Baseline Water Quality Monitoring Salmon River Watershed Summer 2023

Acknowledgements

Thanks to our many Summer Volunteers…
Special thanks to our interns…

Caroline Stanton and Nick LaMantia

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, 2013 to 2017, and then selecting different locations from 2018-2022, we are now back to sampling at those same first five-year locations again for 2023. These sections of streams will continue to be monitored for an additional 4 years and be compared to the previous five years of data. 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

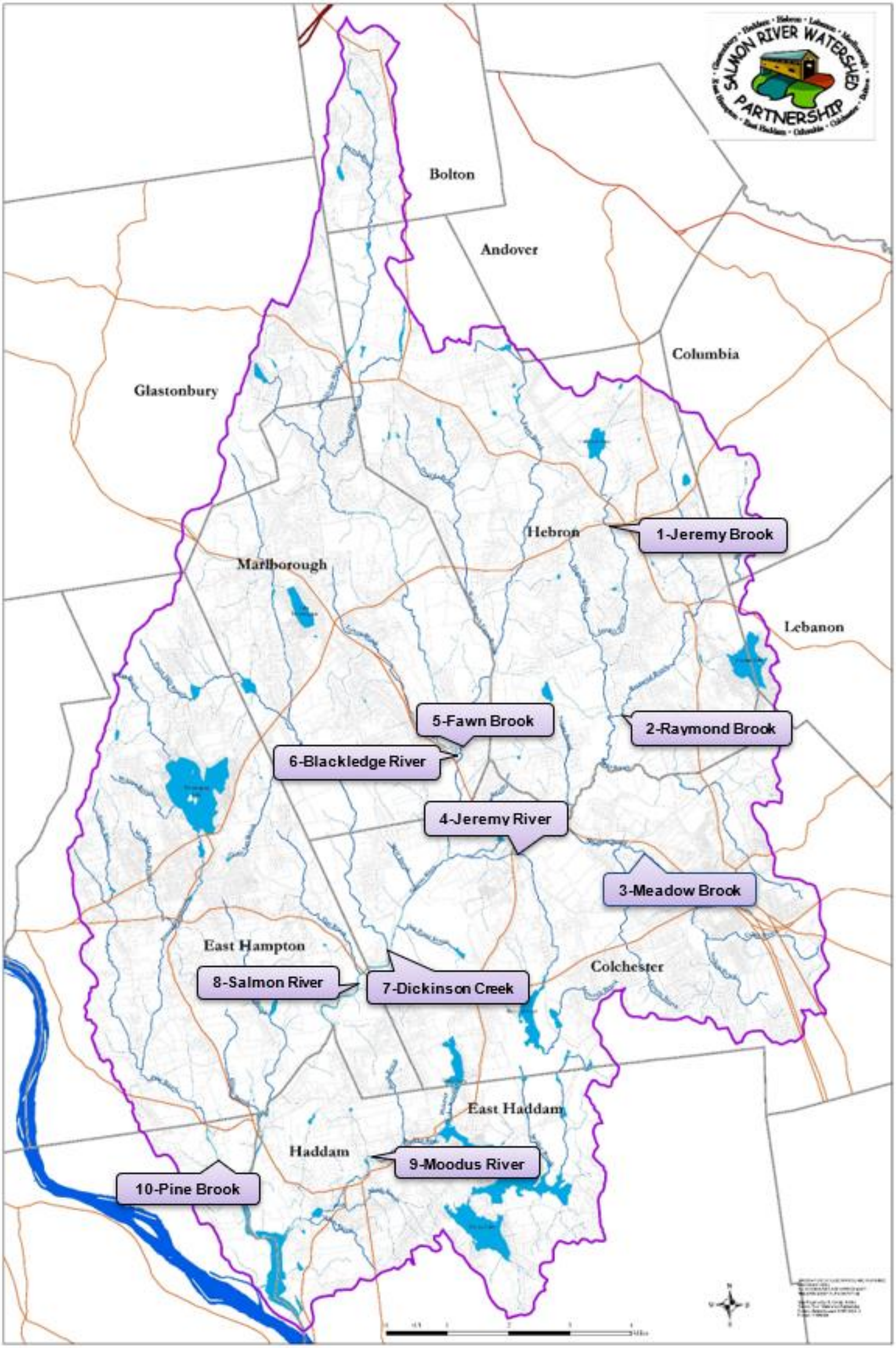
The Salmon River Watershed is approximately 149 square miles and is comprised of land area from the ten towns of Bolton, Colchester, Columbia, East Haddam, East Hampton, Haddam, Hebron, Glastonbury, Lebanon, and Marlborough. The rivers and streams in the watershed are highly prized as fish habitat and 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

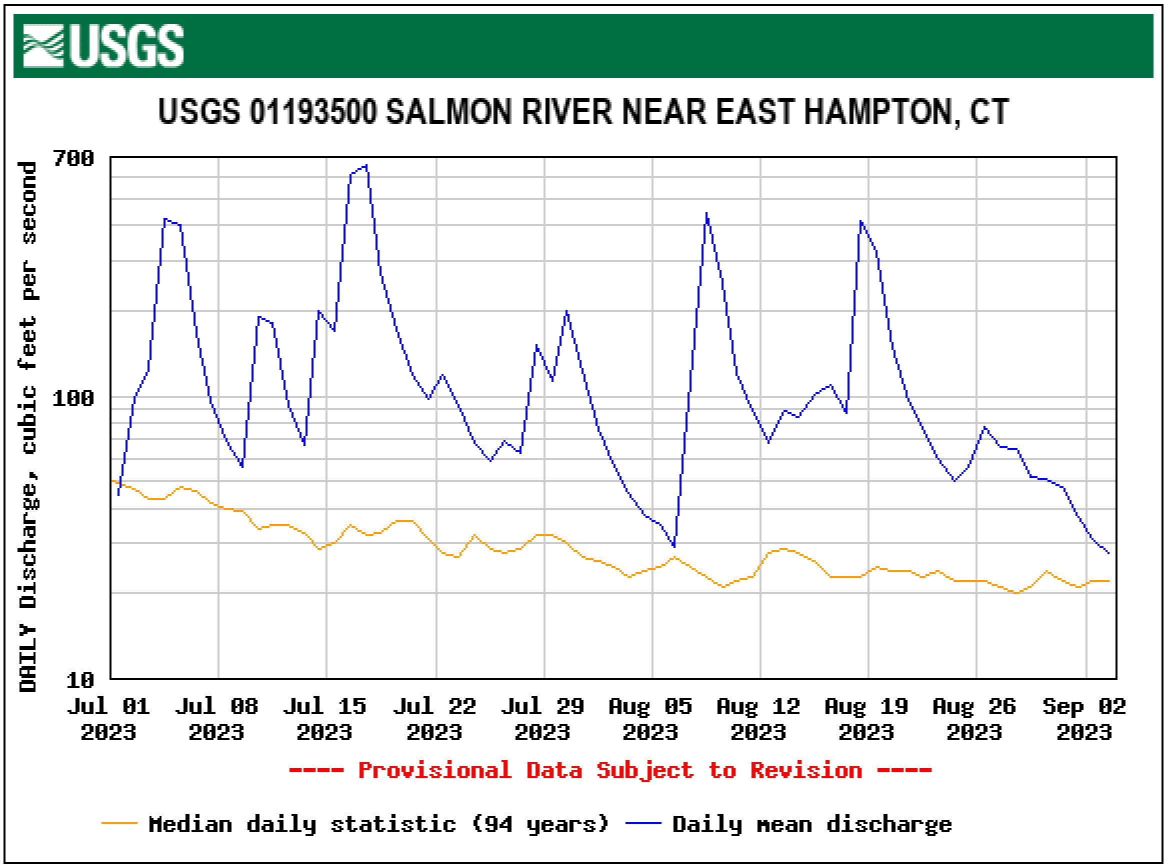
In 2023 a YSI ProDSS multiparameter meter was used to collect the water temperature, dissolved oxygen, conductivity, total dissolved solids and salinity, which has greater accuracy the previously used Extech hand-held meter used for 2013-2017 monitoring season. An Extech hand-held meter was used to collect pH data for both 2013-2017 period along with 2023 period. The instruments were calibrated at the beginning of each sampling day.

