



RECONNECTING WITH OUR GREAT LAKE'S COAST

MAKING LAKE ERIE SHORELINES MORE FISH FRIENDLY

by Casey Yanos, Marty Simonson, Jason Fischer and Holly Embke



WHY ARE SHORE ZONES IMPORTANT?

Shore zones consist of shallow water nearshore areas (< 9 ft.) and adjacent shore areas along Lake Erie that provide important habitat for fish and wildlife. These areas support the food sources young fish need to develop and provide cover from predatory fish. Popular sport fish (e.g., bass and panfish) and other adult fishes feed on the prey fish that use these areas. Migratory waterfowl and other birds often use these areas to feed and nest. Shore zones also provide a smooth transition from land to water, which is important for many wildlife species, such as turtles.

WHAT IS SHORELINE ARMORING?

The Great Lakes region is the third most populated coastal region in the United States with greater than 46 million people in 2016. These high population densities and associated development can play a large role in degrading ecologically and economically important coastlines of the Great Lakes. Development contributes to and often accelerates natural shoreline erosion processes, furthering negative effects. People use armor stone or seawalls, called armoring, to reduce erosion. Ohio has one of the most extensively developed shorelines in the Great Lakes with armoring along approximately 60-95% of the Lake Erie coastline, depending on the county.

OHIO'S MOST COMMON ARMORING TYPES



REVETMENTS ARE BUILT OF STONE THAT VARIES FROM THE SIZE OF A SUITCASE TO THE SIZE OF A CAR. THESE BOULDERS ARE LAID ALONG THE SHORE ABOVE AND BELOW THE WATER. PHOTO CREDIT: PRABHA RUPASINGHE, BGSU



SEAWALLS AND BULKHEADS ARE RETAINING WALLS THAT STABILIZE THE SHORE AND PROVIDE ACCESS TO THE WATER FROM THE SHORE. PHOTO CREDIT: U.S. ARMY CORPS OF ENGINEERS GREAT LAKES OBLIQUE IMAGERY (GREATLAKES.USACE.ARMY.MIL)

HOW DOES ARMORING IMPACT FISH AND WILDLIFE?

An unaltered shoreline with vegetation, shown on the left in the photo below, is a functionally different ecosystem than the non-vegetated, armored shoreline shown on the right.



Lake Erie at Oregon, Ohio. Photo Credit: Rachel Johnson, University of Toledo

Research has shown that areas with armoring often have more predators and invasive species present than areas with natural shorelines. To minimize these effects and make the shorelines more fish friendly, landowners can do many things to transition toward “softer” shorelines that both reduce erosion and provide fish and wildlife habitat. These shorelines, called nature-based (or living) shorelines, combine structures with vegetation and other natural objects like logs and coarse woody debris.

HOW FISH COMMUNITIES CHANGE WITH LEVELS OF ARMORING

Vertical structures like seawalls and bulkheads have no shallow zones, no vegetation, and they reflect most of the wave energy (like a trampoline) which creates turbulent zones that make it hard for fish to swim.

Where are all the fish?



Non-native and invasive species begin to dominate the fish community. Carp, Gizzard Shad, and other undesirable species.

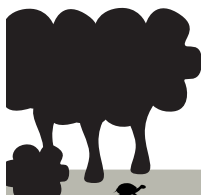
Where's the wildlife?



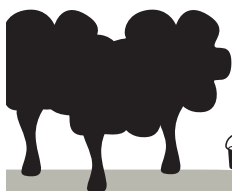
Armor stone reduces erosion but fills in shallow zones and alters the environment.

Adding armor stone squeezes the nearshore zone; it eliminates some shallow water where many species reproduce and small fish are protected from predators.

Look, fish and wildlife!



Allowing plants to grow around armor stone leads to the highest number of species, including popular sport fish species.



Plants protect the shore from erosion and create habitat for wildlife.



Plants provide cover and protection for young fish.

