Geophysical Benthic Mapping of the Falmouth Estuary

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Introduction

Falmouth has been designated a Special Area of Conservation since 1 April 2005 as a result of it's subjection to continuous anthropogenic activity and high pollution levels (JNCC, 1990), threatening the presence of coralline algae (Maerl), specifically *Lithothamnion corallioides*. Conservation of this area began because Maerl beds are spatially complex habitats with a high degree of species and trophic group diversity (Barbera *et al*., 2003), and their particular vulnerability to beam trawls (AWFA, 2016). Research in the area continues however, as anthropogenic perturbations such as extraction, chemical pollution by organic matter and excess nutrients continue to influence Maerl beds.

Methodology

- Subsurface Duel Frequency side-scan sonar running at 410kHz and 100kHz forming high resolution prints with a range of 150 metres and a layback of 12 metres. Further use of SURFER 8 and Google Earth computer programs to plot a set of navigation data.
- Van Veen grab used for ground truthing; stainless steel trapping mechanism capable of obtaining large sample sizes from the seafloor for sediment and species analysis.
- Video footage using a bowtech camera for further ground truthing; verification of side scan sonar results and used for visual species identifications.

NB: Both grab and video footage had to be taken at different locations relative to the side-scan sonar area due to weather/water conditions, for instrument safety issues.

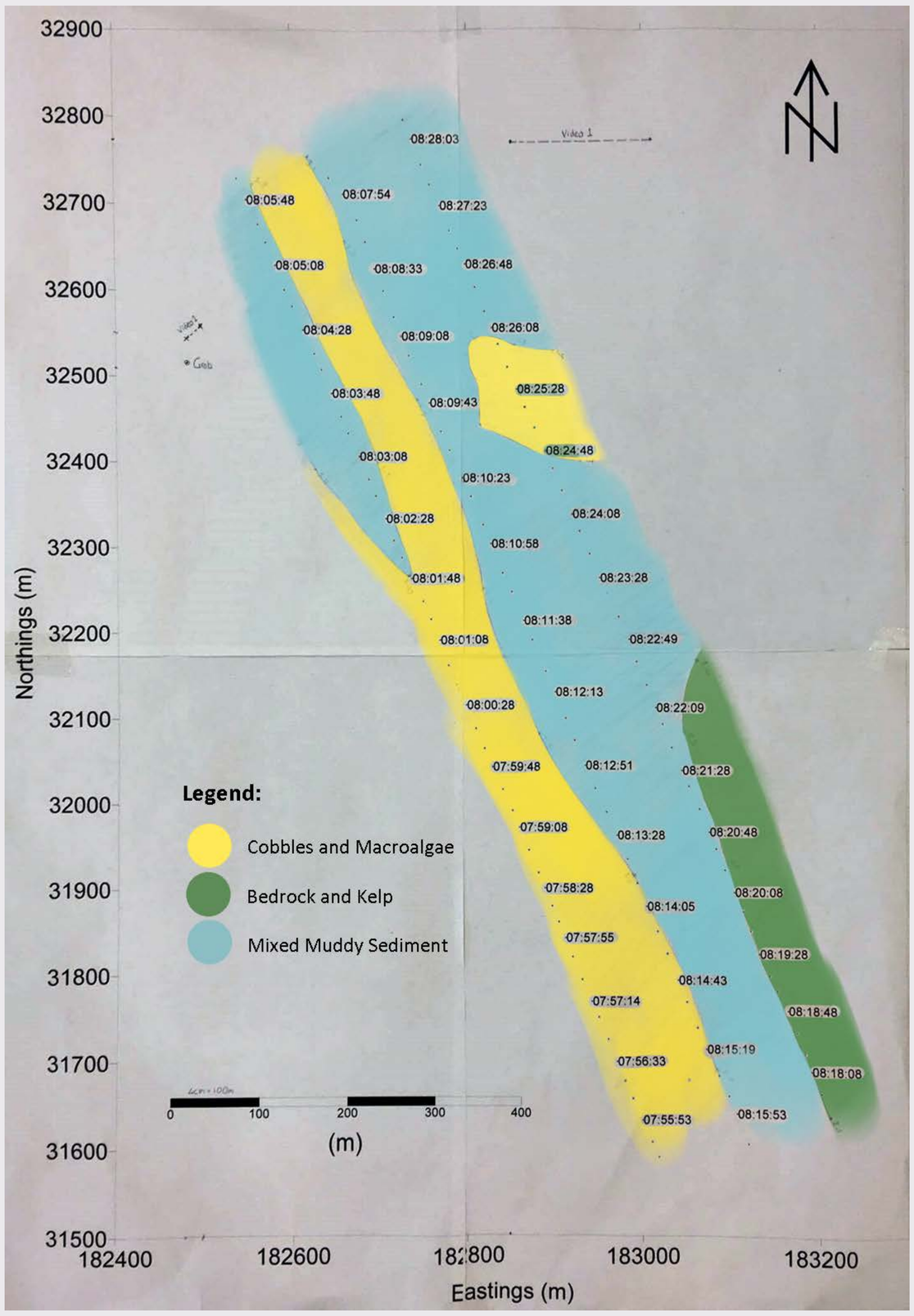

Figure 2. Habitat map produced by side-scan sonar software (SURFER 8) to account for changes in boat speed

