



# **Temperature and its Effects on Nitrogen and Phosphorus Levels in Forested, Urban, and Agricultural Streams**

# Background

- Nitrogen and Phosphorous
  - Essential nutrients
    - Aquatic organism
    - Crops
  - Adverse health and ecological effects
- Excess Nitrogen and phosphorous
  - Overstimulation of growth:  
Harmful to young infants or young livestock
  - Reduce or eliminate oxygen in water
  - Bacteria production of toxins
- Blue-green algae
  - Increased population with warm weather
  - High levels of nutrients in water
- Algal blooms
  - Skin irritation
  - Liver damage
  - Death

**What causes these increase in nutrients in the Vermont streams?**

# Hypothesis



**High temperature will correlate with high levels of Total Nitrogen (TN) and Total Phosphorous (TP) in forested, agricultural, and urban streams.**



# Methods and Materials

## ○ Sample sites:

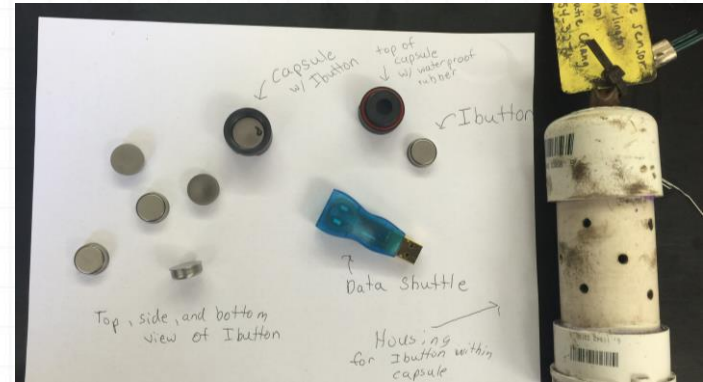
- South Branch Waits – Forested Site
- Indian brook – Urban Site
- Pond brook – Agricultural Site

## ○ Teledyne ISCO automated water sampler (ISCO):

- Total Suspended Solids
- Nutrients sampling
- Grab samples taken during field visits



<http://www.isco.com/webproductimages/3700C.jpg>



## ○ iButton temperature sensors:

- Deployed by RACC High Schools
- Waterproof capsules
- Left at site for months

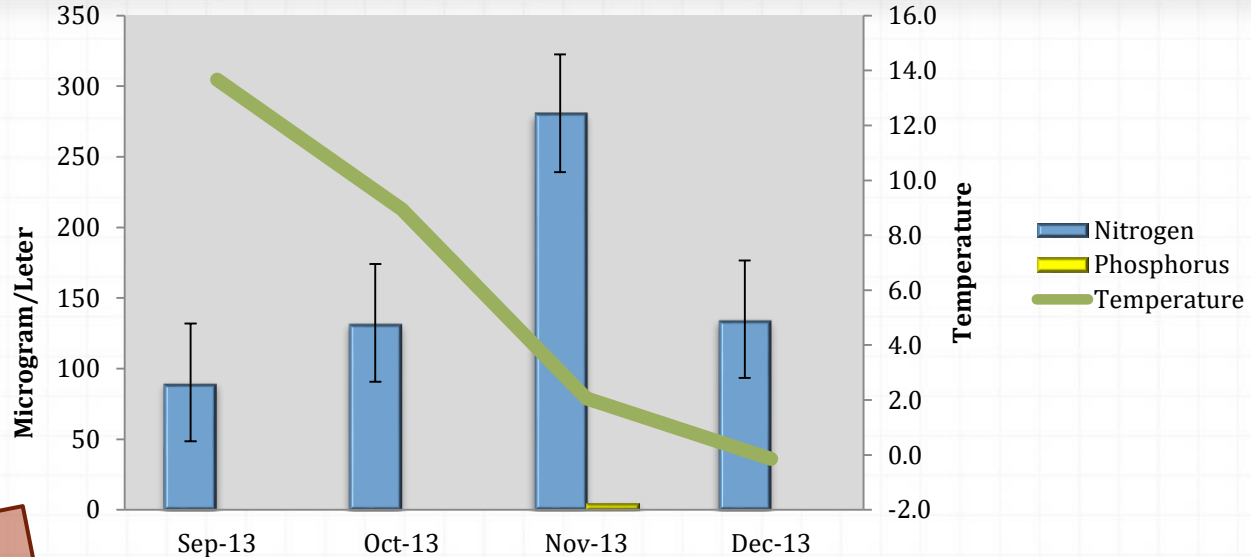
## ○ SEAL AQ2 Discrete Analyzer:

