Tamworth Water Quality Overview

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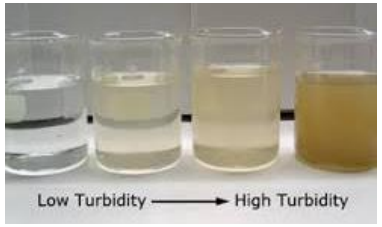
RIVERS parameters

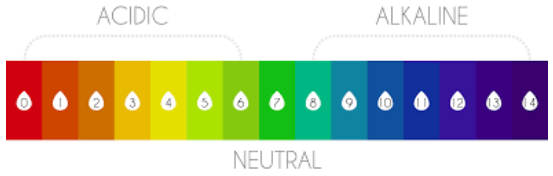
GMCG volunteers tested parameters

- Turbidity
  - Clarity of the fluid
  - Higher level of suspended particles = higher temperature

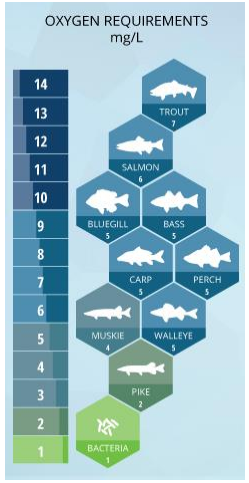


- Temperature
  - Metabolism increases with higher temperatures, which can result in lower DO readings
  - Different organisms prefer different temperatures

- pH
  - Pure water is 7.0
  - Most natural water in NH is slightly acidic
  - Aquatic life prefers pH between 6.5 and 8.2



- Dissolved Oxygen
  - Measures ability to support life
  - VBAP school program looks for various macroinvertebrates which are intolerant to low DO readings



- Conductivity
  - Ability of water to pass an electrical charge
  - Based on other elements in the water that have positive (Mg^+, Ca^+) or negative (Cl^-, NO_3^-) charges
  - Proxy for road salt (NaCl or CaCl2)

- Total Phosphorus (TP)
  - With nitrogen, the two most important nutrients for plant and microbe life
  - Environmental increases indicate decomposition (i.e. sewage)

- General changes to their site
  - Road work
  - New construction/demolition

Water Quality Standards – Acceptable limits

Either from NHDES or EPA*

- Dissolved O2: between 6-11mg/L and between 75% and 120%
- Conductivity: below 500uS/cm
- pH: between 6-8, preferably close to 6.5, unless naturally occurring as less, then no more than 1 pH shift
- Turbidity: less than 10 NTU, unless baseline data indicates naturally occurring turbidity, then standard is less than 10 NTU above background levels (in our cases, there are no sites with naturally occurring turbidity above 10 NTU
- Temperature: No standard, but monitored for changes
- Total P: under 30ug/L, over this is considered “nuisance levels”

Each site we monitor will have naturally occurring differences due to geology, plant life, etc.

*The EPA and NHDES have slight differences between their acceptable limits

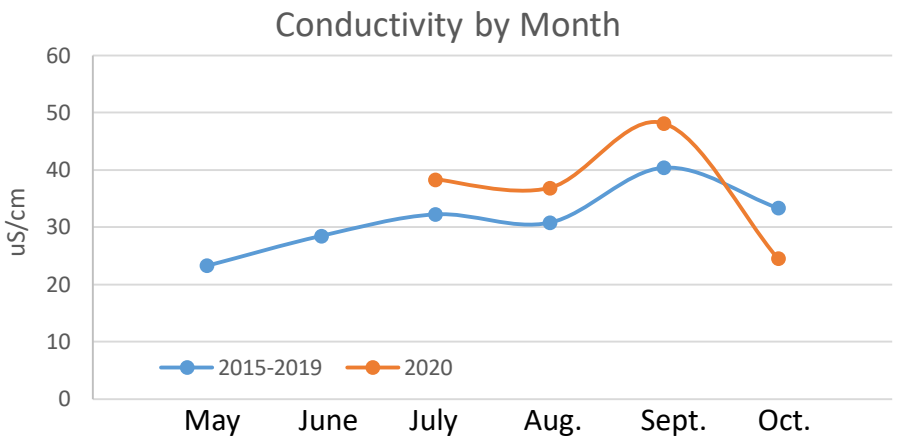
GT-1 Bearcamp River 2015-2020 snapshot

Monitored since 2002

Parameter	Explanation
pH	Worsening; most pH measurements in 2020 were below 6
Turbidity	Worsening; highest levels seen in the last 5 years; higher than most sites, but still considered within acceptable limits
Total P*	Worsening; with a few data points above nuisance levels in 2019.

