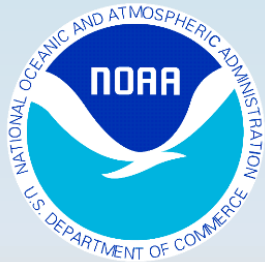


Improved Forecasts of Respiratory Illness Hazard from Gulf of Mexico *Karenia brevis* Red Tide: 2019 NASA Public Health update

¹Rick Stumpf, ²Barbara Kirkpatrick,
¹Wayne Litaker, ²Robert Courier,
¹Shelly Tomlinson, ¹Andrew Meredith,
⁴Tracy Fanara, ³Andy Reich

¹NOAA, ²Gulf of Mexico Coastal Ocean Observing System,
³Florida Department of Health, ⁴Mote Marine Laboratory



Karenia brevis red tide, 2018

The New York Times

Video of Casey Key, Florida, Before (June 2018) and During (August 2018) Red Tide
(video courtesy of Cody Johnson, @codesthedrones)

UPDATE


A Red Tide on Florida's Gulf Coast Has Been a Huge Hit to Tourism

Though an algae bloom on the coast is improving, locals and business owners say it may be too little, too late.



<https://coastalscience.noaa.gov/news/nccos-research-and-support-in-response-to-red-tide/>

Why does this matter?

 Health » Florida's toxic algae problem and your health: 'Red tide' and 'green slime'

Story highlights

Algae produce toxins that can cause a host of symptoms in humans at high concentrations

These toxins may be inhaled or ingested in contaminated water and seafood

(CNN) — When Marcy Cornell's toddler son "couldn't breathe" on the first day of their recent Florida vacation, she took him straight to the emergency room.

"Before they even asked me anything else ... they said, 'Did you go to the beach today?' " she recalled.

Doctors said her son had upper airway inflammation

"brought on by the red tide," she said.

Florida's toxic algae problem and your health: 'Red tide' and 'green slime'

By Michael Nedelman, CNN
Updated 2:00 PM ET, Sat August 18, 2018



Effect of Exposure to brevetoxins

Asthmatics 9% of population

One hour walk on the beach during a red tide; 5 days for pulmonary function to return to baseline

54% increase in ER respiratory (asthma, pneumonia, bronchitis)

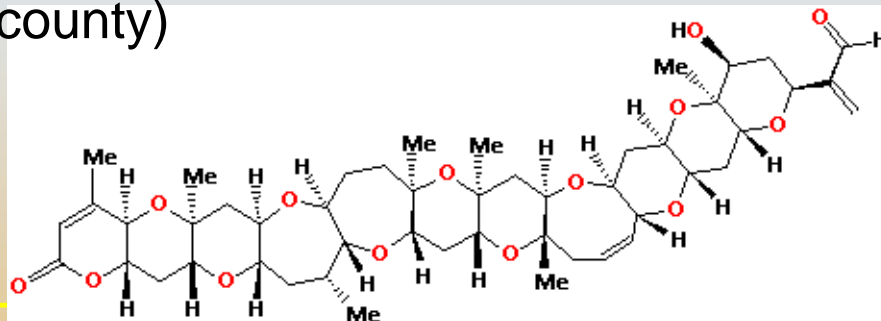
19% increase in pneumonia

40% increase in GI ER admissions

Sarasota County alone, ER costs increase up to \$4 million, depending on bloom severity

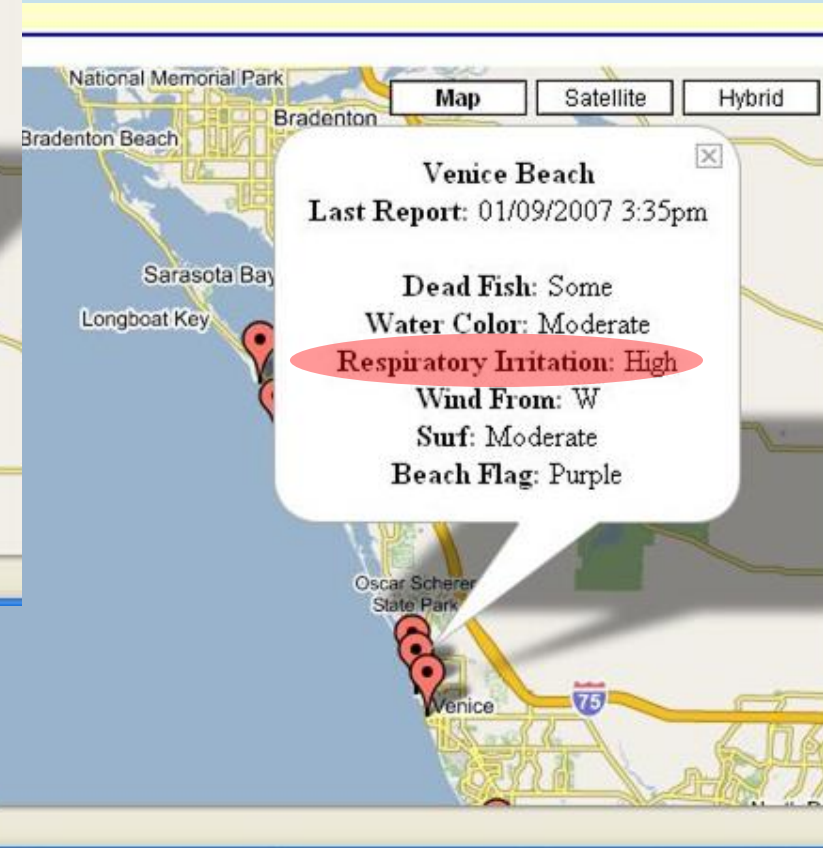
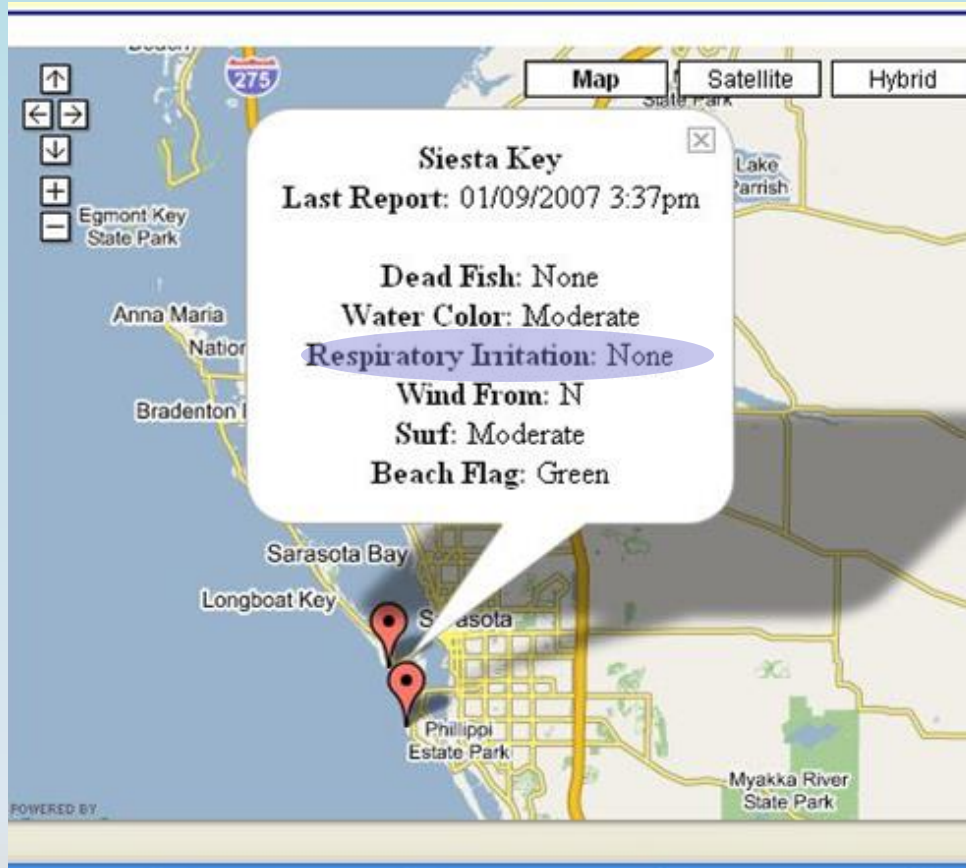
Lifeguards (occupational healthy group) - no pulmonary function normal effect

Loss revenue to area businesses (\$6 million/month per county)



Cell concentration patchy from beach to beach

~10 km apart



Impact changes with cells and wind direction

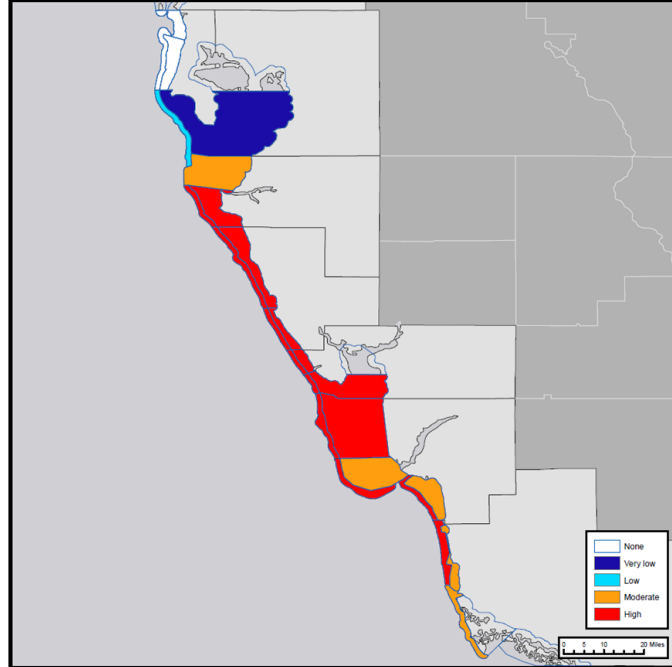
Parts of current NOAA Bulletin



Gulf of Mexico Harmful Algal Bloom Bulletin

Monday, August 20, 2018
 NOAA National Ocean Service
 NOAA Satellite and Information Service
 NOAA National Weather Service

Instructions for viewing this geospatial pdf are available at: <https://go.usa.gov/xn9g2>.



