



INDICATOR: WATER QUALITY IN STREAMS

STRATEGIC DIRECTION: Reduce Threats

TARGET: N/A

THEME: Pressures on Ontario's Biodiversity – Pollution

Background Information:

Water quality has a major influence on the biodiversity of freshwater systems. Water quality in streams is influenced by climate, geology of the watershed, flow regime and land use (Metcalf et al. 2013). Water quality can also be affected directly by the discharge and of substances in effluents or their application on the landscape. Along with aquatic species, many birds, amphibians and invertebrates are dependent upon freshwater bodies at some point in their life-cycle. Hence, the water quality of lakes and streams have a very important role in sustaining biodiversity (Environment Canada 2008).

Every day, hundreds of substances are discharged, directly or indirectly, into rivers and lakes in Ontario. This includes point sources (industrial waste, wastewater from urban and suburban development) and non-point sources (runoff from agricultural and urban areas). In Ontario, nitrate and ammonia are released into water in the largest quantities, while more highly toxic substances, such as mercury, are released in much smaller but significant amounts (Environment Canada 2008). Many more pollutants make their way into Ontario water bodies indirectly after being released into the air or onto the land. A recent review of water quality status and trends for Ontario (OMOE 2013) concluded that there have been some improvements, but that continued efforts were necessary to protect and restore water quality in the province.

This indicator provides an assessment of trends in water quality of Ontario streams by examining three parameters that have a strong influence on stream biodiversity – chloride, nitrates and total phosphorus. High levels of chloride ions can result from the use of de-icing road salts and dust suppressants and are toxic to aquatic life (CCME 2011). Excessive nitrates can arise in streams from nitrogen inputs related to industrial and municipal wastewater and urban and agricultural runoff. High levels of nitrates can be toxic to aquatic life and can promote algal blooms (CCME 2012). High phosphorus levels can cause excessive plant growth that can in turn reduce oxygen levels (MOEE 1994). Chloride and nitrate levels from Ontario streams are assessed against long-term exposure thresholds from the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2011, 2012). Total phosphorus levels are assessed against the threshold to prevent excessive plant growth from the Interim Provincial Water Quality Objectives (MOEE 1994, Table 1).



Table 1. Threshold levels for water quality parameters used in indicator assessment.

| Parameter | Threshold |
|------------------|---|
| Chloride | 120 mg Cl ⁻ / L |
| Nitrates | 3.0 mg NO ₃ ⁻ / N·L |
| Total Phosphorus | 0.03 mg P / L |

Data Analysis:

Stream water quality data from the Provincial Water Quality Monitoring Network (PWQMN) for two 5-year periods (2003-2007 and 2008-2012) were downloaded from Ontario's Open Data Catalogue (see link below). Five-year median concentrations (middle values) of total chloride, total nitrates and total phosphorus were calculated for each station using results from samples collected between April and November. Samples collected between the months of December and March were excluded from the median calculations to ensure comparability among stations as only a portion of the stations have winter sampling. Median concentrations for stations with a minimum of 10 samples over the 5-year period were included in further analyses.

For each time period, stations were mapped showing whether median values were above or below thresholds for each water quality parameter (Figure 1). Stations with median values above the threshold value have levels higher than the threshold in at least half of the samples taken at the site. In addition to mapping all of the stations, the proportion of stations above threshold values was summarized by ecozone (Figure 2) and stations that were sampled in both time periods ($n = 361$) were compared to examine trends (Figure 3).

It is important to note that the PWQMN is designed to provide coverage in populated areas of Ontario, or areas where land uses may be affecting water quality. The network relies heavily on Conservation Authority partners for sample collection. The majority of stations are therefore found in the Mixedwood Plains Ecozone of southern Ontario.

