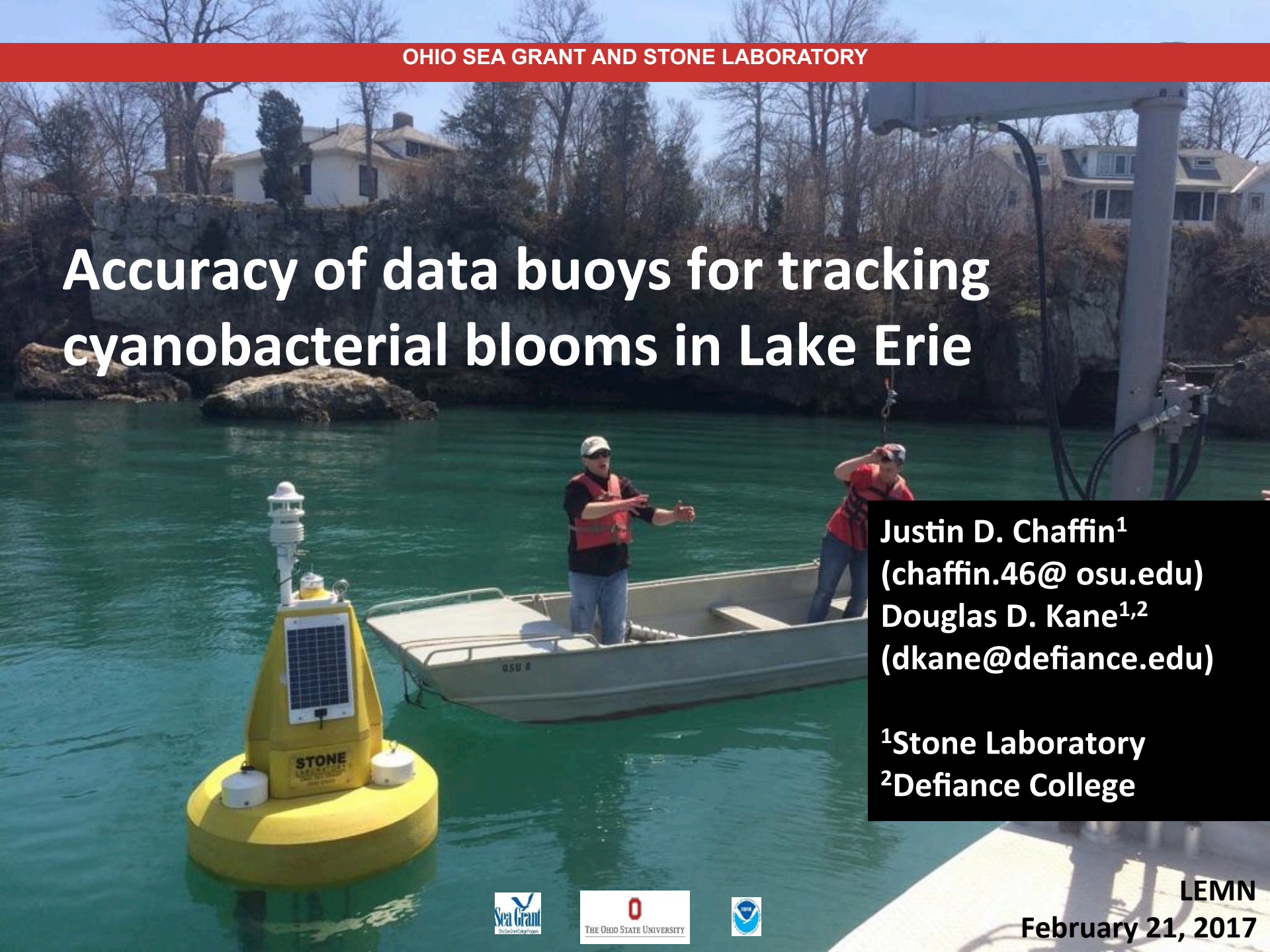
Accuracy of data buoys for tracking cyanobacterial blooms in Lake Erie



