# Maine Healthy Beaches Program Annual Beach Grant Report 2024 Season

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# I.     Program Accomplishments

Maine Healthy Beaches (MHB) is managed by the Maine Department of Environmental Protection (ME DEP). In 2024, MHB staff worked with 30 local management entities to conduct routine monitoring, assessment, and public notification of water quality conditions for 65 beach management areas spanning from Kittery to Mount Desert Island. MHB staff continued to build local capacity to make well-informed beach management decisions and address pollution issues.

The MHB program accomplished the following in 2024:

- Processed 1818 enterococci samples at 117 routine and enhanced monitoring locations.
- Launched a new publicly available data portal and internal user database for program participants including the ability to sign up for beach advisory alerts via email and text message.
- Developed new program signage, implementing significant improvements for local-level beach notification protocols and communication with the public.
- Trained approximately 200 beach managers, local staff, and volunteers to collect water samples, conducted technical trainings for local staff and volunteers, and facilitated planning/problem-solving meetings.
- Facilitated Elevated Bacteria advisories at 29 beaches, Precautionary Rainfall advisories at 30 beaches, and zero beach closures.
- Worked with participating management entities to update their annual Beach Monitoring and Notification Plan documenting how the program is implemented at the local level.
- Continued implementing objectives of MHB's EPA-approved Quality Assurance Project Plan (QAPP, 2021-2026).
- Continued implementing measures outlined in the EPA-approved beach action value (BAV) justification.
- Supported enhanced monitoring and pollution remediation efforts for the Ogunquit River watershed, Goose Rocks Beach watershed, Crescent Beach State Park, Town Landing (Cumberland), MDIBL efforts in Acadia, Wells Harbor, and the Willard Beach watershed.
- Supported limited monitoring efforts for 4 public beaches in the Midcoast not routinely monitored by the program to assess the risk of pollution and the feasibility of including these beaches as part of the routine monitoring program in the future.
- Analyzed 112 samples for optical brightener levels to target human-sourced fecal contamination at 29 enhanced monitoring locations.
- Continued collaborating with Department staff and external partners to expand knowledge of Microbial Source Tracking (MST)/eDNA techniques and best practices.
- Continued updates to the MHB Risk Assessment Matrix (RAM), an evaluation of water quality trends and potential sources of fecal bacteria impacting coastal beaches.
- Continued implementing updates to the program's Beach Assessment Checklist used by program staff to update beach-specific RAMS and to support information/data requests from program partners.
- Provided technical guidance and field support as requested to municipalities with beaches listed as impaired in the most recent cycle of Maine's Integrated Water Quality Monitoring

and Assessment Report (IR) (2024[1]).

- Transformed data into action items and served on several working groups for improving water quality and ecosystem health.
- Provided expertise and advised towns/groups interested in monitoring freshwater recreation areas as well as other areas along the coast.
- Presented to local and regional audiences.

## II.  Program Deliverables/Appendices

Appendix A    MHB 2024 Budget Summary

Appendix B    MHB 2024 Beach Management Area Classification/Tiered Monitoring Plan

Appendix C    MHB 2024 Notification Table

## III.  Budget Information

*Program Activities*

The US EPA sponsored MHB program 2024 budget (Appendix A) supported all routine monitoring, assessment, notification, education/outreach, and enhanced monitoring efforts including:

- Salaries for three staff including two DEP staff and a Maine Conservation Corps (AmeriCorps) Environmental Steward. DEP staff included one full-time Program Coordinator position and half of the salary for a full-time Program Specialist position. This team of personnel provided support to 30 local management entities (towns, state parks, a national park, and private beach associations) including program coordination, quality-assured protocols and structure, field/lab trainings, technical assistance, volunteer recruitment, and education/outreach.
- Data management services provided by the MHB Program Specialist including the transfer of MHB data to DEP's Environmental and Geographic Analysis Database (EGAD) system, managing the submission of MHB data into the US EPA databases (WQX and PRAWN), and fulfillment of data requests as needed.
- Planning and problem-solving meetings with diverse partners including local beach managers, conservation commissions, consultants, researchers, and state/federal agencies.
- Field monitoring supplies, equipment, volunteer training packets, and quality-assurance including annual field, database, and observational trainings for approximately 200 citizen volunteers and local staff.
- Laboratory equipment, supplies, labor, sample transport (courier), training, and quality assurance support for four laboratories processing enterococci samples for 65 beach management areas spanning a large geographic area (approximately 200 mi.).
- Enhanced monitoring and pollution identification efforts as well as numerous planning and problem-solving meetings with diverse partners.
- The development of new program signage for participating program beaches to improve public notification accessibility and sign functionality.
- Education and outreach efforts including delivering presentations to local and regional audiences and the development and distribution of numerous resources.

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[1] The 2024 IR is pending final approval from EPA as of 3/19/2025.

- Miscellaneous expenses including travel, telephone, computer services, postage, office support and supplies, and photocopying.

*Volunteer Contribution*

MHB program participation is voluntary, and towns/parks/associations designate local beach managers and field monitors to collect samples. Beach managers are typically town administrators, health nurses, fire chiefs, state park managers, and others who participate as an add-on to full-time jobs and schedules. Towns and state parks utilize citizen volunteers or devote paid staff time to sample collection, transport, public health advisory postings, and data entry. All volunteer monitors attend a pre-season field training and contribute an average of three hours of time per week during the monitoring season.

## IV.    Performance Criteria

In 2024, the MHB program continued to provide a unified structure and quality-assured tools to implement an adaptive monitoring regime, assess the risk of pollution, notify the public of water quality conditions, and promote best practices on the beach and surrounding drainage areas. MHB staff also provided ongoing daily training and technical support including responding in real-time to water quality data, assessing pollution/risk of illness, and notifying the public of conditions on coastal beaches.

*Monitoring*

There are more than 29 miles of public access beaches along Maine's coast. The MHB program is voluntary and monitoring coastal water quality for swimming and other water contact is the responsibility of local jurisdictions and is not mandated by state law. US EPA funding supports monitoring of moderate to high use beaches with adequate public access. Maine law allows public use of private beaches for "fishing, fowling and navigation" only. Participating beaches must have a management entity capable of meeting objectives and requirements outlined in the MHB program QAPP and MHB Program Management Entity Agreement. New beaches will be recruited over time as resources and funding allow and/or circumstances change eligibility for program participation.

In 2024, MHB staff successfully worked with 30 local management entities to conduct routine monitoring for 65 beach management areas (Appendix B), 55 were classified as "Tier-1" (monitored weekly or more frequently), 10 were classified as "Tier-2" (reduced monitoring effort), and "Tier-4"[2] beaches were not monitored (i.e. did not participate in the program). Through the 2016 BAV selection process, Maine's participating beaches were evaluated and reclassified where necessary in order to reallocate resources to support increased monitoring efforts for beaches categorized as "high-risk". For beaches considered "low-risk", reclassification resulted in a reduced monitoring frequency, typically to a bi-weekly or monthly routine.