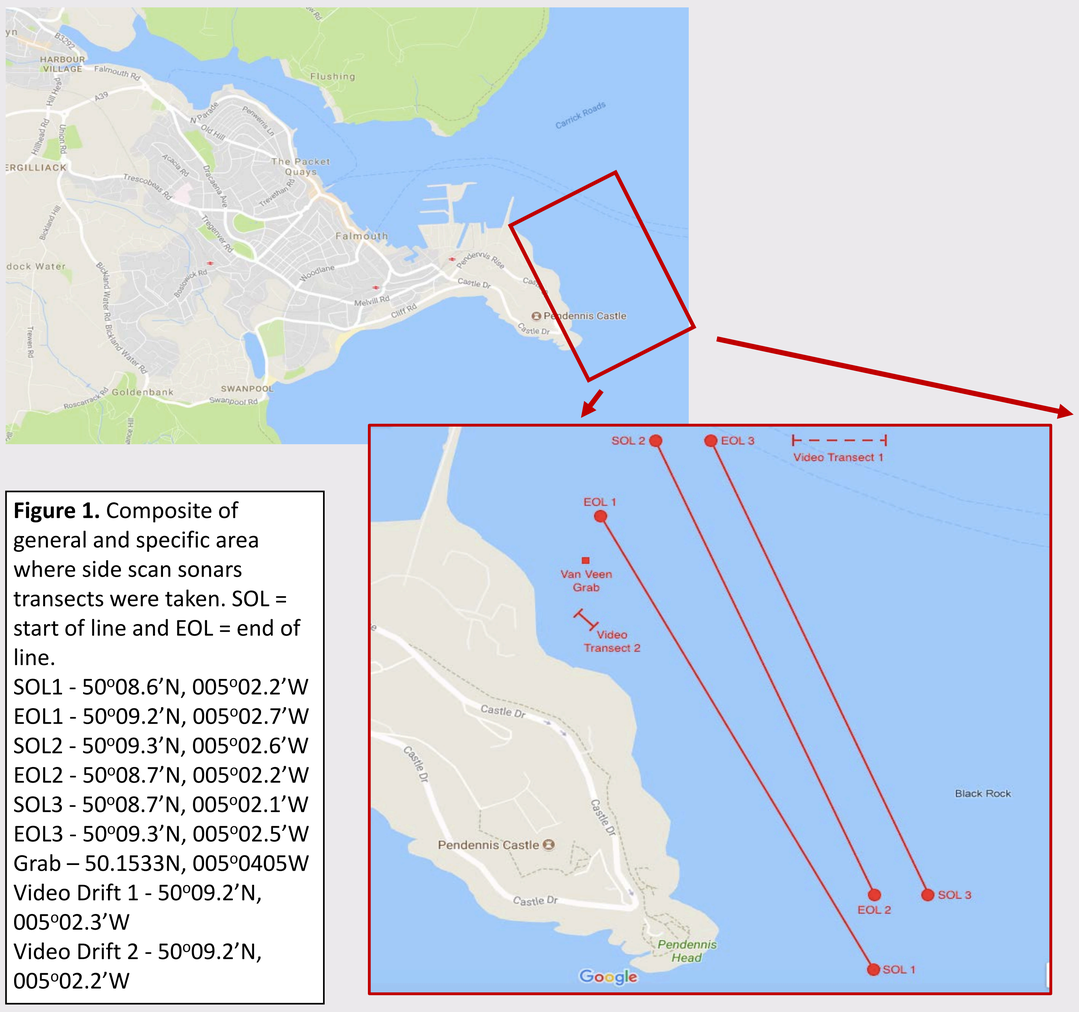

Figure 1. Composite of general and specific area where side scan sonars transects were taken. SOL = start of line and EOL = end of line.
SOL1 - 50°08.6'N, 005°02.2'W
EOL1 - 50°09.2'N, 005°02.7'W
SOL2 - 50°09.3'N, 005°02.6'W
EOL2 - 50°08.7'N, 005°02.2'W
SOL3 - 50°08.7'N, 005°02.1'W
EOL3 - 50°09.3'N, 005°02.5'W
Grab – 50.1533N, 005°0405W
Video Drift 1 - 50°09.2'N, 005°02.3'W
Video Drift 2 - 50°09.2'N, 005°02.2'W

