

Mapping of the Geophysical Benthic habitat

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Introduction

The Fal Estuary has a long history of pollution, notably the “Wheal Jane” incident in 1992 (Bowen *et al.* 1998), which released mining waste into the Estuary. The identification of coralline algae (Maerl) within the estuary provoked interest in conservation, due to the species’ role in localised high species diversity and increased vulnerability due to slow growth rates (e.g Peña *et al.* 2014). This resulted in the designation of the estuary as a Special Area of Conservation (SAC) and production of a time series data set, in order to identify habitat and organism change, and to attempt to protect the area from anthropogenic impacts.

Research Aim: To create a habitat map of a section of the Fal Estuary, west of Black rock.

Method

- Use of Dual Frequency Side Scan Sonar (410kHz) along 4 transects 100m apart to characterise the seabed. Further use of SURFER 8 and Google Earth computer programs to create track plots.
- Van Veen Grab deployed at the end of line 1 and start of line 2 (32725.2 m N, 182655.6 m E), in order to analyse sediment type and identify species present.
- Video camera deployed SE of line 2 (32651.7 m N, 182751.6 m E) and drifted to 362601.4 m N, 182769.4 m E at 10:21 UTC in order to visually analyse benthos. Video camera deployed for a second time at 32183.7 m N, 183014.0 m E at 10:39 UTC . Species identification at intervals of 60 seconds.



Figure 2. Video drift 1 (10:22 UTC)



Figure 3. Video drift 1 (10:26 UTC)

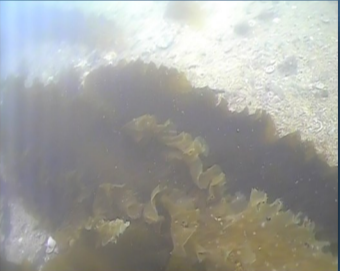


Figure 4. Video drift 1 (10:27 UTC)

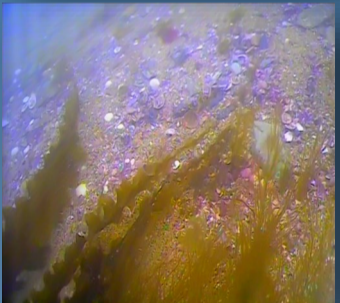


Figure 5. Video drift 2 (10:41 UTC)

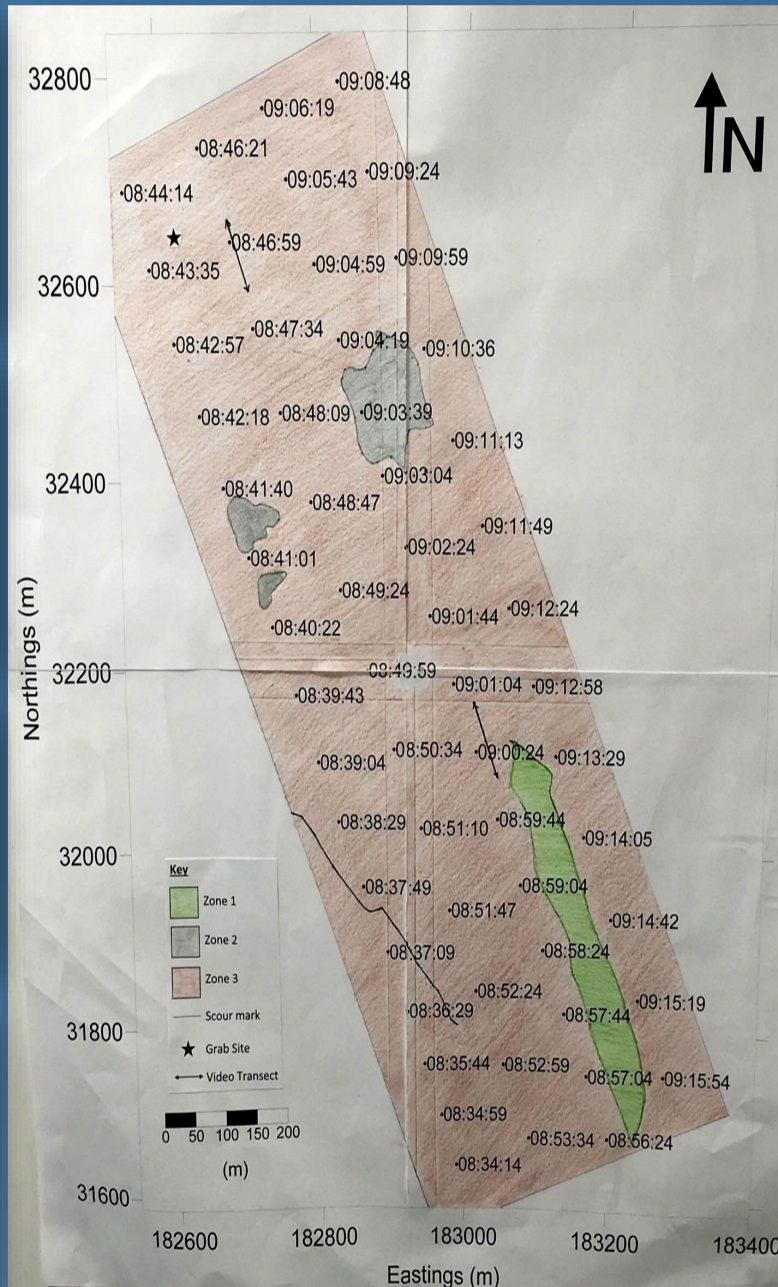


Figure 1. Habitat track plot west of Black Rock, Falmouth, UK. Coordinates given in OSGB36.

