

Selected Chemical Analyses of Water from Lakes in Ellesmere Island National Park Reserve, Nunavut

J.A. Babaluk, L.G. Heuring, J.D. Reist, and B.N. Billeck

Central and Arctic Region
Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

1999

**Canadian Data Report of Fisheries
and Aquatic Sciences 1050**



Fisheries
and Oceans

Pêches
et Océans

Canada¹

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT/RÉSUMÉ.....	iv
INTRODUCTION.....	1
MATERIALS AND METHODS.....	1
Description of the study area.....	1
Water sampling and analysis	1
DATA PRESENTATION	2
ACKNOWLEDGMENTS	2
REFERENCES	2

LIST OF TABLES

Table

1	Chemical analyses of surface water samples from Lake Hazen, Ellesmere Island National Park Reserve, NT.....	4
2	Chemical analyses of surface water samples from selected lakes from the Lake Hazen area, Ellesmere Island National Park Reserve, NT	5
3	Concentration of trace elements in surface water samples from selected lakes from the Lake Hazen area, Ellesmere Island National Park Reserve, NT.....	6

LIST OF FIGURES

Figure

1	Map of the Lake Hazen area, Ellesmere Island National Park Reserve, NT showing approximate locations of water sample collection sites (arrows/dots) and dates (year) samples were collected	7
---	---	---

ABSTRACT

Babaluk, J.A., L.G. Heuring, J.D. Reist, and B.N. Billeck. 1999. Selected chemical analyses of water from lakes in Ellesmere Island National Park Reserve, Northwest Territories. Can. Data Rep. Fish. Aquat. Sci. XXXX: iv + 7 p.

Selected chemical data collected between 1990 and 1998 from lakes in Ellesmere Island National Park Reserve, Northwest Territories are tabulated.

Key words: chemical elements; lakes survey; nutrients (mineral); trace elements; water analysis.

RÉSUMÉ

Babaluk, J.A., L.G. Heuring, J.D. Reist, and B.N. Billeck. 1999. Selected chemical analyses of water from lakes in Ellesmere Island National Park Reserve, Northwest Territories. Can. Data Rep. Fish. Aquat. Sci. XXXX: iv + 7 p.

INTRODUCTION

The Canada Department of Fisheries and Oceans (DFO), in co-operation with the Department of Canadian Heritage, Parks Canada, has been conducting field research in Ellesmere Island National Park Reserve (EINPR) since 1990. During May, 1990 a study on contaminants in Lake Hazen sediments was conducted (Muir et al. 1995). At this time, Arctic char (*Salvelinus alpinus*) were also collected for a study on contaminants in muscle tissue (Muir and Lockhart 1992; Muir and Lockhart 1993). Intermittently between 1992 and 1998, DFO personnel conducted an assessment of the char within EINPR, in particular Lake Hazen char (e.g., population structure; genetic and morphological variation; life history types). Results of these studies have been reported by Brown Gladden et al. (1995), Reist et al. (1995), and Babaluk et al. (1997).

Opportunistically, while fish and sediment samples were collected, water samples for chemical analysis were also collected from several water bodies within EINPR. This report presents the chemical data from those water samples and adds to the existing information on EINPR water chemistry (Oliver and Corbett 1966; Gregor and Dahl 1990; Clark 1997).

MATERIALS AND METHODS

DESCRIPTION OF THE STUDY AREA

Ellesmere Island National Park Reserve (EINPR) is located at the northern end of Ellesmere Island, NT (Fig. 1, left inset). The most northern area of the Park Reserve, Cape Aldrich at 83°06'N is also the most northern point in the Canadian Arctic Archipelago. The Park Reserve, with an area of 37 775 km², is the second largest national park in Canada. Ellesmere Island National Park Reserve is described in detail in Parks Canada (1994).

There are relatively few lakes in EINPR and the most productive ones are located on the Hazen Plateau or along the coastal areas of the Grant Land Mountains (Fig. 1, right inset). Most of these lakes provide suitable habitat for some aquatic flora and invertebrates but are too shallow to support arctic char, the only freshwater fish species present in EINPR (Parks Canada 1994).

Our study was confined to lakes on the Hazen Plateau that either supported arctic char populations or were thought to (Fig. 1). This included Lake Hazen, the largest lake within EINPR and also the largest lake in the Canadian Arctic located completely north of the Arctic Circle. Lake Hazen has a surface area of ca. 540 km²; a length of ca. 75 km and a maximum recorded depth of 263 m. The lake is further described in Johnson (1990) and Stewart (1994).

WATER SAMPLING AND ANALYSIS

Water samples were collected from the following lakes in Ellesmere Island National Park Reserve: Lake Hazen (81°50'N, 70°25'W), Kilbourne Lake (81°52'N, 68°25'W), Turnabout Lake (81°58'N, 68°34'W), unnamed lake, hereafter Lake A (82°06'N, 68°37'W), unnamed lake, hereafter Lake B (82°09'N, 68°29'W), Craig Lake (81°52'N, 68°47'W), Heintzelman Lake (81°42'N, 66°56'W), Alexandra Lake (81°46'N, 65°32'W), Lewis Lake (81°30'N, 74°35'W), Ekblaw Lake (81°40'N, 75°40'W), and Murray Lake (81°20'N, 69°34'W). A seawater sample was also collected from Chandler Fiord (81°33'N, 68°19'W). Collection dates for all locations and more precise sampling locations within Lake Hazen are shown in Fig. 1 and Tables 1, 2, and 3.

Water samples from all locations, except Craig, Lewis, Murray, and Ekblaw lakes and the 1998 Lake Hazen sample, were collected through the ice at a level ca. 1.5 m below the ice undersurface using a 1.5 L Kemmerer sampler. The water samples from Craig Lake were collected during the open-water season by hand-dipping the samples from shore. All other open-water samples were collected by hand-dipping the samples from a boat or helicopter pontoon. Two replicate samples from the same location (a and b) were collected from Craig Lake and one sample from each of two of three Murray Lake basins was collected (a and b) (see Fig. 1).

