The Role of Marine Geophysical Mapping in Characterizing and Managing Marine Ecosystems:

A Federal/State partnership for Massachusetts Coastal Waters

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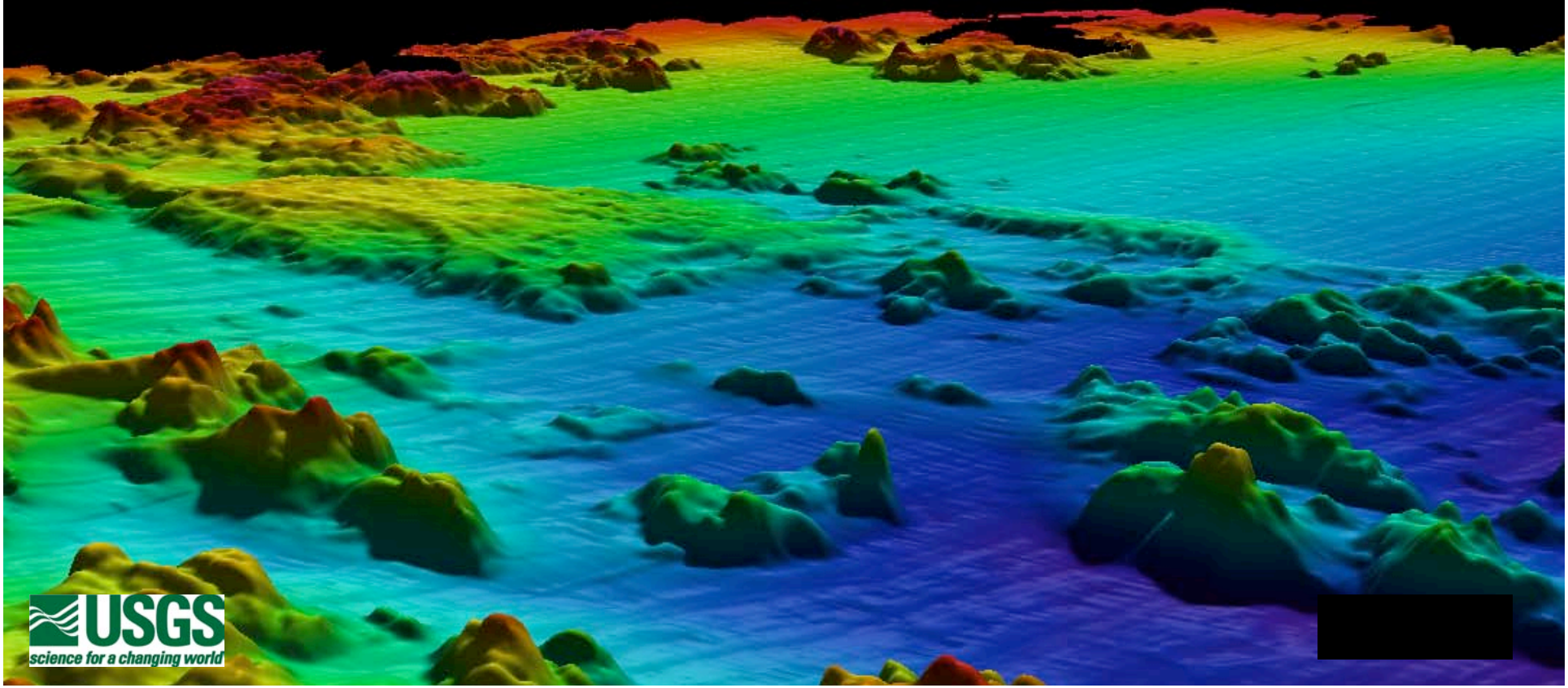

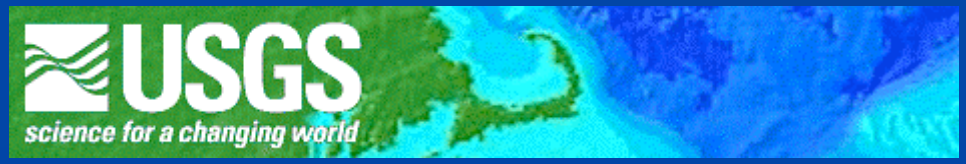

USGS/CZM Cooperative Mapping Project

1. What are we doing?

2. Why are we doing it?

3. Where are we doing it?

4. How are we doing it?

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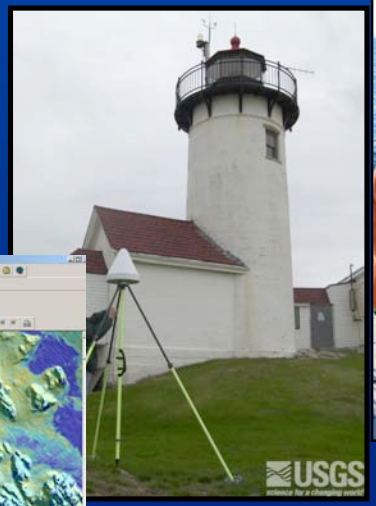
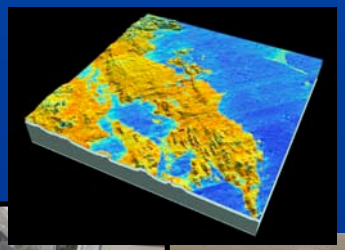
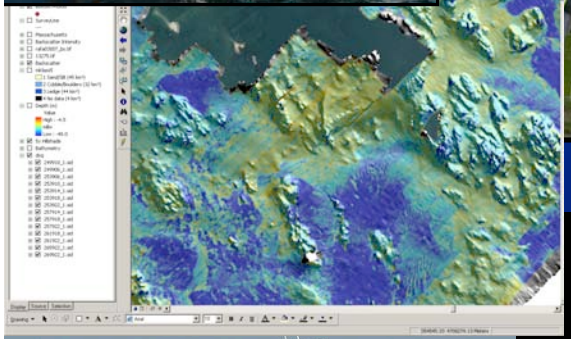
USGS/CZM Cooperative Mapping Project

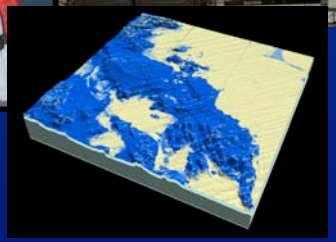
What are we doing?

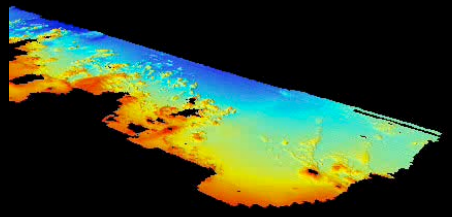
Geophysical mapping of inner continental shelf off MA coast











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Why is the USGS involved in mapping the seafloor?

