THE CANADIAN WILDLIFE SERVICE LRTAP BIOMONITORING PROGRAM

PART 3

SITE LOCATIONS, PHYSICAL, CHEMICAL AND BIOLOGICAL CHARACTERISTICS

D. K. McNicol, M. L. Mallory

Canadian Wildlife Service, Ontario Region, 49 Camelot Dr., Nepean, Ontario, Canada K1A 0H3

J. J. Kerekes

Canadian Wildlife Service, Atlantic Region, 45 Alderney Dr., Dartmouth, Nova Scotia, Canada B2Y 2N6

Canadian Wildlife Service Technical Report Series No. 248

This series may be cited as:

McNicol, D. K.; Mallory, M. L.; Kerekes, J. J.; 1996. The Canadian Wildlife Service LRTAP Biomonitoring Program, Part 3. Site Locations, Physical, Chemical and Biological Characteristics. Technical Report Series No. 248, Canadian Wildlife Service.

Issued under the Authority of the
Minister of Environment
Canadian Wildlife Service

Catalogue No. CW 69-5/248E
ISBN 0-662-21743-8

Copies[a] may be obtained from:

Donald K. McNicol
LRTAP Biologist
Environmental Conservation Branch
Canadian Wildlife Service
Ontario Region
49 Camelot Drive
Nepean, Ontario, Canada
K1A 0H3

Ph: (613) 952 2409
FAX: (613) 952 9027
e-mail: MCNICOLD@AESOTT.AM.DOE.CA

[a] Due to the size and cost of producing this document, some restrictions in its distribution may be necessary.

FORWARD

The loss and degradation of habitat is a major waterfowl management problem in North America today. Formerly secure habitats in the vast boreal forest of eastern Canada are now affected by large-scale land-use practices, including hydropower and recreational developments, certain forestry practices, industrial effluent pollution and atmospheric contamination. The emission and deposition of acidic substances (primarily sulphur dioxide SO_2 and nitrous oxides NO_x, and commonly referred to as "acid rain") and subsequent environmental effects have received considerable attention over the past two decades. Much of eastern Canada is highly sensitive to acid rain since its thin, coarsely-textured soil and granitic bedrock (characteristic of Canadian Shield) has little inherent ability to neutralize acidic pollutants. As a result, acid rain may contribute to declining growth rates and increased mortality in trees. High levels of acidic deposition can result in the acidification of lakes, rivers and streams. Along with elevated levels of metals leached from surrounding soils, high acidity can seriously impair the ability of water bodies to support aquatic life, resulting in a decline in species diversity and undesirable impacts on water-dependent wildlife, such as waterfowl.

Research and monitoring into various aspects of the acid rain problem has been carried out under the auspices of the Long Range Transport of Air Pollutants (LRTAP) Program, an interdepartmental initiative of the federal government involving Agriculture Canada, Fisheries and Oceans Canada, Natural Resources Canada, Health and Welfare Canada and Environment Canada. As a result of combined federal and provincial efforts, Canada has made significant progress towards reducing the environmental threat of acid rain. A Canadian Acid Rain Control Program was formalized in 1985 by establishing federal-provincial agreements to reduce aggregate SO_2 emissions of the seven easternmost provinces to 2.3 million tonnes per year by 1994 (a target which has been achieved). Because more than 50% of the acid rain that falls in eastern Canada comes from the United States, Canada also signed an agreement with the U. S. in 1991 to reduce SO_2 and NO_x emissions, and to establish a permanent national limit on SO_2 of 3.2 million tonnes by the year 2000. In 1995, Canada began to develop a national strategy on acidifying emissions that aims to protect acid-sensitive ecosystems, human health and air visibility beyond the year 2000.

As part of Environment Canada's efforts to study the acid rain problem, the Canadian Wildlife Service (CWS) initiated a research program in 1980 to assess the impacts of acidic deposition on wildlife and wildlife habitats in eastern Canada. Objectives of the first phase of the CWS LRTAP program were to determine which species and habitats were most at risk from acidification, and to establish cause-and-effect relationships between acidification and biological changes, chiefly in bird communities. The results of this phase of the program are contained in two volumes of the CWS Occasional Paper Series (Numbers 62 and 67); McNicol *et al.* (1987) describe work on waterfowl and their food chains in small lakes in northern Ontario, while DesGranges (1989) summarizes results of surveys of freshwater bird communities in Québec, as well as phyto-ecological studies of their associated habitats, in relation to acidification. Research in Québec also focused on relationships between acid rain, forest dieback (especially sugar maple stands) and the associated effects on forest bird communities (Darveau *et al.* 1992). CWS studies were also conducted in the Lepreau area in southwestern New Brunswick, where the relationships between wetland acidity, fish presence, invertebrate biomass and habitat use by young waterfowl broods were examined (Parker *et al.* 1989, 1992). CWS and the Long Point Bird Observatory implemented the Canadian Lakes Loon Survey in the 1980s. This volunteer-based survey gathers data on the breeding success of Common Loons (*Gavia immer*) nesting across Canada, including many lakes in acid-stressed regions of eastern Canada. CWS has also played a major role in interdisciplinary studies of calibrated basins, especially in Atlantic Canada (Kerekes 1989), where Kerekes *et al.* (1994) have studied nutrient release in and limnological characteristics of acidified waters in Kejimkujik National Park, particularly as it pertains to the ecology of fish-eating birds. Scheuhammer (1991) described the results of research at the National Wildlife

Research Centre on the fate of heavy metals in waterfowl food chains, as well as laboratory studies of the effects of dietary heavy metals on the reproductive output of birds under controlled conditions.

Together, these efforts provided the basis for the development and implementation of the CWS LRTAP Biomonitoring Program in 1987. This national program is comprised of research and monitoring activities conducted by the National Wildlife Research Centre and by Regional Offices in Ontario and Atlantic Canada. Instrumental to program delivery are partnerships with various federal and provincial resource agencies, non-government organizations, universities and environmental consultants. Objectives of the program are to:

- track biotic changes expected to occur in sensitive aquatic ecosystems as acidifying emissions are reduced
- evaluate the adequacy of emission control programs to meet environmental objectives to protect aquatic biota important to wildlife.

This report contains information pertaining to the CWS LRTAP Biomonitoring Program and is Part 3 of a series of Canadian Wildlife Service Technical Reports which describe various aspects of the program:

Part 1: A Strategy to Monitor the Biological Recovery of Aquatic Ecosystems in Eastern Canada from the Effects of Acid Rain, *CWS Technical Report Series No. 245, 28 pp.*

Part 2: Food Chain Monitoring in Ontario Lakes: Taxonomic Codes and Collections, *CWS Technical Report Series No. 246, 32 pp.*

Part 3: Site Locations, Physical, Chemical and Biological Characteristics, *CWS Technical Report Series No. 248, 215 pp.*

Part 4: Procedures Manual *(in preparation)*

For more information on the Canadian Wildlife Service LRTAP Biomonitoring Program or to obtain copies of this or any of the reports in this series, please contact:

Donald K. McNicol
LRTAP Biologist
Environmental Conservation Branch
Canadian Wildlife Service
Ontario Region
49 Camelot Drive
Nepean, Ontario, Canada
K1A 0H3

Ph: (613) 952 2409
FAX: (613) 952 9027
e-mail: MCNICOLD@AESOTT.AM.DOE.CA

ABSTRACT

The Canadian Wildlife Service (CWS) Long Range Transport of Air Pollutants (LRTAP) Biomonitoring Program conducts broad scale surveys on over 600 wetlands and lakes in northeastern Ontario and 46 lakes in Kejimkujik National Park, Nova Scotia, to monitor the chemical and biotic response of sensitive aquatic ecosystems to reduced inputs of acidifying emissions. An important component of this program, the Canadian Lakes Loon Survey (CLLS), uses a network of volunteers to assess the breeding success of Common Loons (*Gavia immer*), a key bioindicator species, on larger lakes across Canada. This report provides detailed physical, chemical and biological characteristics of CWS biomonitoring study lakes and their locations in Ontario and Kejimkujik National Park. Maps of a subset of more intensively studied Food Chain Monitoring Program (FCMP) lakes in Ontario are also presented. As well, volunteer effort across Canada and the location of CLLS lakes in Ontario and the Atlantic provinces are documented. This information is intended as a working document for researchers studying the effects of air pollutants and other environmental stressors on aquatic ecosystems. By providing detailed descriptions of our study area characteristics, we hope to encourage collaboration with other researchers.

RÉSUMÉ

Dans le cadre du Programme de biosurveillance concernant le transport à grande distance des polluants atmosphériques (TGDPA) du Service canadien de la faune (SCF), plus de 600 milieux humides et lacs dans le nord-est de l'Ontario et 46 lacs situés dans le parc national de Kejimkujik (Nouvelle-Écosse) ont été l'objet de relevés à grande échelle; il s'agissait de surveiller la réaction sur les plans chimique et biotique des écosytèmes aquatiques sensibles à une réduction des émissions acides. Un volet important de ce programme, l'Inventaire canadien des huarts à collier (ICHC), fait appel à un réseau de volontaires pour évaluer le succès de la reproduction du huarts à collier (*Gavia immer*), bioindicateur clé, dans plus de 1 500 lacs au Canada. On indique dans le présent rapport les caractéristiques physiques, chimiques et biologiques détaillées des lacs étudiés par le SCF et leur emplacement en Ontario et dans le parc national de Kejimkujik. Des cartes d'un sous-ensemble de lacs examinés de façon plus approfondie dans le cadre du programme de surveillance de la chaîne alimentaire sont également jointes. En outre, on fournit des informations sur le travail des volontaires au Canada, l'emplacement des lacs visés par l'ICHC en Ontario et dans les provinces de l'Atlantique. Ces données serviront de document de travail aux chercheurs qui étudient les effets des polluants atmosphériques sur les écosystèmes aquatiques. Par une description détaillée des caractéristiques de notre zone d'étude, nous espérons favoriser la collaboration avec d'autres chercheurs.

ACKNOWLEDGEMENTS

Over the past fifteen years, many individuals, agencies and groups have contributed to CWS LRTAP research and monitoring activities across Canada. We take this opportunity to thank everyone who has been involved in this effort and apologize to those who have been inadvertently omitted. Financial support for this work has been provided by the Long Range Transport of Air Pollutants (LRTAP) Program of Environment Canada, as well as CWS regional and headquarters programs. In addition, we have benefitted from cooperative investigations with other federal and provincial agencies (Algonquin Provincial Park, Atmospheric Environment Service, Bedford Institute of Oceanography, Canadian Museum of Nature, Fisheries and Oceans Canada, INRS-Eau, Kejimkujik National Park, Lesley Frost Centre, National Water Research Institute, National Wildlife Research Centre, Natural Resources Canada (CFS), Ontario Ministry of Energy and Environment, Ontario Ministry of Natural Resources, Royal Ontario Museum, U.S. Fish and Wildlife Service), non-government organizations and environmental consultants (ESSA Technologies Ltd., Geomatics International Inc., Haliburton Forest and Wild Life Reserve, Long Point Bird Observatory, Monenco AGRA Inc., Whitefish Point Bird Observatory, Wildlife Habitat Canada, World Wildlife Fund [Wildlife Toxicology Fund]), and universities (Carleton, Dalhousie, Guelph, Québec, Queen's, Laurentian, McGill, McMaster, Toronto, Trent, Wales).

We thank many CWS managers who have assisted in program coordination from its inception. These include Pete Blancher, Steve Curtis, Tony Diamond, Charles Drolet, Richard Elliot, Kathy Fischer, Tony Keith, Keith Marshall, Dave Peakall, Rick Pratt, Bill Prescott, Austin Reed, Al Smith, and Dan Welsh. We especially wish to thank Barry Bendell, Pete Blancher, Lise Brisebois, Dean Jeffries, Ken Ross, Tony Scheuhammer and Mark Wayland for their key roles in various stages of the development of this program. We also thank Russ Walton for his help in writing and preparing this document, and Jill Sechley, Mike Duggan and Lise Brisebois for their help in preparing the maps and figures presented.

We are also indebted to many individuals, field and laboratory assistants, contractors and scientists who have helped in this project over the years, including: Rob Alvo, Jane Ashenden, Carolyn Atchison, Duncan Bates, Steve Beauchamp, Nikki Benjamin, Gabe Boros, Bob Bracken, Michael Bradstreet, Della Bond, Monique Bronkhorst, Guy Brun, Peter Burke, Barb Campbell, Christine Carey, Daniel Carrière, Debra Chamberlain, Tom Clair, Karen Clark, Jeff Comeau, Daniel Cluis, Francis Cook, John Cooper, Janette Cormack, E. J. Crossman, Marcel Darveau, Ian Davies, Darrell Dennis, Jean-Luc DesGranges, Bruce Di Labio, Dixon Dorland, Connie Downes, Barb Dowsley, Cliff Drysdale, Mike Duggan, Jacques Dupont, John Eadie, Sue Edmunds, Flloyd Elder, Dave Evers, Don and Kim Fillman, Neil Foster, Bill Freedman, Caren Furlonger, Micky Gauthier, Mark and Simon Gawn, Val Glooschenko, Robert Gorman, Dawn Grainger, Susan Greenwood, Zoltán Gribovszki, John Gunn, Ann Harfenist, John Haselmayer, Paul Hazlett, Bálint Heil, Robert Hélie, Jocelyn Heneberry, Keith and Trudy Hinds, Erling Holm, Peter Hope, Benoit Houde, Nancy House, John Howden, Geoff Howell, Dave Hussell, Carol Janes, Mike Jones, Karen Keenleyside, Bill Keller, John Kelso, Gail Krantzberg, Miro Kuc, Don Kurylo, Claude Laberge, Graham LaHaie, Dave Lam, Luc Leblanc, Dave Lockerby, Jerry Longcore, Allan Lowe, Barbara Lukaszewicz, Harry Lumsden, Ken Lynn, Jacqueline Madill, Dave Mallory, Lana Marion, Donald Martin, Brent Matsuda, Dan McAuley, Chris McCall, Anne McCauley, Greg Mierle, Ken Mills, Ken Minns, Todd Merendino, Richard Morash, Don Morgan, P. Morrison, Eric Muntz, Bernie Neary, Roy Neureuther, John and Susan Nicholson, A Nieuwburg, Steve O'Donnell, Steve Ormerod, Abbey Ouellet, Madeline Papineau, Gerry Parker, Paul Payson, John Pedlar, the Peloquin family, Mark Petrie, Tom Pollock, Ed Poropat, Marc Porter, Susan and Fred Postill, Terry Powers, Jason Reaume, Ron Reid, L. Risk, Cathy Rogers, Lesley Rogers, Peter Ross, Elyse Routhier, Michael Runtz, Richard Russell, Jean-Pierre Savard, Rob Saxberg, Rob Sayer, Jessica Scarlett, Valerie Schell, Peter Schleifenbaum, Dan Sears, Carolyn and Dave Seburn, Jill Sechley, Ray Semkin, Gerry Shaw, Margo Shaw, Suzanne Sinden, Dave Shutler, Ed Snucins, Enid Stiles, Vince St. Louis, Rick Swain, Tamás Szücs, Rick Tait, Susan Tait, Marla Thibodeau, Gary Thomas, Ron Threader, Jane Topping, Robert Tordon, Harry Vogel, Linda Vogel, Sherry Walker, Russ Walton, William Wamboldt, Chris Waterman, Nelson Watson, Wayne Weatherall, Pat Weatherhead, Bob Webster, Chris Wedeles, Jordan Wentzell, Greg Wickware, Allan Wong, Isaac Wong, and Chris Wren.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Acid precipitation has been associated with changes to aquatic ecosystems in acid-sensitive areas of eastern North America and Europe (Dillon *et al.* 1984, Schindler 1988). Much of eastern Canada is sensitive to acid rain since its thin, coarsely textured soil and granitic bedrock has little ability to neutralize acidic pollutants. Along with metals leached from surrounding soils, acidity can seriously impair the ability of water bodies to support aquatic life, resulting in a decline in species diversity and undesirable impacts on water-dependent wildlife (Longcore *et al.* 1993). In eastern Canada, much of the breeding habitat for several species of waterfowl and the Common Loon (*Gavia immer*) is threatened by acid precipitation (McNicol *et al.* 1987), mainly through habitat loss and altered density and quality of prey (Blancher and McNicol 1988, McAuley and Longcore 1988).

The Canadian Wildlife Service (CWS) Long Range Transport of Air Pollutants (LRTAP) Biomonitoring Program aims to document the rate, nature and scope of biological recovery in aquatic ecosystems of eastern Canada following implementation of acid rain controls in Canada and the U. S. (McNicol *et al.* 1995a). To meet this objective, we monitor waterfowl, loons and their habitats in selected regions sensitive to or affected by acid rain. Acid-sensitive invertebrates and birds are used as biological indicators that respond to changes in the aquatic food web (especially within the critical pH range of 5 - 6) across all surface waters at risk, including wetlands, small and large lakes. Biomonitoring is conducted in four major areas in eastern Canada (Fig. 1). In Ontario, CWS (Ontario Region) monitors over 600 small lakes and wetlands in the Algoma, Muskoka and Sudbury Districts. These acid-sensitive areas have been heavily affected by acid precipitation, and many sites are expected to improve with reduced emission levels (RMCC 1990, McNicol *et al.* 1995b). In Nova Scotia, CWS (Atlantic Region) monitors 46 lakes in Kejimkujik National Park, one of Canada's most sensitive receptor systems.

The CWS LRTAP Biomonitoring Program has generated a large amount of environmental knowledge and technical expertise, now considered an integral component of Environment Canada's nationwide Ecological Monitoring and Assessment Network (EMAN). This report is intended as a working document for researchers studying the effects of air pollutants and other environmental stressors on aquatic ecosystems. We present maps and figures showing locations of our biomonitoring study areas and lakes, and provide tables summarizing the physical, chemical and biological characteristics of these lakes. This information will allow other researchers to compare our site characteristics with their own study areas and lakes, and to better understand our system. By providing this technical information, we encourage collaboration with other researchers interested in the environmental problems posed by acid rain.

2.0 STUDY DESIGN AND COMPONENTS

The CWS LRTAP Biomonitoring Program uses two main approaches: monitoring and modelling. We monitor whole ecosystems, including higher trophic levels which rely on the integrity of various components of the aquatic food web, as well as certian bioindicator taxa (primarily acid-sensitive invertebrates and birds). Using biomonitoring data, we develop models that predict how proposed emission reductions will manifest themselves at the biotic community level. Major components of the national program are outlined below; however, a detailed description is provided in McNicol *et al.* 1995a, while the Food Chain Monitoring Program (Ontario only) is described in McNicol *et al.* 1996a.

2.1 Monitoring

We measure biological recovery by monitoring ecological responses of waterfowl and their foods to a changing

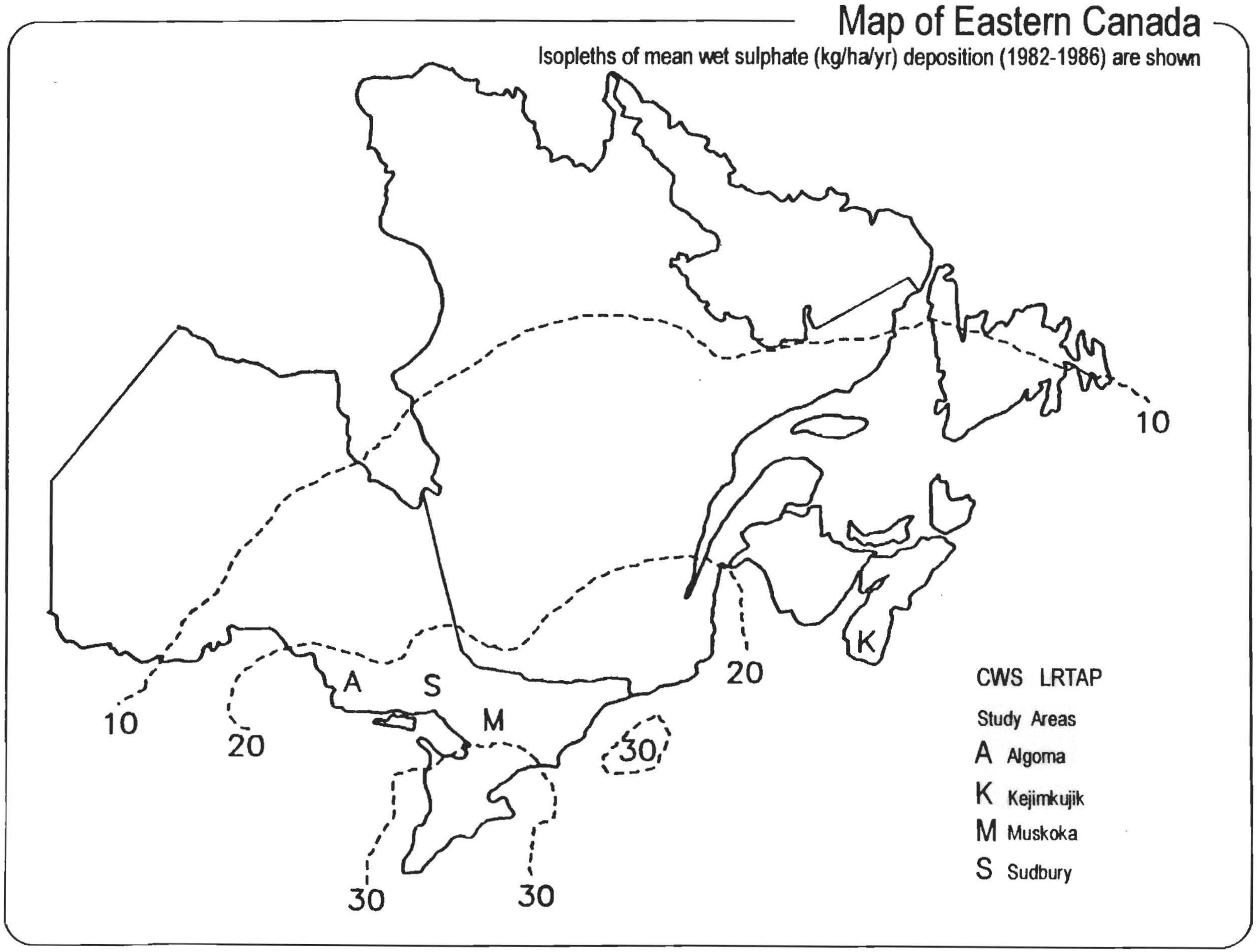


Fig. 1 Map of eastern Canada showing the location of CWS LRTAP Biomonitoring study areas in relation to mean wet SO_4 deposition (1982-1986) isopleths.

acid deposition environment at several spatial and temporal scales. We intend to gather information on the production of waterfowl and the status of fish and invertebrate populations (the prey base for these waterfowl) as acid inputs to these water bodies change.

- Recovery of acidic and damaged lakes in the Sudbury area following reductions in local smelter emissions provides a natural experiment to study recovery of biotic communities following reversal of acidification (McNicol *et al.* 1995c). This work enhances our ability to predict and interpret results from other regions where recovery will occur more slowly.

- Small water bodies are particularly vulnerable to acidification, and constitute the preferred breeding habitat for waterfowl and other wildlife. To establish whether biological recovery occurs at the same rate and to the same degree in these ecosystems as in large lakes (e.g. Keller *et al.* 1992a), a stratified sample of highly sensitive lakes and wetlands is being monitored in two other areas of Ontario. Water bodies in Algoma and Muskoka have similar physical characteristics to those studied near Sudbury, but differ in sensitivity and extent of current acid rain damage, and in predicted changes in SO_4 deposition in response to emission reductions. Major species studied in these areas include Common Loon, Common Merganser (*Mergus merganser*), Hooded Merganser (*Lophodytes cucullatus*) , Common Goldeneye (*Bucephala clangula*), Wood Duck (*Aix sponsa*), American Black Duck (*Anas rubripes*), Mallard (*Anas platyrhynchos*) and Ring-necked Duck (*Aythya collaris*).

- The reproductive success of fish-eating birds, especially Common Loons, is being studied in eastern Canada in relation to recovery of large lakes and improved fisheries production (McNicol *et al.* 1995d). The relationship between lake chemistry, size and hydrology, fish production and loon reproductive success is being investigated at the Kejimkujik watershed in Nova Scotia, where the distribution of lake size and chemistry in a small geographic area is conducive to such a detailed study (Kerekes 1990, Kerekes *et al.* 1994, Wedeles 1996). A special concern exists in parts of Atlantic Canada that biological systems may not respond to reduced acid deposition because of the extreme sensitivity of surface waters. Due to the effects of natural organic acidity, control measures aimed to maintain pH 6 or more in clear waters will not be sufficient to reach this level in organic brown waters which are numerous in this region.

2.1.1 Canadian Lakes Loon Survey

While boreal waterfowl are useful indicators of recovery on small lakes (< 20 ha), the Common Loon is an ideal bioindicator on larger lakes. The loon requires an abundant supply of fish during the breeding season (Kerekes 1990), and thus has been negatively affected by acid-induced habitat degradation (Alvo *et al.* 1988). The CWS LRTAP Biomonitoring Program supports the Canadian Lakes Loon Survey (CLLS), a volunteer program administered by the Long Point Bird Observatory (LPBO) that collects data on loon reproduction on large numbers of lakes across Canada each year (see maps of Atlantic Canada (Fig. 5, 6) and Ontario (Fig. 7)). LPBO initiated the survey in Ontario in 1981, and expanded it nationally in 1989 where it now focuses on the effects of human activity, acid precipitation and other lake chemistry variables on loon reproductive success. Each spring, volunteer loon surveyors receive forms with instructions to record the number of breeding pairs, the maximum number of downy or small young (< 2/3 adult body size) and the maximum number of large young (LY) (≥ 2/3 adult body size) observed on a lake. A minimum of three surveys per lake is recommended to coincide with late nesting (mid-late June), early post-hatch (mid-July), and the period when LY are present (late August). Reports are evaluated for completeness and accuracy and matched with lake area, pH and alkalinity data obtained from available sources. Only records of adequate or high quality (screened as reliable and representing 100% coverage of a lake) with information on all variables are included in subsequent analyses.

Provincial distribution of CLLS volunteer surveyors and the number of lakes surveyed since 1990 are summarized in Table 5. Participation in the survey has risen steadily since the national expansion (1994 levels: 1196 surveyors and 1435 lakes). Volunteers also gather water samples so that loon breeding data can be compared with updated or new chemical data. To date, volunteers have collected mid-lake, surface grab samples (mid-October) on 72 (1994) and 54 (1995) Ontario lakes. Clearly, the CLLS provides a reliable, cost-effective method of assessing the long term health of large acid-sensitive lakes across Canada using volunteers to survey loons. CLLS data have shown that loons experience reduced productivity on acid-stressed lakes in Ontario (McNicol *et al.* 1995d), probably because fewer fish are available. The survey promotes a conservation ethic among citizens concerned about their environment, and provides a tangible link between conditions in our wilderness and our ability to interpret and respond to environmental changes over time. For more information on the Canadian Lakes Loon Survey, please contact the Long Point Bird Observatory, P. O. Box 160, Port Rowan, Ontario N0E 1M0, or any regional office of the Canadian Wildlife Service.

2.2 Modelling

Modelling is a major component of the program because there is no direct means of predicting the nature and extent of aquatic ecosystem recovery from acidification. Modelling enables scientists and policy makers to make predictions about the eventual status of aquatic ecosystems in eastern Canada under various emission scenarios. Ecological models will be used to evaluate critical loads to ensure the protection and recovery of sensitive surface waters. The CWS LRTAP Biomonitoring Program will accomplish this through two major modelling efforts.

The Waterfowl Acidification Response Modelling System (WARMS) has been developed to evaluate effects of acid rain on waterfowl and their habitats in eastern Canada (Blancher *et al.* 1992). WARMS is a flexible computer software program that facilitates the investigation of the effects of changes in lake acidity on waterfowl habitat suitability. Using logistic regression relationships derived for common species, WARMS predicts the probability that the habitat can support pairs and broods under various emission scenarios (McNicol *et al.* 1995b). WARMS can be used to assess current levels of damage to waterfowl populations, predict eventual benefits of various acid deposition scenarios, and assess the suitability of current CWS sites for long term spatial and temporal monitoring.

An effort is also currently underway to integrate the knowledge (data and models) from atmospheric, aquatic, terrestrial and ecological scientists. For a given target objective to protect the ecosystem, the minimum reduction of SO_2 emissions and costs can be determined by running linked models for air, water, land and ecology (Lam *et al.* 1996). The Integrated Assessment Model (IAM) will link source-receptor models to several geochemical and ecological models (including WARMS). For chosen source regions, the IAM can derive optimal emission reduction estimates to achieve specified critical loads at selected receptor sites.

3.0 STUDY AREA DESCRIPTIONS

Presently, there are four study areas in the CWS LRTAP Biomonitoring Program (Fig. 1), three in Ontario (Algoma, Muskoka, Sudbury) and one in Nova Scotia (Kejimkujik). Study areas vary substantially in their current and historic levels of SO_4 deposition, and in their predicted changes in lake water chemistry under proposed emission scenarios. Lakes span a range of chemical and physical characteristics from wetlands to large, oligotrophic lakes (Table1).

Table 1. General characteristics of CWS LRTAP Biomonitoring study areas.

PARAMETER	KEJIMKUJIK	ALGOMA	MUSKOKA	SUDBURY
Location	SW NS	Cent Ont	East Cent Ont	NE Ont
Sensitivity	Extreme	Moderate	Broad	Broad
Number of Lakes	46	240	240	160
Lake Area (ha)	most > 20	most < 20	most < 20	most < 20
Typical Chemistry	pH 4.5-6.2 ↑ DOC, ↓ Ca	pH > 6	pH 5-6	pH < 5.5
Calibrated Basins	Kejimkujik	Turkey Lakes	Dorset	
SO_4 Deposition (kg/ha/yr)	Mod. 15-20	Mod. 15-25 TLW >30	High 25-30	Mod. - High 20-25
CWS Studies	1980	1980	1985	1983
Typical Waterbirds	Piscivore (LO + CM)	Insectivore (CG ↑, WD ↓)	(CG ↓, WD ↑)	All

3.1 Kejimkujik

The CWS (Atlantic Region) LRTAP Biomonitoring Program is currently centred in *Kejimkujik National Park* (surface area 381 km^2) in southwestern Nova Scotia (Fig. 2). Kejimkujik represents one of the most sensitive receptor systems in Canada, and it is now widely recognized that such sensitive waters would remain acidified under proposed deposition levels of 12 kg/ha SO_4 per year. This study area and watersheds have certain advantages for a biomonitoring program, including i) their location in a pristine environment receiving only natural SO_4 deposition and deposition from remote sources, ii) their protection within a national park, iii) their sensitivity to acidification, iv) the variety in water quality from organically-coloured, naturally acidic to clear, oligotrophic water without natural acidity, and v) the availability of other baseline data including meteorology, hydrology, water chemistry, aquatic biology and terrestrial biophysical characteristics collected as parts of programs in other federal departments. Kejimkujik National Park receives roughly 120,000 visits annually, many accessing the interior through canoe routes.

Climate at the Park varies between maritime and continental influences, which creates periods of alternating freezing and thawing in winter, and generally prevents the accumulation of snow except in very cold winters. Average precipitation is 1152 mm (18% of which is from snow), resulting in annual runoff of about 910 mm and evapotranspiration of about 317 mm. Roughly 94% of the Park is forested; forest cover is dominated by mixed deciduous-coniferous forests (75%) and coniferous forests (21%) of the Atlantic Uplands Section of the Acadian Forest Region. Typical tree species found in the Park include red spruce (*Picea rubens*), white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), white birch (*Betula papyrifera*), red maple (*Acer rubrum*), sugar maple (*A. saccharum*), beech (*Fagus grandifolia*) and yellow birch (*B. allegheniensis*). Elevations within the park range from 30 - 150 m. A total of 46 lakes are found within the Park (Fig. 8), many of which are shallow and coloured due to dissolved organic substances leached from boggy substrates on poorly drained soils. Hence, surface waters are dilute with high DOC and very low calcium (<1 mg/L); many are naturally acidic (pHs < 5, but only one lake is fishless), a feature distinguishing this site from other study areas (Kerekes *et al.* 1982, Kerekes and Freedman 1989; Table 1).

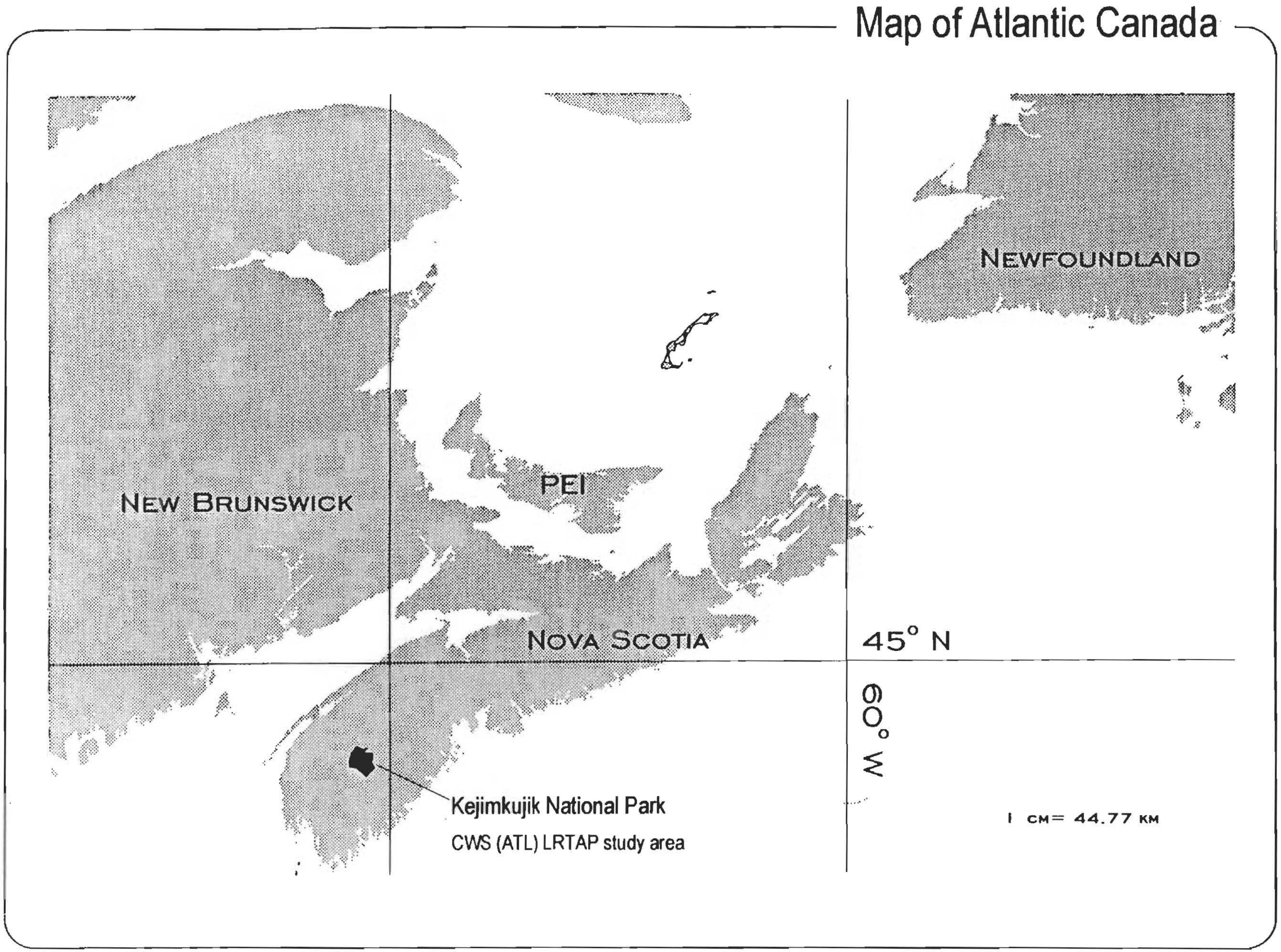


Fig. 2 Map of Atlantic Canada showing the location of the CWS (Atlantic Region) LRTAP Biomonitoring study area in Kejimkujik National Park, Nova Scotia.

3.2 Algoma

The *Algoma study area* is located near the eastern shore of Lake Superior (area centre at 47° 01' N, 83° 55' W) (Fig. 3). Nine study plots measuring 5 x 5 km are located in the area (Fig. 10), containing roughly 240 lakes. Due to their remote location, access to many plots is only possible by helicopter. The Algoma Central Railway, linking Sault Ste. Marie with Chapleau, roughly bisects the study area from north to south, winding its way through the rugged terrain close to Plots 1, 3, 4 and 5. Although remote cabins and camp sites dot the landscape, hunting and fishing pressure is only significant in areas with logging roads and trails. Four tertiary watersheds of the Eastern Lake Superior Tributaries system (2B) and North Channel and Manitoulin Island system (2C) (Cox 1978) fall within the study area (Table 2). Plot 2 overlaps the Turkey Lakes Watershed (TLW) calibrated basin (Jeffries *et al.* 1988), part of the DFO LRTAP Biomonitoring Program (Shaw *et al.* 1992, 1995); TLW has recently been protected as a federal fisheries reserve. Plots 7 and 9 near Ranger Lake contain lakes studied by CWS since 1980 (McNicol *et al.* 1987). Some lakes (N = 26) have historical chemical and biological data from provincial (Neary *et al.* 1990) and federal studies (Kelso and Jeffries 1988). Twenty lakes (minimum 2 per plot) form the Food Chain Monitoring Program (FCMP) study lakes (McNicol *et al.* 1996a).

Precipitation varies in Algoma due to the proximity of Lake Superior and the highly variable topography. For example, total precipitation at the Sault Ste. Marie Airport averages about 935 mm/yr (AES data), whereas total precipitation only 50 km due north at Turkey Lakes (Plot 2) averages 30% more (Jeffries *et al.* 1988). Inland from Lake Superior in the Ranger Lake area (Plots 7-9), annual precipitation is slightly lower due to the "rain shadow effect" from coastal terrain. Sulphate deposition also varies, with most areas receiving about 20 kg/ha/yr (Fig. 1), but locally higher deposition occurs due to high annual precipitation (Shaw *et al.* 1992), with the Turkey Lakes watershed receiving about 30 kg/ha/yr in the late 1970s and 1980s (Sirois and Vet 1988, Kelso *et al.* 1992). Episodic precipitation plays a major role in sulphate and nitrate deposition with only 20% of the daily precipitation events accounting for 60-70% of the total wet and dry deposition (Sirois and Vet 1988). Snow constitutes 30 % of the total annual precipitation in the area, contributing high acidic inputs to water bodies during spring melt (Semkin and Jeffries 1988).

Forest cover is very similar among plots, and is composed primarily of mixed hardwoods of the Great Lakes-St. Lawrence Zone (Rowe 1972) (Table 2). Forests of Plots 1 to 8 are dominated by sugar maple and yellow birch, with smaller influences of white birch, white spruce (*Picea glauca*) and various riparian species. Plot 9 has a much stronger Boreal Zone influence, with white birch and black spruce (*Picea mariana*) surpassing sugar maple. The region is underlain by Precambrian metamorphic basalt and granitic bedrock (principally silicate greenstone and felsic igneous rock near the Turkey Lakes watershed; Jeffries *et al.* 1988). Surficial geology varies little among plots (Table 2), with most plots covered by thin, widespread deposits of glacial till and ground moraine with outcroppings of exposed bedrock. Plots 1, 2, 4, 5 and 6 have very similar surficial geology, dominated by dry till and ground moraine with volcanic rock signatures. In Plots 8 and 9 the till has a more undulating nature, and Plot 7 is characterized more by sand and gravel from a glacial outwash plain. Surficial geology of Plot 3 is quite different, composed mostly of wet organic terrain, principally peat. In the Turkey Lakes watershed, till thickness varies from <1 m at higher elevations to 1-2 m at lower elevations (Jeffries *et al.* 1988).

Lakes of the Algoma study area are located in a region dominated by salmonid fish communities, notably lake trout (*Salvelinus namaycush*) and brook trout (*Salvelinus fontinalis*) (Jeffries *et al.* 1988, Mandrak and Crossman 1992). However, most CWS study lakes are too small or shallow for lake trout (Scott and Crossman 1973), although brook trout have been captured. Of the roughly 240 lakes surveyed in Algoma, 44 % contain no fish (Table 16). Because our study lakes are generally small, fish communities are dominated by minnow

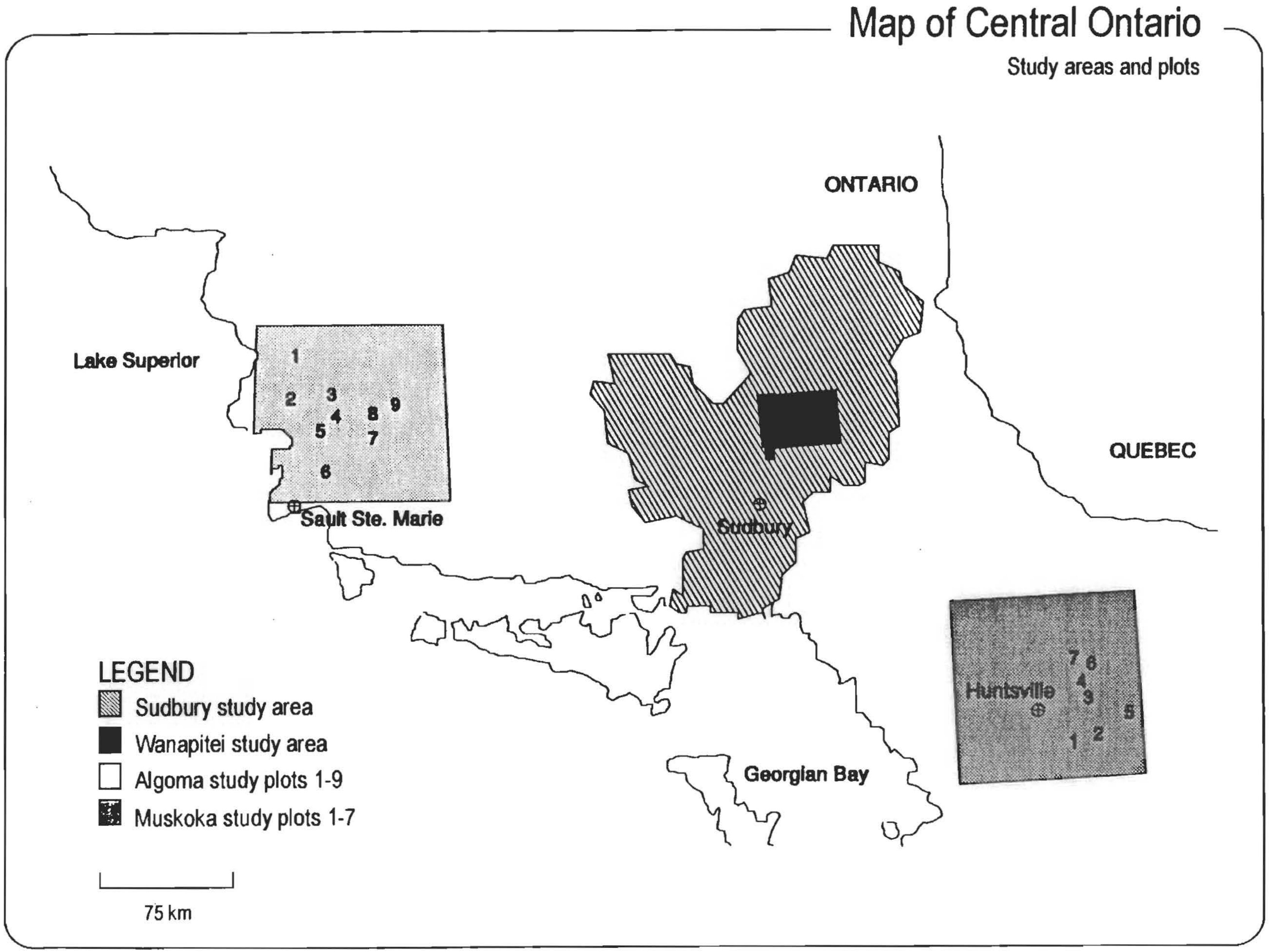


Fig. 3. Map of central Ontario showing the location of CWS (Ontario Region) LRTAP Biomonitoring study areas and plots, as well as outlines of the Sudbury and Wanapitei study areas.

(especially cyprinid) species or white sucker (*Catostomus commersoni*); yellow perch (*Perca flavescens*) are noticeably uncommon. To estimate the potential influence of beavers (*Castor canadensis*) on water levels, we conducted aerial surveys in the autumn of 1994 (Walton and McNicol 1995). Approximately 27 % (66) of 244 study lakes surveyed had active beaver colonies (Table 16). The presence of old dams and lodges indicated that beavers have used at least 93 % of our study lakes, and clearly have a profound influence on water levels and vegetation surrounding these small catchments.

3.3 Muskoka

The *Muskoka study area* (Fig. 3) is located in central Ontario (area centre at 45° 30' N, 79° 06' W), and includes portions of Algonquin Provincial Park (Plots 4, 6, 7), the Lesley Frost Centre (Plot 2), and the Haliburton Fish and Wild Life Reserve (Plot 5). Commonly referred to as "cottage country", recreational development and human

Table 2. Tertiary watersheds, forest cover types and surficial geology for Algoma and Muskoka study plots.

STUDY AREA	PLOT	TERTIARY WATERSHED	MAJOR FOREST COVER[1]	MAJOR SURFICIAL GEOLOGY
ALGOMA	1	2BE, 2BF	SM, YB, BF	Bedrock knob covered with till
	2	2BF	SM, YB, WS	Bedrock knob covered with till
	3	2BF	SM, WB, WS	Organic terrain (peat)
	4	2BF	SM, YB, WS	Bedrock knob covered with till
	5	2BF	SM, YB, WS	Bedrock knob covered with till
	6	2BF, 2CA	SM, YB, WB	Bedrock knob covered with till
	7	2BF, 2CA	SM, WB, WS	Bedrock knob covered with till
	8	2BF	SM, WS, BF	Bedrock knob covered with till
	9	2BF, 2CA, 2CB	WB, BS, SM	Bedrock knob covered with till
MUSKOKA	1	2EB, 2EC	SM, BF, RO	Bedrock knob covered with sandy till
	2	2EB, 2EC, 2HF	WP, SM, EH	Bedrock knob, ridge covered with sandy till
	3	2EB	WC, SM, YB	Bedrock knob, ridge covered with sandy till
	4	2EB	SM, YB, EH	Bedrock knob, ridge covered with sandy till
	5	2EB, 2HF	SM, WB, P	Outwash plain covered with sandy till and gravel
	6	2EB	SM, YB, WS	Bedrock knob, ridge covered with sandy till
	7	2EB	SM, BF, YB	Bedrock knob, ridge covered with sandy till

---

[1] SM = sugar maple, YB = yellow birch, BF = balsam fir, WS = white spruce, WB = white birch, WC = white cedar, BS = black spruce, RO = red oak (*Quercus rubra*), WP = white pine, EH = eastern hemlock (*Tsuga canadensis*), P = *Populus spp.*

activity is heavier than in Algoma or Sudbury, with cottages and camps on many of the larger lakes outside of Algonquin Park. Plots inside the Park are more isolated, but some study lakes are accessible by hiking trails and canoe routes. However, access to most Muskoka plots is undertaken by helicopter. The seven 5 x 5 km plots located in the area contain roughly 240 lakes (Fig. 12). Three tertiary watersheds of the Eastern Georgian Bay Tributaries system (2E) and Lake Ontario Tributaries system (2H) (Cox 1978) fall within the study area (Table 2). Plot 2 overlies the Plastic Lake calibrated basin, a watershed studied intensively by the Ontario Ministry of the Environment and Energy (OMEE). Some study lakes (N = 60, including Plastic Lake) have historical chemical data from provincial studies (Neary *et al.* 1990), including many larger, cottage-type lakes in Plot 1. Several are also part of the DFO LRTAP Biomonitoring Program (Shaw *et al.* 1992). Again, 20 lakes (minimum 2 per plot) form the FCMP study lakes.

Precipitation over the Muskoka study area ranges between 900-1100 mm (Shaw *et al.* 1992; 1995), with 30% in the form of snow (AES data, Peterborough Airport). Sulphate deposition is among the highest in the province, with the area receiving 30 kg/ha/yr or more (Fig. 1). Situated on the Precambrian Shield, the region is underlain by granitic bedrock (granitic gneisses with igneous intrusives; Jeffries and Snyder 1983), with many plots underlain by bedrock ridges. Surficial geology varies little among plots (Table 2), with most plots covered by thin, widespread deposits of glacial till and ground moraine, with outcroppings of exposed bedrock. Plot 2 (Lesley Frost Centre) has more influence of sand and rubble in the till, while Plot 5 (Haliburton Reserve) is predominantly ground moraine and a sand and gravel outwash plain. Forest cover is very similar among plots, and is composed primarily of mixed hardwoods of the Great Lakes-St. Lawrence Zone (Rowe 1972) (Table 2). Sugar maple dominates most plots, except for Plot 2 where white pine is more common, and Plot 3 which is dominated by white cedar (*Thuja occidentalis*).

Most lakes in Muskoka are located south of the region where lake trout are common, although brook trout are widespread. Many lakes are dominated by smallmouth (*Micropterus dolomieui*) and largemouth bass (*M. salmoides*), and commonly contain yellow perch (Mandrak and Crossman 1992). Similar to Algoma, 43 % of lakes surveyed by the CWS in Muskoka are fishless (Table 21). Lakes containing fish are usually dominated by yellow perch or centrarchid species such as pumpkinseed (*Lepomis gibbosus*), with white sucker comprising an important component of some communities. Lakes lacking these larger species are dominated by cyprinids, typically northern redbelly dace (*Phoxinus eos*). Approximately 32% (75) of 236 study lakes were occupied by beavers in autumn 1994, and evidence indicated that at least 94 % of these lakes have been occupied by beavers in the past (Table 21). A distinguishing feature of the Muskoka study area is the large number of "chico swamps" dotting the landscape in certain areas. Typically small, these swamps are characterized by stagnant water with large numbers of standing dead/fallen trees, often making access by helicopter difficult.

3.4 Sudbury

Generally northeast and southwest of Sudbury, the *Sudbury study area* (area centre 46° 54' N, 80° 41' W) has been heavily influenced by local mining, smelting and lumbering activities. Although the effects of mining on lakes are not as visible as the damage caused to the landscape, the consequences of decades of sulphur and metal particulate emissions have been as severe and left a large, damaged zone which covers 17 000 km^2 around Sudbury (Neary et al. 1990) (Fig. 3). It has been estimated that some biological damage has occurred in a majority (est. 7,000) of the 10,643 lakes (mostly <10 ha in size) within the Sudbury Effects Zone. However, a heterogenous mixture of surface deposits and bedrock has produced a high density of lakes with a broad range of pHs (McNicol *et al.* 1995c). The Sudbury study area is drained by watersheds of the French River (2D), North Channel and Manitoulin Island (2C) and Northern Ottawa River (2J) systems (Cox 1978), and contains two provincial parks, Killarney and Lady Evelyn-Smoothwater.

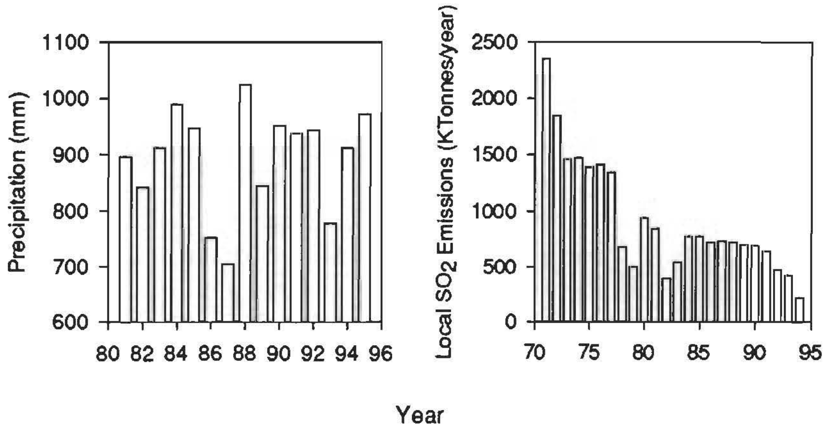


Fig. 4 Patterns of recent total annual precipitation and local SO_2 emissions at Sudbury.

CWS has been active in the Sudbury area since 1983 conducting aerial surveys of waterfowl breeding populations (Fig. 17) and studying relationships between acidity and wildlife/food chain interactions (McNicol *et al.* 1987, 1995c). Research and monitoring of recovery from the effects of acidification continue today (Keller *et al.* 1992a, Gunn 1995). OMEE currently surveys 41 acidic lakes annually (3 intensively) for water chemistry, while other lakes are sampled regularly for phytoplankton (Nicholls *et al.* 1992), zooplankton (Keller *et al.* 1992b) and fish communities (Matuszek *et al.* 1992). In 1989, the Cooperative Freshwater Ecology Unit was established at Laurentian University to share resources and create closer working relationships among government, industry and university researchers involved in aquatic resource management.

Nested within the general Sudbury study area, the ***Wanapitei study area*** lies 50 km northeast of Sudbury. Covering approximately 460 km^2, it contains roughly 378 small lakes and wetlands which surround many large lakes in the area (Fig. 3). Of these, approximately 160 lakes are intensively studied in the area north of Lake Wanapitei (Fig. 14). Due to extensive logging, the majority of study lakes are within 2 km of logging roads and are routinely accessed on the ground. The study area is intensively hunted and fished, but most recreational use occurs on lakes larger than those surveyed. All lakes and wetlands fall within tertiary watersheds 2DA or 2DC (Cox 1978), and vary widely in their sensitivity to acid deposition (McNicol *et al.* 1987). With reductions in local smelter emissions, many lakes are expected to respond rapidly (McNicol *et al.* 1995b), creating a natural experiment for studying recovery from the effects of acidification. Given the historical database and heterogenous nature of lake chemistries in a small area, Wanapitei is treated as one plot containing approximately 160 lakes (Fig. 14). Of these, 22 lakes form the FCMP study lakes (Fig. 15).

Precipitation near Sudbury is lower than at the other sites, with an average of 860 mm falling annually, 27 % as snow (AES data, Sudbury Airport). However, annual precipitation patterns have been quite variable over the past 15 years (Fig. 4) with extreme lows recorded in 1986/87, followed by an unusually wet year in 1988 (see Section 4.2). Sulphate deposition from long range sources is less than received in Muskoka, but deposition from local smelters results in total SO_4 deposition considered to be the highest in the province some years ago (>1.25 g/m^2/yr; Neary and Dillon 1988). However, recent controls put in place as part of Ontario's Countdown Acid Rain Program have reduced local SO_2 emissions to levels below 1994 legislated requirements (Fig.4; see also Potvin and Negusanti 1995).

Located on the Precambrian Shield, the Sudbury study area is underlain by granite, granite gneisses and various volcanic and metamorphic rocks, most of which are considered highly sensitive to acidification (Pearson and Pitblado 1995). As with Algoma and Muskoka, exposed bedrock is common through the Sudbury study area. Predominately quartzite drainages of the unique La Cloche mountains encompass much of Killarney Provincial Park (southwest of Sudbury) and extend in ridges northeast of Lake Wanapitei, providing little buffering capacity (Beamish and Harvey 1972). Surficial geology of the region is generally composed of well-drained, sandy tills, typified by podzols, but pockets of organic overburden and well-buffered till are also important components. It is this variety and "patchwork" pattern of the buffering capacity of the materials underlying lakes that has resulted in a broad range of chemical characteristics, particularly within the Wanapitei site (McNicol *et al.* 1995c).

The Sudbury study area is situated on the transition between the Great Lakes-St. Lawrence Zone and the Boreal Zone, a transition typified by mixed hardwoods with a substantial coniferous component (Rowe 1972). However, the forest cover of the Wanapitei study site has been dramatically affected by local emissions (fumigations) and from logging activities (e.g. Winterhalder 1995). Regeneration has resulted in a poorly developed, second growth forest characterized by jack pine (*Pinus banksiana*), white spruce, balsam fir (*Abies balsamea*) and white birch.

Most large lakes of the Sudbury study area should support lake trout, brook trout, smallmouth bass and walleye (*Stizostedion vitreum*) (Matuszek *et al.* 1992), but the effects of acid precipitation have resulted in the loss of many of these populations. One important loss was the extirpation of the aurora trout, a rare strain of brook trout (*Salvelinus fontinalis*), which has been recently restored to the area through intensive management (Snucins *et al.* 1995). Of the 160 lakes surveyed in the Wanapitei study site, 48 % are fishless (Table 26), a proportion slightly higher than at Algoma and Muskoka. While most lakes are fishless due to altered lake chemistries, some high pH lakes are naturally fishless due to physical isolation. Study lakes containing fish are usually dominated by yellow perch and/or white sucker, the exception being larger lakes stocked with lake trout or rainbow trout (*Salmo gairdneri*). If larger species are absent, fish communities are typically cyprinid, commonly including northern redbelly dace. Approximately 62 % (90) of 145 study lakes surveyed in 1994 were occupied by beavers (Table 26), proportionately twice as many lakes with active beaver colonies as in Algoma and Muskoka. Similar to these areas, however, 93 % of study lakes showed some evidence of past use by beavers.

4.0 DATA COLLECTIONS AND CHARACTERIZATION

The CWS LRTAP Biomonitoring Program monitors both indicator species and biotic communities, and involves an extensive series of survey/sampling procedures. A summary of current biomonitoring data collections is provided in Table 3 according to physical, chemical, biological and waterfowl study components.

4.1 Physical Data

Habitat characterization of all study plots and lakes has been completed, with morphometric characteristics of Kejimkujik, Algoma, Muskoka and Sudbury study lakes presented in Tables 6, 13, 18 and 23, respectively. In Ontario, a mapping system (SPatial ANalysis System - SPANS) was used to characterize the landscape, including forest cover, surficial geology and watershed features (see Table 2), as well as riparian habitat cover, lake size, position, configuration and connectivity. Using SPANS, relationships between ecological variables and chemical and physical data can be examined, and how these relate to fish, invertebrates and waterfowl over time and space. In a recent paper, Shutler *et al.* 1995 examine waterfowl habitat associations using these data.

Because beavers can dramatically affect the riparian landscape, we surveyed 624 study lakes in Ontario in autumn 1994 by helicopter. A site was considered occupied by beavers if fresh food piles, lodges, dams or cuttings were

Table 3. Timing of CWS LRTAP Biomonitoring data collections (1987-1996).

COMPONENT	ALGOMA	MUSKOKA	SUDBURY	KEJIMKUJIK
Chemical	88, 92, 94-96	90, 91, 93, 95, 96	87, 90-96	every year
Landscape		- once because constant -		
Fish		- once because constant -		
FCMP	88-90, 92	91	87-89, 94, 96	N/A
Waterfowl	88, 92, 94-96	89, 93, 95, 96	93-96	88-90, 92-96

observed, and previous use was indicated by the presence of old dams or lodges (Walton and McNicol 1995). Approximately 93 % of lakes in all three study areas showed some sign of current or past use by beavers, and beaver dams were observed on 86 %, 93 %, and 87 % of lakes in Algoma, Muskoka and Sudbury, respectively. While some dams may have a minimal effect on the stability of water levels, others can completely control the presence of water in study lakes. In 1994, roughly twice as many lakes were occupied by beavers at Sudbury (62 %) than at Algoma (27 %) and Muskoka (32 %).

4.2 Chemical Data

Lakes are sampled regularly at all four study areas (Table 3), with additional chemical data often available from other sources. Average chemical characteristics of Kejimkujik, Algoma, Muskoka and Sudbury study lakes are presented in Tables 7, 14, 19 and 24, respectively. However, recent cuts to provincial and other federal agencies mean that we remain one of the few programs collecting chemical data on a regional scale and over the long term in Canada, and the only program collecting data on small water bodies preferred by breeding waterfowl and other wildlife. Water samples collected at Kejimkujik are part of the NAQUADAT system, a national water quality monitoring network. Chemical parameters measured in Ontario are: pH, alkalinity, conductivity, cations (Ca, Mg, Na, K), anions (SO_4, Cl, SiO_2), nutrients (TP, TKN, NO_2&NO_3, NH_3), DOC, water colour and trace metals (Al, Fe, Mn; Sudbury lakes are also monitored for Ni and Cu). In Ontario, mid-lake water samples are collected during fall turnover from a helicopter equipped with floats. For lakes deeper than 3 m, we use a 5 m long tube to collect an integrated sample through the water column (minimum of 1 m above the lake bottom), while shallower lakes are sampled by a surface grab at 0.5 m depth. Samples are cooled and transported to the LRTAP laboratory at the Great Lakes Forestry Centre in Sault Ste. Marie. Samples are immediately coarse-filtered to remove large particulates and preserved with nitric and sulphuric acids (trace metals and nutrient samples, respectively). Samples being analysed for DOC are again vacuum-filtered through a Gelman GN-6, sterilized, 0.45 µm filter paper. Samples are stored at 4°C until being processed according to Environment Canada (1979) guidelines (see McNicol *et al.* 1987 for further details).

Results from Sudbury lakes (N = 161) sampled between 1983-1995 indicate that trends in key chemical parameters (e.g. pH, SO_4) are in the expected direction, but that only a small proportion show statistically significant chemical improvement (16 % with increasing pH), despite local emission cuts, continued declines in SO_4 levels (47 % of lakes; Mallory et al. 1996), and evidence of chemical recovery in larger lakes elsewhere in the region (Keller *et al.* 1992a). However, precipitation (drought and wet cycles - see Fig. 4) has markedly altered small lake chemistries near Sudbury during this period (McNicol and Mallory 1994).

4.3 Biological Data

Examining biological recovery at lower trophic levels (fish and invertebrates) provides the basis for interpreting patterns of waterfowl and loon population change, and whether certain organisms lag behind other species in recovery (i.e. taxa-specific rates of recovery). Fish species composition has been assessed at 638 sites in Ontario and ten sites in Kejimkujik, both because fish are preferred prey for piscivorous species (such as loons and Common Mergansers) and because fish compete with insectivores (e.g. Common Goldeneyes, Ring-necked Ducks) for common macroinvertebrate prey (McNicol *et al.* 1987). Complete characterization of invertebrate communities is impractical; however, because fewer invertebrates are found where fish are prevalent, fish species composition can be used to infer invertebrate availability (McNicol and Wayland 1992, Mallory *et al.* 1994).

The locations of minnow traps (N=10) and species captured in ten Kejimkujik lakes during recent sampling (1990 and 1992) are summarized in Fig. 9 and Table 8, respectively. Yellow perch were recorded in all but one lake, while brook trout were infrequent. Other species recorded were golden shiner (*Notomigonus crysoleucas*), brown bullhead (*Ictalurus nebulosus*), banded killifish (*Fundulus diaphanus*) and ninespine stickleback (*Pungitius pungitius*). American eel (*Anguilla rostrata*), white sucker and white perch (*Morone americana*) are present in most lakes but were not caught.

4.3.1 Food Chain Monitoring Program (FCMP)

The Food Chain Monitoring Program (FCMP) is undertaken on a subset of core lakes in the three study areas in Ontario, and is described in Part 2 of this series (McNicol *et al.* 1996a). Monitoring of aquatic invertebrates, amphibians and fish is conducted on a rotating basis for 62 lakes (20 each in Algoma and Muskoka, 22 in Sudbury) chosen to represent the range of pH and fish status in small lakes (< 20 ha) that are typical breeding habitat for waterfowl species of these regions. Collections are designed to sample specific components of the littoral macroinvertebrate community that comprise principal waterfowl foods or are acid-sensitive indicator species (e.g. leeches, water striders) (Table 4; see also Bendell and McNicol 1991, 1995a,b, McNicol *et al.* 1995e). Locations of food chain lakes within study plots are identified in Fig. 10 (Algoma) and Fig. 12 (Muskoka). Individual scale maps of food chain lakes and sampling locations for Algoma and Muskoka are presented in Fig. 11 and13, respectively. Locations and maps of Wanapitei food chain lakes are presented in Fig. 15 and 16. Morphometric and chemical characteristics of Algoma, Muskoka and Wanapitei food chain lakes are presented in Tables 15, 20 and 25.

• **Fish** - Fish and amphibians are among the best known bioindicators of acid rain damage, and the return of acid-sensitive species to lakes where they had been lost is an important index of recovery. Fish and amphibian tadpoles (collections also include leeches, crayfish, newts and assorted macroinvertebrates) are sampled regularly in food chain lakes using minnow traps (see McNicol *et al.* 1996a), with remaining study lakes sampled at longer intervals. Tables 16, 21 and 26 list the cumulative fish and amphibian species captured at study sites at Algoma, Muskoka and Sudbury, respectively. More than 1,300 amphibian tadpoles have been captured from 638 Ontario lakes, representing 9 species (7 each in Algoma, Muskoka, and Sudbury; primarily Green Frog, *Rana clamitans*, Mink Frog, *R. septentrionalis*, and Bullfrog, *R. catesbeiana*). The primary focus of fish collections is on the small, minnow-type species that are prey for piscivorous waterfowl and loons, as well as the medium-sized fish (e.g. perch) that compete with insectivorous waterfowl. In the absence of fish predation, fishless lakes (44% in Algoma, 43 % in Muskoka, 48 % in Sudbury) tend to have high abundance of certain invertebrates. Invertebrate abundance is also high in lakes with fish having small mouth gapes (e.g. northern redbelly dace), because these species do not eat larger invertebrates (McNicol and Wayland 1992). In contrast, few invertebrates are typically found where fish have large gapes (e.g. yellow perch). To date, more than 10,000 fish have been captured from

Table 4. Sampling methods, intensity and target organisms of the Food Chain Monitoring Program conducted in Ontario lakes (from McNicol *et al.* 1996a).

	COLLECTION METHOD				
	SWEEP	HOOP	BENTHIC	FUNNEL	MINNOW
Target group	Hemiptera	Trichoptera	Anisoptera, Ephemeroptera, Gastropoda	Hirudinea	Nekton, Fish, Amphibians
Location	Open Water < 5m to shore	Shoreline < 0.5m deep	On Bottom < 1m deep	On Bottom < 1m deep	Near Shore < 1m deep
Samples / lake	10	10	10	5	6
Collection approach	10 Dipnet Passes	Visual Search $0.31m^2$	Sediment Drag $0.14\ m^2$	Bottle Trap 24 hr	Wire Trap 24 hr

638 lakes, representing 25 species (16 in Muskoka, 15 in Algoma, 22 in Sudbury) (McNicol *et al.* 1995e). Small, non-game species predominate, including Cyprinidae (13 spp.), yellow perch and white sucker.

- **Aquatic Invertebrates** - Macroinvertebrates are important prey for fish, waterfowl and many riparian birds. Diversity of these organisms increases rapidly as pH improves, and certain invertebrate species are key indicators of acid-stress (e.g. leeches, water striders, mayflies). Because these organisms can disperse quickly and are numerically and taxonomically abundant, they are among the first indicators of biological recovery. The invertebrate component of the FCMP was designed to detect changes in the occurrence, composition and abundance of target groups (Table 4), many of which are important waterfowl foods. To date, more than 25,000 macroinvertebrates representing 159 taxa (genera or species) have been collected from the 62 core lakes (113 spp. in Muskoka 1991, 114 in Algoma 1992, 102 in Sudbury 1994) (McNicol *et al.* 1995e). Major taxonomic groups recorded were: Coleoptera (34 spp.), Odonata (27), Hemiptera (25), Trichoptera (23), Hirudinea (12), Gastropoda (12) and Ephemeroptera (9). In addition, work in Ontario includes continued monitoring of indicator species (leeches and water striders) in Sudbury area lakes (Bendell and McNicol 1991) where chemical change is expected to be most dramatic and biological recovery should occur most rapidly. As yet, there is no evidence of improvements in the distribution of leeches in small, acid-stressed lakes near Sudbury sampled in 1987, 1992 and 1994 (Table 27). For more detailed information about macroinvertebrate sampling techniques and collections, consult Part 2 of this series (McNicol *et al.* 1996a).

4.3.2 Waterbird Monitoring

Waterfowl populations, breeding success and productivity are monitored to determine whether chemical improvements attributable to reduced acid-causing emissions are resulting in improvements in waterfowl populations in affected areas. In Ontario, waterfowl breeding distribution, density and productivity surveys are conducted by helicopter for indicated pairs (mid-May) and broods (July), with some validation by ground surveys (Ross and McNicol 1996). While diver broods are generally more detectable than those of dabblers, comparison of results of aerial and single-visit ground surveys indicated no differences in overall survey efficiencies. Timing of aerial surveys is based on the breeding chronology of focal species to maximize the amount of usable information (Sinden 1995). Pair and brood data can be analysed separately or in combination to compare habitat associations (Shutler *et al.* 1995).

- **Population Studies** - Systematic surveys in the general Sudbury study area are conducted to detect changes in local populations in response to dramatically reduced emissions from Sudbury smelters. Spring surveys of breeding populations were undertaken in 4 km^2 plots located throughout this area between 1983 and 1995 (Fig. 17). These surveys suggest that certain regional populations are responding to chemical improvements in breeding habitats (McNicol *et al.* 1995c). Local populations of piscivorous species, especially Common Loons and Hooded Mergansers, have increased through 1985-1995 in areas where average lake pHs exceed 5.5. Given the apparent lag time between chemical improvements and biological responses, continued monitoring is necessary to track recovery. The observed responses of Sudbury area lakes to past sulphur emission reductions suggest that the additional reductions recently implemented under the Countdown Acid Rain Program in 1994 will produce further improvements, although water quality in some lakes will remain degraded.

- **Production Studies** - Surveys of waterfowl and loon breeding pairs and corresponding brood production are undertaken at all four biomonitoring study areas (for Kejimkujik, see Tables 9-12; for Algoma, Muskoka and Sudbury, see Tables 17, 22 and 28, respectively). When analysed in relation to corresponding chemical, physical and biological data, estimates of the production of young per breeding attempt can be used to assess the suitability of various types of lakes to support breeding waterfowl in each area.

- **Nest Box Studies** - In 74 Sudbury lakes, and all food chain lakes, use of nest boxes by cavity-nesting waterfowl (Common Goldeneye, Hooded Merganser, Wood Duck, Common Merganser) are monitored. Data have been collected on nest box use at Sudbury since 1987. No change in cavity-nesting duck densities has been observed as yet, although a steady reduction in the proportion of nesting attempts on fishless lakes has been observed (McNicol *et al.* 1996b). Shifts in the proportion of boxes occupied, clutch size or hatching success by insectivorous or piscivorous species augment data from population surveys and will indicate trends in biological recovery. Descriptions of the habitat and box characteristics of Sudbury nest box lakes are presented in Table 29, and data on the occupancy and success of waterfowl nesting in boxes are presented in Table 30.

5.0 GUIDE TO TECHNICAL INFORMATION

In sections 7.0, 8.0 and 9.0, we present the current status of each of the biomonitoring study areas comprising the CWS LRTAP Biomonitoring Program in eastern Canada, including locations, collection sites, and physical, chemical and biological characteristics of study lakes for data collected between 1987-1995. As well, the distribution of effort across Canada by volunteers and the locations of CLLS lakes in Ontario and Atlantic Canada are provided. We hope this information will stimulate collaboration with other researchers interested in the environmental problems posed by acid rain.

As a guide to each section, a table of contents is provided as an insert. Where appropriate, information on the years sampled or the type of data presented (e.g. means) is provided in foot notes or in table or figure headings. In sections 8.0 (Kejimkujik study area) and 9.0 (Ontario study areas), each section begins with maps showing the location of study lakes and then proceeds to descriptions of the physical and chemical characteristics of each lake. Detailed scale maps of fish sampling lakes in Kejimkujik and FCMP lakes in Ontario follow next. Finally, relevant biological data are presented for each site. Although we attempted to present our data as clearly as possible, please contact the senior author if any questions arise.

6.0 LITERATURE CITED

Alvo, R. A., D. J. T. Hussell, and M. Berrill. 1988. The breeding success of common loons in relation to alkalinity and other lake characteristics in Ontario. Can. J. Zool. 66: 746-752.

Beamish, R. J., and H. H. Harvey. 1972. Acidification of the La Cloche Mountain lakes, Ontario, and resulting fish mortalities. J. Fish. Res. Board Can. 29: 1131-1143.

Bendell, B. E., and D. K. McNicol. 1991. An assessment of leeches (Hirudinea) as indicators of lake acidification. Can. J. Zool. 69: 130-133.

Bendell, B. E., and D. K. McNicol. 1995a. Lake acidity, fish predation and the distribution and abundance of some littoral insects. Hydrobiol. 302: 133-145.

Bendell, B. E., and D. K. McNicol. 1995b. The diet of insectivorous ducklings and the acidification of small Ontario lakes. Can. J. Zool. 73: 2044-2051.

Blancher, P. J., and D. K. McNicol. 1988. Breeding biology of tree swallows in relation to wetland acidity. Can. J. Zool. 66: 842-849.

Blancher, P. J., D. K. McNicol, R. K. Ross, C. H. R. Wedeles, and P. Morrison. 1992. Towards a model of acidification effects on waterfowl in eastern Canada. Environ. Pollut. 78: 57-63.

Cox, E. T. 1978. Counts and measurements of Ontario Lakes. Fisheries Branch, Ontario Ministry of Natural Resources, Toronto, Ontario. 114 p.

Darveau, M., J.-L. DesGranges, and G. Gauthier. 1992. Habitat use by three breeding insectivorous birds in declining maple forests. Condor 94: 72-82.

DesGranges, J.-L. 1989. Studies of the effects of acidification on aquatic wildlife in Canada: lacustrine birds and their habitats in Quebec. Can. Wildl. Serv. Occ. Pap. No. 67.

Dillon, P. J., N. D. Yan, and H. H. Harvey. 1984. Acidic deposition: effects on aquatic ecosystems. Crit. Rev. Environ. Control 13: 167-194.

Environment Canada. 1979. Analytical methods manual. Inland Waters Directorate, Ottawa, Canada.

Gunn, J. M. 1995. Environmental restoration and recovery of an industrial region. Springer-Verlag, New York. 358 p.

Jeffries, D. S., and W. Snyder. 1983. Geology and geochemistry of the Muskoka-Haliburton study area. Ont. Min. Envir. Data Report DR 83/2.

Jeffries, D. S., J. R. M. Kelso, and I. K. Morrison. 1988. Physical, chemical and biological characteristics of the Turkey Lakes Watershed, central Ontario, Canada. Can. J. Fish. Aquat. Sci. 45 (Suppl. 1): 3-13.

Keller, W., J. R. Pitblado, and J. Carbone. 1992a. Chemical responses of acidic lakes in the Sudbury, Ontario, area to reduced smelter emissions, 1981-1988. Can. J. Fish. Aquat. Sci. 49(Suppl. 1): 25-32.

Keller, W., N. D. Yan, T. Howell, L. A. Molot, and W. D. Taylor. Changes in zooplankton during the experimental neutralization and early reacidification of Bowland Lake near Sudbury, Ontario. Can. J. Fish. Aquat. Sci. 49(Suppl. 1): 52-62.

Kelso, J. R. M., and D. S. Jeffries. 1988. Response of headwater lakes to varying atmospheric deposition in north-central Ontario, 1979-1985. Can. J. Fish. Aquat. Sci. 45: 1905-1911.

Kelso, J. R. M., Shaw, M. A., and Jeffries, D. S. 1992. Contemporary (1979-1988) and inferred historical status of headwater lakes in North Central Ontario, Canada. Environ. Pollut. 78: 65-71.

Kerekes, J. J. 1977. The index of lake basin permanence. Int. Revue ges. Hydrobiol. 62: 291-293.

Kerekes, J. J. (ed.) 1989. Acidification of organic waters in Kejimkujik National Park, Nova Scotia, Canada. Proceedings of a symposium, Wolfville, Nova Scotia, Oct. 1988. Reprinted from: Water, Air, and Soil Pollut. 46, No. 1-4.

Kerekes, J. 1990. Possible correlation of summer loon population with the trophic state of a water body. Verh. Internat. Verein. Limnol. 24: 349-353.

Kerekes, J. J., and P. Schwinghamer. 1973. Aquatic resources inventory, Kejimkujik National Park, Nova Scotia, Part 2. Lake drainage and morphometry. Can. Wildl. Serv. Internal Report. 73 p.

Kerekes, J. J., and B. Freedman. 1989. Characteristics of three acidic lakes in Kejimkujik National Park, Nova Scotia, Canada. Arch. Environ. Contam. Toxicol. 18: 183-200.

Kerekes, J. J., G. Howell, S. Beauchamp, and T. Pollock. 1982. Characterization of three lake basins sensitive to acid precipitation in central Nova Scotia (June 1979 to May 1980). Int. Revue ges. Hydrobiol. 67: 679-694.

Kerekes, J. J., R. Tordon, A. Niewburg, and L. Risk. 1994. Fish eating bird abundance in oligotrophic lakes in Kejimkujik National Park, Nova Scotia, Canada. Hydrobiol. 91: 105-110.

Lam, D. C., L., K. J. Puckett, D. S. Jeffries, I. Wong, M. P. Olson, M. Moran, D. Whelpdale, and D. K. McNicol. 1996. An Integrated Acid Rain Assessment Model for Canada using the RAISON for Windows System.

Longcore, J. R., H. Boyd, R. T. Brooks, G. M. Haramis, D. K. McNicol, J. R. Newman, K. A. Smith, and F. Stearns. 1993. Acidic depositions: effects on wildlife and habitats. Wildl. Soc. Tech. Rev. 93-1. 42 p.

Mallory, M. L., P. J. Blancher, P. J. Weatherhead, and D. K. McNicol. 1994. Presence or absence of fish as a cue to macroinvertebrate abundance in boreal wetlands. Hydrobiol. 279/280: 345-351.

Mallory, M. L., D. K. McNicol, D. C. Cluis, and C. Laberge. 1996. Chemical trends and status of small lakes near Sudbury, Ontario, 1983-1995: evidence of continued chemical recovery. Can. J. Fish. Aquat. Sci. (In prep).

Mandrak, N. E., and E. J. Crossman. 1992. A checklist of Ontario freshwater fishes. Royal Ontario Museum, Toronto, Ontario. 176 p.

Matuszek, J. E., D. L. Wales, and J. M. Gunn. 1992. Estimated impacts of SO_2 emissions from Sudbury smelters on Ontario's sportfish populations. Can. J. Fish. Aquat. Sci. 49(Suppl. 1): 87-94.

McAuley, D. G., and J. R. Longcore. 1988. Survival of juvenile ring-necked ducks on wetlands of different pH. J. Wildl. Manage. 52: 1269-176.

McNicol, D. K., and M.Wayland. 1992. Distribution of waterfowl broods in Sudbury area lakes in relation to fish, macroinvertebrates, and water chemistry. Can. J. Fish. Aquat. Sci. 49(Suppl. 1): 122-133.

McNicol, D. K., and M. L. Mallory. 1994. Trends in small lake water chemistry near Sudbury, Canada, 1983-1991. Water, Air, and Soil Pollut. 73: 105-120.

McNicol, D. K., B. E. Bendell, and R. K. Ross. 1987. Studies of the effects of acidification on aquatic wildlife: waterfowl and trophic relationships in small lakes in northern Ontario. Can. Wildl. Serv. Occ. Pap. No. 62.

McNicol, D. K., J. J. Kerekes, M. L. Mallory, R. K. Ross, and A. M. Scheuhammer. 1995a. The Canadian Wildlife Service LRTAP Biomonitoring Program: Part 1. A Strategy to Monitor the Biological Recovery of Aquatic Ecosystems in Eastern Canada from the Effects of Acid Rain. Can. Wildl. Serv. Tech. Rep. Ser. No. 245.

McNicol, D. K., M. L. Mallory, and C. H. R. Wedeles. 1995b. Assessing biological recovery of acid-sensitive lakes in Ontario, Canada. Water, Air and

Soil Pollut. 85: in press.

McNicol, D. K., R. K. Ross, M. L. Mallory, and L. A. Brisebois. 1995c. Trends in waterfowl populations - evidence of recovery from acidification. Ch. 16. In: Gunn, J. (ed.). Environmental restoration and recovery of an industrial region. Springer-Verlag, New York. p. 205-217.

McNicol, D. K., M. L. Mallory, and H. S. Vogel. 1995d. Using volunteers to monitor the effects of acid precipitation on Common Loon (*Gavia immer*) reproduction in Canada: the Canadian Lakes Loon Survey. Water, Air, and Soil Pollut. 85: (in press).

McNicol, D. K., B. E. Bendell, and M. L. Mallory. 1995e. Evaluating macroinvertebrate responses to recovery from acidification in small lakes in Ontario, Canada. Water, Air, and Soil Pollut. 85: (in press).

McNicol, D. K., M. L. Mallory, and B. E. Bendell. 1996a. The Canadian Wildlife Service LRTAP Biomonitoring Program, Part 2 - Food Chain Monitoring in Ontario Lakes - Taxonomic Codes and Collections. Technical Report Series No. 246, Canadian Wildlife Service.

McNicol, D. K., R. A. Walton, and M. L. Mallory. 1996b. Monitoring nest box use by cavity-nesting ducks on acid-stressed lakes near Sudbury, Canada (1987-1995). Wildlife Biology (in review).

Neary, B. P., and P. J. Dillon. 1988. Effects of sulphur deposition on lake-water chemistry in Ontario, Canada. Nature (London) 333: 340-343.

Neary, B. P., P. J. Dillon, J. R. Munro, and B. J. Clark. 1990. The acidification of Ontario lakes: an assessment of their sensitivity and current status with respect to biological damage. Ont. Min. Env. Rep., Toronto, Ont. 171 p.

Nicholls, K. H., L. Nakamoto, and W. Keller. 1992. Phytoplankton of Sudbury area lakes (Ontario) and relationships with acidification status. Can. J. Fish. Aquat. Sci. 49(Suppl. 1): 40-51.

Parker, G. R., M. Petrie, and D. Sears. 1989. Breeding waterfowl, wetlands acidity and food resources in the Lepreau River watershed of southern New Brunswick. Can. Wildl. Serv. Tech. Rep. Ser. No. 84.

Parker, G. R., M. J. Petrie, and D. T. Sears. 1992. Waterfowl distribution relative to wetland acidity. J. Wildl. Manage. 56:268-274.

Pearson, D. A. B., and J. R. Pitblado. 1995. Geological and geographic setting. pp. 5-15. In: J. M. Gunn (ed.) Restoration and recovery of an industrial region. Springer-Verlag, New York, New York.

Potvin, R. R., and J. J. Negusanti. 1995. Declining industrial emissions, improving air quality, and reduced damage to vegetation. pp. 51-65. In: J. M. Gunn (ed.) Restoration and recovery of an industrial region. Springer-Verlag, New York, New York.

RMCC. 1990. The 1990 Long-range transport of air pollutants and acid deposition assessment report. Federal/provincial research and monitoring coordinating committee. Ottawa, Canada. 151 p. Environmental restoration and recovery of an industrial region. Springer-Verlag, New York.

Ross, R. K., and D. K. McNicol. 1996. Factors affecting efficiency of helicopter surveys of duck broods on northern forested wetlands. Wildl. Soc. Bull.: (under review).

Rowe, J. S. 1972. Forest regions of Canada. For. Serv. Publ. No. 1300: 172 p.

Scheuhammer, A. M. 1991. Effects of acidification on the availability of toxic metals and calcium to wild birds and mammals. Environ. Pollut. 71: 329-375.

Schindler, D. W. 1988. Effects of acid rain on freshwater ecosystems. Science 239: 149-157.

Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Res. Brd. Canada, Bulletin 184. 966 p.

Semkin, R. G., and D. S. Jeffries. 1988. Chemistry of atmospheric deposition, the snowpack, and snowmelt in the Turkey Lakes Watershed. Can. J. Fish. Aquat. Sci. 45(Suppl. 1): 38-46.

Shaw, M. A., S. Geiling, S. Barbour, I. J. Davies, E. A. Hamilton, A. Kemp, R. Reid. P. M. Ryan, N. Watson, and W. White. 1992. The Department of Fisheries and Oceans National LRTAP Biomonitoring Programme: Site locations, physical and chemical characteristics. Can. Tech. Rep. Fish. Aquat. Sci. 1875: 87 p.

Shaw, M. A., I. J. Davies, E. A. Hamilton, A. Kemp, R. Reid, P. M. Ryan, N. Watson, W. White, and K. M. Murphy. 1995. The DFO national LRTAP biomonitoring programme: Baseline characterization 1987-1989. Can. Tech. Rep. Fish. Aquat. Sci. 2032: 69 p.

Shutler, D., D. K. McNicol, R. K. Ross, and R. A. Walton. 1995. Intensive validation of waterfowl habitat suitability models. Unpublished Report, Canadian Wildlife Service, Ontario Region, 48 p.

Sinden, S. K. 1995. Lake acidity and the seasonality, distribution and abundance of macroinvertebrates and waterfowl broods near Sudbury, Canada. M.Sc. thesis, University of Wales, Cardiff. 122 p.

Sirois, A., and R. J. Vet. 1988. Detailed analysis of sulphate and nitrate atmospheric deposition estimates at the Turkey Lakes watershed. Can. J. Fish. Aquat. Sci. 45(Suppl. 1): 14-25.

Snucins, E. J., J. M. Gunn, and W. Keller. 1995. Preservation of biodiversity: aurora trout. pp. 143-153. In: J. M. Gunn (ed.) Restoration and recovery of an industrial region. Springer-Verlag, New York, New York.

Walton, R. A., and D. K. McNicol. 1995. Beaver survey for Algoma, Muskoka and Wanapitei 1994: report and assessment. Can. Wildl. Serv. (Ontario Region), Unpubl. Rep. 25 p.

Wedeles, C. H. R. 1996. Detailed analysis of Kejimkujik and Ontario loon datasets. Can. Wildl. Serv. (Ontario Region), Unpubl. Rep. 23 p.

Winterhalder, K. 1995. Early history of human activities in the Sudbury area and ecological damage to the landscape. pp. 17-31. In: J. M. Gunn (ed.) Restoration and recovery of an industrial region. Springer-Verlag, New York, NY.

CANADIAN LAKES LOON SURVEY

Table of Contents

Table 5. Provincial distribution of Canadian Lakes Loon Survey volunteers (SURV) and number of lakes surveyed (1990-1994) (data provided by H. Vogel, Long Point Bird Observatory).

PROVINCE	**YEAR**									
	1990		**1991**		**1992**		**1993**		**1994**	
	LAKES	**SURV**	**LAKES**	**SURV**	**LAKES**	**SURV**	**LAKES**	**SURV**	**LAKES**	**SURV**
British Columbia	19	11	41	43	48	33	63	47	91	71
Alberta	3	3	37	38	43	23	43	24	89	56
Saskatchewan	2	4	21	13	5	6	8	7	30	28
Manitoba	9	10	26	7	19	7	19	14	41	29
Ontario	595	481	813	797	490	378	610	401	856	707
Québec	62	55	54	68	60	45	72	57	111	107
New Brunswick	11	10	20	20	18	15	25	23	33	28
Nova Scotia	44	32	110	153	148	103	155	149	145	132
Prince Edward Island	0	0	0	0	0	0	0	0	0	0
Nfld and Labrador	11	7	6	5	67	28	45	38	38	31
Yukon Territory	0	0	0	0	1	1	0	0	0	4
Northwest Territories	0	0	0	0	0	0	1	1	1	3
Total	756	613	1128	1144	899	639	1041	761	1435	1196

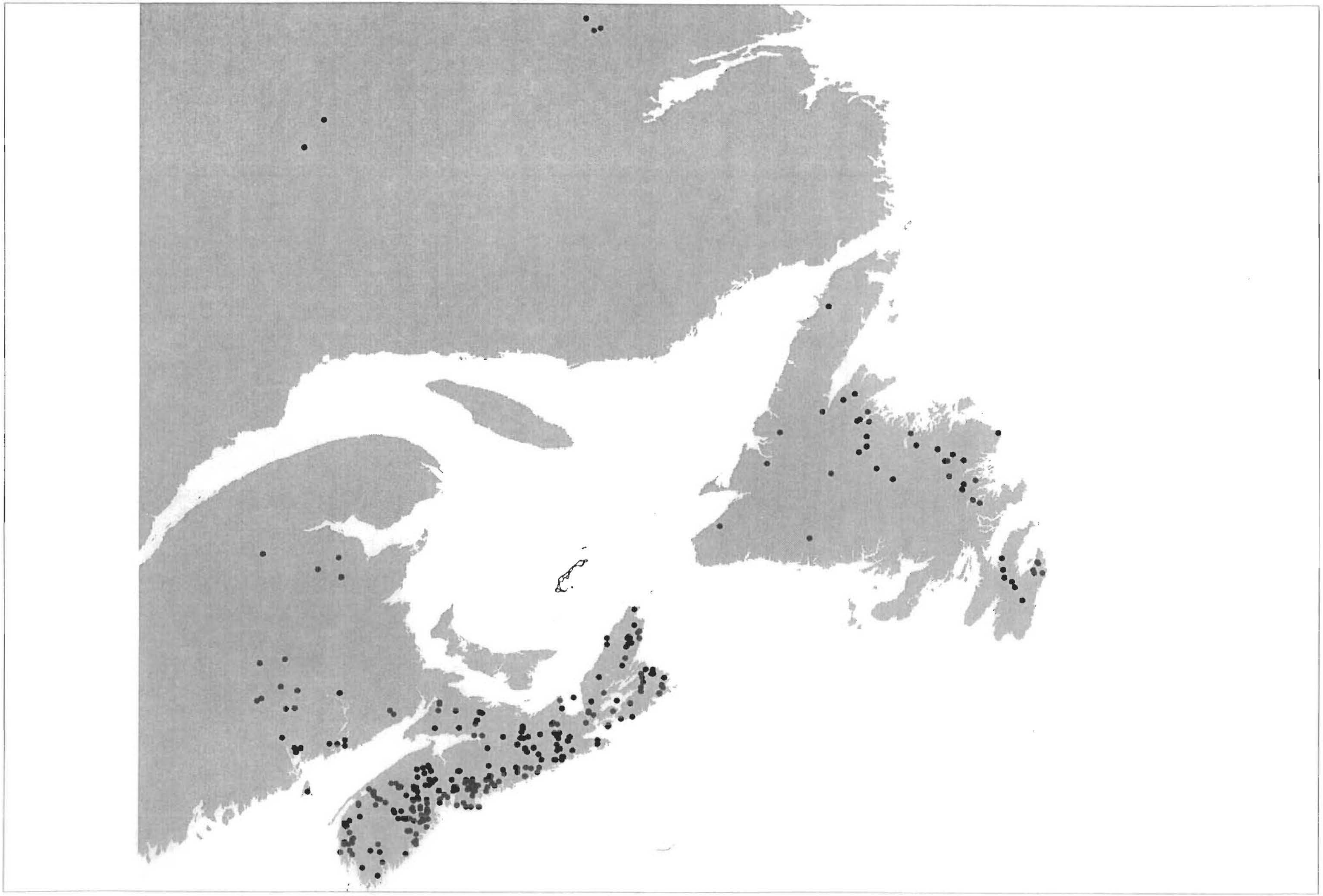


Fig. 5 Map of Atlantic Canada showing the location of Canadian Lakes Loon Survey lakes (1993-1993).

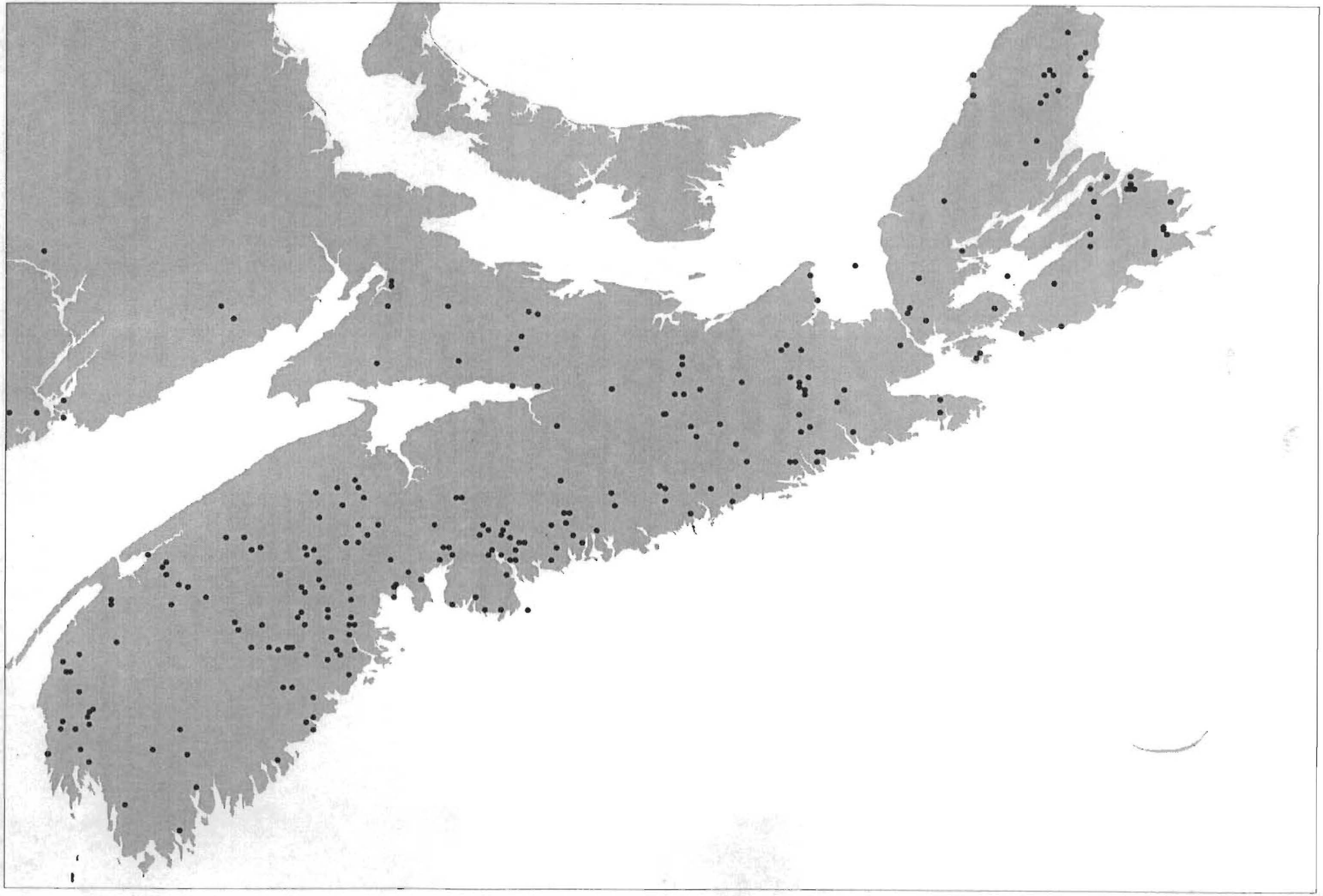


Fig. 6 Map of Nova Scotia showing the location of Canadian Lakes Loon Survey lakes (1992-1993).

