

FWS 388

A SURVEY OF THE BENTHIC MACROINVERTEBRATES OF THE  
BUFFALO RIVER AND A COMPARISON TO PAST SURVEYS AND  
A DIFFERENT METHOD OF COLLECTION

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## INTRODUCTION

People's use of the Buffalo River have degraded it into one of the most seriously polluted streams in America. Recently, efforts have been and are still being made to clean up the river. The purposes of this study are to determine the present environmental quality of the Buffalo River by looking at the benthic macroinvertebrates and to examine changes in the quality of the river by comparing the results of this survey with previous surveys. Benthic macroinvertebrates have been used as indicators of environmental quality of streams and other bodies of water (Howmiller and Scott, 1976).

Several studies have been done in the past on the Buffalo River. In surveys done before 1974, the organisms were not keyed below family level, reducing the value of the data acquired. Resh and Unzicker (1975) noted the importance of keying benthic organisms to species where possible (Bergantz, 1977).

Macroinvertebrates are "large" invertebrates. The many freshwater forms include aquatic insects and other arthropods, snail, clams, and worms. Analysis of macroinvertebrates is one of the most reliable and cost effective approaches to biological monitoring because:

1. they are very sensitive to environmental disturbances,
2. they are less mobile than fish and cannot as easily avoid intermittent pollution,
3. they indicate the condition of the sediment, and
4. their populations are more stable than those of microorganisms, thus providing less sampling variability (Simpson, 1976).

