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Illinois River Bottom Fauna in 1923

BY

ROBERT E. RICHARDSON

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ARTICLE VI.—*The Illinois River Bottom Fauna in 1923.* By ROBERT E. RICHARDSON.

The present paper is based on one hundred and fifty Petersen sampler collections taken in the Illinois River and Peoria Lake between June and September 1923; including 26 taken between La Salle and the head of Peoria Lake; 75 in the lake or its entrance, outlet, or connecting-"narrows"; and 49 below the lake and between Peoria and Beardstown.

The subdivision of the river and lake into zones follows that in the article on the 1922 bottom fauna as respects Peoria Lake, emphasizing distance from the channel center rather than depth, and recognizing three subdivisions as follows: (1) a central, imaginary, channel zone of about 700 feet average total width; (2) to either side and adjacent to this an intermediate zone extending outward to the 1500 foot line, on either side of the channel center; and outside of this, where the width permits, (3) an outer zone extending anywhere from somewhat more than 1500 to more than 4800 feet beyond the mid-channel line at recent summer levels with normal rainfall. In the river the so-called intermediate and outer zones correspond for the most part, except where the river is very shallow, to the zones of 4 to 7 and 1 to 3 feet as used in preceding papers, reference being to recent normal summer levels.

The subdivision of the species on the basis of degree of tolerance also follows in main features that of the 1922 paper, which recognizes, in general, three greater groups, as follows:

Group I. Pollutional or more or less tolerant species, including all recent tubificid worms, leeches, and midge larvae of Peoria Lake; and a number of more than ordinarily tolerant snails belonging chiefly to the sphaeriid genera Musculium and Pisidium. The basis of inclusion in this group has been chiefly the fact of survival in Peoria Lake through 1920, a short time before which year a sizable list of the more sensitive of the members of the old bottom population seem to have been wholly exterminated. For the distinction between the words pollutional and tolerant as used above and elsewhere in this paper, and the general alignment of terminoolgy with that of our 1913 paper on the biology of the Upper Illinois*, see the paper on changes in the bottom fauna of Peoria Lake, 1920 to 1922†.

Group II. Cleaner preference species, including principally current-loving forms of snails, Bryozoa, insects, and Crustacea, that have persisted in Peoria Lake or in the river shortly southward through and.

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* Bul. Ill. State Lab. Nat. Hist., Vol. IX, Art. 10, June, 1913.
† Bul. Ill. State Nat. Hist. Surv., Vol. XV, Art. V, 1925.

since 1920, usually near shore or in unusually good current, but where all of the species in Group III have disappeared.

Group III. Missing members of the old bottom fauna, as of our lists of 1913-1915, including snails of the families Viviparidae and Amnicolidae, chiefly; insects or insect larvae or nymphs of the orders Ephemerida, Odonata, Hemiptera, Neuroptera, and Coleoptera; and various other small bottom animals.

The word pollutional as here used corresponds roughly to Kolkwitz's term "mesosaprobic" and to Forbes and Richardson's term "pollutional", as used in the 1913 paper on the Illinois River. Both in its use and in that of the word "tolerant" (rather than "contaminate") it has been my purpose to attain greater flexibility than might be expected with the customary restricted use of these or similar terms; and by the use of the latter term, more especially, to express better the breadth of range, merging preferences, and adaptability of the not inconsiderable group of species which find their true position, quite unbounded by hard and fast lines, almost anywhere between pollutional and strictly clean-water forms.

Summary

In the 44 miles of the Illinois River above Peoria Lake examined in the summer of 1923 all of the bottom organisms taken belonged to the more strictly pollutional or unusually tolerant kinds; the most of them being small worms, at least one variety of which has previously both in Illinois and elsewhere been found to be characteristic of septic sludge. In this portion of the river the "sludge worms" were found to be most abundant outside the channel, where there is greatest sedimentation after floods.

The small bottom animals taken in 1923 in the broadly expanded 20-mile section of river between Chillicothe and the foot of Peoria Lake were with a few exceptions pollutional or more or less tolerant forms, in variety, abundance, and dispersal, showing no essential change since the summer of 1922.

Toward shore on the west or sand bluff side of the first 14 miles of this 20-mile section, and in the faster current of the upper and lower "narrows" or adjacent waters several less tolerant to fairly clean preference species were taken, as they were also in 1920 and 1922; and these showed some evidence of increase both in variety and numbers within their recent range as thus localized.

In about 71.5 miles of river below Peoria studied in 1923 enumerations showed a clear though irregular decline in abundance of the tubificid worms as compared with numbers above Peoria, as well as a decrease in variety of other pollutional or unusually tolerant species. But when the distribution of the collecting stations is taken into account this can not be believed to signify much if anything more than that the most of this section of river has too hard a bottom or too sharp local gradients to furnish good lodgment and a "settled suspended" food supply for these

types of organisms. This view receives support also from the fact that in this portion of the river such cleaner preference bottom species as are represented at all occur on the average in less variety than do similar forms in the lower part of Peoria Lake.

In respect to the number of species of the old 1913-1915 bottom fauna that have apparently been exterminated by the sewage since somewhat less than 10 years ago, the various reaches below the head of Peoria Lake examined in 1923 compare as follows: Peoria Lake, twelve species exterminated; Wesley to Copperas Creek Dam, thirteen species; Spring Lake Canal to Havana, 68-69 species; Matanzas to Beardstown, 24-25 species.

It is particularly noteworthy that the greatest injury since 1913-1915 seems to have been done in the short but formerly exceedingly rich section just above Havana; where current is slackest and sedimentation most abundant after floods; or where, in other words, there was at the same time most danger and the most that was capable of being destroyed.

The similarity of its hydrographical conditions to those of the one-time rich Liverpool-Havana section, and the fact that the list of species known to be missing from Peoria Lake since 1913-1915 is so small in comparison strongly suggests that at least the portion of Peoria Lake above the lower narrows had been to some extent injured by Chicago sewage previous to 1915.

Evidence that the lower section of Peoria Lake, below the lower narrows and opposite the city, has for several years been receiving serious injury from wind and wave-borne local pollution is seen in the fact that the improvement noted both in 1920, 1922, and 1923 as we proceed southward through the "upper" and "middle" lakes is wholly discontinued in the "lower lake", when we properly discount the occurrences of a few current-loving cleaner preference forms restricted to areas of unusual current.

The bottom animals covered above and in the following pages include only the smaller kinds, and are wholly exclusive of adult commercial mussels, which have been largely exterminated recently in Peoria Lake and in the river as far south as Havana.