- [download PWQMN stream water quality data](#)



Results:

Trend: Mixed **Data Confidence:** High **Geographic Extent:** Mixedwood Plains/Ontario Shield ecozones

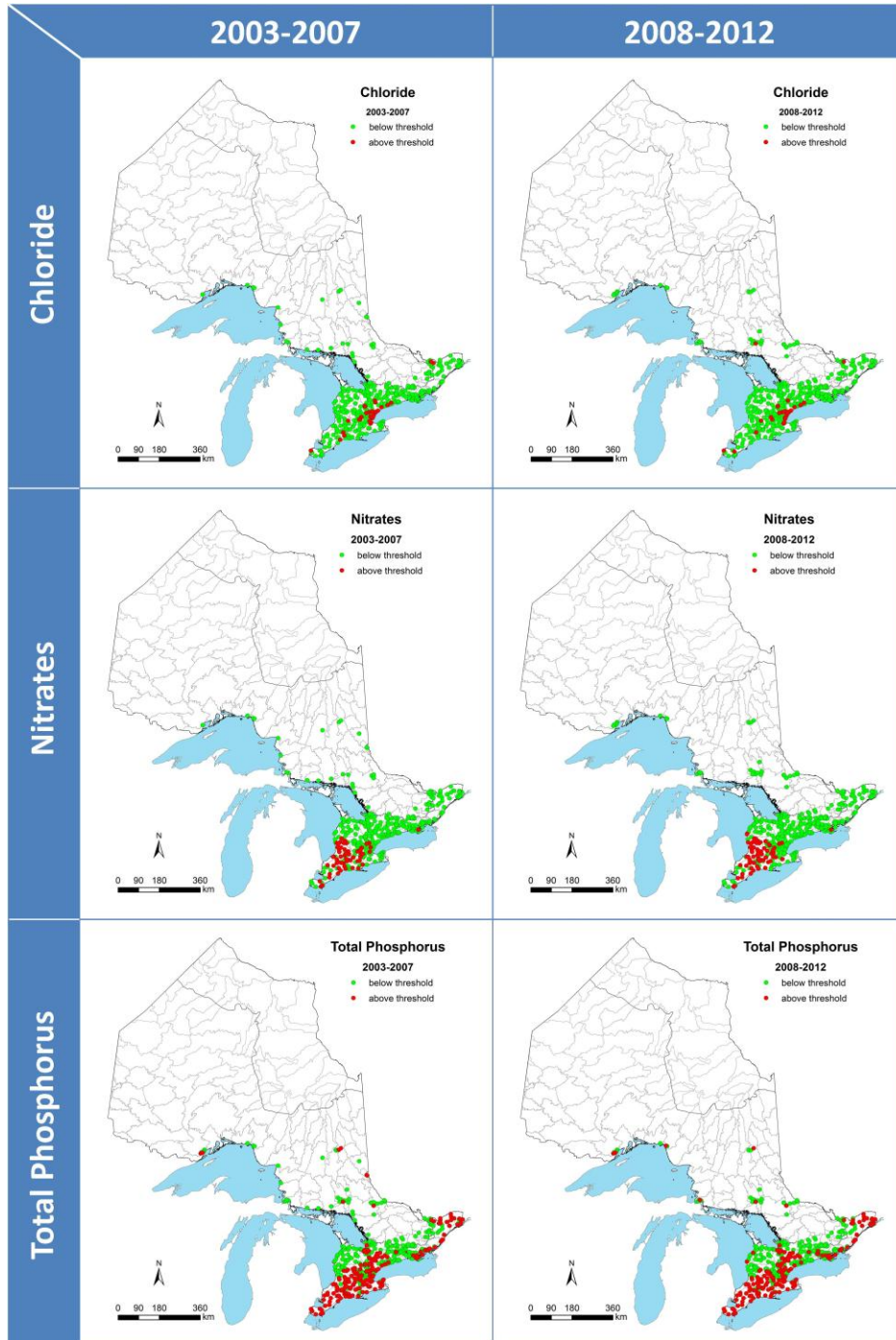


Figure 1. Status of median chloride, nitrate and total phosphorus levels against thresholds for supporting aquatic life for Ontario streams sampled during 2003-2007 ($n = 404$) and 2008-2012 ($n = 431$).

