THE JEMSEG GRAND LAKE WATERSHED ASSOCIATION

Water Quality Report

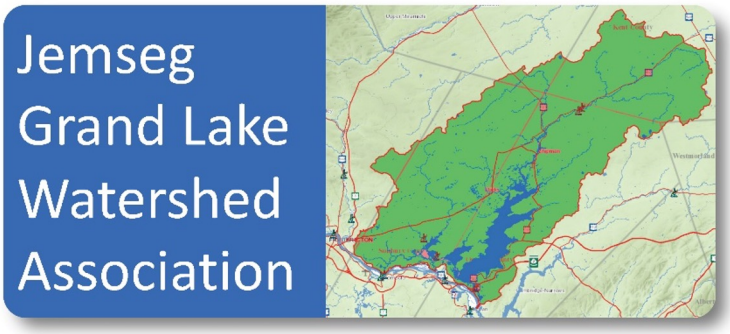
2022

OUR ORGANIZATION

The Jemseg Grand Lake Watershed Association (JGLWA) was formed in October 2019. The Jemseg Grand Lake watershed covers 3,950 km^2 and is home to Grand Lake, the largest freshwater lake in the Maritimes at 171 km^2.

Goal: a healthy Jemseg Grand Lake watershed ecosystem for all.

Mission: to engage the attention, enthusiasm, & support of people, communities, businesses, and organizations in the Jemseg Grand Lake watershed to provide a healthy watershed for all.



Monitoring: The JGLWA began monitoring water quality in 2020.

OUR WATERSHED


Photo: Brian Smith

Clean water is one of New Brunswick's most important resources. We rely on it for drinking, growing food, manufacturing goods, electricity, and for recreational activities. Maintaining good quality surface water is extremely important for ensuring a healthy Jemseg Grand Lake watershed environmental ecosystem. The flora and fauna in the watershed also rely on clean water.

During 2022 water quality was monitored in July, August and early October at ten sites. Three sites in Grand Lake, three in tributary rivers, and four sites in lakes in the southwestern tributaries.

E. coli concentrations were monitored once in August at 21 stations in Grand Lake and tributaries.

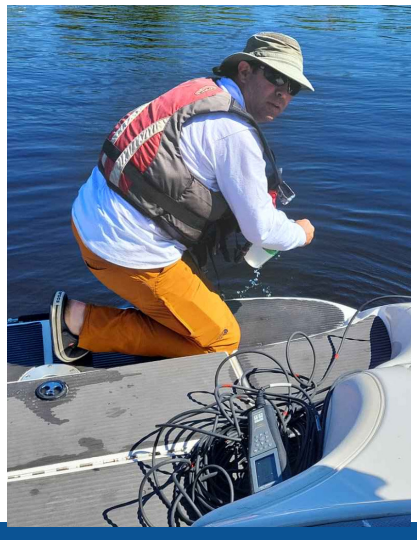
The JGLWA also coordinates patrols of invasive plants and assists ACAP Saint John in their monitoring of cyanobacteria in the lower Wolastoq/Saint-Jean/St. John River

WHAT DO WE MEASURE?

Water Temperature	Water needs to be cool enough for some species (like salmon and trout) to survive
Dissolved Oxygen	All organisms in a lake, even plants, need some amount of oxygen to live.
Dissolved substances	Lake water naturally contains dissolved mineral salts and organic compounds. Elevated levels may indicate contaminated runoff and could be harmful to some species.
Metals	Metals are introduced into water from weathering or erosion of soils or rocks either naturally or at increased rates due to human activities
pH	This measures how acidic/basic the water is- neutral levels are best for fish. Changes to the natural pH might impact nutrients or toxins in the water
Nutrients	While some nutrients are needed to sustain life in lakes, excess nutrients (like phosphorus and nitrogen) can cause algal blooms and harm ecosystems.
Chlorophyll-a	This is a measure of the photosynthetic pigment that causes the green colour in phytoplankton. The concentration is directly related to the phytoplankton abundance and biomass.
Water transparency	A circular black and white disk is used to measure transparency of the water. The depth at which the disk is no longer visible is known as the Secchi depth and is an indicator of the amount of light available for organisms in the lake.
E. Coli	*Escherichia coli* (*E. coli*) bacteria, are found in the digestive tracts of animals and are a good indicator of fecal contamination with the potential to cause health issues in humans.