Illinois River above Peoria Lake, La Salle—Chillicothe, 44 Miles

With the exception of the single occurrence of the little shrimp *Hyalella knickerbockeri* in swift water near the shore below the dam at Henry—an insignificant circumstance—all of the small bottom species taken in 1923 in the river between La Salle and the head of Peoria Lake belonged to the more strictly pollutional or tolerant groups, including only: upwards of half a dozen varieties of Tubificidae, small worms some of which are characteristic of septic sludge; two or three varieties of leeches; a similar number of kinds of chironomid larvae, of which one,

Chironomus decorus, has a previous definite record of pollutional habit; and three species of sphaeriid snails, of which one, *Musculium transversum,* has previously been found in company with tubificid worms where their numbers exceeded 40,000 per square yard. Both in the channel and the outer zones of the river between La Salle and Henry, in the first 28.5 miles of the section dredged in 1923, nothing at all but tubificid worms were taken. *Musculium transversum* was taken at most stations between the Henry dam and Chillicothe (15.5 miles); the few kinds of midge larvae and leeches not until Lacon or below; and the two less tolerant Sphaeriidae only at or within two or three miles of Chillicothe.

The bulk of the tubificid worms taken in the more polluted reaches, as in upper Peoria Lake in 1922 and 1923, were not identified as *Tubifex tubifex,* the common pollutional form recorded in Europe, but as species of the genus Limnodrilus.

The largest numbers of all tubificid worms combined, and of *Tubifex tubifex* and the two principal species of Limnodrilus taken singly, per unit of bottom area, did not occur in the river channel, but in the shallower water close to or outside the 3-foot line, where conditions favor the greatest sedimentation.

Peoria Lake, Chillicothe—P. P. U. Bridge*, 20 Miles

In Peoria Lake in 1923 rather rapid increase is visible in the variety of the small bottom fauna as we proceed southward, as well as increase of the less tolerant forms in identical areas as compared with 1920 and 1922. But it is equally clear that the increases in kinds and in abundance of the less tolerant groups are greatest, and that they in fact show a strong tendency to be localized, either (1) quite close to shore; (2) in the faster current of Peoria Narrows or other essentially river situations included in the comparisons; or (3) in the rather limited area represented by the southwest third or less of the lower lake that lies between Long Shore Beach and Al Fresco Park. Except at a few stations in swifter current*, also, numbers and bulk of the species with greatest preference for clean bottom are uniformly much smaller per unit of bottom area than are the numbers and volume of the tubificid worms and others of the pollutional or more tolerant groups taken alongside of them.

* Where bulky growths of sponge or Bryozoa occurred.

PEORIA LAKE, 1922–1923, INCREASE OR DECREASE IN NUMBER OF SPECIES OF SMALL BOTTOM INVERTEBRATES*

	Channel				Intermed. zone				Outer zone				All zones combined			
	Group I†		Group II‡		Group I		Group II		Group I		Group II		Group I		Group II	
	'22	'23	'22	'23	'22	'23	'22	'23	'22	'23	'22	'23	'22	'23	'22	'23
Upper lake Inclusive of Chillicothe Goose Pond Spr. Bay Nar.	8	19	0	2	10	9	0	2	14	16	1	1	18	.24-25	1	5
Middle lake	11	18	0	1	21	18	0	5	15	21	0	3	23	29-30	0	7
Lower lake Inclusive of Peoria Nar. McK. Bridge P. P. U. Br.	10	16	3	12	19	2	6	0	12	19	0	4	21	24	7	14
Lower lake Exclusive of Peoria Nar. McK. Bridge P. P. U. Br.	7	12	3	1	14	—¶	3	—	12	15	0	1	19	18	4	2
Peoria Narrows McKinley Br. P. P. U. Bridge	5	14	1	12	12	2	3	0	—	13	—	4	13	20	4	14

* For comparison of number of collections these two years see separate table on p. 403.

† Group I = pollutional and more or less tolerant forms; viz., tubified worms, leeches, midge larvae, *Musculium transversum*, several other less tolerant Sphaeriidae, and *Campeloma subsolidum*.

‡ Group II = the less tolerant associated group including other snails than those in Group I, mussels, and various insects, Crustacea, sponges, Bryozoa, etc.

¶ Dashes indicate no collection.

PEORIA LAKE, 1923. AV. NOS. PER SQ. YD.

	Channel	No. of colls.	Group I						Group II	
			Worms Tubific.	Leeches	Poll. midges	Other midges	Very tol. snails	Less tol. snails	Other snails	Less tol. assoc. group
Upper lake	Chillicothe	2	925			84	444	6		
	Rome, incl. Goose Pond	3	15,848	16			312	48		
	Spring Bay, incl. S. B. Nar.	7	1,409	133	27	58	1,621	65		7
Middle lake	Mossville	1	8,592				1,296	168		
	Maple Point	2	2,208		120		2,112	60		
	Long Shore Beach	2	192		48	24	168	24		
	Towhead	1	5,580	72	1,004	24	2,352	288		
	Al Fresco	4	222	66	1,074	36	876	336	6	
Lower lake	Peoria Narrows	4	168	18	12	2,757	12	24	6	306
	U. S. Slips	3	1,552		720	96	16			
	Main St.	3	560	104	456	40	104			8
	McKinley Bridge	4	3	93		63	51	9	9	251
	P. P. U. Bridge	0	No coll.							

PEORIA LAKE, 1923. AV. NOS. PER SQ. YD.

	Intermediate zone	No. of colls.	Group I						Group II	
			Worms Tubific.	Leeches	Poll. midges	Other midges	Very tol. snails	Less tol. snails	Other snails	Less tol. assoc. group
Upper lake	Chillicothe	0	No coll.							
	Rome, incl. Goose Pond	3	2,664	32			8,773	24	32	
	Spring Bay, incl. S. B. Nar.	1	3,168	48			1,536			
Middle lake	Mossville	1	3,264	48	72	72	5,304	312		
	Maple Point	1	48	72	72	24		2,928		
	Long Shore Beach	2	1,476	6	72	12	366	222		18
	Towhead	1		120	48	48	1,512	648		48
	Al Fresco	1	144	624	96	1,968	72	384		72
Lower lake	Peoria Narrows	1	2,160							
	U. S. Slips	0	No coll.							
	Main St.	0	No coll.							
	McKinley Bridge	0	No coll.							
	P. P. U. Bridge	0	No coll.							

PEORIA LAKE, 1923. AV. NOS. PER SQ. YD.

	Outer zone	No. of colls.	Group I						Group II	
			Worms Tubific.	Leeches	Poll. midges	Other midges	Very tol. snails	Less tol. snails	Other snails	Less tol. assoc. group
Upper lake	Chillicothe	0	No coll.							
	Rome, incl. Goose Pond	3	1,664		20	68	16	32		4
	Spring Bay, incl. S. B. Nar.	2	810	12	156	174	42	822		
Middle lake	Mossville	6	2,152	32	104	104	856	336	4	32
	Maple Point	2	502	12	36	24	72	36		
	Long Shore Beach	3	168		160	560	24	55		
	Towhead	1	96	48						
	Al Fresco	2	228	72	1,140	30	84			
Lower lake	Peoria Narrows	2	804	24	324	60	36	90		126
	U. S. Slips	4	48	18	36	36	24	114		3
	Main St.	1	96		120	24				
	McKinley Bridge	1		36			24	12		
	P. P. U. Bridge	1	144	12		152				648

It is noted both of *Tubifex tubifex* and of the more abundant species of Limnodrilus that, quite contrary to the findings in the river above Chillicothe in 1923, their numbers in upper and middle Peoria Lake ran about as high if not higher in the channel than in either of the outer zones. This is, however, in agreement with such information as we have about velocities, which evidently permit much more sedimentation in the lake channel during flood recessions than can ordinarily take place in average river above the lake.