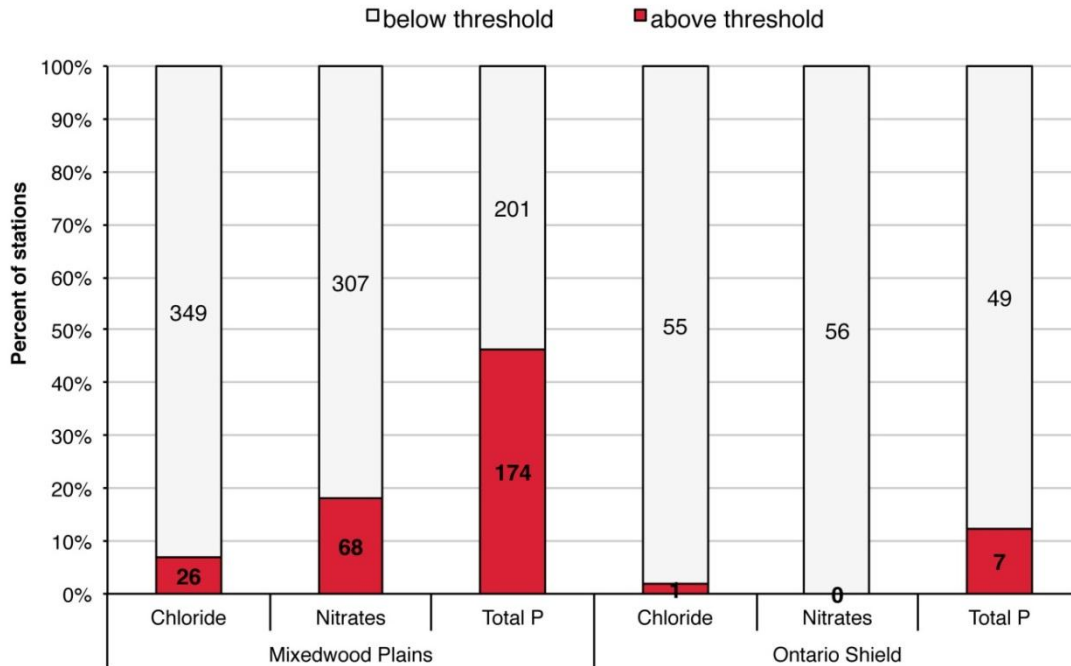


Figure 2. Proportion of water quality stations above thresholds in each ecozone for Ontario streams sampled during 2008-2012 ($n = 431$) [numbers on chart are the number of stations in each category].

