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PRELIMINARY SURVEY OF THE ALGAE OF
HUBBEL POND GAME REFUGE (BECKER COUNTY)¹

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In July 1959, the Hubbel Pond Game Refuge area was visited and a preliminary survey of the algae was made. This wildlife refuge is located in central Becker County, just south of the Tamarac National Wildlife Refuge, and approximately ten miles east of Detroit Lakes (T139N, R39W-R40W). The area is fed by the Otter Tail River which rises in the northern part of the county, and flows from the Height of Land Lake (east of the pond area) through the pond, and thence to the south. Since the pond area was flooded early in the spring of 1959, this report is only a listing of the algae noted in one collection.

The present pond (Fig. 1) has been flooded in the past during log drives down the Otter Tail River. The last occurred in the early 1900's with the exact date being unknown. Before the current inundation, the area comprised the river channel, a small 35 acre pond, and a 'burn out' resulting from a fire during the period of the dry 1930's. The Otter Tail River drains a mixed hardwood and conifer region with many small swamps being found in the drainage area.

The 660 acre pond was formed by putting stop logs in the control dam on March 19, 1959. This dam (A, Fig. 1) is located at the southwest corner of the game refuge near Becker County road 4 (T139N, R40W, S12SW). By March 30, the water level reached the elevation of 1450.0 feet where it is maintained. At this time the land was frozen to a depth of one to three feet. After flooding, much of the river bank that previously ran through the sedge and wild rice area broke loose and floated.

The area investigated in this survey is in the western portion of the pond and is only a small part of the total. This included the area around the small island (B, Fig. 1) and the main channel of the river, just east of the control dam (T139N, R40W, S12). Although the area was burned just before flooding, during the summer period

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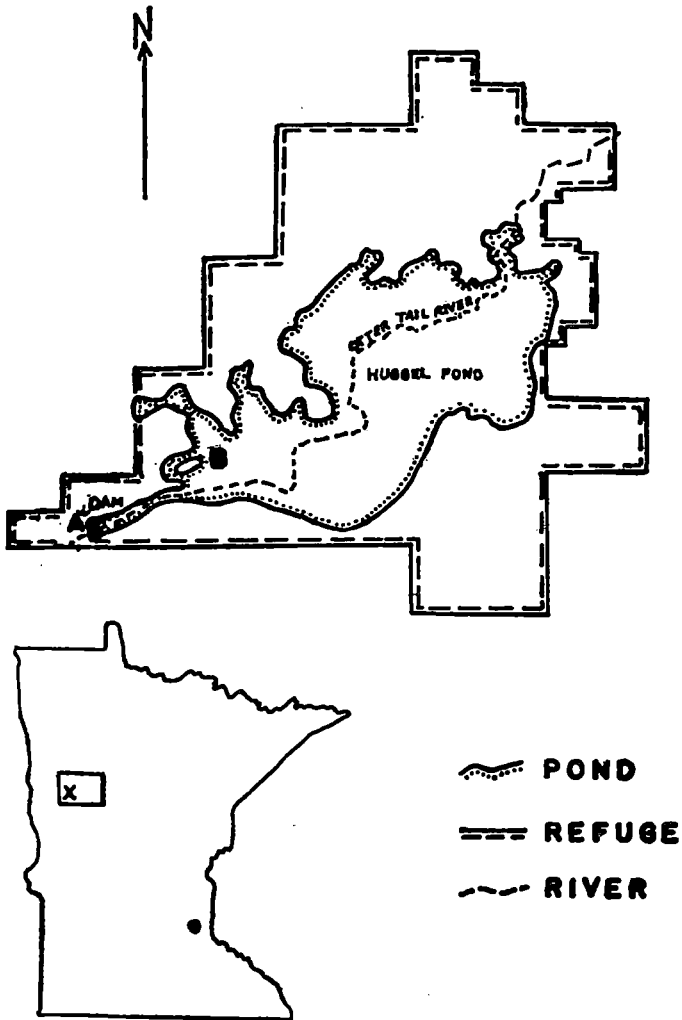


