

A multi-disciplinary environmental survey of Eddystone Rocks, Plymouth, UK

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Close-ups of rocky reefs with the sea fan *Eunicella verrucosa*, the soft coral *Alcyonium digitatum*, the sea cucumber *Holothuria forskali*, the sea urchin *Echinus esculentus* and the sponge *Cliona celata*.

IN 2005 and 2006 SeaStar Survey designed and carried out a multidisciplinary study around Eddystone Rocks, south of Plymouth in the UK, for English Nature. A pre-qualification study had shown Eddystone Rocks to represent a good example of a shallow offshore reef surrounded by a range of ecological habitats and therefore an area potentially qualifying as a special area of conservation (SAC) as part of the European Commission's *Habitats Directive* (92/43/EEC). SeaStar Survey was contracted to undertake an acoustic and a biological survey of Eddystone Rocks and the surrounding area covering a total of 25 km².

The aim of the acoustic element of the survey was to delineate the extent of the potential rocky reef habitats as well as to describe and delineate the various other seabed habitat types which occurred between and around the areas of rocky reef. The aim of the biological element of the survey was to ground-truth the sidescan sonar imagery, identify and quantify the species present and describe the habitats on both the rocky reefs and the interspaced softer substrates. The results of all elements of the survey were presented as a multi layer geographical information system (GIS) using MapInfo.

The biological and ground-truthing element of the project was initially planned to include drop-down camera survey, sediment grab

sampling and dredging but, as a result of limited time and poor weather conditions, camera deployments became the preferred tool. The camera equipment used during the survey was a Kongsberg Simrad OE14-208 digital camera system mounted obliquely on a drop-down camera frame and linked to the surface with a soft umbilical cable.

The acoustic survey was carried out using a GeoAcoustics dual frequency (114/410kHz) sidescan sonar (model 159D) operated at 114kHz. The system comprised a tow fish, soft umbilical, transceiver, a Dowty Maritime Ocean Systems 3710 thermal linescan recorder, and a CodaOctopus 760 geophysical acquisition system, which was used to record the data digitally in XTF format to DVD-RAM. Navigation and heading data were input to the Coda digital recorder from the navigation computer using HyPack Max survey management software.

Bathymetry was recorded on paper trace and digitally using Hypack via a Marimatech E-Sea Sound dual frequency (33 and 200kHz) digital echo sounder. The horizontal control and heading data for the survey were acquired using a CSI wireless vector sensor, with the differential signal obtained from the Lizard lighthouse.

The sidescan sonar was operated at a range of 200m (400m swath) throughout the entire survey. However, due to the size of the survey area and the variation in seabed type, the line spacing used varied throughout the acoustic acquisition from 4,000m in the homogenous sandy areas to the south to an average 400m over rock reef areas.

The analysis of the sidescan sonar mosaic from the acoustic survey revealed areas of different levels of backscatter, suggesting clear changes in bathymetry, sediment type and sediment composition within the survey area. The southern area was dominated by areas of light, even backscatter returns, the northern area consisted of a variety of sidescan sonar returns, including darker, mottled backscatter returns as well as streaks and patches of lower returns while the central area consisted of areas of high backscatter surrounded by areas of lower backscatter returns.

Ground-truthing with the camera equipment revealed mixed sediments

consisting of gravel/sand/mud interspersed with large patches of sand in the north (see figure 1) but also a large muddy area in the north-east corner of the study area. The southern area was dominated by sand while the central area consisted of several rocky reefs with a mixture of sediment types in-between the rocky outcrops. Biologically the rocky reefs were characterised by the relatively rare sea fan *Eunicella verrucosa*, the soft coral *Holothuria forskali*, the sea urchin *Echinus esculentus* and the sponge *Cliona celata* (see images above). The faunal distributions and the habitats appear to be very similar throughout the rocky reef areas, representing habitats on wave-exposed, vertical or steep, bedrock or large boulders, usually subject to moderate or strong tidal streams. The fauna observed on the sediments were dominated by polychaetes (worms), hydroids and echinoderms (e.g. seastars and brittlestars) with a richer epifauna being present in the northern section of the study area.

The integrated approach using acoustic methods together with the ground-truthing using the drop-down camera system and the GIS have proven to be very successful methods for studying the large-scale features around Eddystone Rocks but also to investigate the finer biological and sedimentary features within the study area. The presence of warm-water species, such as the soft coral *Alcyonium glomeratum* and *Holothuria forskali*, together with the rare sea fan *Eunicella verrucosa* and more typical English Channel fauna indicate that this region still spans across a biogeographical boundary with both warm and cold water taxa being present.

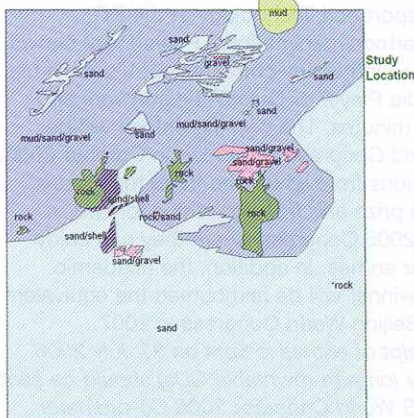


Figure 1. Sidescan sonar interpretation (from the GIS) after ground-truthing using the drop-down camera.

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