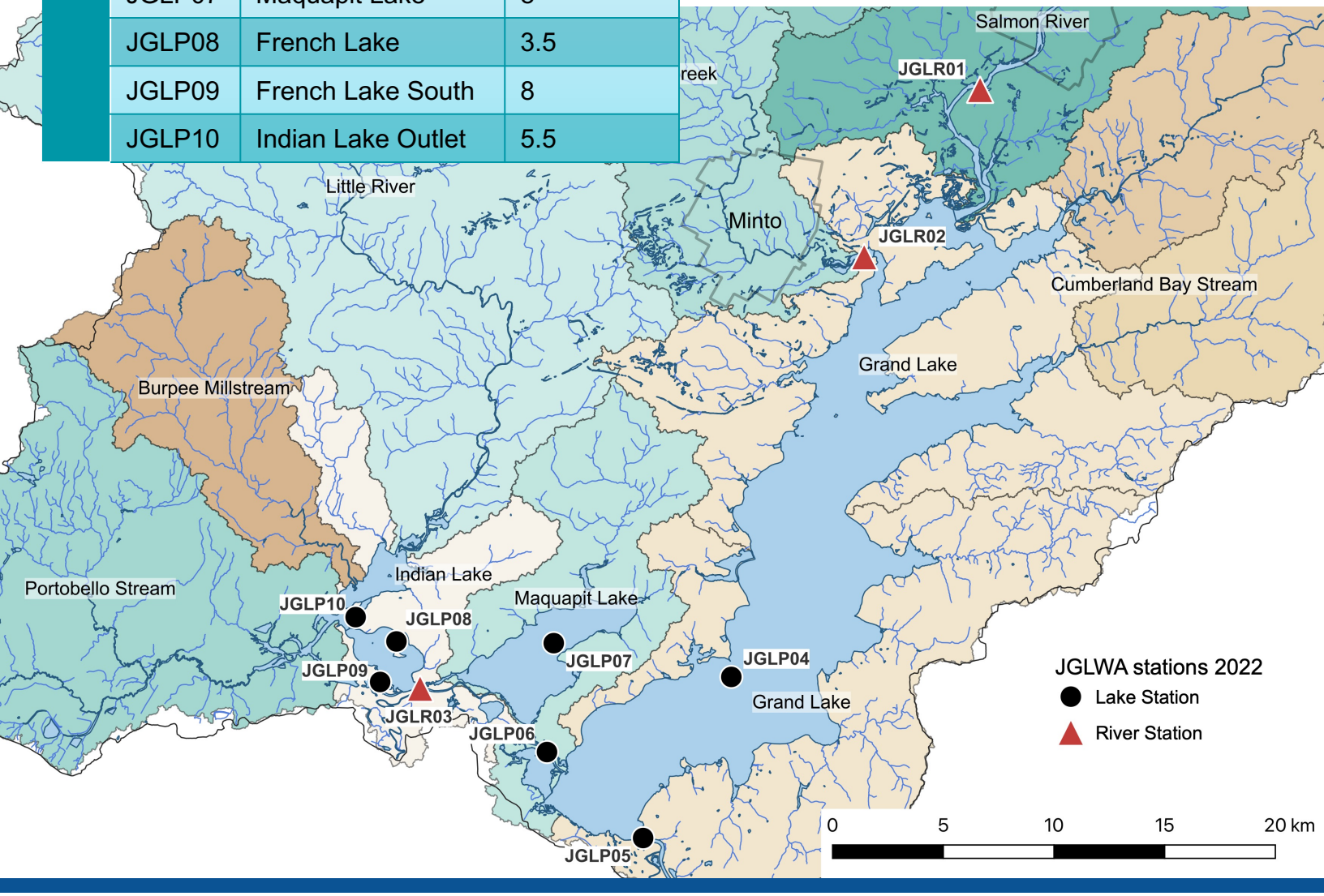
WATER QUALITY SAMPLING SITES

Six sampling locations were established on Grand Lake in 2020. In 2021 three river locations were added in order to evaluate the influence of these tributaries on Grand Lake. In 2022 the program was expanded to in greater detail investigate how the southwestern tributaries influence Grand Lake. Four new stations were sampled in French, Indian and Maquapit Lakes and in order to accommodate this investigation the monitoring in Grand Lake was reduced from six to three stations during 2022.

The different coloured areas on the maps in this report indicate sub-watersheds of the Jemseg Grand Lake Watershed defined by the Nature Conservancy of Canada (CC BY-NC 3.0); the remaining hydrographic data is provided by the NB Department of Energy and Resource Development (Open Government License).

LAKE	Site ID	Location	Depth (m)
	JGLP04	Grand Point Bar	25
	JGLP05	Jemseg River	8
	JGLP06	Maquapit Exit	4
	JGLP07	Maquapit Lake	8
	JGLP08	French Lake	3.5
	JGLP09	French Lake South	8
	JGLP10	Indian Lake Outlet	5.5

RIVER	Site ID	Location
	JGLR01	Salmon River
	JGLR02	Newcastle Creek
	JGLR03	Lakeville Corner