The sludge worms as a whole showed an irregular decline southward of the upper lake in 1923, both in the channel and in the outer zones, with exception of some upturn in the figures at Peoria Narrows and the U. S. Slips, which are unexplained. Unworked out specific differences might be concerned here. It is at least known that not all species of Limnodrilus, or even Tubifex, for that matter, are equally tolerant of or partial to polluted bottom.

Compared with 1922, both the Tubificidae and the very tolerant sphaeriid snail (*M. transversum*) showed conspicuous decline in numbers in the upper lake in 1923 collections. This was true in all zones in the upper lake and should, it would seem, mean improvement. In the middle lake, however, numbers both of the worms and of the snail showed a tendency to equal or even to exceed the numbers per square yard of bottom area found in 1922. Perhaps effects of seining, and of varying amounts of feeding by bottom-ranging fishes might be concerned in these irregularities. If they are, evidence such as we have on the variety of bottom-dwelling forms present, and their preferences, are of more importance in the definition of degrees of pollution than such numbers are likely to be.

PEORIA LAKE, 1923 COMPARED WITH 1922. AV. NOS. PER SQ. YD.

	Channel	Tubificidae total		Musculium transversum	
		1922	1923	1922	1923
Upper lake	Chillicothe	14,400	925	28,800	444
	Rome, incl. Goose Pond	48,000	15,888	49,200	312
	Spr. Bay, incl. S. B. Nar.	2,880	1,409	5,760	1,621
Middle lake	Mossville	48	8,592	768	1,296
	Maple Point	1,560*	2,208	9,600*	2,112
	Long Shore Beach		192		168
	Towhead		5,880		2,352
	Al Fresco	0	222	1,500	876

* Foot of Horshor Isl.

PEORIA LAKE, 1923 COMPARED WITH 1922. AV. NOS. PER SQ. YD.

	Intermediate zone	Tubificidae total		Musculium transversum	
		1922	1923	1922	1923
Upper lake	Chillicothe	27,400	No coll.	63,300	No coll.
	Rome, incl. Goose Pond	31,320	2,664	52,400	8,773
	Spr. Bay, incl. S. B. Nar.	2,484	3,168	12,800	1,536
Middle lake	Mossville	504	3,264	2,700	5,304
	Maple Point	216*	48	1,020*	0
	Long Shore Beach		1,476		366
	Towhead		0		1,512
	Al Fresco	0	144	1,500	72

* Foot of Horshor Isl.

PEORIA LAKE, 1923 COMPARED WITH 1922. AV. NOS. PER SQ. YD.

	Outer zone	Tubificidae total		Musculium transversum	
		1922	1923	1922	1923
Upper lake	Chillicothe	No coll.	No coll.	No coll.	No coll.
	Rome, incl. Goose Pond	22,800	1,664	24,100	16
	Spr. Bay, incl. S. B. Nar.	2,006	810	2,600	42
Middle lake	Mossville	408	2,152	420	856
	Maple Point	543*	502	2,080*	72
	Long Shore Beach		168		24
	Towhead		96		0
	Al Fresco	0	228	6	84

* Foot of Horshor Isl.

Numbers of midge larvae (Chironomidae) in Peoria Lake dredgings in 1923 as in 1922 were irregular and not apparently of great significance. Only two species previously associated by us definitely with pollution were taken, and it was a little mystifying to find them most

abundant in collections from near the lower end of the middle lake, where snails and some of the other less tolerant groups were taken in variety. Incompleteness of the determinations has also probably included among the Chironomidae, which are in the following tables all listed as at least mildly tolerant, some species which are essentially cleaner water forms. But if that is the case, it does not probably invalidate the comparison of 1923 species lists with those of 1922 for evidence of increase in cleaner-preference species, since most of the 1923 larvae seem to have counterparts in the 1922 (or 1920) collections.

Study of the dates of collection of this group in the summer of 1923 shows that from Mossville north decidedly more Chironomidae occurred in July and August than in June collections; while in the lower half of the middle lake the largest numbers were recorded in June in one cross-section (opposite Long Shore Beach) and in July or August in two others (opposite Towhead and Al Fresco). *Chironomus plumosus* var., a supposed pollutional species, occurred in all three months, and *C. decorus*, another with a similar record, occurred both in June and August.

On the face of things to be taken as evidence of improvement in the muds since 1922 would seem to be the sizable increases shown in the twelve-month period in all three of the sections of Peoria Lake in both the total number of bottom species of all kinds taken and in the number of group II* kinds (i. e., current-loving snails, young mussels, other insects than Chironomidae, and miscellaneous associated species such as sponges, Bryozoans, Planarians, etc.). Combining all collections from all zones, and taking account of these gross figures only, without regard to possible special or localized conditions at points of exact occurrence of group II species, it is found that in the upper lake in 1923 there were 5 group II kinds taken as compared with one in 1922; in the middle lake 7 as compared with none at all; and in the lower lake, including Peoria Narrows and P. P. U. Bridge in 1922 and those two stations and the McKinley Bridge in 1923, 11 kinds as compared to 7. Correspondingly, of the total number of all kinds taken, it is found that it rose in the upper lake from 18 to 24-25 in the year; in the middle lake from 23 to 29-30; and in the lower lake from 21 to 24. Since the total number of collections in all zones combined was very nearly the same in all three lakes in 1922 and 1923 (U. L.: 1922, 23; 1923, 21; M. L.: 1922, 30; 1923, 30; L. L.: 1922, 18; 1923, 24), at least the changes in the totals would not be expected to have been due to changes in thoroughness of collecting. Further favoring improvement, particularly in the extra-channel zones of the upper and middle lakes, where the greatest increase in group II species occurred, would appear to be the fact that the increases in the number of species in those areas in both lakes took place in the face of decreases in the number of collections between 1922

* In text and tabulations that follow, the No. II group is set over against group I, made up of the more or less definitely pollutional or tolerant groups of tubificid worms, leeches, midge larvae, and sphaerlid or other snails which have "stood the racket" in Peoria Lake in the last few years.

and 1923 (U. L.: ex-channel, 1922, 20; 1923, 9; M. L.: ex-channel, 1922, 27; 1923, 20).

Points of exception that must be noted are, however, several, as will be seen from what follows:

First it is noted that the two species of snails of the family Valvatidae (*V. bicarinata* and *V. tricarinata*) which made up the sole representation of group II as above defined in the extra-channel zones of the upper lake proper in 1923 both came from very close to the west shore at Rome, and so can not be regarded as standing for any very appreciable part of the extensive upper lake wide-waters. A single occurrence of an unidentified caddis larva was also noted in the haul from the middle of the "Goose Pond", the shallow backwater to the northeast of the upper end of the upper lake which is rather better protected from sewage invasion than the open portions of the main lake. Again, in the upper lake channel in 1923 the only two group II species taken were species of Bryozoa (*Plumatella princeps*, two varieties) which attach themselves to dead shells, and do not live in the mud as do typical bottom species; and both of these have previously been found in the Illinois River to exhibit a considerable degree of tolerance to pollution if there is some current present. One of them was taken in Spring Bay Narrows only, and the other at Chillicothe*, at both of which places there is much more current than in the lake proper.

