THE STANDING CROP AND PRODUCTIVITY OF A ROCK OUTCROP IN THE MIDDLE OCONEE RIVER, GEORGIA

by

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B.S., Iowa State College, 1947

M.S., Oregon State College, 1949

A Dissertation Submitted to the Graduate Faculty

of the University of Georgia in Partial Fulfillment

of the

Requirements for the Degree

of

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

1957

APPROVAL CERTIFICATE

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Date Aug 6, 1957

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ACKNOWLEDGEMENTS

The author is particularly indebted to Dr. Donald C. Scott, who stimulated an interest in stream biology and suggested a problem of this type. He assisted in the detailed taxonomic work and his advice was helpful on many occasions. Dr. Eugene P. Odum's enthusiasm and advice in regard to the community ecological study was both useful and encouraging. Dr. Bernard S. Martof offered suggestions which were deemed valuable in the preparation of the manuscript. Dr. A. C. Cohen assisted with advice on the statistical analyses. The author appreciated the use of private roads on the property of Mr. C. A. Rowland in order to reach the study area.

Personal support for this study was received through a Wildlife Assistantship, The National Council for Stream Improvement, and a graduate assistantship. Equipment and supplies used during the study were obtained from the Ecological Laboratory.

I am grateful to my wife, Barbara, for her understanding and help during this study. She aided in the tabulation of data and has been very patient during the preparation of the manuscript, which she typed.

INTRODUCTION

The study of aquatic communities has provided the basic information for the development of trophic ecology. Forbes (1887) indicated the necessity for the study of an entire biotic community in order to reach an understanding of the factors which affect perhaps only one species of particular interest. Tansley (1935) introduced the idea of the ecosystem which included the abiotic as well as the biotic factors. Lindeman (1941, 1942) and Juday (1940, 1942) applied the results of community studies toward development of a trophic-dynamic approach to ecology. This latter concept involves the rate and efficiency of energy utilization within each trophic level in the community.

The early research elucidating trophic ecology was conducted on lakes since they provided a relatively limited ecosystem which may be studied without undue influence from the surrounding habitat. Odum (1953) listed three general conditions which distinguish between lake and stream communities: 1. current is a major controlling and limiting factor in streams and affords organisms a constant renewal of the medium; 2. land-water interchange is more extensive in streams which results in a more open ecosystem; and 3. oxygen tension is usually higher in streams and thermal and chemical stratification is slight or absent.

Most stream biology research has been limited to a particular group of organisms. Illustrative of this are Ide's (1940) study of the emergence of insects and that of Starrett (1950) who studied food relationships of minnows. A recent study by Allen (1951) included trout and the insect fauna of a stream. Odum and Odum (1955) evaluated the relationship between the standing crop and productivity of a coral reef and Odum (1957) conducted a similar study on water flowing from a large spring. The latter two studies are pertinent since they attempted to assess productivity at all trophic levels.

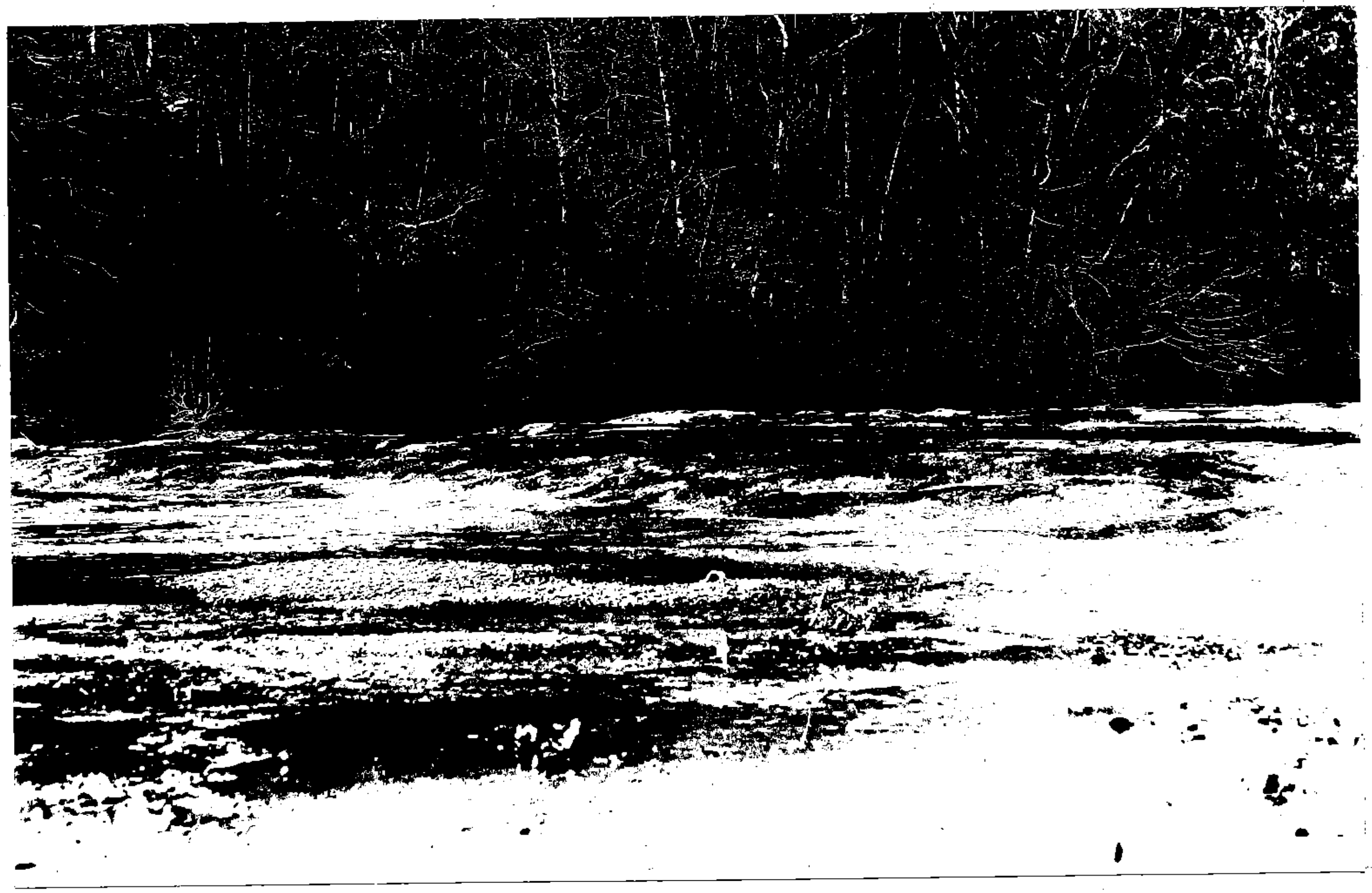
Southern Piedmont streams are characterized by a heavy silt load and shifting sand bottom. The silt seriously limits light penetration and, consequently, the development of a phytoplankton population. The shifting sand bottom prevents the establishment of a phytobenthic community. Flood plain ponds and backwaters are typically absent from these streams eliminating a source of phytoplankton as was reported for the Illinois River by Kofoid (1903). Therefore, it could be anticipated that the primary productivity of Piedmont streams would be very low. Scott (1954) noticed the development of stream communities composed largely of filter- and detritus-feeding organisms in the Savannah River. This observation led him to suggest that the primary productivity of these communities was derived from the surrounding watershed.

The present study is a quantitative evaluation of the standing crop and an estimate of the productivity of a community on a rock outcrop in a small river. The annual cycle of the development of populations of organisms was observed. Several features of the study make it unique in respect to others in trophic ecology. These are: 1. the entire community on the bedrock (excluding bacteria, protozoa, and small metazoa) was sampled; 2. a fine-mesh catch net was used on the bottom sampler permitting the recovery of small organisms; 3. the samples were sorted under a dissecting microscope where it was possible to identify small organisms in the sample material; 4. particulate organic matter in the river water was measured since it was a potential source of food for filter-feeding primary consumers. Sampling was done in order to ascertain the source of organic detritus. The diurnal variation in the dissolved oxygen content of the water was measured in an effort to evaluate productivity within the stream. Field observations were started at the study area during October 1954 when the first water samples were taken. Water samples were taken through December 1956. Preliminary samples for biomass studies were secured in December 1955. Intensive sampling of the bottom fauna began in April 1956, when a satisfactory method of handling the sample material was developed, and ended in April 1957.

DESCRIPTION OF THE STUDY AREA

The study area (Figure 1) was located on the Middle Oconee River, one-half mile upstream from U. S. Highway 29 at Latitude 33° 57' 2" N and Longitude 83° 25' 11" W (U. S. Dept. Int. 1951), near Athens, Clarke County, Georgia. The site was selected because a rock outcrop occurred in the stream bed and the U. S. Coast and Geodetic Survey maintained a gauging station there. The rock outcrop was a desirable feature since it provided an easily sampled, solid substrate. These rock outcrops, which are called shoals, are characteristic of streams in the Georgia Piedmont and are formed by the differential erosion of the rocks in the stream bed. These outcrops usually represent the intrusion of more resistant migmatite and monzonite into the soft "Carolina gneiss" (Woodruff and Parizek 1956).

The average gradient of the Middle Oconee River in Clarke County is 7.5 feet/mile. However, the gradient actually varies from 22.5 to 0.74 feet/mile. Three large shoal areas accounted for 126 feet of drop in 6.6 miles (Woodruff and Parizek 1956). The gradient immediately upstream from the study area was less than one foot per mile and that downstream slightly greater. The fall on the sampling area of the rock outcrop was 60 cm in a distance of four and one-half meters. The length of the entire outcrop varied from eight to ten meters and the river was about 56 meters wide. The river immediately upstream from the outcrop had an irregular rocky bottom, downstream the stream bottom materials were coarse rubble. The constitution of the material downstream from



Photograph Courtesy of D. C. Scott.

Figure 1. The Middle Oconee River at the study area. The sampling site is in the center, immediately to the right of the white water. The river had a discharge of 179 cubic feet/second at the time this picture was made.

the fall was dependent on volume of flow. Sand was found closer to the foot of the fall at low river flows than during high flows. Other than the rock and rubble in the area of the outcrop, the bottom was shifting sand. The average annual discharge of the Middle Oconee River from October 1, 1955 to September 30, 1956 was 285 cubic feet/second (second-feet). During this period the maximum and minimum instantaneous discharge were 8640 and 29 second-feet respectively. The highest discharges occurred during the winter months and the minimum discharges were in August and September (Table 20, appendix).

The rocks supported a growth of Podostemum ceratophyllum in almost all sites which were covered with water. During periods of low water, large areas of the outcrop were exposed and the Podostemum dried up; following high water, only the stolons remained. In either case, when conditions again became favorable rapid growth ensued. Sampling was confined to a midstream channel which maintained a water flow at all times.

The watershed of the river upstream from the study site was 398 square miles (U. S. Dept. of Int. 1951). According to the U. S. Department of Commerce Agricultural Census (1954) land use in the drainage basin was the following: woodland 44%; cropland 30%; pasture 22%; other land uses such as roads, houses, and fallow 4%. The elevation of the gauging station at the study area was 555.66 feet above sea level (U. S. Dept. of Int. 1951). Mr. J. G. Beacham, City Engineer, Athens, Georgia, estimated that in June 1957 the river received sewage from 35 to 40 homes. There was no industrial pollution in the river. Silt was the most obvious pollutant in the water. The river selected for study was considered a typical Piedmont stream.

A small number of pH, bicarbonate alkalinity, and carbon dioxide measurements were made on the Middle Oconee River (Table 1). As may be seen from the bicarbonate alkalinity, the water in the Oconee River was very soft.

Table 1. Carbon Dioxide, Bicarbonate Alkalinity, and pH of Middle Oconee River Water.

Date	pH	Bicarbonate Alkalinity ppm	Carbon Dioxide ppm
IX:5:55	6.86		
IX:9:55	7.25		
IX:12:55	7.50		
IX:13:55	7.25		
IX:26:55	7.30		
X:24:55	7.15	18.70	
X:28:55	7.18	21.15	
XI:5:55	6.90	21.00	
XI:8:55	7.40	20.50	1.60
XI:11:55	7.30	19.60	3.10
XI:25:55	7.01	16.15	2.65
XII:1:55	7.68	17.35	3.45
XII:2:55	7.09	17.40	3.35
I:21:56	7.85	20.10	

METHODS

The bottom sampling method. Bottom samples were taken with a Surber type stream sampler constructed to cover a 10 x 10 cm surface. The catch net was made of number seven, silk, bolting cloth which has 82 meshes per inch. Jónasson (1955) found in a study of the efficiency of sieving techniques that a net with a mesh of 0.2 mm permitted the recovery of from 2 to 6 times as many organisms as the ordinarily used 0.6 mm mesh. The catch net was 50 cm long and cut without any taper, although the end of the net was rounded. The large area of the net allowed the water to flow smoothly through the sampling apparatus, thus preventing the loss of biomass at the front of the sampler. Sheet copper sides were soldered on the frame of the sampler, and these were also of value in preventing loss of material.

A series of five samples was collected on a selected area of the rock outcrop at approximately monthly intervals, although, on two occasions, four samples and once twelve samples were taken. The schedule had to be varied on several occasions because of high water. The rock surface was not flat everywhere but by pressing the sampler into the *Podostemum* mat an effective seal was formed between the rock and the sampler. A putty knife was used to cut the *Podostemum* around the inside edge of the sampler and to scrape the surface of the rock. The flow of water through the sampler carried the loosened materials into the catch net. The material was picked and washed from the net and placed in a pint jar where it was preserved in two per cent formalin.

Sorting of bottom samples. Pupal cases of Calopsectra and Simulium and other clinging organisms were removed from the Podostemum in preliminary sorting. The material was then rinsed in two per cent formalin to wash off organisms too small to be seen with the unaided eye. These washings were examined under the low power (15x) of a dissecting microscope and the small organisms were removed and counted. Allochthonous plant detritus such as tree leaves and animal detritus, which consisted largely of chitinous portions of aquatic insects, were separated at this time. The remainder of the material was classified as autochthonous plant detritus and consisted of dead fragments of Podostemum.

Weighing of biomass. Weights and loss on ignition were determined for organisms and detritus in each sample series by weighing on an analytical balance to 0.1 mg. The organisms were dried at 103° C to a constant weight. After weighing, the biomass was ashed in a muffle for one hour at 550° C and reweighed to determine loss on ignition (ash free dry weight), thus potential errors introduced by gut contents and contamination with sand grains were avoided. The gut of many of the organisms frequently contained much mud or silt. For example, the ash content of Simulium larvae was over twice that of the pupae (Table 2). In order to account for organic matter leached from the Podostemum, the formalin in which each sample was preserved was evaporated and its loss on ignition was added to that of Podostemum. The amount of this material derived from the animals in the samples was negligible.

The water sampling method. Water samples for the determination of

Table 2. Comparative Ash Content of Simulium Larvae and Pupae.

Date	Simulium Larvae			Simulium Pupae		
	Ash Wt.	Dry Wt.	% Ash	Ash Wt.	Dry Wt.	% Ash
Apr. 23 & 25, 1956	13.1	76.5	17.12	0.9	7.6	11.84
May 10, 1956	1.3	8.7	14.94	0.6	1.9	31.58
June 4, 1956	20.8	96.1	21.64	2.1	28.9	7.26
June 24 & 25, 1956	52.4	369.8	14.17	19.8	287.5	6.89
July 23, 1956	27.9	149.2	18.70	2.0	24.7	8.10
Aug. 22, 1956	76.7	278.0	27.59	4.0	47.3	8.46
Sept. 18, 1956	53.2	212.2	25.07	3.4	40.3	8.44
Oct. 3, 1956	6.7	29.8	22.48	1.6	14.2	11.27
Nov. 2, 1956	24.1	126.9	18.99	1.9	30.0	6.33
Nov. 30, 1956	8.3	55.5	14.95	4.5	62.2	7.23
Dec. 19, 1956	5.0	31.8	15.72	0.4	8.4	4.76
Jan 1, 1957	0.2	1.6	12.50			
Feb. 18, 1957	1.2	7.0	17.14			
Apr. 4, 1956	85.4	371.7	22.98	1.7	17.5	9.71
Average			20.74			9.12

detritus in the river were obtained by holding the mouth of a gallon jug about one inch below the surface of the water. Three, one liter aliquots of this sample were passed through a Foerst continuous centrifuge (4400 x g) at the rate of one liter per six minutes. The material retained in the centrifuge cup was designated the particulate fraction, and the material passed by the centrifuge was considered the dissolved fraction (Birge and Juday, 1934). The dissolved fraction was evaporated to dryness over a steam bath and the particulate fraction was washed into a crucible and placed in an oven to dry. Both fractions were dried to constant weight at 103° C. The samples were ashed at 550° C for one hour, wetted with ammonium bicarbonate and dried again at 103° C before weighing to determine loss on ignition (organic material). Wetting the samples with ammonium bicarbonate after ashing, regenerated any bicarbonates and reconstituted waters of crystallization which may have broken down during ashing (APHA 1955). An attempt was made to use millipore filters to separate the particulate and dissolved fractions but the silt and colloidal particles in the water plugged the filters almost immediately. Under the best of conditions it was possible to filter only 200-250 ml of water, consequently, their use was abandoned.

Large pieces of organic material were caught in a wedge-shaped net (mouth 14.6 x 15.2 cm) made of screen wire (2 mm mesh). A current drag was used to determine the rate of flow where the net was set. With these data, it was possible to determine the total amount of large pieces of suspended organic material transported by the river.

Diurnal oxygen curves. Four diurnal oxygen curves were obtained according to the method described by Odum (1956a). Sampling in all but one instance started before dawn and continued until after dark. Three replicate samples were taken at approximately hourly intervals upstream and downstream from the rock outcrop. About five minutes elapsed from the start of upstream sampling to the start of downstream sampling.

Identification of organisms and assignment to trophic level. The following references were used to identify the organisms obtained: general, Pennak (1953); Insecta, Usinger (1956); Plecoptera, Frison (1935, 1942); Tricoptera, Ross (1944); Diptera, Johannsen (1937a, 1937b); Ephemeroptera, Burks (1953) and Berner (1950). The nomenclature of Usinger was followed for the insects and that of Pennak for all other organisms. Food habits were determined by examination of gut contents and from information available in the above taxonomic references. Additional information was obtained from Wesenburg-Lund (1943), Thienemann (1954) and Walshe (1951). Table 3 contains a list of life stages and the trophic classification of all taxa identified in the bottom samples.

Table 3. Species List with Life Stages and Trophic Classification of Organisms which were Found in Samples Studied.

Taxa	Life[1] Stage	Trophic[2] Classification
Coelenterata		
Hydra sp.		C
Platyhelminthes		
Turbellaria		
Dugesia sp.		C
Nematoda		Undet.
Annelida		
Oligochaeta (undet.)		D
Oligochaeta eggs		D
Hirudinea (undet.)		C
Arthropoda		
Crustacea		
Cladocera (undet.)		F
Copepoda (undet.)		D
Arachnoidea		
Hydracarina (undet.)	N,A	C
Hydracarina egg cases		C
Sperchonidae		
Sperchon sp.	N,A	C
Lebertiidae		
Lebertia sp.	N,A	C
Atractideidae	N,A	C
Hygrobatidae		
Megapus sp.	N,A	C
Unionicolidae		
Neumania sp.	N,A	C
Hypochthoniidae (undet.)	N,A	C
Insecta		
Collembola		
Isotomurus palustris	A	D
Ephemeroptera		
Caenidae		
Tricorythodes sp.	N	D&H
Caenis sp.	N	D&H
Ephemerellidae		
Ephemerella sp.	N	D&H

[1]N=Nymph; L=Larva; P=Pupa; A=Adult.

[2]C=Carnivore; D=Detritus Feeder; F=Filter Feeder; H=Herbivore; Undet.=Undetermined.

Table 3. Continued.

Taxa	Life Stage	Trophic Classification
Baetidae (undet.)	N	D&H
Heptageniidae		
Stenonema spp.	N	D&H
Odonata, Zygoptera		
Coenagrionidae		
Argia sp.	N	C
Plecoptera		
Pteronarcidae		
Pteronarcys sp.	N	H
Taeniopterygidae		
Taeniopteryx maura	N	D&H
Brachyptera sp.	N	D&H
Nemouridae		
Nemoura sp.	N	H
Perlidae		
Perlesta placida	N	C
Perlodidae		
Isogenus sp.	N	C
Isoperlidae		
Isoperla sp.	N	C
Hemiptera	N	C
Megaloptera		
Corydalidae		
Corydalus cornutus	L	C
Trichoptera		
Hydropsychidae		
Hydropsyche spp.	L,P	F
Hydroptilidae	L	F
Agraylea sp.	L,P	F
Leptoceridae		
Leptocella sp.	L	F
Coleoptera		
Haliplidae		
Brychius sp.	L	H
Haliplus sp.	L	H
Gyrinidae		
Gyrinus sp.	L	C
Hydrophilidae	L	C
Hydrophilidae	A	H
Helophorus sp.	L	C
Hydrochus sp.	L	C
Berosus sp.	L	H
Anacaena sp.	L	C
Elmidae	A,L	H
Diptera		

Table 3. Continued.

Taxa	Life Stage	Trophic Classification
Tipulidae		
Tipula sp.	L	D
Simuliidae		
Simulium sp.	A,L,P	F
Simulium cast larval and pupal skins		Detritus
Simulium dead pupae		Detritus
Simulium pupal cases		Detritus
Tendipedidae (undet.)	A,L,P	Undet.
Pelopiinae		
Pentaneura sp.	L	C
Procladius sp.	L	C
Hydrobaeninae		
Corynoneura sp.	L,P	H
Brillia sp.	L	D&H
Cardiocladius sp.	L,P	C
Cricotopus (*Spaniotoma*) 4 spp.	L,P	H
Tendipedinae		
Calopsectra sp. cases		Detritus
Calopsectra sp.	L,P	F
Polypedilum fallax	L	D
Polypedilum convictum	L	D
Polypedilum sp.	L,P	D
Cryptochironomus stylifera	L	C
Cryptochironomus sp. b. Joh.	L	C
Glyptotendipes sp.	L	H
Tendipes (*Limnochironomus*) sp.	L	D
Heleidae (undet.)	L,P	D&H
Dolichopodidae (undet.)	L,P	C
Empididae		
Hemerodromia sp.	A,L,P	C
Anthomyiidae (undet.)	L	C
Mollusca		
Gastropoda		
Pleuroceridae		
Goniobasis sp.		H
Goniobasis sp.	Shells	Detritus
Ancylidae		
Ferissia sp.		H

RESULTS AND DISCUSSION

<u>Sampling adequacy</u>. The 100 cm^2 samples used in this study were considerably smaller than the square foot or 1000 cm^2 samples normally taken in bottom fauna studies. The adequacy of the 100 cm^2 samples was verified by application of a species area-curve (Cain 1938). Table 4 shows that in all series of samples, over 90 per cent of the taxa were represented in the first three out of five samples in the series while four samples included 96.6 per cent. A rate of change of five per cent or less was considered the point of diminishing returns for samples of this type. The inclusion of a fifth sample in the present study increased the number of species represented by only 3.41 per cent. A series of 12 successive samples was taken on June 25 and 26, 1956. These contained 38 taxa, 34 of which were represented in the first three samples. Only four additional taxa, represented by eight individuals, were recovered in succeeding samples. This twelve-sample series indicated that individuals, as well as species, were adequately represented in the samples taken.

The mean, the standard deviation, and the coefficient of variation were calculated for the total number of individuals in samples of each series (Table 5). Although the coefficients of variation were usually higher when the number of individuals was small, they were relatively consistent for field data of this type and were similar to those found by Cross (1956) in a study of the arthropods in an old-field ecosystem.

Table 4. Number of Taxa and Additional Taxa Collected in Successive Samples.

Date	Series Sample Number 1	2	3	4	5	Total Taxa	Total Samples
Apr. 23 & 25, 1956	13	10	7	0	0	30	5
May 10, 1956	19	8	3	2	-	32	4
June 4, 1956	23	3	4	1	-	31	4
June 25 & 26, 1956	23	5	6	0	0	34	5[1]
July 23, 1956	15	4	3	3	4	29	5
Aug. 22, 1956	21	4	3	5	0	33	5
Sept. 18, 1956	23	5	1	3	1	33	5
Oct. 3, 1956	15	3	5	2	3	28	5
Nov. 2, 1956	23	4	2	2	1	32	5
Nov. 30, 1956	30	3	1	0	0	34	5
Dec. 19, 1956	26	3	1	1	5	36	5
Jan 21, 1957	22	6	3	4	0	35	5
Feb. 18, 1957	26	3	0	3	1	33	5
Apr. 4, 1957	27	6	7	3	1	44	5
Total	306	67	46	29	16	464	
Average	21.86	4.79	3.29	2.07	1.33	33.14	
Per cent of total	65.96	80.42	90.34	96.59	100.		