In the map above, the highest level of potential respiratory irritation forecast is displayed as a layer for each day from 08-20-18 to 08-23-18. See next page for a table of the respiratory irritation forecasts.

Region: Southwest Florida



Conditions Report

Not present to high concentrations of *Karenia brevis* (commonly known as red tide) are present along-and offshore portions of southwest Florida, and not present in the Florida Keys. *K. brevis* concentrations are patchy in nature and levels of respiratory irritation will vary locally based upon nearby bloom concentrations, ocean currents, and wind speed and direction.

Recently Reported Impacts (Listed by County):

Respiratory irritation: Manatee, Sarasota, Lee, and Collier
Dead fish: Manatee, Sarasota, Charlotte, Lee, and Collier

Definition of respiratory irritation levels.

RESPIRATORY IRRITATION LEVEL	AFFECTED POPULATION				
	NONE	CHRONIC RESPIRATORY CONDITION	SENSITIVE TO RED TIDE	GENERAL PUBLIC (MILD SYMPTOMS)	GENERAL PUBLIC (INTENSE SYMPTOMS)
None	X				
Very low		X			
Low		X	X		
Moderate		X	X	X	
High		X	X	X	X

Additional Resources

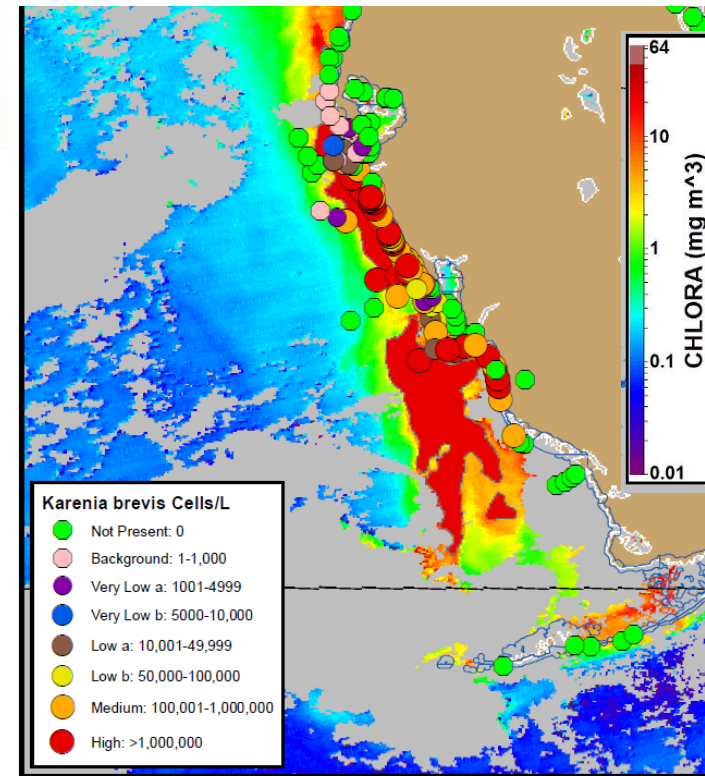
Health Information:

Florida Department of Health:
<http://www.floridahealth.gov/environmental-health/aquatic-toxins/red-tide.html>

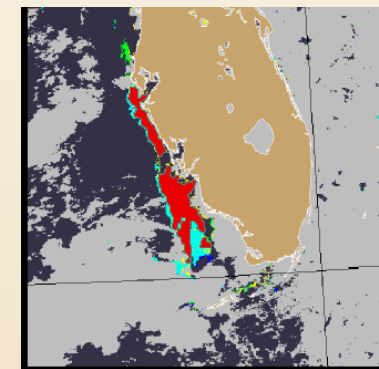
Other resources: <https://go.usa.gov/xQNWp>

Recent, Local Observations and Data:

Mote Marine Laboratory Daily Beach Conditions:
<http://visitbeaches.org>
Florida Fish and Wildlife Conservation Commission:
<http://myfwc.com/redtidestatus>



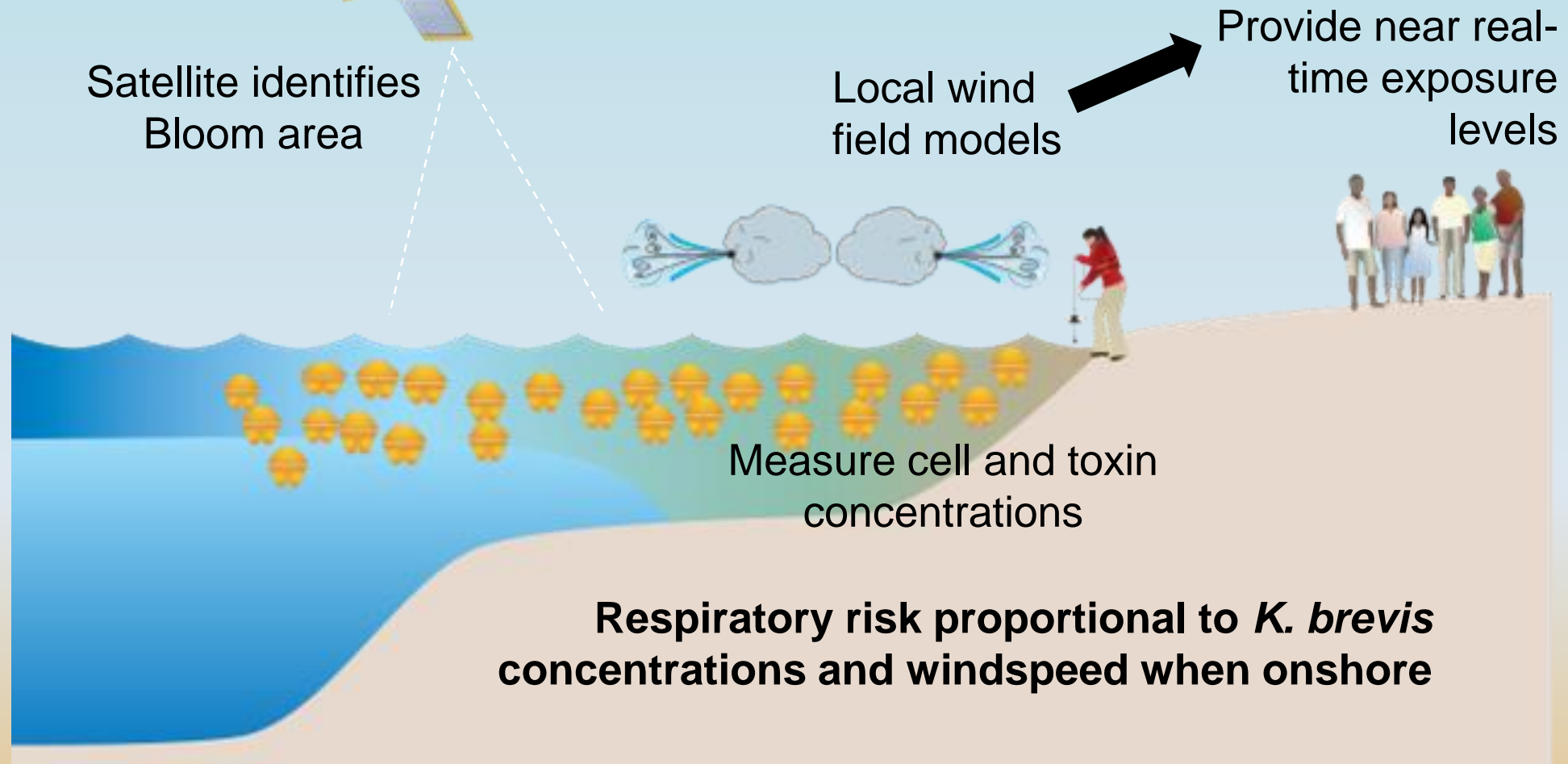
Karenia brevis cell concentration sampling data from: 08/10/18 through 08/17/18.



Verified and suspected HAB areas shown in red. Other areas with *K. brevis* optical characteristics shown in yellow (see p. 4 analysis for interpretation).

