U.S. Department of the Interior
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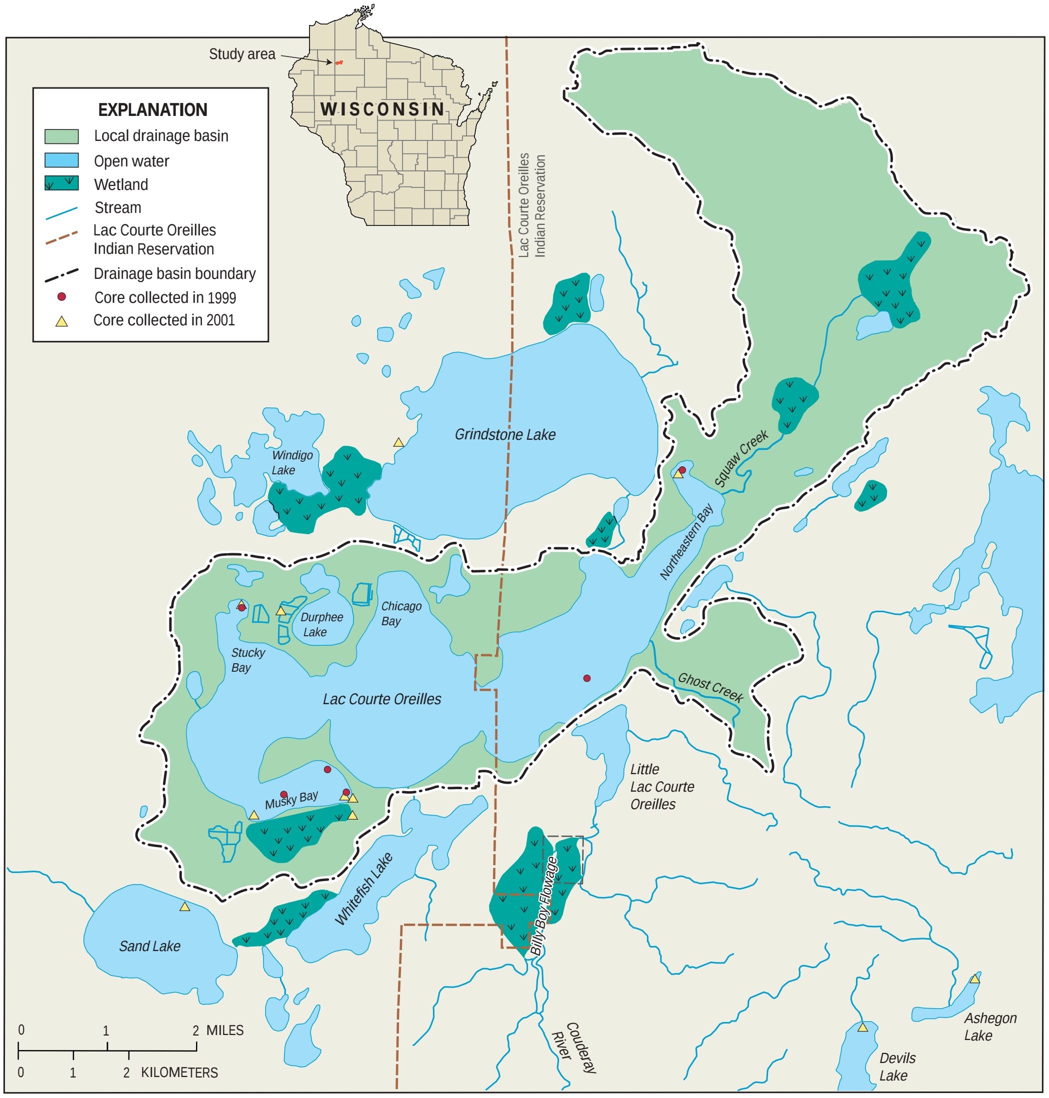
Nutrient, Trace-Element, and Ecological History of Musky Bay, Lac Courte Oreilles, Wisconsin, as Inferred from Sediment Cores

Water-Resources Investigations Report 02–4225



Prepared in cooperation with the

Lac Courte Oreilles Tribe
Wisconsin Department of Agriculture, Trade, and Consumer Protection

USGS
science for a changing world

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By Faith A. Fitzpatrick, Paul J. Garrison, Sharon A. Fitzgerald, and John F. Elder

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Middleton, Wisconsin
2003

science for a changing world

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED UNITS OF MEASUREMENT

Multiply	By	To Obtain
micrometer (µm)	3.937×10^{-5}	inch
millimeter (mm)	0.03937	inch
centimeter (cm)	.3937	inch
meter (m)	3.2808	feet
kilometer (km)	.62137	miles
square kilometer (km^2)	247.105	acres
square kilometer (km^2)	.3861	square miles
cubic kilometer (km^3)	4.168	cubic miles
hectare (ha)	2.47105	acres
micrograms (µg)	2.2×10^{-9}	pounds
gram (g)	.0022	pounds
kilogram (kg)	2.2046	pounds

Temperature, in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by use of the following equation:
°F=1.8(°C) + 32.

Vertical Datum: In this report, “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated units of measurement used in this report: Physical measurements and chemical concentrations and water temperature are given in metric units. Radiometric concentration is given in picoCuries per gram (pCi g^{-1}). Sediment chemical concentration is given in micrograms per gram (µg g^{-1}), millimoles per gram (mmol g^{-1}), or parts per million (ppm). Bulk density is given in grams per cubic centimeter (g cm^{-3}). Sediment accumulation rate is given in grams per square centimeter per year (g cm^{-2} y^{-1}). Linear sedimentation rate is given in centimeters per year (cm y^{-1}). Normality (*N*) is given as equivalents per liter, where equivalent is the mass of a compound per equivalent weight and equivalent weight is the molar mass per H+ per mole.

Nutrient, Trace-Element, and Ecological History of Musky Bay, Lac Courte Oreilles, Wisconsin, as Inferred from Sediment Cores

By Faith A. Fitzpatrick, Paul J. Garrison[1], Sharon A. Fitzgerald, *and* John F. Elder

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Abstract

Sediment cores were collected from Musky Bay, Lac Courte Oreilles, and from surrounding areas in 1999 and 2001 to determine whether the water quality of Musky Bay has declined during the last 100 years or more as a result of human activity, specifically cottage development and cranberry farming. Selected cores were analyzed for sedimentation rates, nutrients, minor and trace elements, biogenic silica, diatom assemblages, and pollen over the past several decades. Two cranberry bogs constructed along Musky Bay in 1939 and the early 1950s were substantially expanded between 1950–62 and between 1980–98. Cottage development on Musky Bay has occurred at a steady rate since about 1930, although currently housing density on Musky Bay is one-third to one-half the housing density surrounding three other Lac Courte Oreilles bays. Sedimentation rates were reconstructed for a core from Musky Bay by use of three lead radioisotope models and the cesium-137 profile. The historical average mass and linear sedimentation rates for Musky Bay are 0.023 grams per square centimeter per year and 0.84 centimeters per year, respectively, for the period of about 1936–90. There is also limited evidence that sedimentation rates may have increased after the mid-1990s. Historical changes in input of organic carbon, nitrogen, phosphorus, and sulfur to Musky Bay could not be directly identified from concentration profiles of these elements because of the potential for postdepositional migration and recycling. Minor- and trace-element profiles from the Musky Bay core possibly reflect historical changes in the input of clastic material over time, as well as potential changes in atmospheric deposition inputs. The input of clastic material to the bay increased slightly after European settlement and possibly in the 1930s through 1950s. Concentrations of copper in the Musky Bay core increased steadily through the early to mid-1900s until about 1980 and appear to reflect inputs from atmospheric deposition. Aluminum-normalized concentrations of calcium, copper, nickel, and zinc increased in the Musky Bay core in the mid-1990s. However, concentrations of these elements in surficial sediment from Musky Bay were similar to concentrations in other Lac Courte Oreilles bays, nearby lakes, and soils and were below probable effects concentrations for aquatic life. Biogenic-silica, diatom-community, and pollen profiles indicate that Musky Bay has become more eutrophic since about 1940 with the onset of cottage development and cranberry farming. The water quality of the bay has especially degraded during the last 25 years with increased growth of aquatic plants and the onset of a floating algal mat during the last decade. Biogenic silica data indicate that diatom production has consistently increased since the 1930s. Diatom assemblage profiles indicate a shift from low-nutrient species to higher-nutrient species during the 1940s and that aquatic plants reached their present density and/or composition during the 1970s. The diatom *Fragilaria capucina* (indicative of algal mat) greatly increased during the mid-1990s. Pollen data indicate that milfoil, which often becomes more common with elevated nutrients, became more widespread after 1920. The pollen data also indicate that wild rice was present in the eastern end of Musky Bay during the late 1800s and the early 1900s but disappeared after about 1920, probably because of water-level changes more so than eutrophication.

INTRODUCTION

Lac Courte Oreilles is located in and near the Indian Reservation of the Lac Courte Oreilles Band of Lake Superior Ojibwa in northwestern Wisconsin (fig. 1). As the second largest water body in the reservation, it has been nearly free of water-quality problems in the past, and it supports an abundance of aquatic life,

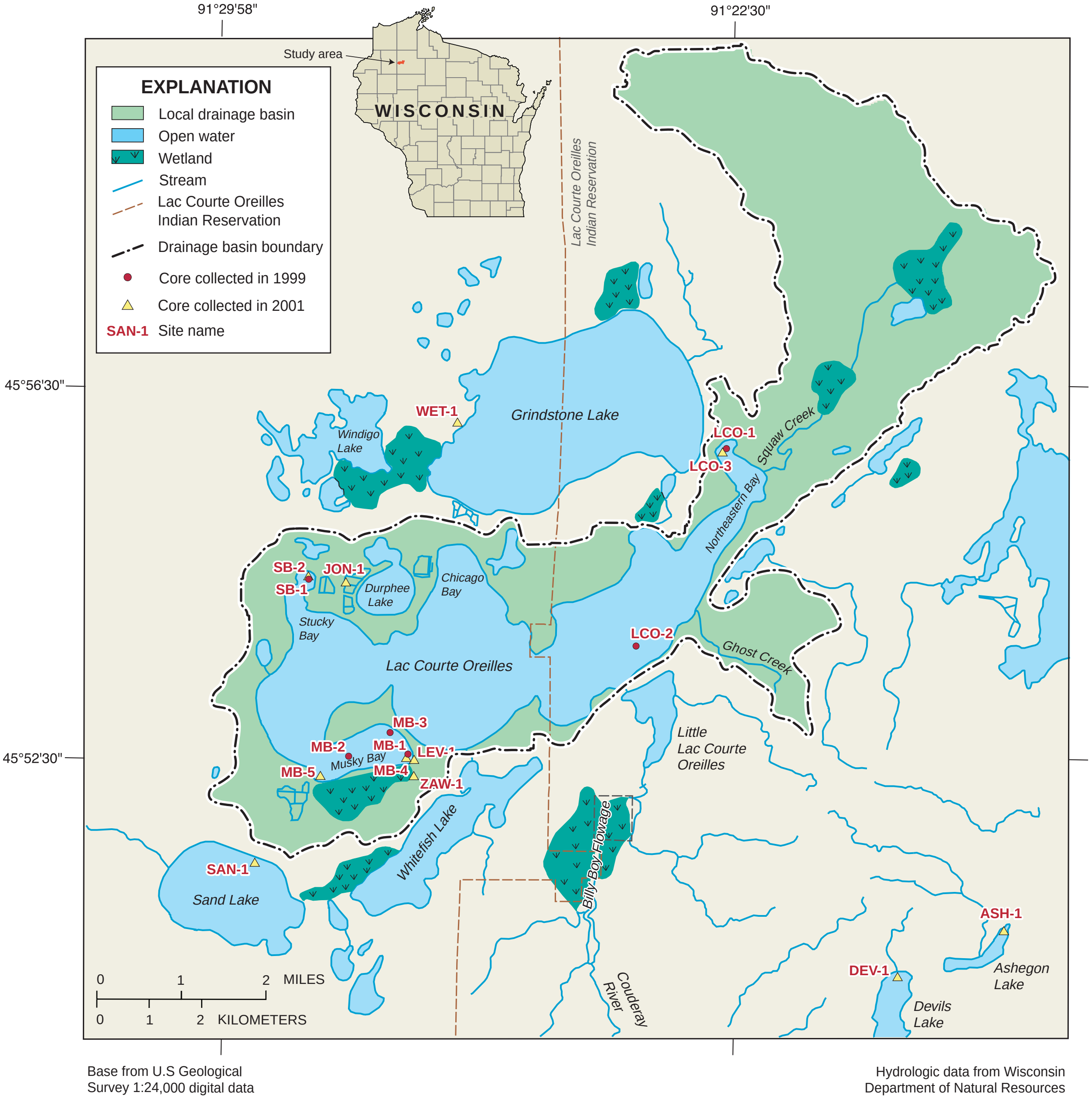


Figure 1. Lac Courte Oreilles study area, 1999 and 2001, and location of sediment-core sites.

Figure 2. Algal masses in Musky Bay, viewed west from the southeast corner of Musky Bay in September 1999. (Photograph by P.J. Garrison, Wisconsin Department of Natural Resources.)

including various sport-fish species. For centuries, Native Americans have depended on the water resources, fisheries, and natural crops (such as wild rice) provided by Lac Courte Oreilles and other nearby lakes.

Recently, however, there have been concerns about deterioration of water quality and fish habitats in the lake. The problems are manifested by increased growth of algae, decreased water clarity, and diminished fish populations. The problem is particularly acute in Musky Bay, in the southwestern part of the lake. Thought to be the former site of wild rice beds and frequent spawning grounds for muskellunge, Musky Bay currently is devoid of wild rice, and muskellunge spawning areas are thought to have declined. Macrophytes (aquatic plants) and algal masses often cover some of the water surface (fig. 2). The Lac Courte Oreilles Tribe is concerned that the aerial spraying of fertilizer on cranberry farms south of the Musky Bay has increased nutrient loadings to the Bay (Barr Engineering, 1998).

The deterioration of water quality and clarity and increase of algal growth and macrophytes, known as eutrophication, is a process caused by increased inputs of nutrients, particularly nitrogen and phosphorus. All lakes receive natural and anthropogenic inputs of nutrients from tributaries, the atmosphere, and ground water. For example, in a study of the phosphorus budget of Balsam Lake, in northwestern Wisconsin, the annual phosphorus input to the lake was comprised of tributary inputs (79–81 percent), precipitation (7–12 percent), and ground water (4–7 percent) (Rose, 1993). It is not known whether human-induced eutrophication, also called cultural eutrophication, has affected Lac Courte Oreilles, but it is a distinct possibility. A recent modeling study of nutrient loads to Lac Courte Oreilles (Barr Engineering, 1998) estimated that nearby cranberry bogs contributed 44 percent of the annual phosphorus load to Musky Bay at that time. Houses and associated lots, mainly seasonal dwellings, also are present along the shoreline of the bay and may supply nutrients through fertilizer runoff and septic-tank leakage. A potentially large source of nutrients is the lake bottom, where algal material decomposes and some nutrients from algal decomposition re-enter the lake and become available for primary production.

The Lac Courte Oreilles Tribe is interested in assessing the importance of nutrient loading from cranberry bogs and shoreline development relative to natural inputs, particularly for Musky Bay. One way to evaluate the relative importance of natural and anthropogenic changes in water quality is to examine historical inputs of nutrients and ecological response as reconstructed from sediment cores. The sediment record commonly preserves observable trends in nutrient cycles and ecosystem character over the last few hundred years, a time that includes a background period and the period of cranberry farming and shoreline development in Lac Courte Oreilles.

The study described in this report focuses on the nutrient history of Musky Bay through the analysis of sediment cores collected in 1999 and 2001. The study was initiated by the Lac Courte Oreilles Tribe in response to the Barr Engineering (1998) report and involved a cooperative effort among the Lac Courte Oreilles Tribe; the U.S. Geological Survey; the Wisconsin Department of Natural Resources; the Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Wisconsin Cranberry Growers Association. The major objective of this study was to reconstruct the history of water quality and ecological changes in Musky Bay and at an additional site in the northeastern end of Lac Courte Oreilles called Northeastern (NE) Bay (also locally known as Barbertown Bay). Changes in historical nutrient conditions in Musky Bay were of primary interest. Sediment cores were also collected from other bays in Lac Courte Oreilles and from the central, deep basin of the lake. A core from NE Bay was selected for comparisons of diatom counts, sediment-accumulation rates, nutrient content, and geochemical analysis because it has shoreline development but does not receive discharge from a cranberry operation.

The principal focus of the investigation of sediment cores was on the nutrient history (input and burial rates) that reflects management practices and possible Musky Bay degradation. Reconstructed algal (mainly diatom) communities and biogenic silica profiles were used as surrogates for actual nutrient input histories. Pollen analysis was also used to identify major historical changes in aquatic and terrestrial vegetation. Another objective was, if possible, to distinguish temporally the nutrients derived from cranberry farming and shoreline development from those derived from natural sources. This study focused on sediment analysis and did not include water sampling or monitoring of water quality.

Sediment samples from cores collected from Musky and NE Bay in 1999 were analyzed for sedimentation rates, nutrients, minor and trace elements, diatom community, biogenic silica, and pollen. Additional cores were collected from Musky Bay, Stucky Bay, and the central, deep basin of Lac Courte Oreilles; a subset of samples were analyzed from these cores. In August 2001, surficial sediment from Lac Courte Oreilles bays and nearby lakes was collected to determine the source of elevated cadmium concentrations observed in 1999 core samples from the Lac Courte Oreilles bays. The nearby lakes sampled included a remote lake with no cranberry bogs or shoreline development (Devils Lake) and two lakes with only shoreline development and no cranberry bogs (Sand Lake and Ashegon Lake, fig. 1). Samples of soil and fertilizer from cranberry bogs on Musky and Stucky bays and soil from a remote wetland also were analyzed.

Purpose and Scope

The main purpose of this report is to document the findings from the nutrient-history analysis and geochemical characterization of Musky Bay, Lac Courte Oreilles. Specific objectives of the study were to answer the following questions about Musky Bay:

(1) Have sedimentation rates increased?
(2) Have minor- and trace-element concentrations in sediment changed over time?
(3) Have increased nutrient inputs caused Musky Bay to become more eutrophic?
(4) Have the diatom and plant community, including wild rice *(Zizania palustris L.*), changed over time?
(5) Have nutrient inputs increased as a result of changes in land cover since European settlement?

This report describes all aspects of the study. First, methods used for sample collection are described. Second, interpretations of historical trends in sedimentation rates, minor and trace elements, nutrients, biogenic silica, diatom assemblages, and pollen are described for Musky Bay and compared to what was found for NE Bay. Third, minor- and trace-element concentrations of surficial sediment from Musky Bay are compared to those is other bays in Lac Courte Oreilles (NE Bay and

Stucky Bay), and other nearby lakes, soils, and fertilizer. Finally, interpretations and implications of the findings of this study for management activities are presented.

Acknowledgments

We wish to express our gratitude for field assistance during coring, including help from Dan Tyrolt and Brett McConnell (Lac Courte Oreilles Environmental Section), Harry Schroeder (Lac Courte Oreilles Lake Association), and Kevin Richards (USGS). The additional geochemical sampling was made possible through the legwork of Randall Jonjak. We are very appreciative for access to cranberry bogs for soil and fertilizer samples for minor and trace-element sampling from Randall Jonjak and William Zawistowski. The Levake family provided shoreline access to Musky Bay. We are very thankful for the special assistance from Rick Sanzolone (USGS, Geologic Division Laboratory, Denver, Colo.) for running blank sediment samples and expediting our minor- and trace-element samples; and from Bill Orem and Terry Lerch (USGS, Geologic Division Laboratory, Reston, Va.) for analyzing our carbon and nitrogen samples. The USGS, Caribbean District, provided logistical support and lab space for the biogenic silica analysis and office facilities for report preparation. John Meier (Wisconsin DNR) retrieved cadmium emission data for us for northern Wisconsin.

James Kennedy, Marie Peppler, and Michelle Greenwood (all with the USGS) made the map and graph illustrations for the report. Marie Peppler, Kathleen Wang, and Susan Jones (all with the USGS) compiled and formatted the data for the tables in the report and appendix A. Michael Eberle and Leah Hout (USGS), Michelle Lutz (USGS), and Heather Whitman (USGS) provided editorial reviews of the draft manuscript. This report has benefited from the thorough, critical reviews and insightful suggestions from Dr. Margorie Winkler (University of Wisconsin-Madison), Dr. Mark Hermanson (University of Pennsylvania), and Peter Van Metre (USGS).

HISTORICAL ANALYSIS OF LAKE SEDIMENT

Questions often arise concerning how the water quality of a lake has changed through time as a result of watershed disturbances. In most cases, reliable long-term data are unavailable. The central questions are: what were the past conditions of the lake, did the condition of the lake change, when did this occur, and what were the causes?

Under ideal circumstances, reconstruction of changes in the lake ecosystem over any period of time since the establishment of the lake can be accomplished by collecting sediment cores and examining nutrients, minor and trace elements, and fossil remains found in the sediment. Lake sediments can integrate effects from an entire watershed and are therefore a convenient record of water-quality and aquatic-life responses to change, including human activities (Engstrom and others, 1985; Charles and others, 1994; Schelske and others, 1988). For example, organic matter often accumulates at increased rates as a result of cultural eutrophication (Fitzgerald, 1989).

Reconstruction of historical diatom assemblages through analysis of sediment cores can be useful for determining historical changes in nutrient inputs (Hall and Smol, 1999). Diatoms, a diverse and usually abundant type of algae that possess siliceous cell walls (frustules), are especially useful in sediment-core analysis because they are ecologically diverse and well preserved in sediments; moreover, the ranges of favorable environmental conditions are known for several species. Most diatoms used as water-quality indicators grow rapidly and are short lived, so the diatom-community composition responds rapidly to changing environmental conditions. Certain genera and species are usually found under nutrient-poor conditions, whereas others are more common at elevated nutrient concentrations. Some diatom species are sensitive to eutrophication. Diatoms also live under a variety of habitats, which enables potential reconstruction of changes in nutrient concentrations in the open water as well as changes in lake-bottom environments such as changes in aquatic-plant communities. In many lakes throughout Wisconsin, diatom and aquatic plant communites in the littoral zone (shallow water zone where rooted plants can live) have undergone significant changes as nutrient loading from the watershed increased (Garrison and Winkelman, 1996; Marshall and others, 1996; Garrison and Wakeman, 2000). Typically these changes include expansion of the submerged-plant community.

In addition to diatoms, lake sediments entomb a selection of siliceous fossil remains that are more or less resistant to bacterial decay or chemical dissolution, including cell walls of certain algal species and subfossils from emergent and submergent aquatic plants, such as wild rice. Profiles of biogenic silica (silica derived from biological sources) from sediment cores can be used as supporting evidence for historical reconstructions of diatom communities and production and as an indicator of species shifts (largely from diatoms to nonsiliceous algae) in response to increased nutrient inputs (Schelske and others, 1983; Conley, 1988; Schelske and others, 1988; Qui and others, 1993; Colman and others, 1995; Schelske, 1999; Wessels and others, 1999*)*. In the Laurentian Great Lakes, for example, relatively small increases in phosphorus due to human activity produced relatively large shifts in the accumulation of biogenic silica and organic and inorganic carbon in sediments (Schelske and others, 1988; Schelske, 1999; Taylor, 1999). Thus, the accumulation rates of biogenic silica and diatoms—which tend to persist in sediment—have been shown to record the effects of increased phosphorus inputs to a lake even when sedimentary phosphorus profiles do not. Phosphorus has been shown to be affected by different factors that obscure phosphorus input history but not the biogenic silica history (Schelske and others, 1986).

Human activities such as shoreline development and cranberry farming could alter the input, recycling, and burial rates of organic carbon and nutrients. If trends in nutrient inputs can be discerned from diagenesis (chemical, physical, and biological changes that occur after initial deposition), then these trends can be related to known dates and types of land-use practices in the watershed. If they can be developed sufficiently, nutrient profiles in sediments can be used to estimate trends in historical concentrations in lake water during times for which no chemical analyses are available. Increased input rates of organic matter and nutrients may result in concomitant increases in recycling (more dissolved nutrients returning to the overlying water), burial (more nutrients removed from the lake ecosystem), or both. The magnitude of any changes in recycling and burial will be reflected to a certain extent in the profiles of organic carbon, nitrogen, phosphorus, and sulfur, among others. Historical changes in ratios of organic carbon, nitrogen, and phosphorus may reflect changes in nutrient concentrations and changes in the relative amounts of terrestrial versus aquatic organic matter in the lake. These ratios may also reflect relative rates of organic carbon, nitrogen, and phosphorus diagenesis (Orem and others, 1991; Fitzgerald, 1989).

Elements and compounds that tend not to recycle, and therefore leave a good input history include those within the mineral part of the sediment. Some mineral elements, such as aluminum and titanium, are not readily recycled under commonly occurring biogeochemical conditions within sediment. Aluminum and titanium are almost entirely associated with eroded soil and rock in lake sediments, and their profiles reflect changes in soil erosion rates (Engstrom and Wright, 1984). Some elements can be associated with land-use practices; for example, potassium is common in soils, but it also may be a major component in commercial fertilizers. Sulfur, uranium, and cadmium also may be present in fertilizers. Copper is sometimes used in fungicides and herbicides for cranberry farming. Other mineral-associated elements are not a good reflection of input rates, such as iron and manganese, which are redox sensitive elements that may undergo post-depositional diagenesis (Engstrom and others, 1985). Thus, like nutrient profiles, iron and manganese profiles may likely not record true input histories.

DESCRIPTION OF STUDY AREA

General Characteristics

Lac Courte Oreilles is in the Upper Chippewa River Basin in Sawyer County in northwestern Wisconsin (fig. 1). Lac Courte Oreilles is a drainage lake (its main inflows and outflows are surface water), although ground-water inflow to the lake also is substantial (Water Resources Management Program, University of Wisconsin-Madison, 1991). The lake is fed by Squaw Creek (flowing into NE Bay), Ghost Creek, Whitefish Creek (from Whitefish Lake), and Grindstone Lake. The immediate drainage of the lake (excluding Grindstone and Whitefish Lakes) is 78.9 km^2 (fig. 1). The outlet is on the southeast side into Little Lac Courte Oreilles and eventually into Billy Boy Flowage and the Couderay River. The outlet on Billy Boy Flowage is controlled by a dam, which started out as a logging structure of unknown age and head. Water levels in Lac Courte Oreilles, Little Lac Courte Oreilles, and Billy Boy Flowage are currently similar (within about 50 cm) based on water level data from Sawyer County records. In about 1936 the structure was replaced with a new dam with a head of about 3.5 m. The head was reduced to 3 m in 1954 and has been at that level since then. Historical water level readings suggest that the new dam raised water levels in Billy Boy Flowage by about 2 m between 1937 and 1940. It is not known how much this change at the Billy Boy Dam affected the water level of Lac Courte Oreilles.

With a surface area of 2,039 ha, a maximum depth of 27 m, and an average depth of 10.4 m, Lac Courte Oreilles has a volume of about 0.2 km^3. In most years, it follows a typical dimictic cycle— its waters mix completely in the fall and the spring, and it develops thermal stratification in summer and winter. Musky Bay has a surface area of 103 ha and a mean depth of 2.0 m. The NE Bay has a surface area of 25 ha and a mean depth of 4.6 m (Barr Engineering, 1998).

The nutrient conditions and biological productivity of Lac Courte Oreilles are generally characteristic of a mesotrophic lake (moderate productivity and water quality) during most of the growing season (Barr Engineering, 1998). During the later summer and fall months, its condition often improves to oligotrophic (clear water with low productivity). However, Musky Bay, which is somewhat isolated and shallower than other parts of the lake, more commonly exhibits characteristics of a eutrophic lake (turbid and highly productive).

The food web of the lake is sufficiently productive to support a substantial fish community. Northern pike (*Esox lucius*) are abundant, and muskellunge (*Esox masquinongy*), walleye (*Stizostedion vitreum*), smallmouth bass (*Micropterus dolomieui*), cisco (*Coregonus artedii*), and a few species of panfish (Percidae spp.) are common (Water Resources Management Program, University Of Wisconsin-Madison, 1991). Many species of aquatic plants (macrophytes) inhabit the lake. Macrophytes that are most common in Musky Bay include Canada waterweed (*Elodea canadensis*), fern pondweed (*Potamogeton robbinsii*), coontail (*Ceratophyllum demersum*), muskgrass (*Chara* spp.), water buttercup (*Ranunculus* spp.), water milfoil (*Myriophyllum* spp.), and wild celery (*Vallisneria americana*) (Mr. Daniel Tyrolt, Lac Courte Oreilles Tribe Conservation Dept., written commun., 2001).

The climate in the vicinity of Lac Courte Oreilles is characterized by long, snowy winters and relatively warm, humid summers. The average annual precipitation is 775 mm, two-thirds of which falls between May and September inclusive (Water Resources Management Program, University Of Wisconsin-Madison, 1991).

Soils in the northern part of Sawyer County are generally better drained than those in the southern part. Common surficial material in the watershed of Lac Courte Oreilles includes loose, unconsolidated loamy or silty soils over glacial till or sand and gravel outwash. Typical depth to bedrock is 15-30 m (Water Resources Management Program, University Of Wisconsin-Madison, 1991).

Non-lake land cover in the immediate drainage basin of Lac Courte Oreilles is mainly forest (72 percent) (Wisconsin Department of Natural Resources, 1998; fig. 3). Grassland accounts for 11 percent. Only 10 percent of the land cover is wetland. Cropland (mainly rotational crops of alfalfa and corn) accounts for 7 percent and is mainly west of Lac Courte Oreilles. Drainage from the cropland area to the western side of Lac Courte Oreilles is not well developed (no streams shown on U.S. Geological Survey 7.5-minute topographic maps, fig. 1). Barren, shrub, and urban land altogether make up less than 1 percent of the land cover.

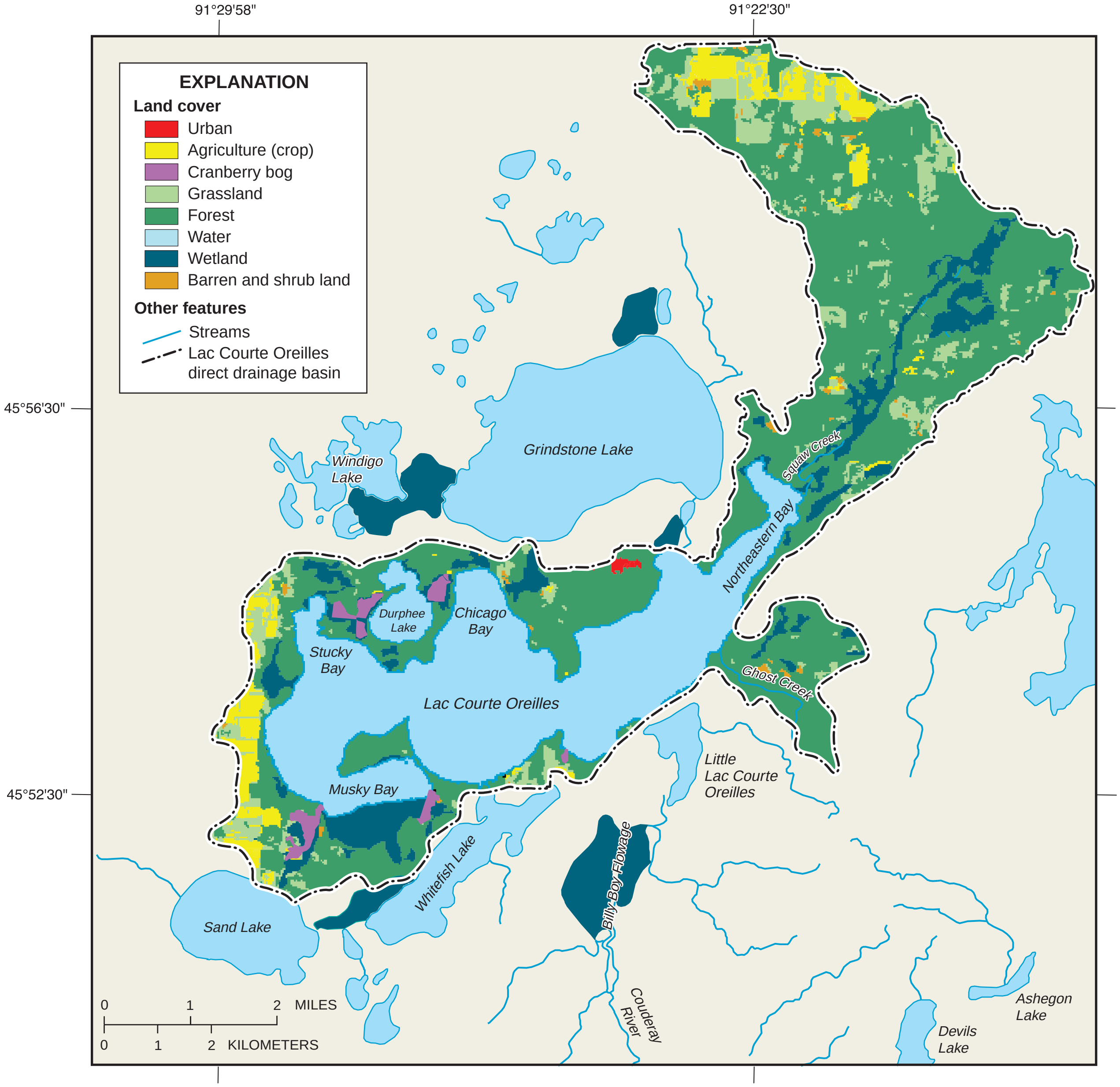
Sources of phosphorus to Lac Courte Oreilles and Musky Bay include tributary inputs, overland flow, and atmospheric deposition (Barr Engineering, 1998). Based on lake monitoring data and modeling, the major sources of phosphorus to Musky Bay are cranberry bogs (44 percent), atmospheric deposition (17 percent), forests and wetlands (25 percent), shoreline development (8 percent) and agriculture (6 percent).

The Indian Reservation of the Lac Courte Oreilles Tribe includes the eastern part of the Lac Courte Oreilles watershed and occupies an area of 30,945 ha in central and western Sawyer County (fig. 1). The reservation is sparsely populated with approximately 2,400 inhabitants. In addition to Lac Courte Oreilles, which lies partly within the reservation and partly to the west of it, numerous other lakes and rivers are in and around the reservation (water covers more than 4,200 ha of the reservation).

Land-Use History

Cranberry Farming

Cranberry agriculture has been an important economic activity in northwest Wisconsin for the past six decades. Practices associated with cranberry farming are potential sources of nutrients, trace elements, synthetic organic compounds, and sediments to Lac Courte Oreilles. Cranberry bogs are constructed on wetlands. Fields are typically flooded with lake water several times a year, and water is discharged back to the lake. Cranberry crops may be treated with various fertil-



Base from U.S Geological Survey 1:24,000 digital data

Land use data source: WISCLAND Land Cover, 1992—93 (Lillesand and others, 1998)

Figure 3. Land cover in the Lac Courte Oreilles watershed.

izers and pesticides. Fertilizer is used largely to enrich the supply of phosphorus in the soil (Roper and Planer, 1996). Statewide, phosphate fertilizers are commonly applied at a rate of about 50 kg P ha^{-1} on cranberry bogs (Schreiber, 1988). Approximately 22 pesticides are commonly used on cranberries, including naproprimide, norflurazon, dichlovenil, and 2,4-D (herbicides); carbaryl, diazinon, chlorpyrifos, and azinphos-methyl (insecticides); and the fungicide copper hydroxide (Mahr and others, 1998; Wisconsin Agricultural Statistics Service, 1996; Schreiber, 1988). Construction or expansion of beds requires removal of all surface vegetation, possibly affecting streamflow, sediment loads, and water quality in receiving waters (Schreiber, 1988). In a study of a Massachusetts cranberry bog, it was found both nitrogen and phosphorus may leach to receiving waters (Howes and Teal, 1995). Nutrients were released seasonally, coincident with flooding of the bog for harvest and winter frost protection. Nitrogen loading from the bog was about one-half of that from a nearby residential housing development, but phosphate loading was higher from the bog (Howes and Teal, 1995).

Five cranberry bogs withdraw water from and discharge water to Lac Courte Oreilles, range in size from approximately 3 to 31 ha, and cover a total area of 84 ha (fig. 4). Bogs 1 and 4 are the largest of all the bogs, occupying 26 and 31 ha, respectively. Bog 1 is connected to Stucky Bay and bogs 4 and 5 are connected to Musky Bay and together occupy 41 ha. Bogs 1 and 5 were created in 1939 (Randall Jonjak, cranberry farmer, oral commun., 2001). Bog 4 was created sometime between 1950 and 1962. The maximum expansion of bogs 1 and 4 occurred between 1950 and 1962 (64 and 45 percent of total area, respectively). Bog 1 has remained the same size since 1962. Between 1980 and 1998, 25 and 43 percent of the total area of bogs 4 and 5 were added. Aerial application of fertilizer to bog 5 was initiated in about 1995 (Dan Tyrolt, Lac Courte Oreilles Tribe, oral commun., 1999).

Shoreline Development

In northern Wisconsin, cottages have been built along lakeshores typically since the first half of the 20th century. Many of the cottages on Lac Courte Oreilles were built between 1914 and 1944 (fig. 5), a period when tourism was heavily advertised for northern Wisconsin as an economic response to a decline in agricultural activities (Davis, 1996). The number of houses along the shoreline of Lac Courte Oreilles continued to grow during 1944–2001. However, since the mid-1970s, there has been a trend to expand the size of existing cottages and build larger new homes. These larger houses occupy a greater surface area, increasing the impervious surface and potential land disturbance compared to initial cottage development. In addition, many cottages have been converted from seasonal to year-round use. Removal of native vegetation is more popular and the landscape is more disturbed and managed than during the initial cottage development. Increases of waste disposal (most homes use septic systems) and use of fertilizers and pesticides associated with this development also are potential sources of additional inputs to the lake ecosystem.

Only a few studies have examined the effects of shoreline housing development on the nutrient levels of lakes. A paleolimnological study of lakes in south-central Ontario found that most lakes have present-day phosphorus concentrations similar to predevelopment concentrations despite moderate cottage development (Hall and Smol, 1999). In a paleolimnological study of four Wisconsin lakes, initial cottage development had little effect on the lakes, but converting seasonal cottages to year-round homes caused increases in soil erosion (Garrison and Wakeman, 2000). Phosphorus deposition increased in all four lakes but the amount was dependent on alkalinity, with low-alkalinity lakes showing more phosphorus deposition to sediments than high-alkalinity lakes (Garrison and Wakeman, 2000).

The history of shoreline housing development on Lac Courte Oreilles was determined through the use of a 1914 Sawyer County Survey map, 1944 and 1971 historical USGS 7.5-minute topographic maps, and a 2001 house survey conducted by the Lac Courte Oreilles tribe (table 1, fig. 5; Dan Tyrolt, Lac Courte Oreilles Conservation Dept., written commun., 2001). Therefore, housing development on the four Lac Courte Oreilles bays can be compared for the three periods: 1914–1944, 1944–1971, and 1971–2001. In 1914, only a few houses were present on Stucky and Chicago bays, and no houses had been built on the shores of Musky or NE bays. By 1944, initial cottage development had begun on all bays, with the most growth on NE and Chicago bays. Development on Musky Bay occurred at a similar rate during 1944–71 and 1971–2001. The majority of growth on NE and Stucky bays occurred during 1944–71. Chicago Bay had the most growth during 1971–2001. Musky Bay's shoreline housing density in 2001 was about one-half or less of the housing density

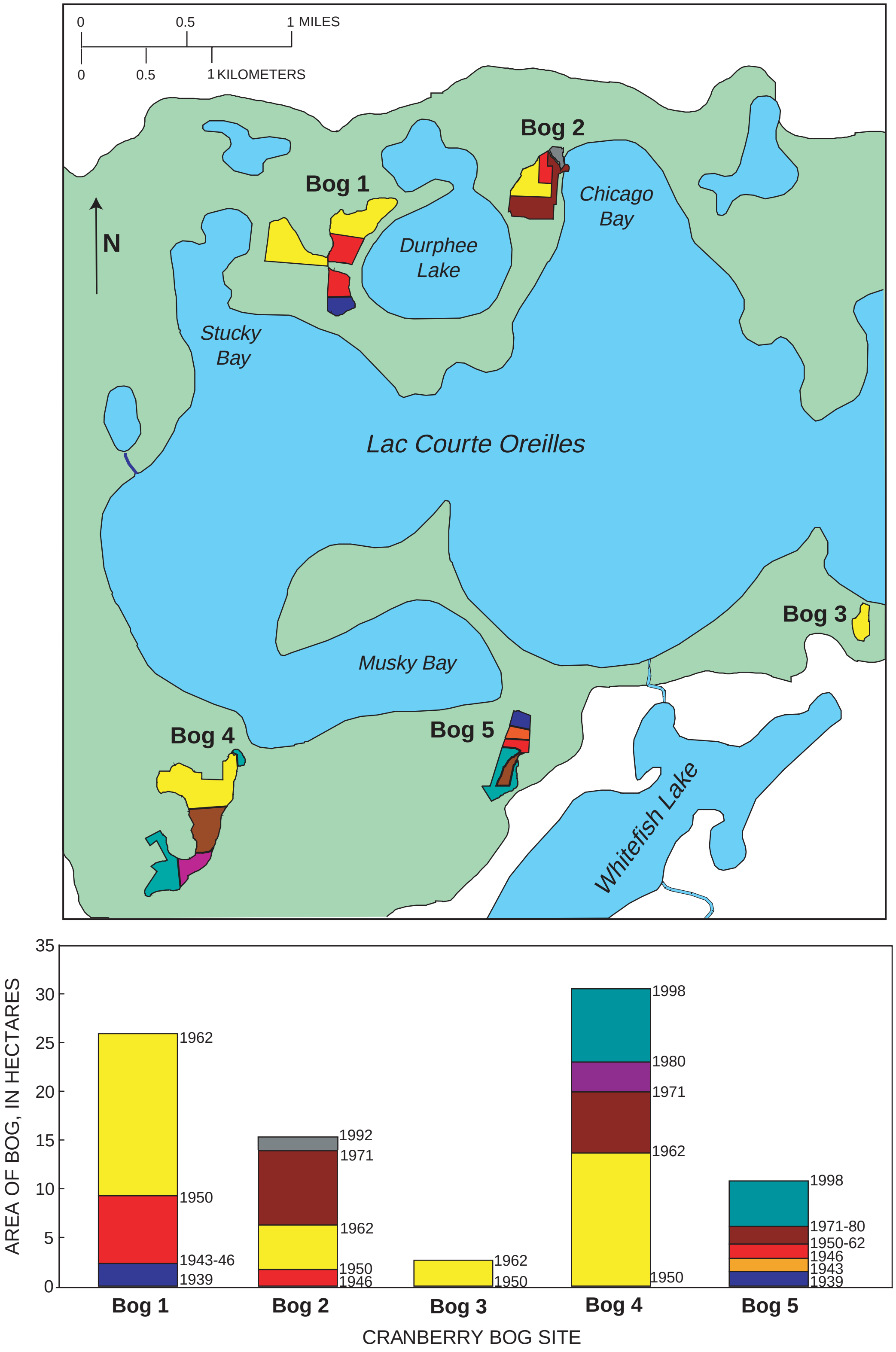


Figure 4. Map and graph showing expansion of cranberry bogs near Lac Courte Oreilles,1939 through 1998. Data from 1943, 1946, 1950, 1962, 1992, and 1998 are based on aerial photographs. Data from 1971 are based on U.S. Geological Survey 7.5-minute topographic maps. Bogs 1 and 5 were constructed in 1939.

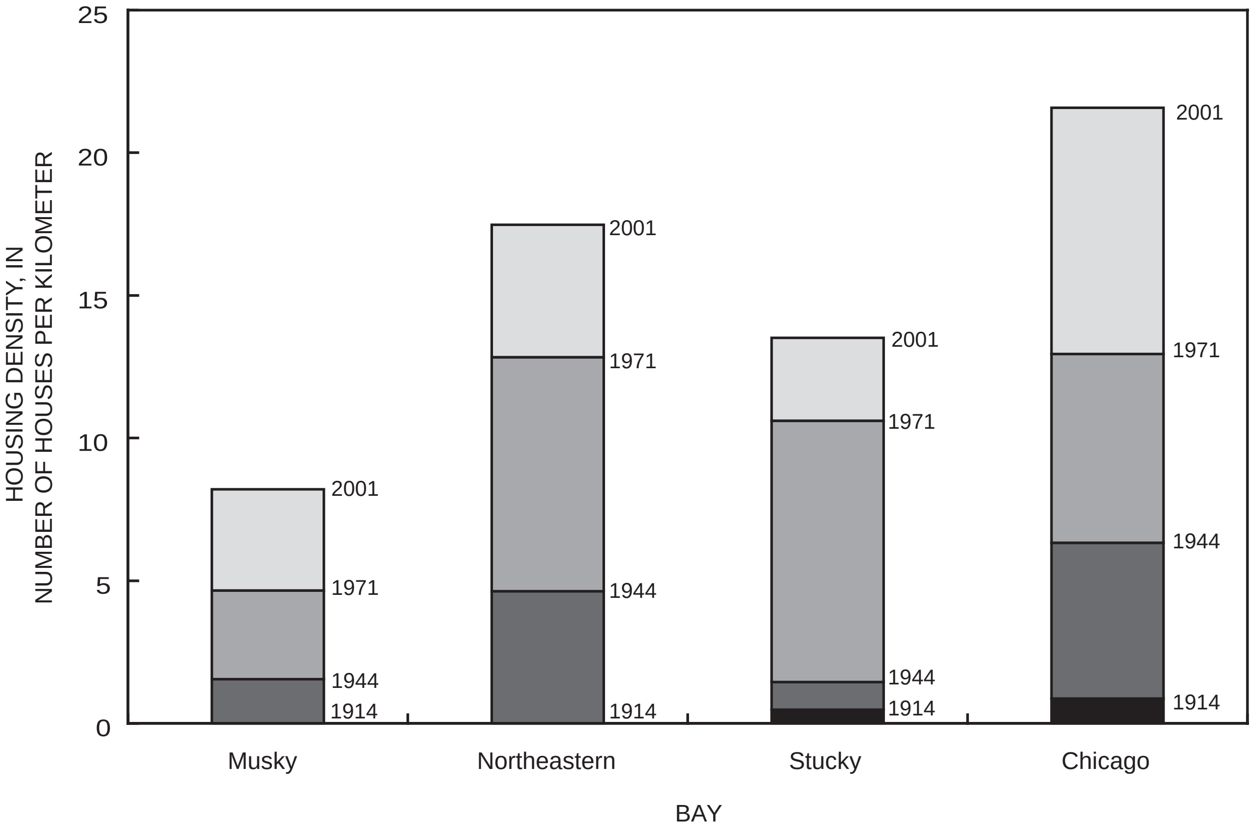


Figure 5. Shoreline development on four bays on Lac Courte Oreilles. Data for 1914 based on a 1914 Sawyer County Survey map. Data for 1944 and 1971 are based on USGS 15- and 7.5-minute topographic maps, respectively. Data for 2001 are based on a boat survey by the Lac Courte Oreilles Conservation Department.

Table 1. Density of houses along selected bays in Lac Courte Oreilles

[Data for 1914 based on a 1914 Sawyer County Survey map. Data for 1944 and 1971 are based on USGS 15- and 7.5-minute topographic maps, respectively. Data for 2001 are based on a boat survey done by the Lac Courte Oreilles Conservation Dept. (Dan Tyrolt, Lac Courte Oreilles Conservation Dept., written commun., 2001)]

Bay	Approximate length of bay shoreline (kilometers)	Number of homes				Average housing density (number houses per kilometer of bay shoreline)			
		1914	1944	1971	2001	1914	1944	1971	2001
Musky	4.5	0	7	21	37	0	1.6	4.7	8.2
Northeastern	2.8	0	13	36	49	0	4.6	12.8	17.5
Stucky	2.1	1	3	22	28	.48	1.4	10.6	13.5
Chicago	3.5	3	22	45	75	.86	6.3	13.0	21.6

for other Lac Courte Oreilles bays, primarily because Musky Bay is surrounded by low-lying wetlands that are less suitable for housing development than the other bays.

STUDY METHODS

Sediment Coring and Subsampling

Sediment cores were collected in 1999 from Musky and NE bays and other sites within Lac Courte Oreilles. The coring site on Musky Bay (MB-1) was on the southeast side of the bay near a cranberry-bog discharge point for surface-water runoff (fig.1). The second site selected for coring was in NE Bay, on the northeast side of Lac Courte Oreilles (LCO-1; fig. 1). Additional cores were collected from Musky Bay (one from the center (MB-2) and one from the northeast side (MB-3)), Stucky Bay (SB-1), and the center (deep basin) of the lake (LCO-2) (fig. 1, table 2).

All cores were collected from an aluminum boat with a WDNR piston corer, except LCO-2, which was collected from the deepest basin of the lake with a USGS gravity corer. The piston corer is composed of a metal head, rubber pistons with steel nuts and bolts, and an 8.8-cm inside-diameter acrylic barrel. The gravity corer has a 6.4-cm inside-diameter acrylic barrel. Before coring in 1999, the corers were washed with low-phosphate detergent and rinsed with deionized water before the field sampling and were rinsed with copious amounts of lake water at the time of sampling. Each core was described briefly, and major changes in color, macrophyte content, water content, and texture were noted (table 3). All cores were vertically extruded in the field, and 1-cm or 2-cm subsamples were extracted from cores collected at sites MB-1, MB-3, LCO-1, LCO-2, and SB-1 (table 2). Only top and bottom intervals were extracted from LCO-2 and no samples were extracted from MB-2. After the field trip, all samples were frozen or freeze-dried, and archived at the USGS office in Middleton, Wis., and the WDNR office in Monona, Wis.

Two side-by-side cores were collected from sites MB-1, LCO-1, and SB-1 (table 2). Subsamples for minor and trace element, nutrient, and biogenic silica analyses were saved from the first side-by-side core and placed into clean plastic jars and chilled after collection. Subsamples for diatom, pollen, and radiometric analysis were saved from the second side-by-side core and placed into plastic bags.

In August and September 2001, supplementary coring was done in Musky Bay, Stucky Bay, and NE Bay, as well as other nearby lakes including Sand Lake, Devils Lake, and Ashegon Lake. Cores from the Lac Courte Oreilles bays, Sand Lake, and Devils Lake were collected with a different piston corer. The piston corer was washed with low-phosphate detergent and rinsed with deionized water before the field sampling and stored in clean plastic bags. In the field, the corer was rinsed with copious amounts of lake water. The cores were vertically extruded, and the top 2 cm was subsampled and placed in plastic wide-mouth jars. Ashegon Lake was shallow enough to allow for wading, and 10 samples of the top 2 cm of sediment were collected by use of a 2.5-cm Teflon tube that was cleaned in the same manner as the piston corer. These surficial-sediment samples were submitted for minor- and trace-element analysis.

In order to help determine potential sources for minor and trace elements, soils and fertilizer also were collected in August 2001 (table 4). Soils from two cranberry bogs were sampled: bog 1 near Stucky Bay and bog 5 near Musky Bay (fig. 4). At bog 1, seven cores from each of three beds were collected by use of a 2.5-m Teflon tube and plastic spatula. The sampling equipment was washed with low-phosphate detergent and rinsed with copious amounts of deionized or tap water between bog sites. The cores from bog 1 penetrated to about 10 cm and contained a mix of sandy sediment associated with the root zone of cranberry plants (approximately 0–8 cm), as well as about 2 cm of peat from the pre-farm wetland soil beneath the sandy sediment. The 21 samples were composited into a single sample to represent soil conditions at each bog. The sample was homogenized and split, with one-half given to the farmers for private analysis. Seven cores were collected and composited from four cranberry beds in bog 5 in the same fashion as those at bog 1, except only the sandy sediment above the pre-farm peat was collected. Two fertilizer samples were collected from the farm at bog 1, one from a 13-13-13 mix applied at about 110 kg ha^{-1} twice a year and a second sample from a high-phosphorus fertilizer from a natural phosphate source with a 0-46-0 mix applied for experimental spot application at about 1 bag (23 kg) per year for all of bog 1. Seven cores of the top 2 cm of a wetland soil (WET-1) and a shoreline residence on the southeastern side of Musky Bay (LEV-1) were collected and com-

Table 2. Description of cores collected by U.S. Geological Survey (USGS) and Wisconsin Department of Natural Resources (WDNR) from Lac Courte Oreilles, October 1999

[WDNR analyzed for diatoms, water weight, loss on ignition, pollen, sedimentation rate; USGS analyzed for biogenic silica, carbon, nitrogen, geochemistry; nd, not determined; m, meter; cm, centimeter; do, ditto]

Site identification code	Latitude/longitude	Location description	Water depth (m)	Penetration (m)	Recovery (m)	Sub-sampling increments	Sample analyses
MB-1A	45°52'35"/91°27'14"	Musky Bay, southeast corner, 100 m from cranberry farm outlet	1.0	1.7	1.3	0–50, 1 cm; 50–100, 2 cm; 100–128, 4 cm	USGS, 3 samples for radiometric dating, 12 samples for diatom analysis
MB-1B	do	do	do	1.5	1.5	0–50, 1 cm; 50–100, 2 cm; 100–148, 4 cm	WDNR
MB-2	45°52'34"/91°28'05"	Musky Bay, center	1.27	nd	1.38	none	None
MB-3	45°52'48"/91°27'30"	Musky Bay, northeast side	.90	nd	1.55	0–100, 2 cm	Pollen analysis; 1 geochemistry sample from 0–2 cm; diatoms and pollen
LCO-1A	45°55'46"/91°22'39"	Northeastern Bay	2.2	nd	1.18	0–50, 1 cm	USGS
LCO-1B	do	do	do	1.19	.91	0–50, 1 cm	WDNR
LCO-2	45°53'44"/91°23'55"	Center of lake	26	nd	.41	top and bottom 1 cm	Diatom analyses only
SB-1A	45°54'22"/91°28'44"	Stucky Bay, 150 m from cranberry farm outlet	2.15	1.05	.930	0–50, 1 cm; 50–60, 2 cm	None
SB-1B	do	do	2.10	1.04	.838	0–50, 1 cm; 50–60, 2 cm	2 geochemistry samples from 0–1 and 1–2 cm

Table 3. Brief lithologic description of selected cores collected by U.S. Geological Survey and Wisconsin Department of Natural Resources from Lac Courte Oreilles in October 1999

[Depths not corrected for recovery ratios; cm, centimeter]

Identification code	Depth (cm)	Sediment description
MB-1B	0–70	Macrophyte-rich
	70–84	Decrease in macrophytes, more dense
	84–148	Increase in macrophytes
	140–148	More dense, increase in blade-like leaves
MB-2	0–25	Organic muck
	25–138	Gyttja, plant fragments
MB-3	0–50	Organic muck, dark
	50–155	Olive gyttja with abundant yellowish plant fragments
LCO-1A	0–14	Dark organic-rich muck
	14–20	Olive organic-rich muck, occasional sand grains
	20	Increase in density, almost peatlike with increase in fibrous content
	20–50	Olive, dense, peatlike, occasional sand grains
LCO-1B	0–15	Dark organic-rich muck
	15–20	Olive organic-rich muck, occasional sand grains
	20	Increase in density, almost peatlike, high in fibrous content
	20–50	Olive, dense, peatlike, occasional sand grains
LCO-2	0–.5	Black muck
	.5–45	Dark gray sediment
SB-1A	0–~11	Dark organic muck, high water content
	11–14	Olive organic muck, high water content
	14	Increase in density and large plant fragments
	14–49	Olive, more dense muck with abundant plant fragments and rootlets
	49	Change to more granular texture, increase in density
	49–60	Olive, granular, peatlike, less plant fragments
SB-1B	0–11	Dark organic muck, high water content
	11–14	Olive organic muck, high water content
	14	Increase in density and large plant fragments
	14–63	Olive, more dense, muck with abundant plant fragments and rootlets
	63	Change to more granular texture, increase in density
	63–66	Olive, granular, peatlike, smaller plant fragments

Table 4. Description of cores collected by USGS from Lac Courte Oreilles and nearby lakes, soils, fertilizer, and wetland, August 2001

[m, meters; cm, centimeters; lb, pound; na, no data; Samples submitted for geochemical analyses only.]

