

# A Preliminary Study of Aquatic Macroinvertebrates From Two Springs in the Pontotoc Ridge Nature Preserve, Oklahoma

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The Pontotoc Ridge Nature Preserve is located in southeastern Pontotoc County, Oklahoma and is currently managed by The Nature Conservancy. It consists of 2000 acres of woodland and prairie vegetation. Several small springs are located on the property and these serve as headwaters for the Blue River and several of its tributaries. Very little is known regarding the spring invertebrate fauna in Oklahoma (1). The purpose of this investigation was to collect baseline data concerning the physicochemical conditions of the water and to determine distributions of macroinvertebrates in springbrooks resulting from two springs emerging on the property. Pot Spring and Coal Creek Cave Spring were selected for this study. Pot Spring (34.4973°N, 96.6022°W) emerges from a forested rocky slope and maintains perennial flow. Coal Creek Cave Spring (34.5247°N, 96.6014°W), as its name implies, emerges from the opening of a small cave in a wooded area and flows intermittently (N. Jones, personal communication). Both springbrooks had depths of less than 0.1 m and widths of less than 1 m. The substrate at Pot Spring was primarily limestone cobble while the substrate at Coal Creek Cave

Spring was mostly sand with a small amount of cobble present.

Water quality measurements conducted in the field included water temperature and dissolved oxygen concentration using a YSI Model 57 meter that was air calibrated at each site. Alkalinity was determined in the field using the sulfuric acid method (2). Water samples were transported to the laboratory to determine the amounts of ammonia, nitrates, nitrites, orthophosphates, and turbidity using methods described by Hach Chemical Company (3). Specific conductance was determined by using an Oakton conductivity meter. Due to the shallow depth of the water at both sites, flow was unable to be measured.

Benthic macroinvertebrates were collected at sites established 0, 50, and 100 m downstream from the emergence source for both springs. Each site was quantitatively sampled by taking replicate Surber net samples. All material collected in the Surber net was preserved in the field with a mixture of formalin and rose-bengal dye and returned to the laboratory where it was sorted using a 500 µm sieve, identified, and counted. In addition, qualitative samples

TABLE 1. Physicochemical conditions of springs at Pontotoc Ridge, 11 February 1995.

|                                 | Pot Spring              |     |     | Coal Creek Cave Spring |     |     |
|---------------------------------|-------------------------|-----|-----|------------------------|-----|-----|
|                                 | Downstream Distance (m) |     |     |                        |     |     |
|                                 | 0                       | 50  | 100 | 0                      | 50  | 100 |
| Water Temperature (°C)          | 16                      | 15  | 14  | 15                     | 12  | 10  |
| Dissolved Oxygen (mg/L)         | 5.5                     | 5.7 | 5.6 | 7.6                    | 9.6 | 9.6 |
| Oxygen Saturation (%)           | 54                      | 56  | 53  | 74                     | 88  | 86  |
| Alkalinity (mg/L)               | 286                     |     |     | 358                    |     |     |
| Turbidity (JTU)                 | 0                       |     |     | 0                      |     |     |
| Specific Conductance (µmhos/cm) | 500                     |     |     | 625                    |     |     |
| Ammonia (mg/L)                  | 0.83                    |     |     | 0.83                   |     |     |
| Nitrite Nitrogen (mg/L)         | 0.23                    |     |     | 0                      |     |     |
| Nitrate Nitrogen (mg/L)         | 0.70                    |     |     | 0.62                   |     |     |
| Orthophosphates (mg/L)          | 0.21                    |     |     | 0.10                   |     |     |

were collected by the examination of as many microhabitats as could be determined to identify taxa missed in the Surber net samples. However, only Surber net samples were used in the statistical analysis.

Results of the physicochemical analysis are in Table 1. These results fall within the ranges expected of streams possessing high water quality in southern Oklahoma (4). Dissolved oxygen concentrations in Pot Spring were lower than those in Coal Creek Cave Spring. Possibly the water from Coal Creek Cave Spring emerges far back in the cave, exposing that water to atmospheric oxygen much longer than the water emerging from Pot Spring. Alkalinity measurements indicate both springs should be capable of maintaining substantial primary production levels. It is possible the low level of nutrients in the water may inhibit further development of aquatic plant communities.

A total of 39 taxa were collected from the two springs (Table 2). Only two of those taxa were not collected in the Surber net samples. Twenty-five taxa were captured in the Surber net at Pot Spring, whereas 22 taxa were found in the Surber net samples from Coal Creek Cave Spring. The number of individuals was much higher in Pot Spring than in Coal Creek Cave Spring, probably because of the more permanent nature of the water. This observation was accentuated by the high population of the caddisfly larvae, *Helicopsyche borealis*. Generally, populations in the two springs increased as the distance downstream increased, probably as a result of greater food availability. This increase in population size is particularly evident when *H. borealis* is omitted from the analysis.