[1] Seven additional samples in this series contained four additional taxa represented by eight individuals.

Table 5. The Mean, Standard Deviation, and Coefficient of Variation of the Total Number of Individuals in Samples of Each Series.

Date	Mean	Standard Deviation	Coefficient of Variation
Apr. 23 & 25, 1956	439	211.2	48.11
May 10, 1956	276	222.0	80.43
June 4, 1956	646	207.9	32.18
June 25 & 26, 1956	946	270.9	28.64
July 23, 1956	535	189.9	35.48
Aug. 22, 1956	1177	868.3	73.77
Sept. 18, 1956	2234	612.5	27.42
Oct. 3, 1956	262	152.4	58.17
Nov. 2, 1956	617	154.8	25.09
Nov. 30, 1956	838	350.2	41.79
Dec. 19, 1956	847	246.5	29.10
Jan 21, 1957	361	177.1	49.06
Feb. 18, 1957	1160	429.8	36.97
Apr. 4, 1957	2621	654.4	24.97

Diversity indices (Simpson 1949) were calculated for each sample and for each sample series. The diversity index is the probability that, if all individuals in a sample were randomly mixed, two individuals picked at random would not be the same species. The diversity index approaches one when all species are represented by equal numbers of individuals. It approaches zero when all species but one are represented by two individuals and the many remaining organisms belong to one species. The diversity index may be considered a mathematical extension of the ideas of Richardson (1928) and Patrick (1949). Richardson studied numbers of individuals and numbers of species in relation to pollution in the Illinois River. Patrick used bar graphs to indicate the dominance of certain pollution tolerant organisms. The diversity indices calculated from Middle Oconee River data (Table 6) show a variation of the same magnitude as that of the coefficient of variation. This variation may exemplify the variability to be expected in a stream community free from organic pollution. Unfortunately, there are no data for comparison. No seasonal or other trends were revealed by the indices.

Standing crops of organisms. The standing crops of organisms are summarized in Table 7. Tables 21-34 (appendix) contain the data from each sample, as well as additional data on such items as *Calopsectra* cases, *Simulium* pupal cases and cast pupal skins. Those series which did not contain five 100 cm^2 samples have been corrected to 500 cm^2 in Table 7.

Diptera, including *Simulium*, *Calopsectra*, *Cricotopus* (*Spaniotoma*), *Polypedilum*, *Corynoneura*, and *Cardiocladius*, were among the most common

Table 6. Diversity Indices for Individual Samples and for Each Sample Series.

Date	Series Sample Number 1	2	3	4	5	Series	Total Individuals	Total Species
Apr. 23 & 25, 1956	0.71	0.52	0.27	0.58	0.49	0.44	2,160	30
May 10, 1956	0.50	0.20	0.09	0.13		0.14	1,089	32
June 4, 1956	0.18	0.27	0.31	0.38		0.29	2,554	31
June 25 & 26, 1956	0.17	0.13	0.14	0.16	0.18	0.20[1]	11,128	34
July 23, 1956	0.59	0.40	0.32	0.51	0.58	0.47	2,655	29
Aug. 22, 1956	0.20	0.42	0.37	0.18	0.51	0.27	5,840	33
Sept. 18, 1956	0.31	0.26	0.31	0.20	0.25	0.27	11,127	33
Oct. 3, 1956	0.13	0.19	0.20	0.12	0.14	0.13	1,300	28
Nov. 2, 1956	0.28	0.17	0.16	0.11	0.19	0.16	3,071	32
Nov. 30, 1956	0.26	0.16	0.27	0.26	0.18	0.17	4,145	34
Dec. 19, 1956	0.43	0.29	0.14	0.27	0.26	0.24	4,206	36
Jan. 21, 1957	0.17	0.21	0.16	0.21	0.13	0.16	1,786	35
Feb. 18, 1957	0.12	0.17	0.14	0.16	0.17	0.14	5,762	33
Apr. 4, 1957	0.33	0.18	0.21	0.25	0.29	0.24	13,059	44

[1]Diversity indices for seven additional samples in this series were as follows: 0.18; 0.16; 0.32; 0.16; 0.34; 0.40; 0.19.

Table 7. Summary of Numbers and Biomass (mg)[1] of Organisms in Each Sample Series (per 500/sq cm).

Taxa	April 23&25, 1956 No.	Wt.	May 10, 1956 No.	Wt.	June 4, 1956 No.	Wt.	June 25&26, 1956 No.	Wt.	July 23, 1956 No.	Wt.	Aug. 22, 1956 No.	Wt.	Sept. 18, 1956 No.	Wt.	Oct. 3, 1956 No.	Wt.	Nov. 2, 1956 No.	Wt.	Nov. 30, 1956 No.	Wt.	Dec. 19, 1956 No.	Wt.	Jan. 21, 1957 No.	Wt.	Feb. 18, 1957 No.	Wt.	April 4, 1957 No.	Wt.	Totals No.	Wt.
Hydra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	1	0.1	1	0.1	3	0.4
Dugesia sp.	-	-	1	0.4	-	-	-	-	12	1.1	22	1.5	12	1.2	8	1.3	2	0.6	5	0.6	7	1.5	5	1.9	13	4.9	15	4.4	102	19.4
Nematoda	10	0.5	9	0.1	14	0.4	36	0.6	50	0.6	11	0.2	99	0.5	35	0.2	70	0.6	35	0.5	67	0.5	25	0.4	55	0.8	42	0.3	558	6.2
Oligochaeta	108	14.4	202	8.0	191	1.0	571	6.2	297	13.5	467	3.4	1128	9.8	42	1.2	295	4.9	890	8.4	259	3.5	268	2.2	1032	7.0	1509	13.2	7,259	96.7
Hirudinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1.8	-	-	-	-	-	-	-	-	-	-	2	1.8
Cladocera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	0.2	24	0.4	27	0.3	92	0.4	161	1.3
Copepoda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	0.4	7	0.1	36	0.4	16	0.4	8	0.3	25	0.3	99	1.9
Hydracarina	-	-	-	-	-	-	9	0.2	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	-	-	-	-	-	-	10	0.4
Sperchon sp.	13	0.7	2	0.4	9	0.5	71	1.4	22	1.6	73	1.8	174	2.8	112	1.5	63	1.5	49	1.0	26	0.5	4	0.2	6	0.5	7	0.7	651	15.1
Lebertia sp.	3	1.0	1	1.0	5	0.9	4	0.5	2	0.8	3	0.1	16	0.6	9	0.5	6	0.4	6	0.3	3	0.4	4	0.6	-	-	2	0.8	64	7.9
Atractideidae	6	0.6	2	0.2	4	0.4	16	0.8	3	0.3	38	0.5	45	1.0	58	1.0	16	0.6	11	0.4	14	0.5	-	-	1	0.5	4	0.5	218	7.3
Megapus sp.	9	0.9	5	0.5	21	1.0	59	2.1	4	0.1	35	1.0	62	2.2	22	0.8	18	0.6	18	0.4	23	0.5	2	0.7	8	0.7	17	0.3	303	11.8
Neumania sp.	1	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.3
Hypochthoniidae	130	1.3	20	0.2	46	0.8	39	0.5	20	0.9	168	0.7	350	1.7	80	0.6	162	0.9	136	1.6	296	1.1	63	0.4	175	0.6	211	1.2	1,896	12.5
Lestomurus palustris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4	-	-	-	-	1	0.4
Tricorythodes sp. (N)	-	-	2	0.5	49	1.4	75	5.9	-	-	211	19.8	173	11.4	1	0.5	1	0.2	-	-	1	0.2	-	-	-	-	-	-	513	39.9
Caenis sp. (N)	-	-	6	0.9	6	0.4	2	0.2	-	-	3	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	2.3
Ephemerella sp. (N)	-	-	-	-	34	10.0	4	5.2	-	-	-	-	-	-	-	-	1	0.6	13	0.9	24	3.8	3	0.7	12	5.6	13	2.0	104	28.8
Baetidae (N)	26	0.9	62	2.0	176	6.4	27	24.2	4	0.6	367	7.3	686	21.3	13	1.0	50	1.2	9	0.5	16	2.7	1	0.5	15	0.9	47	1.5	1,499	71.0
Stenonema sp. (N)	2	0.1	30	2.8	20	0.8	88	7.6	12	0.3	121	7.8	211	17.9	12	0.5	20	2.8	13	1.9	43	11.8	9	1.2	10	2.1	27	4.5	618	62.1
Agria sp. (N)	-	-	-	-	-	-	-	-	-	-	-	-	13	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1.3
Pteronarcys sp. (N)	-	-	-	-	-	-	1	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4	2	10.8
Taeniopteryx sp. (N)	62	0.6	6	0.2	-	-	-	-	-	-	-	-	-	-	-	-	282	9.5	102	12.1	91	24.5	12	4.8	825	4.9	211	1.4	1,591	58.0
Brachyptera sp. (N)	1	0.7	-	-	-	-	-	-	-	-	-	-	-	-	4	0.3	-	-	395	22.0	299	33.7	62	10.9	16	8.0	-	-	777	75.6
Nemoura sp. (N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	1.6	12	1.6
Perlesta placida (N)	19	11.3	49	41.1	2	6.6	9	21.1	-	-	-	-	-	-	-	-	13	0.7	22	1.6	42	1.4	17	1.0	34	2.6	20	4.0	227	91.4
Isogenus sp. (N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.7	-	-	-	-	-	-	1	1.7
Isoperla sp. (N)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.1	20	18.4	21	19.5
Hemiptera (N)	2	0.3	1	1.0	-	-	2	0.2	-	-	1	0.8	6	0.4	-	-	-	-	2	0.6	-	-	-	-	-	-	4	0.6	18	3.9
Corydalus cornutus (L)	-	-	-	-	-	-	-	-	9	2.1	5	45.2	6	119.3	-	-	-	-	-	-	-	-	1	0.6	-	-	-	-	21	167.2
Hydropsyche sp. (L)	7	0.3	21	2.8	86	7.5	209	45.9	26	1.4	19	6.8	107	0.4	17	0.6	9	1.0	30	13.4	63	53.8	2	0.7	2	0.7	4	2.9	602	138.2
Hydropsyche sp. (P)	-	-	-	-	1	2.2	10	17.0	-	-	-	-	1	1.0	1	0.6	-	-	-	-	-	-	-	-	-	-	-	-	13	20.8
Hydroptilidae (L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4	-	-	1	0.4
Agraylea sp. (L)	-	-	-	-	-	-	1	0.5	-	-	-	-	2	0.2	-	-	-	-	1	0.7	-	-	-	-	-	-	1	0.4	5	1.8
Agraylea sp. (P)	3	0.6	-	-	2	1.1	-	-	-	-	-	-	1	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1.9
Leptocella sp. (L)	-	-	1	0.1	34	1.4	5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	2.0
Brychius sp. (L)	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.2
Haliplus sp. (L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3	1	0.3
Gyrinus sp. (L)	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
Hydrophilidae (Ad)	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3
Helophorus sp. (L)	-	-	-	-	-	-	-	-	-	-	1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.0
Hydrochus (L)	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3
Berosus sp. (L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.2	1	1.2
Anacaena sp. (L)	-	-	-	-	-	-	1	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4
Elmidae (Ad)	1	0.6	1	0.2	-	-	10	1.2	2	0.5	6	1.0	2	0.3	1	0.1	1	0.4	1	1.0	2	0.4	-	-	-	-	-	-	27	5.7
Elmidae (L)	4	0.5	-	-	-	-	5	0.5	5	0.5	2	0.3	5	0.4	1	0.3	2	0.4	3	0.9	3	0.5	4	0.8	-	-	3	0.1	37	5.2
Tipula sp. (L)	-	-	-	-	-	-	-	-	-	-	-	-	11	37.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	37.2
Simulium sp. (L)	1373	63.4	416	9.0	1402	94.2	1202	132.2	1507	100.2	2301	158.0	1976	130.5	291	20.8	801	83.7	308	38.0	158	23.6	21	0.9	650	5.8	5513	255.0	17,919	1115.2
Simulium sp. (L) with dark histoblasts	-Not Separated-								107	21.1	212	43.3	130	28.5	8	2.3	59	19.1	34	9.2	13	3.2	1	0.5	-	-	116	31.3	680	158.5
Simulium sp. (P)	37	6.7	2	1.6	250	33.5	634	107.4	168	22.7	332	43.3	264	36.9	74	12.6	128	28.1	267	57.7	44	8.0	-	-	2	0.3	90	15.8	2,292	374.6
Simulium (Ad)	1	0.5	-	-	4	1.4	14	2.8	9	1.7	3	0.4	4	0.5	-	-	1	0.4	3	1.7	1	0.3	-	-	-	-	-	-	40	9.7
Tendipedidae (L)	29	0.7	20	0.8	26	0.6	85	1.2	21	0.4	45	0.3	38	2.0	9	0.1	13	0.9	41	0.4	30	1.3	13	0.2	30	0.4	38	1.0	438	10.3
Tendipedidae (P)	2	0.5	-	-	-	-	8	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	0.6
Tendipedidae (Ad)	4	0.4	-	-	-	-	2	0.6	-	-	1	0.2	3	0.6	2	0.3	-	-	-	-	1	0.2	8	0.9	6	0.3	6	0.7	33	4.2
Pentaneura sp. (L)	2	0.4	8	0.5	2	0.9	4	0.5	1	0.4	2	0.1	3	0.4	-	-	1	0.2	2	0.3	-	-	1	0.2	1	0.2	4	0.6	31	4.7
Procladius sp. (L)	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.3
Corynoneura sp. (L)	38	0.9	72	1.4	35	0.5	13	0.4	42	0.9	35	0.8	157	1.5	39	0.5	232	3.3	43	0.5	39	1.4	35	0.4	64	0.7	87	1.0	921	14.2
Corynoneura sp. (P)	-	-	-	-	2	0.7	-	-	1	0.6	4	1.3	1	0.6	5	0.4	11	0.3	3	0.1	-	-	-	-	3	0.7	4	0.9	34	5.6
Brillia sp. (L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.5	2	0.5
Cardiocladius sp. (L)	-	-	5	0.1	5	0.9	107	4.8	5	0.5	5	1.1	6	1.6	8	0.9	21	1.7	18	0.7	27	1.0	30	0.9	76	8.2	212	8.3	525	30.7
Cardiocladius sp. (P)	-	-	-	-	-	-	1	0.9	-	-	-	-	-	-	-	-	1	0.4	1	0.1	1	1.0	-	-	1	0.8	1	0.7	6	3.9
Cricotopus (Spaniotoma) sp. 1 (L)	95	2.1	105	1.5	237	4.1	302	4.9	47	1.4	54	2.0	72	1.4	89	1.7	144	2.7	312	6.8	344	7.5	139	0.4	334	4.6	835	8.3	3,109	49.4
Cricotopus (Spaniotoma) sp. 2 (L)	98	1.3	56	0.6	11	0.6	180	3.2	56	1.3	227	6.1	396	5.8	155	2.4	36	0.7	17	0.6	4	0.6	20	0.6	61	0.7	303	3.6	1,620	28.1
Cricotopus (Spaniotoma) sp. 3 (L)	7	0.7	-	-	42	1.2	61	1.2	11	0.6	45	0.7	103	2.2	1	0.3	15	0.5	30	1.1	35	2.7	18	0.5	73	1.3	290	6.1	731	19.1
Cricotopus (Spaniotoma) sp. 4 (L)	44	0.7	61	1.1	59	1.6	-	-	13	0.5	2	0.1	8	0.1	1	0.3	29	0.5	45	1.1	193	3.6	280	3.0	1328	12.3	1639	13.6	3,642	38.5
Cricotopus (Spaniotoma) sp. 2 (P)	-	-	-	-	-	-	-	-	-	-	54	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	3.4
Cricotopus (Spaniotoma) sp. 4 (P)	-	-	-	-	15	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	0.7	-	-	23	1.8	50	3.6
Cricotopus (Spaniotoma) sp. (P)	1	0.4	4	0.2	17	1.0	7	0.8	2	0.5	-	-	14	1.1	2	1.1	4	0.5	29	2.2	13	1.1	-	-	33	1.7	-	-	136	10.6
Calopsectra sp. (L)	31	1.2	51	0.7	190	2.5	508	5.3	78	0.9	917	13.7	1491	58.9	148	1.7	529	2.6	1173	8.3	1929	27.7	568	9.6	494	5.8	1101	15.7	12,208	154.6
Calopsectra sp. (P)	-	-	2	0.4	7	0.9	19	0.7	6	0.6	69	2.5	150	5.7	5	0.5	-	-	27	2.0	7	0.7	7	0.7	8	0.8	16	1.1	323	16.6
Polypedilum fallax (L)	-	-	1	0.4	1	0.5	5	0.4	4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5	12	2.0
Polypedilum convictum (L)	21	0.7	62	3.4	86	1.3	120	2.1	30	1.9	12	0.5	181	6.0	44	1.8	29	1.8	62	1.6	46	1.2	160	1.2	371	9.5	446	12.1	1,670	45.0
Polypedilum sp. (L)	2	0.5	37	2.2	27	2.1	74	1.9	81	3.2	1	0.2	-	-	4	0.4	4	0.1	9	0.5	4	0.4	11	0.4	10	0.3	37	1.3	301	13.5
Polypedilum sp. (P)	-	-	15	1.2	-	-	-	-	8	0.4	-	-	2	0.8	-	-	-	-	-	-	-	-	-	-	-	-	8	1.0	32	3.4
Cryptochironomus stylifera (L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.4	4	0.5	2	0.6	2	0.4	-	-	14	1.1	24	3.0
Cryptochironomus sp. b. Joh.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.8	-	-	1	0.2	1	0.4	3	1.4
Glyptotendipes sp. (L)	-	-	-	-	-	-	-	-	1	0.3	-	-	3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.8
Tendipes (Limnochironomus) sp. (L)	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4	5	0.3	-	-	1	0.2	-	-	3	0.6	-	-	8	0.2	18	1.7
Heleidae (L)	1	0.8	4	1.4	-	-	-	-	-	-	6	0.3	-	-	-	-	-	-	-	-	1	0.6	1	0.9	-	-	6	0.5	19	4.5
Heleidae (P)	-	-	-	-	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
Dolichopodidae (L)	-	-	-	-	-	-	-	-	-	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.5
Dolichopodidae (P)	-	-	-	-	-	-	-	-	-	-	3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.2
Hemerodromia sp. (L)	-	-	-	-	4	0.1	20	1.8	7	0.5	-	-	6	0.5	1	0.2	2	0.5	8	0.3	8	0.5	13	0.7	9	0.9	7	1.6	85	7.6
Hemerodromia sp. (P)	1	0.7	-	-	-	-	6	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	1.6
Hemerodromia sp. (Ad)	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1
Anthomyiidae (L)	1	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4
Goniobasis sp.	-	-	31	264.5	86	2.1	83	34.4	2	1.1	4	0.3	6	38.4	2	4.4	-	-	-	-	-	-	-	-	-	-	-	-	214	345.2
Ferissia sp.	-	-	-	-	5	0.6	1	0.6	1	0.6	6	0.4	43	1.7	2	0.5	3	0.6	2	0.2	1	0.6	1	0.4	1	0.1	5	0.6	71	6.9

[1]Loss on ignition

organisms encountered. Five species of Hydracarina were consistently present. Mayflies in the Baetidae and Stenonema and Ephemerella were common. The stoneflies Perlesta placida, Isoperla, Taeniopteryx maura, Brachyptera and the dobson fly Corydalus cornutus were present on the rock outcrop seasonally.

An interesting univoltine condition was exhibited by Taeniopteryx maura. The nymphs found on January 21, 1957 appeared to be at or very near their maximum size (Table 8, Figure 2). One individual was emerging as an adult when the sample was taken. The hatchlings were found in the next samples taken on February 18. A decrease in number of individuals and an increase in their average weight continued until May 10 (1956 data). None was found again until November 2, at which time they showed no growth. Rapid growth ensued until the maximum weight was reached in January. Frison (1935) noted the winter hatch of eggs for Taeniopteryx maura (= nivalis, Frison 1942) but was unable to find the young before October 10 in Illinois. Another stonefly, Brachyptera, exhibited a similar life cycle in the Middle Oconee River (Table 8). The maximum weight of individuals of this genus was attained in February. Univoltine life cycles were exhibited by Perlesta placida (Table 8), Isoperla, Corydalus cornutus, and Ephemerella.

None of the other organisms collected showed distinct life cycles. The similarity of early life history stages of closely related species may have masked the life cycles of these organisms. For instance, the taxon Baetidae was known to include Isonychia pictipes and at least one species of Pseudocloeon; Hydropsyche include both H. betteni and H. frisoni; Stenonema included two and possibly three unidentified

Table 8. The Number, Total Weight, and Average Weight of *Taeniopteryx maura*, *Brachyptera* sp. and *Perlesta placida* Nymphs (No. and Wt./500 cm^2).

Date	*Taeniopteryx maura*			*Brachyptera*			*Perlesta placida*		
	No.	Wt. mg	Av. Wt.	No.	Wt. mg	Av. Wt.	No.	Wt. mg	Av. Wt.
Apr. 23 & 25, 1956	62	0.6	0.0097	1	0.7	0.7000	19	11.3	0.5947[1]
May 10, 1956	5	0.2	0.0400	0	0	0	39	32.9	0.5947[1]
June 4, 1956	0	0	0	0	0	0	2	5.3	2.6500[1]
June 25 & 26, 1956	0	0	0	0	0	0	22	50.7	2.3046[2]
July 23, 1956	0	0	0	0	0	0	0	0	0
Aug. 22, 1956	0	0	0	0	0	0	0	0	0
Sept. 18, 1956	0	0	0	0	0	0	0	0	0
Oct. 3, 1956	0	0	0	4	0.3	0.0725	0	0	0
Nov. 2, 1956	282	9.5	0.0337	0	0	0	13	0.7	0.0538
Nov. 30, 1956	102	12.1	0.1186	395	22.0	0.0557	22	1.6	0.0727
Dec. 19, 1956	91	24.5	0.2692	299	33.7	0.1127	42	1.4	0.0333
Jan. 21, 1957	12	4.8	0.4000	62	10.9	0.1758	17	1.0	0.0588
Feb. 18, 1957	825	4.9	0.0059	16	8.0	0.5000	34	3.6	0.0765
Apr. 4, 1957	211	1.4	0.0066	0	0	0	20	4.0	0.0200

[1]Number and weight/400 cm^2.

[2]Number and weight/1200 cm^2.

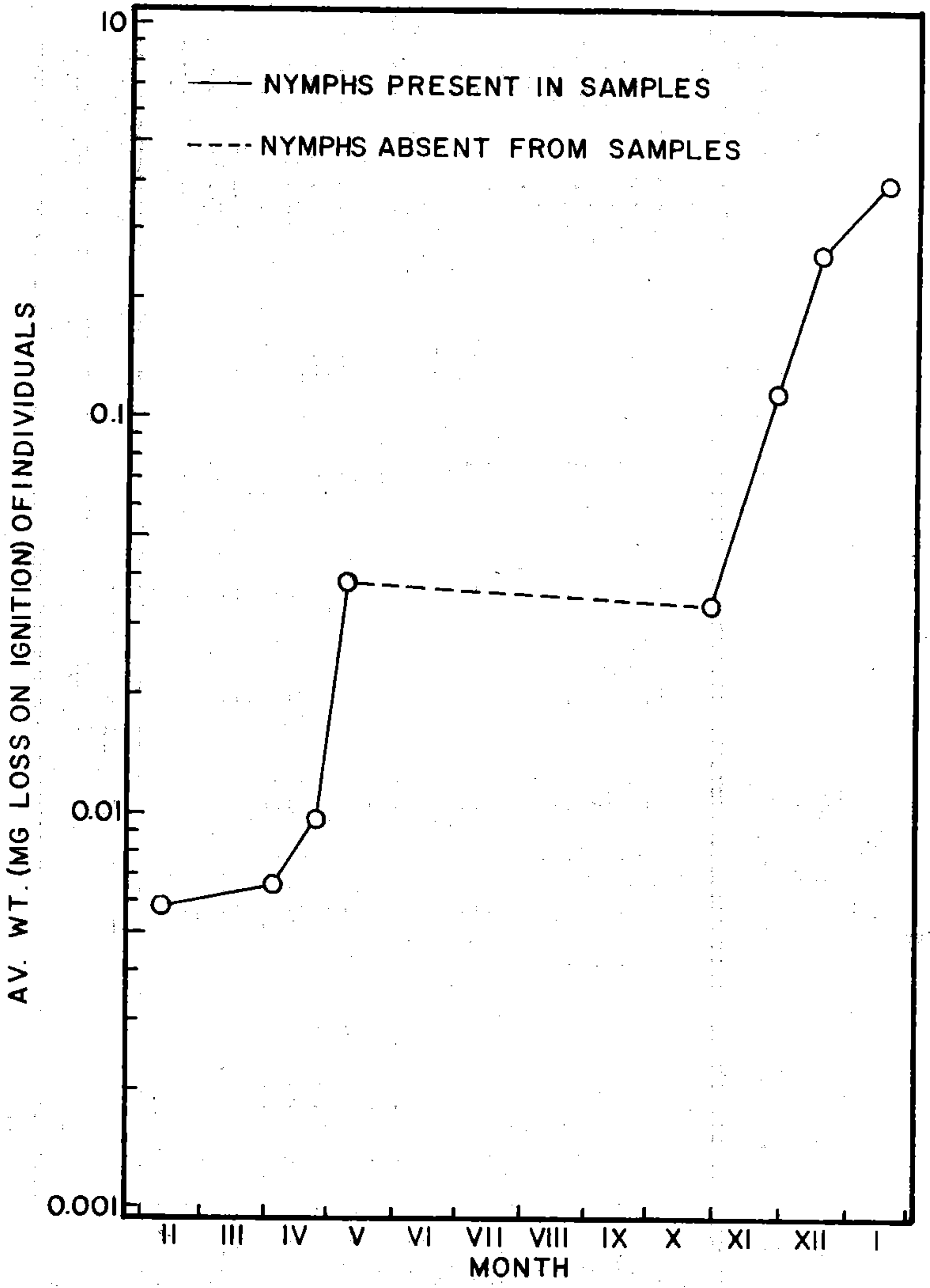


Figure 2. The growth of Taeniopteryx maura and its occurrence in bottom samples from the rock-outcrop community.

species. The seasonal abundance of Simulium larvae and pupae suggested maximum emergence in June, August, and November. However, Wu (1930) has shown that the intervals between peaks of emergence do not necessarily indicate the span of larval and pupal life. He found an incubation period of four to five days, a larval stage of 13 to 17 days, and a pupal stage of four and one-half days. The presence in the Middle Oconee River of pupae in all months but January indicated emergence during most of the year.

