

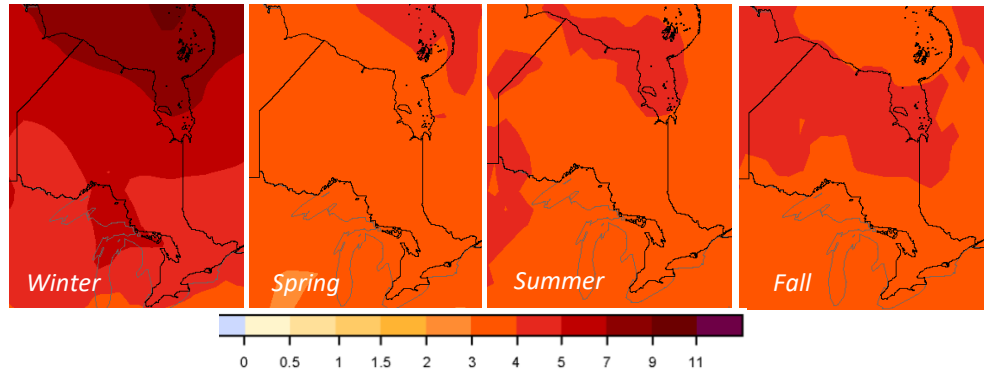


In Hot Water – How climate change impacts our aquatic environments

Aquatic environments like lakes, rivers, and wetlands, are important for animals and humans alike. The impact of climate change on these systems is already being noticed in the north, a trend that will likely continue. Knowing how climate influences these systems can be a helpful step in determining adaptation approaches moving forward.

The impacts of higher temperature

Climate change is expected to bring higher temperatures in all seasons, with northern areas often seeing the biggest increases. As the air warms, so does the water. As such, we can expect to see increases in water temperature in lakes, rivers, and wetlands across the north.



Projected temperatures increase (in °C) for 2050 compared to the average for 1986-2005 assuming little to no reduction in carbon emissions (RCP 8.5, 75th percentile). From <http://climate-scenarios.canada.ca/?page=download-cmip5>

In aquatic systems, water temperature is a major determinant of habitat suitability (where plants and animals can live). Fish are a good example of this. Being cold-blooded (meaning their body is the same temperature as their environment), fish are very dependant on the temperature of the water around them and will seek out areas with the right water temperature. This means that where fish species can live and thrive is likely to change as the climate warms. This is especially an issue for coldwater species, like trout, that may find it difficult to find cold water.

Water temperature can also impact ecological processes like nutrient cycling (how elements like carbon, oxygen, and nitrogen move through the environment). Warmer temperatures increase how quickly algae and

aquatic plants grow and as they go through their life cycle they increase the cycling of nutrients. In some lakes, this sort of increase could lead to eutrophication (an increase of nutrients in a lake) which can lead to algal blooms. When these algae decompose under the ice in winter, oxygen is used up and lead to fish kill in winter.

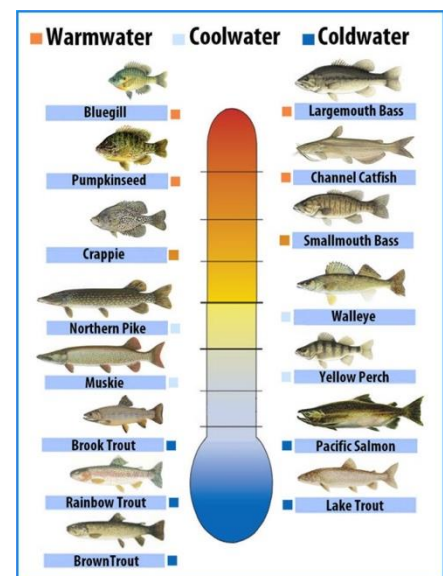
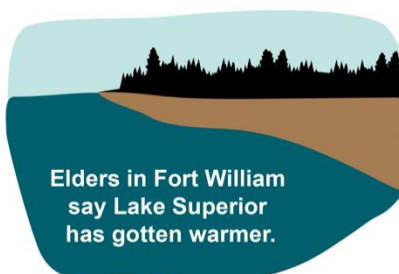


Chart of relative water temperature preferences for fish found in Ontario

Warmer conditions may also open the door to invasive species who can take advantage of this new environment. For example, plants like Eurasian milfoil will grow quickly and shade other plants preventing them from growing.



The impacts of water level changes

Water levels in lakes, rivers, and wetlands are influenced by factors like precipitation, inflow, and evaporation, all of which can be impacted by climate change. Warmer air is an important factor increasing the rate of evaporation. As lakes, rivers, and wetlands lose water to the atmosphere, their water levels can decrease. How much precipitation falls, when it falls, the intensity of the event, and whether the precipitation comes as rain or snow, all impact water levels as well. In general, Ontario is predicted to get wetter but exactly how and where that precipitation will fall is harder to predict. Current research suggests that intense rain falls could become more frequent. Winter snow depth is also predicted to decrease, which can impact water levels even in subsequent seasons. Water level can have a big impact on aquatic systems, influencing water temperature, light penetration, contaminant levels, and access to habitat for animals.



Water level affects:

Temperature



Deeper water stays cooler than shallow water

Impacts

Habitat suitability
Ecological processes

Light Penetration



Less light filters through the water column the deeper you go

Impacts

Aquatic plants and algae use light for growth and photosynthesis.
Less light keeps water cooler.

Contaminants

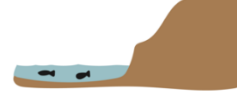


Lower water levels can lead to higher concentrations of contaminants

Impacts

Decreased water quality.
Harm to aquatic species.

Access to Habitat



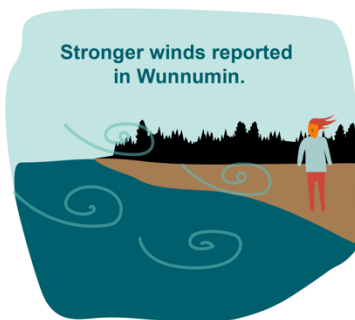
Low water level can limit movement through and between water bodies

Impacts

Hinder ability of fish and other species to migrate.
Impact to spawning.
Loss of habitat.

The impacts of less ice

Climate change is already leading to shorter ice-on seasons in the north. For lakes, decreased periods of ice and longer periods of open water mean an increase in evaporation, affecting water levels. Lake ice cover also serves to protect shorelines from erosion in shoulder periods (late fall and early spring) when strong winds can increase wave action. However, shorter ice cover can also have positive effects on lake and river systems by allowing more oxygen into the water in shoulder seasons and reducing the chance of winterkill of fish.



The impacts of wind

Wind is an important factor in lake ecosystems. Increases in wind have the potential to increase evaporation, speed ice-out, deepen thermocline (the transition between the hot water layer at the top and the cold water layer near the bottom of lakes in summer), and increase sediment deposition. In summer, near surface wind speeds are predicted to decrease by up to 10% across most of Ontario while increasing by up to 10% the rest of the year.

Higher temperatures are impacting aquatic systems and the animals and plants that live there.

Read more: A Summary of the Effects of Climate Change on Ontario's Aquatic Ecosystems, MNR-CCRR11

https://files.ontario.ca/environment-and-energy/aquatics-climate/stdprod_088243.pdf