

An Early Advisement and Reporting System for Recreational Waters of the Southeast: Supporting Public Health and Economic Vitality

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**73rd Annual Mid-Atlantic Interstate Seafood Seminar
&
Gulf and South Atlantic States Shellfish Conference
6-8 November 2023 Wilmington, NC**

Outline

- * Who we are
- * Overview
- * Introduction
- * Goal and objectives
 - * Developing a tool
 - * Data integration and processing
 - * Forecast tools
 - * *How's the Beach* tool
- * Current status
- * Challenges, opportunities and looking ahead
- * Questions

Who we are

- * Funding (at various times) from NOAA, **SECOORA**, NPS, EPA, NIEHS and SCDHEC
- * Collaboration among:



NC STATE UNIVERSITY



Office for Coastal Management
NATIONAL ESTUARINE
RESEARCH RESERVES



Introduction



Golden Beach is one of three beaches where swimmers were being warned July 18, 2018, to stay out of the water because of high levels of fecal matter. Pedro Portal - pportal@miamiherald.com

MIAMI-DADE COUNTY

High levels of poop lead to swimming advisory at three South Florida beaches

BY CARLI TEPROFF
cteproff@miamiherald.com
July 18, 2018 07:15 PM
Updated July 18, 2018 07:23 PM

The Florida Department of Health in Miami-Dade County is warning people to think twice before swimming at three South Florida Beaches — Golden Beach, Crandon Beach North and Crandon Beach South.

Los Angeles Times

LOCAL U.S. WORLD BUSINESS SPORTS ENTERTAINMENT HEALTH STYLE TRAVEL OPINION SHOP

BREAKING PHOTOS VIDEO CRIME OBITUARIES WEATHER TRAFFIC CROSSWORDS SUDOKU HOROSCOPES APPS

Search

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Asia-Pacific Investments

Aberdeen-Asset LIS/Asia-Funds

Number of beach closures due to pollution rose last year, report says

Closures were up to their second-highest level in 20 years, the Natural Resources Defense Council study said, partly because of the Gulf of Mexico oil spill and heavy rains.

Introduction

CAUTION

A SWIMMING ADVISORY HAS BEEN ISSUED FOR THIS SECTION OF THE BEACH BY THE SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL. HIGH BACTERIA LEVELS HAVE BEEN DETECTED IN THIS BEACH AREA AND

SWIMMING IS NOT ADVISED

UNTIL BACTERIA LEVELS RETURN TO NORMAL. WADING, FISHING, AND SHELL COLLECTING DO NOT PRESENT A RISK.

D H E C

PROMOTE PROTECT PROSPER
South Carolina Department of Health
and Environmental Control

FOR INFORMATION ABOUT THIS ADVISORY
CONTACT YOUR LOCAL DHEC EQC OFFICE OR
CALL (803) 898-4015

CAUTION:

WATER QUALITY ADVISORY



FOR YOUR SAFETY

- Swim at your own risk
- Do not ingest lake water
- Shower after swimming
- Wash hands before eating
- Do not swim if you are ill

*Increased risk of illness may be present
Based on recent monitoring for E. coli bacteria*

FOR MORE INFORMATION:
1-800-441-4636 ext. 1500 www.wibeaches.us



CAUTION

Xin Lưu Ý! CUIDADO 小心

NO SWIMMING

Cấm Bơi Prohibido Nadar 不許游泳



NO WADING

Cấm Lội Prohibido Bañarse 不許涉水



A health advisory has been posted based on monitoring results. The current conditions at this beach are not suitable for recreational water activities. Small children and chronically ill people are at higher risk for increased illness.

360-407-6543 or the Web at: www.doh.wa.gov/beach

Introduction



Clean swimming / recreational waters –

- Mom and dad happy!
- Chambers of Commerce happy!

Exposure to bacterial-laden swimming / recreational waters –

- ~~• Mom and dad happy!~~
- ~~• Chambers of Commerce happy!~~

Ain't no one happy!!!




Introduction

Swimming advisories are issued if *Enterococcus* levels

- ≥ 500 MPN/100mL
 - Issue advisory
- ≥ 104 MPN/100mL
 - Resample



So ... today's advisory is based on yesterday's water quality!

CAUTION 

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SWIMMING IS NOT ADVISED

UNTIL BACTERIA LEVELS RETURN TO NORMAL. WADING, FISHING, AND SHELL COLLECTING DO NOT PRESENT A RISK.

FOR INFORMATION ABOUT THIS ADVISORY CONTACT YOUR LOCAL REGION 7 DHEC EOC OFFICE AT (803) 953-4190 OR CALL (803) 898-3541.

PRECAUCIÓN

UN AVISO SOBRE NADAR HA SIDO EMISO POR LA PLAZA DE BARRIO PUNTO POR EL DEPARTAMENTO DE SALUD Y CONTROL AMBIENTAL DE CAROLINA DEL SUR. ALTOS NIVELES DE BACTERIAS HAN SIDO DETECTADOS EN ESTA SECCION DE LA PLAYA Y

NO SE ACONSEJA NADAR

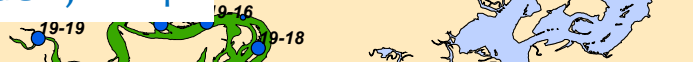
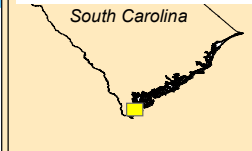
HASTA QUE LOS NIVELES DE LA BACTERIA VUELVAN A LA NORMALIDAD. NO PRESENTA UN RIESGO EL CAMBIO, PESCA Y RECOLECTOR CONCHAS.

