Kinderhook Creek Bioassessment 2005

Stream Ecology
Darrow School
Mr. Kleyman
Rachel Keyes
Juliun Sessa
Sadé Strachan
Dean Felmly
Sam Nevin
Annie Han
Sam Bunin
Katie Medders
Augustus Hilmer
Viviany Pena

Background Information

The Kinderhook Creek is a 4th order, class C trout spawning stream. Its headwaters are a marsh near an elementary school in upstate New York and it feeds into the Hudson River. It is a government stocked trout spawning stream and is valued by the community as a fishing stream. During a drive up along the creek to the borders of the Kinderhook Creek's watershed the stream ecology class of 2005 discovered these potential impacts: many farms surround the stream posing a possible source of nitrates and phosphates. Some houses were spotted right on the stream side that could be possible threats for fecal contamination. There was one logging sight and there was a small town that the stream ran right through. Several bridges could have altered the stream bed. We did not see any real point source threats. All of the possible threats were non-point source. Darrow school has been testing the Adams Crossing sight at the Kinderhook Creek for 7 years. Our purpose is to contribute to the NYS DECs monitoring of the Hudson River Basin by observing the physical, chemical and biological parameters of the Kinderhook Creek. The majority of testing occurred in October and November of 2005.

Physical Assessment

On two different occasions (October 19th and October 27th) Mr. Kleyman's Stream Ecology Class of 2005 took down these results. Both Days were cloudy with no precipitation and a water temperature of 11.05 (Oct. 19th) and 6.9 (Oct. 27th) degrees Celsius respectively. Prior to the testing there was one week of flood conditions and two days had gone by since a light snow of about 2-3 inches respectively.

On October 27th, the height of the water was about one to two feet higher than the last visit and with a velocity of 0.73 meters/second. The turbidity of the stream was no

greater than the regular conditions. The water was similar to its usual shade, a tea brown. There was no trace of an oily film, grease or globules. There was no more algae or weed growth than usual although the water was too high to determine for certain.

The stream was running fast with a well developed riffle as wide as the stream as well as two times the stream's width long. There were a variety of flow patterns including slow, deep and fast, shallow and fast, deep and slow and shallow. There is hardly any channel alteration such as dredging, dams, or abutments but there is a car bridge just past the testing site. The riparian vegetation zone is about 12-35 yards and is covered mostly by mature trees and vegetation growing naturally with no sign of unnatural alteration. Around the stream there is minimal litter and any litter found is removed by the class. Over all, the stream habitat rates an excellent to good.

Chemical Assessment

Temperature

Temperature is important when testing the health of the creek because it affects the rate of many of the stream's biological and chemical processes and the amount of oxygen gas that can dissolve in the water. Many organisms in the stream have a range of temperature that is optimal for its health. The temperature was taken from an alcohol-filled thermometers, it was measured in degrees Celsius. The NYS DEC standard for the temperature for a class C (TS) stream can not go over 21.1 degrees Celsius. The result of the temperature taken on Oct. 19th was 11.1 degrees Celsius and its replicate was 11 degrees Celsius to have an average of 11.05 degrees Celsius. These results meet the standard for the stream. The second test was taken on Oct. 27th. The temperature was 6.8

degrees Celsius. The temperature was only measured once for that day. This test result also meets the standard for the stream.

pH

pH is the measure of the acidity of a solution. It is important to test because it affects many chemical and biological processes in the water and organisms have a pH range that is optimal for growth. More specifically reproduction of fish can be impacted when pH is out of range, death can also occur. pH is measured by pH units on a scale of 0-14, with zero being the most acidic and 14 being the most basic. The pH tests were done with the Lamotte test kit #2118. Only one test was completed on Oct. 19th with the pH of 7. The NYS DEC standard for pH of a class C (TS) stream states that it should not be less than 6.5 or more than 8.5. Our result of the test meets the standard for the stream.

Alkalinity

Alkalinity is important when testing stream health because it protects against pH changes from acid inputs and thus affects the waters' ability to support life. Alkalinity is a measurement of the capacity of a number of compounds in the river to neutralize the input of acid by reacting with hydrogen ions. It is measured as mg/L of calcium carbonate. The Lamotte test kit #2118 was used in testing the alkalinity. The data collected on Oct. 19th was 50 mg/L. for the first test, the replicate was 44 mg/L, and the average was 47 mg/L. Only one test was taken for Oct. 27th; 24 mg/L. Results that should be expected in a stream when testing for alkalinity is natural range between 1-150 mg/L. A result of greater than 20 mg/L is non-sensitive, 10-20 mg/L is sensitive, 5-10 mg/L is highly sensitive, and 2-5 mg/L is endangered. Our stream is non-sensitive.