Shannon's species diversity values (5) increased as distance downstream increased. Although Coal Creek Cave Spring had a higher species diversity value than Pot Spring, this is an artifact of the high population of *Helicopsyche borealis* in Pot Spring. If this species is not included in the diversity calculations, then the Shannon's diversity value at Pot Spring is higher.

Sorenson's index of similarity (6) was 0.47, indicating a small amount of faunal similarity between the two springbrooks. This somewhat low value may be attributed

to differences in substrate and dissolved oxygen concentrations in the two springbrooks, as different species often have different requirements (7).

Dominant taxa in these springs included the caddisfly larvae, *Helicopsyche borealis*; the pulmonate snail, *Physa* sp.; the flatworm, *Dugesia* sp.; and several dipterans (especially chironomid larvae). *H. borealis* has a wide-spread distribution and seems to prefer hard substrates where it feeds by scraping algae and other food particles from the substrate (7). *Physa* has an omnivorous diet and is tolerant of very low dissolved oxygen conditions (8). *Dugesia*, like many flatworms, is common in springs and may feed on living or dead animals (8). All of these taxa have been previously reported from Oklahoma and are well adapted to these spring environments.

Matthews and coworkers (1) collected several taxa from other nearby springs that were also encountered in these Pontotoc Ridge springs. Vaughn (9) reported the amphipod *Allocrangonyx pellucidus* to be present in springs from this area, but no specimens of this species were found in these samples during this sampling period.

Most of the taxa collected in this study are typical of small, lotic environments (7) and are not limited in distribution to springs. Many have been reported by previous investigators from south-central Oklahoma streams (9-12). Further studies involving invertebrate collections from these sites on a year-round basis or over a period of several years would probably yield additional species not reported in this 1995 investigation.

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TABLE 2. Macroinvertebrates collected from Pot Spring and Coal Creek Cave Spring at Pontotoc Ridge 11 February 1995.

| Surber Net Sample Number<br>Distance Downstream (m) | Pot Spring |         |          |          |           |           | Coal Creek Cave Spring |         |         |          |          |           | Total |           |
|---|------------|---------|----------|----------|-----------|-----------|------------------------|---------|---------|----------|----------|-----------|-------|-----------|
|   | 1A<br>0    | 1B<br>0 | 2A<br>50 | 2B<br>50 | 3A<br>100 | 3B<br>100 | Total                  | 4A<br>0 | 4B<br>0 | 5A<br>50 | 5B<br>50 | 6A<br>100 |       | 6B<br>100 |
| Platyhelminthes<br><i>Dugesia</i> sp.               | 1*         |         | 12*      | 11       | 11*       | 25        | 60                     | 1       |         |          |          |           |       | 1         |
| Nematoda  |            |         |          |          |           | 0         | 0                      |         |         |          | 3        | 1         |       | 4         |
| Oligochaeta<br><i>Dero</i> sp.                      | 2          |         | 2        |          | 2         | 1         | 5                      |         |         |          |          |           |       | 0         |
| <i>Limnodrilus</i> sp.                              | 4          |         | 1        |          | 1         | 1         | 8                      | 1       | 1       | 1        |          | 1         |       | 12        |
| <i>Lumbriculus</i> sp.                              |            |         | 1        |          | *         |           | 1                      |         | 3       | 15       | 9*       | 7         |       | 34        |
| <i>Pristina longiseta</i>                           |            |         |          |          | 4         | 13        | 18                     |         |         |          |          |           |       | 0         |
| Nematomorpha  |            |         |          |          |           | 0         | 0                      |         |         |          |          | 1         |       | 1         |
| Gastropoda<br><i>Physa</i> sp.                      | *          |         |          |          | 6         | 2         | 8                      | *       |         | 15*      | 15       | 39*       | 6     | 75        |
| Crustacea<br>Decapoda                               |            | 1       |          |          |           |           | 1                      | *       | *       | *        | *        | *         |       | 0         |
| Hydrocarina   |            |         | *        |          |           |           | 0                      |         |         |          |          |           |       | 0         |
| Ephemeroptera<br><i>Baetis</i> sp.                  | 1          | 4       | 1*       | 2        | 13*       | 4         | 25                     |         |         |          | 1        | 2         | 2     | 5         |
| <i>Paraleptophlebia</i> sp.                         |            |         |          |          |           |           | 0                      |         | *       |          | 4        | 6         |       | 10        |
| <i>Stenonema</i> sp.                                |            |         |          |          |           |           | 0                      |         |         | 1        | 1        |           |       | 1         |
| Odonata<br><i>Argia</i> sp.                         | 25*        | 1       | 6*       |          | 1         |           | 33                     |         |         |          |          |           |       | 0         |
| <i>Cordulegaster</i> sp.                            | *          |         | 1        |          |           |           | 1                      |         |         |          |          |           |       | 0         |
| <i>Hetaerina</i> sp.                                |            | 1       | 2        |          | *         |           | 3                      |         |         |          |          |           |       | 0         |
| <i>Lestes</i> sp.                                   |            |         |          |          |           |           | 0                      |         |         |          |          |           |       | 0         |
| Plecoptera<br><i>Perlinella drymo</i>               |            |         |          |          |           |           | 0                      |         | 9       | 2        | 13*      | 1         |       | 25        |

