THE DREDGE

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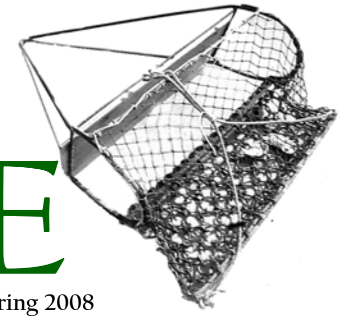

Using Underwater Videography to Monitor Oyster Farms

Raymond E. Grizzle, *University of New Hampshire**
Mike Pietrak, *Maine Aquaculture Innovation Center*
ray.grizzle@unh.edu

New Hampshire Sea Grant (NHSG) recently supported a project to assess various remote sensing methods, including sonars and underwater videography, for mapping and characterizing subtidal oyster reefs. Previous research and the NHSG project demonstrated that various sonars can map and to some extent characterize "shell bottom" areas, and relatively low-cost single beam sounders are commercially available. Towed underwater video, however, might also be an effective lower-cost tool for mapping oyster bottom, including oyster farms. The Maine Aquaculture Innovation Center (MAIC) has an ongoing project investigating the use of video for monitoring oyster farms in Maine, most of which use bottom culture methods. Here we briefly describe the general protocol that has emerged from this research.

The overall system consists of a steel frame, underwater video camera, camcorder, GPS system, and optional laptop computer for navigation and GPS datalogging. The system shown in Figure 1 is mainly deployed as a drop camera that is hopped along the bottom by raising and lowering it as the boat slowly moves along. In this way, complete imagery of the bottom along each shiptrack is potentially acquired and maximum image quality is achieved at selected drop points where the camera remains steady for a few seconds (Figure 2A). The camera can also be deployed on a bottom sled that can be towed at speeds up to about 2 knots and still acquire useful imagery (Figure 2B).

Image analysis can range from simple real-time assessment and manual data recording while watching the video monitor and GPS unit, to the production of detailed maps of the survey area.

(continued on page 2)

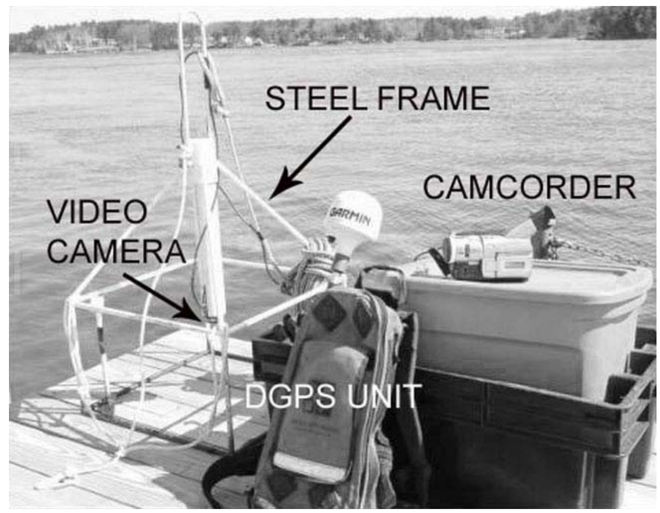

Fig. 1. Underwater video system deployed mainly as a drop camera, consisting of a black & white/infrared camera system (Aqua-Vu Model IR) mounted on a custom-made steel frame, a Garmin differential GPS unit (Model GPS 76), and Sony digital video camera (Model DCR-TRV103) for recording. Total cost is about ~$4,000.

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http://milfordoysterfestival.org

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October

14-16 Seafood HACCP Basic Course, Avery Point, Groton
For more information on HACCP courses, contact nancy.balcom@uconn.edu

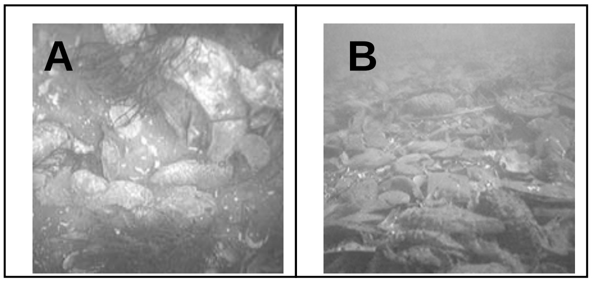

Figure 2. High quality still images extracted from video. A) view provided by drop camera shown in Figure 1 with lens perpendicular to bottom. B) Oblique view provided by sled-deployed camera.

