Science Series
Technical Report no. 145

Mapping Annex I Reefs in the central English Channel: evidence to support the selection of candidate SACs

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Cefas

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defra
Department for Environment Food and Rural Affairs

Cefas

Origin
This report is produced for Defra, as a deliverable within project ME1102 'Broadscale mapping of hard substrates in the central English Channel: providing an evidence base to support regional management of aggregate resources and the designation of SACs relating to Annex 1 reef habitats'. The work is a piece of original research conducted by Cefas.
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Documents

TechRep145.pdf	Coggan, R, Diesing, M and Vanstaen K., 2009. Mapping Annex I Reefs in the central English Channel: evidence to support the selection of candidate SACs. Scientific Series Technical Report, Cefas Lowestoft, 145: 116pp.

Spreadsheets

ME1102 Video Analysis_Portland stations.xls	MNCR sublittoral habitat analysis records for video from Portland ('P' stations)
ME1102 Video Analysis_Wight Transect stations.xls	MNCR sublittoral habitat analysis records for video from the Wight transect ('W' stations)
ME1102 Video Analysis_Wight Video stations.xls	MNCR sublittoral habitat analysis records for Wight AoS ('WV' station).
ME1102 Video Station Summaries.xls	Summary tables of biotopes and geophysical characteristics for each video station and video segment.

Databases

ME1102SnapshotData_Access2000.mdb	Video analysis data (as for spreadsheets) published as a snapshot of the Marine Recorder database
MR_Snapshot_Relationships.doc	Access screen dump showing tables, fieldnames and relationships in the database snapshot (to assist bespoke query building).

Imagery

Acoustic	28 PDF files (470 MB) showing outputs from Multibeam and Sidescan surveys, as detailed in 4.1.4 Data visualisation and Figure 8.
Photographs	Still images for Portland and Wight Transect and Wight Video stations (3 GB)
Photographs	Contact sheets for all still images supplied (10 MB)

1 Executive Summary

- The stated objective of this part of project ME1102 was "to provide information on the distribution, extent and character of potential Habitats Directive Annex I reef habitat within the central English Channel region to facilitate the selection of SACs"
- The study targeted two 'Areas of Search' (AoS) nominated by the JNCC between the 12 nautical mile limit and the UK/France median line, the Wight study area (~1,500 sq km) due south of the Isle of Wight and the Portland area (~1,6000 sq km) due south of Portland Bill.
- A 3-day pilot survey in May 2006 found widespread evidence of rock outcrops in Wight, but not in Portland. This was the opposite outcome to that expected from inspection of the published seabed sediments charts that had informed the selection of the Areas of Search.
- A 12-day cruise in July/August 2006 conducted further acoustic surveys followed by directed ground-truth sampling using underwater video. No rocky reef systems were found in Portland. The majority of effort focused on the extensive reef systems discovered in Wight, which clearly extended to the north and east of the Area of Search.
- Subsequent to the field surveys, a new Digital Survey Bathymetry (DSB) data set was acquired from SeaZone Solutions Ltd and used to produce a reasonably detailed topography of the seabed in the central Channel region. This showed the Portland area to be flat while the Wight area contained complex but well defined seabed features that closely reflected the mapped solid geology of the area and could be used to delineate the extent of the reef system.
- The topography highlighted a large erosional feature in the form of palaeovalley around 20 km wide cutting through the solid rock of the Wight area in a NE-SW orientation, deepening the local seafloor by about 50 metres.
- Terrain modelling was applied in ArcGIS to the DSB data for Wight and Portland to produce seabed character maps discriminating bedrock ridges, palaeovalley, subaqueous dunes and flat, smooth seabed. These were translated into EUNIS habitat classes after incorporating further critical data sets on current velocity and sediment type into the GIS. The process was repeated on higher resolution multibeam data covering a 32 sq km section of the Wight area to give a finescale characterisation of a rocky reef area.
- Underwater video was analysed to assess the range of biotopes found in the Areas of Search. Thirteen ground-truth stations were sample at (or near) the Portland AoS, and 30 at (or near) the Wight AoS.
- No Annex I reef habitats were observed by video in Portland. Rock did occasionally outcrop at the surface but was flat and heavily abraded by coarse sediments that typically lay in a thin layer on top of the rock.
- Annex I reef habitats dominated the video from Wight. Many sites were typified by a series of low lying rock ridges (to ~ 4 m high) supporting encrusting faunal communities. Sponges characterised some of the deeper sites, especially those associated with the palaeovalley. Some stable cobble and pebble substrates were accreted by sponges to the extent that they met the criteria for Annex I rocky reefs. Twenty two of the 30 Wight sites sampled by video contained Annex I reef habitats
- Ten classes of rock biotope and seven classes of sediment biotope were recognised in video from the Wight area. Whilst the rock surfaces were almost completely covered with fauna, the amount of growth was typically not as profuse as in other reef systems in the English Channel. The most common biotope was CR.HCR.XFa.FluCoAs; a mixed fauna characterised by the bryozaon *Flusta* and colonial Ascidians growing on circalittoral rock exposed to strong currents.
- The location of the reefs in 'The Narrows' of the English channel marks the border between recognisably different ecosystems in the western and eastern Channel. The locale is identified as a 'bedload parting zone', where strong currents move particulate matter and sediment away from the area, either to the east or west. This is reflected in the general lack of sediment cover on the rocks and the somewhat limited diversity and biomass of fauna. Under the current climate and hydrographic regimes the area is likely to be one of low natural productivity.
- On the basis of an integrated assessment of the physical and biological interpretations made under this project, the Wight area was mapped into six geophysical regions. Their borders reflect the dominant geological boundaries and/or topographic features. Four of these six regions are considered to be representative of Annex I reef habitats and cover a total of 1,667 sq km. This includes the palaeovalley region which itself covers 512 sq km. For comparison, the land-mass of the Isle of Wight covers an area of ~380 sq km.
- This part of project ME1102 has achieved its objectives. It has also highlighted that there may be significant errors in the current estimates of the area of exposed bedrock in UK territorial waters if these have been derived largely on an interpretation of existing seabed sediment maps.

2 Introduction

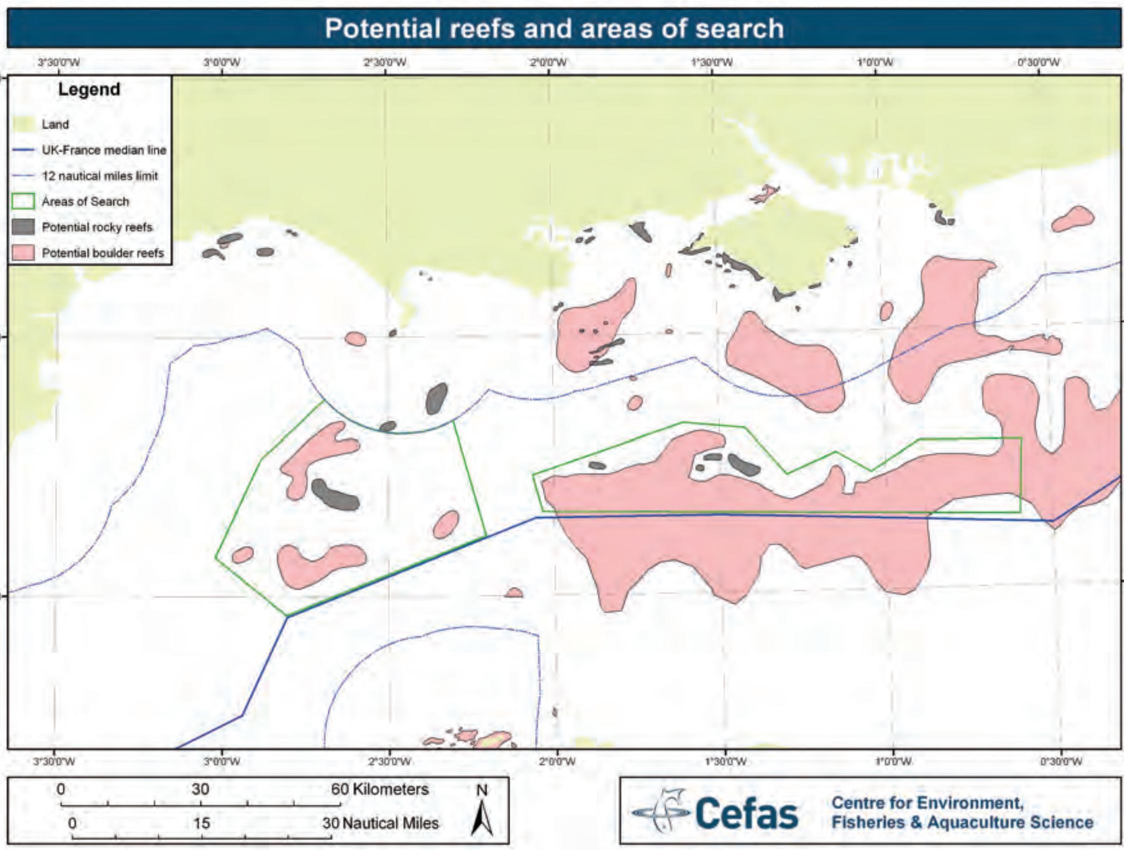
The EU Habitats Directive has identified 'reefs' as one of seven marine habitats in need of special conservation measures. The provisions of the Directive require Member States to introduce a range of measures to protect these 'priority' habitats. In the UK this will be achieved through a Government program designating qualifying areas of seabed as Special Areas of Conservation (SACs).

In England, two agencies are responsible for advising Government about which areas of seabed qualify as SACs, namely Natural England (NE) and the Joint Nature Conservation Committee (JNCC). In the marine environment this remit is divided spatially, with Natural England being responsible for 'territorial waters', that is within 12 nautical miles (nmi) of the land baseline, while the JNCC is responsible for the remaining waters out to the 200 mile Exclusive Economic Zone (EEZ).

Unfortunately, our knowledge of the location, extent and nature of reef habitats in UK waters was extremely limited and further surveys were considered necessary to identify areas that may be suitable as candidate SACs. As it was impracticable to attempt surveying even the majority of the UK EEZ in the time available, the JNCC conducted a project (Johnson *et al*, 2002) and commissioned reports (e.g. Graham *et al*, 2001) to help identify areas most likely to contain these 'priority' habitats. Some of these so called Areas of Search (AoS) were targeted for further survey.

This report details Cefas' surveys and subsequent investigations of two adjacent Areas of Search between the 12 nmi limit and the UK/France median line in the central English Channel, identified by the JNCC as potentially containing rocky reefs (Figure 1). The work was funded by Defra under project ME1102 and commenced in May 2006. The stated objectives of this part of the project were:

Figure 1: Central English Channel showing the two Areas of Search identified by JNCC and targeted by this study. The outlines of potential rocky and boulder reef are essentially the boundaries of rock gravel areas mapped on the BGS seabed sediment charts (further details in Graham et al, 2001 and Johnston *et al*, 2002).



"to provide information on the distribution, extent and character of potential Habitats Directive Annex I reef habitat within the central English Channel region to facilitate the selection of SACs"

The underlying goal was to improve our knowledge and mapping of seabed habitats to create a more profound, scientific basis for the selection of marine protected areas.

The two Areas of Search covered ~ 3,100 sq km of seabed, nearly eight times the land area of the Isle of Wight. The project had fifteen days of survey time available on the RV *Cefas Endeavour* (Figure 2), which was generous but insufficient to conduct a full coverage remote sensing survey using multibeam and sidescan sonar acoustic techniques. To maximise effectiveness, the survey time was split between two cruises, with a 3-day pilot survey used to reconnoitre the area and inform the design of the subsequent 12–day main survey.

The strategy was to conduct a series of acoustic transects through the area and use these to inform the selection of representative ground-truth sites to be sampled using underwater video. Other objectives of the ME1102 project, not concerned with rocky habitats, were also to be addressed during this second survey. The vessel worked a 24-hour day, typically conducting acoustic surveys during daytime and underwater video sampling at night.

The original intention for mapping the rocky reef areas was to interpret each acoustic transect to identify the individual reef features on each of the survey lines and then use expert judgement to interpolate between the lines to derive a broadscale map map. In the event, a far superior approach was made possible by the release of a new data set based on single-beam echo sounder surveys undertaken for the UK Hydrographic Office. From this we produced a topographic image of the seabed in the central English Channel that gave near complete coverage of the two Areas of Search, but at a lower resolution than the multibeam surveys conducted by Cefas. Despite the lower resolution, the topographic image showed clear and well defined seabed features that matched almost perfectly the larger features seen on the multibeam images. This removed the need for interpolating between the multibeam survey lines and allowed us to confidently map the borders of features both between and beyond our multibeam survey lines.

These developments presented the opportunity to make maps with a far higher quality (i.e. confidence and accuracy) than originally envisaged, and consequently a significant amount of effort was redirected towards interpreting the new single-beam data set and providing more reliable maps better suited to the purpose of delineating candidate SACs.

Figure 2: RV *Cefas Endeavour* © MJ Page.

3 Regional overview

The purpose of this overview is to place the study area in a regional context, focusing on the elements that are most pertinent to determining the form and nature of the current seabed habitats in the central English Channel. It is important for the reader to recognise that the Channel has not always existed in its current form and has been influenced by various cyclical events that operate with different periodicity (millions, thousands, hundreds and tens of years).

As recent as 5000 years ago the Channel was not connected to the North Sea at the Dover Straits, which was at that time a terrestrial habitat linking present day France and England. Sea level in the Channel has fluctuated significantly during the glacial and interglacial periods of the last 2 million years (James *et al*, 2007) and the deeper western channel will have been a wholly marine environment for far longer than the shallower eastern channel. During periods of low sea level, many of the rivers of present day France, Germany and England used to drain westwards along what is now the eastern Channel, cutting valleys and channels through the (terrestrial) soils and bedrock and depositing their own sediments (James *et al*, 2007, Hamblin *et al*, 1992).

In addition to cyclical events, certain periodic and singular events will also have had an influence on the variety and spatial distribution of physical habitats open to colonisation by modern day organisms. With life spans measured in days, months and years, these organisms will be more sensitive to environmental changes on those same scales rather than the long term geological changes. Hence, such factors as the rise and fall of the tides, the seasonal temperature cycles and the movement of major water masses will effectively put the final touches on the complex structure that is the modern environment in which many organisms are competing for food and shelter.

3.1 Physical setting

The English Channel is a funnel-shaped, ENE-WSW trending, relatively shallow shelf sea situated between France and England. This study is concerned with the central part of the English Channel roughly between 0° 30′ W and 3° 30′ W in the Exclusive Economic Zone (EEZ) of the United Kingdom.

Physiographically, the most extensive element in the English Channel is a gently dipping planation surface, which slopes directly away from the coast. This marine planation surface is largely of Neogene age, for over most of the area it cuts across Palaeogene and Cretaceous sediments. The planation surface is dissected by palaeovalleys of Pleistocene age. Most of these have been infilled with sediment such that they cannot be distinguished on bathymetric maps. However, the Lobourg Channel in the Dover Strait and the Northern Palaeovalley remain largely unfilled (Hamblin *et al*, 1992). A recent study (Gupta *et al*, 2007) suggests that the network of palaeochannels is due to megaflood events. According to this, breaching of a rock dam (the south-eastern former continuation of the North Downs) at the Dover Strait instigated catastrophic flooding of a meltwater lake, which was situated in the southern North Sea during glacial times.

3.2 Geology

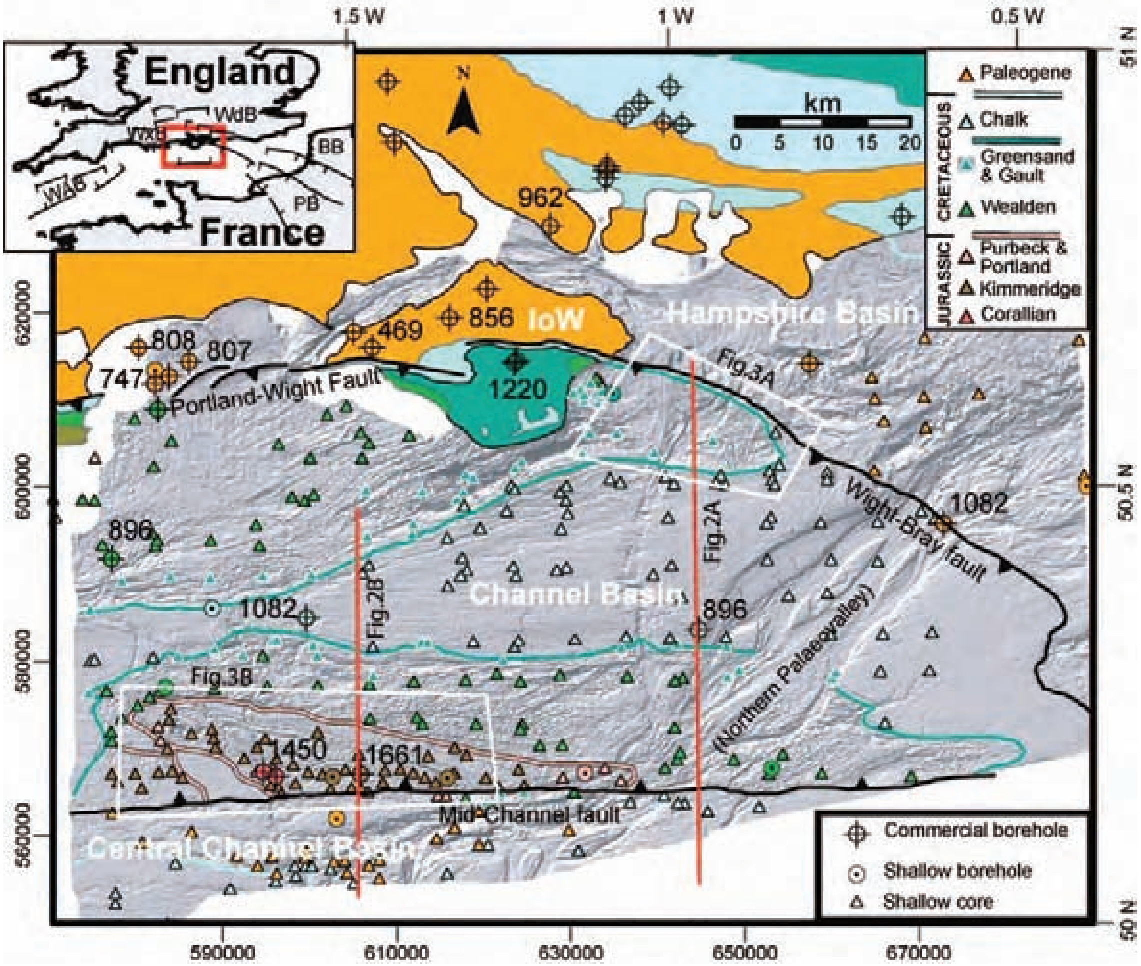
A brief account on the underlying bedrock and the surficial seabed sediments will be given in the following. Description of bedrock geology will be more detailed for the Wight site as bedrock geology has a major influence on habitats there (as will be shown).

3.2.1 Wight

In the Wight site, the thickness of modern sediment is generally below 0.5 m (BGS, 1989); therefore different types of bedrock can be distinguished based on different textures of bathymetry (Collier *et al*, 2006) (Figure 3). Even the Northern Palaeovalley remains largely unfilled, indicating that strong tidal currents (see section 3.3) prevent the deposition of fine-grained material. This is in strong contrast to the eastern English Channel, where bedrock is normally covered by modern sediment over vast areas (James *et al*, 2007).

Bedrock at the seafloor comprises an almost complete succession from the Middle to Upper Jurassic Oxford Clay Formation to the Eocene Wittering Formation. This is equivalent to a time span of 115 million years (Ma), from approximately 165 Ma to 50 Ma ago. The bedrock is exclusively sedimentary, but shows a great variety including sandstone, mudstone, shale, limestone and marl, among others. The oldest rocks of the Oxford Clay Formation are located in the Mid-Channel Anticline, just north of the Mid-Channel fault (Figure 3). In general, rocks are of decreasing age towards the north until the centre of the Channel Basin, where Upper Cretaceous rocks are found. The youngest rocks within the research site are located just south of the Mid-Channel fault in the Central Channel Basin, where Palaeogene rocks crop out. The stratigraphy in the Wight site is summarised in Table 1

Figure 3: Bathymetry (shown as greyscale shaded relief image) and bedrock geology in the Wight site (Collier et al, 2006 © Geological Society of America).



