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The Plankton of the Sangamon River in the Summer of 1929

BY

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THE PLANKTON OF THE SANGAMON RIVER IN THE SUMMER OF 1929

Samuel Eddy

The Sangamon River, a small river in the central part of Illinois, has special interest to students of aquatic biology because it exhibits in a remarkable way the effects of the installation of a sewage treatment plant in alleviating pollution and at the same time the effects of the erection of a dam to impound water for municipal and industrial uses. The present study is an attempt to determine to what extent these effects are reflected by changes in the abundance of certain kinds of microscopic organisms, collectively called plankton, which live suspended in the water. As is well known, some kinds of plankton organisms, if present in sufficient numbers in reservoirs, may give disagreeable flavors to the water; other kinds may aid in the natural purification of polluted waters; and in streams and lakes generally plankton plays a rôle of more or less importance as food for larger organisms, including fishes. In our larger streams, such as the Rock River and the Illinois River, the plankton is a very important factor in fish production. In the Kaskaskia River, as an example of our smaller streams, the plankton is so scanty that it can have very little importance. The Sangamon River illustrates an intermediate stage in which the plankton is abundant enough to enter into the food chains of fishes to some extent but does not result in a yield of fishes appreciably greater than in the Kaskaskia. The writer's observations of plankton development in the upper part of the Sangamon from 1923 to 1929 were included in a general study on "Fresh-water Plankton Communities," submitted as a thesis in the Graduate School of the University of Illinois but not yet published. Further collections, made during the summer of 1929, showing the variety and abundance of organisms present at selected stations along the lower part of the river as well as the upper part, are reported in this paper.

The Sangamon River rises in McLean County and at first flows eastward into the northwestern part of Champaign County, where it turns southward and passes the villages of Foosland, Fisher, and Mahomet. It then flows in a general southwestward direction across

Piatt County, passing Monticello, and across Macon County, passing Decatur. In Sangamon County, it receives its first large tributary, the South Fork, and passes Riverton and Springfield. It flows northward across Menard County, passing Petersburg. At its junction with Salt Creek it turns westward. It continues in a generally westward direction, forming the boundary between Mason County and Cass County, passing the village of Chandlerville, and finally emptying into the Illinois River about ten miles above Beardstown.

The length of the river is about 237 miles. The distance from the source to Decatur is about 103 miles, from Decatur to Springfield about 59 miles, and from Springfield to the mouth about 75 miles. The total drainage area is about 5,390 square miles, of which 1,940 square miles belong to Salt Creek, and 846 square miles belong to South Fork.

The current of the river at normal levels is never very great, since it flows through glacial till and occupies a well-worn valley. The river falls 120 feet in the first 10 miles and 300 feet in the balance of its course, or less than 2 feet per mile. The fall is far from regular, however, and there are many stretches where the gradient is very slight. The bottom is usually sand or fine silt, the latter predominating over most of the river.

Previous to 1923, no obstructions were encountered in the upper course of the river except several small ruined mill-dams. At Decatur a small dam raised the water level a few feet and held back a small supply for municipal purposes. Below this dam the city of Decatur discharged all its sewage, which usually was greater in volume than the water flowing over the dam. During times of low water, the sewage constituted the entire flow of the river below the dam, as all of the water above the dam was then diverted through the city water supply system. As a result of the pollution, the river below Decatur was devoid of normal aquatic life. Jewell (1920) reported no living organisms immediately below Decatur except those accustomed to conditions of pollution. Thirty miles below Decatur conditions were found to be improving, but even at Springfield, almost 60 miles downstream, the normal life was not completely restored. The writer was well acquainted with the river previous to 1920 and clearly remembers the extreme condition of pollution existing for at least 20 miles below Decatur. The bottom was covered with a thick layer of foul sludge, and the opaque water, which varied in color from inky black to milky white, depending on the season, contained large quantities of floating mouldy wastes.

At Springfield a second dam has obstructed the river for many years, raising the level of the water about six feet and forming a narrow pool that extends upstream several miles. Pollution below Spring-

field has been largely eliminated since the city's sewage treatment plant was put into operation, July 10, 1929. The wastes from Petersburg and Chandlerville are not sufficient to pollute the river to an appreciable extent.

