A Bioassessment of the Kinderhook Creek

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Background

The Kinderhook Creek is a class C 4^{th} order stream located in upstate New York. It eventually flows into the Hudson River; however the concentrated area that the 2007 Darrow stream ecology class will be closely observing is located at Adam's Crossing. The following information was gathered during numerous trips around the Kinderhook Creek watershed and the stream itself.

The watershed surrounding the Kinderhook Creek is relatively equally divided amongst farmland, woodlands, recreational/ residential areas.

Roughly one third of the land is reserved for farming. There are more open haying fields and cornfields in the area than there are actual livestock, implying that agriculture takes precedence over the raising of farm animals. Farms that concentrate solely on crops are less likely to produce as much organic waste, hence, the odds of animal manure polluting the water are relatively low.

Another third of the land is vast woodland and forest: areas that are less populated and less likely to foster pollutants that could potentially affect the stream. Generally these wooded areas are divided by roads and a few scattered residences, however on the whole they undergo more wildlife than human interaction. These areas potentially attract scattered wildlife enthusiasts and hikers but not in high numbers.

One sixth of the land is dedicated to recreational areas and roads. The resort Jiminy Peak warrants mention as a semi-large recreational area and the odds are that because of the traffic that passes through pollution and human interaction could affect the Kinderhook Creek. Although the land is not rampant with roads there certainly are enough of them to help compose a sixth of the total land.

The last sixth of the land is residential areas- a compiled estimation of the scattered houses alongside the roads surrounding the Kinderhook Creek.

Physical Assessment

The following information was compiled on September 28th and October 2nd, 2007.

Both days reserved for the physical survey at the Kinderhook Creek were cloudy and relatively warm, averaging at 20 degrees Celsius. The estimated elevation of the site location at Adam's Crossing location is 180 feet. Several odors described as "fish-like" wafted around the location however the water itself is clear with the exception of an estimated 25% of algae.

The water temperature on average is 18 degrees Celsius, only two degrees lower than the air temperature. The width of the stream is roughly 70 centimeters with an average depth of 31 inches, 40 at its deepest and 19 at its most shallow. A floating apparatus took .67 seconds to travel 10 feet in the stream when the flow was average. The bottom of the stream is dotted with scattered sedimentary deposits although not enough to obstruct the flow of water. The streambed is composed of approximately 5% bedrock, 5% boulder, 45% rubble, 25% gravel, 10 % sand, 5% silt, and another 5% of organic debris. Nearly 75% of the sediment is embedded in the creek bed.

The stream itself curves around its banks but never loses its defined shape. The banks on either side are covered by dense foliage. The left upstream bank appears to be covered in roughly 45% of shrubs, 15% grass, 20% hardwood and softwood trees, and a 15% area of unvegetated land. The right upstream bank is nearly identical.

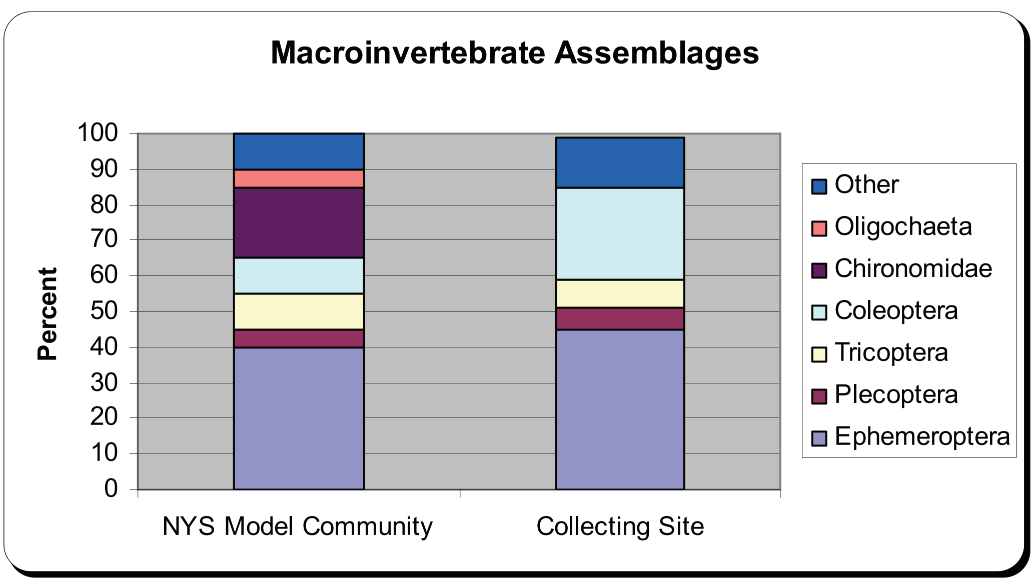
Biological Assessment

Benthic macroinvertebrates play a crucial role in the food chain, serving as prey to fish and predators to other small aquatic life as well as some types of algae and bacteria. The nutrients that are absorbed into the ground after the decay of benthic macro invertebrate are also essential to the survival of many aquatic plants.

Benthic macroinvertebrates are also useful clues to examine when studying the water quality of a stream. Because macroinvertebrates are not as physically inclined to move around underwater they are more likely to suffer the effects of any pollutants that might be in the water. Certain species of macroinvertebrates are incapable of living in conditions that are affected by pollution. Absence of certain species of benthic macroinvertebrates within itself can be a major clue as to the amount of pollutants poor water quality.

The methods used for collecting macro invertebrates were sensitive to the particular conditions of the day. The majority of species was collected on a day that the water was relatively still however the samples were collected from fast moving water towards the center of the stream. Two people collected a net full of specimens by facing each other in the water, approximately five feet apart. One person would stir up the contents of the waterbed by kicking and walking towards the net and would do so for a few minutes, or until it was projected that the net would be filled with specimens. The net was emptied into trays and the benthic macroinvertebrates were picked out of the trays and contained in bottles of ethyl alcohol for preservation.

