

Biotic Comparison of Great Meadow Run and Braddock's Run on Fort Necessity National Battlefield

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ABSTRACT

We compared fish fauna diversity, herptile diversity, water quality parameters, and macroinvertebrate diversity of a cold water fishery, Braddock's Run, to a warm water fishery, Great Meadow Run. The study sites were located on Fort Necessity National Battlefield in the Meadow Run high quality watershed. We determined diversity of fish fauna, herptile, and water quality using the Shannon Index of Diversity and the Shannon-Weaver Diversity Index for macroinvertebrates. The tests concluded that there was no difference in diversity of herptiles, macroinvertebrates, or water quality. There was, however, a significant difference between fish diversity and abundance between the two streams, with a greater diversity and abundance in Braddock's Run.

INTRODUCTION

Communities have long been studied from the standpoint of diversity and relative abundance (Kimmel 1983). Braddock's Run has not been seriously evaluated since 1982, when the Pennsylvania Fish and Boat Commission (1982) studied one sample site, reporting the presence of slimy sculpins (*Cottus cognatus*) and blacknose dace (*Rhinichthys atratulus*). However, both streams have had

preliminary evaluations from May through August of 1997 on water quality, as part of a newly enacted water quality monitoring program at Fort Necessity National Battlefield. These evaluations included water quality (i.e. pH, alkalinity, dissolved oxygen, salinity, and conductivity) and macroinvertebrate sampling. There had not been any electroshocking or herptile hunts done officially, but there had been recommendations to do so in the future. These evaluations were used to establish the normal conditions of the stream so that any serious impacts in the future can be quickly identified and corrected. The study that we conducted presents more in-depth data about conditions of these streams, and the overall health of this section of the Meadow Run Watershed. Our objectives were to determine if there were differences in the diversity and quality between the two streams.

METHODS

The study was conducted on one 100-meter section of each stream. The conditions evaluated were water quality and macroinvertebrate sampling, and herptile and fish fauna surveys. Each stream had four random sampling sites where water quality and macroinvertebrates were measured. Measurements of water quality included conducting chemical analyses for pH, alkalinity, dissolved oxygen, and macroinvertebrate sampling using a Serber Sampler. For macroinvertebrates, species diversity and abundance were used as a biotic indicator.

The herptile sampling was conducted within ten meters of the stream banks and included the stream itself. The sampling method used was a manual search for herptiles under logs, rocks, and within the surrounding habitat. Species abundance was then recorded. Some herptiles were also collected during the electroshocking.

The fish fauna survey was also done on the same 100-meter sections of streams, using a No-Brush Generator, Model 31-001 electrofisher. This method consisted of making three runs up each 100-meter section of stream, as done by Zippen (1958). The specimens from each run were kept alive in holding buckets and released after data was recorded.

RESULTS

Water quality of both Meadow Run and Braddock's Run fell within acceptable standards according to the Pennsylvania Department of Environmental Protection (Table 4). The only distinct difference in these streams was in temperature: Great Meadow Run was consistently higher than Braddock's Run by six to ten degrees at all four sites. Mean width of Braddock's Run was estimated at 1.5 meters, and Great Meadow Run estimated at 1.75 meters.

Macroinvertebrate diversity in both streams was high (Table 3). Hilsenhoff's Biotic Index and Shannon-Weaver Diversity Index show both streams to be unpolluted. However, Beck's Biotic Index indicated that Great Meadow Run was

below standard with a value of nine. This indicates that this stream may have some degree of pollution, whether naturally or artificially impacted.

Fish fauna abundance and diversity was greater within Braddock's Run than Great Meadow Run (Table 1), although species were similar in both streams. According to the Shannon Diversity Index, Braddock's Run was significantly more diverse and species were more abundant.

A list of herptiles collected can be seen in Table 2. All species found at Great Meadow Run were also found at Braddock's Run, but two additional species were found at Braddock's Run. However statistical tests revealed no significant difference in diversity.

DISCUSSION

Macroinvertebrates

Although the Beck's Biotic Index value of nine for Great Meadow Run indicates a polluted stream, Hilsenhoff's and Shannon-Weaver Indices suggest that it is an unpolluted stream with great diversity (Table 5). Therefore, we should assume that Beck's Biotic Index does not accurately show the true quality or diversity of the population. This could be due to the low numbers of high-quality indicator species and high number of low-quality indicator species. However, the presence of high-quality indicator species in any amount shows that the water is unpolluted or of high enough quality to support a population.