Site identification code	Latitude/longitude	Location description	Water depth (m)	Sample type	Sub-sampling increments (cm)
MB-4	45°52'35"/91°27'14"	Musky Bay, southeast corner, 150 m from bog 5, same location as MB-1	1.0	Lake sediment, organic, macrophyte-rich	0–2
MB-5	45°52'23"/91°28'29"	Musky Bay, southwest corner, 150 m from bog 4	1.0	Lake sediment, organic, macrophyte-rich	0–2
SB-2	45°54'25"/91°28'43"	Stucky Bay, 150 m from bog 1, same location as SB-1	1.2	Lake sediment, organic, macrophyte-rich	0–2
LCO-3	45°55'46"/91°22'42"	Northeastern Bay	2.0	Lake sediment, organic, macrophyte-rich	0–2
SAN-1	45°51'29"/91°29'25"	Sand Lake, northern shore	1.5	Lake sediment, sandy, macrophyte-rich	0–2
DEV-1	45°50'30"/91°20'04"	Devils Lake, northern shore	.7	Lake sediment, organic, macrophyte-rich	0–2
ASH-1	45°51'00"/91°18'23"	Ashegon Lake, northern shore	.9	Lake sediment, mix of sand and organics, macrophyte-rich	0–2
WET-1	45°56'01"/91°26'35"	Remote wetland	.15	Soil from wetland, abundant plant fragments and roots	0–2
LEV-1	45°52'34"/91°27'07"	Shoreline residence	na	Soil from residence next to cranberry farm, mix of sand, organic matter, and grass roots	0–2
JON-1	45°54'22"/91°27'59"	Bog 1	na	Soil from cranberry farm, mix of sand and peat	0–10
ZAW-1	45°52'24"/91°27'07"	Bog 5	na	Soil from cranberry farm, mainly sand with minor amounts of cranberry plant detritus	0–8
JON-2	na	Bog 1	na	Fertilizer 13-13-13 used at 110 kg ha^{-1}, twice yearly	na
JON-3	na	Bog 1	na	Fertilizer 0-46-0, experimental spot application	na

posited for each site for comparison to cranberry-bog soils (table 4).

Up to 23 intervals from Musky Bay cores MB-1A and MB-1B and 15 intervals from NE Bay cores LCO-1A and LCO-1B were selected for analysis of minor and trace elements, fossils, and nutrients (table 5). Several intervals from Musky Bay core MB-3 were analyzed for water content, organic material, diatoms, and pollen. Additional samples were run for water content, organic material, and minor and trace elements from the top 2 cm of cores from Musky Bay, NE Bay, and Stucky Bay; and nearby lakes including Sand Lake, Devils Lake, and Ashegon Lake. Four soil samples were analyzed for the same constituents. Two fertilizer samples also were analyzed for minor and trace elements. In addition to the increments listed in table 5, other increments from MB-1, MB-3, LCO-1, and SB-1 were analyzed for water content and organic material. Results for these additional analyses are available through the WDNR, Monona, Wis.

Physical Characteristics and Organic Content

Physical characteristics of cores measured included water weight percent, organic content, and particle size (table 5). Water weight percent and organic content for October 1999 samples were analyzed at the WDNR, Monona, Wis., and August 2001 samples were analyzed at the USGS, Middleton, Wis. Water weight percent was measured by use of standard American Society for Testing and Materials Procedure D2216-92, except that sample sizes were less than 20 g wet weight due to the small sample size. Percentage dry weight was determined by measuring weight loss after 24 hours at 105°C. Organic content was determined by weight loss after ashing or ignition (LOI) at 550°C for 1 hour (Dean, 1974). Dry bulk density was determined by the WDNR for the October 1999 samples by use of a known volume of sediment for determining water weight percent. Thus, dry mass per unit of wet volume of sediment could be calculated. Dry bulk density was calculated by use of the formula:

$$\rho = (D(2.5I_x + 1.6C_x))/(D + (1-D)(2.5I_x + 1.6C_x)), \quad (1)$$

where ρ is dry bulk density (g cm^{-3}), x is depth in the core, D is the proportion dry weight of unit wet volume, I is inorganic proportion of dry material (assuming a density of 2.5 g cm^{-3}), and C is organic proportion of dry material (assuming a density of 1.6 g cm^{-3}). Porosity (P), in percent, was calculated by use of the formula:

$$P = (1 - (\rho/D_s)) * 100, \quad (2)$$

where ρ is dry bulk density (g cm^{-3}), D_s is sediment density (assumed to be 2.5 g cm^{-3}), and water density is assumed to be 1.0 g cm^{-3}.

Five samples from cores collected in August 2001 were submitted for particle-size analysis at the USGS sediment laboratory in Iowa City, Iowa. These samples were determined to have a sand component by hand texturing. Sand/fine breaks were determined for samples from cranberry bog soils (JON-1-1 and ZAW-1-1), NE Bay (LCO-3), Sand Lake, and Ashegon Lake.

Radiometric Dating and Sedimentation Rates

Samples from cores MB-1 and LCO-1 were submitted to the Wisconsin State Laboratory of Hygiene, Madison, Wis., for radiometric analysis. Activity concentrations of ^{210}Pb, ^{226}Ra, and ^{137}Cs were determined from direct gamma counting by use of an ultra-low-background intrinsic germanium semiplanar detector coupled to a multichannel analyzer (Schelske and others, 1994). Detector efficiency was determined as a function of both sample geometry and sample weight. Samples were freeze-dried, and most plant fragments were removed before analysis.

The ^{210}Pb dating technique is based on the escape of ^{222}Rn from the Earth and the subsequent decay of this radioactive gas into ^{210}Pb. Thus, ^{210}Pb is a naturally occurring radionuclide that enters the lake primarily through precipitation and dry atmospheric deposition. This technique is most suitable for dating sediment deposited during the last 150 years because the half-life of ^{210}Pb is 22.26 years (Olsson, 1986).

^{137}Cs was first detected in 1945, and in 1952 the first increase in atmospheric fallout occurred in the Northern Hemisphere, corresponding to increased nuclear weapons testing (Krishnaswami and Lal, 1978; Anderson and others, 1987). In 1960 a minimum occurred, followed by a maximum in 1963. With the signing of the atmospheric nuclear test ban treaty, atmospheric contributions have dropped off substantially. A

Table 5. Summary of laboratory analyses performed on two cores from Musky Bay (MB-1 and MB-3) and one core from Northeastern Bay (LCO-1) collected in October 1999

[Two side-by-side cores were collected from MB-1 and LCO-1. Cores MB-1A and LCO-1A were sub-sampled for geochemistry, biogenic silica, and total organic carbon and nitrogen by the U.S. Geological Survey. Cores MB-1B and LCO-1B were sub-sampled for radiometric dating, diatoms, and pollen by the Wisconsin Department of Natural Resources. Some intervals from both cores were analyzed for radiometric dating and diatoms to confirm similarity between the side-by-side cores. TE, trace and minor elements; OC, total organic carbon; N, total nitrogen; cm, centimeter.]

Interval (cm)	Water and organic content	TE	Biogenic silica	OC and N	Dating	Diatoms	Pollen	Remarks/quality assurance
Musky Bay, Core MB-1A								
0–2		x	x	x				0–2 cm combined
2–3		x	x	x				
3–4					x			
4–5		x	x	x				
5–6					x			
6–7		x	x	x				
7–8					x			
8–9					x			
9–10		x	x	x				
12–13		x	x	x				
15–16		x	x	x				Biogenic silica, OC/N duplicate
18–19		x	x	x				
21–22		x	x	x				
24–25		x	x	x				
26–27					x			Dating done on both cores
27–28		x	x	x				
30–31		x	x	x				Biogenic silica, OC/N duplicate
33–34		x	x	x				TE duplicate
36–37		x	x	x				
40–41		x	x	x				TE duplicate
44–45					x			Dating done on both cores
45–46		x	x	x				Biogenic silica, OC/N duplicate
50–52		x	x	x				
60–62		x	x	x				
70–72		x	x	x				TE duplicate
84–86		x	x	x				
Musky Bay, Core MB-1B								
0–2					x			0–2 cm combined
0–1	x					x		
1–2	x							
2–3	x							
4–5	x							
5–6						x		
6–7	x							
8–9	x							
8–10	x				x			
10–11	x					x		
11–12						x		
12–13	x							
12–14					x			
14–15	x							
14–16					x			

Table 5. Summary of laboratory analyses performed on two cores from Musky Bay (MB-1 and MB-3) and one core from Northeastern Bay (LCO-1) collected in October 1999—Continued

[Two side-by-side cores were collected from MB-1 and LCO-1. Cores MB-1A and LCO-1A were sub-sampled for geochemistry, biogenic silica, and total organic carbon and nitrogen by the U.S. Geological Survey. Cores MB-1B and LCO-1B were sub-sampled for radiometric dating, diatoms, and pollen by the Wisconsin Department of Natural Resources. Some intervals from both cores were analyzed for radiometric dating and diatoms to confirm similarity between the side-by-side cores. TE, trace and minor elements; OC, total organic carbon; N, total nitrogen; cm, centimeter.]

Interval (cm)	Water and organic content	TE	Biogenic silica	OC and N	Dating	Diatoms	Pollen	Remarks/quality assurance
Musky Bay, Core MB-1B								
15–16	x					x		
16–17	x							
16–18	x				x			
18–19	x							Water, organic content duplicate
20–21	x					x		
20–23	x				x			
21–22	x							
22–23	x							
24–25	x							
24–26					x			
26–27	x				x			Dating done on both cores
28–29	x							
30–31	x				x	x		
32–33	x							
33–34	x							
34–35	x							
36–37	x				x			Water, organic content duplicate
38–39	x							
40–41	x				x	x		
41–42	x							
42–43	x							
43–44	x							
44–45	x				x			Dating done on both cores
45–46						x		
46–47	x							
48–49	x							
50–52	x				x	x		
54–56	x				x			
58–60	x							
60–62					x	x		
62–64	x					x		
64–66	x				x	x		
66–68	x					x		Water, organic content duplicate
70–72	x				x	x		
74–76	x							
78–80	x							Water, organic content duplicate
80–82					x	x		
82–84	x							
84–86					x			
86–88	x							
90–92	x					x		

Table 5. Summary of laboratory analyses performed on two cores from Musky Bay (MB-1 and MB-3) and one core from Northeastern Bay (LCO-1) collected in October 1999—Continued

[Two side-by-side cores were collected from MB-1 and LCO-1. Cores MB-1A and LCO-1A were sub-sampled for geochemistry, biogenic silica, and total organic carbon and nitrogen by the U.S. Geological Survey. Cores MB-1B and LCO-1B were sub-sampled for radiometric dating, diatoms, and pollen by the Wisconsin Department of Natural Resources. Some intervals from both cores were analyzed for radiometric dating and diatoms to confirm similarity between the side-by-side cores. TE, trace and minor elements; OC, total organic carbon; N, total nitrogen; cm, centimeter.]

Interval (cm)	Water and organic content	TE	Biogenic silica	OC and N	Dating	Diatoms	Pollen	Remarks/quality assurance
Musky Bay, Core MB-3								
0–2	x					x		
2–4							x	
4–6	x					x		
8–10	x							
10–12						x	x	
12–14	x							
14–16						x		
16–18	x							
20–22	x					x	x	
24–26	x					x		
28–30	x							
30–32						x	x	
32–34	x							
34–36						x		
36–38	x							Water, organic content duplicate
40–42	x					x	x	
44–46	x					x		
48–50	x							
50–52						x	x	
52–54	x							
54–56						x		
56–58	x							
58–60	x						x	
60–62	x					x		
64–66	x					x		
68–70	x							
70–72						x	x	
72–74	x							
76–78	x							Water, organic content duplicate
80–82	x						x	
Northeastern Bay, Core LCO-1A								
0–1		x	x	x				
2–3		x	x	x				
4–5		x	x	x				
6–7		x	x	x				
8–9		x	x	x				OC/N duplicate
10–11		x	x	x				Biogenic silica duplicate
12–13		x	x	x				TE duplicate
14–15		x	x	x				
16–17		x	x	x				
18–19		x	x	x				OC/N duplicate

Table 5. Summary of laboratory analyses performed on two cores from Musky Bay (MB-1 and MB-3) and one core from Northeastern Bay (LCO-1) collected in October 1999—Continued

[Two side-by-side cores were collected from MB-1 and LCO-1. Cores MB-1A and LCO-1A were sub-sampled for geochemistry, biogenic silica, and total organic carbon and nitrogen by the U.S. Geological Survey. Cores MB-1B and LCO-1B were sub-sampled for radiometric dating, diatoms, and pollen by the Wisconsin Department of Natural Resources. Some intervals from both cores were analyzed for radiometric dating and diatoms to confirm similarity between the side-by-side cores. TE, trace and minor elements; OC, total organic carbon; N, total nitrogen; cm, centimeter.]

Interval (cm)	Water and organic content	TE	Biogenic silica	OC and N	Dating	Diatoms	Pollen	Remarks/quality assurance
Northeastern Bay, Core LCO-1A (cont.)								
20–21		x	x	x				Biogenic silica duplicate
22–23		x	x	x				TE duplicate
24–25		x	x	x				
26–27		x	x	x				
28–29		x	x	x				
Northeastern Bay, Core LCO-1B								
0–1	x				x	x		
2–3	x				x			
4–5	x				x			
6–7	x				x			
8–9	x				x			
10–11	x				x	x		
12–13	x				x			
14–15	x				x			
16–17	x				x	x		
18–19	x							
20–21	x							
22–23	x							
24–25	x					x		
26–27	x							
28–29	x							
30–31	x							
32–33	x							
34–35	x							
36–37	x							
38–39	x							Water, organic content duplicate
40–41	x					x		

date of 1963 was assigned to the sample with the highest ^{137}Cs activity, and average mass and linear sedimentation rates were determined for the years 1963 through 1999.8 (time of core collection). The linear sedimentation rate was calculated as the depth (in centimeters) to the peak, divided by the elapsed time between 1963 and 1999.8 (time of core collection). The same post-1963 sedimentation rate was also applied to downcore intervals.

Sedimentation rates were also calculated by use of two popular ^{210}Pb models: (1) the constant initial concentration (CIC) model (Goldberg, 1963; Krishnaswami and others, 1971; and Robbins, 1978), and (2) the constant rate of supply (CRS) model (Appleby and Oldfield, 1978; Robbins, 1978; Binford, 1990). The CIC model is somewhat simpler than the CRS model and has, as its central assumption, that the amount of unsupported ^{210}Pb activity in the uppermost sediment layer is constant through time (Goldberg, 1963; Robbins, 1978). This assumption requires that any change in the sedimentation rate be matched by a similar change in ^{210}Pb inventory at the sediment/water interface. The ^{210}Pb activity exhibits log-linear decreases with depth (as is the case for much of the Musky Bay core). If the sedimentation rate increases because of eutrophication, the ^{210}Pb is diluted, and the CIC model cannot be used. A 1-cm error in the estimate of mixing depth can result in dates as much as 20–30 percent in error (Binford, 1990; Blais and others, 1995). Alternatively, the central assumption for the CRS model is that the flux of ^{210}Pb to the uppermost sediment layer remains constant through time. Any change in sedimentation rate will be reflected proportionately in a dilution of concentration of the ^{210}Pb activity. The CRS model requires that the total ^{210}Pb inventory be measured downcore to background (supported) ^{210}Pb concentrations. Unsupported ^{210}Pb activities for both models were estimated by subtracting the average ^{226}Ra activity (0.22 pCi g^{-1}) for all sampled intervals in the core from total ^{210}Pb activity.

For the CIC model, the age (t) of any interval (z) expressed as cumulative mass (g cm^{-2}) is calculated as follows:

$$t_z = \lambda^{-1} \ln(C_0\, C_z^{-1}), \qquad (3)$$

where t_z is the age (years) of sediment at cumulative mass, z (g cm^{-2}); λ is the decay constant for ^{210}Pb (0.03114 y^{-1}); C_0 is the unsupported ^{210}Pb activity at the sediment/water interface (pCi g^{-1}); and C_z is the unsupported ^{210}Pb activity at cumulative mass, z (pCi g^{-1}). The mass sedimentation rate (g cm^{-2} y^{-1}) was calculated by dividing the ^{210}Pb decay constant (0.03114 y^{-1}) by the absolute value of the slope of the best-fit line for parts of the core that exhibited log-linear decreases with cumulative mass. For core MB-1 the CIC model was used for the interval 8–45 cm.

For the CRS model, the age (t) of any interval (z) is calculated as follows:

$$t_z = \lambda^{-1} \ln(A_0\, A_z^{-1}), \qquad (4)$$

where A_0 is the total, integrated, unsupported (excess) ^{210}Pb activity in the core (pCi g^{-1}) and A_z is the integrated activity of unsupported (excess) ^{210}Pb below depth z. Mass sedimentation rates (ω_z) can be calculated explicitly as:

$$\omega_z = \lambda \cdot (A_z\, C_z^{-1}). \qquad (5)$$

Bioturbation (mixing due to biological activity), erosion, and redeposition are common problems with any radiometric technique. Studies that have used both CIC and CRS models have shown mixed results. The CIC model has been used in many studies of sedimentation in the deep basins of the Great Lakes (for example, Evans and others, 1981), where downcore changes in sedimentation rates are small, and thus the assumption of the CIC model is probably reasonable. The CRS method sometimes is preferred if ^{210}Pb activity is diluted by changes in sedimentation rates (Binford, 1990). Benoit and Rozan (2001) compared the CIC and CRS model results to ^{137}Cs peaks and found that sedimentation rates determined from ^{137}Cs peaks were higher for two of the three lakes studied than both the CRS- and CIC-modeled sedimentation rates. Blais and others (1995) attributed disagreement between the ^{210}Pb and ^{137}Cs dates to ^{137}Cs migration; they also found that these models agreed reasonably well when the bulk sedimentation rate had not changed substantially in recent years. When sedimentation rates had changed in recent years, the dates from the CIC model consistently were more recent than independent date markers, such as the rise in ragweed and stable lead or the ^{137}Cs peak. Remobilization of ^{137}Cs is rare in clay-rich deposits but may be a problem under anaerobic conditions with organic-rich sediment (Evans and others, 1983; Crickmore and others, 1990).

A piecewise CRS model was also constructed by calculating the ^{210}Pb flux for independently dated intervals determined by other chronostratigraphic markers (Appleby, 1998). Independently dated intervals for core MB-1 included ^{137}Cs peak at 30–31 cm (1963), stable Pb peak at 24–26 cm (1976), and organic content changes at 80–82 cm representing European settlement and beginning of clear-cut logging era (1880). In addition, the ^{137}Cs model was assumed to be accurate downcore to 45 cm (1936) because of the good fit of the CIC regression line between ^{210}Pb activity and cumulative mass from 8 to 45 cm (fig. 9). The CRS and CIC modeled date for 7–8 cm (1996) was also assumed to be accurate. These five dates were used to adjust the CRS modeled sedimentation rates by use of methods described by Appleby (1998) where:

$$P = (\lambda\ (\triangle A))/(e^{-\lambda t1}-e^{-\lambda t2}), \tag{6}$$

and P is ^{210}Pb flux in pCi cm^{-2} y^{-1}, $\triangle A$ is the ^{210}Pb inventory between depths of x1 and x2 with known dates of t1 and t2.

Total Organic Carbon and Nitrogen

Total organic carbon and total nitrogen concentrations were determined simultaneously on freeze-dried subsamples with a Leco 932 CHNS analyzer at the U.S. Geological Survey, Geologic Division Laboratory, Reston, Va. Organic carbon content was determined on the Leco after treatment of the samples with hydrochloric acid (HCl) to remove carbonates by means of an acid vapor method (Yamamuro and Kayanne, 1995; Orem and others, 1999). Preliminary analysis on samples pretreated with HCl indicated that virtually all carbon present was organic (not carbonate-related). Therefore, total carbon concentrations essentially represent total organic carbon concentrations. The Leco method is a high-temperature combustion method wherein solid-phase carbon is quantitatively converted to carbon dioxide and nitrogen is initially converted to nitrogen oxides and then to nitrogen gas in a reduction furnace containing copper turnings. The carbon dioxide gas is quantified with a nondispersive infrared detector, and the nitrogen gas is quantified with a thermal conductivity detector.

Minor and Trace Elements

Samples were analyzed for 43 minor and trace elements at the Geologic Division of the USGS Laboratory in Denver, Colo. Freeze-dried samples were completely digested on a hot plate using a mixture of hydrochloric-nitric-perchloric-hydrofluoric acids and all elements except sulfur were analyzed by use of inductively coupled plasma-mass spectrometry (Briggs and Meier, 1999). Sulfur was analyzed by methods describe in Jackson and others (1985) and Jackson and others (1987). Concentrations are given as micrograms per gram (µg g^{-1}) dry weight (weight percent) for trace elements or percent dry weight for minor elements. Samples were not sieved before analyses, so they included plant fragments as well as mineral matter.

Biogenic Silica

Biogenic silica concentrations were analyzed at the USGS Laboratory, Guaynabo, Puerto Rico, by use of a modification of the wet alkaline digestion technique with correction for mineral silica (DeMaster, 1981). The method is specific for amorphous (hydrated) silica and is therefore a good proxy for the abundance of diatoms and other siliceous microfossils including chrysophyte cysts, sponge spicules, and phytoliths. Microscopic examination of sediment from the Musky Bay core revealed relatively few of these nondiatom siliceous organisms. Therefore, the biogenic silica concentrations were assumed to be largely associated with the diatom community. Briefly, freeze-dried sediment samples (about 20 mg) were digested in 1 percent (by weight) Na_2CO_3 at 85°C in 40-mL plastic centrifuge tubes for 4 hours. The tubes were floated in a water bath and were agitated approximately every 15 to 20 minutes during the entire digestion. Subsamples of the digestion solution were withdrawn hourly and analyzed by means of the molybdate blue spectrophotometric method. Standards and reagent blanks had matrices identical to that of the samples (1 percent Na_2CO_3, diluted 1:9 plus 31.5 µL 6 *N* HCl to neutralize). Standards and reagent blanks were run daily, and reagent blanks were subtracted from all standards and samples. Plasticware was used exclusively to avoid silica contamination from glassware.

The method relies on the fact that amorphous silica is solubilized more rapidly than mineral silica under these digestion conditions. A typical curve of silica concentration as a function of extraction time indicates a rapid increase during the first hour corresponding to dissolution of virtually all amorphous (noncrystalline or biogenic) silica, followed by a gradual increase over time reflecting much slower mineral dissolution. The biogenic silica concentration is determined as the Y-intercept using a best-fit linear regression of the sampling points over the period of gradual increase following the initial rapid increase. When virtually all silica in a sample is biogenic, the time points generally define a horizontal line. In this case, an average of all the time points is used as the biogenic silica concentration. This was the case for most of the samples from the Musky Bay and NE Bay cores.

Diatoms

Samples for diatom analysis were cleaned with hydrogen peroxide and potassium dichromate (van der Werff, 1956). A portion of the diatom suspension was dried on a cover slip and samples were mounted in Naphrax (synthetic resin dissolved in toluene). Specimens were identified and counted by microscope under oil immersion objective (1,400X). In the upper four samples from core MB-1, at least 750 valves were counted from four or five slides from each depth. These additional counts were undertaken to ensure greater accuracy in the numbers of the diatom *Fragilaria capucina*. At all the other depths, two to five slides per depth were enumerated. In core MB-3, one to two slides were counted per depth until at least 250 valves were counted. In the NE Bay core, because of dating problems, less emphasis was placed on accuracy of the counts. In this core, counts were made until at least 170 valves were enumerated. A known amount of glass microspheres was added to each sample following the procedure of Battarbee and Keen (1982). This allowed a determination of the concentration of diatom valves in the counted samples.

In the MB-1 core, diatom biovolumes and surface areas were estimated by means of the program BIOVOL (v 2.1) (Kirschtel, 1996) and measurements obtained from a representative number of the common taxa. To substantiate that the variability in the biovolume profile was legitimate, the samples with the highest peaks were redigested and recounted; similar numbers were obtained.

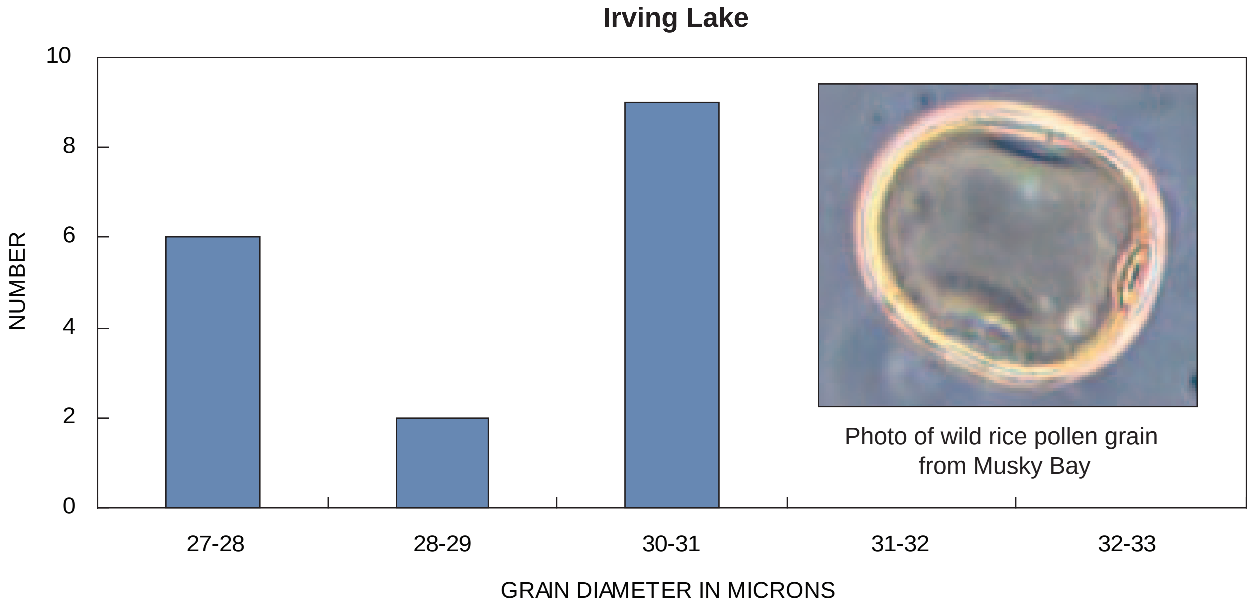
Common nationally and internationally recognized keys were used including those of Patrick and Reimer (1966, 1975), Camburn and others, (1984–86), Dodd (1987), and Krammer and Lange-Bertalot (1986, 1988, 1991a, b). Diatom nomenclature is currently in a state of flux. For this study, we followed the checklist of the Laurentian Great Lakes of Stoermer and others (1999).

Pollen

Samples for pollen analysis were cleaned by use of the technique of Faegri and Iverson (1989). Samples were treated with KOH, HF, and acetolysis. A portion of the sample was mounted on a microscope slide with polyvinyllactophenol. The slides were examined until at least 100 terrestrial grains and spores had been counted. Keys used for identification were those of McAndrews and others (1973) and Moore and others (1991). Wild rice (*Zizania palustris*) was distinguished from other grasses from the size and texture of the pollen grains. Grass pollen from Musky Bay was compared with rice pollen found in Irving Lake, Wis. The latter lake currently has a large population of wild rice. Based upon comparison with pollen from Irving Lake rice in Musky Bay was assumed to have a size range of 27–33 µm (fig. 6) and a psilate (smooth) texture on the pollen grain surface. This agrees with McAndrews (1969) who found that wild rice pollen grains ranged in diameter from 25–32 µm. The mean diameter of the rice pollen in Irving Lake was 29.2 µm and 28.5 µm in Musky Bay. The mean length of the grain was 29.8 µm in Irving Lake and 31.6 µm in Musky Bay. The grains in both lakes had protruding annulate pores with a width of 8–9 µm and height of 2.5 µm. The Musky Bay core also contained other grass pollen that was assumed to be other grasses. These grains did not have a smooth surface texture, but instead they had a wart-like (verrucate) texture and a smaller diameter (about 20–22 µm).

Quality Assurance

About 10 to 15 percent of the samples submitted to the various laboratories were replicate samples (sample splits). A comparison of the results for sample splits is given in table A10. Average percent difference (absolute difference of the two samples divided by the average of the two samples) was generally less than 10 percent for most constituents. Some of the minor- and trace-element data had higher percent differences, including Al (12 percent), Sb (23 percent), Be (34 per-



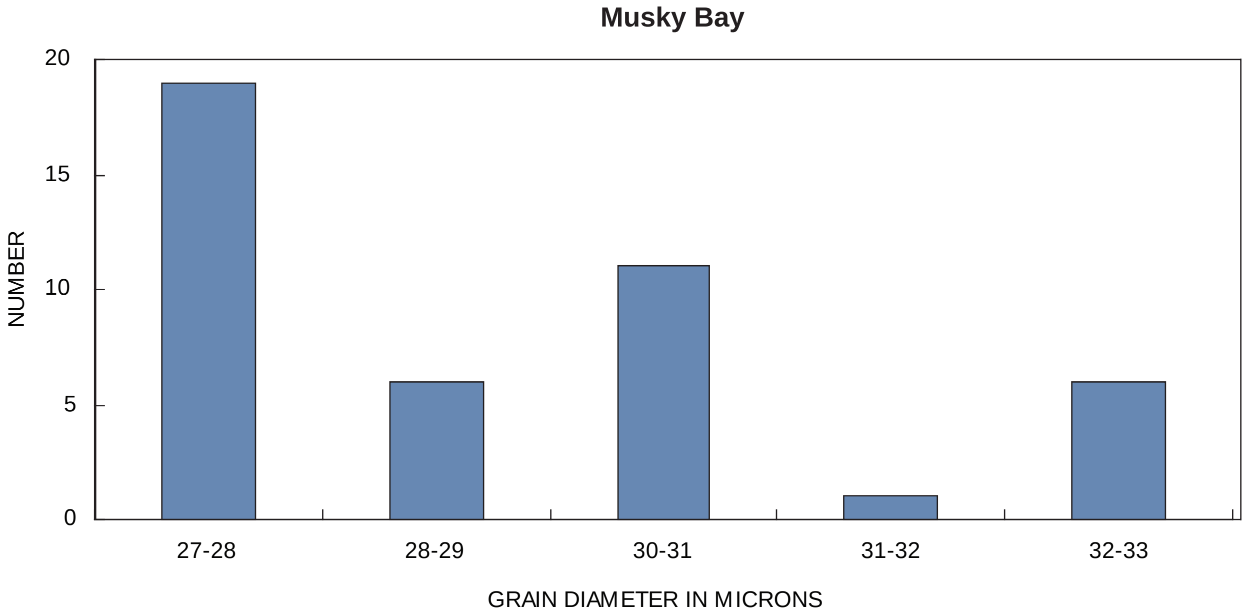


Figure 6. Comparison of the diameter of wild rice pollen grains from Irving lake, Wisconsin and Musky Bay, Lac Courte Oreilles, Wisconsin. Irving Lake has a large population of wild rice.

cent), Cu (33 percent), Pb (18 percent), and Zn (16 percent).

Each laboratory had quality-control measures that included comparisons to standards and standard reference materials, spikes, and duplicates. Quality-control measures for the USGS National Water Quality Laboratory in Denver, Colo., and the Geologic Division Laboratory are given in Pirkey and Glodt (1998) and Arborgast (1990), respectively. For total organic carbon and total nitrogen determinations, appropriate standards and blanks were run at the start of each day to check instrumental operation. Samples were run at least in duplicate, and the values were averaged. Standards and blanks were interspersed among the samples to account for instrumental drift and sample carryover in the calculation of concentration.

For minor- and trace-element samples, a "blank" sediment sample composed of fine-grained abrasive quartz (150 μm) was run through both piston corers and subsampling equipment, and results are shown in table A4. Because of its abrasive characteristics, fine-grained quartz will tend to overestimate potential contamination compared to Musky Bay core sediments. A third blank sediment sample was submitted without exposing it to any coring equipment. For all three samples, only five elements were found in concentrations above the minimum reporting levels. The comparison of the three samples indicates that all samples contained similar concentrations of Al, Ba, and Li. These elements are assumed to be present in the original blank sample. The blank sample run through the piston corer used in 1999 contained a Cd concentration of 1.2 μg/g (the minimum reporting level for Cd is 0.1 μg/g). The source for the Cd in the sampling equipment is not known. Potential sources include steel parts on the corer or contact of the corer with plastics that include Cd as a stabilizer. The blank sample run through the USGS piston corer contained an As concentration of 0.11 μg/g, slightly above the minimum reporting level of 0.1 μg/g.

As a check that the two side-by-side MB-1 cores collected at Musky Bay (MB-1A for nutrients, biogenic silica, and minor and trace elements; and MB-1B for radiometric dating, diatoms, and pollen) represented the same depositional history, additional samples of diatom community and radiometric activity were analyzed at selected depths from core MB-1A. Results were then compared to the same intervals in MB-1B. Diatoms were examined in at least two slides from each depth until at least 300 valves were encountered. A comparison only was made of the common taxa. Appendix A8 lists the results of duplicate counts for the diatom concentration.

HISTORICAL TRENDS FROM MUSKY BAY AND NORTHEASTERN BAY

Data for physical characteristics, nutrients, minor and trace elements, biogenic silica, diatoms, and pollen for all samples can be found in tables A1–A9. The following sections describe the trends in those characteristics and constituents and the possible causes for those trends.

Bulk Density and Organic Content

In general, sediment from Musky Bay cores MB-1 and MB-3 had lower bulk density and higher organic content than sediment from NE Bay core LCO-1 (fig. 7A and B, respectively). In core MB-1, bulk density was constant (except for a peak at about 80 cm defined by a single sample) from the bottom of the core until 45 cm (fig. 7A). A peak occurred from 45 to 40 cm with values approaching 0.07 g cm^{-3}. Above 40 cm values slightly decreased from 0.04 to 0.03 g cm^{-3} at 4 cm (fig. 7A). The top three depths (0–4 cm) had the lowest densities. In MB-3, the bulk density generally decreased from the bottom of the core to 50 cm (fig. 7A). Between about 50 to 40 cm, bulk density decreased sharply from 0.05 to 0.03 g cm^{-3}. From 40 cm to 30 cm there was a peak in the values and then the bulk density was constant at 0.025 g cm^{-3} until above 10 cm when it was variable.

Profiles from both Musky Bay cores suggest a change in sediment input or source at about 40–45 cm and the upper 10 cm. However, the differences in the profiles suggest some subtle differences in local sedimentation history. Increases in bulk density can be the result of drying out of sediment, episodic increases in the input of clastic material, change in organic matter input, or dredging. It is not known what caused the peaks in the Musky Bay cores. The sharp increase downcore in bulk density from 40–50 cm corresponds to the noted change in character of sediment of MB-3 at 50 cm (table 3). Above 50 cm, core MB-3 contained dark, organic-rich muck but below 50 cm core MB-3 contained olive gyttja with abundant yellow blade-like plant fragments. Thus, this interval may reflect a slight increase in water depth that affected the aquatic vegetation, possibly related to an increase in water level at the Billy Boy Dam when it was upgraded about 1936. In core MB-1 the peak in bulk density from about 40–45 cm may reflect an episodic increase in the input of clastic material. Core MB-1 did not have an observable change in the character of the sediment at this interval as did core MB-3 (table 3).

Differences in the profiles of organic content in cores MB-1 and MB-3 also reflect different sedimentation histories that were possibly affected by local conditions (fig. 7B). Organic content in core MB-1 decreased from 63 percent at 85 cm to near 50 percent at 40–42 cm and then ranged from 45–50 percent from there to the core top. In core MB-3, organic content was considerably lower in the bottom of the core with values at 40–45 percent below 50 cm. Between 50 and near 40 cm the organic matter increased significantly from 50 to 63 percent. In core MB-3, the organic matter in the upper 40 cm was higher compared with the same intervals in core MB-1 (fig. 7B). The lowest organic content in core MB-1 was measured between 40 and 25 cm, indicating a possible increase in clastic material input during this interval. The large shift in organic content at about 50 cm in core MB-3 supports the changes observed in the bulk density profile for core MB-3 and suggests a large scale disturbance at this interval.

In the NE Bay core, bulk density had very large peaks at about 44 and 16 cm (fig. 7A). The large peaks in the NE Bay core may reflect episodic inputs of clastic material, drying, dredging or dragging of the bottom, or changes in water level. The peaks in bulk density in the NE Bay core correspond to lows in organic content (fig. 7B). A change in the character of the sediment was also noted for the NE Bay core at about 15 cm (table 3). Above 15 cm, the sediment was described as dark, organic-rich muck, whereas below 15 cm, the sediment was described as olive organic-rich muck with occasional sand grains. This change in the description of the NE Bay core at 15 cm is similar to the change in description of the MB-3 core at 50 cm.

Sedimentation Rates

For Musky Bay, the total ^{210}Pb and ^{137}Cs profiles from the core MB-1B indicate that little postdepositional mixing has occurred in this core, except possibly in the top 8 cm (fig. 8A). The ^{137}Cs profile exhibited a sharp peak at 30-31 cm. Radiometric activities for six intervals from core MB-1A (taken alongside MB-1B) compared well with radiometric activities from the same intervals for core MB-1B, consistent with the likelihood that the cores represent similar depositional histories (fig. 8A). The total ^{210}Pb profile of core MB-1B is relatively smooth downcore to 45 cm, except for the sharp decrease in activity above 8 cm. A decrease in activity is typically an indication of higher sedimentation rate and more dilution of ^{210}Pb inputs. Below 45 cm, the total ^{210}Pb profile flattens and includes an increase in activity from 55-65 cm, typically an indication of a lower sedimentation rate and less dilution of ^{210}Pb inputs. The ^{226}Ra activities remained relatively uniform downcore, indicating that sources for sediment were similar over the period of record exhibited by the core.

The radiometric profiles for the NE Bay core (LCO-1B) indicate that post-depositional mixing, erosion, or slug deposition occurred above 15 cm, and (or) that some major episodic event occurred below 15 cm, such as dredging (fig. 8B). Sharp breaks are evident in both the ^{210}Pb and ^{137}Cs profiles at this depth, and concentrations above this depth are relatively uniform. Slight increases in ^{210}Pb and ^{137}Cs activities in the NE Bay core above about 3 cm possibly indicate that the uppermost sediment layers have not been disturbed and that the mixing/erosion/deposition occurred a few decades ago. The disturbance problem with the NE Bay core severely limited its usefulness for comparison to the Musky Bay core, and further discussion of differences between the two cores in this report is limited to general comparison of recent and presettlement conditions. Sedimentation rates could not be calculated from this core.

Mass and linear sedimentation rates were calculated for the Musky Bay core (MB-1) from the CIC and CRS models and from the ^{137}Cs peak, as listed in table 6. Also listed in table 6 are approximate dates for each sampled interval. Sedimentation rates for the CIC model of the Musky Bay core were based on least-squares regression of the natural log of unsupported (excess) ^{210}Pb for only the 8–45 cm interval because of changes in the slope of the profile above and below this interval (fig. 9). For the interval 8–45 cm, the CIC model yielded an average sedimentation rate of about 0.034 g cm^{-2} y^{-1} (0.97 cm y^{-1}) while the CRS yielded an average sedimentation rate of 0.038 g cm^{-2} y^{-1} (1.12 cm y^{-1}) (table 6). Above 8 cm, the CRS model yielded an increase in sedimentation rate (0.051 g cm^{-2} y^{-1}; 2.25 cm y^{-1}). Below 45 cm, the CRS model indicates that mass sedimentation rates

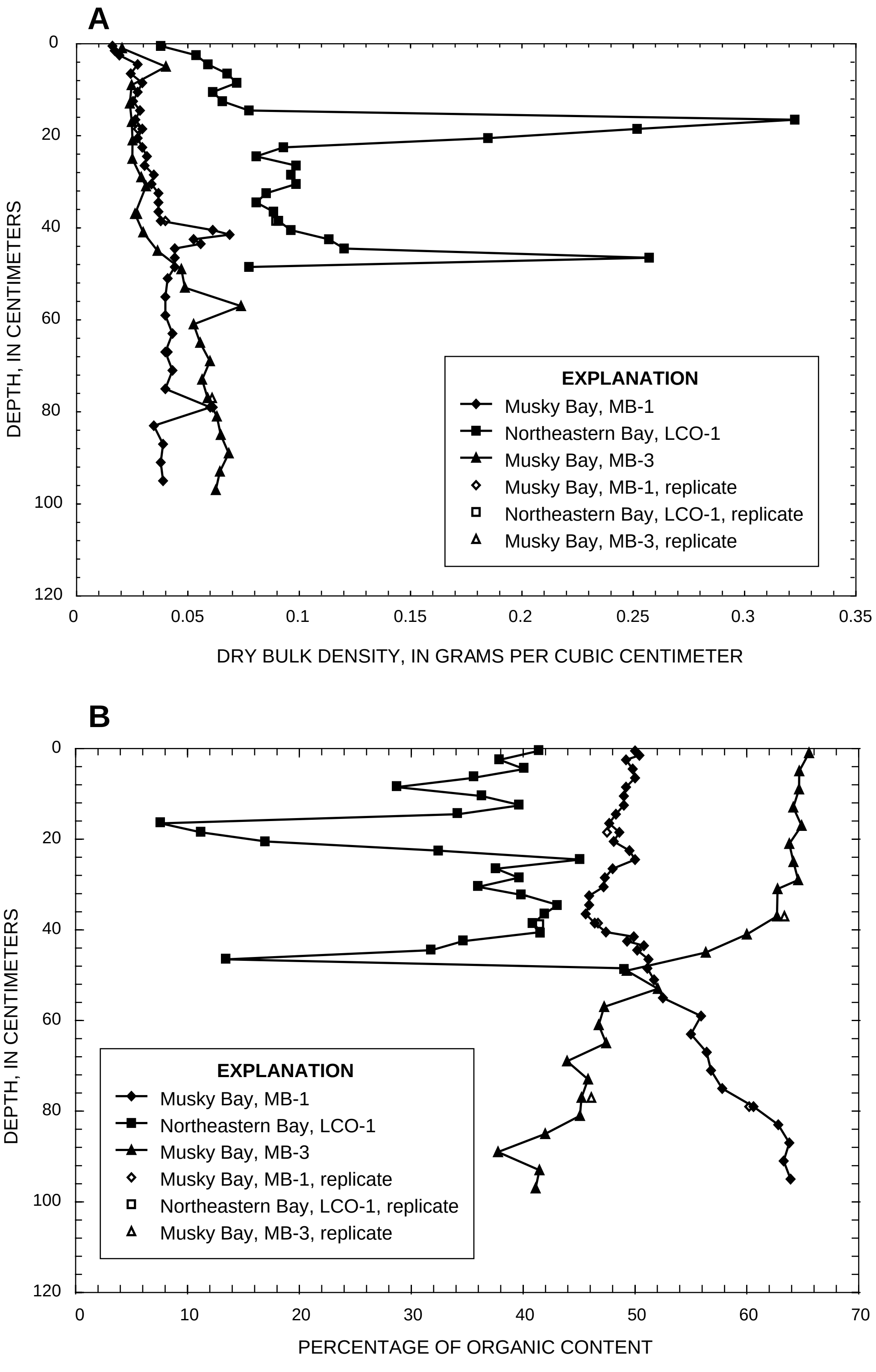


Figure 7. (A) Bulk density and (B) organic content data from loss on ignition for cores collected from Musky Bay and Northeastern Bay, October 1999.

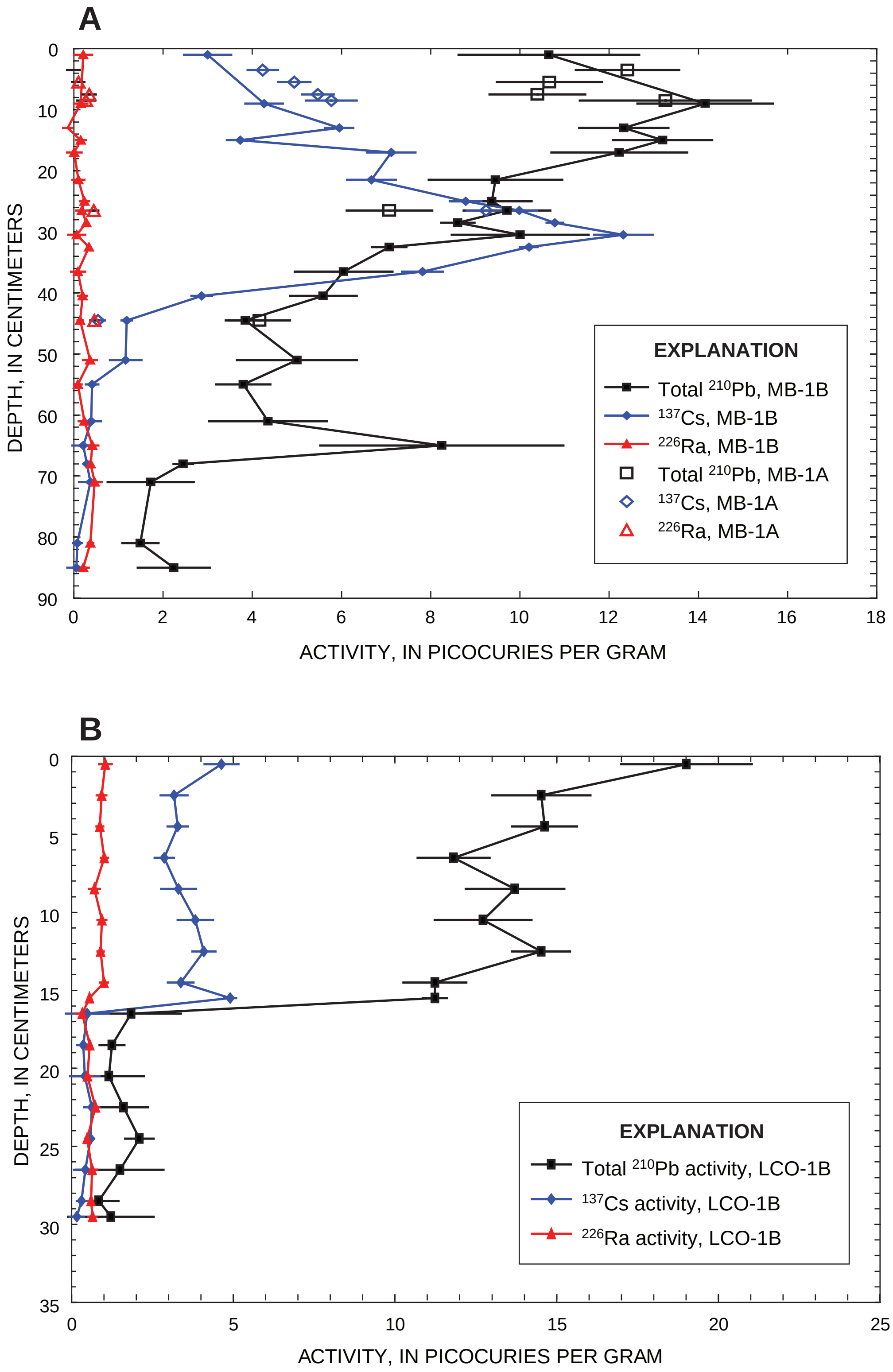


Figure 8. Comparison of radiometric data for (A) Musky Bay core and (B) Northeastern Bay core collected in October 199. Horizontal error bars represent one sigma counting uncertainties.

Table 6. Estimated average mass and linear sedimentation rates from the CRS model, adjusted CRS model, CIC model, and ^{137}Cs activity for Musky Bay core MB-1, Lac Courte Oreilles, October 1999

[--, no data; g, gram; cm, centimeter; y, year; CIC, constant initial concentration model; CRS, constant rate of supply model]

Interval (cm)	Mass sedimentation rate ($g\ cm^{-2}\ y^{-1}$)				Linear sedimentation rate ($cm\ y^{-1}$)				Estimated year (bottom of interval)			
	CRS	Adj. CRS	CIC	^{137}Cs	CRS	Adj. CRS	CIC	^{137}Cs	CRS	Adj. CRS	CIC	^{137}Cs
0–2	0.054	0.067	--	0.023	3.56	4.00	--	0.84	1999	1999	--	1998
3–4	.045	.098	--	.023	2.20	1.12	--	.84	1998	1999	--	1996
5–6	.050	.051	--	.023	1.95	1.16	--	.84	1997	1998	--	1994
7–8	.050	.047	--	.023	1.89	.72	--	.84	1996	1997	1996	1992
8–10	.035	.035	0.034	.023	1.26	.41	0.97	.84	1995	1995	1994	1989
12–14	.037	.025	.034	.023	1.34	1.39	.97	.84	1992	1991	1991	1985
14–16	.033	.023	.034	.023	1.21	.74	.97	.84	1990	1988	1990	1983
16–18	.034	.022	.034	.023	1.22	.33	.97	.84	1988	1986	1988	1980
20–23	.040	.025	.034	.023	1.35	1.16	.97	.84	1985	1980	1984	1974
24–26	.037	.023	.034	.023	1.21	1.97	.97	.84	1982	1976	1981	1970
26–27	.034	.014	.034	.023	1.10	.21	.97	.84	1981	1974	1980	1969
27–30	.036	.013	.034	.023	1.04	1.53	.97	.84	1978	1966	1977	1964
30–31	.029	.010	.034	.023	.87	.21	.97	.84	1977	1963	1976	1963
31–34	.039	.025	.034	.023	1.05	.66	.97	.84	1974	1959	1973	1958
36–37	.041	.025	.034	.023	1.09	.36	.97	.84	1972	1954	1970	1954
40–41	.038	.020	.034	.023	.77	.52	.97	.84	1966	1945	1964	1946
44–45	.048	.024	.034	.023	.87	.23	.97	.84	1962	1936	1958	1936
50–52	.029	.041	--	.023	.83	.85	--	.84	1953	1929	--	1923
54–56	.033	.037	--	.023	.80	.21	--	.84	1948	1924	--	1916
60–62	.022	.031	--	.023	.63	.15	--	.84	1939	1916	--	1906
64–66	.007	.012	--	.023	.22	.28	--	.84	1921	1903	--	1899
66–70	.019	.028	--	.023	.47	.64	--	.84	1912	1897	--	1892
70–72	.023	.037	--	.023	.54	.03	--	.84	1908	1895	--	1888
80–82	.012	.033	--	.023	.35	.14	--	.84	1880	1880	--	1868
84–86	.003	.015	--	.023	.12	.00	--	.84	1846	1870	--	1862

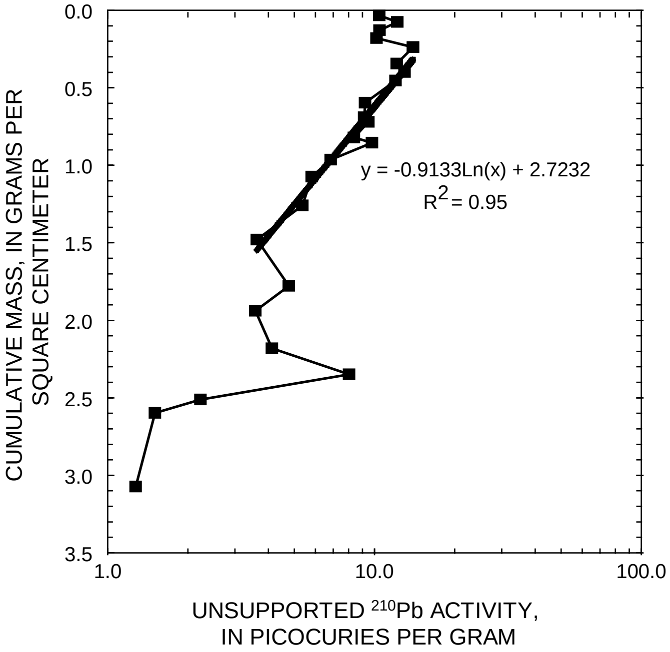


Figure 9. Best-fit log-linear curve (regression line) for unsupported ^{210}Pb activity used in the constant initial concentration model. Regression was done for 8–45 cm interval of MB-1B only.

decreased substantially to an average of 0.019 g cm^{-2} y^{-1} from 45–82 cm (0.45 cm y^{-1}).