Water samples for dissolved element and nutrient analyses were analyzed at the Freshwater Institute Science Laboratory (FWISL) Analytical Water Chemistry Laboratory following the procedures of Stainton et al. (1977). Estimates of precision for these procedures are also given in Stainton et al. (1977). Trace elements were analyzed at the FWISL Trace Element Laboratory by inductively coupled

plasma-atomic emission spectrometry (ICP-AES) using commercial ICP standards and NRC standard reference materials (SLRS-1, SLRS-2). Detection limit was $0.1 \mu\text{g}\cdot\text{L}^{-1}$.

DATA PRESENTATION

Chemical data for Lake Hazen area waters collected between 1990 and 1998 are presented in Tables 1, 2, and 3. In all tables, standard symbols are used to represent elements (Weast 1990). Other symbols and abbreviations used in Tables 1 and 2 are as follows: TDN = total dissolved nitrogen; TDP = total dissolved phosphorus; SRSi = soluble reactive silicon; TSS = total suspended solids; DIC = dissolved inorganic carbon; DOC = dissolved organic carbon; Cond. = conductivity; Alk. = alkalinity; and Org. acid = organic acid.

ACKNOWLEDGMENTS

The work was done in part with the support of the Department of Canadian Heritage (Parks Canada). Natural Resources Canada (Polar Continental Shelf Project) and the staff at Resolute provided logistical support. The authors thank D. Clark, E. Gyselman, J. Johnson, V. Sahanatien, B. Troke, P. Wilkinson, R. Wissink, and G. Walker for field assistance and logistical support while at Lake Hazen; J. Boughen, B. Hunt, C. Ranson, and R. Schade for water sample analysis; P. Wilson for assistance with map preparation; and D. Laroque for assistance in preparing the manuscript. E. Gyselman and J. Johnson provided constructive comments on the manuscript.

REFERENCES

- BABALUK, J.A., N.M. HALDEN, J.D. REIST, A.H. KRISTOFFERSON, J.L. CAMPBELL, and W.J. TEESDALE. 1997. Evidence for non-anadromous behaviour of arctic charr (*Salvelinus alpinus*) from Lake Hazen, Ellesmere Island, Northwest Territories, Canada, based on scanning proton microprobe analysis of otolith strontium distribution. *Arctic* 50: 224-233.
- BROWN GLADDEN, J.G., L.D. POSTMA MAIERS, T.J. CARMICHAEL, and J.D. REIST. 1995. Mitochondrial DNA control region sequence variation in Arctic char (*Salvelinus alpinus* (L.)). *Can. Data Rep. Fish. Aquat. Sci.* 968: iv + 18 p.
- CLARK, D.A. 1997. Assessment the health of the Lake Hazen ecosystem. Ecological Monitoring and Assessment Network Third Annual Science Meeting, Saskatoon, January 21-25. <http://www.cciw.ca/eman>.
- GREGOR, D., and M. DAHL. 1990. Final report on the 1989/1990 Lake Hazen water quality study. Department of Canadian Heritage (Parks Canada), Winnipeg. 46 p.
- JOHNSON, L. 1990. Hazen Lake, p. 1-9. *In* Lake Biwa Research Institute and International Lake Environment Committee (ed.) Data book of world lake environments. United Nations Environment Programme, Otsu, Japan.
- MUIR, D.C.G., and W.L. LOCKHART. 1992. Contaminant trends in freshwater biota, p. 121-125. *In* Synopsis of research conducted under the 1991/1992 Northern Contaminants Program. Indian and Northern Affairs Canada, Environmental Studies Report No. 68. Ottawa.
- MUIR, D.C.G., N.P. GRIFT, W.L. LOCKHART, P. WILKINSON, B.N. BILLECK, and G.J. BRUNSKILL. 1995. Spatial trends and historical profiles of organochlorine pesticides in Arctic lake sediments. *Sci. Total Environ.* 160/161: 447-457.
- MUIR, D.C.G., and W.L. LOCKHART. 1993. Contaminant trends in freshwater biota, p. 167-173. *In* Synopsis of research conducted under the 1992/1993 Northern Contaminants Program. Indian and Northern Affairs Canada, Environmental Studies Report No. 70. Ottawa.
- OLIVER, D.R., and P.S. CORBETT. 1966. Aquatic habitats in a High Arctic locality: the Hazen Camp study area, Ellesmere Island, N.W.T. Defense Research Board of Canada, Ottawa. 172 p.
- PARKS CANADA. 1994. Ellesmere Island National Park Reserve resource description and analysis. Department of Canadian

Heritage, Winnipeg, Vol. 1 and 2.

REIST, J.D., E. GYSELMAN, J.A. BABALUK, J.D. JOHNSON, and R. WISSINK. 1995. Evidence for two morphotypes of arctic char (*Salvelinus alpinus*) from Lake Hazen, Ellesmere Island, Northwest Territories, Canada. Nord. J. Freshwater Res. 71: 496-410.

STAINTON, M.P., M.J. CAPEL, and F.A.J. ARMSTRONG. 1977. The chemical analysis of fresh water. 2nd ed. Can. Fish. Mar. Serv. Misc. Spec. Publ. 25: 166 p.

STEWART, D.B. 1994. Limnology and marine biology. *In* Ellesmere Island National Park Reserve resource description and analysis. Department of Canadian Heritage, Winnipeg.

WEAST, R.C. (ed.) 1990. Handbook of chemistry and physics. 70th edition. Boca Raton, Florida, CRC Press, Inc.