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Preliminary Study of Zooplankton Over a Six Month Period on Lake Dardanelle

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INTRODUCTION

This limnological investigation was undertaken to establish preliminary base lines or normals of zooplankton for use of comparison for future studies on Lake Dardanelle. Lake Dardanelle is a large, artificial lake created by the damming of the Arkansas River as a part of the Arkansas River Navigation Project. It is located in North Central Arkansas near Russellville. The study covers only macrozooplankton and mesozooplankton (Welch, 1963). Samples were taken at two stations (Fig. 7). These stations were chosen because of their positions to incoming streams which have constant flow. The sampling stations were approximately 0.5 miles apart and varied in depth from 6.5 ft. at station I to a depth of 12.0 ft. at Station II. The temperature of the water was generally higher by 0.5°C to 1°C at Station I (Table 2). Only samples from surface to approximately 18 inches were collected. Samples were taken on a weekly basis. This paper is concerned with collections over a 24 week period.

A total of 40 genera were identified during the study. Similar organisms were observed at both stations (table I). The total number of zooplankton organisms per liter reached their peak at both sampling stations on July 30, 1969.

ACKNOWLEDGEMENTS

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Materials and Methods

The first sample was collected on May 29, 1969, and sampling was continued on a weekly basis through November 5, 1969, except for the week of June 8. There were a total of 23 collections made over a period of 24 weeks.

The method used in collecting was the vertical drag method, and not the standard method set forth by Welch (1948). With the use of the standard formula for the volume of a cylinder, $V = \pi r^2 h$ (C.R.C. Standard Mathematical Tables, 1964), it was determined that a 14.38 ft. drag would represent a 200 liter sample. This sample was taken from a boat. Only surface to approximately 18 inch samples were collected at both of the collecting stations. The water temperature was also recorded each time along with other information such as wind and sky conditions.

A plankton net equipped with No. 25 silk bolting cloth was used. The sample was concentrated in a 30cc collecting bottle attached to the plankton net by use of an adapter. Approximately 3 ml. of formaldehyde solution N.F. was used to fix and preserve the organisms. The sample was diluted to 100 ml. and with the use of a Sedgewick-Rafter Counting Chamber the average number of organisms in 10 fields was determined.

The taxonomic scheme of Pennak (1953) was used in this paper in the placement of those flagellated organisms which possess both plant and animal characteristics. Identification below the level of genera was not attempted in this study. The classification of nauplii was not undertaken. They are listed under Copepoda. The works of Hyman (1951), Needham and Needham (1966), Pennak (1953), Samuel Eddy and A. C. Hodson (1967), and Ward and Whipple (1966) were used for the identification of the zooplankton.

Acknowledgement is given to Dr. Carl E. Hoffman, Professor of Zoology, University of Arkansas, for his Identification of **Codenella** and **Difflugia.**

RESULTS

Because of the limiting time factor concerning this research (approximately 6 months during one year) no definite conclusions can be reached. Some of the more notable results of the study are:

1. In the 23 different times when samples were taken, Station I had the highest total number of organisms per liter a total of 7 times. Station II had the highest total number of organisms per liter a total of 16 times (Table 2). Station I has a depth of 6.5 ft. while Station II has a depth of 12.0 ft. (Fig. 7). The surface temperature of the water at Station I was warmer than Station II, 22 times out of the 23 times sampled. The temperature difference ranged from 0.0°C to 4.0°C.

2. **Asplanchna, Hexarthra, Filinia,** (Fig. 2 & 5) and **Brachionus, Keratella, Polyarthra,** (Fig. 1 & 4) were common rotifers to both stations. The follow-

ing is a list of times in 23 samplings that each of the six organisms were observed at the two sampling stations.