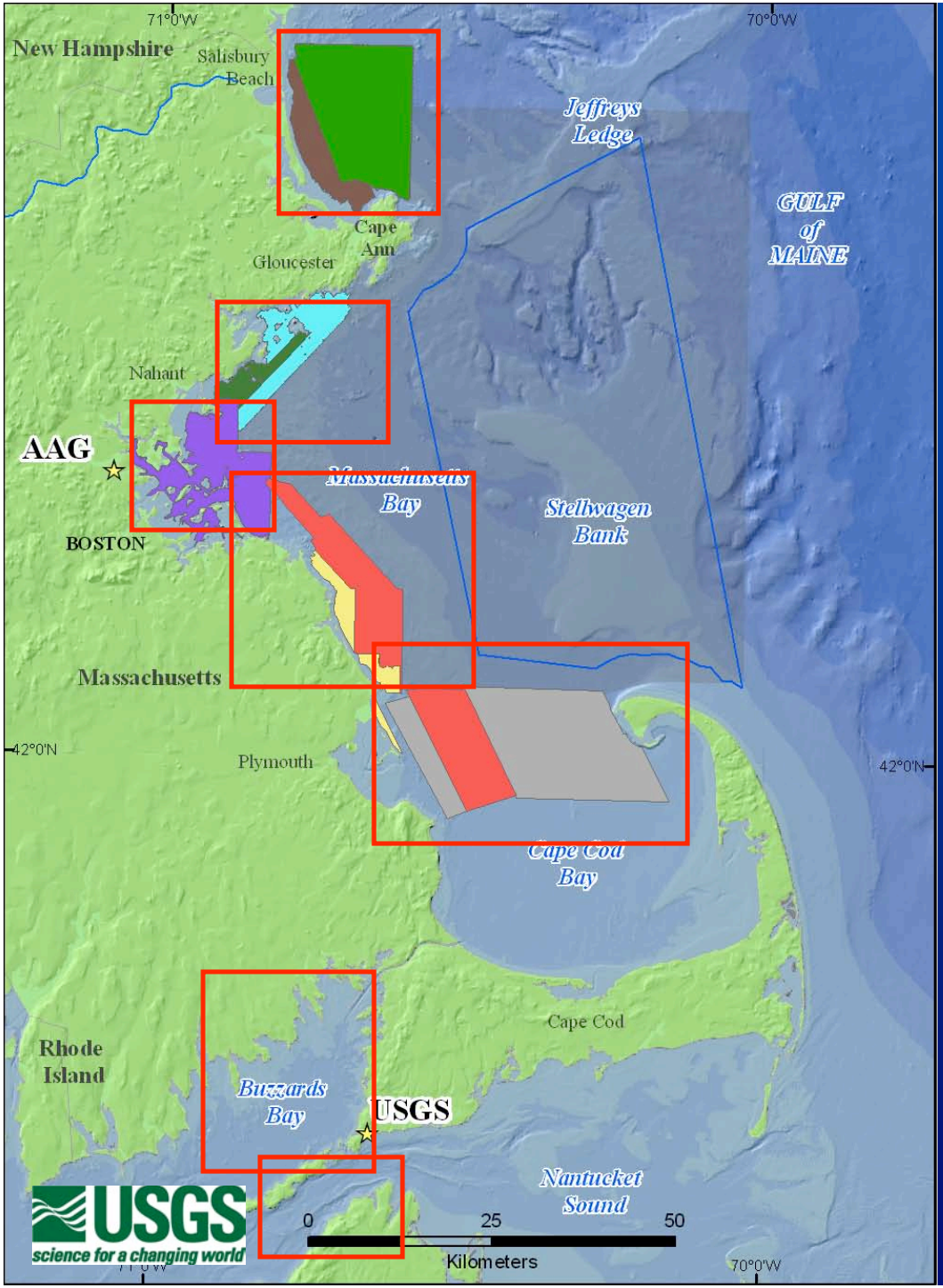
Why are we doing it?

USGS is primary

- civilian mapping agency
- science agency with in DOI

USGS Coastal and Marine Geology Program

- Describe marine and coastal systems
- Understand fundamental geologic processes that create modify and control them
- Develop predictive models



USGS/CZM Project Overview

where are we doing it?

- 7 separate surveys
- 5 Separate survey areas

2003-2007

- 1,300 km^2
- 7,000 km of survey lines
- 2,800 bottom photographs
- 275 sediment samples
- 31 km bottom video

2008-2013 (?)

- Buzzards Bay
- Vineyard Sound

Project Goals – *How are we doing?*

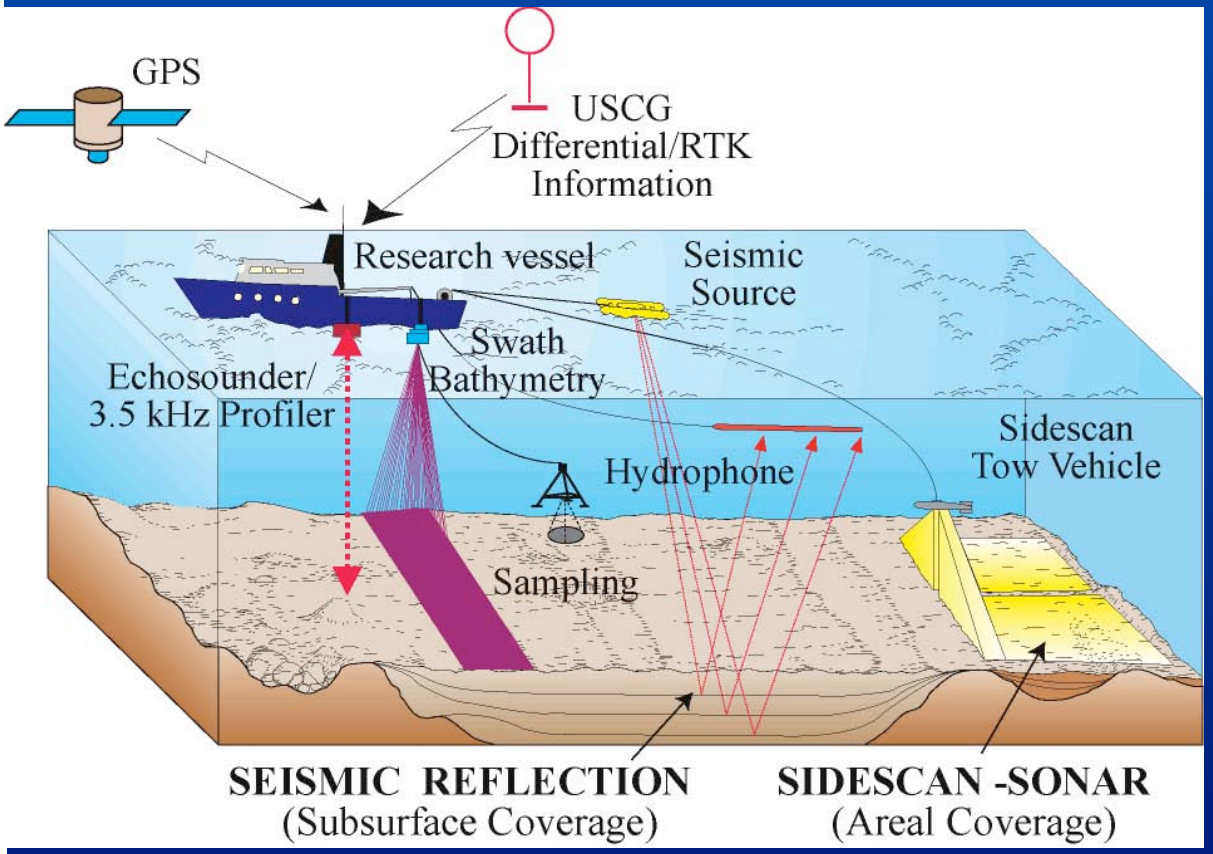
1. **Broad Scale** - Improve our understanding of the regional geologic framework of the inner continental shelf

