PRESIDENTIAL ADDRESS

IN SEARCH OF SOME BLUE-GREEN WANDERERS

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Many thousands of years ago, during the great ice age, the edges of the maximum extension of each of the last two ice sheets (Illinoian and Wisconsin) were reached here in Indiana. As the last glacier retreated, many hundreds of glacial lakes were formed in northern Indiana. In most of those same lakes, existent today, are found some of the blue-green wanderers which are a very important part of the planktonic fresh-water algae and are components of definite blue-green algal communities.

Twenty years ago a study was begun on the phytoplankton found in the waters of Indiana. This was a part of a project concerning the morphology and taxonomy of the Chroococcaceae, a family of the coccoid Myxophyceae or non-filamentous blue-green algae (1). The Myxophyceae are exceedingly primitive plants in structure and their ancestors were probably among the earliest of all living organisms. This evening, very briefly, I wish to discuss the general morphology of the planktonic blue-green algae, their distribution in Indiana as well as the species composition of several blue-green communities.

There are two very general groups of blue-green algae present in the phytoplankton of lakes and ponds in Indiana. One is the euplankton, the free floating wandering open-water microscopic algae which are consistently found in many different kinds of bodies of water. The other group is the tychoplankton composed of the chance wanderers occasionally found in the open-water plankton, but are more commonly found on lake bottoms in shallow water or intermingled in mats of filamentous algae and other vegetation. I have chosen to use the terms "open-water" and "shallow-water" to designate these two groups. Because no other class of the algae will be mentioned in this review, all remarks will pertain to the blue-greens.

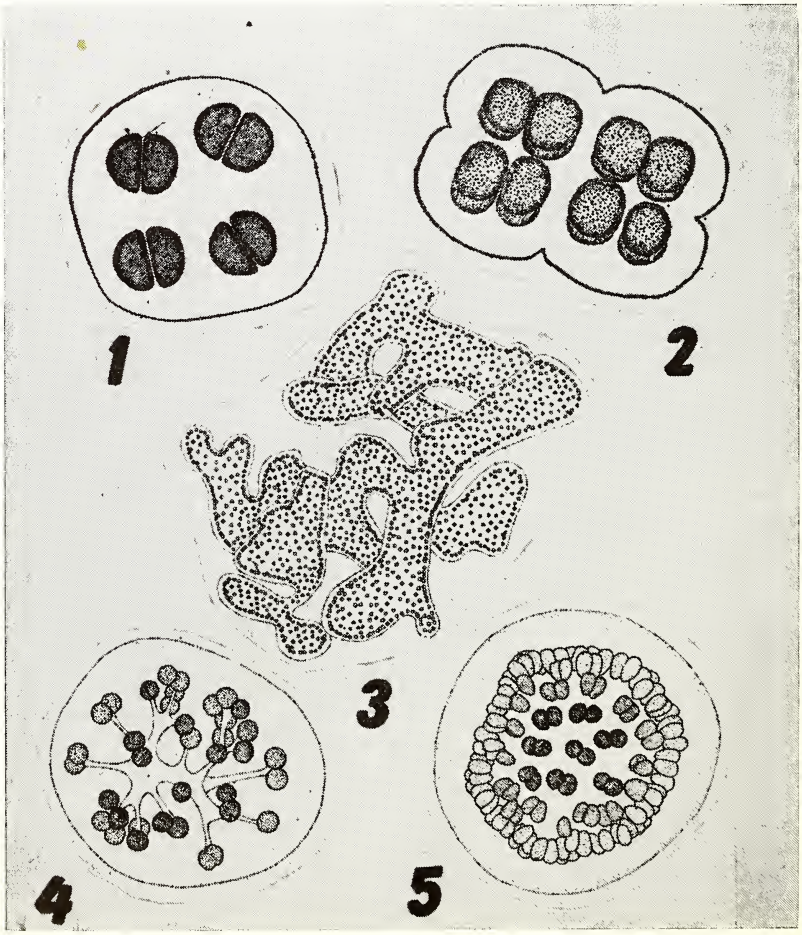
Indiana is admirably located physiographically for students of the fresh-water algae. There is in excess of a thousand lakes and ponds in this state and according to a very late official estimate, the total lake and pond surface area of Indiana is approximately 75,000 acres. A few of these lakes exceed a thousand acres in surface area and several are slightly more than a hundred feet in depth. The lake bottoms are varied, such as clay, gravel, marl, muck, mud, sand, shale and stone. As to types, there are gravel pit, strip mine, limestone quarry, artificial reservoir and perhaps of more interest to me, the lakes of glacial origin in northern Indiana. The physico-chemical nature of these latter lakes is based primarily upon the composition of the glacial drift, the exposed bed-rock or drainage area. Most of them are moderately hard or alkaline in nature with a pH of about 8 and higher. These glacial lakes contain

the greatest number of planktonic blue-green species as well as what is thought to be a typical community of open-water plankters.

To digress for a moment, it is indeed sad to contemplate the fact that ruthless forces such as the natural processes of sedimentation and accumulation of organic deposits, which led to the destruction and disappearance of more lakes in Indiana than now exist, are steadily and relentlessly destroying the ones present today. If for no other reason, this should be justification enough to collect and preserve plankton samples diligently on behalf of future research studies.

This review is based entirely upon herbarium specimens, all of which may be found in the personal herbaria of Francis Drouet, my own and the Cryptogamic Herbarium of the Chicago Natural History Museum. Published records without herbarium specimens are practically worthless, at least from a taxonomic standpoint.

