A Bioassessment of the Kinderhook Creek
Fall, 2006

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Kinderhook Creek Bioassessment
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Background Information

Ms. Williams' Fall 2006 Stream Ecology class at Darrow School is taking a close look at the Kinderhook Creek to evaluate it for its health. We are using visual observations, research, maps, and chemical tests to do so. Our specific location is at Adam's Crossing Rd. and Hanky Mull Rd. Our class has visited the site and has driven through parts of the creek's watershed.

The Kinderhook Creek is a class C stream, meaning it is suitable for trout spawning, fishing, and recreation. At our research site (Adam's Crossing), it is a 4th-order stream. Potential non-point sources of pollution include several horse farms and houses directly on the creek. There are also cemeteries, roads, a landing strip, a speedway, trailer parks, gravel pits, power lines, a school, an old railroad grade, a ski resort, campgrounds, farms, and a drag strip which could be affecting the pollution levels in the stream.

Physical Assessment

Ms. Williams' A Block Stream Ecology class visited the Kinderhook on two dates: October 2nd, and October 5th. The weather on September 30th was clear, and October 1st brought some heavy rain. The weather on the first observation day was overcast, about 68 degrees Fahrenheit at 8:15 A.M. Our second observation day had some scattered clouds, and was breezy at 50 degrees, at 8:15 A.M. Two days prior to the 5th, it was warm and overcast, and the 4th was warm and rainy. On the first day that we observed the creek, October 2nd, we noted the water temperature (50 degrees), the relative flow (high), the sediment deposits (mostly sand), the water appearance (tea-colored and muddy), the algal growth (0-25%), and the overhead canopy (25-50%). We also took note

of the streambank characteristics: we observed that 10% of the left bank consisted of shrubs, 65% grass, and 25% hardwood. There was no apparent softwood. The right bank of the stream consisted of 15% shrubs, 40% grass, 405 hardwood, and 5% unvegetated area (the road). On October 2nd, we also noted that the stream appeared to be slightly channelized (due to the bridge over it and some seemingly placed rocks). We determined that there was not a wastewater treatment facility upstream, and saw 2 pipes by the bridge but it was unclear whether or not they were discharging anything into the water because they were completely submerged. Characterizing the setting, we noted scattered residential area as dominant, while roadless wooded area, wooded area with roads, cropland, grazed pasture, and ungrazed meadow were also present.

On the second observation day, October 5th, we measured the average width of the stream (56.5 feet), the average depth (26.33 inches), and the average velocity (3.99 ft/s). We also observed the substrate composition, which we determined to be 5% rubble, 20% gravel, and 75% sand. We concluded that the embeddedness was about 25-50%. We also noted that the water appeared to be approximately 6 inches lower, with more fallen leaves, than 3 days prior. The pipes became visible; there were actually three of them, but it was still unclear whether they were depositing any waste or chemicals into the stream.

Chemical Analysis

Phosphates

It is important to test for phosphorus because it is an essential nutrient for plants; accumulation of phosphorus and other nutrients can cause eutrophication. Our stream

ecology class used the LaMotte Kit 3121-01 to test for phosphates. It was tested on October 25th. The results from the test showed no signs of phosphates; there could have been an error in testing or in the kit itself, seeing as this is an abnormal result. (The amount in the water could also have been so small that it was difficult to detect any change in the water color during the test). There are no NY state regulations for phosphates because they pose no serious threat, even at high concentrations. The either nonexistent or very low levels of phosphates present in the Kinderhook suggest that there are only natural sources of phosphate (soil, rocks, animal waste, decomposing plants), and not very many pollution sources of phosphate (detergent, human waste, fertilizer).

Nitrates

Testing for nitrates is necessary in the monitoring of the health of a stream because excessively high levels can be harmful and even fatal to the biology, and very low levels can inhibit the growth of helpful nearby plants that filter runoff into the stream. The LaMotte 3304 Nitrates Test Kit was used to test for Nitrates on October 25th in the Stream Ecology class. The results for the shallow bank, deep center, and fast-moving parts of the stream were all equal at .05 mg/L. This is a consistently low level, both harmless and enough to support the biology of the creek.

