Incorporating EWN into Breakwaters and Other Hard Infrastructure

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US Army Corps of Engineers BUILDING STRONG_®





Presentation Overview

- Cleveland & Ashtabula, OH Breakwater Invertebrate/Fish Habitat/Low Vegetation
- Ashtabula, OH Tern Nesting Habitat
- Milwaukee, WI Fish Spawning Habitat
- St. Marys River, MI Multiple options





Great Lakes (GL) 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



Demonstration Projects - Approach

- Demonstrate potential improvements
- GL coastal structures during routine maintenance activities
- Simple design
 modifications to structural elements
- Potential to reduce environmental impairments within GL region





Cleveland East Arrowhead Breakwater

- 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



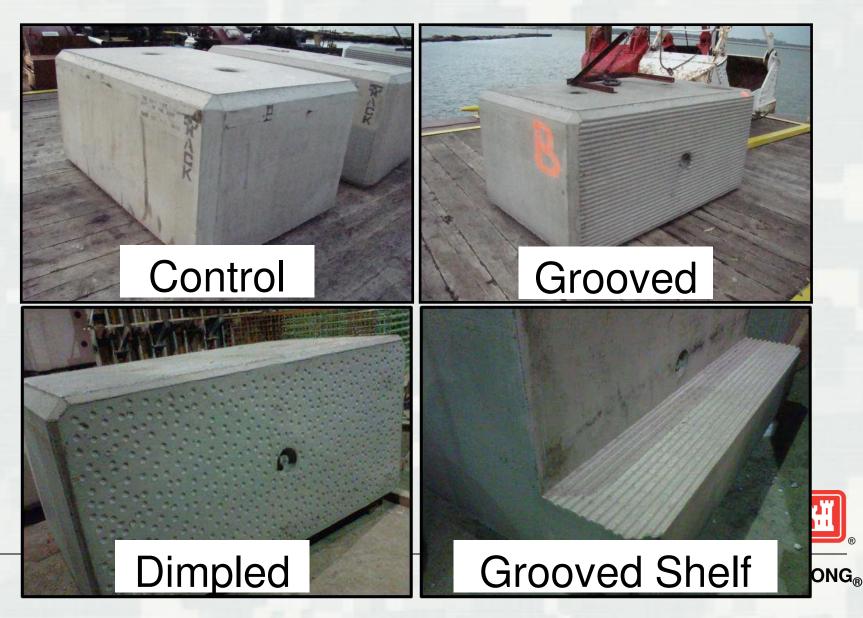


Study Site

Cleveland East Arrowhead Breakwater – Lake Erie

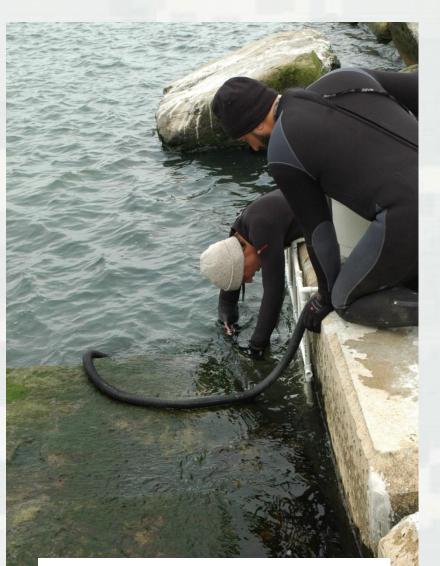