At this time, we have collections from nearly 300 lakes and ponds in Indiana. Approximately two hundred and fifty of these contain at



least one species of blue-green algae. Quite a few plankton collections made by Dr. C. Mervin Palmer and Dr. David G. Frey and his students have aided in extending the distributional records for Indiana lakes and ponds.

In order to assemble for study taxonomic and ecological data, a McBee punch-card file was begun and available information was included thereon. The physical features (acres of water surface, average and maximum depth and type of bottom) of the lakes were taken from a *Guide to Indiana Lakes* (4).

Now, a few remarks about the general morphology of these planktters are given. These non-flagellated small plants are a single cell, or more generally, a group of cells joined together in a gelatinous matrix. As an illustration, think of a dozen marbles in a glass of jelly. Since the plants are almost all multicellular, reproduction is effected mainly

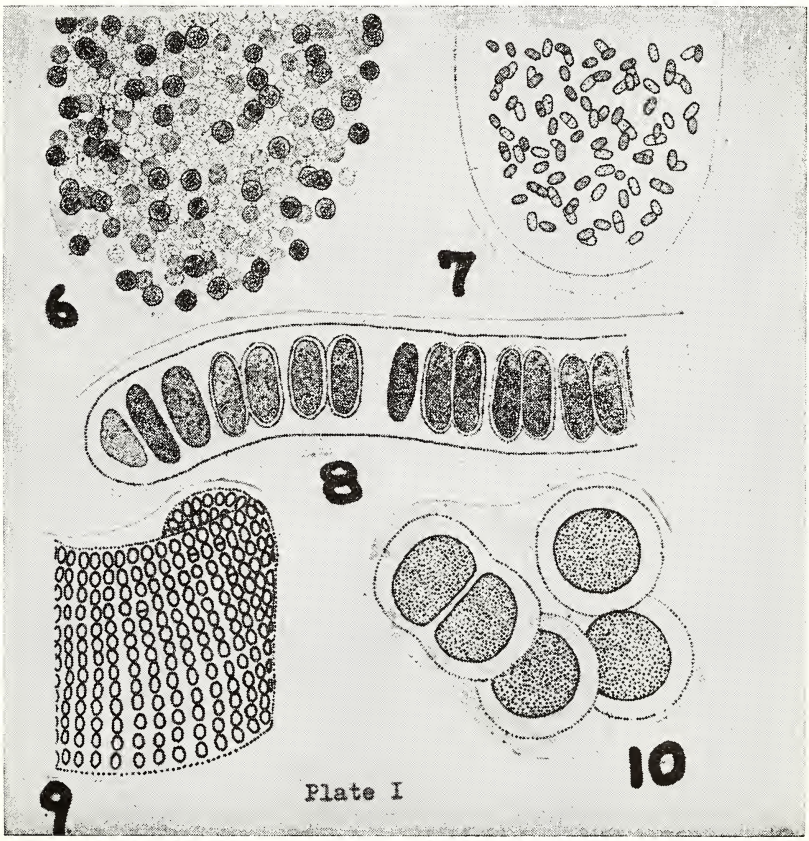


Plate I. Figs. 1 and 2. *Anacystis thermalis* f. *major* (Lagerh.) Dr. and Daily. Figs. 3 and 6. *Anacystis cyanea* (Kütz.) Dr. & Daily. Fig. 4. *Gomphosphaeria lacustris* Chod. Fig. 5. *Gomphosphaeria Wichurae* (Hilse) Dr. & Daily. Fig. 7. *Coccochloris elabens* (Bréb.) Dr. & Daily. Fig. 8. *Johannesbaptistia pellucida* (Dickie) W. R. Taylor & Dr. Fig. 9. *Agmenellum thermale* (Kütz.) Dr. & Daily. Fig. 10. *Anacystis thermalis* (Menegh.) Dr. and Daily f. *thermalis*.

