

_the_coders

Challenge Dataset : Water Quality

“Detecting risk in Massachusetts water bodies”



Team Members: Nathaniel Ince ,Aishat Olaosebikan ,Mina Fahmy, Alex Galbraith , Rohan S ,Shahid Baig

Hack for Human Impact
November 15, 2025

Key Insights

- 4.7% of measurements show critical dissolved oxygen levels (< 3 mg/L) that can cause fish kills, 5.9% show low oxygen levels (3-5 mg/L) stressing aquatic ecosystem and 25.8% of pH measurements fall outside safe ranges (6.5-8.5).

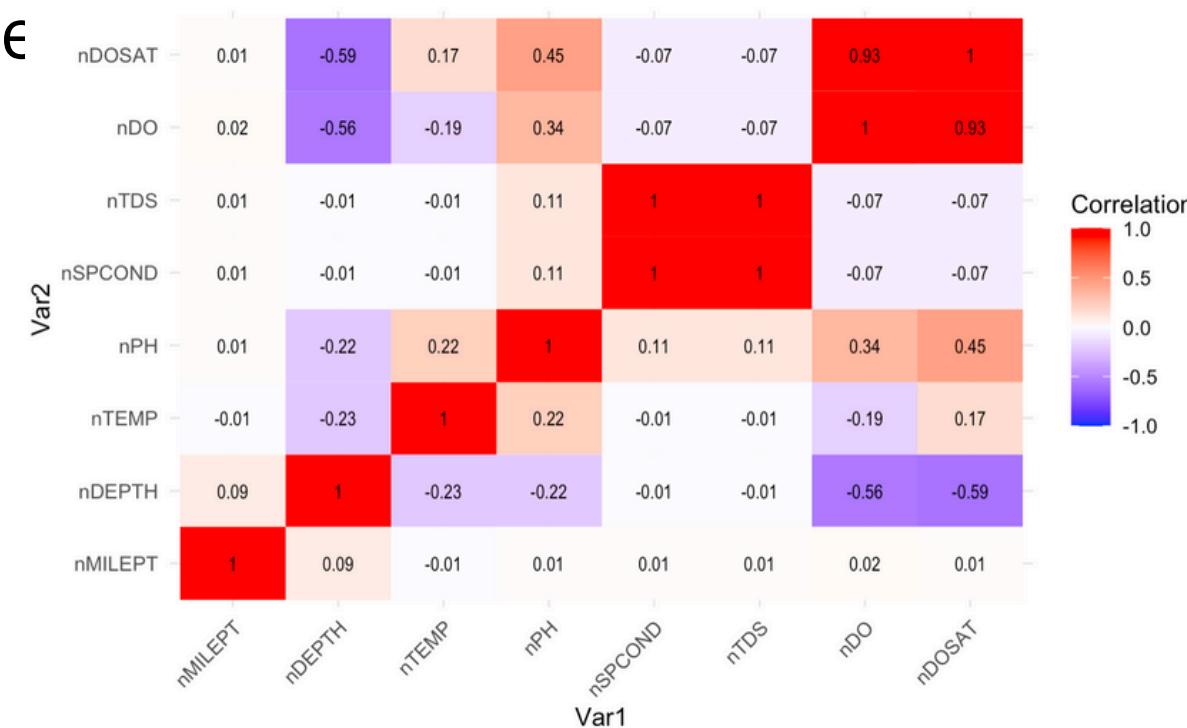
Most Impacted Watersheds:

Millers, Cape Cod, Buzzards Bay

- This matters because communities in the Millers watershed are directly exposed to unsafe water quality, affecting residents who fish, swim, or use the waterways for recreation. At the same time, repeated environmental stress threatens aquatic ecosystems, fish populations, and overall biodiversity.”

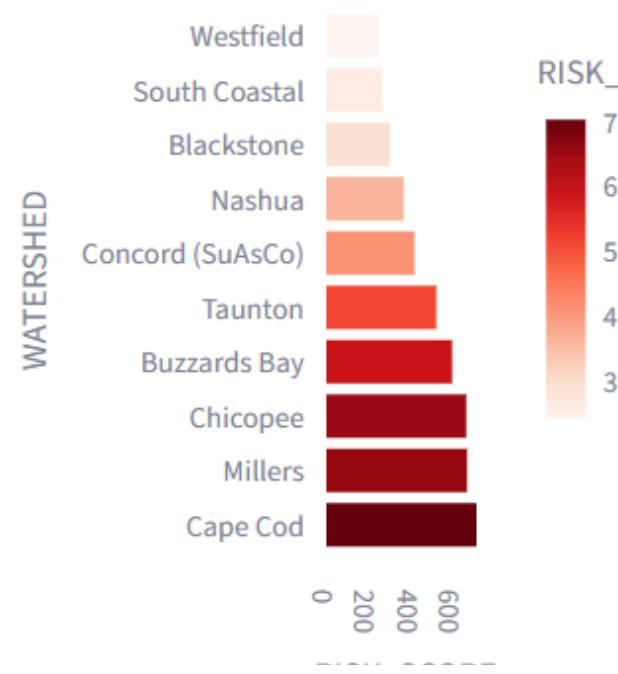
Dataset focus:

- 12,596 water quality measurements across 1287 monitoring sites
- 32 watersheds monitored from 2005 to 2020
- Strong negative correlation between temperature and DO (-0.41): Warmer water holds less oxygen
- DO and pH correlation: 0.33

