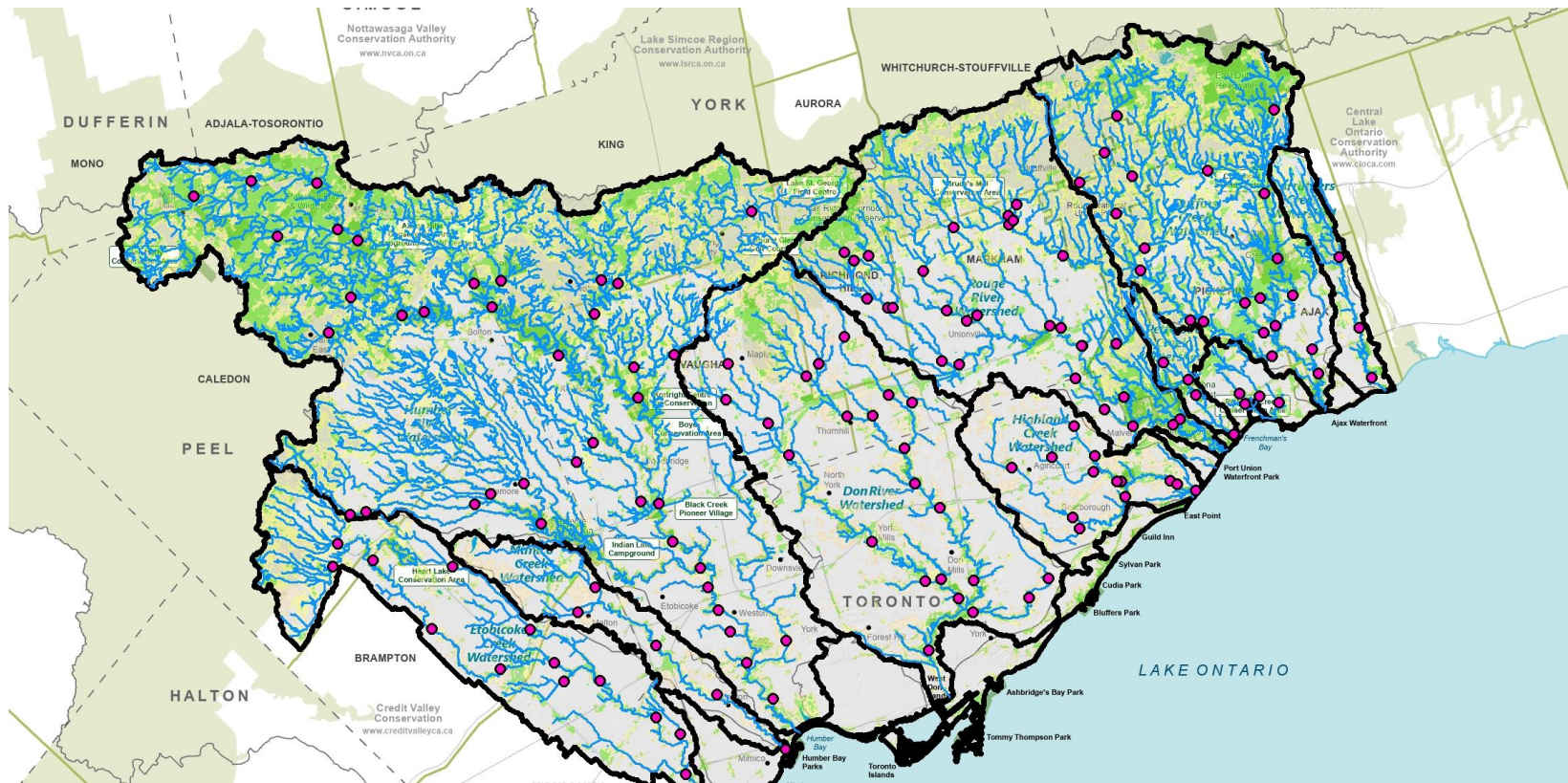


Reassessing Pool Habitat Value in Benthic Monitoring

A 12-year analysis using long-term monitoring data (2013-2024)