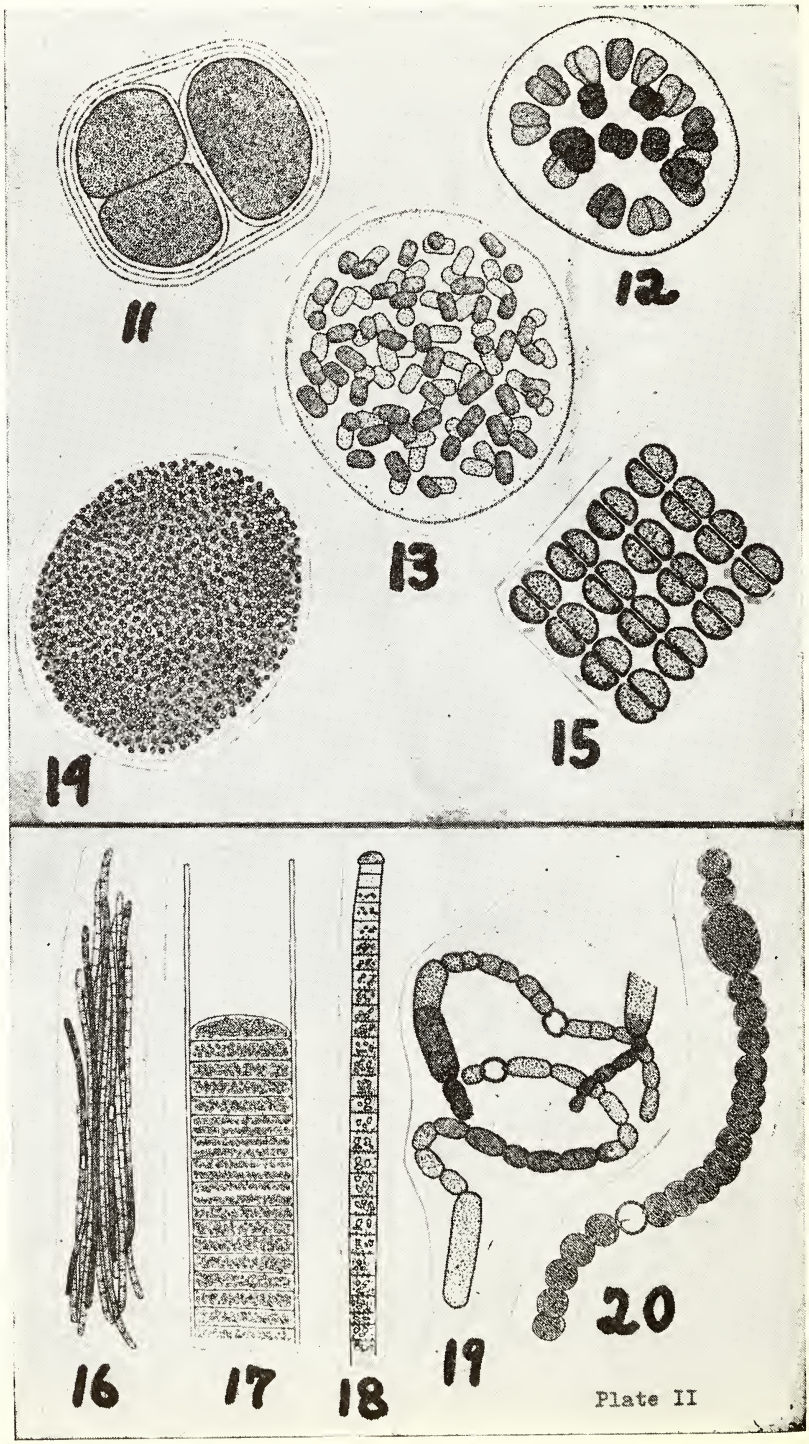


Plate II

by fragmentation. No sexual reproduction is known. The cell is a mass of protoplasm without a differentiated nucleus, and bounded by a membrane. Gelatinous material is secreted through this membrane to form a sheath or gelatinous matrix about the cell. The protoplasm contains various chlorophyll and associated pigments and, of course, always the accessory blue pigment, phycocyanin. In some species, especially those of the plankton, pseudovacuoles are found. These are thought to be gaseous in nature and contribute greatly to the buoyancy of the plants. It is of interest to note that in the list of 250 Indiana lakes and ponds containing myxophycean representatives, the top six species occurring in the greatest number of lakes contained pseudovacuoles. They are all microscopic in size, but on occasion, their accelerated growth by fragmentation may become so dense as to form so-called "water blooms" and may resemble patches of green paint floating in the water. Several years ago while collecting such blobs of "green paint" in shallow water along the shore of Starve Hollow lake near Brownstown, Indiana, we were informed quite seriously by the caretaker that they were pieces of paint scraped from the bottom of a boat.

The general morphology of these interesting algae of which some have a world-wide distribution is illustrated by the figures in Plates I and II.[1] For complete descriptions, photographic illustrations, taxonomic discussions and citation of specimens see Drouet and Daily (3). Figs. 3 and 6 are *Anacystis cyanea* (Kütz.) Dr. and Daily, apparently the most commonly occurring open-water plankter in lakes of Indiana. This alga has also been known as *Microcystis aeruginosa*. The cells appear black because of the presence of pseudovacuoles (Fig. 6, under high magnification). Under favorable conditions, cell division and reproduction by fragmentation occur so rapidly that millions of individual plants appear in the plankton within a short period of time. Those floating to the surface constitute the peculiar mass called "water bloom." This species is characterized mainly by the infinitely diverse shapes it may assume. This is perhaps the reason why this plant has been the favorite subject of so many authors describing "new" species of Microcystis.

Fig. 5, *Gomphosphaeria Wichurae* (Hilse) Dr. & Daily, known to many as *Coelosphaerium Nagelianum*, is another commonly occurring open-water non-filamentous plankter. It also generally possesses pseudovacuoles. The cells are ovoid and radially arranged in a fairly compact single layer about the periphery of the spherical plant. With increasing

[1] Mr. William E. Kruse, Eli Lilly and Company prepared the lantern slides for the address and reproduced and assembled the drawings for Plates I and II.

Original drawings numbered 3-7, 10, 14, 16, 17, 19 and 20 by G. M. Smith and numbers 9 and 18 by G. W. Prescott.

Plate II. Fig. 11. *Anacystis dimidiata* (Kütz.) Dr. & Daily. Fig. 12. *Gomphosphaeria aponina* Kütz. Fig. 13. *Coccochloris stagnina* Spreng. Fig. 14. *Anacystis incerta* (Lemm.) Dr. & Daily. Fig. 15. *Agmenellum quadruplicatum* (Menegh.) Bréb. Fig. 16. *Aphanizomenon flosaquae* (L.) Ralfs. Fig. 17. *Lyngbya Birgei* G. M. Smith. Fig. 18. *Oscillatoria rubescens* DC. Fig. 19. *Anabaena flosaquae* (Lyngb.) Bréb. Fig. 20. *Anabaena circinalis* (Harv.) Rabenh.

age, the plants become lobed and eventually fragment. This species frequently is found as a heavy water-bloom.

