Evaluation of Volunteer Data – The Lakes of Missouri Volunteer Program Review

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LMVP Background

- Program was created in 1992
- Coordinated by the University of Missouri Limnology Lab
- Funding:

US EPA Region VII through the Missouri Department of Natural Resources has provided partial funding for this project under Section 319 of the Clean Water Act

LMVP Goals

1. Determine current water quality in Missouri lakes
2. Monitor for changes in water quality over time
3. Educate the public about lake ecology and water quality issues

Parameters Monitored

- Total Phosphorus (5 – 85 µg/L)
- Total Nitrogen (200 – 1400 µg/L)
- Algal Chlorophyll (3 – 50 µg/L)
- Suspended Solids (0 – 20 mg/L)
- Secchi Transparency (20 – 230 inches)

Volunteer Sampling Protocol

- Composite surface samples
- April – September sampling season
- 8 samples, once every three weeks
- Volunteers process samples at home and store everything in freezer (samples are analyzed at the University)

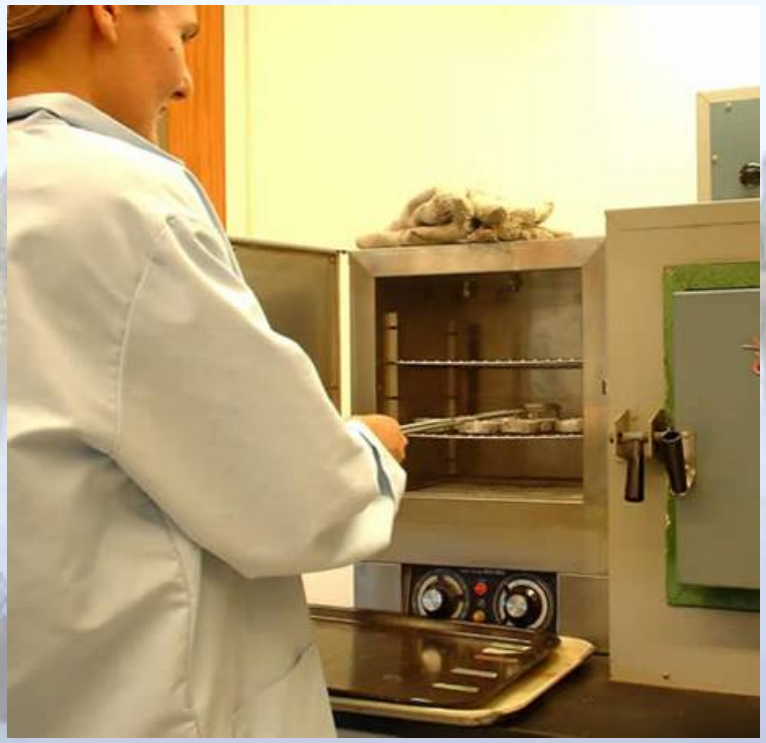
University Monitoring

- Statewide Lake Assessment Project
  - 3 or 4 composite surface samples mid-May to mid-August
- Table Rock Lake Long-Term Monitoring
  - 5 or 6 epilimnetic composite samples May through September
- Lake of the Ozarks Long-Term Monitoring
  - 4 composite surface samples in July and August

Is Volunteer Data Quality Data?

1. Comparison of annual geometric mean values
2. Comparison of long-term geometric mean values
3. Split Samples
4. Evaluation of chlorophyll filter replication

