

Water Quality Of The Sandsea Kill Stream in Pattersonville, New York
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This research will investigate the health of the Sandsea Kill, which is located in Pattersonville, New York. The Sandsea Kill will be monitored because of its proximity to a dump, with runoff from the dump running into the stream, as well as because it has two roads running over it which also contribute to runoff going into the stream. Different teams will determine the discharge of the stream, the number and types of macroinvertebrates in the stream and their significance, and the amount of various chemicals in the stream, including phosphates, nitrates, dissolved oxygen, alkalinity, and pH. The macroinvertebrate and chemistry information will be combined with the streamflow information to determine how those numbers compare considering the size of the stream. The results should indicate that the stream is healthy. The streamflow results will show that there is more water in the stream in the spring than in the summer, the macroinvertebrate results will show that there is biodiversity throughout the year, and the chemistry tests will show that there are typical amounts of each chemical in the stream. Altogether, this information will show that the stream is healthy, and is not greatly affected by the various types of runoff from the surrounding area.

Theoretical Background

The Sandsea Kill is an extensive stream that runs through Pattersonville as well as Rotterdam Junction. This stream has been tested ever since a dump near the stream was reopened. A moderate amount of runoff from the dump finds its way into the stream, and there was concern that this would have an adverse effect on the stream. For this reason, the stream is tested in two sites. The site above the dump is used as the control with which to compare the site below the dump. Also, there are two bridges over the stream that may add to the runoff going into the stream, as well as introducing foreign objects such as asphalt to the stream. Other foreign objects have also been found there, including a rusty bicycle. The Sandsea Kill is located in New York, and is a part of the Mohawk River watershed. It is classified as a Class C stream, which means that it is able to support aquatic life, as well as fishing and limited recreation.

Results

The Sandsea Kill is a stream that runs through Pattersonville and Rotterdam Junction in upstate New York.

During the September 2002 testing, the discharge above the dump was 0.48 cubic feet per second, and the discharge below the dump was 1.50 cubic feet per second. Above the dump, 200 macroinvertebrates were found, with a cumulative score of 1771, which meant a biotic index value of 88.55, showing that the stream is in excellent condition. Below the dump 577 species were counted, with a cumulative score of 4402, which is a biotic value of 76.3, which translates to good condition. On this date, the EPT value was a 6 both above the dump and below the dump because there were no Trichoptera species present. This means that the stream is slightly impacted. At 29.5% percent dominance, Stonefly nymphs were the dominant species above the dump, while below the dump mites had a 22.9% dominance. These percentages show that the stream was non-impacted. The species richness for the upstream site was 12 species, and it was 14 for the downstream site, showing that the stream was moderately impacted at this time. The index of biotic integrity score showed that the stream is considered 'good'. The chemistry test results were very similar both above and below the dump. For both sites, the pH was 6.5, the nitrates were 0 parts per million, and the phosphate level was 0.1 parts per million. Above the dump the dissolved oxygen levels were 8 parts per million and the alkalinity was 190 parts per million while below the dump the dissolved oxygen was 10 parts per million and the alkalinity was 165 parts per million. Overall, the stream quality at this time ranged between good and excellent for the various tests.

The Sandsea Kill was also tested during October 2002. At this time the discharge was found to be 1.26 cubic feet per above the dump, and 0.881 cubic feet per second below the dump. Above the dump there were 286 macroinvertebrates collected, with a cumulative score of 2372, which came out to a biotic value of 82.9, or excellent condition. Downstream a total of 287 macroinvertebrates were found, with a cumulative score of 2532, which is a biotic index score of 88.2, or excellent. The species richness was 13 species upstream and 10 species downstream, which means that the stream is moderately to severely impacted. The EPT index value was 9 for both upstream and downstream which means that the stream is slightly impacted. The dominant species was the same for both sites as well, it being mites both times, but since the percentages are higher, the stream was moderately impacted at this time. Overall, the index of biotic integrity shows that the stream is good to fair. For the chemistry tests, the alkalinity was the only one that changed between sites; above the dump it was 132 parts per million, and below the dump it was 120 parts per million. The other chemistry test were the same for both sites; the dissolved oxygen level was 8 parts per million, the pH was 8, the phosphate level was 0.1 parts per million, and the nitrate level was 0 parts per million. Overall, the quality of the Sandsea Kill at this time still ranged between good and excellent according to the tests taken.