PARA MÁS INFORMACIÓN SOBRE ESTE AVISO CONTACTE A LA OFICINA LOCAL DE LA REGION 7 DE DHEC EOC AL (803) 953-4190 O AL (803) 898-3541.

Our history (in brief)

“Heath Model”, 2004

Beaufort County, SC



“Erica Model”, 2007

Tide Range (lookup) 4.44
Today's weather Fair

Stations	Description
WAC-004	16th Ave N
WAC-005	3rd Ave N
WAC-006	9th Ave S
WAC-007	17th Ave S

Station	Predicted	
	MLR	CART
WAC-004	33	MEDIUM
WAC-005	33	MEDIUM
WAC-006	33	MEDIUM
WAC-007	33	MEDIUM

“Emily Model”, 2008

Pier	In Model Sets
All	CB,CC,CD,CE,CG

RF24h	Previous 24-hour rainfall	Apache Pier
RF48h	Previous 48-hour rainfall	Apache Pier
RF72h	Previous 72-hour rainfall	Apache Pier
SWT	Surface Water Temperature	SUN1; SUN2 Pier;
H20Lvl	Water Level	Sunset Beach (SUN1)
SSAL	Surface Salinity	Sunset Near Buoy (SUN2)
SLWSPD	Shoreline Wind Speed	Sunset Beach (SUN1)
SLWDIR	Shoreline Wind Direction	Sunset Beach (SUN1)
NSWSPD	Nearshore Wind Speed	Sunset Near Buoy (SUN2)
NSWDIR	Nearshore Wind Direction	Sunset Near Buoy (SUN2)
NSCSPD	Nearshore Current Speed	Sunset Near Buoy (SUN2)
NSCDIR	Nearshore Current Direction	Sunset Near Buoy (SUN2)
Moon	Fraction of the moon illuminated	US Naval Ob
DWL	Tidal Range	NOAA - Derinway
YR1212	Previous Days Rainfall	SCDHEC
1DDR	One Day Delayed Rain	SCDHEC
2DDR	Two Day Delayed Rain	SCDHEC
3DDR	Three Day Delayed Rain	SCDHEC
SP2DR	Sum of 2 Days Rainfall	SCDHEC - D
SP3DR	Sum of 3 Days Rainfall	SCDHEC - D
SP4DR	Sum of 4 Days Rainfall	SCDHEC - D
SP5DR	Sum of 5 Days Rainfall	SCDHEC - D
SP6DR	Sum of 6 Days Rainfall	SCDHEC - D
SP7DR	Sum of 7 Days Rainfall	SCDHEC - D
RFI	Rainfall Intensity	SCDHEC - D
Station	Station ID Number	SCDHEC

Calculations - click on grey boxes to see formula

MLR	Ln FC	FC	Ensemble value:
WAC-004	3.51	33.43	1
WAC-005	3.51	33.43	1
WAC-006	3.51	33.43	1
WAC-007	3.51	33.43	1

CART	Level	Ensemble value:
MEDIUM	MEDIUM	2
MEDIUM	MEDIUM	2
MEDIUM	MEDIUM	2
MEDIUM	MEDIUM	2

ENSEMBLE	Average (nearest whole number):	Corresponding FC level:
MEDIUM	2	MEDIUM
MEDIUM	2	MEDIUM
MEDIUM	2	MEDIUM
MEDIUM	2	MEDIUM

MLR Model Output	Variable	Value
Intercept	B	1.373412
WEATHER 00'		0.402602
WEATHER 01'		1.125163
WEATHER 02'		0.61325
WEATHER 22'		0
DWL		0.22767



Goal and objectives

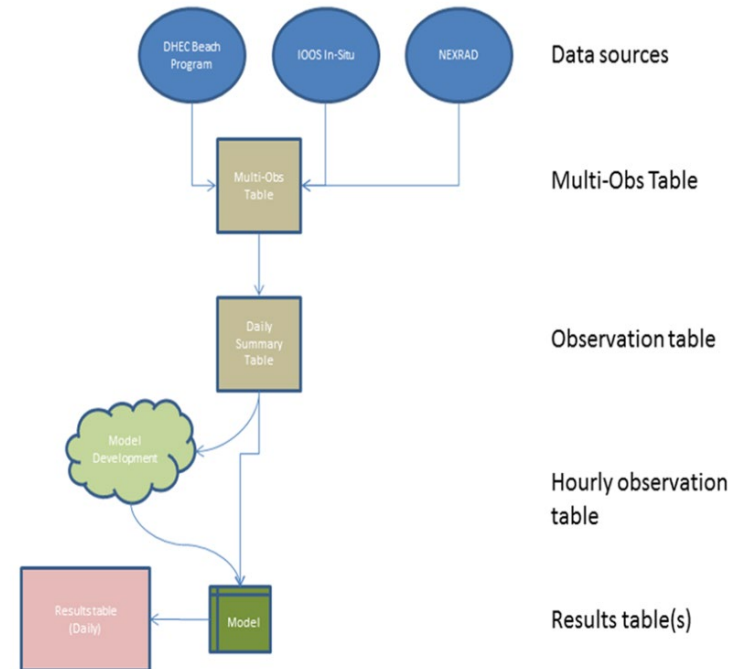
- * The ultimate **goal** of our work is to assist public health, beach management, and tourism officials in support of improved decision making.
- * Our **objectives** are to:
 - * Develop locally-relevant decision-support tools to support our goal, and
 - * Demonstrate the geographic and thematic transferability of our tool development approach.