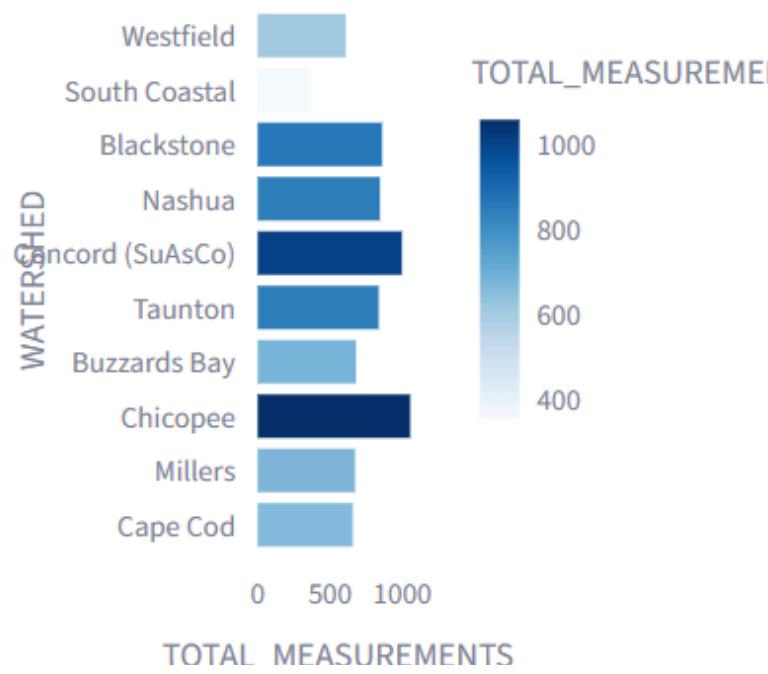


Watershed Comparison Analysis

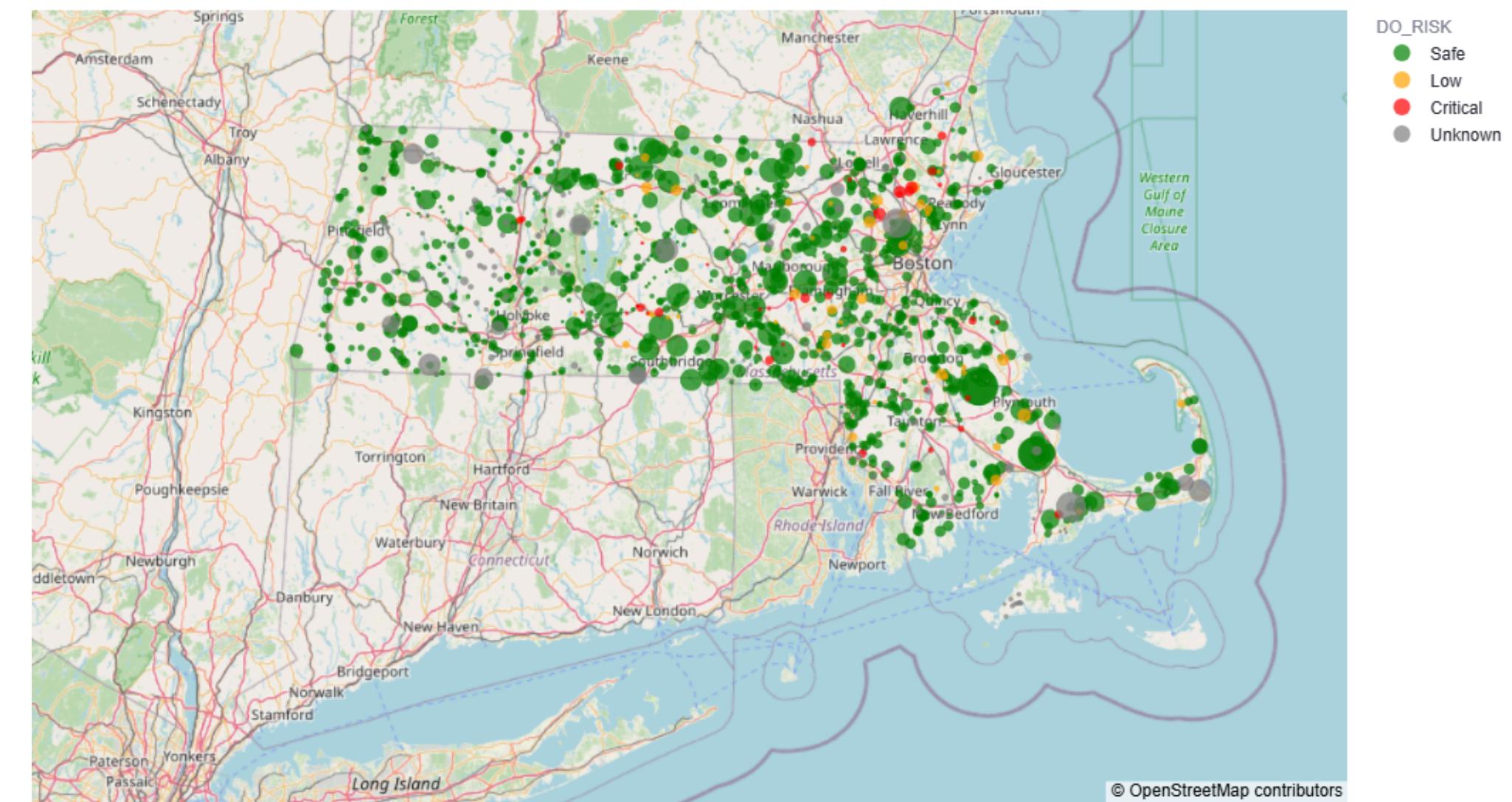
Top 10 Watersheds by Risk Score



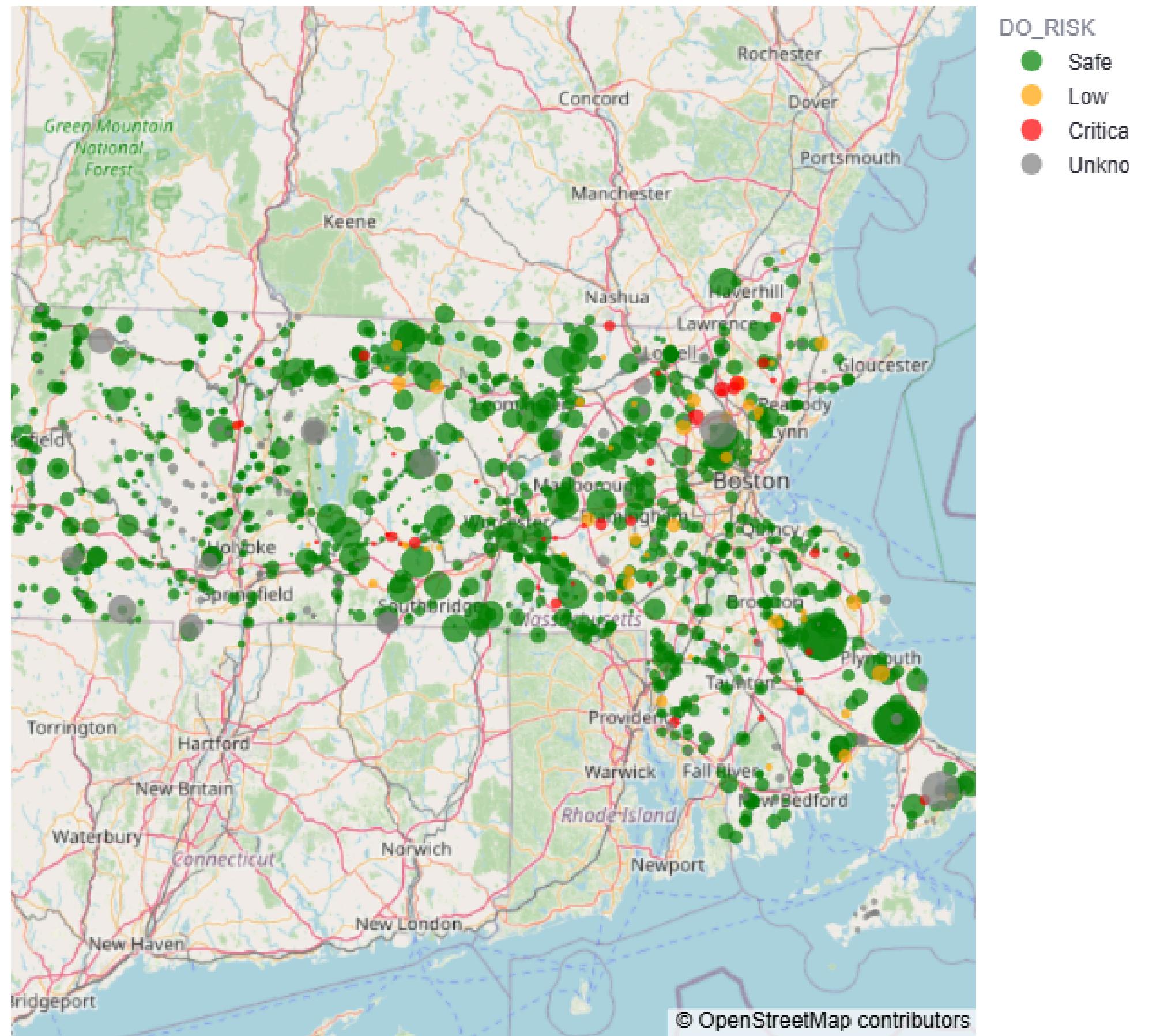
Top 10 Most Monitored Watersheds



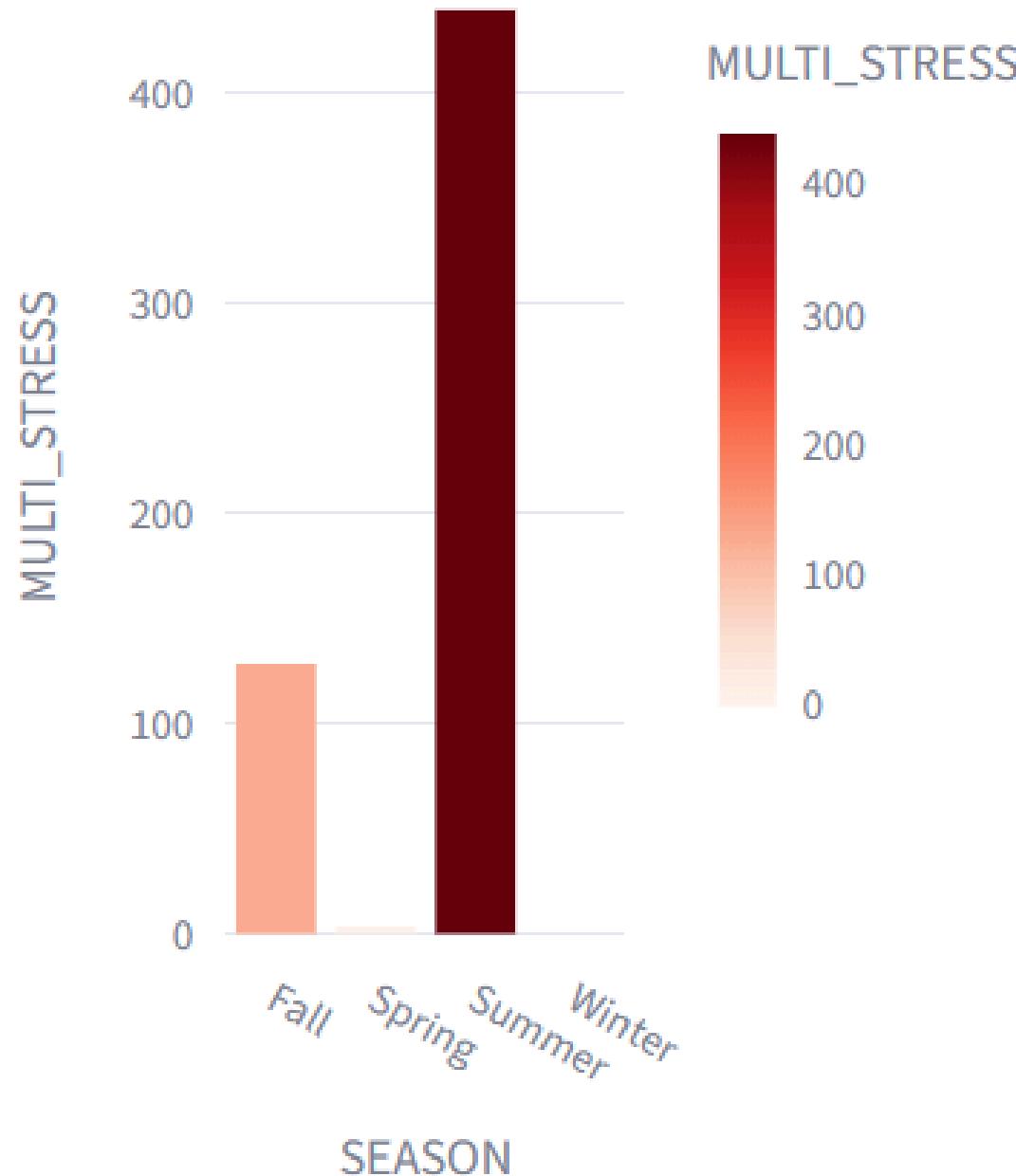
Monitoring Sites by Dissolved Oxygen Risk



