Volunteer Monitoring: Bacteria Monitoring

James Beckley & Mara Dias

National Water Quality Monitoring Council

Webinar Series

DEQ
Virginia Department of Environmental Quality

SURFRIDER FOUNDATION

Agenda:

- Introductions
- Virginia Department of Environmental Quality
- Surfrider Foundation
- Q & A
- Resources

Introductions

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Virginia DEQ and Citizen Bacteria Monitoring

James Beckley

Quality Assurance Coordinator

DEQ

Virginia Department of Environmental Quality

What is Fecal Bacteria

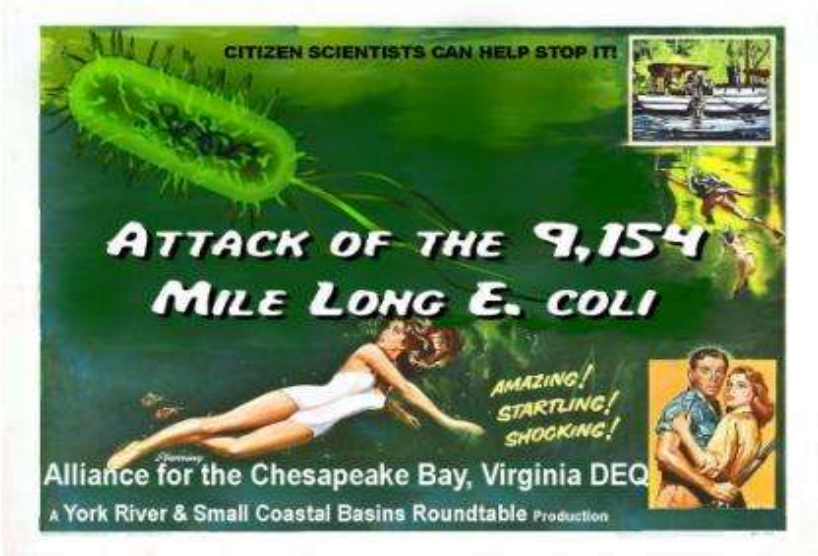
- Bacteria associated with warm-blooded animal waste
  - E. coli (freshwater)
  - Enterococcus (fresh and/or saltwater)
  - Fecal Coliform (freshwater, saltwater, shellfish)
- Above specified levels correlate to increased illness risk when swimming or eating raw shellfish

Terence Baggett: What's that smell?

Lt. Frank Drebin: Oh, that would be me. I've been swimming in raw sewage. I love it!

Why Virginia Monitors for Fecal Bacteria

- High fecal bacteria in waterways increase illness risk
- Can be one of the largest impairment causes of streams
  - In Virginia; >9,154 miles
- Waterbodies with high fecal bacteria often see have other issues (e.g. high sediment and nutrients)



www.youtube.com/watch?v=fyY6YF9xtzc

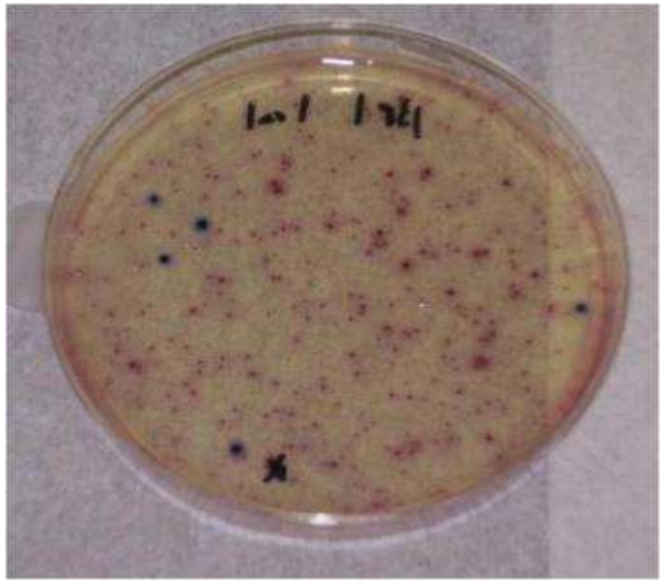
Popular Bacteria Methods

- Presence/Absence
- Petrifilm
- Multiple Tube
- Membrane Filtration
- Coliscan Easygel
- Colilert/Enterolert

So simple even high school students can do it

Coliscan Easygel

- E. coli based method
- No laboratory needed
- Tests 1 to 5 ml of sample
- Results in 24 to 48 hours
- Low cost (~$3/sample)
- Help locate bacteria 'hot spots' and track overall trends
- Not EPA approved
- E. coli sometimes hard to identify



