

Water Quality Report 2024



Purpose

The Park's River Project operates and maintains two hydrological/meteorological monitoring stations, one each at the westernmost points of Pier 25 and Pier 84 as part of the Hudson River Environmental Conditions Observing System (HRECOS). Founded in 2008, the HRECOS network seeks to provide highly accurate, real-time water quality and weather condition data at throughout the Hudson and Mohawk rivers, as well as Newark Bay. The Park's stations transmit data every 15 minutes for a suite of water and weather parameters to better understand long-term river trends.

The Park's River Project is also founding member of the Community Water Quality Testing Program (CWQTP), a coalition of dozens of boathouses, universities, and citizen scientists organized by the Billion Oyster Project (BOP). From May to October, the coalition samples for bacteria at over 90 recreational water-use sites across the five boroughs and New Jersey. This community-driven effort seeks to provide accurate and location-specific health and safety data to keep boaters and recreators informed of weekly sewage contamination in their waterways. Through testing for fecal indicator bacteria of the genus *Enterococcus* (found in the human gut and sewage), the CWQTP helps to inform the safety of tens of thousands of recreators each year.

Key Questions

- How do river conditions change over time, on daily, monthly, and annual timescales?
- Does rainfall have an impact on water quality?
- How do pathogen levels in the Park vary across different sites and over time?



Fig. 1 | HRPK field science staff taking a 100mL water sample from a Pier 40 floating dock for weekly testing.

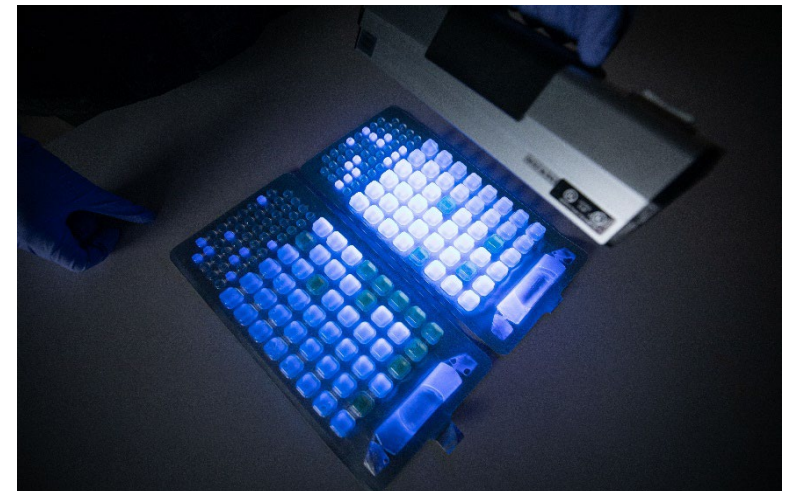


Fig. 2 | Two *Enterolert* Quanti-trays with high concentrations of *Enterococcus* contamination (blue fluorescence)

Monitoring River Conditions: HRECOS

Across the HRECOS network, over 232 miles of waterways are under constant monitoring, with physical sensors uploading real-time conditions every 15 minutes, most of them operating year-round. The HRECOS network is overseen and supported by the New York State Department of Environmental Conservation (NYSDEC) and the United States Geological Survey (USGS).

To gather water quality and weather data here in the Park, YSI EXO-2 sondes are submerged to the bottom of the river by means of a 5-meter PVC tube affixed to pier pilings. These sondes are equipped with various sensor probes to collect different data and are hardwired from their placement on the riverbed to watertight lockboxes that contain dataloggers, modems, and antennas to send real time data to the HRECOS network. Every month, Park staff conduct routine cleaning, calibration, and repairs on our three YSI sondes to maintain a high level of quality data reporting (**Fig. 3**). We host a dashboard displaying real-time parameters of rainfall, water temperature, dissolved oxygen, turbidity, salinity, pH, tide, and sewage overflow risk here on our [website](#) (**Fig. 4**). Data from all HRECOS stations is freely available from a [United States Geological Survey \(USGS\) repository](#), which also includes historic data that has been collected in years prior. This robust dataset is particularly useful for tracking trends over time by scholars and citizen scientists alike.