Sampling Points and Duration

Sampling points were selected to collect data on perennial stream segments throughout the watershed. Access to sites was a consideration as well as the establishment of two separate driving routes. The same northern route and southern route were sampled each summer between 2013-2017 and again in 2023. However, three site locations were moved a little due to ease of access. This included Jeremy River which was moved slightly upstream, Meadow Brook and Moodus River were also moved slightly upstream and Pine Brook in Haddam which was moved downstream. Streams in each route were sampled the same day every week at approximately the same time period of 8am-10am for a ten-week period. Specific sampling locations are noted on the following page.


SALMON RIVER WATERSHED PARTNERSHIP
Bolton
Andover
Columbia
Glastonbury
Hebron
1-Jeremy Brook
Marlborough
Lebanon
5-Fawn Brook
2-Raymond Brook
6-Blackledge River
4-Jeremy River
3-Meadow Brook
East Hampton
Colchester
8-Salmon River
7-Dickinson Creek
East Haddam
Haddam
9-Moodus River
10-Pine Brook

Stream Discharge Summer 2023



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.

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.

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, 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.

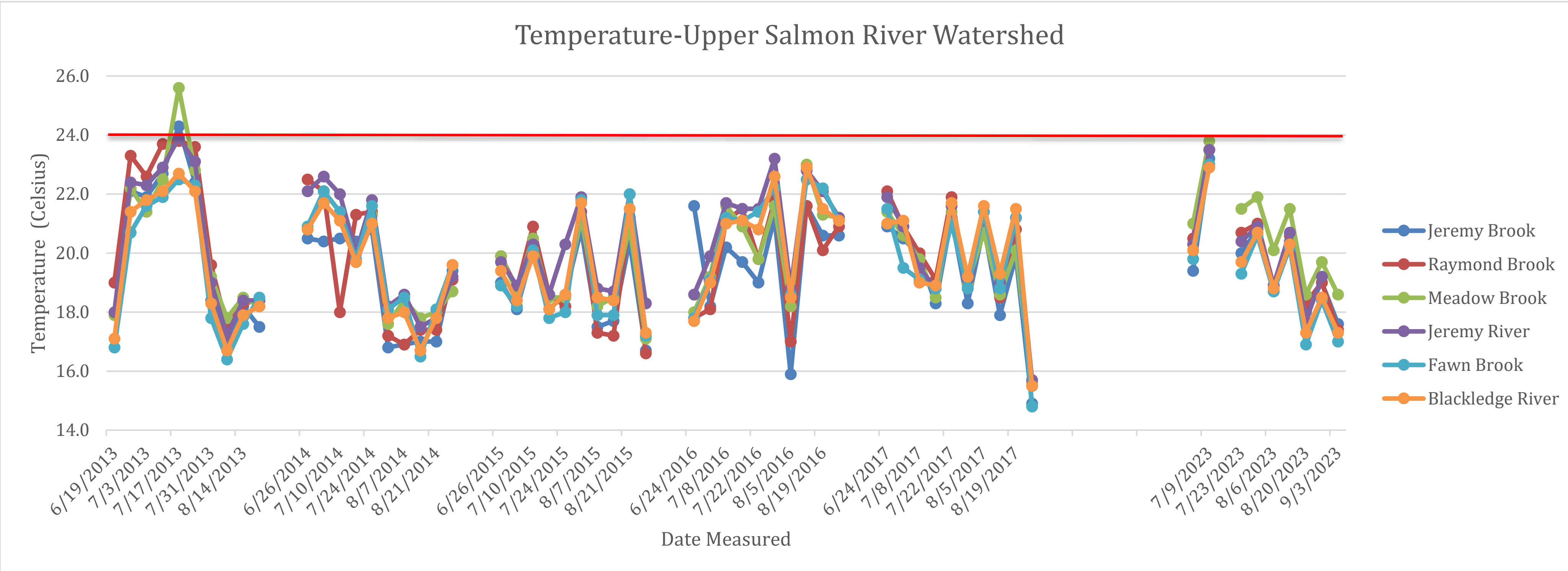
Causes of temperature change include weather, removal of shading streambank vegetation, impoundments (a body of water confined by a barrier, such as a dam), discharge of cooling water, urban stormwater, and groundwater inflows to the stream.

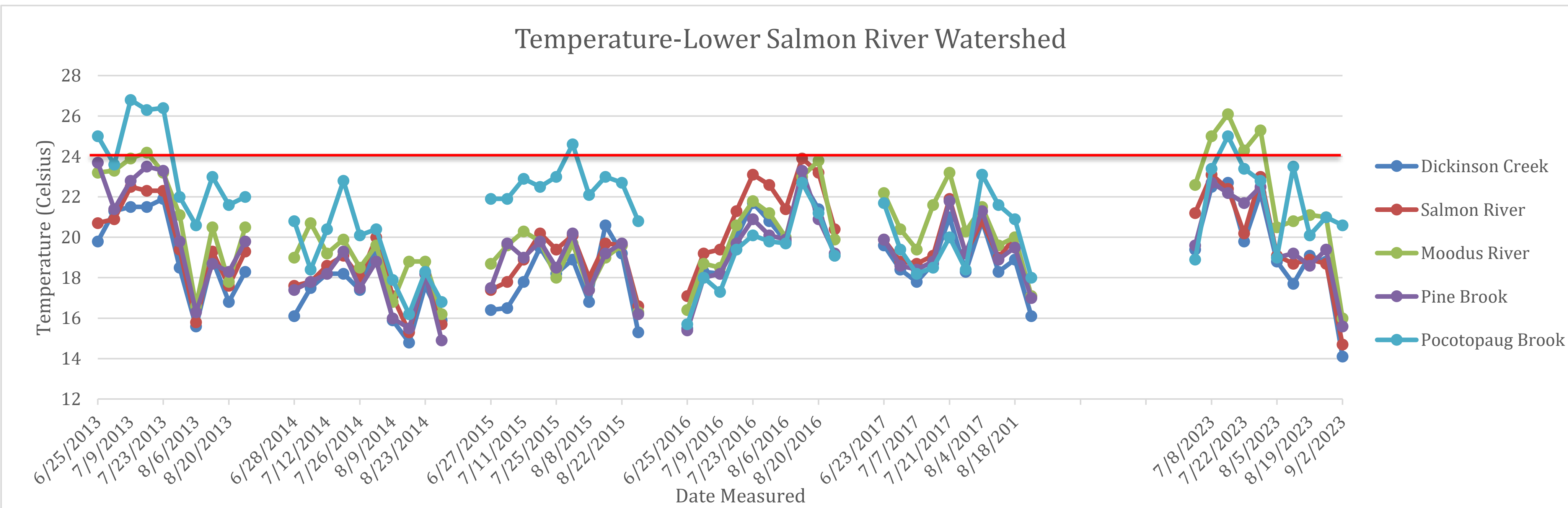
**Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997 http://water.epa.gov/type/rsl/monitoring/stream_index.cfm*