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LEMN
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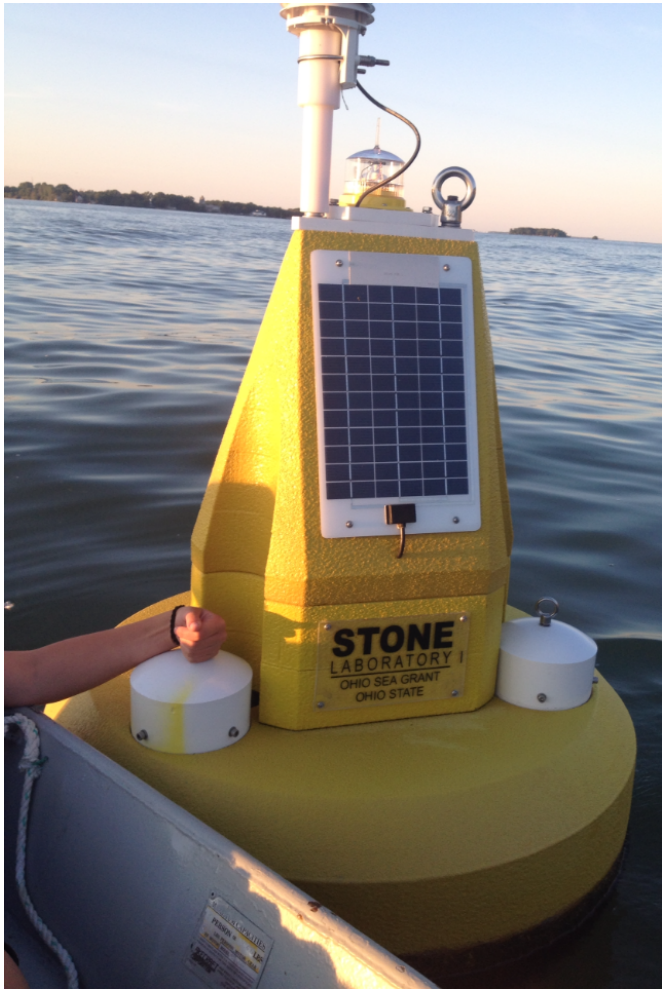
Data buoys provide real-time data

- Fixed monitoring stations
- Records biological, physical, chemical, and meteorological variables
- Continuous, real-time data
- Data can be utilized by lake managers, researchers, water treatment plant operators, tourists and the general public



Gibraltar Buoy

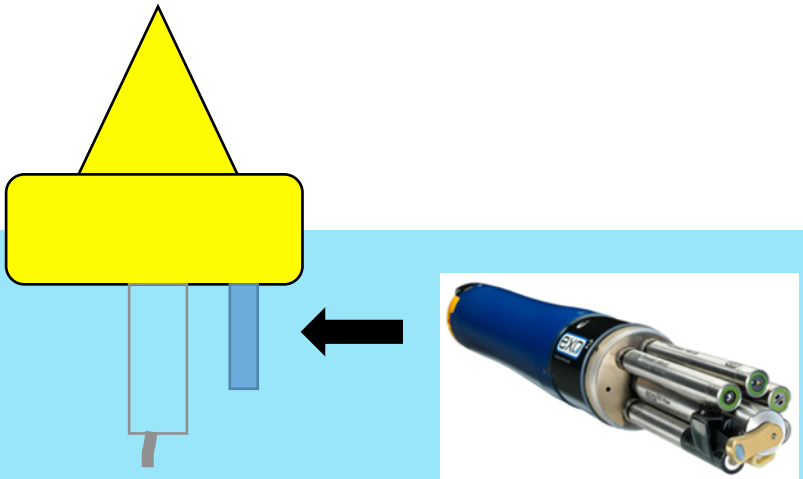
HABs Real-Time Monitoring

Organization
- Bowling Green State U.
- NOAA GLERL
- Ohio State Univ.
- Univ of Toledo
- Water Treatment

0 15 30 60 Miles

Slide courtesy of Ed Verhamme

Data buoys measure water quality 0.7 meter from the surface.



Lake bottom

- Buoy parameters (15 min)
  - Dissolved Oxygen
  - Temperature
  - pH
  - Specific Conductivity
  - **Water clarity (NTU)**
  - **Total algae (chlorophyll fluorescence)**
  - **Cyanobacteria (phycocyanin fluorescence)**

Potential issues with the sensors?

- Infrequent calibration
  - Sensor drift throughout deployment?
- Algae biomass is not measured
  - Sensors measure fluorescence, which can change with physiological status of the cell
- Clogging from *Dreissena* mussels
  - Low water exchange

Sandusky intake buoy after 5 month deployment

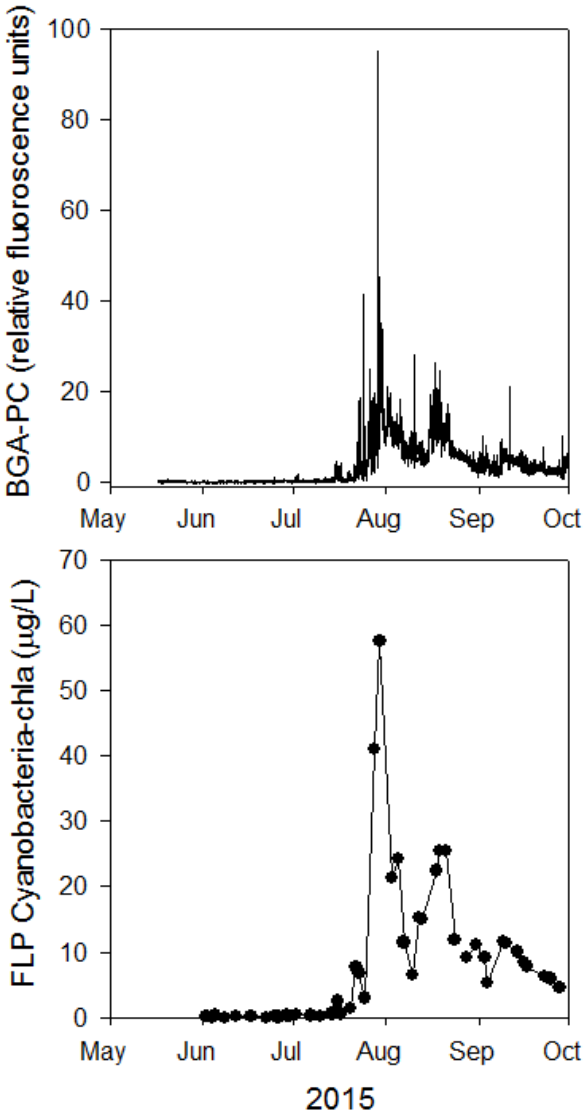
Water samples collected next to the buoy