These high-frequency data allow Park scientists to explore seasonal impacts of water parameters on fishes, oysters, contamination, and everything in between. It also allows visualization of seasonal trends, such as the inverse relationship between temperature and dissolved oxygen (**Fig. 5**), both of which have significant impacts on local wildlife.

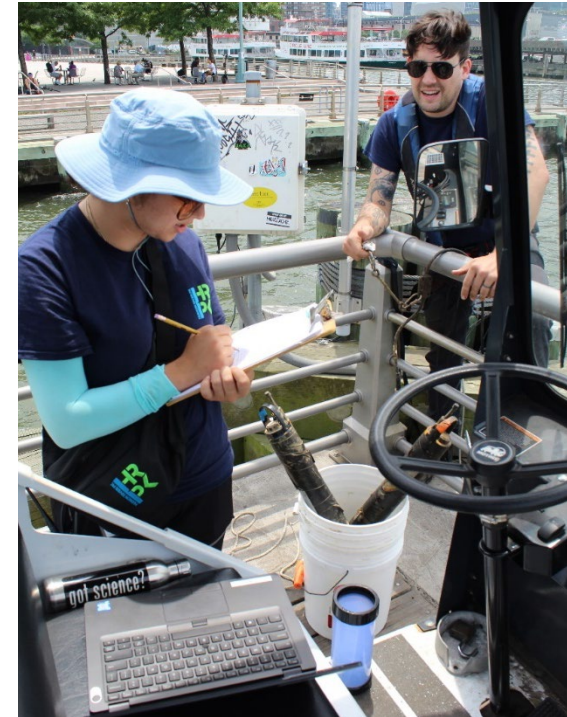


Fig. 3 | Park staff performing a hotswap at Pier 84, comparing EXO-2 readings before switching devices.

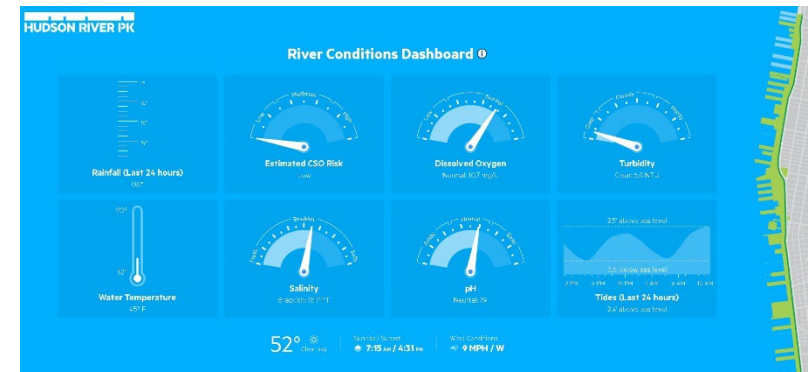


Fig. 4 | River conditions dashboard accessible from Park website and via touchscreen smartboard in the Pier 40 Wetlab (pictured).

