



**CITIZEN MONITORING
of HABs in**

CALIFORNIA WATERS:

A Presentation for CCHAB

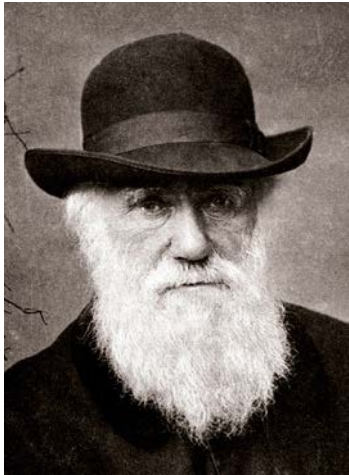
CALIFORNIA CITIZEN MONITORS

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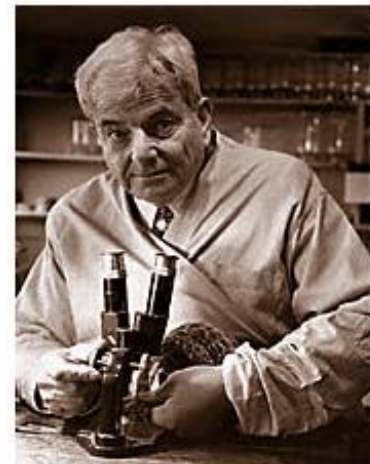
January 2018

Q: What is citizen science?

A: The systematic collection and analysis of data; development of technology; testing of natural phenomena; and the dissemination of these activities by research on a primary *avocational basis*.



Some Famous Citizen Scientists:
Charles Darwin, Albert Einstein, Benjamin Franklin & Laurence Klauber...



Citizen Science, and Crowdsourcing Environmental Monitoring Programs Origins Within The US:

1846 – The United States Coast & Geodetic Survey adds the use of drift bottles to its array of observation techniques.

1880 - Lighthouse Keepers began keeping bird strike information in 1880..

1890 - The National Weather Service Cooperative began recruiting volunteers in to report daily measurements of rainfall and air temperature. More than 11,000 volunteer weather stations now exist nationwide, and we have much knowledge of our nation's climate is based on that data.

1900 - The National Audubon Society started it's Christmas Bird Counts.

1920 - The Izaak Walton League of America kicked off volunteer water monitoring when volunteers conducted the first national water survey for President Calvin Coolidge.



Citizen Science is applicable to all fields of science.

Clearinghouses for ideas, news, and resources in support of citizen science projects that answer real-world questions: www.citsci.org www.birds.cornell.edu/citscitoolkit

Astronomy

www.galaxyzoo.org
<http://faulkes-telescope.com>
<http://science.nasa.gov/citizen-scientists/>
www.citizensky.org/

Fish Tagging Studies

<http://fwie.fw.vt.edu/tagging/>
www.littoralsociety.org/index.php/take-action/citizen-science

Ecosystem Inventories

www.inaturalist.com
http://education.nationalgeographic.com/education/programs/fieldscope/?ar_a=1
www.reefcheck.org/
www.restoretherockies.org/
www.appalachianforest.org/cem_conf_pg.htm

Meteorological and Climate Studies

www.cocorahs.org/

Public Health

www.communitysensing.org/
www.wheresgeorge.com/

Categories of Citizen Science Programs

Contributory – Scientist designed; participants collect data/samples.

Collaborative - Scientist designed; participants do more than just collect data/samples.

Co-created – Scientists and participants collaboratively design the project.

Community based – Participant/Community created and collect samples, take measurements, conduct tests and/or more ...