- Deployed May – October in 2015 and 2016
- Water samples next to the buoy throughout summer using 0-2 meter integrated tube sampler (several samples /week)
  - Microcystin (total and extracellular)
  - Chlorophyll and phycocyanin
  - Phytoplankton biovolume data
  - FluoroProbe (chlorophyll a associated with green algae, diatoms, and cyanobacteria)
  - Nitrate, ammonium, TKN, TP, DRP, Si
  - TSS & NVSS
  - Secchi disk depth
  - 147 samples
  - Vertical profiles of algae on 34 dates

2015 large bloom at Stone Lab buoy

BUOY

Water Sample



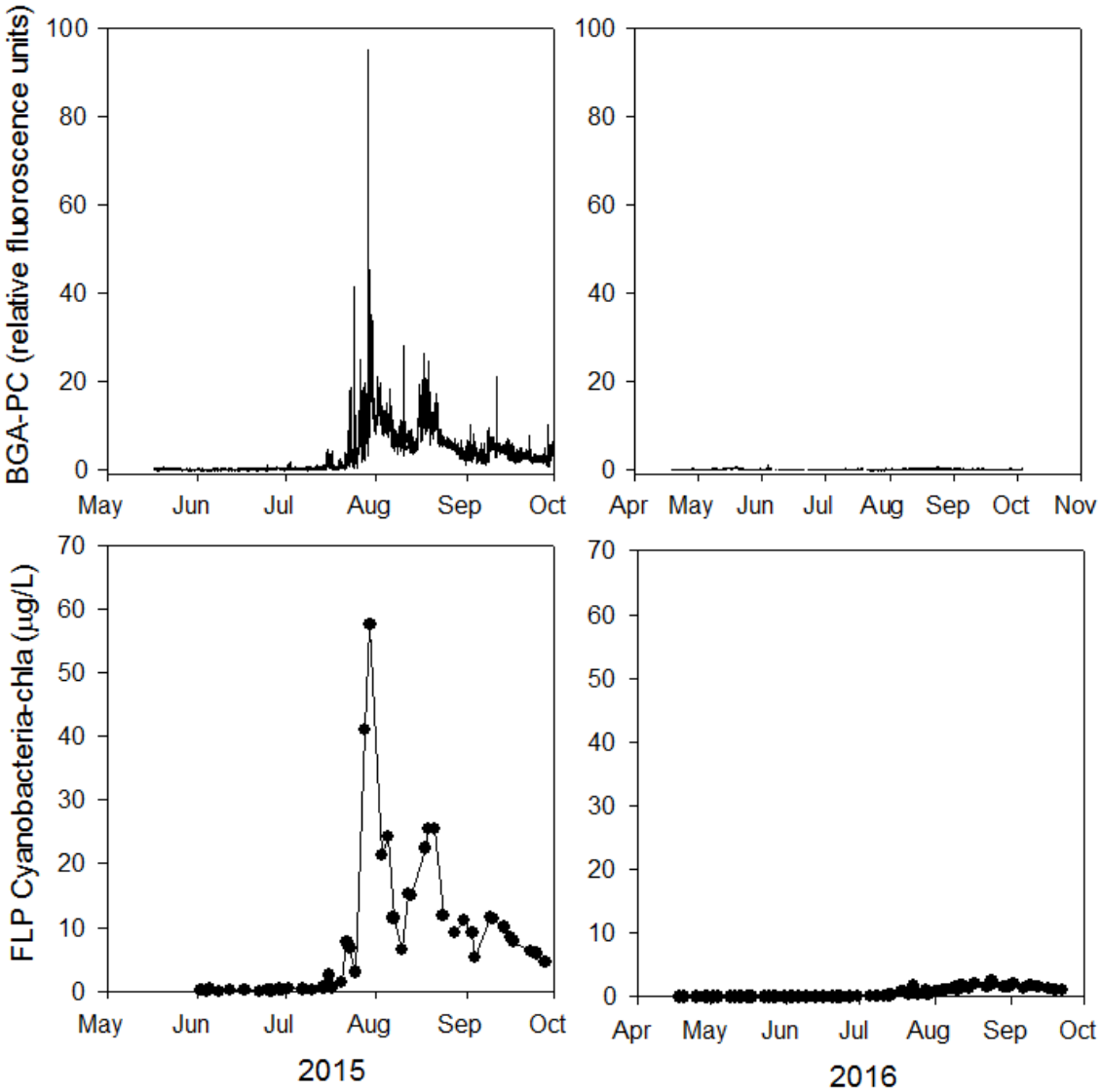
July 24, 2015

Chaffin unpublished

2016 bloom just above detection limit

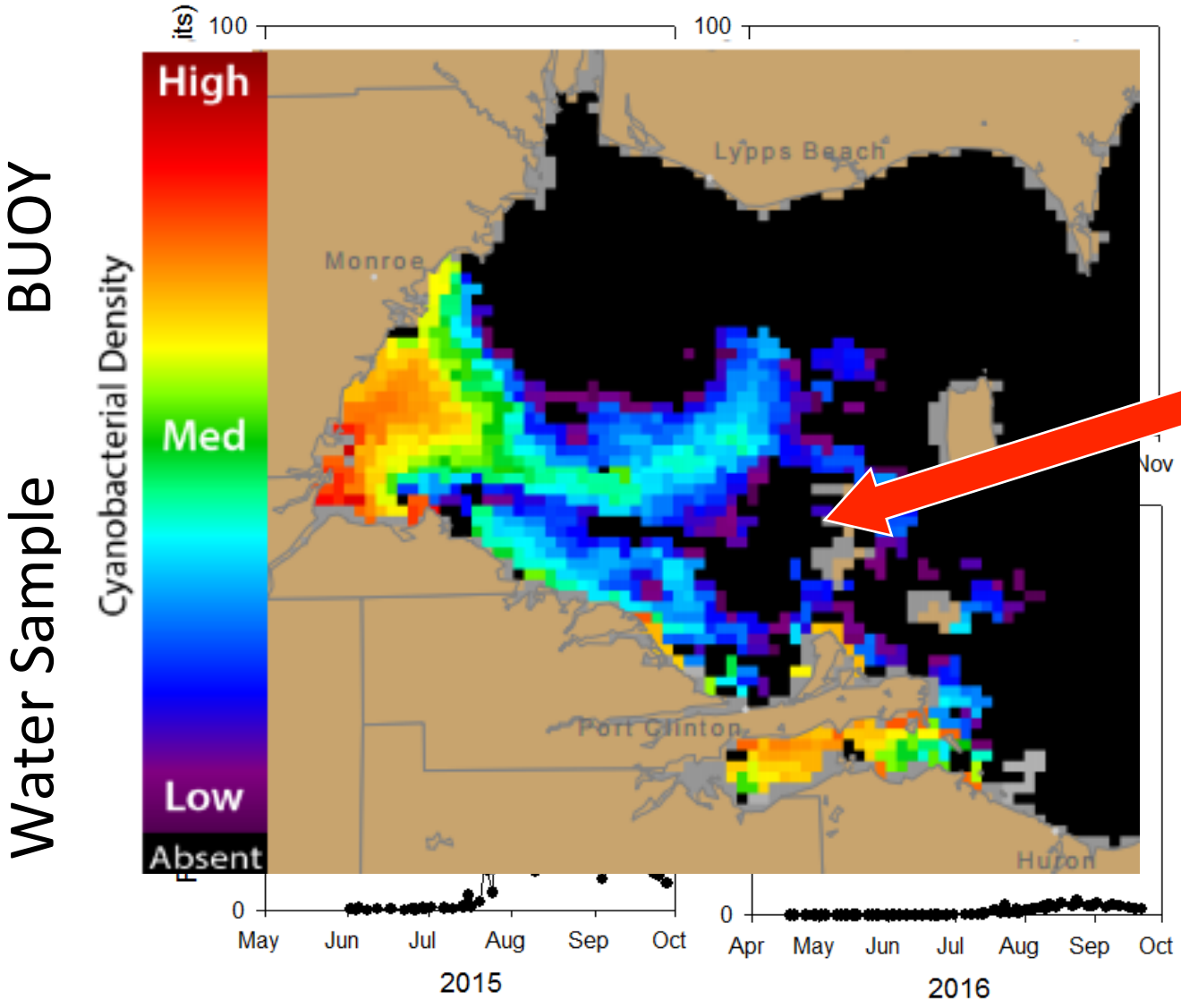
BUOY

Water Sample



Chaffin unpublished

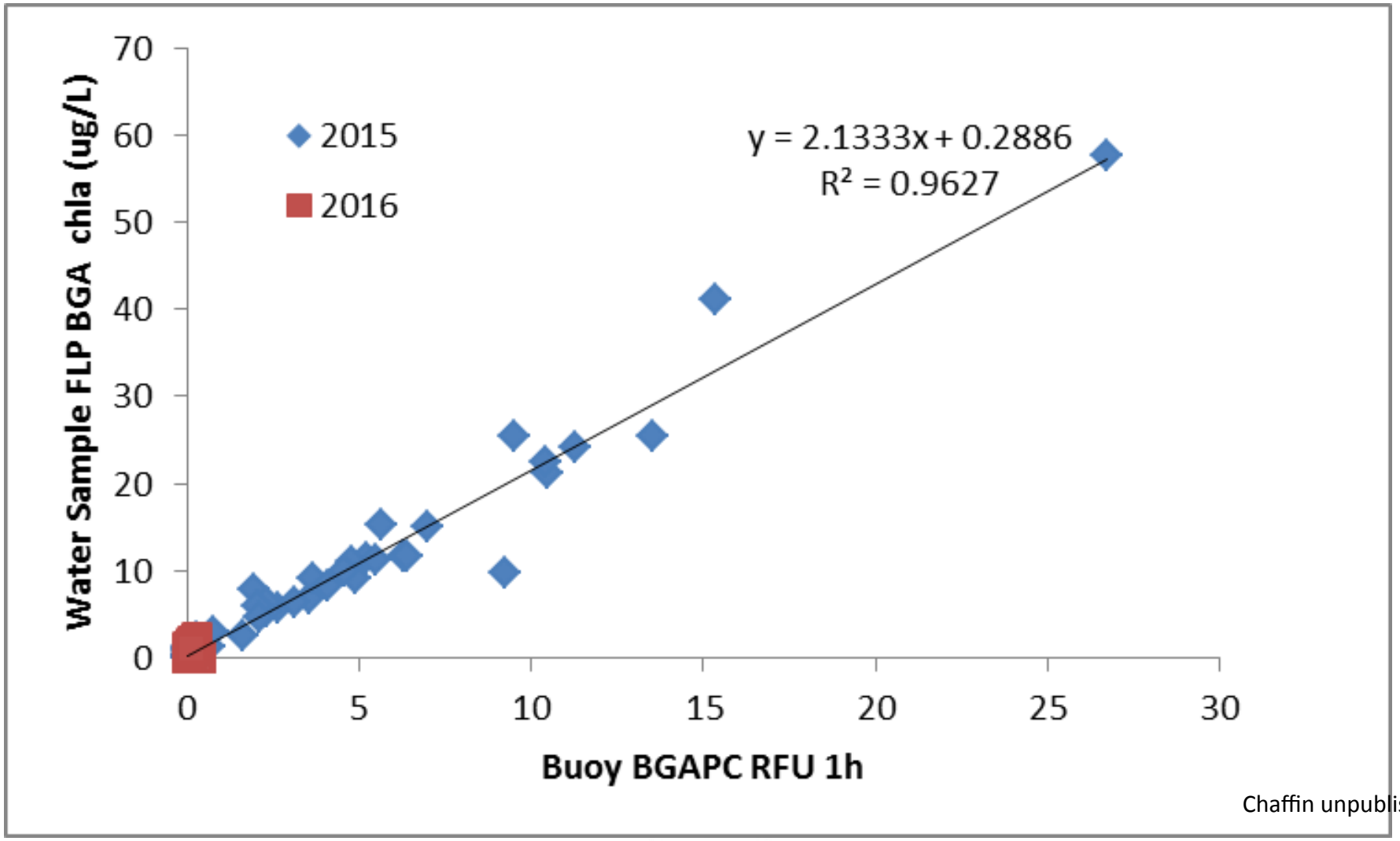
The 2016 bloom never reached the islands.