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)*





*****The red line on both graphs represents 24 degrees Celsius, the maximum temperature for short term survival of juvenile brook trout.**

Quick Summary: Temperatures are reported in degrees Celsius. In 2023, the temperature readings for the upper monitoring route were within the similar range of the results from 2013-2017. Temperatures for all segments in the upper route peaked in July, with Meadow Brook reaching 23.8 degrees on July 9th, but none passed 24.0 degrees. In the past, Meadow Brook spiked to 25.6 degrees in and Jeremy to 24.3 degrees in 2013. However, on the lower monitoring route, Moodus River was above 24.0 degrees for three weeks in July and Poctopaug Brook was 25.0 degrees on July 15th. Pocotopaug Brook was recorded at 26.8 degrees in 2013 and 24.6 degrees in 2015, while Moodus River was also recorded above the threshold, at 24.2 degrees in 2013. These were the only times the streams passed the "fish-kill" threshold of 24.0 degrees in the six years. All other sites stayed within a cooler range throughout all summers of 2013-2017 and 2023.

Variations in stream temperature are generally reflective of air temperature and therefore warmer days result in warmer stream temperature. Stream temperatures can also be affected by discharge to a stream such as with rain events, especially on hot summer days. The summer of 2023 was notably, a wetter summer.

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.

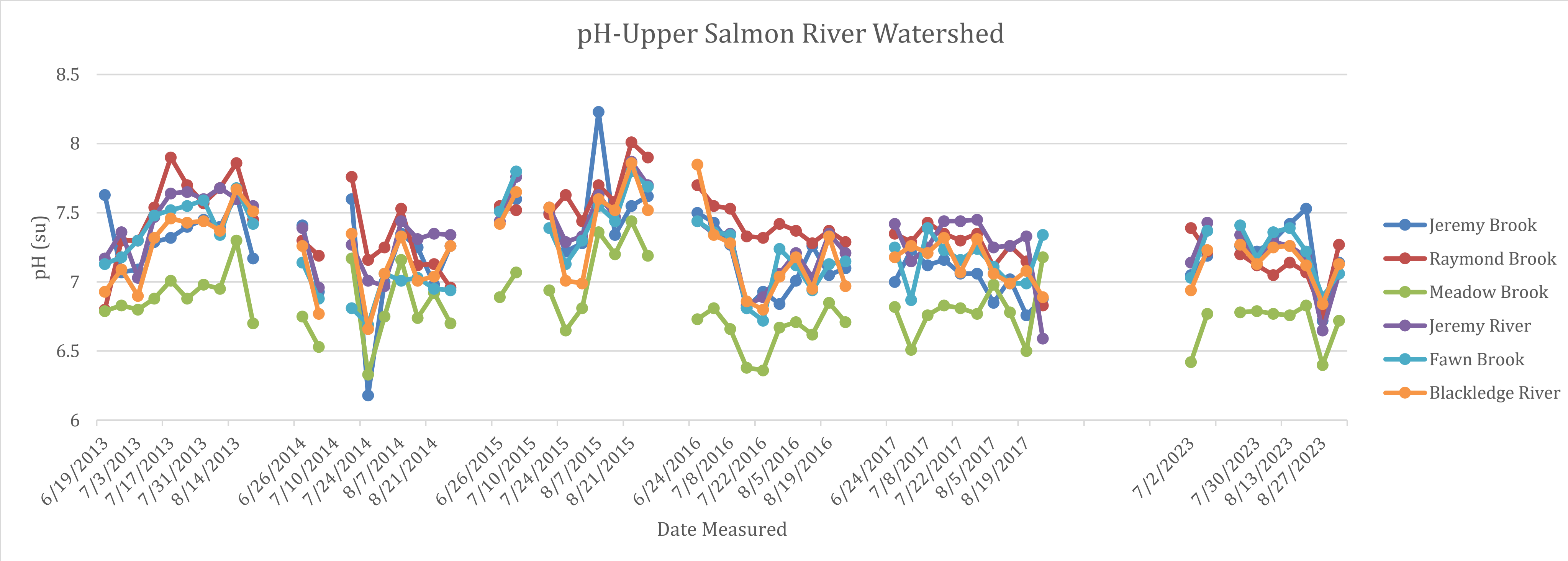
pH affects many chemical and biological processes in the water. For example, different organisms flourish within different ranges of pH. **The largest variety of aquatic animals prefers a range of 6.5-8.0**. pH outside this range reduces the diversity in the stream because it stresses the physiological 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.

