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Motivation

The goal of this study is to provide new information on the spatial extent of hard-bottom habitats in Delaware Bay and the physical conditions that affect these in the intertidal and offshore regions. Understanding the feedbacks between sediment transport and hard-bottom habitats is important since these regions are highly productive and support enhanced biodiversity, including commercial and recreationally fished species. A comparison to offshore hard-bottom habitats will provide insight on how organisms adapt to different hydrologic regimes.

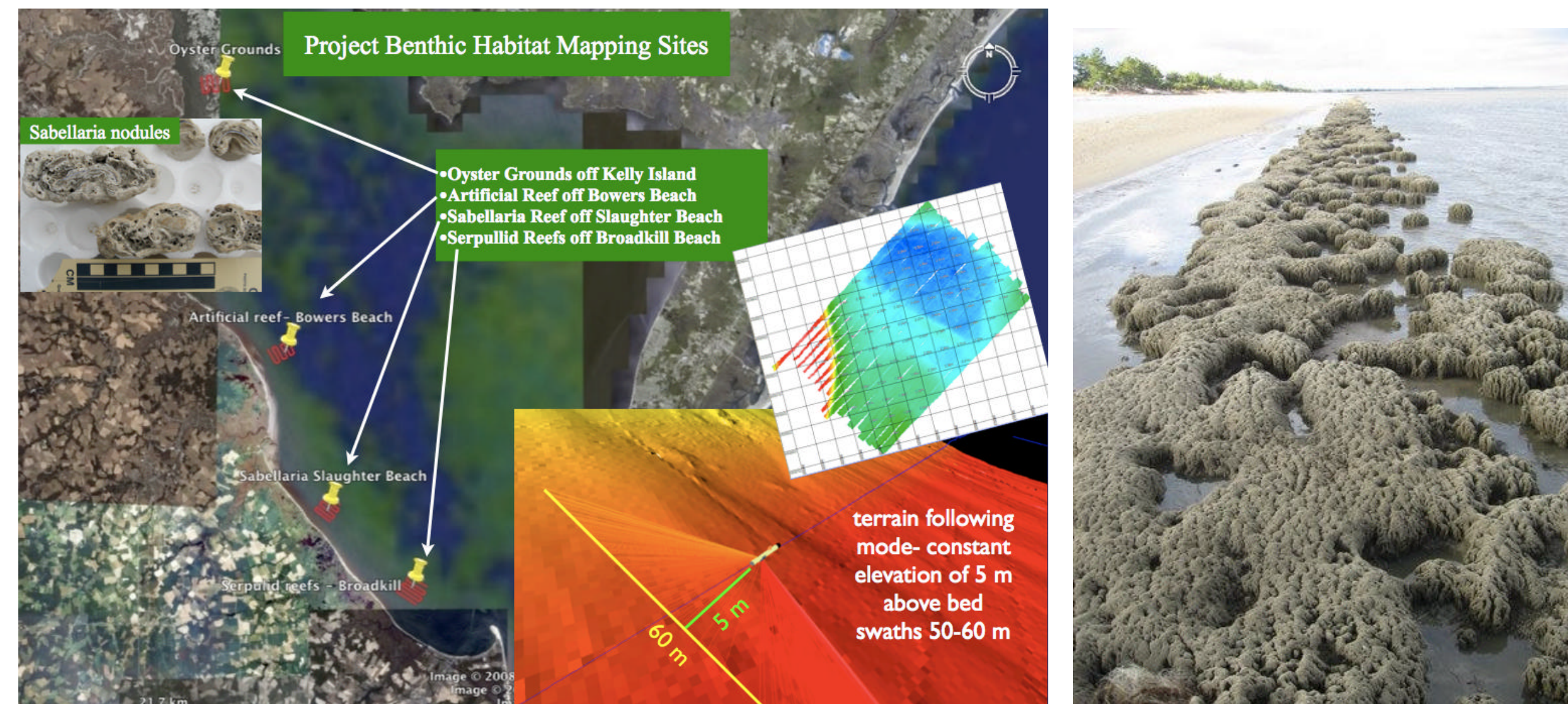


Figure 1 A map of Delaware Bay with locations of target hard bottom areas containing *Sabellaria vulgaris*, *Hydroides dianthus*, and mixed *Hydroides* and *Sabellaria* (at left) intertidal *Sabellaria* reef at Slaughter beach (at right) (Photo Jill Brown).