Water Quality

The difference in temperatures between Great Meadow Run and Braddock's Run is most likely due to the different natures of the streams. Great Meadow Run is classified as a warm-water fishery, while Braddock's Run is classified as a cold-water fishery. Therefore, this difference should be expected and not noted as a significant difference. Otherwise, both streams fell well within DEP standards for stream quality.

Fish Fauna & Herptiles

Species diversity was greater in Braddock's Run, as seen in graphs 1 and 2. Although creek chub (*Semotilus atromaculatus*) was the most abundant species in both streams, Braddock's Run was more easily accessible and shallower, possibly allowing for greater numbers to be shocked and recovered. A second series of samples will be taken later in the year and may possibly reveal greater numbers and diversity in Great Meadow Run than previously thought. In addition, the presence of pumpkinseed (*Lepomis gibbosus*) in Braddock's Run may have been a result of movement from a pond located above the sample site that has a tributary into Braddock's Run. Pumpkinseed, however, also inhabits small streams with quiet pools.

Crayfish were included in the diversity index calculations because they were also obtained by electroshocking. Lower captures of crayfish in Great Meadow Run may be attributed to low visibility of the creek bottom.

The higher abundance of all species of fish in Braddock's Run may be due to the fact that it is shallower than Great Meadow Run. However, Braddock's Run is a high quality cold-water fishery that should naturally support greater abundance and diversity of species.

Herptile sampling revealed no significant difference in diversity between the two stream habitats. The majority of redback salamanders occurred in Great Meadow Run, where the stream is surrounded by mature *Pinus* sp. Northern mountain dusky salamanders seemed to prefer Braddock's Run, which is dominated by mid- to late-successional mixed deciduous woods. The slimy salamander was found only at Braddock's Run on the deciduous-wooded hillside. As previously stated, a second series of samples will be taken later this year to be compared with these results.

LITERATURE CITED

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- Pennsylvania Fish and Boat Commission. 1982. Braddock's Run, Fayette County Survey. Pennsylvania Fish and Boat Commission, Bellefonte, Pennsylvania.
- Zippen, C. 1958. The removal method of population estimation. J. Wildl. Manage. 22(1): 82-90.
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Table 1. Fish Abundance and Diversity.

Species	Great Meadow Run	Braddock's Run
slimy sculpin (<i>Cottus cognatus</i>)	3	69
creek chub (<i>Semotilus atromaculatus</i>)	44	153
blacknose dace (<i>Rhinichthys atratulus</i>)	11	34
white sucker (<i>Catostomus commersoni</i>)	6	2
emerald shiner (<i>Notropis ortenburgeri</i>)	0	20
fallfish (<i>Semotilus corporalis</i>)	0	2
pumpkinseed (<i>Lepomis gibbosus</i>)	0	19

Table 2. Herptile Abundance and Diversity.

Species	Great Meadow Run	Braddock's Run
northern two-lined salamander (<i>Eurycea bislineata</i>)	1	6
northern mountain dusky (<i>Desmognathus ochrophaeus</i>)	4	15
redback salamander (<i>Plethodon cinereus</i>)	16	2
northern slimy salamander (<i>Plethodon glutinosus</i>)	0	1
green frog (<i>Rana clamitans melanota</i>)	1	0

Table 3. Macroinvertebrate Taxa Present.

Taxa	Great Meadow Run	Braddock's Run
Asellidae	1	1
Capniidae	0	4
Chiromonidae	4	5
Corydalidae	3	1
Culicidae	1	5
Elmidae	0	2
Ephmeridae	2	3
Hydropsychidae	0	10
Leptophlebiidae	0	4
Oligonuridae	0	1
Perlidae	0	6
Phryganeidae	13	0
Sialidae	1	0
Tipulidae	8	8

Table 4. Water Quality Parameters.**Great Meadow Run**

Parameters	Site 1	Site 2	Site 3	Site 4	DEP
pH	6.91	6.99	6.99	6.95	6-9
D.O.	10.38 mg/l	10.11	10.59	10.23	5.0 mg/l
Conductivity	75.1 μ s	76.1	74.5	73.4	----
Salinity	0.1 ppt	0.1	0.1	0.1	----
Air Temperature	15°C	13.5°	15°	15°	----
Water Temperature	7.2°C	7.3°	7.4°	7.3°	10°
Alkalinity	3 *(1.600)	4 *(1.600)	3 *(1.600)	4 *(1.600)	20 mg/l

*Concentration of HCl used to titrate sample.