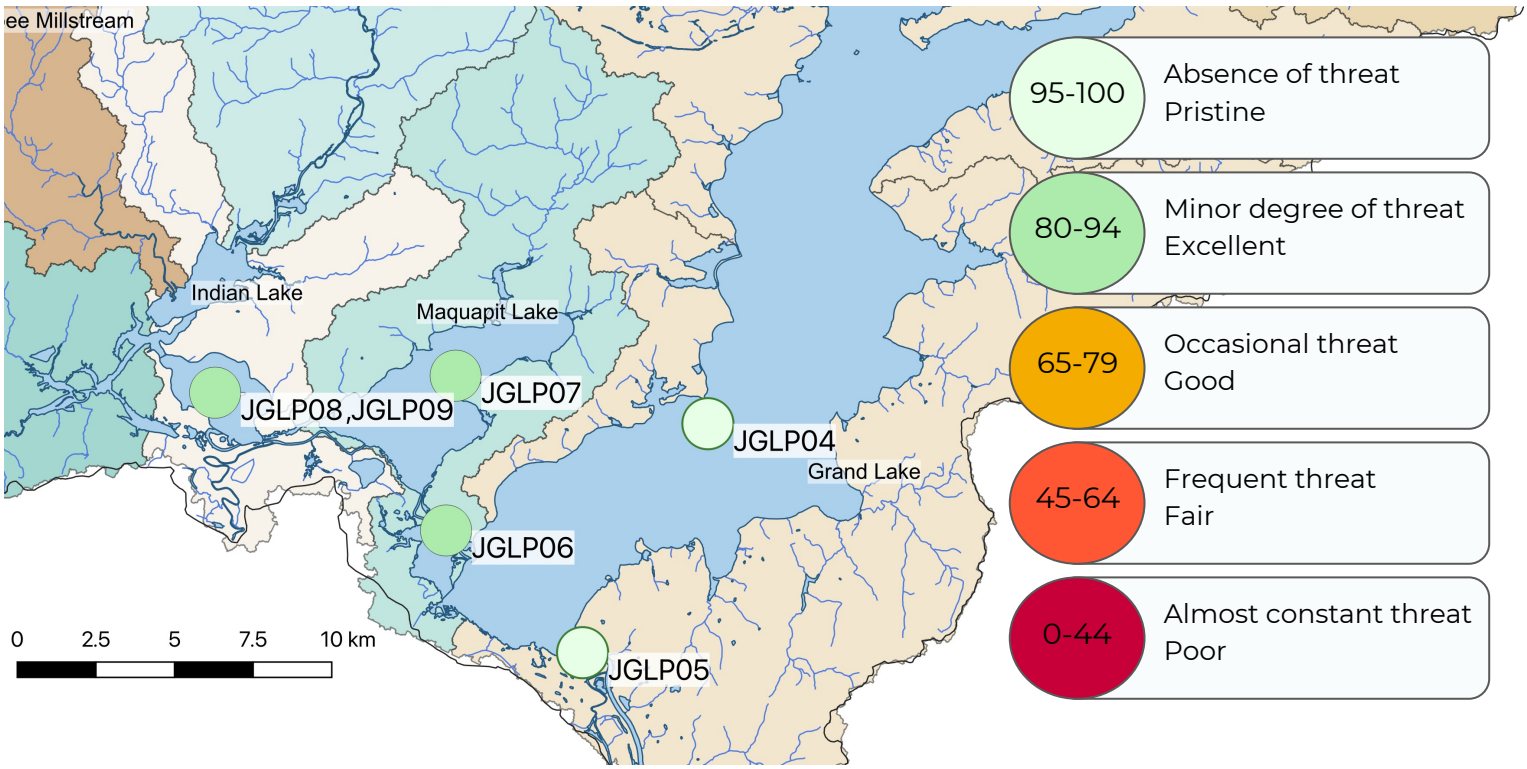


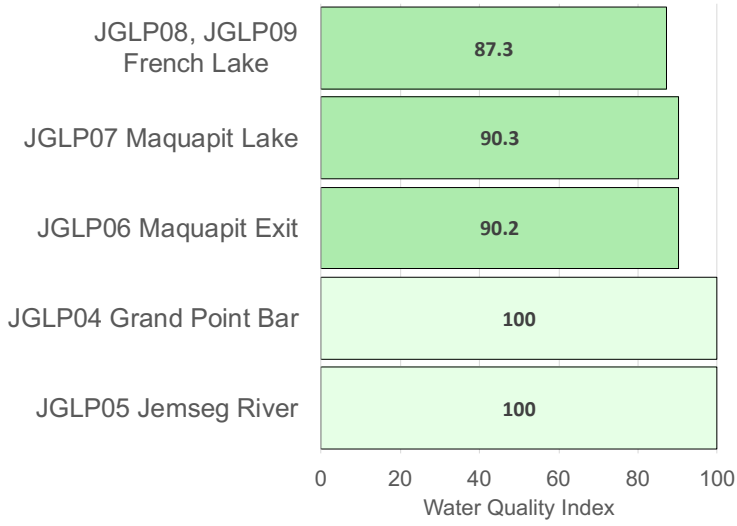
OVERALL WATER QUALITY

WATER QUALITY INDEX

Using the Canadian Council of Ministers of the Environment water quality guidelines, the Water Quality Index (WQI) combines multiple parameters into a single value that summarizes water quality at a site.