The Tendipedidae appeared to emerge at all seasons of the year. Calopsectra pupae were found in every month with the maximum number of larvae and pupae occurring in September. A decrease in Calopsectra larvae and pupae was found in the samples of October 3. High water on September 26 and 27 caused a heavy mortality among the larvae and pupae; numerous dead individuals were found in their sand-filled cases. Four species of Cricotopus (Spaniotoma) larvae were distinguished but not identified. Of these, species 2 had a period of major abundance in August and September at a time when populations of species 1 and 4 were low. An increase in numbers of small larvae of all four species were observed in January, February, and April 1957 samples. Polypedilum convictum, Corynoneura, and Cardiocladius were consistent, but relatively minor, constituents of the dipteran fauna.

It was interesting to note that the three large predators which occurred in the community reached their maximum sizes at different times of the year. Perlesta placida exhibited its greatest growth from late April to late June. Corydalus cornutus grew rapidly from late July through mid-September, after which time it was absent, probably as a result of the September flood. Isoperla was at its greatest size from late February until early April. The seasonal distribution of the large predators resulted in a reduced competition for food among them.

Seasonal standing crops of Podostemum ceratophyllum and detritus. The wide variation in the seasonal standing crops of *Podostemum* (Table 9) was largely the effect of changes in water levels in the river. The gradual increase in the biomass of *Podostemum* from October 3, 1956 until April 4, 1957 was due to a normal increase in average river flow. A slight cessation of growth was found from November 30 until December 19; during this period, the river remained at a relatively constant level and the biomass of *Podostemum* remained approximately the same. A steady decrease in average river discharge resulted in a reduction of the standing crop between the July 23 and August 22, 1956 samples. Receding water levels exposed the plant to air so that it wilted, broke off, and passed downstream as detritus. The damaging effect of high, turbulent flows was demonstrated by the one-third reduction in the standing crop of *Podostemum* between the June 25 and 26 and July 23, 1956 samples and the September 18 and October 3, 1956 samples. Periods of high water were present between each sampling period. A rapid growth of *Podostemum* was observed following both high water flows. The growth of *Podostemum* was not halted by winter water temperatures which were frequently below 10° C.

The breakdown of *Podostemum* within the community resulted in the formation of autochthonous plant detritus (Table 9). The amount of this material present in the samples was generally constant. An irregular increase was indicated in the samples from October 3, 1956 until April 4, 1957. The increase denoted a continuous growth and breakdown of

Table 9. *Podostemum ceratophyllum*, Plant Detritus, and Miscellaneous Animal Detritus in Bottom Samples (mg/500 cm^2).

Date	*Podostemum ceratophyllum*[1]	Autochthonous Plant Detritus	Allochthonous Plant Detritus	Miscellaneous Animal Detritus
April 23 & 25, 1956	15,237.0	1020.5	1401.7	154.6
May 10, 1956	16,583.5	886.2	1697.1	77.4
June 4, 1956	6,842.6	137.6	95.9	79.1
June 25 & 25, 1956	31,752.0	617.7	133.9	163.9
July 23, 1956	20,269.5	709.0	159.7	35.6
Aug. 22, 1956	10,199.4	664.8	81.5	137.2
Sept. 18, 1956	15,684.6	318.0	81.9	321.3
Oct. 3, 1956	11,033.2	289.6	180.2	159.4
Nov. 2, 1956	15,394.4	380.8	465.0	72.1
Nov. 30, 1956	17,967.3	289.4	94.1	144.1
Dec. 19, 1956	17,923.2	325.0	107.1	114.9
Jan 21, 1957	19,478.5	352.7	229.1	96.1
Feb. 18, 1957	20,896.2	434.9	205.6	34.5
Apr. 4, 1957	25,887.8	1479.6	1591.3	152.4

[1]Includes loss on ignition of formalin residues.

Podostemum. The accumulation of autochthonous detritus within the community in April 1956 and April 1957 may have been the result of low water temperatures (below 20° C) which decreased the rate of bacterial decomposition of *Podostemum*. The breakdown of organic material within the community would be expected to proceed at a higher rate from May through September when water temperatures were from 20 to 30° C.

Allochthonous plant detritus (Table 9) consisted primarily of leaves and leaf fragments, although, catkins, twigs, and seeds were found periodically. The increase in the October 3 and November 2, 1956 samples was due to leaves, and the increase in the April and May samples was due to both leaf fragments and catkins. These materials were trapped in the *Podostemum* beds and were most abundant at the same time as the autochthonous plant detritus. The more luxuriant growths of *Podostemum* offered more space in which the allochthonous materials became lodged.

Animal detritus (Table 9) included the chitinous remains of aquatic insects, the cases of *Simulium* pupae, and the cases of *Calopsectra* larvae and pupae. These cases were included since they contained materials produced by the spin-glands of the organisms. The *Calopsectra* cases consisted of silt held together with a silk-like material produced by the larvae. The loss on ignition of *Calopsectra* cases would then be the result of the organic silk-like material and from organic material in the silt. The amount of animal detritus in bottom samples was roughly proportional to the insect biomass. This detritus recovered on three occasions (April 23 & 25, October 3, 1956, and January 21, 1957) was actually greater than the standing crop of animals present, however, if Calopsectra cases were excluded, animal detritus would exceed biomass only on April 23 and 25. The small amount of animal biomass present on October 3, 1956 and January 21, 1957 was preceded in each instance by samples containing a large biomass.

Detritus in river water. The particulate detritus (Table 35, appendix) and the dissolved organic matter (Table 36, appendix) in river water were measured periodically from October 8, 1954 until December 27, 1955. Most samples were collected after June 1955. In the present study the particulate fraction was of greater interest than the dissolved fraction because of its potential value as food for filter-feeding organisms. The loss on ignition of the particulate fraction was plotted (Figure 3) as a function of river discharge after the method of Leopold and Maddox (1953). The samples were separated into summer (May-September) and winter (October-April) groups somewhat arbitarily. This separation roughly corresponded to a water temperature of 20° C. When these data were plotted, a marked difference in the distribution of the two groups of data was noted.

The two lines on Figure 3 are the regression lines showing loss on ignition in mg per liter as a function of river discharge for both summer and winter values. The lines have a formula of the type, $y=ax^b$. The equation for summer samples was $y=+0.0247x^{0.698}$ and that for winter samples was $y=+0.0189x^{0.924}$. A correlation coefficient of $r=+0.5525$ was calculated for summer samples and that of winter samples was $r=+0.7047$. Both r values are significant at the 99% level. The greater dispersion of summer points as compared to winter points and the higher levels of

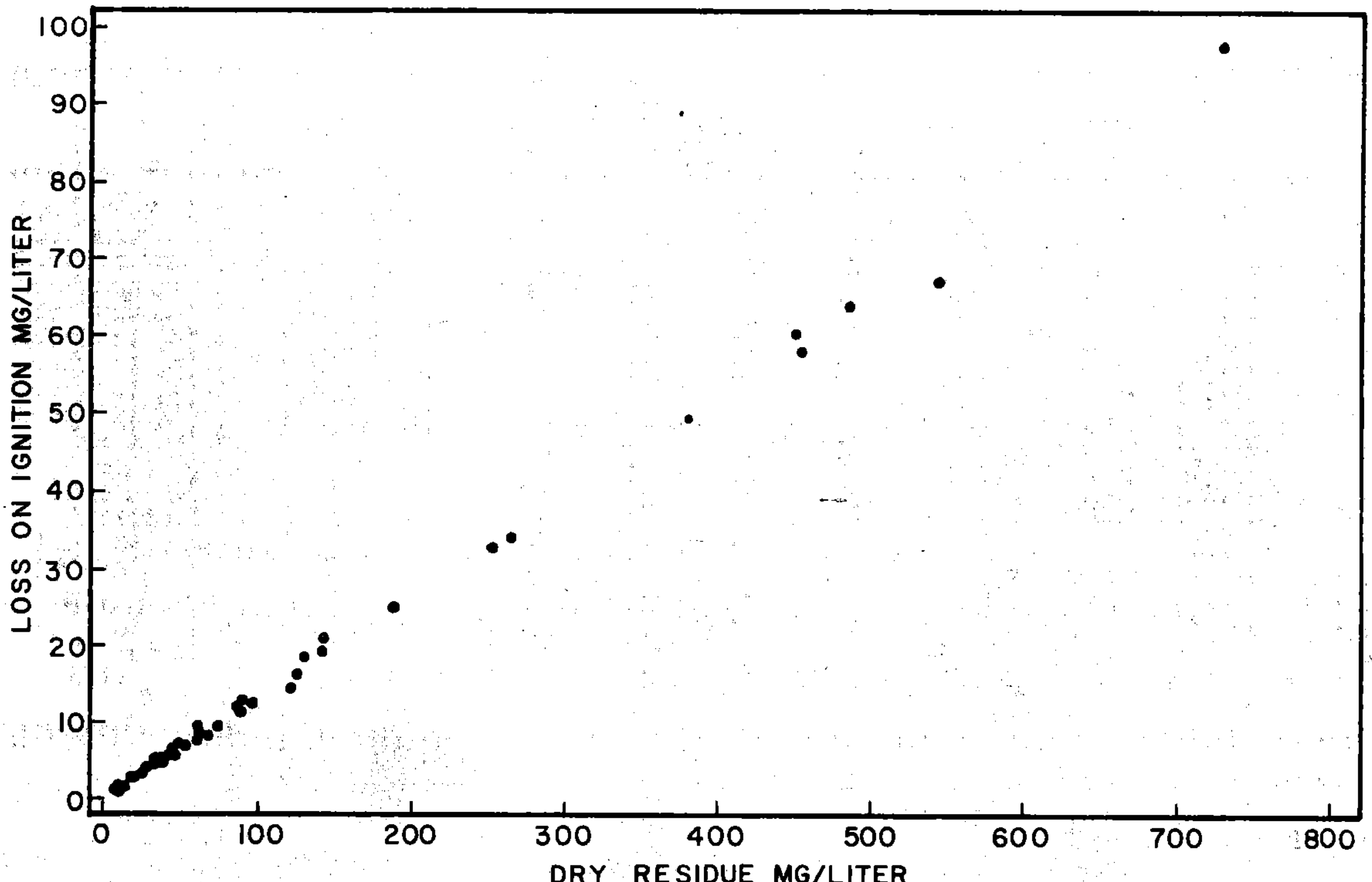


Figure 4. The relationship between dry residue and loss on ignition in the particulate materials from water samples.

organic material in the summer were two significant features observed in Figure 3. Summer thunderstorms were a factor in the variability of samples obtained at that time because of a rapid rate of rainfall and a rapid run-off which resulted in a sudden increase in river discharge. By contrast, the winter rains had a slow rate of precipitation with a gradual increase in river discharge. Another possible factor was the development of a phytobenthic ooze at the time of low, relatively clear water during the summer. A river rise, causing increased turbulence, would pick up the ooze organisms and make them part of the organic material in the water. Conditions favorable for the development of a phytobenthic ooze were so infrequent that the total contribution of this material to the flowing detritus was not considered significant. The data suggest the possibility of a limitation of the amount of particulate detritus at a maximum value during the winter and at minimum values during both summer and winter. The reasons for these limitations are unknown, however, the higher minimum value in the summer may have been due to a constantly sloughing aufwuchs. The winter maximum could have been the result of a limitation imposed by turbulence and the amount of organic debris in the bottom sediments.

A direct relationship existed between loss on ignition and total dry residue in the particulate detritus (Figure 4). Since this relationship existed for both summer and winter samples, all data were plotted together. The factors which caused silt to be present in the river were also responsible for the transport of organic materials. Samples of the sandy stream bottom immediately downstream from the rock outcrop revealed the presence of from 200 to 300 grams of allochthonous organic material

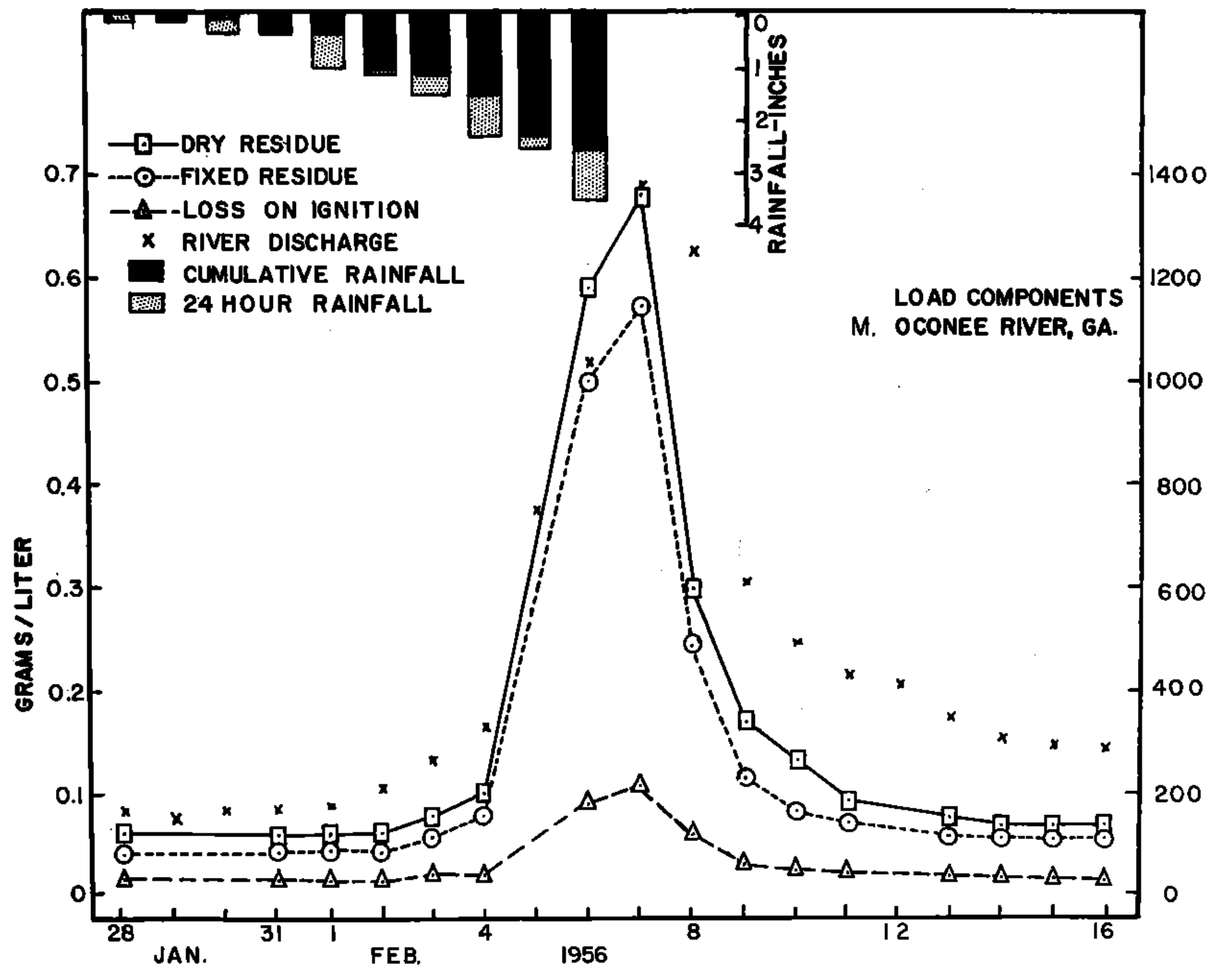


Figure 5. Rainfall and the consequent increase in river discharge and in the components of the total stream load.

per square meter. The increased turbulence of a rising river undoubtedly caused some of this material to become suspended as part of the river load. The bottom sediments in the river act as a trap and reservoir for organic materials. The larger pieces were comminuted by the shifting sand and the fragments carried into suspension. Such detritus stored in the bottom sediments could constantly add organic material to the stream load.

The dissolved fraction of organic material in the samples (Table 36, appendix) was normally two to ten times greater than the particulate fraction. However, a river rise because of rainfall produced conditions in which the particulate organic fraction was twice as great as the dissolved organic fraction. Birge and Juday (1934) found in the Wisconsin lakes they studied that, on an average, the dissolved fraction was 31 times greater than the particulate fraction. Water from Wisconsin lakes was similar to that from the Middle Oconee River at normal levels in respect to the fact that dissolved materials exceeded the particulate fraction.

The source of detritus in river water. A particularly interesting series of observations was made during and immediately following a period of intermittent rain from January 28 through February 16, 1956. The average river discharge at the study area during January 1956 was 140 second-feet (range 102-269 sec.-ft.) which was considerably less than the average of 488 second-feet for that month. Three and one-half inches of rain (U. S. Weather Bureau Station, five miles away) fell from January 28 through February 6 (Figure 5) producing an increase in the instantaneous river discharge from 163 to 1339 second-feet. A

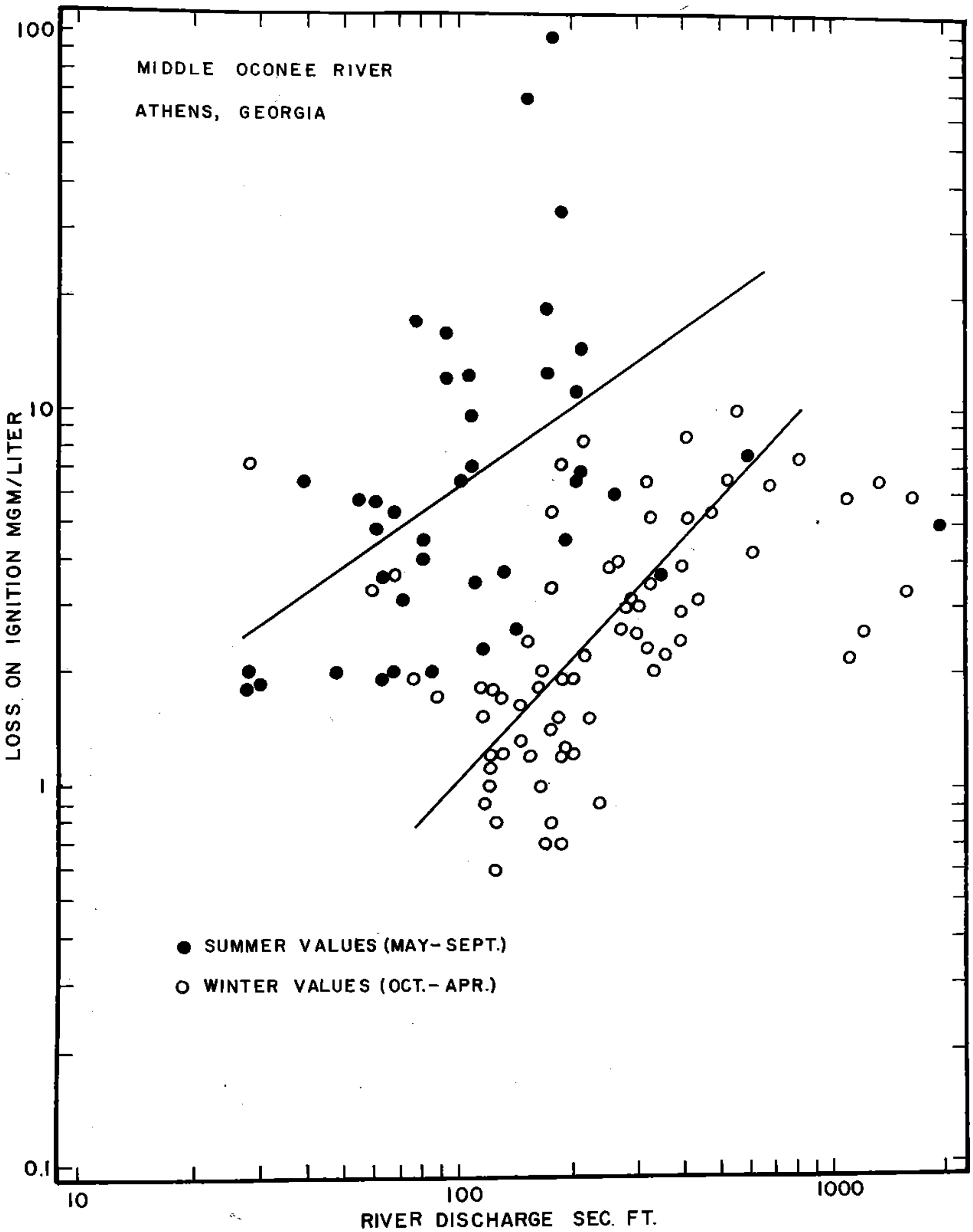


Figure 3. The relationship between loss on ignition in the particulate detritus and river discharge for summer and winter samples.

corresponding rise was noted in the stream load. The particulate and dissolved fractions are shown separately in Figure 6. The increases in the dissolved fraction for dry residue and loss on ignition were from 47 to 193 mg and 13 to 45 mg respectively. More extreme increases were noted in the particulate fraction. The dry residue increased from 9.5 to 488.8 mg and the loss on ignition increased from 1.8 to 64 mg.

The major kinds of fragments of organic material drifting with the river water were noted (Table 10) but not sorted and weighed separately. Podostemum was observed in most of the samples in very small amounts and was recorded because of its particular interest in this study. The predominance of leaf material (an estimated 95%) in these samples was noteworthy. During the fall, entire leaves were found; but, in the spring and summer, leaf fragments only were present. The transport by the river of these organic materials of 8545 mg/second on April 12, 1956 was found when the river level was rising. All other samples were taken when the river discharge was decreasing or steady. A large amount of leaf material was observed in the two samples taken in the last half of October when the leaf fall was the greatest. These samples indicate leaves which fell or were blown into the river were also an important source of organic material. A similar conclusion was reached by Teal (1957) who found that 76 per cent of the energy at the primary producer level in Root Spring was derived from leaves, twigs, and fruits. The allochthonous organic material in the Middle Oconee River washed, fell or was blown into the stream.

