The Effect of Storm Drain Run-off on Total Aerobic and Coliform Bacteria Blooms in Cottonwood Creek, Wasilla, AK

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Experiential Discoveries EDGE in Geoscience Education

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Introduction

•We decided to do our project on the water quality of Cottonwood Creek because we are worried about our stream. The creek connects most of the recreational lakes in the area and we want to keep the water safe.

•The Alaska Department of Environmental Conservation (DEC) has received numerous complaints about foam in Cottonwood Creek and its tributary Dry Creek. Citizens living along the stream below Wasilla Lake have noticed large accumulations of foam. Upon investigation, DEC staff documented a large foam accumulation. Water samples also revealed fecal coliform concentrations of near 500/100ml near the old Matanuska Road Bridge. DEC staff also observed large foam accumulations in Dry Creek, upstream from most human development. The Wasilla Soil and Water Conservation
•District has observed foam throughout the stream. The Alaska Department of Fish and Game (ADFG) found dead and dying sockeye salmon smolt with eroded fins in the weir at the outlet of Wasilla Lake in May of 2001 . The smolt pathological report indicated that the most probable cause of mortality was a ciliated protozoan (*Apiosoma).* The report states that the protozoan is found in freshwater with high organic content. The dead fish may or may not be related to the presence of foam. Due to the sum of all reports and observations, Cottonwood Creek has been Section 303(d) (Federal Clean Water Act) listed by the DEC for non-attainment of the State's residues standard for foam and debris. (ARRI, 2005)

•After doing a little background research on Cottonwood Creek, we contacted Gay and Jeff Davis at ARRI, wondering what problem we could investigate on Cottonwood Creek for our EDGE project. They suggested that we find out where storm drains are located along the creek and how that is related to storm events and coliform bacteria blooms.

Question

Is there a difference in the amount of total aerobic and coliform bacteria after storm events near storm drains on Cottonwood Creek?

Background Information

- Cottonwood Creek is located within Wasilla, Alaska. It arises from springs located between the Little Susitna and Wasilla Creek drainages .The creek is composed of two first order tributaries: Cottonwood Creek which flows into Cornelius Lake to the east and Dry Creek which flows out of Anderson Lake to the west. Both streams flow into Neklason Lake and Cottonwood Creek emerges as a second order stream. The creek then connects Finger Lake, Cottonwood Lake and Wasilla Lake. The creek finally empties into the Knik Arm of the Cook Inlet. The total length of all stream segments is 16.6 miles. (Figure 1)
- Fecal coliform bacteria is a good indicator of contamination in water bodies. The coliform group is the most widely used microbial indicator of water quality. It is defined as the aerobic and facultative anaerobic, Gram-negative, non-spore-forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35 degrees C (Brock, 1986). Most coliforms are found naturally in the intestines of humans and warm-blooded animals and are usually non-pathogenic. They are a good indicator of water quality because if they are found in the water, the water has likely received fecal contamination and is likely to be unsafe.
- There are many previous studies in this field. The Aquatic Restoration and Research Institute (ARRI) has been doing studies on Cottonwood Creek since 2003. Their results showed that Cottonwood Creek is an impaired water body due to the presence of foam. Also, the amount of fecal coliform bacteria exceeds the State Wide Standards and they are developing a recovery plan.

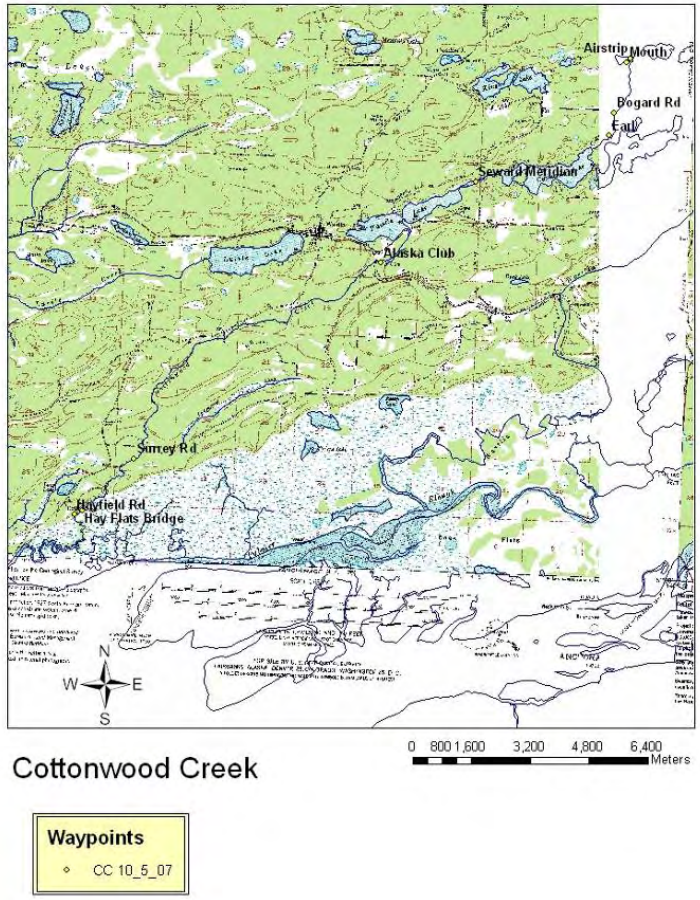

Figure 1

Background Information, cont'd

- According to studies by ARRI, is was determined that foam can be caused by the human input of surfactants or detergents. The development of foam in streams also can occur naturally and can be the result of reduced water surface tension caused by organic matter released from decaying algae or other organics. Aeration occurs through physical processes. Foam development in Cottonwood Creek also could be influenced by organic input from septic systems located along the stream. This hypothesis would also provide an explanation for the abundance of the protozoan seen on fish. Private residents living along the creek downstream of Wasilla Lake also have complained about the abundance of mats of growths occurring on the stream substrate. This could be growths of *Sphaerotilus,* also known as "sewage fungus" which is an iron-oxidizing bacteria known to occur at locations of high organic matter. (ARRI, 2005)