In 1923 the city of Decatur, in order to increase its water supply, completed a large dam across the river just above the site of the old one, creating a lake one-half mile wide and 12 miles long. Later, in 1924, a sewage disposal plant was put into operation, handling one-third of the city wastes, and in 1928 the plant was enlarged to accommodate all the wastes. This relieved the extreme condition of pollution. The dredging of a new channel from Harristown for 20 miles downstream has aided by furnishing a new bed, free from the accumulated bottom sludge. These changes have resulted in a fairly clean stream, flowing through a lake-like reservoir in its upper region.

In the writer's previous study of the plankton of the upper river from 1923 to 1928, inclusive, weekly or semi-monthly collections were made from the river at Decatur and above. Very little plankton was found above Lake Decatur in those years. At Mahomet, about 50 miles from the source, no plankton forms occurred, though bottom organisms, especially diatoms and protozoans, occasionally appeared in the collections. The same was true at Monticello during the greater part of the year, but in mid-summer or early autumn, when the water was low, a scanty population of plankton organisms was found there. This was the first point in the course of the stream where plankton ever appeared. At Rhea's Bridge on the upper end of Lake Decatur, plankton was present in the water during most of the year but was never as abundant as at Lost Bridge, one mile above the dam, where many plankton species were abundant from March until December. During January and February the plankton of the lake was scanty and consisted chiefly of protozoans.

In 1929, trips were made in June, July, and September, for the purpose of collecting samples at intervals of about 20 miles over the entire river. The collections were made from bridges at or near Mahomet, Monticello, Lake Decatur, Harristown, Illiopolis, Riverton, Springfield, Petersburg, and Chandlerville. The method was to dip the water from mid-channel by lowering a ten-liter bucket on a rope. No stratification of plankton was noticed except at Lake Decatur, where the current was negligible and the plankton was much heavier near the surface. The principal collecting station on the lake was at Lost Bridge, and at this station a series of collections was made from bottom to surface and averaged. Each set of collections made at the other stations consisted of a 100-liter silk-net collection and a one-liter

collection which was preserved with formalin and allowed to settle and then decanted in order to obtain the nannoplankton. The organisms were counted by the usual method in a Sedgwick-Rafter slide. All data were computed per cubic meter. The volume of the plankton in the silk-net collections was obtained by centrifuging for 3 minutes at 2000 revolutions per minute. The volume of the decanted plankton was not determined because of the large amount of silt present.

At the times of collecting, the river was 1-2 feet deep and 25-40 feet wide at Mahomet, the uppermost station, and 8-10 feet deep and 200-210 feet wide at Chandlerville, the lowermost station. The deepest portion from which collections were made was in Lake Decatur where the depth in the channel ranged from 10 to 18 feet. Below Decatur the river was quite shallow. It was 2-4 feet deep and 60-75 feet wide at the Harristown and Illiopolis bridges. At Riverton, after the union with the South Fork, the river was 4-6 feet deep and 100-114 feet wide. At the bridge north of Springfield the water (backed up by the dam) was 5-7 feet deep and 100-110 feet wide. At Petersburg the river was 100-150 feet wide and 7-10 feet deep in mid-channel.

The current, which was moderate at most places, was very slow in some stretches of the river and somewhat swifter in others with a greater fall. At Mahomet and Monticello, the current averaged about one-half mile per hour during the summer. In the main part of Lake Decatur no current could be detected. At Harristown and Illiopolis the current averaged about one mile per hour; at Riverton one-half mile per hour; and at Springfield just above the dam it was too slow to estimate. At Petersburg and Chandlerville it averaged a little more than one-half mile per hour.

The river level was slightly above normal when the plankton collections were made in June and July. The readings of the gage at the Decatur sewage disposal plant averaged 587.3 feet for June 25-27 and 587.6 feet for July 26-28. April and May were the highest months for the year 1929, the gage at the disposal plant reaching a maximum of 593.5 feet in those months. The lowest stage for the year was in September, although the gage readings on the dates of collections, September 10-12, averaging 581.0 feet, were not the lowest of the month. Thus the river was about 3½ feet lower in September than it was when the June and July collections were made. The Decatur lake, however, did not fluctuate much, as the gage reading above the dam was 610.25 in June and July and 609.95 in September.

The temperature of the water at the time of collecting was about what would be expected under normal summer conditions. In June it ranged from 24° to 25° C. and in July from 25° to 28° C. No tem-

perature data were obtained on the September trip, as the thermometer was broken in the field.