Approximately 1818 samples were collected at 117 routine and enhanced monitoring locations spanning Kittery to MDI. Monitoring sites were based on where people swim, at freshwater inputs (rivers, streams, storm drains), and near other high-risk features, wildlife areas, etc. Samples were collected in two to three feet of water at six to eight inches below the surface. For areas experiencing chronic bacterial pollution, additional monitoring sites were added in suspect areas

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[2] MHB does not have any beaches with a status equivalent to EPA's Tier-3 beach designation.

to help determine contributing pollution sources and/or the worst-case scenario for water quality.

Parameters included: enterococci bacteria, air and water temperature, salinity, tidal stage and direction, rainfall 48 hours prior to sampling, observed pollution sources, and additional weather/field conditions that may affect beach water quality. Monitoring sites were resampled as soon as possible following an exceedance of Maine's BAV and the monitoring frequency increased until results were below the BAV. Samples were transported to the laboratory (four regional – Maine Environmental Lab, Portland Water District, Rockland Wastewater Treatment Facility, Mount Desert Island Biological Laboratory) for analysis within six hours of collection. Samples were analyzed using the IDEXX Enterolert ® Most Probable Number enumeration method. All samples and parameters were collected and analyzed according to MHB's US EPA-approved QAPP.

*Assessment*

In addition to routine beach monitoring, MHB staff evaluated the risk of pollution and potential/actual sources via a Risk Assessment Matrix (RAM), and in some cases, through GIS mapping and analysis, enhanced monitoring, and other pollution source-tracking efforts. MHB staff continued updates to the RAM for each Beach Management Area (BMA) in 2024, and these preliminary assessments of shoreline characteristics, non-point and point sources of pollution (on and offshore) and water quality, were used to inform local beach management decisions. This risk-based ranking system also guides the program's beach classification and monitoring regime and determines the need for more in-depth monitoring and sanitary surveys.

On December 30, 2024, the current cycle (2024[3]) of Maine's Integrated Water Quality Monitoring and Assessment Report (IR for short) was submitted to the US EPA for review and final approval. MHB's participating beaches (referred to hereafter as coastal designated beaches) were first included in the 2018/2020/2022 IR based on a requirement of the 2014 National Beach Guidance and Required Performance Criteria for Grants[4]. Assessments for coastal designated beaches for the IR are based on bacteria monitoring data collected during the most five recent beach seasons and included seasons 2018-2022 for the 2024 IR. These data were used to determine the attainment of the primary recreation designated use (i.e., Recreation in the Water). For this IR cycle, 59 coastal designated beaches were included in Category 2 (unimpaired), five were included in Category 3 (impairment status undetermined), and four were included in Category 5-B (impaired). These four impaired beaches include Goose Rocks Beach - Batson River and Goose Rocks Beach - Little River in Kennebunkport, Riverside Beach in Ogunquit, and Willard Beach in South Portland. Willard Beach was newly added in the 2024 cycle, and the remaining three were added in the previous 2018/2020/2022 cycle. For more information see Maine's DRAFT 2024 Integrated Water Quality Monitoring and Assessment Report.

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[3] The 2024 IR is pending final approval from EPA as of 3/19/2025. The next cycle of Maine's IR will be finalized in 2026 and will include an assessment of coastal designated beach monitoring data collected during the 2020-2024 beach monitoring seasons.

[4] The IR is required under sections 303(d), 305(b) and 314 of the Clean Water Act, and in fulfillment of the reporting requirements of 38 M.R.S. Section 464(3)(A) of the State of Maine's Water Classification Program. Assessments for all waterbodies in the IR are based on five main listing categories describing their designated use attainment status.

*Notification*

In 2024, the MHB program launched a new internal database for program participants where beach monitoring results were recorded and automatically transferred the program's newly developed public data portal at www.MaineHealthyBeaches.org. Maine's US EPA-approved single sample maximum safety threshold or Beach Action Value (BAV) for enterococci in marine waters was 104 most probable number (MPN[5])/100mL. Once a decision was made to post the beach, the information was made publicly available via the website and signage at beach access points. Additionally, real time beach alerts were available in digital format, with participants able to sign up for text or e-mail notifications via the public data portal starting in 2024. New beach signs were developed by the program and shared with beach managers for use in public notification activities. These signs feature integrated advisory notifications, improving user function and accessibility and public communication. When results exceeded the BAV, and/or a beach status change occurred, an email alert was sent to local beach managers, MHB staff, and partners. In some cases, towns provided supplemental information by providing educational signage (e.g. risk following rainfall, stagnant tide pools), content on local websites, social media pages, and hotlines. Attribute, monitoring, and notification data for each beach was transferred to DEP's database for final submission into EPA's databases. The MHB program continued to make local beach information (site locations, monitoring and notification data, contact information, etc.) more easily accessible to the public via the program's website.

Beach postings fall under local jurisdiction authority and are not mandated by state law. The program made recommendations to local beach managers based on the best and most current information available. In some cases, local managers waited for resample results before posting contamination advisories. Typically, this was for "low-risk" beaches, and the decision was based on the results of neighboring sites, the magnitude of bacteria results, similarity of environmental conditions between sample collection day and results, historical water quality, risk of pollution, and known pollution events. Many towns/parks continued posting Precautionary Rainfall advisories (PRAs) based on local precipitation levels rather than elevated bacteria in 2024. To facilitate efficient re-sampling and beach status notifications, MHB staff worked with each participating management entity prior to the 2024 monitoring season to update their Beach Monitoring and Notification Plan that included relevant contact information and preferred contact methods for all local participants (i.e., beach managers and field monitors). Following each exceedance, MHB staff contacted local jurisdictions to ensure that program protocols were followed in a timely manner according to the program's QAPP. On a daily basis, MHB staff quality-checked the database for accurate entry of field, laboratory, and notification data.

Additionally, MHB staff responded to numerous press, data, and information requests from program participants, state agency partners, the media, non-profits, researchers, students, etc. The MHB program routine and enhanced monitoring data was used by partners to inform ongoing

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[5] EPA's 2012 Recreational Water Quality Criteria (RWQC) recommends using EPA Method 1600 (resulting in colony forming units (CFUs)) to measure culturable enterococci, or another equivalent culturable method. MHB utilizes the equivalent IDEXX Enterolert ® method (resulting in most probable number (MPN) per 100mL).

efforts to address impaired water quality including funding proposals to support pollution source identification and elimination projects, ongoing research initiatives, as well as watershed management, stormwater management, and comprehensive and water resource protection plans.

*Education and Outreach*

In 2024, MHB staff continued efforts to educate beach managers regarding program and public notification protocols as needed and routinely shared research findings, program updates, etc. with local staff and volunteers. Additional support was provided as needed regarding local implementation of the program, issues of concern, etc. MHB staff delivered presentations to diverse audiences and provided extensive support to communities and organizations tackling bacterial pollution issues within and outside of Maine.

