Final Report

Sea Scallop Research

Grant: NOAA/NA05NMF4540013

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Project Title: **Development of an interactive video map detailing the benthic community of the Nantucket Lightship Closed Area and the Western Great South Channel.**

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1. Project Summary

Objectives: The objective of this project was to develop an interactive desktop tool to allow users to query the SMAST video survey database for the Nantucket Lightship Closed Area (NLCA) and the western Great South Channel (GSC) and simultaneously access still images and video survey footage collected at each survey station. This system, called the Underwater Survey Viewer (USV), is user-friendly and uses readily available software. Further, we initiated work on a portable USV to facilitate use by off-site working groups (e.g. New England Fisheries Management Council Plan Development Teams) or in educational outreach programs.

Methodology: We used an Avid Express Pro HD: Real Time Film and Video Editing® (2004 Avid Technologies Inc.) system with the Avid Mojo® digital nonlinear accelerator to convert 2,800 individual analog video clips to digital clips. Each clip and still image was linked to the SMAST video survey database using ESRI ArcGIS® software. To support interpretation of video and still imagery accessed through the USV, we use the video survey species identification and reference guide. Users will be given an introduction to the use of the USV, provided with the reference guide and access to the published scientific literature derived from the SMAST video survey.

Conclusions:

1. The 6 harvest cruises proposed in grant NOAA/ NA05NMF4540012 were completed during the summer of 2005.
2. We successfully converted the analog survey footage of the NLCA (204 stations) and the western Great South Channel (496 stations) to digital clips.
3. The digitized video clips and still images were renamed and hyperlinked to the SMAST video survey database in ArcGIS® and the USV system has been in use at SMAST since September 2006.

Rationale: The research completed under this grant, coupled with our ongoing work, has the potential to greatly enhance our understanding of marine benthic communities simply by making video footage and still imagery accessible alongside georeferenced survey data. In addition, the development of the desktop USV is the first step towards a web-based system which will greatly expand the accessibility of these data.

2. Description of the issue/problem

Beginning in 1999, we conducted a visual census of surficial substrates and megabenthos in offshore sea scallop, *Placopecten magellanicus*, beds using underwater video in a centric, systematic, quadrat survey design. We have examined 172,848 quadrats, viewing >250,000 m^2 of sea floor along 60,000 km^2 of continental shelf. These data are used to map surficial substrates and megabenthos, assess the impacts of a short term sea scallop fishery, produce an identification key for megabenthos and substrates, and provide fishery managers spatially explicit sea scallop density and size distribution information (Stokesbury 2002, Stokesbury et al. 2004, Stokesbury and Harris 2006) . Presently, the SMAST video survey database consists of information collected from one digital still image extracted from each analog video sample. A great deal of information remains on the analog video tapes, but it is difficult to access in a timely fashion.

Project goals and objectives:
The objective of this project was to develop an interactive desktop tool to allow users to query the SMAST video survey database for the NLCA and the GSC and access still images and video survey footage collected at each station. Further, we initiated work on a portable USV system to facilitate use by off site working groups (e.g. New England Fisheries Management Council Plan Development Teams) or in educational outreach programs.

The problem addressed:
To allow interactive data mapping and access to still imagery and video footage we created the underwater survey viewer (USV) (Figure 1). The USV system is a desktop PC-based tool located at the University of Massachusetts Dartmouth School for Marine Science and Technology (SMAST) which links the video survey database with the still images and video footage using ESRI ArcGIS® software.

3. Approach

We have completed the 6 harvest cruises proposed in grant NOAA/ NA05NMF4540012. Table 1 is a time-line listing the cruises completed.

Table 1. The 6 harvest trips were all completed before the end of the fishing year (2/28/05), the date below is the one on the checks received by the University (Support Document 1).

Date	F/V conducting harvest cruise
1/25/2005	Huntress
1/31/2005	Edgartown
1/25/2005	Frontier
1/31/2005	Venture
1/31/2005	Celtic
1/31/2005	Stardust

Before each cruise I contacted Mr. Pete Christopher or Mr. Don Frie of the NMFS who provided a letter of authorization for the research and harvest cruises and notified the Coast Guard of our

activities. Upon returning to port I contacted the NMFS again and provided an account of the cruise.