	Station I	Station II
Asplanchna	20	21
Brachionus	22	22
Filinia	19	14
Hexarthra	15	18
Keratella	22	23
Polyarthra	22	22

Although **Keratella** was observed in more samples, probably the most representative genus was **Polyarthra,** which ranked highest in number of specific organisms per liter in most samples. **Polyarthra** reached its highest count in Sample No. 11 at Station I when a total of 7600 organisms per liter was recorded (Fig. 1). The number of total organisms per liter reached their peak on July 30 Sample No. 18, station II and then showed an irregular decrease during the duration of the research (Table 2).

3. Although the six (6) rotifers listed above were present in most of the samples counted, they did not remain the predominant organisms through the entire study. **Difflugia, Codenella, Ceratium, Peridinium** and other protozoa became predominant in the latter part of the study. This shift in types of predominant organisms was first noted in Sample No. 33 on September 24, temperature 28°C at Station I and Sample No. 34 on September 24 temperature 27.5°C at Station II.

4. The increase and decrease in total number organisms per liter showed a positive correlation to the temperature change (Table 2).

5. Brachionus mictic females (Donner, 1966) were observed on September 24, sample No. 34 (Station II) when a temperature of 27.5°C was recorded.

6. All organisms identified were common to both sampling stations. Neither station ranked consistent with the highest number of organisms present.

   A radical change in the type of predominant organisms occurred only once during the course of the study. Sample No. 7 station I June 25, contained 3600 **Eudorina** per liter. The water was very turbid when this sample was collected due to a very severe rain storm (approximately 5 inches) which had occurred two days prior to this date.

   Number of organisms/liter for three consecutive weeks in samples from Station I and Station II were as follows: (the middle sample represents the sample collected two days after the rain)*

Station I		Station II	
Eudorina	— 150/liter	**Eudorina**	— 0/liter
Polyarthra	— 350/liter	**Polyarthra**	— 250/liter
Brachionus	— 200/liter	**Brachionus**	— 300/liter
Total Number of Organisms in the sample 1750 /liter		Total Number of Organisms in the sample 1800 /liter	
***Eudorina**	— 3600/liter	**Eudorina**	— 50/liter
Polyarthra	— 100/liter	**Polyarthra**	— 0/liter
Brachionus	— 0/liter	**Brachionus**	— 150/liter
Total Number of Organisms in the sample 6100/ liter		Total Number of Organisms in the sample 950/ liter	
Eudorina	— 0/liter	**Eudorina**	— 0/liter
Polyarthra	— 700/liter	**Polyarthra**	— 400/liter
Brachionus	— 150/liter	**Brachionus**	— 600/liter
Total Number of Organisms in the sample 3050 /liter		Total Number of Organisms in the sample 3200 /liter	

Many small developing colonies of **Eudorina** were observed in the sample collected two days after the 5 inch rain. This would indicate either the establishment of probable nutrient features beneficial to the organism or the introduction of organisms already in existence in stagnant areas of the lake at the mouth of Baker's Creek, these being washed in as a result of the heavy precipitation. Due to the autotrophic characteristics of **Eudorina,** and the adverse effects which increased turbidity would establish, and because of the lack of any notable increase in **Eudorina** at Station II, it is the belief of the author that the introduction of the organisms from stagnated areas is the most likely.

This was the only hard rain which occurred during the testing period and this was the only time that a **Volvocidea** representative was present in an abundant amount in a sample.

Hoffman (1952) in his study of the effects of heavy precipitation on the plankton in Lake Fort Smith reported a marked reduction in the number of phytoplankton. In his study **Eudorina** was classified under phytoplankton.

The decrease in number of rotifers after the heavy rain may have been due to increased turbidity or it may be indicative of a periodic cycle. It is of interest to note that in the sample preceding the period of heavy rain, many rotifer eggs were observed. Pennak (1953) states that "the cycles of abundance for plankton species are highly variable within each species, variable from year to year within a single lake, and especially variable from one small lake to another."