## V.     Data Summaries

- Approximately 1818 enterococci samples (including field and laboratory duplicates) were processed.
- 117 sites (86 routine beach sites and 31 enhanced monitoring sites[6]) were monitored.
- 65 beach management areas (BMAs) were routinely monitored in 30 towns/state parks (Figure 1.).
- 10.0% of routine samples exceeded Maine's beach action value (BAV) of 104 MPN/100mL.
- 96% of total beach days (beach season length x beach management areas) were free of beach advisories or closures.
- 256 beach action days were reported including 103 actions at 43 beach management areas. The majority of reported action days (185) were for Elevated Bacteria advisories (69 advisories and zero closures).
- Precautionary Rainfall advisories accounted for 71 action days (34 advisories). These were based on local precipitation levels rather than recorded bacteria levels (Appendix C).
- Nearly one third of the program's exceedances were observed during one week of the monitoring season. These exceedances occurred in mid-August when many coastal Maine communities experienced the impacts of Hurricane Ernesto.

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[6] Sites located in close proximity to BMAs or in enhanced monitoring locations to help identify pollution sources.
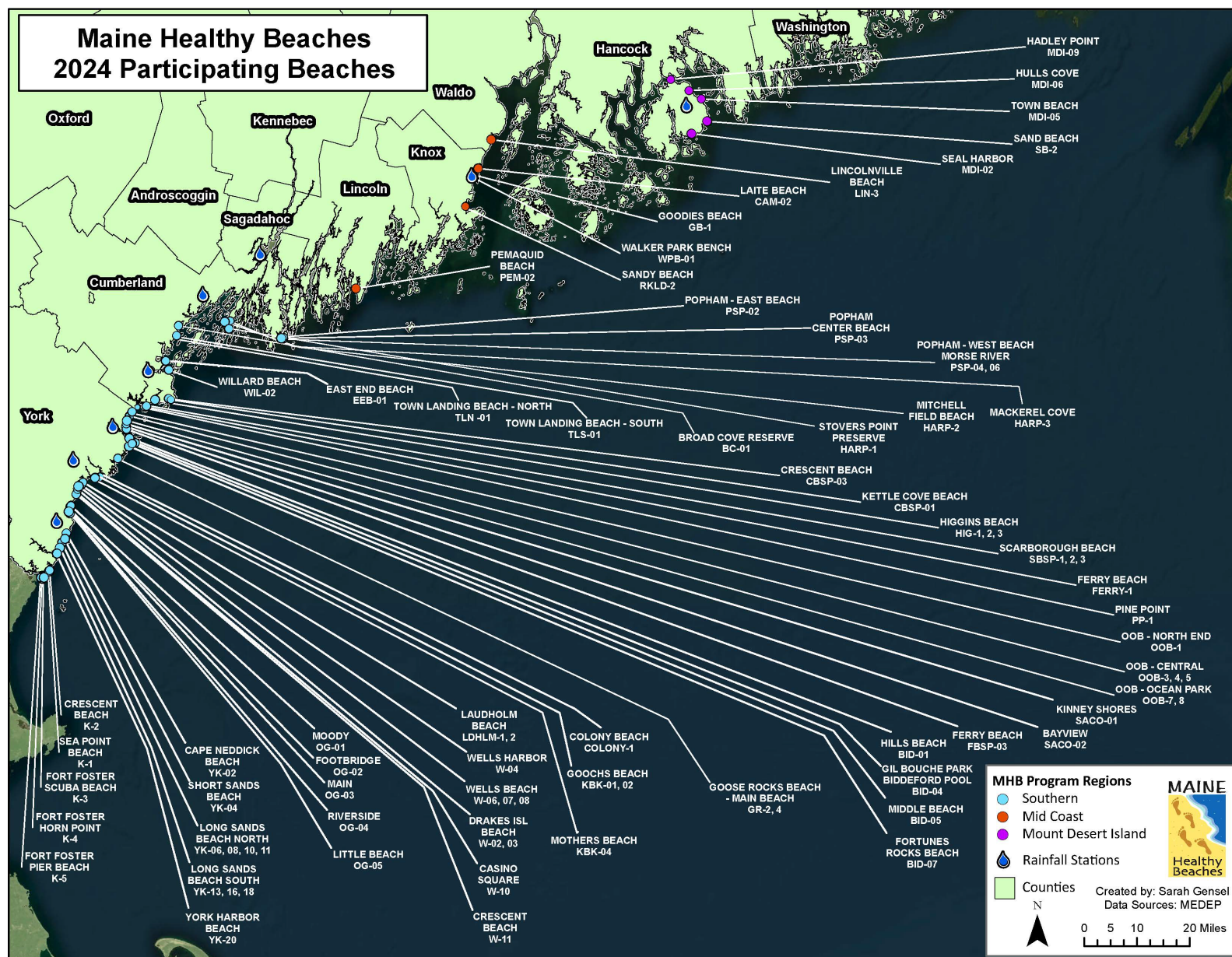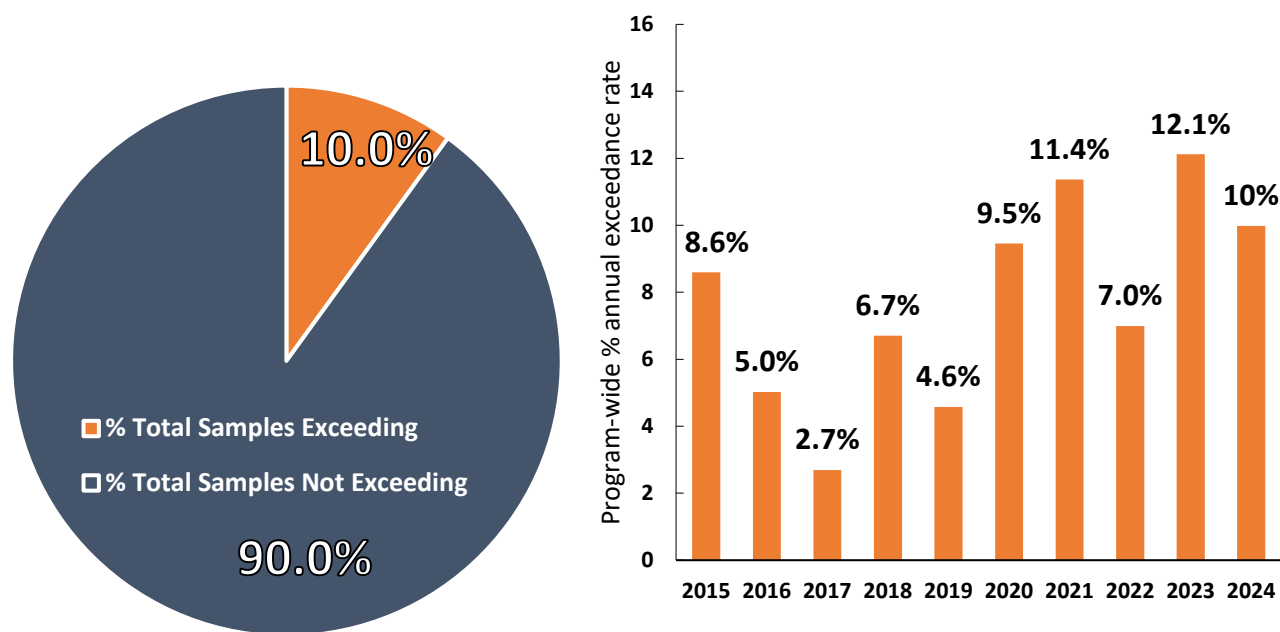
***Figure 1***. MHB's 2024 participating BMAs (Southern, Mid Coast, and Mount Desert Island (MDI) regions) and NOAA NCEI rainfall stations (https://www.ncei.noaa.gov/) .

