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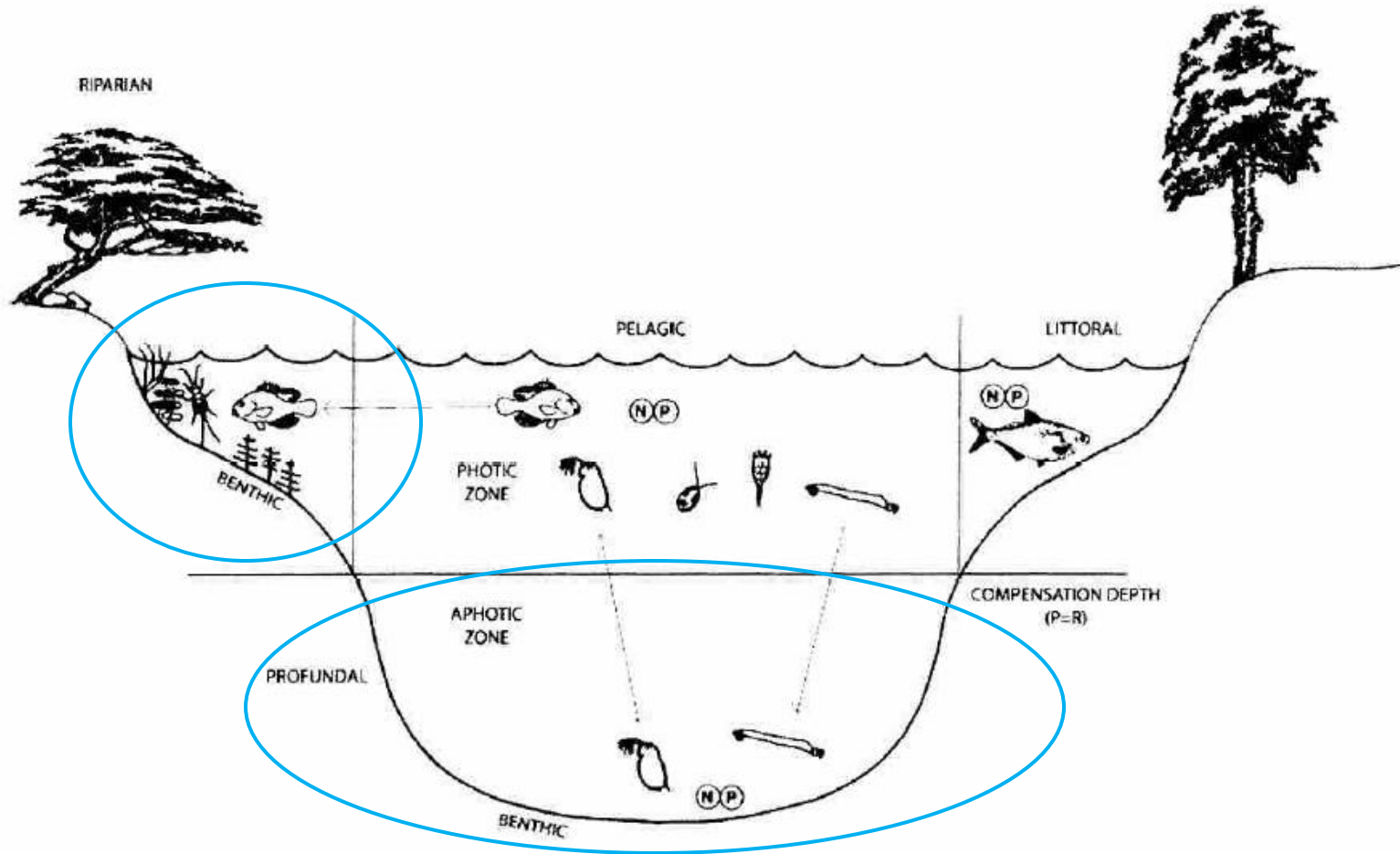
# Benthic Ecological Assessment for the Great Lakes (BEAGL)

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# What are Benthic Habitats?



