

BAIRD.COM

Introduction

Sediment movement along Great Lakes shorelines has created a diverse array of habitats, from sand beaches to embayments and wetlands. The development and degradation of these environments is affected by the availability or scarcity of the sediments which build the landforms along the coastline, which in turn exert physical controls on ecosystem functionality.

Understanding sediment movement through the nearshore zone aids in interpreting the evolution of coastal landforms. The landforms are habitat in their own right, and they exert physical controls on other habitats in their vicinity. Nearshore sediment movement can be linked to changes in habitat or ecosystem functionality. If the historic changes in sediment sources and sinks can be determined, they can be linked to ecosystem enhancement or degradation along the shoreline.

Study Goals

- Understand sediment pathways along south shore of Lake Ontario
- Identify sediment sources and sinks
- Determine magnitude and direction of transport processes
- Understand historic and likely future transport patterns
- Determine impact of human modification on nearshore sediment supply
- Develop linkages between changes in supply, transport, and deposition of sediments within the coastal zone and overall nearshore ecosystem health

Background

Sediment Sources and sinks: Past Studies:



- Kemp and Harper (1976) Focus on fine grained sediments and offshore deposition
- Morang et al. (2012) Sediment budget using GIS-based approach to examine changes in shoreline, beach volume, and longshore transport (Lake Michigan)
- (Woodrow et al., 2002) Summary of sediment distribution and shoreline evolution of eastern Lake Ontario
- IJC (Baird, 2006) Data for bathymetry, topography, historical recession rates, shoreline geology, and parcel level shore protection

mp, A. L. W., and N. S. Harper, 1976, Sedimentation Rates and a Sediment Budget for Lake Ontario, Journal of Great Lakes Research, v. 2, no. 2, p. 324-34 patterns and management implications for eastern Lake Ontario." Prepared for the Nature Conservancy

A Sand Budget for the Southwest Shore of Lake Ontario

Alex Brunton¹, Amanda Stone^{2*}, Peter Zuzek¹, Joshua Friedman¹, Craig Forgette³ ¹W.F. Baird and Associates, Oakville, ON, Canada; ²W.F. Baird and Associates, Madison, WI, USA; *Presenting author; ³U.S. Army Corps of Engineers Buffalo District, Buffalo, NY, USA

Study Area and Methodology

ake Ontario South Shore Harbors

Results and Conclusions



Littoral cells define a complete cycle of sediment from source to transport pathways, to sinks. A typical coastal area can be divided into a series of littoral cells, allowing for shoreline management planning at the scale at which sediment transport processes operate.

or the Indiana Shore from Michigan City Harbor to Burr ment Center, Coastal and Hydraulics Laboratory, Vicksburg, Mississippi. OSTS): Final report on sediment transpor

e IJC database with further data UMERICAL MODELING

- ake potential and supply-limited sediment ort model runs
- nine magnitude and directionality of sed ort in study area
- ne littoral cell divisions where necessary

RICAL SEDIMENT BUDGET CONSTRUCTION

- ine shoreline recession inputs
- ine nearshore downcutting inputs
- e sediment through study area
- nine sinks in fillet beaches
- mine harbor trapping
- mine inputs from offshore
- truct sediment budgets
- uce visualization of budgets

ETAILED ANALYSIS OF SELECTED AREAS

- ment budget to evolution of study site
- te further data sources in support of findings
- nges in ecological functionality of the nearshore

$X \vee \land \land X \times \land \land \land X \vee \land$		
Scenario Name	Shore Protection	Harbors
Pre-1800	None	None
Pre-1950	50% of existing	5/8 (reflecting 1950 condition)
Existing	As observed	As observed
Future - 10%	10% more than existing	As observed
Future - 20%	20% more than existing	As observed

fistorical scenarios estimate how the sediment budget evolved with time, and future scenariosexaminedtheinfluence of ongoing shore protection construction.

shore of Lake Ontario. Several sediment budget scenarios were applied to better understand nearshore sediment movement in historic conditions and under potential future management scenarios. By linking this knowledge in with historic observations of coastal ecosystem change under changing management, we can better understand anthropogenic and natural influences on important coastal ecosystems and make more informed decisions moving forward to protect critical coastal habitat.



The sediment budget for existing The sediment budget for the future conditions for the eastern portion scenario with 20% more shore of the study area shows that bluff protection shows a 21 % reduction recession is the major source of in sediment transport. sediment, with a minor contribution from lakebed downcutting.



Braddock Bay - Sediment Budgets and Ecosystem Health

Regional nearshore sediment budgets were constructed for this study Sediment movement through Braddock Bay explains coastal landform evolution. to identify sources, sinks, and transport of sediment along the southern Contemporary and historic sediment budgets show that human modification of the shoreline has reduced the amount of sediment available to support shoreline ecosystems, and these modifications have largely resulted from shore protection activities. Harbors have played a secondary role in modifying nearshore sand transport. Reduction in sediment supply was a key factor in the degradation of the barrier beach-lagoon complex.

Pre- and mid- development scenarios have larger bluff recession inputs due to lower shore protection. With increasing shore protection under existing and future scenarios, overall sediment supply decreases.







This study was funded by an award under the Great Lakes Restoration Initiative to the USACE Buffalo Distri