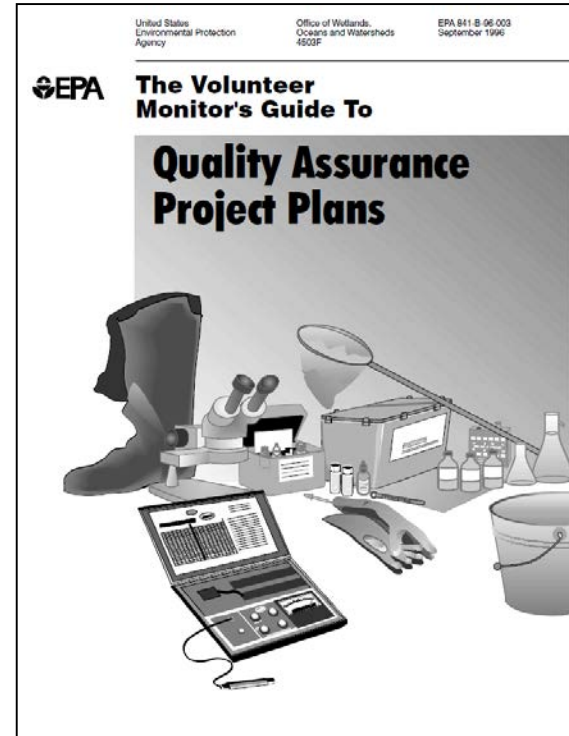
Educational - STEM, Environmental Literacy, Gaming...

MYTH: Use Volunteers = Saving \$\$\$

- Citizen Science *is not free* but it is *cost effective*
 - Citizen Science Requires Investing in Personnel Management & Data Acquisition
- Citizen Science Provides Tangible Benefit Beyond Simple Field Work & Data Acquisition



MYTH: Citizen science data is of unknown quality.



- Quality Assurance Project Plans (QAPP) based on EPA and SWAMP guidance are being implemented.
- Inter-calibration exercises are being held....

Citizen Science Improves ...



- Environmental & Science Literacy
- Public Input & Public Engagement
- Field Detection
- Data & Image Analysis
- Use of and Access to Local/Traditional Knowledge
- Refinement of Research Questions
- The Number and Diversity of Future Scientists and Environmental Resource Managers

Citizen Science Contributes to...

- **Management of Environmental Resources**

- Species Management (Salmonid Monitoring)
- Ecosystem Services (Wetlands Monitoring)
- Climate Change (King Tides Crowdsourcing)



- **Environmental Protection**

- Pollution Detection (Water Quality Monitoring)
- Enforcement of Environmental Laws (MS4...)
- 303(d)/305(b) Reporting (Impaired waters...)



- **Policy Making**

- Adoption of Water Quality Standards (WQMPs, Permits)
- Bans on Specific Pollution Sources/Agents (Pesticides, Shopping Bags)
- Providing Informed Comments (Legal Disclosure Comment Periods,)

- **Obtaining Observational & Opportunistic Data**

- Observing and Notifying Agencies about Spills (Oil, Sewage)

Citizen Scientists...

- Spread Knowledge
 - Shared Stories
 - Broaden Public Awareness
- Increase Local/Personal Env. Stewardship
- Advances Community Pride
- Quickens Environmental Management Decision Making