Comparison of annual geometric mean values



29 lakes

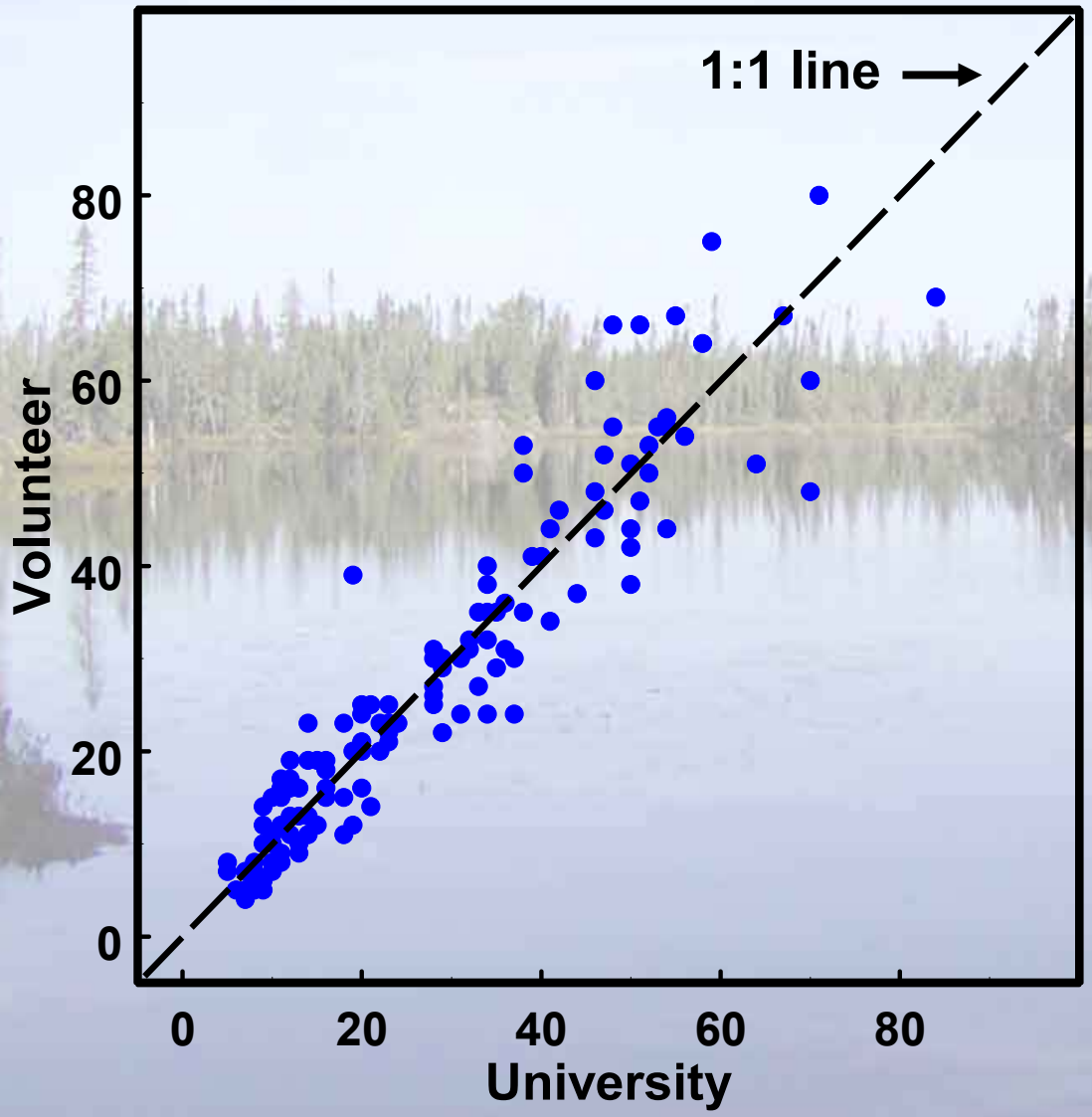
41 lake-sites

178 lake-site/years

At least 3 samples from both Volunteer and University

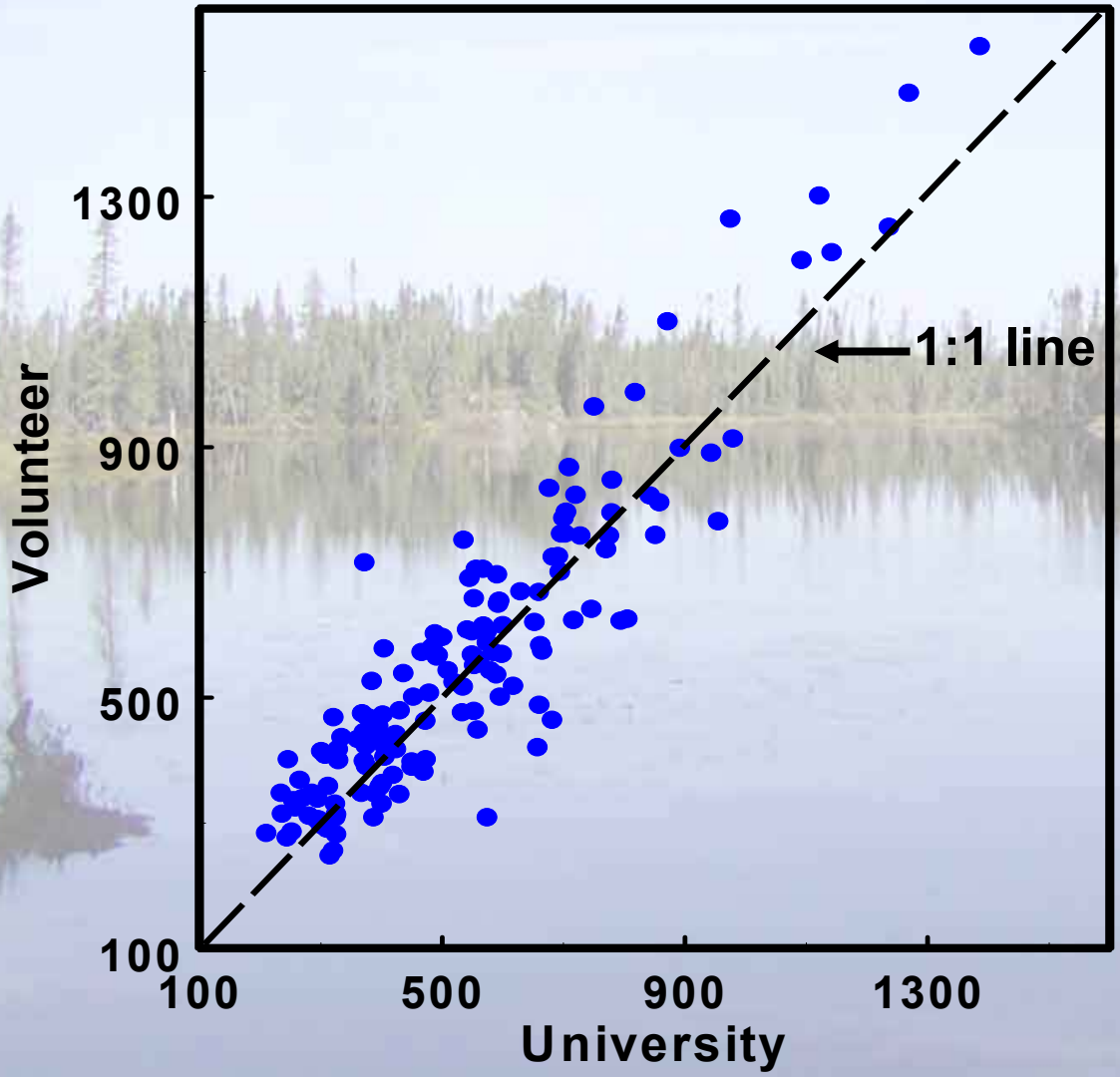
Analyzed using Mann-Whitney Test with significance level set at 0.05

Total Phosphorus



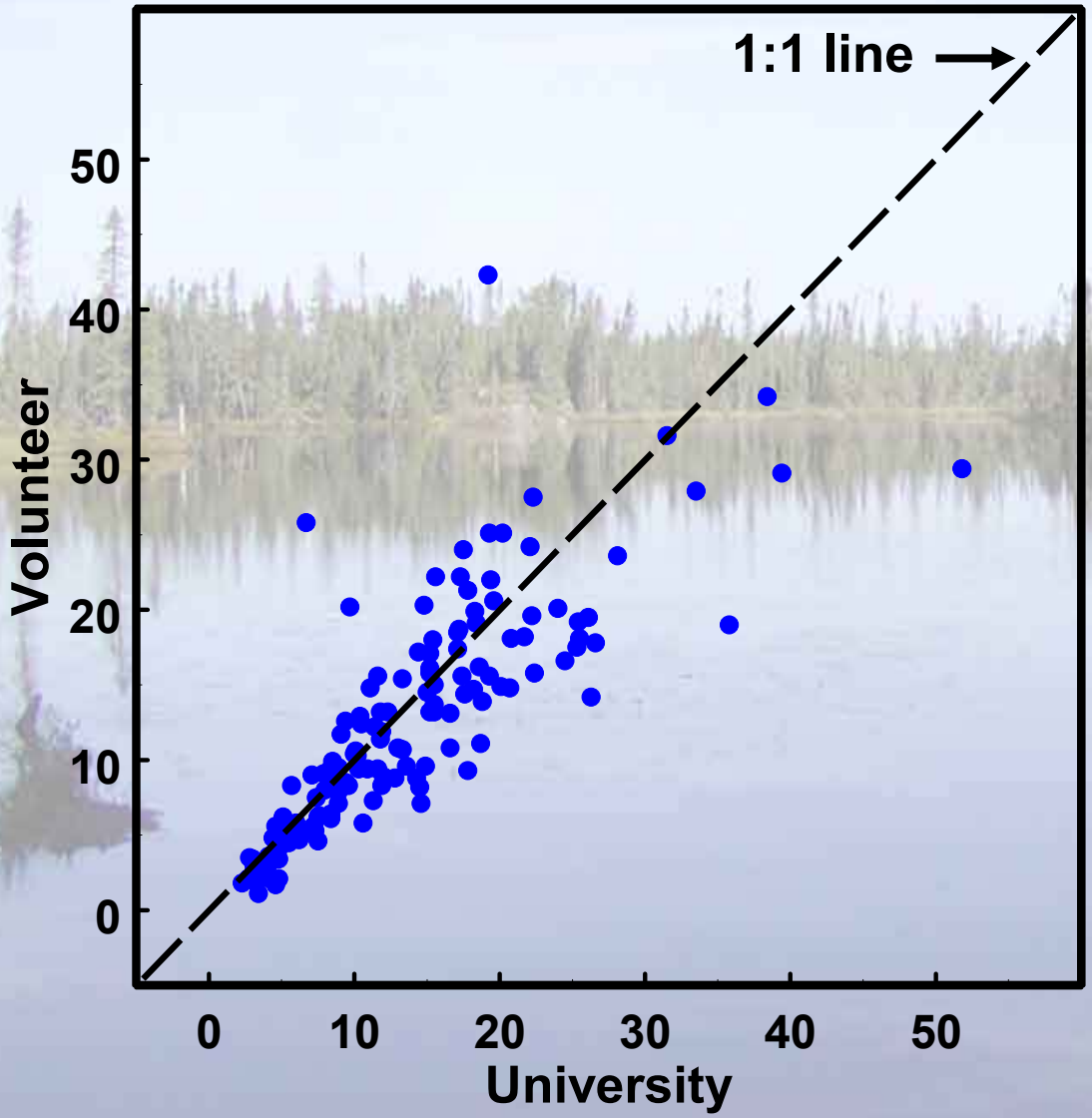
164 comparisons (92%) were not significantly different