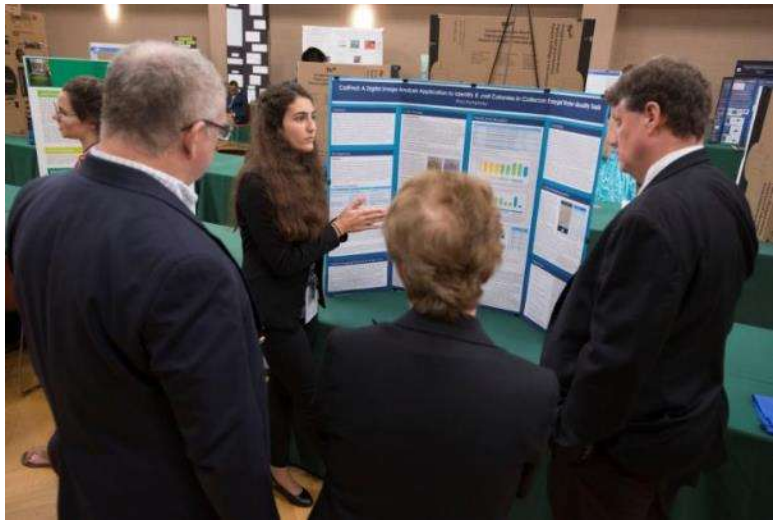
1 ml sample with 5 *E. coli* colonies

Coliscan Method

- Samples collected using sterile sample bottles
- 1.0 to 5.0 ml of sample placed into a bottle of thawed Coliscan media and mixed
- The mixed media is poured into a treated Petri dish and turns into a gel (~45 min)
- Incubate for 24 hours at ~35 ^{o}C or 48 hours at ~25 ^{o}C
- Incubated plates are scored
  - E. coli colonies are dark blue to royal purple
- Training video: www.youtube.com/watch?v=1c59nedG9So

Coliscan Resource: Colifind

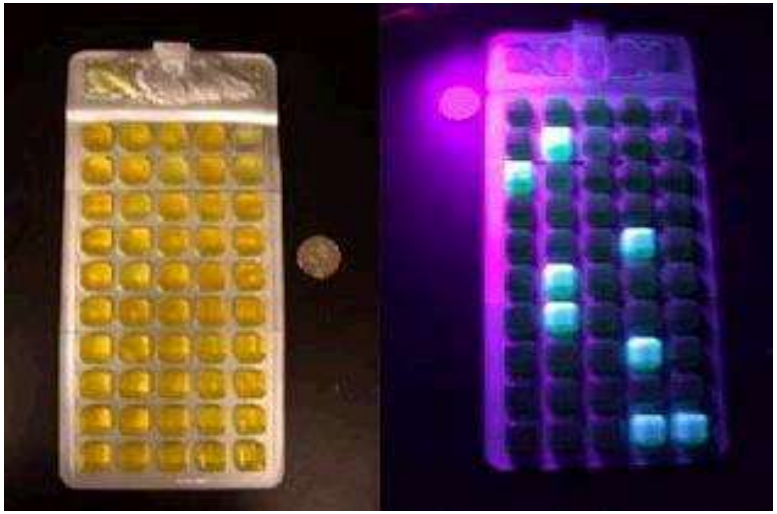
- Online App to identify E. coli in Coliscan photographs
- Over 95% accurate
- Developed by a Virginia high school junior
- Available at: http://colifind.com/



Created by Ana Humphrey

Colilert/Enterolert

- Popular laboratory method
- Low cost and easy to use
- Results in 18 to 24 hours
  - Colilert- Total coliform/E. coli
  - Enterolert- Enterococcus
- EPA approved
- Test susceptible to optical brightener interference

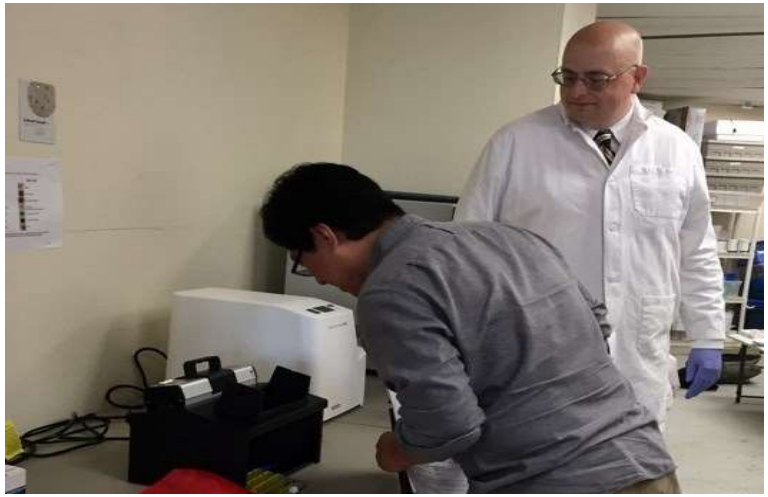


>200.5 coliform 8.7 E. coli

Colilert Quantitray

Colilert/Enterolert Method

- Add media to 100 ml of water
- Pour into multi-well tray
- Seal tray
- Incubate for 18 to 24 hours
- Score samples
  - E. coli: yellow and glow in UV
  - Enterococcus: glow in UV
- Training video: https://youtu.be/x9_XmS8VLZ0

