# Preliminary Survey of Sedentary Invertebrates in an Oklahoma Pond[1]

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## INTRODUCTION

A survey of invertebrate animals in a pond poses many problems. Among the major sources of difficulty are succession and specificity of microhabitats. By succession, we refer to the changes in populations due to environmental changes (physical, chemical, biological). An obvious

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example is seasonal succession. As for difficulties relating to micro-habitats, merely consider planktonic, sedentary, and parasitic modes of life, to mention but a few general categories. Adequate sampling of invertebrates in such diverse microhabitats, even within a small pond, would require radically different collecting methods. Suppose we confine our attention to sampling of sedentary forms. Sieves may serve for mud and fine sand dwellers, but how about the attached forms? Apparently some species settle almost exclusively upon specific living plants, others upon dead plant parts, others upon rocks, others upon snail shells, etc. A complete survey, then, would involve sampling of all sorts of substrates, and would be extremely difficult to duplicate. A further problem would concern technical difficulties in examination of such diverse substrates, most of which are opaque or otherwise unsatisfactory for ordinary microscopic study. This report is based upon a convenient sampling method which reveals only a restricted group of sedentary invertebrates, but which provides a uniform substrate, thus making possible a study of the effects of other environmental variables.

The investigation was conducted over a period of seven months, from October, 1951 through April, 1952. It dealt with the sessile and associated invertebrates of a pond and some of the ecological factors coincident with their collection. The pond is an artificial one formed by the damming of a small stream on the University of Oklahoma campus immediately south of Brooks Street and just west of the Santa Fe Railroad. The pond is separated into four parts by a series of dams. Of these, only the northernmost two were used in the study. Pond A begins at Brooks Street and is approximately 600 feet long and 174 feet wide at its widest part. A slight current is evident at the north inlet and at the south spillway, which separates Ponds A and B. Pond B is directly south of A, is about one foot lower, and is 90 feet long and 48 feet wide, with little or no current. The maturity of the pond is suggested by some of the aquatic plants present: rushes (*Juncus*), sedges (*Eleocharis*), water lilies (*Nuphar advena*), and beds of cattails (*Typha*).

## Materials and Methods

The method employed for collecting was essentially that described by Burbanck and Allen (2). The top and bottom were removed from an ordinary wooden slide box, leaving a frame with slots to hold 25 slides. After preliminary field tests to determine the suitability of various types of covers, ordinary non-copper window screen was tacked over the bottom and wired over the top to prevent macroscopic animals from disturbing the slides. Five slides were placed in the box, four or five slots apart, and the box suspended in the water with the uppermost part of the box an inch or two below the water surface. The box was weighted at the lower end with a rock and suspended by wire through an eye screw at the upper end. Each box was left in the water for a minimum of two weeks, during which time the water was tested twice a week for turbidity, *p*H, and temperature. Observations were also made on wind and water movement.

Following preliminary investigations, five stations were selected as being representative of the various portions of the pond. Three of the stations were in Pond A, one being immediately above the spillway. The other two stations were in Pond B, one being directly beneath the spillway.

Examination and replacement with clean slides at each station took place every two or three weeks (with a few exceptions due to such things as molesting of slide boxes by inquisitive people who apparently pulled the boxes up and left them out of the water or otherwise disturbed them). The box was carried to the laboratory in a bucket of water from the station represented. Slides were examined with a stereoscopic dissecting microscope at magnifications of 30 and 45 diameters. Organisms which could not be seen clearly with the stereoscopic microscope were examined with a compound microscope at magnifications up to 600 diameters. To facilitate examination of the slides, a Petri dish with a grid marked on the bottom was prepared. A diamond-point pencil was used to etch the grid in the glass. The grid was made the size of a slide with ten squares in the long plane and four in the cross-wise or short plane. The former were numbered from one to ten, the latter lettered from A to D. Use of the grid made a more accurate examination of the slide possible. The slide to be examined was placed directly over the grid, supported by a toothpick near each end (to prevent crushing organisms between slide and Petri dish bottom. Pond water in the dish barely covered the slide. After the upper side of the slide had been examined, it was turned over and the underside examined. If a great amount of silt had settled upon the upper side, it was carefully wiped off after examination of the upper side of the slide to permit greater light penetration for examination of the underside. After the organisms were identified, they were recorded in approximate quantities, designated as abundant, common, uncommon, or rare. All invertebrates other than arthropods were recorded.