Fig. 4, is *Gomphosphaeria lacustris*, Chod., another open-water form. Here too, the cells are ovoid, but generally arranged at some distance from one another at the periphery of the usually spherical to ovoid plant. The gelatinous stalks to the cells are easily seen and the cells are generally a beautiful light blue-green in color.

Figs. 1 and 2 at the top of Plate I, illustrate open-water variants of *Anacystis thermalis* f. *major* (Lagerh.) Dr. & Daily known commonly as *Chroococcus limneticus*. Plant variant, Fig. 2, resembles a cube and usually contains 8 to 128 cells in the colony. Neither this alga or Fig. 4 possess pseudovacuoles, but evidently the copious gelatinous matrices serve to keep them afloat. Also, neither of them have ever been found occurring as a bloom, at least in our Indiana collections.

Figs. 7 to 10 represent four taxonomic entities which are definitely shallow-water plankters. Fig. 7, *Coccochloris elabens* (Bréb.) Dr. & Daily is generally found as bright blue-green gelatinous balls or irregular masses large enough to pick up by hand. Quite often they may be seen in shallow water on mucky bottoms of our glacial lakes. Fig. 9, *Agmenellum thermale* (Kütz.) Dr. & Daily, a rather rare plankter, is irregularly quadrangular with convolute margins and easily visible to the unaided eye. They are only one-cell in thickness, but the plants may reach a length of nearly one and one-half inches.

Fig. 10 is *Anacystis thermalis* (Menegh.) Dr. & Daily f. *thermalis*. It is usually 1 to 8-celled and mixed with filamentous algae. The sheaths are very thin and sometimes in layers.

Fig. 8, *Johannesbaptistia pellucida* (Dickie) W. R. Taylor & Dr., seemingly paradoxical from a morphological point of view, is an exceedingly uncommon marine and fresh-water plankter and was reported from a fresh-water habitat in North America for the first time in 1947. This was from Lake Wehi, a large, deep gravel pit lake in Wayne County, Indiana. In spite of its pseudofilamentous structure, it is best left associated with the coccoid Myxophyceae.

Plate II contains the remainder of the shallow-water plankters. Figure 11, *Anacystis dimidiata* (Kütz.) Dr. & Daily, perhaps recalled by some as *Chroococcus turgidus*, probably has the largest cells of all blue-green water forms. They measure from 8 to 50 microns in diameter and quite often are enclosed in hyaline, lamellated sheaths. Here again, the collector should always scoop up some of the bottom debris in shallow water in order to find this alga, because a plankton net catch will very seldom reveal it.

Fig. 12, *Gomphosphaeria aponina* Kütz. is another very pretty alga usually found in a net collection when the net, while being pulled back to shore has riled the lake or pond bottom debris.

Fig. 13, *Coccochloris stagnina* Spreng. is found in small to large, green to brownish, irregular gelatinous masses floating at the surface of the water.

Anacystis incerta (Lemm.) Dr. & Daily, Fig. 14, an open-water form, is a very small counter-part of *Anacystis cyanea*. It possesses pseudovacuoles and at times may form water blooms, but generally it is a very sparse part of plankton collections.

Agmenellum quadruplicatum (Menegh.) Bréb., Fig. 15, often labelled *Merismopedia glauca*, is the smaller counterpart of *Agmenellum thermale*. It is a flat plate, 1-cell thick and composed of usually 1-64 cells.

Figs. 16-20 portray five open-water filamentous species which are found in our lakes of Indiana and particularly the glacial ones. These filamentous forms consist of uniseriate unbranched filaments of cells invested by a common sheath. They belong to the second of the two main divisions of the Myxophyceae. These five species are excellent floaters probably because of the presence of pseudovacuoles within their cells and the long hair-like nature of the plants. The coiled character of *Anabaena circinalis* (Harv.) Rabenh. (Fig. 20) and the lengthy sheaths of *Lyngbya Birgei* G. M. Smith (Fig. 17) also are probably beneficial for floating. *Anabaena flosaquae* (Lyngb.) Bréb. (Fig. 19) is present in the great majority of our glacial lakes and quite often produces a bloom stage. Fig. 18, *Oscillatoria rubescens* DC. is one of probably two filamentous blue-greens which persist in the plankton all year.

Aphanizomenon flosaquae (L.) Ralfs (Fig. 16), another plankter whose specific name implies water flower or bloom very seldom appears as a heavy bloom in Indiana, but when it does occur, the water appears to be filled with small pieces of finely chopped grass. This drawing illustrates a small colony of filaments which would resemble a piece of grass to the unaided eye.

