Unexpected Bathymetry and Habitat Features in Estuarine and Inlet Environments of Georgia, USA

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Background and Significance:

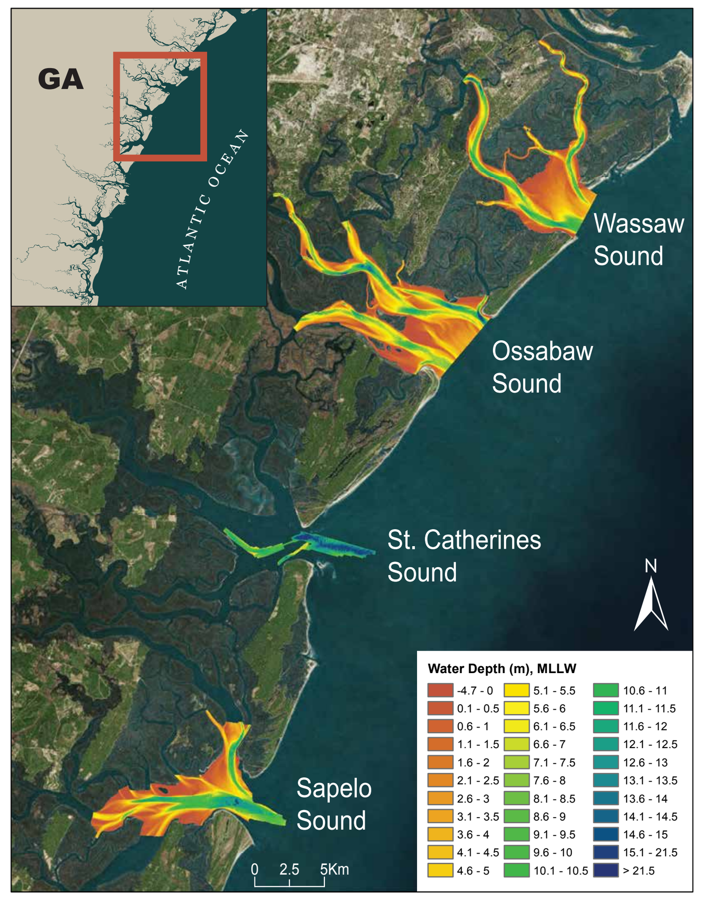


Figure 1.

Sounds and estuaries in the southeastern U.S. are generally thought to be dominated by mobile sediments, redistributed and deposited by coastal physical processes (Fig. 1). Surveying the seafloor with new technologies and techniques provides a new generation of higher-resolution imagery of both bathymetry and benthic habitat. Recent surveys in the estuarine and nearshore areas of coastal Georgia, USA have identified previously unknown patterns in habitat distribution. As part of a multi-year mapping effort, four of the seven sounds in coastal Georgia have been mapped: Wassaw Sound (Fig. 2), Ossabaw Sound (Fig. 3), St. Catherine's Sound (Fig. 4) and Sapelo Sound (Fig. 5). These studies have identified: 1) broad mud or sand flats flanking the main channels; 2) sandy, bedform-rich main channel systems; and 3) hard-bottomed, sediment-poor areas with steep topography - the focus of this poster. This presentation seeks discussion with, and input from, others using similar tools in energetic estuarine inlet and nearshore environments.

Methods:

Bathymetric and sidescan sonar data were collected for all sounds with a 230-kHz Edgetech 4600 interferometric sidescan sonar, providing co-registered sidescan and bathymetric data. Shallow areas where water depths were less than 2-3 meters MLLW were surveyed using a Knudsen single-beam echo sounder system. Real Time Kinematic (RTK) GPS positioning data were collected using a Trimble R6 antenna with Virtual Reference Station (VRS) corrections to provide real-time tide corrections and accurate locations for the surveys. In some areas we used a Riegl VZ-1000 3D terrestrial laser scanner where expansive tidal flats were exposed at low tide, and used airborne LiDAR data along the flanks of the intertidal region to create seamless topobathy charts.

All bathymetric data were processed in Hypack/Hysweep software. Single beam, terrestrial LiDAR, RTK-GPS and airborne LiDAR datasets were combined with the bathymetric data in ARCGIS to create the final bathymetric surface in a 3x3 m grid. Sidescan data were collected in Hypack and processed and mosaiced using Hypack or Sonarwiz. The final mosaic was exported in GeoTiff tiles with an image resolution of 0.1 m. Finally, the Benthic Terrain Modeler (BTM) was used to generate slope maps and identify abrupt topography (Wright et al., 2012).