The ^{137}Cs peak indicates that the sedimentation rate from 0–31 cm is less than that estimated from the CRS and CIC models (table 6, fig. 10). Assuming little remobilization of ^{137}Cs on the basis of the sharpness of the ^{137}Cs peak, the sedimentation rate from 0 to 31 cm averaged 0.023 g cm^{-2} y^{-1} (0.84 cm y^{-1}), indicating that the dates derived from the CRS and CIC models are too recent (table 6, fig. 10). At the interval 30–31 cm, the CRS and CIC models predicted years of about 1977 and 1976, respectively, instead of 1963 (table 6, fig. 10A). The ^{137}Cs-based sedimentation rate of 0.023 g cm^{-2} y^{-1} was extrapolated to intervals below 31 cm (table 6). The first occurrence of detectable ^{137}Cs in the profile is at about 40–41 cm (1946) corresponding well to the known timing of the beginning of recognizable ^{137}Cs fallout from the atmosphere in 1951 or 1952 (Beck and others, 1990). The relative change in CRS-modeled sedimentation rates at about 45 cm (approximately 1936 based on the ^{137}Cs model) is thought to be possible, even though average CRS sedimentation rates are suspected to be too high. Other researchers have found disagreement between ^{137}Cs and ^{210}Pb dates in cores (e.g. Anderson and others, 1987; Appleby, 2000). One possible explanation is that any change in mass sedimentation rate, such as that indicated by the change in the slope of ^{210}Pb activity versus cumulative mass (fig. 9) above 45 cm, will likely violate the assumptions of both the CRS and CIC models. If the additional material deposited in the lake has any excess ^{210}Pb, which is likely because it is derived from the land surface, then the rate of supply (flux) will be greater than prior to the disturbance. Furthermore, unless the additional material has the same initial ^{210}Pb concentration as earlier deposited sediments, which is unlikely, then the CIC assumption will be violated. A similar inconsistency in ^{137}Cs and ^{210}Pb age dates was encountered in a core from Lake Harriet in Minneapolis by Van Metre and others (2000). There, the date of the ^{137}Cs peak estimated using the CRS model was 1978 and a change in sedimentation rate was suggested in about 1940. They adjusted the Lake Harriet ^{210}Pb dates to more closely match the ^{137}Cs dates by use of a ratio based on the difference in estimated mass accumulation rates from the top of the core to the 1964 horizon for the two methods. The resulting dates were corroborated by contaminant peaks (lead, DDT, and PCBs) and by changes in sedimentation rates and numerous major and trace elements in about 1920 coincident with initial urbanization of the

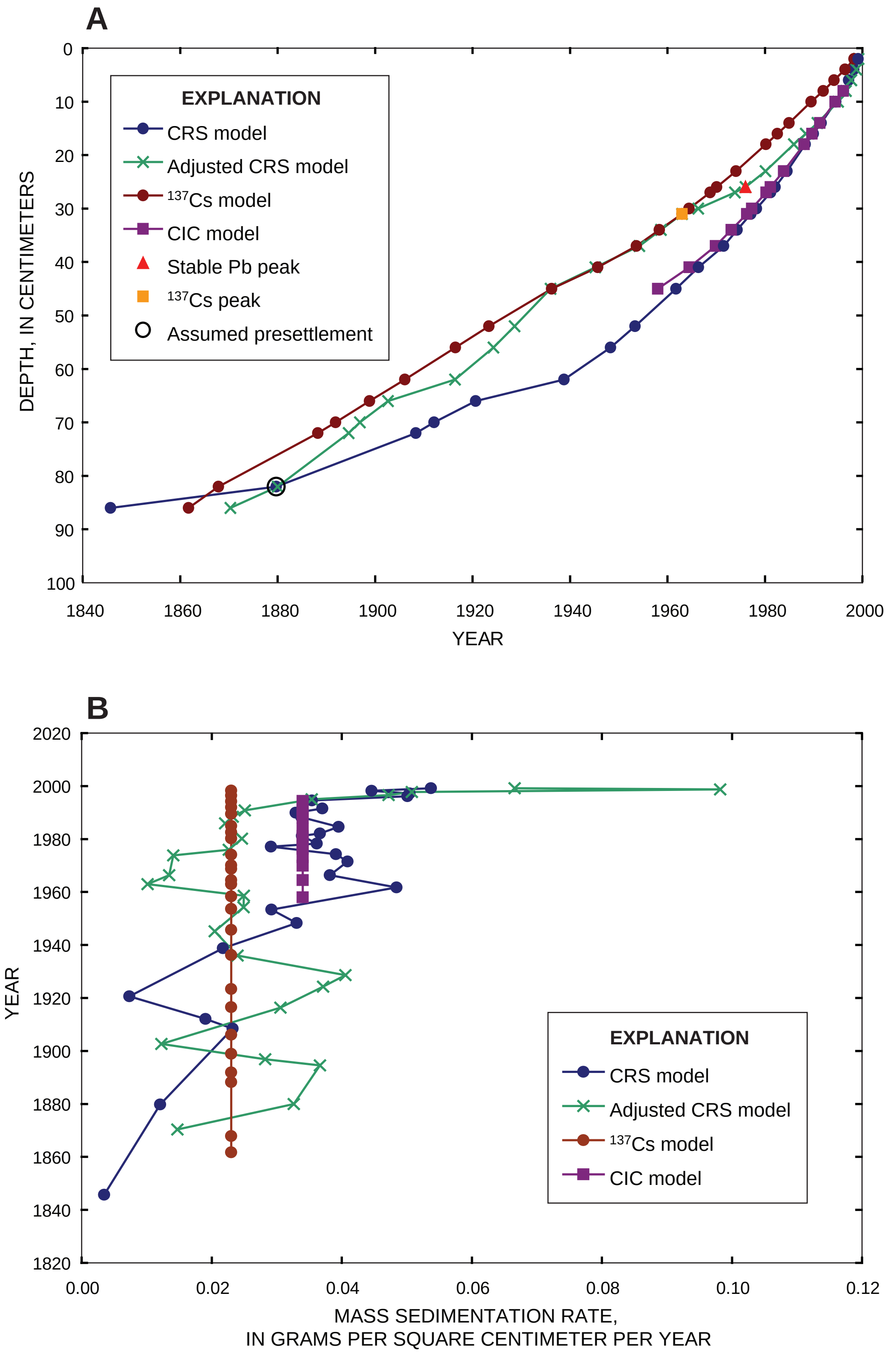


Figure 10. Comparison of (A) dates and (B) sedimentation rates from the constant rate of supply (CRS), adjusted CRS, ^{137}Cs, and the constant initial concentration (CIC) models for Musky Bay core MB-1.

watershed (Peter Van Metre, U.S. Geological Survey, written commun., 2002).

The stable Pb profile also provided supporting evidence that the ^{137}Cs-based dates are reasonable. Stable Pb concentrations peaked at 24–25 cm (assumed to be about 1976), coincident with the peak in leaded gasoline use and subsequent banning of lead from gasoline (table A9, fig. 13C). The stable Pb peak at 24–25 cm in the Musky Bay core agrees within about 5 years of the ^{137}Cs date of 1970 for the bottom of the 24–26 cm interval. Subsurface peaks in Pb have been dated to this time period in other lakes (Gobeil and others, 1995; Callender and Van Metre, 1997; Siver and Wozniak, 2001).

Sedimentation rates and estimated dates for the adjusted CRS model (Appleby, 1998) are listed in table 6 and shown on figure 10. As stated early, the adjusted CRS model was constructed by calculating the ^{210}Pb flux for independently dated intervals determined by other chronostratigraphic markers, including the ^{137}Cs peak at 30–31 cm (1963), stable Pb peak at 24–26 cm (1976), and organic content changes at 80–82 cm representing European settlement and beginning of clear-cut logging era (1880). In addition, the ^{137}Cs model was assumed to be accurate downcore to 45 cm (1936) based upon the good fit of the regression line for ^{210}Pb activity versus cumulative mass (fig. 9). The CRS and CIC modeled date for 7–8 cm (1996) was also assumed to be accurate. Mass sedimentation rates calculated with the adjusted CRS model do not show a decrease below 45 cm as observed with the original CRS model (fig. 10B). This would be consistent with a change in ^{210}Pb flux above 45 cm. Both the original and adjusted CRS models show an increase in sedimentation rates above 8 cm.

The results from the CRS, CIC, and ^{137}Cs models were considered together, and it was determined that the average sedimentation rate calculated from the ^{137}Cs profile would be most useful for subsequent interpretations of the overall timing of historical changes in the nutrient, minor- and trace-element, diatom, and pollen profiles—especially given the timing of land-cover changes from the 1930s through 1990s in the local area surrounding Musky Bay. The ^{137}Cs model may be off by about 12 years (1868 instead of 1880) at the 80–82 cm interval thought to represent the beginning of European settlement. Although the original CRS-model dates are too recent, the model may have some limited usefulness for showing relative short-term changes in sedimentation rates in the profile, such as the change in sedimentation rate shown in both CRS models at the top of the core. Below 45 cm, the sedimentation rates from the adjusted and original CRS models conflict with each other, indicating that the decrease in sedimentation rate calculated in the original CRS model is suspect. Dates from ^{137}Cs activity (table 6) are shown on subsequent graphs included in this report.

Nutrients

Concentration of total organic carbon, total nitrogen, total phosphorus, and total sulfur are shown for Musky and NE bay cores in figure 11A–D. These four elements are major components of the organic matter in the sediments, excluding oxygen and hydrogen. Concentrations of these four elements were always lower in the NE bay core than in the Musky Bay core, consistent with lower organic content in the NE Bay core than the Musky Bay core (fig. 7B). A major discontinuity is evident in the NE Bay profiles of all four elements at about 20 cm (LCO-1A). This break corresponds to the break in the radiometric profiles from LCO-1B (side-by-side core from the same location) at 15 cm. This slight offset of breaks in profiles may be a reflection of different core recoveries for LCO-1A compared to LCO-1B (table 2).

In the Musky Bay core (MB-1), the concentration of organic carbon decreases from 25 percent over the top third of the core to a minimum of about 21 percent at about 30 cm depth and then increases to about 27 percent at the bottom of the core (fig. 11A). Profiles of nitrogen and phosphorus decrease somewhat exponentially downcore to about 28 cm (figs. 11B–C). Concentration ranges for nitrogen and phosphorus are generally one and two orders of magnitude lower, respectively, than that for organic carbon. These proportions are consistent with the remains of macrophytes and epiphytic algal detritus being a major component of the sediments.

The increasing organic carbon (and to a lesser extent nitrogen) concentrations downcore below about 28 cm (prior to circa 1965) in the Musky Bay core indicate a very different balance between input, burial and (or) decomposition rates compared to those occurring during the last few decades. The typical exponential-like decrease with depth at top of the core is consistent with either steady-state organic matter decomposition or possibly increasing OC input and (or) burial rates in recent decades. In contrast, increasing concentrations with depth below about 28 cm (beginning of the twentieth century to about 1965) imply any or all of the fol-

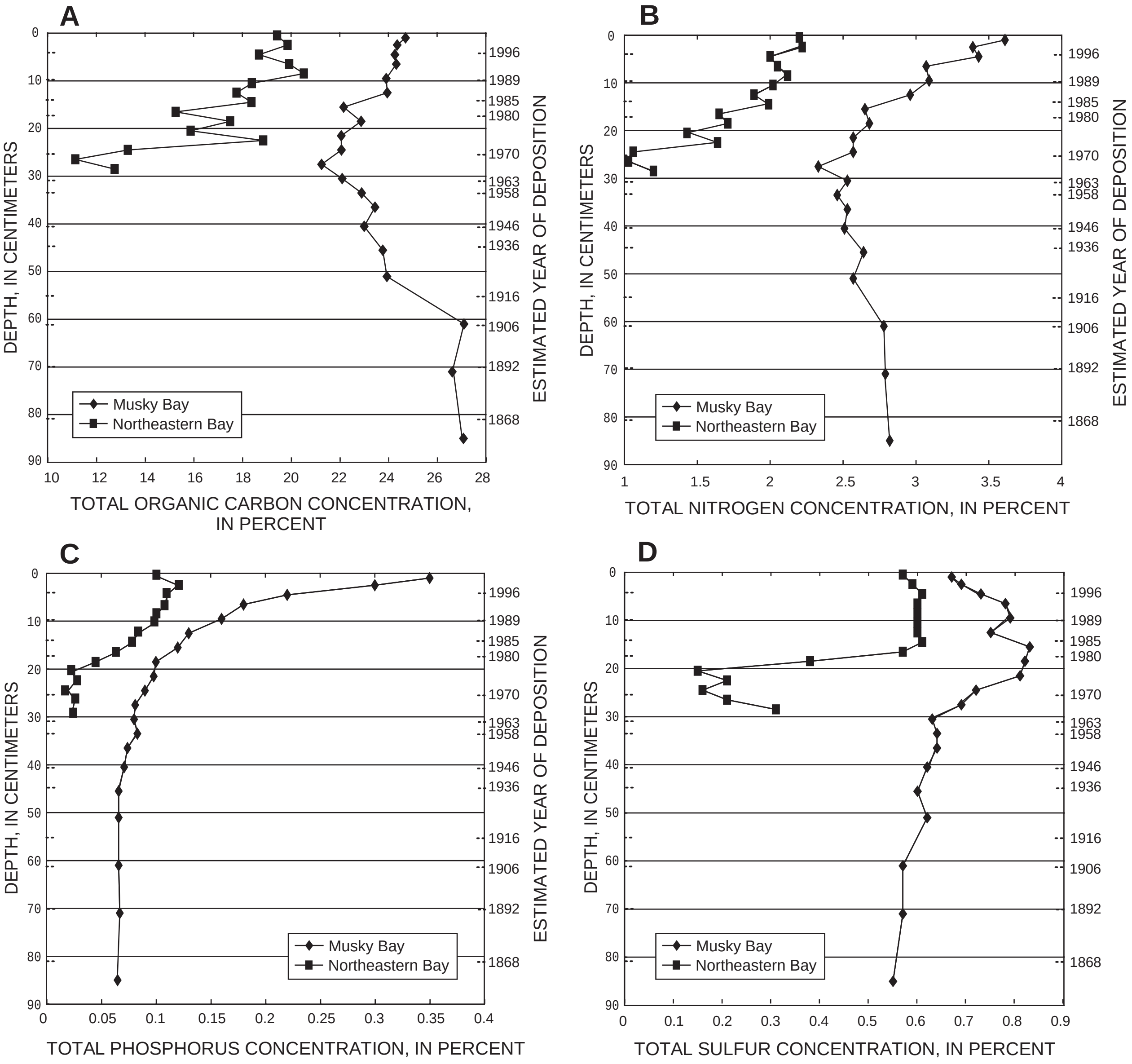


Figure 11. Concentration profiles of (A) total organic carbon, (B) total nitrogen, (C) total phosphorus, and (D) total sulfur in Musky Bay core MB-1A and Northeastern Bay core LCO-1A. Dates refer to Musky Bay profiles only.

lowing for this period of time: (1) decreasing organic carbon input and (or) burial rate; (2) increasing organic carbon recycling rate perhaps driven by input of more easily decomposable organic matter, specifically epiphytic algae; (3) increasing dilution with mineral sediments. The period leading up to 1965 is one of cranberry farm construction wherein bog 4 was created and reached 44 percent of its 1998 size and bog 5 expanded an additional 14 percent of its 1998 size (fig. 4). Residential development was also occurring during this period though it is uncertain how much of the increase between about 1954 and 1971 occurred prior to 1965 (fig. 5, table 1).

In the Musky Bay core, the sulfur profile differed from organic carbon, nitrogen, and phosphorus profiles in that the sulfur profile increased downcore from 0 to 15–16 cm instead of decreased (fig. 11D). Sulfur in surficial sediment from productive lakes is often dominated by organic forms with lesser amounts of pyritic sulfur, acid-volatile sulfur, elemental sulfur, and dissolved sulfate and sulfide (Wetzel, 1983 and references within). Given this, the sulfur profile might be expected to resemble the organic carbon and nitrogen profiles, which decrease below the sediment-water interface. Either organically bound sulfur is preferentially lost compared to organic carbon and nitrogen or inorganic sulfur species must be quantitatively significant. A “rotten egg” odor was detected throughout the entire core, implying sulfate reduction as a major organic matter decomposition pathway. With sulfide in excess, all iron would precipitate as monosulfides and pyrite. The remaining sulfide would diffuse upward and downward and would be oxidized to sulfate at or within millimeters of the sediment-water interface. Sulfate that is not reduced again during organic-matter decomposition can escape to the overlying water. The subsurface peak at ~20 cm may represent a diagenetic zone of maximal sulfide mineral precipitation. If so, the total sulfur profile records diagenetic features more than it does a true input and burial history.

It is possible that nutrient and certain minor- and trace-element profiles reflect postdepositional decomposition and remobilization and not true inputs. For the Musky Bay core, two factors must be considered when interpreting elemental accumulation rates as being either true input histories or subject to postdepositional migration: the presence of seasonal macrophyte stands and the likelihood of organic-matter decomposition within the sediments. Because this core was collected from within a macrophyte stand (though after the macrophytes had died back), the macrophytes might have altered the nutrient profiles enough that the input history of the nutrients has been confounded.

The steadily decreasing ^{210}Pb activities below about 8 cm in the Musky Bay core indicate reasonably steady-state bulk sediment accumulation down to about 45 cm (figs. 8–9). The upper 8 cm might thus represent the macrophyte root zone wherein sediments are affected by root-mediated reactions. Below this zone, the effects of macrophyte roots are assumed to be minimal. Further, given that macrophyte fragments are found throughout the upper 86 cm of the Musky Bay core, any reactions, including the sequestering of various elements by macrophytes, would have the same effect over the entire core. Thus, sediments below the root zone might still record elemental accumulation rates, albeit with potential chemical alteration prior to being buried below the root zone and with decreased temporal resolution.

Examining nutrient concentrations in terms of ratios can help to determine the types of post-depositional chemical reactions that may be occurring, as well as the sources and input of the elements. Before elements can be examined in terms of ratios, concentrations (based on percent weight) are converted to mmol g^{-1}, which then allows comparison on an atom-by-atom basis. Typical ratios examined in this fashion were organic carbon:phosphorus (OC:P), nitrogen:phosphorus (N:P), and organic carbon:nitrogen (OC:N).

The OC:N:P ratio at the top of the core of 182:23:1 (table 7) reflects a mixture of macrophyte and epiphytic algal sources and an additional source of nitrogen with respect to phosphorus. In the surficial sediment, the OC:N ratio (7.9) and OC:P ratio (182) are intermediate between those of macrophytes (OC:N = 17.4 and OC:P = 197; average of various species of *Potamogeton, Myriophyllum, Ceratophyllum, Elodea,* and *Vallisneria*; in Enríquez and others, 1993 and references within) and algae (OC:N = 6.6 and OC:P = 1.6; Redfield and others, 1963). However, nitrogen is enriched with respect to phosphorus in the sediments compared to both of these organic detritus sources. The presence of inorganic fertilizer cannot explain this result; more than about 95 percent of the total nitrogen in the core is estimated to be organically-bound based on commonly observed porewater and sorbed ammonium concentrations

Table 7. Molar ratios of organic carbon (OC), nitrogen (N), and phosphorus (P) in Musky Bay core MB-1A, 1999

[cm, centimeter]

Midpoint depth (cm)	OC:N	OC:N:P
1	7.9	182:23:1
2.5	8.4	209:25:1
4.5	8.4	284:34:1
6.5	9.2	348:38:1
9.5	9.0	385:43:1
12.5	9.5	475:50:1
15.5	9.7	476:49:1
18.5	10.0	590:59:1
21.5	10.0	580:58:1
24.5	10.0	632:63:1
27.5	10.6	677:64:1
30.5	10.2	712:70:1
33.5	10.8	711:66:1
36.5	10.8	817:76:1
40.5	10.7	835:78:1
45.6	10.6	929:88:1
51	10.9	935:86:1
61	11.4	1059:93:1
71	11.1	1024:92:1
85	11.2	1075:96:1

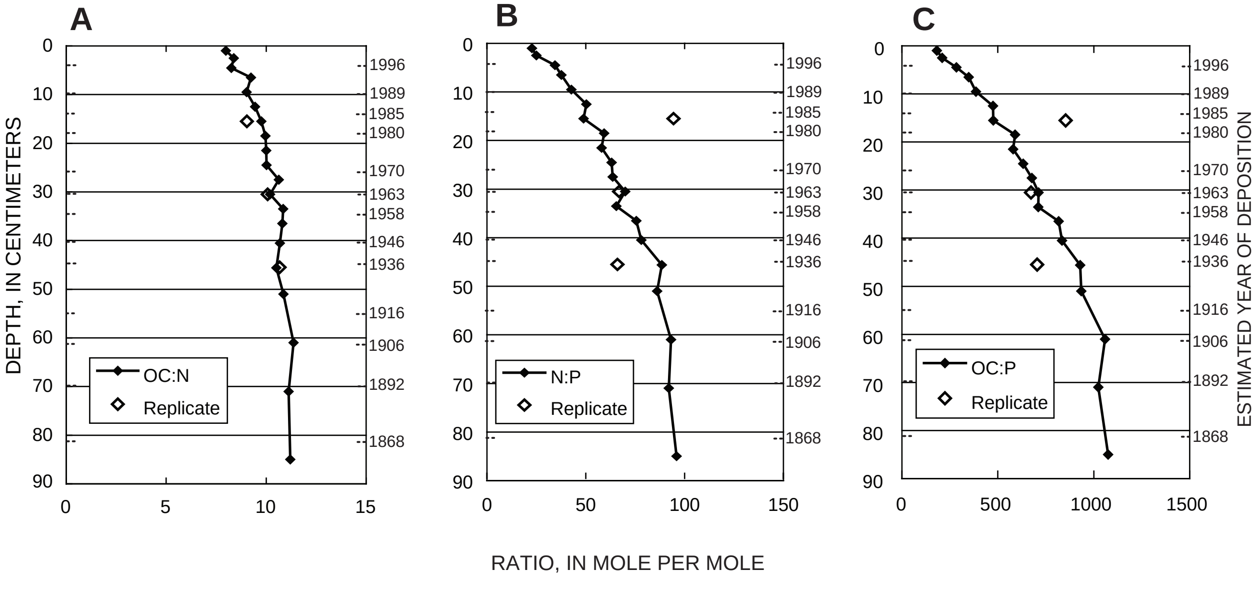


Figure 12. Mole-ratio profiles of (A) total organic carbon and total nitrogen (OC:N), (B) total nitrogen and total phosphorus (N:P), and total organic carbon and total phosphorus (OC:P) for Musky Bay core MB-1A.

(Fitzgerald, unpublished data). The source of this nitrogen enrichment with respect to phosphorus is not known and further work is necessary to characterize its chemical form and likely source.

Sediment OC:N, OC:P, and N:P ratios increase with increasing depth in the Musky Bay core, indicating preferential recycling and loss of phosphorus with respect to both organic carbon and N and preferential recycling of N with respect to organic carbon (fig. 12). The OC:N in the upper two centimeters of the Musky Bay core was 7.9, within the range reported for 46 Minnesota Lakes (7.4–14; Dean and others, 1993) and the Laurentian Great Lakes (7–9; Kemp and others, 1977). These OC:N ratios reflect both the source (discussed above) and the relative freshness of the organic matter, in that the OC:N ratio at the top of the core (7.9) is close to that for live phytoplankton biomass (~6.6; Redfield and others, 1963). The OC:N ratio increases with depth until a fairly constant value of about 11 is reached below at depth of about 28 cm, reflecting more decomposed organic matter which has a OC:N ratio of about 10–20 (Hakanson and Jansson, 2002). N:P and OC:P also start from minimum values and increase towards a relatively constant value. These plots are strong evidence that organic matter decomposition is responsible for at least some of the decrease of organic carbon, nitrogen and phosphorus concentrations with depth in the Musky Bay core. It would be extremely unlikely that organic carbon, nitrogen, and phosphorus input rates would vary in such a smoothly concerted fashion, in the absence of organic-matter decomposition or other biogeochemical processes that selectively retain or release these elements over several decades of deposition.

Another indication that the high nitrogen and phosphorus concentrations in the upper part of the core are due at least in part to diagenesis as opposed to increased input can be discerned from normalizing nitrogen and phosphorus concentrations to those for aluminum (Al) and organic content (LOI) (fig. 13). Aluminum concentration is used here as a proxy for the mineral fraction of the sediments, and organic content is a measure of the total organic matter in the sediments. The relative concentrations of both nitrogen and phosphorus decrease downcore with respect to both of these proxies over the upper third of the core, the location of fastest organic matter decomposition and nutrient recycling. Because these nutrients must have originally been deposited in association with one or both of these fractions, the changing relation with depth is very strong evidence that recycling of nitrogen and phosphorus from the sediments has caused most of the decrease in nitrogen and phosphorus concentration with depth.

Postdepositional recycling, plus organic-matter decomposition, has been shown to alter the accumulation and burial rates of nonconservative sedimentary components such as organic carbon, nitrogen and phosphorus, and certain trace elements. (See Berner, 1980, for a general overview.) Phosphorus profiles in particular have been empirically shown to be inadequate for inferring historical ecosystem responses, including increased phosphorus input (Schelske and others, 1988; Anderson and Rippey, 1994). Phosphorus accumulation rates often underestimate inputs, as was shown for the Laurentian Great Lakes (Schelske, 1999), likely because of the preferential recycling of phosphorus with respect to other nutrients, among other things. There is clearly a lack of understanding of the factors that control phosphorus accumulation, and ultimately, burial, in sediments. In summary, the fact that nutrient profiles cannot be used to reconstruct input histories for Musky Bay is not to say that nutrients have not increased over the last few decades but only that diagensis and changes in input rates cannot be distinguished from each other.

Minor and Trace Elements

Results for analysis of all minor and trace elements are shown in appendix table A4. Concentrations of selected trace elements in the Musky Bay MB-1 core also were normalized with aluminum concentrations. The normalized profiles were similar to the concentration profiles because aluminum concentrations were relatively constant throughout the profile (figs. 14–15).

For the Musky Bay core, many trace elements typically associated with mineral matter, such as aluminum, iron, magnesium, manganese, potassium and sodium, showed relatively constant concentrations throughout the 85-cm profile (for example, aluminum in fig. 14A). Concentrations of these elements were also higher in the NE Bay core than in the Musky Bay core, indicating that the NE Bay core had a higher mineral content and lower organic content and organic carbon concentrations than Musky Bay MB-1 core (as previously shown in figs. 7 and 11). Profiles of calcium, chromium, and nickel in the Musky Bay core reflect the profiles related to mineral matter, except that concentrations slightly increase at the very top of the core (figs. 14B and 15). Evidence for calcium enrichment was found in a paleolimnological study on selected lakes near the Lac du Flambeau Indian Reservation and

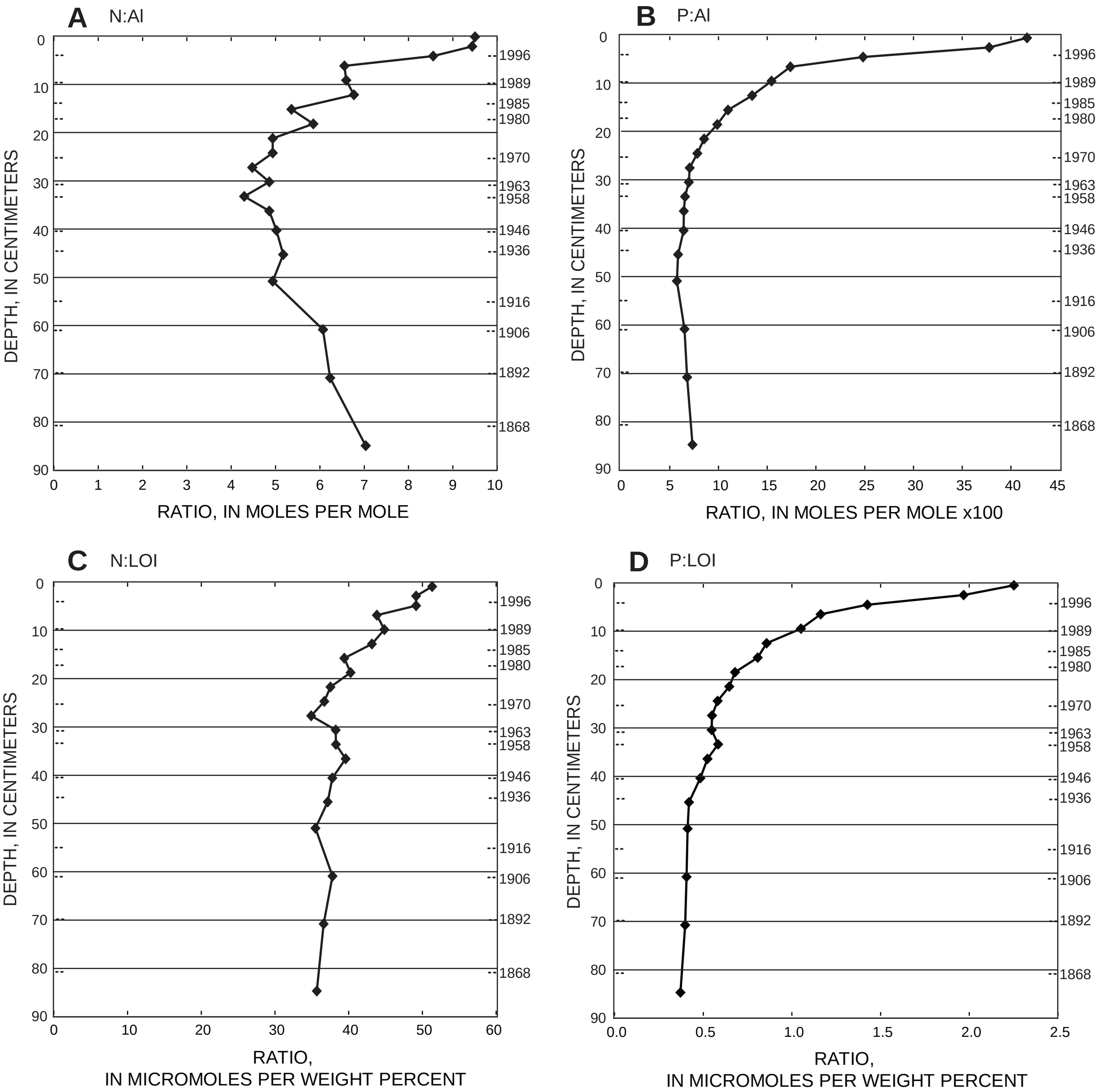


Figure 13. Profiles of nitrogen (N) and phosphorus (P) normalized to aluminium (Al) and organic content (LOI) in Musky Bay core MB-1A; (A) N:Al, (B) P:Al, (C) N:LOI, (D) P:LOI.

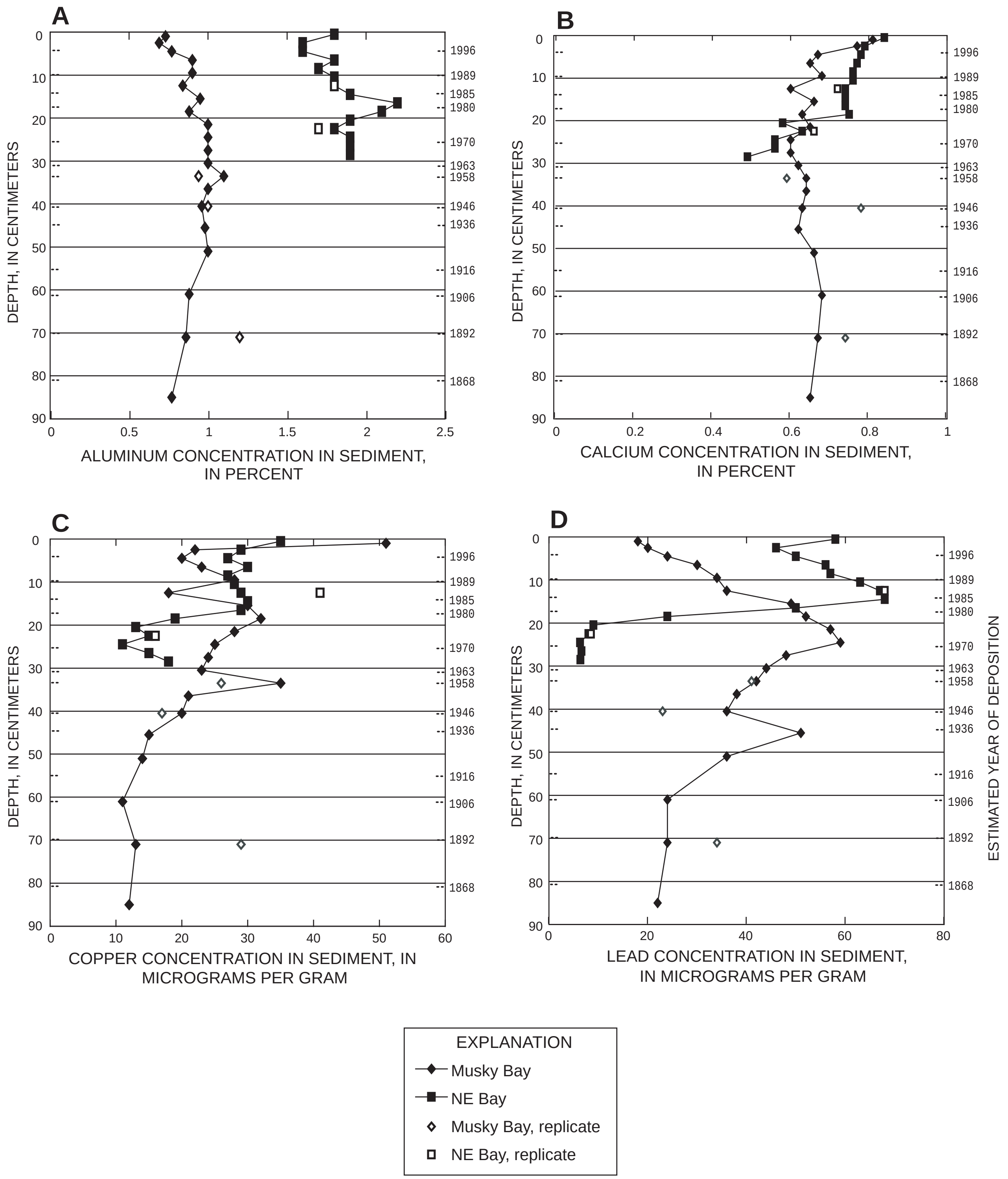


Figure 14. Profiles of selected minor and trace elements in Musky Bay core MB-1A and Northeastern (NE) Bay core LCO-1A for (A) aluminum, (B) calcium, (C) copper, and (D) lead. Dates refer to Musky Bay profiles only.

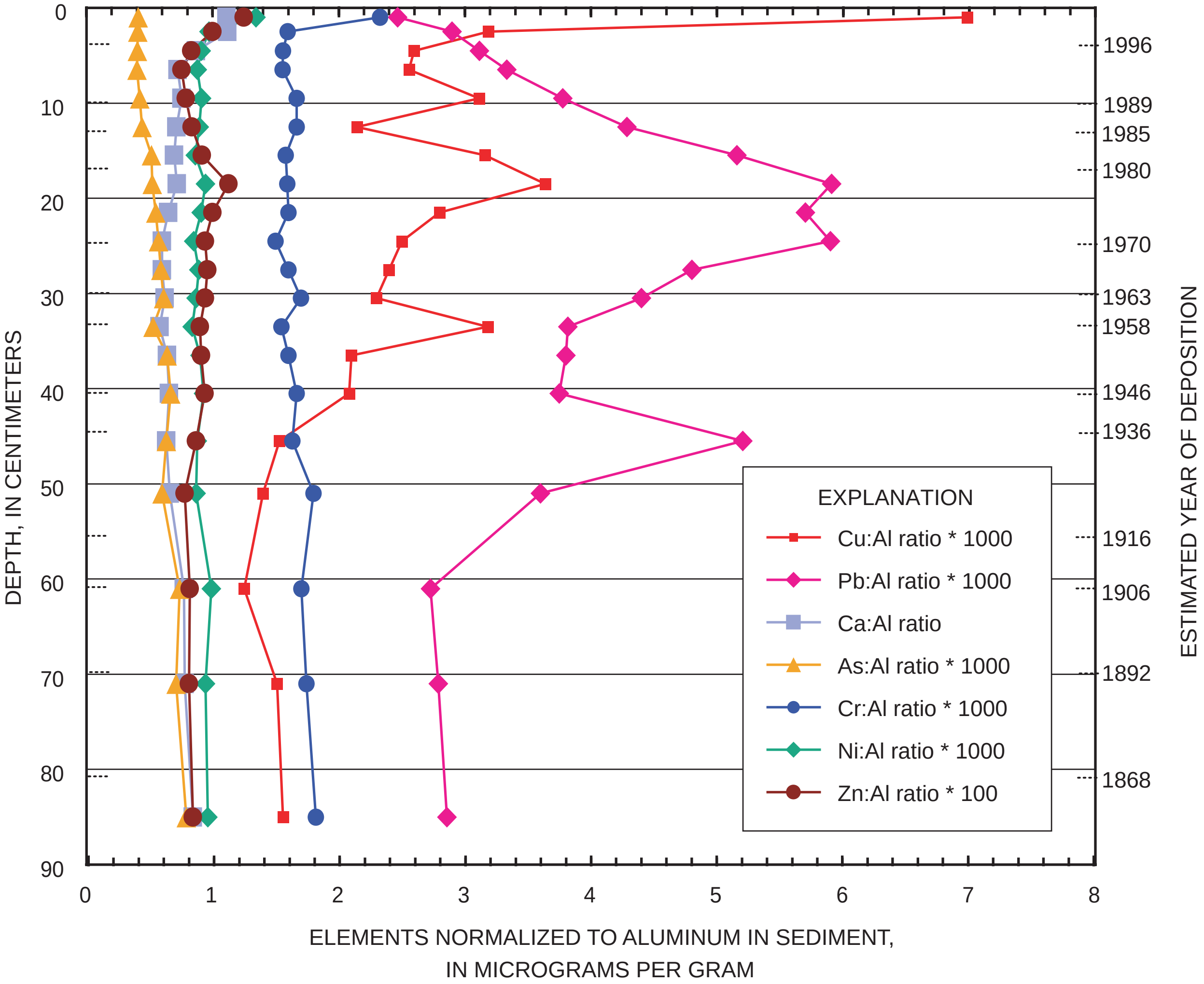


Figure 15. Profiles of selected minor and trace elements normalized to aluminum in Musky Bay core MB-1A.

was related to cranberry farming (Winkler and Sanford, 2000). In this study, there does not appear to be any calcium enrichment in Musky Bay core, except possibly in the upper 5 cm. Calcium is sometimes used as a soil amendment in cranberry operations, although calcium concentrations were not especially high in cranberry bog soils, and calcium concentrations were higher in surficial sediment from Devils Lake than from Musky Bay (table A4). Differences in the results between this study and Winkler and Sanford (2000) are possibly due to differences in farming practices. In addition, as discussed earlier, input histories of iron, manganese, and possibly calcium could not be separated from postdepositional chemical reactions with the sediments.

In general, copper concentrations were similar in Musky Bay and NE Bay cores (fig. 14C). The aluminum-normalized copper profile in the Musky Bay core showed increases from background levels at about 50 cm (1920s) probably corresponding with regional increases in smelting in the northern Great Lakes region (fig. 15). Concentrations slightly decrease above 20 cm (1980s) but then increase above 5 cm (mid-1990s) (fig. 14C). In addition to anthropogenic sources, copper is also an element in bacterial biomass (Gottschalk, 1986) and macrophyte biomass. In addition to copper and calcium, aluminum-normalized concentrations of nickel and zinc also increased in the mid-1990s.

Lead concentrations in the Musky Bay core steadily increased after European settlement and peaked at about 25 cm (around 1970) just prior to the beginning of lead removal from gasoline in the mid-1970s (fig. 14D, fig. 15). As stated earlier, subsurface peaks in lead have been dated to this time period in other lakes (Gobeil and others, 1995; Callender and Van Metre, 1997; Siver and Wozniak, 2001). The relatively low lead concentrations at the top of the core, which are lower than presettlement lead concentrations, suggest increasing proportions of organic matter, as shown in figure 7.

Concentrations of the cadmium from cores collected in 1999 from the Lac Courte Oreilles bays showed evidence of contamination from coring or subsampling equipment (table A4). Subsequent samples of surficial sediment from cores collected with a different core sampler in 2001 from the Lac Courte Oreilles bays and nearby soils and lakes indicate that cadmium concentrations in Musky Bay are not elevated and are similar to concentrations in Devils Lake sediment, a remote lake in the Lac Courte Oreilles reservation with no houses or cranberry bogs near it (table A4). A blank quality-control sample that was submitted in 2000 for the coring tube and subsampling equipment used in 1999 contained relatively high cadmium (1.2 ppm) but the exact source for the cadmium contamination of 1999 samples has not been identified. All other element concentrations were similar in 1999 and 2001 samples.

Concentrations of arsenic, chromium, copper, lead, nickel, and zinc in the Musky Bay core and from all other surficial samples collected from the Lac Courte Oreilles bays and surrounding areas were all below consensus-based probable effect concentrations (PEC). A few samples were just above the threshold effects level (TEC) for arsenic from NE bay and Stucky Bay, for copper from Musky Bay, NE Bay, Stucky Bay, and Devils Lake; and for lead from NE Bay and Stucky Bay (table 8; MacDonald and others, 2000; TEC, concentrations below which harmful effects on aquatic life are not likely to be oberved; PEC, concentrations above which harmful effects on aquatic life are likely to be observed). The source for these elements does not appear to be related to cranberry-bog practices or housing development because the concentrations above the TEC are found in areas without either type of land-cover influence. This finding is contrary to the results from a study of other northern Wisconsin lakes near Lac du Flambeau tribal lands that associated historical increases in these elements with cranberry-bog practices (Winkler and Sanford, 2000), possibly because of differing cranberry farming techniques and soil amendments. As stated earlier, apparent increases in concentrations of these elements (except As) near the top of the Musky Bay core may also represent the last season's macrophyte growth in an early stage of decomposition, in addition to a large population of sediment bacteria just below the sediment/water interface.

Biogenic Silica, Diatom Counts, and Biovolumes

In the Musky Bay core, biogenic silica concentrations generally increase from 16 percent near the bottom of the core (85 cm) to 32 percent at the sediment/water interface (fig. 16). Biogenic silica concentrations in the core from NE Bay had a broad subsurface peak within the upper half (~16 cm) of the core (fig. 16). The biogenic silica profile for the Musky Bay core indicates that diatom production has steadily increased in Musky Bay since the 1930s. Assuming that the diatoms remain phosphorus limited over this entire period, the increase in diatom production is good evidence that phosphorus

Table 8. Concentrations of organic content, arsenic, chromium, copper, lead, nickel, and zinc in selected surficial sediment from Lac Courte Oreilles and surrounding areas, 1999 and 2001

[cm, centimeter; ppm, parts per million; TEC, sediment-quality guideline below which harmful effects on selected aquatic organisms are unlikely to be observed (MacDonald and others, 2000); PEC, sediment-quality guideline above which harmful effects on selected aquatic organisms are likely to be observed (MacDonald and others, 2000)]

Location	Core sample	Depth (cm)	Organic content (percent)	As (ppm)	Cr (ppm)	Cu (ppm)	Pb (ppm)	Ni (ppm)	Zn (ppm)
Musky Bay	MB-1-1	0–2	50	3.0	17	51	18	9.8	91
Musky Bay	MB-3-1	0–2	66	3.2	18	18	36	9.5	90
Musky Bay	MB-4-1	0–2	47	4.6	2.8	21	39	8.4	100
Musky Bay	MB-5-1	0–2	40	9.1	9.8	34	28	12	120
Northeastern Bay	LCO-1-1	0–1	41	12	36	35	58	16	110
Northeastern Bay	LCO-3-1	0–2	41	12	18	26	50	14	97
Stucky Bay	SB-1-1	0–1	39	9.9	32	40	45	16	130
Stucky Bay	SB-2-1	0–2	34	5.9	6.1	40	21	9.8	85
Sand Lake	SAN-1-1	0–2	0.61	2.0	1.5	3.2	5.0	<2	6.2
Devils Lake	DEV-1-1	0–2	31	3.0	30	33	21	20	130
Ashegon Lake	ASH-1-1	0–2	14	1.4	9.6	9.7	11	5.8	24
Wetland soil	WET-1-1	0–2	83	1.9	<1	10	19	4.1	52
Cranberry farm	JON-1-1	0–10	17	2.1	19	83	8.9	11	28
Cranberry farm	JON-1-2	0–10	11	2.6	26	67	8.2	13	26
Cranberry farm	ZAW-1-1	0–8	4.2	1.6	14	17	5.1	12	19
TEC				9.8	43.4	31.6	35.8	22.7	121
PEC				33	111	149	128	48.6	459

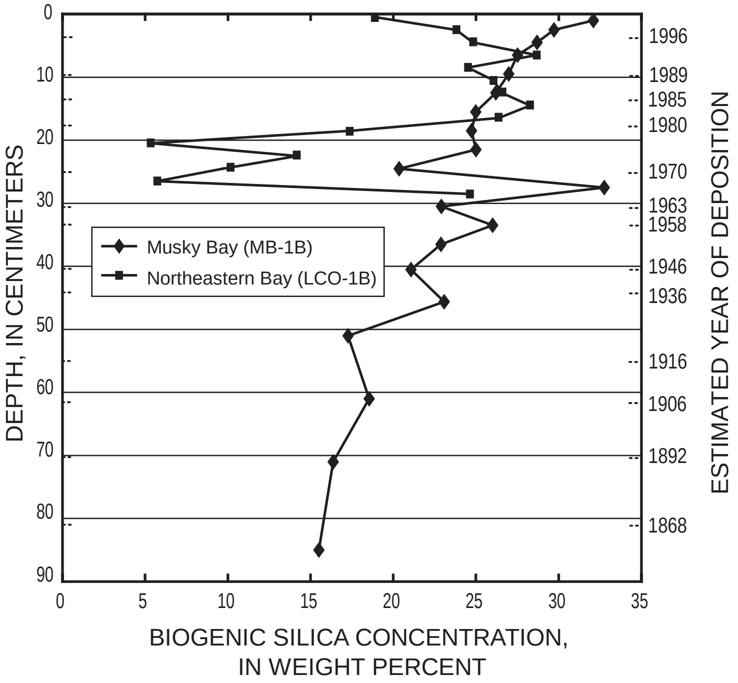


Figure 16. Comparison of profiles of biogenic silica concentrations in Musky and Northeastern bays. Dates refer to Musky Bay profiles only.

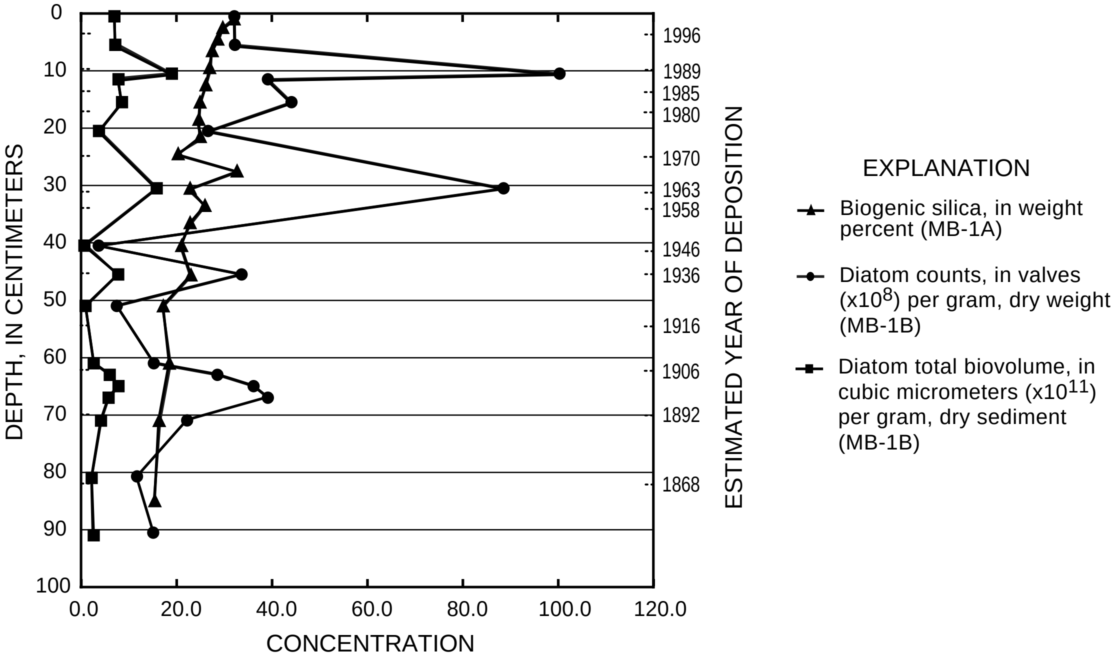


Figure 17. Comparison of profiles of biogenic silica, diatom concentration, and biovolume in Musky Bay core MB-1.

inputs have increased in Musky Bay. As stated earlier, similar increases in biogenic silica accumulation have been shown to reflect increased phosphorus inputs in the Laurentian Great Lakes (Schelske and others, 1986; 1988).

Profiles of diatom counts and biovolumes from the Musky Bay core were more variable than biogenic silica concentrations but do provide some additional evidence for recent increases in nutrient concentrations (fig. 17). Biovolumes are a better estimate of diatom silica changes than diatom counts are, especially in the Musky Bay core, because the dominant diatoms at the bottom of the core differ in size from those present in the upper part of the core. Although the increase in biogenic silica in the top 20 cm of the core is not as evident in the diatom biovolume profile, generally higher levels are indicated. The diatom biovolume and biogenic silica profiles in Musky Bay compare fairly closely considering the different results reported in the literature. For example, Digerfeldt (1972), Renberg (1976), and Engstrom and Wright (1984) reported little agreement between diatom counts and biogenic silica, whereas others have reported close agreement (Flower, 1980; Conley and others, 1989; and Wessels and others, 1999).

Diatom Assemblages

Diatom diagrams for the two cores in Musky Bay (MB-1 and MB-3) and one core in NE Bay are shown in figures 18–20, respectively. As with the radiometric comparisons of the duplicate cores MB-1A and MB-1B, the comparison of selected diatom taxa in both cores from MB-1 was fairly close (fig. 21). Percentages of some taxa such as *Fragilaria capucina* Desmazières and *Staurosira construens* (Ehren.) Williams and Round (1987) agreed very closely, whereas small *Navicula* and *Achnanthidium minutissima* Kützing agreed closely at the top but not as closely at the bottom, possibly because recovery ratios differed between the two cores. Overall, the agreement seems close enough to conclude that these cores are comparable.

Musky Bay

At both of the Musky Bay sites, diatoms associated with benthic substrates (bottom sediments or aquatic plants), for example, *Staurosirella* spp. *and Staurosira* spp. comprised the large majority of the community throughout the cores (figs. 18 and 19). Open-water diatoms (planktonic) were somewhat more common at site MB-3, reflecting its distance further away from shore (figs. 1, 22). The most common open-water diatoms were *Aulacoseira ambigua* (Grun.) Simonsen and *Cyclotella comensis* Grunow. These were the dominant taxa found in the core collected from the deep basin of the lake (appendix B).

The lower parts of the Musky Bay MB-1 and MB-3 cores were dominated by small benthic species of *Achnanthidium (A. minutissima), Navicula (N. pseudoventralis*, Hustedt; *N. atomus var. permitis*, (Hust.) Lange-Bertalot; *N. minima*, Grunow), and *Fragilaria* (figs. 18, 19, and 22). (Diatoms referred to as benthic *Fragilaria* are displayed in the figures as *Staurosira, Staurosirella,* and *Pseudostaurosira* as separated by Williams and Round (1987).) These taxa have been shown to dominate the nonplanktonic (non-floating) diatom component of shallow water bodies in several studies (Osborne and Moss, 1977; Battarbee, 1986; Anderson, 1989). Because of a variety of factors (such as steep gradients of space and light availability, water turbulence, and grazing) benthic diatoms may not always respond in a predictable or direct manner to eutrophication (Hall and Smol, 1999) although Anderson (1990) showed that these types of diatoms supplied information concerning changes in littoral zone conditions during the eutrophication of an Irish lake. Often, these diatoms respond more to changes in substratum and algal-mat chemistry than directly to changes in water chemistry (Hansson, 1988, 1992; Cattaneo, 1987); however, in a whole-lake-basin perspective, benthic communities may actually respond more rapidly to eutrophication than planktonic algae (Goldman, 1981; Kann and Falter, 1989; Hawes and Smith, 1992).

It is likely that benthic diatoms in Musky Bay are responding to changes in the physical environment of the bay. Potential changes that have occurred in the bay from cultural eutrophication include an increase in nutrients along with an increase in the density of macrophyte growth. All of the common benthic *Fragilaria* produce long filamentous chains (Patrick and Reimer, 1966; Round and others, 1990). These diatoms have been known to inhabit the surface of the sediments (Round, 1981; Hickman and White, 1989; Round and others, 1990; Bennion, 1995). Although these diatoms may be present under low nutrient conditions with little macrophyte cover (Garrison and Wakeman, 2000) it seems more likely that their high levels in Musky Bay are the result of increased macrophyte growth. Jor-

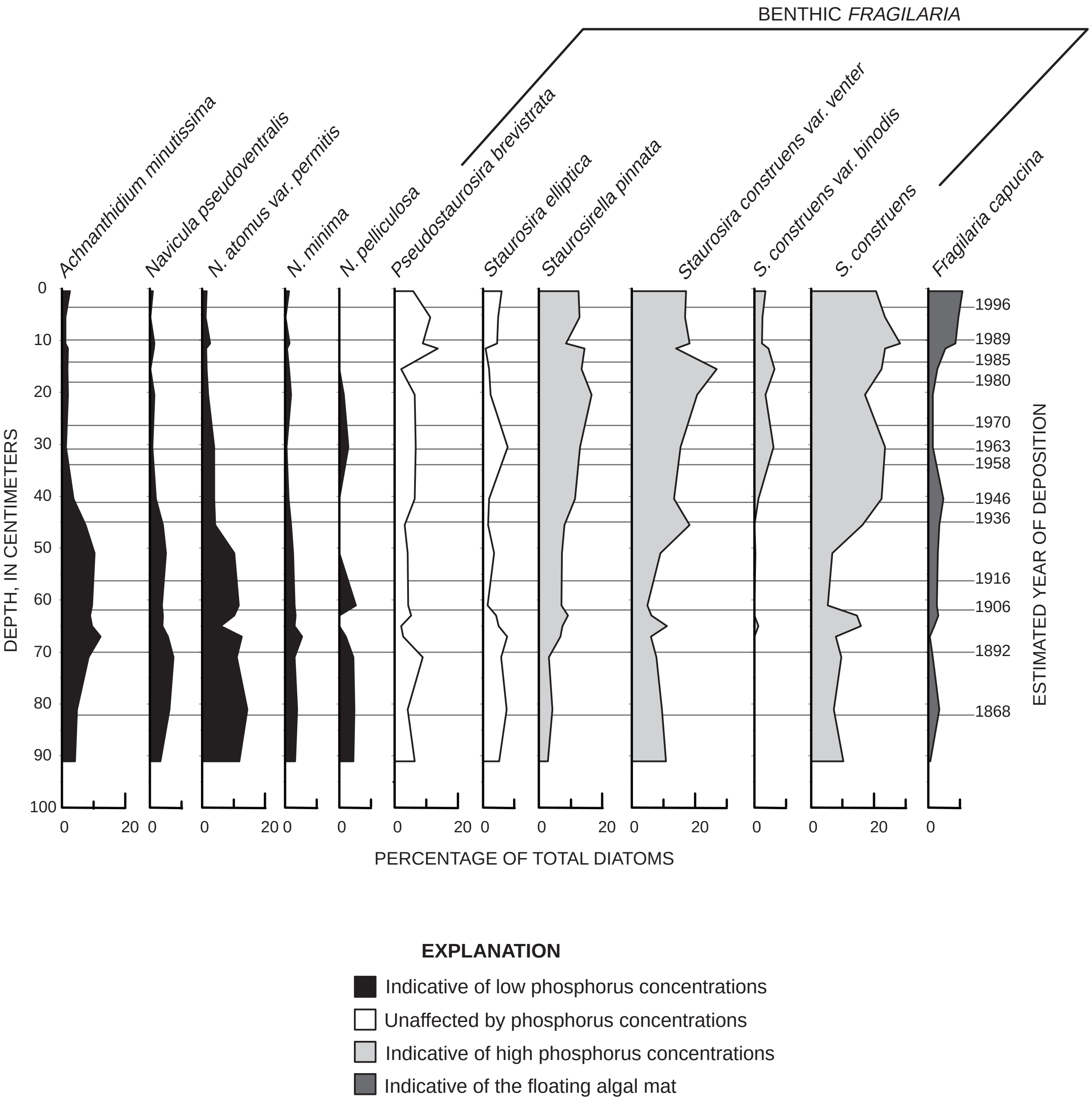


Figure 18. Profiles of selected diatoms in Musky Bay core MB-1B, October 1999.

