Baseline Water Quality Monitoring in the Salmon River Watershed

Summers 2013-2016

Acknowledgements

Thanks to our many summer volunteers

Special thanks to…..

Jessica Lord…...2016 summer intern

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 and have conducted a second, third and fourth year in the summers of 2014, 2015 and 2016. 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 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 8am-10am on days noted.

Sampling Points and Duration

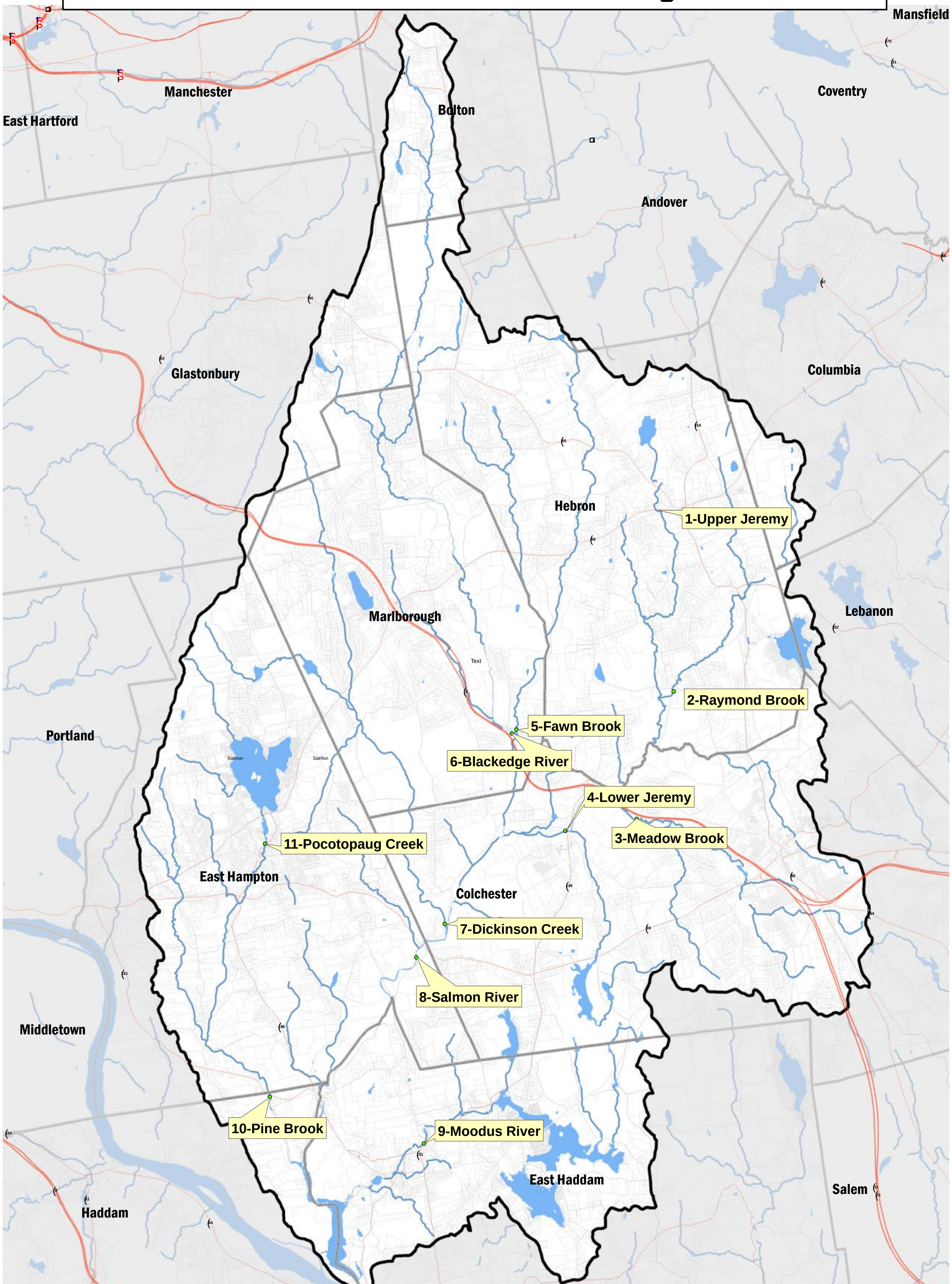
Sampling points were selected to collect data on main stream segments throughout the watershed. Access to sites was a consideration as well as establishment of two separate driving routes. The same northern route and southern route were sampled in all four summers (2013-2016). Streams in each route were sampled the same day every week at approximately the same time for ten week periods. Sampling locations are shown on the map on the following page.

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.

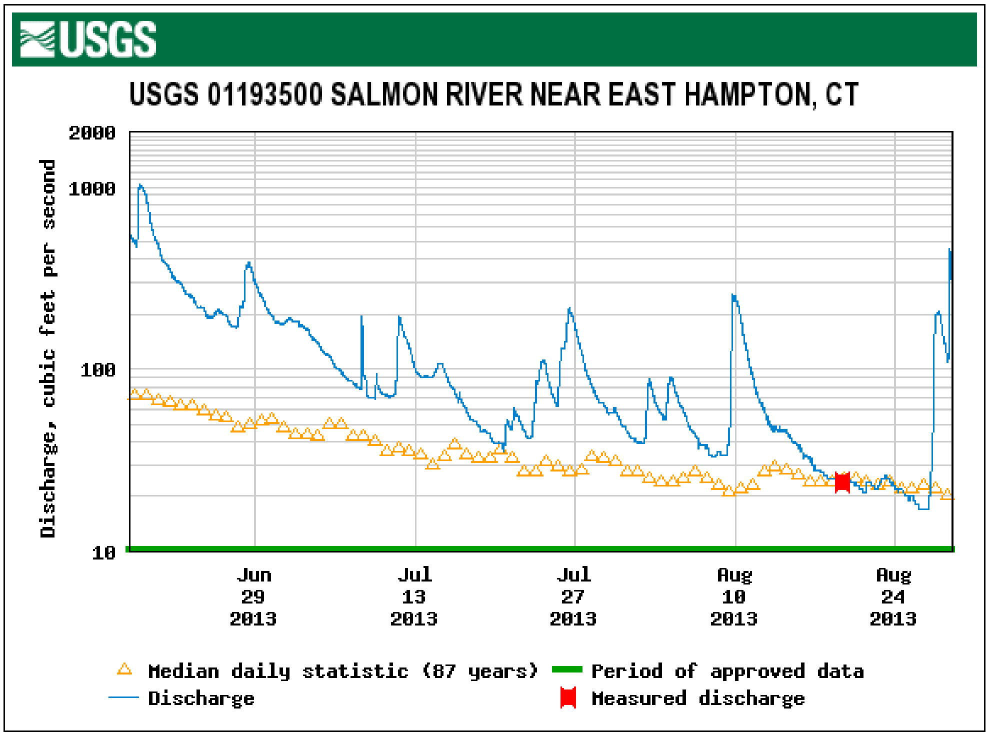
Monitoring is conducted by volunteers. Training is provided by the watershed coordinator. As with any stream monitoring effort both human error and equipment malfunction can result in errors in data.