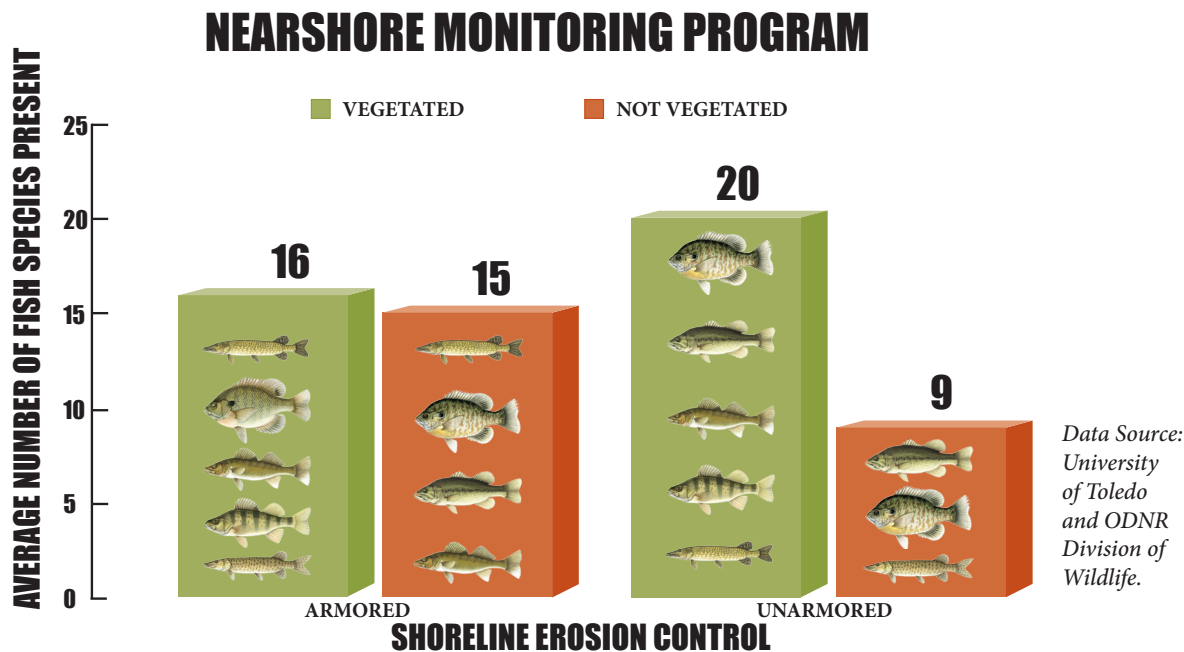
Predators are excluded from the shallow areas.

The slope of a natural shoreline helps disperse wave energy, while plants reduce erosion.

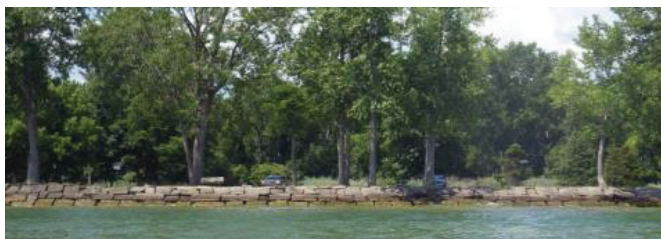
Most to least armored = poorest to best habitat

LAKE ERIE COASTAL FISH MONITORING PROGRAM: RESEARCH SHOWS LAKE ERIE COASTAL FISH COMMUNITIES DIFFER WITH SHORELINE ARMORING AND VEGETATION

The Ohio DNR Division of Wildlife and Office of Coastal Management are working in conjunction with The University of Toledo and Bowling Green State University to develop a long-term evaluation of the coastal fish community using yearly monitoring in Lake Erie's Western and, more recently, Central Basins. Data from the Western Basin appear to show a trend indicating that shoreline structure and vegetation influences the Lake Erie fish community. At unarmored shorelines, vegetation doubles the amount of species present, suggesting that the fish community suffers when natural shoreline plants are removed (see figure below). Future work with BGSU will provide a more detailed analysis of coastal development, which will help to further identify which shorelines provide more suitable habitat for the nearshore fish community.