Hydrogen ion determinations were made at all stations and were found to run consistently about pH 7.6. This seemed normal for the river, as the readings agreed with those obtained by the writer in previous observations. On the upper river from 1923 to 1929, the readings in summer always ranged around pH 7.6, dropping to pH 7.0 or lower in winter.

Determinations of dissolved oxygen in the water at each station on the June trip were as follows: Mahomet 4.15 cc. per liter, Monticello 4.06, Decatur 4.62, Harristown 4.06, Illiopolis 4.62, Riverton 4.25, Petersburg 4.25, and Chandlerville 6.47. No determinations can be given for Springfield, as the June collections and data from that station were accidentally lost. There was only a slight fluctuation in the amount of dissolved oxygen in the water at the various stations. At all points examined, the supply seemed sufficient for the support of abundant aquatic life.

A summary of the plankton collections is given in Table I, and the constituent organisms are listed in Tables II, III, and IV.

The general taxonomic composition of the plankton found in the river below Monticello was the same as that observed in most shallow lakes and larger streams of North America. Certain typical forms were conspicuous in their proper seasons, namely: two protozoans, *Codonella cratera* and *Ceratium hirundinella;* rotifers of the genera *Brachionus, Synchacta, Polyarthra,* and *Keratella;* various cladocerans, particularly *Moina affinis, Daphnia longispina,* and *Bosmina longirostris;* and two copepods, *Diaptomus siciloides* and *Cyclops bicuspidatus.* A few bottom organisms, usually diatoms and protozoans, were often conspicuous in the plankton collections from the shallow portions of the river where the current could easily sweep them up from the bottom. They did not often appear in the collections from Lake Decatur but were quite common in the collections from the other stations, especially at Monticello, Harristown and Illiopolis.

The collections made in June showed no plankton at Mahomet and only a very scanty plankton at Monticello. The first heavy plankton occurred at Lost Bridge in Lake Decatur. Both the volume of the plankton and the number of species in the collections decreased downstream as far as Petersburg and Chandlerville, where the number of species increased slightly, though the volume of the plankton continued to decrease. Of the 50 species observed in the collections from the entire river in June, 36 appeared in Lake Decatur and 12 appeared farther downstream in relatively small numbers. Evidently a large

amount of the downstream plankton owed its origin to the increase in Lake Decatur. Characteristic species which were most conspicuous in Lake Decatur and showed a decrease downstream were *Diffiugia lobostoma, Codonella cratera, Brachionus angularis, Polyarthra trigla, Keratella cochlearis, Moina affinis, Daphnia longispina, Bosmina longirostris, Cyclops bicuspidatus,* and *Lysigonium (Melosira) granulatum.* Several other members of the plankton conspicuous in the lake did not appear at all below. The flagellates, *Trachelomonas volvocina* and *Euglena viridis,* decreased downstream to Petersburg and then started to increase. The only form that showed a decided increase below the lake was one of the algae, *Actinastrum hantzschi.*

The collections made in July showed that the plankton then had a distribution very similar to that of the preceding month. At Mahomet there was no plankton at all, and at Monticello it was very scanty. Of the 58 species found in the July collections, 47 first became abundant in Lake Decatur. Only 8 species occurred downstream which did not occur in the lake, and these were usually rare or inconspicuous, never forming an important part of the plankton. Many forms which were conspicuous in Lake Decatur showed a decided decrease below Decatur and apparently had their origin in the lake. Examples of these were the following: *Pandorina morum, Pleodorina illinoisensis, Codonella cratera, Diffiugia lobostoma, Trachelomonas cusifera, Euglena viridis, Ceratium hirundinella, Endorina elegans,* three species of the genus *Brachionus* and species of *Filinia (Triarthra), Asplanchna, Polyarthra, Synchaeta, Pedalia,* and *Trichocerca, (Rattulus),* and *Lysigonium (Melosira) granulatum.* Only a few forms which decreased below Decatur showed a slight increase at Chandlerville. A peculiar feature was an increase in the number of *Cyclops bicuspidatus, Keratella cochlearis, Diaphanosoma brachyurum,* and *Brachionus angularis* at Harristown and Illiopolis. In general, the July plankton showed a decided decrease below Decatur. Just as in June, the lake apparently was acting as a reservoir, developing an abundant plankton which was then carried downstream and gradually thinned out in the lower river as the water was diluted by tributaries.