Now let us turn to Plate III which will aid in presenting the present status of work with the phytoplankton of Indiana based upon herbarium specimens. We now have collections from more than half of the 92 counties. The dots in the northern half of the map, of course, are based almost entirely upon glacial lakes. The remainder are artificial, chiefly. Prior to 1938, only 8 counties were represented. A solid black dot signifies collections containing one or more non-filamentous species—there are 38 of these. A circled black dot indicates non-filamentous plankter species found previously to 1938. Three of these are in the northern part of the state, the remaining 5 begin in Wayne County in the east, moving westward through Marion, Morgan and finally Vigo and Sullivan on the far west side. There are only 8, which shows a gain of 30 counties. The letter "F," found in only 3 counties, LaPorte, Owen and Jay signifies filamentous but no non-filamentous species present. To complete the picture, there are 8 cross-hatched circles representing lake collections which contained no Myxophyceae whatsoever, but did contain other classes of algae. A county dot may represent any number of collections from any number of lakes and ponds in that area. The dotted line near the bottom of the map outlines the unglaciated area in which there are very few lakes or ponds.

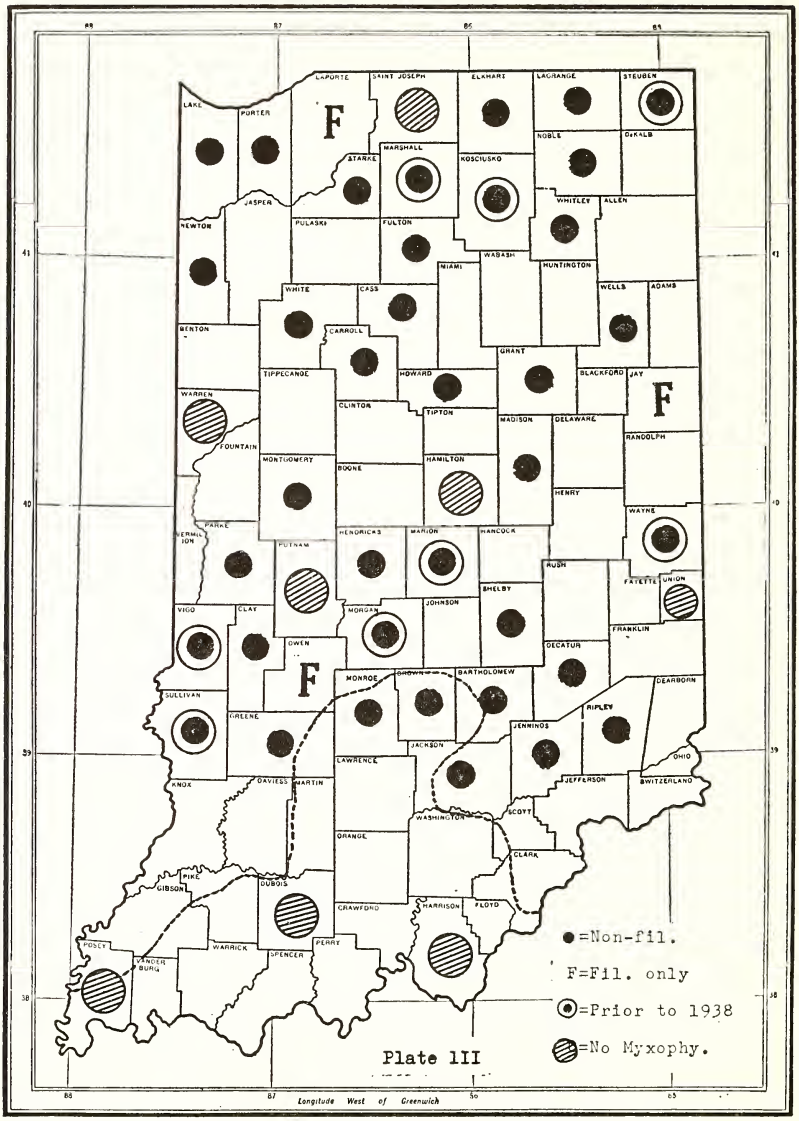


Plate III. Counties of Indiana represented by at least one phytoplankton collection.

Plate IV portrays the distribution in the United States of the blue-green wanderers found in Indiana. The planktonic filamentous species are not included here because a critical distributional study of these species has not been made of this group except for Indiana. Note the dotted line which begins in Montana, continues eastward through the Dakotas, Illinois, Indiana, Ohio, New York and eventually northern

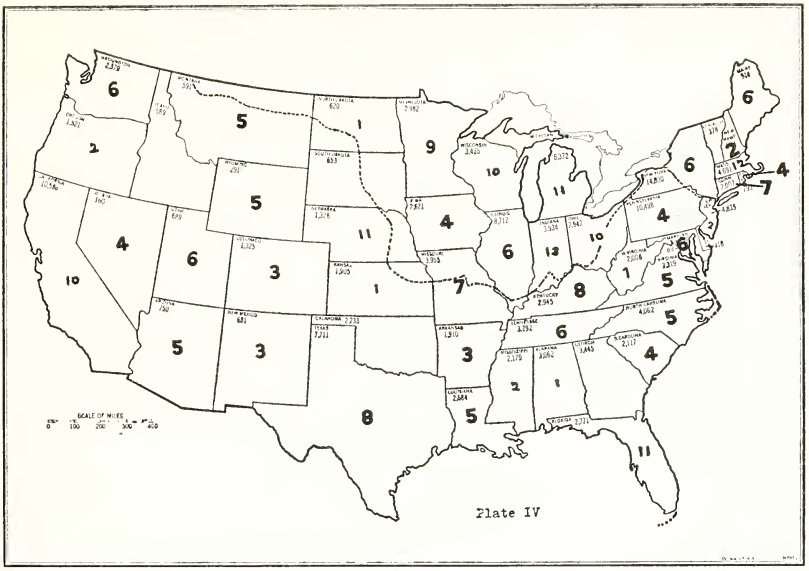


Plate IV. A United States map showing states containing species of the planktonic coccoid myxophyceae.

