Shellfish Sanitation and Recreational Water Quality Section Overview

Presented to: Marine Fisheries Commission

DEPARTMENT OF ENVIRONMENTAL QUALITY

Marine Fisheries

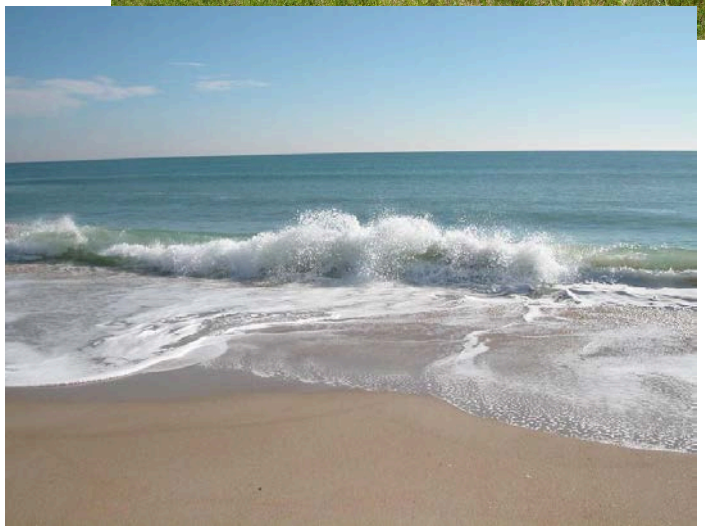
Shannon Jenkins and J.D. Potts | November 15-16, 2018

Role and Responsibilities

- Public health agency

- Shellfish Sanitation: Ensure that all shellfish harvested or processed in North Carolina are safe for human consumption (oversight by U.S. Food and Drug Administration)

- Recreational Water Quality: Monitor coastal recreational waters including ocean and estuarine beaches and post advisories when samples exceed safe standards for human activity (oversight by Environmental Protection Agency)



Organization

- Headquarters in Morehead City with laboratory
- Field office in Wilmington Regional Office with laboratory
- Field office in Nags Head area will be added soon including new laboratory
- Shellfish Sanitation and Recreational Water Quality Programs share workload, laboratories, equipment, and other resources for efficiency

Shellfish Sanitation

Molluscan Shellfish

- Bivalve mollusks such as oysters, clams and mussels are filter feeders
- Can process up to 50 gallons of water per day, and can concentrate pathogens and toxins up to 100 times the ambient levels that are in the water
- Shellfish are commonly eaten alive and raw or undercooked
- ~70% of seafood related illnesses in the United States are tied to consumption of raw shellfish

Shellfish Sanitation Program

- Programs began in 1925 after widespread typhoid fever outbreaks which was traced to sewage polluted oysters
- Part of National Shellfish Sanitation Program
- Uniform guidelines set for all state programs by the Interstate Shellfish Sanitation Conference including the way shellfish are harvested, stored, transported, processed, sold and served
  - State Agencies
  - U.S. Food and Drug Administration
  - Industry Representatives
- Administered by the U.S. Food and Drug Administration

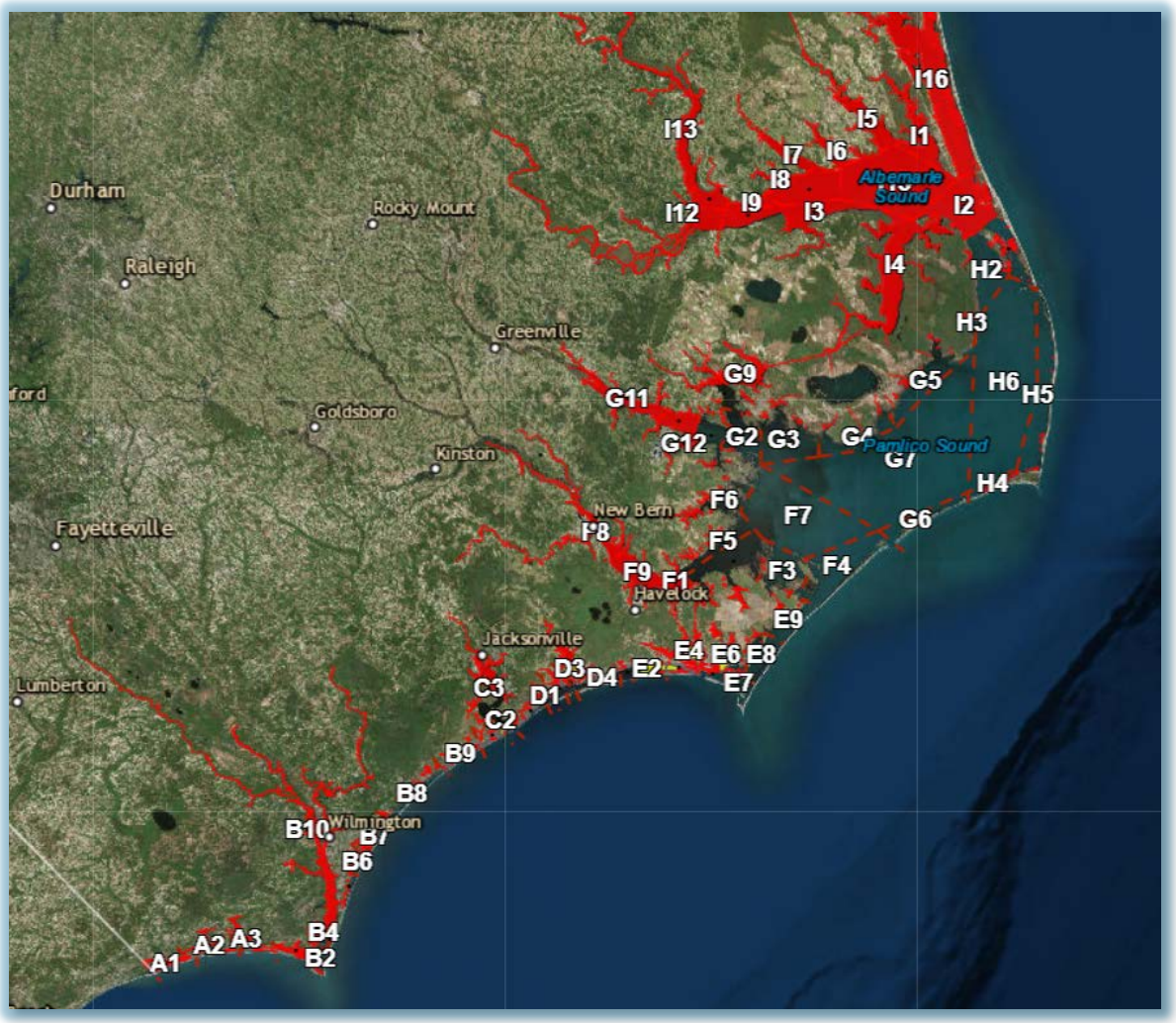
Shellfish Growing Area Program

- Classify coastal waters for safe shellfish harvesting for human consumption

- Waters classified using Sanitary Surveys

- An evaluation of the environmental factors that affect water quality in shellfish growing areas:
  - Bacteriological water quality survey
  - Shoreline survey of pollution sources
  - Hydrographic survey (dye studies)
  - Meteorological survey
  - Sanitary Survey Report

Growing Areas



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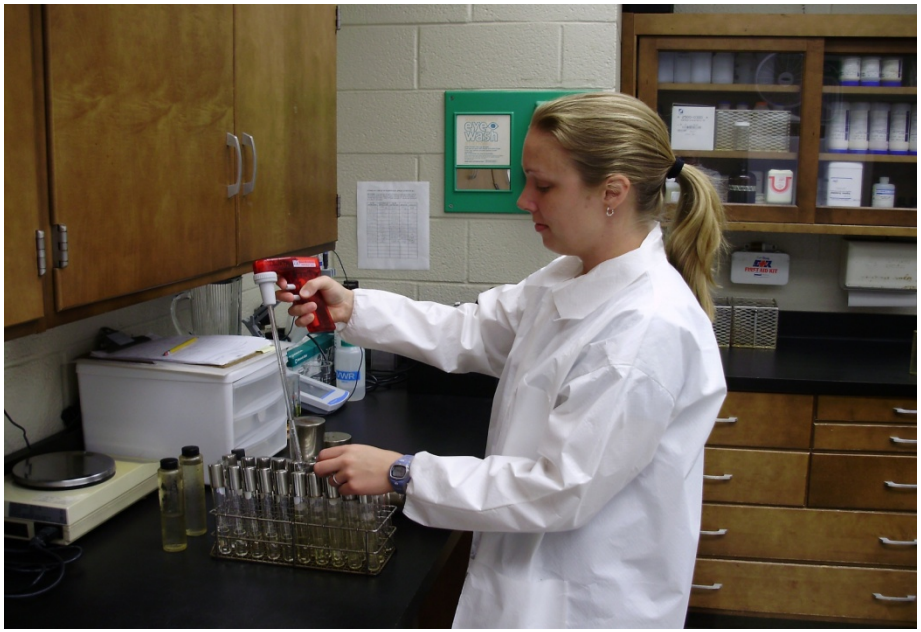
Bacteriological Sampling

