

# Geophysics Habitat Mapping

## Introduction

The Fal Estuary is an industrial estuary and has been subjected pollution from mines agriculture and sewage treatment which has had a long-lasting effect on the benthic habitat making it an area of interest. It has been designated a Special Area of Conservation (SAC); however, certain sites have not been mapped in 10 years.

The aim of the investigation was to map the benthic habitats in the Fal Estuary. This was achieved by using a combination of side scan sonar and underwater videography.

The results of the bathymetric survey and video recordings can give an indication of the biota present, and how they can be further protected and monitored. Due to the Fal and Helford area being a SAC it was not possible to take a Van Veen grab sample to confirm the sediment type.

## Method

Survey location was initially chosen as Maenporth based on previous bathymetric surveys; however, due to adverse weather conditions, an alternative site was chosen in a more sheltered site, so as not to disrupt data collection via the sonar.

Two methods of data collection were used to create an habitat map of the selected area. A side scan sonar TowFish was the primary method used, mapping approximately 665,000m<sup>2</sup> of the estuary bed in the vicinity of Penarrow Point. Areas of interest were noted and revisited with a high definition camera to later classify the species of flora and fauna, substrate types, and significant bedforms.

Sonar paper traces were aligned and key features marked and translated onto a track plot to display the true geometry of the key features. Algal coverage was quantified using the software 'Image J' which used regular intervals during each video transect and a variation coefficients (standard deviation as a % of the mean) for cover was calculated.