Developing a tool

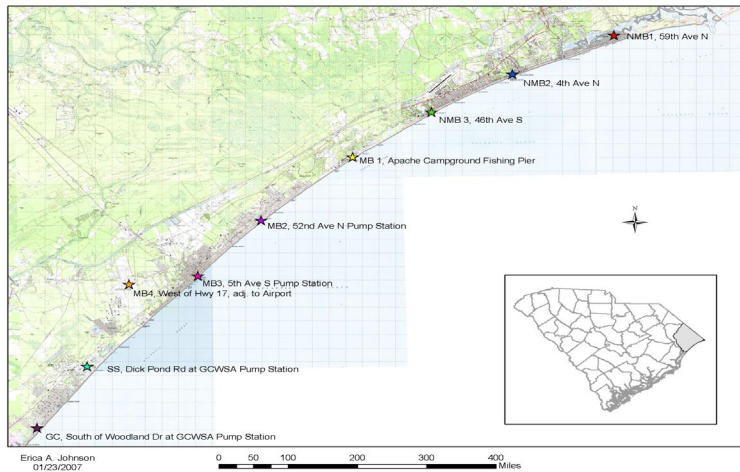
- * In our previous efforts, a water quality tool (app) was developed for beach managers and beach-goers:
 - * Designed to predict bacteria concentrations in swimming beach waters and shellfish harvesting waters
 - * The forecasting tools synthesize data from multiple data platforms (e.g., remote sensing, sampling, Integrated Ocean Observing System, NERRS, etc.)
 - * Statistical models are developed to create predictions
 - * The tool is automated and updates the database where decision rules are applied to generate the forecasts
 - * Forecasts are provided to local officials and displayed via the website and mobile app

Data integration and processing

- * Data collected from a variety of sources
- * Collated, summarized, and processed
- * Historical data used to develop water quality algorithms
 - * Statistical modeling done with both:
 - * R statistical software
 - * EPA's Virtual Beach software
 - * Statistical techniques include
 - * Multiple Linear Regression (MLR)
 - * Classification and Regression Trees (CART)
 - * Ensemble Modeling integrated with EPA's VB
 - * Gradient Boosting Machine Learning (GBM)
- * Algorithms applied to new data and water quality predictions/forecasts made
- * Results uploaded for use in app/website

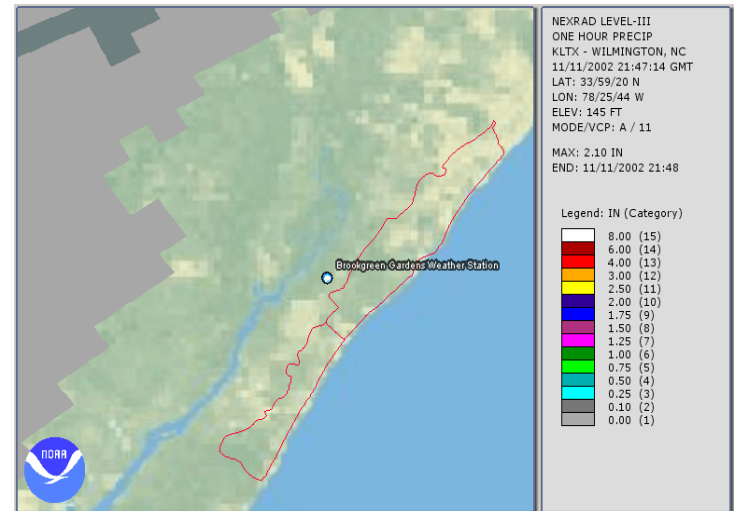
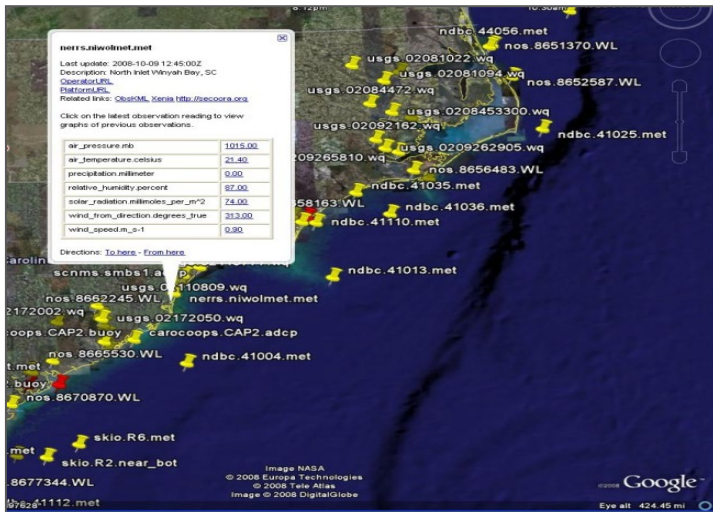


Data integration and processing



Observations? ... what observations?

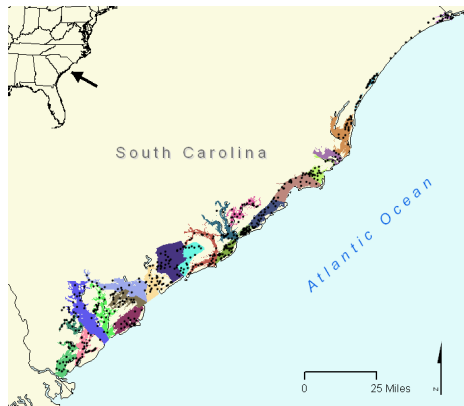
Unknown and/or overwhelming!



