# Use of High Resolution Bathymetry and Backscatter for Mapping Depositional Environments on the New Hampshire Continental Shelf



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### **Overarching Goals of Research Program**

- Further the Understanding of the Geology of Western Gulf of Maine
  - Quaternary Geology
  - Depositional Environments
  - Controlling Processes
- Further the Understanding of the Relationship Between Seafloor Geology and Habitats
- Delineate and Verify Sand and Gravel Resources on the NH Shelf
  - Partnering with NHGS and BOEM
- Develop Sand Resource Needs Assessment of the New Hampshire Coast
  - Partnering with NHGS and BOEM
- Improve Bottom Characterization Ability



## **Rational for Sand and Gravel Studies**

- Due to Climate Change Many Coastal Areas Will Be Exposed to Increased Coastal Flooding and Erosion

   Need to Increase Coastal Resiliency
- A Likely Management Strategy will be to Maintain the Beaches as long as Possible by Sand Nourishment
- Therefore, Need to Identify Sources of Sand Now
  - For Immediate Use in Some Locations
  - For Future Use in Others (i.e., New Hampshire)



## Our Approach

- Develop High Resolution Bathymetric and Backscatter Maps of the NH and Vicinity Shelf
- Locate and Verify Previously Mapped Sand and Gravel Deposits on NH Shelf
  - Location
  - Thickness
- Merge the Database To Develop Seafloor Geology Maps
  - Surficial Sediments
  - Morphology
  - Sand Deposits





# High Resolution Bathymetric Maps

- Shows Bathymetry at the 4 to 8 m Gridding
- New Bathymetry Added as it Becomes Available
- Backscatter Added as it Becomes Available
- Can Serve as Base for Other Data Sets (Jeffreys Ledge)
- Available via
   CCOM/JHC Web
   Site



http://ccom.unh.edu/gis/FlexViewer3.7/GoM/index.html?config=config-JL.xml



#### Multibeam Echosounder Surveys Incorporated into WGOM Synthesis (to Date)

MBES Bathymetric Database

Backscatter Database Recently Obtained and Processing Initiated



# Value of MBES Bathymetry



Other Databases Included With Bathymetric Maps: (Jeffreys Ledge Sediments)



#### Jeffreys Ledge Grab Samples Textural Group (from\_Gradistat Muddy Sandy Gravel Textural Abbrev msG Sediment Name Muddy Sandy Coarse (from\_Gradistat Gravel Sediment Name Muddy Sandy Pebble (Wentworth) Sediment Name Muddy Sandy Pebble (Wentworth) Sediment Name Muddy Sandy Pebble (Wentworth) Sorting (from Very Poorly Sorted

Zoom to

		×
Jeffreys Ledge Grab Samples		
Modes	Bimodal	0
% Gravel	39.2	
% Sand	51.9	
% Mud	8.9	1000
% Silt	2.6	
% Clay	6.3	
Mean phi 🚽	212	4
Sorting phi	3.677	
Skewness	.024	0
Zoom to		



### Mapping Sand Bodies: Merging High Resolution MBES with 1980's Seismics

Archived Subbottom Seismics Records from Birch and others (1981, 1982, 1985)

Converted to Digital Records

Digital Files Analyzed in SonarWIZ and Displayed in Fledermaus and ArcGIS

Seismics Merged With New Seafloor Maps to Achieve the Best Possible Positioning

Sand Body Thicknesses Extracted and Contoured to Form Isopach Maps





### Conversion of Analog Seismic Records to Digital (SEG-Y)

Original Analog Records Scanned and TIFF Files Created

Tiff Files Brought Into "ImageToSegy" Software

Navigation Points and Depth Information Added (Date, Time, Sweep Rate)

Output is Standard SEG-Y File

Challenge is Positioning: Need to Determine Horizontal Uncertainty



Analog Subbottom Seismic Record



Analog Record Converted to Digital

## Northern Sand Body Isopach Map





## Potential Origin of Northern Sand Body

Extends ~2.5 km Between Two Eroded Drumlins (Hypothesis)

Up to 15 m Vertical Relief of Entire Feature

Sand Confined to Upper 6 to 10 m (Needs to Be Verified with Subbottom Seismic Survey and VC)

Drumlins or Other Glacial Features are Possible Source of Sand and Gravel





## Relationship Between Northern Sand Body and Eroded Drumlins





## Relationship Between Northern Sand Body and Eroded Drumlins







## Composition of Glacial Features Based On Backscatter



## Composition of Glacial Features Based On Texture



#### Model for Eroded Drumlins and Sand and Gravel Deposits (Carter and Orford 1988)



Carter and Orford. 1988. Model for Erosion of Drumlin and Beach Ridge Formation (figure reproduced in Masselink, Hughes and Knight. 2011. Introduction to Coastal Processes and Geomorphology, 2<sup>nd</sup> edition. Hodder Education. Figure 11.6

## Summary

- Mapping of Sand Bodies from Early Surveys Enhanced by Conversion to Digital Format
- And Merging with MBES Bathymetry and Backscatter
- However, Comparisons with High Resolution MBES Indicates
   Positioning Uncertainty Needs to be Better Understood
- Origin of Sand and Gravel Features on NH Shelf at Least Related to:
  - Erosion of Glacial Features
    - Drumlins
  - Marine Processes
  - Sea Level Changes
    - Transgression



# Acknowledgements

- BOEM, Marine Minerals Program
   BOEM, NHGS and UNH Cooperative Agreement
- New Hampshire Geological Survey
- UNH/NOAA Joint Hydrographic Center (Award NA10NOS4000073)
- NOS for Supplying Bathymetry and Backscatter
  - Castle Parker
  - LTJG David Rodziewicz
  - LTCD Mathew Jaskoski
- Erin Nagel