## Results and Discussion

In Table I are shown the organisms observed, the number of times each was recorded from each station, estimated abundance, and seasonal occurrence. The letters A, B, C, D, and E represent the five collecting stations (A-just above spillway, B-just beneath spillway, C-in lower pond, and D, E-in upper pond). The number in parentheses immediately below each letter indicates the number of slide boxes studied from that station. The figures in these five columns show the number of boxes from each station found to harbor each of the invertebrates listed. In the column labeled abundance, the number 1 means rare, 2 means uncommon, 3 means common, and 4 means abundant. For example, *Euglena* occurred at all stations and in all boxes examined from stations A, D, and E. It ranged in abundance from rare to uncommon, being uncommon in some boxes and rare in others. In the column labeled season, the letter F means fall, W means winter, and S means spring. *Euglena* occurred from fall to spring, whereas *Paramecium* occurred in fall and spring, but not in winter. As used here, fall includes September through November, winter includes December through February, and spring includes March through May. It should be pointed out, however, that these seasons are not equally represented in the sample. Only two of the twenty-two boxes were examined in the fall, eight in winter, and twelve in spring. Furthermore, those collected in the fall were taken near the end of the season and could hardly be considered representative of the fall season. The table does not include organisms (*Amoeba*, *Tintinnidim*, *Lacrymaria*, gastrotrichs) observed only during preliminary studies, and does not include any of the arthropods. The taxonomic outline is taken from Storer (5). All identifications were made by Mrs. McDaniel, using such manuals as Kudo (3) and Ward and Whipple (6), with frequent reference to more specialized papers listed by McDaniel (4).

It is difficult to decide where to draw the line between sedentary and non-sedentary animals. As will be noted, a number of the organisms listed are not ordinarily sedentary. However, many of the free-swimming forms settle at times, as during reproduction, and are temporarily sedentary. Others are found moving about among the attached organisms and seldom or never occur very far from a substrate. Such forms were recorded and included in the list.

The ecological data are not presented in this paper since little correlation was found between such data and the invertebrate populations—except in a general way. The *p*H varied only from 7.4 to 8.9, and probably played no role in the population changes observed, though this restricted *p*H range may have excluded some types of organisms from the pond during the period of investigation.