- 1,000 stations coast wide sampled randomly a minimum of six times per year
- All samples are planted, cultured, and analyzed using division laboratories
- Sample results used to classify shellfish growing areas and to reopen temporarily closed areas

Laboratory

- Certifications
  - U.S. Food and Drug Administration
  - N.C. State Laboratory of Public Health
- Fecal coliform indicator organism
- Multiple tube fermentation method

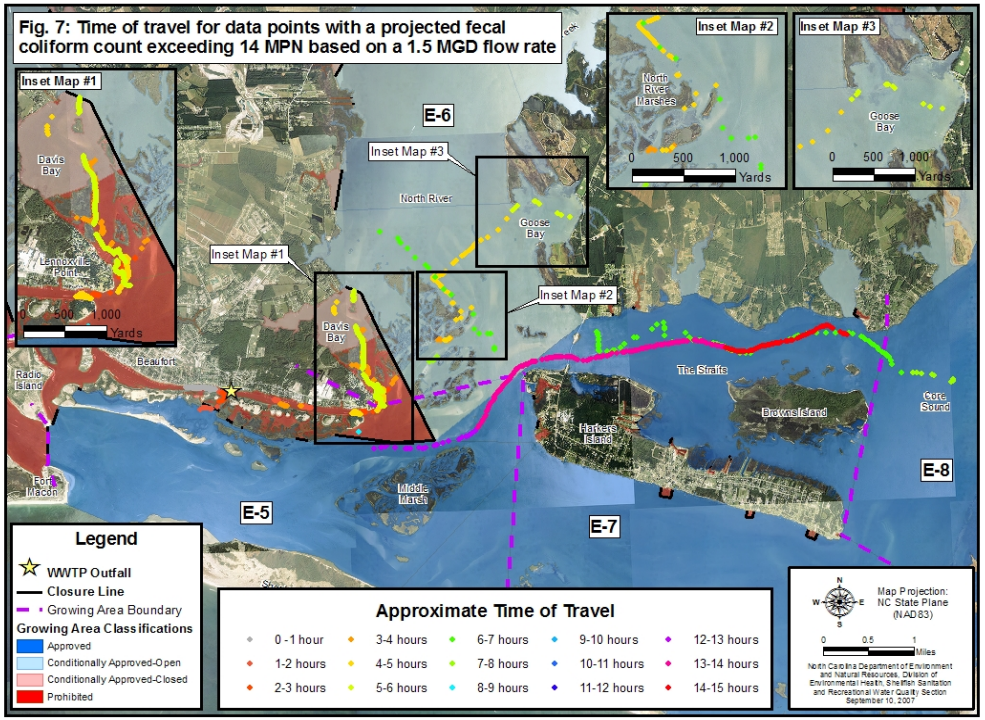


Shoreline Surveys

- Evaluation of all sources of pollution that can affect shellfish growing waters
- Staff evaluate wastewater treatment plants, onsite septic systems, marinas, stormwater conveyances, animals and other areas of concern
- Work with appropriate agencies such as the local Health Departments to resolve issues where possible

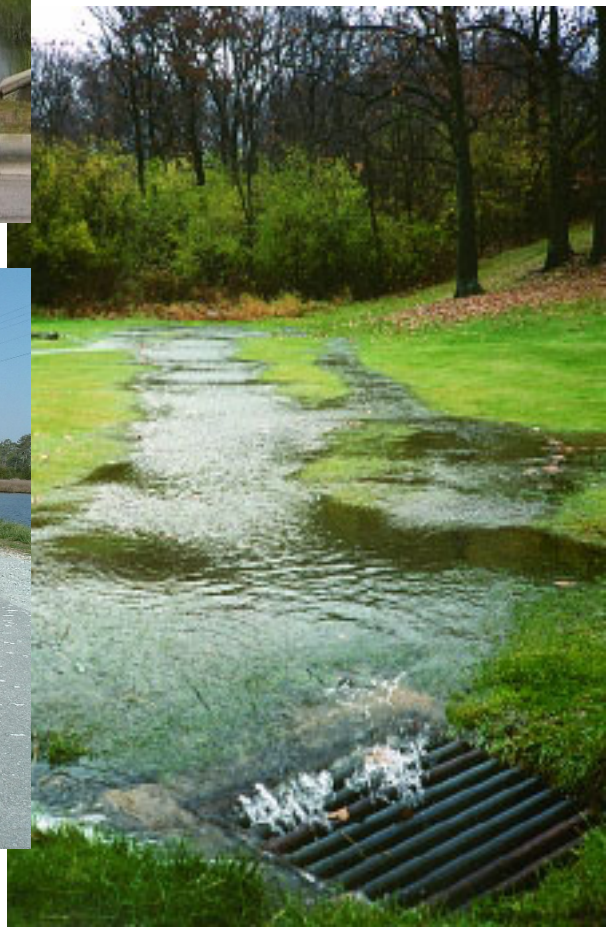
Hydrographic Studies

- Dye studies to assess wastewater treatment plant outfalls
  - Increases in flow
  - New construction
  - Change in permit

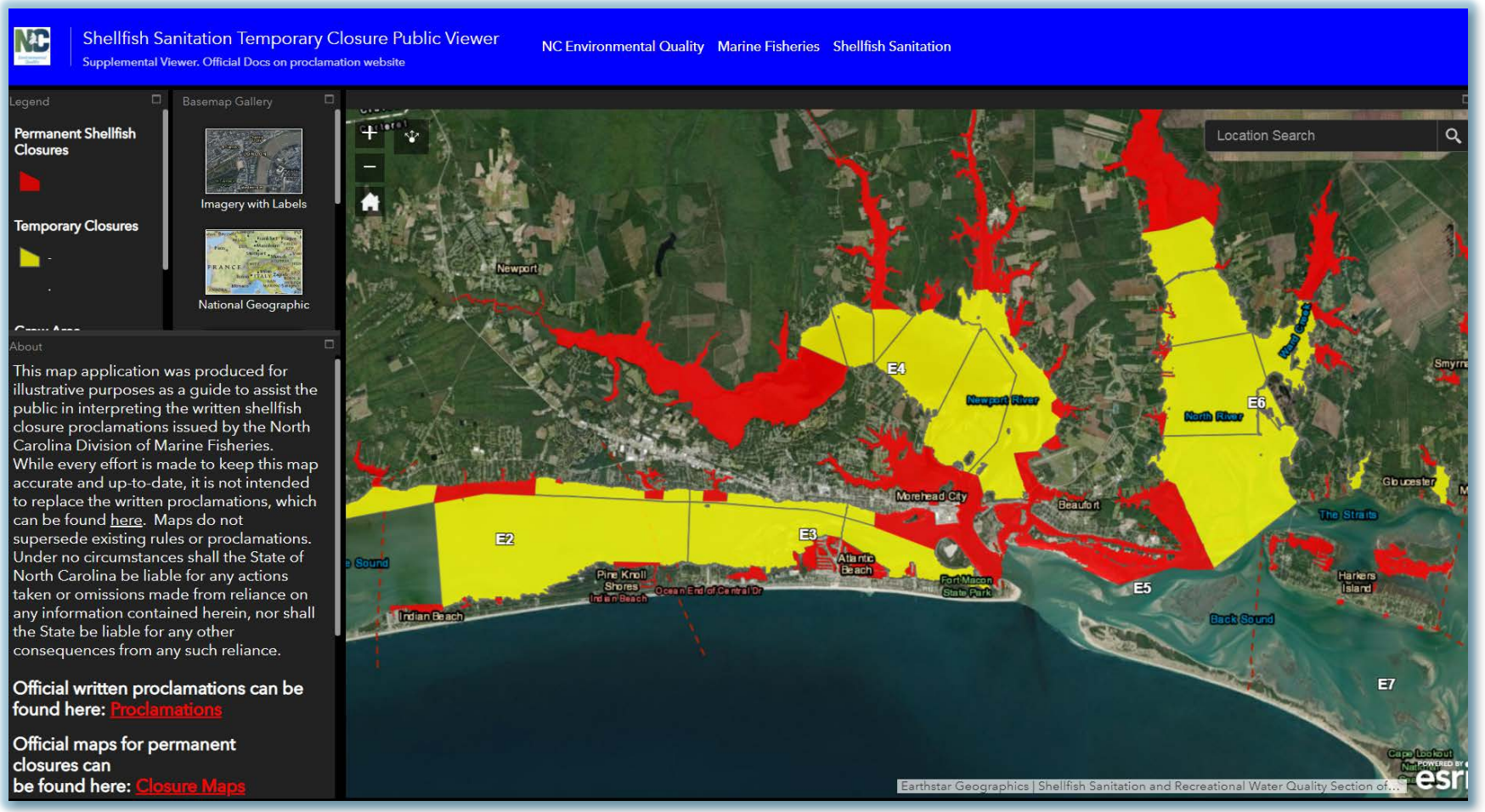


Meteorological Factors- Stormwater Runoff

- Conditional Management Plans for growing areas
- Temporary closures after rainfall elevates bacterial loading through runoff
- Reopened with satisfactory water samples