# What is BEAGL?

- Rapid, *in situ*, quantitative habitat assessment methodology for freshwater benthic areas
- Adapted from the Benthic Ecological Assessment for Marginal Reefs (BEAMR) (Lybolt et al. 2009)
- Visually based, non-consumptive assessment technique
- Structured and consistent approach

# Why BEAGL?

- Benthic habitat information is needed to make responsible management decisions
  - Great Lakes restoration projects
  - Wind farm development in the Great Lakes
- In general, there is a lack of *in situ* data characterizing the benthic habitats of the Great Lakes

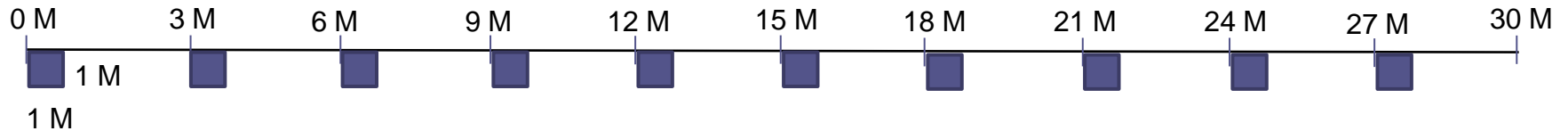
# BEAGL vs Other Benthic Methods

- BEAGL is a *in situ* data collection methodology utilizing SCUBA technology
- Rapid assessment
- Photographic and video documentation
- BEAGL is limited to visibility conditions  $> 2\text{ft}$



# BEAGL Methodology

- Quadrat/transect based methodology



# BEAGL Datasheet

Project Name		Site Name / Transect Name	
Date		Data Collector	Data Entry
<b>Quad Label:</b>	Macrophyte spp. (%)	Burrowing mussel sp. (ct)	Fish sp. (ct) % Cover
Sample Name or #			
Max Relief (cm)			
Max Sed Depth (cm)			
<b>Benthic Abiotic/Biotic %Cover</b>			
Bedrock			
Boulder			
Cobble			
Gravel			
Shell			
Sand			
Silt/Mud			
Detritus			
Woody debris			
Total = 100%			
Macrophytes			
Periphyton			
Dreissenids			
Burrowing mussels (ct)			
other-...			
<b>Quad Label:</b>	Macrophyte spp. (%)	Burrowing mussel sp. (ct)	Fish sp. (ct) % Cover
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Total = 100%			
Macrophytes			
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Bedrock			
Boulder			
Cobble			
Gravel			
Shell			
Sand			
Silt/Mud			
Detritus			
Woody debris			
Total = 100%			
Macrophytes			
Periphyton			
Dreissenids			
Burrowing mussels (ct)			
other-...			

Macrophyte: Ceratophyllum, Cladophora, Elodea, Lyngbia, Myriophyllum, Potamogeton, Stuckenia, Vallisneria, Zosterella...  
Mussel: Zebra, Quagga, Unionid, Sphaerid, Corbicula...  
Other: Annelid, Bryozoan, Hydroid, Insects, Leeches, Snails, Sponge...

Quad Label: 9M		Macrophyte spp. (%)	
Sample Name or #		Burrowing mussel sp. (ct)	% Cover
		Fish sp. (ct)	
Max Relief (cm)	13	Lyn	10
Max Sed Depth (cm)	20	Clado	10
<b>Benthic Abiotic/Biotic</b>	<b>%Cover</b>	valli	5
Bedrock	10		
Boulder	15		
Cobble	10	Unionid	2
Gravel	20		
Shell	20		
Sand	25		
Silt/Mud			
Detritus		Rd Gobies, drum,	
Woody debris		Shiners???	
Total = 100%	100		
Macrophytes	25		
Periphyton	10		
Dreissenids	10		
Burrowing mussels (ct)			
other...hydroid	1		