*Exceedances*

Maine's US EPA-approved single sample maximum safety threshold or Beach Action Value (BAV) for enterococci in marine waters is 104 MPN/100mL. The 2024 overall program exceedance rate of Maine's BAV was 10.0%, representing 127 total exceedances at 44 beach management areas (Figure 2, Table 1). This represents a decrease in the program's overall exceedance rate compared to 2023 and the third highest rate observed since 2015. (Figure 3).



**Figures 2-3.** The 2024 total % annual exceedance rate of Maine's BAV (104 MPN/100mL) and MHB's program-wide annual exceedance rate for the past ten monitoring seasons (2015-2024).

Maine's beaches span a wide geographic area and, as a result, average precipitation levels observed at 12 coastal rainfall stations located in close proximity to participating BMAs[7] varied distinctly (8.55 – 15.89 inches) (Figure 1). Typically, the pattern of yearly exceedance rates (Figure 3) corresponds with the amount of average precipitation during the beach monitoring season. The average precipitation observed for the 2024 monitoring season (12.12 inches) was nearly half that observed in 2023 (20.13 inches) and was similar to precipitation observations for the 2022 monitoring season (10.25 inches). The total percent annual exceedance rate for the program also decreased, at 10% compared to 12.1% in 2023 (Figure 3).

Inter-annual variability of the total program percent exceedance rate is due to multiple factors including but not limited to precipitation levels and timing of precipitation events, water temperatures, beach and watershed characteristics (e.g. impervious surfaces, pollution sources), sample collection day/time, and the number of monitoring sites and beach management areas.

Though decreased precipitation levels in 2024 likely contributed to decreased exceedances overall, the exceedance rate of 10% was still greater than what would be expected for a typical monitoring season based on the observed precipitation levels. The higher exceedance rate for 2024 was likely

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[7] Precipitation data source: NOAA NCEI (https://www.ncei.noaa.gov/). For stations with incomplete datasets, local rainfall totals were obtained from nearby weather stations.

attributable at least in part to the impacts of Hurricane Ernesto experienced in mid-August. Though Hurricane Ernesto didn't make landfall in Maine, coastal communities experienced many impacts as the hurricane moved offshore including increased precipitation, coastal flooding, and turbulent conditions including dangerous rip tides and currents. During the week of August 19-23 when the effects of Hurricane Ernesto were most prominent, 46% of the program's participating beaches (30/65) experienced at least one Enterococci exceedance and for twelve of these beaches, this was the only week during the three-month monitoring season where an exceedance was observed. There were 43 total exceedances during that monitoring week, accounting for approximately one third of all exceedances observed for the total monitoring season.

*Table 1*. All BMAs with exceedances of Maine's single sample maximum BAV for enterococci in marine waters (104 MPN/100mL) in 2024. Summaries include total number of samples, number of samples ≥104 MPN/100mL, and % samples ≥104 MPN/100mL.

| Beach Management Area | Site Name(s) | # Samples | # Samples ≥104 | % Samples ≥104 |
|---|---|---|---|---|
| GOODIES BEACH | GB-1 | 23 | 8 | 34.8 |
| FERRY BEACH (SCARBOROUGH) | FERRY-1 | 21 | 7 | 33.3 |
| CAPE NEDDICK BEACH | YK-02 | 20 | 6 | 30.0 |
| RIVERSIDE (OGUNQUIT) | OG-04 | 20 | 6 | 30.0 |
| LAITE BEACH | CAM-02 | 18 | 5 | 27.8 |
| LITTLE BEACH | OG-05 | 19 | 5 | 26.3 |
| MAIN (OGUNQUIT) | OG-03 | 18 | 4 | 22.2 |
| WELLS HARBOR | W-04 | 18 | 4 | 22.2 |
| FORT FOSTER - SCUBA BEACH | K-3 | 9 | 2 | 22.2 |
| HULLS COVE | MDI-06 | 19 | 4 | 21.1 |
| OOB - OCEAN PARK | OOB-7, OOB-8 | 34 | 7 | 20.6 |
| KINNEY SHORES | SACO-01 | 17 | 3 | 17.6 |
| LINCOLNVILLE BEACH | LIN-3 | 17 | 3 | 17.6 |
| MACKEREL COVE | HARP-3 | 18 | 3 | 16.7 |
| EAST END BEACH | EEB-01 | 26 | 4 | 15.4 |
| TOWN LANDING BEACH - NORTH | TLN-01 | 15 | 2 | 13.3 |
| DRAKES ISL BEACH | W-02, W-03 | 32 | 4 | 12.5 |
| CRESCENT BEACH (KITTERY) | K-2 | 16 | 2 | 12.5 |
| KETTLE COVE BEACH | CBSP-01 | 16 | 2 | 12.5 |
| SANDY BEACH | RKLD-2 | 16 | 2 | 12.5 |
| GOOCHS BEACH | KBK-01, KBK-02 | 51 | 6 | 11.8 |
| WILLARD BEACH | WIL-02 | 34 | 4 | 11.8 |
| TOWN BEACH | MDI-05 | 17 | 2 | 11.8 |
| GOOSE ROCKS BEACH - MAIN BEACH | GR-2, GR-4 | 53 | 6 | 11.3 |
| FORT FOSTER - HORN POINT | K-4 | 9 | 1 | 11.1 |
| HIGGINS BEACH | HIG-1, HIG-2, HIG-3 | 47 | 5 | 10.6 |
| MOTHERS BEACH | KBK-04 | 26 | 2 | 7.7 |

