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BENTHIC MACROINVERTEBRATES OF BOOMER LAKE, PAYNE COUNTY, OKLAHOMA

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ABSTRACT. A study of benthic macroinvertebrates in a 102 ha lake was conducted from March, 1966 through February, 1967. Of the thirty taxa collected, seven (*Chaoborus punctipennis* (Say), *Caenis*, *Sialis*, *Hexagenia*, *Hyalella azteca* (Saussure), *Branchiura sowerbyi* Beddard, and Tendipedidae) comprised 82.74 to 99.51% of the total organisms collected monthly. Seven taxa of oligochaetes were collected, the most abundant being *B. sowerbyi*.

Abundance of *C. punctipennis* increased as depth of water increased. Depth distribution of Tendipedidae was unclear since the family was treated as a single taxon. Other taxa, except *Hexagenia* which is treated in another presentation were not abundant enough in collections to elicit a distinct depth distribution.

Variation and abundance of fauna may have been limited by silt depositions during run-off. The amount of silt was apparent by the abundance of *Hexagenia*.

Studies of benthic macroinvertebrates in Oklahoma have generally been restricted to streams (Hornuff, 1957; Wilhm, 1964; Harrel, 1966;) or large impoundments (Sublette, 1957). In order to better establish the ecological requirements and the taxa present in Oklahoma, data from all impoundments offering different abiotic and biotic factors, should be collected and analyzed.

The objective of this presentation is to list the benthic macroinvertebrates, and related ecological observations, collected during a study of Boomer Lake from March, 1966 through February, 1967.

DESCRIPTION OF LAKE. Boomer Lake, completed in 1925, is located three km north of the intersection of state highways 51 and 177. The reservoir initially was used for a municipal water supply, but in 1951, the city discontinued use of the lake for this purpose. Presently, the water is used for irrigation of the park around the lake and as a source of coolant water for the Boomer Lake power station. Morphometric data are presented in Table 1.

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TABLE 1

Morphometric Data for Boomer Lake

Water-shed ha	Surface area ha	Water-shed surface area ratio km	Shoreline length km	Shoreline development km	Maximum depth measured m	Mean depth m
3,625	102	36 to 1	13.77	4.17	9.0	2.98

METHODS. Benthic samples were collected with a 15.24 by 15.24 cm Ekman dredge. After field washing the sample in a sieve with mesh size of 0.42 mm, the remaining benthos and debris were preserved in 10% formalin. Additional washing and sorting were conducted in the laboratory and organisms were preserved in 70% isopropyl alcohol.

Ekman dredge samples were taken weekly from 18 March through 5 September 1966, biweekly through October, and once a month from November through February 1967. A total number of 750 Ekman dredge samples was taken from the lake during 32 collecting trips.

RESULTS. Thirty taxa were collected. However, seven taxa (*Chaoborus punctipennis* (Say), *Caenis*, *Sialis*, *Hexagenia*, *Hyalella azteca* (Saussure), *Branchiura sowerbyi* Beddard, and Tendipedidae) comprised 92.74 to 99.51% of the organisms collected. Insect taxa, other than those mentioned, contributed little to the abundance of macrobenthos, Table 2.

A decrease in number of invertebrates occurred during spring and summer and an increase, into a size vulnerable to sampling methods,

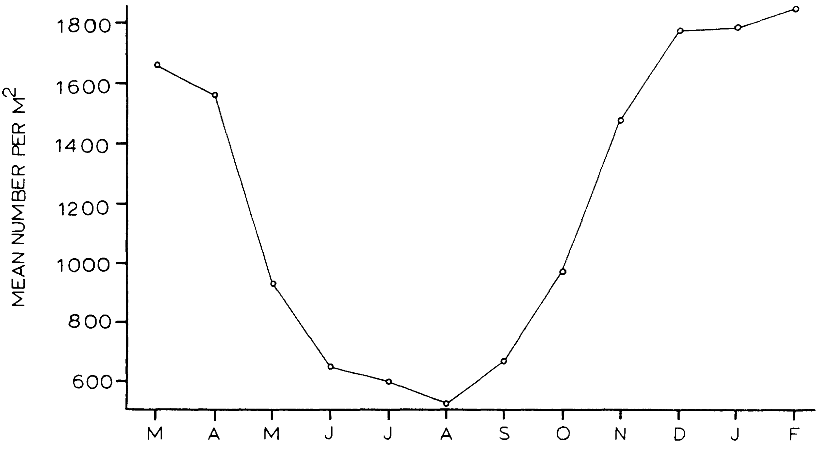

Fig. 1. Monthly Mean Number of Benthic Macroinvertebrates.