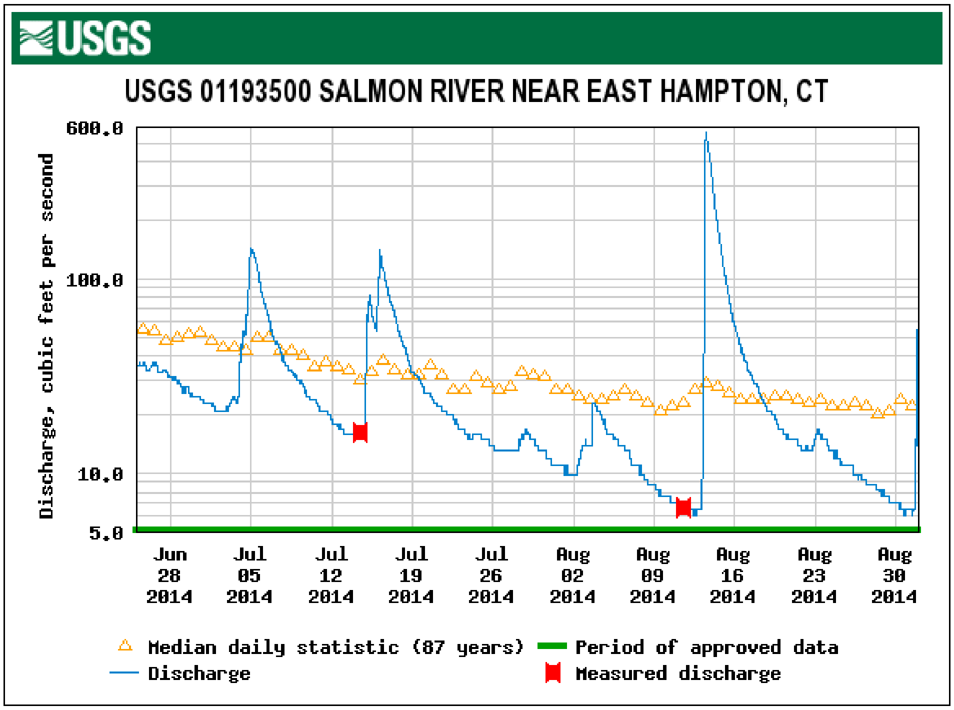
Salmon River Watershed Monitoring Points

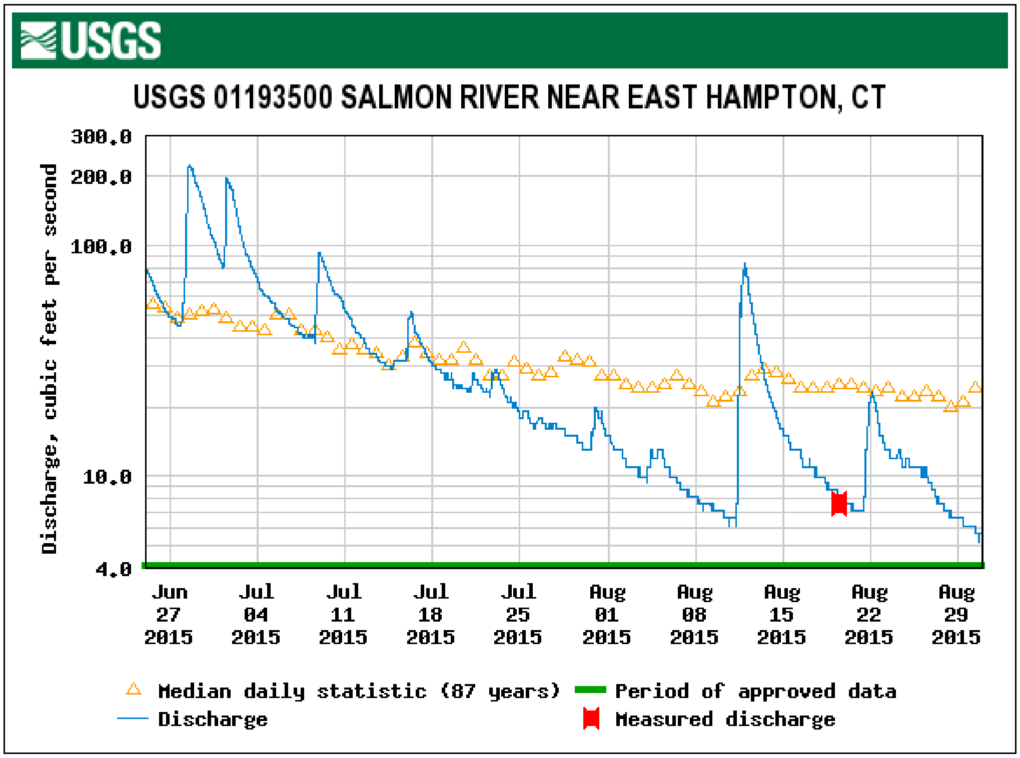


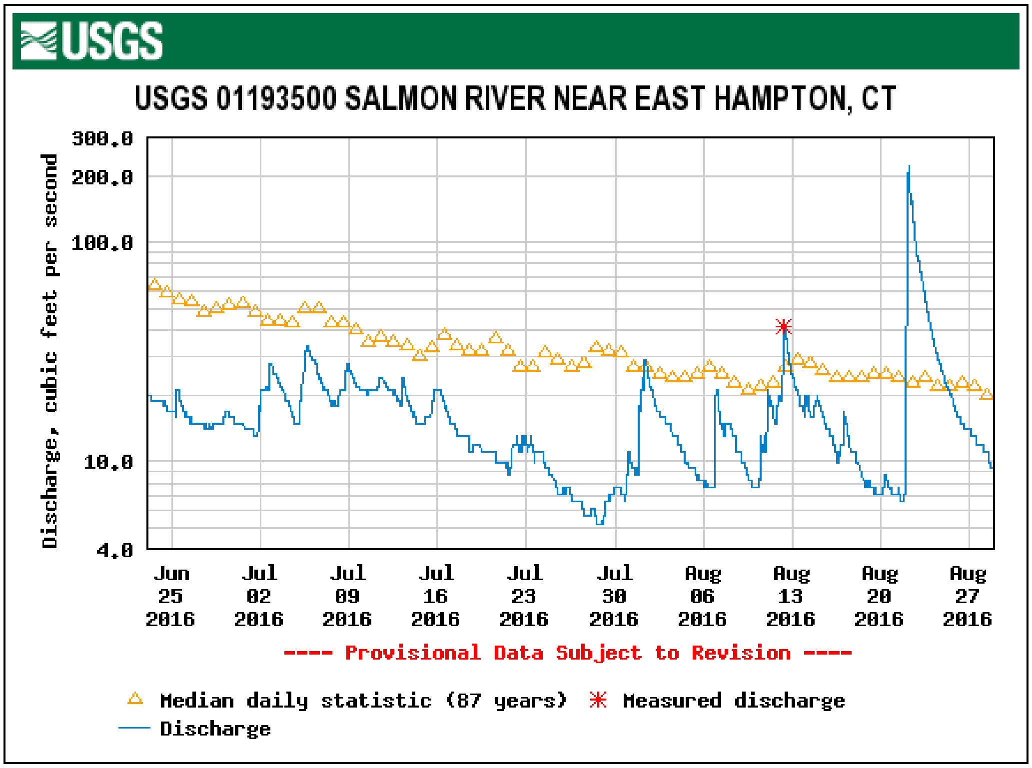
This map is intended for planning and educational purposes only. The accuracy at any given location cannot be guaranteed. Parcel and Open Space information was collected from each municipality. Background data sources include CT DEEP and UConn CLEAR.Map created by Emily Wilson, UConn CLEAR, emily.wilson@uconn.edu.

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 better understand some of the variations noted.






USGS
USGS 01193500 SALMON RIVER NEAR EAST HAMPTON, CT
Discharge, cubic feet per second
300.0
200.0
100.0
10.0
4.0
Jun 27 2015
Jul 04 2015
Jul 11 2015
Jul 18 2015
Jul 25 2015
Aug 01 2015
Aug 08 2015
Aug 15 2015
Aug 22 2015
Aug 29 2015
Median daily statistic (87 years)
Period of approved data
Discharge
Measured discharge


USGS
USGS 01193500 SALMON RIVER NEAR EAST HAMPTON, CT
Discharge, cubic feet per second
300.0
200.0
100.0
10.0
4.0
Jun 25 2016
Jul 02 2016
Jul 09 2016
Jul 16 2016
Jul 23 2016
Jul 30 2016
Aug 06 2016
Aug 13 2016
Aug 20 2016
Aug 27 2016
---- Provisional Data Subject to Revision ----
Median daily statistic (87 years)
Measured discharge
Discharge

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 the maximum temperature for short exposures and a weekly average temperature that 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.

