Fal Estuary Habitat Mapping

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Aims:

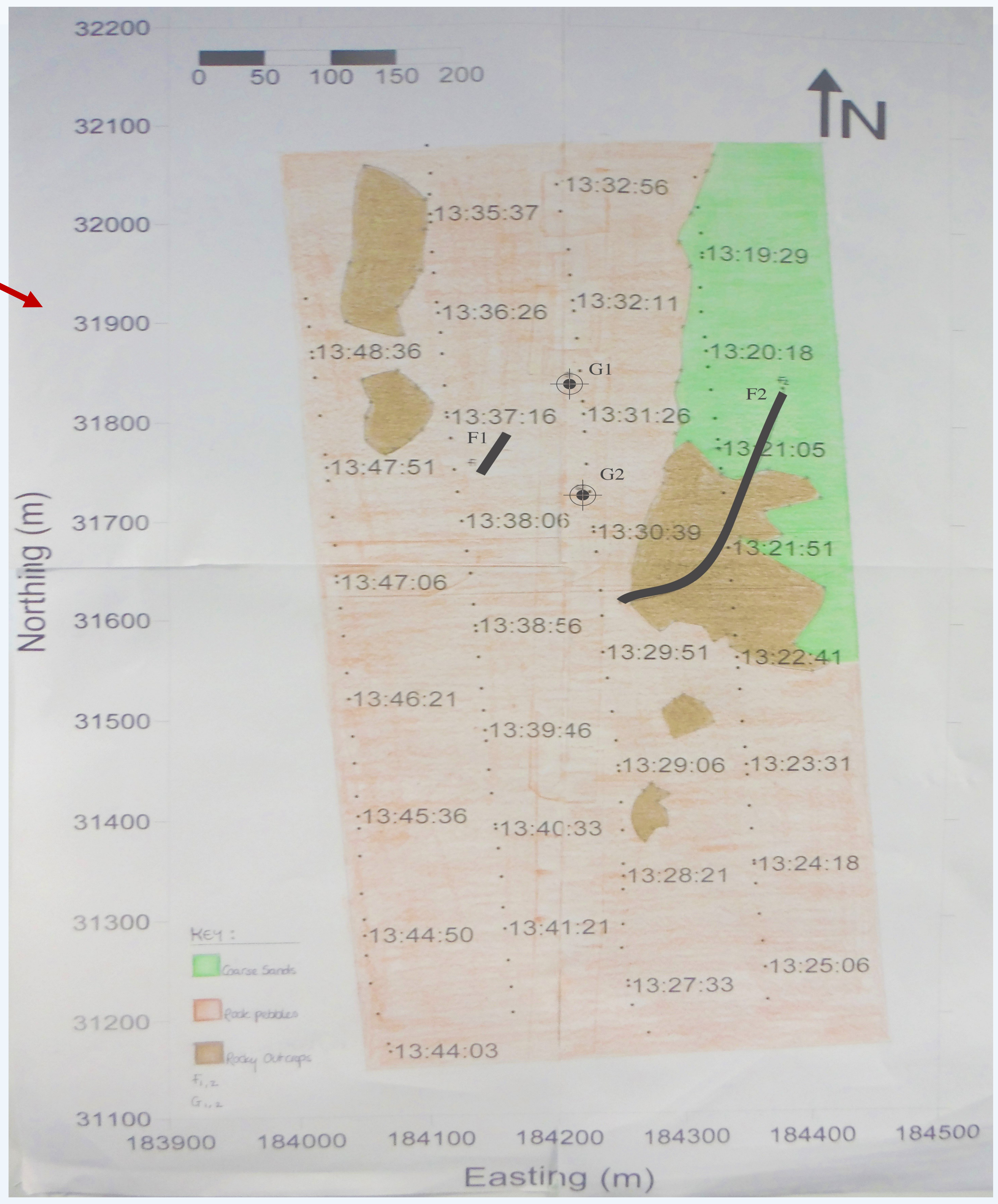
Our primary aim was to produce a prospect survey along the seafloor of the Falmouth Estuary and from our findings produce a zoned Habitat Map depicting the different habitats and substrates present.

The Falmouth Estuary is included in a Special Area of Conservation (SAC) which was designated by the Marine Management Organization (MMO) due to its local populations of Maerl and *Zostera marina* which provide important habitats and promote biodiversity which in turn improves ecosystem services. Due to their protected status this location is a useful indicator of global climate change and provides researchers an area for frequent comparison or control.

