Water Quality Parameters: What are we testing for?

Dissolved Oxygen: The amount of oxygen contained in water is commonly expressed as a concentration in terms of milligrams per liter (mg/L), and/or as a percent (%) saturation. Accurate dissolved oxygen readings are dependent on temperature and atmospheric pressure. Gases, like oxygen, dissolve more easily in cooler water than in warmer water. Depletions in dissolved oxygen can cause major shifts in the kinds of aquatic organisms found in water bodies.

Turbidity: A measurement of the clarity of a fluid. The greater the turbidity, the murkier the water. High levels of suspended particles, which absorb heat from the sun, increases the water temperature. Suspended solids can clog fish gills, reduce growth rates, decrease resistance to disease and prevent egg and larval development of aquatic life.

Temperature: The metabolic rates of organisms increase with increasing water temperature. An increased metabolism increases the need for oxygen. Temperature also influences the amount of oxygen dissolved in water and the rate of photosynthesis by algae and larger aquatic plants.

Conductivity: A measure of the ability of water to pass an electrical current. Conductivity in water is determined by the presence of ions that carry a positive or negative charge. Conductivity in some areas, typically those near roads, may have higher than average levels due to manmade issues such as road salting during the winter months. Conductivity is also influenced by temperature (warmer water has higher conductivity) and by flow volume.

Orthophosphate: Also known as Reactive Phosphates, they are a main constituent in fertilizers used for agriculture and residential purposes. This is the form of phosphorus that is most readily utilized by biota.

pH: Water contains both hydrogen ions and hydroxyl ions. At a pH of 7.0 (neutral) the concentration of both hydrogen ions and hydroxyl ions is equal. When the pH is less than 7.0 (acidic) there are more hydrogen ions than hydroxyl ions. When the pH is greater than 7.0 (alkaline or basic) there are more hydroxyl ions than hydrogen ions. Generally speaking, the ability of aquatic organisms to complete a life cycle greatly diminishes as pH falls below 5.0 or exceeds 9.0.

Non-purgeable Organic Carbon (NPOC): Also known as dissolved organic carbon, it is a potential energy source for plants and animals in aquatic systems. This is an important component for stream metabolism; high levels can be a precursor to high levels of bacteria growth.

Total Phosphorus: Of the two nutrients most important to the growth of aquatic plants, nitrogen and phosphorus, it is generally observed that phosphorus is more limiting to plant growth in freshwater systems. Phosphorus is primarily associated with human related activities within the watershed and is therefore important to monitor and control.

Total Dissolved Nitrogen (TDN): Measurement of all the nitrogen that is available for use by phytoplankton, particularly cyanobacteria. Total dissolved nitrogen consists of dissolved organic nitrogen and dissolved inorganic nitrogen.

Nitrates/Nitrites (NO3/NO2): Both nitrate and nitrite are main constituents in fertilizers used for agriculture and residential purposes. As nitrite is relatively unstable in the environment, it quickly gets converted into nitrates. Nitrates can accelerate eutrophication of lakes.

Alkalinity: Water's capacity to resist changes in pH, sometimes referred to "buffering capacity". Water with a high alkalinity will not change in pH very much, if at all when acid is added to it until the buffering capacity is overloaded.

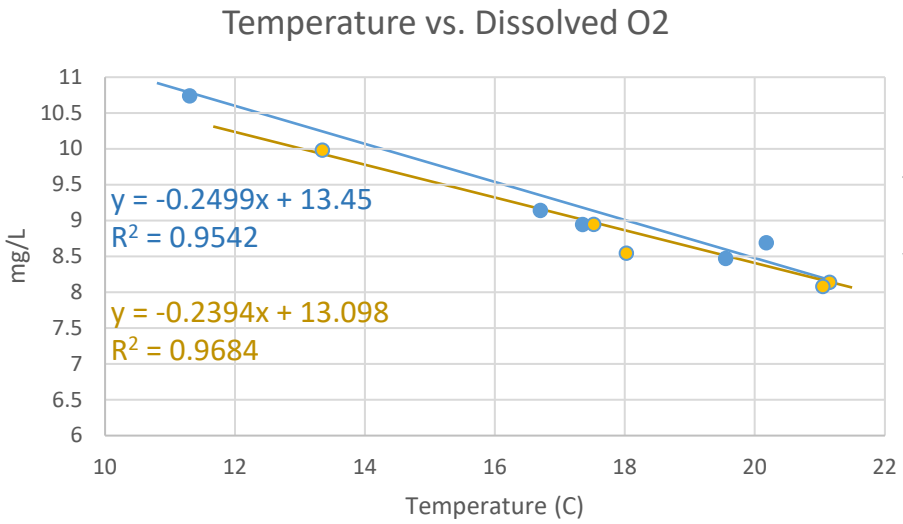
Escherichia coli (*E. coli*): A bacterium found typically in the small intestines of warm-blooded animals. Most *E. coli* strains are harmless, but some serotypes can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls. *E. coli* is expelled into the environment within fecal matter, and in high amounts can cause beach and swim area closures. Values are reported in geometric means.

