Safe for Swimming?

Water Quality at Our Beaches

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Written by:

Gideon Weissman
Frontier Group

John Rumpler
Environment America Research and Policy Center

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Errata: The original version of this report contained inaccuracies resulting from calculation and methodological errors, resulting in some beaches registering more days of potentially unsafe water than was actually the case. This version contains revised results at the national, state, and site level, as well as a revised methodology. Sincere thanks to those who reached out with feedback on the original report.

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Cover: Health advisory at Sunset Beach at Presque Isle State Park by Erie, Pennsylvania. Credit: David Fulmer via Flickr

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Executive Summary

The Clean Water Act, adopted in 1972 with overwhelming bi-partisan support, had the farsighted and righteous goal of making all our waterways safe for swimming. Yet 46 years later, all too often, Americans visiting their favorite beach are met by an advisory warning that the water is unsafe for swimming. Even worse, in recent years millions of Americans have been sickened by swimming in contaminated water.

An analysis of bacteria sampling data from beaches in 29 coastal and Great Lakes states and Puerto Rico reveals that 2,580 beach sites – more than half of all sites tested – were potentially unsafe for swimming on at least one day in 2018, and 546 sites were potentially unsafe at least 25 percent of the days that sampling took place.[1] Sites were considered potentially unsafe if bacteria levels exceeded the U.S. Environmental Protection Agency's most protective "Beach Action Value" thresholds, which the EPA suggests states use as a "conservative, precautionary tool for making beach notification decisions," and are associated with an estimated illness rate of 32 per 1,000 swimmers.[2] (Many states use other thresholds for beach closure and advisory decisions. Therefore, results presented in this report may differ from state reports on beach water quality.) (See Methodology for details.)

To keep our beaches safe for swimming and protect Americans' health, policymakers should undertake efforts to prevent runoff pollution, including through the use of natural and green infrastructure that absorb stormwater onsite.

Fecal contamination makes beaches unsafe for swimming.

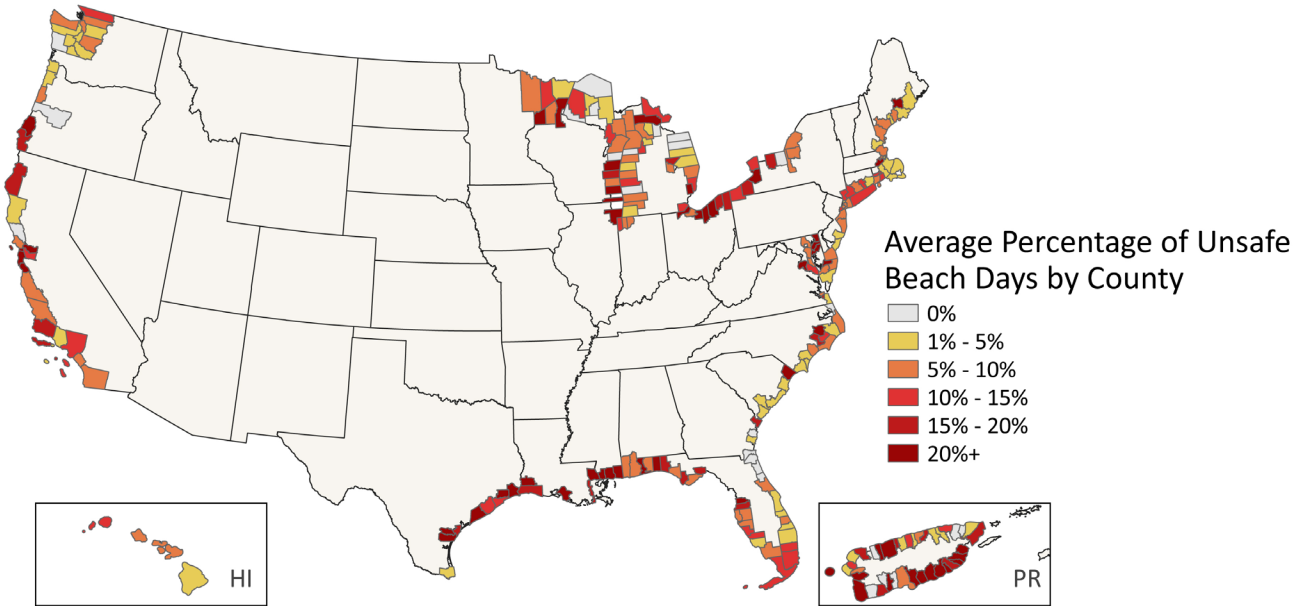
- Human contact with the contaminated water indicated by bacteria testing can result in gastrointestinal illness as well as respiratory disease, ear and eye infections and skin rash.[3]
- Each year in the U.S., swimmers suffer from an estimated 57 million cases of recreational waterborne illness.[4]
- Primary sources of fecal contamination include urban runoff, sewage leaks and overflows, and industrial-scale livestock operations.

More than half of the thousands of beach sites sampled for bacteria across the country were potentially unsafe for swimming on at least one day in 2018.

- In 2018, sampling data from 4,523 beach sites in 29 coastal and Great Lakes states and Puerto Rico were submitted to the National Water Quality Monitoring Council.
- Tests at 2,580 sites indicated potentially unsafe levels of fecal contamination for swimming on at least one day, and 546 were potentially unsafe at least 25 percent of the days that sampling took place.

Bacteria testing of ocean and Great Lakes beaches in every region of the country revealed days of potentially unsafe fecal contamination in 2018.

Figure ES-1. Average Percentage of Potentially Unsafe Beach Days in 2018 by County



- Among Gulf Coast beaches, 329 sites, or 85 percent of the 385 sites tested, were unsafe for at least one day in 2018.
- Among West Coast beaches, 571 sites, or 67 percent of the 850 sites tested, were unsafe for at least one day in 2018.
- Among East Coast beaches, 1,134 sites, or 48 percent of the 2,372 sites tested, were unsafe for at least one day in 2018.
- Among Great Lakes beaches, 380 sites, or 68 percent of the 559 sites tested, were unsafe for at least one day in 2018.

In every coastal and Great Lakes state and Puerto Rico, sampling revealed potentially unsafe levels of contamination in 2018.

- **Alabama:** 21 of 25 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Fairhope Public Beach in Baldwin County was potentially unsafe for 21 days, more than any other site in the state.
- **California:** 464 of 584 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Inner Cabrillo Beach in Los Angeles County was potentially unsafe for 85 days, more than any other site in the state.
- **Connecticut:** 81 of 113 beach sites sampled were potentially unsafe for at least one day in 2018. Sampling sites at Byram Beach in Fairfield County were potentially unsafe for 6 days, more than any other site in the state.
- **Delaware:** 7 of 23 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Slaughter Beach in Sussex County was potentially unsafe for 16 days, more than any other site in the state.
- **Florida:** 180 of 263 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Bayou Texar in Escambia County was potentially unsafe for 24 days, more than any other site in the state.

- **Georgia:** 13 of 26 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at St. Simons Island Lighthouse in Glynn County was potentially unsafe for 6 days, more than any other site in the state.
- **Hawaii:** 90 of 218 beach sites sampled were potentially unsafe for at least one day in 2018. The sampling site at Keehi Lagoon (North) in Honolulu County was potentially unsafe for 11 days, more than any other site in the state.
- **Illinois:** 19 of 19 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at South Shore Beach in Cook County was potentially unsafe for 38 days, more than any other site in the state.
- **Indiana:** 22 of 23 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Jeorse Park Beach in Lake County was potentially unsafe for 38 days, more than any other site in the state.
- **Louisiana:** 24 of 24 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at North Beach in Calcasieu Parish was potentially unsafe for 11 days, more than any other site in the state.
- **Maine:** 39 of 85 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Goose Rocks Beach in York County was potentially unsafe for 14 days, more than any other site in the state.
- **Maryland:** 79 of 158 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Camp Pecometh in Kent County was potentially unsafe for 9 days, more than any other site in the state.
- **Massachusetts:** 223 of 583 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Nahant Bay at Eastern Ave. in Essex County was potentially unsafe for 39 days, more than any other site in the state.
- **Michigan:** 100 of 207 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at St. Clair Shores Memorial Park Beach in Macomb County was potentially unsafe for 18 days, more than any other site in the state.
- **Minnesota:** 24 of 42 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at the New Duluth Boat Club landing facility in St. Louis County was potentially unsafe for 14 days, more than any other site in the state.
- **Mississippi:** 21 of 21 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Gulfport East Beach in Harrison County was potentially unsafe for 44 days, more than any other site in the state.
- **New Hampshire:** 15 of 47 beach sites sampled were potentially unsafe for at least one day in 2018. Sampling sites at State Beach in Rockingham County were potentially unsafe for 5 days, more than any other sites in the state.
- **New Jersey:** 133 of 356 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Beachwood Beach West in Ocean County was potentially unsafe for 14 days, more than any other site in the state.
- **New York:** 272 of 422 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Tanner Park in Suffolk County was potentially unsafe for 48 days, more than any other site in the state.
- **North Carolina:** 127 of 213 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site by the intersection of E. Main St. and Tooley St., in Belhaven, Beaufort County, was potentially unsafe for 11 days, more than any other site in the state.

- **Ohio:** 55 of 58 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Bay View West in Erie County was potentially unsafe for 42 days, more than any other site in the state.
- **Oregon:** 18 of 51 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Sunset Bay State Park Beach at the mouth of Big Creek in Coos County was potentially unsafe for 10 days, more than any other site in the state.
- **Pennsylvania:** 25 of 28 beach sites sampled were potentially unsafe for at least one day in 2018. Sampling sites at Beach 11 in Thompson Bay in Erie County were potentially unsafe for 15 days, more than any other sites in the state.
- **Puerto Rico:** 76 of 139 beach sites sampled were potentially unsafe for at least one day in 2018. The sampling sites at Playa Guayanes in Yabucoa Municipio and Tropical Beach in Naguabo Municipio were potentially unsafe for 16 days, more than any other site in the state.
- **Rhode Island:** 54 of 129 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Easton's Beach in Newport County was potentially unsafe for 10 days, more than any other site in the state.
- **South Carolina:** 55 of 122 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Withers Swash in Horry County was potentially unsafe for 32 days, more than any other site in the state.
- **Texas:** 141 of 167 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Cole Park in Nueces County was potentially unsafe for 52 days, more than any other site in the state.
- **Virginia:** 19 of 37 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at North Community Beach in Norfolk city was potentially unsafe for 7 days, more than any other site in the state.
- **Washington:** 89 of 215 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at Sooes Beach in Clallam County was potentially unsafe for 7 days, more than any other site in the state.
- **Wisconsin:** 94 of 125 beach sites sampled were potentially unsafe for at least one day in 2018. A sampling site at South Shore Beach in Milwaukee County was potentially unsafe for 34 days, more than any other site in the state.

To ensure that all of our beaches are safe for swimming, policymakers should work to protect beaches from runoff and sewage pollution. Solutions include:

- Dramatically increasing funding to fix sewage systems and prevent runoff pollution through natural and green infrastructure, including rain barrels, permeable pavement and green roofs.
- Protecting and restoring natural infrastructure, including riparian areas and wetlands that can filter bacteria, sediment and nutrients.
- Strengthening enforcement of standards for municipal wastewater treatment.
- Enacting moratoria on new or expanded industrial-scale livestock operations, particularly in areas that threaten our beaches and other waterways.
- Using the EPA's most protective "Beach Action Value" bacteria standard for making beach advisory decisions, and implementing same-day bacteria testing and warning systems.

Introduction

Americans love the beach. From the warm waters of the Gulf Coast, to the cliffside beaches of the Pacific Northwest, to the Midwest beaches ringing the edges of every Great Lake, America's beaches enrich the lives of millions of Americans, providing them a place to escape the city, soak up the sun, and cool off in the hot summer months.

Americans should be able to expect that water at our beaches is clean and safe for swimming. In fact, that was a key goal when our nation adopted the Clean Water Act in 1972. But all too often, those looking for a summer getaway arrive at the beach only to be met by an advisory sign warning of unsafe water. Even worse, millions of Americans in recent years have been sickened by swimming in contaminated water, with many hospitalized.

As the following analysis shows, far too many beaches, in every corner of the country, can be unsafe for swimming.

In different regions of the country there are different culprits for beach pollution, including many types of urban and agricultural runoff pollution. But all regions can implement solutions to prevent pollution from being created in the first place, or to keep pollution from reaching the waters where our families go to swim.

Making those changes can protect public health and the environment, and help ensure that families across the country can continue to look to the beach as a summer haven, now and in the future.

Fecal Contamination of Swimming Areas Poses a Public Health Threat

People who swim in water polluted with sewage or other fecal contamination risk falling seriously ill.