Side scan sonar tracking plot

The side-scan sonar data consists of a three line track that covers an area approximately 450 metres by a kilometre along a previously surveyed area shown in figure 1. After being processed by the SURFER 8 software, figure 2 was produced, more comprehensively showing the distinction of each boundary. This figure demonstrates how the seabed is mostly uniform in terms of habitat and substrate, 2 narrowly distinguishable regions and a third highly contrasting area. The rest of the area is muddy sediment, homogenous in acoustic reflection. Boundaries 1 and 3 are theorised to be macro algae with a cobble based sediment and dead, broken up Maerl comprising a significant percentage of the benthos. Furthermore, boundary 2 is a partial kelp habitat with a distinct rocky outcrop as a results of several prominent backscatter features.

Van Veen Grab

The Van Veen Grab gave partial ground truth to boundaries 1 and 3, only by assuming that the hypothesised habitat extends to the point of the grab. The sediment the grab obtained included broken up Maerl, coarse and unsorted sediment and 0.5-5cm size granules. The biota found in this grab includes: *Calliostoma zizyphinum*, the European painted top shell; *Colus gracilis*, the spindle shell; *Talitrus saltator*, the sand hopper.

Video Drift

The video drift, similar to the grab, added further authenticity to the speculation of boundaries 2 and 3; broken up Maerl and coarse, unsorted sediment was the most prominent substrate type. CD of underwater video footage did not work and therefore pictures and videos were taken with group members phones, reducing the quality of the original images making identification less precise. Nevertheless, we were able to identify *Marthasterias glacialis*, the spiny starfish and several algal species including *Laminaria saccharina* (sugar kelp), *Saccorhiza polyschides* (furbelows) and *Dilsea carnosa* (red rags). There was a notable lack of species abundance and diversity in these areas throughout the run time of both videos.

Figure 3. Sediment from the Van Veen Grab showing a substrate of broken maerl and broken rock/cobbles.

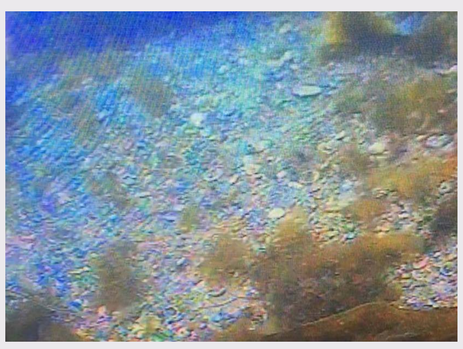

Figure 4. Screenshot of the video footage showing similar substrate found the the grab (broken maerl/cobbles).

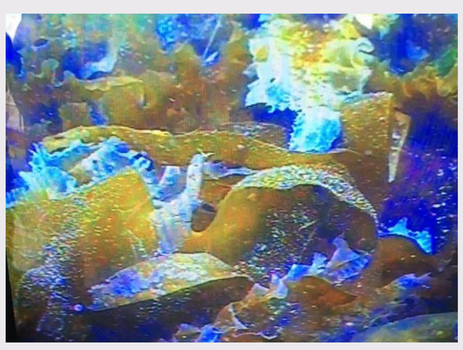

Figure 5. Screenshot of the video footage showing microalgae and kelp with an underlying substrate of cobbles/maerl.

References

AWFA (2016) 'Beam Trawl (Shrimp) on Maerl', [Online] Available at: https://www.naturalresources.wales/media/681791/beam-trawl-shrimp-on-maerl.pdf [Accessed on 13/07/2017]
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Discussion

The theories previously examined are based on the data that figure 2 is based on. As no sediment grab samples were taken or video footage was captured within the region specified in figure 1, only educated assumptions about the sediment composition can be made. Research from Hoskins 2016, provided us with complementary information about recent seabed surveys in the same area. Species observed from both the grab sample and video footage were common place, and may be infrequent due to the areas history with pollution.
The limitations for this investigation caused there to be a margin of error to great to come to safe conclusion; they include:

- Van Veen grab and video recordings were taken outside the side-scan sonar transect area due to the rough weather conditions and strong winds that blew the vessel off the target location during the grab and video equipment deployment. Course corrections could not be made for risk of damaging the equipment.
- Video recording system was not fully functional so although we were able to see a live feed, the video was unable to be saved for later analysis.
- The weather being rain and strong winds resulted in quite choppy water causing the boat to rock. This in turn affected the quality of the side-scan sonar plots, making it harder to identify boundaries in some areas.