The September collections were made under somewhat different conditions from those in June and July, for the level of Lake Decatur was slightly below the crest of the dam, so that little or no water passed over, and the chief source of the water in the river below Decatur was the effluent from the city's sewage disposal plant. The current in the river was not as swift as at higher river levels, and under such conditions the larger tributaries, particularly the South Fork and Salt Creek, might be expected to add a small amount of plankton.

While there still were no plankton organisms found at Mahomet, the plankton was more abundant at Monticello than previously. In Lake Decatur the collections were found to have a somewhat smaller volume and to include fewer species than previously. Downstream from the lake, however, many species, apparently originating in it, especially protozoans and algae, showed a steady increase in abundance; and several species additional to the lake list make their first appearance just below Decatur. Many conspicuous members of the plankton, particularly rotifers, appeared first at Riverton after the union with the South Fork and were abundant downstream from there. A decided increase in both abundance and species was noted at Springfield, which may in part be due to slack water above the dam. A further increase at Petersburg indicated that other conditions were favorable for greater plankton production.

Only a few species abundant in Lake Decatur showed a tendency to decrease rather than increase downstream. These were *Difflugia lobostoma, Codonella cratera, Brachionus angularis, Keratella cochlearis,* and some of the cladocerans and copepods. Of the 66 species found in the September collections, only 25 occurred in Lake Decatur, and 33 species occurred in the downstream collections which did not appear in the lake. Many of the latter showed a tendency to increase downstream. The increase was marked at Springfield and Petersburg, indicating that the lower river was maintaining a plankton population due in part to the low water stage and the reduction of the current. Such conditions in the river approach lake conditions, the waters remaining longer in the pool-like stretches. Since no water was then coming directly downstream from the lake, all the water in the river was effluent from the sewage disposal plant. Agersborg (1929) found this effluent to be teeming with annelids, rotifers, copepods, protozoans and algae, and states that these are organisms such as live in small ponds, though failing to mention any species which are typical of either clean-water or sewage plankton. It is doubtful if many, or any at all, of the lake forms survive passage through the sewage disposal plant, comprising as it does both sand filters, tanks and Dorr separators; and still more doubtful that there is any important development of additional plankton species until after the passage through the plant is completed.

Sphaerotilus natans, although very abundant in the sewage disposal plant, did not appear at any time in the collections. It is probable that the origin of many of the downstream plankton species at this period was in the quiter stretches of the river, which were seeded by the plankton originating in the lake at times when the water was passing over the dam.

The question often arises whether the plankton in a given part of a stream is developed there under local conditions or whether it is carried down from upstream. This survey indicates that, at times, part of the plankton, at least, is carried downstream. Wiebe (1928) and the Minnesota State Board of Health (1928) show that clean plankton from upstream is carried through polluted areas in the Mississippi below Minneapolis and St. Paul. In the Sangamon the downstream decrease observed in June and July may be due partly to the fact that local development was not sufficient to counterbalance the dilution from tributaries. In September, when the low stage of the water cut off the direct supply from the lake, local conditions downstream became more favorable for the development of plankton. When the current becomes very slow, the development of plankton becomes local and is governed by local conditions. If the current averaged one-half mile per hour, the time required for water to flow from the source to the mouth would be about 20 days. However, at normal stages the river has many pool-like stretches which retard part of the water, and rough estimates of the period of detention in the lake at Decatur range from two weeks to two months, depending on the river level. Thus the water remains in the lake at least twice as long as in the rest of the river. The water and the plankton it bears as it flows over the dam at Decatur will ordinarily be in the neighborhood of Chandlerville about a week later. In this way, at normal levels, there is a continual stream of water carrying plankton from the lake and passing downstream. Even though the downstream conditions are not favorable for plankton development, it seems possible for the water to retain part of the original plankton load for a week or more, so that a series of collections made at various points in the lower course of the river do not represent the development of plankton at each point but give glimpses of various stages of senescence as the plankton moves away from its source. It may be possible that the plankton observed downstream in September had originated from the lake when the water was still flowing over the dam, and that it was still progressing downstream. This, however, would hardly explain the origin of the plankton observed in the river immediately below Decatur.