- Physiographic Zones - qualitative

2. **Fine Scale** - Characterize geology of seafloor at a fine scale

- Sediment Type- quantitative

Project Approach



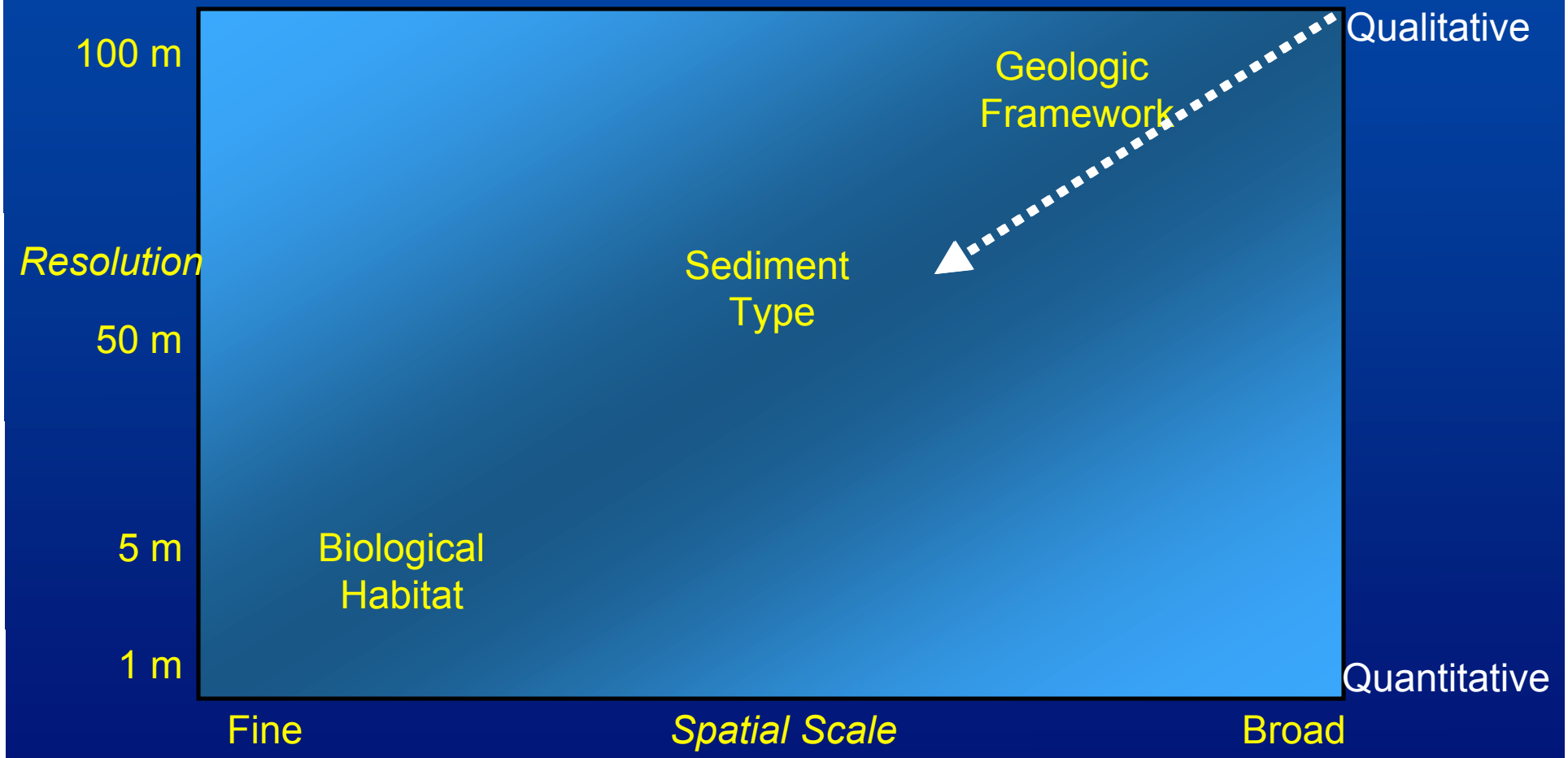
Geophysical

1. Interferometric Sonar Depth/Backscatter
2. Sidescan-sonar
3. Seismic Reflection

Ground Validation

4. Sediment Samples
5. Bottom Photographs
6. Bottom Video

Project Approach- *How are we doing it?*



Project Approach

Physiographic

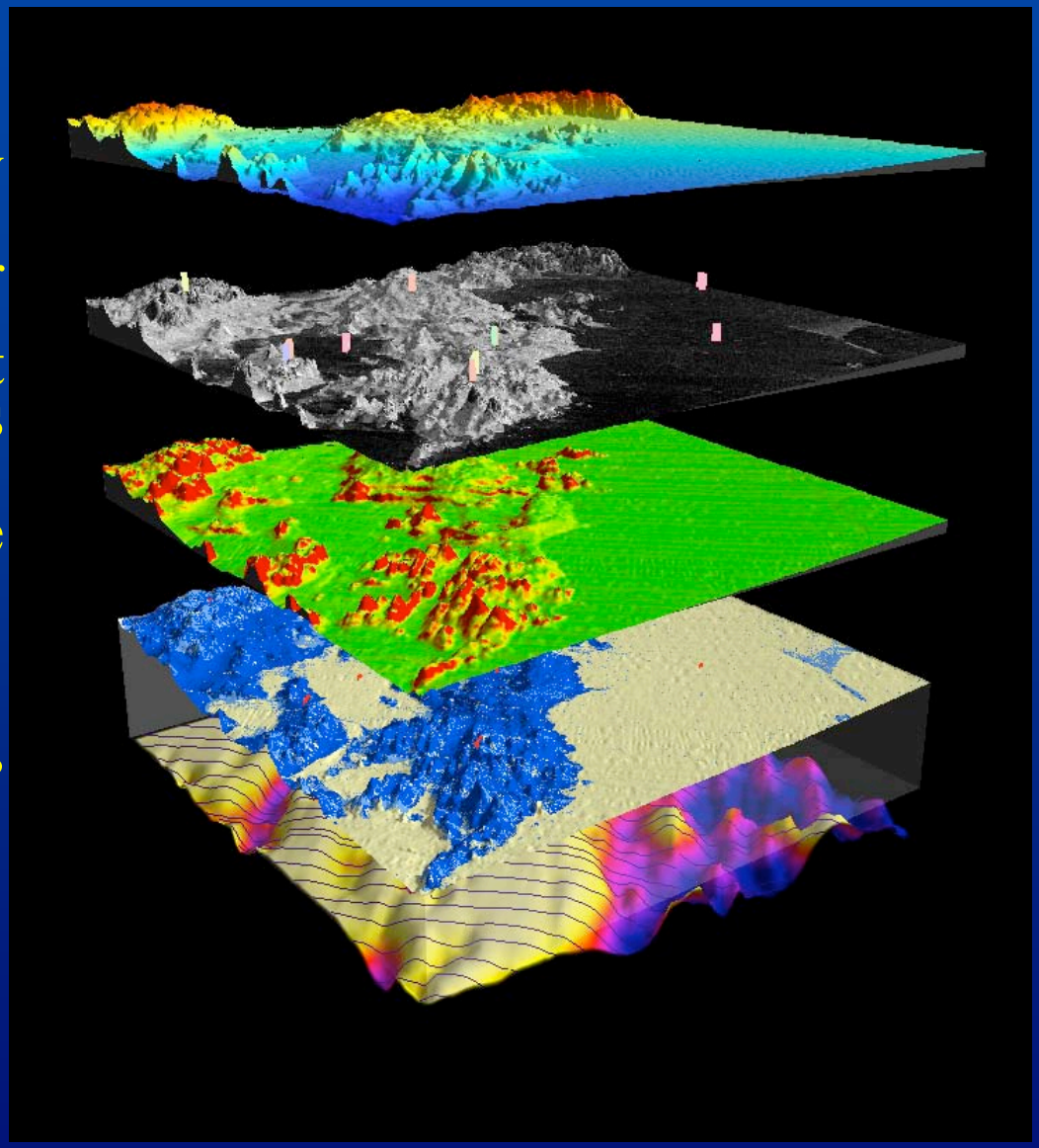
Bathymetry

Backscatter

Sediment Samples

Slope

Seismics



Bottom Type

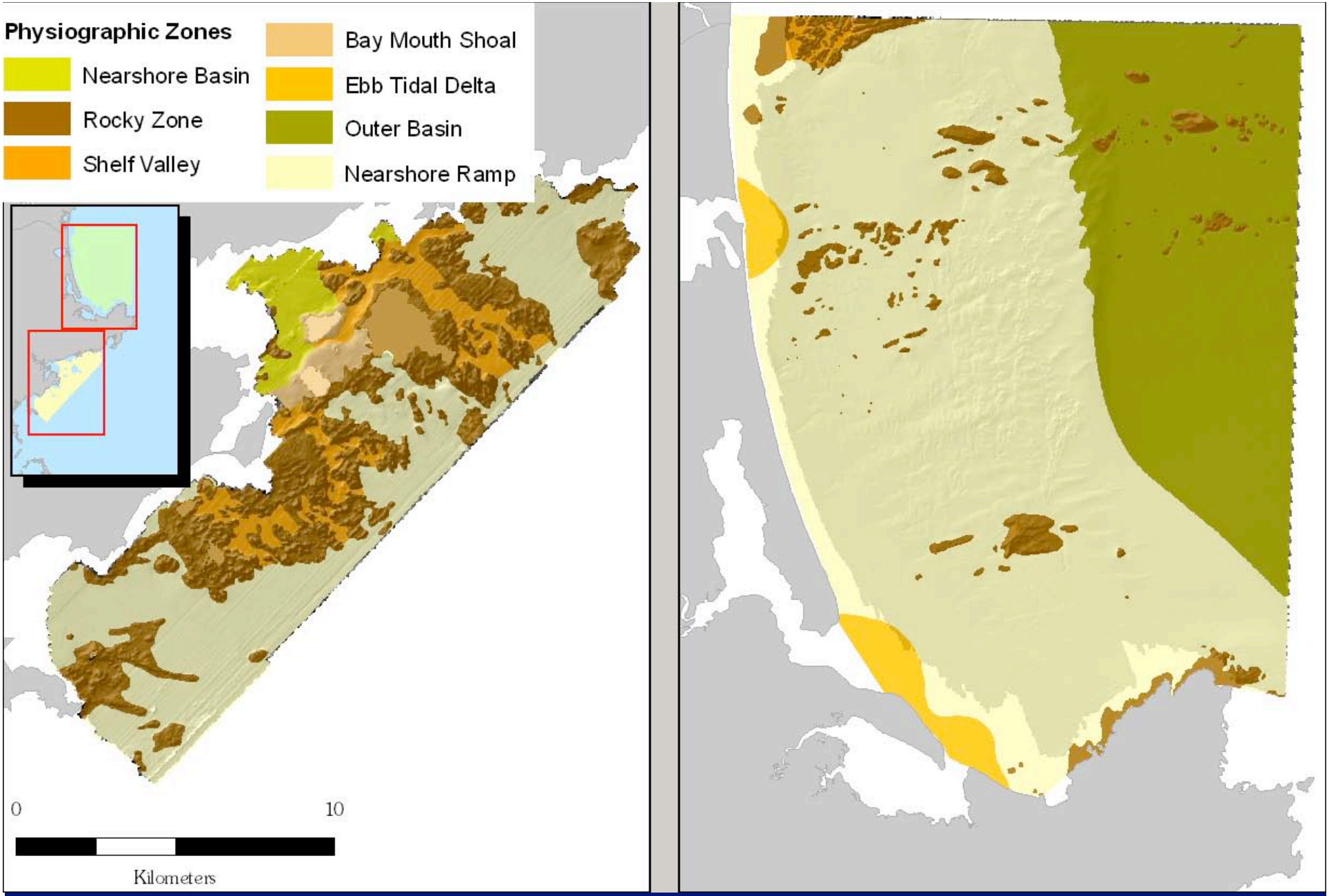
Bathymetry

Backscatter

Slope

=

Bottom type



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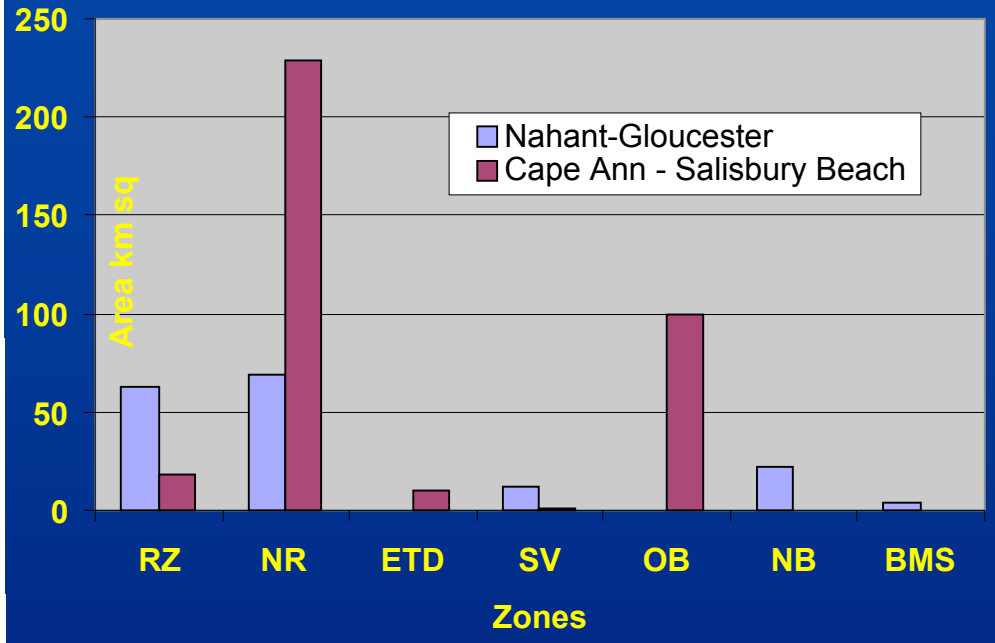
Area (km^2) per Physiographic Zone



Zone	Zone	Description
