

Bathymetric Survey of Lionfish Habitat at a Mid-Shelf Rocky Ledge, Onslow Bay

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ABSTRACT

The problem of growing populations of the venomous lionfish, *Pterois volitans*, along the Southeastern United States coast has become an increasingly pressing issue for the regional fisheries of Onslow Bay. The lionfish has few natural predators allowing populations to reproduce rapidly and threaten indigenous populations. Beginning in 2005, researchers from the NOAA Center for Coastal Fisheries and Habitat Research (Beaufort, NC) began a multibeam sonar study of Onslow Bay, hoping to gain a better understanding of lionfish densities and habitat in order to address management concerns. Multibeam sonar surveys of two mid-shelf sites (water depth ranging 32 to 45 m) Lobster North and Lobster South were conducted aboard NOAA Ship NANCY FOSTER. Each year the area of study was expanded to build a larger, more concise bathymetric image of the sea floor. The bathymetric data have been processed using CARIS HIPS 7.0 and focus on Lobster South using data collected in 2008 and 2009. Comparison to previous Lobster North data will also be made with regard to similarities in ledge relief as a method to assess variations in seabed morphology and lionfish population densities.

BACKGROUND

Onslow Bay, NC is of interest, as the rocky ledges of the area contain habitat similar to venomous lionfish's (Fig. 2) native habitat in the Indo-Pacific. Once the ideal habitat for this invasive species is determined, fisheries management will be more apt to handle the rapid growth of this dangerous fish (Whitfield, 2005). Lionfish feed mainly on the larvae of shrimp, grouper, and snapper, affecting the local and regional fishing economies (Quattrini et al. 2004). Several areas throughout Onslow Bay have been mapped using multibeam sonar; areas of Lobster South were mapped in 2006, April 2008, and June 2009 (Fig. 3) and at Lobster North in 2007 (Whitfield, 2005). In 2004, Paula Whitfield began studying the regional distribution of lionfish in Onslow Bay, NC with the support of NOAA's Undersea Research Center in Wilmington, NC.



Fig. 2. The venomous Red Lionfish, *Pterois volitans*. (photo courtesy of P. Whitfield)

