Restoration Revealed: eDNA and Water Quality As Indicators of Coastal Ecological Health

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Why this research?

- Coastal habitats are degraded by urbanization, pollution, and climate change
- Restoration projects (oyster castles, salt marshes, etc.) aim to improve water quality and biodiversity

How do we measure success **reliably** and **non-invasively**?

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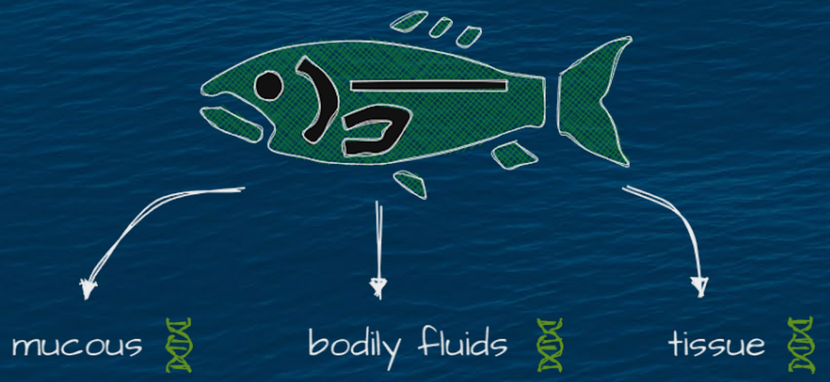
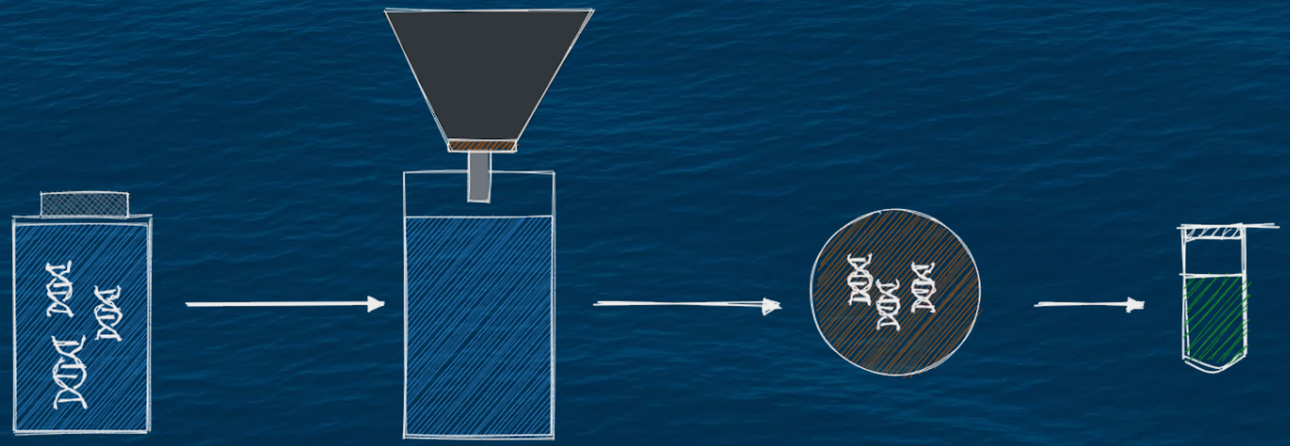
What is eDNA?

DNA is shed as cellular or extracellular material into the surrounding water

collect & filter water from aquatic systems

extract DNA from filters





Strengths

- Non-invasive
- Cost-effective
- Detects biodiversity at multiple scales

(Environmental DNA (EDNA): A Powerful Tool for Exploring Marine Ecosystems, 2025)

Relevance

Complements traditional monitoring tools like:

- Water Quality
- Visual Surveys
- Tagging

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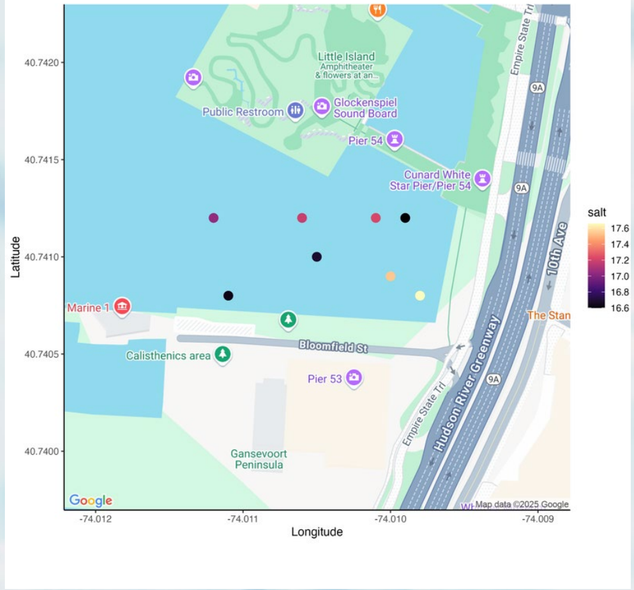
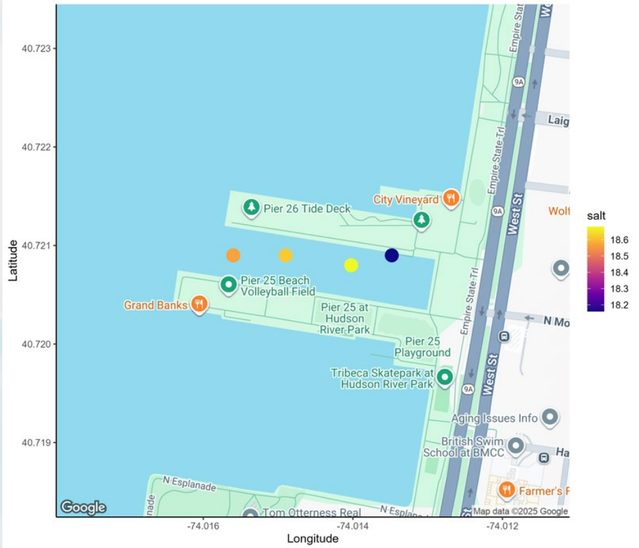
Zoomed out map of entire trip

Gansevoort Peninsula Sites



Pier 25 Sites



22 Total Sites

- 8 within restored Gansevoort Peninsula
- 4 within unrestored Pier 25
- 10 along transect from Atlantic Highlands through the Hudson River

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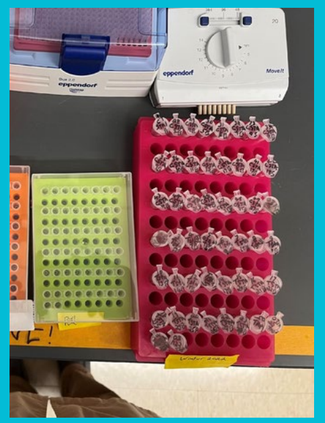
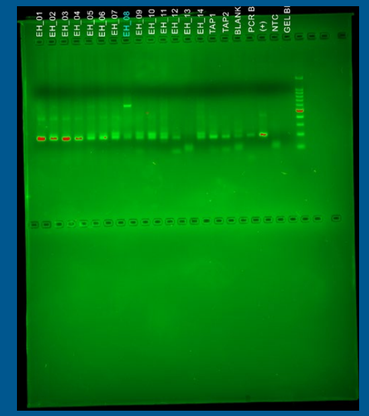
Methodology