Fig. 1.—Diagram of Hubbel Game Refuge Pond and surrounding Area of the Game Refuge. (A.) Control dam at southwest corner of pond, and (B.) Natural island. Scale: $1\frac{1}{2}'' = 1$ mi.

there was extensive development of sedge, grass, cat tail, etc. Thus certain parts were too congested with rooted vegetation to be traveled by canoe. The genera of higher plants observed in the flooded area include: *Equisetum* (horsetail), *Nuphar* (pond lily), *Polygonum* (smart weed), *Utricularia* (bladderwort), *Carex* (sedge), *Eleocharis* (club-rush), *Lemna* (duck weed), *Potamogeton* (2 species) (pond weed), *Scirpus* (bul-rush), *Typha* (cat tail), and *Zizania* (wild rice).

Many floating algal masses were observed near the shore area and

amongst the rooted aquatics. These masses were composed primarily of a species of *Mougeotia* that was in various stages of sexual reproduction. Unfortunately, no mature zygotes were present, therefore specific determination was impossible. Floating in the water near the shore and in the main channel were snails whose shells were covered with algae. The algae present on one snail are reported in Table 1, with the other planktonic forms.

The collection day was quite sunny and there had been little rain during the previous weeks. The pond appeared to be approaching bloom conditions; however, the day after sampling there were extremely heavy rains that raised the water level of most natural bodies of water and undoubtedly diluted the algal flora of Hubbel Pond. The water temperature was $21^{\circ}\text{C} \pm 1\text{-}2^{\circ}\text{C}$ and the pH was 6 (pHydriion paper, Central Scientific Supply Company). The samples were thoroughly studied and identified in the living condition before being preserved.

The plankton algae are listed in Table 1 and those collected along the shore are listed in Table 2. Since it is possible that some forms listed in both tables are true plankters caught in the large algal masses, a cross-index of the two tables is included. Not all the specific designations are made for the diatoms, desmids, or those algae in which reproductive stages are requisite for identification (*Oedogonium*, *Bulbochaete*, *Mougeotia*, *Spirogyra*, *Zygnema*). In general the algae are listed alphabetically within the classes of the recognized divisions according to Smith (1950), and Thompson (1959). The coccoid blue-greens (Cyanophyta) are listed according to Drouet and Daily (1956) and Drouet (1959), while the more familiar names are listed parenthetically.

Discussion: The Cyanophyta were the dominant algae present with regard to numbers of individuals, although not in diversity of species. The taxonomic classification of Drouet and Daily (1956) is not entirely satisfactory. The majority of genera are delimited differently than previously recognized. However, no matter in what taxon a specific form is placed, its actual occurrence is of far more importance. A taxonomic revision of the filamentous forms based in part on cultural studies as well as herbarium specimens is urgently needed. Many akinetes of *Anabaena flos-aquae* were noted and when these are separated from the rest of the filament, it is quite possible to misidentify them as the coccoid *Gloeothece* Nägeli (in part, *Coccolchloris* Sprengel of Drouet and Daily, 1956:13). In the identification of *Rivularia* (Roth) C. Ag., some confusion arose as to whether one or two species were present. It is quite possible that the smaller species, *R. minutula* is actually young colonies of *R. haematitites* that have not secreted much calcium carbonate. Similarly, it is possible that some colonies of *Rivularia* are young *Gloeostrictia* J. Ag. that have not yet developed akinetes.

The most diverse group represented was the Chlorophyta. The occurrence of *Chaetophora pisiformis* is of interest as this species generally grows in cold running water (Prescott, 1951). It may be

THE MINNESOTA ACADEMY OF SCIENCE

able to grow in a wider temperature range than previously believed. It is also possible that it may be a transient form carried by the water. *Zoochlorella parasitica* reported in *Vorticella* L. has been known from other protozoans, however no reference to its occurrence in this ciliate could be found in the literature (Prescott, 1951; Smith, 1950; Tiffany and Britton, 1952).

It will be noted in Table 2 that two forms were not indentifiable to a known species (*Epichrysis* Pascher, and ?*Characium* A. Br.). This is not surprising in that many of the smaller forms are easily overlooked, especially when the material is preserved in the field and not examined while alive. More work is being done with these small forms, however much is still to be learned.