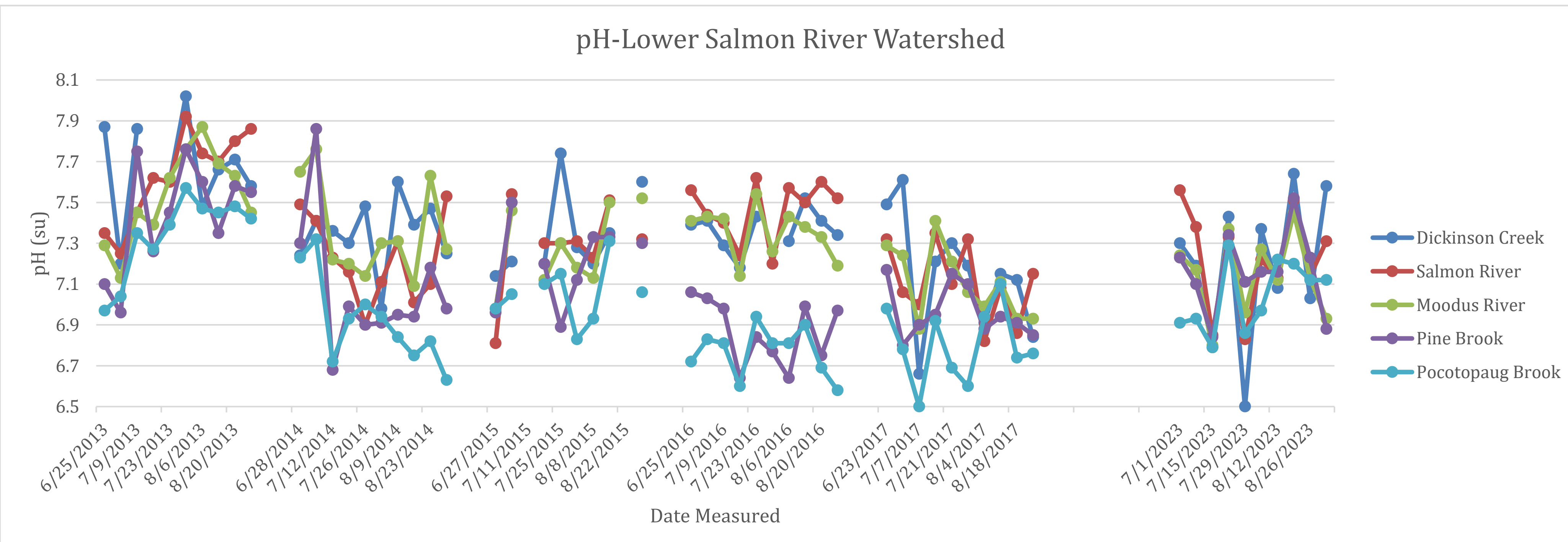
The pH scale measures the logarithmic concentration of hydrogen (H+) and hydroxide (OH-) ions, which make up water (H+ + OH- = H2O). When both types of ions are in equal concentration, the pH is 7.0 or neutral. Below 7.0, the water is acidic (there are more hydrogen ions than hydroxide ions). When the 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 of 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-Upper Salmon River Watershed
8.5
8
7.5
7
6.5
6
pH (su)
6/19/2013
7/3/2013
7/17/2013
7/31/2013
8/14/2013
6/26/2014
7/10/2014
7/24/2014
8/7/2014
8/21/2014
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
6/24/2016
7/8/2016
7/22/2016
8/5/2016
8/19/2016
6/24/2017
7/8/2017
7/22/2017
8/5/2017
8/19/2017
7/2/2023
7/30/2023
8/13/2023
8/27/2023
Date Measured
Jeremy Brook
Raymond Brook
Meadow Brook
Jeremy River
Fawn Brook
Blackledge River


pH-Lower Salmon River Watershed
8.1
7.9
7.7
7.5
7.3
7.1
6.9
6.7
6.5
pH (su)
6/25/2013
7/9/2013
7/23/2013
8/6/2013
8/20/2013
6/28/2014
7/12/2014
7/26/2014
8/9/2014
8/23/2014
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
6/25/2016
7/9/2016
7/23/2016
8/6/2016
8/20/2016
6/23/2017
7/7/2017
7/21/2017
8/4/2017
8/18/2017
7/1/2023
7/15/2023
7/29/2023
8/12/2023
8/26/2023
Date Measured
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: In 2023, the pH for the streams in the upper monitoring route remained in the anticipated range of 6.5-8 except for Meadow Brook, which dropped below 6.5 on July 2nd and August 27th. This data is relatively consistent with the 2013-2017 data, as Meadow Brook tends to be the more acidic stream out of the six sites in the upper watershed. The pH for the lower monitoring route demonstrated some variability but stayed with the anticipated range of 6.5-8.

Over the six years monitored, only Meadow Brook and Jeremy Brook in the upper route fell below a 6.5 pH value and all streams in the lower route have stayed in the anticipated range, with the exception of Dickinson Creek in 2013 which was just slightly out of range at a 8.02 value for pH.

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 because of photosynthesis. Running water, because of its churning, dissolves more oxygen than still water, such as 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.

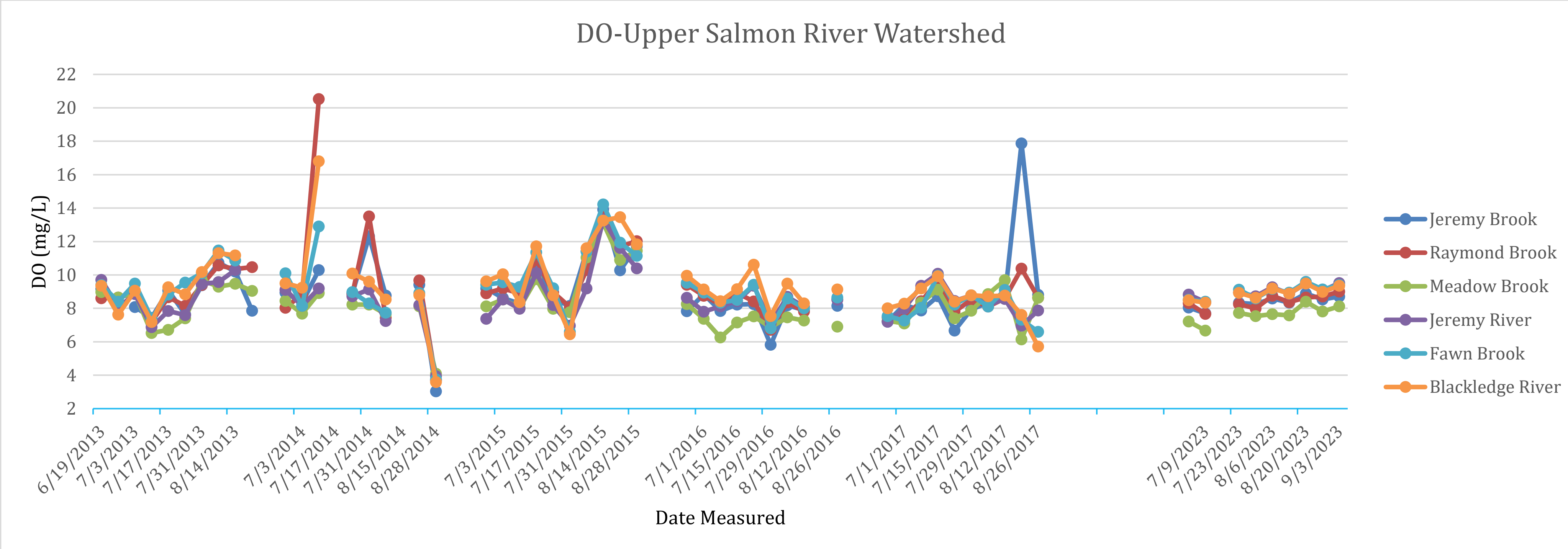
DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitudes. Thermal discharges, such as water used to cool machinery in a manufacturing plant or a power plant, raise 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.**

