

# USACE Green Breakwaters Demonstrate Engineering With Nature through Pilot Projects

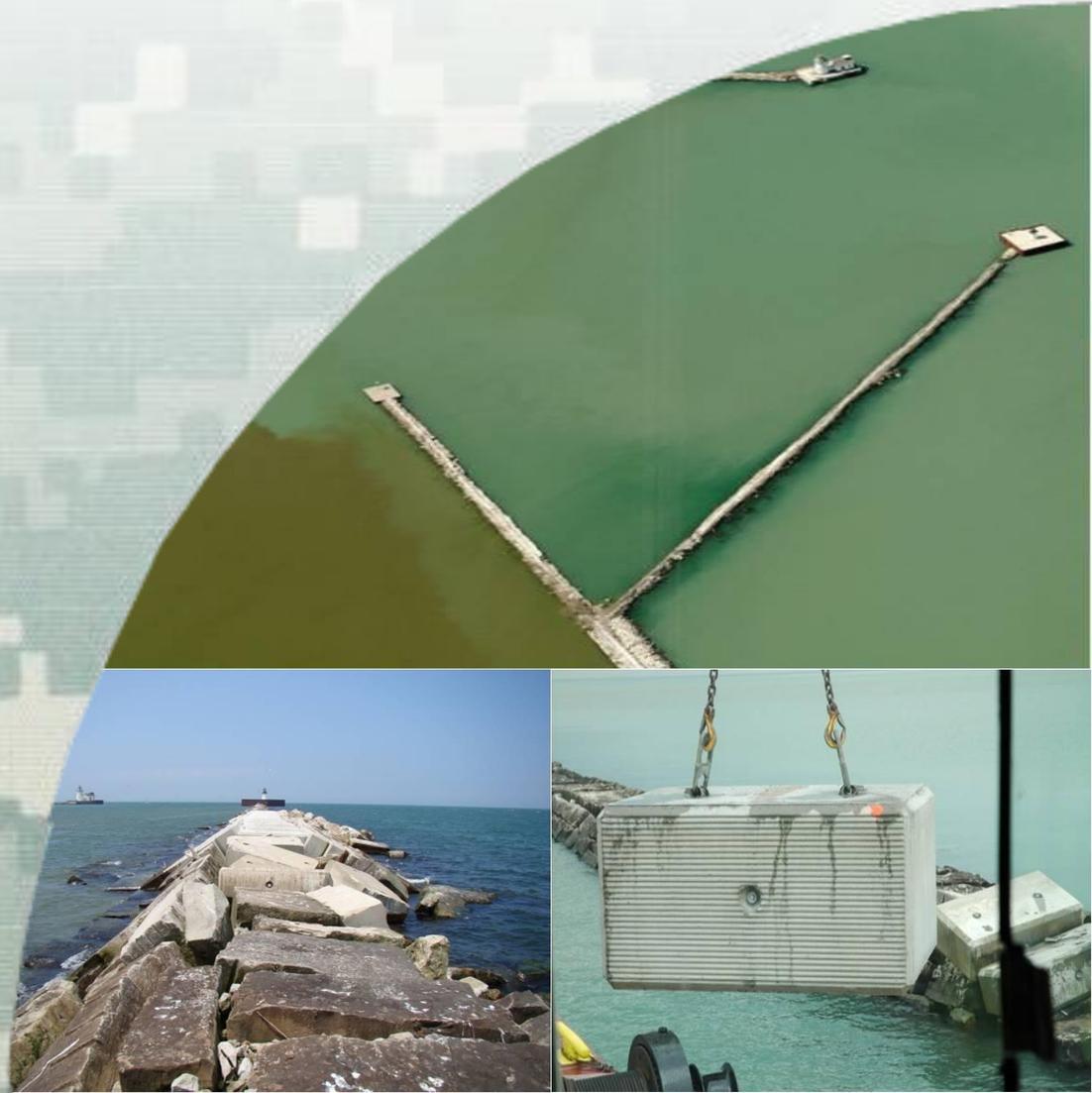
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31 March 2015