Presented by: Jessica Fang, Aquatic Biologist

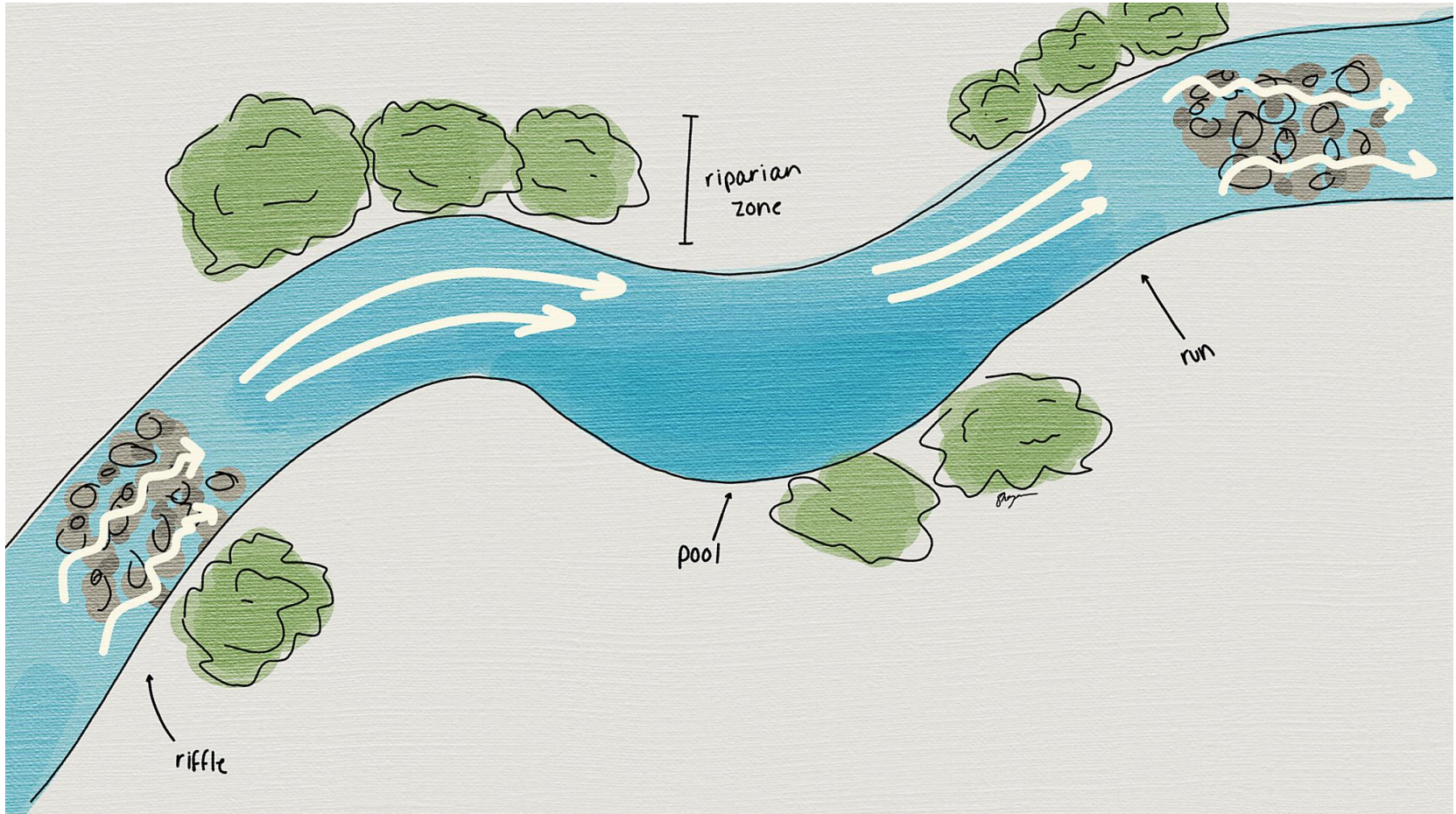
November 3, 2025



Stream Bioassessment in Action: TRCA's Regional Watershed Monitoring Program

- has monitored benthic macroinvertebrates in **nine watersheds** since 2001 at ~135 stations annually
- OBBN protocol used from 2013 onwards – Standard triad: two riffle kicks + one pool kick per reach

Riffle vs Pool- What's the difference?