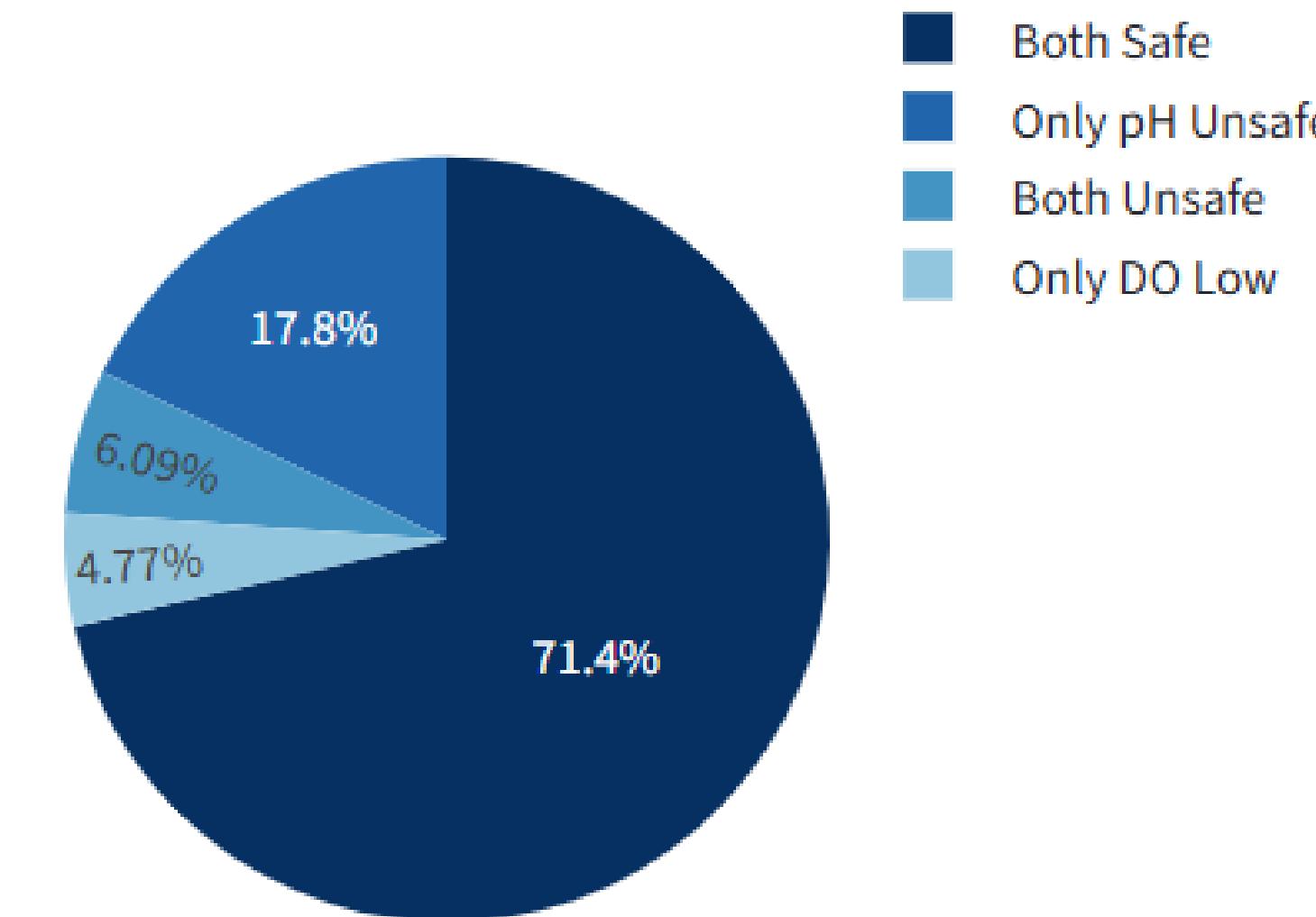
Monitoring Sites by Dissolved Oxygen Risk



Multi-Stressor Events by Season



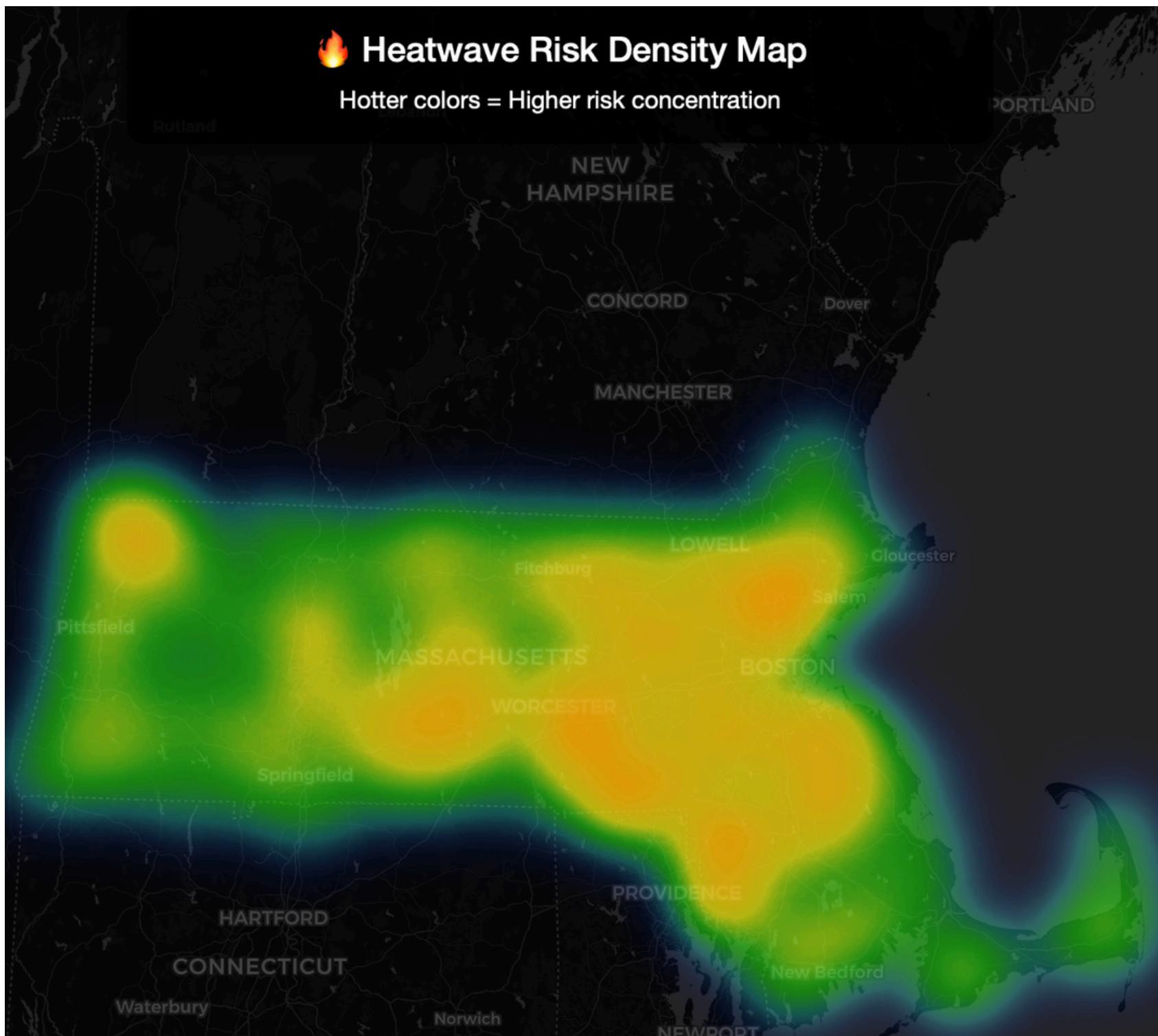
Distribution of Water Quality Status



- Summer dissolved oxygen averages 7.3 mg/L vs 13.5 mg/L in winter
- Higher temperatures correlate with lower oxygen levels, threatening aquatic life