Armored shoreline with (top) and without (bottom) vegetation



Unarmored shoreline with (top) and without (bottom) vegetation



HEALTHY SHORELINES ARE PROFITABLE SHORELINES

Every year recreational anglers and birders take advantage of coastal areas and contribute to local economies by purchasing food, supplies, and lodging. We can do many things to improve the availability and quality of these habitats. In the future, development and maintenance of existing shorelines should consider nature-based techniques that provide protection from erosion while maintaining a healthy coastal areas.

PIERCING THE ARMOR: ALTERNATIVES TO TRADITIONAL SHORELINE ARMORING

Examples of fish-friendly alternatives to shoreline erosion control

METHOD	PRESERVING NATURAL SHORELINE	PLANTING ALONG SHORELINE	ADDING NATURAL FEATURES
PHOTO	 <i>Lake Erie at Marblehead Peninsula. Photo Credit: Prabha Rupasinghe, BGSU.</i>	 <i>Old Woman Creek National Estuarine Research Reserve. Photo Credit: Prabha Rupasinghe, BGSU.</i>	 <i>Lake Erie at Toledo: Bay View Park. Photo Credit: Prabha Rupasinghe, BGSU.</i>
COST (LABOR AND MATERIALS)	LOW	MEDIUM	HIGH
ACTIONS	• Limit mowing and plant removal along shore • Leave a wide strip of native plants along shore • Trim plants back only if absolutely necessary	• Plant native plants with various root depths along shoreline • Plant emergent and floating-leaf vegetation • Native, rooted plants help stabilize the soil	• Combine plants and other natural structures like logs and brush bundles with artificial armoring structures that can withstand wave energy • Leave driftwood that accumulates along shoreline
BENEFITS	• Prevents pollution from entering the lake • Prevents erosion from rain, wind, wave, and ice • Provides food and habitat for fish and wildlife	• Native plants re-establish quickly after storms • Accelerates shoreline stabilization • Low-growing shrubs will not block views of the lake	• Creates natural appearance for fish and wildlife • Long-term, sustainable stabilization • Adaptable to changing water levels

WHAT IS A NATURE-BASED OR “LIVING” SHORELINE?

BEFORE



AFTER



St. Clair River, MI (photo credits: left – EA Engineering, Science and Technology; right – USGS Great Lakes Science Center)



Shoreline Park, Sandusky, OH (photo credit: left – Erie Conservation District; right – ODNR Office of Coastal Management)



Chicago Botanical Gardens, Chicago, IL (photo credit: Chicago Botanical Society)

More information on these and other nature-based shoreline projects can be found at the following sources:

Friends of the St. Clair River: <http://scriver.org/st-clair-river-projects/>

Erie Conservation District: <http://erieconserves.org/our-lake/shoreline-erosion/>

Chicago Botanical Garden: <http://www.chicagobotanic.org/shoreline>

Huron River Watershed Council: <http://www.hrwc.org/take-action/waterfront-wise/>

Center for Coastal Resources Management: <http://ccrm.vims.edu/livingshorelines/>

ABOUT THE AUTHORS

Casey Yanos, Marty Simonson, Jason Fischer and Holly Embke were graduate students in the Department of Environmental Sciences at The University of Toledo, and developed this bulletin as part of a science communications class. Working out of UT's Lake Erie Center, each student used their passion for the Great Lakes to research different aspects of Lake Erie fish ecology by using a combination of field research and statistical modelling.

IMPORTANT CONTACTS AND RESOURCES

Description (from agency websites):

OHIO DEPARTMENT OF NATURAL RESOURCES OFFICE OF COASTAL MANAGEMENT

Web: <http://coastal.ohiodnr.gov>

Phone: (419) 626-7980

The Office administers the federally approved Ohio Coastal Management Program, which sets forth policies and guidelines to monitor activities that impact coastal resources and ensure resource protection while balancing economic, cultural and environmental interests.

OHIO DEPARTMENT OF NATURAL RESOURCES OFFICE OF COASTAL MANAGEMENT LAKE ERIE SHORE EROSION MANAGEMENT PLAN

Web: <http://coastal.ohiodnr.gov/erosion>

Phone: (419) 626-7980

The Lake Erie Shore Erosion Management Plan (LESEMP) is being developed as part of an on-going effort to assist property owners along Ohio's Lake Erie coast by providing free technical assistance to address erosion issues. The LESEMP aims to promote successful erosion control based on regional site conditions.