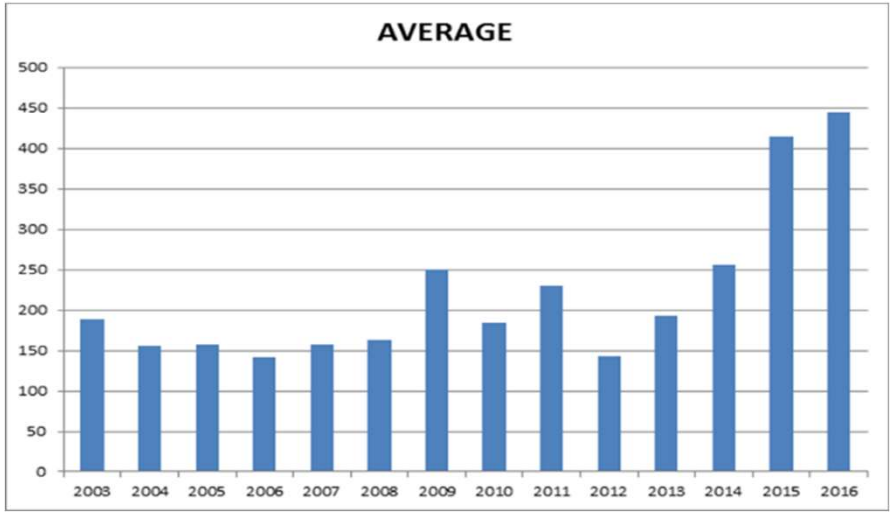


Video made in partnership with Virginia DEQ and Rivanna Conservation Alliance

Test Method	Presence/ Absence	Petrifilm	Multiple Tube	Membrane Filtration	Coliscan Easygel	Colilert/ Enterolert
Lab Required	No	No	Yes	Yes	No	Yes
Min Detection Limit	0	<100	<1	<1	<20	<1
Max Detection Limit	1	>6,000	>10,000	>10,000	>6000	>241,960
Measurement Unit	N/A	CFU	MPN	CFU	CFU	MPN
Consumable Cost	$7.00	$3.50	$2.50	$3.00	$3.00	$5.50
Startup Equipment Cost	$100	$100	>$25,000	>$25,000	$100	$7,000
Time Spent Per Sample	1 min	1 min	>10 min	>10 min	1 min	2 min
Incubation Time (Hrs)	24	24	72 to 120	18 to 24	24 to 48	18 to 24
EPA Approved	Yes	No	Yes	Yes	No	Yes

If Adopting New Methods Beware…

- New method can have a different detection limit, accuracy, or precision
- Keep records of when methods change for future reference
- Account for step trends when analyzing and reporting results



VADEQ statewide yearly average E. coli levels with new method adopted in late 2014

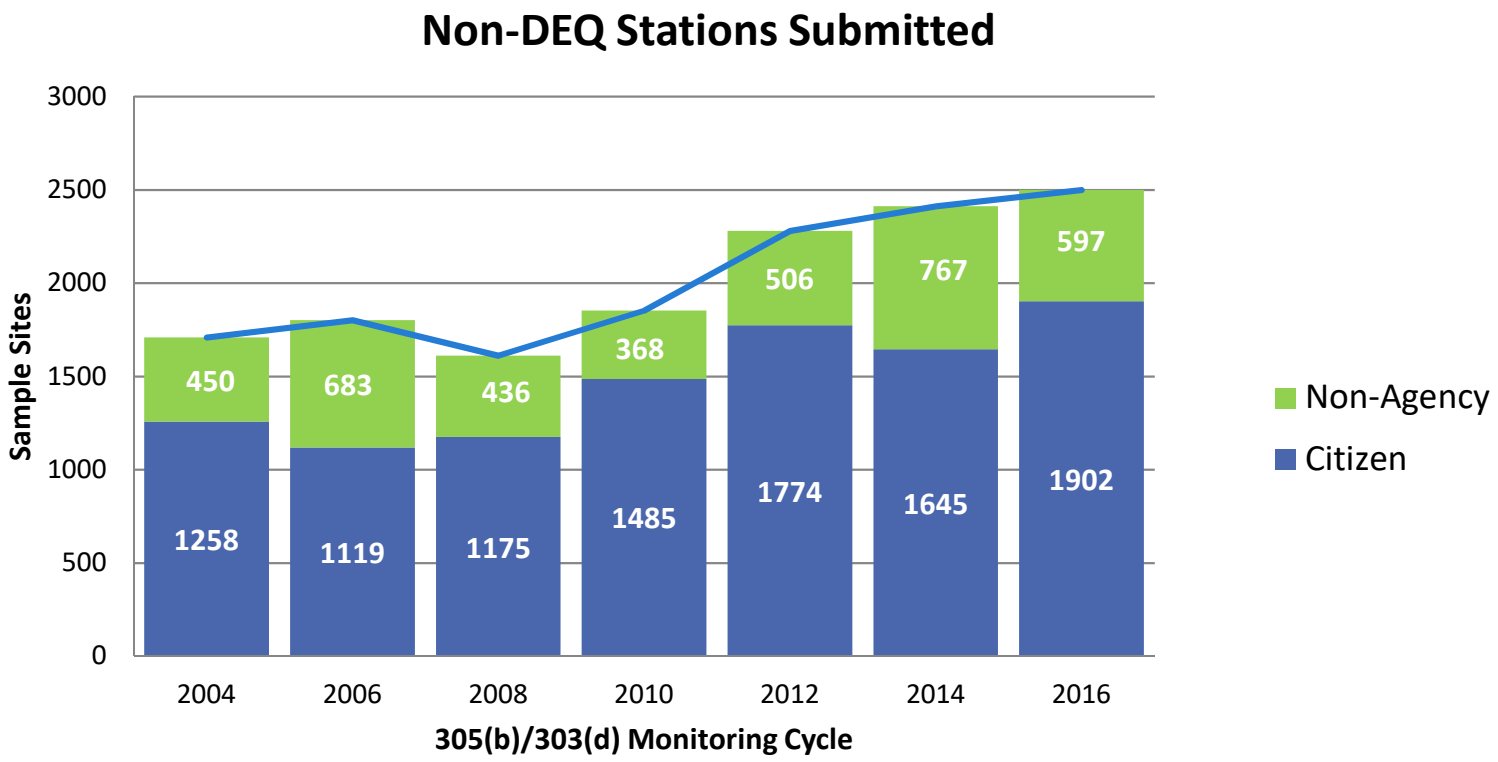
How Citizen Monitoring Helps DEQ

- Increase water quality assessment coverage
- Total Maximum Daily Load (TMDL) monitoring
- Identify sewer spills and other pollution ‘hot spots’
- High return on agency funding and staff investment

