An Evaluation of Antes Creek

Introduction

Antes Creek has a drainage area of 55.75 square miles and is a tributary of the West Branch of the Susquehanna near Jersey Shore, PA. The purpose of this study was to review the water quality of the creek using the EPA's Rapid Bioassessment, Protocol III (Plafkin et al 1989 and Barbour et al 1999). In January, 1985, in a booklet printed by the Susquehanna River Basin Commission, Carl P. McMorran gives and brief history of the West Branch of the Susquehanna River. He states that "over 100 miles of the West Branch and many more miles of tributaries are seriously degraded by acid mine drainage." He goes on the say that some tributaries are unaffected and most that are affected "have the potential to return to good water quality, if sources of acid mine drainage are abated."

The water from Antes Creek runs through basically two types of land: at the headwaters it flows through forested areas and at the mouth flows through farmland. There are several places where the creek flows through underground sinkholes and reemerges several miles later. There are two stations that McMorran (1985) samples on Antes Creek. One is located at the mouth and the other is "about ¼ mile downstream from the point where the stream emerges from underground."

In his study, McMorran (1985) concluded that the biological condition at the quarry testing station in Antes Creek was reduced and the water quality was good. At the other testing station, near the mouth of the creek, the biological condition was determined

healthy and the water quality was again good. McMorran (1985) also discusses the various qualities he used to determine the quality of the water. He collected eighteen macroinvertebrate taxa at the quarry station, noting a large quantity of amphipods, chironomids, mayflies, and caddisflies, but still found number of the remaining taxa to be comparable the other similar streams, ever though the diversity index was low. McMorran (1985) also concluded that fecal colliform levels were high and nitrate, conductivity, calcium, and alkalinity levels were "higher than average but not excessive." He states that the water quality at this station appears good and highly productive, accounting for the high numbers of amphipods which in turn decreases the diversity. At the mouth of the creek, McMorran (1985) found 12 taxa with mayflies and amphipods being dominant, and an increase in the diversity index. Fecal coliforms still exceeded standards, and high levels of nitrate, conductivity, calcium, and alkalinity. Excerpts from the 1985 McMorran report specific to Antes Creek can be found in Appendix 1.

Other studies were also done on Antes Creek. In August, 1994, Dr. Mel Zimmerman of Lycoming College, with the help of some students, also tested Antes Creek. They found all of the water quality to be good as well as the biological conditions. Also, the DEP performed research on Antes Creek in April, 2002. Each site scored 30, within the optimal, good range. They also found the water quality to be good.

Methods

Study Site

Figure 1 (adopted from McMorran 1985) shows the Antes Creek Watershed (55.75 sq mi). The stream itself is a 4th order stream, assuming the underground spring

connections to McMurrin and Rauchtown Runs. Lycoming College established 5 sampling site between the Lyon estate (lat 41° 4.433/long 77° 13.345) and the mouth at lat 41° 19.138 /long 77° 24.162). See Table 1 for locations. The total stream miles between sites 1 and 5 were approximately 3 miles. Four pictures at each site were taken: upstream and downstream, and left and right banks, as well as the GPS noted. Habitat Assessments were done at each site (see Appendix II for forms) and Table 2 summarizes these descriptions. Each category refers to a certain habitat parameter, such as instream cover and embeddedness. The answer can be between 0 and 20, and each of these can be divided into four groups: 16-20 is optimal, 11-15 is suboptimal, 6-10 is marginal, and is 0-5 poor. Site 4, at Johnson's Cabin received the highest total habitat score with 203 while Site 5, at the mouth, received the lowest total score: 167. A perfect score is 340.

Assessment Methods

On October 15, 2002, several Lycoming Biology students accompanied Dr. Zimmerman to Antes Creek, meeting Mr. Toby Johnson from the Antes Creek Watershed Association and members of the Susquehanna River Basin Commission, led by Biologist Susan LeFevre. While at Site 5, the students were able to help and observe the River Basin team who were sampling that day. A habitat analysis was performed by Carey Entz, while Kristin Brown and Jeff Curry helped take water and coliform samples, dissolved oxygen, temperature, width, and depth measurements. Each student was also able to help take a kick sample. Water chemistry from the water samples at each site, including pH, conductivity (μmm), alkalinity, orthophosphate, phosphorus, nitrate, and nitrite (all in ppm) were conducted within 24 hours in the lab at Lycoming College. Later

on, the students accompanied Mr. Johnson to the four other sites and took their own samples and measurements. During the course of the next week or two, Carey Entz, assisted by Kristin Brown, identified the organisms found in the kick samples. Carey Entz also used a computer program to perform evaluations on the number and diversity of the organisms in the creek.