Analysis of the group II records from the middle lake shows, first of the intermediate zone (stations within first 1500 feet of the mid-channel line), that all occurrences were restricted to the lower third of the lake, and to the west† side of the channel; and that four out of the total of seven group II species were taken between Long Shore Beach and Al Fresco Park within 50 feet of the west shore. Of the three group II species taken in the outer zone of the middle lake one was taken close to the west shore opposite Mossville; one 600 feet from the west shore opposite the same station; while the third record (of *Plumatella princeps*, var. *fruticosa*, a current-loving form), from 1900 feet east of the mid-channel line opposite Al Fresco Park, is most probably based on an error—i. e., mixing of material either in the field, the field laboratory, or at Urbana. The amount found in the bottle was only a trace and could easily have been stuck in the sieve at a neighboring channel station and released at the other without having been noticed. Last, the sole representative of group II from the middle lake channel (*Valvata bicarinata* var. *normalis*) was taken in the middle of the channel in 20 feet of water in the same southwest corner of the lake that housed the great majority of the ex-channel representatives of the same group.

The principal increases in number of group II species in lower lake cross-sections over 1922 were not in the extra-channel zones, as in the

* Included as an upper lake station for better comparison with 1922 records, when Chillicothe was last station north in series.

† Stations on this side are for the most part closer to the sandy (west) bluff, and are better washed at times of flood than the formerly largely brushy lake areas to the eastward of the steamboat channel.

upper and middle lakes, but in the channel itself, where both the fastest and the average current are considerably greater than anything to be met with in either the upper or middle lake, if Spring Bay Narrows and possibly also a short stretch of channel below Al Fresco Park be excepted. Also, when the lower lake collections of 1923 are separated into hauls from the open lake, or lake proper (U. S. Slips and Main Street cross-sections), and hauls from Peoria Narrows, McKinley Bridge, and P. P. U. Bridge—included with lower lake averages, for better comparison with 1922 in some of the tables following—it is found that there were 12 species of the II group in the swifter water hauls to only one in the hauls made in the wide portion of the lake. This is quite in line with the finding of 1922 that about the only cleaner-preference forms that have survived in or re-entered these waters since the mortality of the years shortly preceding 1920, are current-loving forms—as Pleuroceridae among snails; caddis species of the family Hydropsychidae; and a few sponges and Bryozoa. The comparatively small representation both of group I and group II species in the extra-channel zones of the lower lake proper suggests, also, as did the data of 1922, that there continues here some bad effect of wind-blown local pollution.

Peoria Lake, 1922–1923
Increase or Decrease in Number of Collections

	All zones combined		Channel		Ex-channel	
	1922	1923	1922	1923	1922	1923
Upper lake Incl. Chillicothe, Goose Pond Spr. B. Nar.	23	21	3	12	20	9
Middle lake	30	30	3	10	27	20
Lower lake Incl. Peoria Nar. McKinley Br. P. P. U. Br.	18	24	4	14	14	10

Another method of testing the extent of change since 1922 in Peoria Lake is to count the number of collections out of the total number taken in which the less tolerant Sphaeriidae (species of Musculium other than *M. transversum;* species of Pisidium; and species of Sphaerium) occurred in 1923 and the preceding year. While these little snails are known to be more tolerant than the species we have referred to Group II, they are also clearly less tolerant than the Tubificidae, than *Musculium transversum*, or than most if not all of the Chironomidae and leeches recently taken, and would be expected to spread over a greater area with any rapid improve-

ment in the sanitary condition of the bottom muds. Tabulation shows, however, for the four commoner species in the upper lake and for six in the middle lake almost identical percentages of occurrence in both years.

	1923		1922	
	No. colls. in which taken	Total colls.	No. colls. in which taken	Total colls.
Upper lake				
All zones combined				
Musculium truncatum	6	21	7	23
Pisidium compressum	4	21	6	23
Pisidium complanatum	2	21	2	23
Pisidium pauperculum var. crystalense	3	21	2	23
Middle lake				
All zones combined				
Musculium truncatum	6	30	1	30
Pisidium compressum	18	30	16	30
Pisidium complanatum	2	30	2	30
Pisidium pauperculum crystalense	4	30	3	30
Sphaerium stamineum	6	30	5	30
Sphaerium striatinum	4	30	3	30

It is necessary finally to add to the negative side of the account in Peoria Lake the still-continuing failure to reappear, anywhere, of several of the most characteristic and, because of their large size as well as their abundance in several instances, the most conspicuous members of the old but now all but completely defunct gastropod snail fauna. Particular mention should be made of *Vivipara contectoides*, *V. subpurpurea*, *Lioplax subcarinatus*, and two or more species of Amnicolidae. Fuller lists of the species which have disappeared from Peoria Lake completely since some time before 1920 are presented in pages following. It is largely on the basis of the failure of these snails to reappear in recent years that it has

been possible to distinguish the present and recent sphaeriid snail fauna of the lake and upper river as belonging to a distinctly more tolerant grouping than any except possibly one *(Campeloma subsolidum)* of the Illinois River Gastropoda.

Illinois River below Peoria, P. P. U. Bridge—Beardstown, 71.5 Miles

Some improvement is indicated as we proceed down the river from Peoria, it appears, both by the lessening variety and abundance of the tubificid worms and the more pollutional midge larvae; tables, pp 407-408. The large decreases in the total of group I—pollutional and more or less tolerant species—from 34-35 kinds in Peoria Lake to just over a dozen kinds in the two reaches of river recognized above and below Havana, do not, however, mean at all what a first glance at the figures might indicate. The far greater portion of the decrease in the number of group I species is in fact due to the dropping out below Peoria Lake of most of the less tolerant sphaeriid snails and Chironomidae; a matter without doubt due largely to the lesser suitability of the generally harder mud or sand and shell bottom of the river in these sections (if we except the first 8 miles above Hanava) than to any other cause; the species of Pisidium and Sphaerium, in particular, which have persisted through the recent pollution in Peoria Lake, never having been found either in variety or numbers in the river between Peoria and Beardstown in the past fourteen years of collecting.