during fall and winter (Fig. 1). In the winter of 1966–67, a minimal increase occurred. The decrease during spring and summer largely was a result of emergence and predation while the increase during fall and winter was a result of recruitment of insects that were hatched from eggs laid during the summer and early fall. Ranges of depth distribution and abundance are presented in Table 3.

Branchiura sowerbyi reached peak abundance (174/m^2) in January (Fig. 2). In August, *B. sowerbyi* comprised 18.35% of the total invertebrates collected. In general, abundance increased from a minimum in May to a maximum in January.

Hexagenia was the most numerous taxa collected during all but two months. At least two species have been identified from adult specimens as *H. limbata* (Serville) and *H. bilineata* (Say). In this study, all

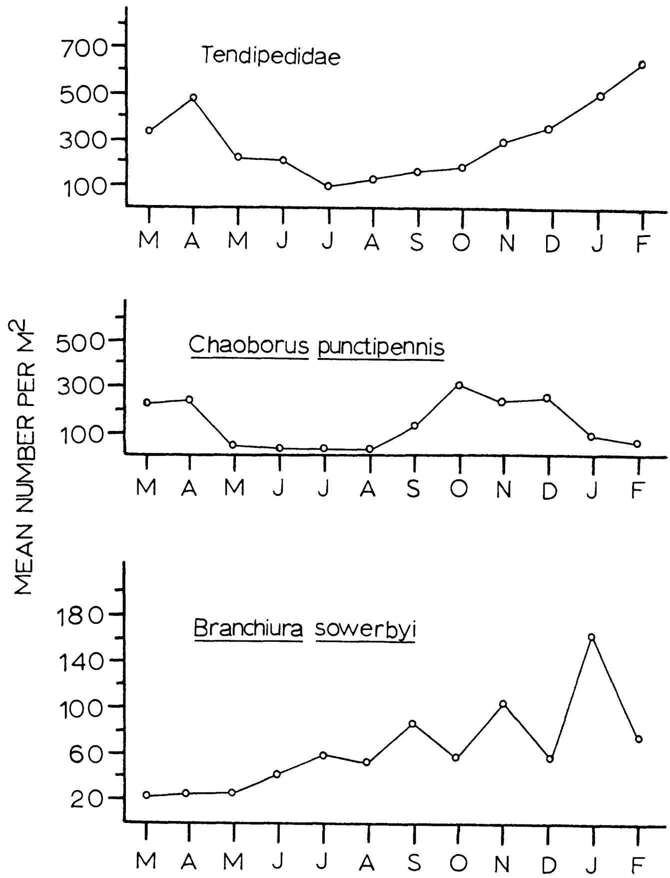

Fig. 2. Monthly Mean Number of Tendipedidae, *Chaoborus punctipennis*, and *Branchiura sowerbyi*.

TABLE 2

Percent contribution of each Taxon to total numbers collected for each month[1]