Rocky Zone (RZ)	RZ	rugged, high-relief outcrops; bedrock, boulders & gravel; water depths 0-90 m
Nearshore Ramp (NR)	NR	gently seaward sloping; sand & gravel; complex bedforms; water depths 0-50
Ebb-tidal Delta (ETD)	ETD	broad platforms seaward of inlets; sandy; lobate in plan view; water depths < 8 m
Shelf Valley (SV)	SV	elongate depressions; rocky walls; sand & gravel in thalwegs; water depths 12-25 m
Outer Basin (OB)	OB	expansive, smooth seafloor; muddy; thick sediment deposits; water depths > 50 m
Nearshore Basins (NB)	NB	Shallow, low relief seafloors, sandy muddy deposits: 0-19m
Bay-Mouth Shoals (BMS)	BMS	shallow, smooth seafloor, sandy, gravelly, entrance to Salem Sound: water depths 0-17m

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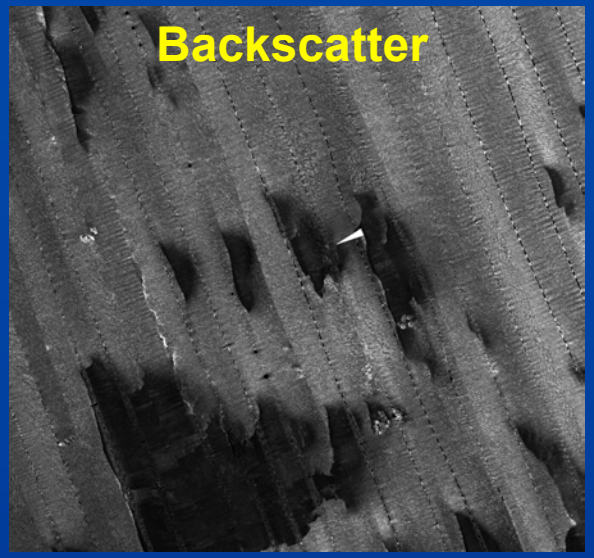