Cleveland & Ashtabula, OH



Sample Collection

Post-sampled Area

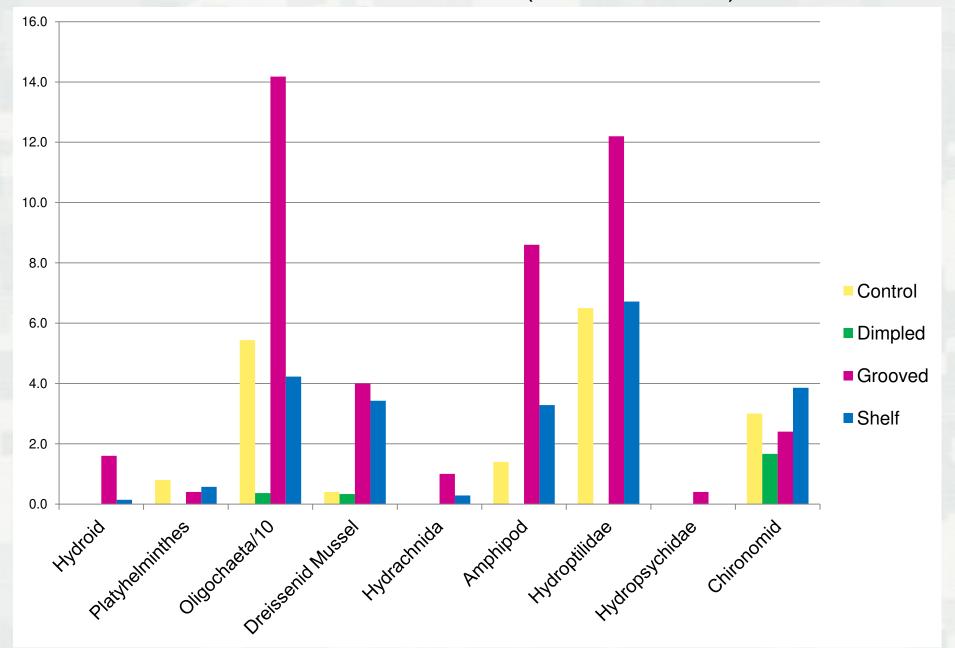


Schedule

	Cleveland
Construction	April 2012
Monitoring 1	October 2012
Monitoring 2	June 2013
Monitoring 3	October 2013
Monitoring 4	September 2014



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
- Extended monitoring?



Ashtabula Harbor Breakwater Project Tern Habitat

- Modify design of breakwater to create tern habitat during routine maintenance
- Habitat created using modified toe blocks
 - Nesting pea gravel
 - Predator/competitor exclusion grid
 - Side fencing
 - Chick shelters





Ashtabula Harbor -Lake Erie

Study Site

© 2013 Google

Imagery Date: 4/5/2012

Lat 41.912231° lon -80.792287° elev 0 ft

Eye alt 8642 ft

W1

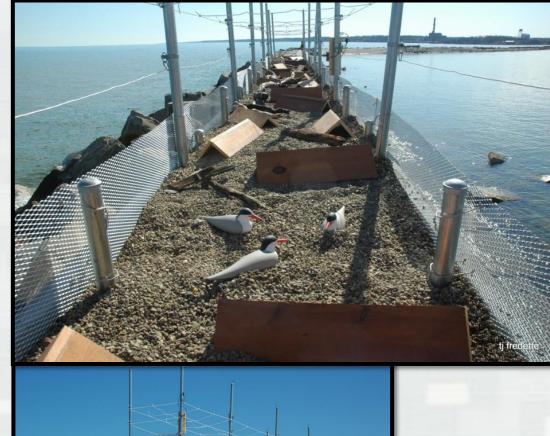
Google RONG®

Ashtabula Harbor Tern Habitat Construction



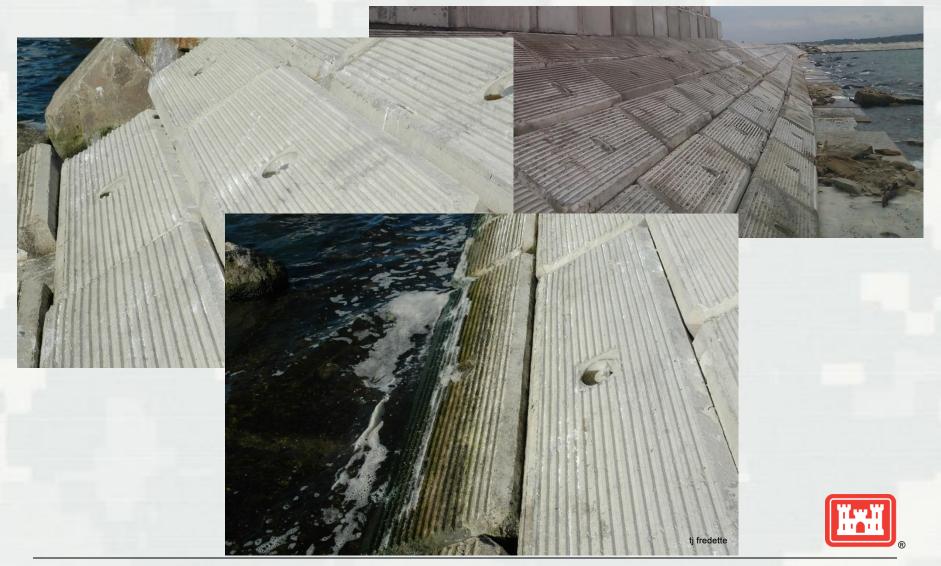
Ashtabula Harbor Breakwater Project Status