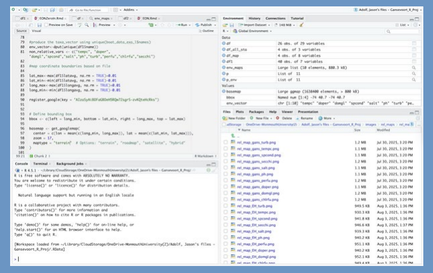
1L of water sample is collected in the field, then filtered in a sterile lab environment



eDNA Extraction



PCR Amplification



Sequencing & Analysis

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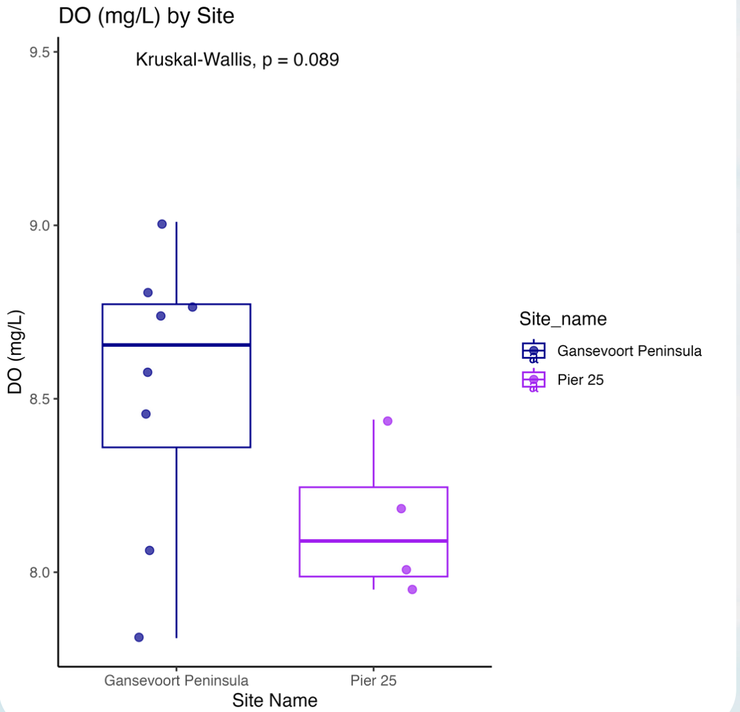
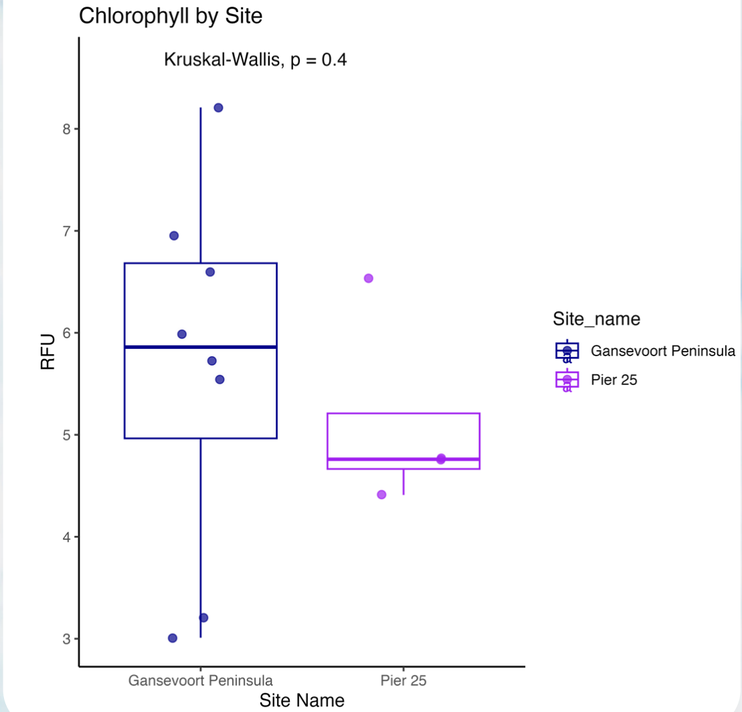
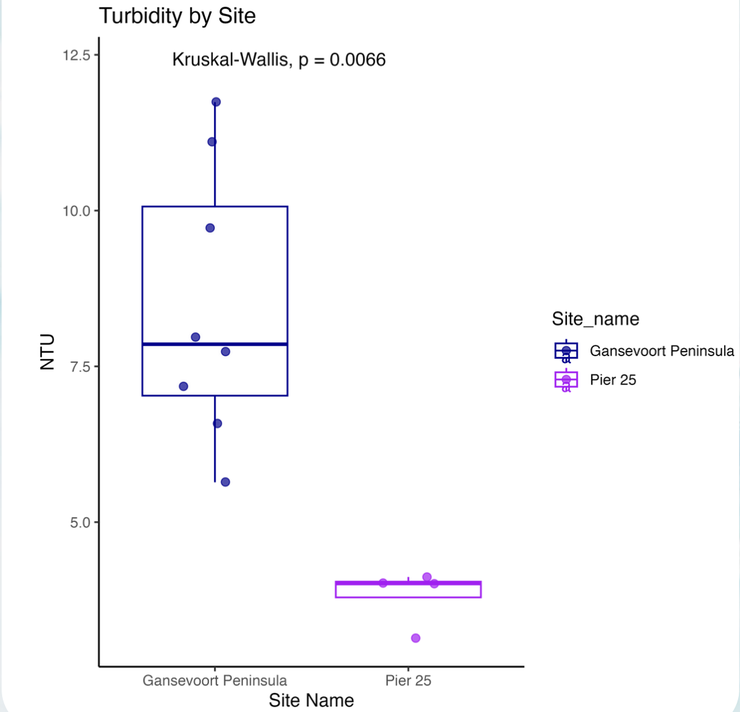
Results: Water Quality Highlights