The ratios of weight and numbers of carnivores to primary consumers. The ratios of carnivores to primary consumers are useful in trophic ecology for describing seasonal changes in community structure, even

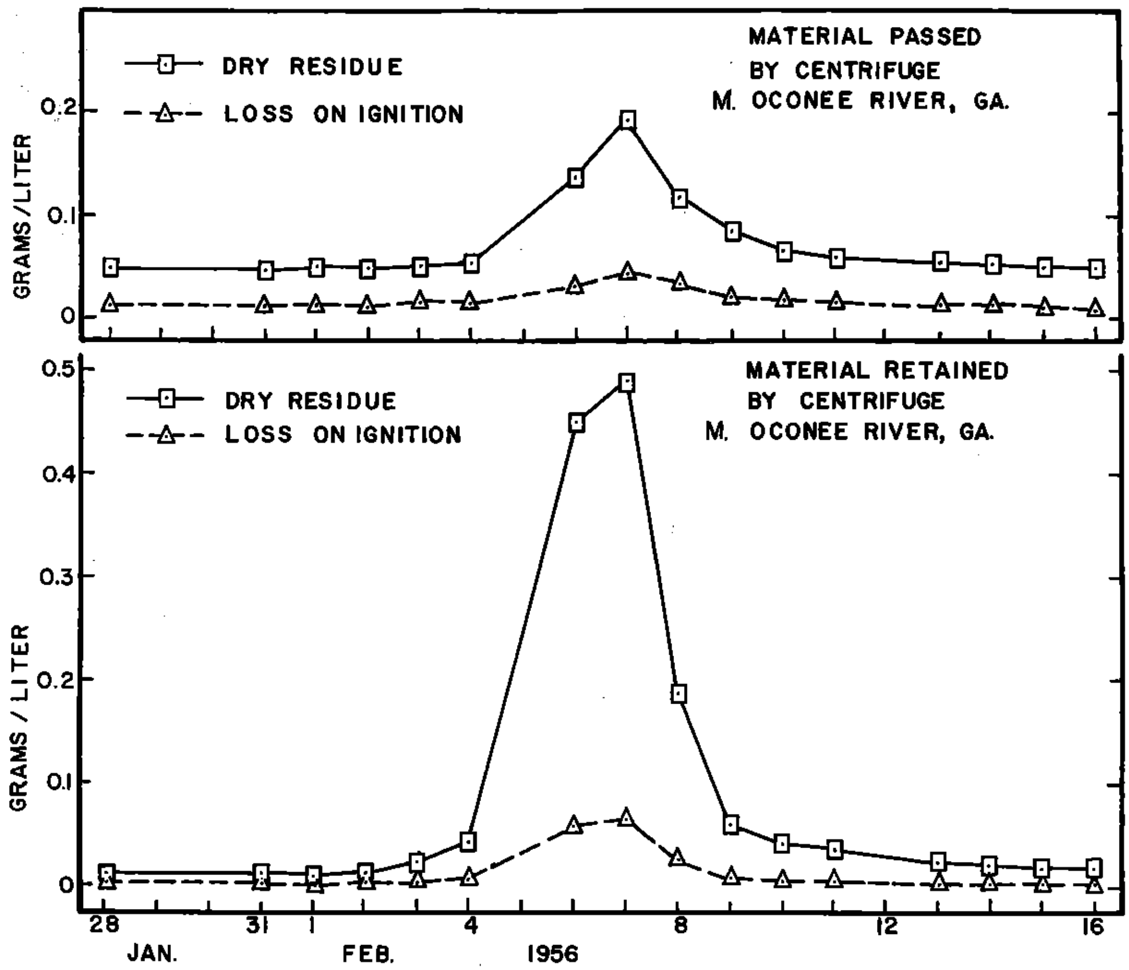


Figure 6. A comparison of the increases in the dissolved fraction (material passed by the centrifuge) and the particulate fraction (material retained by the centrifuge) as the result of rainfall and an increase in river discharge.

Table 10. Transport of Organic Fragments by the Middle Oconee River.

Date	Fragments	mg Loss on Ignition	Duration of Catch (Minutes)	Current ft/sec.	Discharge Sec.-ft.	Fragment Transport mg/sec.
IV:12:56	leaf fragments, sticks, bark	4874.0	30	0.83	1104	8545
IV:13:56	leaf fragments, twigs	1407.4	30	1.00	812	1510
IV:19:56	leaf fragments, twigs, sticks	2744.8	30	2.78	690	897
IV:20:56	leaf fragments	2586.6	30	2.27	618	933
IV:23:56	leaf fragments, <u>Podostemum</u>	453.4	30	1.67	392	141
V:10:56	leaf fragments, <u>Podostemum</u>	158.9	30	1.32	344	55
VI:4:56	leaf fragments, twigs	3797.6	50	1.79	133	225
IX:18:56	leaf fragments, filamentous algae	143.0	15	1.47	29	8
X:3:56	leaves, <u>Podostemum</u>	1018.5	15	2.78	153	148
X:8:56	leaves, <u>Podostemum</u>	519.5	15	2.08	179	118
X:12:56	leaves, <u>Podostemum</u>	424.5	15	1.67	122	82
X:24:56	leaves, twigs	4087.4	10	1.47	326	3583
X:31:56	leaves, <u>Podostemum</u>	4026.0	10	2.27	166	1172
XI:15:56	leaves, <u>Podostemum</u>	1438.2	15	2.08	189	348

though these ratios do not account for carnivores eating other carnivores. During June and July the number and weight ratios were low and approximately equal (Table 11, Figure 7). An increase in the weight ratios was noted in August and September as the result of a decided increase in the average weight of carnivores and a slight decrease in the average weight of herbivores (Table 12). The number ratios, however, did not change noticeably from June to September. An abrupt increase in the number ratios and decrease in weight ratios occurred between September 18 and October 3 probably as a result of the high water on September 26 and 27. The high water removed a large proportion of the big carnivores. This interpretation was substantiated by the fact that the average weight of the carnivores on September 18 was 0.1299 mg, while on October 3, it was only 0.0140 mg. During the same period the average weight of primary consumers increased from 0.0408 to 0.0598 mg. The high number ratio on October 3 was due to the fact that 90.6 per cent of the primary consumers were lost between September 18 and October 3 as compared with 41.8 per cent of the carnivores.

Decreases followed in both ratios until the end of November, after which they again increased. The weight ratios continued to increase until February 18 while the number ratios decreased after December 19. Since the weight ratio was a function of both number and the average weight of individuals, the increase in this ratio from December 19 to February 18 was the result of an increase in both numbers and average weight of the carnivores and a decrease in the average weight of the primary consumers, although, numbers of primary consumers increased. The decrease in the number ratios from December 19 until April 4 was the

Table 11. Carnivore/Primary Consumer and Primary Consumer[1]/Herbs and Detritus Ratios for Each Sample Series.

Date	Carnivore/ Primary Consumer		Primary Consumer[1]/ Herbs & Detritus
	Number	Weight	
Apr. 23 & 25, 1956	0.1092	0.2043	0.00163
May 10, 1956	0.1207	0.1544	0.01533
June 4, 1956	0.0328	0.0697	0.00525
June 25 & 26, 1956	0.0920	0.0880	0.00345
July 23, 1956	0.0621	0.0486	0.00172
Aug. 22, 1956	0.0813	0.1721	0.00513
Sept. 18, 1956	0.1005	0.3202	0.00968
Oct. 3, 1956	0.6211	0.1460	0.00164
Nov. 2, 1956	0.1826	0.0715	0.00190
Nov. 30, 1956	0.1042	0.0474	0.00340
Dec. 19, 1956	0.1740	0.0594	0.00548
Jan 21, 1957	0.1272	0.1917	0.00154
Feb. 18, 1957	0.0697	0.2901	0.00281
Apr. 4, 1957	0.0467	0.1106	0.00270

[1] Excluding filter feeders.

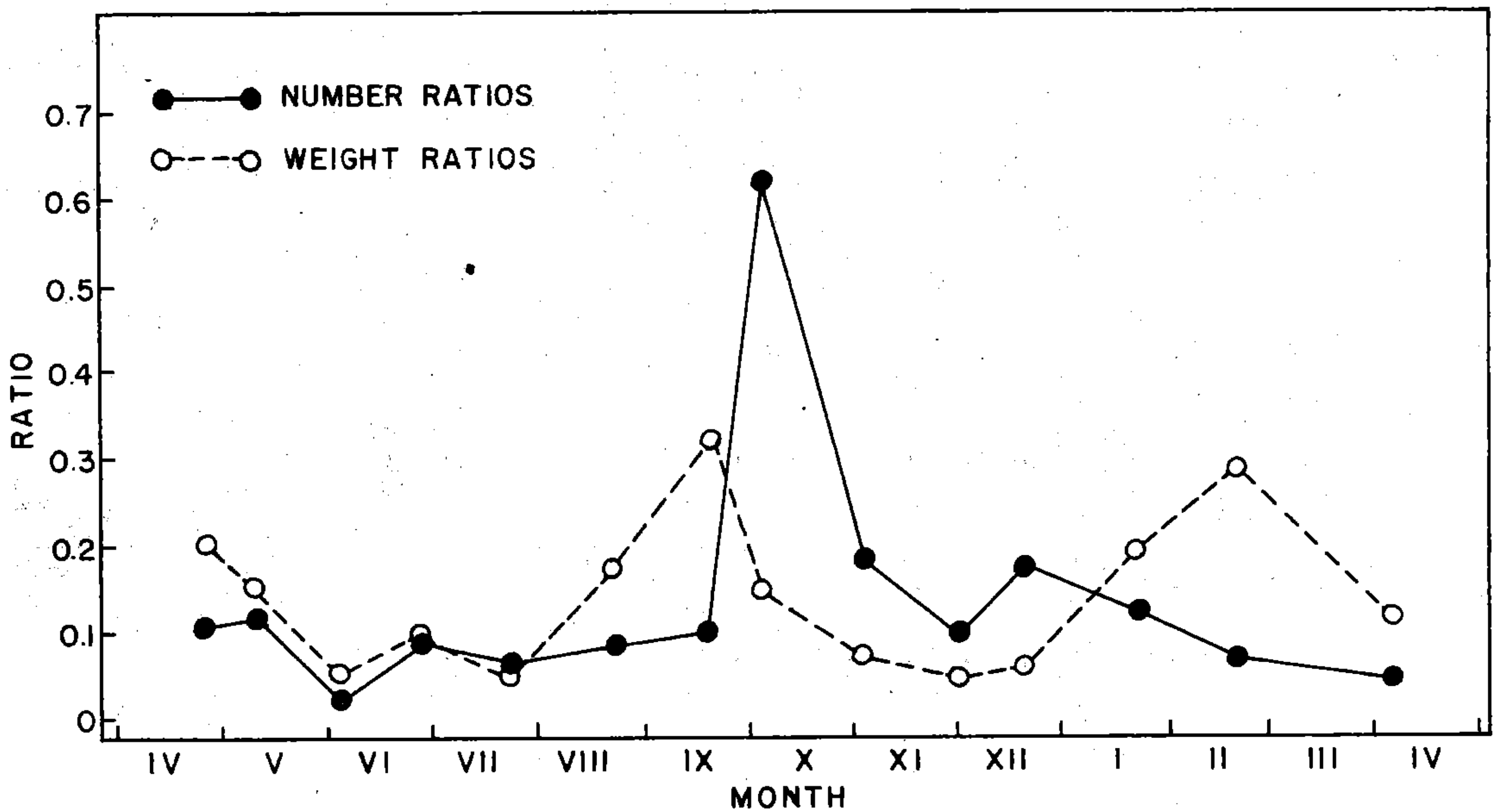


Figure 7. Comparisons of seasonal ratios of carnivores to primary consumers by numbers and weights.

Table 12. Average Weights of Carnivores and Primary Consumers in Bottom Samples (values/500 cm^2).

Date	Carnivore No.	Carnivore Wt.	Carnivore Av. Wt.	Primary Consumer No.	Primary Consumer Wt.	Primary Consumer Av. Wt.
Apr. 23 & 25, 1956	216	20.8	0.0962	1977	101.8	0.0515
May 10, 1956	122	38.3	0.3139	1010	247.9	0.2454
June 4, 1956	81	10.2	0.1259	2464	146.3	0.0594
June 25 & 26	935	89.7	0.0959	10,154	1018.5	0.1003
July 23, 1956	160	9.0	0.0563	2574	185.0	0.0719
Aug. 22, 1956	445	55.9	0.1256	5472	324.8	0.0594
Sept. 18, 1956	1039	135.0	0.1299	10,329	421.6	0.0408
Oct. 3, 1956	605	8.5	0.0140	974	58.2	0.0598
Nov. 2, 1956	492	11.9	0.0242	2693	166.3	0.0618
Nov. 30, 1956	399	9.2	0.0231	3829	193.7	0.0506
Dec. 19, 1956	642	13.0	0.0202	3689	218.8	0.0593
Jan. 21, 1957	206	8.4	0.0408	1619	43.8	0.0271
Feb. 18, 1957	375	21.7	0.0579	5380	74.8	0.0139
Apr. 4, 1957	583	44.4	0.0762	12,477	401.1	0.0321

result of the more rapid increase in numbers of small, primary consumers, implying a shorter reproductive cycle or a greater initial natality for primary consumers. The decrease in the carnivore/primary consumer weight ratios from February 18 until April 4 compares with a similar decrease in the spring and early summer of 1956. While both numbers and weights of the carnivores increased, the more rapid growth of the primary consumer population resulted in a decreased weight ratio.

Generalizations may be made about seasonal changes in the carnivore/ primary consumer ratios as they would be expected to change without the affect of events such as the high water of September 26 and 27. The annual low in weight and number ratios would be expected in June and a gradual increase would occur until maxima were reached in late fall or early winter. Thereafter, a decrease in the ratios would occur until June. The results obtained from the Middle Oconee River indicated the late summer and fall weight ratios increased more rapidly and decreased after the number ratios in the spring. In an old field ecosystem, Cross (1956) found that the number ratios increased more rapidly than did the weight ratios during the fall. The predominance of predators as indicated by both numbers and weight occurred in December.

A specific predator-prey relationship exists between Cardiocladius and Simulium (Thienemann 1953 pp. 58). The data on these organisms are presented in Table 13. Both number and weight ratios were low during the spring, summer, and fall. A marked increase occurred in these ratios in December and the number ratio reached a high of 1.3636 January 21 while the weight ratio was not at its maximum of 1.4754 until February 18. This particular relationship was in general agreement with

Table 13. Annual *Cardiocladius/Simulium* Number and Weight Ratios.

Date	Cardiocladius			Simulium			No. Ratio	Wt. Ratio
	No.	Wt.	Av. Wt.	No.	Wt.	Av. Wt.		
Apr. 23 & 25, 1956	0	0	0	1410	70.1	0.0497	0	0
May 10, 1956	5	0.1	0.0200	418	10.6	0.0254	0.0120	0.0094
June 4, 1956	5	0.9	0.1800	1652	127.6	0.0772	0.0030	0.0071
June 25 & 26, 1956	108	5.7	0.0534	1836	239.6	0.1305	0.0588	0.0239
July 23, 1956	5	0.5	0.1000	1782	144.0	0.0808	0.0028	0.0035
Aug. 22, 1956	5	1.1	0.2200	2845	244.6	0.0860	0.0018	0.0045
Sept. 18, 1956	6	1.6	0.2667	2370	195.9	0.0827	0.0025	0.0082
Oct. 3, 1956	8	0.9	0.1125	373	35.7	0.0957	0.0214	0.0252
Nov. 2, 1956	22	2.1	0.0955	988	130.9	0.1325	0.0223	0.0160
Nov. 30, 1956	19	0.8	0.0042	609	104.9	0.1722	0.0312	0.0076
Dec. 19, 1956	28	2.0	0.0714	215	34.8	0.1619	0.1302	0.0575
Jan. 21, 1957	30	0.9	0.0300	22	1.4	0.0636	1.3636	0.6429
Feb. 18, 1957	77	9.0	0.1169	652	6.1	0.0094	0.1181	1.4754
Apr. 4, 1957	213	9.0	0.0422	5719	302.1	0.0528	0.0372	0.0298

the findings of Cross (1956).

The ratio of primary consumer (excluding filter feeders) biomass to herb and detritus biomass. The primary producer component of the ecosystem in the Middle Oconee River was considered to include all detritus in the samples, as well as the *Podostemum*, because of the indiscriminate feeding habits of some of the primary consumers. The filter feeders have been excluded in calculation of the ratios (Table 11) since these organisms filtered their food from flowing water. The variability of these ratios was the result of changes in both components of the ecosystem. The high value of 0.01533 on May 10 was due to nine large *Goniobasis* in the samples. A gradual increase in the ratios occurred from July 23 until September 18. The high water of September 26 and 27 caused a noticeable decrease in the ratio on October 3, indicating a greater proportional loss among the primary consumers than in the producer component. With these ratios, as was the case with carnivore/primary consumer ratios, the possibility of a maximum in the fall or early winter was indicated. However, the low ratio of 0.00154 in January was considered normal since the primary consumers were represented by very small individuals. An increase in the ratio occurred in the February sample as the result of a more rapid growth by the primary consumers than by the primary producers.

Cross (1956) reported herbivore/primary producer ratios from 0.00069 to 0.00079 in an old field ecosystem. He concluded that early successional stages were characterized by low values. The ratios of 0.001538 to 0.015329 found in the present study indicated a later successional stage for the community. The Middle Oconee River data indicated low ratios occurred in newly established community relationships, such as those which followed high water or when a population of hatchling herbivores was present. The ratios increased with time in either case.

Diurnal oxygen curves. Estimates of primary productivity based on diurnal O_2 curves are questionable for two reasons. The diurnal variation in dissolved oxygen was relatively small on the four occasions when samples were taken (Tables 37-40, appendix). The presence of a turbulent flow over the rock outcrop vitiates this method of determining the productivity of the primary producers on the rock itself. The most logical assumption to be made from these data was that if any primary productivity did occur within the waters of the Middle Oconee River, it was very slight. The water varied in dissolved oxygen content from about 80 per cent of saturation to saturation.

Productivity measurements. The annual net productivity at all trophic levels on the rock outcrop was estimated by the addition of increases in biomass which occurred between successive samples. Negative changes were the result of death, emergence, or losses due to organisms washing downstream. Positive changes were from productivity or from organisms washing into the community. The latter phenomenon has been demonstrated by Müller (1953). Losses downstream were assumed to be greater than additions from upstream because of the high concentration of organisms on the rock outcrop as compared to the adjacent upstream area. The estimate made from the addition of positive changes in biomass was thus considered a minimum value. Errors resulting in minimum estimates are likely to occur for *Podostemum* because of growth and loss downstream between successive sampling periods. A similar error may occur for any animal component which has a life cycle shorter than the time between any two successive sampling periods.

According to Penfound (1956), estimates of the productivity of higher plants by the sum of the periodic increases were more accurate than those obtained by use of the terminal standing crop method. As can be seen from the data in Table 14, the standing crop of Podostemum varied considerably on sampling dates. The first sample collected on April 23 and 25, 1956 was considered an arbitrary base level. Addition of all positive changes resulted in a net productivity of 46,513.8 mg/500 cm^2/year (930.276 gm/m^2/year). The productivity estimate for Podostemum included the aufwuchs which was present.

A seasonal summary of all organisms found in each trophic level is presented in Table 41, appendix. The productivity of primary consumers has been calculated for each group according to the type of feeding habit (Table 15). The net productivity for all primary consumers was 1483.9 mg/500 cm^2/year (29.678 gm/m^2/year). The productivities and standing crops of the primary consumers may be compared in Tables 15 and 16. As can be seen, the standing crops of the respective groups reflect the productivity by the groups. The predominance of herbivores in the May 10, 1956 samples was the result of the inclusion of nine large Goniobasis.

The total net productivity by carnivores was 215.9 mg/500 cm^2/year (4.318 gm/m^2/year) (Table 17). There was a noticeable decline in the net productivity at the higher trophic levels. This decrease was expected since the organisms used some of the energy contained in

Table 14. The Productivity of <u>Podostemum ceratophyllum</u> in the Middle Oconee River (mg/500 cm^2).

Date	Wt.	Change in Wt.
Apr. 23 & 25, 1956	15,237.0	+1,346.5
May 10, 1956	16,583.5	-9,677.9
June 4, 1956	6,842.6	+24,783.4
June 25 & 26, 1956	31,752.0	-11,482.5
July 23, 1956	20,269.5	-10,070.1
Aug. 22, 1956	10,199.4	+5,485.2
Sept. 18, 1956	15,684.6	-4,651.4
Oct. 3, 1956	11,033.2	+4,361.2
Nov. 2, 1956	15,394.4	+2,572.9
Nov. 30, 1956	17,967.3	-44.1
Dec. 19, 1956	17,923.2	+1,555.3
Jan. 21, 1957	19,478.5	+1,417.7
Feb. 18, 1957	20,896.2	+4,991.6
Apr. 4, 1957	25,887.8	
Total increases in biomass		46,513.8

Table 15. The Productivity of the Primary Consumer Components in the Middle Oconee River (mg/500 cm^2).

	Filt. Feed.		Herbivore		Det. Feed.		Herb. & Det. Feed.	
Date	Wt.	Change in Wt.	Wt.	Change in Wt.	Wt.	Change in Wt.	Wt.	Change in Wt.
Apr. 23 & 25, 1956	72.7		7.2		18.8		3.1	
		-57.8		+262.4		-1.2		+4.7
May 10, 1956	14.9		269.6		17.6		7.8	
		+129.7		-255.8		-12.7		+11.1
June 4, 1956	144.6		13.8		4.9		18.9	
		+167.2		+44.2		+6.5		+24.3
June 25 & 25, 1956	311.8		58.0		11.4		43.2	
		-163.2		-49.2		+15.3		-42.3
July 23, 1956	148.6		8.8		26.7		0.9	
		+119.4		+7.8		-22.6		+35.2
Aug. 22, 1956	268.0		16.6		4.1		36.1	
		-5.2		+37.4		+50.1		+14.5
Sept. 18, 1956	262.8		54.0		54.2		50.6	
		-223.7		-42.0		-49.4		-48.3
Oct. 3, 1956	39.1		12.0		4.8		2.3	
		+96.2		-2.1		+2.0		+12.0
Nov. 2, 1956	135.3		9.9		6.8		14.3	
		-4.3		+4.6		+4.0		+23.1
Nov. 30, 1956	131.0		14.5		10.8		37.4	
		-13.5		+3.9		-5.2		+39.9
Dec. 19, 1956	117.5		18.4		5.6		77.3	
		-104.7		-11.6		-0.4		-58.3
Jan. 21, 1957	12.8		6.8		5.2		19.0	
		+1.3		+15.3		+11.9		+2.5
Feb. 18, 1957	14.1		22.1		17.1		21.5	
		+308.5		+17.4		+11.5		-11.1
Apr. 4, 1957	322.6		39.5		28.6		10.4	
		-249.9		-32.3		-9.8		-7.3
Total increases in biomass		822.3		393.0		101.3		167.3
Per cent of total primary consumer productivity		55.42		26.48		6.83		11.27

Table 16. Seasonal and Average Per Cent Composition by Weight of the Primary Consumer Component in the Middle Oconee River (mg/500 cm^2).

Date	Filt. Feed. % Total Wt.	Herbivores % Total Wt.	Det. Feed. % Total Wt.	Herb. & Det. Feed. % Total Wt.
Apr. 23 & 25, 1956	71.41	7.07	18.47	3.05
May 10, 1956	4.81	87.00	5.68	2.52
June 4, 1956	79.36	7.57	2.69	10.37
June 25 & 26, 1956	73.47	13.67	2.69	10.18
July 23, 1956	80.32	4.76	14.43	0.49
Aug. 22, 1956	82.51	5.11	1.26	11.11
Sept. 18, 1956	62.33	12.81	12.86	12.00
Oct. 3, 1956	67.18	20.62	8.25	3.95
Nov. 2, 1956	81.36	5.95	4.09	8.60
Nov. 30, 1956	67.63	7.49	5.58	19.31
Dec. 19, 1956	53.70	8.41	2.56	35.33
Jan. 21, 1957	29.22	15.53	11.87	43.38
Feb. 18, 1957	18.85	29.55	22.86	28.74
Apr. 4, 1957	80.43	9.85	7.13	2.59
Avs.	64.25	17.74	6.97	11.04

Table 17. The Productivity of the Carnivore Component in the Middle Oconee River (mg/500 cm^2).

Date	Wt.	Change in Wt.
Apr. 23 & 25, 1956	20.8	+22.1
May 10, 1956	42.9	-30.1
June 4, 1956	12.8	+24.6
June 25 & 26, 1956	37.4	-28.4
July 23, 1956	9.0	+46.9
Aug. 22, 1956	55.9	+79.1
Sept. 18, 1956	135.0	-126.5
Oct. 3, 1956	8.5	+3.4
Nov. 2, 1956	11.9	-2.7
Nov. 30, 1956	9.2	+3.8
Dec. 19, 1956	13.0	-4.6
Jan 21, 1957	8.4	+13.3
Feb. 18, 1957	21.7	+22.7
Apr. 4, 1957	44.4	-23.6
Total increases in weight		215.9

ingested food materials for respiration and part of it was lost through excretory products. Teal (1957) found that Anatopynia dyari, a predatory tendipedid larvae, was able to assimilate only 30 per cent of its prey. Losses included blood, flesh not ingested, and excretory products.