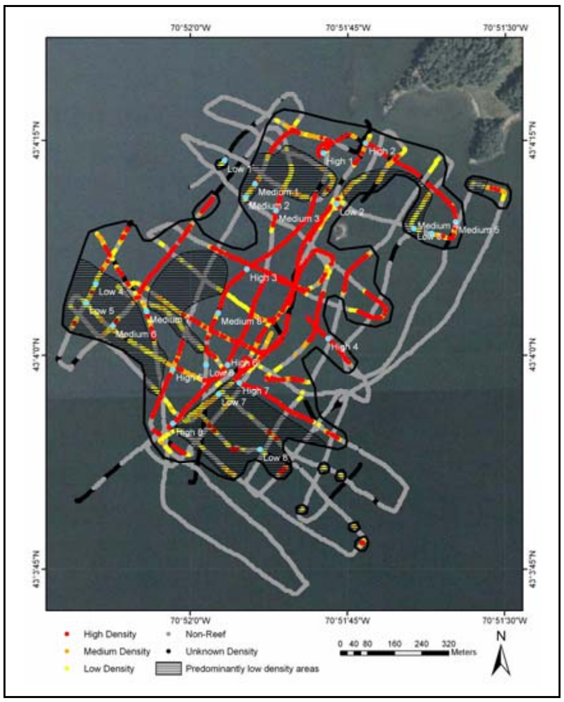

Figure 3. Nannie Island, Great Bay, NH natural oyster reef. Shell density map based on video transects.

The map shown in Figure 3 illustrates the final product when towed video is deployed in the same fashion as single-beam sonars (sounders) where data are continuously logged along multiple transects across the survey area. The key to map production is the concurrent logging of video and GPS data so that all imagery is geo-referenced. Some underwater camera systems imprint the latitude and longitude on the video stream, or the two data files can be linked by time which is usually recorded by both video and GPS.

The NHSG study investigated the possible use of video for obtaining counts of live vs. dead oysters as well as size shell. Both are possible in some cases, but two conditions were identified that limit this application: when spat densities are high, and when there is a lot of dead shell present. The spat are not easily identified due to their small size, and it is typically only possible to unequivocally identify dead shells when the inside of the shell is visible. Thus, total shell counts can be readily obtained but differentiating between live and dead oysters can be difficult, particularly when the oysters are growing as singles and lying flat on the bottom as opposed to clusters of vertically oriented individuals.

Probably the most serious limitation of underwater video is water clarity. The video stills in Figure 2 were obtained when nephelometric turbidity units (NTU) were less than 2. The NHSG study found that useful imagery can probably be acquired in most cases when NTU values are less than ~5, which corresponds to total suspended solids (TSS) of ~10 mg/L. More work, however, is needed on the relation between image quality and water clarity.

The MAIC study is examining the potential for underwater video systems to estimate the number of live market-size oysters. To date, work has focused on the feasibility of collecting video data in a format readily usable by growers. Of the several video systems tested, the towed sled described above has provided the best quality data and been the easiest to use. The entire video stream can be used to get an overview of the conditions of their beds, or stopped at predetermined time intervals to get counts of the number of oysters present.

Water clarity, as discussed above, has also been an issue in Maine. Although test videos taken in the fall and spring have yielded acceptable image quality, unequivocal identification of live oysters remains difficult. One problem (particularly in spring) has been the inability to differentiate between oysters and other objects such as rocks, particularly on soft bottom lease sites where the oysters sometimes are covered by a thin layer of silt. A second problem is differentiating between live and dead oysters. Towed video does provide better imagery in this respect compared to the drop camera mode of deployment because the camera is looking forward and provides a 3-D image.

In sum, our research indicates that underwater video is a promising inexpensive tool that will at a minimum allow growers to monitor the status of their crop on a more regular basis. The next step in the research program in Maine is to develop a spreadsheet-based protocol that will provide total crop estimates based on count data from the video coupled with data on how counts vary spatially across the farm.

