Pyramid Frame SOP

Background

The pyramid frame was developed by Devon and Severn IFCA to be used to survey *Pecten maximus* (king scallop) based on the SMAST sampling pyramid design. The SMAST sampling pyramid was developed in 1999 by Dr Stokesbury and his team in a cooperative with scallop fishermen. This technique has been used in the US since 1999 and in 2003 the scallop fishing industry requested the video survey covered the entire scallop resource in the US waters based on the footprint of the 2002 fishery. This work was carried out between 2003 and 2011 and covered the scalloping areas on Georges Bank and the Mid-Atlantic Bight. The video survey uses quadrats techniques based on scuba diving studies. The aim was to provide spatially explicit, accurate, precise, absolute estimates of sea scallop density and size distribution. A mobile video recording system which is compatible with any scallop vessel wheelhouse layout was used for the sampling pyramid which was deployed and hauled using an electro-hydraulic winch. The sampling pyramid can support 4 cameras and 8 lights (Stokesbury et al, 2010). The pyramid had two vertically placed cameras to provide quadrats of 0.788m² and 3.235m² including a correction factor for scallops on the edge. In some cases a third camera was mounted horizontally 50mm above the base of the frame to provide a side view of the area (Stokesbury et al, 2004). The time, depth, number or live and dead scallops, latitude and longitude were recorded at each of the stations. Density estimates of scallops were made using the larger quadrat area, and the smaller quadrat area was used for estimating recruitment (Stokesbury, 2012).

Equipment

- Pyramid frame constructed with iron
- Vessel
- Bowtech Products SURVEYOR-SD underwater colour zoom camera with monitor
- Two Bowtech Protects DIVECAM-650C-AL miniature high resolution underwater colour CCD cameras
- Four Bowtech Products LED-K-SERIES lights
- Two Toughbook laptops
- Three Bowtech umbilical's
- GoPro Hero 3
- Cable ties
- Recording forms

Set up

The base of the frame makes up a 1m² quadrat for the main sample area, and there is a smaller 10th m² quadrat for a smaller sample area. Four cameras in total are mounted on the frame. The Bowtech Products SURVEYOR-SD camera colour is mounted at the top on the frame to cover the whole m² area. Two Bowtech Products DIVECAM-650C-AL miniature cameras are mounted on the frame, one to film the smaller 10thm² quadrat and one mounted to take an oblique view across the seabed. The cameras are mounted on the frame using pipe clips that are wielded to the frame. A GoPro Hero 3 is mounted to the frame next to the main camera to take stills on a time lapse. Four lights are mounted to the frame, two for the SURVEYOR-SD and one for each of the divecams, again attached with pipe clips. All cameras, apart from the GoPro, and all the lights are connected to monitor systems on the boat via umbilicals. Once set up the umbilicals are secured safely to the frame using cable ties. The monitors were set up in the wheel house of the vessel for real time viewing as well as recording for reviewing the footage later. A deployment rope is attached to the very top of the frame. One side of the frame is kept clear of all equipment and marked in a distinctive colour to keep as the safe hauling side for contact with the side of the vessel to ensure no damage is caused to the equipment.