Total Nitrogen



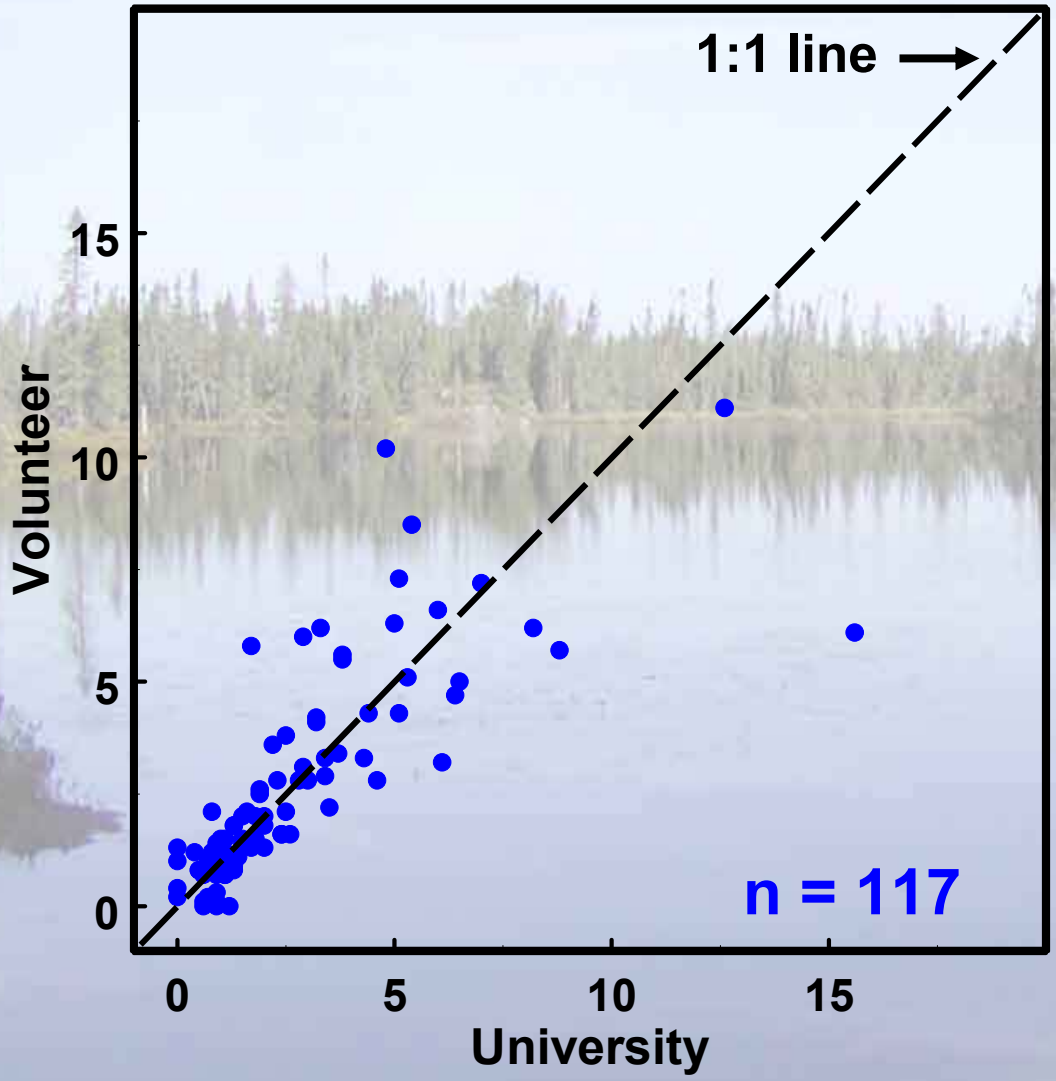
167 comparisons (94%) were not significantly different

Chlorophyll



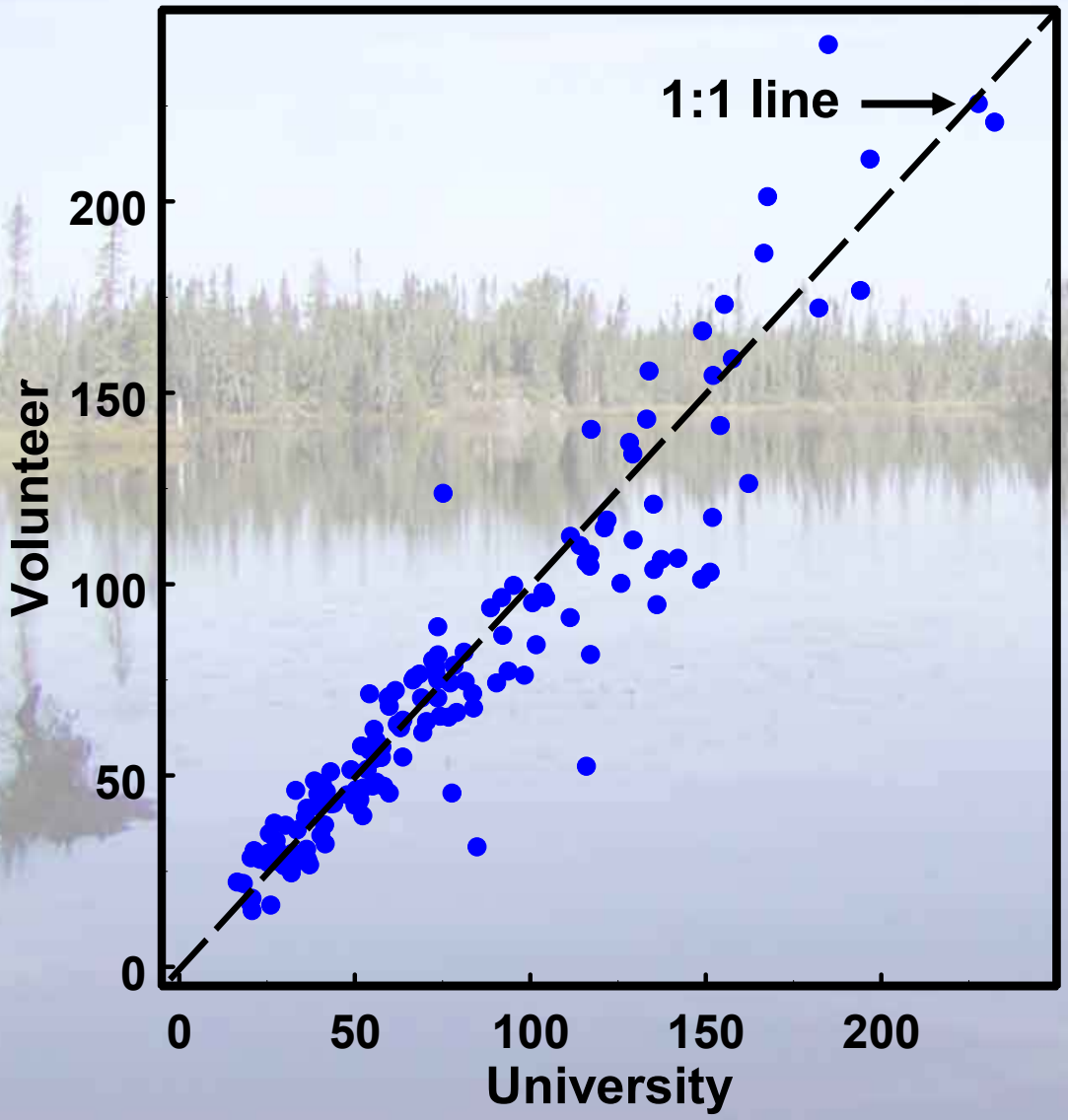
171 comparisons (96%) were not significantly different

Inorganic Suspended Solids



116 comparisons (99%) were not significantly different

Secchi



166 comparisons (93%) were not significantly different

Should we be concerned that 5% of the comparisons were significantly different?