Map of Ontario

Ontario Lakes Loon Survey lakes
(1987 - 1993)

Fig. 7

ATLANTIC REGION BIOMONITORING STUDY

KEJIMKUJIK

Table of Contents **Page**

Key to Figure 8. Names of CWS (Atlantic Region) LRTAP Biomonitoring study lakes in Kejimkujik National Park, Nova Scotia. Lakes are numbered beginning north, going from west to east, then proceeding toward south except for number 47 and 48.

LAKE No.	LAKE NAME	LAKE No.	LAKE NAME
1	Little Cook	23	Snake
2	Big Dam West	24	Nameless
3	Frozen Ocean	25	Little Red
4	Big Dam East	26	Ben
5	Dennis Boot	27	Nameless
6	Channel	28	Nameless
7	Nameless	29	North Cranberry
8	Little Liberty	30	George
9	Liberty	31	Mountain
10	Kejimkujik	32	Puzzle
10a	Kejimkujik Jeremys Bay	33	Peskawa
10b	Kejimkujik Fairy Bay	34	Peskowesk
10c	Kejimkujik Mill Bay	35	Cobrielle
10d	Kejimkujik Minards Bay	36	Loon
11	Grafton	37	Beaverskin
12	Nameless	38	Pebbleloggitch
13	Nameless	39	Back
14	Nameless	40	Lower Silver
15	Mount Tom	41	Hilchemakaar
16	Little Kempton	42	Upper Silver
17	Nameless	43	Little Peskowesk
18	Poplar	44	Mud
19	Luxton	45	Nameless
20	McGinty	46	Nameless
21	Big Red	47	Sewage Lagoon 1
22	High	48	Sewage Lagoon 2

Map of Kejimkujik National Park

Study lakes

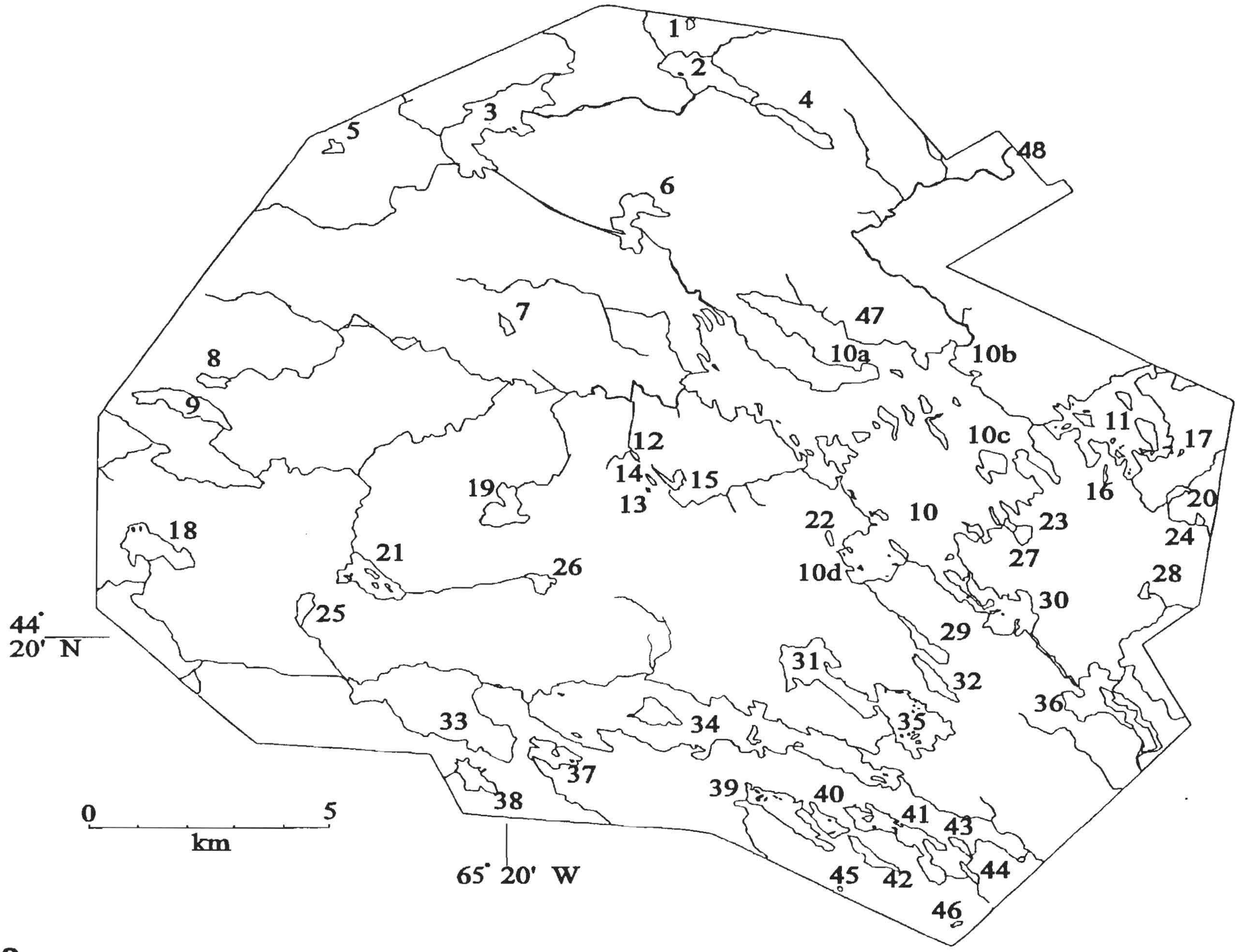


Fig. 8

Table 6. Morphometric features (including NAQUADAT Station numbers) and number of fish species present in study lakes in Kejimkujik National Park, Nova Scotia (from Kerekes and Schwinghamer 1973 and Kerekes 1977). (See legend for description of morphometric indices).

LAKE NAME	LAKE No.	NAQUADAT No.	AREA (ha)	ISLAND AREA (ha)	MAX. DEPTH (m)	L:A	SHORE LENGTH (km)	BASIN PERMANENCE V:L	SHORELINE DEVELOPMENT D_L	ML	MEL	No. of FISH SPECIES
Back	39	NS01ED0067	78.4	1.5	5.75	12.3	8.6	0.20	3.1	2.3	2.2	8
Beaverskin	37	NS01ED0028	39.5	2.3	6.25	13.6	5.4	0.16	2.4	1.1	1.1	8
Ben	26	NS01ED0013	20.4	.	2.0	13.0	2.6	0.05	1.7	0.7	0.7	1
Big Dam East	4	NS01ED0073	45.5	0.1	4.2	10.7	5.0	0.21	2.1	1.9	1.9	9
Big Dam West	2	NS01ED0070	105.0	0.3	9.5	5.8	6.1	0.43	1.7	2.2	2.1	10
Big Red	21	NS01ED0080	70.5	7.4	2.2	12.9	9.1	0.08	3.0	1.7	1.6	1
Channel	6	NS01ED0086	68.4	.	1.8	8.9	6.1	0.13	2.1	1.3	1.3	7
Cobrielle	35	NS01ED0078	132.0	4.2	6.25	9.6	12.7	0.20	3.1	2.0	1.9	9
Dennis Boot	5	NS01ED0090	8.7	.	.	17.1	1.5	.	1.4	0.5	0.5	.
Frozen Ocean	3	NS01ED0085	228.0	0.2	7.6	5.6	12.7	0.34	2.4	2.9	2.9	6
George	30	NS01ED0047	77.8	3.5	8.5	11.3	8.8	0.21	2.8	1.7	1.3	6
Grafton	11	NS01ED0076	270.0	51.1	10.0	12.8	34.8	0.22	6.0	2.6	1.8	7
High	22	NS01ED0077	38.0	.	2.75	30.4	1.2	0.05	1.7	0.4	0.4	7
Hilchemakaar	41	NS01ED0092	95.4	2.0	7.25	13.0	12.4	0.15	3.6	2.3	2.3	8
Kejimkujik	10	NS01ED0007	2435.0	197.0	19.2	3.9	95.4	1.12	5.5	9.7	7.3	12
Liberty	9	NS01ED0083	73.3	0.1	.	8.2	6.0	.	2.0	1.8	1.8	.
Little Cook	1	NS01ED0038	28.0	.	.	25.8	0.7	.	1.2	0.2	0.2	.
Little Kempton	16	NS01ED0041	25.0	.	2.5	49.0	1.2	0.29	2.2	0.3	0.3	3
Little Liberty	8	NS01ED0084	15.4	.	.	13.8	2.1	.	1.5	0.7	0.7	.
Little Peskowesk	43	NS01ED0089	11.3	.	4.0	16.4	1.8	0.09	1.6	0.8	0.8	8
Little Red	25	NS01ED0087	19.6	.	1.3	13.7	2.7	0.33	1.7	0.9	0.9	1
Loon	36	NS01ED0048	73.8	2.7	8.5	13.0	9.6	0.15	3.1	1.5	1.4	7
Lower Silver	40	NS01ED0096	24.7	0.8	5.25	14.8	3.7	0.12	2.1	1.0	0.8	8
Luxton	19	NS01ED0091	47.1	1.0	8.5	13.0	6.1	0.23	2.5	1.1	1.0	2
McGinty	20	NS01ED0093	4.4	.	4.0	23.6	1.0	0.06	1.4	0.4	0.4	7
Mountain	31	NS01ED0004	136.0	0.6	14.25	10.1	13.7	0.43	3.3	2.6	2.6	7
Mount Tom	15	NS01ED0043	14.0	0.1	.	29.8	4.2	.	3.1	0.8	0.7	.

LAKE NAME	LAKE No.	NAQUADAT No.	AREA (ha)	ISLAND AREA (ha)	MAX. DEPTH (m)	L:A	SHORE LENGTH (km)	BASIN PERMANENCE V:L	SHORELINE DEVELOPMENT D_L	ML	MEL	No. of FISH SPECIES
Mud	44	NS01ED0081	7.0	0.1	2.2	27.1	1.9	0.04	2.0	0.6	0.6	5
North Cranberry	29	NS01ED0079	34.3	0.1	5.0	14.2	4.9	0.10	2.4	1.8	1.5	6
Pebbleloggitch	38	NS01ED0010	33.4	.	2.5	13.3	4.4	0.12	2.2	1.2	1.2	3
Peskawa	33	NS01ED0094	388.0	0.7	9.0	4.7	18.2	0.68	2.6	3.8	3.8	6
Peskowesk	34	NS01ED0075	685.0	26.0	13.0	4.2	29.1	0.89	3.1	7.1	5.4	9
Poplar	18	NS01ED0088	82.5	1.5	.	9.1	7.5	.	2.3	1.6	1.6	. .
Puzzle	32	NS01ED0009	33.7	0.0	6.1	13.7	4.6	0.20	2.2	1.6	1.5	6
Snake	23	NS01ED0082	12.7	.	2.5	13.6	1.7	0.10	1.4	0.6	0.6	6
Upper Silver	42	NS01ED0095	24.3	.	5.75	14.2	3.5	0.16	2.0	1.1	1.1	9
Nameless # 7	7		9.8	.	.	.	.	.	.	0.6	0.6	.
Nameless # 12	12		1.3	.	.	49.2	0.6	.	1.6	0.3	0.3	.
Nameless # 13	13		0.3	.	.	64.3	0.2	.	1.0	0.1	0.1	.
Nameless # 14	14		1.4	.	.	51.8	0.7	.	1.7	0.3	0.3	.
Nameless # 17	17		0.9	.	.	.	.	.	.	0.2	0.2	.
Nameless # 24	24		1.2	.	.	.	.	.	.	0.2	0.2	.
Nameless # 27	27		0.5	.	.	.	.	.	.	0.1	0.1	.
Nameless # 28	28		6.3	.	.	22.2	1.4	.	1.6	0.5	0.5	.
Nameless # 46	46		0.5	.	.	.	.	.	.	0.2	0.2	.
Sewage Lagoon 1	47		0.7	.	.	.	0.6	0.02	.	.	.	.
Sewage Lagoon 2	48		0.6	.	.	.	0.4	0.00	.	.	.	.

LEGEND

Morphometric Indices

A = area of lake, excluding islands (km^2)

DL = shoreline development = L/(2sqrt(Aπ))

L = shore length (km)

ML = maximum length (km)

V = lake volume m^{10-9}

MEL = maximum effective length (km)

Table 7. Average chemical constituents of study lakes (N = 35) in Kejimkujik National Park, Nova Scotia. Values are three year growing season means (1983 - 1985). (See legend for explanation of variables).

LAKE NAME	LAKE No.	Cl (μeq/L)	SO_4 (μeq/L)	Ca (μeq/L)	Mg (μeq/L)	K (μeq/L)	Na (μeq/L)	H (μeq/L)	Color (hu)	pH	TP (μg/L)
Back	39	119.5	40.6	16.5	28.2	6	112.7	3.6	5	5.4	7.2
Beaverskin	37	115.5	46.8	27.8	28.9	5.6	108.3	4.3	10	5.4	3.8
Ben	26	104.5	49.9	12.1	26.2	7.7	102.3	22.8	35	4.6	9
Big Dam East	4	128.1	47.9	35.2	37.3	4.8	128.7	1.1	7	6	5.9
Big Dam West	2	130.8	39.6	36.9	36.6	5.7	140.4	9.3	95	5	11.1
Big Red	21	106.3	43.2	13.7	30.2	6.9	116.5	56.5	170	4.2	12
Channel	6	113.8	42.8	30.1	35	5.6	128.6	15.6	110	4.8	9
Cobrielle	35	114	43.6	20.3	28.2	4.7	110.5	4.3	5	5.4	6.8
Frozen Ocean	3	118.9	43.1	30.2	35.9	6.4	127.1	14.2	100	4.8	9
George	30	127.3	47.3	32.9	36.5	6.0	129.0	10.9	75	5.0	10.0
Grafton	11	150.6	46.5	46.0	44.5	4.9	149.3	1.1	25	6.0	9.8
High	22	111.2	37.2	25.4	34.5	5.3	123.4	14.3	90	4.8	9.0
Hilchemakaar	41	115.0	43.0	36.0	39.0	5.4	119.0	2.0	30	5.6	8.0
Kejimkujik	10	128.4	46.9	35.7	37.9	5.9	130.5	9.1	75	5.0	9.1
Liberty	9	126.7	43.7	21.7	34.1	6.0	126.9	5.2	15	5.3	7.0
Little Cook	1	121.0	47.0	37.0	40.0	5.7	122.0	5.2	30	5.3	7.0
Little Kempton	16	110.0	48.0	57.0	45.0	6.0	115.0	15.6	220	4.8	14.0
Little Liberty	8	120.0	43.0	38.0	39.0	4.9	123.0	29.6	140	4.5	12.0
Little Peskowesk	43	115.0	42.0	3.6	38.0	5.6	119.0	6.2	75	5.2	10.2
Little Red	25	102.2	42.9	16.9	29.9	6.4	120.3	46.6	140	4.3	12.0
Loon	36	124.3	46.9	33.0	35.7	6.0	128.8	10.7	70	5.0	10.9
Lower Silver	40	118.0	44.0	30.0	32.0	5.8	120.0	1.5	5	5.8	6.6
Luxton	19	113.4	52.6	16.2	30.0	6.6	122.3	20.0	55	6.0	9.0
McGinty	20	104.7	32.1	57.2	41.8	4.4	116.5	1.1	55	6.0	10.2
Mountain	31	112.1	44.8	21.3	28.4	4.8	111.3	6.2	10	5.2	4.9
Mount Tom	15	102.9	37.1	15.0	27.1	6.0	108.0	20.7	85	4.7	10.0
Mud	44	119.8	51.9	31.9	41.9	4.7	121.8	13.7	65	4.9	9.0
North Cranberry	29	115.0	44.0	25.0	29.0	4.8	119.0	5.2	10	5.3	7.0
Pebbleloggitch	38	109.4	43.5	16.7	30.1	5.3	115.2	29.6	125	4.5	10.0
Peskawa	33	112.8	48.9	17.9	28.3	6.0	120.8	26.1	70	4.6	10.9
Peskowesk	34	119.7	51.4	20.5	32.6	5.8	117.3	16.7	50	4.8	6.0
Poplar	18	120.9	52.8	19.0	31.0	6.2	126.2	17.8	50	4.7	7.0
Puzzle	32	113.0	42.0	25.0	28.0	5.3	115.0	5.2	15	5.3	5.0

LAKE NAME	LAKE No.	Cl (μeq/L)	SO_4 (μeq/L)	Ca (μeq/L)	Mg (μeq/L)	K (μeq/L)	Na (μeq/L)	H (μeq/L)	Color (hu)	pH	TP (μg/L)
Snake	23	104.1	19.6	34.1	34.7	2.5	108.6	16.1	125	4.8	11.0
Upper Silver	42	113.8	46.8	32.7	30.5	5.5	114.7	1.5	5	5.8	6.5

LEGEND

VARIABLE EXPLANATIONS

CL= chloride
SO_4 = sulphate
Ca = calcium
Mg = magnesium
K = potassium
Na = sodium
H = Hydrogen ion
TP = total phosphorus
Color = water color (Hazen platinum-cobalt scale)

Table 8. Fish species caught in minnow traps in ten study lakes in Kejimkujik National Park, Nova Scotia (1990 and 1992)[1].

LAKE NAME	LAKE No.	YEAR	brook trout (*Salvelinus fontinalis*)	golden shiner (*Notomigonus crysoleucas*)	brown bullhead (*Ictalurus nebulosus*)	banded killifish (*Fundulus diaphanus*)	ninespine stickleback (*Pungitius pungitius*)	yellow perch (*Perca flavescens*)
Beaverskin	37	1990		+	+		+	+
		1992						+
Ben	26	1990						
		1992					+	
Big Dam East	4	1990						+
		1992		+	+	+		+
Big Dam West	2	1990		+	+	+		+
		1992		+				+
Cobrielle	35	1990	+	+		+		+
		1992						
Lower Silver	40	1990		+	+	+		+
		1992		+	+			+
North Cranberry	29	1990		+	+	+		+
		1992		+	+	+		+
Pebbleloggitch	38	1990						+
		1992						+
Puzzle	32	1990		+			+	+
		1992		+	+	+		+
Upper Silver	42	1990		+			+	+
		1992				+		+

---

[1] American eel (*Anguilla rostrata*), white sucker (*Catostomus commersoni*) and white perch (*Morone americana*) are present in most lakes but were not caught in minnow traps in 1990 or 1992.

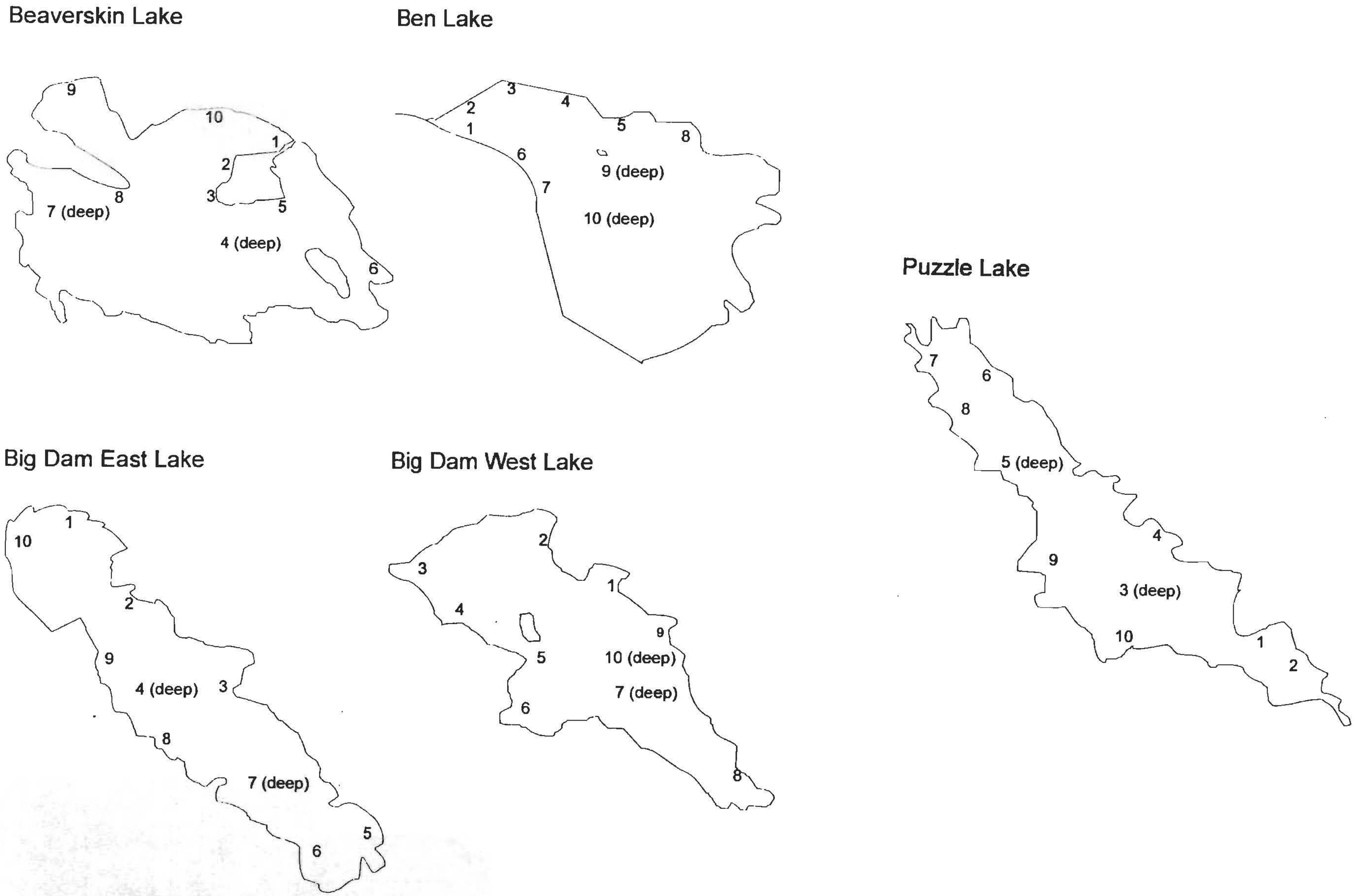
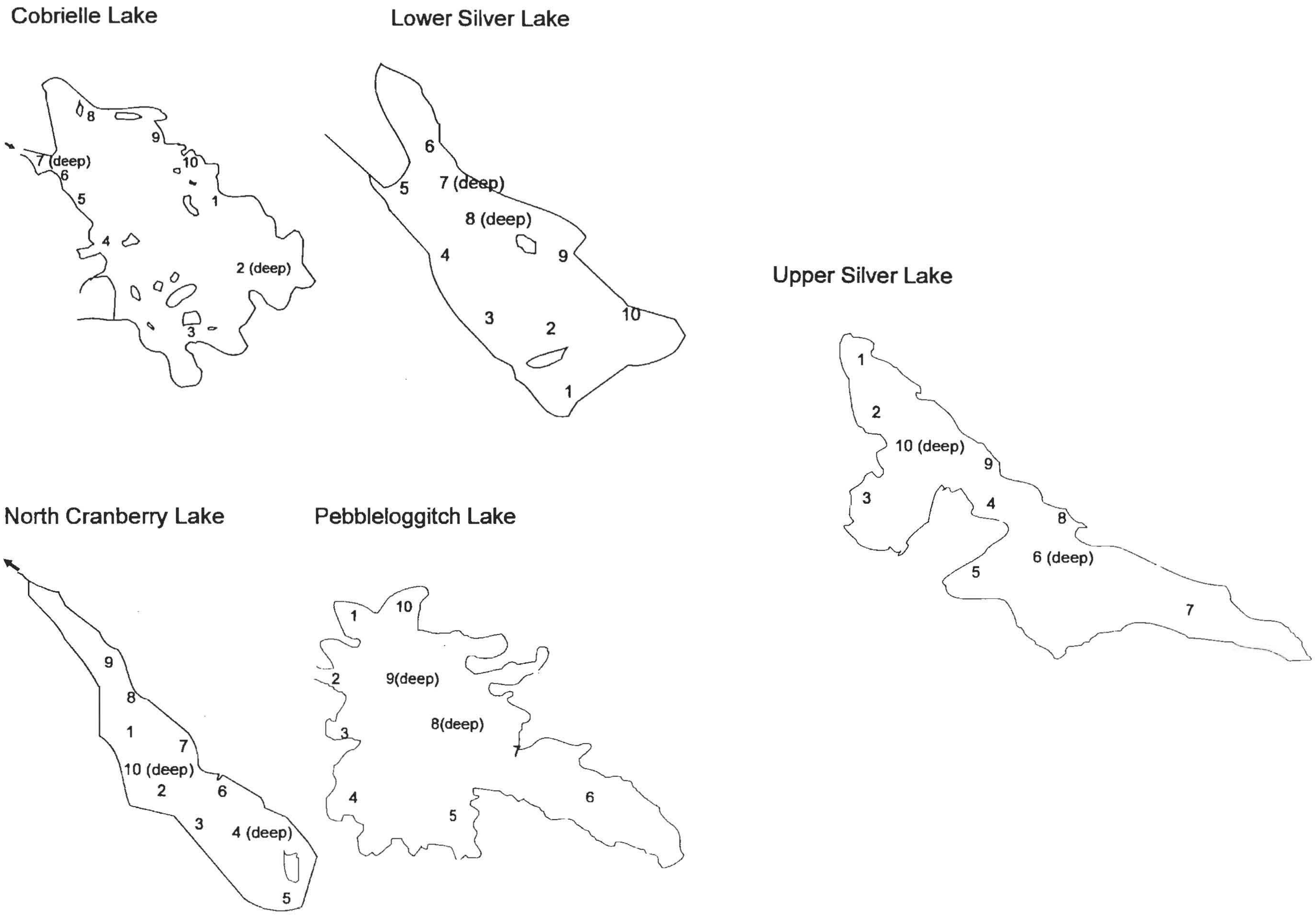


Fig. 9. Maps of ten study lakes in Kejimkujik National Park, Nova Scotia showing the locations of minnow traps set in 1992.



Cobrielle Lake

Lower Silver Lake

Upper Silver Lake

North Cranberry Lake

Pebbleloggitch Lake

Fig. 9 cont'd

Table 9. Number of residential Common Loon pairs observed in 24 study lakes in Kejimkujik National Park, Nova Scotia between 1988-1995 (except 1991).

LAKE	LAKE	AREA	1988	1989	1990	1992	1993	1994	1995	7 YEAR	MIN.	MAX.	MEAN
NAME	No.	(km^2)	RESIDENTIAL PAIRS							MEAN	NUMBER		PAIR/KM^2
Back	39	0.78	1	1	2	1	1	2	2	1.4	1	2	1.83
Beaverskin	37	0.40	1	1	1	1	1	1	1	1.0	1	1	2.50
Ben	26	0.20	1	1	1	1	1	1	1	1.0	1	1	5.00
Big Dam East	4	0.46	1	1	1	1	1	1	1	1.0	1	1	2.17
Big Dam West	2	1.05	1	1	1	1	1	1	1	1.0	1	1	0.95
Big Red	21	0.71	1	1	0	1	1	1	1	0.9	0	1	1.21
Channel	6	0.68	1	1	1	1	1	1	1	1.0	1	1	1.47
Cobrielle	35	1.32	2	2	3	2	2	2	3	2.3	2	3	1.73
Frozen Ocean	3	2.28	2	1	1	1	2	2	1	1.4	1	2	0.63
George	30	0.78	1	2	2	1	1	1	1	1.3	1	2	1.65
Grafton	11	2.70	4	4	3	4	3	3	3	3.4	3	4	1.27
Hilchemakaar	41	0.95	2	2	2	2	2	2	2	2.0	2	2	2.11
Kejimkujik	10	24.35	4	6	7	7	7	7	7	6.4	4	7	0.26
Liberty	9	0.73	1	1	1	1	1	1	1	1.0	1	1	1.37
Loon	36	0.74	2	2	2	1	1	1	2	1.6	1	2	2.12
Lower Silver	40	0.25	1	1	1	1	1	1	1	1.0	1	1	4.00
Luxton	19	0.47	1	1	1	1	1	1	1	1.0	1	1	2.13
Mountain	31	1.36	2	2	2	2	1	2	2	1.9	1	2	1.37
North Cranberry	29	0.34	1	1	1	1	1	1	1	1.0	1	1	2.94
Pebbleloggitch	38	0.33	0	1	1	0	0	0	0	0.3	0	1	0.87
Peskawa	33	3.88	2	2	2	3	2	2	2	2.1	2	3	0.55
Peskowesk	34	6.85	3	2	4	3	3	3	3	3.0	2	4	0.44
Puzzle	32	0.34	1	1	1	1	1	1	1	1.0	1	1	2.94
Upper Silver	42	0.24	1	1	1	1	1	1	1	1.0	1	1	4.17

Table 10. Number of successful Common Loon pairs observed in 24 study lakes in Kejimkujik National Park, Nova Scotia between 1988-1995 (except 1991).

LAKE	LAKE	AREA	1988	1989	1990	1992	1993	1994	1995	7 YEAR	MIN.	MAX.	MEAN
NAME	No.	(km²)	SUCCESSFUL PAIRS							MEAN	NUMBER		PAIR/KM²
Back	39	0.78	0	1	1	1	0	1	0	0.57	0	1	0.73
Beaverskin	37	0.40	0	0	0	1	0	0	1	0.29	0	1	0.71
Ben	26	0.20	0	0	0	0	0	0	0	0.00	0	0	0.00
Big Dam East	4	0.46	0	0	0	0	0	0	0	0.00	0	0	0.00
Big Dam West	2	1.05	0	0	0	0	0	0	0	0.00	0	0	0.00
Big Red	21	0.71	0	0	0	0	0	0	0	0.00	0	0	0.00
Channel	6	0.68	1	0	1	0	0	0	0	0.29	0	1	0.42
Cobrielle	35	1.32	0	2	1	0	0	0	0	0.43	0	2	0.32
Frozen Ocean	3	2.28	1	1	0	1	0	0	0	0.43	0	1	0.19
George	30	0.78	1	0	0	1	0	1	1	0.57	0	1	0.73
Grafton	11	2.70	2	1	2	1	1	0	0*	1.00	0	2	0.37
Hilchemakaar	41	0.95	0	1	1	0	0	0	0	0.29	0	1	0.30
Kejimkujik	10	24.35	2	3	0	4	1	1	1	1.71	0	4	0.07
Liberty	9	0.73	0	1	0	0	1	0	0	0.29	0	1	0.39
Loon	36	0.74	0	1	0	0	1	0	0	0.29	0	1	0.39
Lower Silver	40	0.25	0	1	1	1	0	0	0	0.43	0	1	1.71
Luxton	19	0.47	0	0	0	0	0	0	1	0.14	0	0	0.30
Mountain	31	1.36	1	0	0	0	0	0	0	0.14	0	1	0.11
North Cranberry	29	0.34	0	0	1	1	1	0	1	0.57	0	1	1.68
Pebbleloggitch	38	0.33	0	0	0	0	0	0	0	0.00	0	0	0.00
Peskawa	33	3.88	0	0	0	1	1	0	1	0.43	0	1	0.11
Peskowesk	34	6.85	1	1	0	1	0	0	0	0.43	0	1	0.06
Puzzle	32	0.34	0	0	0	0	0	0	0	0.00	0	0	0.00
Upper Silver	42	0.24	0	0	0	0	0	1	0	0.14	0	1	0.60

* Lake level was lowered in 1995: no suitable nesting location for loons

Table 11. Number of Common Loon chicks observed in 24 study lakes in Kejimkujik National Park, Nova Scotia between 1988-1995 (except 1991).

LAKE	LAKE	AREA	1988	1989	1990	1992	1993	1994	1995	7 YEAR	MIN.	MAX.	MEAN
NAME	No.	(km²)	COMMON LOON CHICKS							MEAN	NUMBER		PAIR/KM²
Back	39	0.78	0	1	2	1	0	2	0	0.9	0	2	1.10
Beaverskin	37	0.40	0	0	0	2	0	0	2	0.6	0	2	1.43
Ben	26	0.20	0	0	0	0	0	0	0	0.0	0	0	0.00
Big Dam East	4	0.46	0	0	0	0	0	0	0	0.0	0	0	0.00
Big Dam West	2	1.05	0	0	0	0	0	0	0	0.0	0	0	0.00
Big Red	21	0.71	0	0	0	0	0	0	0	0.0	0	0	0.00
Channel	6	0.68	1	0	1	0	0	0	0	0.3	0	1	0.44
Cobrielle	35	1.32	0	3	2	0	0	0	0	0.7	0	3	0.54
Frozen Ocean	3	2.28	1	1	0	2	0	0	0	0.6	0	2	0.25
George	30	0.78	2	0	0	2	0	1	2	1.0	0	2	1.28
Grafton	11	2.70	3	1	2	1	1	0	0*	1.1	0	3	0.42
Hilchemakaar	41	0.95	0	1	2	0	0	0	0	0.4	0	2	0.45
Kejimkujik	10	24.35	2	4	0	5	1	2	1	2.1	0	5	0.09
Liberty	9	0.73	0	1	0	0	1	0	0	0.3	0	1	0.39
Loon	36	0.74	0	1	0	0	1	0	0	0.3	0	1	0.39
Lower Silver	40	0.25	0	1	1	1	0	0	0	0.4	0	1	1.71
Luxton	19	0.47	0	0	0	0	0	0	2	0.3	0	2	0.61
Mountain	31	1.36	1	0	0	0	0	0	0	0.1	0	1	0.11
North Cranberry	29	0.34	0	0	2	1	1	0	1	0.7	0	2	2.10
Pebbleloggitch	38	0.33	0	0	0	0	0	0	0	0.0	0	0	0.00
Peskawa	33	3.88	0	0	0	1	2	0	1	0.6	0	2	0.15
Peskowesk	34	6.85	1	1	0	2	0	0	0	0.6	0	2	0.08
Puzzle	32	0.34	0	0	0	0	0	0	0	0.0	0	0	0.00
Upper Silver	42	0.24	0	0	0	0	0	1	0	0.1	0	1	0.60

* Lake level was lowered in 1995: no suitable nesting location for loons

Table 12. Number of Common Merganser broods observed in 24 study lakes in Kejimkujik National Park, Nova Scotia between 1988-1995 (except 1991).

LAKE	LAKE	AREA	1988	1989	1990	1992	1993	1994	1995	7 YEAR	MIN.	MAX.	MEAN
NAME	No.	(km²)	COMMON MERGANSER BROODS							MEAN	NUMBER		PAIR/KM²
Back	39	0.78	1	0	1	0	1	1	1	0.7	0	1	0.92
Beaverskin	37	0.40	1	1	1	0	1	2	1	1.0	0	2	2.50
Ben	26	0.20	0	0	0	0	0	0	0	0.0	0	0	0.00
Big Dam East	4	0.46	0	2	1	0	0	0	0	0.4	0	2	0.93
Big Dam West	2	1.05	0	0	0	1	1	0	1	0.4	0	1	0.41
Big Red	21	0.71	0	0	0	.	0	0	.	0.0	0	0	0.00
Channel	6	0.68	0	0	0	.	0	0	.	0.0	0	0	0.00
Cobrielle	35	1.32	1	0	1	2	1	2	3	1.4	0	2	1.08
Frozen Ocean	3	2.28	0	1	1	0	1	0	0	0.4	0	1	0.19
George	30	0.78	1	1	0	0	1	1	1	0.7	0	1	0.92
Grafton	11	2.70	0	0	1	1	0	2	1	0.6	0	2	0.21
Hilchemakaar	41	0.95	0	1	1	0	0	0	0	0.3	0	1	0.30
Kejimkujik	10	24.35	4	2	5	3	3	1	1	2.7	1	5	0.11
Liberty	9	0.73	0	0	1	.	.	0	.	0.1	0	1	0.34
Loon	36	0.74	1	0	0	0	0	0	1	0.3	0	1	0.39
Lower Silver	40	0.25	1	1	0	0	0	0	0	0.3	0	1	1.14
Luxton	19	0.47	0	0	0	0	0	0	0	0.0	0	0	0.00
Mountain	31	1.36	1	2	1	2	1	1	0	1.1	0	2	0.84
North Cranberry	29	0.34	0	0	0	0	0	0	0	0.0	0	0	0.00
Pebbleloggitch	38	0.33	0	0	0	0	0	0	0	0.0	0	0	0.00
Peskawa	33	3.88	0	0	1	0	1	0	0	0.3	0	1	0.07
Peskowesk	34	6.85	1	3	1	3	1	0	2	1.6	0	3	0.23
Puzzle	32	0.34	0	0	0	0	0	0	0	0.0	0	0	0.00
Upper Silver	42	0.24	0	0	0	0	0	0	0	0.0	0	0	0.00

. insufficient observations

ONTARIO REGION BIOMONITORING STUDY

ALGOMA

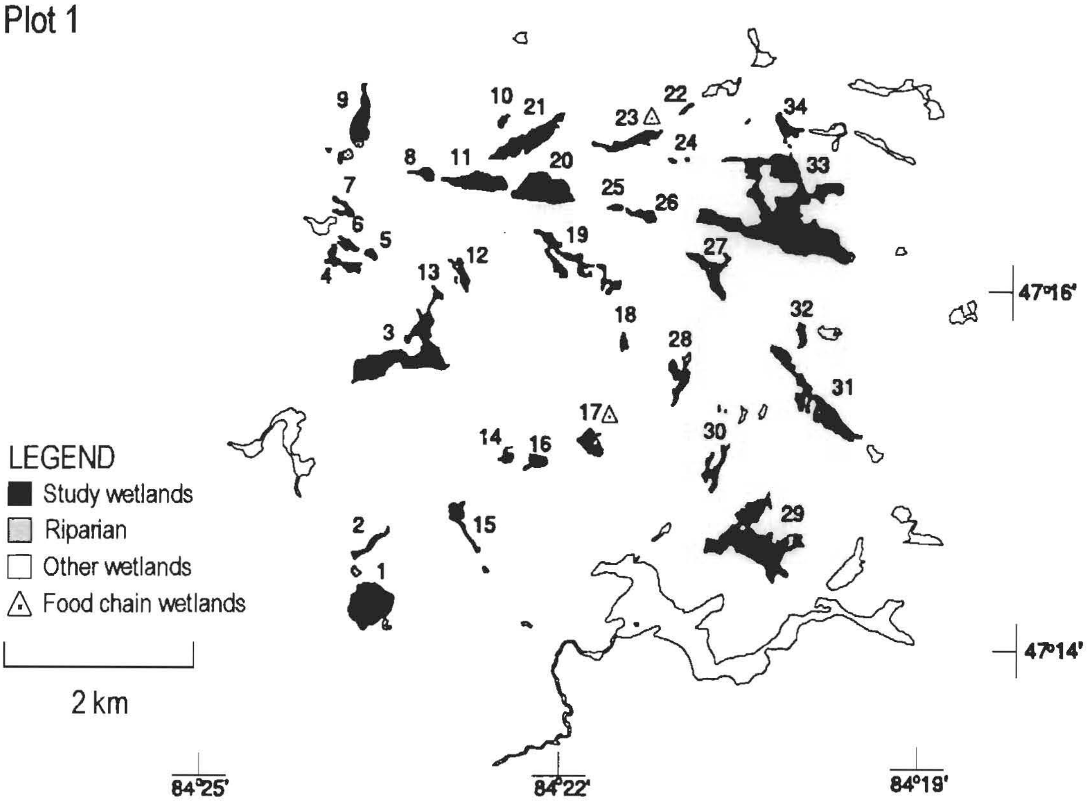
Table of Contents Page

Key to Figure 10. Maps of Algoma study plots 1-9 showing the location of study lakes, including food chain lakes, and other wetlands. Lake names associated with CWS LRTAP study lakes in Algoma are listed below. Local names not present on EMR 1:50 000 and Provincial Series 1:100 000 topographic maps are indicated by NL (not listed). (CWS study names are given for Plots 7 and 9).

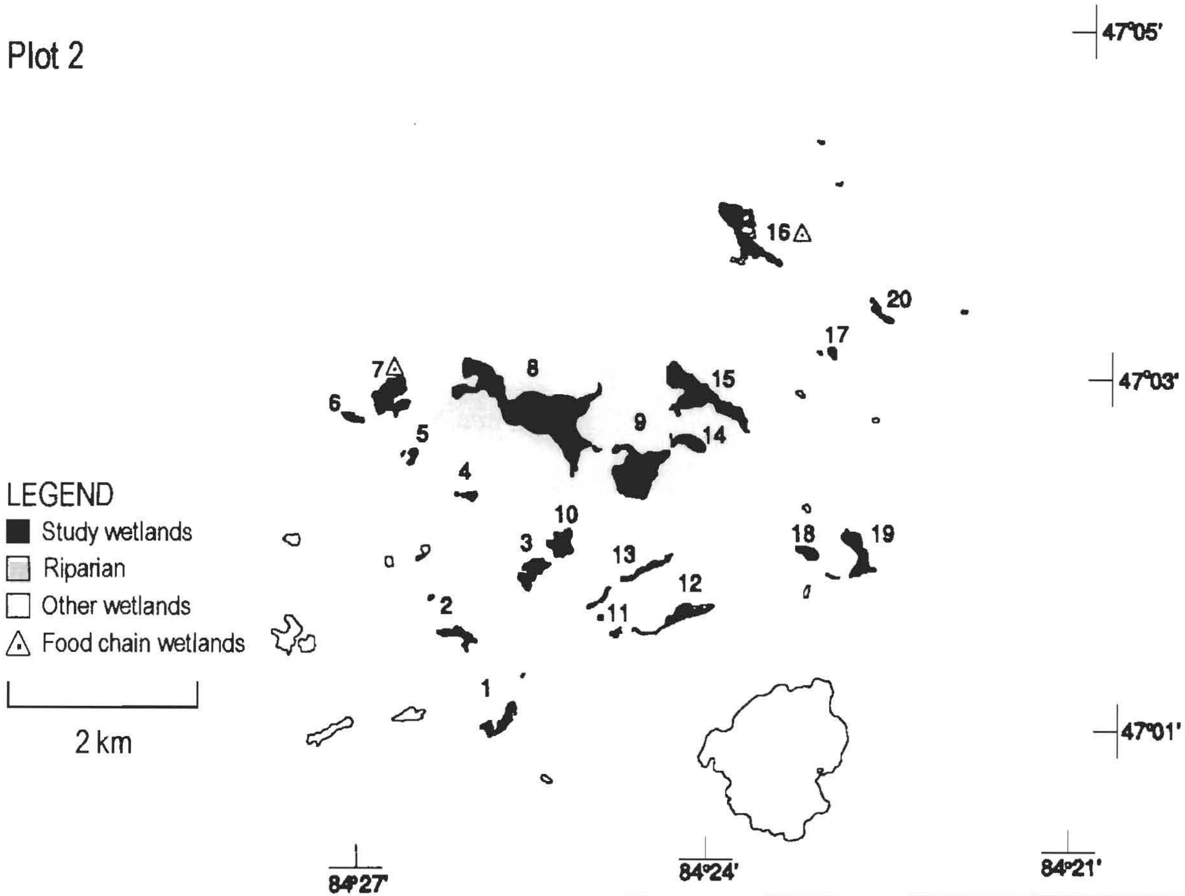
PLOT	LAKE	LAKE NAME
1	1	Shoepack
	3	Roi
	29	Hailey
	33	Barbara
2	8	Turkey
	9	Little Turkey
	15	Wishart
	16	Batchawana
	19	Base Camp (NL)
3	33	Jules
5	12	Prugh
	16	Achigan Creek
	17	Achigan Creek
	18	Achigan Creek
	22	Achigan Creek
6	2	Jarvis
	3	Brilliant
	13	Phelbin
	14	White Birch
	17	Christman
	22	Crooked
	25	Clearwater
7	1	Crooked (NL)
	2	Bullmoose (NL)
	7	Tracy
	8	Outpost (NL)
	9	Gorman-Anvil (NL)
	15	Round (NL)
	16	Swainsons (NL)
	17	Gawn (NL)
	18	Campus (NL)
7	20	Far East (NL)
	23	Stumble-On (NL)
	24	Mandril (NL)
	25	Useless (NL)
	26	Skull Lake (NL)
	27	Skull Pond (NL)
	28	Maybe Moose (NL)
8	1	Little Saddle
	4	Dat (NL)
	15	Ward
	25	Dis (NL)
9	1	Gametrail (NL)
	2	Bittern Pond (NL)
	3	Bittern Lake (NL)
	4	Blackfly (NL)
	5	Dead End (NL)
	7	Rocky Road (NL)
	8	Gravel
	9	South Gravel (NL)
	10	Further-On (NL)
	11	Distant (NL)
	12	Beyond (NL)
	13	Saw
	14	Blackback (NL)
	16	Hard (NL)
	18	Trapper (NL)
	19	Angel Pond (NL)
	21	Anne's Pond (NL)
	22	Otter
	24	Fitness (NL)
	25	Baitbucket (NL)

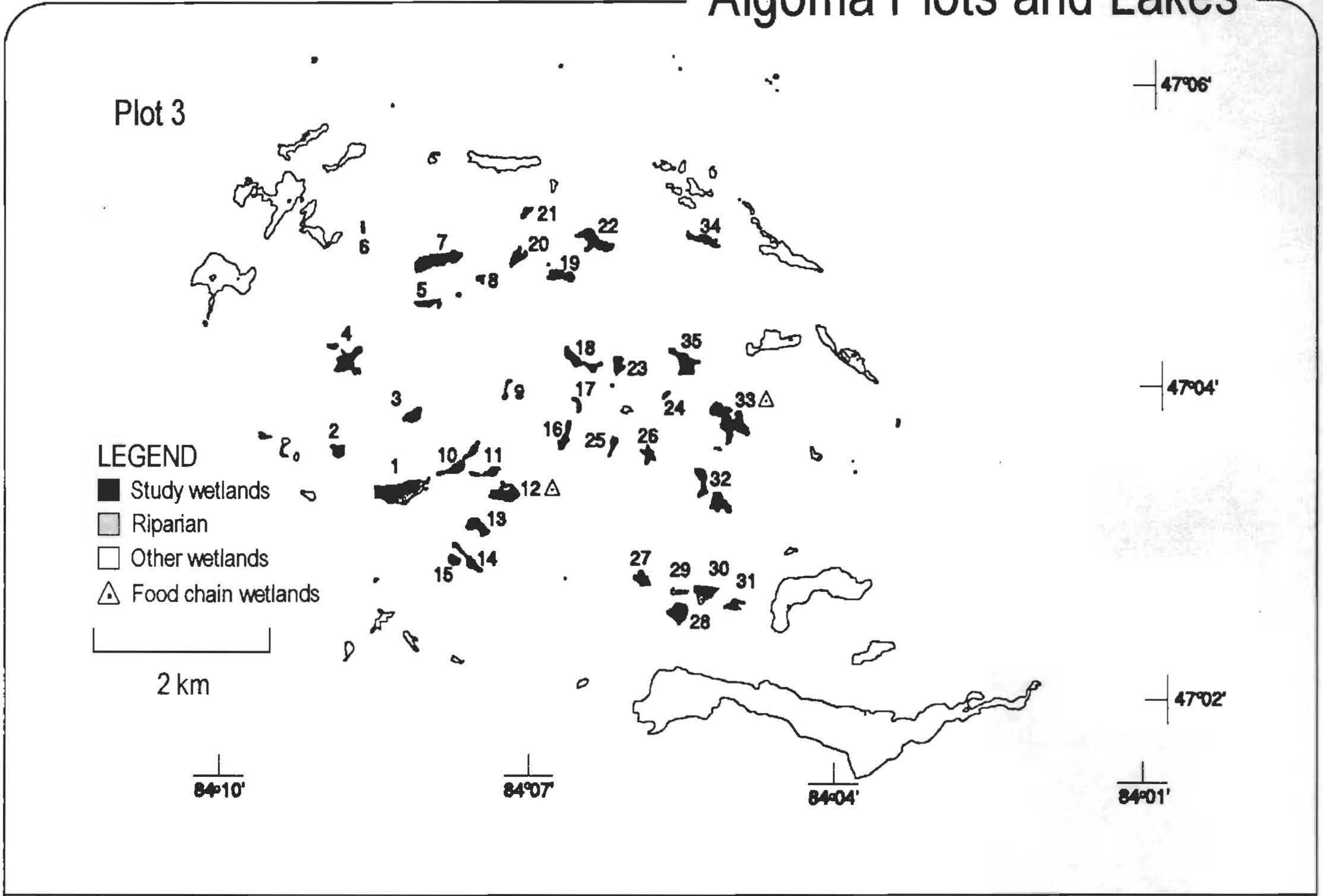
Algoma Plots and Lakes

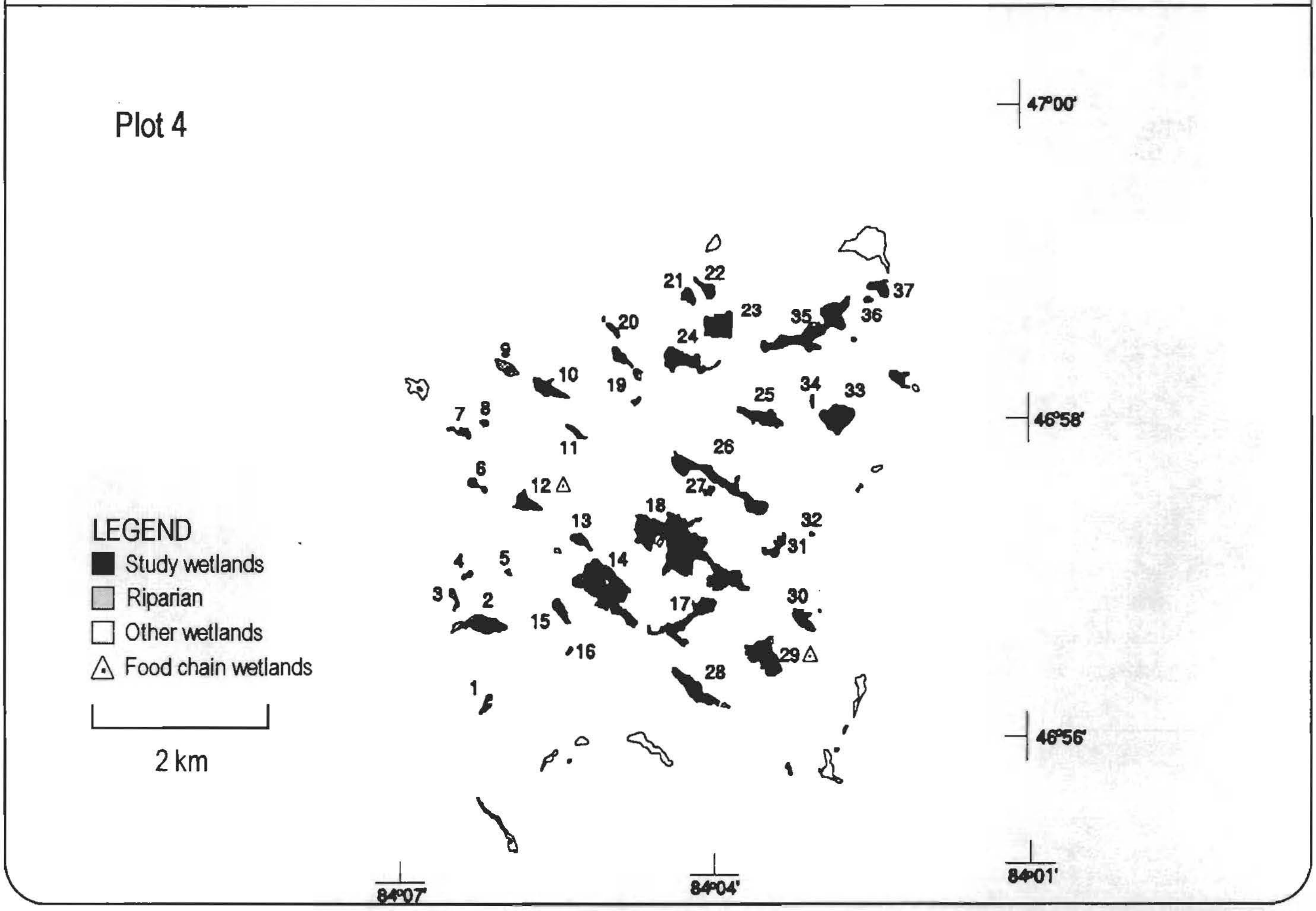
Plot 1



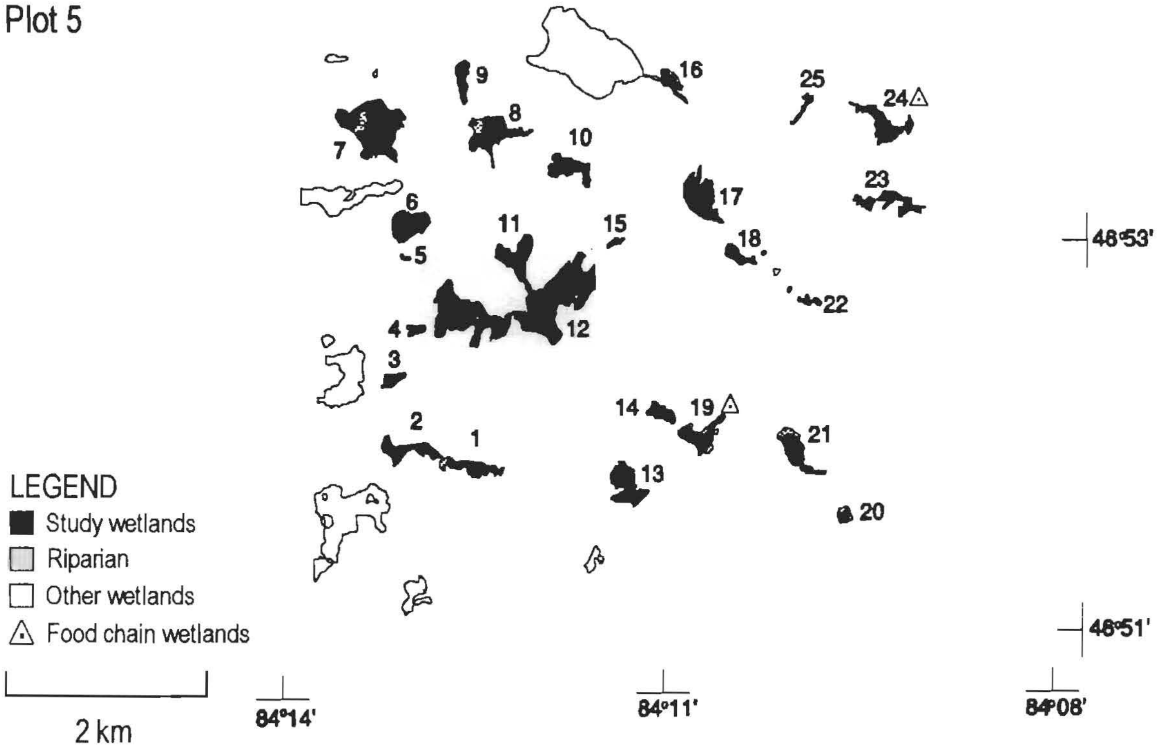
Plot 2




Plot 3
1
2
3
4
5
6
7
8
9
10
11
12 △
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33 △
34
35
LEGEND
■ Study wetlands
▨ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km
47°06'
47°04'
47°02'
84°10'
84°07'
84°04'
84°01'

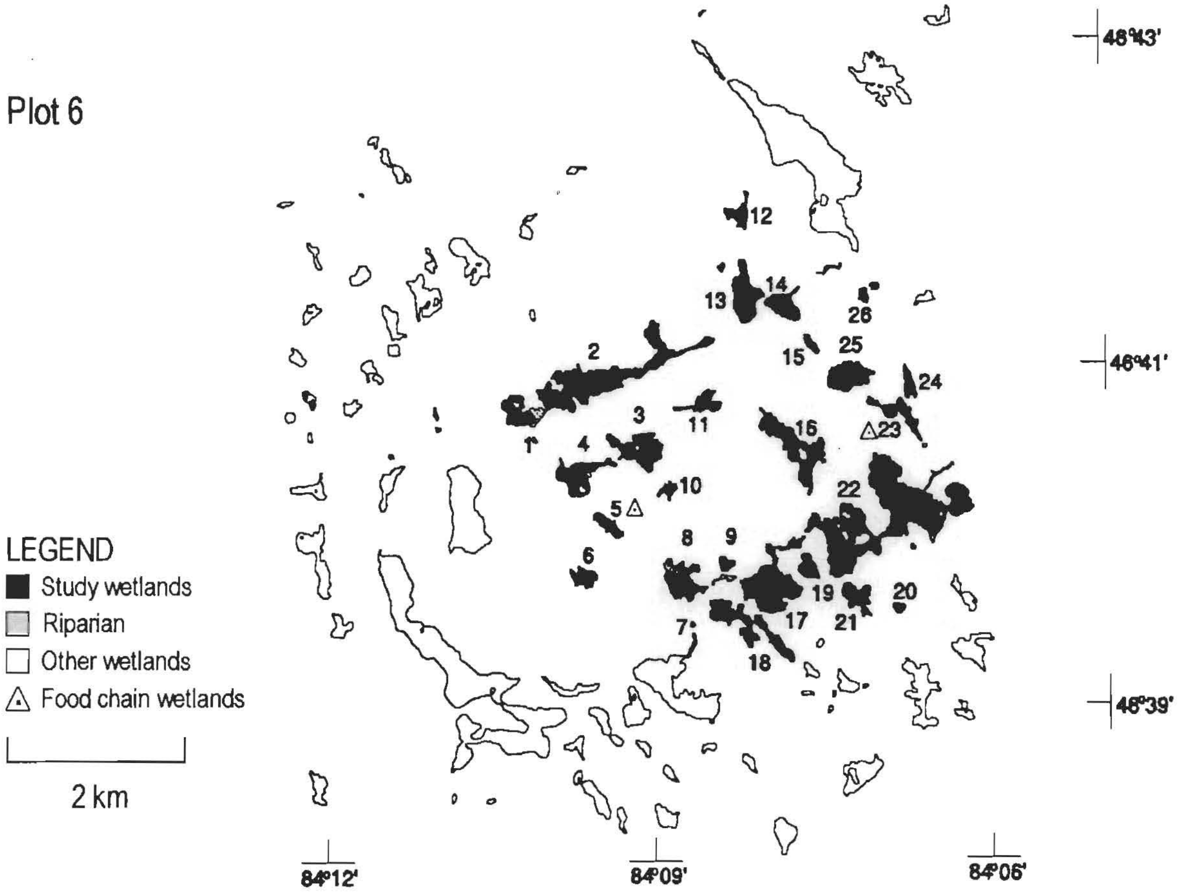

Plot 4
1
2
3
4
5
6
7
8
9
10
11
12 △
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29 △
30
31
32
33
34
35
36
37
LEGEND
■ Study wetlands
▨ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km
47°00'
46°58'
46°56'
84°07'
84°04'
84°01'

Plot 5



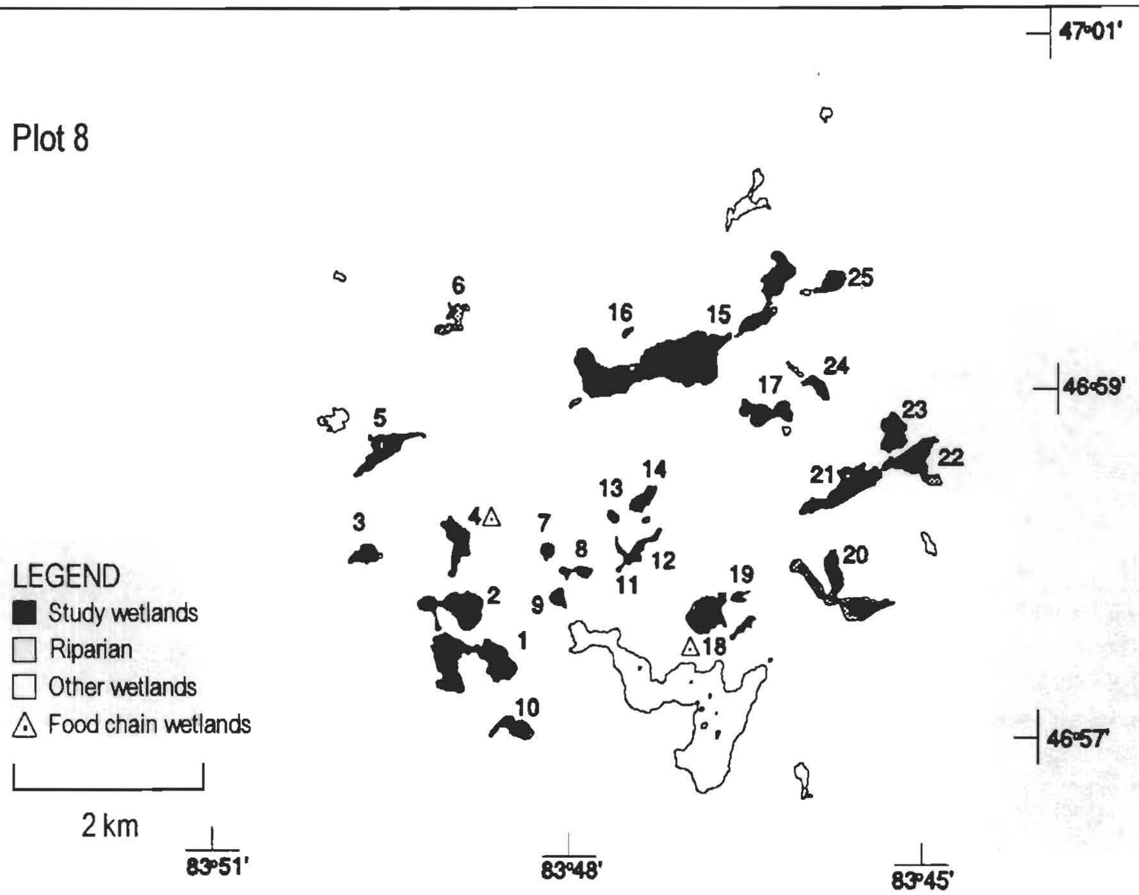
16
25
24△
9
8
7
10
17
23
6
11
15
18
5
22
4
12
3
14
19△
2
1
21
13
20
48°53'
48°51'
84°14'
84°11'
84°08'
LEGEND
■ Study wetlands
▨ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km

Plot 6



48°43'
12
13
14
26
25
15
2
24
46°41'
3
11
16
△23
1
4
10
22
5△
8
9
6
19
20
7
17
21
18
48°39'
84°12'
84°09'
84°06'
LEGEND
■ Study wetlands
▨ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km


Plot 7
28
14
4
13
27
-5
15
26
6
25
3
24
46°51'
23
7
12
22
21
9
11
19
20
LEGEND
Study wetlands
Riparian
Other wetlands
Food chain wetlands
2
18
8
16
1
17
46°49'
2 km
83°51'
83°48'
83°45'


47°01'
Plot 8
6
25
16
15
17
24
46°59'
5
23
22
21
14
13
3
4
7
8
12
20
11
19
2
9
LEGEND
Study wetlands
Riparian
Other wetlands
Food chain wetlands
1
18
10
46°57'
2 km
83°51'
83°48'
83°45'

Plot 9

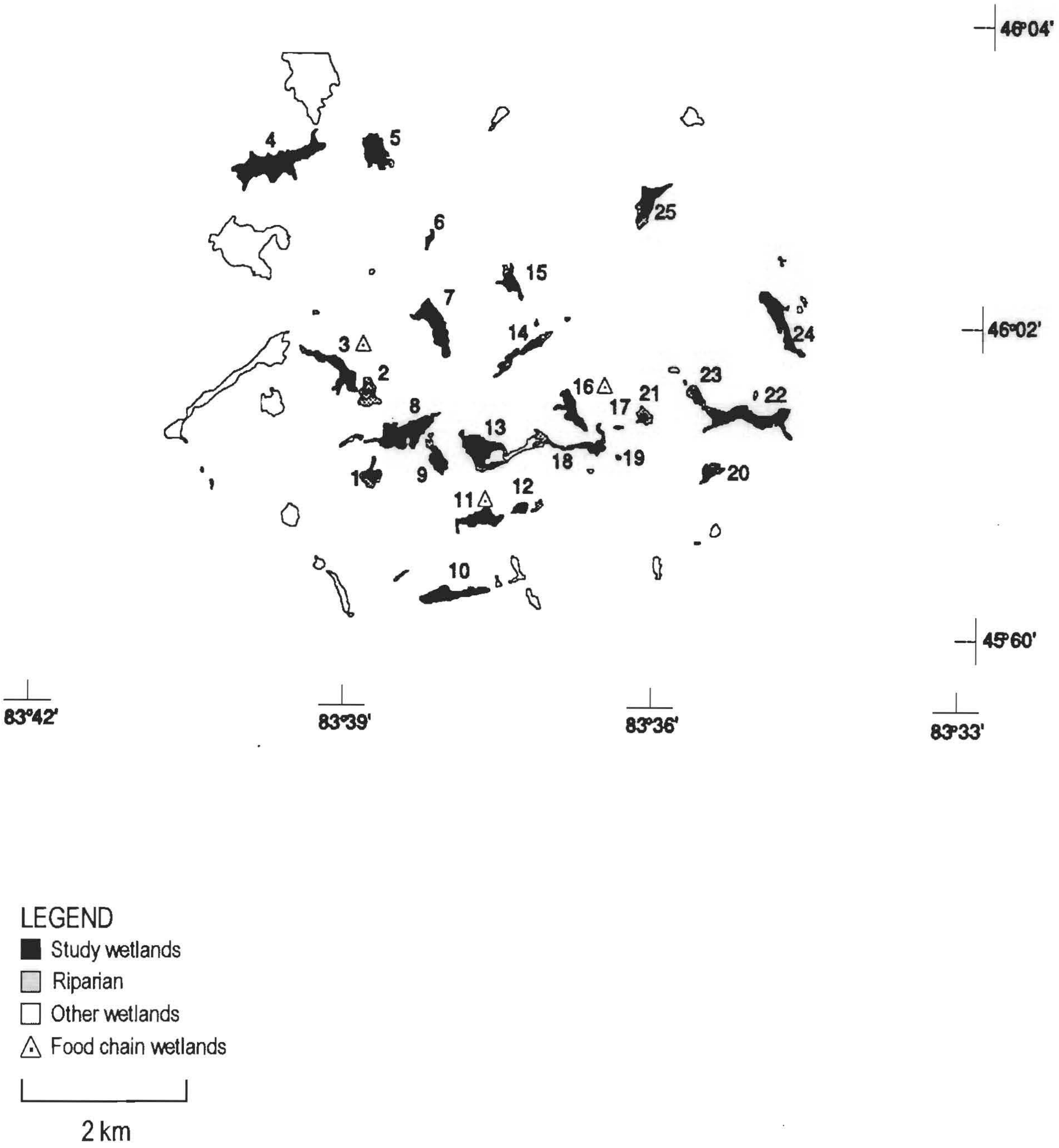

4
5
6
7
15
25
14
24
3
2
16
21
23
22
17
8
13
18
19
1
9
20
11
12
10
46°04'
46°02'
45°60'
83°42'
83°39'
83°36'
83°33'
LEGEND
■ Study wetlands
▨ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km

Table 13. Locations and morphometric characteristics of Algoma study lakes, identified by plot and lake number. (See legend for explanation of variables and notations).

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
1	1	6974	52349	2BF	124	15.7	16.1	1543	12.1	7	0
1	2	6974	52355	2BE	125	2.1	1.2	1131	2.7	2	0
1	3	6977	52374	2BE	136	22.8	6.7	4490	1.4	4	3
1	4	6970	52384	2BE	145	3.3	4.4	1320	0.6	1	1
1	5	6974	52385	2BE	145	0.9	5.7	390	0.2	1	0
1	6	6972	52386	2BE	145	1.5	1.6	757	0.7	6	0
1	7	6971	52389	2BE	140	1.8	4.8	962	0.0	2	0
1	8	6979	52394	2BE	121	1.9	2.7	700	1.4	3	0
1	9	6973	52398	2BE	116	7.3	5.7	1840	7.5	5	0
1	10	6988	52398	2BE	136	0.7	8.5	344	0.9	2	0
1	11	6985	52393	2BE	122	8.6	3.4	1574	0.5	3	0
1	12	6983	52383	2BE	148	2.4	3.9	1121	1.0	1	0
1	13	6981	52381	2BE	136	0.9	1.0	480	0.0	1	0
1	14	6988	52365	2BF	145	2.6	1.1	1381	0.0	2	1
1	15	6983	52358	2BF	126	3.6	0.7	1504	12.4	4	0
1	16	6992	52363	2BF	145	2.2	6.8	746	0.0	1	0
1	FC 17	6998	52364	2BF	150	3.7	8.6	1274	2.4	1	2
1	18	7001	52376	2BE	155	1.0	1.5	476	0.0	2	0
1	19	6996	52384	2BE	145	9.6	2.4	4346	3.0	4	0
1	20	6993	52392	2BE	122	14.3	36.0	1821	0.0	3	0
1	21	6991	52397	2BE	122	11.2	16.4	2273	0.6	5	0
1	22	7006	52400	2BE	129	0.5	2.2	513	0.4	2	0
1	FC 23	7002	52397	2BE	124	5.2	3.7	1696	2.5	3	0
1	24	6707	52395	2BE	131	1.8	0.9	918	0.1	2	0
1	25	6999	52389	2BE	129	0.8	2.3	395	0.2	2	0
1	26**	6701	52389	2BE	129	2.2	3.9	818	2.3	1	0
1	27	7001	52383	2BF	131	6.2	4.2	1801	1.0	1	1
1	28	7007	52373	2BF	145	4.1	4.1	1737	1.3	1	0
1	29	7015	52355	2BF	135	29.0	11.4	5063	2.8	1	2
1	30	7009	52362	2BF	145	3.9	1.3	1813	1.2	7	0
1	31	7021	52369	2BF	132	15.2	9.4	4094	1.4	4	1
1	32	7018	52377	2BF	132	0.5	1.0	388	0.9	2	0
1	33	7017	52388	2BE	134	62.5	25.3	9245	10.9	5	4
1	34	7018	52398	2BE	136	3.4	7.2	1196	0.3	2	0
2	1	6955	52103	2BF	124	4.1	1.2	1756	3.3	2	1
2	2	6950	52113	2BF	128	3.4	1.8	1215	0.4	1	0
2	3	6958	52120	2BF	131	4.2	2.0	1979	1.1	1	6
2	4	6950	52127	2BF	117	1.5	10.0	600	0.4	1	0
2	5	6945	52131	2BF	112	1.0	0.0	469	0.0	2	0
2	6	6939	52135	2BF	117	1.0	2.4	675	0.5	1	0
2	FC 7	6943	52137	2BF	117	9.7	2.6	1764	2.5	1	0
2	8	6960	52137	2BF	112	52.7	22.5	5960	1.3	3	0
2	9	6968	52129	2BF	113	19.8	11.7	2363	1.8	3	0
2	10	6961	52123	2BF	126	4.9	1.9	1095	0.6	1	1

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
2	11	6967	52115	2BF	120	1.5	0.0	848	0.2	2	1
2	12	6975	52116	2BF	116	5.7	1.6	2447	4.3	4	0
2	13	6970	52120	2BF	122	2.5	0.6	1392	7.6	2	1
2	14	6974	52133	2BF	113	3.9	0.6	1073	1.2	5	0
2	15	6974	52138	2BF	122	19.1	4.5	2976	0.2	2	0
2	**FC 16**	6980	52155	2BF	153	12.2	6.9	2899	6.7	2	1
2	17	6988	52143	2BF	140	1.5	0.9	896	1.5	5	0
2	18	6987	52122	2BF	125	1.8	2.5	1369	0.6	1	2
2	19	6993	52122	2BF	114	6.3	1.5	1435	0.7	1	0
2	20	6995	52147	2BF	155	1.4	2.1	844	1.0	1	0
3	1	7176	52155	2BF	139	7.3	8.7	1646	6.9	2	0
3	2	7168	52160	2BF	140	1.6	1.5	667	0.9	2	1
3	3	7176	52164	2BF	145	2.3	2.2	765	3.3	2	0
3	4	7169	52171	2BF	149	5.2	14.0	1619	1.4	1	0
3	5	7179	52178	2BF	135	1.9	0.6	861	2.0	2	0
3	6	7172	52188	2BF	131	0.5	5.0	347	3.9	2	0
3	7	7180	52183	2BF	143	7.2	1.4	1536	11.2	3	0
3	8	7186	52181	2BF	135	0.3	1.0	238	0.4	2	0
3	9	7189	52167	2BF	152	0.7	0.9	630	3.4	4	0
3	10	7183	52159	2BF	139	3.8	1.0	1527	1.7	9	0
3	11	7187	52158	2BF	140	1.8	0.8	903	0.7	4	0
3	**FC 12**	7188	52155	2BF	143	4.6	2.5	1520	1.2	1	3
3	13	7185	52151	2BF	143	3.0	4.4	812	3.4	1	0
3	14	7183	52148	2BF	143	2.0	2.0	956	1.9	3	0
3	15	7182	52147	2BF	143	0.6	6.5	302	1.0	1	0
3	16	7197	52162	2BF	144	2.2	7.7	887	0.8	3	0
3	17	7198	52165	2BF	149	1.0	1.6	587	0.0	1	0
3	18	7198	52171	2BF	145	3.8	4.1	1338	0.3	1	0
3	19	7195	52181	2BF	143	2.7	1.8	1006	1.9	2	0
3	20	7190	52183	2BF	135	2.3	7.3	831	0.9	2	0
3	21	7192	52188	2BF	134	1.0	1.0	497	10.2	4	0
3	22	7200	52185	2BF	139	4.9	9.2	1235	4.7	1	0
3	23	7202	52170	2BF	144	2.2	6.8	801	1.7	5	0
3	25	7202	52161	2BF	134	1.1	1.0	603	2.6	2	0
3	26	7207	52159	2BF	143	1.7	2.7	718	0.3	1	0
3	27	7205	52144	2BF	134	2.1	1.4	788	0.8	1	0
3	28	7210	52140	2BF	135	4.2	9.8	822	0.3	1	0
3	29	7211	52142	2BF	131	0.4	0.6	313	1.1	2	0
3	30	7212	52142	2BF	131	3.0	10.8	778	3.9	5	0
3	31	7218	52141	2BF	126	1.7	4.4	720	0.5	2	0
3	32	7215	52155	2BF	139	5.9	6.0	2032	6.6	2	1
3	**FC 33**	7216	52163	2BF	144	9.4	5.6	2123	1.9	1	0
3	34	7214	52185	2BF	139	1.2	1.5	608	1.7	1	0
3	35	7212	52170	2BF	144	5.7	9.8	1421	0.0	1	1
4	1	7206	52023	2BF	149	0.9	0.9	643	2.3	1	0
4	2	7205	52032	2BF	158	6.7	7.0	1228	10.3	8	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
4	3	7202	52034	2BF	158	0.7	0.6	561	4.4	2	0
4	4	7206	52035	2BF	162	0.5	0.0	332	2.6	2	0
4	5	7208	52039	2BF	162	0.6	0.0	428	9.5	4	0
4	6	7203	52048	2BF	180	1.3	1.6	646	1.0	5	0
4	7	7202	52054	2BF	174	1.3	0.8	697	0.8	2	0
4	8	7205	52055	2BF	177	1.0	0.0	428	0.0	1	0
4	9	7209	52061	2BF	158	0.4	0.0	230	2.5	3	0
4	10	7213	52060	2BF	158	4.6	4.3	1033	0.9	3	0
4	11	7217	52054	2BF	168	1.2	0.8	684	1.5	1	0
4	FC 12	7211	52046	2BF	177	3.8	4.8	965	1.7	5	0
4	13	7217	52042	2BF	163	2.2	2.3	733	1.1	1	0
4	14	7220	52037	2BF	160	24.3	2.7	3295	1.9	4	3
4	15	7217	52032	2BF	159	2.1	1.8	616	4.1	2	0
4	16	7216	52029	2BF	159	0.7	1.2	453	0.6	2	0
4	17	7230	52033	2BF	163	9.2	3.8	3072	1.6	1	2
4	18	7229	52041	2BF	163	43.3	19.9	5919	4.5	2	4
4	19	7225	52060	2BF	158	3.2	7.0	1355	13.1	7	0
4	20	7221	52067	2BF	158	0.9	6.0	495	0.5	0	0
4	21	7230	52071	2BF	158	1.9	2.4	582	1.7	1	0
4	22	7233	52071	2BF	158	2.0	4.1	757	2.2	2	0
4	23	7233	52067	2BF	158	8.5	26.4	1235	4.5	3	0
4	24	7229	52063	2BF	159	8.2	7.7	1505	0.7	1	0
4	25	7238	52056	2BF	168	5.8	1.8	1619	2.5	3	2
4	26	7231	52050	2BF	158	15.0	6.8	3323	7.5	5	0
4	27	7233	52047	2BF	160	1.0	0.9	441	1.2	2	0
4	28	7232	52024	2BF	149	7.9	3.1	1827	1.0	9	0
4	FC 29	7239	52028	2BF	154	9.0	1.5	1577	1.5	1	1
4	30	7243	52033	2BF	158	2.9	2.4	929	3.6	3	0
4	31	7241	52040	2BF	163	2.6	1.7	1253	3.1	1	0
4	32	7244	52042	2BF	158	0.2	1.0	168	1.0	2	0
4	33	7248	52056	2BF	163	9.1	6.2	1202	0.5	2	0
4	34	7244	52058	2BF	163	0.7	0.7	412	0.9	1	0
4	35	7245	52067	2BF	159	18.7	8.1	3488	2.3	3	0
4	36	7250	52070	2BF	158	0.5	0.0	325	0.5	2	0
4	37	7253	52072	2BF	158	2.9	1.2	807	1.2	2	0
5	1	7129	51938	2BF	131	4.8	1.7	2062	1.7	1	2
5	2**	7122	51941	2BF	131	5.8	2.3	1701	3.4	0	0
5	3	7120	51947	2BF	126	2.0	1.9	602	1.4	1	0
5	4	7123	51952	2BF	117	0.9	1.2	439	0.7	1	0
5	5	7122	51958	2BF	117	0.3	0.7	276	1.6	5	0
5	6	7122	51962	2BF	120	8.0	9.7	1155	0.0	0	0
5	7	7118	51972	2BF	122	21.2	6.8	3164	3.9	1	1
5	8	7130	51971	2BF	113	9.6	8.4	2276	4.3	3	1
5	9	7127	51976	2BF	115	3.3	0.8	894	2.1	7	0
5	10	7138	51967	2BF	113	6.1	5.7	1445	1.2	1	0
5	11	7133	51958	2BF	117	8.1	4.7	1678	0.1	1	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
5	12	7132	51953	2BF	116	52.4	6.4	6943	0.7	9	3
5	13	7143	51937	2BF	130	8.7	3.8	1722	0.1	1	0
5	14	7146	51944	2BF	126	3.1	5.9	828	1.8	2	0
5	15	7142	51959	2BF	116	0.8	0.7	456	0.8	2	0
5	16	7148	51976	2BF	103	2.2	1.6	1039	1.0	2	0
5	17	7151	51964	2BF	103	10.4	2.6	2117	5.3	6	1
5	18	7155	51958	2BF	102	2.8	2.2	904	1.9	2	0
5	**FC 19**	7151	51942	2BF	126	5.4	3.5	1471	3.0	1	0
5	20	7166	51934	2BF	116	1.7	1.4	513	0.0	1	0
5	21	7160	51940	2BF	116	5.4	7.7	1318	2.6	3	0
5	22	7162	51954	2BF	102	1.0	2.6	728	8.4	10	0
5	23	7169	51963	2BF	131	5.4	5.2	2319	0.7	1	0
5	**FC 24**	7168	51971	2BF	135	7.4	1.8	2094	3.2	4	0
5	25	7162	51974	2BF	120	0.6	0.0	480	0.6	2	0
6	1	7168	51731	2CA	118	0.8	0.0	361	0.4	2	0
6	2	7175	51738	2CA	117	13.9	16.1	2866	42.6	6	8
6	3	7180	51730	2CA	118	13.9	8.8	2827	1.1	3	1
6	4	7172	51727	2CA	118	11.7	16.5	2595	1.1	4	2
6	**FC 5**	7175	51721	2CA	121	3.9	4.3	1138	0.2	1	0
6	6	7173	51716	2CA	108	4.2	1.8	1601	0.3	1	2
6	7	7185	51711	2CA	116	1.7	0.8	583	0.0	1	0
6	8	7184	51716	2CA	116	11.5	1.5	2679	1.2	3	3
6	9	7189	51718	2CA	117	1.8	3.6	570	0.2	2	0
6	10	7182	51726	2CA	118	2.5	2.9	1136	0.2	1	0
6	11	7186	51735	2CA	118	5.4	6.5	1658	0.0	1	0
6	12	7190	51757	2BF	112	4.2	9.3	1554	0.2	0	1
6	13	7192	51746	2BF	112	13.8	15.7	1860	1.8	3	0
6	14	7196	51746	2BF	111	7.9	10.8	1422	5.0	4	0
6	15	7199	51742	2BF	112	1.3	0.9	496	0.5	2	0
6	16	7198	51731	2CA	118	20.0	5.7	3729	3.2	4	3
6	17	7195	51715	2CA	117	25.2	6.5	3807	6.6	6	0
6	18	7191	51711	2CA	117	16.1	2.2	4128	0.5	2	2
6	19	7199	51718	2CA	117	4.2	6.5	917	0.0	1	0
6	20	7209	51713	2CA	117	2.0	5.2	525	0.0	1	0
6	21	7205	51714	2CA	117	6.7	9.1	1380	0.2	1	0
6	22	7208	51720	2CA	118	81.3	9.0	11761	20.4	12	10
6	**FC 23**	7209	51734	2CA	118	7.3	1.3	2476	3.0	2	1
6	24	7209	51738	2CA	118	3.3	2.8	998	0.0	2	0
6	25	7203	51738	2BF	117	11.9	25.6	1779	0.2	1	2
6	26	7205	51747	2BF	112	2.0	6.6	780	5.1	2	0
6	27••	7205	51749	2BF	.	.	.	.	.	.	.
7	1	2839	51888	2BF	143	5.6	2.0	2510	2.9	2	2
7	**FC 2**	2838	51895	2BF	144	6.3	8.2	1734	2.5	1	0
7	3	2847	51920	2BF	134	4.2	4.7	1528	3.1	2	0
7	4	2847	51932	2BF	140	4.7	2.6	1593	6.4	6	0
7	5	2859	51928	2BF	138	1.5	0.9	808	0.6	2	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
7	6	2851	51923	2BF	138	1.5	7.5	579	2.7	3	0
7	7	2853	51911	2BF	139	7.2	8.1	1188	38.7	10	0
7	8	2856	51893	2BF	144	2.4	6.0	1030	1.2	1	0
7	**FC 9**	2860	51898	2BF	144	10.5	2.8	2570	8.0	3	0
7	10**	2860	51900	2BF	.	.	.	.	.	.	.
7	11	2868	51896	2BF	145	1.1	2.4	406	6.9	1	0
7	12	2870	51907	2BF	150	3.1	2.0	1019	1.0	1	0
7	13	2868	51932	2BF	139	3.1	1.2	1147	2.0	2	0
7	14	2864	51934	2BF	139	0.7	1.1	541	1.9	4	0
7	15	2875	51925	2BF	143	5.2	1.5	874	0.2	1	0
7	16	2892	51889	2CA	130	1.4	1.2	609	0.6	2	0
7	17	2888	51890	2CA	129	1.4	0.8	603	1.2	1	0
7	18	2885	51895	2CA	129	5.3	6.2	1199	0.8	3	0
7	19	2890	51895	2CA	134	0.8	0.0	426	0.3	0	0
7	**FC 20**	2899	51896	2CA	139	4.3	3.4	799	2.1	1	0
7	21	2888	51908	2CA	134	0.9	0.5	410	0.3	3	0
7	22	2889	51911	2CA	134	0.7	0.9	459	0.8	2	0
7	23	2890	51914	2CA	139	0.7	1.0	431	3.9	2	0
7	24	2884	51921	2CA	139	7.0	1.0	2171	2.5	4	0
7	25	2888	51924	2CA	139	0.7	1.3	421	2.3	3	0
7	26	2884	51928	2CA	139	1.9	1.6	648	1.9	2	0
7	27	2886	51932	2CA	139	0.5	1.6	379	4.1	1	0
7	28	2890	51938	2CA	142	3.4	1.0	1247	7.8	8	2
8	1	2858	52039	2BF	148	26.2	11.7	3505	5.0	4	0
8	2	2857	52044	2BF	148	13.9	1.8	2297	13.4	2	0
8	3	2848	52049	2BF	143	3.9	4.1	894	2.7	3	0
8	**FC 4**	2857	52050	2BF	148	8.3	4.9	1975	2.6	2	2
8	5	2850	52060	2BF	144	8.6	5.9	2293	7.8	6	1
8	6	2857	52073	2BF	139	3.1	1.3	1230	1.7	2	0
8	7	2867	52050	2BF	158	1.7	4.4	518	2.0	1	0
8	8	2872	52046	2BF	157	2.2	3.3	916	2.0	3	0
8	9	2868	52045	2BF	157	2.2	7.4	610	0.9	2	0
8	10	2863	52031	2BF	158	4.8	5.5	1264	1.7	3	0
8	11	2872	52046	2BF	157	2.0	0.0	684	4.1	3	0
8	12	2877	52049	2BF	158	0.5	0.0	676	4.4	7	0
8	13	2874	52053	2BF	158	0.4	4.4	262	1.8	1	0
8	14	2877	52054	2BF	158	3.7	4.3	1008	2.6	1	1
8	15	2881	52069	2BF	150	71.7	13.9	7766	9.9	7	1
8	16	2875	52073	2BF	152	0.6	2.8	362	3.3	1	0
8	17	2890	52063	2BF	158	8.1	7.2	1628	2.3	2	1
8	**FC 18**	2884	52044	2BF	154	11.4	5.5	1513	5.2	5	0
8	19	2889	52041	2BF	.	.	0.0	.	.	.	.
8	20	2897	52044	2BF	152	12.2	2.0	3652	14.2	3	0
8	21	2899	52057	2BF	158	15.7	12.9	2668	9.3	2	1
8	22	2905	52058	2BF	159	11.2	2.0	2297	1.8	2	1
8	23	2903	52062	2BF	159	8.1	3.0	1250	0.2	1	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
8	24	2895	52066	2BF	157	2.6	1.3	1429	4.8	4	1
8	25	2897	52078	2BF	153	4.8	5.0	1417	7.8	4	0
9	1	2988	52102	2BF	147	2.7	1.1	930	4.9	1	0
9	2	2988	52112	2BF	155	0.4	2.4	347	5.3	1	0
9	**FC 3**	2984	52114	2BF	154	8.5	1.5	2306	2.4	3	2
9	4	2976	52138	2BF	149	24.6	6.5	3889	1.2	2	0
9	5	2988	52141	2BF	150	8.4	4.8	1958	2.4	2	1
9	6	2996	52130	2BF	155	1.2	0.6	664	3.1	3	0
9	7	2997	52120	2BF	155	11.7	5.2	2142	2.3	1	1
9	8	2993	52106	2BF	147	16.7	6.4	3736	11.4	7	2
9	9	2997	52103	2BF	147	4.5	1.4	969	2.3	2	0
9	10	2998	52086	2BF	158	8.6	5.6	1971	0.5	3	0
9	**FC 11**	3003	52096	2BF	154	7.3	1.7	1726	0.9	2	0
9	12	3008	52098	2BF	154	1.9	1.4	594	5.3	4	0
9	13	3003	52105	2BF	148	16.3	1.2	5038	8.9	2	0
9	14	3007	52117	2BF	148	4.8	1.0	1939	4.9	3	0
9	15	3005	52125	2BF	152	3.2	3.7	774	3.6	2	0
9	**FC 16**	3013	52109	2BF	148	6.3	3.8	1754	2.0	1	0
9	17	3019	52106	2BF	149	0.4	0.8	286	1.6	4	0
9	18	3015	52104	2BF	148	4.4	1.3	1706	1.9	4	0
9	19	3018	52103	2BF	149	0.3	1.3	212	1.8	5	0
9	20	3030	52102	2BF	163	2.1	1.6	912	1.6	2	0
9	21	3023	52108	2BF	149	0.8	1.3	401	2.7	3	0
9	22	3035	52108	2CA	154	15.0	2.4	3438	2.1	2	2
9	23	3028	52111	2CA	154	1.1	0.9	627	1.4	1	0
9	24	3038	52120	2CB	154	10.3	16.5	2425	1.8	2	0
9	25	3022	52134	2CB	143	7.1	1.6	1665	5.9	3	0

LEGEND

VARIABLE EXPLANATIONS

UTM EAST = Universal Transverse Mercator Easting coordinate
UTM NORTH = Universal Transverse Mercator Northing coordinate
(UTM Zone = 16, Plots 1-6; UTM Zone = 17, Plots 7-9)
TERTIARY WATERSHED = tertiary watershed identifier code
ELEV = lake elevation above sea level
AREA = open water area of lake
DEPTH = mean mid-lake depth
SHORELINE = length of open water perimeter
RIPARIAN AREA = area of riparian zone adjacent to lake
TOTAL STREAMS = cumulative number of streams flowing into and draining lake
TOTAL ISLANDS = number of islands in lake

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
Lake Number ** = lake joined to lake above
. = no data

Table 14. Average chemical characteristics of Algoma study lakes, identified by plot and lake number. Chemical values are four year means (fall sampling: 1988, 1992, 1994, 1995). (See legend for explanation of variables and notations).

