



Taunton Bay Tributary Study

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Introduction:

In order to establish a water quality baseline for Taunton Bay, the Friends of Taunton Bay began a study of the bay and tributary streams in 2023. This report is a preliminary report on those streams. Our data will be used to encourage conservation practices such as those in our [Caring for Taunton Bay- A Stewardship Guide](#). Also, data can be used by policy makers to promote the long-term sustainability of the fisheries and health of the bay.

The water quality indicators are (Table 1):

Table 1.

Indicator	Rationale/ Why Important	Source
Water Temperature	High temperatures can be a stressor for aquatic life, at the egg and juvenile stages. (i.e. 24 degrees C is stressful for cold water fish like salmon and trout). Long-term change can lead to loss of species and introduction of non- native species.	YSI Meter
Conductivity (Salinity)	Low conductivity can be stressful for aquatic life due to low nutrient content. It is an indicator of water source (freshwater or sea water) and can be related to rainfall.	YSI Meter also DMR testing
Dissolved Oxygen	Low levels of DO (below 5mg/L can lead to stressful or deadly for plants or animals. If there is a die-off, bacteria decomposition can use up oxygen in the water. Warmer waters cannot hold as much DO as colder.	YSI Meter
pH-Alkalinity	In marine waters low pH can be due to increased CO2. In freshwater values less than pH 6.5 can lead to reproductive failure in many fish and invertebrate species. Alkalinity stabilizes pH and protects animals from extreme pH changes.	YSI Meter
Clarity/ Turbidity	The suspended sediments that cause turbidity can block light to aquatic plants, smother aquatic organisms, and carry contaminants and pathogens, such as lead, mercury, and bacteria.	Secchi Disk or Turbidity Tube or phone app
Total Suspended Solids (TSS)	Under Maine law, state waters are supposed to be “clean and clear” and free of “settleable solids.” So TSS should be close to zero.	Bottle samples
Bacterial cleanliness	E. coli presence monitored for shellfish regulatory decisions	Bangor HS STEM students

Nitrogen & Total Phosphorous	Indicators of fertilizer use, animal waste, failing septic tanks, atmospheric conditions High levels can cause algae blooms which can decrease DO and pH.	Bottle samples
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In addition to chemical parameters, the macroinvertebrate community in Card Mill Stream was evaluated using a version of the Maine Audubon Stream Explorers protocol (<https://maineaudubon.org/projects/stream-explorers/>).

Results:

A. Field Data:

Water chemistry from field measurements is provided below in Table 2.

Table 2. Summary of field measurements for four Taunton Bay tributaries. Means, range, and standard deviations are given.

	Water temp C	DO mg/L	DO % sat.	pH	Alk mg/L	Spec Cond. uS	Clarity cm
High	25	14.2	105.7	6.58	17.5	57.6	>60
Low	1	7.43	83.5	5.5	5	17.9	45
Ave.	13	10.9	98.8	5.98	9.5	31.7	>60
S.D.	9.06	2.4	5.87	0.28	3.8	7.99	59

Water temperature shows a yearly cycle from near freezing in the spring to 25°C in late summer. Not captured in single samples is the daily cycle in temperature, with highest values generally in the mid-afternoon and low values just before dawn. The highest observed temperature for the year, 25°C (77°F), was too warm for coldwater fishes like salmon and brook trout. In the short term, they stop feeding and may move to find better conditions. Short term temperatures that are too hot are common even in Maine, and fish seem to be able to adapt to them. Many animals react to summer daytime heat by reducing activity levels and/or by migration to moist river bottom land. Fish also slow down and may move into colder spring fed tributaries. Long term exposures to high temperatures, especially without nearby cool refugia, are lethal.

Oxygen levels in all four streams, at least at the sample sites (which were all moderate waterfalls) were well aerated. The Maine standard for Class A and AA waters (our best waters, brook trout or salmon waters) is oxygen levels of 7 mg/L or 70% saturation. All our observations exceeded that.