Human contact with fecal contamination can result in gastrointestinal illness as well as respiratory disease, ear and eye infections and skin rash.[5] Although for testing purposes fecal contamination is typically indicated by the presence of bacteria (including the *E. coli* and enterococcus bacteria samples in the following analysis), most illnesses contracted from swimming in contaminated water are transmitted by viruses contained in fecal matter.[6] Norovirus is likely the most common cause of viral recreational water outbreaks, and can cause diarrhea, vomiting, nausea and stomach pain.[7]

Each year in the U.S., swimmers in oceans, lakes, rivers and ponds suffer from an estimated 57 million cases of recreational waterborne illness.[8] From 2000 to 2014, 140 outbreaks caused by recreational water contamination reported to the Centers for Disease Control and Prevention (CDC) caused 4,958 illnesses and two deaths.[9] In a single 2013 incident listed on the CDC's website, 597 people fell ill and three people were hospitalized with gastrointestinal illness from a contaminated Michigan lake (the lake was not named by the CDC).[10] Consuming oysters and other seafood harvested from contaminated water can also pose a health threat.[11]

Water contamination can also ruin a day at the beach, when it results in beach closures or swimming advisories. In 2018, there were 871 beach closings resulting from elevated bacteria or sewage in the U.S., and 4,824 beach contamination advisories warning people not to go in the water.[12] There were an additional 5,295 swimming advisories that water contamination was likely because of rainfall. While beach advisories are a critical tool to protect swimmers, many testing programs rely on a testing process that requires nearly 24 hours to show results, meaning that swimmers have already been exposed to unsafe water by the time advisories are posted.[13]

Causes of fecal contamination of beaches and lakes include:

Urban runoff: When rain runoff flows over yards, parks and other urban and suburban areas, it can pick up fecal waste from pets and wildlife. Runoff flows into streams, lakes and the ocean, either directly or indirectly through storm drains. The U.S. EPA's most recent Water Quality Assessment data shows that the top two probable sources of impairments for coastal shoreline are municipal discharges/sewage and urban-related runoff/stormwater.[14]

Impervious surfaces including roads and parking lots increase the quantity of runoff pollution that reaches waterways and beaches, because water flows over impervious surfaces, rather than absorbing into the

ground. In recent decades, U.S. coastal areas have seen significant increases in development, increasing impervious surface cover. From 1996 to 2010, U.S. coastal areas added 3.6 million acres of development, while losing more than 14.7 million acres of forest and 982,000 acres of wetland.[15]

Sewage overflows and failing septic systems: When sewage systems leak or overflow, human fecal waste spills into the environment and can contaminate waterways.[16] Sewage contamination is particularly dangerous for public health because it contains human waste, which contains bacteria, viruses and parasites capable of causing disease in humans.[17]

All types of sewer systems can be a source of water contamination, including combined sewers, sanitary sewers, and septic systems. Combined sewers are particularly prone to high-volume releases of dangerous pollution because the combination of stormwater and sewage into a single pipe can overwhelm the system following heavy rainfall or snowmelt.[18] In 2004, the EPA estimated that 850 billion gallons of untreated wastewater and stormwater are released as a result of combined sewer overflows each year.[19]

Sanitary sewers, which are designed to carry sewage alone, overflow as many as 75,000 times each year in the U.S.[20] Sanitary sewer overflows have causes including inadequate capacity, system deterioration, blockages and line breaks.[21] Deteriorating sewers can experience exfiltration (sewage leaking from pipes) or infiltration (groundwater or stormwater entering pipes, which can cause backups and overflows).[22]

Failing septic systems, which are used by approximately one in four Americans, are also a serious source of sewage pollution.[23] Septic systems have a failure rate of between 5 and 35 percent.[24]

Concentrated livestock manure: Most livestock is now raised in industrial-scale feedlot operations that generate large amounts of manure, which can contaminate water and make it unsafe for human contact.[25] Animal manure can contain a variety of bacterial and viral pathogens that cause disease in humans.[26] When runoff flows over improperly managed manure, or when waste sites leak or spill, manure pollution can contaminate waterways, and ultimately flow into lakes and oceans.[27] Nationally, industrial-scale livestock operations generate hundreds of millions of tons of manure each year.[28]

Flooding and extreme weather can exacerbate the spread of fecal pollution from all sources. For example, one study conducted following Hurricane Harvey found significant sewage contamination at flooded locations around Houston, Texas, and remarked that "a large number of sewage overflows and stormwater runoff occurred during Harvey flooding."[29]

American Beaches Are Often Unsafe for Swimming

Testing data collected from around the country reveal that, all too often, beach water may be unsafe for swimming.

As of May 2019, sampling data for 2018 from 4,523 beach sites in 29 coastal and Great Lakes states was available through the National Water Quality Monitoring Council's Water Quality Portal. Of those sampling sites, 2,580 had bacteria levels indicating potentially unsafe levels of fecal contamination for swimming on at least one day, and 546 were unsafe at least 25 percent of the days that sampling took place.

Sites were considered potentially unsafe if bacteria levels exceeded the U.S. Environmental Protection Agency's most protective "Beach Action Value" threshold, which the EPA suggests states use as a "conservative, precautionary tool for making beach notification decisions."[30] Many states use other thresholds for beach closure and notification decisions. Therefore, results presented in this report may differ from those in state reports on beach water quality. (See Methodology for details.)

Data for 2018 indicates potentially unsafe fecal contamination in every region of the country.

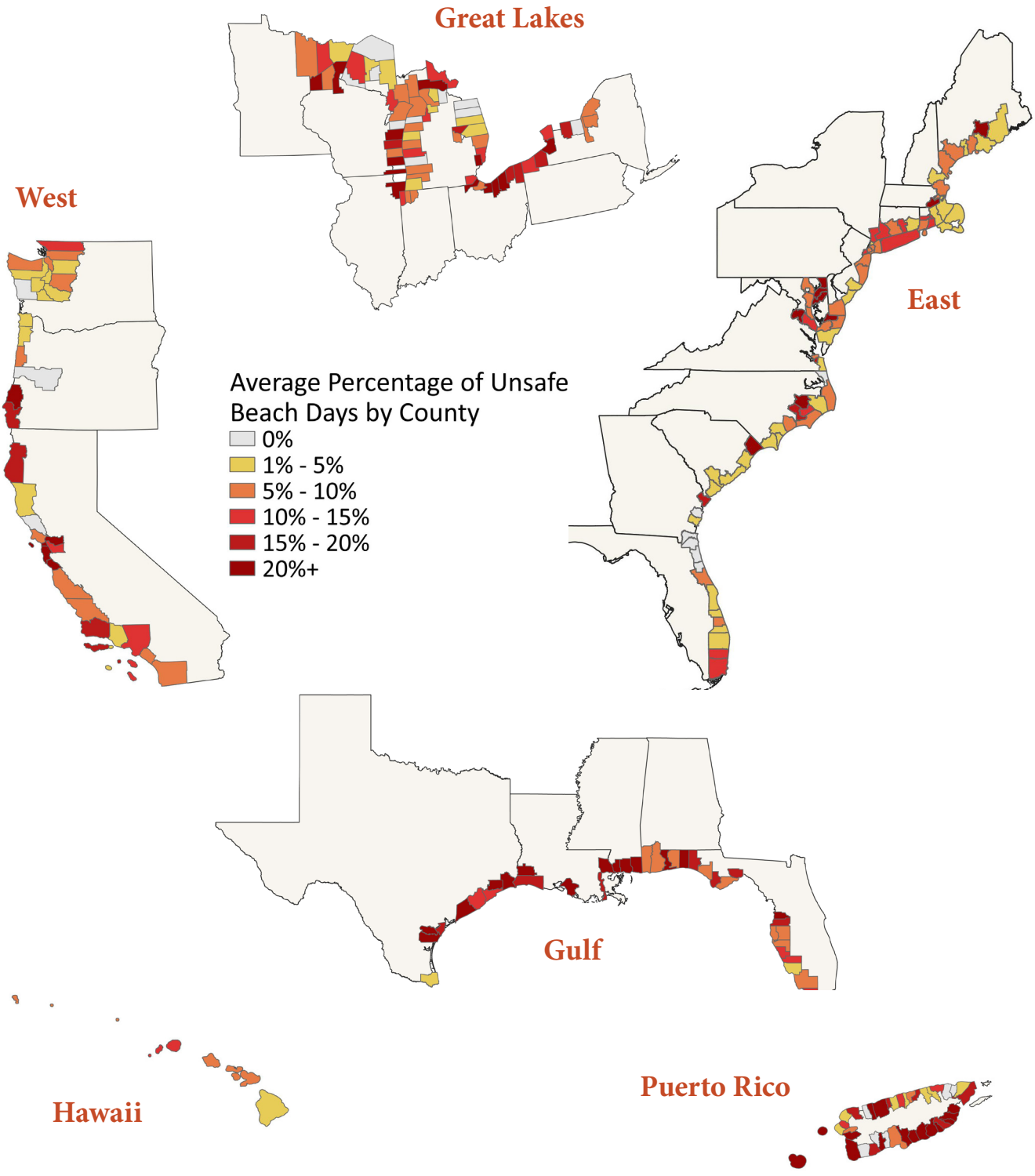
- Among Gulf Coast beaches, 329 sites, or 85 percent of the 385 sites tested, were unsafe for at least one day in 2018.
- Among West Coast beaches, 571 sites, or 67 percent of the 850 sites tested, were unsafe for at least one day in 2018.
- Among East Coast beaches, 1,134 sites, or 48 percent of the 2,372 sites tested, were unsafe for at least one day in 2018.
- Among Great Lakes beaches, 380 sites, or 68 percent of the 559 sites tested, were unsafe for at least one day in 2018.

How the U.S. Tests for Contaminated Water

Across the country, beach areas are monitored on different schedules and with different levels of regularity.

Data in this report come from sampling conducted by more than 40 local, state and federal agencies, and submitted to the National Water Quality Monitoring Council's Water Quality Portal. Different organizations test and submit testing data using different sampling techniques and equipment, over different schedules, and over different distributions of geography and time. Beaches in this analysis were tested between 1 and 398 times in 2018, on between 1 and 258 days. As a result, comparisons between beach sites, let alone between regions or states, are often not meaningful. Nevertheless, beaches where testing frequently indicates unsafe levels of fecal contamination present health risks for swimmers. (See Methodology for more details.)

Figure 1. Average Percentage of Potentially Unsafe Beach Days in 2018 by County
"Average percentage" refers to the average of each beach's percentage of potentially unsafe days out of sampling days in 2018 within each county. See Methodology for details.



Beach Pollution by State

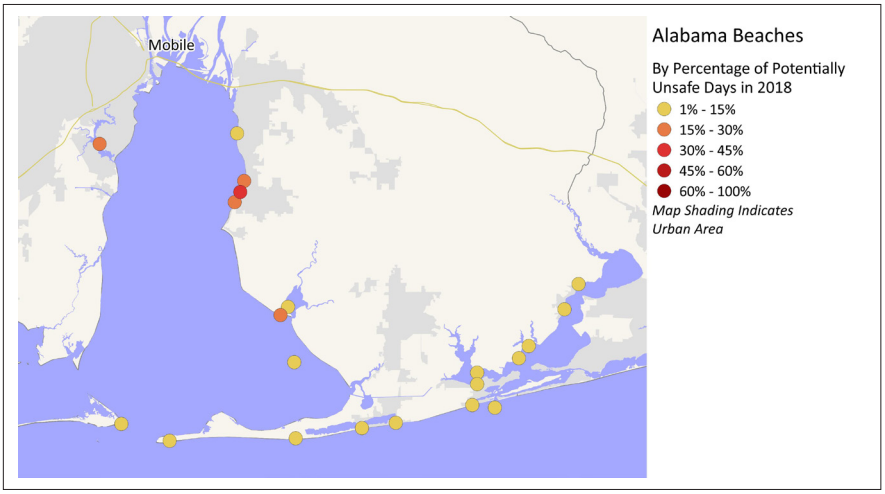


Table 1. Top Beach Sites by Most Potentially Unsafe Swimming Days in Alabama in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Fairhope Public Beach	Baldwin County	21	60	35%
Dog River, Alba Club	Mobile County	9	36	25%
Volanta Avenue	Baldwin County	8	36	22%
Camp Beckwith	Baldwin County	8	58	14%
Orange Street Pier	Baldwin County	6	34	18%
Mary Ann Nelson Beach	Baldwin County	5	20	25%
Kee Avenue	Baldwin County	4	30	13%
Spanish Cove	Baldwin County	4	30	13%
Orange Beach Waterfront Park	Baldwin County	4	31	13%
May Day Park	Baldwin County	3	31	10%

Table 2. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Alabama Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Mobile County	10%
Baldwin County	10%

Alabama

In Alabama, 21 tested beach sites were potentially unsafe for swimming on at least one day in 2018. Note that sample site locations reflect location data as submitted by testing agencies, and reflect any innacuracies contained within the original data source. See Methdology for details.

In 2018, 25 beach sites were sampled in Alabama. Of beaches where sampling took place, tests at 21 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Fairhope Public Beach in Baldwin County tested as potentially unsafe for 21 days, more days than any other site in the state, and 35 percent of the days that sampling took place. In Mobile County, the average beach was potentially unsafe for swimming on 10 percent of the days that sampling took place, a higher percentage than any other county in the state.

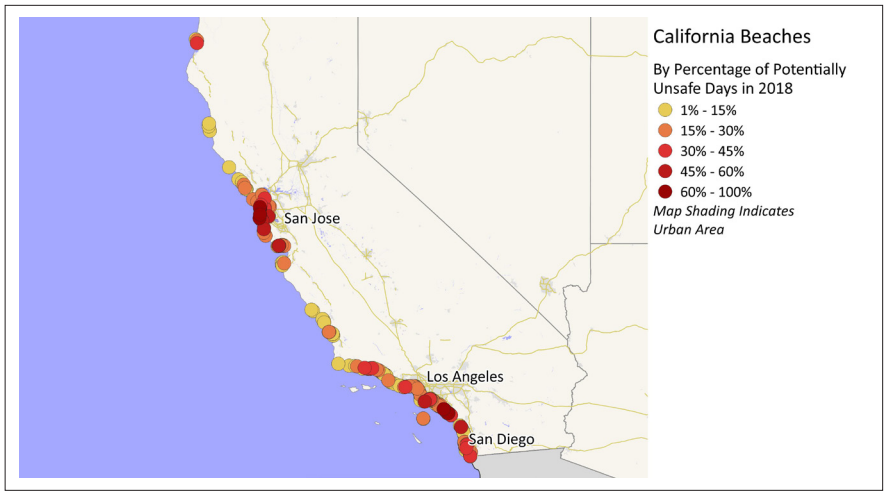


Table 3. Top Beach Sites by Most Potentially Unsafe Swimming Days in California in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Inner Cabrillo Beach I	Los Angeles County	85	175	49%
Coronado Ave Beach	Los Angeles County	62	144	43%
Salt Creek Beach	Orange County	46	80	57%
Molino Ave Beach	Los Angeles County	45	130	35%
5th Place Beach	Los Angeles County	44	140	31%
Inner Cabrillo Beach II	Los Angeles County	43	175	25%
Malibu Lagoon State Beach	Los Angeles County	43	254	17%
Prospect Ave Beach	Los Angeles County	42	141	30%
West Side of Belmont Pier	Los Angeles County	41	138	30%
San Pedro Creek	San Mateo County	40	47	85%

Table 4. Top 10 California Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
San Mateo County	29%
San Francisco County	26%
Contra Costa County	25%
Santa Cruz County	22%
Humboldt County	19%
Santa Barbara County	17%
Alameda County	14%
Los Angeles County	10%
Orange County	9%
Marin County	8%

California

In California, 464 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 584 beach sites were sampled in California. Of beaches where sampling took place, tests at 464 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Inner Cabrillo Beach in Los Angeles County tested as potentially unsafe for 85 days, more days than any other site in the state, and 49 percent of the days that sampling took place. In San Mateo County, the average beach was potentially unsafe for swimming on 29 percent of the days that sampling took place, a higher percentage than any other county in the state.