Water Quality Parameters Guideline

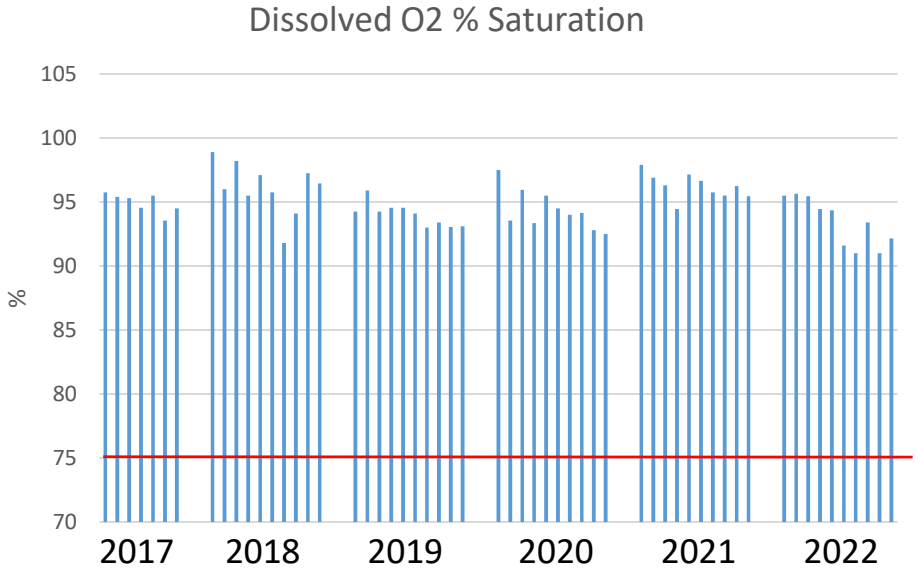
Parameter	**Acceptable Limits**
Dissolved Oxygen	Above 75% saturation; between 6-12mg/L
Temperature	No standard
Turbidity	10 NTUs or lower; preferably in the 1 NTU range
Conductivity	Below 500uS/cm in rural areas; 1500uS/cm in urban areas
E. coli	Below a geometric mean of 64 CFU for Class B, naturally occurring for Class A
Alkalinity	No standard; variable depending on geology
pH	Between 6-8; usually around 6.5
Orthophosphate	Below 10ug/L
Nitrates/nitrites	Below 1mg/L
Total Dissolved Nitrogen	Below 0.5mg/L
Dissolved Organic Carbon	No standard; usually between 1-10mg/L
Total Phosphorus	Below 30ug/L

S1 - Saco Pines Landing at ME-NH Border in Conway, NH

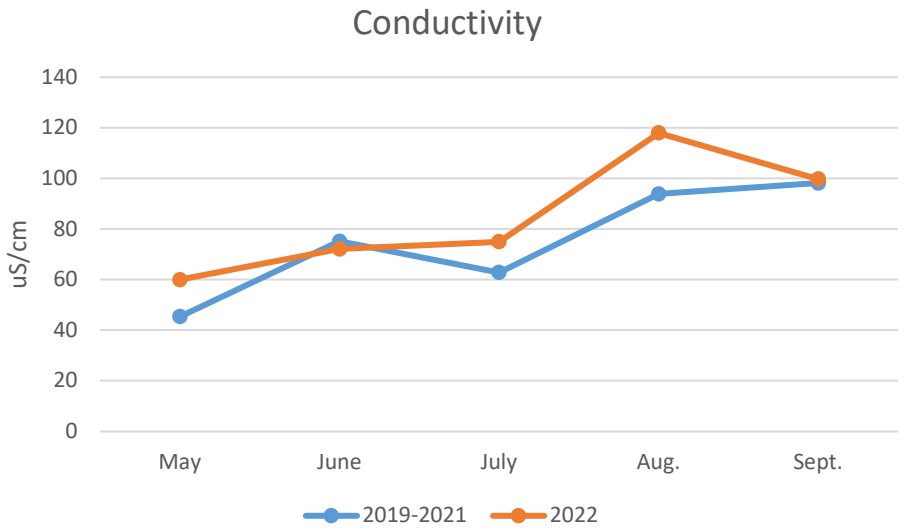
Monitored since 2001



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2022 (orange) show a similar value compared to combined 2017-2021 values (blue) which indicates not much change overall for DO levels.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



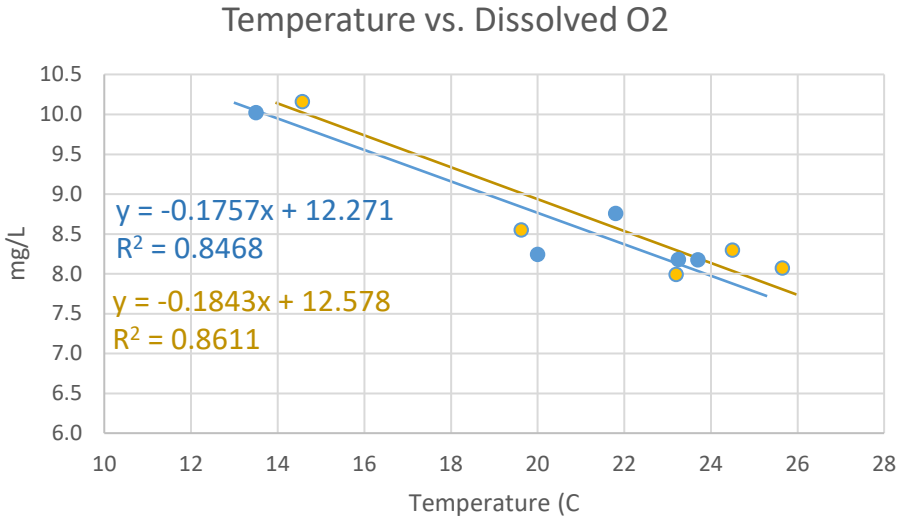
As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show low variability
Turbidity	Stable	No significant trends; data show low variability