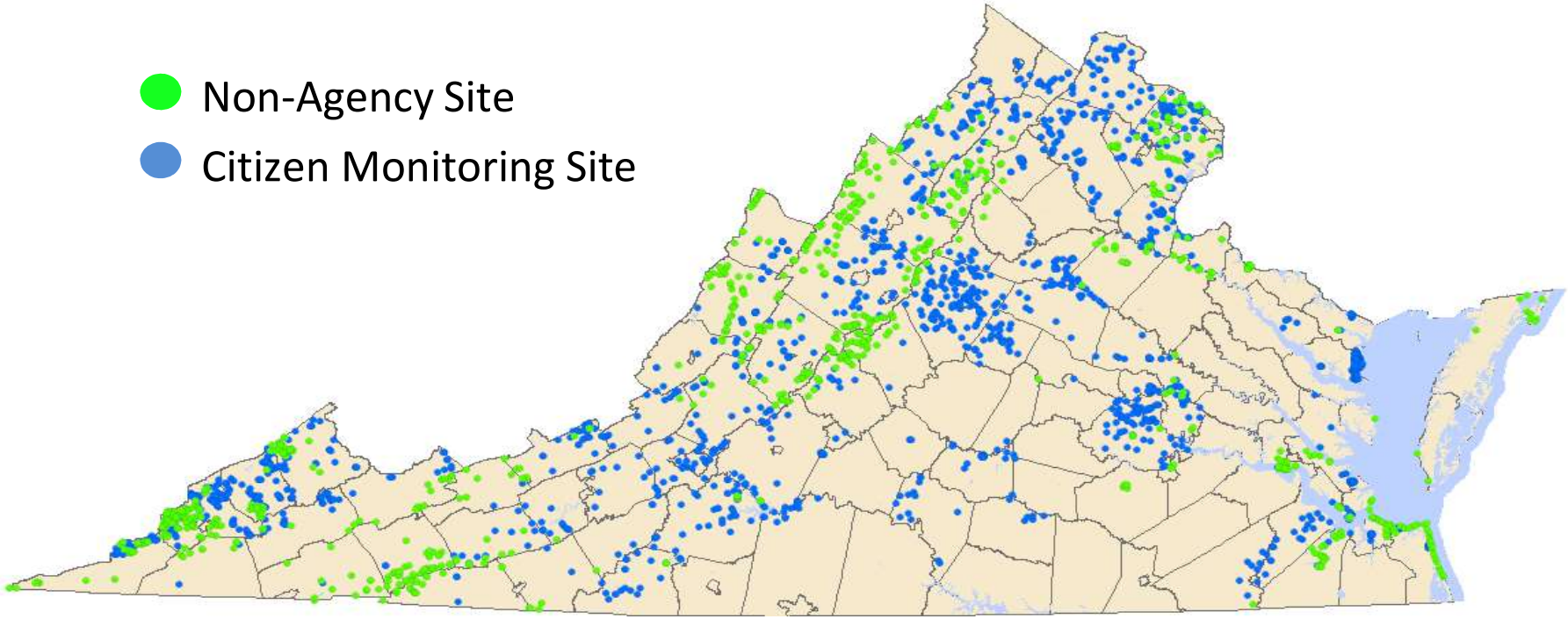
How DEQ Does Not Use Submitted Data

- Submitted data not used by DEQ for enforcement or similar regulatory actions
  - Codified in **§ 62.1-44.19:11**
- Submitted data is not assessed if it was collected in permitted mixing zones or at discharge pipes
- Submitted data not used by itself to develop TMDL Implementation Plans

Water Assessment - Submitted Stations



Citizen or Other Non-DEQ Sample Sites

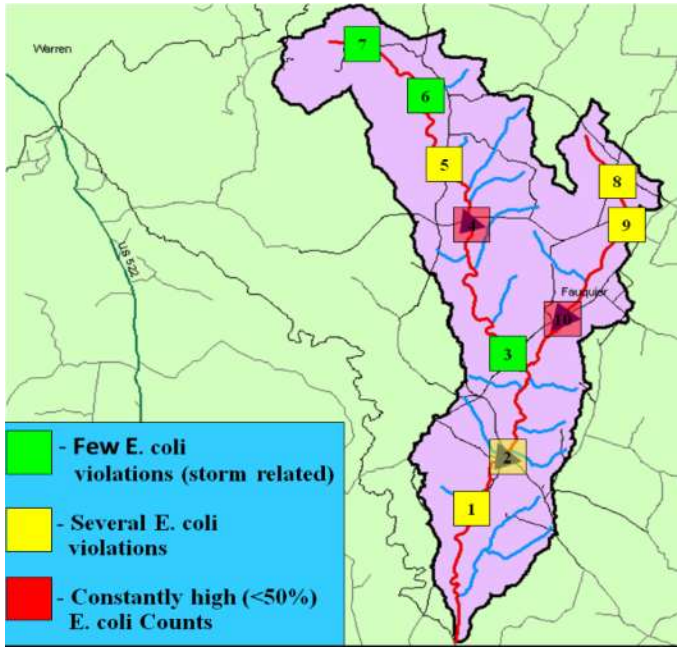


Water Quality Assessment Coverage- Citizen Volunteer Data

Assessment Cycle	Monitoring Year	Citizen Sites Submitted	Stream Miles	Estuary Mi^2	Lake Ac^2
2008	2001-2006	1,175	2,371.61	73.74	9,726.15
2010	2003-2008	1,485	3,499.45	37.48	30,052.98
2012	2005-2010	1,774	4,124.44	40.15	27,975.46
2014	2007-2012	1,645	3,559.96	34.48	24,860.47
2016	2009-2014	1,902	3,766.89	89.31	15,477.64