Efficiencies of biomass conversion. The calculation of conversion of biomass from the primary producer level to the primary consumer level was complicated by the presence of organisms which were both herbivores and detritus feeders. Furthermore, the detritus ultimately came from within the stream (from Podostemum) and from the surrounding watershed (allochthonous detritus). Since 54.79 per cent of the total plant detritus in the community originated within the stream, that percentage of the productivity of detritus feeders was calculated as having derived its energy from Podostemum. It was also assumed that the organisms which were considered to be both herbivores and detritus feeders gained half their food from Podostemum and the other half from detritus; 54.79 per cent of this latter half originated from Podostemum. The conversion efficiency of primary consumers from the primary producer level was equal to: 100 x

$$\frac{\text{Herb. Prod.} + (\text{Det. Feed. Prod.})0.5479 + \frac{\text{Herb.\&Det. Feed. Prod.}}{2} + \left(\frac{\text{Herb.\&Det. Feed. Prod.}}{2}\right)0.5479}{\text{Podostemum productivity}}$$

An efficiency of 1.2699 per cent was calculated. It was not possible to measure directly the amount of water filtered by filter-feeding organisms. However, the net productivity of the filter feeders was determined (Table 15). Assuming their food was derived from allochthonous sources, as was 45.21 per cent of the detritus utilized by detritus feeders, it was possible to determine that 61.05 per cent of the net primary consumer productivity had its ultimate origin outside of the river. Combining the net carnivore productivity of 215.9 mg with a net primary consumer productivity of 1483.9 mg an efficiency of conversion of 14.55 per cent was obtained.

Trophic efficiencies. Trophic efficiencies may be calculated for the entire community from insolation and the caloric content of the living material. The total radiant energy from April 1956 through March 1957 was obtained from a U. S. Weather Bureau Station at Griffin, Georgia, 70 miles southwest of Athens; radiant energy at Athens was assumed to be almost the same as at Griffin. The energy content of the organisms may be calculated in calories on the basis of their weight and percentage composition in fat, carbohydrate, and protein. Birge and Juday (1922) analyzed some higher aquatic plants and aquatic insects for fat, carbohydrate, and protein. Caloric values were obtained from Zoethout and Tuttle (1952) as follows: carbohydrates 4100 cal/gm, proteins 4100 cal/gm (physiological value), and fats 9300 cal/gm. By application of the caloric values to Birge and Juday's analyses, factors for conversion of gm/m^2 loss on ignition (ash free dry weight) to cal/cm^2 were calculated for *Podostemum* (0.4236) and for aquatic insects (0.4887).

A total radiant energy of 156,924 gm cal/cm^2 was obtained from April 1956 through March 1957. The productivity by *Podostemum* was 394.065 gm cal/cm^2/year which yielded an efficiency of 0.2511 per cent. The calculation for the conversion of energy from the primary producer to the primary consumer level involved the same type of calculation as that for the conversion of biomass between these two levels. The net energy gain by the herbivores was 5.649 gm cal/cm^2/year which resulted in a trophic efficiency of 1.434 per cent. The calculation of the energy conversion by the carnivores was based on the entire energy in the primary consumer trophic level of 14.504 gm cal/cm^2/year; the efficiency in this instance was 14.55 per cent.

A comparison of the average biomass and productivity at each trophic level and the efficiencies of conversion is given in Table 18. The difference between the efficiency of conversion of biomass and that of energy for herbivores was due to the lower caloric value for *Podostemum* which resulted in a higher percentage of energy being transferred from *Podostemum* to the herbivore level. Since the caloric value of herbivores and predators was approximately the same, no difference resulted between the transfer of energy and biomass at this trophic level.

The ratio of productivity to average standing crop or turnover (Odum and Odum 1955) was calculated for the various components of the community. It was interesting to note that herbivores, with an average standing crop of 39.4 gm/500 cm^2, had a turnover of 9.97 times. The turnover value of 9.1 for comparable herbivores in Silver Springs reported by Odum (1957) is in very close agreement. Turnovers for the other groups of organisms were from 5.77 for the filter feeders to 7.01 for the carnivores. The *Podostemum* turnover of 2.60 was quite similar to that of 3.17 found by Odum (1957) for *Sagittaria*. Odum (1956b) has suggested that turnover rate is a function of organism size. Since *Podostemum* was relatively large, compared with the other organisms in the community, a low turnover of this component was expected.

Table 18. The Productivity, Turnover, and Conversion Efficiencies at Each Trophic Level in the Rock Outcrop Community in the Middle Oconee River.

	Podostemum	Filter Feeder	Herbivore	Detritus Feeder	Herb.&Det. Feeder	Total Primary Consumer	Carnivore
Annual Productivity ($mg/500\ cm^2$)	45,513.8	822.3	393.0	101.3	167.3	1483.9	215.9
Total Biomass, All Samples	245,149.2	1995.8	551.2	216.6	342.8	3106.4	430.9
Average Biomass ($mg/500\ cm^2$) per Sample Series	17,510.6	142.6	39.4	15.5	24.5	221.9	30.8
Biomass Turnover (per year)	2.60	5.77	9.97	6.54	6.83	6.69	7.01
Efficiency of Biomass Conversion %			1.270[1]				14.55
Energy gm $cal/cm^2/year$	394.065	8.037	3.840	0.990	1.635	14.504	2.159
Efficiency of Energy Conversion %	0.2511[2]		1.434[1]				14.55

[1] Herbivore efficiencies calculated to include 54.79% of detritus feeders plus one-half of herbivore and detritus feeders plus 54.79% of one-half of herbivore and detritus feeders.

[2] Based on radiant energy at Griffin, Georgia of 156,924 gm $cal/cm^2/year$ (April 1956 through March 1957).

Productivity comparisons with other communities. A comparison of two lotic communities, Middle Oconee River and Silver Springs, with two lentic communities, a Minnesota pond and Cedar Bog Lake (Table 19) reveals that the net primary productivity of the flowing water was 4 to 17 times greater. While latitudinal differences are present, these were not considered significant. The net productivity of the primary consumers in the Middle Oconee River was of the same magnitude as that of both the standing water communities. Silver Springs had a productivity ten times as great. Odum (1957) was of the opinion that energy of flowing water may have been indirectly responsible for a greater productivity by and efficiency of the organisms. The organisms in a flowing water community would not necessarily have to expend energy to search for food, however, a certain amount of energy would be required by stream dwelling organisms to maintain themselves against the current. In Silver Springs, where a constant water flow was present, aquatic insects would not be subjected to the damaging effect of periodic high, turbulent flows as they were in the Middle Oconee River. As was demonstrated by the data on standing crops, the rock-outcrop community lost a large proportion of its organisms during periods of high water. The periodic losses of primary consumer organisms may account for the low efficiency at this trophic level. Competition for space with filter feeding organisms could be partially responsible, but even if the trophic efficiency was based on the entire primary consumer component, an efficiency of only 3.68 per cent resulted. The low trophic efficiency (1.4370 per cent) of the herbivores and detritus feeders must have been the result of a low productivity. The efficiency at this trophic level was only about

Table 19. A Comparison of the Net Annual Productivity (gm cal/cm2) and Trophic Efficiencies (%) in Two Lotic Communities with Two Lentic Communities.

	Middle Oconee R.		Silver Springs[1]		Pond[2]		Cedar Bog Lake[3]	
	Prod.	Effic.	Prod.	Effic.	Prod.	Effic.	Prod.	Effic.
Insolation	156,924		170,000		118,872		118,872	
Primary Producers	394.1	0.25	883.3	0.52	49.9	0.04	111.3	0.10
Primary Consumers	14.5	1.43[4]	147.8	16.73	9.2	18.4	14.8	13.3
Carnivores (Including Top Carnivores)	2.1	14.55	7.3	4.95	3.4	36.9	3.1	22.3

[1] Odum 1957

[2] Dineen 1953

[3] Lindeman after Dineen 1953

[4] Efficiency includes only energy derived from primary producer component within the stream.

one-tenth that found in the other aquatic communities (Table 19).

Lindeman (1942) proposed that the trophic efficiency should increase at the higher trophic levels. Dineen (1953), as the result of his study of a Minnesota pond, reached a similar conslusion. An increased efficiency at the higher trophic levels was also observed in the Middle Oconee River. However, as Teal (1957) has pointed out, unless there is a 100 per cent efficiency of utilization of net primary production, organic matter will accumulate within a community. Organic matter in the primary producer level would be decomposed by bacteria and fungi, as well as by other primary consumers. Odum (1957) and Teal (1957) found a decreased efficiency at the higher trophic levels. While the effect of organisms other than the macroscopic primary consumers was not considered in regard to the rock outcrop community, it was obvious that organic material did not accumulate. The primary reason for this was the flow of water which washed organic material downstream from the community. The accumulation of organic material in the bottom of the standing water communities may account for the difference in the trend of trophic efficiencies as demonstrated by the comparison of the results of Lindeman (1942) and Dineen (1953) with those of Odum (1957) and Teal (1957).

The study of the standing crop and productivity of the Middle Oconee River represents the first on a stream which was subject to wide fluctuations in water level. The major questions encountered were coupled with changes in river discharge. Only further studies in similar communities will reveal whether: 1. minimum river discharges are responsible for low productivities in an entire stream community, as are the maximum discharges; 2. other stream communities are largely dependent on allochthonous sources of primary productivity; 3. low net primary consumer productivity is characteristic of stream communities.

SUMMARY

1. The stream bottom community on a rock outcrop in the Middle Oconee River was studied to determine: 1. the seasonal changes in the trophic structure of the community; 2. the annual net productivity by the trophic components of the community; 3. the source of organic detritus in river water which was a food source for filter feeding organisms in the community.

2. A "microtechnique" of stream bottom sampling was successfully employed. The technique consisted of 100 cm^2 sample quadrats secured with a Surber type sampler which had a number seven, silk, bolting cloth catch net. Sorting was done under the low power of a binocular microscope which permitted the recovery of many organisms too small to be seen with the unaided eye.

3. Adequacy of sampling was verified with a species-area analysis which indicated four samples in a series would have been sufficient. Five samples were normally taken in each sample series.

4. The coefficient of variation for the total number of individuals in each sample in a series varied for each sample series and was similar to that expected for field data of this type.

5. The variation in the diversity indices, which were calculated for each sample and each sample series, was of the same magnitude as that of the coefficient of variation. No trends were observed in the indices,

but the variation indicated that the indices exhibited a wide range in a stream community free from heavy organic pollution. Data from other communities were not available for comparison.

6. Loss on ignition was used for all weights because it eliminated a potential source of error due to the inorganic material in the guts of organisms.

7. Diptera, including Simulium, Calopsectra, Cricotopus (Spaniotoma), Polypedilum, Corynoneura, and Cardiocladius, were the most abundant organisms found in the community. Five species of Hydracarina were consistently present as were Baetidae and Stenonema among the Ephemeroptera. Plecoptera in the community included Perlesta placida, Isoperla, Taeniopteryx maura, and Brachyptera. Hydropsyche, Nematoda, and Oligochaeta were also usually present.

8. Univoltine life cycles were exhibited by Taeniopteryx maura, Brachyptera, Isoperla, Perlesta placida, Corydalus cornutus, and Ephemerella. None of the other organisms present exhibited similar life cycles.

9. The three large predators present, Perlesta placida, Isoperla, and Corydalus cornutus, did not compete since they were present or exhibited their greatest growth at different seasons of the year.

10. The seasonal standing crop of the plant component of the community, Podostemum ceratophyllum, was influenced by the level of the water flowing over the rock. Low water levels caused exposure of the rock outcrop

with subsequent wilting and loss downstream of the plant material. Moderate water levels supported a luxuriant growth but high, turbulent flows on two occasions washed as much as one-third of the plant material downstream.

11. Autochthonous detritus in the samples resulted from the breakdown of Podostemum within the community. Allochthonous detritus consisted of leaves, twigs, catkins, and seeds which fell or were washed into the community from the watershed. These two components were present in about equal amounts in the bottom samples.

12. The particulate detritus in river water was derived primarily from allochthonous organic materials. The detritus was of particular interest because of its potential value as food for filter feeding organisms.

13. A higher and more variable quantity of particulate detritus was present in the river water under summer (May-September) conditions than under winter (October-April) conditions. Summer thunderstorms with a rapid run-off, causing a rapid river rise, were considered largely responsible for the increased variability.

14. The shifting sand bottom acted as a trap and reservoir for sticks, leaves, and other organic debris. A constant source of organic material was contributed to the river water as shifting sand comminuted these pieces and the smaller particles were suspended in the stream load.

15. The dissolved organic material in the river water was normally two to ten times greater than the particulate fraction. However, samples

collected on a rising river contained more particulate than dissolved organic material, which supported the idea of deposition in bottom sediments and subsequent resuspension. In addition, the run-off of precipitation carried organic material with it.

16. Carnivore/primary consumer weight and number ratios had a seasonal low in June, followed by a gradual increase in both until early fall. The trend of increasing ratios was disrupted by high water on September 26 and 27, after which the ratios decreased until the end of November. Number ratios increased in December and weight ratios increased until February. Both ratios decreased after these winter maxima. It appeared that these ratios would have increased to late fall or early winter maxima and then decreased to the June low if the high water had not occurred.

17. *Cardiocladius*/*Simulium* weight and number ratios (a specific predator-prey relationship) were low during the spring, summer, and fall. The winter increase was characterized by a peak in the number ratio prior to a peak in the weight ratio. At each maximum ratio *Cardiocladius* exceeded *Simulium*.

18. The primary consumer (excluding filter feeders)/herbs and detritus ratios were variable but indicated the possibility of a fall or early winter maximum and a low ratio in January.

19. The diurnal oxygen curve method of measuring primary productivity was used but changes in dissolved oxygen were so slight that its validity under the conditions on the Middle Oconee River was questioned. The

data indicated that primary productivity in the river water was quite small.

20. Productivity at each trophic level was measured by the addition of increases in biomass between successive samples. Any errors in a method of this type would result in minimum productivities because of death, emergence, or losses downstream between successive sampling periods. The primary consumer trophic level was divided into filter feeders, herbivores, detritus feeders, and herbivore and detritus feeders. This separation was necessary to determine more accurately the trophic relationships at the primary consumer level.

21. The net annual productivity of primary producers was 930.276 gm/m^2, of primary consumers 29.678 gm/m^2, and of carnivores 4.318 gm/m^2.

22. The efficiency of energy transfer to the primary producer level based on an annual insolation of 156,924 gm cal/cm^2 was 0.2511 per cent, herbivores had a trophic efficiency of 1.434 per cent and carnivores had a trophic efficiency of 14.55 per cent. It has been suggested that losses of organisms downstream during periods of high water accounted for the low efficiency at the primary consumer level.

23. The annual turnover of Podostemum was 2.6 times per year, the herbivore turnover was 9.97 times and the other turnovers were from 5.77 times for filter feeders to 7.01 times for carnivores.

24. On the basis of the conclusion that food of filter feeders and part of that of detritus feeders ultimately came from outside the river,

it was estimated that 61.05 per cent of the net annual productivity by primary consumers came from allochthonous sources.

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APPENDIX

Table 20. Average Daily Discharge (Sec.-ft.) of the Middle Oconee River at the Study Area (Jan. 1956-Apr. 4, 1957).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.
1	114	176	445	361	320	189	700	133	63	163	147	182	269	636	412	344
2	110	211	425	338	305	163	379	163	51	144	179	182	256	737	452	367
3	112	269	560	326	504	142	179	130	54	133	176	182	234	672	392	355
4	114	332	452	315	830	133	169	122	51	144	159	182	247	718	379	355
5	114	756	373	305	445	133	147	77	52	144	156	182	756	654	538	
6	114	1040	344	386	373	136	144	92	77	204	156	179	900	535	452	
7	110	1360	315	445	543	139	179	96	68	252	159	179	519	482	412	
8	110	1250	310	373	690	139	284	89	68	159	219	172	412	432	512	
9	110	609	284	326	438	136	1060	85	74	133	332	179	349	412	512	
10	110	497	269	300	361	133	1840	81	62	124	243	182	326	379	419	
11	107	432	252	630	320	87	1500	85	54	119	200	176	305	367	386	
12	112	412	260	1100	294	133	475	56	51	122	189	176	284	344	361	
13	114	350	260	1000	265	150	256	70	50	119	182	189	284	320	355	
14	102	310	274	618	265	153	208	68	45	119	179	211	269	309	338	
15	117	294	425	497	248	211	182	87	42	119	179	226	265	305	332	
16	107	289	2760	1500	204	189	526	77	36	107	172	247	284	289	326	
17	104	300	4040	1960	211	163	1000	68	34	107	269	226	279	305	320	
18	107	310	5980	2100	196	156	405	67	33	112	618	207	252	289	315	
19	133	305	1840	968	200	127	256	65	33	114	412	196	243	284	367	
20	269	419	776	654	200	117	204	67	34	122	305	189	219	305	367	
21	200	519	592	535	196	163	186	133	32	133	269	219	239	294	332	
22	169	399	512	475	189	139	219	102	31	379	252	234	247	260	355	
23	150	338	452	432	176	133	196	85	31	663	243	618	332	265	367	
24	196	294	419	419	169	83	252	72	34	338	222	1053	405	265	350	
25	219	289	386	392	172	110	248	56	252	235	219	1082	373	289	699	
26	189	294	361	373	172	92	200	34	1460	204	207	654	672	512	709	
27	186	320	344	350	182	89	196	63	1430	200	204	440	663	785	485	
28	169	690	332	338	189	83	156	77	544	172	196	367	559	618	432	
29	147	672	386	338	182	77	127	72	274	166	189	320	482		355	
30	166		576	326	166	88	117	65	200	147	189	299	618		349	
31	172		438		208		133	63		169		284	699		344	

Table 21. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected April 23 & 25, 1956					Totals		Av./100 cm^2	
	22	23	26	27	28	Number	Loss on Ignition	Number	Loss on Ignition
Nematoda		1	2		7	10	0.5	2.00	0.10
Oligochaeta		29	53	2	24	108	14.4	21.60	2.88
Oligochaeta eggs			6		8	14	3.2	2.80	0.64
Hydracarina egg cases		8	2	12	7	29	1.9	5.80	0.38
Sperchon			1	11	1	13	0.7	2.60	0.14
Lebertia	1		1		1	3	1.0	0.60	0.20
Atractideidae		2	3		1	6	0.6	1.20	0.12
Megapus	1	1	5	1	1	9	0.9	1.80	0.18
Neumania			1			1	1.3	0.20	0.26
Hypochthoniidae	3	61	30	10	26	130	1.3	26.00	0.26
Baetidae (N)		4	7	6	9	26	0.9	5.20	0.18
Stenonema (N)		2				2	0.1	0.40	0.02
Taeniopteryx maura (N)	1	10	17	13	21	62	0.6	12.40	0.12
Brachyptera (N)		1				1	0.7	0.20	0.14
Perlesta placida (N)	1	8	5	2	3	19	11.3	3.80	2.26
Hemiptera (N)		1			1	2	0.3	0.40	0.06
Hydropsyche (L)		1	3	1	2	7	0.3	1.40	0.06
Agraylea (P)	1	1		1		3	0.6	0.60	0.12
Elmidae (A)			1			1	0.6	0.20	0.12
Elmidae (L)			1	2	1	4	0.5	0.80	0.10
Simulium (L)	65	384	242	283	399	1373	63.4	274.60	12.68
Simulium cast larval skins	1	4	1			6	0.2	1.20	0.04
Simulium (P)	3	5	13		16	37	6.7	7.40	1.34
Simulium dead (P)	20	50	60	17	68	215	16.8	43.00	3.36
Simulium partial cast pupal skins	12	34	93	22	36	197	4.5	39.40	0.90
Simulium complete cast pupal skins	1	7	28	1	7	44	1.8	8.80	0.36
Simulium pupal cases	39	93	136	53	103	424	36.2	84.80	7.24
Simulium (A)			1			1	0.5	0.20	0.10

Table 21. Continued.

Taxa	Samples Collected April 23 & 25, 1956					Totals		Av./100 cm^2	
	22	23	26	27	28	Number	Loss on Ignition	Number	Loss on Ignition
Tendipedidae (L)	4	6	13	3	3	29	0.7	5.80	0.14
Tendipedidae (P)	1		1			2	0.5	0.40	0.10
Tendipedidae (A)		3		1		4	0.4	0.80	0.08
Pentaneura (L)	1		1			2	0.4	0.40	0.08
Corynoneura (L)	1	2	27	2	6	38	0.9	7.60	0.18
Cricotopus (Spaniotoma) sp. 1 (L)		16	47	14	18	95	2.1	19.00	0.42
Cricotopus (Spaniotoma) sp. 2 (L)	3	2	34	22	37	98	1.3	19.60	0.26
Cricotopus (Spaniotoma) sp. 3 (L)			1	2	4	7	0.7	1.40	0.14
Cricotopus (Spaniotoma) sp. 4 (L)	3	14	15	3	9	44	0.7	8.80	0.14
Cricotopus (Spaniotoma) (P)		1				1	0.4	0.20	0.08
Calopsectra cases	18	44	215	36	73	386	18.6	77.20	3.72
Calopsectra (L)	4	7	10	2	8	31	1.2	6.20	0.24
Polypedilum convictum (L)		2	7	1	11	21	0.7	4.20	0.14
Polypedilum (L)			1		1	2	0.5	0.40	0.10
Heleidae (L)	1					1	0.8	0.20	0.16
Hemerodromia (P)			1			1	0.7	0.20	0.14
Anthomyiidae (L)			1			1	0.4	0.20	0.08
Goniobasis shells	2	2	2	1	2	9	60.5	1.80	12.10

Table 22. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected May 10, 1956				Totals		Av./100 cm^2	
	30	31	32	33	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia				1	1	0.3	0.25	0.07
Nematoda	1	3	3		7	0.1	1.75	0.02
Oligochaeta	2	92	41	27	162	6.6	40.50	1.65
Oligochaeta eggs		1	4		5	1.7	1.25	0.42
Hydracarina egg cases	22	5	13	5	45	0.5	11.25	0.12
Sperchon			1	1	2	0.3	0.50	0.07
Lebertia		1			1	0.8	0.25	0.20
Atractideidae			2		2	0.2	0.50	0.05
Megapus		1	2	1	4	0.4	1.00	0.10
Hypochthoniidae	1	10	3	2	16	0.2	4.00	0.05
Tricorythodes (N)	1	1			2	0.4	0.50	0.10
Caenis (N)		1	3	1	5	0.7	1.25	0.17
Baetidae (N)	2	10	23	15	50	1.6	12.50	0.40
Stenonema (N)		1	19	4	24	2.2	6.00	0.55
Taeniopteryx maura (N)	1	2	2		5	0.2	1.25	0.05
Perlesta placida (N)	1	4	31	3	39	32.9	9.75	8.22
Hemiptera (N)		1			1	0.9	0.25	0.22
Hydropsyche (L)	1	1	12	3	17	2.2	4.25	0.55
Agraylea (L)	1				1	0.1	0.25	0.02
Elmidae (A)	1				1	0.2	0.25	0.05
Simulium (L)	99	230	3	1	333	7.4	83.25	1.85
Simulium (P)	1	1			2	1.3	0.50	0.32
Simulium partial cast pupal skins	1	23	1	1	26	0.8	6.50	0.20
Simulium pupal cases	4	12			16	1.2	4.00	0.30
Tendipedidae (L)	1	8	5	2	16	0.7	4.00	0.17
Pentaneura (L)	1	4	1		6	0.4	1.50	0.10
Corynoneura (L)	10	46		2	58	1.1	14.50	0.27
Cardiocladius (L)				4	4	0.1	1.00	0.02

Table 22. Continued.