USV

To make the analog footage available we converted the video samples to individual digital video clips using used an Avid Express Pro HD: Real Time Film and Video Editing® (2004 Avid Technologies Inc.) system with the Avid Mojo® digital nonlinear accelerator. Each clip and still image was linked to the present SMAST video survey data set using an ArcGIS® based interactive map. To support interpretation of video and still imagery accessed through the USV, and to help users understand the video survey sampling design we use the video survey species identification and reference guide.

Results

USV

We proposed to develop the USV using the 2004 Nantucket Lightship Closed Area (NLCA) video survey (816 samples) but were able to expand the system to include the 2004 Western Great South Channel (GSC) survey making over 2,800 sampling locations available (Figures 1 and 2). This system provides immediate access to data, still images and video footage for 9059 m^2 of sea floor covering 1099 km^2. Presently, the desktop USV system is available for use at SMAST. A laptop based portable USV system is being tested by a graduate student examining skates (Figure 3)

Figure 1. The USV allows information to be visualized in an interactive GIS map, which links data to the 3.235 m^{-2} (upper) and the 0.8m^{-2} (lower) digital still images of the sea bed from the video survey (NLCA Station 547 Quadrat 1). A color coding system identifies species; here scallops are shown with red dots.

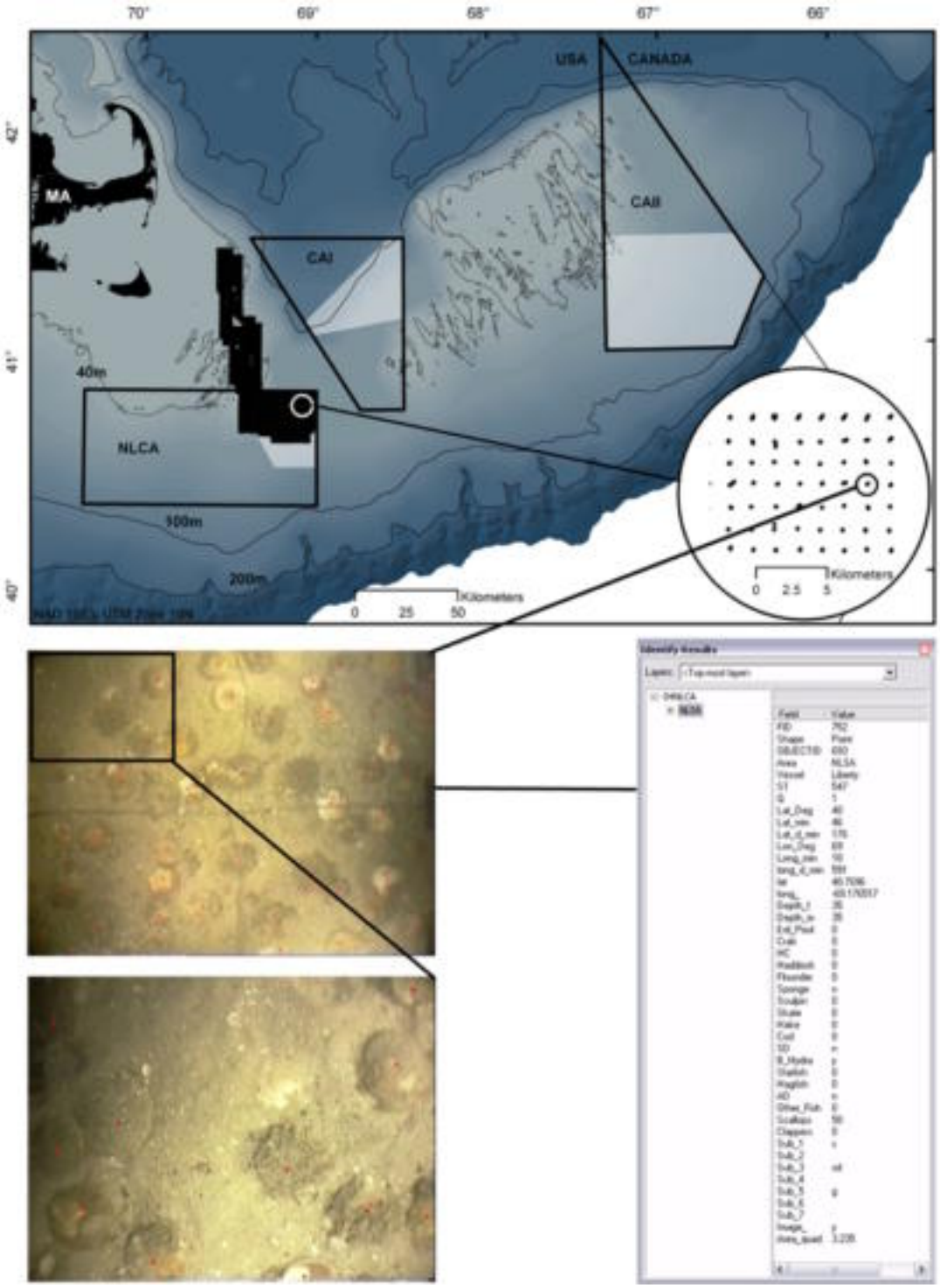
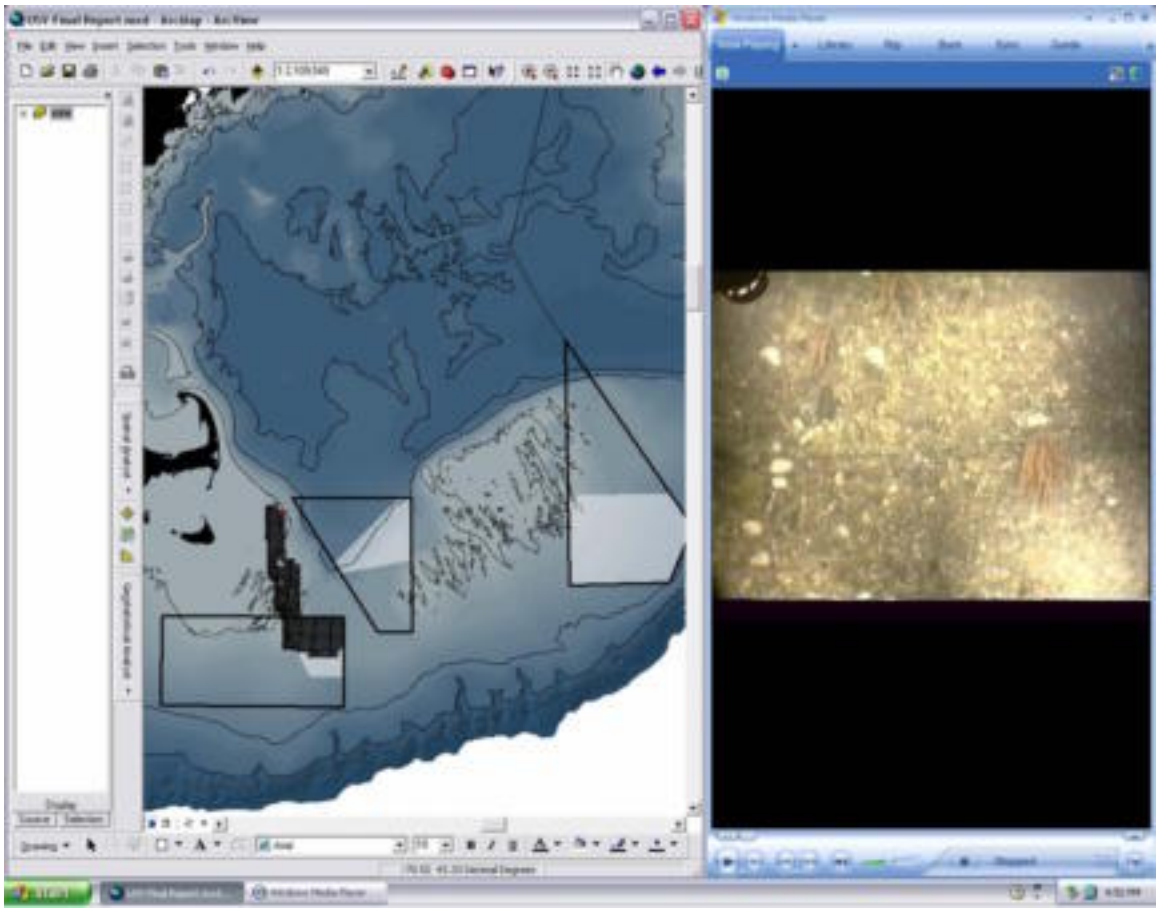


Figure 2. The digital footage from Station 14 Quadrat 2 in the GSC (highlighted red) playing through the USV interactive GIS map using Windows Media Player®.