Jurassic

Within the Wight site, mainly rocks of the Upper Jurassic Series are present at the seafloor, while the oldest rocks found here – the lower parts of the Oxford Clay Formation – belong to the Middle Jurassic. The Upper Jurassic displays a wide range in lithology and the rock succession is strongly cyclic. Therefore, and because of a widespread lateral persistence of rock types, the seabed consists of a series of closely spaced 2 – 4 m high ridges and troughs that give a corrugated appearance (Collier *et al*, 2006).

Oxford Clay Formation

Sediments of the Oxford Clay Formation are poorly exposed in the Wight site. They were cored in three commercial boreholes (98/22-1, 98-22/2 and 98/23-1) in the Mid-Channel Anticline and dominantly consist of claystones (85 - 98%), but siltstones and limestones were also retrieved.

Corallian Group

Sediments of the Corallian Group rest with sharp contact on the Oxford Clay beds and generally comprise grey sandstones, overlain by pale to dark grey mudstones, which in turn are capped by grey, medium to coarse grained sandstones (Hamblin *et al*, 1992). Different from that, the Corallian sediments in the centre of the Mid-Channel Anticline (commercial borehole 98/23-1) are almost exclusively built up by limestone (90%), with some subordinate siltstone and claystone (5% each).

Kimmeridge Clay Formation

Sediments of the Kimmeridge Clay Formation make up the largest part of Upper Jurassic bedrock outcrops in the study site. They are found widespread in the Mid-Channel Anticline north of the Mid-Channel fault. Sediments at the type locality in south Dorset mainly comprise grey marls, grey to greenish-black shales, laminated shales, greyish to brownish-black mudstones (oil-shales) and thin limestones (Morgans-Bell *et al*, 2001). Shallow drilling at boreholes 75/32 and 75/33 revealed a sequence of dark grey mudstones (Dingwall and Lott, 1979).

Portland and Purbeck Groups

The Portland beds are generally well exposed on the Isle of Portland. They comprise a wide variety of lithologies, namely claystones, siltstones, mudstones, sandstones, limestones, dolostones and cherts (Hamblin *et al*, 1992). Purbeck beds generally consist of alternations of laminated limestones and laminated mudstones. Sediments of the Portland and Purbeck Groups are restricted to small areas at the rim of

Table 1: Stratigraphy of bedrock geology in the Wight site.

System	Series	Unit	Major rock types
Palaeogene	Eocene	Wittering Formation	Silty clays
	55.8 Ma	London Clay Formation	Sand, clay, mudstone, flint pebbles
	Palaeocene 65.5 Ma	Reading Formation	Clay, siltstone, sandstone
Cretaceous	Upper Cretaceous 99.6 Ma	Chalk Group	Micritic limestone, marl, flint
	Lower Cretaceous	Gault-Greensand	Siltstone, sand(stone), mudstone
		Wealden Group	Sand(stone), shale, mudstone, siltstone
	145.5 Ma	Purbeck Group	Laminated limestone, laminated mudstone
Jurassic	Upper Jurassic	Portland Group	Limestone, sandstone, chert, mudstone
		Kimmeridge Clay Formation	Marl, shale, mudstone, thin limestone
		Corallian Group	Sandstone, limestone, mudstone
	161.2 Ma	Oxford Clay Formation	Claystone, siltstone, limestone
	Middle Jurassic		

the Mid-Channel Anticline, namely in the east, south and west. Dark grey-green, laminated mudstones of the Durlston Formation (upper part of the Purbeck Group of Lower Cretaceous age) were recovered from boreholes 75/28 and 75/36 (Dingwall and Lott, 1979).

Cretaceous

Wealden Group

Rocks of the Wealden Group generally consist of two major units: a lower unit of mainly sandy sediments (Hastings Beds) and an upper muddier formation (Weald Clay) with interbedded sandstones and siltstones (Hamblin *et al*, 1992). In the Wight site they were retrieved from shallow boreholes 75/31 and 75/37, where they are described as green to grey mudstones with interbedded sand and sandstones (Dingwall and Lott, 1979). Commercial borehole 99/16-1 also shows an interbedded sequence of sandstone, mudstone, siltstone and shale. As a result of the interbedding, the bathymetry displays a distinctive texture, where Lower Cretaceous Wealden Beds crop out. The seabed typically is very rough, with numerous ridges and troughs that can be traced laterally for tens of kilometres (Collier *et al*, 2006). From the eastern English Channel, it is known that the ridges are more chaotic and less linearly that those associated with Upper Jurassic strata (James *et al*, 2007). Wealden Group sediments crop out as two elongated patches with E-W orientation, rimming the Channel Basin.

Gault-Greensand

Lower Greensand, Gault and Upper Greensand have been amalgamated in this report. In the Wight site they crop out as relatively narrow bands between Wealden beds and Upper Cretaceous chalk (see below). The whole sequence was cored in shallow borehole 75/29 (Dingwall and Lott, 1979). Here, dark grey siltstones and mudstones (Lower Greensand) are overlain by dark grey mudstone, siltstone and silty sandstone (Gault), which in turn are overlain by green to dark green, fine-grained sandstone (Upper Greensand). From the eastern English Channel, it is known that the contact between relatively soft Gault-Greensand and the overlying more durable chalk creates a scarp up to 25 m high (James *et al*, 2007).

Chalk Group

Chalk is found at the seafloor in the Channel Basin and south of the Mid Channel fault in the Central Channel Basin. The seabed exhibits a characteristically smooth texture (Collier *et al*, 2006). Chalk is a micritic limestone mainly consisting of a matrix of debris from planktonic algae. Besides this, siliceous flint is common in certain levels within the chalk as irregular shaped nodules or beds. Flints are rare in the lower part and are most abundant in the upper part of the chalk succession (Hamblin *et al*, 1992). Marl beds are found in the lower parts of the chalk. In shallow borehole 75/29, white chalk with grey argillaceous bands was cored (Dingwall and Lott, 1979).

Palaeogene

Reading, London Clay and Wittering Formations

Palaeogene rocks are limited to the so-called Central Channel Outlier (Hamblin *et al*, 1992) south of the Mid Channel fault. Variegated and mottled clays, siltstones and sandstones belonging to the Reading Beds were found by Curry (1962). Shallow borehole 75/27 retrieved brown, fine-grained sands, brown clay with sandy laminae and a grey-green mudstone. A basal pebble layer followed by sand and mudstone (all belonging to the London Clay Formation) overlies these sediments (Dingwall and Lott, 1979). The youngest rocks in the Wight site are grey to grey-brown silty clays, which belong to the Wittering Formation (Curry, 1962; Hamblin *et al*, 1992).

Seabed sediments

The Wight site is a tide-swept, low-depositional environment (see section 3.3); therefore it exhibits a discontinuous cover of coarse-grained lag deposits generally less than 0.5 m thick. This lag deposit was formed by the winnowing away of fine-grained material. Lag deposits are predominantly gravels and sandy gravels. Flint and chert are dominant among the lithic pebbles. Besides this, chalk pebbles (restricted to the Chalk outcrop, Figure 3), glauconitic sandy limestones (Lower Chalk), Jurassic limestones, sandstones and ironstones and some fine-grained pebbles derived from outside the area can be found. Lag deposits rest either upon solid strata or on older palaeovalley infill sediments. Significant areas of sediment-free rock occur coincident with outcrops of hard strata within the Jurassic and Lower Cretaceous. The gravel lag is often encrusted with serpulids, bryozoans and barnacles; hence it is immobile under the current hydrodynamic regime. Lag deposits are locally overlain by mobile patches of sand in the form of ribbons, subaqueous dunes and sand patches (BGS, 1989).

3.2.2 Portland

Bedrock

Bedrock in the Portland site covers an age range from the Upper Triassic (228 – 200 Ma) to the Upper Cretaceous (100 – 65 Ma). The oldest rocks belong to the Mercia Mudstone Group, which is dominated by red mudstones and evaporates. These are followed by Lower Jurassic (Lias) mudstones and shales, which are rhythmically interbedded with limestones. Middle Jurassic rocks predominantly comprise yellow limestones and mudstones. The Upper Jurassic displays the widest range in lithology of all Jurassic Series, including mudstones, sandstones, limestones and evaporites. Cretaceous bedrock comprises sandstones, siltstones and mudstones of the Wealden Group, sandstones and mudstones of the Lower and Upper Greensand and Upper Cretaceous chalk. More details are given in the previous section.

Seabed sediments

The thickness of surficial sediments over most of the site is less than 1 m, except in the west where subaqueous dunes are present. Coarse-grained lag deposits are widespread and mainly consist of flint with some sandstone, limestone and igneous and metamorphic rocks. These lag deposits rest on the rock surface and can be muddy where mud from the subsurface is incorporated. In some places the lag deposits are overlain by sand, where it has accumulated to a significant thickness.

3.3 Hydrodynamics

The English Channel is a tide-dominated environment, although the influence of long swell waves approaching from the open Atlantic Ocean cannot be neglected. Spring tide peak current speeds at the surface are highest south of the Isle of Wight, reaching values of 2.5 m/s. Current speeds decrease in both east and west direction, with lowest values of 0.9 m/s at the western edge of the research site and 1.3 m/s at the eastern boundary (Department of Trade and Industry, 2004). Current speeds at the seabed in excess of 1 m/s have been measured along a transect between the Isle of Wight and Cotentin peninsula, France (Velegrakis *et al*, 1997). Under such conditions, grains up to pebble size are mobile.

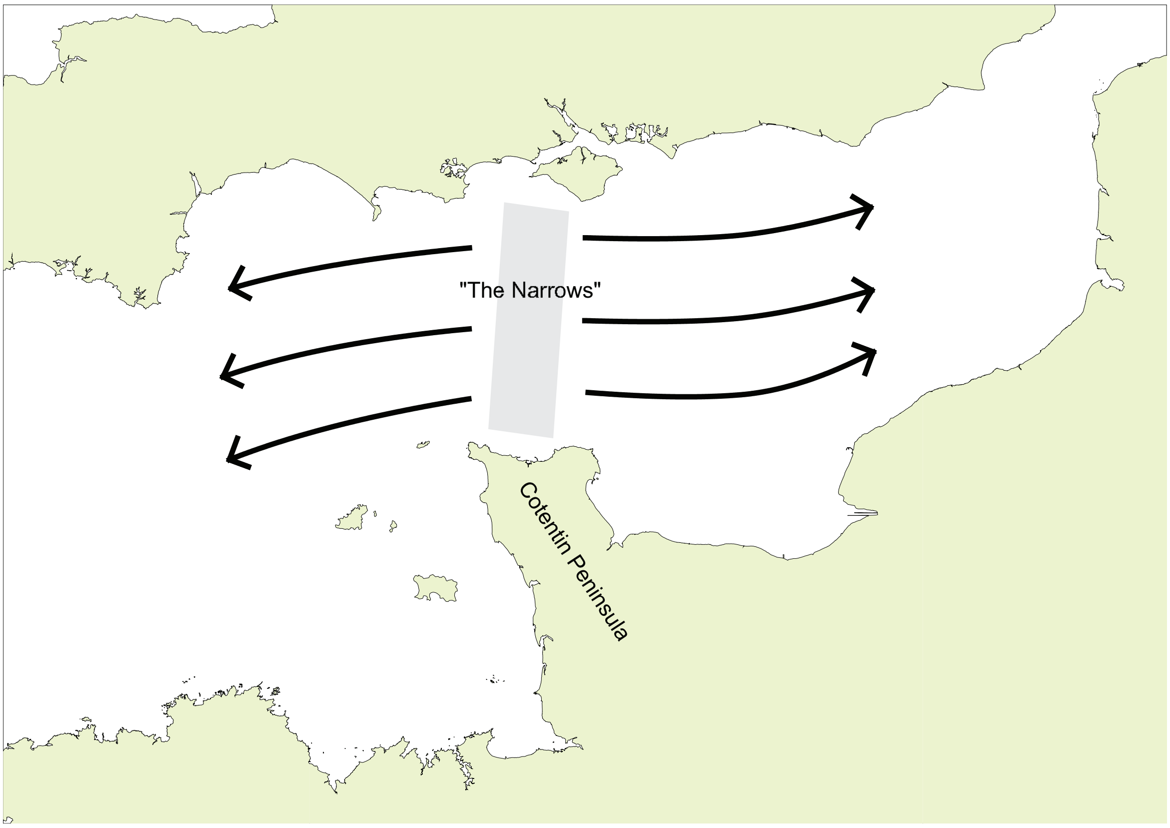
The study areas is a bedload parting zone (Graham *et al*, 2001, Hamblin *et al*, 1992) with fairly strong currents, resulting in a net transport away from the area (to both east and west) of particulate matter such as mobile sands and suspended organic material (Figure 4). There is therefore little supply of sediment or plankton to the seabed, and any that does arrive there may be rapidly winnowed away.

Annual mean significant wave heights range between 1.5 and 2.2 m in the offshore areas of the Central English Channel (Department of Trade and Industry, 2004). Significant disturbance of the seabed (i.e. more than 5% of the time during a year) is largely limited to the coastal zone in waters less than 30 m (Grochowski and Collins, 1994). However, annual maximum significant wave heights can be much higher. Under such conditions, waves are able to disturb the seabed in all but the deepest parts of the research site (Connor *et al*, 2006).

3.4 Benthic biology

A number of oceanographic and biological studies undertaken in the 20th century provide the foundation of our

Figure 4: Schematic representation of the bedload parting zone and net transport directions in the central English Channel. (after Hamblin *et al*, 1992)



current understanding of the ecology of the English Channel. The key message relevant to this study is that, in modern times, the western and eastern Channel have markedly different hydrodynamic and physical characteristics and can be regarded as different ecosystems. This is not to say that they are discrete and never intermix. Rather, there is a strong west to east gradient of change which appears to reach a tipping point at the bedload parting zone in the 'The Narrows' between the Isle of Wight and the Cotentin Peninsula (Figure 4). To the west lie deeper waters (> 100m) that stratify in summer (Stanford & Pitcher, 2004), promoting primary production in the form of algal blooms. When the thermocline breaks down in autumn there is a pulsed input of carbon and nutrients to the benthos. To the east, the water is shallower (< 40 m), remains well mixed all year, and appears less productive. The stratification and mixing confer different temperature regimes. The western Channel is usually warmer during the winter (lowest monthly mean at Newlyn = 8.9°C compared to 5.9°C at Dover) while the mixed waters in eastern Channel tend to have a greater temperature range, becoming warmer in the summer (16.7°C at Dover compared to 15.8°C at Newlyn; Stanford & Pitcher, 2004).

The southwest channel appears close to a latitudinal boundary that separates cold water species in the north from warmer water species in the south. As this boundary drifts north or south past the Western Approaches, so the western channel changes from one system to the other. These changes have had recorded effects on the plankton, pelagic fish and littoral benthic communities, remaining in a warm phase from the 1930's to the 1960's when the cooler phase returned (Stanford & Pitcher, 2004). Such changes will undoubtedly affect the longitudinal (east-west) distribution of temperature sensitive species in the channel, as warmer (or cooler) water penetrates deeper eastwards up the Channel.

This influence of temperature (climate) was recognised by both Norman Holme and Louis Cabioch who studied the composition of benthic communities and distribution of indicator species in the Channel in the mid 20th Century. Both recognised a strong longitudinal cline and some latitudinal variations between the northern coast of France and the south coast of England. (Holme, 1961, 1966; Cabioch 1968; Cabioch *et al*, 1977). Both pieces of work recognised that there was also a depth effect, with western species penetrating farther up the channel in deeper mid-channel waters than along the shallower coastal waters. However, substrate type remained the principal determinand of the type of community that could establish at any given point, and it is the distribution of those substrates within the channel that is the principal determinand of the distribution of those community types, irrespective of changes in environmental conditions. Gravel communities in the west will comprise a similar range of organism as those in the east, but there will be certain species substitutions depending on the particular environmental tolerances of each component species.

Hiscock (1998) provides a concise summary of these two seminal bodies of work (see section 6.3 "The English Channel"), but in the context of the objectives of the present study, that of locating and characterising rocky reef habitats, their work is of limited relevance on account of the sampling equipment and facilities available to them. Holme used an anchor dredge, best suited to coarse substrates, while Cabioch used and Rallier du Batty dredge, more suited to softer substrates. Neither gear was adequate for sampling hard or rock substrates. Furthermore, both studies understandably focused on nearshore waters and undertook only limited sampling in the deeper or mid-channel.

Ellis (2001) reported on a programme of 4-metre beam trawl sampling of epifauna that included sites in the southern North Sea and eastern (but not western) English Channel. He described five broad categories of assemblage in this sector, two of which were near the current Areas of Search. A '*Flustra foliacea* – *Henricia oculata*' assemblage occurred at four stations south of the Isle of Wight and only one other station, in the Dover Strait. Those by the Isle of Wight were somewhat to the north of the current Areas of Search in water around 40 m deep, with three of the stations being inside the 12 nmi limit (Figure 5). Sponges, *Flustra*, Ascidians and Ophiuroids were characteristic and the area was noted to have a relatively low diversity of invertebrates and fish.

A second assemblage called '*Psammechinus miliaris* – *Asterias rubens*' was represented at 18 stations in all, three of these occurring in or near the Area of Search south of the Isle of Wight. It occurred in deeper waters of the central English Channel and along the French Coast from Cap d'Antifer to Dieppe. The sites shown in Figure 5 have depths of 44, 55 and 72 metres. *Ophiothrix fragilis, Crossaster papposus, Psammechinus miliaris* and *Spatangus purpureus* characterised the assemblage but some differences in species composition were noted between NW and SE (i.e. coastal) stations.

Ellis also presented plots of beam trawl fishing activity for 1998 and 1999 which show zero activity in the AoS south of the Isle of Wight, and only small amounts in the AoS south of Portland.

The only prior study known from this region that used equipment capable of sampling communities on rock substrate are the underwater video studies reported by Holme & Wilson (1985). These targeted coarse rather than hard substrates, although the latter were clearly visible on the early sidescan images they presented. The main study area was 37 km due south of Durlston Head[= Anvil Point], in about 50 m of water, just outside the NW edge of the current Area of Search south of the Isle of Wight. They also mentioned a single point south of Portland Bill, inside one of the current Areas of Search (Figure 6).

During their video deployments they did encounter some outcropping rock and describe three faunal communities associated with different degrees of substrate stability.

> "Type A. Stable faunal assemblage with diverse sponge cover. This occurs on the surface of non-mobile hard floors such as pebbles, cobbles, boulders and rock outcrops which are not subject to scour by sand or gravel in transit nor periodic cover by sand and gravel" They noted "brightly coloured sponges stand out clearly" and "the bryozoan *Pentapora foliacea* is also characteristic"
>
> "Type B Assemblages….. present on hard surfaces of rock, cobbles or pebbles, that are more of less subject to sand scour and/or periodic submergence by sand". Three sub-types were described related to varying degrees of scour
>
> > "B1 – Well developed faunal assemblage with *Polycarpa violacea* [Ascidian; = *P. fibrosa*]. …a relatively stable fauna associated with pebbles, cobbles, rock outcrop and the lower parts of large boulders …. Overlaps with type A but sponges are much less frequent"
> >
> > "B2 – Impoverished *Polycarpa violacea* – *Flustra foliacea* assemblages….. on pebbles cobbles and rock surfaces evidently subject to considerable sand scour and/or periodic submergence by thin layers of sand……sponges are absent …. *Urticina felina* seems adapted to survive under such conditions…. *Flustra foliacea* is characteristic… *Pentapora foliacea* is never present".
> >
> > "B3 – Impoverished *Balanus* – *Pomatoceros* assemblage. On hard surfaces which are at times subject to severe scour or deep submergence by sand or gravel the fauna is restricted to fast-growing colonisers which can rapidly settle and establish themselves during the summer months.
>
> "Type C. Cobble floor covered by sand. …..typically derived from B2 or B3 …certain members of the B2 assemblage appear to survive under a temporary cover of sand, notably *Urticina felina*… *Flustra foliacea* and…*Sabellaria spinulosa*.

Figure 5: Sites near the Areas of Search sampled by Ellis (2001) using a 4-metre beam trawl. These were associated with two faunal assemblages, F/H = *Flustra-Henricia*, P/A – *Psammechinus-Asterias*.