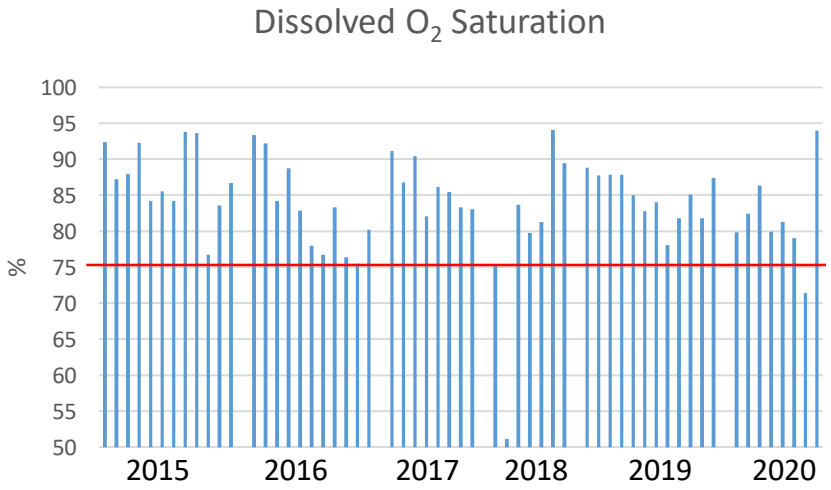
*TP Data available through 2019

*Summer field sampling began in July 2020 due to complications with COVID-19

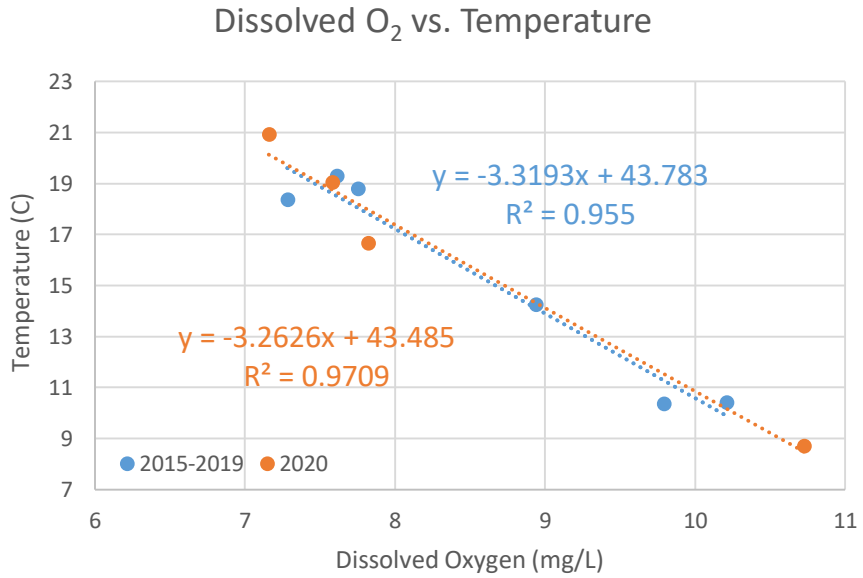


Site location

Conductivity increases slightly in 2020 from combined 2015-2019 median values. However, these data points at GT-1 do not rise above 50 uS/cm which indicates healthy water quality in terms of salt levels.



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2020 (orange) show a similar value compared to combined 2015-2019 values (blue) which indicates a strong correlation. DO levels at GT-1 are stable and point to good water quality.