Data

To determine the feedbacks between biological and physical processes in the hard bottom areas we need to measure several properties.

Property	Description	Rationale	Instrument
Bathymetry	Bottom topography and relief	Locate hard bottom areas	AUV Geoswath
Backscatter	Strength of sound reflection	Determine bottom type	AUV, Side-scan sonar, rotary sonar
Currents/ Waves	Predominant speed and direction	Determine sediment mobilization	ADCP
Turbidity	Water clarity due to suspended sediment	Determine constraints on ecology	ADCP, AUV turbidity sensor
Sediment Properties	Bed composition and grain size	Determine suitable substrate	Ponar benthic grab sampler
Water Quality	Temperature, salinity, dissolved oxygen, chlorophyll concentration	Determine range of chemical properties	AUV sensors

Future Work

Initial surveys of the bay to locate hard bottom areas begin in June 2009. We will choose target sites for longer instrumented studies beginning in the fall of 2009, continuing through the spring of 2011. Repeat mapping using the AUV will occur annually.

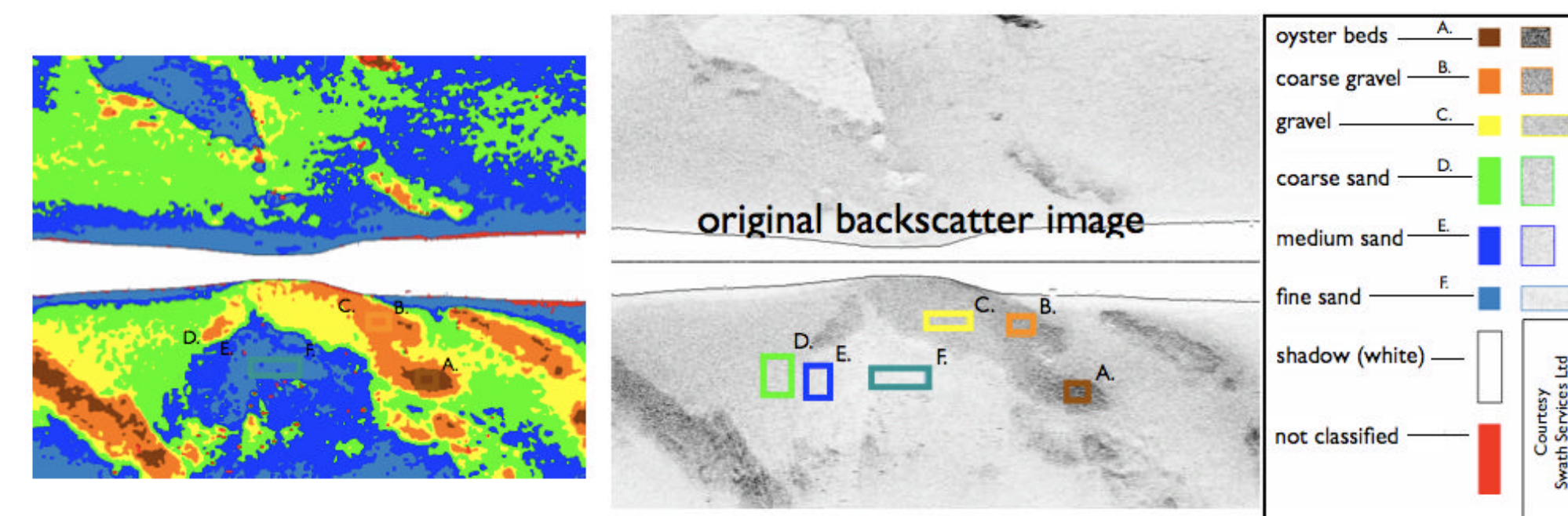
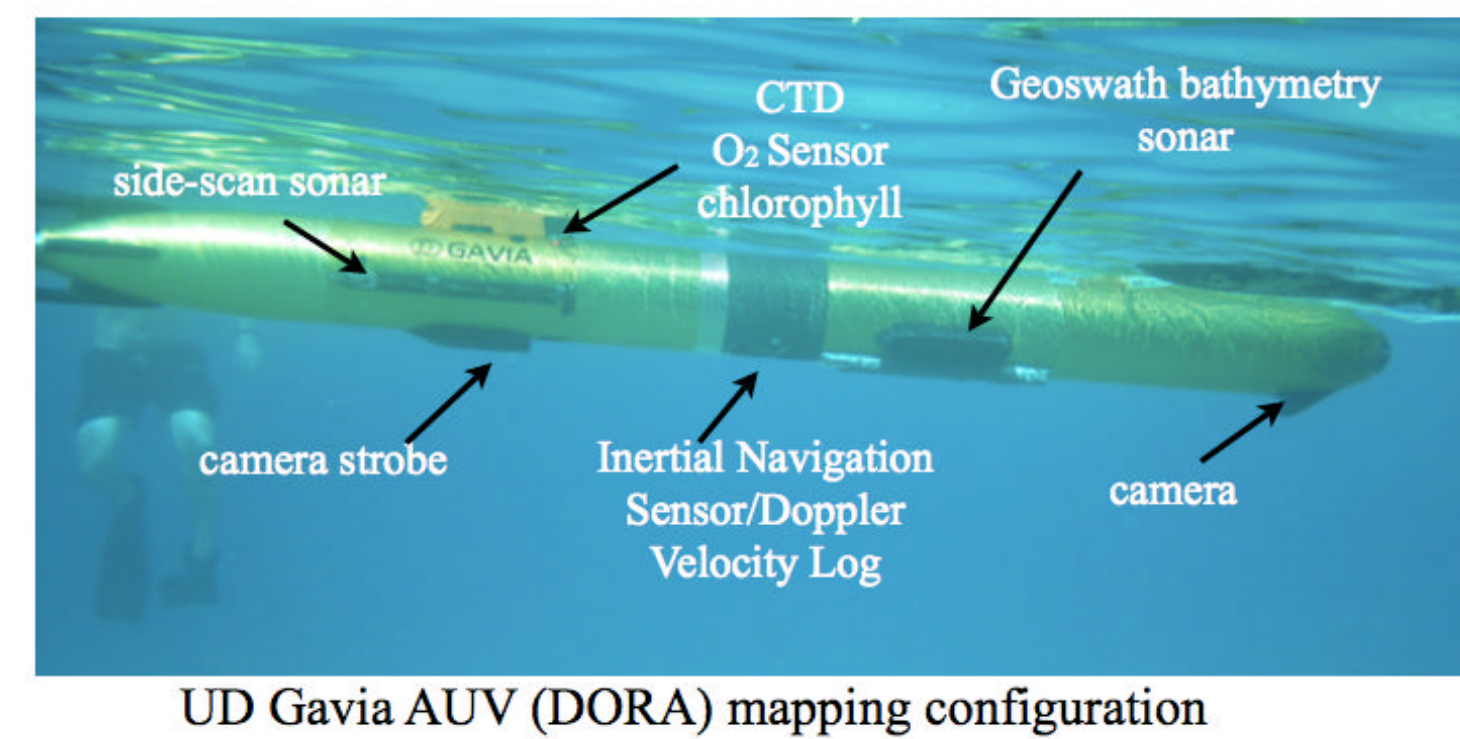


Figure 2 AUV instruments (top) and example from Geotexture software used on sonar data to determine bay bottom environment. (bottom).