Data integration and processing

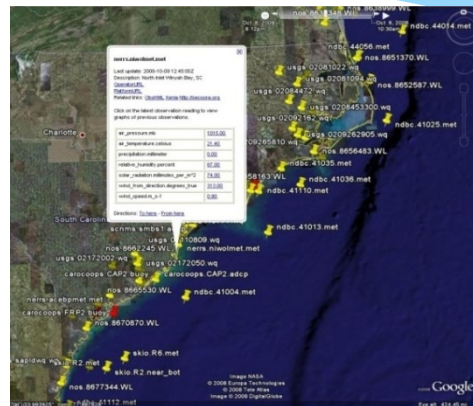
The real value is in integrating observing systems!

Field programs



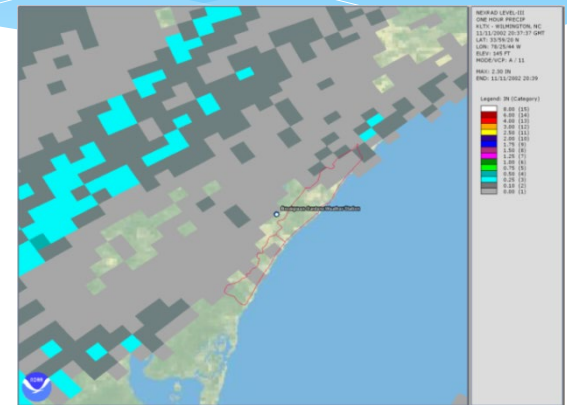
- Bacteria density
- Salinity
- Air/water temp
- Tide
- Weather

Observing systems



- Rainfall
- Currents
- Salinity
- Wind

Remote sensing / Models



- Salinity
- Air/water temp
- Rainfall
- Currents
- Wave activity

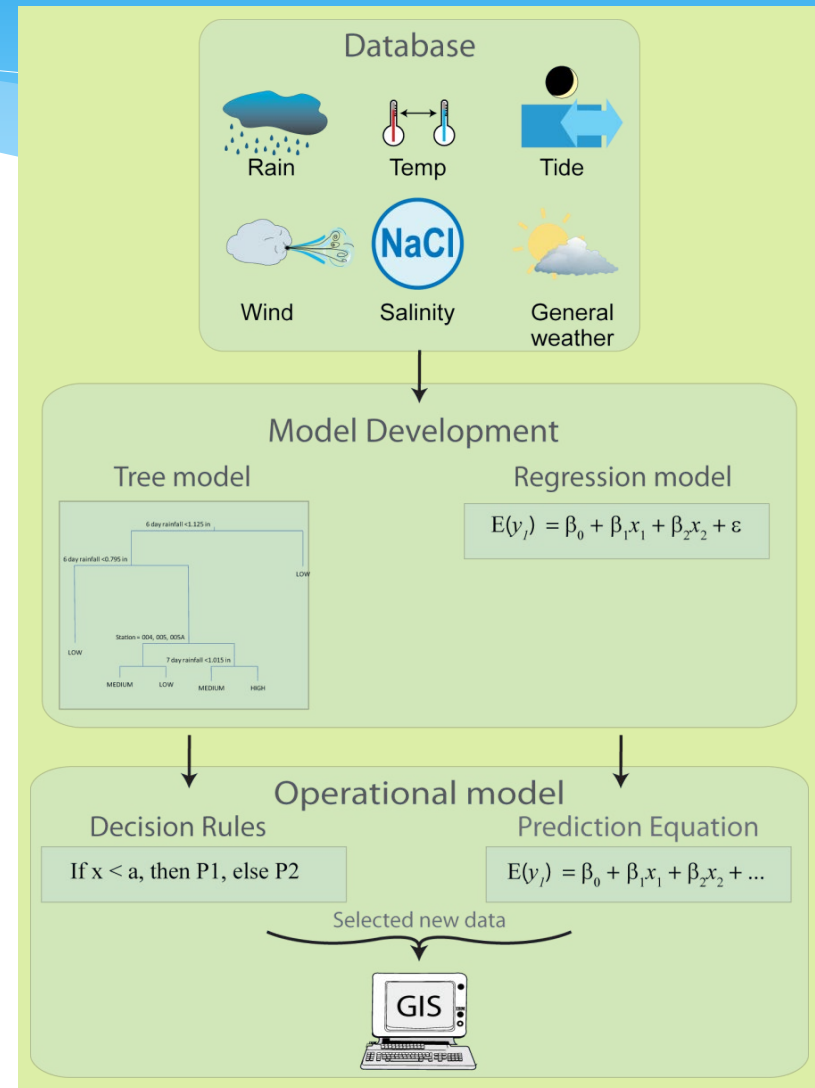
Data integration and processing

Data assimilation  Data integration



Predictive Forecasts

Forecasts have to be accurate, reliable, understandable and implementable!