So far as the group II or cleaner-preference species are concerned, again, instead of increasing down stream below Peoria as the group I kinds decrease, as we would expect if the latter indicated improvement, they also fall off rapidly in variety as we proceed south, though, it is to be noted, along with a rather marked decrease also in the number of collections; table, p. 406. The greatest variety of group II kinds in the three reaches recognized below Peoria Lake was taken in the somewhat more than 20 miles between Wesley and the Copperas Creek Dam, where 18 group II species were taken in 1923 in 27 collections, comparing with 20 in Peoria Lake from 75 collections the same season. Here there is for the most part good current, and principally harder bottom than in Peoria Lake, both of which indicate reduced sedimentation, which seems to protect a good many current-loving organisms, such as Planaria, Bryozoa of several kinds, the larvae of certain Trichoptera (caddis-flies), and others, which might otherwise succumb in the face of the new load of Peoria and Pekin pollution. Between the mouth of the Spring Lake Canal, shortly below Copperas Creek Dam, and Havana, the number of cleaner-preference species taken dropped to only twelve kinds in the total of nine collections taken; a number perhaps not unduly small, in view both of the condition of the mud and the small number of collections; though it is recalled that this was by all odds the richest section along the whole Illinois River some ten years ago, at which time it yielded nearly seventy kinds of small

bottom animals, practically all of common occurrence at some stations in the range, which have since then disappeared from collections altogether: pp. 413 and 419. Here, in the first eight miles above the Spoon River bar, at Havana, sedimentation is especially active at times of flood recession, finally depositing on the bottom a goodly portion of the load of more or less putrescible suspended solids that mostly passed over the heads of the bottom animals in the reaches between Liverpool and Peoria. Below Havana, in the thirty odd miles to Beardstown, in the summer of 1923 only six group II species were found in a total of thirteen bottom hauls taken. This section of the Illinois, was, however, rather noticeably poor in bottom species at most of the stations worked in the seasons of collecting between 1913 and 1915: though even our lists from it show a total of fully two dozen kinds of small bottom animals that have failed altogether to appear in collections made since and including 1920.

DECREASE OF BOTH GROUP I AND GROUP II* SPECIES FROM PEORIA LAKE SOUTHWARD, 1923

	Group I species—with subdivision						Number colls. all zones combined	Group I	Group II
	Tubificid worms	Leeches	Pollutional midge larvae	Other midge larvae	Very tolerant snails†	Less tolerant snails		Total species	Total species
Chillicothe to ft. of Peoria L., incl. 20 mi. to P. P. U. Br.	5	4–5	2	13–14	1	9	75	34–35	20
Wesley to Copperas Cr. Dam, below 23.7 mi. P. P. U. Br. to Cop. Cr. Dam, incl.	5	2–3	2	12–13	1	1	27	23–25	18
Spring L. Canal to Havana, incl. 16.8 mi. Cop. Cr. Dam to Havana	2	4	0	5–6	1	0	19	12–13	12
Matanzas to Beardstown 31 mi. Havana to Beardstown, incl.	4	3	0	3–4	1	0	13	11–12	6

* Cleaner preference group.
† *Musculium transversum*.

TOTAL TUBIFICIDAE AND T. TUBIFEX TAKEN ABOVE PEORIA, 1923*
AVERAGE NOS. PER SQ. YD.

	Total Tubificidae			Tubifex tubifex		
	Channel	Intermediate zone	Outer zone	Channel	Intermediate zone	Outer zone
La Salle	960					
Spring Valley	312	———	576	24		
Mth. Hennepin Canal	498	———	———	24		
Hennepin	1,336					
Henry above Dam	15,120	17,088	———	———	840	
Henry below Dam	1,260	———	238,080	24	———	29,184
Lacon	961	4,684	12,478	25	———	288
3-4 mi. abv. Chillicothe	———	———	41,856	———	———	4,608
3-4 mi. in slough	———	———	1,392			
A. T. S. F. Bridge	1,926	2,280	32,640	666	12	1,152
E. channel opp. Chillicothe	———	———	1,680			
Chillicothe	925	No coll.	No coll.			
Rome (incl. Goose Pond)	15,848	2,664	1,664	128	88	48
Spring Bay (incl. Nar.)	1,409	3,168	810	42	24	12
Mossville	8,592	3,264	2,152	840	96	4
Maple Point	2,208	48	502	———	24	24
Long Shore Beach	192	1,476	168	———	24	
Towhead	5,580	———	96	144		
Al Fresco	222	144	228			
Peoria Narrows	168	2,160	804	———	———	6
U. S. Slips	1,552	No coll.	48			
Main Street	560	No coll.	96			
McKinley Bridge	3	No coll.				
P. P. U. Bridge	No coll.	No coll.	144			

* For comparison with table next following.

TOTAL TUBIFICIDAE AND T. TUBIFEX TAKEN BELOW PEORIA, 1923*
AVERAGE NOS. PER SQ. YD.

	Total Tubificidae			Tubifex tubifex		
	Channel	Inter-mediate zone	Outer zone	Channel	Inter-mediate zone	Outer zone
Wesley	192	———	940			
7 mi. Island	———	524	1,458	———	———	12
2 mi. above Pekin in dredge ditch	240	———	———	12		
Pekin	30	———	2,196	———	———	36
Old mouth Mackinaw	432					
Mackinaw	———	———	48			
Kingston Ferry	288	1,224	4,392	48		
Lancaster	96					
Cop. Cr. abv. Dam	———					
Cop. Cr. below Dam	48	———	———	12		
Spring L. Canal inside mouth	112					
Liverpool	1,008					
Quiver Beach	———	12	———			
Havana	144	———	———			
Matanzas	120	72	———			
Foot Grand Isl.	———	———	640			
Hd. Hickory Isl.	108	———	7,056	———	———	48
Mouth Sangamon	———	———	———			
Beardstown	1,688	———	———			

* To show decrease down stream from Peoria. Compare with preceding table.

When we compare with the bottom collections made in 1920—the last preceding date when we made hauls in the Illinois River below Peoria Lake—it is found that there were in all twenty group II or cleaner-preference species taken in 1923 in forty-nine collections in the seventy odd miles of river between Wesley and Beardstown, to only thirteen in thirty-six collections in a somewhat reduced distance within the same section in the summer three years preceding. Sharp increase over 1920

is noted, on the other hand, in the limited reach of around nineteen miles between the Spring Lake Canal and Havana, where in 1923 twelve cleaner-preference forms were taken in nine dredge hauls compared with only two in fourteen hauls in 1920, a finding that would seem at least on its face to indicate some improvement in the condition of the muds in the three years. The number of group II species taken below Havana was, however, only half as many in 1923 as in 1920, in a mileage considerably greater, though with the number of collections less, running to a total of only six species in thirteen collections covering thirty miles of river length in 1923, compared with twelve kinds in twenty-two collections from about 19 miles of river in the summer three years before. As already mentioned, the section of more or less shifting sand or sand and shell to hard bottom between Havana and Beardstown was known before the recent mortality for the sparseness and irregularity of distribution of its small bottom population; and because of this and the factors favorable to error that lie back of it, less importance is probably to be attached to such variations in numbers than in sections where the bottom-dwelling organisms—chiefly mud bottom forms in the Illinois River—have a more suitable and more stable substratum on which to live. A better test of the changes that have taken place in recent years in this and other sections of the Illinois River, inclusive of Peoria Lake, because it concerns both larger numbers and greater and therefore more convincing contrasts, consists in going farther back, to the period 1913-1915, comparing our recent species lists with those of that time, and noting the absentee names of the old fauna, side by side with recent survivals and new entrants.