New Jersey. The land above the line was glaciated. The figure in the center of a state indicates the total number of plankter species found therein. Forty-two states are represented by at least one plankter. Only 4 species are represented in more than half of the states and just one of these 4 is an open-water form, *Anacystis cyanea*. Indiana heads the entire list by virtue of taxonomic entities representing 12 species. It is worthy to note that the 5 states containing the 4 chief open-water plankters are located within the glaciated area. The other 4 states are: Massachusetts, Ohio, Michigan and Wisconsin. Ten of the above plankters are also recorded for the Canadian provinces, the range extending from New Brunswick in the east, to British Columbia in the far west. At least two of these plankters have been found in Alaska. It cannot be too strongly emphasized that these distributional figures are largely determined by the thoroughness with which a region has been studied. However, the presence of literally thousands of lakes having a glacial origin undoubtedly accounts for this picture.

The world-wide geographical distribution of these non-filamentous plankters is probably not so unusual, because it is rather well established that completely asexual-reproducing organisms (as are the Myxophyceae) have wide distribution patterns. Of course, the rate of speciation is much slower, but when a single celled, asexual-reproducing organism reproduces so rapidly by simple cell division, the chances of survival, species constancy, and dispersal are very great. As with the diatoms (5), temperature and other factors of the environment are important to the blue-green plankters and inasmuch as water is less variable in these respects than the air and soil environments are to land plants, the rate of survival is probably higher with the algae.

Table 1 points out the occurrence of the 4 chief non-filamentous

TABLE 1

Non-filamentous, Open-water Plankters In Glacial Lakes

	Sand	Gravel	Muck	Marl	Mud	Clay	Totals
	20	22	21	42	42	1	116
1. *Anacystis cyanea*	20	21	19	35	6	1	102
2. *Gomphosphaeria Wichurae*	18	15	21	35	10	1	100
3. *Gomphosphaeria lacustris*	11	11	9	20	5	0	56
4. *Anacystis thermalis* f. *major*	9	12	8	20	3	0	52

open-water plankters in 116 glacial lakes of Indiana based upon the type of lake bottom. The total number of lakes is given with the type, for example, Sand—20, Gravel—22, etc. In the far right-hand column are the complete totals. It will be noted that the top 2 species, numbers 1 and 2, occur in nearly all of the 116 lakes. The last 2 plankters occur in approximately half of the lakes. It is quite evident that the 4 plankters are distributed fairly evenly between the various types of bottom. The single glacial lake with clay bottom requires additional collections for study before the present figures can be fully explained. These figures are based upon the occurrence of any one of the 4 algae at any time of the year, not upon all occurring simultaneously in the same collection. However, upon examining communities of species, it was observed that the first 2 species in this chart occurred simultaneously in 100 lakes; the first 3 occurred together in 42; the first 2 and the last one in 44 lakes and finally all 4 together in 30 lakes. If the 5 open-water filamentous forms are added to this list, only two lakes in the state to date have had all 9 open-water blue-green species occurring in the same collections. These lakes are Wawasee and Cicott, one of the largest and one of the smallest in surface area of our Indiana lakes.

In Table 2, the occurrence of the same 4 important non-filamentous

TABLE 2

Occurrence of Non-filamentous, Open-water Plankters in Different Types of Lakes

	Glacial	Artificial	Gravel Pits	Strip Mines	Limestone Quarry Ponds
	116	20	10	2	7
1. *Anacystis cyanea*	102	14	3	1	3
2. *Gomphosphaeria Wichurae*	100	12	1	0	4
3. *Gomphosphaeria lacustris*	56	2	0	0	0
4. *Anacystis thermalis* f. *major*	52	1	0	0	0

open-water plankters is compared in the five general types of lakes. The number with the name of each lake type, refers to the total number of lakes chosen at random for that category. The remaining numbers indicate the total number of lakes in which the organism appears. It is

readily observed that the glacial lakes, at this time, support a higher occurrence rate of these 4 plankters than the remaining 4 types of lakes. This is especially noticeable in the case of algae, numbers 3 and 4, in which the occurrence rate is nearly 50% greater in favor of glacial lakes.

The second category of lakes referred to as "artificial" are man-made reservoirs, for example: Geist, Freeman and Schaffer, Sylvan, Yellowwood and Shakamak. Most of these lakes have a mud bottom and the water is relatively soft. It is noteworthy that plankters, numbers 3 and 4, are absent from the last 3 categories of lakes and ponds and almost entirely from the artificial lake column. Without doubt, these two plankters aid greatly in distinguishing glacial lakes from all other kinds of lakes, at least in Indiana. Of added interest, the 3 artificial lakes in which these 2 important plankters have been found are all in the glaciated area and the pH of at least one of them, Geist Reservoir, varies between 7.7 and 8.0 and this approaches the alkalinity of some of our glacial lakes in the northern part of the state.

In comparing 20 of the 116 glacial lakes with the 20 artificial lakes shown here, the picture for the five open-water filamentous plankters is comparable to that of the 4 non-filamentous ones in that the occurrence rate ranges from 16 to 90% higher in favor of glacial lakes.