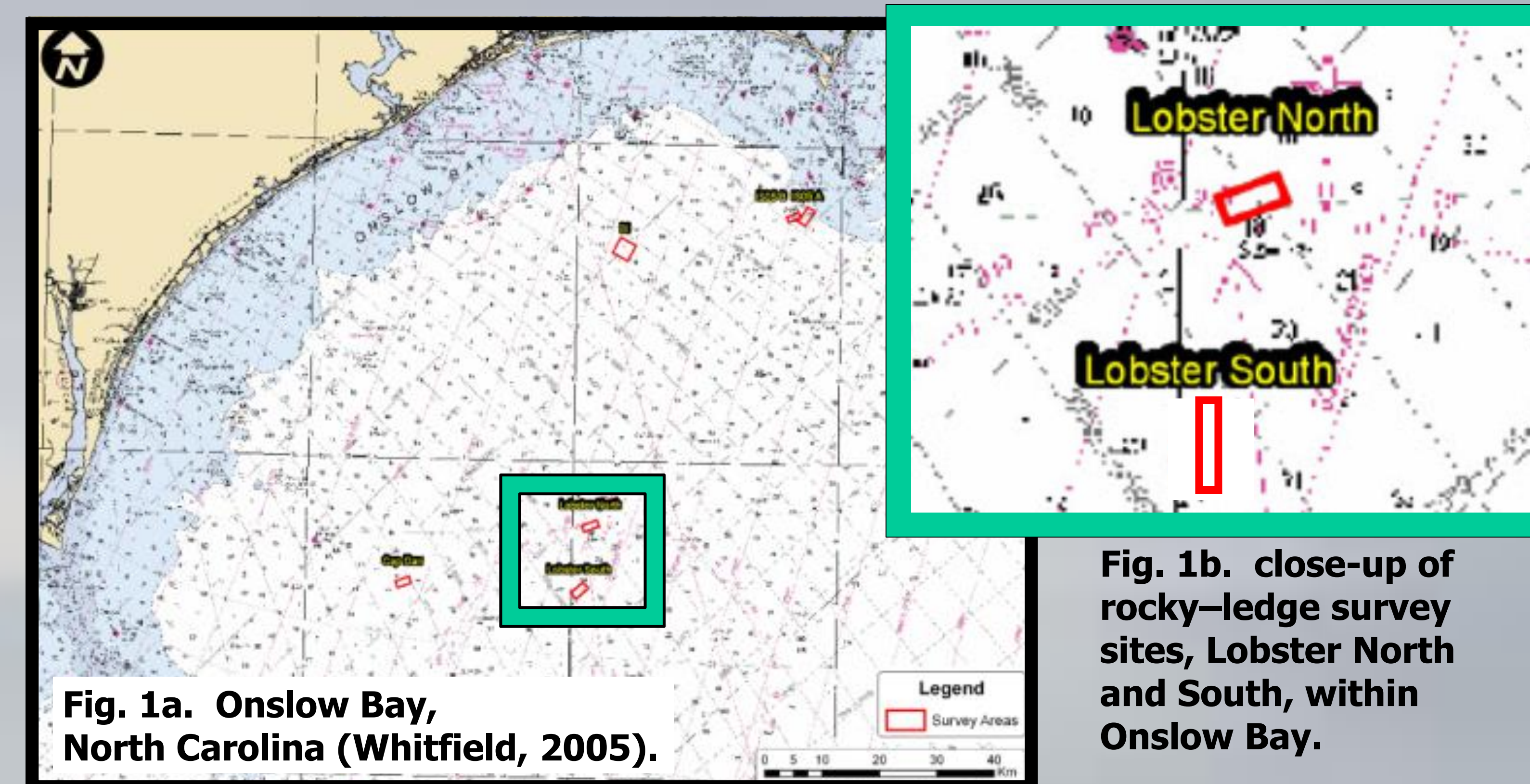


Fig. 1a. Onslow Bay, North Carolina (Whitfield, 2005).

Fig. 1b. close-up of rocky-ledge survey sites, Lobster North and South, within Onslow Bay.



Fig. 5 Lionfish in Onslow Bay. Example of ledge relief.



METHODS

Scientists from the Undersea Research Center in Wilmington, NC (Paula Whitfield, PI) conducted multibeam sonar mapping aboard the NOAA Ship Nancy Foster, using a SIMRAD EM1002 data acquisition system. Raw data for the study region were collected in 2008 and 2009, then were cleaned and processed using CARIS HIPS 7.0. New multibeam data coupled with data processed previously were used to assess the rocky ledges of Lobster South and Lobster North.