Evidence of periodic plankton cycles is present in McGaha's data from his sampling of Sardis Reservoir in Northern Mississippi. McGaha (1966) states that in his sampling of Sardis Reservoir, he has observed shifts in plankter from predominant, to virtually absent, to predominant in types of organisms present in a period as short as one week. This type of periodic cycle may be interpreted from the data present when one considers the number of **Polyarthra** present in the first and third samples in the three (3) samples listed.

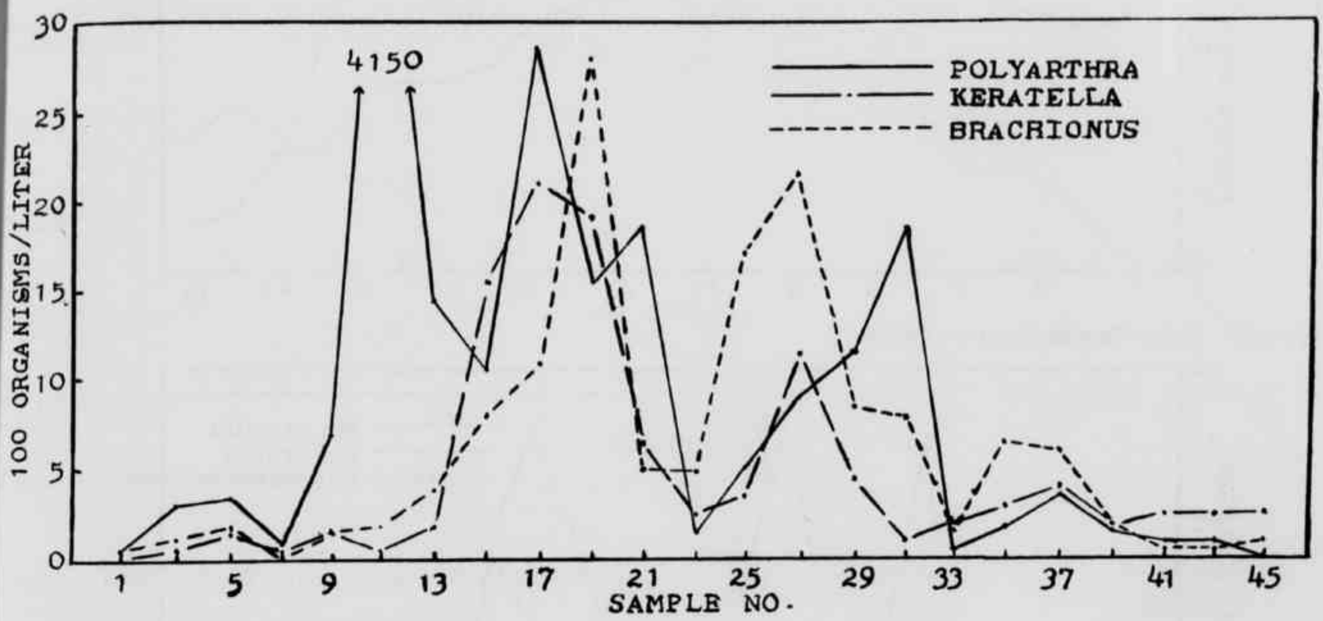


Figure 1. Polyarthra, Keratella, and Brachionus at Station I.