Identifying benthic macroinvertebrates was as simple as inspecting each individual specimen underneath the microscope and matching it with a benthic macro invertebrate order and family. Below is a data table documenting the orders of benthic macroinvertebrates identified.



Benthic Macroinvertebrates in Subsample

Order	Family	#	Order	Family	#
Coleoptera	Elmidae	2	Ephemeroptera	Ephemerellidae	2
Coleoptera	Limnichidae	1	Ephemeroptera	Heptageniidae	2
Coleoptera	Psehenidae	2	Ephemeroptera	Isonychiidae	1
Coleoptera	Ptilodactylidae	1	Ephemeroptera	Leptophlebiidae	1
Crustacea	Amphipoda	1	Ephemeroptera	Metretopodidae	1
Crustacea	Isopoda	1	Ephemeroptera	Polymitarcidae	2
Diptera	Culicidae	1	Ephemeroptera	Potamanthidae	3
Diptera	Ceratopogonidae	1	Ephemeroptera	Siphlonuridae	2
Diptera	Chaoboridae	1	Ephemeroptera	Tricorythidae	2
Diptera	Culicidae	2	Megaloptera	Corydalidae	1
Diptera	Tipulidae	2	Odonata	Anisoptera	1
Emphemeroptera	Baetidae	7	Odonata	Zygoptera	1
Emphemeroptera	Ameletidae	1	Plecoptera	Capniidae	1
Emphemeroptera	Caenidae	1	Plecoptera	Chloroperildae	1

The EPT Richness is a score that is representative of how many specific organisms were recorded to be present within the specimens taken from the site. This estimate is approximately 12, hence it is non-impacted.

The Biotic Index is a scale that gauges the quality of the site by accurately representing how many organisms are present at the site. The Biotix Index Score was approximately 2.9- indicative that the site is non-impacted.

The Taxa Richness is the number of distinct species of benthic macroinvertebrates that are found within a sample. There were approximately 44 distinct species found in the creek sample.

The Percent Model Affinity compares the number of benthic macroinvertebrates found in a typical, non-impacted community with the number of invertebrates gathered at any other particular site. The Percent Model Affinity for the gathered species at the Kinderhook is approximately 23.5. Yet again, it is non-impacted.

Finally, the organism density is exactly 442 with 46 mayflies, 6 stoneflies, 8 caddisflies, 7 midges, and 26 beetles. The benthic macro invertebrate species differ in a healthy spectrum and the water quality in which they dwell is on the whole non-impacted by chemicals or pollutants.

Chemical Assessment

Turbidity is the scientific measurement that is used to determine the murkiness of water. Turbidity increases water temperature, reducing the dissolved oxygen of the water body. This makes it impossible for certain creatures to survive in the ecosystem. It is important to measure turbidity because it can indicate the healthy of a body of water. It can indicate whether or not it is a safe environment. Water temperature affects the dissolved oxygen levels, chemical and biological processes. The optimum temperature is where organisms best function. The Kinderhook Creek is at a healthy 50 STU.

Dissolved oxygen makes up one in five of every air molecule. Dissolved oxygen gets into the water by diffusion from the surrounding air, by aeration, and as a waste product of photosynthesis. Testing for dissolved oxygen can help actuate the types of animals, and organisms that can survive in the water. The Kinderhook Creek is a class C stream where a healthy measurement of dissolved oxygen is approximately 7 mg/l. The Kinderhook is at a healthy 5 mg/l.

Fecal indicator bacteria are common in both warm and cold water. The bacteria is often good for the stream, but some of the bacteria can damage the health of the stream. Pathogenic bacteria can make people sick when they are swimming or drinking the water. Pathogenic bacteria is an indicator of water pollution. There are less than 200 coliforms in the Kinderhook Creek.

Phosphates are nutrients that are essential to plants and animals. An unhealthy phosphate level approaches 0.1 mg/l. The levels in the Kinderhook Creek were equal to or less than this. The data is a maximum of 0.1 mg/l or less. The Kinderhook Creek has healthy phosphate levels.

Nitrates are a form of nitrogen that enter the water through soil, animal waste, the decomposition of plants, sewage, fertilizer, farm waste, and domesticated animals. Nitrates are healthy in small amounts, they can even be beneficial. Only very large amounts of nitrates are harmful. The Kinderhook Creek has a healthy nitrate levels.

Conclusion

In terms of the physical parameters, the Kinderhook Creek came out as healthy. There are some pollutants that can and may affect the stream greatly, but overall, it is a healthy stream physically. Another way that the Kinderhook Creek proved itself to be a healthy stream was by its chemical parameters. When testing the creek, it seemed very healthy through the tests for nitrates, alkalnity, pH, phosphates, dissolved oxygen, fecal indicator bacteria, and turbidity. When testing the biological parameters and components of the Kinderhook Creek, it came out be non-impacted and healthy.

Suggestions for further study

In order to preserve the creek, people should not flow the sewage without filtering, try to make pastures away from the creek, and continue to monitor the creek and prevent the pollution.

Bibliography

Behar, Sharon. Testing the Waters: Chemical and Physical Vital Signs of a River. Montpelier, VT: River Watch Network, 1997.

Mitchel, Mark K. and Stapp, William B. Field Manual for Water Qualit Monitoring: An Environmental Education Program for Schools. Iowa: Kendal/Hunt Publishing Company, 1996.

Oram, Brian. "What are Phosphates?" Accessed November 6, 2007. http://www.water-research.net/Watershed/phosphates.

Water Quality Regulations. New York State: New York State Department of Environmental Conservation, 1999.