Comparison of long-term geometric mean values

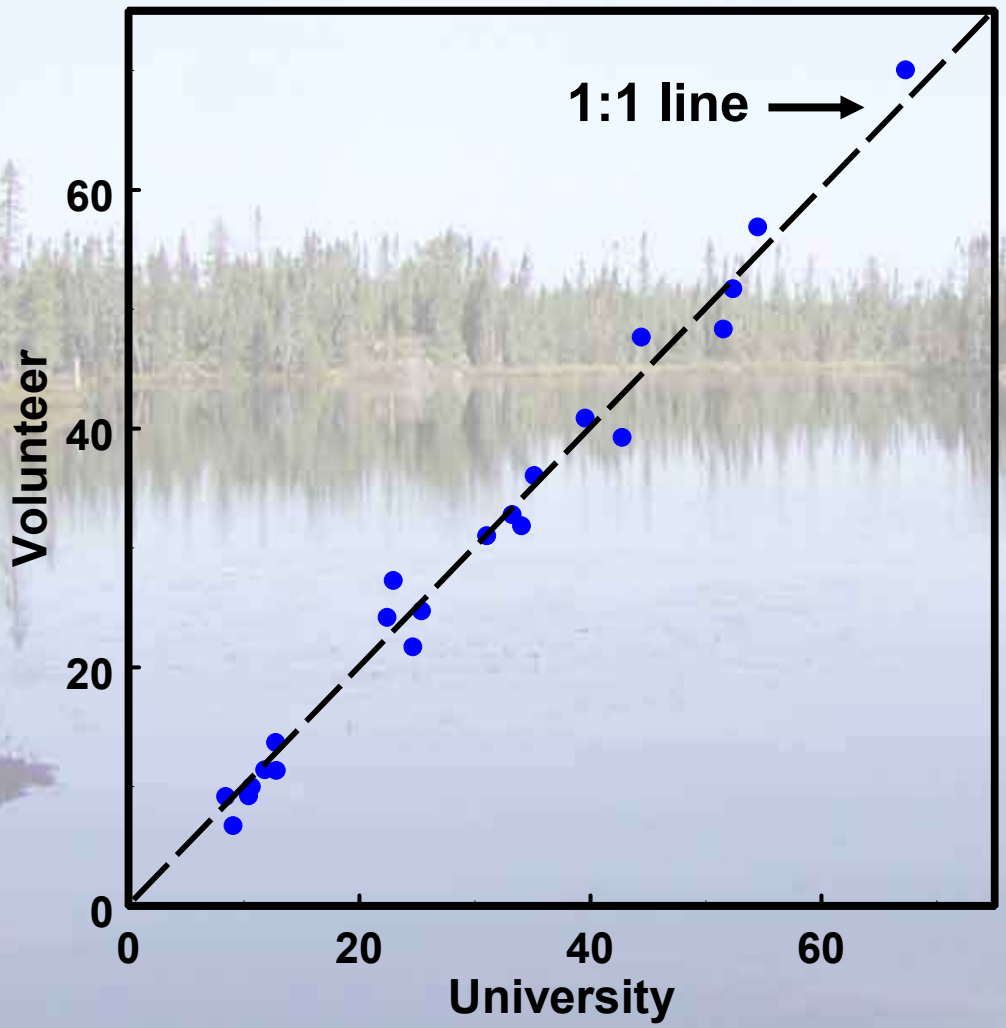
11 lakes

23 lake-sites

4 to 10 years of data per lake-site

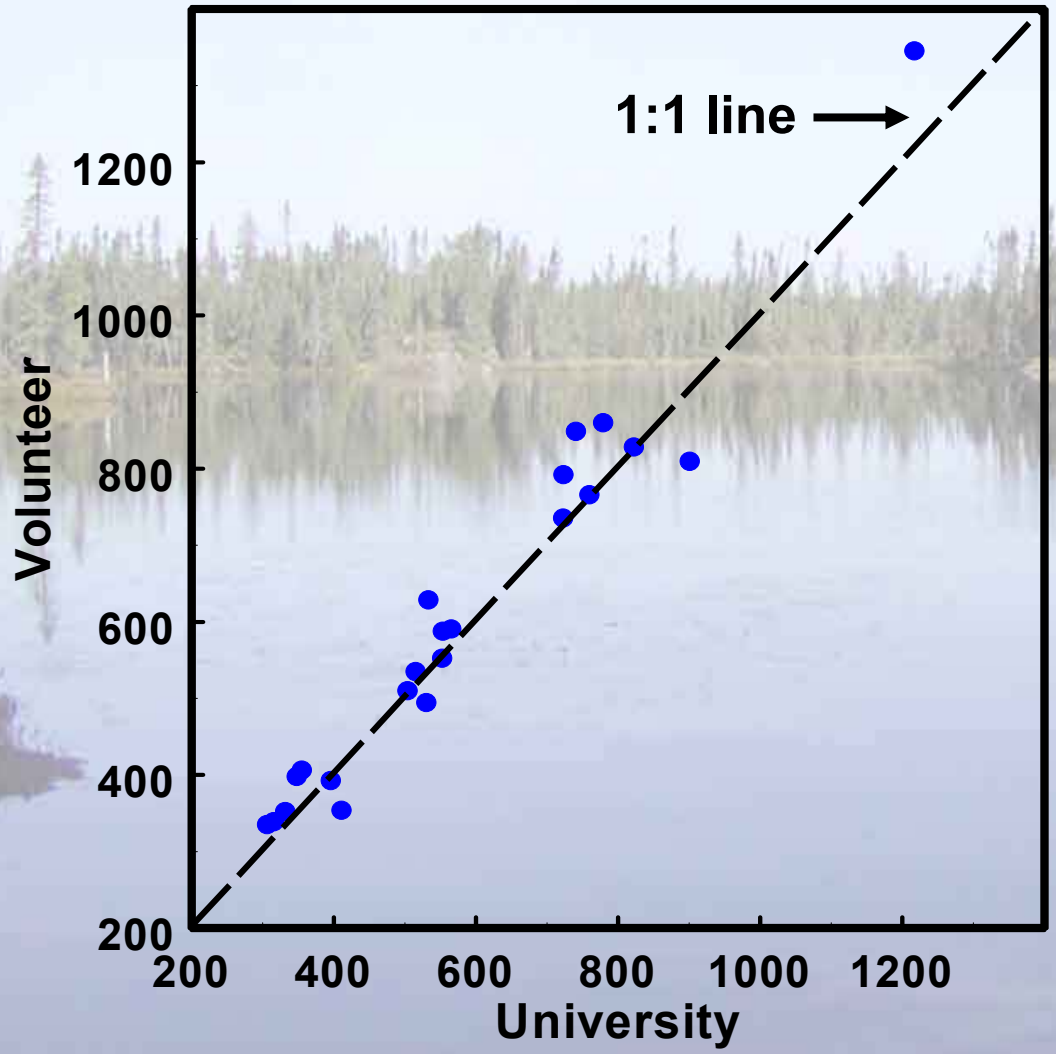
Analyzed using Mann-Whitney Test with significance level set at 0.05

