inundatum
8.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00
22.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.20
36.00	0.26	0.51	0.00	0.00	0.51	0.00	0.00	0.00
43.00	0.24	0.00	0.00	0.00	0.24	0.00	0.00	0.00
50.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
64.00	0.55	0.00	0.00	0.00	0.27	0.00	0.00	0.00
78.00	0.00	0.00	0.00	0.00	2.62	0.00	0.00	0.00
92.00	0.00	0.00	0.00	0.22	0.67	0.00	0.00	0.00
99.00	0.00	0.00	0.00	0.40	1.00	0.00	0.00	0.00
107.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00
110.00	0.00	0.27	0.53	0.27	0.00	0.00	0.00	0.00
117.00	0.00	0.24	0.00	0.00	0.24	0.00	0.00	0.00
131.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00
138.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.00
152.00	0.00	0.40	0.00	0.00	0.20	0.00	0.00	0.00
166.00	0.00	0.00	0.00	0.00	1.42	0.00	0.00	0.00
180.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.00
187.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
194.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.00
201.00	0.00	0.00	0.00	0.00	1.13	0.00	0.00	0.00
214.00	0.00	0.00	0.00	0.13	0.92	0.00	0.13	0.00
228.00	0.00	0.16	0.00	0.00	0.32	0.00	0.00	0.00
242.00	0.31	0.00	0.00	0.00	1.40	0.00	0.00	0.00
249.00	0.00	0.00	0.00	0.00	1.08	0.36	0.00	0.00
262.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
277.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00
291.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
305.00	0.16	0.00	0.00	0.00	1.15	0.00	0.00	0.00
322.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00
336.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00
350.00	0.00	0.00	0.00	0.00	1.68	0.00	0.00	0.00
356.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
371.00	0.00	0.28	0.00	0.00	0.42	0.00	0.00	0.00
385.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00
399.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
413.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
429.50	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
443.50	0.00	0.25	0.00	0.00	0.13	0.00	0.00	0.00
457.50	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
471.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
478.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
497.50	0.00	0.12	0.00	0.00	0.12	0.00	0.00	0.00

Pollen Percent Abundance: Teapot Lake								
Core Depth (cm)	Taxon							
	Other/Unkown	Potamogeton pentin	Potamogeton natans	Nuphar	Cyperaceae	Nymphaea	Typha	Charcoal
8.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.00	12.35	0.00	0.58	0.00	0.00	0.00	0.77	5.49
36.00	14.65	0.00	0.25	0.25	0.25	0.00	1.01	0.77
43.00	7.76	0.00	0.00	0.23	0.00	0.23	0.00	6.12
50.00	8.06	0.00	0.00	0.00	0.00	0.00	0.00	4.84
64.00	10.11	0.00	0.00	0.00	0.00	0.00	0.00	11.20
78.00	7.33	0.00	0.00	0.00	0.00	0.00	0.00	14.92
92.00	9.31	0.00	2.16	0.22	0.22	0.00	0.00	9.09
99.00	9.24	0.00	0.60	0.00	0.00	0.00	0.00	8.84
107.00	3.88	0.00	0.00	0.00	0.24	0.00	0.00	26.70
110.00	6.95	0.00	0.00	0.00	0.00	0.00	0.00	9.36
117.00	3.53	0.00	0.00	0.00	0.00	0.70	0.00	18.12
131.00	9.34	0.00	0.00	0.00	0.00	0.00	0.00	5.84
138.00	6.73	0.00	0.00	0.57	0.00	0.00	0.76	6.73
152.00	5.44	0.00	0.00	0.00	0.00	0.00	0.00	3.43
166.00	10.12	0.00	0.20	0.00	0.00	0.00	0.20	11.74
180.00	9.59	0.00	0.00	0.20	0.00	0.00	0.00	31.31
187.00	4.28	0.00	0.12	0.00	0.00	0.00	0.00	3.35
194.00	8.62	0.00	0.00	0.00	0.29	0.00	0.00	17.53
201.00	6.40	0.00	0.00	0.00	0.00	0.00	0.00	3.39
214.00	6.93	0.00	0.00	0.13	0.00	0.00	0.00	3.53
228.00	5.83	0.00	0.00	0.00	0.32	0.00	0.32	10.37
242.00	6.55	0.00	0.00	0.46	0.15	0.15	0.00	3.28
249.00	15.32	0.35	1.24	0.18	0.00	0.00	0.00	10.63
262.00	6.09	0.00	0.00	0.00	0.00	0.16	0.00	5.29
277.00	4.21	0.00	0.00	0.27	1.20	0.00	0.00	1.63
291.00	1.85	0.00	0.00	0.15	1.07	0.00	0.00	2.62
305.00	10.53	0.00	0.00	0.00	0.00	0.00	0.00	1.81
322.00	5.63	0.00	0.00	0.00	0.00	0.00	0.00	1.41
336.00	8.18	0.00	0.00	0.00	0.00	0.00	0.00	1.52
350.00	4.27	0.00	0.00	0.00	0.00	0.15	0.00	1.07
356.00	7.55	0.00	0.00	0.15	0.00	0.00	0.00	0.76
371.00	2.93	0.14	0.00	0.00	0.00	0.00	0.00	1.26
385.00	4.91	0.00	0.27	0.00	0.00	0.00	0.00	0.68
399.00	3.41	0.00	0.00	0.00	0.00	0.00	0.00	0.28
413.00	1.62	0.00	0.00	0.00	0.00	0.12	0.00	0.00
429.50	2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.39
443.50	2.29	0.00	0.00	0.00	0.00	0.00	0.00	0.25
457.50	1.28	0.00	0.00	0.00	0.12	0.00	0.00	0.12
471.50	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.22
478.50	3.20	0.00	0.00	0.09	0.18	0.00	0.00	0.91
497.50	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.24