Nolan Shayenna (2023). Stream Habitats Illustration.

Beyond OBBN:

Region	Program	Habitat sampled	Notes
Canada	CABIN	Mostly Riffles	3 mins zigzag in best riffle of the area
	BioMAP (Ontario)	Riffle + multi-habitat	2 density + 1 qualitative
USA	EPA RBP	Riffle or multi-habitat	Depends on stream gradient
	MD MBSS	Riffle/run only	Pools assessed visually only
Australia	AUSRIVAS	Riffle + pool (separate)	Sample both habitats independently
Europe	EU Water Framework Directive	Multi-habitat (composite)	Proportional to area

The Pool Paradox: routinely sampled, too often left out of analysis

Procedure for evaluating streams with the family-level biotic index

1. Using an aquatic net, samples are collected from a riffle area or shallow run where the current is greater than 0.30 m/s (1.0 ft/s) and the substrate is composed of gravel, pebbles, and (or) small rocks. Collection of arthropods is best accomplished by placing the net against the stream bottom and disturbing the substrate immediately upstream from the net. Snags of debris may be sampled if no riffle or run is present.

Hilsenhoff, W.L. (1988). Rapid Field Assessment of Organic Pollution with a Family-Level Biotic Index. J-NABS 7:65–68

Some agencies decided to skip pool data often due to cost or "skewed" results.

Assessing the value of the pools

Key Trade-off:

Removing pool sampling isn't just about data loss- it breaks consistency with standard protocols, reducing comparability across years, sites, and agencies.

Our Approach:

We analyzed 12 years (2013–2024) of TRCA benthic data, containing paired riffle–pool samples across hundreds of sites and multiple watersheds (from rural to urban).

What We Examined:

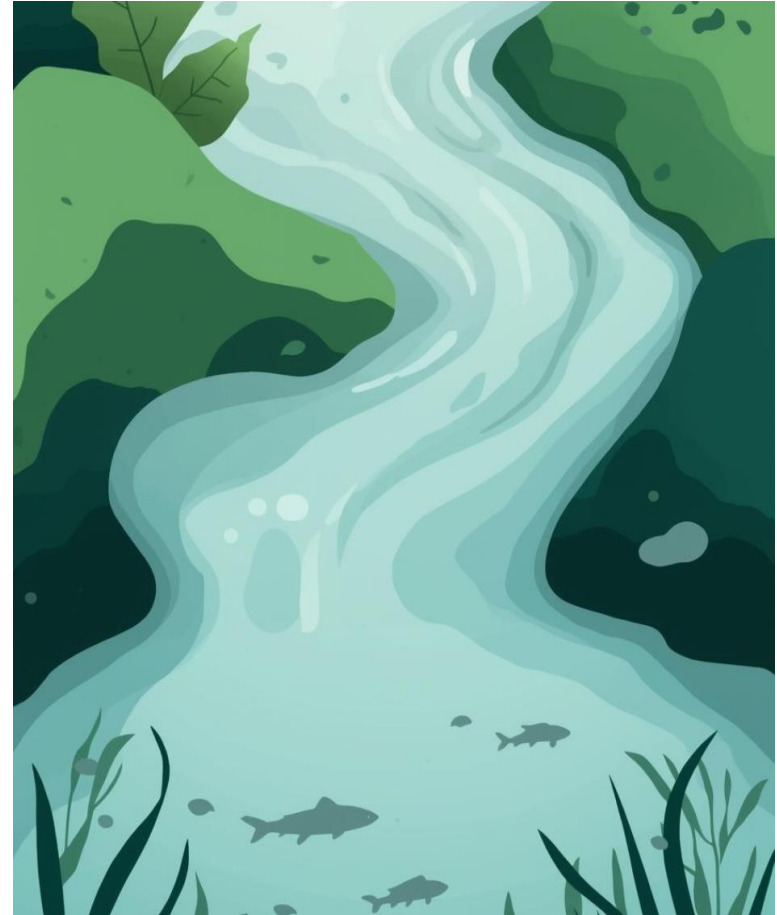
Family Biotic Index (FBI)