Total Phosphorus



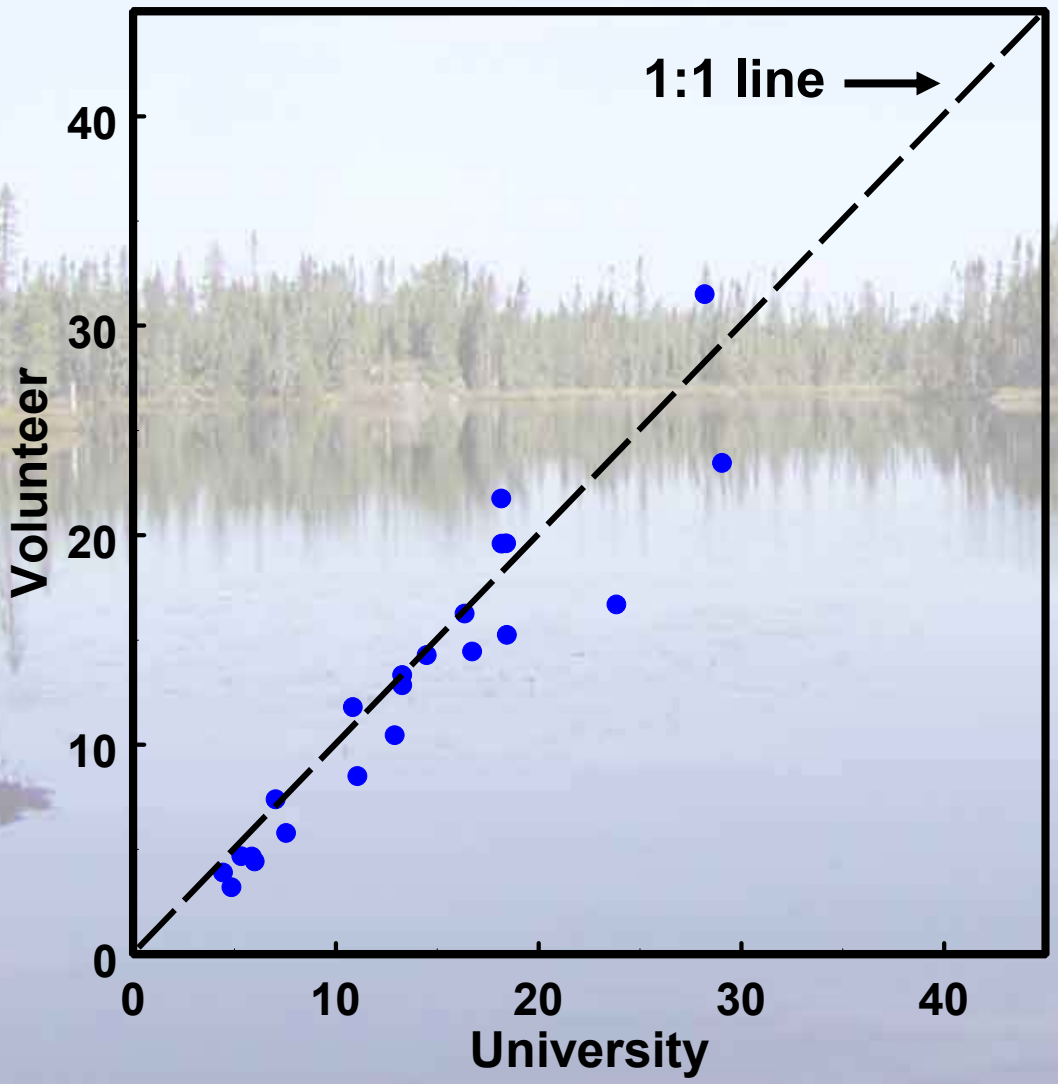
no significant differences

Total Nitrogen



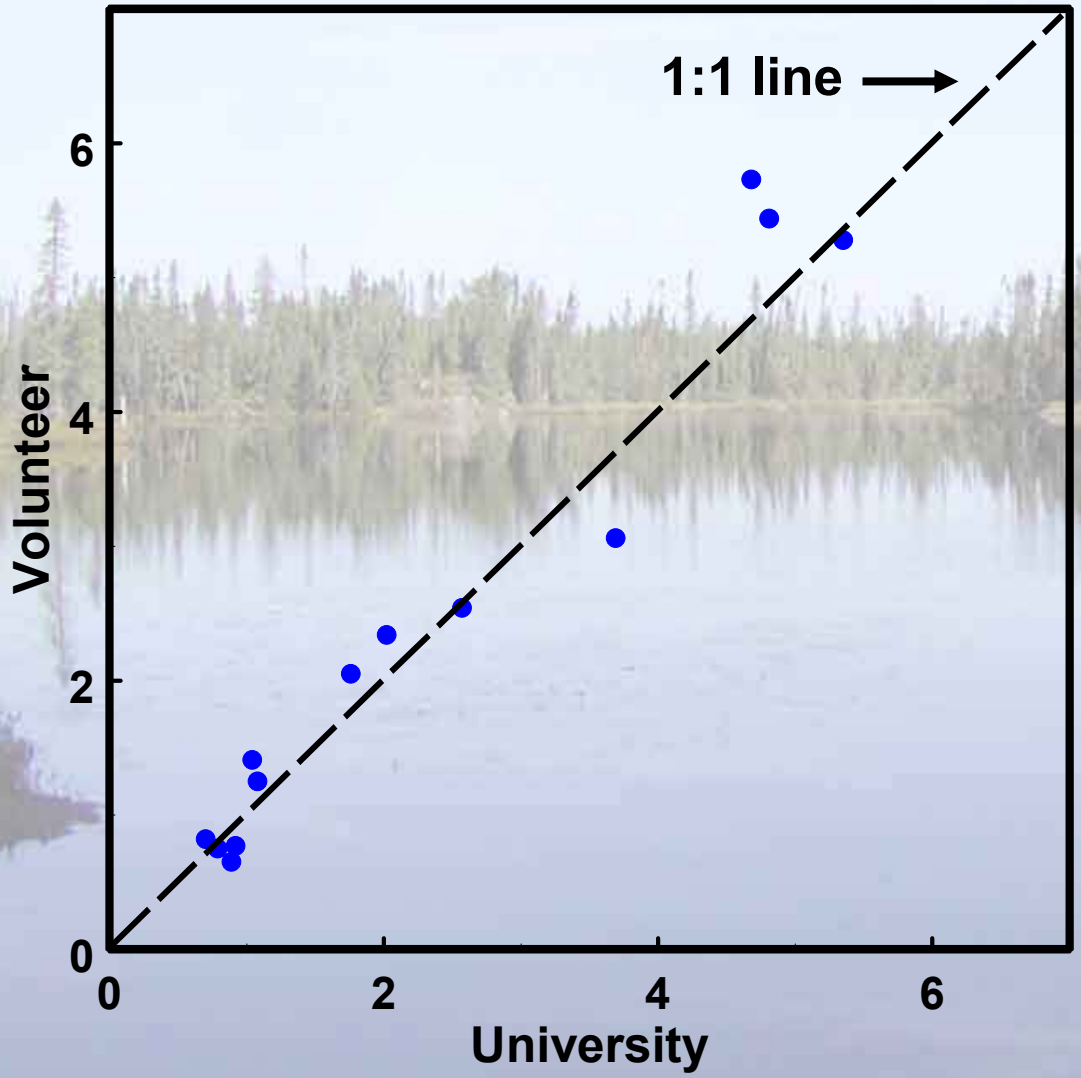
no significant differences

Chlorophyll



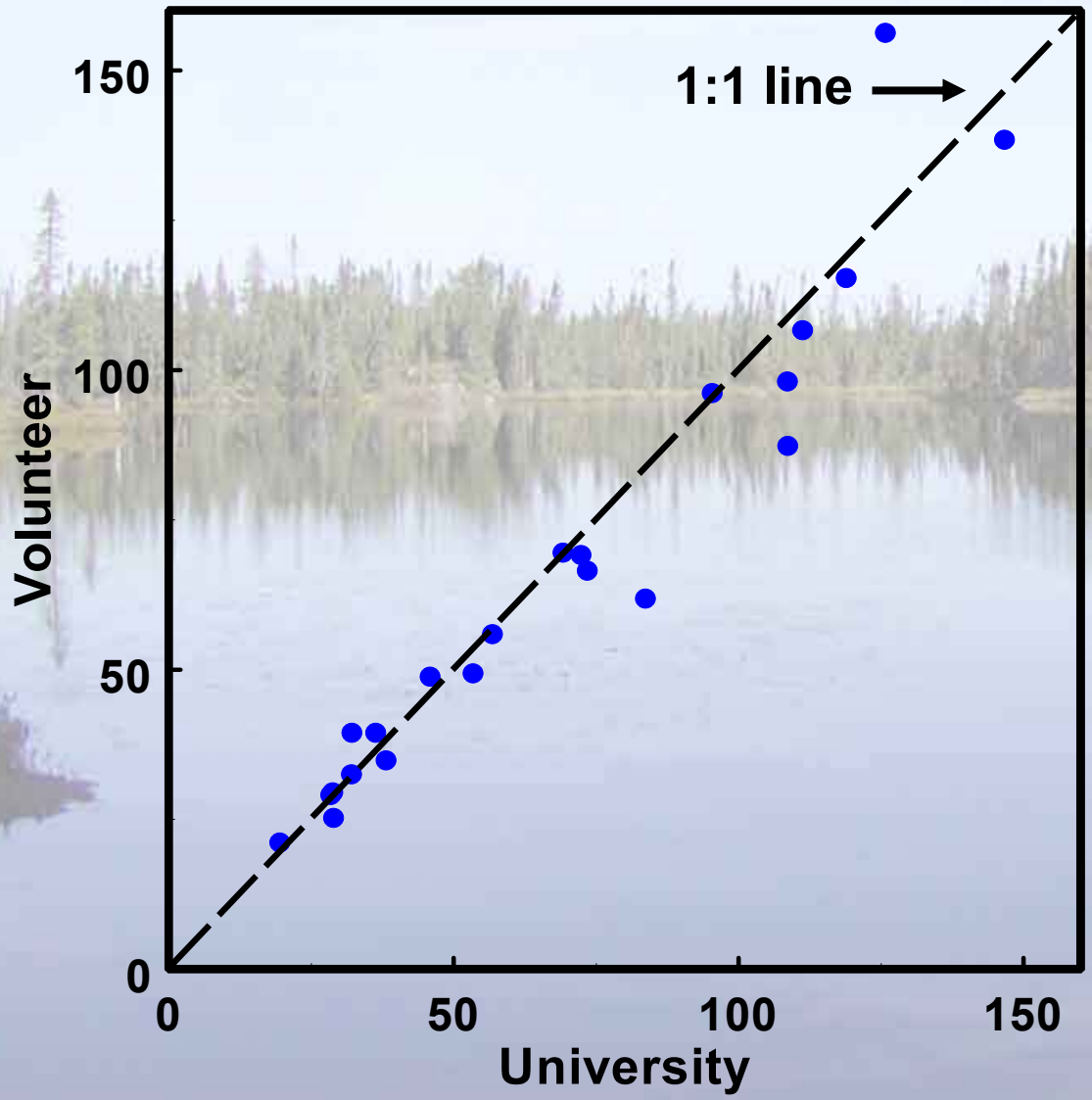
no significant differences

Inorganic Suspended Solids



no significant differences

Secchi



no significant differences