Shellfish Closures



https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=5759aa19d7484a3b82a8e440fba643aa

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Inspections and Certification Program

- Inspect and certify shellfish and crustacea (crab) processing plants
- Year 2017- 233 shellfish facilities and 14 crab picking facilities certified
- Inspectors are “Registered Environmental Health Specialists”

Inspections and Certification Program

- Hazard Analysis and Critical Control Point inspections
  - Receiving
  - Product storage
  - Time-temperature in shucking, repacking
  - Product labeling
- Background bacteria can grow quickly if improperly stored
- Adulteration and cross-contamination can occur if conditions are unsanitary or unprotected
- Crabmeat is a ready-to-eat product that is processed largely by hand and requires adequate cooking and sanitation to be safe for consumption

Emerging Concern- Vibrio bacteria

- Naturally occurring in the environment and not related to pollution
- More abundant when water temperatures are warm
- Rare, but can cause serious gastrointestinal illness or wound infections
- Immunocompromised individuals are more at risk:
  - Liver disease
  - Diabetes
  - Stomach or iron disorders
  - Alcoholism
  - Cancer
  - Acid reducing medicines
- Centers for Disease Control and Prevention have reported increase nationally

Education

N.C. SHELLFISH HARVESTER EDUCATION PROGRAM

Beginning in 2015, all commercial shellfish harvesters must complete a ***Shellfish Harvester Education Program*** prior to obtaining a license to harvest shellfish. This pamphlet will serve as a training document, and shellfish harvesters will be asked to attest that they have read it before receiving a license to harvest shellfish.

Shellfish are filter-feeders and concentrate in their bodies whatever is found in water. This includes bacteria, viruses and chemicals that can cause human illness when oysters or clams are eaten partially cooked or raw. Even cooked shellfish can contain chemicals that can make people sick. The Division of Marine Fisheries aggressively monitors and enforces shellfish harvest areas to ensure consumers are provided with a safe and quality product. The division's Shellfish Sanitation Program classifies coastal waters for shellfish harvesting based on pollution levels.

Quick References

For coastal waters open to harvesting: http://www.ncmarinefisheries.net/shellfish-closure-maps

For coastal waters temporarily opened or closed: http://www.ncmarinefisheries.net/proclamations-polluted-areas

For the latest regulations for the time from harvest to refrigeration: http://www.ncmarinefisheries.net/commercial-fishing/shellfishharvester

To speak with a N.C. Shellfish Sanitation Program representative, call: 252-726-7021.

CONTROL MEASURES

Reducing the risk of human illness due to consumption of naturally occurring bacteria, like *Vibrio vulnificus* or *Vibrio parahaemolyticus,* depend on the cooperation of shellfish harvesters and dealers.

The *Vibrio* bacteria are naturally occurring and may cause illness in those with compromised immune systems, and even the general public, when shellfish are not kept at the proper temperature after harvest. *Vibrios* can be found during warmer months in areas approved for harvest and are not associated with pollution.

Commercial harvest and sale of shellfish (clams, oysters and mussels) is regulated by the N.C. Division of Marine Fisheries and the U.S. Food and Drug Administration under the National Shellfish Sanitation Program.

HARVESTING

For clams harvested year-round and oysters harvested during the open oyster season, fishermen must:

- Record the time of the start of harvest on the harvest tag
- Affix the harvest tag to each shellfish container
- Deliver clams and oysters to a licensed dealer within 12 hours of the time of the start of harvest

For oysters harvested from shellfish leases from June through September, fishermen must:

- Contact DMF by telephone prior to oyster harvest from leases
- Record the time of the start of harvest on the harvest tag
- Affix the harvest tag to each container
- Deliver oysters to a licensed dealer within 5 hours of the time of the start of harvest

HANDLING

- Shade the shellfish from direct sun exposure
- Keep shellfish out of bilge water, standing water or waste in the harvest boat
- Do not discharge human waste overboard since it can lead to contamination of the shellfish harvest waters
- Use proper culling techniques

TRANSPORTATION

To reduce the risk of growth of bacteria like *Vibrios*, shellfish must be shaded from direct sun exposure while being transported to the dealer. Shellfish are also easily contaminated if placed in vessel bilge water or in standing water or waste in transport vehicles.

HARVEST TAG

Name John Smith
Address 123 Shellfish Rd
Coastal Towne, NC
Phone# 555-555-5555
Harvester's Cert. No. 111111
Harvest Date: 3/11/13 Time: 7:00 A.M.
Harvest Area: E-5
Type & Quantity

Oyster 1 Bu. Clams #

"THIS TAG IS REQUIRED TO BE ATTACHED UNTIL CONTAINER IS EMPTY AND THEREAFTER KEPT ON FILE FOR 90 DAYS"

TO:

Shellfish fishermen must log harvester identification information; the date and time of harvest; the growing area designation and the shellfish harvested on a harvester tag and affix it to each shellfish container.

20,000 copies of this information sheet were printed at a cost of $2,908.85 or 14.5 cents per page.

Memorandum of Agreement

- N.C. Department of Health and Human Services, Division of Public Health, State Health Director

- Provides specific areas of cooperation where both agencies have shared responsibilities

  - Epidemiologic investigations of foodborne (shellfish and crustacea) and waterborne (recreational) illness outbreaks

  - Traceback and recalls of implicated product

  - Harmful algal bloom toxin testing and related risk recommendations

  - Radiochemistry testing of shellfish

  - Recommendation from State Health Director regarding shellfish growing area closures due to pollution

Recreational Water Quality

N.C. Recreational Water Quality Program Mission

"To protect the public health by monitoring the quality of North Carolina's Coastal recreational waters and notifying the public when bacteriological standards for safe bodily contact are exceeded."

Recreational Water Quality Program

- Started in 1997 in response to public concern regarding coastal swimming waters.
- Mandated by the Environmental Protection Agency in October 2000.
- Monitors coastal recreational waters including ocean beaches, sounds, bays and estuarine rivers.

Overview

- 209 swimming sites monitored
- Three regional labs
- Four boats for sampling sound-side waters for both shellfish and recreational waters

Overview

- 14 people directly involved in the recreational water quality program during the swimming season

- 3.5 staff are funded by the **B**eaches **E**nvironmental **A**ssessment and **C**oastal **H**ealth (BEACH) Act grant