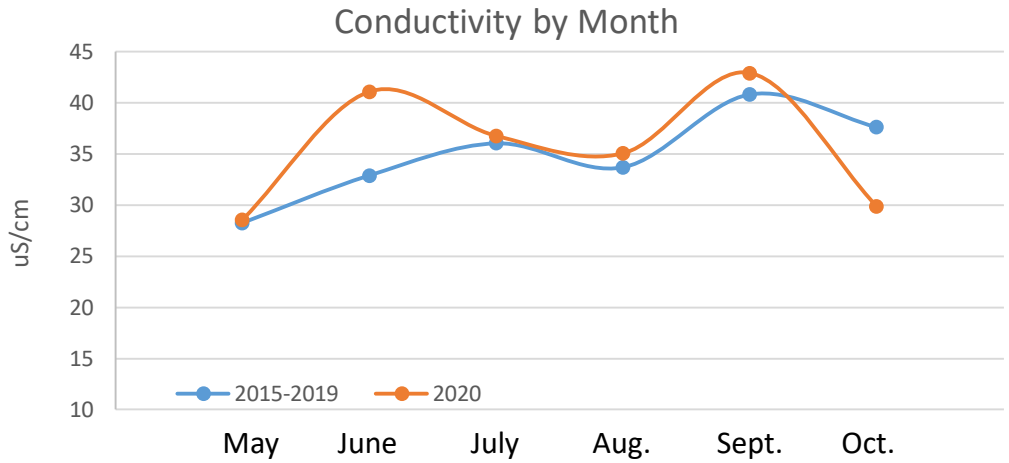
GT-5 Swift River 2015-2020 snapshot

Monitored since 2005

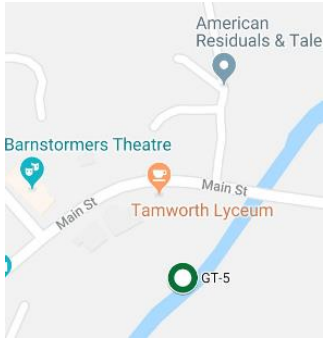
Collecting for: pH, turbidity, TP, temperature, conductivity, dissolved O2

Parameter	Explanation
pH	Slightly worsening; but values within accepted limits
Turbidity	Stable
Total P*	Stable; some increases in 2019 but still within accepted range

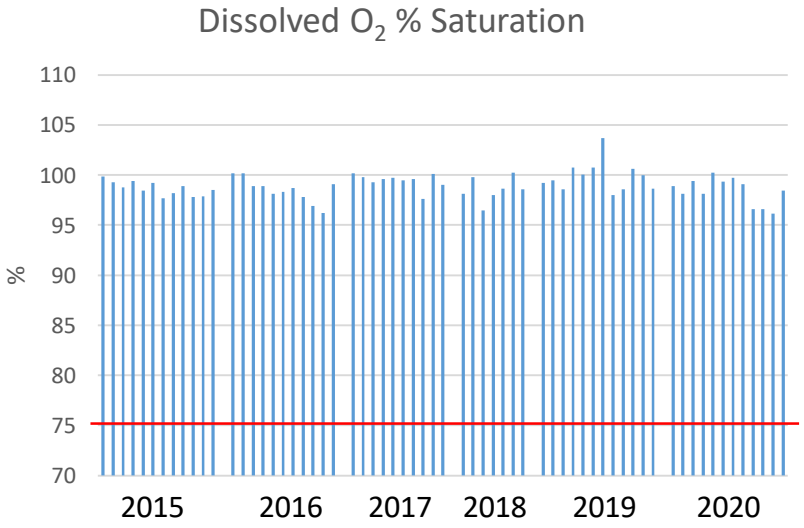
*TP Data available through 2019



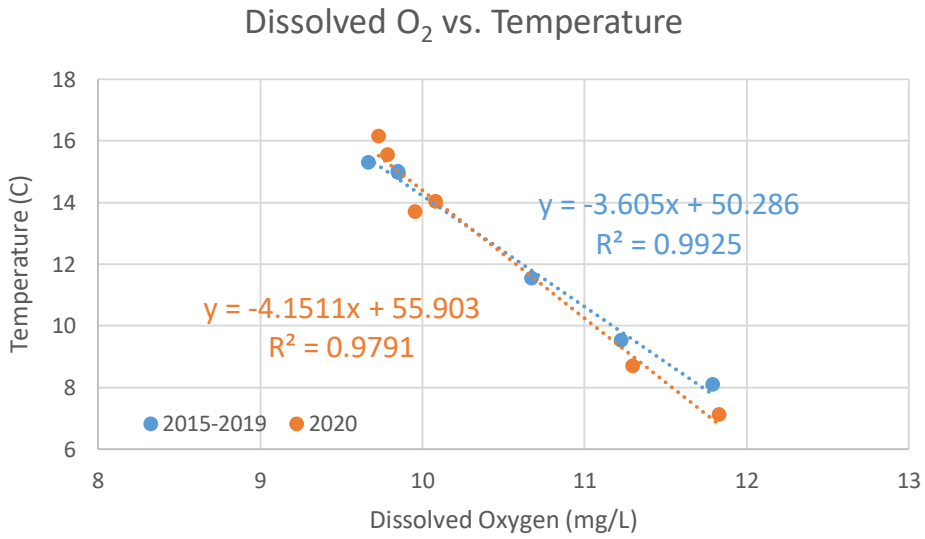
Site Location



Conductivity shows little to no trend in 2020 from combined 2015-2019 median values. In addition, these data points at GT-5 do not rise above 45 uS/cm which indicates healthy water quality in terms of salt levels.



