2019 RHODE ISLAND BEACH AND RECREATIONAL WATER QUALITY REPORT

RHODE ISLAND DEPARTMENT OF HEALTH

BEACHES ENVIRONMENTAL ASSESSMENT AND COASTAL HEALTH PROGRAM

Photo courtesy of Jillian Chopy, Seasonal Policy Intern

2019 RHODE ISLAND BEACH AND RECREATIONAL WATER QUALITY REPORT

Rhode Island Department of Health
Division of Environmental Health
3 Capitol Hill, Room 201
Providence, RI 02908

June 7, 2020

Prepared By:

Sherry Poucher
Beaches Environmental Assessment and Coastal Health Program,
Rhode Island Department of Health
3 Capitol Hill, Room 203
Providence, RI 02908
www.Health.ri.gov/beaches

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Executive Summary

The Rhode Island Department of Health (RIDOH) is responsible for the licensing and regulation of bathing beach facilities in the State of Rhode Island, including both fresh and saltwater beaches. Funding for the Beach Program is provided by the United States Environmental Protection Agency (USEPA) through the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000, an amendment to the Federal Water Pollution Control Act (also known as the Clean Water Act) of 1972. These funds support primary programmatic activities including sanitary surveys, development and implementation of a risk-based monitoring plan, bacteriological testing at marine beaches, and a public notification system.

During the 2019 Beach Season (from May 29th through August 31st) RIDOH sampled and analyzed approximately 1593 samples collected from 67 licensed saltwater beaches (Appendix A) and from two urban beaches which are under consideration to become licensed beaches. RIDOH partner, Save the Bay, collected an additional 60 samples for three other unlicensed urban beaches for analysis by the RIDOH Beach Program. Samples were analyzed for *Enterococcus* bacteria using the IDEXX *Enterolert* Method at the RIDOH State Laboratory (Budnick et al., 1996).

In the 2019 bathing season, saltwater beach closure days were in the range of those observed over the past ten years. For the 67 monitored saltwater beaches, there were 68 closure days over 36 closure events. The closures in 2019 occurred at 21 beaches, up from 11 beaches in 2018 and from the all-time low of eight beaches in 2016. The total rainfall was greater in 2019 at 11.4 inches compared to 2018, 2017 and 2016 seasonal totals of 9.1, 8.8 and 9.2 inches, respectively. Inter-annual variability in beach closures associated with poor water quality may still be correlated with precipitation to some degree, but apparently much less than during the early years of the millennium. This pattern will not be fully tested until there are additional high rainfall seasons (i.e., at least 15 cumulative inches during the season).

Notably, only two (Bristol and Conimicut) of the six licensed Upper Narragansett Bay beaches experienced any closure in 2019, representing only 2% of the total. This is a dramatic improvement over 2018 when 54% of the total closure days were attributed to Upper Bay beaches. Again, data from additional years with varying environmental conditions are needed to determine if this apparent change persists.

RIDOH research continues to investigate methods that could allow advisories to close beaches closer to the time when risks of pathogen exposure are the greatest. Studies to establish the status of water quality at several “Urban Beaches” in upper Narragansett Bay are also ongoing.

Currently, RIDOH does not conduct surface water monitoring at freshwater bathing beaches. To ensure public safety, freshwater beach managers are responsible for sampling and following RIDOH approved regulations and monitoring recommendations.

1.0 PROGRAM STANDARDS

1.1 Mission

The mission of the RIDOH is to prevent disease and to protect and promote the health and safety of the people of Rhode Island. Within RIDOH, the Beach Program works to protect the public from illness associated with swimming in contaminated bathing waters. The Beach Program furthers this mission through continuous monitoring during the bathing season and by assisting beach owners and managers with finding and eliminating sources of contamination.

1.2 History

RIDOH began monitoring beaches in the summer of 1995. Prior to 1995, the Rhode Island Department of Environmental Management (RIDEM) was responsible for monitoring recreational waters.

In 1999, RIDOH initiated a comprehensive beach-monitoring program titled Bacterial Water Quality Monitoring at Upper Narragansett Bay Bathing Beaches with USEPA funding from an Environmental Monitoring for Public Access and Community Tracking (EMPACT) grant. This grant enabled RIDOH to establish a public notification system including a website, telephone hotline, and beach signage system. RIDOH evaluated conditions in Upper Narragansett Bay, which has long been impacted by urban runoff, point source discharges, and combined sewer overflows (CSOs).

The EMPACT Program provided RIDOH with the resources to sample 23 stations in the Upper Narragansett Bay during wet and dry weather. The study concluded that additional sampling was necessary at the licensed Upper Bay beaches to adequately protect the public. In addition, due to identified contamination sources and analytical results, the areas north of Conimicut Point in Warwick and Nayatt Point in Barrington were deemed unsuitable to serve as licensed facilities.

In 2000, Congress enacted the Beaches Environmental Assessment and Coastal Health (BEACH) Act, an amendment to the Federal Water Pollution Control Act. The BEACH Act authorizes USEPA to distribute grants to eligible states, territories, and tribes to reduce the risk of disease and illness in the nation's bathing waters. State objectives under this program were published by USEPA in June 2002. The National Beach Guidance and Required Performance Criteria for Grants document promulgated by USEPA further stipulates several requirements of the BEACH Act, including: a tiered categorization of beaches according to risk, identification and mitigation of pollution sources, a risk communication plan, and specific beach monitoring information.

Since 2000, USEPA has provided RIDOH with over $3.2 million in beach grants to manage Rhode Island's Beach Program. These grants have provided RIDOH with the resources to maintain critical continuity in monitoring Rhode Island's licensed bathing beaches for the purpose of characterizing risks, and how they change over time. Without this data, it would not be possible to understand which of our States valuable beach resources need the most attention to identify and reduce sources (point and non-point) of contamination. Likewise, the monitoring data are critical in assessments that tell us how well management strategies are working to improve coastal water quality in Rhode Island.

1.3 Enacted Legislation

In accordance with the Rhode Island Regulation 216-RICR-50-10-3 (1/17/2018), and prior Regulation (R23-21-RF(A)(1.4 as amended January 2002) within the General Laws of Rhode Island, a "bathing beach" is defined as a natural area or tract of land that is used in connection with swimming and/or bathing in any waters of the state provided:

a) It is open to the public by permit and/or payment of a fee; or

b) It is maintained as a private club or association requiring membership fees or dues; or

c) It is maintained with or without charge for the recreation of groups of ten (10) or more children.

Please Note: Due to the important monitoring and protections provided by licensed beaches, RIDOH recommends only swimming at licensed bathing beach facilities.

Also per Rhode Island Regulation 216-RICR-50-10-3 (1/17/2018), and prior Regulation (R23-21-RF(A)(1.4 as amended January 2002), licensing of recreational facilities requires facilities to have electrical service; refuse storage and disposal; sewage disposal facilities; adequate toilets, showers, or lavatories with hot and cold running water; a drinkable water supply; and the water adjacent to a bathing beach must meet bacteriological standards. Specific requirements are dependent on the number of users. Reference to these requirements can be found within the Rules and Regulations for Licensing of Recreation Facilities within the General Laws of Rhode Island ().

Per R23-22.5 Drowning Prevention and Lifesaving

Beach Rules and Regulations Promulgated in Accordance with Chapter 3343 of the Public Health Laws of 1954

1. All individuals employed as lifeguards after June 30, 1954 at bathing areas within the State of Rhode Island shall hold an active state lifeguard certification card as issued by the Division of Parks and Recreation, within RIDEM. Lifeguards holding surf cards may be employed at either surf or non-surf bathing areas. Lifeguards holding non-surf cards shall be employed only at non-surf bathing areas. All certification cards are active during the season of their employment and until the following June 30 unless suspended or revoked by the Division of Parks and Recreation.

2. All bathing areas shall provide lifeguard equipment and personnel according to the requirements of the Division of Parks and Recreation and shall provide such equipment and personnel whenever the facilities of the area are open for business.

3. All lifesaving equipment shall be maintained in good operating condition ready for immediate use.

4. All bathing areas shall post conspicuously the hours of duty of lifeguard personnel.

5. A telephone for emergency calls shall be readily accessible from every bathing area. Numbers of police, fire, and rescue units of the area shall be posted conspicuously beside the telephone.

6. No power boats shall be allowed within any bathing and swimming area. The management of each bathing area shall maintain his area free from driftwood and other objects which may cause injury.

7. No bathing area shall operate on any given day unless a state certified lifeguard is present during all hours which the facilities are being used.

8. During periods of severe surf, undertow and other emergency conditions the Recreational Safety Inspectors of the Division of Parks and Recreation shall have the authority to close any and all bathing areas whenever such action is deemed necessary in the interest of public safety. Whenever a bathing area has been closed because of the aforesaid conditions, lifeguards shall be retained on the beach to caution prospective bathers against entering the water.

