THE DEVELOPMENT OF BOTTOM FAUNA IN A NEWLY CONSTRUCTED IMPOUNDMENT

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By

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INTRODUCTION

The objective of this paper is to present the results of a bottom fauna investigation of a newly constructed pond in Central Oklahoma. The study was started when the pond received its first water and continued throughout most of the first year.

It has been common practice to stock new impoundments with fishes as soon as some water was present. In most reservoirs nature is expected to supply the food from a food chain developed in the water. In the food studies of most fishes the bottom organisms have been important (Evermann and Clark, 1920), however, little attention has been given to bottom fauna in new reservoirs.

This study was intended to find some indication as to when various organisms appeared and to follow their trend in population development during the first critical year. It was hoped that this investigation would be the first of a series of studies to establish a guide for bottom fauna development in southwestern impoundments.

SITUATION INVESTIGATED

The impoundment studied is a pond formed by an earthen dam constructed with the aid of the Soil Conservation Service and is located six and one-half miles east and one-half mile south of Main and Sixth streets of Stillwater, Oklahoma (S½, SW¼, NE¼, S24, T19N, R3E). The soil for the dam was removed from the area to be impounded, leaving clay exposed on over half of the basin (Fig. 1, 2, 3, 4). The dam was completed in February, 1948, and the first water entered the basin in March.

When filled, the pond had approximately one-half acre of surface water with a maximum depth of ten feet. The maximum depth (7 feet) and area (1/3 acre)(Fig. 5), during the study were reached as a result of runoff from spring and summer rains. Little decrease from evaporation or seepage was noticeable because of the unusually frequent summer rains.

The watershed was exceptionally well covered with native grasses except for the sloping banks of the pond.

The water was muddy until an area with vegetation, equal to one-eighth of the total surface area, had been inundated between June 16 and 24, then cleared sometime between July 23 and August 1.

The water was alkaline, usually having a pH of 8.2 to 8.4; however, extremes of 7.6 and 9.9 were found.

No higher aquatic plants or fishes inhabited the impoundment during the period of study. The nearest body of water, an old one-acre pond with muddy water and very little aquatic vegetation, was in a separate watershed about three hundred yards distant.

PROCEDURE

Data including the date, the time of day, pH, air temperature, surface water temperature, and greatest water depth were recorded with each collection (Table 1).

The pH was measured with a Hellige Comparator. Bottom samples were taken with a Peterson dredge (100 square inches) and the area sampled converted in terms of square feet. The method used in sampling was a random type taken by wading or from a boat and care was exercised to be certain that all slopes of the pond were sampled. A sample consisted of one to three dredges taken at one depth. The samples were taken at depths of one, three, five, and seven feet, as required to reach maximum depths, and occasionally at depths increasing by one foot.

The dredges for each sample were emptied into a tub, screened through a No. 30 mesh seive having openings 0.0198 inch square, and the organisms stored in jars. Sometimes it was necessary to pick organisms from the screen with grass stems which were found to be superior to forceps. Some water was usually added to the samples while washing the organisms into sample jars to prevent their death. Each sample was labeled according to date and depth, and temporarily refrigerated or the organisms sorted at once from the remaining debris, and preserved in 70 per cent alcohol.

A white porcelain tray or a large shallow culture dish was used for analysis of samples. One advantage of the culture dish was that different colored backgrounds could be used, for example, specimens of <u>Chaoborus</u> were more easily seen with a black background while dark animals were more easily seen above a white background.

The next part of the procedure consisted of identifying, counting, and measuring the volume of organisms found in each sample.

Identification keys used were by Comstock (1936), Johannsen (1934)(1935)(1937), Johannsen and Thomsen (1937), Needham and Needham (1941), and Ward and Whipple (1918). In most cases the identification was carried to genera. When large numbers of organisms were encountered, a hand tally was used in counting.

The volume of each sample of organisms was measured as follows. Preservative was placed in a centrifuge tube (graduated to 0.1 ml.) and a reading, estimated to 0.05 ml., was taken. The organisms were dried until the visible liquid was gone, then transferred to the centrifuge tube and another reading taken. The difference between the two readings was recorded as the sample's volume.

POPULATION ESTABLISHMENT AND DEVELOPMENT

Twenty genera of five orders of Insecta and other groups in small numbers were collected during the investigation and listed with dates of first occurence in Table 2.