Taxa	March	April	May	June	July	August	September	October	November	December	January	February
NEMATODA	...	...	...	...	0.2	...	...	...	...	...	...	...
ANNELIDA												
Stylaria lacustris (Linnaeus)	...	...	...	...	...	...	0.2	...	...	...	0.1	0.5
Nais communis (Pignet)	0.1	...	...	0.1	0.1	0.1	0.2	*	0.1	...	2.5	...
Limnodrilus	0.3	*	0.1	0.2	0.1	0.4	...	0.5	0.1	...	0.9	0.6
Tubifex	0.1	0.1	...	...	0.8	1.6	1.1	0.6	0.4	0.6	2.7	0.2
Dero	...	*	...	...	...	...	0.2	...	0.9	...	0.1	...
Aeolosoma	...	...	...	0.1	...	...	...	...	...	...	0.1	...
Branchiura sowervyi Beddard	1.0	1.0	1.6	5.6	8.5	18.4	11.0	8.2	5.7	3.2	5.7	3.8
ARTHROPODA												
Hyalella azteca (Saussure)	2.3	0.2	0.6	6.9	3.6	2.5	6.3	3.2	0.6	0.1	2.0	7.4
Procambarus simulans (Faxon)	...	0.4	...	...	...	...	...	...	...	...	...	...
Hexagenia	55.7	49.8	56.3	52.6	39.0	22.0	18.5	30.6	48.7	55.4	42.3	37.6
Caenis	2.9	2.2	6.0	2.3	7.2	11.3	3.1	6.3	2.5	2.2	3.8	3.6
Ameletus	...	...	...	...	0.3	...	...	...	0.1	...	...	...
Sialis	0.8	0.8	1.5	1.6	5.6	5.4	3.9	2.0	0.9	1.1	0.4	0.5
Hydroporus	...	...	...	...	...	...	...	...	...	0.1	0.1	...
Berosus	0.1	0.1	0.1	...	0.3	0.3	0.3	0.3	0.3	...	...	...
Gomphus	0.1	...	...	0.2	...	0.3	...	0.1	...	...	0.2	...
Ischnura	...	0.1	...	...	1.0	0.5	0.2	0.4	0.1	0.3	0.2	0.6
Epicordulia	...	*	...	...	0.1	0.3	...	...	...	...	...	...
Oecetis	0.1	0.1	...	...	...	...	...	...	...	...	0.2	...
Cheumatopsyche	...	...	...	...	0.1	...	...	...	...	...	...	...
Chaoborus punctipennis (Say)	11.2	11.2	6.9	3.9	4.9	9.5	26.3	27.2	18.2	15.6	7.8	8.8

Tendipedidae	25.1	33.5	25.5	26.2	28.1	26.9	28.7	20.4	21.6	21.4	30.9	36.1
Palpomyia	0.1	*	0.1	...	0.1	...	...	0.1	...	...	0.1	...
MOLLUSCA												
Physa	...	...	...	...	01.	0.3	...	...	...	...	0.1	0.1
Gyraulus	...	...	...	...	...	0.3	...	...	...	...	...	0.1
Anodonta grandis (Say)	...	...	...	0.2	...	0.1	...	0.1	...	...	0.1	...
Carunculina parva Barnes	...	...	...	0.2	0.1	0.1	...	0.1	...	...	0.1	0.1
Sphaerium	...	...	0.1	0.2	...	0.1	0.2	...	...	0.2	0.1	...
Pisidium	0.5	...	...	...	...	...	...	...	...	...	...	...

[1] Rounded to nearest 0.1; * = less than 0.05%.

Hexagenia were lumped since taxonomic characters of naiads could not be relied upon to always provide positive species recognition. Mean no./m^2 decreased from 881 in March to 148 in August, then increased to a maximum of 968 in December, and subsequently decreased. Decreases were due to natural mortality, fish predation, and emergence

TABLE 3

Ranges of depth of collection and abundance

Taxa	Range of depth of collection (meters)	†Minimum abundance No./m^2	†Maximum abundance No./m^2
NEMATODA	0.7–2.0	0	*
ANNELIDA			
Stylaria lacustris	0.5–1.3	0	*
Nais communis	0.3–4.0	0	45
Dero	1.2–6.3	0	*
Branchiura sowerbyi	0.2–6.7	20	174
Limnodrilus	0.2–5.8	0	*
Tubifex	0.3–5.0	0	*
Aeolosoma	0.3–0.5	0	*
ARTHROPODA			
Hyalella azteca	0.3–3.7	0	136
Procamburus simulans	0.6–2.7	0	*
Hexagenia	0.3–7.3	148	968
Caenis	0.2–7.5	0	67
Ameletus	3.7–4.0	0	*
Sialis	0.6–5.8	0	94
Hydroporus	1.2–2.5	0	*
Berosus	0.2–5.0	0	*
Ischnura	0.5–4.5	0	*
Epicordulia	0.7–1.5	0	*
Gomphus	1.2–4.5	0	*
Oecetis	1.2–3.7	0	*
Cheumatopsyche	1.8–3.4	0	*
Chaoborus punctipennis	0.3–7.3	21	330
Tendipedidae	0.3–7.3	131	665
Palpomyia	1.1–3.5	0	*
MOLLUSCA			
Physa	0.5–1.5	0	*
Gyraulus	0.5–1.5	0	*
Anodonta grandis	0.9–3.0	0	*
Carunculina parva	0.5–3.4	0	*
Sphaerium	0.4–2.5	0	*
Pisidium	2.1	0	*