9. The bathing season shall, for each year, last from May 30th until 6:00 PM of each Labor Day unless the Division of Parks and Recreation gives notice to the contrary.

1.4 Standards

Recreational water quality standards for Rhode Island saltwater bathing waters are under review, but the State currently applies a single sample benchmark, also known as the Beach Action Value (BAV) of 60 *Enterococcus* (measured in most probable number [MPN]) per 100 milliliters (ml) of water. The Rhode Island Department of Environmental Management (DEM) regulations include an additional standard, a geometric mean of 33 *Enterococcus* (MPN). In practice, the DEM standard is applied across broad areas rather than the smaller areas that represent recreational waters adjacent to beaches.

The analytical method for monitoring for conformance with the BAV utilizes the IDEXX *Enterolert*© 1600, a USEPA-approved method to enumerate *Enterococcus*. *Enterolert*© provides a range of *Enterococcus* counts from less than 10 to greater than 24,192 MPN/100ml. The principal limitation of IDEXX *Enterolert*© is that it takes more than 24 hours from sample reception at the laboratory to reporting of analytical result. In other words, there is over a full day delay from when the sample is collected to when the results are received. Decisions to close and/or re-open a beach are generally made in the late afternoon on the day after sample collection. This translates to risk for beach-goers who may be exposed to contaminated water that will not be identified until the next day, with a management response a full two days after the sample was collected. In some cases the delay may result in beach closures after the beach(es) may have become safe for swimming.

RIDOH is continuously reviewing promising new methods that would better meet the intent of standards to protect public health without unnecessary restrictions of use. These methods include new analytical methods and predictive modeling (see Section 4).

2.0 NATIONAL BEACH GUIDANCE AND REQUIRED PERFORMANCE CRITERIA FOR GRANTS, 2014 ED.

USEPA has developed 11 performance criteria for the implementation of monitoring, assessment and notification programs. To be eligible for a grant to implement a monitoring and notification program the state, tribal, or local government's program must be consistent with these performance criteria. These performance criteria are based on and incorporate other requirements of the BEACH Act as well. The 11 performance criteria described below are quoted directly from the National Beach Guidance and Required Performance Criteria for Grants, 2014 Ed (U.S. EPA 2014). Details regarding approaches to meet these Criteria are available in the Performance Criteria Summary Report that RIDOH prepares for USEPA annually.

Performance Criterion 1: Risk-based Beach Evaluation and Classification Process

Performance criterion 1 requires a state or tribe to develop a risk-based beach evaluation and classification process and apply the process to its coastal recreation waters. The process must describe the factors used in the state's or tribe's evaluation and classification process and explain how the state's or tribe's coastal recreation waters are ranked as a result of the process. That process must result in a list of specific coastal recreation waters adjacent to beaches or similar points of access used by the public.

Performance Criterion 2: Tiered Monitoring Plan

Performance criterion 2 requires a state or tribe to develop a tiered monitoring plan. The plan must adequately address the frequency and location of monitoring and the assessment of coastal recreation waters on the basis of the periods of recreational use of the waters, the nature and extent of use during certain periods, the proximity of the waters to known point and nonpoint sources of pollution, and any effect of storm events on the waters.

Performance Criterion 3: Methods and Assessment Procedures

Performance criterion 3 requires a state or tribe to develop detailed assessment methods and procedures. States and tribes must adequately address and submit to EPA methods for detecting levels of pathogens and pathogen indicators that are harmful to human health in coastal recreation areas. States and tribes must also provide documentation to support the validity of methods other than those that EPA validated or approved. Finally, states and tribes must identify and submit to EPA assessment procedures for identifying short-term increases in pathogens and pathogen indicators that are harmful to human health in coastal recreation areas.

Performance Criterion 4: Monitoring Report Submission

Performance criterion 4 requires states and tribes to develop a mechanism to collect and report monitoring data in timely reports. States and tribes must report their monitoring data to the public in a timely manner, including posting on a website. They must report their monitoring data to EPA at least annually or at a frequency required by the EPA Administrator. EPA encourages states to coordinate closely with local governments to ensure that monitoring information is submitted consistently. Reported data must be consistent with the list of required data elements.

Performance Criterion 5: Delegation of Monitoring Responsibilities

Performance criterion 5 requires a state to document any delegation of monitoring responsibilities that might have been made to local governments. If monitoring responsibilities are delegated to local governments, the state grant recipient must describe the process by which the state may delegate to local governments responsibility for implementing the monitoring program.

Performance Criterion 6: Public Notification and Risk Communication Plan

Performance criterion 6 requires that a state or tribe develop a public notification and risk communication plan. The plan must describe the state's or tribe's public notification efforts and measures to inform the public of the potential risks associated with water contact activities in the coastal recreation waters that do not meet applicable Water Quality Standards (WQS).

The state or tribe must adequately identify measures to promptly communicate the occurrence, nature, location, pollutants involved, and extent of any exceedance or likelihood of exceedance of applicable WQS for pathogens and pathogen indicators. The state or tribe must identify how it will promptly communicate that information to EPA. States are responsible for identifying how they will promptly communicate the failure to meet applicable standards to a designated official of the local government in the area adjoining the coastal recreation waters with water quality problems.

A state or tribal government program must describe procedures for posting signs at beaches or similar points of access, or for taking functionally equivalent communication measures that are sufficient to give notice to the public that the coastal recreation waters are not meeting or are not expected to meet applicable WQS for pathogens and pathogen indicators.

Performance Criterion 7: Actions to Notify the Public

Performance criterion 7 requires that a state or tribe give notice to the public when coastal recreation waters are not meeting or are not expected to meet applicable WQS for pathogens and pathogen indicators.

A state or tribe must post signs at beaches or similar points of access or must provide functionally equivalent communication measures that are sufficient to give notice to the public that the coastal recreation waters are not meeting or are not expected to meet applicable WQS for pathogens and pathogen indicators.

Performance Criterion 8: Notification Report Submission

Performance criterion 8 requires that states and tribes compile their notification data into timely reports. States and tribes must report to EPA the actions they have taken to notify the public when WQS are exceeded.

Performance Criterion 9: Delegation of Notification Responsibilities

Performance criterion 9 requires that states describe any notification responsibility they have delegated or intend to delegate to local governments. The state must describe the process by which the state may delegate to local governments responsibility for implementing the notification program.

Performance Criterion 10: Adoption of New or Revised WQS and Identification and Use of a Beach Notification Threshold

Performance criterion 10 is a new criterion, intended to focus on adoption of new or revised WQS as required by CWA section 303(i)(1)(B) and identification and use of an appropriate beach notification threshold. These requirements apply to states and tribes receiving grants under CWA section 406(b), and they will be implemented through conditions included in the grants.

Performance Criterion 11: Public Evaluation of Program

Performance criterion 11 requires that states and tribes provide the public with an opportunity to review the program through public notice and provide an opportunity to comment. This is not a one-time requirement; public input must be sought whenever a state or tribe makes significant changes to its beach program. If a state or tribe significantly changes its List of Beaches, beach ranking, or other elements of its monitoring and notification program, the public must have an opportunity to review the changes before implementation. Further, states and tribes should consult with the applicable EPA Region prior to making significant program changes.

The public evaluation can be accomplished through notice and public comment, meetings, forums, or workshops. For example, when classifying and ranking beaches, it is beneficial to gather input from members of the community regarding the recreational waters they would like monitored. Annual public or community meetings, surveys of the users at the beach, local newspaper articles, or other sources can provide insight into public opinion about the beach, including why the beach is or is not used (e.g., for sunning, running, swimming, or surfing); perceptions of water quality and health problems; and whether beach users desire a monitoring and notification program (if none exists) or how satisfied they are with the current program.