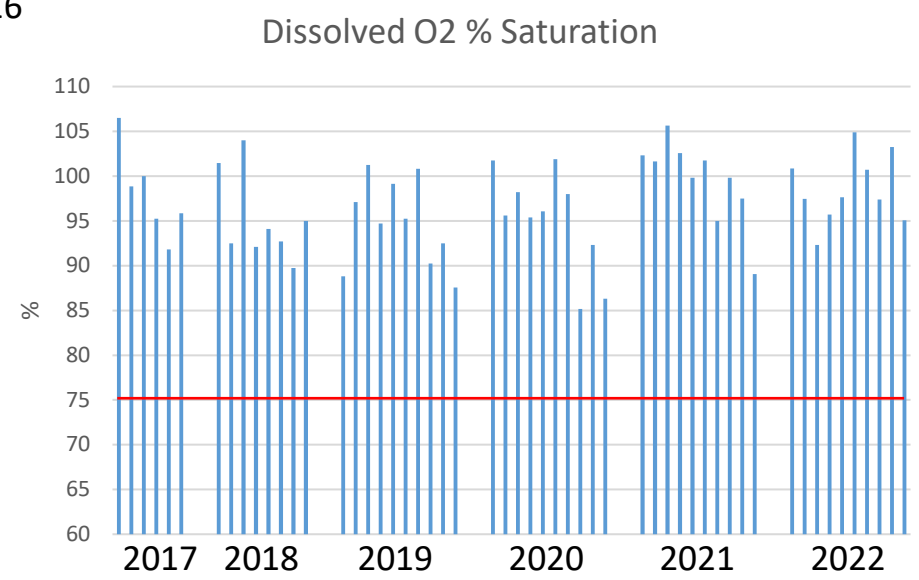
Trends observed from 2017-2022 show levels within appropriate ranges.

LWP5- Lovewell Pond, off of Dearborn Drive in Fryeburg

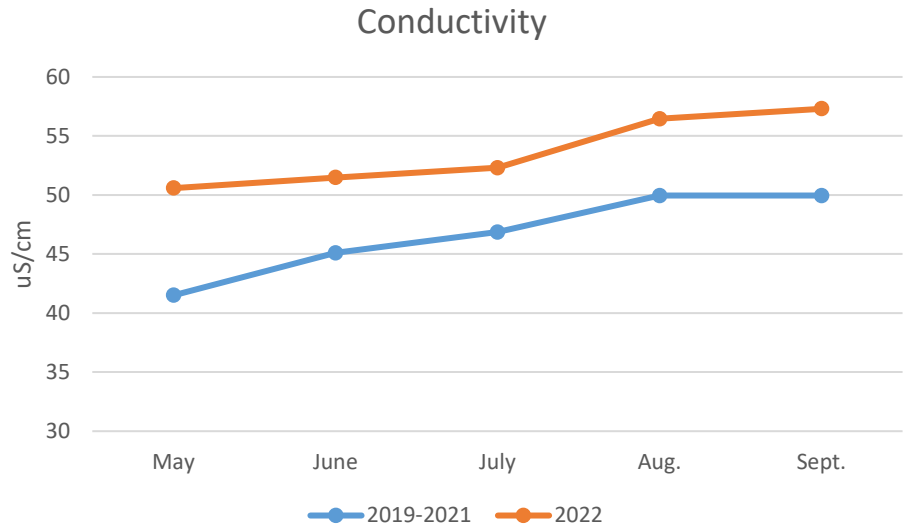
Monitored since 2016



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases. The R^2 values from 2022 (orange) show a similar value compared to the combined 2017-2021 values (blue). The correlation is not quite as strong here as it is at other sites.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Year	CFUs	Rating
2017	3.46	Excellent
2018	8.05	Excellent
2019	2.50	Excellent
2020	1.39	Excellent
2021	4.4	Excellent
2022	14.68	Excellent

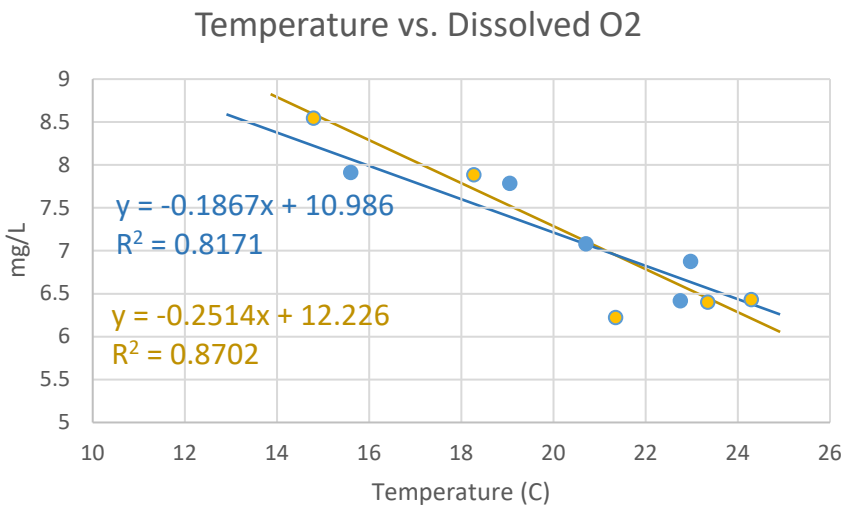
Maine state *E. coli* standard for Class B waters is below 64 CFU.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show moderate variability
Turbidity	Stable	No significant trends; data show low variability (2018 levels were high but this is not a consistent finding)
TDN	Low	Within appropriate levels
TP	Stable	No significant trends; data show low variability
NO2/NO3	Low	Within appropriate levels
PO4	Low	Within appropriate levels
NPOC	Normal	Within appropriate levels