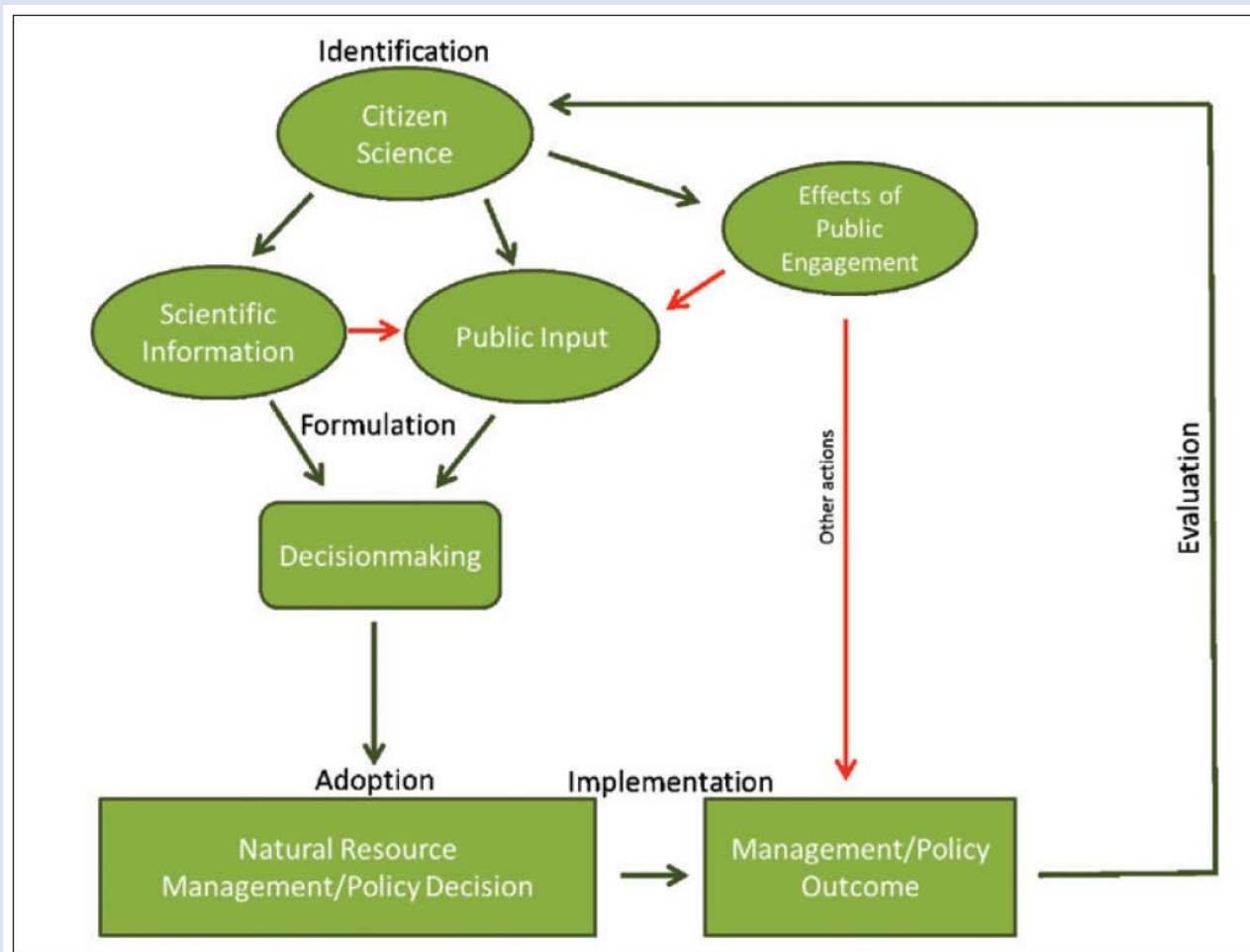
Citizen Science Changes How People See The World In Terms Of:

Scientific *Educational* *Social and Policy*

Collaborative and co-created approaches often have very **practical goals** derived from collaborating with citizens. These are expressed in actions and practical results rather than in emphasis on data gathering for mainly scientific interpretations and outcomes.

Facilitates **building mutual trust** between scientists, the general public and decision makers

A Modeled Pathway of Citizen Science Influence



1) Generating scientific Information

(2) Facilitating direct (green arrows) and indirect (red arrows) public input and engagement.