No evidence of the former pollution was observed in the plankton of the Sangamon River. No pollutional organisms were found at Harristown, about eight miles below Decatur, where Jewell ten years earlier had found the plankton to be characterized by *Sphaerotilus natans*, nematodes, ciliates, and creeping rotifers, with desmids and phytoflagellates common when the water was high. In this area in 1929 the plankton was typical of clean water and was characterized by *Codonella cra-*

tera, Polyarthra trigla, rotifers of the genus *Brachionus, Cyclop's bicuspidatus, cladocerans*, and *Lysigonium (Melosira) granulatum*. Jewell found the dissolved oxygen usually low in that part of the river, especially during periods of low water. The determinations of dissolved oxygen made in 1929 showed an abundant supply. The sludge which was formerly so abundant had nearly disappeared, the water was clear, and a number of fishes were observed.

Very little is known regarding the former condition of the plankton below the polluted part of the river. Jewell's studies in 1918-1919, which extended only as far as Springfield, showed that the influence of pollution had partly ceased there and that a few typical clean-water plankton organisms were present in the river at that point. The abundant clean-water plankton now found in that part of the stream, including many more species than were reported by Jewell, indicates that the plankton population in the lower river is much greater than formerly, and this is due, no doubt, to the creation of the lake at Decatur and to the removal of the pollution barrier.

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TABLE I.

SUMMARY OF PLANKTON COLLECTIONS, SANGAMON RIVER, 1929.

Station	Volume (cc. per cubic meter)			Number of species represented		
	June 25-27	July 26-28	Sept. 10-12	June 25-27	July 26-28	Sept. 10-12
Monticello	.08	.08	.05	9	8	16
Lake Decatur	15.20	9.50	9.60	36	47	25
Harristown	6.00	8.00	10.00	22	34	27
Illiopolis	9.00	8.00	8.40	23	31	26
Riverton	3.00	3.90	3.60	17	35	35
Springfield	....	.80	12.60	..	28	36
Petersburg	2.20	.40	17.00	22	22	39
Chandlerville	.50	.30	6.00	24	22	30

TABLE II.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, JUNE 25-27, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Petersburg	Chandlerville
PROTOZOA							
Difflugia lobostoma Leidy	*86,820*	*100,000*	*86,658*	*60,000*	*25,000*	*22,000*	*20,000*
Trachelomonas ensifera Daday	*43,000*						*888,000*
Englena sp.	*40,000*	*50,000*					*660,000*
Codonella cratera (Leidy)	*42,000*	*6,000,000*	*288,860*	*280,000*	*290,000*	*440,000*	*60,000*
Tintinnidium fluviatile Stein		*750,000*			*14,000*	*11,500*	*220,000*
Phacus longicauda (Ehr.)		500		580		400	
Ceratium hirundinella O.F.M.		1,000					2,500
Euglena oxyuris Schmarda		*50,000*		1,100		800	
Trachelomonas volvocina Ehr.		*50,000*	*28,850*	*27,000*	*28,000*	*20,000*	*84,000*
Euglena viridis Ehr.		*100,000*	*28,000*	*55,000*	*16,000*	*22,200*	*110,000*
Dinobryon sertularia Ehr.		15,000	15,000	11,600			250
Centropyxis aculeata Stein			2,000	2,200	1,000	1,600	
Arcella vulgaris Ehr.			*25,000*	*28,000*	550	800	
Trachelomonas hispida (Perty)				*25,000*			
Pleodorina illinoisensis Kofoid					510		250
Eudorina elegans Ehr.						2,400	500
Euglena acus Ehr.							120
Pandorina morum Bory							*110,000*
ROTATORIA							
Filinia longiseta (Ehr.)	240	10,000					
Brachionus angularis Gosse	200	10,000	500	580	500	700	2,500
Brachionus capsuliflorus Pallas		3,000					
Brachionus calyciflorus Pallas		1,500					
Brachionus budapestinensis Daday		15,000				400	
Synchaeta pectinata Ehr.		500				1,200	
Brachionus patulus O.F.M.		500					
Asplanchna sp.		15,000					500
Polyarthra trigla Ehr.		90,000	15,000	8,700	1,100	12,000	1,000