Buoy location

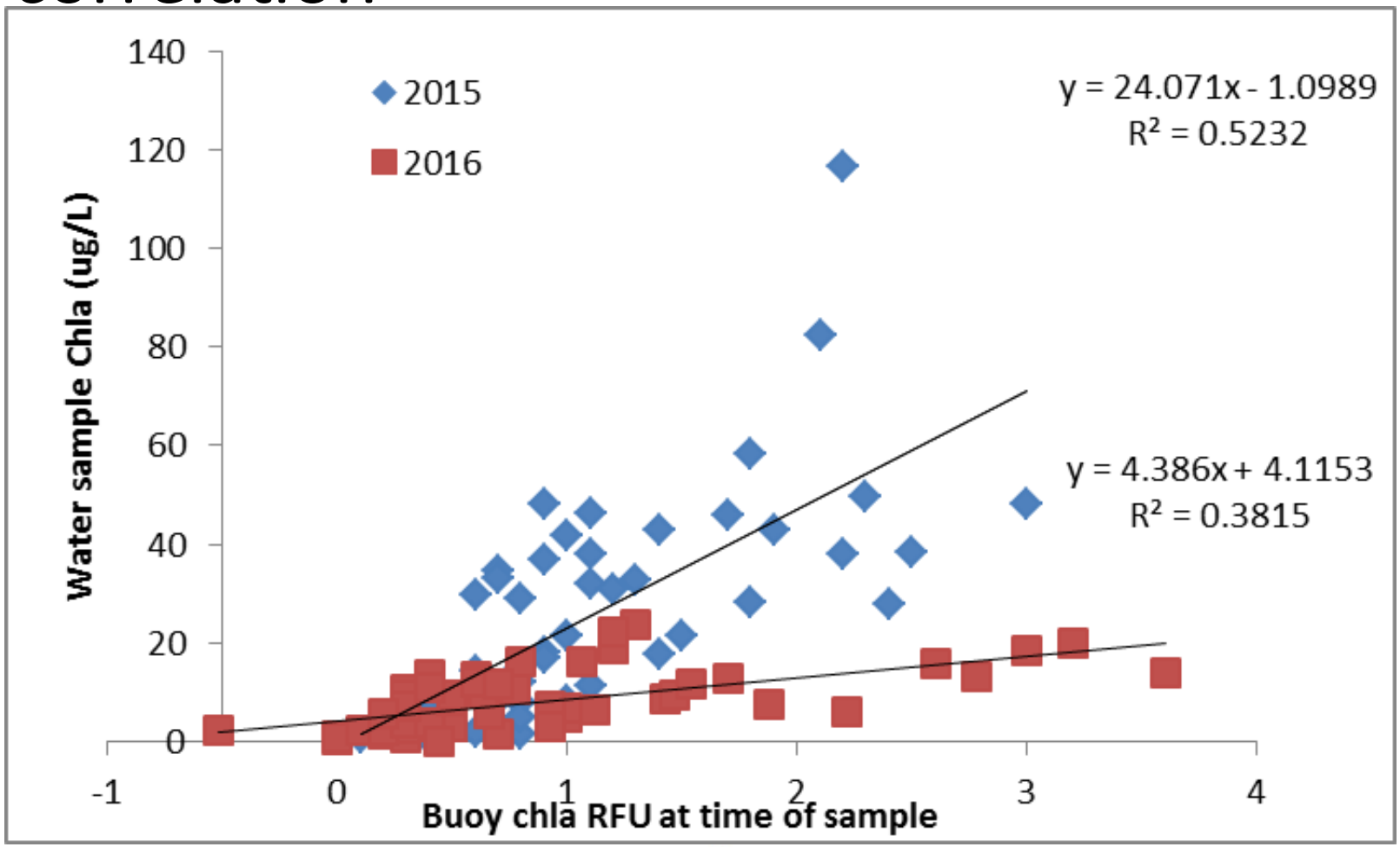
NOAA HAB Bulletin
August 11 2016

Good relationship between buoy BGA-PC RFU and water sample cyanobacteria



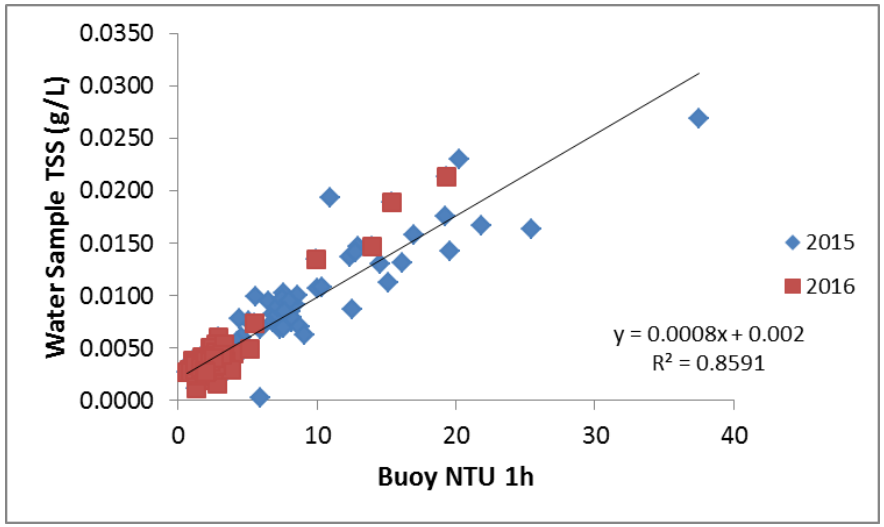
Chaffin unpublished

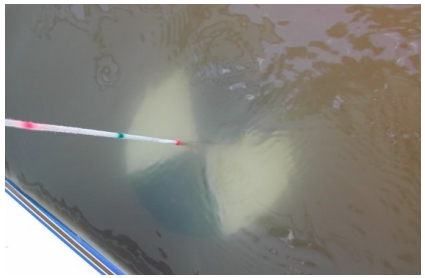
Total Chlorophyll: Different trends between the two years and low correlation