Table 3 shows us a nearly complete listing of all plankters found

TABLE 3

Myxophycean Plankters of Indiana Waters

Form	Plankter	No. of lakes	Plankter	No. of lakes
Open-water	*Anacystis cyanea*	142	*Lyngbya Birgei*	93
	Gomphosphaeria Wichurae	125	*Anabaena flos-aquae*	90
	Gomphosphaeria lacustris	64	*Anabaena circinalis*	82
	Anacystis thermalis f. *major*	55	*Aphanizomenon flos-aquae*	68
			Oscillatoria rubescens	57
Shallow-water	*Agmenellum quadruplicatum*	45	*Oscillatoria tenuis*	11
	Anacystis dimidiata	30	*Gloeotrichia echinulata*	9
	Goomphosphaeria aponina	28	*Oscillatoria princeps*	8
	Agmenellum thermale	19	*Gloeotrichia natans*	6
	Anacystis thermalis f. *thermalis*	11	*Lyngbya aestuarii*	6
	Coccochloris elabens	8	*Oscillatoria Agardhii*	6
	Coccochloris stagnina	5	*Gloeotrichia pisum*	4
	Johannesbaptistia pellucida	3	*Phormidium mucicola*	4
	Anacystis incerta	2	*Spirulina major*	4
	Anacystis montana f. *minor*	1	*Lyngbya purpurea*	2
			Oscillatoria splendida	2

in 200 Indiana lakes and ponds. Evidently all of the 29 plankters listed belong singly or collectively at one time or another during the year to the Myxophycean plankton community.

There are 13 non-filamentous and 16 filamentous plankters. The 9 above the dividing line are open-water forms while those below it are shallow-water. The number with each alga indicates the number of lakes and ponds in Indiana in which that particular kind of plant has been found.

Now I wish to discuss Table 4 which shows the occurrence rate of

TABLE 4

Myxophycean Plankton Communities
"Open-water" Plankters

Percentage Occurrence	In Glacial Lakes	%	In Artificial Lakes	%
80-100%	*Anabaena flosaquae*	100	None	
	Lyngbya Birgei	90		
	Anacysts cyanea	87		
	Gomphosphaeria Wichurae	86		
	Anabaena circinalis	80		
40-80%	*Aphanizomenon flosaquae*	60	*Anacystis cyanea*	70
	Oscillatoria rubescens	60	*Anabaena circinalis*	65
	Gomphosphaera lacustris	48	*Gomphosphaeria Wichurae*	60
	Anacystis thermalis f. *major*	44		
0-40%	None		*Aphanizomenon flosaquae*	35
			Oscillatoria rubescens	30

these plankters in some of our Indiana lakes and ponds and the influence this may have in the establishment of two typical myxophycean communities and their compositions.

A typical Indiana glacial lake myxophycean community contains the following species which occur in over 80% of the 116 lakes studied. They are: *Anabaena flosaquae, Lyngbya Birgei, Anacystis cyanea, Gomphosphaeria Wichurae,* and *Anabaena circinalis.*

Also belonging here are those plankters possessing an occurrence rate of over 40%, but less than 80%, which are *Aphanizomenon flosaquae, Oscillatoria rubescens, Gomphosphaeria lacustris* and *Anacystis thermalis.* I feel quite certain that some, or perhaps all in the lower class will be in the higher one when periodical studies are conducted for all glacial lakes.

As previously pointed out, all nine open-water plankters have occurred as a community in the phytoplankton of two glacial lakes. However, such an abundance of species at one time is not necessary to indicate a typical glacial lake community.

A typical Indiana artificial lake community according to those lakes chosen for that category in this study would probably contain the following species: *Anacystis cyanea, Gomphosphaeria Wichurae* and

Anabaena circinalis. In spite of the sporadic occurrence of all nine important open-water plankters in artificial lakes, it is not difficult to distinguish artificial from glacial lakes, because the occurrence rate of the top 3 species is only 40-80% instead of the 80 to 100% in the glacial lakes. The next two species occur in only 30-35% of the lakes and the last four plankters in 5 to 15%. It is quite noticeable in the lake communities that:

1. *Anabaena flosaquae*, so prevalent in the glacial lake occurs in only 10% of the artificial. The same is true for *Lyngbya Birgei*, except the percentage is 15% in the artificial lake community and 90% for glacial.

2. The 5 and 10% occurrence rate of *Gomphosphaeria lacustris* and *Anacystis thermalis* f. *major* respectively in artificial lakes is very significant, because these two non-filamentous plankters are chiefly glacial lake species.

3. Generally speaking, glacial lake communities will contain more species at one time than the artificial lake communities. This ratio is about 7 to 3 in favor of the glacial lakes.

To my knowledge, no periodical qualitative or quantitative studies of any permanent Indiana lakes have been made for the phytoplankton. However, in 1951 an opportunity was afforded me to study a series of weekly plankton collections made from Lake Wawasee, our largest lake of glacial origin in water surface area (2). The earliest plankton net collection was made on April 28 and the latest on October 30. At least 3 species of the open-water, high-occurrence rate category appeared in all of the weekly catches. Four other open-water forms appeared a little later in the spring and persisted until fall.

There is evidence that at least one non-filamentous form, *Gomphosphaeria lacustris* and two filamentous forms, *Oscillatoria rubescens* and *Aphanizomenon flosaquae* are found in some glacial lakes all months of the year.