CHANGES IN NUMBER OF GROUP II (CLEANER PREFERENCE) SPECIES BETWEEN 1920 AND 1923
ALL ZONES COMBINED

	1923		1920	
		Number colls.		Number colls.
Chillicothe—P. P. U. Bridge, incl.	20	75	7*	35
Wesley—Beardstown, incl.	20	49	13*	36
Wesley—Copperas Creek Dam, below, incl.	18	27	——	None
Spring Lake Canal—Havana, incl.	12	9	2†	14
Matanzas—Beardstown, incl.	6	13	12‡	22

* All from lower lake.
† Liverpool to Havana.
‡ Matanzas to head of Hickory Lake.

The Missing Small Bottom Animals of the 1913-1915 Species Lists, apparently Exterminated some Time between 1915 and 1920. Head of Peoria Lake to Beardstown

To any one familiar with the biology of the Illinois River between 1910 and 1923 a more striking change in the period than even the intrusion of pollutional forms and their increase has been the complete disappearance in the nearly ninety miles between the head of Peoria Lake and Beardstown of a long list of the more sensitive snails and associated bottom animals in the less than ten year period between 1910 and 1920. In making comparisons of the more recent species lists with those of 1913-1915, allowance needs to be made for some inequalities in number and distribution of collections, as well as in completeness of determination of material, in the two periods. The total number of dredge hauls made between Chillicothe and Beardstown in the seasons 1913-1915 was 210, distributed quite evenly, as will be seen in table, p. 413, between the four short reaches distinguished in this distance. In the three years of collecting between 1920 and 1923 there were taken in all 266 collections in substantially the same areas and linear distance, but with much

greater emphasis on the area embraced under the head of Peoria Lake, which, inclusive of Chillicothe and the P. P. U. Bridge, amounts to an even twenty miles; and where 181 of the total number of 266 hauls were made. In the three short reaches recognized below Peoria collections ran only 27, 23, and 35, compared with 50, 55, and 59 in the same sections in the period 1913-1915. In both periods there was an essentially similar distribution of collections as between channel and shore, or shallower water zones; with the difference, itself apparently attributable to the same influence that destroyed the bottom organisms, that more vegetation was encountered at the shallower stations in the earlier than in the more recent collecting. In making the comparisons many of the more distinctly weed-forms have been thrown out entirely, though some species of both periods that live a part of the time in the bottom and a part on vegetation are necessarily included. To equalize matters further, some of the 1913-1915 material that had been earlier rather incompletely determined for a mass-valuation calculation, was gone over again in 1923 for additional species, at the expense of several weeks' time.

The results of the comparisons are shown in the table on page 413, following. Briefly, the figures show around a dozen kinds of formerly common cleaner-preference species of small bottom animals that have disappeared from Peoria Lake in ten years; a similar number for the twenty odd miles between Peoria and the Copperas Creek Dam; nearly seventy kinds that have recently failed to appear in the first ten to nineteen miles above Havana; and twenty-four or more kinds that are missing in the more than thirty miles between Havana and Beardstown. These numbers include no fresh-water mussels except a very few scattering occurrences of very young or dwarf individuals, taken with the mud dipper, small Blake dredge, or Petersen dredge; and would be very much larger, particularly in Peoria Lake, had it been possible recently to cover the area thoroughly with a commercial mussel bar, for comparison with Danglade's 1911-1912* lists of mussels from the Illinois River.

Despite the inequalities and deficiencies mentioned, the results of the comparisons seem for the most part understandable, as they are consistent with each other and with otherwise ascertained facts of the biology and hydrography. First, with regard to the relatively enormous losses of cleaner-preference species in the formerly exceedingly rich reach of river just above Havana: Here is where the bottom fauna formerly had both its greatest variety and its greatest abundance; favored both by the slacker current above the Havana or Spoon River bar and the rich soft mud bottom resulting therefrom. Here also because of the same factor of more abundant sedimentation was where the more sensitive bottom organisms might be expected to be put in the greatest jeopardy as the stability of the suspended matters carried this far down the river became lessened.

* Report, U. S. Bureau of Fisheries, 1913.

The notably small size of the list of missing species of the old 1913-1915 fauna of Peoria Lake, on the other hand, particularly when it is considered that the number of collections taken in the earlier period, 46 in all, was more than four-fifths as many as supplied the abundantly varied species lists from the reach Liverpool-Havana, seems at first practically unexplainable unless we assume that Peoria Lake had already been injured by the sewage of Chicago and up-river towns still earlier than that time. Conspicuous among the missing forms in Peoria Lake collections in 1913-1915 were various aquatic insects, particularly those belonging to groups other than the Diptera: as Odonata, Hemiptera, Neuroptera, and Coleoptera. Though the shallower areas at that time were abundantly supplied with aquatic plants it was noticed that results even of "weed tank" collecting were extremely poor, also, as compared with results obtained in the same way in the shallow lakes at Havana. But though aquatic insects other than Chironomidae were rare, the relatively sensitive Viviparidae and Amnicolidae, that have since disappeared as far south as Beardstown, were still holding on, though not in nearly as great numbers as near Havana. And as late as 1912-1914 Danglade in work for the U. S. Fisheries Bureau found more than forty kinds of mussels between Chillicothe and Peoria Lake, of which twenty kinds were counted in the piles picked over at Chillicothe. Evidently, if there was any injury previously to 1913-1915 it must have been principally in the wide waters—the mussels are for the most part of the channel or near it—and would point to certain groups of aquatic insects as even more sensitive than the recently exterminated Gastropoda.

Of the "missing" lists from the reaches distinguished below Peoria Lake it may be noted that the first one, that between Wesley and the Copperas Creek Dam, was very probably quite as early as 1913-1915 influenced somewhat unfavorably by the heavy load of Peoria and Pekin wastes; as well as by the limiting influences on the variety of small bottom animals of the swifter current and harder bottom. In the latter respect the section of river between Havana and Beardstown was similar, to a large though not to quite so great an extent, perhaps, if the slack water pool above the mouth of the Sangamon be taken into account. That, and the greater distance from the Peoria and Pekin drains, favored a somewhat greater variety of cleaner-preference forms ten years ago than we could have expected between Peoria and the Copperas Creek Dam; though far from that which seemed to develop so easily in the lake-like section of ten or so miles just above Havana.

NUMBER OF SPECIES* OF SMALL BOTTOM ANIMALS IN 1923 COLLECTIONS COMPARED WITH NUMBER MISSING IN SAME COLLECTIONS ON BASIS OF 1913–1915 RECORDS
ALL ZONES COMBINED

	1923			1913–1915	
	Group I spp.†	Group II spp.‡	Total colls.	Group III spp.¶	Total colls.
Chillicothe to P. P. U. Br., incl.	34–35	20	75	12	46
Wesley to Cop. Creek Dam (below), incl.	23–25	18	27	13	50
Spring Lake Canal to Havana, incl.	12–13	12	9	68–69	55
Matanzas to Beardstown, incl.	11–12	6	13	24–25	59

* Includes no mussels except a very few young individuals or dwarf species such as are occasionally taken with small apparatus.
† Pollutional or tolerant. ‡ Cleaner preference spp. ¶ Now missing.