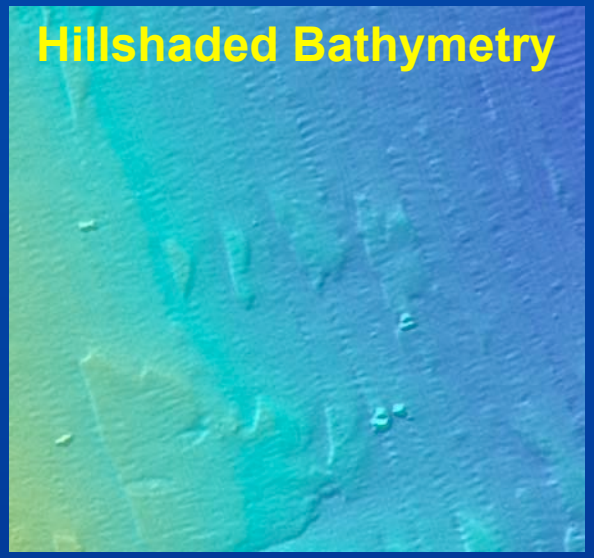

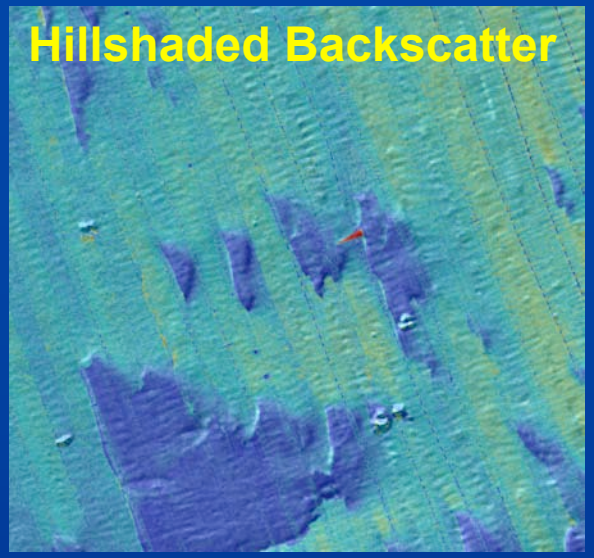

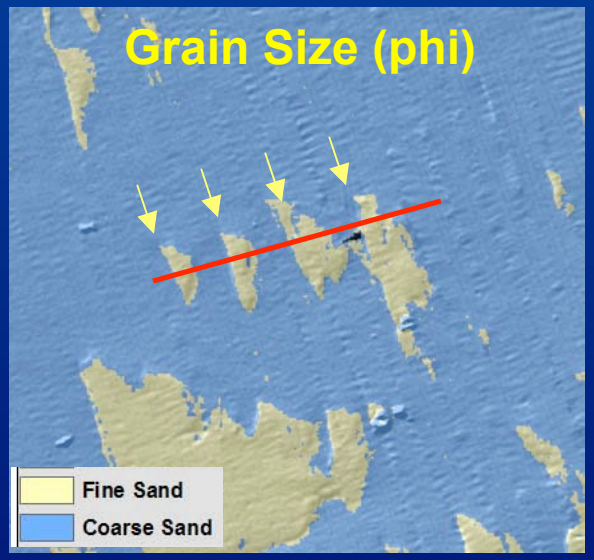

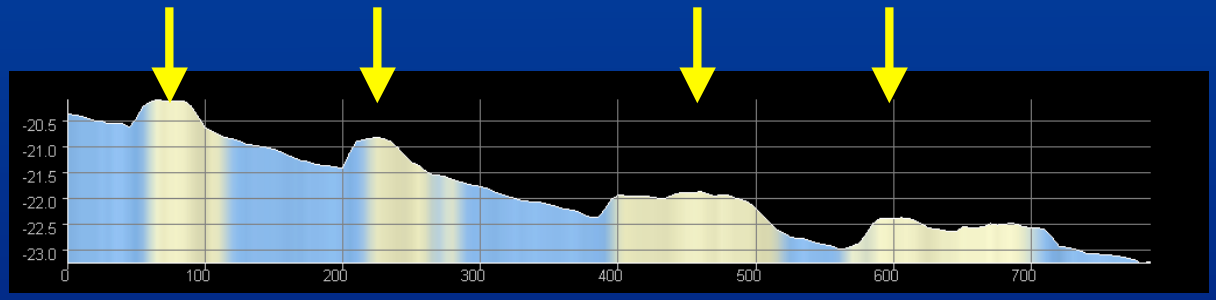

Topographic High = Low Backscatter = Fine Sand

Topographic Low = High Backscatter= Coarse Sand

