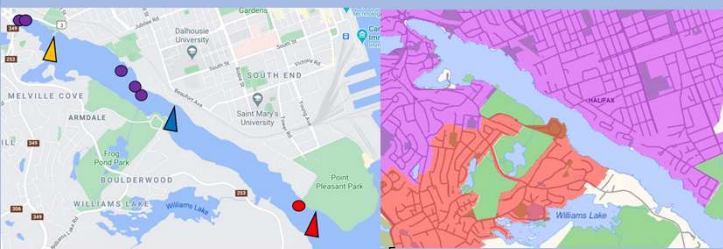


Objectives:

- Understand the fate of nitrogen in the Northwest Arm
- Study impacts of combined sewer overflows on Northwest Arm nitrogen content
- Study seasonality of nitrogen content in the Northwest Arm

Location:



- Horseshoe Island Park
- Oakland Dock
- Point Pleasant
- Combined Sewer Overflow
- Pumping Station
- Pink and purple shading on map indicate areas with wastewater treatment

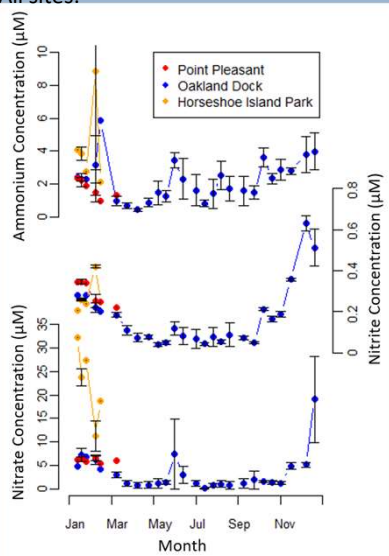
Methods:

- Nitrate: Chemiluminescence detection₁
- Nitrite: Chromatographic method₂
- Ammonium: Fluorometric method₃

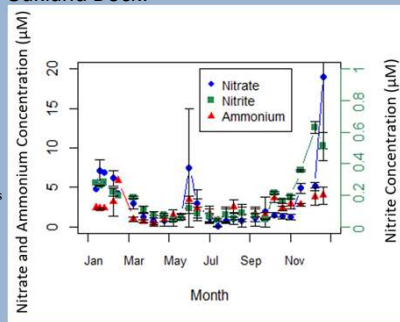
1. Holmes et al. 1999. A simple and precise method for measuring ammonium in marine and freshwater ecosystems. *Can. J. Fish. Aquat. Sci.* 56: 1801-1808.
2. Braman RS, Hendrix SA. Nanogram nitrite and nitrate determination in environmental and biological materials by vanadium (III) reduction with chemiluminescence detection. *Anal Chem.* 1989 Dec 15;61(24):2715-2718.
3. Pai, Su-Cheng, Chung-Cheng Yang, and John P. Riley. 1990. Formation kinetics of the pink azo dye in the determination of nitrite in natural waters. *Analytica Chimica Acta* 232:345-349. <http://www.sciencedirect.com.libproxy.mit.edu/science/article/B6TF4-44V43PY-9D/2/031684cbcf984cb10b9f342976aca> (accessed June 27, 2007).
4. Map points interpreted from: https://halifaxwater.ca/sites/default/files/2019-01/2018-23_hw_busplan.pdf
5. <https://hwc.maps.arcgis.com/apps/InformationLookup/index.html?appid=fe494ffcd144087a142dce3703afa8b>

Results:

All sites:



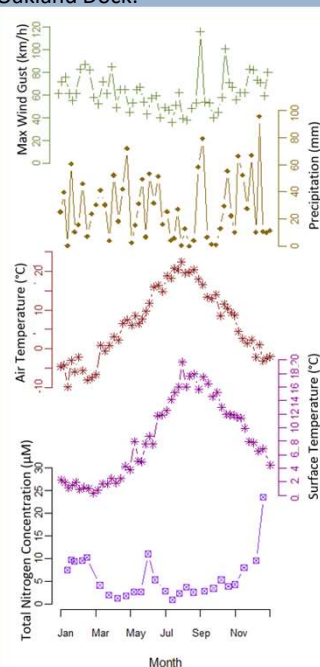
Oakland Dock:



Nutrient	Surface Water Temperature (°C)	Air Temperature (°C)	Maximum Wind Gust (km/h)	Cumulative Precipitation (mm)
Nitrate	0.1201	0.0267	0.0527	0.0009
Nitrite	0.4301	0.1689	0.0624	0.0195
Ammonium	0.1743	0.0855	0.1254	0.0147
Total Nitrogen	0.1675	0.0480	0.01866	0.0041

A table of calculated R^2 values from regression analysis. Comparisons with significant p-values (less than 0.05) have the R^2 outlined in red.

Oakland Dock:



Results:

- On average, Horseshoe Island has highest measured nitrogen concentrations.
- Two nitrogen peaks during the year, June and December.
- Significant relationships between surface water temperature and nitrogen content.
- No significant relationship between precipitation or wind and nitrogen content.

Conclusions:

- Longer flushing time at Horseshoe Island leads to nitrogen buildup.
- Suggests combined sewer overflows are not significant source of nitrogen to the Northwest Arm, more study needed.
- June nitrogen spike requires more study to determine cause.
- December nitrogen spike due to decreased biological uptake due to slow phytoplankton and bacteria growth and cold temperatures.