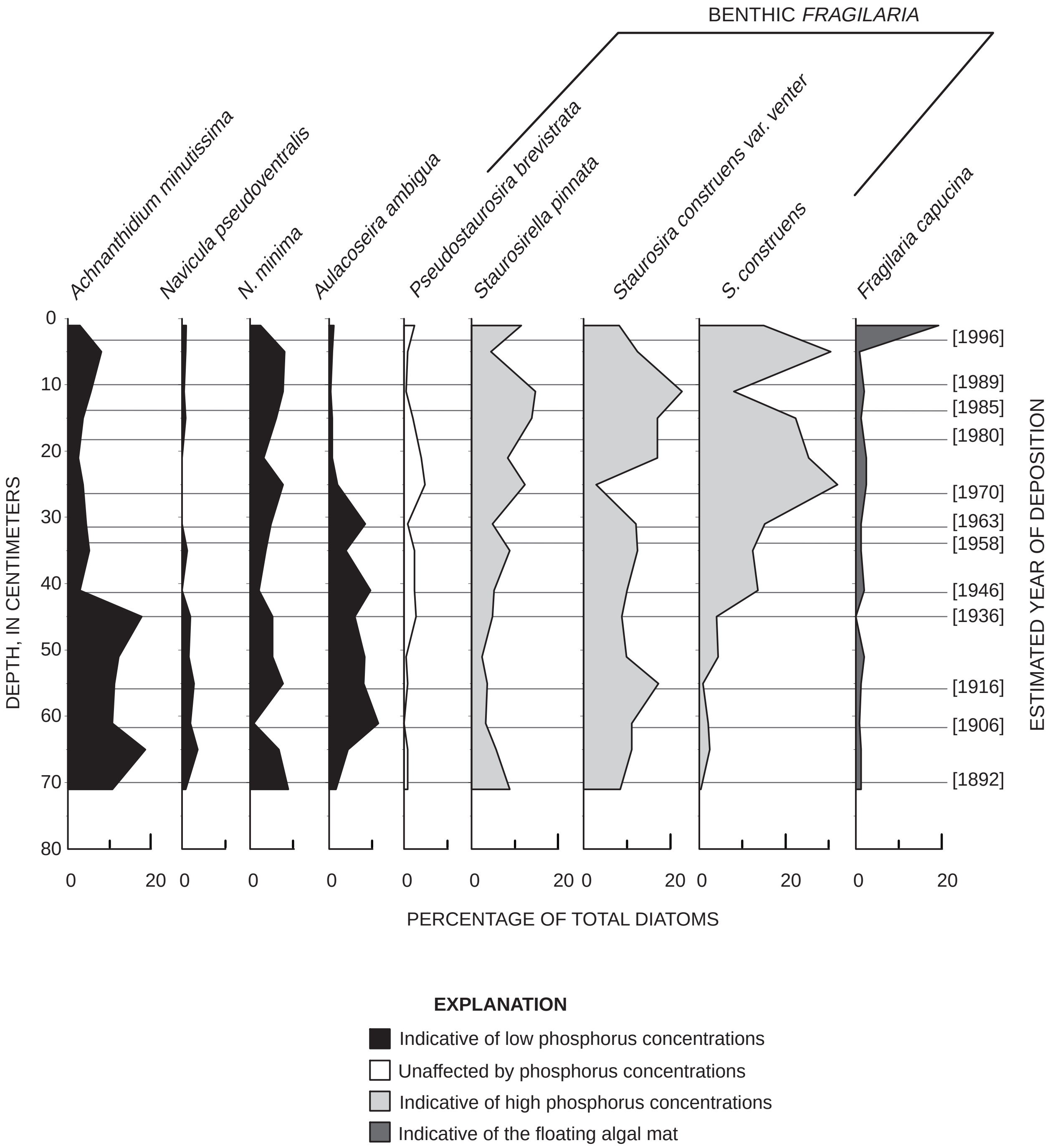


Figure 19. Profiles of selected diatoms in Musky Bay core MB-3, October 1999. The dates in brackets are estimated from core MB-1.

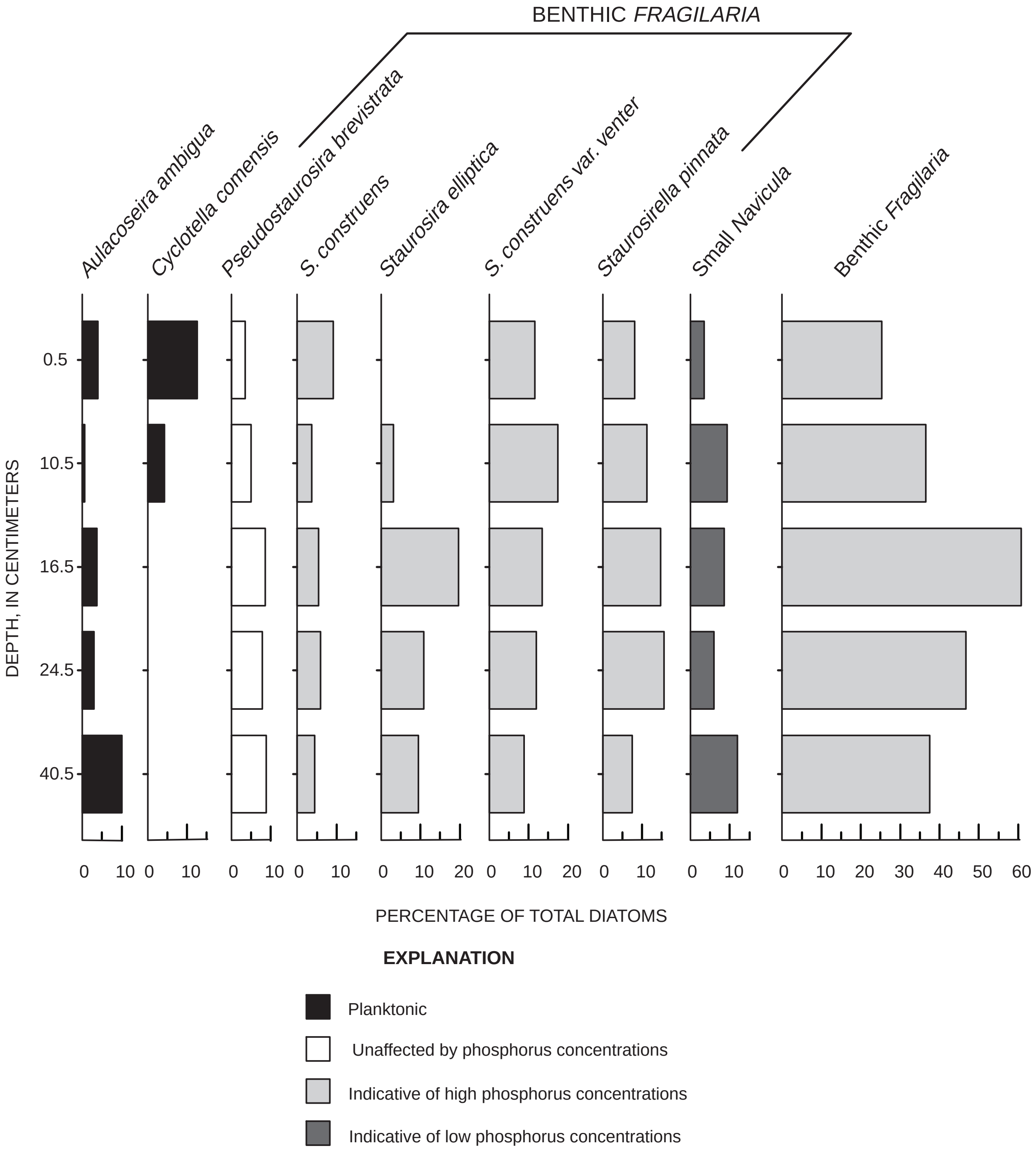


Figure 20. Profiles of selected diatoms in Northeastern Bay core LCO-1B, October 1999.

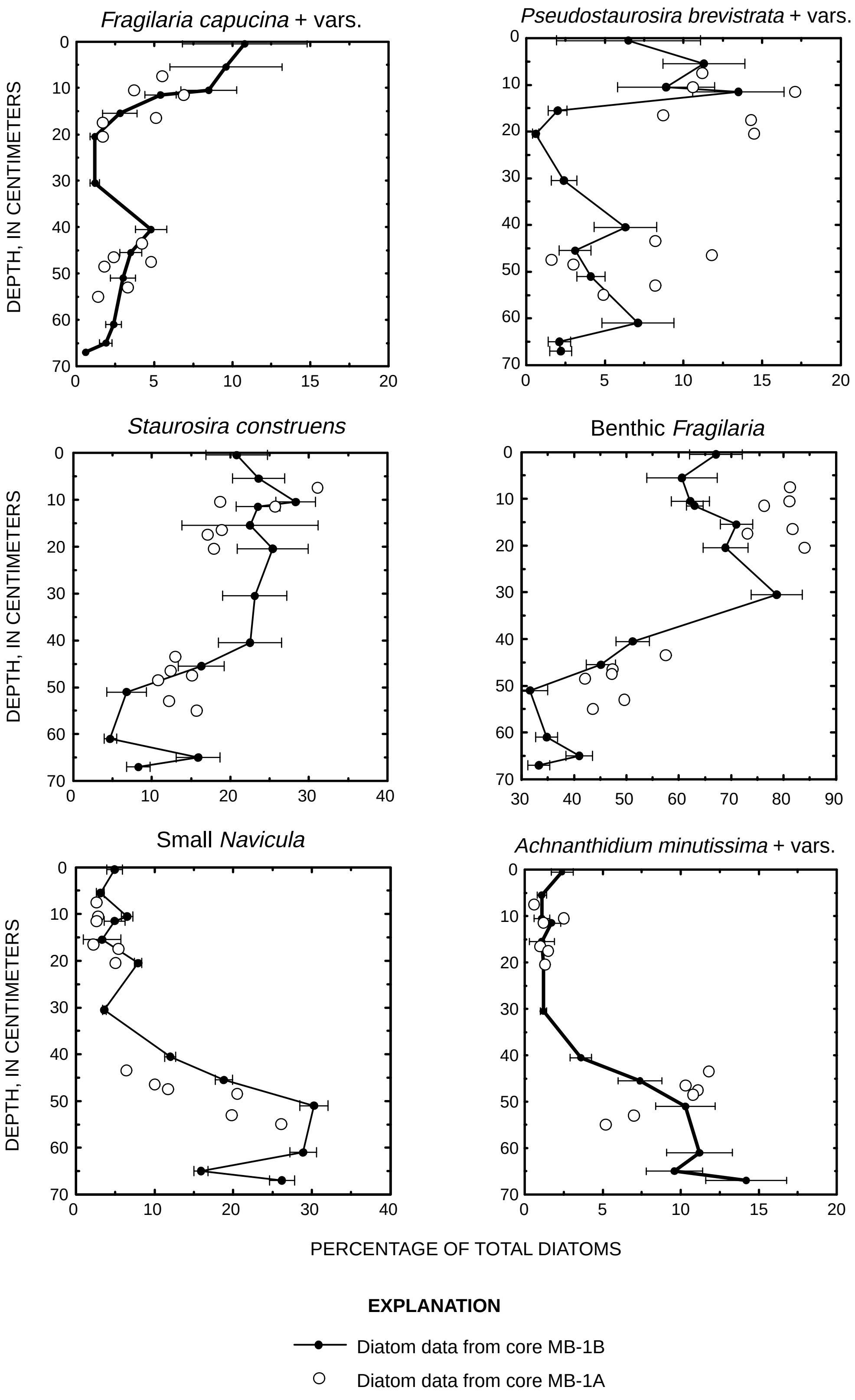


Figure 21. Comparison of diatom assemblages in side-by-side cores collected from Musky Bay core MB-1, October 1999. The error bars illustrate one standard deviation.

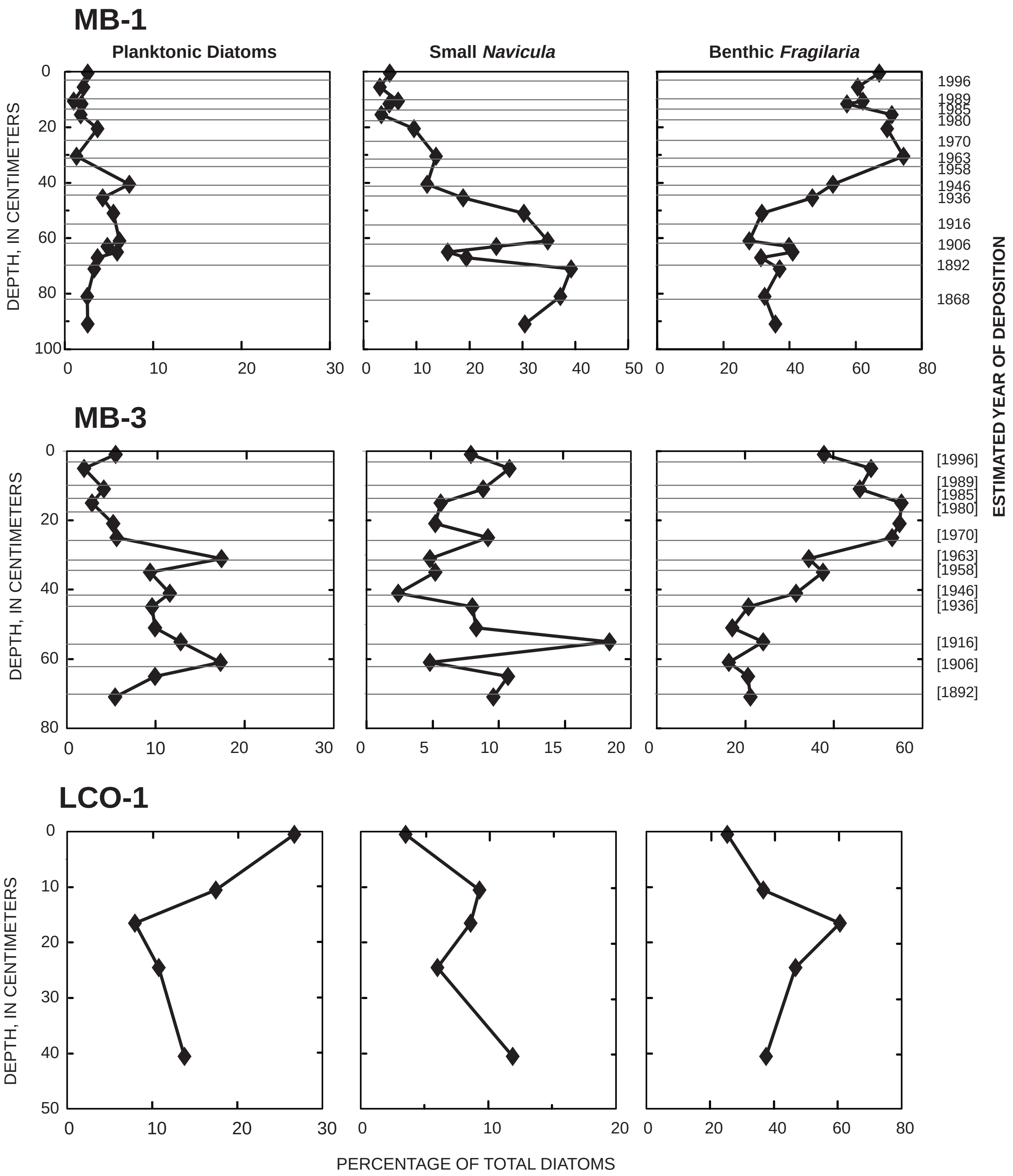


Figure 22. Profiles of planktonic diatoms, small *Navicula*, and benthic *Fragilaria* for two cores in Musky Bay (MB-1B and MB-3) and one core in Northeastern Bay (LCO-1B), October 1999. The dates in brackets for core MB-3 are estimated from core MB-1B.

gensen (1948) and Florin (1970) found that these benthic *Fragilaria* were common in littoral zones of eutrophic lakes. These chain-forming diatoms are susceptible to wind mixing and being redistributed into deeper waters. Macrophytes themselves can influence the hydrodynamics of a lake basin through sediment trapping by roots and stems (Carpenter and Lodge, 1986). As macrophytes become more abundant as a consequence of increased nutrients, productivity of these diatoms increases, and the increased plants restrict water movement, thus the diatoms are less likely to be displaced into deeper waters. Cores from a number of other northern Wisconsin lakes have similarly shown an increase in these benthic *Fragilaria* after European settlement as macrophyte density has increased (Garrison and Winkelman, 1996; P.J. Garrison, Wisconsin Department of Natural Resources, unpublished data, 2002). Bradbury and Winter (1976) also found benthic *Fragilaria* in association with macrophytes in eutrophic Lake Sallie, Minnesota. Further evidence of the presence of macrophytes at the bottom of the core is the presence of *Achnanthidium minutissima* (figs. 17, 18, and 20). This diatom, which has been found to be associated with macrophytes (Moss, 1978; Reavie and Smol, 1997; Garrison and Wakeman, 2000), was most common near the bottom of the core and declined upcore around 40 cm (1940s) in cores MB-1 and MB-3.

Less is known about the small *Navicula* species found in the cores in this study (figs. 17–19). Although these diatoms were not present in large numbers in other studies, their optimal total phosphorus concentrations were some of the lowest for the benthic species (Fritz and others, 1993; Bennion, 1994; Dixit and others, 1999). In addition, *N. pseudoventralis*, *N. atomus* var. *permitis*, and *N. minima* were found in a calibration set constructed for Wisconsin lakes to have low total phosphorus optima (P.J. Garrison, Wisconsin Department of Natural Resources, unpublished data, 2002). It seems likely in Musky Bay that *A. minutissima* and small *Navicula* taxa are indicative of low phosphorus concentrations, whereas the benthic *Fragilaria* are indicative of denser macrophyte growth and possibly higher phosphorus concentrations in water. Carpenter (1981) and Wetzel (1983) reported that with increased phosphorus inputs there is an increase in macrophyte productivity until algal growth shades the plants.

As *Achnanthidium* and *Navicula* declined in MB-1, small *Fragilaria* increased (examples include *Staurosira construens, S. construens* var. *venter* (Ehren.), *S. construens* var. *binodis* (Ehren.), and *Staurosirella pinnata* (Ehren.) Williams and Round (1987), fig. 18). The increase in *S. construens* var. *binodis* is especially informative. This diatom was found growing attached to macrophytes in areas of Lake Sallie (Minnesota) with the highest phosphorus levels (Bradbury and Winter, 1976). The increase of these taxa during the 1940s is further indication of the increase in nutrients beginning at this time. Their increase also likely indicates an increase in macrophyte growth in Musky Bay.

The diatom community at site MB-3 indicates a greater change throughout the core than at MB-1 (figs. 18, 19, and 22). This is probably because site MB-1 is close to shore and macrophytes have been present in significant numbers for at least the last 100 years at this site. The diatom community indicates that greater changes have occurred farther out in Musky Bay. There was a greater decline in *A. minutissima* around 40 cm (1940s) and a larger increase in *S. construens* first at 40 cm and again at 25 cm (around 1970). The increase in the latter diatom likely reflects an increase in nutrients, resulting in more extensive macrophyte growth. Around 25 cm (1970), there also was a decline in the planktonic diatom *A. ambigua* that likely reflects a further increase in macrophyte growth. Planktonic diatoms probably were not present in fewer numbers; instead, the number of benthic diatoms increased diluting the representation of planktonic species.

There was a 1- to almost 20-percent increase in the diatom *Fragilaria capucina* in the top 5–10 cm of the MB-1 and MB-3 cores (figs. 17–18). This diatom commonly increases under elevated nutrient levels (Stoermer and Yang, 1970; Bradbury, 1975; Stoermer and others, 1985; Reavie and others, 1995; Stoermer and others, 1996). Surface sediment studies in Wisconsin and other U.S. lakes have found that this diatom has a high phosphorus optimum compared to other diatoms (P.J. Garrison, Wisconsin Department of Natural Resources, unpublished data, 2002; Bennion, 1994; Fritz and others, 1993; Dixit and others, 1999). *F. capucina* was also found to be the dominant diatom associated with the floating algal mat in Musky Bay in August 1999. Although the algal mat was made up largely of filamentous blue-green algae, a number of diatoms grew attached to the mat. The diatom present in the highest numbers was *F. capucina*. The size of the floating algal mat appears to have increased greatly in the last decade at both sites. This size increase likely indicates a significant increase in phosphorus levels in Musky Bay.

Northeastern Bay

Because of the dating problems associated with the NE Bay core, fewer diatom samples were examined than in the Musky Bay cores. On the basis of the ^{210}Pb profile (fig. 8B), samples below 15 cm likely represent sediment that was deposited much earlier, whereas the upper part of the core reflects sediment that was deposited more recently. As with Musky Bay, benthic diatoms dominate the community (fig. 20). In fact, the common taxa in the Musky Bay cores (figs. 18–19) are also found in NE Bay core. In general, the community was more diverse in the NE Bay than Musky Bay. Although benthic *Fragilaria* were the dominant diatoms in the NE Bay core, the trend differs from that in the Musky Bay cores. The peak of this macrophyte-inhabiting diatom is at 16.5 cm in the NE Bay core whereas it is in the upper part of the cores in Musky Bay (fig. 22). This peak in apparent macrophyte growth occurs just below the major discontinuity in the core, recorded in bulk density and radiometric profiles. It is perhaps an indicator of slightly shallower water prior to the increase in head at the Billy Boy dam in about 1936. These benthic *Fragilaria* generally decline in the upper part of the core in NE Bay. In contrast to Musky Bay core MB-3, the planktonic diatoms such as *C. comensis* reach their highest levels at the top of the core. Apparently, some macrophytes have been present in the NE Bay during the last 100 or more years, but their growth has not significantly increased as in Musky Bay.

In summary, the diatom community was dominated by benthic diatoms including *A. minutissima*, small *Navicula*, and *Fragilaria* at the bottom of cores from Musky Bay (figs. 18, 19, and 22). The first two diatoms are indicative of low nutrient levels in Musky Bay. The low-nutrient-indicating diatoms declined upcore between 40–25 cm and high-nutrient-indicating diatoms such as benthic *Fragilaria*, increased substantially. The time period of this increase in nutrients was 1940 to 1970. In contrast, in the NE Bay, the benthic diatoms declined in the upper part of the core and were replaced by planktonic diatoms. It appears that Musky Bay has experienced much greater increases in nutrients and macrophyte growth compared with the NE Bay. There appears to be a significant increase in nutrients in Musky Bay beginning around the mid-1990s as indicated by the increase in *F. capucina*. The increase of this diatom also indicates a significant expansion of the floating algal mat (fig. 2). The primary difference in land use in the watershed of the Musky and NE bays is the presence of two cranberry bogs on Musky Bay. Winkler and Sanford (2000) found evidence in the diatom-assemblage record for increased nutrient loading starting in the 1940s near the Lac du Flambeau Tribal lands, coincident with expansion of cranberry farming. Even though their cores were not collected in the littoral zone of the lakes, they documented similar changes in the diatom community as was seen in Musky Bay. Specifically, they saw an increase in benthic *Fragilaria* in response to the addition of phosphorus attributed to the cranberry operations.

Pollen

Pollen profiles from the Musky Bay MB-3 core indicate changes in some plant species over the last 100+ years (fig. 23). The majority of the pollen in MB-3 was terrestrial and it was mostly arboreal (trees and shrubs). Of this group, pollen from pine trees generally composed over 40 percent of the pollen count (fig. 23). This reflects the high number of pine trees near the shoreline as well as their high production of pollen. Even though there was considerable logging activity in the area during the late 1800’s, this does not appear to have had an impact upon the pine pollen production at this site. Birch and oak were also an important component of the pollen record.

Of the herbs, only ragweed and non-aquatic grass pollen were present in significant numbers. The increase in ragweed near the bottom of the core likely is the result of land disturbance as a result of the logging activity and human settlement. During the last 25 years, grass pollen increased (fig. 23). This likely is the result of continued shoreline development on Musky Bay. As lawns replace native vegetation more grass pollen enters the bay.

The most important pollen profiles from MB-3 for this study are the aquatic pollen; wild rice (*Zizania palustris*) in particular (fig. 23). Wild rice pollen was present from the bottom of the core until about 1920, when it rapidly disappeared. The disappearance of wild rice occurs just before the rapid increase in benthic *Fragilaria* (fig. 22), and may have corresponded to a potential change (most likely increase) in water level associated with the reconstruction of the Billy Boy dam, an increase in mineral sediment input, and (or) an

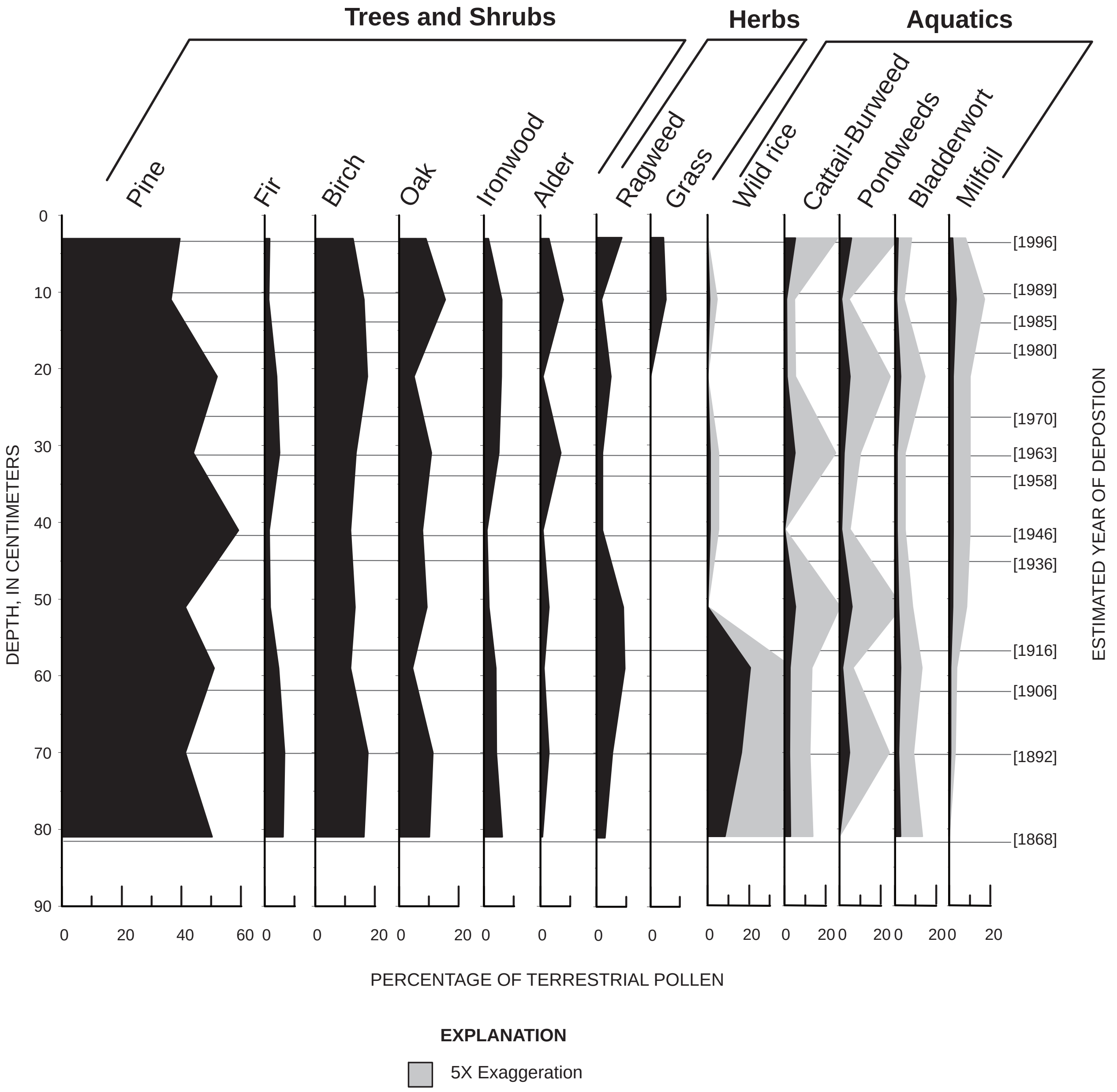


Figure 23. Pollen diagram from Musky Bay core MB-3, October 1999. The dates in brackets are estimated from core MB-1B. Aquatic pollen percentages were calculated by dividing aquatic pollen by total terrestrial pollen count.

increase in turbidity. Other aquatic pollen such as cattail-burweed, pondweeds and bladderwort were present throughout the core. This indicates that aquatic plants have been present in the bay for at least the last 100+ years. The diatom community data also supports this finding. Milfoil pollen was only found in very low concentrations at the bottom of the core but its numbers increased after the disappearance of rice pollen after about 1920. Other paleolimnological studies have found that the macrophyte community increases in response to increased phosphorus levels (Garrison and Winkelman, 1996; Garrison and Wakeman, 2000).

SUMMARY AND CONCLUSIONS

The U.S. Geological Survey and Wisconsin Department of Natural Resources collected several sediment cores from Musky Bay, Lac Courte Oreilles, and from surrounding areas in 1999 and 2001 to determine whether the water quality of Musky Bay has declined during the last 100 years or more as a result of human activity, specifically cottage development and cranberry farming. This study was done in cooperation with the Lac Courte Oreilles Tribe and the Wisconsin Department of Agriculture, Trade, and Consumer Protection. Selected cores were analyzed for sedimentation rates, minor and trace elements, nutrients, biogenic silica, diatom assemblages, and pollen over the past several decades. Much of the analysis was done on two cores from Musky Bay (one near cottage development on the northeast side of the bay and the other near a discharge outlet for a cranberry bog on the southeast side of the bay) and one core from the Northeastern Bay.

Comparison of historical maps and aerial photographs indicates that shoreline development commenced about 1930 and that two cranberry bogs were constructed along Musky Bay in about 1939 and the early 1950s. Cranberry bogs on Musky Bay were substantially expanded during the periods 1950–62 and 1980–98. Shoreline development on Musky Bay has increased steadily since about 1930. Currently housing density on Musky Bay is one-third to one-half the housing density surrounding three other Lac Courte Oreilles bays.

Sedimentation rates were reconstructed for a core from Musky Bay by use of three lead radioisotope (^{210}Pb) models (constant initial concentration, constant rate of supply, and an adjusted constant rate of supply), and the profile of the radioisotope cesium-137 (^{137}Cs) in the sediment. Of these methods, dates estimated from the ^{137}Cs profile proved to be the least problematic. On the basis of the ^{137}Cs profile, the estimated historical average mass and linear sedimentation rates for Musky Bay are 0.023 grams per square centimeter per year and 0.84 centimeters per year, respectively. The profile for total lead-210 (^{210}Pb) activity (normally smooth for constant sedimentation rates and ^{210}Pb inputs) had two breaks, one at about 8 cm and the other at about 45 cm). Based on ^{137}Cs -derived dates, these two breaks occurred at about the early 1990s and mid-1930s. The two constant rate of supply models indicated an increase in sedimentation after the early 1990s. Radiometric data were also collected for a core from the Northeastern Bay in Lac Courte Oreilles (surrounded by houses but no cranberry bogs) but the profiles reflected postdepositional disturbance, and sedimentation rates could not be calculated and compared to the Musky Bay core.

For the two Musky Bay cores, profiles of bulk density and organic matter suggest disturbance at about 45 cm. Bulk density decreases upcore above 45 cm (mid-1930s) in the core closest to cottage development, and in the core closest to the cranberry farm bulk density peaks at about 45 cm then continues to decrease upcore. The profiles for organic matter for the two cores diverge at this interval, with percentages of organic matter increasing upcore in the core closest to cottage development and decreasing upcore in the core closest to the cranberry-bog discharge. These changes are coincident in the timing with the rebuilding of the Billy Boy dam (about 1936 and located downstream of Lac Courte Oreilles) and the onset of cranberry farming (1939). The head on the Billy Boy dam was raised at this time but it is not known how much this increase affected water levels in Lac Courte Oreilles.

Input histories of organic carbon, nitrogen, phosphorus, and sulfur for Musky Bay are potentially confounded by organic-matter decomposition and chemical redistribution after deposition. Therefore, profiles of organic carbon, nitrogen, phosphorus, and sulfur were not directly useful for reconstructing nutrient input histories.

No identifiable influences from cranberry bogs or shoreline development were evident in the minor- and trace-element profiles for Musky Bay. These profiles from the Musky Bay core possibly reflect historical changes in the input of clastic material over time, as well as potential changes in atmospheric deposition inputs. The input of clastic material to the bay slightly increased after European settlement and possibly in the 1930s through 1950s. Concentrations of copper in the Musky Bay core increased steadily through the early to mid-1900s until about 1980 and appear to reflect inputs from atmospheric deposition. Aluminum-normalized concentrations of calcium, copper, nickel, and zinc increased in the Musky Bay core in the mid-1990s. Concentrations of these elements in surficial sediment from Musky Bay were similar to concentrations in other Lac Courte Oreilles bays, nearby lakes, and soils. All concentrations were below probable effects concentrations for aquatic life.

Contrary to core samples collected in 1999, cadmium concentrations in core samples collected in 2001 with a different corer were not elevated in Musky Bay or surrounding areas. The exact source for the cadmium contamination of 1999 samples has not been identified. All other element concentrations were similar in 1999 and 2001 samples.

Evidence from biogenic-silica, diatom-community, and pollen data indicate that Musky Bay has become more eutrophic since about 1940 with the onset of shoreline development and cranberry farming. The water quality of the bay has especially degraded during the last 25 years with increased growth of aquatic plants and the onset of a floating algal mat during the last decade. Several lines of evidence indicate that nutrient input to the bay has increased after about 1940 and again in the 1990s: (1) the diatom assemblage data indicate a shift from low-nutrient species to higher-nutrient species during the 1940s, (2) the diatom assemblage indicate that aquatic plants reached their present density and/or composition during the 1970s, (3) the diatom *Fragilaria capucina* (indicative of the algal mat) greatly increased during the mid-1990s, (4) pollen data indicate that milfoil, which often becomes more common with elevated nutrients, became more common after 1920, and (5) biogenic silica data indicate that diatom production has consistently increased since the 1930s. Pollen data also indicate that wild rice was present in the eastern end of Musky Bay prior to the early 1800s until about 1920; the loss of wild rice after about 1920 was probably related to water-level changes and not eutrophication.

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APPENDIXES A–B

Table A1. Results from analysis of water content, loss on ignition, bulk density, and porosity data from core samples collected from Lac Courte Oreilles, October 1999 and July 2001

[cm, centimeter; g, gram]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Water weight (percent)	Organic content (percent)	Bulk density (g/cm^3)	Porosity (percent)
MB-1-1	10/12/99	0	1	98.4	50.0	0.016	99.3
MB-1-2	10/12/99	1	2	98.3	50.4	.017	99.3
MB-1-3	10/12/99	2	3	98.1	49.2	.019	99.2
MB-1-5	10/12/99	4	5	97.3	49.8	.027	98.9
MB-1-7	10/12/99	6	7	97.6	50.0	.024	99.0
MB-1-9	10/12/99	8	9	97.1	49.2	.029	98.8
MB-1-11	10/12/99	10	11	97.3	49.0	.027	98.9
MB-1-13	10/12/99	12	13	97.5	49.0	.025	99.0
MB-1-15	10/12/99	14	15	97.2	48.3	.028	98.8
MB-1-17	10/12/99	16	17	97.4	47.7	.026	98.9
MB-1-19	10/12/99	18	19	97.1	48.6	.029	98.8
MB-1-19R	10/12/99	18	19	97.3	47.5	.027	98.9
MB-1-21	10/12/99	20	21	97.3	48.1	.027	98.9
MB-1-23	10/12/99	22	23	97.1	49.5	.029	98.8
MB-1-25	10/12/99	24	25	96.9	50.0	.032	98.7
MB-1-27	10/12/99	26	27	97.0	48.0	.030	98.8
MB-1-29	10/12/99	28	29	96.6	47.3	.035	98.6
MB-1-31	10/12/99	30	31	96.7	47.2	.034	98.6
MB-1-33	10/12/99	32	33	96.4	45.9	.037	98.5
MB-1-35	10/12/99	34	35	96.4	45.9	.037	98.5
MB-1-37	10/12/99	36	37	96.4	45.6	.037	98.5
MB-1-39	10/12/99	38	39	96.3	46.4	.038	98.5
MB-1-39R	10/12/99	38	39	96.1	46.7	.040	98.4
MB-1-41	10/12/99	40	41	94.1	47.4	.061	97.5
MB-1-42	10/12/99	41	42	93.4	49.9	.068	97.2
MB-1-43	10/12/99	42	43	94.9	49.3	.052	97.9
MB-1-44	10/12/99	43	44	94.6	50.8	.056	97.7
MB-1-45	10/12/99	44	45	95.7	50.2	.044	98.2
MB-1-47	10/12/99	46	47	95.7	51.2	.044	98.2

Table A1. Results from analysis of water content, loss on ignition, bulk density, and porosity data from core samples collected from Lac Courte Oreilles, October 1999 and July 2001—Continued

[cm, centimeter; g, gram]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Water weight (percent)	Organic content (percent)	Bulk density (g/cm^3)	Porosity (percent)
MB-1-49	10/12/99	48	49	95.7	51.1	.044	98.2
MB-1-51	10/12/99	50	52	96.0	51.7	.041	98.3
MB-1-53	10/12/99	54	56	96.1	52.5	.040	98.4
MB-1-55	10/12/99	58	60	96.1	55.9	.040	98.4
MB-1-57	10/12/99	62	64	95.8	55.0	.043	98.2
MB-1-59	10/12/99	66	68	96.1	56.4	.040	98.4
MB-1-59R	10/12/99	66	68	96.0	56.4	.041	98.3
MB-1-61	10/12/99	70	72	95.8	56.8	.043	98.2
MB-1-63	10/12/99	74	76	96.1	57.8	.040	98.4
MB-1-65	10/12/99	78	80	94.2	60.6	.060	97.5
MB-1-65R	10/12/99	78	80	94.1	60.2	.061	97.5
MB-1-67	10/12/99	82	84	96.6	62.8	.035	98.6
MB-1-69	10/12/99	86	88	96.2	63.8	.039	98.4
MB-1-71	10/12/99	90	92	96.3	63.3	.038	98.5
MB-1-73	10/12/99	94	96	96.2	63.9	.039	98.4
MB-3-1	10/12/99	0	2	98.0	65.6	.020	99.2
MB-4-1	07/24/01	0	2	98.4	46.8	.016	99.3
MB-5-1	07/25/01	0	2	97.9	40.0	.021	99.1
LCO-1-1	10/13/99	0	1	96.3	41.4	.038	98.5
LCO-1-3	10/13/99	2	3	94.8	37.9	.053	97.8
LCO-1-5	10/13/99	4	5	94.3	40.1	.059	97.6
LCO-1-7	10/13/99	6	7	93.5	35.5	.067	97.2
LCO-1-9	10/13/99	8	9	93.1	28.7	.072	97.1
LCO-1-11	10/13/99	10	11	94.1	36.3	.061	97.5
LCO-1-13	10/13/99	12	13	93.7	39.8	.065	97.3
LCO-1-15	10/13/99	14	15	92.6	34.2	.077	96.8
LCO-1-17	10/13/99	16	17	73.1	7.6	.320	86.9
LCO-1-19	10/13/99	18	19	78.2	11.2	.250	89.8
LCO-1-21	10/13/99	20	21	83.4	17.0	.183	92.5
LCO-1-23	10/13/99	22	23	91.2	32.4	.092	96.2

Table A1. Results from analysis of water content, loss on ignition, bulk density, and porosity data from core samples collected from Lac Courte Oreilles, October 1999 and July 2001—Continued

[cm, centimeter; g, gram]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Water weight (percent)	Organic content (percent)	Bulk density (g/cm^3)	Porosity (percent)
LCO-1-25	10/13/99	24	25	92.3	45.1	.080	96.7
LCO-1-27	10/13/99	26	27	9.7	37.6	.098	96.0
LCO-1-29	10/13/99	28	29	9.9	39.6	.096	96.1
LCO-1-31	10/13/99	30	31	9.7	36.0	.098	96.0
LCO-1-33	10/13/99	32	33	91.9	40.3	.085	96.5
LCO-1-35	10/13/99	34	35	92.3	43.1	.080	96.7
LCO-1-37	10/13/99	36	37	91.6	41.9	.088	96.4
LCO-1-39	10/13/99	38	39	91.4	40.9	.090	96.3
LCO-1-39R	10/13/99	38	39	91.5	41.3	.089	96.3
LCO-1-41	10/13/99	40	41	9.9	41.6	.096	96.1
LCO-1-43	10/13/99	42	43	89.4	34.6	.112	95.4
LCO-1-45	10/13/99	44	45	88.8	31.8	.119	95.1
LCO-1-47	10/13/99	46	47	77.8	13.5	.255	89.6
LCO-1-49	10/13/99	48	49	92.6	49.2	.077	96.8
LCO-3-1	07/25/01	0	2	97.8	40.9	.022	99.1
SB-1-1	10/13/99	0	1	87.9	38.5	.129	94.7
SB-1-3	10/13/99	2	3	93.7	38.9	.065	97.3
SB-2-1	07/25/01	0	2	97.9	34.2	.021	99.1
SAN-1-1	07/25/01	0	2	23.5	.6	1.41	42.9
DEV-1-1	07/25/01	0	2	94.8	31.4	.054	97.8
ASH-1-1	07/25/01	0	2	75.5	13.6	.286	88.3
WET-1-1	08/14/01	0	2	9.2	82.7	.102	95.8
LEV-1-1	09/27/01	0	2	14.1	6.5	1.74	28.7
JON-1-1	07/24/01	0	10	51.7	16.5	.669	72.4
JON-1-1R	07/24/01	0	10	43.0	11.0	.854	64.9
ZAW-1-1	07/24/01	0	8	21.3	4.2	1.48	39.9
ZAW-1-1R	07/24/01	0	8	19.8	na	na	na

Table A2. Results from particle-size analysis of lake and soil samples collected in July 2001 from areas surrounding Lac Courte Oreilles

[cm, centimeter]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Percent sand	Percent silt/clay
LCO-3-1	07/25/01	0	2	63.9	36.1
SAN-1-1	07/25/01	0	2	99.3	0.7
ASH-1-1	07/25/01	0	2	79.0	21.0
JON-1-1	07/24/01	0	10	90.8	9.2
JON-1-1R	07/24/01	0	10	91.4	8.6
ZAW-1-1	07/24/01	0	8	97.5	2.5

Table A3. Results from analysis of ^{210}Pb, ^{226}Ra, and ^{137}Cs from core samples from Musky Bay and Northeastern Bay, Lac Courte Oreilles, October 1999

[LLD, limit of detection; pCi g^{-1}, picocuries per gram]

Top interval (cm)	Bottom interval (cm)	Total ^{210}Pb activity (pCi g^{-1})	Total ^{210}Pb Uncertainty (pCi g^{-1})	Total ^{210}Pb LLD (pCi g^{-1})	^{226}Ra activity (pCi g^{-1})	^{226}Ra Uncertainty (pCi g^{-1})	^{226}Ra LLD (pCi g^{-1})	^{137}Cs activity (pCi g^{-1})	^{137}Cs Uncertainty (pCi g^{-1})	^{137}Cs LLD (pCi g^{-1})
Musky Bay core (MB-1B)										
0	2	10.65	2.02	2.72	0.21	0.20	0.61	3.00	0.53	0.57
8	10	14.15	1.52	1.87	.15	.15	.45	4.26	.42	.40
12	14	12.33	1.00	1.26	-.14	-.10	.31	5.95	.32	.26
14	16	13.20	1.11	1.36	.16	.11	.33	3.73	.30	.29
16	18	12.23	1.52	1.95	.01	.16	.51	7.12	.54	.47
20	23	9.45	1.49	1.93	.10	.14	.44	6.67	.55	.41
24	26	9.37	.89	1.20	.24	.10	.29	8.78	.35	.25
26	27	9.71	.97	1.37	.18	.12	.35	9.99	.40	.29
27	30	8.61	.37	.42	.28	.04	.10	10.78	.18	.08
30	31	10.00	1.53	2.27	.06	.19	.59	12.32	.66	.50
31	34	7.07	.38	.46	.34	.04	.10	10.20	.19	.09
36	37	6.05	1.09	1.75	.09	.15	.46	7.81	.46	.41
40	41	5.59	.75	1.14	.19	.10	.29	2.87	.23	.25
44	45	3.85	.44	.68	.14	.06	.17	1.18	.12	.14
50	52	5.00	1.34	1.99	.36	.16	.48	1.16	.35	.47
54	56	3.80	.60	.96	.09	.08	.25	.41	.14	.22
60	62	4.35	1.32	2.03	.24	.13	.39	.39	.23	.34
64	66	8.25	2.72	4.28	.41	.13	.40	.21	.24	.40
66	70	2.45	.22	.29	.38	.03	.06	.29	.04	.06
70	72	1.72	.96	1.88	.47	.15	.46	.37	.26	.41
80	82	1.49	.40	.74	.37	.06	.18	.08	.10	.16
84	86	2.24	.81	1.48	.21	.12	.39	.06	.21	.35

Table A3. Results from analysis of ^{210}Pb, ^{226}Ra, and ^{137}Cs from core samples from Musky Bay and Northeastern Bay, Lac Courte Oreilles, October 1999—Continued

Top interval (cm)	Bottom interval (cm)	Total ^{210}Pb activity (pCi g^{-1})	Total ^{210}Pb Uncertainty (pCi g^{-1})	Total ^{210}Pb LLD (pCi g^{-1})	^{226}Ra activity (pCi g^{-1})	^{226}Ra Uncertainty (pCi g^{-1})	^{226}Ra LLD (pCi g^{-1})	^{137}Cs activity (pCi g^{-1})	^{137}Cs Uncertainty (pCi g^{-1})	^{137}Cs LLD (pCi g^{-1})
Musky Bay core (MB-1A)										
3	4	12.41	1.16	1.71	-.01	-.14	.43	4.23	.34	.38
5	6	10.66	1.18	1.73	.10	.14	.42	4.94	.36	.36
7	8	10.39	1.07	1.69	.34	.15	.43	5.47	.36	.38
8	9	13.26	1.92	2.53	.27	.20	.63	5.77	.57	.55
26	27	7.07	.96	1.26	.45	.10	.30	9.24	.43	.26
44	45	4.16	.68	1.00	.46	.09	.26	.54	.15	.23
Northeastern Bay core										
0	1	19.01	2.40	2.78	1.04	.22	.64	4.63	.62	.62
2	3	14.53	1.94	2.21	.92	.18	.52	3.17	.49	.51
4	5	14.63	2.14	2.46	.87	.20	.58	3.28	.53	.55
6	7	11.81	1.63	1.95	1.01	.16	.44	2.86	.41	.43
8	9	13.71	1.97	2.35	.71	.19	.56	3.30	.49	.50
10	11	12.72	2.33	2.98	.94	.25	.75	3.83	.64	.69
12	13	14.52	1.73	1.97	.90	.16	.45	4.09	.44	.38
14	15	11.23	1.55	1.87	1.00	.15	.42	3.37	.40	.36
15	16	11.24	.82	.94	.55	.08	.21	4.90	.25	.18
16	17	1.84	.50	.73	.33	.05	.14	.48	.10	.12
18	19	1.25	.49	.77	.56	.07	.17	.36	.11	.16
20	21	1.15	.43	.69	.49	.06	.15	.41	.10	.14
22	23	1.61	.73	1.17	.74	.10	.27	.62	.17	.23
24	25	2.10	.55	.87	.48	.08	.22	.58	.13	.19
26	27	1.50	.67	1.09	.63	.09	.25	.42	.15	.22
28	29	.84	.57	.98	.60	.08	.23	.30	.13	.20
29	30	1.22	.60	.99	.65	.08	.23	.16	.13	.21

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm

[cm, centimeters; %, percent; ppm, parts per million; --, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Average depth (cm)	Al (%)	Sb (ppm)	As (ppm)	Ba (ppm)	Be (ppm)	Cd (ppm)	Ca (%)	Ce (ppm)	Cr (ppm)	Co (ppm)	Cu (ppm)	Eu (ppm)	Ga (ppm)	Ho (ppm)	Fe (%)
MB-1-1	10/12/99	0	2	1.0	0.73	0.23	3.0	90	0.23	60	0.81	6.8	17	2.2	51	<1	1.6	<1	0.64
MB-1-3	10/12/99	2	3	2.5	.69	.23	2.8	97	.27	23	.77	8.3	11	2.3	22	<1	1.6	<1	.54
MB-1-5	10/12/99	4	5	4.5	.77	.26	3.1	95	.3	5.8	.67	9.6	12	2.4	20	<1	1.9	<1	.60
MB-1-7	10/12/99	6	7	6.5	.90	.31	3.6	99	.43	3.1	.65	10	14	2.7	23	<1	2.2	<1	.68
MB-1-10	10/12/99	9	10	9.5	.90	.38	3.8	110	.27	2.5	.68	12	15	2.6	28	<1	2.5	<1	.72
MB-1-13	10/12/99	12	13	12.5	.84	.35	3.7	110	.33	1.2	.60	11	14	2.5	18	<1	2.2	<1	.70
MB-1-16	10/12/99	15	16	15.5	.95	.42	4.9	120	.32	1.6	.66	12	15	2.7	30	<1	2.5	<1	.79
MB-1-19	10/12/99	18	19	18.5	.88	.36	4.6	130	.39	1.1	.63	12	14	2.6	32	<1	2.4	<1	.80
MB-1-22	10/12/99	21	22	21.5	1.0	.48	5.5	140	.18	1.2	.65	12	16	2.9	28	<1	2.9	<1	.86
MB-1-25	10/12/99	24	25	24.5	1.0	.50	5.7	150	.46	1.1	.60	14	15	2.8	25	<1	2.9	<1	.80
MB-1-28	10/12/99	27	28	27.5	1.0	.46	5.9	140	.40	1.2	.60	15	16	3.0	24	<1	3.0	<1	.80
MB-1-31	10/12/99	30	31	30.5	1.0	.63	6.1	150	.45	1.2	.62	15	17	3.0	23	<1	3.0	<1	.79
MB-1-34	10/12/99	33	34	33.5	1.1	.48	5.8	150	.45	1.3	.64	15	17	3.2	35	<1	3.2	<1	.82
MB-1-QA-1	10/12/99	33	34	33.5	.94	.52	6.0	150	.43	1.3	.59	15	17	3.1	26	<1	3.0	<1	.80
MB-1-37	10/12/99	36	37	36.5	1.0	.50	6.4	160	.51	1.3	.64	15	16	3.1	21	<1	3.0	<1	.82
MB-1-41	10/12/99	40	41	40.5	.96	.49	6.4	160	.46	1.3	.63	15	16	3.0	20	<1	2.9	<1	.81
MB-1-QA-2	10/12/99	40	41	40.5	1.0	.36	6.6	170	.26	1.1	.78	14	13	2.4	17	<1	2.5	<1	.78
MB-1-46	10/12/99	45	46	45.5	.98	.45	6.2	170	.45	1.3	.62	16	16	2.9	15	<1	3.0	<1	.84
MB-1-51	10/12/99	50	52	51.0	1.0	.51	6.0	180	.51	1.2	.66	16	18	2.8	14	<1	3.0	<1	.87
MB-1-56	10/12/99	60	62	61.0	.88	.38	6.5	170	.34	1.2	.68	14	15	2.6	11	<1	2.7	<1	.84
MB-1-61	10/12/99	70	72	71.0	.86	.31	6.1	170	.24	1.1	.67	14	15	2.5	13	<1	2.5	<1	.83
MB-1-QA-3	10/12/99	70	72	71.0	1.2	.48	5.9	160	.33	1.3	.74	15	16	2.9	29	<1	2.8	<1	.78

