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Publication date:
2011

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Catch and habitat mapping of the scallop dredging fishery in Shetland: with a focus on bycatch

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Introduction

Since 2000, a Regulating Order has been in place around Shetland covering the main shellfish species. Such an Order has enabled yearly, species-specific, stock assessments to be carried out but little information has been available on the environmental impact of these fisheries in Shetland. Scallop dredging in general has notoriously been regarded as an industry with a high direct impact to the benthic environment with an indiscriminate species bycatch.

The aim of the study was to quantify and catalogue species bycatch, and corresponding scallop catch, from the scallop dredging fishery around Shetland in order to highlight areas of potential importance to conservation.

Materials and Methods

- Scallop sampling
  - Four scallop dredges towed on one bar in six sampling areas (blue circle on map)
  - Each area sampled a minimum of three times (3 tows per area)
  - Tow duration was site specific (~50 minutes)
  - All species were identified and weighed. Scallops were also measured and aged.
- Habitat mapping
  - Multibeam sonar (WASSP WMB-160F)
  - Produces detailed information on bathymetry and backscatter
  - Areas scanned in a gridded, overlapping pattern
  - Ground-truthed using a digital video camera system
  - Initial areas focussed on horse mussels *(Modiolus modiolus)* and maerl

Results – Scallop sampling

A total of 63 different animals were identified from 15 taxonomical classes. Of these animals, 13 made up 98% of the total catch weight (Figure 2) with the king scallop (*Pecten maximus*) accounting for 62.6% of the catch. Species of commercial interest included the queen scallop (*Aequipecten opercularis*, 1.8%) and monkfish (*Lophius piscatorius*, 0.7%) as well as an additional nine other species (contributing to 0.6% of the catch). In all six sampling areas *P. maximus* was the dominant species (Figure 1).

Throughout the study, a total of 5992 *P. maximus* were caught accounting for 1140 kg. Undersized *P. maximus* accounted for 16% of the total catch. A total of 1858 *P. maximus* were measured and aged during the study with a shell width range of 42 to 161 mm (mean = 113 mm) and an age range of 2 to 15 years (mean = 6 years old). The data showed a unimodal length-frequency distribution with a peak in the 108 to 112 mm size class. This unimodal pattern was evident in each area, although peaks were found to differ between areas (Figure 1). The two west coast areas were found to have significantly smaller scallops than those from the east coast (P<0.001).

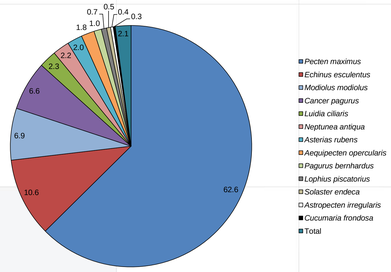

Figure 2. Overall bycatch by weight, expressed as a percentage, from all six areas.

