

Multibeam Sonar Analysis Comparing Shelf-Edge Sites off South Carolina

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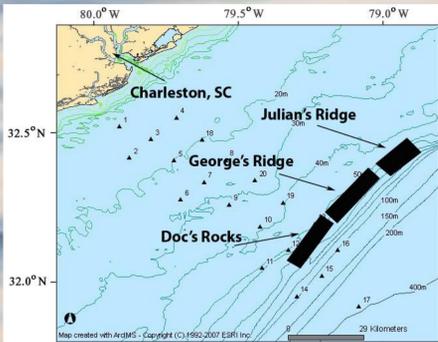


Figure 1: Doc's Rocks and George's Ridge, located ~85 km off the SC coast. Both are both southwest of Julian's Ridge.

The shallow portion of the continental shelf edge, approximately 85 km off the coast of Charleston, SC in water depths ranging from 40 to 200 m, is located within an area known as the South Atlantic Bight. Here, upward tilted, exposed rocky ridges and other hardground environments interact with the Gulf Stream to create unique habitats with potential importance to future marine conservation, such as Marine Protected Area designation plans. From August 19 to 28, 2006, Dr. George Sedberry of the South Carolina Department of Natural Resources led a cruise aboard the NOAA Ship *Nancy Foster* to collect multibeam sonar data along the shelf edge using a Simrad EM1002 multibeam system. The study area, here referred to as George's Ridge, is approximately 21 km long and 2.5 km wide, with a northeast/southwest orientation, and depth ranging from 47 to 77 m. In the same year (October 11), College of Charleston Seafloor Mapping Program students collected additional multibeam sonar data from aboard the NOAA Ship *Nancy Foster* at an area now referred to as Doc's Rocks. This site is southwest of and nearly adjacent to George's Ridge. Doc's Rocks is approximately 18.5 km long and 1.5 km wide, and is similarly oriented NE/SW to George's Ridge, with depths ranging from 47 to 61 m. Data from both sites were processed using Caris HIPS 6.1 software, and their bathymetry and features were compared and interpreted for the purpose of preliminary benthic habitat characterization.



METHODS

- NOAA Ship *Nancy Foster*
- Data collected with Simrad EM1002 multibeam sonar system
- Data processed with CARIS HIPS 6.1
- Underwater video taken on previous cruises using Phantom 300 ROV and Johnson Sealink submersible systems.

RESULTS

- Multibeam data analysis shows that George's Ridge has linear features similar to those found at Doc's Rocks and Julian's Ridge (James et al., 2008).
- Ridge-like feature in the north of Doc's Rocks continues into the South of George's Ridge.
- Similar relief (approximately 47 – 77 m) is found at all three shelf edge sites.
- Underwater video of features at Doc's Rocks and Julian's Ridge show hardground environments that are exposed in some areas and infilled with sediment in others.

Figure 2: George's Ridge

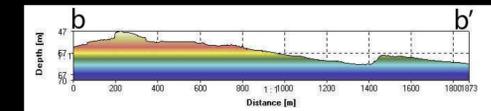


Figure 2b: 3-d view (right) and profile b-b' (above)

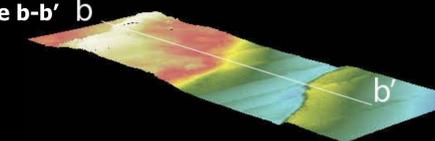


Figure 2a: 3-d view (right) and profile a-a' (below, right)

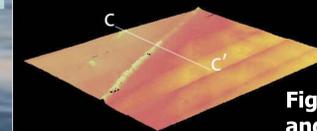
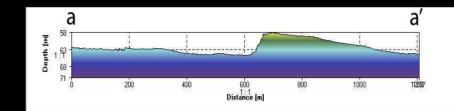


Figure 2c: 3-d view (left) and profile c-c' (below, left)

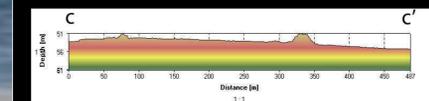


Figure 2: Close up of George's Ridge, an area approximately 21 km long and 2.5 km wide. Profile a-a' : A linear feature approximately 400 m wide with steep relief on one side. Profile b-b' : A cross section from a broad elevated area to the relatively parallel linear feature. Profile c-c' : A linear feature approximately 100 m wide with steep relief on both sides. All 3-d views looking North with vertical exaggeration of 5x.

Figure 3: Doc's Rocks

Photo from Mode et al. 2007

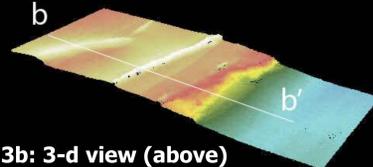


Figure 3b: 3-d view (above) and profile b-b' (below)

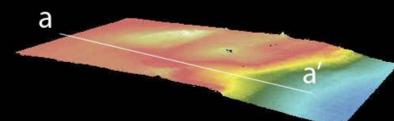
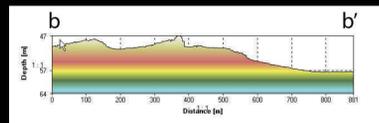


Figure 3a: 3-d view (above), profile a-a' (below) and underwater image of exposed rocky habitat (left)