TABLE 2. (contd.) Macroinvertebrates collected from Pot Spring and Coal Creek Cave Spring at Pontotoc Ridge 11 February 1995.

| Surber Net Sample Number<br>Distance Downstream (m) | Pot Spring |         |          |          |           |           | Coal Creek Cave Spring |         |         |          |          |           | Total |           |
|---|------------|---------|----------|----------|-----------|-----------|------------------------|---------|---------|----------|----------|-----------|-------|-----------|
|   | 1A<br>0    | 1B<br>0 | 2A<br>50 | 2B<br>50 | 3A<br>100 | 3B<br>100 | Total                  | 4A<br>0 | 4B<br>0 | 5A<br>50 | 5B<br>50 | 6A<br>100 |       | 6B<br>100 |
| <b>Hemiptera</b>                                    |            |         |          |          |           |           |                        |         |         |          |          |           |       |           |
| <i>Gerris</i> sp.                                   |            | 1       | *        |          | *         |           | 1                      |         |         | *        |          |           |       | 0         |
| <i>Trepobates</i> sp.                               |            |         |          |          | 2         |           | 2                      |         |         |          | *        |           |       | 0         |
| <b>Trichoptera</b>                                  |            |         |          |          |           |           |                        |         |         |          |          |           |       |           |
| <i>Helicopsyche borealis</i>                        | 168        | 58*     | 122      | 27*      | 8         | 6*        | 387                    |         |         | 2        | 2        | 1         |       | 0         |
| <i>Ochrotrichia</i> sp.                             |            |         |          |          |           | 3         | 3                      |         |         |          |          |           |       | 4         |
| <i>Parapsyche</i> sp.                               |            |         | 1        |          |           |           | 1                      |         |         |          |          | 1         |       | 1         |
| <b>Coleoptera</b>                                   |            |         |          |          |           |           |                        |         |         |          |          |           |       |           |
| <i>Derovatellus</i> sp.                             | *          |         |          |          |           |           | 0                      |         |         | 1        |          |           |       | 1         |
| <i>Helichus</i> sp.                                 |            |         |          |          |           |           | 0                      |         | 1       | 1        |          |           |       | 2         |
| <i>Hydrochus</i> sp.                                |            |         |          |          |           |           | 0                      |         | 1       | 2        | 2        | 7         |       | 12        |
| <i>Peltodytes</i> sp.                               |            |         |          |          | *         |           | 0                      |         |         |          |          |           |       | 0         |
| <b>Diptera</b>                                      |            |         |          |          |           |           |                        |         |         |          |          |           |       |           |
| <i>Antherix</i> sp.                                 | 1          |         | 11*      | 7        | 11*       | 2         | 32                     |         |         |          |          |           |       | 0         |
| <i>Bezzia</i> sp.                                   |            |         |          |          | 6         | 12        | 18                     |         |         |          |          |           |       | 0         |
| <i>Cricotopus</i> sp.                               |            | 8       |          |          |           | 6         | 14                     | 2       |         |          |          |           |       | 2         |
| <i>Cryptochironomus</i> sp.                         |            |         |          |          |           |           | 0                      |         |         |          | 1        |           |       | 1         |
| <i>Dicrotendipes</i> sp.                            |            |         |          |          |           |           | 0                      |         |         |          | 5        | 1         |       | 6         |
| <i>Dixa</i> sp.                                     |            |         |          |          |           | 1         | 1                      |         |         |          |          |           |       | 0         |
| <i>Larsia</i> sp.                                   |            |         |          |          | 3         | 1         | 4                      |         |         |          | 6        |           |       | 6         |
| <i>Odontomyia</i> sp.                               | *          | 1       | 2*       | 22       | *         | 10        | 35                     |         |         |          | 2        | 1         |       | 0         |
| <i>Paramerina</i> sp.                               |            |         |          |          |           |           | 0                      |         |         |          |          |           |       | 3         |
| <i>Pseudochironomus</i> sp.                         | 2          | 5       | 6        | 6        | 1         | 21        | 19                     | 2       |         |          |          |           |       | 2         |
| <i>Rhectanytarsus</i> sp.                           |            |         | 3        |          |           |           | 25                     |         |         |          |          |           |       | 0         |
| <i>Stenochironomus</i> sp.                          |            |         |          |          | 1         |           | 1                      |         |         |          |          |           |       | 0         |
| <b>Total Individuals</b>                            | 202        | 80      | 171      | 75       | 71        | 107       | 706                    | 6       | 1       | 33       | 39       | 104       | 44    | 227       |
| <b>Total Species</b>                                | 8          | 9       | 14       | 6        | 15        | 14        | 25                     | 4       | 1       | 8        | 8        | 14        | 12    | 22        |
| <b>Species Diversity</b>                            |            |         |          |          |           |           | 2.69                   |         |         |          |          |           |       | 3.31      |

\* indicates taxon collected in qualitative sample