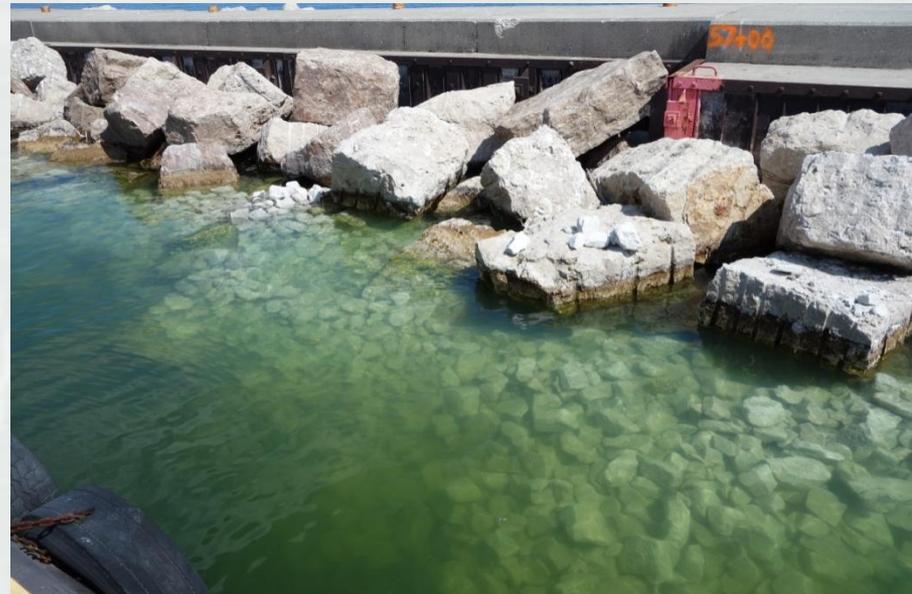


US Army Corps of Engineers  
**BUILDING STRONG**



# Great Lakes Green Breakwaters Study

- Evaluate alternatives for enhancing aquatic ecosystem benefits at existing breakwaters and navigation structures
- During routine repairs and maintenance, as part of modifications, or during comprehensive structural repairs and replacements
- Concept extends to shore protection structures, non-USACE structures



# Presentation Overview

- Cleveland & Ashtabula, OH Breakwater Invertebrate/Fish Habitat
- Ashtabula, OH Tern Nesting Habitat
- Milwaukee, WI Fish Spawning Habitat



# Cleveland East Arrowhead Breakwater Project

- Beyond indirect and unplanned habitat creation
- Modify design of featureless concrete toe blocks used for breakwater maintenance
- Provide features creating habitat opportunities for GL fish and other aquatic life
- Examines creation of habitat surfaces on toe blocks
  - Protected indented shelf
  - Dimpled block surface
  - Grooved block surface



# Deteriorating Breakwater



## Short Repair Section w/ Block



## 8' x 5' x 4' Repair Toe Block



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# Are there ways to improve biological value of blocks?





