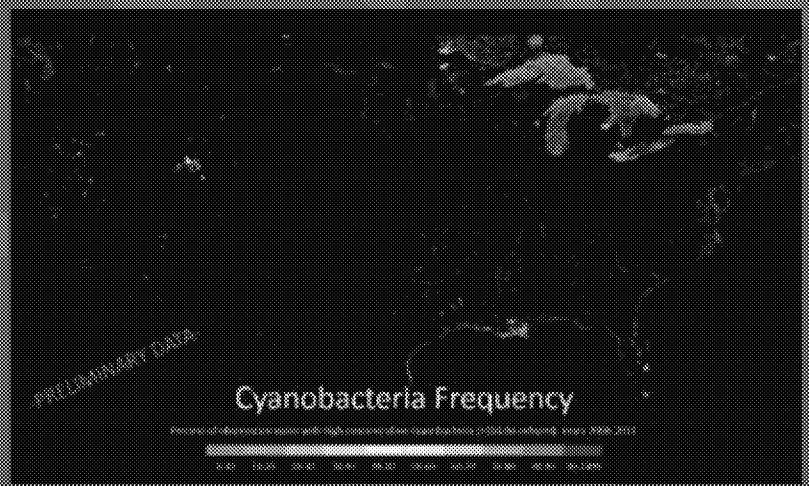
EPA
United States Environmental Protection Agency

CyanoHAB Frequency and Extent, and Monitoring through a Mobile Application

Blake A. Schaeffer



Region 4 State Commissioners' Visit to EPA RTP
August 30, 2017

Office of Research and Development

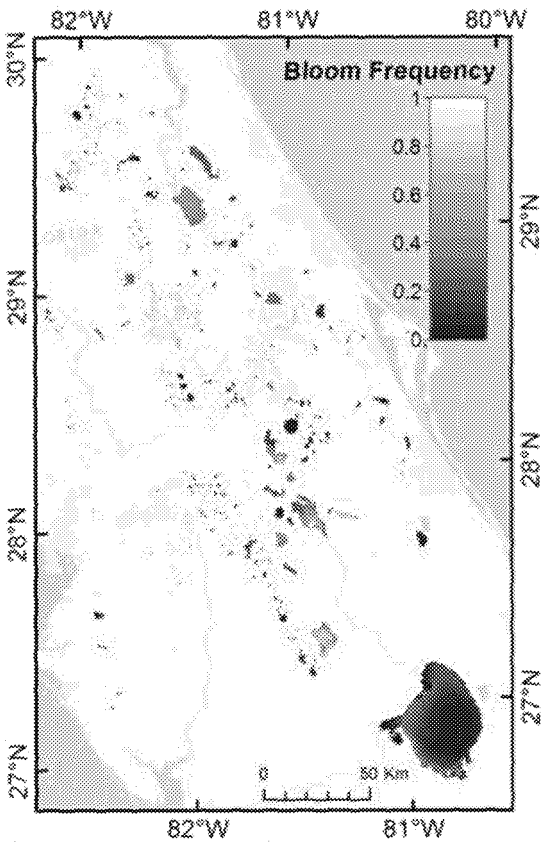
Cyanobacteria Assessment Network (CyAN)

- *Problem:* How to support the use of U.S. waters with satellite monitoring?
- *Opportunity:* Water quality indicators can be monitored with satellites and used to protect public health.
- *Approach:* Strengthen cross-agency research to mainstream satellite capabilities for water quality management decisions.
- *Results:* New methods and tools to monitor cyanobacteria harmful algal blooms (HABs).
- *Impact:* Scalable information across any geo-political boundary, and ability to prioritize locations for management actions.

Schaeffer et al. 2015. Agencies collaborate, develop a cyanobacteria assessment network. Eos. 96:16-20.

Quantifying Cyanobacteria *Frequency*

- *Problem:* How do we quantify bloom frequency?
- *Action: S*ite-specific frequencies >100,000 cells/mL.
- *Result:* Derive relative exposure risk profiles from frequency data.
- *Impact:* Ability to prioritize locations for management actions, e.g. surface water intakes or recreational waters.



