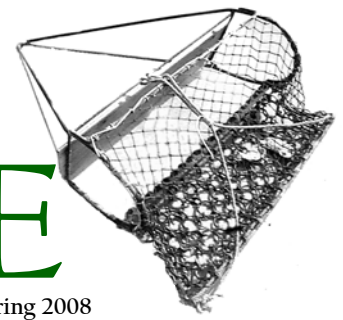


THE DREDGE

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Using Underwater Videography to Monitor Oyster Farms

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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.

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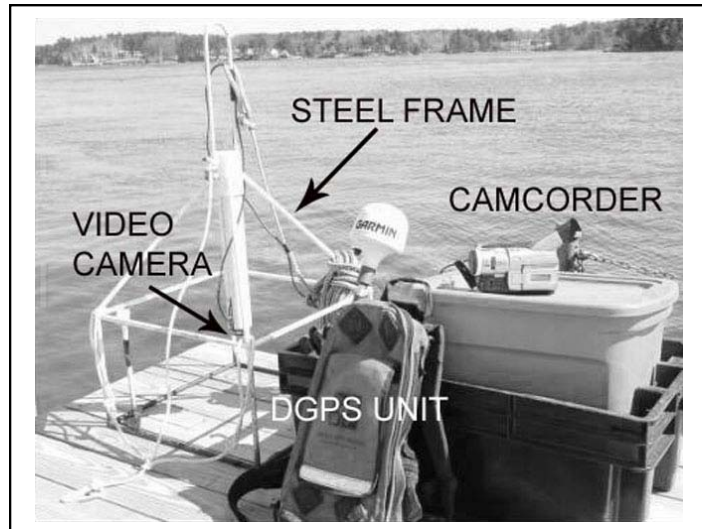


Fig. 1. Underwater video system deployed mainly as a drop camera, consisting of a black & white/infrared camera system (Aqua-Vu Model IR) mounted on a custom-made steel frame, a Garmin differential GPS unit (Model GPS 76), and Sony digital video camera (Model DCR-TRV103) for recording. Total cost is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

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CALENDAR

August

16 Milford Oyster Festival
<http://milfordoysterfestival.org>

September

5-7 Norwalk Oyster Festival
http://www.seaport.org/oyster_festival.htm

24 Segment Two Seafood HACCP Course (follow-up to Internet course offered through Cornell University), Avery Point, Groton

October

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

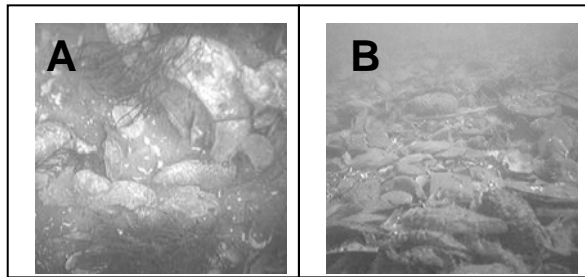


Figure 2. High quality still images extracted from video. A) view provided by drop camera shown in Figure 1 with lens perpendicular to bottom. B) Oblique view provided by sled-deployed camera.

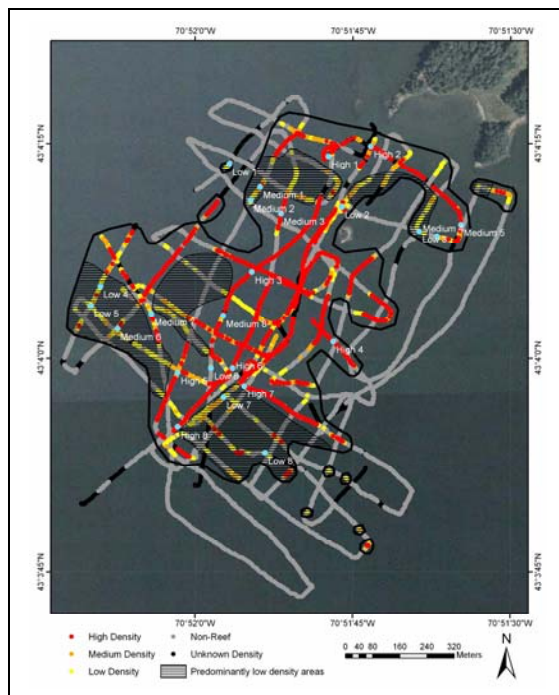


Figure 3. Nannie Island, Great Bay, NH natural oyster reef. Shell density map based on video transects.

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.