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; --, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Average depth (cm)	Al (%)	Sb (ppm)	As (ppm)	Ba (ppm)	Be (ppm)	Cd (ppm)	Ca (%)	Ce (ppm)	Cr (ppm)	Co (ppm)	Cu (ppm)	Eu (ppm)	Ga (ppm)	Ho (ppm)	Fe (%)
MB-1-68	10/12/99	84	86	85.0	.77	.32	6.1	170	.26	.94	.65	14	14	2.3	12	<1	2.3	<1	.81
MB-3-1	10/12/99	0	2	1.0	1.0	.27	3.2	140	.23	14	.84	11	18	2.6	18	<1	2.7	<1	1.1
MB-4-1	07/24/01	0	2	1.0	1.0	.37	4.6	120	.27	.79	.80	11	2.8	2.7	21	<1	2.4	<1	.80
MB-5-1	07/25/01	0	2	1.0	1.2	.38	9.1	220	.40	.74	.80	17	9.8	5.6	34	<1	3.1	<1	1.7
LCO-1-1	10/13/99	0	1	.5	1.8	.84	12	260	.49	20	.84	25	36	7.7	35	<1	4.8	<1	3.6
LCO-1-3	10/13/99	2	3	2.5	1.6	.61	11	250	.72	1.3	.79	26	34	7.6	29	<1	4.5	<1	4.4
LCO-1-5	10/13/99	4	5	4.5	1.6	.55	12	240	.60	1.2	.78	26	34	7.1	27	<1	4.3	<1	3.8
LCO-1-7	10/13/99	6	7	6.5	1.8	.61	14	260	.71	1.2	.77	28	35	7.6	30	<1	4.6	<1	3.7
LCO-1-9	10/13/99	8	9	8.5	1.7	.58	13	260	.64	1.1	.76	28	34	7.8	27	<1	4.6	<1	3.5
LCO-1-11	10/13/99	10	11	1.5	1.8	.63	13	260	.58	1.2	.76	28	34	7.6	28	<1	4.7	<1	3.3
LCO-1-13	10/13/99	12	13	12.5	1.8	.67	15	260	.46	1.2	.74	30	33	7.5	29	<1	5.0	<1	2.6
LCO-1-QA-1	10/13/99	12	13	12.5	1.8	.70	15	250	.76	1.4	.72	29	34	7.5	41	<1	4.8	<1	2.8
LCO-1-15	10/13/99	14	15	14.5	1.9	.74	15	270	.66	1.3	.74	31	35	7.7	30	<1	5.0	<1	2.4
LCO-1-17	10/13/99	16	17	16.5	2.2	.74	15	290	.61	1.3	.74	31	38	7.8	29	<1	5.6	<1	1.9
LCO-1-19	10/13/99	18	19	18.5	2.1	.65	10	290	.54	.88	.75	29	32	6.5	19	<1	5.1	<1	1.5
LCO-1-21	10/13/99	20	21	20.5	1.9	.30	5.2	270	.49	.29	.58	22	26	4.4	13	<1	4.4	<1	.90
LCO-1-23	10/13/99	22	23	22.5	1.8	.29	5.7	240	.53	.26	.63	26	28	4.8	15	<1	4.2	<1	.94
LCO-1-QA-2	10/13/99	22	23	22.5	1.7	.22	6.5	240	.40	.31	.66	26	28	5.4	16	<1	4.2	<1	1.0
LCO-1-25	10/13/99	24	25	24.5	1.9	.21	3.7	270	.36	.16	.56	21	24	4.1	11	<1	4.3	<1	.80
LCO-1-27	10/13/99	26	27	26.5	1.9	.22	4.7	230	.52	.20	.56	24	28	4.6	15	<1	4.4	<1	.88
LCO-1-29	10/13/99	28	29	28.5	1.9	.26	5.7	210	.66	.21	.49	26	29	4.7	18	<1	4.7	<1	.93
LCO-3-1	07/25/01	0	2	1.0	1.5	.46	12	320	.49	.99	1.0	23	18	6.7	26	<1	4.2	<1	4.9

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; --, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Date collected	Top interval (cm)	Bottom interval (cm)	Average depth (cm)	Al (%)	Sb (ppm)	As (ppm)	Ba (ppm)	Be (ppm)	Cd (ppm)	Ca (%)	Ce (ppm)	Cr (ppm)	Co (ppm)	Cu (ppm)	Eu (ppm)	Ga (ppm)	Ho (ppm)	Fe (%)
SB-1-1	10/13/99	0	1	.5	1.7	.48	9.9	240	.45	14	.72	17	32	6.1	40	<1	4.7	<1	3.0
SB-1-2	10/13/99	1	2	1.5	1.5	.45	7.5	220	.43	3.6	.55	15	30	5.3	32	<1	4.3	<1	2.4
SB-2-1	07/25/01	0	2	1.0	1.0	.30	5.9	230	.25	.58	.74	12	6.1	4.5	40	<1	2.6	<1	1.7
SAN-1-1	07/25/01	0	2	1.0	1.3	.16	2	250	.22	<.1	.17	16	1.5	<1	3.2	<1	2.9	<1	.35
DEV-1-1	07/25/01	0	2	1.0	3.4	.31	3	340	.74	.42	.98	35	30	6.2	33	<1	8.3	<1	1.3
ASH-1-1	07/25/01	0	2	1.0	2.2	.19	1.4	360	.54	.10	.35	21	9.6	2.0	9.7	<1	5.4	<1	.60
WET-1-1	08/14/01	0	2	1.0	.42	.21	1.9	99	<.1	.54	.30	6.0	<1	1.5	10	<1	1.2	<1	.29
LEV-1-1	09/27/01	0	2	1.0	2.2	.56	2.1	300	.41	.15	.53	20	21	4.5	13	<1	5.5	<1	1.2
JON-1-1	07/24/01	0	10	5.0	2.1	.20	2.1	240	.5	.11	.64	21	19	4.3	83	<1	4.5	<1	1.3
JON-1-2	07/24/01	0	10	5.0	2.2	.18	2.6	250	.54	<.1	.72	21	26	4.6	67	<1	4.6	<1	1.3
ZAW-1-1	07/24/01	0	8	4.0	1.9	.20	1.6	240	.44	<.1	.56	20	14	4.2	17	<1	4.7	<1	1.3
JON-2-1	07/24/01	na	na	na	.32	.46	3.9	11	1.2	1.2	.97	3.1	22	1.0	320	<1	1.5	<1	.26
JON-3-1	07/24/01	na	na	na	.88	2.4	13	45	2.9	4.6	12	70	70	6.1	5.9	1.8	5.7	2.4	1.6
W-Blank	05/09/01	na	na	na	.054	<.1	<.1	9.3	<.1	1.2	<.005	<1	<1	<1	<1	<1	<1	<1	<.005
Blank	05/09/01	na	na	na	.055	<.1	<.1	7.5	<.1	<.1	<.005	<1	2	<1	<1	<1	<1	<1	<.005
U-Blank	05/09/01	na	na	na	.058	<.1	.11	8.8	<.1	<.1	<.005	<1	<1	<1	<1	<1	<1	<1	<.005

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	La (ppm)	Pb (ppm)	Li (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	No (ppm)	Ni (ppm)	Nb (ppm)	P (%)	K (%)	Sc (ppm)	Ag (ppm)	Na (%)	Sr (ppm)	S (%)	Tl (ppm)	Th (ppm)
MB-1-1	1.0	3.6	18	3.5	0.20	260	0.64	3.2	9.8	<4	0.35	0.32	<2	<.1	0.08	24	0.67	<1	<1
MB-1-3	2.5	4.2	20	3.4	.18	220	.61	3.7	6.7	<4	.30	.27	<2	<.1	.08	22	.69	<1	1.0
MB-1-5	4.5	5.0	24	4.2	.18	220	.69	4.3	7.0	<4	.22	.24	<2	<.1	.07	23	.73	<1	1.1
MB-1-7	6.5	5.1	30	4.8	.19	230	.82	4.8	7.9	<4	.18	.24	2.1	<.1	.09	24	.78	<1	1.3
MB-1-10	9.5	6.0	34	5.1	.18	250	1.1	5.1	8.2	<4	.16	.25	2.2	<.1	.09	25	.79	<1	1.5
MB-1-13	12.5	5.6	36	4.7	.16	260	.85	5.0	7.5	<4	.13	.23	2.0	<.1	.08	24	.75	<1	1.4
MB-1-16	15.5	6.1	49	5.0	.18	290	.95	5.5	8.2	<4	.12	.25	2.0	<.1	.10	27	.83	<1	1.6
MB-1-19	18.5	6.4	52	5.1	.17	290	.91	5.6	8.3	<4	.10	.24	<2	<.1	.10	28	.82	<1	1.7
MB-1-22	21.5	6.5	57	5.8	.18	320	1.0	5.8	9.1	<4	.098	.28	2.1	<.1	.11	31	.81	<1	1.7
MB-1-25	24.5	7.3	59	5.7	.18	290	.94	6.5	8.5	<4	.090	.27	2.0	<.1	.11	30	.72	<1	1.9
MB-1-28	27.5	7.7	48	6.0	.18	310	.83	6.8	8.9	<4	.081	.28	2.1	<.1	.11	31	.69	<1	2.0
MB-1-31	30.5	8.6	44	6.2	.18	320	.85	7.1	8.7	<4	.080	.29	2.2	<.1	.11	32	.63	<1	2.2
MB-1-34	33.5	7.6	42	6.1	.18	340	.88	7.1	9.2	<4	.083	.29	2.3	<.1	.11	33	.64	<1	2.0
MB-1-QA-1	33.5	8.0	41	5.8	.16	330	.97	7.1	8.9	<4	.075	.26	2.0	<.1	.10	33	.64	<1	2.2
MB-1-37	36.5	7.6	38	6.0	.18	340	.98	6.8	9.0	<4	.074	.29	2.1	<.1	.12	33	.64	<1	2.0
MB-1-41	40.5	7.7	36	5.7	.17	360	.87	7.1	8.9	<4	.071	.28	2.1	<.1	.11	33	.62	<1	2.0
MB-1-QA-2	40.5	7.3	23	5.7	.21	390	.92	6.7	7.9	<4	.085	.28	2.5	<.1	.13	30	.56	<1	1.8
MB-1-46	45.5	8.0	51	5.8	.17	360	.88	7.3	8.6	<4	.066	.29	2.2	<.1	.12	34	.60	<1	2.2
MB-1-51	51.0	8.2	36	5.8	.18	390	.84	7.4	8.7	<4	.066	.29	2.2	<.1	.12	35	.62	<1	2.2
MB-1-56	61.0	7.2	24	4.9	.18	400	.80	6.6	8.7	<4	.066	.26	2.1	<.1	.12	34	.57	<1	2.1
MB-1-61	71.0	7.1	24	5.1	.18	410	.75	6.5	8.1	<4	.067	.25	2	<.1	.11	32	.57	<1	1.8
MB-1-QA-3	71.0	7.5	34	6.3	.21	350	.88	7.0	9.1	<4	.086	.30	2.6	<.1	.13	31	.61	<1	1.9

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	La (ppm)	Pb (ppm)	Li (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	No (ppm)	Ni (ppm)	Nb (ppm)	P (%)	K (%)	Sc (ppm)	Ag (ppm)	Na (%)	Sr (ppm)	S (%)	Tl (ppm)	Th (ppm)
MB-1-68	85.0	7.4	22	4.4	.16	400	.82	6.5	7.4	<4	.065	.23	<2	<.1	.10	31	.55	<1	1.7
MB-3-1	1.0	5.7	36	4.8	.21	360	.59	5.0	9.5	<4	.18	.34	2.2	<.1	.15	35	na	<1	1.8
MB-4-1	1.0	5.5	39	4.4	.22	200	.96	5.6	8.4	<4	.23	.29	2.1	<.1	.11	28	na	<1	1.6
MB-5-1	1.0	8.4	28	5.4	.24	1,200	1.2	9.3	12	<4	.095	.32	3.6	<.1	.17	35	na	<1	1.7
LCO-1-1	.5	12	58	8.5	.31	1,900	.90	12	16	4.3	.10	.58	5.3	<.1	.28	47	.57	<1	2.4
LCO-1-3	2.5	12	46	8.9	.30	2,100	.92	13	15	4.1	.12	.48	5.2	<.1	.24	41	.59	<1	2.5
LCO-1-5	4.5	12	50	8.5	.29	1,800	.94	12	15	4.0	.11	.47	5.2	<.1	.23	39	.61	<1	2.4
LCO-1-7	6.5	13	56	9.1	.31	1,800	1.0	14	16	4.9	.11	.53	5.5	<.1	.26	44	.60	<1	2.7
LCO-1-9	8.5	13	57	9.2	.30	1,800	1.0	13	15	4.1	.10	.52	5.4	<.1	.25	42	.60	<1	2.6
LCO-1-11	10.5	14	63	9.2	.31	1,700	.99	14	16	4.2	.098	.53	5.6	<.1	.26	43	.60	<1	2.8
LCO-1-13	12.5	14	67	9.1	.31	1,500	1.1	14	16	4.6	.084	.57	5.5	<.1	.27	45	.60	<1	3.0
LCO-1-QA-1	12.5	14	68	9.4	.31	1,600	1.1	14	16	4.6	.082	.52	5.3	<.1	.25	42	.62	<1	2.8
LCO-1-15	14.5	15	68	9.6	.32	1,300	1.2	14	16	5.1	.078	.60	5.7	<.1	.28	47	.61	<1	3.0
LCO-1-17	16.5	16	50	9.8	.33	970	1.3	15	17	5.8	.064	.75	5.9	<.1	.36	56	.57	<1	3.3
LCO-1-19	18.5	14	24	8.1	.32	760	.90	15	14	5.5	.045	.94	5.3	<.1	.41	61	.38	<1	3.0
LCO-1-21	20.5	12	9.0	6.3	.25	430	<.5	11	10	4.4	.024	1.0	4.1	<.1	.41	58	.15	<1	2.3
LCO-1-23	22.5	12	8.0	6.2	.26	520	.63	13	12	4.6	.027	.86	4.5	<.1	.39	55	.21	<1	2.4
LCO-1-QA-2	22.5	14	8.5	6.5	.28	570	.68	13	12	4.2	.03	.82	4.6	<.1	.38	54	.28	<1	2.4
LCO-1-25	24.5	11	6.3	6.1	.24	340	<.5	11	9.0	4.7	.02	1.0	3.8	<.1	.43	60	.16	<1	2.3
LCO-1-27	26.5	12	6.6	7.6	.26	450	.85	12	11	4.7	.026	.84	4.4	<.1	.36	52	.21	<1	2.7
LCO-1-29	28.5	14	6.4	9.4	.28	550	1.6	13	12	5	.024	.65	4.5	<.1	.25	42	.31	<1	3.5
LCO-3-1	1.0	11	50	7.6	.33	3,300	.65	12	14	<4	.14	.43	4.7	<.1	.21	41	--	<1	2.3

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	La (ppm)	Pb (ppm)	Li (ppm)	Mg (%)	Mn (ppm)	Mo (ppm)	No (ppm)	Ni (ppm)	Nb (ppm)	P (%)	K (%)	Sc (ppm)	Ag (ppm)	Na (%)	Sr (ppm)	S (%)	Tl (ppm)	Th (ppm)
SB-1-1	.5	8.4	45	7.3	.29	2,000	.77	7.6	16	< 4	.10	.45	3.7	<.1	.22	45	--	< 1	2.5
SB-1-2	1.5	7.5	41	6.3	.24	1,400	.71	6.6	15	< 4	.079	.42	3.1	<.1	.21	41	--	< 1	2.1
SB-2-1	1.0	5.6	21	4.4	.20	1,600	.77	6.0	9.8	<4	.12	.24	2.4	<.1	.11	26	--	<1	1.4
SAN-1-1	1.0	8.5	5	2.9	.05	100	<.5	8.2	<2	<4	.013	1.1	<2	<.1	.21	37	na	<1	2.8
DEV-1-1	1.0	18	21	12	.47	180	.64	18	2.0	8.6	.13	1.1	6.3	.14	.62	100	na	<1	4.6
ASH-1-1	1.0	12	11	5.2	.15	140	<.5	11	5.8	6.5	.019	1.4	2.8	.10	.45	70	na	<1	3.0
WET-1-1	1.0	2.9	19	1.3	.11	170	<.5	2.7	4.1	<4	.12	.14	<2	<.1	.04	17	na	<1	<1
LEV-1-1	1.0	11	27	7.0	.35	230	<.5	10	10	5	.040	1.0	4.4	<.1	.42	59	na	<1	3.0
JON-1-1	5.0	11	8.9	5.0	.39	150	<.5	11	11	<4	.068	1.2	4.4	<.1	.43	52	na	<1	2.4
JON-1-2	5.0	11	8.2	5.2	.44	160	<.5	11	13	<4	.065	1.2	4.6	<.1	.45	57	na	<1	2.3
ZAW-1-1	4.0	10	5.1	5.2	.35	150	<.5	11	12	<4	.079	1.1	4.2	<.1	.40	53	na	<1	2.7
JON-2-1	na	2.6	11	1.5	.65	700	2.8	1.8	7.2	<4	6.9	1.0	2	<.1	.28	28	na	<1	2.2
JON-3-1	na	47	8.8	2.9	.46	280	12	41	31	<4	23	3.1	7.6	<.1	.36	500	na	1.5	6.3
W-Blank	na	<1	<1	9.7	<.005	<4	<.5	<1	<2	<4	<.005	<.005	<2	<.1	<.005	<2	na	<1	<1
Blank	na	<1	<1	11	<.005	<4	<.5	<1	<2	<4	<.005	<.005	<2	<.1	<.005	<2	na	<1	<1
U-Blank	na	<1	<1	10	<.005	<4	<.5	<1	<2	<4	<.005	<.005	<2	<.1	<.005	<2	na	<1	<1

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	Sn (ppm)	Ti (%)	U (ppm)	V (ppm)	Yb (ppm)	Y (ppm)	Zn (ppm)
MB-1-1	1.0	<1	0.031	0.36	11	<1	2.8	91
MB-1-3	2.5	<1	.033	.43	12	<1	3.1	69
MB-1-5	4.5	<1	.037	.48	13	<1	3.4	64
MB-1-7	6.5	<1	.042	.50	16	<1	4.0	68
MB-1-10	9.5	1.4	.047	.56	16	<1	4.3	71
MB-1-13	12.5	1.0	.044	.55	15	<1	4.0	70
MB-1-16	15.5	1.2	.046	.63	17	<1	4.4	87
MB-1-19	18.5	1.2	.045	.60	17	<1	4.5	99
MB-1-22	21.5	1.2	.045	.67	20	<1	5.0	100
MB-1-25	24.5	1.4	.052	.70	18	<1	5.2	94
MB-1-28	27.5	1.4	.053	.70	20	<1	5.6	96
MB-1-31	30.5	1.4	.055	.75	21	<1	5.7	94
MB-1-34	33.5	1.4	.052	.72	22	<1	5.7	99
MB-1-QA-1	33.5	1.6	.052	.74	22	<1	6.0	94
MB-1-37	36.5	1.3	.054	.72	22	<1	5.8	91
MB-1-41	40.5	1.4	.051	.73	22	1	5.8	90
MB-1-QA-2	40.5	<1.0	.057	.63	18	<1	5.4	72
MB-1-46	45.5	1.1	.054	.75	21	1	6.0	85
MB-1-51	51.0	1.0	.052	.72	21	<1	6.1	78
MB-1-56	61.0	<1	.05	.65	19	<1	5.7	72
MB-1-61	71.0	<1	.045	.65	18	<1	5.5	70
MB-1-QA-3	71.0	1.0	.057	.69	22	<1	5.8	91

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	Sn (ppm)	Ti (%)	U (ppm)	V (ppm)	Yb (ppm)	Y (ppm)	Zn (ppm)
MB-1-68	85.0	<1	.045	.63	17	<1	5.3	65
MB-3-1	1.0	1.4	.051	.53	18	< 1	4.9	90
MB-4-1	1.0	1.8	.051	1.0	17	<1	3.8	100
MB-5-1	1.0	1.8	.089	.88	44	<1	7.5	120
LCO-1-1	.5	1.7	.13	1.2	51	1.7	13.0	110
LCO-1-3	2.5	1.6	.12	1.2	51	1.6	13.0	100
LCO-1-5	4.5	1.6	.11	1.2	49	1.6	12.0	100
LCO-1-7	6.5	1.8	.13	1.3	53	1.9	14.0	110
LCO-1-9	8.5	2.1	.12	1.3	52	1.7	13.0	100
LCO-1-11	10.5	1.9	.13	1.4	52	1.9	13.0	110
LCO-1-13	12.5	2.1	.13	1.5	54	1.8	13.0	110
LCO-1-QA-1	12.5	2.0	.13	1.5	54	1.8	14.0	130
LCO-1-15	14.5	2.3	.14	1.5	55	2.0	14.0	120
LCO-1-17	16.5	2.2	.16	1.6	56	2.1	14.0	110
LCO-1-19	18.5	1.2	.16	1.4	48	2.0	14.0	68
LCO-1-21	20.5	<1	.14	1.0	33	1.8	12.0	31
LCO-1-23	22.5	<1	.15	1.2	37	1.9	13.0	28
LCO-1-QA-2	22.5	<1	.13	1.2	39	1.8	12.0	31
LCO-1-25	24.5	<1	.14	.96	30	1.6	11.0	20
LCO-1-27	26.5	<1	.13	1.3	37	1.8	12.0	25
LCO-1-29	28.5	<1	.11	1.7	43	1.7	11.0	29
LCO-3-1	1.0	2.5	.12	1.0	46	1.0	10.0	97

Table A4. Results of geochemical analysis of core samples from Lac Courte Oreilles and surrounding areas, 1999–2001. All concentrations of bismuth, gold, and tantalum were less than 1 ppm—Continued

[cm, centimeters; %, percent; ppm, parts per million; na, no data; W-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through WDNR corer, and oven dried; Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, not passed through corer, and oven dried; U-Blank, fine grained abrasive quartz (150 micrometers) from USGS Geologic Division laboratory, combined with deionized water, passed through USGS corer, and oven dried]

Field no.	Average depth (cm)	Sn (ppm)	Ti (%)	U (ppm)	V (ppm)	Yb (ppm)	Y (ppm)	Zn (ppm)
SB-1-1	.5	2.8	.096	.95	44	< 1	9.1	130
SB-1-2	1.5	2.4	.087	.86	38	< 1	7.8	99
SB-2-1	1.0	1.7	.06	.79	27	<1	4.6	85
SAN-1-1	1.0	1.0	.062	.61	7.6	<1	6.4	6.2
DEV-1-1	1.0	2.2	.32	1.6	59	1.4	12.0	130
ASH-1-1	1.0	1.5	.29	.82	20	1.1	8.6	24
WET-1-1	1.0	1.7	.025	.19	8.2	<1	1.6	52
LEV-1-1	1.0	1.8	.21	.89	36	1.1	8.6	42
JON-1-1	5.0	1.3	.14	1.7	37	1.1	9.0	28
JON-1-2	5.0	1.3	.15	1.5	36	1.0	8.6	26
ZAW-1-1	4.0	1.2	.13	1.3	33	1.1	9.4	19
JON-2-1	na	1.9	.0087	50	44	1.6	15.0	1600
JON-3-1	na	1.2	.056	190	170	7	97.0	62
W-Blank	na	<1	<.005	<.1	<2	<1	<1	<2
Blank	na	<1	<.005	<.1	<2	<1	<1	<2
U-Blank	na	<1	<.005	<.1	<2	<1	<1	<2

Table A5. Results from nutrients analysis of core samples from Musky and Northeastern Bays, Lac Courte Oreilles, October 1999
[cm, centimeter]

Sample ID	Top interval (cm)	Bottom interval (cm)	Organic carbon (percent)	Nitrogen (percent)
		Musky Bay core		
MB-1-1	0	2	24.7	3.61
MB-1-3	2	3	24.4	3.39
MB-1-5	4	5	24.3	3.43
MB-1-7	6	7	24.3	3.07
MB-1-10	9	10	23.9	3.09
MB-1-13	12	13	24.0	2.96
MB-1-16	15	16	22.2	2.65
MB-1-QA1	15	16	24.8	3.20
MB-1-19	18	19	22.9	2.68
MB-1-22	21	22	22.1	2.57
MB-1-25	24	25	22.1	2.57
MB-1-28	27	28	21.2	2.33
MB-1-31	30	31	22.1	2.53
MB-1-QA2	30	31	22.2	2.57
MB-1-34	33	34	22.9	2.46
MB-1-37	36	37	23.4	2.53
MB-1-41	40	41	23.0	2.51
MB-1-46	45	46	23.8	2.64
MB-1-QA3	45	46	23.5	2.57
MB-1-51	50	52	23.9	2.57
MB-1-56	60	62	27.1	2.78
MB-1-61	70	72	26.6	2.79
MB-1-68	84	86	27.1	2.82

Table A5. Results from nutrients analysis of core samples from Musky and Northeastern Bays, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

Sample ID	Top interval (cm)	Bottom interval (cm)	Organic carbon (percent)	Nitrogen (percent)
Northeastern Bay core				
LCO-1-1	0	1	19.4	2.20
LCO-1-3	2	3	19.9	2.22
LCO-1-5	4	5	18.7	2.00
LCO-1-7	6	7	19.9	2.05
LCO-1-9	8	9	20.5	2.12
LOC-1-QA1	8	9	18.8	2.03
LCO-1-11	10	11	18.4	2.02
LCO-1-13	12	13	17.8	1.89
LCO-1-15	14	15	18.4	1.99
LCO-1-17	16	17	15.3	1.65
LCO-1-19	18	19	17.5	1.71
LCO-1-QA2	18	19	17.6	1.85
LCO-1-21	20	21	15.9	1.43
LCO-1-23	22	23	18.9	1.64
LCO-1-25	24	25	13.3	1.06
LCO-1-27	26	27	11.1	1.03
LCO-1-29	28	29	12.8	1.20

Table A6. Results from biogenic silica analysis of core samples from Musky and Northeastern Bays, Lac Courte Oreilles, October 1999
[cm, centimeter]

Sample ID	Top interval (cm)	Bottom interval (cm)	Biogenic silica (weight percent)
Musky Bay core			
MB-1-1	0	2	32.1
MB-1-3	2	3	29.7
MB-1-5	4	5	28.7
MB-1-7	6	7	27.5
MB-1-10	9	10	27.0
MB-1-13	12	13	26.2
MB-1-16	15	16	25.0
MB-1-QA1	15	16	23.6
MB-1-19	18	19	24.7
MB-1-22	21	22	25.0
MB-1-25	24	25	20.4
MB-1-28	27	28	32.7
MB-1-31	30	31	22.9
MB-1-QA2	30	31	22.8
MB-1-34	33	34	26.0
MB-1-37	36	37	22.9
MB-1-41	40	41	21.1
MB-1-46	45	46	23.1
MB-1-QA3	45	46	20.4
MB-1-51	50	52	17.3
MB-1-56	60	62	18.5
MB-1-61	70	72	16.4
MB-1-68	84	86	15.5

Table A6. Results from biogenic silica analysis of core samples from Musky and Northeastern Bays, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

Sample ID	Top interval (cm)	Bottom interval (cm)	Biogenic silica (weight percent)
Northeastern Bay core			
LCO-1-1	0	1	18.9
LCO-1-3	2	3	23.8
LCO-1-5	4	5	24.8
LCO-1-7	6	7	28.7
LCO-1-9	8	9	24.5
LCO-1-11	10	11	26.1
LOC-1-QA1	10	11	27.0
LCO-1-13	12	13	26.6
LCO-1-15	14	15	28.3
LCO-1-17	16	17	26.4
LCO-1-19	18	19	17.4
LCO-1-21	20	21	5.4
LCO-1-QA2	20	21	6.8
LCO-1-23	22	23	14.2
LCO-1-25	24	25	9.7
LCO-1-27	26	27	5.7
LCO-1-29	28	29	24.6

Table A7. Results from analysis of diatom valve concentration from Musky and Northeastern Bays, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram]

Top interval (cm)	Bottom interval (cm)	Diatom counts, in valves (x10^8) g^{-1}, dry weight
Musky Bay core		
0	1	32.2
5	6	32.3
10	11	100.4
11	12	39.2
15	16	44.2
20	21	26.7
30	31	88.6
40	41	3.7
45	46	33.7
50	52	7.5
60	62	15.3
62	64	28.6
64	66	36.2
66	68	39.2
Northeastern Bay core		
0	1	7.9
10	11	24.7
16	17	10.0
24	25	8.1
40	41	7.7

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 7–8 cm			
Achnanthidium minutissima + vars.	1	1	0.006
Amphora ovalis	1	0	.003
Amphora perpusilla	2	0	.006
Cocconeis placentula var. lineata	2	0	.006
Cocconeis placentula (RV)	1	2	.009
Cyclotella ocellata	0	1	.003
Cymbella angustata	0	1	.003
Cymbella cymbiformis var. nonpunctata	1	0	.003
Cymbella subaequalis	1	0	.003
Encyonema silesiacum	0	1	.003
Epithemia arcus	1	0	.003
Epithemia sp.	1	1	.006
Epithemia turgida	0	2	.006
Eunotia pectinalis	1	.5	.004
Fragilaria capucina + vars.	16	3	.054
Gomphonema acuminatum	1	0	.003
Gomphonema tenellum	2	0	.006
Gomphonema (GV)	0	2	.006
Gomphonema sp.	0	1	.003
Navicula atomus var. permitis	1	2	.009
Navicula lanceolata	0	1	.003
Navicula minima	1	0	.003
Navicula pseudoventralis	2	1	.009
Navicula (GV) (short)	2	0	.006
Navicula sp.	0	2	.006
Nitzschia amphibia	1	0	.003
Nitzschia sp.	0	2	.006
Pseudostaurosira brevistrata + vars.	8	31	.112
Staurosira construens	41	67	.309
Staurosira construens var. binodis	6	4	.029
Staurosira construens var. venter	32	31	.180
Staurosira elliptica	2	1	.009
Staurosirella leptostauron var. dubia	0	3	.009
Staurosirella pinnata	33	23	.160
Synedra sp.	0	1	.003
Unknown (raphid)	1	0	.003
Unknown	1	1	.006
TOTAL	163	186.5	1.000
		3	
Chrysophyte cysts	1	1	
Scenedesmus coenobia	0	2	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 10–11 cm			
Achnanthidium minutissima + vars.	2	6	0.025
Amphora ovalis	0	1	.003
Aulacoseira ambigua	0	2	.006
Cocconeis placentula var. lineata	0	5	.016
Encyonema silesiacum	1	0	.003
Epithemia sp.	0	1	.003
Epithemia turgida	2	0	.006
Eunotia incisa	0	.5	.002
Fragilaria capucina + vars.	8	4	.037
Fragilaria crotonensis	6	0	.019
Fragilaria cf. oldenburgiana	0	2	.006
Gomphonema tenellum	1	0	.003
Gomphonema truncatum	1	1	.006
Navicula atomus var. permitis	1	0	.003
Navicula lanceolata	1	0	.003
Navicula minima	2	2	.012
Navicula schadei	0	2	.006
Navicula (GV) (short)	2	0	.006
Navicula sp.	0	1	.003
Nitzschia amphibia	0	2	.006
Nitzschia sp.	2	0	.006
Pseudostaurosira brevistrata + vars.	23	11	.106
Staurosira construens	26	34	.187
Staurosira construens var. binodis	5	12	.053
Staurosira construens var. venter	38	50	.275
Staurosira elliptica	7	5	.037
Staurosirella pinnata	30	17	.147
Synedra ulna	1	0	.003
Unknown (raphid)	0	1	.003
Unknown	1	1	.006
TOTAL	160	160.5	1.000
		3	
Chrysophyte cysts	1	1	
Scenedesmus coenobia	0	2	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 11–12 cm			
Achnanthidium exiguum	1	0	0.003
Achnanthidium minutissima + vars.	2	2	.012
Amphora ovalis var. affinis	0	1	.003
Aulacoseira ambigua	3	0	.009
Aulacoseira italica	0	2	.006
Cocconeis placentula var. lineata	0	1	.003
Cocconeis placentula (RV)	1	2	.009
Cyclostephanos sp.	0	1	.003
Cyclotella glomerata	1	0	.003
Cyclotella sp.	0	1	.003
Cymbella cistula	1	0	.003
Cymbella sp.	1	1	.006
Epithemia arcus	1	0	.003
Epithemia sp.	2	1	.009
Epithemia turgida	1	5	.017
Eunotia incisa	.5	0	.001
Eunotia pectinalis	.5	0	.001
Eunotia sp.	.5	0	.001
Fragilaria capucina + vars.	14	10	.069
Gomphonema sp.	0	2	.006
Navicula atomus var. permitis	3	3	.017
Navicula cryptotenella	1	0	.003
Navicula minima	1	0	.003
Navicula (GV) (short)	2	0	.006
Navicula sp.	4	2	.017
Nitzschia amphibia	0	2	.006
Nitzschia sp.	1.5	0	.004
Pseudostaurosira brevistrata + vars.	30	29	.171
Sellaphora rectangularis	0	1	.003
Stauroneis sp.	0	1	.003
Staurosira construens	56	33	.257
Staurosira construens var. binodis	9	22	.090
Staurosira construens var. venter	13	31	.127
Staurosira elliptica	2	5	.020
Staurosirella pinnata	20	14	.098
Unknown	2	0	.006
TOTAL	174	172	1.000
		3	
Chrysophyte cysts	1	0	
Zooplankton parts	0	1	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 17–18 cm			
Achnanthidium exiguum	0	1	0.003
Achnanthidium minutissima + vars.	1	5	.015
Cocconeis placentula var. lineata	4	3	.018
Cocconeis placentula	1	0	.003
Cocconeis placentula (RV)	0	3	.008
Cyclotella michiganiana	1	0	.003
Cyclotella ocellata	0	2	.005
Cymbella angustata	2	0	.005
Cymbella cistula	1	0	.003
Cymbella sp.	1	0	.003
Encyonema silesiacum	0	2	.005
Epithemia turgida	0	1	.003
Eunotia incisa	0	1	.003
Eunotia rhomboides	0	1	.003
Fragilaria capucina + vars.	27	3	.076
Fragilaria crotonensis	4	0	.010
Gomphonema sp.	1	0	.003
Navicula atomus var. permitis	1	2	.008
Navicula cryptotenella	0	1	.003
Navicula lanceolata	0	1	.003
Navicula minima	0	2	.005
Navicula pelliculosa	2	2	.010
Navicula pseudoventralis	2	6	.020
Navicula tripunctata	0	1	.003
Navicula (GV) (short)	2	2	.010
Navicula sp.	1	2	.008
Nitzschia amphibia	3	0	.008
Nitzschia sp.	0.5	2	.006
Planothidium lanceolata	1	0	.003
Pseudostaurosira brevistrata + vars.	24	32	.143
Staurosira construens	33	34	.171
Staurosira construens var. binodis	1	7	.020
Staurosira construens var. subsalina	0	1	.003
Staurosira construens var. venter	46	35	.206
Staurosira elliptica	2	7	.023
Staurosirella leptostauron var. dubia	1	0	.003
Staurosirella pinnata	20	44	.163
Synedra fasciculata	0	1	.003
Synedra minuscula	2	0	.005
Synedra rumpens var. familaris	0	3	.008
Unknown (raphid)	1	0	.003
TOTAL	185.5	207	1.000
		3	
Chrysophyte cysts	0	0	
Scenedesmus coenbia	0	0	
Tetraedron coenbia	0	1	
Sponge spicules	0	1	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 20–21 cm			
Achnanthes minutissima + vars.	2	4	0.013
Amphora ovalis var. affinis	1	0	.002
Amphora perpusilla	0	1	.002
Aulacoseira (VV)	0	1	.002
Cocconeis placentula (RV)	3	0	.006
Cyclotella glomerata	0	1	.002
Cymbella cistula	1	0	.002
Cymbella sp.	1	2	.006
Epithemia sorex	2	0	.004
Epithemia turgida	0	1	.002
Epithemia sp.	1	0	.002
Eunotia sp.	1	0	.002
Fragilaria capucina + vars.	0	8	.017
Fragilaria crotonensis	0	7	.015
Gomphonema acuminatum	0	1	.002
Gomphonema truncatum var. capitatum	0	3	.006
Gomphonema sp.	0	1	.002
Navicula atomus var. permitis	3	3	.013
Navicula glomus	0	2	.004
Navicula lanceolata	0	1	.002
Navicula minima	0	5	.011
Navicula pelliculosa	2	2	.008
Navicula pseudoventralis	0	3	.006
Navicula (GV) (short)	4	0	.008
Navicula sp.	1	0	.002
Nitzschia amphibia	0	3	.006
Nitzschia sp.	0	2	.004
Planothidium lanceolata	0	1	.002
Pseudostaurosira brevistrata + vars.	24	45	.145
Staurosira construens	42	43	.179
Staurosira contruens var. subsalina	0	1	.002
Staurosira construens var. binodis	13	27	.084
Staurosira construens var. venter	38	51	.187
Staurosira elliptica	7	10	.036
Staurosirella leptostauron var. dubia	1	0	.002
Staurosirella pinnata	18	81	.208
Synedra rumpens var. familaris	0	1	.002
Unknown (raphid)	1	2	.006
Unknown	4	0	.008
TOTAL	165	311	1.000
Chrysophyte cysts	0	1	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 43–44 cm			
Achnanthes exiguum	1	2	0.009
Achnanthes minutissima + vars.	21	18	.118
Aulacoseira ambigua	3	1	.012
Aulacoseira italica	4	0	.012
Cocconeis placentula var. lineata	3	0	.009
Cocconeis placentula (RV)	2	2	.012
Cyclotella glomerata	1	0	.003
Cymbella angustata	1	0	.003
Cymbella cistula	0	2	.006
Cymbella sp.	0	2	.006
Encyonema silesiacum	0	3	.009
Epithemia sp.	0	1	.003
Eunotia incisa	.5	0	.002
Fragilaria capucina + vars.	2	12	.042
Fragilaria crotonensis	9	4	.039
Fragilaria radians	0	2	.006
Geissleria ignota var. palustris	0	2	.006
Gomphonema acuminatum	0	1	.003
Gomphonema affine var. insigne	2	0	.006
Gomphonema tenellum	1	0	.003
Gomphonema subtile	0	1	.003
Gomphonema (GV)	2	0	.006
Gomphonema sp.	1	1	.006
Navicula atomus var. permitis	7	4	.033
Navicula lanceolata	1	1	.006
Navicula minima	0	1	.003
Navicula pseudoventralis	2	1	.009
Navicula schadei	1	5	.018
Navicula sp.	2	2	.012
Nitzschia palea	1	0	.003
Pseudostaurosira brevistrata + vars.	25	8	.100
Stauroneis sp.	1	0	.003
Staurosira construens	22	21	.130
Staurosira construens var. binodis	0	10	.030
Staurosira construens var. venter	25	31	.169
Staurosira elliptica	5	3	.024
Staurosirella pinnata	21	25	.139
Stephanodiscus niagarae	0	1	.003
Stephanodiscus parvus	0	1	.003
Synedra acus	4	0	.012
Synedra rumpens var. familaris	5	0	.015
Unknown (raphid)	1	2	.009
Unknown	1	1	.006
TOTAL	166.5	164	1.000
		3	
Chrysophyte cysts	0	3	
Zooplankton parts	0	1	
Sponge spicules	1	1	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 46–47 cm			
Achnanthes minutissima + vars.	7	27	0.103
Amphora ovalis var. affinis	0	2	.006
Asterionella formosa	0	2	.006
Aulacoseira ambigua	10	12	.067
Aulacoseira subarctica	0	2	.006
Aulacoseira (VV)	1	0	.003
Brachysira vitrea	0	1	.003
Cocconeis placentula var. lineata	2	1	.009
Cocconeis placentula (RV)	0	1	.003
Cyclotella michiganiana	4	0	.012
Cymbella angustata	2	0	.006
Encyonema silesiacum	0	2	.006
Epithemia arcus	4	2	.018
Epithemia turgida	0	1	.003
Eunotia sp.	2	0	.006
Fragilaria capucina + vars.	5	3	.024
Fragilaria oldenburgiana	0	2	.006
Fragilaria vaucheriae	1	0	.003
Geissleria ignota var. palustris	1	0	.003
Gomphonema parvulum	0	1	.003
Gomphonema tenellum	2	0	.006
Gomphonema subtile	0	1	.003
Gomphonema (GV)	4	2	.018
Navicula atomus var. permitis	8	3	.033
Navicula lanceolata	5	0	.015
Navicula minima	2	0	.006
Navicula pelliculosa	5	2	.021
Navicula pseudoventralis	6	1	.021
Navicula radiosa	0	2	.006
Navicula schadei	0	3	.009
Navicula (GV) (short)	2	0	.006
Navicula sp.	1	2	.009
Neidium affine var. amphirhynchus	0	1	.003
Neidium sp.	1	0	.003
Nitzschia sp.	2	0	.006
Pseudostaurosira brevistrata +vars.	22	17	.118
Sellaphora vitabunda	0	1	.003
Staurosira construens	17	24	.124
Staurosira construens var. venter	23	25	.145
Staurosira elliptica	10	0	.030
Staurosirella leptostauron var. dubia	0	2	.006
Staurosirella pinnata	11	10	.064
Synedra rumpens var. familaris	0	1	.003
Synedra sp.	0	3	.009
Tabellaria (GV)	1	2	.009
Unknown (raphid)	1	0	.003
Unknown	2	5	.021
TOTAL	164	166	1.000
Zooplankton parts	2	2	
Sponge spicules	1	0	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 47–48 cm			
Achnanthes exiguum	0	1	0.003
Achnanthes minutissima + vars.	24	18	.111
Amphora ovalis	1	0	.003
Amphora ovalis var. affinis	0	2	.005
Asterionella formosa	1	0	.003
Aulacoseira ambigua	4	4	.021
Aulacoseira subarctica	3	0	.008
Brachysira vitrea	0	1	.003
Cocconeis placentula var. lineata	2	2	.011
Cocconeis placentula (RV)	0	2	.005
Cyclotella bodanica var. lemanica	0	1	.003
Cymbella cistula	4	1	.013
Cymbella sp.	2	0	.005
Encyonema silesiacum	3	0	.008
Epithemia arcus	0	1	.003
Epithemia sp.	1	0	.003
Epithemia turgida	1	0	.003
Eunotia pectinalis	1.5	0	.004
Fragilaria capucina + vars.	2	16	.048
Fragilaria crotonensis	0	3	.008
Fragilaria vaucheriae	2	0	.005
Geissleria ignota var. palustris	2	0	.005
Gomphonema tenellum	2	1	.008
Gomphonema truncatum	0	1	.003
Gomphonema (GV)	3	2	.013
Gomphonema sp.	1	2	.008
Navicula atomus var. permitis	4	7	.029
Navicula lanceolata	1	3	.011
Navicula pelliculosa	3	1	.011
Navicula pseudoventralis	1	2	.008
Navicula schadei	3	0	.008
Navicula (GV) (short)	20	2	.058
Navicula sp.	7	4	.029
Neidium sp.	1	0	.003
Nitzschia sp.	0	2	.005
Pinnularia sp.	0	1	.003
Pseudostaurosira brevistrata + vars.	1	5	.016
Rhopalodia gibba	0	.5	.001
Sellaphora pupula	1	0	.003
Sellaphora rectangularis	1	0	.003
Sellaphora vitabunda	0	1	.003
Staurosira construens	40	17	.151
Staurosira construens var. binodis	6	5	.029
Staurosira construens var. subsalina	0	1	.003
Staurosira construens var. venter	11	15	.069
Staurosira elliptica	4	4	.021
Staurosirella leptostauron var. dubia	2	0	.005
Staurosirella pinnata	8	59	.178
Stephanodiscus niagarae	1	0	.003
Synedra rumpens var. familaris	0	1	.003
Synedra (GV)	0	1	.003
Tabellaria (central area)	0	1	.003
Unknown (raphid)	1	5	.016
Unknown	0	6	.016
TOTAL	175.5	201.5 3	1.000
Chrysophyte cysts	2	2	
Scenedesmus coenobia	0	2	
Sponge spicules	2	0	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 48–49 cm			
Achnanthes exiguum	0	1	0.003
Achnanthes minutissima + vars.	23	13	.108
Aulacoseira ambigua	6	4	.030
Aulacoseira subarctica	0	2	.006
Aulacoseira (VV)	1	1	.006
Brachysira vitrea	2	3	.015
Cocconeis placentula var. eugypta	0	1	.003
Cocconeis placentula var. lineata	3	1	.012
Cyclotella stelligera	1	1	.006
Cymbella angustata	3	0	.009
Cymbella cistula	0	2	.006
Cymbella sp.	2	0	.006
Encyonema silesiacum	1	0	.003
Eunotia incisa	2	0	.006
Eunotia pectinalis	1.5	0	.005
Fragilaria capucina	4	2	.018
Geissleria ignota var. palustris	1	0	.003
Gomphonema tenellum	1	3	.012
Gomphonema (GV)	2	2	.012
Gomphonema truncatum var. capitatum	2	0	.006
Navicula atomus var. permitis	8	6	.042
Navicula cryptotenella	1	1	.006
Navicula lanceolata	0	1	.003
Navicula pelliculosa	5	3	.024
Navicula pseudoventralis	3	6	.027
Navicula radiofallax	0	2	.006
Navicula schadei	3	2	.015
Navicula seminuloides	2	1	.009
Navicula tripunctata	0	2	.006
Navicula (GV) (short)	15	13	.084
Navicula sp.	1	3	.012
Nitzschia amphibia	0	1	.003
Nitzschia sp.	0	3	.009
Pinnularia sp.	1	2	.009
Planothidium lanceolata var. dubia	0	1	.003
Pseudostaurosira brevistrata + vars.	10	13	.069
Sellaphora pupula	1	0	.003
Sellaphora rectangularis	0	1	.003
Sellaphora vitabunda	0	1	.003
Staurosira construens	15	21	.108
Staurosira construens var. venter	24	19	.129
Staurosira elliptica	3	11	.042
Staurosirella leptostauron	2	2	.012
Staurosirella leptostauron var. dubia	0	3	.009
Staurosirella pinnata	5	12	.051
Synedra acus	0	2	.006
Synedra rumpens var. familaris	6	0	.018
Unknown (raphid)	0	1	.003
Unknown	1	2	.009
TOTAL	161.5	171	1.000
		3	
Chrysophyte cysts	3	1	
Scenedesmus coenbia	1	0	
Tetraedron coenbia	1	0	
Zooplankton parts	1	0	

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 52–54 cm			
Achnanthes minutissima + vars.	10	13	0.070
Asterionella formosa	0	1	.003
Aulacoseira ambigua	1	2	.009
Aulacoseira italica	2	0	.006
Brachysira vitrea	1	0	.003
Cyclotella glomerata	0	2	.006
Cyclotella michiganiana	1	0	.003
Cymbella angustata	1	0	.003
Epithemia sp.	4	0	.012
Epithemia turgida	1	0	.003
Eunotia sp.	2.5	1	.011
Fragilaria capucina + vars.	11	0	.033
Fragilaria crotonensis	0	4	.012
Fragilaria cf. oldenburgiana	1	0	.003
Fragilaria vaucheriae	1	0	.003
Geissleria ignota var. palustris	1	0	.003
Gomphonema acuminatum	0	2	.006
Gomphonema (GV)	4	2	.018
Gomphonema sp.	3	2	.015
Navicula atomus var. permitis	13	18	.094
Navicula minima	2	2	.012
Navicula muralis	2	0	.006
Navicula pelliculosa	5	1	.018
Navicula pseudoventralis	1	8	.027
Navicula schadei	1	0	.003
Navicula (GV) (short)	8	4	.037
Navicula sp.	3	7	.030
Nitzschia amphibia	0	1	.003
Nitzschia sp.	2	0	.006
Pseudostaurosira brevistrata + vars.	9	18	.082
Sellaphora rectangularis	0	1	.003
Staurosira construens	14	26	.122
Staurosira construens var. venter	38	17	.167
Staurosira elliptica	8	3	.033
Staurosirella leptostauron var. dubia	0	1	.003
Staurosirella pinnata	17	12	.088
Staurosirella pinnata var. intercedens	2	0	.006
Stephanodiscus niagarae	1	0	.003
Synedra rumpens var. familaris	0	1	.003
Synedra (GV)	0	2	.006
Tabellaria fenestrata	1	0	.003
Unknown	3	3	.018
Unknown (raphid)	0		.000
Total	174.5	154	1.000

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999–Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero. Concentration was not determined for samples from MB-1A.]

