Baseline Water Quality Monitoring

Salmon River Watershed

Summers *2018-2019*

Acknowledgements

Thanks to our many Summer Volunteers…

Special thanks to our 2019 Summer Interns…

Emma Coffey

&

Cameron Jaks

A Word about the Results

Following the graphed results for each parameter, a "Quick Summary" is provided. These include general observations. Since variations in rainfall and streamflow affect measurements, it is important not to over interpret the results at this stage. Multiple years of data will be a better reflection of the ranges associated with each stream segment monitoring location.

Purpose

The Salmon River Watershed Partnership initiated a volunteer stream sampling program in the summer of 2013. After regularly collecting data at the same sampling locations for five summers (summer 2013 to summer 2017), we selected new monitoring points for 2018 and 2019 summers. These section of streams will continue to be monitored for an additional three years (summer 2020, 2021 & 2022). Selecting new monitoring locations on different stream sections is done to achieve a wider scope of data sites in the watershed.

The purpose of multi-year sampling is to help establish baseline data for future comparisons. Collected data will be used to ascertain seasonal ranges and long-term trends. Summer represents a particularly stressful time for stream inhabitants. Higher water temperature with lower stream flow results in lower dissolved oxygen levels. Additionally, summer rain events can be intense, elevating stream temperatures and depositing whatever pollutants it picks up along the way. Understanding baseline conditions allows us to set realistic goals to protect the river system.

Watershed

The Salmon River Watershed is approximately 149 square miles and is comprised of land area from the ten towns of Bolton, Colchester, Columbia, East Haddam, East Hampton, Haddam, Hebron, Glastonbury, Lebanon and Marlborough. The rivers and streams in the watershed are highly prized as fish habitat and it remains one of only two watersheds still stocked by the Department of Energy and Environmental Protection (DEEP) for salmon fry. The towns in the watershed have all demonstrated their commitment to protect surface and groundwater, especially within the Salmon River Watershed.

Equipment and Parameters Sampled

Two Extech hand-held instruments (ExStik® EC500 & ExStik® DO600) were used to collect data. The instruments were calibrated at the beginning of each sampling day and were also calibrated at a lab at the beginning of the season and again half way through the monitoring season. Data was collected for temperature, pH, dissolved oxygen, conductivity, total dissolved solids and salinity. Field monitoring was generally conducted between 8:00 am-10:00 am on days noted.

Sampling Points and Duration

Sampling points were selected to collect data on main stream segments throughout the watershed. Access to sites was a consideration as well as establishment of two separate driving routes. The same northern route and southern route were sampled both summers (2018-2019). Streams in each route were sampled the same day every week at approximately the same time for a ten-week period. Specific sampling locations are noted on the following page, with a map on pg 5.

East Hampton/Colchester Monitoring Route

Stream	***Town***	***Latitude***	***Longitude***
Pine Brook	Colchester	41.5743	- 72.3961
Gilletes Brook	Colchester	41.5792	- 72.3698
Cabin Brook	Colchester	41.5604	- 72.3192
Flat Brook	East Hampton/ Colchester Line	41.5539	- 72.4520
Safstrom Brook	East Hampton	41.5280	- 72.4801

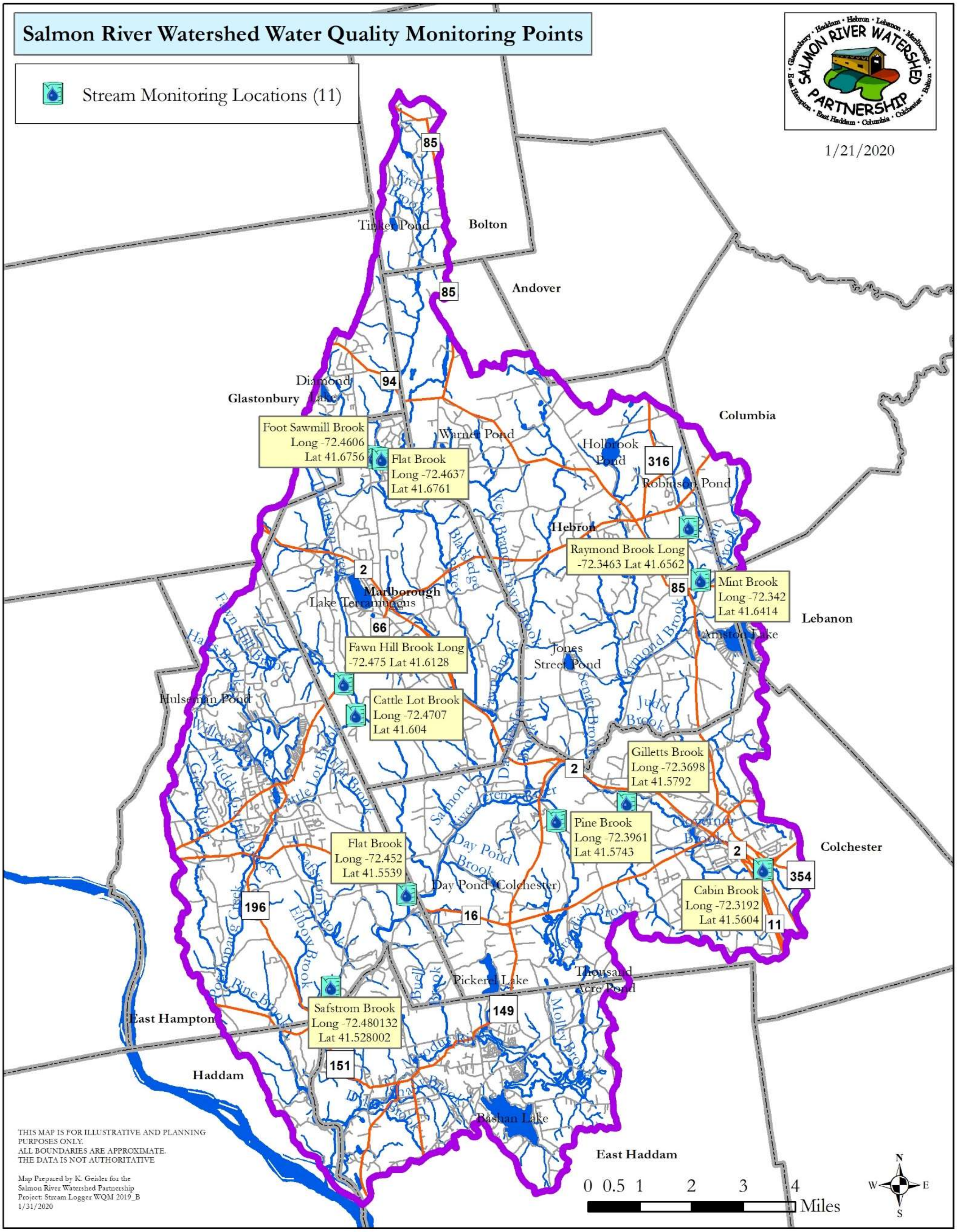
Marlborough/Hebron Monitoring Route

Stream	***Town***	***Latitude***	***Longitude***
Cattle Lot Brook	Marlborough	41.6040	- 72.4707
Fawn Hill Brook	Marlborough	41.6128	- 72.4750
Flat Brook	Marlborough	41.6761	- 72.4637
Foot Sawmill Brook	Marlborough	41.6756	- 72.4606
Raymond Brook	Hebron/Amston	41.6562	- 72.3463
Mint Brook	Hebron/Amston	41.6414	- 72.3420