One specimen of Oligochaeta was taken April 30 in a sample consisting of two dredges from a one foot depth. It was the only specimen of this group captured.

Three Hydracarina were collected: two at a one foot depth in a two dredge sample on June 11, and one in a one dredge sample from three feet on December 23.

Nematoda were collected only in June: one was found in a two dredge sample at a depth of two feet, and one was taken at five feet following a three foot rise in water level.

Coleoptera

Adult members of the family Gyrinidae were first seen on the pond April 1. The larvae of this order were seldom collected, and most of the specimens were taken in one foot of water from an area having some dead vegetation. One _Gyrinus_ larva was collected on July 13. Two _Peltodytes_ larvae and one pupa, believed to be _Peltodytes_, were found December 23.

Three larvae of _Berosus_ were taken, one each on August 7, September 15, and November 10. One _Hydrophilus_ was captured at three feet on July 23.

Three larvae of Laccophilus were collected: one July 2 at one foot, one July 13 at three feet, and One August 17 at three feet. One Thermonectes was collected July 11 from one foot.

Diptera

The Chironomus larvae were more numerous in the one foot zone than any other depth throughout the study (Fig. 6). They reached a peak in August with an average of three hundred eighty specimens per square foot in the one foot depth and seventeen specimens per square foot in the three foot depth. Specimens were found at seven feet on June 24 after a three foot rise in water level. Chironomus pupae were collected on four occasions as follows: one May 21 in a two dredge sample from a one foot depth; four June 11 in a three dredge sample from one foot; two June 24 in a one dredge sample from three feet, following the three foot rise in water level; ten August 17 in a two dredge sample from one foot, and one in a one dredge sample from three feet.

Clinotanypus larvae were collected on two occasions: one November 10 at one foot in a one dredge sample, and another on November 23 at three feet in a one dredge sample.

Chrysops larvae were taken on four occasions: one April 21 from three feet, one May 28 from three feet, one July 13 from two feet, and one August 17 from one foot.

The Chaoborus larvae were progressively more abundant with increase in water depth reaching maximum numbers in October and November in three, five, and seven foot depths (Fig. 7). In

June, a peak was reached in the three foot zone before the five and seven foot zones were established. The first pupa was collected April 30 with the first larva. Pupae were collected again May 28 from three feet, June 11 from four feet, June 16 from three feet, June 24 from six feet, and August 23 from five feet.

Members of the Palpomyia group were found in greater numbers in the one and three foot zones appearing June 11 and reaching their highest population in November and December. Stilobezzia represented by one larva was collected in one foot of water on May 21.

Ephemeroptera

Caenis and Hexagenia, the only mayfly naiads taken, were collected in water from one to five feet in depth.

Caenis appeared May 21 and reached its maximum population in November (Fig. 8). Hexagenia naiads were collected as follows: one from one foot September 15, two from four feet November 10, two from one foot and three from three feet November 23.

Odonata

Large populations of damselfly and dragonfly naiads did not appear, but an emergence was indicated for both groups by the presence of exuviae on emergent vegetation. The damselflies emerged between August 1 and 17. The dragon flies emerged between July 23 and August 1. The specimens of this order were collected only in one foot of water.

Enallagma, the only damselfly taken, was collected in small numbers during September, October, November, and December.

Gomphus, *Pachydiplax*, and *Gynacantha* were collected only once (Table 2). *Plathemis* were taken several times during October, November, and December.

Trichoptera

Caddisfly larvae of the family Psychomyidae were found on November 3, four from the one foot zone and one from the three foot zone.

DISCUSSION

The average volume of organisms per square foot (Fig. 9) showed that the one and three foot zones had similar development. The low volume in July for these zones may be due in part to the three foot rise in water level, for following the rise only a few organisms were found in the newly inundated area. No organisms were found in the one and two foot zones for two weeks, however, a few organisms were found in the three foot zone. This seemed to indicate little migration of the organisms present to the shallow waters just established.

The five and seven foot zones established the last of June showed similar development in the volume of organisms. The volume of organisms, largely *Chaoborus*, reached a peak in November in the deeper zones.

The largest volume of organisms for the entire pond was reached in November. The average volume for November was 1.5 cubic feet (11.3 gallons) of bottom fauna for the pond, or 4.2 cubic feet (31.5 gallons) per acre. These volumes were calculated from the volumes in Fig. 9 and the surface areas in Fig. 5, and therefore were lower than the actual volume for the bottom area.