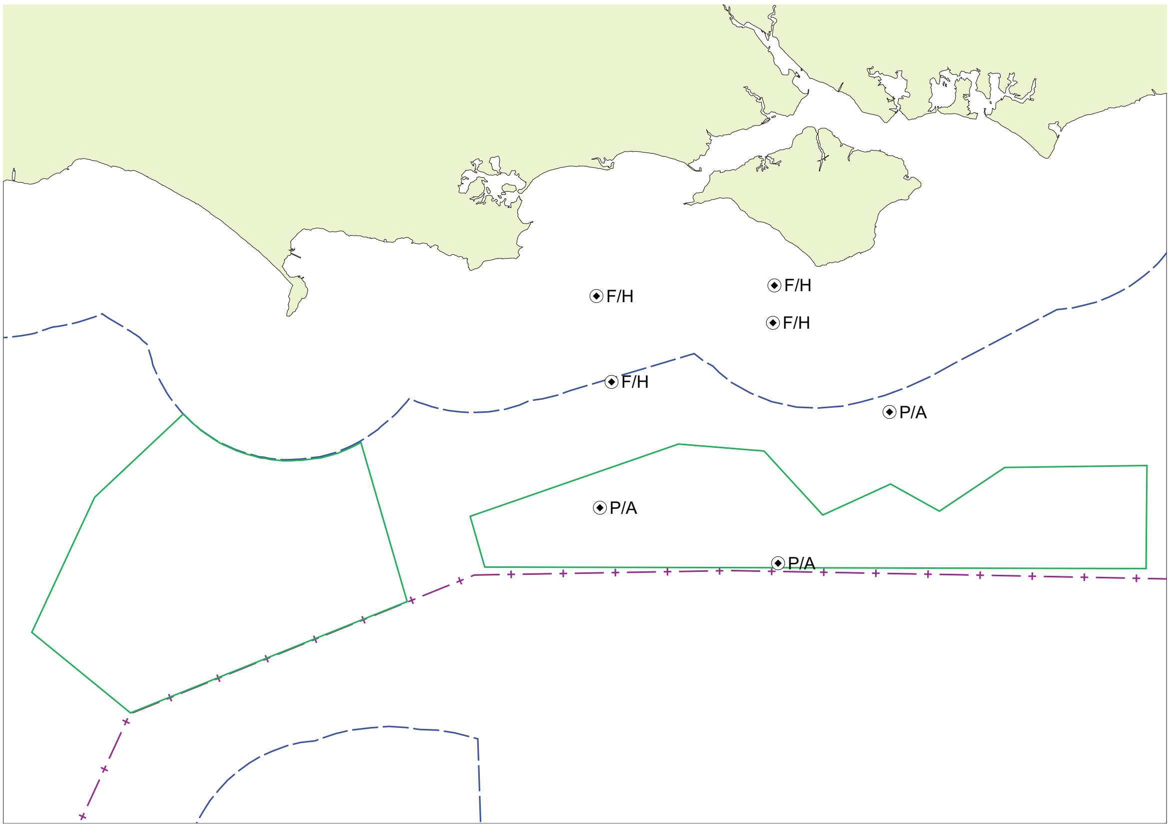
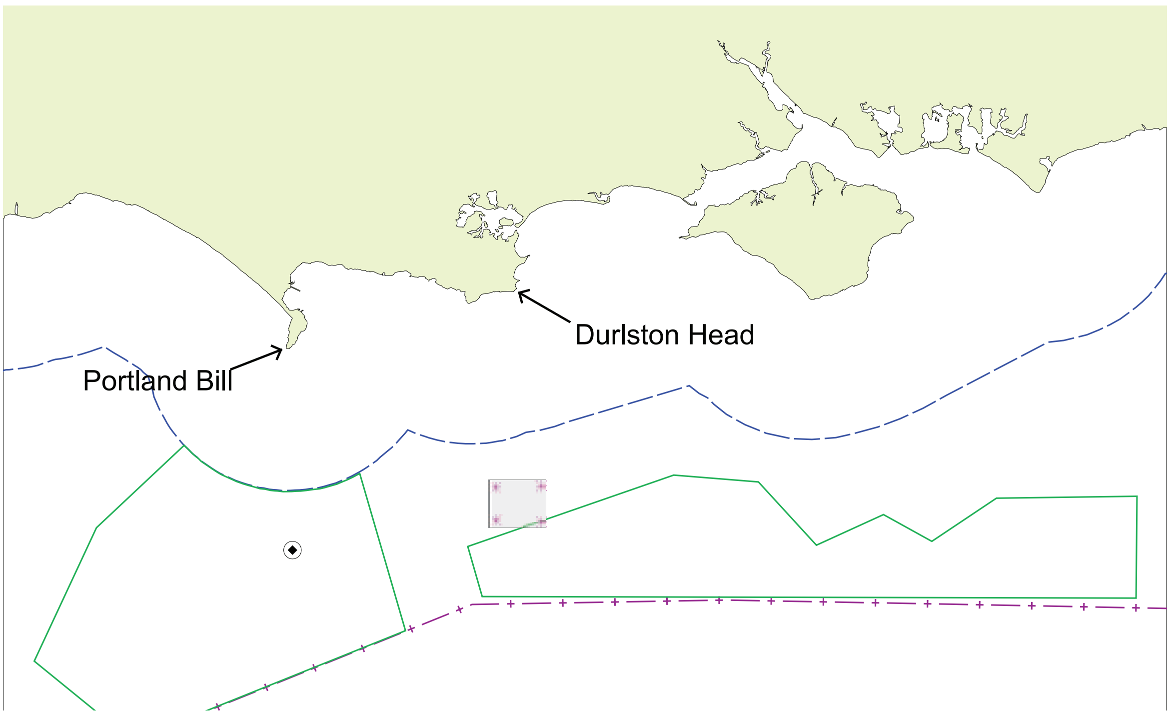


Figure 6: Approximate location of TV sampling reported by Holme & Wilson (1985). Shaded box shows main study area; point shows another site mentioned in the text. Green polygons = Areas of search for the current project; blue line = 12 nmi limit, purple line = UK/France medina line.



Holme & Wilson viewed these assemblages as a stage in continuum moving towards a 'climax' or persistent community on cobble or rock cover, as opposed to distinct communities in their own right, and that the community present at a particular location would vary according to the frequency or magnitude of recent scour or smothering events. They also drew parallels between these assemblages and those described by Cabioch (1968), but noted "Sabellaria is very much less common than in the western Channel and cannot here be considered a characteristic species".

Finally they noted a far more restricted list of species at this site just 37 km to the west, lying due south of Portland Bill (Figure 6). "In particular, the echinoderms *Asterias rubens*, *Echinus esculentus*, *Ophiothrix fragilis* and *Ophiocomina nigra* were not recorded, and while *Asterias* and *Ophiothrix* are otherwise widely distributed in the channel, it is likely that the *Echinus* and *Ophiocomina* were here beyond their limits of up-Channel penetration".

During a recent broadscale mapping study of the eastern English Channel, James *et al* (2007) conducted widespread acoustic and ground-truth sampling surveys, including the use of underwater video cameras. These did not reveal any significant expanses of rock exposed at the seabed surface. Areas of consolidated cobble substrate, accreted by encrusting communities featuring sponge, bryozoa and hydroids were recorded at several locations in the in south west of their study area, and there were some notable associations between some of the biotope complexes they identified and the distribution of major substrate types. In the southwest, where substrates thinly overlaid bedrock on the so-called 'Western Axial Platform' there was some correspondence between the distribution of different epifaunal biotopes and different rock types, suggesting the physical nature of the rock may have some influence on the properties of the habitat that determine its suitability for supporting certain communities.

4 Methodology

4.1 Acoustic data acquisition and processing

Acoustic surveys are a way of remotely sensing the seabed, enabling the production of acoustic images showing seabed morphology and texture that can be used to interpret the nature of the seabed surface. To facilitate the identification and *in-situ* characterisation of potential Annex I Habitats in the central English Channel, simultaneous sidescan sonar and multibeam echo sounder surveys were conducted prior to ground-truth surveys. The fieldwork was split between two research cruises onboard RV *Cefas Endeavour*. A first survey was conducted between 4th and 6th June 2006 and will be referred to as CEND12/06 hereafter. The second survey started on 26th July and finished on 8th August 2006 and will be referred to as CEND14/06 hereafter.

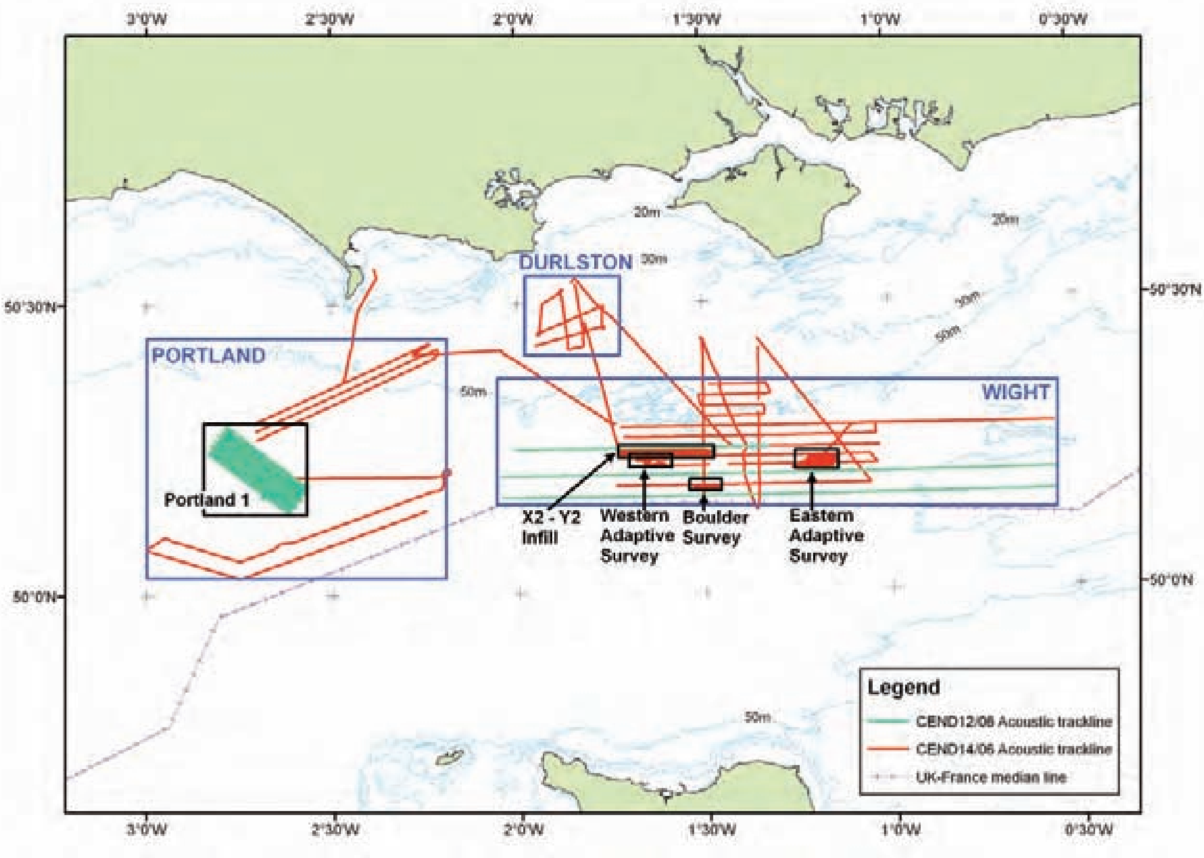
The survey was split into two main study areas: the "Wight" area south of the Isle of Wight and the "Portland" area south of Portland Bill and (Figure 7). A third area known as "Durlston" (southeast of Durlston Head) was surveyed opportunistically on CEND14/06 (as explained in Section 4.1.2). During the two surveys, over 1,900 line kilometres of sidescan and multibeam data were collected.

4.1.1 Tools

Sidescan sonar

Sidescan sonar was used in this project for its ability to gather information on the nature of the seabed, and especially identifying boulder reefs and bedrock outcrops. During survey CEND12/06 a Benthos SIS-1500 sidescan sonar system was used. This system operates at a frequency of 200 kHz and collected data within a range of 200 m from nadir. The data was acquired using the Triton Imaging ISIS v6.7 software.

Figure 7: Overview of the survey area and the trackline for both research cruises.



A dual-frequency Benthos SIS-1624 was used during survey CEND14/06. This sidescan sonar can operate simultaneously at frequencies of 100 kHz and 400 kHz. Generally, the system was optimised for collecting data at the 100 kHz frequency with a range of 200 m from nadir. Where high-resolution data was required, the system was optimised for collecting data at 400 kHz with a range of 75 m. Triton Imaging ISIS v7.0 software was used during this survey to acquire all sidescan sonar data.

Multibeam echosounder

Multibeam echosounders were used in this project for their ability to provide detailed morphological information from the seabed surface. Multibeam data was collected using the Kongsberg EM3000D echosounder on the drop keel of the RV *Cefas Endeavour*. The system operates at a frequency of 300 kHz, ideally suited to the water depth encountered in the survey area. The data was acquired using Kongsberg SIS software and data recorded in the Kongsberg proprietary "ALL" file format.

4.1.2 Survey strategy

Survey approach

Due to the large extent of the area of interest and the limited resource available to undertake the survey, it was not possible to produce acoustic maps of the entire area of interest. Therefore, the survey was optimised to deal with the resource limitations and the survey requirements. During survey CEND12/06 a broadscale survey was carried out in the Wight area. Sidescan sonar and multibeam bathymetry was collected along three survey lines, spaced at a distance of 4-5 kilometres (Figure 7). This approach allowed examination of the data prior to the next survey to identify areas of interest and focus further survey effort. In the Portland area, a more intensive survey was carried out over in an area of approximately 33 sq km shown on the BGS seabed sediment map as "undifferentiated bedrock lithology". A 100% sidescan sonar coverage survey was carried out in this area, with multibeam data being collected simultaneously, approximately achieving 50% coverage.

Following the assessment of the data collected during survey CEND12/06, survey CEND14/06 was designed around the identified areas of interest. In the Wight area, five additional sidescan sonar and multibeam lines were collected. Three of these were in between the existing lines collected during CEND12/06, whereas a further two were collected to the north of the existing lines, aimed at identifying the northern extent of the area of interest. A number of north-south orientated lines were surveyed to facilitate identifying the northern extent of the area of interest. To identify the eastern extent, a number of existing lines were extended.

A review of the data collected in the Portland area highlighted that little or no features of interest were identified in the area shown on the BGS seabed sediment map as "undifferentiated bedrock lithology". The survey showed the area to be gravel and sand substrates rather than the anticipated expanse of outcropping rock. Therefore, a broader scale survey strategy was adopted during CEND14/06 with a view to detecting significant features around which a more detailed survey could be designed. No such features were found beyond the 12 nmi limit, so no further detailed surveys were carried out in this area.

Seabed sediment charts report two distinctly linear areas of "undifferentiated bedrock lithology" in southeast of Durlston Head. Opportunity was taken during survey CEND14/06 to run an open grid pattern of survey lines (Figure 7) over these charted features to try and locate their East-West and North-South extents. It was considered valuable to try to understand why these features appeared so linear on the seabed sediment chart, as this would contribute to understanding the paradoxical results from the pilot acoustic survey where the apparently large rock outcrop in the Portland area was not detected, while the apparently small, localised outcrops in the Wight area turned out to be far more extensive than indicated.

Survey operations

The survey operations varied between surveys CEND12/06 and CEND14/06, as a new sidescan sonar system became available. A Benthos SIS-1500 single-frequency (200 kHz) sidescan sonar was used during survey CEND12/06. This system has been used successfully for many years by Cefas in seabed and habitat mapping studies. This system provided good detail of the seabed and thanks to the Chirp technology achieves good detail at far ranges (up to 200 m).

During survey CEND14/06 the new Benthos SIS-1624 dual-frequency system (100/400 kHz) was employed. This system allows collecting simultaneously data at both frequencies. The majority of the surveys were optimised for best coverage, using the 100 kHz frequency.

Full information on the acoustic surveys detailing quality control, metadata collection and data processing are given in Appendix 1, with a brief layman's summary provided below.

Quality Control

Quality control measures were implemented during the acquisition and processing of acoustic data, including a full calibration of the multibeam system. The acquisition of the acoustic data took many days and covered a large geographic area and so was influence by the cyclical rise and fall of the tides and significant differences across the survey are in the tidal range. Such systematic errors can be removed by applying a 'tidal correction' to the data. In this case, the spatial extent of the survey made it inappropriate to apply a single tidal curve to all the data. Instead, the area was divided into 49 'tidal zones' and a predicted tidal curve calculated for each zone. This provided a fully 'cleansed' and seamless bathymetry data set.

Metadata collection

All survey activities were recorded on Cefas' bespoke metadata database 'DigiLog'. In addition, a copy was kept of the *Cefas Endeavour*'s continuous log, a sophisticated electronic record of all ship-based sensors which provides information on the operational status of the vessel and the local environmental conditions.

4.1.3 Data processing

Sidescan sonar

Processing of sidescan sonar data involves several steps, which are explained fully in Appendix 1. The majority of processing was done on board, immediately after completion of the survey lines, allowing suitable ground-truth sites could be identified and sampled during the same cruise. It took in the region of eight hours to process the data collected during a 24 h continuous survey; the large data files needing to be divided into smaller batches that could be handled by the processing computer.

Multibeam echosounder

Processing of multibeam data is significantly more involved than the processing sidescan sonar data, and is again explained in Appendix 1. Briefly, the raw data contains both systematic and random errors which have to be removed in order to maximise the quality of the final image. Systematic errors include changes in water depth as the ship rides the rise and fall of the tide. Such errors are predictable and can be removed from the raw data by applying a systematic correction (i.e. the 'tidal curves'). Random errors are not predictable and include changes in the ship's attitude (roll, pitch, yaw) as it is buffeted by wind and waves. These errors can be recoded by a 'motion sensing unit' on the ship and so 'subtracted' from the raw data during processing.

During the surveys, time did not allow for the complete cleaning of the multibeam data. Instead a rough cleansing was applied followed by a quick processing to produce coarse resolution images of suitable quality for planning the ground-truth sampling. Full cleansing and thorough processing were completed ashore, after the surveys, to produce top quality high resolution images. This took roughly 36 hours for every 24 hours of continuous multibeam survey.

4.1.4 Data visualisation

All sidescan sonar mosaics and multibeam bathymetry images were exported in georeferenced TIFF format. ESRI ArcGIS 9.1 was used to manage and display all acoustic data, and integrated with all other survey data. Grab positions with analytical results or stills image positions with hyperlinks to the photographs, facilitated the interpretation of the data.

The often long and widely spaced survey lines presented a challenge to display the survey results in paper format. The normal approach to split a large area into survey sheets would have resulted in a very large number of sheets, with often only one corridor being shown. This would have made comparison between survey lines impractical and interpretation difficult (Figure 8).

It was chosen to produce survey sheets that displayed as much information as possible on one sheet and allowed comparison between parallel survey lines. Long survey lines were split into sections, and adjacent or parallel sections are shown one under the other on the survey sheet. This removed the large areas in between parallel survey lines, allowing displaying all parallel survey lines onto one survey sheet (Figure 8).