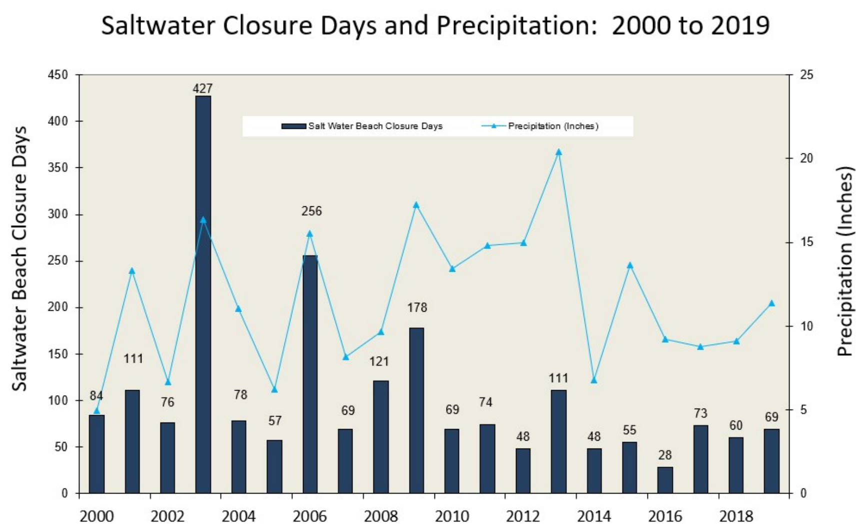
3.0 DATA SUMMARY

During the 2019 bathing season, the number of saltwater beach closure events and closure days increased compared to the 2018 season. Closure events are defined as each occasion when a closure recommendation occurs (on a per-beach basis). Closure days are the accumulation of all days when beaches were closed over one or more closure events. The number of closure days has been the standard tracking measure to capture variability in water quality related closures. However, unlike the number of closure events which has a direct association with water quality, the count of closure days is dependent on logistics and management at each beach, including the time needed to conduct follow up sampling required to affirm that it is safe to lift a closure advisory. The number of closure days may be the best representation of impact to beachgoers, while the number of events is a better expression of water quality conditions from year to year.

In 2019, the total of 36 closure events over 68 closure days was greater than the 20 events and 60 days in 2018. The closures in 2019 occurred at 21 beaches, up from eleven beaches in 2018 and an all-time low of eight beaches in 2016. The total volume of rainfall was greater in 2019 at 11.4 inches compared with 9.1, 8.8 and 9.2 inches to 2018, 2017and 2016, respectively. Since heavy rain events may affect water quality, tracking these events provides a basis to evaluate their influence. There were eight significant rainfall instances (greater than one-half inch in a 24-hour period) in 2019, vs six in 2018 and seven in both 2017 and 2016. In 2019, thirteen of the 36 closures occurred over a two-day period (July 24-25) following heavy rain. Only three other closures were associated with rain > 0.5 inches in a day. More than half of all closures occurred on relatively dry days. While closures associated with the heavy rain event in 2019 were notable, in 2016 a similar rain event in July did not result in closures. The 2016 event was on a weekend and two days passed before any samples were collected. This comparison conforms to our understanding that in recent years, rain events alone are not adequate predictors of poor water quality.

In looking at the broader closure record (Figure 1), the years 2014 and 2007 had low rainfall, with 6.8 and 8.2 inches of rain, including seven and six significant rain events, respectively. In 2014 and 2007 closure days were nearly identical (73 and 69), and within the range of the 2015-2019 recent years (23-73). However, in terms of closure events (not pictured), during 2014 and 2007 there were 34 events in both years, more than in 2016-2018 (12-28). The reduction of closure events did not hold in 2019 with 36 events, but remained in the broader range of the past decade, as did the total of 69 closure days. The last year with rainfall that approximated the 2019 seasonal total (11.4 inches) was in 2008, when there were 121 closure days.

Figure 1. Rhode Island Saltwater Beach Closure Days and Precipitation 2000-2019



The data appear to be building a case for an overall decline in the influence of seasonal precipitation rates, at least as a generalized systemic driver of degraded water quality across the state.

Looking at annual closure days from 2000 through 2019 relative to the seasonal rainfall totals in Figure 1, the pattern of decreasing correlation between closures and rain totals from 2003 to 2015 is clearer. While it appears that we may be in a sustained period of less beach closures (< 100 per season) and less association of water quality with rain, we have not had a moderately wet season since 2015 (13.7”). Closure data for wet years, which occurred in 2003, 2006, 2009 and 2013, present a steady downward trend. These years had total rainfall ranging from 15.5 to 20.4”. Since 2009, the influence of rainfall on the magnitude of beach closures appears diminished, however establishing this as a persistent pattern would require data from additional wet years (e.g., >15”).

If the reduced association to rain and downward trend in closure events prevails during heavy rain years, it would be strong supportive evidence that beneficial changes correlate with a major sewage treatment plant management initiative. First operational in 2008, stormwater infrastructure was built to prevent high volumes of combined sewer overflow from the state's largest treatment sewage treatment plant from reaching Narragansett Bay. The facility located on Narragansett Bay at Fields Point in Providence was a phased project, with the last stage completed in 2013. The number of beach closure days per inch of rain decreased from a mean of 13.3 for the period from 2003 (first year when *Enterolert* was used) through 2008 down to 5.8 for the period from 2009 through 2019. This difference is statistically significant (two tailed t test, p=0.05), while the average rainfall over those periods were not significantly different (11.2 vs 12.8 inches, respectively). Still, there is considerable uncertainty in this analysis with respect to trends, particularly because it includes all licensed saltwater beaches in the state, including many outside of Narragansett Bay. Additional information about regional patterns in beach closures over time can be found in Chapter 23 of the State of Narragansett Bay and Its Watershed 2017 Technical Report prepared by the Narragansett Bay Estuary Program.

Table 1 show the distribution of 2019 beach closure days across nine Rhode Island towns. Collectively, 44% of all closures occurred at seven beaches in Newport and Middletown on the southern end of Aquidneck Island. The second highest percentage groups were in two upper Sakonnet Bay beaches in Tiverton and Portsmouth (16%), matched by two beaches in the mid-bay area of Narragansett Bay in North Kingstown and Saunderstown. One beach in a tidal river (Camp Grosvenor) and one on a tidally flushed salt pond (YMCA Camp Fuller) contributed 10% of the closure days. Notably, only two (Bristol and Conimicut) of the six licensed Upper Narragansett Bay beaches experienced any closure in 2019 and represented only 2% of the total. This is a dramatic improvement over 2018 when Upper Bay beaches were attributed 54 % of the total closure days. At Oakland Beach, there was one poor water quality event that occurred prior to opening, and that event was not included in the above data analysis.

Table 1. Percentage of 2019 Saltwater Beach Closure Days by City/Town

Percent of Closures	City/Town	Closure Days	Beaches
25%	Newport	17	Easton's Beach, Fort Adams Beach, Gooseberry Beach, Hazards Beach, King Park Beach
19%	Middletown	13	Peabody's Beach, Third Beach
16%	Tiverton/Portsmouth	11	Grinell's Beach, Sandy Point Beach
12%	Saunderstown (NMB)	8	Saunderstown Yacht Club,
10%	Tidal River/Salt Pond	7	Camp Grosvenor, YMCA Camp Fuller)
7%	South Kingstown	5	Roy Carpenter Beach
3%	Barrington (NUB)	2	Barrington Town Beach
3%	North Kingstown (NMB)	2	North Kingstown Town Beach
3%	Westerly	2	Dunes Park Beach
1%	Bristol (NUB)	1	Bristol Town Beach

NMB = Narragansett Mid-Bay; NUB=Narragansett Upper-Bay

It is also of note that fifteen of the twenty one beaches had only one or two closure events during 2019. Third Beach in Middletown and Sandy Point in Portsmouth had five and three closure events, respectively. Fort Adams and Gooseberry Beach in Newport also had three closures. Each 2019 closure event is detailed in Table 2.

Table 2: 2019 Saltwater Beach Closures

2019 Saltwater Beach Closure Summary by City/Town				
Closure Date	**Re-Opened Date**	**Beach Name**	**City/Town**	**Closure Days**
5/29/2019	5/31/2019	Third Beach	Middletown	2
6/6/2019	6/7/2019	Barrington Town Beach	Barrington	1
6/19/2019	6/21/2019	Grinell's Beach	Tiverton	2
6/20/2019	6/21/2019	King Park Beach	Newport	1
6/20/2019	6/21/2019	Third Beach	Middletown	1
6/20/2019	6/21/2019	Peabody's Beach	Middletown	1
6/20/2019	6/25/2019	Sandy Point Beach	Portsmouth	5
6/22/2019	6/26/2019	Fort Adams State Park	Newport	4
6/27/2019	6/28/2019	Third Beach	Middletown	1
6/27/2019	6/29/2019	Sandy Point Beach	Portsmouth	2
7/24/2019	7/25/2019	Scarborough Beach South	Narragansett	1
7/24/2019	7/25/2019	Easton's Beach	Newport	1
7/24/2019	7/26/2019	North Kingstown Town	North	2
7/24/2019	7/26/2019	Saunderstown Yacht Club	Saunderstown	2
7/24/2019	7/25/2019	Barrington Town Beach	Barrington	1
7/24/2019	7/29/2019	Camp Grosvenor	Saunderstown	5
7/24/2019	7/26/2019	Gooseberry Beach	Newport	2
7/24/2019	7/26/2019	Bonnet Shores Beach	Narragansett	2
7/25/2019	7/26/2019	Fort Adams State Park	Newport	1
7/25/2019	7/27/2019	Third Beach	Middletown	2
7/25/2019	7/27/2019	Peabody's Beach	Middletown	2
7/25/2019	7/27/2019	Sandy Point Beach	Portsmouth	2
7/25/2019	7/27/2019	Dunes Park Beach	Westerly	2
7/30/2019	8/1/2019	Scarborough Beach South	Narragansett	2
7/30/2019	7/31/2019	Scarborough Beach North	Narragansett	1
8/1/2019	8/2/2019	Easton's Beach	Newport	1
8/2/2019	8/3/2019	Conimicut Point Beach	Warwick	1
8/2/2019	8/6/2019	Roy Carpenter Beach	South	4
8/16/2019	8/20/2019	Third Beach	Middletown	4
8/21/2019	8/22/2019	Gooseberry Beach	Newport	1
8/21/2019	Closed for	YMCA Camp Grosvenor	Saunderstown	1
8/22/2019	8/23/2019	Bristol Town Beach	Bristol	1
8/28/2019	8/30/2019	Hazards Beach	Newport	2
8/28/2019	8/30/2019	Gooseberry Beach	Newport	2
8/28/2019	8/30/2019	Fort Adams State Park	Newport	2