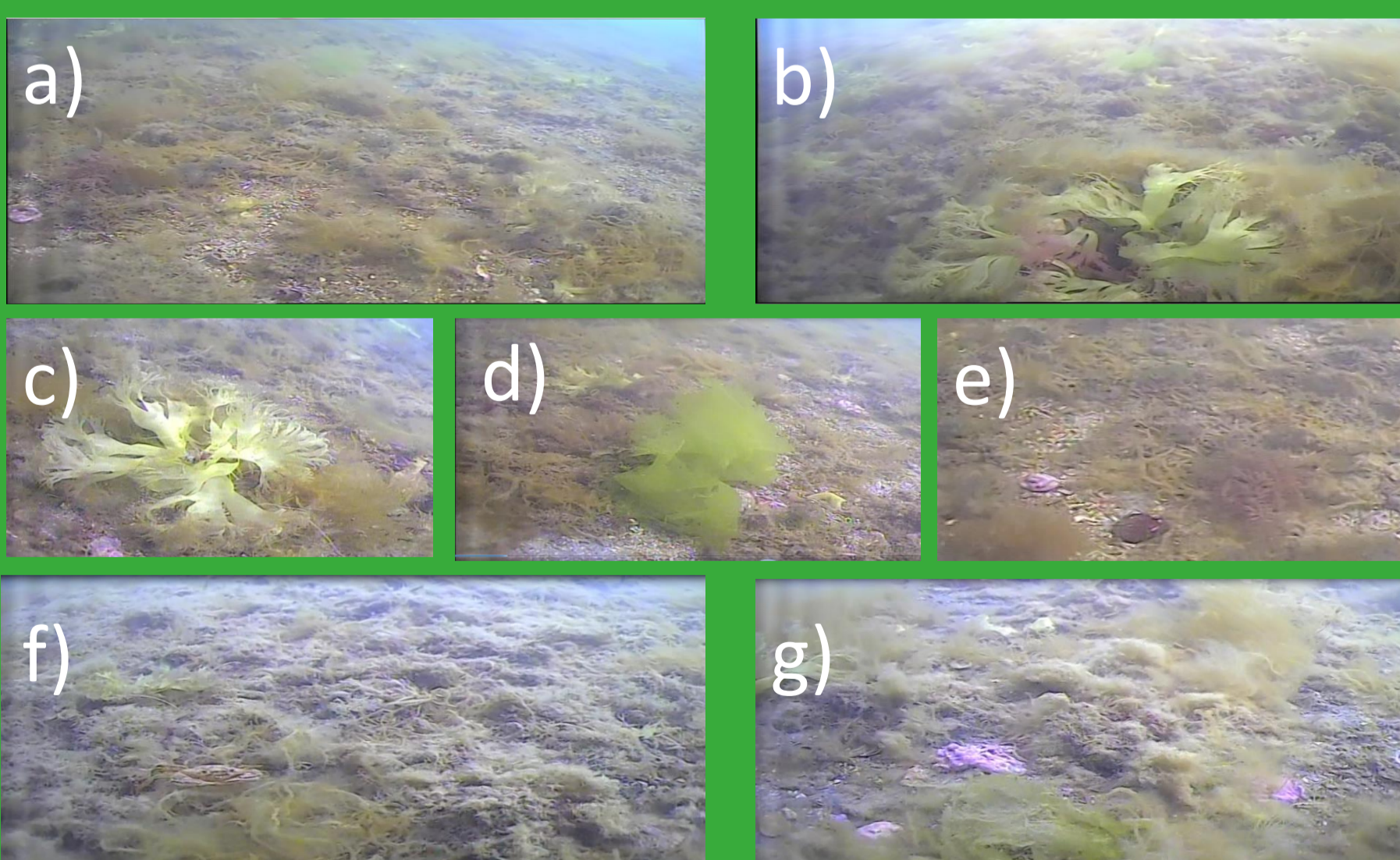


Figure 2. Images taken from the video survey in the Penarrow area (Falmouth, Cornwall). A) Typical picture from Video 1, B) Typical image from Video 2, C) Chondrus crispus, D) Ulva lactuca, E) Dead oyster (*Ostrea edulis*) shells F) *Carcinus maenus*, G) *Phymatolithon calcareum*. Locations of the videos 1 and 2 survey was (50° 10'50.1"N 5° 02'26.9" W)(50° 11'08.3"N 5° 02'45.7" W) respectively.