* = less than 10/m^2 † Mean of 5 Ekman dredge samples.

while increase was due to recruitment from the naiads hatched during summer and fall. Ecology of *Hexagenia* naiads in Boomer Lake has been described by Craven and Brown (In Press).

Caenis was found in greatest abundance in January and February (67/m^2). Maximum abundance in a single Ekman dredge sample (594/m^2) occurred on 28 July and was associated with aquatic vegetation.

Chaoborus punctipennis mean abundance decreased from 321/m^2 in March to 21/m^2 in June (Fig. 2). Greatest decrease was in May and probably was due to emergence. Monthly means increased in September and peaked (330/m^2) in October. After October, abundance decreased until cessation of sampling in February. The greatest decrease was during January.

Stahl (1966) indicated that young *Chaoborus* larvae tended to be benthic during the daytime but at night, vertically migrate. This may account for the reduced numbers captured with the Ekman dredge in Boomer Lake during summer months. Since larvae that hatched in May probably would be planktonic during the summer, they would have escaped the dredge. In Myers Lake, Indiana, planktonic larvae were found about two meters above the substrate (Stahl, 1966).

Depth distribution of *C. punctipennis* varied from 0.3 to 7.3 m and in geenral, distribution was opposite to that found in Tendipedidae. Maximum abundance occurred in the deeper areas in Boomer Lake during most seasons (Fig. 3). Sublette (1957) also found minimum

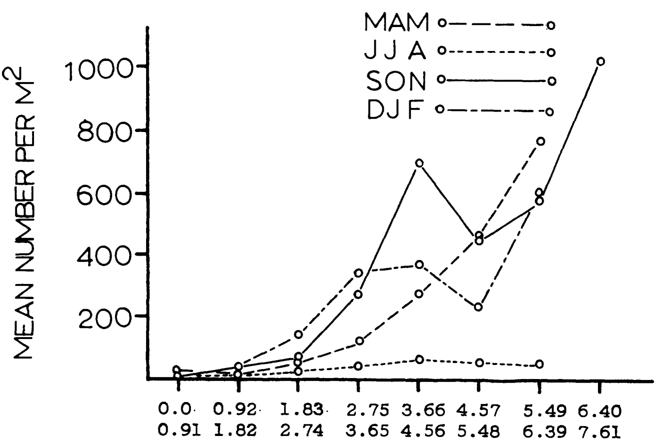

Fig. 3. Depth Distribution (Meters) of *Chaoborus punctipennis*.

number of *Chaoborus* in the littoral and maximum number in the profundal region in Lake Texoma.

Specimens in the family Tendipedidae were not identified to genus. In 1966, the maximum and minimum numbers were 470/m^2 in April and 131/m^2 in July. Beginning in August, abundance increased to 665/m^2 in February. The May and July declines in population density were attributed to emergences (Fig. 3). The pronounced decrease during January in *C. punctipennis* was not observed in Tendipedidae. Much of the decrease possibly was due to predation since *C. punctipennis* was undoubtedly more vulnerable during vertical migration.