Occasional sampling of older ponds in this area indicated that the volume reached in November was not as large as the average estimated volume of other ponds. It could not be determined whether or not the presence of fish would have decreased the total volume of food produced. The investigation did show that bottom fauna was established the first year. The Chironomus and Chaoborus were apparently well established whereas larger forms were scarce or not present.

The results indicated that additional new ponds and reservoirs should be studied to reveal the rate of fish food development before one can conclude that the first year bottom fauna will support a large fish population.

SUMMARY

1. A quanitative and qualitative analysis of bottom fauna development was undertaken on a newly developed pond.
2. The Phyla Annelida, Nemathelminthes, and Arthropoda (twenty genera of Insecta) were represented in the bottom organisms.
3. The peak of population and volume for the entire pond was reached in November.
4. Chironomus and Chaoborus were the most numerous bottom organisms.
5. Chironomus was most abundant in the one and three foot zones.
6. Chaoborus was most abundant in the deeper zones.
7. Some of the larger organisms had not reached a normal population as compared with other ponds of this area.

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TABLE 1

Collection Date, Time, pH, Air Temperature, Surface Temperature, and Maximum Water Depth at Time of Collections

COLLECTION DATE		TIME	pH	AIR TEMPERATURE	SURFACE TEMPERATURE	MAXIMUM WATER DEPTH
April	1	9:30 AM	8.2	14°C	13°C	3'
	14	9:00 AM	8.3	15°C	14°C	3'
	21	9:00 AM	8.3	27°C	20°C	3'
	30	9:00 AM	8.3	25°C	21°C	3½'
May	6	5:00 PM	8.4	24°C	23°C	3½'
	13	10:30 AM	8.3	28°C	25°C	3½'
	21	9:00 AM	8.4	27°C	23.5°C	3½'
	28	10:30 AM	8.4+	31°C	29°C	4'
June	11	2:30 PM	8.9	37°C	33°C	4'
	16	2:00 PM	8.7	34.5°C	31°C	4'
	24	5:00 PM	8.3	31°C	29.5°C	7'
July	2	2:00 PM	9.3	32°C	29.5°C	7'
	13	4:30 PM	9.9	32°C	37.5°C	7'
	23	9:00 AM	7.8	21.5°C	27.5°C	7'
Aug.	1	6:30 PM	8.2	33.5°C	31.5°C	7'
	17	9:00 AM	---	33°C	28.5°C	7'
	25	5:00 PM	8.2	31°C	29°C	7'
Sept.	7	9:00 AM	7.6	30°C	26°C	7'
	15	11:00 AM	8.1	33°C	28°C	7'
Oct.	26	3:00 PM	8.2	25°C	16.5°C	7'
Nov.	10	2:30 PM	---	----	12°C	7'
	23	4:30 PM	8.0	21°C	7°C	7'
Dec.	23	2:30 PM	8.1	4.5°C	5.5°C	7'