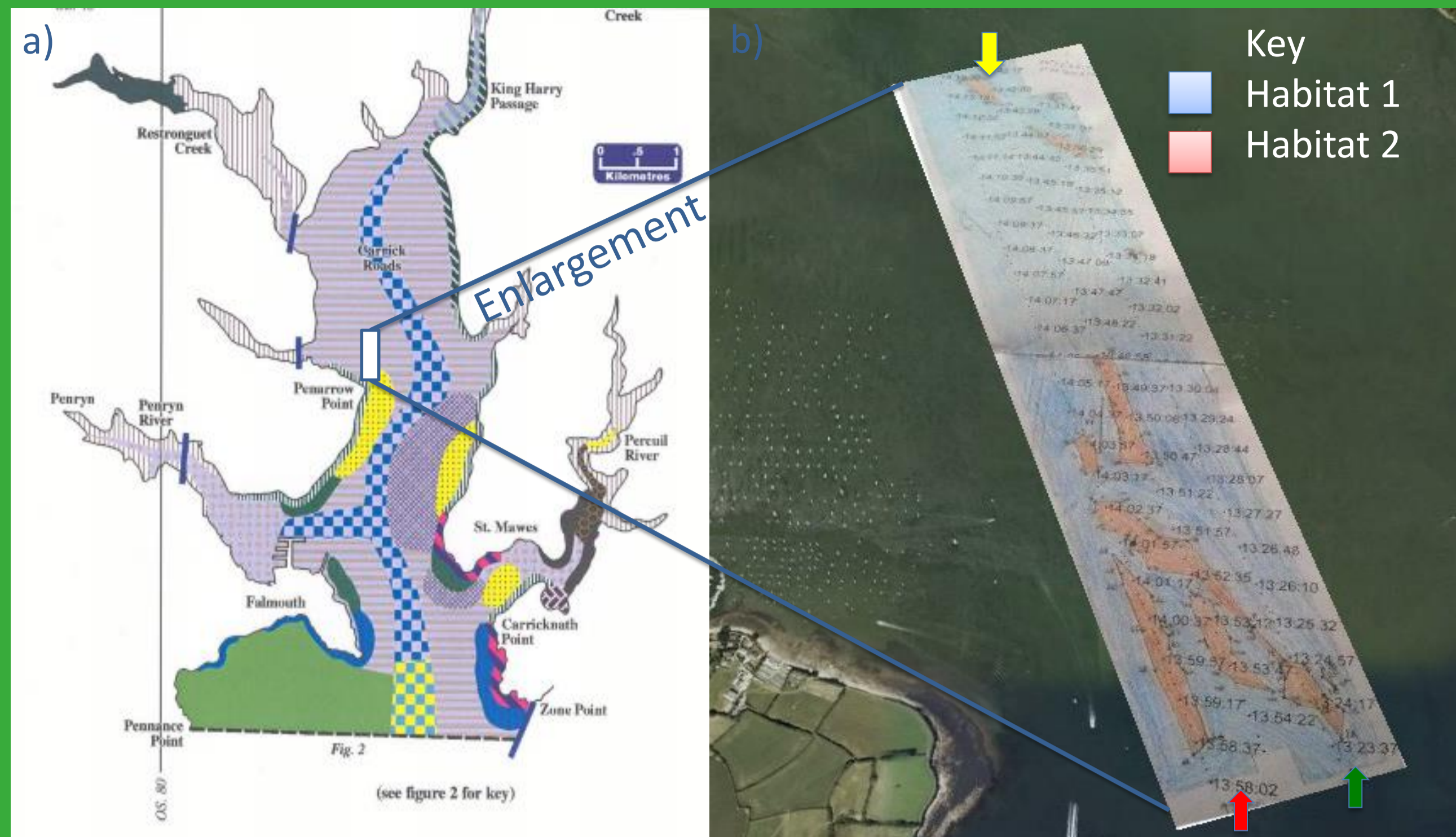


Figure 1. a) Shows the results of a previous bathymetric survey in the Penarrow, Falmouth, Cornwall area. Image is taken from (Mcleod C. R., Yao et al) and image b) The overlay shows the habitat map created from the side scan sonar. The image is overlaid on an image taken from GoogleEarth. The arrows indicate direction of survey line and the start of the transects green, yellow red represent transect 1,2,3 respectively. Transect 1 starts at (50° 10'28.3"N 5° 02'01.9" W).

## Discussion

The side scan sonar paper plot showed that only two habitat types are present (figure 2b) across the chosen surveying area. The footage shows thick algal cover, over what appears to be a sublittoral muddy gravel substrate. There was also evidence of both live and dead mearl (figure 2g). However the algal cover obscures a clear view of the mearl, therefore estimations of exact population density across the site cannot be accurately made.

Mcleod, *et al* supports our prediction that habitat 1 may be sub littoral muddy gravel, indicated by the purple area surrounding the surveyed site (figure 1a) and blue shaded area in figure 1b. The benthic environment is extremely dynamic and only relatively recent publications should be referenced. Mcleod C. R., Yao et al shows eelgrass in the southerly parts of the sonar survey, which could indicate that habitat 2 is likely to be eelgrass. However, without video footage to support the sonar data, this is purely speculative.

A benthic map (World Beneath the Waves) records oyster beds (*Ostrea edulis*) throughout the survey area. However, the footage collected shows very few oysters. This could be due to the oyster season in the Fal estuary being from October to March (reference 3), so at this time of year high densities of oysters are not expected.

Figure 2a and 2b depict the differences between videos 1 and 2 respectively. Both videos show a relatively flat bed with no significant major bedforms.

The flora of the bed was dominated by green and brown algae, such as *Chondrus crispus* (figure 2c) and *Ulva lactuca* (figure 2d). Seaweed species in video 2 had a higher abundance and were more diverse than in video 1. A higher frequency of benthic macrofauna was recorded in Video 2, with species such as the common shore crab (*Carcinus maenus*) (figure 2f), peacock worm (*Sabella pavonina*) and small patches of calcareous algae mearl (*Phymatolithon calcareous*) (Figure 2g).

## Statistical analysis

The variation coefficient (analysed using Image J software) of algal coverage calculated for Video 2 was 1.82, which illustrated the almost complete cover found throughout this site. Video 1 had a higher variation coefficient of 7.55, showing that the benthos at that location was more patchy seaweed coverage.