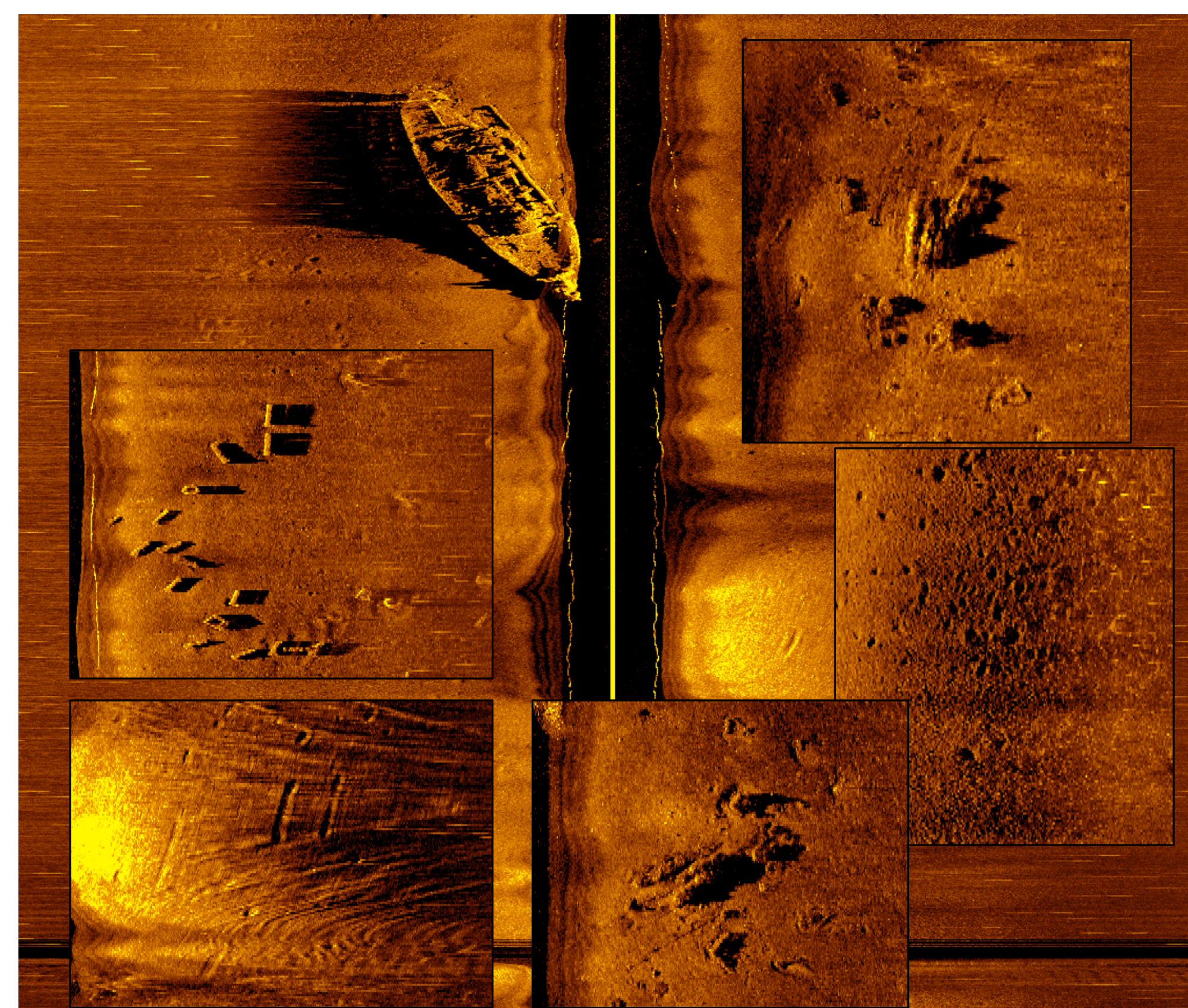


Figure 3 July 2008 data: Side-scan sonar images from the AUV Gavia in Delaware Bay showing the Spartan ship wreck, artificial reefs, and different bottom formations.