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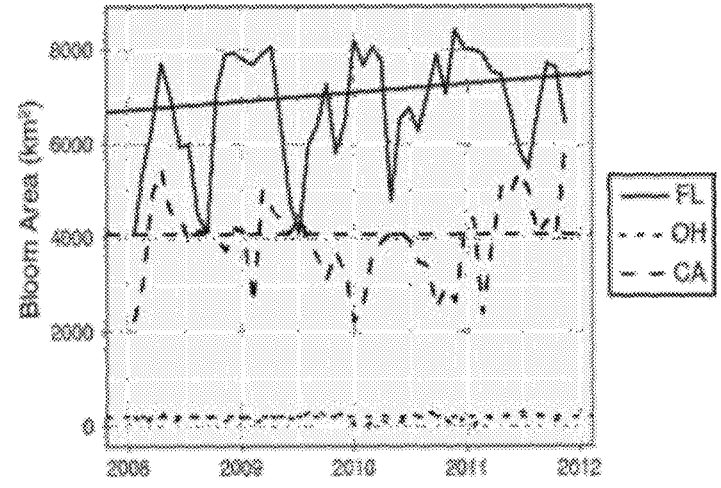
Clark et al. 2017. Methods for monitoring cyanobacteria harmful algal blooms in recreational waters and drinking source waters with satellites. Ecological Indicators. 80:94-95.

Quantifying Cyanobacteria *Extent*

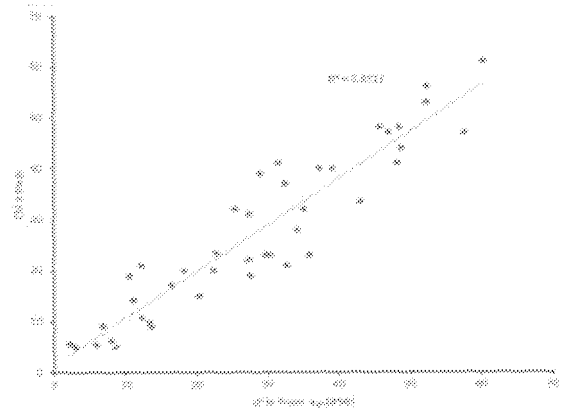
- *Problem:* How do we quantify the spatial extent of cyanobacteria?
- *Action:* Time series analysis evaluated overall trend.
- *Result:* 2008-2012 and 2017+ for the continental U.S. (CONUS).
- *Impact:* Each year report on status of HABs in the U.S. by state.

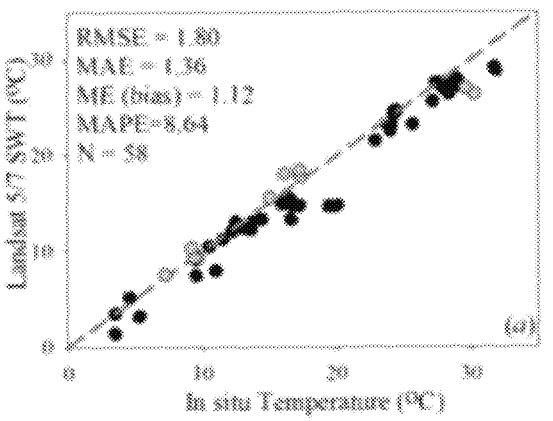


Urquhart et al. 2017. A method for examining temporal changes in cyanobacteria harmful algal bloom spatial extent using satellite remote sensing. Harmful Algae. 67: 144-152.

Higher Resolution Satellites

- *Problem:* How do we quantify water quality in smaller lakes?
- *Action:* Testing Landsat-8 and Sentinel-2 satellite algorithms.
- *Result:* Some promise with chlorophyll-a and turbidity. Excellent results with temperature.
- *Impact:* Provide measures from 1980-present for 170,240 lakes and reservoirs.



