

An aerial photograph of Lake Erie, showing the water's surface and surrounding green land. The text is overlaid in the center of the image.

Lake Erie Monitoring

Justin Chaffin

Stone Laboratory and Ohio Sea Grant

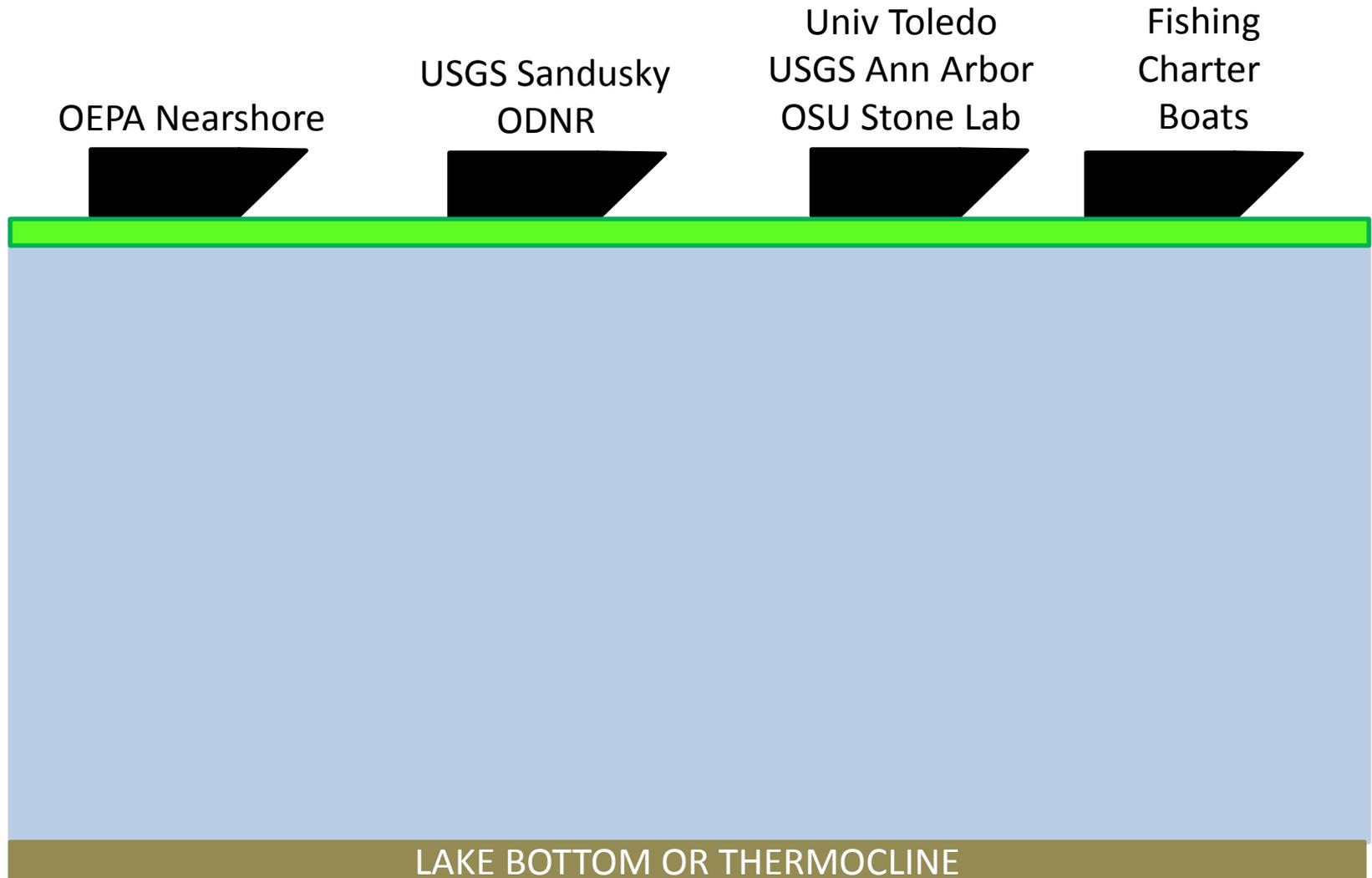
The Ohio State University

Song Qian, Thomas Bridgeman

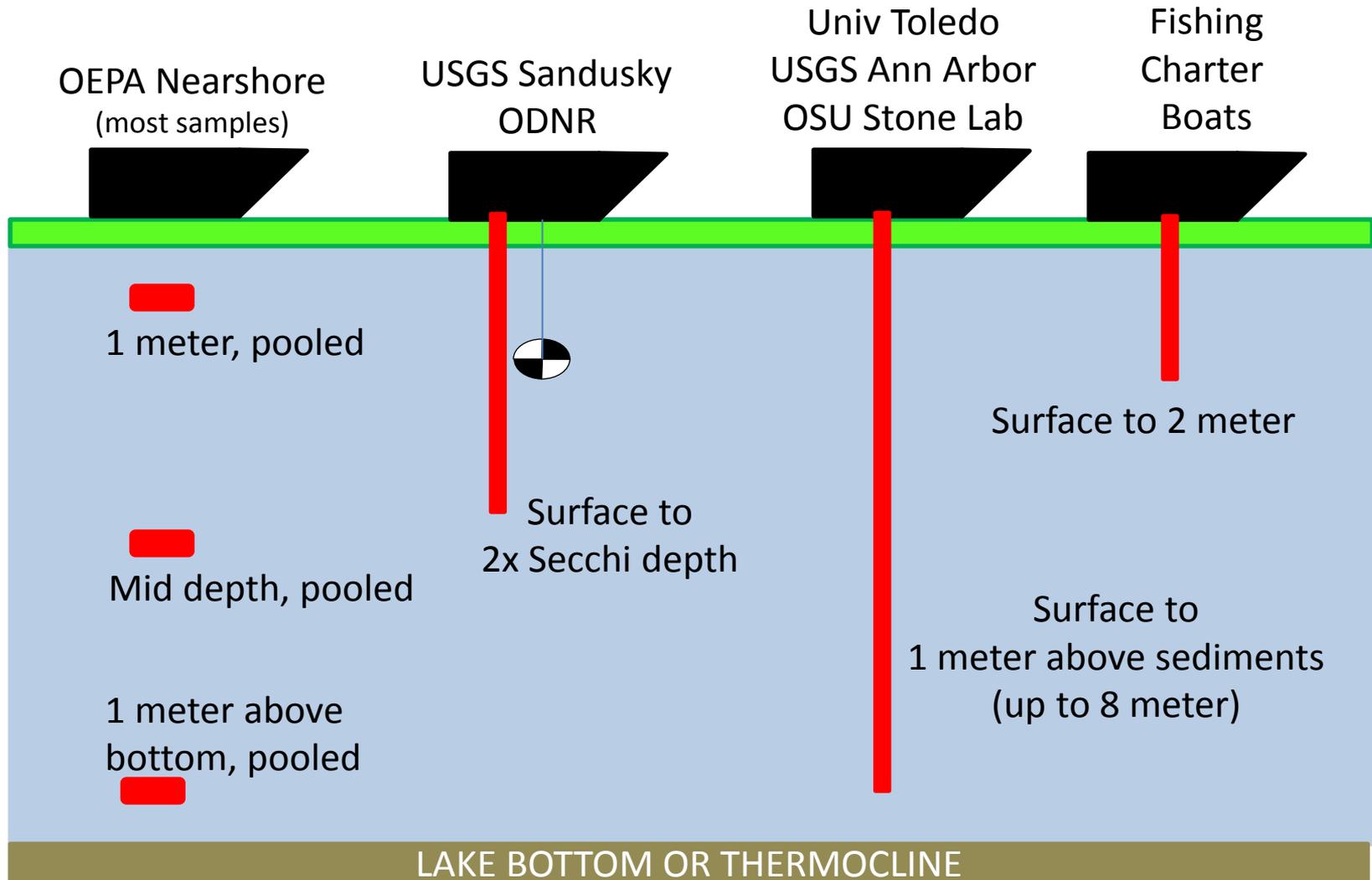
Lake Erie Center

University of Toledo

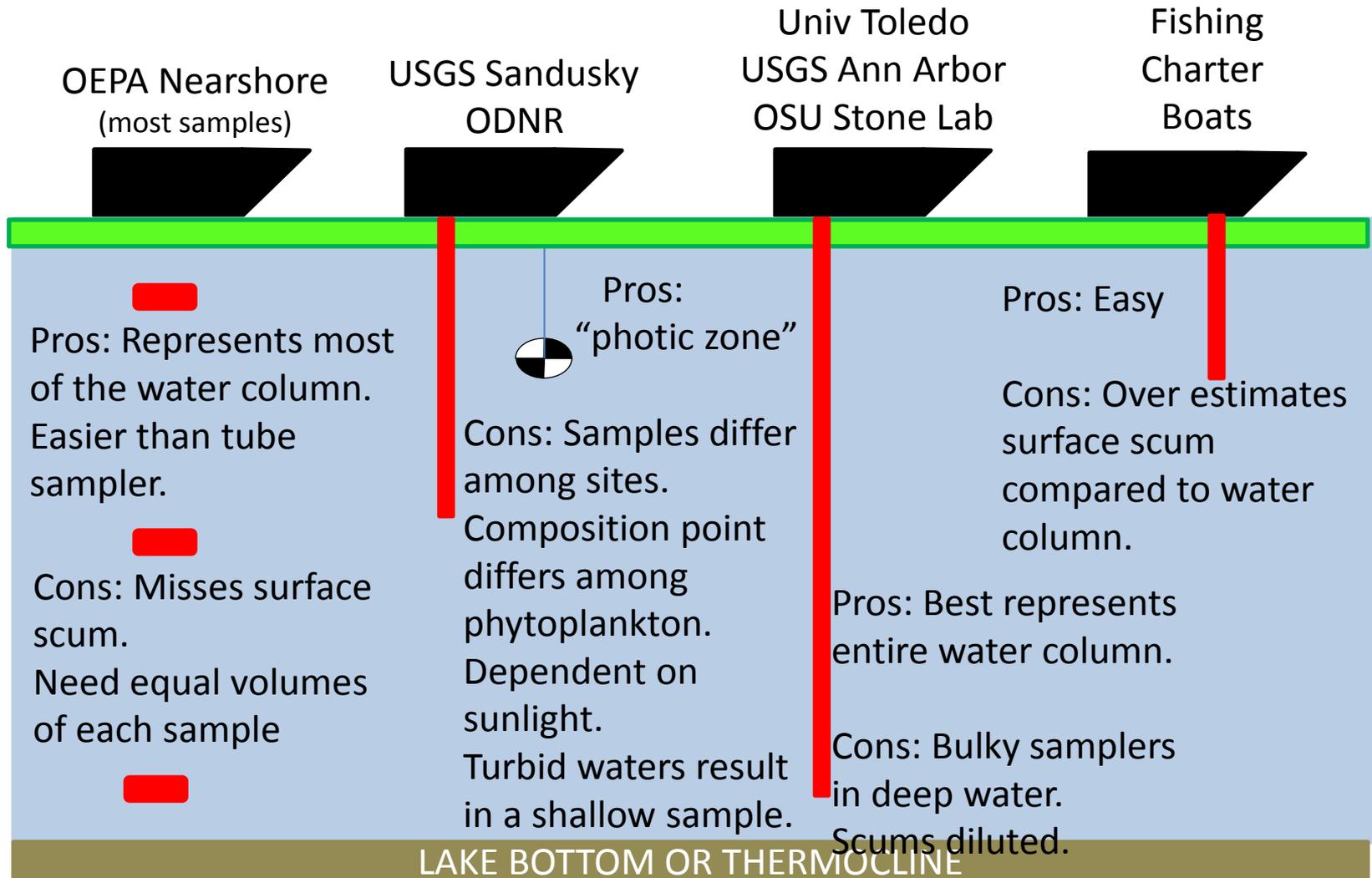