Control



Grooved



Dimpled

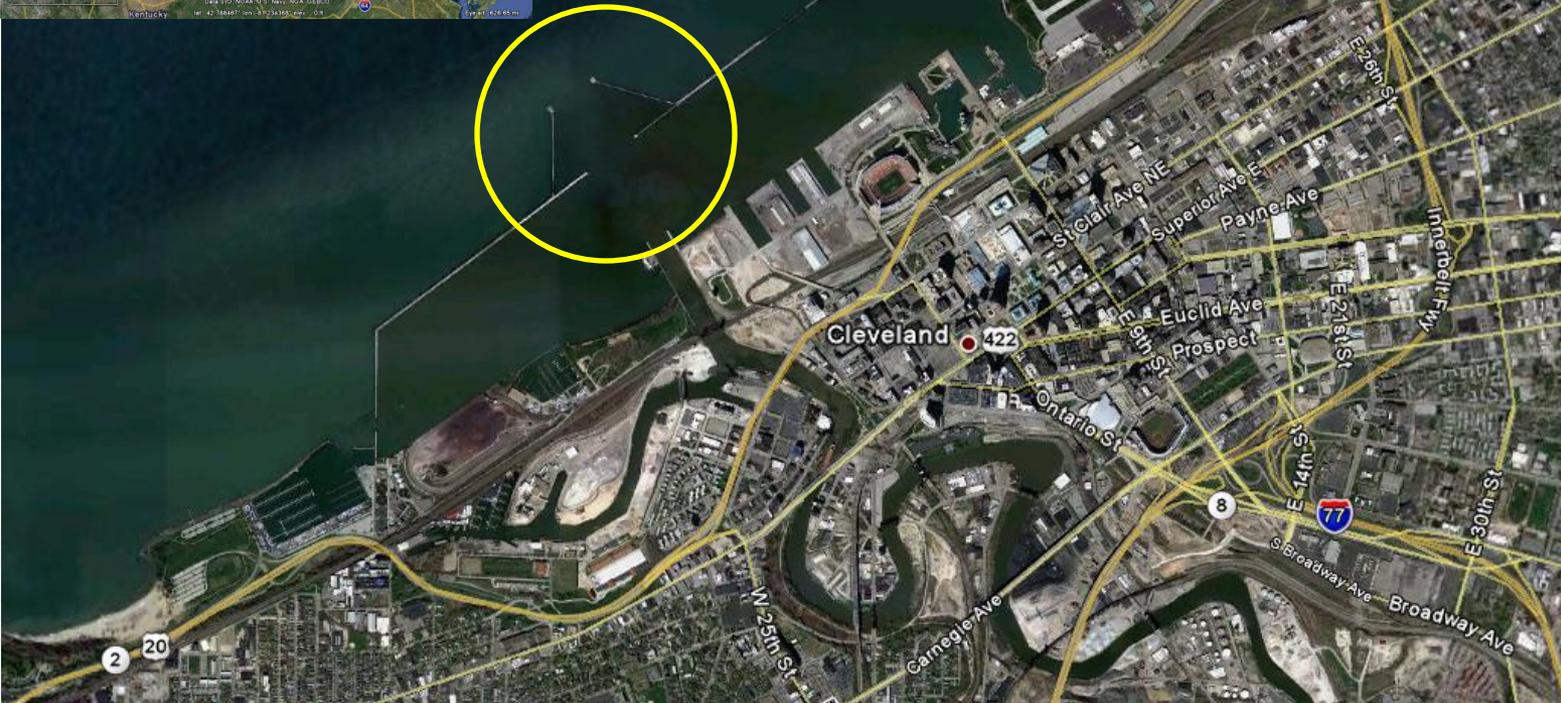
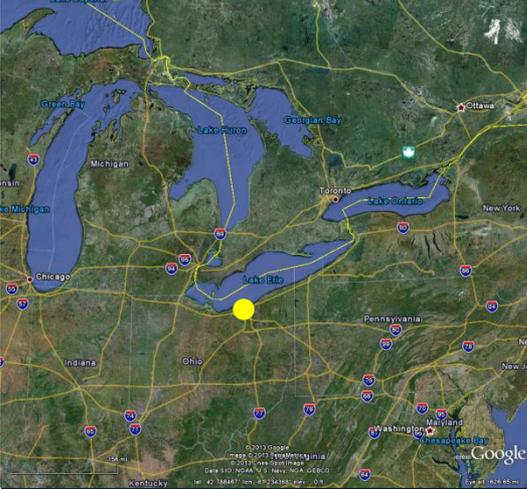


Grooved Shelf

# Texture Scale



# Cleveland Harbor Study Site



Cleveland  
East  
Arrowhead  
Breakwater –  
Lake Erie

Study Site



# Cleveland Project Schedule

- April/May 2012 – 13 toe blocks installed
- October 2012 – sampling
- April/May 2013 – 3 of the 2012 blocks reset – Hurricane Sandy repairs – no new toe blocks
- June 2013 – sampling
- October 2013 – sampling
- April/May 2014 – remaining 21 blocks set
- 2014/15 - data analysis & reporting