TABLE 2

Time of Appearance of Organisms

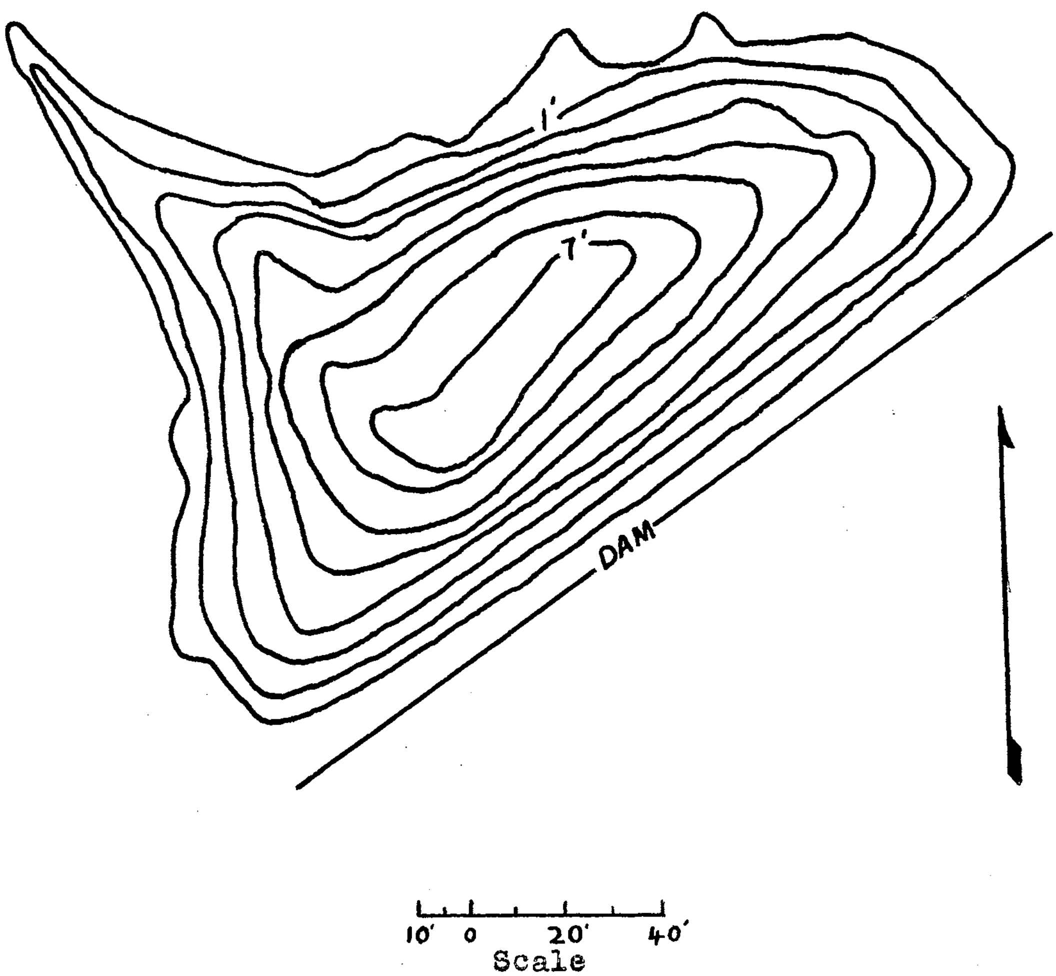
April 14	Chironomus	July 13	Gyrinus
April 21	Chrysops		Pachydiplax
April 30	Chaoborus	July 23	Hydrophilus
	Oligochaeta	Aug. 17	Berosus
May 21	Caenis	Sept. 7	Enallagma
	Stilobezzia	Sept. 15	Hexagenia
June 11	Palpomyia Group	Oct. 26	Plathemis
	Hydracarina		Gynacantha
	Thermonectes	Nov. 10	Clinotanypus
June 16	Nematoda	Nov. 23	Psychomyidae
July 2	Laccophilus		Gomphus
		Dec. 23	Peltodytes

Fig. 1.— Water depth 1'.

Fig. 2.— Water depth 4'.

Fig. 3.— Water depth 1'.

Fig. 4.— Water depth 1'.



Contour Interval — 1'
Total Surface Area — 15,632 Sq. Ft.

Fig. 5.— Map of investigated pond.