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
1-1	6.98	208.8	35.4	4.44	0.95	0.72	0.37	0.23	3.9	5.53	50	6.46	2.49	15.46	0.023	0.33	6.11	83.4	6.4	52.8
1-2	5.38	-11	26.6	1.47	0.44	0.53	0.1	0.27	3.14	4.48	60	9.75	0.47	12.52	0.009	0.44	13.13	240.6	26.2	92
1-3	4.88	-16.5	19.7	0.84	0.22	0.42	0.13	0.16	2.92	3.92	35	6.27	0.28	30.14	0.015	0.35	4.53	328.7	21	90.2
1-4	5.06	-14.8	19.1	0.88	0.21	0.38	0.11	0.17	2.45	4	30	4.83	0.2	72.84	0.031	0.39	5.05	274.2	22.9	39.8
1-5	4.51	-37.2	23.4	0.84	0.24	0.39	0.14	0.19	2.68	2.79	90	13.6	0.49	31.51	0.007	0.46	6.54	423.3	26.8	303
1-6	4.83	-23.8	21.3	0.9	0.23	0.4	0.12	0.27	2.21	3.88	50	7.42	0.22	79.7	0.032	0.39	4.79	308.7	23.7	87.9
1-7	5.09	-5.9	17	0.91	0.24	0.44	0.15	0.18	2.76	3.56	45	6.35	0.25	88.38	0.033	0.37	6.53	331.8	20.3	98.1
1-8	5.18	-4.8	18	0.98	0.27	0.44	0.15	0.19	2.86	4	30	5.14	0.2	26.05	0.028	0.28	5.71	249	32.8	74.3
1-9	5.2	-6.1	18.4	1.07	0.27	0.44	0.15	0.11	2.64	4.26	25	4.87	0.17	31.07	0.034	0.3	5.86	235	19.7	53.1
1-10	4.88	-19.9	22.9	0.9	0.22	0.57	0.1	0.19	3.38	5.02	20	5.11	0.24	23.26	0.014	0.27	5.06	263.8	20.9	36.7
1-11	5.18	-4.2	17.2	0.97	0.26	0.57	0.14	0.2	2.83	3.97	35	5.22	0.19	24.67	0.028	0.24	3.67	258.2	33.7	81
1-12	5.18	-3.2	14.5	0.79	0.21	0.38	0.15	0.16	1.1	3.1	25	5.08	0.26	46.41	0.019	0.3	6.14	183.6	17.6	89
1-13	5.3	5.5	15.2	0.95	0.23	0.48	0.15	0.2	2.29	3.21	35	5.81	0.42	42.75	0.01	0.4	9.85	234.3	35.2	81.3
1-14	4.88	-11.2	18.4	0.84	0.25	0.42	0.13	0.21	2.9	3.43	45	8.25	0.28	27.61	0.009	0.38	6.59	457.7	31.1	96.3
1-15	5.54	12.7	18	1.32	0.37	0.54	0.16	0.31	4.1	3.64	40	7.84	0.37	35.08	0.015	0.36	6.29	364.1	33.8	86.6
1-16	5.4	0.5	15.4	0.99	0.28	0.46	0.16	0.15	1.58	3.79	20	4.7	0.24	49.06	0.019	0.32	5.74	189.6	16.2	138
FC 1-17	4.91	-11.1	16.9	0.75	0.19	0.37	0.12	0.16	2.2	3.52	25	5.62	0.21	29.21	0.016	0.34	5.65	386.4	30	93
1-18	4.8	-16.2	18.1	0.77	0.2	0.34	0.12	0.19	2.78	3.14	45	7.04	0.28	18.45	0.009	0.35	4.95	404	26.2	81.7
1-19	5.11	-4.8	16.7	1	0.24	0.39	0.11	0.14	2.88	3.48	45	7.14	0.21	72.17	0.019	0.46	8.93	342.7	22.3	93.4
1-20	5.12	-8.2	18.6	0.95	0.25	0.54	0.15	0.23	2.8	4.12	30	5.01	0.18	29.41	0.048	0.27	3.66	256.8	34.7	73.7
1-21	5.22	-1.8	16.1	0.97	0.26	0.56	0.14	0.22	2.94	3.64	35	5.74	0.2	18.88	0.021	0.27	4.21	265.1	34.2	85.4
1-22	4.71	-6.1	35	0.9	0.25	0.44	0.11	0.39	3.79	5.37	55	9.3	0.18	19.67	0.012	0.39	6.45	388.4	26.8	178.1
FC 1-23	5.20	-0.3	22.9	1.01	0.27	0.57	0.15	0.24	3.12	4.51	40	6.52	0.18	19.08	0.017	0.32	5.23	305.3	26.8	115.2
1-24	5.29	0.6	14.9	0.79	0.22	0.37	0.14	0.17	2.37	3.37	20	5.13	0.1	35.6	0.024	0.24	3	184.2	26.8	67.8
1-25	4.57	-32.5	28.7	1.34	0.33	1.03	0.19	0.51	4.54	6.28	.	9.66	.	.	.	.	6.35	.	.	.
1-26**	4.99	-5.8	16.3	0.86	0.25	0.43	0.11	0.16	3.07	2.9	60	8,96	0.28	28.32	0.011	0.36	6.18	418.3	29.4	170.6
1-27	4.61	-37	28.3	0.91	0.25	0.54	0.12	0.23	2.84	4.55	60	10.53	0.25	20.11	0.008	0.45	6.13	462.2	31.1	163.1
1-28	4.67	-15.6	19.5	0.84	0.21	0.36	0.1	0.21	3.17	3.28	60	9.53	0.27	102.2	0.009	0.45	7.11	501.7	35.3	203.2

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SIO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
1-29	5.1	-7.7	17.8	0.96	0.25	0.42	0.17	0.16	1.62	3.97	25	4.98	0.19	21.55	0.018	0.32	4.43	145.2	24.7	105.7
1-30	4.52	-30.9	22.4	0.77	0.23	0.4	0.07	0.2	2.71	3.33	75	10.65	0.18	13.1	0.007	0.34	5.14	515.3	21.5	205.2
1-31	5.08	-5.6	17.5	0.98	0.28	0.46	0.15	0.17	2.56	3.94	40	6.29	0.23	35.6	0.018	0.33	5.18	305.9	33.5	138
1-32	4.61	-27.7	25.1	0.96	0.27	0.46	0.2	0.23	3.73	4.54	55	9.67	0.26	21.06	0.008	0.39	5.52	443.4	34.7	133.1
1-33	5.1	-10	19.2	0.94	0.25	0.52	0.16	0.22	2.19	4.73	10	4.48	0.19	49.5	0.019	0.21	4.27	115.2	31.3	17.4
1-34	4.95	-11.4	20.9	0.95	0.26	0.56	0.13	0.26	2.72	4.35	50	7.51	0.25	86.15	0.029	0.45	5.31	364.1	37.8	145.2
2- 1	6.66	155	32.4	4.78	0.6	0.55	0.17	0.2	2.71	4.1	55	9.54	1.99	96.48	0.045	0.62	11.04	80.7	7	82.7
2-2	6.76	161.8	33.4	4.93	0.41	0.44	0.21	0.14	1.72	4.96	20	6.85	1.97	57.5	0.053	0.46	7.28	47.6	4.4	21.2
2-3	6.78	192.9	36.6	5.56	0.41	0.39	0.21	0.16	1.36	5.19	25	5.15	2.4	72.1	0.056	0.47	8.44	18.5	3.5	19.3
2-4	7.06	376.4	54.5	9.56	0.46	0.53	0.2	0.25	4.1	5.18	50	6.91	4.37	34.79	0.077	0.37	5.86	42.9	7.1	26.4
<u>2-5</u>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2-6	7.16	421.2	57.9	10.4	0.49	0.49	0.2	0.17	1.44	5.43	35	5.31	5.18	34.73	0.035	0.38	6.95	25.8	4.5	52.7
FC 2-7	6.98	212.6	35.1	5.72	0.38	0.4	0.17	0.16	0.9	4.16	25	4.83	2.44	36.43	0.012	0.37	6.15	9.7	5.3	5
2-8	6.97	173.4	36	5.28	0.44	0.53	0.2	0.19	2.35	5.9	10	3.19	2.39	13.94	0.095	0.22	3.78	11.5	2	5
2-9	6.81	144.3	33.3	4.58	0.45	0.54	0.19	0.19	2.77	6.07	15	3.86	1.93	23.1	0.087	0.27	4.24	16.6	6.5	12
2-10	6.85	175.1	36.3	5.47	0.4	0.43	0.2	0.14	1.31	5.49	15	5.25	2.07	63.29	0.046	0.48	8.2	19.1	3.7	11.7
<u>2-11</u>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2-12	6.9	230.3	40.6	6.58	0.64	0.59	0.22	0.27	3.93	4.75	55	7.55	2.78	35.56	0.05	0.46	8.84	85.5	6.5	69.5
2-13	6.9	272.4	45.9	7.98	0.58	0.54	0.22	0.23	3.78	5.2	60	9.62	3.28	13.6	0.036	0.43	7.39	79	3.6	45.1
2-14	7.09	378.6	60.4	9.77	0.87	0.97	0.18	0.29	5.99	7.52	40	5.16	4.89	60.52	0.12	0.38	3.74	38.4	3.3	24.4
2-15	6.7	103.8	27	3.52	0.42	0.52	0.19	0.19	2.73	4.93	25	4.54	1.27	49.78	0.041	0.33	5.33	43.3	5.9	13.6
FC 2-16	6.31	32.7	19.6	1.95	0.36	0.45	0.18	0.14	1.3	4.49	15	3.66	0.7	33.66	0.034	0.29	4.01	37.3	7.9	29.1
2-17	5.84	33.5	24.7	2.64	0.39	0.47	0.33	0.37	4.66	5.39	50	5.53	1	17.9	0.089	0.28	5.27	149.7	8.2	60.2
2-18	6.84	222.9	37.5	5.68	0.53	0.46	0.21	0.15	1.11	4.73	25	4.55	3.1	29.5	0.029	0.4	6.58	18.2	5.8	60.5
2-19	6.89	217.9	39.7	5.89	0.63	0.59	0.24	0.22	3.04	5.71	20	5.47	2.58	11.58	0.017	0.5	7.31	45.5	2	30.3
2-20	5.87	25.5	22.3	2.54	0.33	0.39	0.16	0.21	2.62	5.12	40	6.09	0.76	20.27	0.042	0.32	4.93	128.6	4.4	30.3
3-1	5.7	12.9	18.1	1.53	0.38	0.57	0.2	0.24	2.2	3.82	55	8.13	0.43	45.12	0.012	0.46	5.37	198.8	27.4	178.5
3-2	5.2	1.3	20.3	1.58	0.38	0.64	0.17	0.3	4.29	3.94	70	10.77	0.48	29.34	0.014	0.49	8.9	298.5	22.1	193
3-3	5.35	7.6	21.4	1.73	0.41	0.65	0.17	0.27	3.73	4.87	70	9.39	0.37	16.23	0.012	0.38	4.98	344.4	26.7	104.9
3-4	5.61	5.3	20.9	1.62	0.36	0.6	0.2	0.25	1.73	5.27	25	5.56	0.5	25.35	0.036	0.33	3.98	98	17.8	40.4
3-5	6.01	23	21.8	1.79	0.4	0.57	0.16	0.34	4.17	5.1	50	6.93	0.53	10.56	0.007	0.34	5.5	230.3	18.3	63.4

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
3-6	6.11	35.4	15.8	1.57	0.31	0.54	0.16	0.2	2.07	4.17	45	6.17	0.69	35.85	0.009	0.47	5.03	111.9	14.2	196.9
3-7	6.02	14.1	18	1.6	0.35	0.53	0.15	0.19	1.33	4.83	45	6.25	0.4	102.5	0.058	0.57	9.08	110.6	10.4	48.6
3-8	4.3	-59	41.6	1.64	0.36	0.75	0.17	0.35	5.92	8.44	.	11	.	.	.	.	5.67	.	.	.
3-9	4.91	-7.8	19.7	1.16	0.29	0.49	0.1	0.23	2.78	3.43	70	11.34	0.36	79.46	0.012	0.36	8.18	317	41.4	190.9
3-10	4.98	-5.3	20.5	1.27	0.34	0.57	0.2	0.29	3.59	3.74	70	11.09	0.4	56.42	0.007	0.53	8.68	280.7	31.3	228.4
3-11	5.17	-0.6	18.3	1.14	0.31	0.53	0.12	0.21	2.53	4.3	50	6.13	0.41	27.09	0.014	0.34	5.05	214.8	26	83.5
FC 3-12	5.21	0.2	17.2	1.04	0.28	0.47	0.19	0.19	1.07	4	45	6.1	0.33	79.42	0.021	0.48	6.39	171.7	23.3	101.9
3-13	5.18	-3.5	19	1.16	0.35	0.48	0.18	0.19	1.28	4.26	45	6.64	0.25	9.94	0.007	0.33	5.71	91.5	16.5	59
3-14	4.82	-11	23	1.72	0.45	0.62	0.23	0.28	3.56	3.63	90	9.76	0.49	56.66	0.014	0.5	8.28	175.2	15.5	189.1
3-15	6.26	47	21.9	2.06	0.47	0.65	0.31	0.22	2.84	4.58	45	6	1.49	38.14	0.025	0.39	5.5	105	6.7	93.6
3-16	5.12	0.2	17.8	1.17	0.33	0.56	0.14	0.16	3.38	3.55	60	8.24	0.42	21.67	0.01	0.37	6.35	328.8	38.6	159.4
3-17	4.97	-3.1	20.4	1.36	0.36	0.59	0.16	0.24	4.63	3.36	90	12.12	0.59	35.94	0.007	0.53	9.38	359	35.4	201
3-18	5.47	6.9	21.7	1.71	0.36	0.55	0.19	0.22	3.43	4.95	30	6.09	0.56	48.34	0.029	0.39	5.57	236.3	21	46
3-19	5.68	9.1	19.5	1.65	0.34	0.49	0.2	0.19	1.87	4.5	30	6.43	0.45	48.09	0.023	0.42	5.22	143.9	5.3	27.5
3-20	6.62	92.3	24.8	2.92	0.49	0.54	0.25	0.22	2.92	3.9	45	6.1	1.22	21.95	0.016	0.36	6.71	84.5	26.4	157.5
3-21	6.47	85.8	26	3.23	0.59	0.55	0.15	0.23	2.67	4.1	70	9.37	1.39	13.77	0.009	0.44	7.08	133.3	8.6	196.7
3-22	6.21	43.4	23.6	2.91	0.44	0.47	0.14	0.21	2.45	4.24	75	10.43	0.94	39.23	0.009	0.48	6.92	156.4	15	164.2
3-23	5.35	1.3	21.6	1.82	0.36	0.58	0.13	0.24	4.28	4.81	50	7.74	0.44	34.99	0.013	0.37	5.56	268.4	29.5	94.1
3-24	5.4	15.5	18.9	1.58	0.41	0.6	0.35	0.22	3.89	2.45	90	13.84	0.71	21.31	0.005	0.59	8.04	231.9	32.8	203.4
3-25	5.85	15	19.3	1.77	0.4	0.69	0.17	0.27	4.01	3.9	55	7.09	0.44	13.47	0.015	0.36	5.23	241.9	21.2	107.7
3-26	6.24	47.4	21.2	1.96	0.45	0.72	0.21	0.2	2.18	3.96	35	5.43	0.85	63.73	0.033	0.49	10.81	102	17.4	84.8
3-27	5.91	19	21.8	1.94	0.43	0.88	0.17	0.35	5.23	5.24	50	6.55	0.46	26.87	0.019	0.36	5.85	236.7	9.3	39.4
3-28	6.39	52.1	22.3	2.04	0.5	0.75	0.22	0.24	1.23	5.19	20	3.96	0.96	28.78	0.019	0.35	4.69	37.1	5.3	13.9
3-29	5.9	23.7	22.6	1.99	0.47	0.8	0.16	0.35	5.71	5.63	45	6.18	0.61	16.61	0.033	0.32	5.02	247.2	9.3	49
3-30	6.14	31.1	19.9	1.7	0.4	0.7	0.17	0.31	2.71	4.34	35	5.05	0.74	46.26	0.033	0.35	7.06	121.4	25.6	130.1
3-31	6.22	32.5	19.6	1.73	0.41	0.73	0.17	0.27	2.52	4.25	30	4.55	0.58	21.98	0.044	0.34	5.25	103.3	9.3	103.9
3-32	5.69	17.3	18.8	1.42	0.33	0.64	0.22	0.23	1.7	3.75	55	6.59	0.73	135.8	0.015	0.56	9	163.8	16.2	175.9
FC 3-33	6.05	26.3	19.7	1.48	0.39	0.55	0.19	0.23	0.82	4.47	25	5.23	0.53	38.04	0.018	0.41	6.56	78.7	7.7	66.1
3-34	6.3	40.4	20.7	2.17	0.34	0.53	0.13	0.26	4.71	4.19	30	5.09	0.91	11.13	0.009	0.3	3.69	151.3	4.2	12.2
3-35	6.52	63.1	24.1	2.38	0.52	0.69	0.19	0.26	2.35	5.05	20	3.83	0.98	51.42	0.038	0.32	3.44	47.6	4.7	28
4-1	5.9	19.6	18.5	1.59	0.32	0.57	0.19	0.29	3.5	4.51	20	4.69	0.45	18.64	0.012	0.28	3.81	119.9	6.6	33.9

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR^1 (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al^1 (µeq/L)	Mn^1 (µeq/L)	Fe^1 (µeq/L)
4-2	5.29	5.1	20.5	1.5	0.34	0.59	0.17	0.18	2.8	4.49	50	6.79	0.37	26.6	0.021	0.32	5.58	220.4	24.8	165.1
4-3	5.68	22.5	20.3	1.77	0.37	0.63	0.28	0.46	5.22	4.43	25	5.26	0.6	10.99	0.015	0.25	4.66	152	13.7	49
4-4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-6	4.95	-4.7	18.9	1.17	0.28	0.5	0.24	0.31	3.87	3.68	55	8.09	0.47	34.33	0.007	0.39	8.24	250.9	38.4	247
4-7	5.48	5.6	17.2	1.45	0.3	0.53	0.14	0.21	3.5	4	40	6.17	0.36	20.77	0.016	0.37	10.73	193.9	48.5	115.5
4-8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-10	6.04	21.4	19	1.81	0.34	0.54	0.16	0.18	2.97	4.77	15	3.59	0.49	36.84	0.038	0.24	3.97	111.3	6.3	15.7
4-11	5.36	3.5	16.9	1.32	0.27	0.45	0.1	0.22	3.86	4.3	20	4.25	0.32	6.88	0.008	0.22	2.72	230	25.3	22.2
FC 4-12	5.23	-4.7	20.4	1.35	0.27	0.42	0.17	0.18	2.25	4.74	30	5.46	0.31	70.95	0.032	0.38	7.76	230.1	26.9	73.4
4-13	5.65	12	16.8	1.17	0.27	0.42	0.34	0.13	1.29	2.5	20	5.79	0.47	80.77	0.041	0.51	9.13	70.1	11	45.7
4-14	5.24	-2.7	16.6	1.05	0.29	0.39	0.14	0.13	0.85	4.09	25	5.22	0.22	23	0.019	0.3	6.14	148.8	20.9	59.1
4-15	5.41	4.2	14.6	0.86	0.24	0.37	0.1	0.09	1.08	3.22	60	5.58	0.32	172.1	0.019	0.58	11.02	245.8	15.4	169.5
4-16	5.44	7.7	15	1.03	0.28	0.41	0.23	0.17	1.44	3.1	35	5.63	0.53	51.92	0.016	0.47	10.51	166.1	22.8	134.2
4-17	5.21	-2.7	16.6	0.88	0.24	0.43	0.17	0.13	0.95	3.76	25	4.48	0.33	96.45	0.029	0.45	7.62	90.5	19.2	63.7
4-18	5.3	1.8	16.7	1.15	0.28	0.41	0.17	0.16	0.91	4.03	20	4.54	0.21	56.29	0.021	0.29	5.18	99.7	17.6	59.3
4-19	5.3	3	17.6	1.24	0.31	0.52	0.22	0.23	2.3	4.02	25	6.68	0.41	68.21	0.019	0.38	6.67	186.1	28.6	105.2
4-20	5.61	10.2	17.1	1.3	0.35	0.53	0.23	0.2	1.66	4.51	15	4.08	0.32	20.27	0.02	0.25	5.04	103.4	13.8	38.4
4-21	5.86	15.6	18.9	1.66	0.35	0.55	0.18	0.15	1.26	4.81	15	4.47	0.39	26.61	0.03	0.34	6.25	75.1	3.5	15.7
4-22	6.55	66.7	23.8	2.75	0.44	0.55	0.21	0.21	1.87	4.43	15	5.07	1.05	15.67	0.017	0.36	7.09	63.3	4.9	21.1
4-23	6.68	83.2	24.8	3.1	0.47	0.57	0.22	0.17	2.52	4.59	20	4.26	1.2	12.52	0.013	0.23	4.37	47.4	5.4	14.2
4-24	6.23	37.1	20.1	1.94	0.38	0.51	0.19	0.16	1.18	4.87	10	3.62	0.67	43.01	0.02	0.33	6.02	35.6	5.5	27.4
4-25	5.19	-8	18.9	1.06	0.32	0.39	0.17	0.14	0.88	4.16	25	5.38	0.27	18.77	0.017	0.36	7.57	105.6	14.7	40.9
4-26	5.72	11.1	19.7	1.81	0.39	0.54	0.2	0.26	1.87	4.56	60	6.45	0.39	28.18	0.019	0.37	5.41	186	17.4	150.2
4-27	5.32	-0.3	17.1	1.22	0.29	0.43	0.19	0.18	1.02	4.14	25	4.55	0.29	13.81	0.02	0.26	4.38	113.3	17.7	65.1
4-28	6.17	25.6	19.8	1.7	0.44	0.62	0.2	0.17	2.45	4.86	20	3.99	0.58	17.08	0.021	0.25	4.55	86.4	8.9	95.2
FC 4-29	5.15	-3.6	18	1.09	0.27	0.48	0.1	0.1	1.34	4.61	20	4.12	0.22	114.6	0.06	0.4	5.19	142.1	22.1	19.6
4-30	5.94	21.5	17	1.2	0.27	0.43	0.32	0.16	1.5	3.72	35	5.71	0.56	140.5	0.023	0.59	10.08	127.3	12.1	98.9
4-31	5.67	9.9	16.5	1.38	0.35	0.52	0.21	0.14	1.85	3.44	50	8.01	0.42	32.59	0.021	0.48	7.87	133.5	15.8	92.6
4-32	5.86	11.4	17.9	1.61	0.37	0.57	0.25	0.19	3.71	3.92	40	6.45	0.52	10.93	0.028	0.34	7.53	160.2	24.9	131.7

PLOT-LAKE	pH	ALK (μeq/L)	COND (μS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO$_3$ (mg/L)	SO$_4$ (mg/L)	COLOR^1 (hu)	DOC (mg/L)	TIC (mg/L)	NH$_3$ (μeq/L)	NO$_2$NO$_3$ (mg/L)	TKN (mg/L)	TP (μeq/L)	Al^1 (μeq/L)	Mn^1 (μeq/L)	Fe^1 (μeq/L)
4-33	5.94	21.3	17.9	1.65	0.33	0.44	0.18	0.17	0.8	4.45	15	4.09	0.45	18.49	0.014	0.29	5.99	63.4	8.5	26.6
4-34	5.2	1.6	20.1	1.68	0.31	0.46	0.15	0.4	4.88	4.61	25	5.28	0.54	7.86	0.015	0.24	3.46	216.1	15.3	43.9
4-35	6.6	101.5	26.7	3.36	0.46	0.54	0.18	0.19	1.42	4.81	20	5.35	1.08	33.08	0.017	0.35	6.05	55.9	5.4	24.7
4-36	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-37	6.65	105.4	26.9	3.57	0.47	0.53	0.2	0.2	1.74	4.41	30	5.42	1.41	25.8	0.026	0.35	5.94	67.7	7.4	43.1
5-1	5.85	19.4	18.7	1.74	0.36	0.75	0.22	0.26	1.71	3.8	.	7.65	0.59	81.64	0.063	0.42	7.44	113.2	13.9	78.6
5-2**	5.98	13.7	16.1	1.43	0.33	0.47	0.22	0.23	1.12	3.03	.	7.23	0.31	14.37	0.013	0.41	7.85	109.1	12.4	48.9
5-3	5.92	20.2	18.1	1.41	0.3	0.54	0.2	0.33	1.65	3.91	.	6.27	0.51	33.4	0.028	0.37	7.19	105.9	10	43.4
5-4	5.71	16.3	19.7	1.78	0.36	0.65	0.19	0.13	2.41	4.27	40	7.79	0.62	25.81	0.019	0.4	7.49	153.5	14.7	67.9
5-5	6.11	37.7	22.2	1.98	0.4	0.58	0.27	0.31	1.92	4.92	25	4.61	0.71	15.99	0.046	0.23	4.32	54.3	12.4	48.4
5-6	6.35	44.1	21.4	2.02	0.41	0.57	0.27	0.3	1.9	4.47	30	4.67	0.74	18.62	0.042	0.26	7.35	51.2	20.9	51.1
5-7	6.38	44.3	20.5	1.89	0.4	0.57	0.18	0.28	2.22	4.28	25	4.7	0.71	30.44	0.022	0.3	5.03	46	15.7	74.5
5-8	6.33	23.4	20.7	1.96	0.41	0.54	0.16	0.31	1.97	4.26	30	5.97	0.79	24.51	0.012	0.35	4.99	85.5	16.2	82
5-9	6.37	69.7	22.9	2.33	0.47	0.62	0.17	0.32	2.37	4.19	30	5.94	1.12	9.86	0.03	0.33	7.13	84.2	13.6	83.5
5-10	5.42	1.9	18.7	1.18	0.36	0.46	0.2	0.14	1.66	3.42	40	7.33	0.36	34.39	0.015	0.4	5.74	152.9	16.9	98.4
5-11	5.75	15.8	19.3	1.53	0.37	0.57	0.22	0.23	1.47	4.58	60	7.4	0.31	33.85	0.008	0.34	4.99	173	20.2	213.7
5-12	6.35	45.7	21.7	2.02	0.41	0.59	0.27	0.31	2.24	4.55	20	4.42	0.75	27.31	0.047	0.25	4.65	52.5	13.1	57.2
5-13	5.45	5.4	17.6	1.26	0.32	0.63	0.25	0.32	1.57	4.3	45	6.53	0.36	54.22	0.021	0.38	9.4	135.1	20.5	105
5-14	5.98	23.2	18.6	1.57	0.34	0.65	0.25	0.31	1.26	4.63	15	4.18	0.59	46.35	0.049	0.27	4.32	83.2	11.6	54.4
5-15	6.42	44.8	21.4	2.1	0.42	0.79	0.26	0.2	2.23	3.88	25	4.35	0.69	24.64	0.035	0.29	3.98	54.9	9	50.4
5-16	6.53	62.6	24.3	2.51	0.52	0.86	0.29	0.3	3.71	4.74	20	4.79	0.9	12.01	0.091	0.22	3.19	60.6	4.7	32
5-17	6.44	55.1	24.4	2.53	0.52	0.85	0.28	0.31	3.61	5.22	20	4.64	0.96	10.87	0.217	0.18	3.85	61.7	7	39.7
5-18	6.47	56.5	23.6	2.37	0.5	0.85	0.29	0.32	3.44	4.76	25	4.27	0.83	30.83	0.217	0.23	4.09	64.2	10.9	49.6
FC 5-19	6.16	26.2	20	2.01	0.39	0.64	0.21	0.23	1.64	4.39	30	6.23	0.59	41.11	0.064	0.35	4.34	117.7	5.2	55.9
5-20	6.37	61.4	24.1	2.37	0.56	1.01	0.22	0.26	3.64	4.93	25	6.13	0.98	26.21	0.028	0.4	5.95	84.8	6.1	35.7
5-21	6.12	37.4	22.9	2.06	0.46	0.7	0.21	0.52	3.53	5.23	45	7.28	0.72	52.62	0.022	0.39	5.86	162.7	16.4	154.7
5-22	6.42	53.5	24.2	2.47	0.51	0.86	0.29	0.35	3.52	5.21	25	4.27	0.86	12.25	0.074	0.23	4.28	65.5	6.6	48.5
5-23	5.2	-0.5	16.5	1.04	0.27	0.55	0.12	0.25	1.7	3.85	30	6.68	0.38	41	0.007	0.36	6.65	179.3	20.2	80.3
FC 5-24	5.27	3.7	20	1.64	0.36	0.66	0.14	0.24	3.05	4.32	70	10.21	0.33	13.01	0.012	0.41	6.68	283.6	20.5	135.2
5-25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

PLOT-LAKE	pH	ALK (μeq/L)	COND (μS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (μeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (μeq/L)	Al[1] (μeq/L)	Mn[1] (μeq/L)	Fe[1] (μeq/L)
6-2	6.17	22.1	19.5	2.05	0.44	0.53	0.28	0.32	1.81	5.42	35	5.64	0.42	34.97	0.039	0.28	4.87	98	18.7	68.2
6-3	5.87	6.2	16.8	1.5	0.41	0.47	0.23	0.2	0.68	4.62	35	5.11	0.26	34.28	0.022	0.3	5.36	131.2	8.9	126.2
6-4	5.86	11.1	18.7	1.62	0.42	0.48	0.24	0.19	0.68	4.7	25	4.57	0.36	21.95	0.025	0.27	3.76	74.8	2	50
FC 6-5	6.03	15.3	19.7	1.74	0.4	0.43	0.24	0.21	1	4.93	25	5.13	0.53	24.22	0.023	0.32	5.12	111.3	4	44.4
6-6	4.97	-15.3	22.5	1.31	0.35	0.38	0.21	0.15	1.06	4.49	55	8.29	0.31	26.18	0.017	0.41	7.89	155.5	26.5	135.4
6-7	6.19	34.9	20.9	2.1	0.48	0.5	0.27	0.34	1.42	4.56	30	5.8	0.72	14.77	0.016	0.38	6.01	86.6	17.6	107.8
6-8	6.09	26.1	20.8	2.13	0.49	0.51	0.28	0.29	1.53	4.28	30	6.38	0.53	11.4	0.01	0.36	6.01	78.7	16.5	123.3
6-9	5.14	-6.8	27.4	1.86	0.47	0.54	0.26	0.41	2.35	5.66	90	10.85	0.33	35.74	0.008	0.44	7.68	511.1	44.6	451.8
6-10	4.98	-8.2	25.6	1.81	0.48	0.49	0.22	0.2	2.38	4.52	110	14.79	0.31	84.17	0.017	0.66	11.32	332.6	38.7	312.9
6-11	5.78	7.2	15.6	1.2	0.37	0.44	0.28	0.17	0.61	3.6	25	4.93	0.34	30.39	0.015	0.33	5.34	65.5	8	98.1
6-12	5.8	13.3	18.8	1.64	0.49	0.49	0.29	0.18	0.96	4.2	50	7.07	0.47	26.55	0.013	0.33	4.72	142.9	6.2	81.4
6-13	5.91	14.4	20.6	2.03	0.44	0.54	0.29	0.26	2.21	4.55	50	6.53	0.46	25.26	0.055	0.33	6.25	146.4	26.5	165.8
6-14	5.9	18.3	21.1	2.05	0.44	0.53	0.3	0.26	1.93	4.88	40	6.24	0.43	54.87	0.061	0.32	4.75	134.7	26.2	95.1
6-15	6.16	32.2	19.7	2.14	0.42	0.55	0.27	0.46	2.02	4.76	35	6.09	0.68	9.35	0.011	0.28	4.83	110.6	11.3	114.9
6-16	5.51	8.2	19.2	1.62	0.42	0.54	0.29	0.26	1.46	4.04	40	6.68	0.28	12.36	0.005	0.38	6.35	122	12.5	149.6
6-17	6.23	32.5	21.4	2.03	0.45	0.47	0.25	0.29	1.36	4.85	25	5.47	0.59	21.93	0.02	0.28	5.12	51.3	11	74.5
6-18	6.01	19.2	16.1	1.48	0.38	0.43	0.25	0.24	0.93	4.69	15	6.26	0.33	19.95	0.016	0.39	7.78	38.1	20.8	66.2
6-19	5.92	11	16	1.36	0.33	0.35	0.21	0.24	0.35	3.8	20	4.02	0.35	32.36	0.018	0.25	4.25	40	21.8	113.7
6-20	5.84	28.9	17	1.54	0.36	0.43	0.27	0.16	1.82	2.95	50	7.62	0.8	77.5	0.014	0.5	7.32	96.7	25.3	168.3
6-21	6.24	30.3	19.5	1.91	0.41	0.5	0.24	0.21	1.66	4.59	15	4.19	0.47	28.32	0.022	0.3	4	52.2	20.8	86.6
6-22	6.44	45.5	21.8	2.27	0.52	0.49	0.28	0.24	1.59	4.4	30	5.03	0.62	31.97	0.043	0.33	4.64	72.6	16.4	57.2
FC 6-23	5.68	15.9	16.6	1.66	0.43	0.46	0.18	0.16	0.6	4.91	45	8.48	0.38	11.38	0.005	0.41	7.25	156.9	2	58.8
6-24	5.64	8.5	19.6	1.8	0.39	0.46	0.17	0.17	0.99	5.14	30	5.5	0.33	14.61	0.016	0.28	5.17	181.4	19.7	76
6-25	6.12	15.6	18.5	1.73	0.4	0.47	0.24	0.31	0.34	4.7	10	3.13	0.37	39.82	0.011	0.21	3.18	22.9	2	8.9
6-26	6.3	85.6	26.9	3.16	0.54	0.69	0.24	0.68	3.3	4.21	50	6.48	1.28	54.93	0.026	0.42	6.11	131.7	22.5	223.6
6-27**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7-1	5.5	13.6	19.8	1.92	0.41	0.58	0.22	0.18	3.05	4.29	55	10.7	0.35	52.13	0.012	0.49	8.34	275.3	18.6	121.5
FC 7-2	5.9	25.7	22.7	2.39	0.61	0.66	0.26	0.15	2.37	3.49	90	12.54	0.64	17.2	0.009	0.4	10.03	176.5	21.8	196.1
7-3	6.64	111.5	31.8	3.79	0.94	0.81	0.2	0.22	4.51	5.31	65	9.19	1.54	38.71	0.021	0.4	7.34	153.2	18.7	203.3
7-4	6.78	126.8	34.2	4	1	0.75	0.17	0.22	1.29	6.4	55	8.2	1.64	35.53	0.019	0.44	7.67	109.2	4.7	115.1
7-5	6.28	64.5	27.6	3.42	0.84	0.79	0.26	0.33	5.21	4.15	110	15.92	0.77	33.4	0.008	0.6	10.77	177.9	26.4	358.4

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
7-6	6.37	90.3	29.8	3.48	0.86	0.78	0.2	0.27	5.59	5.19	70	10.32	1.43	68.04	0.022	0.75	8.94	174.2	29.2	260.5
7-7	6.37	73.3	26.7	3.18	0.73	0.7	0.24	0.25	2.9	4.41	90	11.48	1.02	48.76	0.016	0.64	8.95	153.4	22.2	330.2
7-8	5.24	14.2	28.7	3.06	0.57	0.65	0.21	0.29	6.2	5.05	125	18.7	1.08	148.4	0.009	0.7	11.89	368.1	42.4	778
FC 7-9	5.48	17	24.6	2.64	0.57	0.56	0.19	0.24	2.04	4.43	90	15.91	0.38	99.81	0.027	0.63	8.25	198.7	19.1	412.2
7-10**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7-11	5.87	27.4	21.8	2.9	0.5	0.59	0.16	0.18	3	2.4	135	19.53	0.47	57.85	0.01	0.59	8.25	186.1	22.2	339.7
7-12	6.43	70.3	27.5	2.96	0.67	0.71	0.3	0.18	1.63	5.6	40	8.44	1.19	38.21	0.021	0.39	6.34	75.6	4.3	36.4
7-13	6.94	195	37	4.33	1.35	1.06	0.22	0.2	4.24	4.91	60	9.33	2.11	19.99	0.01	0.36	5.99	66.8	8.6	113.4
7-14	6.62	157.5	32.4	3.68	1.12	1.03	0.28	0.28	4.71	3.91	60	10.04	1.94	13.16	0.007	0.38	6.17	58	4.8	175.9
7-15	6.74	145.2	36.7	4.53	1.42	0.72	0.28	0.25	3.67	5.23	55	14.71	1.53	93.15	0.04	0.54	9.08	114.4	11.2	479
7-16	6.77	172.6	38.7	4.67	1.04	1.1	0.31	0.32	5.16	6.15	55	8.91	2.12	57.48	0.024	0.4	8.54	118.2	6	112.1
7-17	6.74	150.9	36.6	4.55	0.99	0.93	0.32	0.42	6.03	5.78	60	9.28	1.97	19.04	0.037	0.38	7.16	110	13.8	215.8
7-18	6.65	145.7	36.3	4.52	0.98	0.91	0.3	0.39	4.93	5.63	70	10.05	1.83	39.64	0.039	0.43	7.27	116	18	297.5
7-19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FC7-20	7.02	213.7	40.2	4.84	1.23	0.92	0.36	0.2	2.01	5.58	40	6.84	2.51	16.73	0.008	0.4	8.37	43	8.2	87.1
7-21	6.21	52.4	31	3.7	0.79	0.82	0.22	0.36	6.65	6.68	75	11.9	0.84	13.3	0.028	0.35	6	229.8	7	106.3
7-22	6.57	110.2	35.2	4.24	0.92	0.86	0.27	0.31	6.16	6.43	55	9.22	1.76	29.34	0.057	0.3	5.25	153.7	5	84.3
7-23	6.72	144.1	35.2	4.33	1.03	0.76	0.28	0.24	4.56	5.79	60	8.92	1.88	34.31	0.041	0.38	6.05	155.9	8.2	145.8
7-24	6.93	214.6	40.7	4.93	1.4	0.87	0.29	0.22	5.17	5.3	65	9.02	2.4	22.86	0.029	0.37	6.71	72.2	12	234.1
7-25	6.74	138.3	33.9	4.02	1.01	0.72	0.29	0.21	3.57	5.83	40	7.28	1.88	97.32	0.038	0.47	5.72	106.7	10.5	68.2
7-26	6.69	113.7	27.2	2.86	0.82	0.67	0.3	0.15	1.8	4.1	35	5.9	1.7	43.24	0.017	0.37	6.54	38.7	6.3	67.3
7-27	6.43	114.2	23.7	2.62	0.72	0.64	0.31	0.13	2.96	2.5	50	8.48	1.84	36.05	0.018	0.42	6.6	37.8	7.1	94.6
7-28	6.82	196.6	39.9	5.03	1.38	1.1	0.27	0.23	6.38	5.24	90	12.8	2.23	33.61	0.03	0.51	7.04	93.1	5.1	123
8-1	6.48	66	26.2	2.85	0.61	0.66	0.3	0.22	1.34	5.3	35	6.5	1.03	17.17	0.018	0.37	4.61	52.9	5.3	40.7
8-2	6.38	52	25	2.76	0.62	0.63	0.31	0.18	0.8	4.91	45	9.48	0.82	13.62	0.01	0.47	5.55	70.1	2.3	48.8
8-3	6.31	40.3	24.3	2.28	0.62	0.77	0.31	0.22	1.67	5.57	30	6.8	0.67	35.47	0.017	0.41	5.83	103.2	4.5	56.1
FC 8-4	6.02	30	24.3	2.8	0.62	0.65	0.25	0.19	2.59	4.81	70	11.69	0.53	14.54	0.008	0.46	7.49	141.4	5	136.5
8-5	5.74	27.4	24.1	2.5	0.63	0.69	0.28	0.23	3.99	4.65	90	13.7	0.99	39.64	0.008	0.5	7.25	248.1	17.1	212.6
8-6	5.62	30.9	26.2	2.82	0.66	0.76	0.28	0.4	6.73	4.49	80	14.99	0.94	12.87	0.006	0.4	5.88	323.6	19.1	148.9
8-7	6.28	41.9	25	2.76	0.59	0.72	0.26	0.2	2.38	5.22	40	9.69	0.73	20.74	0.007	0.47	7.98	107.9	7.5	66.3
8-8	5.48	18.6	23.2	2.42	0.5	0.64	0.25	0.25	2.51	4.5	90	13.81	0.4	22.39	0.013	0.51	8.92	248.7	18.7	158.4

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
8-9	5.83	25.1	22.9	2.43	0.52	0.63	0.3	0.21	2.37	4.51	65	11.21	0.68	72.93	0.015	0.51	7.4	200.1	17.7	185.8
8-10	6.88	164.5	36.9	4.52	0.96	0.88	0.24	0.19	2.8	6.04	35	6.65	2.01	19.31	0.014	0.35	4.51	56.3	4.8	426.8
8-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8-13	5.85	26.1	25.3	2.87	0.53	0.68	0.31	0.29	3.22	5.71	50	10.74	0.51	52.27	0.027	0.46	6.82	148.9	5.1	51.5
8-14	5.44	11.1	26.1	2.66	0.49	0.65	0.18	0.25	4.2	5.75	60	12.04	0.5	38.58	0.016	0.42	6.02	231.3	17.3	120.9
8-15	6.49	78	25.4	2.71	0.55	0.64	0.32	0.21	1.19	5.37	25	5.49	0.79	16.05	0.016	0.27	4.58	28.3	18.2	39
8-16	4.97	9.7	26.2	2.64	0.57	0.53	0.18	0.19	5.21	3.67	170	21.28	0.41	58.51	0.009	0.58	9.03	223.1	20.2	372.4
8-17	6.64	92.4	31.1	3.54	0.82	0.88	0.36	0.18	2.49	4.9	40	8.43	1.71	33.6	0.016	0.46	7.87	62.2	17.1	51.4
FC 8-18	6.15	24.4	21.4	2.31	0.45	0.6	0.26	0.18	1.09	4.48	45	8.71	0.44	31.72	0.01	0.9	6.12	80.3	7	113.9
8-19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8-20	6.51	52.6	28.5	3.43	0.64	0.68	0.22	0.25	3	5.74	55	8.08	1.12	49.18	0.017	0.4	6.65	105	6.6	67.9
8-21	6.21	40.1	20.5	2.21	0.4	0.51	0.2	0.23	0.79	4.82	25	4.92	0.64	14.03	0.007	0.27	4.18	30.9	19.9	63.1
8-22	5.72	17.1	16.8	1.68	0.34	0.46	0.2	0.18	0.67	5.43	25	5.37	0.28	14.06	0.009	0.33	4.79	66.8	8.8	24.8
8-23	6.15	28.2	24.1	2.23	0.4	0.51	0.25	0.25	0.77	6.14	20	3.84	0.67	337	0.027	0.6	4.52	14.6	7.5	12.8
8-24	5.57	13.8	22.4	2.32	0.47	0.66	0.19	0.2	4.36	5.01	60	11.92	0.4	56.3	0.015	0.47	7.21	240.1	20.2	121
8-25	6.36	48.7	24	2.61	0.56	0.61	0.21	0.2	2.61	4.75	30	6.61	0.81	44.98	0.019	0.38	6.81	69.7	13.3	129.5
9-1	5.51	15.1	18.5	1.7	0.46	0.5	0.22	0.16	2.09	3.16	70	13.41	0.24	16.9	0.007	0.65	10.23	173	15.3	97
9-2	6.22	62.6	20.8	2.18	0.6	0.57	0.3	0.14	2.21	1.79	75	10.06	1.36	122.3	0.012	0.57	8.38	42.1	11.5	190.2
FC 9-3	6.05	30.7	22.9	2.35	0.64	0.62	0.23	0.19	1.42	4.78	60	10.02	0.39	45.7	0.012	0.52	8.73	121.4	7.5	75
9-4	6.45	58.7	24	2.54	0.65	0.61	0.28	0.21	2.63	4.63	45	7.52	0.7	23.4	0.01	0.36	6.24	52.5	9.2	97.8
9-5	6.44	62.8	27.7	3.17	0.74	0.71	0.26	0.27	4.35	5.33	55	9.3	0.86	58.74	0.038	0.46	7.63	123.1	6.2	98.8
9-6	6.47	113.5	33.5	4	0.87	0.81	0.21	0.31	6.76	6.48	55	7.93	1.47	26.67	0.045	0.31	4.69	152.5	3.4	70.5
9-7	6.76	96.1	30.1	3.55	0.79	0.7	0.26	0.26	1.87	5.86	35	6.81	1.2	33.95	0.011	0.37	5.72	40.1	7.5	53.6
9-8	6.66	82.3	29.3	3.32	0.84	0.72	0.27	0.29	2.92	4.64	55	8.78	1.12	62.09	0.012	0.4	7.37	65	14.8	261.2
9-9	6.62	91.9	25.1	2.56	0.85	0.69	0.32	0.2	1.6	3.65	45	8.28	1.15	25.84	0.009	0.48	8.61	35.5	5.6	73.9
9-10	6.27	32.8	22.8	2.18	0.58	0.66	0.18	0.2	3.48	5.5	25	5.21	0.48	23.9	0.01	0.29	4.97	86.1	17.7	69.4
FC 9-11	5.75	15.6	22.8	2.03	0.58	0.62	0.12	0.16	1.41	5.73	35	8.56	0.27	46.38	0.014	0.47	8.52	89.6	3.5	39.8
9-12	6.15	35.9	25.7	2.84	0.63	0.65	0.09	0.22	2.96	5.5	55	10.23	0.53	119	0.028	0.6	9.99	147.4	7.5	81.5
9-13	5.89	36.7	23.9	2.2	0.65	0.63	0.18	0.25	1.04	5.08	60	10.96	0.41	24.86	0.008	0.54	8.33	113.2	3.8	68.5
9-14	6.48	120.7	34.4	4.3	0.97	0.79	0.2	0.35	6.54	5.74	90	11.84	1.53	65.34	0.024	0.51	7.42	158	3.9	173.2

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SIO_2 (mg/L)	SO_4 (mg/L)	$COLOR^1$ (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µeq/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µeq/L)	Al^1 (µeq/L)	Mn^1 (µeq/L)	Fe^1 (µeq/L)
9-15	6.2	48.7	27.5	3.08	0.8	0.71	0.26	0.2	2.55	5.45	90	12.25	0.65	85.54	0.022	0.65	10.01	143.3	7.1	115.3
FC 9-16	6.57	70.5	23.9	2.73	0.63	0.56	0.27	0.38	1.23	3.68	45	7.67	0.83	20.09	0.008	0.36	6.5	49.7	7.5	67.2
9-17	5.84	29.2	27.4	3.42	0.74	0.75	0.11	0.33	5.97	4.76	110	17.12	0.75	12.91	0.016	0.5	7.67	279.9	10.4	200.7
9-18	6.34	55.8	27.8	3.2	0.8	0.76	0.19	0.33	3.34	4.78	70	12.44	0.82	40.34	0.019	0.5	8.42	146	10.4	171.2
9-19	6.3	79.6	33.3	2.86	0.64	0.78	0.18	0.25	4.34	5.86	35	6.19	1.17	26.94	0.013	0.31	5.28	82.4	4.2	58.5
9-20	6.33	61.8	22.3	2.27	0.52	0.65	0.17	0.2	1.24	4.41	25	5.98	0.77	33.72	0.025	0.43	6.71	71.6	4.1	34.4
9-21	5.64	30.9	26.8	3.39	0.71	0.71	0.1	0.27	6.19	4.48	125	19.33	0.51	24.92	0.013	0.55	7.27	293.6	9.7	204.6
9-22	6.48	57.8	24.9	2.61	0.62	0.67	0.23	0.28	2.75	5.23	25	6.79	0.75	13.27	0.01	0.4	8.22	50.3	7.8	50.3
9-23	6.05	40.4	28.2	3.25	0.71	0.68	0.17	0.26	4.01	5.52	90	14.72	0.65	54.97	0.024	0.54	5.25	226.8	7.8	172.5
9-24	6.62	74.9	25.4	2.74	0.63	0.67	0.24	0.2	1.46	4.82	25	6.33	0.97	12.13	0.007	0.3	5.02	43.7	7.5	35.3
9-25	6.57	91.3	33.1	4.04	0.9	0.81	0.19	0.3	5.23	6.29	70	11.74	1.16	66.26	0.035	0.55	10.32	129.7	7	123.5

LEGEND

VARIABLE EXPLANATIONS

ALK = total inflection point alkalinity
Ca = calcium
Na = sodium
Cl^a = chloride
SO_4 = sulphate
DOC = dissolved organic carbon
NH_3 = ammonia
TKN = total Kjeldahl nitrogen
Al^a = aluminum
Fe^b = iron

COND = specific conductance (µS/cm at 25° C)
Mg = magnesium
K = potassium
SIO_2 = silica
COLOR = water color (Hazen platinum-cobalt scale)
TIC = total inorganic carbon
$NO_2NO_3{}^b$ = nitrite + nitrate
TP^b = total phosphorus
Mn^b = manganese

[a] values below detection limit assigned a value of 4.90 µg/L
[b] values below detection limit assigned a value of 1.90 µg/L

NOTATIONS

FC ***Plot-Lake Number*** = food chain lake
Plot-Lake number = drained as of autumn 1995
Plot-Lake Number** = lake joined to lake above
. = no data
[1] 1995 values only

Key to Figure 11.	Maps of individual food chain lakes (N = 20) in Algoma showing the habitat features associated with each lake, as well as the locations of water, minnow, leech and macroinvertebrate sampling sites (see McNicol *et al*. 1996a for description of methods). Habitat characterization is based on the Canadian Wetland Classification System.

HABITAT CHARACTERISTICS

Shrub Wetland:	ericaceous/ shrub wetlands (includes all shrub dominated bogs and fens)
Emergent Wetland:	includes shallow water and deep water marshes
Wetland Meadow:	includes meadow marsh and graminoid fen
Upland Forest:	for site maps, includes hardwood and conifer swamps, as well as treed islands
Chico Swamp:	swamps with standing dead trees
Open Water:	open water

SAMPLING VARIABLES

Minnow Trap:	locations of six minnow traps
Leech Trap:	locations of five leech traps
Water Sample:	location of autumn water sample by helicopter
Duck Box:	location of duck box
Benthic:	locations of ten benthic net drags used to sample benthic macroinvertebrates
Sweep:	locations of ten sweep net samples used to collect nektonic macroinvertebrates
Hoop:	locations of ten hoop samples used primarily to collect larval trichopterans

Algoma Plot 1 Wetland 17

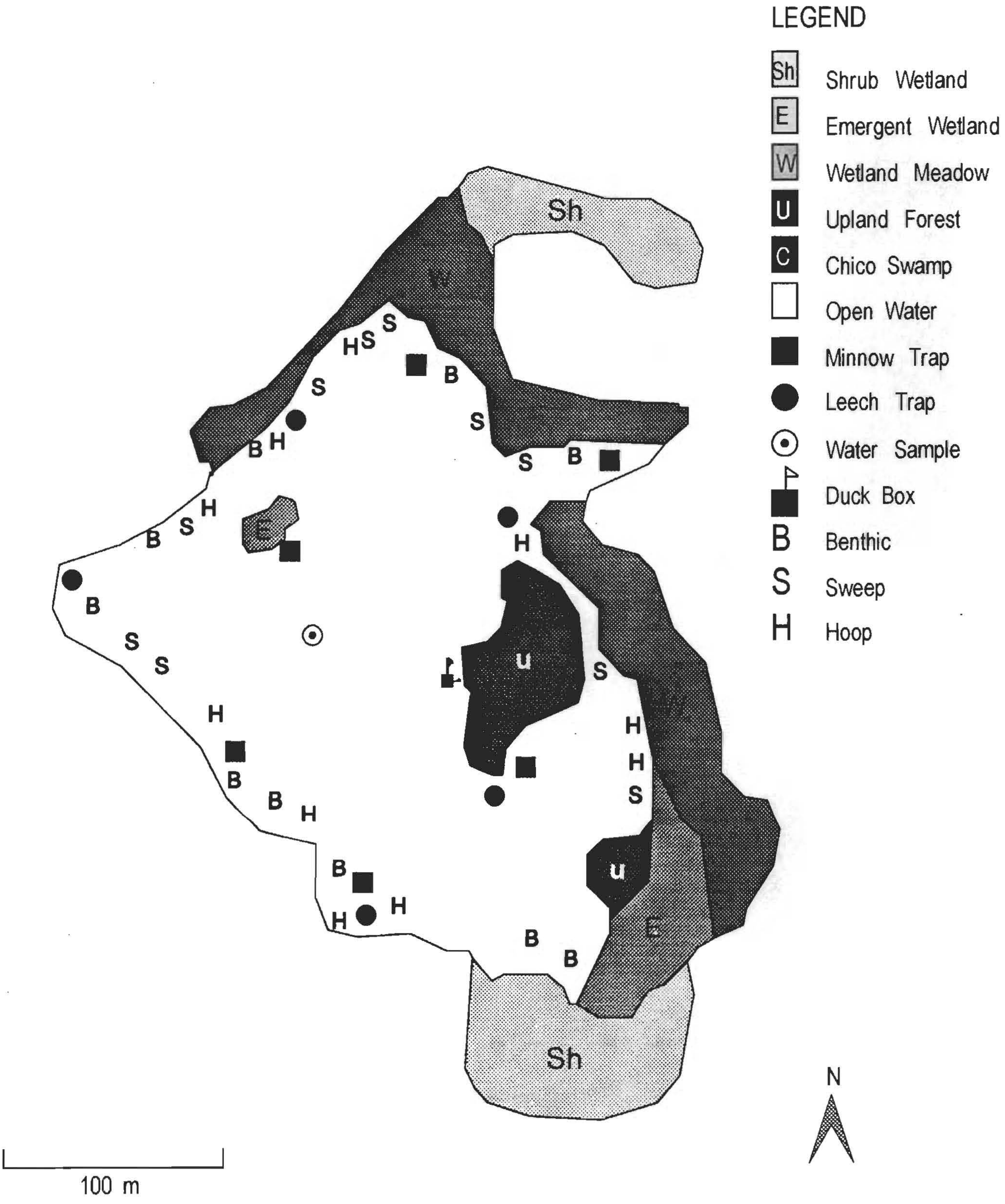
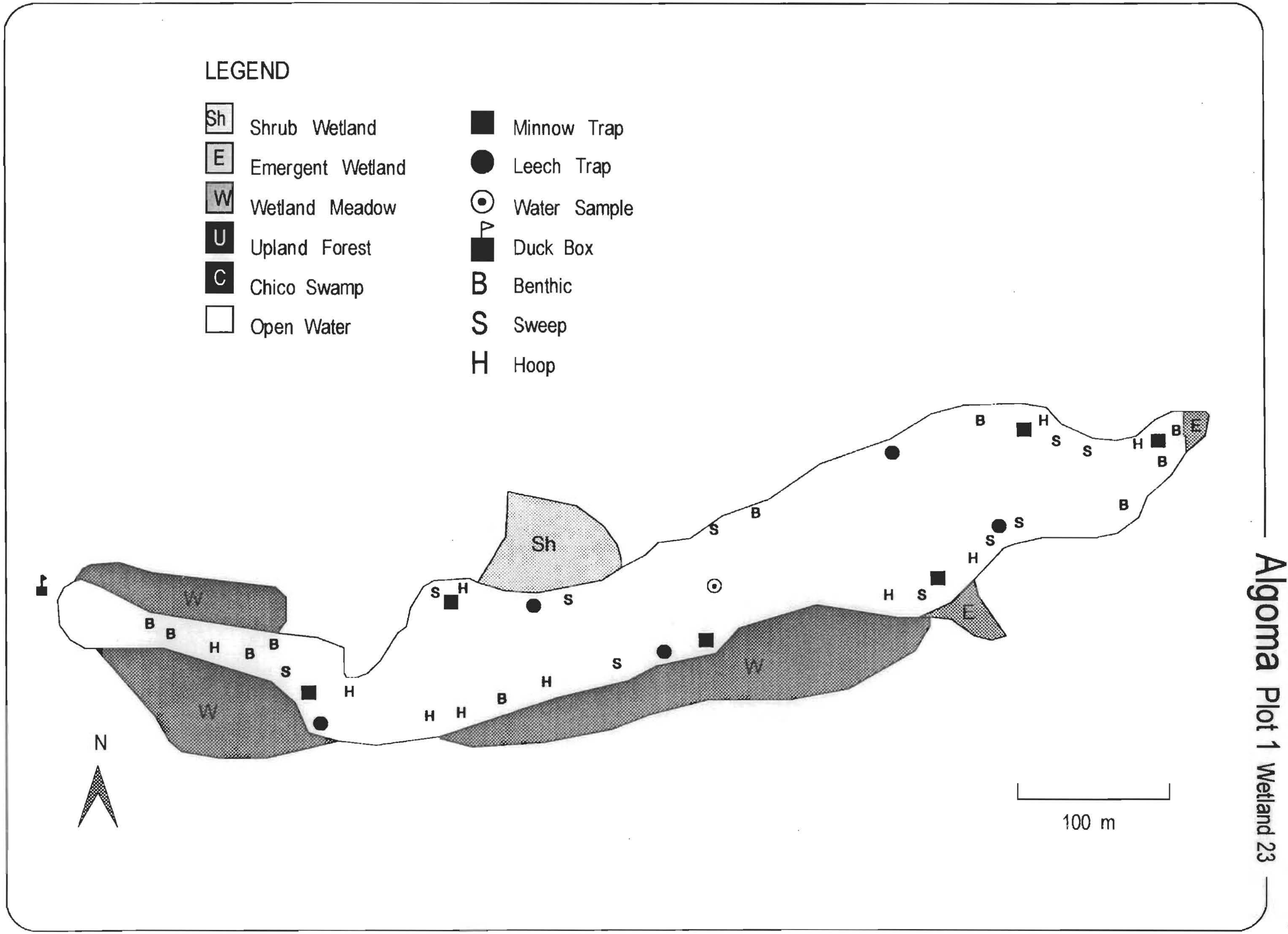