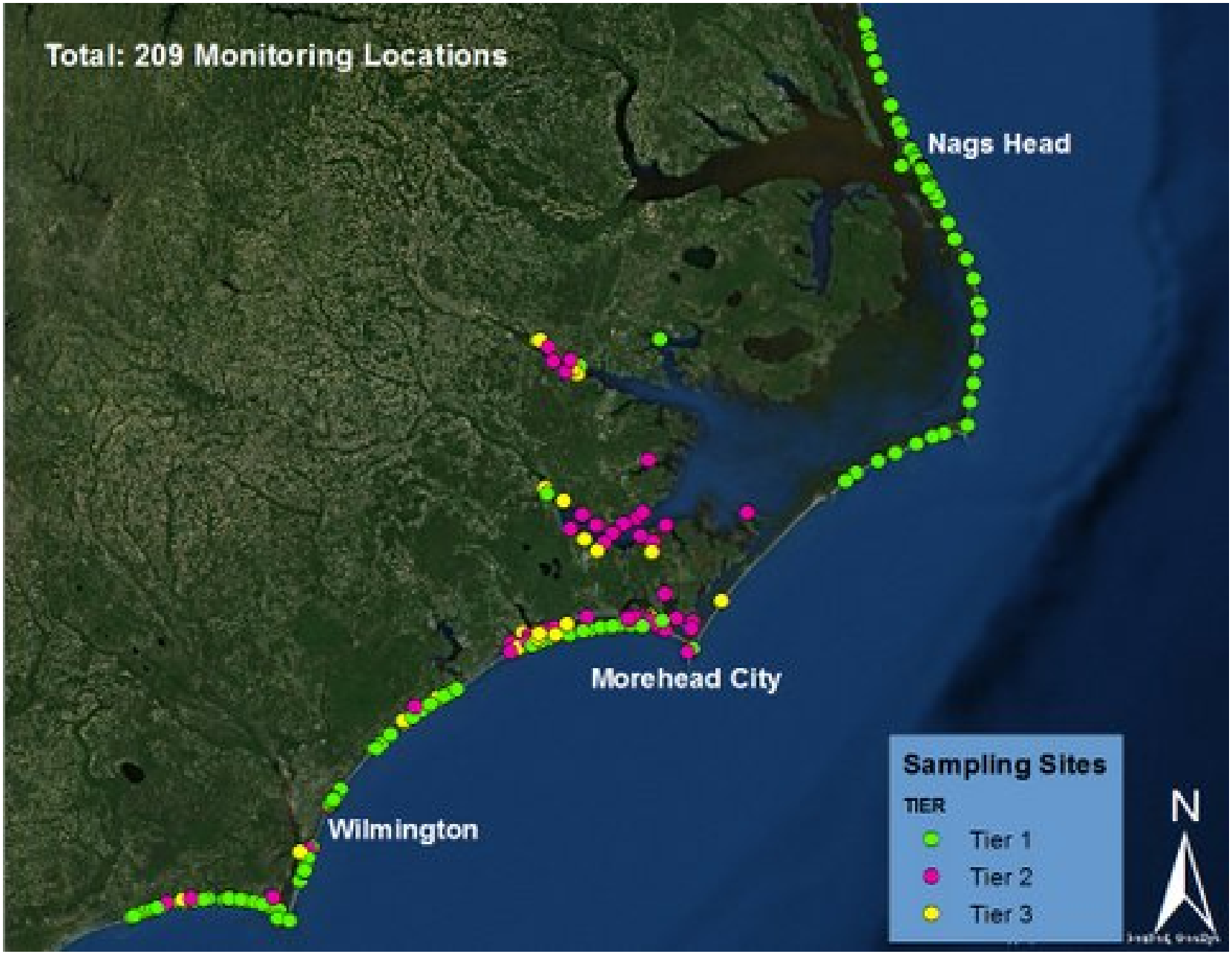
- Three funding sources - State allocation, EPA BEACH grant, Albemarle Pamlico National Estuarine Partnership

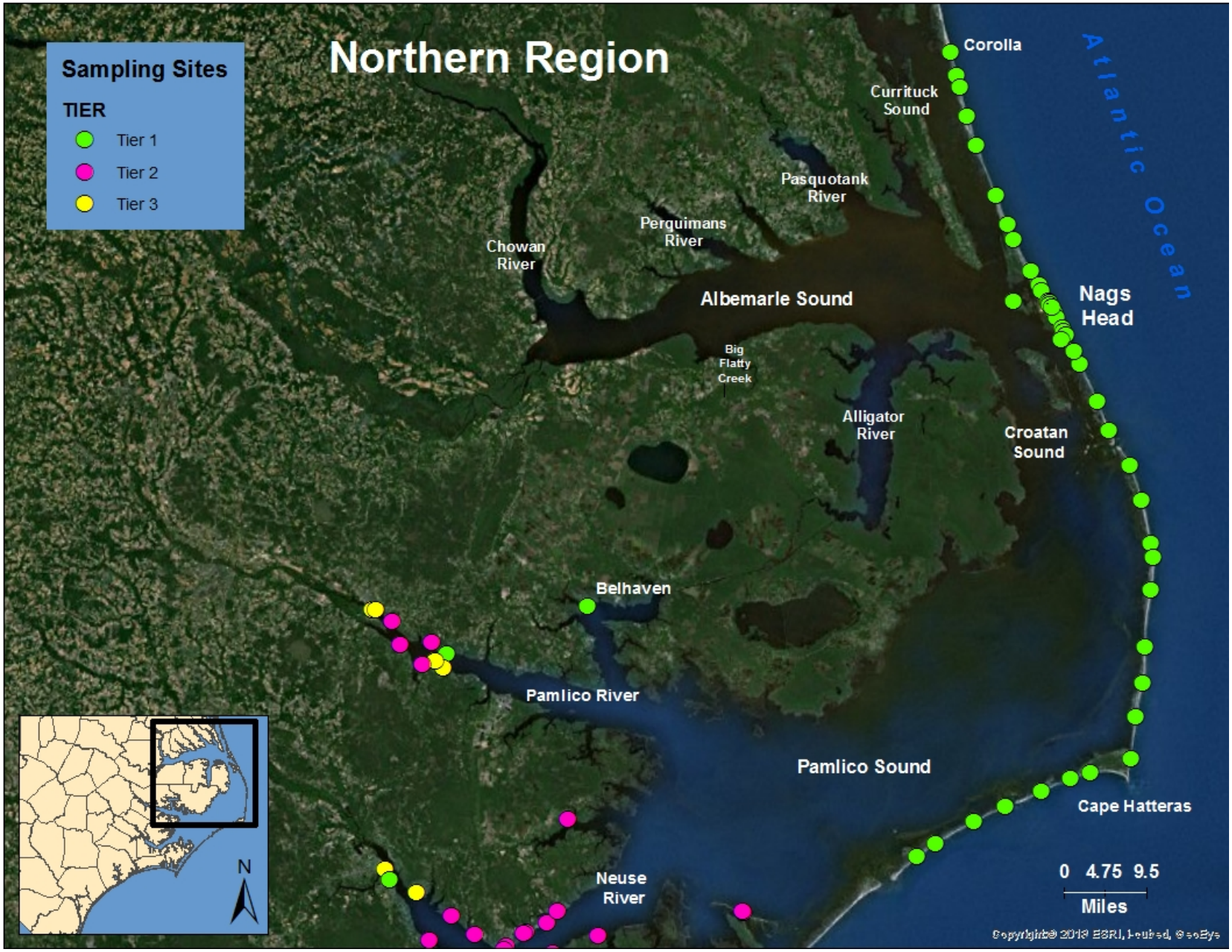
Enterococci

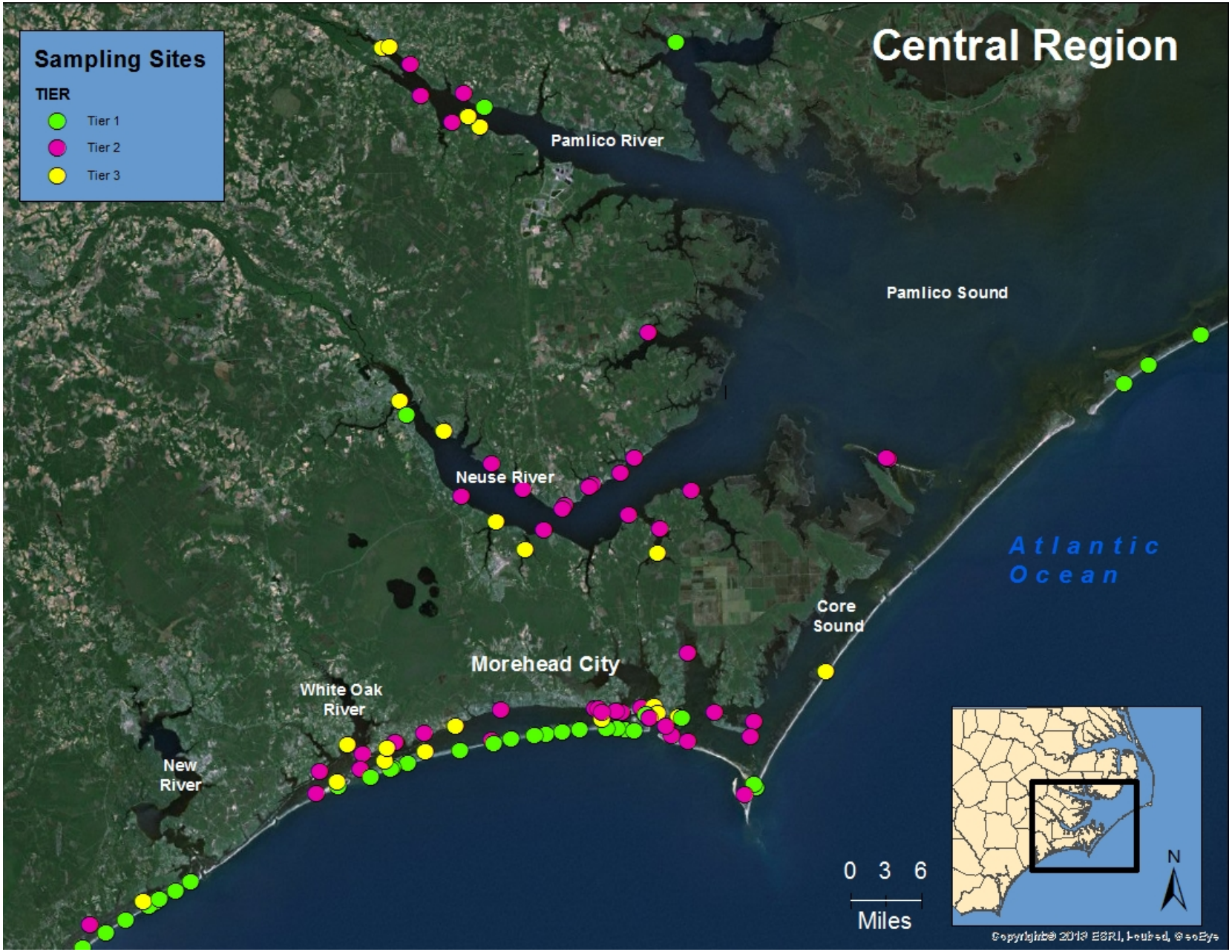
- Bacteria - indicator of fecal contamination
- Found in the gut of all warm blooded animals
- Associated with pathogenic organisms