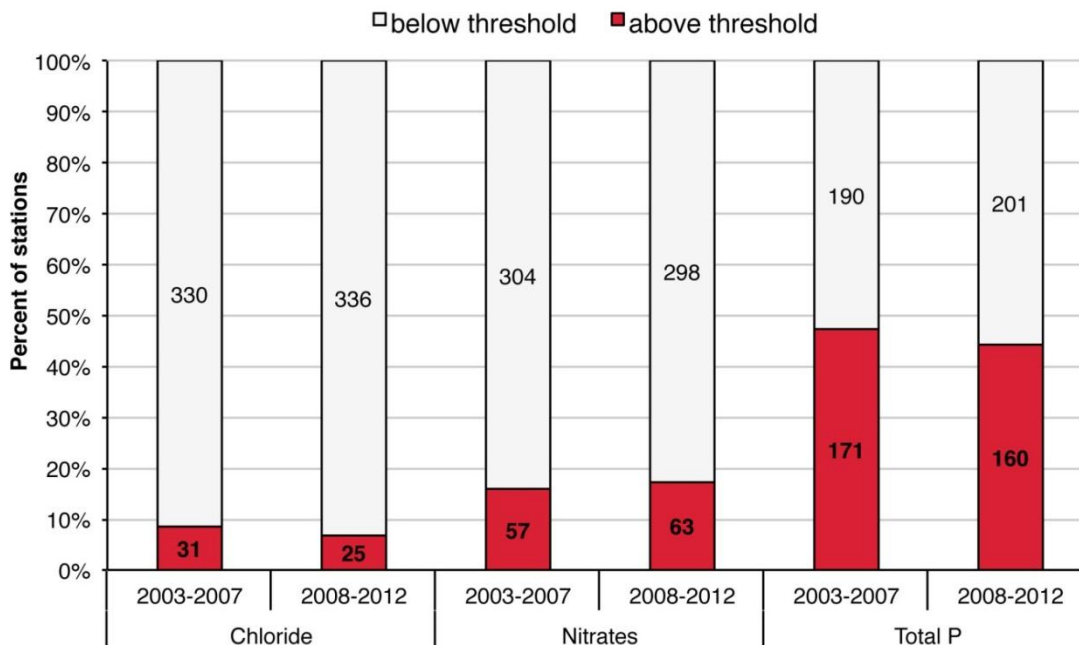


Figure 3. Proportion of water quality stations above thresholds for Ontario streams sampled during 2003-2007 and resampled during 2008-2012 ($n = 361$) [numbers on chart are the number of stations in each category].



Status:

- Median chloride levels were below thresholds at more than 90% of stations during both time periods and there was a small decrease between time periods. Most stations with chloride levels above long-term exposure thresholds are in or adjacent to urban areas.
- Median nitrate levels were above thresholds at 15-16% of stations with a slight increase between time periods. Stations above threshold levels are concentrated in southwestern Ontario.
- Median total phosphorus levels were above thresholds at almost half of stations (42-47%) with a slight decrease between time periods. Stations with excessive phosphorus were distributed across the sampled area.
- Water quality at stations in the Ontario Shield Ecozone was consistently better than in the Mixedwood Plains Ecozone where urban and agricultural land use is more prevalent.

Links:

Related Targets: 8. By 2015, the release of pollutants harmful to biodiversity is reduced.

Related Themes: N/A

Web Links:

Ontario Ministry of Environment and Climate Change - Provincial (Stream) Water Quality Monitoring Network <https://www.ontario.ca/environment-and-energy/provincial-stream-water-quality-monitoring-network-pwqmn-data>

References:

- Canadian Council of Ministers of the Environment (CCME). 2011. Canadian water quality guidelines for the protection of aquatic life: Chloride. *In*: Canadian environmental quality guidelines, Canadian Council of Ministers of the Environment, Winnipeg, MB. [Available at: <http://ceqg-rcqe.ccme.ca/download/en/337/>]
- Canadian Council of Ministers of the Environment (CCME). 2012. Canadian water quality guidelines for the protection of aquatic life: Nitrate. *In*: Canadian environmental quality guidelines, Canadian Council of Ministers of the Environment, Winnipeg, MB. [Available at: <http://ceqg-rcqe.ccme.ca/download/en/197/>]
- Environment Canada. 2008. Canadian environmental sustainability indicators. Environment Canada Catalogue No.81-5/1-2008E. Environment Canada, Ottawa, ON.
- Metcalfe, R.A., R.W. Mackereth, B. Grantham, N. Jones, R.S. Pyrcce, T. Haxton, J.J. Luce, and R. Stainton. 2013. Aquatic ecosystem assessments for rivers. Aquatic Research Series 2013-06. Science and Research Branch, Ministry of Natural Resources, Peterborough, ON.
- Ministry of Environment and Energy (MOEE). 1994. Water management policies, guidelines and provincial water quality objectives of the Ministry of Environment and Energy. Queen's Printer for Ontario, Toronto, ON. [Available at: <http://www.ontario.ca/environment-and-energy/water-management-policies-guidelines-provincial-water-quality-objectives>]



Ontario Ministry of the Environment (OMOE). 2013. Water quality in Ontario: 2012 report. Queen's Printer for Ontario, Toronto, ON. [Available at: <https://www.ontario.ca/environment-and-energy/water-quality-ontario-report-2012>]

Citation

Ontario Biodiversity Council. 2015. State of Ontario's Biodiversity [web application]. Ontario Biodiversity Council, Peterborough, Ontario. [Available at: <http://ontariobiodiversitycouncil.ca/sobr> (Date Accessed: May 19, 2015)].