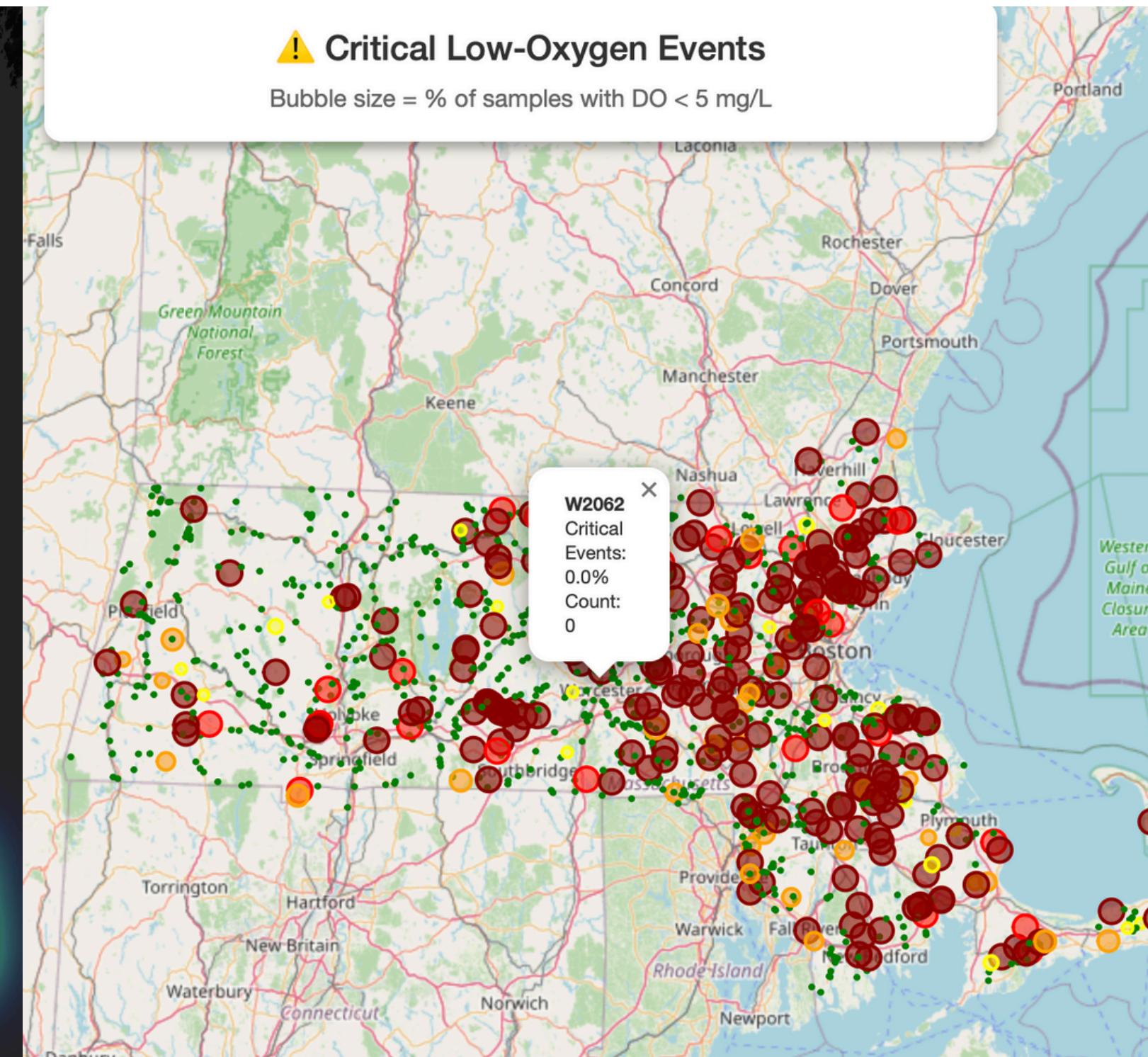
🔥 Heatwave Risk Density Map

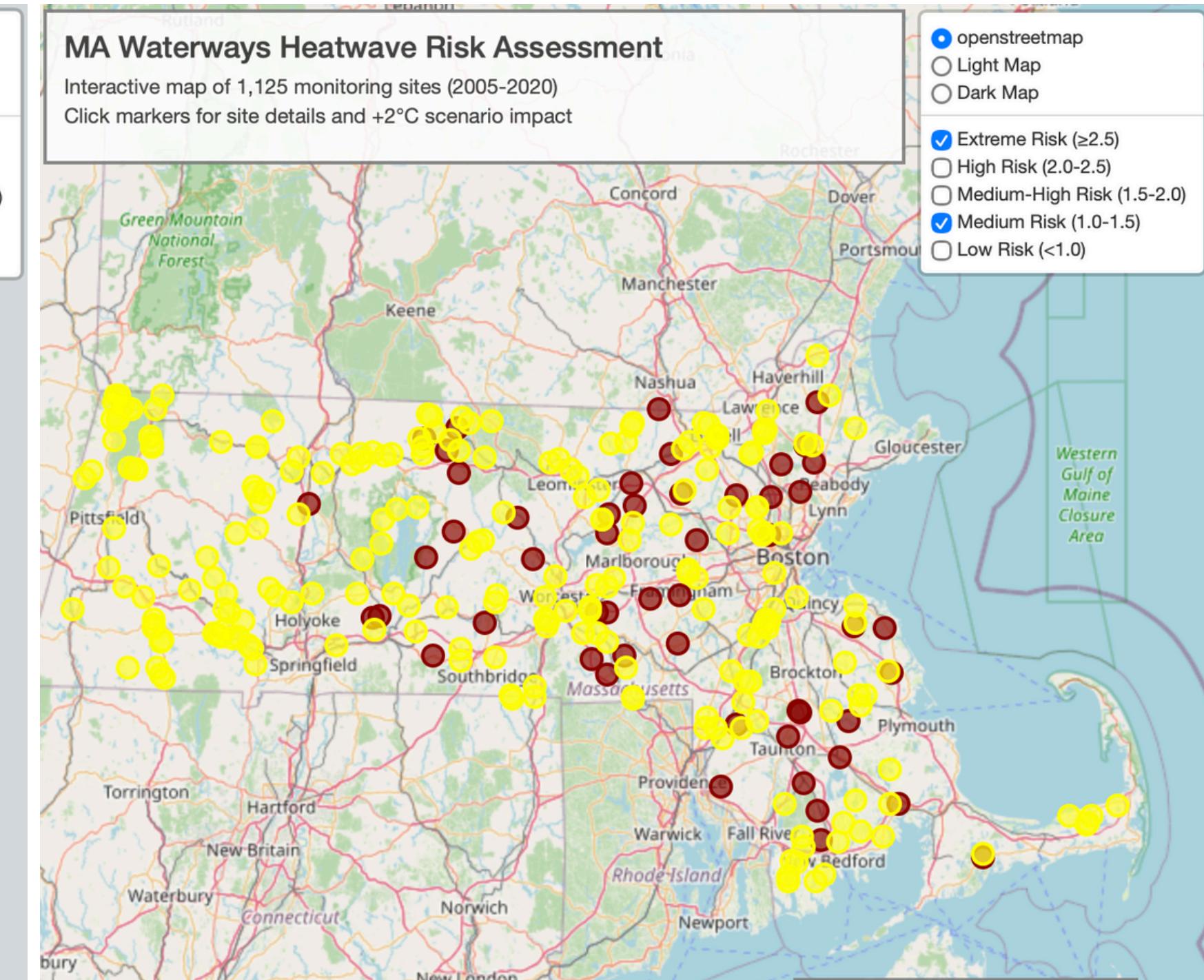
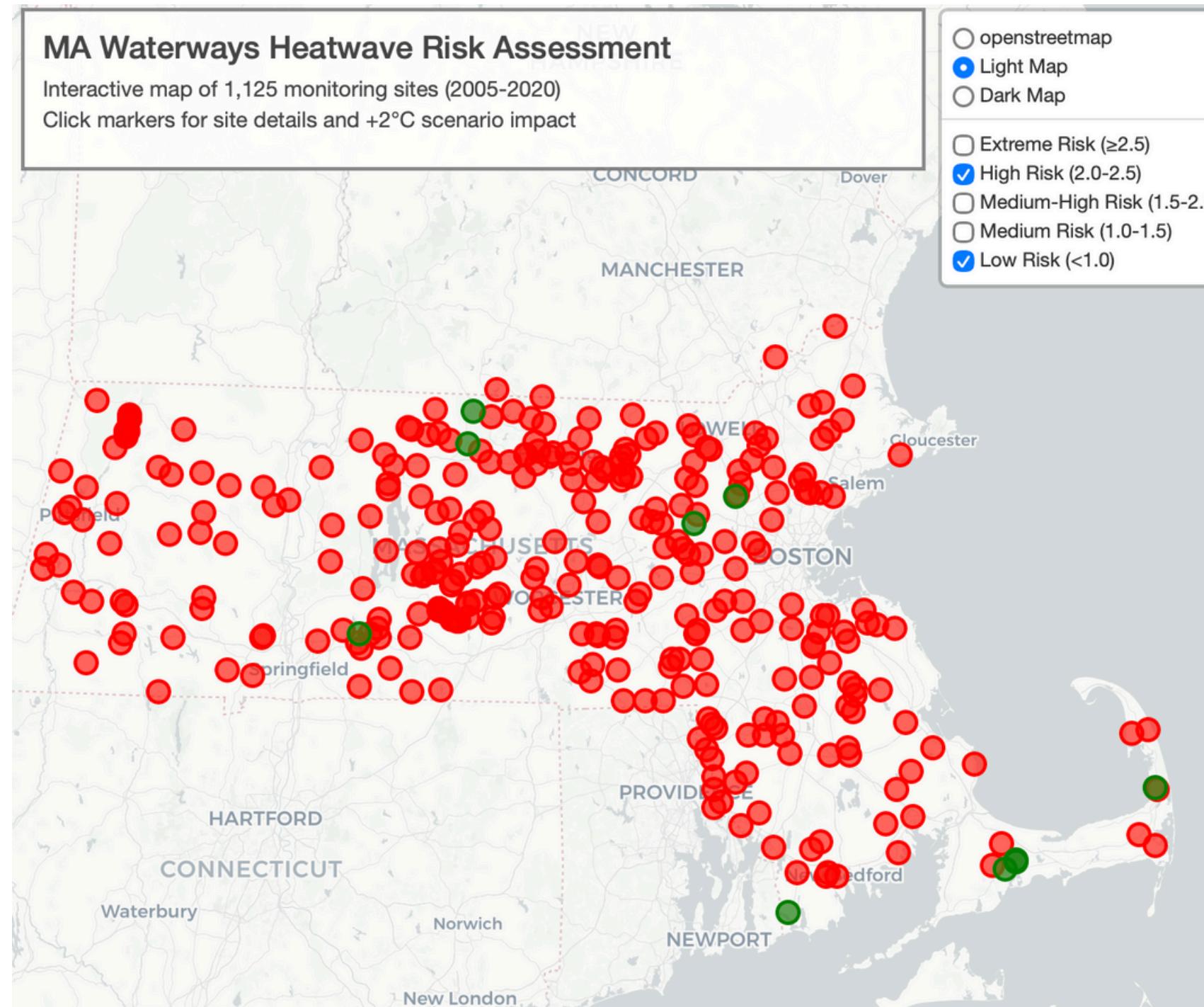
Hotter colors = Higher risk concentration