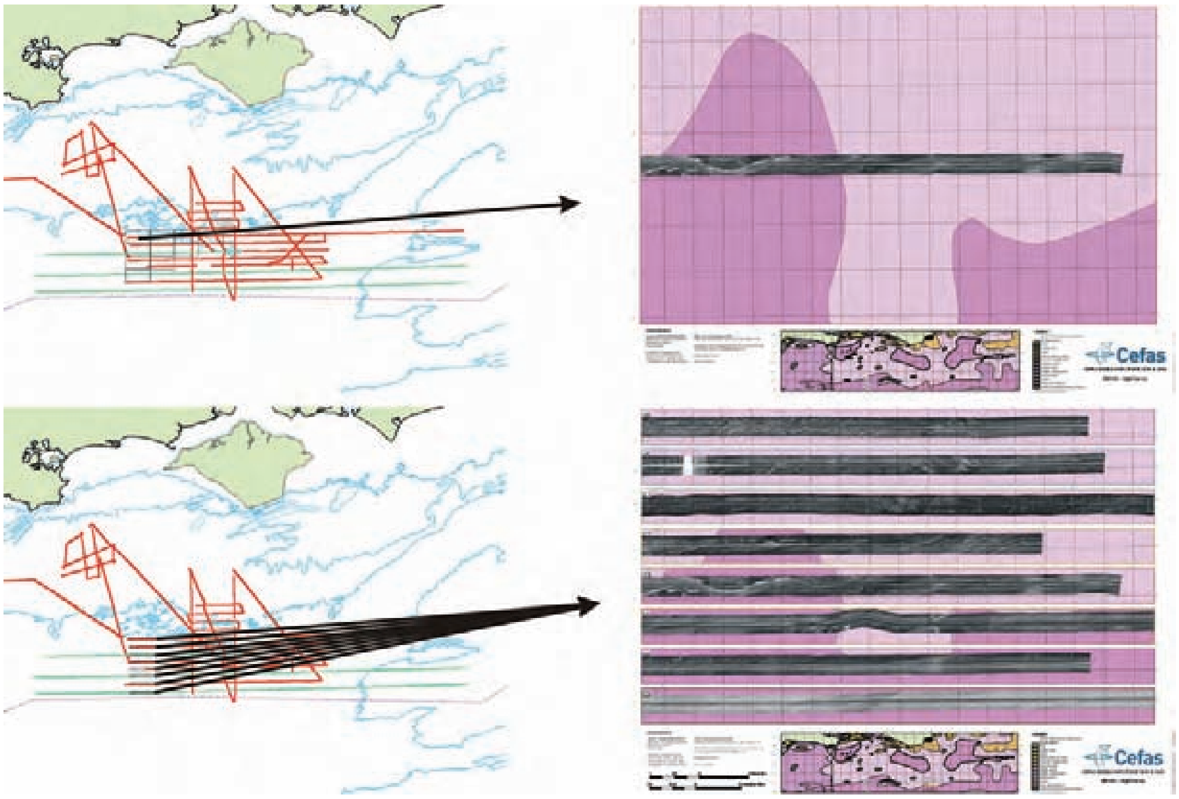
For most surveys, it was possible to display sidescan and multibeam data on the same survey sheets. However, the large number of parallel lines in the Wight area did not allow this, and separate sheets were produced for sidescan sonar and multibeam data. For targeted surveys such as the boulder survey, the full extent of the entire survey is displayed on one survey sheet.

All survey sheets use the British Geological Survey seabed sediment chart as a background layer. This allows the user to have a general idea about the nature of the seabed sediments, but more importantly, allows comparison between the rocky areas specified on the BGS charts and the rocky bedrock features that can be identified from the sidescan sonar and multibeam data.

4.2 QTC Multi View processing

Part of the multibeam data collected in the Wight site was processed using QTC's MultiView software (release 3.00). This applies an automated ('unsupervised') or user-defined

Figure 8: Comparison between traditional (top) and stacked survey sheets (bottom).



('supervised') classification to multibeam backscatter data to produce a classified map of the seabed that reflects the spatial distribution of different substrate types. Again, full details of the procedures followed are given in Appendix 1.

In this instance, we attempted a very simple classification to differentiation 'rock' from 'sediment' with a view to applying this to all the multibeam data collected. For the test data set we found a good correlation between the QTC results and what was expected from expert review of the data. However, the need to further apply the procedure to all the multibeam data was negated by the emergence of a new dataset from SeaZone Solutions Ltd, the commercial arm of the UK Hydrographic Office, as explained below.

4.3 Acquisition of SeaZone Digital Survey Bathymetry data

Digital Survey Bathymetry (DSB) is a relatively new data product from SeaZone Solutions Ltd that provides the bathymetric data used to compile Admiralty charts in a digital format. It draws on legacy and recent survey data to produce a digital bathymetry of the seabed. Where surveys have been undertaken using modern techniques the quality and density of the data is such that it can be used to model the surface of the seabed, rather than merely producing the depth contours that we are familiar with from paper charts.

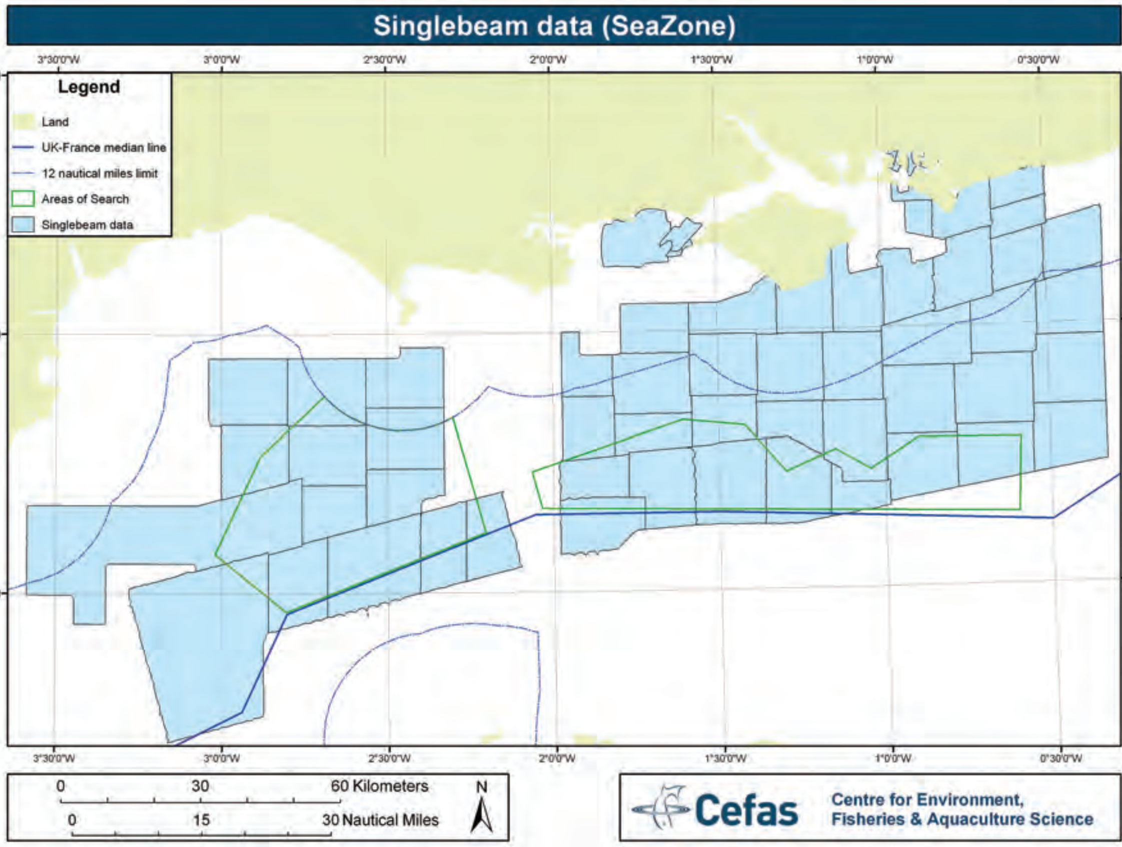
Following our field surveys we became aware of new DSB data sets covering parts of the central English Channel, including the majority of the Wight and Portland Areas of Search (Figure 9). This compiled data from 55 surveys using single-beam echosounders between 1978 and 2003, with the majority of the data being collected since yr 2000. Furthermore, after 1996 all positional data was determined by differential global positioning system (dGPS). This provenance of the data suggested that it was of sufficient accuracy and precision to be of use in meeting the objectives of the current project and the data was licensed from SeaZone in May 2007.

The DSB data was gridded into bins of 75 x 75 metres, meaning a single depth value was given to each 75 m square of seabed. This grid was used to produce a digital image of the seabed in the surveyed areas (Figure 10) that proved to be extremely useful.

4.4 Application of Benthic Terrain Modeler

Benthic Terrain Modeler is an ArcGIS extension that classifies bathymetric data into benthic zones and structures, such as crest, depressions, slopes and flats. This is achieved by calculating a Bathymetric Position Index (BPI) for each data point, showing if it is higher, lower or at the same level as the points that surround it. Details of how this was applied to the DSB data set are given in Appendix 1, but it should be noted here that following trials with different user-based settings we applied a cut off point of a 0.5° incline to differentiate 'slopes' from 'flats'. The default setting of 5° is more appropriate to multibeam data where individual data points may only be a few metres apart, but as

Figure 9: Coverage of SeaZone's Digital Survey Bathymetry (DSB) for the central English Channel in relation to JNCC's 'Areas of Search'.



our gridded DSB data set had one point for every 75 m square of seabed, it was necessary to adjust this 'critical angle' to a value more appropriate to the data being used.

Benthic Terrain Modeler was also applied to classify an area in the Wight site referred to as the 'X2-Y2 Infill' survey (Figure 2), which provided full multibeam coverage between two of the survey lines ('X2' and 'Y2') used in the more open survey design. This 'infill' multibeam data was gridded into 2-metre bins and, again after trials on the data, a critical angle of 5° selected to differentiate slope from flats. Further detail is again provided in Appendix 1, but the lay reader should be aware that the Benthic Terrain Modeller and Bathymetric Position Index also enable the slope and rugosity (roughness) of the seabed to be mapped. The technical reader is directed to Lundblad *et al* (2006) for further details of the applications and procedures.

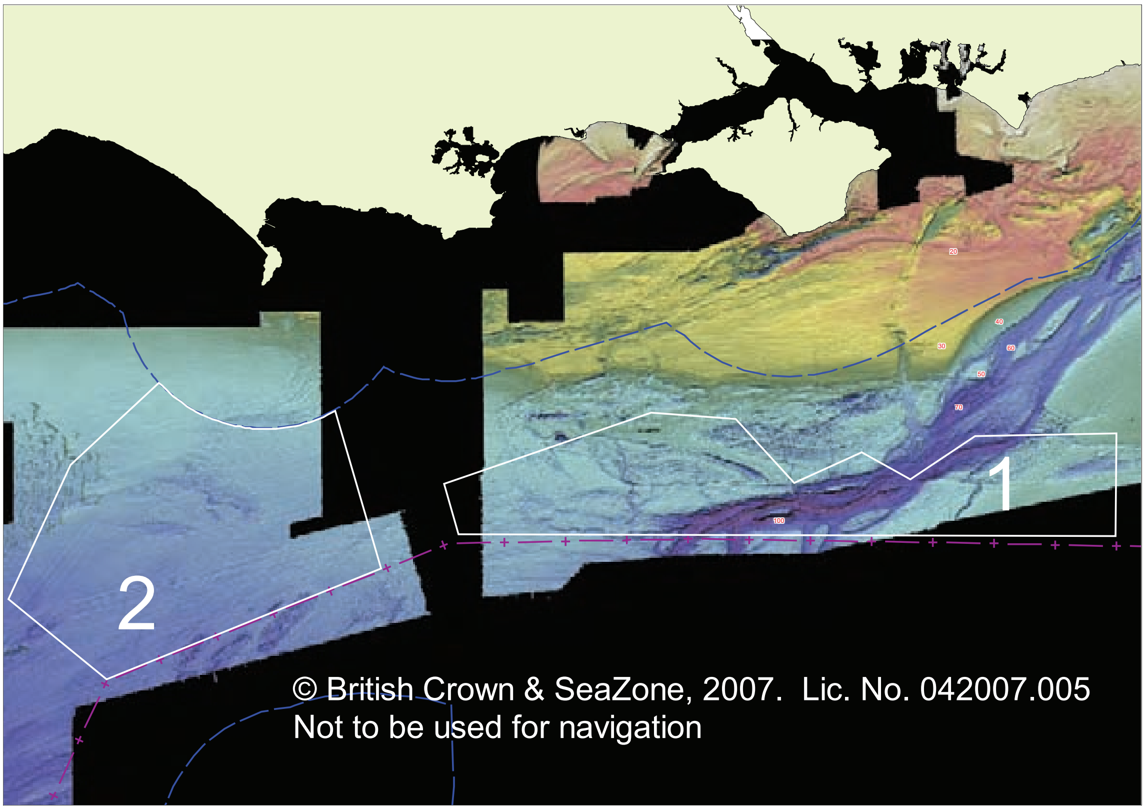
4.5 Biological data acquisition and processing

Video observations were made at ground-truth sampling stations selected to cover a representative range of seabed features and acoustic signatures identified in the acoustic surveys (Figure 11). On flat grounds, the camera was mounted on a sledge and towed along the seabed. On rough grounds, it was mounted in a drop frame and hovered ~1m above the seabed as the vessel moved along a each transect. Deployments were for a nominal time of 20 minutes, at ~0.5-0.75 knots, and covered ~300 metres of ground. Positions were recorded continuously on dGPS and the dynamic positioning capability of the vessel used to steer along pre-determined transects. Video was recorded continuously, with still images taken at 1 minute intervals (or thereabouts). Full details of the system and protocols for Camera Sedge and Drop Camera are given in James *et al* (2007) and form the core of the MESH guidelines on use of this equipment (Coggan *et al*, 2008).

A station coding system was employed to identify the sampling sites. A long east-west transect of 24 stations placed at intervals of 6 minutes of longitude was sampled for a different objective in project ME1102, investigating gravel communities. These stations were denoted by the code 'W' and opportunity was taken to sample *alternate* stations to inform the work on Annex I reefs. Video stations within the Wight AoS were prefixed with 'WV' (Wight Video; WV01 – WV22) to discriminate them from the transect stations. Video stations in, or closely associated with, the Portland AoS were prefixed with 'P' (P01-P12).

Full metadata records were kept in the field, accompanied by notes and sketches of video observations. A more complete analysis of the video was made later. In the laboratory, the video for each station was analysed following a protocol developed over several years of similar work by Cefas and JNCC. This entails dividing the video record up into segments representing different ground types

Figure 10: Cefas visualisation of the SeaZone's Digital Survey Bathymetry (DSB) for the central English Channel in relation to the two 'Areas of Search', the 12 nmi limit (blue dashed line) and the UK/France median line (purple line). A colour ramp has been used to show differences in depth, with white being the shallowest areas, progressing through red, yellow green and blue to the deepest areas (dark blue, ~100m).



encountered along the transect, then making a detailed analysis of each segment, recording the physical characteristics of the substrate and the life forms and/or recognisable taxa observed. The details were recorded on a modified MNCR 'Sublittoral Habitat Recording Form' to assist their incorporation into the JNCC's Marine Recorder database.

For some videos, still images representative of each segment were subject to similar detailed recording, but this is a lengthy process and was not completed for all video stations. Instead, the relevant still images were viewed during the video analysis to help get a greater precision to, or confidence in, taxon identification; for example enabling two morphologically similar taxa to be discriminated. Once the analysis was complete, the observer used expert judgement to assign each segment of the video to one of the classes in "The Marine Habitat Classification for Britain and Ireland" v 04.05 (Connor *et al*, 2005).

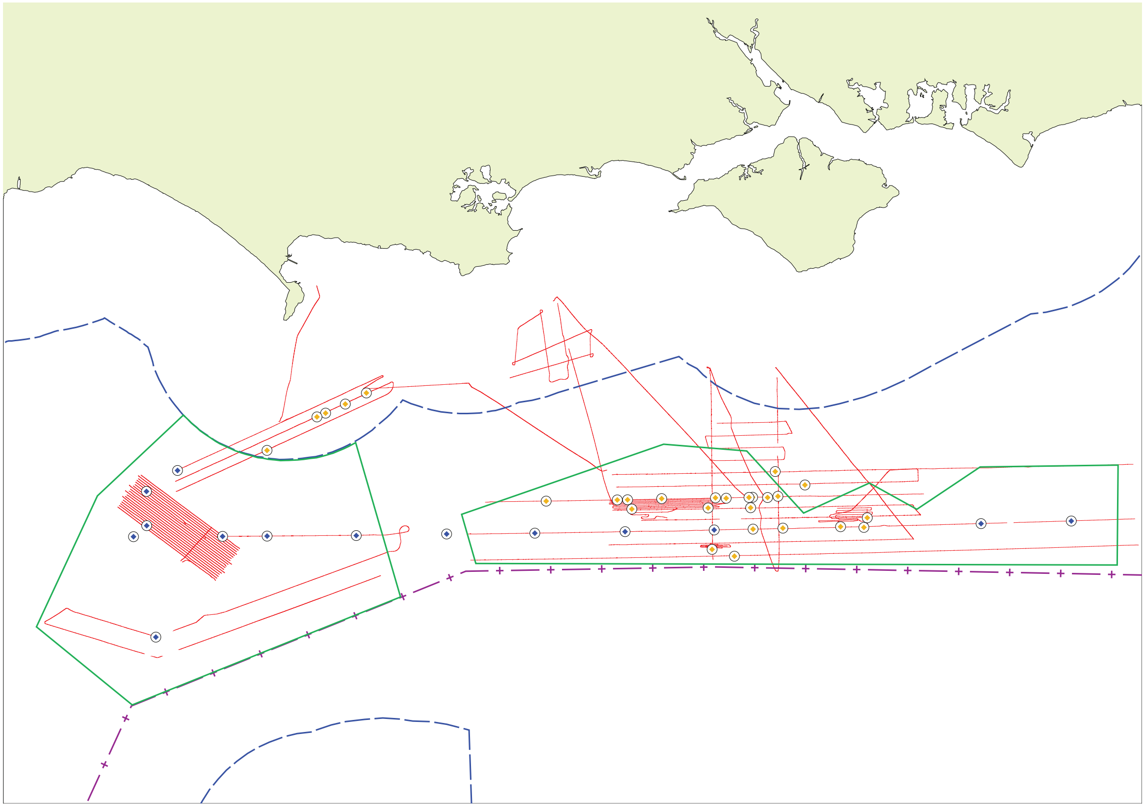
The higher resolution of the stills images can assist species identification, but presents something of a dilemma in that many of the smaller taxa such as gastropods and stone crabs may be resolved on still images *if* the camera is close enough to the seabed at the time the image was shot, but they are almost never resolvable in the moving video image. In our experience, it was the larger, more easily recognisable taxa and physical features that were most important in characterising the habitats and enabling them to be assigned to one of the biotope classes listed in the habitat classification. Viewing the stills images was still an imperative part of the process, especially where small encrusting taxa such as barnacles or *Pomatoceros* were important, but such observations typically helped to drill further down into the hierarchical classification, between levels 4 and 5, rather than discriminate between significantly different habitats between levels 3 and 4.

Quality Control

For taxa that proved difficult to identify from video and /or stills images, we adopted a policy of identifying 'life-forms' to enable analysis to progress equitably between the different observers. For example, some sponges are polymorphic and may require the specimen to be examined under a microscope before they can be identified to species level. They can also be polychromic, so colour was not used as an identifying trait. Instead we adopted a the morphological typology used by Bell & Barnes (2002; Figure 12). Exceptions were made if a sponge species was particularly characteristic, such as *Pachymatisma johnstonia*.

The variable resolution (*sensu stricto*) of video and stills images means that a particular taxon may be identifiable to species level in one image, but only to Genus, Family, Order or Class in others. The JNCC recording scheme encourages identification to species level, but allows some note to be made as to the confidence of identification. This is an

Figure 11: Location of video sampling sites from the Wight and Portland areas taken on the main survey cruise (CEND 1406). Blue dots = Camera Sledge, orange dots = Drop Camera



historical aspect of the recording scheme which was developed for use in surveys using direct (not remote) observation and the observer could usually examine specimens by hand. We considered this facet of the recoding scheme to be inappropriate for remote observations for two reasons; firstly it encourages guessing and secondly, future users of the data are likely to take insufficient notice of such 'confidence' scores. We preferred to adopt a policy of positive identification, and to adjust the hierarchical level at which taxon identity was recorded to one in which we had 'high confidence'. For example we would record *Nemertesia antennina* if we were sure of the species, but only Nemertesia if the resolution of the image made it impossible to discriminate between *N. antennina* and *N. ramosa*. A collection was made of reference images from the video and stills records as a quality assurance measure to help ensure equitable in identification among different observers. A second QA measure provided internal consistency by using just one observer to process all the main block of video taken by drop camera in the Wight area.