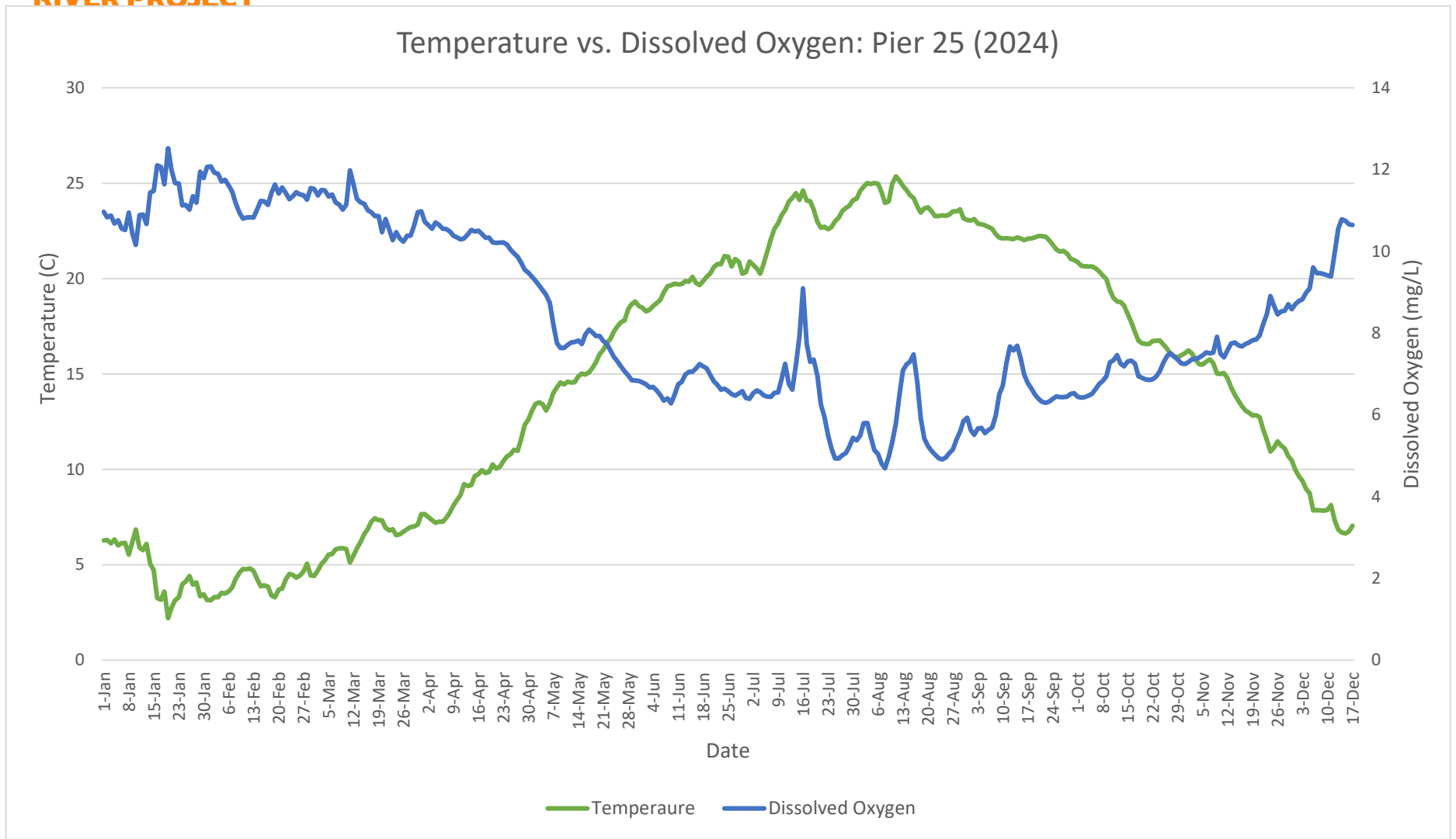


Fig. 5 | Water temperature and dissolved oxygen compared across the 2024 calendar year using data from the Pier 25 HRECOS station. Values plotted are daily averages. These parameters are inverse to each other – as the water warms, it has less capacity to hold onto dissolved oxygen (which is essential for all life underwater).

How does bacteria enter the river?

Combined sewer systems, which make up 60% of NYC's sewage infrastructure, are designed to release untreated sewage and rainwater into NYC waterways during precipitation events that exceed the system's capacity. For this reason, rainfall continues to be a primary factor influencing sewage contamination in the Hudson River and New York Harbor. The variability of these fecal contamination spikes is high despite significant overall correlation with rainfall, illustrating the importance of high frequency, site-specific sampling that is often not performed by city agencies.