In Indiana, the area in acres of water surface of lakes and ponds apparently has very little to do with the planktonic species present. The arbitrary class of 5 to 250 acres of surface area, to which the great majority of the lakes and ponds belong, supports the same number of plankton species as do those which may exceed a thousand acres in area. In fact, the class of 0-5 acres contains all but one of the 13 kinds of non-filamentous plankters.

The maximum depth of 200 lakes and ponds reviewed here does not seem to influence greatly the number of species found therein. For example, the arbitrary category of 0-25 feet contains all 13 kinds of non-filamentous plankters. Only 8 lakes, 7 of which are of glacial origin, fell in this class. The depth is not recorded for the majority of the small artificial ponds.

In comparing the average depth of these same lakes, including the glacial, they are divided nearly equally between the arbitrary classes of 0-25 and 26-50 feet. Evidently, the average depth has very little effect, or none, upon the maximum number of plankter species present.

To briefly summarize, the species composition of the planktonic myxophycean communities of some lakes and ponds of Indiana has been discussed. It is concluded that in lakes of glacial origin in Indiana, at this time, there exists a definite combination of species.

The artificial or man-made reservoirs also support a fairly definite and different community of blue-green plankters.

The list of all known myxophycean plankters and their distribution in Indiana lakes and ponds is based upon herbarium specimens. The distribution figures appearing on the United States map were also noted from herbarium specimens.

Citation of Specimens

This is a complete list of all specimens by collection numbers which are the basis of this paper: W. A. DAILY 5, 15, 16, 82, 92, 861, 862, 876, 877, 965, 1004, 1005, 1014, 1019, 1022-1024, 1026, 1031, 1035, 1038, 1039-1041, 1050, 1056, 1062, 1154, 1161, 1162, 1165, 1166, 1168, 1182, 1185, 1457, 1461, 1465, 1468, 1473, 1474, 1476, 1477, 1479, 1480, 1482, 1485, 1495, 1503, 1507, 1510, 1514, 1516, 1518, 1522-1524, 1527, 1529, 1533, 1542, 1544, 1553, 1560-1563, 1566, 1570, 1581B, 1663, 1879, 1880, 1906, 1910, 1912, 1912A, 1913, 1914, 1914A, 1917, 1917A, 1918, 1919, 1919A, 1922, 1924, 1931, 1931A, 1932, 1932A, 1933, 1933A, 1934, 1934A, 1936, 1936A, 1943, 1943A, 1945, 1945A, 1946, 1948, 1952, 1952A, 1954A, 2104, 2105, 2115, 2115A, 2116, 2119, 2126, 2126A, 2129, 2168, 2169, 2171, 2174-2177, 2180, 2183, 2190, 2191, 2195, 2203, 2207, 2209, 2211, 2214, 2217, 2219, 2220, 2222, 2226-2229, 2232, 2238, 2245, 2250, 2258, 2260, 2262, 2265, 2268, 2270-2275, 2277, 2278, 2325, 2339, 2343, 2357, 2368, 2375, 2378, 2380, 2386, 2387, 2441, 2433, 2443-2445, 2449, 2450, 2452, 2454, 2457-2459, 2461, 2462, 2464, 2465, 2467-2470, 2474, 2479A, 2481, 2485, 2487, 2488, 2490, 2520, 2523, 2524, 2525, 2528, 2530, 2531, 2533, 2539, 2544, 2546, 2547, 2555, 2558, 2558A, 2559, 2561-2563, 2565-2567, 2569, 2572, 2573-2576, 2582, 2585, 2588, 2590, 2603-2605, 2614, 2616, 2618, 2619, 2621, 2626, 2630, 2631, 2636, 2654-2657, 2659, 2661, 2666, 2669, 2671, 2672, 2674, 2675, 2677, 2678, 2680-2682, 2686, 2687, 2689, 2690, 2692, 2693, 2741, 2744, 2745, 2747, 2748, 2750, 2751, 2755, 2759, 2760. H. W. CLARK & B. W. EVERMANN 27, 41, 52, 255; Lake Maxinkuckee, 31 July, 18 Oct. 1906. W. R. EBERLY 1-5, 7, 8; Myers Lake, 20 Aug. 1954; Kreighbaum Lake, 7 Aug. 1953. D. G. FREY 1-77. M. FRITSCHE 1-3, 3A, 4. S. A. JOYNER, Lonidaw Lake 2, 6, 15, 27, 31, Aug. 1949; Lake James, 6 Aug. 1949. L. J. KING 371, 739. L. LEE, Lagoon in Shades State Park, 17 June 1942. M. S. MARKLE 10. H. B. METCALF 2, 3. E. E. MINER 1-26. J. MCCORMICK, Lagoon 11, 21 July, 24 Aug. 1951. C. M. PALMER B 18, B 44, B 49, B 49b, B 50, B 50(4), B 54, B 420, B 425, 433, B 434, B 435, B 436, B 437, B 1014, B 1015, 1019, 72D1, 162, 245; Winona Lake, summer 1935. B. H. SMITH 647.

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1. DAILY, W. A. 1942. The Chroococcaceae of Ohio, Kentucky, and Indiana. Amer. Midland Nat. **27**(3):636-661.
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3. DROUET, F. and W. A. DAILY. 1956. Revision of the Coccoid Myxophyceae. Butler Univ. Bot. Stud. **12**:1-218.
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5. PATRICK, RUTH. 1948. Factors affecting the distribution of diatoms. Bot. Review **14**:473-524.