- Simplified chemistry fun for TP/TN (keep it simple)
- Chemistry!

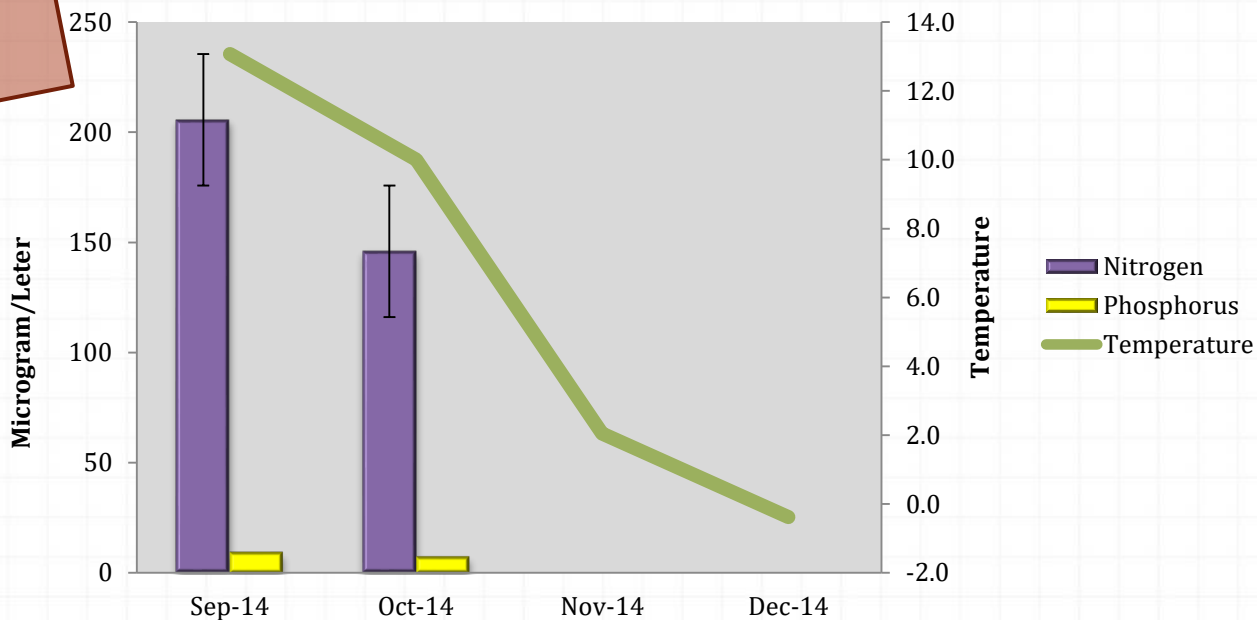


<http://seal-analytical.com/portals/0/AQ400/AQ400-500.jpg>

# Results

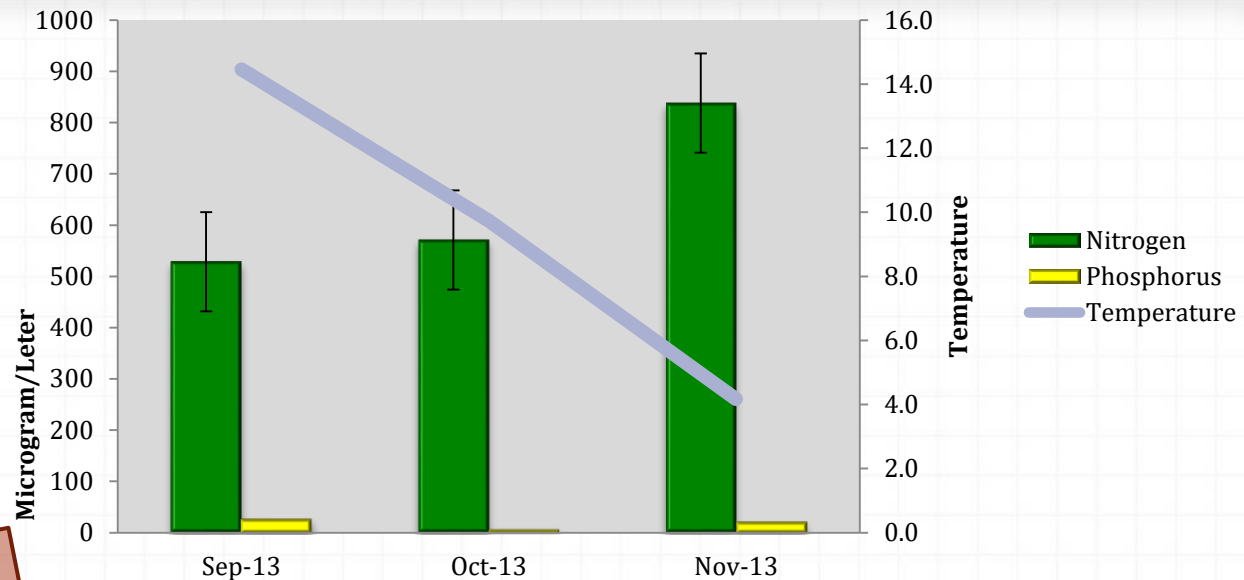