All sites within the Park showed significantly higher bacteria levels during wet weather (**Fig. 9**). Even 7.5mm (1/3") of rainfall within a few days prior to sampling significantly increases sewage contamination levels ($p < 0.05$). This indicates that mitigating CSO impacts should be a major focus of any water quality improvement measures in the future.

To examine the difference in results between IDEXX *Enterolert* testing that CWQTP relies on and traditional membrane filtration methods, the Park partnered with the Interstate Environmental Commission (IEC). Duplicate field samples were taken at Pier 26 and Pier 40 and tested by IEC for *Enterococcus* contamination in a more rigorous lab environment. No statistical significance was found between samples, indicating the reliability of the CWQTP protocol.

In general, the Park recommends caution when interacting with waterways after periods of significant rainfall. Due to the Hudson's strong tides and currents, contamination typically lasts only 24-48 hours before it becomes dissipated and moves out into deeper waters where it is diluted. This is not the case across all bodies of water in the city.

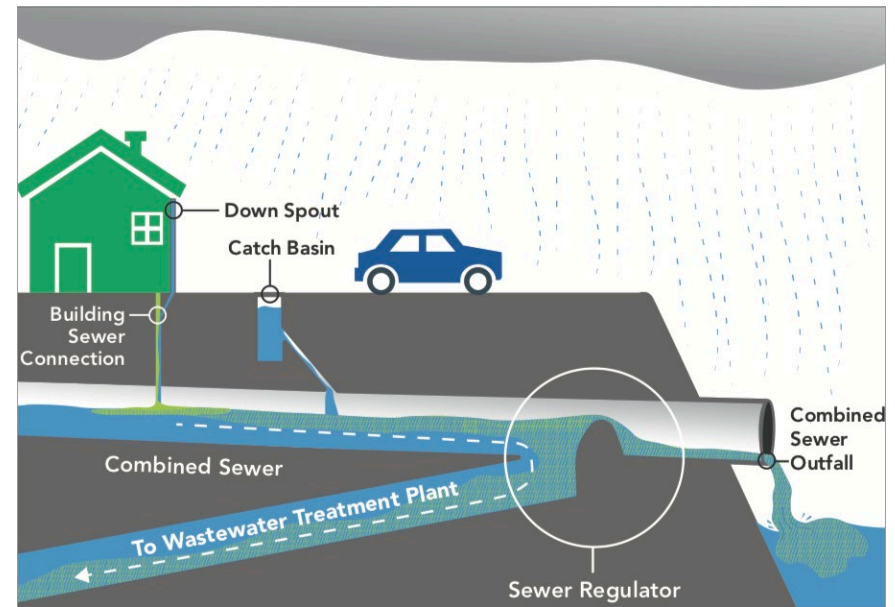


Fig. 6 | A graphic depicting how the city's sewers may be inundated and release excess waste to the environment.

CAUTION

Wet Weather Discharge Point

THIS OUTFALL MAY DISCHARGE RAINWATER MIXED WITH UNTREATED SEWAGE DURING OR FOLLOWING RAINFALL AND CAN CONTAIN BACTERIA THAT CAN CAUSE ILLNESS

IF YOU SEE A DISCHARGE DURING DRY WEATHER:

- PLEASE CALL 311 - REFER TO CSO OUTFALL #WIM-040
- For more information visit www.nyc.gov/dep
- Or Contact: New York State Department of Environmental Conservation
Division of Water Regional Office
47-40 21st St., Long Island City, NY 11101
718-482-4900
- New York State Wet Weather discharge point
- SPDES Permit # NY 0026131

New York City Department of Environmental Protection

Fig. 7 | An example of a sign that is posted near a sewage outfall. Such signage may be found along the river's edge throughout the Park.