Respiratory forecast is over entire county only twice a week

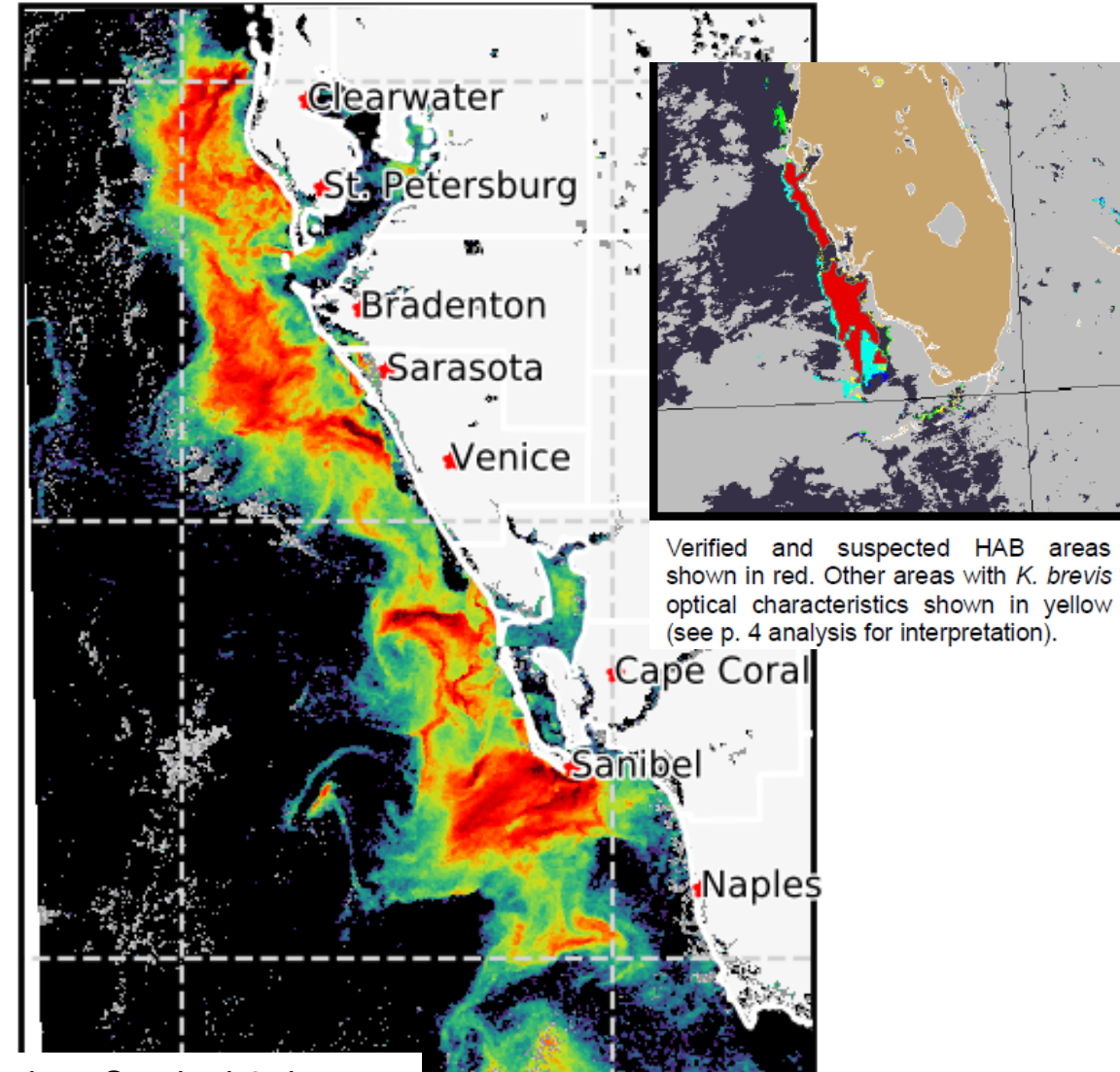
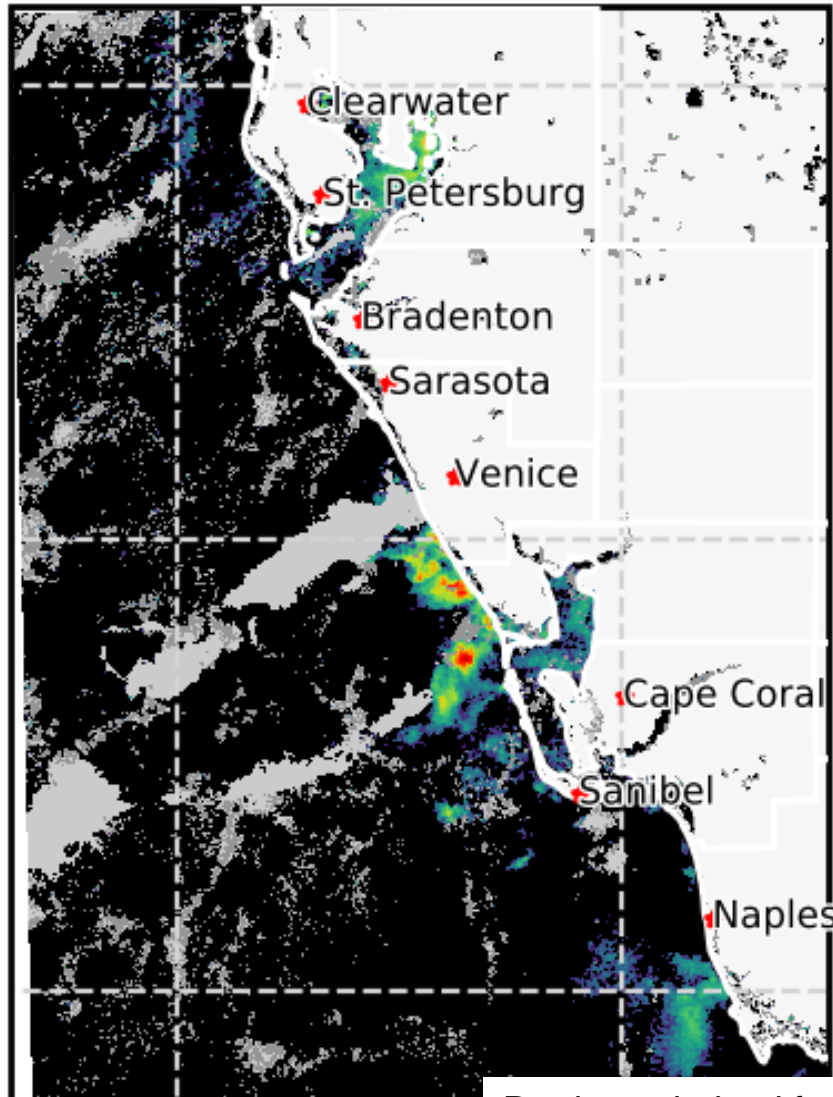
Strategy: Use satellite data to inform sampling to improve resolution with volunteer monitoring goal of “every beach, every day”