Fig. 2: Wassaw Sound

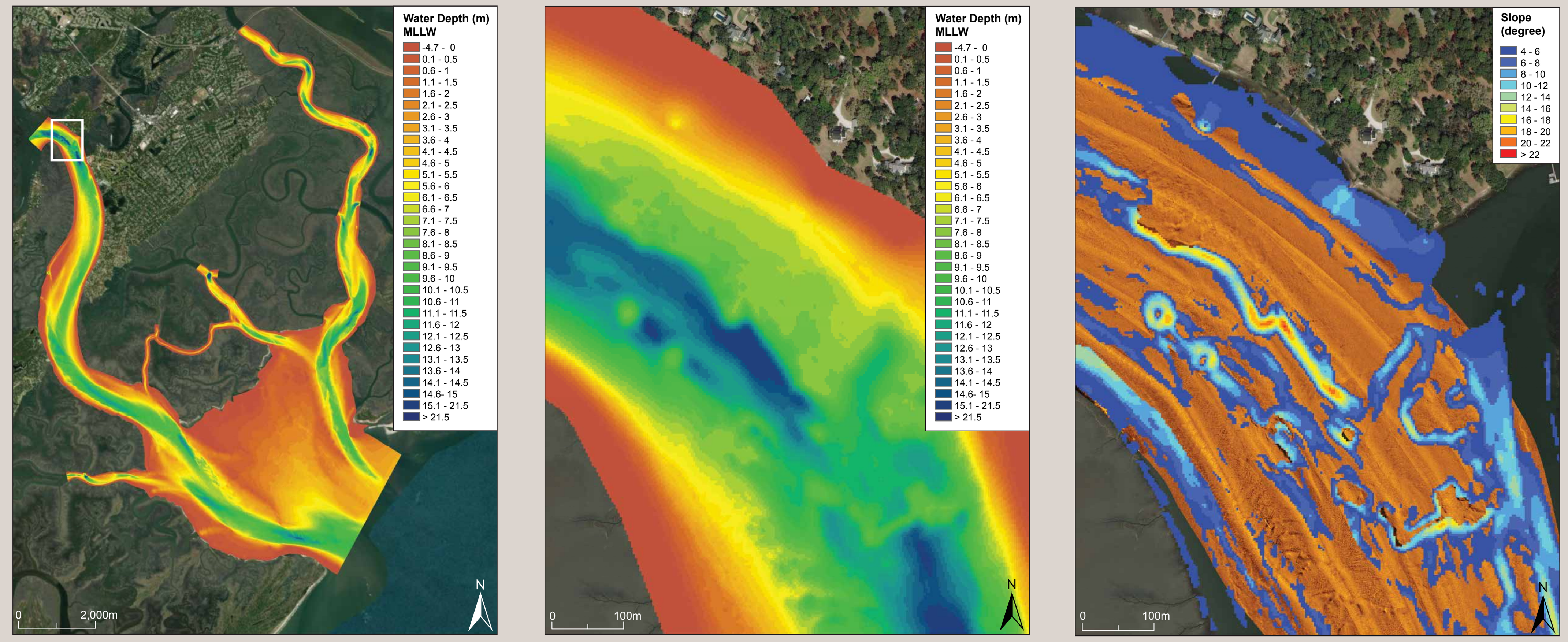


Fig. 3: Ossabaw Sound

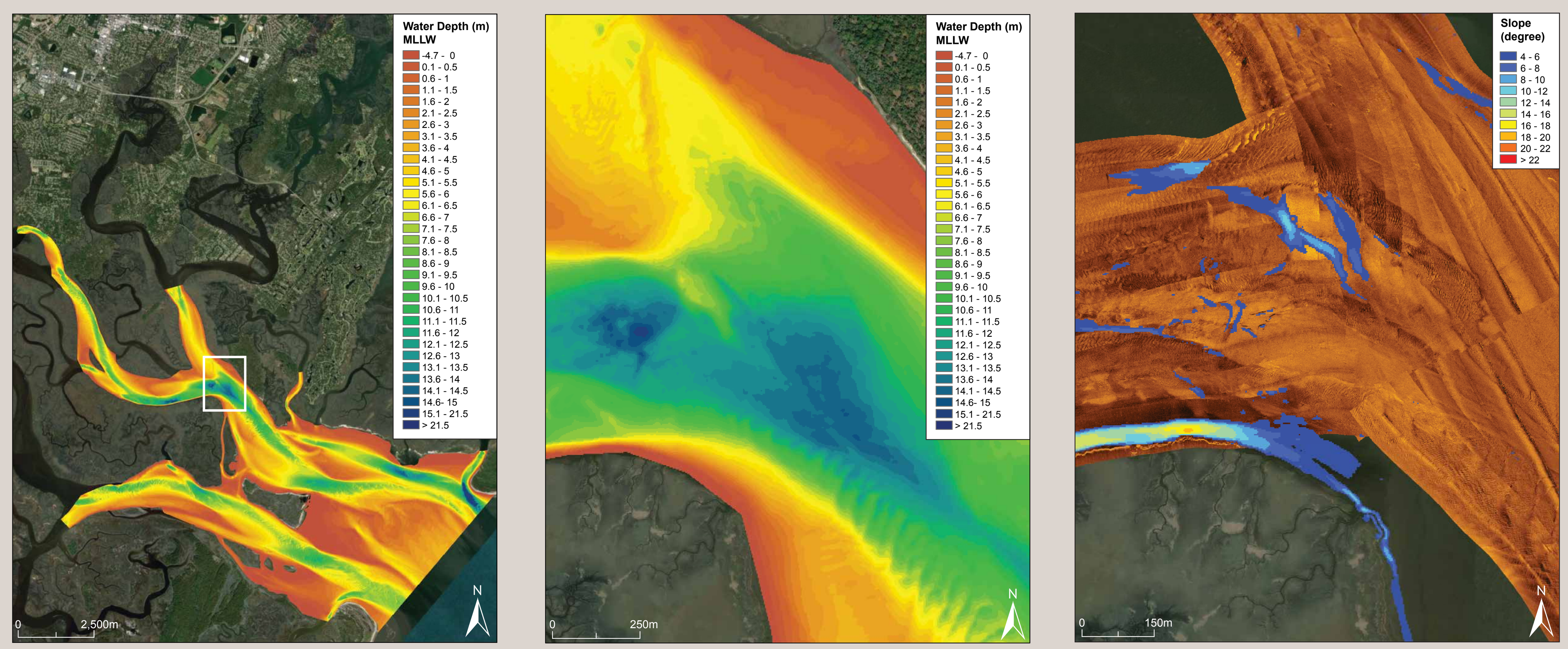