Significant!



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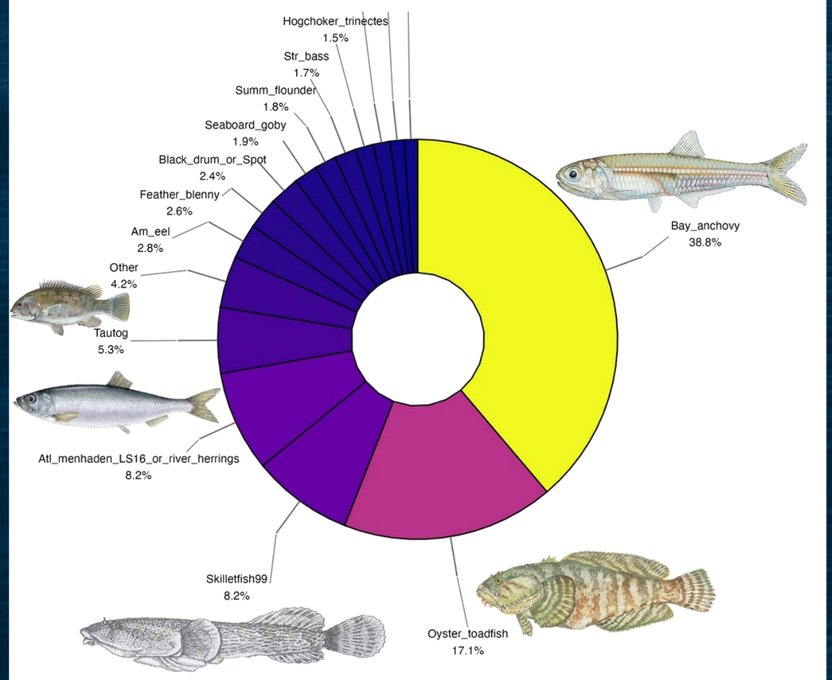
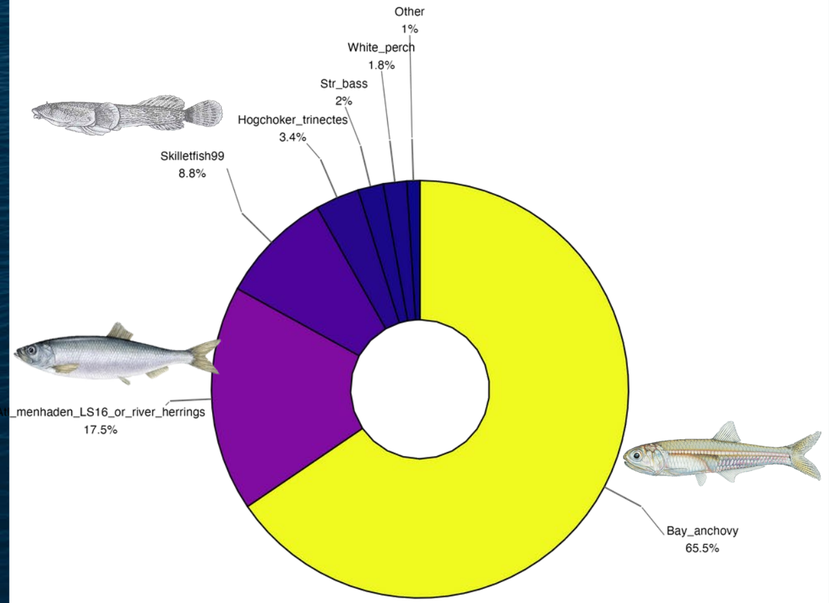
Results: eDNA