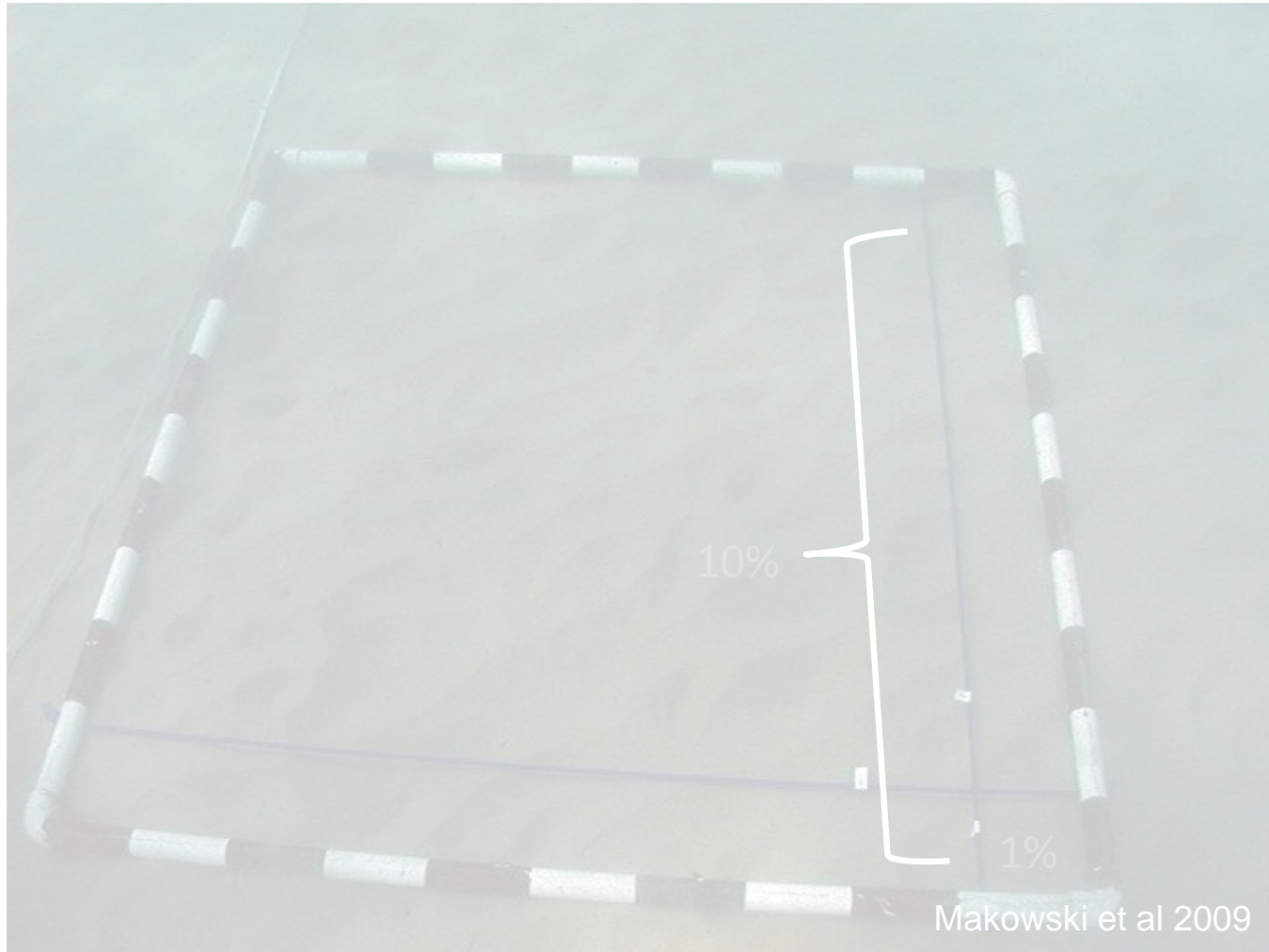
**Macrophyte:** *Ceratophyllum*, *Cladophora*, *Elodea*, *Lyngbia*, *Myriophyllum*, *Potamogeton*, *Stuckenia*, *Vallisnaria*, *Zosterella*...