Fig. 4: St. Catherine's

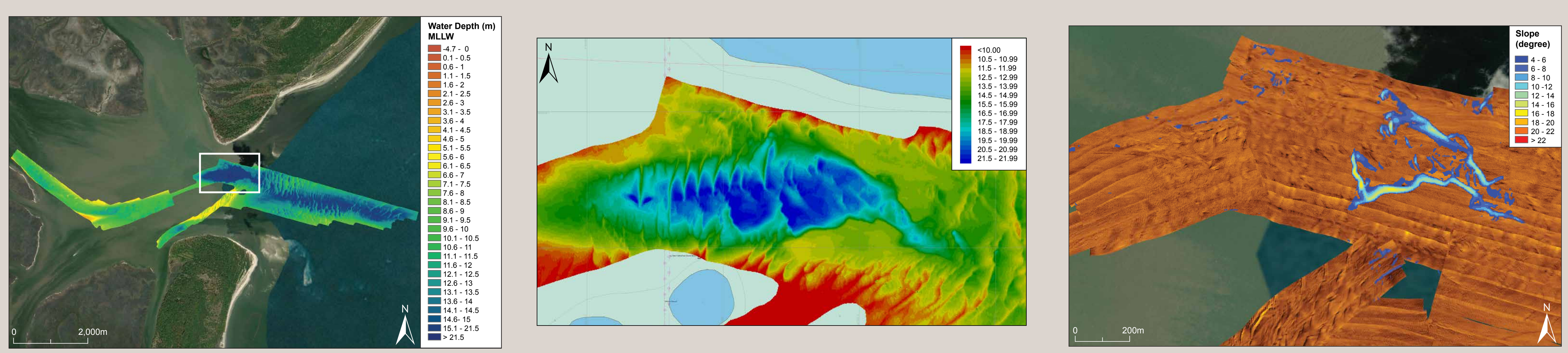
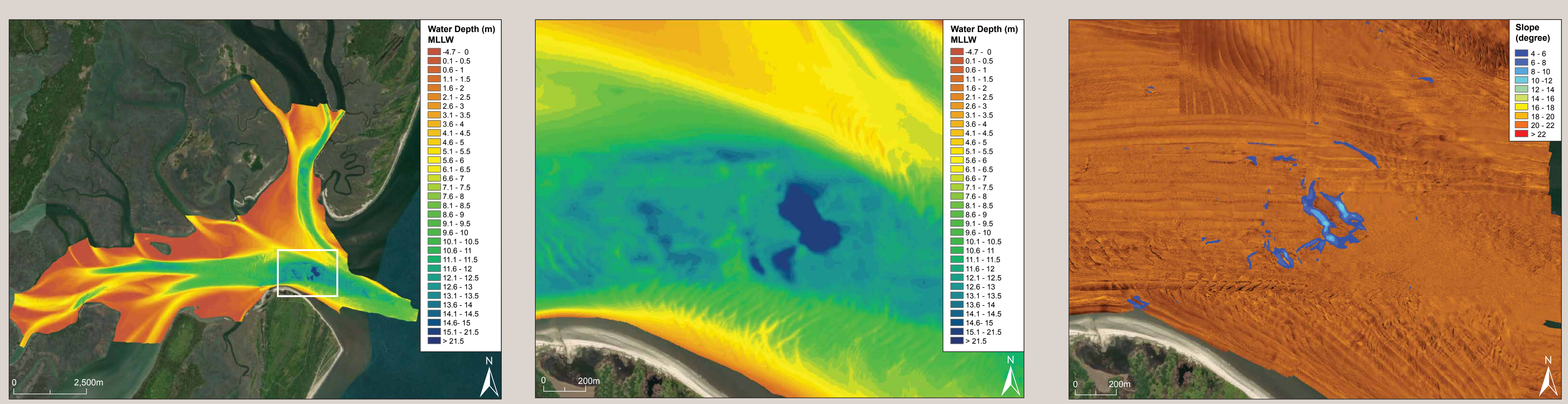