Species identification was assisted by reference to a number of on-line catalogues of UK and European marine benthic taxa. For example:

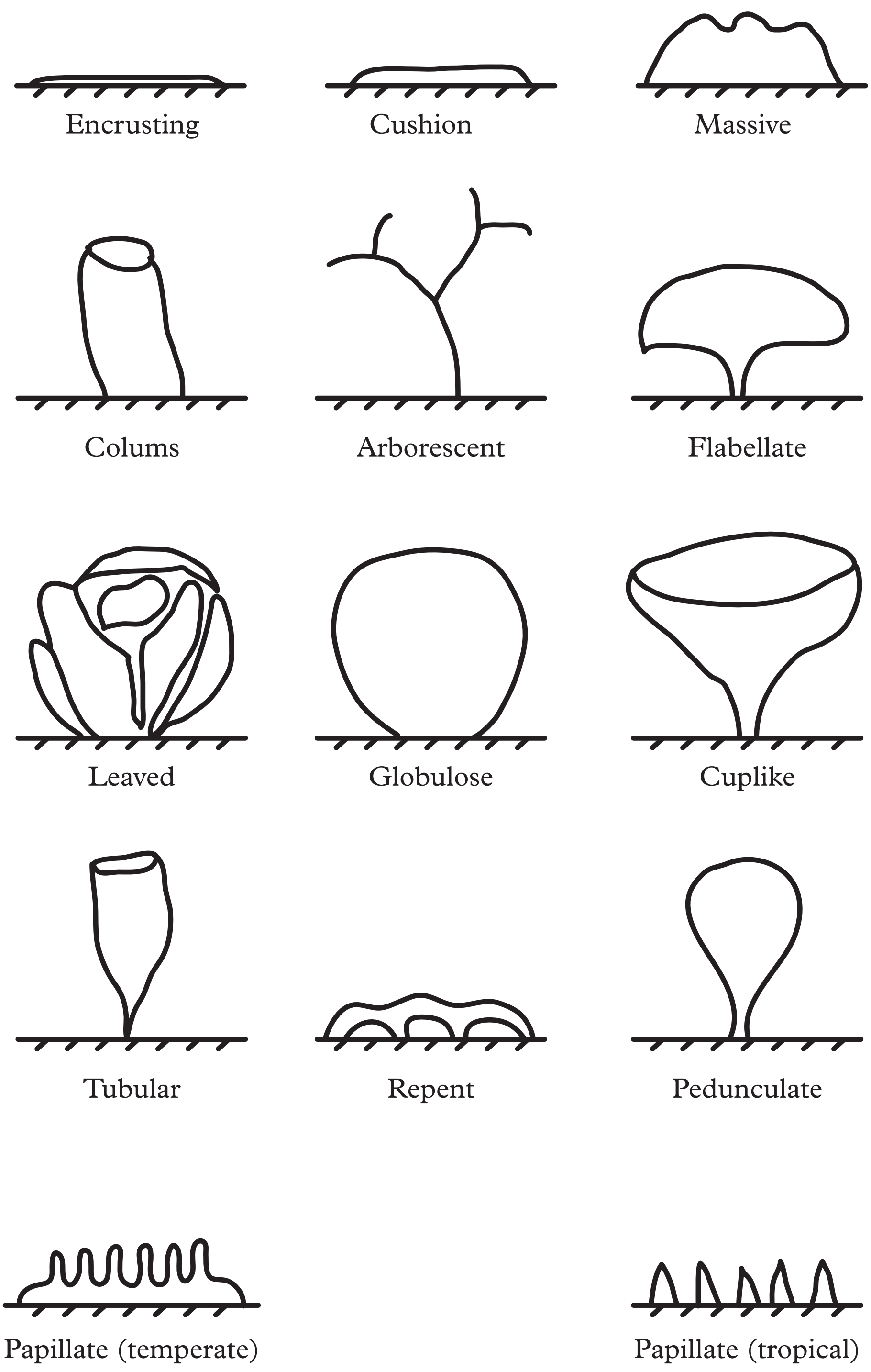
UK: http://www.habitas.org.uk/marinelife/; http://www.marlin.ac.uk/;

France: http://www.corynactis.org/bds/consult_esp/dispatch_consult_esp.php?action=all

Analysis Records

Video analysis was recorded on paper sheets and transferred to Excel spreadsheet following a template devised by Envision Ltd and JNCC. Cefas has added a number of sheets to this template providing summary tables of species and habitats recorded for each video station and video segment. These spreadsheets are supplied (in electronic form only) with this report, one each for the P, W and WV stations.

Figure 12: Sponge morpho-types (Source; Bell & Barnes 2002 © Elsevier)



5 Results and interpretation

Owing to the nature of the available data-sets, i.e. "full-coverage", low-resolution single-beam data, high-resolution multibeam and sidescan sonar data with limited coverage of the research sites and very detailed but localised seabed imagery (videos and still images) and grab samples, we decided to break down the interpretive process into several steps:

1. A broadscale analysis based on the available SeaZone DSB data was initially performed. With the aid of Benthic Terrain Modeler results, areas of different seabed character were identified. The results were then translated into EUNIS habitats (level 3 and 4), thereby incorporating available data on current speed and seabed sediments. Finally, areas that qualify as (rocky) reef habitats according to Annex I of the EU Habitats Directive were delineated.
2. High-resolution multibeam and sidescan sonar data was used to validate the broadscale analysis. Thereby, it was possible to confirm or – if necessary – adapt the placement of boundaries. Also, more detailed seabed signatures of the previously defined areas of seabed character were obtained. A detailed analysis of seabed character and EUNIS habitats was performed in the X2-Y2 Infill area (Figure 2). Also, the occurrence of boulder reefs (Annex I reef habitats) was mapped based on sidescan sonar data.
3. At the finest scale, seabed imagery from ground-truth stations was analysed and expert judgement used to assigned biotope classes according to The Marine Habitat Classification for Britain and Ireland (Connor *et al*, 2004) and its EUNIS equivalent (http://eunis.eea.eu.int/habitats.jsp).
4. Finally, all available information was incorporated into an integrated interpretation of habitats and biotopes present in the Portland and Wight sites.

Interpretations are limited to the Exclusive Economic Zone, i.e. the area between the 12 nautical miles limit and the UK-France median line, being the zone of UK territorial water for which the JNCC currently has responsibilities.

5.1 Broadscale characterisation

5.1.1 Portland

Water depths range from 45 m in the north to 70 m in the south (Figure 13). Large areas of the seafloor are flat (Figure 14) and rugosity is low (Figure 15). Accordingly, Benthic Terrain Modeler classifies these areas as flats (Figure 16). Characteristic patterns of roughly north-south trending bands of high slope and rugosity values are found in the west. In an east-to-west transect, these bands show characteristic successions of flat - slope - crest - slope - depression (not everywhere realised) - flat. Irregular patches of intermediate slope and rugosity are located northeast of the centre and along the UK-France median line. These areas are predominantly classified as slopes with some crests present.

Based on these results, three different areas of seabed character were identified (Figure 17): **Flat, smooth seabed** is found widespread in the Portland site. It roughly coincides with the occurrence of Chalk and/or thicknesses of surficial sediment in excess of 0.5 m. Fields of **subaqueous dunes** (Ashley, 1990) are present in the west. Sediment thickness is significantly increased in these areas (up to 5 m according to Figure 64 in Hamblin *et al* (1992)). According to BGS seabed sediment maps, the dunes are predominantly made up of sandy gravel and gravelly sand. **Bedrock ridges** comprise rocks of Permo-Triassic to lower Jurassic age in the south and lower to middle Jurassic age in the north.

For the translation into EUNIS habitats, additional data was incorporated. Water depths between 45 m and 70 m place the research site into the offshore circalittoral marine biological zone (Connor *et al*, 2004). Tidal current speed (Department of Trade and Industry, 2004) was grouped into classes according to Connor *et al*, (2004). Surface tidal currents range from moderately strong (0.5 – 1.5 m/s) in the western and central parts to strong (1.5 – 3.0 m/s) in the eastern part of the study site (Figure 18). Finally, BGS seabed sediments, consisting of 15 textural classes, were simplified into the four classes coarse sediment, mixed sediment, sand and mud (Figure 19). This was done similar to Long (2006), however the differentiation between sands and muds was placed where the sand-to-mud ration is 1:9, consistent with the original boundary between sand and muddy sand. Within the study site, coarse sediments are predominant, but mixed sediments in the east and sands in the west are present.

We assumed that the distribution of bedrock based on the interpretation of single-beam echosounder data is much more accurate than from grab sampling (as in the case of the BGS seabed sediment maps). Therefore, while data on bedrock occurrence from BGS seabed sediment maps were omitted, areas classified as bedrock ridges were translated into EUNIS level 2 "A4 circalittoral rock and other hard substrata". These were further subdivided into "A4.1 Atlantic and Mediterranean high-energy circalittoral rock", where current speeds are strong and "A4.2 Atlantic and

Figure 13: Bathymetry in the Portland site.

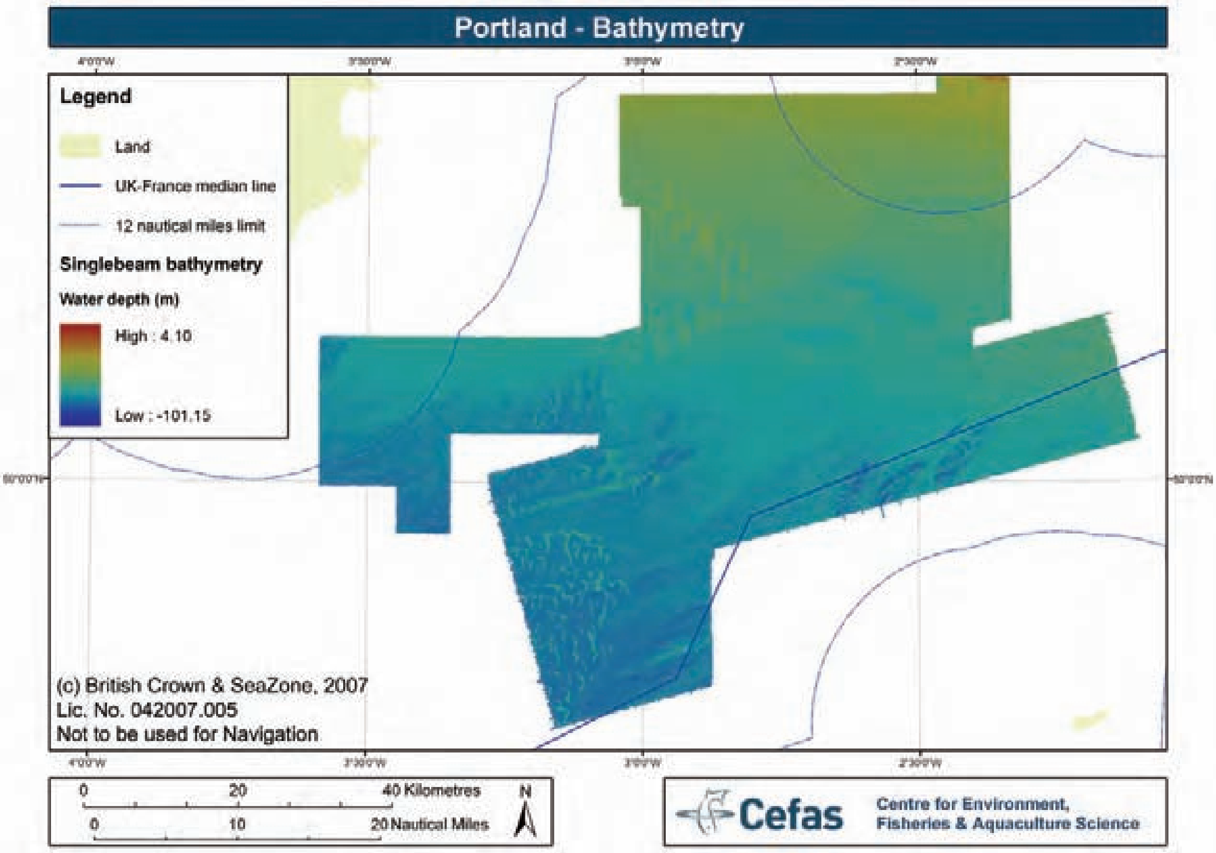
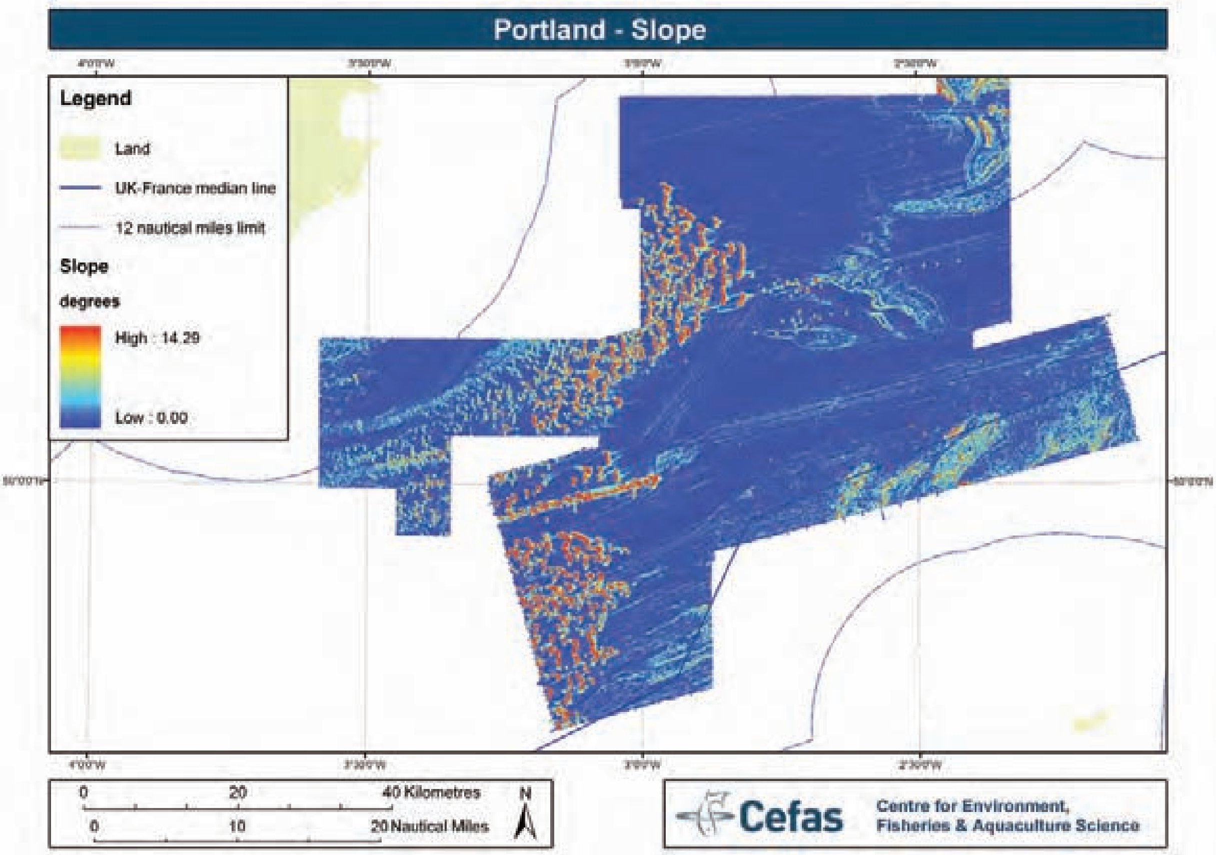


Figure 14: Slope in the Portland site.



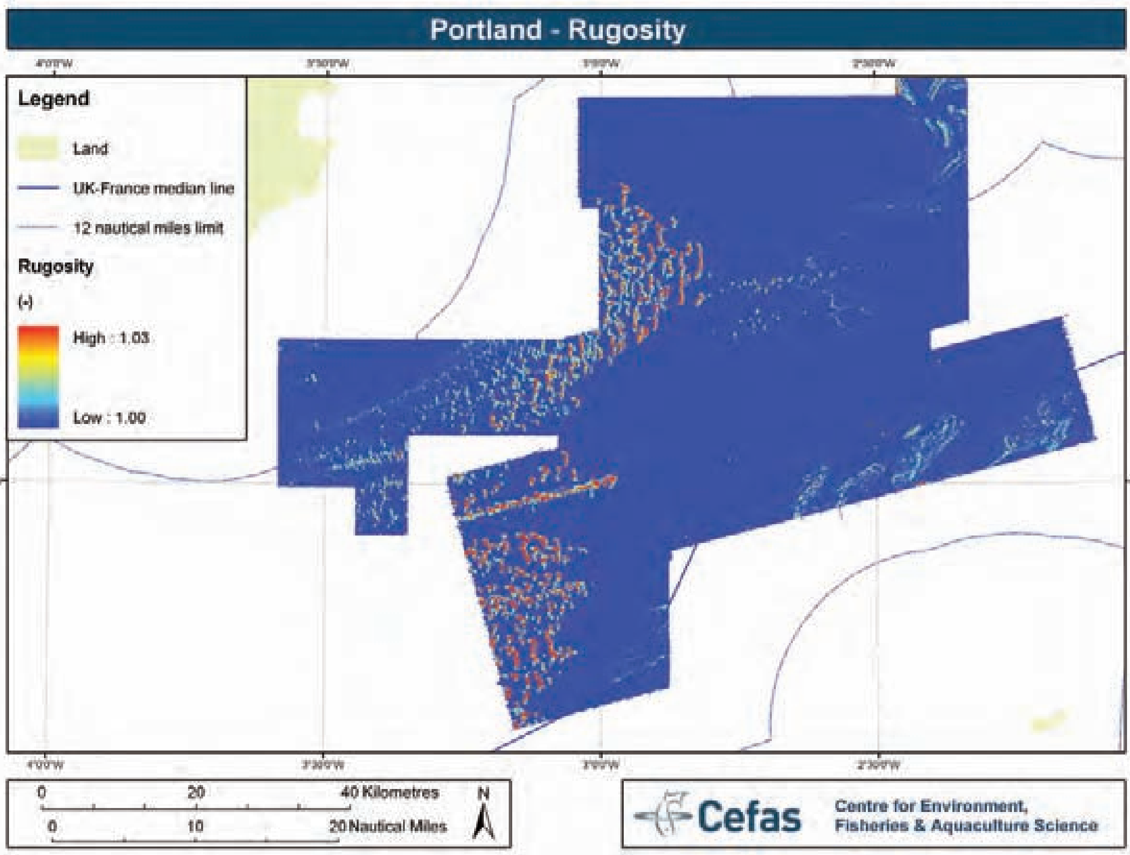


Figure 15: Rugosity in the Portland site.

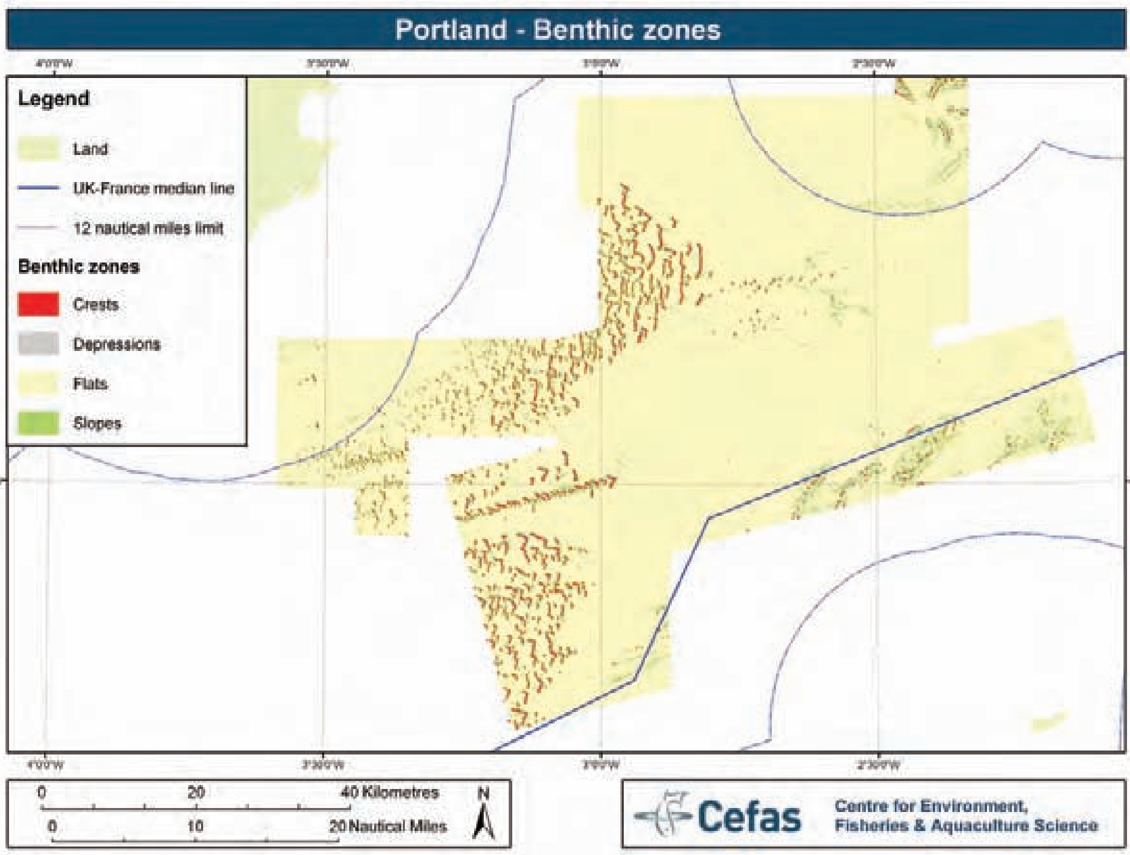


Figure 16: Benthic zones in the Portland site.