Taxonomic Richness

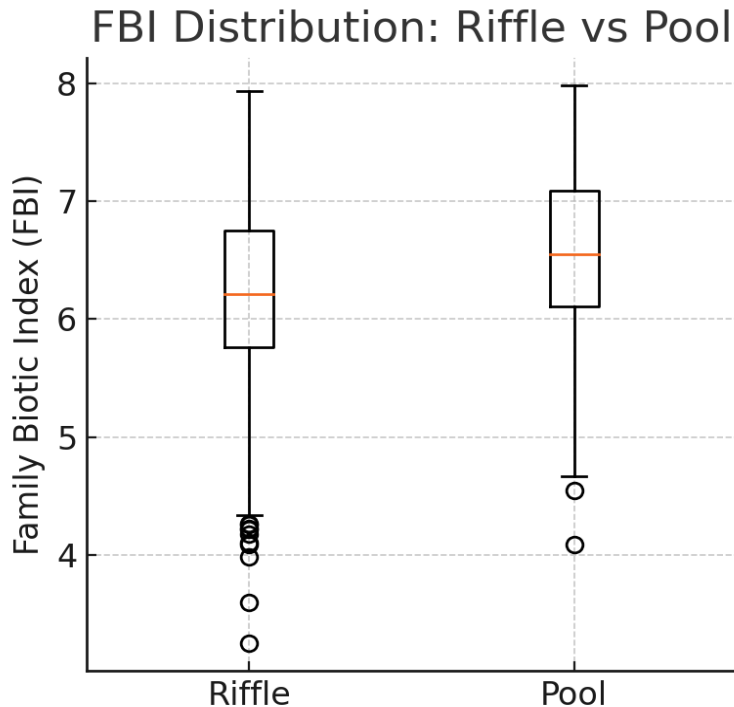
Community Composition

Response to Stressors

(All statistics on FBI, richness, and unique taxa from TRCA OBBN dataset (2013–2024), paired riffle–pool samples; medians with IQR unless noted)



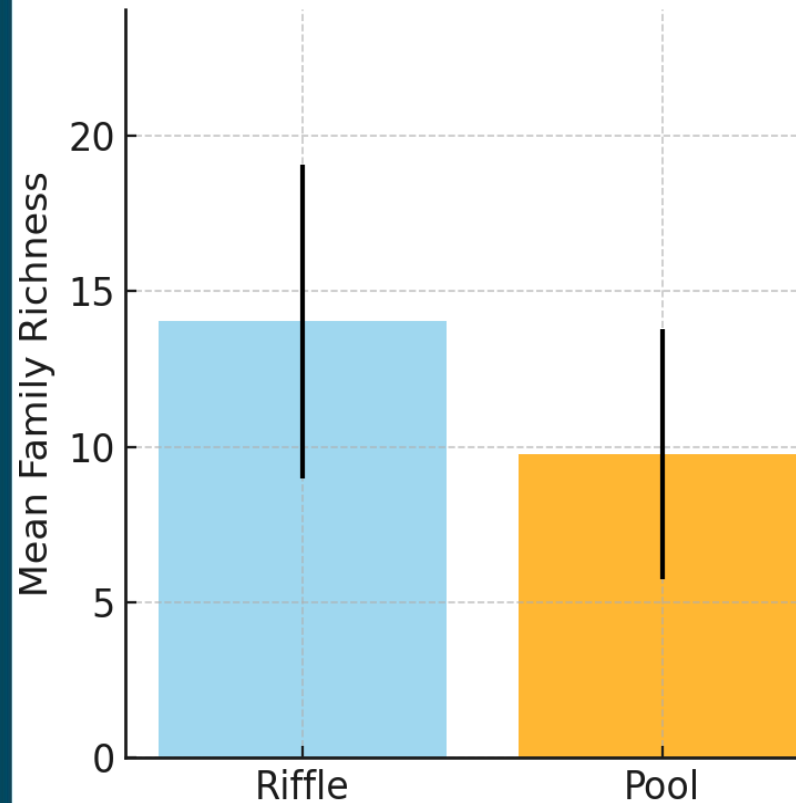
Family Biotic Index - ("Are Pools Worse?")