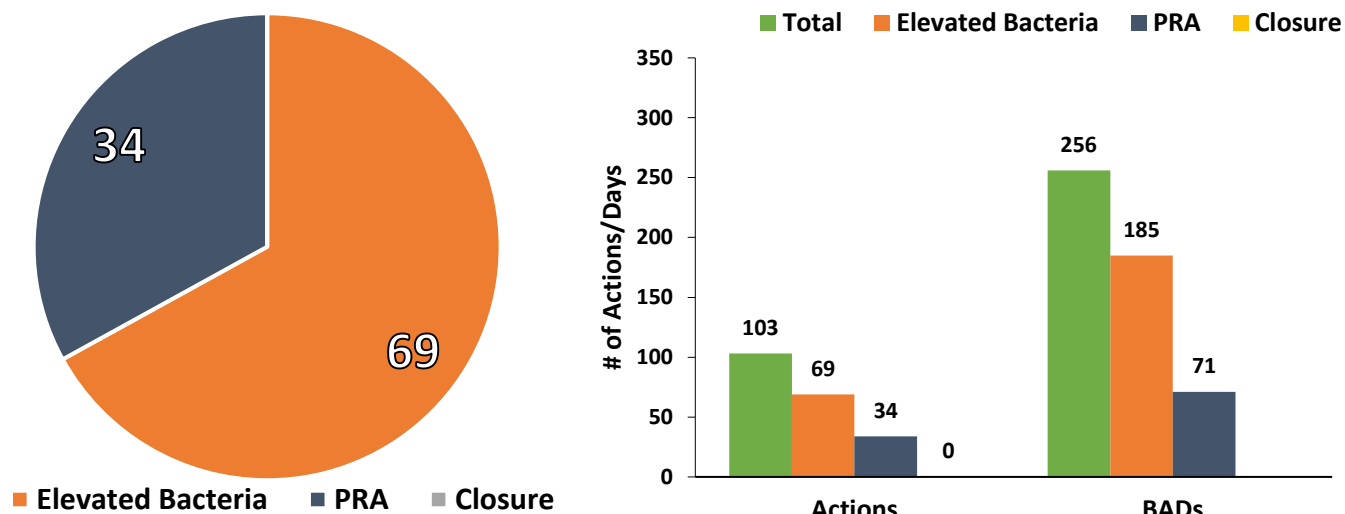| HILLS BEACH | BID-01 | 14 | 1 | 7.1 |
|---|---|---|---|---|
| PEMAQUID BEACH | PEM-02 | 14 | 1 | 7.1 |
| TOWN LANDING BEACH - SOUTH | TLS-01 | 14 | 1 | 7.1 |
| LAUDHOLM BEACH | LDHLM-1, LDHLM-2 | 29 | 2 | 6.9 |
| BAY VIEW | SACO-02 | 15 | 1 | 6.7 |
| BROAD COVE RESERVE | BC-01 | 15 | 1 | 6.7 |
| CRESCENT BEACH (WELLS) | W-11 | 15 | 1 | 6.7 |
| FOOTBRIDGE (OGUNQUIT) | OG-02 | 15 | 1 | 6.7 |
| MOODY (OGUNQUIT) | OG-01 | 15 | 1 | 6.7 |
| SEA POINT BEACH | K-1 | 15 | 1 | 6.7 |
| SHORT SANDS BEACH | YK-04 | 15 | 1 | 6.7 |
| SEAL HARBOR | MDI-02 | 16 | 1 | 6.3 |
| COLONY BEACH | COLONY-1 | 26 | 1 | 3.8 |
| LONG SANDS BEACH - SOUTH | YK-13, YK-16, YK-18 | 40 | 1 | 2.5 |
| WELLS BEACH | W-06, W-07, W-08 | 43 | 1 | 2.3 |
| OOB - CENTRAL | OOB-3, OOB-4, OOB-5 | 44 | 1 | 2.3 |
| LONG SANDS BEACH - NORTH | YK-06, YK-08, YK-10, YK-11 | 51 | 1 | 2.0 |

*Beach Actions*

In Maine, beach actions include advisories (Elevated Bacteria or Precautionary Rainfall) and closures. Elevated Bacteria advisories represent those issued in response to elevated bacteria results, while Precautionary Rainfall advisories (PRAs) are issued pre-emptively based on local precipitation levels (typically following 1 inch of rainfall or more in a 24-hour period). A Beach Action Day (BAD) represents the amount of time a beach is under an advisory or closure. This distinction is used as the duration of actions (or advisories) varies depending on the conditions under which they were posted. BADs are calculated for each beach as the number of days where the beach was under an action for any part of a day. This may over-estimate the length of BADs in some cases.  The MHB program provides beach management recommendations to local beach managers, but the decision to post an action at a beach falls under local jurisdiction. For that reason, the number of beach actions does not always align with the number of bacteria exceedances as action posting protocols vary locally.

Overall, 96% of total beach days (beach season length x beach management areas) were free of beach actions in 2024. There were 256 BADs in 2024, including 185 Elevated Bacteria[8] (69 actions), 71 Precautionary Rainfall (34 actions), and 0 closures [9]. There were less total beach actions and beach action days in 2024 than were observed in 2023 (combining Elevated Bacteria advisories, Precautionary Rainfall advisories, and closures). The total number of Elevated Bacteria BADs (including Elevated Bacteria advisories and closures) in 2024 **(**185) was slightly higher to those reported in 2022 (140), and 2020 (147) when similar overall program exceedances rates were observed (11.4% and 9.5%, see Figure 3). Just 12% of the beaches monitored in 2024 (8/65) collectively accounted for 49.7% of the reported Elevated Bacteria BADs in 2024. Those included

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[9] Total BADs include all action types (Elevated Bacteria Advisories, Precautionary Rainfall Advisories, and Closures).

Ogunquit's Little Beach and Riverside Beach, Harpswell's Mackerel Cove, Camden's Laite Beach, Rockport's Goodies Beach, Kennebunkport's Goose Rocks Beach – Main Beach, Portland's East End Beach, and South Portland's Willard Beach (Table 2).



**Figures 4-5.** The 2024 total number of beach actions (Elevated Bacteria advisories, Precautionary Rainfall advisories (PRAs), and closures) and beach action days (BADs) for all participating program beaches.

The decrease in total beach actions and total BADs for 2024 was due, in part, to decreased levels of precipitation in 2024 compared to 2023, and therefore less Precautionary Rainfall advisories and Elevated Bacteria advisories. Rainfall advisories accounted for 27.7% of the total 256 recorded Beach Action Days as well as 33% of the 103 total number of actions in 2024 (Figures 4-5). In comparison, 2023 saw nearly double the amount of Precautionary Rainfall actions (73 actions) and Beach Action Days (131 BADs).
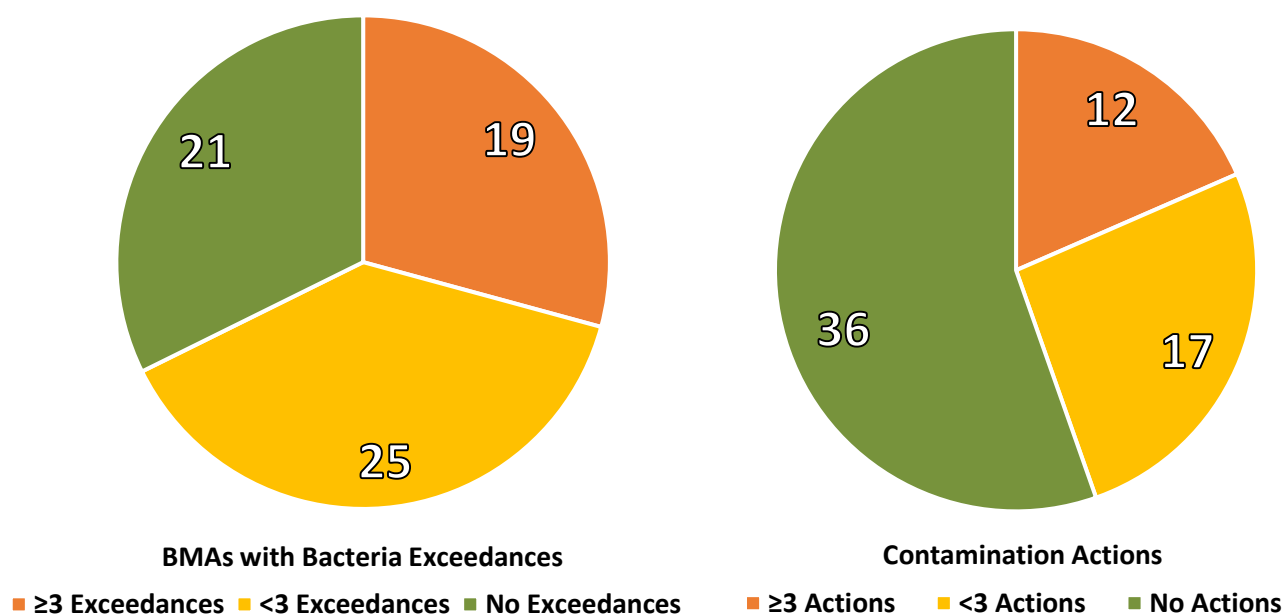
Depending on the timing of results and the availability of monitors/laboratories, resampling did not always occur the same day results were available. Additionally, beach managers sometimes kept an advisory in place until the next routine monitoring day indicated acceptable enterococci levels, rather than collecting a resample. There were also some "running" advisories where PRAs blended with Elevated Bacteria advisories and vice versa. PRAs often preceded Elevated Bacteria advisories and once bacteria results were available, PRAs were lifted, and Elevated Bacteria advisories were put in place until routine results indicated safe levels. These factors, as well as the practice of counting any part of one day as an action day, inflated the duration and number of beach action days in 2024.