Dissolved Oxygen

Dissolved oxygen is the presence of oxygen gas molecules in the water. It is important in testing because aquatic organisms need a certain amount of oxygen to survive. "Waters of consistently high DO are generally considered healthy ecosystems, capable of supporting many different kinds of aquatic organisms." (Behar, p.93) The Lamotte test kit #5860 was used in testing the DO. Dissolved oxygen is measured in mg/L. The test result of DO from Oct 19th was 8.5 mg/L. The result from test two on Oct. 27th was 11.2 mg/L. The NYS DEC standard for dissolved oxygen for a class C(TS) stream must be greater than 7.0 mg/L. Our tests results meet the standard for dissolve oxygen of a class C (TS) stream.

Nitrate

"Nitrate is a form of nitrogen that is an important nutrient for plants and animals as the building block to make protein. Excess nitrates can cause a great increase in plant growth and affect the health of aquatic animals." (Behar, p.145) Nitrates in streams causes eutrophication, a process by which large algae blooms cause a dramatic reduction in dissolved oxygen. Nitrates are measured by mg/L. The Lamotte test kit #3354 was used in testing nitrates in the stream. The test results for Oct. 19th was <1 mg/l for the first test and the replicate <1 mg/l. On Oct. 27th the result was < 1 mg/l. The regulation for nitrates states that "there should be none in amounts that will result in growths of algae, weeds, and slimes that will impair the waters for their best usages." The natural levels of nitrates are typically low (less than 1 mg/L.). Based on observation the results the Kinderhook Creek meet the standards for nitrate levels.

Phosphorus

Phosphorus is important to test because it is a crucial element for plant growth and animals. If there is too much phosphorus in the water it can lead to rapid production of algae or an algae bloom. Phosphorus is measured in mg/L. The two testing kits for phosphorus is one for high concentration for levels of 1 mg/L to 5 mg/L and one for low concentration for levels of 0 mg/L to 1 mg/L. Both high and low range testing kits were used (Lamotte kit #3121-01). The NYS DEC regulations on phosphorus for class C (TS) streams state that there can not be enough phosphorus in the stream to have any negative affects. The test results from Oct. 19th were <1 ppm for high range test and the replicate was also <1 ppm for high range test. The result for Oct. 27th for the low range test was <0.1 ppm. These results meet the regulations for phosphorus of a class C (TS) stream.

Turbidity

Turbidity is a measurement for the amount of light able to pass through water which determines its clarity. It is important to test because turbidity causes higher water temperatures, which affect stream life. The warmer the water the less dissolved oxygen. The Lamotte testing kit model TTM #7519 was used in testing turbidity. The test results taken from Oct. 19th was 20 JTU for the first test, the replicate was 10 JTU and the average was 15 JTU. The result from Oct. 27th was < 1. Standard and regulations were not gathered for turbidity.

Biological Assessment

Macro invertebrates are ecologically important because they are an imperative part of the food chain, especially for fish. Many invertebrates feed on algae and bacteria,

which are known to be on the lower end of the food chain. Because of their abundance and position in the aquatic food chain, macro invertebrates play a critical role in the natural flow of energy and nutrients. When they die they decay and leave behind nutrients that are reused by different aquatic plants and animals. The importance of monitoring for benthic macro invertebrates is to help understand the heath of our stream. Benthic macro invertebrates do not move around as much as other animals so they are less able to escape the effects of sediment and other pollutants that diminish water quality. For that reason, benthics can give us reliable information on stream water quality. Because many macro invertebrates live in the stream for many years, their presence or absence provides valuable information about a river's health over a period of time. Their life cycles allow studies to determine any possible decline in environmental quality. To collect benthic macro invertebrates you must have an 18”X 8”net with a 500-600 micron mesh. One person will be holding the net while the other person stands in front of it and kicks sediments from the bottom so they will enter the net. This will be performed for five minutes and will continue to move across the stream on a 10-15 meter transect, to obtain a diverse sample. After collecting the sample you use a magnifying lens to find any living or dead insect. Then using a dichotomous key we can conclude what order (Tier 1, 2) and family (Tier 3) are represented.

BMI Table:

Our stream ecology class collected a 50 organism sample. We multiplied it by 2 to get our values, so that they could be based on a 100 organism sample.