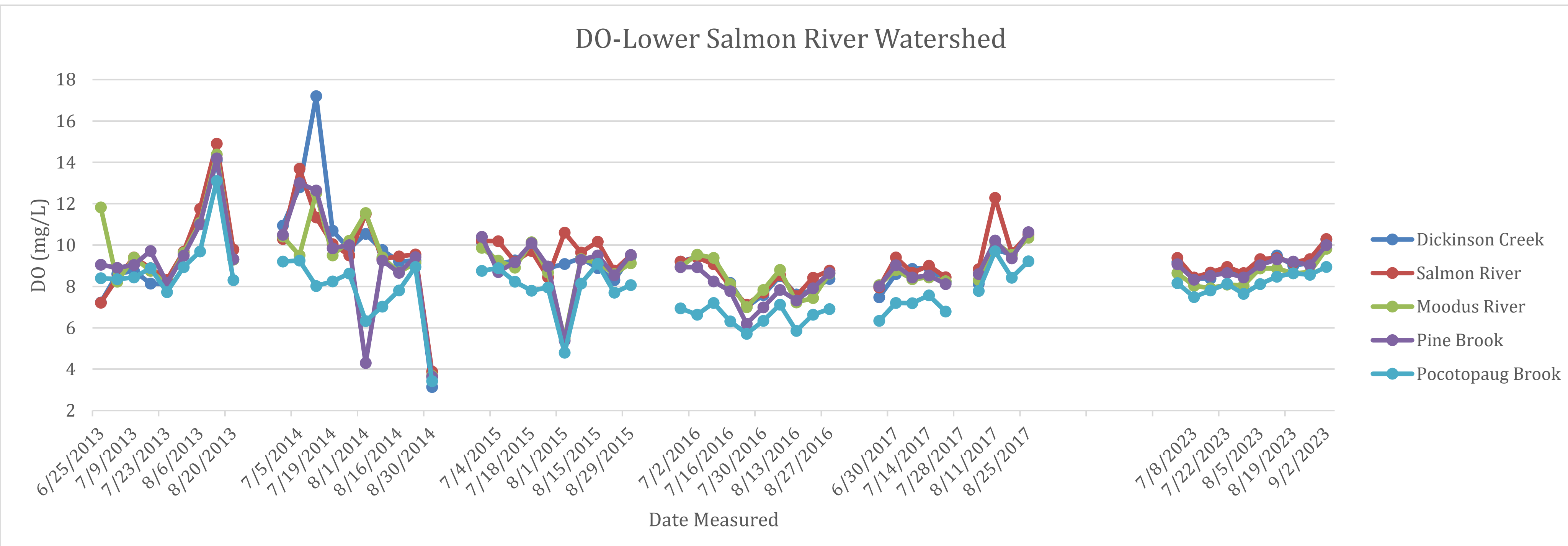
**Excerpted from Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, November 1997*
http://water.epa.gov/type/rsl/monitoring/stream_index.cf

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/


DO-Upper Salmon River Watershed
DO (mg/L)
22
20
18
16
14
12
10
8
6
4
2
6/19/2013
7/3/2013
7/17/2013
7/31/2013
8/14/2013
7/3/2014
7/17/2014
7/31/2014
8/15/2014
8/28/2014
7/3/2015
7/17/2015
7/31/2015
8/14/2015
8/28/2015
7/1/2016
7/15/2016
7/29/2016
8/12/2016
8/26/2016
7/1/2017
7/15/2017
7/29/2017
8/12/2017
8/26/2017
7/9/2023
7/23/2023
8/6/2023
8/20/2023
9/3/2023
Date Measured
Jeremy Brook
Raymond Brook
Meadow Brook
Jeremy River
Fawn Brook
Blackledge River


DO-Lower Salmon River Watershed
DO (mg/L)
18
16
14
12
10
8
6
4
2
6/25/2013
7/9/2013
7/23/2013
8/6/2013
8/20/2013
7/5/2014
7/19/2014
8/1/2014
8/16/2014
8/30/2014
7/4/2015
7/18/2015
8/1/2015
8/15/2015
8/29/2015
7/2/2016
7/16/2016
7/30/2016
8/13/2016
8/27/2016
6/30/2017
7/14/2017
7/28/2017
8/11/2017
8/25/2017
7/8/2023
7/22/2023
8/5/2023
8/19/2023
9/2/2023
Date Measured
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: In 2023, all sites showed very little variability in dissolved oxygen in comparison to the previous years of 2013-2017. Per the diagram on page 14, Brook Trout requires a minimum of 7 mg/L of dissolved oxygen. Out of both routes, Meadow Brook was the only one that fell below the 7 mg/L threshold in the summer of 2023. In the previous five years monitoring period, several sites on the upper route fell below 7 mg/L. In 2014 on the upper route, the highest DO reading of 20.5 mg/L was recorded at Raymond Brook and the lowest DO reading of 3.0 mg/L was recorded at Jeremy Brook. The highest reading on the lower route was recorded at 17.2 mg/L at Dickinson Creek and the lowest was also Dickinson Creek at 3.1 mg/L, both in 2014. Pocotopaug Brook, on the lower route, had been below 7 mg/L a number of times in the 2013-2017 timeframe, but not in 2023, as the lowest value was 7.49 mg/L, more consistent with the other streams.

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. Groundwater inflows can have the same effects depending on the bedrock they flow through.

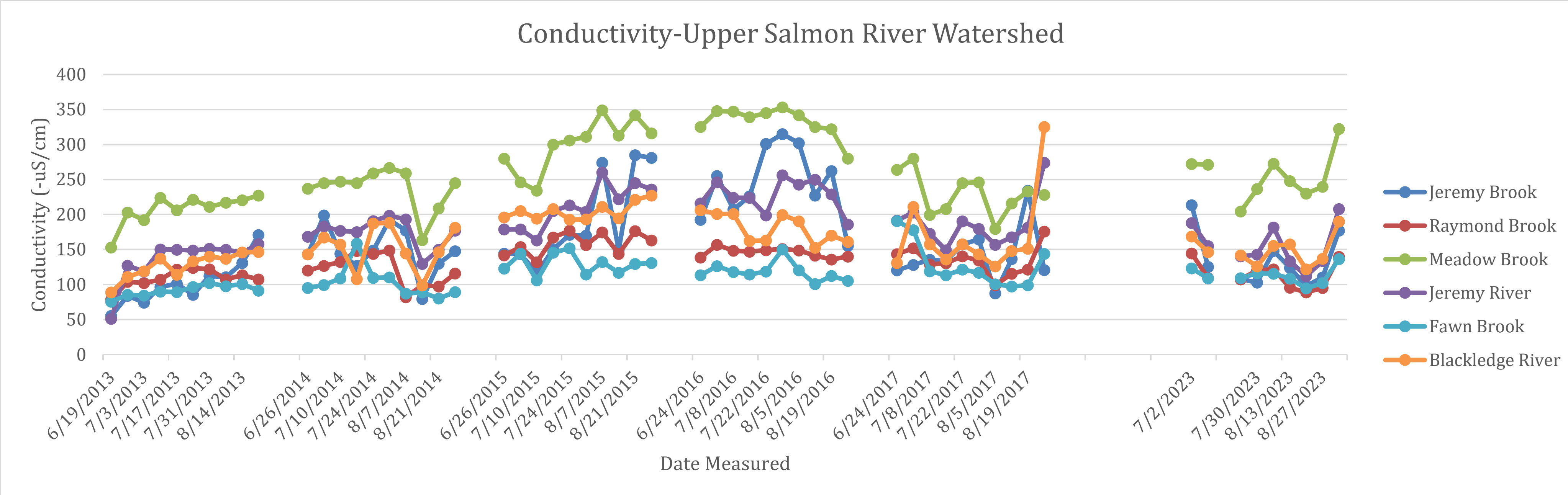
Discharges to streams can change the conductivity depending on their make-up. A failing sewage system would raise the conductivity because of the presence of chloride, phosphate, and nitrate; an oil spill would lower the conductivity.