Discussion

There are multiple tests used to determine the health of the stream, including tests to find the discharge of the stream, its biodiversity, and the chemicals that are found in the stream.

The discharge of the stream is calculated by first measuring the depth of the stream, and then finding the velocity. The amount of water in the stream is significant because it can be compared to the other data to show the significance of the amount of chemicals and the amount of macroinvertebrates in the stream.

The purpose of the macroinvertebrate test is to find out the biotic index of the stream, which can show the biodiversity of the stream. This is done by separating all the macroinvertebrates, and counting the number of individuals in each species, and then working out the total cumulative score according to the values given to each species. These values are determined according to how tolerant an organism is to pollution; the higher the score, the more tolerant they are. According to the biotic index calculated for the Sandsea Kill, the stream is in good to excellent condition because it is very diverse. An EPT value is also calculated. This value is the sum of the number of different types of Ephemeroptera, Plecoptera, and Trichoptera species found in the stream. These orders are used because they are made up of pollution sensitive organisms. Therefore, the more types of species for each order that there are, the higher the EPT value is, and the healthier the stream is. A score of less than 1 means its severely impacted, 2-5 is moderately impacted, 6-10 is slightly impacted, and above 10 would be non-impacted. For the September testing of the stream, there were no species of Trichoptera found, and therefore the EPT value was only 6. However, in October all species for each of the three orders were found. Therefore, for both dates, the stream would be considered slightly impacted. The percent dominant species is calculated to show the diversity of the stream; the lower the percentage of one species, the higher the biodiversity of the stream. Also, the dominant species shows the health of the stream through its biotic value; a dominant species with a high biotic value means that the stream is healthier than it would be for a dominant species with a low biotic value. If the percent dominance of a species is less than 30 it is non-impacted, if it is between 30 and 50 it is moderately impacted, and if it is above 50 it is severely impacted. In September, the dominant species upstream was the stonefly nymph, and the dominant species downstream was the mite, and for each the percentage was low, indicating that the stream was non-impacted. In October the dominant species was the mite for both up and downstream, but the percentages were higher because the stream was moderately impacted, this also meant that there was slightly less biodiversity than there was in September. The biotic value is 10 for both the stonefly nymphs and the mites. These percent dominance values show that the stream is moderately impacted. Overall, when all the data was combined, the health of the stream was determined to be good.

Chemistry tests include determining the amount of phosphates, nitrates, dissolved oxygen, and the pH of the stream. These amounts are then compared to the standard amounts of chemicals in a healthy stream. The optimal amount (for organisms) of dissolved oxygen in the water is 5-6 parts per million. In September, the dissolved oxygen was found to be 8 parts per million upstream, and 10 parts per million downstream. In October both upstream and downstream had levels of 8 parts per million. A pH of about 6.5-8.2 is optimal for organisms, and the Sandsea Kill was found to have a

pH of 6.5 for all sites in September, but there was a pH of 8 at both sites when the stream was tested in October. Although there is no specific numerical standard for phosphates, nitrates, and alkalinity, there are general standards. Low levels of nitrates and phosphates, and a high alkalinity signify a healthy stream. A phosphate level about 0.3 will contribute to eutrophication, and levels of 0.1 and above signify that the stream is impacted. The Sandsea Kill was found to have a phosphate level of 0.1 parts per million at each site on each testing date. Nitrate levels that are 1 part per million or less show that a stream is healthy, and over 10 parts per million means the stream is undrinkable. At all sites on both dates the nitrate level was found to be 0 parts per million. In September, the alkalinity for the Sandsea Kill was 165 parts per million upstream and 190 parts per million downstream. In October the alkalinity was 132 parts per million upstream and 120 parts per million downstream.