ECSRI To Conduct Shellfish Cultivation and Harvesting Studies

Applications for leasing grounds for shellfish farming in most states are subject to extensive review. Critical components of this review determine whether or not the bottom is "productive" for some commercial species, is out of navigation channels, avoids areas of submerged aquatic vegetation, and is in waters approved for the cultivation of food organisms. A study is being designed that will document changes to new farming areas and those actively being cultivated.

The East Coast Shellfish Growers Association, with the help of Representative Rosa L. DeLauro (D-CT), has been instrumental in securing funding for a study on the effects of various mechanical harvest methods on leased shellfish bottom. Aspects of this issue have been the cause of controversy for a long time. A significant number of studies have looked at effects of harvest methods or other activities that disrupt the bottom, but few have focused on the spectrum of changes that take place over an entire production cycle. It is obvious that there is disruption caused by harvest, but the changes that take place when the ground is prepared for seeding and that which takes place in the subsequent years of the culture cycle have not been as well documented. During most of this time the bottom retains some or all of its natural attributes and in some aspects may be more productive than it was before it was planted with shellfish. The magnitude of the difference between the natural condition and the cultured bottom has not been well documented, and is to be the subject of the current study. It is also quite likely that there are substantial differences between the impacts of wild harvest activities when compared with the impacts of aquaculture on cultivated grounds that are replanted after harvest. The effects of wild harvest are not the subject of the current study.

The study, to be conducted by the East Coast Shellfish Research Institute (ECSRI), is in its initial design phases and will include:

- an extensive literature review of dredging and other shellfish harvest techniques,
- selection of areas for the study that provide a continuum of leased areas with a time series of known harvest, seeding, grow-out beds as well as bottom that is not under culture
- selection of harvest and culture techniques and potential effects that are to be investigated

Photo courtesy of David Carey, Connecticut Department of Agriculture, Bureau of Aquaculture.

Any input on effects (real or potential) that might be incorporated into the study design would be welcome, but we wish to emphasize the focus on leased grounds.

For additional information on this project, contact:
John Kraeuter, *East Coast Shellfish Research Institute*
kraeuter@hsrl.rutgers.edu
Bob Rheault, *East Coast Shellfish Growers Association*
bob@moonstoneoysters.com

- UPCOMING ISSUES -

- Predicting Harmful Algal Blooms
- Developing an Aquaculture Business Plan

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Geospatial Tools Aid Molluscan Shellfisheries Managers

Geospatial technologies, including Geographic Information Systems (GIS) and Global Positioning Systems (GPS), can be powerful planning tools for natural resource management. A GIS is a computer-based system that is able to capture, store, edit, integrate, analyze and display spatially-referenced information, in other words, data that is identified by a geographic location on Earth. GPS, a system of satellites, computers, and receivers, determine and record these geographic locations. Data used in a GIS is often derived from GPS data collected in the field and transformed into points, lines or polygons. These features represent a single or ordered set of X,Y coordinates. Raster or 'picture-based' data collected in the form of aerial photographs or satellite imagery can also be incorporated into GIS platforms.

Each data set or "layer" can be analyzed and compared to data in other layers, and also visualized in descriptive maps. In the past, resource managers relied solely on paper maps for decision-making. These maps were often at different scales and difficult to overlay, which in many cases resulted in confusion and delays in management processes. "One major advantage of GIS over other management tools is its ability to organize multiple types of geo-referenced data into one format" says Sandy Prisloe, Extension Specialist with the Geospatial Technology Program at the University of Connecticut. Today, many of these data sets are available in digital formats suitable for use in a GIS. These tools have been utilized by planning officials and resource managers to make decisions and answer questions regarding land-use and development, and are now becoming increasingly important for managing molluscan shellfisheries.