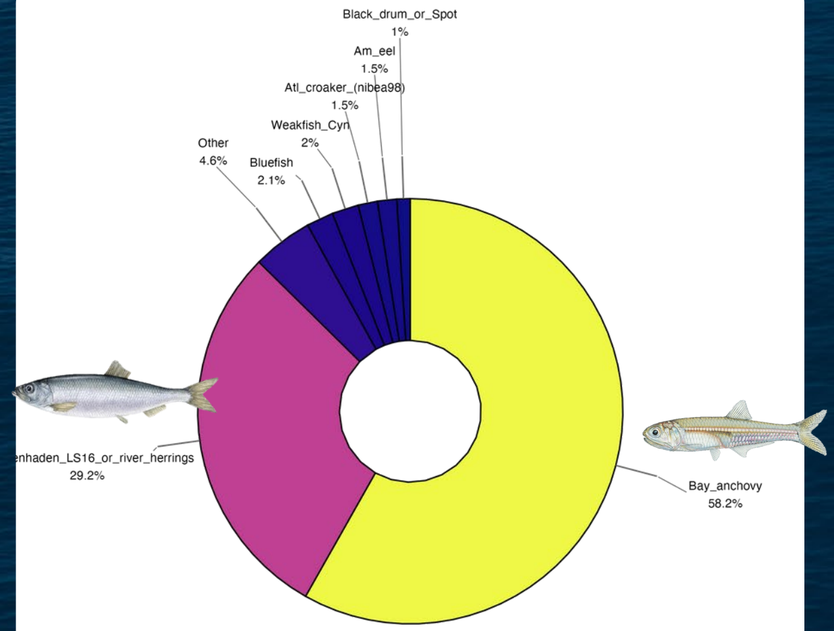
Gansevoort

Restored



Pier 25

Unrestored



Transect

AH through Hudson River

Discussion & Implications

What We Observed

- Turbidity levels within the Gansevoort site were significantly greater
- **DO** levels did not differ significantly, with a p value of 0.089
- Gansevoort sites show a **more diverse** community composition and contained fish associated with oyster reefs

What It Means

- Fish composition—namely the presence of skilletfish and oyster toadfish—within the Gansevoort site is **indicative of early oyster reef restoration benefits.**
- Installation of restoration efforts may cause increased turbidity due to **disruption of sediments.**
- Long-term tracking is needed to confirm

Conclusion & Next Steps

Takeaway

eDNA is a powerful, non-invasive tool for evaluating restoration outcomes

Broader Impact

Improves monitoring for urban coastal restoration, informs NJ and NYC resilience efforts

Next Steps

- Continued monitoring of the Gansevoort Peninsula into 2027
- Further applications and broader study across vastly different locations

References

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Thank You!

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Acknowledgments

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