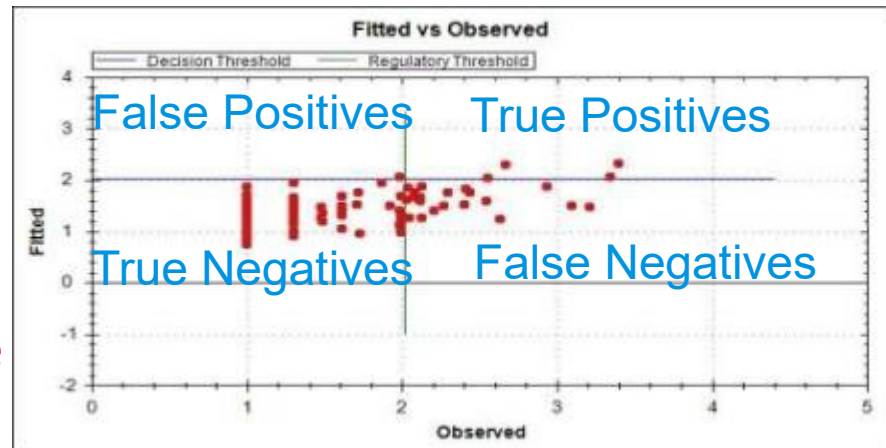


Predictive Forecasts

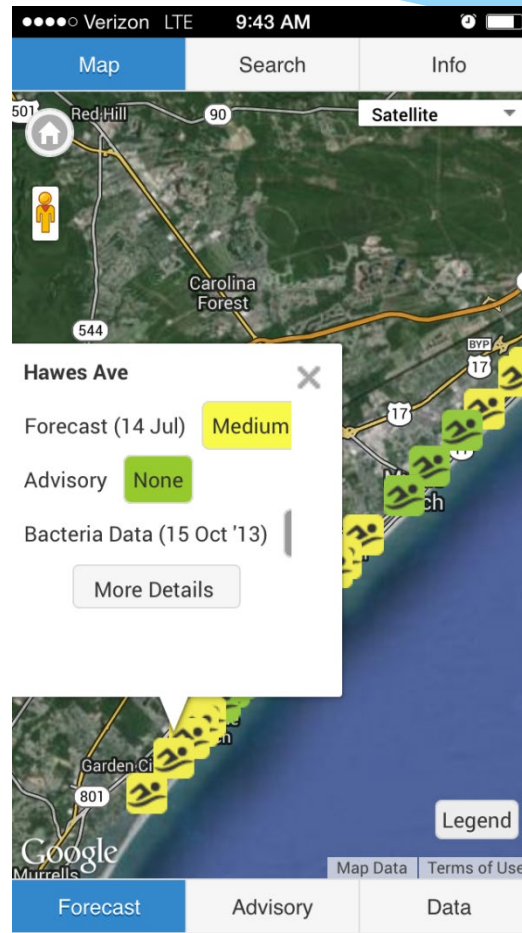
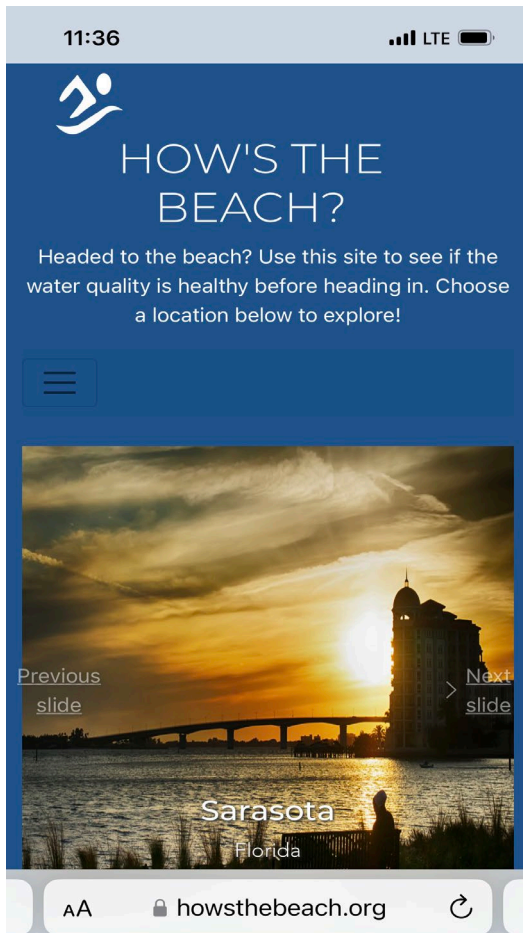
Level 1	Level 2	Level 3
Cumulative Rainfall	Cumulative Rainfall	Cumulative Rainfall
Rain Intensity	Rain Intensity	Rain Intensity
Preceding Dry Days	Preceding Dry Days	Preceding Dry Days
Weather	Weather	Weather
	Tidal Range	Tidal Range
	Lunar Phase	Lunar Phase
		Station
		Wind Speed
		Wind Salinity

Forecast complexity is ...

- Location
- Availability of data
- Acceptable error
- **Errors of omission**
 - Fail to issue advisory when water quality is poor
 - Public health risk
- **Errors of commission**
 - Issue advisory when water quality is good
 - Poor image / revenue loss (i.e., the Chamber of Commerce is not happy)