Taxa	Samples Collected May 10, 1956				Totals		Av./100 cm^2	
	30	31	32	33	Number	Loss on Ignition	Number	Loss on Ignition
Cricotopus (Spaniotoma) sp. 1 (L)	5	41	21	17	84	1.2	21.00	0.30
Cricotopus (Spaniotoma) sp. 2 (L)	9	20	8	8	45	0.5	11.25	0.12
Cricotopus (Spaniotoma) sp. 4 (L)	13	26	4	6	49	0.9	12.25	0.22
Cricotopus (Spaniotoma) (P)		3			3	0.2	0.75	0.05
Calopsectra cases	29	108	62	29	228	8.3	57.00	2.07
Calopsectra (L)	1	17	19	4	41	0.6	10.25	0.15
Calopsectra (P)			2		2	0.3	0.50	0.07
Polypedilum fallax (L)		1			1	0.3	0.25	0.07
Polypedilum convictum (L)	1	34	12	3	50	2.7	12.50	0.67
Polypedilum (L)	2	24	4		30	1.8	7.50	0.45
Polypedilum (P)		6	6		12	1.0	3.00	0.25
Heleidae (L)		3			3	1.1	0.75	0.27
Goniobasis		6	17	2	25	211.6	6.25	52.90
Goniobasis shells	5		5		10	30.6	2.50	7.65

Table 23. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected June 4, 1956				Totals		Av./100 cm^2	
	34	35	36	37	Number	Loss on Ignition	Number	Loss on Ignition
Nematoda		1	2	8	11	0.3	2.75	0.07
Oligochaeta	58	44	30	21	153	0.8	38.25	0.20
Hydracarina egg cases			2		2	0.6	0.50	0.15
Sperchon	3	1	2	1	7	0.4	1.75	0.10
Lebertia	1	1	2		4	0.7	1.00	0.17
Atractideidae	1	1	1		3	0.3	0.75	0.07
Megapus	8	4	3	2	17	0.8	4.25	0.20
Hypochthoniidae	7	2	13	15	37	0.6	9.25	0.15
Tricorythodes (N)	7	10	11	11	39	1.1	9.75	0.27
Caenis (N)	2	2		1	5	0.3	1.25	0.07
Ephemerella (N)	5	12	4	6	27	8.0	6.75	2.00
Baetidae (N)	25	24	51	41	141	5.1	35.25	1.27
Stenonema (N)	7	3	4	2	16	0.6	4.00	0.15
Perlesta placida (N)				2	2	5.3	0.50	1.32
Hydropsyche (L)			17	52	69	6.0	17.25	1.50
Hydropsyche (P)			1		1	1.8	0.25	0.45
Agraylea (P)			1	1	2	0.9	0.50	0.22
Leptocella (L)	2	11	12	2	27	1.1	6.75	0.27
Simulium (L)	155	166	316	485	1122	75.3	280.50	18.82
Simulium cast larval skins		4	2	3	9	0.6	2.25	0.15
Simulium (P)	27	62	48	63	200	26.8	50.00	6.70
Simulium dead (P)	1	5	7	5	18	2.7	4.50	0.67
Simulium partial cast pupal skins	9	9	11	10	39	0.8	9.75	0.20
Simulium complete cast pupal skins	4	3	9	11	27	1.1	6.75	0.27
Simulium pupal cases	31	73	66	82	252	10.5	63.00	2.62
Simulium (A)		1	1	1	3	1.1	0.75	0.27
Tendipedidae (L)	7	7	4	3	21	0.5	5.25	0.12
Pentaneura (L)			1	1	2	0.7	0.50	0.17

Table 23. Continued.

Taxa	Samples Collected June 4, 1956				Totals		Av./100 cm^2	
	34	35	36	37	Number	Loss on Ignition	Number	Loss on Ignition
Corynoneura (L)	4	7	12	5	28	0.4	7.00	0.10
Corynoneura (P)	1	1			2	0.6	0.50	0.15
Cardiocladius (L)	1		2	1	4	0.7	1.00	0.17
Cricotopus (Spaniotoma) sp. 1 (L)	26	33	61	70	190	3.3	47.50	0.82
Cricotopus (Spaniotoma) sp. 2 (L)	2	2	2	3	9	0.5	2.25	0.12
Cricotopus (Spaniotoma) sp. 3 (L)			10	24	34	1.0	8.50	0.25
Cricotopus (Spaniotoma) sp. 4 (L)	7	17	11	12	47	1.3	11.75	0.32
Cricotopus (Spaniotoma) (P)	6	2		6	14	0.8	3.50	0.20
Cricotopus (Spaniotoma) sp. 4 (P)	5	2	1	4	12	0.9	3.00	0.22
Calopsectra cases	192	69	65	138	464	7.1	116.00	1.77
Calopsectra (L)	48	18	28	58	152	2.0	38.00	0.50
Calopsectra (P)	2	1	1	2	6	0.7	1.50	0.17
Polypedilum fallax (L)	1				1	0.4	0.25	0.10
Polypedilum convictum (L)	30	13	16	10	69	1.0	17.25	0.25
Polypedilum (L)	20	2			22	1.7	5.50	0.42
Hemerodromia (L)		1	1	1	3	0.1	0.75	0.02
Goniobasis	24	22	14	9	69	1.7	17.25	0.42
Goniobasis shell	1				1	24.7	0.25	6.17
Ferissia		1	1	2	4	0.5	1.00	0.12

Table 24. Numbers and Biomass[1] of Organisms in Bottom Samples (100 sq cm).

Taxa	Samples Collected June 25, 1956				Samples Collected June 26, 1956								Totals		Av./100 sq cm	
	40	41	42	43	45	46	47	48	49	50	51	52	Number	Loss on Ignition	Number	Loss on Ignition
Nematoda	3	6	9	6	9	4		4	18	13	3	12	87	1.4	7.25	0.12
Oligochaeta	43	96	147	176	376	78	84	51	106	72	46	96	1371	14.9	114.25	1.24
Oligochaeta eggs			3										3	1.9	0.25	0.16
Hydracarina	3	4			3	4	3					5	22	0.4	1.83	0.03
Hydracarina egg cases	4		8	6	2	2	4	1	4	4	7	3	45	1.0	3.75	0.08
Sperchon sp.	20	8	6	13	15	19	15	19	12	11	34	46	218	3.4	18.17	0.28
Lebertia sp.			3	1				1	1	1		2	9	1.2	0.75	0.10
Atractideidae			6		3	3	2	3	1	2	9	9	38	1.8	3.17	0.15
Megapus sp.	3	9	9	17	10	14	7	14	5	16	22	16	142	5.1	11.83	0.43
Hypochthoniidae	14	2	11	7	18	1	7	13	5	1	4	11	94	1.2	7.83	0.10
Tricorythodes sp. (N)	10	13	8	17	24	18	7	15	16	14	23	14	179	14.2	14.92	1.18
Caenis sp. (N)		1				1			1	1			4	0.5	0.33	0.04
Ephemerella sp. (N)	1			3		1		1		1	3		10	12.6	0.83	1.05
Baetidae (N)	3	5	6	9	2	4	6	4	3	8	9	5	64	56.1	5.33	4.84
Stenonema sp. (N)	22	12	21	21	32	11	14	11	15	17	21	13	210	18.2	17.50	1.52
Pteronarcys sp. (N)										1		2	3	25.0	0.25	2.08
Perlesta placida (N)		5	1		1		1	4	4	3	2	1	22	50.7	1.83	4.23
Hemiptera (N)		1				2	1	1		1			6	0.5	0.50	0.04
Hydropsyche sp. (L)	71	46	42	36	70	28	20	25	45	42	38	38	501	110.1	41.75	9.18
Hydropsyche sp. (P)	2	4	2	3	5			1	2	3		1	23	40.8	1.92	3.40
Agraylea sp. (L)			2							1			3	0.1	0.25	0.01
Leptocella sp. (L)			4	1						1	3	2	11	1.2	0.92	0.10
Gyrinus sp. (L)											1		1	0.2	0.08	0.02
Hydrophilidae (Ad)			1										1	0.8	0.08	0.07
Hydrochus sp. (L)												1	1	0.8	0.08	0.07
Anacaena sp. (L)			1										1	1.0	0.08	0.08
Elmidae (Ad)		2	1	1	3	1	1	1	2	3	6	2	23	3.0	1.92	0.25
Elmidae (L)		2	3		1			1		3	3		13	1.2	1.08	0.10
Simulium sp. (L)	232	99	90	132	199	127	141	378	217	477	527	265	2884	317.4	240.33	26.45
Simulium sp. cast larval skins	22		19	12	38	19	8	47	21	54	59	25	324	4.8	27.00	0.40
Simulium sp. (P)	68	54	91	150	108	94	38	154	94	227	342	102	1522	257.7	126.83	21.47
Simulium sp. dead (P)	24	4	9	13	11	10	5	19	10	14	34	10	163	12.7	13.58	1.06
Simulium sp. partial cast pupal skins	84	68	140	126	109	64	54	69	124	146	126	88	1198	22.1	99.83	1.84
Simulium sp. complete cast pupal skins	40	19	128	120	53	43	57	72	71	100	142	127	972	20.0	81.00	1.67
Simulium sp. pupal cases	148	86	232	269	172	160	119	234	203	354	532	251	2760	167.0	230.00	13.92
Simulium sp. (Ad)	1	1		5	4	1	3	6	2	3	7	1	34	6.8	2.83	0.57
Tendipedidae (L)	17	6	12	15	16	8	19	12	13	22	24	39	203	2.8	16.92	0.23
Tendipedidae (P)			2	1	1				1	5	4	4	18	0.2	1.50	0.02
Tendipedidae (Ad)	1	1			1							2	5	1.4	0.42	0.12
Pentaneura sp. (L)	3		2		3			1			1		10	1.2	0.83	0.10
Procladius sp. (L)									3				3	0.7	0.25	0.06
Corynoneura sp. (L)	4	2		3	4		4	3	7	2	2		31	0.9	2.58	0.08
Cardiocladius sp. (L)	27	19	11	14	15	17	20	19	28	26	42	19	257	11.5	21.42	0.96
Cardiocladius sp. (P)			1								1		2	2.2	0.17	0.18
Cricotopus (Spaniotoma) sp. 1 (L)	78	98	59	55	72	51	24	47	72	57	47	64	724	11.8	60.33	0.98
Cricotopus (Spaniotoma) sp. 3 (L)	49	45	50	36	41	20	11	24	49	46	34	28	433	7.5	36.08	0.63
Cricotopus (Spaniotoma) sp. 4 (L)	13	4	7	8	16	7	15	27	15	14	16	4	146	2.9	12.17	0.24
Cricotopus (Spaniotoma) sp. (P)	3	2	2	3	3				1	2			16	1.9	1.33	0.16
Calopsectra sp. cases	396	322	462	283	422	203	145	288	331	207	194	247	3500	86.6	291.67	7.22
Calopsectra sp. (L)	156	73	165	97	163	53	51	124	96	73	80	88	1219	12.6	101.58	1.05
Calopsectra sp. (P)	5	4	5	5	7	4	3	3	3	4	3		46	1.6	3.83	0.13
Polypedilum fallax (L)		1				2	3			4	2	1	13	1.0	1.08	0.08
Polypedilum convictum (L)	4	9	11	7	20	17	16	19	70	67	14	34	288	5.1	24.00	0.43
Polypedilum sp. (L)	2		23	58	11		12				40	32	178	4.4	14.83	0.37
Hemerodromia sp. (L)	10	1	1	4	5	4	5	2	4	6	4	2	48	4.3	4.00	0.36
Hemerodromia sp. (P)	1	1		2	1	1	2	1	2			4	15	2.2	1.25	0.18
Hemerodromia sp. (Ad)							1						1	0.3	0.08	0.03
Goniobasis sp.	34	24	10	21	13	20	16	14	15	19	8	5	199	82.7	16.58	6.89
Ferissia sp.						1		1					2	1.6	0.17	0.13

[1]mg loss on ignition

Table 25. Numbers and Biomass (mg Loss on Ignition) Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected July 23, 1956: 53	54	55	56	57	Totals: Number	Totals: Loss on Ignition	Av./100 cm^2: Number	Av./100 cm^2: Loss on Ignition
Dugesia					12	12	1.1	2.40	0.22
Nematoda	11	9	18	3	9	50	0.6	10.00	0.12
Oligochaeta	15	58	93	77	54	297	13.5	59.40	2.70
Oligochaeta eggs		22	23	6	3	54	7.6	10.80	1.52
Hydracarina egg cases	17	28	21	6	3	75	0.7	15.00	0.14
Sperchon			3	7	12	22	1.6	4.40	0.32
Lebertia			1	1		2	0.8	0.40	0.16
Atractideidae				1	2	3	0.3	0.60	0.06
Megapus		2		1	1	4	0.1	0.80	0.02
Hypochthoniidae	1			11	8	20	0.9	4.00	0.18
Baetidae (N)		1	1	1	1	4	0.6	0.80	0.12
Stenonema (N)				5	7	12	0.3	2.40	0.06
Corydalus cornutus (L)					9	9	2.1	1.80	0.42
Hydropsyche (L)	2		2	4	18	26	1.4	5.20	0.28
Elmidae (A)		1			1	2	0.5	0.40	0.10
Elmidae (L)					5	5	0.5	1.00	0.10
Simulium (L)	245	236	170	455	401	1507	100.2	301.40	20.04
Simulium (L) dark histoblasts	23	14	8	28	34	107	21.1	21.40	4.22
Simulium cast larval skins	4	3	1	14	8	30	0.9	6.00	0.18
Simulium (P)	16	14	11	62	65	168	22.7	33.60	4.54
Simulium dead (P)	3	2		3	7	15	1.4	3.00	0.28
Simulium partial cast pupal skins	1	7		6	11	25	0.5	5.00	0.10
Simulium complete cast pupal skins	3		1	18	37	59	1.1	11.80	0.22
Simulium pupal cases	21	18	12	83	115	249	9.9	49.80	1.98
Simulium (A)	1			1	7	9	1.7	1.80	0.34
Tendipedidae (L)		2	5	11	3	21	0.4	4.20	0.08
Pentaneura (L)					1	1	0.4	0.20	0.08
Corynoneura (L)	7	14	7	13	1	42	0.9	8.40	0.18

Table 25. Continued.

Taxa	Samples Collected July 23, 1956: 53	54	55	56	57	Totals: Number	Totals: Loss on Ignition	Av./100 cm^2: Number	Av./100 cm^2: Loss on Ignition
Corynoneura (P)		1				1	0.6	0.20	0.12
Cardiocladius (L)	2	1		1	1	5	0.5	1.00	0.10
Cricotopus (Spaniotoma) sp. 1 (L)	6	17	6	17	1	47	1.4	9.40	0.28
Cricotopus (Spaniotoma) sp. 2 (L)	13	8	15	17	3	56	1.3	11.20	0.26
Cricotopus (Spaniotoma) sp. 3 (L)			2	5	4	11	0.6	2.20	0.12
Cricotopus (Spaniotoma) sp. 4 (L)	3		5	5		13	0.5	2.60	0.10
Cricotopus (Spaniotoma) (P)	1			1		2	0.5	0.40	0.10
Calopsectra cases	31	61	41	148	57	338	6.8	67.60	1.36
Calopsectra (L)	6	6	3	49	14	78	0.9	15.60	0.18
Calopsectra (P)	1	2	1	1	1	6	0.6	1.20	0.12
Polypedilum fallax (L)	1	2		1		4	0.2	0.80	0.04
Polypedilum convictum (L)	8	11	3	7	1	30	1.8	6.00	0.36
Polypedilum (L)	12	33	31	5		81	3.2	16.20	0.64
Polypedilum (P)		4	2	2		8	0.4	1.60	0.08
Glyptotendipes (L)				1		1	0.3	0.20	0.06
Hemerodromia (L)	1	3	1		2	7	0.5	1.40	0.10
Goniobasis		1		1		2	1.1	0.40	0.22
Goniobasis shells		1		2		3	1.0	0.60	0.20
Ferissia					1	1	0.6	0.20	0.12

Table 26. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected August 22, 1956					Totals		Av./100 cm^2	
	63	64	65	66	67	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia			22			22	1.5	4.40	0.30
Nematoda	4	5	1		1	11	0.2	2.20	0.04
Oligochaeta	71	135	73	102	86	467	3.4	93.40	0.68
Hydracarina egg cases	10	2	48	17	10	87	1.4	17.40	0.28
Sperchon	22		29	14	8	73	1.8	14.60	0.36
Lebertia			1	1	1	3	0.1	0.60	0.02
Atractideidae	4		19	9	6	38	0.5	7.60	0.10
Megapus	5		16	10	4	35	1.0	7.00	0.20
Hypochthoniidae	21	39	84	17	7	168	0.7	33.60	0.14
Tricorythodes (N)	34		57	84	36	211	19.8	42.20	3.96
Caenis (N)	1	2				3	0.8	0.60	0.16
Baetidae (N)	89	1	154	18	105	367	7.3	73.40	1.46
Stenonema (N)	41	1	67		12	121	7.8	24.20	1.56
Hemiptera (N)		1				1	0.8	0.20	0.16
Corydalus cornutus (L)	1		4			5	45.2	1.00	9.04
Hydropsyche (L)	2		12	3	2	19	6.8	3.80	1.36
Brychius (L)		1				1	0.2	0.20	0.04
Helophorus (L)		1				1	1.0	0.20	0.20
Elmidae (A)	2		3		1	6	1.0	1.20	0.20
Elmidae (L)	1		1			2	0.3	0.40	0.06
Simulium (L)	199	3	1271	91	737	2301	158.0	460.20	31.60
Simulium (L) dark histoblasts	36		99	5	72	212	43.3	42.40	8.66
Simulium cast larval skins	15		6	2	11	34	0.8	6.80	0.16
Simulium (P)	42		90	63	137	332	43.3	66.40	8.66
Simulium dead (P)	8		19	10	17	54	3.9	10.80	0.78
Simulium partial cast pupal skins	13	8	48	67	96	232	3.4	46.40	0.68
Simulium complete cast pupal skins	28		40	93	102	263	4.5	52.60	0.90
Simulium pupal cases	89	3	160	205	322	779	25.6	155.80	5.12

Table 26. Continued.

Taxa	Samples Collected August 22, 1956: 63	64	65	66	67	Totals: Number	Totals: Loss on Ignition	Av./100 cm^2: Number	Av./100 cm^2: Loss on Ignition
Simulium (A)					3	3	0.4	0.60	0.08
Tendipedidae (L)	12	5	12	6	10	45	0.3	9.00	0.06
Tendipedidae (A)			1			1	0.2	0.20	0.04
Pentaneura (L)				1	1	2	0.1	0.40	0.02
Corynoneura (L)	6		4	4	11	25	0.8	5.00	0.16
Corynoneura (P)	1			2	1	4	1.3	0.80	0.26
Cardiocladius (L)				2	3	5	1.1	1.00	0.22
Cricotopus (Spaniotoma) sp. 1 (L)	15		20	14	5	54	2.0	10.80	0.40
Cricotopus (Sapniotoma) sp. 2 (L)	114	13	52	7	41	227	6.1	45.40	1.22
Cricotopus (Spaniotoma) sp. 3 (L)	7		26	6	6	45	0.7	9.00	0.14
Cricotopus (Spaniotoma) sp. 4 (L)			1		1	2	0.1	0.40	0.02
Cricotopus (Spaniotoma) sp. 2 (P)	43	1	2	2	6	54	3.4	10.80	0.68
Calopsectra cases	617	98	946	253	67	1981	82.5	396.20	16.50
Calopsectra (L)	335	5	364	158	55	917	13.7	183.40	2.74
Calopsectra (P)	31		24	9	5	69	2.5	13.80	0.50
Polypedilum convictum (L)	4	3	3	1	1	12	0.5	2.40	0.10
Polypedilum (L)				1		1	0.2	0.20	0.04
Heleidae (L)		6				6	0.3	1.20	0.06
Heleidae (P)		1				1	0.1	0.20	0.02
Dolichopodidae (L)		2				2	0.5	0.40	0.10
Dolichopodidae (P)		3				3	0.2	0.60	0.04
Goniobasis				2	2	4	0.3	0.80	0.06
Goniobasis shells	2					2	4.7	0.40	0.94
Ferissia	4			1	1	6	0.4	1.20	0.08

Table 27. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected September 18, 1956					Totals		Av./100 cm^2	
	68	69	70	71	72	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia		8	2		2	12	1.2	2.40	0.24
Nematoda		3	7	71	18	99	0.5	19.80	0.10
Oligochaeta	131	44	169	442	342	1128	9.8	225.60	1.96
Hydracarina egg cases	16	124	54	76	70	340	2.0	68.00	0.40
Sperchon	21	68	51	23	11	174	2.8	34.80	0.56
Lebertia		2	11	2	1	16	0.6	3.20	0.12
Atractideidae	4	24	7	6	4	45	1.0	9.00	0.20
Megapus	9	30	17	2	4	62	2.2	12.40	0.44
Hypochthoniidae	19	49	35	114	133	350	1.7	70.00	0.34
Tricorythodes (N)	42	23	23	56	29	173	11.4	34.60	2.28
Baetidae (N)	175	99	128	217	67	686	21.3	137.20	4.26
Stenonema (N)	28	48	24	72	39	211	17.9	42.20	3.58
Argia (N)				6	7	13	1.3	2.60	0.26
Hemiptera (N)					6	6	0.4	1.20	0.08
Corydalus cornutus (L)		2	3		1	6	119.3	1.20	23.86
Hydropsyche (L)	16	49	32	9	1	107	0.4	21.40	0.08
Hydropsyche (P)				1		1	1.0	0.20	0.20
Agraylea (L)				2		2	0.2	0.40	0.04
Agraylea (P)				1		1	0.2	0.20	0.04
Elmidae (A)	1			1		2	0.3	0.40	0.06
Elmidae (L)			4		1	5	0.4	1.00	0.08
Tipula (L)	1			4	6	11	37.2	2.20	7.44
Simulium (L)	304	471	1082	90	29	1976	130.5	395.20	26.10
Simulium (L) dark histoblasts	32	21	68	3	6	130	28.5	26.00	5.70
Simulium cast larval skins	4	5	3	2	2	16	0.5	3.20	0.10
Simulium (P)	59	24	122	25	34	264	36.9	52.80	7.38
Simulium dead (P)	8	1	8	16	6	39	2.2	7.80	0.44
Simulium partial cast pupal skins	66	16	33	211	124	450	6.8	90.00	1.36

Table 27. Continued.

Taxa	Samples Collected September 18, 1956					Totals		Av./100 cm^2	
	68	69	70	71	72	Number	Loss on Ignition	Number	Loss on Ignition
Simulium complete cast pupal skins	43	33	93	114	25	308	4.8	61.60	0.96
Simulium pupal cases	202	63	288	217	97	867	29.1	173.40	5.82
Simulium (A)	2		1	1		4	0.5	0.80	0.10
Tendipedidae (L)	7	10	7	5	9	38	2.0	7.60	0.40
Tendipedidae (A)			1	2		3	0.6	0.60	0.12
Pentaneura (L)			1	1	1	3	0.4	0.60	0.08
Corynoneura (L)	36	82	22	14	3	157	1.5	31.40	0.30
Corynoneura (P)		1				1	0.6	0.20	0.12
Cardiocladius (L)	2	1	3			6	1.6	1.20	0.32
Cricotopus (Spaniotoma) sp. 1 (L)	14	6	16	22	14	72	1.4	14.40	0.28
Cricotopus (Spaniotoma) sp. 2 (L)	57	195	126	16	2	396	5.8	79.20	1.16
Cricotopus (Spaniotoma) sp. 3 (L)	16	15	23	40	9	103	2.2	20.60	0.44
Cricotopus (Spaniotoma) sp. 4 (L)	5		3			8	0.1	1.60	0.02
Cricotopus (Spaniotoma) (P)	3	1	2	5	3	14	1.1	2.80	0.22
Calopsectra cases	953	1393	1609	934	1360	6249	225.5	1249.80	45.10
Calopsectra (L)	986	990	1170	716	629	4491	58.9	898.20	11.78
Calopsectra (P)	20	17	51	28	34	150	5.7	30.00	1.14
Polypedilum convictum (L)	1	11	4	44	121	181	6.0	36.20	1.20
Polypedilum (P)					2	2	0.8	0.40	0.16
Glyptotendipes (L)	1	2				3	0.5	0.60	0.10
Tendipes (Limnochironomus) (L)				1		1	0.4	0.20	0.08
Hemerodromia (L)	1			5		6	0.5	1.20	0.10
Goniobasis		2		3	1	6	38.4	1.20	7.68
Goniobasis shells	1	7	3			11	30.8	2.20	6.16
Ferissia	2	11	8	13	9	43	1.7	8.60	0.34

Table 28. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected October 3, 1956					Totals		Av./100 cm^2	
	73	74	75	76	77	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia					8	8	1.3	1.60	0.26
Nematoda		6	2	3	24	35	0.2	7.00	0.04
Oligochaeta	1	1	7	13	20	42	1.2	8.40	0.24
Oligochaeta eggs					7	7	1.1	1.40	0.22
Hydracarina egg cases	63	20	115	76	33	307	1.7	61.40	0.34
Sperchon	15	4	54	36	3	112	1.5	22.40	0.30
Lebertia			4	4	1	9	0.5	1.80	0.10
Atractideidae	2		21	32	3	58	1.0	11.60	0.20
Megapus	4		9	9		22	0.8	4.40	0.16
Hypochthoniidae	10	2	28	13	27	80	0.6	16.00	0.12
Tricorythodes (N)			1			1	0.5	0.20	0.10
Baetidae (N)	1		5	5	2	13	1.0	2.60	0.20
Stenonema (N)			4	4	4	12	0.5	2.40	0.10
Brachyptera (N)		2	2			4	0.3	0.80	0.06
Hydropsyche (L)	1		8	2	6	17	0.6	3.40	0.12
Hydropsyche (P)			1			1	0.6	0.20	0.12
Elmidae (A)					1	1	0.1	0.20	0.02
Elmidae (L)					1	1	0.3	0.20	0.06
Simulium (L)	15	15	138	46	77	291	20.8	58.20	4.16
Simulium (L) dark histoblasts			3	2	3	8	2.3	1.60	0.46
Simulium cast larval skins	1		5		1	7	0.2	1.40	0.04
Simulium (P)	7	1	39	26	1	74	12.6	14.80	2.52
Simulium dead (P)	4	1	32	123		160	17.1	32.00	3.42
Simulium partial cast pupal skins	3	1	10	28	1	43	1.8	8.60	0.36
Simulium complete cast pupal skins	1	1	2	11		15	0.6	3.00	0.12
Simulium pupal cases	27	8	94	188	1	318	18.0	63.60	3.60
Tendipedidae (L)			3	1	5	9	0.1	1.80	0.02
Tendipedidae (A)			1	1		2	0.3	0.40	0.06

Table 28. Continued.