Methods:

A Dual beam side scan sonar system was used to image the seafloor in the targeted area of the Fal Estuary. A low frequency sonar has a low accuracy and a high slant range whereas the high frequency sonar has a high precision but lower slant range. Four transects of 2km long with a 100 m spacing were surveyed. Based on images produced by the sonar system, two locations for grabs and two locations for videos were selected for ground truthing. The grabs were conducted using a Van Veen grab but were unsuccessful due to the rocky seabed preventing proper closure of the grab. An underwater camera system was deployed while the boat was free drifting due to currents. A mosaic of the side scan images from the four transects was created to give an overall picture of the surveyed area. By combining observations from the video footage with the side scan mosaic different boundaries were identified to create a habitat map.

Date: 21st June 2016 Vessel: Xplorer
Location: Off Carricknath Point, Falmouth, UK
Conditions: Periods of Sun and showers, moderate cloud cover (6/8), 6 Knots from SSW, Flat sea
Tide: Low (0.82m) at 13:07 GST, High (4.96m) at 18:55 GST



Three clear habitats were identified:

Sublittoral sediment –Characterised by pale areas with some small darker patches, indicating the predominance of fine particles. Streaks of darkness are also seen in the side scanner readings of these areas, this highlights the presence of Eelgrass (*Zostera marina*), a species that requires soft, sandy sediments to grow. Stronger evidence that these areas have a benthic environment consisting of soft, sandy sediments came from the video transect which filmed *Z. marina* alongside burrows and casts of infaunal invertebrates.

Sublittoral rock/gravel – Characterised by darker areas with more texture indicating coarser sediment consisting of larger particles. This deduction was strengthened by sediment grabs that were carried out that collected a small amount of large material. A video transect also proved this by filming cobble sized sediment particles and species (eg *Asteris rubris, Callophyllis lacinata, etc.*) that prefer rocky environments.

Isolated rock outcrops – The side sonar scan transects depicted these areas as a few, isolated very dark patches. This is due to the hard rock outcrops being more reflective than other material in the benthos.

Video	Location Start/Finish	Flora/ Fauna
1	Start: N 31746 E 184133 Finish: N 31795 E 184156	*Callophyllis lacinata* *Saccharina latisima (dominant)* *Plocamium cartilagineum* *Asteris rubis*
2	Start: N 31634 E 184272 Finish: N 31867 E 184375	*Laminaria digitata* *Ulva Lactuca* *Zoestra marina (dominant)*

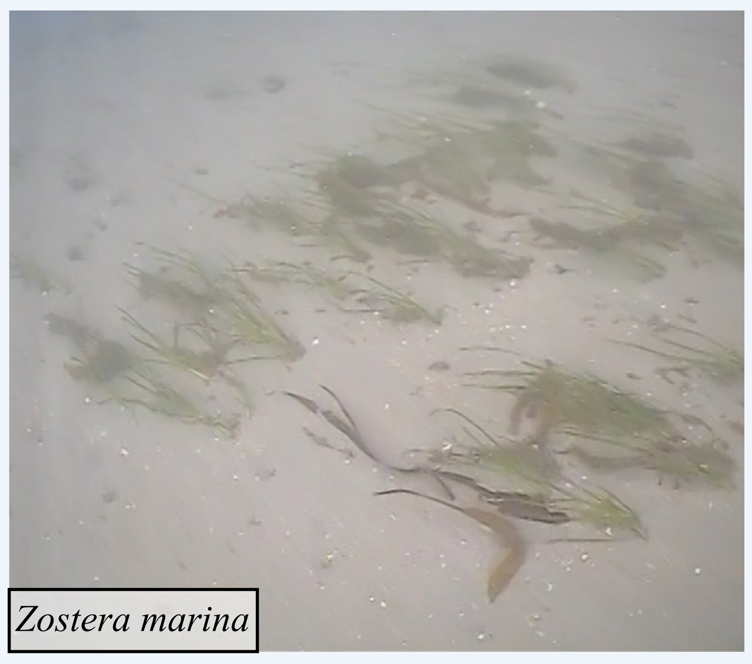
The predominant species observed in the first video transect is Saccharina latisima, the Sugar Kelp. Saccharina thrives on the rocky seabed in moderately sheltered areas up to 30 meters depth. The video evidence of Saccharina abundance and substratum support the findings of the side-scanner in that area. In the second video transect, *Zostera marina* was dominant. Zostera only grows on muddy or sandy sediment in sheltered areas up to 15 meters depth. In previous surveys of this region Zostera was not present, its subsequent expansion is a good thing for biodiversity and ecosystem services.