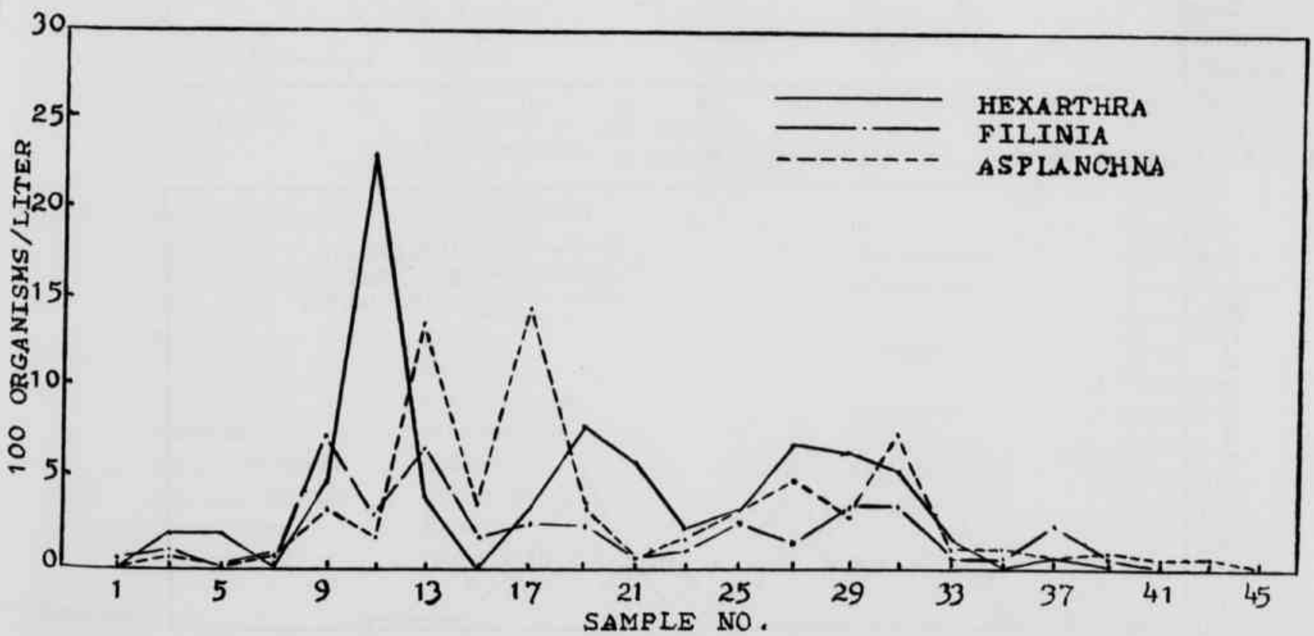


Figure 2. Hexarthra, Filinia, and Asplanchna at Station I.

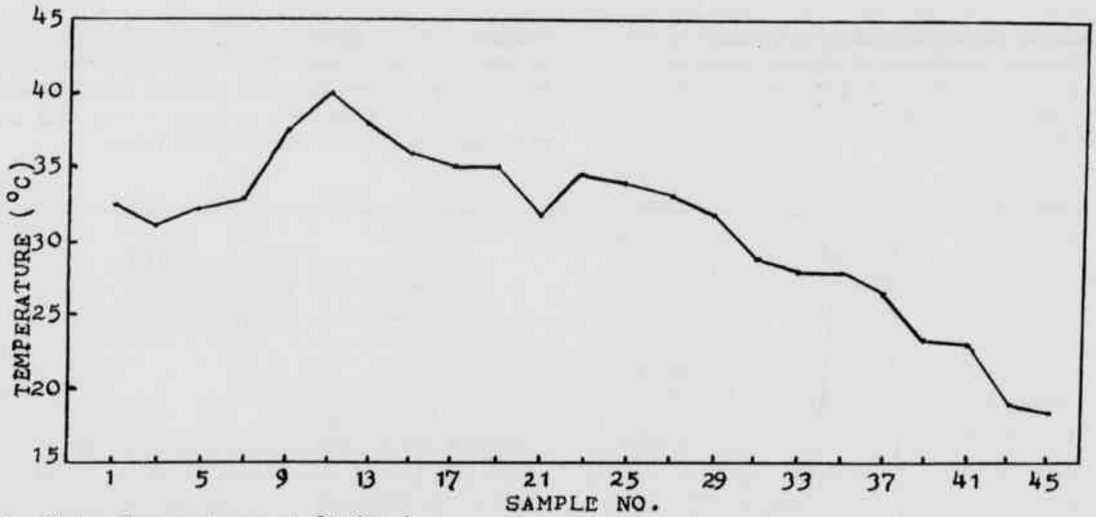


Figure 3. Water Temperatures at Station I.