TABLE II—Concluded.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, JUNE 25-27, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Petersburg	Chandlerville
Keratella cochlearis (Gosse)		50,000	2,500	1,200	1,080	8,000	3,700
Lecane spinifera (Western)		1,000					
Rotaria neptunia (Ehr.)		250					250
Pedalis mira (Hudson)			1,000				
CLADOCERA							
Moina affinis Birge		30,000	500				
Diaphanosoma brachyurum (Liéven)		2,500	15,000	2,000			
Daphnia longispina (O.F.M.)		15,000	1,000	1,100			
Bosmina longirostris (O.F.M.)		10,000	1,000	5,800			2,500
Scapholeberis mucronata (O.F.M.)		500					
Chydorus sphaericus (O.F.M.)		500					
COPEPODA							
Cyclops bicuspidatus Claus		75,000	25,000	47,200	540		1,000
Cyclops viridis Jurine	240						
Immature copepods		150,000	190,000	92,000	2,700	12,000	5,000
ALGAE							
Undetermined diatoms	*1,736,460*	*2,500,000*	*2,880,000*	*1,728,000*	*1,300,000*	*1,200,000*	*1,110,000*
Gyrosigma spp.	*43,411*	*50,000*	*25,000*				
Lysigonium granulatum (Ehr.)		*25,000,000*	*8,665,800*	*2,800,000*	*1,450,000*	*1,334,000*	*2,220,000*
Closterium acutum (Lyngb.)		*50,000*					
Coelastrum microporum (Nägel)		*40,000*					*22,000*
Ankistrodesmus falcatus (Corda)		*60,000*	*288,860*	*884,000*	*56,000*		
Actinastrum hantzschi Lager		*35,000*					*21,200*
Scenedesmus quadricauda (Turp.)			*28,000*	*58,000*		*22,000*	
Pedlastrum duplex Meyen			1,000	5,800	5,400	2,000	
Scenedesmus dimorphus (Turp.)				*26,000*	*28,000*	800	
Synedra tenuissima Kütz						2,400	

TABLE III.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, JULY 26-28, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
PROTOZOA								
Difflugia acuminata Ehr.	*15,000*					800		
Pandorina morum Bory		*400,000*			*187,200*	*24,000*	*25,500*	*69,600*
Platydorina caudata Kofoid		75,000			220			
Pleodorina illinoisensis Kofoid		125,000	660		880			
Codonella cratera (Leidy)		*1,600,000*	*490,000*	*966,000*	*1,248,000*	*1,470,000*	*357,000*	*70,000*
Difflugia lobostoma Leidy		*650,000*	*98,000*	*644,000*	*624,000*	*26,000*	*51,000*	1,260
Trachelomonas ensifera Daday		*220,000*		*32,200*	*62,000*	*73,500*	*12,000*	*70,000*
Trachelomonas hispida (Perty)		7,500			*30,000*			
Phacus longicauda (Ehr.)		250					220	420
Euglena viridis Ehr.		*210,000*	*95,000*		*125,000*	*98,000*	*76,500*	*139,200*
Euglena acutissima Lemm.		750						*46,500*
Ceratium hirundinella O.F.M.		8,700	650	7,100	1,320			2,520
Phacus pleuronectes (O.F.M.)		250						
Tintinnidium fluviatile Stein		*120,000*	*25,500*	*30,000*	*60,000*	*122,500*	*51,000*	*140,000*
Eudorina elegans Ehr.		*410,000*		*32,000*	*31,000*	*12,000*		*70,000*
Euglena oxyuris Schmarda		*21,000*		*32,000*	*30,000*			*11,000*
Dinobryon sertularia Ehr.		12,500	19,800	5,400				
Trachelomonas volvocina Ehr.		*30,000*	*49,000*		*62,000*	*245,000*	*76,500*	
Centropyxis aculeata Stein			600	2,160	850	400	440	
Arcella vulgaris Ehr.				4,320				
Gonium pectorate O.F.M.					220			