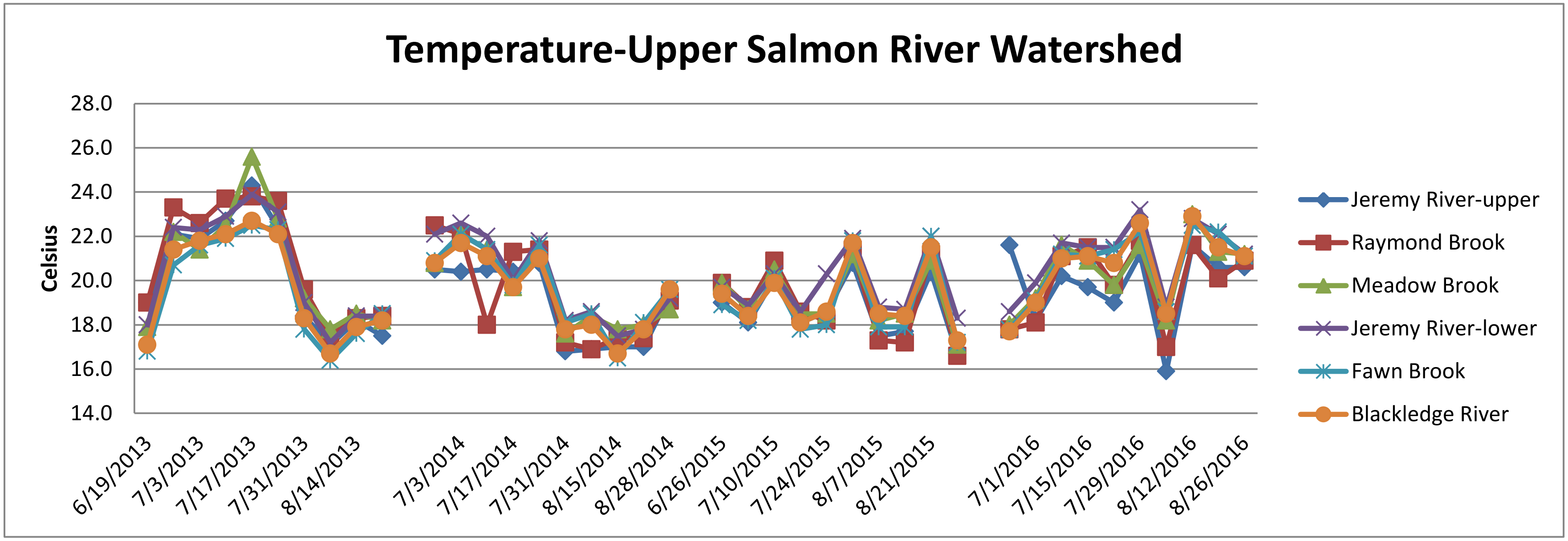
Table 5.5-Maximum average temperatures for growth and short-term maximum temperatures for selected fish (°C and ° F)

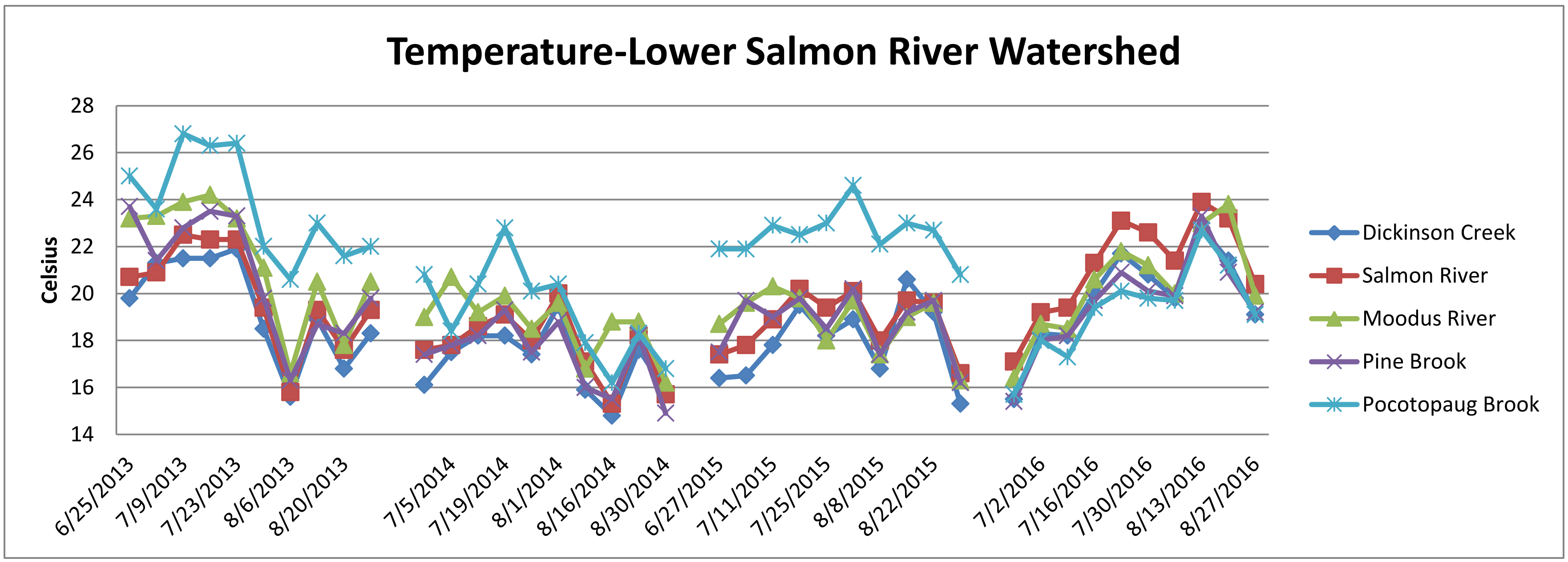
Species	Max. weekly average temp for growth (juveniles)	Max. temp for survival of short exposure (juveniles)	Max. average weekly temp. for spawning (a)	Max. temp. for embryo spawning(b)
Atlantic salmon	20 °C (68 °F)	23 °C (73 °F)	5 °C (41 °F)	11 °C (52 °F)
Bluegill	32 °C (90 °F)	35 °C (95 °F)	25 °C (77 °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)*

*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


Temperature-Upper Salmon River Watershed
Celsius
28.0
26.0
24.0
22.0
20.0
18.0
16.0
14.0
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
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
7/1/2016
7/15/2016
7/29/2016
8/12/2016
8/26/2016
Jeremy River-upper
Raymond Brook
Meadow Brook
Jeremy River-lower
Fawn Brook
Blackledge River


Temperature-Lower Salmon River Watershed
Celsius
28
26
24
22
20
18
16
14
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
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
7/2/2016
7/16/2016
7/30/2016
8/13/2016
8/27/2016
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Of primary note on the lower watershed was Pocotopaug Creek, which had consistently lower temperature the summer of 2016 than the three previous summers. Streamflow was also notability lower, which may have meant that the water in the stream was primarily groundwater flow rather than a combination of groundwater and surface flow from the lake.

On the majority of streams sampled, temperatures continued to climb through the summer until about mid-August, where they cooled, most likely in response to cooler air temperatures. They rose again, but started to come back down near the end of the monitoring season. Temperatures in the ten week monitoring period did not exceed 24°C.

Please Note: 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 gets lower.