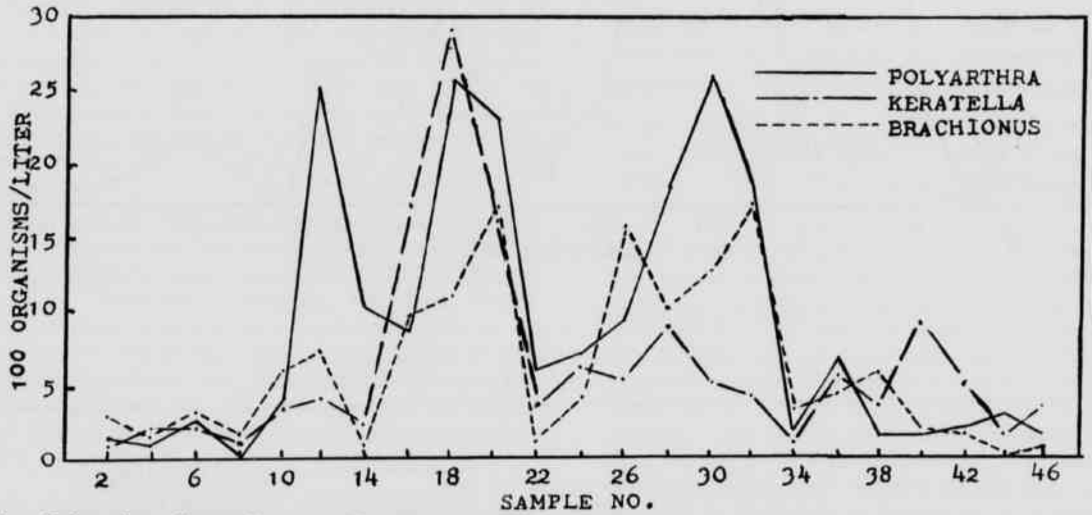


Figure 4. Polyarthra, Keratella, and Brachionus at Station II.

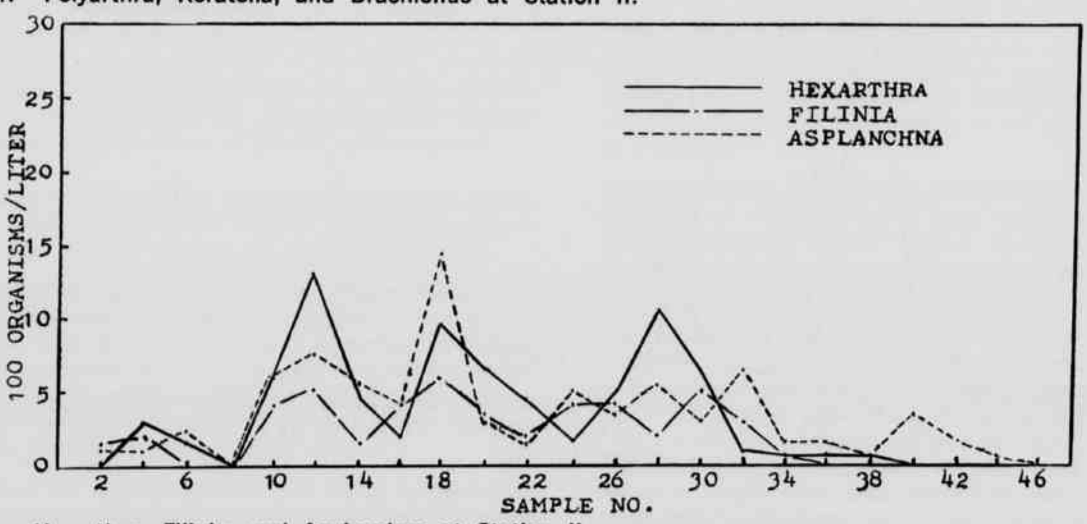


Figure 5. Hexarthra, Filinia, and Asplanchna at Station II.