**Mussel:** Zebra, Quagga, Unionid, Sphaeriid, Corbicula...

**Others:** Annelid, Bryozoan, Hydroid, Insects, Leeches, Snails, Sponge...



# BEAGL Quadrat

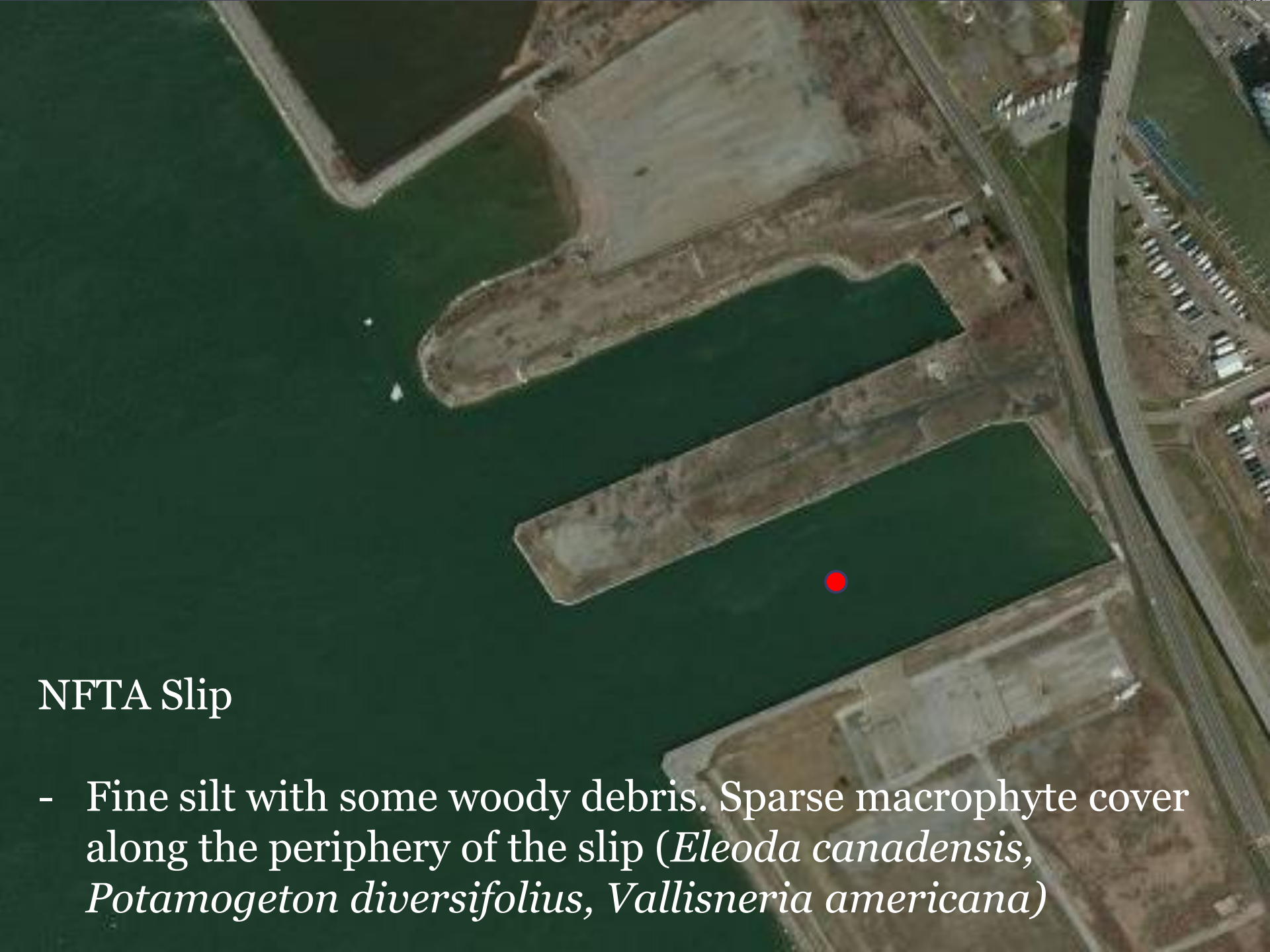


# Data Analysis

- Parametric stats
  - t-tests, ANOVA's, regression...
- Nonparametric stats
  - PRIMER version 6.0 - MDS, SIMPER, ANOSIM...