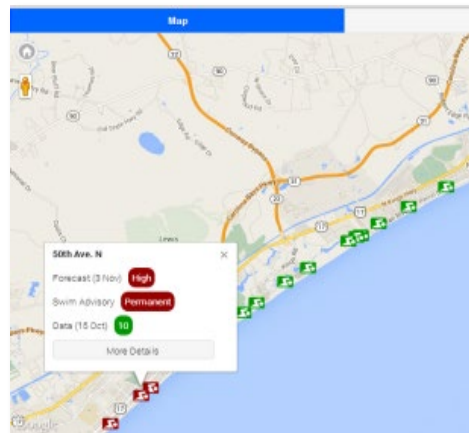
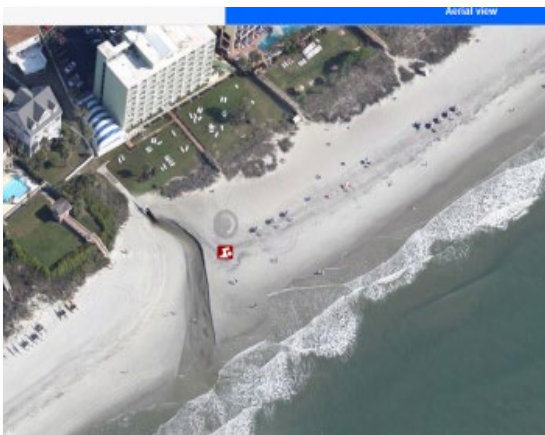
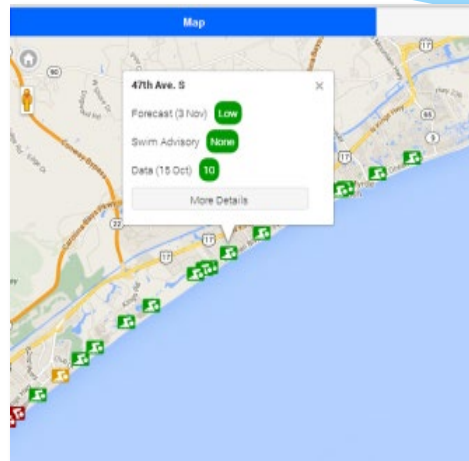
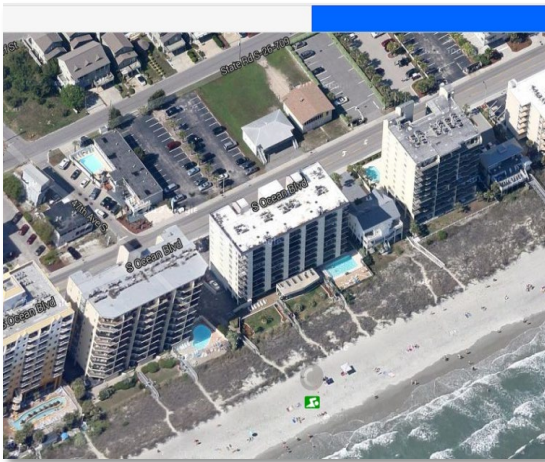
How's the Beach tool



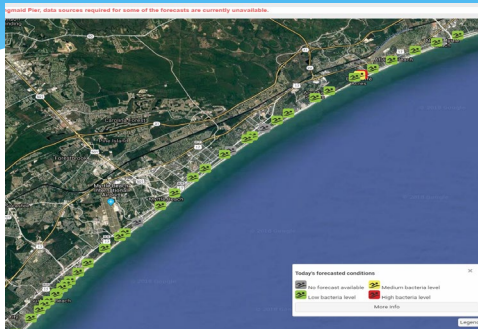
- * Water quality advisory app
- * Provides near real-time forecasts along beaches of interest
- * Provides quick “go/no-go” recommendations for swimming and water activities
- * Resulting in ...

How's the Beach tool

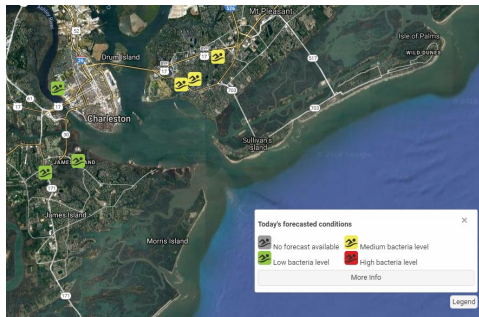
... a win – win situation for *public health* and *economic vitality*!