# Toe Block Layout



S – Shelf (5)  
D – Dimple (2)  
C – Control (3)  
G – Groove (3)

- A total of 34 blocks were set
- 2013 work was delayed due to necessary Hurricane Sandy repairs





Sampling Grid

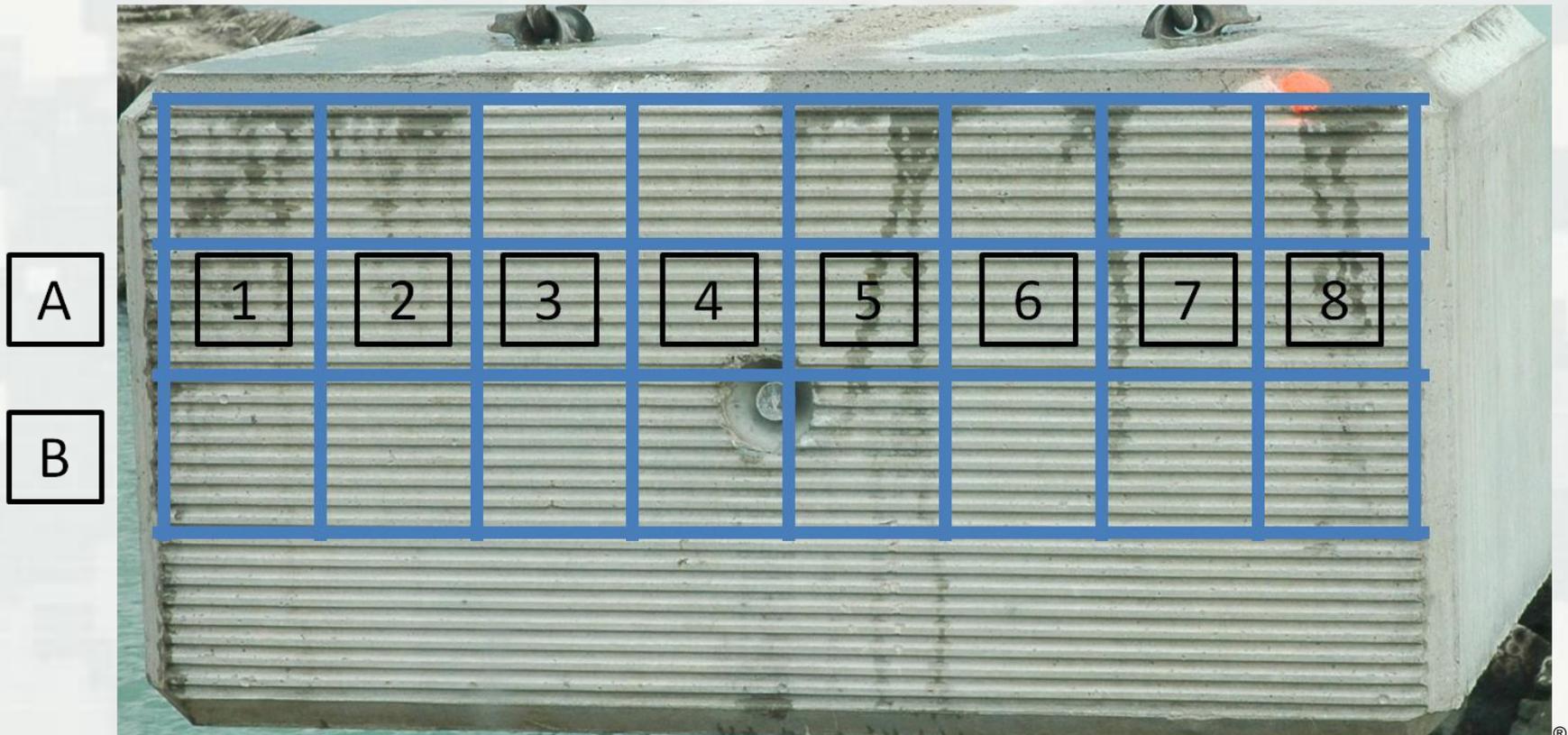


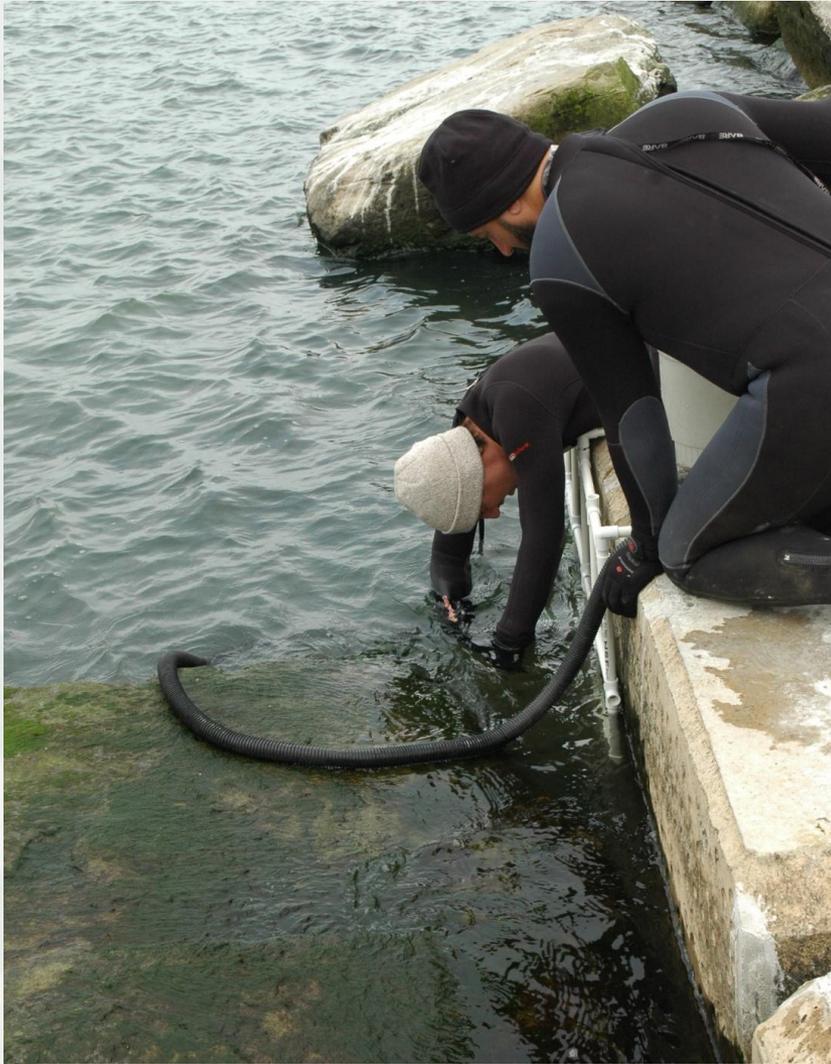
Sample Collector



# Sampling Grid

- Top row was not submerged





Sample Collection



Post-sampled Area

# Representative Samples



Control