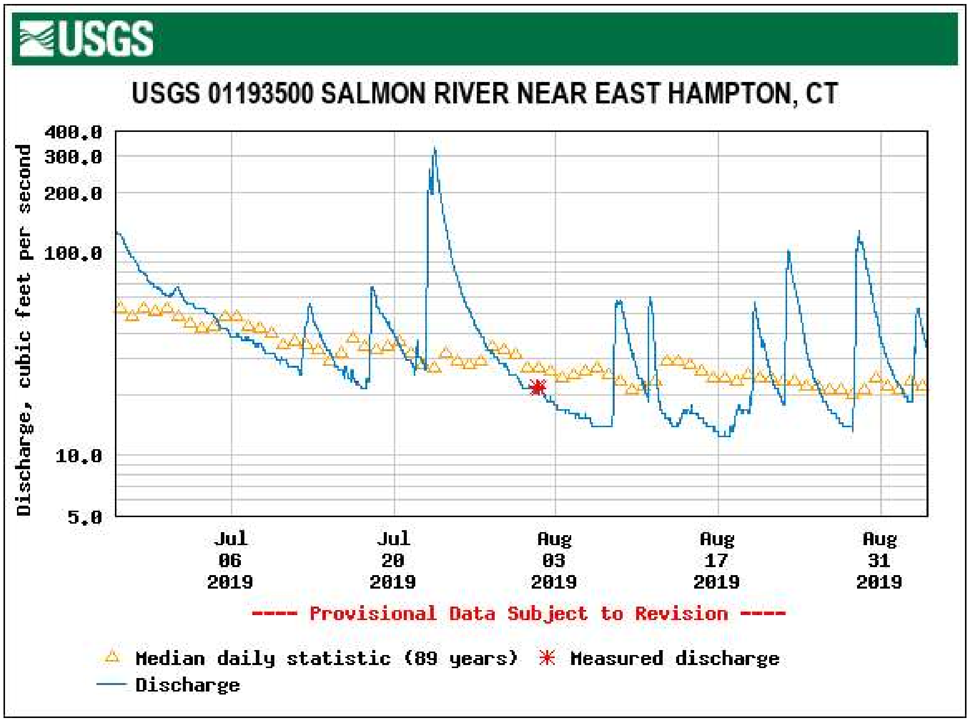
Note: A detailed map of the Salmon River Watershed can be found on the next page. This map is intended for planning and educational purposes only. The accuracy at any given location cannot be guaranteed. Map created by Ken Geisler.

Limitations

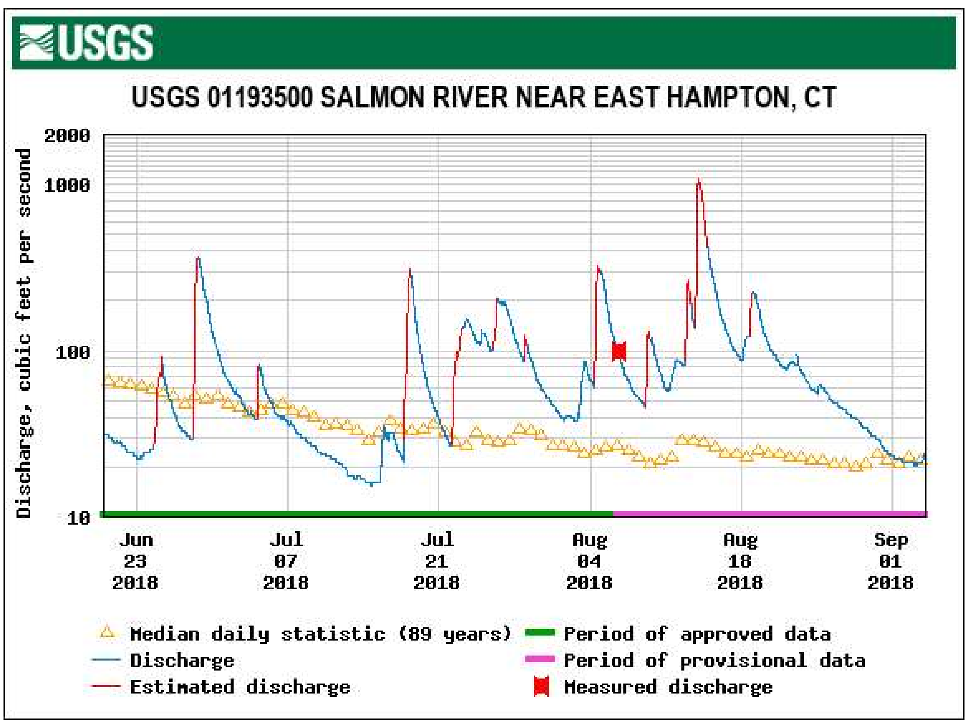
This data collection and reporting is intended for general management purposes. Constituents such as temperature and dissolved oxygen change throughout the day, so results do not necessarily reflect the full range spectrum. Further, all constituents may be affected by rain events or other discharges to a stream system and depending upon the timing of sampling the results may or may not fully reflect the complete impact. Even short duration changes however can be of significant concern to aquatic life. Monitoring is conducted by volunteers. Training is provided by the watershed coordinator and summer interns. As with any stream monitoring effort both human error and equipment malfunction can result in errors in data.


Salmon River Watershed Water Quality Monitoring Points
Stream Monitoring Locations (11)
1/21/2020
Foot Sawmill Brook Long -72.4606 Lat 41.6756
Flat Brook Long -72.4637 Lat 41.6761
Raymond Brook Long -72.3463 Lat 41.6562
Mint Brook Long -72.342 Lat 41.6414
Fawn Hill Brook Long -72.475 Lat 41.6128
Cattle Lot Brook Long -72.4707 Lat 41.604
Gilletts Brook Long -72.3698 Lat 41.5792
Pine Brook Long -72.3961 Lat 41.5743
Flat Brook Long -72.452 Lat 41.5539
Cabin Brook Long -72.3192 Lat 41.5604
Safstrom Brook Long -72.480132 Lat 41.528002
Bolton
Andover
Glastonbury
Columbia
Hebron
Marlborough
Lebanon
Colchester
East Hampton
Haddam
East Haddam
Tinker Pond
Diamond Lake
Warner Pond
Holbrook Pond
Robinson Pond
Lake Terramuggus
Amston Lake
Jones Street Pond
Hulseman Pond
Day Pond (Colchester)
Pickerel Lake
Thousand Acre Pond
Bashan Lake
85
94
316
2
66
16
196
149
151
354
11
THIS MAP IS FOR ILLUSTRATIVE AND PLANNING PURPOSES ONLY.
ALL BOUNDARIES ARE APPROXIMATE.
THE DATA IS NOT AUTHORITATIVE
Map Prepared by K. Geisler for the Salmon River Watershed Partnership
Project: Stream Logger WQM 2019_B
1/31/2020
0 0.5 1 2 3 4 Miles
W E N S

Stream Discharge Summer 2019



Stream Discharge Summer 2018



Streamflow Graphs are generated from data collected at the Salmon River gaging station just south of RT 16. It is helpful to compare monitoring results to stream flow to better understand some of the variations noted.

Water Temperature

Why is temperature important?

The rates of biological and chemical processes depend on temperature. Aquatic organisms from microbes to fish are dependent on certain temperature ranges for their optimal health. Optimal temperatures for fish depend on the species: some survive best in colder water, whereas others prefer warmer water. Benthic macroinvertebrates are also sensitive to temperature and will move in the stream to find their optimal temperature. If temperatures are outside this optimal range for a prolonged period of time, organisms are stressed and can die. Temperature is measured in degrees Fahrenheit (˚F) or degrees Celsius (˚C).

For fish, there are two kinds of limiting temperatures. Maximum temperature for short exposures and a weekly average temperature which varies according to the time of year and the life cycle stage of the fish species. Reproductive stages (spawning and embryo development) are the most sensitive stages. Table 5.5 provides temperature criteria for some species.

Temperature affects the oxygen content of the water (oxygen levels become lower as temperature increases); the rate of photosynthesis by aquatic plants; the metabolic rates of aquatic organisms; and the sensitivity of organisms to toxic wastes, parasites, and diseases.

