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Assessing Bottom Gear Impact in the WGOM Closure Area: A Multifaceted Approach

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Assessing Bottom Gear Impacts in the WGOMCA: A Multifaceted Approach

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Mashkoor Malik presented the results of a UNH Center for Coastal and Ocean Mapping (CCOM) study of the seafloor of the WGOMCA.

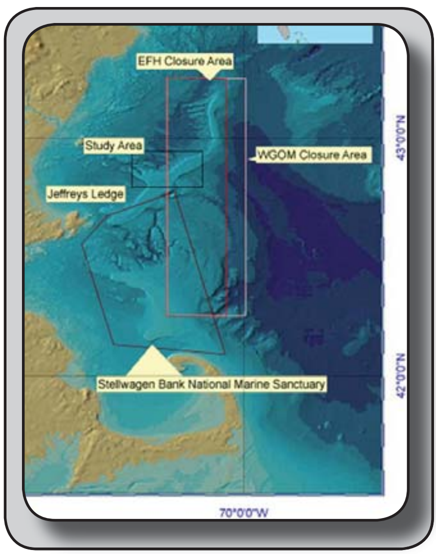
Objectives

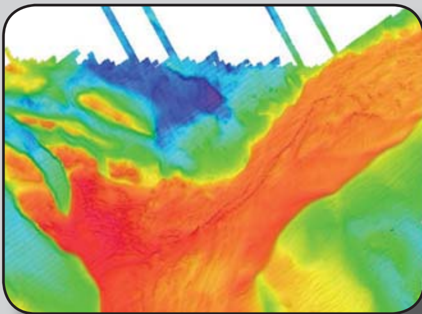
The objectives for the CCOM study were to:

- Construct a bathymetric map of Jeffrey's Ledge to serve as a framework for subsequent studies.
- Test the potential use of multibeam sonar to monitor fishing gear impacts.
- Determine if it is possible to observe closure impacts with multibeam sonar.

Summary of Results

Video, sidescan sonar and multibeam sonar (MBES) were used to investigate the study site. A Reson 8101 MBES survey was conducted in December 2002-January 2003. It covered the middle of Jeffrey's Ledge with a total of 16.6 km x 24.6 km of area surveyed. It was used to create a high-resolution (~5m) bathymetric map, which was made available to UNH researchers for subsequent planning and research. The resolution was fine enough to see iceberg scours, sand waves, end moraine-like structures and bottom gear marks. Reson 8125 MBES (a higher frequency

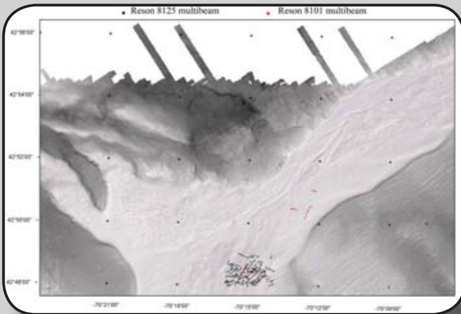




Bathymetric map of the study area produced by CCOM.

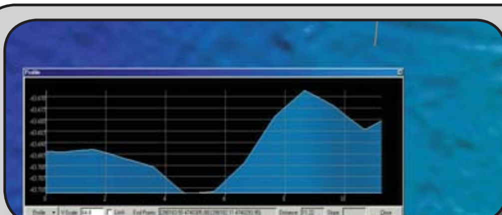
MBES) was used in 2003. It allowed enhanced resolution (up to one meter) covering a 2 x 3 km area in the middle of the study site. Both MBES surveys were conducted to provide coverage over both the open and closed areas in the western GOM. About 25 km of sidescan transects were collected in 2003 overlapping the previously collected MBES data. A bottom videographic survey of over 189 bottom sampling sites (collected by Larry Ward, UNH) was also analyzed during this study.

Amongst the widely known impacts of bottom-tending gear (i.e., scraping the seafloor, removing sessile epifauna and infauna, and leveling off features), MBES was used to successfully map the scraping impacts in the form of bottom marks. The analysis of high-resolution MBES data identified bathymetric scars that later were attributed to bottom-tending gear. The depth of these bottom marks was described as several cm deep with lengths up to several km. The widths of these marks were observed to be about 3-5 m and the marks did not show any strong directionality. Bottom marks were also detected using side scan sonar (2003, Klein 5500; 2004, Benthos 3D), but were not visible in the video data. The bottom marks were found on both the open and closed sides around the WGOMCA, and there was no difference in density inside versus outside the closed area. Indeed, some seabed marks were continuous across the open–closed boundary. The bottom marks are often, though not always, associated with boulders at one end and a depression at the other. Physical evidence (size, length, orientation, presence of single rather than double marks) sug-

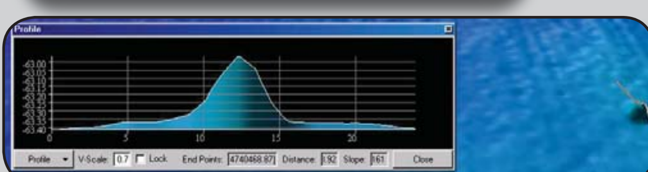


Bathymetric map produced by CCOM of bottom marks observed in the study area.

gests that the marks were made by scallop or clam dredges. In those cases where a boulder was found at the end of the bottom mark, the cause may be related to the indirect interaction of dredges or trawls dragging the boulders. The bottom marks seen with the sonar systems were not discernible by inspection with a video camera. This implies that the marks were old enough for the textural contrast expected in fresh marks to have disappeared, perhaps as a consequence of re-colonization or sedimentation. This, along with the fact that there were no differences in the bottom marks re-surveyed more than one year apart, implies that the bottom marks may be long-lasting and/or created before the Closure.



Cross section of a bottom mark observed in the study area.



Cross section of bottom mark ending in a boulder.

During the course of the study, bottom-tending gear impacts resulting in a leveling of features (i.e., loss of habitat complexity) were also addressed. The video data were used to classify the video sites into one of the seven classes (e.g., flat mud and sand, mud and sand with biogenic structure). The underlying assumption of this model is that with increasing level of bottom fishing, the level of habitat complexity would be lost (e.g., biogenic structure like burrows would be leveled off converting a site described as mud and sand with biogenic structure to flat mud and sand). Although video data was able to differentiate between classifications, the complexity loss in each class has yet to be determined. Another critical concern is the potential resolution of the MBES whereby MBES is not expected to differentiate between features at scales of few cm (e.g., burrows, sponge cover, etc.). During this study, MBES derived classification maps were constructed with seven classes from video data (flat mud and sand 41.18%, biogenic structure 0%, shell aggregate 36.36%, pebble and cobble 32.43%, pebble and cobble with cover 41.67%, boulders or partially buried boulders 55.81%, and piled boulders 57.14%).

An ability to integrate and compare multi-beam sonar, sidescan-sonar and bottom-video data in a single, interactive, three-dimensional workspace greatly facilitated the analysis and interpretation of these complex data. The evidence collected during this study suggests that bottom fishing may cause long-term physical impacts on seafloor structure. Having now established a detailed, precisely positioned base-map of bottom marks, future work will continue to monitor the fate of these features and include additional work on Jeffrey's Ledge to map the distribution of demersal and benthic species. Comparison of these distributions with bottom-impact maps will inevitably result in a better understanding of long-term changes in benthic populations.