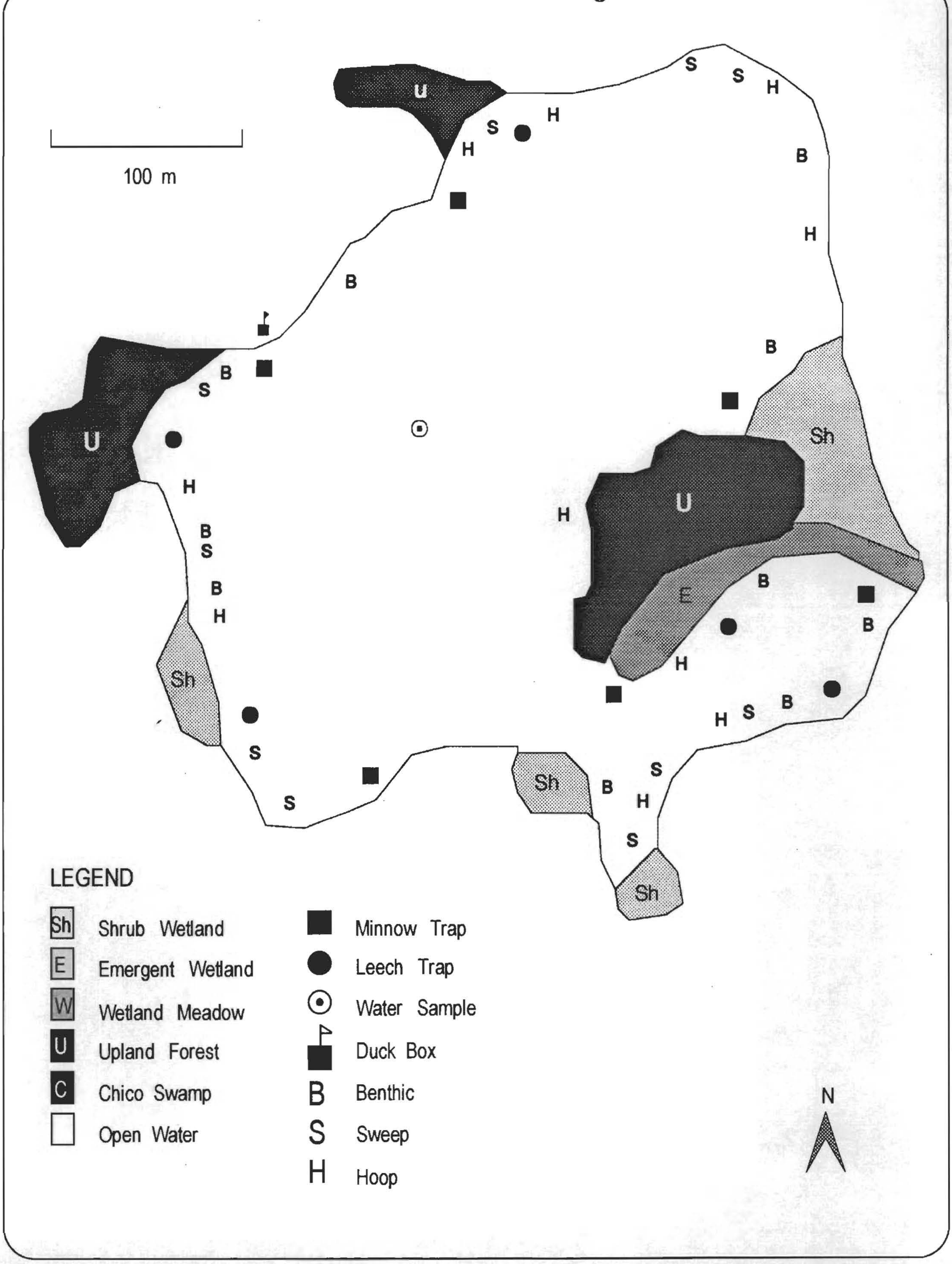
Fig. 11



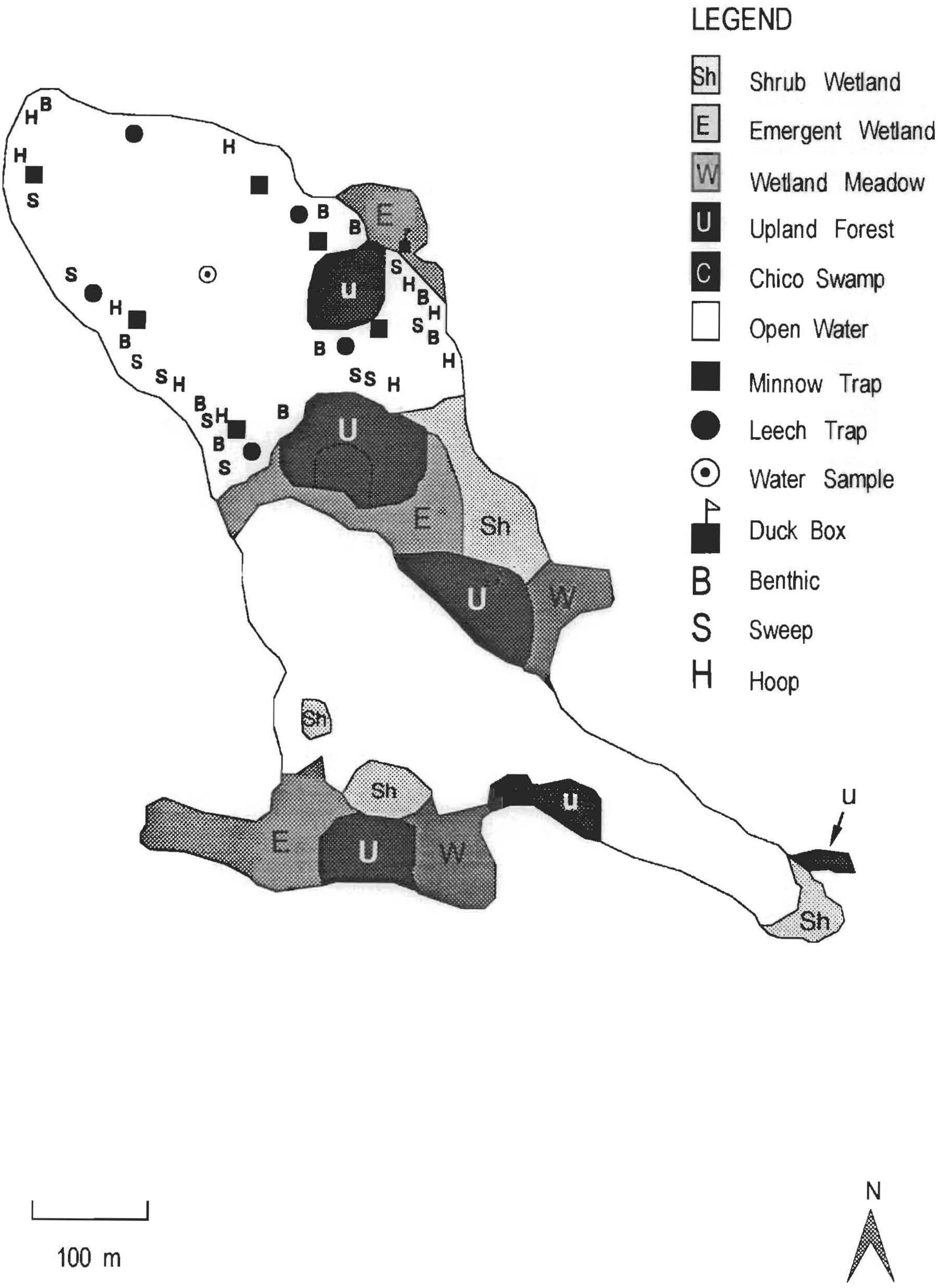
Food Chain Monitoring Program

Algoma Plot 1 Wetland 23

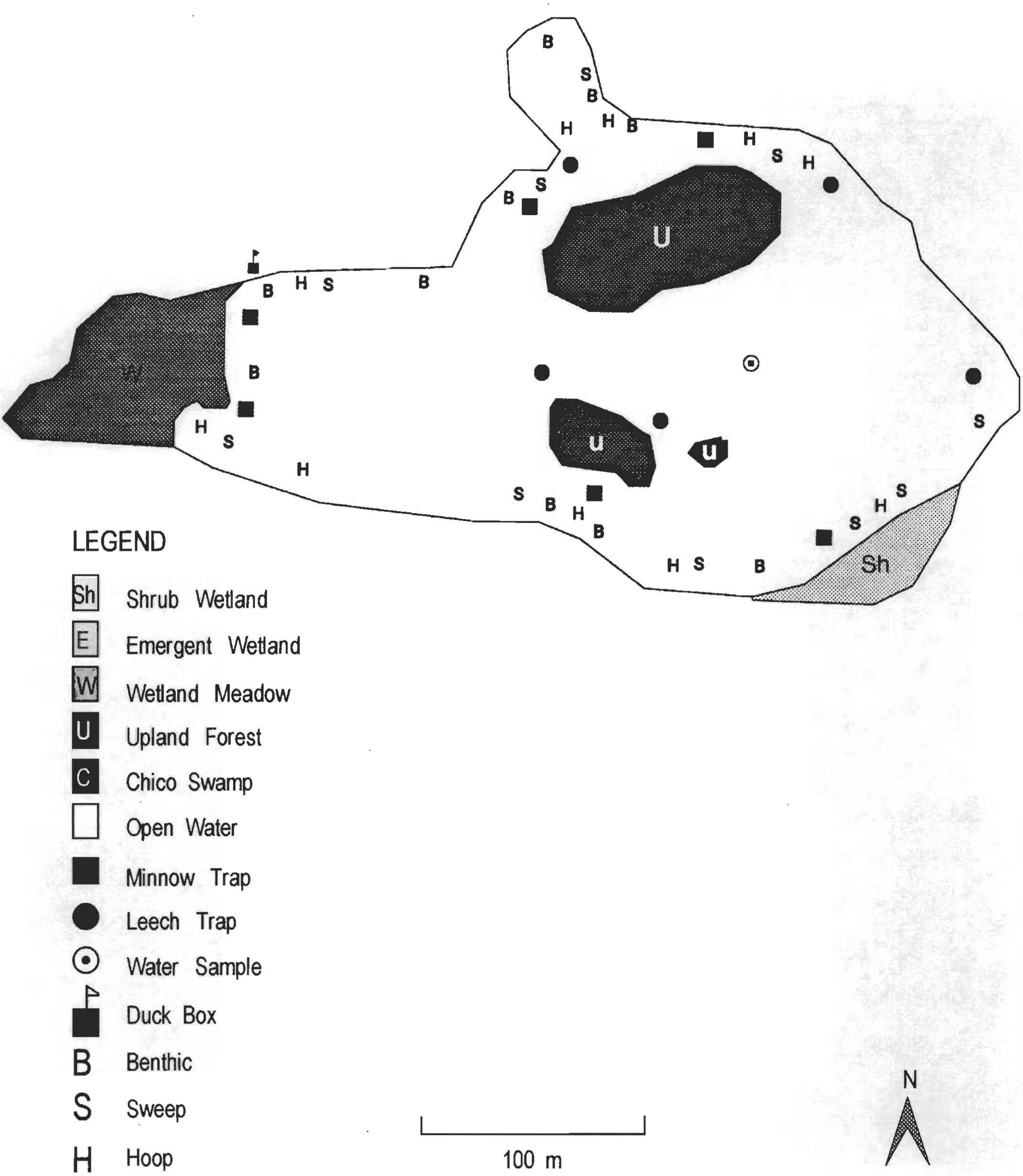
Algoma Plot 2 Wetland 7



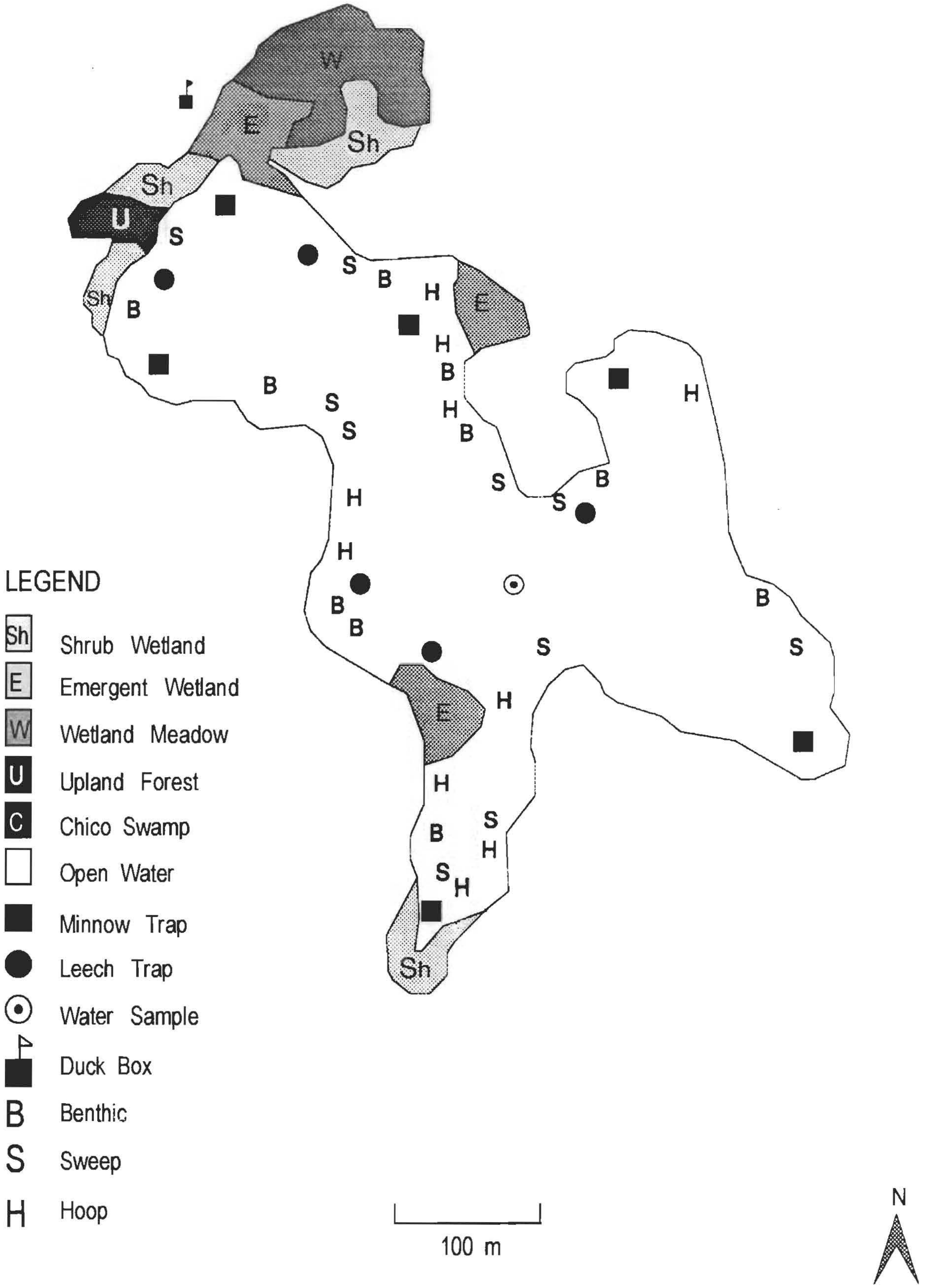
Algoma Plot 2 Wetland 16



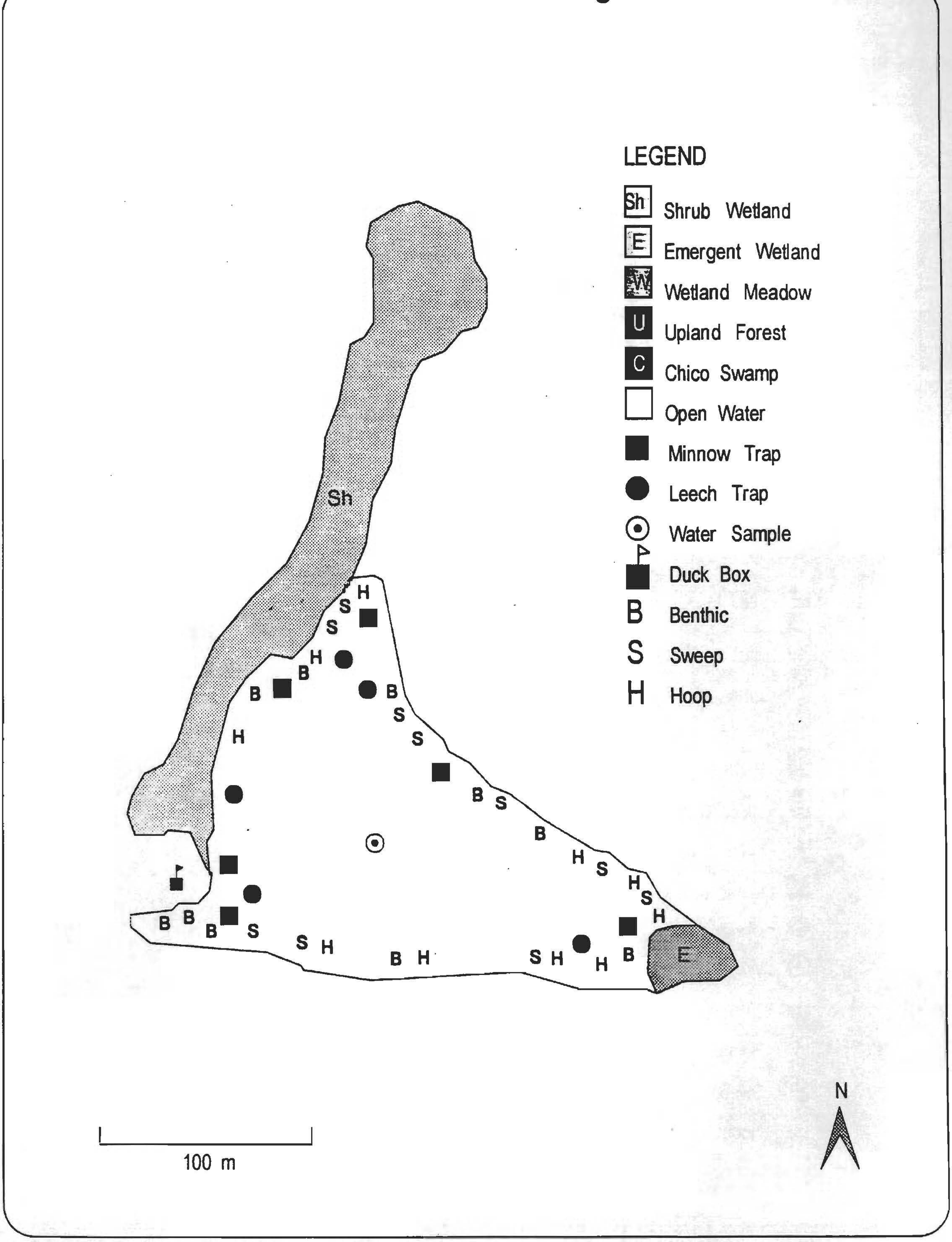
Algoma Plot 3 Wetland 12



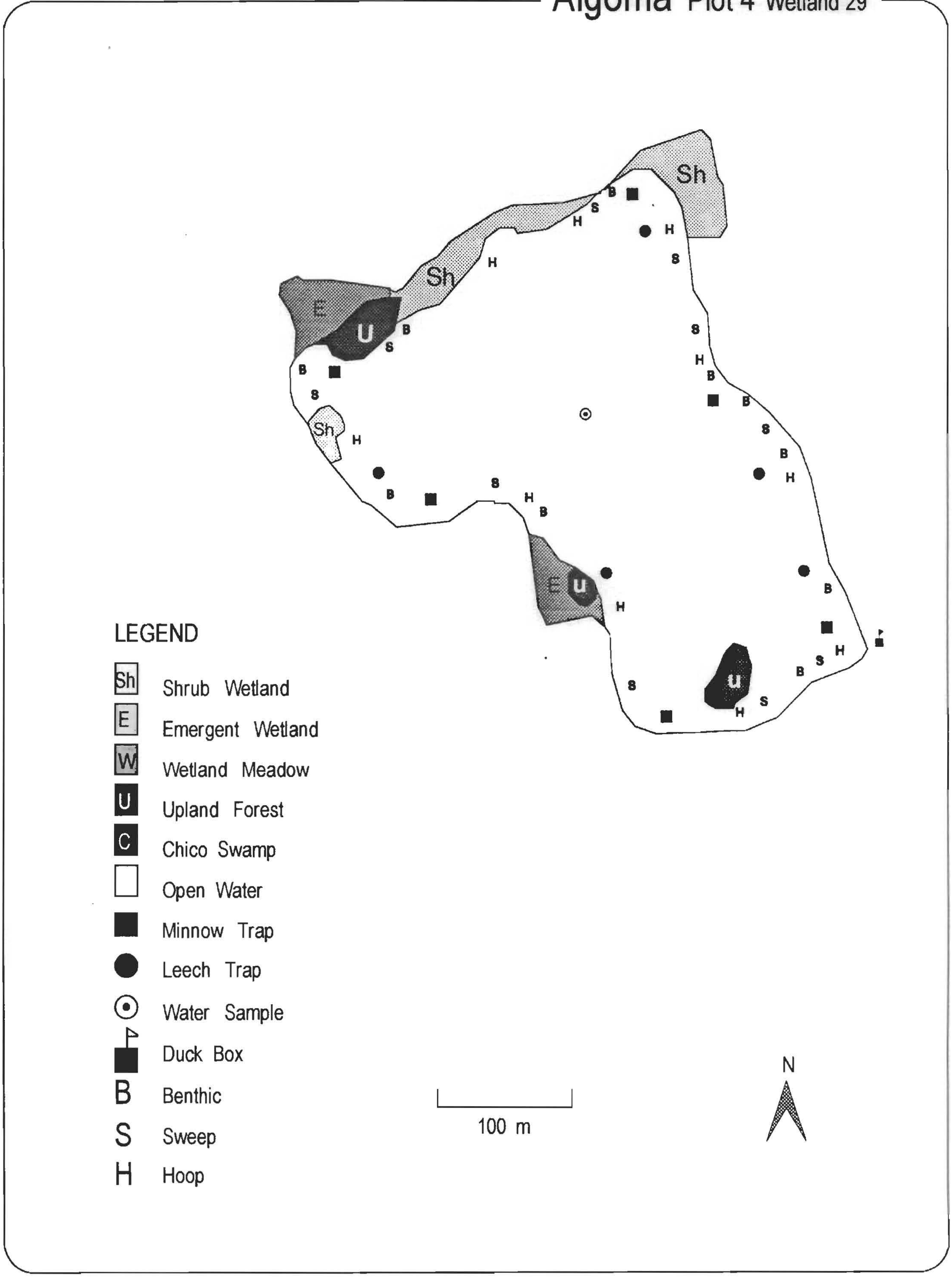
Algoma Plot 3 Wetland 33



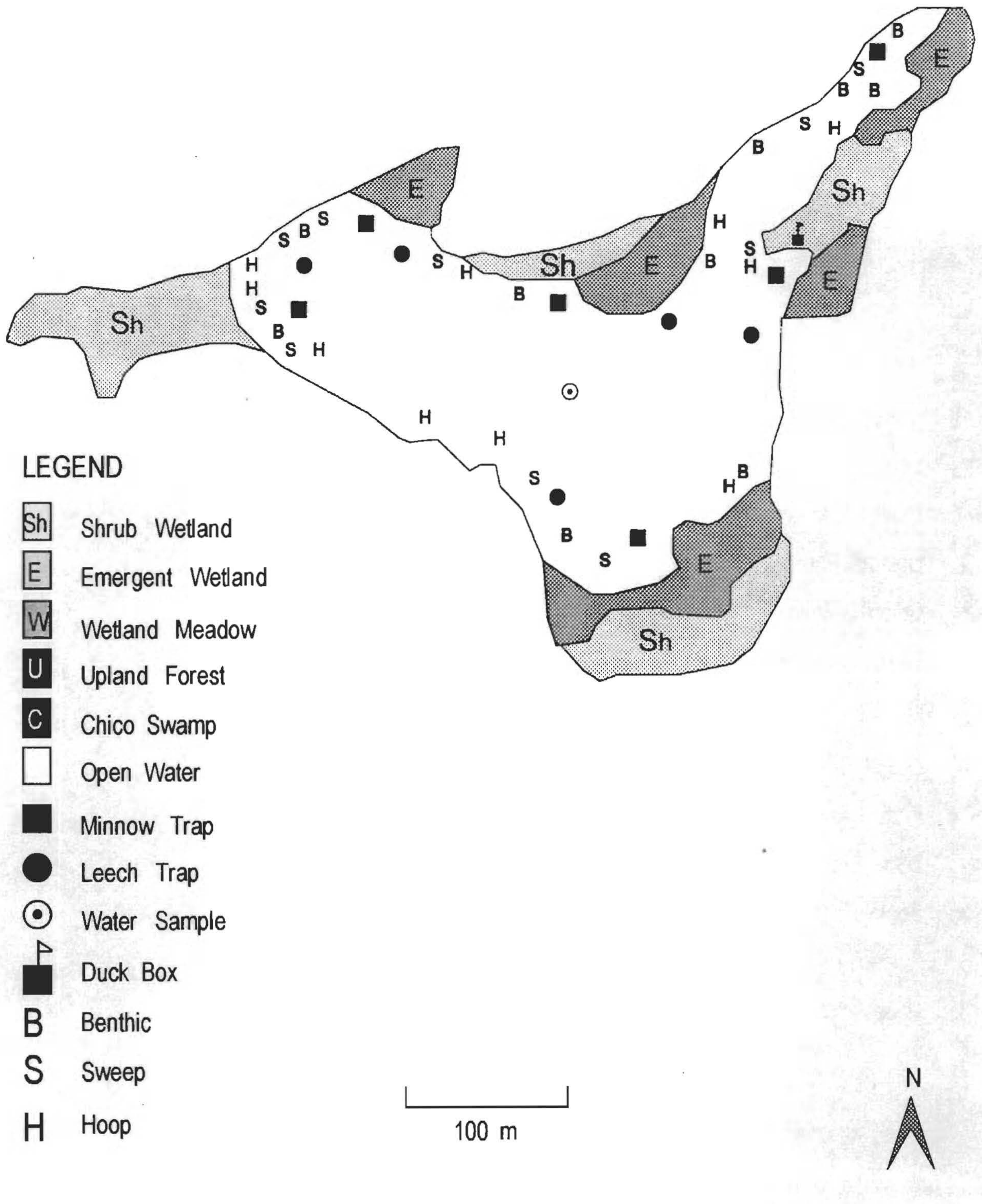
Algoma Plot 4 Wetland 12



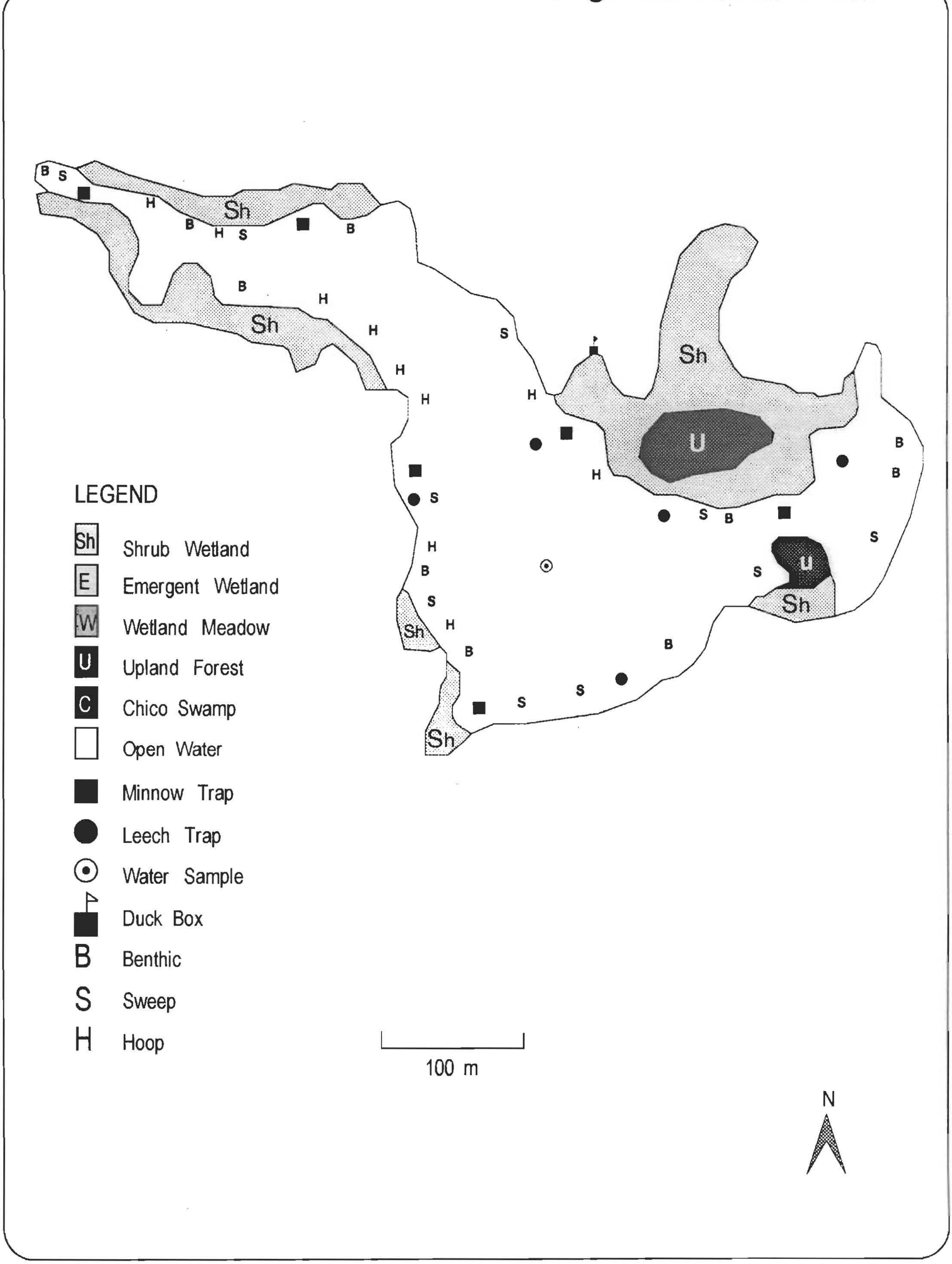
Algoma Plot 4 Wetland 29



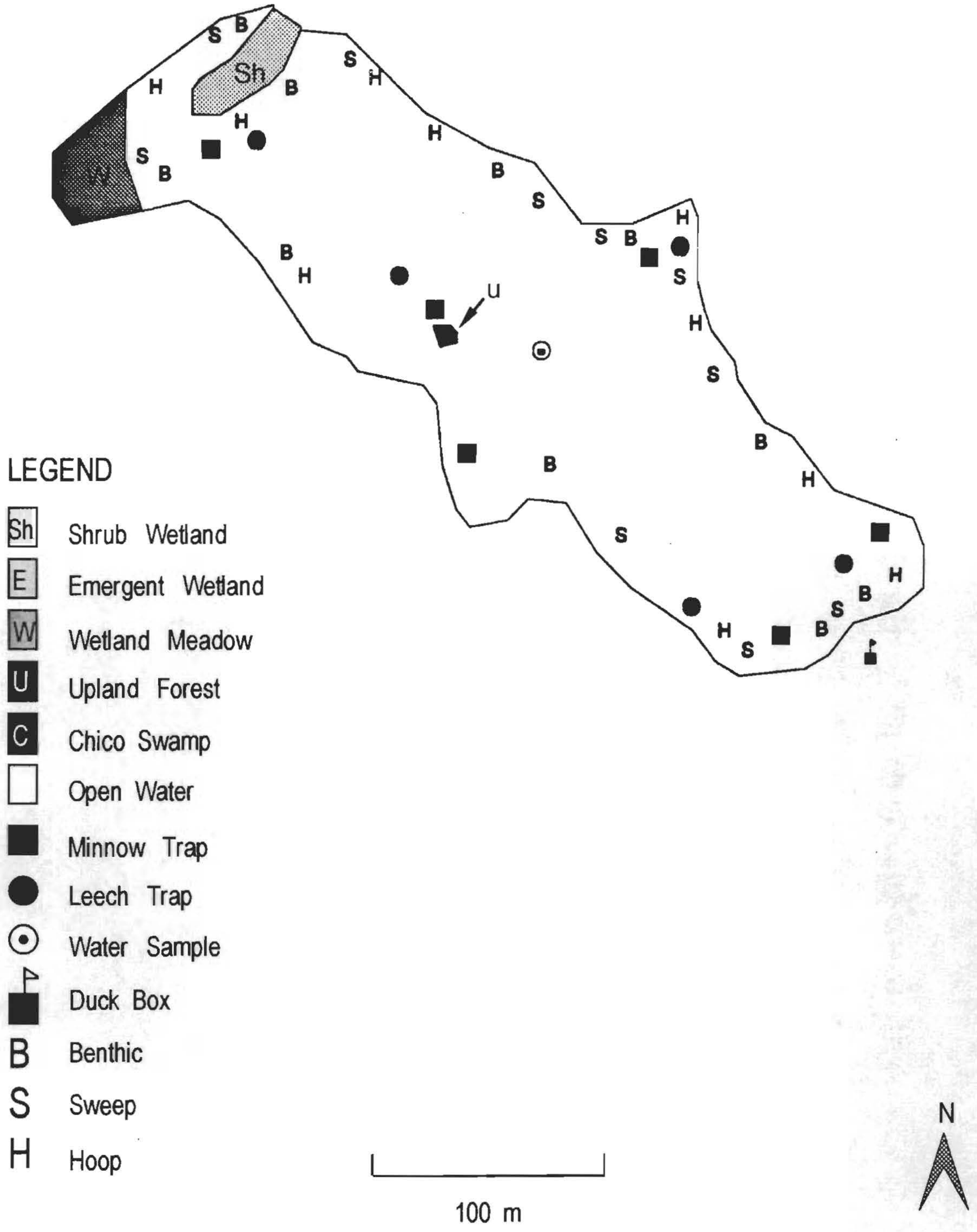
Algoma Plot 5 Wetland 19



Algoma Plot 5 Wetland 24

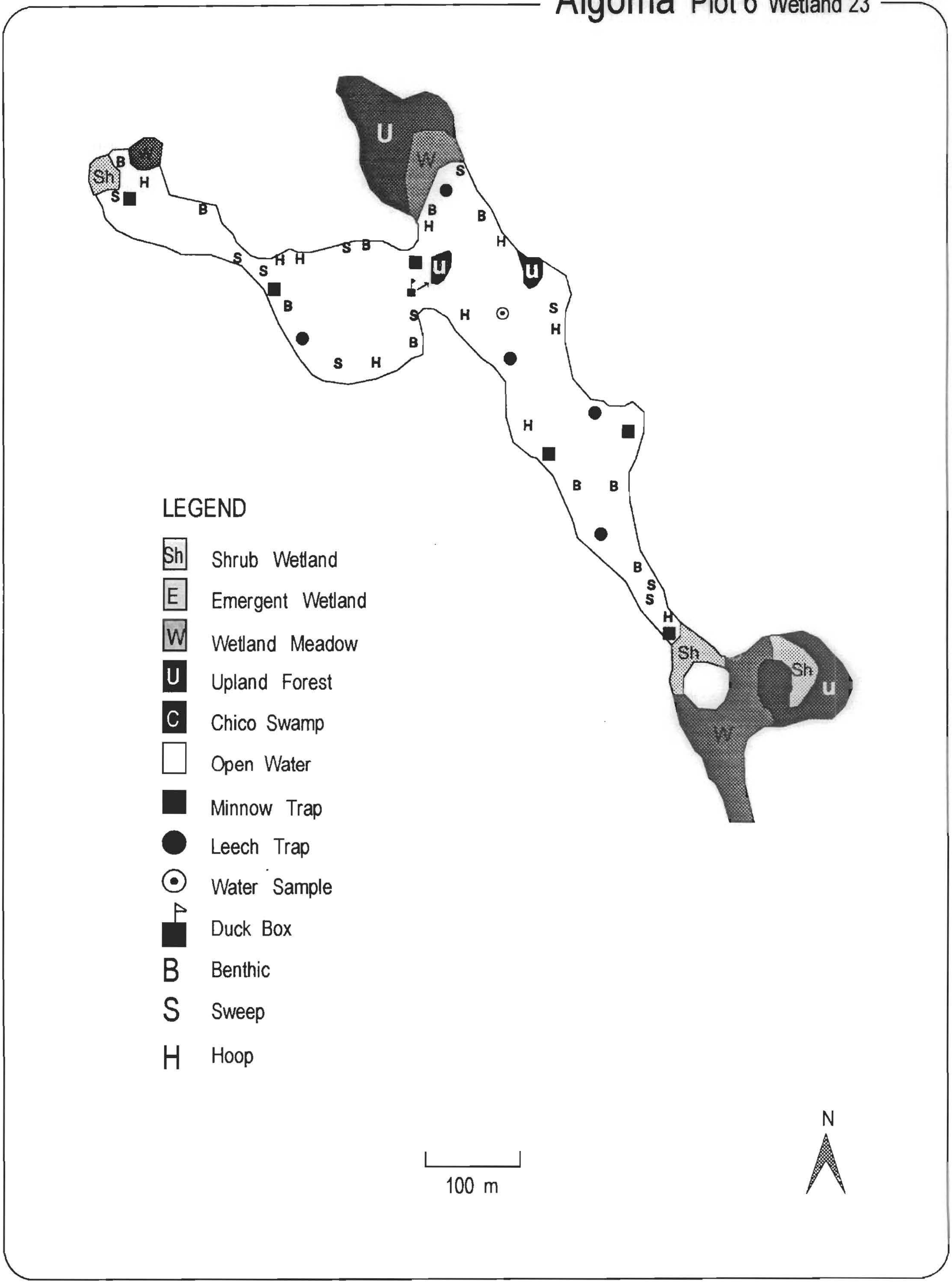


Algoma Plot 6 Wetland 5

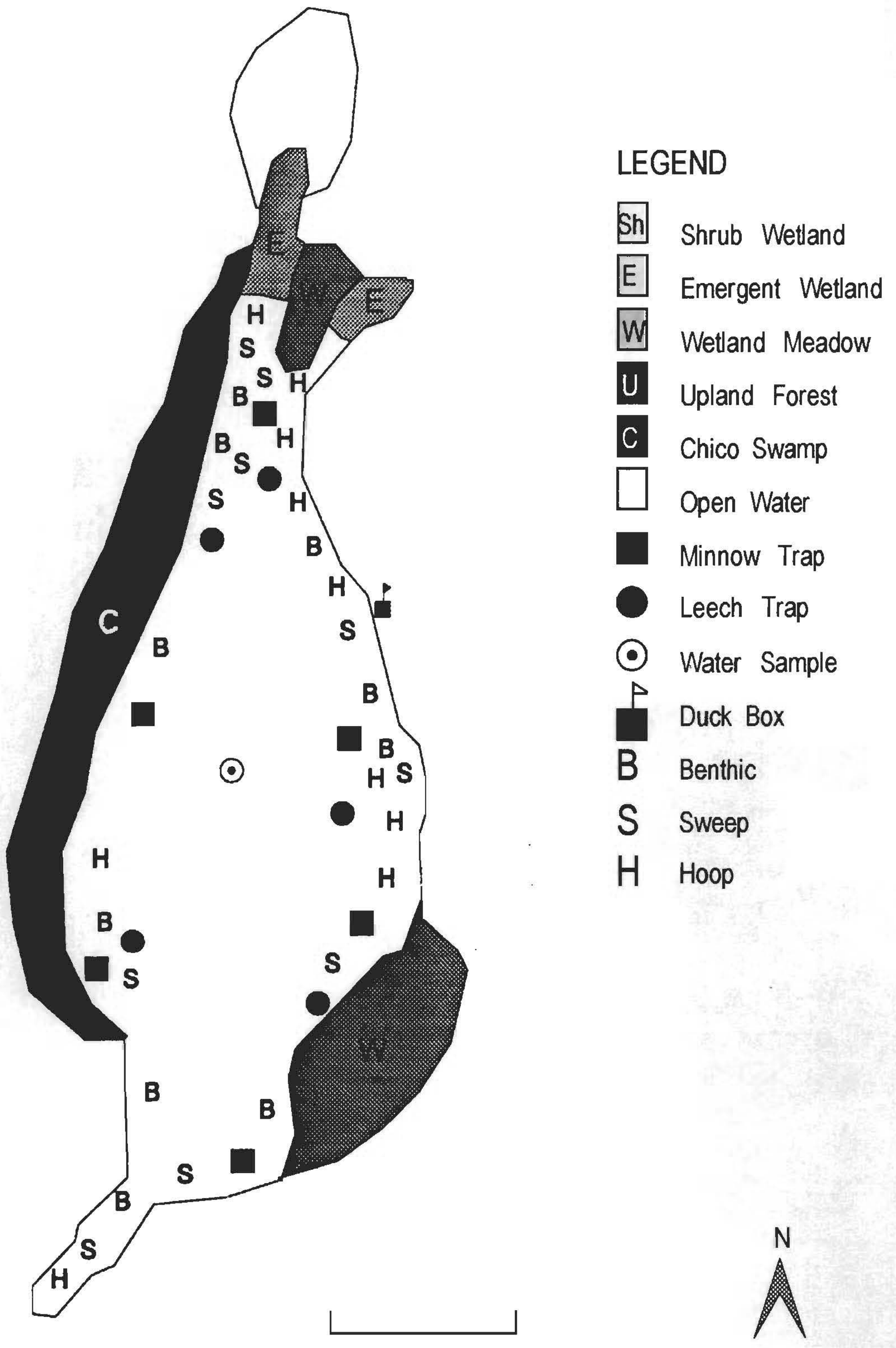


Food Chain Monitoring Program

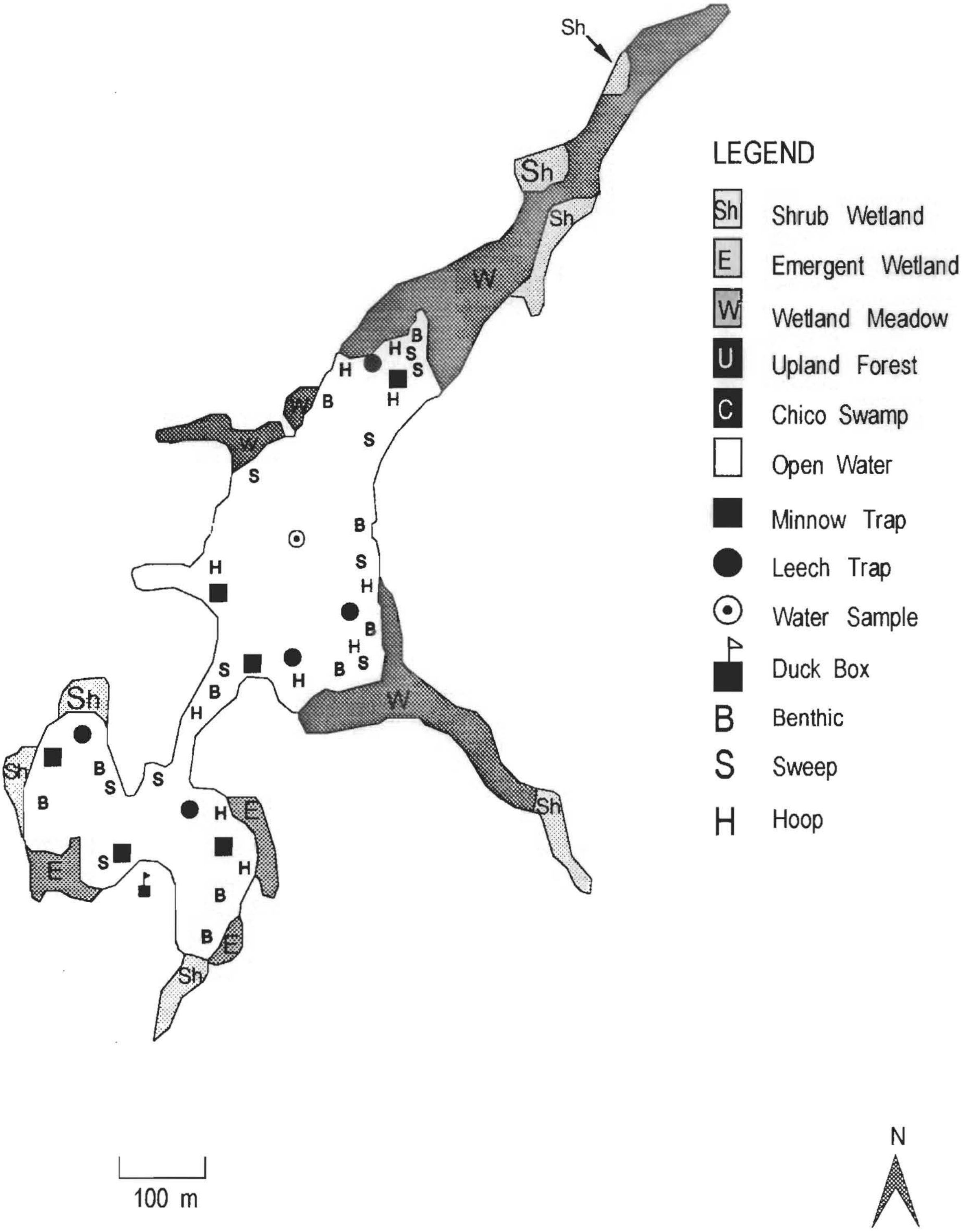
Algoma Plot 6 Wetland 23



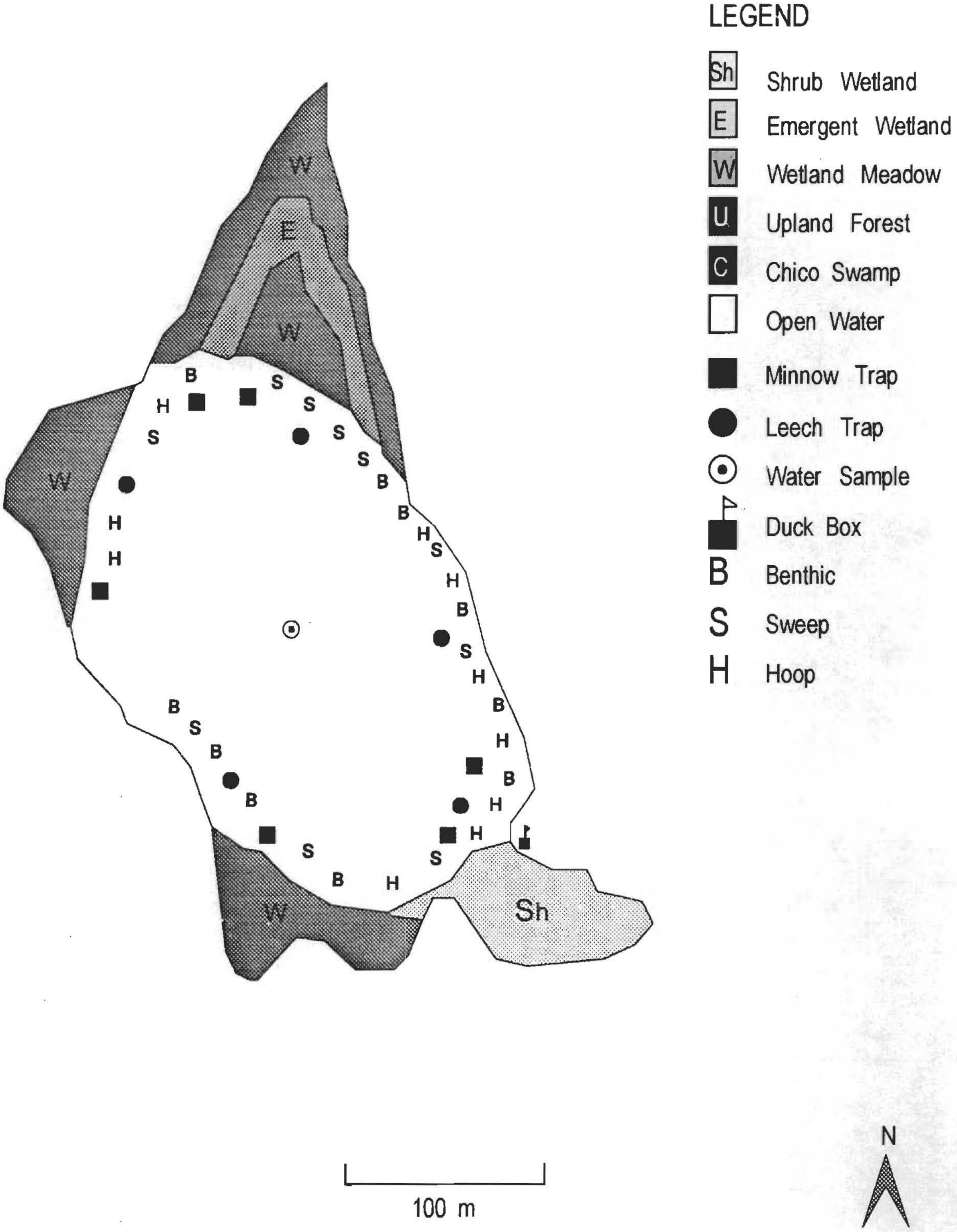
Algoma Plot 7 Wetland 2



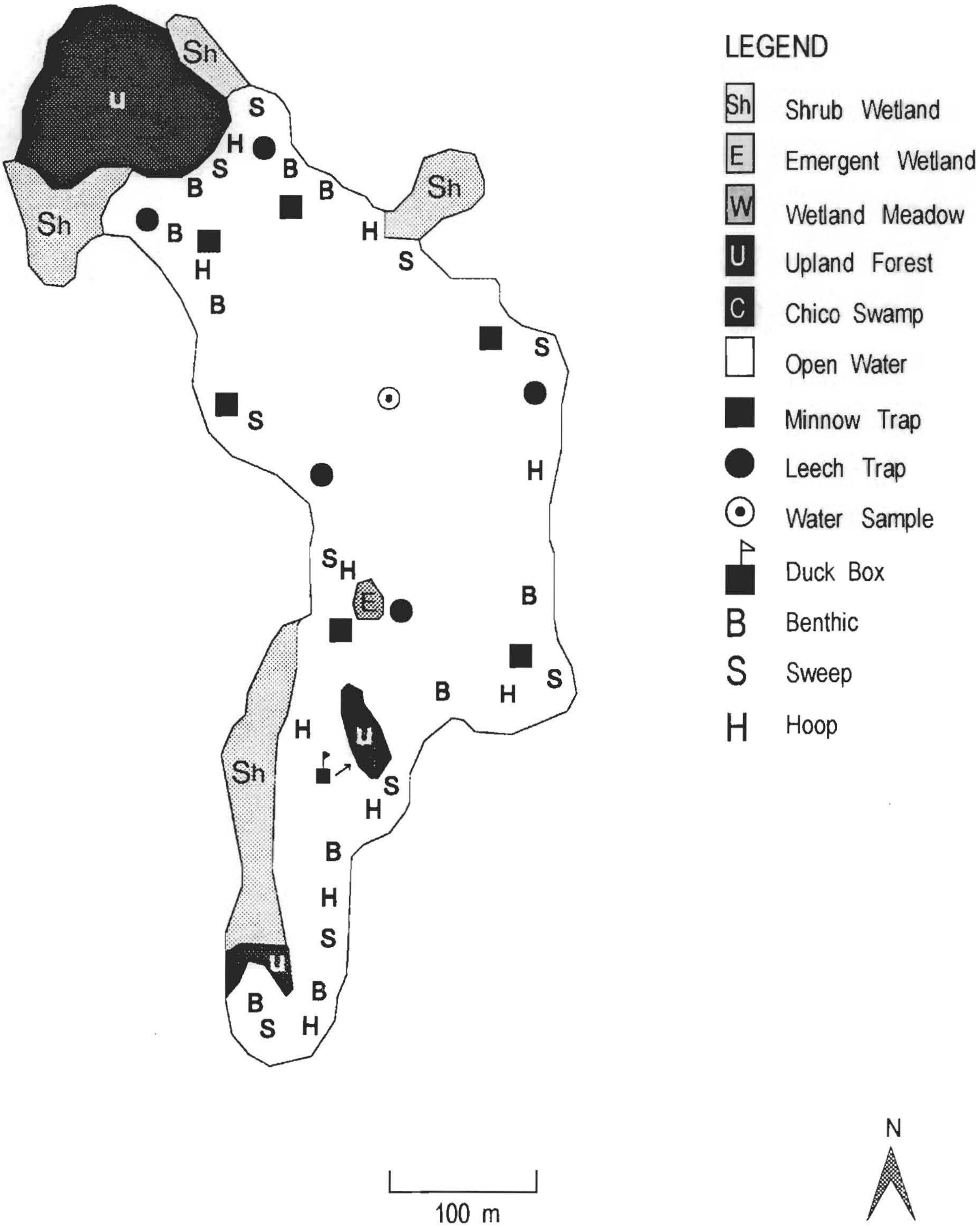
Algoma Plot 7 Wetland 9



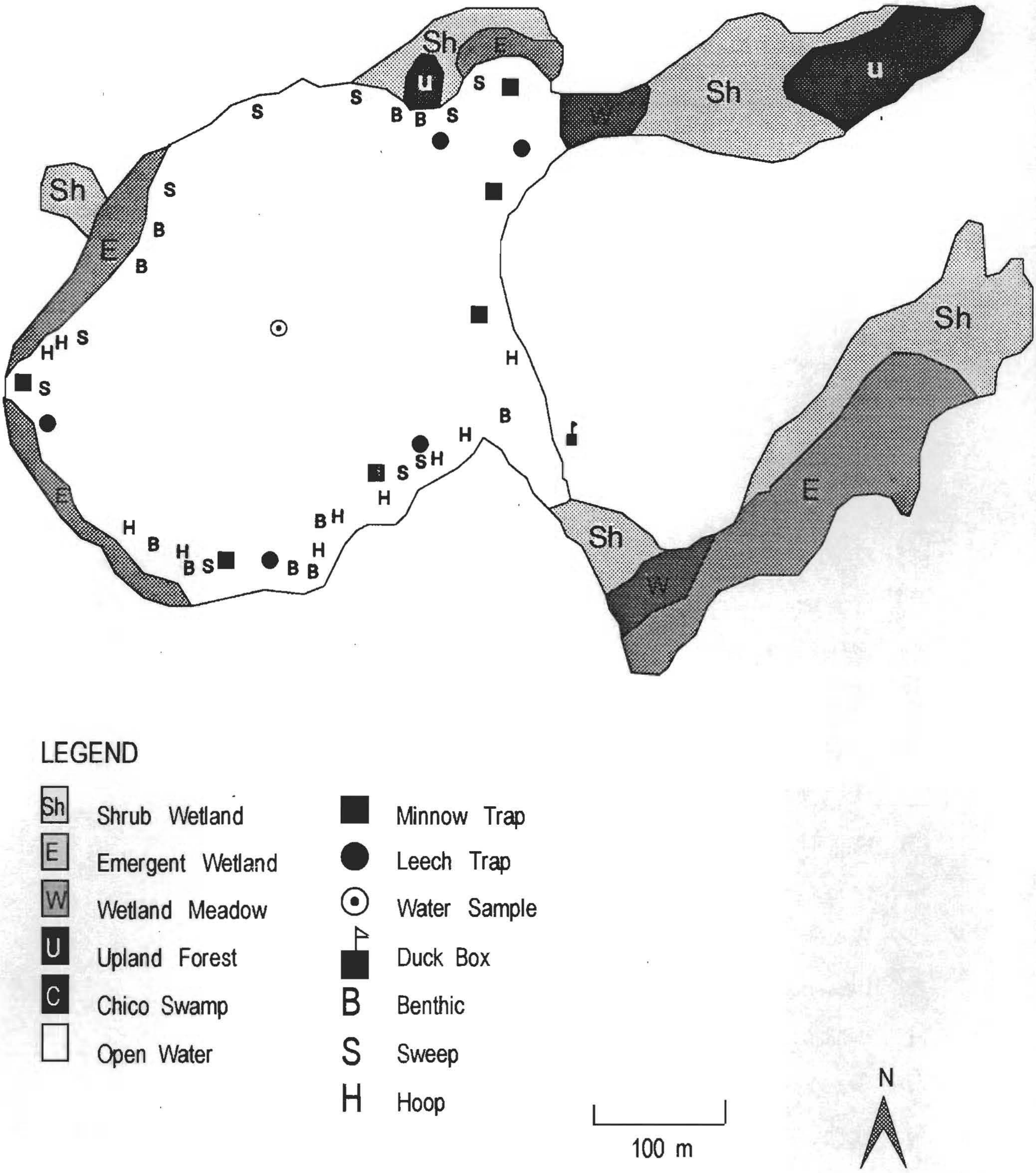
Algoma Plot 7 Wetland 20



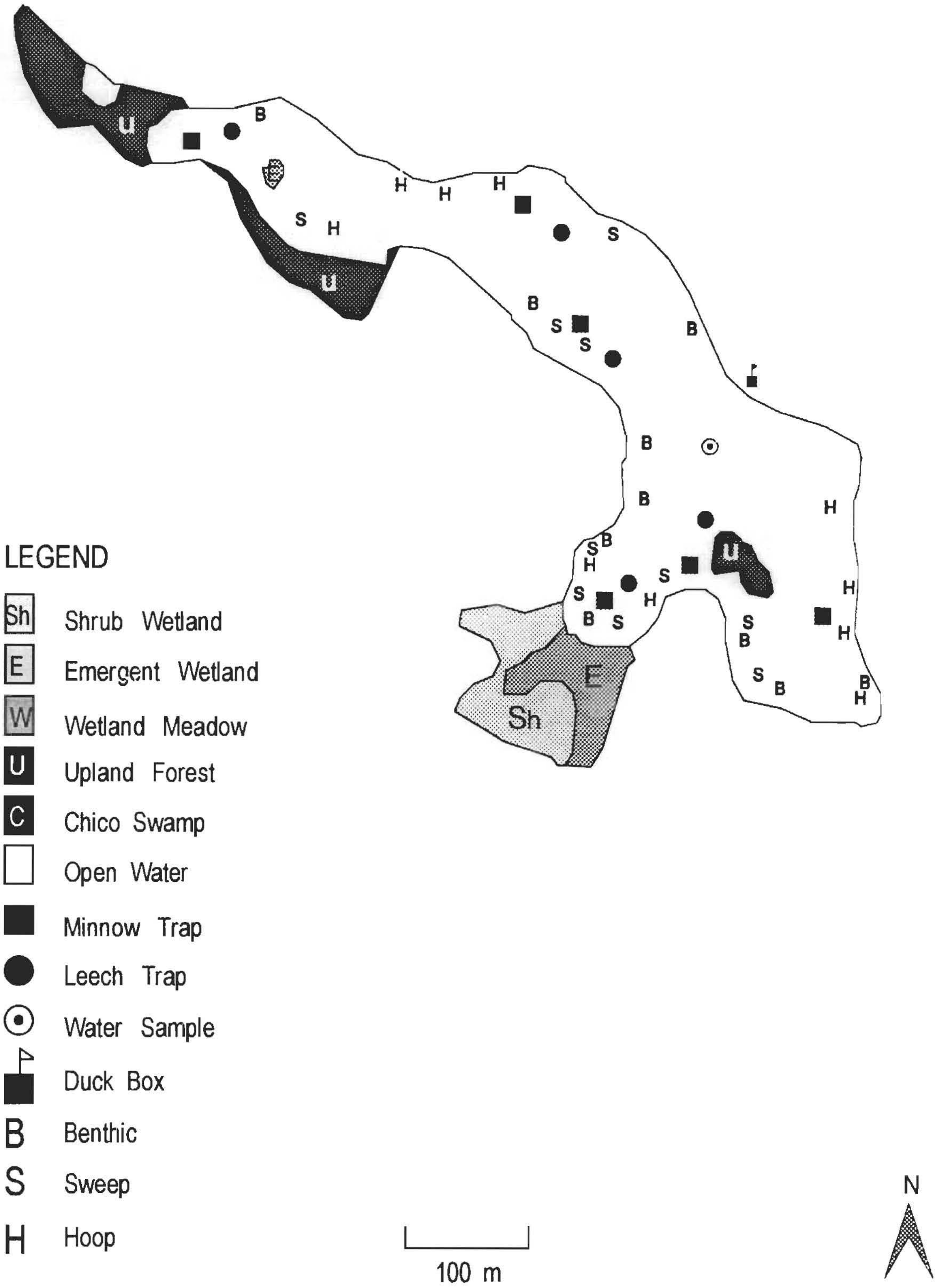
Algoma Plot 8 Wetland 4



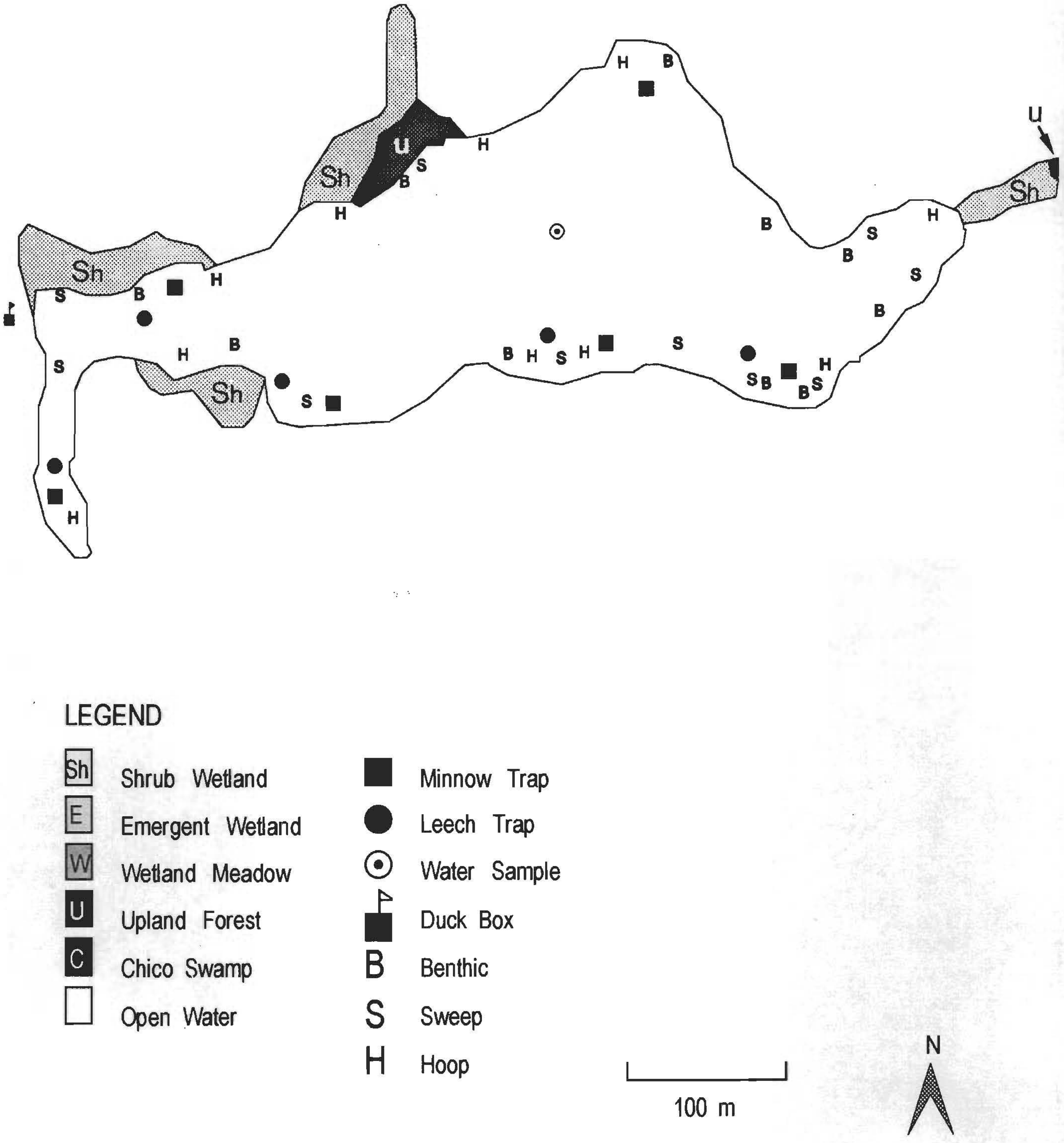
Algoma Plot 8 Wetland 18



Algoma Plot 9 Wetland 3



Algoma Plot 9 Wetland 11



Food Chain Monitoring Program

Algoma Plot 9 Wetland 16

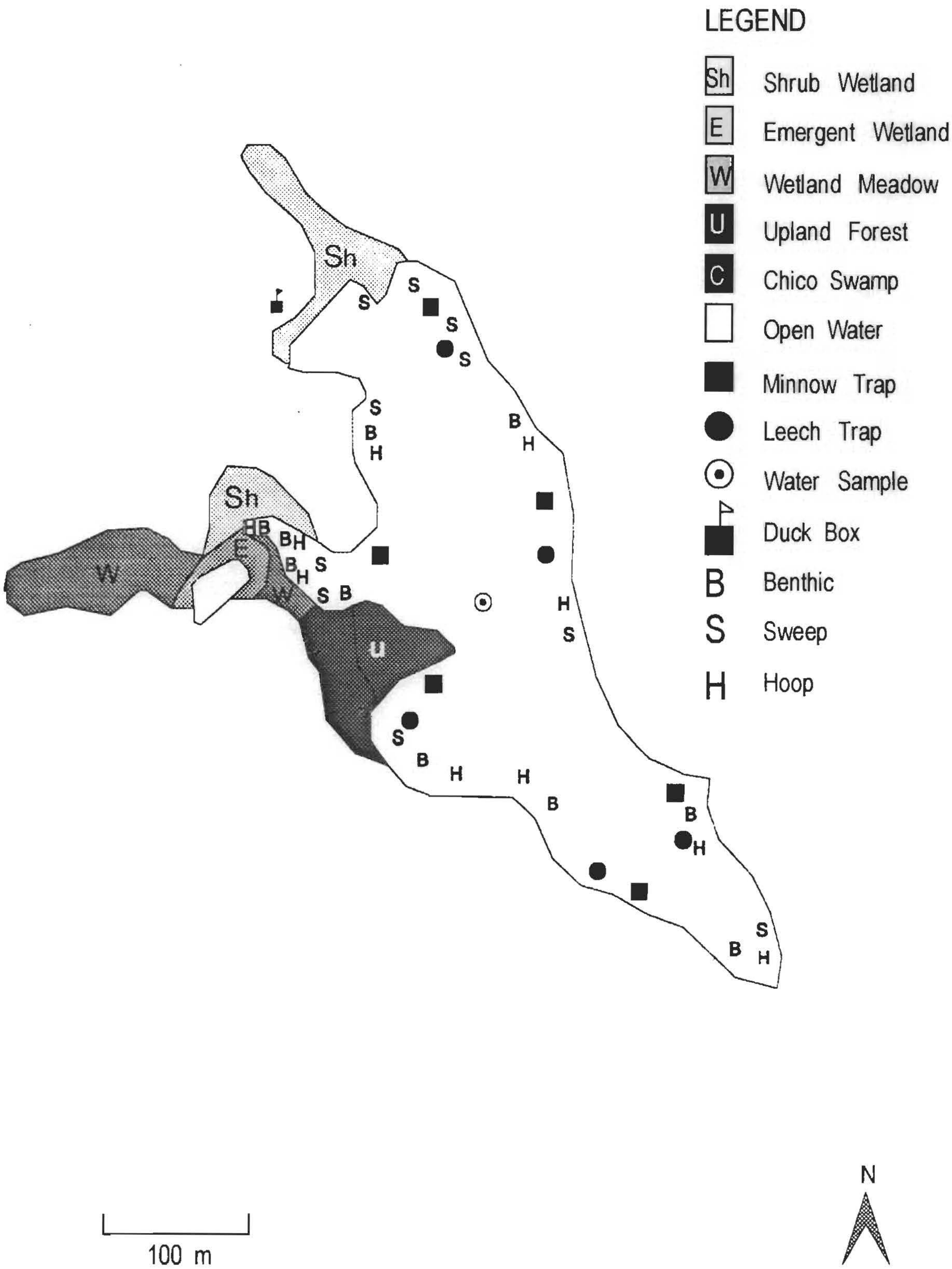


Table 15. Locations, morphometric and chemical characteristics of 20 Algoma food chain lakes. Chemical values are four year means (fall sampling: 1988, 1992, 1994, 1995). Fish are scored as absent (FA) or dominant fish groups are scored as Cyp (cyprinid), Bst (brook stickleback), or WS (white sucker).

PLOT	LAKE	UTM ZONE	UTM EAST	UTM NORTH	AREA (ha)	DEPTH (m)	pH	ALK (μeq/L)	DOC (mg/L)	FISH TYPE
1	17	16	6998	52364	3.7	8.6	4.91	-11.1	5.62	FA
1	23	16	7002	52397	5.2	3.7	5.20	-0.3	6.52	FA
2	7	16	6943	52137	9.7	2.6	6.98	212.6	4.83	FA
2	16	16	6980	52155	12.2	6.9	6.31	32.7	3.66	FA
3	12	16	7188	52155	4.6	2.5	5.21	0.2	6.10	FA
3	33	16	7216	52163	9.4	5.6	6.05	26.3	5.23	Cyp
4	12	16	7211	52046	3.8	4.8	5.23	-4.7	5.46	FA
4	29	16	7239	52028	9.0	1.5	5.15	-3.6	4.12	FA
5	19	16	7151	51942	5.4	3.5	6.16	26.2	6.23	Cyp
5	24	16	7168	51971	7.4	1.8	5.27	3.7	10.21	FA
6	5	16	7175	51721	3.9	4.3	6.03	15.3	5.13	FA
6	23	16	7209	51734	7.3	1.3	5.68	15.9	8.48	BSt
7	2	17	2838	51895	6.3	8.2	5.90	25.7	12.54	FA
7	9	17	2860	51898	10.5	2.8	5.48	17.0	15.91	Cyp
7	20	17	2899	51896	4.3	3.4	7.02	213.7	6.84	Cyp
8	4	17	2857	52050	8.3	4.9	6.02	30.0	11.69	Cyp
8	18	17	2884	52044	11.4	5.5	6.15	24.4	8.71	WS
9	3	17	2984	52114	8.5	1.5	6.05	30.7	10.02	WS
9	11	17	3003	52096	7.3	1.7	5.75	15.6	8.56	WS
9	16	17	3013	52109	6.3	3.8	6.57	70.5	7.67	WS

Table 16. Summary of fish and amphibian species collected in minnow traps in Algoma study lakes (1988-1994), and use of study lakes by beavers (1994 aerial survey). (See legend for explanation of variables and notations).

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
1	1	6.98	FA	0			OLD
1	2	5.38	FP-NC	1	NRD		OLD
1	3	4.88	FA	0			OLD
1	4	5.06	FA	0			OLD
1	5	4.51	FA	0			ACTIVE
1	6	4.83	FA	0			OLD
1	7	5.09	FA	0			OLD
1	8	5.18	FA	0		GF	OLD
1	9	5.2	FP-NC	1	BS		OLD
1	10	4.88	FA	0			OLD
1	11	5.18	FA	0			OLD
1	12	5.18	FA	0			OLD
1	13	5.3	FA	0			OLD
1	14	4.88	FA	0			ACTIVE
1	15	5.54	.	.			OLD
1	16	5.4	FA	0			OLD
1	FC 17	4.91	FA	0		GMF	OLD
1	18	4.8	FA	0			ACTIVE
1	19	5.11	FA	0			OLD
1	20	5.12	FA	0			OLD
1	21	5.22	FA	0			OLD
1	22	4.71	FA	0			OLD
1	FC 23	5.20	FA	0		GF	ACTIVE
1	24	5.29	.	.			UNUSED
1	25	4.57	FA	0			OLD
1	26**	4.99	.	.			OLD
1	27	4.61	FA	0			ACTIVE
1	28	4.67	FA	0			OLD
1	29	5.1	FA	0			OLD
1	30	4.52	FA	0			ACTIVE
1	31	5.08	FP-NC	1	ID		OLD
1	32	4.61	.	.			OLD
1	33	5.1	FA	0			.
1	34	4.95	FA	0			OLD
2	1	6.66	FA	0		MF	OLD
2	2	6.76	FA	0			ACTIVE
2	3	6.78	FA	0		GF	ACTIVE
2	4	7.06	FA	0		GF	ACTIVE

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
2	5	.	FA	0			UNUSED
2	6	7.16	FA	0			OLD
2	FC 7	6.98	FA	0		MF	ACTIVE
2	8	6.97	FP-C	5	WS, NRD, LC, BS, BT		.
2	9	6.81	FP-C	6	WS, NRD, LC, BS, BT, CC		.
2	10	6.85	FA	0			OLD
2	11	.	.	.			UNUSED
2	12	6.9	FP-C	5	LC, FM, PD, NRD, FD		ACTIVE
2	13	6.9	FP-C	4	NRD, FD, PD, SS		OLD
2	14	7.09	FP-C	6	WS, NRD, FD, FM, CC, CS		UNUSED
2	15	6.7	FP-C	6	BT, BS, CC, LC, NRD, WS		.
2	FC 16	6.31	FA	0		GF	ACTIVE
2	17	5.84	FA	0		MF	OLD
2	18	6.84	FA	0		RSN	OLD
2	19	6.89	FP-C	5	CS, CC, FM, NRD, FD		ACTIVE
2	20	5.87	FA	0		GMF	ACTIVE
3	1	5.7	FP-NC	1	PD		OLD
3	2	5.2	FA	0		RSN	OLD
3	3	5.35	FA	0		GF	OLD
3	4	5.61	FA	0			ACTIVE
3	5	6.01	FA	0		RSN	OLD
3	6	6.11	FP-NC	2	NRD, FD		ACTIVE
3	7	6.02	FP-NC	2	NRD, FD		ACTIVE
3	8	4.3	FA	0			OLD
3	9	4.91	FA	0		GF	OLD
3	10	4.98	FA	0		GF, RSN	OLD
3	11	5.17	FA	0		GF	OLD
3	FC 12	5.21	FA	0		GF	OLD
3	13	5.18	FA	0		GF	UNUSED
3	14	4.82	FP-C	1	CC		ACTIVE
3	15	6.26	FP-C	1	CC		OLD
3	16	5.12	FA	0			ACTIVE
3	17	4.97	FA	0			ACTIVE
3	18	5.47	FA	0			OLD
3	19	5.68	FP-NC	2	NRD, FD		OLD
3	20	6.62	FP-NC	2	NRD, FD		OLD
3	21	6.47	FP-NC	2	NRD, FD		ACTIVE
3	22	6.21	FA	0			ACTIVE
3	23	5.35	FA	0			OLD
3	24	5.4	FP-C	5	BS, CC, GS, NRD, FD		ACTIVE
3	25	5.85	FP-NC	1	PD		OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER STATUS
			TYPE	NO. SPECIES	SPECIES	SPECIES	
3	26	6.24	FP-NC	1	PD		OLD
3	27	5.91	FA	0			OLD
3	28	6.39	FP-NC	2	NRD, FD		OLD
3	29	5.9	FP-NC	1	PD		OLD
3	30	6.14	FP-C	2	CC, NRD		OLD
3	31	6.22	FP-C	2	CC, PD		OLD
3	32	5.69	FP-NC	2	NRD, FD		ACTIVE
3	FC 33	6.05	FP-NC	2	NRD, FD		OLD
3	34	6.3	FP-NC	1	NRD		OLD
3	35	6.52	FP-C	2	WS, CC		OLD
4	1	5.9	FA	0			OLD
4	2	5.29	FA	0			OLD
4	3	5.68	FA	0			OLD
4	4	.	.	.			UNUSED
4	5	.	.	.			UNUSED
4	6	4.95	FA	0			ACTIVE
4	7	5.48	FA	0		SP	OLD
4	8	.	.	.			OLD
4	9	.	.	.			UNUSED
4	10	6.04	FA	0		RSN	OLD
4	11	5.36	FA	0			OLD
4	FC 12	5.23	FA	0		GF	OLD
4	13	5.65	FA	0			ACTIVE
4	14	5.24	FA	0			ACTIVE
4	15	5.41	FA	0			OLD
4	16	5.44	.	.			ACTIVE
4	17	5.21	FA	0			OLD
4	18	5.3	FP-C	1	CC		OLD
4	19	5.3	FP-C	1	CC		ACTIVE
4	20	5.61	FA	0			OLD
4	21	5.86	FA	0			UNUSED
4	22	6.55	FP-C	1	CC		OLD
4	23	6.68	FA	0			ACTIVE
4	24	6.23	FA	0			OLD
4	25	5.19	FA	0			OLD
4	26	5.72	FP-C	1	CC	RSN	UNUSED
4	27	5.32	FP-C	1	CC		OLD
4	28	6.17	FA	0			ACTIVE
4	FC 29	5.15	FA	0		MF	OLD
4	30	5.94	FA	0		RSN	ACTIVE
4	31	5.67	FA	0		RSN	ACTIVE

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
4	32	5.86	FA	0			OLD
4	33	5.94	FA	0			OLD
4	34	5.2	FA	0			OLD
4	35	6.6	FP-C	1	CC		ACTIVE
4	36	.	.	.			OLD
4	37	6.65	FP-C	1	CC		OLD
5	1	5.85	FP-C	2	CC, PD		ACTIVE
5	2**	5.98	.	.			OLD
5	3	5.92	FA	0		RSN	ACTIVE
5	4	5.71	FA	0		BF, GF	OLD
5	5	6.11	FP-C	2	CC, PD		OLD
5	6	6.35	FA	0			OLD
5	7	6.38	FP-C	4	WS, PD, NRD, CC		OLD
5	8	6.33	FP-C	4	PD, FD, NRD, CC		ACTIVE
5	9	6.37	FP-C	4	WS, PD, CC, BD		OLD
5	10	5.42	FA	0		RSN	UNUSED
5	11	5.75	FP-C	1	CC		OLD
5	12	6.35	FA	0		RSN	.
5	13	5.45	FP-C	1	CC		ACTIVE
5	14	5.98	FP-NC	1	PD		ACTIVE
5	15	6.42	FP-C	1	CC		OLD
5	16	6.53	FA	0			UNUSED
5	17	6.44	FA	0			OLD
5	18	6.47	FA	0			OLD
5	FC 19	6.16	FP-NC	1	PD	GF	ACTIVE
5	20	6.37	FA	0			OLD
5	21	6.12	FP-NC	1	PD	GF	OLD
5	22	6.42	FA	0			UNUSED
5	23	5.2	FA	0			ACTIVE
5	FC 24	5.27	FA	0		MF	OLD
5	25	.	.	.			OLD
6	1	.	.	.			.
6	2	6.17	FP-NC	2	BS, FM	BF, GF	.
6	3	5.87	FP-NC	1	BS	BF, GMF	OLD
6	4	5.86	FP-C	2	BS, CC	BF	OLD
6	FC 5	6.03	FA	0		GF	OLD
6	6	4.97	FA	0		GF	ACTIVE
6	7	6.19	FP-C	7	CC, CS, BD, BS, FM, NRD, LC		OLD
6	8	6.09	FP-NC	4	BD, BS, CS, FM	BF	ACTIVE
6	9	5.14	FP-NC	1	BS	GF	OLD
6	10	4.98	FA	0		GMF	OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER STATUS
			TYPE	NO. SPECIES	SPECIES	SPECIES	
6	11	5.78	FA	0		GMF	ACTIVE
6	12	5.8	FP-NC	2	NRD, PD	GMF	OLD
6	13	5.91	FP-C	6	CC, CS, BD, BS, FM, LC		OLD
6	14	5.9	FP-C	6	CC, CS, BD, BS, FM, LC	BF	OLD
6	15	6.16	FP-C	2	CC, NRD		ACTIVE
6	16	5.51	FP-NC	5	GS, GS, BS, NRD, FD	BF, GMF	ACTIVE
6	17	6.23	FP-C	5	CC, BS, CS, NRD, FD	BF	OLD
6	18	6.01	FP-NC	2	BS, NRD	GF	OLD
6	19	5.92	FP-NC	1	BS	BF, GMF	OLD
6	20	5.84	FA	0			OLD
6	21	6.24	FP-C	2	WS, CC	BF	OLD
6	22	6.44	FP-C	4	BS, CC, FM, NRD	GMF	.
6	FC 23	5.68	FP-NC	1	BS	GF	ACTIVE
6	24	5.64	FA	0			OLD
6	25	6.12	FP-NC	3	NRD, FD, BS	BF, GMF	OLD
6	26	6.3	FP-C	1	CC		OLD
6	27**	.	.	.			.
7	1	5.5	FA	0			ACTIVE
7	FC 2	5.9	FA	0		GF	ACTIVE
7	3	6.64	FP-NC	2	BS, PD		OLD
7	4	6.78	FP-NC	1	PD	RSN, GMF	OLD
7	5	6.28	.	.			OLD
7	6	6.37	FP-NC	2	BS, PD		OLD
7	7	6.37	FP-NC	2	BD, BS		OLD
7	8	5.24	FA	0			ACTIVE
7	FC 9	5.48	FP-NC	1	PD	GF	OLD
7	10**	.	.	.			.
7	11	5.87	FP-NC	1	PD		ACTIVE
7	12	6.43	FP-NC	1	PD	GMF	OLD
7	13	6.94	FP-NC	1	PD	GF	ACTIVE
7	14	6.62	FP-C	1	CC, PD	GF	OLD
7	15	6.74	FP-C	5	WS, PS, PD, CC, BD		UNUSED
7	16	6.77	FP-NC	1	PD		OLD
7	17	6.74	FA	0			OLD
7	18	6.65	FP-C	5	WS, PD, CC, CS, BD		OLD
7	19	.	.	.			OLD
7	FC 20	7.02	FP-NC	2	NRD, FD	GF	OLD
7	21	6.21	.	.			OLD
7	22	6.57	FP-C	3	CC, BD, CS		OLD
7	23	6.72	FP-C	3	BD, CC, PD		OLD
7	24	6.93	FP-C	5	WS, PD, CC, CS, BD		OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
7	25	6.74	FP-C	4	BD, CC, PD, PS		OLD
7	26	6.69	FP-C	2	CC, PD		OLD
7	27	6.43	FP-NC	1	PD		ACTIVE
7	28	6.82	FP-C	4	FM, CC, BD, BT		OLD
8	1	6.48	FP-C	6	BS, CC, FM, GS, PD, FD		OLD
8	2	6.38	FP-NC	1	BS		ACTIVE
8	3	6.31	FA	0			OLD
8	FC 4	6.02	FP-C	6	BS, CS, CC, FM, GS, NRD		OLD
8	5	5.74	FP-NC	2	ID, GS		OLD
8	6	5.62	FP-NC	1	NRD	MF, AT	OLD
8	7	6.28	FP-C	5	CC, FM, GS, PD, NRD		OLD
8	8	5.48	FP-NC	3	CS, FM, NRD		OLD
8	9	5.83	FP-NC	1	FM		ACTIVE
8	10	6.88	FP-NC	1	BS		OLD
8	11	.	.	.			.
8	12	.	.	.			.
8	13	5.85	FP-NC	1	NRD	GMF	OLD
8	14	5.44	FP-NC	3	CC, FM, NRD		OLD
8	15	6.49	FP-NC	5	BS, ID, FM, CS, NRD		.
8	16	4.97	FA	0			UNUSED
8	17	6.64	FP-NC	2	PD, NRD	RSN	ACTIVE
8	FC 18	6.15	FP-C	7	BS, CC, FM, GS, PD, NRD, FD	GF	ACTIVE
8	19	.	.	.			UNUSED
8	20	6.51	FP-C	8	WS, FD, NRD, PD, FM, CC, CS, BS		OLD
8	21	6.21	FP-NC	1	ID		OLD
8	22	5.72	FP-C	1	CC		ACTIVE
8	23	6.15	FA	0			OLD
8	24	5.57	FA	0			ACTIVE
8	25	6.36	FP-C	7	BS, CC, CS, FM, PD, NRD, GS		OLD
9	1	5.51	FP-NC	3	PS, PD, BS		ACTIVE
9	2	6.22	FP-NC	3	NRD, FD, BS		OLD
9	FC 3	6.05	FP-NC	5	FD, NRD, FM, CS, BS	GF	OLD
9	4	6.45	FP-C	5	WS, NRD, FD, LC, BS		ACTIVE
9	5	6.44	FP-C	7	WS, BD, BS, CC, PD, PS, CS		ACTIVE
9	6	6.47	FP-C	4	WS, LC, FM, CC		UNUSED
9	7	6.76	FP-NC	2	NRD, BS		ACTIVE
9	8	6.66	FP-C	2	LC, FM		ACTIVE
9	9	6.62	FP-C	5	NRD, LC, FM, CC, BS		OLD
9	10	6.27	FP-C	5	WS, PS, BD, CC, CS		OLD
9	FC 11	5.75	FP-NC	5	BS, FM, NRD, FD, PD	GF	ACTIVE
9	12	6.15	FP-NC	4	NRD, FM, PD, BS		OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
9	13	5.89	FP-C	7	WS, PS, PD, FM, CC, CS, BS	RSN	ACTIVE
9	14	6.48	.	.			OLD
9	15	6.2	FP-C	4	CC, PD, NRD, FD	GMF	OLD
9	FC 16	6.57	FP-C	4	WS, NRD, PD, BS		OLD
9	17	5.84	.	.			OLD
9	18	6.34	FP-NC	1	NRD		OLD
9	19	6.30	FP-NC	4	PD, NRD, FD, BS		OLD
9	20	6.33	FA	0			OLD
9	21	5.64	FP-NC	5	CS, BS, PD, NRD, FD		OLD
9	22	6.48	FP-C	6	WS, PS, PD, FM, CC, BS		OLD
9	23	6.05	FP-C	6	CC, NRD, BD, BLS, FM, PD		OLD
9	24	6.62	FP-NC	3	ID, PD, PS	.	OLD
9	25	6.57	FP-C	8	WS, PS, PD, FM, CC, CS, BS, BLS		OLD

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1988, 1992, 1994, 1995)
TYPE = fish community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
ACTIVE = beavers occupying lake in autumn 1994
OLD = beavers not present in autumn 1994, but signs of past use
UNUSED = no sign of beaver presence observed during aerial survey

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
Lake Number ** = lake joined to lake above
. = no data

Fish Species

FM = fathead minnow (*Pimephales promelas*)
LB = largemouth bass (*Micropterus salmoides*)
YP = yellow perch (*Perca flavescens*)
NRD = northern redbelly dace (*Phoxinus eos*)
PD = pearl dace (*Semotilus margarita*)
BS = brook stickleback (*Culaea inconstans*)
ID = Iowa darter (*Etheostoma exile*)
BD = blacknose dace (*Rhinichthys atratulus*)
BRM= brassy minnow (*Hynognathus hankinsoni*)
NP = northern pike (*Esox lucius*)
BM = bluntnose minnow (*Pimephales notatus*)
CC = creek chub (*Semotilus atromaculatus*)
WS = white sucker (*Catostomus commersoni*)
BLS = blackchin shiner (*Notropis heterodon*)
FD = finescale dace (*Phoxinus neogaeus*)
HCS = hybrid creek chub - common shiner
BT = brook trout (*Salvelinus fontinalis*)
RT = rainbow trout (*Salmo gairdneri*)
SB = smallmouth bass (*Micropterus dolomieui*)
LT = lake trout (*Salvelinus namaycush*)
PUM = pumpkinseed (*Lepomis gibbosus*)
CS = common shiner (*Notropis cornutus*)
GS = golden shiner (*Notemigonus crysoleucas*)
BB = brown bullhead (*Ictalurus nebulosus*)
PS = *Phoxinus* spp.
LC = lake chub (*Couesius plumbeus*)
SS = sand shiner (*Notropis stramineus*)
CM = central mudminnow (*Umbra limi*)
RB = rock bass (*Ambloplites rupestris*)

Amphibian Species

GF = green frog (*Rana clamitans*)
BF = bullfrog (*Rana catesbeiana*)
WF = wood frog (*Rana sylvatica*)
MF = mink frog (*Rana septentrionalis*)
RSN = red spotted newt (*Notophthalmus viridescens*)
SP = spring peeper (*Hyla crucifer*)
GMF = green or mink frog
AT = American toad (*Bufo americanus*)

Table 17. Summary of waterfowl species and Common Loons observed as indicated breeding pairs or broods during helicopter surveys of Algoma study lakes (1988, 1992, 1994, 1995). (See legend for explanation of variables and notations).

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
1	1	6.98	FA	MA, BD, CG	CG
1	2	5.38	FP-NC	HM, MA, BD, RD, CG	BD, RD, CG
1	3	4.88	FA	CM, HM, MA, BD, CG	CG
1	4	5.06	FA	RD, CG	BD, CG
1	5	4.51	FA	HM, BD, CG	
1	6	4.83	FA	HM, CG	
1	7	5.09	FA	HM, CG	CG
1	8	5.18	FA	BD, CG	
1	9	5.20	FP-NC	HM, BD, CG	HM, RD, CG
1	10	4.88	FA	HM, CG	CG
1	11	5.18	FA	CM, HM, BD, CG	
1	12	5.18	FA	HM, BD, WD, CG	CG
1	13	5.30	FA	CG	WD
1	14	4.88	FA	MA, CG	BD
1	15	5.54	-	CG	
1	16	5.40	FA	HM, CG	
1	FC 17	4.91	FA	CG	
1	18	4.80	FA	CG	
1	19	5.11	FA	HM, BD, RD, CG	HM, CG
1	20	5.12	FA	BD, CG	
1	21	5.22	FA	RD, CG	
1	22	4.71	FA	RD	
1	FC 23	5.20	FA	HM, WD, CG	CG
1	24	5.29	-		
1	25	4.57	FA	CG	
1	26**	4.99	-	CG	
1	27	4.61	FA	HM, RD, CG	CG
1	28	4.67	FA	CG	BD
1	29	5.10	FA	CL, MA, BD	CL
1	30	4.52	FA	HM, BD, CG	CG
1	31	5.08	FP-NC	CL, HM, RD, CG	CG
1	32	4.61	-	RD, CG	
1	33	5.10	FA	CL, MA, BD, CG	HM, MA, BD, CG
1	34	4.95	FA	CG	BD
2	1	6.66	FA	HM, MA, BD, RD, CG	RD, CG
2	2	6.76	FA	WD, RD, CG	CG
2	3	6.78	FA	MA, BD, RD, CG	HM, WD, RD, CG
2	4	7.06	FA	HM, MA, BD, CG	CG
2	5	.	FA		
2	6	7.16	FA	CG	CG
2	FC 7	6.98	FA	CL, HM, BD, CG	CL, BD

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
2	8	6.97	FP-C	CL, CM	CM
2	9	6.81	FP-C	CM, MA	CM
2	10	6.85	FA	CL, BD, CG	CL, CG
2	11	-	-		
2	12	6.90	FP-C	CL, RD, CG	CM, BD, RD
2	13	6.90	FP-C	MA, BD, RD	HM, CG
2	14	7.09	FP-C	BD	
2	15	6.70	FP-C	CL, CM	CM
2	FC 16	6.31	FA	CL, CM, MA, BD, CG	CG
2	17	5.84	FA	HM	CG
2	18	6.84	FA	MA, CG	CG
2	19	6.89	FP-C	CL, HM, RD	CL, BD, CG
2	20	5.87	FA	HM, MA, BD, CG	HM
3	1	5.70	FP-NC	CL, CG	RD
3	2	5.20	FA	HM, CG	BD, CG
3	3	5.35	FA	MA, RD, CG	RD
3	4	5.61	FA	HM, BD, RD, CG	
3	5	6.01	FA		BD
3	6	6.11	FP-NC	HM, MA, BD, RD, CG	RD
3	7	6.02	FP-NC	HM, RD, CG	RD
3	8	4.30	FA		
3	9	4.91	FA	MA, BD, CG	CG
3	10	4.98	FA	HM, RD, CG	BD, RD, CG
3	11	5.17	FA		HM, MA, BD, WD
3	FC 12	5.21	FA	HM, BD, RD, CG	RD, CG
3	13	5.18	FA	HM, MA, RD	RD, CG
3	14	4.82	FP-C	HM, RD, CG	BD, RD
3	15	6.26	FP-C	BD	CG
3	16	5.12	FA	HM, WD, CG	CG
3	17	4.97	FA	BD, CG	
3	18	5.47	FA	MA, CG	CG
3	19	5.68	FP-NC	HM, RD, CG	
3	20	6.62	FP-NC	HM, MA, BD, CG	MA, BD
3	21	6.47	FP-NC	HM, BD	WD, RD
3	22	6.21	FA	HM, MA, BD, RD, CG	RD, CG
3	23	5.35	FA	HM, BD, WD, CG	BD, CG
3	24	5.40		HM	BD, CG
3	25	5.85	FP-NC	CM, CG	RD
3	26	6.24	FP-NC	CG	CG
3	27	5.91	FA	BD, CG	HM, BD, RD, CG
3	28	6.39	FP-NC	HM, MA, BD, RD, CG	RD, CG
3	29	5.90	FP-NC	HM, MA, BD, RD	
3	30	6.14	FP-C	WD, CG	CG
3	31	6.22	FP-C	HM, RD, CG	
3	32	5.69	FP-NC	CM, MA, BD, RD, CG	HM, BD, WD, RD, CG
3	FC 33	6.05	FP-NC	CM, HM, MA, BD, WD, RD, CG	CM, BD

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
3	34	6.30	FP-NC	MA	
3	35	6.52	FP-C	CM	CM, HM
4	1	5.90	FA	RD	RD
4	2	5.29	FA	HM, BD, RD, CG	BD, RD, CG
4	3	5.68	FA		
4	4	.	.		
4	5	.	.		
4	6	4.95	FA	HM, RD, CG	HM, CG
4	7	5.48	FA	CG	MA, BD
4	8	.	.		
4	9	.	.		
4	10	6.04	FA	HM, BD, CG	HM, CG
4	11	5.36	FA		
4	FC 12	5.23	FA	BD, CG	CG
4	13	5.65	FA	HM, RD, CG	BD, CG
4	14	5.24	FA	CL, HM, BD, RD, CG	CL, HM, BD, RD, CG
4	15	5.41	FA	HM, BD, RD, CG	HM, BD, WD, CG
4	16	5.44	.	HM, BD, WD	
4	17	5.21	FA	HM, MA, RD, CG	BD, RD, CG
4	18	5.30	FP-C	CL, CM, HM, MA, BD, WD, RD, CG	BD, CG
4	19	5.30	FP-C	HM, MA, BD, WD, RD, CG	RD, CG
4	20	5.61	FA	HM, CG	CG
4	21	5.86	FA	HM, BD, RD, CG	RD, CG
4	22	6.55	FP-C	CM, HM, BD, RD, CG	
4	23	6.68	FA	CM, CG	RD
4	24	6.23	FA	HM, BD, CG	BD, RD
4	25	5.19	FA	HM, MA, BD, RD, CG	BD, RD, CG
4	26	5.72	FP-C	CM, HM, MA, BD, RD, CG	BD, WD, RD, CG
4	27	5.32	FP-C	RD	
4	28	6.17	FA	CL, HM, BD, RD, CG	
4	FC 29	5.15	FA	CL, HM, BD, RD, CG	HM, BD, CG
4	30	5.94	FA	HM, RD, CG	HM, CG
4	31	5.67	FA	HM, BD, RD, CG	BD, CG
4	32	5.86	FA		
4	33	5.94	FA	BD, WD, RD, CG	
4	34	5.20	FA		WD
4	35	6.60	FP-C	CL, CM, HM, MA, BD, RD, CG	CM, HM, RD, CG
4	36	.	.		
4	37	6.65	FP-C	RD	WD
5	1	5.85	FP-C	CL, CM, HM, BD, RD, CG	HM, MA, BD, WD, RD, CG
5	2**	5.98	.	CL, MA, BD, CG	CG
5	3	5.92	FA	HM, BD, RD, CG	HM, BD, RD, CG
5	4	5.71	FA	HM, MA, BD, CG	HM, BD
5	5	6.11	FP-C		CM
5	6	6.35	FA		
5	7	6.38	FP-C		

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
5	8	6.33	FP-C	CM	CM, BD, RD
5	9	6.37	FP-C	CM, WD, RD	BD
5	10	5.42	FA	HM, MA, BD, WD, RD, CG	BD, CG
5	11	5.75	FP-C	CL	
5	12	6.35	FA	CL	CM
5	13	5.45	FP-C	HM, MA, BD, RD, CG	HM, MA, CG
5	14	5.98	FP-NC	BD, RD, CG	RD
5	15	6.42	FP-C	BD	
5	16	6.53	FA	BD	CM
5	17	6.44	FA	HM, BD, RD, CG	CM, HM, CG
5	18	6.47	FA	CG	HM, CG
5	FC 19	6.16	FP-NC	HM, MA, BD, RD, CG	HM
5	20	6.37	FA	BD, RD, CG	CG
5	21	6.12	FP-NC	CL, CM, BD, RD, CG	MA, BD, RD
5	22	6.42	FA	CG	
5	23	5.20	FA	HM, BD, WD, RD, CG	HM, BD, CG
5	FC 24	5.27	FA	HM, BD, RD, CG	BD, CG
5	25	.	.		
6	1	.	.		
6	2	6.17	FP-NC	CL, CM, HM, BD, CG	CL, CM, BD, RD
6	3	5.87	FP-NC	CL, HM, BD	CL, CM, BD
6	4	5.86	FP-C	CL, CM, HM, BD	CL, BD, WD
6	FC 5	6.03	FA	HM, MA, BD, CG	HM, RD, CG
6	6	4.97	FA	MA, BD, RD, CG	HM, BD, CG
6	7	6.19	FP-C	HM	CM
6	8	6.09	FP-NC	CM, HM	CM
6	9	5.14	FP-NC	HM, BD	
6	10	4.98	FA	HM, BD, WD, RD, CG	HM, WD, CG
6	11	5.78	FA	CL, BD, CG	
6	12	5.80	FP-NC	CL, CM, MA, BD, RD, CG	CG
6	13	5.91	FP-C	CL, CM, HM	
6	14	5.90	FP-C	CM	CM
6	15	6.16	FP-C	BD	RD
6	16	5.51	FP-NC	CL, CM	CL
6	17	6.23	FP-C	CL, CM, BD	CL, CM
6	18	6.01	FP-NC	CL, CM	CL, HM
6	19	5.92	FP-NC	CL	CL
6	20	5.84	FA	CG	CG
6	21	6.24	FP-C	CL, CM	
6	22	6.44	FP-C	CL, CM, HM, MA, BD, WD, CG	CM, HM, BD
6	FC 23	5.68	FP-NC	CL, HM	BD
6	24	5.64	FA	CL	
6	25	6.12	FP-NC	CL, CM	CL, CM
6	26	6.30	FP-C	BD, CG	CG
6	27**	.	.	CM	RD
7	1	5.50	FA	HM, RD, CG	RD, CG

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
7	FC 2	5.90	FA	CL, HM, BD, CG	HM, RD, CG
7	3	6.64	FP-NC	CM, HM, RD	
7	4	6.78	FP-NC	CM, BD, RD, CG	BD
7	5	6.28	.		
7	6	6.37	FP-NC	BD, RD	
7	7	6.37	FP-NC	CL, CM, MA, BD, RD	CL, HM, RD
7	8	5.24	FA	HM, CG	HM
7	FC 9	5.48	FP-NC	HM, BD, RD, CG	BD, RD
7	10**		.		
7	11	5.87	FP-NC	RD	
7	12	6.43	FP-NC	HM, RD, CG	CG
7	13	6.94	FP-NC	CM, HM, RD, CG	HM
7	14	6.62	FP-C		
7	15	6.74	FP-C	CM	
7	16	6.77	FP-NC	HM, BD	HM
7	17	6.74	FA		
7	18	6.65	FP-C		
7	19	.	.		
7	FC 20	7.02	FP-NC	RD, CG	CG
7	21	6.21	.		
7	22	6.57	FP-C		
7	23	6.72	FP-C	BD, RD	
7	24	6.93	FP-C	BD, RD	HM, BD
7	25	6.74	FP-C	HM, BD	
7	26	6.69	FP-C	RD	CG
7	27	6.43	FP-NC		HM
7	28	6.82	FP-C	CL, HM, MA, BD, RD, CG	BD
8	1	6.48	FP-C	CL, CM, BD, RD	CL, CM, BD, RD
8	2	6.38	FP-NC	BD, RD	CL, CM, HM, RD
8	3	6.31	FA	RD	
8	FC 4	6.02	FP-C	CL, CM, HM, MA, BD	HM, RD
8	5	5.74	FP-NC	CL, HM, RD, CG	RD, CG
8	6	5.62	FP-NC		
8	7	6.28	FP-C	CM, HM, BD, RD	
8	8	5.48	FP-NC	BD, RD, CG	BD, RD, CG
8	9	5.83	FP-NC	HM, BD, RD, CG	
8	10	6.88	FP-NC	CM, MA, BD, RD	BD
8	11	.	.		
8	12	.	.		
8	13	5.85	FP-NC	CL, HM, BD, RD	
8	14	5.44	FP-NC	CL, HM, RD, CG	MA
8	15	6.49	FP-NC	CL, CM, HM, RD	CL, HM, RD
8	16	4.97	FA	BD, RD	
8	17	6.64	FP-NC	CL, CM, HM	BD, RD, CG
8	FC 18	6.15	FP-C	CL, HM, BD, RD	BD, RD
8	19	.	.		

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
8	20	6.51	FP-C	CL, CM, HM, BD, RD, CG	HM, BD, WD
8	21	6.21	FP-NC	CL, HM, MA, BD	
8	22	5.72	FP-C	CM, HM, BD, RD	CM, HM, RD
8	23	6.15	FA	CM	
8	24	5.57	FA	CM, HM, MA, BD, WD, RD, CG	MA, CG
8	25	6.36	FP-C	CM, HM, BD, RD, CG	CM, BD
9	1	5.51	FP-NC	HM, RD	RD
9	2	6.22	FP-NC	MA, BD, RD	HM
9	FC 3	6.05	FP-NC	CL, CM	HM
9	4	6.45	FP-C	CL	
9	5	6.44	FP-C	CL	CL
9	6	6.47	FP-C		BD
9	7	6.76	FP-NC	CL	
9	8	6.66	FP-C	CM, BD	
9	9	6.62	FP-C	CL, CM, MA	HM, WD
9	10	6.27	FP-C		
9	FC 11	5.75	FP-NC	CL, RD	
9	12	6.15	FP-NC	CL, HM, BD	BD
9	13	5.89	FP-C	CL, HM, CM, BD, RD	HM, BD, RD
9	14	6.48	.	CM, BD	BD
9	15	6.20	FP-C	CM	
9	FC 16	6.57	FP-C	CM	HM
9	17	5.84	.		
9	18	6.34	FP-NC	CM, HM, BD, WD, RD	BD, RD
9	19	6.30	FP-NC	BD	
9	20	6.33	FA	HM	
9	21	5.64	FP-NC	BD	BD
9	22	6.48	FP-C	CL, CM	CL
9	23	6.05	FP-C	BD, RD	
9	24	6.62	FP-NC	CL	
9	25	6.57	FP-C	CL, CM, HM, RD	RD

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1988, 1992, 1994, 1995)
FISH TYPE = fish community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
INDICATED PAIRS = presence of breeding pair of a waterfowl species
BROODS = presence of broods of a waterfowl species

NOTATIONS

FC ***Lake Number*** = food chain lake
Lake number = drained as of autumn 1995
Lake Number ** = lake joined to lake above
. = no data

Waterfowl Species

CL = Common Loon (*Gavia immer*)
CM = Common Merganser (*Mergus merganser*)
HM = Hooded Merganser (*Lophodytes cucullatus*)
MA = Mallard (*Anas platyrhynchos*)

BD = Black Duck (*Anas rubripes*)
WD = Wood Duck (*Aix sponsa*)
RD = Ring-necked Duck (*Aythya collaris*)
CG = Common Goldeneye (*Bucephala clangula*)

ONTARIO REGION BIOMONITORING STUDY

MUSKOKA

Table of Contents Page

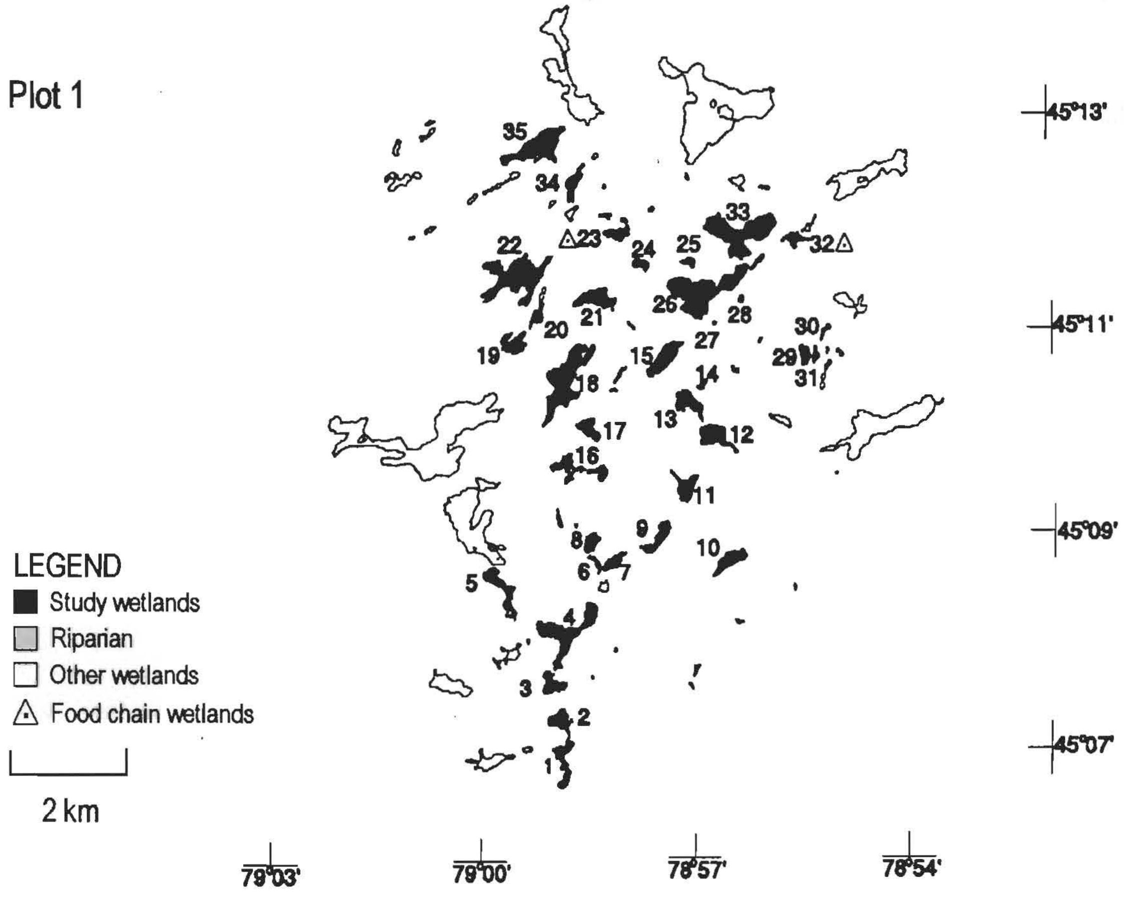
Key to Figure 12. Maps of Muskoka study plots 1-7 showing the location of study lakes, including food chain lakes, and other wetlands. Lake names associated with CWS LRTAP study lakes in Muskoka are listed below. Local names not present on EMR 1:50 000 and Provincial Series 1:100 000 topographic maps are indicated by NL (not listed).

PLOT	LAKE	LAKE NAME
1	2	Circular (Round)
	3	Grouse
	4	Teapot
	5	Campstool
	7	Saucer
	8	Sugarbowl
	9	Jill (Long)
	11	Mug
	12	Pairo (Lower Twin)
	13	Pairo (Upper Twin)
	15	Carcass (Skeleton)
	16	Cream
	18	Ridout (Stoney)
	19	Splatter
	21	Insula (Porky Island)
	22	Martin
	23	Fly
	26	Red Chalk
	33	Blue Chalk
	35	Chub
2	1	Silver Buck
	2	Silver Doe
	3	Silver Otter Pond (NL)
	4	Dawson Pond (Lower)
	5	Dawson Pond (Upper)
	6	Mouse
	8	Plastic
	10	Sundew Pond (NL)
	13	Little Avery
2	14	Bruin (NL)
	15	Long Pond (Roche Pond) (NL)
	18	Avery
	19	Emmerson Pond (NL)
	21	Orley
	26	Shoelace Creek
	27	Wallace Pond (NL)
	29	Shoelace
	30	Glennies Pond (NL)
	34	Nehemiah
	35	Ronald
	36	Ernest
3	2	Corbett
	5	McTaggart (NL)
	6	Beast
	8	Arbuckle
	9	Quiver Creek Reservoir
	12	Bertie
	14	Notsobig
	23	Bright
	24	Thumb
	25	Lumber
	28	Niger
	29	Quiver
4	13	West Frog
	14	Sly
	15	Doughnut
	22	Skunk
	23	Hardy Creek

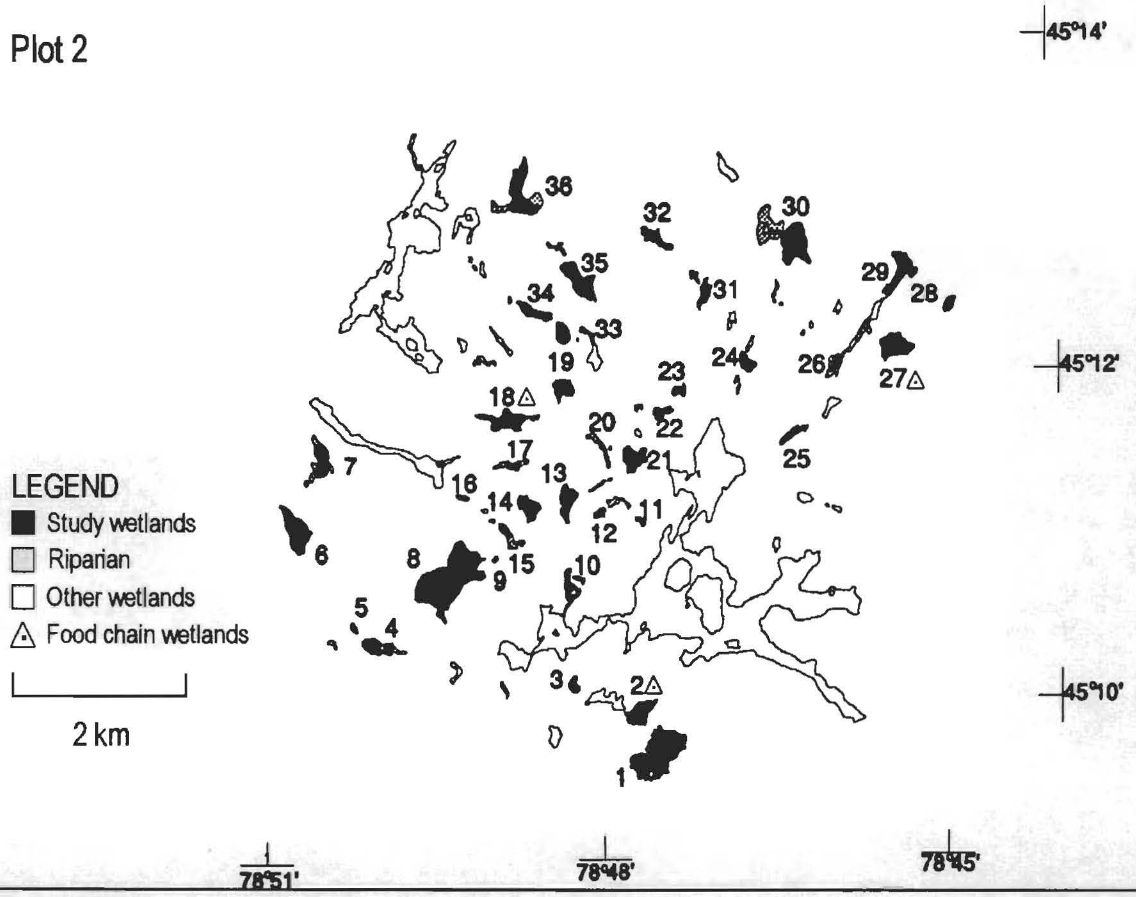
PLOT	LAKE	LAKE NAME
4	24	Slim
	25	Little Hardy
	34	Dale
	35	Steeprise
5	6	Little Kennisis River
	8	Round (NL)
	9	Lisa (NL)
	13	Little Kennisis River (Archer's Marsh)
	14	Little Kennisis River (Archer's Marsh)
	15	Depot (NL)
	16	Buck (NL)
	22	Ban (NL)
	29	Head (NL)
6	1	Norah
	3	Oak
	4	Dace
	5	Ramona (NL)
	6	Namakootchie
	8	Kagh
	9	Drummer and Little Drummer
	10	Tonakela
	11	Panther
	13	North Oak
	14	Telma
	15	Mossy
	16	Forlorn
	17	Thunder
6	19	Red Wing
	20	Lupus Creek
	21	Lupus
	22	Guide
	23	Brownie
	25	Snowshoe
	26	Mermaid
	28	Susan
	29	South Snowbird
	30	Trail
	34	Lark
	36	West Otterpaw
	38	Pincher
7	4	Splash
	5	Sunset
	11	Little Eastend Lake
	20	O'Gorman
	21	Way
	22	Wee
	24	Lay
	25	Stutter
	26	North Clyde
	27	Stammer
	28	Long Thin
	30	Weed
	35	Mackinaw

Muskoka Plots and Lakes

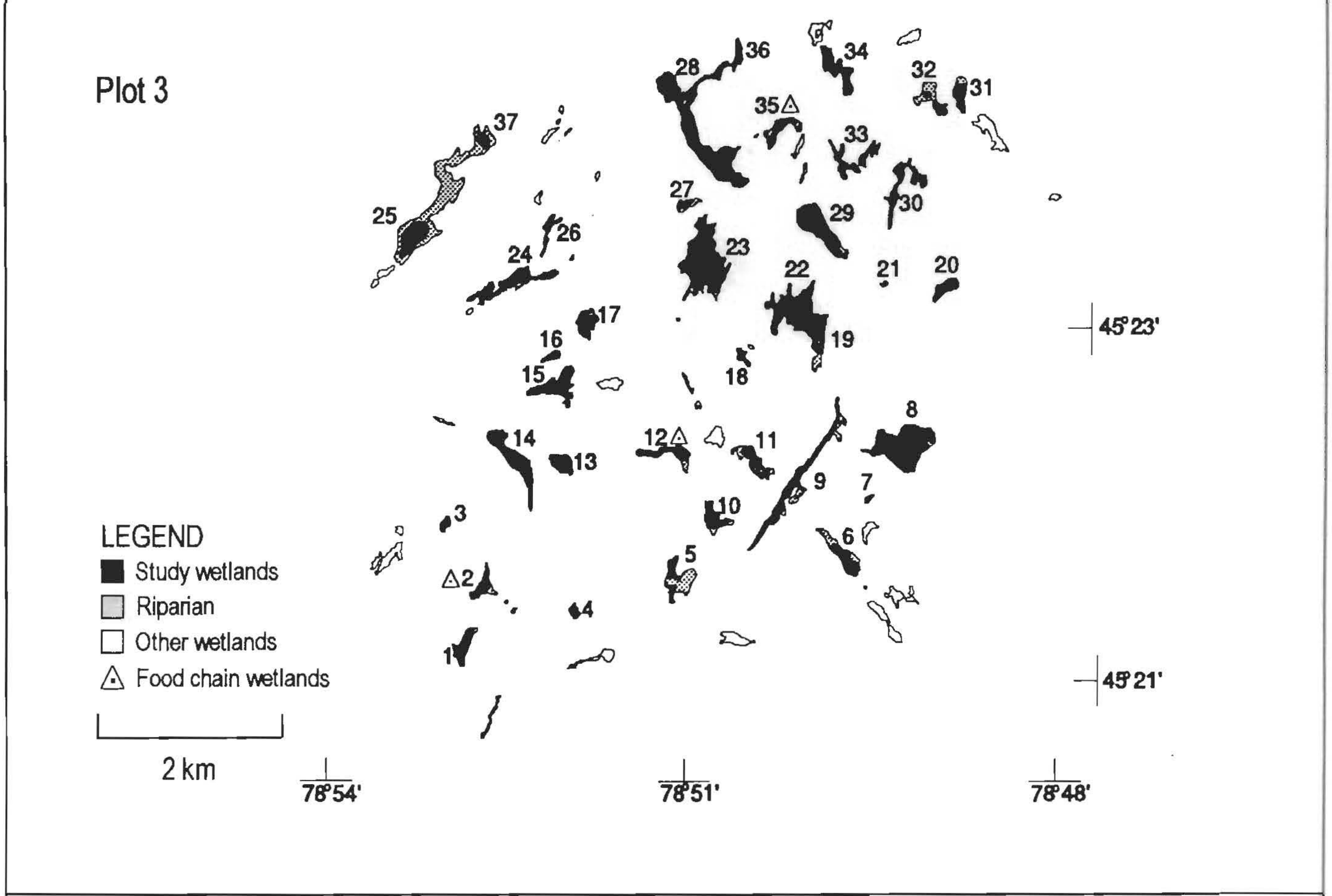
Plot 1

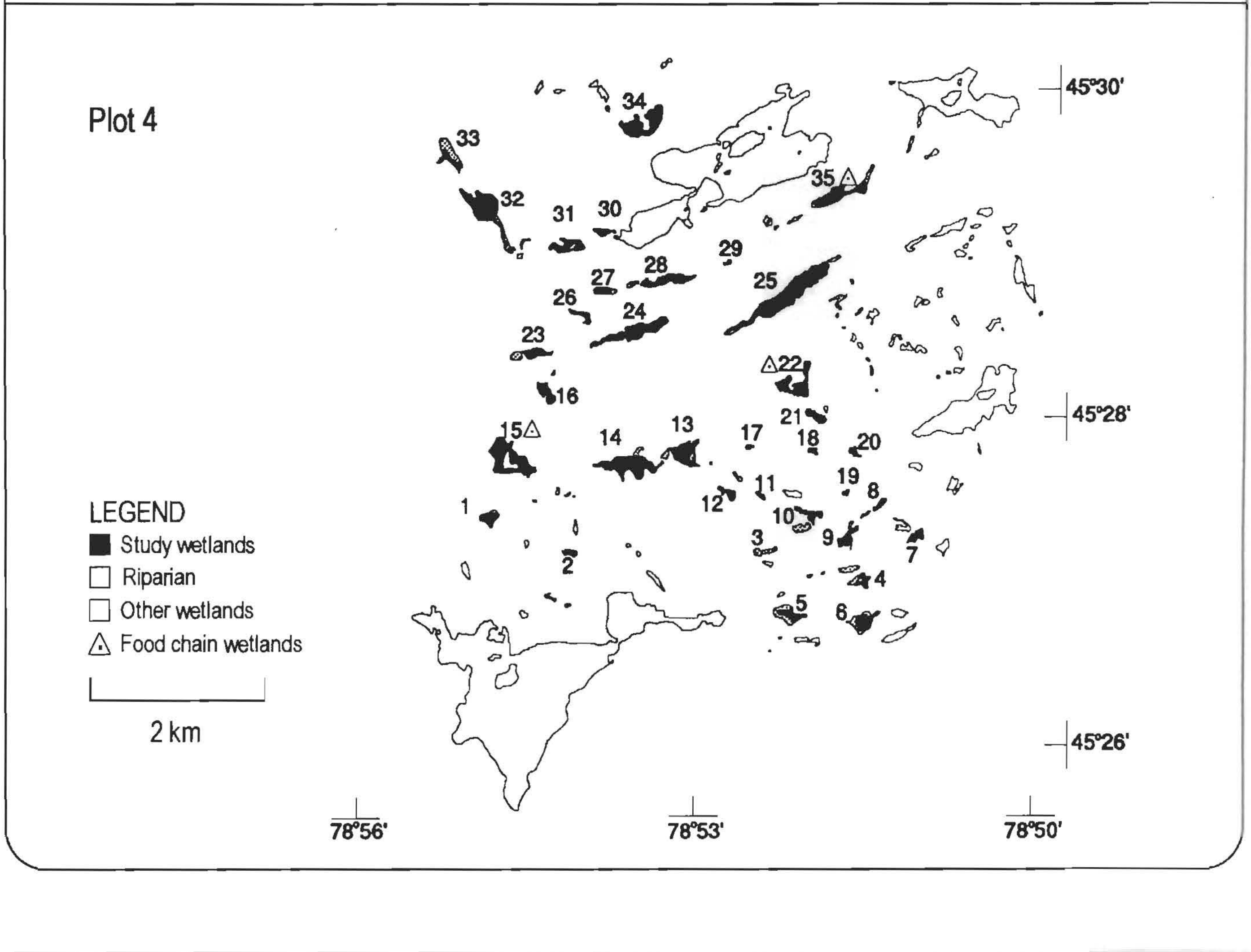


Plot 2

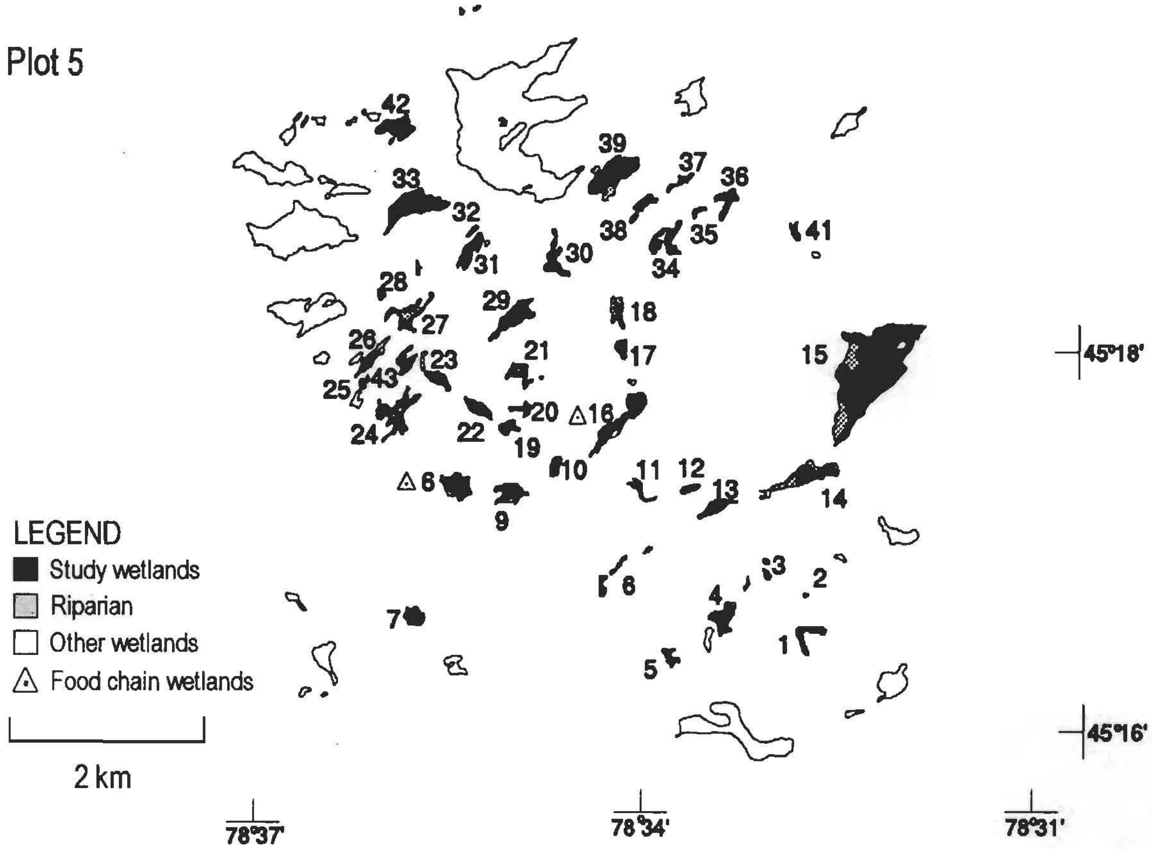


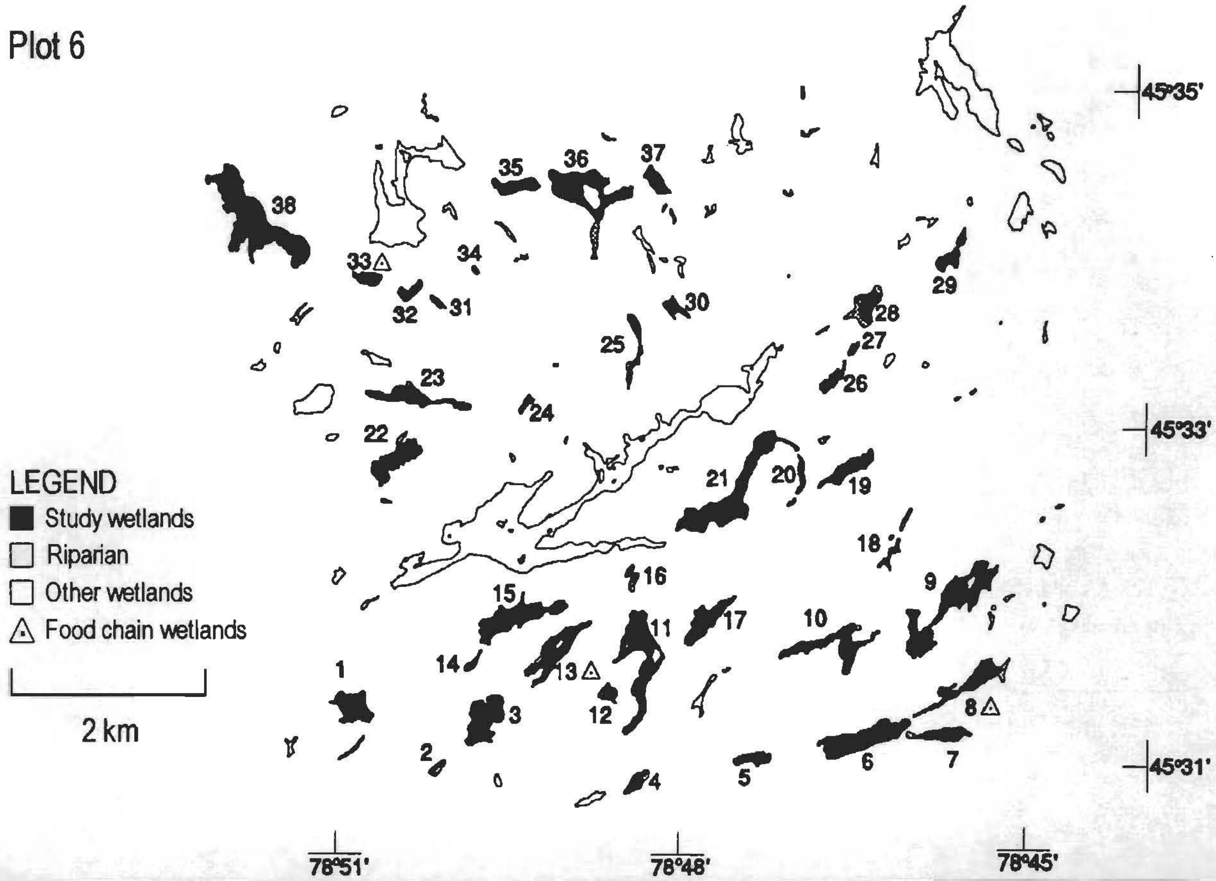
Muskoka Plots and Lakes





Muskoka Plots and Lakes





Plot 7

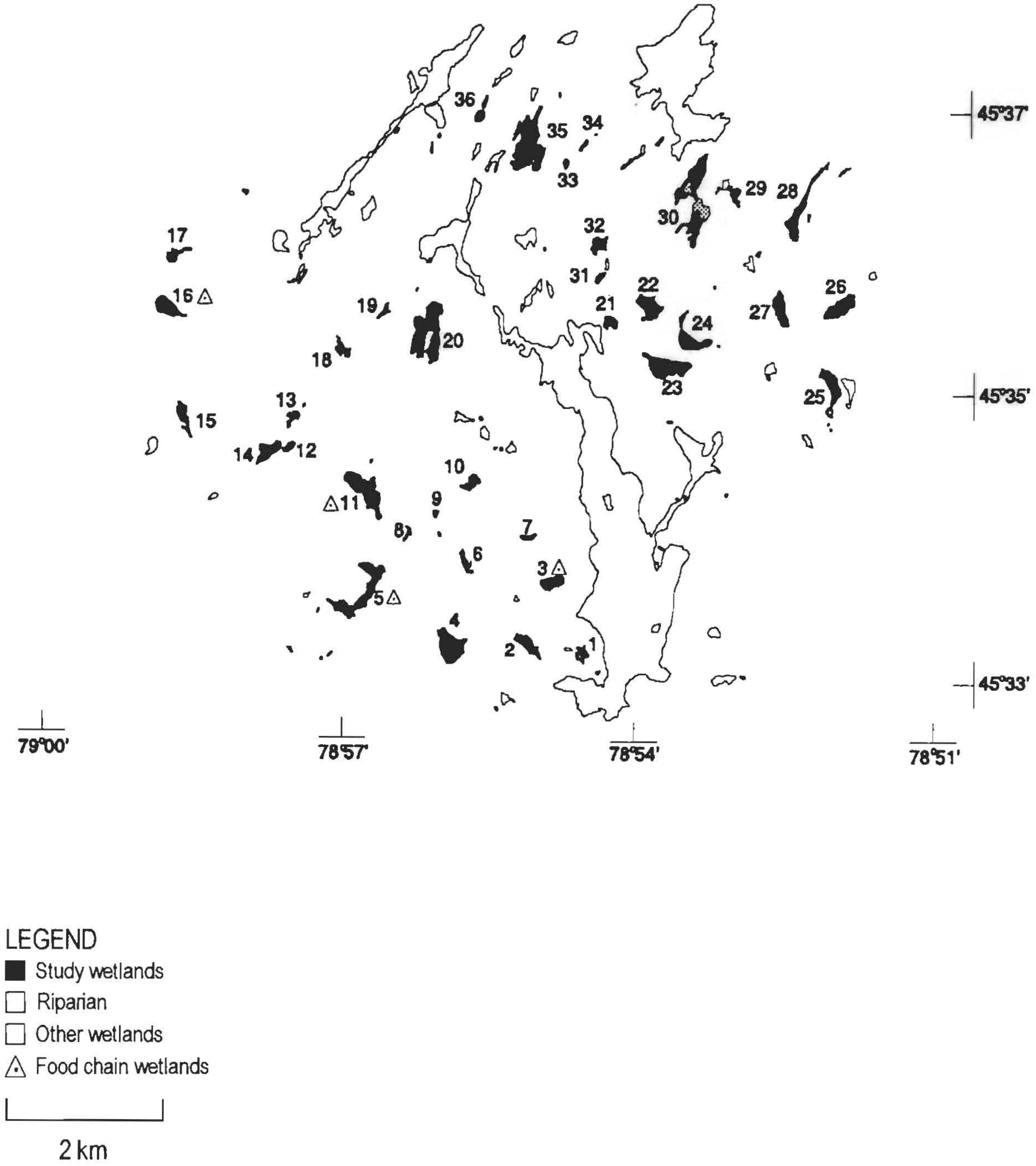

36
35
34
33
29
28
30
32
17
31
22
26
16
19
21
27
24
20
18
23
13
25
15
14
12
10
11
9
8
7
6
3
5
4
2
1
45°37'
45°35'
45°33'
79°00'
78°57'
78°54'
78°51'
LEGEND
■ Study wetlands
☐ Riparian
☐ Other wetlands
△ Food chain wetlands
2 km

Table 18. Locations and morphometric characteristics of Muskoka study lakes, identified by plot and lake number. (See legend for explanation of variables and notations).