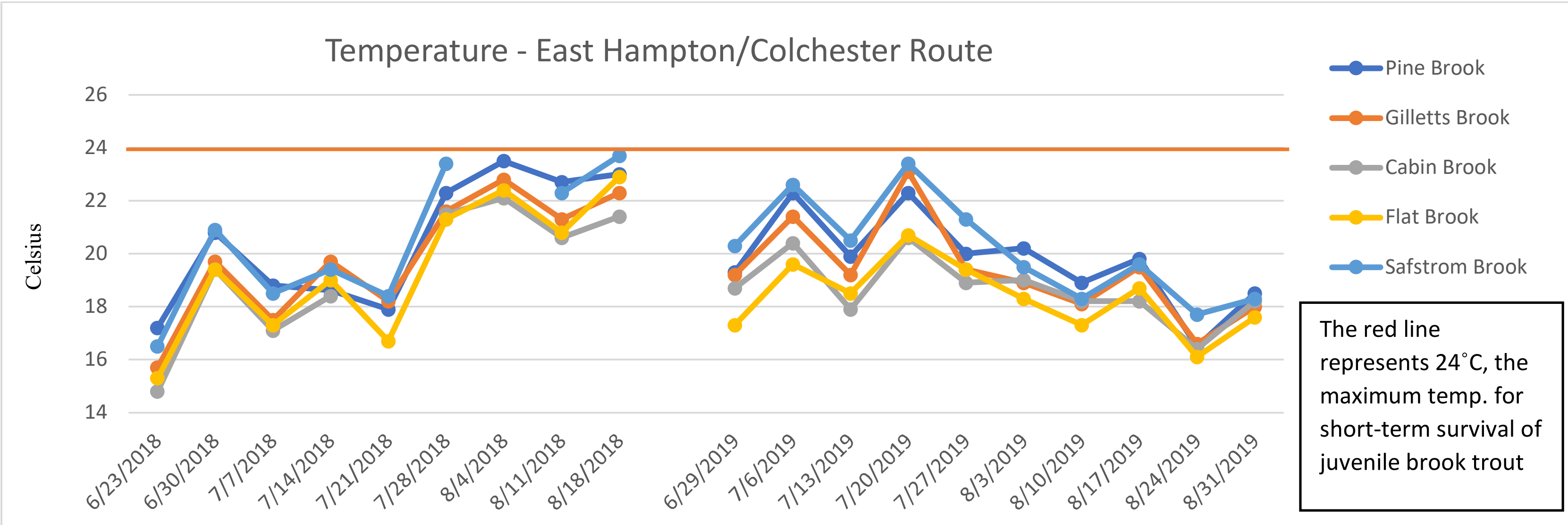
Causes of temperature change include weather, removal of shading streambank vegetation, impoundments (a body of water confined by a barrier, such as a dam), discharge of cooling water, urban storm water, and groundwater inflows to the stream.

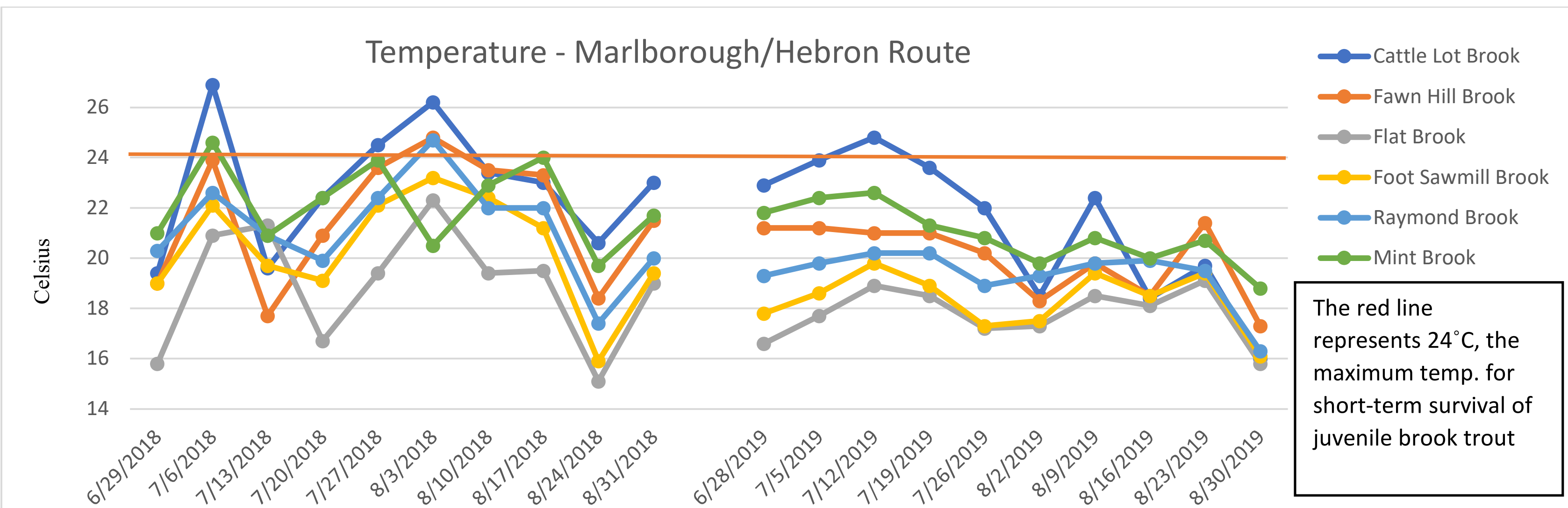
*Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997
http://water.epa.gov/type/rsl/monitoring/stream_index.cfm

Table 5.5-Maximum average temperatures for growth and short-term maximum temperatures for selected fish (°C and ° F)

Species	Max. weekly average temp for growth (juveniles)	Max. temp for survival of short exposure (juveniles)	Max. average weekly temp. for spawning (a)	Max. temp. for embryo spawning(b)
Atlantic salmon	20 °C (68 °F)	23 °C (73 °F)	5 °C (41 °F)	11 °C (52 °F)
Bluegill	32 °C (90 °F)	35 °C (95 °F)	25 °C (77 °F)	34 °C (93 °F)
Brook trout	19 °C (66 °F)	24 °C (75 °F)	9 °C (48 °F)	13 °C (55 °F)
Common carp	---	---	21 °C (70 °F)	33 °C (91 °F)
Channel catfish	32 °C (90 °F)	35 °C (95 °F)	27 °C (81 °F)	29 °C (84 °F)
Largemouth bass	32 °C (90 °F)	34 °C (93 °F)	21 °C (70 °F)	27 °C (81 °F)
Rainbow trout	19 °C (66 °F)	24 °C (75 °F)	9 °C (48 °F)	13 °C (55 °F)
Smallmouth bass	29 °C (84 °F)	---	17 °C (63 °F)	23 °C (73 °F)
Sockeye salmon	18 °C (64 °F)	22 °C (72 °F)	10 °C (50 °F)	13 °C (55 °F)

a - Optimum or mean of the range of spawning temperatures reported for the species
b - Upper temperature for successful incubation and hatching reported for the species
c - Upper temperature for spawning *(Brungs and Jones 1977)*


Temperature - East Hampton/Colchester Route
Celsius
26
24
22
20
18
16
14
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
8/10/2019
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook
The red line represents 24˚C, the maximum temp. for short-term survival of juvenile brook trout


Temperature - Marlborough/Hebron Route
Celsius
26
24
22
20
18
16
14
6/29/2018
7/6/2018
7/13/2018
7/20/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
8/31/2018
6/28/2019
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/9/2019
8/16/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Hill Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook
The red line represents 24˚C, the maximum temp. for short-term survival of juvenile brook trout

Quick Summary: In the 2019 monitoring time period, the temperature readings for the East Hampton/Colchester Route dropped during the second half of the monitoring season, the reverse of what happened during the 2018 season. Temperatures in the ten-week monitoring period for both years did not exceed 24°C for the East Hampton/Colchester Route.

The temperature readings for the Marlborough/Hebron Route appeared more variable for both monitoring seasons. In the Summer of 2018, the temperature rose above or equal to 24˚C three times during the ten-week monitoring period at various stream segments. In the summer of 2019, the temperature only spiked above 24˚C once on July 12th at Cattle Lot Brook. Other temperature readings on this day were also somewhat elevated.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements, which is why multiple years of data are important.

pH

What is pH and why is it important?

pH is a term used to indicate the alkalinity or acidity of a substance as ranked on a scale from 1.0 to 14.0. Acidity increases as the pH decreases.

pH affects many chemical and biological processes in the water. For example, different organisms flourish within different ranges of pH. **The largest variety of aquatic animals prefers a range of 6.5-8.0.** pH outside this range reduces the diversity in the stream because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH can also allow toxic elements and compounds to become mobile and "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life, particularly to sensitive species like rainbow trout. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges.

The pH scale measures the logarithmic concentration of hydrogen (H+) and hydroxide (OH-) ions, which make up water (H+ + OH- = H2O). When both types of ions are in equal concentration, the pH is 7.0 or neutral. Below 7.0, the water is acidic (there are more hydrogen ions than hydroxide ions). When the pH is above 7.0, the water is alkaline, or basic (there are more hydroxide ions than hydrogen ions). Since the scale is logarithmic, a drop in the pH by 1.0 unit is equivalent to a 10-fold increase in acidity. So, a water sample with a pH of 5.0 is 10 times as acidic as one with a pH of 6.0, and pH 4.0 is 100 times as acidic as pH 6.0.

*Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997 http://water.epa.gov/type/rsl/monitoring/stream_index.cfm

The diagram below shows pH ranges for types of water and general ranges affecting survival of various plants and animals

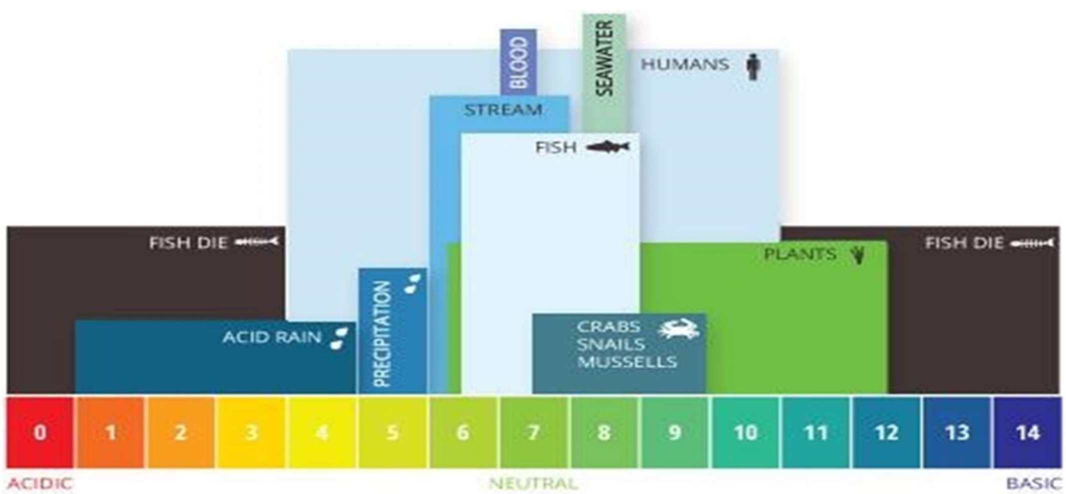
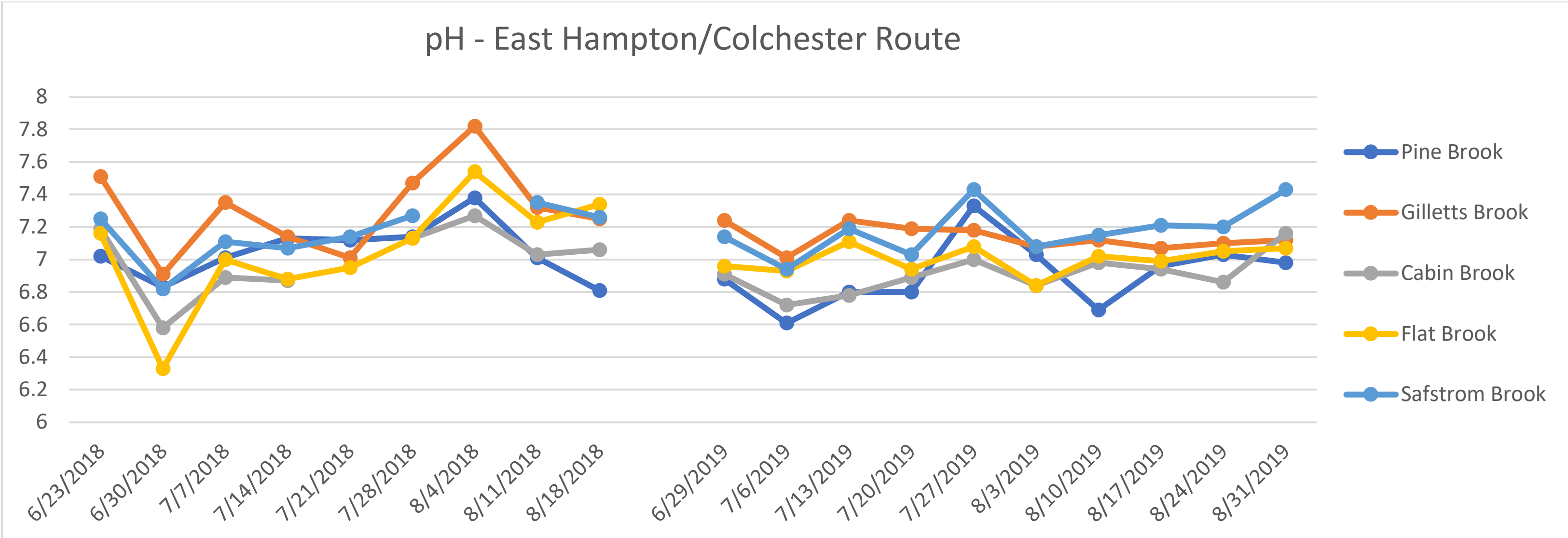
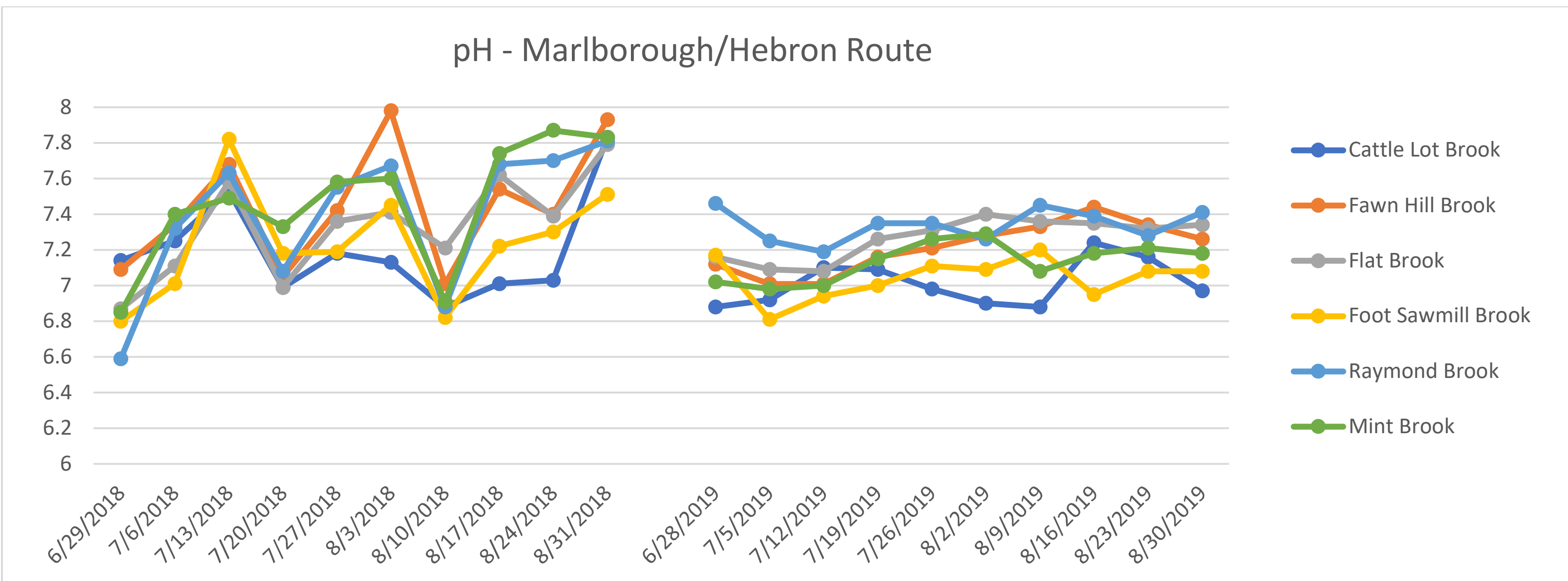


Diagram and facts information from the article "Fundamentals of Environmental Measurement" on the Fondriest website: https://www.fondriest.com/environmental-measurements/parameters/water-quality/ph/#p1


pH - East Hampton/Colchester Route
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
8/10/2019
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook


pH - Marlborough/Hebron Route
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
6/29/2018
7/6/2018
7/13/2018
7/20/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
8/31/2018
6/28/2019
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/9/2019
8/16/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Hill Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook

Quick Summary: pH for these two years remain within anticipated range of 6.5 – 8, with the exception of one reading at Flat Brook (Colchester-East Hampton Route) on June 30th, 2018, when all levels dipped on that route. For both the East Hampton/Colchester Route and the Marlborough/Hebron Route, summer monitoring in 2018 tended to have more variable measurements than summer 2019.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements, which is why multiple years of data are important.

Dissolved Oxygen

What is dissolved oxygen and why is it important?