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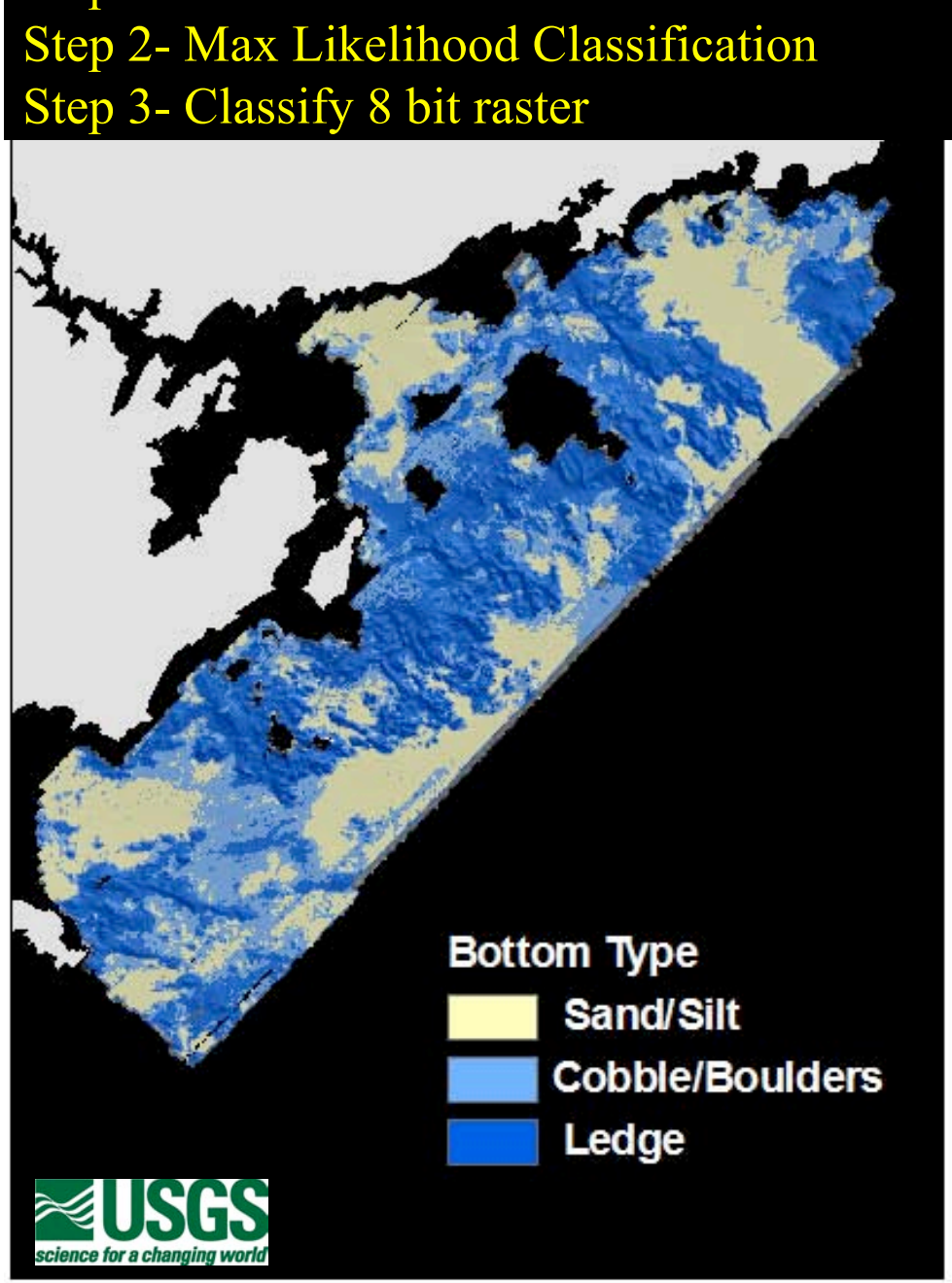
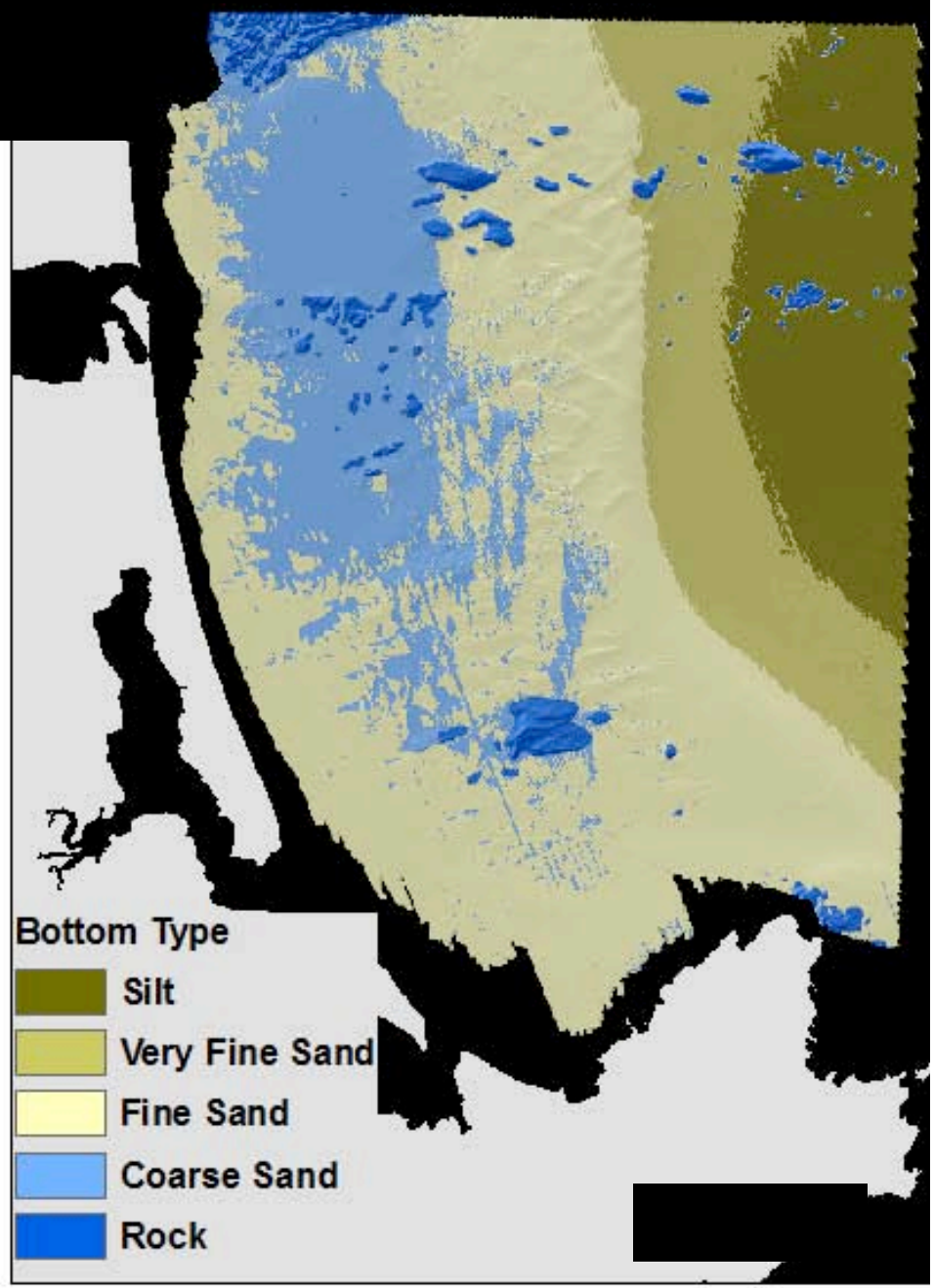
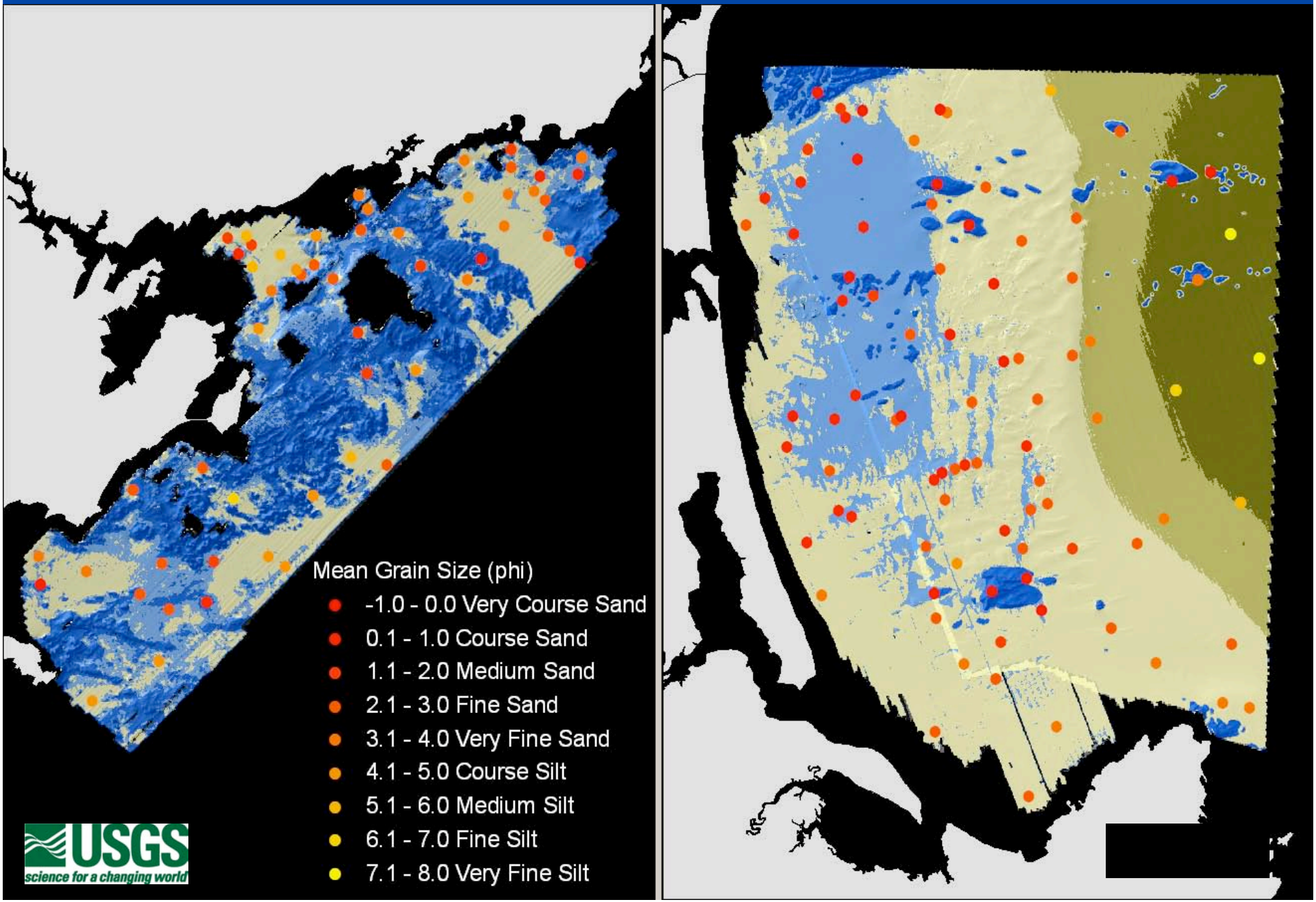
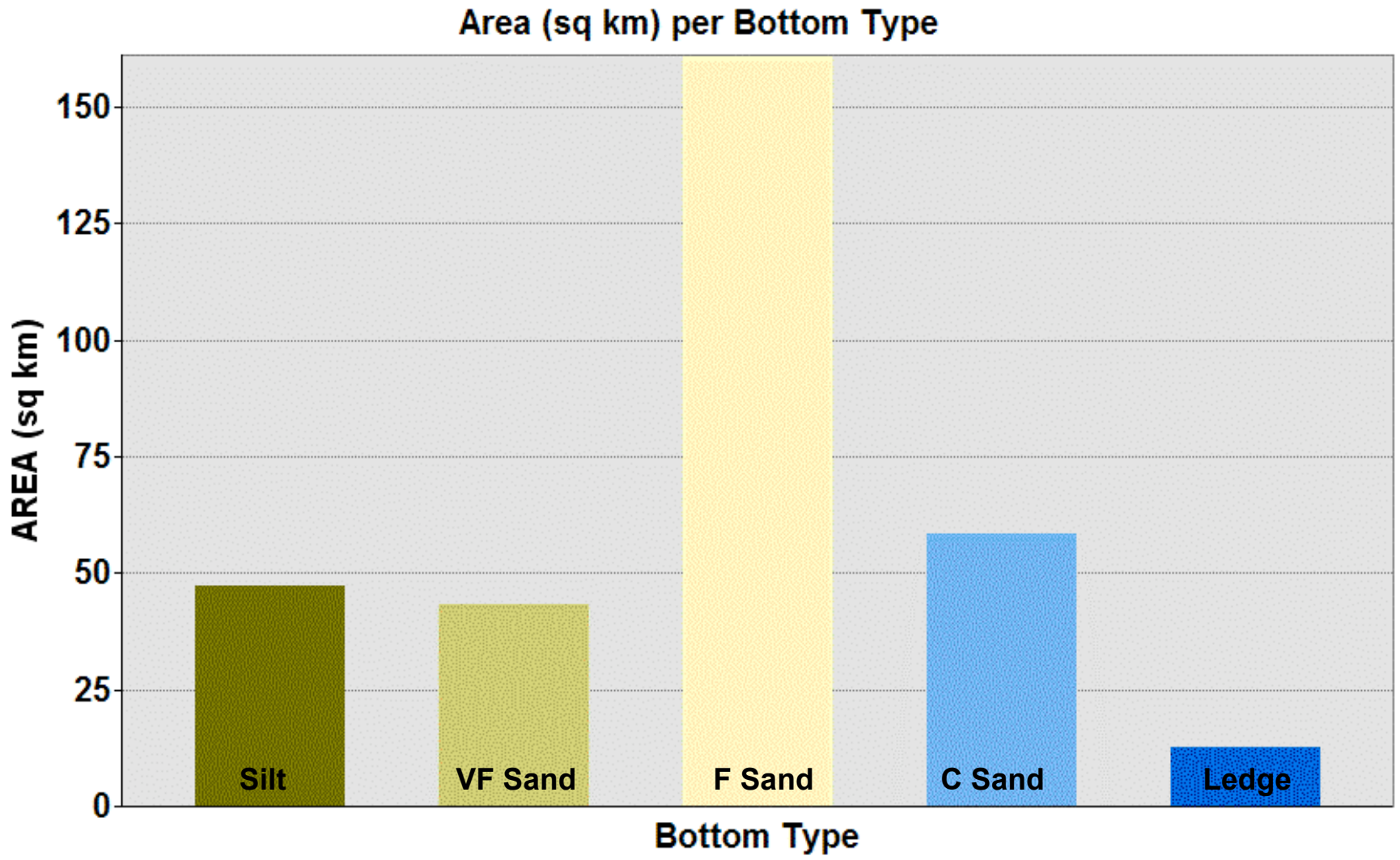
Unsupervised Multivariate
Step 1- ISODATA Clusters
Step 2- Max Likelihood Classification
Step 3- Classify 8 bit raster