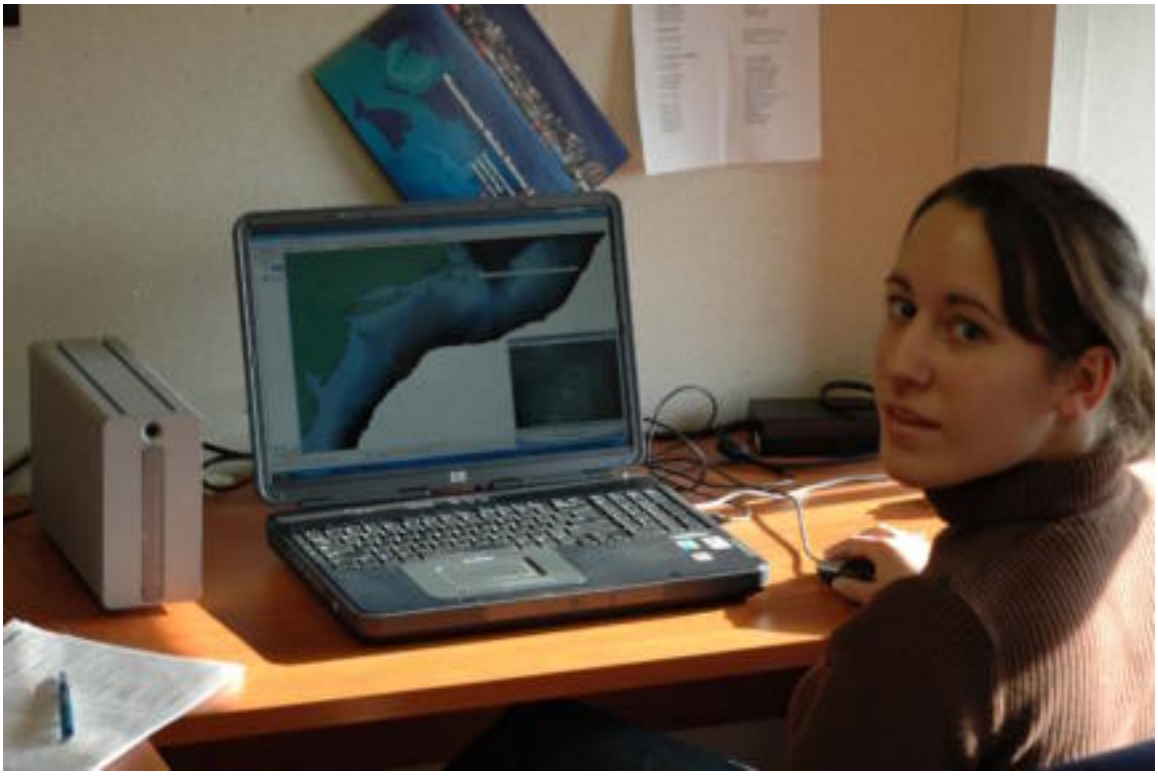


Portable USV

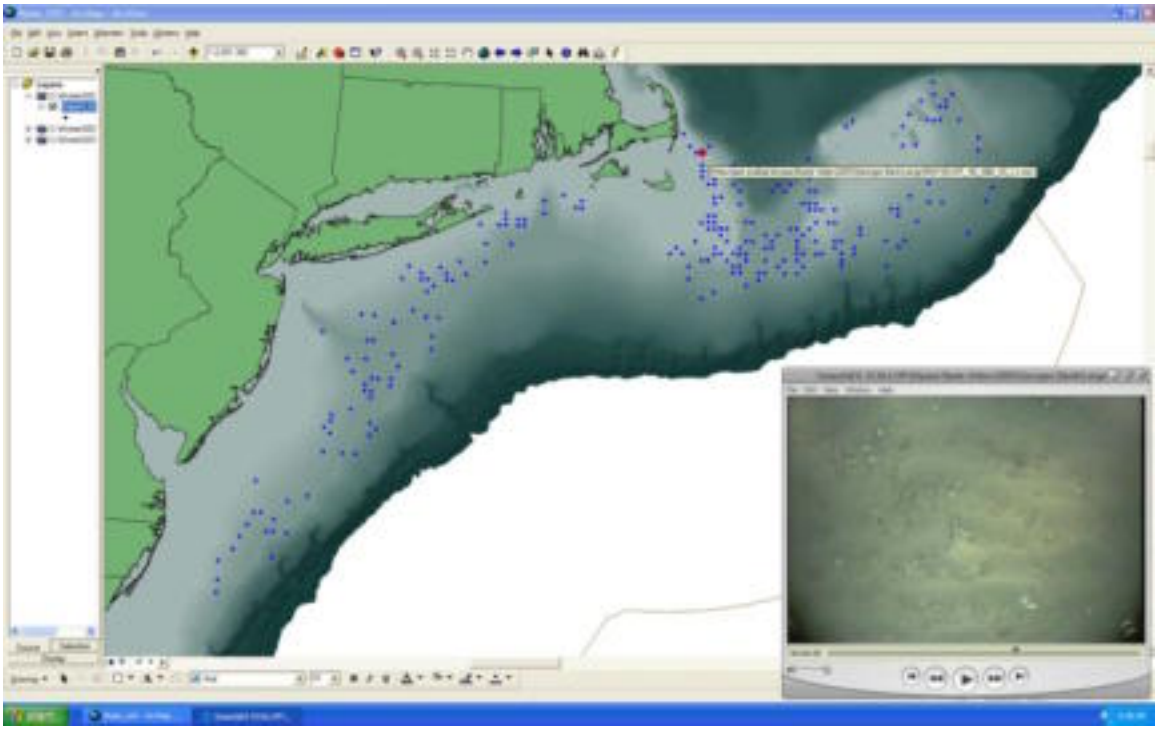
Presently, a MS student is using a laptop based version of the USV to examine the effects of the SMAST video pyramid on skate behavior (Figure 3). The USV is an integral part of the skate behavior sampling because it allows for immediate access to the survey footage by selecting only clips in which skate are present and allowing the viewer to watch each clip at the click of a button.

Figure 3. A. Graduate student Alyssa MacDonald uses the portable USV system to examine skate behavior. B. The survey footage (highlighted red) playing through the USV using QuickTime®.

A.



B.



Species identification and reference guide

To support the analysis of the video survey footage and the standardization of image processing we developed a species identification and reference guide (Figure 4; Support document 2). The guide is key to the interpretation of video and still imagery accessed through the USV and will help users understand the video survey sampling design.

The video survey species identification reference guide is a 76 page document with detailed information on over 29 species groups. The primary purpose of this document is species identification for video surveys and as such it is a work in progress. We have drawn heavily from the descriptions found in Scott and Scott's *Atlantic Fishes of Canada*, Bigelow and Schroeder's *Fishes of the Gulf of Maine*, Pechenik's *Biology of the Invertebrates*, Martinez's *Marine Life of the North Atlantic*, and Gosner's *A Field Guide to the Atlantic Seashore*. The scientific names are from the American Fisheries Society's *Common and scientific names of fishes from the United States, Canada, and Mexico*, 6th edition, and from the Integrated taxonomic information system.