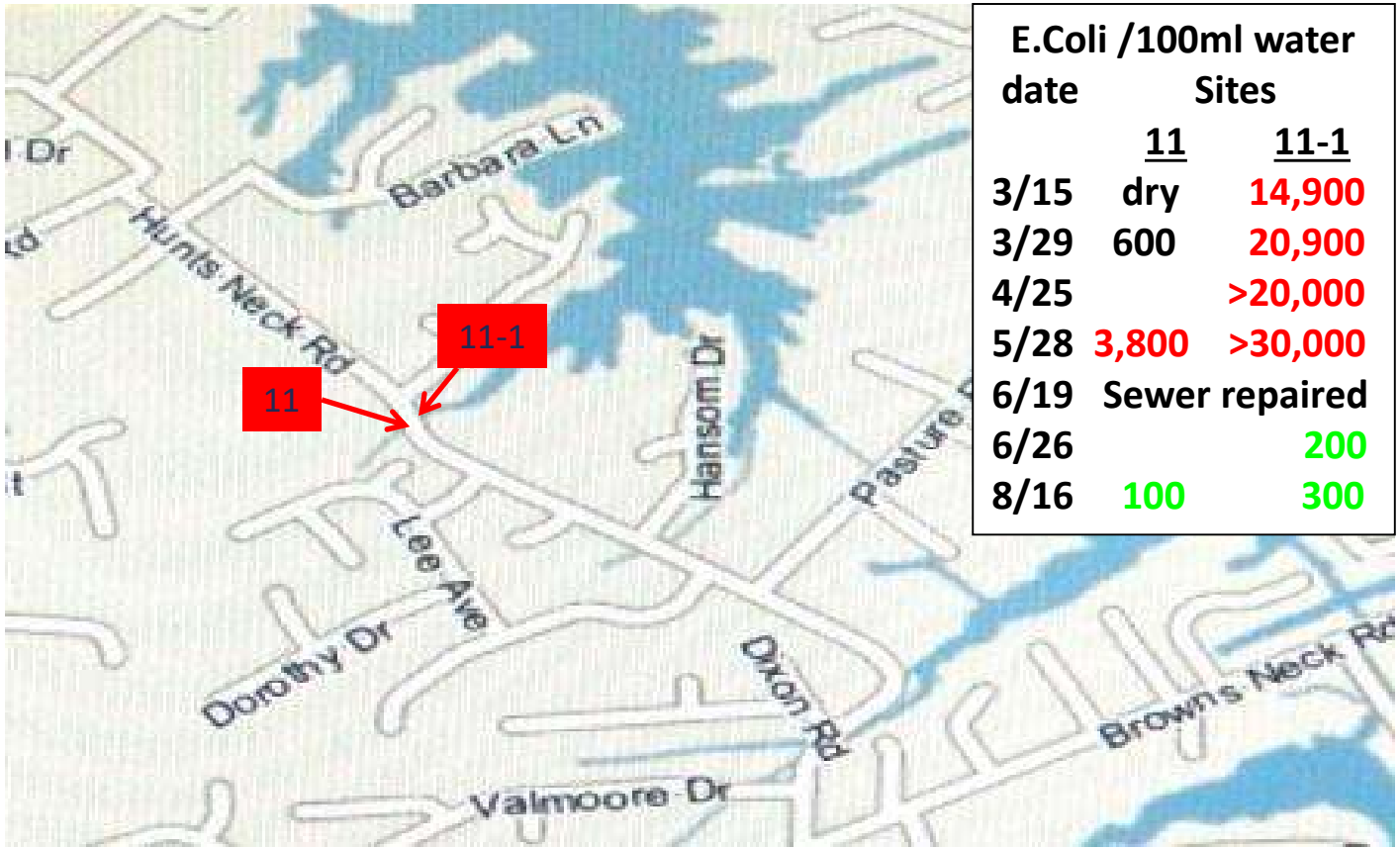
Citizen Monitoring and TMDLs

- Opportunities for citizens to help with TMDL projects
  - Provide additional data to develop a more targeted TMDL
  - Perform implementation and Best Management Practice (BMP) monitoring
  - Help promote public education and TMDL involvement



Thumb Run: One of our first Coliscan TMDL monitoring projects

Identify Sewer and Other Fecal Pollution Sources



E.Coli /100ml water		
date	Sites	
	11	11-1
3/15	dry	14,900
3/29	600	20,900
4/25		>20,000
5/28	3,800	>30,000
6/19	Sewer repaired	
6/26		200
8/16	100	300

High Return from DEQ Investment

- There are over 1,200 Virginia citizen monitors
- Each volunteer spends about 24 hours a year sampling
- DEQ estimates over $750,000 worth of data is collected
- DEQ invests ~$200,000 through grants ($88,000) and staff time (~1.5 FTE) to QA data and coordinate groups
- >275% Return on Investment (ROI) of agency resources

Quotes on the Citizen Volunteer and DEQ Partnership

- “We would not have a McClure River TMDL without the McClure River Restoration Project”- Martha Chapman DEQ SWRO TMDL Coordinator
- “Of the 1230 monitoring stations utilized in the VRO 2016 assessment, 685 were from citizen monitors.” - James Shiflet DEQ VRO Water Resources Planner
- “In fact, Virginia is the only state to receive an A for volunteer engagement. The Virginia Department of Environmental Quality relies on volunteers to provide the most accurate picture of stream health across the state.”- Izaak Walton League of America *Clean Water: Your Right to Know* report page 138.