Analyses to determine exceedances of EPA 2012 Recreational Criteria were conducted on data from 2016 through 2019. This analysis, reported for the first time in this 2019 annual report, includes only Tier 1 beaches, for which the frequency of data collection (two times per week) were deemed sufficient to meet EPA's recommendation for synthesis on a monthly basis. The EPA recommends that these criteria should not be exceeded more than once every three years.

Table 3 summarizes results from the analysis. In the analysis, every month with a geometric mean greater than 30 colony-forming units (cfu)/100 ml (one of EPA's recommended criteria) is counted as a single exceedance. Given three months with sufficient data for analysis, (June - August), the highest potential count for a given year is three. Of the thirteen Tier 1 beaches, most exceeded the criteria, with the exception of four Upper Bay Town beaches (Barrington, Warren, Bristol and Warwick's City Park) and one lower Sakonnet Bay beach, Peabody's Beach.

Table 3. Exceedances of EPA's monthly geometric means Criteria at Tier 1 Beaches

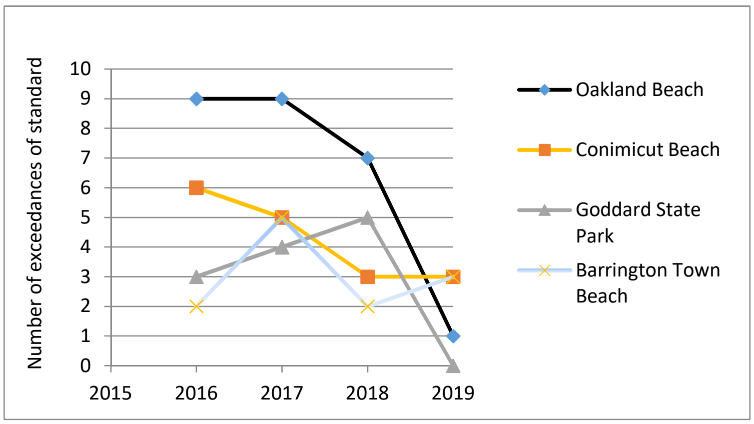
Tier 1 Beaches: Number of Monthly Geometric Means > 30 cfu/100 ml					
Beaches	2016	2017	2018	2019	Criteria Exceeded?
Oakland Beach	1	2	0	0	YES
Conimicut Beach	1	1	1	0	YES
Goddard State Park	0	1	2	0	YES
City Park Beach	0	0	0	0	NO
Barrington Town Beach	0	0	0	0	NO
Warren Town Beach	0	0	0	0	NO
Bristol Town Beach	0	0	0	0	NO
Third Beach	1	0	0	2	YES
Peabody's Beach	0	0	0	0	NO
Easton's Beach	3	3	3	3	YES
Scarborough North	0	0	0	1	YES
Scarborough South	1	0	0	2	YES
Sandy Point	0	1	1	1	YES

It is interesting to note that none of the three first entries in the table exceeded the Geometric Mean Criteria during 2019. In prior years, at least one of these beaches (all in the town of Warwick), exceeded the criteria for at least one month, and sometimes for two months.

While not included in the table, there is a second criteria presented in EPA's 2012 Recreational Criteria document; a Statistical Threshold Value (110 cfu/100 ml) to be applied as an instantaneous exceedance in any month when it occurs. The counts for our Tier I beaches were much higher for this criteria, and all beaches had cases of exceedances in almost every year during the period. While both metrics are important, the geometric mean is considered a more reliable measure of chronic impairment. It should be noted that the raw data (*Enterococcus* counts) used in the analysis only included results from RIDOH sampling. While additional samples are taken and analyzed by private laboratories for each of the Tier 1 beaches, the inclusion of these additional data points would have resulted in substantially different representation of each beach (given that the number of samples collected by private laboratories varies by beach). It also would have introduced other quality assurance uncertainties.

Additional analysis of Upper Narragansett Bay beaches Statistical Threshold exceedances suggests a potential downward trend over the past four years (Figure 2). Only the four beaches with the highest average number of exceedances are shown in the figure.

Figure 2. Inter-annual progression of Statistical Threshold Exceedances at Upper Bay beaches



Noting the variability both amongst beaches and years, the apparent trend is quite uncertain. The apparent improvement at Oakland Beach is the most evident, but additional years of data will be needed to establish more certain change(s).

One of the limitations in tracking trends with respect to the two EPA Criteria threshold values is that the magnitudes of exceedances above the Criteria are not taken into account. This year, RIDOH experimented with another index to characterize annual data sets. This index applies weighting factors to consider how high the actual *Enterococcus* (cfu/100 ml) counts were. In the weighting approach, any day with a count greater than 60 cfu/100 ml was weighted once (1x); greater than 110 cfu/100 ml was weighted twice (2x); greater than 1000 cfu/100 ml was weighted three times (3x). The sum of all weighted exceedances was normalized to the number of sample days.

We applied this index to the Upper Bay beaches with the greatest number of exceedances (Table 4) and found that the index showed improvement for all five Upper Bay beaches in 2019, relative to 2018, and also lower values for all other years at every beach except Barrington Town Beach.

Table 4. Magnitude-weighted Index of Threshold Exceedances in Upper Narragansett Bay

Beach	2015	2016	2017	2018	2019
Oakland Beach	0.69	1.00	0.38	0.71	0.18
Conimicut Beach	0.64	0.65	0.41	0.59	0.22
Goddard State Park	0.57	0.15	0.30	0.36	0.06
Barrington Town Beach	0.12	0.11	0.32	0.23	0.17
Warren Town Beach	0.19	0.14	0.30	0.12	0.07

This approach to characterizing beach water quality in a comparative sense, across beaches and years, has not yet been subject to peer review. It appears to have potential to express water quality data in a way that more holistically captures incremental risks associated with incremental fecal indicator bacteria (FIB) exposure concentrations. It may also reveal changes that can be obscured in the simpler binary criteria exceedance measures. Minimally, the new index suggests that it is important to use multiple approaches to characterize FIB data.

The root causes of beach closures continue to be a concern for the RIDOH Beach Program. While the data show that total seasonal precipitation alone is no longer strongly correlated with the poor water quality that results in beach closures, it may be possible, with extended environmental data sets, to develop better correlative predictors for specific high FIB count conditions. The Beach Program has been tracking meteorological data at eleven weather stations throughout the state, as well as tidal data for each day during the beach season since 2009. The weather data includes precipitation, air temperatures and wind direction/speed. This information is provided in Appendix C. The program also records environmental observations at the time of sampling at each beach. These include local water temperature, prevalence of seaweed in the water and at the wrack line and current and wave observations, as well as numbers and activities of visitors and wildlife type and numbers (generally for birds). All of this information may contribute to statistical modeling to predict water quality conditions (See section 4.2, below).

4.0 BEACH PROGRAM ACTIVITIES AND PROJECTS

4.1 Beach Season Kick-Off Meeting

Each year the Beach Program holds a topic-based meeting for beach owners/managers, cities/towns, state agencies, laboratories, and any interested stakeholders. Meetings may include guest speakers knowledgeable in the applicable topic as well as federal representatives to answer questions and concerns.

The 2019 Kick-Off Meeting was held on May 10th at the Jamestown Library. There was a special session on cyanobacteria monitoring and health risks presented by Brian Zalewsky from the RI Department of Environmental Management. Speakers from the US EPA Atlantic Ecology Division presented findings from studies on the impacts of beach closures on local economies. While the most complete studies were conducted on Cape Cod, the findings are largely applicable to Rhode Island. Rhode Island-specific studies are underway.