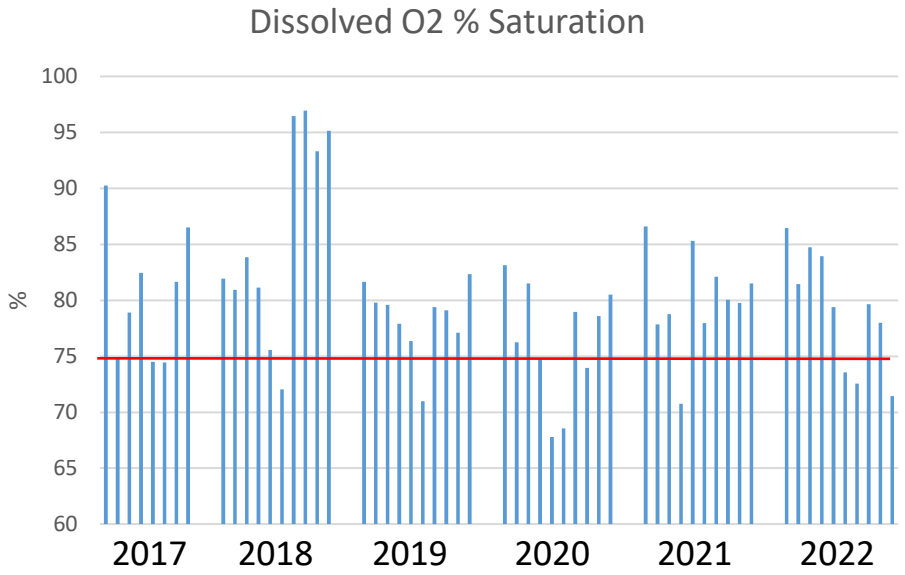
Trends observed from 2017-2022 show stable levels within appropriate ranges; new parameters in 2021 of TDN, PO4, and NO2/NO3 show values within appropriate levels. NPOC monitoring began in 2022 and is within appropriate levels.

OCS4-B: Old Course Downstream of Hemlock Bridge in Fryeburg

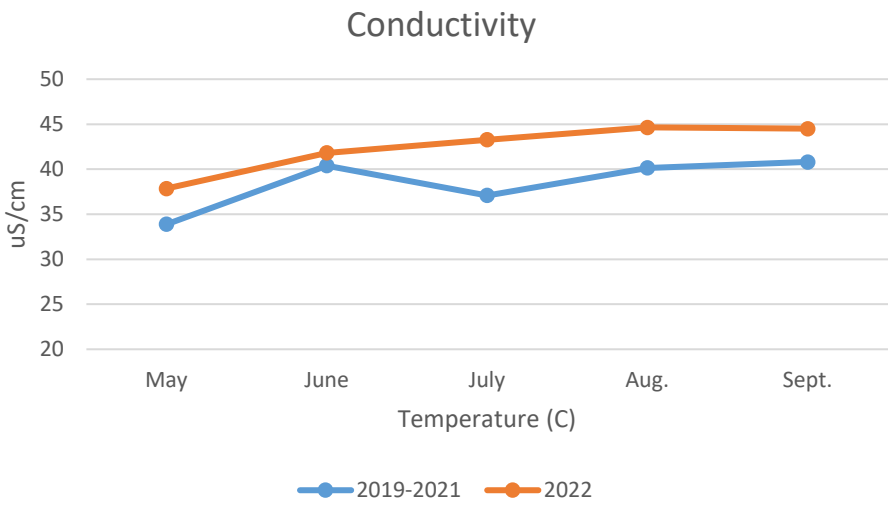
Monitored since 2007



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases, DO decreases. The R^2 values from 2022 (orange) show a similar value compared to the combined 2017-2021 values (blue). The correlation is not as strong here as at other sites.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



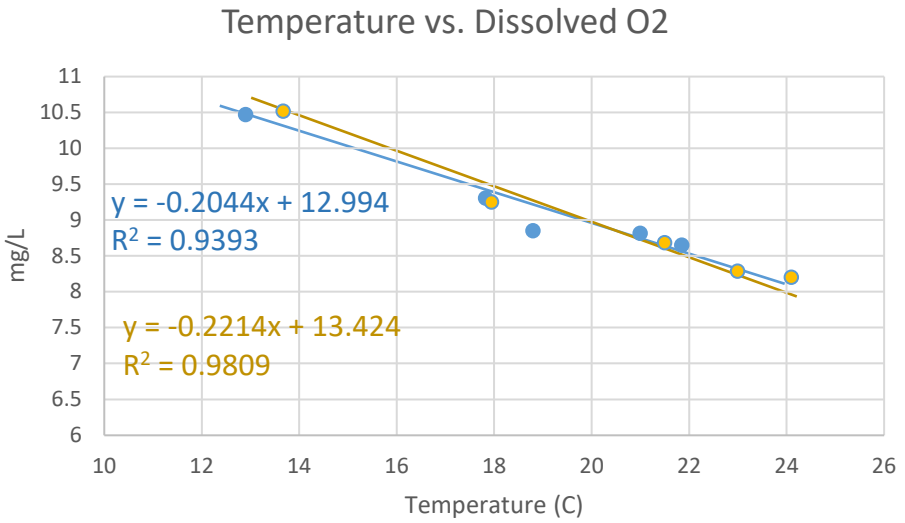
As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show low variability
Turbidity	Stable	No significant trends; data show low variability
TDN	Low	Within appropriate levels
PO4	Approaching threshold	Approaching 10ug/L
Alkalinity	Stable	No significant trends; data show low variability
NO2/NO3	Low	Within appropriate levels
NPOC	Normal	Within appropriate levels