Pathogen Methods

- Water samples are collected from Piers 26, 40, 66, and both the north/south sides of Gansevoort Peninsula for 20 weeks from May to September. Partner sites across the river in Hoboken also deliver samples weekly.
- Samples are collected using shrink-wrapped, 120mL sample bottles.
- Samples are diluted 1:10 with sterile water and *Enterolert* reagent (bacteria food) is added. If *Enterococcus* is present, it will react with the food to release compounds that glow under UV light.
- Samples are transferred to Quanti-Trays and incubated for 24-26 hours at 41 degrees Celsius (106 degrees Fahrenheit).
- Enterococcus levels are assessed according to Department of Health standards of water safety and reported to the CWQTP network/BOP each week.

What is MPN?

MPN is the **Most Probable Number** of colony-forming units (CFUs) of bacteria in 100mL of water, estimating the concentration of bacteria in that sample (Budnick et al., 1996). An MPN less than 35 is safe for indirect water contact, between 35 and 105 is unsafe if levels persist, and greater than 105 is always unsafe. While enterococcus itself is not a particularly pathogenic microbe, its presence is highly correlated with other bacteria that are, such as *E. coli*.

Major Findings

Despite there being less rainfall over the 2024 sampling season than 2023, higher levels of bacteria were found across sites on average (**Fig. 8b**). Park waters were observed to be safe for secondary contact recreation 64% of days sampled. When comparing between wet/dry weather, the correlation between rain and unsafe bacteria levels was found to be highly significant ($p < 0.05$) across all sites (**Fig. 9**).

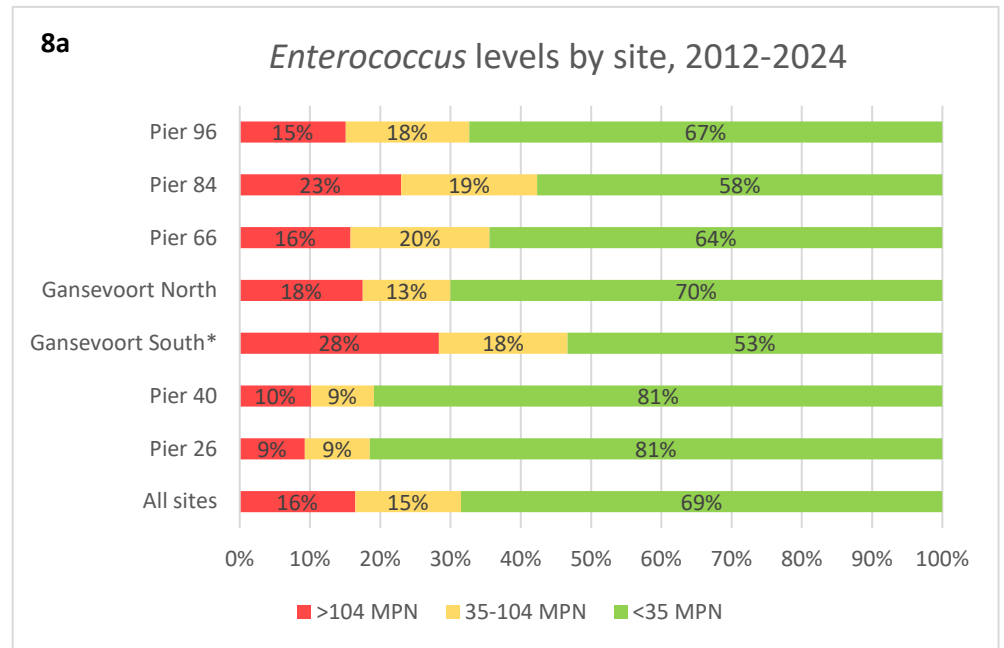


Fig. 8a | *Enterococcus* levels within the Park across all years of the CWQTP. Sites are organized from north to south, *Gansevoort South was a combination of several sampling points in 2023 and since reduced to one to better mirror north.