# Preliminary Data





## NFTA Slip

- Fine silt with some woody debris. Sparse macrophyte cover along the periphery of the slip (*Eleoda canadensis*, *Potamogeton diversifolius*, *Vallisneria americana*)



## Squaw Island

- Fine silts and sands with some woody debris. Sparse macrophyte cover along the shoreline of the pond (*Ceratophyllum demersum*)

An underwater photograph showing a rocky seabed. A white ruler is positioned horizontally at the top of the frame, providing a scale. The ruler has markings in centimeters and millimeters, with numbers like 0, 6, 12, 18, 24, 30, 36, 42, 48, and 54 visible. The seabed is covered with dark, irregularly shaped rocks and pebbles of various sizes. The water is clear, and the lighting is somewhat dim, typical of an underwater environment.

## Adam's Point West

- Mix of bed rock, boulder, cobble and gravel. Macrophyte species: *Vallisneria americana*, *Potamogeton crispus*, *P. diversifolius*, *P. zosteriformus*, *Myriophyllum sibiricum*, *Ruppia maritima*, *Callitriche* sp.
- Live and spent Dreissenid shells present



## Adam's Point East

- Sand substrate with abundant macrophyte cover (*Cladophora glomerata*, *Myriophyllum sibiricum*, *Potamogeton diversifolius*, *P. pectinatus*, *P. richardsonii*, *Vallisneria americana*)
- Dresseinids spent shells

An underwater photograph showing a diver's path marked by a yellow and black striped line. The seabed is covered in a dense layer of green algae, likely Cladophora glomerata. The water is clear and greenish. The diver's path starts from the bottom left and moves towards the top right, with a slight turn at the top.

