

### Introduction

The Fal estuary is a drowned river (ria) containing a central deep water channel which dates back to the last ice age. The harbour has been used for many hundreds of years, notably as an anchorage in the years following the Second World War, due to it being the third largest natural harbour in the world. Nowadays the estuary is still a busy seaport and is used as a ship repair yard, bunkering facilities and anchoring of pleasure yachts. The estuary is also an SSSI (Area of Special Scientific Interest) due to its wide range of habitats, created from the different sediments and shelter. The strong tidal influence within the harbour and at the estuary mouth leads to bed form morphology changes. Varying from stable kelp colonies and rocky outcrops to mudflats and mega ripples.

### Zone A:

#### Geophysics:

The benthic area was stable with ripples indicating a steady tidal flow (both velocity and direction). Mega ripples were 38cm tall (as calculated from side scan data) and the presence of ripples shows an increase in flow strength. The sediment appeared very well sorted and consisted of sand with a grain size of 0.0625-2.000mm.

#### Biology:

The biology of the area was widely distributed and thus sparse. The sandy sediment had no large stable substrate for settlement of macroalgae. Where bedforms were observed the dominant flora was *Zostera marina* (Eelgrass), these areas were relatively sheltered and stable thus allowing settlement and the spreading of rhizomes. These areas had higher light levels when compared to the areas dominated by rhodophyta and kelp. No large epifauna was observed, possibly due to the higher chance of predation and no immediate food source, i.e. algae upon which to graze.



Figure 1: Sand ripples can be seen on the seafloor, as in Zone A.

**Feature 1:** An anthropogenic scour potentially caused by dredging or anchor damage. Seen as a darkened trail on the side scan output.



Figure 2: The Kelp forest showing bryozoans living on the fronds. May be found in Zone B.



Figure 3: *Pollachius sp.* (Pollock) are found amongst the kelp beds, showing the Fal to be important to fisheries.

### Zone B

#### Geophysics:

This boundary was close to the headland, which consisted of mainly rocky outcrops of the same geology, orientated in a South-Westerly direction. Between the rock protruding from the bed, fine grained material such as sand and silt provided an environment for basic flora.

#### Biology:

Kelp (*Laminaria sp.*) was seen around the boundary to the rocky outcrop where rocks were exposed. This provided a solid grounding for holdfasts, silts and sands created a base for other flora. Below the kelp other species such as sponges and anemones competed for space, whereas animals hid amongst the holdfasts and other algae. The Kelp fronds themselves provided a habitat for small epiphytes such as colonial bryozoans and red algae.

Timothy Eldridge  
Kathryn Hambly  
Gemma Barker  
Kirsty Bradley  
Emily Holden  
Edward Sadler  
Ollie Moat  
Cameron Furnidge  
Allison Atterbury  
Joe Lawson

**Date:** 25/06/2013  
**Sea State:** Calm  
**Low Water:** 13:04 GMT - 0.2m  
**High Water:** 18:43 GMT - 5.4m  
**Weather:** 4/8 - 7/8 Cloud cover  
**Wind:** S/SW  
**Temperature:** 14°C to 18°C.  
**Vessel:** VIKING, SW.

#### Overview:

Using the side-scan sonar trace and faunal evidence inferred from the video footage, four zones of benthic habitat were identified over the study area. The first zone identified (D) was estuarine mud and soft silts, deposited north of the headland. Coarser sediments (C) were located to the west of boundary (D). As you move from the northern end of the surveyed area southwards there was a rocky habitat, the orientation of the features suggests a continuation of similar geology to the headland. South of this protecting headland the restriction of the channel results in increased tidal energy forming mega-ripples in the sediment (A).

The video feed was taken on a parallel transect to the surveyed area, however, in future surveys it would be beneficial to ensure that the video trawl crosses the side scan transects to provide ground truthing for the habitat map. To more effectively map the habitats, additional non-overlapping transects could be undertaken, as this reduced the area covered during the survey.