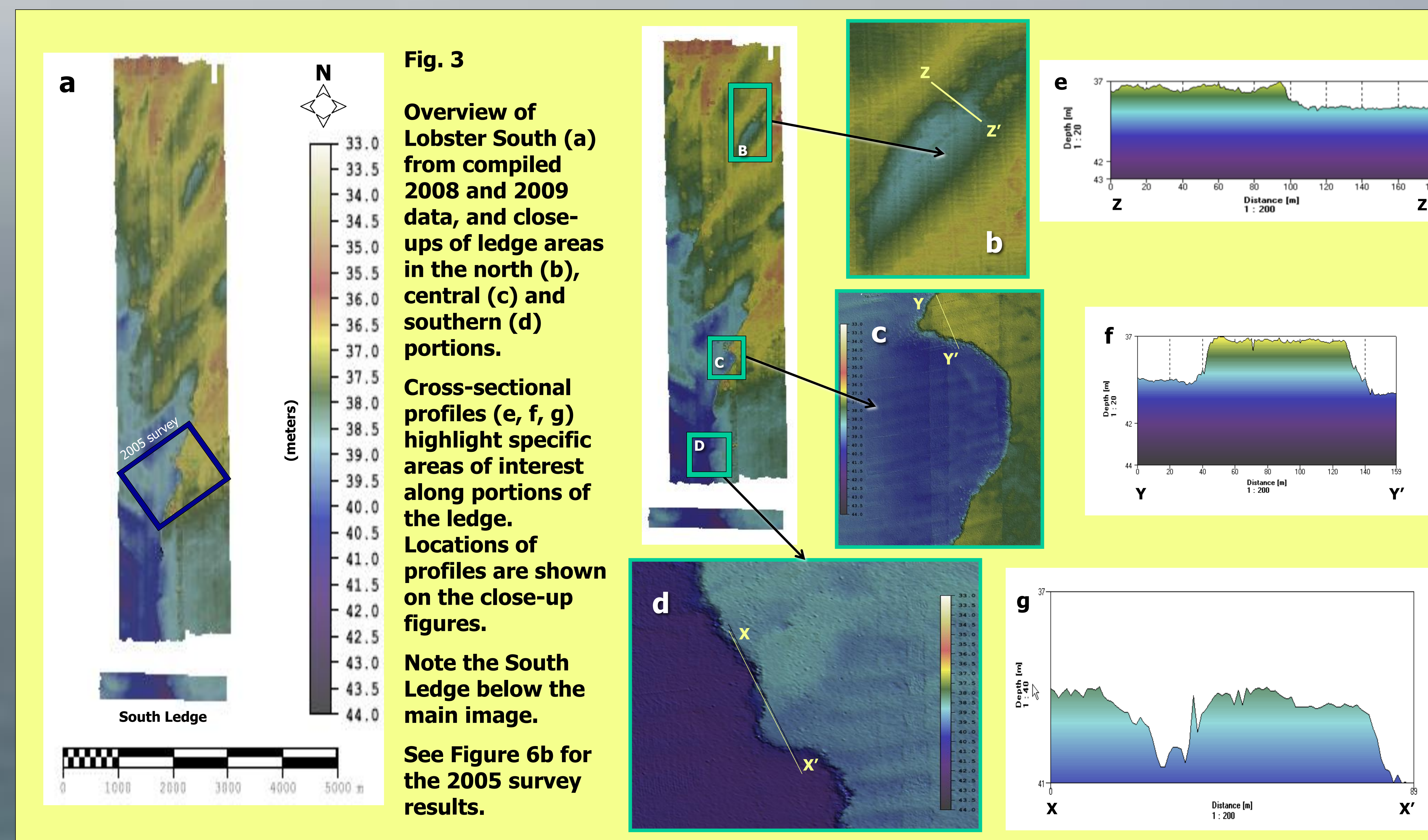


Fig. 3

Overview of Lobster South (a) from compiled 2008 and 2009 data, and close-ups of ledge areas in the north (b), central (c) and southern (d) portions.

Cross-sectional profiles (e, f, g) highlight specific areas of interest along portions of the ledge. Locations of profiles are shown on the close-up figures.

Note the South Ledge below the main image.

See Figure 6b for the 2005 survey results.