- Pools ~ 0.3 FBI units higher → more tolerant assemblages.
- Pattern consistent across years.
- Higher FBI = real habitat difference, not error.

Richness – Family Level

- Median families:
Riffle ≈ 14
Pool ≈ 10 (70 %).
- Some pools approach riffle richness (e.g., 25 vs 28).
- Combined habitats increase site-level richness.



Unique Taxa and Community Composition



Unique taxa:

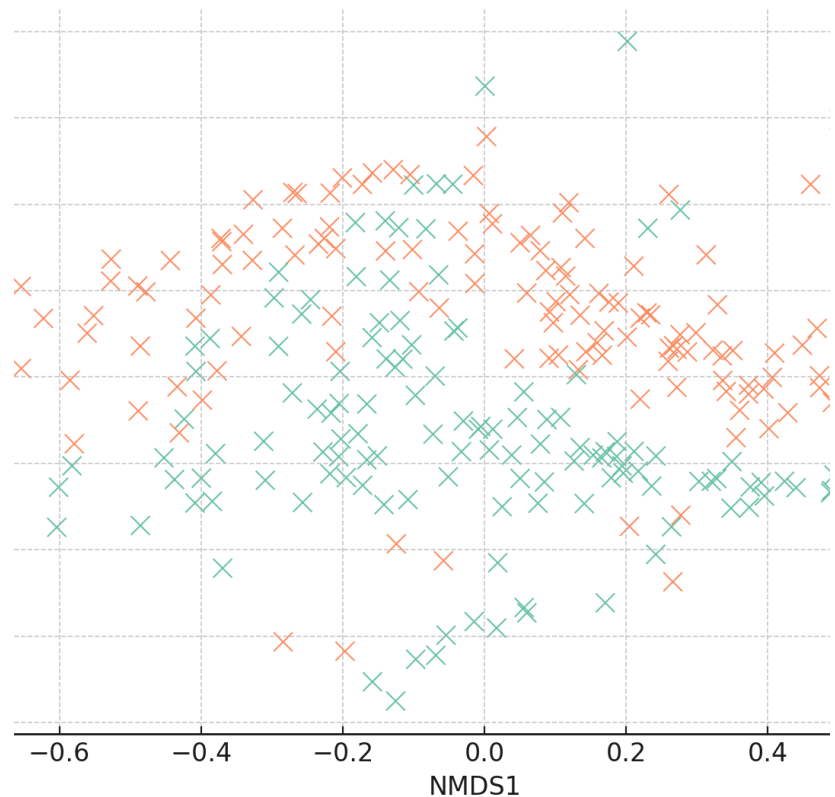
35 taxa unique to
pools;

58 to riffles;

300+ shared

Multivariate analysis:
habitat = major driver

NMDS (Top 25 Families, All 2019 Samples)
Riffle vs Pool



Habitat-Specific Trends Over Time

Riffle and pool metrics sometimes follow different long-term trends-revealing habitat-specific responses to stressors.

Examples:

- Etobicoke Creek: Pool FBI steadily worsened; riffle stable → early warning missed
- East Humber: Pool FBI ↓ (improving), riffle flat → recovery detected only in pools



Data Interpretation

- Analyze separately - habitats differ in flow, substrate and taxa
- Don't mix indices - riffle \neq pool
- Compare side by side - OBBN's design supports direct comparison
- Adjust Benchmarks - pool $FBI \approx \text{riffle} + 0.3$ (program-specific)



Smarter Sampling: Efficiency and Innovation



Field Efficiencies:

- Shorter kick durations
- Only sample pools if >20% of reach
- Rotate pool sampling across years

ID Workflow Improvements:

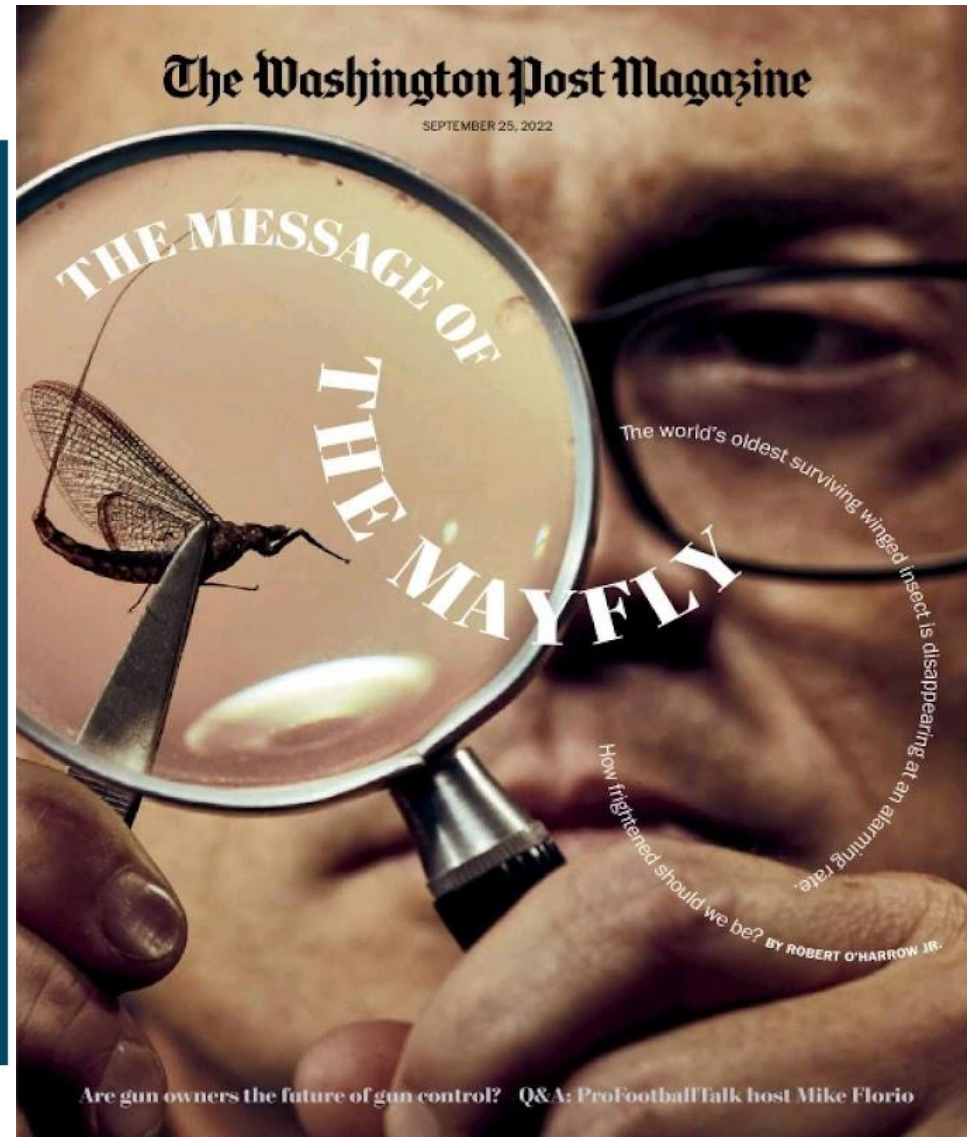
- Find the bottleneck and target it
- Specialize roles
- Invest in tools/training

Emerging Tools:

- eDNA metabarcoding - active pilots in Canada (STREAM/CABIN; Parks Canada) and growing EU evaluation under the Water Framework Directive.

Final Takeaway

- Pools offer distinct ecological information and can improve site-level biodiversity assessments
- If you include pools, ensure consistent methods and thoughtful interpretation
- If you must omit pools, document the rationale and consider program trade-offs



Acknowledgements:

Aquatic Monitoring and Management Team, TRCA

TRCA's regional partners: the City of Toronto, the Regional Municipality of Durham, the Regional Municipality of Peel, and the Regional Municipality of York.