The WQI for five of the six lake sites was calculated using the following parameters: arsenic, ammonia, chloride, dissolved oxygen (surface measurement), iron, nitrate, pH, total phosphorus, turbidity, and zinc. The guidelines provided by the CCME and Atlantic Water Network recommend a minimum of four samples to calculate the WQI. However, only three or fewer samples were retrieved from most sites in 2022. The Indian lake outlet station only had two samples and was omitted from calculations. The five samples from the two French lake sites were pooled together. All other sites had three samples each.





The overall average water quality index for all stations of all three lakes 2022 was 93.6 (“Excellent”) The average for the three Grand Lake stations was 96.7 (“Pristine”).

The sparse number of sampling dates during 2022 makes the WQI results less reliable and comparisons with previous years are not recommended.

LAKE PRODUCTIVITY

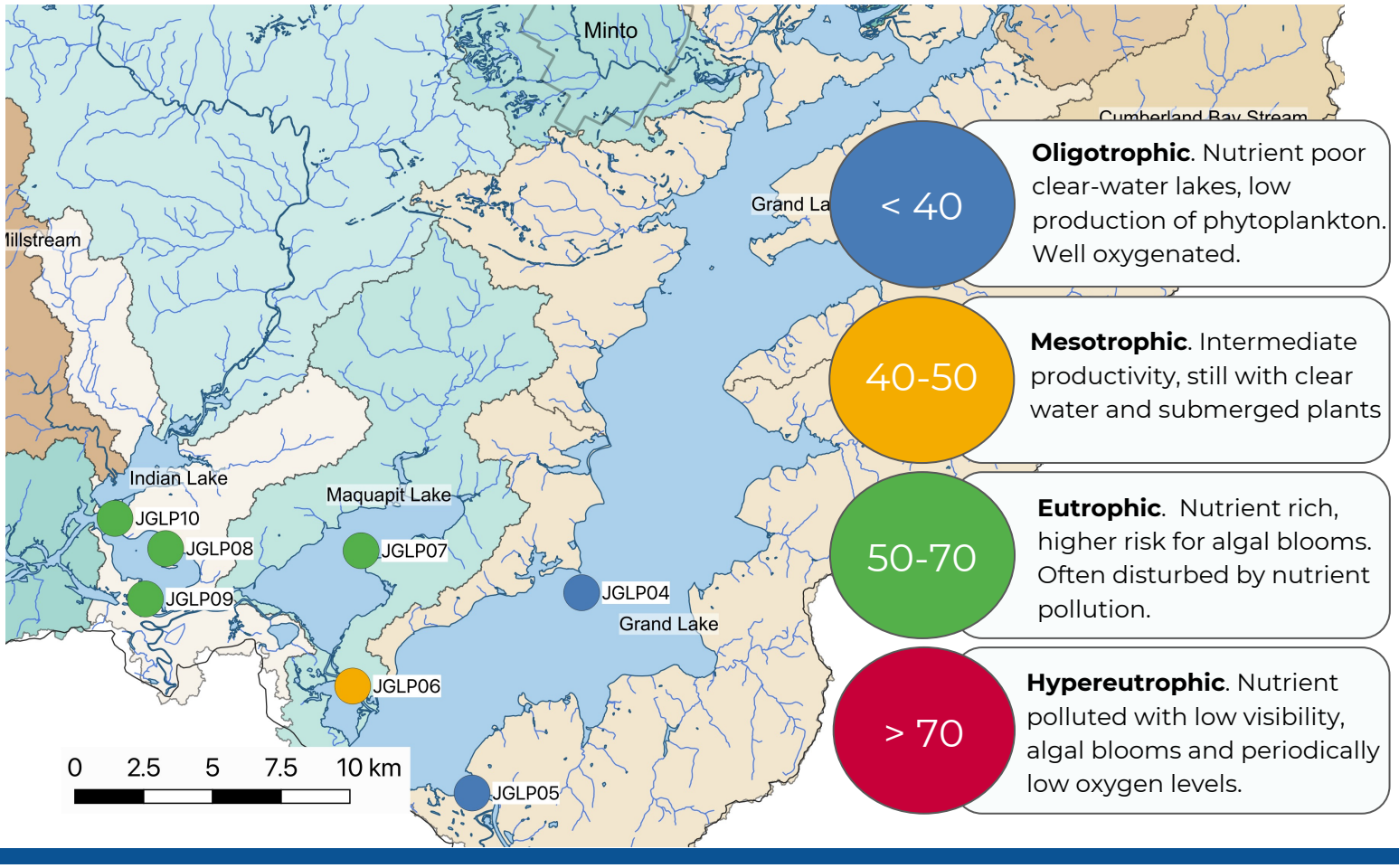
TROPHIC STATE INDEX

The Trophic State Index (TSI) describes the biological productivity of a lake. The higher the number, the higher the productivity.
Here we show the average TSI based on the total phosphorus, and chlorophyll-a content from July, August, and early October. Lake productivity affects both the total number of organisms, for example fish, and which species that are favoured.