⚠ Critical Low-Oxygen Events

Bubble size = % of samples with DO < 5 mg/L





Listing which rivers had highest measurements



nDO 2020 - 10 highest

[\['Singletary Brook', 'Cold Spring Brook', 'Blackstone River', 'Poor Farm Brook', 'Dark Brook', 'Big Bummet Brook', 'Quinsigamond River', 'Weasel Brook', 'Seavers Brook', 'Tatnuck Brook'\]](#)

nDO 2020 - 10 lowest

[\['Cook Allen Brook', 'Moose Brook', 'Axtell Brook', 'Miscoe Brook', 'Thousand Acre Brook', 'Natty Pond Brook', 'Asnebumskit Brook', 'Broad Brook', 'Chickering Brook', 'Rock Meadow Brook'\]](#)

nPH 2020 - highest

[\['Blackstone River', 'Seavers Brook', 'Coal Mine Brook', 'Blodgett Mill Brook', 'Danforth Brook', 'Singletary Brook', 'East Branch Ware River', 'Fish Brook', 'Dark Brook', 'Run Brook'\]](#)

nPH 2020 - lowest

[\['Rich Brook', 'Moose Brook', 'Thousand Acre Brook', 'Miscoe Brook', 'Chickering Brook', 'Natty Pond Brook', 'Asnebumskit Brook', 'Lawrence Brook', 'Muddy Brook', 'Maynard Brook'\]](#)

Arsenic - Dissolved 2020

[\['Abbott Run', 'Asnebumskit Brook', 'Axtell Brook', 'Baker Brook', 'Beaver Brook', 'Big Bummet Brook', 'Blackstone River', 'Blodgett Mill Brook', 'Broad Brook', 'Browns Brook'\]](#)

Lead - Total Recoverable 2020

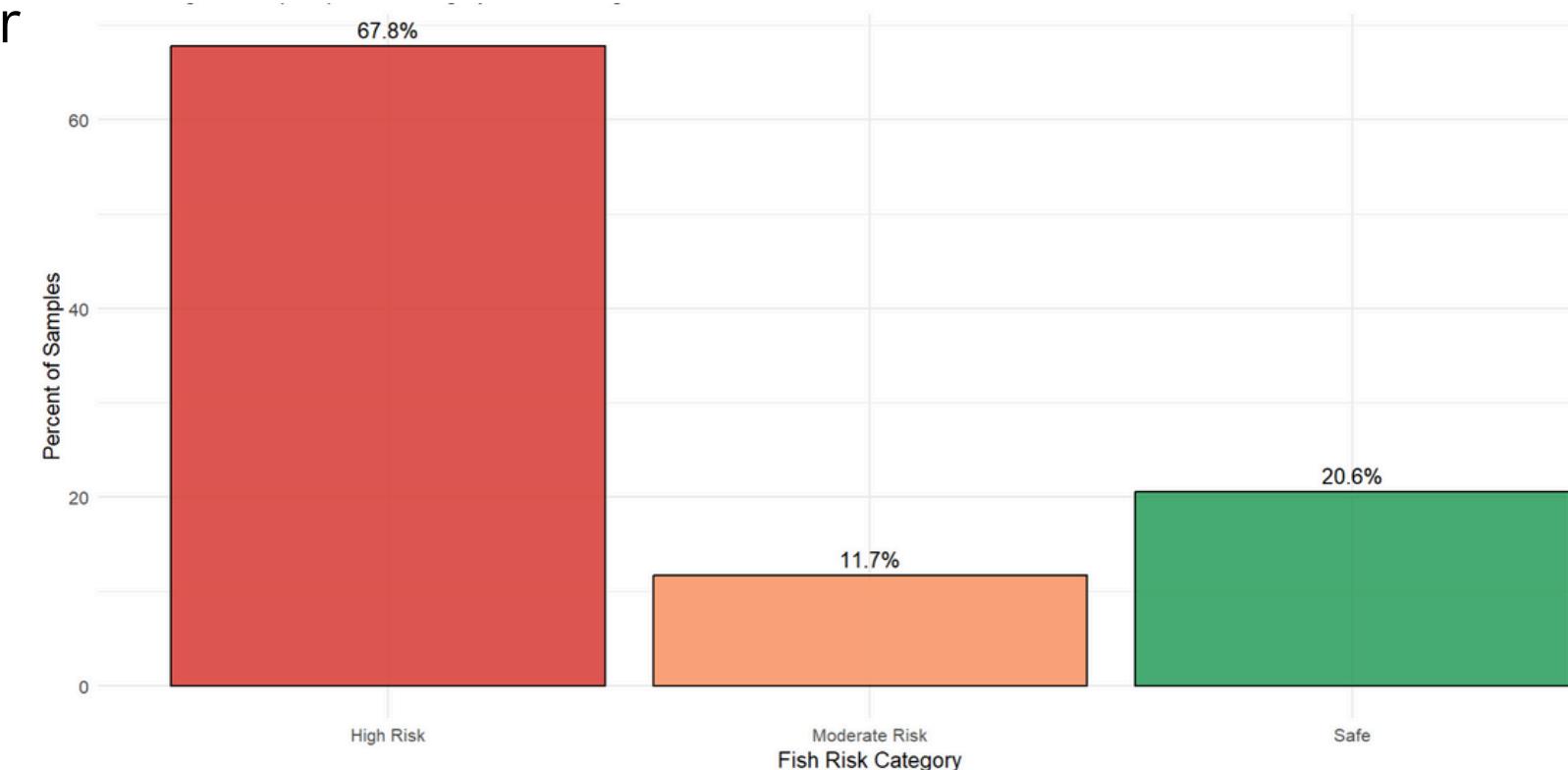
[\['Abbott Run', 'Asnebumskit Brook', 'Axtell Brook', 'Baker Brook', 'Beaver Brook', 'Big Bummet Brook', 'Blackstone River', 'Blodgett Mill Brook', 'Broad Brook', 'Browns Brook'\]](#)