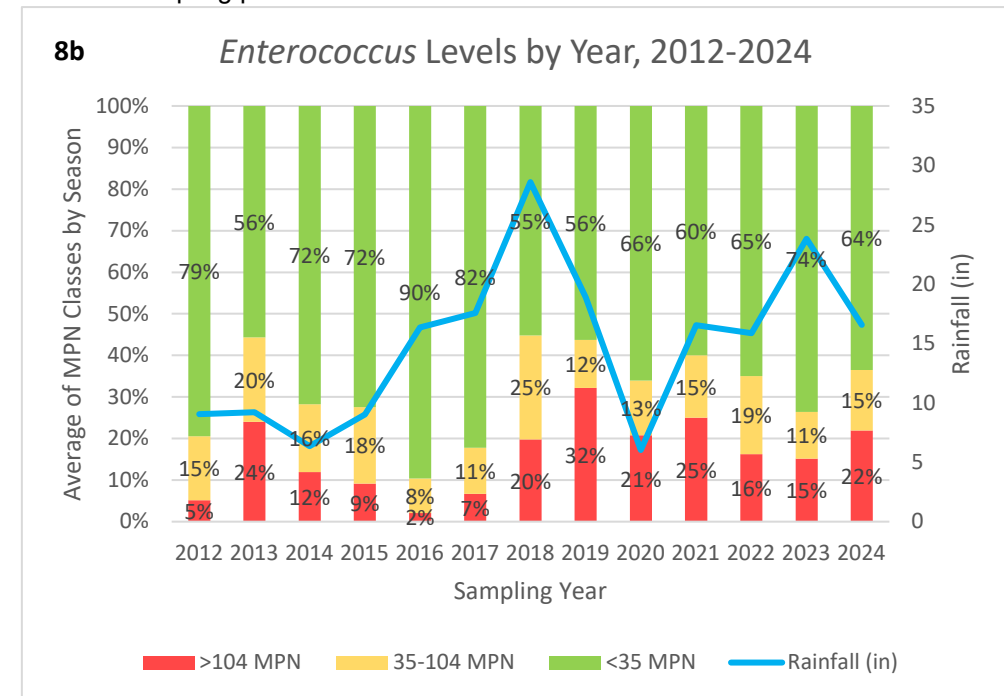


Fig. 8b | *Enterococcus* levels within the Park by year and compared against rainfall totals per sampling season.

Major Findings

Park sites frequently show MPN levels in line with EPA recreational standards (<35 MPN) despite the presence of ~30 CSO outfalls in the park (**Fig. 8a**). This year, seasonal geometric means for Piers 84, 40, and 26 as well as Gansevoort North were found to be below 35 MPN, with Pier 96 and Gansevoort South just above the 35 MPN threshold (42 & 47 MPN, respectively). May had the highest levels of contamination with all sites showing 30-day means above 35 MPN.

Park sites routinely exhibit some of the lowest *Enterococcus* levels within the entire CWQT program; this year only 15 sites out of the 93 total saw seasonal means under the MPN safety threshold, with 4 of those 15 sites located within the Park. This is likely due to high water flow & exchange rates as the Park is situated just a mile above where the Hudson River empties into New York Harbor. Many other CWQTP sites are located in canals, basins, marinas, and other relatively low-flow points of water access.

In general, *Enterococcus* contamination is highly variable between years, even week to week, exhibiting stochastic variation and belying the need for continued, high-frequency monitoring and innovative modeling techniques to best inform the general public.

Future Directions

Moving forward, the Park will continue its participation in the CWQTP to provide robust contamination data for NYC’s recreators and water users while gathering important data on sewage contamination levels within the Estuarine Sanctuary. As the Park seeks to reduce our rainfall runoff (employing bioswales and green infrastructure) and the City works to improve our sewage capacity, this data will prove invaluable for tracking the progress of mitigating the release of pathogens to the environment.