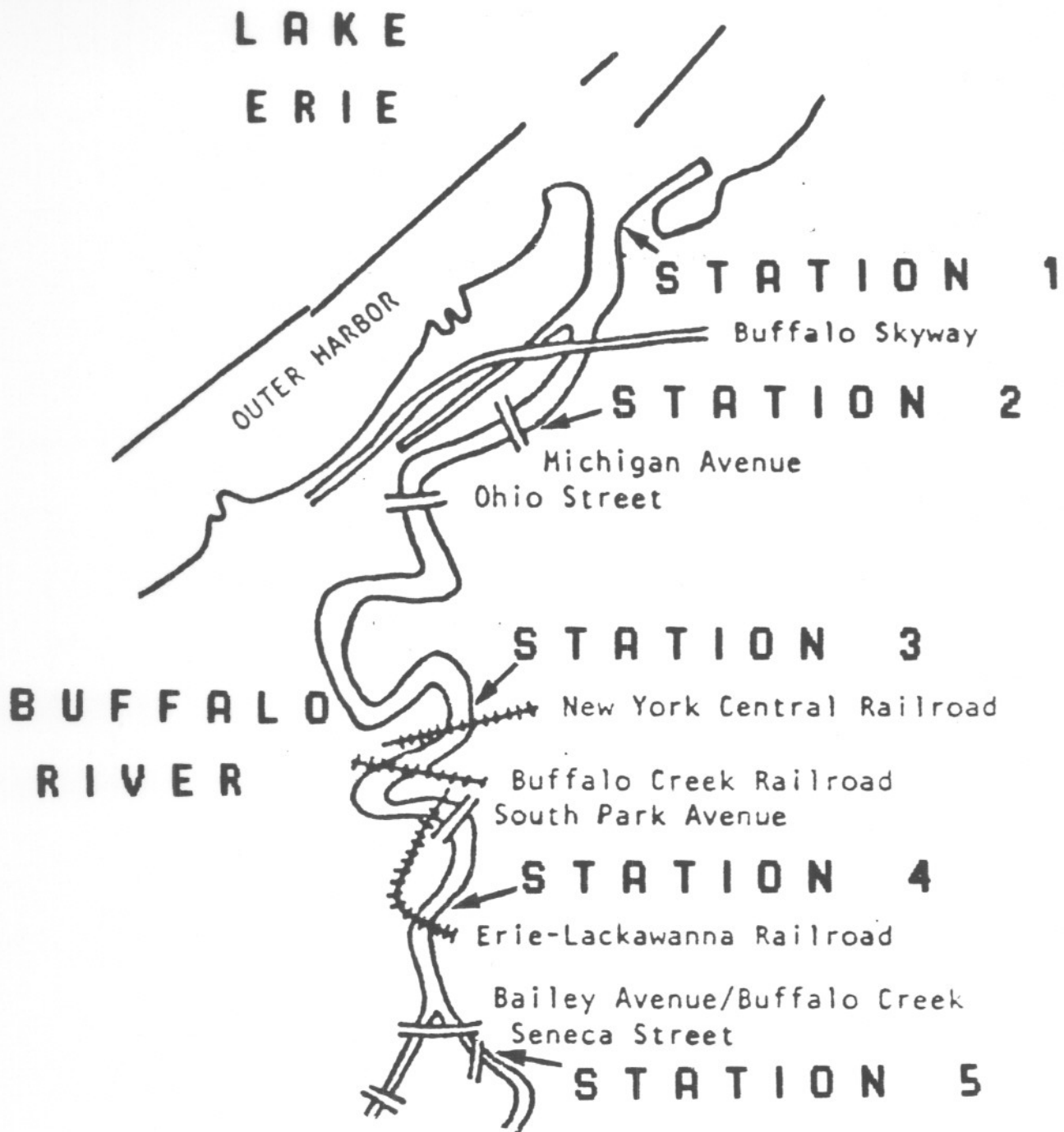


FIGURE 1

Map of Buffalo River showing locations of the sampling stations.

The data is usually reduced to some sort of numerical index. There are several indices that have been developed. Some use the concept of species diversity to determine environmental quality. One is a measure of species richness and of the equitability of distribution of individuals among species. Some indices are based on the presence or abundance of some group or groups of organisms which are comprised of many species, such as the oligochaete worms (Howmiller and Scott, 1976).

There are several methods used in collection samples. The Ponar grab was used in this survey. Another method of collecting samples is the multiplate sampler, which is used by the NYS Department of Environmental Conservation (DEC). The results of this survey are compared to the DEC results as well as with past studies.

#### MATERIALS AND METHODS

Five stations were established along the Buffalo River and the Buffalo Creek tributary (see figure 1). Stations 1 through 4 were located in the dredged section of the Buffalo River. Station 5 was located in the Buffalo Creek just upstream of the Seneca Street bridge. Station 1 was at the mouth of the river. Station 2 was between the Skyway bridge and Michigan Ave. bridge. Station 3 was just downstream of the Penn Central RR bridge. Station 4 was just downstream of the upper Erie-Lackawanna RR bridge.

Samples were collected in the summer of 1988 using a Wilder Co. mini Ponar grab. The mini Ponar grab was dropped in 2 places

at each station, one in midstream and one near the south bank of the river. If the grab was not full, it was discarded and the drop repeated. The samples were sieved through a No. 30 mesh sieve and the material retained by the sieve was preserved in a 10% formalin solution.

In the lab the samples were again rinsed in a No. 30 mesh sieve and put into 70% ethyl alcohol solution. A small amount of Rose Bengal was added to each sample. This stained any tissue in the sample, making the organisms easier to pick out.

The macroinvertebrates were picked from the samples using a binocular 10X dissecting microscope, separated into major taxa and represerved in 70% ethyl alcohol solution.

Due to the large number of oligochaetes in each sample, a subsample of 50 specimens was randomly selected from each sample for identification. The total number of individuals for each specie in the entire sample was estimated from those 50.

The oligochaetes were permanently mounted on slides using Hydramount no. 89250 and protected with a cover slip. The chironomids were temporarily mounted on slides in glycerin after a slit was made on the ventral side of the animal between the head and the first segment of the thorax. Both were identified to specie where possible using a binocular light microscope with 100X - 1000X magnification. All other taxa were identified using the binocular 10X dissecting microscope.