The stream system both produces and consumes oxygen. It gains oxygen from the atmosphere and from plants as a result of photosynthesis. Running water, because of its churning, dissolves more oxygen than still water, such as that in a reservoir behind a dam. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen.

Wastewater from sewage treatment plants often contains organic materials that are decomposed by microorganisms, which use oxygen in the process. The amount of oxygen consumed by these organisms in breaking down the waste is known as the biochemical oxygen demand, or BOD. Other sources of oxygen-consuming waste include stormwater runoff from farmland or urban streets, feedlots, and failing septic systems.

Oxygen is measured in its dissolved form as dissolved oxygen (DO). If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die.

DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitudes. Thermal discharges, such as water used to cool machinery in a manufacturing plant or a power plant, raise the temperature of water and lower its oxygen content. **Aquatic animals are most vulnerable to lowered DO levels in the early morning on hot summer days when stream flows are low, water temperatures are high, and aquatic plants have not been producing oxygen since sunset.**

*Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997
http://water.epa.gov/type/rsl/monitoring/stream_index.cfm

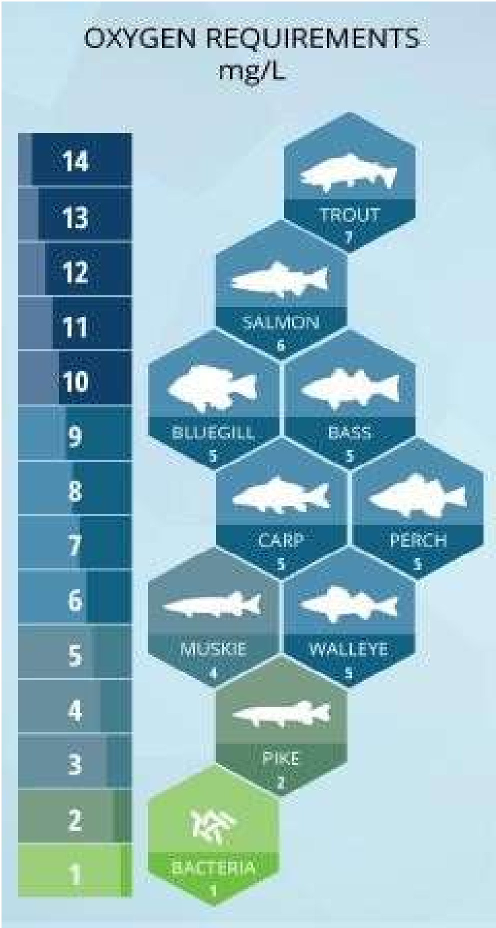
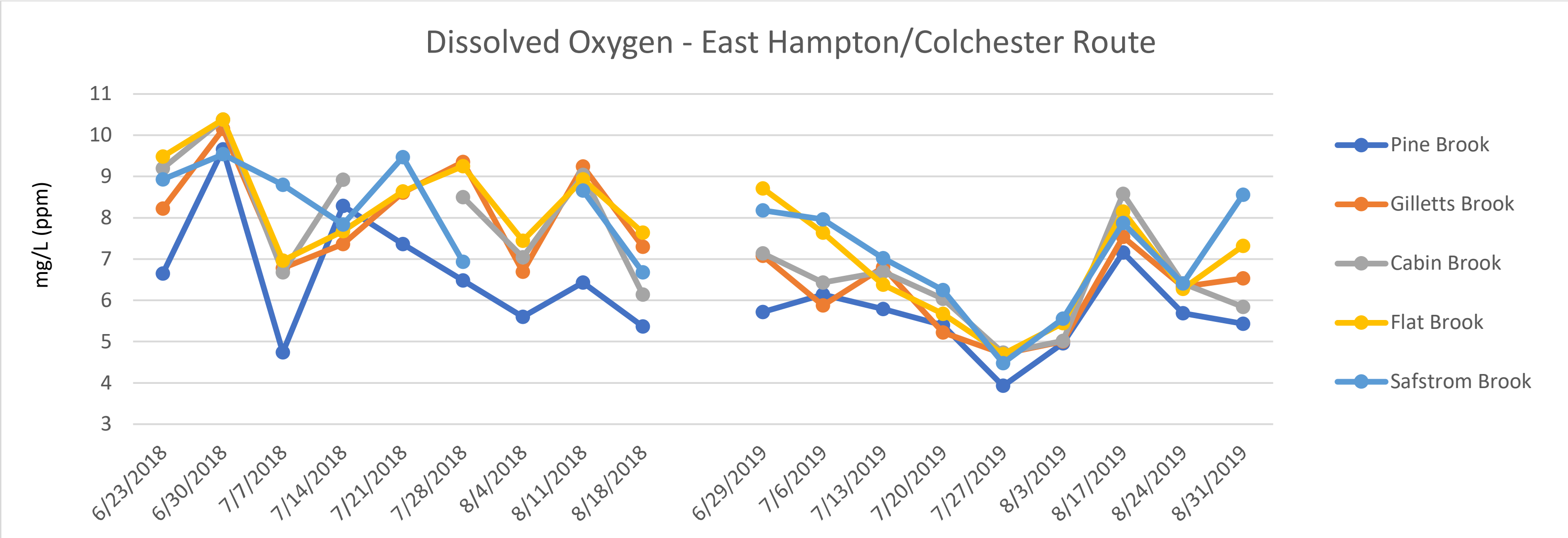
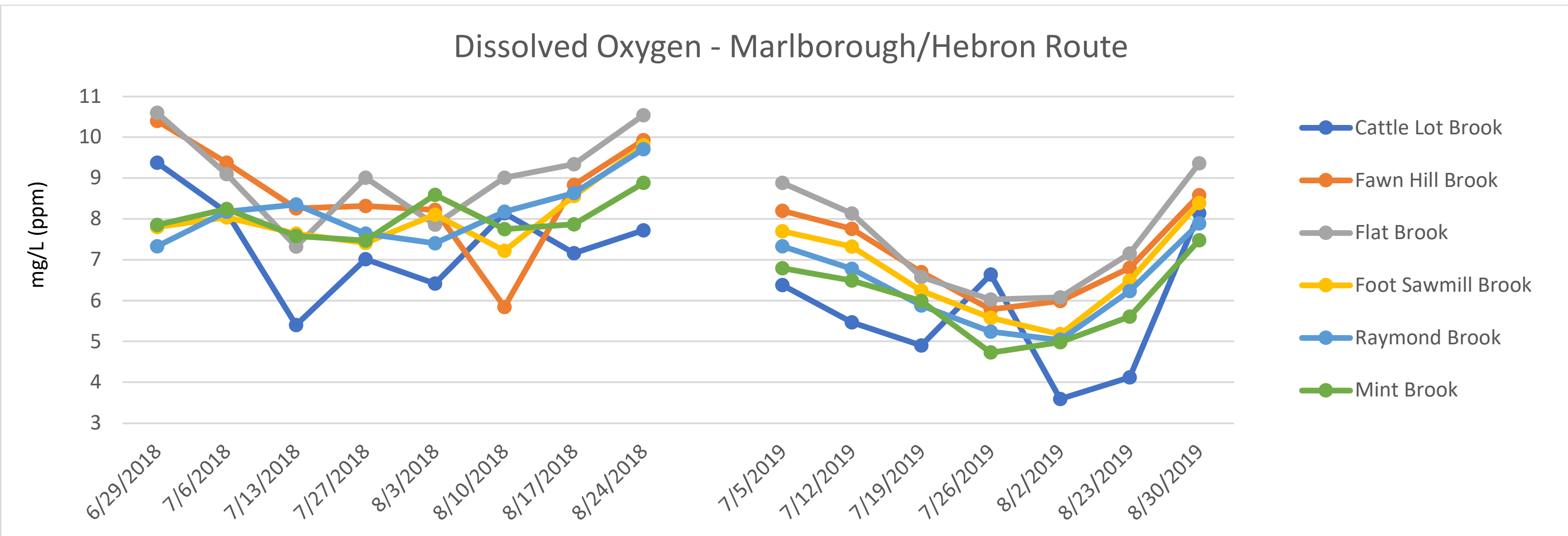


Diagram showing the minimum oxygen requirements of freshwater fish.