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
1	1	6587	49976	2EC	98	12.1	1.7	4006	16.8	2	1
1	2	6586	49983	2EC	99	11.2	8.2	2489	1.8	3	0
1	3	6585	49990	2EC	99	6.7	5.5	1804	5.0	3	0
1	4	6587	49999	2EC	99	30.7	8.8	4540	3.8	13	2
1	5	6575	50007	2EC	101	11.6	8.0	2577	4.7	4	0
1	6	6595	50013	2EC	100	3.1	0.6	1145	0.2	3	0
1	7	6596	50011	2EC	100	5.6	7.7	1009	1.9	2	0
1	8	6592	50014	2EC	100	6.1	8.4	1266	9.7	2	0
1	9	6607	50017	2EC	101	9.9	3.4	1916	1.5	2	0
1	10	6618	50013	2EC	100	11.1	9.1	1732	0.1	1	0
1	11	6609	50024	2EC	106	9.5	5.2	1448	1.5	5	0
1	12	6615	50035	2EC	98	13.9	5.8	2389	4.9	10	0
1	13	6610	50040	2EC	99	11.4	9.6	2309	5.6	6	2
1	14	6613	50043	2EC	99	1.3	0.0	720	2.3	6	0
1	15	6605	50047	2EC	101	16.3	11.2	2154	0.0	1	0
1	16	6589	50029	2EC	110	9.4	3.0	2761	7.2	2	0
1	17	6592	50035	2EC	114	7.7	8.5	1713	0.3	1	2
1	18	6588	50044	2EC	108	45.0	20.4	5563	2.0	2	1
1	19	6579	50048	2EB	107	9.9	5.1	2000	23.2	7	0
1	20	6584	50054	2EB	108	4.3	0.6	2572	1.5	2	1
1	21	6595	50058	2EC	104	15.2	8.6	2360	0.6	1	2
1	22	6580	50063	2EB	107	45.0	12.2	6113	17.2	3	1
1	FC 23	6598	50068	2EB	111	6.5	4.9	1264	0.5	5	0
1	24	6602	50064	2EC	106	3.9	4.1	904	9.0	1	0
1	25	6610	50064	2EC	104	2.6	6.0	736	0.9	3	0
1	26	6612	50058	2EC	104	51.8	30.5	4789	2.9	5	1
1	27	6615	50053	2EC	103	0.2	0.7	196	2.2	4	0
1	28	6619	50058	2EC	104	1.0	4.2	385	1.4	1	0
1	29	6631	50048	2EC	112	4.6	15.0	1003	0.2	1	0
1	30	6633	50048	2EC	111	1.3	2.6	1111	0.7	3	1
1	31	6636	50046	2EC	106	0.9	0.0	578	0.7	2	0
1	FC 32	6629	50068	2EB	111	4.5	3.7	1184	0.5	2	1
1	33	6619	50069	2EC	107	47.1	20.0	4339	1.7	1	0
1	34	6589	50077	2EB	114	3.3	6.3	1154	5.4	1	0
1	35	6585	50085	2EB	115	32.1	21.0	3929	2.2	2	0
2	1	6736	50032	2HF	112	21.9	23.9	2565	2.0	2	2
2	FC 2	6733	50036	2HP	112	5.7	8.6	1110	0.0	2	0
2	3	6726	50039	2HF	110	1.5	4.5	557	1.6	1	0
2	4	6704	50042	2HF	116	2.8	4.0	906	4.7	2	0
2	5	6701	50044	2HF	116	0.5	3.8	306	2.3	1	0
2	6	6694	50055	2EB	112	8.7	7.6	1456	0.2	1	0
2	7	6697	50063	2EB	115	4.8	5.6	997	3.0	1	0
2	8	6710	50049	2HF	116	31.2	14.8	3365	0.5	2	0
2	9	6717	50052	2HF	116	0.3	0.5	218	0.3	1	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
2	10	6725	50049	2HF	112	3.0	0.9	1497	2.4	1	1
2	11	6733	50056	2HF	114	0.7	3.3	368	0.8	2	0
2	12	6729	50057	2HF	120	1.0	6.7	448	0.9	1	0
2	13	6725	50059	2HF	115	4.8	15.0	1113	4.0	7	0
2	14	6721	50057	2HF	115	4.4	12.3	919	1.0	1	0
2	15	6717	50056	2HF	110	1.8	4.5	1183	2.7	2	0
2	16	6713	50058	2HF	110	0.7	0.9	357	1.6	2	0
2	17	6718	50063	2EB	118	1.8	3.5	1908	0.9	1	0
2	**FC 18**	6718	50067	2EC	121	7.5	12.0	1852	0.6	1	0
2	19	6724	50072	2HF	121	3.8	7.1	936	0.8	2	0
2	20*	6728	50066	2HF	122	1.6	.	925	0.4	1	0
2	21	6732	50063	2HF	115	5.4	8.9	1226	1.6	1	1
2	22	6736	50068	2HF	119	3.7	4.2	2175	0.8	1	1
2	23	6737	50071	2HF	115	1.4	0.3	571	0.4	2	0
2	24	6745	50075	2HF	124	2.3	3.4	1006	0.2	5	1
2	25	6750	50067	2HF	115	2.1	0.0	937	1.5	5	0
2	26	6756	50074	2HF	124	1.4	12.7	520	3.8	1	0
2	**FC 27**	6762	50076	2EB	120	7.5	14.2	1194	2.0	3	0
2	28	6768	50081	2HF	125	2.9	5.1	753	0.6	1	0
2	29	6763	50085	2HF	125	6.5	9.1	1588	2.9	0	0
2	30	6751	50087	2EB	121	11.1	4.9	1490	13.2	2	0
2	31	6741	50083	2EB	116	2.6	0.9	1258	7.7	2	1
2	32	6735	50088	2EB	125	3.7	0.0	1138	4.4	1	0
2	33	6727	50077	2EB	106	0.5	.	344	3.1	0	0
2	34	6723	50079	2EB	125	6.3	12.1	1690	3.3	3	0
2	35	6727	50083	2EB	125	8.3	4.0	1687	3.4	1	0
2	36	6719	50092	2EB	117	9.8	2.3	1821	8.4	2	0
3	1	6660	50244	2EB	126	3.6	2.9	1015	0.7	1	0
3	**FC 2**	6663	50250	2EB	126	3.6	8.0	1172	1.4	1	0
3	3	6658	50257	2EB	135	0.7	3.2	383	2.8	3	0
3	4	6673	50248	2EB	124	2.2	0.6	927	0.8	8	0
3	5	6684	50251	2EB	129	3.4	1.5	1517	5.2	1	0
3	6	6702	50253	2EB	130	4.5	5.6	1033	5.2	4	0
3	7	6704	50259	2EB	134	0.5	8.8	306	1.4	1	0
3	8	6708	50264	2EB	128	20.3	4.3	2337	2.6	5	0
3	9	6694	50258	2EB	130	15.8	1.9	5107	0.8	6	0
3	10	6687	50257	2EB	139	4.0	11.6	1030	0.9	1	0
3	11	6692	50263	2EB	139	3.3	5.2	963	3.1	1	0
3	**FC 12**	6683	50264	2EB	135	4.5	5.9	1403	1.4	3	0
3	13	6672	50263	2EB	130	3.9	10.2	818	3.4	2	0
3	14	6666	50264	2EB	130	10.4	14.1	2312	2.6	3	0
3	15	6670	50272	2EB	135	8.0	2.1	1889	0.5	2	0
3	16	6670	50275	2EB	134	1.3	5.6	541	3.2	1	0
3	17	6674	50278	2EB	143	4.8	3.9	1777	1.7	3	2
3	18	6690	50275	2EB	147	1.4	1.4	627	0.0	1	0
3	19	6697	50277	2EB	135	6.6	6.9	1469	1.7	2	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
3	20	6713	50282	2EB	130	3.3	2.4	846	1.5	2	0
3	21	6705	50282	2EB	129	0.3	0.8	246	7.0	9	0
3	22	6697	50281	2EB	140	2.1	0.6	837	0.7	0	0
3	23	6686	50285	2EB	144	25.6	9.2	3453	1.1	2	0
3	24	6666	50283	2EB	134	10.1	11.2	2839	2.0	2	0
3	25	6655	50287	2EB	125	6.8	1.5	1100	5.9	1	0
3	26	6667	50288	2EB	139	2.3	0.0	1262	0.0	0	0
3	27	6684	50290	2EB	140	0.4	4.5	248	2.4	3	0
3	28	6683	50300	2EB	136	27.1	11.4	4337	0.3	4	1
3	29	6697	50288	2EB	130	11.7	8.7	1768	10.4	5	0
3	30	6707	50293	2EB	141	6.8	1.6	2683	0.2	1	1
3	31	6713	50303	2EB	139	2.6	2.3	808	1.1	2	0
3	32	6712	50300	2EB	140	3.2	0.8	1220	1.9	1	0
3	33	6702	50296	2EB	141	4.8	0.6	2411	1.0	3	0
3	34	6701	50304	2EB	139	0.8	0.0	404	6.0	0	0
3	FC 35	6694	50297	2EB	139	4.3	2.5	1482	3.7	1	0
3	36	6689	50306	2EB	136	5.3	0.9	2152	0.2	1	0
3	37	6630	50297	2EB	125	1.8	6.4	595	2.5	0	0
4	1	6633	50357	2EB	139	2.4	2.8	634	1.0	2	0
4	2	6642	50353	2EB	149	1.3	0.0	687	0.3	2	0
4	3	6664	50354	2EB	140	0.6	0.6	310	1.2	1	0
4	4	6675	50352	2EB	143	2.1	1.2	956	0.2	1	1
4	5	6667	50347	2EB	134	2.2	0.6	828	3.3	2	0
4	6	6675	50346	2EB	130	3.0	14.0	833	2.1	4	0
4	7	6682	50356	2EB	150	2.3	1.4	1117	0.1	1	1
4	8	6678	50359	2EB	151	0.9	0.6	459	0.2	3	0
4	9	6674	50356	2EB	148	1.8	0.5	913	3.5	2	0
4	10	6668	50357	2EB	150	2.2	0.0	976	1.7	1	0
4	11	6665	50359	2EB	153	1.2	0.0	541	0.4	1	0
4	12	6660	50361	2EB	147	1.5	0.0	677	0.7	0	0
4	13	6655	50365	2EB	148	5.7	6.7	1574	0.4	1	1
4	14	6648	50363	2EB	149	9.9	12.9	2059	1.9	1	0
4	FC 15	6635	50365	2EB	149	11.2	6.3	2437	3.0	1	1
4	16	6639	50372	2EB	149	2.6	1.2	882	0.0	1	0
4	17	6663	50365	2EB	152	0.3	0.6	248	0.1	2	0
4	18	6669	50365	2EB	157	0.6	0.6	337	0.9	1	0
4	19	6672	50361	2EB	165	0.7	0.8	368	0.4	0	0
4	20	6674	50365	2EB	157	0.7	1.2	360	0.1	0	0
4	21	6670	50369	2EB	160	1.9	0.8	685	0.2	2	0
4	FC 22	6668	50372	2EB	158	6.1	7.1	1939	0.0	1	0
4	23	6637	50376	2EB	134	3.8	0.9	1125	0.8	2	0
4	24	6649	50378	2EB	139	8.9	8.7	2284	7.4	5	0
4	25	6667	50383	2EB	143	18.5	11.3	3253	2.8	4	0
4	26	6642	50381	2EB	141	2.6	0.0	1259	4.5	2	0
4	27	6646	50383	2EB	149	1.2	0.0	525	0.5	2	0
4	28	6653	50384	2EB	154	4.7	5.8	1372	1.0	3	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
4	29	6658	50386	2EB	154	0.3	0.4	278	0.3	0	0
4	30	6646	50389	2EB	151	1.1	1.8	463	0.2	2	0
4	31	6642	50388	2EB	138	3.5	1.1	1415	0.6	2	1
4	32	6632	50393	2EB	139	10.6	6.8	2322	5.6	2	0
4	33	6627	50398	2EB	139	1.7	0.5	941	4.8	4	0
4	34	6650	50401	2EB	153	8.6	3.8	1892	1.1	4	0
4	**FC 35**	6673	50394	2EB	158	6.5	6.7	1732	1.2	2	1
5	1	6926	50164	2HF	139	2.7	0.6	1161	0.0	1	0
5	2*	6928	50167	2HF	140	2.7	.	1627	0.9	3	1
5	3	6922	50170	2HF	144	0.5	6.5	308	2.8	1	0
5	4	6918	50166	2HF	143	4.6	1.8	1107	0.3	2	0
5	5*	6912	50162	2HF	134	1.6	.	733	0.0	0	0
5	6	6906	50168	2HF	126	0.6	1.8	518	7.4	2	0
5	7*	6886	50166	2HF	138	2.6	.	828	1.2	0	1
5	**FC 8**	6890	50178	2HF	144	5.5	1.5	1088	0.4	1	0
5	9	6895	50177	2HF	135	4.2	0.9	1103	3.1	2	0
5	10	6901	50181	2HF	140	1.4	5.6	754	0.6	1	2
5	11	6908	50178	2HF	134	1.1	1.8	848	1.4	2	0
5	12	6914	50177	2HF	130	0.9	3.0	420	16.5	2	0
5	13	6917	50176	2HF	130	1.7	8.5	550	1.2	2	0
5	14	6926	50179	2HF	130	5.1	7.3	1745	12.7	6	0
5	15	6933	50190	2HF	136	43.7	6.4	4369	14.2	5	1
5	**FC 16**	6907	50185	2HF	138	7.0	9.2	2136	2.6	2	0
5	17	6907	50192	2EB	143	1.1	4.2	436	3.3	3	0
5	18	6907	50196	2EB	144	1.1	6.3	624	2.4	2	0
5	19	6895	50184	2EB	153	1.7	9.3	614	1.5	0	0
5	20	6896	50186	2EB	154	2.3	0.6	1112	0.0	1	0
5	21	6897	50190	2EB	154	3.5	1.2	1238	0.2	2	1
5	22	6893	50186	2EB	154	2.7	8.5	792	0.3	1	0
5	23	6888	50188	2HF	153	2.4	5.5	784	3.2	5	0
5	24	6884	50185	2HF	153	6.6	1.3	3072	1.3	1	1
5	25*	6882	50188	2HF	148	0.7	.	404	0.0	0	0
5	26	6882	50192	2HF	148	2.3	1.4	869	3.6	3	0
5	27	6885	50196	2EB	143	6.3	6.7	3844	7.9	1	0
5	28	6882	50197	2EB	142	6.0	0.0	1710	0.4	2	0
5	29	6896	50195	2EB	153	6.1	3.5	1562	0.5	1	0
5	30	6900	50200	2EB	149	3.9	1.2	1527	0.3	1	0
5	31	6892	50202	2EB	146	3.9	0.8	1082	0.0	1	0
5	32	6892	50203	2EB	143	0.8	1.0	572	0.5	2	0
5	33	6885	50206	2EB	140	10.7	7.4	1893	2.7	1	0
5	34	6912	50202	2EB	149	5.6	0.7	2086	0.1	2	0
5	35	6916	50206	2EB	154	0.6	0.0	479	2.2	1	0
5	36	6918	50207	2EB	158	5.2	0.5	1901	0.3	0	0
5	37	6913	50208	2EB	143	2.8	1.4	1653	1.8	6	0
5	38	6910	50206	2EB	144	2.2	0.9	961	0.0	1	0
5	39	6907	50202	2EB	140	10.4	3.7	1592	2.4	2	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
5	41[1]	6925	50204	2EB	138	1.0	0.6	623	2.6	2	0
5	42	6884	50213	2EB	148	4.0	2.3	1765	1.1	1	0
5	43	6885	50190	2HF	143	0.9	1.0	565	2.7	2	0
6	1	6682	50433	2EB	150	9.6	13.0	1681	0.8	2	0
6	2	6691	50426	2EB	148	1.3	0.8	817	0.4	1	1
6	3	6697	50432	2EB	148	15.2	8.1	2166	1.8	3	2
6	4	6715	50425	2EB	144	2.9	1.2	899	1.1	3	0
6	5	6727	50427	2EB	154	4.2	6.1	1069	0.1	1	0
6	6	6740	50430	2EB	149	19.5	9.9	2561	0.6	2	0
6	7	6748	50431	2EB	149	5.8	10.6	1407	0.7	2	0
6	FC 8	6752	50437	2EB	150	9.2	10.7	2051	2.4	1	0
6	9	6750	50446	2EB	152	27.6	7.2	4899	4.8	3	1
6	10	6738	50440	2EB	153	13.1	2.9	3256	6.4	1	1
6	11	6715	50444	2EB	153	23.8	5.5	4576	2.5	2	2
6	12	6711	50434	2EB	154	1.2	5.7	433	1.1	1	0
6	FC 13	6705	50439	2EB	153	14.2	16.1	3040	1.5	1	3
6	14	6696	50437	2EB	154	5.5	0.3	2228	1.1	1	2
6	15	6700	50442	2EB	154	17.8	6.9	3170	0.4	1	1
6	16	6713	50447	2EB	149	2.0	0.5	888	0.5	2	0
6	17	6722	50442	2EB	158	10.1	6.2	1837	0.3	1	0
6	18	6742	50450	2EB	154	1.7	0.8	1228	0.0	1	0
6	19	6739	50460	2EB	141	8.0	4.9	1693	1.4	5	0
6	20	6732	50458	2EB	141	3.9	0.6	2279	12.5	6	0
6	21	6725	50455	2EB	139	29.1	13.5	3952	0.6	1	0
6	22	6687	50461	2EB	163	11.6	6.0	2139	2.0	3	1
6	23	6688	50467	2EB	163	10.4	9.2	2564	1.7	2	0
6	24	6702	50467	2EB	149	2.1	0.5	1143	1.8	3	0
6	25	6714	50473	2EB	145	4.0	4.9	1851	1.4	1	1
6	26	6736	50468	2EB	143	3.9	2.4	1846	0.5	1	1
6	27	6738	50473	2EB	143	1.0	0.0	520	0.1	2	0
6	28	6740	50477	2EB	140	5.5	4.9	1092	4.6	3	0
6	29	6748	50483	2EB	144	4.8	3.9	1441	4.5	1	0
6	30	6718	50477	2EB	162	2.5	5.0	846	1.4	1	0
6	31	6692	50477	2EB	162	1.0	0.9	512	0.8	1	0
6	32	6688	50478	2EB	162	2.8	0.0	1115	2.1	2	0
6	FC 33	6683	50480	2EB	158	3.0	4.6	888	1.9	1	0
6	34	6695	50482	2EB	163	0.4	2.7	262	1.5	2	0
6	35	6700	50491	2EB	154	6.1	3.8	1315	0.5	1	0
6	36	6708	50490	2EB	154	23.2	10.9	4506	4.8	2	2
6	37	6716	50492	2EB	152	4.3	8.4	1034	0.3	3	0
6	38	6670	50486	2EB	157	40.8	12.2	5774	4.7	3	2
7	1	6632	50464	2EB	148	2.0	4.9	1231	0.4	3	1
7	2	6625	50466	2EB	149	4.5	3.1	1136	0.4	2	0
7	FC 3	6628	50473	2EB	154	4.0	7.0	850	0.4	1	0
7	4	6615	50465	2EB	158	11.6	7.0	1886	0.8	1	0
7	FC 5	6604	50473	2EB	158	12.8	6.2	3033	2.5	2	0

PLOT	LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
7	6	6617	50476	2EB	149	2.3	1.2	1182	2.5	3	0
7	7	6624	50480	2EB	148	0.9	1.1	497	2.5	4	0
7	8	6608	50481	2EB	162	0.7	0.9	567	0.3	1	0
7	9	6612	50483	2EB	153	0.5	1.6	284	1.4	2	0
7	10	6617	50487	2EB	148	2.6	0.5	805	1.8	1	0
7	**FC 11**	6604	50486	2EB	157	11.9	10.2	1987	2.2	6	0
7	12	6593	50492	2EB	141	1.2	1.4	483	0.5	2	0
7	13	6594	50496	2EB	141	1.5	0.9	903	1.2	3	0
7	14	6591	50492	2EB	140	5.4	6.6	1255	0.7	2	0
7	15	6579	50496	2EB	140	2.9	4.7	1718	0.7	1	4
7	**FC 16**	6577	50508	2EB	135	5.1	7.9	1087	0.6	1	0
7	17	6578	50516	2EB	138	2.0	2.0	708	2.0	2	0
7	18	6601	50503	2EB	139	2.9	1.8	1133	1.0	2	0
7	19	6606	50508	2EB	140	1.0	0.6	645	0.2	1	0
7	20	6612	50507	2EB	141	18.7	4.8	3223	5.5	4	1
7	21	6637	50507	2EB	139	2.1	0.9	655	2.5	4	0
7	22	6642	50508	2EB	144	6.3	5.0	1296	0.5	1	0
7	23	6643	50502	2EB	149	10.6	5.3	1700	0.6	1	0
7	24	6647	50504	2EB	146	6.1	3.0	1533	1.0	1	0
7	25	6664	50498	2EB	157	5.8	3.9	1487	0.0	4	0
7	26	6665	50508	2EB	150	6.7	11.0	1168	0.4	1	0
7	27	6657	50508	2EB	154	5.3	7.4	1142	1.3	1	0
7	28	6659	50519	2EB	159	7.1	4.6	2597	3.6	2	0
7	29	6652	50523	2EB	152	1.5	0.8	480	0.5	4	0
7	30	6647	50520	2EB	143	15.2	1.3	4179	29.4	4	1
7	31	6634	50513	2EB	149	1.0	0.5	448	1.2	3	0
7	32	6633	50517	2EB	149	3.7	5.3	1315	1.3	0	0
7	33	6629	50527	2EB	141	0.7	0.8	334	0.8	2	0
7	34	6632	50530	2EB	141	0.5	0.8	413	0.4	2	0
7	35	6625	50530	2EB	141	20.2	5.0	3410	7.9	5	2
7	36	6618	50533	2EB	141	2.1	2.4	852	3.1	1	0

LEGEND

VARIABLE EXPLANATIONS

UTM EAST = Universal Transverse Mercator Easting coordinate
UTM NORTH = Universal Transverse Mercator Northing coordinate
(UTM Zone = 17 for all lakes)
TERTIARY WATERSHED = tertiary watershed identifier code
ELEV = lake elevation above sea level
AREA = open water area of lake
DEPTH = mean mid-lake depth
SHORELINE = length of open water perimeter
RIPARIAN AREA = area of riparian zone adjacent to lake
TOTAL STREAMS = cumulative number of streams flowing into and draining lake
TOTAL ISLANDS = number of islands in lake

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
Lake Number * = lake inaccessible by helicopter
. = no data
[1] Plot 5 Lake 40 does not exist

Table 19. Average chemical characterisitics of Muskoka study lakes, identified by plot and lake number. Chemical values are three year means (fall sampling: 1990, 1993, 1995). (See legend for explanation of variables and notations).

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO$_2$ (mg/L)	SO$_4$ (mg/L)	COLOR^1 (hu)	DOC (mg/L)	TIC (mg/L)	NH$_3^2$ (µeq/L)	NO$_2$NO$_3^3$ (mg/L)	TKN (mg/L)	TP (µeq/L)	Al^1 (µeq/L)	Mn^1 (µeq/L)	Fe^1 (µeq/L)
1-1	6.48	66.2	28.4	2.42	0.81	0.87	0.45	0.43	1.22	6.30	35	4.99	1.10	35.25	0.009	0.29	8.11	23.3	12.4	215.1
1-2	6.43	70.6	30.1	2.59	0.83	0.85	0.47	0.45	1.81	6.73	25	4.36	1.34	10.15	0.006	0.29	5.93	15.0	13.5	103.1
1-3	6.53	93.9	31.0	2.79	0.87	0.91	0.49	0.47	1.98	6.13	25	4.68	1.53	17.20	0.008	0.22	5.47	20.0	26.4	180.9
1-4	6.36	66.9	31.2	2.72	0.85	0.88	0.50	0.50	2.03	7.09	25	4.80	1.25	14.35	0.006	0.27	4.71	15.1	33.2	149.0
1-5	6.47	57.7	25.2	2.45	0.73	0.80	0.44	0.42	1.07	6.90	30	4.65	1.06	13.70	0.005	0.29	5.74	15.7	5.1	88.1
1-6	6.47	32.1	25.3	2.24	0.58	0.69	0.55	0.38	1.24	4.60	50	6.36	1.23	11.00	0.008	0.38	7.70	42.3	15.9	301.2
1-7	5.99	45.4	31.6	2.68	0.88	0.85	0.47	0.43	3.03	7.51	40	5.87	1.13	22.00	0.005	0.31	5.50	41.3	23.1	210.3
1-8	6.12	56.2	30.2	2.80	0.75	0.81	0.53	0.43	2.19	6.80	55	7.25	1.22	45.35	0.006	0.33	8.29	54.7	23.7	370.7
1-9	6.39	71.7	30.4	2.74	0.83	0.85	0.48	0.44	2.63	6.64	20	5.45	1.00	30.20	0.005	0.27	6.88	13.9	3.8	90.5
1-10	6.33	36.7	25.9	2.24	0.65	0.75	0.33	0.43	1.84	6.83	15	4.41	0.75	8.15	0.007	0.19	5.60	10.1	9.6	48.2
1-11	6.33	31.0	26.0	2.37	0.77	0.80	0.40	0.60	1.38	8.52	20	4.11	0.72	12.18	0.008	0.29	5.96	19.1	7.7	55.9
1-12	6.56	103.1	35.9	3.15	1.08	1.01	0.48	0.42	4.41	8.16	20	4.14	1.61	15.98	0.007	0.34	4.96	8.9	7.9	167.6
1-13	6.70	142.1	36.6	3.23	1.10	1.11	0.48	0.60	4.50	6.87	25	3.96	2.02	12.88	0.007	0.18	4.64	9.1	9.5	164.4
1-14	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1-15	6.55	78.1	32.4	2.72	0.94	0.92	0.46	0.56	2.51	7.53	25	4.16	1.26	23.30	0.008	0.20	5.00	12.2	3.4	27.0
1-16	6.00	25.2	21.7	1.89	0.54	0.56	0.27	0.30	0.87	5.38	25	4.87	0.58	10.53	0.006	0.34	8.30	29.1	9.6	86.6
1-17	6.42	59.1	24.1	2.09	0.61	0.78	0.36	0.37	0.49	5.07	20	4.32	0.83	42.70	0.005	0.27	6.27	11.3	3.8	27.7
1-18	6.35	29.1	24.9	2.28	0.72	0.73	0.39	0.45	0.13	8.08	20	4.29	0.69	9.35	0.005	0.18	4.53	11.1	6.3	19.1
1-19	6.09	39.9	25.2	2.29	0.66	0.79	0.27	0.55	0.77	5.40	55	6.63	0.95	41.95	0.008	0.35	9.12	43.8	24.0	292.2
1-20	5.79	24.0	24.4	1.90	0.58	1.03	0.20	0.99	0.57	4.99	55	7.52	0.75	14.14	0.006	0.43	13.23	56.0	39.4	169.8
1-21	6.55	92.3	32.6	2.74	1.15	0.79	0.50	0.44	1.13	7.06	25	4.46	1.57	16.15	0.007	0.25	5.47	11.9	14.7	69.8
1-22	6.12	26.0	22.0	2.01	0.59	0.79	0.31	0.69	1.01	6.37	40	5.74	0.54	15.40	0.008	0.31	5.56	37.1	22.4	62.2
FC 1-23	6.47	54.8	25.9	2.20	0.67	0.83	0.33	0.49	1.22	6.06	15	3.16	1.00	10.95	0.006	0.23	5.28	13.0	7.7	51.4
1-24	5.59	19.5	29.7	2.33	0.83	0.97	0.38	0.53	3.85	6.62	75	11.73	0.76	28.30	0.018	0.38	12.63	65.3	12.7	166.4
1-25	5.58	17.5	24.2	1.76	0.62	0.72	0.40	0.52	2.06	5.52	55	7.28	0.99	70.60	0.005	0.47	8.73	63.5	12.1	125.3
1-26	6.35	53.1	28.7	2.37	0.77	0.82	0.36	0.55	1.69	7.07	15	3.31	0.98	10.40	0.005	0.26	3.56	11.2	2.0	11.1
1-27	6.51	161.9	37.0	3.28	1.10	1.28	0.70	0.71	2.07	5.88	50	6.02	1.47	8.59	0.006	0.31	9.82	43.1	63.6	242.9
1-28	4.73	5.9	33.5	2.19	0.57	0.82	0.27	0.68	2.62	6.91	110	13.00	0.43	28.60	0.005	0.55	7.49	245.3	16.9	204.0
1-29	5.99	24.0	27.7	2.07	0.87	0.72	0.32	0.55	0.39	7.49	20	4.67	0.60	10.14	0.006	0.30	4.79	13.4	5.4	14.7

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3[2] (µeq/L)	NO_2NO_3[2] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
1-30	6.11	42.8	28.2	2.18	0.81	0.77	0.27	0.62	0.71	6.51	40	5.81	0.96	91.75	0.022	0.42	9.95	40.0	11.1	153.2
1-31	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FC 1-32	5.77	20.5	28.4	2.41	0.69	0.64	0.21	0.31	0.38	8.49	20	4.40	0.52	26.45	0.008	0.31	7.41	38.7	10.9	205.3
1-33	6.31	55.2	28.3	2.41	0.73	0.80	0.35	0.42	0.25	7.07	10	2.69	1.17	21.20	0.006	0.17	3.87	8.4	2.0	14.1
1-34	5.89	51.6	30.0	2.20	0.64	1.80	0.38	2.54	2.83	3.76	90	9.45	1.00	40.55	0.004	0.53	13.67	92.8	23.0	395.5
1-35	5.56	3.9	26.6	2.10	0.62	0.73	0.30	0.46	0.81	7.23	40	5.64	0.42	14.80	0.006	0.26	4.44	64.4	7.7	59.6
2-1	5.34	9.8	24.5	1.84	0.48	0.66	0.32	0.43	0.87	6.21	50	6.94	0.36	9.95	0.006	0.33	8.15	101.9	22.9	152.5
FC 2-2	5.24	-1.2	26.3	1.78	0.47	0.62	0.31	0.37	1.14	6.60	40	5.95	0.44	17.85	0.008	0.34	8.48	89.4	24.2	149.5
2-3	5.55	12.2	23.4	1.73	0.64	0.61	0.28	0.35	1.01	5.66	50	8.15	0.43	57.10	0.008	0.41	11.00	71.7	20.1	85.8
2-4	6.09	30.0	21.1	1.80	0.52	0.59	0.20	0.36	0.30	4.81	20	5.22	0.60	15.40	0.006	0.32	4.81	31.9	4.6	446.8
2-5	5.27	6.2	18.6	1.26	0.34	0.51	0.16	0.21	1.52	4.30	35	6.44	0.53	43.55	0.009	0.31	7.10	75.3	23.3	406.9
2-6	5.72	9.3	25.8	2.18	0.59	0.67	0.28	0.41	1.10	7.27	20	4.33	0.29	23.35	0.004	0.22	4.70	49.7	28.9	114.5
2-7	5.49	2.9	28.4	2.15	0.71	0.66	0.27	0.40	0.46	7.99	10	5.31	0.35	11.00	0.005	0.26	4.96	41.4	29.2	67.3
2-8	5.25	9.5	26.6	1.79	0.43	0.51	0.19	0.38	0.21	6.95	5	2.72	0.24	8.27	0.005	0.13	2.94	11.2	39.4	53.7
2-9	4.88	-8.7	13.9	0.53	0.21	0.29	0.10	0.13	0.26	1.07	90	12.45	0.52	36.45	0.004	0.74	20.87	99.0	22.2	268.0
2-10	5.84	14.2	19.9	1.63	0.49	0.51	0.13	0.21	0.33	5.15	20	4.68	0.46	15.35	0.008	0.38	7.53	32.9	6.6	42.5
2-11	5.41	7.3	21.3	1.73	0.45	0.52	0.05	0.17	2.14	5.36	50	7.26	0.35	17.30	0.007	0.43	10.21	135.4	24.4	314.8
2-12	5.23	0.2	19.7	1.29	0.36	0.45	0.05	0.21	1.29	4.97	25	4.85	0.33	80.35	0.011	0.36	6.57	62.5	25.6	250.5
2-13	5.74	12.3	22.8	1.90	0.53	0.56	0.22	0.31	0.38	6.39	15	4.17	0.34	46.05	0.006	0.28	3.90	25.4	15.0	24.0
2-14	5.82	13.6	21.7	1.81	0.49	0.51	0.23	0.33	0.21	5.86	15	4.33	0.53	19.15	0.009	0.25	4.54	18.6	19.4	34.2
2-15	6.04	45.6	22.2	2.06	0.57	0.51	0.22	0.24	1.15	4.49	40	6.48	1.02	54.30	0.012	0.42	9.50	48.2	11.9	124.2
2-16	6.12	63.4	21.6	1.71	0.57	0.62	0.68	0.38	0.66	2.85	60	9.84	0.97	29.70	0.008	0.54	13.30	53.7	14.3	387.1
2-17	6.01	42.2	20.5	1.69	0.54	0.60	0.36	0.28	1.51	3.71	40	6.43	0.96	26.60	0.013	0.53	9.46	48.3	11.7	165.7
FC 2-18	5.77	8.6	25.9	2.25	0.50	0.57	0.26	0.39	0.41	7.59	10	3.13	0.29	28.40	0.008	0.26	4.08	13.4	54.0	27.3
2-19	5.82	9.9	23.6	1.98	0.52	0.60	0.28	0.35	1.02	7.09	10	3.87	0.33	43.80	0.010	0.31	4.94	18.2	21.2	34.7
2-20*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2-21	5.64	7.4	23.1	1.74	0.54	0.56	0.18	0.33	0.45	7.01	10	2.61	0.29	29.00	0.018	0.22	4.18	21.7	13.0	55.2
2-22	5.32	11.6	18.4	1.33	0.39	0.48	0.15	0.24	2.88	4.17	55	7.05	0.53	79.50	0.032	0.50	13.57	80.2	31.0	224.5
2-23	5.37	6.0	24.0	1.61	0.48	0.55	0.15	0.26	2.92	5.78	50	8.04	0.44	8.10	0.005	0.78	33.10	90.3	26.9	206.3
2-24	6.23	64.3	18.7	1.78	0.53	0.61	0.53	0.31	3.08	2.01	55	10.07	0.84	44.55	0.009	0.78	38.03	63.9	17.0	500.3
2-25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2-26	5.36	8.4	25.3	1.92	0.63	0.61	0.39	0.36	2.35	6.87	30	6.14	0.54	7.54	0.006	0.36	7.53	109.8	39.7	48.3

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3[2] (µeq/L)	NO_2NO_3[2] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
FC 2-27	5.89	12.7	24.5	2.04	0.60	0.56	0.40	0.38	1.09	7.02	20	3.99	0.32	19.45	0.005	0.27	4.77	45.3	29.0	33.5
2-28	5.42	9.9	25.8	2.06	0.59	0.58	0.22	0.32	1.94	7.35	35	4.99	0.36	80.05	0.007	0.39	8.93	124.6	26.0	109.0
2-29	5.37	3.3	25.3	1.95	0.53	0.57	0.41	0.43	0.56	7.10	20	4.32	0.29	27.05	0.011	0.32	4.40	52.1	16.1	38.1
2-30	5.53	7.8	20.6	1.71	0.40	0.46	0.33	0.35	0.23	5.50	15	3.86	0.28	26.40	0.010	0.32	4.81	25.3	9.0	86.7
2-31	5.66	13.6	22.6	2.26	0.49	0.65	0.21	0.56	3.07	3.71	75	13.68	0.61	12.30	0.003	0.43	8.51	159.2	29.4	407.1
<u>2-32</u>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2-33	4.96	3.1	21.2	1.45	0.39	0.54	0.47	0.66	0.95	0.97	145	26.02	0.40	29.80	0.005	0.99	19.20	266.2	55.7	595.9
2-34	5.13	2.1	25.9	2.03	0.51	0.57	0.25	0.40	2.33	6.37	55	7.84	0.50	15.65	0.004	0.39	7.64	110.0	28.1	165.4
2-35	5.60	6.4	22.1	1.91	0.41	0.56	0.18	0.37	0.43	6.49	15	3.34	0.29	26.75	0.013	0.22	3.94	84.8	20.6	137.2
2-36	5.66	7.6	21.9	1.87	0.46	0.56	0.28	0.37	0.76	5.95	25	4.97	0.26	37.25	0.008	0.47	6.62	50.0	18.8	129.5
3-1	6.08	35.6	27.0	2.19	0.65	0.74	0.49	0.50	0.64	6.78	10	6.36	0.80	62.00	0.014	0.43	6.12	20.6	8.1	45.6
FC 3-2	5.86	24.7	26.8	2.30	0.62	0.72	0.43	0.40	1.51	6.74	45	7.18	0.73	34.10	0.008	0.42	8.39	131.5	28.7	274.1
3-3	5.39	13.1	19.4	1.32	0.38	0.58	0.46	0.33	1.96	3.71	65	10.01	0.73	80.55	0.014	0.59	9.85	149.7	35.3	163.2
3-4	5.71	11.1	22.2	1.62	0.55	0.63	0.44	0.42	2.48	4.66	75	9.03	1.94	27.10	0.028	0.42	13.21	167.7	45.2	488.3
3-5	5.92	11.9	26.1	1.99	0.72	0.66	0.34	0.42	0.55	7.23	10	4.71	0.54	12.65	0.085	0.41	6.64	34.2	19.6	29.1
3-6	5.59	18.4	26.7	2.09	0.69	0.64	0.33	0.29	1.50	6.54	45	7.76	0.54	37.65	0.011	0.38	7.07	94.0	14.4	148.5
3-7	4.91	1.9	24.8	1.56	0.52	0.63	0.36	0.34	5.13	4.87	75	12.19	0.79	17.60	0.007	0.38	10.80	148.1	36.2	196.6
3-8	6.23	41.9	27.7	2.47	0.73	0.90	0.41	0.30	1.35	6.35	35	7.78	0.88	17.20	0.009	0.36	6.20	29.2	17.2	189.0
3-9	6.11	67.9	31.6	2.63	0.89	1.25	0.46	0.43	4.15	6.69	55	8.46	1.15	7.51	0.019	0.42	12.00	86.4	16.7	307.2
3-10	5.70	5.1	19.3	1.58	0.48	0.55	0.32	0.29	0.30	6.76	15	4.53	0.34	63.35	0.010	0.30	4.40	32.1	10.8	21.7
3-11	5.67	16.7	20.4	1.68	0.49	0.53	0.29	0.26	1.85	4.44	50	8.27	0.51	25.90	0.011	0.51	9.25	93.0	37.1	271.9
FC 3-12	5.45	12.8	22.9	1.75	0.54	0.59	0.45	0.29	2.95	4.88	90	11.04	0.79	99.10	0.010	0.56	17.73	168.3	39.8	721.3
3-13	5.75	15.9	23.3	1.84	0.59	0.62	0.38	0.34	2.25	5.79	45	6.82	0.50	41.75	0.074	0.39	7.50	121.6	28.6	203.8
3-14	5.51	10.8	23.6	1.88	0.58	0.58	0.36	0.31	1.91	5.92	55	8.34	0.46	23.20	0.044	0.42	7.25	165.9	39.5	284.3
3-15	5.80	9.7	22.5	1.78	0.58	0.55	0.30	0.27	0.18	6.60	15	3.87	0.34	19.45	0.022	0.32	6.63	40.5	10.0	48.9
3-16	5.68	26.1	25.9	2.04	0.68	0.64	0.42	0.36	2.32	6.09	55	9.20	1.14	134.8	0.018	0.57	10.33	109.4	25.7	184.5
3-17	5.46	7.2	16.8	1.12	0.33	0.42	0.29	0.22	0.79	4.06	30	5.18	0.45	36.65	0.017	0.44	6.83	66.0	16.6	159.9
3-18	5.67	16.7	16.7	1.11	0.36	0.45	0.50	0.14	0.79	2.86	50	8.05	0.76	118.8	0.028	0.63	17.43	56.2	26.9	628.2
3-19	5.40	6.7	23.3	1.87	0.52	0.53	0.24	0.27	1.29	5.69	35	7.03	0.57	25.20	0.008	0.39	7.98	72.6	39.1	277.0
3-20	5.55	7.1	23.9	1.78	0.57	0.75	0.28	0.27	0.97	6.42	40	6.87	0.36	17.20	0.008	0.42	8.88	99.1	21.0	118.8
3-21	5.94	38.4	28.8	2.23	0.82	0.97	0.47	0.37	2.51	6.65	30	7.24	0.79	21.15	0.009	0.48	9.57	42.4	21.4	130.5
3-22	5.22	12.0	20.7	1.41	0.46	0.56	0.21	0.22	0.49	2.91	90	13.76	0.93	14.25	0.007	0.96	19.50	107.7	47.9	342.0

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_4[2] (µeq/L)	NO_2NO_3[3] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
3-23	5.86	11.0	19.7	1.47	0.55	0.49	0.37	0.29	0.25	6.53	5	4.14	0.35	11.97	0.006	0.29	4.25	19.6	18.5	53.3
3-24	5.66	9.8	23.1	1.91	0.51	0.41	0.28	0.30	0.55	6.46	20	5.09	0.39	31.05	0.009	0.30	4.33	64.8	20.5	106.7
3-25	5.07	-0.9	25.2	1.70	0.56	0.62	0.28	0.33	1.08	6.01	75	9.25	0.24	20.65	0.046	0.41	8.08	109.3	18.2	177.9
3-26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3-27	5.78	15.2	21.6	1.66	0.60	0.60	0.48	0.27	1.37	4.45	75	9.81	0.50	42.05	0.013	0.55	10.67	152.0	34.7	438.7
3-28	5.72	8.9	23.3	1.82	0.55	0.61	0.37	0.33	0.60	6.19	15	4.27	0.51	9.80	0.008	0.25	3.85	22.5	36.4	78.2
3-29	5.73	23.6	24.3	1.88	0.60	0.60	0.40	0.30	1.11	6.38	15	5.05	0.51	11.30	0.007	0.29	8.01	25.2	16.5	60.1
3-30	5.72	19.6	18.3	1.37	0.48	0.49	0.52	0.13	0.97	3.32	55	9.64	0.63	23.65	0.015	0.59	20.20	101.8	22.9	298.1
3-31	5.32	0.7	25.5	1.74	0.56	0.59	0.29	0.24	0.99	6.23	35	6.49	0.53	25.00	0.029	0.43	9.70	87.5	18.1	158.2
3-32	5.58	13.3	22.5	1.80	0.52	0.57	0.32	0.26	1.20	4.89	45	10.33	0.39	63.00	0.005	0.74	12.98	75.0	12.7	140.3
3-33	5.28	12.3	24.5	1.98	0.64	0.65	0.29	0.26	3.30	4.46	125	15.64	0.56	20.80	0.012	0.71	28.53	221.5	52.3	762.3
3-34	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FC 3-35	5.35	-9.9	29.9	1.60	0.53	0.60	0.35	0.25	0.28	6.34	20	5.91	0.44	15.75	0.015	0.37	6.01	37.7	12.7	71.6
3-36	5.56	15.9	23.3	1.68	0.54	0.63	0.41	0.37	0.67	5.50	40	7.18	0.55	8.55	0.008	0.37	6.75	56.6	23.0	107.9
3-37	5.92	61.7	111.5	4.15	1.27	14.7	0.66	24.3	7.69	4.72	145	17.73	1.93	106.0	0.007	0.65	17.50	144.0	66.4	1559.0
4-1	5.99	17.7	22.9	1.89	0.48	0.70	0.29	0.26	0.70	6.35	20	3.99	0.38	31.85	0.030	0.44	6.26	76.9	13.8	113.9
4-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-3	5.98	31.2	24.1	2.22	0.53	0.84	0.29	0.28	1.92	5.14	.	7.41	0.52	37.00	0.014	0.75	28.25	.	.	.
4-4	5.96	24.3	17.6	1.54	0.40	0.62	0.32	0.15	1.72	3.28	40	6.73	0.61	53.20	0.009	0.61	18.83	73.3	25.1	231.2
4-5	5.96	19.9	22.2	1.82	0.51	0.78	0.28	0.24	2.57	4.62	.	7.43	0.41	20.70	0.026	0.63	17.55	.	.	.
4-6	6.22	32.2	24.5	2.15	0.60	0.80	0.35	0.29	1.40	5.91	20	5.18	0.54	28.25	0.016	0.33	6.67	49.1	18.3	154.4
4-7	5.62	17.3	16.9	1.33	0.33	0.60	0.26	0.28	1.78	3.50	45	6.42	0.54	27.45	0.008	0.35	9.09	113.9	36.4	272.0
4-8	5.90	27.9	22.4	1.83	0.47	0.72	0.51	0.39	1.82	4.65	50	6.76	0.44	14.55	0.016	0.63	17.30	134.6	78.0	307.1
4-9	5.78	12.5	22.7	1.92	0.50	0.73	0.26	0.42	2.08	5.34	55	7.14	0.37	8.84	0.014	0.67	14.47	138.4	31.7	297.9
4-10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-13	5.92	13.6	21.7	1.73	0.48	0.72	0.37	0.29	0.58	5.84	15	4.19	0.37	43.30	0.020	0.38	4.27	66.7	11.6	272.4
4-14	5.68	8.1	22.4	1.74	0.46	0.70	0.36	0.31	1.09	6.11	20	5.12	0.37	11.85	0.011	0.35	3.97	64.8	13.3	115.6
FC 4-15	5.50	9.8	21.4	1.40	0.39	0.60	0.40	0.34	0.13	5.67	35	3.56	0.38	66.65	0.007	0.36	4.76	73.3	76.4	654.0
4-16	5.82	18.6	19.6	1.51	0.39	0.62	0.39	0.27	0.84	4.48	35	5.84	0.67	89.15	0.034	0.64	12.36	85.8	23.6	243.8
4-17	5.61	8.0	19.9	1.64	0.40	0.64	0.29	0.35	1.63	4.90	35	6.49	0.36	34.05	0.033	0.35	13.65	124.9	45.7	249.0

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3[2] (µeq/L)	NO_2NO_3[2] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
4-18	6.06	27.1	21.5	1.69	0.44	0.69	0.32	0.29	1.35	3.73	45	7.30	0.70	42.10	0.054	1.08	27.93	161.9	36.1	438.4
4-19	5.96	17.2	17.0	1.39	0.34	0.52	0.44	0.31	0.85	3.34	25	6.36	0.43	54.00	0.019	0.61	18.63	116.0	30.3	374.5
4-20	5.83	21.6	21.7	1.70	0.52	0.80	0.37	0.21	1.96	3.57	45	7.70	0.74	59.00	0.038	0.45	17.40	121.1	33.2	380.2
4-21	5.41	13.8	19.0	1.44	0.39	0.67	0.47	0.31	2.16	3.25	.	13.40	0.55	95.90	0.041	1.27	62.50	.	.	.
FC 4-22	5.64	8.1	19.2	1.25	0.37	0.64	0.34	0.30	0.54	5.35	10	3.01	0.27	76.00	0.032	0.41	4.11	42.8	19.5	90.8
4-23	6.09	26.3	21.8	1.70	0.54	0.69	0.37	0.32	1.01	5.35	20	3.85	0.50	21.20	0.013	0.30	5.62	51.8	12.2	139.9
4-24	5.89	18.2	21.9	1.66	0.51	0.61	0.36	0.30	0.88	5.90	10	3.47	0.45	19.25	0.022	0.32	4.09	36.7	11.4	95.4
4-25	6.03	20.4	20.9	1.66	0.48	0.57	0.34	0.27	1.25	5.41	10	3.11	0.43	14.65	0.021	0.24	3.72	32.3	20.6	121.1
4-26	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4-28	5.60	6.0	19.4	1.34	0.34	0.61	0.18	0.20	0.82	5.39	20	3.26	0.32	88.45	0.022	0.48	7.63	96.4	15.1	172.1
4-29	5.76	17.4	20.0	1.20	0.31	0.57	0.54	0.32	2.49	4.43	20	6.43	0.52	17.35	0.009	0.81	43.05	164.9	171.0	435.4
4-30	5.70	10.1	19.9	1.50	0.41	0.54	0.28	0.34	0.92	5.61	15	3.01	0.33	17.10	0.020	0.23	7.32	54.3	27.8	75.6
4-31	5.86	12.7	22.2	1.64	0.45	0.56	0.30	0.36	1.19	5.98	20	3.05	0.34	91.95	0.044	0.51	12.20	93.5	27.0	104.4
4-32	5.96	11.8	20.8	1.68	0.46	0.64	0.32	0.35	0.89	5.34	20	3.76	0.48	26.35	0.015	0.28	4.11	42.4	16.3	266.3
4-33	5.89	28.7	21.2	1.58	0.46	0.68	0.31	0.38	1.07	5.42	20	4.35	0.44	45.10	0.023	0.42	4.80	68.4	13.9	136.2
4-34	6.28	28.6	23.3	1.93	0.61	0.57	0.35	0.28	0.46	5.58	5	3.58	0.74	39.15	0.021	0.38	5.09	13.2	31.7	85.6
FC 4-35	6.21	34.5	21.6	1.83	0.49	0.57	0.37	0.31	0.92	5.05	15	3.38	0.62	45.05	0.034	0.37	5.22	31.4	47.3	168.0
5-1	5.98	36.7	23.7	2.33	0.55	0.66	0.41	0.25	1.97	4.84	75	9.63	0.79	37.45	0.010	0.61	33.87	122.4	23.5	475.2
5-2*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5-3	4.67	-22.3	35.7	2.31	0.69	0.69	0.30	0.48	5.52	7.31	90	14.04	0.95	64.25	0.007	0.49	13.27	182.6	16.1	208.0
5-4	5.30	8.9	25.3	1.94	0.53	0.64	0.34	0.35	1.20	6.56	60	7.96	0.33	37.50	0.012	0.46	13.17	143.1	31.4	377.8
5-5*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5-6	6.01	22.4	24.1	2.07	0.58	0.70	0.38	0.33	1.17	5.63	45	5.78	0.63	13.15	0.025	0.30	5.77	61.6	15.9	328.6
5-7*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FC 5-8	5.08	-6.7	30.4	2.15	0.46	0.61	0.22	0.24	0.90	8.24	35	4.32	0.19	109.1	0.145	0.51	11.01	230.8	29.3	102.5
5-9	4.94	-11.2	28.0	1.86	0.47	0.60	0.14	0.28	0.96	7.14	30	7.43	0.20	20.95	0.012	0.50	9.10	123.5	32.8	63.3
5-10	5.57	6.1	20.5	1.64	0.44	0.54	0.21	0.26	1.13	5.44	40	5.24	0.47	49.35	0.020	0.42	10.85	120.6	33.0	264.6
5-11	5.58	12.7	19.3	1.47	0.40	0.60	0.31	0.23	1.05	4.33	40	6.61	0.57	38.50	0.010	0.43	13.47	89.3	27.5	410.0
5-12	5.50	10.6	20.5	1.63	0.43	0.62	0.26	0.24	1.46	4.44	65	8.92	0.44	39.10	0.012	0.57	14.17	131.4	22.4	448.1
5-13	6.05	33.5	24.6	2.22	0.59	0.69	0.37	0.34	1.28	5.67	45	6.06	0.70	43.45	0.023	0.37	6.44	56.9	32.0	417.7
5-14	6.12	27.3	25.1	2.23	0.60	0.69	0.39	0.36	1.22	6.13	40	5.42	0.65	29.50	0.032	0.31	5.22	57.3	33.0	369.4

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3[2] (µeq/L)	NO_2NO_3[2] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
5-15	6.08	21.4	25.0	2.21	0.59	0.69	0.39	0.34	1.32	6.32	35	5.38	0.50	17.60	0.047	0.35	4.81	57.5	21.1	177.5
FC 5-16	5.38	1.2	23.7	1.72	0.43	0.60	0.33	0.35	0.91	6.28	30	5.02	0.38	22.30	0.012	0.36	8.34	80.1	25.9	212.6
5-17	5.84	28.5	20.6	1.70	0.43	0.62	0.42	0.33	2.21	4.59	55	6.97	0.60	67.50	0.008	0.59	17.87	149.1	29.1	666.2
5-18	5.60	24.9	20.9	1.76	0.41	0.59	0.47	0.35	2.84	4.21	90	8.42	0.97	36.75	0.007	0.67	26.37	163.2	52.3	1201.0
5-19	5.65	11.2	20.9	1.82	0.46	0.51	0.19	0.30	0.63	5.74	20	4.35	0.32	26.35	0.017	0.30	6.60	33.1	8.2	75.6
5-20	5.51	9.5	15.9	1.27	0.34	0.44	0.19	0.14	0.98	3.30	55	6.40	0.38	7.14	0.005	0.53	22.43	79.5	19.2	326.4
5-21	5.59	14.2	15.7	1.28	0.32	0.42	0.22	0.19	0.60	3.34	40	5.67	0.39	100.7	0.027	0.51	19.93	51.1	18.7	212.6
5-22	5.78	9.3	20.2	1.62	0.42	0.63	0.21	0.34	0.81	5.33	20	4.14	0.32	15.70	0.013	0.46	51.36	46.2	17.1	74.5
5-23	5.86	10.0	16.1	1.56	0.39	0.49	0.22	0.25	0.71	5.65	15	4.17	0.41	16.80	0.008	0.36	5.56	24.7	8.6	112.2
5-24	5.60	12.6	17.2	1.42	0.36	0.46	0.21	0.27	0.94	3.93	50	4.97	0.43	17.50	0.011	0.39	12.19	39.7	12.8	264.6
5-25*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5-26	5.95	19.5	17.6	1.80	0.42	0.49	0.18	0.29	0.58	3.60	30	6.26	0.38	32.90	0.023	0.45	12.80	51.3	9.3	136.9
5-27	5.74	45.0	14.5	1.39	0.29	0.36	0.36	0.28	2.54	1.37	90	7.02	1.47	16.45	0.009	0.50	22.50	46.1	33.0	665.3
5-28	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5-29	5.44	4.2	18.6	1.48	0.35	0.48	0.18	0.29	0.26	5.43	10	2.67	0.17	15.60	0.011	0.25	4.21	23.1	30.2	36.8
5-30	5.11	0.2	28.1	2.16	0.51	0.57	0.23	0.37	2.55	6.92	65	9.47	0.38	11.20	0.005	0.45	20.43	205.1	49.8	268.6
5-31	5.16	-9.4	19.2	1.22	0.36	0.28	0.08	0.10	0.74	3.02	55	10.19	0.41	24.00	0.005	0.56	16.07	64.2	25.7	168.3
5-32	5.73	21.1	17.1	1.49	0.40	0.43	0.20	0.20	1.64	2.99	50	8.72	0.50	41.70	0.014	0.58	19.21	59.9	20.7	264.8
5-33	5.85	15.9	18.1	1.49	0.39	0.52	0.23	0.35	0.76	4.55	20	3.57	0.39	38.95	0.021	0.21	5.02	33.8	31.8	212.2
5-34	5.32	13.4	22.3	1.82	0.42	0.48	0.30	0.23	0.92	4.81	50	11.07	0.42	12.00	0.009	0.94	30.55	100.8	23.2	132.5
5-35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5-36	5.65	19.4	15.9	1.22	0.32	0.41	0.40	0.27	0.69	2.34	55	8.59	0.59	37.10	0.008	0.67	28.83	78.1	20.3	658.5
5-37	5.79	32.0	15.7	1.47	0.35	0.50	0.25	0.26	1.06	2.19	65	9.43	0.63	166.0	0.016	0.76	26.57	64.8	26.0	451.6
5-38	5.70	15.5	16.7	1.51	0.37	0.39	0.18	0.22	0.35	3.49	55	6.13	0.49	28.00	0.007	0.51	23.84	76.8	18.2	676.8
5-39	5.98	11.8	15.7	1.53	0.37	0.64	0.31	0.35	0.43	5.78	15	4.49	0.40	18.90	0.016	0.21	12.82	21.7	9.0	46.6
5-41[3]	5.65	9.8	35.8	3.59	0.86	0.72	0.48	0.51	3.57	9.91	65	9.44	0.70	6.88	0.006	0.43	10.43	180.3	32.7	313.4
5-42	5.45	6.9	15.8	1.23	0.35	0.48	0.15	0.25	1.41	3.29	90	7.09	0.34	21.00	0.012	0.52	19.80	110.9	14.7	486.1
5-43	5.23	-21.7	29.6	1.61	0.45	0.51	0.22	0.29	0.42	6.30	35	4.79	0.38	8.51	0.007	0.32	10.02	61.1	14.2	117.8
6-1	6.03	12.3	21.3	1.86	0.44	0.60	0.39	0.31	0.26	5.52	10	3.83	0.34	26.00	0.023	0.23	4.50	18.8	13.2	21.2
6-2	6.01	27.6	24.0	2.09	0.66	0.86	0.27	0.29	1.57	5.65	.	6.27	0.81	41.50	0.063	0.49	16.25	.	.	.
6-3	6.17	19.8	21.4	1.74	0.53	0.66	0.30	0.37	0.34	5.63	10	2.75	0.53	13.00	0.010	0.24	3.34	15.8	39.6	124.8
6-4	6.08	20.9	26.6	2.15	0.68	0.92	0.35	0.39	2.21	6.43	20	4.06	0.57	18.35	0.053	0.27	6.22	74.6	9.4	101.1

PLOT-LAKE	pH	ALK (μeq/L)	COND (μS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO$_2$ (mg/L)	SO$_4$ (mg/L)	COLOR^1 (hu)	DOC (mg/L)	TIC (mg/L)	NH$_3$^{2} (μeq/L)	NO$_2$NO$_3$^{2} (mg/L)	TKN (mg/L)	TP (μeq/L)	Al^1 (μeq/L)	Mn^1 (μeq/L)	Fe^1 (μeq/L)
6-5	6.16	26.0	22.4	1.84	0.54	0.77	0.36	0.39	0.86	5.19	10	3.42	0.51	12.50	0.008	0.31	4.84	14.4	7.8	14.6
6-6	6.26	24.5	23.8	1.97	0.57	0.74	0.39	0.38	2.03	5.41	5	3.11	0.51	11.30	0.036	0.26	3.01	19.9	22.3	32.5
6-7	6.22	23.4	23.3	1.93	0.56	0.74	0.38	0.38	1.42	5.24	10	2.96	0.57	13.15	0.032	0.21	2.58	17.1	21.4	37.4
FC 6-8	6.04	15.4	23.4	1.81	0.58	0.72	0.39	0.36	1.23	5.87	5	3.77	0.32	70.15	0.011	0.29	4.11	29.3	11.1	63.4
6-9	5.66	9.9	19.4	1.35	0.39	0.64	0.45	0.36	0.82	4.80	20	3.90	0.33	13.85	0.013	0.30	5.97	61.2	23.2	200.7
6-10	5.37	6.6	18.3	1.15	0.32	0.62	0.43	0.30	0.39	4.39	20	4.34	0.29	21.00	0.028	0.29	5.55	102.9	16.3	49.9
6-11	5.64	5.1	20.0	1.44	0.41	0.65	0.32	0.31	0.86	5.19	5	3.20	0.36	15.15	0.018	0.28	4.91	32.2	34.5	40.0
6-12	5.85	15.1	21.1	1.74	0.45	0.65	0.27	0.33	1.03	4.94	10	4.22	0.52	45.95	0.021	0.35	6.16	45.9	26.2	84.7
FC 6-13	5.74	5.8	22.6	1.75	0.55	0.59	0.28	0.35	0.68	5.92	10	3.20	0.37	13.80	0.022	0.21	3.08	16.5	26.2	28.1
6-14	5.92	18.7	30.4	2.60	0.83	0.88	0.46	0.93	3.83	7.35	75	7.21	0.54	15.10	0.008	0.34	9.43	165.8	48.8	328.3
6-15	6.09	16.5	21.7	1.76	0.52	0.68	0.38	0.33	0.81	5.60	10	3.76	0.50	18.75	0.012	0.25	4.42	28.9	11.9	75.5
6-16	5.51	12.3	20.2	1.54	0.46	0.68	0.31	0.30	2.11	5.33	.	4.34	0.34	10.70	0.038	0.28	13.80	.	.	.
6-17	6.01	13.8	22.6	1.72	0.52	0.74	0.37	0.34	0.89	5.95	5	2.85	0.42	13.20	0.017	0.24	3.78	11.5	25.5	33.4
6-18	5.84	10.3	20.9	1.24	0.43	0.62	0.60	0.40	2.78	3.25	55	10.62	0.32	44.50	0.018	1.07	59.75	277.2	52.6	517.8
6-19	6.30	34.7	25.4	2.01	0.74	0.87	0.44	0.35	2.53	5.66	20	5.17	0.60	6.97	0.007	0.32	6.49	27.7	13.8	73.3
6-20	6.33	58.8	27.6	2.17	0.80	1.10	0.43	0.50	3.81	5.02	40	6.58	0.98	61.50	0.063	0.41	7.04	60.7	10.3	154.6
6-21	6.19	23.6	24.5	1.92	0.62	0.87	0.42	0.35	2.34	5.67	25	4.80	0.51	33.45	0.026	0.26	4.34	37.6	17.2	88.5
6-22	5.22	0.0	20.7	1.44	0.35	0.57	0.32	0.30	0.75	5.71	10	2.86	0.22	20.50	0.023	0.26	7.24	112.3	42.2	152.8
6-23	5.48	7.0	20.0	1.45	0.37	0.60	0.39	0.30	1.01	5.06	15	3.96	0.23	11.90	0.021	0.27	3.98	118.7	26.7	54.8
6-24	5.79	17.8	20.2	1.53	0.44	0.76	0.41	0.34	1.09	4.83	.	5.19	0.30	32.70	0.015	0.41	15.28	.	.	.
6-25	6.27	30.5	27.9	2.23	0.77	0.89	0.40	0.33	2.21	7.20	15	3.88	0.65	66.05	0.063	0.33	5.73	56.5	12.9	44.1
6-26	5.94	13.2	21.0	1.55	0.51	0.73	0.36	0.34	0.33	5.09	20	4.66	0.33	13.45	0.011	0.41	6.30	29.0	8.1	29.3
6-27	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6-28	5.94	25.8	27.0	2.09	0.81	0.85	0.39	0.35	1.65	6.50	30	6.22	0.69	7.26	0.006	0.34	6.69	41.3	12.3	117.7
6-29	6.02	18.2	24.0	1.76	0.74	0.90	0.38	0.37	0.91	5.37	50	7.67	0.41	26.30	0.012	0.45	7.83	97.9	11.1	82.1
6-30	5.47	6.1	19.7	1.40	0.38	0.57	0.45	0.32	0.85	4.91	25	5.61	0.28	76.55	0.040	0.42	6.54	161.5	40.1	188.0
6-31	5.59	11.7	22.7	1.84	0.47	0.69	0.41	0.43	2.04	6.09	25	4.76	0.61	3.55	0.010	0.28	9.48	169.2	40.8	100.3
6-32	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
FC 6-33	5.75	11.6	19.7	1.54	0.42	0.62	0.33	0.25	0.59	5.09	20	4.47	0.31	33.30	0.028	0.37	7.43	88.6	23.2	53.8
6-34	6.16	24.4	25.3	1.85	0.72	0.94	0.34	0.41	3.01	6.53	15	4.42	0.60	16.95	0.020	0.35	6.03	85.0	9.5	49.2
6-35	5.76	9.7	21.5	1.69	0.45	0.64	0.34	0.28	0.69	6.26	10	2.55	0.31	11.95	0.014	0.18	3.72	18.0	10.1	10.9
6-36	5.76	8.4	21.9	1.66	0.49	0.68	0.37	0.33	0.94	6.14	10	2.96	0.40	11.25	0.018	0.25	4.10	15.8	6.0	19.0

PLOT-LAKE	**pH**	**ALK** (µeq/L)	**COND** (µS/cm)	**Ca** (mg/L)	**Mg** (mg/L)	**Na** (mg/L)	**K** (mg/L)	**Cl** (mg/L)	**SIO_2** (mg/L)	**SO_4** (mg/L)	**COLOR**[1] (hu)	**DOC** (mg/L)	**TIC** (mg/L)	**NH_3**[2] (µeq/L)	**NO_2NO_3**[2] (mg/L)	**TKN** (mg/L)	**TP** (µeq/L)	**Al**[1] (µeq/L)	**Mn**[1] (µeq/L)	**Fe**[1] (µeq/L)
6-37	5.89	13.9	21.3	1.60	0.49	0.69	0.37	0.33	0.60	5.82	10	2.92	0.41	17.27	0.015	0.20	3.74	17.7	17.4	40.5
6-38	5.69	5.8	19.4	1.50	0.39	0.65	0.36	0.33	1.02	5.33	10	2.91	0.33	6.78	0.010	0.31	3.76	27.5	32.0	46.0
7-1	6.16	49.2	20.9	1.77	0.46	0.62	0.45	0.33	1.04	4.21	25	4.54	0.77	64.25	0.034	0.37	9.42	43.1	12.4	211.8
7-2	6.40	43.5	23.4	2.00	0.58	0.87	0.39	0.32	1.09	5.13	15	4.53	0.62	11.90	0.012	0.28	7.18	30.7	10.8	45.9
FC 7-3	6.10	22.7	22.6	1.85	0.41	0.67	0.37	0.35	0.33	5.71	10	3.45	0.40	112.9	0.046	0.42	7.49	33.2	16.9	67.3
7-4	6.37	39.9	23.3	2.08	0.51	0.82	0.36	0.31	0.52	5.51	15	3.75	0.49	68.45	0.012	0.23	5.59	11.8	7.9	31.8
FC 7-5	5.56	9.6	20.0	1.39	0.36	0.60	0.30	0.30	1.07	5.18	45	4.56	0.26	125.1	0.101	0.40	13.05	196.9	42.7	446.0
7-6	6.21	36.8	25.9	2.30	0.65	1.06	0.31	0.40	2.03	5.40	60	7.85	0.72	22.85	0.018	0.50	15.17	164.0	14.6	194.5
7-7	6.64	126.2	32.3	3.05	0.80	1.36	0.48	0.38	3.79	5.25	35	5.38	1.67	27.55	0.023	0.36	12.67	101.6	19.2	227.1
7-8	5.95	25.6	20.4	1.57	0.40	0.61	0.41	0.18	1.67	3.25	.	6.91	.	.	.	0.64	61.00	.	.	.
7-9	6.06	29.3	20.7	1.71	0.42	0.74	0.33	0.26	1.27	4.85	30	4.78	0.52	90.25	0.032	0.38	9.15	88.6	10.9	89.1
7-10	6.51	138.6	47.8	5.02	1.35	1.50	0.20	0.37	3.60	11.88	.	5.97	1.56	40.40	0.006	0.54	13.85	.	.	.
FC 7-11	5.79	9.8	20.6	1.80	0.45	0.63	0.32	0.31	1.78	5.31	25	5.11	0.29	7.58	0.012	0.23	5.86	82.7	22.0	54.3
7-12	5.83	13.7	21.9	1.66	0.53	0.79	0.29	0.29	2.12	5.88	25	4.73	0.43	27.72	0.032	0.46	8.74	107.4	21.9	64.1
7-13	6.04	34.0	20.6	1.55	0.50	0.59	0.64	0.42	1.28	3.43	60	9.22	0.75	6.10	0.008	0.50	8.50	106.4	55.1	397.1
7-14	6.25	36.4	24.3	2.12	0.55	0.81	0.32	0.34	2.19	5.90	15	3.67	0.59	28.20	0.038	0.30	4.18	38.0	8.9	98.0
7-15	6.18	48.3	28.1	2.44	0.60	0.78	0.27	0.36	3.46	6.39	30	6.18	0.80	154.9	0.021	0.73	10.59	132.5	29.1	231.1
FC 7-16	6.66	115.0	32.2	2.90	0.79	1.37	0.45	0.34	6.09	5.88	35	4.72	1.43	19.95	0.024	0.34	5.08	40.6	11.1	69.4
7-17	6.39	57.5	26.1	2.25	0.57	1.11	0.37	0.40	3.84	5.47	30	5.10	0.87	20.70	0.039	0.31	7.45	94.2	29.3	250.9
7-18	6.10	28.8	24.1	1.88	0.57	0.82	0.33	0.34	1.65	5.86	25	4.98	0.56	28.75	0.059	0.35	7.47	102.8	13.9	124.4
7-19	5.87	10.7	23.0	1.87	0.54	0.73	0.16	0.19	1.72	6.32	35	4.73	0.41	8.95	0.008	0.53	25.50	141.0	27.1	134.1
7-20	6.20	27.8	23.9	2.24	0.58	0.87	0.30	0.30	1.73	5.17	40	6.69	0.53	20.30	0.025	0.30	8.23	63.9	11.2	202.4
7-21	5.97	11.4	25.1	2.03	0.57	0.78	0.33	0.49	1.66	6.31	45	5.66	0.42	65.30	0.025	0.40	7.41	101.5	27.4	187.2
7-22	5.85	9.6	21.7	1.77	0.48	0.67	0.24	0.35	0.14	6.33	15	2.79	0.30	11.10	0.012	0.20	3.35	17.8	3.6	12.3
7-23	6.28	29.2	22.3	1.87	0.51	0.72	0.39	0.36	0.15	5.54	10	3.76	0.66	6.40	0.008	0.24	5.46	9.4	9.6	21.8
7-24	5.94	10.6	21.0	1.64	0.49	0.68	0.35	0.31	0.23	5.71	15	3.92	0.39	11.21	0.008	0.28	6.22	33.3	7.6	72.6
7-25	5.67	7.8	20.0	1.51	0.37	0.64	0.32	0.30	0.22	5.61	10	3.21	0.28	41.55	0.025	0.21	4.42	62.7	10.8	39.8
7-26	6.12	15.1	22.1	1.83	0.51	0.65	0.34	0.30	0.79	6.03	15	3.16	0.41	20.10	0.011	0.16	3.73	24.5	7.9	19.4
7-27	5.56	6.7	21.4	1.66	0.47	0.70	0.30	0.31	0.98	5.94	25	4.41	0.31	29.00	0.017	0.25	4.20	81.9	19.4	55.9
7-28	5.54	11.5	20.5	1.60	0.43	0.66	0.35	0.30	2.30	4.72	55	7.93	0.33	54.60	0.019	0.49	11.27	154.5	27.6	277.6
7-29	6.17	34.0	26.8	2.29	0.56	0.80	0.43	0.28	1.71	6.07	55	5.78	0.79	195.5	0.027	0.64	27.17	129.2	46.1	1612.0
7-30	5.82	7.8	22.2	1.91	0.51	0.70	0.26	0.27	0.41	5.84	35	5.66	0.32	29.15	0.033	0.36	7.43	94.8	13.5	161.1

PLOT-LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3[2] (µeq/L)	NO_2NO_3[2] (mg/L)	TKN (mg/L)	TP (µeq/L)	Al[1] (µeq/L)	Mn[1] (µeq/L)	Fe[1] (µeq/L)
7-31	5.74	18.9	23.4	1.50	0.44	0.61	0.40	0.35	0.96	4.84	45	8.20	0.34	50.70	0.042	1.07	40.67	112.6	28.4	126.7
7-32	5.80	12.1	21.7	1.65	0.51	0.67	0.39	0.33	0.83	5.36	40	6.69	0.38	76.50	0.028	0.44	8.65	87.9	18.8	132.8
7-33	5.07	8.4	30.3	2.47	0.75	0.89	0.31	0.49	5.05	6.10	125	19.42	0.37	45.50	0.014	0.68	20.47	259.6	40.0	632.9
7-34	5.46	11.6	26.8	2.21	0.57	0.98	0.33	0.64	2.49	6.96	50	7.72	0.38	21.30	0.013	0.28	11.63	166.4	38.3	231.7
7-35	5.91	14.1	23.9	1.94	0.55	0.87	0.33	0.32	1.10	6.42	35	5.74	0.36	20.30	0.012	0.24	5.94	68.0	18.3	157.6
7-36	5.36	5.5	18.5	1.21	0.41	0.60	0.38	0.28	1.37	4.06	50	7.31	0.27	39.30	0.033	0.40	10.00	102.4	25.4	102.2

LEGEND

VARIABLE EXPLANATIONS

ALK = total inflection point alkalinity
Ca = calcium
Na = sodium
Cl^a = chloride
SO_4 = sulphate
DOC = dissolved organic carbon
NH_3 = ammonia
TKN = total Kjeldahl nitrogen
Al^a = aluminum
Fe^b = iron

COND = specific conductance (µS/cm at 25° C)
Mg = magnesium
K = potassium
SiO_2 = silica
COLOR = water color (Hazen platinum-cobalt scale)
TIC = total inorganic carbon
$NO_2NO_3{}^b$ = nitrite + nitrate
TP^b = total phosphorus
Mn^b = manganese

[a] values below detection limit assigned a value of 4.90 µg/L
[b] values below detection limit assigned a value of 1.90 µg/L

NOTATIONS

FC ***Plot-Lake Number*** = food chain lake
<u>Plot-Lake number</u> = drained as of autumn 1995
Plot-Lake number* = lake inaccessable by helicopter
. = no data
[1] 1995 values only
[2] 2 year means from 1993 and 1995 data
[3] Plot 5 Lake 40 does not exist

Key to Figure 13. Maps of individual food chain lakes (N = 20) in Muskoka showing the habitat characteristics associated with each lake, as well as the locations of water, minnow, leech and macroinvertebrate sampling sites (see McNicol *et al.* 1996a for description of methods). Habitat characterization is based on the Canadian Wetland Classification System.

HABITAT CHARACTERISTICS

Shrub Wetland: ericaceous/ shrub wetlands (includes all shrub dominated bogs and fens)

Emergent Wetland: includes shallow water and deep water marshes

Wetland Meadow: includes meadow marsh and graminoid fen

Upland Forest: for site maps, includes hardwood and conifer swamps, as well as treed islands

Chico Swamp: swamps with standing dead trees

Open Water: open water

SAMPLING VARIABLES

Minnow Trap: locations of six minnow traps

Leech Trap: locations of five leech traps

Water Sample: location of autumn water sample by helicopter

Duck Box: location of duck box

Benthic: locations of ten benthic net drags used to sample benthic macroinvertebrates

Sweep: locations of ten sweep net samples used to collect nektonic macroinvertebrates

Hoop: locations of ten hoop samples used primarily to collect larval trichopterans

Muskoka Plot 1 Wetland 23

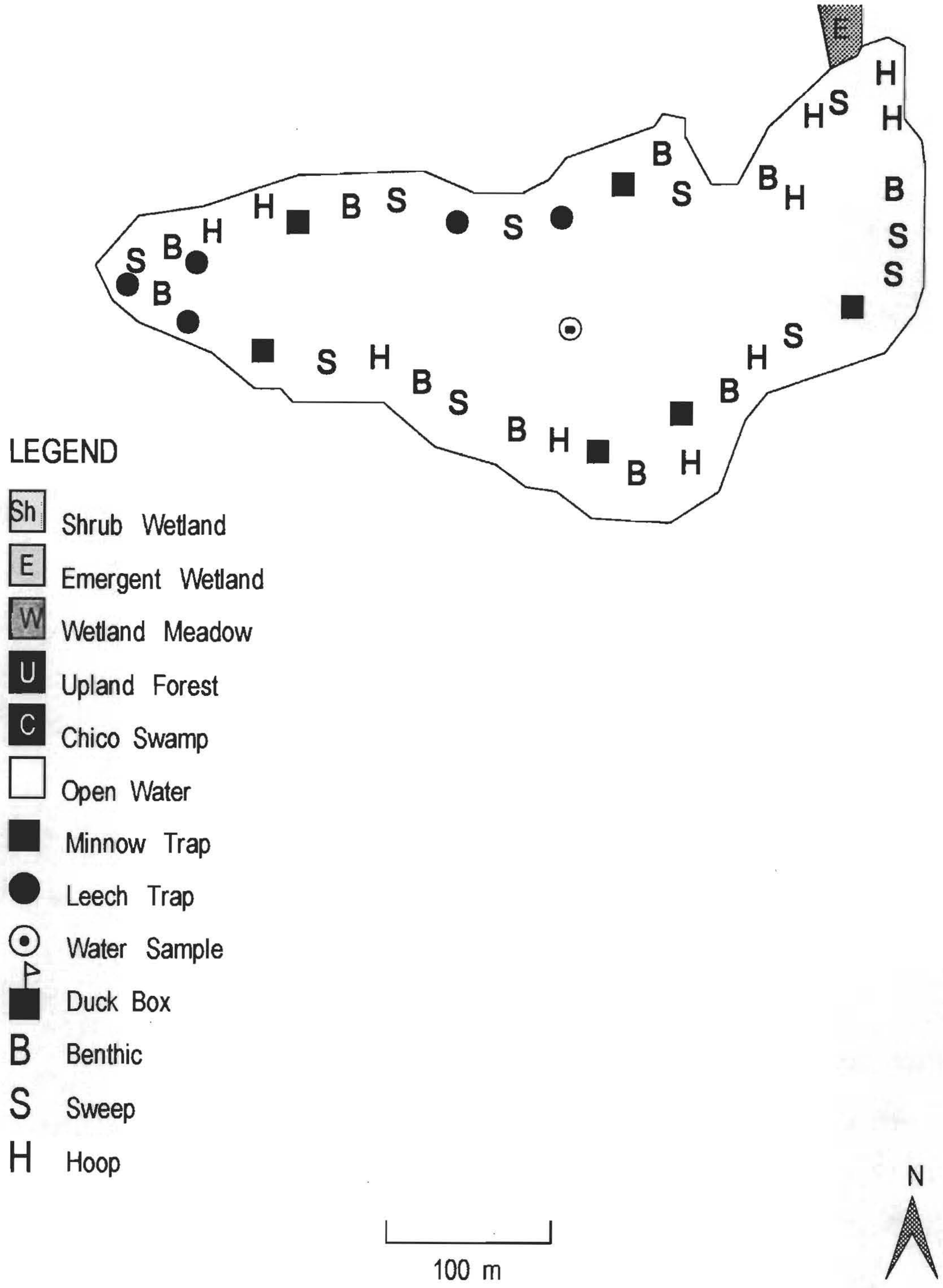
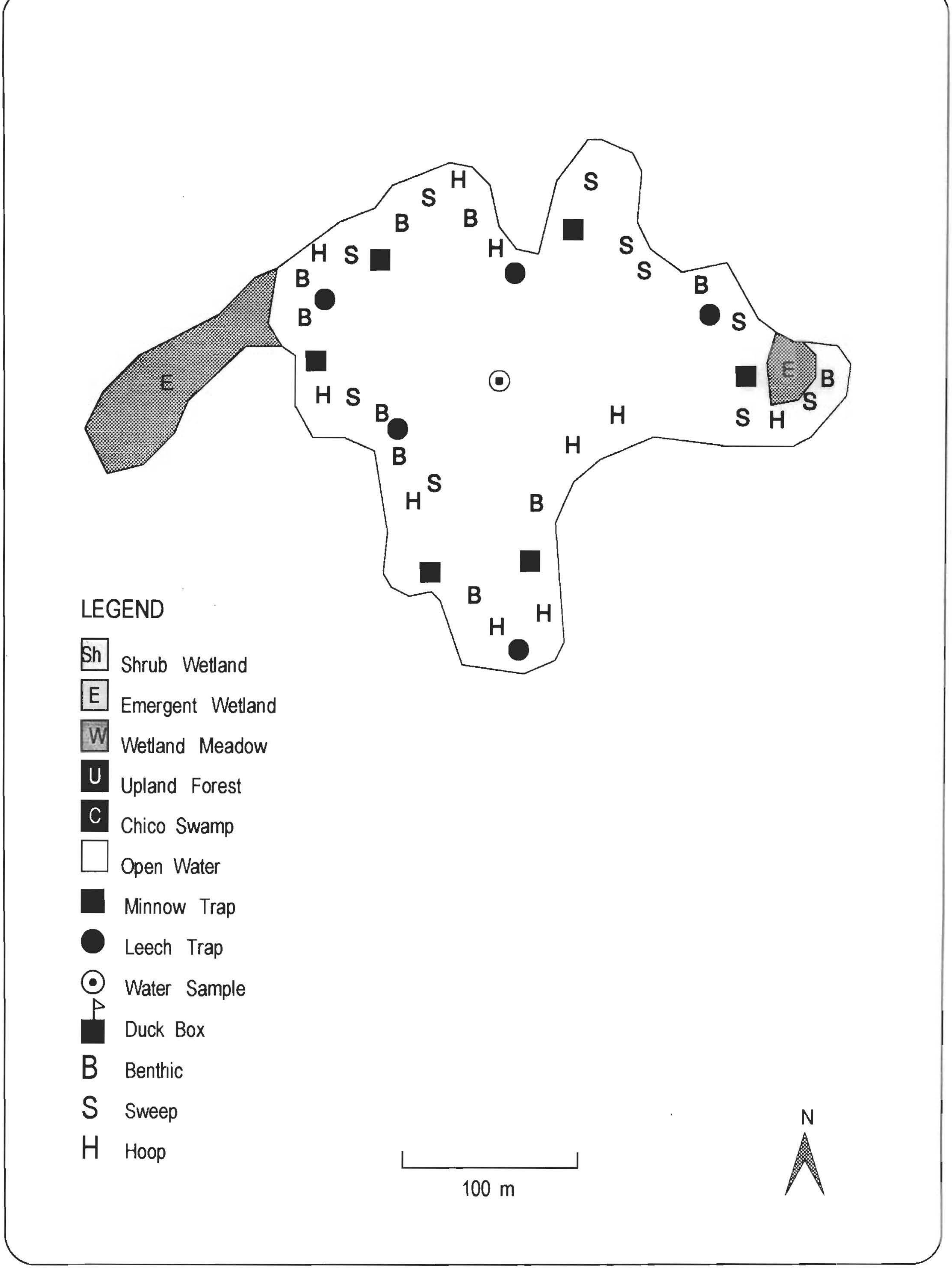