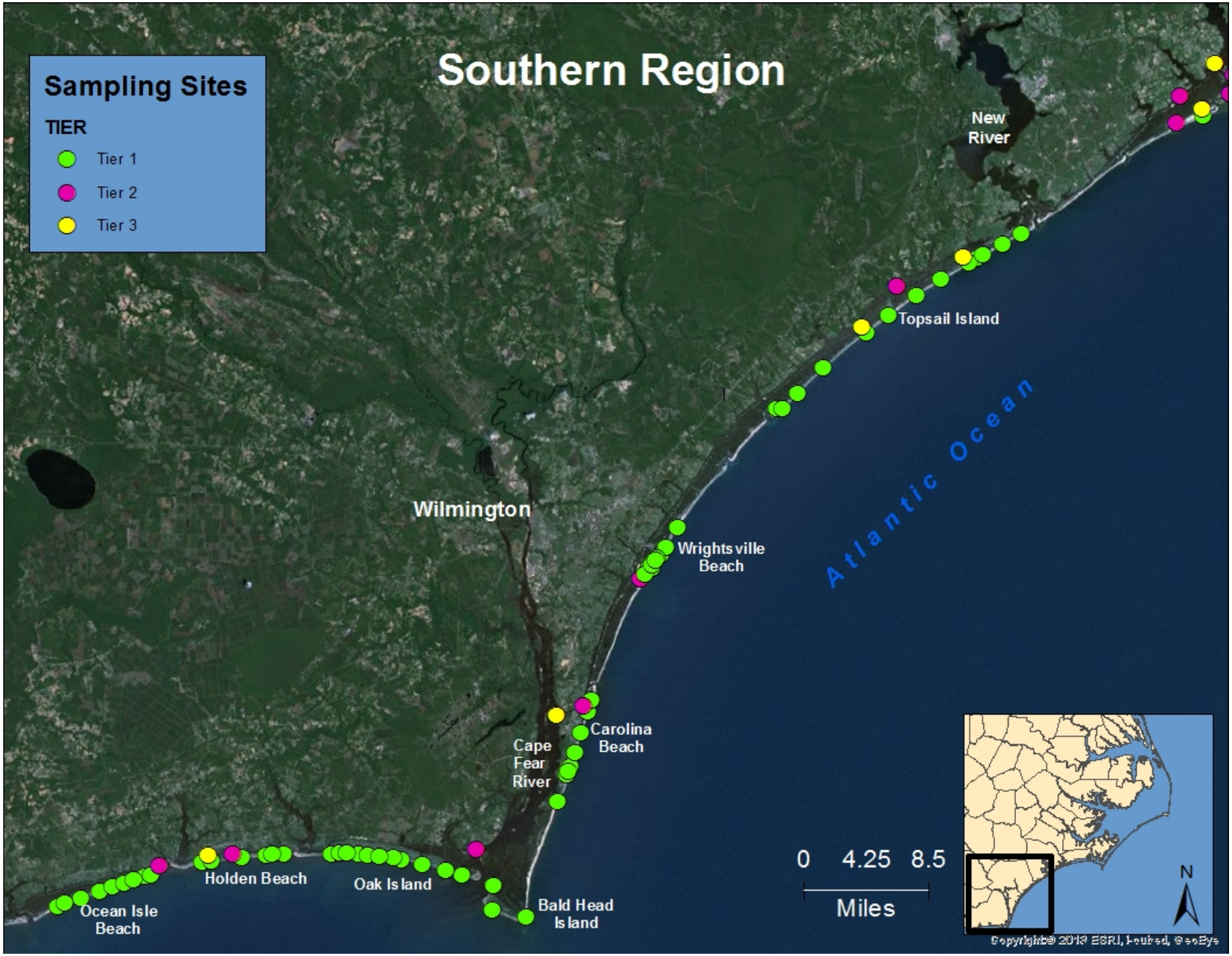
Action Levels for Posting Swimming Advisories

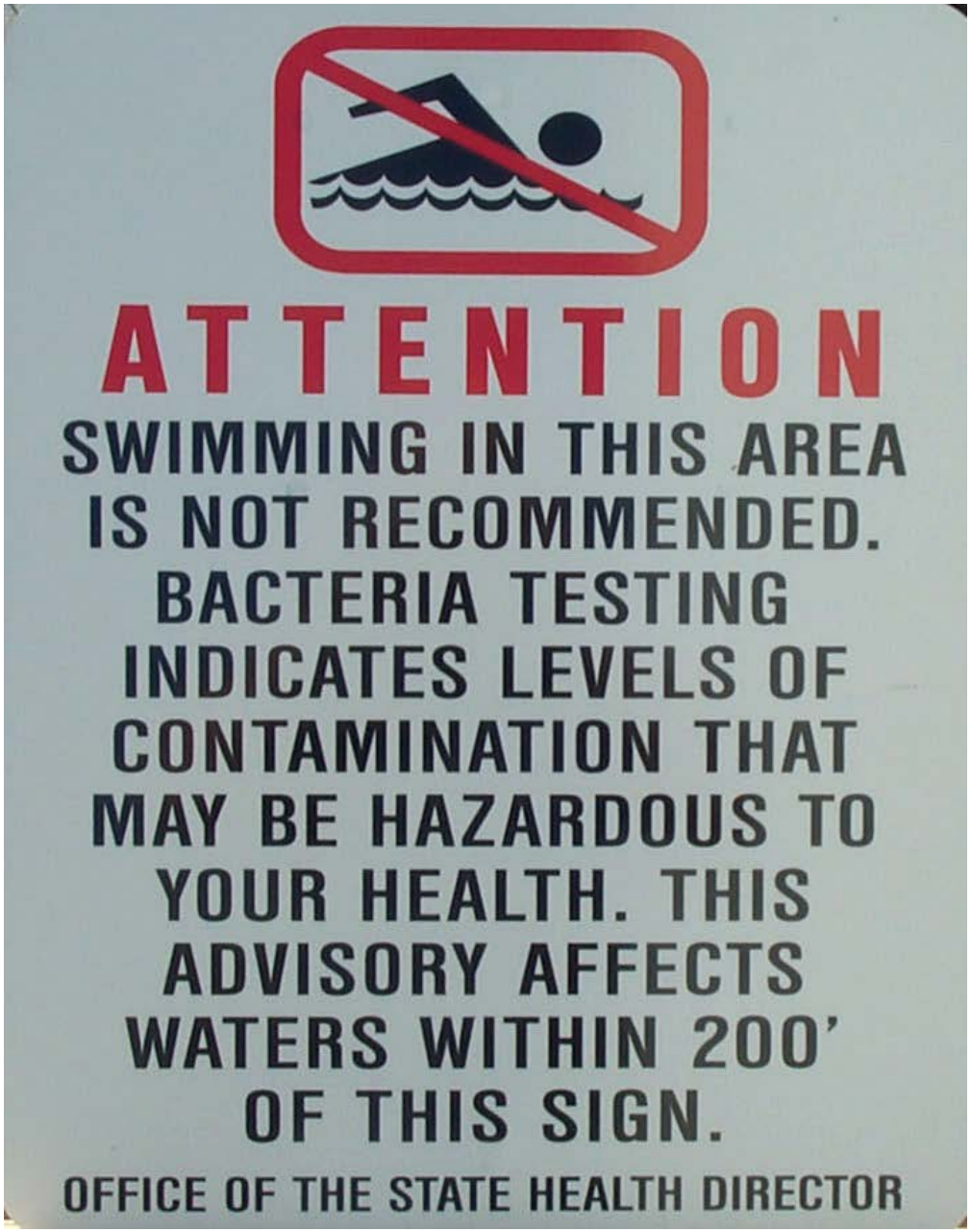
Tier I	104 enterococci per 100ml or geometric mean of 35 per 100ml	Used daily during the swimming season
Tier II	276 enterococci per 100ml	Usage averages three days a week during the swimming season
Tier III	500 enterococci per 100ml	Usage averages four days a month during the swimming season