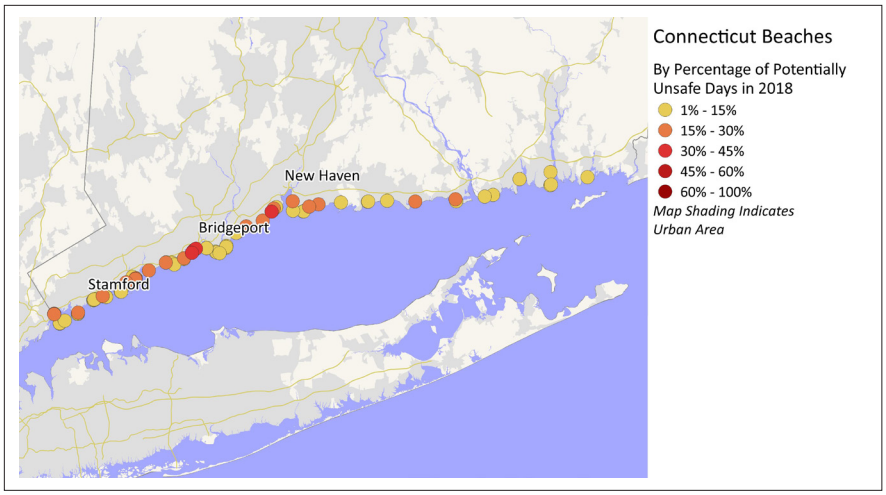


Table 5. Top Beach Sites by Most Potentially Unsafe Swimming Days in Connecticut in 2018*

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Byram Beach I	Fairfield County	6	20	30%
Byram Beach II	Fairfield County	6	20	30%
Seaside Park Beach I	Fairfield County	5	14	36%
Seaview Beach	New Haven County	4	10	40%
Seaside Park Beach II	Fairfield County	4	12	33%
Seaside Park Beach III	Fairfield County	4	13	31%
Seaside Park Beach IV	Fairfield County	4	14	29%
Clark Avenue Beach	New Haven County	4	15	27%
Seaside Park Beach V	Fairfield County	4	15	27%
Hickory Bluff Beach	Fairfield County	4	17	24%

** Some sample sites with similar names reflect multiple sites at the same location. Site names have been numbered here for clarity.*

Table 6. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Connecticut Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Fairfield County	12%
Middlesex County	11%
New Haven County	9%
New London County	5%

Connecticut

In Connecticut, 81 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 113 beach sites were sampled in Connecticut. Of beaches where sampling took place, tests at 81 indicated potentially unsafe levels of contamination on at least one day. Sampling sites at Byram Beach in Fairfield County tested as potentially unsafe for 6 days, more days than any other site in the state, and 30 percent of the days that sampling took place. In Fairfield County, the average beach was potentially unsafe for swimming on 12 percent of the days that sampling took place, a higher percentage than any other county in the state.

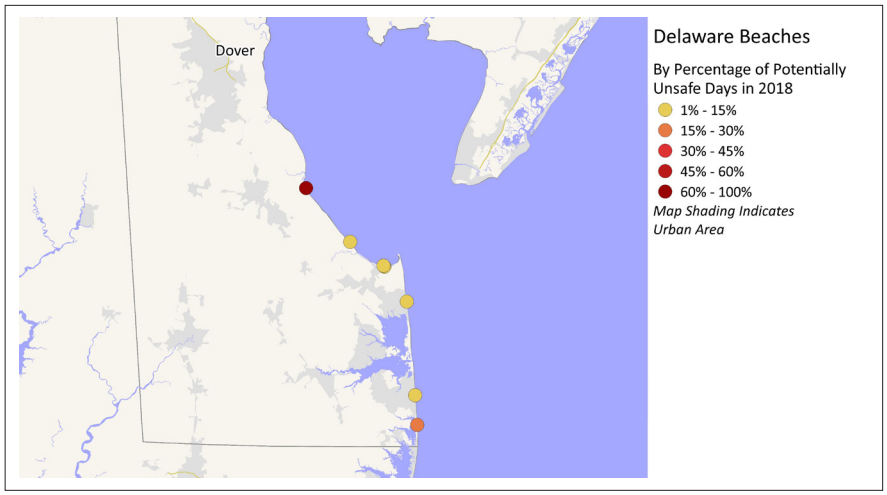


Table 7. Top Beach Sites by Most Potentially Unsafe Swimming Days in Delaware in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Slaughter Beach	Sussex County	16	25	64%
Fenwick Island State Park Beach	Sussex County	3	16	19%
Rehoboth Beach	Sussex County	3	32	9%
Broadkill Beach	Sussex County	2	16	12%
Lewes Beach North	Sussex County	2	17	12%
Lewes Beach South	Sussex County	1	16	6%
Bethany Beach	Sussex County	1	33	3%

Table 8. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Delaware Counties (Only One County with Testing Data)

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Sussex County	5%

Delaware

In Delaware, 7 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 23 beach sites were sampled in Delaware. Of beaches where sampling took place, tests at 7 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Slaughter Beach in Sussex County tested as potentially unsafe for 16 days, more days than any other site in the state, and 64 percent of the days that sampling took place. In Sussex County, the only county where testing took place, the average beach was potentially unsafe for swimming on 5 percent of the days that sampling took place.

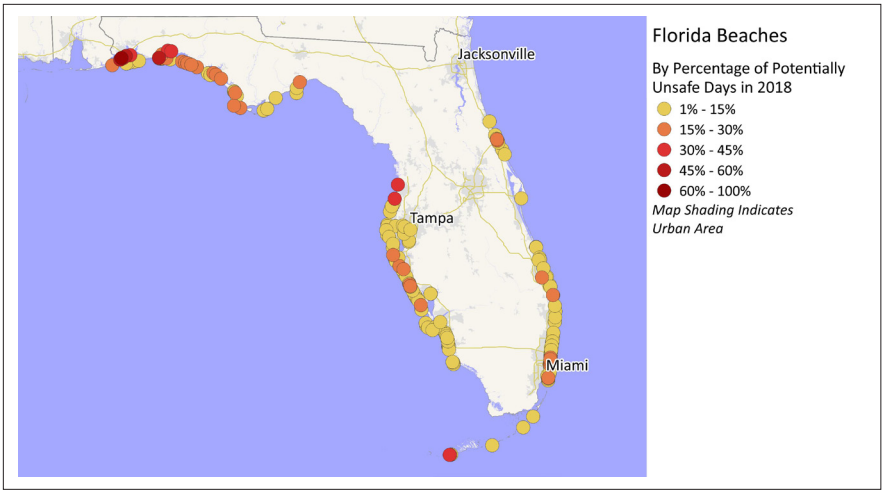


Table 9. Top Beach Sites by Most Potentially Unsafe Swimming Days in Florida in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Bayou Texar	Escambia County	24	50	48%
Sanders Beach	Escambia County	23	64	36%
Crandon Park on Key Biscayne	Miami-Dade County	17	63	27%
Bird Key Park	Sarasota County	17	67	25%
Venice Fishing Pier	Sarasota County	15	64	23%
Bayou Chico	Escambia County	14	20	70%
South Beach	Monroe County	14	31	45%
Eastern Lake Dune Walkover	Walton County	13	44	30%
Venice Beach	Sarasota County	13	63	21%
Escambia Bay	Santa Rosa County	12	37	32%

Table 10. Top 10 Florida Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Hernando County	38%
Okaloosa County	22%
Escambia County	20%
Walton County	18%
Gulf County	17%
Wakulla County	17%
Pasco County	17%
Sarasota County	14%
Miami-Dade County	13%
Broward County	11%

Florida

In Florida, 180 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 263 beach sites were sampled in Florida. Of beaches where sampling took place, tests at 180 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Bayou Texar in Escambia County tested as potentially unsafe for 24 days, more days than any other site in the state, and 48 percent of the days that sampling took place. In Hernando County, the average beach was potentially unsafe for swimming on 38 percent of the days that sampling took place, a higher percentage than any other county in the state.

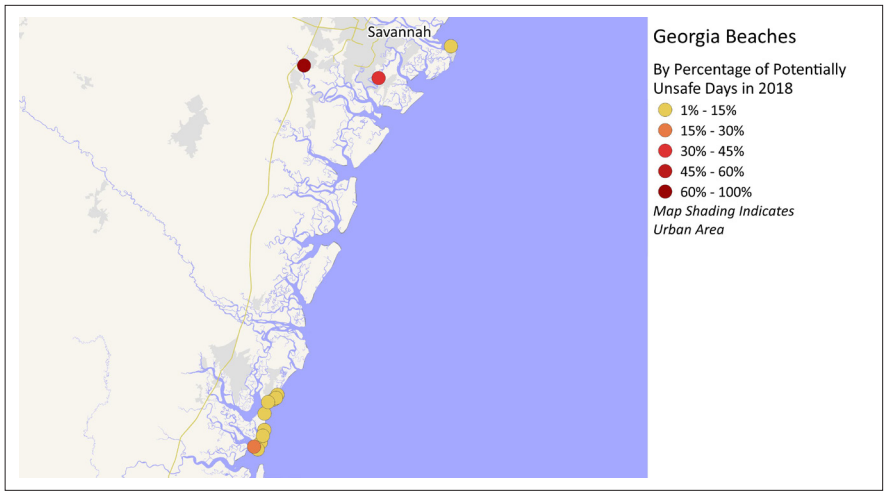


Table 11. Top Beach Sites by Most Potentially Unsafe Swimming Days in Georgia in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
St. Simons Island Lighthouse	Glynn County	6	50	12%
Kings Ferry	Chatham County	3	4	75%
Skidaway Narrows	Chatham County	3	8	38%
Tybee Island Polk St.	Chatham County	3	46	7%
Jekyll Driftwood Beach	Glynn County	2	46	4%
Jekyll Island Convention Center	Glynn County	2	46	4%
4H Camp on Jekyll Island	Glynn County	2	46	4%
East Beach	Glynn County	2	47	4%
St. Andrews Picnic Area (Jekyll)	Glynn County	1	4	25%
Capt. Wylly Rd. near Beachview on Jekyll Island	Glynn County	1	45	2%

Table 12. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Georgia Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Chatham County	17%
Glynn County	4%
McIntosh County	0%

Georgia

In Georgia, 13 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 26 beach sites were sampled in Georgia. Of beaches where sampling took place, tests at 13 indicated potentially unsafe levels of contamination on at least one day. A sampling site at St. Simons Island Lighthouse in Glynn County tested as potentially unsafe for 6 days, more days than any other site in the state, and 12 percent of the days that sampling took place. In Chatham County, the average beach was potentially unsafe for swimming on 17 percent of the days that sampling took place, a higher percentage than any other county in the state.

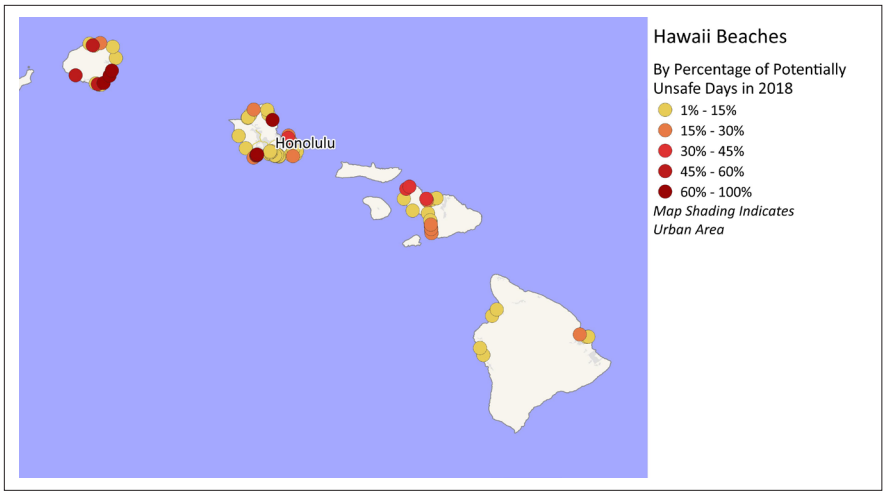


Table 13. Top Beach Sites by Most Potentially Unsafe Swimming Days in Hawaii in 2018*

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Keehi Lagoon (North)	Honolulu County	11	91	12%
Keehi Lagoon (South)	Honolulu County	10	91	11%
Punaluu Beach Park	Honolulu County	9	12	75%
MS2 (Kapoho Point)	Honolulu County	9	20	45%
Kalihi Channel	Honolulu County	8	91	9%
West Sand Island Park	Honolulu County	7	91	8%
Hanauma Beach Park	Honolulu County	6	37	16%
Hanakaoo	Maui County	6	42	14%
Kakaako Park	Honolulu County	5	91	5%

** Four Hawaii sites tied for the tenth-most potentially unsafe days, and had the same percentage of potentially unsafe days. Those sites have been left off of the above list.*

Table 14. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Hawaii Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Kauai County	13%
Honolulu County	8%
Maui County	5%
Hawaii County	4%

Hawaii

In Hawaii, 90 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 218 beach sites were sampled in Hawaii. Of beaches where sampling took place, tests at 90 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Keehi Lagoon (North) in Honolulu County tested as potentially unsafe for 11 days, more days than any other site in the state, and 12 percent of the days that sampling took place. In Kauai County, the average beach was potentially unsafe for swimming on 13 percent of the days that sampling took place, a higher percentage than any other county in the state.