TOTAL NUMBERS OF GROUP II, OR CLEANER-PREFERENCE SPECIES, COMPARED WITH TOTAL NUMBER OF COLLECTIONS, 1920–1923

	Species of			Species of
	1920	1922	1923	1920–1923, incl.* No duplication
Chillicothe to P. P. U. Br. incl.	7† / 35	8 / 71	20 / 75	23 / 181
Wesley to Copperas Cr. Dam (below) incl.	—‡	—	18 / 27	18 / 27
Spring L. Canal to Havana, incl.	2 / 14	—	12 / 9	13 / 23
Matanzas to Beardstown, incl.	12 / 22	—	6 / 13	13 / 35

* Purpose of this table to show that adding in the 1920 and 1921 collections adds very little—except in the Matanzas-Beardstown section—to the total number of Group II species taken in 1923.

† The upper line of figures against an entry gives the number of species; the lower one, the number of collections.

‡ A dash indicates no collection.

Small Bottom Invertebrates* of Illinois River and Peoria Lake, La Salle to Beardstown, 1923

GROUP I

POLLUTIONAL OR MORE OR LESS TOLERANT SPECIES †

1. Small Annelid Worms. (Tubificidae)
   - *Limnodrilus* species like *L. hoffmeisteri* Claparède
   - *Limnodrilus* species like *L. claparedeianus* Ratzel
   - *Limnodrilus* species
   - *Tubifex tubifex* Müller, or var.
   - *Tubifex* species, apparently undescribed.
   - *Dero* species, one occurrence, outer zone, Peoria Narrows.
   - Other Oligochaeta, unidentified, in bad state of preservation, or immature, several thousand specimens.

* No mussels included except very young individuals or dwarf species, taken with 1/12 sq. yd. Petersen sampler.

† See definitions of terms in introduction.

2. Leeches (Hirudinea).

At least four or five species, including apparently, *Erpobdella punctata* (Leidy), and two species of Helobdella; taken in all zones of the river and lake, from Lacon southward, 1923. The species of Erpobdella mentioned was definitely associated with pollution in Weston and Turner's studies of the Coweeset River in 1914.

3. Midge Larvae of pollutional habit. (Chironomidae)

Chironomus plumosus Linnaeus, var.
Chironomus decorus Johannsen
Chironomus lobiferus Say
Several undetermined Chironominae and Tanypinae, like the three species of Chironomus preceding, with range from Chillicothe or head of upper Peoria Lake, south.

4. Other Chironomidae, with distribution for most part from middle or lower Peoria Lake southward.

Chironomus digitatus Malloch
Cricotopus species
Orthocladius
Palpomyia spp., probably two.
Forcipomyia species
Procladius species
Tanypus species
Unidentified Chironominae and Tanypinae, several species.

It is quite possible that some of these imperfectly determined forms are in reality species with distinct preference for clean bottom; but occurrence in Peoria Lake, even in the outer zones, in its recent condition, may be taken to indicate rather more than the degree of tolerance shown by the more sensitive species of that description.

5. Sphaeriid Snail of especially tolerant habit.

Musculium transversum Say. This species was found associated with sludge worms of the genera Limnodrilus and Tubifex, where there was almost complete oxygen exhaustion one foot from bottom, both in 1920 and 1922.

6. Sphaeriid Snails of less tolerant* habit.

Musculium truncatum Linsley
Pisidium compressum Prime
Pisidium complanatum Sterki
Pisidium pauperculum var. *crystalense* Sterki
Pisidium species
Sphaerium stamineum Conrad
Sphaerium striatinum Lamarck
Sphaerium striatinum var. *lilycashense* Baker
Sphaerium species

* The distribution of this subdivision of group I, and reasons for their distinction in degree of tolerance from other Illinois River snails, is discussed in detail in the 1922 paper on Peoria Lake.

7. Viviparid Snail of unusual tolerance.

Compeloma subsolidum Anthony. This species was taken in upper Peoria Lake in 1922; and in the river as far north as Starved Rock in 1912, which was at that time slightly above the lower limit of the Sphaerotilus zone.

Group II

CLEANER PREFERENCE SPECIES; BUT SEE QUALIFICATIONS BELOW

Though these species are clearly to be grouped as cleaner-preference forms by comparison with those included in Group I preceding, as compared with the assemblage of species wholly exterminated in Peoria Lake and the Illinois River to a point below Havana shortly before 1920 even they may be judged to possess a measurable, if rather slight, degree of tolerance. They are for the most part, both in Peoria Lake and elsewhere, however, confined either to locations very near shore; to the swifter water sections, as the narrows of the lake, or shortly below dams; or to the southwest corner of middle Peoria Lake, just above Peoria Narrows (see p. 17, and foot-note thereto).

1. Mussels (Unionidae)

Lampsilis parvus Barnes. S. W. portion of middle lake and Peoria Narrows.

Lampsilis gracilis Barnes, young. Wesley, shore-zone in good current.

Lampsilis species, young. Wesley and Seven Mile Island, in current.

Plagiola donaciformis Lea. Quiver Beach, more probably from the lake than the river hauls. Label does not distinguish.

2. Snails. (Valvatidae and Pleuroceridae)

Valvata bicarinata Lea. W. beach, Rome.

Valvata tricarinata (Say). W. beach, Rome; also taken in same location summer 1922.

Valvata bicarinata var. *normalis* Walker. Shore zone, Mossville; channe, Al Fresco Parkl

Goniobasis livescens Menke. Channel, Peoria Narrows and McKinley Bridge, in strong current.

Pleurocera elevatum var. *lewisii*. Channel, Peoria Narrows, McKinley Bridge, and Pekin, in strong current.

3. Sponges (Porifera)

One or more species taken. Channel at Peoria Nerrows and Pekin, in strong current.

4. Fresh-water Hydroids. (Hydrozoa)

Cordylophara lacustris Allman. Kingston Ferry near shore.

5. Planarian Worms. (Turbellaria)

Several unidentified species. Common in the channel from Spring Bay south; and in outer zones from P. P. U. Bridge south.

6. Crustaceans. (Amphipoda and Isopoda)

Hyalella knickerbockeri Bate. Channel from Peoria Narrows south; outer zone, as far north, once, as below dam at Henry.
Asellus intermedius Forbes. Channel, Kingston Ferry.

7. *Moss Animals. (Bryozoa)

Plumatella princeps Kraepelin, var. *fruticosa*. From Chillicothe south, in the channel; was noted to be especially tolerant, also, in the upper river in 1911-1912, at that time occurring as far north as Starved Rock, but incorrectly named. A recorded occurrence in 1923 in the outer zone opposite Al Fresco Park is probably an error, as the organism requires good current unless conditions are otherwise excellent.
Plumatella princeps Kraepelin, var. *mucosa-spongiosa*. Channel, Peoria Narrows south.
Plumatella polymorpha Kraepelin, var. *repens*. Channel, Wesley south, in current.
Paludicella ehrenbergii van Benden. Channel, McKinley Bridge south, in good current; outer zone, Seven Mile Island and Kingston and south.
Urnatella gracilis Leidy. Channel at McKinley Bridge and Pekin, in strong current.