Fecal Coliforms 2020

[\['Abbott Run', 'Asnebumskit Brook', 'Axtell Brook', 'Baker Brook', 'Beaver Brook', 'Big Bummet Brook', 'Blackstone River', 'Blodgett Mill Brook', 'Broad Brook', 'Browns Brook'\]](#)

(These 10 rivers were consistently the highest for circa 90 pollutants)

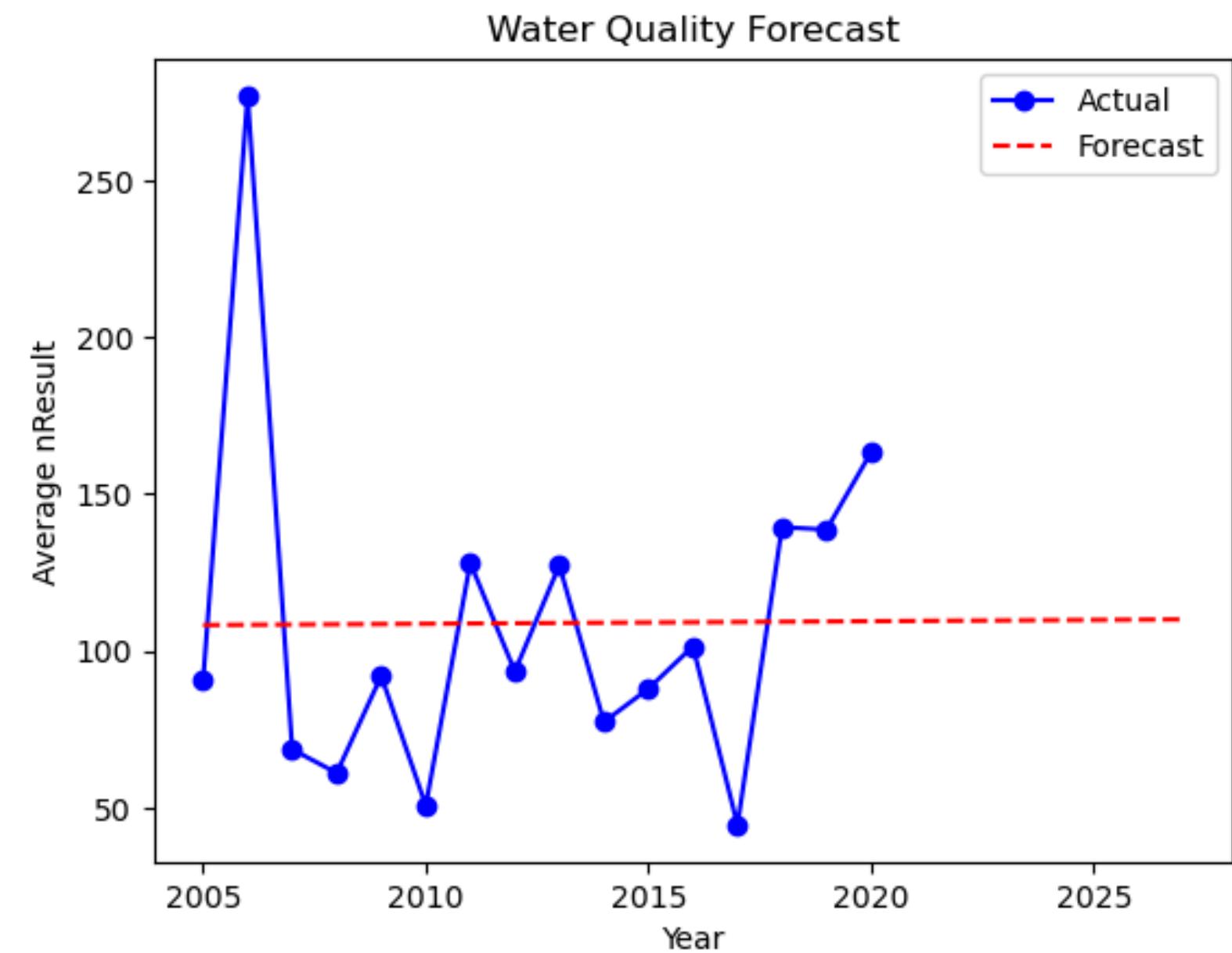
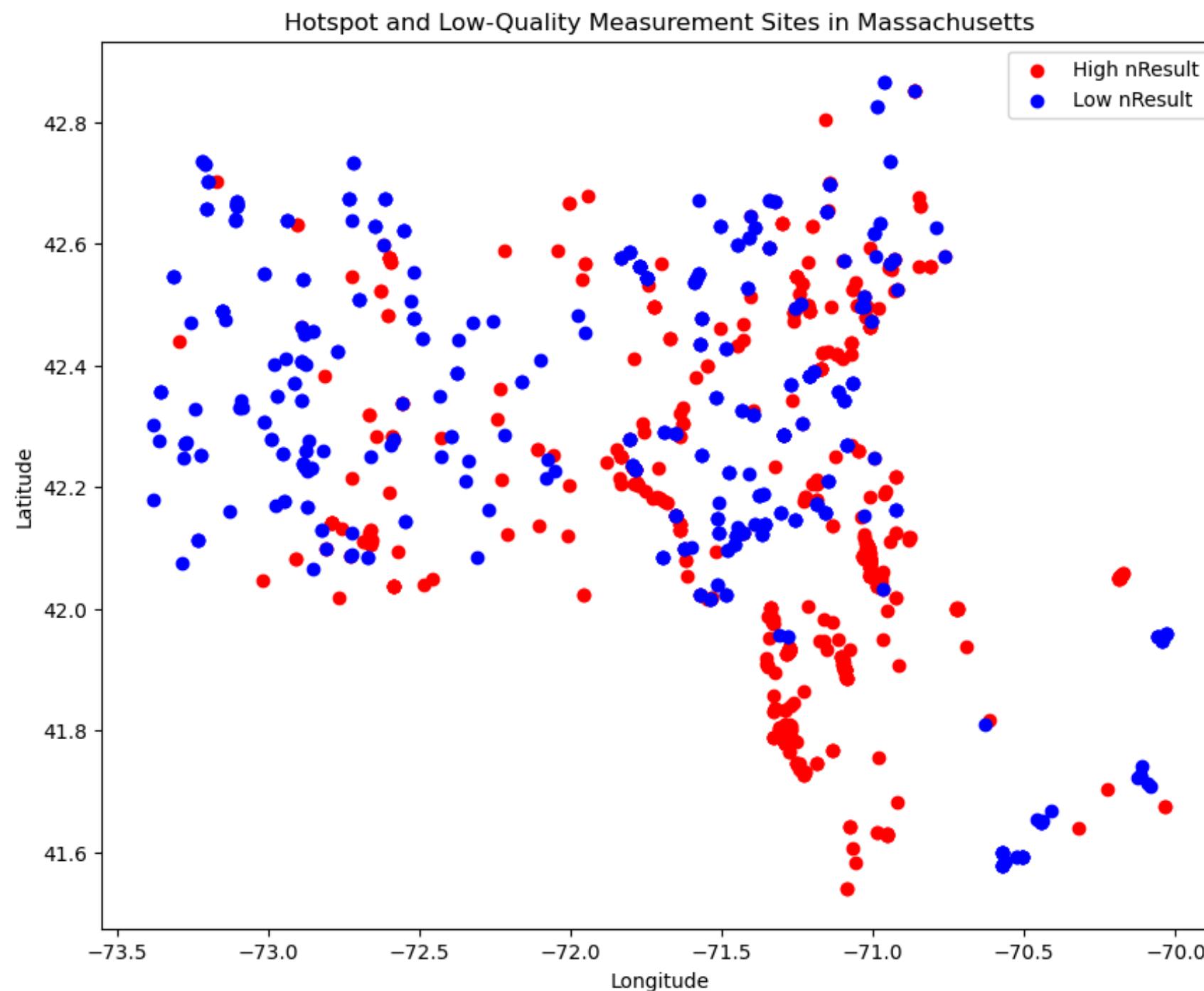
- High Risk dominates the dataset
 - 6,779 samples (67.8%) fall into the High Risk category
 - Mean DO = 0.51 mg/L; extremely low oxygen levels indicate poor survival conditions
- Moderate Risk is relatively small
 - 1,165 samples (11.7%)
 - Mean DO = 2.75 mg/L; fish are stressed but may survive
- Safe conditions are limited
 - 2,056 samples (20.6%)
 - Mean DO = 10.5 mg/L; healthy conditions for fish survival
- Overall distribution indicates critical oxygen issues
 - Majority of samples are below 2 mg/L, highlighting widespread risk
 - Only a fifth of the water samples are truly safe
- Implications for environmental monitoring
 - Immediate attention needed in areas with High Risk DO levels
 - Moderate Risk areas may require ongoing observation
 - Safe areas demonstrate conditions to maintain and protect