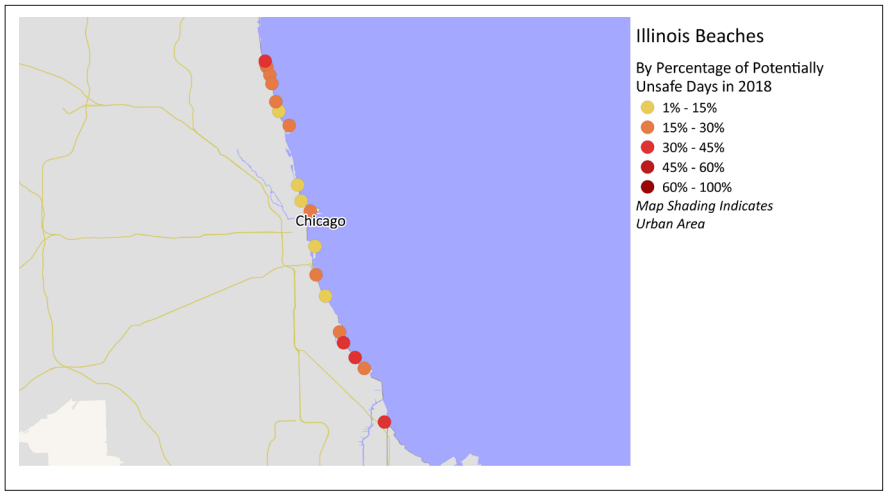


Table 15. Top Beach Sites by Most Potentially Unsafe Swimming Days in Illinois in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
South Shore Beach	Cook County	38	98	39%
Hartigan Beach	Cook County	35	96	36%
63rd Street Beach	Cook County	34	95	36%
Rogers Avenue Park Beach	Cook County	33	95	35%
Howard Street Park Beach	Cook County	28	96	29%
Calumet South Beach	Cook County	27	96	28%
Margaret T Burroughs (31st St. Beach)	Cook County	26	99	26%
Montrose Beach	Cook County	25	95	26%
Rainbow Beach	Cook County	23	96	24%
Ohio Street Beach	Cook County	20	92	22%

Table 16. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Illinois Counties (Only One County with Testing Data)

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Cook County	22%

Illinois

In Illinois, 19 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 19 beach sites were sampled in Illinois. Of beaches where sampling took place, tests at all 19 indicated potentially unsafe levels of contamination on at least one day. A sampling site at South Shore Beach in Cook County tested as potentially unsafe for 38 days, more days than any other site in the state, and 39 percent of the days that sampling took place. In Cook County, the only county where testing was reported in the national database, the average beach was potentially unsafe for swimming on 22 percent of the days that sampling took place.

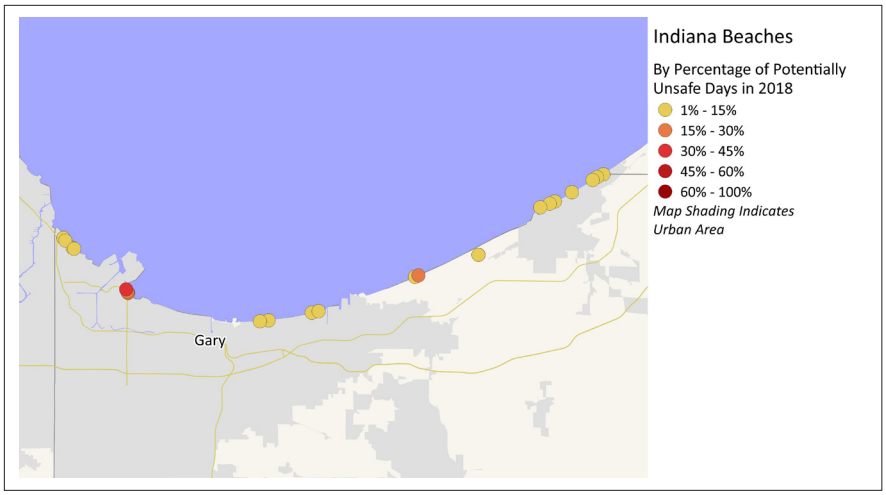


Table 17. Top Beach Sites by Most Potentially Unsafe Swimming Days in Indiana in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Jeorse Park Beach I	Lake County	38	111	34%
Jeorse Park Beach II	Lake County	31	111	28%
Buffington Harbor Beach	Lake County	24	111	22%
Indiana Dunes State Park East Beach	Porter County	18	101	18%
Washington Park Beach	LaPorte County	15	105	14%
Indiana Dunes State Park West Beach	Porter County	13	100	13%
Whihala Beach East	Lake County	12	104	12%
Hammond Marina East Beach	Lake County	12	105	11%
Sheridan Beach Stop 2	LaPorte County	9	105	9%
Whihala Beach West	Lake County	8	104	8%

Table 18. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Indiana Counties

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Lake County	14%
Porter County	8%
LaPorte County	7%

Indiana

In Indiana, 22 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 23 beach sites were sampled in Indiana. Of beaches where sampling took place, tests at 22 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Jeorse Park Beach in Lake County tested as potentially unsafe for 38 days, more days than any other site in the state, and 34 percent of the days that sampling took place. In Lake County, the average beach was potentially unsafe for swimming on 14 percent of the days that sampling took place, a higher percentage than any other county in the state.

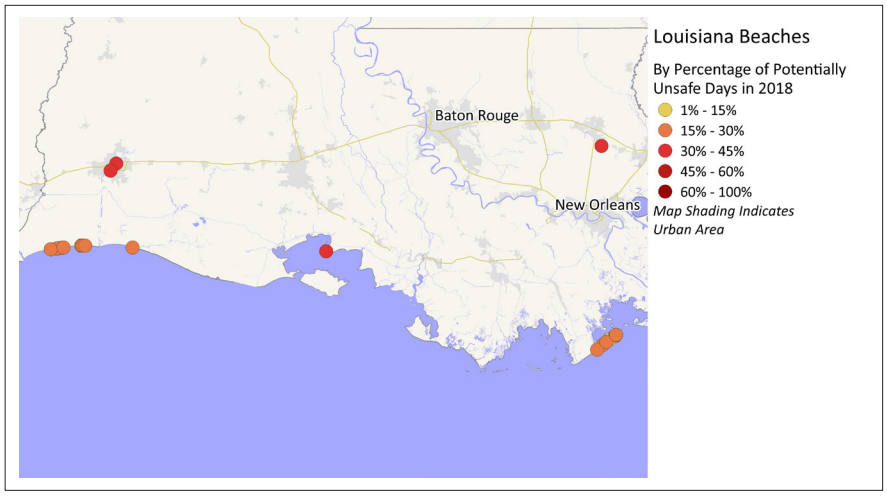


Table 19. Top Beach Sites by Most Potentially Unsafe Swimming Days in Louisiana in 2018

Sampling Site	Parish	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
North Beach	Calcasieu Parish	11	31	35%
Fontainebleau State Park	St. Tammany Parish	10	29	34%
Cypremort Point State Park	St. Mary Parish	10	31	32%
Rutherford Beach	Cameron Parish	9	31	29%
Holly Beach - 4	Cameron Parish	7	31	23%
Constance Beach	Cameron Parish	7	31	23%
Holly Beach - 1	Cameron Parish	7	31	23%
Grand Isle State Park - 1	Jefferson Parish	6	30	20%
Elmer's Island - 1	Jefferson Parish	6	30	20%
Grand Isle Beach - 2	Jefferson Parish	6	30	20%

Table 20. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Louisiana Parishes

Parish	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in Parish
Calcasieu Parish	39%
St. Tammany Parish	34%
St. Mary Parish	32%
Cameron Parish	18%
Jefferson Parish	17%

Louisiana

In Louisiana, 24 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 24 beach sites were sampled in Louisiana. Of beaches where sampling took place, tests at all 24 indicated potentially unsafe levels of contamination on at least one day. A sampling site at North Beach in Calcasieu Parish tested as potentially unsafe for 11 days, more days than any other site in the state, and 35 percent of the days that sampling took place. In Calcasieu Parish, the average beach was potentially unsafe for swimming on 39 percent of the days that sampling took place, a higher percentage than any other parish in the state.

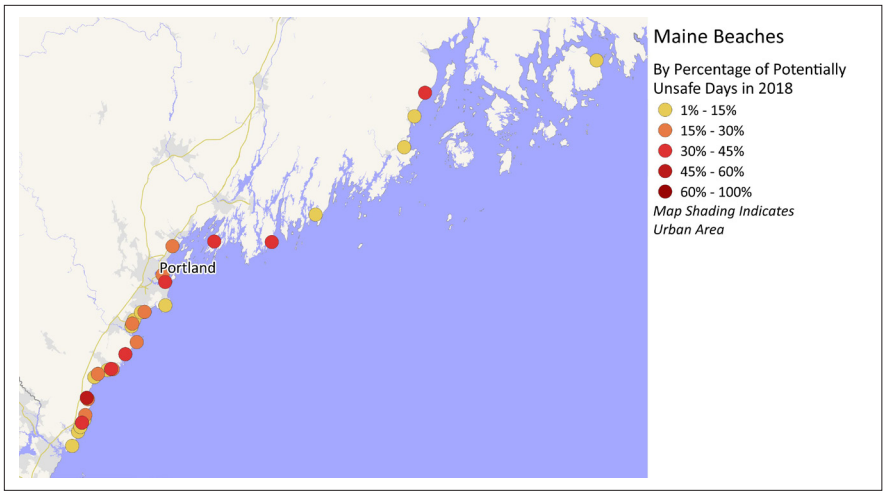


Table 21. Top Beach Sites by Most Potentially Unsafe Swimming Days in Maine in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Goose Rocks Beach - Site 5	York County	14	39	36%
Goose Rocks Beach - Site 1	York County	9	39	23%
Willard Beach	Cumberland County	8	26	31%
Ogunquit Beach	York County	7	14	50%
Kennebunk Beach	York County	6	18	33%
Harpswell Beach	Cumberland County	5	13	38%
Long Sands Beach	York County	5	14	36%
Lincolnville Beach	Waldo County	5	16	31%
Cape Neddick Harbor	York County	4	15	27%
Colony Beach	York County	4	25	16%
East End Beach	Cumberland County	4	25	16%

Table 22. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Maine Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Waldo County	31%
York County	9%
Cumberland County	9%
Lincoln County	8%
Knox County	5%
Sagadahoc County	4%
Hancock County	1%

Maine

In Maine, 39 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 85 beach sites were sampled in Maine. Of beaches where sampling took place, tests at 39 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Goose Rocks Beach - Site 5 in York County tested as potentially unsafe for 14 days, more days than any other site in the state, and 36 percent of the days that sampling took place. In Waldo County, the average beach was potentially unsafe for swimming on 31 percent of the days that sampling took place, a higher percentage than any other county in the state.

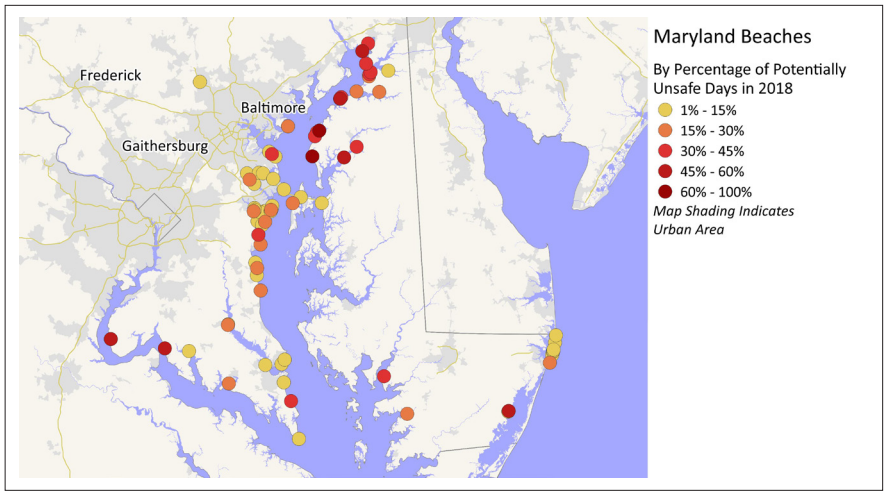


Table 23. Top Beach Sites by Most Potentially Unsafe Swimming Days in Maryland in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Camp Pecometh	Kent County	9	16	56%
Public Landing Beach near Snow Hill	Worcester County	8	15	53%
Ocean City Beach 1	Worcester County	8	28	29%
Ferry Park	Kent County	7	10	70%
Purse State Park	Charles County	7	12	58%
Charlestown Manor	Cecil County	6	10	60%
Rolph's Wharf	Queen Anne's County	6	16	38%
Elm's Beach - Public Beach	St. Mary's County	6	17	35%
Breezy Point	Calvert County	5	17	29%
YMCA Camp Tockwogh	Kent County	4	8	50%
Gilligan's Pier Restaurant	Charles County	4	8	50%

Table 24. Top 10 Maryland Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Kent County	45%
Charles County	36%
Cecil County	28%
Queen Anne's County	23%
Wicomico County	22%
St. Mary's County	10%
Worcester County	10%
Somerset County	8%
Calvert County	7%
Baltimore County	6%

Maryland

In Maryland, 79 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 158 beach sites were sampled in Maryland. Of beaches where sampling took place, tests at 79 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Camp Pecometh in Kent County tested as potentially unsafe for 9 days, more days than any other site in the state, and 56 percent of the days that sampling took place. In Kent County, the average beach was potentially unsafe for swimming on 45 percent of the days that sampling took place, a higher percentage than any other county in the state.