Like in previous years, the deeper parts and outflow of Grand lake has a low to moderate level of productivity. Indian, French, and Maquapit lake all had a higher productivity.

The fact that the water leaving Grand lake has a lower productivity than the water entering it highlights the important role of the lake as a nutrient sink.

Site	TSI	Status
JGLP04 Grand Point Bar	39	Oligotrophic
JGLP05 Jemseg River	39	Oligotrophic
JGLP06 Maquapit Exit	47	Mesotrophic
JGLP07 Maquapit Lake	53	Eutrophic
JGLP08 French Lake	53	Eutrophic
JGLP09 French Lake South	51	Eutrophic
JGLP10 Indian Lake Outlet	51	Eutrophic



LAKE TEMPERATURE & VERTICAL PROFILING

SURFACE TEMPERATURE

Between January 1st and September 10th, surface water temperature (depth of 0.5 m) was measured every 30 minutes using a HOBO logger attached to a dock in Cumberland Bay. Here we present temperatures only for the months of the water quality sampling period. Compared to previous years, maximum temperatures were more moderate and there were fewer days in 2022 with temperatures high enough to potentially disturb fish. Comparison with previous years is not possible for September because the logger was not deployed the entire month.

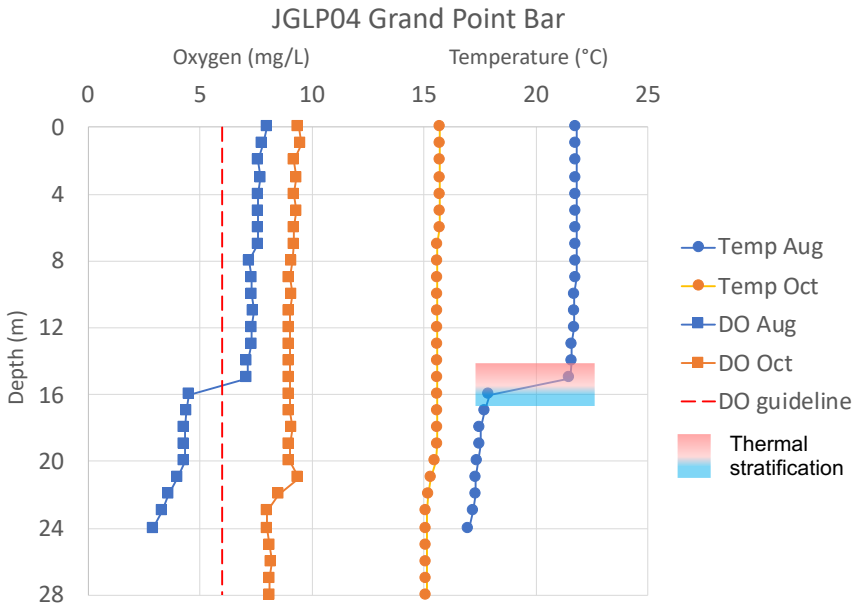
Month	Max Temp (°C)		Min Temp (°C)		Average (°C)		No. days >23°C	
	Previous years*	2022	Previous years*	2022	Previous years*	2022	Previous years*	2022
July	27	25	18	19	23	22	14	11
August	28	26	19	21	23	23	25	19
September	24	23**	16	**	20	**	0.5	1
Overall	28	26	13	**	22	**	33	31

* Average of 2020 and 2021
** Data omitted or to be used with caution, because there were only 10 days of sampling in September this year.

VERTICAL PROFILE

Measurements of temperature, pH, dissolved oxygen (DO), and conductivity were measured every metre from the surface to bottom at all six lake sites. Temperature and oxygen data from August and October are shown here for the deepest site in Grand Lake (Grand Point).

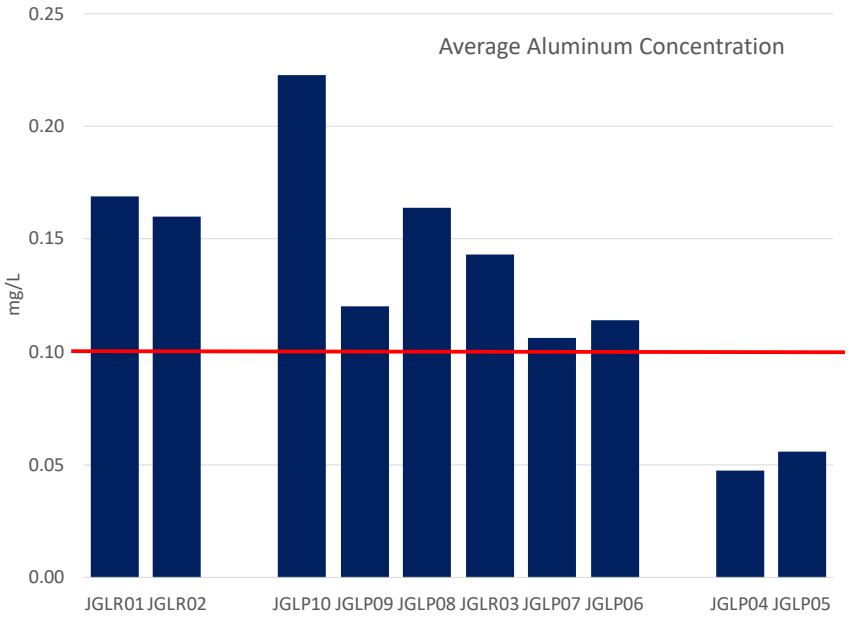
No data are available for Grand Point from June or July but in August there was a clearly defined thermal stratification at 15 metres depth with oxygen concentration under the stratification falling below the level of concern.
By October, near surface temperatures have dropped enough to allow wind to fully circulate water and oxygen throughout the entire depth of the lake.