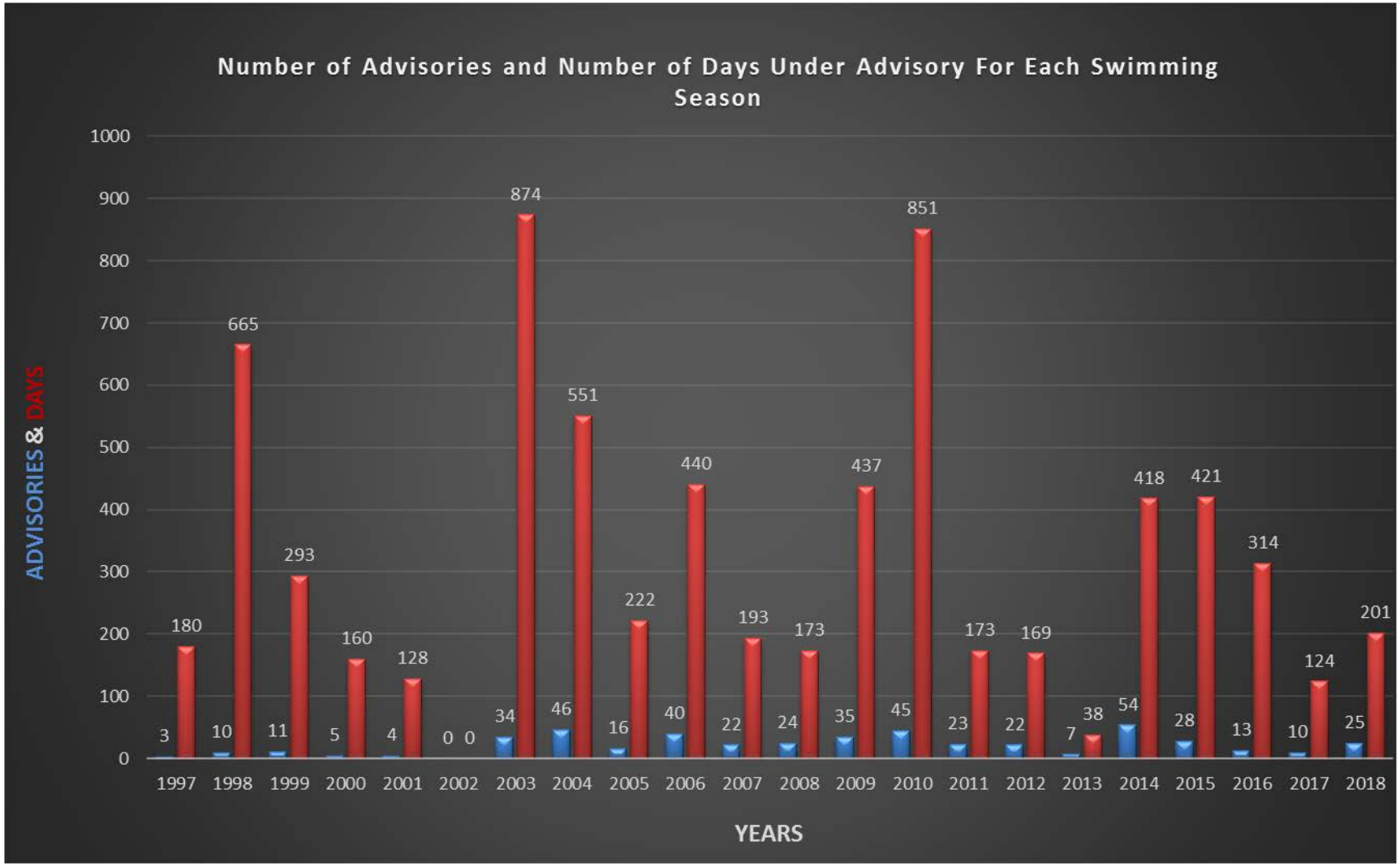

Total: 209 Monitoring Locations
Nags Head
Morehead City
Wilmington
Sampling Sites
TIER
Tier 1
Tier 2
Tier 3
N

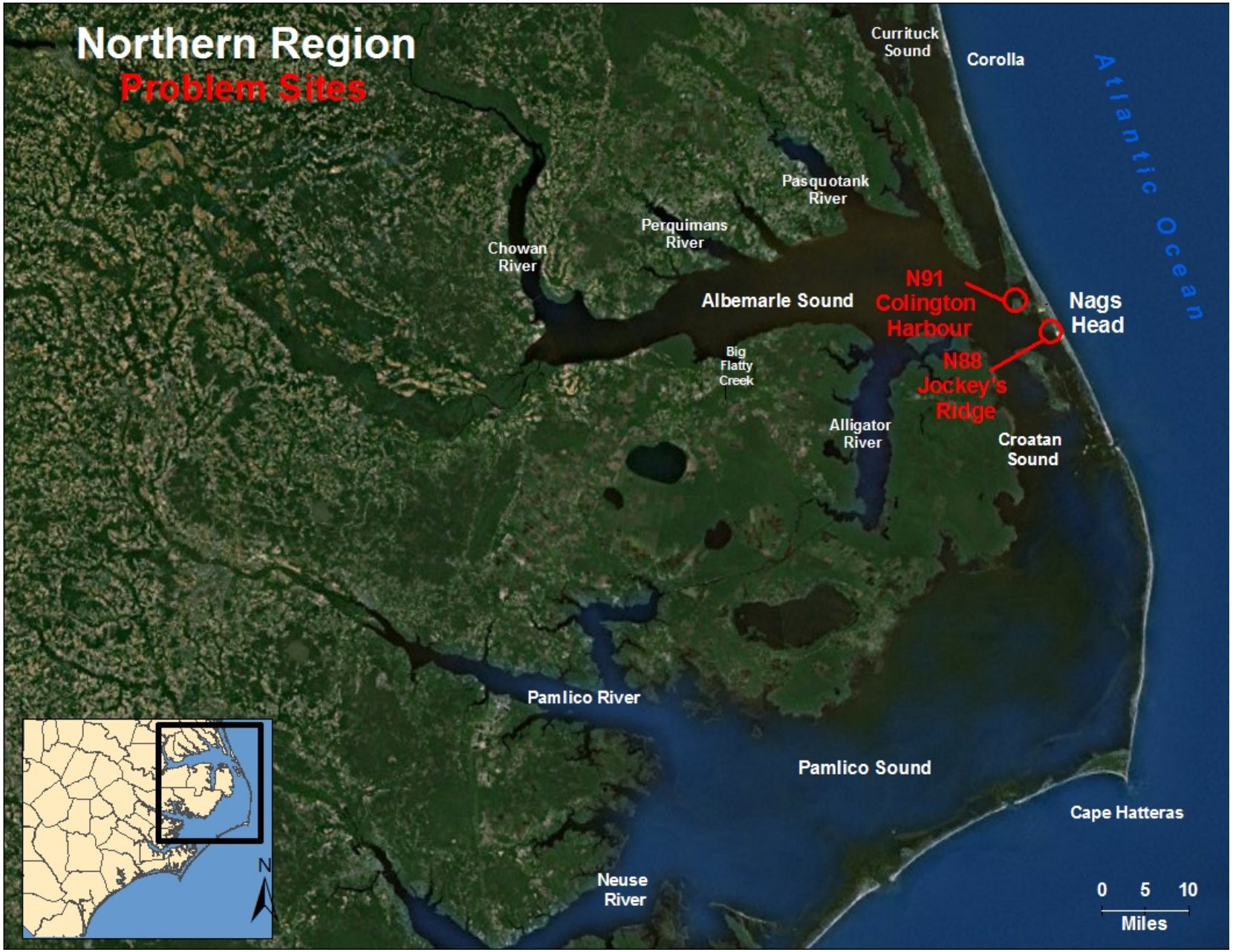

Northern Region
Sampling Sites
TIER
Tier 1
Tier 2
Tier 3
Corolla
Currituck Sound
Atlantic Ocean
Pasquotank River
Perquimans River
Chowan River
Albemarle Sound
Nags Head
Big Flatty Creek
Alligator River
Croatan Sound
Belhaven
Pamlico River
Pamlico Sound
Cape Hatteras
Neuse River
N
0 4.75 9.5
Miles