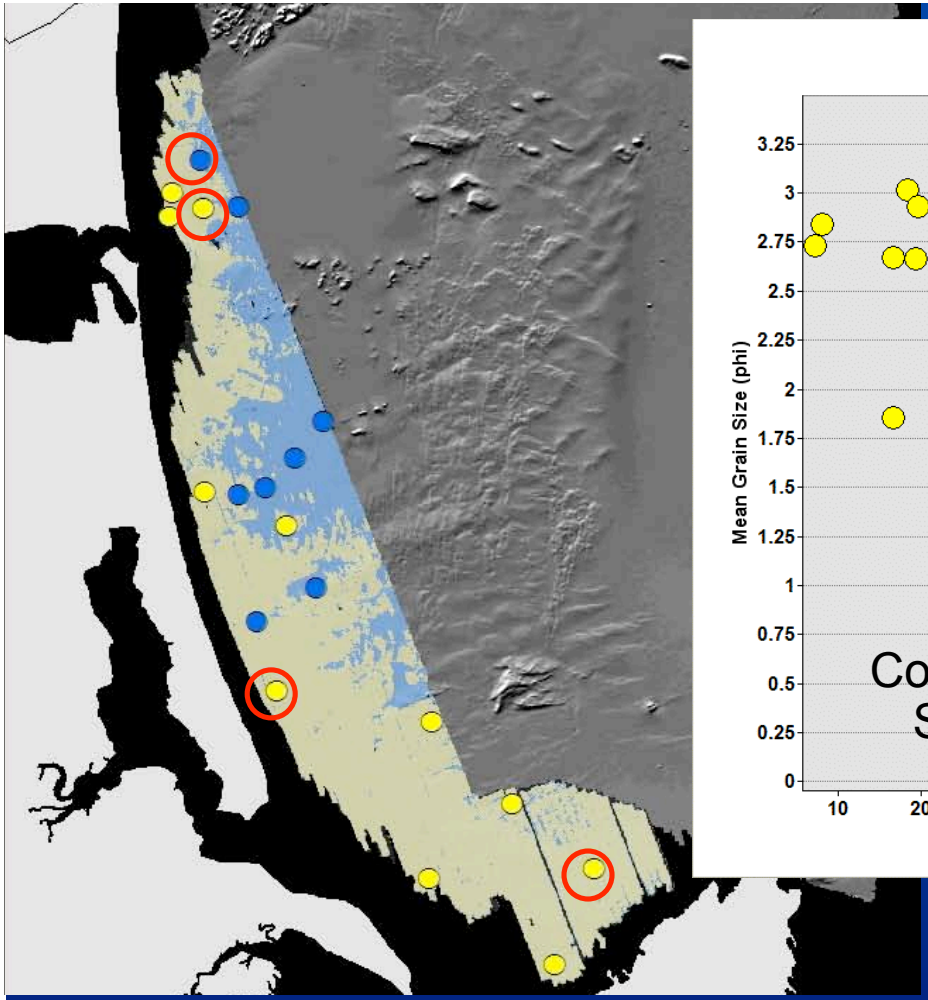


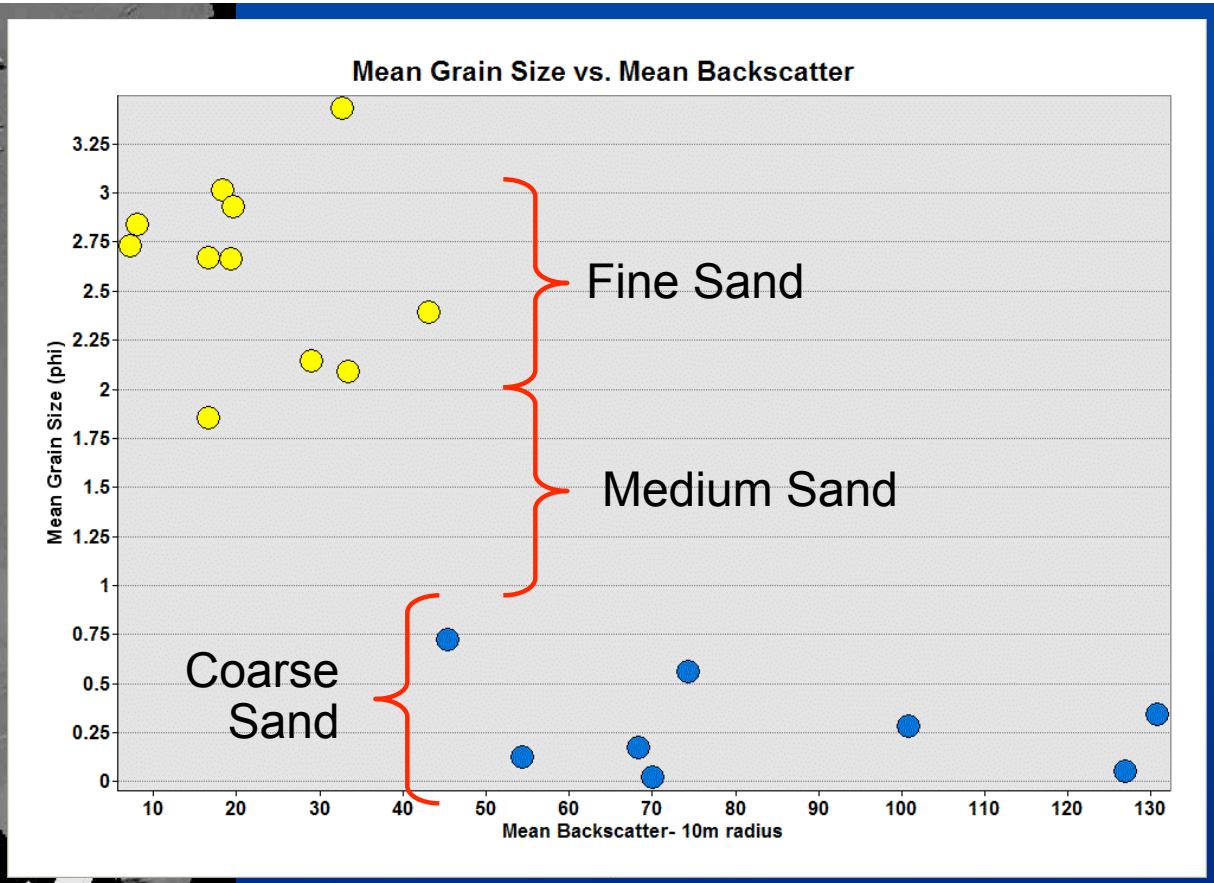


Reclass output based on **mean grain size phi**




Area (sq km) per Bottom Type
AREA (sq km)
150
125
100
75
50
25
0
Silt
VF Sand
F Sand
C Sand
Ledge
Bottom Type





19 samples

- 4 misclassified in multivariate output
- 1 coarse sand to fine sand
- 1 medium sand to fine by 1 cell
- 2 very fine sand to fine sand

73% correctly classified
Using mean grain size (phi)

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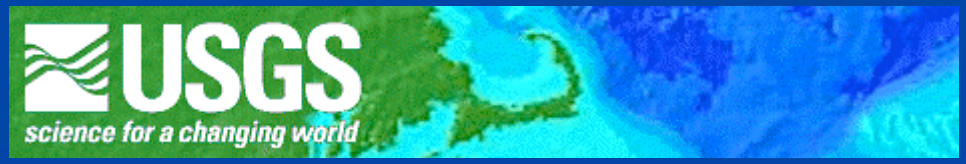

Current research

- Reprocess offshore Reson backscatter
- Look at using inteferometric backscatter
- Normalize input data for ISO clustering
- Compare supervised vs. unsupervised
- Use sediment samples from *usSEABED*
- Compare Crisp vs. Fuzzy classification