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

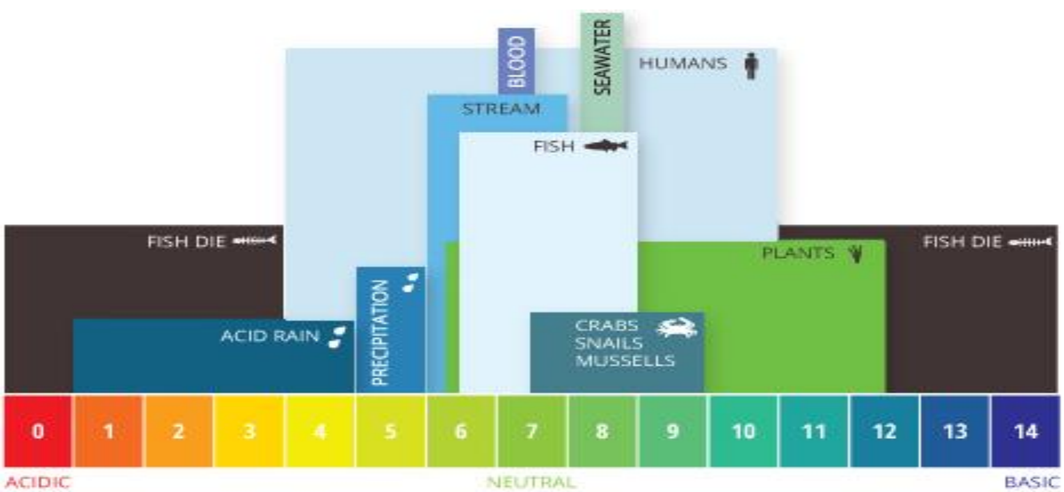
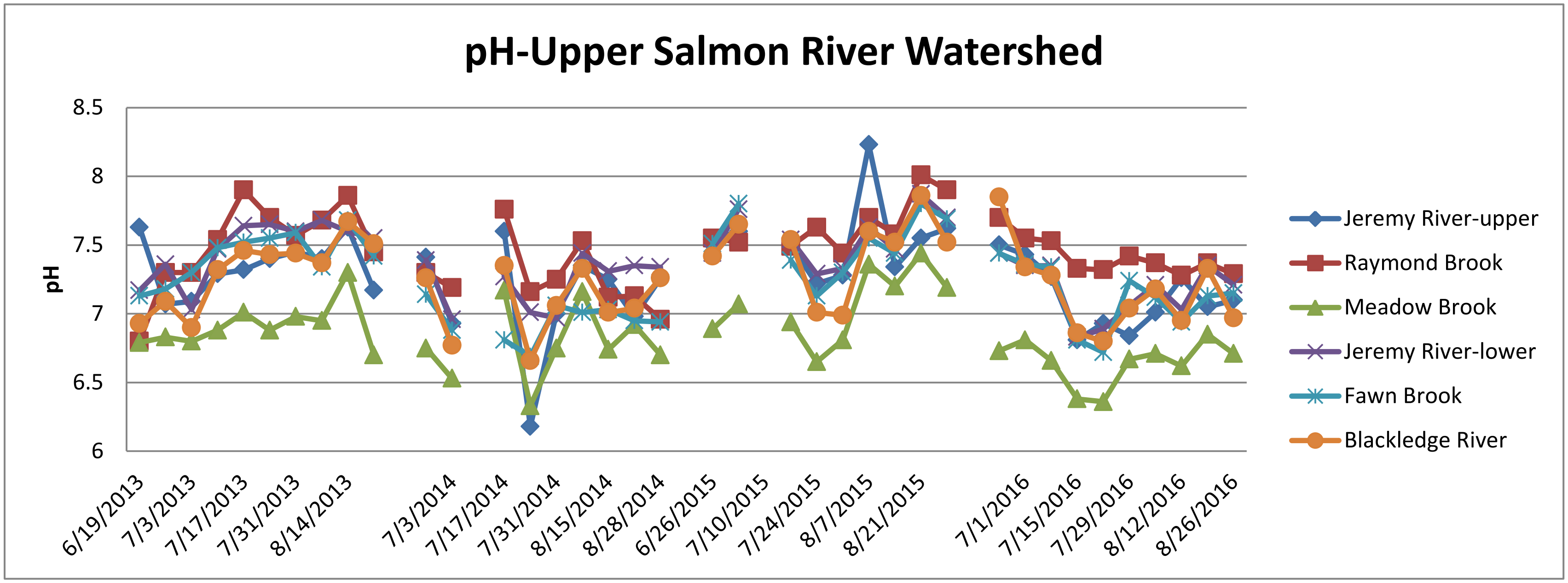
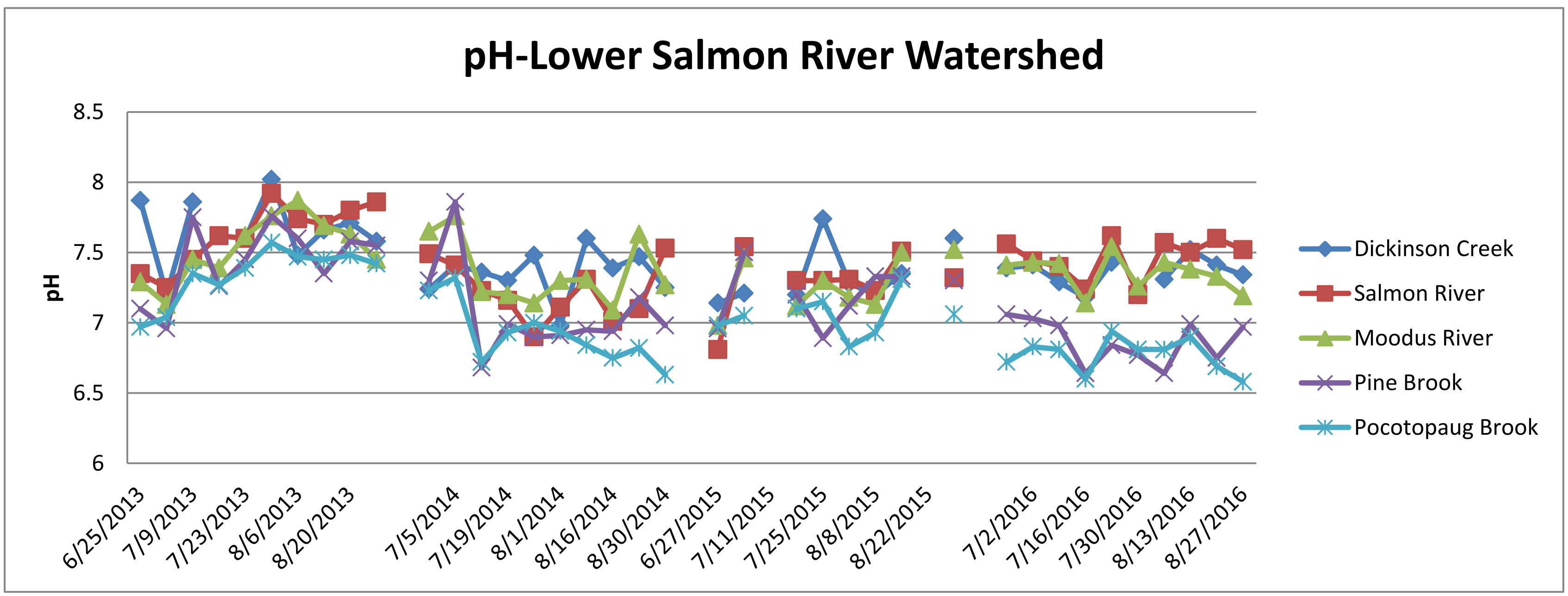


Diagram and facts information from the article *"Fundamentals of Environmental Measurement"* on the Fondriest website: http://www.fondriest.com/environmental-measurements/parameters/water-quality/ph/#p1


pH-Upper Salmon River Watershed
8.5
8
7.5
7
6.5
6
pH
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
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
7/1/2016
7/15/2016
7/29/2016
8/12/2016
8/26/2016
Jeremy River-upper
Raymond Brook
Meadow Brook
Jeremy River-lower
Fawn Brook
Blackledge River


pH-Lower Salmon River Watershed
8.5
8
7.5
7
6.5
6
pH
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
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
7/2/2016
7/16/2016
7/30/2016
8/13/2016
8/27/2016
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Gaps in data indicate instrument malfunction. pH measurements for the summer of 2013 were generally higher than the subsequent summers, but within the 65.-8 range. Ranges for pH in the summer of 2014 are generally within anticipated range of 6.5-8, with the exception of two readings in the upper route on the Jeremy River and Meadow Brook on July 24th. Results in 2015 were all within desirable range. With the exception of Meadow Brook, which dipped below 6.5 for two readings, all pH readings were within anticipated ranges for 2016 monitoring period.