**TABLE I**

*Occurrence of Invertebrates at All Stations*

| Phylum | Class | Organism | A (3) | B (4) | C (5) | D (5) | E (5) | Abundance | Season |
|---|---|---|---|---|---|---|---|---|---|
| Protozoa | Mastigophora | *Euglena* sp. | 3 | 3 | 2 | 5 | 5 | 1-2 | F-S |
| | | *Peranema* sp. | 1 | | | | | 1 | F |
| | Sarcodina | *Arcella* sp. | 2 | | 3 | 3 | | 1 | F-S |
| | Ciliata | *Amphileptus claparedei* | 3 | 3 | 4 | 5 | 3 | 1-3 | F-S |
| | | *Amphileptus* (?) | | | | | 1 | 1 | F |
| | | *Lionotus* (?) | 1 | 2 | | | | 1-2 | W-S |
| | | *Trachelius* sp. | 1 | 1 | | | | 1 | W |
| | | *Dileptus* (?) | 1 | 1 | 1 | | | 1 | W |
| | | *Paramecium* sp. | | 2 | 1 | 3 | 2 | 1-2 | F, S |
| | | *Spirostomum* sp. | 1 | 3 | 2 | 2 | 3 | 1-2 | F, S |
| | | *Stentor roeseli* (?) | 3 | 4 | 5 | 5 | 4 | 1-4 | F-S |
| | | *Stentor coeruleus* (?) | 3 | 3 | 3 | 3 | 3 | 1-2 | F-S |
| | | *Stentor* sp. | 2 | | | 2 | 2 | 1 | W-S |
| | | *Ophrydium* sp. | 1 | 2 | 3 | 3 | 3 | 1-3 | S |
| | | *Scyphidia* (?) | | 1 | 2 | 2 | 1 | 1 | S |
| | | *Epistylis* sp. | 1 | 2 | 2 | 2 | 1 | 1-4 | S |
| | | *Opercularia* | 1 | 2 | 3 | 2 | 2 | 1-3 | S |
| | | *Vorticella* sp. a | 3 | 4 | 5 | 5 | 5 | 1-4 | F-S |
| | | *Vorticella* sp. b | 1 | 2 | 2 | 2 | 1 | 2-4 | S |
| | | *Vorticella* sp. c. | 2 | 2 | 5 | 5 | 3 | 1-3 | F-S |
| | | *Carchesium* sp. | 3 | 1 | 5 | 4 | 5 | 1-4 | F-S |
| | | *Zoothamnium* sp. | 3 | 4 | 5 | 5 | 5 | 1-4 | F-S |
| | | *Vaginicola* (?) | 1 | 2 | 3 | 2 | | 1-2 | S |
| | | *Cothurnia* (?) | | | 1 | | 1 | 1 | S |
| | | unidentified spp. | | 1 | 2 | 1 | 1 | 1-2 | W-S |
| | Suctoria | *Trichophrya* (?) | 1 | 4 | 4 | 2 | 3 | 1-4 | F-S |
| | | *Sphaerophrya* (?) | | | | 1 | | 1 | S |
| | | *Acineta* (?) | | 1 | | | | 1 | S |
| | | *Tokophrya* sp. | | 2 | 1 | 1 | 1 | 1 | S |

TABLE I (Continued)
*Occurrence of Invertebrates at All Stations*

| Phylum | Class | Organism | A (3) | B (4) | C (5) | D (5) | E (5) | Abundance | Season |
|---|---|---|---|---|---|---|---|---|---|
| Protozoa | Suctoria | unidentified sp. | 1 | 2 | 3 | 4 | 1 | 1-2 | F-S |
| Coelenterata | Hydrozoa | *Hydra oligactis* | | 1 | 1 | | 1 | 1 | S |
| Platyhelminthes | Turbellaria | *Catenula* (?) | | | | 1 | | 1 | S |
| | | *Stenostomum* (?) | | 1 | | | | 1 | S |
| | | *Dalyellia* sp. | 1 | 1 | | | 1 | 1 | S |
| Aschelminthes | Rotifera | *Notommata* (?) | 3 | 3 | 3 | 5 | 4 | 1-3 | F-S |
| | | *Copeus* sp. | 1 | 2 | 3 | 3 | 3 | 1-2 | W-S |
| | | *Rattulus* (?) | | | 1 | | | 1 | S |
| | | *Metopidia* sp. | 1 | 1 | 2 | 4 | 3 | 1-2 | W-S |
| | | *Hydatina senta* | | 1 | | | | 1 | S |
| | | *Brachionus pala* (?) | | | | 1 | | 1 | W |
| | | *Brachionus* sp. | | 2 | 1 | | | 1 | W-S |
| | | *Noteus quadricornis* | | | 1 | | | 1 | S |
| | | *Noteus* sp. | | | 1 | | 1 | 1 | W-S |
| | | *Harringia* (?) | 2 | 2 | 4 | 4 | 3 | 1-3 | W-S |
| | | *Pterodina patina* | 1 | 3 | 4 | | | 1 | F-S |
| | | *Limnias ceratophylli* | 3 | 4 | 5 | 5 | 5 | 1-4 | F-S |
| | | *Rotifer neptunius* | 3 | 4 | 5 | 5 | 5 | 1-3 | F-S |
| | | *Rotifer citrinus* (?) | 2 | 4 | 4 | 4 | 4 | 1-3 | F-S |
| | | *Philodina megalotrocha* | | 1 | 2 | 1 | 1 | 1 | S |
| | | *Philodina* (?) | 2 | 1 | 1 | 1 | 1 | 1-3 | F-W |
| | Nematoda | unidentified spp. | | 4 | 3 | 2 | 2 | 1 | F-S |
| Bryozoa | Phylactolaemata | *Plumatella* sp. | 1 | 3 | 4 | 1 | | 1-3 | W-S |
| | | statoblasts of *Plumatella* | | 3 | 4 | 4 | 1 | 1-3 | F-S |
| Mollusca | Gastropoda | *Physa* sp. | | | | | 1 | 1 | S |
| Annelida | Oligochaeta | *Dero* sp. | 2 | 4 | 5 | 5 | 4 | 1-3 | F-S |
| | | *Chaetogaster* sp. | 3 | 4 | 4 | 2 | 2 | 1-3 | F-S |