Taxa	Samples Collected October 3, 1956: 73	74	75	76	77	Totals: Number	Totals: Loss on Ignition	Av./100 cm^2: Number	Av./100 cm^2: Loss on Ignition
Corynoneura (L)	11	4	8	11	5	39	0.5	7.80	0.10
Corynoneura (P)	1	2	1	1		5	0.4	1.00	0.08
Cardiocladius (L)			3	3	2	8	0.9	1.60	0.18
Cricotopus (Spaniotoma) sp. 1 (L)	13	5	43	18	10	89	1.7	17.80	0.34
Cricotopus (Spaniotoma) sp. 2 (L)	29	30	18	31	47	155	2.4	31.00	0.48
Cricotopus (Spaniotoma) sp. 3 (L)				1		1	0.3	0.20	0.06
Cricotopus (Spaniotoma) sp. 4 (L)				1		1	0.3	0.20	0.06
Cricotopus (Spaniotoma) (P)			1	1		2	1.1	0.40	0.22
Calopsectra cases	273	62	531	922	86	1874	104.2	374.80	20.84
Calopsectra (L)	13	3	32	57	43	148	1.7	29.60	0.34
Calopsectra (P)	1		1	2	1	5	0.5	1.00	0.10
Polypedilum convictum (L)	5	5	13	8	13	44	1.8	8.80	0.36
Polypedilum (L)	1	1	1	1		4	0.4	0.80	0.08
Tendipes (Limnochironomus) (L)			1		4	5	0.3	1.00	0.06
Hemerodromia (L)					1	1	0.2	0.20	0.04
Goniobasis	1			1		2	4.4	0.20	0.16
Goniobasis shells		1		2	1	4	12.2	0.80	2.44
Ferissia		2				2	0.5	0.40	0.10

Table 29. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected November 2, 1956					Totals		Av./100 cm^2	
	78	79	80	81	82	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia		2				2	0.6	0.40	0.12
Nematoda	1	7	42	1	19	70	0.6	14.00	0.12
Oligochaeta	6	37	43	56	153	295	4.9	59.00	0.98
Hirudinea		2				2	1.8	0.40	0.36
Copepoda					7	7	0.4	1.40	0.08
Hydracarina egg cases	13	50	51	13	56	183	1.6	36.60	0.32
Sperchon	19	8	13	16	7	63	1.5	12.60	0.30
Lebertia			3	2	1	6	0.4	1.20	0.08
Atractideidae	2	2	6	4	2	16	0.6	3.20	0.12
Megapus	1	4	1	10	2	18	0.6	3.60	0.12
Hypochthoniidae	16	26	45	19	56	162	0.9	32.40	0.18
Ephemerella (N)			1			1	0.6	0.20	0.12
Tricorythodes (N)	1					1	0.2	0.20	0.04
Baetidae (N)	5	3	19	21	2	50	1.2	10.00	0.24
Stenonema (N)	6	2	6	6		20	2.8	4.00	0.56
Taeniopteryx maura (N)	84	57	64	33	44	282	9.5	56.40	1.90
Perlesta placida (N)	5	1	2	2	3	13	0.7	2.60	0.14
Hydropsyche (L)	2	1	3	1	2	9	1.0	1.80	0.20
Elmidae (A)	1					1	0.4	0.20	0.08
Elmidae (L)			2			2	0.4	0.40	0.08
Simulium (L)	234	120	187	51	209	801	83.7	160.20	16.74
Simulium (L) dark histoblasts	13	6	18	4	18	59	19.1	11.80	3.82
Simulium cast larval skins	1	2			3	6	0.3	1.20	0.06
Simulium (P)	31	17	16	9	55	128	28.1	25.60	5.62
Simulium dead (P)	3	3	2		21	29	2.8	5.80	0.56
Simulium partial cast pupal skins	49	13	28	11	31	132	3.3	26.40	0.66
Simulium complete cast pupal skins	17	12	17	9	94	149	3.7	29.80	0.74
Simulium pupal cases	111	44	53	27	208	443	27.6	88.60	5.52

Table 29. Continued.

Taxa	Samples Collected November 2, 1956 78	79	80	81	82	Totals Number	Totals Loss on Ignition	Av./100 cm^2 Number	Av./100 cm^2 Loss on Ignition
Simulium (A)			1			1	0.4	0.20	0.08
Tendipedidae (L)	1		6	2	4	13	0.9	2.60	0.18
Pentaneura (L)	1					1	0.2	0.20	0.04
Corynoneura (L)	16	55	25	87	49	232	3.3	46.40	0.66
Corynoneura (P)	1	3	1	4	2	11	0.3	2.20	0.06
Cardiocladius (L)	5		5	3	8	21	1.7	4.20	0.34
Cardiocladius (P)	1					1	0.4	0.20	0.08
Cricotopus (Spaniotoma) sp. 1 (L)	16	21	38	32	37	144	2.7	28.80	0.54
Cricotopus (Spaniotoma) sp. 2 (L)	3	7	9	6	11	36	0.7	7.20	0.14
Cricotopus (Spaniotoma) sp. 3 (L)	2	2	4	3	4	15	0.5	3.00	0.10
Cricotopus (Spaniotoma) sp. 4 (L)	14	1	4	5	5	29	0.5	5.80	0.10
Cricotopus (Spaniotoma) (P)			2	2		4	0.5	0.80	0.10
Calopsectra cases	129	259	339	247	185	1159	23.9	231.80	4.78
Calopsectra (L)	98	94	144	74	119	529	2.6	105.80	0.52
Polypedilum convictum (L)		4	12	9	4	29	1.8	5.80	0.36
Polypedilum (L)		2			2	4	0.1	0.80	0.02
Cryptochironomus stylifera (L)				2		2	0.4	0.40	0.08
Hemerodromia (L)	1				1	2	0.5	0.40	0.10
Goniobasis shells	1	1				2	4.8	0.40	0.96
Ferissia				3		3	0.6	0.60	0.12

Table 30. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected November 30, 1956					Totals		Av./100 cm^2	
	83	84	85	86	87	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia	3	2				5	0.6	1.00	0.12
Nematoda	8	5	6	7	9	35	0.5	7.00	0.10
Oligochaeta	18	42	376	27	427	890	8.4	178.00	1.68
Copepoda		1	2		4	7	0.1	1.40	0.02
Hydracarina egg cases	9	30	11	11	57	118	0.9	23.60	0.18
Hydracarina	1					1	0.2	0.20	0.04
Sperchon	15	8	9	7	10	49	1.0	9.80	0.20
Lebertia	1	1			4	6	0.3	1.20	0.06
Atractideidae	1	5		2	3	11	0.4	2.20	0.08
Megapus	5	3	4	2	4	18	0.4	3.60	0.08
Hypochthoniidae	8	21	15	22	70	136	1.6	27.20	0.32
Ephemerella (N)	4			2	7	13	0.9	2.60	0.18
Baetidae (N)	2			5	2	9	0.5	1.80	0.10
Stenonema (N)	5	1		4	3	13	1.9	2.60	0.38
Taeniopteryx maura (N)	24	12	15	20	31	102	12.1	20.40	2.42
Brachyptera (N)	66	71	65	89	104	395	22.0	79.00	4.40
Perlesta placida (N)	3	4	2	3	10	22	1.6	4.40	0.32
Hemiptera (N)		2				2	0.6	0.40	0.12
Hydropsyche (L)	7	11	3	4	5	30	13.4	6.00	2.68
Agraylea (L)		1				1	0.7	0.20	0.14
Elmidae (A)	1					1	1.0	0.20	0.20
Elmidae (L)	2				1	3	0.9	0.60	0.18
Simulium (L)	23	54	61	64	106	308	38.0	61.60	7.60
Simulium (L) dark histoblasts	2	7	6	4	15	34	9.2	6.80	1.84
Simulium cast larval skins			1		1	2	0.3	0.40	0.06
Simulium (P)	31	47	53	41	95	267	57.7	53.40	11.54
Simulium dead (P)	15	5	5	3	8	36	2.4	7.20	0.48
Simulium partial cast pupal skins	20	13	28	33	41	135	3.6	27.00	0.72

Table 30. Continued.

Taxa	Samples Collected November 30, 1956					Totals		Av./100 cm^2	
	83	84	85	86	87	Number	Loss on Ignition	Number	Loss on Ignition
Simulium complete cast pupal skins	15	24	43	35	76	193	4.6	38.60	0.92
Simulium pupal cases	87	110	136	114	234	681	50.8	136.20	10.16
Simulium (A)		1	1		1	3	1.7	0.60	0.34
Tendipedidae (L)	7	5	14	9	6	41	0.4	8.20	0.08
Tendipedidae (A)		2				2	0.3	0.40	0.06
Corynoneura (L)	7	2	9	7	18	43	0.5	8.60	0.10
Corynoneura (P)		2			1	3	0.1	0.60	0.02
Cardiocladius (L)	3	2	7	5	1	18	0.7	3.60	0.14
Cardiocladius (P)		1				1	0.1	0.20	0.02
Cricotopus (Spaniotoma) sp. 1 (L)	49	55	32	60	116	312	6.8	62.40	1.36
Cricotopus (Spaniotoma) sp. 2 (L)	7	4	5	1		17	0.6	3.40	0.12
Cricotopus (Spaniotoma) sp. 3 (L)	8	7	4	4	7	30	1.1	6.00	0.22
Cricotopus (Spaniotoma) sp. 4 (L)	5	1	21	6	12	45	1.1	9.00	0.22
Cricotopus (Spaniotoma) (P)	6	5	2	5	11	29	2.2	5.80	0.44
Calopsectra cases	386	207	129	329	334	1385	30.1	277.00	6.02
Calopsectra (L)	316	131	95	332	299	1173	8.3	234.60	1.66
Calopsectra (P)	3	5	1	4	14	27	2.0	5.40	0.40
Polypedilum convictum (L)	15	6	3	10	28	62	1.6	12.40	0.32
Polypedilum (L)	4				5	9	0.5	1.80	0.10
Cryptochironomus stylifera (L)	2				2	4	0.5	0.80	0.10
Tendipes (Limnochironomus) (L)			1			1	0.2	0.20	0.04
Hemerodromia (L)	3		2		3	8	0.3	1.60	0.06
Goniobasis shells		1		2	3	6	47.1	1.20	9.42
Ferissia	1		1			2	0.2	0.40	0.04

Table 31. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected December 19, 1956					Totals		Av./100 cm^2	
	88	89	90	91	92	Number	Loss on Ignition	Number	Loss on Ignition
Hydra			1			1	0.2	0.20	0.04
Dugesia	2	3	1		1	7	1.5	1.40	0.30
Nematoda	2	18	13	14	20	67	0.5	13.40	0.10
Oligochaeta	5	62	142	4	46	259	3.5	51.80	0.70
Oligochaeta eggs		2				2	0.1	0.40	0.02
Cladocera				12	6	18	0.2	3.60	0.04
Copepoda	8	10	3	9	6	36	0.4	7.20	0.08
Hydracarina egg cases	1	5	102	28	54	190	1.3	38.00	0.26
Sperchon	1	4	6	10	5	26	0.5	5.20	0.10
Lebertia	1	1	1			3	0.4	0.60	0.08
Atractideidae	4	2	1	5	2	14	0.5	2.80	0.10
Megapus	3	10	6	3	1	23	0.5	4.60	0.10
Hypochthoniidae	15	79	47	62	93	296	1.1	59.20	0.22
Tricorythodes (N)		1				1	0.2	0.20	0.04
Ephemerella (N)	2	5	5	5	7	24	3.8	4.80	0.76
Baetidae (N)	2	5	3	4	2	16	2.7	3.20	0.54
Stenonema (N)	8	15		5	15	43	11.8	8.60	2.36
Taeniopteryx maura (N)	20	23	15	13	20	91	24.5	18.20	4.90
Brachyptera (N)	49	52	76	58	64	299	33.7	59.80	6.74
Perlesta placida (N)	5	16	5	12	4	42	1.4	8.40	0.28
Isogenus (N)	1					1	1.7	0.20	0.34
Hydropsyche (L)	13	25	4	7	14	63	53.8	12.60	10.76
Elmidae (A)		1	1			2	0.4	0.40	0.08
Elmidae (L)					3	3	0.5	0.60	0.10
Simulium (L)	4	20	68	25	41	158	23.6	31.60	4.72
Simulium (L) dark histoblasts		2	4	4	3	13	3.2	2.60	0.64
Simulium (P)	3	3	13	14	11	44	8.0	8.80	1.60
Simulium dead (P)	1	1	3	3	3	11	1.1	2.20	0.22

Table 31. Continued.

Taxa	Samples Collected December 19, 1956					Totals		Av./100 cm^2	
	88	89	90	91	92	Number	Loss on Ignition	Number	Loss on Ignition
Simulium partial cast pupal skins	11	18	17	25	27	98	2.5	19.60	0.50
Simulium complete cast pupal skins	10	14	21	21	21	87	2.4	17.40	0.48
Simulium pupal cases	27	33	62	71	72	265	17.4	53.00	3.48
Simulium (A)			1			1	0.3	0.20	0.06
Tendipedidae (L)	6	7	3	8	6	30	1.3	6.00	0.26
Tendipedidae (A)				1		1	0.2	0.20	0.04
Corynoneura (L)	4	14	9	4	8	39	1.4	7.80	0.28
Cardiocladius (L)	3	4	7	8	5	27	1.0	5.40	0.20
Cardiocladius (P)					1	1	1.0	0.20	0.20
Cricotopus (Spaniotoma) sp. 1 (L)	56	82	26	91	89	344	7.5	68.80	1.50
Cricotopus (Spaniotoma) sp. 2 (L)					4	4	0.6	0.80	0.12
Cricotopus (Spaniotoma) sp. 3 (L)	5	9	2	6	13	35	2.7	7.00	0.54
Cricotopus (Spaniotoma) sp. 4 (L)	10	51	38	55	39	193	3.6	38.60	0.72
Cricotopus (Spaniotoma) (P)	1	2	2	5	3	13	1.1	2.60	0.22
Calopsectra cases	379	414	139	312	552	1796	74.3	359.20	14.86
Calopsectra (L)	421	567	18	428	495	1929	27.7	385.80	5.54
Calopsectra (P)		1		3	3	7	0.7	1.40	0.14
Polypedilum convictum (L)	9	6	4	14	13	46	1.2	9.20	0.24
Polypedilum (L)		1	3			4	0.4	0.80	0.08
Cryptochironomus stylifera (L)					2	2	0.6	0.40	0.12
Cryptochironomus sp. b. Joh. (L)					1	1	0.8	0.20	0.16
Heleidae					1	1	0.6	0.20	0.12
Hemerodromia (L)	2	3	1	1	1	8	0.5	1.60	0.10
Goniobasis shells	1	1			1	3	11.0	0.60	2.20
Ferissia					1	1	0.6	0.20	0.12

Table 32. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected January 21, 1957					Totals		Av./100 cm^2	
	93	94	95	96	97	Number	Loss on Ignition	Number	Loss on Ignition
Dugesia			2	2	1	5	1.9	1.00	0.38
Nematoda	7	2	3	11	2	25	0.4	5.00	0.08
Oligochaeta	73	51	58	46	40	268	2.2	53.60	0.44
Cladocera	11	3	6	2	2	24	0.4	4.80	0.08
Copepoda	7		5	2	2	16	0.4	3.20	0.08
Hydracarina egg cases	22	1	1	37	3	64	0.8	12.80	0.16
Sperchon	1		1	2		4	0.2	0.80	0.04
Lebertia			2	1	1	4	0.6	0.80	0.12
Megapus	1			1		2	0.7	0.40	0.14
Hypochthoniidae	26	10	7	14	6	63	0.4	12.60	0.08
Isotomurus palustris		1				1	0.4	0.20	0.08
Ephemerella (N)	1	1		1		3	0.7	0.60	0.14
Baetidae (N)		1				1	0.5	0.20	0.10
Stenonema (N)	1	1	1	4	2	9	1.2	1.80	0.24
Taeniopteryx maura (N)	1	3	2	6		12	4.8	2.40	0.96
Brachyptera (N)	5	13	8	19	17	62	10.9	12.40	2.18
Perlesta placida (N)	3	5		6	3	17	1.0	3.40	0.20
Corydalus cornutus (L)			1			1	0.6	0.20	0.12
Hydropsyche (L)				2		2	0.7	0.40	0.14
Elmidae (L)	1	1		2		4	0.8	0.80	0.16
Simulium (L)	2	3	4	11	1	21	0.9	4.20	0.18
Simulium (L) dark histoblasts			1			1	0.5	0.20	0.10
Simulium dead (P)				2		2	0.5	0.40	0.10
Simulium partial cast pupal skins	1	3	2	7		13	0.5	2.60	0.10
Simulium complete cast pupal skins		1	1		1	3	0.3	0.60	0.06
Simulium pupal cases	2	1	1	6	1	11	1.2	2.20	0.24
Tendipedidae (L)	1	6	4	1	1	13	0.2	2.60	0.04
Tendipedidae (A)		1	3	1	3	8	0.9	1.60	0.18

Table 32. Continued.

Taxa	Samples Collected January 21, 1957					Totals		Av./100 cm^2	
	93	94	95	96	97	Number	Loss on Ignition	Number	Loss on Ignition
Pentaneura (L)		1				1	0.2	0.20	0.04
Corynoneura (L)	7	6	9	9	4	35	0.4	7.00	0.08
Cardiocladius (L)	4	11	3	10	2	30	0.9	6.00	0.18
Cricotopus (Spaniotoma) sp. 1 (L)	11	29	47	39	13	139	0.4	27.80	0.08
Cricotopus (Spaniotoma) sp. 2 (L)		1	7	9	3	20	0.6	4.00	0.12
Cricotopus (Spaniotoma) sp. 3 (L)		7	4	4	3	18	0.5	3.60	0.10
Cricotopus (Spaniotoma) sp. 4 (L)	18	29	47	100	26	220	3.0	44.00	0.60
Cricotopus (Spaniotoma) sp. 4 (P)	1	3		5	3	12	0.7	2.40	0.14
Calopsectra cases	119	262	251	516	85	1233	68.5	246.60	13.70
Calopsectra (L)	13	154	117	248	36	568	9.6	113.60	1.92
Calopsectra (P)		3	2	1	1	7	0.7	1.40	0.14
Polypedilum convictum (L)	9	42	40	59	10	160	1.2	32.00	0.24
Polypedilum (L)	2	2	1	3	3	11	0.4	2.20	0.08
Cryptochironomus stylifera (L)				1	1	2	0.4	0.40	0.08
Tendipes (Limnochironomus) (L)				1	2	3	0.6	0.60	0.12
Heleidae (L)	1					1	0.9	0.20	0.18
Hemerodromia (L)		5	5	2	1	13	0.7	2.60	0.14
Goniobasis shells		3		1		4	20.3	0.80	4.06
Ferissia				1		1	0.4	0.20	0.08

Table 33. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected February 18, 1957					Totals		Av./100 cm^2	
	98	99	100	101	102	Number	Loss on Ignition	Number	Loss on Ignition
Hydra				1		1	0.1	0.20	0.02
Dugesia	9	2		1	1	13	4.9	2.60	0.98
Nematoda	7	8	2	27	11	55	0.8	11.00	0.16
Oligochaeta	117	88	69	411	347	1032	7.0	206.40	1.40
Cladocera	6	4	8	4	5	27	0.3	5.40	0.06
Copepoda	2		1		5	8	0.3	1.60	0.06
Hydracarina egg cases	3	12	3	24	6	48	0.4	9.60	0.08
Sperchon	2	4				6	0.5	1.20	0.10
Atractideidae		1				1	0.5	0.20	0.10
Megapus	2	3	1		2	8	0.7	1.60	0.14
Hypochthoniidae	87	18	7	14	49	175	0.6	35.00	0.12
Ephemerella (N)		3	2	3	4	12	5.6	2.40	1.12
Baetidae (N)	5	1	2	7		15	0.9	3.00	0.18
Stenonema (N)	3		1	3	3	10	2.1	2.00	0.42
Taeniopteryx maura (N)	230	153	101	188	153	825	4.9	165.00	0.98
Brachyptera (N)	2	4	1	6	3	16	8.0	3.20	1.60
Perlesta placida (N)	5	12	5	8	4	34	2.6	6.80	0.52
Isoperla (N)					1	1	1.1	0.20	0.22
Hydropsyche (L)	1	1				2	0.7	0.40	0.14
Hydroptilidae (L)	1					1	0.4	0.20	0.08
Simulium (L)	141	133	82	191	103	650	5.8	130.00	1.16
Simulium (P)		1		1		2	0.3	0.40	0.06
Simulium partial cast pupal skins	3			3	6	12	1.0	2.40	0.20
Simulium pupal cases		1		1		2	0.3	0.40	0.06
Tendipedidae (L)	11	1	1	8	9	30	0.4	6.00	0.08
Tendipedidae (A)	1			3	2	6	0.3	1.20	0.06
Pentaneura (L)				1		1	0.2	0.20	0.04
Corynoneura (L)	25	3	15	13	8	64	0.7	12.80	0.14

Table 33. Continued.

Taxa	Samples Collected February 18, 1957: 98	99	100	101	102	Totals: Number	Totals: Loss on Ignition	Av./100 cm^2: Number	Av./100 cm^2: Loss on Ignition
Corynoneura (P)		1		1	1	3	0.7	0.60	0.14
Cardiocladius (L)	8	16	14	17	21	76	8.2	15.20	1.64
Cardiocladius (P)				1		1	0.8	0.20	0.16
Cricotopus (Spaniotoma) sp. 1 (L)	131	36	39	79	49	334	4.6	66.80	0.92
Cricotopus (Spaniotoma) sp. 2 (L)	17	12	5	23	4	61	0.7	12.20	0.14
Cricotopus (Spaniotoma) sp. 3 (L)	22	24	6	13	8	73	1.3	14.60	0.26
Cricotopus (Spaniotoma) sp. 4 (L)	234	316	129	413	236	1328	12.3	265.60	2.46
Cricotopus (Spaniotoma) (P)	10	7	3	6	7	33	1.7	6.60	0.34
Calopsectra cases	245	50	31	89	126	541	26.6	108.20	5.32
Calopsectra (L)	186	67	44	109	88	494	5.8	98.80	1.16
Calopsectra (P)	5	1		1	1	8	0.8	1.60	0.16
Polypedilum convictum (L)	122	42	27	142	38	371	9.5	74.20	1.90
Polypedilum (L)	1	1	3	1	4	10	0.3	2.00	0.06
Cryptochironomus sp. b. joh. (L)				1		1	0.2	0.20	0.04
Hemerodromia (L)	4			2	3	9	0.9	1.80	0.18
Goniobasis shells	3					3	0.4	0.60	0.08
Ferissia		1				1	0.1	0.20	0.02

Table 34. Numbers and Biomass (mg Loss on Ignition) of Organisms in Bottom Samples (100 cm^2).