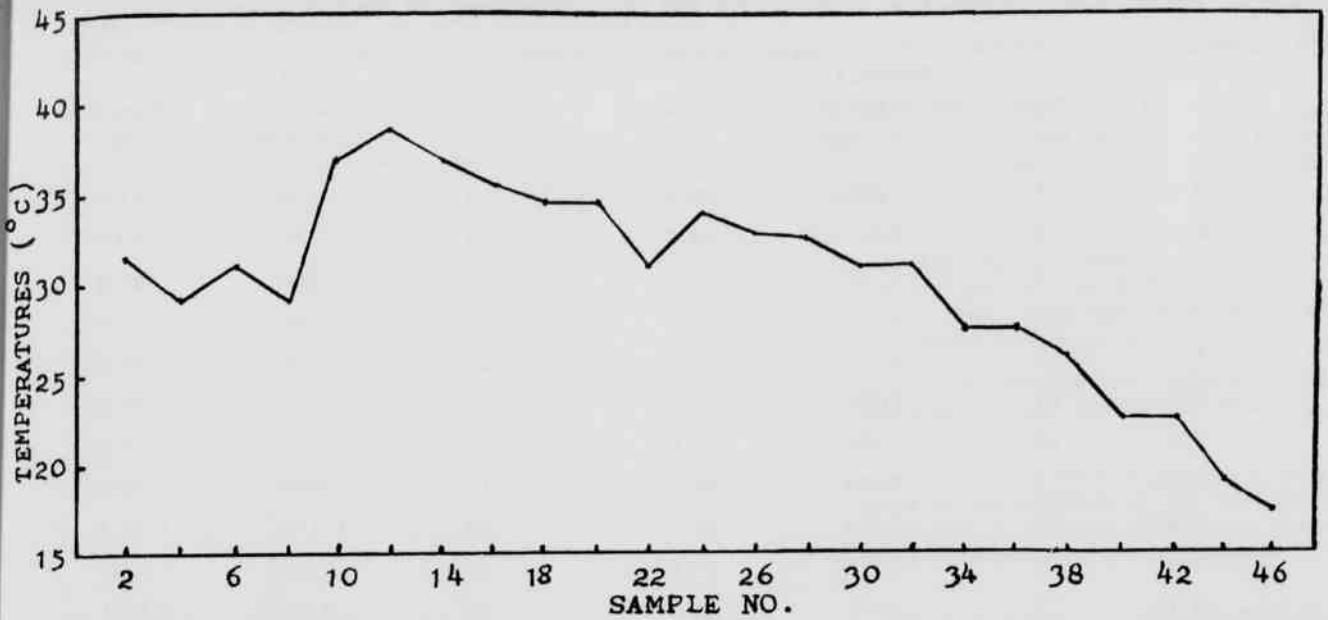


Figure 6. Water temperature at Station II.

Table 1. Phylum, family, and genera of the zooplankton according to Pennak (1953)

Phylum	Family	Genera
Crustaceae*	Bosminidae	Bosmina
	Cyclopidae	Cyclops
	Daphnidae	Daphnia
	Diaptomidae	Diaptomas
	Sididae	Diaphanosoma
Protozoa	Actinophryidae	Actionshaerium
	Ceratioceae	Ceratium
	Chlamydomonadaceae	Chlamydomonas
	Difflugiidae	Difflugia
	Euglenuaceae	Euglena
		Phacus
		Trachelomonas
	Halteriidae	Strombidium
	Mallomonadaceae	Mallomonas
	Ochromonadaceae	Dinobryon
	Oxytrichidae	Urostyla
	Paramecidae	Paramecium
	Peridinaceae	Peridinium
	Tintinnidae	Codonella
	Volvocidae	Eudorina
		Pandorina
		Volvox
Rotatoria	Asplanchnidae	Asplanchna
		Asplanchnopus
	Brachionidae	Anuraeopsis
		Brachionus
		Epiphanes
		Keratella
		Lepadella
	Collothecidae	Collotheca
	Conochilidae	Conochiloides
		Conochilus
	Filiniidae	Filinia
		Hexarthra
	Lecanidae	Lecane
	Philodinidae	Rotaria
	Ploesomatidae	Plaesoma
	Synchaetidae	Polyarthra
		Synchaeta
	Trichocercidae	Trichocerca