**Average nutrient vs Average temperature from september to december of 2013 at South Branch stream (Forested)**

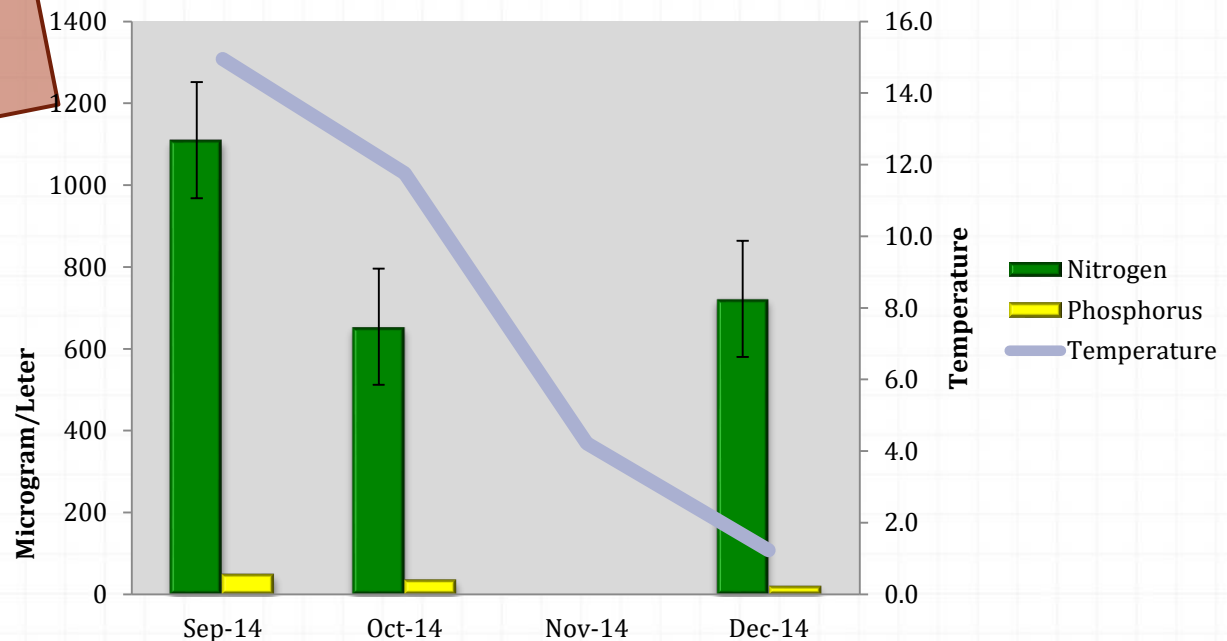


**Average nutrient vs Average temperature from september to