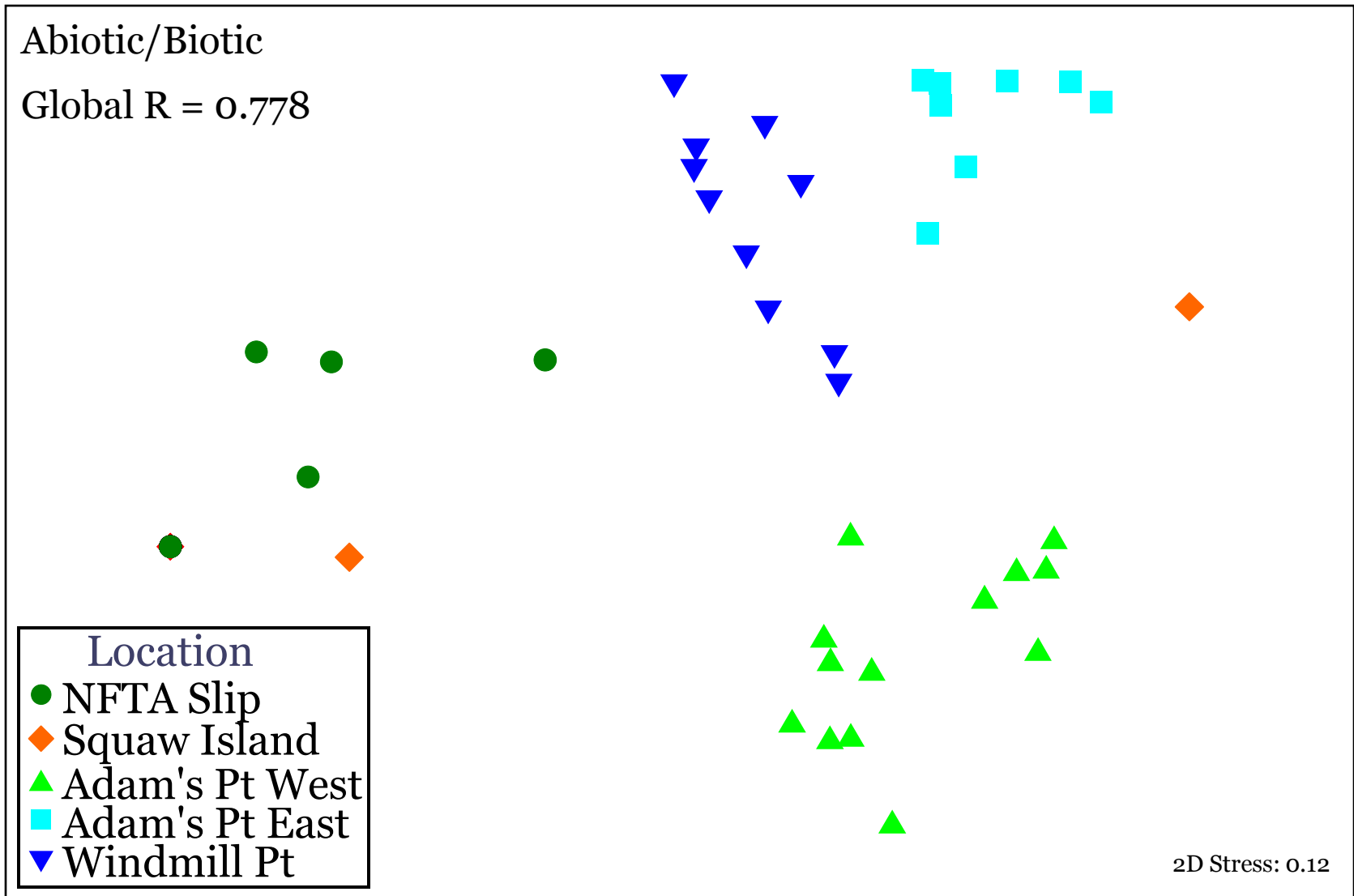
## Windmill Point

- Bedrock, boulder and cobble substrate covered with *Cladophora glomerata*
- Live Dreissenids present



# Preliminary results

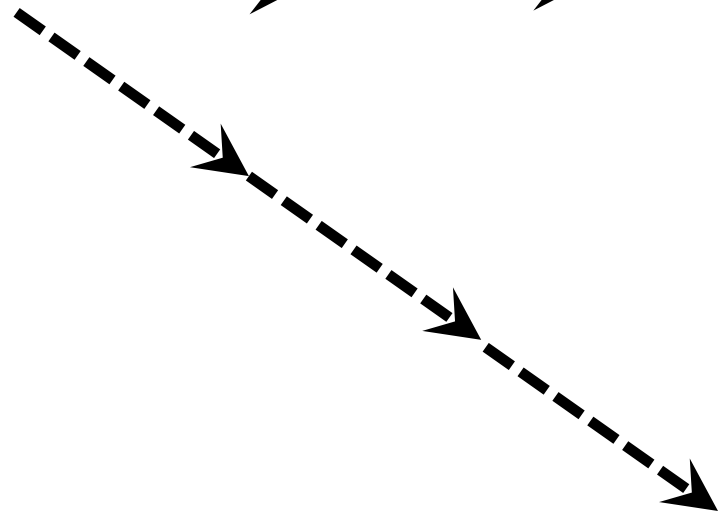
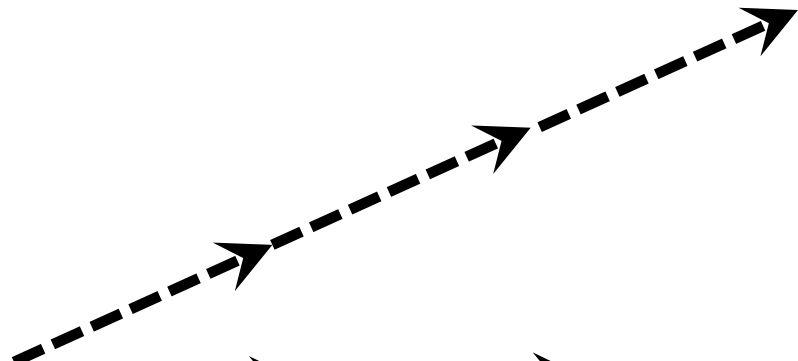
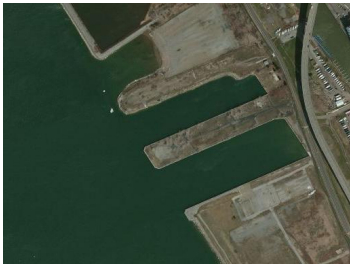
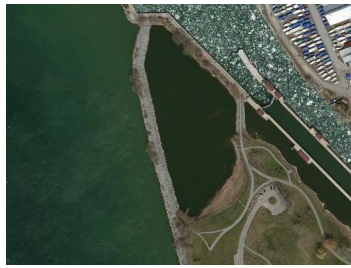
Resemblance: S17 Bray Curtis similarity