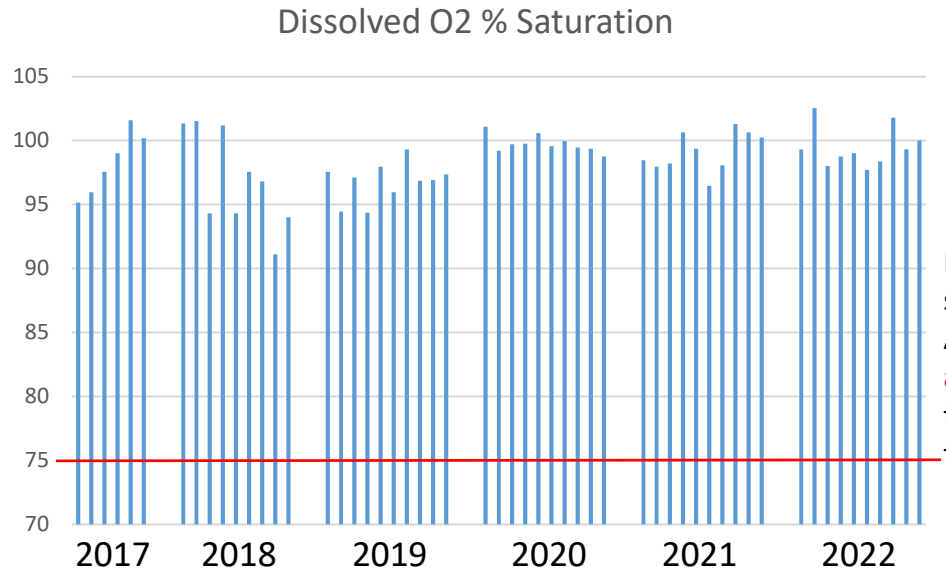
Trends observed from 2017-2022 show stable levels within appropriate ranges; new parameters in 2021 of TDN, PO4, and NO2/NO3 show values within ideal levels although PO4 is approaching the ideal limit. NPOC, new in 2022, show levels at appropriate levels.

SF1- Swans Falls Dam in Fryeburg

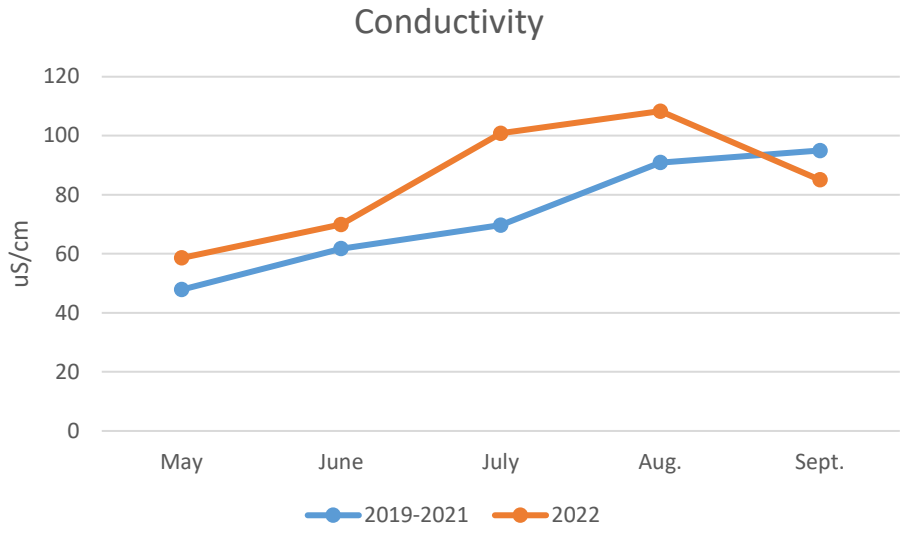
Monitored since 2016



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2021 (orange) show a similar value compared to combined 2016-2020 values (blue) which indicates not much change overall for DO levels.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Year	CFUs	Rating
2022	21.939	Good

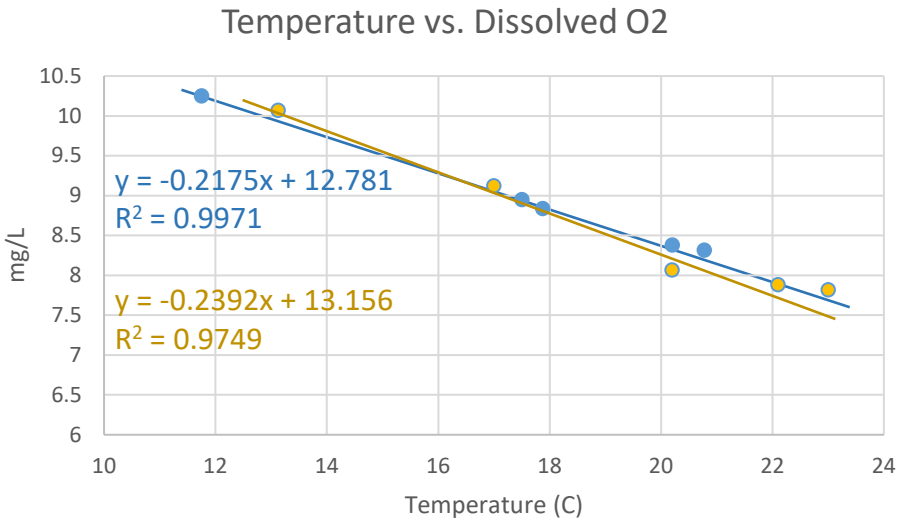
Maine state *E. coli* standard for Class B waters is below 64 CFU.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show low variability
Turbidity	Stable	No significant trends; data show low variability