- Winter ice conditions delayed installation of decoys, tern call box, predator cable grid, and shelters until late April
- Site discovery and colony establishment could take 2-3 years
- Tern monitoring ongoing
- Habitat size doubled during Phase 2 (Sept. 2014) to sixteen blocks further increasing the chances of success





Ashtabula Harbor Slope Blocks Low-Growing Vegetated Plant Potential

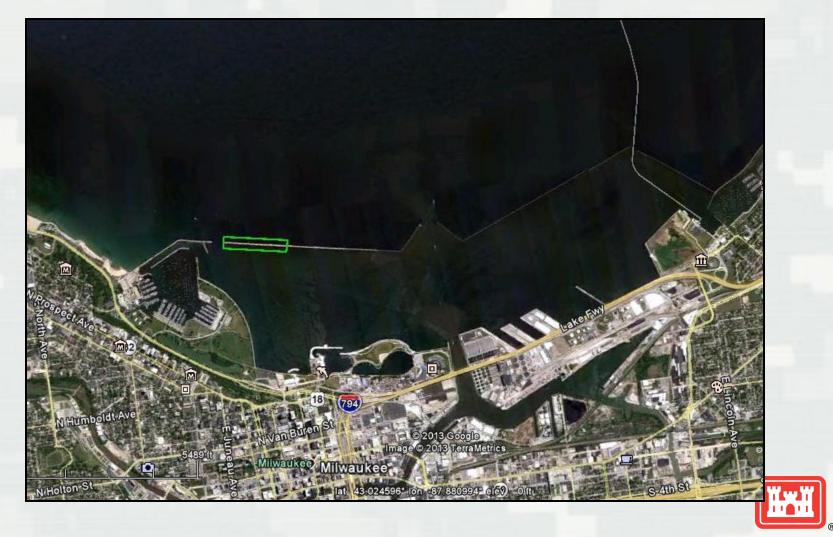


Milwaukee Harbor Project Approach

- Modify design of rubble mound breakwater during maintenance
- Create spawning bed for fish such as walleye and smallmouth bass
- Habitat for forage species
- Modifications
 - Smaller stone size (lee/harbor side)
 - Gentler sloping shelf



Milwaukee Harbor, WI Lake Michigan



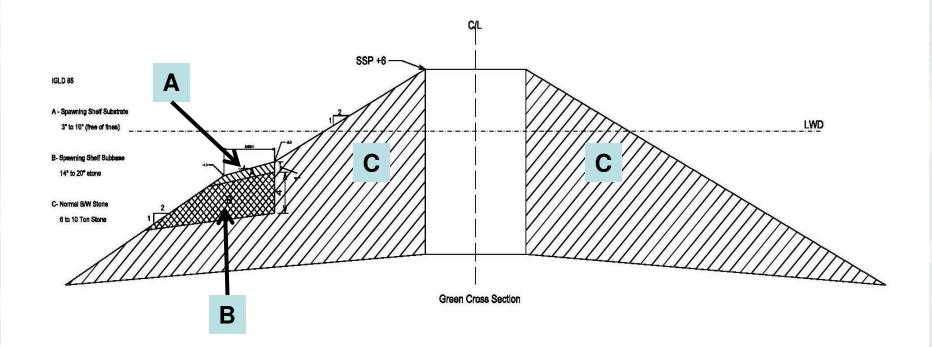
Fish Spawning Bed Location

500' demonstration section Spring 2014 construction





Modified Rubble Mound Breakwater Fish Spawning Shelf



- A Spawning Shelf Substrate: 4-8" stone free of fines
- B Spawning Shelf Sub-base: 8-18" stone
- C Normal B/W Stone: 6-10 ton stone



Post Construction Monitoring

CS 61+00



Visual Confirmation



Smallmouth Bass



Crawfish



St Marys River, MI





Path Forward

- Seek opportunities to conduct demonstrations or full scale projects with partners
- Assess and report

 on benefits and
 realized ecosystem
 goods and services
- Lessons learned adaptively manage
- Fully communicate with partners, academia, and public