SURFRIDER
FOUNDATION
BLUE WATER
TASK FORCE

Who is Surfrider?

The Surfrider Foundation is a non-profit grassroots organization dedicated to the protection and enjoyment of our world's ocean, waves and beaches.

Surfrider Foundation’s Chapter Network

SURF
ING
DAY
JUNE20

ENVIRONMENTAL INITIATIVES

OCEAN PROTECTION

COASTAL PRESERVATION

CLEAN WATER

BEACH ACCESS

PLASTIC POLLUTION

Clean Water Initiative

To protect water quality in local waterways and reduce ocean pollution so it is safe to surf, swim and play in the ocean

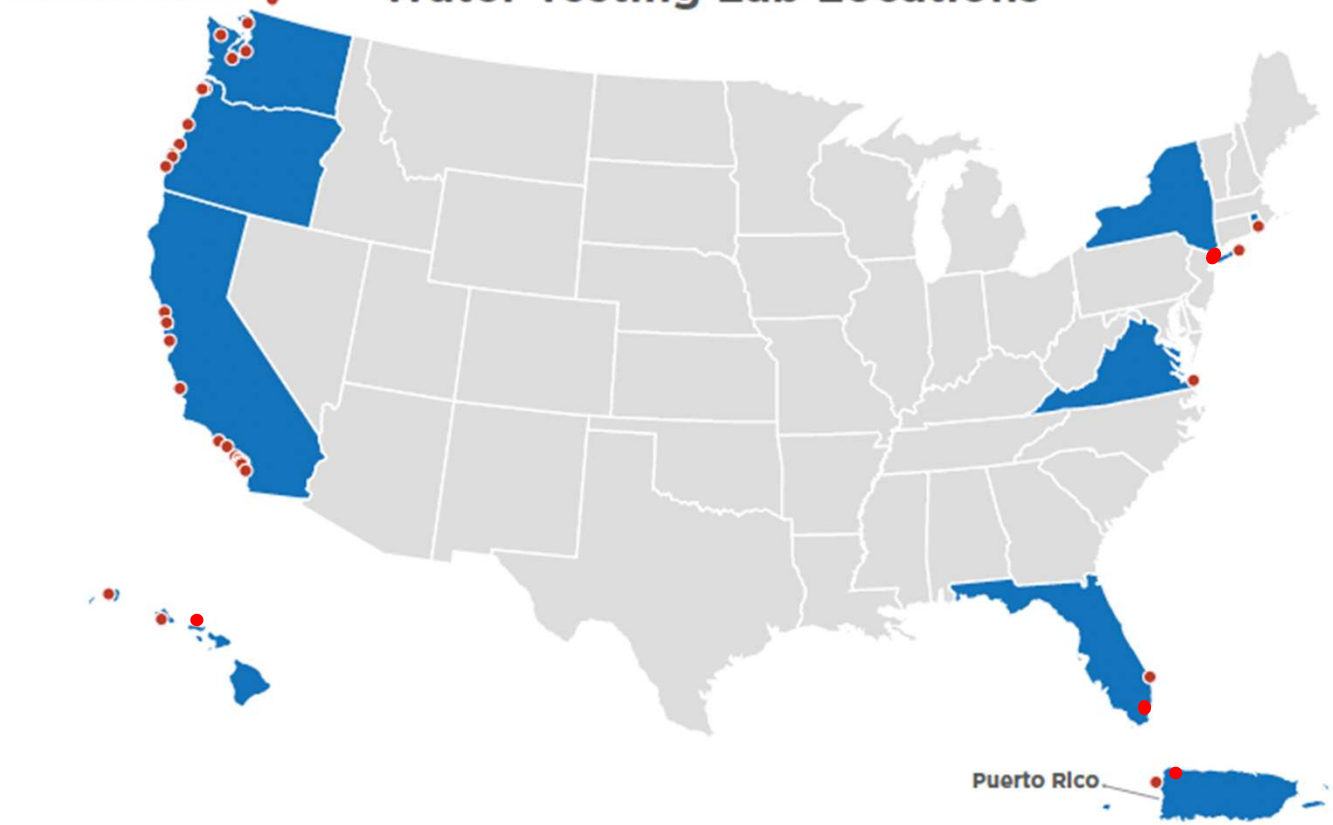
SURFRIDER FOUNDATION

Blue Water Task Force

Surfrider's volunteer water testing program.

Operating through a national network of 40+ labs, BWTF citizen scientists are providing critical water quality information to protect public health at the beach, raise awareness of local pollution problems and to bring together communities to implement solutions.