Fig. 5: Sapelo Sound



Discussion:

Although the distribution of habitat types differs within each of these sites, important habitat types are common to all areas. Each study site exhibits regions of mobile sediments, but of critical importance, exhibits deep scours into semi-indurated materials that create vertical relief and hard substrates. Bedforms are common where mobile sediments occur, and scarps and ledges (up to 10 m high and 1000 m long) are distinctly recognizable in bathymetry, sidescan imagery and through slope analysis. These scarps represent previously unknown, potentially important, complex habitat for sessile and mobile organisms, the presence of which has been verified by divers. These scarps also represent essential fish habitat, the presence of which can affect how these areas are managed.

The BTM calculates slope using the bathymetry as the input raster. Slope values in the survey area are overall low, only exceeding 4 degrees in few areas in our 3x3 m gridded data. Steep slopes are commonly found along channel flanks where erosion is actively occurring and where incision has occurred into resistant underlying units. The greatest values are located within the deeply incised inlet throats and at river confluences. Based on incision depths, these scours are incised into the very resistant, Middle Miocene Berryville Clay member of the Coosawhatchie Formation (Fig. 6).

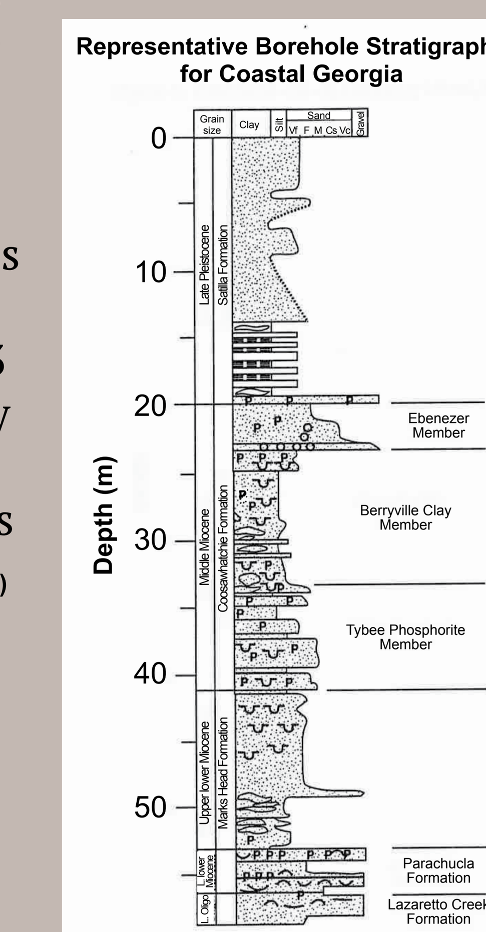


Figure 6.

The authors thank the Georgia Department of Natural Resources Coastal Management Program, NOAA and Skidaway Institute small boat operations for their support of our mapping efforts in coastal Georgia.

Reference:

Wright, D.J., Pendleton, M., Boulware, J., Walbridge,S., Gerlt, B., Eslinger, D., Sampson, D., and Huntley, E. 2012. ArcGIS Benthic Terrain Modeler (BTM),v. 3.0, Environmental Systems Research Institute, NOAA Coastal Services Center, Massachusetts Office of Coastal Zone Management. Available online at http://esriurl.com/5754.