Figure 17: Distribution of different classes of seabed character in the Portland site.

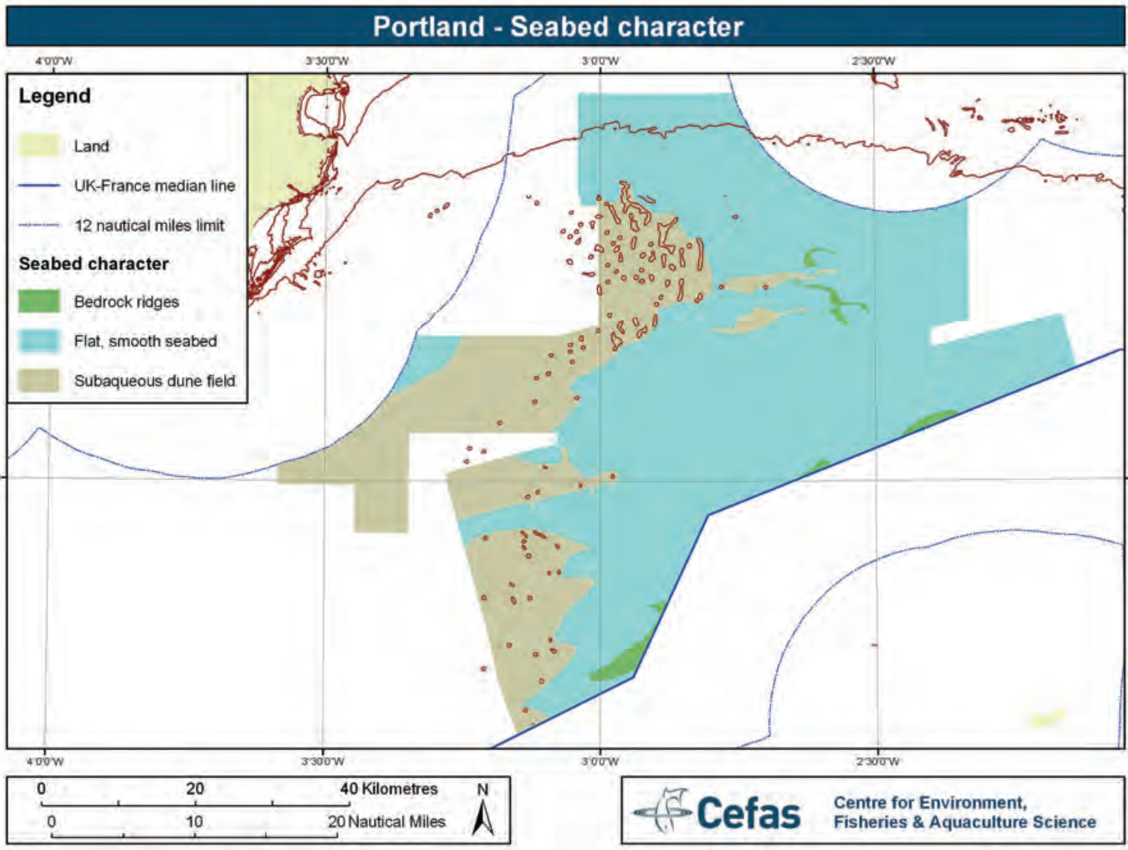


Figure 18: Modelled spring tide peak current speeds at the surface in the Portland site (Data source: Department of Trade and Industry, 2004).

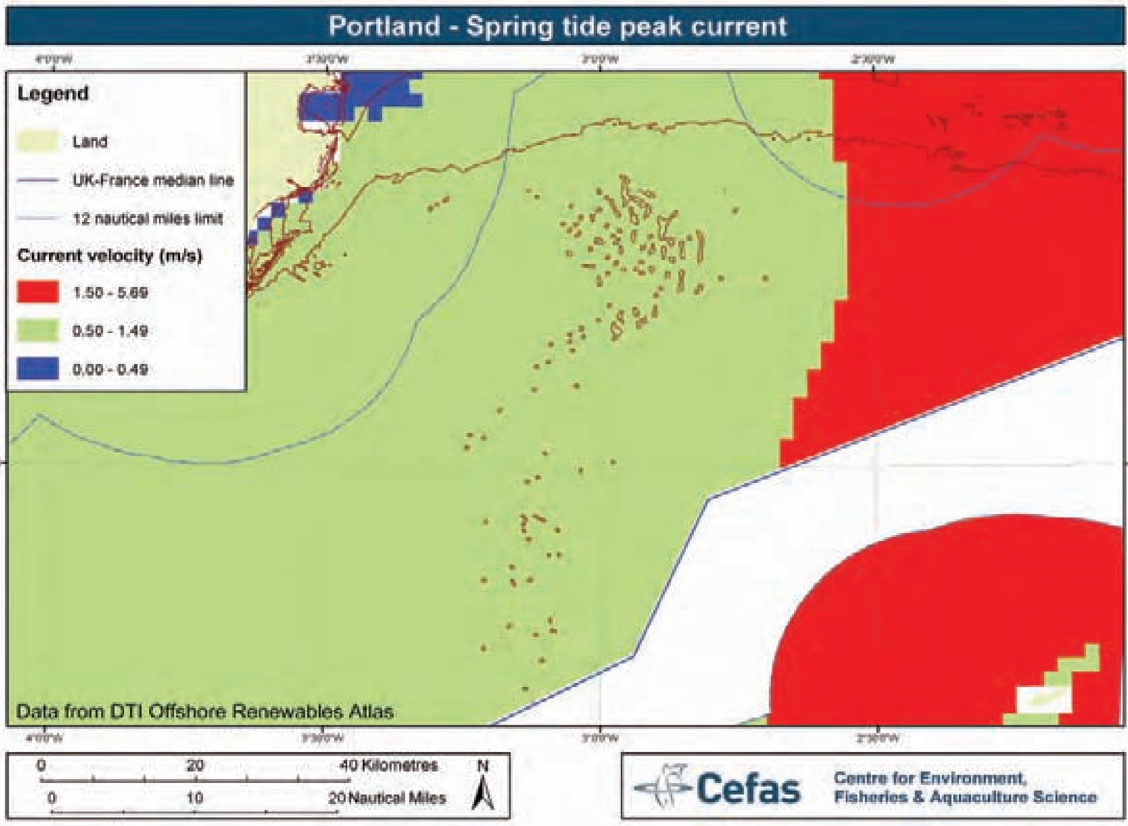


Figure 19: Distribution of four broad classes of seabed sediments (plus rock) in the Portland site (derived from BGS seabed sediments data).

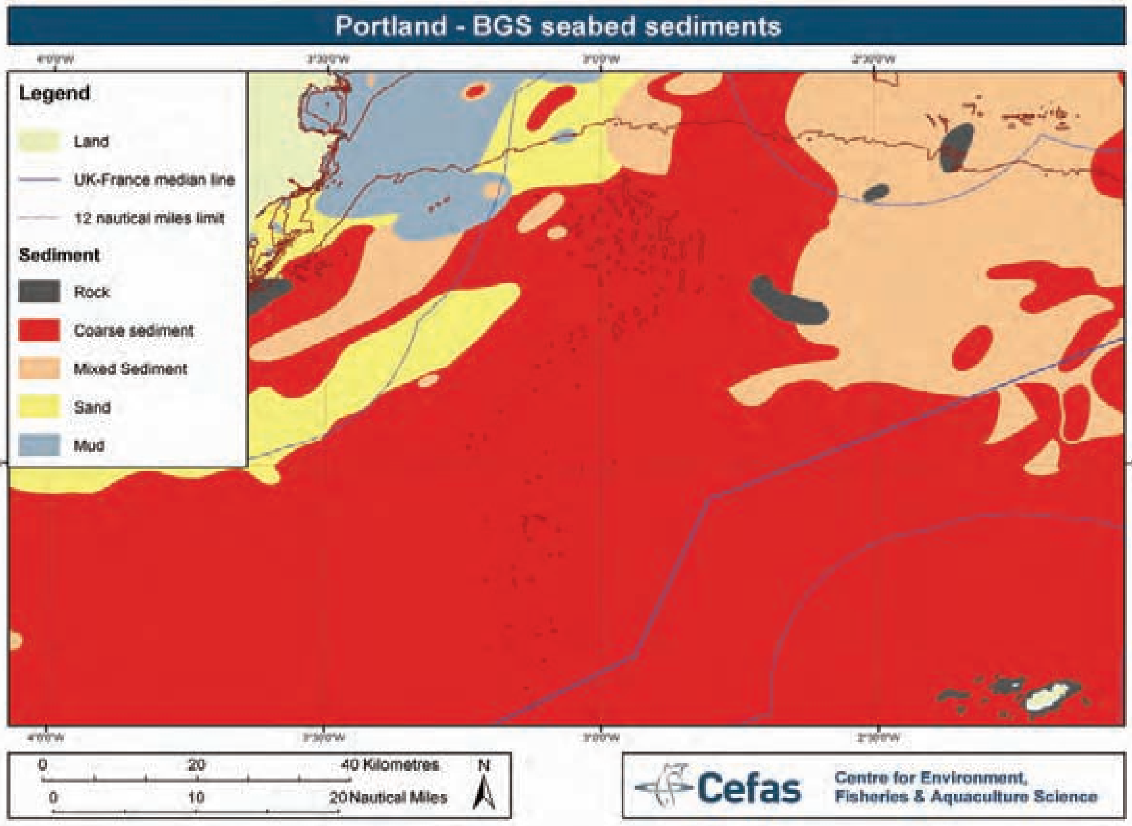
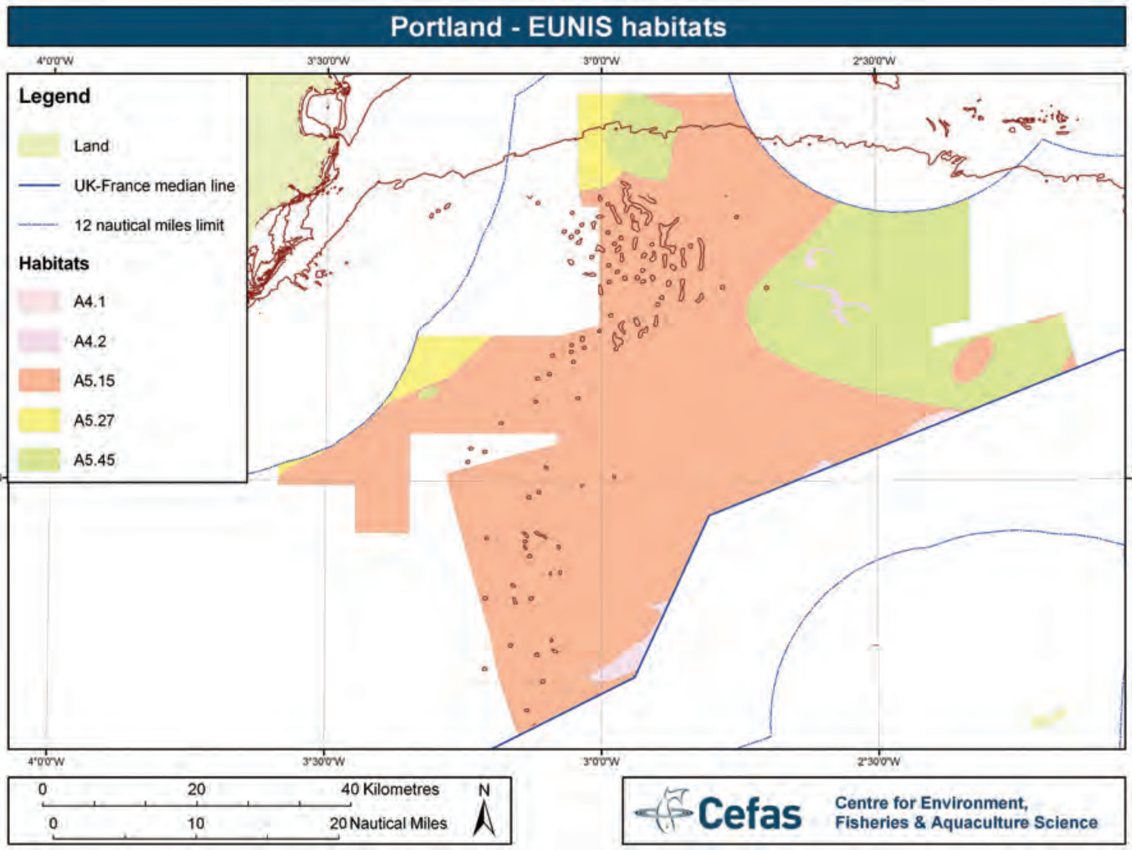


Figure 20: Modelled distribution of EUNIS habitats in the Portland site.



Mediterranean moderate energy circalittoral rock", where current speeds are moderately strong. Both classes are consistent with "1170 Reefs" according to Annex I of the Habitats Directive. In total, 45 km^2 of seabed area are classed as reef.

The remainder of the seabed falls within the EUNIS level 2 class "A5 Sublittoral sediment". Based on the modified BGS seabed sediments data, this can be further subdivided into "A5.15 Deep circalittoral coarse sediment", "A5.27 Deep circalittoral sand" and "A5.45 Deep circalittoral mixed sediments". The boundary between coarse and mixed sediment was slightly modified based on information gathered during the 2006 surveys and the fact that its placement in the original BGS seabed sediments map relied on a small number of samples. The modelled distribution of these EUNIS habitat classes for the Portland Are of Search is illustrated in Figure 20.

5.1.2 Wight

Water depths range between roughly 25 m and 100 m, generally increasing from south to north (Figure 21). An elongated east-west trending area centred in the study site is characterised by highly variable values of slope (Figure 22) and rugosity (Figure 23), displaying crests, slopes flats and depressions (Figure 24). There is a preference for an east-west orientation of benthic zones. Individual crests can be followed for several tens of kilometres. This area is surrounded by rather flat seabed of low rugosity. Consequently, Benthic Terrain Modeler classifies this area as flat. Both areas are cut by roughly northeast-southwest trending bands of slopes and crests.

Based on these results, three different areas of seabed character were identified (Figure 25). The area occupied by **bedrock ridges** coincides with the occurrence of folded and partly faulted sedimentary bedrock of late Jurassic and Lower Cretaceous age. Especially the Jurassic bedrocks display series of well-defined ridges and depressions due to

Figure 21: Bathymetry in the Wight site.

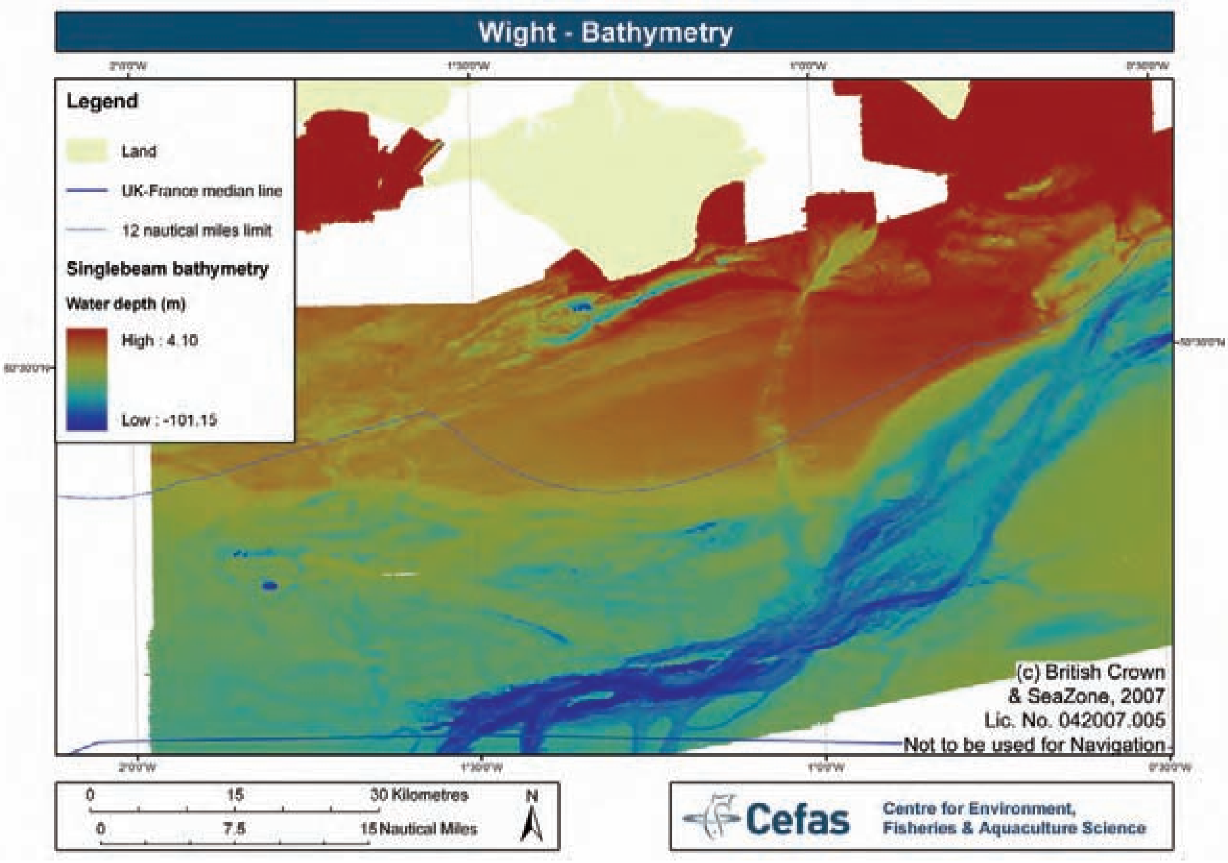


Figure 22: Slope in the Wight site.

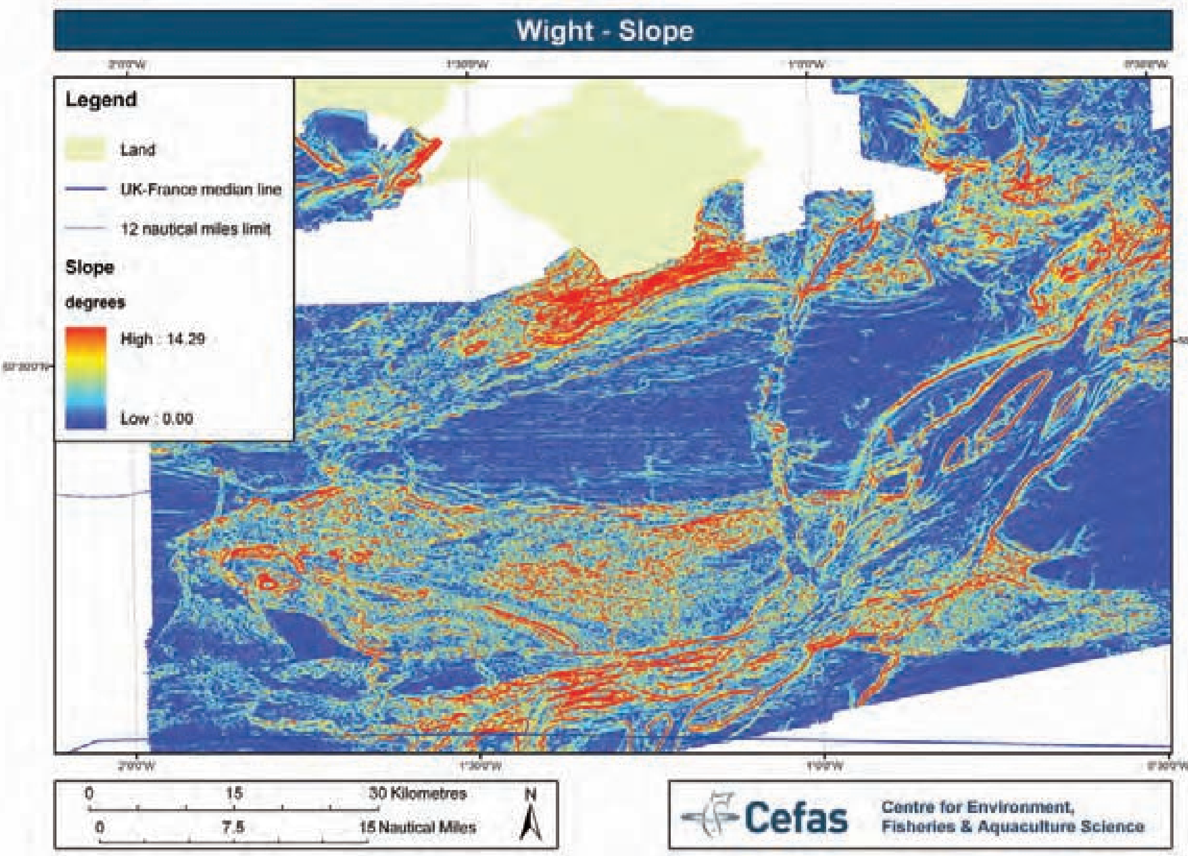


Figure 23: Rugosity in the Wight site.