Groups monitoring the western basin



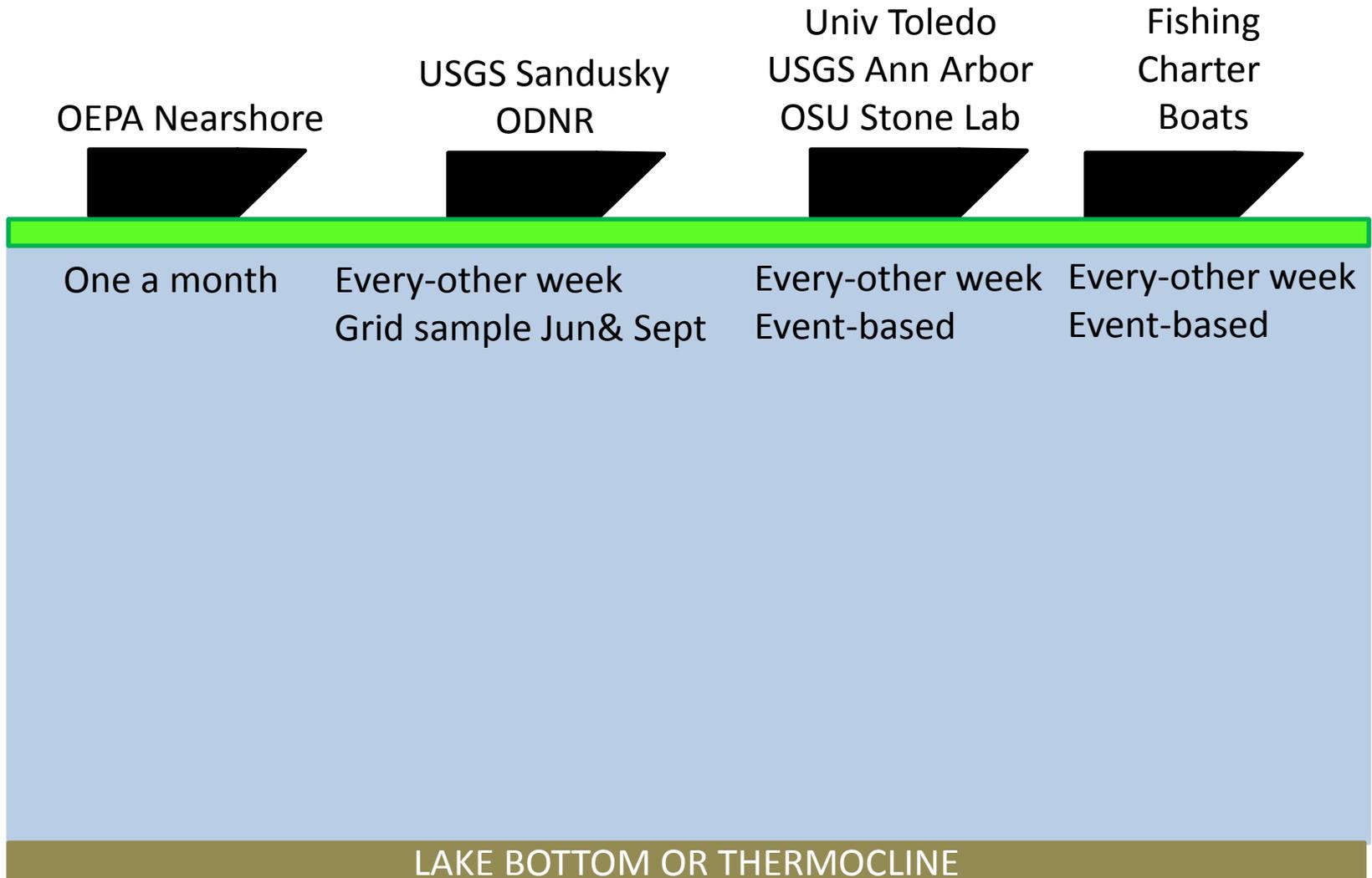
Water Collection Methods



Sampling methods pros and cons



Sampling Frequency



Water Quality Analyzes

OEPA Nearshore



TP,
Chlorophyll a

USGS Sandusky
ODNR



TP,
Chlorophyll a

Univ Toledo
USGS Ann Arbor
OSU Stone Lab



TP,
Chlorophyll a

Fishing
Charter
Boats



TP,
Chlorophyll a

LAKE BOTTOM OR THERMOCLINE

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TP,
Chlorophyll a*
DRP (SRP),
Nitrate,
Microcystin,
Phytoplankton

TP,
Chlorophyll a*
Phytoplankton

TP,
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DRP (SRP),
TDP,
Nitrate,
Nitrite,
Urea, TDN,
Ammonium,
Total Kjeldahl N,
Silicate,
Total SS, NVSS,
Microcystin,
Phytoplankton,
Microcystis biovolume

TP,
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DRP (SRP),
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*Different analysis methods