Taxa	Samples Collected April 4, 1957					Totals		Av./100 cm^2	
	103	104	105	106	107	Number	Loss on Ignition	Number	Loss on Ignition
Hydra				1		1	0.1	0.20	0.02
Dugesia		2		8	5	15	4.4	3.00	0.88
Nematoda	8	11	13	3	7	42	0.3	8.40	0.06
Oligochaeta	102	356	616	158	277	1509	13.2	301.80	2.64
Cladocera	41	11	17	10	13	92	0.4	18.40	0.08
Copepoda	4	6	3	8	4	25	0.3	5.00	0.06
Hydracarina egg cases	3	25	13	2		43	0.7	8.60	0.14
Sperchon	3	1	1	2		7	0.7	1.40	0.14
Lebertia	2					2	0.8	0.40	0.16
Atractideidae	1	2	1			4	0.5	0.80	0.10
Megapus	6	2	5	3	1	17	0.3	3.40	0.06
Hypochthoniidae	13	47	46	34	71	211	1.2	42.20	0.24
Ephemerella (N)		2	5	4	2	13	2.0	2.60	0.40
Baetidae (N)	7	8	7	12	13	47	1.5	9.40	0.30
Stenonema (N)		6	6	9	6	27	4.5	5.40	0.90
Pteronarcys (N)					1	1	0.4	0.20	0.08
Taeniopteryx maura (N)	35	50	47	45	34	211	1.4	42.20	0.28
Nemoura (N)	1	3		4	4	12	1.6	2.40	0.32
Perlesta placida (N)	2	6	5	3	4	20	4.0	4.00	0.80
Isoperla (N)	2	5	5	3	5	20	18.4	4.00	3.68
Hydropsyche (L)			2	1	1	4	2.9	0.80	0.58
Agraylea (L)			1			1	0.4	0.20	0.08
Hemiptera (N)	2			2		4	0.6	0.80	0.12
Haliplus (L)			1			1	0.3	0.20	0.06
Berosus (L)				1		1	1.2	0.20	0.24
Elmidae (L)			1	2		3	0.1	0.60	0.02
Simulium (L)	869	785	901	1359	1599	5513	255.0	1102.60	51.00
Simulium (L)	13	17	24	33	29	116	31.3	23.20	6.26
Simulium (P)	18	12	15	26	19	90	15.8	18.00	3.16
Simulium dead (P)	1		1	5	1	8	0.5	1.60	0.10

Table 34. Continued.

Taxa	Samples Collected April 4, 1957					Totals		Av./100 cm^2	
	103	104	105	106	107	Number	Loss on Ignition	Number	Loss on Ignition
Simulium partial cast pupal skins		7		3	3	13	0.6	2.60	0.12
Simulium complete cast pupal skins	2	2	3	6	7	20	0.5	4.00	0.10
Simulium pupal cases	22	15	21	41	39	138	8.6	27.60	1.72
Tendipedidae (L)	8	10	7	4	9	38	1.0	13.60	0.20
Tendipedidae (A)	2		1	1	2	6	0.7	1.20	0.14
Pentaneura (L)	2		2			4	0.6	0.80	0.12
Corynoneura (L)	18	30	13	18	8	87	1.0	17.40	0.20
Corynoneura (P)		2	1		1	4	0.9	0.80	0.18
Brillia (L)			1	1		2	0.5	0.40	0.10
Cardiocladius (L)	44	45	40	32	51	212	8.3	42.40	1.66
Cardiocladius (P)	1					1	0.7	0.20	0.14
Cricotopus (Spaniotoma) sp. 1 (L)	78	158	121	253	225	835	8.3	167.00	1.66
Cricotopus (Spaniotoma) sp. 2 (L)	14	99	43	73	74	303	3.6	60.60	0.72
Cricotopus (Spaniotoma) sp. 3 (L)	21	41	57	93	78	290	6.1	58.00	1.22
Cricotopus (Spaniotoma) sp. 4 (L)	178	396	314	426	325	1639	13.6	327.80	2.72
Cricotopus (Spaniotoma) sp. 4 (P)	3	3	6	5	6	23	1.8	4.60	0.36
Calopsectra cases	208	423	282	543	447	1903	101.3	380.60	20.26
Calopsectra (L)	126	173	185	345	272	1101	15.7	220.20	3.14
Calopsectra (P)	2	2	5	3	4	16	1.1	3.20	0.22
Polypedilum fallax (L)				1		1	0.5	0.20	0.10
Polypedilum convictum	25	78	74	141	128	446	12.1	89.20	2.42
Polypedilum (L)	4	7	15	8	3	37	1.3	7.40	0.26
Polypedilum (P)				3	5	8	1.0	1.60	0.20
Cryptochironomus stylifera (L)		1	4	9		14	1.1	2.80	0.22
Cryptochironomus sp. b. Joh. (L)			1			1	0.4	0.20	0.08
Tendipes (Limnochironomus) (L)		3	4		1	8	0.2	1.60	0.04
Heleidae		2	4			6	0.5	1.20	0.10
Hemerodromia (L)	2	2		1	2	7	1.6	1.40	0.32
Goniobasis shells		1		1		2	20.2	0.40	4.04
Ferissia			2	2	1	5	0.6	1.00	0.12

Table 35. Particulate Material in River Water (mg/L.).

Date	River Discharge Sec. ft.	Dry Residue	Fixed Residue	Loss on Ignition
X:8:54	28	54.9	47.8	7.1
X:14:54	39	50.4	44.0	6.4
VI:6:55	94	125.8	110.2	15.8
VI:29:55	172	90.9	77.5	13.4
VII:11:55	189	266.5	232.8	33.7
VII:20:55	105	54.5	48.1	6.4
VII:25:55	211	122.1	107.9	14.3
VIII:2:55	207	90.1	78.8	11.2
VIII:4:55	109	75.3	65.5	9.5
VIII:5:55	109	55.6	48.4	7.1
VIII:16:55	153	542.9	476.4	66.6
VIII:17:55	107	97.9	85.5	12.3
IX:5:55	61	38.6	33.8	4.8
IX:9:55	61	46.2	40.5	5.7
IX:12:55	55	45.1	39.9	5.6
IX:13:55	77	141.3	124.0	17.0
IX:26:55	45	66.7	58.6	8.1
X:28:55	60	22.5	19.1	3.3
XI:5:55	67	24.9	21.3	3.6
XI:8:55	89	12.7	11.0	1.7
XI:11:55	77	12.8	11.0	1.9
XI:25:55	189	48.2	41.0	7.1
XII:1:55	122	7.2	5.4	1.8
XII:2:55	130	6.6	4.9	1.7
XII:9:55	117	9.1	7.6	1.5
XII:20:55	200	13.4	11.6	1.9
XII:21:55	147	9.6	8.3	1.3
I:4:56	127	6.0	5.2	0.8
I:5:56	127	4.9	4.2	0.6
I:9:56	122	4.1	3.1	1.0
I:9:56	122	4.2	3.1	1.1
I:12:56	119	5.7	4.5	1.2
I:17:56	117	4.2	3.3	0.9
I:19:56	150	10.3	8.7	1.6
I:20:56	215	61.2	53.0	8.2
I:28:56	163	11.1	9.3	1.8
I:31:56	169	12.9	10.9	2.0
II:1:56	176	9.5	8.1	1.4
II:2:56	196	9.8	7.9	1.9
II:2:56	219	11.8	9.6	2.2
II:3:56	269	24.3	20.6	3.8
II:4:56	320	44.8	39.7	6.3
II:6:56	1087	453.4	395.6	57.7
II:7:56	1339	488.8	424.8	64.0

Table 35. Continued.

Date	River Discharge Sec. ft.	Dry Residue	Fixed Residue	Loss on Ignition
II:8:56	1210	188.2	163.2	25.1
II:9:56	559	62.2	52.9	9.3
II:10:56	475	43.1	37.8	5.3
II:11:56	409	35.4	30.4	5.1
II:13:56	326	23.6	20.1	3.4
II:14:56	300	22.3	19.3	3.0
II:15:56	279	19.7	16.7	3.0
II:16:56	272	19.0	16.4	2.6
III:24:56	392	20.4	17.5	2.9
III:26:56	332	12.8	10.8	2.0
III:27:56	320	13.7	11.4	2.3
IV:3:56	300	17.7	15.1	2.5
IV:4:56	294	19.8	16.7	3.1
IV:6:56	399	18.5	15.5	2.9
IV:12:56	1104	143.6	122.3	21.3
IV:13:56	812	60.6	53.3	7.3
IV:19:56	690	46.2	40.0	6.2
IV:20:56	618	30.6	26.4	4.2
IV:23:56	392	16.6	14.2	2.4
IV:25:56	355	15.2	13.1	2.2
V:7:56	600	50.6	43.1	7.4
V:10:56	344	25.7	22.1	3.6
VI:4:56	133	24.1	20.4	3.7
VI:21:56	172	130.7	112.4	18.4
VI:25:56	112	28.2	24.3	3.9
VI:26:56	81	27.1	23.0	4.0
VII:9:56	179	730.8	633.1	97.7
VII:10:56	1930	382.4	333.1	49.3
VII:14:56	193	36.5	32.0	4.5
VII:19:56	260	41.0	35.1	5.9
VII:23:56	200	40.5	34.2	6.3
VII:26:56	207	42.4	36.0	6.4
VII:30:56	117	17.8	15.5	2.3
VIII:2:56	142	21.4	18.8	2.6
VIII:9:56	85	12.3	10.3	2.0
VIII:16:56	68	12.1	10.1	2.0
VIII:17:56	65	24.4	20.9	3.5
VIII:20:56	63	11.5	9.6	1.9
VIII:22:56	94	88.2	76.2	12.0
IX:6:56	72	20.6	17.5	3.1
IX:13:56	48	15.8	13.8	2.0
IX:18:56	29	11.0	9.2	1.8
IX:19:56	29	10.8	9.0	1.8
IX:24:56	28	10.7	8.7	2.0

Table 35. Continued.

Date	River Discharge Sec. ft.	Dry Residue	Fixed Residue	Loss on Ignition
IX:25:56	67	30.5	25.3	5.3
IX:26:56	1645	451.1	392.9	58.2
IX:27:56	1596	253.0	220.1	32.9
IX:28:56	405	60.6	52.2	8.4
IX:29:56	260	33.4	29.6	3.8
X:1:56	179	18.5	15.3	3.3
X:3:56	153	15.1	12.6	2.4
X:8:56	179	35.2	30.0	5.3
X:12:56	122	10.5	9.3	1.2
X:15:56	117	9.3	7.5	1.8
X:22:56	512	54.1	47.6	6.4
X:24:56	326	36.6	31.4	5.1
X:31:56	166	9.5	8.5	1.0
XI:2:56	200	12.2	11.0	1.2
XI:7:56	156	8.0	6.8	1.2
XI:15:56	189	5.6	4.4	1.2
XI:17:56	186	11.6	10.0	1.5
XI:19:56	399	26.7	23.0	3.8
XI:23:56	239	6.4	5.5	0.9
XI:30:56	186	3.3	2.7	0.7
XII:1:56	179	3.2	2.4	0.8
XII:7:56	172	4.8	4.1	0.7
XII:15:56	222	8.3	6.8	1.5
XII:19:56	186	7.6	6.4	1.2
XII:27:56	438	18.2	15.0	3.2

Table 36. Dissolved Material in River Water (mg/L.) and Water Temperature.

Date	Dry Residue	Fixed Residue	Loss on Ignition	Water Temperature °C
X:8:54	60.2	49.2	11.1	15.7
X:14:54	57.9	44.1	13.8	23.2
VI:6:55	118.4	88.6	29.8	
VI:29:55	87.5	70.0	17.4	
VII:11:55	180.4	147.9	32.5	
VII:20:55	63.2	49.3	13.8	
VII:25:55	78.9	63.3	15.5	24.5
VIII:2:55	75.0	61.5	13.5	26.8
VIII:4:55	86.4	70.7	15.7	27.3
VIII:5:55	67.0	54.1	13.0	26.5
VIII:16:55	257.2	214.2	43.0	27.3
VIII:17:55	85.8	68.9	16.9	28.1
IX:5:55	57.6	47.3	10.3	23.3
IX:9:55	59.7	49.8	9.9	23.9
IX:12:55	64.4	54.1	10.3	25.5
IX:13:55	69.5	57.4	12.1	22.3
IX:26:55	58.1	48.6	9.5	22.0
X:28:55	50.4	39.2	11.4	11.3
XI:5:55	58.3	44.1	14.3	9.9
XI:8:55	49.7	37.5	12.1	13.0
XI:11:55	50.9	38.3	12.6	9.0
XI:25:55	67.2	49.6	17.6	12.3
XII:1:55	49.5	40.8	8.7	3.8
XII:2:55	46.8	37.3	9.5	4.5
XII:9:55	46.7	37.7	9.0	8.5
XII:20:55	48.0	36.3	11.7	5.2
XII:21:55	47.0	36.5	10.5	5.0
I:4:56	44.3	36.5	7.8	6.5
I:5:56	46.0	37.6	8.4	6.0
I:9:56	44.1	33.5	10.6	4.3
I:9:56	47.1	36.6	10.5	4.3
I:12:56	45.8	34.0	11.8	6.2
I:17:56	45.7	35.2	10.5	4.0
I:19:56	45.0	34.0	11.0	5.5
I:20:56	57.9	39.5	18.5	6.0
I:28:56	49.5	36.1	13.4	6.0
I:31:56	47.0	34.0	13.0	9.5
II:1:56	50.6	38.9	11.7	6.0
II:2:56	48.9	35.8	13.1	5.5
II:2:56	50.4	37.7	12.7	6.0
II:3:56	53.1	36.4	16.6	7.0
II:4:56	54.9	39.7	15.2	8.2
II:6:56	137.4	105.0	32.4	10.5

Table 36. Continued.

Date	Dry Residue	Fixed Residue	Loss on Ignition	Water Temperature °C
II:7:56	193.3	148.0	45.4	10.5
II:8:56	116.5	84.1	32.4	9.5
II:9:56	84.4	62.5	21.9	10.0
II:10:56	64.8	45.5	19.2	10.0
II:11:56	57.7	40.0	17.7	11.0
II:13:56	54.0	39.8	14.1	10.0
II:14:56	52.1	37.9	14.2	11.0
II:15:56	50.3	38.1	12.2	11.0
II:16:56	48.0	38.0	9.4	12.5
III:24:56	46.8	35.2	11.6	11.5
III:26:56	45.6	36.0	9.7	12.0
III:27:56	46.9	36.2	10.7	12.5
IV:3:56	49.8	36.8	13.0	18.0
IV:4:56	48.4	39.3	9.1	19.7
IV:6:56	49.5	37.6	11.8	17.0
IV:12:56		66.6		12.8
IV:13:56	64.2	50.6	13.7	13.5
IV:19:56	64.2	51.7	12.5	14.8
IV:20:56	53.5	43.6	10.0	13.4
IV:23:56	47.5	38.1	9.4	15.0
IV:25:56	48.6	39.1	9.6	16.6
V:7:56	53.6	42.6	11.0	20.1
V:10:56	54.3	42.8	11.4	19.4
VI:4:56	59.4	46.4	13.0	20.2
VI:21:56	115.3	95.3	20.1	25.5
VI:25:56	62.2	50.9	11.3	30.2
VI:26:56	63.7	49.4	14.3	30.5
VII:9:56	218.6	177.5	41.1	24.0
VII:10:56	189.5	151.1	38.3	24.0
VII:14:56	62.8	48.9	13.9	25.0
VII:19:56	75.8	59.8	16.0	25.0
VII:23:56	67.4	49.9	17.8	25.5
VII:26:56	75.6	51.6	24.0	26.0
VII:30:56	62.7	45.5	17.2	29.3
VIII:2:56	59.3	44.5	14.8	28.3
VIII:9:56	52.7	41.5	11.1	27.8
VIII:16:56	54.1	40.9	13.2	26.4
VIII:17:56	70.1	54.2	15.8	28.4
VIII:20:56	62.2	50.2	12.0	28.6
VIII:22:56	111.0	88.0	23.0	25.2
IX:6:56	54.9	45.1	9.8	26.9
IX:13:56	53.7	42.4	11.3	21.1
IX:18:56	58.7	47.6	11.1	
IX:19:56	57.3	47.8	9.4	24.2

Table 36. Continued.

Date	Dry Residue	Fixed Residue	Loss on Ignition	Water Temperature °C
IX:24:56	63.1	43.9	19.1	21.9
IX:25:56	57.8	39.4	18.4	20.0
IX:26:56	144.1	110.0	34.1	15.3
IX:27:56	120.3	84.3	36.0	15.9
IX:28:56	78.7	61.8	16.9	17.3
IX:29:56	65.1	48.5	16.6	18.1
X:1:56	57.2	41.1	16.2	20.1
X:3:56	53.8	38.8	15.0	20.1
X:8:56	62.8	47.8	15.0	17.0
X:12:56	49.4	39.5	9.6	16.3
X:15:56	51.8	34.2	17.4	16.0
X:22:56	59.2	46.4	12.8	16.6
X:24:56	78.8	57.8	20.8	17.4
X:31:56	53.6	41.2	12.4	18.4
XI:2:56	52.0	38.8	13.2	18.4
XI:7:56	50.5	35.4	15.1	16.0
XI:15:56	50.5	40.9	9.6	11.8
XI:17:56	48.5	38.2	10.3	12.6
XI:19:56	71.7	54.3	17.4	10.2
XI:23:56	50.9	40.1	10.8	9.2
XI:30:56	48.5	38.8	9.8	5.8
XII:1:56	51.3	42.5	8.8	4.5
XII:7:56	49.4	41.2	8.2	
XII:15:56	50.7	38.7	12.0	14.3
XII:19:56	51.4	38.6	12.8	14.0
XII:27:56	55.3	37.1	18.2	7.5

Table 37. Dissolved Oxygen (ppm) in the Middle Oconee River, August 9, 1956 (0800-2000 hours) and August 10, 1956 (0435-0800 hours), (Av. Discharge 83 Sec.-ft.).

			Dissolved Oxygen		Changes in Dissolved Oxygen	
Time	Sky[1]	Water Temp.	Above Outcrop	Below Outcrop	Above Outcrop	Below Outcrop
0800	0/10	25.5	7.15	7.34		
					+0.04	+0.30
0900	0/10	26.1	7.19	7.64		
					+0.20	+0.21
1000	1/10	26.9	7.39	7.85		
					+0.26	+0.16
1100	2/10	27.6	7.67	8.10		
					+0.09	-0.03
1200	6/10	27.8	7.76	7.98		
					+0.04	+0.01
1600	8/10	28.6	7.80	7.99		
					-0.23	-0.54
1930	dusk	27.1	7.57	7.45		
					-0.07	-0.01
2000	dark	26.8	7.50	7.44		
0435	dark	25.1	7.27	7.39		
					0	-0.05
0545	dawn	25.3	7.27	7.34		
					-0.06	+0.07
0715	0/10	25.5	7.21	7.41		
					-0.02	+0.06
0800	0/10	25.5	7.19	7.47		

[1]An estimate of per cent cloudiness. 0/10=clear; 10/10=completely cloudy.

Table 38. Dissolved Oxygen (ppm) in the Middle Oconee River, September 19, 1956 (Av. Discharge 33 Sec.-ft.).

Time	Sky[1]	Water Temp.	Dissolved Oxygen Above Outcrop	Dissolved Oxygen Below Outcrop	Changes in Dissolved Oxygen Above Outcrop	Changes in Dissolved Oxygen Below Outcrop
0500	dark	21.8	7.06	7.34		
					+0.01	-0.03
0600	dawn	21.7	7.07	7.31		
					+0.08	+0.12
0700	10/10	21.5	7.15	7.43		
					+0.04	+0.07
0800	9/10	21.5	7.19	7.50		
					+0.14	+0.17
0900	9/10	21.5	7.33	7.67		
					+0.22	+0.07
1000	9/10	21.7	7.55	7.74		
					+0.08	+0.16
1100	6/10	21.9	7.63	7.90		
					+0.21	+0.12
1200	5/10	22.6	7.84	8.02		
					+0.15	+0.20
1300	2/10	23.2	7.99	8.22		
					+0.18	+0.03
1400	5/10	23.4	8.17	8.25		
					0	+0.01
1500	5/10	23.7	8.17	8.26		
					+0.18	+0.16
1600	6/10	24.0	8.35	8.42		
					+0.15	+0.06
1700	5/10	24.3	8.50	8.48		
					+0.01	-0.03
1800	6/10	24.5	8.51	8.45		
					-0.01	-0.18
1900	dusk	24.6	8.50	8.27		
					-0.20	-0.10
2000	dark	24.5	8.30	8.17		
					-0.25	-0.14
2100	dark	24.4	8.05	8.03		

[1]See footnote Table 37.

Table 39. Dissolved Oxygen (ppm) in the Middle Oconee River, November 2, 1956 (Av. Discharge 179 Sec.-ft.).

Time	Sky[1]	Water Temp.	Dissolved Oxygen Above Outcrop	Dissolved Oxygen Below Outcrop	Changes in Dissolved Oxygen Above Outcrop	Changes in Dissolved Oxygen Below Outcrop
0605	dark	17.3	8.31	8.55		
					+0.10	+0.08
0700	1/10	17.1	8.41	8.63		
					+0.06	+0.05
0800	1/10	16.9	8.47	8.68		
					+0.06	+0.08
0900	5/10	16.9	8.53	8.76		
					+0.07	+0.06
1005	0/10	17.1	8.60	8.82		
					+0.08	-0.16
1110	0/10	17.6	8.72	8.66		
					-0.05	+0.09
1220	3/10	18.2	8.67	8.75		
					+0.14	+0.23
1335	3/10	-	8.81	8.98		
					-0.09	-0.50
1445	4/10	-	8.72	8.48		
					-0.11	+0.27
1545	2/10	-	8.61	8.75		
					+0.01	-0.01
1630	0/10	18.7	8.62	8.74		
					-0.06	-0.05
1715	0/10	18.5	8.56	8.69		
					0	-0.08
1815	dark	18.4	8.56	8.61		
					-0.06	-0.03
1900	dark	18.4	8.50	8.58		

[1] See footnote Table 37.

Table 40. Dissolved Oxygen (ppm) in the Middle Oconee River, December 7, 1956 (Av. Discharge 179 Sec.-ft.).

Time	Sky[1]	Water Temp.	Dissolved Oxygen Above Outcrop	Dissolved Oxygen Below Outcrop	Changes in Dissolved Oxygen Above Outcrop	Changes in Dissolved Oxygen Below Outcrop
0630	dark	9.4	10.58	10.71		
					+0.07	+0.08
0730	4/0	9.3	10.65	10.79		
					-0.03	+0.08
0830	2/10	9.2	10.62	10.87		
					+0.04	+0.03
0927	0/10	9.3	10.66	10.99		
					+0.06	+0.02
1017	0/10	9.5	10.72	10.92		
					+0.03	+0.05
1107	0/10	9.8	10.75	10.97		
					-0.12	-0.16
1202	1/10	10.3	10.63	10.81		
					-0.09	-0.14
1244	1/10	10.6	10.54	10.67		
					+0.13	+0.16
1329	4/10	10.9	10.67	10.83		
					-0.11	-0.17
1416	3/10	11.0	10.56	10.66		
					0	+0.04
1459	5/10	11.0	10.56	10.70		
					-0.06	-0.13
1558	0/10	11.0	10.50	10.57		
					-0.05	-0.02
1638	1/10	11.0	10.45	10.55		
					-0.01	-0.03
1721	1/10	11.0	10.44	10.52		
					-0.01	-0.02
1802	dark	11.0	10.43	10.50		

[1] See footnote Table 37.

Table 41. Numbers and Biomass (mg Loss on Ignition) of Organisms in Each Trophic Classification (per 500 cm^2).

Date	Carnivore		Filter Feeder		Herbivore		Detritus Feeder		Herb.&Det. Feeder		Undet.		Totals	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
Apr. 23&25, 1956	216	20.8	1452	72.7	288	7.2	145	18.8	92	3.1	45	2.1	2,238	124.7
May 10, 1956	152	47.9	495	14.9	331	269.6	325	17.6	111	7.8	29	1.0	1,444	358.8[1]
June 4, 1956	101	12.8	1977	144.6	511	13.8	306	4.9	285	18.9	40	1.0	3,221	196.6[1]
June 25&26, 1956	390	37.4	2601	311.8	663	58.0	772	11.4	195	43.2	130	2.4	4,751	464.2[1]
July 23, 1956	160	9.0	1901	148.6	183	8.8	474	26.7	16	0.9	71	1.0	2,805	195.0
Aug. 22, 1956	445	55.9	3853	268.0	430	16.6	480	4.1	709	36.1	57	0.7	5,974	381.4
Sept. 18, 1956	1039	135.0	7126	262.8	810	54.0	1323	54.2	1070	50.6	140	3.1	11,508	559.7
Oct. 3, 1956	605	8.5	544	39.1	298	12.0	102	4.8	30	2.3	46	0.6	1,625	67.3
Nov. 2, 1956	492	11.9	1534	135.3	477	9.9	328	6.8	354	14.3	83	1.5	3,268	179.7
Nov. 30, 1956	399	9.2	1843	131.0	485	14.5	969	10.8	532	37.4	78	1.2	4,306	204.1
Dec. 19, 1956	642	13.0	2233	117.5	634	18.4	347	5.6	475	77.3	98	2.0	4,429	233.8
Jan. 21, 1957	206	8.4	623	12.8	449	6.8	459	5.2	88	19.0	46	1.5	1,871	53.7
Feb. 18, 1957	375	21.7	1184	14.1	1897	22.1	1421	17.1	878	21.5	91	1.5	5,846	98.0
Apr. 4, 1957	583	44.4	6933	322.6	3204	39.5	2034	28.6	306	10.4	86	2.0	13,146	447.5

[1]Figures in these sample series rounded when values per 500 cm^2 were computed.