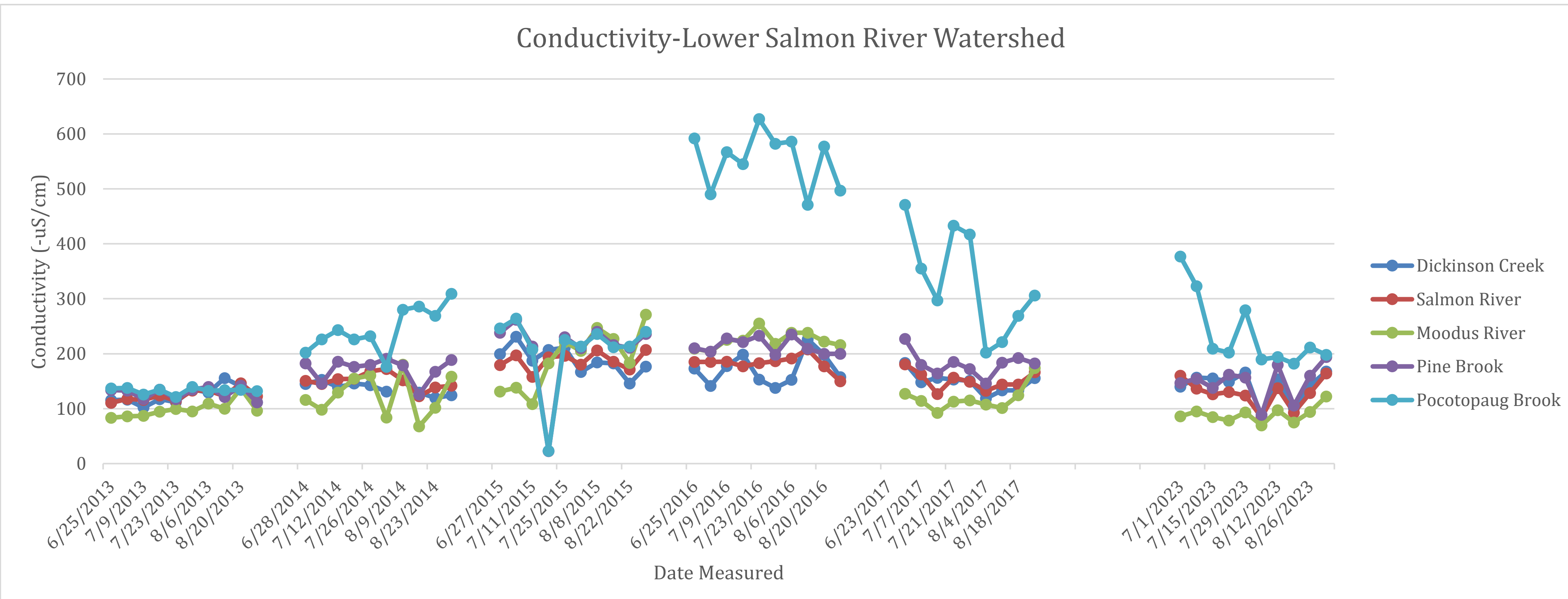
The basic unit of measurement of conductivity is the mho or siemens. Conductivity is measured in micromhos per centimeter (µmhos/cm) or microsiemens per centimeter (µs/cm). Distilled water has a conductivity in the range of 0.5 to 3 µmhos/cm. **The conductivity of rivers in the United States generally 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-Upper Salmon River Watershed
400
350
300
250
200
150
100
50
0
Conductivity (-uS/cm)
6/19/2013
7/3/2013
7/17/2013
7/31/2013
8/14/2013
6/26/2014
7/10/2014
7/24/2014
8/7/2014
8/21/2014
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
6/24/2016
7/8/2016
7/22/2016
8/5/2016
8/19/2016
6/24/2017
7/8/2017
7/22/2017
8/5/2017
8/19/2017
7/2/2023
7/30/2023
8/13/2023
8/27/2023
Date Measured
Jeremy Brook
Raymond Brook
Meadow Brook
Jeremy River
Fawn Brook
Blackledge River


Conductivity-Lower Salmon River Watershed
700
600
500
400
300
200
100
0
Conductivity (-uS/cm)
6/25/2013
7/9/2013
7/23/2013
8/6/2013
8/20/2013
6/28/2014
7/12/2014
7/26/2014
8/9/2014
8/23/2014
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
6/25/2016
7/9/2016
7/23/2016
8/6/2016
8/20/2016
6/23/2017
7/7/2017
7/21/2017
8/4/2017
8/18/2017
7/1/2023
7/15/2023
7/29/2023
8/12/2023
8/26/2023
Date Measured
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: For the upper monitoring route, conductivity values over the summers of 2013-2017 and 2023 have been fairly consistent. Meadow Brook continues to have the highest values. In the lower route, Pocotopaug Brook continues to show the greatest fluctuation in values, which may be related to activities associated with Lake Pocotopaug as the monitoring site is downstream of the lake outlet. Without other manmade influences, conductivity is mostly impacted by the bedrock geology and therefore values in the Salmon River Watershed tend to be in the lower range.

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 throughout the watershed. SRWP has subsequently purchased 6 additional loggers for use in the watershed. The loggers take readings every hour.