Please Note: 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

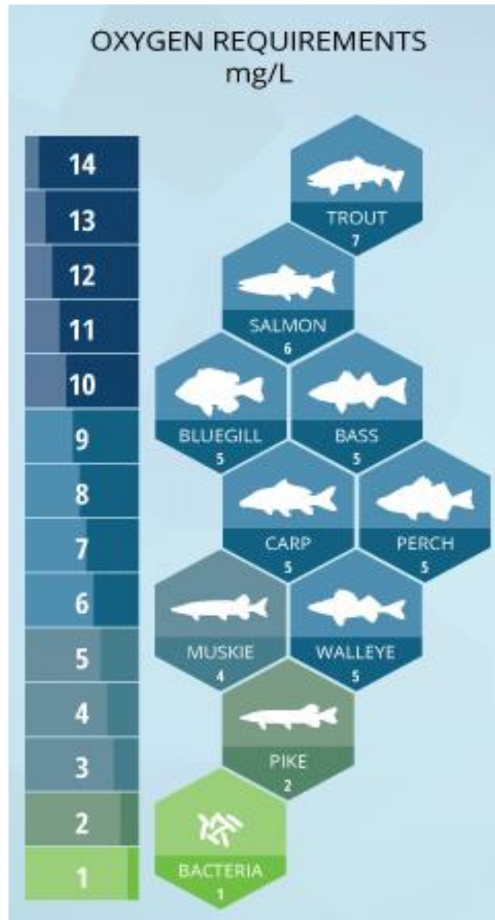
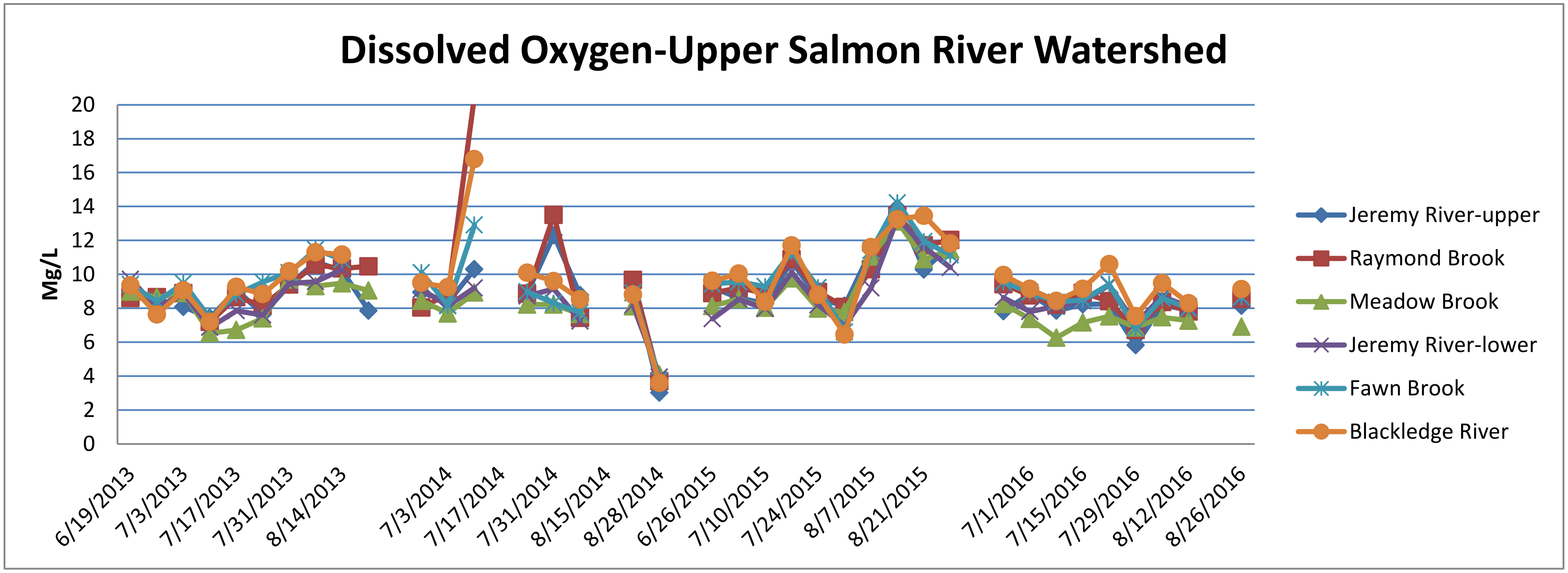
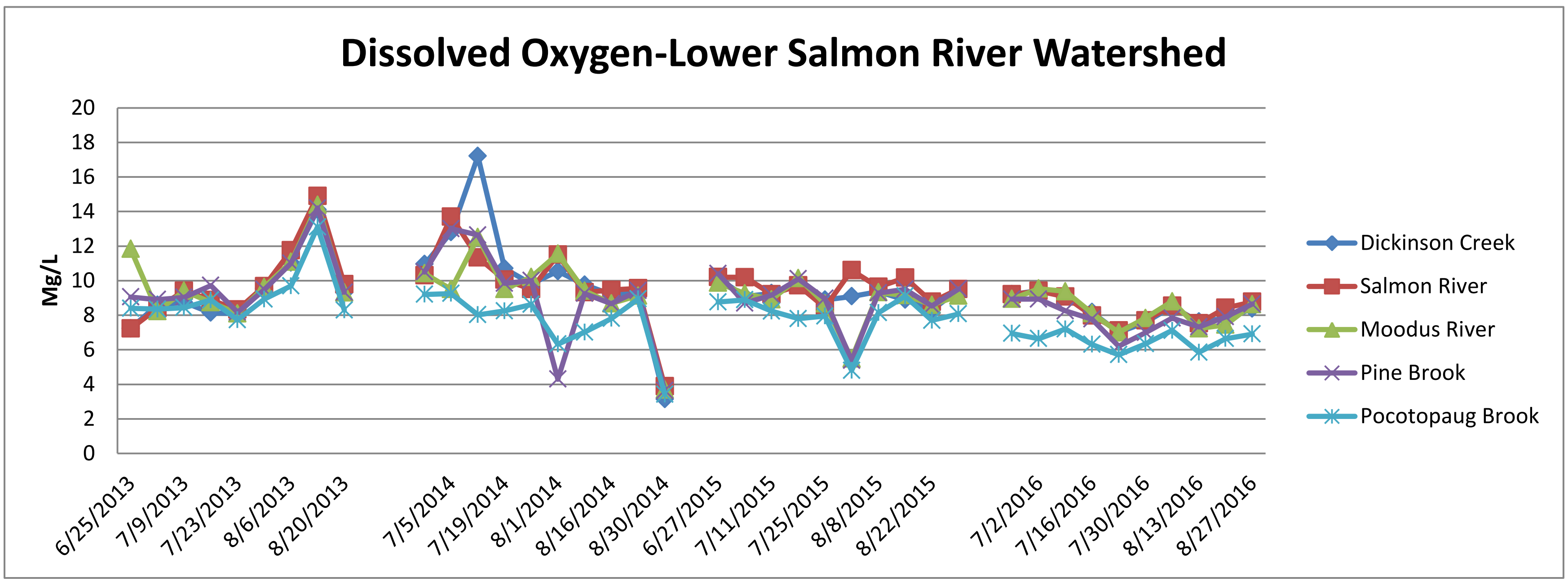


Diagram showing the Minimum dissolved oxygen requirements of freshwater fish.