GIS has a number of uses in shellfisheries management, from fundamental to very sophisticated applications. One of the most basic functions is it's map-making ability. GIS allows for the production of extremely detailed maps from which data can be accurately analyzed. For example, one can map the distribution and abundance of a particular shellfish species in a defined geographic area and with regular sampling, this data can be compared over time. Some other examples include:

- Identifying location and extent of recreational and commercial harvest areas
- Determining environmental suitability of sites for aquaculture based on water column and sediment parameters (e.g. temperature, salinity, DO, phytoplankton productivity, nutrients, substrate type, etc.) (Figure 1)

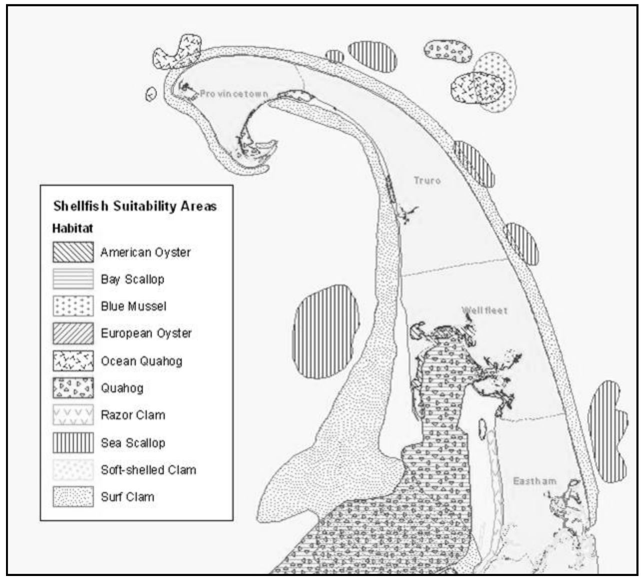


Figure 1. Shellfish suitability areas on upper Cape Cod. (Massachusetts Division of Marine Fisheries) http://www.mass.gov/mgis/shlfshsuit.htm

- Identifying and monitoring sites with potential human health implications (e.g. point- and non-point sources of pollution harmful algal blooms, heavy metals, etc.) (Figure 2) and facilitating emergency and routine harvest closures
- Identifying potential site conflicts by mapping recreational and commercial activity (e.g. navigation channels, mooring areas, fixed fishing gear, etc.)

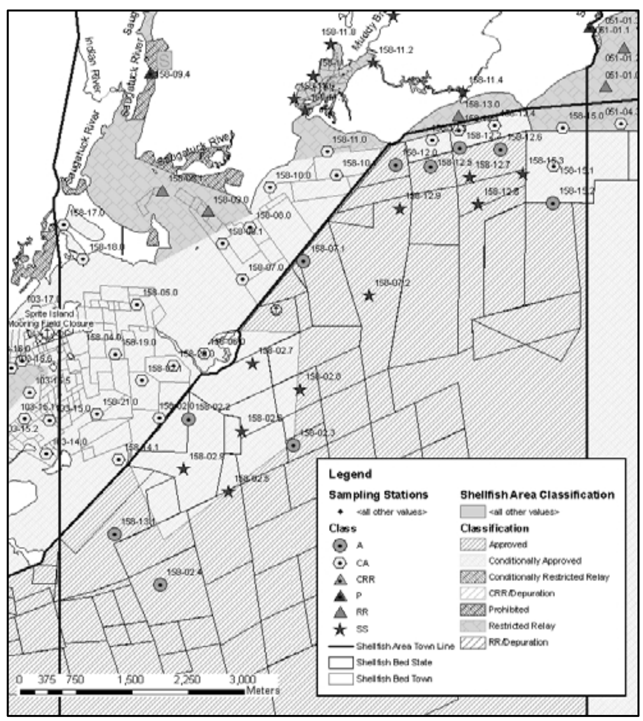


Figure 2. Water quality sampling stations and shellfish classification areas in the Town of Westport, Connecticut. (Connecticut Department of Agriculture, Bureau of Aquaculture)

- Identifying and monitoring of sites with shellfish health/mortality issues (e.g. disease, pests, predators)

- Aiding in restoration planning (e.g. optimum habitat, historic distribution and abundance) and project evaluation (e.g. larval dispersal, recruitment)

GIS-based management tools have been employed successfully in the U.S., Canada and beyond. Some states are interested in making shellfisheries information more widely available among municipalities and other natural resource agencies that share a role in shellfisheries management. For example, The University of Connecticut is collaborating with the State Department of Agriculture to produce a "one-stop shop" for shellfisheries management information. This website will contain interactive GIS maps containing shellfisheries data.