Total Dissolved Solids*

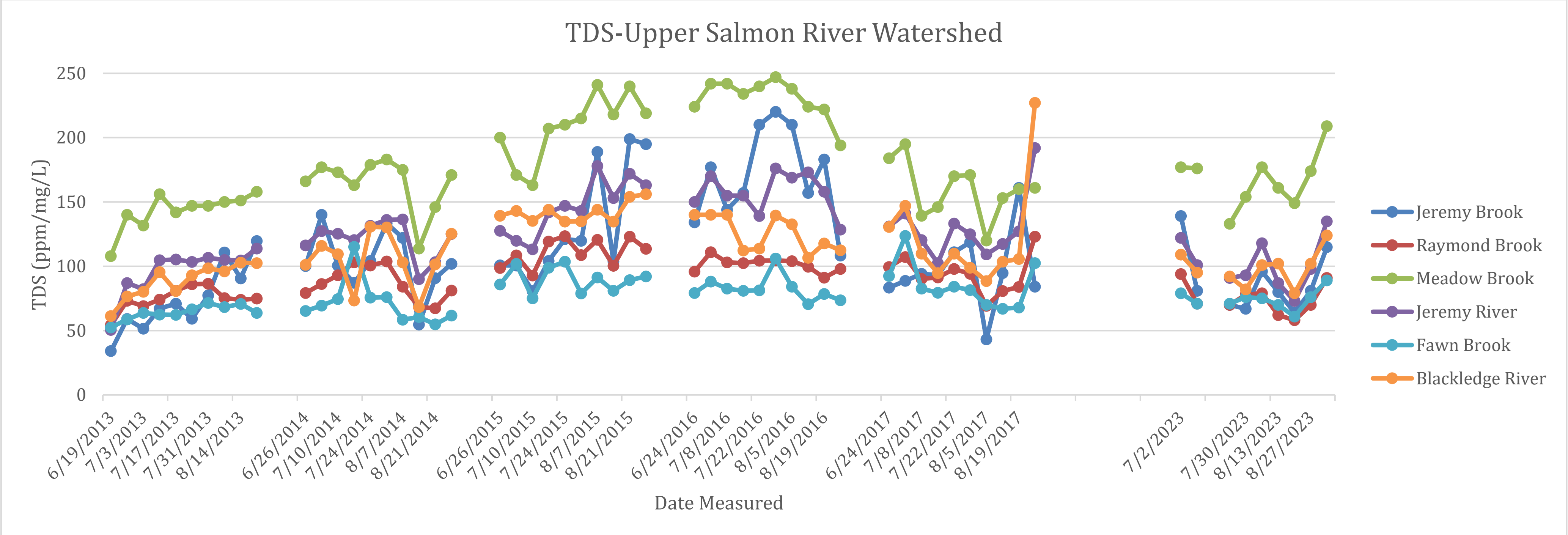
What are total dissolved solids and why are they important?

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.

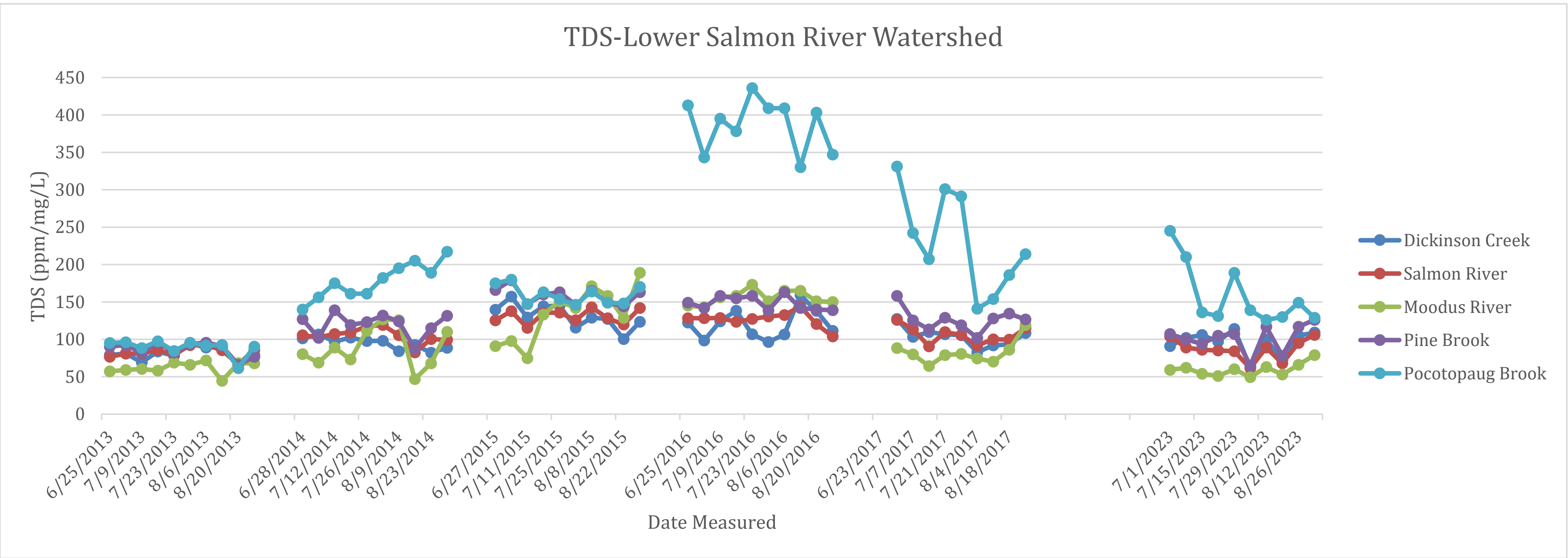
Sources of total dissolved solids include industrial discharges, sewage, fertilizers, road runoff, and soil erosion. Total solids are measured in milligrams per liter (mg/L).

**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*](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.



TDS-Upper Salmon River Watershed
TDS (ppm/mg/L)
Date Measured
Jeremy Brook
Raymond Brook
Meadow Brook
Jeremy River
Fawn Brook
Blackledge River



TDS-Lower Salmon River Watershed
TDS (ppm/mg/L)
Date Measured
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Total dissolved solids (TDS) value is related to conductivity values and therefore demonstrates similar patterns. Similar to previous years, the upper monitoring route remained within expected levels (with two exceptions) of TDS over the summer of 2023. Meadow Brook generally exhibited higher TDS values throughout 2013-2017 and it continued in 2023. The highest TDS recorded in the six years is from Meadow Brook with 247 ppm/mg/L in 2016 and the lowest at 34.1 ppm/mg/L at Jeremy Brook in 2013. The lower monitoring route was also within anticipated normal levels of TDS solids with the exception Moodus River, which generally trends lower than other segments. Pocotopaug Brook continues to have the highest TDS values out of all the streams but had lower values in 2023 from the highs of 2016 and 2017. The highest reported TDS is Pocotopaug Brook at 436 ppm/mg/L in 2016 and the lowest reported is 44.4 ppm/mg/L from Moodus River in 2013.

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 saltier, while low salinity means that the water is fresher. Salinity is measured in parts per million (ppm) or mg/L.