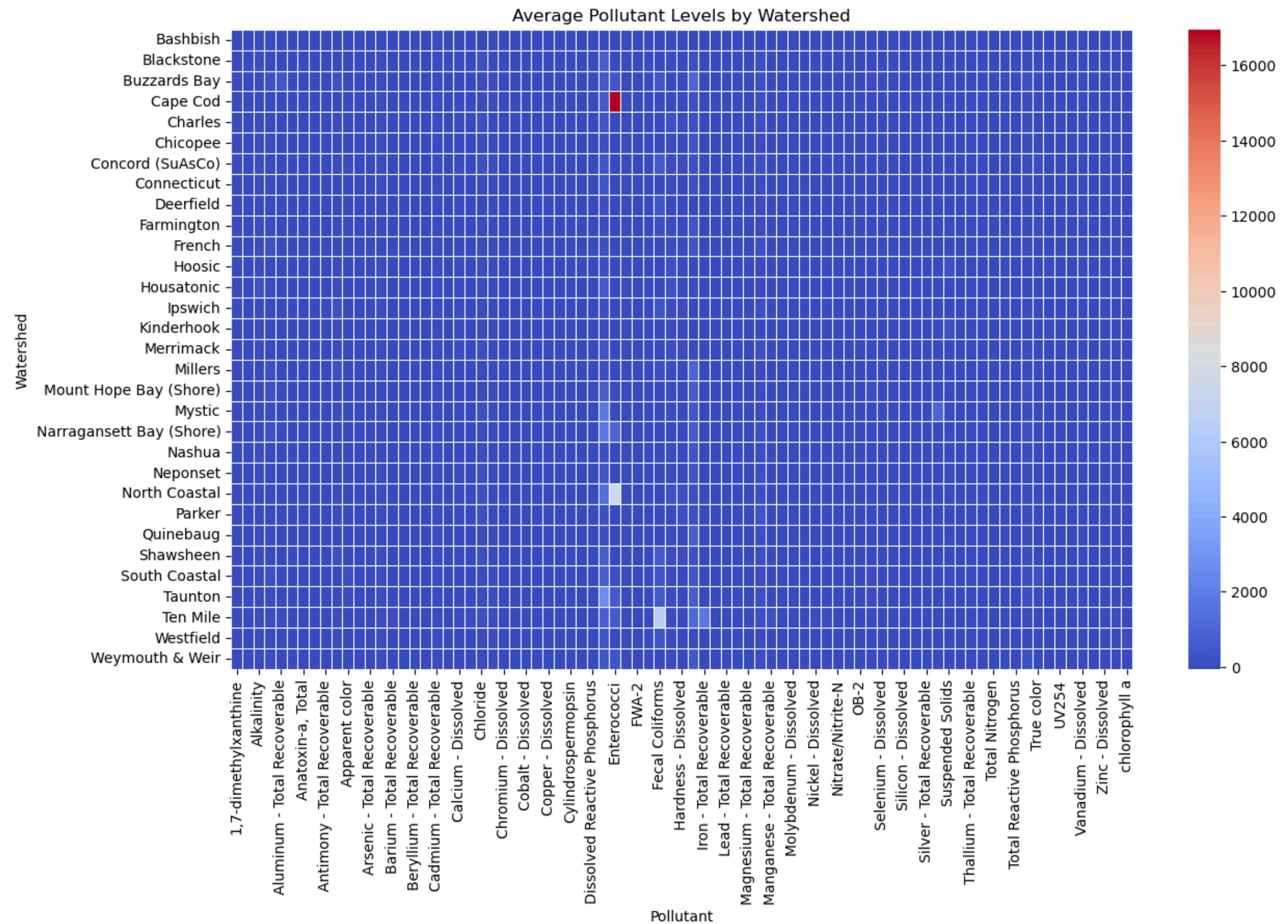


Recommendation:

Maintain safe zones

- Preserve the areas with DO > 4 mg/L by limiting pollution, controlling runoff, and protecting habitats.
- Use these safe areas as reference sites for best practices in lake or river management.





heat map of avg pollutions by watershed

Who Is at Risk—and How Massachusetts Can Respond Smartly

What should be done next :

- 1. Targeted monitoring:
 - Deploy continuous sensors
 - Prioritize monitoring and mitigation in Millers, Cape Cod watersheds
- 2. Early-warning + dashboards:
 - public dashboard that shows live risk levels and pushes alerts to residents during heatwaves.
- 3. Prioritized adaptation:
 - Combine this Heatwave Risk Index with socio-economic and EJ data to make interventions in the most vulnerable corridors.
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Who is impacted:

- Communities near the 65 high-risk sites
- Subsistence and recreational fishers

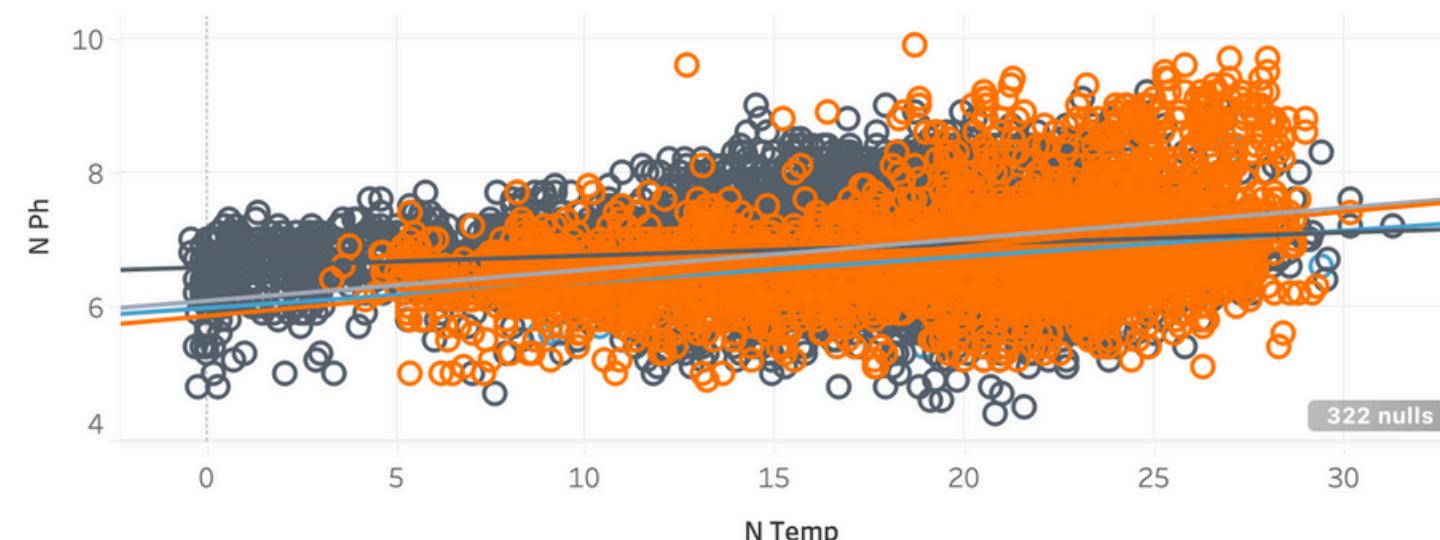
“A small, targeted investment in continuous monitoring and heat-resilient green infrastructure at 65 high-risk river sites can prevent a 21.8% surge in oxygen crises, protect frontline communities, and save money compared to cleaning up after every fish kill.”