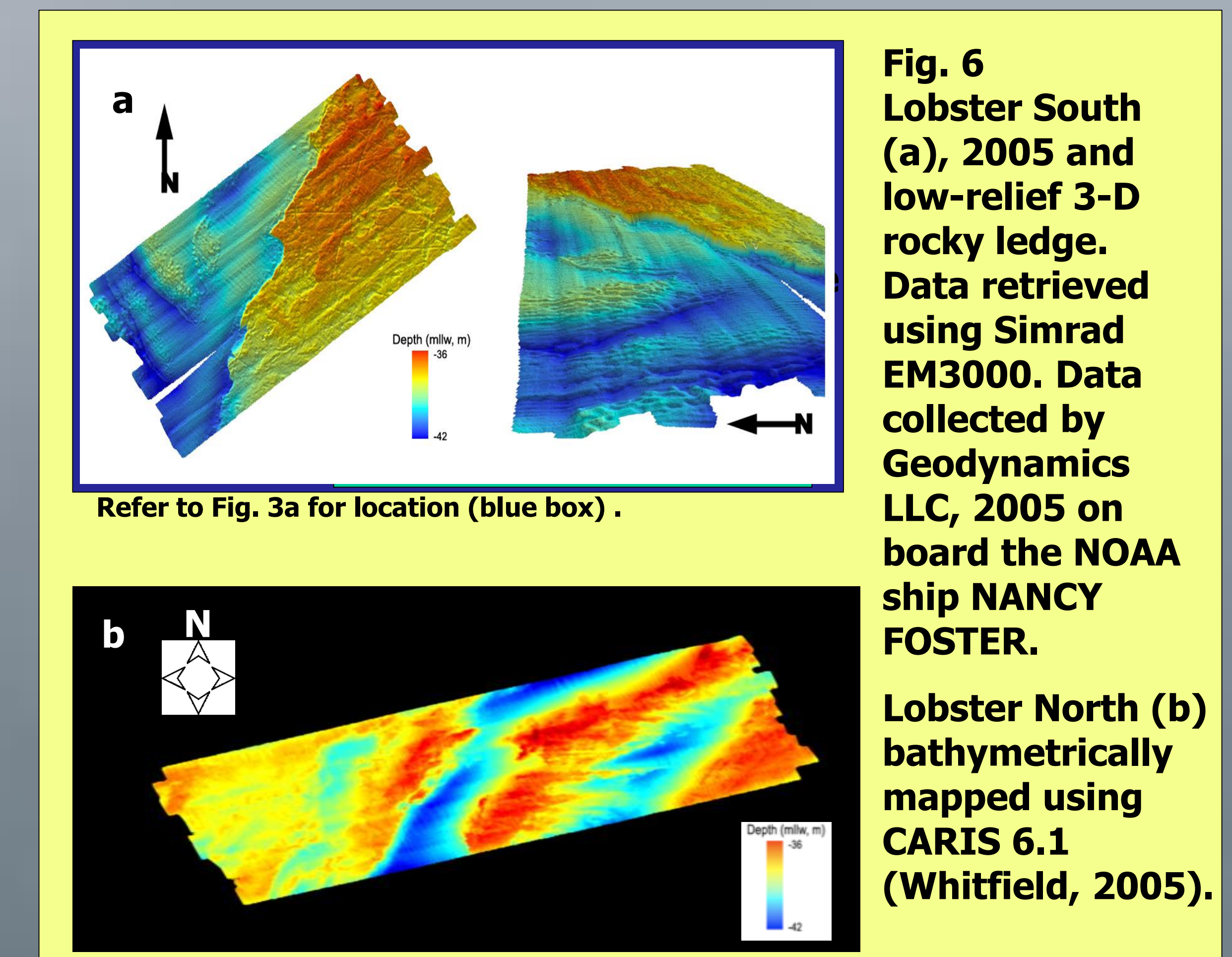


Fig. 6 Lobster South (a), 2005 and low-relief 3-D rocky ledge. Data retrieved using Simrad EM3000. Data collected by Geodynamics LLC, 2005 on board the NOAA ship NANCY FOSTER. Lobster North (b) bathymetrically mapped using CARIS 6.1 (Whitfield, 2005).