Text in black refers to the policy cycle: problem or issue

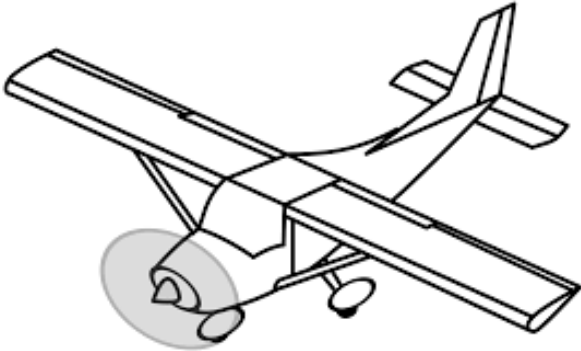
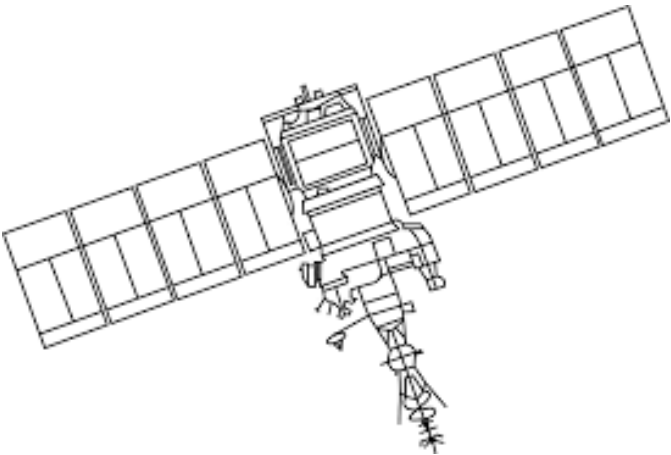
Levels of Citizen Monitoring Engagement

- Water Quality Condition Assessments
- Sampling and Analysis
- Sampling
- Bioassessments
- Biosurveys
- Snapshots
- Visual Assessments
- Participatory Sensing
- Education



Citizen Science Data Collection Tools

Visual/Sensory



Physical Measurements

- Temperature



- Turbidity

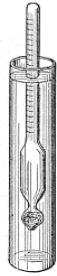


- pH



Physical Measurements

- Conductivity/Salinity



- Dissolved Oxygen



Chemical

- Colormetric



- Colorimeter



- Spectrophotometer

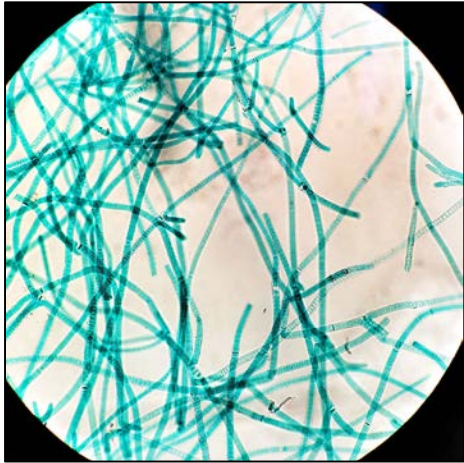


- Fluorescence

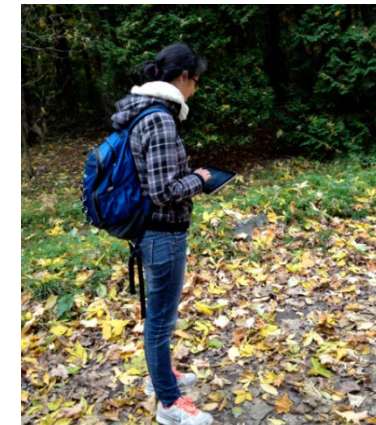
- Test Strips



Biological



Smartphone and Tablet Revolution



THE CLEAN WATER TEAM



The mission of the Clean Water Team is to support the State's Watersheds Stewardship through involvement by Citizen Monitoring in order to reduce and prevent water pollution and recover lost beneficial uses.