Interactive Dashboard:

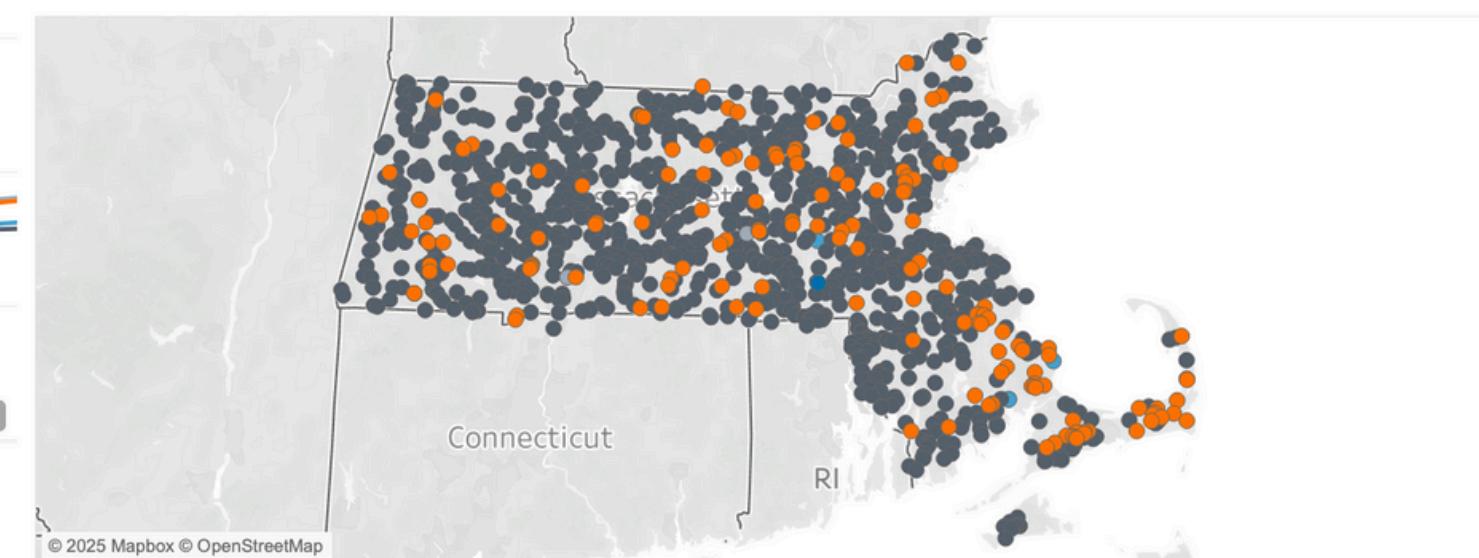
Water Quality By The Coders

Avg. N Depth	Avg. N Do	Avg. N Dosat	Avg. N Milept	Avg. N Ph	Avg. N Temp
1.66	7.45	79.18	8.61	6.85	17.78

PH levels vs. Temp



Mass Map by Water Type



Watershed

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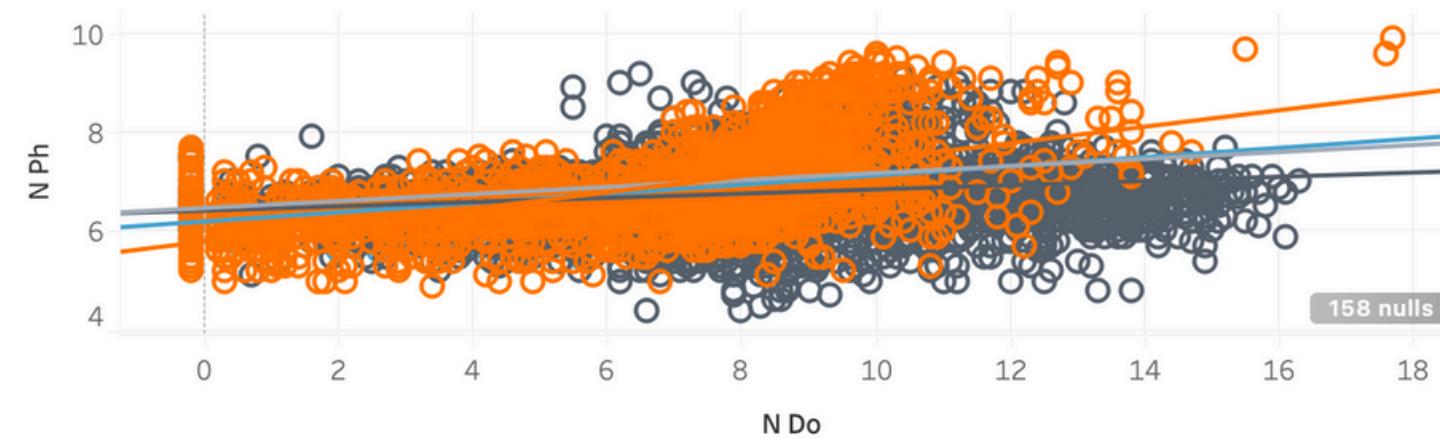
Mltyp Name

- Facility Industrial
- Lake
- Other-Surface Water
- River/Stream
- Riverine Impoundme..
- Spring

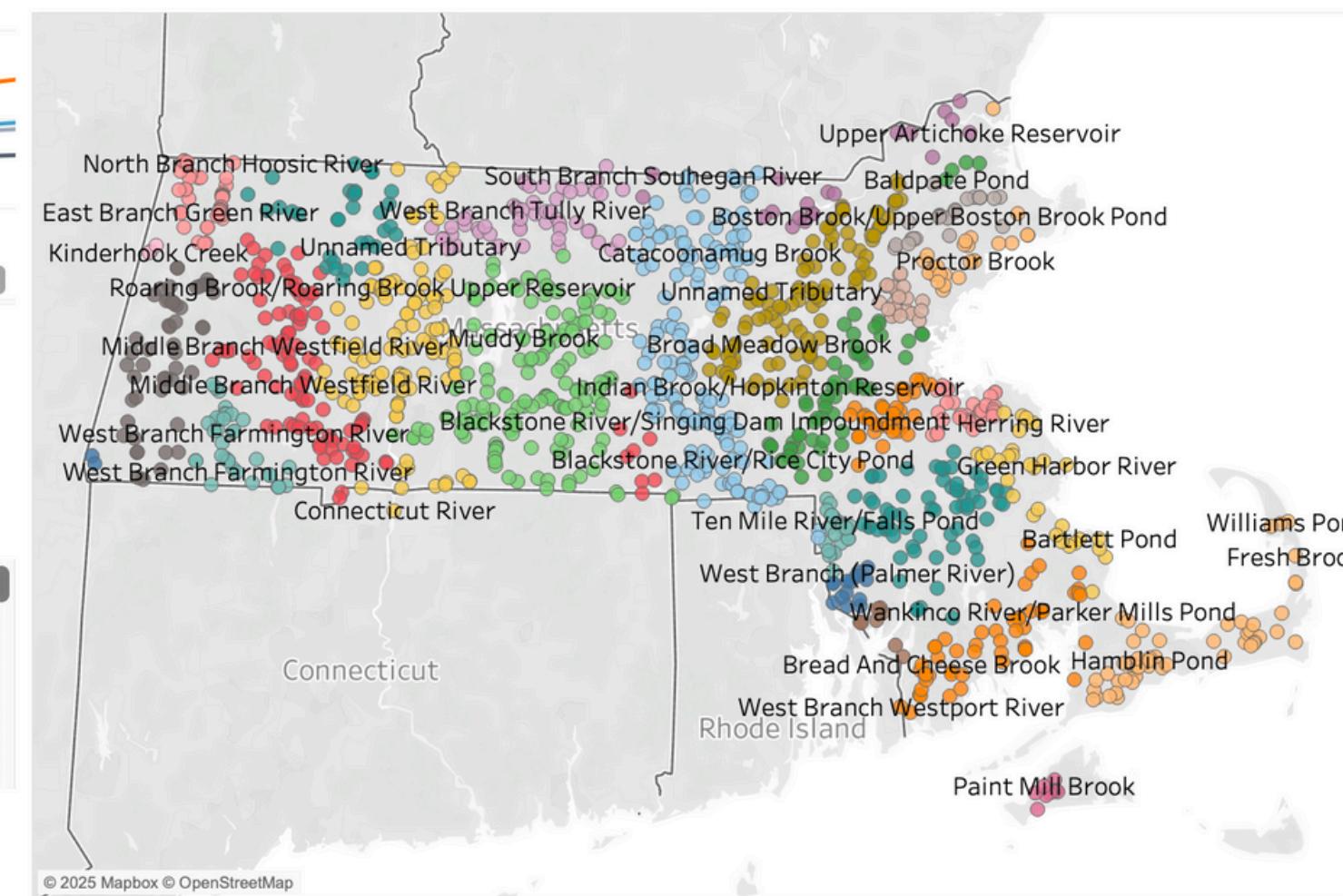
Watershed

- Bashish
- Blackstone
- Buzzards Bay
- Cape Cod
- Charles
- Chicopee
- Concord (SuAsCo)
- Connecticut
- Deerfield
- Farmington
- French
- Hoosic
- Housatonic
- Ipswich
- Islands
- Kinderhook
- Merrimack
- Millers
- Mount Hope Bay (..)
- Mystic
- Narragansett Bay..
- Nashua
- Neponset
- North Coastal
- Parker
- Quinebaug
- Shawsheen

PH levels vs. DO levels



Mass Map by Watershed



Average PH by Waterbody