Pollen Percent Abundance: Teapot Lake					
Core Depth (cm)	Taxon				
	Nymphaea hairs	Tilletia caries	Ustilago	Pediastrum	Spicules
8.00	0.00	0.00	0.44	0.00	0.00
22.00	0.00	0.00	0.00	0.20	5.10
36.00	0.00	0.00	0.00	0.26	8.23
43.00	0.00	0.00	0.00	0.00	8.00
50.00	0.00	0.00	0.27	0.00	5.38
64.00	0.00	0.00	0.00	0.00	8.20
78.00	0.00	0.00	0.00	0.00	10.47
92.00	0.00	0.00	0.00	0.00	2.66
99.00	0.00	1.00	0.00	0.00	5.02
107.00	0.00	0.49	0.00	0.00	6.31
110.00	0.00	0.00	0.00	0.00	6.95
117.00	0.24	0.00	0.00	0.00	1.18
131.00	0.00	0.00	0.00	0.00	0.39
138.00	0.00	0.00	0.00	0.00	0.19
152.00	0.00	0.00	0.00	0.00	0.00
166.00	0.00	0.00	0.00	0.00	0.20
180.00	0.00	0.00	0.00	0.00	0.20
187.00	0.12	0.58	0.00	0.00	0.00
194.00	0.00	0.00	0.00	0.00	0.00
201.00	0.00	0.00	0.00	0.00	0.19
214.00	0.13	0.00	0.00	0.00	0.26
228.00	0.16	0.16	0.00	0.00	0.32
242.00	0.00	0.00	0.00	0.00	0.00
249.00	0.00	0.00	0.00	0.00	0.18
262.00	0.00	0.32	0.00	0.00	0.16
277.00	0.00	0.00	0.00	0.27	1.63
291.00	0.00	0.15	0.00	0.00	4.48
305.00	0.00	0.00	0.00	0.00	0.33
322.00	0.00	0.16	0.00	0.00	0.31
336.00	0.00	0.00	0.00	0.00	2.27
350.00	1.07	0.15	0.00	0.15	0.46
356.00	0.00	0.30	0.00	0.00	1.81
371.00	0.00	0.42	0.00	0.14	9.92
385.00	0.00	0.00	0.00	0.00	0.27
399.00	0.00	0.14	0.00	0.00	3.98
413.00	0.00	0.00	0.00	0.00	6.00
429.50	0.00	0.00	0.00	0.00	0.26
443.50	0.00	0.13	0.00	0.00	0.76
457.50	0.00	0.12	0.00	0.00	0.35
471.50	0.00	0.00	0.00	0.00	1.53
478.50	0.09	1.55	0.00	0.18	0.27
497.50	0.00	0.24	0.00	0.00	0.61