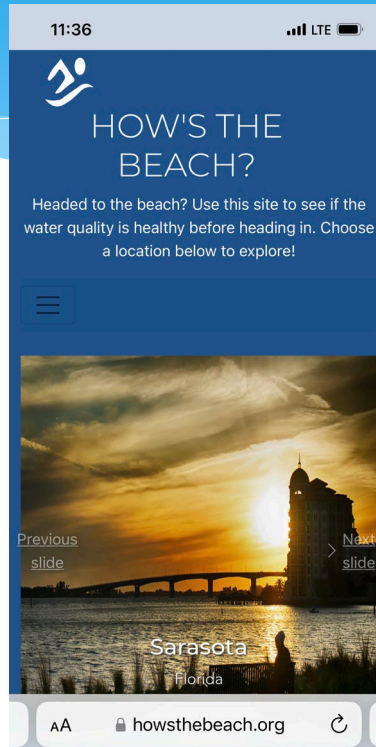
Current status



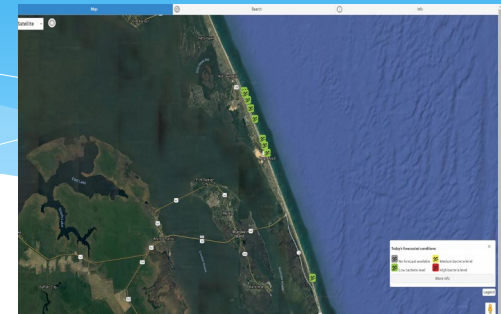
Grand Strand, SC



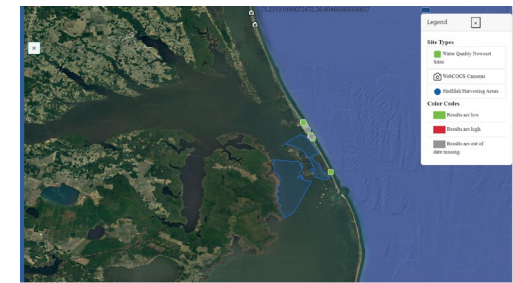
Charleston & Folly Beach, SC



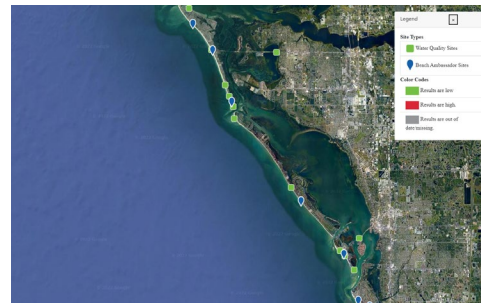
Sarasota, FL



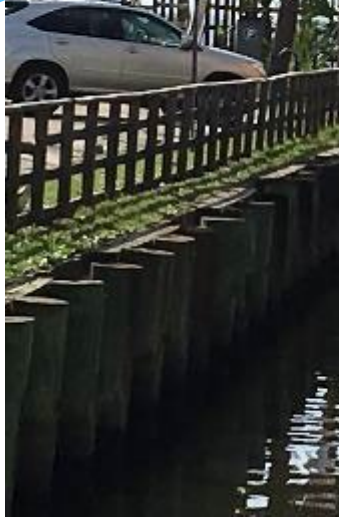
Kill Devil Hills, NC



Radio Island, NC



... But not the end of the story ...



Challenges, opportunities and looking ahead

HOW'S THE BEACH?
Headed to the beach? Use this site to see if the water quality is healthy before heading to. Choose a location below to explore.

QUITTER BANKS MIDDLE BEACH SUBSIDY CHARLESTON HARBOR FOLLY BEACH SARASOTA
North Carolina South Carolina South Carolina South Carolina South Carolina Florida

Sarasota
Research teams can change rapidly between sampling sites to find the gaps, we make daily releases of sampling conditions. These conditions are released swimming conditions, but provide information of the beachfront that bacteria conditions would result. Using an advisory sampling were conducted that day.

Legend
Site Types
● High Quality Sites
● Beach Accessibility Sites
Color Codes
● Beachs are low
● Beachs are high
● Beachs are hot of swimming

Staying Safe in the Water Guard Against Germs While Swimming

When the weather gets warm, you may want to get outside for some fun in the sun. Going to a pool, lake, or beach often tops that list. Spending time in the water may bring health hazards. But some simple habits can help keep your summer fun—and healthy.

Many different germs and organisms can live in water. These include bacteria, viruses, parasites, and plant matter that can make you sick. A lot of germs that live in water cause stomach and intestinal upset. These can bring diarrhea or vomiting. You can also get skin rashes, ear or eye pain, and a cough or congestion after swimming in contaminated waters.

Common culprits for gut symptoms after swimming are parasites. These include *Cryptosporidium* (Crypto) and *Giardia intestinalis*. But bacteria, like *E. coli*, and viruses can also be the cause.

Many water-borne germs live in the poop of people and animals. So it's important to never go to the bathroom or to change dirty diapers near the water. If you bring a pet, be sure to pick up after them. Pools are often treated with a chemical called chlorine to kill germs. But it doesn't work on all of them immediately. Some, like Crypto, can linger for days despite the chlorine. And natural bodies of waters, like oceans and lakes, can't be treated with chemicals.

"You can't just look at the water and say, 'I think that there's an elevated level of bacteria,'" says Dr. Dwight Porter at the University of South Carolina. But scientists can test recreational waters for certain bacteria.

Porter's group studies ways to monitor water conditions around the local beaches. They collect data about a bacteria called *enterococcus*. *Enterococcus* lives in the guts of people and animals. High levels of the bacteria can mean the water is contaminated with poop. That often means that other germs are present, too.

His group works with local partners to create daily water forecasts. The forecasts predict which areas may have high levels of bacteria. They alert local residents using their website howsthebeach.org and howsmyscriver.org.

Porter and his colleagues plan to expand the alert system to include *Vibrio vulnificus* (Vibrio). Vibrios can make you very ill if you eat contaminated seafood. They are also flesh-eating bacteria. If they infect a wound on your skin and aren't treated, it can lead to amputation or death.

The team is trying to figure out what factors can predict an increased risk of Vibrio infections. Changes to the water's temperature and salt levels may increase the bacteria's growth.

Another possibility is toxic algae blooms. These release nutrients that help the bacteria thrive. Certain types of algae also release toxins that contaminate the water and the air. So, in general, it's important to avoid areas with toxic algae and not eat the seafood found there.

Being aware of local water conditions before you go to the beach can help you stay safe. "If there are concerns with either the bacteria or other [hazards], focus on other activities to do," Porter advises.

For more tips on staying safe in the water, see the **Wise Choices** box.

Wise Choices Stay Healthy While Playing in the Water

- Shower before and after swimming.
- Try not to swallow the water.
- Never go to the bathroom in the water. Take kids to bathroom breaks and check diapers every hour. Change diapers away from the water.
- Stay out of the water if you've had diarrhea recently to help protect others from infectious germs.
- Always wash your hands before you eat or drink after playing in recreational waters or in the sand.
- Cover open wounds with waterproof bandages.
- Don't swim in water that looks murky or has an odor.
- Stay out of the ocean for at least 24 hours after a storm. Acidic places where storm water is released on the beach.
- Check for warning signs around the water conditions.
- Check local alert systems. Visit gousa.gov/hub2hw for information on specific U.S. beaches.