Karenia “red tide” satellite bloom comparison July and Sep 2018

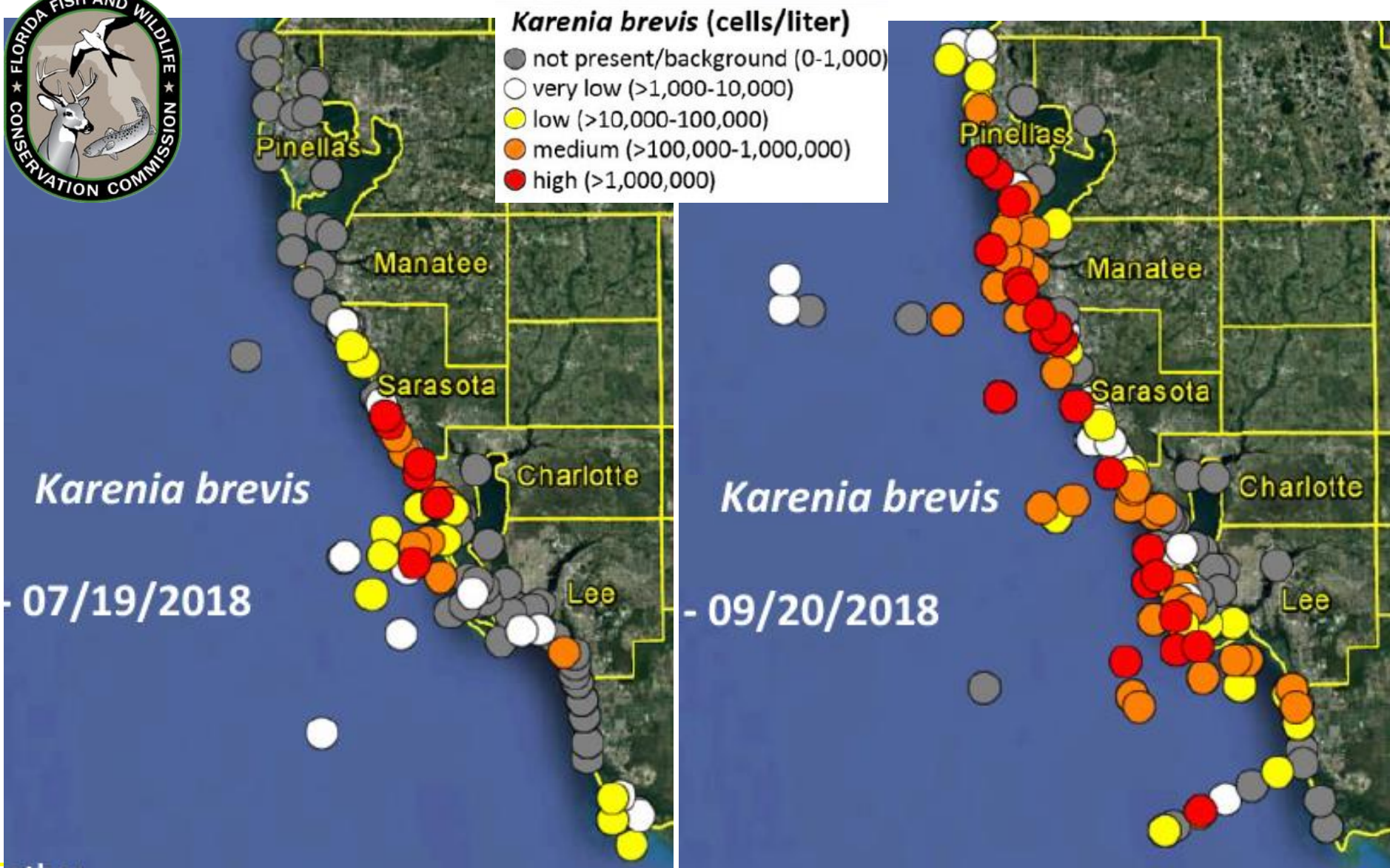
Image date: 2018-07-17

Image date: 2018-09-17

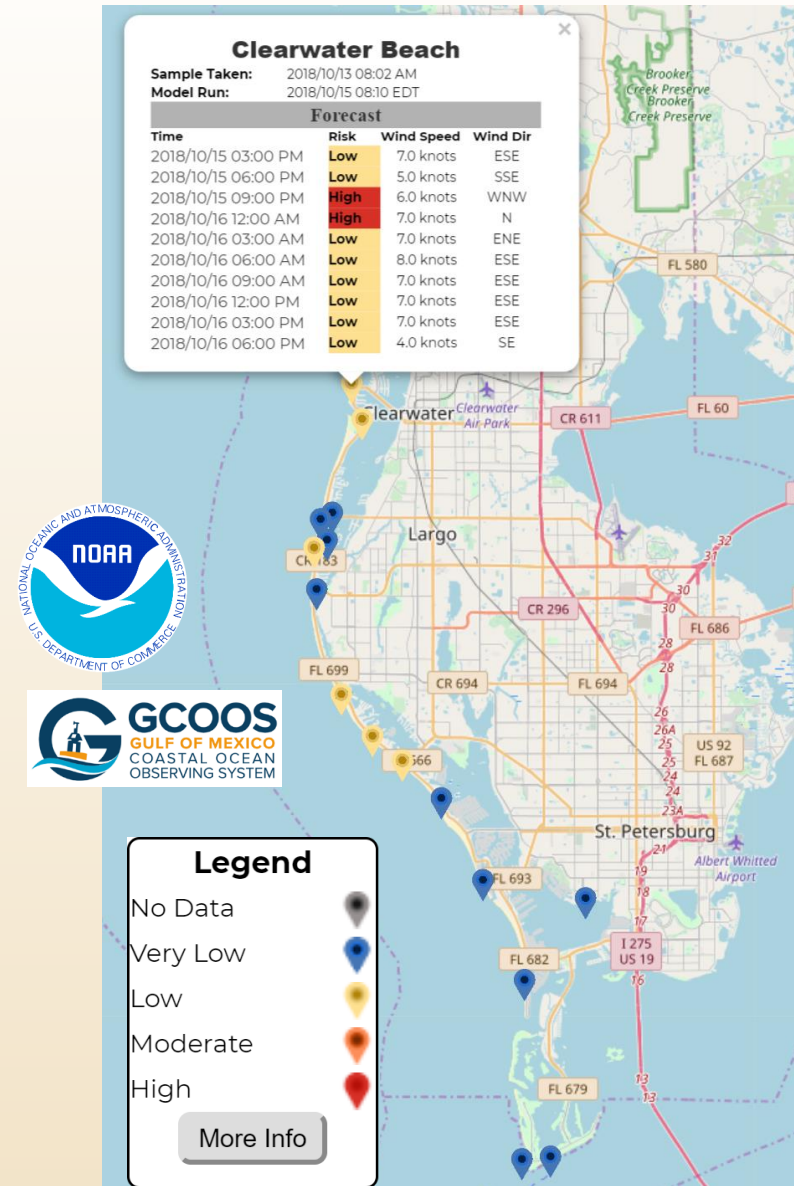
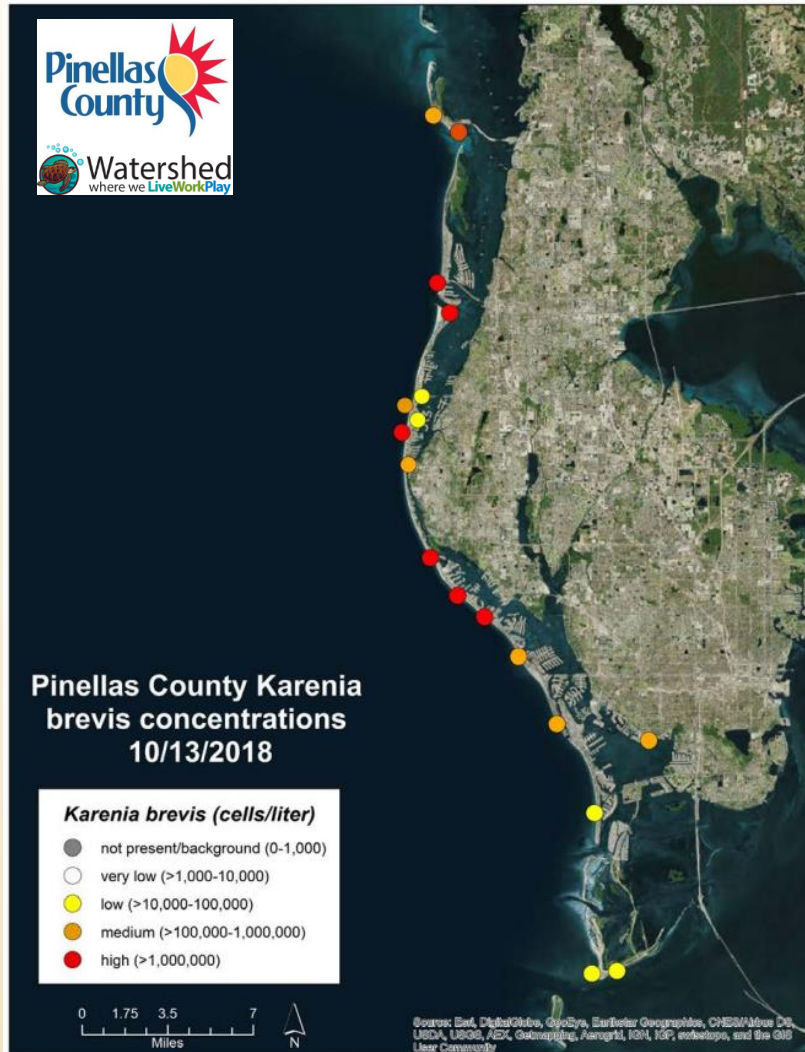