Trichoptera(caddisfly)	Total # in each family	**Ephmeroptera(mayfly)**	Total # in each family
Hydroptilidae	1	Heptageniidae	14
Brachycentridae	2	Isonychiidae	10
Rhyacophilidae	3	Baetidae	3
Hydropsychidae	1		
Coleoptera(beetle)	Total # in each family	**Odonata(dragonfly)**	Total # in each family
Elmidae	8	Gomphidae	1
Psepuenidae	1	Corduliidae	1
Plecoptera(stonefly)	Total # in each family	**Diptera**	Total # in each family
Peclidae	3	Tipulidae	1
		Chironomidae	1

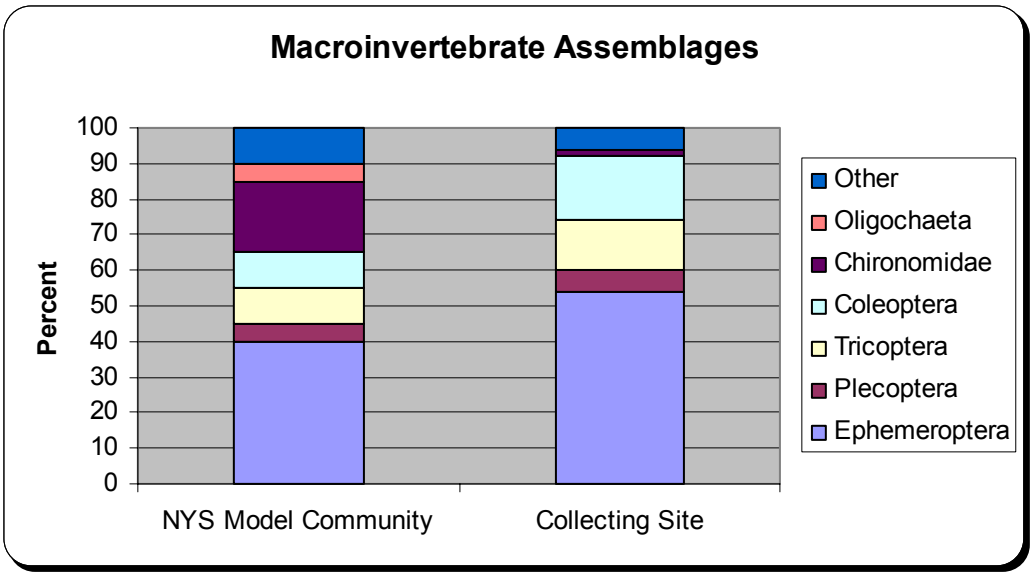
Family richness is the number of macro invertebrate families that are found when a kick sample is taken. Our results from our sample were 14 families which from the expected ranges for New York state streams is non- impacted.

Family EPT richness shows that if certain organisms are present like mayflies, stoneflies and caddisflies than it is a good indicator that our streams water is clean and good quality. Our results and calculated data for this were 8, which is non-impacted, translating to very good water quality.

The family biotic index is the measurements of the tolerance that organism have in a sample to organic pollution including sewage and animal waste. It also determines the tolerance these organisms have to low DO levels. This is calculated by multiplying the number of organisms in each family by tolerance level, adding these products and then

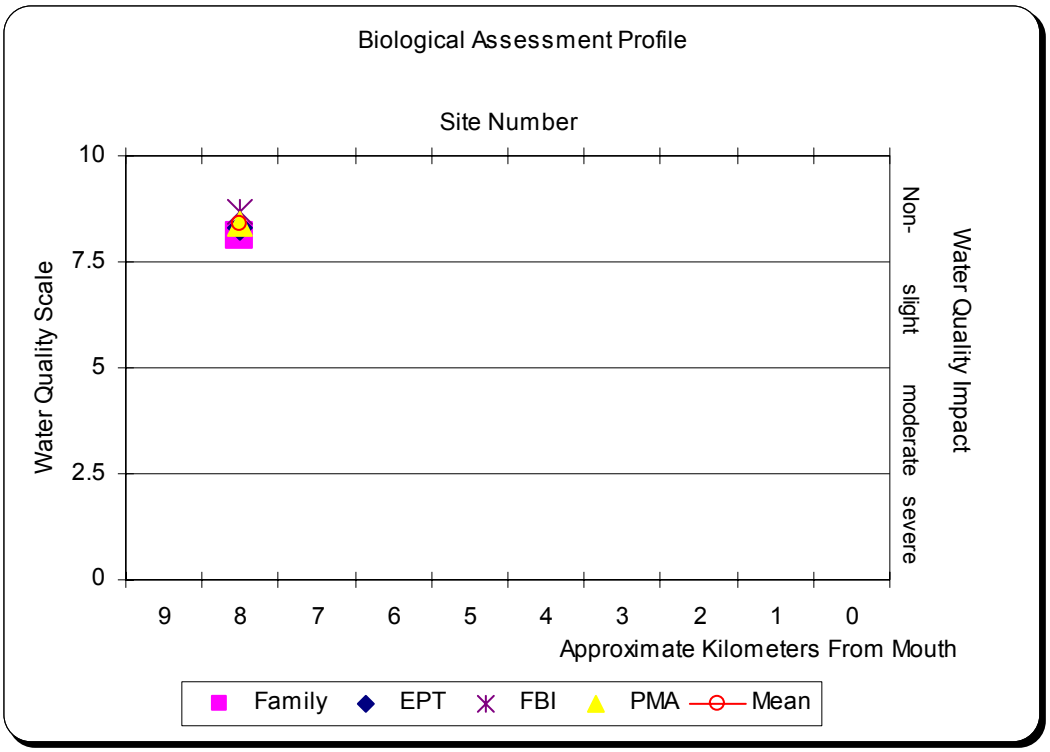
dividing by the total number of organisms. Tolerance is judged on a scale of 0-10, 10 being tolerant and 0 being intolerant. Our calculated results were 3.34, which is non-impacted as well.