# Habitat Map

## Group 4

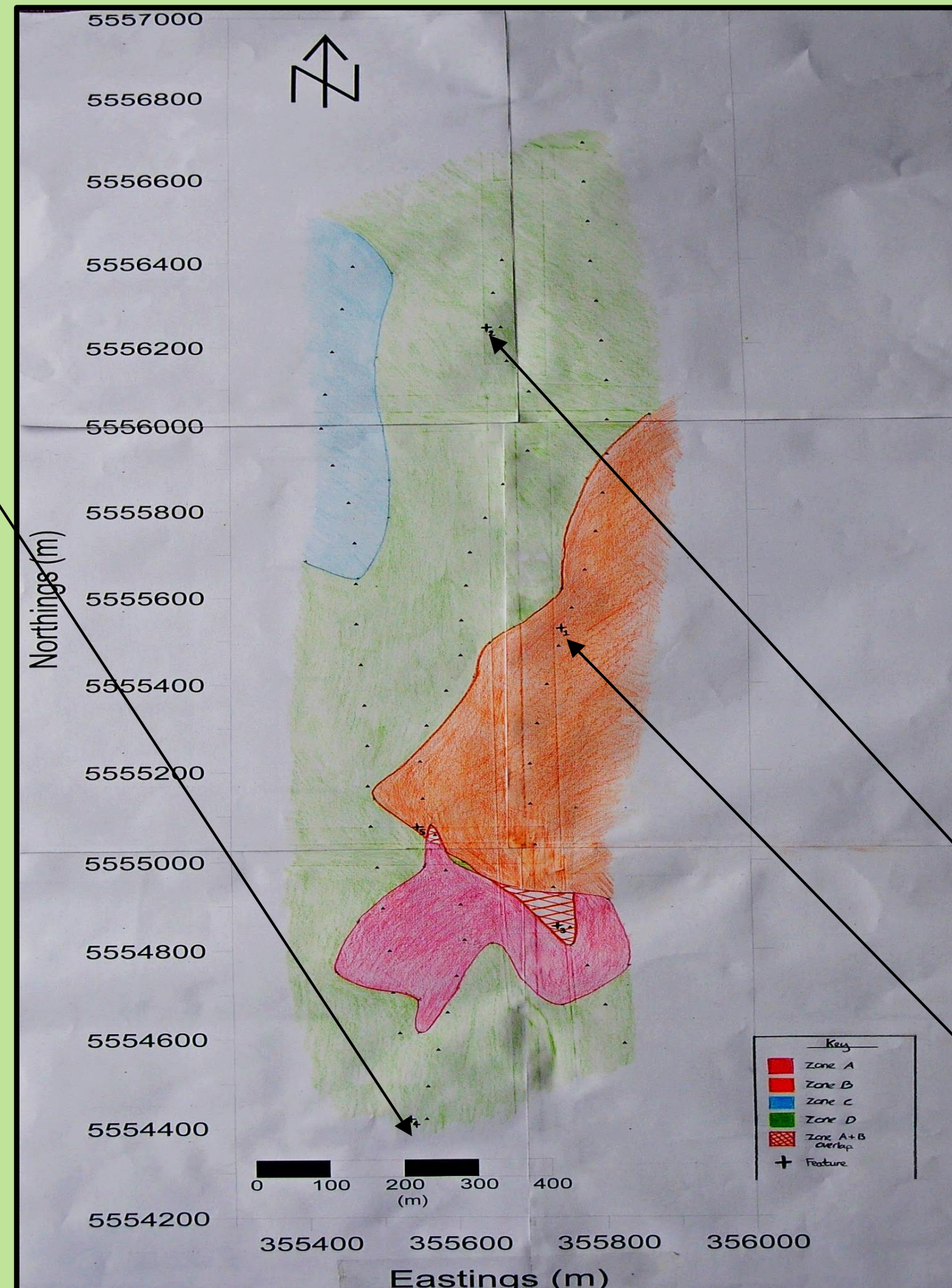
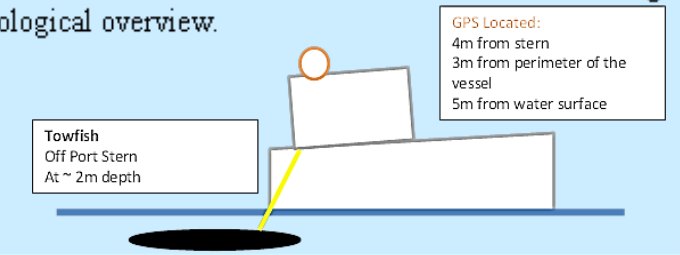