Grooved

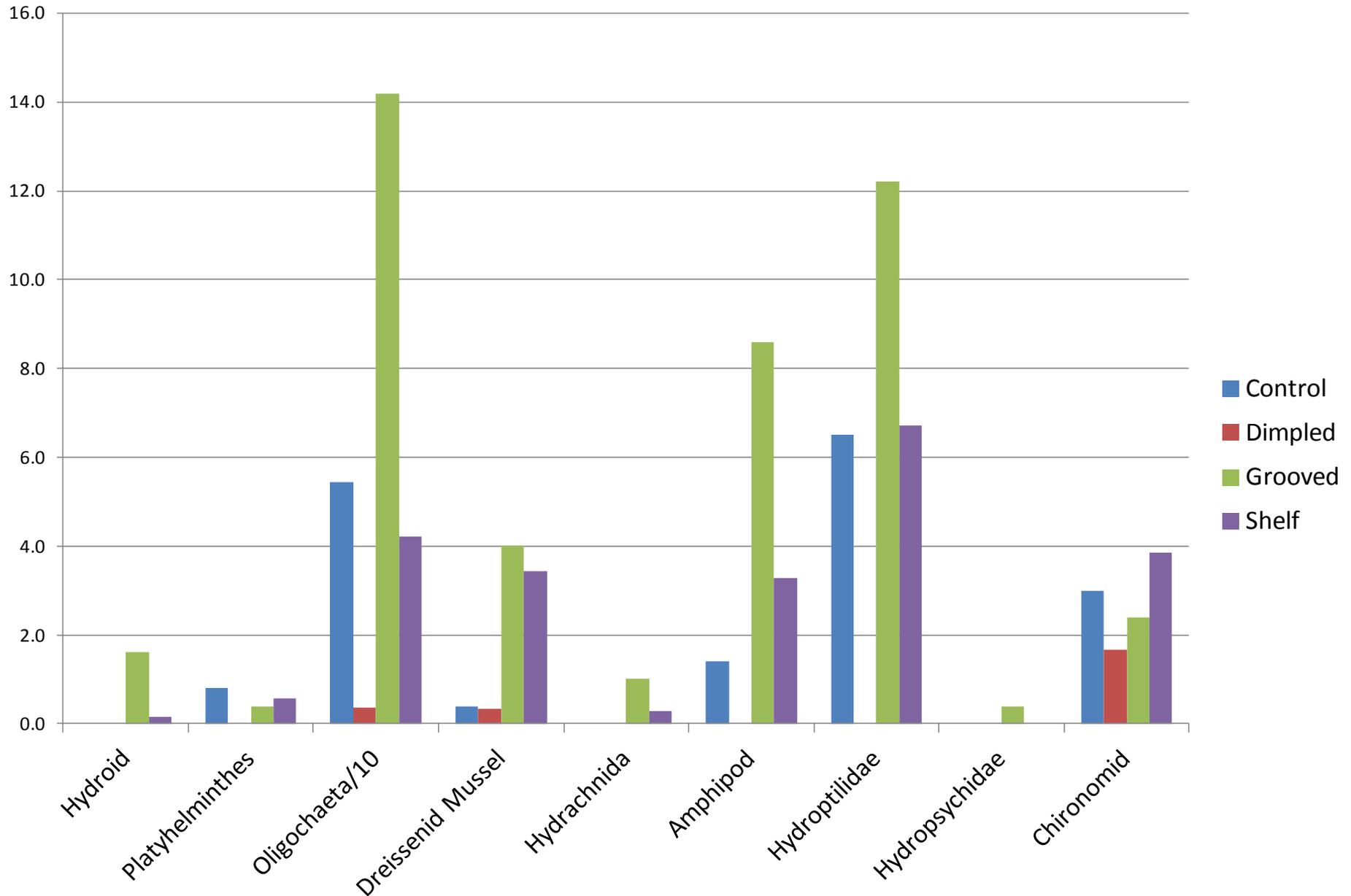


Dimpled



Grooved Shelf

# Preliminary Results – Abundance – October 2012



# What Have We Learned to Date?

- Initial colonization (Oct. 2012) greater for most groups on grooved blocks
  - Invertebrate secondary production increase
- Potential to provide juvenile fish refuge
- Awaiting sample processing and analysis from other monitoring events





# CERTIFICATE OF RECOGNITION

**PIANC**, the World Association for Waterborne Transport Infrastructure,

hereby grants the company

*US ACE*

the **"Certificate of Recognition"** for the project

(name) *"Cleveland Arrowhead Breakwater"*

(place/country) *United States*

developed following the **"Working with Nature"** philosophy as approved by the jury.

Brussels, *October 8, 2013* (date)

Louis Van Schel  
Secretary-General

Geoffroy Caude  
President