TABLE III—Continued.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, JULY 26-28, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
ROTATORIA								
Brachionus calyciflorus Pallas	260	112,500	28,400	48,600	400			
Brachionus capsuliflorus Pallas		5,000	650	540	1,200	400	220	
Brachionus budapestinensis Daday		187,500	6,600	32,400	890	400		
Brachionus angularis Gosse		10,000	13,200	21,600		1,600	440	
Trichocerca pusilla (Jennings)		5,000	660	550				
Filinia longiseta (Ehr.)		62,500	9,900	37,800	13,200	6,000		1,260
Trichocerca gracilis (Gosse)		12,500		5,400	1,300	800	400	
Asplanchna sp.		70,000	1,980	16,200	880	400		
Polyarthra trigla Ehr		75,000	33,000	64,800	4,400	450	1,320	1,300
Keratella cochlearis (Gosse)		2,500	13,200	81,000	35,200	8,000	8,800	12,600
Synchaeta pectinata (Ehr.)		225,000	2,640	2,700	2,200	2,000	450	
Pedalia mira (Hudson)		87,500	27,000	43,200	1,760			
Brachinous patulus O.F.M.		250		270				420
Diurella stylata Eyferth		250						
Conochiloides natans (Seligo)		250		1,620				
Schizocerca diversicornis Daday								
CLADOCERA								
Diaphanosoma brachyurum (Liéven)	250	9,900	2,700					
Moina affinis Birge	500	650	540					
Daphnia longispina (O.F.M.)		660	540					
Bosmina longirostris (O.F.M.)		650						

TABLE III—Concluded.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, JULY 26-28, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
COPEPODA								
Cyclops bicuspidatus Claus		5,500	5,200	5,400	880	800	880	3,800
Diaptomus siciloides Lillje		120	650	550	440			
Immature copepods	260	37,500	19,800	5,500	2,200	800	880	25,200
ALGAE								
Undetermined Diatoms	*936,000*	*5,000*	*735,000*	*322,000*	*1,560,000*	*490,000*	*25,000*	*3,480,000*
Gyrosigma sp.	*15,500*		*980,000*	1,620	450	*24,500*		
Closterium acutum (Lyngb.)	250							
Lysigonium granulatum (Ehr.)		*10,000,000*	*4,900,000*	*644,000*	*1,872,000*	*49,000*	*127,500*	*139,200*
Scenedesmus quadricauda (Turp.)		*40,000*			*31,200*	*24,000*		
Scenedesmus dimorphus (Turp.)		*20,000*	*25,500*			*23,000*	*25,500*	
Pediastrum duplex Meyen		2,500			870	1,600	440	2,520
Synedra tenuissima Kütz		12,500	*980,000*	2,160	880	2,400	880	
Pediastrum simplex Meyen		240						
Actinastrum hantzschi Lager		*20,000*	*24,000*	*32,000*	*30,000*	*24,500*	*26,000*	*70,000*
Coelastrum microporum Nägel		230						
Surirella robusta Ehr			650					
Sphinctocystis librilis (Ehr.)					*31,000*			
Closterium moniliferum (Bory)								1,260
Aphanocapsa sp.								1,300

TABLE IV.

NUMBERS OF PLANKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, SEPTEMBER 10-12, 1929.

Italics indicate decantation collections

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
PROTOZOA								
Difflugia acuminata Ehr.	250		*27,000*	1620	920	500		
Eudorina elegans Ehr.	250	220					480	5,600
Ceratium hirundinella O.F.M.	250	880						
Euglena viridis Ehr.	*62,000*	*1,222,100*	*1,310,000*	*1,400,000*	*97,600*	*1,385,000*	*400,000*	*534,000*
Pleodorina illinoisensis Kofoid		200				500		
Euglena oxyuris Schmarda		*60,000*	*30,000*	*35,000*	*24,000*		*160,000*	
Difflugia lobostoma Leidy		*288,000*	*32,000*	*12,000*	*25,000*	*28,000*	*20,000*	
Codonella cratera (Leidy)		*489,000*	*27,000*	*14,000*	*10,000*	*27,000*	*40,000*	2,800
Phacus longicauda (Ehr.)		*24,400*	*14,000*	540	1,380	500	1,920	
Trachelomonas hispida (Perty)		440	27,700			*2,770,000*	*1,600,000*	
Chlamydomonas spp.		*488,840*				*6,925,000*		
Arcella vulgaris Ehr.			*28,000*	5,500	3,060	5,000		280
Centropyxis aculeata Stein			480	1,080				
Trachelomonas volvocina Ehr.			*1,668,000*	*1,750,000*	*1,220,000*	*48,475,000*	*6,400,000*	*2,670,000*
Phacus acuminata Stokes			*13,000*				*34,000*	
Trachelomonas ensifera Daday				*70,000*	*25,000*	*1,385,000*	*4,000,000*	
Phacus pleuronectes (O.F.M.)				250		500		
Euglena acutissima Lemm				*70,000*	*20,000*		*80,000*	
Glenodinium sp.					*45,000*	*28,000*	*75,000*	
Tintinnidium fluviatile Stein					*976,000*	*21,930,000*	*4,000,000*	*26,700*
Pandorina morum Bory					*24,400*		480	
Gonium pectorale O.F.M.						*14,000*		
Platydorina caudata Kofoid							2,880	

TABLE IV—Continued.