Diagram and facts information from the article "Fundamentals of Environmental Measurement" on the Fondriest website: http://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/#1


Dissolved Oxygen-Upper Salmon River Watershed
20
18
16
14
12
10
8
6
4
2
0
Mg/L
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
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
7/1/2016
7/15/2016
7/29/2016
8/12/2016
8/26/2016
Jeremy River-upper
Raymond Brook
Meadow Brook
Jeremy River-lower
Fawn Brook
Blackledge River


Dissolved Oxygen-Lower Salmon River Watershed
20
18
16
14
12
10
8
6
4
2
0
Mg/L
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
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
7/2/2016
7/16/2016
7/30/2016
8/13/2016
8/27/2016
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Gaps in data indicate instrument malfunction. In general, DO ranges showed more variability in the summer of 2014 versus the summer of 2013, but less in the summer of 2015. In 2015, readings dipped the lowest in the season around 7/31 and 8/1, corresponding with the highest water temperatures. In 2016, dissolved oxygen levels on average were a bit lower with less variability. Poctopaug Creek exhibited the lowest readings overall, with Meadow Brook being the next lowest set. Native Brook Trout require a minimum of 7 mg/L of dissolved oxygen.

Please Note: 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.

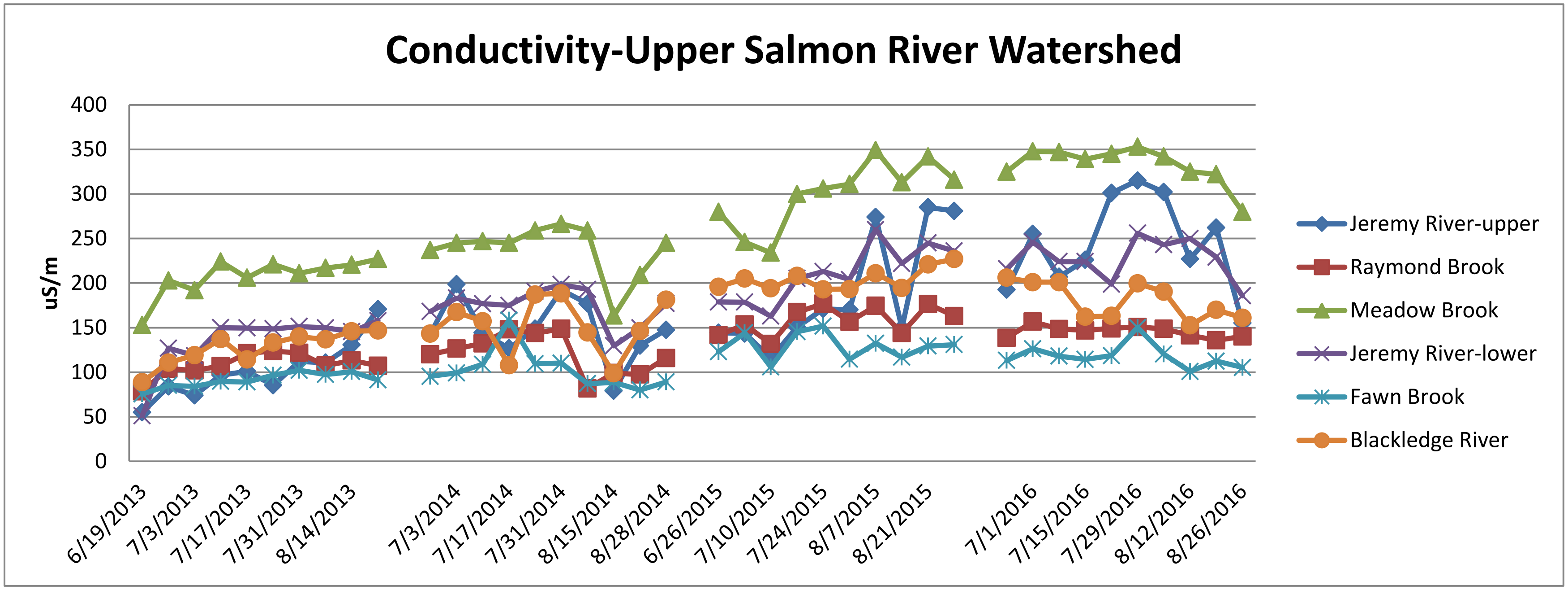
The basic unit of measurement of conductivity is the mho or siemens. Conductivity is measured in micromhos per centimeter (µmhos/cm) or microsiemens per centimeter (µs/cm). Distilled water has a conductivity in the range of 0.5 to 3 µmhos/cm. **The conductivity of rivers in the United States generally 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-Upper Salmon River Watershed
uS/m
400
350
300
250
200
150
100
50
0
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
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
7/1/2016
7/15/2016
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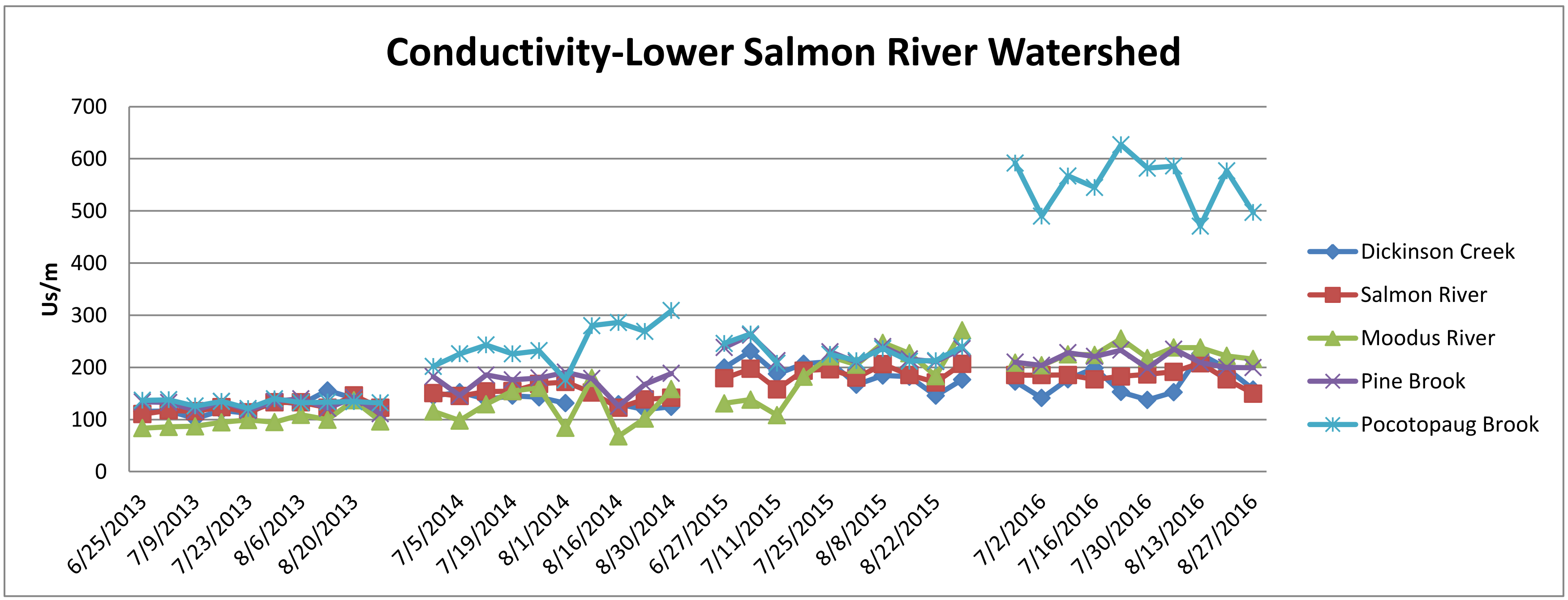
Jeremy River-upper
Raymond Brook
Meadow Brook
Jeremy River-lower
Fawn Brook
Blackledge River


Conductivity-Lower Salmon River Watershed
Us/m
700
600
500
400
300
200
100
0
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
6/27/2015
7/11/2015
7/25/2015
8/8/2015
8/22/2015
7/2/2016
7/16/2016
7/30/2016
8/13/2016
8/27/2016
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Gaps in data indicate instrument malfunction. Please note that y axis values on the lower watershed graph are almost twice that of the upper watershed to accommodate Pocotopaug Creek values, which are significantly higher than previous seasons. Streamflow was also notability lower in Pocotopaug Creek, which may have meant that the water in the stream was primarily groundwater flow rather than a combination of groundwater and surface flow from the lake.