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2020 (orange) show a similar value compared to combined 2015-2019 values (blue) which indicates a strong correlation. DO levels at GT-5 are stable and point to good water quality.

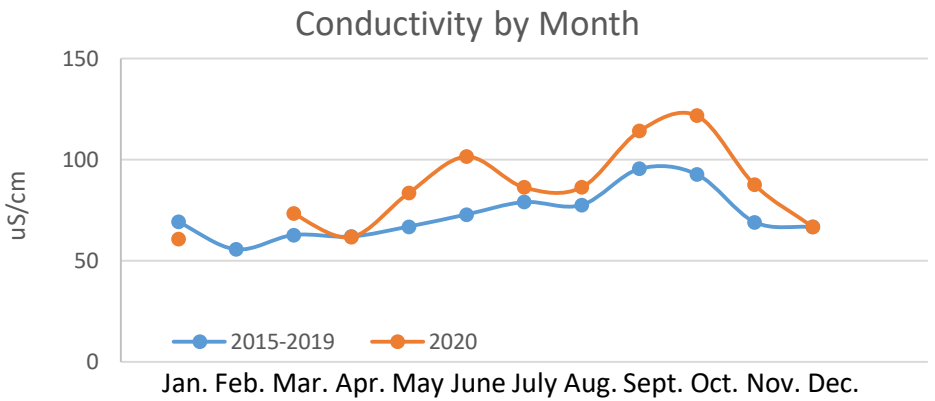
GT-4 Chocorua River 2015-2020 snapshot

Monitored since 2004

Collecting for: pH, turbidity, TP, temperature, conductivity, dissolved O2, TN, cations, anions, silica, DOC

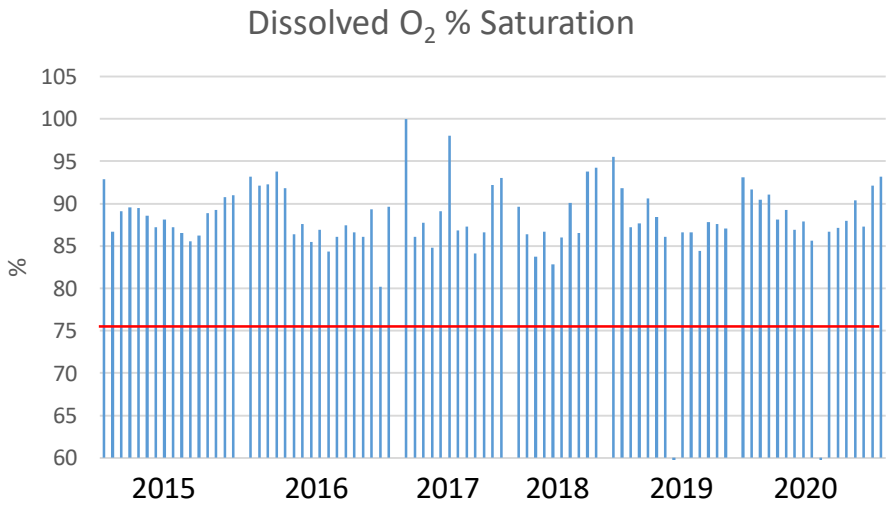
Parameter	Explanation
pH	Stable
Turbidity	Stable
Total P*	Stable