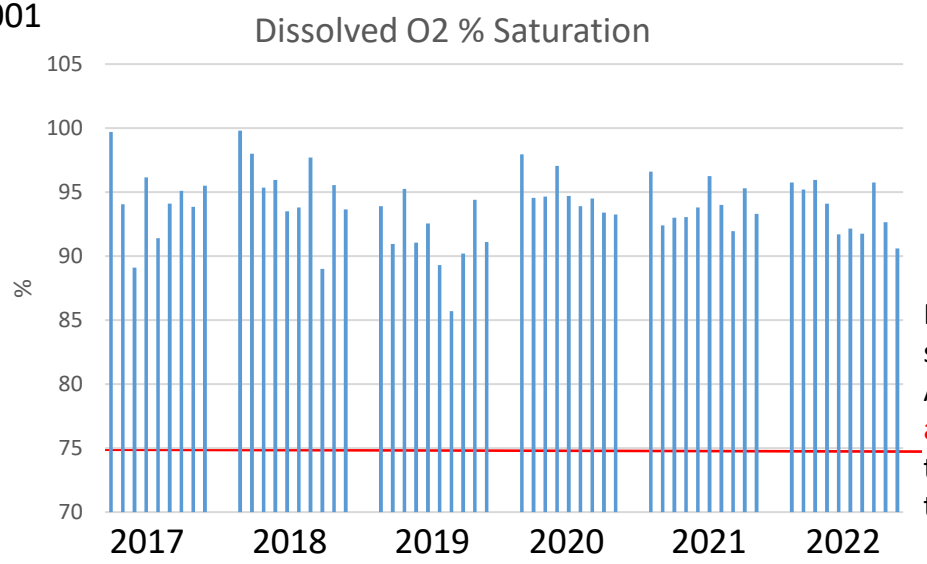
Trends observed from 2017-2022 show levels within appropriate ranges.

S3- Canal Bridge Beach, Route 5 in Fryeburg

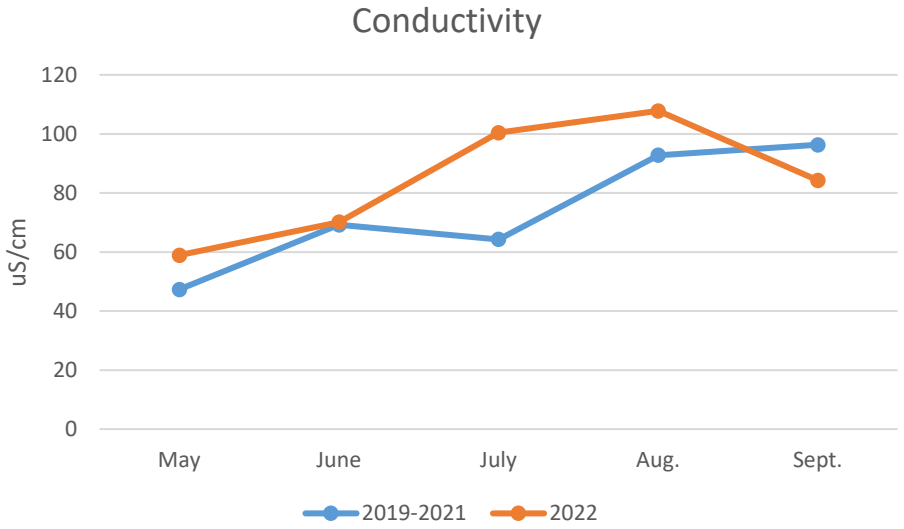
Monitored since 2001



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2022 (orange) show a similar value compared to combined 2017-2021 values (blue) which indicates not much change overall for DO levels.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Year	CFUs	Rating
2017	43.29	Fair
2018	21.08	Good
2019	19.42	Excellent
2020	62.82	Approaching Class B Standards
2021	74	Over Class B
2022	21.23	Good

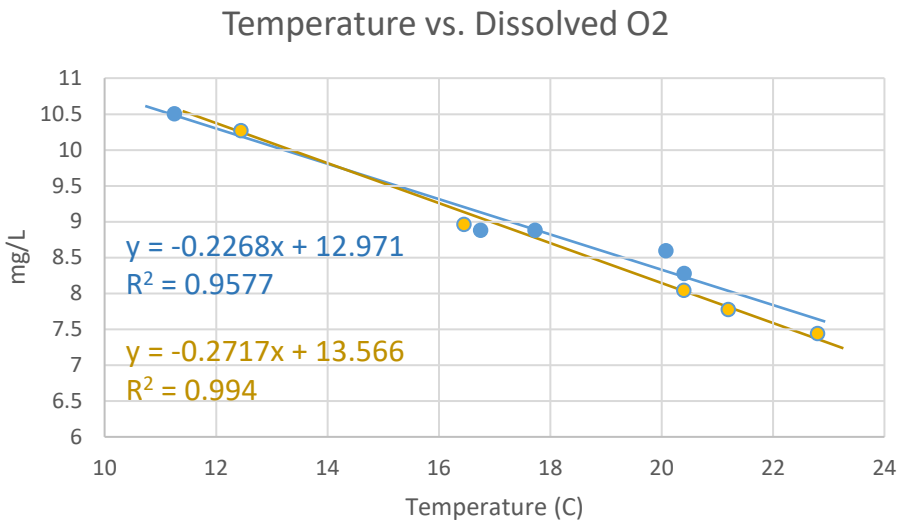
Maine state *E. coli* standard for Class B waters is below 64 CFU.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show low variability
Turbidity	Stable	No significant trends; data show low variability

