

A SURVEY OF LAKE JESSE, NOVA SCOTIA.*

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ABSTRACT.

The results of a mid-summer survey of the physical and chemical conditions of the water and of the species comprising the flora and fauna of Lake Jesse, Nova Scotia, are presented. As indicated by the predominance of desmids in the phytoplankton, the waters belong to the Caledonian type.

This survey was made in connection with an experiment being carried out by the Fish Culture Branch of the Department of Fisheries, whereby copper sulphate was added to the waters of Lake Jesse on August 3, 1934, in an attempt to eradicate the competitor and predator fish of the brook trout. It is anticipated that a more suitable habitat in which to plant trout fry will thereby be created, after the food organisms, which were practically all destroyed by this procedure, have re-established themselves. Various phases of this experiment have already been described and discussed by Catt¹ and Smith².

This paper by no means presents a complete survey of Lake Jesse. It does, however, provide an index to physical and biological conditions which probably obtain in many small and similar lakes in the region, a region of Nova Scotia that has received no attention from a limnological viewpoint.

Lake Jesse covers an area of forty-five acres, and is situated at the head-waters of the Salmon river system, Yarmouth County, at latitude 44°2'0" North and longitude 66°0'30" West, and at an altitude of about 175 feet above sea-level. It lies in a formation of Precambrian quartzites and slates³. The maximum depth of water sounded in the lake was 6.6 metres, while the average depth was determined

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¹Catt. *Trans. Amer. Fish. Soc.*, 64, 276-280. (1934).

²M. W. Smith. *Trans. Amer. Fish. Soc.*, 65, 101-114. (1935).

³Department of Mines, Canada. Geol. Surv., Map 39A.

as 2.4 metres (May 30, 1929). The annual fluctuation in level of the water is not greater than 0.5 metre. There is one small inlet which, however, goes dry during the summer months (Fig. I). For the most part the bottom in the shallow water along the shores is composed of gravel and rubble; in the deeper water a soft organic ooze predominates.

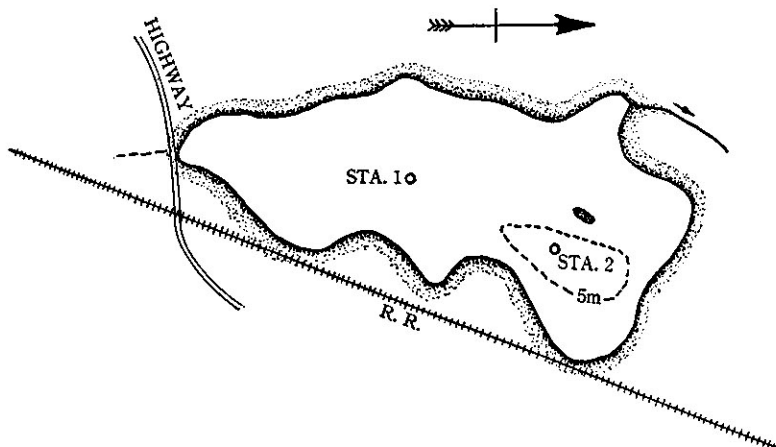


Figure I. Sketch Map of Lake Jesse.

Practically all of the data herein presented were secured by the writer from July 31 to August 8, 1934.

HYDROGRAPHIC DATA

Two stations were occupied, one at a depth of 4.0 metres, and another at 5.5 metres (Fig. I). The temperature, pH value, bicarbonate and dissolved oxygen content of the water were determined on a number of occasions. The data are presented in Table 1. The records for August 4 and 7 were made after the lake had been treated with copper sulphate, but apparently this treatment had little or no effect upon the factors involved.

Since the lake is not deep and there are no sudden depressions in the bottom contour, the waters are prone to overturn throughout the summer whenever subjected to a

TABLE 1
Physical and Chemical Conditions of Lake Jesse Water.

Date 1934	Temperature °C.		pH value		O ₂ , c.c./litre.		Bicarbonate, p.p.m.	
	Air		Surface	Bottom	Surface	Bottom	Surface	Bottom
July 31.....	22.8	23.7	Station 1, Depth 4.0 metres		5.93	.....	11.0	.....
Aug. 1.....	19.9	22.3	6.6	.....	6.04	5.83	10.0	9.9
2.....	23.3	23.5	6.5	6.3	6.38	5.53	10.1	10.6
3.....	18.9	21.8	.....	.....	.....	.....	.....	.....
4.....	22.1	23.2	6.3	6.3	7.40	6.22	10.7	10.0
July 31.....			Station 2, Depth 5.5 metres.		5.97	.....	11.3	.....
Aug. 1.....		23.8	6.6	.....	6.06	5.62	10.2	10.0
2.....		22.5	6.5	6.2	6.17	5.66	9.8	9.5
4.....		24.0	6.5	6.2	6.81	5.66	10.4	9.9
7.....		23.5	6.3	6.3	5.83	5.08	10.6	9.9
		22.6	6.4	6.3				