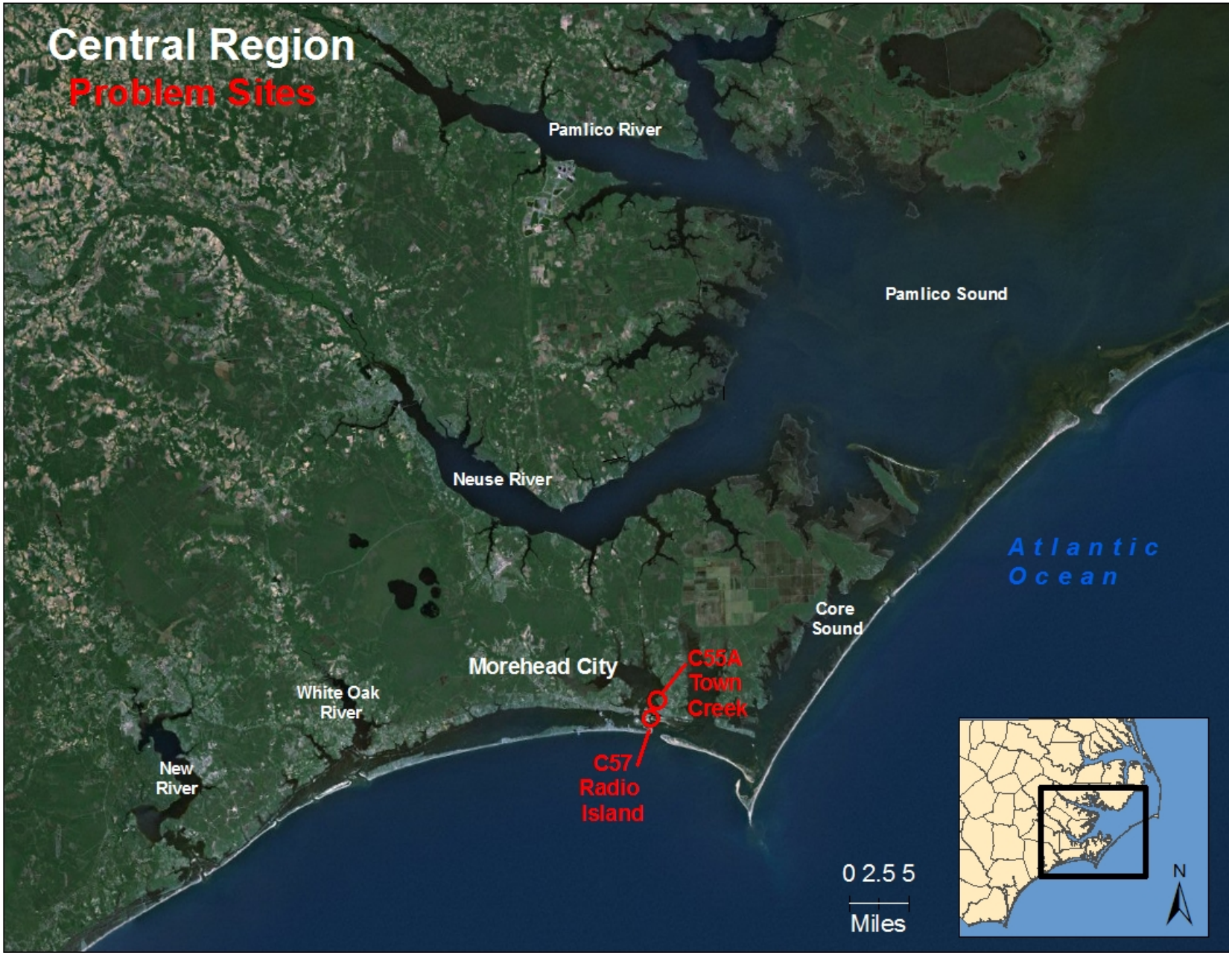

Central Region
Sampling Sites
TIER
Tier 1
Tier 2
Tier 3
Pamlico River
Pamlico Sound
Neuse River
Atlantic Ocean
Core Sound
Morehead City
White Oak River
New River
0 3 6
Miles
N


Southern Region
Sampling Sites
TIER
Tier 1
Tier 2
Tier 3
New River
Topsail Island
Atlantic Ocean
Wilmington
Wrightsville Beach
Carolina Beach
Cape Fear River
Holden Beach
Oak Island
Ocean Isle Beach
Bald Head Island
0 4.25 8.5
Miles
N

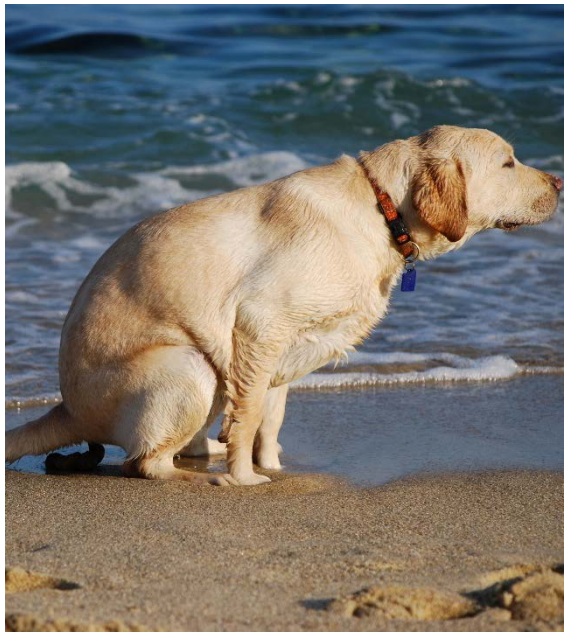

ATTENTION
SWIMMING IN THIS AREA IS NOT RECOMMENDED. BACTERIA TESTING INDICATES LEVELS OF CONTAMINATION THAT MAY BE HAZARDOUS TO YOUR HEALTH. THIS ADVISORY AFFECTS WATERS WITHIN 200' OF THIS SIGN.
OFFICE OF THE STATE HEALTH DIRECTOR


Number of Advisories and Number of Days Under Advisory For Each Swimming Season
ADVISORIES & DAYS
YEARS
1000
900
800
700
600
500
400
300
200
100
0
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
3 180
10 665
11 293
5 160
4 128
0 0
34 874
46 551
16 222
40 440
22 193
24 173
35 437
45 851
23 173
22 169
7 38
54 418
28 421
13 314
10 124
25 201


Northern Region
Problem Sites
Currituck Sound
Corolla
Atlantic Ocean
Pasquotank River
Perquimans River
Chowan River
Albemarle Sound
N91 Colington Harbour
Nags Head
N88 Jockey's Ridge
Big Flatty Creek
Alligator River
Croatan Sound
Pamlico River
Pamlico Sound
Cape Hatteras
Neuse River
N
0 5 10
Miles


Central Region
Problem Sites
Pamlico River
Pamlico Sound
Neuse River
Atlantic Ocean
Core Sound
Morehead City
C55A Town Creek
C57 Radio Island
White Oak River
New River
0 2.5 5
Miles
N


Southern Region
Problem Sites
421
17
New River
74
140
WILMINGTON INTL AIRPORT
Wilmington
S22B
S22C
S22E
Banks Channel
76
132
Atlantic Ocean
Cape Fear River
17
Bald Head Island
0 2 4 8
Miles
N



What are the fecal sources to the surf?