*Table 2.* All BMAs with contamination actions (Elevated Bacteria advisories and closures) in 2024. Summaries include the total number of contamination actions, number of contamination BADs, and the % of total contamination BADs the number of contamination BADs represents for each beach.

| Beach Management Area | Site Name(s) | # Contamination Actions | # Contamination BADs | % Total Contamination BADs |
|---|---|---|---|---|
| LITTLE BEACH | OG-05 | 5 | 17 | 9.2 |
| MACKEREL COVE | HARP-3 | 4 | 13 | 7.0 |
| LAITE BEACH | CAM-02 | 4 | 13 | 7.0 |
| RIVERSIDE (OGUNQUIT) | OG-04 | 6 | 11 | 5.9 |
| GOODIES BEACH | GB-1 | 4 | 10 | 5.4 |
| GOOSE ROCKS BEACH - MAIN BEACH | GR-2, GR-4 | 5 | 10 | 5.4 |
| EAST END BEACH | EEB-01 | 4 | 9 | 4.9 |
| WILLARD BEACH | WIL-02 | 2 | 9 | 4.9 |
| GOOCHS BEACH | KBK-01, KBK-02 | 3 | 8 | 4.3 |
| LONG SANDS BEACH - SOUTH | YK-13, YK-16, YK-18 | 1 | 8 | 4.3 |
| WELLS HARBOR | W-04 | 1 | 8 | 4.3 |
| MAIN (OGUNQUIT) | OG-03 | 4 | 8 | 4.3 |
| FORT FOSTER - SCUBA BEACH | K-3 | 1 | 8 | 4.3 |
| HIGGINS BEACH | HIG-1, HIG-2, HIG-3 | 3 | 6 | 3.2 |
| MOTHERS BEACH | KBK-04 | 3 | 6 | 3.2 |
| OOB - OCEAN PARK | OOB-7, OOB-8 | 2 | 6 | 3.2 |
| LINCOLNVILLE BEACH | LIN-3 | 3 | 5 | 2.7 |
| LAUDHOLM BEACH | LDHLM-1, LDHLM-2 | 1 | 5 | 2.7 |
| FERRY BEACH (SCARBOROUGH) | FERRY-1 | 2 | 4 | 2.2 |
| CAPE NEDDICK BEACH | YK-02 | 2 | 3 | 1.6 |
| KETTLE COVE BEACH | CBSP-01 | 1 | 3 | 1.6 |
| DRAKES ISLAND BEACH | W-02, W-03 | 1 | 3 | 1.6 |
| BROAD COVE RESERVE | BC-01 | 1 | 2 | 1.1 |
| HILLS BEACH | BID-01 | 1 | 2 | 1.1 |
| FOOTBRIDGE (OGUNQUIT) | OG-02 | 1 | 2 | 1.1 |
| MOODY (OGUNQUIT) | OG-01 | 1 | 2 | 1.1 |
| TOWN BEACH | MDI-05 | 1 | 2 | 1.1 |
| HULLS COVE | MDI-06 | 1 | 1 | 0.5 |
| COLONY BEACH | COLONY-1 | 1 | 1 | 0.5 |

*High Risk Beaches*

In 2024, 32% of BMAs (21/65) were free of bacteria exceedances. For the remaining 44 BMAs, 25 had <3 exceedances and 19 BMAs had ≥3 exceedances. The 19 BMAs with ≥3 exceedances accounted for the majority of exceedances: 74% or 94 out of the total 127 observed exceedances (Table 1, Figure 5). Contamination actions[10] were observed at 29 BMAs in 2024, and of these 29, 17 BMAs had <3 contamination actions and 12 BMAs had ≥3 contamination actions (Table 2, Figure 6). These 12 BMAs accounted for the majority of contamination actions: 70% or 48 out of the total 69 contamination actions (Table 2). While 32% of BMAs were free of bacteria exceedances in 2024, a greater number of BMAs, 55% (36/65 BMAs), were free of contamination beach actions. The percentage of BMAs with exceedances did not align with the percentage of contamination beach actions issued because the decision to post an action at a beach falls under local jurisdiction and action protocols vary locally.



**BMAs with Bacteria Exceedances**
■ ≥3 Exceedances  ■ <3 Exceedances  ■ No Exceedances

**Contamination Actions**
■ ≥3 Actions  ■ <3 Actions  ■ No Actions

*Figures 5-6*. The number of BMAs with ≥3, <3, or no bacteria exceedances and the number of BMAs with ≥3, <3, or no contamination actions for the 2024 beaches season.

Overall, most of MHBs participating BMAs experience either very few or no exceedances each monitoring season.  Typically, a subset beaches contribute to the majority of exceedances and, as a consequence, the majority of beach actions issued. MHB considers these BMAs with persistent bacterial contamination issues to be "higher-risk" due to various non-point and point sources of pollution impacting those beaches. In 2024, there were 26 BMAs for which ≥10% of samples exceeded Maine's BAV, many of which were also among the top beaches with exceedances for the past several years. For all 26 BMAs, sample exceedances were associated with antecedent precipitation 66.7% or more of the time, and for 20 of these BMAs, sample exceedances were associated with antecedent precipitation 100% of the time (Table 3, Figure 7).

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[10] Contamination Actions include Elevated Bacteria advisories and closures.