Diagram and information from the article "Fundamentals of Environmental Measurement" on the Fondriest website: https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/



Dissolved Oxygen - East Hampton/Colchester Route
mg/L (ppm)
11
10
9
8
7
6
5
4
3
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook



Dissolved Oxygen - Marlborough/Hebron Route
mg/L (ppm)
11
10
9
8
7
6
5
4
3
6/29/2018
7/6/2018
7/13/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Hill Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook

Quick Summary: In general, DO ranges showed more variability in the summer of 2018 versus the summer of 2019. Dissolved oxygen generally decreased through July and increased mid-August for the summer of 2019. Pine Brook and Cattle Lot Brook both displayed some of the lowest dissolved oxygen levels for summers 2018 and 2019. Per the diagram on pg 13, Brook Trout require a minimum of 7 mg/L of dissolved oxygen. Between the two monitoring routes all sites measured below 7 mg/L at some point.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements which is why multiple years of data are important.

Conductivity

What is conductivity and why is it important?

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (ions that carry a negative charge) or sodium, magnesium, calcium, iron, and aluminum cations (ions that carry a positive charge). Organic compounds like oil, phenol, alcohol, and sugar do not conduct electrical current very well and therefore have a low conductivity when in water. Conductivity is also affected by temperature: the warmer the water, the higher the conductivity. For this reason, conductivity is reported as conductivity at 25 degrees Celsius (25˚C).

Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials that do not ionize (dissolve into ionic components) when washed into the water. On the other hand, streams that run through areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Ground water inflows can have the same effects depending on the bedrock they flow through.

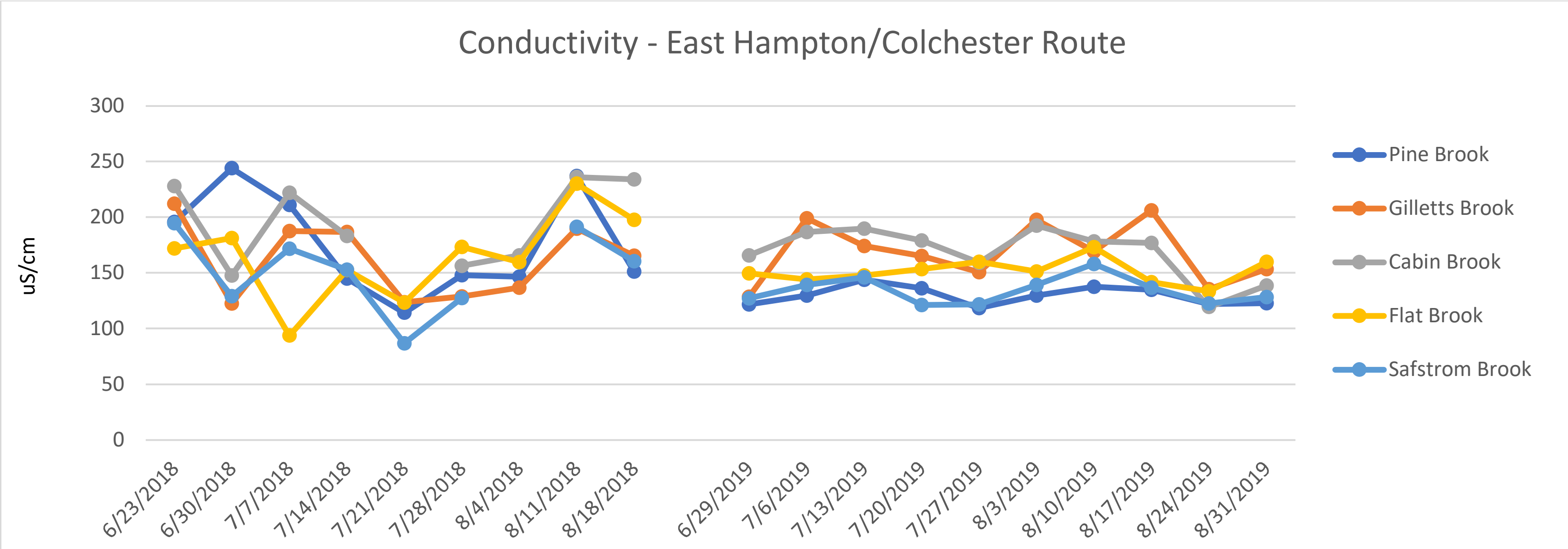
Discharges to streams can change the conductivity depending on their make-up. A failing sewage system would raise the conductivity because of the presence of chloride, phosphate, and nitrate; an oil spill would lower the conductivity.

The basic unit of measurement of conductivity is the mho or siemens. Conductivity is measured in micromhos per centimeter (µmhos/cm) or microsiemens per centimeter (µs/cm). Distilled water has a conductivity in the range of 0.5 to 3 µmhos/cm. **The conductivity of rivers in the United States generally ranges from 50 to 1500 µmhos/cm.** Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 and 500 µhos/cm. Conductivity outside this range could indicate that the water is not suitable for certain species of fish or macroinvertebrates. Industrial waters can range as high as 10,000 µmhos/cm.

Sampling Considerations

Conductivity is useful as a general measure of stream water quality. **Each stream tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements.** Significant changes in conductivity could then be an indicator that a discharge or some other source of pollution has entered a stream.

*Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997
http://water.epa.gov/type/rsl/monitoring/stream_index.cfm


Conductivity - East Hampton/Colchester Route
uS/cm
300
250
200
150
100
50
0
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
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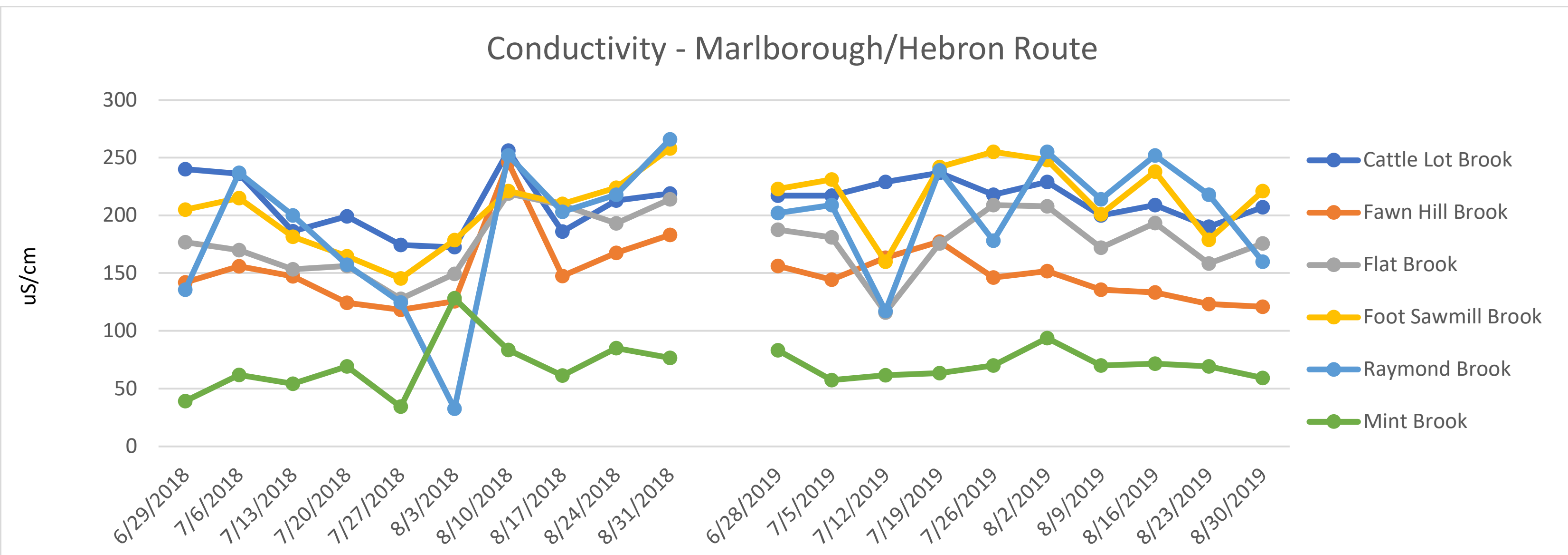
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook


Conductivity - Marlborough/Hebron Route
uS/cm
300
250
200
150
100
50
0
6/29/2018
7/6/2018
7/13/2018
7/20/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
8/31/2018
6/28/2019
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/9/2019
8/16/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Hill Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook

Quick Summary: Both monitoring routes for summer 2018 and 2019 remained within normal conductivity levels. Due to types of bedrock in the watershed, without any other inputs, conductivity tends to be on the lower end. Mint Brook has displayed consistently lower conductivity levels, which may be related to the large marsh area just upstream. With the exception of Mint Brook, over the past two monitoring summers, conductivity levels along the Marlborough/Hebron route have displayed slightly higher levels than the East Hampton/Colchester route.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements which is why multiple years of data are important.