Blue Water Task Force
Water Testing Lab Locations



Chapter-run BWTF Labs

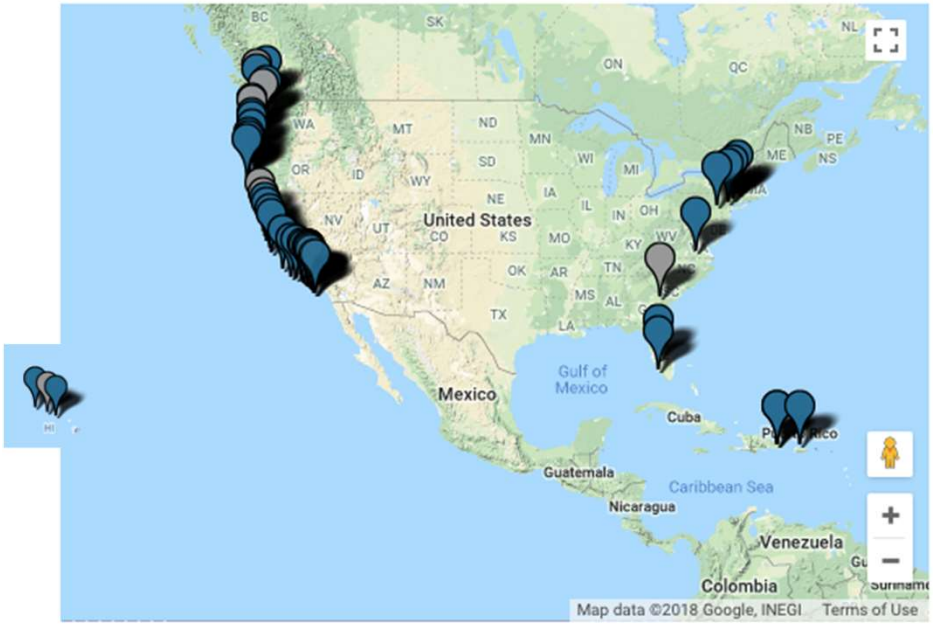
- Chapter maintained labs often using borrowed space from local partners
  - Other local env groups, aquariums, universities
- Collect samples for partner organizations & help communicate data
  - State & local beach programs, & other watershed groups
- School & youth programs

Blue Water Task Force

- Test ocean & bay beaches and freshwater sources
  - Creek & river mouths
  - Stormwater discharge
  - Upper watershed sites
- Sampling plans complement agency-run beach programs
  - Fill in temporal & geographical data gaps, cover popular surf spots, & sources of pollution
- Measure Enterococcus Bacteria – indicator of fecal pollution and public health risk

http://www.surfrider.org/blue-water-task-force

Intro | Resources | Recent Blog Posts | Contact



WATER TESTING LABS

CALIFORNIA:

- Huntington Beach
- Isla Vista
- Marin County
- Mendocino County
- Monterey
- Newport Beach Chapter-Corona Del Mar HS
- Newport Beach Chapter-Esperanza HS
- Newport Beach Chapter-Mater Dei HS
- Newport Beach Chapter-Newport Harbor HS
- Newport Beach Chapter-Northwood HS
- Newport Beach Chapter-Orange HS
- Newport Beach Chapter-Valencia HS
- Newport Beach Ocean Quest
- San Clemente HS
- San Diego
- San Luis Obispo
- San Mateo County
- Santa Cruz

Easy to Share Data from BWTF website

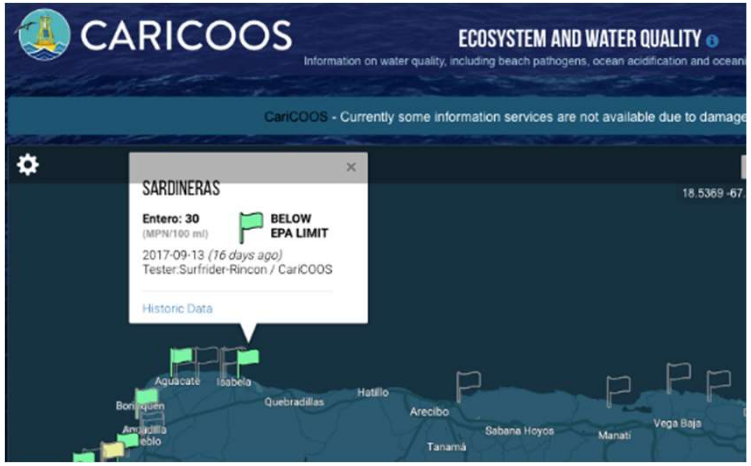
SHARE

LOCAL INFORMATION

SAMPLE SITE	TEST DATE	ENTERO	INDICATION OF
San Luis Creek Mouth	3-8-18	20	Low Bacteria
San Luis Obispo Creek #3	3-8-18	52	Medium Bacteria
San Luis Obispo Creek at San Luis Bay Dr. #2	3-8-18	216	High Bacteria
San Luis Obispo Creek Estuary	3-8-18	122	High Bacteria

Elevation of Citizen Science: Increased Visibility and Use of Volunteer Data

- https://scistarter.com
- http://www.caricoos.org - MARACOOS, NANOOS
- https://www.theswimguide.org



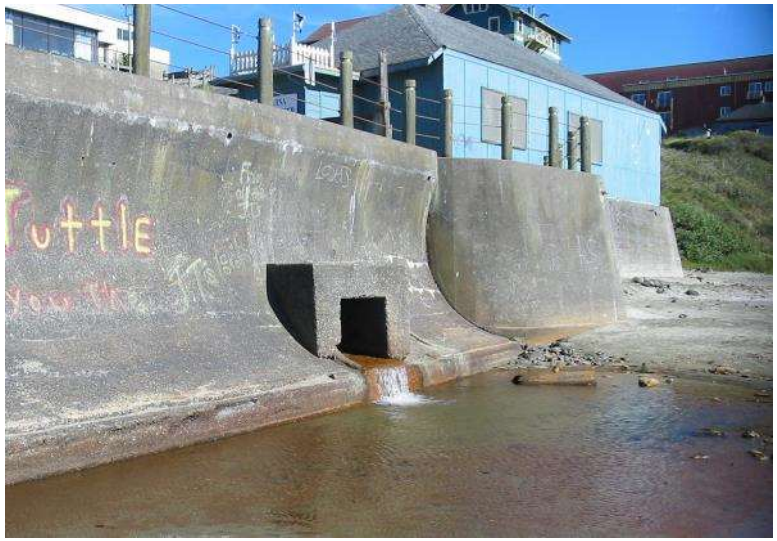
Community Presentations, Workshops & Education Programs

