Water Monitoring in Spa Creek: A Summary

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Water monitoring is very important in order to determine the health of the Chesapeake Bay and its tributaries, including Spa Creek. At the Chesapeake BaySavers, we do weekly water monitoring at multiple sites around Spa Creek to determine the health of the local aquatic ecosystem and the greater Chesapeake Bay area. Our sites are around Annapolis at Capital Sup, Hawkins Cove, and Ego Ally. When we do water monitoring, we measure dissolved oxygen levels, salinity, temperature, conductivity, secchi depth and total suspended solids, and pH on site. We also take water samples to send to a lab in order to get them tested for Chlorophyll A, Nitrogen and Phosphorous, and Enterococci. These measurements, described below, help us determine the health of the Chesapeake Bay and its watershed, and the effects of the Chesapeake BaySavers' restoration efforts.

One of the most important and revealing measurements we take is the level of dissolved oxygen, or the quantity of oxygen in the water measured in mg/L. Most marine organisms need a dissolved oxygen level above 5 mg/L in order to be healthy and survive. The dissolved oxygen level is considered degraded, and organisms suffer, when it falls below 5.0 mg/L. When the levels fall below 2.0 mg/L it is considered hypoxic and organisms suffocate and barely any fish or other creatures can survive. Levels below 0.2 mg/L are considered anoxic and the water is considered a "dead zone". Warmer temperatures, less wind, the presence of algal blooms, and problematic

levels of some of the other following water quality measurements all diminish dissolved oxygen levels and decrease the health of the Bay (BaySavers).

Another measurement taken is salinity, the measurement of salt concentration in a body of water and an important indicator of ecosystem health. The Chesapeake Bay is a brackish estuary, meaning the water is a combination of fresh and salt water. This can cause a wide range in salinity measurements across the Bay. At the top of the Bay, water tends to have low salinity levels and be fresher, whereas at the bottom of the Bay it tends to have high salinity levels and be more like seawater. The salinity of Spa Creek, a tributary of the Chesapeake Bay, varies between 7 ppt (parts per thousand) and 11 ppt, depending on the temperature and amount of rain. An increase in water temperature generally correlates to an increase in salinity, whereas salinity decreases with large amounts of rain, as rain is fresh water and dilutes the concentration of salt water. Due to the varying salinities of the Chesapeake Bay, the organisms that live in it have to be able to adapt to the constantly changing levels.

Water temperature is another aspect of water monitoring and is very helpful in determining the health of Spa Creek and the Bay. Measuring the water temperature of different sites along Spa Creek allows BaySavers to determine where the water is warmer and cooler. This is important because water temperature has a significant affect on many other water conditions of the Chesapeake Bay and its tributaries. The Bay's water temperature fluctuates from 34 degrees Fahrenheit in the winter to 84 degrees Fahrenheit in the summer during an average year (Chesapeake Bay Program).

Conductivity is the water quality measure, in Siemens per Celsius, of the ability of water to conduct electricity by measuring the total amount of ions in the water. Some common ions found in the Chesapeake Bay are calcium, magnesium, potassium and sodium cations and bicarbonates, carbonate, chloride, nitrate, and sulfate anions (BaySavers). These ions come from inorganic materials and dissolved salts (Fundamentals of Environmental Measurements). We measure for conductivity because large changes in conductivity can be an indicator of pollutants being dumped into the water. These pollutants cause great harm to Spa Creek and the Bay's ecosystem.

Secchi depth is a part of water monitoring to measure turbidity, or water clarity. The secchi is a tool we use to test water clarity based on how deep down you can see the black and white pattern of the secchi. The depth which it is no longer visible is how far down sunlight can penetrate the water. The secchi depth is an important indicator of the health of aquatic plant life because if the secchi depth is shallow, the water has high turbidity and very little sunlight is reaching plants, which need sunlight to conduct photosynthesis. Turbidity is affected by the water's color, light extinction, and amount of suspended solids (Wisconsin Citizen Lake Monitoring Training Manual). Total suspended solids, measured in mg/L, is a measure of solid particles in the water column. Suspended solids can be any material, including dirt, decaying animal and plant matter, sewage, and industrial pollution (BASIN Water Quality Monitoring). Suspended solids have a major affect on the secchi depth as they cloud the water. A total suspended solids measurement of less than 15 mg/L is needed for aquatic plant life to grow, otherwise sunlight cannot reach plants.

Without sunlight due to factors like high levels suspended solids, the plants die and the amount of dissolved oxygen decreases.

Yet another aspect of water monitoring measures pH, or the amount of hydrogen ions in the water, on a scale from 0-14. Pure water has a pH of 7, substances with a pH of 0-6 are acidic, and those with a pH of 8-14 are basic. In the Chesapeake Bay, a pH between 6.5 and 8 is considered ideal. However, factors such as car exhaust and storm runoff tend to affect the pH of the Bay, making the rivers and creeks more acidic. If the pH of the water is too acidic or too basic, it becomes toxic for the creatures living in it.

We also measure levels of Chlorophyll A, nitrogen, and phosphorus, since, although these things are good for aquatic ecosystems in moderation, in excess they cause big problems for the Bay. Chlorophyll is the green pigment that colors many plants and is used by them to absorb light necessary for photosynthesis. There are several types of chlorophyll, but the type that is present in every photosynthesizing organism. Chlorophyll A, measured in mg/L, needs to be at a level below 15 mg/L for sub-aquatic vegetation to grow. Too much Chlorophyll A can lead to algal blooms and lower levels of dissolved oxygen. Nitrogen and phosphorus, measured in mg/ L, are both nutrients found naturally in the Bay that are very important to the lifecycles of plants and animals. However, excess nitrogen and phosphorus comes into the Bay from pollution, fertilizer, and manure runoff. These excess nutrients end up being "too much of a good thing" and actually poison the water by promoting the growth of algal blooms, which in turn reduce the dissolved oxygen levels of the water and create dead zones.

Finally, measuring for enterococci is arguably the most important water test conducted along Spa Creek because enterococci levels determine if an area is swimmable. This is very important because it directly concerns the health of people living along Spa Creek who enjoy swimming in the water. Enterococci is a colony forming bacteria measured in colony-forming units/100 mL. The presence of enterococci indicates that fecal matter of warm-blooded animals has contaminated the water. Swimming in contaminated water can cause skin and gastrointestinal infections, so is recommended that people do not swim in a body of water where the enterococci level is 104 CFU/100 mL or higher, especially if they have opened wounds or immunosuppression. Because of the dangers of storm runoff leading to the presence of enterococci, it is recommended to avoid swimming in the Bay and its tributaries for at least 48 hours after a rain event of 0.5 inches or more.

Overall, testing for these various measured parameters helps Chesapeake BaySavers and our partners at Spa Creek Conservancy determine the health of Spa Creek and the greater Chesapeake Bay area. If we understand the health of these waterways, we can better decide what restoration efforts we should partake in, which legislation we should support or oppose, and how we should be communicating our results to the community of the Chesapeake watershed. Water monitoring is not only important to what we do at BaySavers, but also important to our goal of a healthier Chesapeake Bay and clean water for generations to come.