And a Second Note: Higher conductivity readings have been related to higher chloride levels, which can be a result of deicing materials. The SRWP, working with GZA GeoEnvironmental Inc. (Glastonbury), received a grant and volunteer hours to launch 4 conductivity loggers which are placed in streams and take readings every hour. This upcoming spring, we will be launching an additional 6 loggers within the watershed. This will give us a better understanding of the total impact of chlorides in our local streams.

Total Dissolved Solids

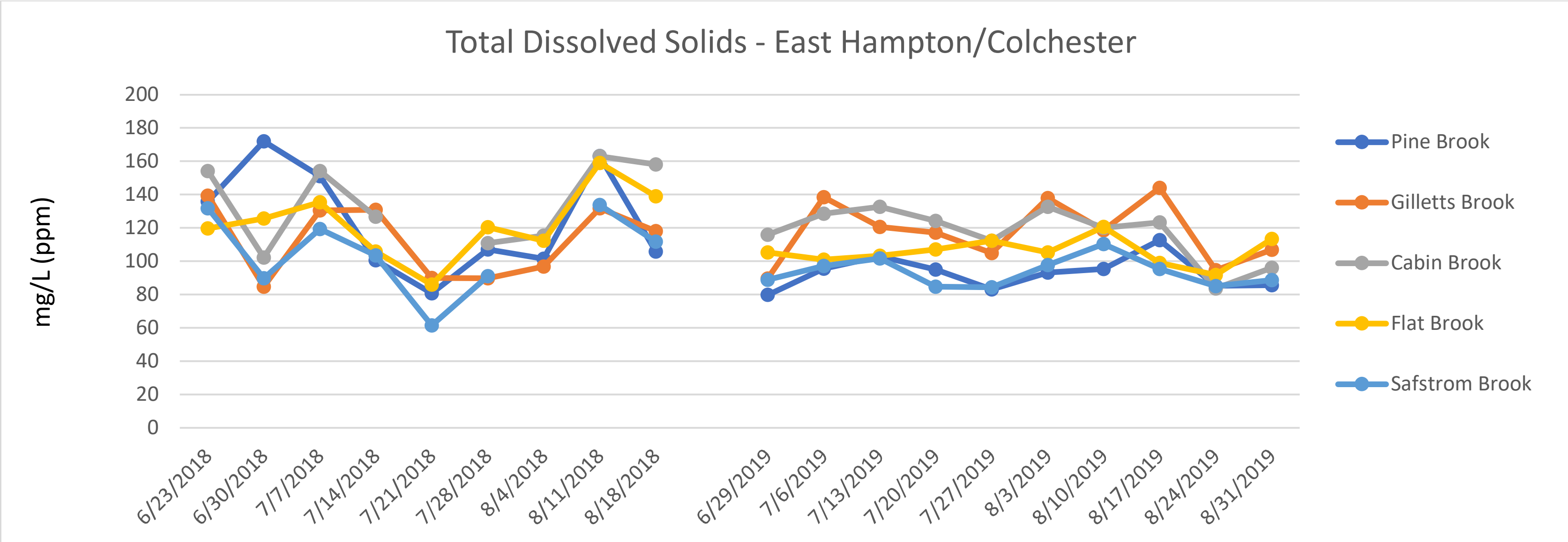
What are total dissolved solids and why are they important?

In stream water, dissolved solids consist of calcium, chlorides, nitrate, phosphorus, iron, sulfur, and other ions particles that will pass through a filter with pores of around 2 microns (0.002 cm) in size. The concentration of total dissolved solids affects the water balance in the cells of aquatic organisms. An organism placed in water with a very low level of solids, such as distilled water, will swell up because water will tend to move into its cells, which have a higher concentration of solids. An organism placed in water with a high concentration of solids will affect that organism's ability to maintain the proper cell density, making it difficult to keep its position in the water column. It might float up or sink down to a depth to which it is not adapted, and it may not survive.

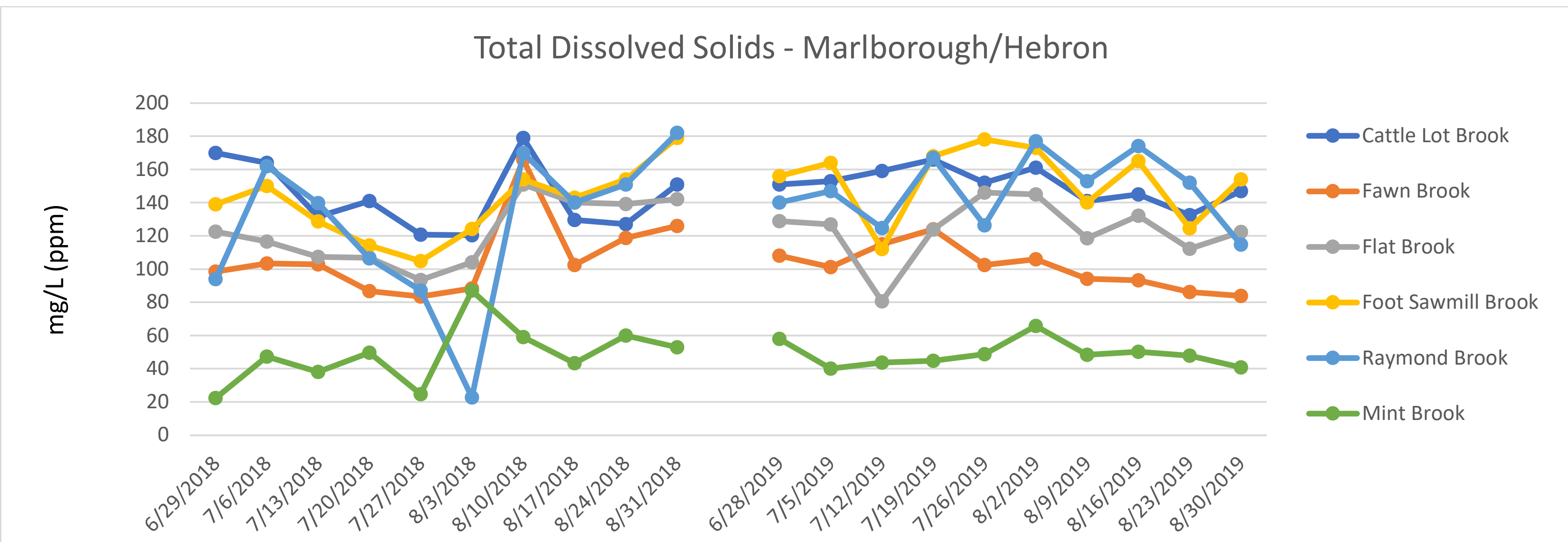
Sources of total dissolved solids include industrial discharges, sewage, fertilizers, road runoff, and soil erosion. Total solids are measured in milligrams per liter (mg/L).

*Excerpted from Volunteer Stream Monitoring: A Methods Manual, Total Solids Section, EPA 841-B-97-003, November 1997 http://water.epa.gov/type/rsl/monitoring/stream_index.cfm

Note: Freshwater lakes and streams generally fall within the range of 50-250 mg/L.



Total Dissolved Solids - East Hampton/Colchester
mg/L (ppm)
0
20
40
60
80
100
120
140
160
180
200
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
8/10/2019
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook



Total Dissolved Solids - Marlborough/Hebron
mg/L (ppm)
0
20
40
60
80
100
120
140
160
180
200
6/29/2018
7/6/2018
7/13/2018
7/20/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
8/31/2018
6/28/2019
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/9/2019
8/16/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook

Quick Summary: The East Hampton/Colchester route remained within anticipated Total Dissolved Solids (TDS) range for summers 2018 and 2019. On the Marlborough/Hebron route, 0nly Mint Brook has displayed consistently lower TDS levels over the past two summers compared to other monitoring locations. As with conductivity results, the large wetland system just upstream of the monitoring point on Mint Brook, may be contributing to lower TDS values.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements which is why multiple years of data are important.

Salinity

Salinity is a measure of the salt concentration of water. It is a measure of the total amount of dissolved salts. Higher salinity means the water is more salty, while low salinity means that the water is more fresh. Salinity is measured in parts per million (ppm) or mg/L.