DISCUSSION and CONCLUSIONS

- The areas of Lobster South and Lobster North of Onslow Bay, NC are both ideal habitats for the invasive lionfish. The rocky ledges of the regions are proxy to the native environments of the Indo-Pacific, and aided by the Gulf Stream the annual water temperature (Kimball et al. 2004) remains within the lionfish's zone of comfort. These factors will allow the lionfish to survive and thrive in its new Atlantic environment.
- Using fisheries acoustics in conjunction with multibeam will create more concise reports of lionfish population densities and preferred habitats.
- Future topics of study include ledge substrate analysis, lionfish reproduction rates and cycles, annual population density reports, and continuous monitoring of grouper, snapper, and shrimp fisheries populations.
- Determination of future multibeam survey sites depends on known population densities of lionfish in Onslow Bay (Whitfield 2005), and therefore would require more dive operations wherever possible.
- Through cooperative use of fisheries studies and multibeam surveys a sustainable solution to the presence of the exotic lionfish along the eastern seaboard of the United States can be developed.

RESULTS

- The rocky nature of the ledges is evident in the digitized profiles of Lobster South (Fig. 3c and e)
- Overall bathymetry of Lobster South ranges from 32 to 45 meters with an approximate relief of 2 meters along rocky ledge edges (Fig. 3a, b, and c)
- Lobster South and Lobster North both have similar ledge features, those of Lobster South being more defined (Fig. 6a and b)

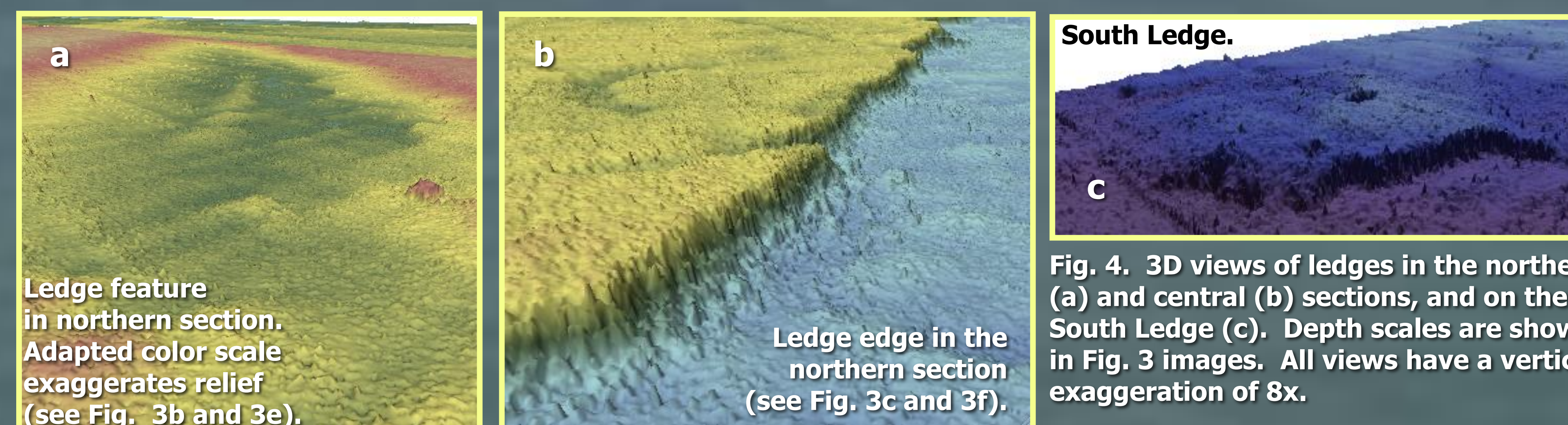


Fig. 4. 3D views of ledges in the northern (a) and central (b) sections, and on the South Ledge (c). Depth scales are shown in Fig. 3 images. All views have a vertical exaggeration of 8x.

References

- Quattrini AM, Ross SW, Sulak KJ, Necaime AM, Casazza TL, Dennis GD. 2004. Marine fishes new to continental United States waters, North Carolina, and the Gulf of Mexico. *Southeastern Naturalist* 3(1):155-172.
- Kimball ME, Miller JM, Whitfield PE, Hare JA. 2004. Thermal tolerance and potential distribution of invasive lionfish on the east coast of the United States. *Marine Ecology Progress Series* 283: 269-278.
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