*Table 3.* BMAs for which ≥10% of enterococci samples exceeded Maine's BAV in 2024. Summaries include total number of samples, number of samples ≥104 MPN, % samples ≥104 MPN, and % exceedances associated with antecedent precipitation.

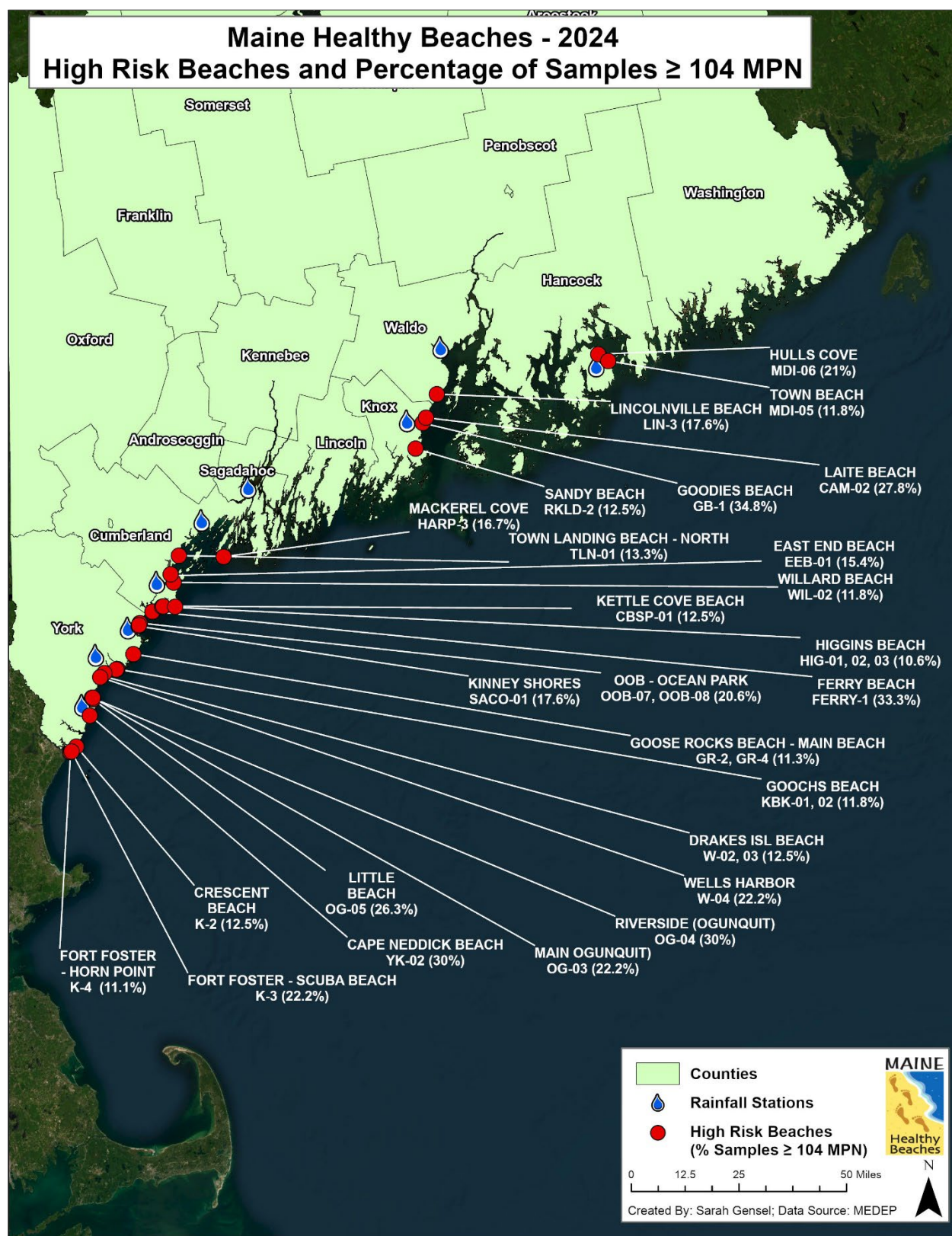| Beach Management Area | Site Name | # Samples | # Samples ≥104 | % Samples ≥104 | % Exceedances Antecedent Precipitation |
|---|---|---|---|---|---|
| GOODIES BEACH | GB-1 | 23 | 8 | 34.8% | 87.5 |
| FERRY BEACH (SCARBOROUGH) | FERRY-1 | 21 | 7 | 33.3% | 100.0 |
| CAPE NEDDICK BEACH | YK-02 | 20 | 6 | 30.0% | 100.0 |
| RIVERSIDE (OGUNQUIT) | OG-04 | 20 | 6 | 30.0% | 83.3 |
| LAITE BEACH | CAM-02 | 18 | 5 | 27.8% | 100.0 |
| LITTLE BEACH | OG-05 | 19 | 5 | 26.3% | 100.0 |
| FORT FOSTER - SCUBA BEACH | K-3 | 9 | 2 | 22.2% | 100.0 |
| MAIN (OGUNQUIT) | OG-03 | 18 | 4 | 22.2% | 100.0 |
| WELLS HARBOR | W-04 | 18 | 4 | 22.2% | 100.0 |
| HULLS COVE | MDI-06 | 19 | 4 | 21.1% | 75.0 |
| OOB - OCEAN PARK | OOB-7, OOB-8 | 34 | 7 | 20.6% | 100.0 |
| KINNEY SHORES | SACO-01 | 17 | 3 | 17.6% | 100.0 |
| LINCOLNVILLE BEACH | LIN-3 | 17 | 3 | 17.6% | 100.0 |
| MACKEREL COVE | HARP-3 | 18 | 3 | 16.7% | 100.0 |
| EAST END BEACH | EEB-01 | 26 | 4 | 15.4% | 100.0 |
| TOWN LANDING BEACH - NORTH | TLN-01 | 15 | 2 | 13.3% | 100.0 |
| CRESCENT BEACH (KITTERY) | K-2 | 16 | 2 | 12.5% | 100.0 |
| DRAKES ISL BEACH | W-02, W-03 | 32 | 4 | 12.5% | 100.0 |
| KETTLE COVE BEACH | CBSP-01 | 16 | 2 | 12.5% | 100.0 |
| SANDY BEACH | RKLD-2 | 16 | 2 | 12.5% | 100.0 |
| GOOCHS BEACH | KBK-01, KBK-02 | 51 | 6 | 11.8% | 66.7 |
| TOWN BEACH | MDI-05 | 17 | 2 | 11.8% | 100.0 |
| WILLARD BEACH | WIL-02 | 34 | 4 | 11.8% | 75.0 |
| GOOSE ROCKS BEACH - MAIN BEACH | GR-2, GR-4 | 53 | 6 | 11.3% | 100.0 |
| FORT FOSTER - HORN POINT | K-4 | 9 | 1 | 11.1% | 100.0 |
| HIGGINS BEACH | HIG-1, HIG-2, HIG-3 | 47 | 5 | 10.6% | 80.0 |

Figure 7. BMAs for which ≥10% of samples exceeded Maine's single sample maximum BAV for enterococci in marine waters (104 MPN/100mL) in 2024.