For the upper watershed, the Jeremy River (upper and lower) and Meadow Brook appear to continue some minor upward trending. For the lower watershed, with the exception of Pocotopaug Creek, numbers while elevated since 2013, were for the most part similar to 2015.

In general since 2013, conductivity values show upward trending for most stream segments. This may be partially explained because compared to 2013, 2014 had less precipitation, followed by another drought year in 2015 and finally an even worse drought season in 2016.

Please Note: 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 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?*

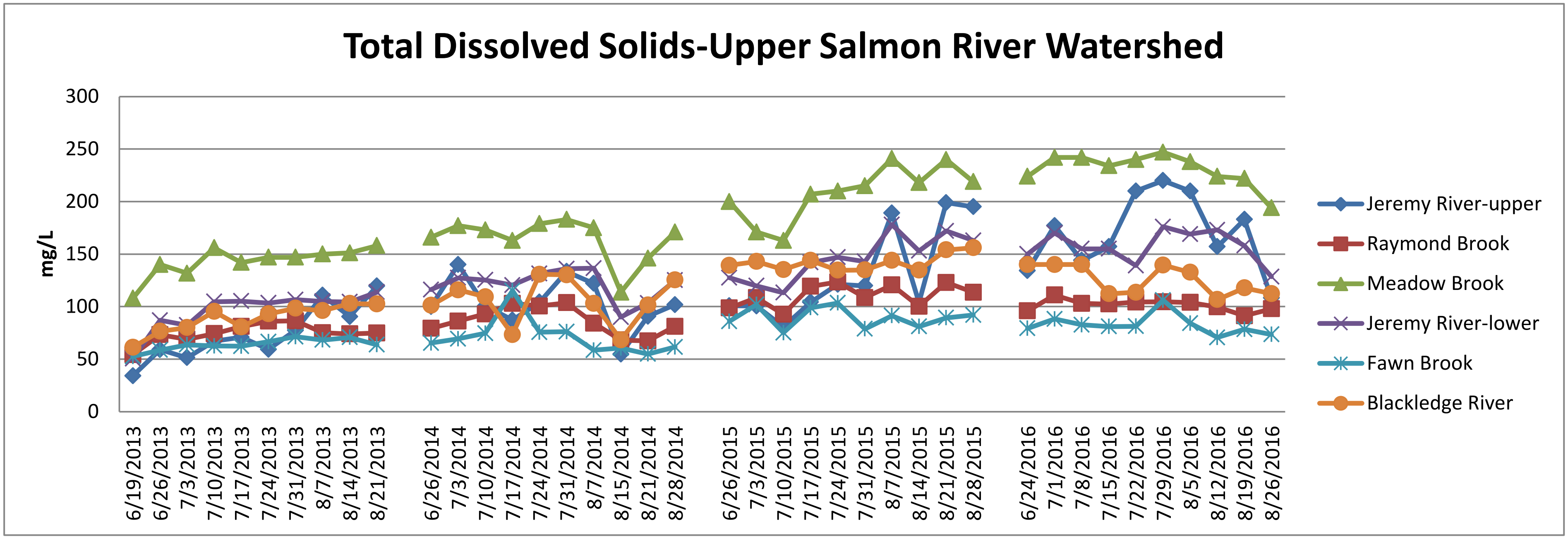
In stream water, dissolved solids consist of calcium, chlorides, nitrate, phosphorus, iron, sulfur, and other ions particles that will pass through a filter with pores of around 2 microns (0.002 cm) in size. The concentration of total dissolved solids affects the water balance in the cells of aquatic 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 might not survive.

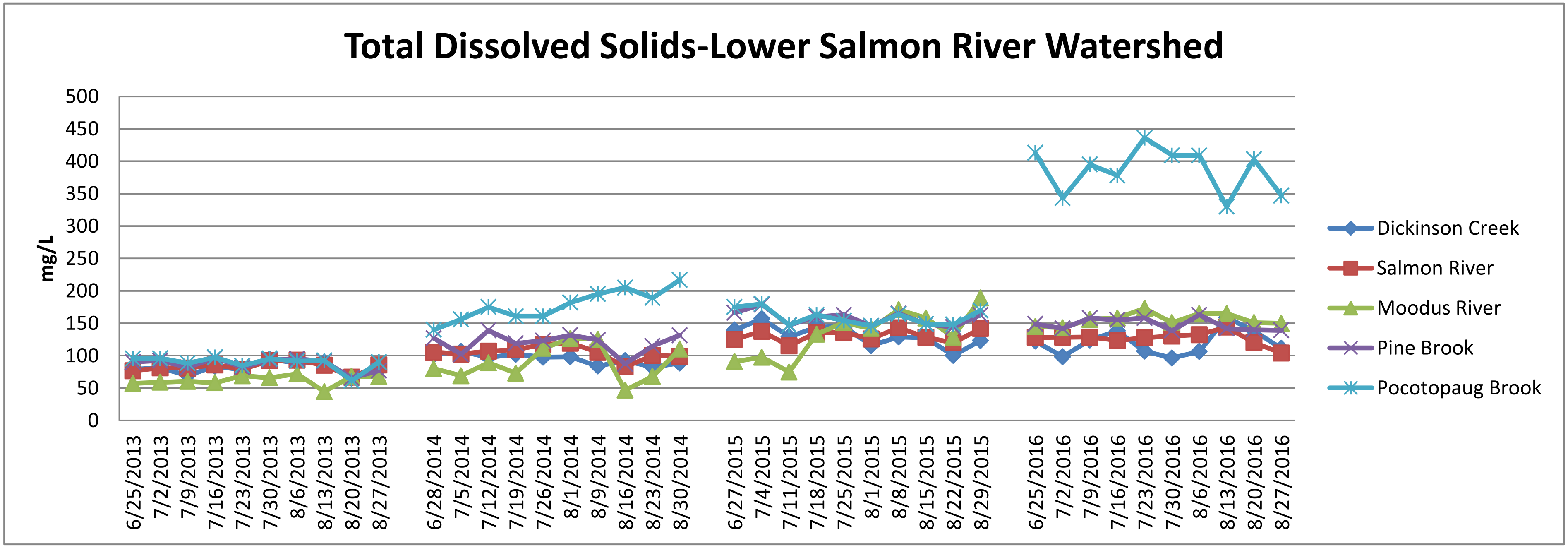
Sources of total dissolved solids include industrial discharges, sewage, fertilizers, road runoff, and soil erosion. Total solids are measured in milligrams per liter (mg/L).

*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-Upper Salmon River Watershed
mg/L
300
250
200
150
100
50
0
6/19/2013
6/26/2013
7/3/2013
7/10/2013
7/17/2013
7/24/2013
7/31/2013
8/7/2013
8/14/2013
8/21/2013
6/26/2014
7/3/2014
7/10/2014
7/17/2014
7/24/2014
7/31/2014
8/7/2014
8/15/2014
8/21/2014
8/28/2014
6/26/2015
7/3/2015
7/10/2015
7/17/2015
7/24/2015
7/31/2015
8/7/2015
8/14/2015
8/21/2015
8/28/2015
6/24/2016
7/1/2016
7/8/2016
7/15/2016
7/22/2016
7/29/2016
8/5/2016
8/12/2016
8/19/2016
8/26/2016
Jeremy River-upper
Raymond Brook
Meadow Brook
Jeremy River-lower
Fawn Brook
Blackledge River


Total Dissolved Solids-Lower Salmon River Watershed
mg/L
500
450
400
350
300
250
200
150
100
50
0
6/25/2013
7/2/2013
7/9/2013
7/16/2013
7/23/2013
7/30/2013
8/6/2013
8/13/2013
8/20/2013
8/27/2013
6/28/2014
7/5/2014
7/12/2014
7/19/2014
7/26/2014
8/1/2014
8/9/2014
8/16/2014
8/23/2014
8/30/2014
6/27/2015
7/4/2015
7/11/2015
7/18/2015
7/25/2015
8/1/2015
8/8/2015
8/15/2015
8/22/2015
8/29/2015
6/25/2016
7/2/2016
7/9/2016
7/16/2016
7/23/2016
7/30/2016
8/6/2016
8/13/2016
8/20/2016
8/27/2016
Dickinson Creek
Salmon River
Moodus River
Pine Brook
Pocotopaug Brook

Quick Summary: Please note that y axis values on the lower watershed graph are almost twice that of the upper watershed to accommodate Pocotopaug Creek values, which are significantly higher than previous seasons. Streamflow was also notability lower in Pocotopaug Creek, which may have meant that the water in the stream was primarily groundwater flow rather than a combination of groundwater and surface flow from the lake.