strong wind. Thus on August 3, a day on which a steady southeasterly wind was blowing, the waters of the lake were found to be homothermous throughout (Station 1). According to Whipple's⁴ classification of lakes, based on their temperature relationships, this type of lake belongs to the third order, in contrast to lakes of the first and second orders in which the difference between surface and bottom temperature is marked, and the waters are thermally stratified.

The dissolved oxygen content of the bottom waters was somewhat lower than that of the surface. This condition indicates decomposition taking place in the bottom deposits. The circulation of the water, however, would rarely permit much decrease in the dissolved oxygen content at the bottom. In such lakes where the bottom deposits contain decomposable organic materials, considerable diminution of the bottom oxygen content can, nevertheless, occur during periods of warm calm weather.

The waters of Lake Jesse are quite soft. The determined pH value ranged from 6.2 (bottom) to 6.6 (surface). The bicarbonate content was small, varying from 9.5 to 11.3 p.p.m.

FLORA

1. *Spermatophyta*.

Rooted emergent aquatics covered only a small area in the shallow water, most particularly at the south end of the lake and in coves at the northeast corner and at the outlet. We are indebted to Mr. E. W. Hart, Central Experimental Farm, Ottawa, for assistance in making the identifications of the following species:

- Carex filiformis* L.
- Eleocharis palustris* (L.) R. and S.
- Sparganium eurycarpum* Englm.
- Eriocaulon articulatum* (Huds.) Morong.
- Pontederia cordata* L.
- Juncus acuminatus* Michx.
- Nymphaea advena* Ait.
- Castalia odorata* (Ait) Woodville and Wood.
- Lobelia dortmanna* L.
- Cicuta*, sp.

⁴Whipple. *Amer. Nat.* 32, 25-33. (1898).

2. *Algae.*

Eighty-three species of algae were specifically identified from the plankton taken on August 2. In addition there were representatives of the genera *Oedogonium*, *Spirogyra*, *Mougeotia* and *Zygnema*, which could not be determined owing to the absence of conjugating filaments. The identifications were kindly made by Professor C. W. Lowe, University of Manitoba.

This phytoplankton was characterized by an abundance of desmids. Of the eighty-three determined species of algae, fifty-one belonged to the Desmidiaceae. This feature is not surprising when one considers the moderately low pH value and small bicarbonate content of the Lake Jesse waters, for it is in acid waters with little calcium that the desmids reach their best development. Considering the abundance of desmids, both in numbers and species, Lake Jesse may be assigned to the Caledonian type of lake, in which the phytoplankton is distinguished by a large desmid flora. This type is contrasted with the Baltic division with a predominance of Myxophyceae and Chlorococcales.

The following is a list of the planktonic algae:

MYXOPHYCEAE.

Chroococcales.

- Chroococcus limneticus* Lemm.
- Chroococcus turgidus* (Kütz.) Näg.
- Aphanocapsa delicatissima* W. and G. S. West.
- Microcystis aeruginosa* Kütz.
- Merismopedia glauca* (Ehr.) Näg.
- Coelosphaerium Kützingianum* Näg.

Hormogoniales.

- Anabaena circinalis* (Kütz.) Rab.

HETEROKONTAE.

Heterococcales.

- Botryococcus Braunii* Kütz.

CHRYSOPHYCEAE.

Chrysomonadales.

- Dinobryon divergens* Imhof.
- Dinobryon stipilatum* Stein.

BACILLARIEAE.

Centrales.

Melosira granulata (Ehr.) Ralfs.

Pennales.

Tabellaria fenestrata (Lyngb.) Kütz.

Tabellaria fenestrata (Lungb.) Kütz. var. *asterionelloides*, Grun.

Tabellaria flocculosa (Rothe) Kütz.

Synedra revaliensis Lemm.

Asterionella formosa Hass.

Pinnularia viridis (Nitzsch.) Ehr.

Frustulina rhomboides (Ehr.) De Toni.

Gyrosigma attenuatum (Kütz.) Cleve.

Surirella guatemalensis Ehr.

Surirella robusta Ehr.

CHLOROPHYCEAE.

Tetrasporales.