Antecedent precipitation calculations include any precipitation concentrations observed 48 hours prior to the monitoring date as well as any precipitation observed the day of sample collections because rainfall often occurred overnight and in the early pre-monitoring morning hours. Including the precipitation levels from the day of sample collection may over-estimate the % exceedances with antecedent precipitation as it includes a portion of the day after samples have been collected; however, a reliable dataset with the precision for hourly measurements is not available at this time.

Non-point source pollution likely contributed to fecal indicator bacteria (FIB) loading at BMAs with the greatest exceedance rates in 2024, as the majority of them are impacted by freshwater inputs (rivers, streams, storm drains). As a result, pollutants are transported from upland areas during all weather conditions, but especially when it rains. MHB's historical data demonstrates a relationship between antecedent precipitation and observed bacteria exceedances. In response, many of Maine's participating towns/state parks continue to implement preemptive PRAs during and following moderate/heavy rainfall. Given the limited 1-2x per week sampling frequency for Tier 1 beaches, this preemptive advisory protocol allows beach managers to be more protective of public health at these BMAs when bacteria results are not available.

When feasible, MHB partners with towns/state parks managing high-risk BMAs to support ongoing efforts to find, fix, and prevent bacterial pollution sources (see VI. Collaborative Efforts).

# VI.    Collaborative Efforts

Maine's coastal tourism and recreation industry contribute billions of dollars annually to Maine's economy and clean coastal waters are a major priority. Results from a 2015 survey of Maine residents and visitors revealed reducing coastal pollution as the first of 13 possible priority actions, and clean waters and sandy beaches were the two most important factors when planning visits to coastal areas.  Improving coastal water quality can be challenging as sources of bacteria are typically difficult to find, often requiring intensive investigations beyond the immediate shoreline. For instance, the majority of Maine's beaches are impacted by freshwater inputs that transport pollutants from upland areas. Once sources are verified, solutions are often complex and expensive. Investing in improvements to coastal water quality can confer significant benefits to local economies largely sustained by revenue from coastal beach recreation activities by decreasing potential bacteria sources at beaches and in turn, costly beach advisories and closures (Lyon et al., 2018)[11].

The MHB program plays a critical role in keeping coastal waters healthy. Since 2003, the program has provided extensive support to communities experiencing bacterial pollution issues with a focus on sharing resources and solving problems. Some examples include: circulation studies, sanitary surveys, GIS mapping/analysis, stakeholder workshops, outreach campaigns, applying pollution source tracking tools like optical brighteners and DNA markers, etc. This work has built the foundation for historical and current local actions to identify, remove, and prevent pollution sources. For example, this work includes surveys of the shoreline and watershed, investigations of and improvements to wastewater/stormwater infrastructure, septic/cesspool removal, boat pump

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[11] Lyon, Sarina F.; Merrill, Nathaniel H.; Mulvaney, Kate K.; and Mazzotta, Marisa J. (2018) "Valuing Coastal Beaches and Closures Using Benefit Transfer: An Application to Barnstable, Massachusetts," Journal of Ocean and Coastal Economics: Vol. 5: Iss. 1, Article 1.

out installation, beach and watershed management plans, protective ordinances, local monitoring efforts, and outreach campaigns.

*Enhanced monitoring*

The MHB program has supported enhanced monitoring of multiple parameters (toolbox approach) targeting human sourced fecal contamination for areas demonstrating persistent bacterial pollution issues. Typically, as the number of parameters that exceed a threshold (or detectable) limit increases, so does the confidence that human sources are impacting water quality. The focus areas have changed over time with the primary targets being freshwater inputs to the shoreline. However, program data and support (historical and current) has raised awareness regarding water quality issues and has helped make addressing them a priority. Although limited resources and staff have reduced the number of toolbox parameters monitored for the past several years, MHB staff continued collaborating with universities and research institutions (University of New Hampshire (UNH), Bigelow Laboratory for Ocean Sciences) to incorporate microbial source tracking (MST) tools into ongoing pollution source identification and remediation efforts.

In an effort to improve water quality at participating BMAs, MHB supported efforts beyond routine beach monitoring in the Ogunquit River watershed, Goose Rocks Beach watershed, Crescent Beach State Park, Town Landing (Cumberland), MDIBL efforts in Acadia, Wells Harbor, and the Willard Beach watershed in 2024.

These efforts included the collection and analysis of 290 samples for fecal indicator bacteria at 31 enhanced monitoring locations in 2024. Samples were collected upland in freshwater inputs to the beach on designated dates throughout the season or were collected on a routine basis in "high-risk" areas such as the mouths of rivers and streams, storm drains, stagnant tide pools, etc. MHB also supported assessment of intermittent, suspected sources such as seepages and runoff typically associated with heavy rainfall. Additionally, MHB staff analyzed 134 samples for optical brightener (OB) levels at 29 enhanced monitoring locations in 2024. Optical brighteners are commonly used in commercial/retail products and are typically flushed down the drain. Therefore, when optical brightener concentrations are coupled with elevated fecal bacteria levels, it can be indicative of human-sourced fecal contamination.

*Working groups and applied research partnerships*

MHB staff supported numerous working groups and applied research partnerships aimed at improving decision-making, addressing pollution issues, reaching diverse audiences, and supporting student advancement in Maine and beyond in 2024. MHB staff continued to seek feedback from local participants for the 2024 implementation of the EPA approved BAV plan (approved in 2016). In 2025, MHB staff will continue to collaborate with EPA, consulting their expertise on the latest research and development of new guidance, and seek the expertise of its advisory committee, the research community, and other partners when necessary, in establishing important program policies as well as addressing challenges.

Coastal beaches are complex systems and the regrowth and persistence of enterococci in sand, seaweed and sediments confounds our understanding of recorded bacteria levels, especially because these "naturalized" contributions have not been linked to human illness. However, studies in Maine and elsewhere have indicated extremely elevated bacteria levels in seaweed that has been cast and warmed on the beach, as well as in neighboring beach water that has rinsed previously

stranded algal mats. In response to concerns, MHB staff continued to consult experts in 2024 to guide information shared with beach managers, the public, press, etc. MHB staff also worked with local and state agency partners to inform strategies that would allow communities to better and more quickly respond to episodic events that pose safety and other concerns. More research is needed to understand any health risks posed by FIB levels generated from seaweed that's been "seeded" with fecal material from birds, pets, stormwater, etc. The MHB program will continue to consider FIB levels sourced from seaweed as a potential health risk until further research and guidance develops.

Additionally, Program staff served on or participated in the following working groups: Casco Bay Monitoring Network, Goosefare Brook Watershed Restoration Committee, Kennebunk River Watershed Steering Committee, Ogunquit River Watershed Steering Committee, and Coastal Watersheds Working Group. As part of MHB's ongoing efforts to improve the program and its effectiveness, MHB staff will continue to seek opportunities for collaboration in 2025.

**The MHB program would like to thank EPA for their continued support.**