A Comparison of Pelagic Invertebrate Communities in Vernal Pools and Lakes around Sewanee, TN

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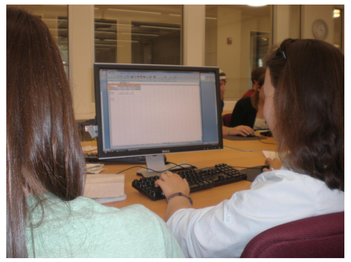
Bio 210: Ecology (D. McGrath)



Introduction

Vernal pools are low depression areas that are filled with water during part of the year and dry during others. They are associated with high species richness and high endemism. King (1998) found that roughly 25% of vernal pool crustaceans in California only inhabit one pool. Many crustaceans, such as the branchipods, inhabit vernal pools because they face lower predation risks since fish are absent in these habitats (Keeley, 1998). Vernal pools also provide habitat for many insectivorous vertebrate species. Scheffers *et al.* 2006 observed a higher diversity and abundance of birds at vernal pools than in surrounding forests. Many salamanders species use vernal pools as their breeding ground (Colburn, 2004).

In light of the importance of vernal pools to many species, we decided to study pelagic invertebrate species richness and abundance in vernal pools on the Southern Cumberland Plateau in Sewanee, Tennessee. The Southern Cumberland Plateau is a hotspot for vernal pools, containing hundreds of them. All other wetlands in this region are man-made and are filled with water all year long. Because of variations in these two habitats, we expected to find a difference in pelagic invertebrate abundance and community diversity between vernal pools and lakes. We did this by determining the number of pelagic invertebrate orders and their respective abundances in three vernal pools (Brakefield Pond, Airport Pond, and Mushroom Pond) and three nearby lakes (Brushy Lake, Lake O'Donnell, and the Saint Andrews Sewanee Reservoir) in Sewanee, TN.

Methods

Study Site

We conducted this study at vernal pools and lakes on and near the Domain of Sewanee, TN in February 2010. We sampled three pools that included one near Gate 9 on Brakefield, one near the airport, and Mushroom Pond near Deep Woods road. The three lakes we sampled were Brushy Lake, the Saint Andrews Sewanee Reservoir, and Lake O'Donnell. These lakes were chosen because of their proximity to the vernal pools so that we would have paired samples.

Sampling

At each pond and lake, we took four samples (at the north, south, east, and west points of the water body). At each point we threw a plankton net attached to a 125 mL collecting bottle as far as we could. The maximum distance was 11 m, although some throws were shorter because they were obstructed by trees. The opening of the net was 0.2 m diameter. Samples were then refrigerated. Under 8x magnification we identified all organisms to order using Colburn (2004) and counted their abundance in three 10 mL samples from each direction. We used a two-tailed t-test to compare mean abundance and order diversity between lakes and vernal pools. We then used an analysis of variance test to compare mean abundance and order diversity among the vernal pools.

Results

There was no significant difference in order diversity of pelagic invertebrates between vernal pools and lakes (Figure 1, p=0.296); however, vernal pools did have a higher abundance of invertebrates (Figure 2, p=0.001). Among the three different vernal pools, Airport, Mushroom, and Brakefield, there was no difference in pelagic invertebrate abundance (Figure 3, p=0.501), but there was a significant difference in pelagic invertebrate diversity, with Airport Pond having the highest number of invertebrate orders (Figure 4, p=0.007). More specifically, the Airport Pond had higher crustacean diversity but the Brakefield Pond had the highest abundance of crustaceans (Figure 5).

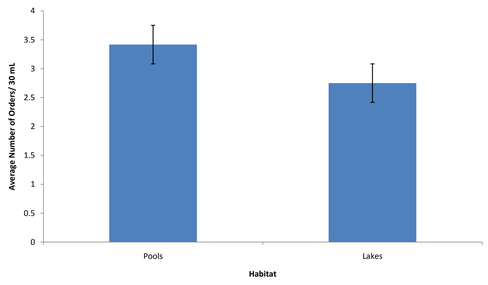


Figure 1: A comparison of pelagic invertebrate order diversity (per 30 mL) between vernal pools and lakes sampled in Sewanee, TN, 2010 (n=3, p=0.296).