All four streams are moderately acidic and have a brown tint due to organic acids (tannin and lignin) from forest soils and bogs. This is normal for Maine and especially for Hancock and

Washington Counties. The pH values are moderately low but are acidic enough to be a problem for most fish and animal species. Maine DEP’s draft water quality criteria for pH is greater than or equal to 6.5 in order to protect Atlantic salmon, maintain the integrity of aquatic communities, and to honor Native American fishing rights (DEP Chapter 583 - draft). Springer Creek has the best pH (but only the highest values of the year are pH 6.5 or better). Egypt Stream is the most acidic. We know that Card Mill Stream had Atlantic salmon in the past, so it is likely our streams were less acidic (probably circumneutral or even slightly alkaline) in the past. Acid rain and forestry are the likely drivers of this change. Climate change increases the demand for nutrient cations (sodium, potassium, calcium, and magnesium) and makes matters worse.

Field measurements of Alkalinity used a LaMotte titration kit (buffering capacity is measured by adding hydrochloric acid drop by drop to an end point of pH 5, the point where the carbonate buffering system is exhausted). We are wondering if this inexpensive but sophisticated kit is giving us good data. We will compare our LaMotte field measurements with our lab data from the Maine Health & Environmental Testing Lab (HETL).

Specific conductance is a measure of the electrical conductance of water (which depends on temperature and salts). Our streams are very dilute, with Springer Creek having the most salts (and nutrients) and Egypt Stream the least.

Water Clarity was very good most of the time at all sites except for one site, Springer Creek during a high flow event.

B. Lab Results

A comparison of Field Alkalinity with the Lab measure shows that the LaMotte kits provide results that are much higher than the lab value (average of 2.6 times higher) (Table 3). Sadly, the LaMotte kits are not appropriate for soft and colored waters in Maine. The titration endpoint is indicated by a blue dye. The natural color of the water (yellow-brown) and acidic tannin and lignin appears to interfere with the interpretation of the endpoint (where blue turns to purple).

Table 3: Comparison of Field Alkalinity (LaMotte kit) and Lab Alkalinity and Lab Calcium

Site	Date	Alkalinity mg/L LaMotte field kit	Total Alk mg/l HETL	Calcium mg/L 0.05
Card Mill Stream	5/22/2023	8	2	1.22
Springer Creek	5/22/2023	8	5	2.44
Grist Mill Stream	5/22/2023	9	4	1.57
Egypt Stream	5/22/2023	8	3	1.23

Our results varied from Fair to Good. The Mayflies, Caddisflies and Stoneflies (the so called “EPT taxa”) dominate. Group 2 and 3 species are almost missing. This pattern is thought to be due to acid rain impairment. The water is clean but is toxic due to low and variable pH and low calcium.

Summary:

Like the water quality of Taunton Bay, the water quality of the tributary streams is mostly very good. The exception is that a legacy of acid rain and intensive forestry has depleted local soils of calcium and other base cations. Poor buffering capacity (low Alkalinity) leads to low and variable pH. Even Springer Creek, the least acidic of the four streams, is generally below recommended pH thresholds for salmon, aquatic life, and treaty fishing rights.

The species that seem to be missing are Atlantic salmon, slimy sculpin, burbot (cusk), minnows, mummichogs, stickleback, and sucker. Grist Mill Stream has a commercial alewife run that breed in Great Pond. Card Mill Stream has a commercial elver fishery and a rainbow smelt run. Alewives, American eel and rainbow smelt adults live in the ocean and form their eggs in seawater, which is loaded with calcium. Other potentially missing species are hellgrammites, snails, mussels, dragonflies and damselflies, amphipods, worms, fall blackflies, and midges. One crayfish was observed at Card Mill Stream independent of the rock bag collections. Card Mill Stream is known to have brook trout. Species diversity appears to be impaired and these cold-water streams appear to lack the “reference condition” fish for the Northeastern US (brook trout, salmon, slimy sculpin, and burbot) (Halliwell et al. 2001).

References:

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