# Preliminary results

Resemblance: S17 Bray Curtis similarity

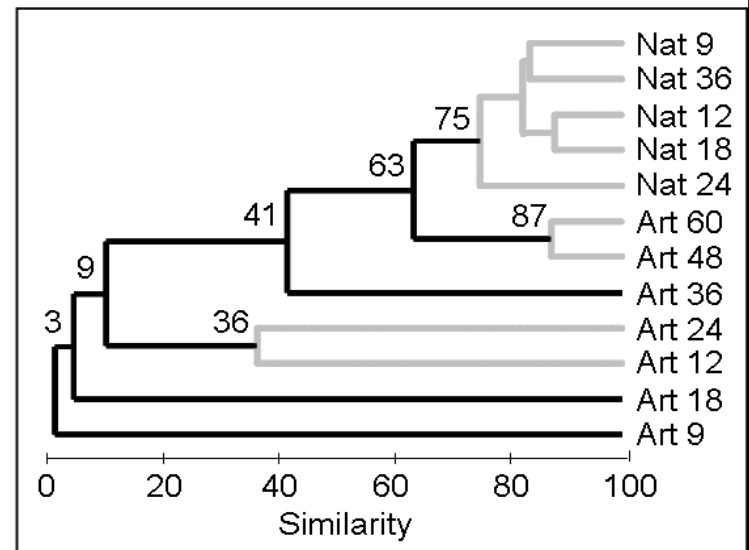
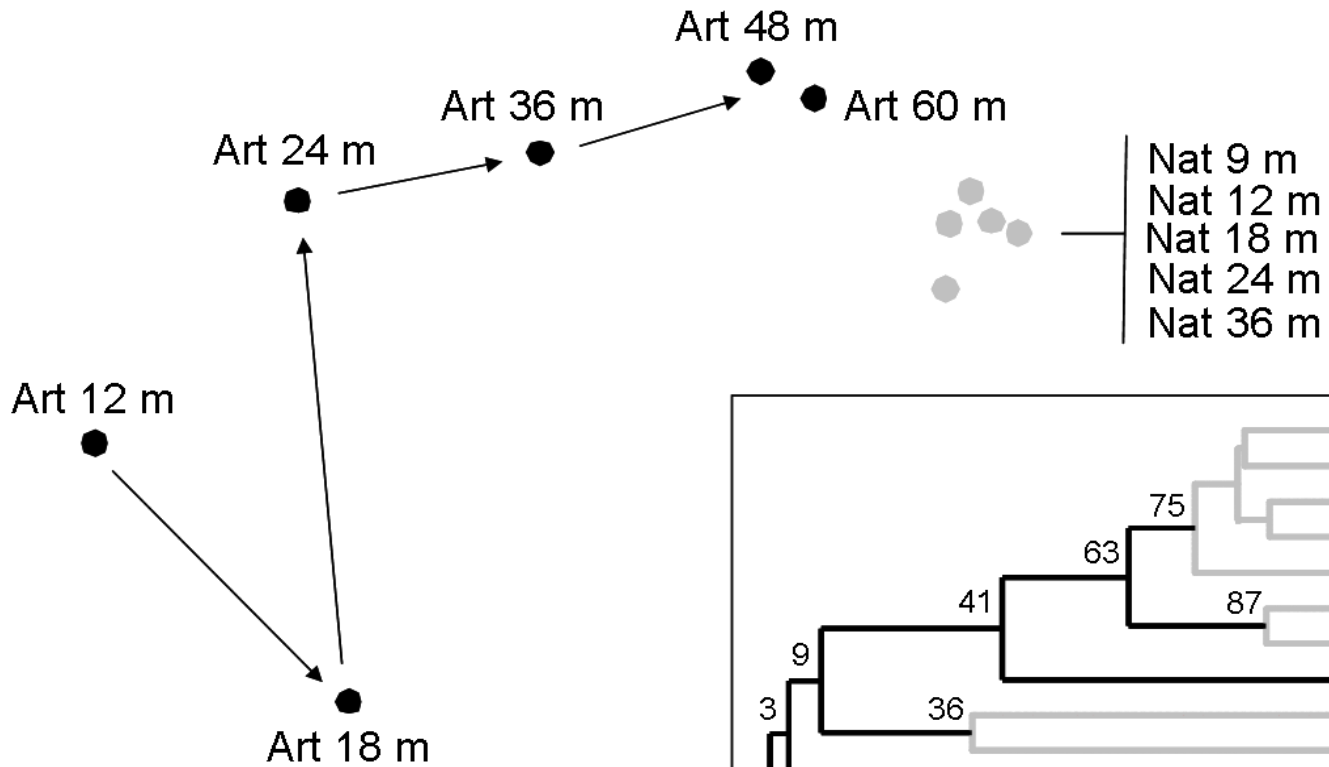
2D Stress: 0.1