Products derived from Copernicus Sentinel-3 data

Karenia “red tide” bloom comparison July and Sep 2018

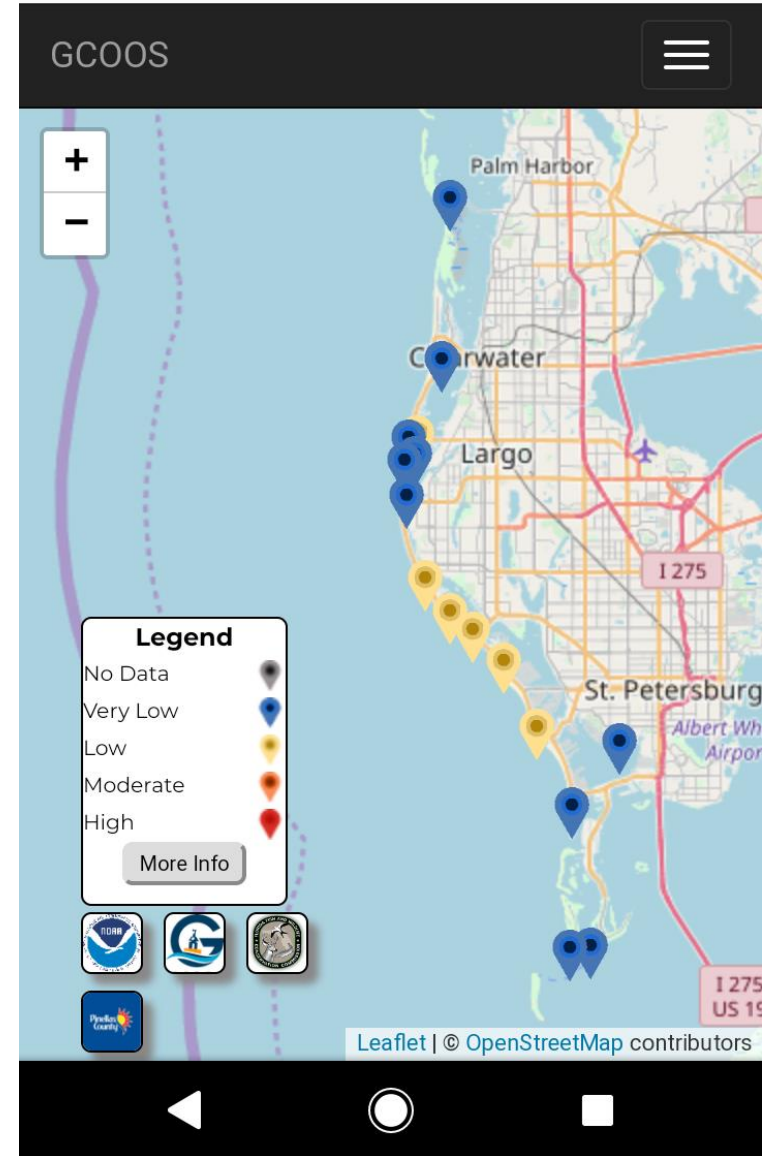
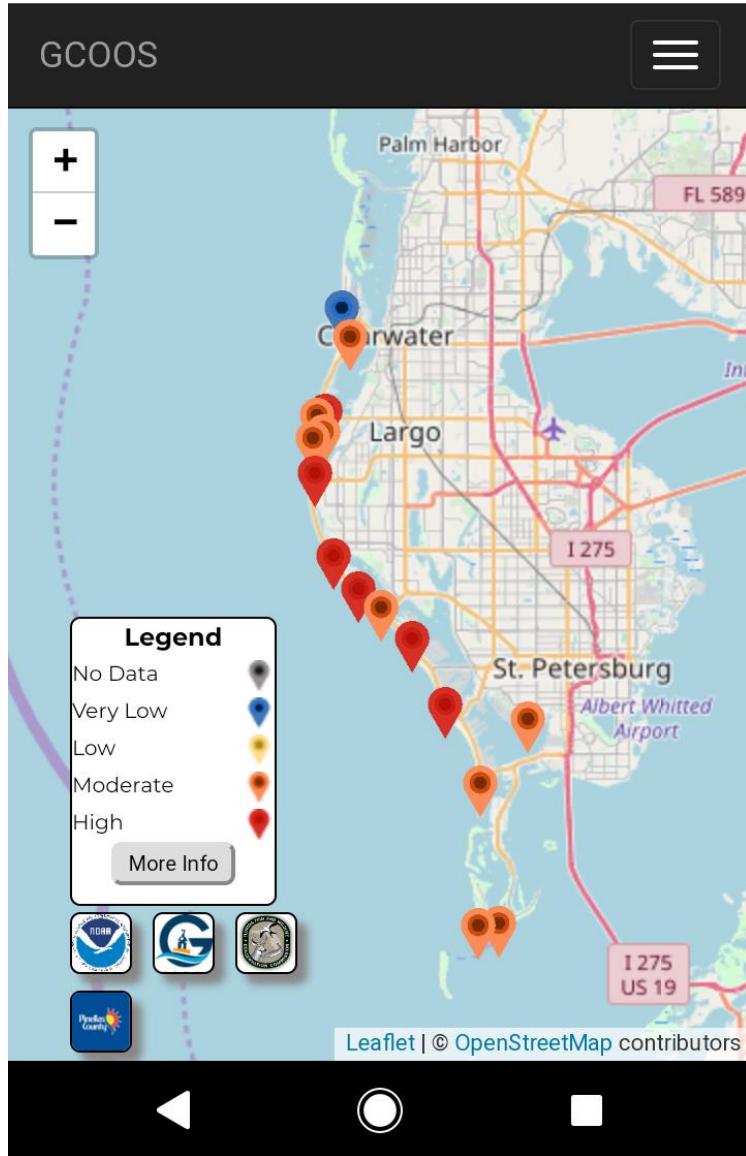


Respiratory Forecasts ARL 7-8 Experimental respiratory forecast <https://habscope.gcoos.org/>



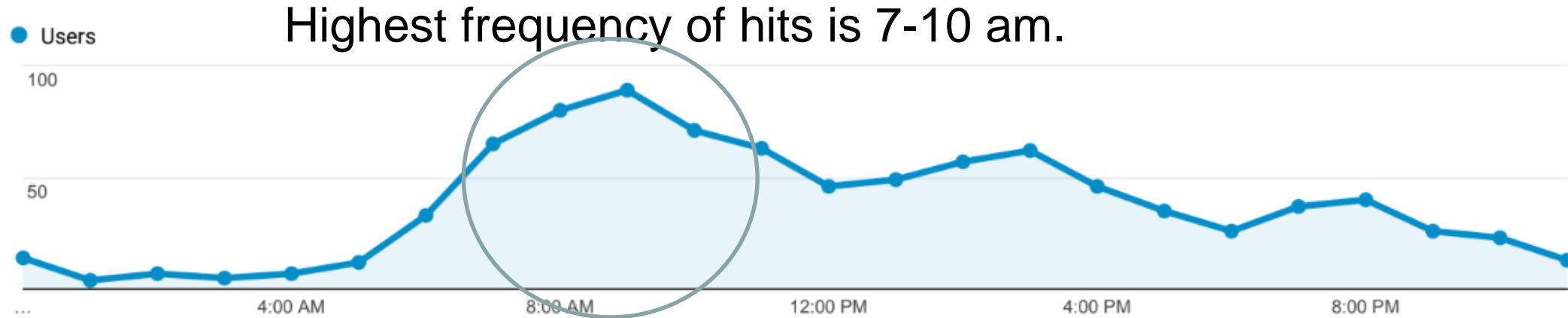
Pinellas County is onboard with forecasts: ARL 8

Example forecast change during day

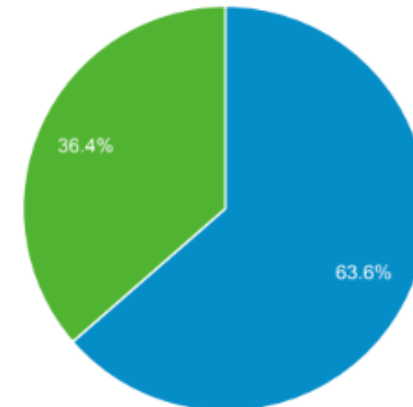


Public use of forecasts

Overview



■ New Visitor ■ Returning Visitor



HABscope

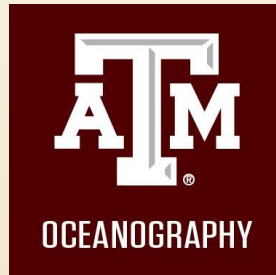


1 Components Illustration

1 Eyepiece WF10X	14 Focusing Rack Stop Screw
2 Diopter Adjusting Ring	15 Coarse Focus Knob
3 Eyepiece Tube	16 Fine Focus Knob
4 Nosepiece	17 X-Y Stage Moving Knobs
5 Objective	18 Power Switch
6 Slide Holder	19 Brightness Intensity Dial
7 Mechanical Stage	20 Immersion Oil
8 Light Collector	21 Dust Cover
9 Microscope Base	22 Condenser Lock Thumb Screw
10 Eyepiece WF20X	23 Condenser Control Knob
11 Color Filter	24 Condenser
12 Viewing Head	25 Color Filter Holder
13 Microscope Body	26 Iris Diaphragm Lever

HABscope Quick List:

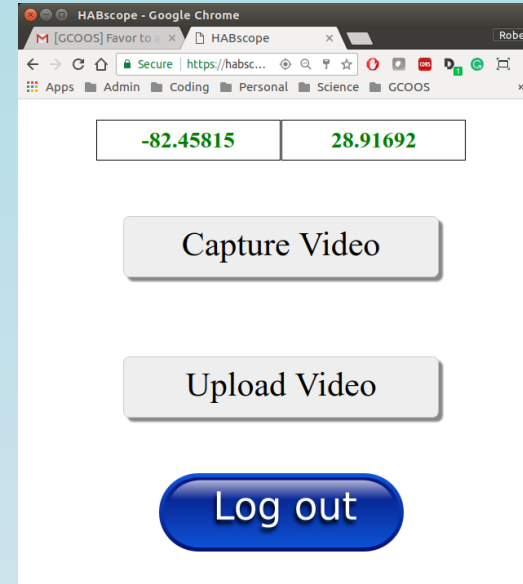
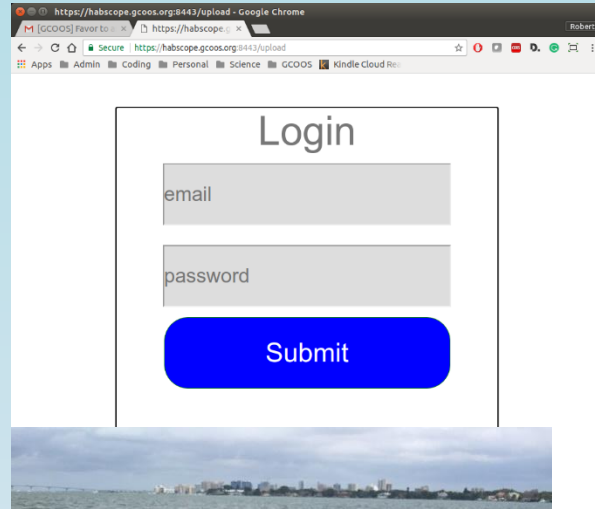
1. Place exactly 3 drops of sample on slide.
2. Condenser must be at the highest possible setting to avoid crystallization.
3. Scope brightness should be at maximum intensity.
4. Begin with the diaphragm lever all the way to the right (closed position) and slide it back slightly to the left (open) until there is a crisp black circle around your field of view.
5. Adjust zoom so that the knob appears directly above the "e" in video, or roughly 55%.
6. Use fine and coarse adjustment knobs to focus. (Living cells will move in and out of focus periodically).
7. Tap screen once to engage manual focus-lock.
8. Record 30 seconds. Avoid handling the HABscope during this time so as to prevent shaking in the video.
9. Select "Upload video". If all goes well you will see a smiling rainbow fish.
10. Document your experience in the HABlog.