## References

Mcleod C. R., Yao et al, *The habitat directive: selection of special areas of conservation in the U.K. second edition*, JNCC.gov.uk/SACselection.  
World Beneath the Waves: <http://www.soes.soton.ac.uk/teaching/courses/soes3018/2009/group5/habitat.gif>

**Disclaimer** :The ideas expressed in this website are those of the group and do not reflect those of the University of Southampton or the National Oceanography Centre (NOC).

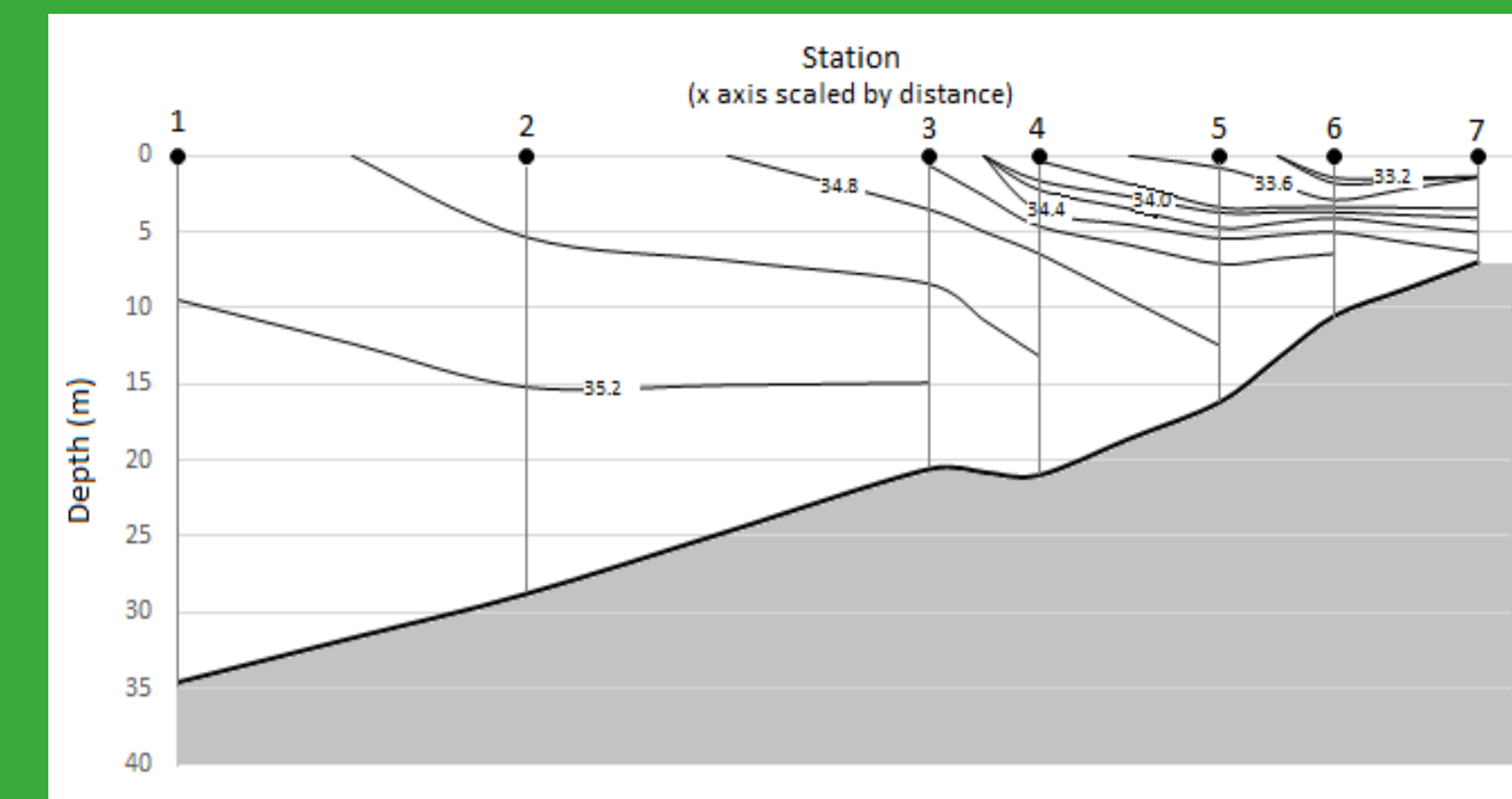


Figure 3(Right) Oxygen saturation profile in the vicinity of Penarrow, Falmouth, Cornwall area (50°10.25" N 05°02.15" W) sampled at 9:00 (UTC), 23/06/2015, high tide 9:20 (UTC).