www.waterboards.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

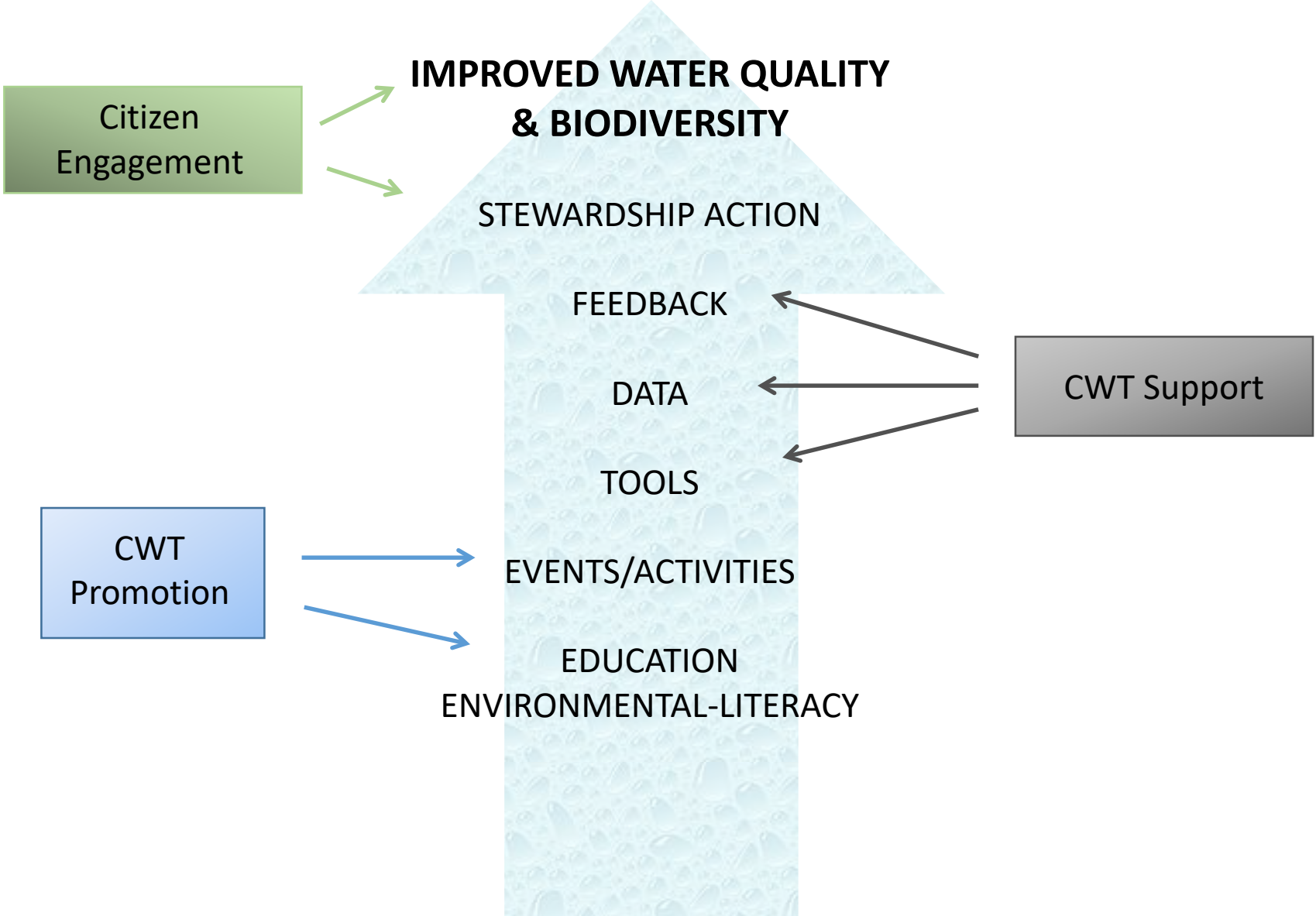
About the Clean Water Team

The Clean Water Team (CWT) is the citizen monitoring program of the State Water Resources Control Board. The CWT is a part of the Surface Water Ambient Monitoring Program (SWAMP). The CWT Citizen Monitoring Coordinator works statewide in order to provide technical assistance and guidance documents, training, QA/QC support, temporary loans of equipment and communication to citizen monitoring programs and watershed stewardship organizations.

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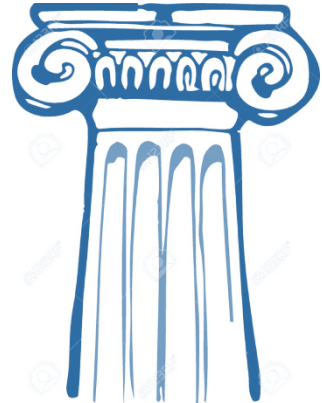