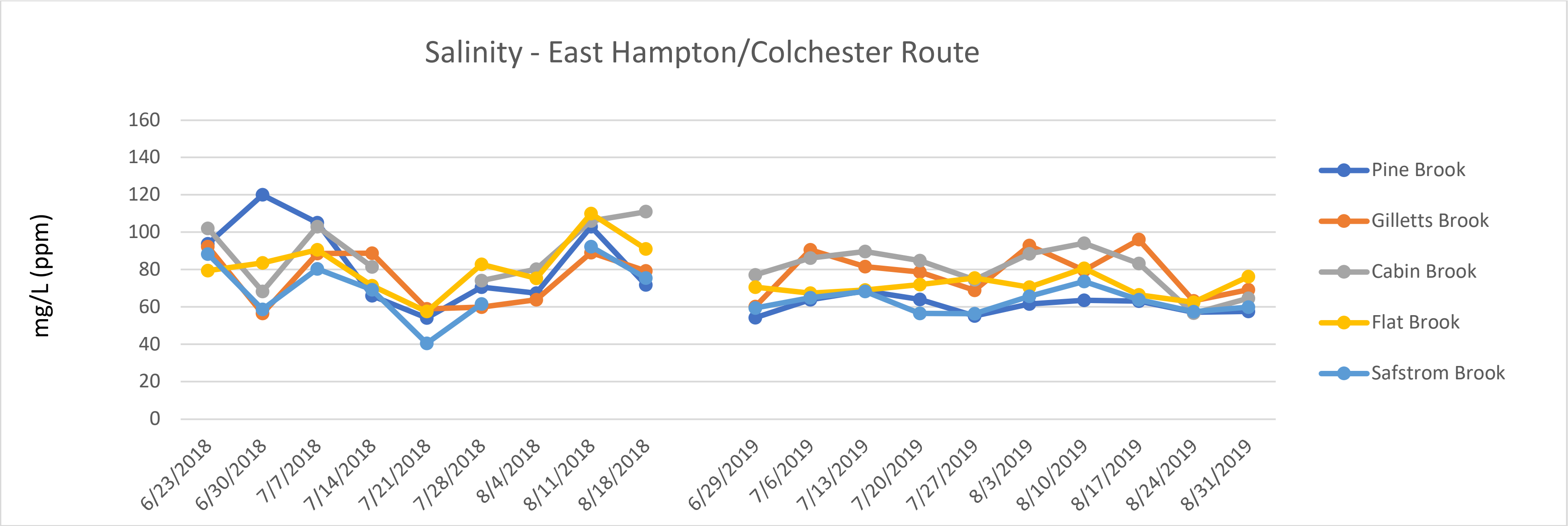
Saline in Various Waters

- **fresh water (typical city water in United States) : < 100 ppm**
- **fresh water, ponds, lakes, rivers, streams, aquifers: 0-500ppm**
- **water supply typically restricted to : 500 ppm**
- **fresh water - official salt concentration limits in drinking water US: 1000 ppm**
- **typical limit agriculture irrigation : 2000 ppm**
- **brackish water, mildly : 1000 - 5,000 ppm**
- **brackish water, moderately : 5000 - 15,000 ppm**
- **brackish water, heavily : 15,000 - 35,000 ppm**
- **sea water : 30,000 - 50,000 ppm (approx. 35,000)**

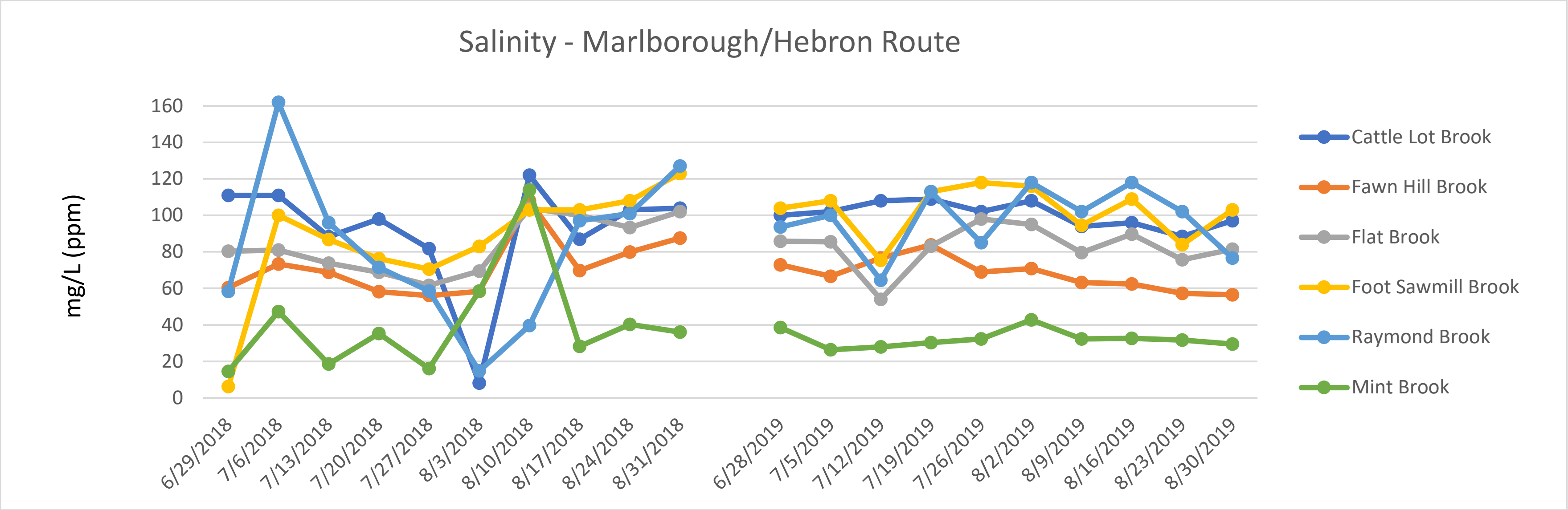
Increasingly, due to winter deicing practices, especially in northern states, the possibility of increased salinity levels in ground and surface waters has raised concerns. While there may be flushes of higher salinity concentrations after winter storm events in surface waters, higher concentration of salts in groundwater is a concern when it contributes to base flow in streams. In summer months when rainfall may be more limited, contributing groundwater through base flow may make up a higher percentage of water in a stream segment. Baseline data during summer months will help determine whether there are any changes to salinity in stream segments during critical times.

The link below provides further information about the connection of impervious surfaces and levels of salinity in streams.

http://www.bayjournal.com/article/impervious_surfaces_driving_up_levels_of_salinity_in_streams



Salinity - East Hampton/Colchester Route
mg/L (ppm)
160
140
120
100
80
60
40
20
0
6/23/2018
6/30/2018
7/7/2018
7/14/2018
7/21/2018
7/28/2018
8/4/2018
8/11/2018
8/18/2018
6/29/2019
7/6/2019
7/13/2019
7/20/2019
7/27/2019
8/3/2019
8/10/2019
8/17/2019
8/24/2019
8/31/2019
Pine Brook
Gilletts Brook
Cabin Brook
Flat Brook
Safstrom Brook



Salinity - Marlborough/Hebron Route
mg/L (ppm)
160
140
120
100
80
60
40
20
0
6/29/2018
7/6/2018
7/13/2018
7/20/2018
7/27/2018
8/3/2018
8/10/2018
8/17/2018
8/24/2018
8/31/2018
6/28/2019
7/5/2019
7/12/2019
7/19/2019
7/26/2019
8/2/2019
8/9/2019
8/16/2019
8/23/2019
8/30/2019
Cattle Lot Brook
Fawn Hill Brook
Flat Brook
Foot Sawmill Brook
Raymond Brook
Mint Brook

Quick Summary: Overall, stream segments in the Marlborough/Hebron route displayed more variability than the East Hampton/Colchester route. Mint Brook has displayed consistently lower salinity levels over the past two summers compared to other monitoring locations, with the exception of a spike in 2018 on August 10th.

The highest reading for these two summers occurred on July 6th, 2018 at Raymond Brook, with a reading of 162 mg/L (ppm). The lowest reading for these two summers occurred on June 29th, 2018 at Foot Sawmill Brook. With a reading of 6.2 mg/L (ppm). Both routes remained within normal salinity range for summers 2018 and 2019.

Please Note: Gaps in data indicate instrument malfunction. Variations in weather, rainfall and streamflow from one summer to another can account for differences in measurements which is why multiple years of data are important.