Tendipedidae was relatively uniformly distributed in depth during the summer and fall, but in winter and spring exhibited maximum abundance at the 0.92 and 1.82 m interval (Fig. 4). The increase at

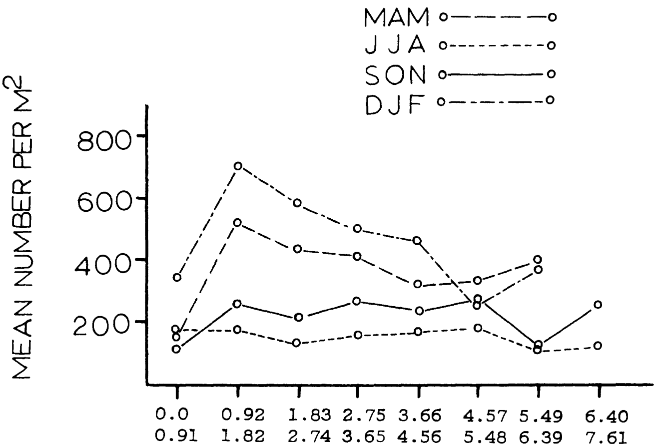

Fig. 4. Depth Distribution (Meters) of Tendipedidae.

these depths may have been due to hatching. Mundie (1955) found a distinct zonation of species from shallow to deep water in Kempton Park East Reservoir, England. Thus, the apparent even distribution in Boomer Lake may be due to lumping all genera as a single taxon.

Only six specimens of *Anodonta grandis* were collected by Ekman dredge. The low water level at the north end of the lake during July resulted in making visible the substrate of sand and *Potomogeton*. Numberous *A. grandis* were observed in this area.

DISCUSSION. Fluctuations in transparency of Boomer Lake water resulted mainly from run-off and addition of suspended matter and wind action. Mean transparency of the water was 127 cm on 6 May which was the highest transparency recorded. This measurement was preceded by several days of calm sunny weather which possibly resulted in a settling of clay particles. Transparency decreased to a mean of 16 cm on 28 July, and then increased but moderate turbidities were probably maintained due to wind action (Craven and Brown, In Press).

The turbidity of Boomer Lake may have limited the variation and abundance of invertebrate fauna. Since the insects collected in the present study respire by means of gills, the turbidity of the water may adversely affect respiration. High clay turbidity may have reduced the rooted vegetation that could provide habitat for taxa. McGaha (1952) stated that silt may be detrimental to insects living on plants, by discouraging oviposition, or preventing insects from entering the plants. Harrel (1966) attributed reduced number of species collected at sixth order pools as compared to fifth order pools in Otter Creek, Oklahoma, to heavy siltation which reducted the number of available microhabitats.

The small number of mollusks collected may be a result of siltation-smothering and reduction of habitat. Scarcity of snails in Lakes Chautaugua and Matanzas, Illinois, has been suggested to have been caused by smothering as a result of siltation (Paloumpis and Starrett, 1960). Mollusks in the present study were not collected beyond a depth of 3.4 m which may reflect intolerance to increasing silt accumulations, or decreasing availability of food.

Oligochaete populations, except for *B. sowerbyi*, were relatively small. The silt substrate present in much of the lake would seem to provide oligochaetes with a suitable habitat, but the sparce numbers collected indicates a small population. However, Brinkhurst (1965) states that tubificids demonstrated no clear habitat preference. Evans (1959) first reported *B. sowerbyi* in Oklahoma from a single specimen collected from a Marshall County pond. Shaefer, Harrel, and Mathis (1965) reported additional distributional data for north-central Oklahoma. In the present study, *B. sowerbyi* was commonly found. The apparent sporadic occurrence of *B. sowerbyi* in Oklahoma possibly is due to the omission of oligochaetes in many surveys and also due to few surveys having been conducted.

Depth of sediment generally increased toward the middle of the lake in the vicinity of the old creek channel. The depth distribution of benthos possibly was a reflection of a taxon's tolerance to silt accumulation. Thus, those taxa being intolerant of silt would be expected to be found near the shore in many cases. However, in Boomer Lake a tremendous amount of allocthonous material was added to the lake during rainy dates which possibly resulted in heavy silt deposits being found at practically all depths and most taxa being generally distributed over the lake bottom. The abundance of *Hexagenia* that live in burrows constructed from sediments, indicates that a substantial amount of sediment was present in the lake.

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