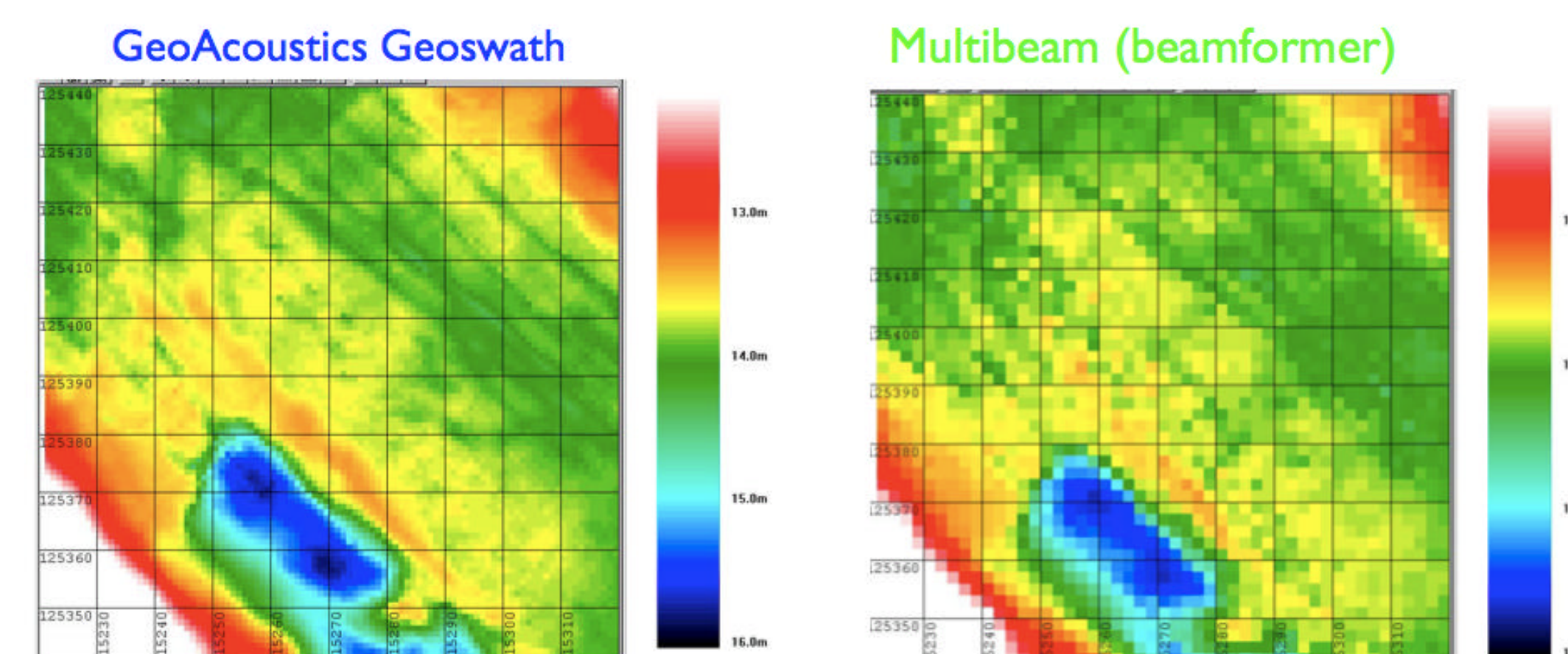


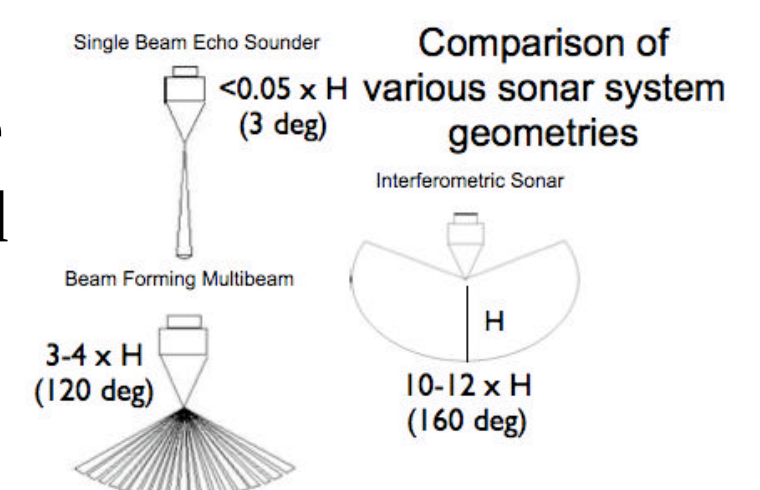
Figure 4 Larger beamwidth and greater data density allow interferometric sonars to produce higher resolution images and survey shallow regions.