UNITED STATES ARMY CORPS OF ENGINEERS GREAT LAKES AND OHIO RIVER DIVISION: BUFFALO DISTRICT

Web: <http://www.lrb.usace.army.mil/>

Phone: 1-800-833-6390 (option 3)

The Corps of Engineers regulates activities involving dredging, excavation, placement of fill, or construction of certain structures in waterways and wetlands of the United States, including the Great Lakes and its tributaries.

OHIO DEPARTMENT OF AGRICULTURE DIVISION OF SOIL AND WATER CONSERVATION

Web: <http://www.agri.ohio.gov/divs/SWC/SWC.aspx>

Phone: (614) 265-6610

Provides leadership and services that enable Ohioans to conserve, protect, and enhance soil, water, and land resources. The Ohio DSWC strives to be a leader in soil and water resource management by providing high quality public service.

UNITES STATES GEOLOGICAL SURVEY GREAT LAKES SCIENCE CENTER

Web: <http://www.glsc.usgs.gov/coastal-ecosystems>

Phone: (419) 625-1976

Resources on Great Lakes coastal research including wetland quality, harmful algae blooms, and western Lake Erie. Also contains information on lake levels, invasive species, restoration projects, and publications.

GLOSSARY

ARMORING:

Armoring describes erosion control methods that add artificial structure (often armor stone or concrete seawalls) to the shoreline to withstand wave energy and stop sediment loss.

SEAWALL:

Seawalls and bulkheads, are vertical structures that serve as retaining walls along the shoreline.

SHORE ZONE:

The shore zone is the interface between land and water, extending from land to water that is less than 9 feet deep.

EROSION:

Erosion is a natural process where physical energy (wind and water) transports sediment to different places along the coast.

NATURE-BASED SHORELINES:

Nature-based Shorelines consist of native plants used to soften the transition of our developed land into the coastal environment. Native plants help to protect the shore from erosion, provide essential habitat, and aid in the management of undesirable wildlife.

NEARSHORE ZONE:

The shallow area of lakes that extends from land to about 9 feet deep.

ARMOR STONE:

Quarry stone (e.g., sandstone, limestone) positioned such that the rocks are interlocking to reduce wave energy. Stones can range from basketball-sized to car-sized.



OLD WOMAN CREEK NATIONAL ESTUARINE RESEARCH RESERVE

Old Woman Creek National Estuarine Research Reserve (OWCNERR) is managed as a cooperative partnership between the Ohio Department of Natural Resources Division of Wildlife and the National Oceanic and Atmospheric Administration (NOAA). OWCNERR is one of 28 coastal reserves connected nationally through NOAA to address state and regional coastal management needs through research, education, and stewardship. The National Estuarine Research Reserve System uses its network of living laboratories to help understand and find solutions to crucial issues facing America's coastal communities.

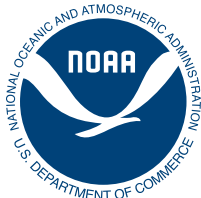
The mission of OWCNERR is to improve the understanding, stewardship, and appreciation of Great Lakes estuaries and coastal wetland ecosystems. Integrated Reserve research, education, and stewardship programs address threats to Great Lakes coastal wetland ecosystems including nonpoint source pollution, aquatic invasive species, habitat loss, and climate change. OWCNERR provides laboratories for ecological research and education and training to support decisions and actions that benefit Lake Erie ecosystems.

OWCNERR publishes the OWCNERR Technical Bulletin series to provide constituents with information derived from Great Lakes coastal research, management, education, and outreach projects conducted in partnership with and/or at OWCNERR.

Frank Lopez, *Manager*

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The Old Woman Creek National Estuarine Research Reserve is part of the National Estuarine Research Reserve System, (NERRS), established by Section 315 of the Coastal Zone Management Act, as amended. Additional information about the system can be obtained from the National Ocean Service Office for Coastal Management, National Oceanic and Atmospheric Administration, US Department of Commerce, 1305 East West Highway – N/ORM5, Silver Spring, MD 20910.



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