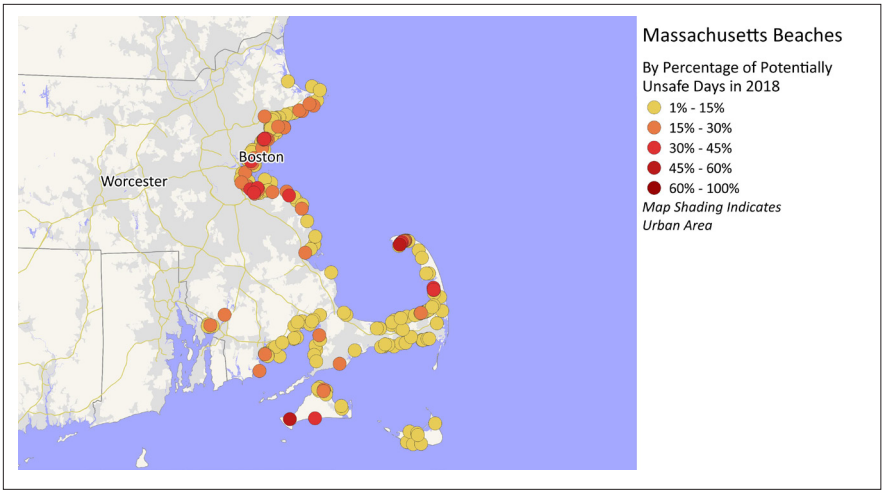


Table 25. Top Beach Sites by Most Potentially Unsafe Swimming Days in Massachusetts in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Nahant Bay at Eastern Ave	Essex County	39	92	42%
Tenean Beach	Suffolk County	26	94	28%
Nahant Bay at Pierce Road	Essex County	23	92	25%
Nahant Bay at Kimball Road	Essex County	21	92	23%
Quincy Shore at Channing Street	Norfolk County	18	93	19%
Quincy Shore at Sachem Street	Norfolk County	14	93	15%
Provincetown Harbor at Franklin Street	Barnstable County	13	26	50%
Malibu Beach in Dorchester Bay	Suffolk County	11	92	12%
Quincy Shore at Milton Road	Norfolk County	11	93	12%
Quincy Shore at Rice Road	Norfolk County	10	94	11%

Table 26. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Massachusetts Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Norfolk County	21%
Suffolk County	9%
Essex County	8%
Nantucket County	5%
Dukes County	4%
Bristol County	4%
Barnstable County	4%
Plymouth County	4%

Massachusetts

In Massachusetts, 223 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 583 beach sites were sampled in Massachusetts. Of beaches where sampling took place, tests at 223 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Nahant Bay at Eastern Ave. in Essex County tested as potentially unsafe for 39 days, more days than any other site in the state, and 42 percent of the days that sampling took place. In Norfolk County, the average beach was potentially unsafe for swimming on 21 percent of the days that sampling took place, a higher percentage than any other county in the state.

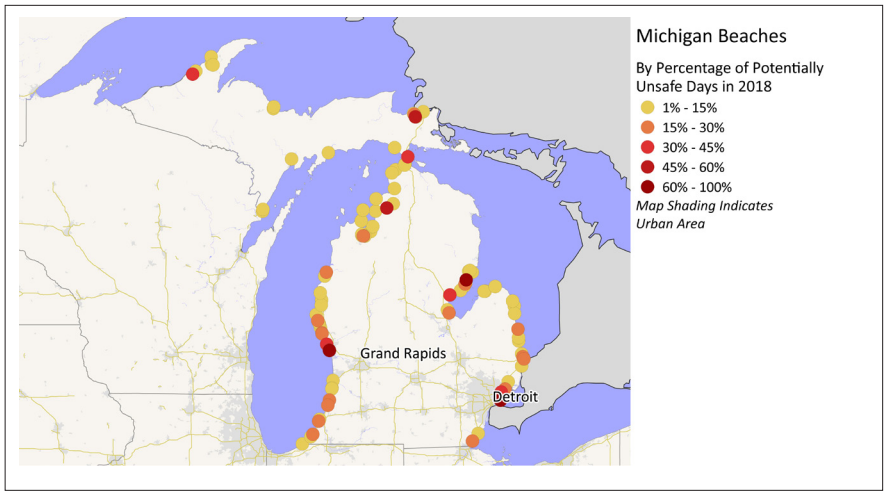


Table 27. Top Beach Sites by Most Potentially Unsafe Swimming Days in Michigan in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
St. Clair Shores Memorial Park Beach	Macomb County	18	49	37%
Pier Park	Wayne County	15	20	75%
H.C.M.A. - Lake St. Clair Metropark Beach	Macomb County	13	51	25%
Kiwanis Beach	Mackinac County	10	25	40%
Singing Bridge Beach	Arenac County	8	11	73%
East Jordan Tourist Park	Charlevoix County	7	13	54%
Bay City State Recreation Area	Bay County	7	39	18%
Holland Road Beach	St. Clair County	6	33	18%
New Baltimore Park Beach	Macomb County	6	48	12%
P.J. Hoffmaster State Park - Public Beach Area	Muskegon County	5	8	62%

Table 28. Top 10 Michigan Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Wayne County	75%
Mackinac County	26%
Macomb County	25%
Arenac County	19%
Monroe County	14%
Muskegon County	14%
Ontonagon County	13%
St. Clair County	13%
Menominee County	12%
Chippewa County	11%

Michigan

In Michigan, 100 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 207 beach sites were sampled in Michigan. Of beaches where sampling took place, tests at 100 indicated potentially unsafe levels of contamination on at least one day. A sampling site at St. Clair Shores Memorial Park Beach in Macomb County tested as potentially unsafe for 18 days, more days than any other site in the state, and 37 percent of the days that sampling took place. In Wayne County, the average beach was potentially unsafe for swimming on 75 percent of the days that sampling took place, a higher percentage than any other county in the state.

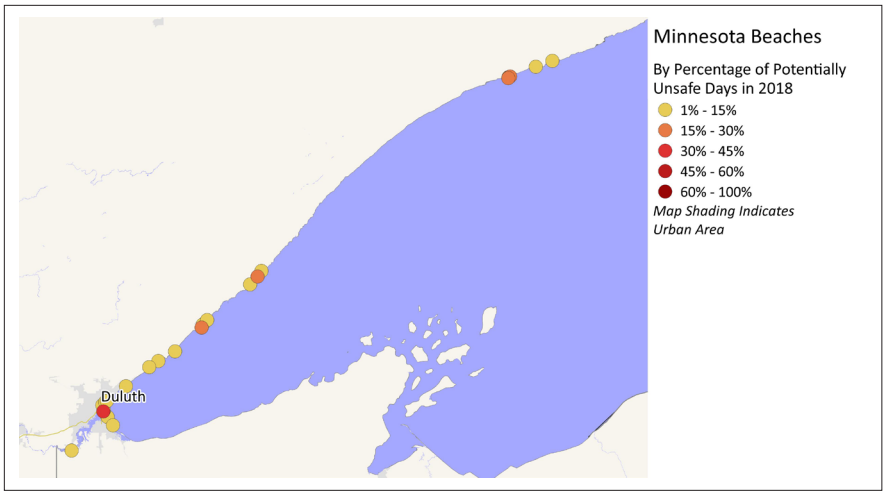


Table 29. Top Beach Sites by Most Potentially Unsafe Swimming Days in Minnesota in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
New Duluth Boat Club landing facility	St. Louis County	14	37	38%
Twin Points Public Access	Lake County	4	16	25%
Agate Bay	Lake County	4	17	24%
Approximately 5 miles southeast of Duluth Aerial Lift Bridge	St. Louis County	4	29	14%
Mouth of the Lester River	St. Louis County	2	13	15%
Flood Bay	Lake County	2	14	14%
Mouth of the Gooseberry River	Lake County	2	15	13%
Brighton Beach	St. Louis County	2	28	7%
Leif Erikson Park	St. Louis County	2	28	7%
Site by Grand Marais Campground	Cook County	1	5	20%

Table 30. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Minnesota Counties

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Lake County	11%
St. Louis County	7%
Cook County	5%

Minnesota

In Minnesota, 24 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 42 beach sites were sampled in Minnesota. Of beaches where sampling took place, tests at 24 indicated potentially unsafe levels of contamination on at least one day. A sampling site at New Duluth Boat Club landing facility in St. Louis County tested as potentially unsafe for 14 days, more days than any other site in the state, and 38 percent of the days that sampling took place. In Lake County, the average beach was potentially unsafe for swimming on 11 percent of the days that sampling took place, a higher percentage than any other county in the state.

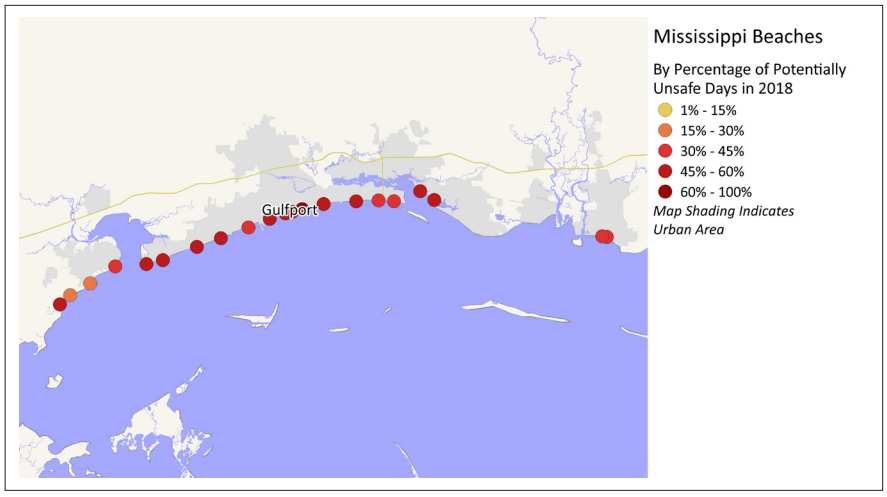


Table 31. Top Beach Sites by Most Potentially Unsafe Swimming Days in Mississippi in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Gulfport East Beach	Harrison County	44	66	67%
Gulfport Central Beach	Harrison County	35	62	56%
Shearwater Beach	Jackson County	35	64	55%
Long Beach	Harrison County	35	67	52%
Courthouse Road Beach	Harrison County	34	60	57%
Front Beach	Jackson County	33	60	55%
Edgewater Beach	Harrison County	32	61	52%
Pass Christian West Beach	Harrison County	30	63	48%
Biloxi West Central Beach	Harrison County	29	57	51%
Lakeshore Beach	Hancock County	28	58	48%

Table 32. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Mississippi Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Harrison County	50%
Jackson County	48%
Hancock County	35%

Mississippi

In Mississippi, 21 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 21 beach sites were sampled in Mississippi. Of beaches where sampling took place, tests at all 21 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Gulfport East Beach in Harrison County tested as potentially unsafe for 44 days, more days than any other site in the state, and 67 percent of the days that sampling took place. In Harrison County, the average beach was potentially unsafe for swimming on 50 percent of the days that sampling took place, a higher percentage than any other county in the state.

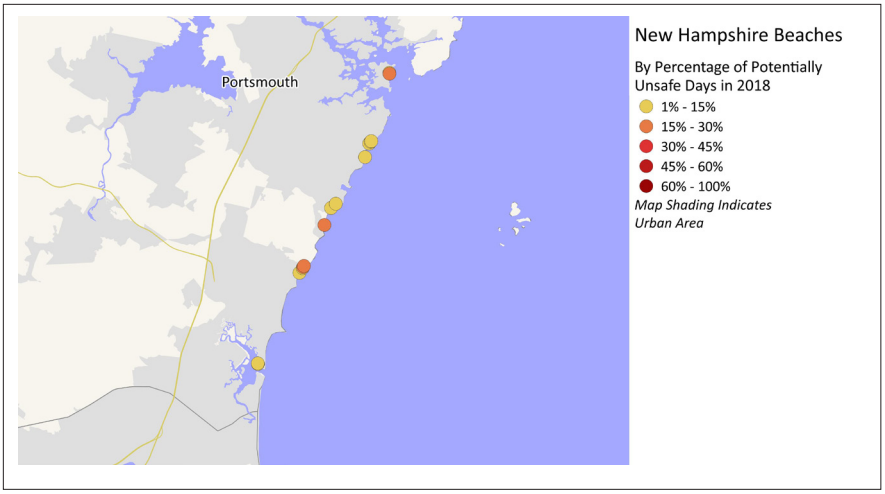


Table 33. Top Beach Sites by Most Potentially Unsafe Swimming Days in New Hampshire in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
State Beach-Left	Rockingham County	5	26	19%
State Beach-Center	Rockingham County	5	27	19%
New Castle Island-Right	Rockingham County	4	23	17%
State Beach-Right	Rockingham County	3	26	12%
Sawyer Beach-Right	Rockingham County	2	8	25%
Hampton Harbor Beach-Center	Rockingham County	1	8	12%
Hampton Harbor Beach-Left	Rockingham County	1	9	11%
Northside Park-Left	Rockingham County	1	9	11%
Wallis Sands State Park-Left	Rockingham County	1	22	5%
New Castle Island-Center	Rockingham County	1	23	4%

Table 34. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in New Hampshire Counties (Only One County with Testing Data)

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Rockingham County	3%

New Hampshire

In New Hampshire, 15 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 47 beach sites were sampled in New Hampshire. Of beaches where sampling took place, tests at 15 indicated potentially unsafe levels of contamination on at least one day. Sampling sites at State Beach in Rockingham County tested as potentially unsafe for 5 days, more days than any other sites in the state, and 19 percent of the days that sampling took place. In Rockingham County, the only county where testing took place, the average beach was potentially unsafe for swimming on 3 percent of the days that sampling took place.

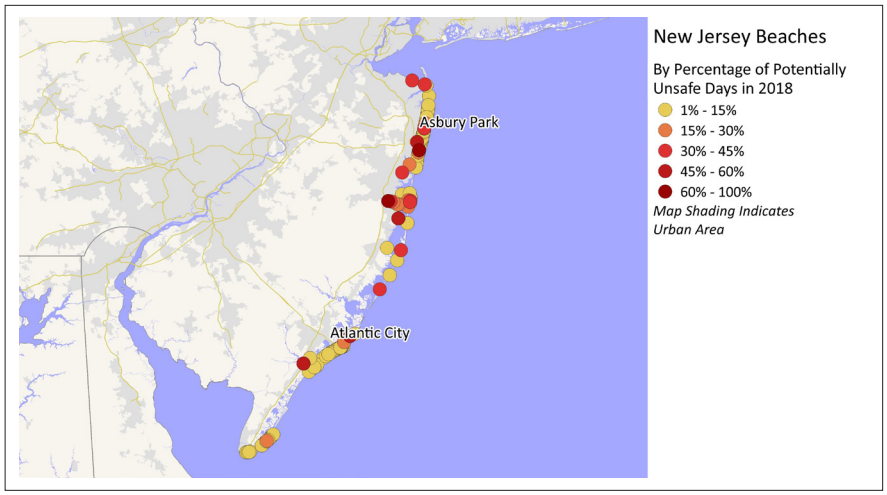


Table 35. Top Beach Sites by Most Potentially Unsafe Swimming Days in New Jersey in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Berkeley Township at Beachwood Beach West	Ocean County	14	22	64%
Belmar Borough at L Street Beach	Monmouth County	11	21	52%
Highlands Borough at Highlands Rec Center	Monmouth County	8	19	42%
Berkeley Township at West Beach Avon Rd	Ocean County	8	19	42%
Brick Township at Windward Beach	Ocean County	8	22	36%
Barnegat Light Borough at 25th St	Ocean County	7	17	41%
Berkeley Township at East Beach Station Ave	Ocean County	7	25	28%
Long Beach Township Bay Beach	Ocean County	5	15	33%
Ocean Gate Borough at Wildwood	Ocean County	5	20	25%
Ocean Gate Borough at Anglesea	Ocean County	5	20	25%

Table 36. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in New Jersey Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Monmouth County	9%
Ocean County	9%
Atlantic County	4%
Cape May County	2%

New Jersey

In New Jersey, 133 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 356 beach sites were sampled in New Jersey. Of beaches where sampling took place, tests at 133 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Beachwood Beach West in Ocean County tested as potentially unsafe for 14 days, more days than any other site in the state, and 64 percent of the days that sampling took place. In Monmouth County, the average beach was potentially unsafe for swimming on 9 percent of the days that sampling took place, a higher percentage than any other county in the state.