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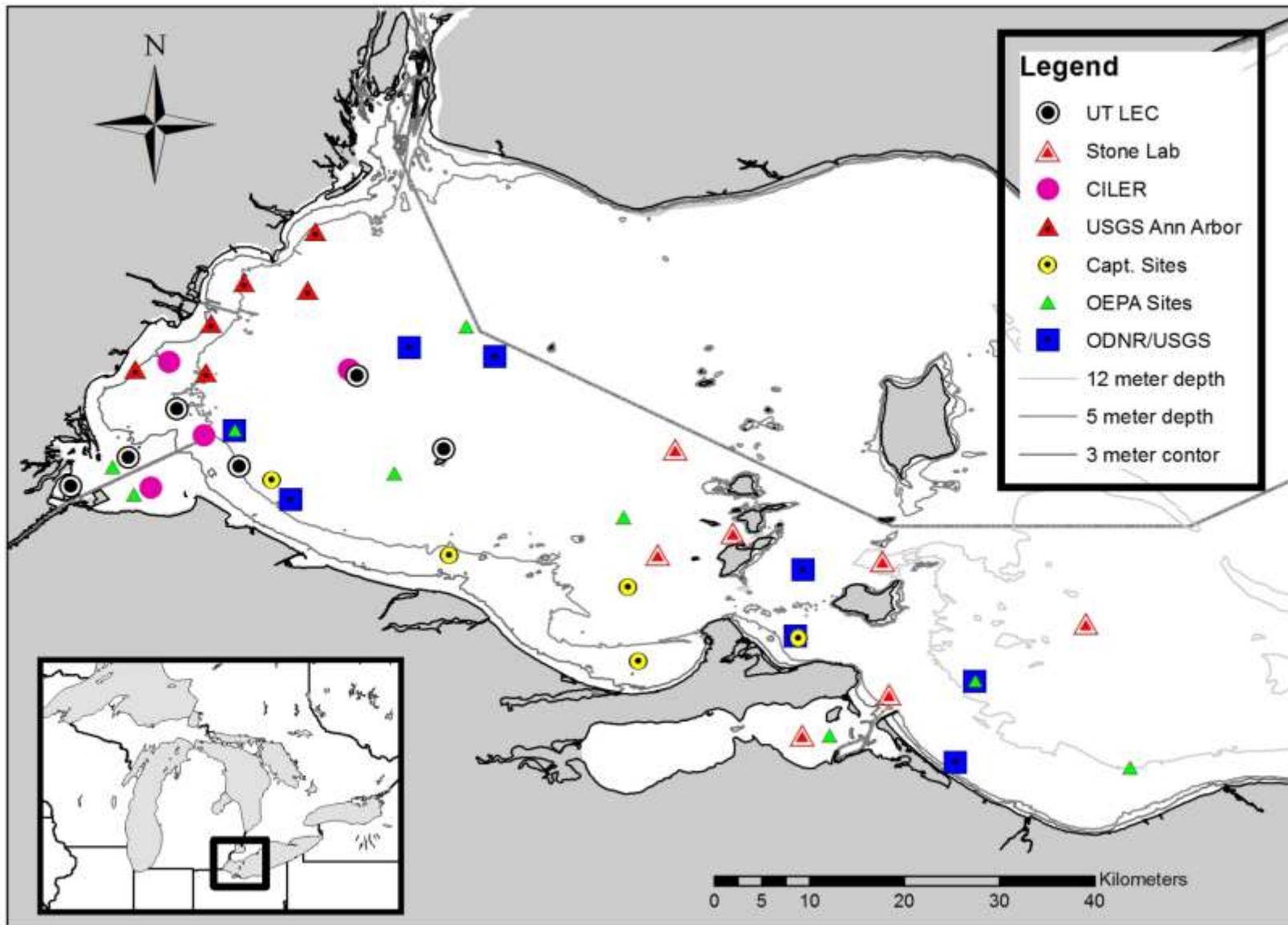
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LAKE BOTTOM OR THERMOCLINE



A Bayesian Hierarchical Modeling Approach for Comparing Water Quality Measurements from Different Sources

- Song Qian and Thomas Bridgeman
 - University of Toledo
- Other team members:
 - OSU Stone Lab, USGS, Univ. Michigan, Ohio EPA, Ohio DNR, Heidelberg University
- Funded by University of Michigan Water Center, Graham Sustainability Institute
- Ohio EPA provided funding in 2013
- Ohio Sea Grant/ Stone Lab REU program

Question and Project Phases:

- Do the different data sets differ, and if so, is there a conversion factor we can use?
- Phase 1: Compile existing data from the different institutions and develop models linking measurements (Song Qian – UT).
- Phase 2: Field study to compare side-by-side water samples that were collected using multiple sampling methods (Chaffin – OSU, Bridgeman – UT)