Sherry Poucher presented findings from preliminary statistical modeling that might lead to a predictive capability for high-risk beaches, as well as 2018 results from saltwater and freshwater monitoring. A copy of the 2019 Beach Season Kick-Off Meeting invitation and Agenda can be found in Appendix F.

4.2 Statistical Analysis of Water Quality Data

During 2019, RIDOH continued collaborative work with the non-profit organization Clean Ocean Access (COA) to improve our understanding of current marine beach water quality status and trends at Rhode Island beaches. Our work was partially supported by the New England Interstate Water Pollution Control Commission (NIEWPCC). The 2018-2019 project was conducted for the Narragansett Bay Estuary Program (NBEP) to address analytical shortcomings identified in the State of Narragansett Bay Report (NBEP 2018, Chapter 23, Saltwater Beaches). We leveraged $16,000, split between RIDOH and COA, to advance the work. The project reached beyond the beach closure data to evaluate raw water quality monitoring data (*Enterococcus* concentrations) for trends. The project also provided an exploratory evaluation of the factors that influence water quality through use of “Virtual Beach”, a statistical modeling software package developed and supported by U.S. EPA.

Methodologies were developed and reported for case studies for two beaches with historic and persistent water quality problems: Oakland Beach in Warwick and Easton’s Beach in Newport. The first task was to analyze raw *Enterococcus* data (2006-2018) to establish status with respect to state water quality standards, and to evaluate trends over time. As a whole, the data records for Oakland and Easton’s beaches did meet EPA’s water quality standards for recreational use, albeit conditions were acceptable for recreation more often than not. Neither beach exhibited a significant trend toward improved water quality.

The next task was to develop statistical models using Virtual Beach. Data sets containing environmental variables that were temporally associated with *Enterococcus* concentration served as the input to predict counts of the bacteria. For each beach, 2015-2017 data formed the basis for the models. Guidance dictates that the data sets must be representative of current conditions, which is why the number of years of data was limited. If successful, the models could be used to predict water quality for more timely and appropriate management actions to better protect public health. They might also, through inference, provide clues to better understand root causes of contamination. The case-study work supported by NEIWPCC was completed during the first half of 2019.

An important finding was that the environmental variables found to be statistically significant predictors of *Enterococcus* were different for each beach, and that no single variable was a good predictor. At Oakland beach, rain and tide variables along with depth to groundwater were found to be statistically significant predictors. Easton's beach models did incorporate rain factors, but water temperature and operation of Newport's UV Disinfection Treatment Plant were also important factors. Although the models for both sites demonstrated strong relationships between the predictors and measured *Enterococcus* concentrations, they were not successful at predicting 2018 *Enterococcus* counts. This may due to the generally low *Enterococcus* concentrations in 2018. While the base models met statistical standards for acceptability, their predictive capacity would most likely improve if they were augmented with more years of data. Individual case study reports and the integrated final report are available on request (McLaughlin et al., 2019).

During the second half of 2019, the data set used to develop the Oakland Beach model was applied toward the development of potentially predictive capabilities for six additional Upper Narragansett Bay beaches. Given the large time commitment required to develop model data sets, this work intended to test whether a single set of explanatory environmental data might be useful for multiple beaches located within close proximity. While the range of model fits was variable, the base year model fits did generally meet acceptability criteria. Again, we found that the predictive variables were unique to each beach. Unsurprisingly, the models seem to perform best for beaches with the highest counts of *Enterococcus*.

4.3. Investigation of New Rapid Testing Technology (TECTA)

During 2019, the Beach Program started to investigate the value of TECTA, a new technology that may provide an alternative to *Enterococcus*, allowing reportable test results in a shorter time frame. The technical basis for the test parallels IDEXX *Enterolert*, using similar selective media and an enzyme reaction that produces a fluorescent signal. TECTA's advantage is that it uses the relationship between detection time and concentration, allowing the quickest reporting for high concentrations. Compared with *Enterolert*, TECTA costs are roughly equivalent, and TECTA also has some automation advantages.

The Beach Program conducted a preliminary trial with TECTA (instrument on loan from the developer, Pathogen Detection Systems, Inc.) during the fall and winter of 2019-2020. RIDOH's methods for testing TECTA build on experience gained in our earlier studies with quantitative polymerase chain reaction (qPCR), another method with a relatively short test turn-around-time, but which proved more costly and logistically problematic. Preliminary TECTA testing was conducted in parallel with *Enterolert* and Membrane Filtration standard methods, with field samples spiked with *Enterococcus faecium* and *Enterococcus faecalis* over a range of relevant concentrations.

Initial results are encouraging but more work needs to be done, testing beach samples with elevated counts under summer conditions. RIDOH hopes to use data obtained from summer samples to apply EPA's protocols for the development of Alternative Recreational Criteria to 'validate' the TECTA method.

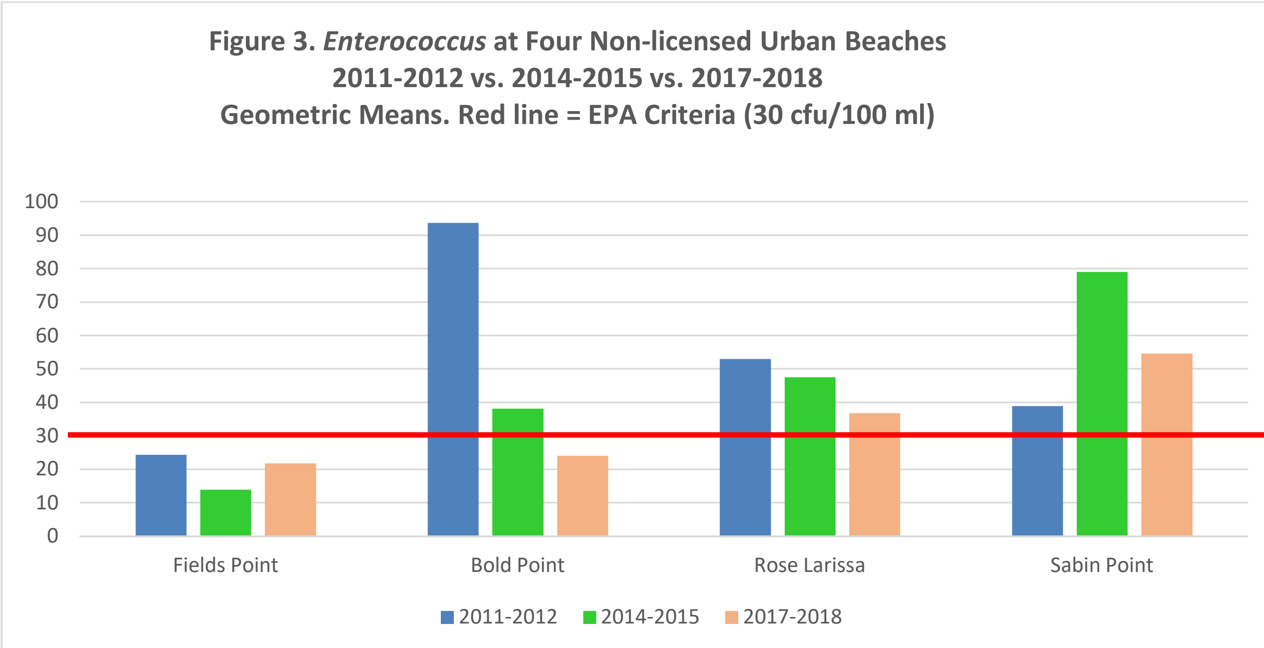
4.4 Urban Beach Initiative

In 2018, RIDOH completed the formal study to statistically examine status and trends of water quality at four areas in upper Narragansett Bay: Bold Point and Fields Point in Providence, and Rose Larisa and Sabin Point in East Providence. The objective was to determine if these locations might prove to be suitable for primary contact recreation. The formal study was reported by John Snow Inc. (JSI). It included data from 2011 through 2015, but analysis consistent with the JSI study continues with additional data collected through 2019. Due to the paucity of *Enterococcus* data (9 to 29 sample days per year), the JSI analysis grouped results from the years 2011 and 2012 to compare with results from 2014 and 2015. The years 2013 and 2016 were excluded from the analysis because only two beaches, Fields Point and Sabin Point, were sampled. Importantly, data from these years were neither the highest nor lowest over the study period. It is also of note that 2013 was a heavy rain year (20.4"), outside of the 99% normal distribution of the rainfall for the decade period.