Braddock's Run

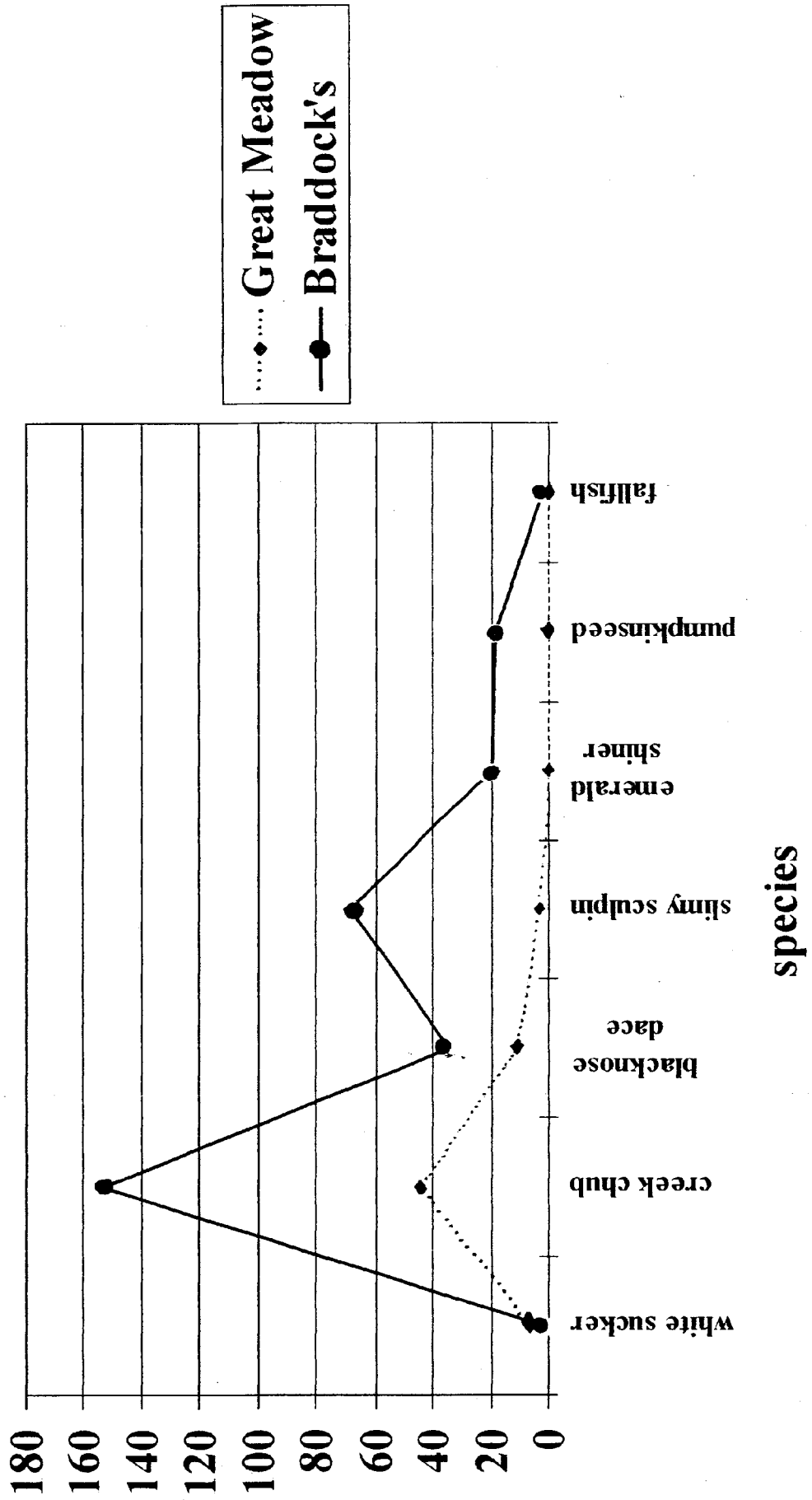
Parameters	Site 1	Site 2	Site 3	Site 4	DEP
pH	6.44	6.83	7.00	6.80	6.0-9.0
D.O.	11.81 mg/l	11.88	11.77	11.88	5.0 mg/l
Conductivity	47.7 μ s	50.4	81.0	50.2	----
Salinity	0.0ppt	0.0	0.0	0.0	----
Air Temperature	7°C	7°	5°	5°	----
Water Temperature	4.6°C	4.5°	4.4°	4.4°	
Alkalinity	3 *(1.600)	2 *(1.600)	3 *(1.600)	3 *(1.600)	20 mg/l

*Concentration of HCl used to titrate sample.

Table 5. Biotic Indices.

	Great Meadow Run	Braddock's Run
Mean #	4.25	4.41
Beck's	9	29
Hilsenhoff's	3.84	3.31
Shannon-Weaver	2.38	3.11
Equability	1.25	1

Graph 1. Fish Species Abundance



Graph 2. Herptile Abundance