Sampling equipment

Van Dorn Sampler

OEPA Nearshore



Integrated Tube Samplers

USGS Sandusky
ODNR



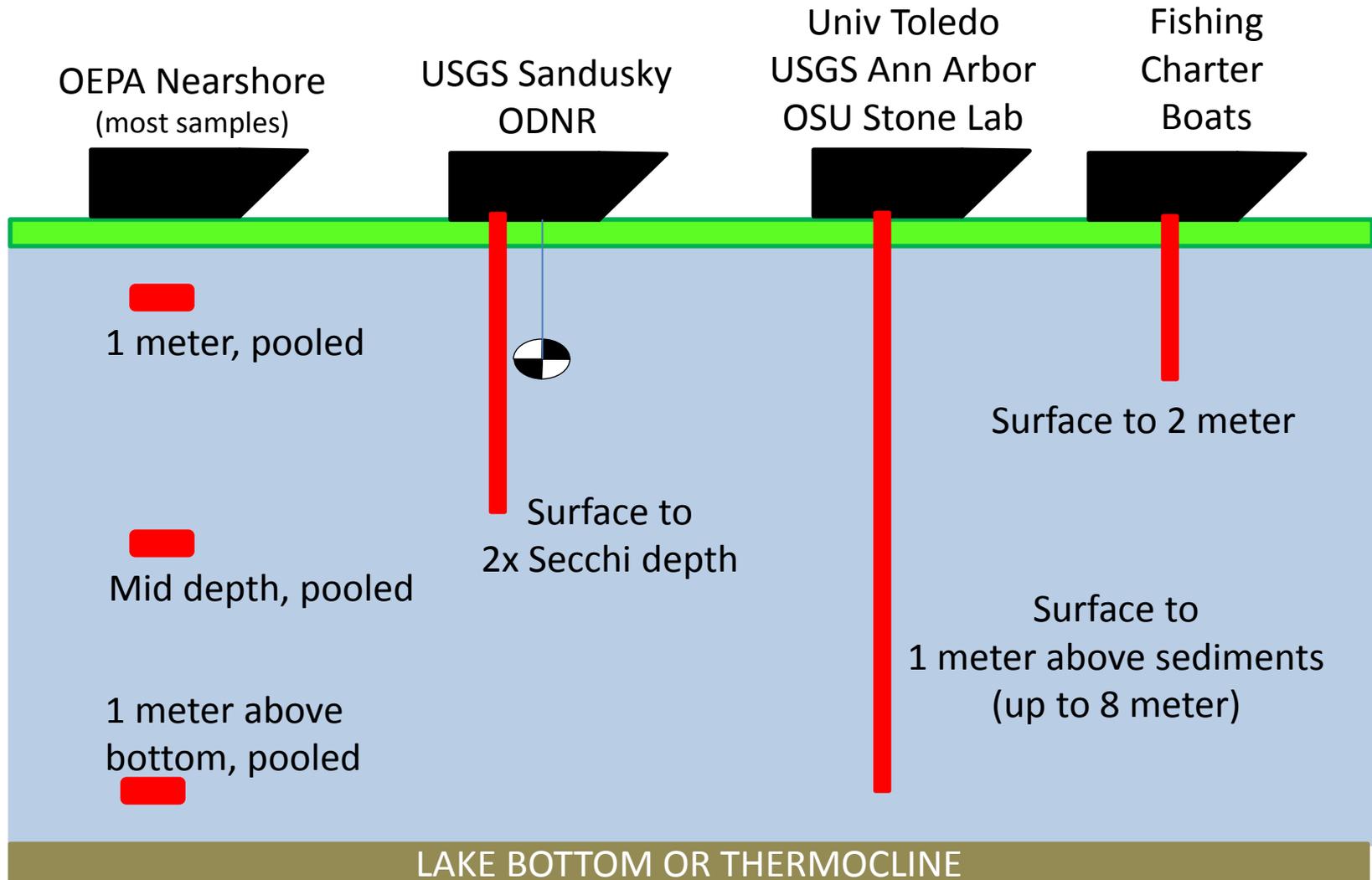
Univ Toledo
USGS Ann Arbor
OSU Stone Lab



Fishing
Charter
Boats

OCLINE

Water Collection Methods



Overall Study Methods

- Sampled July 15 to October 29 2013
- 4 water samples collected at each site/date using the 4 different methods
 - Samples within 0.5 m were considered the same
- TP ranged from 0.0084 to 0.1829 mg P/L
- Chl *a* ranged from 3.9 to 127.8 $\mu\text{g/L}$
- 224 samples analyzed

Sample overlap

	WC	CBC	2xSD	OEPA
Water Column	-	9%	0%	0%
Charter boat captain	9%	-	27%	0%
2xSD	0%	27%	-	0%
Ohio EPA	0%	0%	0%	-

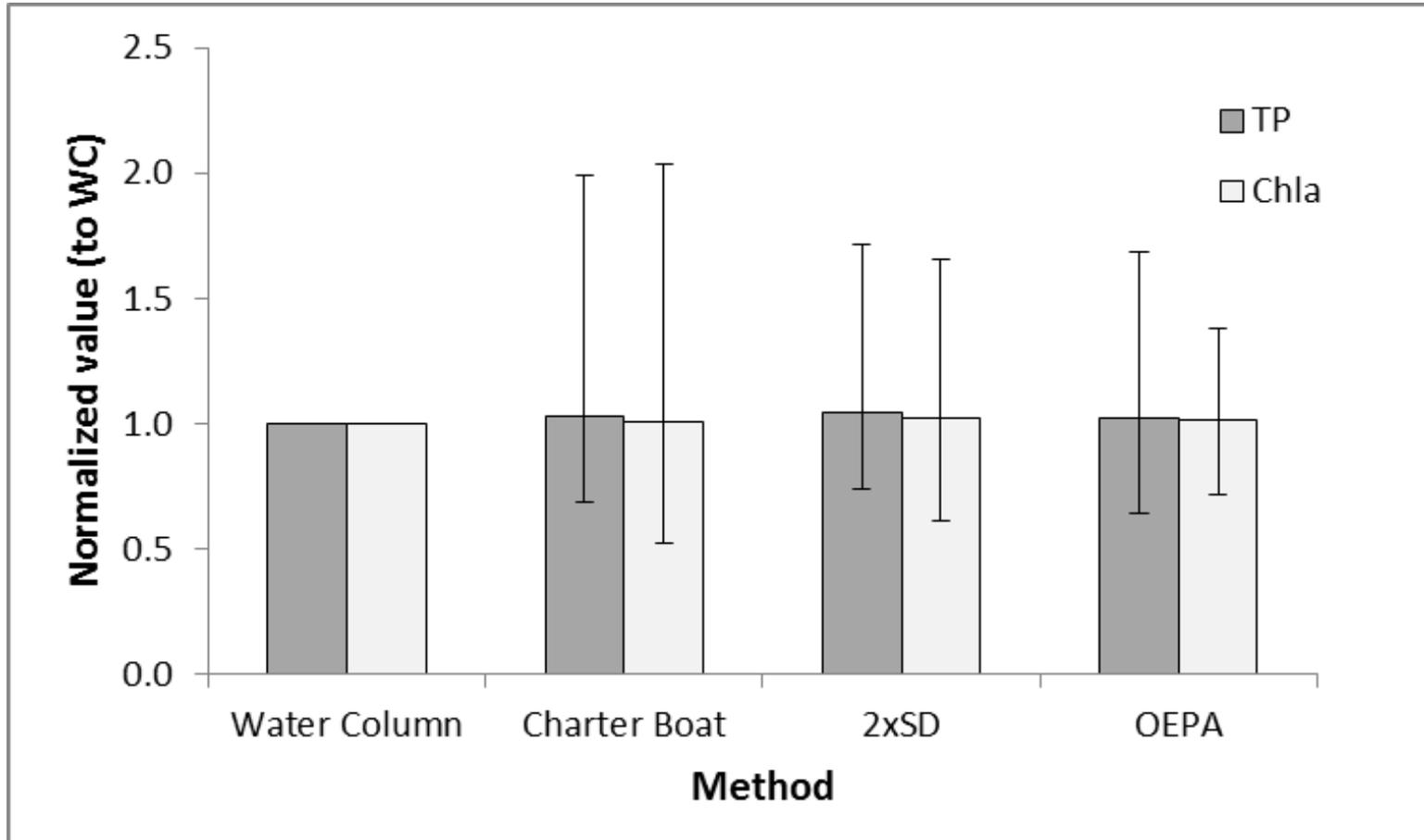
Looking for a conversion factor

- The water column sample (surface to sediments) is “main sample” because this method is more likely to capture a stratified algal bloom.
- The other 3 methods are comparison samples.
 - Data normalized to the water column sample.
 - Normalized value can be a conversion factor.