8. Caddis-fly Larvae. (Trichoptera)

Hydropsyche species. Channel, Peoria Narrows south, in current; outer zone at foot of Grand Island.
Polycentropus species. Channel, Copperas Creek below dam and south, in current.
Molanna species. Near shore, Quiver Beach. Probably a lake collection, as this is a sand beach form.
Unidentified species. Unknown current-loving form at McKinley Bridge in channel, and south; one or two stagnant-water species, with basket-shaped cases, in outer zones from Rome south.

9. May-fly Nymphs (Ephemerida)

Hexagenia bilineata Say. Channel at Havana and at head of Hickory Island; near shore, once at Pekin and once each at foot of Grand Island and head of Hickory Island.

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* I think a better common name would be soft-walled or fresh-water coral; as the group was originally included with the marine corals by Ehrenberg about a hundred years ago.

10. Dragon-fly Nymphs (Odonata)
    Ischnura species. Channel, McKinley Bridge, in strong current.
    Gomphus plagiatus Selys. Channel at Liverpool.
    Gomphus species. Near shore at Kingston Ferry.

11. Orl-fly Larvae (Neuroptera)
    Sialis infumata Newman. Near shore, S. W. end lower Peoria Lake.

Pre-1920 Bottom Species* Recently Missing from Illinois River and Peoria Lake Dredge Hauls

From Species Lists of 1913–1915, referred to as Group III in preceding Tables

1. *Illinois River and Peoria Lake, Chillicothe to P. P. U. Bridge, inclusive. Twelve species; 46 collections; all zones combined.*
   - Mollusca
     - Viviparidae
       - *Vivipara contectoides* W. G. Binney
       - *Vivipara subpurpurea* Say
       - *Lioplax subcarinatus* (Say)
     - Amnicolidae
       - *Amnicola emarginata* Küster
       - *Amnicola limosa* (Say)
       - *Somatogyrus subglobosus* (Say)
     - Ancylidae
       - *Ancylus* species
   - Insects
     - Ephemerida
       - *Hexagenia bilineata* Say
       - *Callibaetis* species
       - *Caenis* species
     - Diptera
       - *Chironomus tentans* Fabricius
       - *Chironomus nigricans* Johannsen

2. *Illinois River, Pekin to Copperas Creek Dam, inclusive. Thirteen species; 50 collections; all zones combined.*
   - Mollusca
     - Unionidae
       - *Anodonta imbecillis* Say

* No mussels included except very young individuals or dwarf species; i. e., those taken with mud dipper or small iron dredge.

Viviparidae
Vivipara contectoides W. G. Binney
Vivipara subpurpurea Say
Lioplax subcarinatus (Say)
Campeloma subsolidum Anthony
Pleuroceridae
Goniobasis livescens Menke
Ancylidae
Ancylus species
Amnicolidae
Amnicola emarginata Küster
Amnicola lustrica Pilsbry
Valvatidae
Valvata tricarinata (Say)
Planorbidae
Planorbis parvus Say
Porifera
Unidentified fresh-water sponges, at least one species.
Crustacea
Isopoda
Asellus intermedius Forbes

3. *Illinois River, Liverpool to Havana inclusive. Sixty-nine species; 55 collections; all zones combined.*

Mollusca
Unionidae
Anodonta corpulenta Cooper. Young
Anodonta imbecillis Say
Lampsilis luteolus (Lamarck). Young
Lampsilis fallaciosus Simpson, Young
Lampsilis parvus Barnes
Plagiola donaciformis Lea
Sphaeriidae
Sphaerium stamineum Conrad
Sphaerium striatinum Lamarck
Sphaerium simile Say
Viviparidae
Vivipara contectoides W. G. Binney
Vivipara subpurpurea Say
Campeloma decisum Say
Lioplax subcarinatus (Say)
Pleuroceridae
Goniobasis livescens Menke
Pleurocera elevatum, var. *lewisii* Lea
Amnicolidae
Somatogyrus subglobosus (Say)

Amnicola cincinnatiensis (Anthony)
Amnicola limosa (Say)
Amnicola lustrica Pilsbry
Valvatidae
Valvata tricarinata Lea
Valvata bicarinata (Say)
Physidae
Apparently at least two species
Planorbidae
Planorbis parvus Say
Planorbis trivolvis Say
Planorbis exacutus Say
Lymnaeidae
Lymnaea humilis Say
Lymnaea palustris (Müller)
Ancylidae
Ancylus species
Porifera
Unidentified fresh-water sponges, at least 3 kinds
Hirudinea
Apparently at least 3 species of leeches not recently taken.
Crustacea
Palaemonidae
Palaemonetes exilipes Stimpson
Insects
Ephemerida
Callibaetis species
Caenis species
Hexagenia bilineata Say
Heptagenia species
Odonata
Calopteryx species
Unidentified Agrionidae, at least two species.
Mesothemis simplicicollis Say
Epicordulia princeps Hagen
Hemiptera
Corixa burmeisteri Fieber
Corixa species
Notonecta species
Zaitha fluminea (Say)
Neuroptera
Sialis infumata Newman
Corydalis species
Trichoptera
Rhyacophila species

Polycentropus species
Coleoptera
Berosus species
Tropisternus species
Peltodytes species
Stenelmis species
Unidentified parnid, etc., at least two species.
Diptera
Chironomus tentans Fabricius
Chironomus viridicollis v. d. Wulp
Chironomus ferrugincovittatus Zetterstedt
Chironomus modestus Say
Cricotopus trifasciatus Panzer
Corethra punctipennis Say
Sepedon species
Odontomyia species
Unidentified tabanid
Psychoda species

4. *Illinois River, Matanzas to Beardstown, inclusive. Twenty-five species; 59 collections; all zones combined*

Mollusca
Unionidae
Strophitus edentulus (Say). Young
Plagiola elegans Lea. Young
Anodonta imbecillis Say
Viviparidae
Vivipara contectoides W. G. Binney
Vivipara subpurpurea Say
Lioplax subcarinatus Say
Pleuroceridae
Pleurocera elevatum, var. *lewisii* Lea
Goniobasis livescens Menke
Amnicolidae
Amnicola emarginata Küster
Somatogyrus subglobosus (Say)
Physidae
Apparently at least two species.
Ancylidae
Ancylus species
Hirudinea
At least two species of leeches not recently taken.
Insects
Ephemerida
Hexagenia bilineata Say

Heptagenia species
Coleoptera
Stenelmis species
Diptera
Tanypus monilis Linnaeus
Palpomyia longipennis Loew
Chironomus dux Johannsen
Chironomus ferrugineovittatus Zetterstedt
Chironomus tentans Fabricius
Cricotopus trifaciatus Panzer
Procladius concinnus Coquillett