Conclusions

According to the data taken, the stream is slightly affected by the presence of sites that will cause runoff to enter the stream. Streamflow data shows that there is a higher discharge in the spring than in the fall. This is due to rain and melting snow in the spring and typically drier conditions in the fall. Using the index of biotic integrity, the macroinvertebrate data showed that the quality of the Sandsea Kill ranges between good and fair. The chemistry tests showed that the stream had typical levels of chemicals in it. Overall, the data showed that the Sandsea Kill was in good condition.

Suggestions

Some suggestions would include adding more sites and more test dates. Only a small section of the stream is tested, and adding more test sites would allow for a more total monitoring of the stream. Also, tests are only taken in the spring and fall of each year. If test dates were added to the summer and winter it would be possible to monitor the health of the stream throughout the year.

Sandsea Kill Upstream
September 26, 2002

Macroinvertebrates

Name	# of individuals	Value	Score
Water Penny	9	10	90
Mite	33	10	330
Crane fly Larva	12	8	94
Dobsonfly	7	10	70
Stonefly	59	10	590
Mayfly	23	10	230
Midge Larva	3	5	15
Aquatic Worm	10	0	0
Beetle Larva	7	8	56
Scud	11	6	66
Water Snipe Fly	2	8	16
Black Fly	1	6	6
Whirligig Beetle	11	8	88
Riffle Beetle	12	10	120
Total	200	_____	1771
1771 / 20.0 = 88.55 biotic index = excellent			
Species Richness = 14 score = 6			

EPT

Mayflies	Stoneflies	Caddisflies	value	Score
3	3	0	6	9

% Dominant Species

Name	# of Individuals	/100=% dominance	Score
Stonefly Nymph	59	29.5%	12

Index of Biotic Integrity: 27

Water Quality: Good

Streamflow

Above Dump: .48 ft³/sec

Chemistry

Dissolved Oxygen (ppm)	pH	Temperature (degrees Celsius)	Alkalinity (ppm)	Phosphates (ppm)	Nitrates (ppm)
8	6.5	5	190	.1	0

Sandsea Kill Downstream
September 26, 2002

Macroinvertebrates

Name	# of individuals	Value	Score
Water Penny	87	10	870
Snail	70	4	280
Mite	132	10	1320
Crane fly Larva	38	8	284
Beetle Larva	18	8	144
Stonefly	40	10	440
Mayfly	26	10	260
Midge Larva	104	4	520
Riffle Beetle	14	10	140
Damselfly Nymph	20	6	120
Dragonfly Nymph	2	6	12
Sowbug	26	2	52
Total	577	—————	4402
4402 / 57.7 = 76.3 biotic index = good			
Species Richness = 12 score = 6			

EPT

Mayflies	Stoneflies	Caddisflies	value	Score
3	3	0	6	9

% Dominant Species

Name	# of Individuals	/100=% dominance	Score
Mites	132	22.9%	12

Index of Biotic Integrity: 27
Water Quality: Good

Streamflow

Below dump: 1.50 ft³/sec

Chemistry

Dissolved Oxygen (ppm)	pH	Temperature (degrees Celsius)	Alkalinity (ppm)	Phosphates (ppm)	Nitrates (ppm)
10	6.5	5	165	.1	0

Sandsea Kill Upstream
October 3, 2002

Macroinvertebrates

Name	# of individuals	Value	Score
Water Penny	3	10	30
Snail	6	4	24
Mayfly Nymph	15	10	150
Dobsonfly	1	6	6
Caddisfly larva	2	10	20
Dragonfly Larva	5	6	30
Mites	143	10	1430
Riffle Beetle	11	10	110
Midge larva	60	5	300
Cray fish	2	6	12
Crane fly Larva	25	8	200
Stonefly larva	6	10	60
Aquatic Worms	6	0	0
Total	286	—————	2372
2372 / 28.6 = 82.9 biotic index = excellent			
Species Richness = 13 score = 6			