This preliminary survey of the algal flora of the Hubbel Pond shows that it is probably of intermediate productivity, or mesotrophy. A comparison of the dominant species occurring in Hubbel Pond at this time and those in the lakes of Western Canada as reported by Rawson (1956) shows many of the same species to be present (Table 3). It will be noted from this table that a predominance of mesotrophic indicators (cf. Rawson, 1956) are present in the Hubbel Pond. Thus, Hubbel Pond during its first year may be considered to be a mesotrophic area.

Future studies of the algal flora of this pond will be of interest to not only the person interested in the wildlife of the game refuge but also to the algologist. The evolution of this pond from the mesotrophic condition to that of eutrophy should be of much interest and will probably occur quickly if the numbers and types of algae observed in this collection made during the first year are an indication of the future. The several small undescribed algae that are present and may be present offer the challenge to the algologist from the taxonomic and morphologic points of view.

Summary: A survey of the organisms present in one set of samples made during the first year of the Hubbel Game Refuge Pond has been given. The sampling area included only a small part of the pond, and the dominant forms present are the Cyanophyta (quantitatively) and the Chlorophyta (qualitatively). A discussion of some of the algae encountered is given, as well as the productiveness of the area. It is concluded that the Hubbel Pond may be considered as moderately productive, or mesotrophic.

TABLE 1. Plankton algae, Hubbel Pond, Minnesota

Alga	on snail	open	near shore	channel
CHLOROPHYTA				
Chlorophyceae				
<i>Aphanochaete repens</i> A.Br.	+			
<i>Closterium ?ehrenbergii</i> Meneg.			+	
² <i>Coelastrum microporum</i> Näg.	+			+
<i>C. reticulatum</i> (Dang.) Senn		+		
<i>Cosmarium</i> sp.	+			+
<i>Crucigenia rectangularis</i> (A.Br.) Gay	+			
<i>Mougeotia</i> sp.	+ ¹			

PROCEEDINGS, VOLUME TWENTY-EIGHT, 1960

Table 1.—Continued

Alga	on snail	open	near shore	channel
<i>Oedogonium</i> sp.	+ ¹			
² <i>Oocystis borgei</i> Snow				+
<i>O. gloeocystiformis</i> Borge	+			+
<i>O. parva</i> West & West		+		
<i>O. pusilla</i> Hansgirg				+
² <i>Pediastrum boryanum</i> (Turp.) Meneg.		+		+
<i>P. duplex</i> Meyen		+		
<i>Planktosphaeria gelatinosa</i> G. M. Smith		+		
<i>Scenedesmus bijuga</i> (Turp.) Lagerheim	+			
<i>S. denticulatus</i> Lagerheim		+		
² <i>Sphaerocystis Schroeteri</i> Chodat	+	+		
² <i>Spirogyra</i> sp. (Single chloroplast)	+ ¹			
² <i>Spirogyra</i> sp. (double chloroplast)	+ ¹			
<i>Staurastrum</i> sp.				+
<i>Tetraëdron constrictum</i> G. M. Smith			+	
<i>T. limneticum</i> Borge			+	
<i>T. lobulatum</i> (Näg.) Hansgirg				
var. <i>polyfurcatum</i> G. M. Smith		+		
<i>Zoochlorella parasitica</i> Brandt				
on <i>Vorticella</i> sp.	+			+
² <i>Zygnema</i> sp.	+ ¹			
EUGLENOPHYTA				
Euglenophyceae				
<i>Peranema ?granuliferum</i> Penard				+
<i>Trachelomonas intermedia</i> Dang.	+			
CHRYSOPHYTA				
Xanthophyceae				
<i>Botryococcus braunii</i> Kütz.		+		
<i>Characiopsis longipes</i> (Rab.) Borzi	+			
Chrysophyceae				
<i>Dinobryon sertularia</i> Ehrb.				+ ¹
<i>Mallomonas acaroides</i> Perty				+
<i>Synura uvella</i> Ehrb.				+
<i>Uroglenopsis americana</i> (Calkins) Lemm.			+	+
Bacillariophyceae				
<i>Amphora ovalis</i> Kütz.	+			
<i>Asterionella formosa</i> Hass.		+ ¹	+ ¹	+
<i>Cymbella excisa</i> Kütz.	+ ¹			
² <i>Cymbella</i> sp.				+
<i>Diatoma vulgare</i> Bory				+
<i>Epithemia turgida</i> (Ehrb.) Kütz.				+
<i>Fragilaria crotonensis</i> Kitton	+ ¹	+		
² <i>F. pinnata</i> Ehrb.			+	
<i>Gomphonema constrictum</i> Ehrb.	+			
<i>G. ?olivaceum</i> (Lyngb.) Kütz.	+			
² <i>Melosira granulata</i> (Ehrb.) Ralfs		+ ¹	+	+
<i>Navicula rhyncocephala</i> Kütz.				+
<i>Pinnularia acrosphaeria</i> (Breb.) Cleve	+ ¹			
<i>Pinnularia</i> sp.		+		
² <i>Rhopalodia gibba</i> (Ehrb.) O. Müll.	+			
<i>R. ventricosa</i> (Kütz.) O. Müll.	+			
<i>Stephanodiscus</i> sp.			+	
<i>Synedra danica</i> Kütz.	+	+		
<i>S. ulna</i> (Nitzsch) Ehrb.		+		
<i>Synedra</i> sp.	+			