*TP Data available through 2019

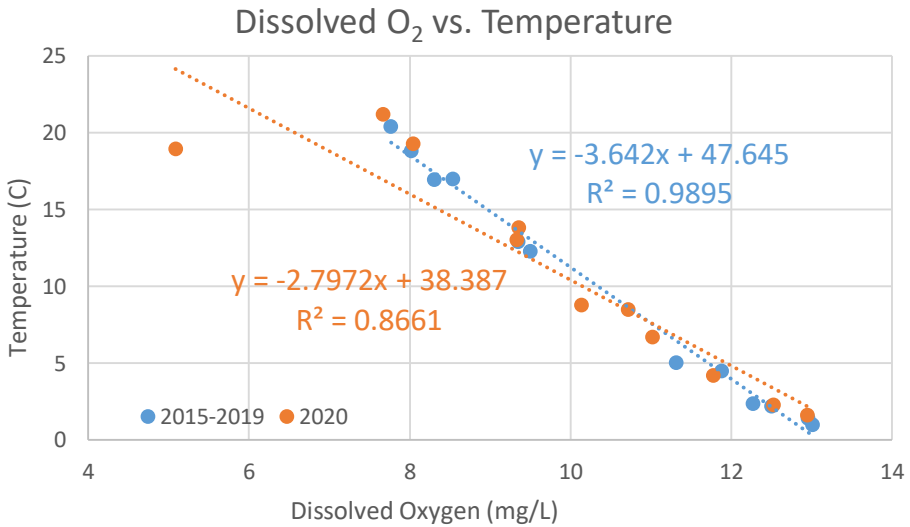


Site location

Conductivity shows an increase in 2020 from combined 2015-2019 median values. In addition, these data points at GT-4 rose above 100 uS/cm in 2020 multiple times, which is fairly high. This does not currently signify poor water quality in regards to salt levels, but this increasing trend is worth monitoring closely each year as an indication of potential road salt runoff.



New Hampshire State DO standard for Class A waters is above 75% during the months GMCG tests.



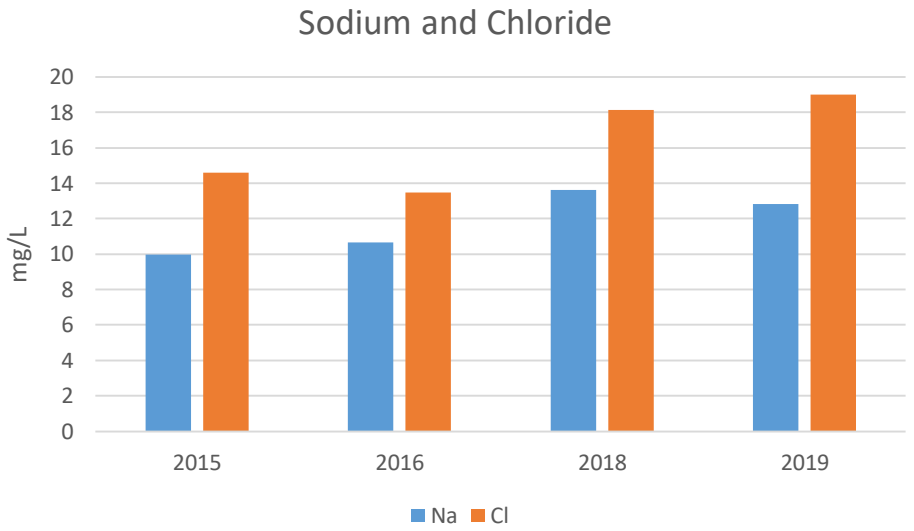
Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2020 (orange) show a similar value compared to combined 2015-2019 values (blue) which indicates a strong correlation. Overall, DO levels at GT-4 are stable and point to good water quality.

GT-4 Chocorua River 2015-2019 snapshot

Monitored since 2004

Parameter	2015-2019 Evaluation*
Ammonium	Stable
Nitrate	Stable
Total dissolved nitrogen	Stable
Dissolved organic nitrogen	Stable
Chloride	Stable; increasing slightly but still within accepted limits
Sodium	Stable; increase in 2018 but still within acceptable limits.
DOC	Stable
Sulfate	Stable
Magnesium	Stable
Orthophosphate	Stable

*Data currently available only through 2019



Higher levels of sodium and chloride indicate an increase in road salt (rock salt) in the 2018 season. As 2019 levels of sodium decreased while chloride increased some more. These concentrations are not alarmingly high but should be monitored closely. All other chemical parameters at GT-4 show stable and healthy trends the last 5 years.

In Summation

- Overall, data on these 3 stream sites – GT-1, GT-4, and GT-5 demonstrate good water quality within the last 6 years.
- Data from GT-1 in 2020 demonstrates a negative trend in pH and turbidity, as well as TP in 2019.
  - TP from GT-1 had a few very high values in 2019 that can be harmful for water quality.
  - Monitoring at this site in the next few years will be very important to determine if these trends continue.
- Conductivity continues to increase slightly at GT-4 (Chocorua River) indicating a potential increase in road salt runoff into streams. Values are starting to reach greater than 100 uS/cm consistently. Continued monitoring for this parameter at this site is important.
- Ways to reduce road salt impact?
  - Best Management Practices (BMP's) such as brining
  - Reduction of road salt usage on major roads