Table 7: Bacterial Densities in Warm-Blooded Animals Feces
(Sources: Pitt, 1998; Godfrey, 1992; Geldrich et al., 1962)

Waste stream	Fecal coliform *(Density/gm)*	Fecal streptococci	Unit discharge *(lbs/day)*
Human	1.3×10^7	3.0×10^6	0.35
Cats	7.9×10^6	2.7×10^7	0.15
Dogs	2.3×10^7	9.8×10^8	0.32
Rats	1.6×10^5	4.6×10^7	0.08
Cows	2.3×10^5	1.3×10^7	15.4
Ducks	3.3×10^7	5.4×10^7	0.15
Waterfowl	3.3×10^7		0.18 - 0.35

Center for Watershed Protection

Table 1. Numbers of Viable Bacteria Found Per Gram of Feces of Adult Animals[8]
(Median values from 10 animals)

Animal	*E. coli*	*C. perfringens*	Enterococci	*Bacteriodes*	*Lactobacilli*
Cow	20,000	200	200,000	No Data	250
Horse	13,000	No Data	6,300,000	No Data	10,000,000
Pig	3,200,000	4,000	2,500,000	500,000	250,000,000
Sheep	3,200,000	20,000	1,300,000	No Data	7,900
Chicken	4,000,000	250	32,000,000	No Data	320,000,000
Dog	32,000,000	250,000,000	40,000,000	500,000,000	40,000
Cat	40,000,000	25,000,000	200,000,000	790,000,000	1,300,000,000
Human	5,000,000	1,600	160,000	5,000,000,000	630,000,000

Center for Watershed Protection

Precautionary Advisories

Storm Drains

Nine ocean storm drains have dry weather discharges

Storm Drains

Ten additional ocean storm drains have wet weather discharges

Dredge Disposal

Precautionary Blanket Advisories

Precautionary Swimming Advisory for Florence

- Issued press release prior to the storm to advise against swimming for all coastal counties.
- Press release advised public that heavy rains and flooding could result in discharges of human and animal waste into coastal waters.
- Approximately a week after the storm, a second press release was issued lifting the precautionary advisory in Currituck and Dare Counties while the remaining coastal counties were still advised not to swim.
- No signs were posted. Public was informed of the advisory by the recreational water quality website, media, and social media.
- The precautionary advisory was lifted October 5 as most sampling sites had enterococci levels within the standard for swimming.

Collection System

- Sewer Lines
- Manholes
- Lift Stations

Hog waste on the beach?

NC Recreational Water Quality

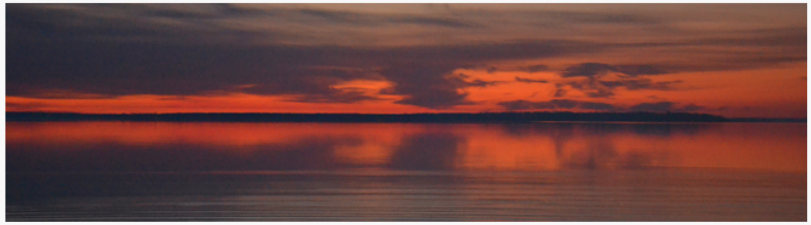
Website and Database

Employee Sign In

NORTH CAROLINA
Environmental Quality

DMF - Homepage ▾ | About DMF | Contact DMF | DMF Offices | - Text +

- Marine Fisheries Homepage
- Environmental Assistance and Customer Service
- Educational Materials
- N.C. DENR
- Links
- Press Releases
- Rules
- Sampling Data
- Swimming Advisories
- Testing Sites
- DENR Disclaimer



N.C. Recreational Water Quality Program

The N.C. Recreational Water Quality Program began testing coastal waters in 1997. Our mission is to protect the public health by monitoring the quality of N.C.'s coastal recreational waters and notifying the public when bacteriological standards for safe bodily contact are exceeded. The coastal waters monitored include the ocean beaches, sounds, bays and estuarine rivers.

We test for *enterococcus* bacteria, an indicator organism found in the intestines of warm-blooded animals. While it will not cause illness itself, its presence is correlated with that of organisms that can cause illness.

The program tests 204 swimming sites, most of them on a weekly basis during the swimming season, which runs from April through September. All ocean beaches and high-use sound-side beaches are tested weekly from April though September; lower-use beaches are tested twice a month. All sites are tested twice a month in October and monthly from November through March. Water quality sampling results for all locations are posted on this site along with information about archived swimming advisories. In most cases swimming advisories will not be issued during the non-swimming season from Nov. 1 to March 31.

N.C. Division of Marine Fisheries • 3441 Arendell Street • Morehead City, NC 28557 • 252-726-7021 or 800-682-2632

Contacts

North Carolina Department of Environmental Quality

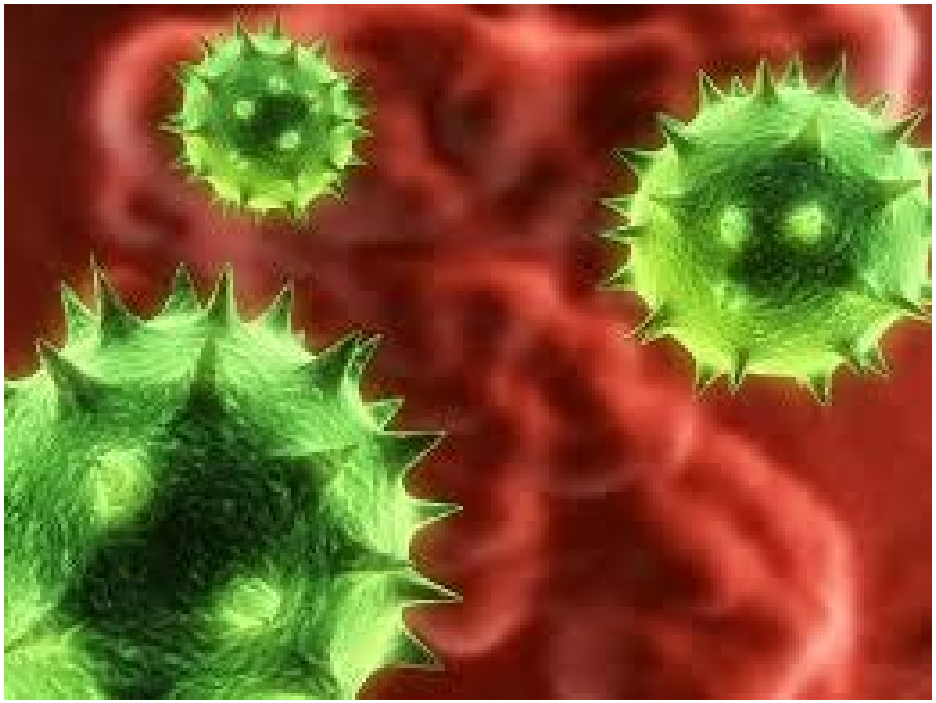
facebook

Waterborne Illness
Fecal Contamination

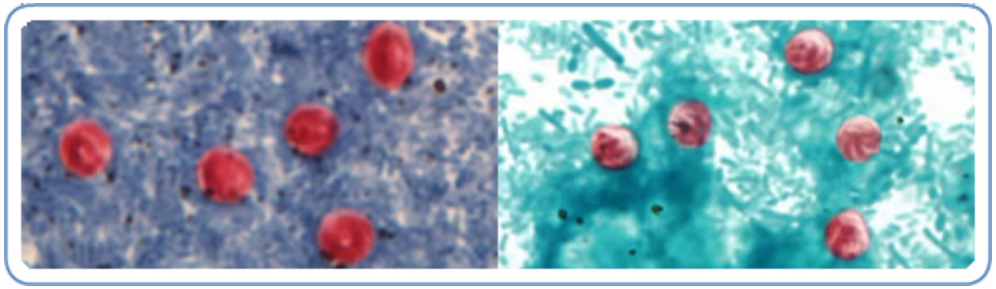
- Gastroenteritis – Bacteria, viruses, protozoa
- Flu-like symptoms
- Abdominal cramps, diarrhea, fever, nausea
- Ear, nose, throat, and skin infections

Viruses

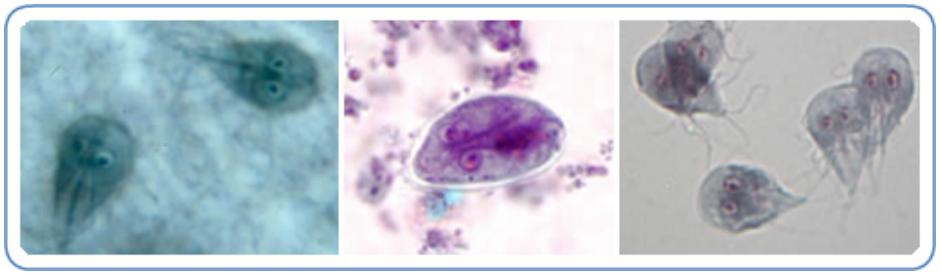
- Norovirus
- Adenovirus
- Enterovirus
- Rotavirus
- Hepatitis A



Protozoa



Cryptosporidia



Giardia

Bacteria

- Campylobacter
- Salmonella
- Pathogenic *E. coli*

Acknowlegements

Albemarle - Pamlico National Estuary Partnership

BHI CONSERVANCY

EPA United States Environmental Protection Agency

NORTH CAROLINA MARINE FISHERIES