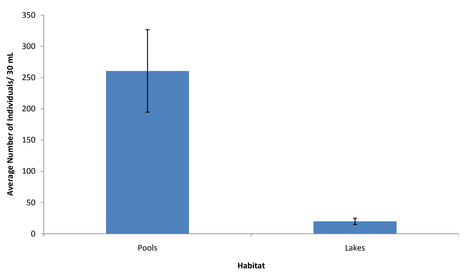


Figure 2: A comparison of the average number of pelagic invertebrate individuals found (per 30. mL) in all sampled vernal pools and lakes in Sewanee, TN, 2010 (n=3, p=0.001).

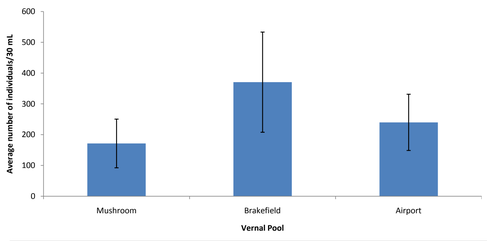


Figure 3: A comparison of pelagic invertebrate abundance (individuals/30 mL) among three vernal pools (Mushroom Pond, Brakefield, Airport) in Sewanee, TN, 2010 (n=4, p=0.501).

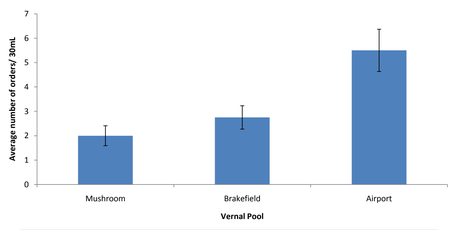


Figure 4: A comparison of pelagic invertebrate orders found (individuals/30 mL) in three vernal pools (Mushroom Pond, Brakefield Pond, and Airport Pond) in Sewanee, TN, 2010 (n=4, p=0.007).

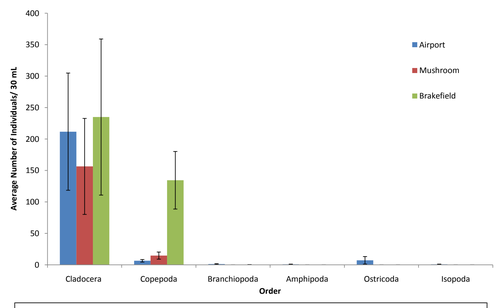


Figure 5: Average number of crustaceans in each of the vernal pools (Airport Pond, Mushroom Pond, and Brakefield Pond) in Sewanee, TN, 2010 (n=4).

Discussion

Vernal pools are areas that are associated with high species diversity. They provide habitat for many aquatic invertebrates as well as predatory vertebrates such as birds (Colburn 2004 and Scheffers *et al.,* 2006.). We wanted to know if there is a distinct difference in pelagic invertebrate abundance and diversity between vernal pools and lakes in Sewanee, Tennessee. We discovered that vernal pools had a higher abundance of pelagic invertebrates, but there was no significant difference in pelagic invertebrate diversity between pools and lakes. The lower abundance of pelagic invertebrates in lakes as compared to vernal pools is probably due to lower predation pressures in vernal pools since fish are completely absent in these habitats (Keeley, 1998). Among vernal pools, diversity was highest in Airport Pond and we believe this is true since this pond receives a high amount of disturbance all year long. Haskell *et al.* (2006) found that bird species richness and evenness increased in the most disturbed habitats due to the opening of niche space. The opening of niche spaces is probably true for Airport Pond, although we do not understand this process. In conclusion, vernal pools provide habitat for many invertebrates and seem to be essential for their breeding since they are found in such high abundance. In the future, we recommend that studies be undertaken that compare the abundance of these invertebrate communities before and after amphibian hatching periods.

Literature Cited

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