Example video, worst case



HABscope Upload Ap working



HABscope - Google Chrome

Secure | https://habscope.gcoos.org/8443

HOME VIDEOS IT NASBA ABOUT TEAM CONTACT

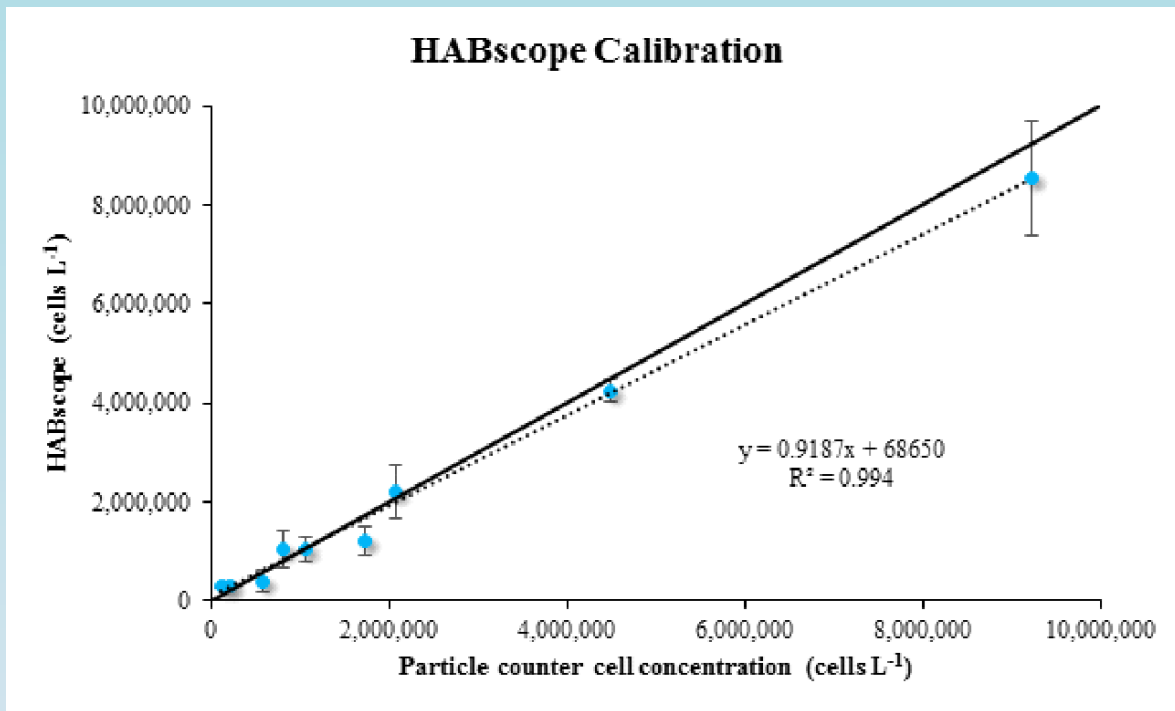
VIDEOS

Past 60 days. For historical data please use the Data Portal.












Timestamp (UTC)	Sentinel	Organization	Lat	Lon	Raw Video	Analyzed Video	Estimated c/L
Tue Sep 05 2017 15:05:14 GMT-0000 (UTC)	Linda Powers	Mote	26.93296	-82.36493			120000
Tue Sep 05 2017 13:51:59 GMT-0000 (UTC)	Sia Maleknasri	Mote	27.46240	-82.65463			0
Fri Sep 01 2017 12:07:01 GMT-0000 (UTC)	Cindy Polzer	Mote	27.07906	-82.45255			120000
Fri Sep 01 2017 11:16:42 GMT+0000 (UTC)	Cindy Polzer	Mote	27.05909	-82.38917			0
Thu Aug 31 2017 15:19:31 GMT-0000 (UTC)	Lindsey Flynn	CMA	27.97723	-82.81944			120000
Thu Aug 31 2017 15:13:34 GMT-0000 (UTC)	Lindsey Flynn	CMA	27.97734	-82.81943			120000
Tue Aug 29 2017 13:25:11 GMT-0000 (UTC)	Linda Powers	Mote	26.93299	-82.36488			1156000
Tue Aug 29 2017 12:40:58 GMT-0000 (UTC)	Sia Maleknasri	Mote	27.46219	-82.65462			120000
Fri Aug 25 2017 14:51:42 GMT+0000 (UTC)	Tony TabEEK	Mote	27.97720	-82.81943			120000
Fri Aug 25 2017 14:43:04 GMT+0000 (UTC)	Tony TabEEK	Mote	27.97723	-82.81937			120000
Fri Aug 25 2017 10:47:05 GMT+0000 (UTC)	Cindy Polzer	Mote	27.07863	-82.45197			120000
Wed Aug 23 2017 12:09:24 GMT-0000 (UTC)	Tony TabEEK	Mote	27.26662	-82.55452			279000
Wed Aug 23 2017 12:05:02 GMT-0000 (UTC)	Tony TabEEK	Mote	27.26675	-82.55467			348000
Wed Aug 23 2017 10:41:20 GMT+0000 (UTC)	Cindy Polzer	Mote	27.08005	-82.45242			0
Tue Aug 22 2017 15:14:53 GMT-0000 (UTC)	Linda Powers	Mote	26.93300	-82.36487			120000

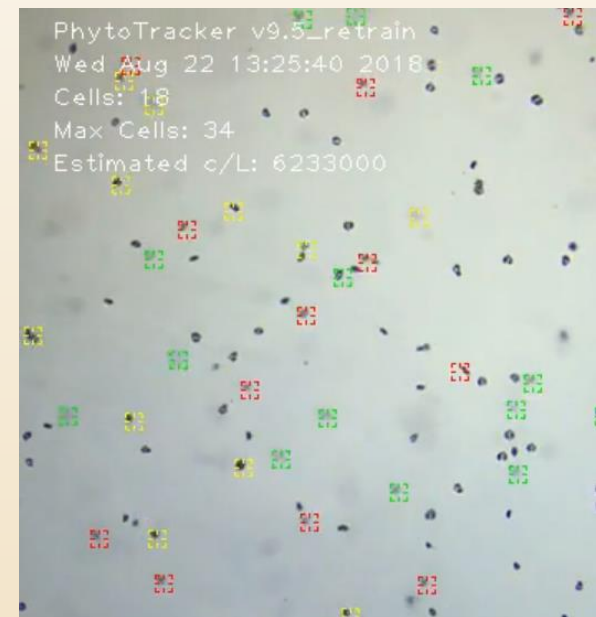
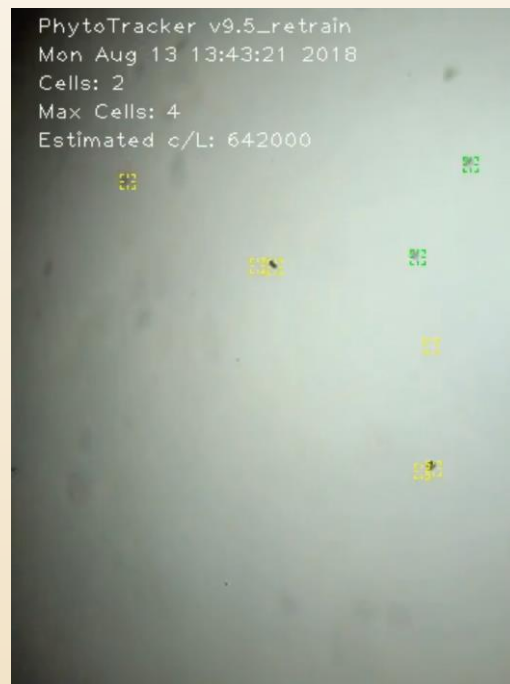
Validation