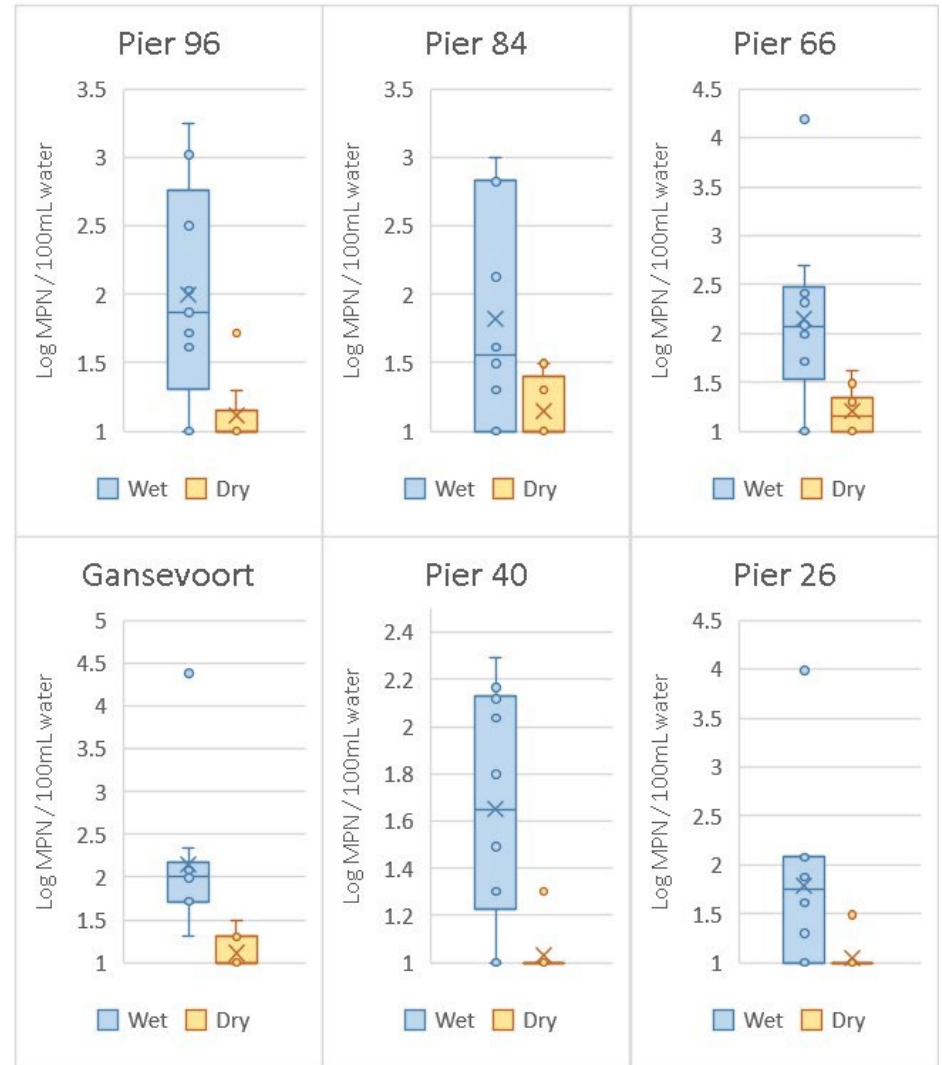


Fig. 9 | Wet vs dry weather *Enterococcus* concentrations in Hudson River Park throughout the 2024 sampling season. Wet weather is defined as >7.5mm of rain within the week prior to sampling – rainfall data is sourced from the NOAA Central Park monitoring station. All Park sites showed significance ($p < 0.05$) when comparing between weather conditions. Gansevoort data refer to waters tested on the south side of the peninsula.

References

Billion Oyster Project (2024). Water Quality. <https://www.billionoysterproject.org/water-quality>

Budnick GE, Howard RT, Mayo DR (1996). Evaluation of Enterolert for Enumeration of Enterococci in Recreational Water. *Applied Environmental Microbiology*, 62, 3881–3884. <https://doi.org/10.1128/aem.62.10.3881-3884.1996>

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