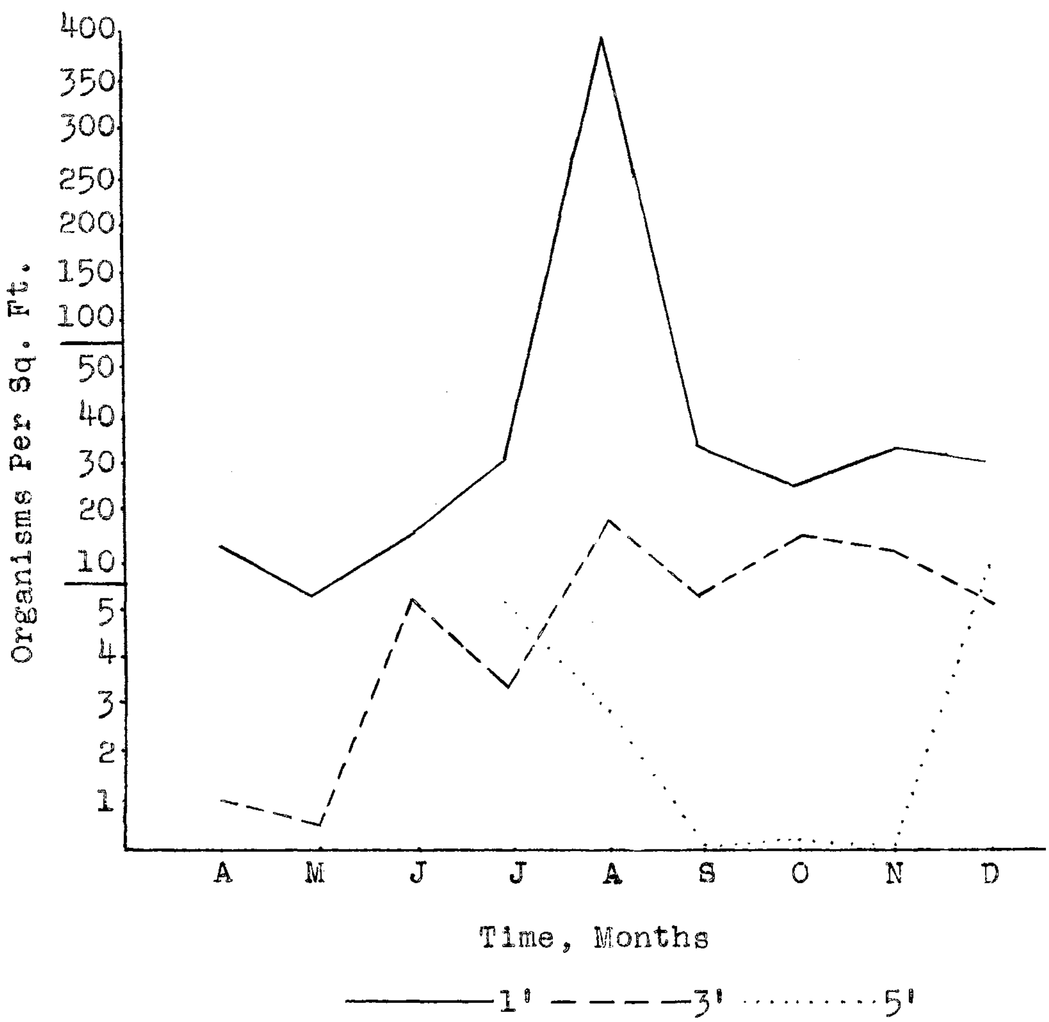


Fig. 6.— Chironomus population.