Figure 4. Sea scallop section of the SMAST video survey species identification reference guide.

Evaluation

Benefits and contributions to management decision making:
This project focuses on information accessibility. The SMAST video survey continues to provide critical spatially and temporally specific information for assessments of the sea scallop stock and benthic habitat. Prior to developing the USV, the survey information is accessible in the form of primary literature, special reports, presentations and testimony. The design of the video survey permits a very unique process for examining and evaluating scientific information. That is, before, during and after data analysis the raw footage and imagery of the sea bed can be viewed based on its geographical location.

To make the USV available and applicable to fisheries management we are soliciting input from the Chairpersons of the Scallop and Habitat Plan Development Teams of the New England Fisheries Management Council. We will incorporate their comments and continue development of a portable USV.

References

Stokesbury, K. D. E. (2002). "Estimation of sea scallop abundance in closed areas of Georges Bank, USA." Trans Am Fish Soc 131: 1081-1092.

Stokesbury, K. D. E., Harris, B. P., Marino, M. C., and Nogueira, J. I. 2004. Estimation of sea scallop abundance using a video survey in off-shore USA waters. J Shell Fish Res, 23: 33–44.

Stokesbury, K.D.E., and B.P. Harris, Impact of a limited fishery for sea scallop, *Placopecten magellanicus*, on the epibenthic community of Georges Bank closed areas, Mar Ecol Prog Ser 307:85-100**.**