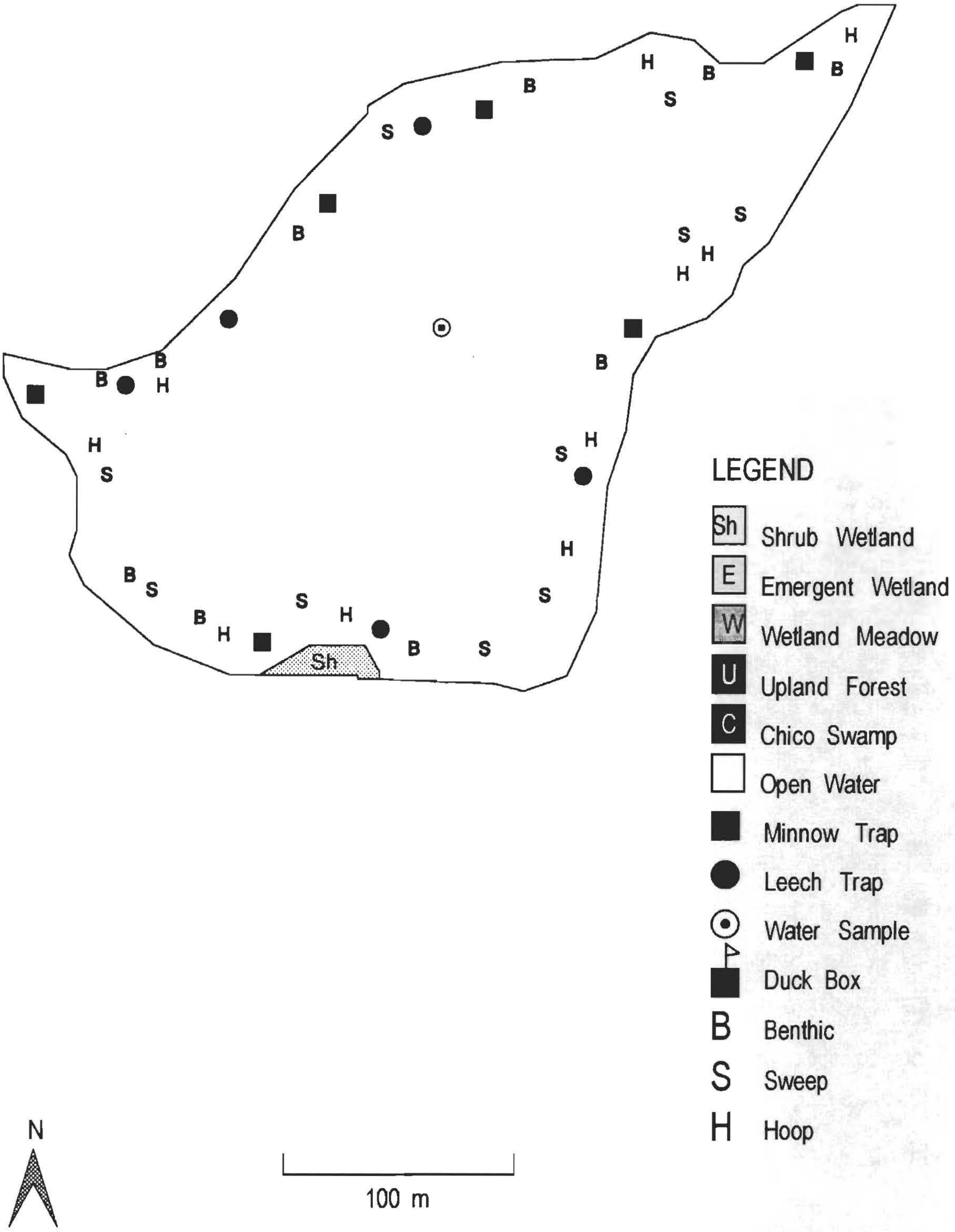
Fig. 13

Food Chain Monitoring Program

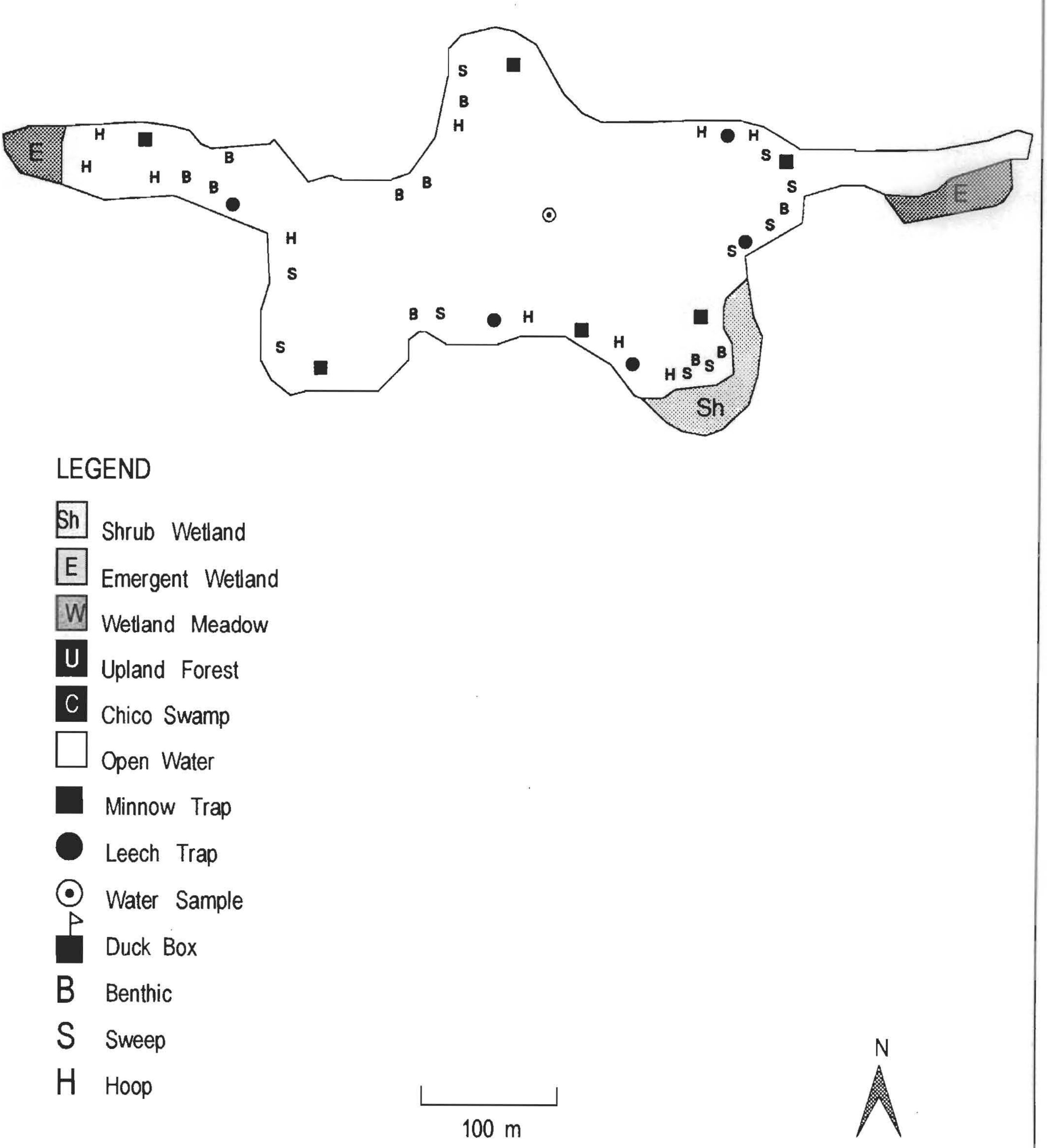
Muskoka Plot 1 Wetland 32



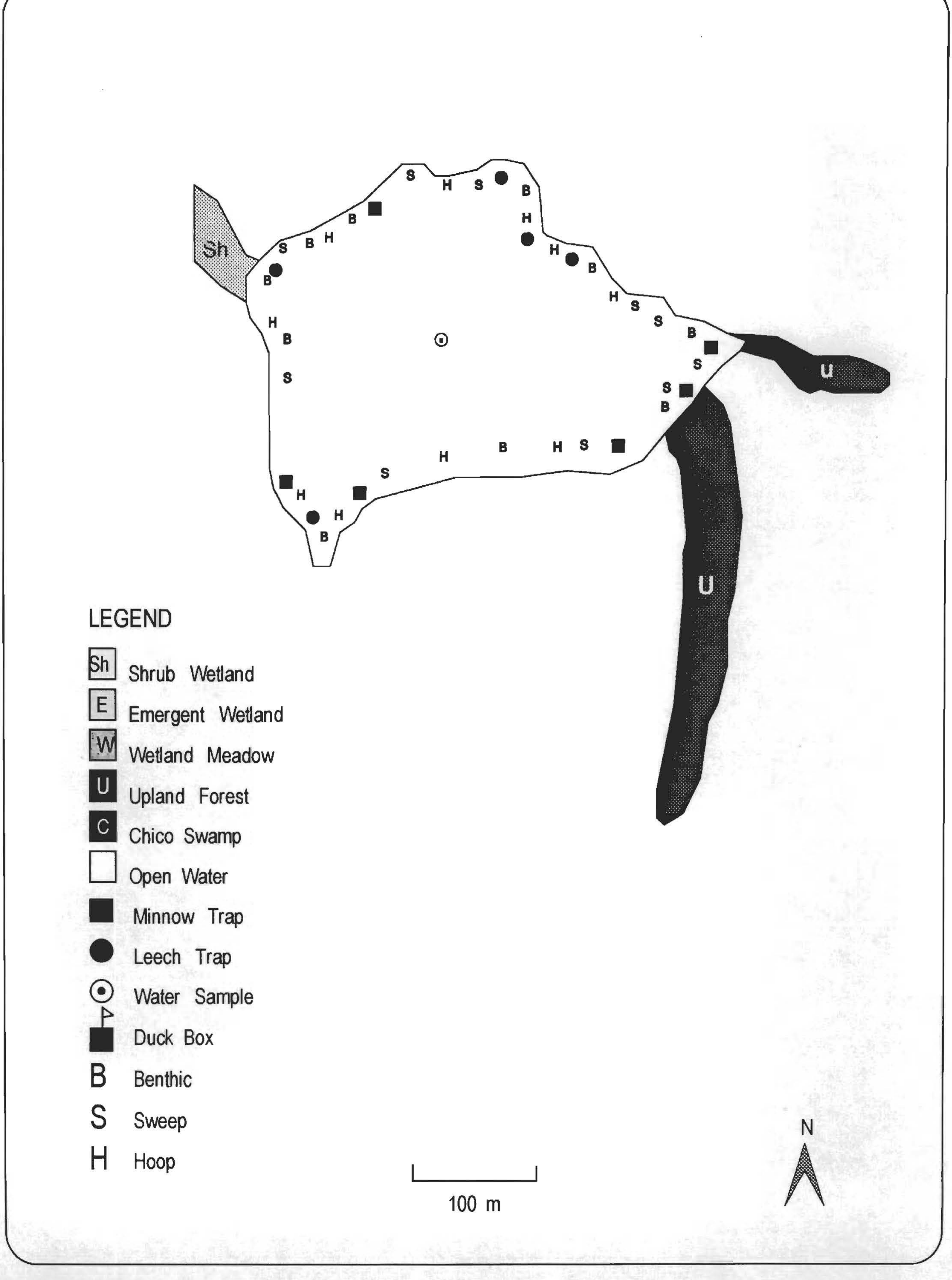
Muskoka Plot 2 Wetland 2



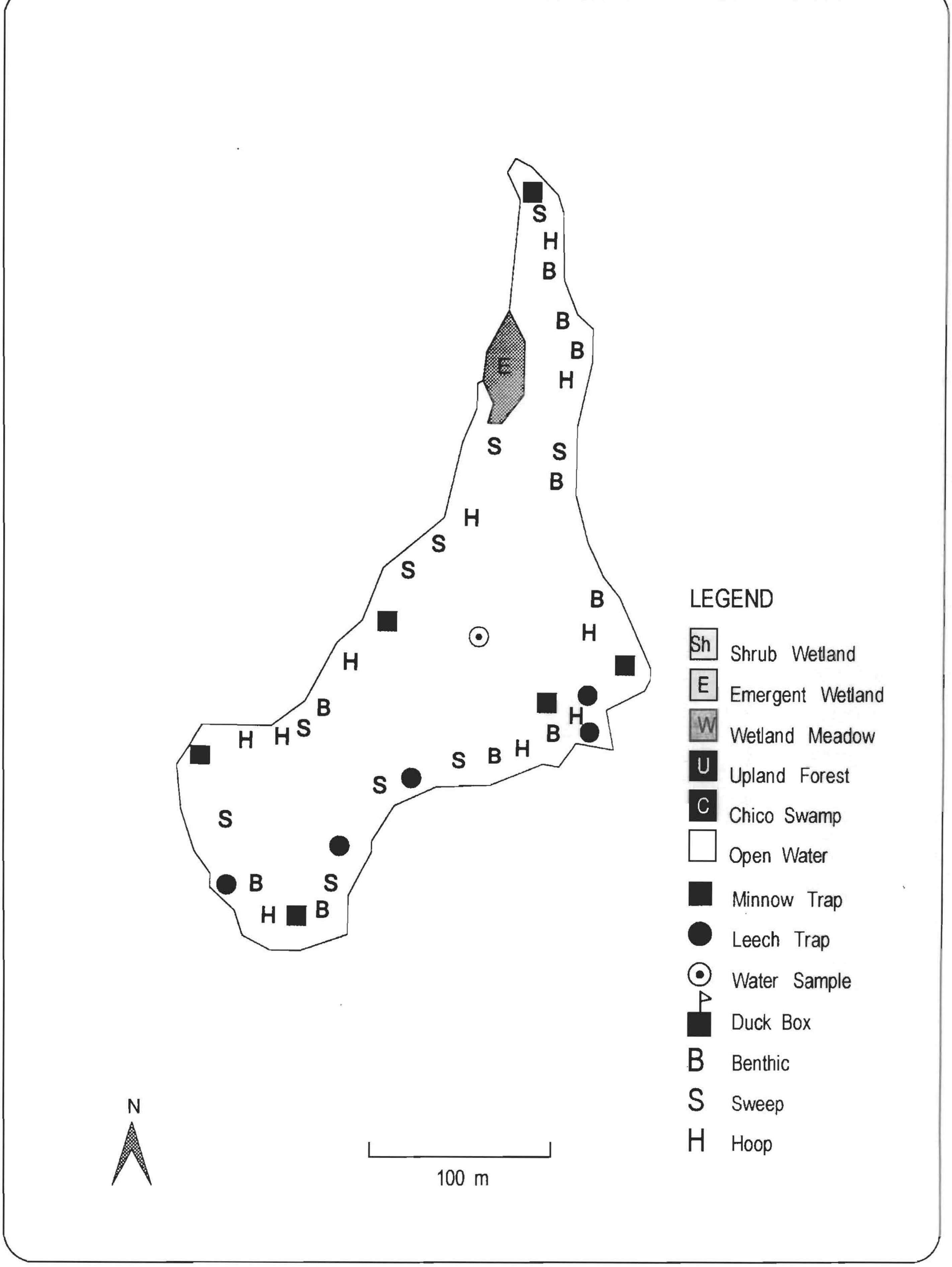
Muskoka Plot 2 Wetland 18



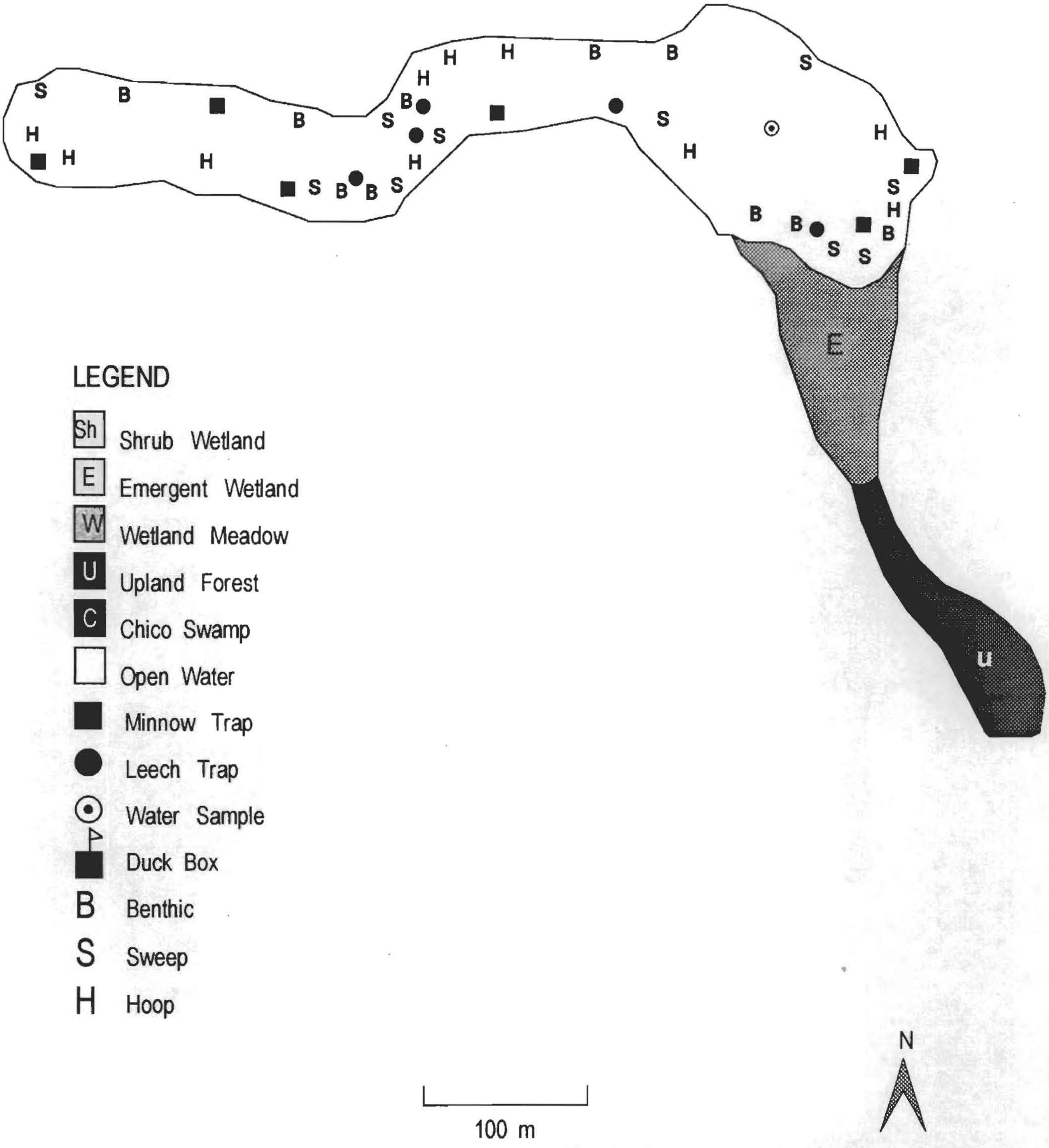
Muskoka Plot 2 Wetland 27



Muskoka Plot 3 Wetland 2

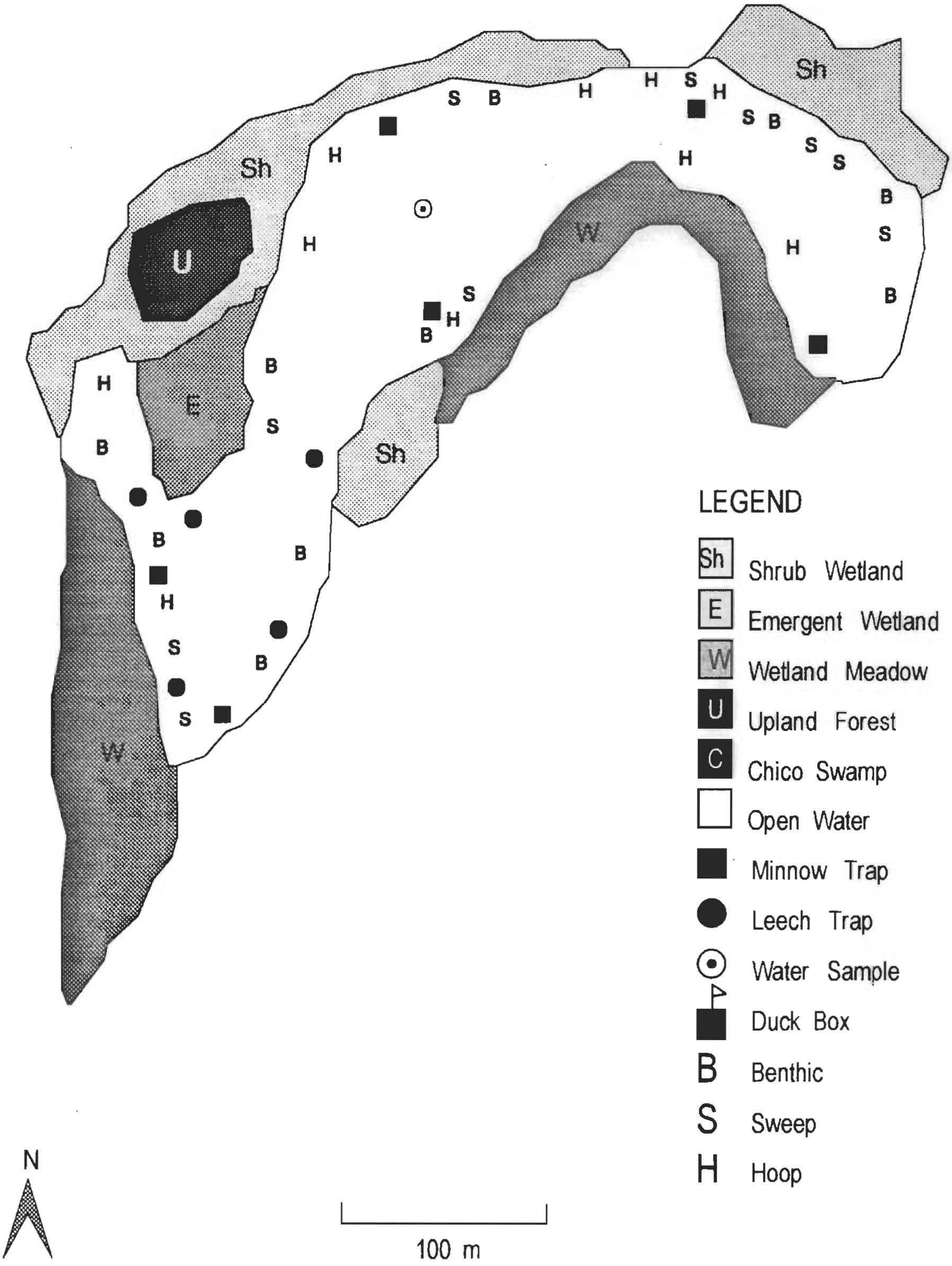


Muskoka Plot 3 Wetland 12

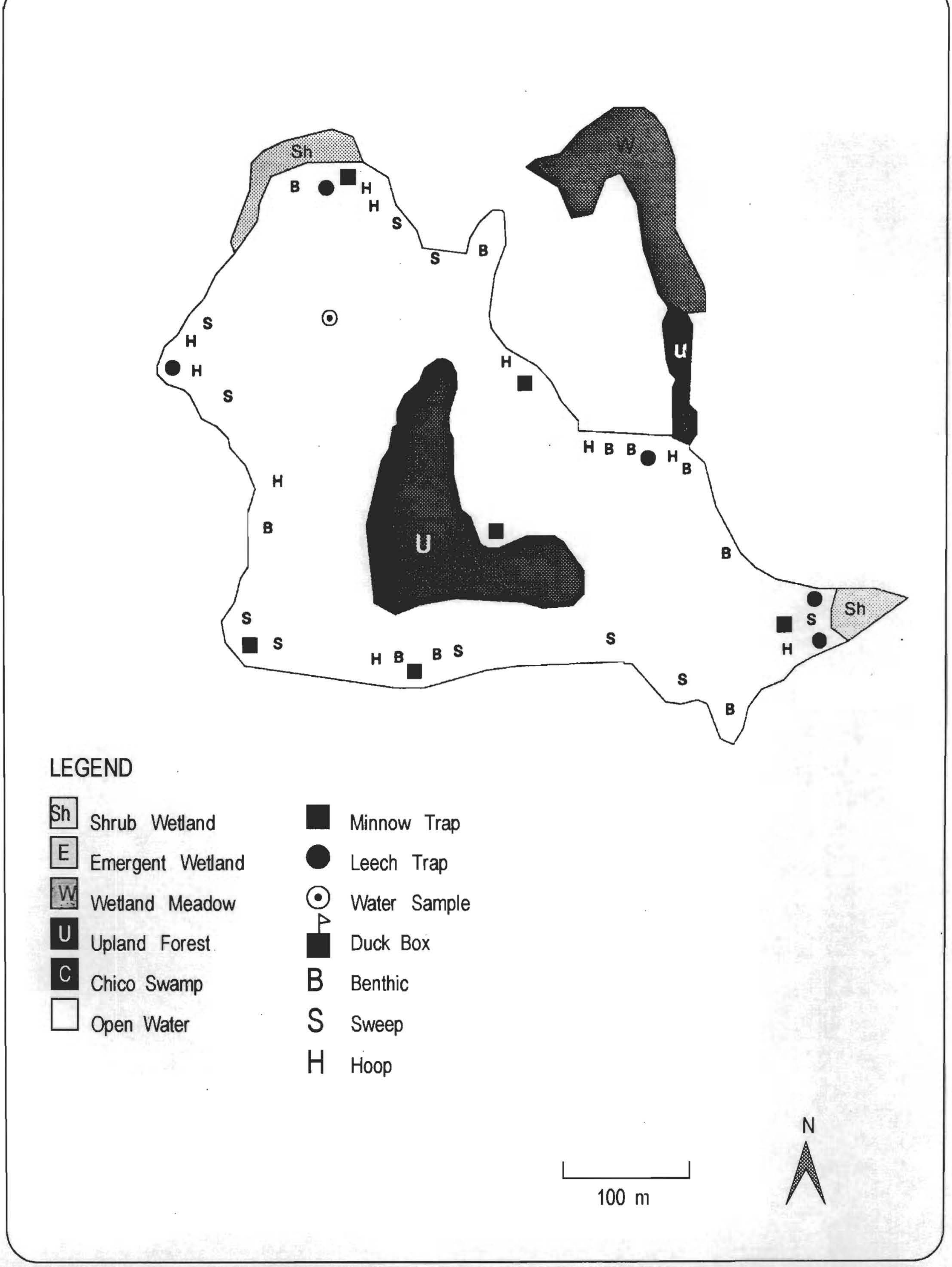


Food Chain Monitoring Program

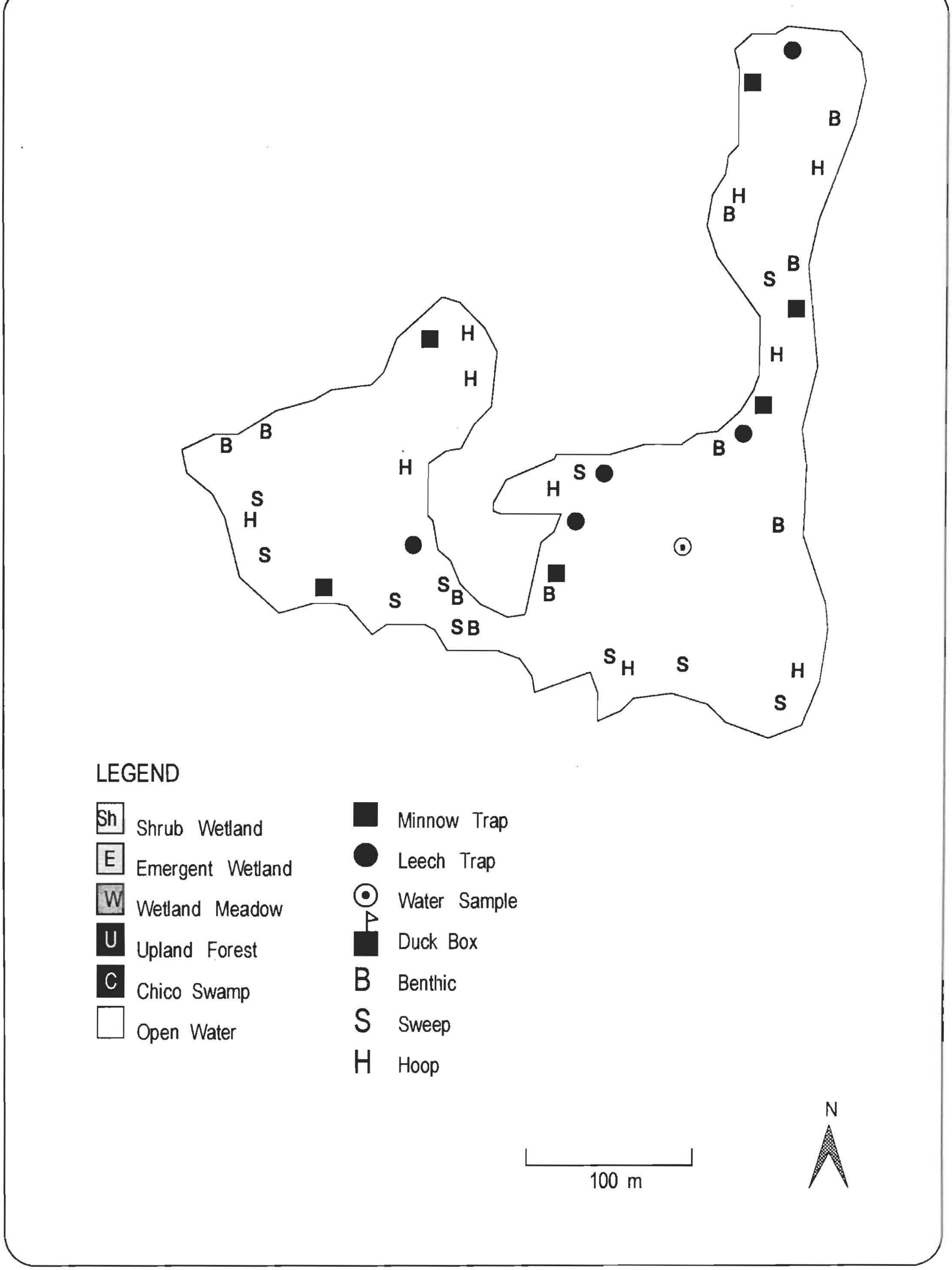
Muskoka Plot 3 Wetland 35



Muskoka Plot 4 Wetland 15

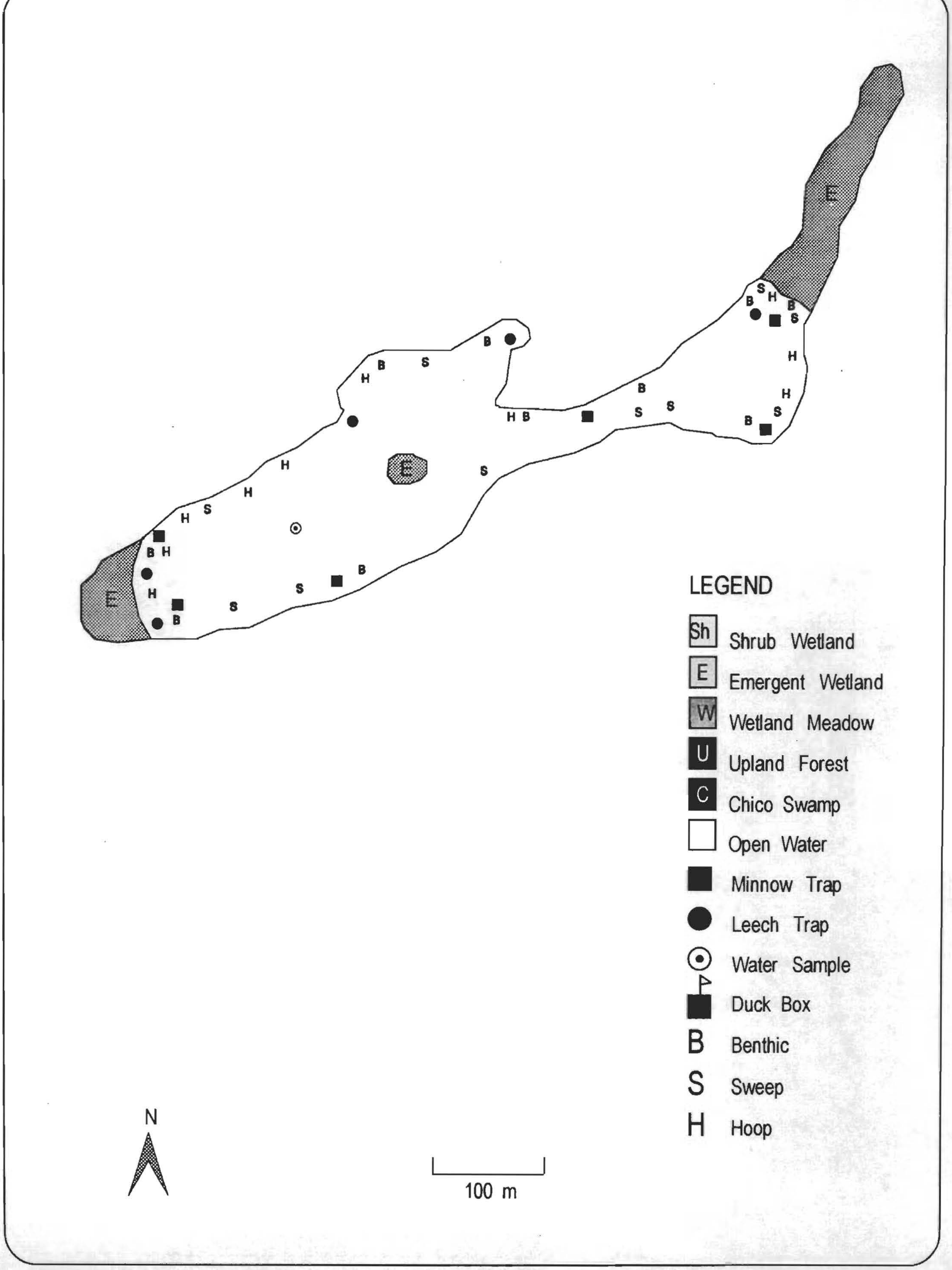


Muskoka Plot 4 Wetland 22

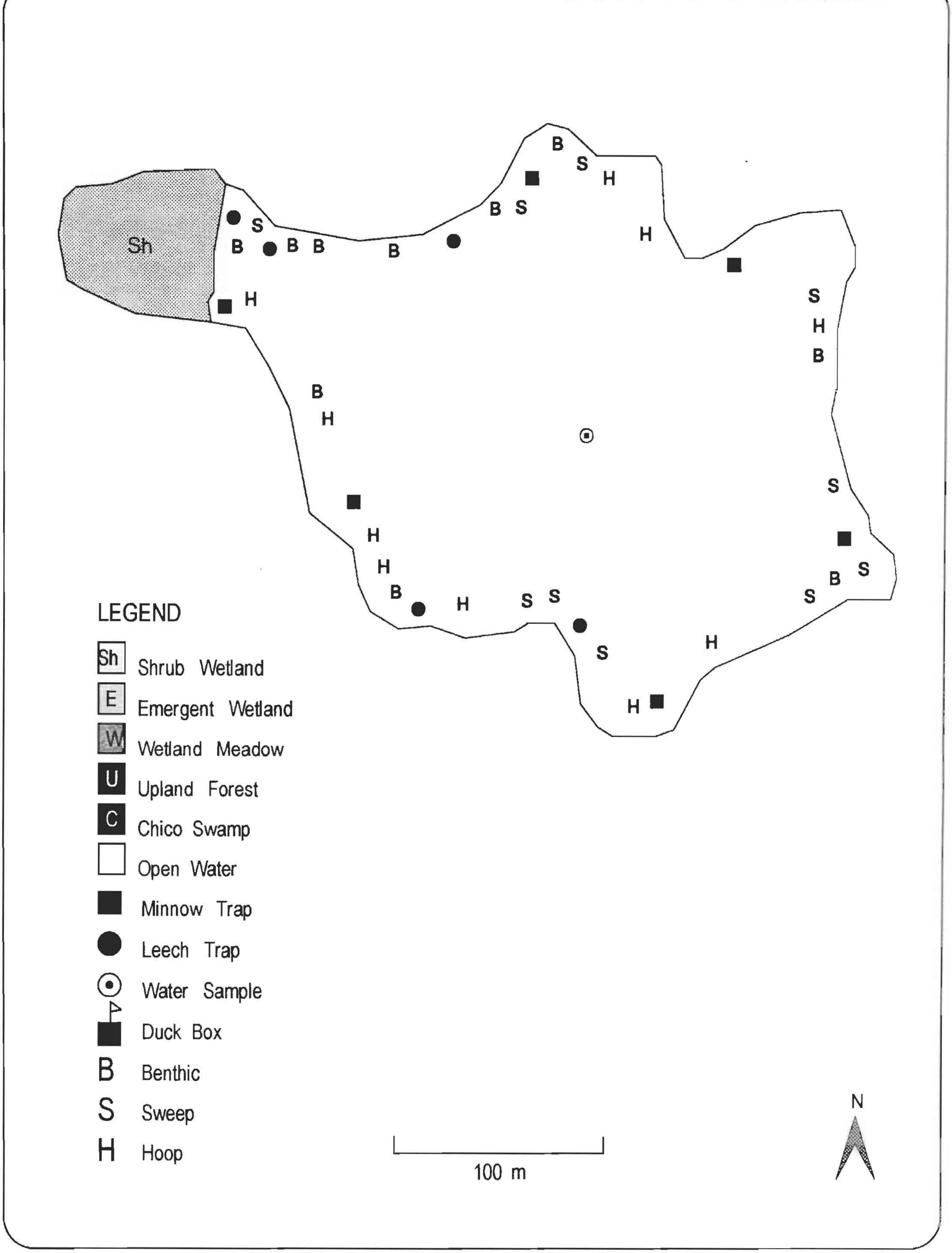


Food Chain Monitoring Program

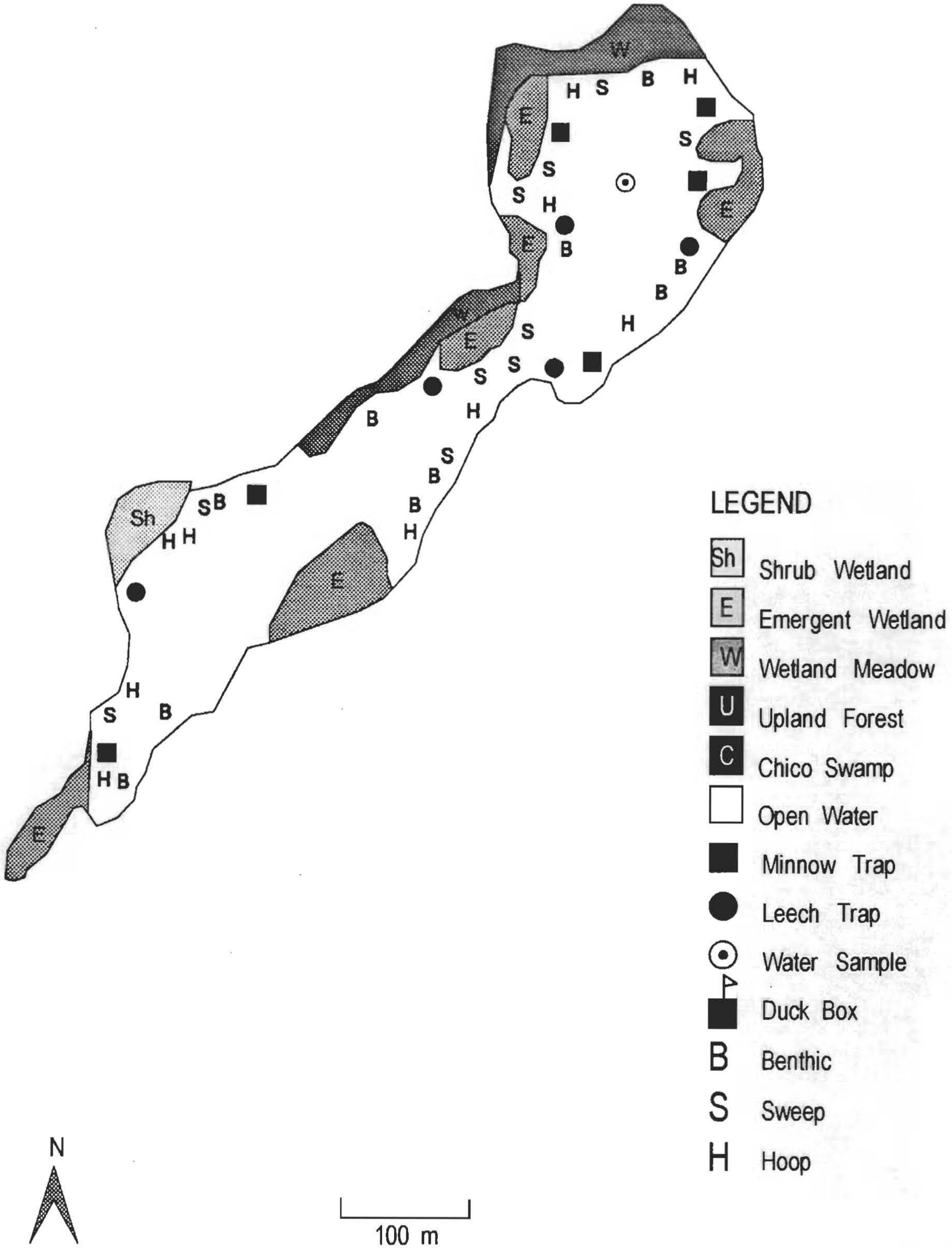
Muskoka Plot 4 Wetland 35



Muskoka Plot 5 Wetland 8

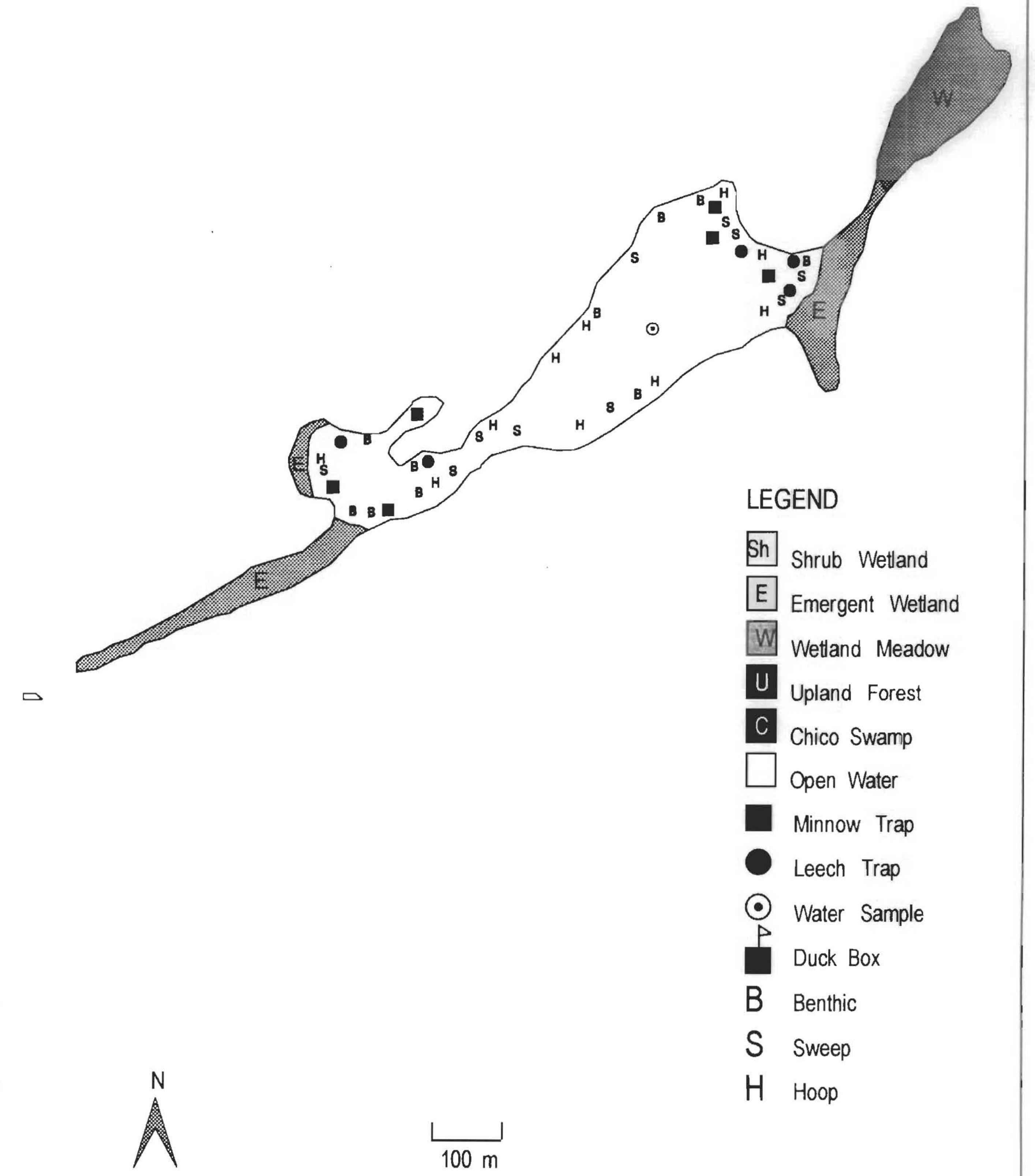


Muskoka Plot 5 Wetland 16

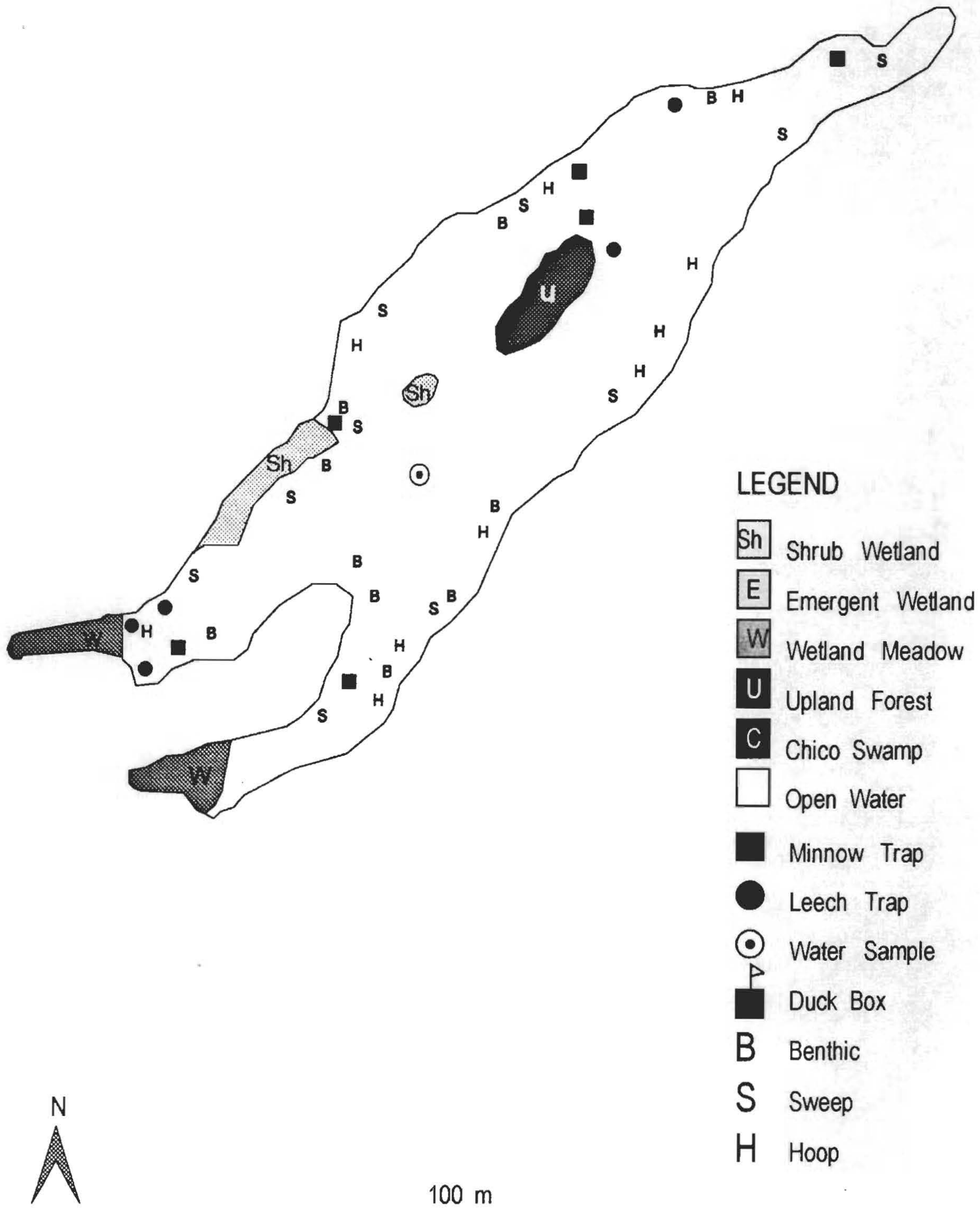


Food Chain Monitoring Program

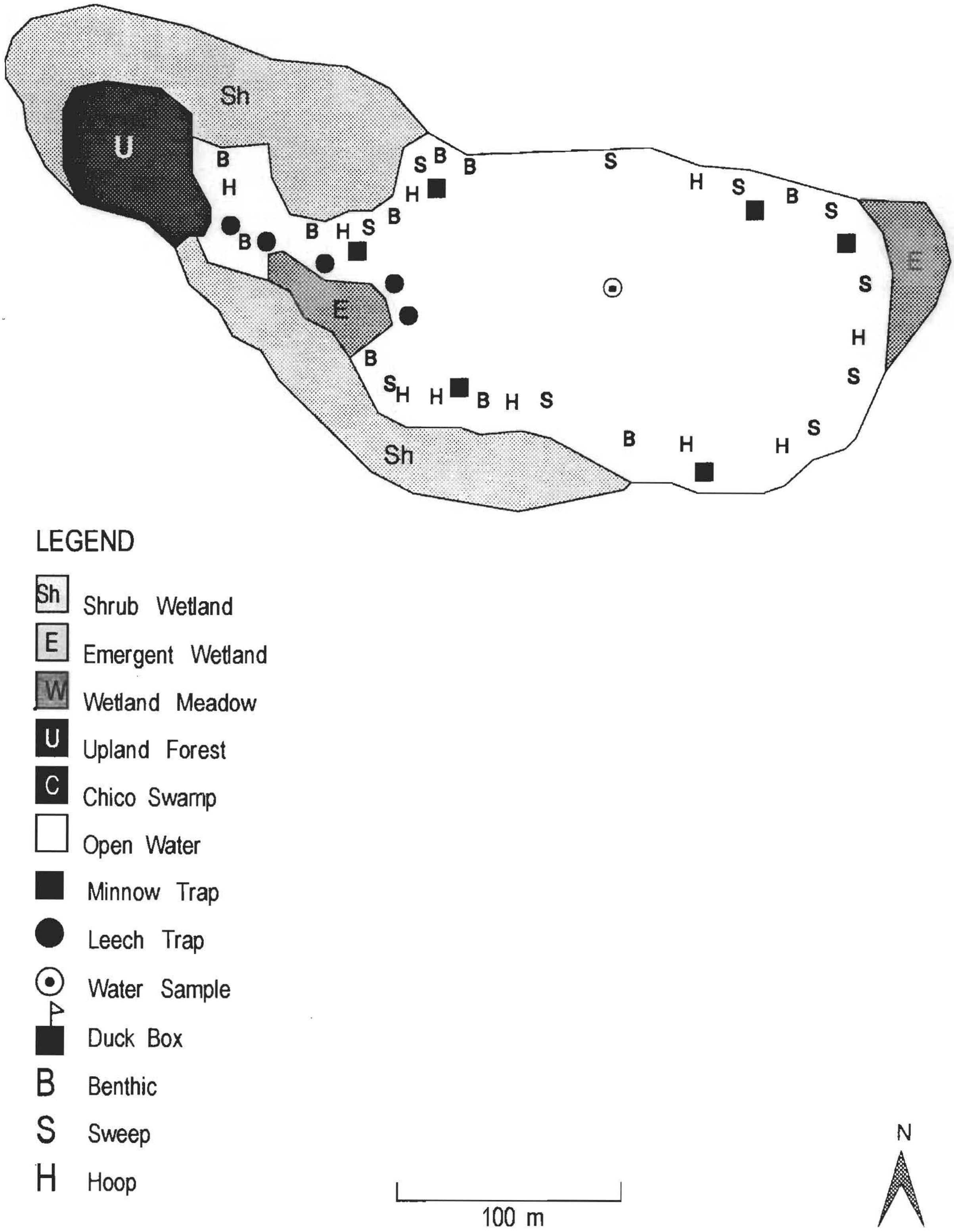
Muskoka Plot 6 Wetland 8



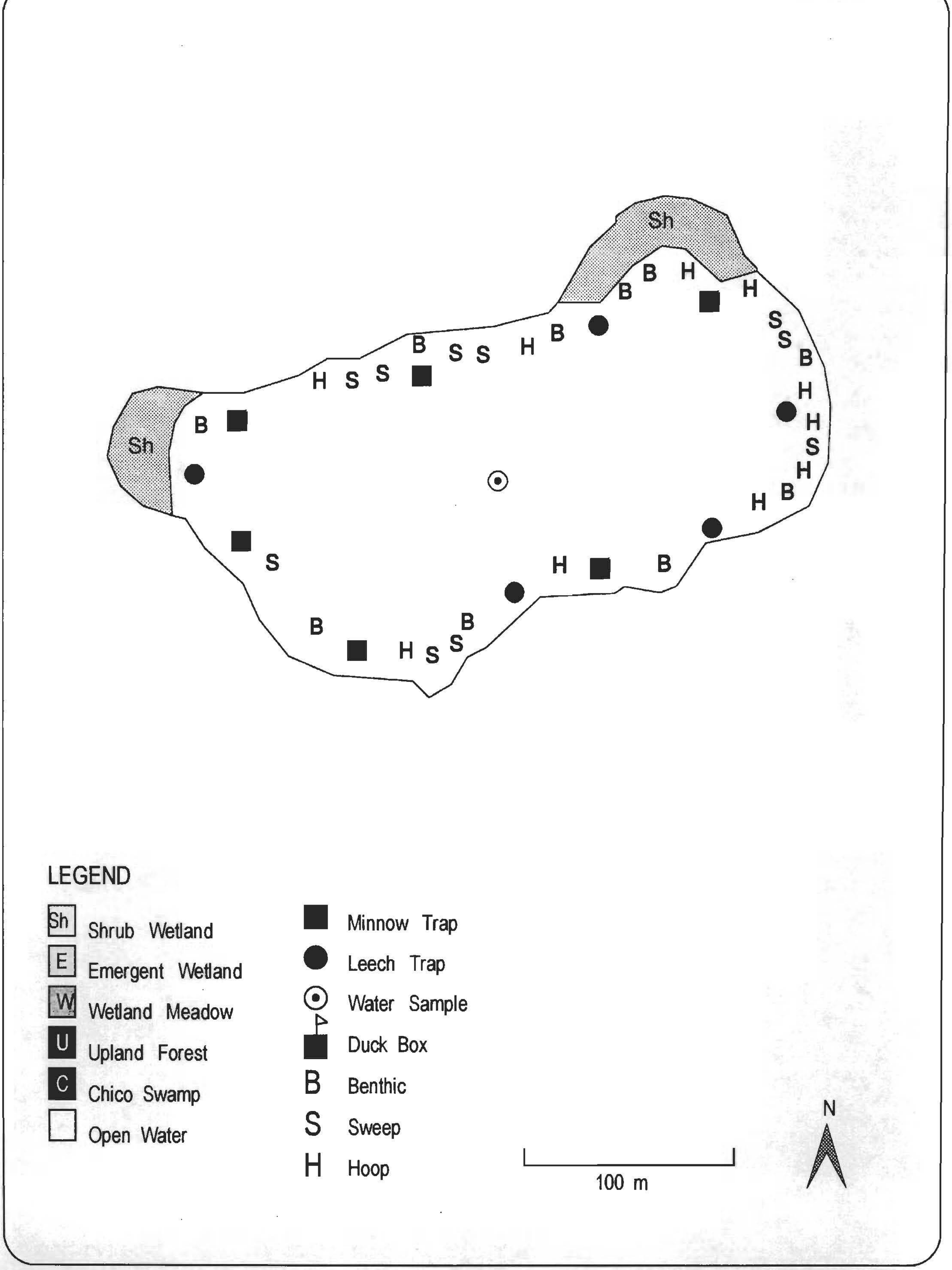
Muskoka Plot 6 Wetland 13



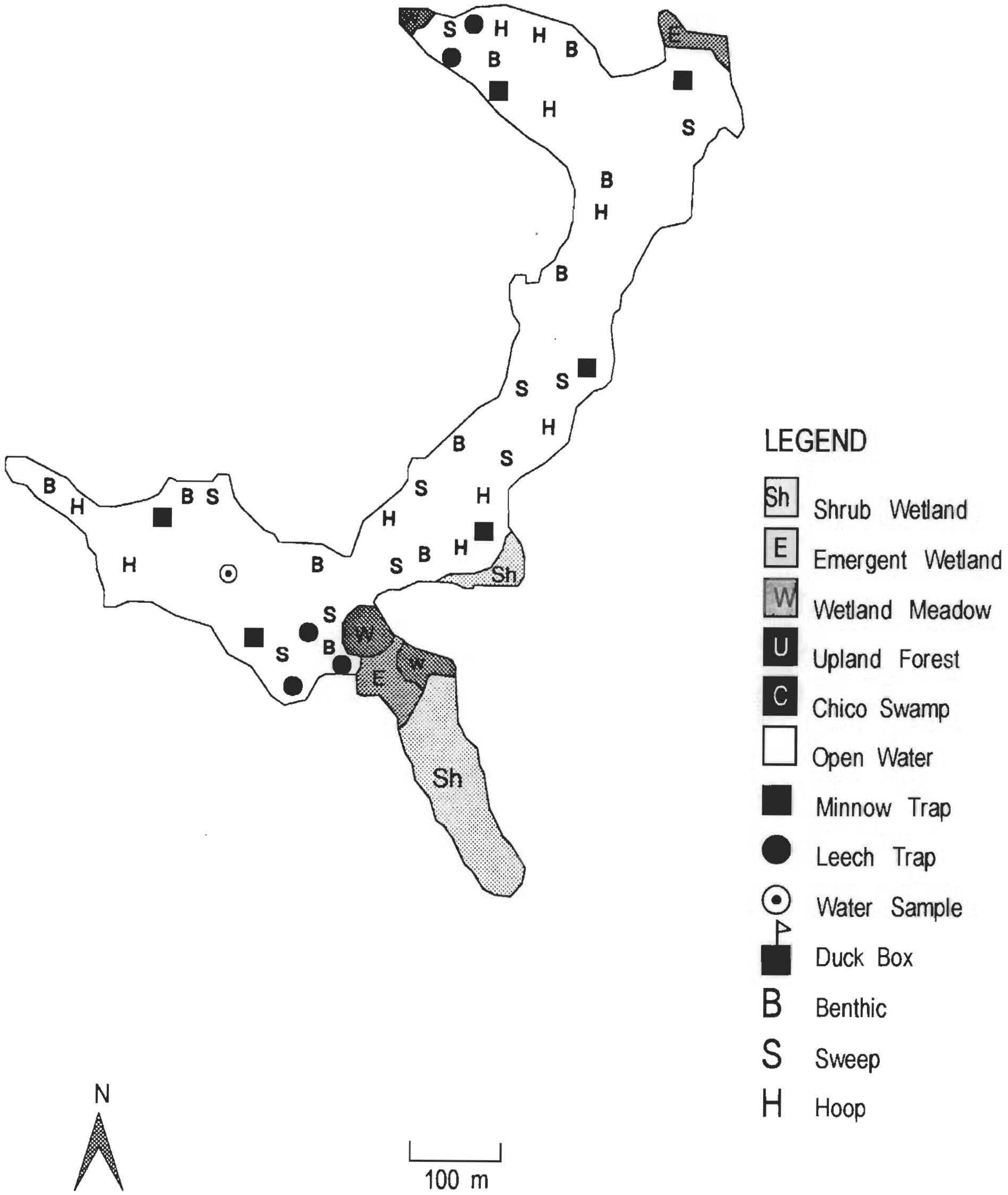
Muskoka Plot 6 Wetland 33



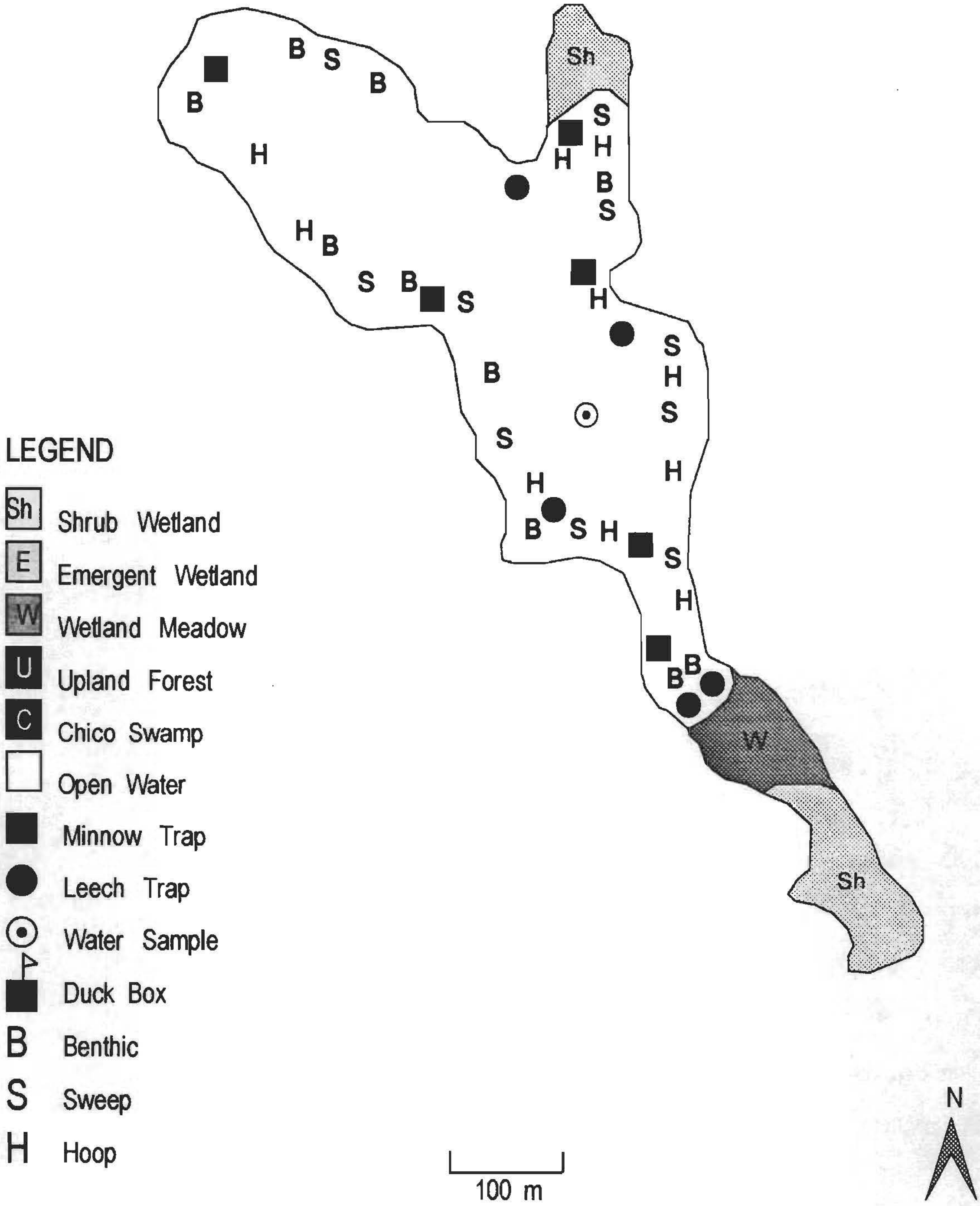
Muskoka Plot 7 Wetland 3



Muskoka Plot 7 Wetland 5



Muskoka Plot 7 Wetland 11



Muskoka Plot 7 Wetland 16

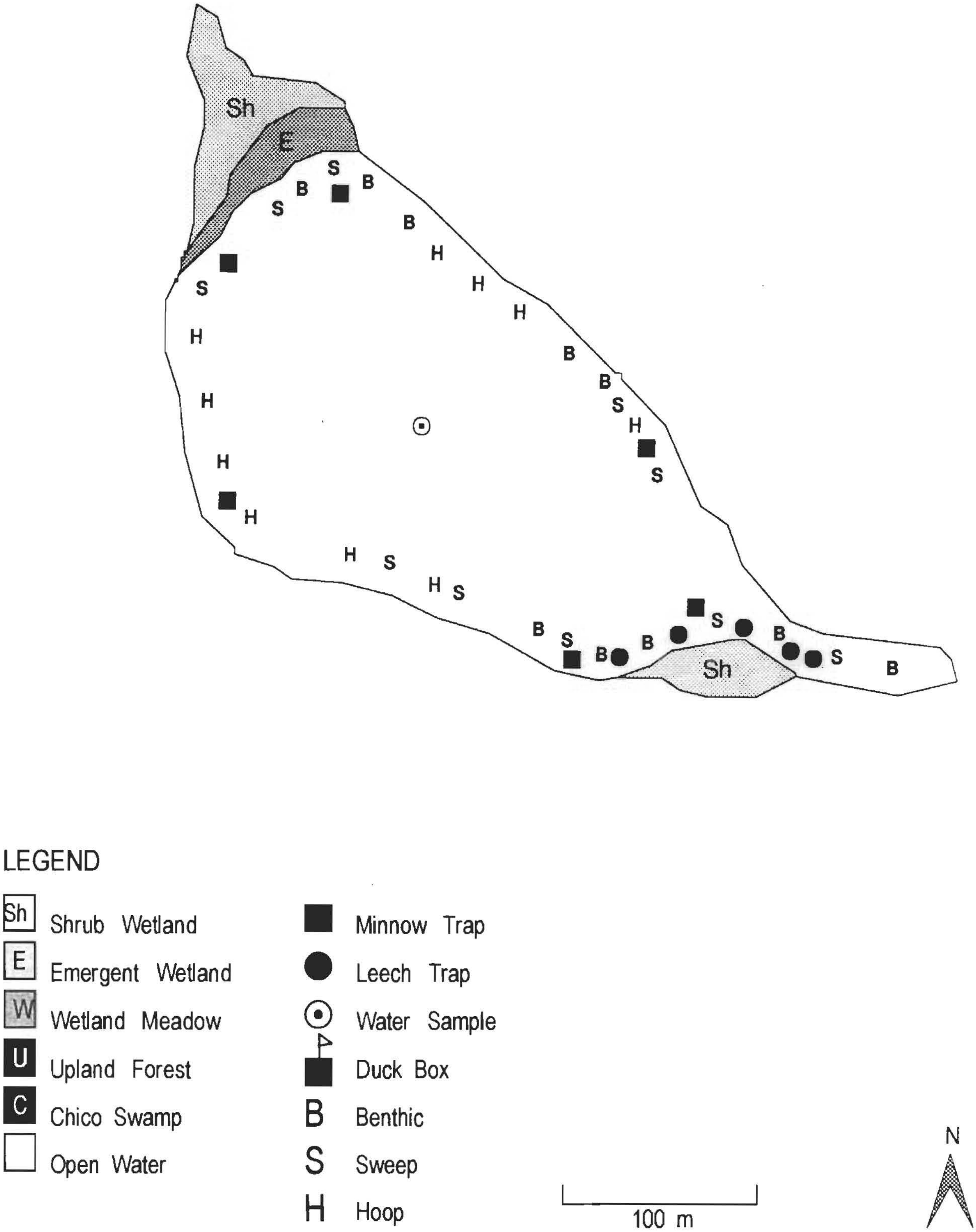


Table 20. Locations, morphometric and chemical characteristics of 20 Muskoka food chain lakes. Chemical values are three year means (fall sampling: 1990, 1993, 1995). Fish are scored as absent (FA) or dominant fish groups are scored as Cyp (cyprinid), Bst (brook stickleback), YP (yellow perch), and Pum (pumpkinseed).

PLOT	LAKE	UTM ZONE	UTM EAST	UTM NORTH	AREA (ha)	DEPTH (m)	pH	ALK (μeq/L)	DOC (mg/L)	FISH TYPE
1	23	17	6598	50068	6.5	4.9	6.47	54.8	3.16	YP
1	32	17	6629	50068	4.5	3.7	5.77	20.5	4.40	Cyp
2	2	17	6733	50036	5.7	8.6	5.24	-1.2	5.95	Cyp
2	18	17	6718	50067	7.5	12.0	5.77	8.6	3.13	Cyp
2	27	17	6762	50076	7.5	14.2	5.89	12.7	3.99	Pum
3	2	17	6663	50250	3.6	8.0	5.86	24.7	7.18	Cyp
3	12	17	6683	50264	4.5	5.9	5.45	12.8	11.04	FA
3	35	17	6694	50297	4.3	2.5	5.35	-9.9	5.91	FA
4	15	17	6635	50365	11.2	6.3	5.40	5.1	3.14	BSt
4	22	17	6668	50372	6.1	7.1	5.51	4.4	2.86	FA
4	35	17	6673	50394	6.5	6.7	6.21	34.5	3.38	FA
5	8	17	6890	50178	5.5	1.5	5.08	-6.7	4.32	FA
5	16	17	6907	50185	7.0	9.2	5.38	-1.2	5.02	FA
6	8	17	6752	50437	9.2	10.7	5.98	15.8	3.65	YP
6	13	17	6705	50439	14.2	16.1	5.72	7.9	3.15	Cyp
6	33	17	6683	50480	3.0	4.6	5.75	11.6	4.47	FA
7	3	17	6628	50473	4.0	7.0	6.10	22.7	3.45	FA
7	5	17	6604	50473	12.8	6.2	5.48	11.5	4.42	FA
7	11	17	6604	50486	11.9	10.2	5.72	12.7	5.26	FA
7	16	17	6577	50508	5.1	7.9	6.66	115.0	4.72	YP

Table 21. Summary of fish and amphibian species collected in minnow traps in Muskoka study lakes (1989, 1991), and use of study lakes by beavers (1994 aerial survey). (See legend for explanation of variables and notations).

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
1	1	6.48	FP-C	2	PUM, YP		ACTIVE
1	2	6.43	FP-C	1	YP		UNUSED
1	3	6.53	FP-C	2	LB, PUM		OLD
1	4	6.36	FP-C	1	PUM		.
1	5	6.47	FA	0			ACTIVE
1	6	6.47	.	.			UNUSED
1	7	6.08	FP-C	1	PUM		OLD
1	8	6.12	FP-C	1	PUM		ACTIVE
1	9	6.39	FP-C	3	PUM, YP, WS		OLD
1	10	6.33	FA	0			OLD
1	11	6.33	FP-C	2	PUM, YP		OLD
1	12	6.56	FP-C	3	CS, GS, YP		OLD
1	13	6.7	FP-C	3	PUM, YP, GS		OLD
1	14	.	.	.			UNUSED
1	15	6.55	FA	0			ACTIVE
1	16	6	FP-NC	2	CS, NRD	MF	ACTIVE
1	17	6.42	FP-NC	3	BLS, FM, NRD		OLD
1	18	6.35	FP-C	3	PUM, YP, CC	BF	.
1	19	6.09	FP-C	2	PUM, YP		OLD
1	20	5.79	FP-C	4	PUM, CC, FM, NRD	GMF	ACTIVE
1	21	6.55	FP-C	3	PUM, YP, BM	BF	ACTIVE
1	22	6.12	FP-C	1	PUM		.
1	FC 23	6.47	FP-C	2	PUM, YP	BF	OLD
1	24	5.59	FP-C	6	BLS, BB, FM, PD, NRD, FD	GF	UNUSED
1	25	5.58	FP-C	4	PUM, FD, NRD, PD		OLD
1	26	6.37	FP-C	2	YP, CC		.
1	27	6.51	FP-C	2	YP, CC		ACTIVE
1	28	4.73	FA	0		WF	UNUSED
1	29	5.99	FP-NC	1	FM		.OLD
1	30	6.11	FP-NC	2	NRD, FD	GF	OLD
1	31	.	.	.			UNUSED
1	FC 32	5.77	FP-NC	1	NRD	GMF	OLD
1	33	6.43	FP-C	2	PUM, CC		.
1	34	5.89	FP-C	3	PUM, YP, PD		ACTIVE
1	35	5.63	FP-C	1	PUM		.
2	1	5.34	FP-NC	2	PD, PS	GMF	.
2	FC 2	5.24	FP-NC	2	PD, PS		OLD
2	3	5.55	FP-C	2	PUM, GS		OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
2	4	6.09	FP-C	5	PUM, NRD, FD, CC, BS		ACTIVE
2	5	5.27	FP-C	1	PUM		ACTIVE
2	6	5.72	.	.			OLD
2	7	5.49	FP-C	2	PUM, YP		OLD
2	8	5.23	FP-C	3	PUM, YP, CC	BF	.
2	9	4.88	FA	0		WF	OLD
2	10	5.84	FP-C	3	PUM, GS, CC	GF	ACTIVE
2	11	5.41	FA	0		GF	UNUSED
2	12	5.23	FA	0			OLD
2	13	5.74	FP-C	5	PUM, NRD, PD, GS, CC	MF	ACTIVE
2	14	5.82	FP-NC	2	NRD, FD	BF	OLD
2	15	6.04	FP-NC	1	NRD	GF	OLD
2	16	6.12	.	.			ACTIVE
2	17	6.01	FA	0			ACTIVE
2	FC 18	5.77	FP-NC	4	GS, NRD, FM, BM		OLD
2	19	5.82	FP-NC	3	GS, PD, FM	BF	OLD
2	20*	.	.	.			UNUSED
2	21	5.64	FA	0		GMF	OLD
2	22	5.32	FA	0		WF	OLD
2	23	5.37	FA	0			UNUSED
2	24	6.23	FA	0			OLD
2	25	.	.	.			UNUSED
2	26	5.36	FA	0		WF	OLD
2	FC 27	5.89	FP-C	1	PUM	BF, GMF	OLD
2	28	5.42	FA	0		WF	OLD
2	29	5.38	FP-NC	1	NRD		OLD
2	30	5.53	FP-NC	2	NRD, FM	RSN, MF	ACTIVE
2	31	5.66	.	.			OLD
2	32	.	.	.			OLD
2	33	4.96	.	.			UNUSED
2	34	5.13	FP-NC	1	GS		OLD
2	35	5.6	FP-NC	1	GS	GF, RSN	OLD
2	36	5.66	FP-C	3	PUM, YP, GS		OLD
3	1	6.08	FP-C	1	CC		OLD
3	FC 2	5.86	FP-NC	1	PD	MF, GF	ACTIVE
3	3	5.39	FA	0		RSN	OLD
3	4	5.71	.	.			ACTIVE
3	5	5.92	FP-NC	1	NRD	BF, GMF	ACTIVE
3	6	5.63	FP-C	3	CC, NRD, PD	BF, MF	ACTIVE
3	7	4.91	.	.			UNUSED
3	8	6.23	FP-C	5	WS, NRD, PD, CC, CS	MF	ACTIVE

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
3	9	6.11	FP-C	5	HCS, NRD, PD, CC, CS	BF, GMF	ACTIVE
3	10	5.7	FA	0		RSN, GMF	OLD
3	11	5.67	FA	0		RSN, MF	OLD
3	FC 12	5.45	FA	0		MF, GF	OLD
3	13	5.75	FP-NC	1	NRD	RSN, MF	ACTIVE
3	14	5.51	FA	0		GF	OLD
3	15	5.8	FP-NC	1	NRD	GMF	OLD
3	16	5.68	FP-NC	1	NRD		OLD
3	17	5.46	FA	0			ACTIVE
3	18	5.67	FA	0			OLD
3	19	5.4	FA	0		MF	ACTIVE
3	20	5.55	FP-NC	2	PD, NRD	GMF	OLD
3	21	5.94	FP-C	5	WS, NRD, HCS, CC, CS	MF	OLD
3	22	5.22	FA	0		BF	OLD
3	23	5.86	FP-NC	2	FM, NRD		.
3	24	5.66	FP-C	5	CC, GS, FD, NRD, BS	GF	ACTIVE
3	25	5.06	FA	0		MF	ACTIVE
3	26	.	.	.			OLD
3	27	5.78	FA	0		MF	OLD
3	28	5.72	FP-NC	4	NRD, PD, FD, FM	GMF	.
3	29	5.73	FP-C	6	WS, PD, LC, FM, CC, CS		OLD
3	30	5.72	FA	0			OLD
3	31	5.32	FP-NC	1	NRD	GMF	OLD
3	32	5.58	FP-NC	1	NRD		ACTIVE
3	33	5.28	FA	0		WF	ACTIVE
3	34	.	.	.			OLD
3	FC 35	5.35	FA	0		RSN, GMF	ACTIVE
3	36	5.56	FP-C	6	NRD, FD, PD, CC, FM, BS	GF	ACTIVE
3	37	5.92	FP-C	1	YP		OLD
4	1	5.99	FA	0		MF	OLD
4	2	.	.	.			OLD
4	3	5.98	FA	0		MF	.
4	4	5.96	FA	0			OLD
4	5	5.96	FP-NC	1	NRD	MF	OLD
4	6	6.22	FP-C	4	CC, FM, NRD, FD	GF	OLD
4	7	5.62	FA	0			OLD
4	8	5.9	FA	0		RSN, GMF	OLD
4	9	5.78	FA	0		MF	OLD
4	10	.	.	.			.
4	11	.	.	.			.
4	12	.	.	.			.

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
4	13	5.92	FP-NC	1	GS	GF	ACTIVE
4	14	5.68	FP-NC	2	GS, NRD	GMF	OLD
4	FC 15	5.4	FP-NC	1	BS	BF, GF, MF	ACTIVE
4	16	5.82	FA	0		GMF	ACTIVE
4	17	5.61	.	.			OLD
4	18	6.06	FA	0		BF	OLD
4	19	5.96	FA	0		GF	.
4	20	5.83	.	.			OLD
4	21	5.41	FA	0		MF	ACTIVE
4	FC 22	5.51	FA	0		RSN, GF	OLD
4	23	6.09	FP-C	3	CC, FD, NRD		OLD
4	24	5.89	FP-C	2	CC, NRD	GF	ACTIVE
4	25	6.03	FP-C	3	CC, FM, NRD	GF	ACTIVE
4	26	.	.	.			OLD
4	27	.	.	.			OLD
4	28	5.6	FA	0		GF	OLD
4	29	5.76	FA	0		GF	OLD
4	30	5.7	FA	0		MF	OLD
4	31	5.86	FA	0		GF	OLD
4	32	5.96	FA	0			OLD
4	33	5.89	FP-C	1	CC	GF	ACTIVE
4	34	6.28	FP-C	4	CC, NRD, PD, FD		ACTIVE
4	FC 35	6.21	FA	0		GF	OLD
5	1	5.98	FA	0		GMF	OLD
5	2*	.	.	.			ACTIVE
5	3	4.67	FA	0		WF, SP	UNUSED
5	4	5.3	FA	0		MF	ACTIVE
5	5*	.	.	.			OLD
5	6	6.01	FP-C	6	FD, HCS, GS, CC, CS, BS		ACTIVE
5	7*	.	.	.			OLD
5	FC 8	5.08	FA	0		WF, GF	OLD
5	9	4.94	FP-C	1	YP	MF	OLD
5	10	5.57	FP-NC	1	BS	RSN	ACTIVE
5	11	5.58	FP-C	2	YP, BS	MF	ACTIVE
5	12	5.5	FP-C	2	YP, CC	GMF	ACTIVE
5	13	6.05	FP-C	3	YP, GS, CC		ACTIVE
5	14	6.12	FP-C	4	YP, GS, CC, NRD		OLD
5	15	6.06	FP-C	3	YP, GS, CC	BF	.
5	FC 16	5.38	FA	0		RSN, MF	OLD
5	17	5.84	FA	0		RSN, MF	ACTIVE
5	18	5.6	FA	0		MF	OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
5	19	5.65	FP-NC	2	BS, NRD	MF, GF	OLD
5	20	5.51	FA	0		RSN, GF	OLD
5	21	5.59	FA	0			ACTIVE
5	22	5.78	FP-NC	1	BS	GMF	OLD
5	23	5.86	FA	0		RSN, GMF	OLD
5	24	5.6	FA	0			ACTIVE
5	25*	.	.	.			ACTIVE
5	26	5.95	FA	0		MF	OLD
5	27	5.74	FA	0		GF	ACTIVE
5	28	.	.	.			.
5	29	5.44	FA	0		RSN, GMF	ACTIVE
5	30	5.11	FA	0			OLD
5	31	5.16	FA	0		WF, MF	OLD
5	32	5.73	FA	0			OLD
5	33	5.85	FP-NC	1	FM	RSN, BF, GF	ACTIVE
5	34	5.32	FA	0		MF	ACTIVE
5	35	.	.	.			OLD
5	36	5.65	FA	0		GMF	ACTIVE
5	37	5.79	FA	0		MF	ACTIVE
5	38	5.7	FA	0		RSN, WF, MF	OLD
5	39	5.98	FA	0		RSN	ACTIVE
5	41[1]	5.65	FP-C	3	CC, NRD, FD	GF	OLD
5	42	5.45	FA	0		MF	ACTIVE
5	43	5.23	FA	0		GMF	OLD
6	1	6.03	FP-C	4	WS, FD, NRD, FM		ACTIVE
6	2	6.01	FP-NC	1	BS	MF	OLD
6	3	6.17	FP-C	2	CC, CS		ACTIVE
6	4	6.08	FP-C	5	NRD, FD, CC, CS, BB	BF, MF	OLD
6	5	6.16	FP-C	4	CC, PD, NRD, WS		OLD
6	6	6.26	FP-C	2	YP, NRD		ACTIVE
6	7	6.22	FP-C	7	YP, PUM, NRD, CS, CC, BB, BS		OLD
6	FC 8	5.98	FP-C	6	YP, WS, PUM, NRD, CC, BB	GF	ACTIVE
6	9	5.53	FP-C	1	BB	GMF	.
6	10	5.22	FA	0		MF	ACTIVE
6	11	5.64	FA	0		RSN, GF, MF	OLD
6	12	5.85	FA	0		GF	OLD
6	FC 13	5.72	FP-NC	1	PS	RSN, GMF	OLD
6	14	5.92	FP-C	2	CC, CS	GMF	OLD
6	15	6.09	FP-C	3	WS, CC, CS		ACTIVE
6	16	5.51	FP-NC	1	NRD	GF	OLD
6	17	6.01	FP-NC	2	NRD, FD	RSN	OLD

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
6	18	5.84	FA	0			OLD
6	19	6.3	FP-C	5	CC, CS, NRD, FD, FM		ACTIVE
6	20	6.33	FP-C	5	YP, WS, NRD, CC, FM	RSN, GMF	OLD
6	21	6.14	FP-C	2	CC, NRD		.
6	22	5.22	FA	0		GF	OLD
6	23	5.48	FA	0		RSN, GMF	OLD
6	24	5.79	FA	0		RSN, MF	OLD
6	25	6.27	FP-NC	2	BS, NRD	MF	OLD
6	26	5.94	FP-C	5	WS, NRD, PD, CC, FM	GF	ACTIVE
6	27	.	.	.			UNUSED
6	28	5.94	FP-NC	2	NRD, FD	RSN	OLD
6	29	6.02	FP-NC	5	NRD, FD, PD, BS, FM	GF	ACTIVE
6	30	5.47	FA	0		GF	OLD
6	31	5.59	FA	0		GMF	OLD
6	32	.	.	.			OLD
6	FC 33	5.75	FA	0		GF	OLD
6	34	6.16	FA	0		RSN, GMF	OLD
6	35	5.76	FA	0		GF	OLD
6	36	5.73	FP-C	3	CC, FM, NRD	MF	ACTIVE
6	37	5.89	FP-C	2	WS, CC		OLD
6	38	5.57	FA	0		RSN, BF, GMF	.
7	1	6.16	FA	0		MF	OLD
7	2	6.4	FP-NC	1	NRD	GF	OLD
7	FC 3	6.1	FA	0		RSN, MF	OLD
7	4	6.33	FP-C	2	WS, NRD	GF	OLD
7	FC 5	5.48	FA	0		RSN, GF	ACTIVE
7	6	6.21	FP-C	4	CC, PD, NRD, FD		OLD
7	7	6.64	FP-C	1	CC	GF	OLD
7	8	5.95	FA	0			OLD
7	9	6.06	FA	0		RSN, GF, MF	OLD
7	10	6.51	FA	0		RSN, MF	OLD
7	FC 11	5.72	FA	0		RSN, GF, MF	ACTIVE
7	12	5.83	FP-NC	1	NRD	GMF	OLD
7	13	6.04	.	.			.
7	14	6.25	FP-C	2	CC, NRD		OLD
7	15	6.18	FA	0		RSN, GMF	OLD
7	FC 16	6.66	FP-C	1	YP	RSN, GMF	OLD
7	17	6.39	FP-C	4	WS, NRD, CC, CS	GMF	OLD
7	18	6.1	FP-NC	1	NRD	GF	OLD
7	19	5.87	FP-NC	1	NRD	RSN, GMF	OLD
7	20	6.2	FP-C	4	YP, GS, CC, BB	RSN, GMF	ACTIVE

PLOT	LAKE	pH	FISH			AMPHIBIANS	BEAVER
			TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
7	21	5.97	FP-C	4	YP, GS, CC, BB		OLD
7	22	5.85	FA	0		RSN, MF	OLD
7	23	6.28	FP-NC	2	PD, NRD	BF, GF	OLD
7	24	5.94	FP-C	1	YP		OLD
7	25	5.67	FA	0		MF	ACTIVE
7	26	6.12	FP-NC	2	FM, NRD	GMF	OLD
7	27	5.56	FA	0		MF	ACTIVE
7	28	5.54	FA	0		MF	ACTIVE
7	29	6.17	FA	0			OLD
7	30	5.68	FP-C	1	YP	BF	.
7	31	5.74	FA	0		GF	OLD
7	32	5.8	FP-C	4	WS, NRD, GS, CC	GMF	OLD
7	33	5.07	FA	0		GF	OLD
7	34	5.46	FP-NC	1	NRD	RSN, MF	ACTIVE
7	35	5.8	FP-C	4	YP, WS, GS, CC		.
7	36	5.36	FA	0		GF	OLD

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1990, 1993, 1995)
TYPE = fish community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
ACTIVE = beavers occupying lake in autumn 1994
OLD = beavers not present in autumn 1994, but signs of past use
UNUSED = no sign of beaver presence observed during aerial survey

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
Lake Number * = lake inaccessible by helicopter
. = no data
[1] Plot 5 Lake 40 does not exist

Fish Species

FM = fathead minnow (*Pimephales promelas*)
LB = largemouth bass (*Micropterus salmoides*)
YP = yellow perch (*Perca flavescens*)
NRD = northern redbelly dace (*Phoxinus eos*)
PD = pearl dace (*Semotilus margarita*)
BS = brook stickleback (*Culaea inconstans*)
ID = Iowa darter (*Etheostoma exile*)
BD = blacknose dace (*Rhinichthys atratulus*)
BRM= brassy minnow (*Hynognathus hankinsoni*)
NP = northern pike (*Esox lucius*)
BM = bluntnose minnow (*Pimephales notatus*)
CC = creek chub (*Semotilus atromaculatus*)
WS = white sucker (*Catostomus commersoni*)
BLS = blackchin shiner (*Notropis heterodon*)
FD = finescale dace (*Phoxinus neogaeus*)
HCS = hybrid creek chub - common shiner
BT = brook trout (*Salvelinus fontinalis*)
RT = rainbow trout (*Salmo gairdneri*)
SB = smallmouth bass (*Micropterus dolomieui*)
LT = lake trout (*Salvelinus namaycush*)
PUM = pumpkinseed (*Lepomis gibbosus*)
CS = common shiner (*Notropis cornutus*)
GS = golden shiner (*Notemigonus crysoleucas*)
BB = brown bullhead (*Ictalurus nebulosus*)
PS = *Phoxinus* spp.
LC = lake chub (*Couesius plumbeus*)
SS = sand shiner (*Notropis stramineus*)
CM = central mudminnow (*Umbra limi*)
RB = rock bass (*Ambloplites rupestris*)

Amphibian Species

GF = green frog (*Rana clamitans*)
BF = bullfrog (*Rana catesbeiana*)
WF = wood frog (*Rana sylvatica*)
MF = mink frog (*Rana septentrionalis*)
RSN = red spotted newt (*Notophthalmus viridescens*)
SP = spring peeper (*Hyla crucifer*)
GMF = green or mink frog
AT = American toad (*Bufo americanus*)

Table 22. Summary of waterfowl species and Common Loons observed as indicated breeding pairs or broods during helicopter surveys of Muskoka study lakes (1990, 1993, 1995). (See legend for explanation of variables and notations).

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
1	1	6.48	FP-C	CL, CM, HM, BD	BD
1	2	6.43	FP-C	HM, BD	MA, WD
1	3	6.53	FP-C	HM, MA, BD, WD	BD
1	4	6.36	FP-C	CL, BD	
1	5	6.47	FA	CL, MA, BD, WD	
1	6	6.47	.	MA, BD, WD	
1	7	6.08	FP-C	HM	
1	8	6.12	FP-C	MA	
1	9	6.39	FP-C	CL, CM	
1	10	6.33	FA	HM, WD	
1	11	6.33	FP-C	CL, CM, MA	
1	12	6.56	FP-C	CL	CM
1	13	6.70	FP-C	CL, CM, BD	
1	14	.	.		
1	15	6.55	FA		CM
1	16	6.00	FP-NC	HM, BD, WD	HM, WD
1	17	6.42	FP-NC	HM, BD	
1	18	6.35	FP-C	CL	CL, CM
1	19	6.09	FP-C	BD	
1	20	5.79	FP-C	CM, HM, MA, BD, WD, RD	HM, BD, WD
1	21	6.55	FP-C	CM, BD	
1	22	6.12	FP-C	CL, HM, MA, BD	BD
1	FC 23	6.47	FP-C	CM	CM, HM
1	24	5.59	FP-C	CM, HM	
1	25	5.58	FP-C	MA, BD	
1	26	6.37	FP-C	CL, CM, MA	CM
1	27	6.51	FP-C	BD	
1	28	4.73	FA	BD	
1	29	5.99	FP-NC	CL, CM, BD, WD	
1	30	6.11	FP-NC		
1	31	.	.		
1	FC 32	5.77	FP-NC	CL, HM, MA, RD	HM, MA, BD
1	33	6.43	FP-C	CM, MA, BD	CM, HM
1	34	5.89	FP-C	MA, WD	MA, WD
1	35	5.63	FP-C	CM, MA, BD, RD	
2	1	5.34	FP-NC	CL, CM, HM, BD	
2	FC 2	5.24	FP-NC	CM, HM, MA, BD	
2	3	5.55	FP-C		

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
2	4	6.09	FP-C	CM, HM, BD	
2	5	5.27	FP-C		
2	6	5.72	.	CM, MA	CM
2	7	5.49	FP-C	CL	HM
2	8	5.23	FP-C	CL, CM, HM, BD	
2	9	4.88	FA	WD	
2	10	5.84	FP-C	CM, BD	
2	11	5.41	FA	WD	
2	12	5.23	FA	HM, BD	HM
2	13	5.74	FP-C	CL, CM	CM, BD
2	14	5.82	FP-NC	CM, HM, MA, BD	HM
2	15	6.04	FP-NC	HM, MA, BD, WD	HM
2	16	6.12	.		
2	17	6.01	FA	MA	HM
2	FC 18	5.77	FP-NC	CL, WD	HM
2	19	5.82	FP-NC		
2	20*	.	.		
2	21	5.64	FA	HM	HM
2	22	5.32	FA	HM, MA, BD	HM, RD
2	23	5.37	FA	MA, BD, RD	WD
2	24	6.23	FA	HM, MA, WD	HM, WD
2	25	.	.		
2	26	5.36	FA	MA	HM
2	FC 27	5.89	FP-C	CL, MA, BD	
2	28	5.42	FA	HM	
2	29	5.38	FP-NC	CL, HM, BD, CG	HM
2	30	5.53	FP-NC	CL, CM, MA, BD	CL, HM
2	31	5.66	.		
2	32	.	.		
2	33	4.96	.	MA, BD, WD	
2	34	5.13	FP-NC	MA, BD	
2	35	5.60	FP-NC	CL, HM, MA, BD	RD
2	36	5.66	FP-C	CL, CM, MA	HM
3	1	6.08	FP-C		
3	FC 2	5.86	FP-NC	HM, BD, WD	HM
3	3	5.39	FA	HM, WD, RD	HM, BD
3	4	5.71	.	CM	
3	5	5.92	FP-NC	CL, HM	HM, WD, RD
3	6	5.63	FP-C	CL, CM, HM	HM, WD
3	7	4.91	.		
3	8	6.23	FP-C	CL, CM, WD	CL, HM
3	9	6.11	FP-C	CM, HM, BD	HM, BD, WD
3	10	5.70	FA	CL, HM, WD	HM

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
3	11	5.67	FA	HM, WD, RD	HM, RD
3	FC 12	5.45	FA	HM, WD, RD	HM
3	13	5.75	FP-NC	HM, BD, WD	HM, RD
3	14	5.51	FA	HM, RD	HM
3	15	5.80	FP-NC	HM, MA, BD, WD, RD	BD, RD
3	16	5.68	FP-NC	MA, RD	
3	17	5.46	FA	BD, WD, RD	HM, WD, RD
3	18	5.67	FA	HM, BD	HM
3	19	5.40	FA	HM, RD	HM, MA, BD, WD, RD
3	20	5.55	FP-NC	HM	HM, RD
3	21	5.94	FP-C	CM, HM	
3	22	5.22	FA	HM, RD	BD, WD
3	23	5.86	FP-NC	CL, CM, HM, MA, BD	CL
3	24	5.66	FP-C	CL	CL, HM, WD
3	25	5.06	FA	CM, HM, BD, RD	HM, WD, RD
3	26	.	.		
3	27	5.78	FA	HM, BD, RD	HM, BD, WD
3	28	5.72	FP-NC	CL, BD	CL, CM, HM
3	29	5.73	FP-C		
3	30	5.72	FA	HM, BD	HM, BD
3	31	5.32	FP-NC	HM	RD
3	32	5.58	FP-NC	HM, BD, RD	MA, RD
3	33	5.28	FA	HM, BD, WD	HM, BD, WD
3	34	.	.		
3	FC 35	5.35	FA	HM, BD, WD, RD	HM, RD
3	36	5.56	FP-C	HM, MA, BD, WD, RD	
3	37	5.92	FP-C		
4	1	5.99	FA	HM, BD, WD, RD	HM, RD
4	2	.	.	HM, MA	HM
4	3	5.98	FA	HM, WD	
4	4	5.96	FA	HM, BD, WD	HM, BD
4	5	5.96	FP-NC	HM, RD	HM, BD
4	6	6.22	FP-C	CL	
4	7	5.62	FA	HM, MA, BD, WD, RD	HM
4	8	5.90	FA	HM, BD, RD	BD, WD, RD
4	9	5.78	FA		MA
4	10	.	.		
4	11	.	.		
4	12	.	.		
4	13	5.92	FP-NC	CL, HM, MA, BD, WD, RD	CL, HM, WD
4	14	5.68	FP-NC	CL, HM, BD, WD, RD	
4	FC 15	5.40	FP-NC	CL, HM, BD	CL
4	16	5.82	FA	HM	HM, WD

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
4	17	5.61	.		
4	18	6.06	FA	HM	
4	19	5.96	FA	HM	
4	20	5.83	.		
4	21	5.41	FA	HM	HM, BD
4	FC 22	5.51	FA	MA, BD, RD	HM, BD
4	23	6.09	FP-C		
4	24	5.89	FP-C	HM, MA, BD, WD, RD	
4	25	6.03	FP-C	CL, CM, HM, MA, BD	CM
4	26	.	.		
4	27	.	.		
4	28	5.60	FA	HM, BD, WD, RD	HM, RD
4	29	5.76	FA	HM	
4	30	5.70	FA		
4	31	5.86	FA	HM, MA, RD	HM, MA, RD
4	32	5.96	FA		
4	33	5.89	FP-C	HM, RD	BD, RD
4	34	6.28	FP-C	CL, CM, MA, BD	HM
4	FC 35	6.21	FA	HM, BD, WD, RD	HM
5	1	5.98	FA	HM, MA, WD	HM, MA
5	2*	.	.	HM, BD	HM, WD
5	3	4.67	FA		
5	4	5.30	FA	HM, MA, BD, WD	HM
5	5*	.	.	BD	HM
5	6	6.01	FP-C	CM	WD
5	7*	.	.	BD, WD, RD	HM, BD, WD
5	FC 8	5.08	FA	CL, MA, BD, RD	HM, BD
5	9	4.94	FP-C	CM, MA, BD, RD	BD
5	10	5.57	FP-NC	HM, BD, RD	HM, BD
5	11	5.58	FP-C	HM, BD, RD	MA
5	12	5.50	FP-C		
5	13	6.05	FP-C	BD	
5	14	6.12	FP-C	CL, CM, BD	RD
5	15	6.06	FP-C	CL, CM	CL
5	FC 16	5.38	FA	BD, RD	WD, RD
5	17	5.84	FA	HM, BD, WD, RD	HM, BD, WD
5	18	5.60	FA	HM, MA, BD, WD, RD	HM, BD
5	19	5.65	FP-NC	CM, BD	
5	20	5.51	FA	CM, HM, WD	HM, WD, RD
5	21	5.59	FA	HM, BD	HM, BD
5	22	5.78	FP-NC	CM	
5	23	5.86	FA	RD	HM
5	24	5.60	FA	HM, BD, WD, RD	CM, HM, BD, WD, RD

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
5	25*	.	.	HM, BD, RD	HM, BD
5	26	5.95	FA	RD	HM, MA, BD, RD
5	27	5.74	FA	HM, BD, WD, RD	HM, MA, BD, WD, RD
5	28	.	.		
5	29	5.44	FA	HM, BD, RD	RD
5	30	5.11	FA	HM, BD, WD	
5	31	5.16	FA	HM, BD, WD	HM, BD, WD
5	32	5.73	FA	HM, RD	MA, BD, WD
5	33	5.85	FP-NC	CL, CM	CL, CM
5	34	5.32	FA	HM, MA, BD, RD	HM, MA, BD, WD
5	35	.	.		
5	36	5.65	FA	HM, BD, WD, RD	HM, BD, WD
5	37	5.79	FA	BD, WD, RD	HM, BD, WD
5	38	5.70	FA	HM, MA, BD	HM, BD, WD
5	39	5.98	FA	CL, BD	
5	41[1]	5.65	FP-C	HM	
5	42	5.45	FA	HM, BD, RD	HM
5	43	5.23	FA	RD	HM, BD, RD
6	1	6.03	FP-C	CL, BD	
6	2	6.01	FP-NC	HM, BD, WD, RD	HM, BD
6	3	6.17	FP-C	CL	CL
6	4	6.08	FP-C	CL, HM	CM, WD
6	5	6.16	FP-C		CM
6	6	6.26	FP-C	CM	CL
6	7	6.22	FP-C	CL, WD	
6	FC 8	5.98	FP-C	CM	CM
6	9	5.53	FP-C	CL	CL, HM
6	10	5.22	FA	CL, HM, BD, CG	HM
6	11	5.64	FA	CL, HM, BD	
6	12	5.85	FA	HM	HM
6	FC 13	5.72	FP-NC	HM, BD	
6	14	5.92	FP-C	HM, BD	
6	15	6.09	FP-C	CL, CM, HM	HM
6	16	5.51	FP-NC	HM	HM, BD
6	17	6.01	FP-NC	CL, HM, BD	HM
6	18	5.84	FA	HM	
6	19	6.30	FP-C	CL, CM	CM, WD
6	20	6.33	FP-C		
6	21	6.14	FP-C	CL, BD	CL
6	22	5.22	FA	CL, HM, MA, BD, RD, CG	HM
6	23	5.48	FA	CL, HM, BD, RD	HM, RD
6	24	5.79	FA	HM, BD	HM
6	25	6.27	FP-NC	CM, HM, MA, BD, WD	

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
6	26	5.94	FP-C	CL, CM, HM, BD	HM
6	27	.	.		
6	28	5.94	FP-NC	BD	
6	29	6.02	FP-NC	CL, CM	
6	30	5.47	FA	HM	HM
6	31	5.59	FA		BD
6	32	.	.		
6	FC 33	5.75	FA	HM, BD, WD, CG	BD, RD, CG
6	34	6.16	FA	HM, BD	RD
6	35	5.76	FA	CL, HM	BD, RD
6	36	5.73	FP-C	CL, CM, BD, WD	CL
6	37	5.89	FP-C	CM	HM
6	38	5.57	FA	CL, HM, BD	
7	1	6.16	FA	HM, RD, CG	HM, CG
7	2	6.40	FP-NC	HM, BD, CG	HM
7	FC 3	6.10	FA	HM, BD, CG	HM, CG
7	4	6.33	FP-C	CL, HM	HM
7	FC 5	5.48	FA	HM, MA, BD, RD, CG	HM, BD
7	6	6.21	FP-C	HM	HM
7	7	6.64	FP-C	HM, RD	
7	8	5.95	FA		BD
7	9	6.06	FA	HM, RD	
7	10	6.51	FA	BD	
7	FC 11	5.72	FA	CG	HM
7	12	5.83	FP-NC	HM, BD, WD	HM
7	13	6.04	.		
7	14	6.25	FP-C	CM, BD	
7	15	6.18	FA	HM, BD, WD	WD
7	FC 16	6.66	FP-C		
7	17	6.39	FP-C	CM, HM	
7	18	6.10	FP-NC	HM, MA, BD, RD	HM
7	19	5.87	FP-NC	HM	
7	20	6.20	FP-C	CL, CM	HM
7	21	5.97	FP-C		
7	22	5.85	FA	CL, HM, BD	HM, BD, RD
7	23	6.28	FP-NC	CL, CM, HM, WD	
7	24	5.94	FP-C	CM, HM, BD, WD	WD, RD
7	25	5.67	FA	CL, RD	HM, RD
7	26	6.12	FP-NC	CL, CM, HM, BD, RD	CL
7	27	5.56	FA	CL, HM, BD, RD, CG	HM, RD
7	28	5.54	FA	CM, HM, BD, RD	HM
7	29	6.17	FA	HM, WD	HM
7	30	5.68	FP-C	CL, BD	WD

PLOT	LAKE	HABITAT		WATERFOWL	
		pH	FISH TYPE	INDICATED PAIRS	BROODS
7	31	5.74	FA		HM
7	32	5.80	FP-C	HM, WD	HM, WD
7	33	5.07	FA	HM, BD	
7	34	5.46	FP-NC	MA	
7	35	5.80	FP-C	CL, BD	CL, CM, HM, BD
7	36	5.36	FA	HM, BD, RD	HM, WD

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1990, 1993, 1995)
FISH TYPE = fish community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
INDICATED PAIRS = presence of breeding pair of a waterfowl species
BROODS = presence of broods of a waterfowl species

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
***Lake Number* *** = lake inaccessible by helicopter
. = no data

[1] Plot 5 Lake 40 does not exist

Waterfowl Species

CL = Common Loon (*Gavia immer)*
CM = Common Merganser (*Mergus merganser*)
HM = Hooded Merganser (*Lophodytes cucullatus*)
MA = Mallard (*Anas platyrhynchos*)

BD = Black Duck (*Anas rubripes*)
WD = Wood Duck (*Aix sponsa*)
RD = Ring-necked Duck (*Aythya collaris*)
CG = Common Goldeneye (*Bucephala clangula*)

ONTARIO REGION BIOMONITORING STUDY

SUDBURY

Table of Contents

Key to Figure 14. Lake names associated with CWS LRTAP study lakes in the Sudbury area. Local names not present on EMR 1:50 000 and Provincial Series 1:100 000 topographic maps are indicated by NL (not listed).

LAKE	LAKE NAME	LAKE	LAKE NAME
258	Mountaintop (NL)	906	Marjorie
292	Beaver	933	Wallin
472	Carlo	949	Sawhorse
475	Eaglenest	954	Camp 2 (NL)
524	Red Pine (NL)	955	Anelia (NL)
526	Adelaide	947	Evelyn
531	Button (Barton)	965	Telfer
573	Blackwater (NL)	968	Pine

Sudbury Study Lakes

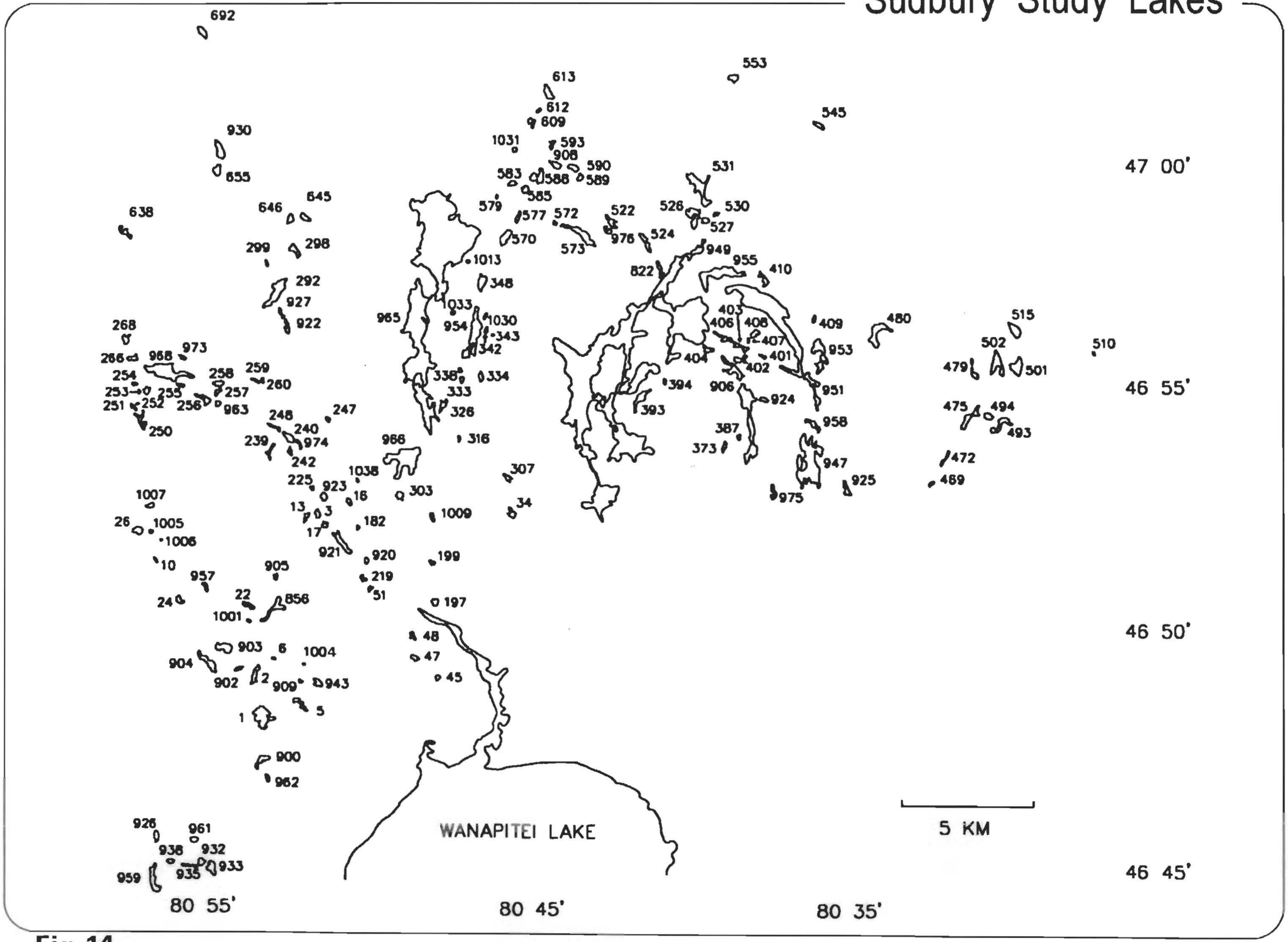


Fig. 14

Table 23. Locations and morphometric characteristics of Sudbury study lakes, identified by lake number. (See legend for explanation of variables and notations).

LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	WATERSHED AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
1	5098	51836	2DA	338	31.9	12.3	4595	18.7	217.9	1	5
2	5095	51852	2DA	323	6.6	3.9	1422	2.8	117.0	2	1
3	5121	51917	2DA	308	3.8	7.0	885	3.3	61.9	3	0
5	5113	51842	2DA	323	6.6	8.0	2809	3.1	116.7	1	4
6	5103	51859	2DA	338	0.9	2.4	459	2.8	8.0	0	0
10	5058	51898	2DA	354	0.5	1.1	466	6.3	94.6	0	0
13	5117	51915	2DA	323	2.6	2.0	1715	0.6	46.7	1	2
FC 16	5133	51922	2DA	308	3.2	7.5	1678	2.8	43.8	0	3
17	5215	51913	2DA	323	2.8	2.4	759	0.2	140.2	2	0
22	5095	51879	2DA	323	4.6	3.7	1665	0.1	39.4	1	0
24	5067	51883	2DA	338	4.4	17.7	918	3.2	56.7	1	0
26	5052	51912	2DA	354	8.1	6.4	1420	0.5	68.4	1	0
34	5197	51915	2DA	323	5.6	15.1	1326	0.4	56.2	1	0
45	5166	51851	2DA	323	0.6	2.7	555	2.8	170.7	2	0
47	5158	51858	2DA	338	3.4	10.6	853	0.9	54.5	0	2
48	5157	51867	2DA	354	2.8	8.9	964	0.0	50.3	0	1
51	5141	51887	2DA	338	2.1	4.5	676	0.5	54.7	0	0
182	5136	51911	2DA	262	0.6	0.6	444	0.2	2.8	1	0
FC 197	5166	51880	2DA	277	4.3	11.0	823	5.0	34.2	0	0
FC 199	5165	51896	2DA	323	1.9	6.0	637	0.5	11.9	1	0
219	5137	51890	2DA	323	1.8	6.8	833	1.5	33.8	1	1
225	5118	51927	2DA	308	0.8	1.0	394	1.1	28.1	1	0
239	5103	51942	2DA	400	3.8	2.8	1973	1.0	45.6	1	5
FC 240	5111	51948	2DA	354	7.8	17.4	1292	1.2	132.3	2	0
FC 242	5111	51942	2DA	354	2.5	6.4	1132	0.3	39.3	0	3
247	5125	51955	2DA	308	1.9	2.8	610	1.5	33.1	1	0
FC 248	5105	51952	2DA	369	3.8	2.4	2640	1.3	58.8	1	6
250	5053	51955	2DA	369	6.7	2.6	2194	1.7	190.6	2	1
251	5050	51961	2DA	369	2.6	1.9	2228	1.5	29.6	2	8
252	5053	51962	2DA	385	0.7	5.8	519	0.8	5.8	1	1
253	5055	51967	2DA	369	4.6	8.0	1161	3.3	277.1	2	0
254	5052	51969	2DA	369	1.5	5.8	480	0.8	21.7	1	0
255	5069	51968	2DA	369	1.9	8.9	938	0.4	6264.0	2	0
FC 256	5078	51963	2DA	354	6.7	2.5	1803	4.8	6355.0	2	0
257	5083	51965	2DA	354	2.5	2.1	809	2.4	93.9	2	0
258	5084	51969	2DA	369	5.5	8.5	1111	0.7	61.7	1	0
FC 259	5098	51970	2DA	369	2.5	3.9	950	1.2	49.9	1	1
260	5101	51970	2DA	369	1.0	1.6	729	0.6	70.4	2	3
266	5051	52979	2DA	369	4.3	4.1	1017	1.2	677.2	2	0
268	5048	51987	2DA	369	3.9	1.2	1511	6.3	455.0	2	1
292	5106	52005	2DA	338	26.7	22.2	4007	2.3	809.8	2	5
298	5115	52020	2DA	338	8.3	9.9	2453	7.4	115.8	1	2
299	5103	52017	2DA	338	1.0	1.8	680	1.3	21.0	1	1
303	5153	51924	2DA	323	4.9	7.3	1075	0.7	34.4	1	1
307	5196	51929	2DA	354	4.2	11.7	1392	3.6	70.5	1	2
FC 316	5176	51945	2DA	308	1.3	1.1	1244	2.3	38.9	0	0

LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	WATERSHED AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
326	5171	51958	2DA	323	6.4	7.7	2283	0.8	96.7	1	2
333	5178	51969	2DA	308	2.5	9.3	644	0.2	28.1	0	0
334	5185	51969	2DA	292	4.9	4.7	1415	3.0	23.7	1	1
338	5178	51972	2DA	308	1.1	1.0	592	0.7	17.2	0	1
342	5187	51988	2DA	308	1.2	1.8	610	6.9	23.2	0	0
343	5190	51986	2DA	308	0.5	2.9	284	1.7	7.4	0	0
348	5186	52007	2DA	308	10.9	19.1	1864	4.0	13330.6	2	0
373	5279	51941	2DC	400	3.3	12.2	1052	0.3	46.2	1	0
387	5284	51944	2DC	354	2.1	4.8	788	0.6	236.5	2	1
393	5247	51960	2DC	354	12.5	13.6	3685	2.8	122.1	0	3
394	5257	51967	2DC	338	1.8	1.7	772	1.5	300.8	2	1
401	5295	51976	2DC	323	1.4	3.6	667	1.8	55.0	1	0
FC 402	5285	51975	2DC	323	6.2	7.8	1439	0.9	26.0	2	0
403	5286	51981	2DC	323	6.8	3.8	1881	1.7	270.5	3	2
FC 404	5274	51979	2DC	323	5.2	6.0	1250	0.8	67.7	1	0
406	5277	51986	2DC	323	6.1	5.7	2198	3.7	355.7	2	1
407	5288	51984	2DC	323	1.4	2.6	1527	2.0	99.8	2	7
FC 408	5292	51986	2DC	323	5.9	2.1	1294	1.0	89.6	1	1
409	5315	51991	2DC	308	2.8	5.6	888	0.0	21.1	1	0
FC 410	5296	52007	2DC	308	7.4	5.0	2822	3.0	46.2	1	2
469	5357	51924	2DC	323	1.4	4.4	604	0.2	49.3	1	0
472	5365	51936	2DC	308	3.4	0.9	1504	3.2	1010.7	3	0
475	5372	51948	2DC	292	17.2	10.8	4078	1.5	859.6	3	0
FC 479	5374	51974	2DC	323	6.7	1.4	2464	3.6	123.0	0	1
480	5338	51986	2DC	277	25.2	3.3	3602	4.9	1302.5	3	0
493	5386	51947	2DC	292	14.9	2.5	3054	5.6	121.5	1	0
494	5382	51951	2DC	292	3.5	4.3	887	1.7	41.1	2	0
501	5384	51974	2DC	292	18.4	2.8	2176	0.2	373.8	1	1
502	5392	51972	2DC	292	25.3	11.6	3787	0.3	89.3	1	0
510	5418	51975	2DC	277	3.8	1.0	2709	2.2	40.2	0	0
515	5392	51985	2DC	277	14.1	2.1	1842	3.6	507.1	3	0
522	5236	52026	2DC	354	7.4	4.6	2029	7.0	37.7	1	1
524	5251	52022	2DC	323	10.3	11.1	2100	1.7	118.1	1	1
526	5268	52034	2DC	323	20.0	6.3	4004	1.7	73.2	1	1
527	5273	52030	2DC	323	3.6	7.0	793	2.8	38.6	0	0
FC 530	5277	52032	2DC	323	1.9	9.1	742	2.2	37.9	0	0
531	5271	52046	2DC	323	35.3	8.8	5688	2.2	301.6	2	3
545	5317	52066	2DC	338	4.2	9.5	1064	0.6	44.7	1	0
553	5286	52085	2DC	323	8.2	3.4	1644	3.2	66.7	1	0
570	5196	52025	2DA	308	11.6	15.5	1711	1.2	8169.6	2	0
572	5216	52029	2DA	323	1.4	0.9	577	1.2	459.9	2	1
573	5227	52025	2DA	323	27.3	7.9	5607	2.4	432.6	3	3
577	5201	52032	2DA	308	2.9	4.6	919	0.1	37.9	2	0
579	5194	52040	2DA	308	0.6	1.8	325	0.2	7.4	0	0
583	5199	52045	2DA	308	3.9	12.7	1177	0.6	1784.2	2	0
585	5204	52044	2DA	308	4.3	12.0	1324	0.9	4973.3	2	0
588	5209	52047	2DA	308	15.6	19.8	3063	0.8	4755.3	2	0
FC 589	5226	52048	2DA	338	3.4	2.6	1590	0.8	58.2	1	5
590	5223	52051	2DA	338	5.2	3.8	2089	1.0	168.3	2	6

LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	WATERSHED AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
FC 593	5215	52059	2DA	354	2.8	9.4	1186	0.0	53.4	1	0
609	5207	52067	2DA	323	5.8	9.1	2140	0.5	67.6	1	0
612	5210	52073	2DA	323	1.2	1.6	562	0.5	3907.7	1	0
613	5214	52078	2DA	323	9.4	19.4	1509	0.1	81.4	0	0
638	5048	52028	2DA	400	6.8	1.0	1822	2.7	67.4	1	2
645	5117	52034	2DA	354	5.6	2.3	1041	3.6	48.5	1	0
646	5113	52034	2DA	369	3.7	4.5	1045	1.0	23.4	1	1
655	5085	52050	2DA	369	5.3	13.0	1093	2.2	40.8	1	0
692	5078	52104	2DA	354	7.1	1.5	2016	2.2	81.0	1	5
822	5255	52013	2DC	323	2.4	1.4	826	3.0	175.8	2	0
856	5106	51879	2DA	338	6.8	2.2	3162	14.1	136.4	2	2
900	5097	51819	2DA	323	8.3	2.0	2758	3.4	94.4	1	4
FC 902	5089	51855	2DA	338	2.1	8.0	1067	0.9	29.8	1	1
903	5085	51863	2DA	354	15.0	11.4	2090	0.0	74.6	1	0
904	5076	51859	2DA	338	15.1	3.0	2620	10.8	105.4	1	2
FC 905	5104	51892	2DA	338	2.0	3.6	599	0.2	14.4	1	0
906	5284	51973	2DC	323	86.0	14.3	14436	7.6	1120.1	4	10
908	5217	52052	2DA	323	6.7	1.2	1523	3.2	256.5	2	0
909	5113	51849	2DA	323	1.0	1.8	494	0.3	11.8	0	0
FC 920	5138	51897	2DA	292	2.4	3.3	612	1.6	35.6	1	0
921	5130	51905	2DA	323	16.2	12.3	3135	0.2	91.8	1	3
FC 922	5112	51990	2DA	323	5.1	7.4	1238	0.8	66.4	1	0
923	5124	51922	2DA	292	3.9	1.0	1067	1.3	313.0	2	1
924	5295	51959	2DC	338	3.3	14.5	805	0.5	180.7	2	0
925	5322	51927	2DC	308	7.8	2.8	1710	3.0	48.7	1	0
926	5054	51785	2DA	308	9.0	1.6	2764	10.4	369.0	3	5
927	5108	51997	2DA	338	1.5	1.3	1341	1.4	40.5	0	2
930	5086	52057	2DA	369	13.4	11.1	2376	0.3	46.7	1	2
932	5074	51779	2DA	354	4.5	7.5	2167	2.1	129.9	2	4
933	5077	51777	2DA	354	12.1	10.1	2144	1.1	103.6	2	7
935	5070	51777	2DA	338	4.7	1.9	1711	0.1	173.0	2	0
938	5063	51780	2DA	338	3.2	1.1	1540	0.8	205.0	2	3
943	5119	51848	2DA	308	4.4	1.4	1735	2.5	69.8	2	2
947	5313	51935	2DC	308	112.4	10.1	17075	13.9	.	4	19
949	5270	52018	2DC	308	15.5	5.8	5048	8.8	182.7	0	4
951	5315	51957	2DC	308	18.9	2.7	5187	3.5	1880.7	2	3
953	5317	51975	2DC	323	25.0	2.8	5902	2.6	184.0	1	4
954	5184	51987	2DA	308	43.4	21.3	6242	2.6	13639.1	2	1
955	5280	52010	2DC	308	62.4	11.3	7177	7.8	257.0	1	3
957	5077	51887	2DA	338	4.0	0.9	1048	0.5	48.6	0	1
FC 958	5314	51949	2DC	308	9.5	4.6	3197	5.6	2050.5	2	4
959	5055	51776	2DA	308	10.4	3.1	1701	16.9	299.8	3	1
961	5072	51789	2DA	354	0.7	1.2	1019	0.7	21.7	1	1
962	5098	51812	2DA	308	3.5	1.5	1552	0.6	134.9	2	1
963	5084	51962	2DA	354	1.4	1.3	472	1.1	112.0	2	0
965	5160	51980	2DA	330	350.0	10.7	21554	.	2292.8	7	8
966	5155	51940	2DA	323	35.5	12.5	4688	1.2	247.3	2	7
968	5065	51975	2DA	369	53.2	5.6	4980	12.4	5958.7	3	0
973	5070	51979	2DA	400	2.8	2.2	1279	0.7	33.9	1	5

LAKE	UTM EAST	UTM NORTH	TERTIARY WATERSHED	ELEV (m)	AREA (ha)	DEPTH (m)	SHORELINE (m)	RIPARIAN AREA (ha)	WATERSHED AREA (ha)	TOTAL STREAMS	TOTAL ISLANDS
974	5114	51944	2DA	354	1.0	1.2	1048	2.4	150.8	2	2
975	5297	51924	2DC	385	5.0	6.0	3601	3.8	81.5	1	7
976	5236	52026	2DC	354	3.4	2.0	1182	6.3	54.4	0	0
1001	5093	51874	2DA	332	1.2	2.7	461	11.0	85.6	2	0
1004	5114	51856	2DA	305	0.2	2.3	200	1.4	6.1	1	0
1005	5056	51910	2DA	366	0.2	2.8	201	5.5	11.1	0	0
1006	5065	51908	2DA	377	0.4	4.9	255	2.5	33.8	0	0
1007	5055	51921	2DA	362	0.2	5.2	242	3.4	13.0	0	0
1009	5165	51915	2DA	305	0.3	2.6	409	3.1	13.8	0	0
1013	5181	52016	2DA	322	0.1	5.2	154	2.4	10.7	0	0
1030	5187	51994	2DA	317	1.0	4.0	614	4.2	14.4	0	0
1031	5200	52060	2DA	349	0.6	5.4	434	4.3	61.0	0	0
1033	5174	51995	2DA	362	0.2	6.4	200	0.7	10.6	0	0
1038	5136	51930	2DA	320	0.7	3.8	410	3.5	5.6	0	0

LEGEND

VARIABLE EXPLANATIONS

UTM EAST = Universal Transverse Mercator Easting coordinate
UTM NORTH = Universal Transverse Mercator Northing coordinate
(UTM Zone = 17 for all lakes)
TERTIARY WATERSHED = tertiary watershed identifier code
ELEV = lake elevation above sea level
AREA = open water area of lake
DEPTH = mean mid-lake depth
SHORELINE = length of open water perimeter
RIPARIAN AREA = area of riparian zone adjacent to lake
WATERSHED AREA = area of watershed that drains into lake
TOTAL STREAMS = cumulative number of streams flowing into and draining lake
TOTAL ISLANDS = number of islands in lake

NOTATIONS

FC ***Lake Number*** = food chain lake
. = no data

Table 24a. Average chemical characteristics (Part 1) of Sudbury study lakes, identified by lake number. Chemical values are four year means (fall sampling: 1991, 1993, 1994, 1995). (See legend for explanation of variables and notations).

LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)
1	6.84	163.1	45.8	6.61	0.86	0.69	0.43	0.35	2.02	8.84
2	6.54	83.5	37.7	4.69	0.87	0.63	0.46	0.17	1.07	9.06
3	5.55	6.9	30.8	2.75	0.64	0.76	0.28	0.15	1.02	9.80
5	7.10	316.5	54.4	8.68	0.81	0.67	0.41	0.24	1.09	8.05
6	7.60	1432.0	151.4	28.5	1.36	0.73	0.69	0.59	8.07	5.50
10	6.73	222.3	62.1	9.83	1.32	0.65	0.34	0.19	1.26	13.23
13	4.81	-14.0	34.1	2.26	0.58	0.82	0.22	0.12	1.51	10.55
FC 16	6.32	59.8	32.7	4.02	0.63	0.76	0.27	0.19	2.80	8.16
17	4.92	-9.6	29.5	2.30	0.49	0.62	0.22	0.15	0.88	8.72
22	5.67	20.4	22.6	2.46	0.54	0.59	0.39	0.13	3.43	4.17
24	6.63	109.2	44.3	5.99	1.06	0.64	0.43	0.20	0.72	9.61
26	5.87	26.4	26.6	2.33	0.72	0.73	0.32	0.23	1.89	7.46
34	4.47	-35.1	35.5	1.16	0.30	0.66	0.23	0.16	1.87	9.60
45	5.17	-1.0	33.6	2.47	0.84	0.82	0.17	0.15	2.72	10.68
47	4.70	-20.8	32.7	1.51	0.65	0.67	0.27	0.23	0.51	9.57
48	4.34	-47.8	39.4	1.01	0.36	0.57	0.27	0.20	0.30	9.41
51	4.93	-23.2	37.2	3.05	0.71	0.76	0.15	0.06	0.85	10.65
182	7.16	583.4	77.4	11.2	2.57	1.08	0.36	0.38	3.18	7.50
FC 197	5.66	11.8	36.3	3.95	0.84	0.67	0.34	0.20	0.34	10.61
FC 199	6.47	72.5	33.9	3.50	0.91	0.74	0.28	0.19	0.49	8.12
219	5.95	33.7	35.6	4.00	0.73	0.78	0.25	0.24	2.83	10.87
225	6.21	44.7	35.7	3.47	0.97	1.07	0.47	0.28	4.56	9.67
239	4.95	-9.1	27.1	1.50	0.56	0.69	0.27	0.15	0.19	8.24
FC 240	4.93	-12.9	29.6	1.87	0.51	0.81	0.25	0.16	1.48	8.95
FC 242	6.05	53.7	21.6	1.87	0.60	0.82	0.39	0.16	2.92	4.10
247	7.25	505.5	76.6	9.93	2.94	0.72	0.73	0.15	0.68	10.33
FC 248	4.51	-29.5	33.8	1.62	0.48	0.80	0.24	0.07	0.49	9.14
250	5.23	-2.1	24.9	1.80	0.53	0.75	0.28	0.13	0.39	7.84
251	5.41	4.4	22.3	1.71	0.54	0.75	0.35	0.11	0.27	6.49
252	5.74	15.0	22.7	1.99	0.52	0.80	0.24	0.12	0.59	6.67
253	6.16	46.7	26.4	2.26	0.83	0.90	0.37	0.16	2.42	6.47
254	6.18	33.1	24.4	1.93	0.72	0.81	0.44	0.18	1.34	6.14
255	6.15	24.5	29.2	2.58	0.79	0.86	0.38	0.17	2.69	8.33
FC 256	6.17	30.5	29.4	2.54	0.81	0.86	0.36	0.17	2.08	8.23
257	4.83	-13.8	26.6	1.52	0.44	0.75	0.21	0.08	0.60	7.78
258	4.69	-20.5	30.6	1.54	0.44	0.74	0.22	0.15	1.62	8.59
FC 259	4.78	-14.5	28.2	1.60	0.40	0.72	0.22	0.12	0.71	8.13
260	4.83	-12.2	25.1	1.43	0.37	0.68	0.24	0.11	0.80	7.10
266	5.70	12.3	28.2	2.30	0.65	0.90	0.42	0.18	1.93	8.32
268	5.03	-7.8	26.5	1.78	0.51	0.79	0.33	0.16	0.91	7.41
292	7.02	247.1	51.7	6.19	1.66	0.79	0.55	0.16	3.44	9.75
298	5.75	7.9	32.5	2.72	0.75	0.88	0.52	0.18	1.01	10.21

LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)
299	7.29	677.6	87.2	10.1	4.46	0.70	0.57	0.15	0.91	8.36
303	5.70	6.0	29.5	2.85	0.56	0.77	0.23	0.22	0.79	9.63
307	4.42	-37.4	33.6	1.11	0.31	0.63	0.21	0.12	0.54	8.37
FC 316	5.50	12.8	35.2	3.34	0.82	0.98	0.35	0.17	2.68	10.66
326	5.19	-0.7	27.1	2.30	0.53	0.66	0.28	0.20	1.60	8.13
333	6.65	103.7	36.3	3.69	1.04	0.88	0.42	0.26	0.26	8.59
334	6.83	195.0	42.5	4.23	1.66	1.03	0.35	0.24	5.06	8.02
338	5.47	12.3	37.2	3.86	0.85	1.00	0.41	0.23	2.17	10.63
342	5.25	3.6	20.6	1.34	0.72	0.58	0.38	0.16	1.63	4.43
343	5.16	-2.3	12.6	0.58	0.22	0.17	0.23	0.07	1.42	2.75
348	6.55	114.4	41.7	4.33	1.19	1.02	0.37	0.26	5.66	10.33
373	4.33	-45.0	39.2	0.92	0.32	0.56	0.21	0.17	0.89	9.47
387	4.27	-54.0	41.6	0.85	0.33	0.54	0.14	0.06	0.32	9.17
393	4.43	-36.3	37.8	1.47	0.46	0.60	0.27	0.17	0.47	9.74
394	4.45	-37.7	38.7	1.61	0.48	0.61	0.23	0.16	0.30	9.65
401	4.51	-30.2	33.9	1.54	0.66	0.67	0.21	0.15	1.05	8.58
FC 402	4.39	-41.4	39.1	1.28	0.43	0.63	0.28	0.16	0.37	9.80
403	4.42	-38.7	37.5	1.33	0.46	0.62	0.24	0.13	1.06	9.35
FC 404	5.04	-7.0	28.8	1.90	0.56	0.77	0.32	0.17	2.16	8.85
406	4.45	-36.0	36.4	1.37	0.49	0.62	0.21	0.10	0.31	9.28
407	4.37	-43.7	35.9	1.28	0.43	0.61	0.21	0.05	0.88	8.30
FC 408	4.25	-57.1	44.6	1.34	0.44	0.64	0.12	0.08	0.65	10.17
409	6.97	208.5	55.6	7.57	1.16	0.96	0.31	0.22	3.80	12.09
FC 410	5.45	1.5	28.5	2.59	0.47	0.68	0.23	0.18	0.24	9.03
469	6.46	68.2	32.7	3.65	0.60	0.84	0.34	0.15	0.33	8.56
472	5.82	16.5	35.9	3.83	0.77	0.99	0.22	0.29	4.48	10.45
475	6.20	24.4	32.4	3.42	0.63	0.82	0.25	0.15	1.87	9.26
FC 479	5.50	13.3	30.6	3.35	0.53	0.79	0.26	0.08	1.25	8.56
480	5.95	15.7	33.9	3.55	0.63	0.79	0.27	0.19	0.44	10.43
493	5.45	4.4	29.5	2.92	0.50	0.67	0.19	0.14	0.40	8.94
494	5.22	1.6	30.0	2.72	0.51	0.77	0.09	0.12	1.35	9.17
501	6.15	32.3	32.8	3.68	0.75	0.82	0.18	0.14	0.90	9.16
502	6.22	79.5	45.2	5.16	0.89	0.95	0.30	0.13	1.97	9.80
510	5.75	20.1	31.7	2.79	0.71	0.86	0.68	0.15	0.88	8.55
515	6.72	127.9	44.2	5.97	0.86	0.96	0.25	0.14	2.54	10.15
522	5.22	-1.4	28.2	2.29	0.65	0.72	0.23	0.12	0.49	8.24
524	5.78	13.9	32.4	3.28	0.72	0.77	0.28	0.19	4.12	9.91
526	6.87	188.5	43.4	4.97	1.15	1.07	0.37	0.24	3.67	8.65
527	5.45	5.8	22.5	1.83	0.62	0.54	0.33	0.17	0.39	6.28
FC 530	5.31	1.7	29.1	2.55	0.59	0.61	0.39	0.19	0.28	9.00
531	6.48	55.4	35.6	4.07	0.84	0.79	0.28	0.20	1.55	9.81
545	6.54	84.4	42.2	4.79	0.96	0.96	0.45	0.24	4.53	10.95
553	6.26	39.8	37.1	4.38	0.82	0.83	0.25	0.20	2.29	9.85
570	6.67	156.9	45.0	4.79	1.42	1.23	0.37	0.26	8.04	10.03
572	4.88	-9.5	32.3	2.22	0.65	0.91	0.33	0.20	2.91	9.22
573	4.98	-5.6	29.1	2.13	0.63	0.79	0.27	0.17	2.67	8.86

LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)
577	6.80	210.8	51.7	5.28	1.67	1.63	0.38	0.24	10.58	11.09
579	5.83	9.2	35.5	3.21	0.98	0.76	0.32	0.20	0.92	11.40
583	5.35	2.7	30.7	2.63	0.70	0.80	0.46	0.29	4.69	8.60
585	6.39	52.5	32.7	3.33	0.91	0.89	0.30	0.18	3.23	8.75
588	6.51	67.6	34.5	3.63	0.97	0.91	0.29	0.20	4.08	8.79
FC 589	5.14	-2.3	28.7	2.48	0.63	0.76	0.14	0.11	0.94	8.58
590	5.36	2.3	30.9	2.84	0.68	0.78	0.21	0.15	1.09	9.35
FC 593	5.17	-3.0	30.1	2.71	0.61	0.63	0.18	0.18	1.25	9.62
609	6.08	25.4	28.3	2.99	0.70	0.64	0.24	0.23	1.56	7.46
612	6.46	69.5	34.5	3.52	0.97	0.94	0.28	0.25	4.12	8.70
613	6.69	118.9	31.2	3.59	0.85	0.60	0.32	0.23	0.94	6.24
638	5.14	0.2	30.0	2.40	0.56	1.00	0.33	0.24	1.27	8.97
645	4.53	-29.3	34.9	1.65	0.47	0.73	0.16	0.13	0.35	9.33
646	4.59	-25.3	28.0	1.09	0.34	0.56	0.15	0.13	0.22	7.31
655	6.15	29.8	28.0	2.57	0.73	0.84	0.27	0.21	0.85	7.88
692	5.86	18.6	29.8	2.59	0.77	1.02	0.27	0.20	0.56	8.55
822	5.96	21.6	29.3	3.08	0.66	0.73	0.27	0.17	2.13	8.38
856	6.15	46.5	23.0	2.67	0.56	0.58	0.33	0.14	1.58	4.24
900	6.78	237.5	46.2	7.12	0.96	0.67	0.21	0.15	1.94	5.87
FC 902	5.57	9.7	27.9	2.55	0.65	0.61	0.50	0.14	0.92	8.67
903	7.07	239.2	56.0	7.63	1.74	0.60	0.44	0.29	0.44	12.28
904	6.13	33.1	32.3	3.60	0.77	0.56	0.62	0.17	1.51	8.69
FC 905	6.66	124.9	37.4	4.58	0.77	0.79	0.57	0.18	2.23	8.04
906	4.46	-36.0	38.0	1.25	0.43	0.63	0.30	0.20	0.67	9.62
908	5.61	8.3	27.4	2.47	0.67	0.77	0.19	0.11	0.31	8.35
909	7.27	446.8	69.7	10.6	1.54	0.70	0.34	0.16	0.78	9.34
FC 920	6.79	165.3	43.7	6.10	0.84	0.61	0.34	0.25	0.83	8.75
921	5.08	-6.2	29.5	2.28	0.51	0.64	0.27	0.20	1.63	9.71
FC 922	5.31	-1.0	27.1	2.11	0.57	0.69	0.37	0.10	1.39	8.71
923	6.13	33.7	32.4	3.09	0.87	0.92	0.36	0.21	1.98	9.57
924	4.46	-33.4	37.6	1.40	0.52	0.79	0.31	0.28	3.61	9.49
925	5.20	-0.9	28.9	2.53	0.45	0.67	0.13	0.07	1.01	8.73
926	7.33	606.7	97.0	10.9	2.90	3.25	0.94	2.54	8.81	9.92
927	5.22	0.5	22.0	1.65	0.42	0.56	0.35	0.03	1.31	6.32
930	5.46	3.6	29.3	2.43	0.58	0.86	0.32	0.24	0.64	9.47
932	4.55	-26.6	31.1	1.47	0.42	0.62	0.18	0.18	0.92	8.17
933	4.52	-28.1	32.4	1.36	0.40	0.65	0.24	0.25	1.06	7.36
935	4.83	-14.6	27.7	1.63	0.45	0.63	0.16	0.17	1.12	7.66
938	5.20	-1.2	30.0	2.45	0.63	0.66	0.16	0.08	3.10	10.22
943	7.42	786.1	91.6	13.8	3.10	0.67	0.22	0.15	3.45	6.45
947	6.03	17.7	33.2	3.36	0.78	0.71	0.31	0.23	0.48	10.43
949	6.72	144.9	41.0	4.26	1.29	1.07	0.40	0.23	3.53	8.60
951	6.21	33.9	35.3	3.82	0.80	0.68	0.33	0.20	0.23	10.54
953	6.15	25.2	32.4	3.62	0.72	0.69	0.24	0.18	0.28	9.30
954	6.56	81.6	38.4	3.93	1.07	0.97	0.36	0.23	4.34	10.21
955	6.60	94.2	40.9	4.85	0.82	0.81	0.42	0.22	0.57	10.98

LAKE	pH	ALK (µeq/L)	COND (µS/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Cl (mg/L)	SiO_2 (mg/L)	SO_4 (mg/L)
957	5.19	6.5	25.9	2.21	0.55	0.71	0.46	0.17	2.60	5.88
FC 958	5.96	22.3	34.2	3.44	0.83	0.75	0.31	0.26	0.69	10.41
959	7.36	662.4	124.3	12.9	3.53	6.83	0.44	9.57	0.65	11.95
961	6.25	62.3	19.2	1.70	0.53	0.69	0.40	0.16	1.25	3.68
962	6.76	215.7	45.6	6.41	1.10	0.72	0.20	0.14	2.10	6.42
963	5.85	14.8	19.2	1.44	0.47	0.78	0.30	0.13	0.67	4.95
965	4.88	-12.0	33.2	2.45	0.55	0.69	0.26	0.21	0.89	10.55
966	5.84	9.5	30.4	2.78	0.59	0.77	0.35	0.22	1.03	9.65
968	6.11	27.0	29.1	2.62	0.78	0.86	0.38	0.16	2.72	8.30
973	4.76	-16.1	30.9	1.66	0.41	0.72	0.14	0.11	0.33	8.96
974	5.44	5.4	22.7	1.71	0.50	0.83	0.25	0.17	1.86	6.48
975	4.41	-34.9	37.9	1.42	0.48	0.77	0.27	0.09	0.77	9.74
976	4.82	-14.8	33.0	2.46	0.72	0.74	0.17	0.12	0.89	8.79
1001	5.64	15.3	26.4	3.04	0.64	0.64	0.37	0.22	5.34	4.53
1004	7.16	613.9	76.9	10.4	2.56	0.88	0.37	0.19	6.47	6.39
1005	5.47	12.0	23.1	1.76	0.61	0.80	0.21	0.26	2.53	5.89
1006	5.85	43.4	25.8	2.87	0.49	0.83	0.25	0.21	3.59	5.54
1007	5.92	51.4	16.1	1.47	0.51	0.48	0.36	0.16	2.92	2.12
1009	6.59	124.1	40.8	4.92	0.78	0.92	0.25	0.11	0.61	9.31
1013	4.36	-28.8	32.9	1.13	0.40	0.51	0.18	0.10	3.38	5.77
1030	5.33	3.0	19.4	1.17	0.59	0.49	0.31	0.10	3.16	4.88
1031	4.70	-16.1	28.4	1.86	0.51	0.54	0.22	0.16	3.09	6.74
1033	4.28	-58.3	38.9	1.37	0.40	0.58	0.17	0.12	2.92	7.31
1038	5.85	19.9	31.9	3.64	0.62	0.77	0.24	0.15	0.97	8.62

LEGEND

VARIABLE EXPLANATIONS

ALK = total inflection point alkalinity
COND = specific conductance (µS/cm at 25° C)
Ca = calcium
Mg = magnesium
Na = sodium
K = potassium
Cl^{*} = chloride
SiO_2 = silica
SO_4 = sulphate

NOTATIONS

FC *Lake Number* = food chain lake
Lake Number = drained in autumn 1995

* values below detection limit assigned a value of 4.90 µg/L

Table 24b. Average chemical characteristics (Part 2) of Sudbury study lakes, identified by lake number. Chemical values are four year means (fall sampling: 1991, 1993, 1994, 1995). (See legend for variable descriptions and notations).

LAKE	COLOR^1 (hu)	DOC (mg/L)	TIC (mg/L)	NH$_3$ (µg/L)	NO$_2$NO$_3$ (mg/L)	TKN (mg/L)	TP (µg/L)	Al (µg/L)	Fe (µg/L)	Mn (µg/L)	Cu^2 (µg/L)	Ni^2 (µg/L)
1	25	7.07	2.18	11.47	0.014	0.45	6.11	17.1	49.7	20.0	3.99	9.12
2	25	6.99	1.22	81.26	0.011	0.54	9.52	33.7	80.2	12.5	3.23	9.93
3	20	3.47	0.36	269.6	0.020	0.57	5.64	89.1	139.1	84.1	2.93	11.15
5	20	4.95	3.90	14.74	0.008	0.41	6.18	16.7	30.5	13.4	2.93	7.58
6	30	8.07	16.09	58.39	0.009	0.62	9.55	10.2	36.1	6.3	1.95	2.23
10	.	11.65	2.87	32.28	0.008	0.76	14.73	115.8	207.5	18.9	2.74	7.09
13	10	3.50	0.23	84.88	0.013	0.30	5.06	458.9	54.3	174.0	1.95	14.87
FC 16	50	6.78	1.05	16.53	0.009	0.54	9.63	31.9	63.3	9.4	1.95	2.18
17	20	4.31	0.36	14.40	0.007	0.39	7.53	148.7	144.0	102.6	2.26	12.18
22	110	13.62	0.64	155.4	0.008	0.77	13.68	137.3	714.5	35.1	2.85	10.69
24	50	9.46	1.48	12.13	0.007	0.49	6.91	63.1	63.3	10.9	3.69	8.66
26	35	4.38	0.64	11.73	0.008	0.34	6.12	85.5	337.5	50.9	2.32	6.12
34	5	0.83	0.22	10.24	0.007	0.06	3.57	615.4	38.6	73.5	3.85	26.98
45	30	5.05	0.30	84.58	0.012	0.37	13.35	169.5	563.8	86.4	2.07	14.04
47	10	1.09	0.27	22.37	0.012	0.13	3.77	201.6	71.1	81.8	1.95	30.29
48	10	0.98	0.23	42.00	0.013	0.17	3.66	370.1	95.5	57.4	2.72	32.84
51	25	5.28	0.35	7.52	0.007	0.38	11.34	137.3	283.6	77.0	2.14	16.06
182	40	8.12	6.82	108.8	0.008	0.48	8.26	38.2	222.1	11.0	1.95	1.95
FC 197	55	8.38	0.30	103.5	0.007	0.47	11.45	76.6	57.3	16.5	3.00	5.78
FC 199	50	7.03	1.13	19.99	0.008	0.35	8.18	49.8	28.7	17.1	2.10	4.53
219	15	4.46	0.79	17.36	0.009	0.34	6.55	78.5	78.3	65.6	2.27	10.35
225	40	6.90	0.91	76.40	0.012	0.50	11.71	122.5	131.9	28.8	2.94	7.12
239	10	2.85	0.27	105.5	0.021	0.36	6.38	115.4	66.1	59.7	1.95	9.25
FC 240	10	2.19	0.24	18.57	0.010	0.13	3.47	91.9	47.3	89.9	1.95	9.65
FC 242	80	7.92	1.11	88.43	0.008	0.91	15.43	99.5	565.9	37.7	2.24	4.59
247	30	6.70	6.13	16.80	0.009	0.45	8.46	28.9	26.7	3.4	1.95	2.02
FC 248	10	3.20	0.23	12.30	0.008	0.27	4.89	133.9	58.4	56.0	1.95	8.02
250	10	3.03	0.22	59.42	0.015	0.27	6.29	72.3	92.9	35.0	2.04	6.20
251	35	4.99	0.30	64.02	0.013	0.45	7.97	64.1	98.1	23.0	2.11	4.14
252	20	5.06	0.42	10.64	0.008	0.42	4.32	45.2	80.0	11.1	1.95	2.11
253	55	5.72	0.99	17.92	0.007	0.36	5.87	53.2	575.3	30.1	1.95	3.17
254	20	4.71	0.60	51.75	0.008	0.42	6.90	22.2	127.9	23.6	1.95	2.88
255	25	4.13	0.55	12.84	0.010	0.28	6.04	40.7	125.8	27.5	1.95	2.37
FC 256	20	3.76	0.55	33.68	0.008	0.36	5.40	36.6	115.3	18.6	1.95	1.95
257	10	2.94	0.18	39.15	0.007	0.21	5.26	131.3	30.8	60.7	1.95	6.55
258	10	2.29	0.18	27.79	0.008	0.24	5.87	212.1	79.6	67.6	1.95	10.42
FC 259	10	2.91	0.19	73.07	0.011	0.33	5.46	175.7	26.2	50.9	1.95	8.91
260	20	3.61	0.33	66.48	0.014	0.40	7.99	168.8	118.3	46.0	1.95	7.46
266	30	4.11	0.37	56.73	0.017	0.31	6.95	122.9	467.9	29.5	1.95	2.71
268	20	5.24	0.24	68.38	0.019	0.47	10.98	156.1	356.7	62.8	2.00	3.13
292	10	3.61	2.97	5.72	0.009	0.16	4.81	17.6	13.3	5.7	1.95	2.08
298	10	4.19	0.33	26.30	0.020	0.29	4.43	70.1	26.7	32.6	1.95	4.83

LAKE	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µg/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µg/L)	Al (µg/L)	Fe (µg/L)	Mn (µg/L)	Cu[2] (µg/L)	Ni[2] (µg/L)
299	25	7.26	8.35	46.04	0.024	0.46	7.55	20.7	46.4	8.3	1.95	1.95
303	5	2.82	0.31	16.12	0.008	0.27	4.34	19.7	20.9	43.1	1.95	7.16
307	5	1.64	0.22	23.41	0.010	0.33	4.24	288.0	64.3	60.5	8.30	16.18
FC 316	50	9.36	0.27	351.4	0.031	0.54	13.19	196.2	167.5	47.7	2.47	7.91
326	35	5.35	0.32	19.66	0.006	0.23	5.87	140.3	211.7	107.6	1.95	8.35
333	15	3.56	1.51	133.4	0.005	0.40	6.57	11.8	38.2	8.3	1.95	1.95
334	10	3.33	2.50	12.54	0.007	0.30	5.51	8.0	75.3	6.9	1.95	1.95
338	65	11.92	0.38	184.6	0.008	0.69	20.40	195.0	139.6	58.0	3.39	6.55
342	110	10.68	0.34	21.66	0.006	0.52	14.60	122.1	1198.1	31.5	2.74	4.57
343	15	4.69	0.33	195.6	0.012	0.92	9.95	26.8	158.2	34.5	1.95	2.00
348	10	2.56	1.65	12.70	0.026	0.24	5.52	35.8	139.4	33.1	2.39	2.19
373	5	0.98	0.17	44.44	0.021	0.11	2.44	581.4	52.8	99.1	2.35	21.39
387	5	2.39	0.17	44.87	0.031	0.21	3.39	544.9	54.1	40.8	2.30	17.10
393	5	1.01	0.14	28.98	0.022	0.15	3.75	299.8	33.4	125.3	2.24	13.64
394	5	1.67	0.13	15.02	0.006	0.14	3.80	206.1	34.9	197.6	2.24	13.89
401	10	6.09	0.26	13.32	0.007	0.28	5.61	243.3	101.5	57.4	1.95	9.55
FC 402	5	0.98	0.17	48.31	0.023	0.09	3.44	327.3	33.6	190.2	3.02	15.74
403	5	2.05	0.19	16.06	0.012	0.12	3.66	297.6	51.4	150.5	2.09	15.04
FC 404	10	2.07	0.22	26.82	0.006	0.13	3.38	88.6	67.4	141.4	1.95	9.27
406	5	2.27	0.16	24.98	0.007	0.16	3.25	277.9	42.4	139.1	2.10	13.49
407	20	4.11	0.27	30.08	0.010	0.24	6.18	242.1	97.7	67.5	1.95	9.23
FC 408	5	4.00	0.19	39.07	0.012	0.20	4.35	470.6	49.0	79.1	1.95	14.47
409	15	4.91	2.59	11.65	0.006	0.32	5.40	36.2	11.1	18.0	1.95	1.98
FC 410	10	2.61	0.32	69.38	0.015	0.26	5.10	68.1	44.4	57.8	1.95	5.97
469	10	3.30	1.06	11.60	0.010	0.27	7.45	10.3	23.3	6.8	1.95	2.22
472	20	8.88	0.44	8.70	0.006	0.33	6.46	187.1	101.9	36.1	2.59	4.73
475	15	4.82	0.56	11.82	0.007	0.31	4.61	44.0	30.5	25.7	1.95	4.41
FC 479	45	9.67	0.28	21.60	0.009	0.51	7.15	154.6	98.6	37.4	1.95	6.33
480	10	4.26	0.37	8.33	0.008	0.25	3.60	40.2	20.1	9.7	1.95	2.99
493	25	6.14	0.25	34.33	0.014	0.50	6.11	94.2	34.9	22.7	1.95	7.98
494	15	6.50	0.25	16.83	0.008	0.33	5.14	175.0	54.9	62.5	1.95	10.74
501	25	6.33	0.60	15.15	0.008	0.53	6.29	31.1	34.2	12.3	1.95	4.26
502	20	4.84	1.36	7.32	0.008	0.32	4.96	16.9	26.9	13.1	1.97	2.09
510	40	10.85	0.51	200.4	0.019	1.65	77.23	384.8	189.9	67.3	5.23	4.34
515	35	7.38	1.62	10.19	0.009	0.58	8.24	60.3	44.2	4.5	2.34	3.08
522	25	5.81	0.31	8.22	0.005	0.40	7.67	110.0	95.1	29.2	1.95	5.43
524	25	4.91	0.33	69.37	0.005	0.26	4.64	75.2	58.3	43.8	2.04	4.76
526	10	2.72	2.49	15.58	0.008	0.23	6.05	7.6	128.1	24.4	1.95	1.95
527	40	5.70	0.27	96.97	0.005	0.45	11.96	27.5	88.0	20.0	1.95	2.67
FC 530	50	4.68	0.27	102.8	0.012	0.36	9.01	62.6	27.1	36.2	1.97	3.94
531	10	3.07	0.88	6.53	0.006	0.18	3.39	14.6	23.5	18.5	2.51	1.95
545	10	4.09	1.32	22.28	0.010	0.31	2.92	20.8	20.2	12.6	1.95	1.95
553	40	8.53	0.69	17.24	0.006	0.38	6.39	92.4	73.6	8.1	1.95	2.73
570	10	3.10	2.16	19.83	0.048	0.30	4.04	65.5	254.0	32.2	1.95	2.05
572	35	4.89	0.22	50.88	0.008	0.36	7.32	204.5	233.9	84.6	2.18	7.30
573	30	4.52	0.27	11.04	0.006	0.27	6.41	185.9	347.4	93.3	1.96	6.86

LAKE	COLOR^{1} (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µg/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µg/L)	Al (µg/L)	Fe (µg/L)	Mn (µg/L)	Cu^{2} (µg/L)	Ni^{2} (µg/L)
577	10	1.47	2.77	31.32	0.062	0.18	3.84	9.5	13.0	2.0	1.95	1.95
579	45	6.25	0.30	63.55	0.007	0.56	16.06	27.7	23.4	6.0	1.95	1.95
583	100	7.91	0.30	75.93	0.012	0.34	9.15	238.5	932.9	46.6	1.95	6.32
585	20	3.68	0.87	11.08	0.007	0.19	3.62	36.2	100.2	10.1	1.95	2.21
588	25	4.10	1.11	16.66	0.012	0.25	4.28	48.6	251.4	13.9	1.95	1.95
FC 589	35	6.49	0.30	20.51	0.007	0.33	6.33	118.6	68.8	33.9	1.95	4.61
590	20	4.99	0.31	31.07	0.012	0.33	6.20	66.7	48.0	34.4	1.95	5.07
FC 593	5	3.85	0.24	31.27	0.012	0.24	4.78	97.1	61.8	61.1	1.95	8.10
609	35	6.78	0.63	25.42	0.011	0.34	7.08	83.6	157.9	21.2	2.19	3.35
612	25	4.53	1.18	80.23	0.065	0.32	6.37	73.2	358.0	24.9	2.41	2.22
613	10	2.59	1.61	11.46	0.007	0.18	4.62	9.4	8.8	9.1	1.95	1.95
638	15	7.35	0.22	15.75	0.016	0.56	6.64	348.9	90.4	33.5	2.14	3.54
645	5	3.42	0.25	34.92	0.021	0.21	5.21	255.2	33.5	69.3	1.95	9.55
646	5	0.66	0.21	56.08	0.032	0.19	2.70	191.9	22.4	43.1	1.98	9.73
655	15	3.94	0.57	12.88	0.008	0.23	5.57	19.0	22.8	10.0	1.95	1.95
692	20	6.21	0.41	32.24	0.016	0.37	7.31	98.9	116.8	13.2	1.95	2.16
822	15	5.32	0.48	10.91	0.006	0.30	6.93	74.9	146.0	12.6	1.95	4.22
856	55	8.38	1.03	95.77	0.031	0.58	10.05	51.5	216.0	18.1	1.95	4.74
900	60	11.15	2.92	177.1	0.007	0.82	12.42	68.0	180.2	9.5	2.25	6.87
FC 902	20	5.14	0.45	102.7	0.011	0.50	9.83	71.1	182.2	75.3	2.05	12.66
903	5	2.65	3.13	7.67	0.007	0.25	3.91	11.3	5.1	6.8	1.95	2.06
904	45	7.96	0.64	31.79	0.007	0.55	8.72	71.9	79.3	28.4	1.95	8.67
FC 905	20	4.26	1.74	81.41	0.013	0.43	7.15	16.8	38.9	7.5	1.95	1.95
906	5	0.81	0.18	34.27	0.031	0.12	2.29	392.8	51.4	165.7	1.95	15.43
908	15	5.41	0.29	9.01	0.005	0.40	5.94	48.8	36.9	18.9	1.95	1.95
909	20	6.31	5.29	87.96	0.015	0.61	7.13	28.8	40.3	8.3	1.95	3.81
FC 920	25	6.57	1.99	49.90	0.015	0.52	8.15	26.1	21.3	5.6	2.10	4.77
921	5	1.68	0.23	23.42	0.012	0.15	3.33	104.4	20.0	129.6	1.95	14.01
FC 922	5	2.24	0.26	18.71	0.010	0.23	4.34	55.7	20.0	39.9	1.95	7.38
923	15	4.97	0.72	25.40	0.023	0.43	9.76	82.9	261.4	20.4	2.35	7.48
924	10	4.27	0.23	14.36	0.006	0.21	2.74	443.9	86.6	79.9	1.95	17.84
925	10	4.63	0.25	80.43	0.017	0.43	7.38	133.2	97.5	58.0	2.33	9.67
926	20	3.99	6.78	10.51	0.005	0.31	7.72	21.7	131.3	9.6	1.95	2.69
927	30	5.69	0.35	45.24	0.011	0.50	12.28	121.1	89.0	51.8	1.95	5.46
930	5	2.51	0.27	11.26	0.009	0.18	3.25	110.0	18.2	45.0	1.95	3.74
932	15	2.01	0.26	44.81	0.013	0.31	7.07	138.2	164.3	66.5	2.31	26.22
933	10	1.86	0.22	37.61	0.033	0.21	5.12	193.3	134.5	76.7	5.53	33.54
935	55	2.78	0.40	19.22	0.006	0.32	10.13	141.5	311.1	63.2	2.42	23.10
938	40	3.67	0.34	70.60	0.013	0.45	12.38	129.7	473.7	92.3	4.92	16.29
943	20	7.93	6.00	10.98	0.008	0.64	8.68	21.7	75.3	6.3	2.49	3.55
947	10	3.15	0.38	21.89	0.011	0.29	4.77	15.6	41.8	25.2	1.95	3.79
949	20	4.34	2.00	16.89	0.006	0.68	7.30	14.1	224.2	11.3	1.95	1.95
951	15	3.68	0.61	22.36	0.011	0.26	5.13	22.6	28.3	16.8	1.95	2.34
953	15	7.25	0.48	35.35	0.012	0.60	11.03	31.4	33.7	19.4	1.95	4.70
954	10	2.55	1.20	7.19	0.006	0.31	3.40	24.0	77.4	10.8	1.95	2.17
955	10	3.32	1.34	11.30	0.007	0.27	4.79	15.4	12.3	14.0	1.95	1.95

LAKE	COLOR[1] (hu)	DOC (mg/L)	TIC (mg/L)	NH_3 (µg/L)	NO_2NO_3 (mg/L)	TKN (mg/L)	TP (µg/L)	Al (µg/L)	Fe (µg/L)	Mn (µg/L)	Cu[2] (µg/L)	Ni[2] (µg/L)
957	175	12.80	0.57	25.96	0.005	0.66	12.24	251.7	689.9	62.9	2.59	14.24
FC 958	15	4.48	0.53	15.62	0.009	0.26	4.86	42.2	49.0	18.3	1.95	3.43
959	25	5.55	6.74	14.99	0.009	0.58	7.58	29.8	52.2	7.0	3.98	8.19
961	70	7.52	1.00	103.8	0.023	0.84	17.28	55.6	580.8	10.4	3.01	4.07
962	35	11.22	2.83	11.68	0.007	0.46	12.33	76.3	325.6	31.6	4.33	13.39
963	40	5.80	0.40	51.97	0.010	0.35	6.97	104.9	698.8	21.5	2.00	2.73
965	5	0.76	0.23	21.79	0.034	0.10	1.75	123.3	31.8	131.9	2.34	11.95
966	5	3.00	0.38	21.45	0.007	0.20	3.64	19.2	42.5	57.3	1.95	4.08
968	20	3.92	0.52	14.11	0.012	0.26	3.52	43.9	126.1	15.9	1.95	2.32
973	15	2.12	0.25	162.8	0.015	0.38	4.26	207.3	77.3	94.3	1.95	10.64
974	55	5.52	0.38	26.87	0.013	0.42	10.29	82.3	223.5	45.1	1.95	4.65
975	10	4.57	0.16	11.71	0.007	0.25	4.19	427.1	48.1	119.2	2.48	20.65
976	40	8.27	0.25	7.75	0.005	0.45	6.67	192.3	127.4	30.1	1.95	8.34
1001	110	17.02	0.55	51.68	0.037	0.55	9.23	234.0	607.7	40.1	4.10	16.32
1004	35	6.89	7.00	167.4	0.022	0.50	8.07	16.9	176.9	11.8	2.00	3.08
1005	65	8.28	0.42	17.87	0.016	0.32	5.86	173.2	382.6	51.7	2.95	11.34
1006	75	10.05	1.23	86.91	0.012	0.46	14.06	84.7	677.3	33.6	2.00	7.93
1007	110	8.07	1.40	9.45	0.007	0.37	12.01	41.4	1459.7	26.9	2.00	4.75
1009	25	6.71	1.75	125.6	0.024	0.51	9.02	62.7	34.4	18.3	2.00	6.25
1013	60	11.58	0.89	44.31	0.007	0.35	10.12	246.8	209.8	30.7	2.00	7.92
1030	70	6.80	0.35	19.80	0.009	0.39	10.23	69.9	579.4	21.4	2.00	4.62
1031	70	9.31	0.57	26.04	0.007	0.40	10.80	257.8	316.6	30.1	2.00	8.82
1033	55	9.00	0.83	9.63	0.006	0.36	9.07	186.5	215.9	69.1	2.00	8.20
1038	80	11.04	0.48	33.34	0.013	0.45	11.13	98.4	137.2	18.3	2.00	5.73

LEGEND

VARIABLE EXPLANATIONS

COLOR = water color (Hazen platinum-cobalt scale)
DOC = dissolved organic carbon
TIC = total inorganic carbon
NH_3 = ammonia
NO_2NO_3[a] = nitrite + nitrate
TKN = total Kjeldahl nitrogen
TP[a] = total phosphorus
Al[b] = aluminum
Fe[a] = iron
Mn[a] = manganese
Cu[a] = copper
Ni[a] = nickel

[a] values below detection limit assigned a value of 1.90 µg/L
[b] values below detection limit assigned a value of 4.90 µg/L

NOTATIONS

FC ***Lake Number*** = food chain lake
Lake Number = drained in autumn 1995
[1] 1995 values only
[2] 2 year means from 1991 and 1993

Sudbury Food Chain Wetlands

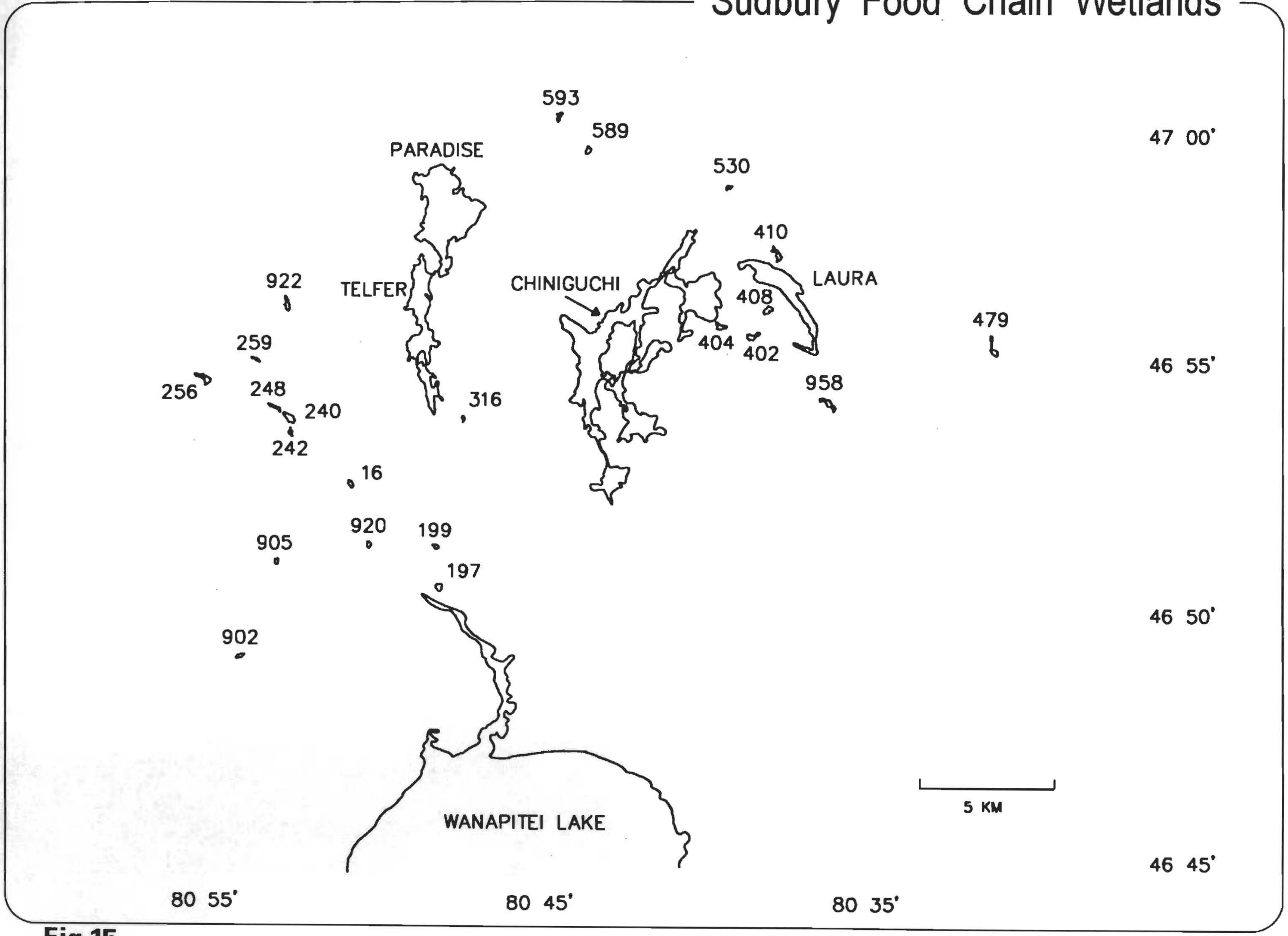


Fig.15

Key to Figure 16. Maps of individual Sudbury food chain lakes (N = 22) depicting crude habitat characteristics associated with each lake, as well as the locations of water, minnow, leech and macroinvertebrate sampling sites (see McNicol *et al.* 1996a for description of methods).

HABITAT CHARACTERISTICS

Open water is indicated by enclosed polygons containing sampling symbols. Associated riparian vegetation is indicated by enclosed polygons lacking sampling symbols. No differentiation among vegetation types is made for Sudbury food chain lakes.

SAMPLING VARIABLES

Minnow Trap:	locations of six minnow traps
Funnel Trap:	locations of five funnel traps used primarily to sample leeches
Water Sample:	location of autumn water sample by helicopter
Duck Box:	location of duck box
Benthic:	locations of ten benthic net drags used to sample benthic macroinvertebrates
Sweep:	locations of ten sweep net samples used to collect nektonic macroinvertebrates
Hoop:	locations of ten hoop samples used primarily to collect larval trichopterans

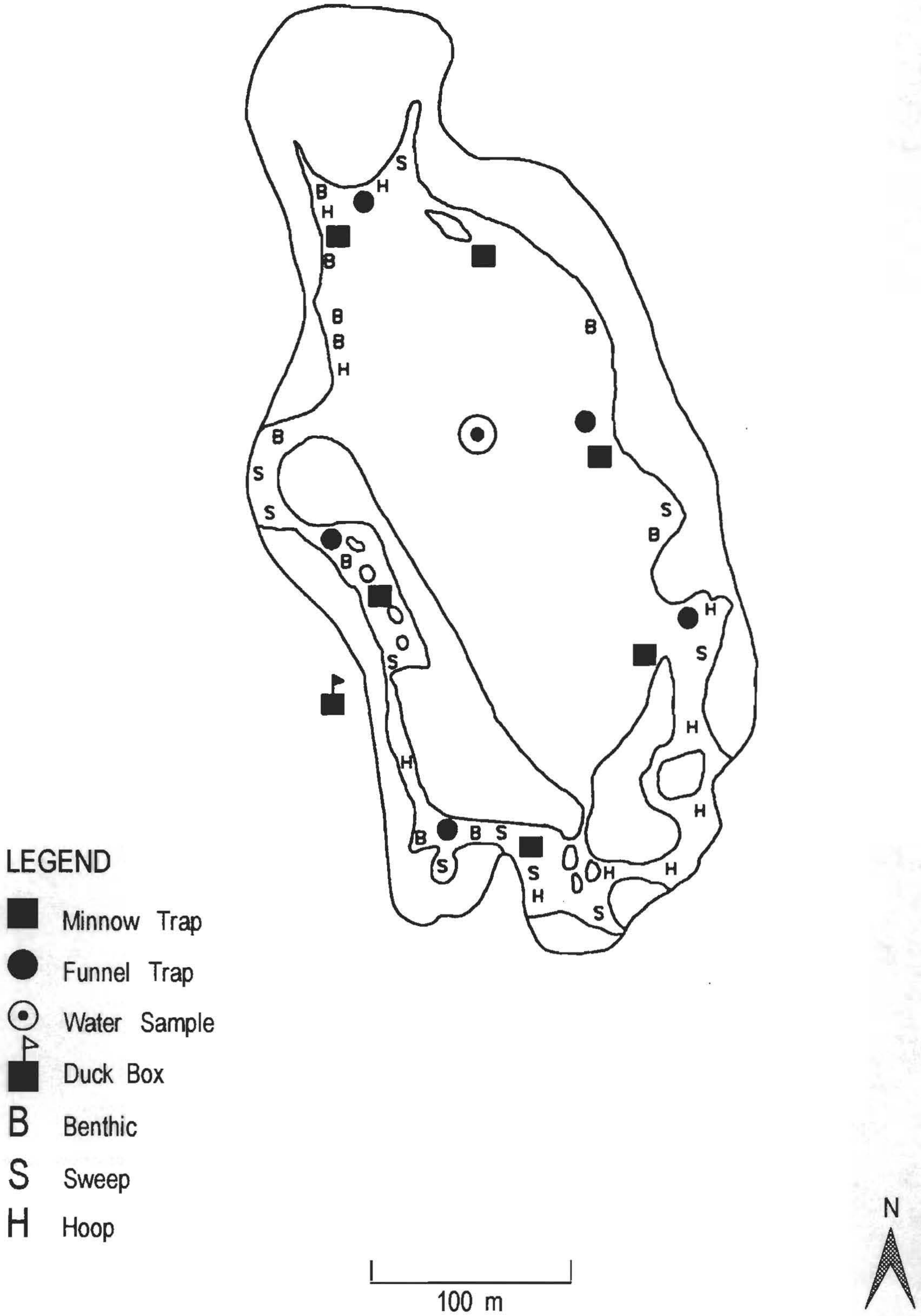
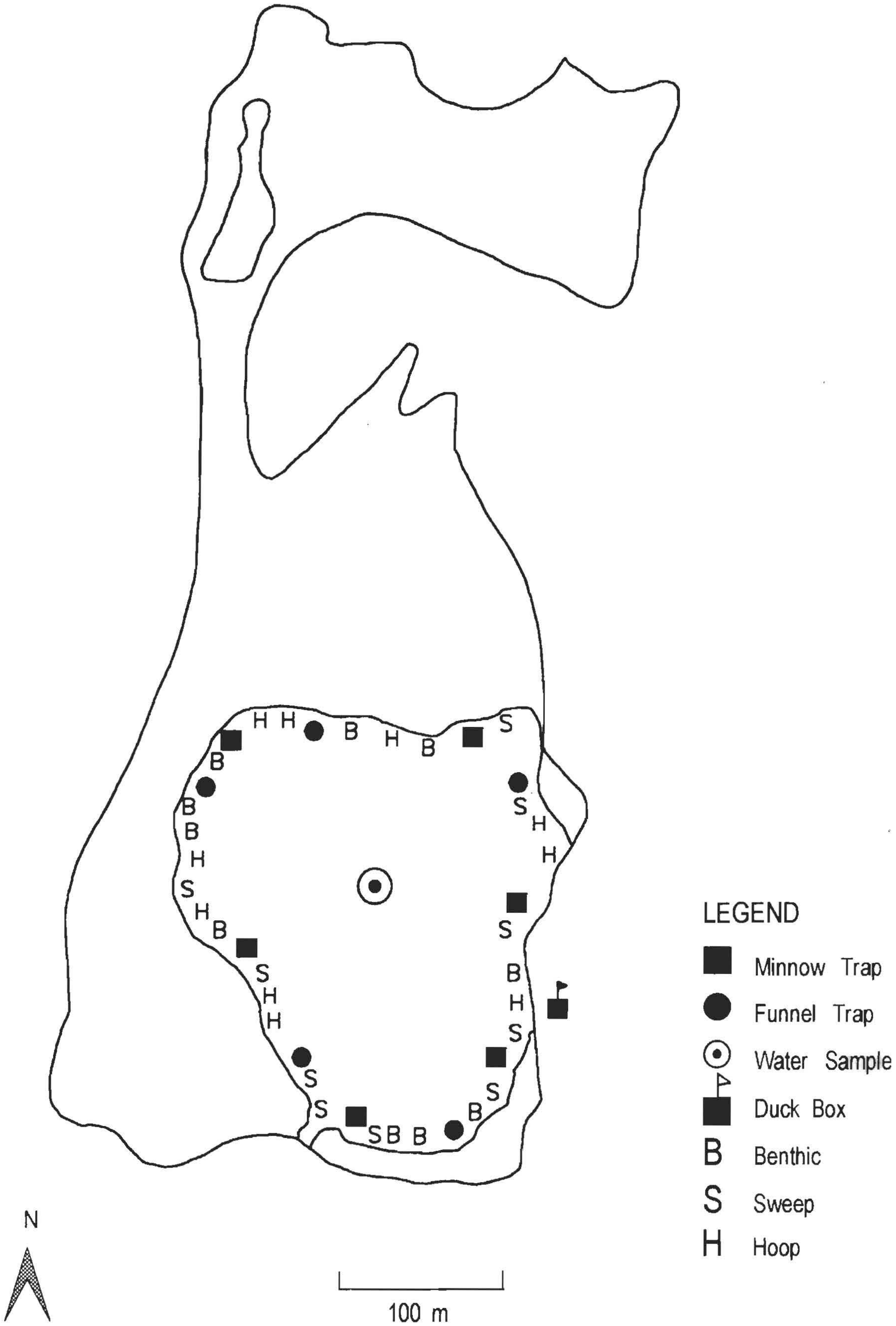
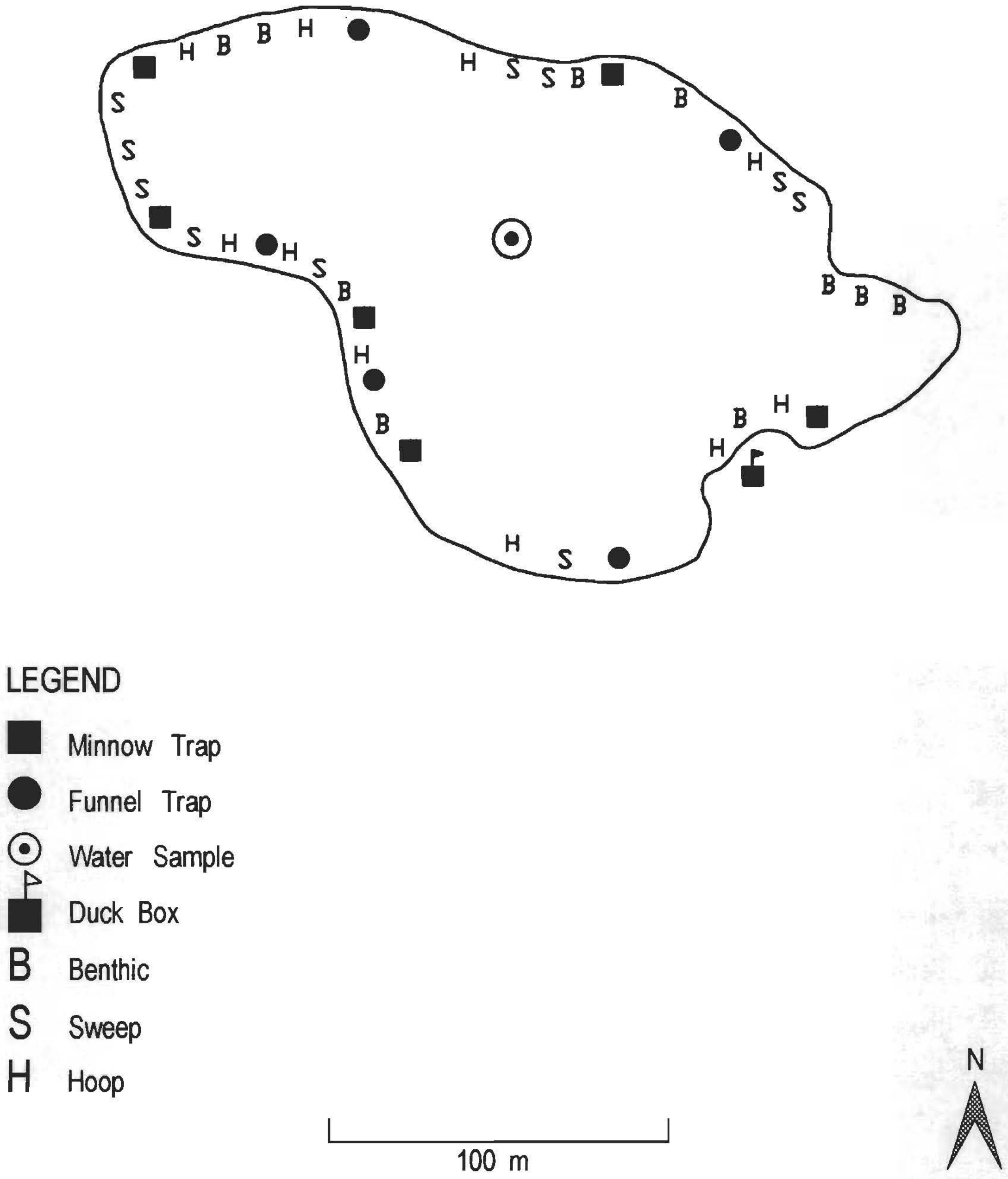

LEGEND
■ Minnow Trap
● Funnel Trap
⊙ Water Sample
Duck Box
B Benthic
S Sweep
H Hoop
100 m
N