Automated GIS management systems with predictive capabilities are also being developed. One such system is being employed in the State of Mississippi. The State Department of Marine Resources is utilizing a "decision-support tool" that uses a combination of rainfall, river gauge and fecal coliform data to provide recommendations on whether a shellfishing area should be opened or closed to harvest[1].

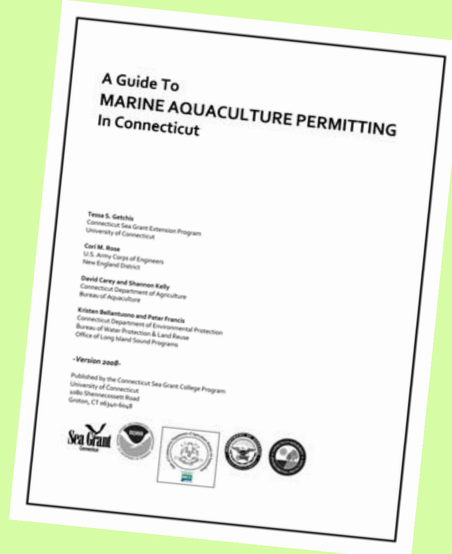
Geospatial technologies are being used to foster the sharing of information and have become powerful tools for real-time decision-making in shellfisheries management. The benefit is not limited to the resource managers, as a growing number of research institutions and non-profit organizations are now utilizing GIS to compile, analyze, and share field data.

Environmental Systems Research Institute's (ESRI) ArcGIS software is the most widely utilized desktop GIS program for viewing and analyzing geospatial data. Information can be downloaded at http://www.esri.com/. Free information and software with comparable functionality is currently available online by AccuGlobe at http:///www.accuglobe.net.

[1]Chigbu, P., Strange, T., Gordon, S., Jester, K., Baham, J., Young, J., Hughes, R., Remata, R., Martinolich, K., Hilbert, K., Mott, D.K., Watts, M. & McIntosh, M. 2006. A decision support tool for shellfish management in Mississippi Sound. *Journal of Shellfish Research*. 25 (3): 1091-1099.

Tessa Getchis is an Extension Educator with Connecticut Sea Grant and UConn Cooperative Extension.

AQUACULTURE PERMITTING
What's New For You!


A Guide To
MARINE AQUACULTURE PERMITTING
In Connecticut

Tessa S. Getchis
Connecticut Sea Grant Extension Program
University of Connecticut

Cori M. Rose
U.S. Army Corps of Engineers
New England District

David Carey and Shannon Kelly
Connecticut Department of Agriculture
Bureau of Aquaculture

Kristen Bellantuono and Peter Francis
Connecticut Department of Environmental Protection
Bureau of Water Protection & Land Reuse
Office of Long Island Sound Programs

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1080 Shennecossett Road
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Over the past several years, the Connecticut Aquaculture Permitting Workgroup has made efforts to streamline the permitting process for marine aquaculture, gear culture in particular, in the State. Workgroup members include representatives from the University of Connecticut (Sea Grant and Cooperative Extension Programs), the Connecticut Department of Agriculture, Bureau of Aquaculture, Connecticut Department of Environmental Protection and the U.S. Army Corps of Engineers.

The project has included hosting informational workshops and one-on-one consultations with industry members, and developing outreach publications that explain the permitting process and provide contact information for each of the resource management agencies. The Workgroup has developed a new application form and two new outreach publications to aid in the processing of applications for commercial aquaculture as well as research and educational activities:

- **A Guide to Permitting Marine Aquaculture in Connecticut**; http://www.seagrant.uconn.edu/aquaguide/permitguide.pdf

- **Guidelines for the Use of Aquatic Organisms for Scientific/Educational Purposes in Connecticut**; http://www.seagrant.uconn.edu/aquaguide/aquause.pdf

For additional information or to obtain hard copies, contact tessa.getchis@uconn.edu

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The Annual Milford Oyster Festival was enjoyed by all in 2007, and 2008 promises to be even better. Aside from a plethora of educational activities and craft booths, the East Coast Shellfish Growers will again be offering their tasty shellfish, and showcasing the region's best shellfish shuckers in its annual contest on August 16th. Get in line early!

For additional information, visit: http://milfordoysterfestival.org