Certain species (*Epistylis* sp., *Vorticella*, *Limnias*) increased with a decrease in turbidity and a concurrent rise in temperature. Others *Vaginicola*, *Ophrydium*, *Epistylis* sp., *Opercularia*, *Tokophrya*, *Philodina*) did not appear at all until the temperature had risen and the turbidity decreased in the spring. Since all of these organisms feed upon microplankton, and chiefly that drawn to the animal by ciliary action, we might expect high turbidity to interfere mechanically with feeding. For instance, clogging of the ciliary mechanism with silt could markedly reduce its efficiency. Or the rise in temperature might accelerate growth of food organisms, thus providing the basis for ascendance of the animals listed. Decreased turbidity might indirectly have a comparable effect as a result of increased light penetration, which, in turn, should favor the growth of phytoplankton. We have no basis for even estimating the relative importance of these or other factors possibly involved.

*Amphileptus claparedei*, *Notommata* (?), and *Harringia* (?) occurred most commonly attached to the stalks of peritrichs (e.g., *Vorticella*, *Carchesium*, *Zoothamnium*), and fluctuated in direct proportion to the peritrich population.

Although many of the invertebrates occurred on both the upper and under surfaces of the slides, most of them exhibited an apparent preference for one surface or the other. The majority preferred the under side. In this group were *Arcella*, *Amphileptus* (?), *Lionotus* (?), *Trachelius*, most of the peritrichs, most of the suctorians, *Hydra*, *Metopidia*, *Noteus*, *Pterodina*. *Limnias*, the bryozoans, and the organisms which occurred upon peritrich stalks. *Stentor coeruleus*, *Dalyellia*, *Copeus*, *Rotifer*, and the oligochetes appear to prefer the upper side of the slide. No preference was noted in the remaining group. Most of the peritrichs are about as common on the edges of the slide as on the under surface. Perhaps the most important factor in the preferences noted above is the presence or absence of silt. On the upper surface of the slide, the settling silt might bury some types of sessile creatures or might simply hamper the ciliary feeding mechanism of others. On the other hand, it provides material in which the obligochetes can burrow. If future studies of this sort should be made, it might be worthwhile to try boxes suspended in such a manner that the surfaces of the slides would be vertical instead of horizontal.

Bryozoa were most abundant beneath the spillway. This may well have been due to a higher concentration of dissolved oxygen in the water (vide Brown, 1933).

## Summary


1. A study of sedentary invertebrates of an Oklahoma pond was carried on from October, 1951 through April, 1952.
2. The invertebrates were collected with slides in an ordinary wooden slide box with the lid and bottom replaced by window screen. Each box was left suspended in the water for at least two weeks.
3. While the slide boxes were in the water, such ecological factors as turbidity, *p*H, and temperature were recorded twice a week at each station.
4. The invertebrates observed are tabulated according to station, abundance, and seasonal occurrence.
5. Certain species appeared for the first time and others increased in number as the temperature rose and the turbidity declined.
6. One kind of ciliate and two kinds of rotifers generally occurred attached to stalks of peritrich ciliates.
7. Some species occurred almost exclusively on the under surface of the slide, others on the upper surface, and yet others exhibited no preference. The majority appeared to prefer the underside of the slide.

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