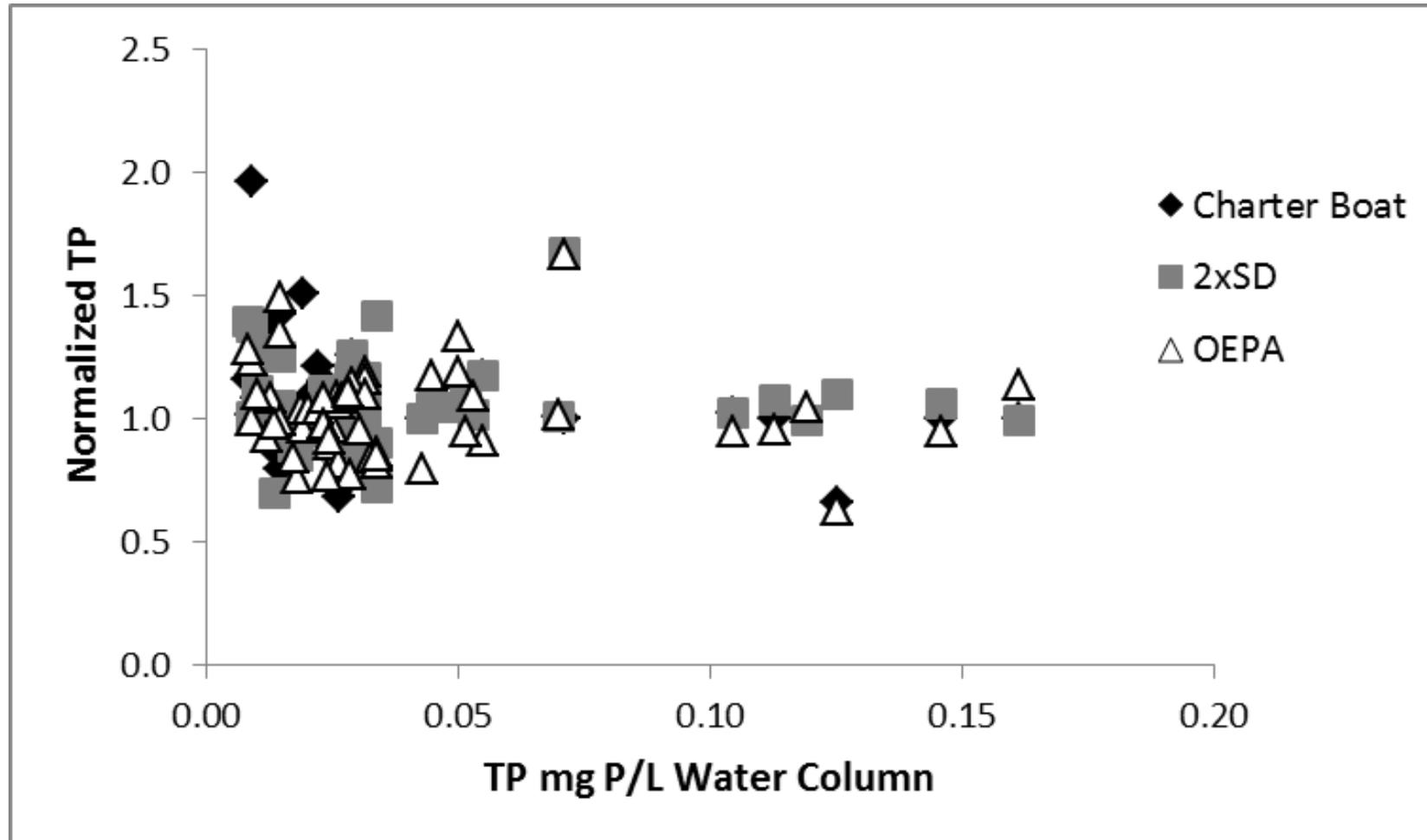
– Example:

	Chl a ug/L	Chl a normalized
WC	10	1.00
CBC	20	2.00
2xSD	5	0.50
OEPA	15	1.50

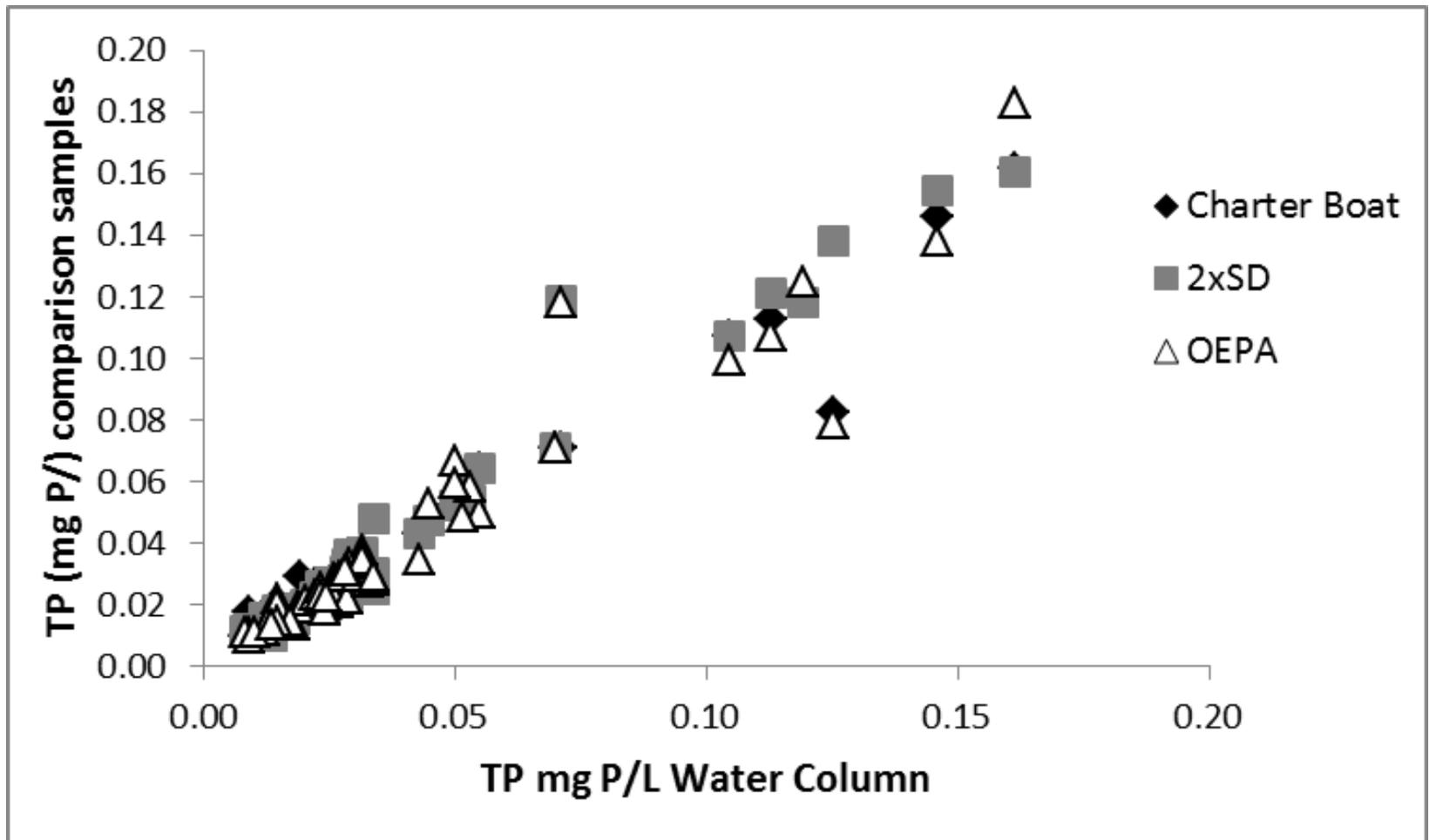
Average normalized values are near 1.0, but the range is wide.



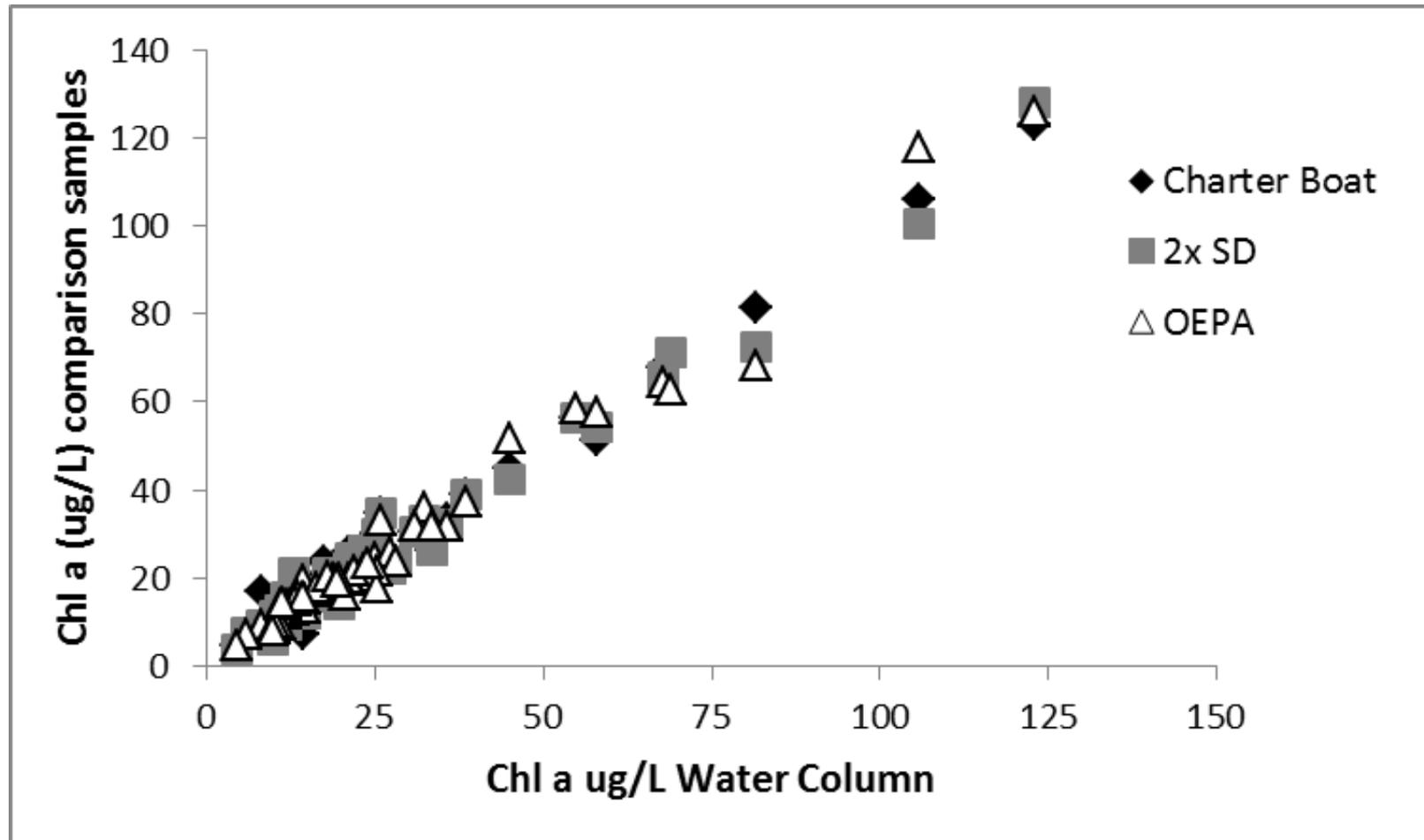
Most of the differences occur at low TP concentrations