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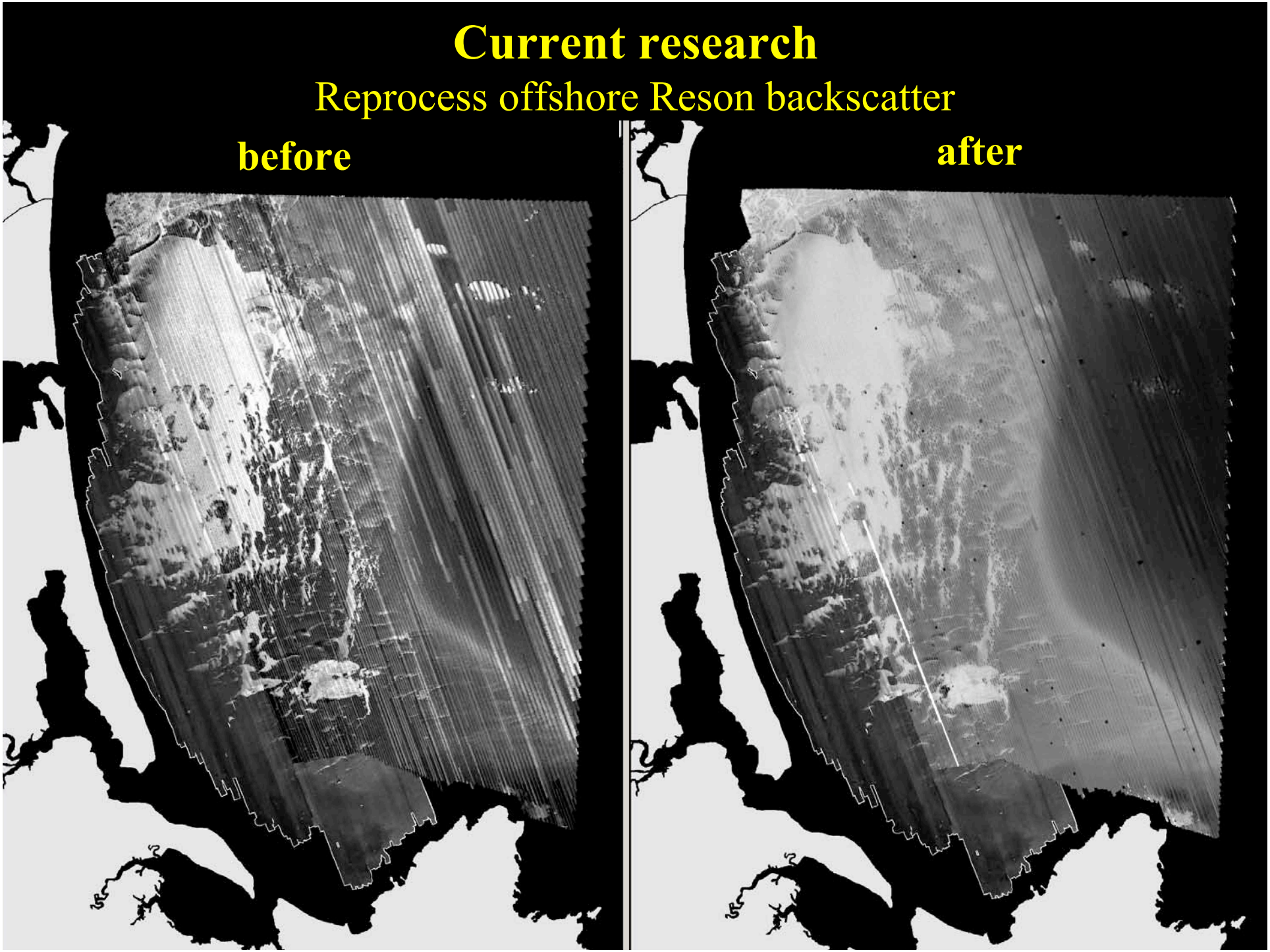
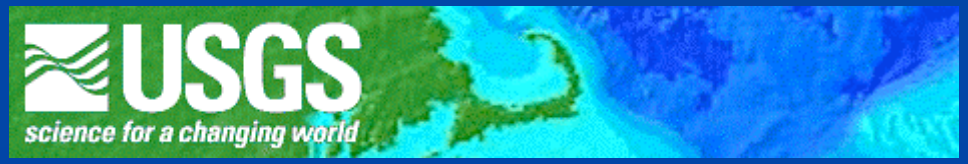
Current research

Reprocess offshore Reson backscatter





Conclusions & Recommendations

- Regional seafloor geomorphology characterization is *crucial* first step to understanding any "habitat."
- Multi-scale interpretive data products (broad/fine)
- Different approaches required for different sonar data
- Ground validation is the *key* to any classification
- Project will continue to focus on geophysical properties
- Inherent error in precision, accuracy, classification
- High resolution survey data > high resolution interpretations

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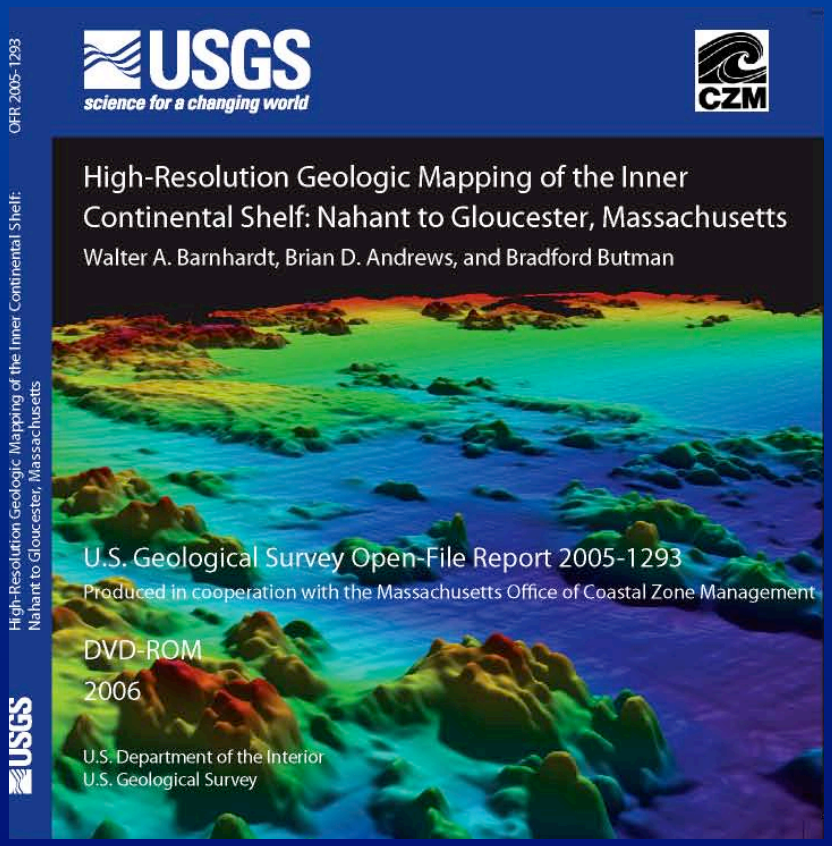
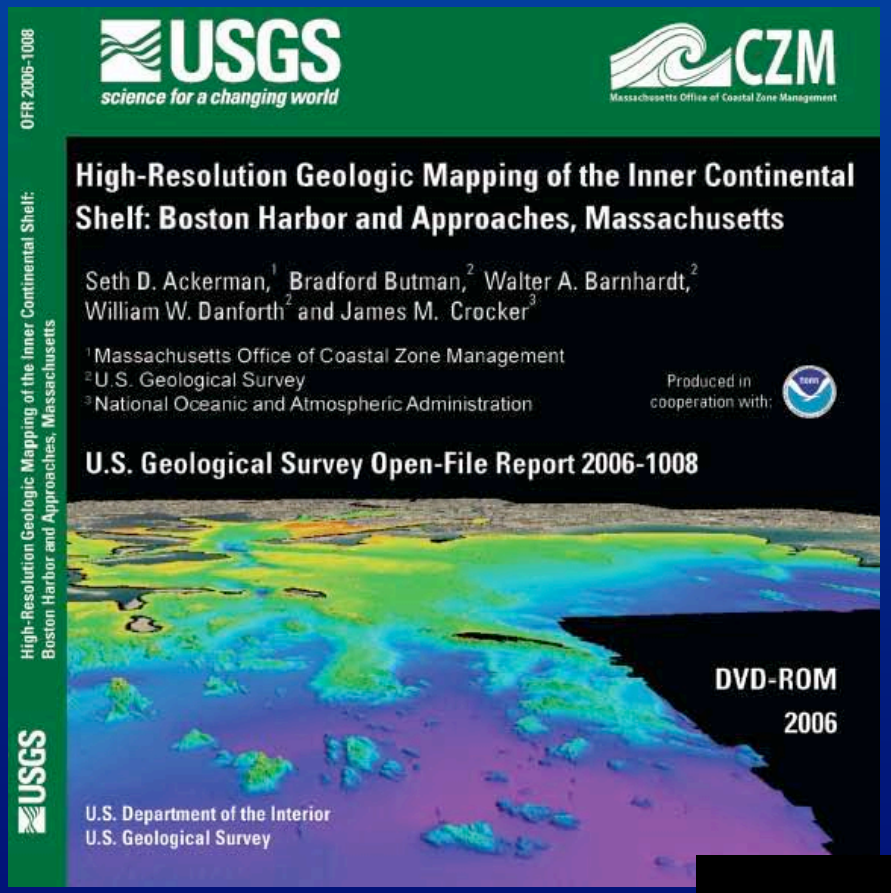
Publications

1. USGS Open File-Reports
2. Spatial Data delivered in Geodatabase (ArcMarine)





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