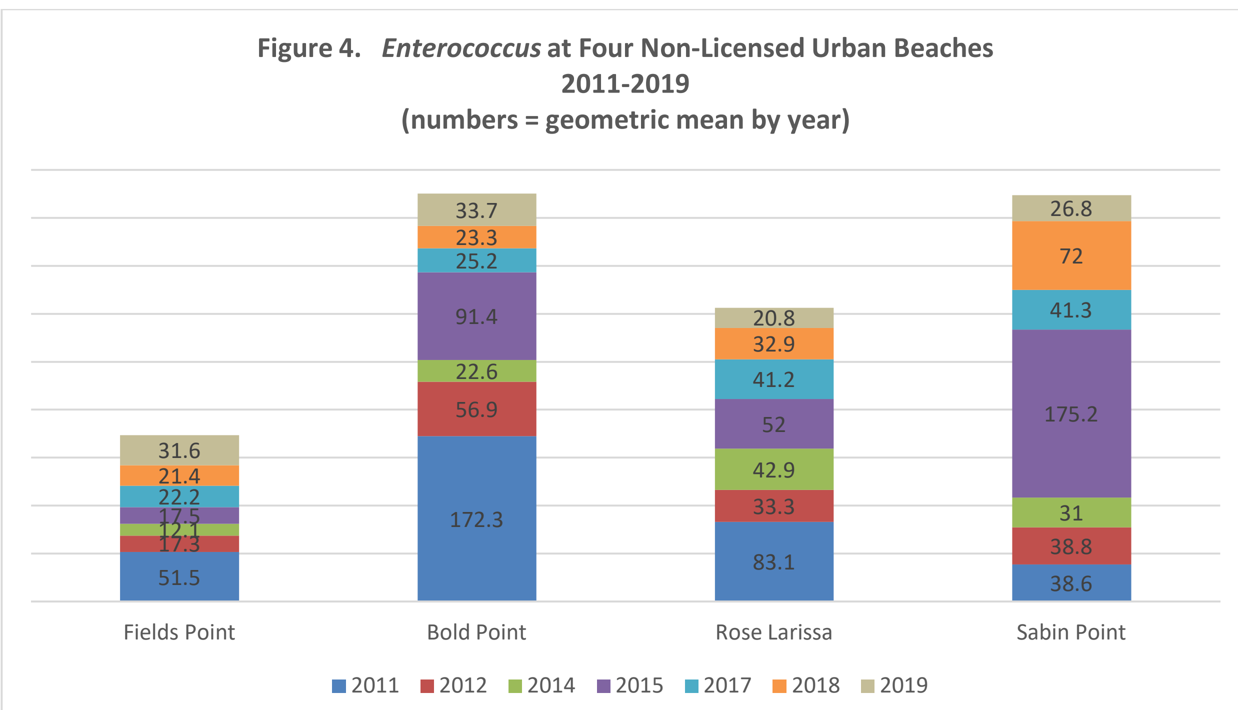
Results from the JSI study, as summarized below (Figure 3), indicate that recent conditions at Providence's Fields Point were better than at East Providence's Bold Point. However, Bold Point appears to have been improving. Data from both sites are courtesy of a collaboration with Save the Bay, whose staff have sampled locations since the initiation of the Urban Beach Project. Save the Bay sampled once per week at Fields Point and Bold Point in contrast with the biweekly sampling at Rose Larisa and Sabin Point conducted by RIDOH.

The improvements at Bold Point are consistent with wastewater treatment plant upgrades which have been ongoing there, lagged behind the major improvements which were completed at the Field's Point treatment plant by 2014. Fields Point and Bold Point appear to be approaching conditions at three urban beaches that are open for swimming, Barrington, Warren and Bristol town beaches. At these town beaches, annual geometric mean concentrations are generally near 20 cfu/100 ml or less.

During 2017-2018, the East Providence beaches, Rose Larisa and Sabin Point, continued to have geometric means > 30 cfu/100 ml which, as noted above, is one of U.S EPA's recommended criteria to determine impairment for recreational use. At these East Providence sites, local inputs may be contributing to the persistent water quality problems.



However, in 2019, the results from both Rose Larisa and Sabin Point beaches indicate an improvement, with geometric means of 20.8 and 26.8 cfu/100 ml, respectively; even slightly better than Fields Point and Bold Point (Figure 4).



Using RIDOH's new experimental weighted index, both Rose Larisa and Sabin Point did suggest improvements relative to prior years (Table 4), even though 2019 geometric means for these beaches were not lower than in recent years.

Table 5: Magnitude-weighted Index for two non-licensed Urban Beaches

Beach	2015	2016	2017	2018	2019
Sabin Point	1.17	0.73	0.63	1.00	0.62
Rose Larisa	0.76	0.64	0.78	0.74	0.38

*Bold Point and Fields Point are not included due to a lower frequency of sampling

The urban beaches should be a priority for additional management actions, whether for the continued need for pathogen load reductions, or, where conditions have improved sufficiently, to develop the needed community infrastructure that would promote recreational use. During the hot summer months, many Rhode Islanders use recreational beaches as sanctuaries to escape the heat. Populations most in need are those living in Rhode Island's urban core, where buildings and pavement heat retention elevates temperatures through the "heat island effect". These populations are also some of the most at risk in the state for water-borne illness as social and economic restraints interfere with access to cleaner, more costly water bodies. Southern Rhode Island waterbodies may also not be accessible to at-risk communities due to restrictions in public transportation. Working to create clean, healthy, and safe recreational outlets for at-risk communities is an integral part of the BEACH Program's mission.

Bristol Town Beach is a preeminent and nationally acclaimed example for how to re-claim an underutilized recreational water asset. The comprehensive program in Bristol demonstrated that combining best management practices to improve water quality with local initiatives such as camps and other promotions of recreational uses have leveraged the beach resource to develop an exceptional asset for the town.

2019 marked the Urban Beach Initiative's ninth season. Since the start of this project, monitoring locations and schedules have been adjusted to potential bather population as well as municipal interest in opening a recreational outlet. For example, Save the Bay added Stillhouse Cove in Cranston to their weekly monitoring effort beginning in 2016. Table 6 shows results from Stillhouse Cove monitoring, compared with the Fields Point results. Since the two sites are approximately two miles apart on the western edge of Upper Narragansett Bay, Similarities in the statistics presented are not surprising. A single high result at Field's Pont appears to be an anomaly. Stillhouse Cove is in a more residential area, and would be expected to receive more localized and variable loads of pathogens. The results to date indicate that it could be a good candidate to license for recreational uses, with risks similar to other Upper Bay licensed beaches.

Table 6. Stillhouse Cove and Fields Point *Enterococcus* Results (geometric mean cfu/100 ml)

	Fields Point				Stillhouse Cove			
Metric	**2016**	**2017**	**2018**	**2019**	**2016**	**2017**	**2018**	**2019**
Geometric mean	25	22	21	32	17	24	20	19
Mean	49	54	43	1218	44	63	32	36
Standard Deviation	77	86	64	3736	99	96	38	51

RIDOH will continue to collaborate with Save the Bay as we examine water quality in upper Narragansett Bay. We will also continue to work with Save the Bay to assist with training water quality monitors and to provide grant guidance and application support for remediation work at the beaches.

4.5. Quantitative Polymerase Chain Reaction (qPCR) Rapid Testing

The qPCR study was successfully completed in 2018. The first objective was to build capacity to perform quantitative Polymerase Chain Reaction (qPCR; EPA Method 1609) to quantify fecal indicator bacteria, *Enterococcus,* in beach water samples. The State laboratory is now fully competent and practiced in this method. The other objective was to establish the utility of the method for beach water quality testing in Rhode Island. Unfortunately, the method, tested on two of the most severely impacted beaches in the state, did not prove to be a reliable surrogate for other EPA approved methods (*Enterolert* and Membrane Filtration). Nonetheless, the new qPCR capabilities at the laboratory can be used for enumeration and for targeting pathogenic strains of *Vibrio*, as well as for rabies confirmation and for various microbial source tracking functions. Having completed qPCR training and analysis of over 400 samples for this study, it is expected that additional applications would require little if any further training.

The project methods and findings are detailed in two reports, one completed through contract support for statistical analysis provided by the John Snow Institute (JSI). The second is a manuscript-style report which includes study background, information regarding experimental design, and a discussion of findings in the context of methodological uncertainties as well as practical application limitations of the method as a routine tool for beach water quality monitoring. The project was funded through USEPA's grants for research within Southeast New England Coastal Watersheds (SNEP).

4.6. Publication of the Beach Sands Study

In 2009 the BEACH Program investigated bacterial contamination in sand at 10 coastal beaches throughout Rhode Island. Eight of the 10 locations have known sources of contamination and close due to high bacteria levels on a regular basis. Sand and water samples were collected along with data on wind speed, direction, wave intensity, and precipitation.