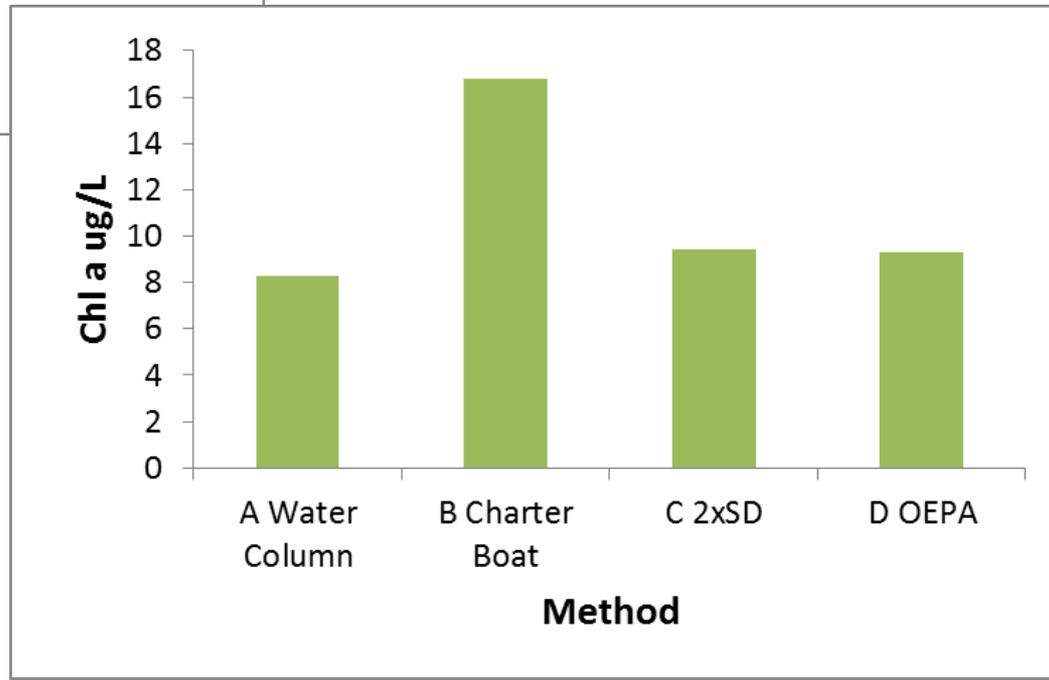
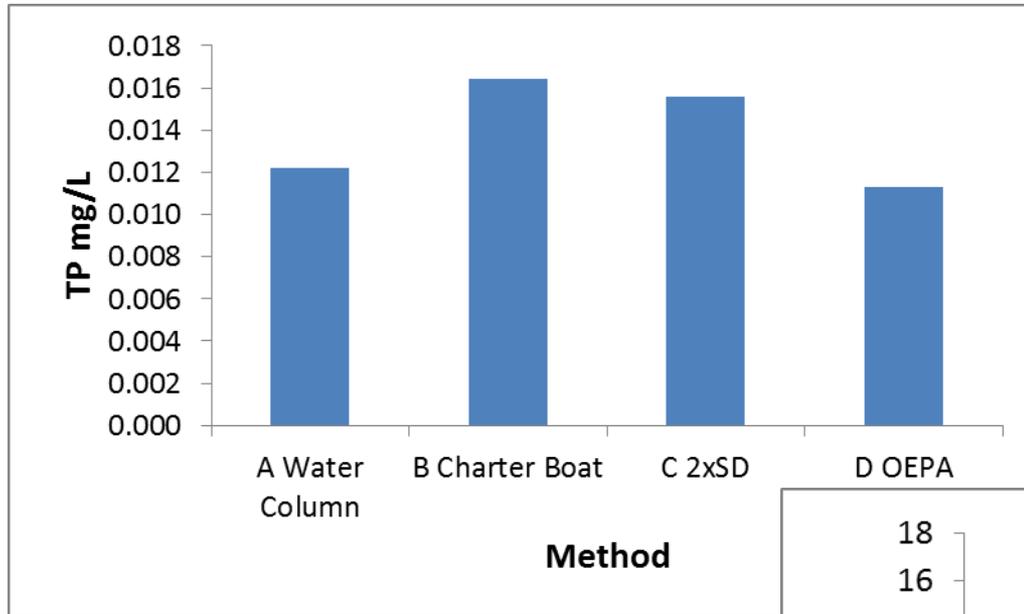
Regression between WC data and comparison samples.



Regression between WC data and comparison samples.



Scum sample: July 15 2013 Central Basin



Conclusions

- The different water collection methods give similar data at high concentrations.
 - For example: chl *a* 100 ug/L compared to 115 ug/L
 - Both considered “high chl a and eutrophic”
- Differences in data increases at low concentrations.
 - For example: chl *a* 3 ug/L compared to 6 ug/L
 - Both considered “low chl a and oligotrophic”
 - But the difference between samples is 2X.
- Scum samples results in differences in chl a.

In progress, next steps

- Building models to compare data collected from institutions in recent years
- Continued sampling in 2014.

Acknowledgements

- Funding: Ohio EPA, Univ. Michigan
- Data sources: Ohio EPA, ODNR, USGS
- Field assistance: Sam McCoy and Stone Lab seasonal staff 2013