Hypothesis

There will be a significant difference in the amount of total aerobic and coliform bacteria in Cottonwood Creek after storm events compared to non-storm weather. There will be a significant difference in the amount of total aerobic and coliform bacteria after storm events in sites near storm drain compared to sites farther away from storm drains.

Materials and methods

- We will collect water samples at least once a month from five sites along Cottonwood Creek in Wasilla, Alaska. The first site is on Earl Road where Cottonwood Creek runs into Finger Lake. The second site, “Duck Pond”, is at the outlet of Cottonwood Creek from Wasilla Lake. The next site is where Cottonwood Creek runs through the Creekside Plaza parking lot near the Alaska Club. Our fourth site is half a mile down Edlund road. The last site is on Surrey Road. We will monitor these five sites at least once a month for aerobic and coliform bacteria. We will also do water quality testing for alkalinity, ammonia, dissolved oxygen, pH, hardness, nitrate, and phosphate. We also will measure temperature and depth of the water and the air temperature and monitor for foam accumulations.
- The samples for everything except dissolved oxygen will be collected with glass jars (one jar per sample site). To test the water samples for alkalinity, ammonia, pH, hardness, nitrate, and phosphate we will use LaMotte water quality test kits. To test for aerobic and coliform bacteria we will use Hach paddle testers. To measure the bacteria we will dip a double-sided paddle in the water sample, one side measures total aerobic bacteria and the other total coliform bacteria. We will incubate the paddles for 48 hours at 37°C, we then count the colonies on each side of the paddle. Dissolved oxygen samples will be collected in air tight sample bottles that are sealed underwater. The method we will use is called the Winkler Method using LaMotte D.O. test kits where we will fix the samples and then we will titrate each sample to find the amount of D.O. in mgOxygen/L. We will also use data that has been collected by agencies that have been monitoring Cottonwood Creek prior to our project when we do our data analysis. We will collect data for storm drain locations by taking gps waypoints and plotting them on a map. We also have taken gps waypoints for several sites along Cottonwood Creek, including our five sample sites.

Data

10/28/07

Water Samples Taken 10/28/07	Duck Pond	Alaska Club	Edlund Road	Surrey Road	Earl Road
Alkalinity	200	240	200	200	240
Ammonia	0	0.5	0.5	0	0
Dissolved Oxygen	9.2	10.3	12.0	11.1	10.6
% Saturation D.O.	69%	76%	83%	80%	74%
pH wide range	8.5	8.5	8	8.5	8
Hardness	160	160	160	160	160
Nitrate	0	0	0	0	0
Phosphate	1	0.5	0.5	0.5	1.5
Water Temperature °C	3.9	3.3	3.0	3.7	2.0
Air Temperature °C	4.3	2.3	4.4	4.1	4.2
Coliform Bacteria	1	2	3	4	0
Total Aerobic Bacteria	2	6	11	12	4

Data

11/2/07

Water Samples Taken 11/2/07	Duck Pond	Alaska Club	Edlund Road	Surrey Road	Earl Road
Alkalinity	200	200	200	200	200
Ammonia	0	0	0	0	0
Dissolved Oxygen	12.8	11.6	11.6	13	12.2
% Saturation D.O.	90	83	81	89	86
pH wide range	8.5	8.5	8	8	8.5
Hardness	160	160	160	160	160
Nitrate	0	0	5	1	1
Phosphate	4	1.5	3	1	1
Water Temperature °C	3.5	3.4	3.2	3.1	3.6
Air Temperature °C	4.0	3.6	3.3	3.7	4.5
Coliform Bacteria	0	10^3	5	5	0
Total Aerobic bacteria	1	10^6	13	24	9

Data

11/25/07

Water Samples Taken 11/25/07	Duck Pond	Alaska Club	Edlund Road	Surrey Road	Earl Road
Alkalinity	240	280	240	280	240
Ammonia	0	0	0	0	0
Dissolved Oxygen	12.8	12.4	12.4	12.8	12.2
% Saturation D.O.	81	80	79	83	78
pH wide range	8.5	8.5	8.5	8.5	8.5
Hardness	200	160	160	160	160
Nitrate	0	5	5	5	5
Phosphate	0.5	0.5	3	0.5	0.5
Water Temperature °C	1.6	1.6	1.3	1.4	1.8
Air Temperature °C	5.8	6.1	6.5	7.2	5.2
Coliform Bacteria	3	2	1	3	3
Total Aerobic Bacteria	5	5	10^2	7	10^3

Results

- The data suggests that after rainfall in urban areas there is an increase in both coliform bacteria and total aerobic bacteria. One possible cause of this could be the runoff in these areas.
- (e.g. support or reject it)

Conclusions….coming soon!

Discussion of Data

- When you have your data you will discuss what it means in this section

Literature Cited

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