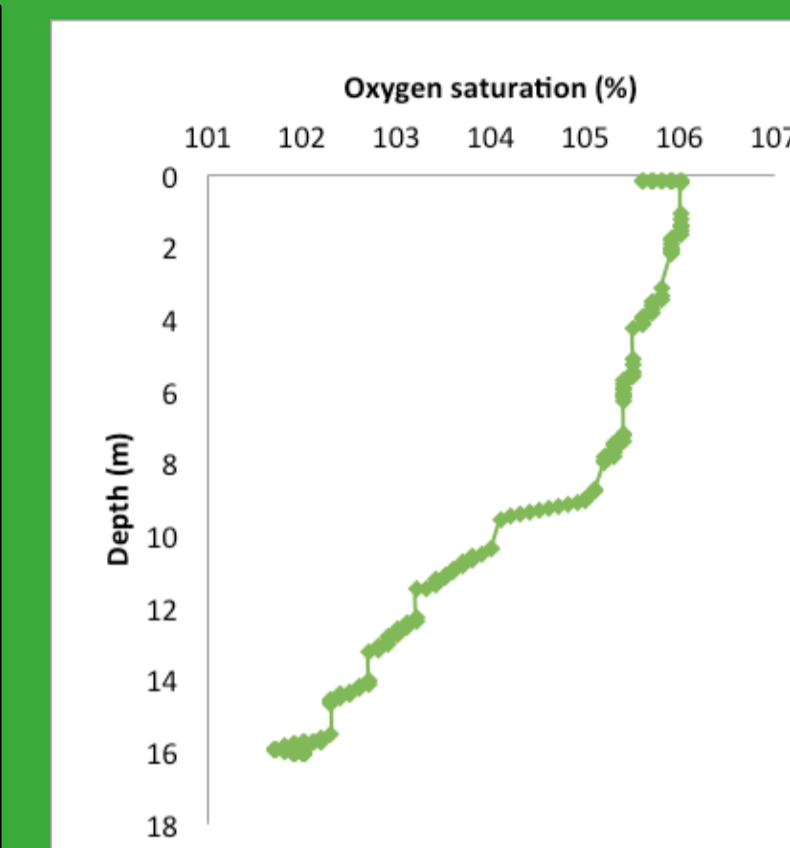


Figure 4 (Above) Salinity contour plot of the Fal estuary between Black rock and the mouth of the Truro river. 23/06/2015, high tide 9:20 (UTC).

## Station 2

CTD and oxygen profiles were performed from the mouth of the estuary to the upper estuary at seven stations. Station 2 was in very close proximity to the southern region of the sonar-surveyed site. (50°10.25" N 05°02.15" W)

A steep reduction in oxygen was observed at station 2 (see figure 3). This was greater than expected for a partially mixed area of the estuary, such as station 2 depicted in figure 4. This reinforces the assumptions that the main substrate type is muddy or fine sediment with high biological activity at the estuary floor depleting oxygen in the bottom waters.



Figure 5. Team studying the side scan sonar track plot at the Falmouth Marine School.

## Meta Data

Date: 27/06/2015  
Time: 13:23 (AST)  
Cloud cover: 6/8  
Weather conditions: Choppy and Strong Winds  
High Tide: 14:17 (UTC)  
Vessel: MTS Explorer  
Group 6 Members: Jobe Bryer, Chris Edwards, Harriet Knight, Elise Quinn, George Cottell, Natasha Busjeet, Amy Thompson and Ally Irwin