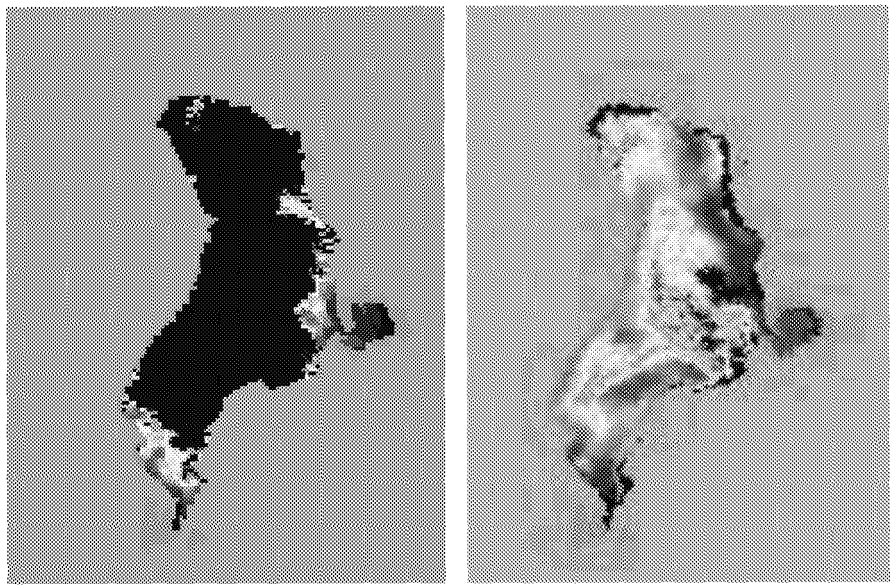


*w/ Jason Green @ NC DEQ

Keith et al. (*Accepted*). Monitoring algal blooms in drinking water reservoirs using the Landsat 8 Operational land Imager. International Journal of Remote Sensing.

Utah Case Study

- Utah (DEQ/DWQ) conducted routine monthly sampling June 12, 2017
- Satellite imagery the following week indicated a bloom was developing
- DWQ scientists returned to the area June 22, 2017
- June 29, DEQ issued an advisory, warning the public and pets to stay out
- Ben Holcomb Utah DEQ statement:
  - "…provides UDWQ confidence that our in-situ, bloom-response data are representative…."
  - "…better target field sampling and more efficiently use our limited resources."
  - "…images are easily shared with response agencies as a useful visual communication aid."

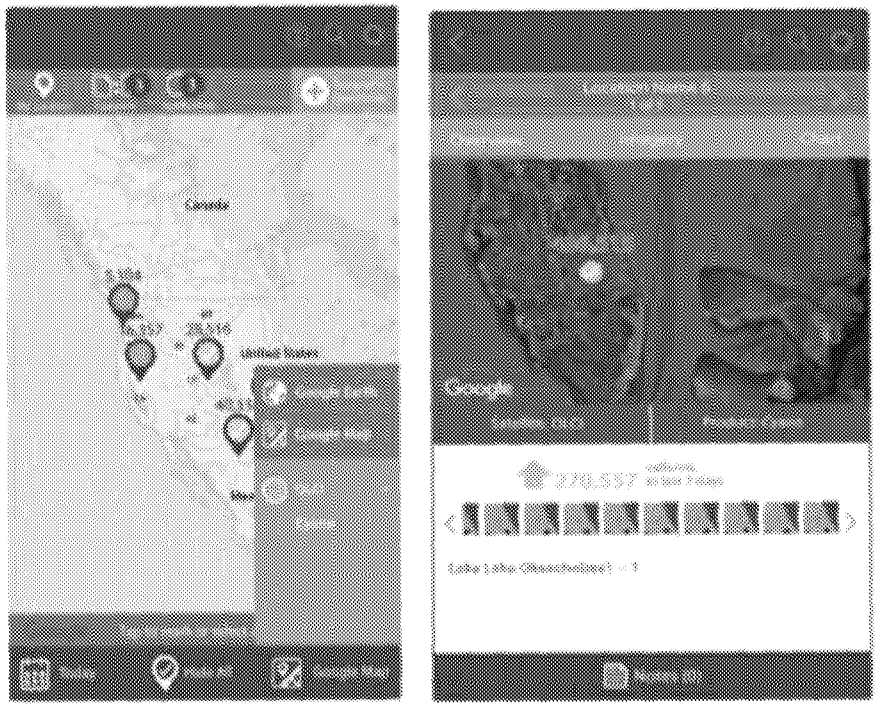


June 18, 2017 July 3, 2017

Sentinel-3 OLCI imagery from ESA and processed by NOAA

CyAN Android Mobile Application

- *Problem:* How to effectively distribute satellite-derived cyanoHAB data?
- *Action:* CyAN app provides intuitive satellite data handling and engagement.
- *Result:* Currently beta testing with new Sentinel-3 data.
- *Impact:* Supports a comprehensive management strategy.