Split Samples

Difference in processing and storage include:

Hand pump vs. vacuum

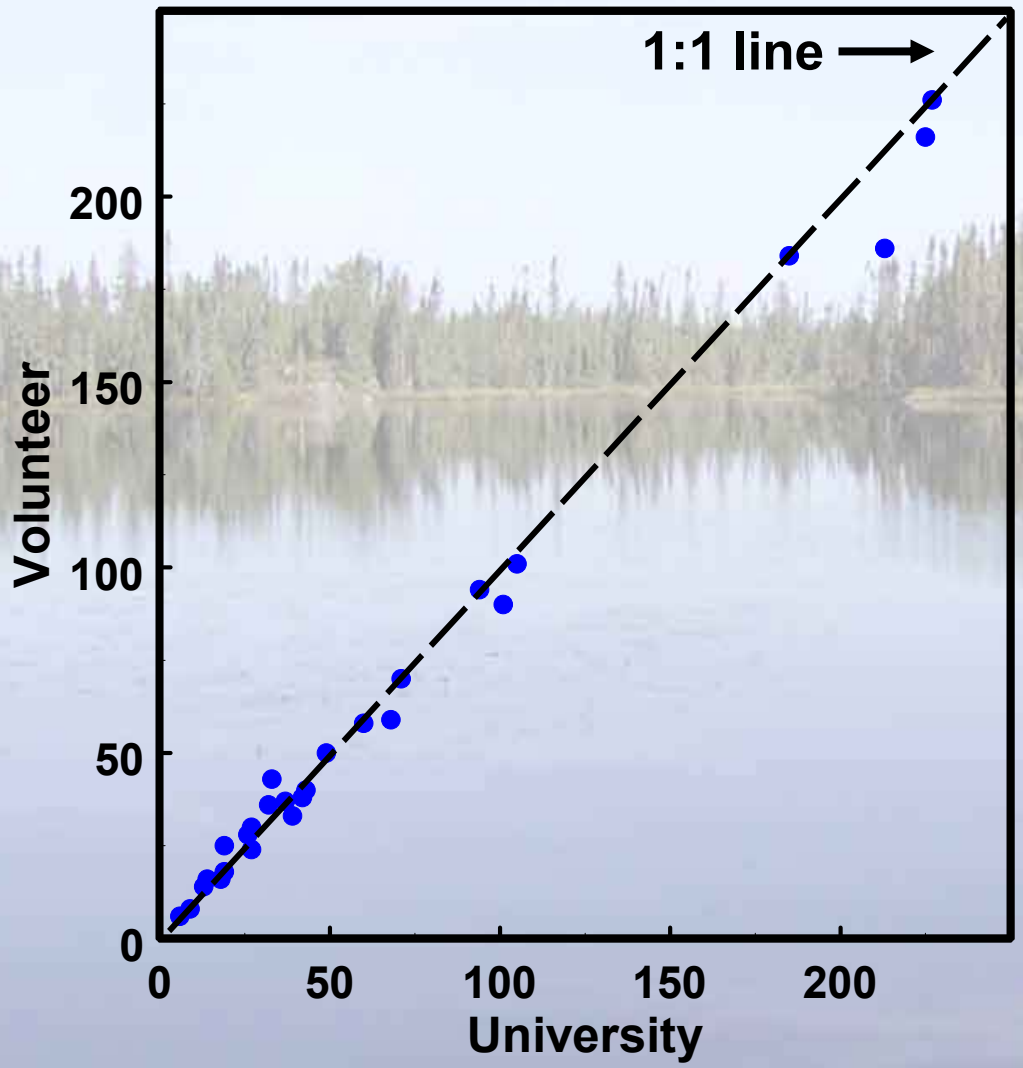
Frozen TP bottles vs. refrigerated tubes

Volunteers generally process samples quicker

18 lakes 27 lake-sites

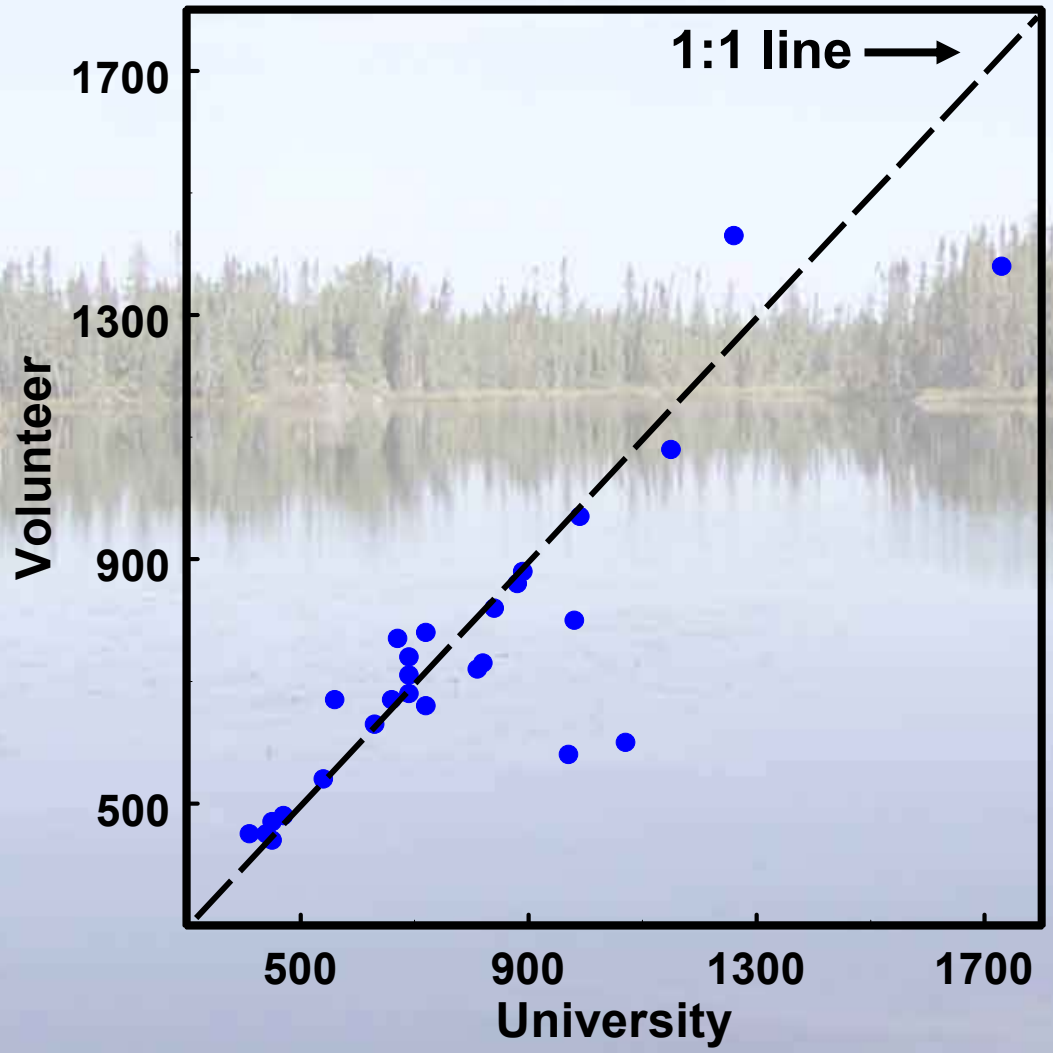
Analyzed using Paired T-Test on log transformed data with significance level set at 0.05