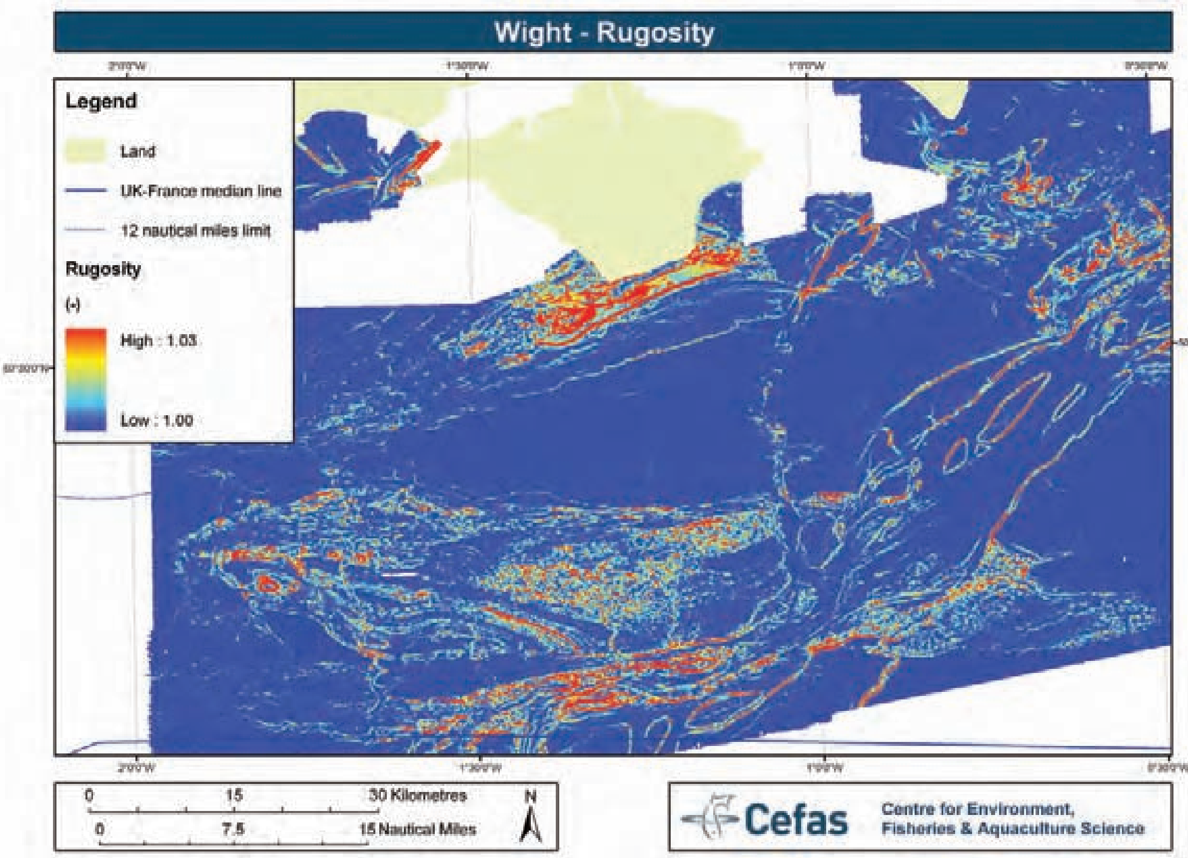
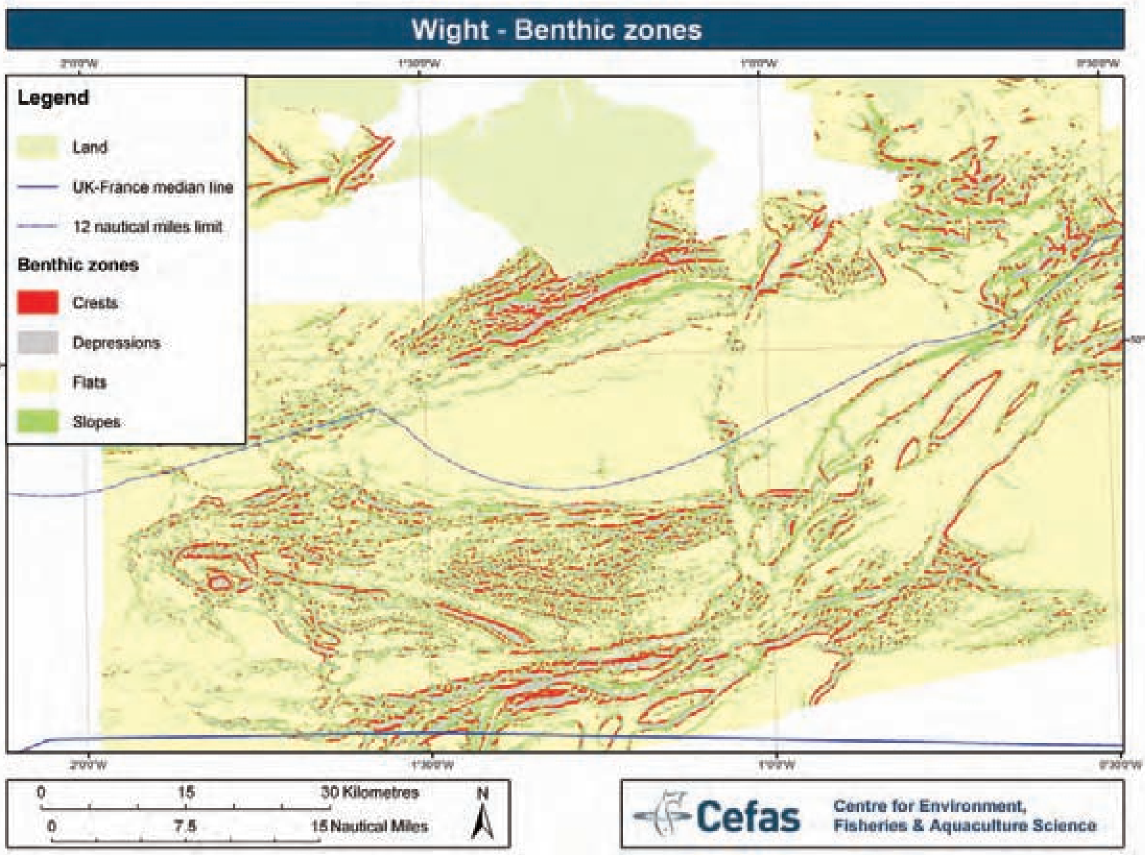


Figure 24: Benthic zones in the Wight site.



the cyclic nature of the strata. Lower Cretaceous bedrock outcrop is somewhat more irregular. Flat, smooth seabed largely coincides with the occurrence of Upper Cretaceous chalk. The chalk bedrock is most likely covered by a thin gravel lag, presumably consisting of flint. A major palaeovalley is cut into the seabed in a northeast-southwest direction. This so-called "Northern Palaeovalley" is a part of a wider channel system present on the seafloor of the English Channel. The Northern Palaeovalley is largely unfilled; hence it is clearly recognisable as a structure at the seabed. Smaller tributary palaeovalleys feed into the larger structure.

Translation into EUNIS habitats was done in the same way as outlined in the previous section. The site broadly falls into the offshore circalittoral marine biological zone. Surface tidal currents are strong (1.5 – 3.0 m/s, Figure 26) and seabed sediments are almost exclusively classed as coarse (Figure 27). As a consequence, bedrock ridges are translated into "A4.1 Atlantic and Mediterranean high-energy circalittoral rock". They are equivalent to "1170 Reefs" of the Habitats Directive and cover an area of 1103.7 km^2. There are indications from seabed imagery that the floor of the palaeovalley is covered with a thin layer of gravel lag. Palaeovalley and flat, smooth seabed therefore translate into "A5.15 Deep circalittoral coarse sediment", except where mixed sediment was encountered ("A5.45 Deep circalittoral mixed sediments"). Results are shown in Figure 28.

5.2 Finescale characterisation

5.2.1 Portland

A 100% sidescan sonar coverage survey was carried out over in an area shown as "undifferentiated bedrock lithology" on the BGS seabed sediment map. However, inspection of the gathered acoustic data and seabed imagery showed no expanses of outcropping rock at the surface. This is in line with the results of the broadscale characterisation based on DSB data, which only identified 45 km^2 of outcropping bedrock. It was therefore decided not to proceed with a detailed interpretation for the Portland site.

5.2.2 Wight

The X2-Y2 Infill area was completely covered with multibeam and therefore investigated in greater detail. It has a size of 16 km in east-west direction by 2 km in north-south direction and mainly sits within the Jurassic bedrock area. Water depths range from 47 m to 65 m (Figure 29). Benthic Terrain Modeler identified eleven different benthic structures, however seven of them are negligible with occurrences below 1% of area (Figure 30). Most widespread are broad flats, which cover roughly 81% of classified seabed area. An exclusively flat area of significant size is

Figure 25: Distribution of different classes of seabed character in the Wight site.

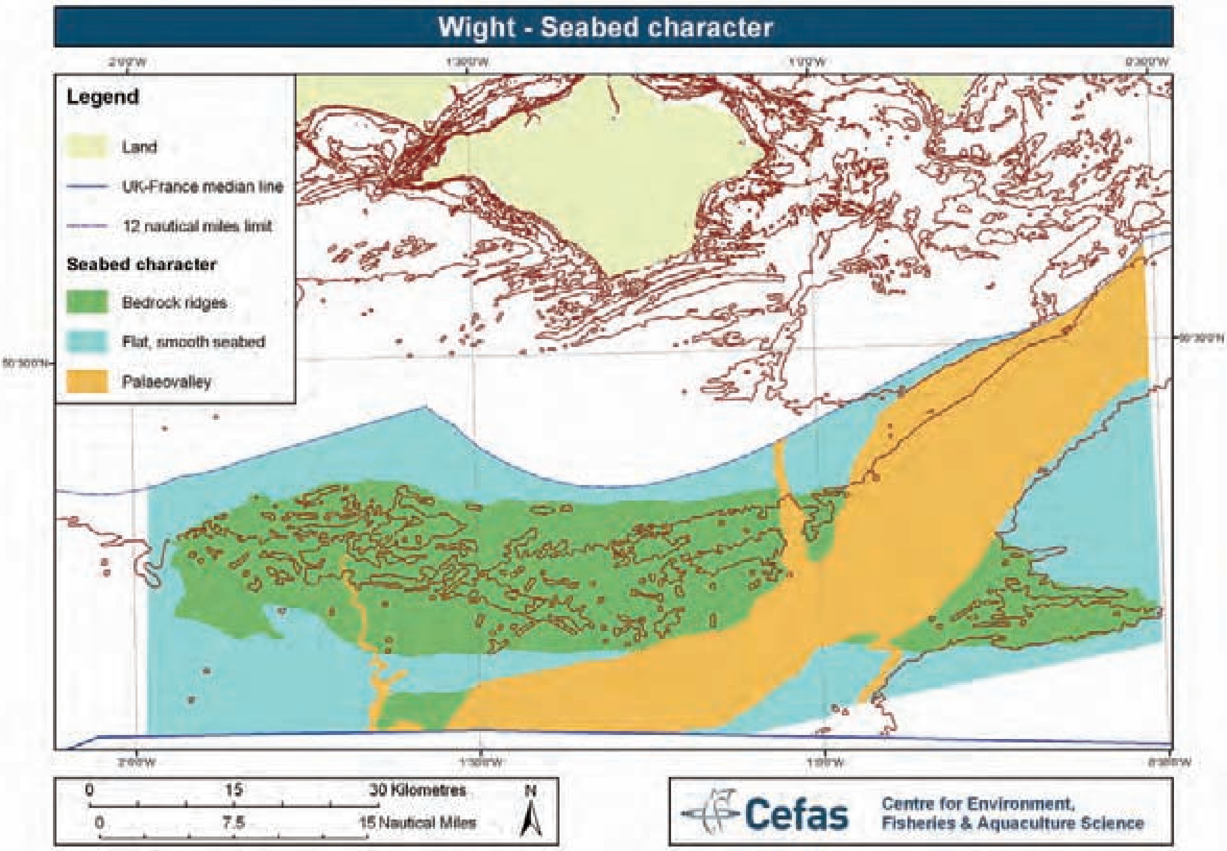


Figure 26: Modelled spring tide peak current speeds at the surface in the Wight site (Department of Trade and Industry, 2004).

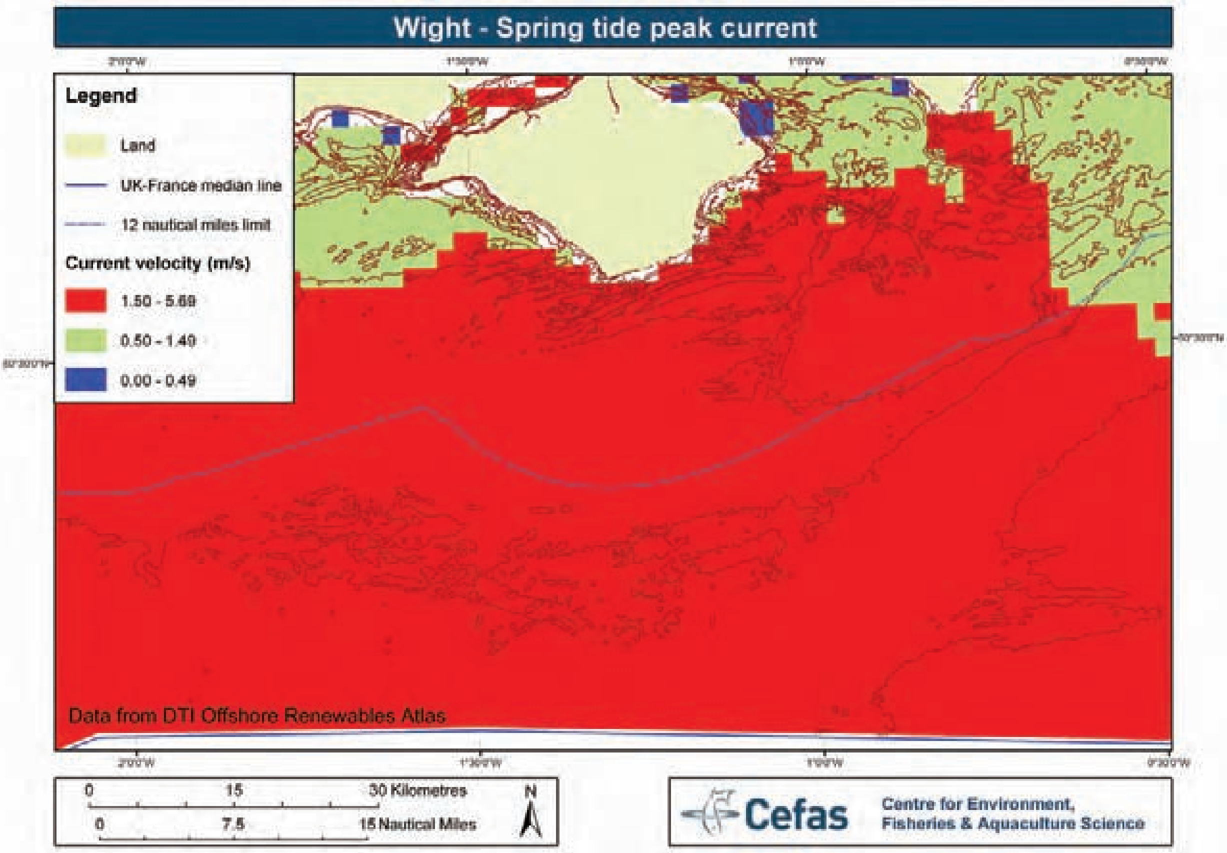


Figure 27: Distribution of four broad classes of seabed sediments (plus rock) in the Wight site (derived from BGS seabed sediments data).

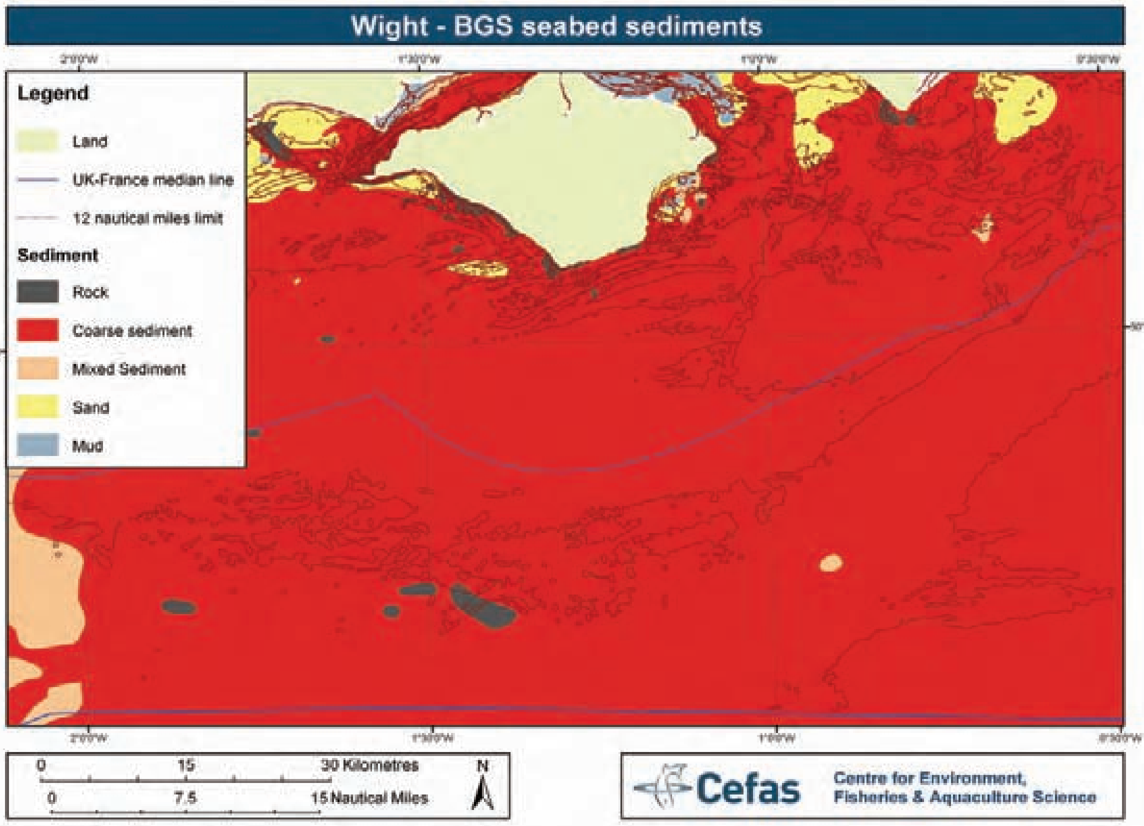
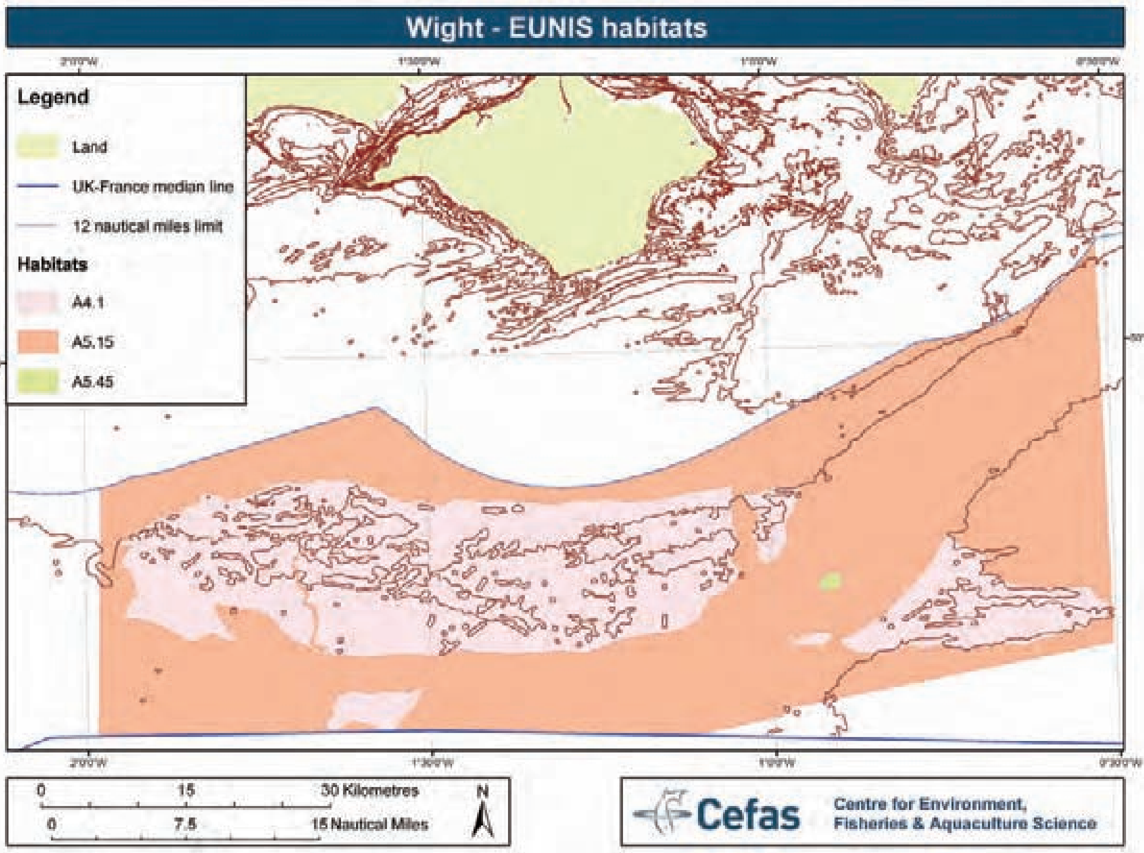


Figure 28: Modelled distribution of EUNIS habitats in the Wight site.



located in the west and is bounded by a northwest-southeast trending narrow crest line. Although ground-truth data is not available, we interpret this area as upper Cretaceous chalk bedrock, presumably covered with a gravel lag, due to the smoothness and flatness of the seabed surface.