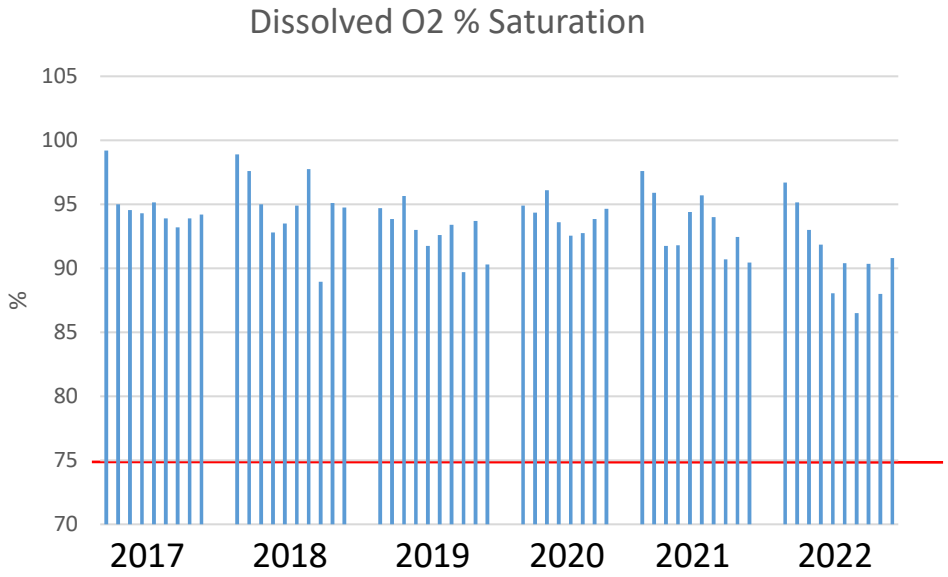
Trends observed from 2017-2022 show levels within appropriate ranges.

S2- Weston's Beach, off River Street/ Route 113 in Fryeburg

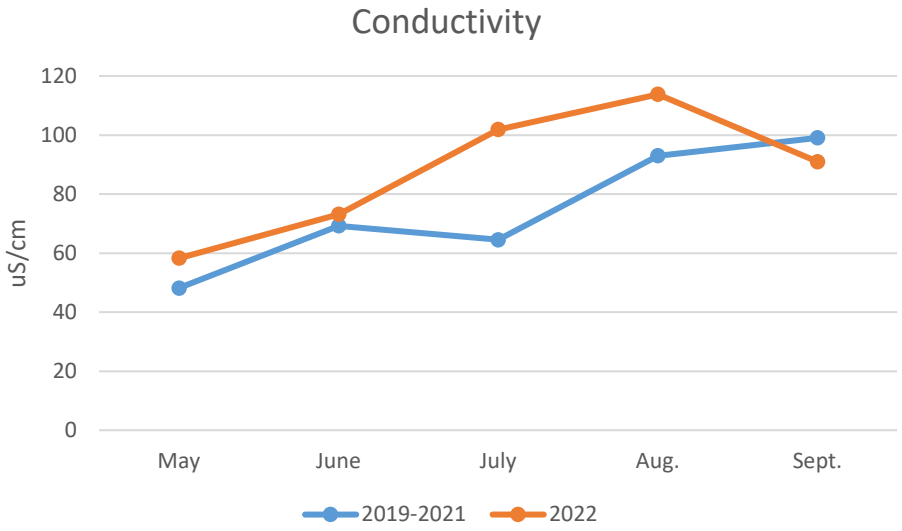
Monitored since 2001



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2022 (orange) show a similar value compared to combined 2017-2021 values (blue) which indicates not much change overall for DO levels.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Year	CFUs	Rating
2017	33.44	Good
2018	29.42	Good
2019	35.93	Good
2020	49.30	Fair
2021	58.89	Fair
2022	48.96	Fair

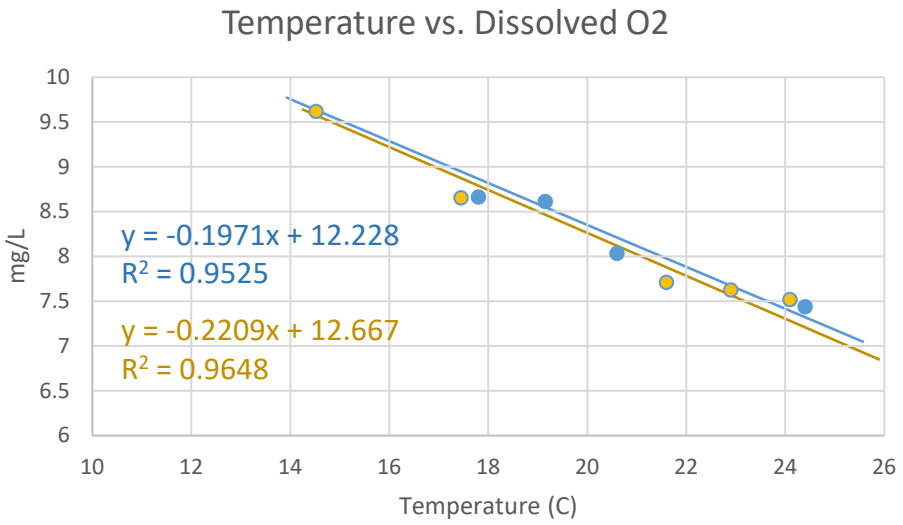
Maine state *E. coli* standard for Class B waters is below 64 CFU.