Fig. 16

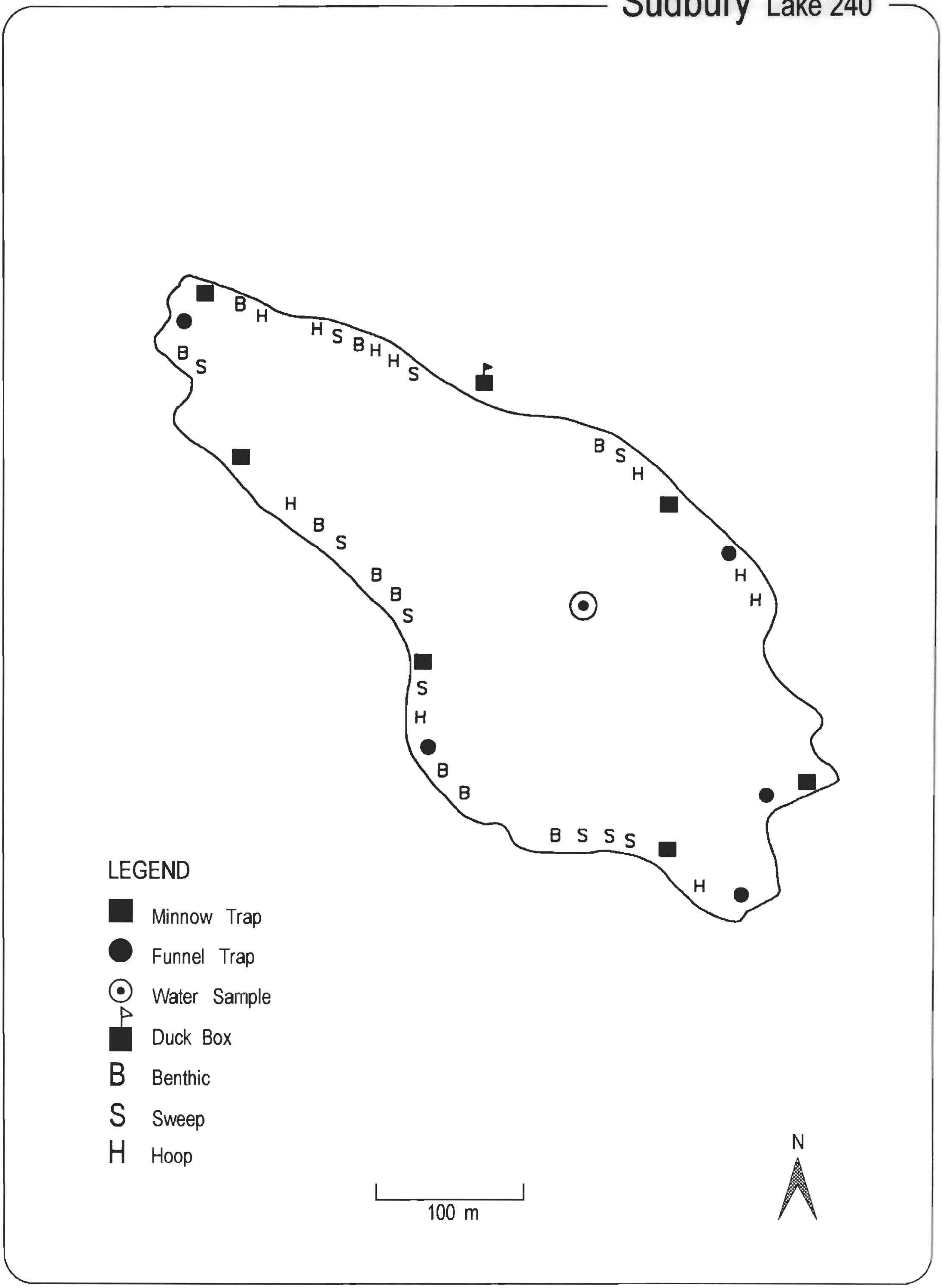
Sudbury Lake 197



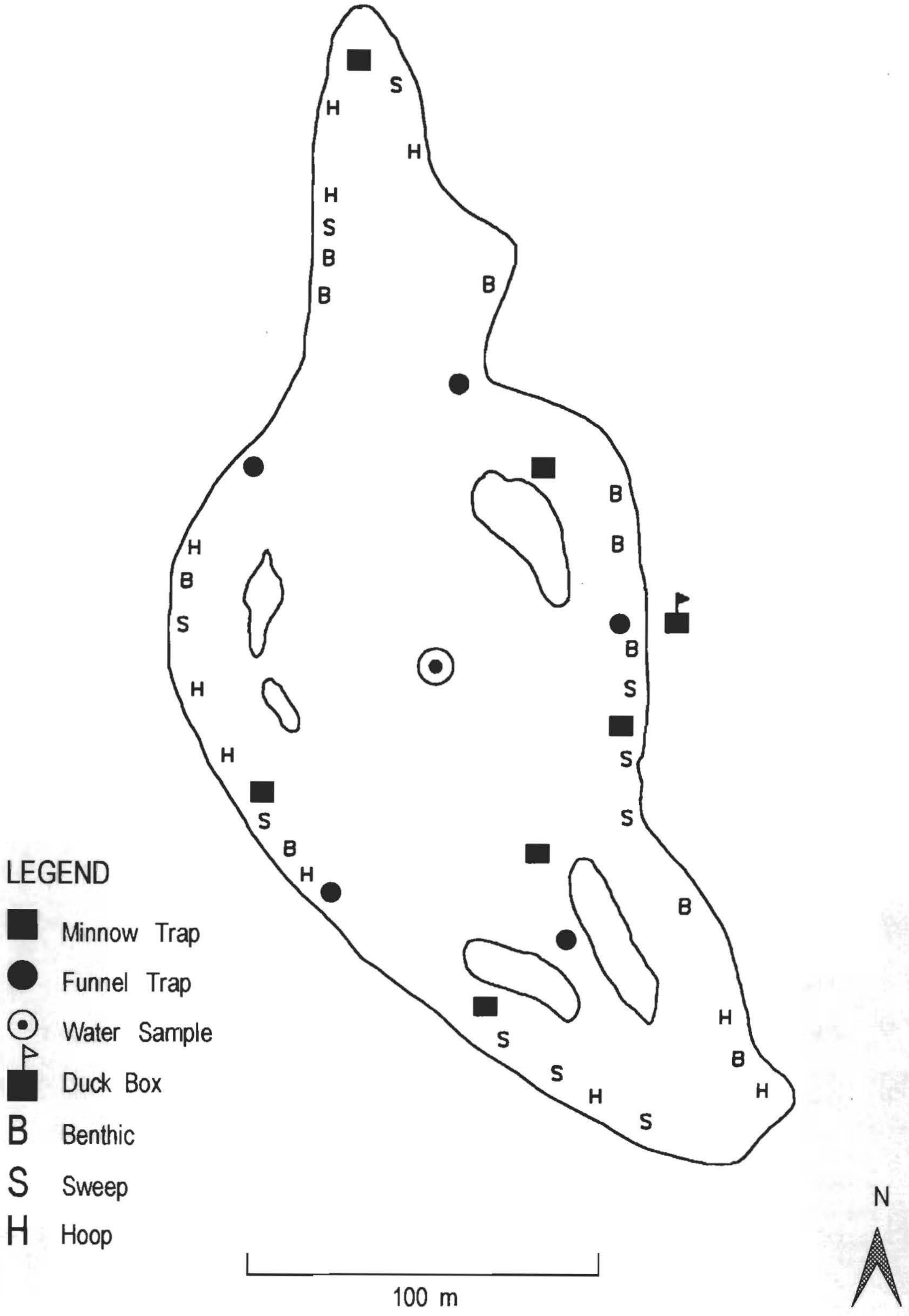
Sudbury Lake 199



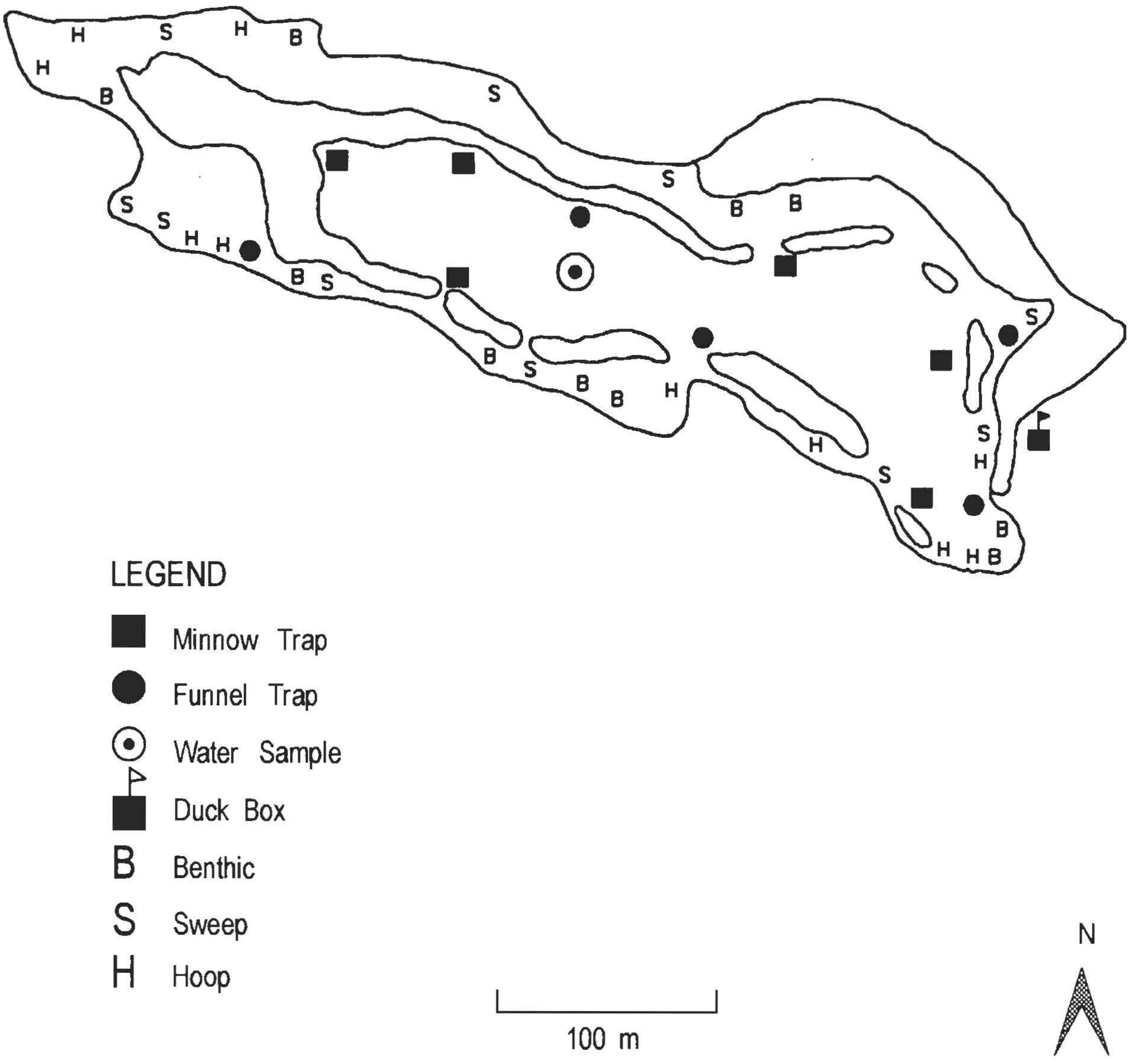
Sudbury Lake 240



Sudbury Lake 242

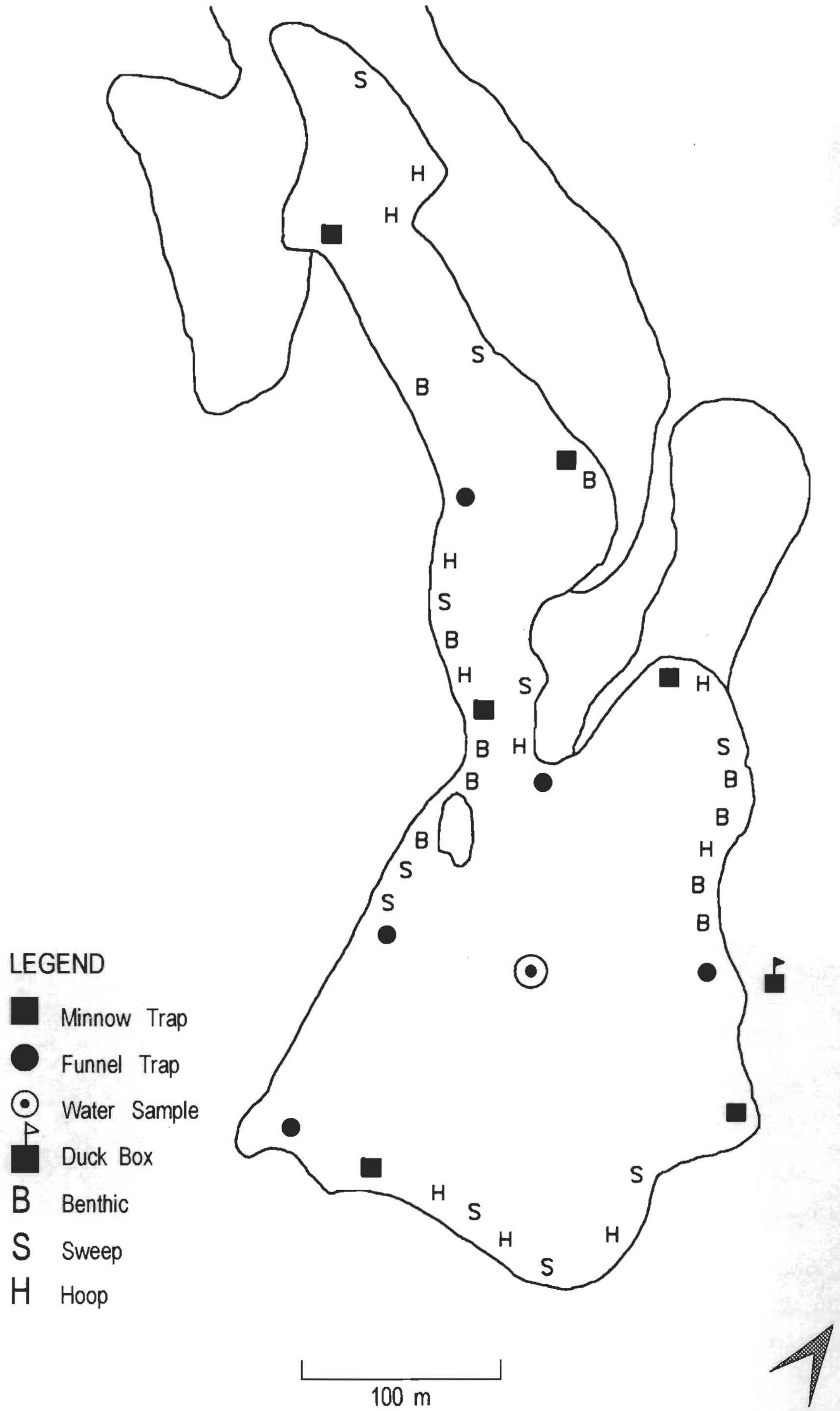


Sudbury Lake 248

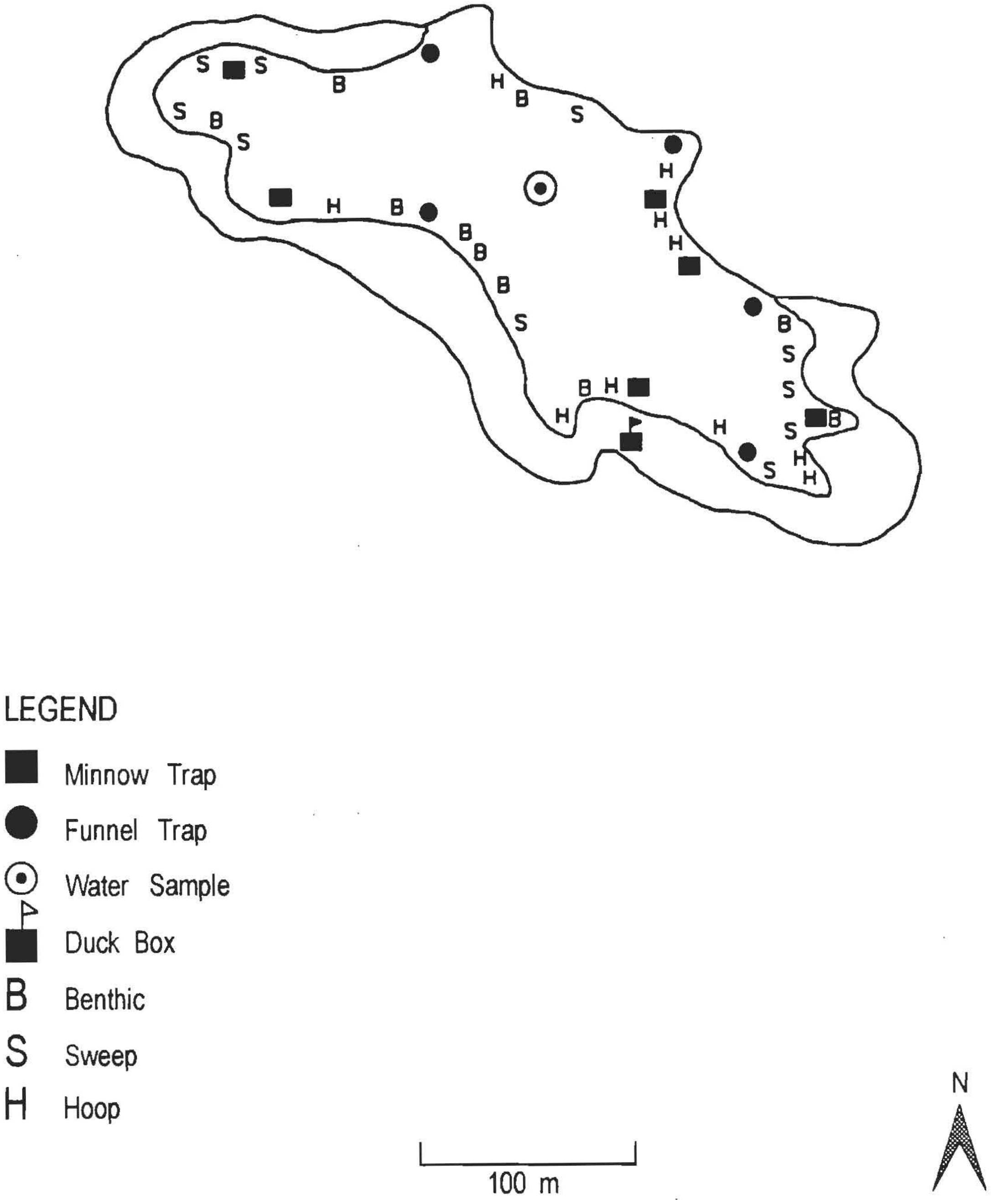


Food Chain Monitoring Program

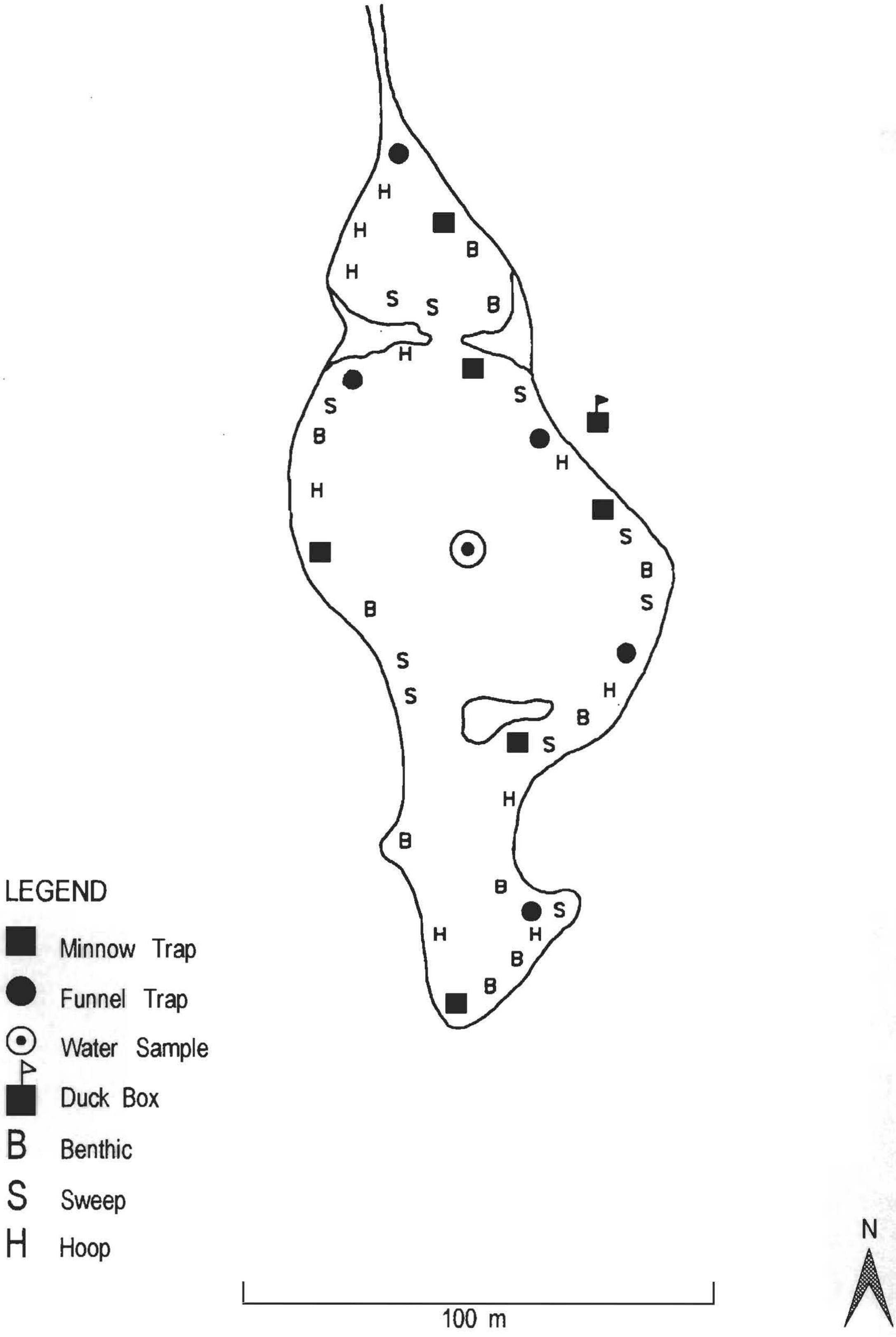
Sudbury Lake 256



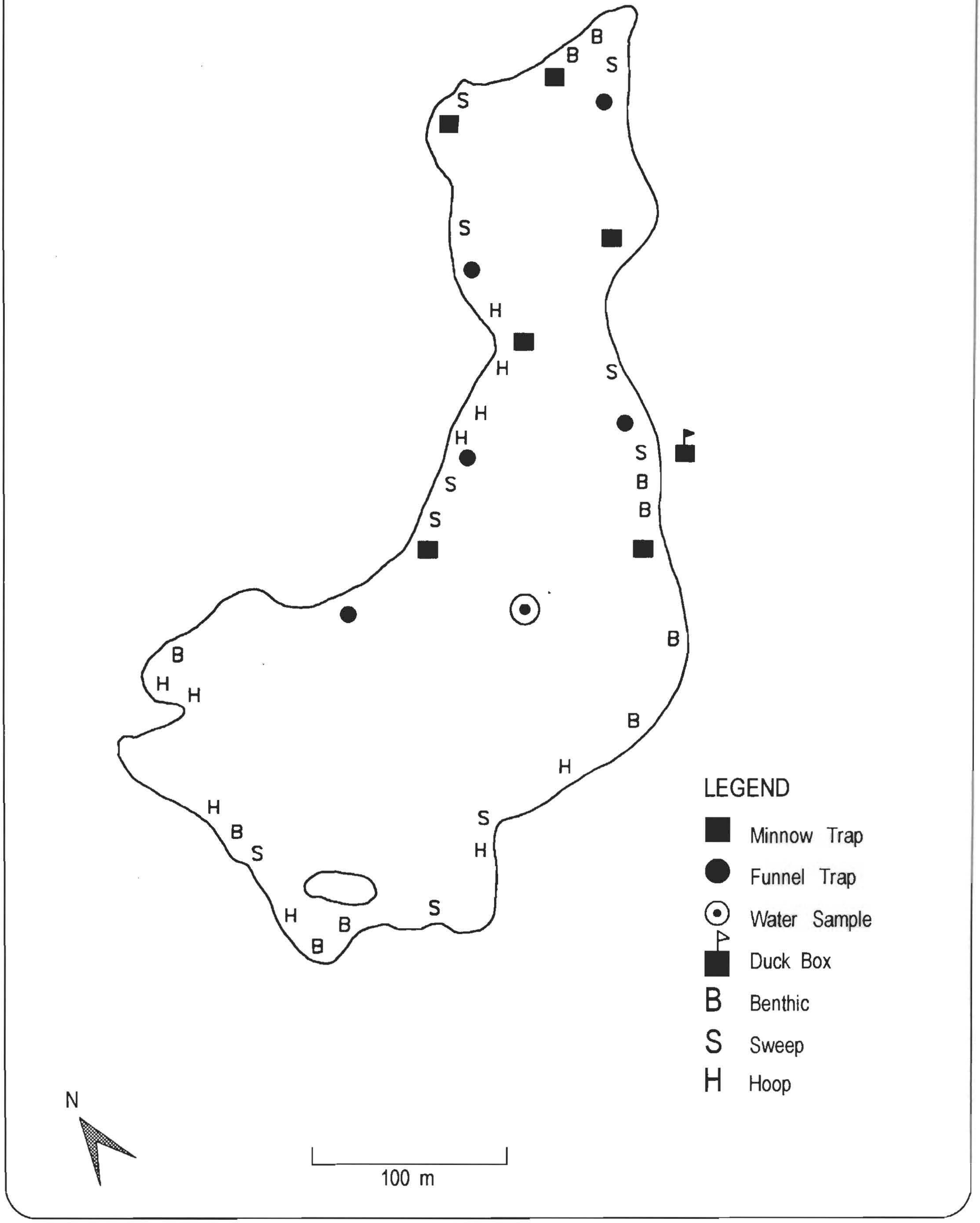
Sudbury Lake 259



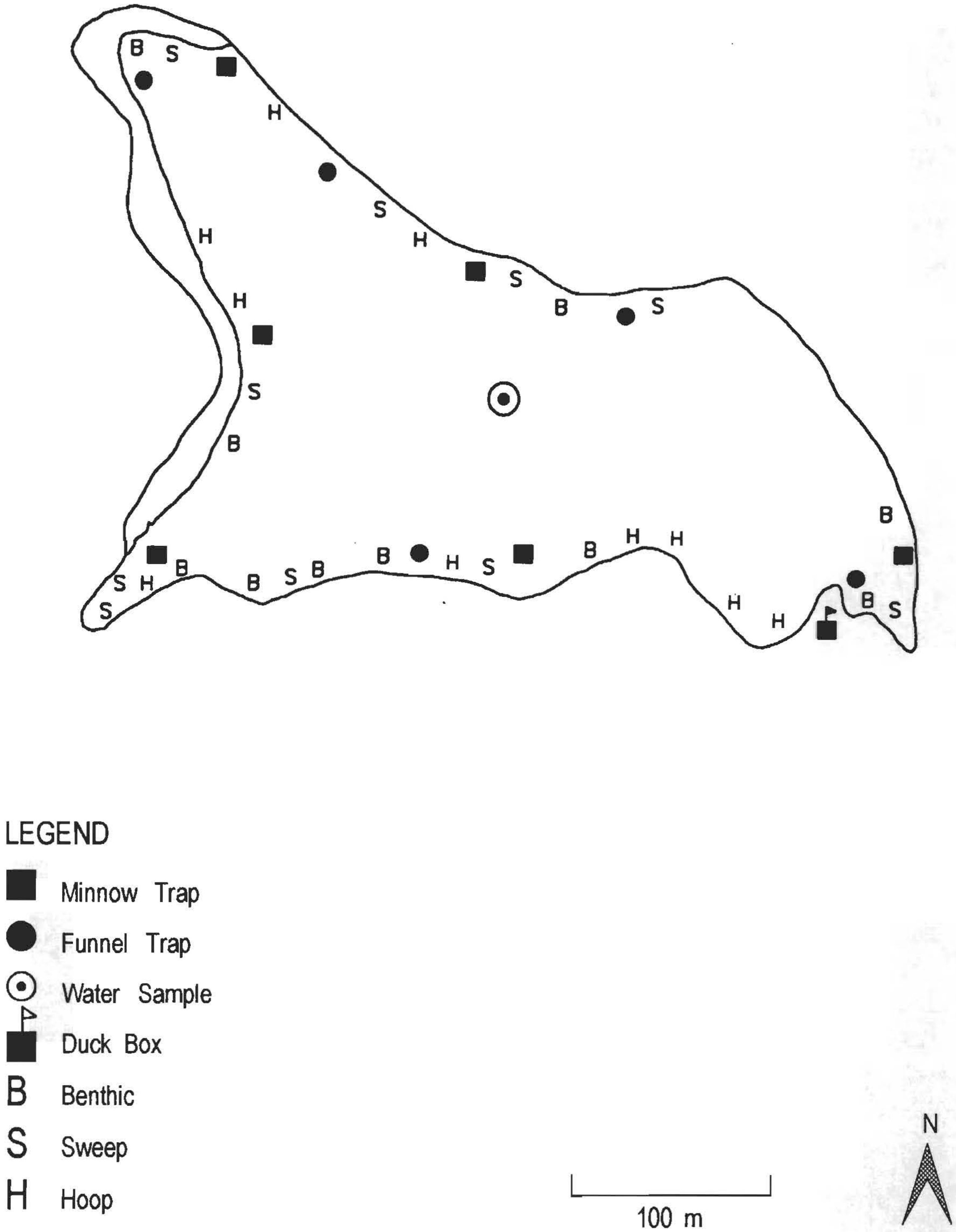
Sudbury Lake 316



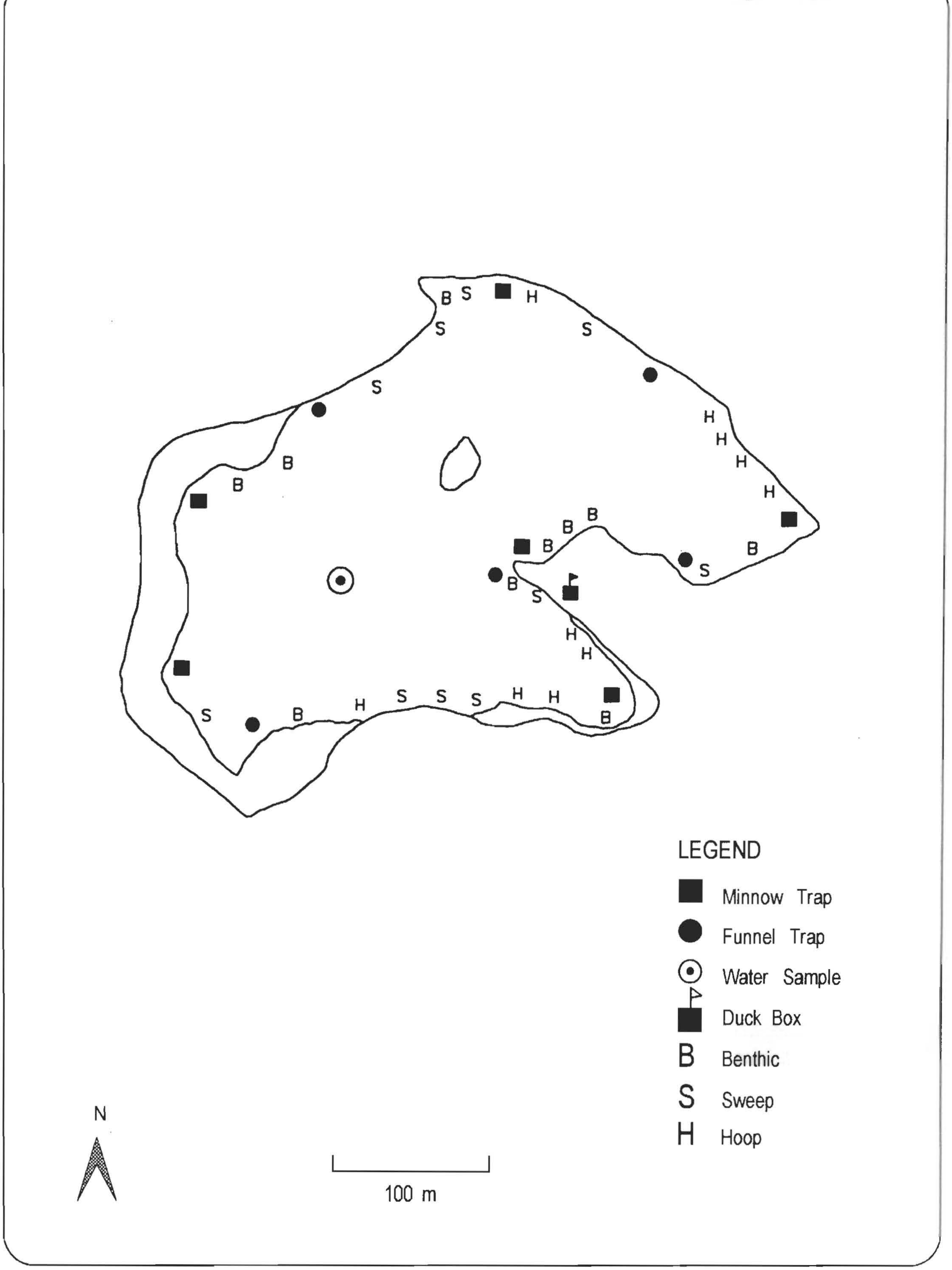
Sudbury Lake 402

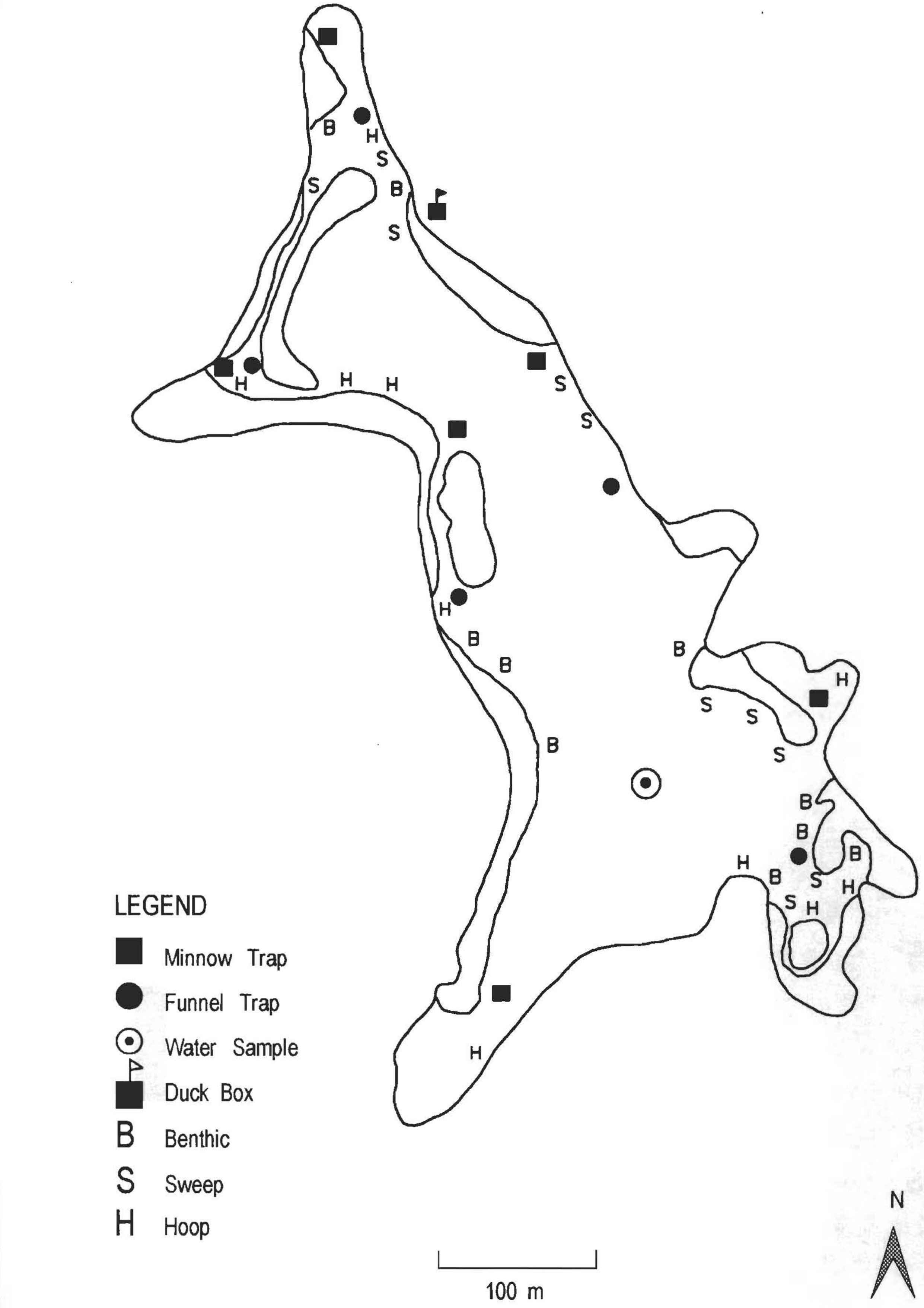


Sudbury Lake 404

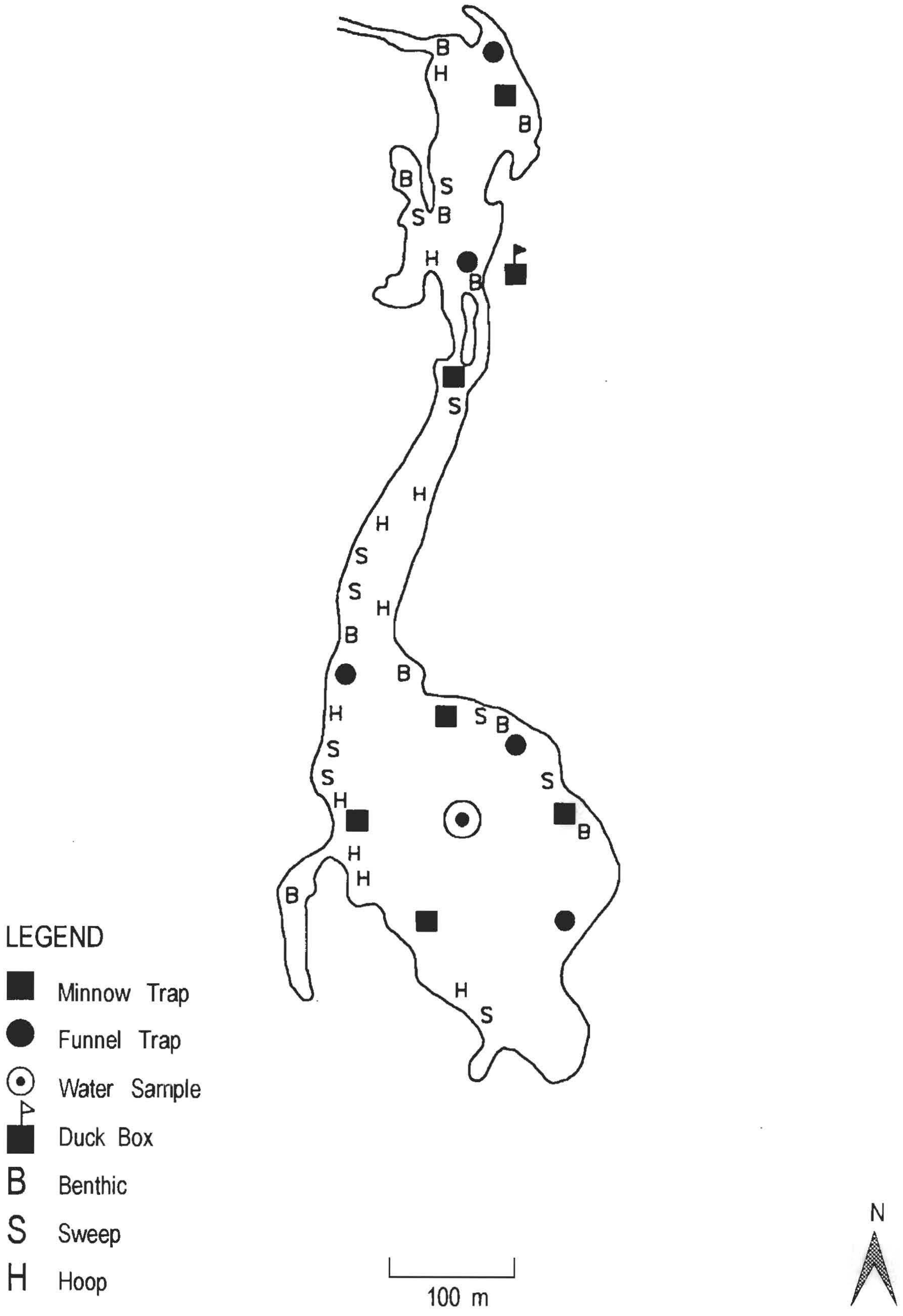


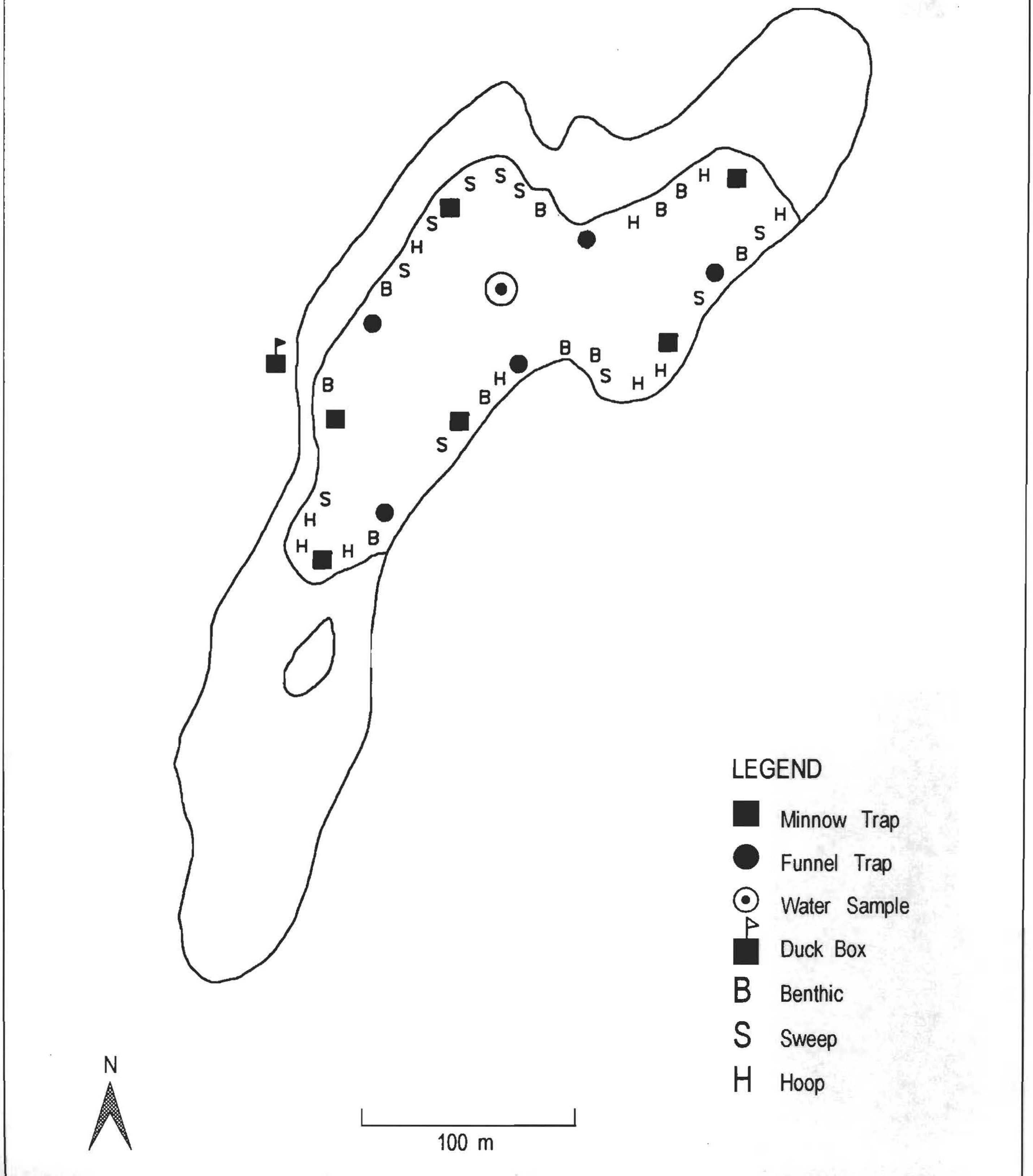
Sudbury Lake 408



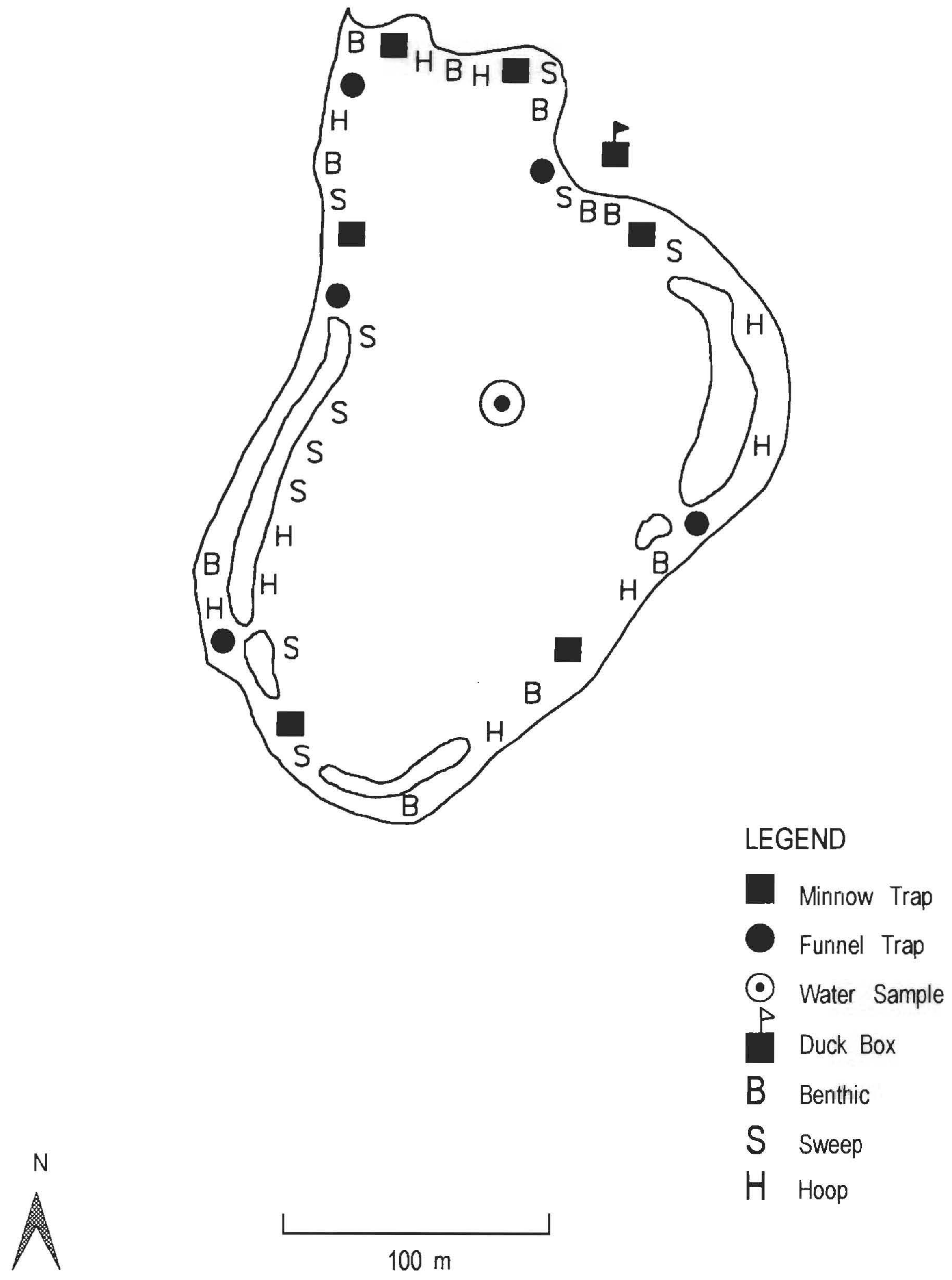

LEGEND
■ Minnow Trap
● Funnel Trap
⊙ Water Sample
Duck Box
B Benthic
S Sweep
H Hoop
100 m
N
B
H
S
B
S
H
H
H
S
S
H
B
B
B
B
H
S
S
S
B
B
B
H
B
S
H
S
H
H

Sudbury Lake 479

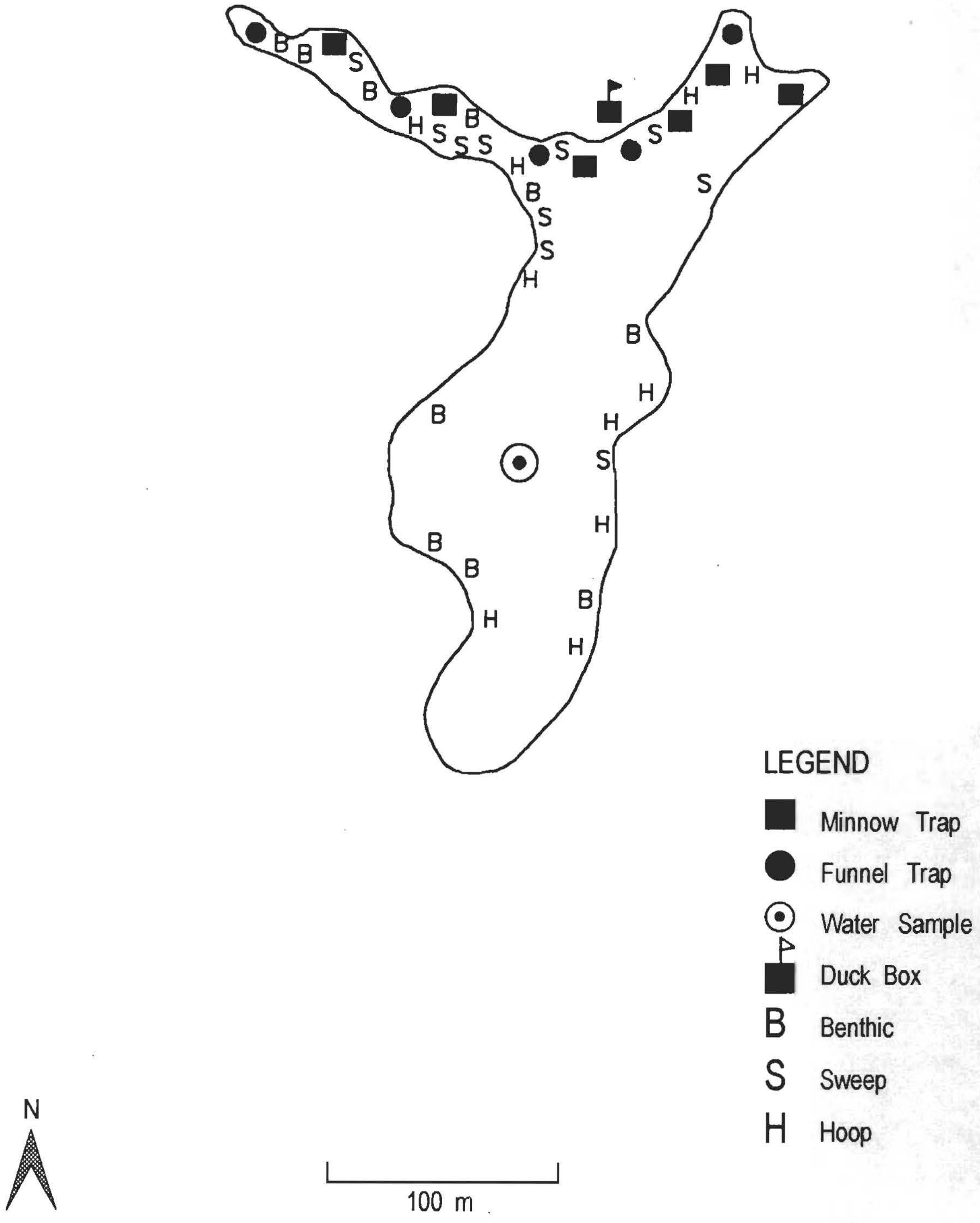



S
S
S
S
S
B
H
B
B
H
H
S
B
S
H
S
B
S
B
B
B
S
H
H
H
B
B
S
S
H
H
H
H
B
LEGEND
Minnow Trap
Funnel Trap
Water Sample
Duck Box
B Benthic
S Sweep
H Hoop
N
100 m

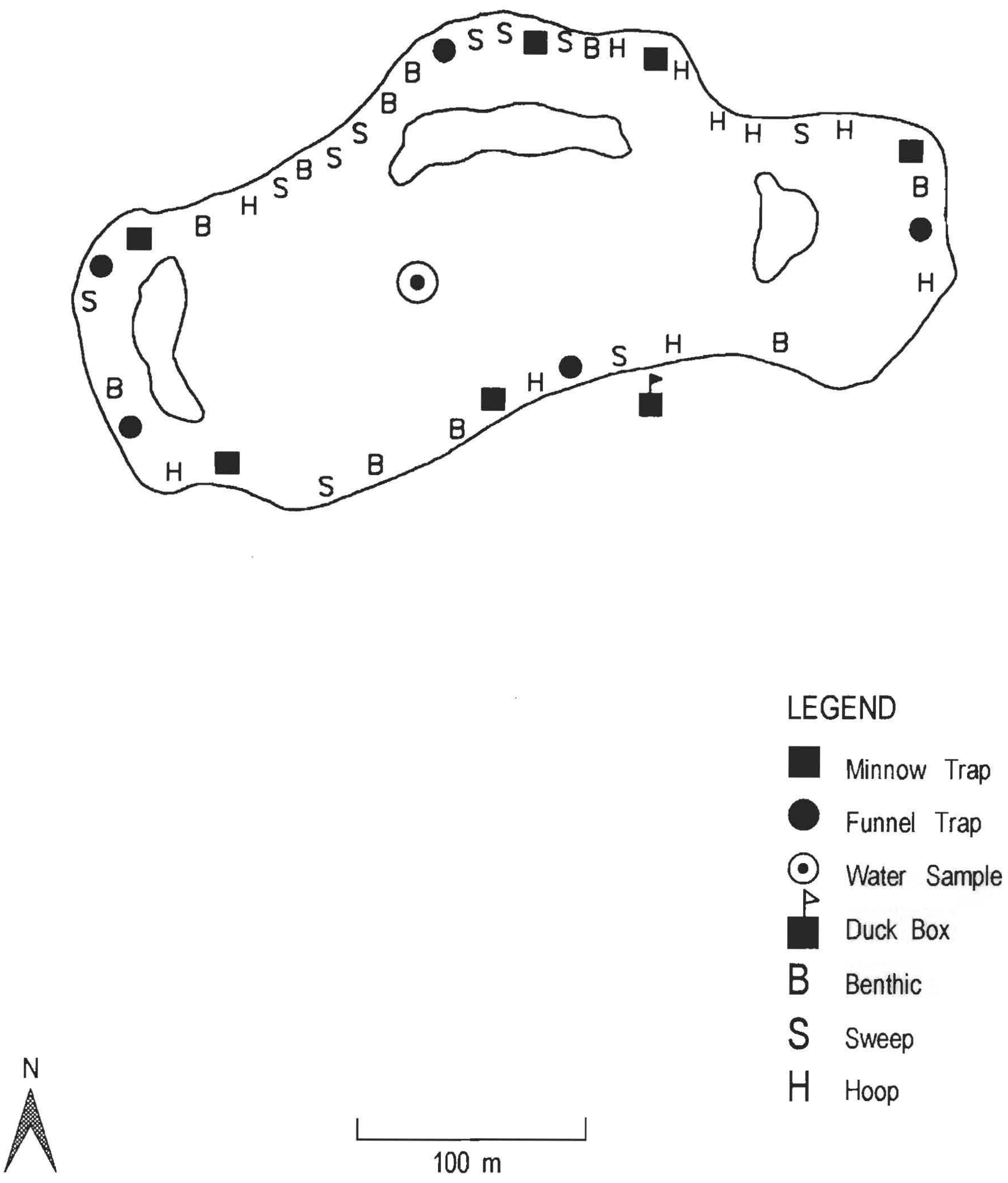
Sudbury Lake 589



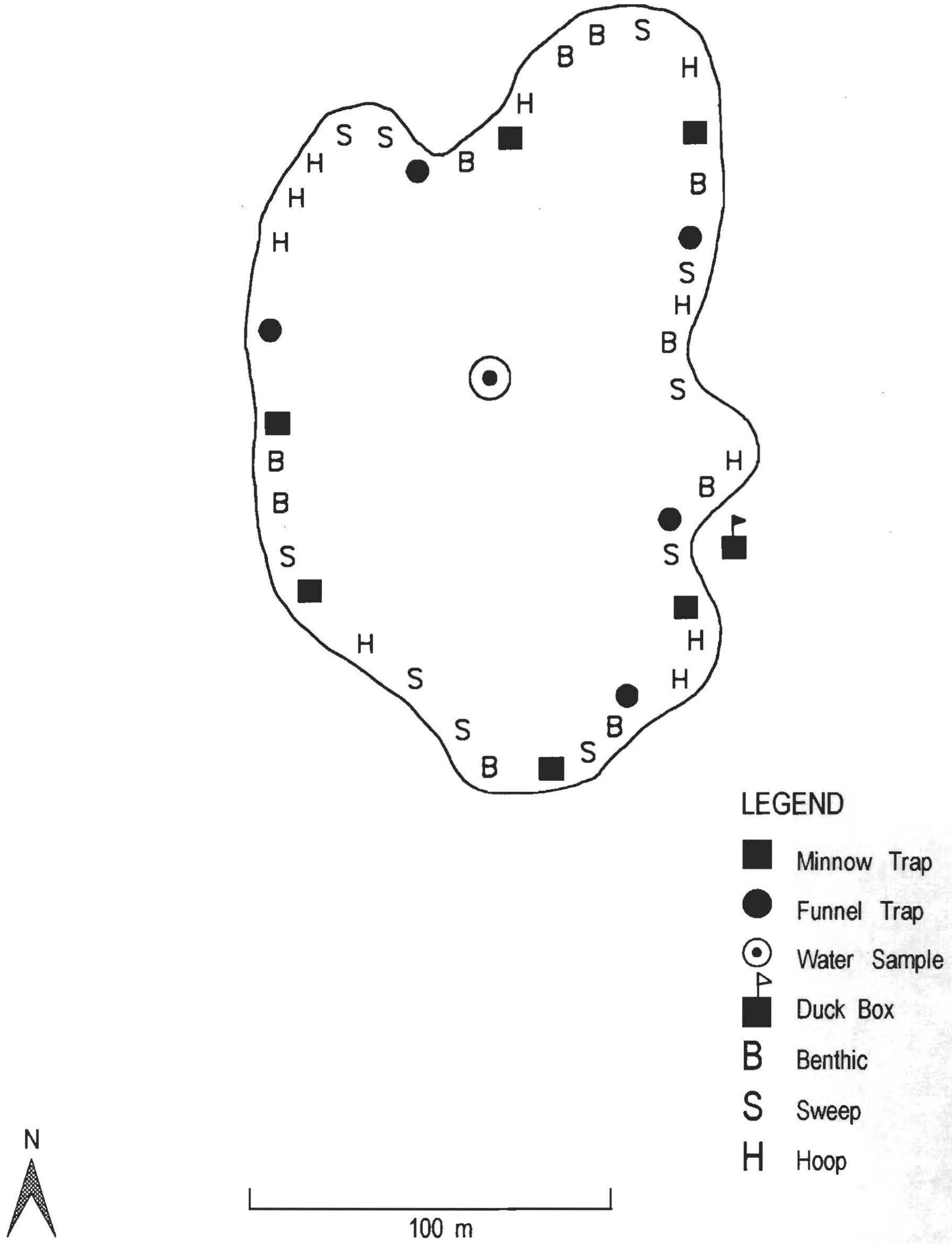
Sudbury Lake 593



Sudbury Lake 902

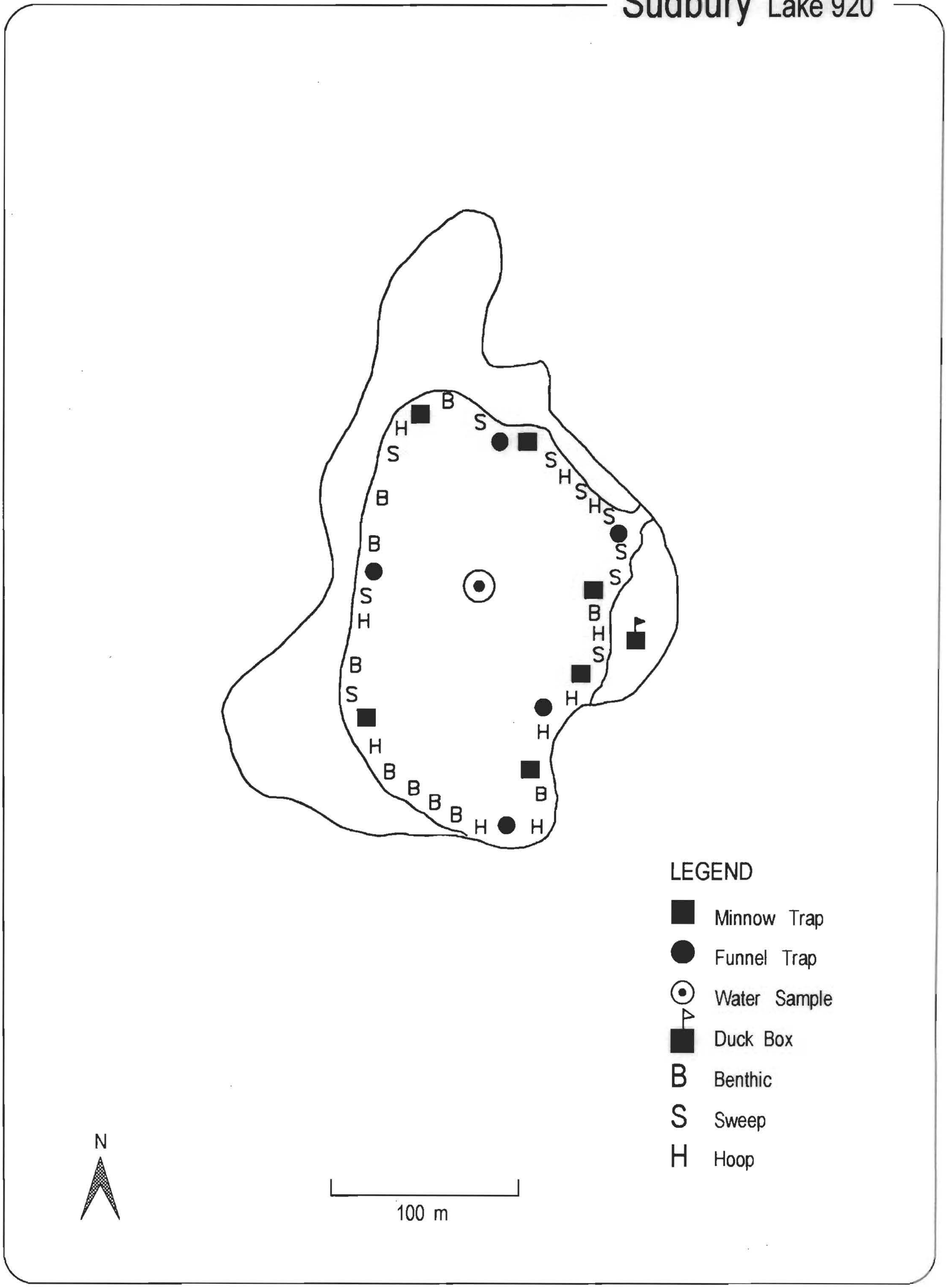


Sudbury Lake 905

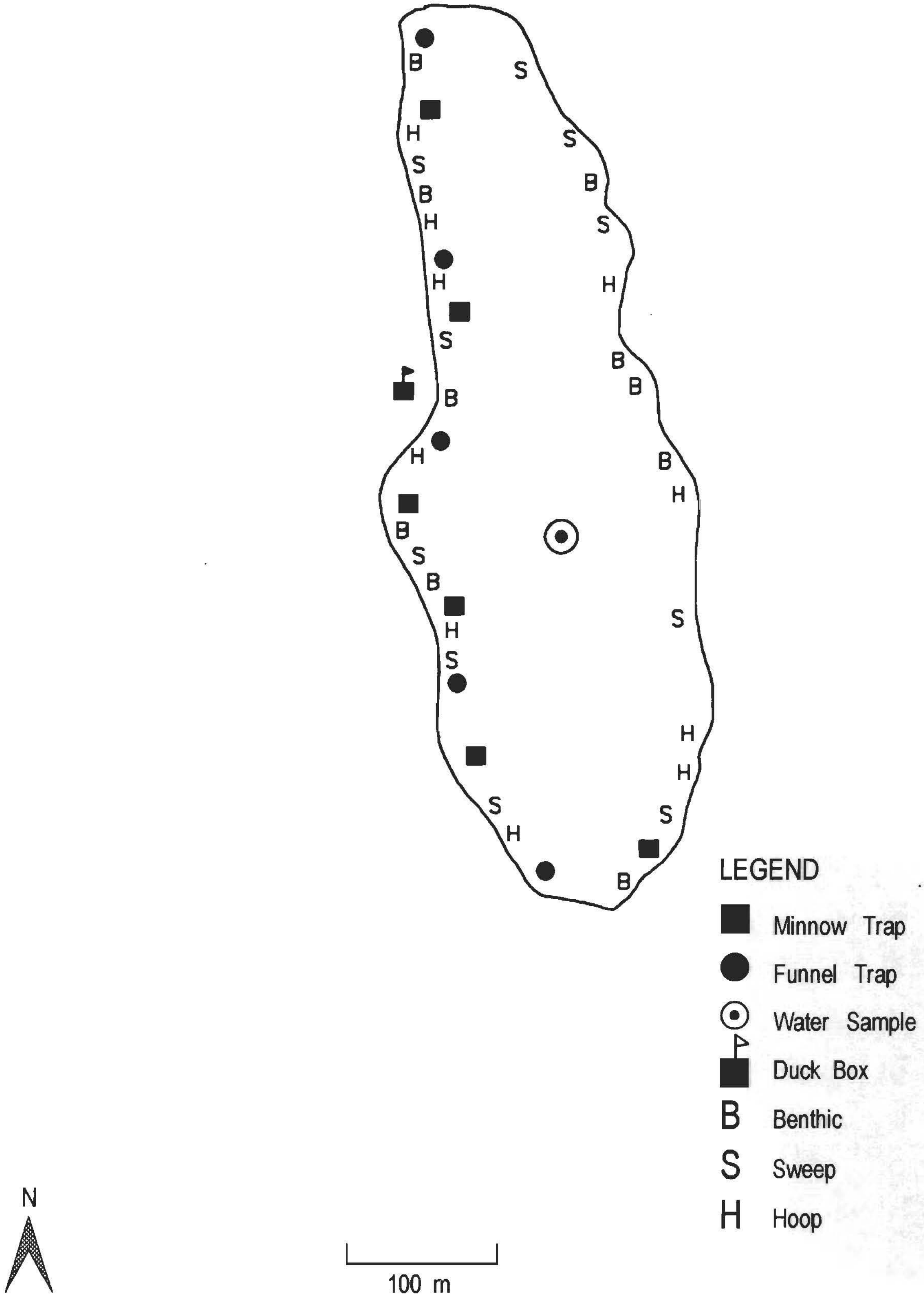


Food Chain Monitoring Program

Sudbury Lake 920



Sudbury Lake 922



Sudbury Lake 958

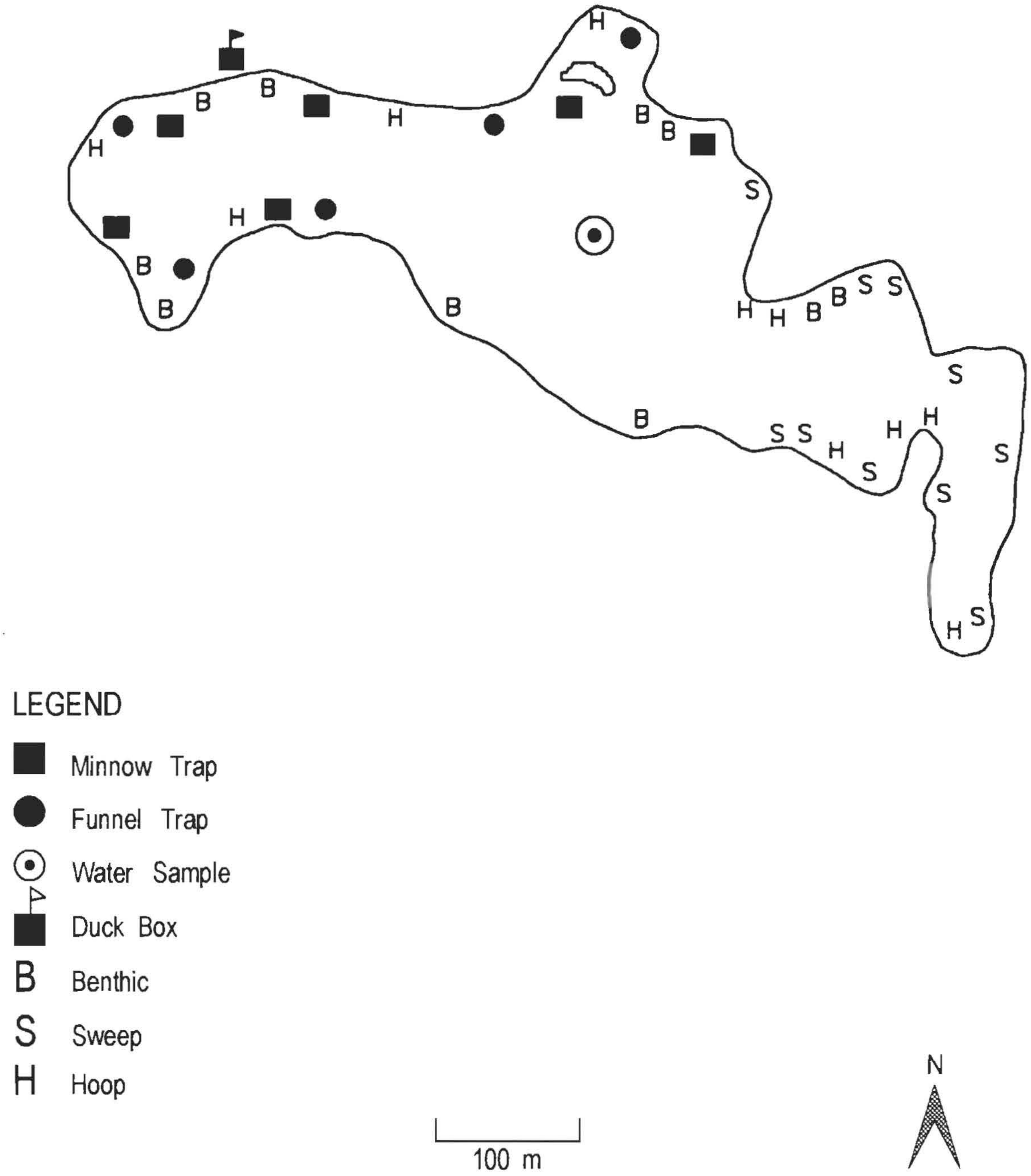


Table 25. Locations, morphometric and chemical characteristics of 22 Sudbury food chain lakes. Chemical values are four year means (fall sampling: 1991, 1993, 1994, 1995). Fish are scored as absent (FA) or dominant fish groups are scored as Cyp (cyprinid), WS (white sucker), or YP (yellow perch).

LAKE	UTM ZONE	UTM EAST	UTM NORTH	AREA (ha)	DEPTH (m)	pH	ALK (μeq/L)	DOC (mg/L)	FISH TYPE
16	17	5133	51922	3.2	7.5	6.32	59.8	6.78	Cyp
197	17	5166	51880	4.3	11.0	5.66	11.8	8.38	WS
199	17	5165	51896	1.9	6.0	6.47	72.5	7.03	FA
240	17	5111	51948	7.8	17.4	4.93	-12.9	2.19	YP
242	17	5111	51942	2.5	6.4	6.05	53.7	7.92	FA
248	17	5105	51952	3.8	2.4	4.51	-29.5	3.20	FA
256	17	5078	51963	6.7	2.5	6.17	30.5	3.76	YP
259	17	5098	51970	2.5	3.9	4.78	-14.5	2.91	FA
316	17	5176	51945	1.3	1.1	5.50	12.8	9.36	FA
402	17	5285	51975	6.2	7.8	4.39	-41.4	0.98	FA
404	17	5274	51979	5.2	6.0	5.04	-7.0	2.07	YP
408	17	5292	51986	5.9	2.1	4.25	-57.1	4.00	FA
410	17	5296	52007	7.4	5.0	5.45	1.5	2.61	YP
479	17	5374	51974	6.7	1.4	5.50	13.3	9.67	Cyp
530	17	5277	52032	1.9	9.1	5.31	1.7	4.68	FA
589	17	5226	52048	3.4	2.6	5.14	-2.3	6.49	FA
593	17	5215	52059	2.8	9.4	5.17	-3.0	3.85	FA
902	17	5089	51855	2.1	8.0	5.57	9.7	5.14	Cyp
905	17	5104	51892	2.0	3.6	6.66	124.9	4.26	YP
920	17	5138	51897	2.4	3.3	6.79	165.3	6.57	FA
922	17	5112	51990	5.1	7.4	5.31	-1.0	2.24	FA
958	17	5314	51949	9.5	4.6	5.96	22.3	4.48	YP

Table 26. Summary of fish and amphibian species collected in minnow traps in Sudbury study lakes (1989-1994), and use of study lakes by beavers (1994 aerial survey). Fish species in brackets are present from stocking based on MNR records. (See legend for explanation of variables and notations).

LAKE	pH	FISH			AMPHIBIANS	BEAVER
		TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
1	6.84	FP-C	4	FM, PD, NRD, SS (RT)		.
2	6.54	FP-C	8	WS, FD, NRD, PD, GS, ID, FM, BS	GMF	ACTIVE
3	5.55	FP-C	2	CM, ID		ACTIVE
5	7.1	FP-C	3	FM, GS, NRD (BT)		ACTIVE
6	7.6	FP-NC	4	BS, GS, NRD, FD		ACTIVE
10	6.73	FA	0		GMF	OLD
13	4.81	FA	0			ACTIVE
FC 16	6.32	FP-NC	1	NRD	MF	ACTIVE
17	4.92	FA	0		GF	ACTIVE
22	5.67	FP-NC	2	GS, BS	MF	ACTIVE
24	6.63	FP-NC	4	NRD, FD, BS, FM	BF	OLD
26	5.87	FP-NC	3	NRD, FD, BS		OLD
34	4.47	FA	0			ACTIVE
45	5.17	FA	0		GMF	ACTIVE
47	4.7	FA	0			ACTIVE
48	4.34	FA	0			ACTIVE
51	4.93	FA	0		GF	ACTIVE
182	7.16	FP-C	3	YP, CS, ID		ACTIVE
FC 197	5.66	FP-C	9	BLS, BRM, BS, FM, ID, PD, NRD, FD, WS(RT)	GF, MF	ACTIVE
FC 199	6.47	FA	0		RSN, MF	ACTIVE
219	5.95	FA	0		MF	ACTIVE
225	6.21	FA	0		RSN, GF	ACTIVE
239	4.95	FA	0		GF	ACTIVE
FC 240	4.93	FP-C	1	YP	WF, GF	ACTIVE
FC 242	6.05	FA	0		RSN, BF, MF, GF	ACTIVE
247	7.25	FA	0		WF, GMF	ACTIVE
FC 248	4.51	FA	0			ACTIVE
250	5.23	FP-C	1	YP		ACTIVE
251	5.41	FA	0			ACTIVE
252	5.74	FP-NC	2	PD, ID	MF	OLD
253	6.16	FP-C	6	YP, WS, PUM, PD, GS, CC	BF	OLD
254	6.18	FP-C	3	YP, PS, PD	BF	OLD
255	6.15	FP-C	3	YP, CC, GS		ACTIVE
FC 256	6.17	FP-C	8	YP, WS, PUM, NRD, BB, CC, GS, ID	BF	ACTIVE
257	4.83	FA	0		GF, MF	OLD
258	4.69	FA	0		GMF	ACTIVE
FC 259	4.78	FA	0		MF	OLD
260	4.83	FA	0		GF	ACTIVE
266	5.7	FP-C	4	YP, PUM, CC, ID	BF	ACTIVE
268	5.03	FP-C	1	YP	MF	ACTIVE
292	7.02	FP-C	4	WS, FM, NRD, PD		OLD
298	5.75	FA	0		BF, GMF	ACTIVE
299	7.29	FA	0		WF	OLD

LAKE	pH	FISH			AMPHIBIANS	BEAVER
		TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
303	5.7	FP-NC	1	BS	GF	ACTIVE
307	4.42	FA	0			ACTIVE
FC 316	5.5	FA	0		BF, MF, GF, WF	ACTIVE
326	5.19	FA	0		GF	ACTIVE
333	6.65	FP-C	2	BRM, WS	BF	OLD
334	6.83	FA	0			OLD
338	5.47	FA	0		GF	ACTIVE
342	5.25	FA	0		MF	OLD
343	5.16	FA	0		GF	OLD
348	6.55	FP-C	3	YP, BRM, ID		OLD
373	4.33	FA	0			OLD
387	4.27	FA	0			ACTIVE
393	4.43	FA	0			ACTIVE
394	4.45	FA	0		MF	OLD
401	4.51	FA	0		MF	ACTIVE
FC 402	4.39	FA	0			OLD
403	4.42	FA	0			ACTIVE
FC 404	5.04	FP-C	2	CM, YP		ACTIVE
406	4.45	FA	0		MF	ACTIVE
407	4.37	FA	0		GF	ACTIVE
FC 408	4.25	FA	0			OLD
409	6.97	FP-C	5	WS, NRD, PD, ID, FM	BF	OLD
FC 410	5.45	FP-C	1	YP	BF, GF, MF	ACTIVE
469	6.46	FP-NC	3	BS, NRD, FD	GMF	ACTIVE
472	5.82	FP-C	6	PUM, NRD, PD, BS, CS, CC	GMF	ACTIVE
475	6.2	FP-C	8	SB, WS, YP, RB, PUM, GS, CC, CM	BF	ACTIVE
FC 479	5.5	FP-NC	1	NRD	RSN	ACTIVE
480	5.95	FP-C	2	YP, PUM	BF	.
493	5.45	FP-C	3	YP, CM		ACTIVE
494	5.22	FP-C	3	YP, PUM, CM, BM	GMF	OLD
501	6.15	FP-C	6	YP, WS, RB, PUM, GS, BM		ACTIVE
502	6.22	FP-C	7	GS, CC, CS, PD, PUM, RB, YP		ACTIVE
510	5.75	FA	0			OLD
515	6.72	FP-C	4	GS, NP, PUM, YP		ACTIVE
522	5.22	FA	0		MF	ACTIVE
524	5.78	FP-C	6	BS, CM, FM, GS, PD, WS	BF	ACTIVE
526	6.87	FP-C	2	YP, PD	BF	.
527	5.45	FP-NC	4	BS, CS, NRD, FM		OLD
FC 530	5.31	FA	0		GF	ACTIVE
531	6.48	FP-C	1	SB		.
545	6.54	FP-C	1	WS		OLD
553	6.26	FA	0		BF	ACTIVE
570	6.67	FP-C	1	RB		OLD
572	4.88	FA	0		GF	OLD
573	4.98	FP-C	1	YP	BF, MF	.
577	6.8	FA	0			ACTIVE
579	5.83	FP-C	2	CC, PD	MF	UNUSED

LAKE	pH	FISH			AMPHIBIANS	BEAVER
		TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
583	5.35	FP-C	1	YP	MF	ACTIVE
585	6.39	FP-C	3	YP, RB, CS	BF	ACTIVE
588	6.51	FP-C	3	YP, RB, CS		ACTIVE
FC 589	5.14	FP-NC	1	ID	RSN, MF, GF	OLD
590	5.36	FP-C	5	WS, NRD, PD, FM, CS	MF, GF	ACTIVE
FC 593	5.17	FA	0		MF, GF	OLD
609	6.08	FA	0			OLD
612	6.46	FP-C	1	RB		OLD
613	6.69	FP-NC	1	BS, PD, FD		ACTIVE
638	5.14	FA	0		GMF	OLD
645	4.53	FA	0		BF, MF	ACTIVE
646	4.59	FA	0			ACTIVE
655	6.15	FP-NC	2	ID, FD	BF	ACTIVE
692	5.86	FA	0		BF	OLD
822	5.96	FP-C	5	YP, CM, FD, NRD, FM	GMF	OLD
856	6.15	FP-NC	6	FD, NRD, BS, FM, ID, PD		ACTIVE
900	6.78	FP-NC	6	BRM, BS, FM, ID, NRD, FD		OLD
FC 902	5.57	FP-NC	5	GS, BS, FM, NRD, FD	MF	ACTIVE
903	7.07	FP-C	6	WS, PS, PD, FM, CS, BS	GMF	OLD
904	6.13	FP-C	6	WS, NRD, FD, FM, CS, BS	BF	ACTIVE
FC 905	6.66	FP-C	9	YP, WS, FD, NRD, PD, GS, FM, CC, CS	BF	OLD
906	4.46	FA	0			.
908	5.61	FP-C	9	WS, FD, NRD, PD, ID, FM, CS, BS, BLS	MF	ACTIVE
909	7.27	FP-NC	3	NRD, FD, ID	GMF	OLD
FC 920	6.79	FA	0		RSN, BF, WF, GF	ACTIVE
921	5.08	FA	0		MF	ACTIVE
FC 922	5.31	FA	0		GF	OLD
923	6.13	FP-C	2	CC, NRD		ACTIVE
924	4.46	FA	0			ACTIVE
925	5.2	FA	0		GF, MF	ACTIVE
926	7.33	FP-C	1	PUM		ACTIVE
927	5.22	PA	0		GMF	ACTIVE
930	5.46	FA	0		MF	ACTIVE
932	4.55	FA	0			ACTIVE
933	4.52	FA	0			ACTIVE
935	4.83	FA	0			ACTIVE
938	5.2	FA	0		MF	OLD
943	7.42	FP-C	11	YP, WS, NRD, FD, PD, ID, FM, CC, CS, BS,BRM		ACTIVE
947	6.03	FP-C	5	YP, WS, PS, ID, BS (LT)	BF	.
949	6.72	FP-C	1	FM, (SB)		ACTIVE
951	6.21	FP-C	4	YP, WS, BB, PD	BF	ACTIVE
953	6.15	FP-C	4	YP, NRD, PD, GS		.
954	6.56	FP-C	3	YP, RB, CS		.
955	6.6	FP-C	3	YP, ID, PD, (LT)		.
957	5.19	FA	0		BF, MF, GF	UNUSED
FC 958	5.96	FP-C	4	YP, WS, GS, BS	BF, GF	OLD
959	7.36	FP-C	5	PUM, NP, ID, BB, BM		OLD

LAKE	pH	FISH			AMPHIBIANS	BEAVER
		TYPE	NO. SPECIES	SPECIES	SPECIES	STATUS
961	6.25	FA	0			OLD
962	6.76	FP-C	8	WS, FD, NRD, PD, ID, FM, CS, BS	GMF	ACTIVE
963	5.85	FP-C	3	YP, PUM, CC		ACTIVE
965	4.88	FA	0			.
966	5.84	FP-C	1	BT	BF, GMP	.
968	6.11	FP-C	4	YP, RB, ID, BS		.
973	4.76	FA	0		GF	ACTIVE
974	5.44	FA	0		GF, MF	OLD
975	4.41	FA	0			OLD
976	4.82	PA	0			OLD
1001	5.64	FP-C	7	WS, FD, NRD, PD, CC, CS, BS		UNUSED
1004	7.16	FP-NC	7	FD, NRD, PD, ID, FM, CS, BS		ACTIVE
1005	5.47	FA	0		GF	UNUSED
1006	5.85	FA	0		GF	UNUSED
1007	5.92	FA	0		BF	UNUSED
1009	6.59	FP-NC	2	BS, FD	GMF	UNUSED
1013	4.36	FA	0			UNUSED
1030	5.33	FA	0		GF	ACTIVE
1031	4.7	FA	0		GF	UNUSED
1033	4.28	FA	0			UNUSED
1038	5.85	FP-NC	4	BS, FM, NRD, FD		ACTIVE

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1991, 1993, 1994, 1995)
TYPE = fish community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
ACTIVE = beavers occupying lake in autumn 1994
OLD = beavers not present in autumn 1994, but signs of past use
UNUSED = no sign of beaver presence observed during aerial survey

NOTATIONS

FC *Lake Number* = food chain lake
Lake number = drained as of autumn 1995
. = no data

Fish Species

FM = fathead minnow (*Pimephales promelas*)
LB = largemouth bass (*Micropterus salmoides*)
YP = yellow perch (*Perca flavescens*)
NRD = northern redbelly dace (*Phoxinus eos*)
PD = pearl dace (*Semotilus margarita*)
BS = brook stickleback (*Culaea inconstans*)
ID = Iowa darter (*Etheostoma exile*)
BD = blacknose dace (*Rhinichthys atratulus*)
BRM = brassy minnow (*Hynognathus hankinsoni*)
NP = northern pike (*Esox lucius*)
BM = bluntnose minnow (*Pimephales notatus*)
CC = creek chub (*Semotilus atromaculatus*)
WS = white sucker (*Catostomus commersoni*)
BLS = blackchin shiner (*Notropis heterodon*)
FD = finescale dace (*Phoxinus neogaeus*)
HCS = hybrid creek chub - common shiner
BT = brook trout (*Salvelinus fontinalis*)
RT = rainbow trout (*Salmo gairdneri*)
SB = smallmouth bass (*Micropterus dolomieui*)
LT = lake trout (*Salvelinus namaycush*)
PUM = pumpkinseed (*Lepomis gibbosus*)
CS = common shiner (*Notropis cornutus*)
GS = golden shiner (*Notemigonus crysoleucas*)
BB = brown bullhead (*Ictalurus nebulosus*)
PS = *Phoxinus* spp.
LC = lake chub (*Couesius plumbeus*)
SS = sand shiner (*Notropis stramineus*)
CM = central mudminnow (*Umbra limi*)
RB = rock bass (*Ambloplites rupestris*)

Amphibian Species

GF = green frog (*Rana clamitans*)
BF = bullfrog (*Rana catesbeiana*)
WF = wood frog (*Rana sylvatica*)
MF = mink frog (*Rana septentrionalis*)
RSN = red spotted newt (*Notophthalmus viridescens*)
SP = spring peeper (*Hyla crucifer*)
GMF = green or mink frog
AT = American toad (*Bufo americanus*)

Table 27. Summary of leech (Hirudinea) species caught in funnel traps (N = 5) in leech recovery study lakes (N = 42) at Sudbury in 1987, 1992 and 1994. (See legend for explanation of variables).

LAKE	pH	FISH TYPE	Σ SPP	1987		1992		1994	
				SPECIES	No. SPP	SPECIES	No. SPP	SPECIES	No. SPP
5	7.10	FP	8	PM, MD, MG, NO, EP, PO, BP	7	PM, MD, NO, BP	4	PM, MD, MG, NO, EP, GC	6
13	4.81	FA	0		0		0		0
FC 16	6.32	FP	7	PM, MD, NO, EP, BP, GC, HS	7	PM, MD, EP, BP	4	PM, MD, BP, HS	4
17	4.92	FA	0		0		0		0
FC 197	5.66	FP	5	PM, MD, NO, BP	4	PM, MD	2	PM, MD, NO, TH	4
FC 199	6.47	FA	4	PM, BP	2	PM, MG, BP	3	PM, MG, EP, BP	4
219	5.95	FA	6	PM, NO, PO, BP	4	PM, NO	2	PM, MG, NO, EP, BP	5
225	6.21	FA	7	PM, MD, NO, BP	4	PM, MD, MG, NO, BP, GC	6	PM, MD, NO, EP	4
247	7.25	FA	5	PM, MG, NO, BP, GC	5	PM, NO	2	PM, NO	2
FC 248	4.51	FA	0		0		0		0
251	5.41	FA	4	PM, MD, NO	3	PM, MD, NO, BP	4	PM, NO	2
254	6.18	FP	4	PM, MD, BP	3	PM, MD, GL	3	PM, MD, BP, GL	4
258	4.69	FA	0		0		0		0
FC 259	4.78	FA	1	PM	1	PM	1	PM	1
266	5.70	FA	4	PM, MD, NO	3	PM, MD, MG	3	PM	1
268	5.03	FA	1		0	PM	1		0
299	7.29	FA	6	PM, MG, NO, EP, GC, HS	6	PM, NO, GC	3	PM, NO, EP, GC, HS	5
FC 316	5.50	FA	1		0	NO	1	NO	1
326	5.19	FA	0		0		0		0
333	6.65	FP	2	PM, MD	2	PM	1		0
338	5.47	FA	3		0	PM, NO	2	PM, NO, EP	3
342	5.25	FA	0		0		0		0
401	4.51	FA	0		0		0		0
402	4.39	FA	0		0		0		0
404	5.04	FP	1	PM	1	PM	1	PM	1
408	4.25	FA	0		0		0		0
409	6.97	FP	7	PM, MD, NO	3	PM, MD, NO	3	PM, NO, EP, BP, GC, GL	6
410	5.45	FP	0		0		0		0
524	5.78	FP	2	PM, MD	2	PM, MD	2	MD	1
527	5.45	FP	4	MD, BP	2		0	MD, NO, EP	3
530	5.31	FA	4	PM, BP	2	PM, NO, EP	3	PM, BP	2
583	5.35	FP	1		0	PM	1		0
590	5.36	FP	4	PM, MD, PO, BP	4	PM, MD, BP	3	PM, MD, BP	3

LAKE	pH	FISH TYPE	∑ SPP	1987		1992		1994	
				SPECIES	No. SPP	SPECIES	No. SPP	SPECIES	No. SPP
900	6.78	FP	10	PM, MD, MG, NO, BP	5	PM, MD, MG, NO, EP, PO, BP, GC, GL	9	PM, MD, MG, NO, MF, BP	6
FC 902	5.57	FP	2	Not sampled		PM, MD	2	PM	1
FC 905	6.66	FP	6	PM, MD, MG	3	PM, MD, HS, GL	4	PM, BP	2
909	7.27	FP	8	PM, NO, BP, GC	4	PM, MG, NO, EP, PO, BP, GC	7	PM, MG, NO, EP, PO, BP, GC, HS	8
FC 920	6.79	FA	3	MG, NO, EP	3	NO	1	NO, EP	2
FC 922	5.31	FA	2		0	PM, NO	2	NO	1
931	5.62	FP	4	PM, NO, EP, PO	4	Not sampled		Not sampled	
932	4.55	FA	0	Not sampled			0		0
1030	5.33	FA	0		0	Not sampled		Not sampled	

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1991, 1993, 1994, 1995)
FISH TYPE: FA = fish absent **FP** = fish present
∑ SPP = cumulative species present over all sampling years
No. SPP = number of species present in each sampling year

NOTATIONS

FC *Lake Number* = food chain lake

Leech Species

PM = *Percymoorensis marmoratis*
NO = *Nephelopsis obscura*
PO = *Placobdella ornata*
HS = *Helobdella stagnalis*
GL = Glossiphoniidae (excludes **PO** and **GC**)
MD = *Macrobdella decora*
EP = *Erpobdella punctata*
BP = *Batracobdella picta*
HE = *Helobdella elongata*
MG = *Mollibdella grandis*
MF = *Mooreobdella fervida*
GC = *Glossiphonia complanata*
TH = *Theromyzon*

Table 28. Summary of waterfowl species and Common Loons observed as indicated breeding pairs or broods during helicopter surveys of Sudbury study lakes (1993, 1994, 1995). (See legend for explanation of variables and notations).

LAKE	HABITAT		WATERFOWL	
	pH	FISH TYPE	INDICATED PAIRS	BROODS
1	6.84	FP-C	CL	CL, HM
2	6.54	FP-C	BD	
3	5.55	FP-C	CG	
5	7.10	FP-C	CL, RD	HM
6	7.60	FP-NC	RD	
10	6.73	FA	WD	HM
13	4.81	FA	HM, BD, CG	HM
FC 16	6.32	FP-NC	CM, HM	CL
17	4.92	FA	HM, MA, BD, CG	HM
22	5.67	FP-NC	HM, BD	
24	6.63	FP-NC		
26	5.87	FP-NC	CL	
34	4.47	FA	MA, CG	
45	5.17	FA	MA, BD	HM, BD, RD, CG
47	4.70	FA	HM, CG	CG
48	4.34	FA	CG	CG
51	4.93	FA	HM, CG	
182	7.16	FP-C		
FC 197	5.66	FP-C	CL, HM	
FC 199	6.47	FA	HM, CG	HM, CG
219	5.95	FA	WD, CG	CG
225	6.21	FA	HM	CG
239	4.95	FA	CL, HM, CG	CG
FC 240	4.93	FP-C	CL	
FC 242	6.05	FA	HM, BD, CG	HM
247	7.25	FA	CL, CG	
FC 248	4.51	FA	CM, HM, MA, BD, RD, CG	CG
250	5.23	FP-C	CL, CM, HM, WD	
251	5.41	FA	HM, BD, WD, RD, CG	HM, RD, CG
252	5.74	FP-NC	BD	
253	6.16	FP-C	CL	
254	6.18	FP-C	CM	
255	6.15	FP-C		
FC 256	6.17	FP-C	CL, CM, MA	WD
257	4.83	FA	HM, MA, CG	HM, CG
258	4.69	FA	CL, HM, CG	CG
FC 259	4.78	FA	CG	
260	4.83	FA	HM, CG	HM, CG
266	5.70	FP-C	CM, CG	
268	5.03	FP-C	HM, BD, RD, CG	HM, RD
292	7.02	FP-C	CL, CM, HM	
298	5.75	FA	CL, HM, MA, CG	HM, RD
299	7.29	FA	HM, CG	
303	5.70	FP-NC	CL	

LAKE	HABITAT		WATERFOWL	
	pH	FISH TYPE	INDICATED PAIRS	BROODS
307	4.42	FA	BD	
FC 316	5.50	FA	WD, CG	MA
326	5.19	FA	HM, BD, CG	
333	6.65	FP-C	CL	HM
334	6.83	FA	CL, HM	CL
338	5.47	FA	HM, BD	CG
342	5.25	FA	HM	HM
343	5.16	FA	RD, CG	
348	6.55	FP-C		
373	4.33	FA	CG	
387	4.27	FA	MA, BD	HM, CG
393	4.43	FA	HM, CG	
394	4.45	FA	RD	HM, RD
401	4.51	FA	WD, CG	
FC 402	4.39	FA		
403	4.42	FA	CM, HM, BD, WD, RD, CG	
FC 404	5.04	FP-C	CM, CG	
406	4.45	FA	BD, RD, CG	HM
407	4.37	FA	HM, BD, RD, CG	RD, CG
FC 408	4.25	FA	CL, HM, RD, CG	RD, CG
409	6.97	FP-C		
FC 410	5.45	FP-C	CL, CM	
469	6.46	FP-NC		
472	5.82	FP-C	CL, CM, HM	CM
475	6.20	FP-C	CL	
FC 479	5.50	FP-NC	HM, BD, RD	HM, WD, RD, CG
480	5.95	FP-C	CL, HM	
493	5.45	FP-C	CL	CL, RD
494	5.22	FP-C	CL, HM, RD	
501	6.15	FP-C	CL, CM	
502	6.22	FP-C	CL, CM, HM	
510	5.75	FA	HM, MA, RD	MA, RD, CG
515	6.72	FP-C	CL, CM, MA, BD	RD
522	5.22	FA	CL, BD	HM
524	5.78	FP-C	CM, HM	
526	6.87	FP-C	CL, CM	
527	5.45	FP-NC	CL, CM	
FC 530	5.31	FA	CL, HM, BD, CG	HM
531	6.48	FP-C	CL	CL
545	6.54	FP-C	CM, HM	
553	6.26	FA	CL, HM, BD, CG	
570	6.67	FP-C	CM	
572	4.88	FA	HM, CG	
573	4.98	FP-C	CL, HM, RD, CG	
577	6.80	FA	CL	
579	5.83	FP-C	BD	
583	5.35	FP-C	CL	

LAKE	HABITAT		WATERFOWL	
	pH	FISH TYPE	INDICATED PAIRS	BROODS
585	6.39	FP-C		CM
588	6.51	FP-C	CM	CM
FC 589	5.14	FP-NC	CL, HM, BD, CG	CG
590	5.36	FP-C	CM, HM, BD	
FC 593	5.17	FA	CG	
609	6.08	FA	CL, RD, CG	RD
612	6.46	FP-C		
613	6.69	FP-NC	CL, CM	CL
638	5.14	FA	MA, BD, RD, CG	MA, WD, RD, CG
645	4.53	FA	HM	RD
646	4.59	FA	CL, CG	RD
655	6.15	FP-NC	CL, CM, BD	CL
692	5.86	FA	CL, HM, MA, RD	HM, RD
822	5.96	FP-C	CM, HM, BD	HM
856	6.15	FP-NC	CL, HM, MA, BD, RD	CL, MA, RD
900	6.78	FP-NC	CL, HM, WD, RD	
FC 902	5.57	FP-NC	HM	
903	7.07	FP-C	CL	
904	6.13	FP-C	CL, HM, BD	CL
FC 905	6.66	FP-C		
906	4.46	FA	CL, HM, CG	CL, CG
908	5.61	FP-C	CL	HM
909	7.27	FP-NC	HM	RD
FC 920	6.79	FA	CG	HM
921	5.08	FA	CL, HM, CG	CL
FC 922	5.31	FA	CG	CG
923	6.13	FP-C	CM, MA	
924	4.46	FA	CL, CG	
925	5.20	FA	CL, HM, BD, RD	
926	7.33	FP-C	HM, MA, BD, RD	
927	5.22	FA	MA, BD, CG	
930	5.46	FA	CL	
932	4.55	FA	HM, MA, BD, CG	
933	4.52	FA	CL	CL
935	4.83	FA	HM., CG	HM, WD
938	5.20	FA	HM, BD, WD, RD	
943	7.42	FP-C	HM, RD	RD
947	6.03	FP-C	CL, CM, BD, WD	CM
949	6.72	FP-C	CL, CM	BD, RD
951	6.21	FP-C		
953	6.15	FP-C	CL	
954	6.56	FP-C	CM	CL, CM
955	6.60	FP-C	CL, CM	CM
957	5.19	FA	MA, BD, RD	MA
FC 958	5.96	FP-C	CL, CM	
959	7.36	FP-C	BD	
961	6.25	FA	RD	

LAKE	HABITAT		WATERFOWL	
	pH	FISH TYPE	INDICATED PAIRS	BROODS
962	6.76	FP-C		
963	5.85	FP-C	CG	
965	4.88	FA	.	.
966	5.84	FP-C	CL	CL
968	6.11	FP-C	CL, CM, HM	CL
973	4.76	FA	HM, MA, BD, RD, CG	CG
974	5.44	FA	HM, CG	HM
975	4.41	FA	HM, MA, BD, WD, RD, CG	RD
976	4.82	FA	RD, CG	HM, RD, CG
1001	5.64	FP-C		
1004	7.16	FP-NC		
1005	5.47	FA		
1006	5.85	FA		
1007	5.92	FA	BD	
1009	6.59	FP-NC		
1013	4.36	FA		
1030	5.33	FA	HM, CG	HM
1031	4.70	FA	HM, BD	
1033	4.28	FA	BD	
1038	5.85	FP-NC	RD	

LEGEND

VARIABLE EXPLANATIONS

pH = mean pH (fall sampling: 1991, 1993, 1994, 1995)
FISH TYPE = Fish Community present in the lake
FA = fish absent
FP-NC = fish present, non-competitor species only
FP-C = fish present, competitor species
INDICATED PAIRS = Presence of breeding pair of a waterfowl species
BROODS = Presence of broods of a waterfowl species

NOTATIONS

FC *Lake Number* = food chain lake
Lake Number = lake drained in autumn 1995
. = no data

Waterfowl Species

CL = Common Loon (*Gavia immer*)
CM = Common Merganser (*Mergus merganser*)
HM = Hooded Merganser (*Lophodytes cucullatus*)
MA = Mallard (*Anas platyrhynchos*)

BD = Black Duck (*Anas rubripes*)
WD = Wood Duck (*Aix sponsa*)
RD = Ring-necked Duck (*Aythya collaris*)
CG = Common Goldeneye (*Bucephala clangula*)

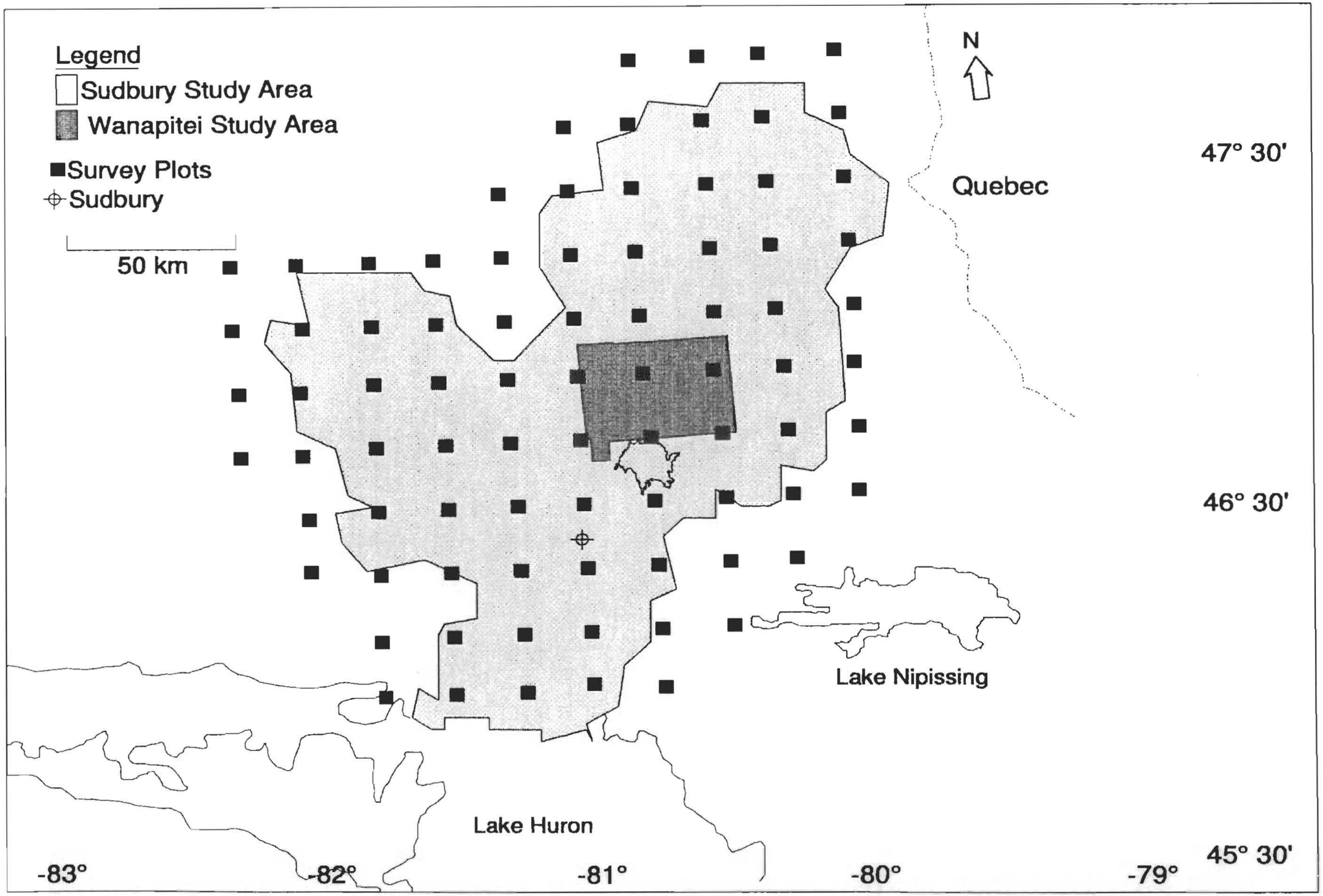


Fig. 17 Map showing outlines of the Sudbury and Wanapitei study areas, and the location of waterfowl survey plots (2x2 km) that fall inside the Sudbury area (N = 57) or within 20 km (N = 26).

Table 29. Habitat and box descriptions for duck boxes on Sudbury study lakes (N = 75). (See legend for explanation of variables).

LAKE	HABITAT							BOX DESCRIPTIONS						
	MEAN pH	FISH TYPE	WATER AREA (ha)	WATDIST (m)	WETB500	MINBOX (m)	BOX500	YEAR BOX ERECTED	TREE SPECIES	BOX HT. (m)	DIST. TO WATER (m)	TREE HT. FROM WATER (m)	CBH (m)	COMPASS BEARING (°)
2	6.59	FP	6.6	398	1	450	1	88	RP	4.2	2.4	1.8	1	305
3	5.63	FP	3.8	204	3	200	2	86	JP	4.1	0	0	0.9	256
5	7.15	FP	6.6	572	0	600	0	86	RP	4.8	0	0.2	0.7	196
13	4.85	FA	2.6	204	1	200	2	86	WS	4.4	7	0	0.8	90
FC 16	6.36	FP	3.2	102	2	1075	0	86	JP	4.8	1.8	1	0.9	60
17	4.94	FA	2.8	217	2	200	2	86	JP	4.3	3.1	1.1	1.2	192
22	5.68	FP	4.6	331	2	500	1	88	RP	3.8	4.3	1	1	220
FC 197	5.69	FP	4.3	408	1	1325	0	86	WS	4.8	2.6	1	0.8	283
FC 199	6.51	FA	1.9	107	1	1325	0	86	RP	4.6	4.8	1	1.1	332
219	5.94	FA	1.8	256	2	400	1	89	RP	4	4.5	1.8	0.4	160
239	4.95	FA	3.8	374	4	475	2	89	RP	3.4	4.6	4.3	0.3	305
FC 240	4.99	FP	7.8	71	4	100	2	86	WP	4.4	4.6	0.5	1	198
247	7.25	FA	1.9	221	1	1425	0	86	JP	4.2	5.8	0.5	0.7	76
FC 248	4.54	FA	3.8	142	3	100	2	86	RP	4.7	2.7	0.3	0.7	309
250	5.3	FP	6.7	90	2	100	1	86	RP	4.4	1.6	1.5	1	192
251	5.46	FA	2.6	29	2	100	1	86	WP	4.5	15	1.5	0.6	193
253	6.16	FP	4.6	315	6	625	0	88	RP	4.2	3.2	1.5	1.2	110
FC 256	6.17	FP	6.7	207	6	250	1	88	JP	3.9	6	2	1	220
257	4.83	FA	2.5	74	3	50	2	86	JP	4.8	0	0	0.8	218
258	4.7	FA	5.5	74	2	50	1	86	WP	4.5	0	0.2	1	280
FC 259	4.8	FA	2.5	81	2	75	1	86	RP	4.2	4.6	1.5	0.7	29
260	4.82	FA	1	81	1	75	1	86	JP	4.2	5.8	1.5	0.7	54

LAKE	HABITAT							BOX DESCRIPTIONS						
	MEAN pH	FISH TYPE	WATER AREA (ha)	WATDIST (m)	WETB500	MINBOX (m)	BOX500	YEAR BOX ERECTED	TREE SPECIES	BOX HT. (m)	DIST. TO WATER (m)	TREE HT. FROM WATER (m)	CBH (m)	COMPASS BEARING (°)
268	5.05	FP	3.9	351	2	1850	0	88	JP	3.7	2.4	0.8	0.7	300
299	7.31	FA	1	407	1	2175	0	86	WP	4.3	6.4	1.5	1.2	54
FC 316	5.53	FA	1.3	301	1	2075	0	86	WP	4.1	0	0	1.8	214
333	6.66	FP	2.5	89	2	175	1	86	JP	4.5	1	0	0.8	308
338	5.5	FA	1.1	122	3	175	1	86	WS	4.1	3.5	0	0.9	258
394	4.45	FA	1.8	21	4	1800	0	86	WP	4.6	1.3	0	0.9	134
401	4.51	FA	1.4	415	3	450	2	86	BS	4.4	8.5	0.5	0.8	38
FC 402	4.39	FA	6.2	73	4	75	3	86	RP	4.7	21	2	1.2	304
403	4.42	FA	6.8	29	5	50	5	86	WP	4.3	0.3	0	0.8	187
FC 404	5.1	FP	5.2	70	3	350	1	86	RP	4.6	1.2	0.3	1.2	309
406	4.45	FA	6.1	29	4	50	1	86	RP	4	4.9	1	1.5	300
407	4.38	FA	1.4	52	5	75	2	86	WP	4.3	4.5	1	0.7	71
FC 408	4.25	FA	5.9	52	2	75	2	86	RP	4.2	4.4	0.5	1.2	206
409	6.98	FP	2.8	320	2	2050	0	86	BS	4.7	6.4	0	0.7	228
FC 410	5.42	FP	7.4	93	3	1450	0	86	WP	4.7	0	0	0.8	228
469	6.46	FP	1.4	246	2	650	0	86	RP	3.9	2	2.3	1	203
472	5.82	FP	3.4	50	3	650	0	86	WP	4.5	0	0	1.3	270
475	6.2	FP	17.2	86	3	950	0	86	RP	4.6	1.5	1.3	0.8	263
FC 479	5.5	FP	6.7	45	2	1050	0	88	RP	4.1	6.2	3	1.1	305
510	5.75	FA	3.8	121	2	2600	0	86	BS	4.7	5.5	1.3	1.2	192
515	6.72	FP	14.1	544	0	2000	0	88	RP	4	4.4	2.5	1.1	220
524	5.83	FP	10.3	413	1	1275	0	88	RP	3.6	1.7	1	1.1	165
526	6.87	FP	20	38	3	100	2	88	RP	3.7	7.4	5	0.9	290
527	5.52	FP	3.6	85	3	100	2	86	RP	4.5	3.2	1	1.1	195

LAKE	HABITAT							BOX DESCRIPTIONS						
	MEAN pH	FISH TYPE	WATER AREA (ha)	WATDIST (m)	WETB500	MINBOX (m)	BOX500	YEAR BOX ERECTED	TREE SPECIES	BOX HT. (m)	DIST. TO WATER (m)	TREE HT. FROM WATER (m)	CBH (m)	COMPASS BEARING (°)
FC 530	5.33	FA	1.9	205	3	250	2	86	WP	4	2.1	0.9	1	86
572	4.88	FA	1.4	107	2	150	1	86	WS	4.5	15.9	1.5	1	41
573	4.98	FP	27.3	107	2	150	1	86	JP	4.4	0.5	0	1	241
579	5.83	FP	0.6	203	2	550	0	86	JP	4.4	5.5	1.8	0.9	247
583	5.32	FP	3.9	96	3	500	1	86	WS	4.7	8.8	1.5	1.2	186
588	6.51	FP	15.6	65	3	500	1	88	WP	4	3.1	1.5	1.5	195
FC 589	5.14	FA	3.4	84	2	100	1	86	RP	4.1	3	3	1.2	202
590	5.43	FP	5.2	84	3	100	1	86	WP	4.4	0	0	1.1	152
FC 593	5.16	FA	2.8	428	1	650	0	86	JP	4.5	0	0	1	158
609	6.08	FA	5.8	223	3	250	1	88	RP	3.8	9	4.5	1.3	265
612	6.46	FP	1.2	228	3	250	1	86	WP	4.5	5.4	2	2.2	10
856	6.19	FP	6.8	357	2	500	1	93	WP	4	1	0.2	0.7	170
900	6.83	FP	8.3	98	2	2250	0	86	WS	4.3	1.2	0.5	1.1	118
FC 902	5.59	FP	2.1	398	2	450	1	86	RP	4.6	6.1	2	1	348
903	7.11	FP	15	442	2	425	1	88	JP	3.9	4.4	2	1	40
904	6.17	FP	15.1	450	2	425	1	88	RP	4	6.7	1	1.1	200
FC 905	6.67	FP	2	250	1	675	0	86	RP	4.6	4.7	0.3	1	277
906	4.45	FA	86	47	9	50	3	88	WP	4	0.5	1	1.2	200
909	7.31	FP	1	276	3	600	0	88	RP	3.9	3.4	0.5	0.7	60
FC 920	6.83	FA	2.4	225	2	400	1	86	JP	4.4	2.4	0	0.6	247
921	5.11	FA	16.2	313	1	300	1	88	RP	3.5	5.5	1	1.3	155
FC 922	5.36	FA	5.1	117	2	2000	0	86	JP	4.4	3	1.5	0.7	72
924	4.46	FA	3.3	47	1	50	1	88	JP	4.1	7	0.2	1.1	250
932	4.55	FA	4.5	43	4	100	2	88	RP	3.7	8.5	2	1.2	192

LAKE	HABITAT							BOX DESCRIPTIONS						
	MEAN pH	FISH TYPE	WATER AREA (ha)	WATDIST (m)	WETB500	MINBOX (m)	BOX500	YEAR BOX ERECTED	TREE SPECIES	BOX HT. (m)	DIST. TO WATER (m)	TREE HT. FROM WATER (m)	CBH (m)	COMPASS BEARING (°)
933	4.51	FA	12.1	31	7	50	2	88	RP	4	1.3	0.3	1.1	140
935	4.83	FA	4.7	42	6	50	2	88	JP	4	4.4	0.4	0.7	284
949	6.72	FP	15.5	13	2	525	0	88	WS	4.6	1	0.5	0.8	80
FC 958	5.96	FP	9.5	11	4	1600	0	88	RP	4.4	6.1	2	0.9	195
973	4.76	FA	2.8	352	2	1035	0	89	WC	2.7	2	1.5	0.6	15

LEGEND

HABITAT VARIABLES

Mean pH = mean pH 1987-1995

WETB500 = number of lakes within 500m

FISH TYPE: FA = fish absent **FP** = fish present

MINBOX = minimum distance to nearest box

WATDIST = minimum distance to nearest lake

BOX500 = number of box lakes within 500m

BOX DESCRIPTION VARIABLES

Box Ht. = box hole height from ground

CBH = tree circumference at breast height

Dist. to water = tree distance from water

Compass Bearing = direction box hole faces

Tree Ht. from water = tree base height from water

Tree Species

WP = white pine (*Pinus strobus*)

BS = black spruce (*Picea mariana*)

JP = jack pine (*Pinus banksiana*)

WC = eastern white cedar (*Thuja occidentalis*)

RP = red pine (*Pinus resinosa*)

WS = white spruce (*Picea glauca*)

Table 30. Occupancy and success of waterfowl species nesting in duck boxes on Sudbury study lakes (N = 75) between 1987-1995 (boxes not checked in 1991). (See legend for explanation of variables and notations).

LAKE	**MEAN pH**	**FISH TYPE**	**YR BOX ERECTED**	**YRS AVAIL.**	**YRS OCC.**	**1987**	**1988**	**1989**	**1990**	**1992**	**1993**	**1994**	**1995**
2	6.59	FP	88	6	2	▨	▨				CG	HM	
3	5.63	FP	86	8	6		**HM**	**CG**	CG	**CG**	CG		**HM**
5	7.15	FP	86	7	6		**HM**	**HM**	**HM**	▨	**HM**	**HM**	**HM**
13	4.85	FA	86	8	4	CG			CG		CG		CG/HM
FC 16	6.36	FP	86	8	7	**CG**	**CG**	**CG**	CG		**HM**	**HM**	**HM**
17	4.94	FA	86	8	7	**CG**	**CG**	**CG**	CG	**CG**	CG	CG	
22	5.68	FP	88	5	3	▨	▨			▨	**HM**	**HM**	HM
FC 197	5.69	FP	86	8	6		**CG**	CG	CG		**CG**	**CG**	**CG**
FC 199	6.51	FA	86	8	5		**CG**		**CG**		**CG**	**CG**	**CG**
219	5.94	FA	89	5	2	▨	▨	▨	CG	**CG**			
239	4.95	FA	89	5	2	▨	▨	▨		**HM**	**CG**		
FC 240	4.99	FP	86	7	6	**CG**	CG	▨		CG	**CG**	**CG**	HM
247	7.25	FA	86	8	4		**CG**	**CG**		CG			**CG**
FC 248	4.54	FA	86	7	4	HM	CG			▨	**CG**	CG	
250	5.3	FP	86	8	8	**CG**	**HM**	HM	CG	HM	CG	**CG**	**WD**
251	5.46	FA	86	8	5		HM	**CG**		**CG**		**WD**	**CG**
253	6.16	FP	88	5	4	▨	▨		HM	▨	WD	**HM**	**CG**
FC 256	6.17	FP	88	6	4	▨	▨		CG	**CG**	**CG**	**CG**	
257	4.83	FA	86	7	7	CG	CG	**HM**	**HM**	CG	▨	**CG**	**CG**
258	4.7	FA	86	7	5	CG	**CG**	**CG**	**CG**	▨	CG		
FC 259	4.8	FA	86	7	5		**CG**	CG		CG	**CG**	▨	CG
260	4.82	FA	86	8	6			CG	CG	CG	**HM**	**CG**	**HM**
268	5.05	FP	88	5	3	▨	▨			▨	**CG**	**CG**	CG
299	7.31	FA	86	6	5		▨	CG	**HM**	**CG**	HM	**CG**	▨
FC 316	5.53	FA	86	8	5	**CG**	**CG**	**CG**	**CG**	HM			
333	6.66	FP	86	8	5	HM		HM		**CG**		**CG**	**CG**
338	5.5	FA	86	7	3			**CG**	CG	CG			▨
394	4.45	FA	86	5	0	▨				▨	▨		
401	4.51	FA	86	8	3	**CG**	**CG**			CG			
402	4.39	FA	86	8	2	**CG**	**CG**						
403	4.42	FA	86	8	1	CG							
404	5.1	FP	86	7	1	▨	HM						
406	4.45	FA	86	8	3	CG			**CG**			**CG**	

LAKE	MEAN pH	FISH TYPE	YR BOX ERECTED	YRS AVAIL.	YRS OCC.	1987	1988	1989	1990	1992	1993	1994	1995
407	4.38	FA	86	6	0				▨				▨
408	4.25	FA	86	8	1	**CG**							
409	6.98	FP	86	8	0								
410	5.42	FP	86	8	7	**CM**	**CG**	**CM**	**CM**	CM	CG		CG
469	6.46	FP	86	8	2					CM			CM
472	5.82	FP	86	5	0					▨	▨	▨	
475	6.2	FP	86	8	0								
479	5.5	FP	88	4	0	▨	▨				▨	▨	
510	5.75	FA	86	8	1					HM			
515	6.72	FP	88	6	2	▨	▨			CG/HM			**CG**
524	5.83	FP	88	6	2	▨	▨		**CG**	CG			
526	6.87	FP	88	6	1	▨	▨					**HM**	
527	5.52	FP	86	8	0								
530	5.33	FA	86	7	3		**CG**	**CG**	▨		**CG**		
572	4.88	FA	86	5	1			▨	▨	▨			**CG**
573	4.98	FP	86	8	2			HM		**HM**			
579	5.83	FP	86	2	0			Box removed					
583	5.32	FP	86	8	5				**CM**	**CG**	**CG**	**CG**	CG
588	6.51	FP	88	5	2	▨	▨				CM	CG	▨
589	5.14	FA	86	8	1						**HM**		
590	5.43	FP	86	7	4	**CG**	**CG**	**CG**	**CG**	▨			
FC 593	5.16	FA	86	8	4	**CG**	**CG**	CG	HM				
609	6.08	FA	88	3	1	▨	▨		HM		0	0	▨
612	6.46	FP	86	5	1	▨	**CG**					0	▨
856	6.19	FP	93	2	0	▨	▨	▨	▨	▨	▨		
900	6.83	FP	86	8	3		HM					**CG**	HM
FC 902	5.59	FP	86	8	5	**HM**			**HM**		**HM**	**HM**	**HM**
903	7.11	FP	88	6	4	▨	▨			**HM**	**CG**	**CG**	**CG**
904	6.17	FP	88	6	3	▨	▨		**WD**	**HM**			**HM**
FC 905	6.67	FP	86	8	4				**WD**	**CG**	HM		CG
906	4.45	FA	88	5	5	▨	▨	**CG**	**CG**	▨	**CG**	**CG**	**CG**
909	7.31	FP	88	5	2	▨	▨			**HM**	▨		**CG**
FC 920	6.83	FA	86	8	2	CG					CG		
921	5.11	FA	88	6	2	▨	▨	CG	**CG**				
FC 922	5.36	FA	86	7	6	**CG**	▨	**CG**	CG	**HM**	CG	**HM**	
924	4.46	FA	88	6	2	▨	▨		**CG**		CG		

LAKE	MEAN pH	FISH TYPE	YR BOX ERECTED	YRS AVAIL.	YRS OCC.	1987	1988	1989	1990	1992	1993	1994	1995
932	4.55	FA	88	4	2	▨	▨		**HM**	▨	HM	▨	
933	4.51	FA	88	6	3	▨	▨		**HM**			**CG**	**HM**
935	4.83	FA	88	5	4	▨	▨	HM	CG	▨		CG	**CG**
949	6.72	FP	88	6	1	▨	▨		CG				
FC 958	5.96	FP	88	5	3	▨	▨		**CG**	▨	CM	**CG**	
973	4.76	FA	89	4	1	▨	▨	▨		WD		0	

LEGEND

VARIABLE EXPLANATIONS

Mean pH = mean pH 1987-1995
FISH TYPE: **FA** = fish absent **FP** = fish present

Waterfowl Species

CG = Common Goldeneye (*Bucephala clangula*)
WD = Wood Duck (*Aix sponsa*)

HM = Hooded Merganser (*Lophodytes cucullatus*)
CM = Common Merganser (*Mergus merganser*)

NOTATIONS

Bold face type = ≥ 1 egg hatched
Underlined type = fate of nest unknown
Hatched cell = box destroyed or unavailable
. = box not checked