Gloeocystis gigas (Kütz.) Lagerh.

Sphaerocystis Schroeteri Chod.

Oedogoniales.

Oedogonium sp.

Chlorococcales.

Characium stipitatum (Bachmann) Wille.

Dictyosphaerium pulchellum Wood.

Pediastrum araneosum Racib.

Pediastrum araneosum.

var. *rugulosum* (G. S. West) G. M. Smith.

Pediastrum Boryanum (Turp.) Menegh.

Pediastrum duplex Meyen.

Coelastrum microporum Näg.

Kirchneriella obesa (W. West) Schmidle.

Zygnemales.

Spirogyra sp.

Mougeotia sp.

Zygnema sp.

Desmidaceae.

Closterium Ralfsii Bréb.

var. *hybridum* Raben.

Closterium didymoclocum Corda.

Closterium gracile Bréb.

Closterium intermedium Ralfs.

Closterium setaceum Ehr.

Netrium digitus (Ehr.) Itz. and Rothe.

- Pleurotaenium Ehrenbergii* (Bréb.) De Bary.
Pleurotaenium eugenium (Turn.) W. and G. S. West.
Triploceras gracile Bailey.
Triploceras verticillatum, Bailey.
Euastrum affine Ralfs.
Euastrum crassum (Bréb.) Kütz.
Euastrum didelta (Turp.) Ralfs.
Euastrum pinnatum Ralfs.
Micrasterias foliacea Bailey.
Micrasterias laticeps Nordst.
Micrasterias muricata (Bailey) Ralfs.
Micrasterias Nordstedtiana Wolle.
Micrasterias pinnatifida (Kütz.) Ralfs.
Micrasterias radiata Hass.
 var. *gracillimum* G. M. Smith.
Micrasterias radiosa Ralfs.
 var. *ornata* Nordst.
Micrasterias truncata (Corda) Bréb.
Cosmarium contractum Kirch.
Cosmarium subumidium Nordst.
 var. *Klebsii* (Gutsw.) W. and G. S. West.
Xanthidium antilopaeum (Bréb.) Kütz.
Xanthidium antilopaeum (Bréb.) Kütz.
 var. *polymazon* Nordst.
Xanthidium armatum (Bréb.) Ralfs.
 var. *mediolaeve* G. M. Smith.
Xanthidium subhastiferum W. West.
 var. *Murrayi* W. and G. S. West.
 forma *triqueta* W. and G. S. West.
Xanthidium cristatum Bréb.
 var. *uncinatum* Bréb.
Arthrodesmus Incus (Bréb.) Hass.
Arthrodesmus triangularis Lagerh.
Staurastrum anatinum Cooke and Willis.
 var. *longibrachiatum* W. and G. S. West.
Staurastrum ankyroides Wolle.
Staurastrum arcticon (Ehr.) Lund.
Staurastrum brevispinum Bréb.
Staurastrum brevispinum Bréb.
 var. *tumidum* G. M. Smith.
Staurastrum cerastes Lund.
Staurastrum grande Bulnh.
Staurastrum leptacanthum Nordst.
Staurastrum leptocladum Nordst.
Staurastrum megacanthum Lund.

Staurastrum Ophiura Lund.
Staurastrum punctulatum Bréb.
Staurastrum Wolleanum Butler.
Spondylosum planum (Wolle) W. and G. S. West.
Spondylosum pulchrum Arch.
Hyalotheca dissiliens (Smith) Bréb.
Hyalotheca mucosa (Dillw.) Ehr.
Desmidiium Baileyi (Ralfs) Nordst.
Desmidiium Grevellii (Kütz.) De Bary.
Gymnozyga moniliformis Ehr.

DINOPHYCEAE.

Peridinium cinctum Ehr.

FAUNA.

1. *Rotatoria*.

Of the planktonic rotifers, *Conochilus unicornis* Rouss. was the most abundant. *Notholca longispina* Kellic. and *Keratella (Anuraea) cochlearis* (Gosse) were common. *Polyarthra platyptera* Ehr. was represented by a few individuals, while *Rattulus rattus* (O.F.M.) was found only rarely. All except the last species are common constituents of limnetic plankton and are widely distributed.

2. *Hirudinea*.

Two species of leeches, *Macrobdella decora* (Say) Verrill and *Herpobdella punctata* (Leidy) were quite common. The identifications were made by Dr. R. J. Myers, Colgate University.

3. *Cladocera*.