Taxa	Number 1	Number 2	Proportion
MB-1A, 54–56 cm			
Achnanthes exiguum	2	0	0.006
Achnanthes minutissima + vars.	1	16	.052
Amphipleura pellucida	.5	0	.002
Aulacoseira ambigua	0	4	.012
Aulacoseira italica	1	1	.006
Brachysira vitrea	1	1	.006
Cocconeis placentula var. lineata	0	1	.003
Cocconeis placentula (RV)	0	1	.003
Cyclotella glomerata	0	1	.003
Cyclotella michiganiana	0	3	.009
Cyclotella sp.	2	0	.006
Cymbella angustata	3	1	.012
Cymbella cistula	2	0	.006
Cymbella sp.	1	0	.003
Encyonema silesiacum	0	1	.003
Epithemia turgida	0	1	.003
Eunotia incisa	.5	.5	.003
Eunotia sp.	0	2.5	.008
Fragilaria capucina + vars.	4	.5	.014
Fragilaria crotonensis	0	6	.018
Fragilaria vaucheriae	2	0	.006
Geissleria ignota var. palustris	0	1	.003
Gomphonema tenellum	0	1	.003
Gomphonema sp.	3	0	.009
Navicula atomus var. permitis	15	9	.074
Navicula lanceolata	2	1	.009
Navicula minima	2	4	.018
Navicula pelliculosa	4	1	.015
Navicula pseudoventralis	9	12	.065
Navicula schadei	4	1	.015
Navicula tripunctata	0	2	.006
Navicula (GV) (short)	12	12	.074
Navicula sp.	6	2	.025
Neidium iridis	2	0	.006
Planothidium lanceolata	1	0	.003
Pseudostaurosira brevistrata + vars.	6	10	.049
Reimeria sinuata	0	1	.003
Staurosira construens	32	19	.157
Staurosira construens var. venter	19	18	.114
Staurosira elliptica	6	5	.034
Staurosirella leptostauron var. dubia	4	2	.018
Staurosirella pinnata	12	9	.065
Stephanodiscus niagarae	1	0	.003
Synedra rumpens var. familaris	5	1	.018
Synedra sp.	0	1	.003
Tabellaria (central area)	1	0	.003
Unknown (raphid)	1	0	.003
Unknown	4	2	.018
Total	171	154.5	1.000

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Proportion	Number/g dry sediment
MB-1B, 0–1 cm						
Achnanthidium minutissima + vars.	7	8	3	3	0.025	9.75E+07
Achnanthidium exiguum	0	1	0	0	.001	6.50E+06
Amphora ovalis var. affinis	0	1	0	0	.001	6.50E+06
Amphipleura pellucida	0	0	0	1	.001	0.00E+00
Aulacoseira ambigua	3	1	0	0	.005	2.60E+07
Aulacoseira italica	1	0	0	0	.001	6.50E+06
Cocconeis placentula var. lineata	1	1	0	5	.008	1.30E+07
Cocconeis placentula (RV)	2	1	1	0	.005	1.95E+07
Cocconeis placentula	0	0	2	0	.002	0.00E+00
Cyclotella comensis	0	0	1	0	.001	0.00E+00
Cyclotella michiganiana	1	0	0	0	.001	6.50E+06
Cymbella angustata	1	1	0	1	.004	1.30E+07
Cymbella sp.	0	0	1	0	.001	0.00E+00
Encyonema silesiacum	1	0	1	0	.002	6.50E+06
Epithemia arcus	1	0	0	0	.001	6.50E+06
Epithemia sp.	3	2	3	0	.010	3.25E+07
Epithemia turgida	0	1	0	0	.001	6.50E+06
Eunotia incisa	2	1	0	0	.004	1.95E+07
Eunotia soleirolii	2	0	0	0	.002	1.30E+07
Fragilaria capucina + vars.	9	32	33	7	.098	2.66E+08
Fragilaria constricta	2	2	0	0	.005	2.60E+07
Fragilaria crotonensis	0	5	0	0	.006	3.25E+07
Fragilaria vaucheriae	0	2	1	0	.004	1.30E+07
Geissleria ignota var. palustris	2	2	1	0	.006	2.60E+07
Gomphonema consector	1	1	0	0	.002	1.30E+07
Gomphonema gracile	0	0	0	1	.001	0.00E+00
Gomphonema parvulum f. micropus	0	1	0	0	.001	6.50E+06
Gomphonema parvulum	0	1	0	0	.001	6.50E+06
Gomphonema tenellum	3	2	1	2	.010	3.25E+07
Gomphonema sp.	1	1	1	1	.005	1.30E+07
Navicula atomus var. permitis	2	5	1	4	.015	4.55E+07
Navicula lanceolata	1	0	1	3	.006	6.50E+06
Navicula minima	2	5	1	3	.013	4.55E+07
Navicula seminuloides	1	0	1	0	.002	6.50E+06
Navicula pseudoventralis	2	4	1	1	.010	3.90E+07
Navicula seminulum	3	0	0	0	.004	1.95E+07
Navicula (GV) (short)	0	3	0	2	.006	1.95E+07
Navicula sp.	1	4	3	0	.010	3.25E+07
Neidium sp.	0	1	0	0	.001	6.50E+06
Nitzschia amphibia	4	3	2	1.5	.013	4.55E+07
Nitzschia fonticola	1	0	0	1	.002	6.50E+06
Nitzschia palea	1	2	1	3	.008	1.95E+07
Nitzschia sp.	0	.5	0	0	.001	3.25E+06
Pseudostaurosira brevistrata + vars.	0	6	33	10	.059	3.90E+07
Reimeria sinuata	0	1	0	0	.001	6.50E+06
Sellaphora rectangularis	0	1	0	0	.001	6.50E+06
Staurosira construens	67	35	23	46	.207	6.63E+08
Staurosira construens var. binodis	18	7	0	4	.035	1.62E+08
Staurosira contruens var. subsalina	0	0	1	0	.001	0.00E+00
Staurosira construens var. venter	47	46	27	22	.172	6.04E+08
Staurosira elliptica	19	19	4	10	.063	2.47E+08
Staurosirella pinnata	28	28	19	28	.125	3.64E+08
Stephanodiscus niagarae	0	1	0	0	.001	6.50E+06
Stephanodiscus sp.	0	1	0	0	.001	6.50E+06
Synedra demerarae	3	0	0	0	.004	1.95E+07
Synedra rumpens	0	1	1	0	.002	6.50E+06
Synedra rumpens var. familaris	1	2	0	1	.005	1.95E+07
Synedra sp.	0	0	0	1	.001	0.00E+00
Rhopalodia gibba	1	1	0	0	.002	1.30E+07
Unknown (raphid)	6	0	0	0	.007	3.90E+07
Unknown	1	0	0	0	.001	6.50E+06
TOTAL	252	243.5	168	161.5	1.000	3.22E+09
Chrysophyte cysts	0	0	2	2		0.00E+00
Scenedesmus coenobia	2	2	0	4		2.60E+07
Tetraedron coenobia	1	0	0	1		6.50E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Number 5	Proportion	Number/g dry sediment
MB-1B, 5–6 cm							
Achnanthidium exiguum	1	0	0	0	0	0.001	1.06E+07
Achnanthidium lanceolata var. dubia	0	0	0	1	0	.001	0.00E+00
Achnanthidium minutissima + vars.	3	2	2	0	2	.011	5.28E+07
Amphora ovalis var. affinis	0	0	0	1	0	.001	0.00E+00
Amphora perpusilla	2	0	0	0	0	.002	2.11E+07
Amphora normanii	0	0	0	1	0	.001	0.00E+00
Aulacoseira ambigua	0	0	3	1	1	.006	0.00E+00
Aulacoseira (VV)	2	0	1	0	0	.004	2.11E+07
Cocconeis placentula var. eugypta	4	0	0	0	0	.005	4.23E+07
Cocconeis placentula var. lineata	0	0	4	2	1	.009	0.00E+00
Cocconeis placentula (RV)	2	0	0	1	1	.005	2.11E+07
Cyclotella sp.	0	3	0	0	0	.004	3.17E+07
Cymbella angustata	0	0	1	0	0	.001	0.00E+00
Cymbella cistula	1	0	1	0	0	.002	1.06E+07
Cymbella sp.	0	0	1	2	1	.005	0.00E+00
Encyonema silesiacum	0	1	0	0	2	.004	1.06E+07
Epithemia arcus	0	0	0	2	0	.002	0.00E+00
Epithemia turgida	0	3	2	0	2	.009	3.17E+07
Epithemia sp.	0	1	0	0	3	.005	1.06E+07
Eunotia incisa	0	0	2	2	.5	.006	0.00E+00
Eunotia pectinalis var. recta	0	0	0	1	0	.001	0.00E+00
Fragilaria capucina + vars.	47	4	17	4	15	.107	5.39E+08
Fragilaria crotonensis	3	1	1	0	0	.006	4.23E+07
Geissleria ignota var. palustris	1	0	0	0	0	.001	1.06E+07
Gomphonema angustatum	2	0	0	0	0	.002	2.11E+07
Gomphonema parvulum	1	0	1	0	0	.002	1.06E+07
Gomphonema tenellum	1	1	2	0	1	.006	2.11E+07
Gomphonema (GV)	0	2	0	0	2	.005	2.11E+07
Hantzschia amphioxys	0	0	0	0	.5	.001	0.00E+00
Navicula atomus var. permitis	2	0	4	0	3	.011	2.11E+07
Navicula glomus	1	0	0	0	0	.001	1.06E+07
Navicula lanceolata	2	0	1	0	1	.005	2.11E+07
Navicula minima	1	0	0	0	1	.002	1.06E+07
Navicula pseudoventralis	2	0	0	0	0	.002	2.11E+07
Navicula seminuloides	1	0	1	0	0	.002	1.06E+07
Navicula tripunctata	1	0	0	0	0	.001	1.06E+07
Navicula (GV) (short)	2	2	0	4	2	.012	4.23E+07
Navicula sp.	2	1	1	0	1	.006	3.17E+07
Nitzschia amphibia	1	1	3	2	0	.009	2.11E+07
Nitzschia palea	1	0	0	0	0	.001	1.06E+07
Nitzschia sp.	0	0	1	0	0	.001	0.00E+00
Pinnularia cuneicephala	0	0	0	0	1	.001	0.00E+00
Pseudostaurosira brevistrata + vars	33	17	27	10	6	.113	5.28E+08
Rhoicosphenia curvata	0	0	2	0	0	.002	0.00E+00
Staurosira construens	31	38	28	40	48	.228	7.29E+08
Staurosira construens var. binodis	4	0	1	16	0	.026	4.23E+07
Staurosira construens var. venter	30	21	17	28	40	.167	5.39E+08
Staurosira elliptica	4	8	8	10	7	.046	1.27E+08
Staurosirella pinnata	17	15	25	28	16	.124	3.38E+08
Staurosirella pinnata var. intercedens	0	0	0	0	1	.001	0.00E+00
Synedra rumpens var. familaris	0	0	0	2	0	.002	0.00E+00
Synedra ulna	2	0	0	0	0	.002	2.11E+07
Synedra sp.	0	0	1	0	0	.001	0.00E+00
Unknown (raphid)	0	1	1	0	1	.004	1.06E+07
Unknown	0	1	1	0	1	.004	1.06E+07
TOTAL	207	123	164	158	161	1.000	3.49E+09
Chrysophyte cysts	0	0	1	0	2		0
Scenedesmus coenobia	2	2	2	2	2		4.23E+07
Tetraedron coenobia	1	0	0	0	0		1.06E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Number 5	Proportion	Number/g dry sediment
MB-1B, 10–11 cm							
Achnanthidium lanceolata	0	0	1	0	0	0.001	1.79E+07
Achnanthidium lanceolata var. dubia	0	0	2	0	0	.002	3.59E+07
Achnanthidium lewisiana	0	0	0	1	0	.001	0.00E+00
Achnanthidium minutissima + vars.	1	1	5	1	1	.010	1.26E+08
Amphora perpusilla	0	0	0	0	1	.001	0.00E+00
Aulacoseira ambigua	0	1	0	0	0	.001	1.79E+07
Brachysira sp.	0	0	0	0	1	.001	0.00E+00
Cocconeis placentula var. lineata	1	2	1	0	2	.007	7.18E+07
Cocconeis placentula (RV)	1	2	1	2	0	.007	7.18E+07
Craticula cuspidata	0	0	0	0	1	.001	0.00E+00
Cyclotella michiganiana	0	0	0	1	1	.002	0.00E+00
Cyclotella sp.	0	0	4	0	0	.005	7.18E+07
Cymbella angustata	0	0	1	0	0	.001	1.79E+07
Cymbella cistula	0	0	0	3	0	.003	0.00E+00
Cymbella cymbiformis var. nonpunctata	1	0	0	0	0	.001	1.79E+07
Cymbella sp.	0	1	0	0	1	.002	1.79E+07
Epithemia arcus	0	0	0	1	0	.001	0.00E+00
Epithemia sp.	0	1	1	2	0	.005	3.59E+07
Eunotia flexuosa	0	.5	0	0	0	.001	8.97E+06
Fragilaria capucina + vars.	23	12	11	7	21	.084	8.25E+08
Fragilaria crotonensis	0	0	4	0	0	.005	7.18E+07
Geissleria ignota var. palustris	0	0	0	1	0	.001	0.00E+00
Gomphonema angustatum	0	0	0	2	0	.002	0.00E+00
Gomphonema consector	0	0	1	0	0	.001	1.79E+07
Gomphonema subclavatum var. commutatum	0	0	0	1	0	.001	0.00E+00
Gomphonema tenellum	1	0	3	1	0	.006	7.18E+07
Gomphonema sp.	1	0	2	1	1	.006	5.38E+07
Navicula atomus var. permitis	7	2	2	6	5	.025	1.97E+08
Navicula cryptotenella	1	0	0	1	0	.002	1.79E+07
Navicula glomus	0	2	0	0	0	.002	3.59E+07
Navicula lanceolata	1	1	1	0	1	.005	5.38E+07
Navicula minima	3	0	6	1	2	.014	1.61E+08
Navicula pseudoventralis	2	4	4	0	2	.014	1.79E+08
Navicula tripunctata	1	2	1	0	0	.005	7.18E+07
Navicula (short) (GV)	2	6	1	0	0	.010	1.61E+08
Navicula sp.	0	1	0	2	4	.008	1.79E+07
Nitzschia amphibia	1	2	2	0	1.5	.007	8.97E+07
Nitzschia palea	0	0	1	0	0	.001	1.79E+07
Nitzschia sp.	2.5	1	0	0	0	.004	6.28E+07
Pinnularia sp.	1	1	0	0	0	.002	3.59E+07
Pseudostaurosira brevistrata + vars.	26	45	10	9	2	.105	1.45E+09
Sellaphora pupula	0	0	0	0	1	.001	0.00E+00
Sellaphora bacillum	0	1	0	0	0	.001	1.79E+07
Staurosira construens	59	68	33	52	38	.285	2.87E+09
Staurosira construens var. binodis	3	5	1	6	6	.024	1.61E+08
Staurosira construens var. venter	20	45	34	27	35	.183	1.78E+09
Staurosira elliptica	1	3	5	11	17	.042	1.61E+08
Staurosirella pinnata	14	17	11	13	19	.084	7.53E+08
Staurosira pinnata var. lancettula	0	0	0	1	0	.001	0.00E+00
Stephanodiscus minutulus	1	0	0	0	0	.001	1.79E+07
Synedra minuscula	1	0	0	0	0	.001	1.79E+07
Synedra rumpens	0	0	2	0	0	.002	3.59E+07
Synedra rumpens var. familaris	1	0	0	0	0	.001	1.79E+07
Synedra sp.	0	0	0	0	1	.001	0.00E+00
Tabellaria sp.	0	0.5	0	0	0	.001	8.97E+06
Unknown (raphid)	2	1	1	0	0	.005	7.18E+07
Unknown	1	0	0	1	0	.002	1.79E+07
TOTAL	179.5	228	152	154	164.5	1.000	1.00E+10
Chrysophyte cysts	0	3	0	0	0		5.38E+07
Scenedesmus coenobia	7	1	2	10	5		4.48E+08
Sponge spicule	1	1	0	0	0		3.59E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Proportion	Number/g dry sediment
MB-1B, 11–12 cm						
Achnanthidium minutissima + vars.	0	3	4	7	0.019	6.62E+07
Aulacoseira ambigua	0	0	0	1	.001	0.00E+00
Cocconeis placentula	1	2	0	0	.004	4.73E+07
Cocconeis placentula var. lineata	2	1	2	0	.007	2.84E+07
Cocconeis placentula (RV)	2	0	0	0	.003	6.38E+06
Craticula cuspidata	0	0	1	0	.001	0.00E+00
Cyclotella ocellata	0	1	0	0	.001	2.21E+07
Cymbella angustata	0	2	0	1	.004	4.41E+07
Cymbella cistula	1	0	0	1	.003	3.19E+06
Cymbella sp.	1	0	0	1	.003	3.19E+06
Encyonema silesiacum	0	0	0	2	.003	0.00E+00
Epithemia arcus	0	0	0	1	.001	0.00E+00
Epithemia turgida	3	0	0	1	.005	9.57E+06
Epithemia sp.	0	1.5	0	1	.003	3.31E+07
Fragilaria capucina + vars.	12	4	13	12	.054	1.27E+08
Fragilaria crotonensis	2	0	0	0	.003	6.38E+06
Fragilaria radians	1	0	0	0	.001	3.19E+06
Gomphonema tenellum	1	1	0	3	.007	2.53E+07
Gomphonema truncatum	1	0	0	0	.001	3.19E+06
Gomphonema (GV)	3	0	0	0	.004	9.57E+06
Gomphonema sp.	0	1	0	1	.003	2.21E+07
Navicula lanceolata	1	1	2	0	.005	2.53E+07
Navicula minima	0	3	0	2	.007	6.62E+07
Navicula atomus var. permitis	3	2	2	3	.013	5.37E+07
Navicula pseudoventralis	1	3	2	3	.012	6.94E+07
Navicula glomus	0	2	0	1	.004	4.41E+07
Navicula seminuloides	0	4	3	0	.009	8.82E+07
Navicula (GV) (short)	2	0	0	0	.003	6.38E+06
Navicula sp.	2	0	0	3	.007	6.38E+06
Nitzschia amphibia	3	2	1	2.5	.011	5.37E+07
Nitzschia palea	0	0	0	.5	.001	0.00E+00
Nitzschia sp.	0	.5	0	2.5	.004	1.10E+07
Pseudostaurosira brevistrata + vars.	10	27	41	26	.138	6.28E+08
Sellaphora pupula	0	0	0	1	.001	0.00E+00
Sellaphora rectangularis	0	1	0	0	.001	2.21E+07
Staurosira construens	41	28	64	46	.237	7.49E+08
Staurosira construens var. binodis	6	16	2	8	.042	3.72E+08
Staurosira construens var. venter	22	10	27	51	.146	2.91E+08
Staurosira elliptica	7	16	16	11	.066	3.75E+08
Staurosirella pinnata	28	24	28	27	.142	6.19E+08
Stephanodiscus niagarae	0	0	0	1	.001	0.00E+00
Synedra amphicephala var. austriaca	0	1	0	0	.001	2.21E+07
Synedra rumpens	0	0	1	0	.001	0.00E+00
Synedra rumpens var. familaris	4	3	1	1	.012	7.89E+07
Unknown (raphid)	2	1	0	1	.005	2.84E+07
TOTAL	162	161	210	222.5	1.000	4.07E+09
Scenedesmus coenbia	5	5	1	1		2.21E+08
Tetraedron coenbia	0	0	1	0		0.00E+00
Sponge spicule	0	1	0	1		2.21E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Proportion	Number/g dry sediment
MB-1B, 15–16 cm					
Achnanthidium exiguum	0	1	0	0.002	1.29E+07
Achnanthidium lanceolata	0	1	0	.002	1.29E+07
Achnanthidium (GV)	0	2	0	.004	2.58E+07
Achnanthidium minutissima + vars.	0	7	1	.017	9.03E+07
Amphora ovalis var. affinis	0	0	1	.002	0.00E+00
Aulacoseira ambigua	1	0	0	.002	1.29E+07
Cocconeis placentula var. lineata	1	1	3	.010	2.58E+07
Cocconeis placentula (RV)	1	2	1	.008	3.87E+07
Cyclostephanos sp.	1	0	0	.002	1.29E+07
Cyclotella sp.	0	0	2	.004	0.00E+00
Cymbella angustata	0	0	1	.002	0.00E+00
Cymbella cistula	0	1	0	.002	1.29E+07
Cymbella tumida	0	1	0	.002	1.29E+07
Cymbella sp.	0	2	0	.004	2.58E+07
Epithemia turgida	4	0	0	.008	5.16E+07
Epithemia sp.	0	1	0	.002	1.29E+07
Eunotia flexuosa	0	.5	0	.001	6.45E+06
Fragilaria capucina + vars.	1	13	3	.036	1.81E+08
Fragilaria crotonensis	2	3	0	.010	6.45E+07
Fragilaria (GV) short no central area	0	0	7	.015	0.00E+00
Gomphonema acuminatum	0	1	0	.002	1.29E+07
Gomphonema affine	0	2	0	.004	2.58E+07
Gomphonema affine var insigne	0	1	0	.002	1.29E+07
Gomphonema sphaerophorum	0	0	2	.004	0.00E+00
Gomphonema subtile var. sagitta	1	0	0	.002	1.29E+07
Gomphonema tenellum	0	1	0	.002	1.29E+07
Gomphonema sp.	0	3	0	.006	3.87E+07
Navicula atomus var. permitis	1	6	0	.015	9.03E+07
Navicula glomus	0	1	0	.002	1.29E+07
Navicula minima	0	5	1	.013	6.45E+07
Navicula pseudoventralis	0	1	0	.002	1.29E+07
Navicula radiosafallax	0	1	4	.010	1.29E+07
Navicula tripunctata	0	1	0	.002	1.29E+07
Navicula (GV)	0	8	0	.017	1.03E+08
Navicula sp.	0	8	0	.017	1.03E+08
Nitzschia amphibia	2	4.5	2	.018	8.38E+07
Nitzschia dissipata	0	1	0	.002	1.29E+07
Nitzschia sp.	.5	0	0	.001	6.45E+06
Pinnularia sp.	1	0	0	.002	1.29E+07
Pseudostaurosira brevistrata + vars.	2	7	8	.036	1.16E+08
Rhopalodia gibba	1	0	0	.002	1.29E+07
Sellaphora rectangularis	0	1	0	.002	1.29E+07
Staurosira construens	9	44	53	.222	6.84E+08
Staurosira construens var. binodis	0	3	24	.057	3.87E+07
Staurosira construens var. venter	39	63	12	.239	1.32E+09
Staurosira elliptica	0	14	1	.031	1.81E+08
Staurosirella pinnata	12	45	11	.143	7.35E+08
Staurosirella pinnata var. intercedens	0	2	0	.004	2.58E+07
Synedra acus	0	1	0	.002	1.29E+07
Synedra rumpens var. familaris	0	1	0	.002	1.29E+07
Unknown (raphid)	2	0	3	.010	2.58E+07
Unknown	1	1	1	.006	2.58E+07
TOTAL	82.5	260	134	1	4.42E+09
Chrysophyte scales	0	0			0.00E+00
Chrysophyte cysts	0	1			1.29E+07
Scenedesmus coenobia	0	0	1		1.29E+07
Sponge spicule	0	1	0		1.29E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Proportion	Number/g dry sediment
		MB-1B, 20–21 cm			
Achnanthidium minutissima + vars.	4	3	3	0.020	3.42E+07
Amphora coffeiformis	1	0	0	.002	4.88E+06
Asterionella formosa	1	0	0	.002	4.88E+06
Aulacoseira ambigua	3	1	0	.008	1.95E+07
Aulacoseira VV	0	0	1	.002	0.00E+00
Cocconeis placentula	0	1	0	.002	4.88E+06
Cocconeis placentula var. lineata	3	1	2	.012	1.95E+07
Cocconeis placentula (RV)	2	1	0	.006	1.47E+07
Cyclostephanos sp.	2	0	0	.004	9.77E+06
Cyclotella bodanica var. lemanica	1	0	0	.002	4.88E+06
Cymbella angustata	1	0	1	.004	4.88E+06
Cymbella cuspidata	0	1	0	.002	4.88E+06
Cymbella norvegica	0	1	0	.002	4.88E+06
Cymbella sp.	1	2	0	.006	1.47E+07
Encyonema silesiacum	1	0	0	.002	4.88E+06
Epithemia turgida	1	0	0	.002	4.88E+06
Eunotia incisa	0	0	1	.002	0.00E+00
Eunotia sp.	.5	0	0	.001	2.44E+06
Fragilaria capucina + vars.	4	1	2	.014	2.44E+07
Fragilaria crotonensis	3	0	0	.006	1.47E+07
Geissleria ignota var. palustris	2	0	0	.004	9.77E+06
Gomphonema acuminatum	1	0	0	.002	4.88E+06
Gomphonema affine var. insigne	0	4	0	.008	1.95E+07
Gomphonema parvulum	0	0	1	.002	0.00E+00
Gomphonema tenellum	1	0	2	.006	4.88E+06
Gomphonema (GV)	1	2	0	.006	1.47E+07
Gomphonema sp.	3	0	0	.006	1.47E+07
Navicula lanceolata	3	0	2	.010	1.47E+07
Navicula minima	7	3	0	.020	4.88E+07
Navicula atomus var. permitis	4	4	2	.020	3.91E+07
Navicula pelliculosa	2	5	0	.014	3.42E+07
Navicula pseudoventralis	6	0	1	.014	2.93E+07
Navicula glomus	0	2	1	.006	9.77E+06
Navicula seminuloides	1	0	0	.002	4.88E+06
Navicula tripunctata	3	0	0	.006	1.47E+07
Navicula radiosa var. parva	1	0	0	.002	4.88E+06
Navicula radiosa var. tenella	0	1	0	.002	4.88E+06
Navicula variostriata	1	0	0	.002	4.88E+06
Navicula vitabunda	0	1	0	.002	4.88E+06
Navicula (GV) (short)	4	6	0	.020	4.88E+07
Navicula sp.	2	2	1	.010	1.95E+07
Nitzschia amphibia	.5	4.5	4	.018	2.44E+07
Nitzschia palea	2	0	1	.006	9.77E+06
Nitzschia sp.	0	.5	0	.001	2.44E+06
Pinnularia sp.	0	1	0	.002	4.88E+06
Planothidium lanceolata	1	0	2	.006	4.88E+06
Pseudostaurosira brevistrata + vars.	10	15	8	.065	1.22E+08
Stauroneis sp.	0	1	0	.002	4.88E+06
Staurosira construens	45	14	30	.175	2.88E+08
Staurosira construens var. binodis	5	12	1	.035	8.30E+07
Staurosira construens var. venter	54	36	17	.210	4.40E+08
Staurosira elliptica	9	2	2	.026	5.37E+07
Staurosirella pinnata	40	27	19	.169	3.27E+08
Staurosirella pinnata var. lancettula	0	1	0	.002	4.88E+06
Stephanodiscus hantzschii	4	0	0	.008	1.95E+07
Stephanodiscus medius	1	0	0	.002	4.88E+06
Stephanodiscus minutulus	1	0	0	.002	4.88E+06
Stephanodiscus sp.	1	0	0	.002	4.88E+06
Synedra acus	0	1	0	.002	4.88E+06
Synedra rumpens var. familaris	0	1	1	.004	4.88E+06
Synedra (GV)	1	0	0	.002	4.88E+06
Synedra sp.	1	0	0	.002	4.88E+06
Unknown (raphid)	7	1	0	.016	3.91E+07
TOTAL	246	158	105	1.000	1.97E+09
Chrysophyte cysts	2	1	1		1.95E+07
Scenedesmus coenobia	5	1	0		2.93E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Proportion	Number/g dry sediment
MB-1B, 30–31 cm					
Achnanthidium minutissima + vars.	2	2	3	0.013	1.19E+08
Aulacoseira ambigua	3	1	1	.010	8.51E+07
Cocconeis placentula var. lineata	0	1	1	.004	3.41E+07
Cocconeis placentula (RV)	1	1	0	.004	3.41E+07
Cyclotella bodanica var. lemanica	1	0	0	.002	1.70E+07
Cyclotella glomerata	0	1	0	.002	1.70E+07
Cymbella cistula	0	0	1	.002	1.70E+07
Cymbella sp.	0	2	1	.006	5.11E+07
Encyonema silesiacum	0	2	0	.004	3.41E+07
Epithemia sorex	1	0	1	.004	3.41E+07
Eunotia incisa	2	0	1	.006	5.11E+07
Eunotia sp.	0	0	.5	.001	8.51E+06
Fragilaria capucina + vars.	3	4	1	.015	1.36E+08
Gomphonema angustatum	0	0	1	.002	1.70E+07
Gomphonema subtile	0	1	0	.002	1.70E+07
Gomphonema truncatum	0	0	1	.002	1.70E+07
Gomphonema sp.	1	2	2	.010	8.51E+07
Navicula atomus var. permitis	1	9	10	.038	3.41E+08
Navicula glomus	2	1	2	.010	8.51E+07
Navicula lanceolata	0	0	3	.006	5.11E+07
Navicula minima	1	0	1	.004	3.41E+07
Navicula pelliculosa	4	3	8	.029	2.55E+08
Navicula pseudoventralis	3	0	1	.008	6.81E+07
Navicula radiosafallax	1	0	0	.002	1.70E+07
Navicula seminuloides	3	0	0	.006	5.11E+07
Navicula (GV) (short)	3	4	15	.042	3.75E+08
Navicula sp.	0	1	3	.008	6.81E+07
Neidium iridis	0	0	1	.002	1.70E+07
Nitzschia amphibia	0	0	5	.010	8.51E+07
Nitzschia palea	0	1	0	.002	1.70E+07
Nitzschia sp.	0	0	1	.002	1.70E+07
Pseudostaurosira brevistrata + vars.	4	10	20	.065	5.79E+08
Sellaphora rectangularis	2	0	0	.004	3.41E+07
Staurosira construens	39	16	68	.236	2.09E+09
Staurosira construens var. binodis	28	1	2	.060	5.28E+08
Staurosira construens var. venter	30	14	36	.154	1.36E+09
Staurosira elliptica	7	15	19	.079	6.98E+08
Staurosirella leptostauron var. dubia	0	0	5	.010	8.51E+07
Staurosirella pinnata	30	7	30	.129	1.14E+09
Synedra demerarae	0	0	1	.002	1.70E+07
Synedra rumpens var. familaris	0	0	1	.002	1.70E+07
Synedra sp.	0	0	3	.006	5.11E+07
Unknown (raphid)	0	0	0	.000	0.00E+00
Unknown	0	0	0	.000	0.00E+00
TOTAL	172	99	249.5	1.000	8.86E+09
Chrysophyte cysts	0	0	1		1.70E+07
Scenedesmus coenobia	2	2	5		1.19E+08
Cosmarium coenobia	0	0	1		1.70E+07
Sponge spicule	0	1	2		3.41E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Number 5	Proportion	Number/g dry sediment
MB-1B, 40–41 cm							
Achnanthidium exigua	0	0	0	2	0	0.004	0.00E+00
Achnanthidium minutissima + vars.	4	3	2	7	4	.036	1.67E+07
Asterionella formosa	1	0	0	0	0	.002	2.39E+06
Aulacoseira ambigua	3	0	4	0	0	.013	7.17E+06
Aulacoseira italica	0	0	3	0	0	.005	0.00E+00
Brachysira vitrea	1	0	0	0	0	.002	2.39E+06
Cocconeis placentula var. eugypta	1	0	0	2	0	.005	2.39E+06
Cocconeis placentula var. lineata	1	1	3	0	1	.011	4.78E+06
Cocconeis placentula (RV)	0	0	1	1	1	.005	0.00E+00
Cocconeis placentula	0	0	0	1	2	.005	0.00E+00
Cyclostephanos sp.	0	1	0	1	0	.004	2.39E+06
Caloneis ventricosa var. truncatula	0	0	0	0	2	.004	0.00E+00
Cyclotella delicatula	0	0	0	1	0	.002	0.00E+00
Cyclotella michiganiana	0	0	0	0	1	.002	0.00E+00
Cyclotella sp.	0	1	0	1	0	.004	2.39E+06
Cymbella angustata	0	0	1	0	0	.002	0.00E+00
Cymbella cistula	0	0	0	1	1	.004	0.00E+00
Cymbella hybrida var. lanceolata	2	0	0	0	0	.004	4.78E+06
Cymbella sp.	0	0	0	0	1	.002	0.00E+00
Epithemia arcus	0	0	1	0	0	.002	0.00E+00
Epithemia turgida	3	1	0	0	0	.007	9.56E+06
Epithemia sp.	0	0	0	1	0	.002	0.00E+00
Eunotia flexuosa	0	0	1	0	0	.002	0.00E+00
Eunotia incisa	1	0	0	0	0	.002	2.39E+06
Eunotia pectinalis var. recta	0	0	0	.5	0	.001	0.00E+00
Fragilaria capucina + vars.	2	7	6	10	3	.050	2.15E+07
Fragilaria crotonensis	0	1	1	8	0	.018	2.39E+06
Fragilaria vaucheriae	0	1	0	1	0	.004	2.39E+06
Gomphonema affine	0	1	0	1	0	.004	2.39E+06
Gomphonema sp.	1	0	0	0	0	.002	2.39E+06
Navicula atomus var. permitis	1	4	2	8	6	.038	1.20E+07
Navicula glomus	3	0	1	2	0	.011	7.17E+06
Navicula lanceolata	0	0	3	0	1	.007	0.00E+00
Navicula minima	2	0	0	3	1	.011	4.78E+06
Navicula perparva	1	0	0	0	0	.002	2.39E+06
Navicula pseudoventralis	3	2	0	5	1	.020	1.20E+07
Navicula seminuloides	1	0	1	2	0	.007	2.39E+06
Navicula (GV) (short)	4	4	2	2	6	.032	1.91E+07
Navicula sp.	1	3	0	4	4	.021	9.56E+06
Neidium iridis	0	0	1	0	0	.002	0.00E+00
Nitzschia adapta	0	.5	0	.5	0	.002	1.20E+06
Nitzschia palea	0	0	0	1	0	.002	0.00E+00
Nitzschia sp.	0	0	1	0	0	.002	0.00E+00
Pinnularia sp.	0	0	0	0	1	.002	0.00E+00
Planothidium lanceolata	1	0	0	0	0	.002	2.39E+06
Pseudostaurosira brevistrata + vars.	0	2	3	9	21	.063	4.78E+06
Rhopalodia gibba	0	0	0	.5	0	.001	0.00E+00
Sellaphora rectangularis	0	1	0	0	0	.002	2.39E+06
Stauroneis sp.	0	0	0	0	1	.002	0.00E+00
Staurosira construens	26	8	12	21	59	.225	8.13E+07
Staurosira construens var. binodis	1	0	0	7	0	.014	2.39E+06
Staurosira contruens var. subsalina	0	0	1	0	0	.002	0.00E+00
Staurosira construens var. venter	11	3	18	24	19	.134	3.35E+07
Staurosira elliptica	0	3	1	6	1	.020	7.17E+06
Staurosirella pinnata	11	15	9	15	14	.114	6.22E+07
Staurosirella pinnata var. lancettula	0	0	0	1	0	.002	0.00E+00
Stephanodiscus hantzschii	0	0	0	3	2	.009	0.00E+00
Stephanodiscus niagarae	0	0	0	2	0	.004	0.00E+00
Stephanodiscus parvus	0	0	0	2	0	.004	0.00E+00
Stephanodiscus sp.	0	0	0	6	0	.011	0.00E+00
Synedra acus	0	0	0	1	0	.002	0.00E+00
Synedra demerarae	1	0	0	0	0	.002	2.39E+06
Synedra rumpens var. familaris	0	0	0	2	0	.004	0.00E+00
Synedra ulna	1	0	0	0	0	.002	2.39E+06
Synedra sp.	1	0	0	2	0	.005	2.39E+06
Tabellaria flocculosa str. IIIp	0	0	0	1	0	.002	0.00E+00
Unknown (raphid)	1	0	0	1	1	.005	2.39E+06
Unknown	2	1	2	0	0	.009	7.17E+06
TOTAL	92	63.5	80	169.5	154	1.000	3.72E+08
Chrysophyte cysts	2	0	0	0	0		4.78E+06
Scenedesmus coenobia	4	1	3	1	0		1.20E+07
Tetraedron coenobia	0	0	0	0	2		0.00E+00
Sponge spicule	0	1	0	0	0		2.39E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 45–46 cm				
Achnanthidium lewisiana	1	0	0.002	6.53E+06
Achnanthidium minutissima + vars.	25	13	.074	2.48E+08
Aulacoseira ambigua	2	0	.004	1.31E+07
Aulacoseira italica	0	2	.004	1.31E+07
Aulacoseira subarctica	0	2	.004	1.31E+07
Aulacoseira (VV)	1	0	.002	6.53E+06
Aulacoseira sp.	0	1	.002	6.53E+06
Cocconeis neothumensis	0	1	.002	6.53E+06
Cocconeis placentula	2	0	.004	1.31E+07
Cocconeis placentula var. lineata	2	4	.012	3.92E+07
Cocconeis placentula (RV)	4	2	.012	3.92E+07
Cyclotella glomerata	0	1	.002	6.53E+06
Cyclotella michiganiana	0	1	.002	6.53E+06
Cyclotella ocellata	1	0	.002	6.53E+06
Cymbella angustata	2	1	.006	1.96E+07
Cymbella cuspidata	1	0	.002	6.53E+06
Cymbella hybrida var. lanceolata	2	0	.004	1.31E+07
Cymbella subaequalis	1	0	.002	6.53E+06
Cymbella tumida	1	0	.002	6.53E+06
Cymbella sp.	2	0	.004	1.31E+07
Eunotia incisa	1	1	.004	1.31E+07
Eunotia sp.	.5	0	.001	3.26E+06
Fragilaria capucina + vars.	5	13	.035	1.18E+08
Fragilaria crotonensis	8	0	.015	5.22E+07
Fragilaria oldenburgiana	2	0	.004	1.31E+07
Fragilaria radians	1	0	.002	6.53E+06
Fragilaria vaucheriae	2	3	.010	3.26E+07
Geissleria ignota var. palustris	1	0	.002	6.53E+06
Gomphonema subtile var. sagitta	1	0	.002	6.53E+06
Gomphonema tenellum	5	3	.015	5.22E+07
Gomphonema (GV)	2	0	.004	1.31E+07
Gomphonema sp.	1	0	.002	6.53E+06
Navicula atomus var. permitis	9	12	.041	1.37E+08
Navicula cryptotenella	2	1	.006	1.96E+07
Navicula glomus	3	0	.006	1.96E+07
Navicula lanceolata	3	0	.006	1.96E+07
Navicula minima	5	5	.019	6.53E+07
Navicula perparva	2	2	.008	2.61E+07
Navicula pseudoventralis	8	13	.041	1.37E+08
Navicula seminuloides	5	1	.012	3.92E+07
Navicula (GV) (short)	16	16	.062	2.09E+08
Navicula sp.	3	3	.012	3.92E+07
Neidium sp.	1	0	.002	6.53E+06
Nitzschia dissipata	1	0	.002	6.53E+06
Nitzschia palea	1	0	.002	6.53E+06
Nitzschia sp.	.5	2	.005	1.63E+07
Pinnularia sp.	1	0	.002	6.53E+06
Pseudostaurosira brevistrata + vars.	3	13	.031	1.04E+08
Rhopalodia gibba	.5	0	.001	3.26E+06
Rhopalodia gibba var. parallela	2	0	.004	1.31E+07
Sellaphora pupula	1	0	.002	6.53E+06
Sellaphora rectangularis	1	0	.002	6.53E+06
Stauroneis anceps f. gracilis	1	0	.002	6.53E+06
Stauroneis phoenicenteron f. gracilis	1	0	.002	6.53E+06
Staurosira construens	69	15	.163	5.48E+08
Staurosira construens var. venter	10	85	.184	6.20E+08
Staurosira elliptica	2	7	.017	5.88E+07
Staurosirella leptostauron var. dubia	2	2	.008	2.61E+07
Staurosirella pinnata	18	23	.079	2.68E+08
Stephanodiscus niagarae	0	1	.002	6.53E+06
Synedra acus	0	1	.002	6.53E+06
Synedra amphicephala var. austriaca	1	0	.002	6.53E+06
Synedra rumpens	1	0	.002	6.53E+06
Synedra rumpens var. familaris	2	2	.008	2.61E+07
Synedra (GV)	4	0	.008	2.61E+07
Synedra sp.	1	0	.002	6.53E+06
Tabellaria (central area)	0	1	.002	6.53E+06
Tabularia fasciculata	1	0	.002	6.53E+06
Unknown (raphid)	1	2	.006	1.96E+07
Unknown	3	0	.006	1.96E+07
TOTAL	261.5	255 3	1.000	3.37E+09
Chrysophyte scales	1	1		1.31E+07
Chrysophyte cysts	0	3		1.96E+07
Scenedesmus coenobia	7	2		5.88E+07
Tetraedron coenobia	0	1		6.53E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Number 5	Proportion	Number/g dry sediment
MB-1B, 50–52 cm							
Achnanthidium minutissima + vars.	9	9	28	11	18	0.100	7.59E+07
Amphora ovalis var. affinis	1	0	0	0	2	.004	4.22E+06
Amphora perpusilla	0	1	0	0	0	.001	4.22E+06
Amphipleura pellucida	0	0	.5	0	0	.001	0.00E+00
Asterionella formosa	0	0	1	0	0	.001	0.00E+00
Aulacoseira ambigua	0	0	1	0	9	.013	0.00E+00
Aulacoseira italica	1	0	0	0	4	.007	4.22E+06
Aulacoseira subarctica	0	0	2	0	0	.003	0.00E+00
Aulacoseira (VV)	0	0	0	1	2	.004	0.00E+00
Aulacoseira sp.	0	1	0	0	0	.001	4.22E+06
Brachysira vitrea	0	0	2	0	0	.003	0.00E+00
Cocconeis placentula	0	0	0	1	0	.001	0.00E+00
Cocconeis placentula var. eugypta	0	1	0	0	0	.001	4.22E+06
Cocconeis placentula var. lineata	0	0	0	4	2	.008	0.00E+00
Cocconeis placentula (RV)	1	1	1	0	0	.004	8.43E+06
Craticula cuspidata	1	0	0	0	0	.001	4.22E+06
Cyclotella bodanica var. lemanica	0	0	0	0	1	.001	0.00E+00
Cyclotella glomerata	1	0	1	0	0	.003	4.22E+06
Cyclotella michiganiana	0	0	0	0	2	.003	0.00E+00
Cyclotella ocellata	0	0	0	0	1	.001	0.00E+00
Cyclotella stelligera	0	0	0	1	1	.003	0.00E+00
Cymbella angustata	0	3	1	0	1	.007	1.26E+07
Cymbella cistula	0	0	0	0	1	.001	0.00E+00
Cymbella minuta	0	0	1	0	0	.001	0.00E+00
Cymbella sp.	0	1	0	0	1	.003	4.22E+06
Encyonema silesiacum	0	0	1	1	0	.003	0.00E+00
Epithemia sp.	0	0	0	0	1	.001	0.00E+00
Epithemia turgida	0	0	3	1	0	.005	0.00E+00
Eunotia incisa	0	.5	0	1	.5	.003	2.11E+06
Eunotia pectinalis	0	0	0	0	1.5	.002	0.00E+00
Eunotia soleirolii	0	0	2	0	0	.003	0.00E+00
Eunotia sp.	2	0	0	0	2.5	.006	8.43E+06
Fragilaria capucina + vars.	2	2	2	10	5	.028	1.69E+07
Fragilaria crotonensis	0	3	0	10	0	.017	1.26E+07
Fragilaria vaucheriae	0	0	0	1	2	.004	0.00E+00
Gomphonema affine var. insigne	0	0	0	1	0	.001	0.00E+00
Gomphonema tenellum	0	0	3	3	2	.011	0.00E+00
Gomphonema (GV)	0	3	0	0	2	.007	1.26E+07
Gomphonema sp.	1	1	1	0	0	.004	8.43E+06
Karayevia exigua	1	1	0	1	1	.005	8.43E+06
Navicula atomus var. permitis	5	13	12	20	26	.102	7.59E+07
Navicula explanata	0	1	0	0	0	.001	4.22E+06
Navicula glomus	1	4	2	2	9	.024	2.11E+07
Navicula lanceolata	0	0	0	3	1	.005	0.00E+00
Navicula minima	5	0	8	3	3	.025	2.11E+07
Navicula perparva	0	1	1	3	2	.009	4.22E+06
Navicula pseudoventralis	2	4	13	11	8	.051	2.53E+07
Navicula radiosa	0	0	0	1	0	.001	0.00E+00
Navicula radiosafallax	0	2	0	0	2	.005	8.43E+06
Navicula seminuloides	4	0	3	2	2	.015	1.69E+07
Navicula ventralis	1	0	0	0	0	.001	4.22E+06
Navicula (GV) (short)	4	5	16	17	21	.084	3.79E+07
Navicula sp.	0	1	4	2	2	.012	4.22E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Number 5	Proportion	Number/g dry sediment
MB-1B, 50–52 cm—Continued							
Nitzschia amphibia	2	2	0	0	1	.007	1.69E+07
Nitzschia adapta	0	1	0	0	0	.001	4.22E+06
Nitzschia palea	0	0	0	3	3	.008	0.00E+00
Nitzschia sp.	0	0	1	0	2.5	.005	0.00E+00
Pinnularia sp.	0	0	2	0	1	.004	0.00E+00
Planothidium lanceolata	0	0	0	0	2	.003	0.00E+00
Pseudostaurosira brevistrata + vars.	5	4	8	8	4	.039	3.79E+07
Rhopalodia gibba	0	0	0	.5	.5	.001	0.00E+00
Sellaphora pupula	0	0	0	1	0	.001	0.00E+00
Sellaphora rectangularis	0	0	0	2	2	.005	0.00E+00
Stauroneis sp.	0	0	0	1	0	.001	0.00E+00
Staurosira construens	14	6	4	6	12	.056	8.43E+07
Staurosira construens var. binodis	0	0	0	0	4	.005	0.00E+00
Staurosira construens var. venter	13	11	13	2	21	.080	1.01E+08
Staurosira elliptica	0	4	7	7	12	.040	1.69E+07
Staurosirella leptostauron var. dubia	0	0	2	2	1	.007	0.00E+00
Staurosirella pinnata	6	3	12	15	23	.079	3.79E+07
Stephanodiscus minutulus	0	0	0	1	0	.001	0.00E+00
Synedra acus	0	0	0	0	1	.001	0.00E+00
Synedra minuscula	0	0	0	2	1	.004	0.00E+00
Synedra rumpens var. familaris	1	3	1	1	4	.013	1.69E+07
Synedra (GV)	0	0	0	2	3	.007	0.00E+00
Synedra sp.	0	0	1	0	0	.001	0.00E+00
Tabellaria fenestrata	0	0	0	0	1	.001	0.00E+00
Unknown (raphid)	2	0	2	0	2	.008	8.43E+06
Unknown	1	0	0	3	0	.005	4.22E+06
TOTAL	86	92.5	162.5	167.5	239.5	1.000	7.53E+08
Chrysophyte cysts	0	3	0	0	0		1.26E+07
Scenedesmus coenobia	1	0	2	0	4		4.22E+06
Zooplankton parts	0	0	0	0	1		0.00E+00
Sponge spicule	0	1	0	2	1		4.22E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Proportion	Number/g dry sediment
MB-1B, 60–62 cm					
Achnanthidium minutissima + vars.	19	7	23	0.095	1.46E+08
Asterionella formosa	1	0	0	.002	2.97E+06
Aulacoseira ambigua	5	0	11	.031	4.75E+07
Aulacoseira granulata	0	3	0	.006	8.91E+06
Aulacoseira italica	0	2	1	.006	8.91E+06
Aulacoseira (VV)	1	0	0	.002	2.97E+06
Brachysira vitrea	2	0	2	.008	1.19E+07
Cocconeis placentula var. lineata	1	0	0	.002	2.97E+06
Cyclotella glomerata	1	1	2	.008	1.19E+07
Cyclotella stelligera	3	0	0	.006	8.91E+06
Cyclotella sp.	0	0	1	.002	2.97E+06
Cymbella angustata	1	0	2	.006	8.91E+06
Cymbella cistula	0	0	4	.008	1.19E+07
Cymbella tumida	1	0	0	.006	8.91E+06
Cymbella sp.	0	0	4	.002	2.97E+06
Encyonema silesiacum	1	0	2	.008	1.19E+07
Eunotia incisa	2	0	0	.004	5.94E+06
Eunotia flexuosa	0	0	.5	.001	1.49E+06
Eunotia sp.	0	0	1.5	.003	4.46E+06
Fragilaria capucina + vars.	4	8	3	.029	4.46E+07
Fragilaria crotonensis	0	2	5	.014	2.08E+07
Fragilaria radians	0	0	1	.029	4.46E+07
Fragilaria vaucheriae	0	1	0	.002	2.97E+06
Geissleria ignota var. palustris	1	0	0	.002	2.97E+06
Gomphonema affine	1	0	0	.002	2.97E+06
Gomphonema subtile	0	1	1	.004	5.94E+06
Gomphonema tenellum	2	2	1	.010	1.49E+07
Gomphonema (GV)	3	6	3	.023	3.56E+07
Gomphonema sp.	3	1	1	.010	1.49E+07
Navicula atomus var. permitis	10	14	36	.116	1.78E+08
Navicula glomus	1	0	4	.010	1.49E+07
Navicula lanceolata	0	0	2	.004	5.94E+06
Navicula laterostrata	0	0	2	.004	5.94E+06
Navicula minima	7	2	6	.029	4.46E+07
Navicula pelliculosa	0	5	22	.052	8.02E+07
Navicula pseudoventralis	7	3	10	.039	5.94E+07
Navicula seminuloides	6	0	0	.012	1.78E+07
Navicula (GV) (short)	18	6	22	.089	1.37E+08
Navicula sp.	3	0	7	.019	2.97E+07
Neidium iridis	0	0	1	.002	2.97E+06
Nitzschia amphibia	0.5	2	0	.005	7.43E+06
Nitzschia sp.	0	1	6	.014	2.08E+07
Pinnularia sp.	1	0	0	.002	2.97E+06
Planothidium lanceolata	1	0	0	.002	2.97E+06
Pseudostaurosira brevistrata + vars.	12	0	10	.043	6.53E+07
Sellaphora rectangularis	0	2	0	.004	5.94E+06
Staurosira construens	8	6	14	.054	8.32E+07
Staurosira construens var. venter	11	4	10	.048	7.43E+07
Staurosira elliptica	1	2	5	.016	2.38E+07
Staurosirella leptostauron var. dubia	1	3	11	.029	1.07E+08
Staurosirella pinnata	26	6	4	.070	2.97E+06
Stephanodiscus medius	0	0	1	.004	5.94E+06
Synedra acus	0	1	1	.004	5.94E+06
Synedra minuscula	0	0	2	.002	2.97E+06
Synedra rumpens var. familaris	0	0	2	.004	5.94E+06
Synedra ulna	0	0	2	.004	5.94E+06
Synedra (GV)	0	0	1	.002	2.97E+06
Tabellaria (central area)	0	0	1	.002	2.97E+06
Unknown (raphid)	1	2	2	.010	1.49E+07
Unknown	3	0	0	.006	8.91E+06
TOTAL	169.5	93	253	1.000	1.53E+09
Chrysophyte cysts	1	0	5		1.78E+07
Scenedesmus coenobia	2	2	5		2.67E+07
Sponge spicule	0	0	1		2.97E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 62–64 cm				
Achnanthidium exigua	1	0	0.002	5.27E+06
Achnanthidium minutissima + vars.	21	28	.090	2.58E+08
Asterionella formosa	1	0	.002	5.27E+06
Aulacoseira ambigua	4	4	.015	5.27E+07
Aulacoseira granulata	2	0	.004	1.05E+07
Aulacoseira (VV)	1	1	.004	0.00E+00
Aulacoseira sp.	1	0	.002	5.27E+06
Brachysira vitrea	3	2	.009	2.64E+07
Cocconeis placentula var. lineata	0	1	.002	1.05E+07
Cocconeis placentula (RV)	1	0	.002	0.00E+00
Craticula cuspidata	0	1	.002	5.27E+06
Cyclotella stelligera	0	1	.002	5.27E+06
Cymbella angustata	2	1	.006	1.58E+07
Cymbella minuta	1	0	.002	5.27E+06
Cymbella sp.	0	2	.004	1.05E+07
Epithemia arcus	1	0	.002	5.27E+06
Epithemia sp.	0	2	.004	1.05E+07
Eunotia incisa	.5	2.5	.006	1.58E+07
Eunotia pectinalis	0	1.5	.003	7.91E+06
Eunotia sp.	0	.5	.001	2.64E+06
Fragilaria capucina + vars.	14	4	.033	9.49E+07
Fragilaria crotonensis	0	10	.018	5.27E+07
Fragilaria vaucheriae	2	2	.007	2.11E+07
Geissleria ignota var. palustris	2	1	.006	1.58E+07
Gomphonema subclavatum var. commutatum	2	0	.004	1.05E+07
Gomphonema tenellum	2	3	.009	2.64E+07
Gomphonema truncatum	0	2	.004	1.05E+07
Gomphonema (GV)	4	0	.007	2.11E+07
Gomphonema sp.	0	3	.006	1.58E+07
Navicula atomus var. permitis	32	24	.103	3.32E+08
Navicula cryptotenella	1	0	.002	5.27E+06
Navicula glomus	2	4	.011	3.16E+07
Navicula lanceolata	0	5	.009	2.64E+07
Navicula minima	8	10	.033	1.03E+08
Navicula muralis	0	2	.004	0.00E+00
Navicula pelliculosa	6	13	.035	1.09E+08
Navicula pseudoventralis	9	13	.041	1.26E+08
Navicula radiosafallax	1	0	.002	5.27E+06
Navicula seminuloides	2	1	.006	1.58E+07
Navicula tripunctata	2	0	.004	1.05E+07
Navicula (GV) (short)	4	6	.018	5.27E+07
Navicula sp.	9	4	.024	6.85E+07
Neidium sp.	0	1	.002	5.27E+06
Nitzschia palea	1	0	.002	5.27E+06
Nitzschia sp.	4.5	4	.016	4.48E+07
Planothidium lanceolata	2	0	.004	1.05E+07
Pseudostaurosira brevistrata + vars.	16	12	.052	1.48E+08
Sellaphora pupula	1	0	.002	5.27E+06
Sellaphora rectangularis	0	1	.002	5.27E+06
Stauroneis recondita	0	1	.002	5.27E+06
Stauroneis sp.	0	1	.002	5.27E+06
Staurosira construens	38	41	.146	4.17E+08
Staurosira construens var. venter	21	12	.061	1.74E+08
Staurosira elliptica	12	11	.042	1.21E+08
Staurosirella leptostauron var. dubia	0	4	.007	2.11E+07
Staurosirella pinnata	25	25	.092	2.64E+08
Staurosirella pinnata var. lancettula	2	2	.007	2.11E+07
Stephanodiscus minutulus	1	0	.002	5.27E+06
Stephanodiscus niagarae	1	0	.002	5.27E+06
Synedra acus	0	1	.002	5.27E+06
Synedra rumpens var. familaris	1	1	.004	1.05E+07
Synedra ulna	1	0	.002	5.27E+06
Tabellaria (central area)	1	0	.002	5.27E+06
Unknown (raphid)	2	0	.004	1.05E+07
TOTAL	271	271.5	1.000	2.91E+09
Chrysophyte cysts	1	1		1.05E+07
Scenedesmus coenobia	3	1		2.11E+07
Sponge spicule	0	1		5.27E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 64–66 cm				
Achnanthidium exiguum	2	0	0.004	1.39E+07
Achnanthidium minutissima + vars.	22	27	.094	3.40E+08
Achnanthidium sp.	0	1	.002	6.95E+06
Asterionella formosa	0	2	.004	1.39E+07
Aulacoseira ambigua	9	3	.023	8.33E+07
Aulacoseira subarctica	0	1	.002	6.95E+06
Aulacoseira sp.	1	1	.004	1.39E+07
Brachysira vitrea	1	1	.004	1.39E+07
Brachysira sp.	2	0	.004	1.39E+07
Cocconeis placentula var. lineata	4	1	.010	3.47E+07
Cocconeis placentula (RV)	0	1	.002	6.95E+06
Cyclotella glomerata	1	4	.010	3.47E+07
Cymbella angustata	2	1	.006	2.08E+07
Cymbella cistula	1	3	.008	2.78E+07
Cymbella cymbiformis	0	2	.004	1.39E+07
Cymbella naviculiformis	2	0	.004	1.39E+07
Cymbella sp.	1	2	.006	2.08E+07
Epithemia arcus	0	1	.002	6.95E+06
Eunotia incisa	.5	1	.003	1.04E+07
Eunotia pectinalis	0	1	.002	6.95E+06
Eunotia sp.	0	6	.012	4.17E+07
Fragilaria capucina + vars.	4	6	.019	6.95E+07
Fragilaria crotonensis	5	9	.027	9.72E+07
Fragilaria vaucheriae	1	0	.002	6.95E+06
Geissleria ignota var. palustris	0	1	.002	6.95E+06
Gomphonema acuminatum	0	1	.002	6.95E+06
Gomphonema tenellum	0	1	.002	6.95E+06
Gomphonema (GV)	6	8	.027	9.72E+07
Gomphonema sp.	1	1	.004	1.39E+07
Navicula atomus var. permitis	19	12	.059	2.15E+08
Navicula cryptotenella	2	1	.006	2.08E+07
Navicula explanata	1	0	.002	6.95E+06
Navicula glomus	0	3	.006	2.08E+07
Navicula lanceolata	5	1	.012	4.17E+07
Navicula minima	8	7	.029	1.04E+08
Navicula perparva	2	3	.010	3.47E+07
Navicula pseudoventralis	8	13	.040	1.46E+08
Navicula seminuloides	0	1	.002	6.95E+06
Navicula tripunctata	6	0	.012	4.17E+07
Navicula (GV) (short)	1	4	.010	3.47E+07
Navicula sp.	6	11	.033	1.18E+08
Neidium sp.	0	1	.002	6.95E+06
Nitzschia palea	.5	0	.001	3.47E+06
Nitzschia sp.	2	4	.012	4.17E+07
Pinnularia sp.	1	0	.002	6.95E+06
Planothidium lanceolata	1	0	.002	6.95E+06
Pseudostaurosira brevistrata + vars.	8	3	.021	7.64E+07
Rhopalodia gibba	.5	0	.001	3.47E+06
Sellaphora rectangularis	0	2	.004	1.39E+07
Sellaphora seminulum	0	2	.004	1.39E+07
Staurosira construens	57	26	.159	5.77E+08
Staurosira construens var. binodis	7	0	.013	4.86E+07
Staurosira construens var. venter	32	26	.111	4.03E+08
Staurosira elliptica	20	6	.050	1.81E+08
Staurosirella pinnata	6	32	.073	2.64E+08
Staurosirella pinnata var. lancettula	2	0	.004	1.39E+07
Synedra rumpens var. familaris	2	0	.004	1.39E+07
Synedra (GV)	0	2	.004	1.39E+07
Synedra sp.	1	1	.004	1.39E+07
Tabellaria (central area)	0	1	.002	6.95E+06
Unknown (raphid)	2	2	.008	2.78E+07
Unknown	2	4	.012	4.17E+07
TOTAL	267.5	254	1.000	3.62E+09
Chrysophyte cysts	2	1		2.08E+07
Scenedesmus coenobia	5	2		4.86E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 66–68 cm				
Achnanthidium exiguum	2	0	0.004	1.22E+07
Achnanthidium lewisiana	1	0	.002	6.11E+06
Achnanthidium minutissima + vars.	39	28	.123	4.09E+08
Aulacoseira ambigua	0	8	.015	4.89E+07
Caloneis ventricosa	0	2	.004	1.22E+07
Cocconeis placentula	1	2	.005	1.83E+07
Cyclotella glomerata	0	1	.002	6.11E+06
Cyclotella stelligera	2	1	.005	1.83E+07
Cyclotella sp.	3	1	.007	2.44E+07
Cymbella angustata	1	3	.007	2.44E+07
Cymbella cuspidata	1	0	.002	6.11E+06
Cymbella hebridica	0	1	.002	6.11E+06
Cymbella subaequalis	1	1	.004	1.22E+07
Cymbella sp.	2	1	.005	1.83E+07
Encyonema silesiacum	1	1	.004	1.22E+07
Epithemia turgida	1	0	.002	6.11E+06
Epithemia sp.	3	0	.005	1.83E+07
Eunotia praerupta	1	0	.002	6.11E+06
Eunotia sp.	.5	0	.001	3.06E+06
Fragilaria capucina + vars.	1	1	.004	1.22E+07
Fragilaria crotonensis	0	2	.004	1.22E+07
Geissleria ignota var. palustris	3	1	.007	2.44E+07
Gomphonema acuminatum	1	2	.005	1.83E+07
Gomphonema consector	0	3	.005	1.83E+07
Gomphonema gracile	2	1	.005	1.83E+07
Gomphonema subclavatum var. commutatum	2	0	.004	1.22E+07
Gomphonema (GV)	6	0	.011	3.67E+07
Gomphonema sp.	0	3	.005	1.83E+07
Navicula atomus var. permitis	34	35	.126	4.22E+08
Navicula glomus	2	1	.005	1.83E+07
Navicula lanceolata	1	6	.013	4.28E+07
Navicula minima	18	12	.055	1.83E+08
Navicula pelliculosa	6	5	.020	6.72E+07
Navicula pseudoventralis	12	19	.057	1.89E+08
Navicula seminuloides	6	3	.016	5.50E+07
Navicula tripunctata	0	2	.004	1.22E+07
Navicula (GV) (short)	16	6	.040	1.34E+08
Navicula sp.	6	17	.042	1.41E+08
Nitzschia amphibia	2	2	.007	2.44E+07
Nitzschia palea	1	0	.002	6.11E+06
Pinnularia cuneicephala	0	1	.002	6.11E+06
Pseudostaurosira brevistrata + vars.	10	4	.026	8.55E+07
Rhopalodia gibba	0	1	.002	6.11E+06
Sellaphora bacillum	0	1	.002	6.11E+06
Sellaphora pupula	1	0	.002	6.11E+06
Sellaphora mutata	0	2	.004	1.22E+07
Sellaphora rectangularis	2	2	.007	2.44E+07
Staurosira construens	14	29	.079	2.63E+08
Staurosira construens var. venter	12	21	.060	2.02E+08
Staurosira elliptica	23	19	.077	2.57E+08
Staurosirella leptostauron	0	1	.002	6.11E+06
Staurosirella leptostauron var. dubia	1	0	.002	6.11E+06
Staurosirella pinnata	23	14	.068	2.26E+08
Stephanodiscus minutulus	0	1	.002	6.11E+06
Synedra rumpens	1	0	.002	6.11E+06
Synedra rumpens var. familaris	2	2	.007	2.44E+07
Tabellaria fenestrata	0	1	.002	6.11E+06
Tabellaria flocculosa str. IIIp	0	1	.002	6.11E+06
Tabellaria sp.	0	1	.002	6.11E+06
Unknown (raphid)	1	1	.004	1.22E+07
Unknown	3	1	.007	2.44E+07
TOTAL	271.5	274	1.000	3.33E+09
Chrysophyte cysts	3	5		4.89E+07
Scenedesmus coenobia	8	7		9.17E+07
Pediastrum coenobia	0	2		1.22E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 70–72 cm				
Achnanthidium exiguum	3	0	0.005	1.17E+07
Achnanthidium minutissima + vars.	18	17	.061	1.36E+08
Aulacoseira ambigua	4	3	.012	2.73E+07
Aulacoseira (VV)	0	1	.002	3.89E+06
Cocconeis placentula (RV)	0	1	.002	3.89E+06
Caloneis ventricosa	1	0	.002	3.89E+06
Cyclotella bodanica var. lemanica	0	1	.002	3.89E+06
Cyclotella comensis	1	0	.002	3.89E+06
Cyclotella glomerata	2	0	.003	7.79E+06
Cyclotella stelligera	2	0	.003	7.79E+06
Cymbella angustata	1	0	.002	3.89E+06
Cymbella sp.	1	1	.003	7.79E+06
Epithemia turgida	0	1	.002	3.89E+06
Eunotia praerupta	0	1	.002	3.89E+06
Fragilaria capucina + vars.	3	5	.014	3.11E+07
Fragilaria cf. oldenburgiana	1	0	.002	3.89E+06
Fragilaria radians	0	1	.002	3.89E+06
Fragilaria vaucheriae	1	1	.003	7.79E+06
Geissleria ignota var. palustris	2	0	.003	7.79E+06
Gomphonema gracile	1	0	.002	3.89E+06
Gomphonema truncatum	0	1	.002	3.89E+06
Gomphonema (GV)	3	0	.005	1.17E+07
Gomphonema sp.	0	3	.005	1.17E+07
Navicula atomus var. permitis	36	28	.111	2.49E+08
Navicula explanata	0	1	.002	3.89E+06
Navicula glomus	4	10	.024	5.45E+07
Navicula lanceolata	1	2	.005	1.17E+07
Navicula latelongitudinalis	0	1	.002	3.89E+06
Navicula minima	9	8	.030	6.62E+07
Navicula pelliculosa	11	15	.045	1.01E+08
Navicula pseudoventralis	28	15	.075	1.67E+08
Navicula seminuloides	1	0	.002	3.89E+06
Navicula tripunctata	1	1	.003	7.79E+06
Navicula (GV) (short)	45	10	.096	2.14E+08
Navicula sp.	3	3	.010	2.34E+07
Nitzschia amphibia	0	3	.005	1.17E+07
Nitzschia palea	2	1	.005	1.17E+07
Nitzschia sp.	1	0	.002	3.89E+06
Pinnularia sp.	1	4	.009	1.95E+07
Pseudostaurosira brevistrata + vars.	29	22	.089	1.99E+08
Sellaphora rectangularis	1	1	.003	7.79E+06
Sellaphora seminulum	2	1	.005	1.17E+07
Sellaphora vitabunda	0	2	.003	7.79E+06
Staurosira construens	16	39	.096	2.14E+08
Staurosira construens var. venter	25	20	.078	1.75E+08
Staurosira elliptica	15	19	.059	1.32E+08
Staurosirella leptostauron var. dubia	2	2	.007	1.56E+07
Staurosirella pinnata	14	3	.030	6.62E+07
Staurosirella pinnata var. lancettula	4	2	.010	2.34E+07
Stephanodiscus niagarae	0	2	.003	7.79E+06
Synedra parasitica	2	0	.003	7.79E+06
Synedra rumpens	2	0	.003	7.79E+06
Synedra rumpens var. familaris	2	1	.005	1.17E+07
Synedra ulna	1	0	.002	3.89E+06
Synedra (GV)	0	1	.002	3.89E+06
Tabellaria fenestrata	0	2	.003	7.79E+06
Unknown (raphid)	1	1	.003	7.79E+06
Unknown	0	1	.002	3.89E+06
TOTAL	308	266	1.000	2.23E+09
Chrysophyte scales	1	1		7.79E+06
Chrysophyte cysts	1	1		7.79E+06
Scenedesmus coenobia	1	5		2.34E+07
Sponge spicule	1	0		3.89E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Number 3	Number 4	Proportion	Number/g dry sediment
MB-1B, 80–82 cm						
Achnanthidium exiguum	1	0	0	1	0.001	0.00E+00
Achnanthidium minutissima + vars.	6	9	17	32	.047	5.85E+07
Asterionella formosa	0	1	0	1	.001	2.25E+06
Asterionella ralfsii var. americana	0	0	0	0	.000	0.00E+00
Aulacoseira ambigua	1	5	3	9	.013	1.80E+07
Brachysira vitrea	0	2	0	2	.003	4.50E+06
Cocconeis placentula var. lineata	0	1	0	1	.001	2.25E+06
Cyclotella glomerata	0	2	0	2	.003	4.50E+06
Cyclotella sp.	2	0	0	2	.003	0.00E+00
Cymbella angustata	0	1	1	2	.003	4.50E+06
Cymbella cistula	2	1	1	4	.006	4.50E+06
Cymbella sp.	1	2	0	3	.004	4.50E+06
Encyonema silesiacum	0	1	1	2	.003	4.50E+06
Epithemia sorex	0	0	2	2	.003	4.50E+06
Epithemia turgida	0	0	4	4	.006	9.00E+06
Eunotia praerupta	3	0	1.5	5	.007	3.38E+06
Eunotia sp.	0	1	.5	2	.002	3.38E+06
Fragilaria capucina + vars.	6	8	10	24	.035	4.05E+07
Fragilaria crotonensis	0	3	0	3	.004	6.75E+06
Fragilaria vaucheriae	2	0	0	2	.003	0.00E+00
Geissleria ignota var. palustris	0	3	0	3	.004	6.75E+06
Gomphonema acuminatum	0	2	0	2	.003	4.50E+06
Gomphonema consector	1	0	1	2	.003	2.25E+06
Gomphonema gracile	1	2	3	6	.009	1.13E+07
Gomphonema parvulum f. micropus	0	0	1	1	.001	2.25E+06
Gomphonema tenellum	2	4	1	7	.010	1.13E+07
Gomphonema truncatum	2	0	0	2	.003	0.00E+00
Gomphonema pseudosphaerophorum	0	0	1	1	.001	2.25E+06
Gomphonema sp.	2	2	7	11	.016	2.03E+07
Navicula atomus var. permitis	31	26	41	98	.144	1.51E+08
Navicula cryptotenella	0	0	1	1	.001	2.25E+06
Navicula glomus	5	1	6	12	.018	1.58E+07
Navicula lanceolata	6	4	3	13	.019	1.58E+07
Navicula minima	12	2	11	25	.037	2.93E+07
Navicula pelliculosa	8	11	13	32	.047	5.40E+07
Navicula pseudoventralis	10	6	27	43	.063	7.43E+07
Navicula seminuloides	0	1	0	1	.001	2.25E+06
Navicula tripunctata	0	1	3	4	.006	9.00E+06
Navicula (GV) (short)	6	18	15	39	.057	7.43E+07
Navicula sp.	1	5	6	12	.018	2.48E+07
Neidium iridis	0	0	1	1	.001	2.25E+06
Nitzschia amphibia	0	3	1	4	.006	9.00E+06
Nitzschia palea	.5	2	2.5	5	.007	1.01E+07
Nitzschia sp.	0	1	5	6	.009	1.35E+07
Pseudostaurosira brevistrata + vars.	4	20	4	28	.041	5.40E+07
Rhopalodia gibberula var. vanheurckii	0	1	0	1	.001	2.25E+06
Sellaphora pupula	0	0	1	1	.001	2.25E+06
Sellaphora rectangularis	0	0	1	1	.001	2.25E+06
Sellaphora vitabunda	2	0	2	4	.006	4.50E+06
Stauroneis phoenicenteron f. gracilis	1	0	0	1	.001	0.00E+00
Stauroneis sp.	1	0	0	1	.001	0.00E+00
Staurosira construens	6	34	9	49	.072	9.68E+07
Staurosira construens var. venter	8	47	10	65	.095	1.28E+08
Staurosira elliptica	16	15	20	51	.075	7.88E+07
Staurosirella leptostauron	0	1	0	1	.001	2.25E+06
Staurosirella pinnata	8	13	7	28	.041	4.50E+07
Synedra rumpens	1	2	1	4	.006	6.75E+06
Synedra rumpens var. familaris	1	1	2	4	.006	6.75E+06
Synedra (GV)	0	0	2	2	.003	4.50E+06
Tabellaria fenestrata	1	0	1	2	.003	2.25E+06
Tabellaria (central area)	1	0	0	1	.001	0.00E+00
Unknown (raphid)	1	0	2	3	.004	4.50E+06
Unknown	0	2	0	2	.003	4.50E+06
TOTAL	162.5	267	252.5	682	1.000	1.17E+09
Chrysophyte cysts	1	2	1	4		6.75E+06
Scenedesmus coenobia	2	7	5	14		2.70E+07
Sponge spicule	1	1	0	2		2.25E+06
Zooplankton parts	1	1	0	2		2.25E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-1B, 90–92 cm				
Achnanthidium exiguum	0	3	0.006	9.09E+06
Achnanthidium minutissima + vars.	8	13	.041	6.36E+07
Amphora ovalis var. affinis	0	1	.002	3.03E+06
Asterionella formosa	0	1	.002	3.03E+06
Aulacoseira ambigua	1	0	.002	3.03E+06
Aulacoseira (VV)	2	0	.004	6.06E+06
Brachysira vitrea	2	0	.004	6.06E+06
Cocconeis placentula var. lineata	1	1	.004	6.06E+06
Cocconeis placentula	1	0	.002	3.03E+06
Cyclotella atomus	1	0	.002	3.03E+06
Cyclotella bodanica var. lemanica	1	0	.002	3.03E+06
Cyclotella michiganiana	2	0	.004	6.06E+06
Cyclotella stelligera	0	1	.002	3.03E+06
Cymbella angustata	1	2	.006	9.09E+06
Cymbella cistula	0	1	.002	3.03E+06
Cymbella cuspidata	1	0	.002	3.03E+06
Cymbella sp.	0	4	.008	1.21E+07
Encyonema silesiacum	5	1	.012	1.82E+07
Epithemia arcus	1	0	.002	3.03E+06
Eunotia incisa	0	2.5	.005	7.58E+06
Eunotia arcus	1	0	.002	3.03E+06
Eunotia praerupta	0	.5	.001	1.52E+06
Eunotia sp.	.5	2	.005	7.58E+06
Fragilaria capucina + vars.	0	3	.006	9.09E+06
Fragilaria vaucheriae	0	3	.006	9.09E+06
Geissleria ignota var. palustris	2	2	.008	1.21E+07
Gomphonema consector	1	0	.002	3.03E+06
Gomphonema gracile	4	3	.014	2.12E+07
Gomphonema subtile var. sagitta	1	0	.002	3.03E+06
Gomphonema truncatum	1	0	.002	3.03E+06
Gomphonema (GV)	2	0	.004	6.06E+06
Gomphonema sp.	1	2	.006	9.09E+06
Navicula atomus var. permitis	24	36	.118	1.82E+08
Navicula glomus	0	2	.004	6.06E+06
Navicula graciloides	0	1	.002	3.03E+06
Navicula lanceolata	4	3	.014	2.12E+07
Navicula latelongitudinalis	0	3	.006	9.09E+06
Navicula minima	5	11	.032	4.85E+07
Navicula pelliculosa	18	5	.045	6.97E+07
Navicula pseudoventralis	9	8	.034	5.15E+07
Navicula radiosa	1	0	.002	3.03E+06
Navicula radiosafallax	1	0	.002	3.03E+06
Navicula tripunctata	0	1	.002	3.03E+06
Navicula viridula	1	0	.002	3.03E+06
Navicula (GV) (short)	18	18	.071	1.09E+08
Navicula sp.	10	8	.036	5.46E+07
Nitzschia amphibia	0	2.5	.005	7.58E+06
Nitzschia fonticola	1	1	.004	6.06E+06
Nitzschia palea	1.5	2	.007	1.06E+07
Nitzschia sp.	0	2	.004	6.06E+06
Pinnularia viridis	1	1	.004	6.06E+06
Planothidium lanceolata	1	0	.002	3.03E+06
Pseudostaurosira brevistrata + vars.	28	4	.063	9.70E+07
Sellaphora bacillum	0	1	.002	3.03E+06
Sellaphora pupula	0	1	.002	3.03E+06
Sellaphora vitabunda	0	4	.008	1.21E+07
Sellaphora rectangularis	1	2	.006	9.09E+06
Staurosira construens	28	24	.103	1.58E+08
Staurosira construens var. venter	20	34	.107	1.64E+08
Staurosira elliptica	18	9	.053	8.18E+07
Staurosirella leptostauron var. dubia	0	2	.004	6.06E+06
Staurosirella pinnata	10	4	.028	4.24E+07
Synedra demerarae	1	0	.002	3.03E+06
Synedra delicatissima	1	0	.002	3.03E+06
Synedra rumpens	1	2	.006	9.09E+06
Synedra rumpens var. familaris	5	9	.028	4.24E+07
Synedra tenera	0	2	.004	6.06E+06
Synedra ulna	0	2	.004	6.06E+06
Synedra (GV)	1	0	.002	3.03E+06
Synedra sp.	1	0	.002	3.03E+06
Tabellaria flocculosa str. IIIp	0	1	.002	3.03E+06
Unknown (raphid)	1	2	.006	9.09E+06
Unknown	1	0	.002	3.03E+06
TOTAL	253	253.5	1.000	1.53E+09
Chrysophyte cysts	1	2		9.09E+06
Scenedesmus coenobia	4	8		3.64E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
MB-3, 0–2 cm				
Achnanthidium conspicua	0	1	0.002	2.14E+06
Achnanthidium exiguum	1	0	.002	2.14E+06
Achnanthidium exiguum var. heterovalvum	0	1	.002	2.14E+06
Achnanthidium lewisiana	1	0	.002	2.14E+06
Achnanthidium minutissima + vars.	2	11	.031	2.78E+07
Amphora ovalis var. affinis	0	1	.002	2.14E+06
Aulacoseira ambigua	1	3	.010	8.54E+06
Aulacoseira sp.	0	1	.002	2.14E+06
Brachysira sp.	1	0	.002	2.14E+06
Cocconeis placentula var+A22. euglypta	0	6	.014	1.28E+07
Cocconeis placentula var. lineata	3	6	.022	1.92E+07
Cocconeis placentula (RV)	1	0	.002	2.14E+06
Cyclotella bodanica var. affinis	0	1	.002	2.14E+06
Cyclotella michiganiana	0	1	.002	2.14E+06
Cyclotella sp.	0	2	.005	4.27E+06
Cymbella angustata	2	1	.007	6.41E+06
Cymbella cistula	0	2	.005	4.27E+06
Cymbella sp.	2	1	.007	6.41E+06
Epithemia turgida	0	2	.005	4.27E+06
Eunotia incisa	1	3	.010	8.54E+06
Eunotia sp.	1	3	.010	8.54E+06
Fragilaria capucina + vars.	32	48	.192	1.71E+08
Fragilaria crotonensis	2	10	.029	2.56E+07
Fragilaria vaucheriae	1	0	.002	2.14E+06
Gomphonema consector	1	0	.002	2.14E+06
Gomphonema tenellum	1	0	.002	2.14E+06
Gomphonema truncatum	1	0	.002	2.14E+06
Gomphonema (GV)	8	6	.034	2.99E+07
Gomphonema sp.	1	1	.005	4.27E+06
Hantzschia sp.	0	1	.002	2.14E+06
Navicula crytotenella	0	2	.005	4.27E+06
Navicula atomus var. permitis	8	0	.019	1.71E+07
Navicula lanceolata	1	1	.005	4.27E+06
Navicula minima	0	10	.024	2.14E+07
Navicula pseudoventralis	3	1	.010	8.54E+06
Navicula radiosa	0	1	.002	2.14E+06
Navicula radiosafallax	0	2	.005	4.27E+06
Navicula schadei	2	0	.005	4.27E+06
Navicula seminuloides	5	0	.012	1.07E+07
Navicula ventralis	1	0	.002	2.14E+06
Navicula (GV)	10	0	.024	2.14E+07
Navicula sp.	3	5	.019	1.71E+07
Neidium sp.	0	1	.002	2.14E+06
Nitzschia amphibia	1	1	.005	4.27E+06
Nitzschia dissipata	0	2	.005	4.27E+06
Nitzschia palea	3	0	.007	6.41E+06
Nitzschia sp.	3	2	.012	1.07E+07
Pseudostaurosira brevistrata + vars.	3	7	.024	2.14E+07
Sellophora rectangularis	0	2	.005	4.27E+06
Sellaphora vitabunda	0	1	.002	2.14E+06
Stauroneis sp.	1	0	.002	2.14E+06
Staurosira construens	15	47	.149	1.32E+08
Staurosira construens var. venter	4	30	.082	7.26E+07
Staurosira elliptica	3		.007	6.41E+06
Staurosirella pinnata	33	15	.115	1.03E+08
Synedra rumpens var. familaris	1	0	.002	2.14E+06
Synedra ulna	0	4	.010	8.54E+06
Unknown (raphid)	4	2	.014	1.28E+07
Unknown	0	2	.005	4.27E+06
TOTAL	167	250	1.000	8.89E+08
Chrysophyte scales	0	1		2.14E+06
Chrysophyte cysts	2	5		1.50E+07
Scenedesmus coenobia	8	0		1.71E+07
Tetraedron coenobia	2	0		4.27E+06
Pediastrum coenobia	1	0		2.14E+06
Sponge spicule	1	0		2.14E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 4–6 cm			
Achnanthidium exiguum var. heterovalvum	2	0.008	1.76E+06
Achnanthidium minutissima + vars.	20	.080	1.76E+07
Achnanthidium sp.	5	.020	4.40E+06
Amphora montana	1	.004	8.79E+05
Aulacoseira ambigua	2	.008	1.76E+06
Cocconeis placentula var. euglypta	3	.012	2.64E+06
Cocconeis placentula var. lineata	8	.032	7.04E+06
Cyclotella sp.	1	.004	8.79E+05
Cymbella cistula	1	.004	8.79E+05
Encyonema silesiacum	2	.008	1.76E+06
Epithemia turgida	1	.004	8.79E+05
Eunotia sp.	3	.012	2.64E+06
Fragilaria capucina + vars.	2	.008	1.76E+06
Fragilaria crotonensis	3	.012	2.64E+06
Gomphonema (GV)	4	.016	3.52E+06
Gomphonema sp.	2	.008	1.76E+06
Navicula cryptotenella	2	.008	1.76E+06
Navicula glomus	3	.012	2.64E+06
Navicula lanceolata	1	.004	8.79E+05
Navicula minima	20	.080	1.76E+07
Navicula pseudoventralis	2	.008	1.76E+06
Navicula radiosafallax	1	.004	8.79E+05
Navicula seminuloides	1	.004	8.79E+05
Navicula sp.	7	.028	6.16E+06
Nitzschia amphibia	4	.016	3.52E+06
Nitzschia sp.	4	.016	3.52E+06
Pinnularia mormonorum	1	.004	8.79E+05
Pinnularia sp.	4	.016	3.52E+06
Pseudostaurosira brevistrata + vars.	2	.008	1.76E+06
Sellaphora parapupula	1	.004	8.79E+05
Sellaphora rectangularis	3	.012	2.64E+06
Sellaphora vitabunda	1	.004	8.79E+05
Staurosira construens	76	.304	6.68E+07
Staurosira construens var. venter	31	.124	2.73E+07
Staurosirella leptostauron	1	.004	8.79E+05
Staurosirella pinnata	11	.044	9.67E+06
Unknown (raphid)	10	.040	8.79E+06
Unknown	4	.016	3.52E+06
Total	250	1.000	2.20E+08
Chrysophyte scales	2		1.76E+06
Chrysophyte cysts	1		8.79E+05