Figure 4: A habitat map constructed from track plots obtained via Surfer and details gained from the side scan output. Ground truthing was attempted with the use of HD video tracks; however the video track did not cross the side scan track plot so no assumptions have been made.

### Method

- A Towfish was deployed off the side of the boat. The fish had a sweep time of 96m/s, a swath width of 75m and a frequency of 100kHz. The fish was towed approximately 1m below the surface.
- 3 transects were conducted in total; a preliminary line was generated using a pair of coordinates with further parallel transects added using a navigation programme.
- Side-scan sonar equipment on board the Towfish releases an acoustic pulse towards the sea bed. The strength of the returning signal is dependent on substrate, where rough and irregular surfaces have a higher reflectivity than planar surfaces.
- Interpretation of the side-scan data allow us to speculate on the morphology of the benthic environment
- A HD video camera was attached to a plastic sheet and lowered into the sea to within a meter of the seabed. The images were used to ground truth the side-scan data and to give a general biological overview.



### Zone C

#### Geophysics:

No bedforms were present and the sediment was poorly sorted, with a mixture of large pebbles and shell fragments overlying gravel (2-16mm).

#### Biology:

Flora was sparse and dominated by a number of short red algal species, which indicated low light levels. Casts were observed from burrowing invertebrates, possibly polychaetes, holothurians and bivalves. Predatory Sea Stars (*Asterias rubens*) were the dominant macrofauna and could be seen clearly using the HD camera.

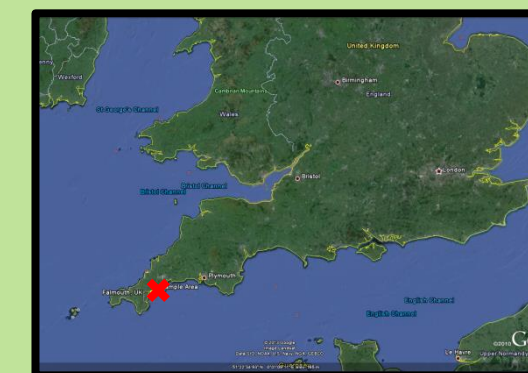


Figure 8: The location of the Fal estuary. Image courtesy of Google Earth.



Figure 5: Shows the area sampled. 50° 08' 23.99" N, 005° 01' 15.92" W.

**Feature 2:** A 4m tall object projects from the seabed casting a white shadow. This may be a rock.



Figure 6: The coarse sediment which could be expected in Zone C.

**Feature 3:** The mixture of shadows and light patches could indicate a rocky area, or it may represent a biological feature such as a kelp forest.

### Zone D

#### Geophysics:

Zone D was dominated by fine silts and muds, shown by sonar scan as lighter shaded areas due to stronger reflectivity. A decreased amount of large bedforms were present although there were scour marks and very fine ripples present. These features are consistent with a deeper water channel where the action of waves and currents affects the benthos less strongly.

#### Biology:

A decrease in floral diversity was seen due to resuspension of the sediment, however many burrowing polychaetes and bivalves can be expected. Lack of large photosynthetic plants such as kelp would be due to the unstable fine bed and increased depth.