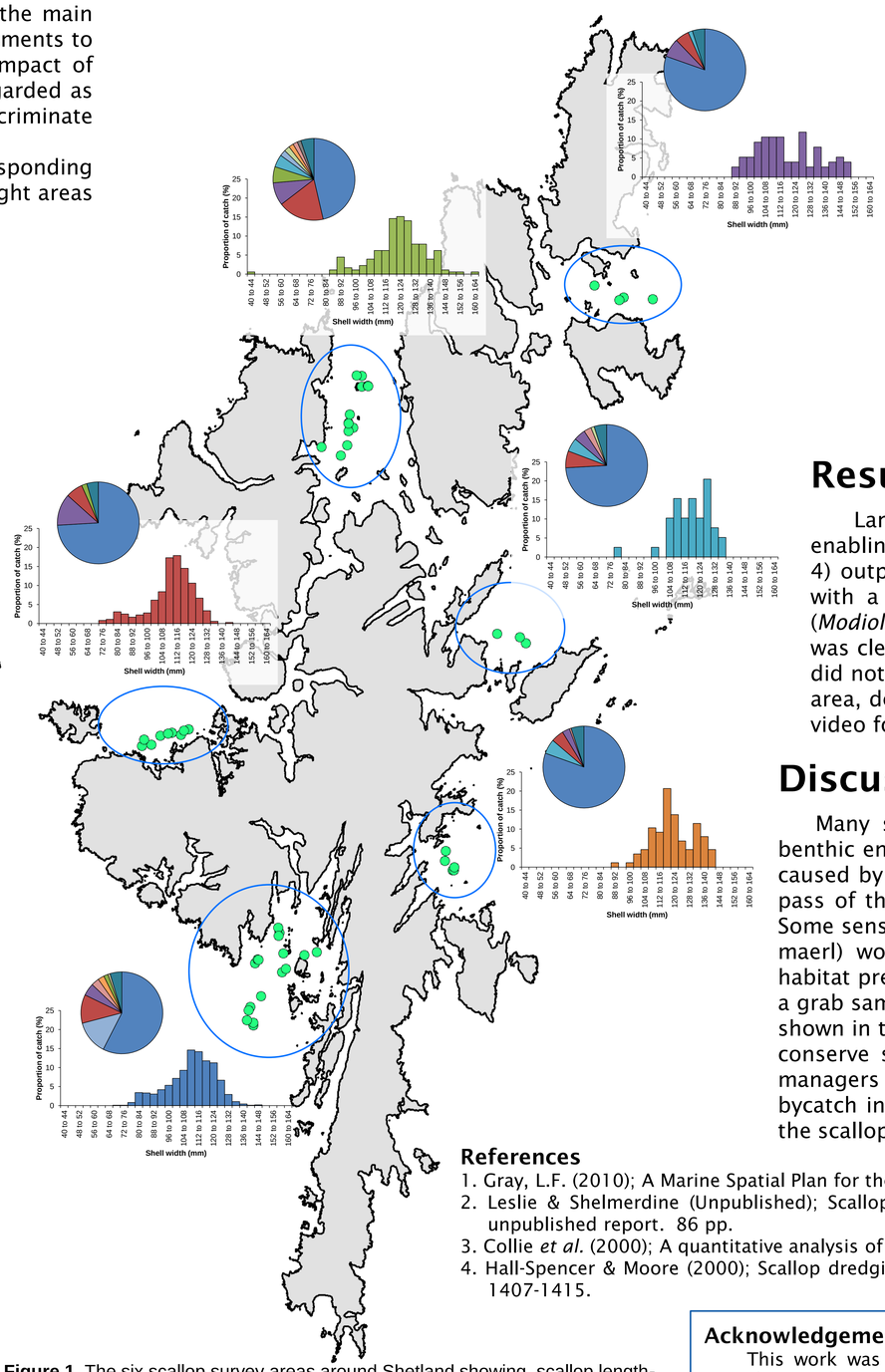

Figure 1. The six scallop survey areas around Shetland showing scallop length-frequencies and bycatch (pie charts, see Figure 2 for details of colour coding) for each area.

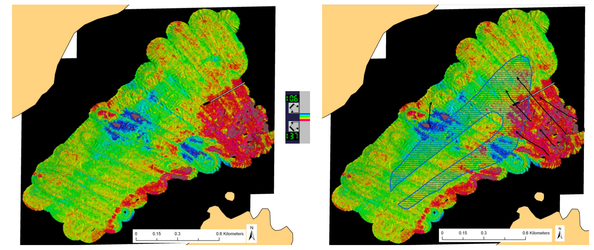

Figure 3. Backscatter images of a surveyed area (a) with camera drifts and potential sensitive habitats (blue hatched area[1]) overlaid (b).

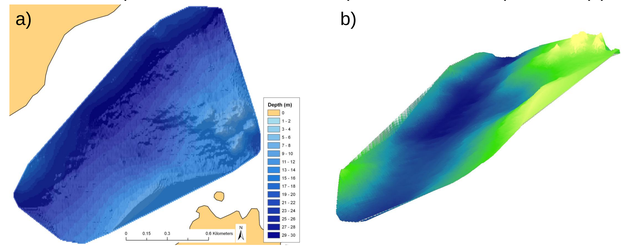

Figure 4. Interpolated bathymetry of the scanned area in 2D (a) and 3D (b). The scale refers to Figure 4a.

Results – Habitat mapping

Large areas were scanned relatively quickly using the multibeam sonar enabling *in situ* analysis of the backscatter (Figure 3) and bathymetry (Figure 4) output. The total area scanned, in this example, amounted to 1.5 km^2 with a predicted sensitive habitat, in this case a potential horse mussel (*Modiolus modiolus*) bed (blue hatching of Figure 3b) covering 0.4 km^2. It was clear from the backscatter image that the majority of the predicted area did not contain *M. modiolus* which was only found in the east of the scanned area, depicted as red and covering 0.2 km^2, after being ground-truthed with video footage.

Discussion

Many studies have demonstrated the effects of scallop dredging on the benthic environment[2] which have also been shown to be site specific. Damage caused by dredging on new ground is thought to mainly occur during the first pass of the gear[2,4], which emphasises the need for good habitat information. Some sensitive habitats (e.g. those consisting of horse mussels (*M. modiolus*) or maerl) would be more prone to the effects of bottom trawling. Although habitat predictions, based on a small sample size (e.g. the presence of maerl in a grab sample) are important, these predictions are not always very accurate, as shown in this study (Figure 3b). Accurate habitat maps are essential in order to conserve sensitive habitats as well as accurately inform fishers and fisheries managers of areas to potentially avoid. By combining habitat mapping with bycatch information it may be possible to reduce bycatch of certain species in the scallop dredge fishery.

References

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Acknowledgements

This work was funded by the Shetland Shellfish Management Organisation (SSMO) and in-kind contributions by NAFC Marine Centre. Many people were involved with the day to day workings of this project and without their valued help and input it would not have been possible.