Habitat Tracking Plot

The side-scan sonar track-plots suggested that the area surveyed was approximately uniform in terms of habitat, only 2 small zones differed from the majority of the seabed. The benthos of zone 3 was theorised to be level and composed of coarse sand and shell fragments. The use of a video camera and a Van Veen grab allowed the confirmation of this theory, and also highlighted that Maerl was commonly present in small fragments. Zone 2 is theorised to be dominated by rocky outcrops, due to strong backscatter characteristics. However, no further observational data was collected from this zone, thus there is a lack of clear evidence necessary to confirm Zone 2 habitat. The boundaries of this zone were indistinct, which made accurately plotting zone boundaries difficult. Zone 1 displays a high density kelp bed, observed from the side-scan prints. However, as with zone 2, a lack of further evidence from ground-truths (video/grab data) means there is currently little evidence supporting this theory.

Van Veen Grab

The Van Veen Grab gave a partial ground-truthing for a small area of zone 3. The grab retrieved *Saccharina latissima* among coarse sediments chiefly composed of crushed shell. These are the two principle characteristics of Zone 3. Grab fauna included

- *Leocarcinus spp.* from the swimming crabs
- *Nucula nucleus*, a small saltwater clam
- *Tapes decussatus*; the grooved carpet shell (a commonly aquacultured clam and important bio-indicator).

Video Ground-Truthing

The video footage collected showed benthic substrate to be composed of mostly coarse sand, Maerl and shell debris (Figure 2). Larger rock bedforms were present providing an attachment site for the main kelp present (*Saccharina latissima*— Figure 4). This was viewed within both video transects. Lack of living organisms was significant with mollusc and bivalve shells dominating the area viewed. Exceptions included two *Raja clavata* (Figure 3), a *Marthasterias glacialis* and macro-algae species including *Saccharina latissima* (Figure 2, 3 and 4), *Plocamium cartilagineum* and *Desmarestia sp* (Figure 5).

Discussion

Sporophytes of *Saccharina latissima* have a tolerance to heavy metals, but the early life stages are more intolerant. The effects of heavy metals on *S. latissima* have been investigated by Thompson & Burrows (1984), observing that the growth of sporophytes was significantly inhibited at 50 µg Cu/l, 1000 µg Zn/l and 50 µg Hg/l. Zoospores were found to be more intolerant and reductions in survival rates were observed at 25 µg Cu/l, 1000 µg Zn/l and 5 µg Hg/l. This is a potential explanation as to why *S. latissima* was seen only in adult form at low densities. Any spores have reduced growth due to pollution (e.g Bowen *et al.* 1998)

The Van Veen Grab failed to enter the sediment by more than a few centimetres; no infaunal species were retrieved. The shell debris retrieved was remnants from *Nucula nucleus* and *Tapes decussatus*, both infaunal species (Sobral & Widdows 2000; Queirós *et al.* 2013). The lack of living specimens in the grab and video data is likely because of a failure to sample the infauna.

Bowen, G.G., Dussek, C. and Hamilton, R.M., 1998. Pollution resulting from the abandonment and subsequent flooding of Wheal Jane Mine in Cornwall, UK. *Geological Society, London, Special Publications*, 128, pp. 93-99.

Peña, V., Bárbara, I., Grall, J., Maggs, C.A. and Hall-Spencer, J.M., 2014. The diversity of seaweeds on maerl in the NE Atlantic. *Marine Biodiversity*, 44, pp.533-551.

Queirós, A.M., Birchenough, S.N., Bremner, J., Godbold, J.A., Parker, R.E., Romero-Ramirez, A., Reiss, H., Solan, M., Somerfield, P.J., Colen, C. and Hoey, G., 2013. A bioturbation classification of European marine infaunal invertebrates. *Ecology and evolution*, 3, pp. 3958-3985.

Thompson, R.S., and Burrows, E.M., 1984. The toxicity of copper, zinc, and mercury to the brown macroalgae *Laminaria saccharina*. *MAR. TOX.*, pp. 259-270.

ENVIRONMENTAL PARAMETERS (21/6/16)

Air Temperature	17°C
Wind Speed	17 knts
Wind Direction	SW
Precipitation	None
Sea State	Slight
Tide Times	H: 05:41 UTC 17:55 UTC L: 12:07 UTC

Limitations

- Transect: Interpretation of sonar print-out difficult, due to vulnerability to errors (identifying features, calculations, transferring to track plot)
- Grab: Only 1 grab is not representative, very little grab content
- Video: Drift instead of along transect lines or any parallel path.
- Camera angle may have distorted image, inhibiting accurate species identification.