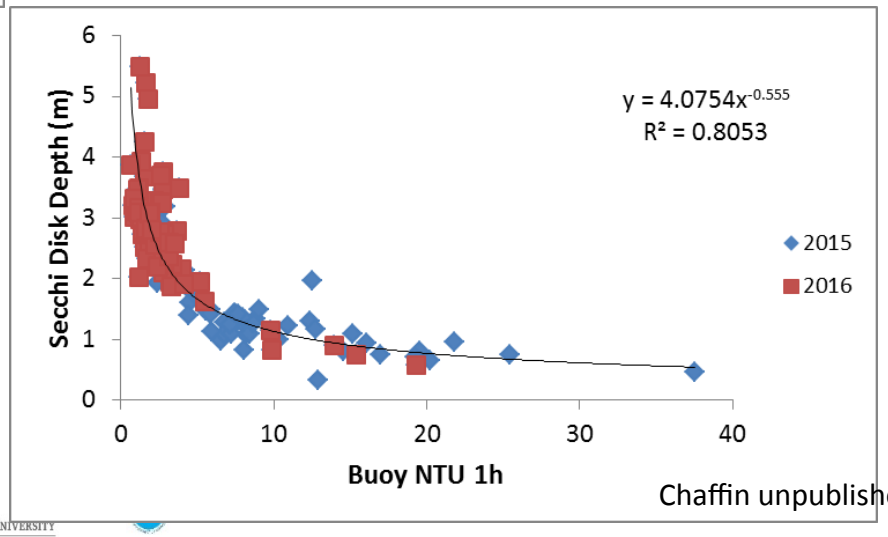


Chaffin unpublished

Buoy NTU sensor good indicator of water clarity.