THE MINNESOTA ACADEMY OF SCIENCE

Table 1.—Continued

Alga	on snail	open	near shore	channel
² <i>Tabellaria fenestrata</i> (Lyngb.) Kütz.		+		
PYRROPHYTA				
Dinophyceae				
<i>Ceratium hirundinella</i> (O. Müll.) Duj.		+		
<i>Peridinium</i> sp.		+		
CYANOPHYTA				
Cyanophyceae				
² <i>Anacystis cyanea</i> (Kütz.) D. & D. (<i>Microcystis aeruginosa</i> Kütz.)			+	+ ¹
<i>A. thermalis</i> (Meneg.) D. & D. f. <i>major</i> (Lagerheim) D. & D. (<i>Chroococcus limneticus</i> Lemm.)		+ ¹		
<i>Anabaena flos-aquae</i> (Lyngb.) Breb.			+ ¹	+
<i>Coccochloris stagnina</i> Sprengel (<i>Aphanocapsa rivularis</i> (Carm.) Rab.)		+		+
<i>Gloeotrichia echinulata</i> (J. Smith) P. Richter			+	+ ¹
<i>Gomphosphaeria lacustris</i> Chodat (<i>Coelosphaerium naegelianum</i> Unger)				+ ¹
<i>Oscillatoria</i> sp.				+

¹ Abundant.

² Also in shore collection. (Table 2)

TABLE 2. Shore algae, Hubbel Pond, Minnesota

Alga	near island	near channel
CHLOROPHYTA		
Chlorophyceae		
<i>Ankistrodesmus falcatus</i> (Corda) Ralfs		+
<i>A. spiralis</i> (Turner) Lemm.		+
<i>Apiocystis brauniana</i> Näg.	+	
<i>Bulbochaete</i> sp.	+	+
<i>Chaetophora incrassata</i> (Huds.) Hazen		+
<i>C. pisiformis</i> (Roth) C. Ag.		+
<i>Chaetosphaeridium globosum</i> (Nordst.) Klebahn	+	
? <i>Characium</i> sp. (nov.?)	+	
² <i>Coelastrum microporum</i> Näg.	+	
² <i>Cosmarium</i> sp.	+	+
<i>Gloeocystis gigas</i> (Kütz.) Lagerheim	+	+
² <i>Mougeotia</i> sp.	+ ¹	+ ¹
² <i>Oedogonium</i> sp. (?macandrous)		+
² <i>Oedogonium</i> spp. (nannandrous)	+	
² <i>Oocystis borgei</i> Snow	+	
<i>O. ?novae-semiliae</i> Wille	+	
<i>Oocystis</i> sp.		+
² <i>Pediastrum boryanum</i> (Turp.) Meneg.	+	
<i>P. obtusum</i> Lucks	+	+
<i>P. tetras</i> (Ehrb.) Ralfs	+	+
<i>Scenedesmus incrassatulus</i> Bohlin		+