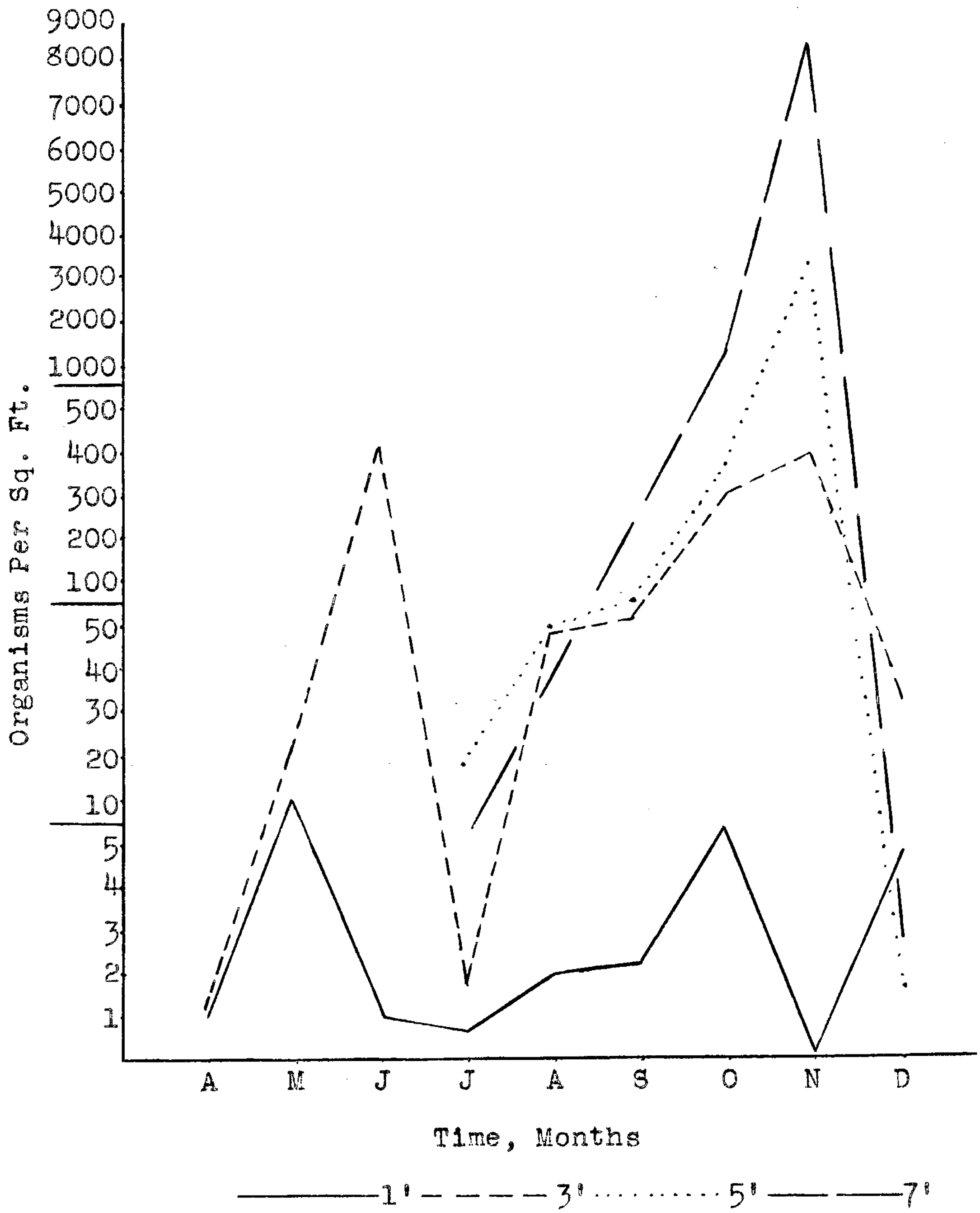


Fig. 7.— Chaoborus population.

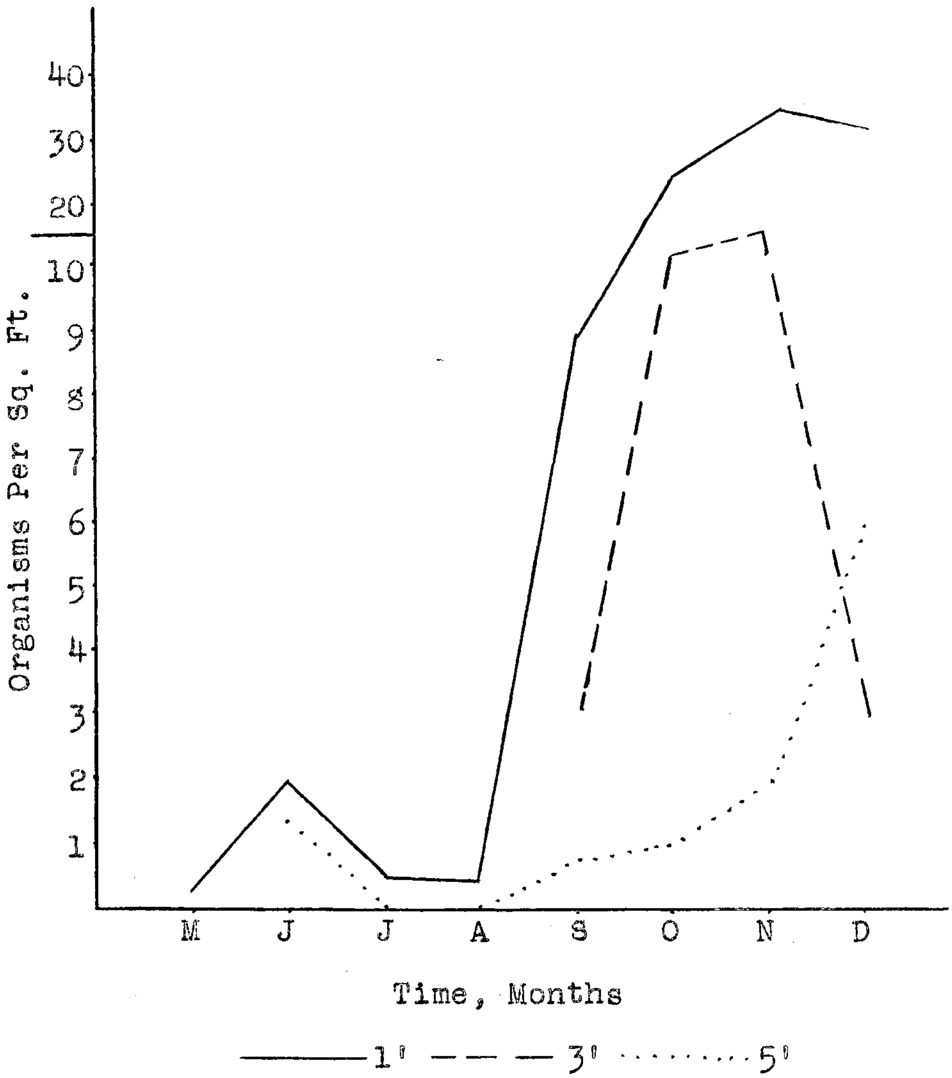


Fig. 8.— Caenis development.