december of 2014 at South Branch stream (Forested)**

# Results

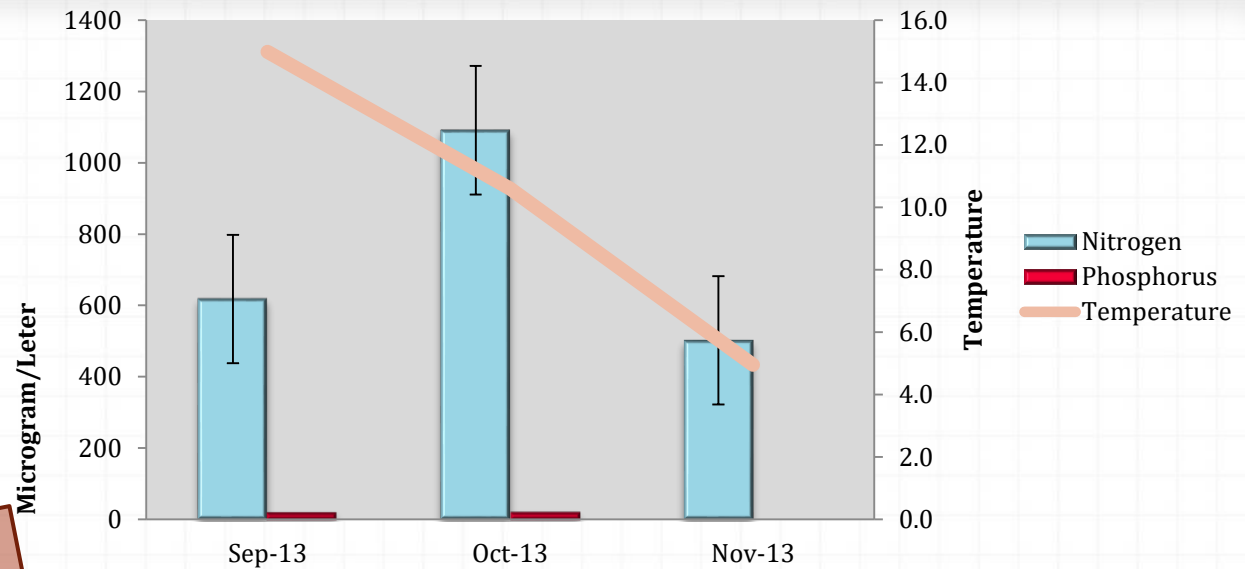


Average nutrient vs Average temperature from september to december of 2013 at Pond Brook stream (Agricultural)