For the upper watershed, the Jeremy River (upper and lower) and Meadow Brook appear to continue some minor upward trending. For the lower watershed, with the exception of Pocotopaug Creek, numbers while elevated since 2013 were for the most part similar to 2015.

In general since 2013, total dissolved solids values show upward trending for most stream segments. This may be partially explained because compared to 2013, 2014 had less precipitation, followed by another drought year in 2015 and finally an even worse drought season in 2016.

Please Note: 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)

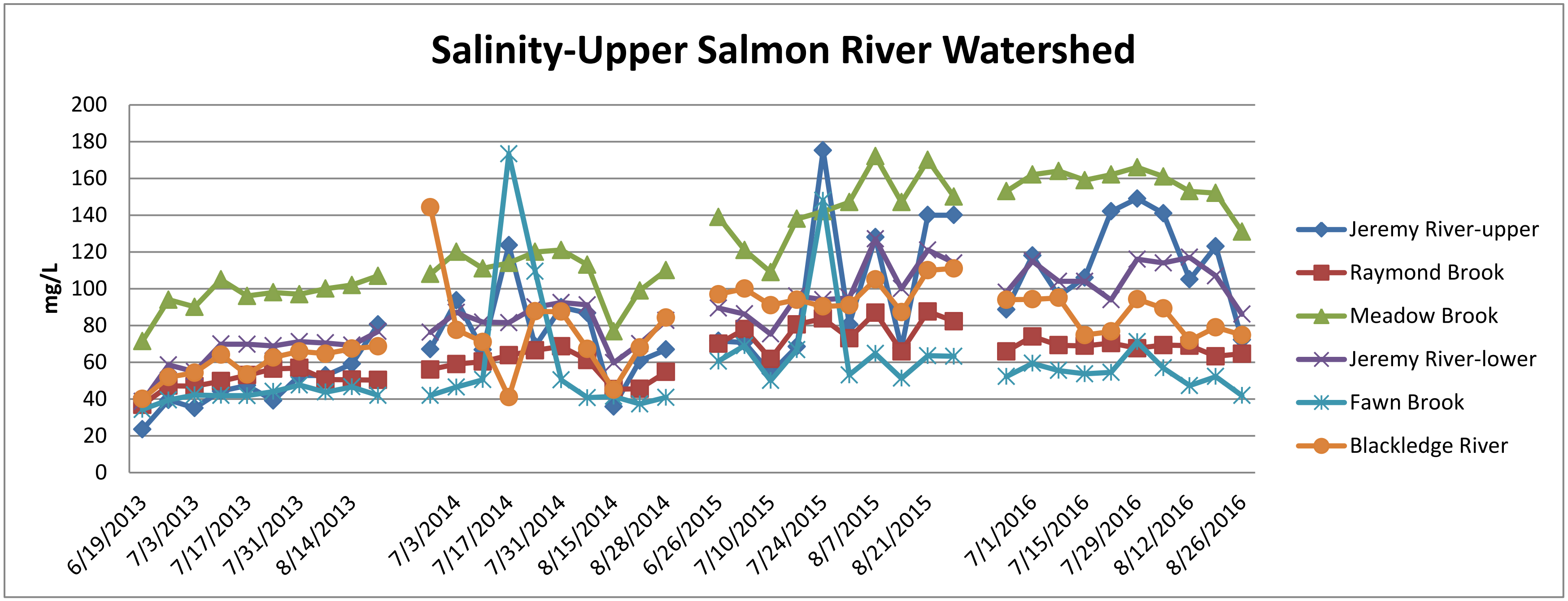
Saline in Various Waters

- **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
mg/L
200
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
7/3/2014
7/17/2014
7/31/2014
8/15/2014
8/28/2014
6/26/2015
7/10/2015
7/24/2015
8/7/2015
8/21/2015
7/1/2016
7/15/2016
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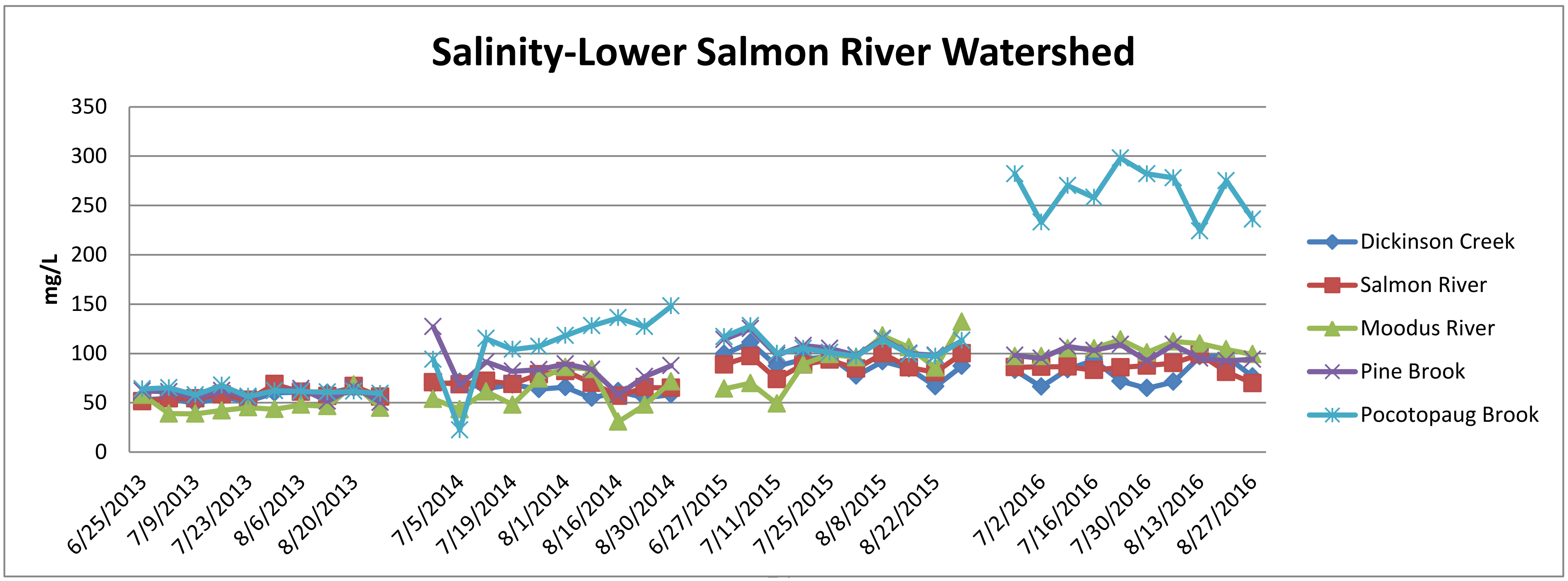
Salinity-Lower Salmon River Watershed
mg/L
350
300
250
200
150
100
50
0
6/25/2013
7/9/2013
7/23/2013
8/6/2013
8/20/2013
7/5/2014
7/19/2014
8/1/2014
8/16/2014
8/30/2014
6/27/2015
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