Hardison et al.,
PLoSone 2019

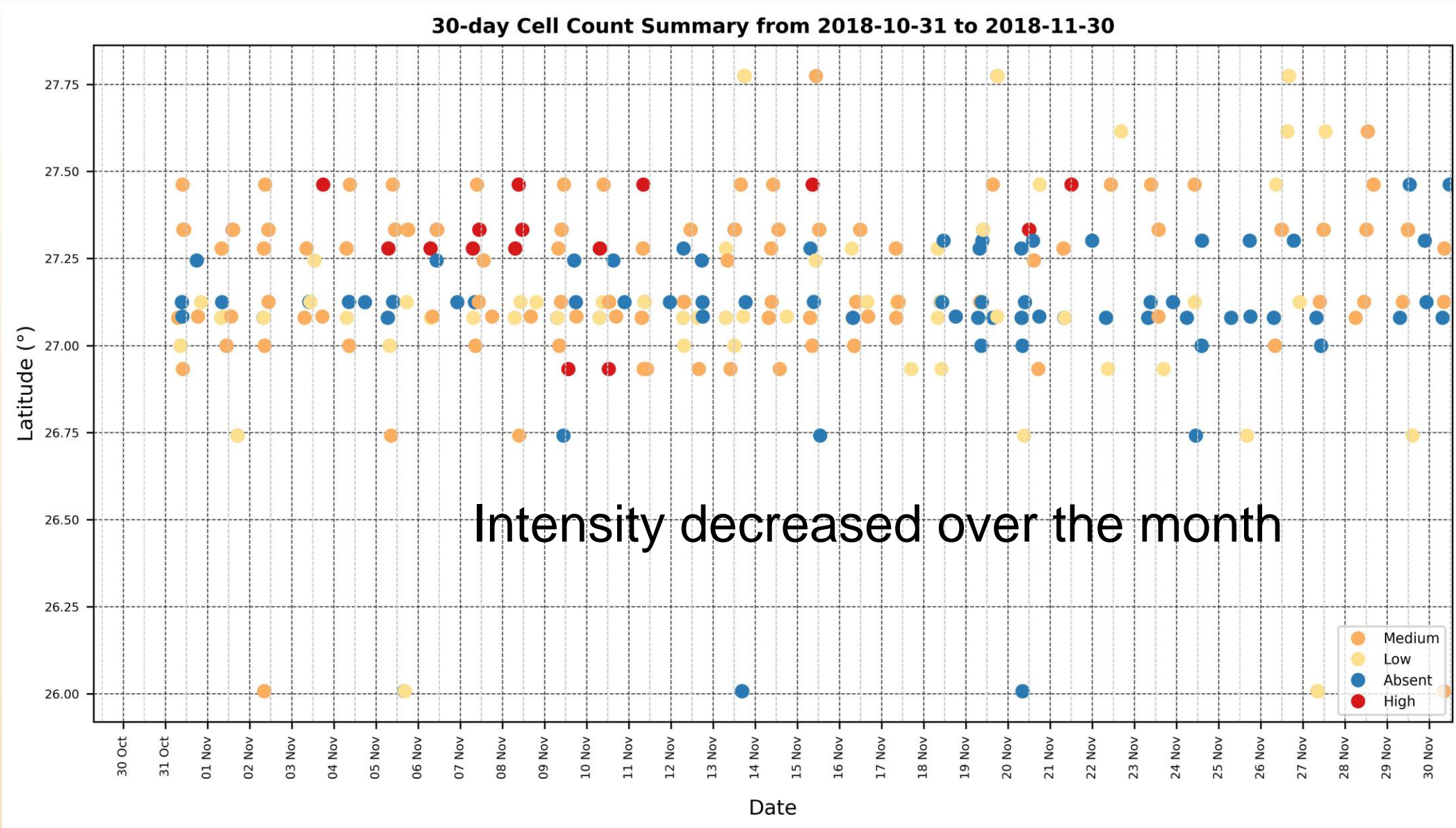


Video assessment

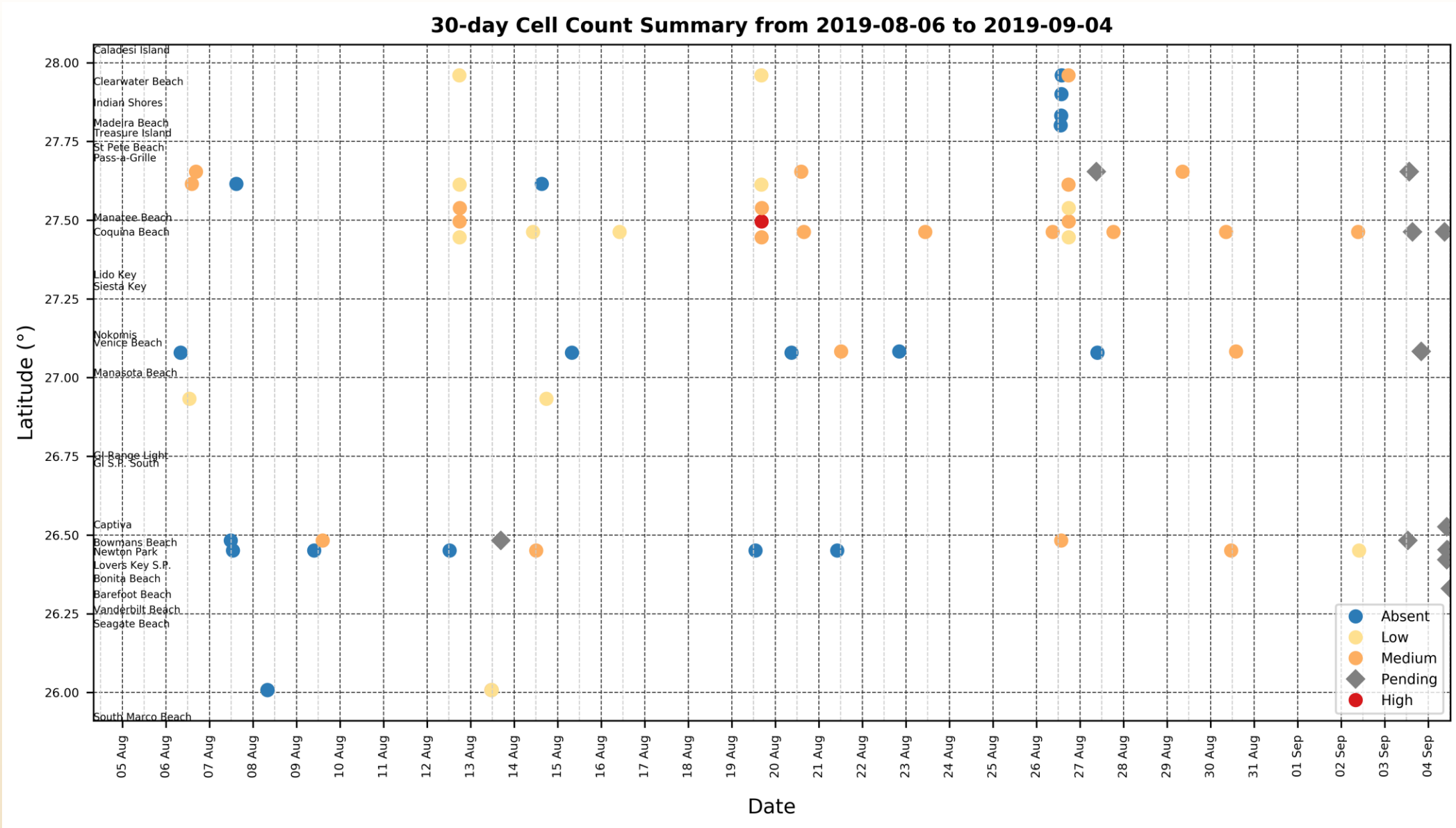
Timestamp (UTC)	Site	GPS	Video	Status	Analyst	HABscope c/L	Manual c/L	Admin
2018-09-08 18:53:35	Little Sarasota Bay	-82.5173 27.2442		Pending		590000	0	
2018-09-08 18:52:27	Little Sarasota Bay	-82.5173 27.2442		Pending		590000	0	
2018-09-08 16:38:26	Venice Beach	-82.4524 27.0830		Pending		694000	0	
2018-09-06 13:42:18	Longboat Key	-82.6546 27.4625		Approved	Chris Holland	642000	0	
2018-09-06 13:15:06	NaN	-82.5774 27.3330		Approved	Chris Holland	50000	0	
2018-09-06 13:11:26	Manasota Key	-82.3648 26.9329		Overestimated	Chris Holland	642000	0	