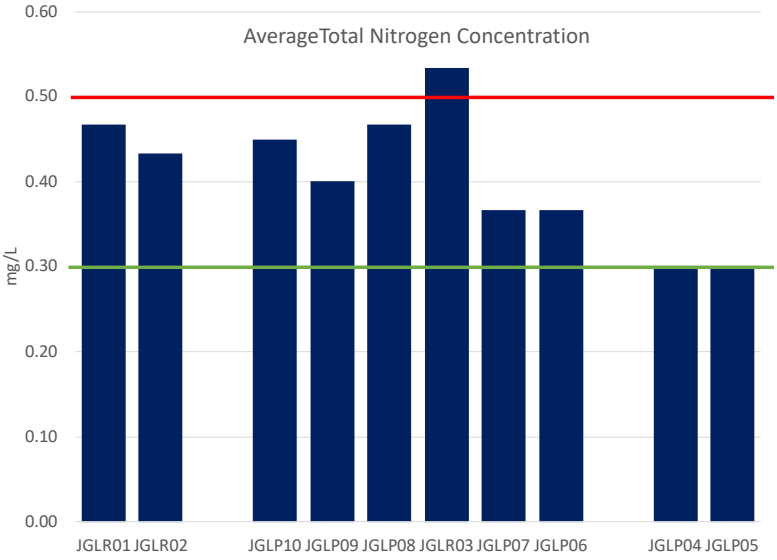


WATER QUALITY ANALYSIS

Average aluminum concentrations exceeded the CCME limit of 0.1 mg/L at all sites, except for the main part and outlet of Grand Lake. The highest levels (0.22 mg/L) were found at the outlet of Indian Lake.

Aluminum is found naturally in most rocks and soils and it can enter water via weathering (or erosion) of rocks. It can also be derived from mining, industrial processes, and wastewater. High levels of aluminum can negatively affect fish. Further analysis and discussion is available in our 2022 water quality **program** report at https://bit.ly/3yyCdhf.



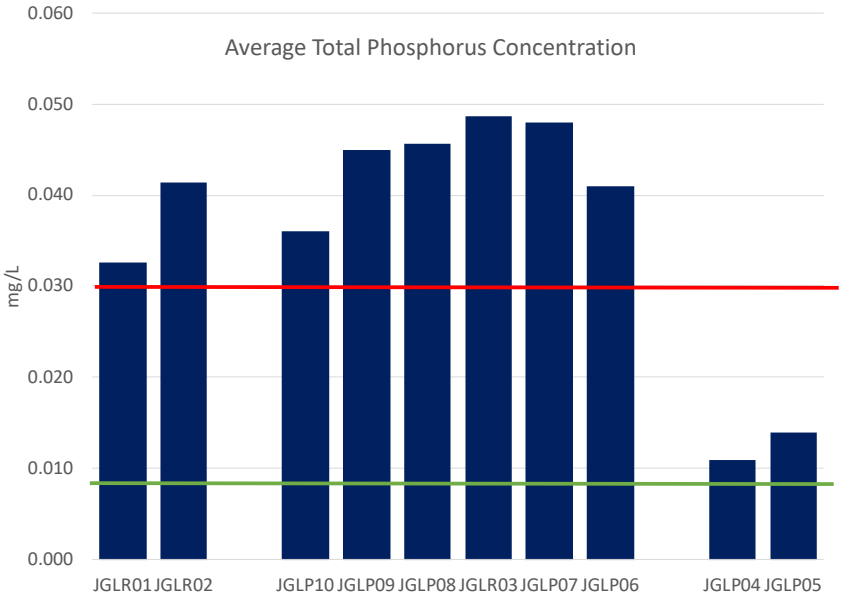


Total Nitrogen levels were ideal (at or below 0.3 mg/L, the green line) at the deep site and outlet of Grand Lake. Levels were acceptable (0.31-0.5 mg/L) in the other lakes and tributaries except for the river station at Lakeville corner, between French and Maquapit lakes, where concentrations were above the level of concern.