EPT

Mayflies	Stoneflies	Caddisflies	value	Score
3	3	3	9	9

% Dominant Species

Name	# of Individuals	/100=% dominance	Score
Mites	143	50%	8

Index of Biotic Integrity: 23

Water Quality: Good

Streamflow

Above Dump: 1.26 ft³/sec

Chemistry

Dissolved Oxygen (ppm)	pH	Temperature (degrees Celsius)	Alkalinity (ppm)	Phosphates (ppm)	Nitrates (ppm)
8	8.0	———	132	.1	0

Sandsea Kill Downstream
October 3, 2002

Macroinvertebrates

Name	# of individuals	Value	Score
Water Penny	8	10	80
Mite	117	10	1170
Crane fly Larva	11	8	88
May fly Larva	54	10	540
Stonefly Larva	32	10	320
Snails	7	4	28
Caddisfly Larva	4	10	40
Midge Larva	50	5	250
Aquatic Worm	3	2	6
Aquatic Sowbug	1	10	10
Total	287	—————	2532
2532 /28.7 = 88.2 biotic index = excellent			
Species Richness = 10 score = 3			

EPT

Mayflies	Stoneflies	Caddisflies	value	Score
3	3	3	9	9

% Dominant Species

Name	# of Individuals	/100=% dominance	Score
Mites	117	40.8%	8

Index of Biotic Integrity: 20

Water Quality: Fair

Streamflow

Above: .881 ft³/sec

Chemistry

Dissolved Oxygen (ppm)	pH	Temperature (degrees Celsius)	Alkalinity (ppm)	Phosphates (ppm)	Nitrates (ppm)
8	8.0	_____	120	.1	0

Streamflow

Materials:

- ~ Compass
- ~ Thermometer
- ~ Stopwatch
- ~ Measuring string
- ~ Yard stick
- ~ Recording sheets
- ~ Stick
- ~ Sling psychrometer
- ~ Sketching equipment
- ~ Pencil

Procedures:

- 1.) Measure 10 ft on either side of stream using measuring string
- 2.) Use yard stick to measure depth of stream at 1 ft (or 1 inch) intervals
- 3.) Repeat on opposite end of cross-section and record data
- 4.) Split stream into sections (A,B,C)
- 5.) Drop stick upstream and measure amount of time it takes to travel downstream
- 6.) Repeat three times in each section
- 7.) Record data
- 8.) Calculate velocity and discharge
- 9.) Fill out stream characteristic sheet
 - ~ Determine direction of wind
 - ~ Determine temp of water
 - ~ Sketch stream environment
 - ~ Measure humidity and dew point

Chemistry

Materials:

- ~ Chemistry kits for each test (D.O., pH, alkalinity, phosphates, nitrates)
- ~ Water container
- ~ Stream observation sheet
- ~ Thermometer
- ~ Sling psychrometer
- ~ Pencil
- ~ Data recording sheet

Procedures:

Standard procedures for the dissolved oxygen, pH, alkalinity, phosphates, and nitrates tests were followed according to the LaMotte Chemistry Test Kits.

Macro

Materials:

- ~ 1 net
- ~ 12 jars with lids
- ~ Spoons
- ~ 4 trays
- ~ Pipettes
- ~ Pencil
- ~ Stopwatch
- ~ Gloves
- ~ Petri dishes (several)
- ~ Funnel
- ~ Masking tape

Procedures:

Standard procedures were followed for macroinvertebrate testing according to the “Guide to Macro Sampling” by the River Watch Network. These procedures included three one-minute kicks per site. The organisms were categorized back at school.