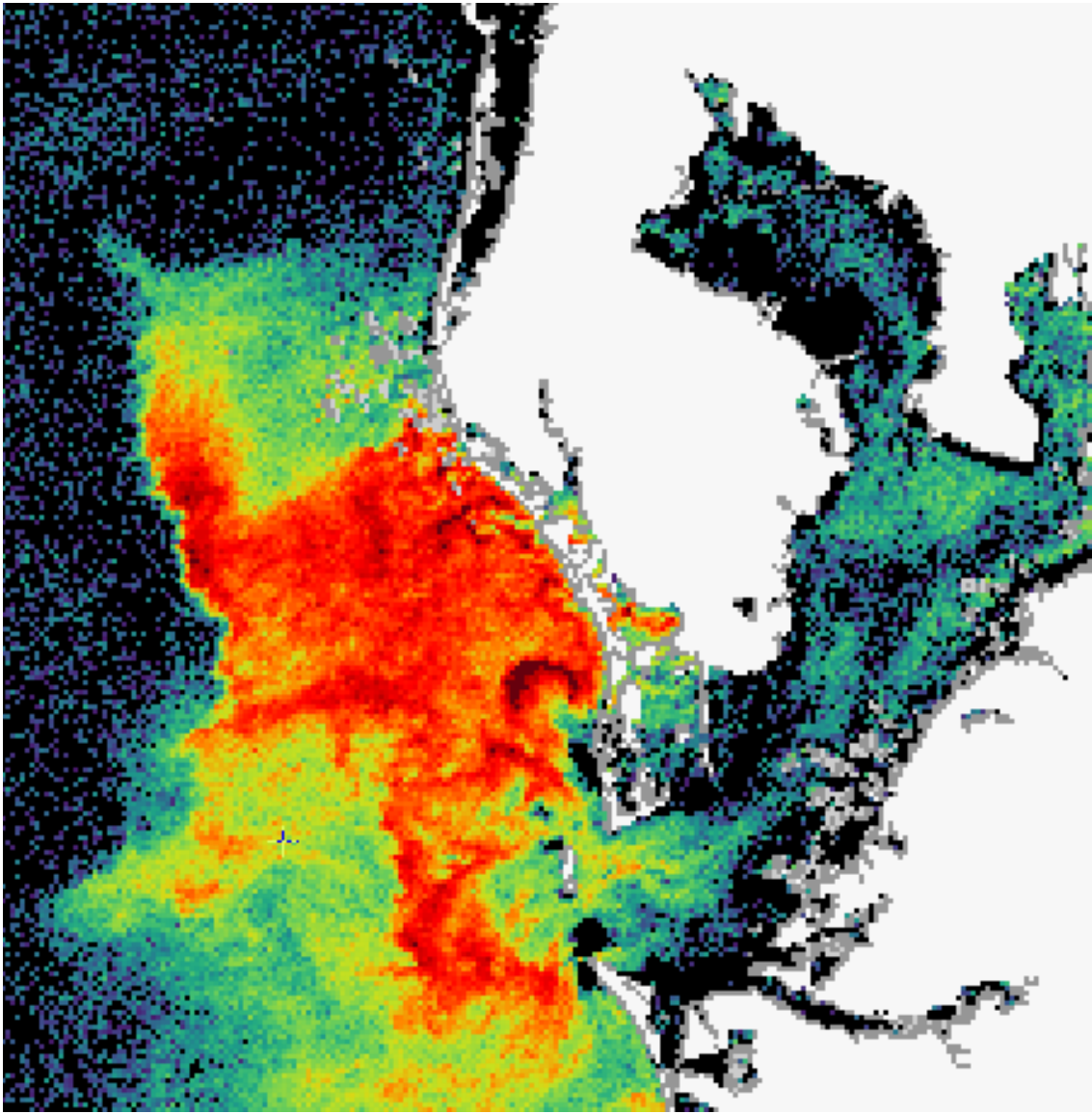
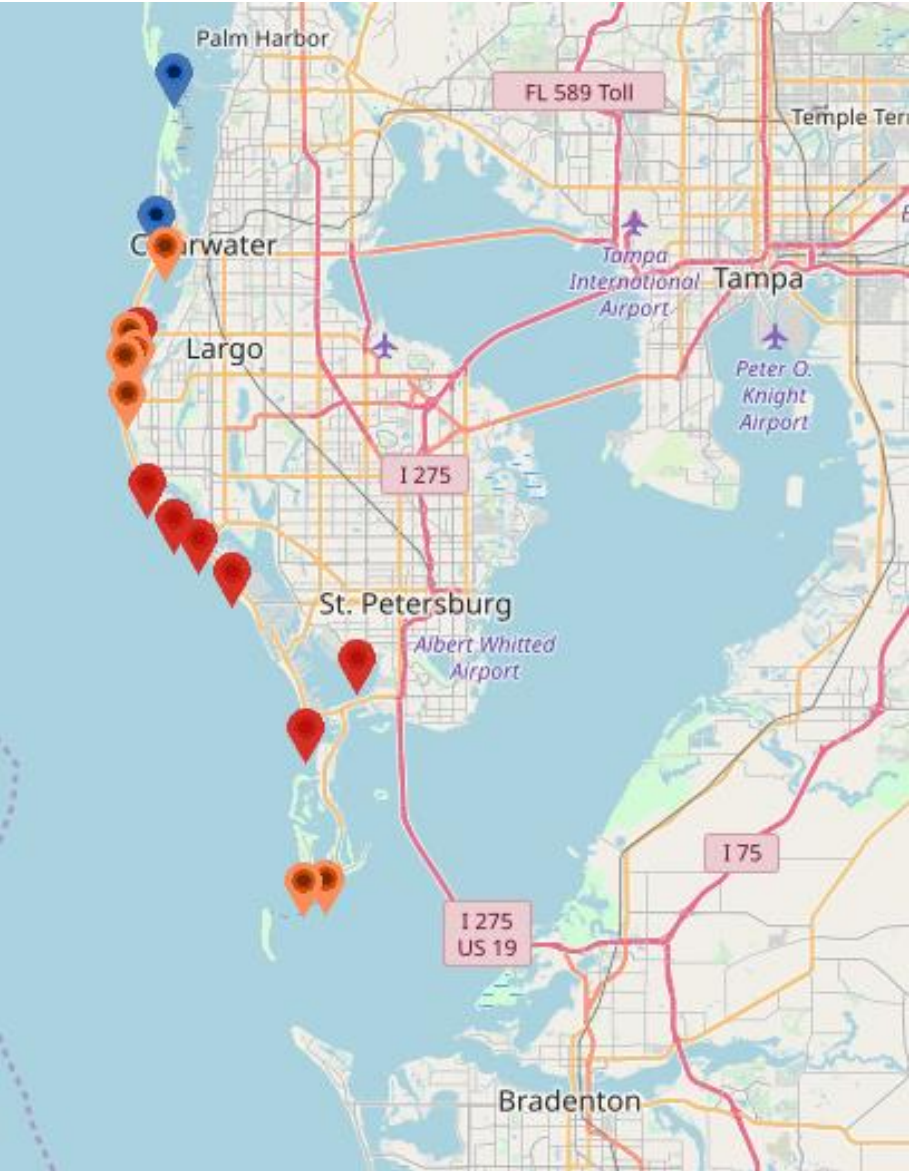
HABscope sampling frequency (Nov 2018)



HABscope sampling frequency in maintenance mode, Aug 2019



Oct 26 11 am nowcast, Oct 25 image, satellite may help fill in on clear days.



Milestones	2019 completion year
Started at ARL 3, Viability established Currently ARL 7 Potential demonstrated	Late 2019, ARL 8 functionality proven, included in county and state programs
Satellite Modeling Development (RS)	Satellite data being posted for state use
Forecast Creation (RS) Code developed, python based	Continue model validation, design “gap filling” for missing days
Integrate weather (NDFD) & data	Bring in other data to expand forecast. Lee County addition (Collier County likely)
Forecast Distribution (RS/BK)	Review of products,
Skill Assessment (RS)	Standardize skill assessment
Smartphone Communication (BK)	Maintain app
Community group recruit/training (BK)	Volunteer coordinator, Expand network
Training materials for sentinel groups and forecasters. (BK)	Update training material
End User workshops (BK)	Comment by a variety of users
Public outreach (BK)	Design media engagement

Risks to project

No risks at this time. ARL 7-8 completion.

GCOOS system up

NOAA NOS system

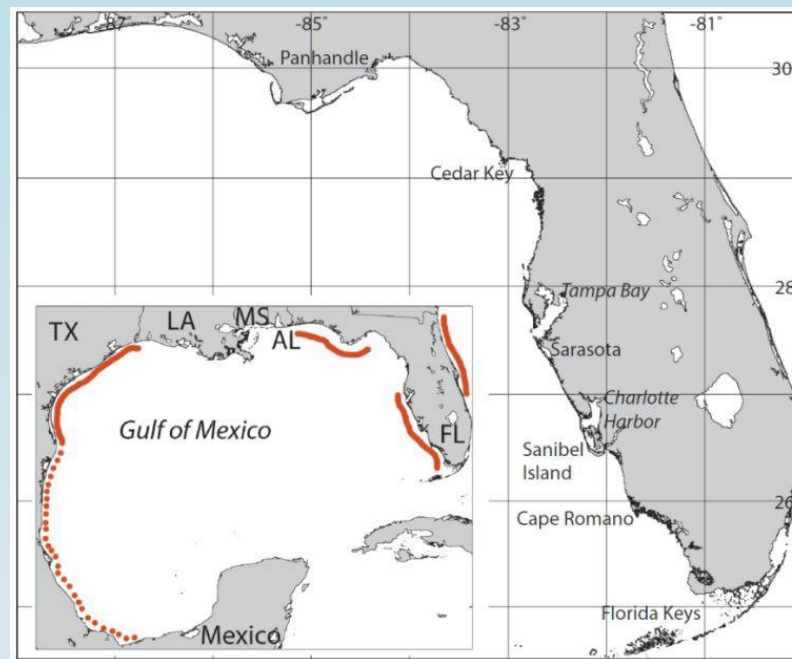
Florida (FWC) commitment to HABscope

County support

Routine validation of HABscope

Sentinel-3a/b missions nominal

Next year: Florida Sea Grant supporting liaison for outreach. additional extension.



Red indicates regions where *K. brevis* blooms adversely impact coastal communities most often.

Performance Metrics

Metric	Measures	
Forecast resolution	# of beaches during red tide	
Forecast frequency	# daily forecasts during red tide	
Skill	Accuracy of risk prediction	Accuracy of wind forecasts
Visibility	Number of Web hits, Feeds, # and freq. media outlets	# of media outlets and frequency
Training	Organizations trained in field program	Managers informed of products
Monitoring skill	Accuracy of volunteer beach reports	
Operational Efficiency	Total time per week required for forecasts	
End user satisfaction	Quantitative assessment Qualitative assessment Feedback/concern logbook	Initial and then ongoing annual



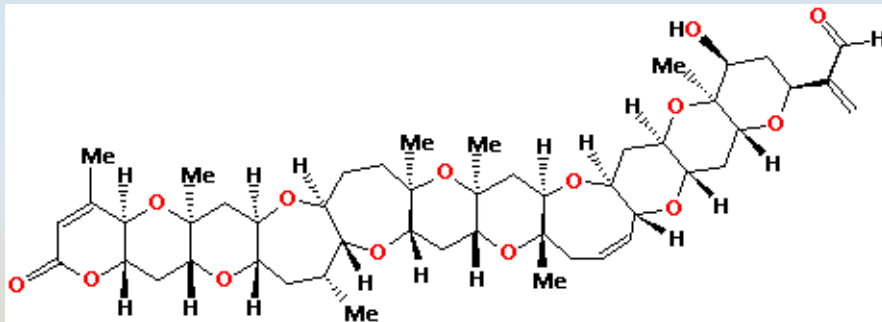
Questions

Richard.stumpf@noaa.gov

barb.kirkpatrick@gcoos.org



K. brevis cell



Brevetoxin structure