Nitrogen is an essential nutrient for plant life but excess can lead to low levels of oxygen. Anthropogenic sources of nitrogen include fertilizers, wastewater, failing septic systems, and organic wastes.

As with aluminum and nitrogen, the lowest phosphorus concentrations were found in the deep part and outlet of Grand Lake. Concentrations at these sites fell in the “acceptable” span, just above the cut-off for “ideal” levels (0.008 mg/L, green line in the graph). All other sites were above the limit of “concern” (0.03 mg/L, red line).

Phosphorus is an essential element for plant life. Anthropogenic sources of phosphorus include fertilizers, manure, and organic wastes. Elevated contents can lead to eutrophication and decreased oxygen levels.



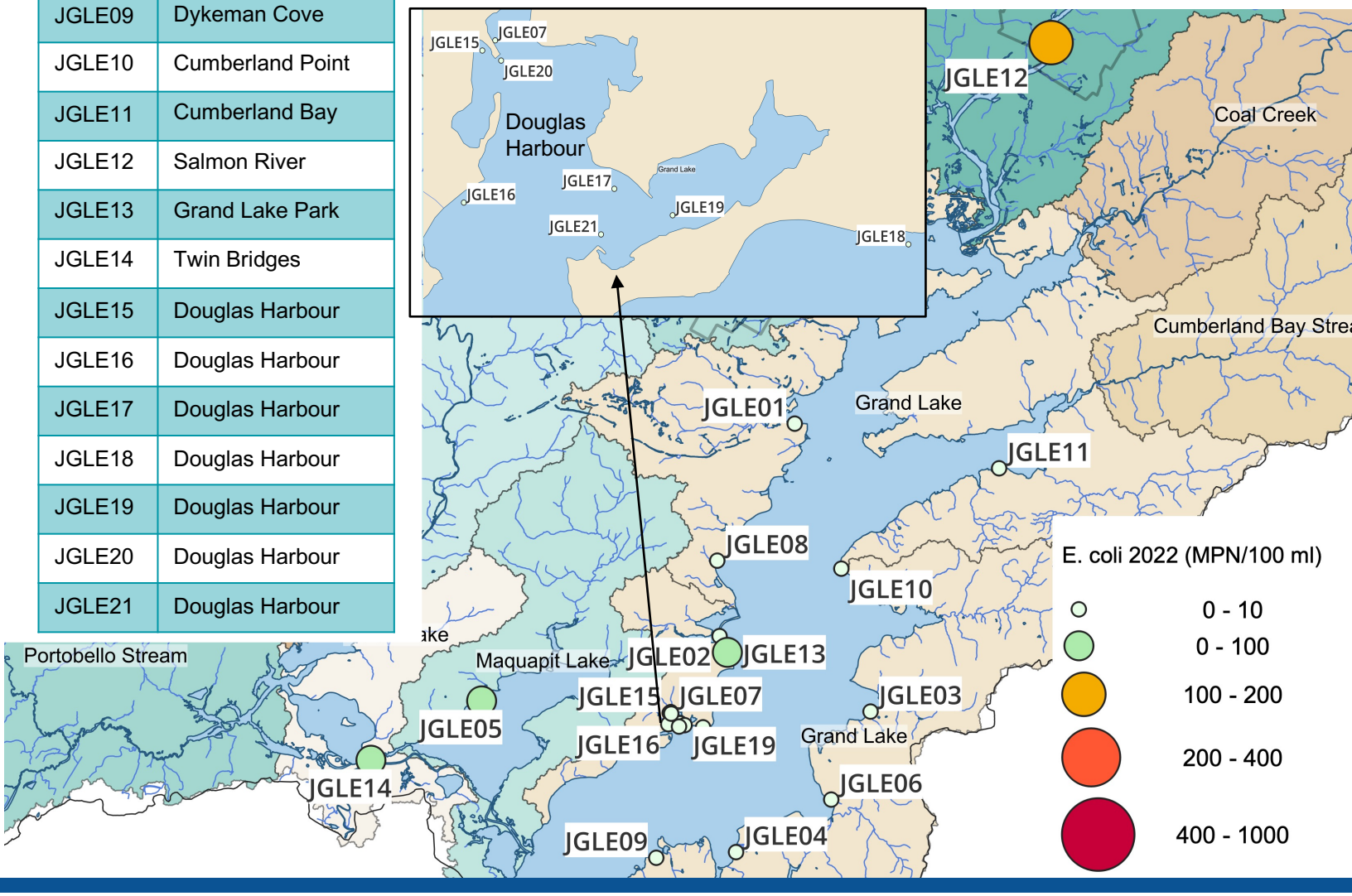
E. COLI SAMPLING & ANALYSIS

In 2022, 21 sampling locations were established on Grand Lake and tributary waters. Sites were sampled once in late August.