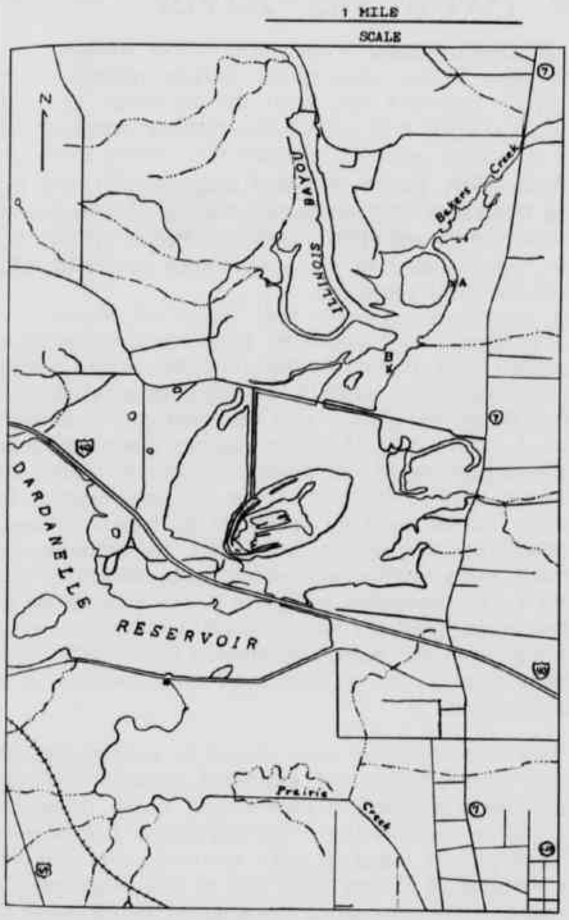
* Nauplii included.

Other organisms present stone fly larva and nematodes.

Table 2. The dates of collection, total organisms per liter, and temperatures for stations 1 and 2.

Date Month/day 1969	Sample No.	Station I Total organisms Per liter	Temperature °C	Sample No.	Station II Total organism per liter	Temperature °C
5/29	1	250	32.5	2	950	31.5
6/ 3	3	1300	31.0	4	1150	29.0
6/18	5	1750	32.0	6	1800	31.0
6/25	7	6100	33.0	8	950	29.0
7/ 2	9	3050	37.5	10	3200	37.0
7/10	11	7600	40.0	12	6850	38.5
7/17	13	4500	38.0	14	2600	37.0
7/25	15	4100	36.0	16	5250	35.5
7/30	17	9200	35.0	18	10150	34.5
8/ 7	19	8050	35.0	20	7350	34.5
8/15	21	5050	31.8	22	3750	31.1
8/21	23	1600	34.5	24	3850	34.0
8/28	25	4250	34.0	26	5250	33.0
9/ 4	27	6100	33.0	28	6350	32.5
9/12	29	4700	31.5	30	6600	31.0
9/17	31	5650	29.0	32	6300	28.5
9/24	33	1550	28.0	34	2950	27.5
10/ 1	35	2600	28.0	36	2950	27.5
10/ 8	37	2650	26.5	38	2450	26.0
10/15	39	2600	23.5	40	2650	22.5
10/22	41	1150	23.0	42	1950	22.5
10/29	43	1050	19.0	44	1400	19.0
11/ 5	45	800	18.0	46	1250	17.5

Figure 7. Dardanelle Reservoir northwest of Russellville with sample station 1 at point "A" and station 2 at point "B";



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