The study was published in the Journal of Environmental Health (Coakley et al., 2016). The study reported statistically significant gradients in *Enterococcus* concentrations among tidal zones, with dry (supra-tidal, or above high tide mark) sand having the highest level, followed by wet (intra-tidal, or below high tide mark) and underwater sand. There were two beaches without a statistically significant gradient (Easton's Beach and Conimicut Point); for these beaches, mean levels were uniformly high in all three zones. Beaches with higher wave action had significantly lower *Enterococcus* count levels in wet and underwater sand compared to beaches with lower wave action. Results from the sand study are just a first step. Further investigation with respect to fate, transport and associated exposure risks is needed.

5.0 2020 PROJECTED ACTIVITIES

5.1 Monitoring Program

Beach interns will conduct sampling at coastal beaches from Memorial Day through Labor Day. Approximately 1600 samples will be collected, submitted, and analyzed for *Enterococcus* during the summer season.

5.2 Illness Tracking

The BEACH Program will work with the Division of Infectious Disease and Epidemiology to research and develop standard operating procedures for tracking and responding to water-borne disease and illness.

5.3 Data Submission

The BEACH Program will prepare both notification and monitoring data for submission to EPA's Environmental Exchange Network Services Center. Verification of the submittals, and updates and corrections in historic data will be accomplished using EPA's new Verification Tool, and with assistance from EPA contract staff.

5.4 Reporting

<u>Annual Season Report</u>

Reporting of previous year's data will be prepared and submitted to EPA Region 1 as required. The Season Report will include analysis and descriptions of data collected and trends affecting the beaches and water quality of Rhode Island.

5.5 Outreach

2020 Beach Season Kickoff

The Beach Program will hold a one-day meeting for beach owners, managers, and interested stakeholders to kick-off the summer season. Each year is a unique theme with presenters and take-home materials on the day's topic. The annual kick-off meeting also provides an opportunity for beaches to ask questions, sign up for summer training and events hosted by RIDOH and to network with other beaches and state officials.

Governor's Beach Day

The RIDOH Beach Program annual conducts a summer education and outreach event during the Governor's Beach Day, generally held during the last weekend in July. Two sampling interns man a table for beach visitors interested in learning about water quality and healthy beaches. Some of the activities include an Enviroscape presentation, Beach Bingo, Beach Trivia, and Scavenger hunts. Other outreach activities can be scheduled for a "Beach Program at your Beach", on request, on Friday's when sampling does not occur. Beach managers and camp supervisors are required to oversee these events. Beaches are notified of this opportunity at the annual Kick-off meeting. 2020 will be the ninth year for this option.

5.6 Risk Assessment

Rank Beaches by Tier

At the beginning of each season, RIDOH uses our risk-based beach evaluation and classification process to rank beaches by tiers. Using information and data gathered from evaluation of the prior year's beach data, along with sanitary surveys, tier rankings are adjusted needed.

TECTA Study

The plan for additional testing of the TECTA method in Rhode Island is based on the assumption that the state could use the Alternative Recreational Criteria guidelines to derive a TECTA benchmark. The guidance for Alternative Criteria requires at least 30 samples above the limit of quantitation. The approach to achieve this goal will target samples that far exceed the BAV, and will require substantially more sampling than the 30 required samples, given the limited ability to predict the conditions that produce high results, and the unpredictability of the weather which plays principally in providing predictive factors. Sampling will target summer conditions at beaches with the worst water quality records. Testing will continue to be conducted in parallel with standard methods.

If warranted, developing protocols for integrating TECTA testing into a monitoring schema would require a logic model to incorporate a broad review of FIB analysis methods literature along with additional input from TECTA and stakeholders. The comprehensive evaluation would also involve consideration for previously documented differences between methods of practice, particularly related to the detection 'efficiency' of each *Enterococcus* species/strain. The review of results will assume that Enterococcus spp. is an acceptable FIB for quantifying public health risks.

Improving Risk Assessments with New Tools and Initiatives

Over the next three to five years, the Beach Program will work to develop an environmental assessment plan for Rhode Island Coastal beaches. This plan will refresh beach specific information/data such as sources of contamination, stormwater improvement projects, review water quality, and public access. This plan may include the following:

- Site-specific comprehensive assessments for coastal beaches
- Sanitary surveys using USEPA's new template and survey guidance recommended in the 2014 Beaches Environmental Assessment and Coastal Health Act Guidance Document
- Incorporate rapid testing methods, as appropriate
- Data collection to better characterize temporal and spatial variability
- Use of forensic dogs to identify sources and pathways of contamination
- Identification and characterization of the nature and extent of groundwater seepage
- Develop predictive models in areas with known sources of contamination that pose the greatest risk to public health.
- Incorporate predictive models into beach closures/advisories to better protect the public
- Hold stakeholder workshops, sampler training, etc.

5.7 New Recreational Water Quality Criteria Standards

The BEACH Program will work to assist the Rhode Island Department of Environmental Management (RIDEM) as they review, and report on state-wide water quality data to meeting recreational water quality standards (RWQS) in Rhode Island. The BEACH Program will also provide a beach-by-beach assessment of all beach water quality monitoring and notification data generated by RIDOH to characterize which beaches are meeting U.S. EPA recommended criteria.

6.0 REFERENCES

Budnick, G.E., R.T. Howard, D.R. Mayo. 1996. “Evaluation of *Enterococcus* for Enumeration of Enterococci in Recreation Waters”. Applied and Environmental Microbiology. 62:3881-3884.

Coakley, E., A. L. Parris, Al Wyman, G. Latowsky Assessment of *Enterococcus* Levels in Recreational Beach Sand Along the Rhode Island Coast, Journal of Environmental Health, Vol. 78, No. 8 (April 2016), pp. 12-17.

McLaughlin, D, S. Poucher, E. Touhey and J. Chopy and S. Pereira. 2019. Research Needs for Marine Beaches: Final Report, Federal Award Identification Number: CE00A00004 NBEP: Section 320 Funds, NEI Job Code: 318-001, Project Code: S-2018-005, 2018/2019 Grant Program, June 13, 2019.

U.S. EPA. 2014. National Beach Guidance and Required Performance Criteria for Grants, 2014 Edition (PDF)(116 pp, 2 MB, July, 2014, EPA 823-B-14-001

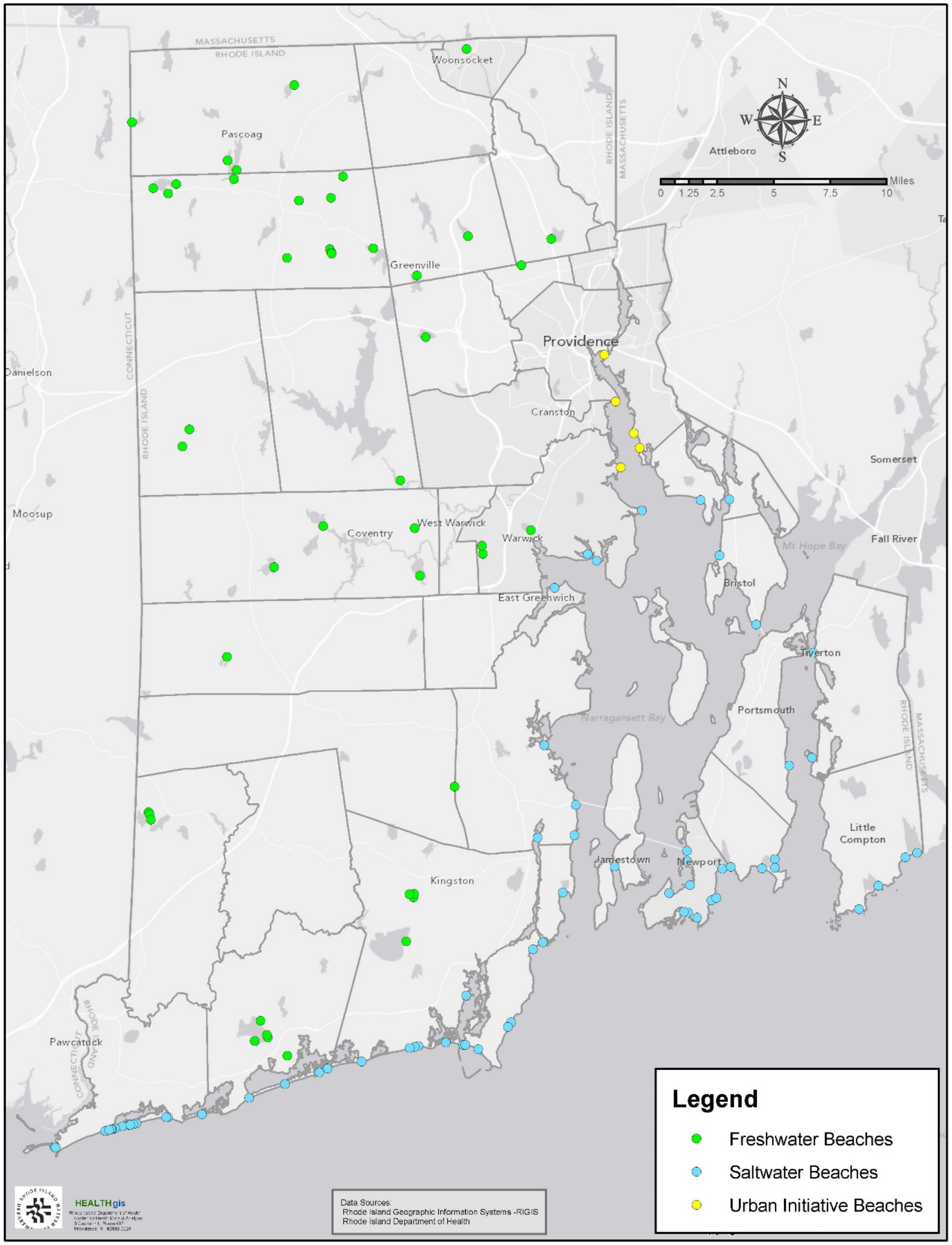
U.S. EPA. 2014. Site-Specific Alternative Recreational Criteria Technical Support Materials For Alternative Indicators and Methods EPA-820-R-14-011, U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Health and Ecological Criteria Division.