Total Phosphorus



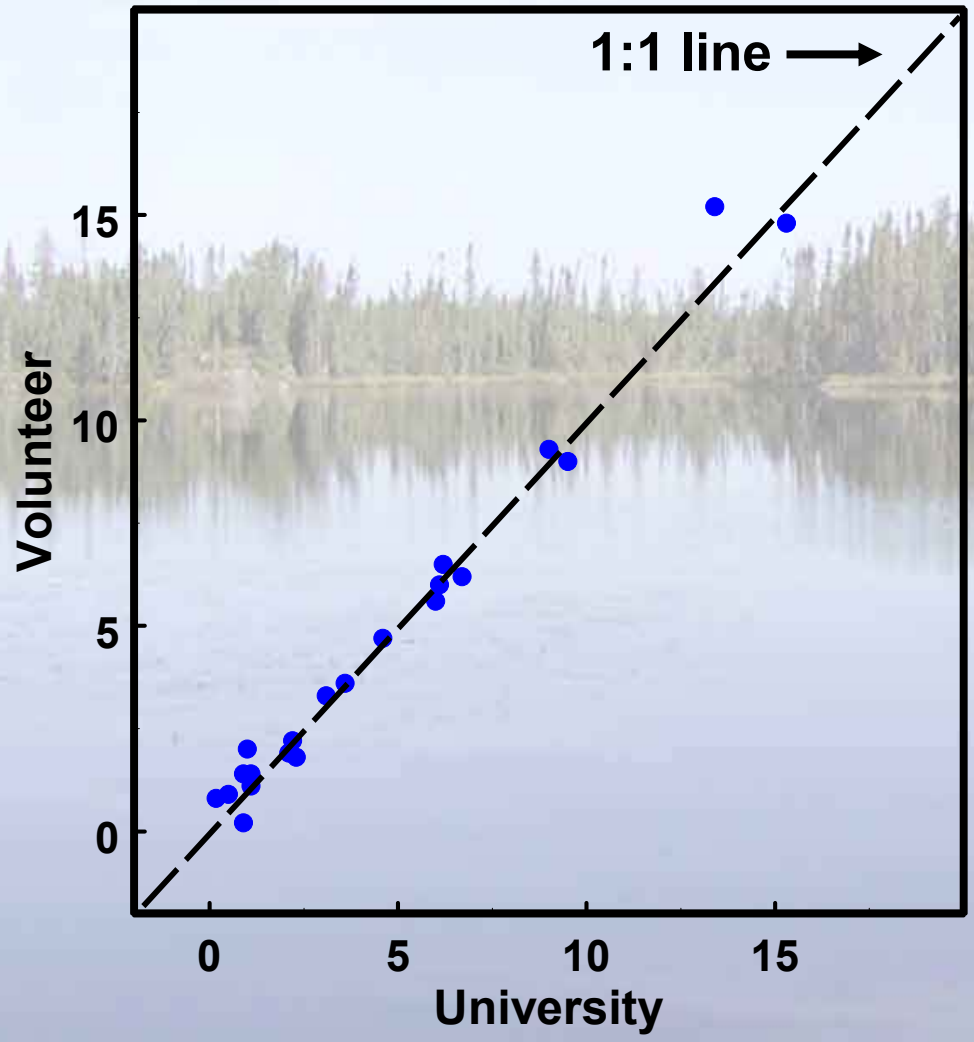
no significant difference

Total Nitrogen



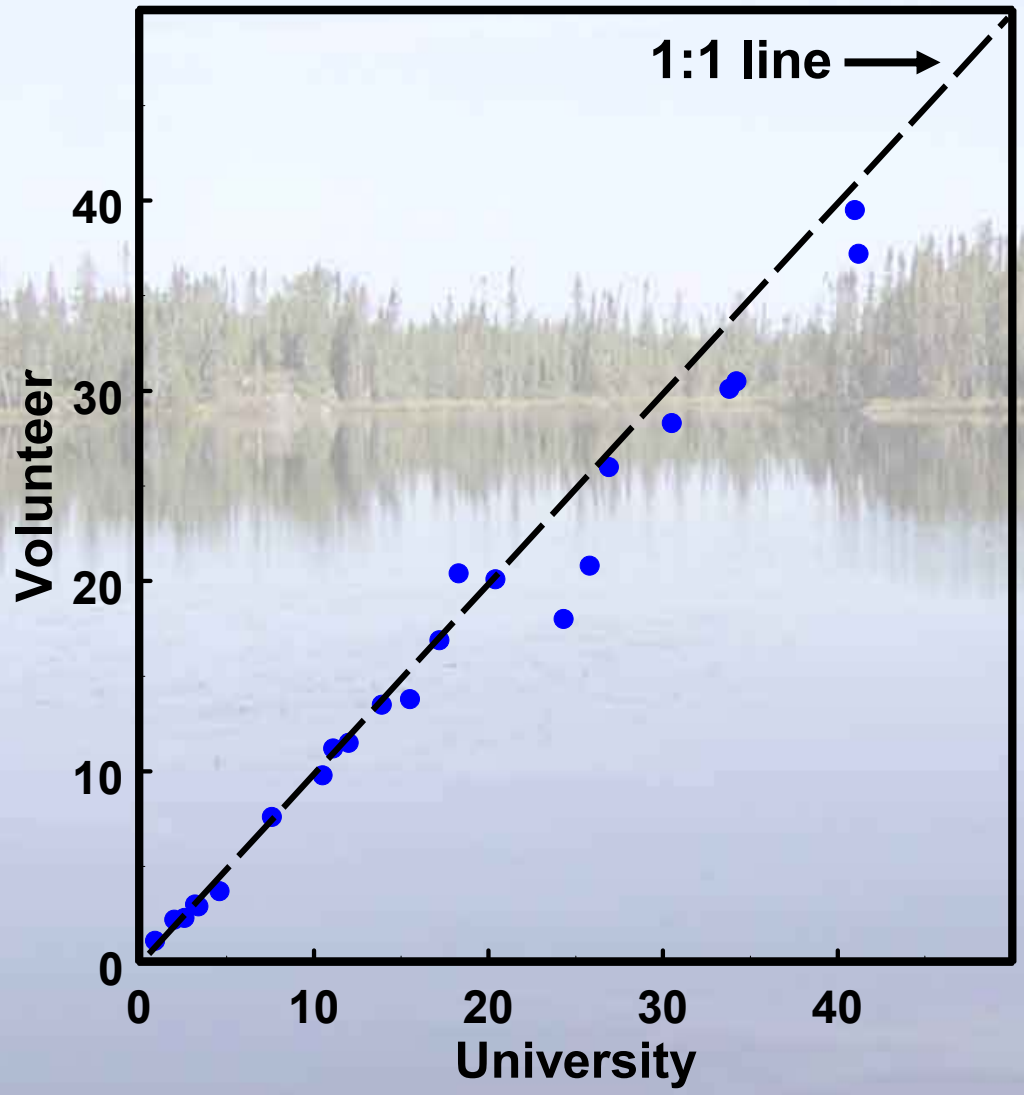
no significant difference

Inorganic Suspended Solids



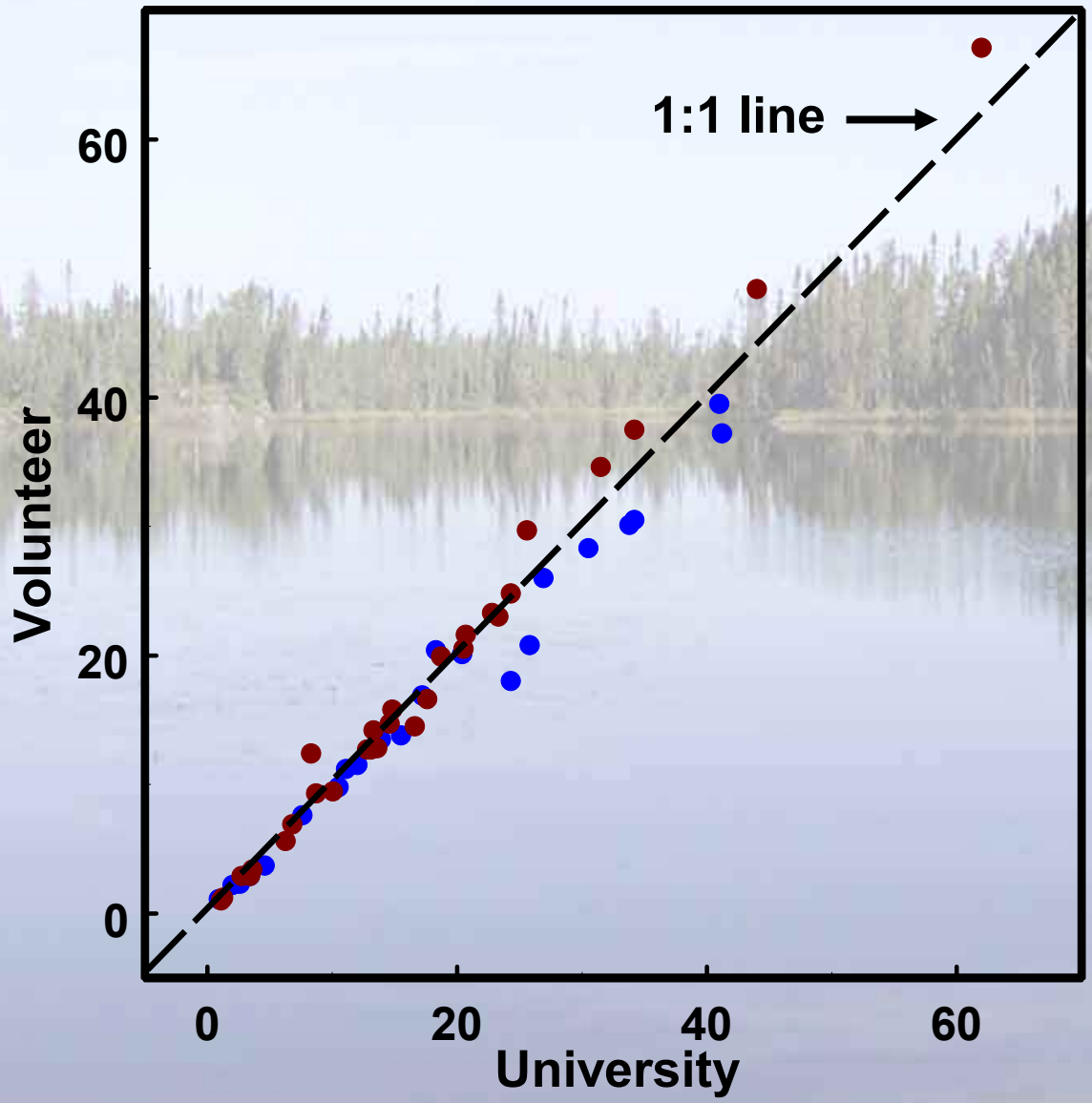
no significant difference

Chlorophyll



significant difference

Chlorophyll



Evaluation of filter replication

Two chlorophyll filters processed from each sample

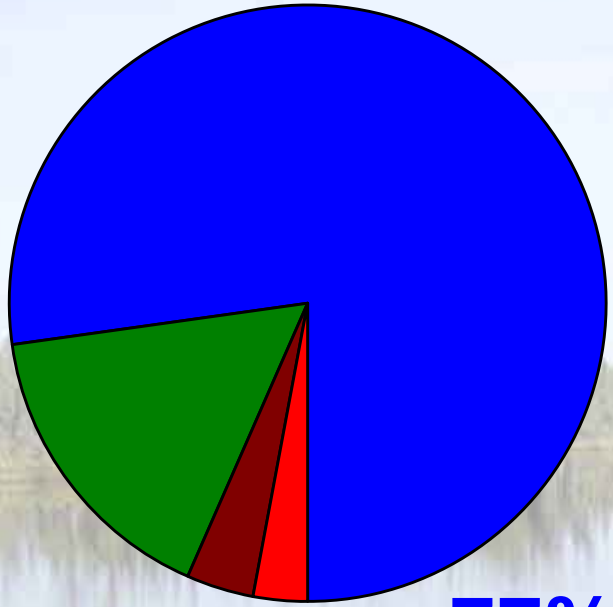
Evaluation was made using the following criteria:

≤ 5% = Excellent
≤ 10% = Good
≤ 15% = Fair
> 15% = Poor

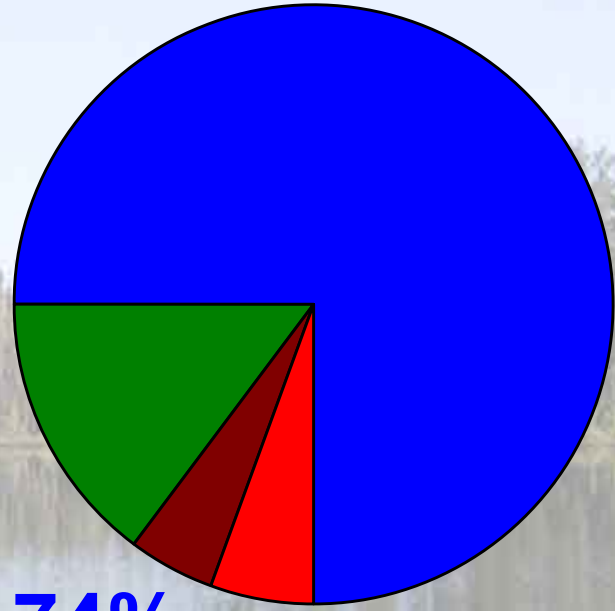
Percent difference was calculated using:
((M – m) / m) x 100
where M is maximum CHL value and m is minimum CHL value

If filter pair averaged ≤ 5.0 µg/L the formula was altered to: ((M – m) / 5) x 100

University
n = 4035



Volunteer
n = 3947



University		Volunteer
77%	Excellent	74%
16%	Good	15%
4%	Fair	5%
3%	Poor	6%

Summary

- **Volunteer and University annual geometric means do not differ in majority of cases – given the slight differences in site locations and natural variation in parameters, some differences should be expected**

- **Long-term geometric means (4+ years) do not differ**

Summary

- Split samples for phosphorus and inorganic suspended solids showed no differences. Nitrogen was not statistically different, though outliers were present. Chlorophyll was statistically different, though results may be anomaly.

- Volunteer chlorophyll filter replication is extremely comparable to University results

The Missouri DNR uses LMVP data for 305b reporting. Currently Missouri does not have nutrient criteria, so volunteer data has not been used for 303d listing.