CLEAN WATER TEAM'S AREAS of IMPACT



Grassroots Organizations, Environmental Justice, Community Based Organizations, Resource Conservation Districts, Non-Profits, Tribes, Farm Bureaus, Universities and Community Colleges, Advocacy Groups, Cities, Counties, Environmental Organizations

**The Clean Water Team
provides 6 Core Programs that
support the production of actionable data from
*CITIZEN SCIENCE***



Technical Support



Training



QA/QC



Loans of Equipment

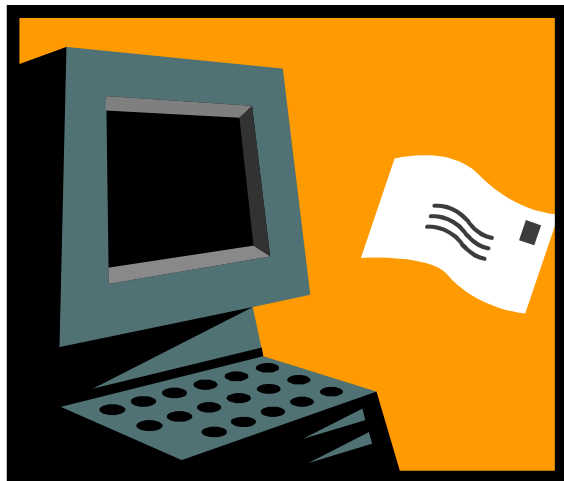


**Outreach
&
Communication**



Event Support

Clean Water Team Communication Tools



Self-Subscribe Email
Listserve

[http://www.waterboards
.ca.gov/lyrisforms/swrc
b_subscribe.html](http://www.waterboards.ca.gov/lyrisforms/swrc_b_subscribe.html)

**Webinars: CA Water
Quality Monitoring
Collaboration Network**



Calendars



Already started published HAB pics and weblinks:



| April 2018 | | | | | | |
|-------------|---------------------------------------|-----|----------------------------|---|--------------|-----|
| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
| EARTH MONTH | | | NATIONAL PEPPERMOUTH MONTH | April is National Volunteer Month Celebrating People in Action | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | National Public Health Week | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| | Creek Week | | | | | |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | Celebrate Service | | | CITIZEN SCIENCE DAY | | |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| | National Environmental Education Week | | | | | |
| 29 | 30 | | | | CWT Tool Box | |
| | RIVER RALLY | | | | | |

www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/volunteer/cwt2018cal.pdf

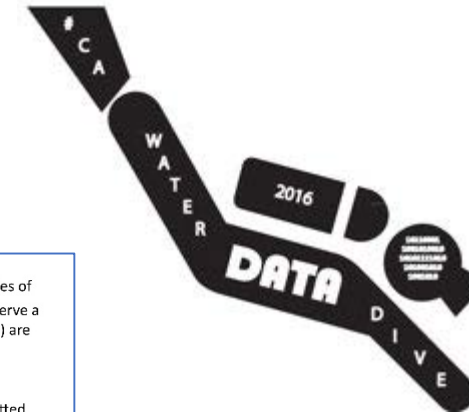
www.waterboards.ca.gov/press_room/press_releases/2017/pr122917_water_monitoring_calendar.pdf

Newsletter articles are in the works



www.waterboards.ca.gov/water_issues/programs/swamp/cwt_newsletter.shtml

Poster Presentations +



CROWDSOURCING TO FIND AND REPORT POTENTIAL CYANOBACTERIA BLOOMS

BloomWatch

BLOOMWATCH APP

Water sports, aquatic recreation and other water contact activities are very popular in California and with 189,454 miles of river and more than 3,000 named lakes and reservoirs; it's very likely those people seeking relaxation and recreation will observe a Harmful Algal Bloom (HAB) before a scientist will. Freshwater HABs are visible blooms of cyanobacteria (aka blue green algae) are capable of producing toxins which have the potential to cause risks to human and animal health, including pets. That is why California's Water Boards have collaborated with the [BloomWatch App](#) (Android, IOS).

Reports submitted by App Users are sent to Water Board staff who can then investigate the report, the same as reports submitted online www.mywaterquality.ca.gov/habs/do/index.html#how.