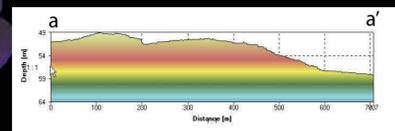


Figure 3c: 3-d view (right) and profile c-c' (below, right)

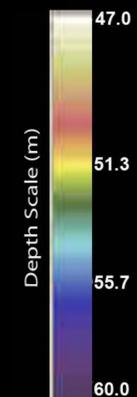
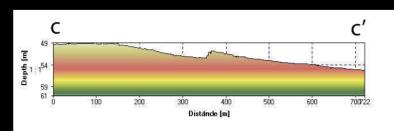


Figure 3: Close up of the southern portion of Doc's Rocks, an area approximately 18.5 km long and 1.5 km wide. Profile a-a' : Broad elevated area bisected by a ledge. Profile b-b' : Cross section of multiple parallel ledges. Profile c-c' : A linear feature approximately 100 m wide with steep relief on one side. All 3-d views looking North with a vertical exaggeration of 5x.

Figure 4: Doc's Rocks and George's Ridge

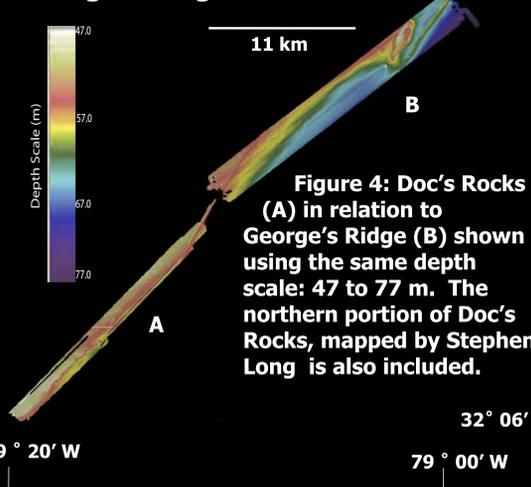


Figure 4: Doc's Rocks (A) in relation to George's Ridge (B) shown using the same depth scale: 47 to 77 m. The northern portion of Doc's Rocks, mapped by Stephen Long is also included.

DISCUSSION

Submersible dives at Julian's Ridge (Figure 5) observed that concentrations of fish and seafloor bathymetry are related (Sedberry et al., 2004). The most dense populations of fish were associated with areas of exposed hardground with high relief. Many economically important types of fish including grouper, tilefish, amberjack, and snapper live in these habitats. Multibeam sonar analysis can be used to characterize the benthic habitat and locate possible areas favorable to fish spawning. At Julian's Ridge, rocky hardground surfaces of bioeroded rocks with low to high relief were observed in videos from submersible dives (Figure 5). ROV video at Doc's Rocks confirmed rocky ledges covered in invertebrates (Figure 3a). Linear ridge-like features analyzed with multibeam sonar at George's Ridge are similar in orientation and relief to those of Julian's Ridge and Doc's Rocks (Figures 4 and 5). It is likely that underwater video would show similar low to high bioeroded rocks and benthic fauna at George's Ridge. Marine Protection Areas are intended to protect the spawning sites of overfished species declining in population. Further shelf edge mapping and benthic habitat characterization is necessary in order to designate MPAs in the most beneficial locations.

Figure 5 : Julian's Ridge



Figure 5a: High relief bioeroded rock



Figure 5b: Moderate relief bioeroded rock

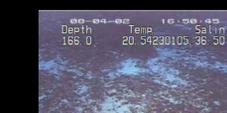


Figure 5c: Low relief bioeroded rock

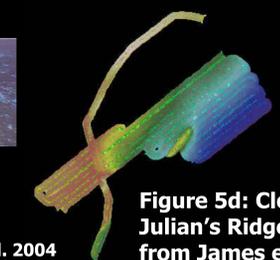
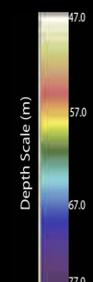


Figure 5d: Close up of Julian's Ridge (modified from James et al., 2008)



Photos from Sedberry et al. 2004

ACKNOWLEDGEMENTS
We would like to thank NOAA Ship *NANCY FOSTER*, Dr. George Sedberry, Stephen Long, Josh Mode, Katrina Wyllie, the TRANSECTS Program, the CofC Geology Dept., and CARIS.

REFERENCES

- Schobernd, C., Sedberry, G., Shelf-Edge and Upper-Slope Reef Fish Assemblages In the South Atlantic Bight: Habitat Characteristics, Spatial Variation, and Reproductive Behavior. *Bulletin of Marine Science*, January 2009.
- Sedberry, G., Cooksey, C.L., Crowe, S.E., Hyland, J., Jutte, P.C., Ralph, C.M., and Sautter, L.R., Characterization of Deep Reef Habitat off the Southeastern U.S., with Particular Emphasis on Discovery, Exploration, and Description of Reef Fish Spawning Sites. May 2004., project # NA16RP2697
- James, S., Meany, K., Munn, G., Wyllie, K., Sautter, L. "Multibeam Sonar Analysis of the South Carolina Shelf Edge." 2008.
- Mode, J., Stubbs, C., Sautter, L. "Triple Ledges: Sonar Characterization of Rocky Continental Shelf-Edge Exposures off Charleston, South Carolina." 2007.