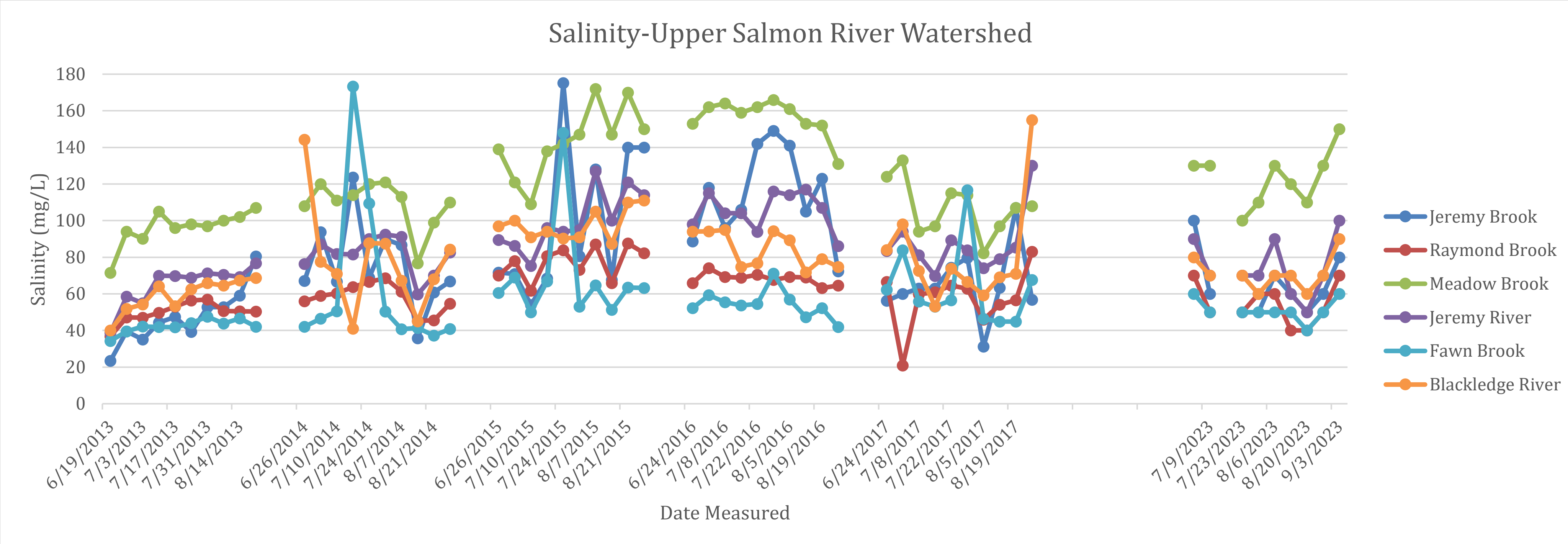
Saline in Various Waters

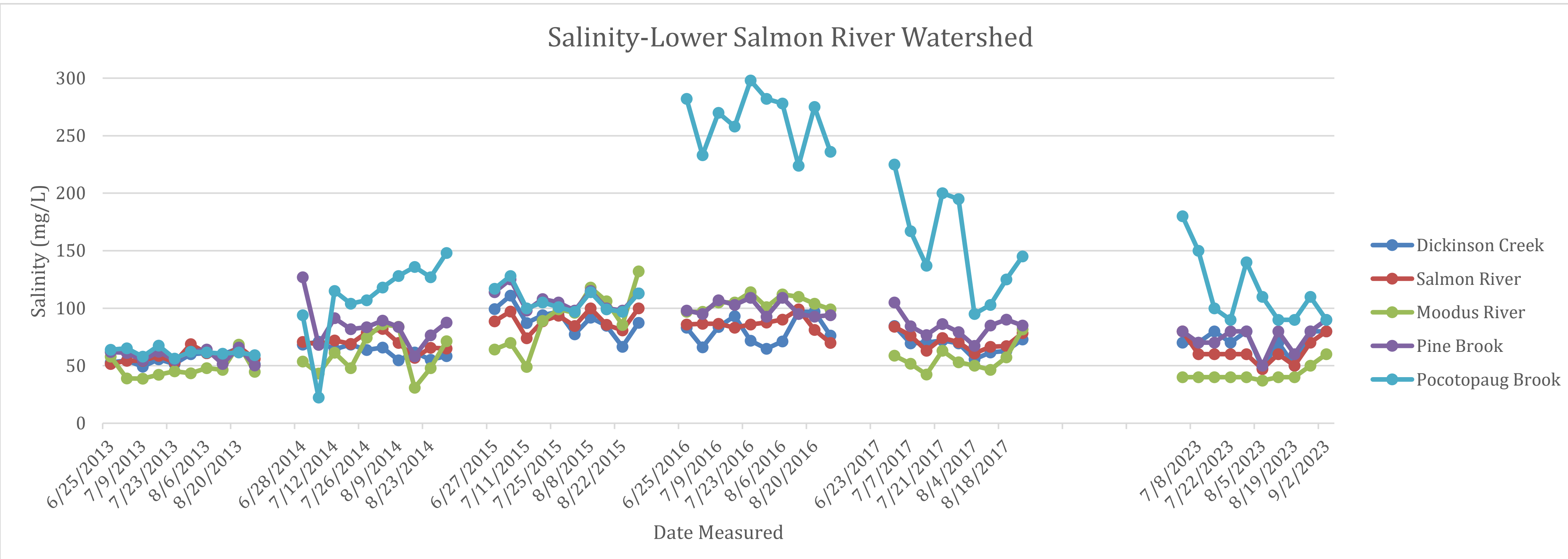
- **fresh water (typical city water in United States) : < 100 ppm**
- **fresh water, ponds, lakes, rivers, streams, aquifers: 0-500ppm**
- **water supply typically restricted to: 500 ppm**
- **fresh water - official salt concentration limits in drinking water US: 1000 ppm**
- **typical limit agriculture 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-Upper Salmon River Watershed
Salinity (mg/L)
180
160
140
120
100
80
60
40
20
0
6/19/2013
7/3/2013
7/17/2013
7/31/2013
8/14/2013
6/26/2014
7/10/2014
7/24/2014
8/7/2014
8/21/2014
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
6/24/2016
7/8/2016
7/22/2016
8/5/2016
8/19/2016
6/24/2017
7/8/2017
7/22/2017
8/5/2017
8/19/2017
7/9/2023
7/23/2023
8/6/2023
8/20/2023
9/3/2023
Date Measured
Jeremy Brook
Raymond Brook
Meadow Brook
Jeremy River
Fawn Brook
Blackledge River


Salinity-Lower Salmon River Watershed
Salinity (mg/L)
300
250
200
150
100
50
0
6/25/2013
7/9/2013
7/23/2013
8/6/2013
8/20/2013
6/28/2014
7/12/2014
7/26/2014
8/9/2014
8/23/2014
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
6/25/2016
7/9/2016
7/23/2016
8/6/2016
8/20/2016
6/23/2017
7/7/2017
7/21/2017
8/4/2017
8/18/2017
7/8/2023
7/22/2023
8/5/2023
8/19/2023
9/2/2023
Date Measured
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary Salinity value is related to conductivity and TDS values and therefore demonstrates similar patterns. Similar to prior years, the variability of the salinity of the upper monitoring route was greater than that of the lower route. Both monitoring routes had relatively consistent salinity readings in 2023, except for some variability with Meadow Brook and Pocotopaug Brook. August. It is worth noting that Meadow Brook continues to trend higher than any of the other monitoring sites for the upper route. On the lower route, the trends were consistent with previous years with Pocotopaug Brook showing the most variability.

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

Please 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.