U.S. EPA. 2012. Recreational Water Quality Criteria. Office of Water. 820-F-12-058

U.S EPA. Beaches Environmental Assessment and Coastal Health Act of 2000, 33 USC § 1251 (2012).

Map of Rhode Island Licensed and Urban Beaches

Closure Evaluation Spreadsheet 2000-2019


MASSACHUSETTS
RHODE ISLAND
Woonsocket
Pascoag
Greenville
Attleboro
N
S
E
W
0 1.25 2.5 5 7.5 10
Miles
Providence
Danielson
CONNECTICUT
RHODE ISLAND
Cranston
Somerset
Moosup
Coventry
West Warwick
Warwick
Mt Hope Bay
Fall River
Bristol
East Greenwich
Tiverton
Portsmouth
Narragansett Bay
Little Compton
Jamestown
Newport
Kingston
Pawcatuck
Legend
Freshwater Beaches
Saltwater Beaches
Urban Initiative Beaches
HEALTHgis
Data Sources:
Rhode Island Geographic Information Systems -RIGIS
Rhode Island Department of Health

APPENDIX B

Summary of Beach Closures: 2000-2019

Rhode Island Department of Health Beach Monitoring Program ***Closure Evaluation Spreadsheet***																				
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Number of Monitored Freshwater Beaches	51	51	49	51	47	50	53	49	50	50	42	42	35	46	46	46	35	40	29	35
Number of Monitored Saltwater Beaches	31	31	70	72	71	69	69	69	74	68	72	70	76	69	69	69	69	69	69	69
Total Number of Monitored Beaches	82	82	119	123	118	119	122	118	124	118	114	112	111	115	115	115	115	115	98	104
Sample Count* (RIDOH - EPA Funded Sampling Only)	515	976	1,779	2,567	2,701	3,211	2,769	1,718	1,655	1,770	1,988	2,678	1,680	1,604	1,747	2,025	1,718	1,586	1,506	1,403
Rainfall Total (Memorial Day - Labor Day)	4.93	13.32	6.65	16.34	11.04	6.24	15.54	8.18	9.64	17.24	13.42	14.8	15	20.42	6.8	13.65	9.21	8.79	9.08	11.38
Significant Rain Events (>0.5" in 24-hr)	4	7	6	12	9	4	7	6	6	13	11	9	5	13	7	8	7	7	6	
S.W. Events	13	26	27	67	41	30	91	43	52	89	56	37	34	41	36	41	12	23	20	36
S.W. Closure Days	103	144	103	503	122	65	351	95	161	230	148	74	54	119	52	61	27	78	60	68
*Sample count estimates do not include approximately 1,000 samples submitted by Beach Operators on an annual basis, which are reviewed by RIDOH notes: Significant Rain Events Calculated from Warwick RI - Central location of state																				

APPENDIX C
2019 Meteorological Data

Available on Request

APPENDIX D

Urban Beach Study Results

Enterococcus Results from Urban Beaches, 2011-2019 (through 2016 and ANOVA, results from JSI study)

Urban Beach	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**ANOVA p-value**	**2017**	**2018**	**2019**
Sabin Point Park (closed)								(n=27)	(n=26)	(n=24)
Mean	106	620	563	404	2930	270		1596	533	159
Standard Deviation	191	2033	1,909	1,202	6,597	655		5604	1417	406
Largest value	860	9,800	7,700	836	24,200	2,910		24,200	6650	1940
Geometric mean	38.6	38.8	44.5	31	175.2	41.9	0.09 (ns)	41.3	72	26.8
New Index					117	73		63	100	62
Rose Larisa Park (closed)								(n=54)	(n=76)	(n=72)
Mean	480	80	n/a	646	125	167		926	242	63.6
Standard Deviation	1,203	151		2921	219	359		4207	792	191.6
Largest value	5,794	624		15,500	1,070	1,620		24,200	4610	1180
Geometric mean	83.1	33.3		42.9	52	40	0.28 (ns)	41.2	32.9	20.8
New Index					76	64		78	74	38
Warren Town Beach (open)								(n=27)	(n=27)	(n=25)
Mean	28	27	97	77	30	24		29.6	21.2	19.6
Standard Deviation	35	41	216	190	48	26		40.3	29.4	19
Largest value	146	199	776	878	243	97		156	132	86
Geometric mean	19	16.9	26.7	20.3	18.4	17.3	0.61 (ns)	17.2	14.2	15.1
New Index					19	14		30	12	7
Barrington Town Beach open								(n=106)	(n=102)	(n=95)
Mean	92	26	638	29	24	23		33.5	24.4	39.7
Standard Deviation	368	48	3,524	36	29	39		70.2	36.5	133.7
Largest value	2,613	278	24,200	183	158	262		627	269	972
Geometric mean	24.6	16.1	25.4	20.4	17.2	15.7	0.07 (ns)	17	15.5	15.3
New Index					12	11		32	23	17

Urban Beach	2011	2012	2013	2014	2015	2016	ANOVA p-value	2017	2018	2019
Field's Point (closed)								(n=22)	(n=22)	(n=20)
Mean	190	25	64	24	19	49		53.5	43.3	1217.5
Standard Deviation	294	32	79	46	12	77		86 3	63.7	3736.3
Largest value	884	109	269	173	41	263		315	228	14100
Geometric mean	51.5	17.3	34.5	12.1	17.5	24.9	0.02 (s)	22.2	21.4	31.6
Bold Point (closed)								(n=14)	(n=22)	(n=12)
Mean	279	150	n/a	44	420	n/a		81.4	44.6	170.5
Standard Deviation	243	339		63	881			158	62.6	346.7
Largest value	860	1,610		199	2,720			512	259	970
Geometric mean	172.3	56.9		22.6	91.4		<0.01 (s)	25.2	23.3	33.7
Bristol Town Beach (open)								(n=52)	(n=54)	(n=52)
Mean	252	34	28	32	27	87		76.5	26.4	17.8
Standard Deviation	1,106	62	29	72	38	381		175.6	46.1	22.4
Largest value	6,294	305	148	402	201	2,400		794	285	145
Geometric mean	36.4	19.3	21.4	18	18.1	22.4	0.04 (s)	21.2	15.8	13.2

(ns) = No significant differences between years

(s) = Significant differences between years.

APPENDIX E

Kick-Off Meeting Invitation

Rhode Island Department of Health 2019 Beach Season Kick-Off

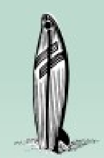
The RIDOH Beach Program has an interesting informational program planned for our 2019 kick-off meeting. Please come to join fellow beach owners and managers, volunteer organizations, and state/federal personnel involved in Rhode Island's beaches.

On the agenda:

- Bluegreen algae monitoring program: guidance from RIDEM's Brian Zalewski
- Skin cancer outreach program: volunteer your beach
- Summary of 2018 monitoring results
- Update on predictive modeling – Oakland Beach and Easton's Beach case studies.
- Open forum - let's talk!

Where: Jamestown Philomenian Library
26 North Road
Jamestown, RI
When: May 9, 2019 at 1:10 p.m.

Please RSVP[1] to Sherry Poucher
Phone: 401-222-7727
Email: sherry.poucher@health.ri.gov By May 3, 2019



[1] But do come even if you don't rsvp.