- Location
- NFTA Slip
  - ◆ Squaw Island
  - ▲ Adam's Pt West
  - Adam's Pt East
  - ▼ Windmill Pt

Resemblance: S17 Bray Curtis similarity

2D Stress: 0.01



# Conclusion

- BEAGL has the sensitivity to detect differences between littoral benthic habitat types
- BEAGL can be a useful tool for assessing existing benthic habitat conditions and for monitoring benthic habitat changes over time

# Acknowledgements

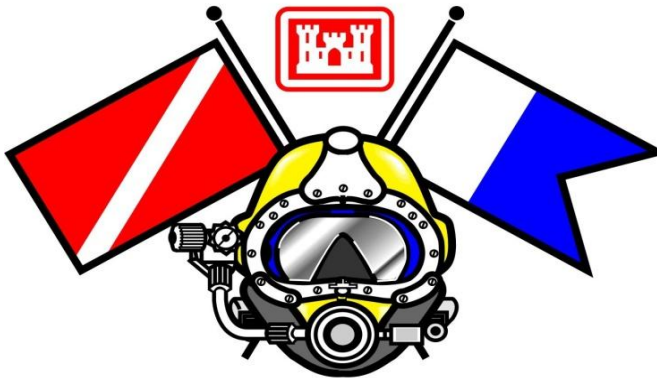
USACE - Buffalo District Dive Team

USACE - Buffalo District Environmental Analysis Team

USACE - Leadership Development Program

Dr. Matt Lybolt for development of Benthic Ecological Assessment for Marginal Reefs (BEAMR)

Captain Lance Hannes for support in the field



# Preliminary results

Resemblance: S17 Bray Curtis similarity