Web Links
For more about water safety, see "Live" in the online article: news.health.nih.gov/2022/06/staying-safe-water

Water Quality Site: Longboat Key Beach Access
Site ID: LONGBOAT KEY ACCESS

Nowcast @
Nowcast for May 31st 2022: LOW

Current Conditions
Temperature: 81 F
Wind: 8Mph E

Tides
Station: Siesta Key, Big Sarasota Pass (8726034)
02:05 AM High
04:05 AM Low
11:05 AM High
07:05 PM Low

Alerts
Rip Currents @
No Alerts
UV Index @
4-Moderate

Forecast for Today
Sunny, then Scattered Showers And Thunderstorms
Temperature: 88 F
Wind: 10 to 16 mph NNE

Forecast for Tonight
Chance Showers And Thunderstorms
Temperature: 89 F
Wind: 14 to 18 mph ENE

Forecast for Wednesday
Sunny, then Scattered Showers And Thunderstorms
Temperature: 86 F
Wind: 15 mph NNE

Forecast for Wednesday Night
Scattered Showers And Thunderstorms
Temperature: 76 F
Wind: 10 to 14 mph E

MOTÉ BEACH CONDITIONS REPORTING SYSTEM

Search Name (by county or state)

Show Beach Locations

Beach Accessibility Report
Community Report

Reports
Longboat Key
Longboat Key
05/31/22
05/31/22
05/31/22

Weather
05/31/22
02:21:04 PM
05/31/22
02:21:04 PM
05/31/22
02:21:04 PM

Wind Direction @
136
Air Temperature @
81.8 F
Weather Summary @
Clear

Rip Currents @
None
Surf Type @
Clean

Surf Conditions
Take @
02:21:04 PM
05/31/22
02:21:04 PM
05/31/22
02:21:04 PM

Surf Height @
0.0
Surf Type @
Clean

Surf Difficulty @
Low

Challenges, opportunities and looking ahead

HOW'S THE BEACH?

Kill Devil Hill
Bacteria levels can change rapidly between sampling dates. To fill in the gaps we make daily Nowcast of bacteria conditions. These predictions do not represent swimming advisories, but provide estimates of the likelihood that bacteria conditions would warrant issuing an advisory if sampling were conducted that day.

Water Quality Site: Drain Pipe at S Nags Head/Federal Park Border
Site ID: [redacted]

Nowcast @ ShellCast
Home Map About Us How ShellCast Works FAQs Feedback Sign In/Create Account

Last updated: October 24, 2023 06:40 AM (3 hours ago) Today: October 24 (Tuesday) Tomorrow: October 25 (Wednesday) In 2 days: October 26 (Thursday) [Table View](#)

Growing units shown below are colored by closure risk. The colors are defined in a legend on the map. For more information on the forecast, find out [how ShellCast works](#).

Current Conditions
Temperature: N/A
Tides: 03:20 AM High
Alerts: No Alerts
Rip Currents: No Alerts
Forecast for This Afternoon: [redacted]

MOTE BEACH CONDITIONS REPORTING SYSTEM

Legend: Beach Ambassador Report, Community Report, Login / Create a Report, Filter Community Reports by Layer

SECOORA WebCOOS

Get Involved Cameras Products Documentation About Feedback

Cameras | Beachfront from Sailfish Street Beach Access, Corolla, NC

Beachfront from Sailfish Street Beach Access, Corolla, NC

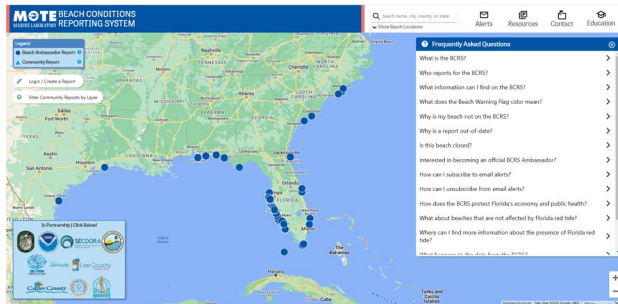
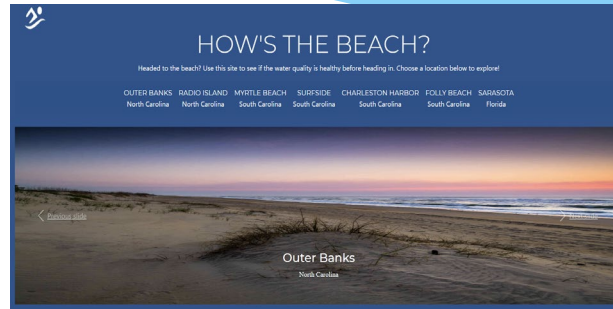
This camera is located at the Sailfish Street Public Beach Access in Corolla, NC. Currituck County partnered with the WebCOOS team to install this camera to monitor, assess, and report on beach hazards and activities. Live beach footage is available to the public to view from their desktop and mobile devices.

Partners:
• Currituck County, NC

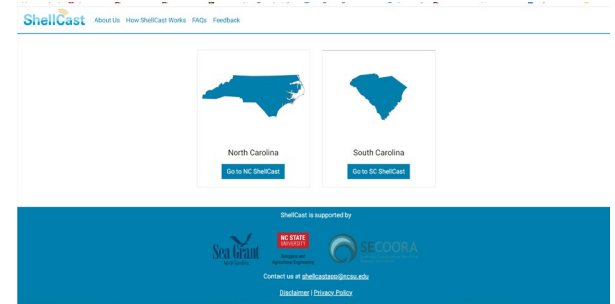
11/4/2023

IMAGE-GALLERY VIDEO-GALLERY

Questions



- * Questions?
- * Concerns?
- * Suggestions?



For more information

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