Parameter	Trend	Explanation
pH	Stable	No significant trends; data show low variability
Turbidity	Stable	No significant trends; data show moderate variability
Alkalinity	Stable	No significant trends; data show low variability

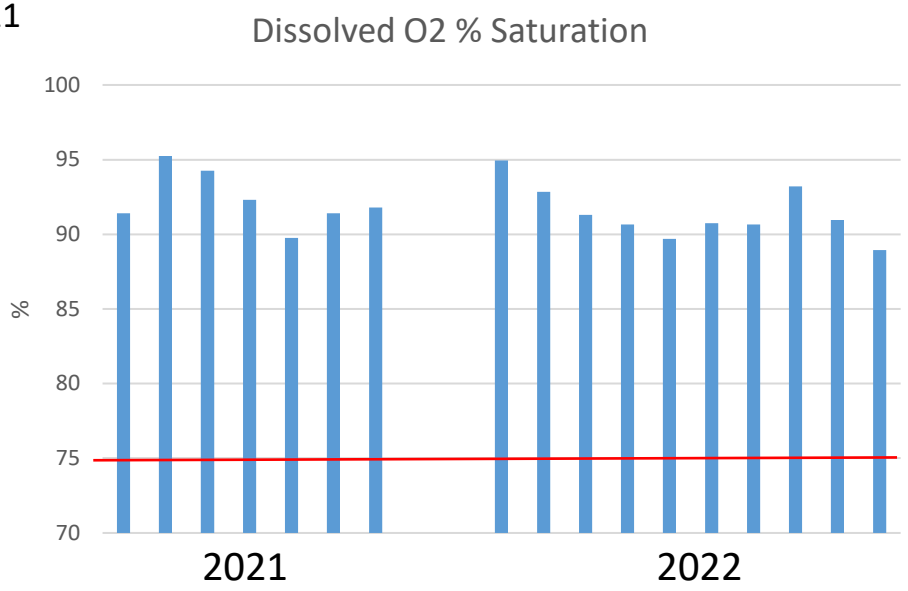
Trends observed from 2017-2022 show levels within appropriate ranges.

S4 - Walker's Bridge in Fryeburg

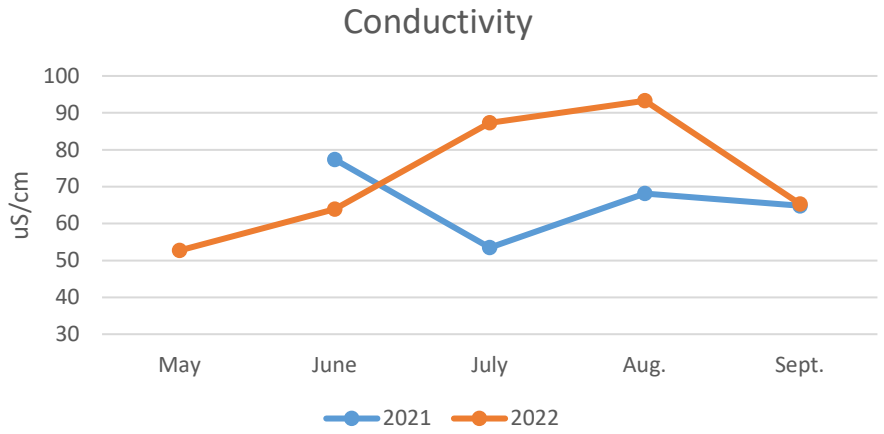
Monitored since 2021



Dissolved Oxygen (DO) has an inverse relationship with temperature: as temperature increases DO decreases. The R^2 values from 2022 (orange) show a similar value compared to 2021 values (blue) which indicates not much change overall for DO levels.



Maine State DO standard for Class AA waters is above 75% during the months SRCC tests.



As water levels decrease over the summer, conductivity levels tend to increase. It is not because the salt level increases, but rather the water level decreases so the salt is more concentrated.

Parameter	Trend	Explanation
pH	Stable	Within appropriate levels
Turbidity	Low	Within appropriate levels

As this site began in 2021, there is not enough data to discern trends. The data collected though show levels of these parameters within appropriate ranges.

Overall comments on Fryeburg water quality

- Fryeburg's water quality for the sites tested in 2022 is good.
  - OCS4-B had levels of PO4 approaching the ideal threshold limit.
  - OCS4-B had DO levels lower than the Class A recommendations at various points throughout the summer.
  - *E. coli* testing started at SF1 in 2022.
  - *E. coli* at S3 was much improved in 2022 compared to 2020-2021.
- Ways to improve/protect water quality:
  - Make sure there is good riparian vegetation near running water.
  - Best Management practices to prevent erosion and nutrient loading.
  - Reduced/no salt areas around bodies of water.
    - Recalibrate trucks so salt stays on road.
    - Brining.
  - Have septic systems checked regularly.
  - Consider having Port-a-Potties at popular swim areas.
  - Look for obvious sources of nitrogen loading, such as fertilizer use near water way.