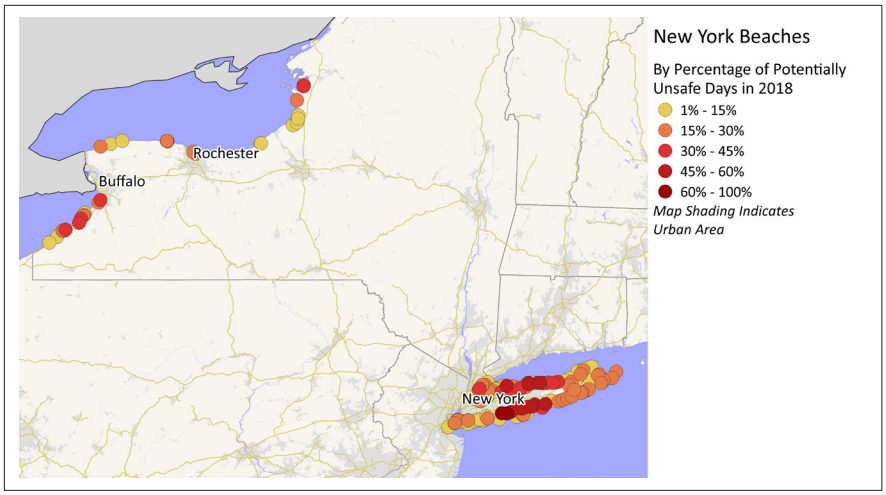


Table 37. Top Beach Sites by Most Potentially Unsafe Swimming Days in New York in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Tanner Park	Suffolk County	48	71	68%
Woodlawn Beach State Park	Erie County	36	104	35%
Shirley Beach	Suffolk County	28	47	60%
Venetian Shores	Suffolk County	28	48	58%
Valley Grove Beach	Suffolk County	24	51	47%
Sayville Marina Park	Suffolk County	23	43	53%
Benjamins Beach	Suffolk County	21	49	43%
East Islip Beach	Suffolk County	20	40	50%
Corey Creek Beach	Suffolk County	20	40	50%
Amityville Beach	Suffolk County	20	42	48%

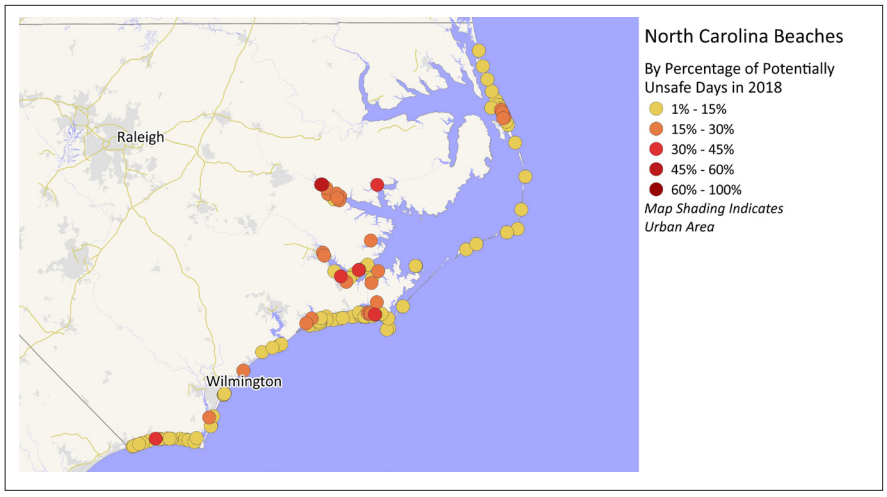
Table 38. Top 10 New York Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Erie County	23%
Chautauqua County	19%
Monroe County	19%
Suffolk County	15%
Niagara County	14%
Westchester County	11%
Richmond County	11%
Queens County	9%
Kings County	8%
Jefferson County	8%

New York

In New York, 272 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 422 beach sites were sampled in New York. Of beaches where sampling took place, tests at 272 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Tanner Park in Suffolk County tested as potentially unsafe for 48 days, more days than any other site in the state, and 68 percent of the days that sampling took place. In Erie County, the average beach was potentially unsafe for swimming on 23 percent of the days that sampling took place, a higher percentage than any other county in the state.



North Carolina

In North Carolina, 127 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 213 beach sites were sampled in North Carolina. Of beaches where sampling took place, tests at 127 indicated potentially unsafe levels of contamination on at least one day. A sampling site by the intersection of E. Main St. and Tooley St. in Belhaven, Beaufort County, tested as potentially unsafe for 11 days, more days than any other site in the state, and 31 percent of the days that sampling took place. In Beaufort County, the average beach was potentially unsafe for swimming on 28 percent of the days that sampling took place, a higher percentage than any other county in the state.

Table 39. Top Beach Sites by Most Potentially Unsafe Swimming Days in North Carolina in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Sound access at the intersection of E. Main St. and Tooley St., Belhaven	Beaufort County	11	35	31%
Pamlico River- City Park	Beaufort County	8	17	47%
NC Maritime Museum Sailing Camp on Taylors Creek	Carteret County	8	41	20%
Pamlico River - Washington - Railroad Trestle	Beaufort County	7	17	41%
Mouth of Slocum Creek, north side beach	Craven County	7	18	39%
Green Spring Swim Area in Neuse River	Craven County	7	33	21%
Ragged Point Swim Area in Pamlico River	Beaufort County	7	34	21%
Public Access end of Shore Line Dr.	Pender County	7	39	18%
Lennoxville Boat Ramp	Carteret County	6	17	35%
Public Beach, south side of Dawson Creek Bridge	Pamlico County	6	19	32%
Intracoastal Waterway, near marker #67, Sailfish Street	Brunswick County	6	19	32%

Table 40. Top 10 North Carolina Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Beaufort County	28%
Craven County	17%
Pamlico County	10%
Carteret County	7%
Onslow County	6%

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Dare County	5%
Brunswick County	3%
New Hanover County	3%
Pender County	3%
Hyde County	3%

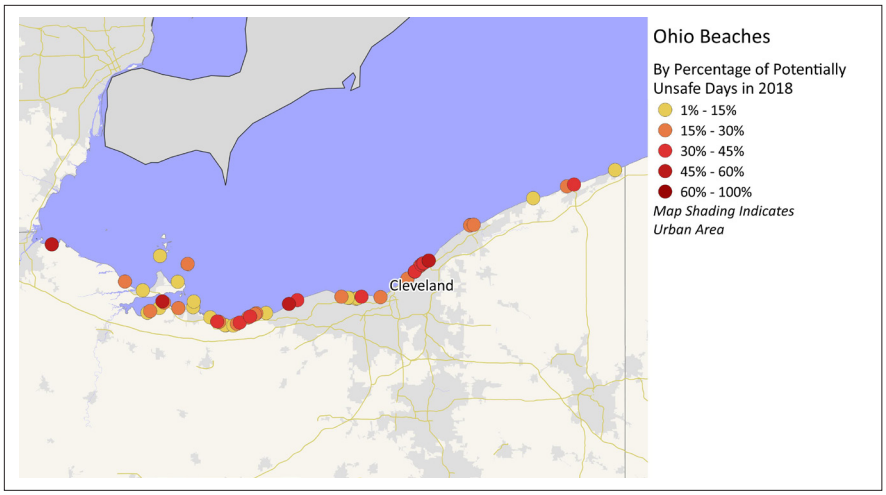


Table 41. Top Beach Sites by Most Potentially Unsafe Swimming Days in Ohio in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Bay View West	Erie County	42	70	60%
Villa Angela State Park	Cuyahoga County	38	115	33%
Euclid State Park	Cuyahoga County	36	112	32%
Maumee Bay State Park (Inland)	Lucas County	33	56	59%
Lakeview Beach	Lorain County	32	60	53%
Huntington Beach	Cuyahoga County	26	105	25%
Maumee Bay State Park (Erie)	Lucas County	25	54	46%
Lake Front Park	Erie County	25	69	36%
Sherod Park Beach	Erie County	23	67	34%
Beulah Beach	Erie County	22	69	32%

Table 42. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Ohio Counties

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Lucas County	53%
Lorain County	30%
Cuyahoga County	27%
Erie County	21%
Lake County	20%
Ashtabula County	17%
Ottawa County	8%

Ohio

In Ohio, 55 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 58 beach sites were sampled in Ohio. Of beaches where sampling took place, tests at 55 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Bay View West in Erie County tested as potentially unsafe for 42 days, more days than any other site in the state, and 60 percent of the days that sampling took place. In Lucas County, the average beach was potentially unsafe for swimming on 53 percent of the days that sampling took place, a higher percentage than any other county in the state.

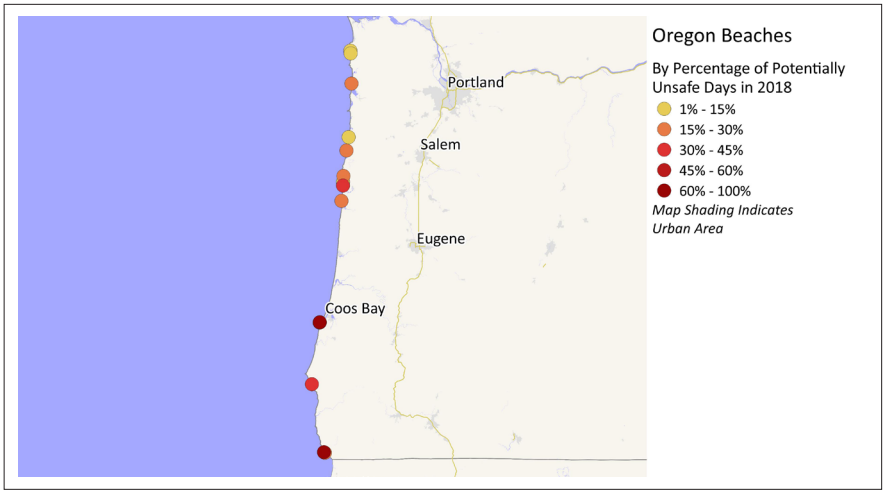


Table 43. Top Beach Sites by Most Potentially Unsafe Swimming Days in Oregon in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Sunset Bay State Park Beach at mouth of Big Creek	Coos County	10	18	56%
Harris Beach State Park at Harris Creek	Curry County	5	7	71%
Nye Beach turnaround at outflow from discharge pipe	Lincoln County	5	11	45%
Sunset Bay, seep creek	Coos County	5	11	45%
Sunset Bay, North Parking Lot Creek	Coos County	3	4	75%
Sunset Bay State Park Beach at restroom	Coos County	3	17	18%
Hubbard Creek Beach at Hubbard Creek	Curry County	2	5	40%
D River Beach	Lincoln County	2	8	25%
Twin Rocks Beach at Watseco Creek	Tillamook County	2	8	25%
Seal Rock Beach at the mouth of Hill Creek	Lincoln County	2	10	20%

Table 44. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Oregon Counties

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Coos County	23%
Curry County	15%
Lincoln County	9%
Tillamook County	5%
Clatsop County	3%
Lane County	0%

Oregon

In Oregon, 18 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 51 beach sites were sampled in Oregon. Of beaches where sampling took place, tests at 18 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Sunset Bay State Park Beach at the mouth of Big Creek in Coos County tested as potentially unsafe for 10 days, more days than any other site in the state, and 56 percent of the days that sampling took place. In Coos County, the average beach was potentially unsafe for swimming on 23 percent of the days that sampling took place, a higher percentage than any other county in the state.