Appendix 11. Teapot Lake ²¹⁰Pb data

Location: Science Museum of Minnesota												
Top of Interval	Base of Interval	Cum. Dry Mass	Unsup. Activity	Error of Unsup. Act.	Cum. Act. below Int.	Age of Int.	Error of Age	Date	Sediment Accum.	Error of Sed. Accum.		
(cm)	(cm)	(g/cm ²)	(pCi/g)	(±s.d.)	(pCi/cm ²)	(yr)	(±s.d.)	A.D.	(g/cm ² yr)	(±s.d.)		
0	1	0.0757	5.3898	0.2404	2.9387	4.17	1.03	2001.5	0.0181	0.00086		
2.1	3.1	0.2345	4.5232	0.1365	2.1857	13.68	1.10	1991.9	0.0162	0.00061		
3.1	4.2	0.3122	3.6951	0.1465	1.8987	18.20	1.19	1987.4	0.0172	0.00080		
5.2	6.3	0.4867	2.8754	0.1150	1.3664	28.77	1.27	1976.9	0.0162	0.00077		
6.3	7.3	0.5574	2.5129	0.1111	1.1887	33.24	1.39	1972.4	0.0158	0.00086		
8.4	9.4	0.7322	1.6308	0.0682	0.8685	43.32	1.13	1962.3	0.0179	0.00083		
10.5	11.5	0.9043	1.6345	0.0755	0.5874	55.88	1.42	1949.7	0.0124	0.00068		
12.6	13.6	1.0616	1.5146	0.0756	0.3443	73.03	2.07	1932.6	0.0082	0.00056		
13.6	14.7	1.1456	1.2114	0.0550	0.2425	84.29	2.79	1921.3	0.0075	0.00061		
14.7	15.7	1.2064	1.2285	0.0626	0.1678	96.11	3.90	1909.5	0.0051	0.00055		
15.7	16.8	1.2687	1.2234	0.0554	0.0916	115.55	6.97	1890.1	0.0032	0.00053		
16.8	17.8	1.3184	0.8744	0.0530	0.0481	136.24	13.10	1869.4	0.0024	0.00073		
17.8	18.9	1.3770	0.3919	0.0412	0.0251	157.12	24.89	1848.5	0.0028	0.00161		

Supported Pb-210: 0.5465 ± 0.0283 pCi/g
Number of Supported Samples: 6

Cum. Unsup. Pb-210: 3.3467 pCi/cm ²
Unsup. Pb-210 Flux: 0.1116 pCi/cm ² yr

Appendix 12. Common diatom species images: Teapot Lake, Ontario

These images, as well as subsample material and microscope slides, are archived at the Canadian Museum of Nature, Research Division, Ottawa, Ontario.

Achnantheidium minutissimum var. *minutissimum*

Core Depth: 410 cm

Length: 11 μm ; Width: 2.66 μm

Cyclotella comensis

Core Depth: 410 cm

Length: 6.23 μm ; Width: 6.23 μm

Encyonema minuta
Core Depth: 10 cm
Length: 13.8 μm ; Width: 4.58 μm

Cf. Eolimna minima
Core Depth: 410 cm
Length: 9.33 μm ; Width: 3.77 μm

Eunotia flexuosa
Core Depth: 10 cm
Length: 74.7 μm ; Width: 3.61 μm

Eunotia incisa
Core Depth: 10 cm
Length: 19.2 μm ; Width: 3.73 μm

Fragilaria tenera
Core Depth: 10 cm
Length: 34.5 μm ; Width: 2.25 μm

Navicula radiosa
Core Depth: 10 cm
Length: 39.1 μm ; Width: 5.72 μm

Nitzschia perminuta
Core Depth: 410 cm
Length: 26.6 μm ; Width: 2.87 μm

Appendix 13. Sediment core x-ray images: Teapot Lake, Ontario

Note: The images below are those not included within the text. The top direction is all of these images is to the left.

Teapot Lake Core TPLC2-1: ~ 0-20 cm depth

Teapot Lake Core TPLC2-1: ~ 40-60 cm depth

Teapot Lake Core TPLC2-1: ~ 60-80 cm depth

Teapot Lake Core TPLC2-1: ~ 80-100 cm depth

Teapot Lake Core TPLC2-1: ~ 90-110 cm depth

Teapot Lake Core TPLC2-2: ~ 110-130 cm depth

Teapot Lake Core TPLC2-2: ~ 150-170 cm depth

Teapot Lake Core TPLC2-2: ~ 170-190 cm depth

Teapot Lake Core TPLC2-3: ~ 206 – 226 cm depth

Teapot Lake Core TPLC2-3: ~ 226 – 246 cm depth

Teapot Lake Core TPLC2-3: ~ 246 – 266 cm depth

Teapot Lake Core TPLC2-3: ~ 266 – 286 cm depth

Teapot Lake Core TPLC2-3: ~ 287-307 cm depth

Teapot Lake Core TPLC2-3: ~ 294 – 314 cm depth

Teapot Lake Core TPLC2-4: ~ 314 – 334 cm depth

Teapot Lake Core TPLC2-4: ~ 356 cm – 376 cm depth

Teapot Lake Core TPLC2-4: ~ 376 – 396 cm depth

Teapot Lake Core TPLC2-5: ~ 421 – 441 cm depth

Teapot Lake Core TPLC2-5: ~ 441 – 461 cm depth

Teapot Lake Core TPLC2-5: ~ 461 – 481 cm depth

Teapot Lake Core TPLC2-5: ~ 481 – 497 cm depth