Alkalinity & pH

Alkalinity acts as a defense system for bodies of water against acid. High alkalinity is more desirable because it indicates that a stream is highly capable of neutralizing any added acid. The pH of a stream is a measurement of how acidic of basic

the water is. It is important because if a stream is too acidic, the fish become ill and die. A healthy range for alkalinity is anything high, above 35 mg/L. A healthy pH range is anything between 4 and 8, with 6-7 being ideal. Using LaMotte kit 4491 for alkalinity and kit p3100 for pH, we collected the results on October 25th. The alkalinity of the Kinderhook was 50 mg/L, which is in the mid-range, indicating a strong buffer against acid. The pH of the Kinderhook came out to be 8.1, only very slightly higher than the healthy range. Despite the slightly basic water of the stream, its pH is fairly healthy for fish.

Dissolved Oxygen

The lives of fish (and, consequentially, organisms that are dependent on them) depend on the levels of DO in a stream. DO can also be an indicator of pollution sources and natural changes in the environment. Using LaMotte Dissolved Oxygen Kit 5860, we obtained two results of the Kinderhook creek's DO. The first came out to be 17 mg/L, clearly the result of error, seeing as this is an impossible result. The second came out as 11 mg/L, a more feasible result. 11 mg/L is within the range for healthy DO (5-11, according to NYSDEC Standards). It is also very high, which indicates that the stream is ideal for many types of fish and for recreational fishing.

Turbidity & Temperature

Turbidity is a measurement of suspended particles in water. Too much fine sediment can clog the gills of fish; in slow-moving water, the sediments can settle, cover, and smother macro-invertebrates and fish eggs. The particles can also carry pollutants or harmful

bacteria. No results were obtained through testing for turbidity, so the turbidity levels were estimated to be between 5 and 10 NTU's. Temperature is important to the stream's health if it is suddenly changed from a very low temperature to a very high one or vice versa. The shock is harmful to fish and plants; however, such a sudden change is usually caused by human interference. The Kinderhook is fairly consistently 50 degrees Fahrenheit. There are no NYSDEC regulations for turbidity, but the temperature of a class C stream should be no higher than approximately 70 degrees, and our measurements showed that the creek was well below this standard.

Biological Assessment

Benthic macroinvertebrates, or BMIs, are a vital part of the Kinderhook Creek. These small creatures help us to know the condition of the creek; they are also very important to the life of the fish living within the stream. BMIs are crucial to the overall "flow" of the stream, for they are at the bottom of the food chain, supplying everything above them with energy. Even when they die, they decay and support other aquatic life with nutrients.

Because BMIs aren't able to move themselves as other animals, it is much easier to observe them. They are not capable of escaping the pollutants in the sediment. This allows us to obtain reliable information on the quality of the water. These invertebrates stay in the stream for years. For example, the dragonfly can live a life underwater for 7 years before flapping its week in air. The presence or absence of certain BMIs enable us to determine any changes in the quality of the stream.

Kinderhook Creek Bioassessment
Fall 2006

In order to collect benthic macro invertebrates, you need a net that's 18"x8" with 500-600 micron mesh. For five minutes, someone needs to be holding the net while another person upstream kicks up dirt/sediments/BMI's, which will be caught in the net.

As a class, we collected BMI's in 1ft deep water containing large rocks in substrate. We identified 100 organisms. Finding certain organisms indicate that the water is healthy, certain BMI's like mayflies, stoneflies and caddisflies. We found the biotic index score to be 2.09, which indicates that the stream is in the non-impacted range.