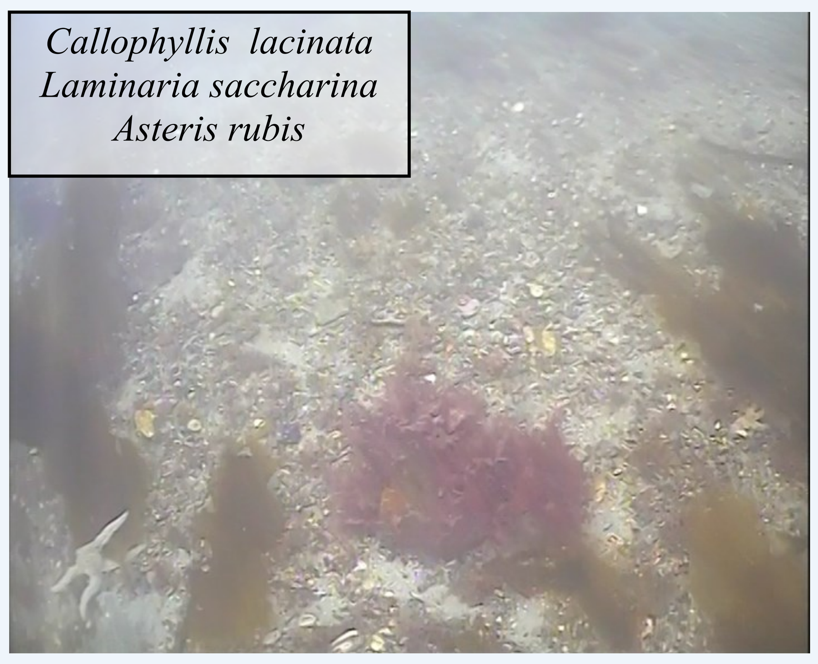
Saccharina: In large enough abundance, Saccharina kelp forests provide important habitat for marine invertebrates and nurseries for fish species. The 3-D environment offers places for animals to shelter and find food within the forests, generating increased biodiversity.

It has however seen a decline in the north sea between 40-80% in recent years with lesser impacts elsewhere. If the water becomes eutrophic there will likely be an increase in ethemeral algae species such as *Ulvae* that are faster growing and have higher nutrient requirements. Observations suggest that nutrient increase alongside climate change may lead to the decline in Saccharina and subsequent replacement by ethemeral species which provide an alternate steady state (Moy & Christie 2012).

Zostera: Zostera grows only in muddy and sandy shores below spring tides between 2 and 15m. This plant is an important member of the coastal ecosystem in many areas because it helps to physically form the habitat via sediment deposition and stabilisation. (Hartog 1970) It also acts as a biocenosis and nursery for many commercially important species of fish and bivalve. For example, it provides a sheltered spawning ground for the Pacific herring (*Clupea pallasii*). Juvenile Atlantic cod (*Gadus morhua*) hide in eelgrass beds as they grow. The blue mussel (*Mytilus edulis*) attaches to its leaves. (Torbjørn 2003).

Threats to Zostera include an increase in water turbidity causing smothering or reduced irradiance. Human activities such as dredging, trawling, water pollution and nutrient run-off. Invasive species have also been shown to negatively affect seagrass meadows. (Hanson 2004). Seagrass is likely to increase in productivity and abundance due to an increase in aqueous co2 coinciding with climate change. (Sherry & Zimmerman 2007)


Zostera marina


Callophyllis lacinata
Laminaria saccharina
Asteris rubis


Average sediment size from grab 1

Conclusion

The results of the survey show 2 main seabed substrates (sublittoral sand/gravel and sublittoral coarse sands), with isolated rock outcroppings, as displayed on the habitat map. Ground truthing through Van Veen grabs and seabed video footage confirmed the presence of these major substrates. The presence of coarse sand substrates was an important finding for this area in particular due to its requirement for further seagrass expansion into an area where there was previously no record. This has potential to serve as nursery grounds for commercially viable fish species. Further monitoring and conservation of this area can serve as indicator for climactic changes.

References

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