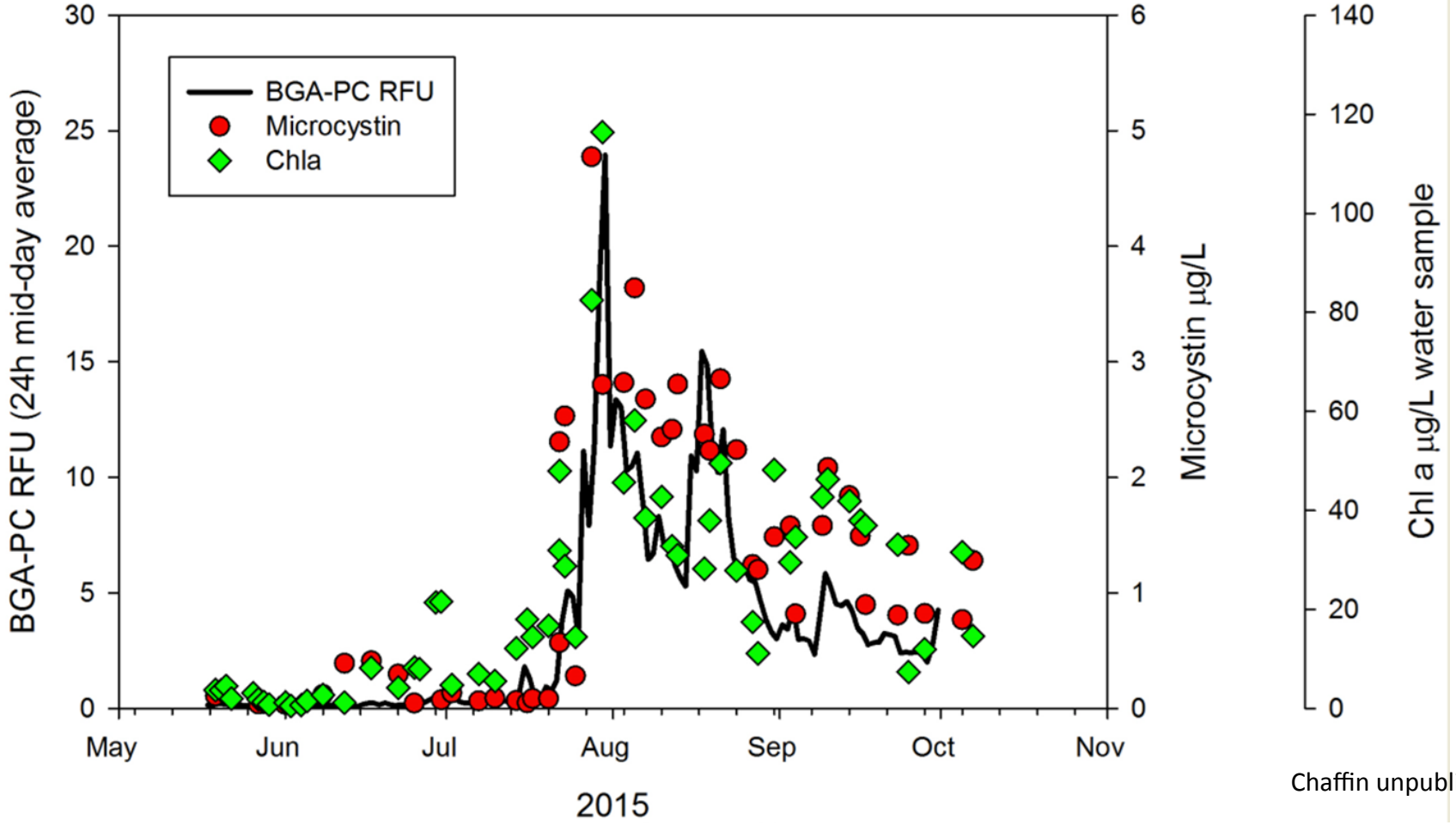






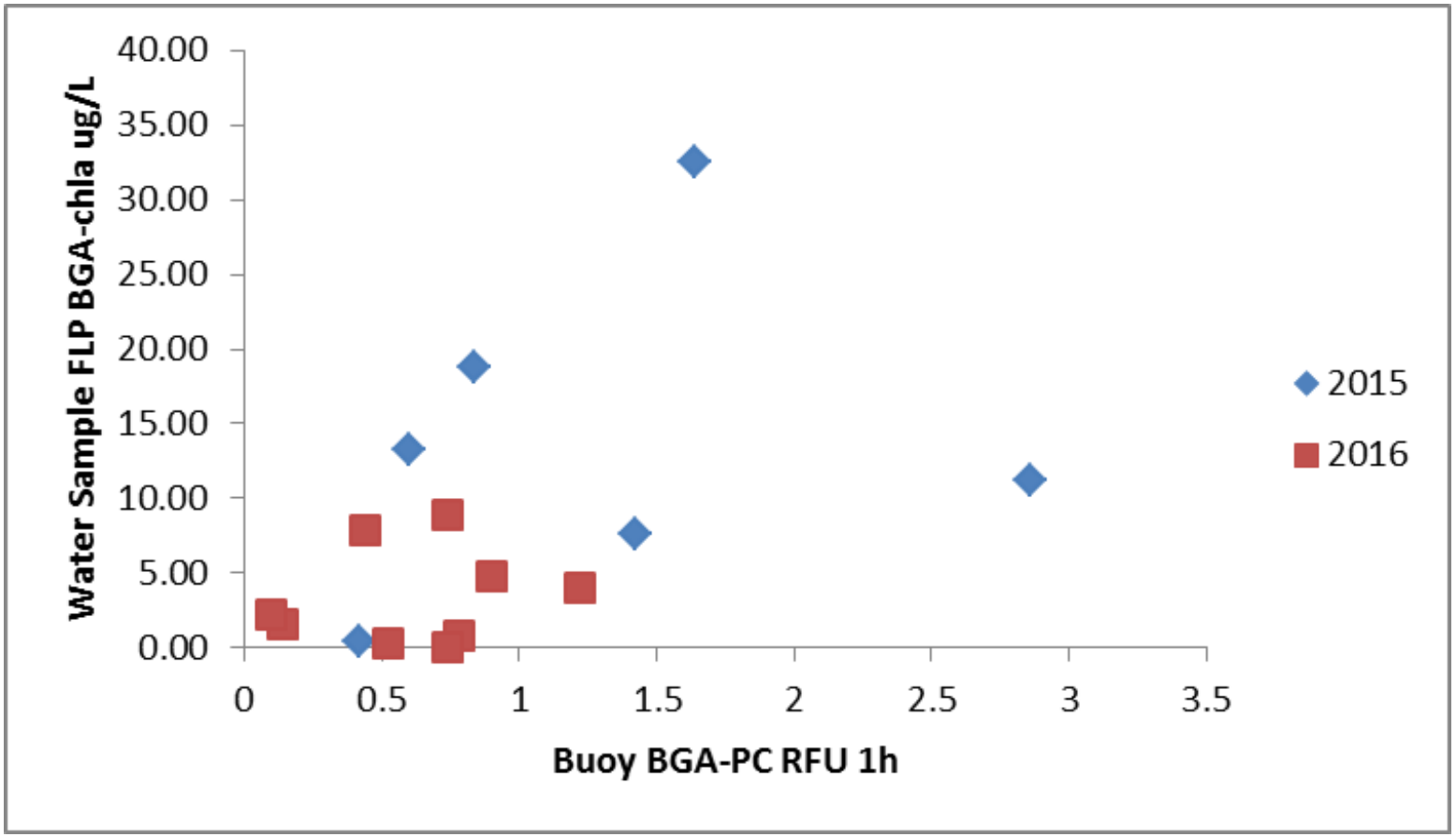
Chaffin unpublished

Microcystin concentration tracked with buoy data



Chaffin unpublished

Sandusky Intake BGSU buoy not as good correlation



Can buoy sensor data be used to predict water quality?

- Cyanobacteria: **Yes. $R^2 = 0.96$**
  - **Sandusky Buoy not as good**

- Total chlorophyll: **No. $R^2 < 0.50$; different relationship between the years**

- Water clarity: **Yes. $R^2 = 0.86$ for TSS**
  Yes. $R^2 = 0.81$ for Secchi Disk

- Microcystin concentration tracked the buoy cyanobacteria fluorescence data.

Plans for 2017

- Continued sample collection by our buoy
- Analyze vertical profiles of phytoplankton
  - How do surface buoy measurements compare to bottom water (i.e. where an intake could be)?
  - Factor in wind data

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- Stone Lab REU students and staff

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