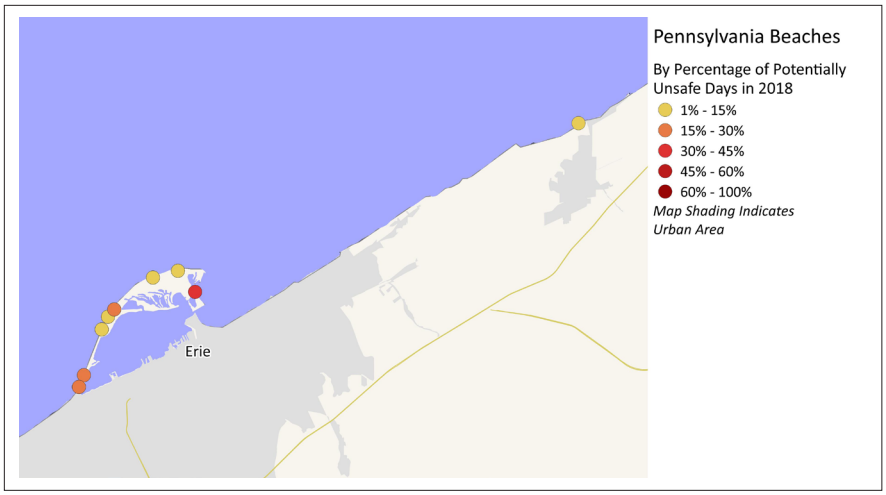


Table 45. Top Beach Sites by Most Potentially Unsafe Swimming Days in Pennsylvania in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Beach 11 East in Thompson Bay	Erie County	15	39	38%
Beach 11 West in Thompson Bay	Erie County	15	39	38%
Beach 11 Center in Thompson Bay	Erie County	13	39	33%
1 East Center	Erie County	6	28	21%
1 East West	Erie County	5	27	19%
Barracks Beach Center	Erie County	5	31	16%
Barracks Beach East	Erie County	5	31	16%
Pettinato Beach Center	Erie County	4	17	24%
1 East East	Erie County	4	28	14%
Barracks Beach West	Erie County	4	31	13%

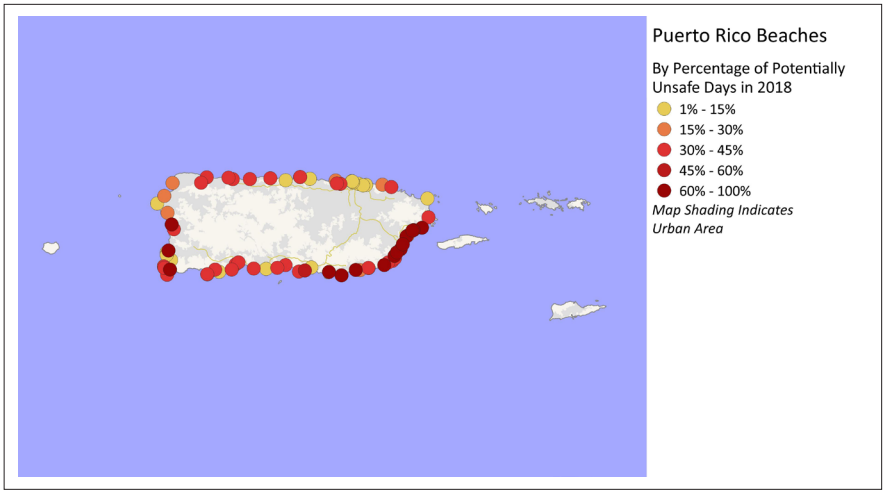
Table 46. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Pennsylvania Counties (Only One County with Testing Data)

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Erie County	13%

Pennsylvania

In Pennsylvania, 25 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 28 beach sites were sampled in Pennsylvania. Of beaches where sampling took place, tests at 25 indicated potentially unsafe levels of contamination on at least one day. Sampling sites at Beach 11 in Thompson Bay in Erie County tested as potentially unsafe for 15 days, more days than any other sites in the state, and 38 percent of the days that sampling took place. In Erie County, the only county where testing took place, the average beach was potentially unsafe for swimming on 13 percent of the days that sampling took place.



Puerto Rico

In Puerto Rico, 76 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 139 beach sites were sampled in Puerto Rico. Of beaches where sampling took place, tests at 76 indicated potentially unsafe levels of contamination on at least one day. Sampling sites at Playa Guayanes in Yabucoa Municipio and Tropical Beach in Naguabo Municipio tested as potentially unsafe for 16 days, more days than any other site in the territory, and 48 percent of the days that sampling took place. In Naguabo Municipio, the average beach was potentially unsafe for swimming on 71 percent of the days that sampling took place, a higher percentage than any other municipio in the territory.

Table 47. Top Beach Sites by Most Potentially Unsafe Swimming Days in Puerto Rico in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Playa Guayanes	Yabucoa Municipio	16	33	48%
Tropical Beach	Naguabo Municipio	16	33	48%
Playa Muelle De Arecibo	Arecibo Municipio	15	34	44%
Balneario Manuel "Nolo" Morales O Sardinera	Dorado Municipio	7	28	25%
Balneario Punta Santiago	Humacao Municipio	7	28	25%
Balneario Pico De Piedra	Aguada Municipio	6	26	23%
Balneario Punta Guilarte	Arroyo Municipio	6	26	23%
Balneario Tres Hermanos	Añasco Municipio	6	27	22%
Balneario Crash Boat	Aguadilla Municipio	5	27	19%
Balneario Punta Salinas	Toa Baja Municipio	5	27	19%

Table 48. Top 10 Puerto Rico Municipios by Average Percentage of Potentially Unsafe Sampling Days in 2018

Municipio	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in Municipio
Naguabo Municipio	71%
Guayama Municipio	67%
Mayagüez Municipio	67%
Humacao Municipio	65%
Maunabo Municipio	50%

Municipio	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in Municipio
Yabucoa Municipio	50%
Santa Isabel Municipio	42%
Salinas Municipio	35%
Juana Díaz Municipio	33%
Guayanilla Municipio	33%

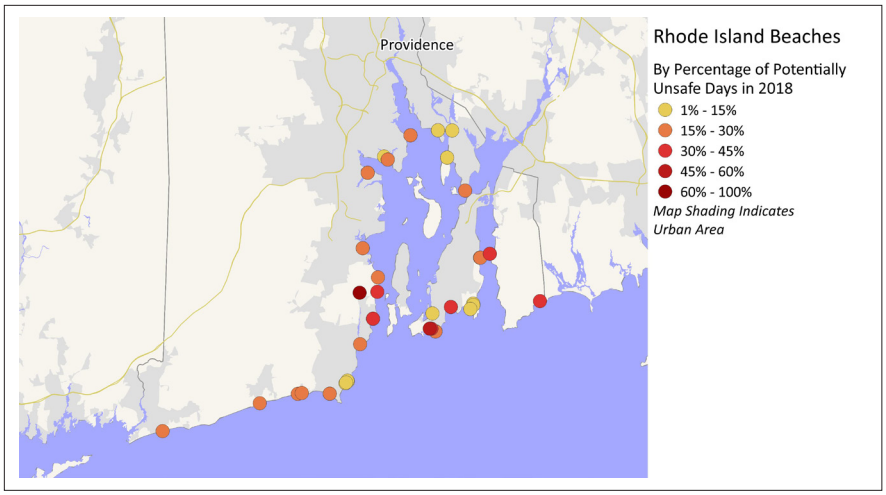


Table 49. Top Beach Sites by Most Potentially Unsafe Swimming Days in Rhode Island in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Easton's Beach	Newport County	10	29	34%
Conimicut Point Beach -West	Kent County	6	25	24%
Sandy Point Beach -North	Newport County	5	26	19%
Sandy Point Beach -South	Newport County	5	26	19%
Oakland Beach -Center	Kent County	5	26	19%
Goddard Memorial State Park -Center	Kent County	5	27	19%
Conimicut Point Beach -East	Kent County	4	25	16%
Oakland Beach -East	Kent County	4	26	15%
Goddard Memorial State Park -West	Kent County	4	27	15%
Camp Grosvenor -Center	Washington County	3	4	75%

Table 50. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Rhode Island Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Kent County	14%
Newport County	12%
Bristol County	10%
Washington County	5%

Rhode Island

In Rhode Island, 54 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 129 beach sites were sampled in Rhode Island. Of beaches where sampling took place, tests at 54 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Easton's Beach in Newport County tested as potentially unsafe for 10 days, more days than any other site in the state, and 34 percent of the days that sampling took place. In Kent County, the average beach was potentially unsafe for swimming on 14 percent of the days that sampling took place, a higher percentage than any other county in the state.

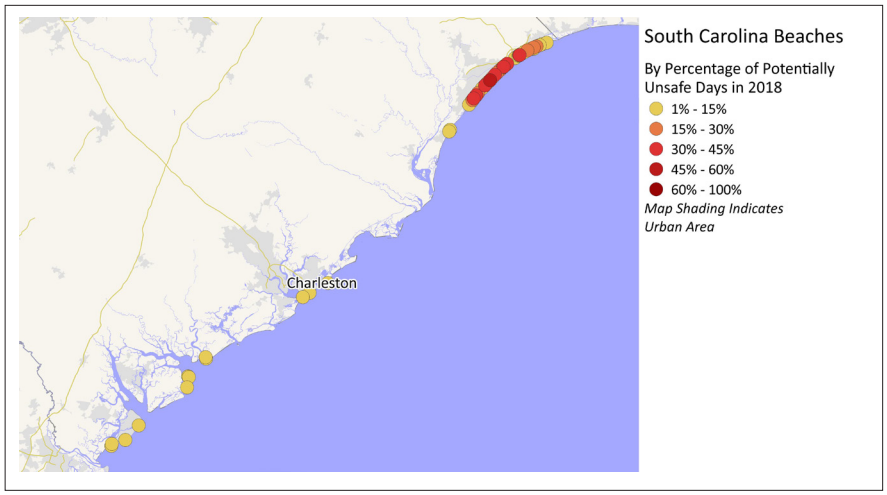


Table 51. Top Beach Sites by Most Potentially Unsafe Swimming Days in South Carolina in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Withers Swash	Horry County	32	70	46%
Myrtle Beach at 24th Ave N	Horry County	30	70	43%
White Point Swash	Horry County	26	70	37%
Bear Branch Swash	Horry County	26	70	37%
Cane Patch Swash	Horry County	26	70	37%
Midway Swash	Horry County	25	70	36%
Myrtle Beach at 34th Ave N	Horry County	21	72	29%
Myrtle Beach at 8th Ave N	Horry County	20	70	29%
North Myrtle Beach at 17th Ave S	Horry County	19	74	26%
Myrtle Beach at 15th Ave S	Horry County	18	70	26%

Table 52. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in South Carolina Counties

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Horry County	20%
Beaufort County	2%
Georgetown County	2%
Colleton County	1%
Charleston County	1%

South Carolina

In South Carolina, 55 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 122 beach sites were sampled in South Carolina. Of beaches where sampling took place, tests at 55 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Withers Swash in Horry County tested as potentially unsafe for 32 days, more days than any other site in the state, and 46 percent of the days that sampling took place. In Horry County, the average beach was potentially unsafe for swimming on 20 percent of the days that sampling took place, a higher percentage than any other county in the state.

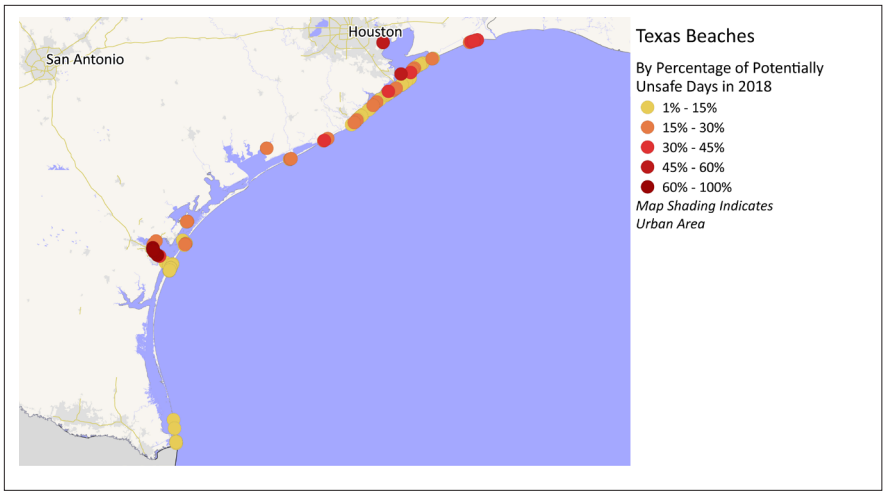


Table 53. Top Beach Sites by Most Potentially Unsafe Swimming Days in Texas in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Cole Park - Site 3	Nueces County	52	64	81%
Ropes Park - Site 2	Nueces County	43	59	73%
Cole Park - Site 4	Nueces County	42	53	79%
Cole Park - Site 2	Nueces County	38	56	68%
Poenisch Park	Nueces County	35	55	64%
Corpus Christi Marina South	Nueces County	34	54	63%
Cole Park - Site 6	Nueces County	26	46	57%
Sylvan Beach - South	Chambers County	21	45	47%
Texas City Dike	Galveston County	20	43	47%
Ropes Park - Site 3	Nueces County	18	26	69%

Table 54. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Texas Counties

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Chambers County	44%
San Patricio County	27%
Matagorda County	23%
Nueces County	22%
Jefferson County	22%
Aransas County	20%
Galveston County	13%
Brazoria County	12%
Cameron County	2%

Texas

In Texas, 141 tested beach sites were potentially unsafe for swimming on at least one day in 2018

In 2018, 167 beach sites were sampled in Texas. Of beaches where sampling took place, tests at 141 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Cole Park in Nueces County tested as potentially unsafe for 52 days, more days than any other site in the state, and 81 percent of the days that sampling took place. In Chambers County, the average beach was potentially unsafe for swimming on 44 percent of the days that sampling took place, a higher percentage than any other county in the state.

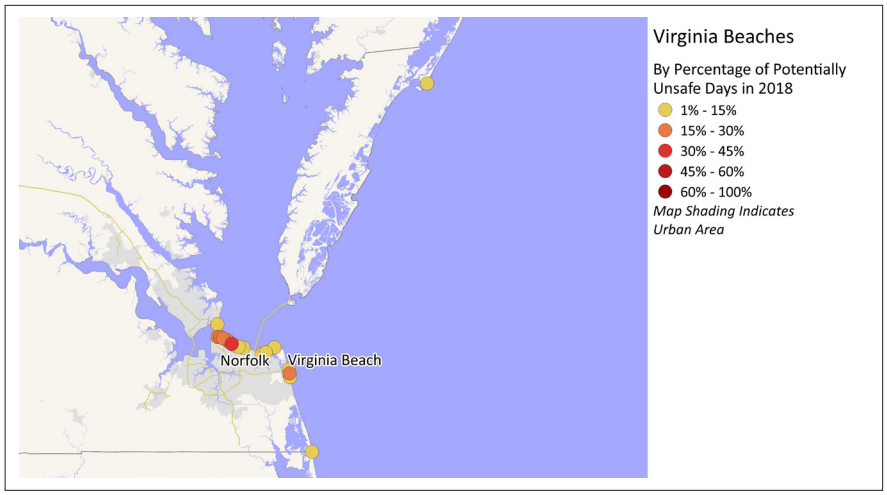


Table 55. Top Beach Sites by Most Potentially Unsafe Swimming Days in Virginia in 2018

Sampling Site	County or Independent City	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
North Community Beach	Norfolk city	7	18	39%
Captains Quarters	Norfolk city	5	18	28%
10th View, Behind Quality Inn,1010 W Ocean View Ave	Norfolk city	4	18	22%
15th Street	Virginia Beach city	4	20	20%
13th View, North End	Norfolk city	3	18	17%
Sarah Constant Park, East End	Norfolk city	3	18	17%
Ocean View Park, East Side Of Parking Lot	Norfolk city	2	18	11%
5th Bay St., North End	Norfolk city	2	19	11%
East Community Beach, End Of East Ocean View Ave.	Norfolk city	2	19	11%
21st Bay St., North End Behind Ship's Captain Restaurant	Norfolk city	2	19	11%
Capeview Ave., North End	Norfolk city	2	19	11%

Table 56. Average Percentage of Potentially Unsafe Sampling Days in 2018 for Beaches in Virginia Counties and Independent Cities

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Norfolk city	18%
Hampton city	6%
Virginia Beach city	3%
Accomack County	2%

Virginia

In Virginia, 19 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 37 beach sites were sampled in Virginia. Of beaches where sampling took place, tests at 19 indicated potentially unsafe levels of contamination on at least one day. A sampling site at North Community Beach in Norfolk city tested as potentially unsafe for 7 days, more days than any other site in the state, and 39 percent of the days that sampling took place. In Norfolk city, the average beach was potentially unsafe for swimming on 18 percent of the days that sampling took place, a higher percentage than any other county or independent city in the state.