Data Analysis

After identifying the organisms in the kick samples, they were put into metrics using the EPA's Rapid Bioassessment Protocol III (Plafikin et al 1989). The total taxa, Hilsenhoff Biotic Index, scraper/filterer ratio, percent dominant taxon, EPT taxa, community loss, percent shredders, and Shannon-Wiener Diversity were all calculated. The water chemistry was performed by Alisa Deday and Theresa Black in the lab at Lycoming College. They used the Hach for nitrates, nitrites, and phosphorus. The pH meter and conductivity meter.

Results

The results for the water chemistry of Antes Creek can be seen in Table 3. A pH reading of 7.0 is neutral, but 6.0-9.0 is a reasonable score for most aquatic life and 7.5-8.4 is the best range for algal growth. All of the sites scored within this range, so they had a good pH score. Normal conductivity scores are between 50 and 1500 μmho/cm. Each site also scored within this range giving them a good conductivity score. Natural alkalinity ranges from 20-200 mg/L, although limestone areas, such as Antes Creek, tend to be higher. Even so, each site on Antes Creek scored well within this range, so the

creek received a good score in this area as well. For phosphorus, the common range in uncontaminated lakes is 0.01-0.03 mg/L. 0.1mg/L is the recommended maximum for rivers and streams. The phosphorus levels in each site were high, especially in Sites 2, 4, and 5. The creek received a marginal score here. 10.0 mg/L is the extreme human consumption limit for nitrates. Each site scored well under this, giving the creek a good score. 1.0 mg/L is the human consumption limit for nitrites. Each site scored well below this, too, so the creek also received a good score in nitrites. An average number of coliforms in healthy streams is 100. Site 1 was the only site to score higher than this at 130 +/- 20, which is not many, so the creek scored well here. As far as DO goes, 6 mg/L is fair and 8 mg/L is good. Anything below 3 or 4 mg/L is considered stressful to aquatic life. Site 1 scored fair (7.85 ppm), but all the other sites scored above this. Antes Creek received a marginal score in DO. The average temperature of streams from October 1-15 is between 12.2 and 22.2 °C. Each site scored just below this, so the creek receives a marginal score. Finally, for turbidity, each site received an optimal score, since they each scored within the range of <25 NTU, which is the average for aquatic life.

A list of the metrics scores for each site on Antes Creek is available in Appendix 4, where Site 1 is used as a reference. Using the EPA's Rapid Bioassessment Protocol III (Plafikin et al 1989), each site, with the exception of Site 3, was found to be non-impaired. Site 3 was found to be moderately impaired, though on the high end of the range. When considering each individual metric, Site 1 had a 6 in each category except percent dominant taxon. Site 2 scored 6 in everything but EPT ratio and percent dominant taxon, in which it scored 0, and community loss, where it scored a 4. Site 3 scored 6 in each metric except EPT ratio, percent dominant taxa, and percent shredders,

where it scored 0, and community loss, where it scored 4. Site 4 scored 6 in each metric except percent shredders, where it scored 0, percent dominant taxa, where it scored 2, and community loss, where it scored 4. Site 5 scored 6 in each metric except percent dominant taxa, where it scored 0 and community loss, where it scored 4. An appropriate score for the Shannon-Wiener Diversity is 1. Site 1 was the only site to score 1 in the optimal range, Sites 2, 3, and 5 scored 3, the suboptimal range, but Site 4 scored 5, which is the marginal score. A table of the percent taxa and food webs is available in Table 5.

Discussion

In January, 1985, Carl P. McMorran prepared a survey of the condition of Antes Creek, along with several other streams and rivers. He determined that the general condition of the creek in reference to biological condition was healthy and the water quality was good. McMorran also made the note that the number of amphipods was unusually high, and the fact that the creek runs underground for a long distance results in high alkalinity.

In August, 1994, Dr. Mel Zimmerman of Lycoming College, with the help of some students, also tested Antes Creek. They found all of the water quality to be good as well as the biological conditions.

In April, 2002, the DEP performed research on Antes Creek as well. Each site scored 30, within the optimal, good range. They also found the water quality to be good.

With all of this historical data within reach, we can easily note the progression of Antes Creek through the years. After this survey was performed and the data collected and put into context, we found Antes Creek to be in good condition. Because of the

section where it runs underground for such a considerable distance, the alkalinity is high. This will then affect the number and kind of organisms found at each site. Though there were some low scores in percent dominant taxa and community loss, there is no reason for concern.