NUMBERS OF PLENKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, SEPTEMBER 10-12, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
ROTATORIA								
Brachionus angularis Gosse	250	2,640	240				960	1,400
Brachionus budapestinensis Daday	250							560
Brachionus calyciflorus Pallas	250	850			1,840	375,000	196,800	67,200
Distylla spinifera Western	250				1,600			
Polyarthra trigla Ehr	250	8,800	480		500	15,000	1,920	1,400
Synchaeta pectinata (Ehr.)	250				980		9,600	
Asplanchna sp.	120						950	
Keratella cochlearis (Gosse)		860	480		230			
Brachionus capsuliflorus Pallas				250	9,200	80,000	2,400	2,800
Synchaeta stylata Wierz					13,800	1,050,000	384,000	8,400
Trichotria tetractis (Ehr.)					5,060			
Diurella stylata Eyferth						500		
Trichocerca pusilla (Jennings)						5,000		
Trichocerca gracilis (Gosse)						10,000		
Asplanchna sp.						1,000		2,100
Rotaria neptunia (Ehr.)							480	
Trichocerca stylata (Gosse)							450	
Annureopsis fissa (Gosse)								270
CLADOCERA								
Diaphanosoma brachyurum (Liéven)		450						
Daphnia longispina (O.F.M.)		4,500						

TABLE IV—Concluded.

NUMBERS OF PLENKTON ORGANISMS PER CUBIC METER IN THE SANGAMON RIVER, SEPTEMBER 10-12, 1929.

Italics indicate decantation collections.

Organisms	Monticello	Lake Decatur	Harristown	Illiopolis	Riverton	Springfield	Petersburg	Chandlerville
COPEPODA								
Diaptomus siciloides Lillje		6,600	4,800	600	250			
Cyclops viridis Jurine	110	450						
Immature copepods		52,800	9,600	1,200	50	500	900	2,900
ALGAE								
Undetermined diatoms	*3,120,000*	*1,222,100*	*55,550,000*	*35,000,000*	*3,660,000*	*11,080,000*	*10,000,000*	*53,400,000*
Gyrosigma spp.	*936,000*		*277,750*	*350,000*	*732,000*	*28,000*	*160,000*	*1,602,000*
Sphinctocystis librilis (Ehr.)	*15,000*		960					550
Schroederia setigera (Schröder)	*31,200*							
Cyclotella spp.		*2,444,200*				*27,700,000*		*26,700,000*
Pediastrum duplex Meyen		440	7,200	16,200	9,200	45,000	192,000	56,000
Lysigonium granulatum (Ehr.)		*3,660,300*	*22,220,000*	*17,500,000*	*244,000*	*11,080,000*	*4,000,000*	*1,335,000*
Scenedesmus quadricauda (Turp.)		2,200	*111,100*	*1,050,000*	*122,000*	*1,662,000*	*9,600,000*	*2,136,000*
Closterium acutum (Lyngb.)		*122,000*	*277,750*	*350,000*	*24,000*	*13,600*	*800,000*	*276,000*
Selenastrum gracile Reinsch		220						
Closterium acerosum (Schrank)			960				480	
Closterium moniliferum (Bory)			480					540
Ankistrodesmus falcatus (Corda)			*84,713,750*	*14,000,000*	*45,000*	*554,000*	*800,000*	*1,602,000*
Scenedesmus dimorphus (Turp.)			*55,550*	*35,000*	*46,000*	*210,000*	*800,000*	*560,000*
Synedra tenuissima Kütz			*416,625*	*700,000*	*123,000*	*1,108,000*	*70,000*	*534,000*
Coelastrum microporum Nägel				*10,000*	*12,000*	*25,000*	*75,000*	*26,000*
Cosmarium sp.				*10,800*	1,820			
Actinastrum hantzschi Lager				*700,000*	*24,000*	*12,465,000*	*3,200,000*	*1,835,000*
Micratinium pusillum							1,440	5600
Surirella robusta Ehr					4,600			
Pediastrum simplex Meyen							450	