PROCEEDINGS, VOLUME TWENTY-EIGHT, 1960

Table 2.—Continued

Alga	near island	near channel
<i>S. obliquus</i> (Turp.) Kütz.	+	
<i>S. quadricauda</i> (Turp.) Breb.	+	+
<i>Sphaerocystis schroeteri</i> Chodat	+	+
² <i>Spirogyra</i> sp. (single chloroplast)	+	+
² <i>Spirogyra</i> sp. (double chloroplast)	+	+
<i>Tetraëdron minum</i> (A.Br.) Hansgirg	+	
<i>T. regulare</i> Kütz.		+
² <i>Zygnema</i> sp.	+	
EUGLENOPHYTA		
Euglenophyceae		
<i>Dinema griseolum</i> Perty		+
<i>Euglena</i> sp.	+	
<i>Phacotus</i> sp.	+	
CHRYSOPHYTA		
Xanthophyceae		
<i>Chlorothecium</i> sp. (not <i>pirottæ</i> Borzi)	+	
Chrysophyceae		
<i>Epichrysis</i> sp. (nov.?)	+	
Bacillariophyceae		
<i>Cocconeis placentula</i> Ehrb.	+	
² <i>Cymbella</i> sp.	+	
<i>Epithemia zebra</i> (Ehrb.) Kütz.	+	
² <i>Fragilaria pinnata</i> Ehrb.		+
<i>Fragilaria</i> sp.	+	+
<i>Gomphonema</i> sp.	+	
² <i>Melosira granulata</i> (Ehrb.) Ralfs		+
<i>Navicula</i> sp.	+	
² <i>Rhopalodia gibba</i> (Ehrb.) O.Müll.		+
² <i>R. ventricosa</i> (Kütz.) O.Müll.		+
² <i>Synedra</i> sp.	+	+
CYANOPHYTA		
Cyanophyceae		
² <i>Anacystis cyanea</i> (Kütz.) D.&D.		+ ¹
(<i>Microcystis aeruginosa</i> Kütz.)		
² <i>A. thermalis</i> (Meneg.) D.&D.		+
f. <i>major</i> (Lagerheim) D.&D.		
(<i>Chroococcus limneticus</i> Lemm.)		
<i>Anabaena bornetiana</i> Collins		+
<i>A. unisporea</i> Gardner		+
<i>Rivularia minutula</i> (Kütz.) B.&F.	+	
<i>R. haematites</i> (D.C.) C.Ag.		+

¹ Abundant.

² Also in Plankton Collection (Table 1)

THE MINNESOTA ACADEMY OF SCIENCE

Table 3. Comparison of algae of Western Canada and Hubbel Pond.

Productivity ¹	Alga	W. Canada	Hubbel
Oligotrophic	<i>Asterionella formosa</i>	+	+
	<i>Melosira islandica</i>	+	
	<i>Tabellaria fenestrata</i>	+	+
	<i>Dinobryon divergens</i>	+	
	<i>Fragilaria capucina</i>	+	
	<i>Stephanodiscus niagarae</i>	+	
	<i>Staurastrum</i> spp.	+	+
Mesotrophic	<i>Melosira granulata</i>	+	+
	<i>Fragilaria crotonensis</i>	+	+
	<i>Ceratium hirundinella</i>	+	+
	<i>Pediastrum boryanum</i>	+	+
	<i>Pediastrum duplex</i>	+	+
	<i>Coelosphaerium naegelianum</i>	+	+
	<i>Anabaena</i> spp.	+	+
	<i>Aphanizomenon flos-aquae</i>	+	
Eutrophic	<i>Microcystis aeruginosa</i>	+	+
	<i>Microcystis flos-aquae</i>	+	

¹ Rawson, 1956.

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