Confirmed reports can be viewed at www.mywaterquality.ca.gov/habs/index.html.

California Harmful Algal Blooms

HAB events represented are voluntarily reported to the State Water Board's Surface Water Ambient Monitoring Program. Data provided are for general information purposes only and may contain errors. The exact location, extent and toxicity of the reported bloom may not be accurate and may not be affecting the entire waterbody. The data are subject to change as new information is received. Please check back for updates.

www.mywaterquality.ca.gov/habs/index.html

More detailed information on freshwater HAB events.

- 2017 CABW
- 2017 Watershed Health Indicator and Data Science Symposium
- 2016 CA Water Board Data Innovation Challenge

GUIDANCE COMPENDIUM FOR WATERSHED MONITORING AND ASSESSMENT

Section 3.0 “Grab Samples” - Measurements Taken at One Point in a Water Body or in a Container (including Water Quality Fact Sheets)

| | | |
|-------|---------------------------------------|--|
| 3.5.3 | Freshwater Algae | SOP Freshwater Algae Protocol |
| | 3.5.3.1 | Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California |
| 3.5.4 | What are harmful algal blooms (HABs)? | |
| | 3.5.4.1 | SWAMP's California Freshwater Harmful Algal Bloom Field Guide |
| | 3.5.4.2 | BloomWatch App (Data submitted via the BloomWatch App is shared with the California Water Boards.) |
| | 3.5.4.3 | Cyanoscope |
| | 3.5.4.4 | Eye On Water App |

Educational and Training Videos

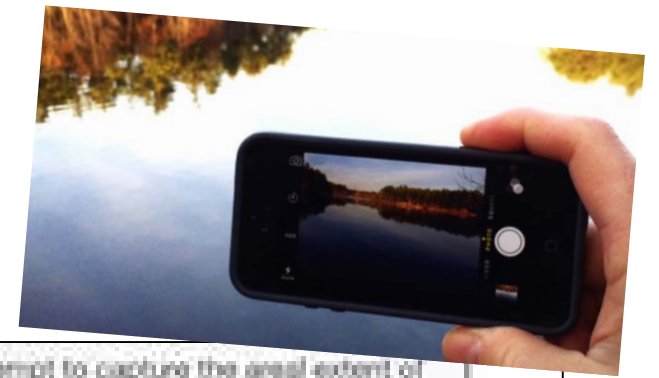


www.youtube.com/watch?v=lh90P7nsBTM&list=PLvTjRb8VCKp7y1NtA-b2NTNF1L8puCcIM

www.youtube.com/watch?v=wfo1cVUj2Sk&list=PLMSa5d-ill6NoflglxwYS0ySPw4bpomA



Visual/Sensory Tools - Apps





The logo for bloomWatch, featuring a stylized blue eye shape with a green wavy line representing water inside the pupil.

Surface conditions:

Choppy

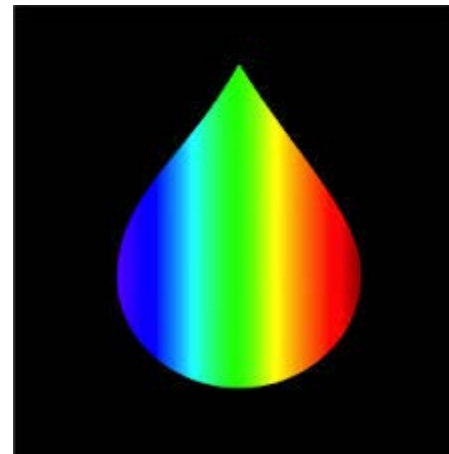
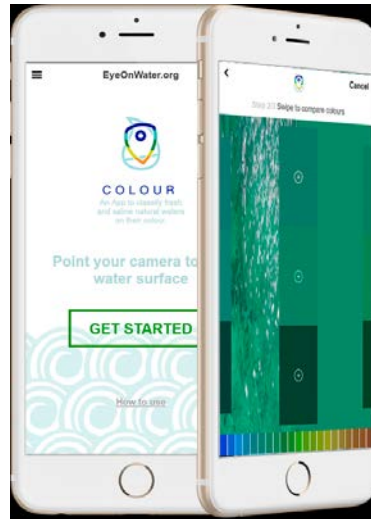
Bloom size or extent:

Smaller than a sedan

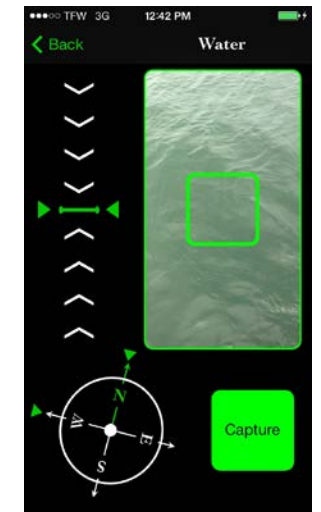
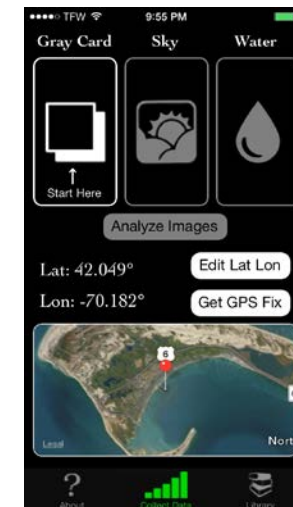
Photo 1: Attempt to capture the areal extent of the bloom. (lake/pond wide, along the shoreline, etc.). If additional description is necessary, enter it in the box below.



A close-up of a camera app interface, showing a lens and a plus sign button.



HydroColor



More Visual/Sensory Tools



General aviation (GA) pilots functioning as citizen scientists can help develop an early warning system to alert communities of ensuing algal blooms.



<https://re.grc.nasa.gov/citizen-scientists-track-algal-blooms/>



Balloon mapping is a low-cost way to take aerial photos using a camera, attached to a balloon, on a spool of string. People have done this from a few hundred feet up all the way to over 4,000 feet in the air.



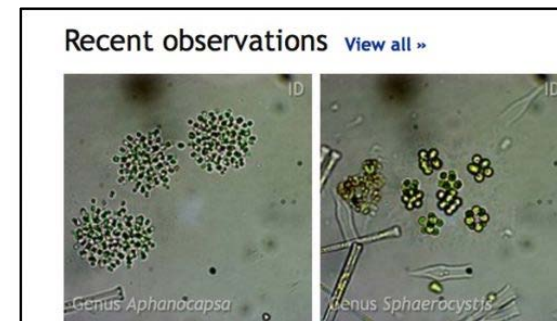
<https://publiclab.org/wiki/balloon-mapping>

DIY Spectrometry ?



<https://publiclab.org/notes/abdu/10-13-2016/desktop-spectrometry-starter-kit-3-0-instructions>

Biomonitoring - Cyanoscope



Stats

Totals

794

Observations »

68

Species »

104

People »



Quality Assurance Program Plan (QAPP)
For the
CYANOBACTERIA MONITORING COLLABORATIVE PROGRAM

By the

U.S. ENVIRONMENTAL PROTECTION AGENCY
ECOLOGY MONITORING TEAM
ECOSYSTEMS ASSESSMENT UNIT
OFFICE OF ENVIRONMENTAL MEASUREMENT & EVALUATION
NEW ENGLAND REGIONAL LABORATORY
11 TECHNOLOGY DRIVE
NORTH CHELMSFORD, MASSACHUSETTS 01863



Meters

Fluorometry

- Handheld
- Bench-top



Test Strips

- Abraxis @ <http://www.abraxiskits.com/products/algal-toxins/> - Strip tests; recreational water w/lysis (1-10 ug/L) - Adding anatoxin-a & cylindrospermopsin
- Beacon Analytical Systems @ <http://www.beaconkits.com/welcome/category/algal-toxins> - Microcystin ELISA tube kits (0.3-5 ug/L)





www.waterboards.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