Surfrider Foundation's Blue Water Task Force

Bringing together coastal communities to protect clean water

Newport, Oregon

- Lab at Oregon Coast Aquarium
- BWTF High Bacteria Counts at Nye Creek & Nye Beach
- City posted signs & State started testing
- DEQ started testing



Newport, Oregon

- Smoke tests revealed sewer misconnects
- Wetland restoration projects
- Stormwater utility established & stormwater BMPs codified by City
- Bacteria levels improved at Nye Beach & Creek

2015 Bacteria Levels Increase

- DEQ & Surfrider data confirm problems
- City prompted study to sample upstream in creek and stormwater system

Blue Water Scholar Internship

- Surfrider, Oregon Coast Aquarium, City of Newport & Oregon Community Foundation

Fresh Pond Creek, Peconic Bay

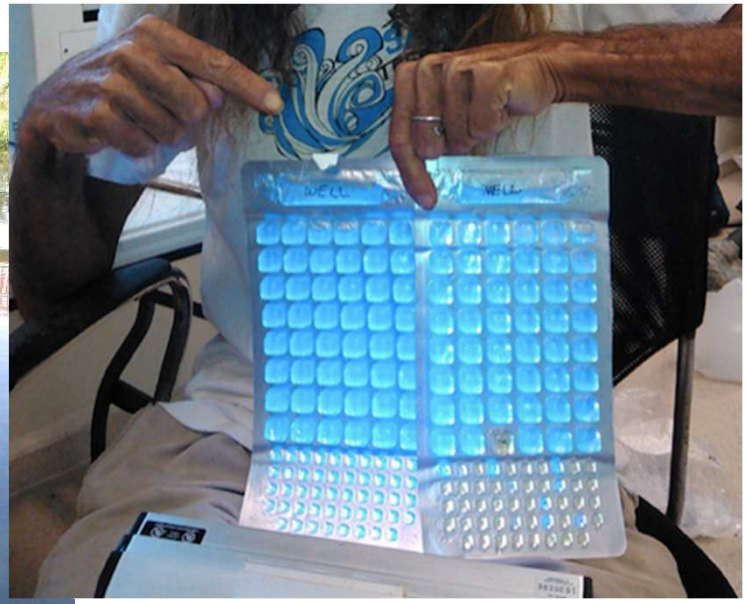
Eastern Long Island, NY

Surfrider Rincon, Puerto Rico

Post-Maria Water Sampling Program

- Days, weeks & months after Hurricane Maria: electricity, potable water, communications and travel were challenging.
- Rincon BWTF has established a strong reputation & many community partners over last decade.
- 1 month post-storm, BWTF lab re-located to Costa Salud Health Center with generator powered electricity.
- Weekly sampling of beaches resumed, conditions mostly good. Sewage infrastructure problems reported.

Rincon BWTF starts freshwater sampling program



E. coli testing using Aquagenx Compartment Bag Tests

Adapting to challenging conditions

Intro | **Resources** | Recent Blog Posts | Contact

http://www.surfrider.org/blue-water-task-force

Frequently Asked Questions

Planning a Water Testing Program

2016 Clean Water Annual Report, 2015 CW Report , 2014 BWTF Annual Report , 2013, 2012, 2011

Water Sampling Instructions & Sampling Data Sheet

BWTF Lab Instructions for IDEXX Quantitray/Enterolert method

MPN Table for the Quantitray Sealer

How-to videos posted by IDEXX for using the Quantitray Method with Enterolert or Colilert

Video demonstrations of Water Sampling Technique & Water Sample Preparation in the lab

How to Communicate Blue Water Task Force Data

Safe Waters, Healthy Waters: A Guide for Citizen Groups on Bacteria Monitoring in Local Waterways, Center for Watershed Protection

Volunteer Bacteria Monitoring Program Guide, Neighborhood Water Watch, Chattahoochee Riverkeeper

Thank you!
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Resources

- **National Water Quality Monitoring Council**
  - https://acwi.gov/monitoring/vm/resources.html

- **USA Volunteer Water Monitoring Network**
  - http://volunteermonitoring.org/

- **Listserves:**
  - The EPA volunteer monitoring listserve: To subscribe, send a blank email message to volmonitor-subscribe@lists.epa.gov
  - The extension listserve: https://list.uvm.edu/cgi-bin/wa?SUBED1=EXTVOLMONNETWORK&A=1
  - Citizen Science Association: http://citizenscience.org/elist/

National Water Quality Monitoring Council
Working together for clean water

www.volunteermonitoring.org

volunteermonitoring.org

Apps NSF Summary Page

UVM Blogs

Publications

This page was developed to provide Volunteer Monitoring Program Coordinators with easy access to a number of relevant publications for planning and carrying out effective programs. If you know of other relevant publications that should be linked from this site, please let us know!

Photo Credit: St. Louis Riverwatch

Getting Started in Citizen Monitoring

- Getting Started in Volunteer Monitoring, Extension National Water Resource Project (2003)
- Guide to Citizen Science, London Natural History Museum and The Biological Records Centre (2012)
- Guide to Volunteer Watershed Monitoring Options in the Merrimack River Watershed,Volunteer Environmental Monitoring Network (1996)
- Monitoring Equipment Suppliers
- Riparian and Aquatic Ecosystem Monitoring: A Manual of Field and Lab Procedures,

SEARCH

UPCOMING EVENTS

European Citizen Science Association Conference, June 3-5, 2018, Geneva, Switzerland

Questions?

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