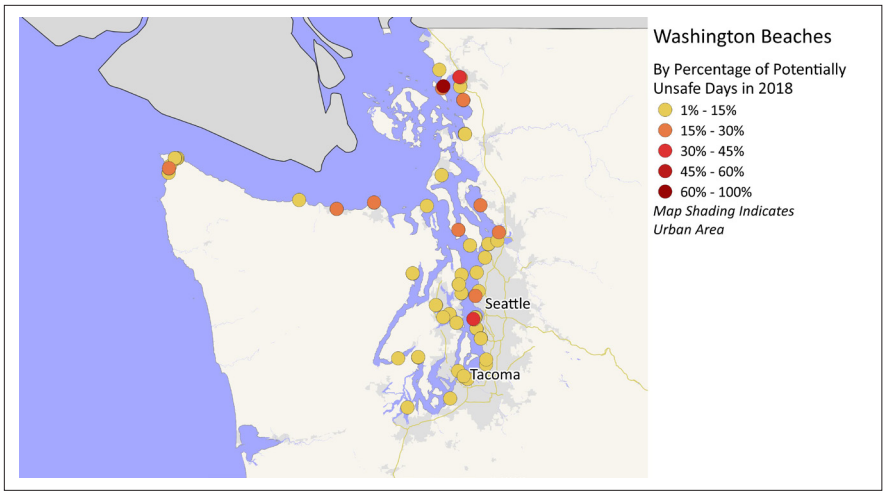


Table 57. Top Beach Sites by Most Potentially Unsafe Swimming Days in Washington in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
Sooes Beach - Site C	Clallam County	7	41	17%
Little Squalicum Park - Site E	Whatcom County	5	15	33%
Lummi Bay directly adjacent to second tidegate	Whatcom County	5	34	15%
Dakwas Park Beach, Neah Bay - Site A	Clallam County	5	48	10%
Richey Viewpoint - Site C	King County	4	13	31%
Golden Gardens - Site A	King County	4	14	29%
Cline Spit County Park - Site A	Clallam County	4	15	27%
Freeland County Park / Holmes Harbor - Site C	Island County	3	16	19%
Hollywood Beach - Site C	Clallam County	3	16	19%
Freeland County Park / Holmes Harbor - Site B	Island County	3	16	19%
Larrabee State Park, Wildcat Cove - Site F	Whatcom County	3	16	19%

Washington

In Washington, 89 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 215 beach sites were sampled in Washington. Of beaches where sampling took place, tests at 89 indicated potentially unsafe levels of contamination on at least one day. A sampling site at Sooes Beach in Clallam County tested as potentially unsafe for 7 days, more days than any other site in the state, and 17 percent of the days that sampling took place. In Whatcom County, the average beach was potentially unsafe for swimming on 12 percent of the days that sampling took place, a higher percentage than any other county in the state.

Table 58. Top 10 Washington Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Whatcom County	12%
Island County	7%
King County	6%
Clallam County	5%
Skagit County	5%

County	Average Percentage of Sampling Days with Potentially Unsafe Water for Beaches in County
Snohomish County	5%
Jefferson County	3%
Kitsap County	3%
Mason County	2%
Pierce County	2%

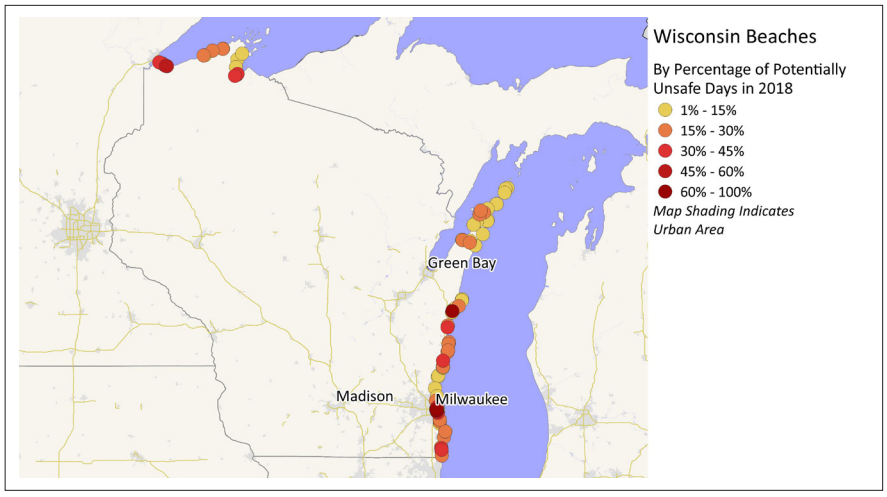


Table 59. Top Beach Sites by Most Potentially Unsafe Swimming Days in Wisconsin in 2018

Sampling Site	County	Potentially Unsafe Days in 2018	Days with Sampling	Percentage of Sampling Days with Potentially Unsafe Water
South Shore Beach	Milwaukee County	34	60	57%
McKinley Beach	Milwaukee County	26	61	43%
Eichelman Beach	Kenosha County	21	51	41%
Maslowski Beach	Ashland County	14	32	44%
Nicolet Beach	Door County	14	59	24%
Kreher Park Beach	Ashland County	12	29	41%
Memorial Park in Chequamegon Bay	Ashland County	12	30	40%
Barker's Island Inner Beach	Douglas County	11	28	39%
Pennoyer Park Beach	Kenosha County	11	33	33%
Fish Creek Beach	Door County	11	58	19%

Table 60. Top 10 Wisconsin Counties by Average Percentage of Potentially Unsafe Sampling Days in 2018*

County	Average Percentage of Days with Potentially Unsafe Water for Beaches in County
Ashland County	42%
Douglas County	30%
Kenosha County	23%
Milwaukee County	22%
Manitowoc County	21%
Sheboygan County	19%
Ozaukee County	10%
Bayfield County	9%
Door County	5%
Kewaunee County	0%

Wisconsin

In Wisconsin, 94 tested beach sites were potentially unsafe for swimming on at least one day in 2018.

In 2018, 125 beach sites were sampled in Wisconsin. Of beaches where sampling took place, tests at 94 indicated potentially unsafe levels of contamination on at least one day. A sampling site at South Shore Beach in Milwaukee County tested as potentially unsafe for 34 days, more days than any other site in the state, and 57 percent of the days that sampling took place. In Ashland County, the average beach was potentially unsafe for swimming on 42 percent of the days that sampling took place, a higher percentage than any other county in the state.

** A significant percentage of tests in Racine County were recorded as using a qPCR method to test for E. Coli, for which a national Beach Action Value could not be determined. The small percentage of tests included in this analysis were deemed unrepresentative of overall conditions in Racine County, and thus the percentage of potentially unsafe results for Racine County is not included in the table at left. See Methodology for details.*

Conclusion and Policy Recommendations

In every corner of the country, Americans should be able to enjoy beaches that are clean and safe for swimming. There are many steps that communities can take to keep beaches safe.

Policymakers at every level of government should take actions to prevent dangerous pollution from reaching the beaches where Americans swim, including the following:

Prevent urban runoff pollution.

- Dramatically increase public investment in natural and green infrastructure features that prevent bacteria-laden pollution, such as rain barrels, permeable pavement, urban greenspace, and green roofs
- Require the use of green infrastructure in new development/redevelopment and use additional policy tools to promote its use at existing development.
- Protect and restore natural infrastructure, including riparian areas and wetlands that can filter bacteria, sediment and nutrients.

Prevent sewage pollution.

- Dramatically increase public investment in fixing aging sewage systems and using green infrastructure to prevent sewage overflows by reducing the quantity or rate of water flowing into sewer systems.[31]
- Strengthen enforcement of standards for municipal wastewater treatment, as opposed to allowing a "blending" of partially treated sewage into wastewater.
- Upgrade or relocate wastewater facilities that are in danger of overflowing during storms and floods.
- Ensure more frequent inspections and proper maintenance of residential septic systems.

Prevent manure pollution.

- Enact moratoriums on new or expanded industrial-scale livestock operations, especially in watersheds already overburdened by manure pollution.
- Require best practices for reducing manure pollution from cropland, including the maintenance of conservation buffers set up around fields.
- Encourage livestock operations to raise animals on rotational pasture.

Policymakers should also take actions to **provide beachgoers with the information they need to stay safe**, including the following:

- Use the EPA's most protective "Beach Action Value" bacteria standard for posting beach advisories.
- Put in place systems for same-day water testing and warnings, particularly during times of heavy water recreation.[32]

Finally, federal policymakers should maintain a strong Clean Water Act that protects all streams and other waterways that flow to our beaches and wetlands that help filter out pollution before it reaches the places where we swim.

Methodology

National beach testing data was downloaded from the National Water Quality Monitoring Council's Water Quality Data portal on 20 May 2019.[33] Sampling data was included in this analysis if it met the following criteria:

- Result parameter CharacteristicName: Enterrococcus or *Escherichia coli*.
- Station parameter MonitoringLocationTypeName: BEACH Program Site-Estuary, BEACH Program Site-Great Lake, BEACH Program Site-Ocean, Great Lake, Ocean, or Ocean: Coastal.

Some data cleanup and categorization were performed before conducting the analysis:

- Because not all beach station data included an associated county, beach stations were associated with counties by performing an analysis overlaying station latitude and longitude data with geographic county data downloaded from the U.S. Census Bureau.
- Samples with parameter ResultConditionText of "Not Detected," "Detected Not Quantified" and other similar entries were treated as safe samples. Samples with ResultConditionText of "Present Above Quantification Limit" were treated as potentially unsafe.
- Measure values that included a "<" (less than) symbol were treated as safe samples. Measure values that included a ">" (more than) symbol were assumed to be whatever result followed the symbol.
- Certain errors in latitude and longitude values from the Water Quality Data portal were corrected. For example, latitude and longitude values were swapped for many South Carolina sites.
- Measurements for which concentrations were not specified were assumed to be reported in concentration per 100 milliliters.

Jurisdictions with beaches whose monitoring data is not included in the Water Quality Data portal are not included in this analysis.

Beach sites were considered "potentially unsafe" if single sample tests or daily geometric means exceeded the EPA Beach Action Value (BAV) associated with an estimated illness rate of 32 per 1,000 swimmers.[34] EPA suggests states use BAVs "as a conservative, precautionary tool for making beach notification decisions."[35] Results reported as daily geometric means may include individual tests that exceed the BAV that would otherwise be considered "potentially unsafe" if the individual test results had been reported to the database.

For enterococcus, the BAV threshold is 60 colony-forming units per 100 milliliters (cfu/100mL). For *E. coli* the BAV is 190 cfu/100mL. For tests conducted using a quantitative polymerase chain reaction (qPCR) method, with results reported as calibrator cell equivalent (cce) per 100mL, the BAV is 640 cce/100mL.

E. coli qPCR tests, which appeared for eight sample sites in Racine County, Wisconsin, were not considered for this analysis, as the EPA does not specify a Beach Action Value for such tests in its 2012 Recreational Water Quality Criteria document.

For the purposes of this analysis, bacteria tests were grouped together by day, by site to determine "potentially unsafe days." If multiple tests occurred on a single day, and one of those tests exceeded the safe limit for bacteria, that day was considered a "potentially unsafe day." Tests recorded as results for "30-day Geometric Means" tests were not considered for this analysis, as those tests cannot be used to determine potentially unsafe beach days.

The average percentage of unsafe days by county, used for county comparisons, was calculated by averaging percentages of unsafe sampling days for all beaches within each county (as opposed to dividing the total number of unsafe beach days by total sampling days in the county). In tables listing sample sites by number of potentially unsafe days, sites with equal number of days were secondarily ranked by percentage of potentially unsafe days.

To group sample sites by region, sites were grouped by county, and counties were then manually assigned to their most appropriate region. New York and Florida both contain sample sites grouped to two different regions: New York has sample sites in the Great Lakes and the East Coast, and Florida has sample sites in the Gulf and the East Coast.

In state tables of beach sites, site names are formatted and cleaned up versions of language contained in the original dataset. Occasionally, when no identifying naming information could be found, site names reflect locations as determined by the report authors using site location data.

Throughout the report, maps of sample sites reflect location data as submitted by testing agencies and contained in the original data source. Because of the nature of the geotagging process, sample sites displayed on maps may occasionally reflect imprecise locations.

Jurisdictions vary both in the safety thresholds they apply to beaches in making public health decisions and in the methods they use to communicate the results of beach testing. (For example, some states average the results of tests across several monitoring sites on a single beach to develop a single result for that beach that is compared with the safety threshold.) For this reason, estimates of the number of potentially unsafe beach days will often differ between this report and others issued by local and/or state governments.

Notes

1 Bacteria sample and testing site data source: National Water Quality Monitoring Council, *Water Quality Data*, downloaded from https://www.waterqualitydata.us/portal/ on 20 May 2019. See Methodology for details. Data was downloaded separately for testing results, "Sample Results (Physical/Chemical Metadata)," and for sampling stations.

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5 See note 3.

6 See note 2.

7 R.G. Sinclair et al., "Viruses in Recreational Water-Borne Disease Outbreaks: A Review," *J Appl Microbiol*, 107(6), DOI: 10.1111/j.1365-2672.2009.04367.x, December 2009.

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15 National Oceanic and Atmospheric Administration, *Coastal Land Cover Change Summary Report 1996–2010*, date not given, archived on 4 March 2017 at http://web.archive.org/web/20170304210552/https://coast.noaa.gov/data/digitalcoast/pdf/landcover-report-summary.pdf.

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34 See note 2.

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