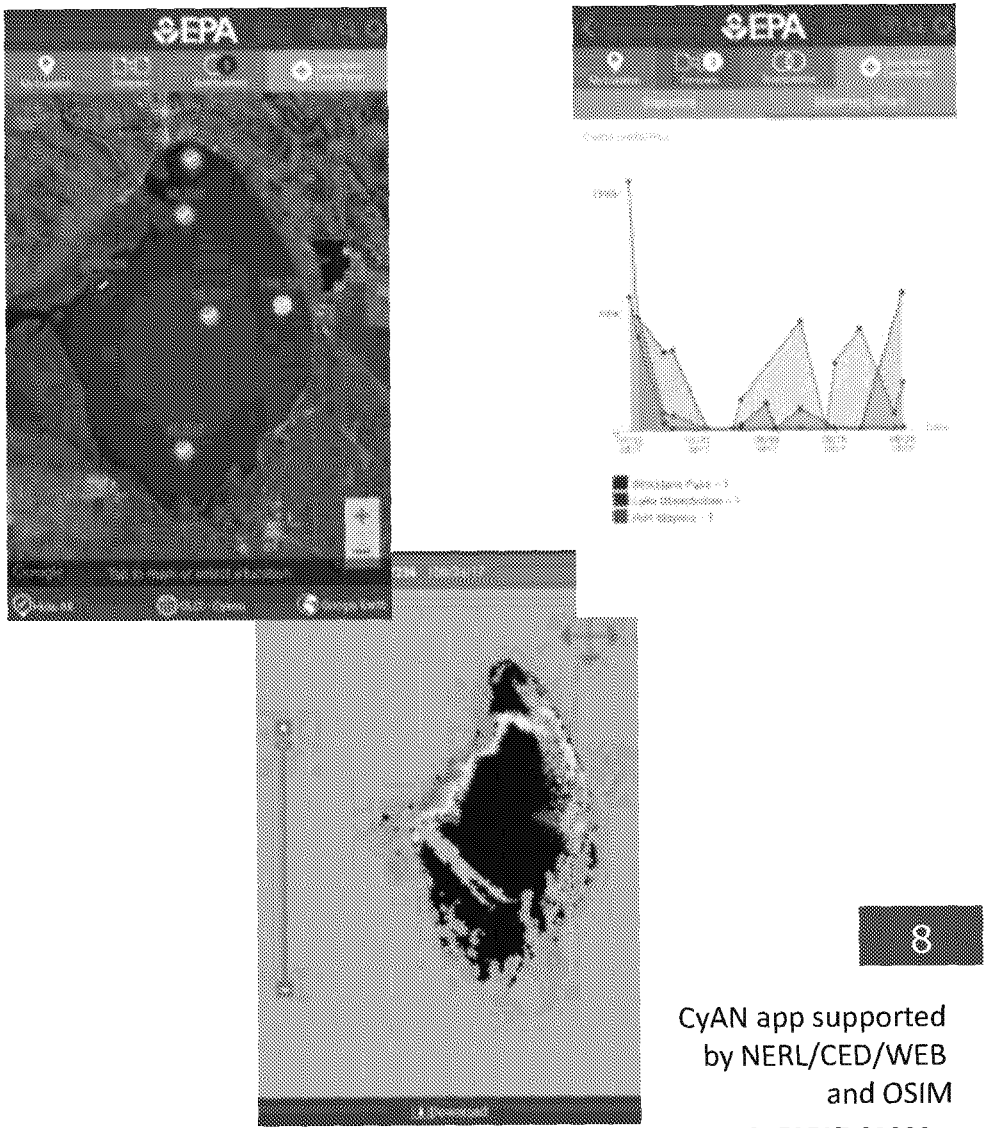


YouTube

Schaeffer et al. (*In Review*). Mobile device application for monitoring cyanobacteria harmful algal blooms using Sentinel-3 satellite Ocean and Land Colour Instruments. Environmental Modelling and Software.

Florida Case Study

- Lake Okeechobee
- CyAN app near real-time monitoring beta test case
- Rich Botta - South Florida Water Management Division
  Jim Riley - US Army Corps of Engineers
  Frank Baker - EPA Region 4
- Testing app functionality for weekly (standard) and daily images
- *In coming days*: CONUS weekly cyanoHAB data starts



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