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 10–12 cm			
Achnanthidium exiguum var. heterovalvum	3	0.012	3.86E+06
Achnanthidium minutissima + vars.	14	.056	1.80E+07
Achnanthidium sp.	1	.004	1.29E+06
Aulacoseira ambigua	1	.004	1.29E+06
Cocconeis placentula var. euglypta	4	.016	5.15E+06
Cocconeis placentula var. lineata	3	.012	3.86E+06
Cyclotella sp.	2	.008	2.57E+06
Cymbella angustata	3	.012	3.86E+06
Cymbella cesatii	1	.004	1.29E+06
Cymbella cistula	2	.008	2.57E+06
Cymbella heteropleura var. subrostrata	1	.004	1.29E+06
Cymbella muelleri var. ventricosa	1	.004	1.29E+06
Encyonema silesiacum	3	.012	3.86E+06
Epithemia turgida	2	.008	2.57E+06
Eunotia arcus	1	.004	1.29E+06
Eunotia incisa	1	.004	1.29E+06
Eunotia sp.	3	.012	3.86E+06
Fragilaria capucina + vars.	5	.020	6.44E+06
Fragilaria crotonensis	7	.028	9.01E+06
Fragilaria sp.	5	.020	6.44E+06
Gomphonema (GV)	8	.032	1.03E+07
Gomphonema angustata	1	.004	1.29E+06
Gomphonema clevei	3	.012	3.86E+06
Gomphonema sp.	1	.004	1.29E+06
Navicula aurora	2	.008	2.57E+06
Navicula cryptotenella	2	.008	2.57E+06
Navicula glomus	1	.004	1.29E+06
Navicula ignota var. palustris	5	.020	6.44E+06
Navicula minima	19	.076	2.45E+07
Navicula pseudoventralis	1	.004	1.29E+06
Navicula radiosa	2	.008	2.57E+06
Navicula radiosafallax	1	.004	1.29E+06
Navicula seminuloides	1	.004	1.29E+06
Navicula sp.	9	.036	1.16E+07
Nitzschia amphibia	2	.008	2.57E+06
Nitzschia dissipata	2	.008	2.57E+06
Nitzschia sp.	1	.004	1.29E+06
Pseudostaurosira brevistrata + vars.	1	.004	1.29E+06
Pinnularia mesolepta	1	.004	1.29E+06
Sellaphora laevissima	1	.004	1.29E+06
Sellaphora rectangularis	1	.004	1.29E+06
Staurosira construens	20	.080	2.57E+07
Staurosira construens v. binodis	1	.004	1.29E+06
Staurosira construens var. venter	57	.228	7.34E+07
Staurosirella pinnata	37	.148	4.76E+07
Stephanodiscus medius	1	.004	1.29E+06
Stephanodiscus sp.	1	.004	1.29E+06
Tabellaria sp.	.5	.002	6.44E+05
Unknown (raphid)	5	.020	6.44E+06
Total	250.5	1.000	3.19E+08
Chrysophyte scales	1		1.29E+06
Chrysophyte cysts	2		2.57E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 14–16 cm			
Achnanthidium exiguum var. heterovalvum	3	0.012	6.35E+06
Achnanthidium minutissima + vars.	9	.036	1.90E+07
Achnanthidium sp.	5	.020	1.06E+07
Aulacoseira ambigua	2	.008	4.23E+06
Caloneis silicula	1	.004	2.12E+06
Cocconeis placentula var. euglypta	4	.016	8.46E+06
Cocconeis placentula var. lineata	5	.020	1.06E+07
Cymbella angustata	2	.008	4.23E+06
Cymbella cesatii	1	.004	2.12E+06
Cymbella cistula	1	.004	2.12E+06
Cymbella heteropleura var. subrostrata	1	.004	2.12E+06
Cymbella sp.	4	.016	8.46E+06
Encyonema silesiacum	1	.004	2.12E+06
Epithemia arcus	1	.004	2.12E+06
Epithemia turgida	1	.004	2.12E+06
Eunotia arcus	1	.004	2.12E+06
Eunotia incisa	1	.004	2.12E+06
Fragilaria capucina + vars.	3	.012	6.35E+06
Fragilaria crotonensis	4	.016	8.46E+06
Fragilaria sp.	2	.008	4.23E+06
Gomphonema (GV)	6	.024	1.27E+07
Gomphonema angustata	1	.004	2.12E+06
Gomphonema clevei	3	.012	6.35E+06
Gomphonema sp.	1	.004	2.12E+06
Navicula glomus	3	.012	6.35E+06
Navicula ignota v. palustris	2	.008	4.23E+06
Navicula laterostrata	2	.008	4.23E+06
Navicula minima	15	.060	3.17E+07
Navicula pseudoventralis	2	.008	4.23E+06
Navicula sp.	6	.024	1.27E+07
Neidium sp.	2	.008	4.23E+06
Nitzschia dissipata	2	.008	4.23E+06
Nitzschia sp.	1	.004	2.12E+06
Pseudostaurosira brevistrata + vars.	5	.020	1.06E+07
Pinnularia mesolepta	1	.004	2.12E+06
Sellaphora rectangularis	2	.008	4.23E+06
Stauroneis phoenocenteron var. braunii	1	.004	2.12E+06
Staurosira construens	56	.223	1.18E+08
Staurosira construens var. venter	43	.171	9.10E+07
Staurosirella pinnata	35	.139	7.41E+07
Stephanodiscus niagarae	1	.004	2.12E+06
Synedra rumpens	1	.004	2.12E+06
Synedra sp.	1	.004	2.12E+06
Synedra ulna	1	.004	2.12E+06
Unknown (raphid)	5	.020	1.06E+07
Unknown	1	.004	2.12E+06
Total	251	1.000	5.27E+08
Chrysophyte scales	2		4.23E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 20–22 cm			
Achnanthidium exiguum var. heterovalvum	5	0.020	1.74E+07
Achnanthidium minutissima + vars.	6	.024	2.08E+07
Achnanthidium sp.	2	.008	6.94E+06
Amphora ovalis	1	.004	3.47E+06
Aulacoseira ambigua	2	.008	6.94E+06
Brachysira vitrea	1	.004	3.47E+06
Cavinula variostraita	1	.004	3.47E+06
Cocconeis placentula var. euglypta	1	.004	3.47E+06
Cocconeis placentula var. lineata	2	.008	6.94E+06
Craticula cuspidata	1	.004	3.47E+06
Cyclotella rossii	1	.004	3.47E+06
Cyclotella sp.	2	.008	6.94E+06
Cymbella angustata	1	.004	3.47E+06
Cymbella sp.	2	.008	6.94E+06
Encyonema silesiacum	2	.008	6.94E+06
Epithemia arcus	2	.008	6.94E+06
Epithemia sp.	2	.008	6.94E+06
Eunotia incisa	2	.008	6.94E+06
Fragilaria capucina + vars.	6	.024	2.08E+07
Fragilaria crotonensis	11	.044	3.82E+07
Geissleria kriegerii	1	.004	3.47E+06
Gomphonema (GV)	2	.008	6.94E+06
Gomphonema angustata	4	.016	1.39E+07
Gomphonema brebissonii	1	.004	3.47E+06
Gomphonema gracile	1	.004	3.47E+06
Gomphonema sp.	2	.008	6.94E+06
Navicula atomus var. permitis	3	.012	1.04E+07
Navicula aurora	2	.008	6.94E+06
Navicula glomus	2	.008	6.94E+06
Navicula ignota var. palustris	2	.008	6.94E+06
Navicula laterostrata	2	.008	6.94E+06
Navicula minima	8	.032	2.78E+07
Navicula radiosa	2	.008	6.94E+06
Navicula radiosafallax	1	.004	3.47E+06
Navicula sp.	7	.028	2.43E+07
Neidium sp.	2	.008	6.94E+06
Nitzschia amphibia	2	.008	6.94E+06
Nitzschia sp.	3	.012	1.04E+07
Pinnularia mormonorum	2	.008	6.94E+06
Pseudostaurosira brevistrata + vars.	10	.040	3.47E+07
Rhopalodia gibba	1	.004	3.47E+06
Sellaphora mutata	3	.012	1.04E+07
Sellaphora parapupula	2	.008	6.94E+06
Sellaphora rectangularis	3	.012	1.04E+07
Staurosira construens	64	.254	2.22E+08
Staurosira construens var. venter	43	.171	1.49E+08
Staurosirella pinnata	21	.083	7.29E+07
Unknown (raphid)	3	.012	1.04E+07
Total	252	1.000	8.75E+08
Chrysophyte cysts	4		1.39E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 24–26 cm			
Achnanthidium conspicua	1	0.004	2.75E+06
Achnanthidium exiguum var. heterovalvum	5	.020	1.38E+07
Achnanthidium minutissima + vars.	9	.036	2.48E+07
Amphora ovalis	1	.004	2.75E+06
Asterionella formosa	.5	.002	1.38E+06
Aulacoseira ambigua	5	.020	1.38E+07
Cocconeis placentula var. euglypta	1	.004	2.75E+06
Cocconeis placentula var. lineata	6	.024	1.65E+07
Cyclotella michiganiana	2	.008	5.51E+06
Cyclotella rossii	1	.004	2.75E+06
Cyclotella stelligera	2	.008	5.51E+06
Cymbella cesatii	5	.020	1.38E+07
Cymbella sp.	3	.012	8.26E+06
Encyonema silesiacum	3	.012	8.26E+06
Eunotia monodon	1	.004	2.75E+06
Eunotia sp.	2	.008	5.51E+06
Fragilaria capucina + vars.	6	.024	1.65E+07
Fragilaria crotonensis	3	.012	8.26E+06
Fragilaria vaucheriae	1	.004	2.75E+06
Gomphonema (GV)	4	.016	1.10E+07
Gomphonema angustata	2	.008	5.51E+06
Gomphonema parvulum	1	.004	2.75E+06
Gomphonema sp.	1	.004	2.75E+06
Navicula aurora	1	.004	2.75E+06
Navicula atomus var. permitis	2	.008	5.51E+06
Navicula cryptotenella	1	.004	2.75E+06
Navicula glomus	1	.004	2.75E+06
Navicula graciloides	2	.008	5.51E+06
Navicula ignota v. palustris	1	.004	2.75E+06
Navicula lanceolata	1	.004	2.75E+06
Navicula laterostrata	3	.012	8.26E+06
Navicula minima	19	.076	5.23E+07
Navicula radiosafallax	2	.008	5.51E+06
Navicula sp.	6	.024	1.65E+07
Neidium iridis	3	.012	8.26E+06
Neidium sp.	1	.004	2.75E+06
Nitzschia amphibia	1	.004	2.75E+06
Pinnularia mormonorum	1	.004	2.75E+06
Pinnularia sp.	1	.004	2.75E+06
Pseudostaurosira brevistrata + vars.	12	.048	3.31E+07
Sellaphora mutata	1	.004	2.75E+06
Sellaphora rectangularis	1	.004	2.75E+06
Sellaphora seminulum	1	.004	2.75E+06
Staurosira construens	80	.320	2.20E+08
Staurosira construens var. binodis	2	.008	5.51E+06
Staurosira construens var. venter	7	.028	1.93E+07
Staurosirella pinnata	31	.124	8.54E+07
Staurosirella pinnata v. lancettula	1	.004	2.75E+06
Synedra sp.	1	.004	2.75E+06
Tabellaria sp.	.5	.002	1.38E+06
Unknown (raphid)	1	.004	2.75E+06
Total	250	1.000	6.89E+08
Chrysophyte cysts	2		5.51E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 30–32 cm			
Achnanthidium exiguum var. heterovalvum	4	0.016	4.53E+06
Achnanthidium minutissima + vars.	12	.048	1.36E+07
Achnanthidium sp.	3	.012	3.40E+06
Amphora ovalis	1	.004	1.13E+06
Aulacoseira ambigua	15	.060	1.70E+07
Aulacoseira italica	6	.024	6.79E+06
Cocconeis naviculiformis	1	.004	1.13E+06
Cocconeis placentula var. lineata	5	.020	5.66E+06
Craticula cuspidata	1	.004	1.13E+06
Cyclotella michiganiana	5	.020	5.66E+06
Cyclotella stelligera	4	.016	4.53E+06
Cyclotella sp.	1	.004	1.13E+06
Cymbella angustata	2	.008	2.26E+06
Cymbella cistula	1	.004	1.13E+06
Cymbella sp.	4	.016	4.53E+06
Encyonema silesiacum	2	.008	2.26E+06
Epithemia turgida	1	.004	1.13E+06
Eunotia arcus	2	.008	2.26E+06
Eunotia incisa	4	.016	4.53E+06
Eunotia sp.	2	.008	2.26E+06
Fragilaria capucina + vars.	3	.012	3.40E+06
Fragilaria crotonensis	10	.040	1.13E+07
Fragilaria vaucheriae	1	.004	1.13E+06
Gomphonema (GV)	4	.016	4.53E+06
Gomphonema acuminatum var. pusilla	2	.008	2.26E+06
Gomphonema angustata	2	.008	2.26E+06
Gomphonema sp.	3	.012	3.40E+06
Navicula aurora	5	.020	5.66E+06
Navicula cryptotenella	1	.004	1.13E+06
Navicula explanata	1	.004	1.13E+06
Navicula glomus	1	.004	1.13E+06
Navicula graciloides	1	.004	1.13E+06
Navicula ignota v. palustris	1	.004	1.13E+06
Navicula laterostrata	3	.012	3.40E+06
Navicula minima	12	.048	1.36E+07
Navicula obdurata	2	.008	2.26E+06
Navicula radiosa	2	.008	2.26E+06
Navicula radiosafallax	2	.008	2.26E+06
Navicula sp.	11	.044	1.25E+07
Neidium sp.	3	.012	3.40E+06
Nitzschia amphibia	2	.008	2.26E+06
Pseudostaurosira brevistrata + vars.	2	.008	2.26E+06
Sellaphora rectangularis	4	.016	4.53E+06
Stauroneis sp.	1	.004	1.13E+06
Staurosira construens	38	.152	4.30E+07
Staurosira construens var. venter	30	.120	3.40E+07
Staurosirella pinnata	12	.048	1.36E+07
Staurosirella pinnata v. lancettula	4	.016	4.53E+06
Stephanodiscus niagarae	1	.004	1.13E+06
Stephanodiscus sp.	1	.004	1.13E+06
Synedra sp.	1	.004	1.13E+06
Synedra ulna	1	.004	1.13E+06
Tabellaria sp.	.5	.002	5.66E+05
Unknown (raphid)	3	.012	3.40E+06
Unknown	4	.016	4.53E+06
Total	250.5	1.000	2.84E+08
Chrysophyte cysts	5		5.66E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 34–36 cm			
Achnanthidium exiguum var. heterovalvum	8	0.032	2.48E+07
Achnanthidium minutissima + vars.	14	.056	4.34E+07
Achnanthidium stewartii	3	.012	9.30E+06
Achnanthidium sp.	3	.012	9.30E+06
Amphora ovalis	1	.004	3.10E+06
Aulacoseira ambigua	7	.028	2.17E+07
Aulacoseira italica	3	.012	9.30E+06
Cocconeis disculus	1	.004	3.10E+06
Cocconeis placentula var. lineata	5	.020	1.55E+07
Craticula cuspidata	1	.004	3.10E+06
Cyclotella sp.	1	.004	3.10E+06
Cyclotella stelligera	5	.020	1.55E+07
Cymbella angustata	2	.008	6.20E+06
Cymbella cesatii	1	.004	3.10E+06
Cymbella sp.	1	.004	3.10E+06
Encyonema silesiacum	4	.016	1.24E+07
Epithemia arcus	1	.004	3.10E+06
Eunotia arcus	3	.012	9.30E+06
Eunotia incisa	1	.004	3.10E+06
Fragilaria capucina + vars.	3	.012	9.30E+06
Fragilaria crotonensis	4	.016	1.24E+07
Fragilaria radians	2	.008	6.20E+06
Fragilaria vaucheriae	1	.004	3.10E+06
Gomphonema (GV)	2	.008	6.20E+06
Gomphonema acuminatum	1	.004	3.10E+06
Gomphonema angustata	7	.028	2.17E+07
Navicula aurora	1	.004	3.10E+06
Navicula glomus	1	.004	3.10E+06
Navicula graciloides	2	.008	6.20E+06
Navicula ignota v. palustris	8	.032	2.48E+07
Navicula laterostrata	8	.032	2.48E+07
Navicula minima	9	.036	2.79E+07
Navicula obdurata	2	.008	6.20E+06
Navicula pseudoventralis	3	.012	9.30E+06
Navicula radiosa	2	.008	6.20E+06
Navicula radiosafallax	5	.020	1.55E+07
Navicula sp.	8	.032	2.48E+07
Neidium iridis	2	.008	6.20E+06
Neidium sp.	2	.008	6.20E+06
Nitzschia palea	2	.008	6.20E+06
Pseudostaurosira brevistrata + vars.	6	.024	1.86E+07
Sellaphora rectangularis	5	.020	1.55E+07
Stauroneis phoenicenteron f. gracilis	3	.012	9.30E+06
Stauroneis sp.	2	.008	6.20E+06
Staurosira construens	31	.124	9.61E+07
Staurosira construens var. venter	31	.124	9.61E+07
Staurosirella pinnata	22	.088	6.82E+07
Staurosirella pinnata v. lancettula	4	.016	1.24E+07
Stephanodiscus niagarae	1	.004	3.10E+06
Synedra sp.	1	.004	3.10E+06
Tabellaria sp.	.5	.002	1.55E+06
Unknown (raphid)	4	.016	1.24E+07
Total	250.5	1.000	7.77E+08
Chrysophyte cysts	8		2.48E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 40–42 cm			
Achnanthidium exiguum var. heterovalvum	6	0.024	9.32E+06
Achnanthidium minutissima + vars.	7	.028	1.09E+07
Achnanthidium sp.	1	.004	1.55E+06
Amphora ovalis	1	.004	1.55E+06
Aulacoseira ambigua	20	.080	3.11E+07
Aulacoseira italica	4	.016	6.21E+06
Cocconeis placentula var. lineata	7	.028	1.09E+07
Craticula cuspidata	1	.004	1.55E+06
Cyclotella bodanica var. lemanica	2	.008	3.11E+06
Cyclotella michiganiana	1	.004	1.55E+06
Cyclotella ocellata	1	.004	1.55E+06
Cymbella angustata	6	.024	9.32E+06
Cymbella cistula	7	.028	1.09E+07
Encyonema silesiacum	3	.012	4.66E+06
Epithemia sp.	5	.020	7.76E+06
Epithemia turgida	1	.004	1.55E+06
Eunotia arcus	5	.020	7.76E+06
Eunotia incisa	4	.016	6.21E+06
Eunotia sp.	5	.020	7.76E+06
Fragilaria capucina + vars.	5	.020	7.76E+06
Fragilaria crotonensis	1	.004	1.55E+06
Fragilaria vaucheriae	3	.012	4.66E+06
Gomphonema (GV)	10	.040	1.55E+07
Gomphonema acuminatum	3	.012	4.66E+06
Gomphonema affine var. insigne	1	.004	1.55E+06
Gomphonema angustata	4	.016	6.21E+06
Gomphonema tenellum	1	.004	1.55E+06
Gomphonema truncatum	1	.004	1.55E+06
Gomphonema sp.	7	.028	1.09E+07
Gyrosigma sp.	1	.004	1.55E+06
Navicula aurora	5	.020	7.76E+06
Navicula cryptotenella	3	.012	4.66E+06
Navicula glomus	1	.004	1.55E+06
Navicula graciloides	1	.004	1.55E+06
Navicula ignota v. palustris	2	.008	3.11E+06
Navicula laterostrata	3	.012	4.66E+06
Navicula minima	5	.020	7.76E+06
Navicula radiosafallax	1	.004	1.55E+06
Navicula sp.	4	.016	6.21E+06
Neidium iridis	6	.024	9.32E+06
Nitzschia sp.	1	.004	1.55E+06
Pinnularia abaujensis	1	.004	1.55E+06
Pinnularia sp.	2	.008	3.11E+06
Pseudostaurosira brevistrata + vars.	6	.024	9.32E+06
Sellaphora pupula	2	.008	3.11E+06
Sellaphora rectangularis	4	.016	6.21E+06
Stauroneis phoenicenteron f. gracilis	1	.004	1.55E+06
Staurosira construens	34	.135	5.28E+07
Staurosira construens var. venter	25	.100	3.88E+07
Staurosirella pinnata	13	.052	2.02E+07
Staurosirella pinnata v. lancettula	1	.004	1.55E+06
Synedra capitata	1	.004	1.55E+06
Synedra sp.	2	.008	3.11E+06
Unknown (raphid)	3	.012	4.66E+06
Total	251	1.000	3.90E+08
Chrysophyte cysts	2		3.11E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 44–46 cm			
Achnanthidium exiguum var. heterovalvum	9	0.036	3.38E+07
Achnanthidium minutissima + vars.	45	.179	1.69E+08
Achnanthidium sp.	2	.008	7.52E+06
Amphora ovalis	2	.008	7.52E+06
Aulacoseira ambigua	11	.044	4.13E+07
Aulacoseira italica	4	.016	1.50E+07
Cocconeis naviculiformis	1	.004	3.76E+06
Cocconeis placentula var. lineata	4	.016	1.50E+07
Cyclotella michiganiana	3	.012	1.13E+07
Cymbella angustata	2	.008	7.52E+06
Cymbella cistula	3	.012	1.13E+07
Cymbella sp.	1	.004	3.76E+06
Encyonema silesiacum	4	.016	1.50E+07
Epithemia sp.	2	.008	7.52E+06
Eunotia arcus	2	.008	7.52E+06
Eunotia incisa	5	.020	1.88E+07
Fragilaria crotonensis	4	.016	1.50E+07
Fragilaria radians	1	.004	3.76E+06
Geissleria ignota var. palustris	3	.012	1.13E+07
Gomphonema (GV)	6	.024	2.26E+07
Gomphonema affine var. insigne	1	.004	3.76E+06
Gomphonema angustata	8	.032	3.01E+07
Gomphonema gracile	2	.008	7.52E+06
Gomphonema parvulum	1	.004	3.76E+06
Gomphonema truncatum	1	.004	3.76E+06
Gomphonema sp.	6	.024	2.26E+07
Navicula aurora	1	.004	3.76E+06
Navicula biconica	2	.008	7.52E+06
Navicula cryptotenella	3	.012	1.13E+07
Navicula graciloides	1	.004	3.76E+06
Navicula lanceolata	1	.004	3.76E+06
Navicula laterostrata	4	.016	1.50E+07
Navicula minima	13	.052	4.89E+07
Navicula obdurata	1	.004	3.76E+06
Navicula pseudoventralis	5	.020	1.88E+07
Navicula radiosa	2	.008	7.52E+06
Navicula radiosafallax	1	.004	3.76E+06
Navicula sp.	8	.032	3.01E+07
Neidium iridis	1	.004	3.76E+06
Nitzschia amphibia	3	.012	1.13E+07
Nitzschia palea	2	.008	7.52E+06
Nitzschia sp.	1	.004	3.76E+06
Pinnularia abaujensis	1	.004	3.76E+06
Pinnularia mormonorum	1	.004	3.76E+06
Pinnularia sp.	1	.004	3.76E+06
Pseudostaurosira brevistrata + vars.	7	.028	2.63E+07
Sellaphora parapupula	1	.004	3.76E+06
Sellaphora rectangularis	4	.016	1.50E+07
Stauroneis sp.	1	.004	3.76E+06
Staurosira construens	10	.040	3.76E+07
Staurosira construens var. venter	22	.088	8.27E+07
Staurosirella pinnata	12	.048	4.51E+07
Staurosirella pinnata var. lancettula	1	.004	3.76E+06
Synedra acus	2	.008	7.52E+06
Synedra ulna	2	.008	7.52E+06
Tabellaria sp.	1	.004	3.76E+06
Unknown (raphid)	3	.012	1.13E+07
Total	251	1.000	9.43E+08
Chrysophyte scales	1		3.76E+06
Chrysophyte cysts	5		1.88E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 50–52 cm			
Achnanthidium exiguum var. heterovalvum	13	0.052	3.87E+07
Achnanthidium minutissima + vars.	31	.123	9.23E+07
Aulacoseira ambigua	17	.067	5.06E+07
Aulacoseira italica	4	.016	1.19E+07
Cocconeis placentula var. lineata	3	.012	8.93E+06
Cyclotella bodanica var. lemanica	1	.004	2.98E+06
Cymbella angustata	2	.008	5.95E+06
Cymbella cistula	3	.012	8.93E+06
Cymbella sp.	2	.008	5.95E+06
Encyonema silesiacum	4	.016	1.19E+07
Epithemia turgida	1	.004	2.98E+06
Eunotia arcus	6	.024	1.79E+07
Eunotia incisa	8	.032	2.38E+07
Eunotia pectinalis	2	.008	5.95E+06
Eunotia sp.	2	.008	5.95E+06
Fragilaria capucina + vars.	5	.020	1.49E+07
Fragilaria crotonensis	2	.008	5.95E+06
Fragilaria vaucheriae	2	.008	5.95E+06
Gomphonema acuminatum	1	.004	2.98E+06
Gomphonema affine var. insigne	5	.020	1.49E+07
Gomphonema angustata	5	.020	1.49E+07
Gomphonema clevei	3	.012	8.93E+06
Gomphonema gracile	3	.012	8.93E+06
Gomphonema parvulum	1	.004	2.98E+06
Gomphonema tenellum	1	.004	2.98E+06
Gomphonema truncatum	1	.004	2.98E+06
Gomphonema sp.	9	.036	2.68E+07
Gomphonema (GV)	9	.036	2.68E+07
Navicula aurora	2	.008	5.95E+06
Navicula biconica	3	.012	8.93E+06
Navicula cryptotenella	1	.004	2.98E+06
Navicula glomus	1	.004	2.98E+06
Navicula graciloides	1	.004	2.98E+06
Navicula minima	13	.052	3.87E+07
Navicula pseudoventralis	4	.016	1.19E+07
Navicula radiosa	1	.004	2.98E+06
Navicula radiosafallax	1	.004	2.98E+06
Navicula sp.	7	.028	2.08E+07
Neidium iridis	1	.004	2.98E+06
Pinnularia sp.	1	.004	2.98E+06
Pseudostaurosira brevistrata + vars.	1	.004	2.98E+06
Sellaphora pupula	1	.004	2.98E+06
Sellaphora rectangularis	5	.020	1.49E+07
Stauroneis phoenicenteron f. gracilis	3	.012	8.93E+06
Staurosira construens	11	.044	3.27E+07
Staurosira construens var. venter	25	.099	7.44E+07
Staurosirella pinnata	6	.024	1.79E+07
Surirella sp.	1	.004	2.98E+06
Synedra acus	1	.004	2.98E+06
Synedra sp.	3	.012	8.93E+06
Synedra ulna	3	.012	8.93E+06
Tabellaria sp.	1	.004	2.98E+06
Unknown (raphid)	3	.012	8.93E+06
Total	252	1.000	7.50E+08
Chrysophyte cysts	6		1.79E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 54–56 cm			
Achnanthidium exiguum var. heterovalvum	8	0.032	4.80E+07
Achnanthidium minutissima + vars.	28	.112	1.68E+08
Achnanthidium sp.	3	.012	1.80E+07
Brachysira vitrea	1	.004	6.00E+06
Aulacoseira ambigua	12	.048	7.20E+07
Aulacoseira italica	8	.032	4.80E+07
Cocconeis placentula var. lineata	5	.020	3.00E+07
Cyclotella glomerata	1	.004	6.00E+06
Cyclotella michiganiana	3	.012	1.80E+07
Cyclotella stelligera	1	.004	6.00E+06
Cymbella angustata	4	.016	2.40E+07
Cymbella cistula	1	.004	6.00E+06
Cymbella sp.	3	.012	1.80E+07
Encyonema minutum	3	.012	1.80E+07
Encyonema silesiacum	5	.020	3.00E+07
Epithemia turgida	1	.004	6.00E+06
Eunotia arcus	3	.012	1.80E+07
Eunotia incisa	2	.008	1.20E+07
Eunotia sp.	1	.004	6.00E+06
Fragilaria capucina + vars.	3	.012	1.80E+07
Fragilaria crotonensis	4	.016	2.40E+07
Geissleria ignota v. palustris	1	.004	6.00E+06
Gomphonema (GV)	6	.024	3.60E+07
Gomphonema acuminatum	2	.008	1.20E+07
Gomphonema affine v. insigne	3	.012	1.80E+07
Gomphonema angustata	2	.008	1.20E+07
Gomphonema clevei	4	.016	2.40E+07
Gomphonema gracile	3	.012	1.80E+07
Gomphonema tenellum	2	.008	1.20E+07
Gomphonema truncatum	2	.008	1.20E+07
Gomphonema sp.	3	.012	1.80E+07
Navicula biconica	2	.008	1.20E+07
Navicula cryptotenella	4	.016	2.40E+07
Navicula minima	19	.076	1.14E+08
Navicula obdurata	1	.004	6.00E+06
Navicula pseudoventralis	7	.028	4.20E+07
Navicula radiosa	1	.004	6.00E+06
Navicula radiosafallax	2	.008	1.20E+07
Navicula sp.	2	.008	1.20E+07
Nitzschia amphibia	2	.008	1.20E+07
Nitzschia fonticola	1	.004	6.00E+06
Nitzschia palea	1	.004	6.00E+06
Nitzschia sp.	1	.004	6.00E+06
Pseudostaurosira brevistrata + vars.	2	.008	1.20E+07
Sellaphora rectangularis	6	.024	3.60E+07
Stauroneis acuta var. terryana	1	.004	6.00E+06
Stauroneis sp.	1	.004	6.00E+06
Staurosira construens	2	.008	1.20E+07
Staurosira construens var. venter	43	.172	2.58E+08
Staurosirella pinnata	9	.036	5.40E+07
Staurosirella pinnata v. lancettula	4	.016	2.40E+07
Synedra radians	1	.004	6.00E+06
Synedra rumpens var. familaris	5	.020	3.00E+07
Synedra ulna	1	.004	6.00E+06
Tabellaria sp.	2	.008	1.20E+07
Unknown (raphid)	1	.004	6.00E+06
Unknown	1	.004	6.00E+06
Total	250	1.000	1.50E+09
Chrysophyte cysts	2		1.20E+07