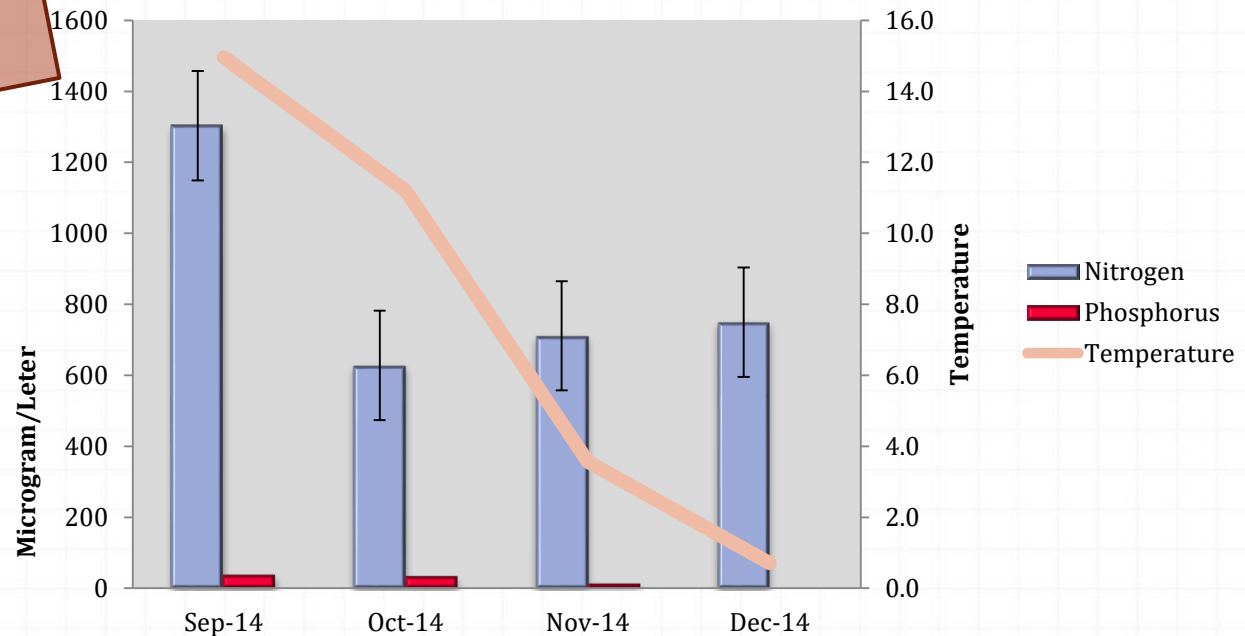


Average nutrient vs Average temperature from september to december of 2014 at Pond Brook stream (Agricultural)

# Results



Average nutrient vs Average temperature from september to december of 2013 at Indian Brook stream (Urban)



Average nutrient vs Average temperature from september to december of 2014 at Indian Brook stream (Urban)

# Discussion

- Results do not support hypothesis
- Vermont weather
  - 2013 vs. 2014

## Future Work

Look at temperature and nutrients for more years

Incorporate total suspended solids in water quality

- A rise in TP/TN during the month of October and November
  - Eutrophication
  - Leaves
  - Winter crops
  - Cover crops
    - Hairy vetch
- Lake Champlain Basin Program





## **I would like to thank:**

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- o RACC
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- o Johnson State College Water Quality Laboratory

**Questions?**

# References

- Templer, P., Toll, J., Hutyra, L., & Raciti, S. Nitrogen and carbon export from urban areas through removal and export of litterfall. Environmental Pollution, 256-261, 2015.
- Wu, J., & Malmström, M. (2015). Nutrient loadings from urban catchments under climate change scenarios: Case studies in Stockholm, Sweden. Science of The Total Environment, 393-406.
- Third awesome source you find!
- <http://pubchem.ncbi.nlm.nih.gov/compound/sulfanilamide#section=Top>
- <http://www.sigmaaldrich.com/catalog/product/sial/222488?lang=en&region=US>
- [http://www.chemicalbook.com/ChemicalProductProperty\\_EN\\_CB6162083.htm](http://www.chemicalbook.com/ChemicalProductProperty_EN_CB6162083.htm)
- <http://www.sigmaaldrich.com/catalog/product/sial/383376?lang=en&region=US>
- <http://img.guidchem.com/casimg/12054-85-2.gif>
- Field Work Photographs taken by Kaylee Jackson

# Lake Champlain Basin Program

- o The top priorities of the management plan are:
  - o Reduce phosphorus inputs to Lake Champlain
  - o Reduce toxic contamination
  - o Minimize the risks to humans from water-related health hazards in the Lake Champlain Basin
  - o Control the introduction, spread, and impact of non-native nuisance species