Percent Model Affinity is the measure of similarity to non-impacted communities based on the percent abundance in 7 major groups, the similarity to a certain community of organisms. 73% was our class calculations and this also shows that the Kinderhook creek is a non-impacted stream.



Non- impacted means that our stream has very good water quality where the community is diverse, and mayflies, stoneflies and caddisflies are well represented.

Biological Assessment Profile



E-Coli and Total Coliforms

Coliforms are usually known as the bacteria found in the intestinal tract of warm-blooded animals and are used as indicators of fecal contamination in water. It is important to test for this because if it is present in the stream it can limit the use of the stream for contact recreation. People cannot come in contact with contaminated water because it can severely affect their health. E-Coli are a subset of total coliforms and are found in animal and human intestines. Most E-coli is not harmful but some strains can be pathogenic. For E-Coli there is no NY DEC standard, but it is testing is recommended because of possible health risks of water for recreation. For coliforms the state says that monthly median value and more than 20 percent of the values, from a minimum of five

examinations shall not exceed 2,400-5,000. From the samples that the stream ecology class took we can see that the total coliforms based on either 1mL or 5mL samples were as follows:

Date	1 mL sample	5 mL sample
10/19	2,600 colonies per 100 ml	940 colonies per 100 ml (sample not done correctly)
10/27	Not taken	2,760 colonies per 100 ml
11/2	4,300 colonies per 100 ml	2,040 colonies per 100 ml

According to our gathered results it will be important to go to the stream and test again.

Summary of Study Results

Physical

We completed most of the physical survey, however the water level was too high to safely measure the width and depth of some parts of the stream. In addition, we were unable to assess cobble embedeness. Overall, our stream had good to excellent physical characteristics.

Chemical

We tested for pH, alkalinity, dissolved oxygen, turbidity, temperature, nitrates, and phosphates. We tested on two different occasions, October 19 and 27, and all results were within New York state standards.

Biological

Family richness was calculated as 14, indicating non-impacted. EPT richness was calculated as 8, indicating non-impacted. Percent model affinity was calculated as 73%, indicating non-impacted. The Family Biotic Index was calculated as 3.34, indicating non-impacted. The overall Biological Assessment Profile indicated that our stream is non-impacted.

Bacteriological

We did not collect the necessary five samples to determine the monthly mean of total colliforms. Therefore, we cannot state whether our stream meets New York state bacteriological standards. However, many of our values over the three days of testing were over the New York state standard.

Conclusions

Overall, we believe our stream is healthy. Based on biological, physical and chemical data we have determined that our stream is suited for its intended purposes. All of our data suggests that the Kinderhook Creek at Adams Crossing is adequate for Trout Spawning. The total coliforms are potentially above NYSDEC standards. This high level of coliform may be due to the surrounding land use, specifically agriculture and grazing. This could be due to heavy rain prior to and during water collection samples. This is a potential non-point source impact to our stream. But we do not see an affect on the biology of the stream. So, overall our stream is healthy.

Suggestions

1. Test when it is not raining.
2. Complete the total coliform testing, and do five samples in one month.
3. Collect and identify a complete 100 specimen sub-sample to determine biological assessment.
4. Overall, test more often.