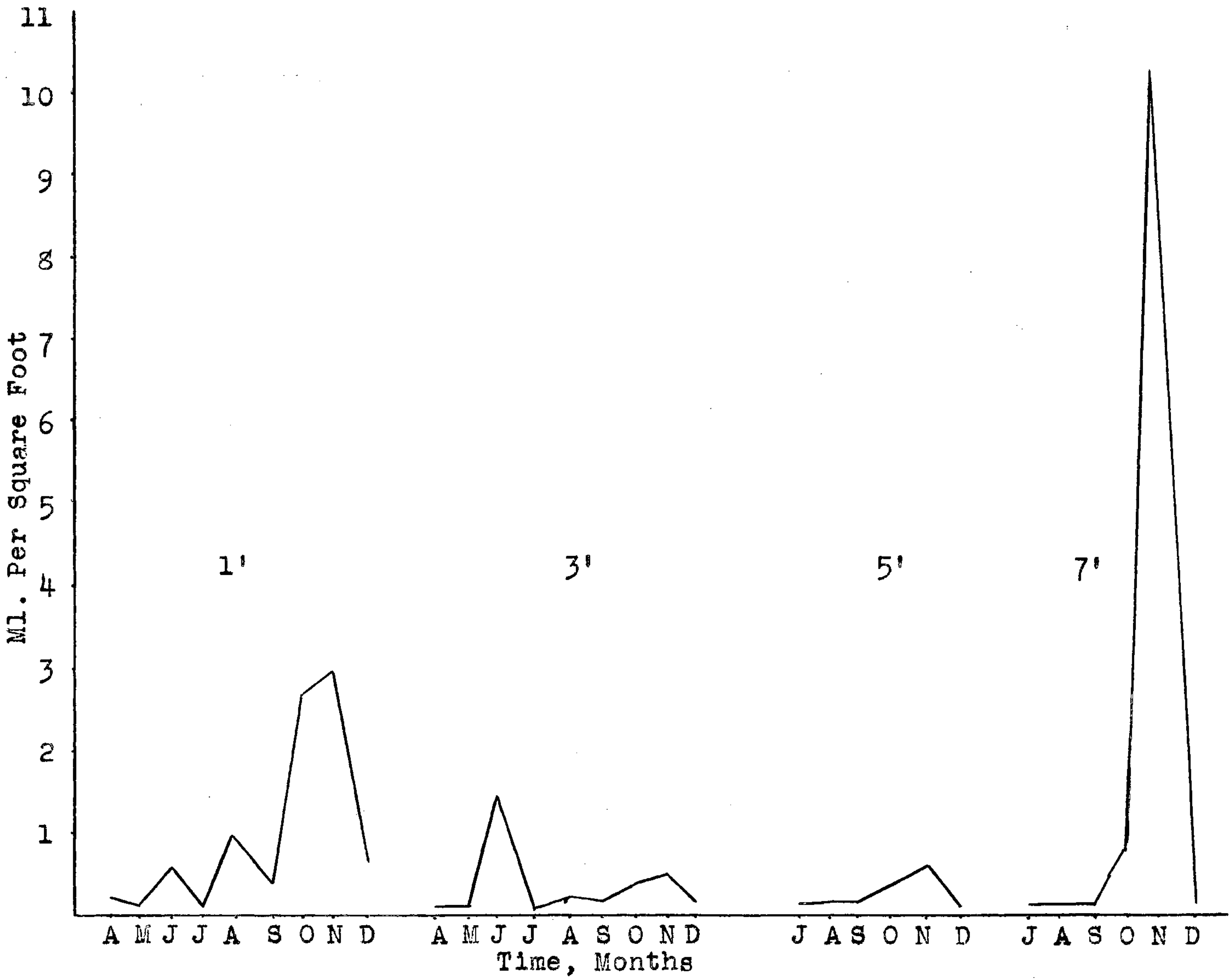


Fig. 9. — Volume per square foot of all organisms.

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