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 60–62 cm			
Achnanthidium exiguum var. heterovalvum	7	0.028	1.41E+07
Achnanthidium minutissima + vars.	28	.111	5.62E+07
Brachysira vitrea	1	.004	2.01E+06
Aulacoseira ambigua	19	.076	3.82E+07
Aulacoseira italica	10	.040	2.01E+07
Cocconeis placentula var. euglypta	2	.008	4.02E+06
Cocconeis placentula var. lineata	8	.032	1.61E+07
Craticola cuspidata	1	.004	2.01E+06
Cyclotella bodanica var. lemanica	1	.004	2.01E+06
Cyclotella glomerata	2	.008	4.02E+06
Cyclotella michiganiana	1	.004	2.01E+06
Cyclotella sp.	1	.004	2.01E+06
Cyclotella stelligera	1	.004	2.01E+06
Cymbella angustata	5	.020	1.00E+07
Cymbella cesatii	1	.004	2.01E+06
Cymbella cistula	2	.008	4.02E+06
Cymbella sp.	2	.008	4.02E+06
Encyonema minutum	2	.008	4.02E+06
Epithemia arcus	3	.012	6.03E+06
Epithemia turgida	2	.008	4.02E+06
Eunotia arcus	1	.004	2.01E+06
Eunotia incisa	9	.036	1.81E+07
Eunotia sp.	2	.008	4.02E+06
Fragilaria capucina + vars.	2	.008	4.02E+06
Fragilaria crotonensis	4	.016	8.03E+06
Fragilaria sp (65u L)	6	.024	1.21E+07
Fragilaria vaucheriae	4	.016	8.03E+06
Fragilaria sp.	2	.008	4.02E+06
Gomphonema acuminatum	6	.024	1.21E+07
Gomphonema affine var. insigne	4	.016	8.03E+06
Gomphonema angustata	7	.028	1.41E+07
Gomphonema clevei	4	.016	8.03E+06
Gomphonema intricatum	1	.004	2.01E+06
Gomphonema truncatum	2	.008	4.02E+06
Gomphonema truncatum v. turgidum	1	.004	2.01E+06
Gomphonema (GV)	8	.032	1.61E+07
Navicula atomus var. permitis	1	.004	2.01E+06
Navicula cryptotenella	2	.008	4.02E+06
Navicula laevissima	1	.004	2.01E+06
Navicula minima	2	.008	4.02E+06
Navicula obdurata	1	.004	2.01E+06
Navicula pseudoventralis	5	.020	1.00E+07
Navicula radiosa	2	.008	4.02E+06
Navicula radiosafallax	1	.004	2.01E+06
Navicula secura	4	.016	8.03E+06
Navicula sp.	2	.008	4.02E+06
Neidium sp.	1	.004	2.01E+06
Nitzschia amphibia	3	.012	6.03E+06
Nitzschia palea	2	.008	4.02E+06
Nitzschia sp.	4	.016	8.03E+06
Pinnularia sp.	1	.004	2.01E+06
Sellaphora pupula	2	.008	4.02E+06
Staurosira construens	5	.020	1.00E+07
Staurosira construens var. venter	28	.111	5.62E+07
Staurosirella pinnata	8	.032	1.61E+07
Surirella sp.	1	.004	2.01E+06
Synedra delicatissima	2	.008	4.02E+06
Synedra rumpens var. fragilariodes	2	.008	4.02E+06
Synedra rumpens var. familaris	1	.004	2.01E+06
Synedra ulna	2	.008	4.02E+06
Tabellaria sp.	4.5	.018	9.04E+06
Unknown (raphid)	2	.008	4.02E+06
Total	251.5	1.000	5.05E+08
Chrysophyte scales	1		2.01E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 64–66 cm			
Achnanthidium exiguum var. heterovalvum	15	0.060	6.36E+07
Achnanthidium minutissima + vars.	47	.187	1.99E+08
Achnanthidium sp.	1	.004	4.24E+06
Aulacoseira ambigua	11	.044	4.66E+07
Cocconeis placentula var. euglypta	1	.004	4.24E+06
Cocconeis placentula var. lineata	4	.016	1.70E+07
Cyclotella michiganiana	2	.008	8.48E+06
Cyclotella stelligera	3	.012	1.27E+07
Cymbella angustata	2	.008	8.48E+06
Cymbella cesatii	2	.008	8.48E+06
Cymbella cistula	3	.012	1.27E+07
Cymbella sp.	1	.004	4.24E+06
Encyonema minutum	2	.008	8.48E+06
Encyonema silesiacum	4	.016	1.70E+07
Epithemia arcus	1	.004	4.24E+06
Eunotia incisa	3	.012	1.27E+07
Eunotia pectinalis	1	.004	4.24E+06
Eunotia sp.	2	.008	8.48E+06
Fragilaria capucina + vars.	3	.012	1.27E+07
Fragilaria crotonensis	6	.024	2.54E+07
Fragilaria radians	1	.004	4.24E+06
Fragilaria vaucheriae	1	.004	4.24E+06
Geissleria ignota var. palustris	2	.008	8.48E+06
Gomphonema acuminatum	5	.020	2.12E+07
Gomphonema affine var. insigne	2	.008	8.48E+06
Gomphonema angustata	3	.012	1.27E+07
Gomphonema gracile	3	.012	1.27E+07
Gomphonema intricatum	1	.004	4.24E+06
Gomphonema subclavatum var. commutatum	1	.004	4.24E+06
Gomphonema tenellum	1	.004	4.24E+06
Gomphonema truncatum	2	.008	8.48E+06
Gomphonema (GV)	8	.032	3.39E+07
Gomphonema sp.	1	.004	4.24E+06
Navicula cryptotenella	3	.012	1.27E+07
Navicula glomus	1	.004	4.24E+06
Navicula graciloides	2	.008	8.48E+06
Navicula laterostrata	1	.004	4.24E+06
Navicula minima	17	.067	7.21E+07
Navicula pseudoventralis	9	.036	3.81E+07
Navicula radiosa	2	.008	8.48E+06
Navicula sp.	4	.016	1.70E+07
Neidium iridis	1	.004	4.24E+06
Nitzschia amphibia	4	.016	1.70E+07
Nitzschia palea	2	.008	8.48E+06
Nitzschia sp.	1	.004	4.24E+06
Pseudostaurosira brevistrata + vars.	2	.008	8.48E+06
Staurosira construens	6	.024	2.54E+07
Staurosira construens var. venter	28	.111	1.19E+08
Staurosirella leptostauron	1	.004	4.24E+06
Staurosirella pinnata	14	.056	5.93E+07
Staurosirella pinnata var. lancettula	1	.004	4.24E+06
Surirella sp.	1	.004	4.24E+06
Synedra rumpens var. familaris	1	.004	4.24E+06
Synedra rumpens var. fragilariodes	1	.004	4.24E+06
Synedra ulna	1	.004	4.24E+06
Tabellaria sp.	2	.008	8.48E+06
Unknown (raphid)	2	.008	8.48E+06
Total	252	1.000	1.07E+09
Chrysophyte scales	1		4.24E+06
Chrysophyte cysts	1		4.24E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
MB-3, 70–72 cm			
Achnanthidium exiguum var. heterovalvum	6	0.024	2.27E+07
Achnanthidium minutissima + vars.	27	.108	1.02E+08
Achnanthidium sp.	5	.020	1.89E+07
Asterionella formosa	.5	.002	1.89E+06
Aulacoseira ambigua	4	.016	1.51E+07
Cocconeis placentula var. euglypta	1	.004	3.79E+06
Cocconeis placentula var. lineata	4	.016	1.51E+07
Craticola cuspidata	1	.004	3.79E+06
Cyclotella bodanica var. lemanica	1	.004	3.79E+06
Cyclotella sp.	1	.004	3.79E+06
Cymbella angustata	11	.044	4.17E+07
Cymbella cesatii	3	.012	1.14E+07
Cymbella cistula	4	.016	1.51E+07
Cymbella sp.	3	.012	1.14E+07
Encyonema minutum	4	.016	1.51E+07
Encyonema silesiacum	4	.016	1.51E+07
Epithemia sp.	2	.008	7.57E+06
Eunotia arcus	1	.004	3.79E+06
Eunotia incisa	3	.012	1.14E+07
Eunotia pectinalis	1	.004	3.79E+06
Fragilaria capucina + vars.	3	.012	1.14E+07
Fragilaria crotonensis	5	.020	1.89E+07
Fragilaria leptostauron	1	.004	3.79E+06
Fragilaria radians	1	.004	3.79E+06
Fragilaria vaucheriae	2	.008	7.57E+06
Geissleria ignota var. palustris	3	.012	1.14E+07
Gomphonema acuminatum	2	.008	7.57E+06
Gomphonema acuminatum var. pusilla	1	.004	3.79E+06
Gomphonema affine var. insigne	2	.008	7.57E+06
Gomphonema angustata	5	.020	1.89E+07
Gomphonema clevei	4	.016	1.51E+07
Gomphonema gracile	2	.008	7.57E+06
Gomphonema tenellum	3	.012	1.14E+07
Gomphonema (GV)	22	.088	8.33E+07
Gomphonema sp.	6	.024	2.27E+07
Navicula aurora	1	.004	3.79E+06
Navicula cryptotenella	8	.032	3.03E+07
Navicula laterostrata	2	.008	7.57E+06
Navicula minima	22	.088	8.33E+07
Navicula pseudoventralis	2	.008	7.57E+06
Navicula radiosa	3	.012	1.14E+07
Navicula sp.	2	.008	7.57E+06
Nitzschia amphibia	2	.008	7.57E+06
Nitzschia sp.	1	.004	3.79E+06
Pinnularia mesolepta	1	.004	3.79E+06
Pseudostaurosira brevistrata + vars.	2	.008	7.57E+06
Sellaphora pupula	1	.004	3.79E+06
Staurosira construens	1	.004	3.79E+06
Staurosira construens var. pumilla	3	.012	1.14E+07
Staurosira construens var. venter	21	.084	7.95E+07
Staurosirella pinnata	22	.088	8.33E+07
Staurosirella pinnata var. lancettula	3	.012	1.14E+07
Synedra rumpens var. fragilariodes	1	.004	3.79E+06
Synedra sp.	1	.004	3.79E+06
Synedra ulna	2	.008	7.57E+06
Synedra ulna var. chaseana	1	.004	3.79E+06
Unknown (raphid)	1	.004	3.79E+06
Total	250.5	1.000	9.53E+08
Chrysophyte cysts	2	0.008	7.57E+06

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Number 2	Proportion	Number/g dry sediment
LCO-1, 0–1 cm				
Achnanthidium exiguum	3	0	0.017	1.97E+07
Achnanthidium lewisiana	1	1	.012	1.31E+07
Achnanthidium minutissima + vars.	2	1	.017	1.97E+07
Achnanthidium sp.	2	2	.023	2.63E+07
Asterionella formosa	3	0	.017	1.97E+07
Aulacoseira ambigua	5	2	.040	4.60E+07
Aulacoseira italica	0	1	.006	6.57E+06
Aulacoseira subarctica	0	3	.017	1.97E+07
Cavinula cocconeiformis	2	1	.017	1.97E+07
Cocconeis placentula var. lineata	1	0	.006	6.57E+06
Cocconeis neothumensis	2	0	.012	1.31E+07
Cyclotella sp. 1	3	0	.017	1.97E+07
Cyclotella comensis	14	8	.127	1.45E+08
Cyclotella michiganiana	3	0	.017	1.97E+07
Cyclotella planctonica	1	0	.006	6.57E+06
Cyclotella sp.	3	0	.017	1.97E+07
Cymbella cistula	2	0	.012	1.31E+07
Encyonema silesiacum	1	0	.006	6.57E+06
Epithemia turgida	1	0	.006	6.57E+06
Epithemia sp.	2	0	.012	1.31E+07
Eunotia flexuosa	0	1	.006	6.57E+06
Eunotia sp.	.5	0	.003	3.28E+06
Fragilaria capucina + vars.	4	0	.023	2.63E+07
Fragilaria vaucheriae	1	0	.006	6.57E+06
Geissleria ignota var. palustris	1	0	.006	6.57E+06
Gomphonema parvulum fo. micropus	0	1	.006	6.57E+06
Gomphonema pseudotenellum	1	0	.006	6.57E+06
Gomphonema sp.	1	0	.006	6.57E+06
Navicula minima	1	1	.012	1.31E+07
Navicula pseudoventralis	2	0	.012	1.31E+07
Navicula radiofallax	2	0	.012	1.31E+07
Navicula (GV)	2	0	.012	1.31E+07
Navicula sp.	1	1	.012	1.31E+07
Nitzschia sp.	2	0	.012	1.31E+07
Pinnularia abaujensis var. linearis	1	0	.006	6.57E+06
Pinnularia sp.	1	1	.012	1.31E+07
Planothidium lanceolata	4	1	.029	3.28E+07
Pseudostaurosira brevistrata + vars.	5	1	.035	3.94E+07
Rhizosolenia erensis	.5	0	.003	3.28E+06
Sellaphora rectangularis	1	0	.006	6.57E+06
Staurosira construens	0	16	.092	1.05E+08
Staurosira construens var. venter	17	3	.116	1.31E+08
Staurosira lapponica	2	2	.023	2.63E+07
Staurosirella pinnata	10	4	.081	9.20E+07
Synedra rumpens var. familaris	1	0	.006	6.57E+06
Synedra sp.	1	0	.006	6.57E+06
Tabellaria flocculosa str. IIIp	3	0	.017	1.97E+07
Tabellaria quadrasepta	0	1	.006	6.57E+06
Unknown (raphid)	2	0	.012	1.31E+07
Unknown	3	0	.017	1.97E+07
TOTAL	121	52	1.000	1.14E+09
Chrysophyte cysts	1	2		
Scenedesmus coenobia	5	1		
Tetraedron coenobia	1	0		

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
LCO-1, 10–11 cm			
Achnanthidium minutissima + vars.	4	0.025	6.13E+07
Aulacoseira ambigua	1	.006	1.53E+07
Aulacoseira granulata	1	.006	1.53E+07
Aulacoseira italica	2	.012	3.06E+07
Aulacoseira subarctica	2	.012	3.06E+07
Aulacoseira VV	1	.006	1.53E+07
Cyclotella sp1	1	.006	1.53E+07
Cyclotella comensis	7	.043	1.07E+08
Diploneis elliptica	1	.006	1.53E+07
Cyclotella bodanica var. lemanica	2	.012	3.06E+07
Cyclotella glomerata	1	.006	1.53E+07
Cyclotella michiganiana	3	.019	4.60E+07
Cymbella angustata	2	.012	3.06E+07
Eucocconeis flexella	1	.006	1.53E+07
Epithemia adnata	1	.006	1.53E+07
Epithemia turgida	1	.006	1.53E+07
Eunotia incisa	1	.006	1.53E+07
Fragilaria capucina + vars.	5	.031	7.66E+07
Fragilaria crotonensis	6	.037	9.19E+07
Fragilaria vaucheriae	1	.006	1.53E+07
Fragilaria cf. nitzschioides	1	.006	1.53E+07
Geissleria ignota var. palustris	3	.019	4.60E+07
Gomphonema pseudotenellum	1	.006	1.53E+07
Navicula atomus var. permitis	2	.012	3.06E+07
Navicula lanceolata	3	.019	4.60E+07
Navicula minima	5	.031	7.66E+07
Navicula pseudoventralis	4	.025	6.13E+07
Navicula seminuloides	1	.006	1.53E+07
Navicula tripunctata	3	.019	4.60E+07
Navicula sp1 LCO	2	.012	3.06E+07
Navicula (GV)	4	.025	6.13E+07
Navicula sp.	2	.012	3.06E+07
Nitzschia sp.	1	.006	1.53E+07
Planothidium lanceolata	3	.019	4.60E+07
Pseudostaurosira brevistrata + vars.	16	.099	2.45E+08
Rhopalodia gibba	1	.006	1.53E+07
Staurosira construens	6	.037	9.19E+07
Staurosira construens var. venter	28	.174	4.29E+08
Staurosira elliptica	5	.031	7.66E+07
Staurosirella pinnata	18	.112	2.76E+08
Synedra rumpens	1	.006	1.53E+07
Synedra (GV)	1	.006	1.53E+07
Synedra sp.	1	.006	1.53E+07
Tabellaria flocculosa str. IIIp	1	.006	1.53E+07
Unknown (raphid)	3	.019	4.60E+07
Unknown	1	.006	1.53E+07
TOTAL	161	1.000	2.47E+09
Scenedesmus coenobia	2		

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
LCO-1, 16–17 cm			
Achnanthidium exiguum	1	0.006	6.14E+06
Achnanthidium stewartii	1	.006	6.14E+06
Achnanthidium suchlandtii	1	.006	6.14E+06
Achnanthidium minutissima + vars.	1	.006	6.14E+06
Amphora perpusilla	2	.012	1.23E+07
Aulacoseira ambigua	6	.037	3.68E+07
Aulacoseira subarctica	1	.006	6.14E+06
Cavinula cocconeiformis	1	.006	6.14E+06
Cyclotella bodanica var. lemanica	2	.012	1.23E+07
Cymatosira robusta	1	.006	6.14E+06
Cymbella angustata	1	.006	6.14E+06
Epithemia turgida	1	.006	6.14E+06
Fragilaria crotonensis	3	.018	1.84E+07
Fragilaria oldenburgiana	1	.006	6.14E+06
Fragilaria vaucheriae	1	.006	6.14E+06
Geissleria ignota var. palustris	1	.006	6.14E+06
Geissleria schoenfeldii	1	.006	6.14E+06
Karayevia clevei	1	.006	6.14E+06
Martyi martyi	1	.006	6.14E+06
Navicula atomus var. permitis	1	.006	6.14E+06
Navicula minima	3	.018	1.84E+07
Navicula pseudoventralis	4	.025	2.46E+07
Navicula schadei	1	.006	6.14E+06
Navicula seminuloides	4	.025	2.46E+07
Navicula ventralis	1	.006	6.14E+06
Navicula tripunctata	1	.006	6.14E+06
Navicula sp.	2	.012	1.23E+07
Nitzschia amphibia	2	.012	1.23E+07
Nitzschia sp.	2	.012	1.23E+07
Pinnularia sp.	1	.006	6.14E+06
Pseudostaurosira brevistrata + vars.	14	.086	8.60E+07
Stauroneis sp.	1	.006	6.14E+06
Staurosira construens	9	.055	5.53E+07
Staurosira construens var. binodis	5	.031	3.07E+07
Staurosira construens var. venter	22	.135	1.35E+08
Staurosira elliptica	32	.196	1.96E+08
Staurosirella pinnata	24	.147	1.47E+08
Stephanodiscus minutulus	1	.006	6.14E+06
Synedra rumpens	2	.012	1.23E+07
Synedra rumpens var. familaris	1	.006	6.14E+06
Unknown (raphid)	2	.012	1.23E+07
Unknown	0	.000	0.00E+00
TOTAL	163	1.000	1.00E+09
Chrysophyte scales	1		
Chrysophyte cysts	1		
Scenedesmus coenobia	6		

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
LCO-1, 24–25 cm			
Achnanthidium exiguum	2	0.012	9.71E+06
Achnanthidium stewartii	5	.030	2.43E+07
Achnanthidium suchlandtii	5	.030	2.43E+07
Amphora perpusilla	1	.006	4.86E+06
Aulacoseira ambigua	5	.030	2.43E+07
Aulacoseira distans	1	.006	4.86E+06
Aulacoseira subarctica	1	.006	4.86E+06
Aulacoseira (VV)	3	.018	1.46E+07
Cocconeis placentula var. lineata	1	.006	4.86E+06
Cocconeis placentula (RV)	4	.024	1.94E+07
Cyclotella michiganiana	4	.024	1.94E+07
Cyclotella sp.	1	.006	4.86E+06
Cymbella cistula	1	.006	4.86E+06
Epithemia adnata	1	.006	4.86E+06
Epithemia sp.	1	.006	4.86E+06
Fragilaria oldenburgiana	1	.006	4.86E+06
Fragilaria vaucheriae	2	.012	9.71E+06
Geissleria ignota var. palustris	3	.018	1.46E+07
Geissleria schoenfeldii	1	.006	4.86E+06
Gomphonema acuminatum	1	.006	4.86E+06
Gomphonema subclavatum var. commutatum	2	.012	9.71E+06
Gomphonema pseudotenellum	1	.006	4.86E+06
Gomphonema sp.	2	.012	9.71E+06
Martyi martyi	4	.024	1.94E+07
Navicula cocconeiformis	2	.012	9.71E+06
Navicula lanceolata	1	.006	4.86E+06
Navicula pseudoventralis	4	.024	1.94E+07
Navicula seminuloides	2	.012	9.71E+06
Navicula tripunctata	4	.024	1.94E+07
Navicula sp.	4	.024	1.94E+07
Neidium sp.	1	.006	4.86E+06
Pinnularia sp.	2	.012	9.71E+06
Planothidium lanceolata var. dubia	2	.012	9.71E+06
Pseudostaurosira brevistrata + vars.	13	.078	6.31E+07
Staurosira construens	10	.060	4.86E+07
Staurosira construens var. venter	20	.120	9.71E+07
Staurosira elliptica	18	.108	8.74E+07
Staurosirella pinnata	26	.156	1.26E+08
Stephanodiscus minutulus	1	.006	4.86E+06
Stephanodiscus medius	1	.006	4.86E+06
Tabellaria flocculosa str. IIIp	1	.006	4.86E+06
Unknown (raphid)	1	.006	4.86E+06
Unknown	1	.006	4.86E+06
TOTAL	167	1.000	8.11E+08
Chrysophyte cysts	2		
Scenedesmus coenobia	3		

Table A8. Results from analysis of diatom assemblages from Musky Bay MB-1 and MB-3 cores and Northeastern Bay LCO-1 core, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter; g, gram; Concentration (Number/g dry sediment) was not determined in all counts, therefore the concentration value may be zero.]

Taxa	Number 1	Proportion	Number/g dry sediment
LCO-1, 40–41 cm			
Achnanthidium exiguum	8	0.050	3.84E+07
Achnanthidium stewartii	3	.019	1.44E+07
Achnanthidium suchlandtii	1	.006	4.81E+06
Achnanthidium (GV)	1	.006	4.81E+06
Amphora ovalis var. affinis	3	.019	1.44E+07
Amphora perpusilla	5	.031	2.40E+07
Aulacoseira ambigua	16	.100	7.69E+07
Aulacoseira distans	1	.006	4.81E+06
Aulacoseira subarctica	2	.013	9.61E+06
Cyclotella bodanica var. lemanica	2	.013	9.61E+06
Cyclotella ocellata	1	.006	4.81E+06
Cymbella cuspidata	1	.006	4.81E+06
Fragilaria oldenburgiana	2	.013	9.61E+06
Geissleria ignota var. palustris	2	.013	9.61E+06
Geissleria schoenfeldii	5	.031	2.40E+07
Gomphonema subclavatum var. commutatum	1	.006	4.81E+06
Gomphonema pseudotenellum	1	.006	4.81E+06
Gomphonema sp.	1	.006	4.81E+06
Martyi martyi	1	.006	4.81E+06
Navicula atomus var. permitis	3	.019	1.44E+07
Navicula lanceolata	1	.006	4.81E+06
Navicula minima	2	.013	9.61E+06
Navicula pseudoventralis	3	.019	1.44E+07
Navicula seminuloides	3	.019	1.44E+07
Navicula tripunctata	7	.044	3.36E+07
Navicula sp.	6	.038	2.88E+07
Nitzschia amphibia	2	.013	9.61E+06
Nitzschia sp.	2	.013	9.61E+06
Pinnularia sp.	1	.006	4.81E+06
Planothidium lanceolata	3	.019	1.44E+07
Planothidium lanceolata var. dubia	1	.006	4.81E+06
Pseudostaurosira brevistrata + vars.	14	.088	6.73E+07
Sellaphora seminulum	1	.006	4.81E+06
Staurosira construens	7	.044	3.36E+07
Staurosira construens var. venter	14	.088	6.73E+07
Staurosira elliptica	15	.094	7.21E+07
Staurosirella pinnata	12	.075	5.77E+07
Staurosirella pinnata var. intercedens	3	.019	1.44E+07
Staurosira contruens var. subsalina	2	.013	9.61E+06
Thalassiosira sp.	1	.006	4.81E+06
Unknown (raphid)	0	.000	0.00E+00
Unknown	0	.000	0.00E+00
TOTAL	160	1.000	7.69E+08
Chrysophyte cysts	4		
Scenedesmus coenobia	2		

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999

[cm, centimeter]

	Number	Proportion
2–4 cm		
Terrestrial Pollen		
Acer	24	0.076
Celtis	3	.010
Cornus	1	.003
Corylus	3	.010
Larix	1	.003
Betula	40	.127
Alnus	9	.029
Quercus	28	.089
Populus	3	.010
Abies	5.5	.017
Pinus	124.5	.395
Ostrya	5	.016
Tilia	3	.010
Ulmus	1	.003
Thalictrum	2	.006
Ambrosia	27	.086
Carophyllaceae	3	.010
Plantago	1	.003
Grass	14	.044
Unknown	17	.054
TOTAL	315	1.000
Aquatic Pollen		
Typha	16	.051
Myriophyllum	5	.016
Potamogeton, reticulated	11	.035
Potamogeton, smooth	7	.022
Heterantera dubia	3	.010
Utricularia	5	.016
Nymphaea	2	.006
Coelastrum coenobia	3	.010
Tetraedron coenobia	1	.003
Pediastrum coenobia	23	.073
Scenedesmus coenobia	39	.124
Zooplankton parts	21	
Chironomid mental plate	1	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
10–12 cm		
Terrestrial Pollen		
Larix	2	0.017
Betula	19	.164
Alnus	9	.078
Quercus	18	.155
Abies	1.5	.013
Pinus	42.5	.366
Ostrya	7	.060
Tsuga	1	.009
Ambrosia	2	.017
Artemsia	2	.017
Chenopodiaceae	2	.017
Pteridium	1	.009
Grass	6	.052
Unknown	3	.026
TOTAL	116	1.000
Aquatic Pollen		
Zizania palustris	1	.009
Typha	1	.009
Myriophyllum	4	.034
Potamogeton, reticulated	1	.009
Heterantera dubia	1	.009
Utricularia	1	.009
Ceratophyllum spine	1	.009
Coelastrum coenobia	1	.009
Tetraedron coenobia	1	.009
Pediastrum coenobia	5	.043
Scenedesmus coenobia	8	.063
Zooplankton parts	2	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued
[cm, centimeter]

	Number	Proportion
20–22 cm		
Terrestrial Pollen		
Celtis	2	0.020
Larix	1	.010
Betula	18	.176
Alnus	1	.010
Quercus	5	.049
Abies	4	.039
Pinus	53	.520
Ostrya	6	.059
Tilia	1	.010
Tsuga	1	.010
Ambrosia	5	.049
Carophyllaceae	1	.010
Dryopteris	1	.010
Chenopodiaceae	1	.010
Unknown	2	.020
TOTAL	102	1.000
Aquatic Pollen		
Zizania palustris		
Typha	1	.010
Myriophyllum	2	.020
Potamogeton, reticulated	5	.049
Utricularia	3	.029
Coelastrum coenobia	1	.010
Pediastrum coenobia	4	.039
Scenedesmus coenobia	6	.059
Zooplankton parts	2	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued
[cm, centimeter]

	Number	Proportion
30–32 cm		
Terrestrial Pollen		
Celtis	3	0.029
Juniperus or *Thuja*	2	.020
Larix	1	.010
Betula	14	.137
Alnus	7	.069
Quercus	11	.108
Abies	5	.049
Pinus	45	.441
Ostrya	5	.049
Tilia	4	.039
Ambrosia	2	.020
Artemsia	1	.010
Pteridium	1	.010
Unknown	1	.010
TOTAL	102	1.000
Aquatic Pollen		
Zizania palustris	1	.010
Typha	5	.049
Myriophyllum	2	.020
Potamogeton, reticulated	2	.020
Utricularia	1	.010
Coelastrum coenobia	1	.010
Tetraedron coenobia	1	.010
Pediastrum coenobia	8	.078
Scenedesmus coenobia	6	.059
Zooplankton parts	2	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
40–42 cm		
Terrestrial Pollen		
Acer	1	0.010
Celtis	2	.020
Betula	12	.118
Alnus	1	.010
Quercus	8	.078
Abies	1.5	.015
Pinus	60.5	.593
Ostrya	1	.010
Salix	1	.010
Tsuga	3	.029
Ambrosia	2	.020
Artemsia	3	.029
Chenopodiaceae	2	.020
Pteridium	2	.020
Unknown	2	.020
TOTAL	102	1.000
Aquatic Pollen		
Zizania palustris	1	.010
Myriophyllum	2	.020
Potamogeton, smooth	1	.010
Utricularia	1	.010
Lemna	1	.010
Sphagnum	1	.010
Coelastrum coenobia	1	.010
Tetraedron coenobia	1	.010
Pediastrum coenobia	1	.010
Scenedesmus coenobia	2	.020
Staurastrum coenobia	1	.010
Zooplankton parts	1	
Chironomid mental plate	1	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
50–52 cm		
Terrestrial Pollen		
Acer	24	0.080
Celtis	3	.010
Cornus	1	.003
Corylus	3	.010
Larix	1	.003
Betula	40	.133
Alnus	9	.030
Quercus	28	.093
Populus	3	.010
Abies	5.5	.018
Pinus	124.5	.414
Ostrya	5	.017
Tilia	3	.010
Ulmus	1	.003
Thalictrum	2	.007
Ambrosia	27	.090
Carophyllaceae	3	.010
Plantago	1	.003
Unknown	17	.056
TOTAL	301	1.000
Aquatic Pollen		
Typha	16	.053
Myriophyllum	5	.017
Potamogeton, reticulated	11	.037
Potamogeton, smooth	7	.023
Heterantera dubia	3	.010
Utricularia	5	.017
Nymphaea	2	.007
Coelastrum coenobia	3	.010
Tetraedron coenobia	1	.003
Pediastrum coenobia	23	.076
Scenedesmus coenobia	39	.130
Zooplankton parts	21	
Chironomid mental plate	1	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
58–60 cm		
Terrestrial Pollen		
Juniperus or *Thuja*	1	0.007
Betula	18	.119
Alnus	2	.013
Quercus	7	.046
Abies	7	.046
Pinus	77	.510
Ostrya	6	.040
Tilia	2	.013
Ulmus	2	.013
Tubuliflorae	1	.007
Iva	1	.007
Ambrosia	13	.086
Osmunda	1	.007
Urtica	2	.013
Artemsia	1	.007
Chenopodiaceae	1	.007
Plantago	1	.007
Pteridium	2	.013
Grass	4	.026
Unknown	2	.013
TOTAL	151	1.000
Aquatic Pollen		
Zizania palustris	27	.179
Typha	4	.026
Isoetes	1	.007
Myriophyllum	1	.007
Potamogeton, reticulated	2	.013
Heterantera dubia	4	.026
Utricularia	4	.026
Coelastrum coenobia	1	.007
Pediastrum coenobia	10	.066
Zooplankton parts	2	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
70–72 cm		
Terrestrial Pollen		
Acer	1	0.006
Corylus	1	.006
Betula	29.5	.177
Alnus	5	.030
Quercus	19	.114
Abies	11	.066
Pinus	69	.414
Ostrya	7	.042
Tilia	1	.006
Ulmus	1	.006
Tubuliflorae	2	.012
Iva	7	.042
Ambrosia	4	.024
Urtica	3	.018
Artemsia	2	.012
Chenopodiaceae	1	.006
Pteridium	1	.006
Grass	1	.006
Unknown	1	.006
TOTAL	166.5	1.000
Aquatic Pollen		
Zizania palustris	26	.156
Typha	4	.024
Myriophyllum	1	.006
Potamogeton, reticulated	8	.048
Utricularia	3	.018
Tetraedron coenobia	1	.006
Pediastrum coenobia	13	.078
Zooplankton parts	3	

Table A9. Results from analysis of pollen assemblages from Musky Bay core MB-3, Lac Courte Oreilles, October 1999—Continued

[cm, centimeter]

	Number	Proportion
80–82 cm		
Terrestrial Pollen		
Corylus	3	0.020
Betula	24	.163
Alnus	1	.007
Quercus	15	.102
Abies	9	.061
Pinus	74	.503
Ostrya	9	.061
Ulmus	2	.014
Iva	2	.014
Ambrosia	2	.014
Chenopodiaceae	1	.007
Pteridium	1	.007
Heterantheria dubia	2	.014
Grass	2	.014
TOTAL	147	1.000
Aquatic Pollen		
Zizania palustris	10	.068
Typha	4	.027
Utricularia	4	.027
Coelastrum coenobia	2	.014
Pediastrum coenobia	9	.061
Zooplankton parts	1	

Table A10. Results from quality assurance analysis of replicate core samples from Lac Courte Oreilles and surrounding areas, October 1999 and July 2001

[cm, centimeter; %, percent; wt, weight; na, no data]

Field no.	Interval (cm)	Type of data	Replicate 1	Replicate 2	Absolute difference	Percent error	Average percent error
MB-1-19	18–19	Water weight (%)	97.1	97.3	0.2	0.2	4.4
MB-1-39	38–39	Water weight (%)	96.3	96.1	.2	.2	
MB-1-59	66–68	Water weight (%)	96.1	96	.1	.1	
MB-1-65	78–80	Water weight. (%)	94.2	94.1	.1	.1	
JON-1-1	0–10	Water weight (%)	51.7	43	8.7	18.4	
ZAW-1-1	0–8	Water weight (%)	21.3	19.8	1.5	7.3	
MB-1-19	18–19	Organic content (%)	48.6	47.5	1.1	2.3	8.7
MB-1-39	38–39	Organic content (%)	46.4	46.7	.3	.6	
MB-1-59	66–68	Organic content (%)	56.4	56.4	.0	.0	
MB-1-65	78–80	Organic content (%)	60.6	60.2	.4	.7	
JON-1-1	0–10	Organic content (%)	16.5	11	5.5	40.0	
LCO-1-13	12–13	Aluminum	1.8	1.8	.0	.0	11.7
LCO-1-23	22–23	Aluminum	1.8	1.7	.1	5.7	
MB-1-34	33–34	Aluminum	1.1	.94	.16	15.7	
MB-1-41	40–41	Aluminum	.96	1.0	.04	4.1	
MB-1-61	70–72	Aluminum	.86	1.2	.34	33.0	
LCO-1-13	12–13	Antimony	.67	.7	.03	4.4	22.7
LCO-1-23	22–23	Antimony	.29	.22	.07	27.5	
MB-1-34	33–34	Antimony	.48	.52	.04	8.0	
MB-1-41	40–41	Antimony	.49	.36	.13	30.6	
MB-1-61	70–72	Antimony	.31	.48	.17	43.0	
LCO-1-13	12–13	Arsenic	15	15	.0	.0	4.6
LCO-1-23	22–23	Arsenic	5.7	6.5	.8	13.1	
MB-1-34	33–34	Arsenic	5.8	6	.2	3.4	
MB-1-41	40–41	Arsenic	6.4	6.6	.2	3.1	
MB-1-61	70–72	Arsenic	6.1	5.9	.2	3.3	
LCO-1-13	12–13	Barium	260	250	10	3.9	3.2
LCO-1-23	22–23	Barium	240	240	0	0	
MB-1-34	33–34	Barium	150	150	0	0	
MB-1-41	40–41	Barium	160	170	10	6.1	
MB-1-61	70–72	Barium	170	160	10	6.1	
LCO-1-13	12–13	Beryllium	.46	.76	.3	49.2	33.8
LCO-1-23	22–23	Beryllium	.53	.4	.13	28.0	
MB-1-34	33–34	Beryllium	.45	.43	.02	4.5	
MB-1-41	40–41	Beryllium	.46	.26	.2	55.6	
MB-1-61	70–72	Beryllium	.24	.33	.09	31.6	
LCO-1-13	12–13	Cadmium	1.2	1.4	.2	15.4	13.3
LCO-1-23	22–23	Cadmium	.26	.31	.05	17.5	
MB-1-34	33–34	Cadmium	1.3	1.3	.0	.0	
MB-1-41	40–41	Cadmium	1.3	1.1	.2	16.7	
MB-1-61	70–72	Cadmium	1.1	1.3	.2	16.7	

Table A10. Results from quality assurance analysis of replicate core samples from Lac Courte Oreilles and surrounding areas, October 1999 and July 2001—Continued

[cm, centimeter; %, percent; wt, weight; na, no data]

Field no.	Interval (cm)	Type of data	Replicate 1	Replicate 2	Absolute difference	Percent error	Average percent error
LCO-1-13	12–13	Calcium	.74	.72	.02	2.7	9.3
LCO-1-23	22–23	Calcium	.63	.66	.03	4.7	
MB-1-34	33–34	Calcium	.64	.59	.05	8.1	
MB-1-41	40–41	Calcium	.63	.78	.15	21.3	
MB-1-61	70–72	Calcium	.67	.74	.07	9.9	
LCO-1-13	12–13	Cerium	30	29	1	3.4	3.4
LCO-1-23	22–23	Cerium	26	26	0	0	
MB-1-34	33–34	Cerium	15	15	0	0	
MB-1-41	40–41	Cerium	15	14	1	6.9	
MB-1-61	70–72	Cerium	14	15	1	6.9	
LCO-1-13	12–13	Chromium	33	34	1	3.0	6.0
LCO-1-23	22–23	Chromium	28	28	0	0	
MB-1-34	33–34	Chromium	17	17	0	0	
MB-1-41	40–41	Chromium	16	13	3	20.7	
MB-1-61	70–72	Chromium	15	16	1	6.5	
LCO-1-13	12–13	Cobalt	7.5	7.5	0.0	0.0	10.4
LCO-1-23	22–23	Cobalt	4.8	5.4	.6	11.8	
MB-1-34	33–34	Cobalt	3.2	3.1	.1	3.2	
MB-1-41	40–41	Cobalt	3.0	2.4	.6	22.2	
MB-1-61	70–72	Cobalt	2.5	2.9	.4	14.8	
LCO-1-13	12–13	Copper	29	41	12	34.3	32.5
LCO-1-23	22–23	Copper	15	16	1	6.5	
MB-1-34	33–34	Copper	35	26	9	29.5	
MB-1-41	40–41	Copper	20	17	3	16.2	
MB-1-61	70–72	Copper	13	29	16	76.2	
LCO-1-13	12–13	Gallium	5.0	4.8	.2	4.1	7.3
LCO-1-23	22–23	Gallium	4.2	4.2	0.0	0.0	
MB-1-34	33–34	Gallium	3.2	3.0	.2	6.5	
MB-1-41	40–41	Gallium	2.9	2.5	.4	14.8	
MB-1-61	70–72	Gallium	2.5	2.8	.3	11.3	
LCO-1-13	12–13	Iron	2.6	2.8	.2	7.4	5.2
LCO-1-23	22–23	Iron	.94	1.0	.06	6.2	
MB-1-34	33–34	Iron	.82	.80	.02	2.5	
MB-1-41	40–41	Iron	.81	.78	.03	3.8	
MB-1-61	70–72	Iron	.83	.78	.05	6.2	
LCO-1-13	12–13	Lanthanum	14	14	0	0	6.3
LCO-1-23	22–23	Lanthanum	12	14	2	15.4	
MB-1-34	33–34	Lanthanum	7.6	8.0	.4	5.1	
MB-1-41	40–41	Lanthanum	7.7	7.3	.4	5.3	
MB-1-61	70–72	Lanthanum	7.1	7.5	.4	5.5	
LCO-1-13	12–13	Lead	67	68	1	1.5	17.7
LCO-1-23	22–23	Lead	8.0	8.5	.5	6.1	

Table A10. Results from quality assurance analysis of replicate core samples from Lac Courte Oreilles and surrounding areas, October 1999 and July 2001—Continued

[cm, centimeter; %, percent; wt, weight; na, no data]

Field no.	Interval (cm)	Type of data	Replicate 1	Replicate 2	Absolute difference	Percent error	Average percent error
MB-1-34	33–34	Lead	42	41	1	2.4	
MB-1-41	40–41	Lead	36	23	13	44.1	
MB-1-61	70–72	Lead	24	34	10	34.5	
LCO-1-13	12–13	Lithium	9.1	9.4	.3	3.2	6.8
LCO-1-23	22–23	Lithium	6.2	6.5	.3	4.7	
MB-1-34	33–34	Lithium	6.1	5.8	.3	5.0	
MB-1-41	40–41	Lithium	5.7	5.7	0.0	0.0	
MB-1-61	70–72	Lithium	5.1	6.3	1.2	21.1	
LCO-1-13	12–13	Magnesium	.31	.31	.00	.0	11.1
LCO-1-23	22–23	Magnesium	.26	.28	.02	7.4	
MB-1-34	33–34	Magnesium	.18	.16	.02	11.8	
MB-1-41	40–41	Magnesium	.17	.21	.04	21.1	
MB-1-61	70–72	Magnesium	.18	.21	.03	15.4	
LCO-1-13	12–13	Manganese	1,500	1,600	100	6.5	8.5
LCO-1-23	22–23	Manganese	520	570	50	9.2	
MB-1-34	33–34	Manganese	340	330	10	3.0	
MB-1-41	40–41	Manganese	360	390	30	8.0	
MB-1-61	70–72	Manganese	410	350	60	15.8	
LCO-1-13	12–13	Molybdenum	1.1	1.1	0.0	0.0	7.8
LCO-1-23	22–23	Molybdenum	.63	.68	.05	7.6	
MB-1-34	33–34	Molybdenum	.88	.97	.09	9.7	
MB-1-41	40–41	Molybdenum	.87	.92	.05	5.6	
MB-1-61	70–72	Molybdenum	.75	.88	.13	16.0	
LCO-1-13	12–13	Neodymium	14	14	0	0	2.6
LCO-1-23	22–23	Neodymium	13	13	0	0	
MB-1-34	33–34	Neodymium	7.1	7.1	0.0	0.0	
MB-1-41	40–41	Neodymium	7.1	6.7	.4	5.8	
MB-1-61	70–72	Neodymium	6.5	7.0	.5	7.4	
LCO-1-13	12–13	Nickel	16	16	0	0	5.4
LCO-1-23	22–23	Nickel	12	12	0	0	
MB-1-34	33–34	Nickel	9.2	8.9	.3	3.3	
MB-1-41	40–41	Nickel	8.9	7.9	1	11.9	
MB-1-61	70–72	Nickel	8.1	9.1	1	11.6	
LCO-1-13	12–13	Niobium	4.6	4.6	0.0	0.0	1.8
LCO-1-23	22–23	Niobium	4.6	4.2	.4	9.1	
MB-1-34	33–34	Niobium	<4	<4	0	0	
MB-1-41	40–41	Niobium	<4	<4	0	0	
MB-1-61	70–72	Niobium	<4	<4	0	0	
LCO-1-13	12–13	Phosphorus	.084	.082	.002	2.4	13.2
LCO-1-23	22–23	Phosphorus	.027	.030	.003	10.5	
MB-1-34	33–34	Phosphorus	.083	.075	.008	10.1	
MB-1-41	40–41	Phosphorus	.071	.085	.014	17.9	

Table A10. Results from quality assurance analysis of replicate core samples from Lac Courte Oreilles and surrounding areas, October 1999 and July 2001—Continued

[cm, centimeter; %, percent; wt, weight; na, no data]

Field no.	Interval (cm)	Type of data	Replicate 1	Replicate 2	Absolute difference	Percent error	Average percent error
MB-1-61	70–72	Phosphorus	.067	.086	.019	24.8	
LCO-1-13	12–13	Potassium	.57	.52	.05	9.2	8.6
LCO-1-23	22–23	Potassium	.86	.82	.04	4.8	
MB-1-34	33–34	Potassium	.29	.26	.03	10.9	
MB-1-41	40–41	Potassium	.28	.28	.00	.00	
MB-1-61	70–72	Potassium	.25	.30	.05	18.2	
LCO-1-13	12–13	Scandium	5.5	5.3	.2	3.7	12.7
LCO-1-23	22–23	Scandium	4.5	4.6	.1	2.2	
MB-1-34	33–34	Scandium	2.3	2.0	.3	14.0	
MB-1-41	40–41	Scandium	2.1	2.5	.4	17.4	
MB-1-61	70–72	Scandium	2.0	2.6	.6	26.1	
LCO-1-13	12–13	Sodium	.27	.25	.02	7.7	10.6
LCO-1-23	22–23	Sodium	.39	.38	.01	2.6	
MB-1-34	33–34	Sodium	.11	.10	.01	9.5	
MB-1-41	40–41	Sodium	.11	.13	.02	16.7	
MB-1-61	70–72	Sodium	.11	.13	.02	16.7	
LCO-1-13	12–13	Strontium	45	42	3	6.7	4.3
LCO-1-23	22–23	Strontium	55	54	1	1.8	
MB-1-34	33–34	Strontium	33	33	0	0	
MB-1-41	40–41	Strontium	33	30	3	9.5	
MB-1-61	70–72	Strontium	32	31	1	3.2	
LCO-1-13	12–13	Sulfur	.60	.62	.02	3.3	9.8
LCO-1-23	22–23	Sulfur	.21	.28	.07	28.6	
MB-1-34	33–34	Sulfur	.64	.64	0	0	
MB-1-41	40–41	Sulfur	.62	.56	.06	10.2	
MB-1-61	70–72	Sulfur	.57	.61	.04	6.8	
LCO-1-13	12–13	Thorium	3.0	2.8	.2	6.9	6.5
LCO-1-23	22–23	Thorium	2.4	2.4	0	0	
MB-1-34	33–34	Thorium	2.0	2.2	.2	9.5	
MB-1-41	40–41	Thorium	2.0	1.8	.2	10.5	
MB-1-61	70–72	Thorium	1.8	1.9	.1	5.4	
LCO-1-13	12–13	Tin	2.1	2.0	.1	4.9	3.6
LCO-1-23	22–23	Tin	<1.0	<1.0	0	0	
MB-1-34	33–34	Tin	1.4	1.6	.2	13.3	
MB-1-41	40–41	Tin	1.4	<1.0	na	na	
MB-1-61	70–72	Tin	<1.0	1.0	na	na	
LCO-1-13	12–13	Titanium	.13	.13	0	0	9.8
LCO-1-23	22–23	Titanium	.15	.13	.02	14.3	
MB-1-34	33–34	Titanium	.052	.052	0	0	
MB-1-41	40–41	Titanium	.051	.057	.006	11.1	
MB-1-61	70–72	Titanium	.045	.057	.012	23.5	
LCO-1-13	12–13	Uranium	1.5	1.5	0	0	4.7

Table A10. Results from quality assurance analysis of replicate core samples from Lac Courte Oreilles and surrounding areas, October 1999 and July 2001—Continued

[cm, centimeter; %, percent; wt, weight; na, no data]

Field no.	Interval (cm)	Type of data	Replicate 1	Replicate 2	Absolute difference	Percent error	Average percent error
LCO-1-23	22–23	Uranium	1.2	1.2	0	0	
MB-1-34	33–34	Uranium	.72	.74	.02	2.7	
MB-1-41	40–41	Uranium	.73	.63	.1	14.7	
MB-1-61	70–72	Uranium	.65	.69	.04	6.0	
LCO-1-13	12–13	Vanadium	54	54	0	0	9.1
LCO-1-23	22–23	Vanadium	37	39	2	5.3	
MB-1-34	33–34	Vanadium	22	22	0	0	
MB-1-41	40–41	Vanadium	22	18	4	20.0	
MB-1-61	70–72	Vanadium	18	22	4	20.0	
LCO-1-13	12–13	Ytterbium	1.8	1.8	0	0	1.1
LCO-1-23	22–23	Ytterbium	1.9	1.8	.1	5.4	
MB-1-34	33–34	Ytterbium	<1.0	<1.0	0	0	
MB-1-41	40–41	Ytterbium	1.0	<1.0	na	na	
MB-1-61	70–72	Ytterbium	<1	<1.0	0	0	
LCO-1-13	12–13	Yttrium	13	14	1	7.4	6.6
LCO-1-23	22–23	Yttrium	13	12	1	8.0	
MB-1-34	33–34	Yttrium	5.7	6.0	.3	5.1	
MB-1-41	40–41	Yttrium	5.8	5.4	.4	7.1	
MB-1-61	70–72	Yttrium	5.5	5.8	.3	5.3	
LCO-1-13	12–13	Zinc	110	130	20	16.7	16.1
LCO-1-23	22–23	Zinc	28	31	3	10.2	
MB-1-34	33–34	Zinc	99	94	5	5.2	
MB-1-41	40–41	Zinc	90	72	18	22.2	
MB-1-61	70–72	Zinc	70	91	21	26.1	
MB-1-16	15–16	Organic carbon (%)	22.2	24.8	2.6	11.1	4.5
MB-1-31	30–31	Organic carbon (%)	22.1	22.2	.1	.5	
MB-1-46	45–46	Organic carbon (%)	23.8	23.5	.3	1.0	
LCO-1-9	8–9	Organic carbon (%)	20.5	18.8	1.7	8.9	
LCO-1-19	18–19	Organic carbon (%)	17.5	17.6	.1	.8	
MB-1-16	15–16	Nitrogen (%)	2.65	3.20	.55	18.8	7.1
MB-1-31	30–31	Nitrogen (%)	2.53	2.57	.04	1.6	
MB-1-46	45–46	Nitrogen (%)	2.64	2.57	.07	2.7	
LCO-1-9	8–9	Nitrogen (%)	2.12	2.03	.09	4.3	
LCO-1-19	18–19	Nitrogen (%)	1.71	1.85	.14	7.9	
MB-1-16	15–16	Biogenic silica (wt %)	25.0	23.6	1.4	5.7	9.1
MB-1-31	30–31	Biogenic silica (wt %)	22.9	22.8	.1	.4	
MB-1-46	45–46	Biogenic silica (wt %)	23.1	20.4	2.7	12.3	
LCO-1-10	10–11	Biogenic silica (wt %)	26.1	27.0	.9	3.4	
LCO-1-21	20–21	Biogenic silica (wt %)	5.4	6.8	1.4	23.7	

APPENDIX B

Interpretation of Nutrient History for the Main Basin of Lac Courte Oreilles from Diatom Assemblages

By Paul J. Garrison

Aquatic organisms are useful indicators of lake water quality because they are in direct contact with the water and are strongly affected by the chemical composition of their surroundings. Most indicator-organism groups grow rapidly and are short lived, so the community composition responds rapidly to changing environmental conditions. Diatom assemblages are especially useful sets of organisms for paleolimnological analysis. Diatoms are a type of algae that possess siliceous cell walls, which enable them to be highly resistant to degradation; moreover diatoms are usually abundant, ecologically diverse, and well preserved in sediments. Diatom species have unique features (some of which are shown in fig. B1) that enable them to be readily identified. Certain taxa are usually found under nutrient-poor conditions, whereas others are more common at elevated nutrient concentrations. Some species float in the open-water areas, whereas others are attached to objects such as aquatic plants or the lake bottom.

By determining changes in the diatom community, it is possible to determine certain water-quality changes that have occurred in the lake. The diatom community provides information about changes in nutrient and pH conditions, as well as alterations in the aquatic plant community.

Diatom assemblages were examined from core LCO-2 collected from the deep area of the Lac Courte Oreilles in October 1999. The water depth at this site was 30 meters. The top of the core was examined, as was a section at 40 centimeters that was assumed to represent a time period prior to the late 1800s.

In the main part of Lac Courte Oreilles, at the present time and historically, the major component of the diatom community are those species that float in the open water of the lake (planktonic diatoms; fig. B2). The major species of the planktonic diatoms is the chain forming taxa *Aulacoseira* (fig. B1, left). The second most important diatom group is *Cyclotella* (fig. B1, right), which also float in open water.

The slight decrease in the percentage of *Aulacoseira* at the present time compared with historical times indicates a small increase in nutrients. *Cyclotella* usually are found under slightly higher nutrient levels than *Aulacoseira*. It is likely this increase has only been very slight, probably on the order of 2-4 micrograms liter^{-1} of phosphorus over the last 100 or more years. There also appears to have been an increase in aquatic plants, as indicated by an increase in the diatom *Achnanthidium*. This diatom typically is attached to submerged plants. This increase in plants is very common in northern Wisconsin lakes and results from increased nutrient delivery from watershed disturbance. In the case of Lac Courte Oreilles, the possible disturbance sources are cottage development and discharge from cranberry operations.

In summary, the diatom community indicates nutrient concentrations in the middle of Lac Courte Oreilles have increased only a small amount over the past 100 years. The aquatic plant community does appear to have increased slightly. The diatoms indicate that the overall health of the main body of the lake remains very good. Because this core was collected in the deep area of the main lake basin, the diatom community does not reflect changes that may have occurred over time in the various bays of the lake.

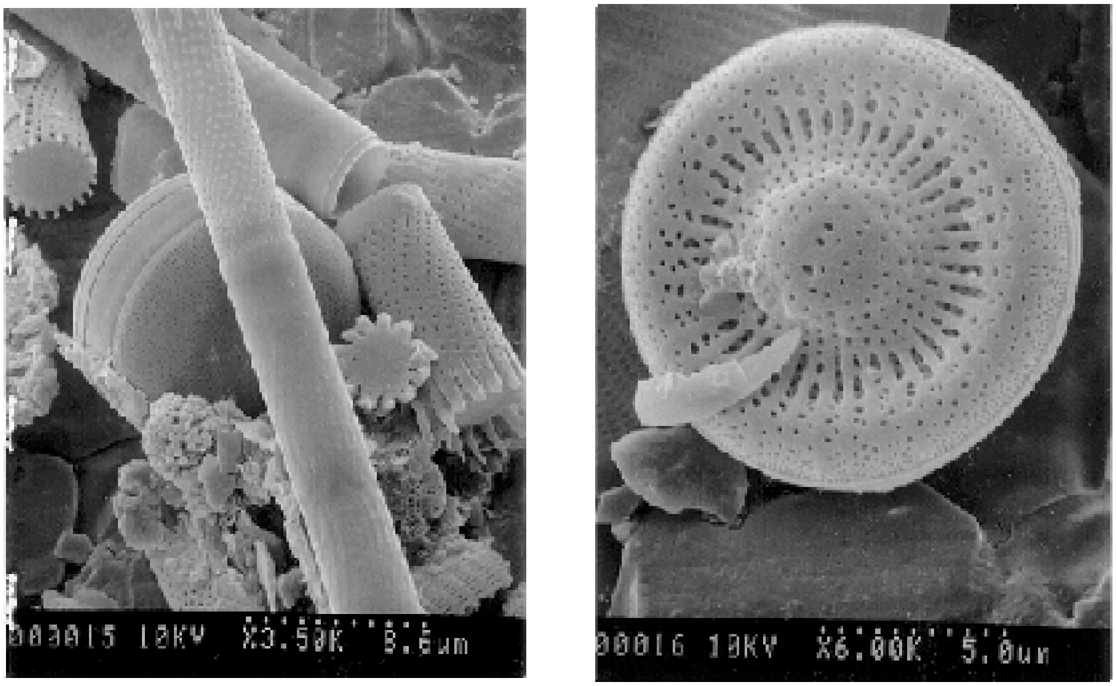

Figure B1. Electron-micrographs of diatoms Aulacoseira (left) and Cyclotella (right). Both of these diatoms float in the open water. The diatom on the left is indicative of lower nutrients than the one on the right.

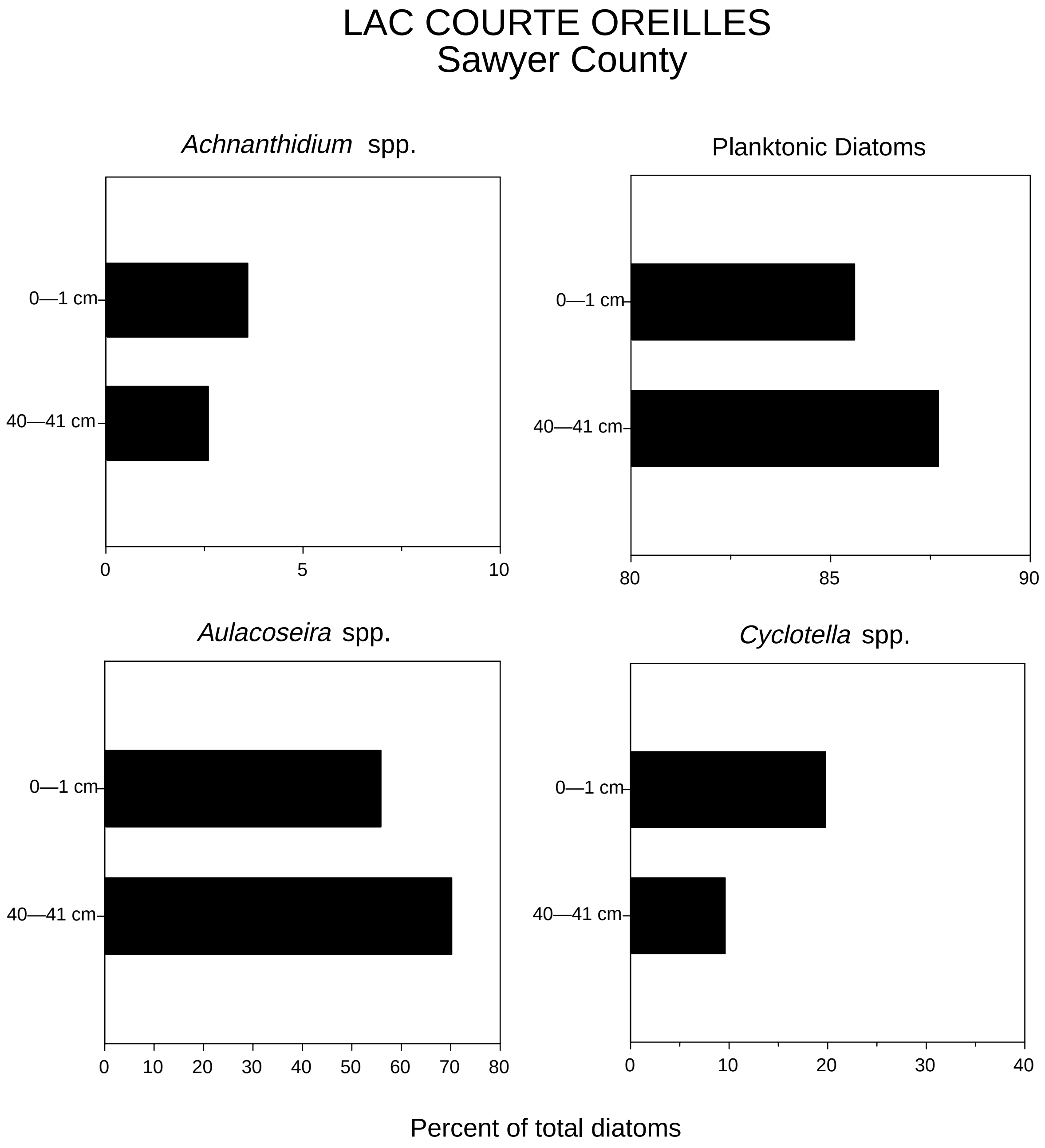

Figure B2. Changes in abundance of important diatoms found at present (0–1 centimeters) and presettlement times (40–41 centimeters).