Orders and Species Found	Amount Found
Trichoptera (caddisfly)	**17**
Fingernet Caddisfly	1
Net-spinner Caddisfly	1
Casemaker Caddisfly	6
Net Tube Caddisfly	9
Ephmeroptera (mayfly)	**77**
Common Burrower Mayfly	1
Ameletide Minnow Mayfly	1
Spiny Crawler Mayfly	1
Flathead Mayfly	16
Small Minnow Mayfly	58
Odonata (dragonfly)	**1**
Dragonfly Nymph	1
Plecoptera (stonefly)	**2**

Golden Stonefly Nymph	2

Our taxa richness was found to be 8, which we measured by totaling the number of different kinds of macroinvertebrates. The Percent Model Affinity was found to be 56, indicating that the stream is only slightly impacted. We find this number by subtracting the sum of absolute difference x .5 from 100, 100-(+ of absolute – x .5). The organism density was discovered to be 100. Our water being slightly impacted means that the quality of the water is affecting the representation of BMI's in the stream. The Biotic Index Score is 2.09, placing the stream in the non-impacted range. This score indicates that the water is not impacted by any pollutants.

Fecal Coliforms

Fecal coliform is bacteria that is present in the feces of all warm-blooded animals. It is important to find out whether water contains fecal coliform because if it does, that indicates there are diseases causing organisms in the water. Sewage dumping and farmland runoff contribute to higher levels of fecal bacteria in water. This bacteria in water can make people sick; E.coli is an example of such a bacteria that can be fatal. Results showed that there were 2450 colonies in 3 tests; this is an incomplete test because it was not conducted 5 times. The standard for coliforms must meet a mean between 2400-2500 from 5 tests taken in a month.

Kinderhook Creek Bioassessment
Fall 2006

Summary

Physical

The Kinderhook Creek flows into the Hudson River. It is approximately 56.5 feet across, with an average depth of approximately 26.3 inches. It flows at an average velocity of 3.99 ft/s. The Kinderhook Creek is surrounded primarily by vegetation composed of shrubs, grass, and hardwood. The land beyond the vegetation of the streambanks is mostly scattered residential area, with farming area, woods, and roads also in the vicinity.

Chemical

We found little to no phosphates present in the Kinderhook Creek (this result is possibly due to error in testing or expiration of the test kit). We found .05mg/L of nitrates present throughout the Kinderhook Creek, which is very low and therefore healthy. Because only 3 rather than 5 fecal coliform tests were performed, our results are inconsequential to the chemical analysis of the creek. The alkalinity of the Kinderhook is 50 mg/L, indicating a strong ability to fight change due to added acid. The pH came out to be 8.1, a bit on the basic side, but still healthy for fish. The applicable DO level obtained was 11 mg/L, within the naturally occurring range and healthy for trout spawning and fishing, as well as recreation.

Biological

According to our bacteriological tests on Fecal Coliforms, which were incomplete, the Kinderhook Creek appeared to be healthy, but our results are unreliable. The results from

our Benthic Macroinvertebrate analysis revealed the creek's good health, as the water supports a variety and abundance of life, particularly mayflies.

Overall Conclusions

The Kinderhook Creek's immediate surroundings help indicate that it is healthy. It has a large overhead canopy, keeping the water cool (and, therefore, the DO high). Although there are roads very close to the creek, there is dense vegetation helping to filter any runoff and prevent litter from falling into the water. There are several potential non-point sources surrounding the Kinderhook Creek, such as the roads and farms. However, our chemical tests show no signs of consequential pollution in the water. The lack of phosphates in the water indicates good health, as does the consistently low nitrates level. The mid-range alkalinity acts as a strong buffer against acid, and although the water is slightly basic, it is still very close to the healthy range (4-8) of pH. The creek's cold temperature and high DO also indicate that the water is healthy.

Suggestions

For future analyses, taking note of litter and cleaning it up would certainly improve the creek's health. Educating people who use the creek for fishing about the water's current health conditions and letting them know how they can contribute positively could also improve the health of the Kinderhook Creek. It would also be beneficial to continue regular testing of the site, and perhaps broaden our parameters to include other sections of the creek in a bioassessment.

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