Technology



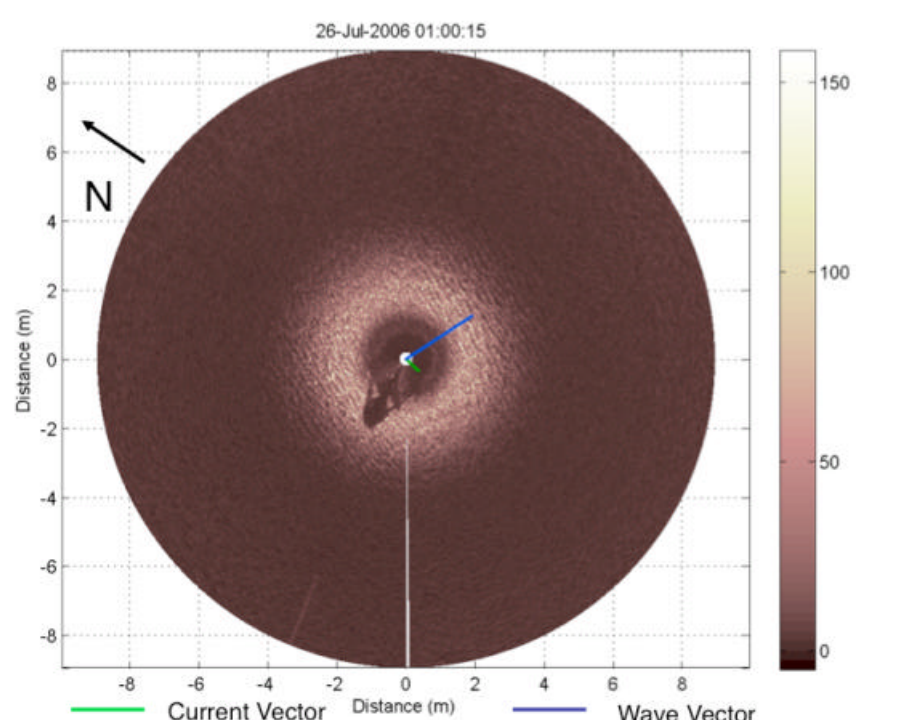
AUV The autonomous underwater vehicle (AUV) (at left) is a platform for the Geoswath interferometric sonar, side-scan sonar, camera, and water quality sensors. Since it can be deployed from land or a small ship and is programmed remotely by a computer, it is ideal for repeatedly mapping shallow water areas.

Geoswath The Geoswath has a swath width 10-12 times the distance from the bed (at right) at a very high data density and resolution to measure bed bathymetry (Figure 4).



ADCP Acoustic Doppler current profilers (ADCP) (at left) measures the time between when the instrument sends a pulse of sound out and when the reflected sound returns to determine wave and current velocity and direction and backscatter or suspended sediment concentrations.

Rotary Sonar Rotary sonar units use sound to measure sea floor bathymetry at a set interval and can be mounted on the bay bottom to gather data over longer time periods. Rotary sonar gathers data at fixed intervals in a 4-9 m radius from the instrument producing an image similar to the one seen at the right.



Ponar Sampler A ponar grab sampler will retrieve 23x23 cm benthic samples from the seabed surface. It will be used to ground truth sonar data (at left).

Summary

We will use interferometric sonar mounted on an AUV to locate hard bottom areas in Delaware Bay. These environments are important hotspots for ecological diversity and abundance in Delaware Bay. Target areas will be studied seasonally for two years to determine physical and biological feedbacks. Understanding the hydrological and geological conditions necessary to support these ecosystems will aid in management of these areas.

Acknowledgements

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