Data from this survey was compared with a survey done by Bergantz (1977) using the mini Ponar grab, and with a survey done by the DEC in 1987 using a multiplate sampler. The multiplate

sampler consists of 3 plates tempered hardwood, 6 inches square and 1/8 inch thick, mounted on a no. 13 aluminum turnbuckle. The upper two plates are separated by one inch and the lower plates by 3/8 inch. The samplers were installed three feet below the surface (Simpson and Bode, 1980).

References used in identification of the organisms were:

- Oligochaeta - Brinkhurst, 1980
- Polychaetae - Pennak, 1978
- Hirudinae - Pennak, 1978
- Turbellaria - Pennak, 1978
- Isopoda - Pennak, 1978
- Chironomidae - Mason, 1973  
Simpson and Bode, 1980
- Culicidae - Pennak, 1978
- Trichoptera - Pennak, 1978
- Gastropoda - Harman and Berg, 1971  
Mackie et al, 1980
- Pelecypoda - Mackie et al, 1980  
Herrington, 1962

## RESULTS

The macroinvertebrates found are listed in Table 1. Station 1M is the sample taken from the middle and 1S is the sample taken near the south bank of the river at station 1 and so forth. The number of organisms per square meter was calculated by multiplying the number of organisms counted by 38.34. At all the stations tubificids were the most common organisms collected with Limnodrilus hoffmeisteri found at every station. The second most common group in stations 1 and 2 were the Pelecypoda, but these

and the Gastropoda were not found further upstream. At stations 3, 4 and 5 the Chironomidae were the second most abundant group.

The data from Table 1 is summarized in Table 2. The bottom type for all stations was similar except stations 3S and 5M. Station 3S bottom type was an oily muck in which a very small number of organisms were found. All were tubificids and only one was identified to be a Limnodrilus hoffmeisteri. Station 5M bottom was very gravelly, which prevented the Ponar grab from closing. The best grab kept for the survey was not full.

The number of taxa found in the shore samples was generally greater than the midstream sample for each station.

The Shannon-Weiner H' diversity index (Fager, 1972; as cited by Bergantz, 1977) and the Equitability were calculated using the following formulas:

$$H' = \sum_{i=1}^S p_i \ln p_i$$

$$H_{max} = \ln S$$

$$\text{Equitability} = H' / H_{max}$$

$$P_i = n_i / N$$

$$S = \text{no. of species}$$

$$n_i = \text{no. organisms in the } i^{\text{th}} \text{ species}$$

$$N = \text{no. of organisms}$$

The diversity index is a number that takes into account both species richness and equitability. For this calculation the number of immature Tubificidae with and without hair chaetae were split proportionally and added to the number of the identified Tubificidae. For example, at station 2M, since there was only one specie of Tubificidae without hair chaetae identified, all the immature without hair chaetae were considered to be Limnodrilus hoffmeisteri. Since there were no mature Tubificids with hair chaetae identified, the immature Tubificids with hair

chaetae were considered one specie.

The highest  $H'$ , at station 3M, was due to a high equitability, whereas the second highest  $H'$ , at station 1S, was due to the highest number of taxa found there. Stations 2M and 2S have low  $H'$  despite a relatively large number of taxa because most of the organisms counted were considered one specie.

The percent Tubificidae ranged from 91% to 100% for all stations. A high % of Tubificids indicates a high degree of organic pollution (Goodnight and Whitley, 1961: as cited in Bergantz, 1977).

A comparison was made with a survey done by Bergantz (1977). Comparisons were made between 2 sites that were at similar locations for both surveys. Table 3 shows how the samples compared. The taxa collected were similar but Bergantz had a higher number of taxa. Two differences in the survey methods may account for this discrepancy. The Bergantz survey was collected in November while the 1988 survey was collected in July. The Bergantz survey is an average of two Ponar grabs per station while only one grab was taken at each station in the 1988 survey.

Finally, a comparison was made between the 1988 survey and a survey done by the DEC using a multiplate sampler (Table 4). Because the method of sampling was different, only a comparison of organisms could be made, and none of the taxa matched. The taxa collected with the Ponar grab were predominantly Oligochaetae and the taxa collected with the multiplate sampler were predominantly Chironomidae.