Diaphanosoma brachyurum (Liéven), *Holopedium gibberum* Zaddach, *Daphnia pulex pulicaria* Forbes, *Daphnia longispina hyalina* Leydig (forma *galeata*), *Bosmina longirostris* (O. F. Müller) and *Leptodora kindtii* (Focke), usually found in plankton samples from lakes in the Maritimes and elsewhere, were common to abundant in Lake Jesse on July 31, and August 1 and 2. *Polyphemus pediculus* (Linné) was rare. The cosmopolitan *Chydorus sphaericus* (O. F. Müller) was also rare in the samples. The more typical littoral species, *Acantholeberis curvirostris* (O. F. Müller), *Alona affinis* (Leydig), *Rhyn-*

chotalona falcata (Sars) and *Alonella nana* (Baird) were found only in small numbers from hauls made in the shallow water.

4. Copepoda.

Epischura lacustris Forbes, *Diaptomus minutus* Lilljeborg and *Mesocyclops obsoletus* (Koch) were abundant in the open-water plankton. After the lake had been treated with copper sulphate *Eucyclops agilis* (Koch) (probably the limnetic variety *elegans* Herrick), along with *Diaptomus minutus*, were the first planktonic crustaceans to reoccur in moderate numbers. *Cyclops viridis* Jurine, *Eucyclops prasinus* (Fischer) and *Ectocyclops phaleratus* (Koch) were also encountered in small numbers.

5. Amphipoda.

The widely distributed *Hyaella knickerbockeri* (Bate) was common in the littoral zone.

6. Hydracarina.

Dr. Ruth Marshall, Rockford College, has identified the following species from the Lake Jesse plankton:

- Arrhenurus elevatus* Marshall.
- Diplodotus despiciens* (Müller).
- Unionicola crassipes* (Müller).
- Neumania punctata* Marshall.
- Neumania extendens* Marshall.
- Neumania semicircularis* Marshall.
- Hydychoreutes ungulatus* (Koch.).
- Piona* sp.
- Megaptes* sp.

7. Insecta.

Limited collections were made of the insects and insect larvae. These collections were confined mostly to the shallow littoral zone.

Plecoptera (identified by Professor P. W. Claassen, Cornell University).

Acroneuria lycorias Newman.

Leuctra, sp.

Ephemera (identified by Dr. F. Ide, University of Toronto).

Choroterpes basalis Banks.

Stenonema canadense Walk.

Odonata (identified by Dr. E. M. Walker, University of Toronto).

Gomphus exilis, Selys.

Hagenius brevistylus Selys.

Argia moesta putrida Hagen.

Hemiptera.

Represented by the genera *Ranatra*, *Gerris*, *Notonecta* and *Corixa* (*Callicorixa*).

Trichoptera (identified by Miss Jean Fraser, University of Toronto).

Represented by the families Sericostomatidae, (*Helicopsyche borealis* Hagen), Leptoceridae (*Oecetis*, sp.) and Limnophilidae.

Coleoptera (identified by Mr. W. J. Brown, Entomological Branch, Ottawa).

Gyrinus affinis Aube.

Macronychus glabratus Say.

8. *Mollusca.*

Professor F. C. Baker, University of Illinois, has identified the following species from Lake Jesse:

Campeloma decisum (Say).

Helisoma campanulatum (Say).

Helisoma anceps sayi F. C. Baker.

Annicola limosa porata Say.

Gyraulus deflectens obliquus (DeKay).

Anodonta marginata Say.

9. *Batrachia.*

Triturus viridescens (Rafinesque) was present in small numbers. A few *Rana clamitans* Latreille, and presumably its immature stages, were also found. *Rana palustris* LeConte was noted at the outlet of the lake, and *Rana sylvatica* LeConte was common in the adjacent woods.

10. *Pisces.*

A preliminary note on the fish population of Lake Jesse, as revealed from the fish killed by the copper sulphate treatment, has already been presented by the writer⁵. The following is a list of the species that occurred in the lake:

Salvelinus fontinalis (Mitchill).

Notemigonus crysoleucas (Mitchill).

Semotilus atromaculatus (Mitchill).

⁵M. W. Smith. *Trans. Amer. Fish. Soc.*, 65, 297-299. (1935).

Catostomus commersonii (Lacépède).

Ameiurus nebulosus (LeSueur).

Anguilla rostrata LeSueur.

Fundulus diaphanus (LeSueur).

Perca flavescens (Mitchill).

Morone americana (Gmelin).

Pungitius pungitius (Linnaeus).

The writer is indebted to the Department of Fisheries for the opportunity of making the observations. The assistance of Mr. James Catt, District Supervisor of Fish Culture, St. John, is gratefully acknowledged.