Figure 1 Basic Frame

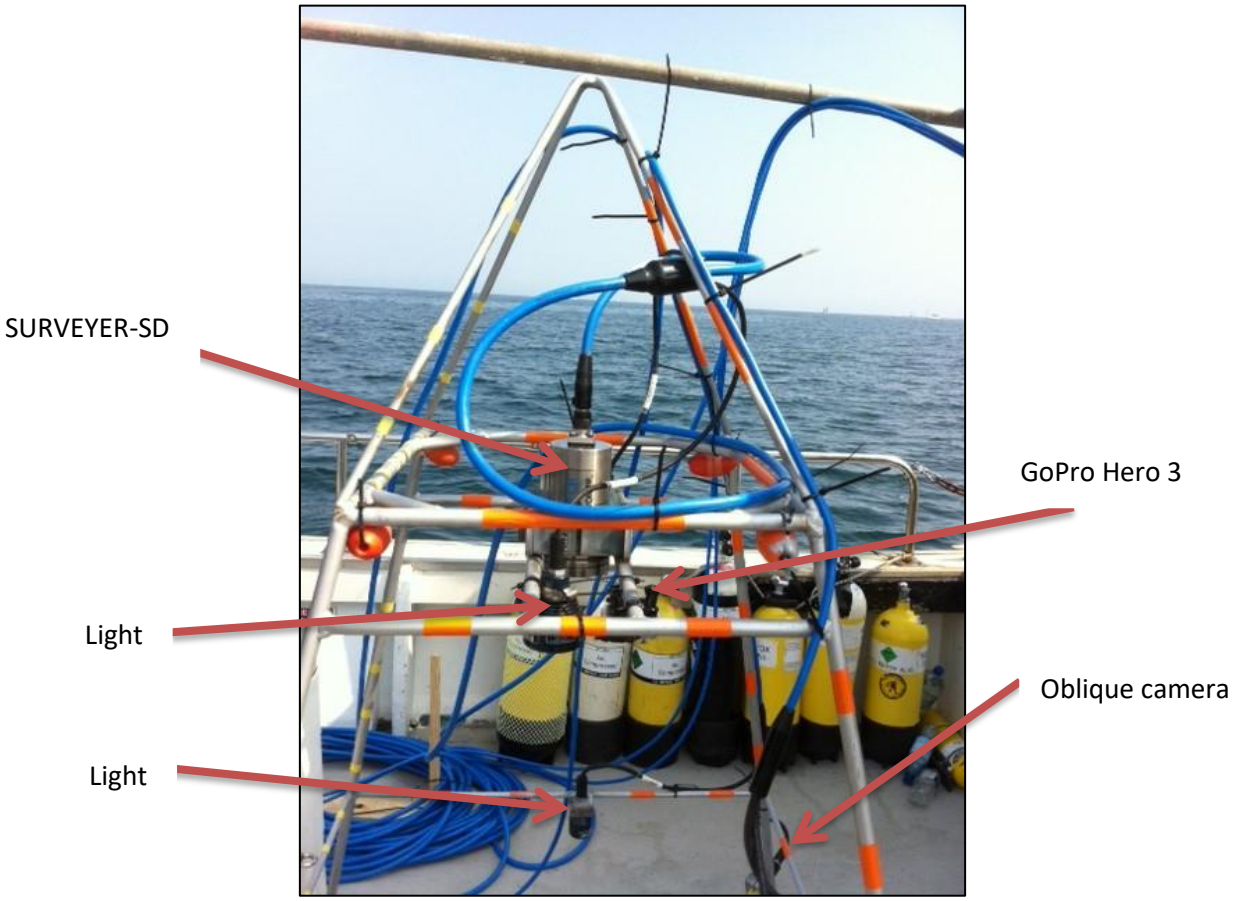

Figure 2 Set up frame

Figure 3 Monitor systems

Deployment

During trials for this method the frame was deployed alongside divers to verify the sightings and number of scallops, the following method has been adjusted for use without divers.

The frame is deployed from the vessel by slowly lowering it by a rope attached to the top of the frame with the umbilicals being let out at the same time without any strain put on them, this is important to ensure no damage is caused to the equipment. Once the frame has reached the seabed start recording on all three cameras, leave filming for five minutes or longer if waiting for any sediment which may have been stirred up to settle. View the live feed of all three cameras and record any scallops present within the quadrat. Whilst the frame in on seabed it is important ensure that the umbilicals and deployment rope have enough slack so the frame doesn't move with the movement of the vessel. After the five or so minutes haul the frame a few meters from the seabed using the monitors as an indicator for when the frame is away from the seabed. To move the frame to the next drop the anchor of the boat is paid out 10metres and boat allowed to drift on the currents and wind. Once the boat has drifted the 10metres (or desired distance) the frame is lowered to the seabed again for the second drop. This process is repeated for four replicate drops (or desired amount). Once four drops have been completed the frame is hauled back onto the boat. The process is then repeated for each site.

Data Analysis

All footage can be viewed in real time apart from the GoPro time lapse stills. Footage can be transferred to a hard drive and DVD to be viewed again in the office for further analysis and to verify scallop sightings. The data can then be used to calculate scallop densities for stock assessments.

Possible Future Uses

The frame was initially tested for the use in scallop stock assessments however there are other possible uses. For example the SMAST frame developed by Dr Stokesbury was used to carry out broad-scale sediment mapping of Georges Bank, USA between 1999 and 2009. The

sediment type, spatial structure of local sediment coarseness, dominance, heterogeneity and maximum size were all analysed using the video footage taken with the frame (Harris and Stokesbury, 2010). This type of work could be carried out with the Devon and Severn IFCA version of the frame. Along with sediment identification and mapping the frame could potentially be used for mapping mussel beds and other biogenic reefs. Deployment of the frame would be the same as for the scallop surveys.

References

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Stokesbury K., Harris B., Marino II M., Nogueira J. 2004. Estimation of Sea Scallops Abundance using a Video Survey in Off-shore US Waters. Journal of Shellfish Research. Vol. 23. No. 1. 33-40.