Site ID	Location name
JGLE01	Wuhr's Beach
JGLE02	Keyhole
JGLE03	Wiggins Cove
JGLE04	Whites Cove
JGLE05	Maquapit Lake
JGLE06	Mill Cove
JGLE07	Douglas Harbour
JGLE08	Camp Rotary
JGLE09	Dykeman Cove
JGLE10	Cumberland Point
JGLE11	Cumberland Bay
JGLE12	Salmon River
JGLE13	Grand Lake Park
JGLE14	Twin Bridges
JGLE15	Douglas Harbour
JGLE16	Douglas Harbour
JGLE17	Douglas Harbour
JGLE18	Douglas Harbour
JGLE19	Douglas Harbour
JGLE20	Douglas Harbour
JGLE21	Douglas Harbour

E. coli concentrations were all well below the CCME guideline for Canadian recreational water quality of less than 400 MPN (most probable number) of cells per 100 ml of sample. The highest concentrations this year (108 MPN/100 ml) were found in Salmon river.

In 2021, the highest concentrations were found in Douglas Harbour which led the Association to focus efforts there in 2022. Seven stations were sampled in Douglas Harbour (inset map) but concentrations were all extremely low.
In 2023 the Association plans to reduce E. coli monitoring to 2 sites based on results from this and previous years.



GET INVOLVED IN YOUR WATERSHED!

How can you improve the water quality of the Jemseg Grand Lake watershed?

1. *Green the shoreline*: Plant native vegetation like red-tip willows (*Salix eriocephala*) along the shore to reduce erosion, filter run-off, provide habitat for wildlife, and shade the water.

2. *Keep sewage out of the water:* Ensure that your septic tanks are regularly maintained and clean up pet waste.

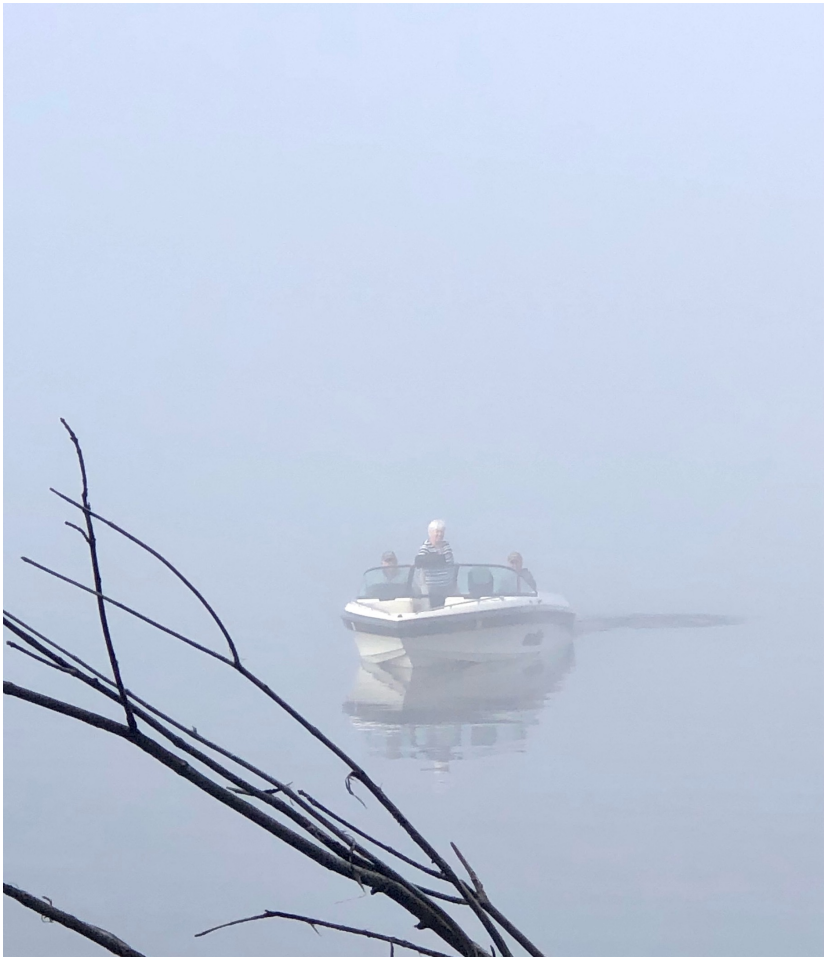
3. *Reduce pesticide and chemical use*: Use phosphate-free or biodegradable cleaning and personal care products. Reduce the use of pesticides on lawns and gardens.

4. *Improve water retention*: Use porous alternatives to pavement, collect runoff in a rain barrel or plant a rain garden.

5. Fence watercourses near farms: Livestock are a major source of *E. coli* and can erode riverbanks. Fencing the watercourse keeps our rivers and lakes healthier.

6. *Learn more about your watershed and its issues*.





Acknowledgements

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We thank our water quality program volunteers who contributed their time, resources and expertise to organize, collect, transport, and analyse water samples.

NEW BRUNSWICK ALLIANCE OF LAKE ASSOCIATIONS

ACAP SAINT JOHN

New Nouveau Brunswick

Your Environmental Trust Fund at Work