Open slopes and narrow crests tend to be largely parallel to each other. They roughly trend in an east-west direction and indicate ridges of upper Jurassic (Corallian and Kimmeridge clay) bedrock. The cyclic nature of the upper Jurassic lithology is reflected in series of rock ridges, intervened by flats or troughs. Due to different resistance to erosion, hard substrata such as limestone stay proud and form ridges while soft substrata (e.g. marl) are eroded and form troughs. The ridges display bends due to folding and displacements due to faulting.

Meandering broad depressions with open bottom, roughly trending north-south, indicate the presence of small-scale palaeovalleys.

Multibeam backscatter data was classified with QTC Multiview into two main classes. These two classes have been attributed to rock and sediment. According to this classification, rock is predominantly found in the eastern half of the study site (covering 28% of the seabed) and sediment predominates in the west (54% of the seabed; Figure 31). The remaining 18% are unspecified classes. Although the results of this classification should not be taken literally, they were nevertheless helpful for the overall interpretation.

Based on the results presented above and the presence of subaqueous dunes visible in the multibeam bathymetry data, we identified five different types of seabed character (Figure 32). Bedrock ridges, flat and smooth seabed with underlying Chalk bedrock and palaeovalleys were already described above. Besides these, flat bedrock, which is partly covered by mobile sediment (subaqueous dunes) and small-scale gullies were discerned.

Seabed character classes were then translated into EUNIS habitats in the following way: Palaeovalleys, gullies

Figure 29: Multibeam bathymetry in the X2-Y2 Infill site. SeaZone DSB data is underlain.

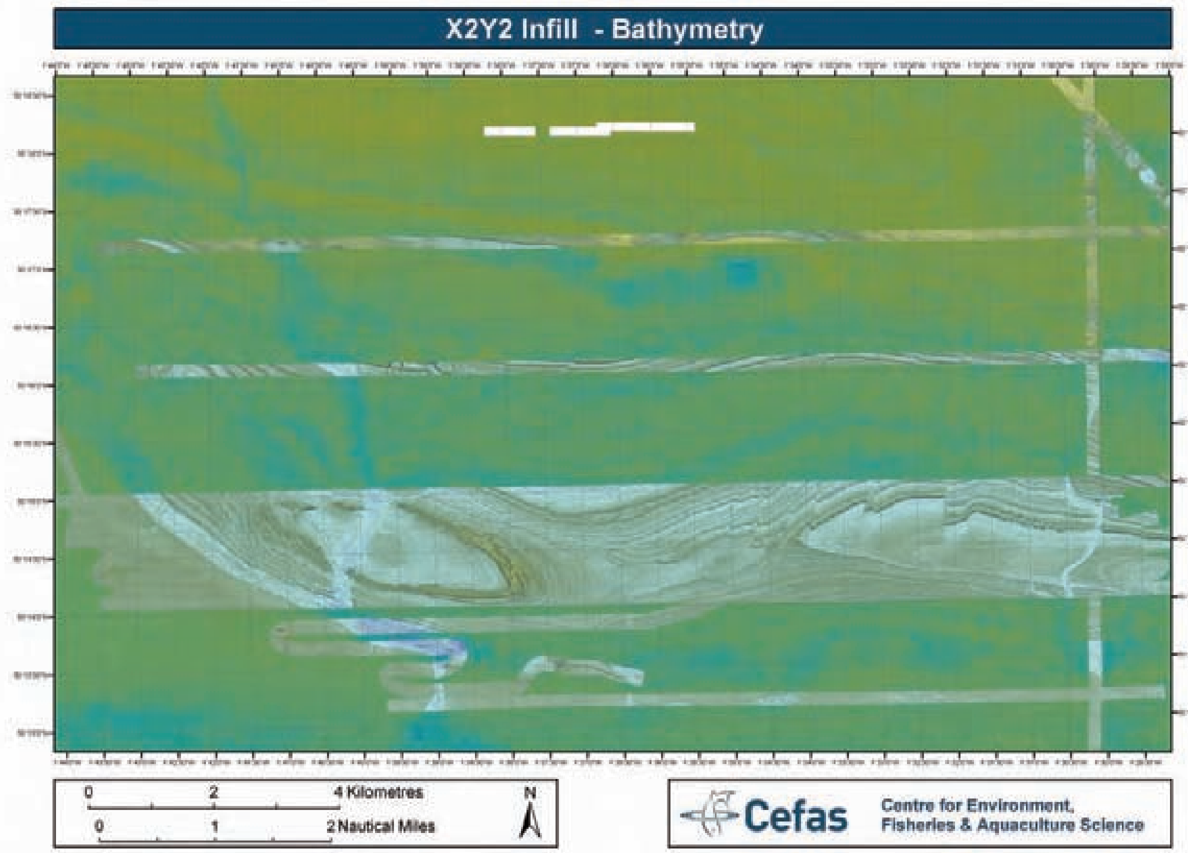


Figure 30: Benthic structures in the X2-Y2 Infill site.

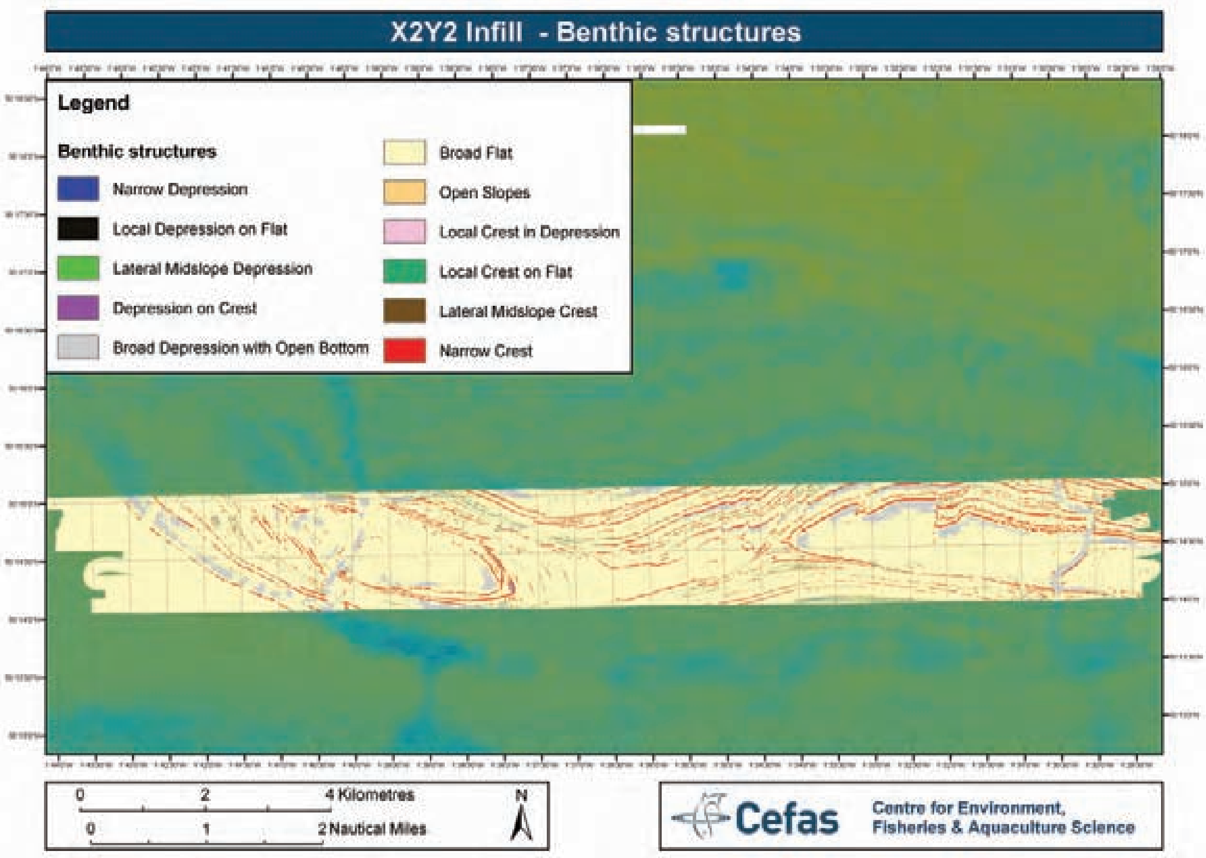


Figure 31: Seabed classification of the full coverage X2-Y2 Infill multibeam survey, based on analysis with QTC Multiview.

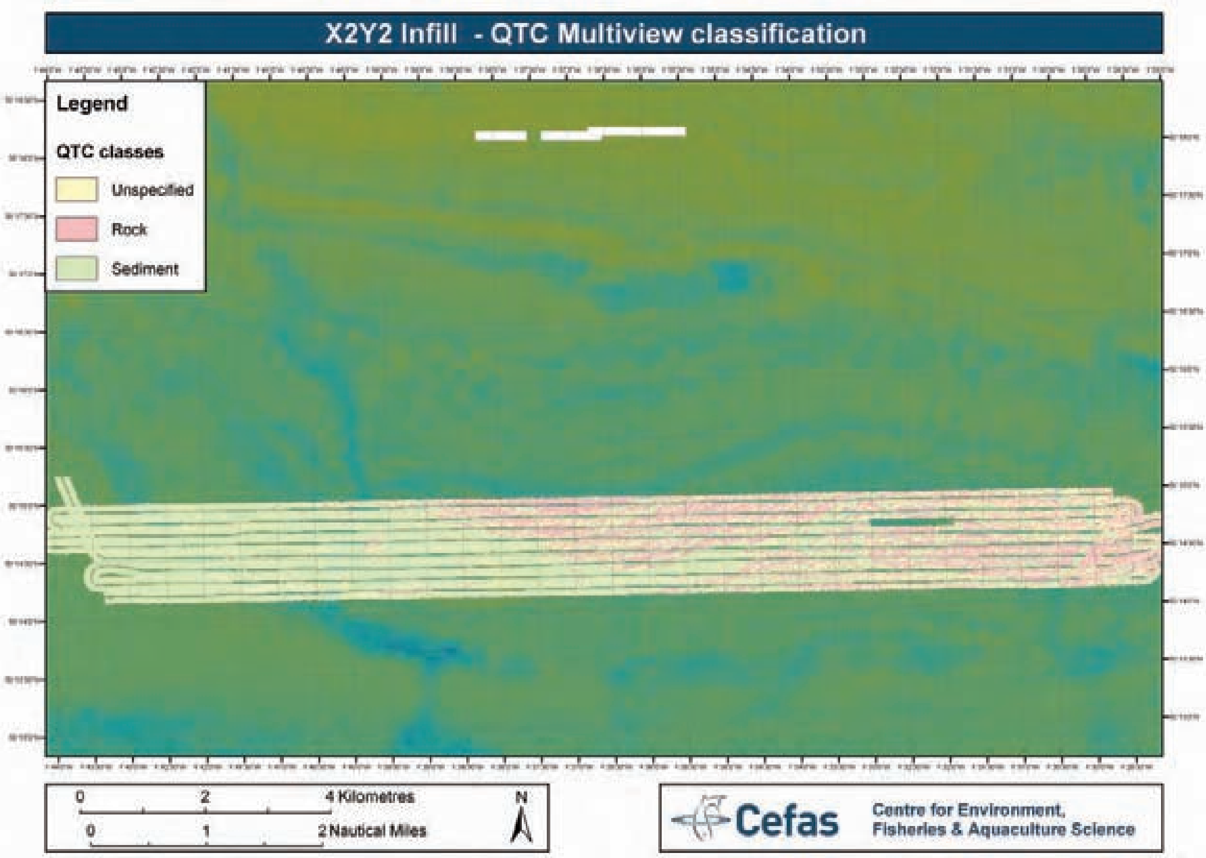
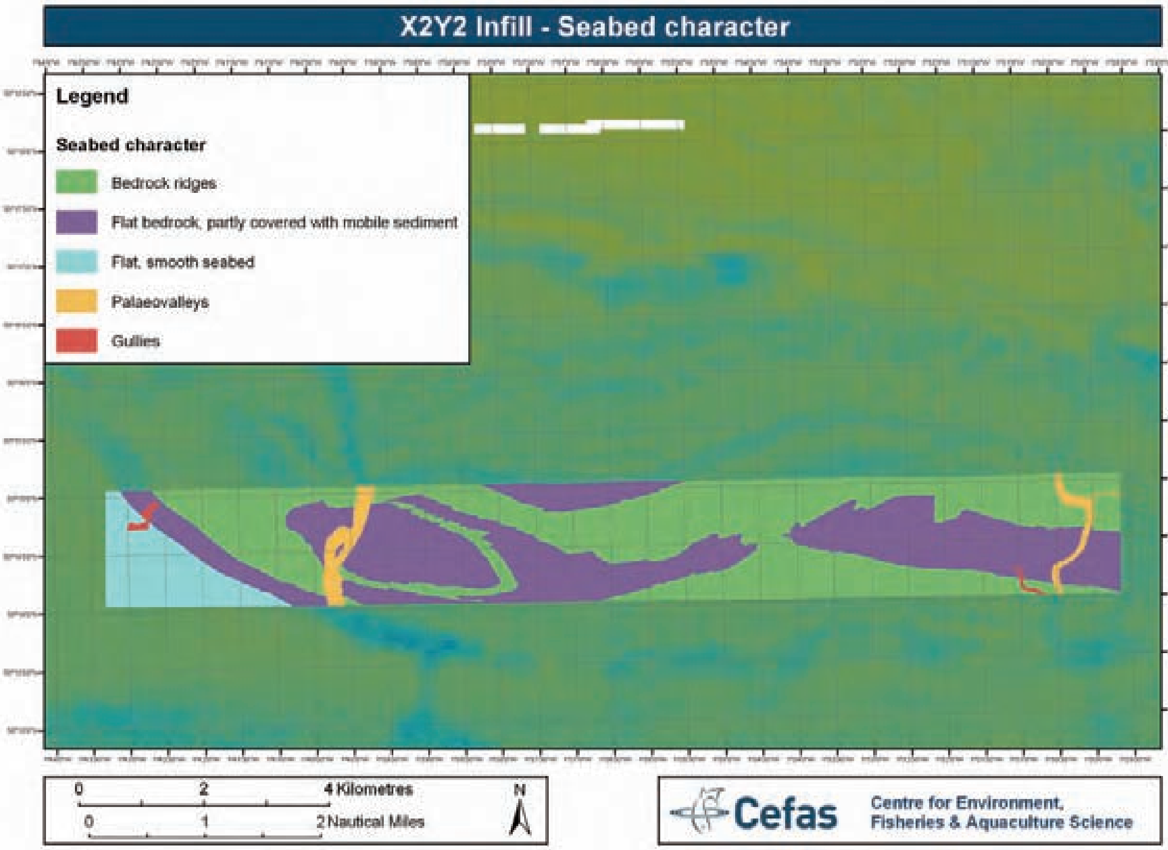


Figure 32: Distribution of different classes of seabed character in the X2-Y2 Infill site.



and flat, smooth seabed were translated into "A5.15 Deep circalittoral coarse sediment". Bedrock ridges were translated into "A4.1 Atlantic and Mediterranean high-energy circalittoral rock". The translation of areas classified as flat bedrock, partly covered by mobile sediment was less straightforward. Based on the classification results of QTC Multiview and the less common occurrence of subaqueous dunes, the areas in the east and north were translated into "A4.1 Atlantic and Mediterranean high-energy circalittoral rock", while the remainder was classified as "A5.15 Deep circalittoral coarse sediment". A4.1 covers roughly 65% or 20 km^2 of surface, while A5.15 occupies 35% or 11 km^2 of seabed (Figure 33).

Several small patches of boulders have been identified from sidescan sonar data, the largest of which measuring 3 km in east-west direction by 0.7 km in north-south direction. The patches are located at the northern edge of the palaeovalley south of the central channel fault (Figure 34). Interestingly, they are all located within the area where Palaeogene rocks crop out. These areas qualify as "1170 Reefs" according to the EU Habitats Directive. The area of identified boulder reefs amounts to 1.5 km^2.

5.3 Benthic biotopes

As will be evident by now, there was a major difference between the two Areas of Search in terms of their habitats and biotopes. No Annex I rocky reefs were observed in Portland, but they dominated in Wight area. A summary for each area, giving the range of biotopes encountered is given below. Records of the video analysis are supplied in the Excel spreadsheets

ME1102 Video Analysis_Portland stations.xls
ME1102 Video Analysis_Wight Transect stations.xls
ME1102 Video Analysis_Wight Video stations.xls

5.3.1 Portland

Eight video stations lay within the Portland Area of Search. The overwhelming majority of the video showed a substrate of coarse sediment, mostly lag gravel. Rock was only rarely exposed and was clearly subject to significant scouring action that severely limited its colonisation by attached life forms (Figure 35). The lag gravel contained few cobbles or boulders and was predominantly recorded as stone gravel in the 4-16 mm size class. This meant it remained fairly mobile and so no consolidated patches accreted by surficial fauna had developed.

Three biotopes were recoded at the eight stations inside the Portland Area of Search, two sublittoral coarse sediments and one sublittoral mixed sediments. The two coarse sediment biotopes should be regarded as being the same; the difference is entirely attributable to different observers making the biotope assignments, one giving greater weight to the depth of the stations and so assigning them to the SCS.OCS (offshore coarse sediments) category while the other gave greater weight to the presence of the

Figure 33: Modelled distribution of EUNIS habitats in the X2-Y2 Infill site.

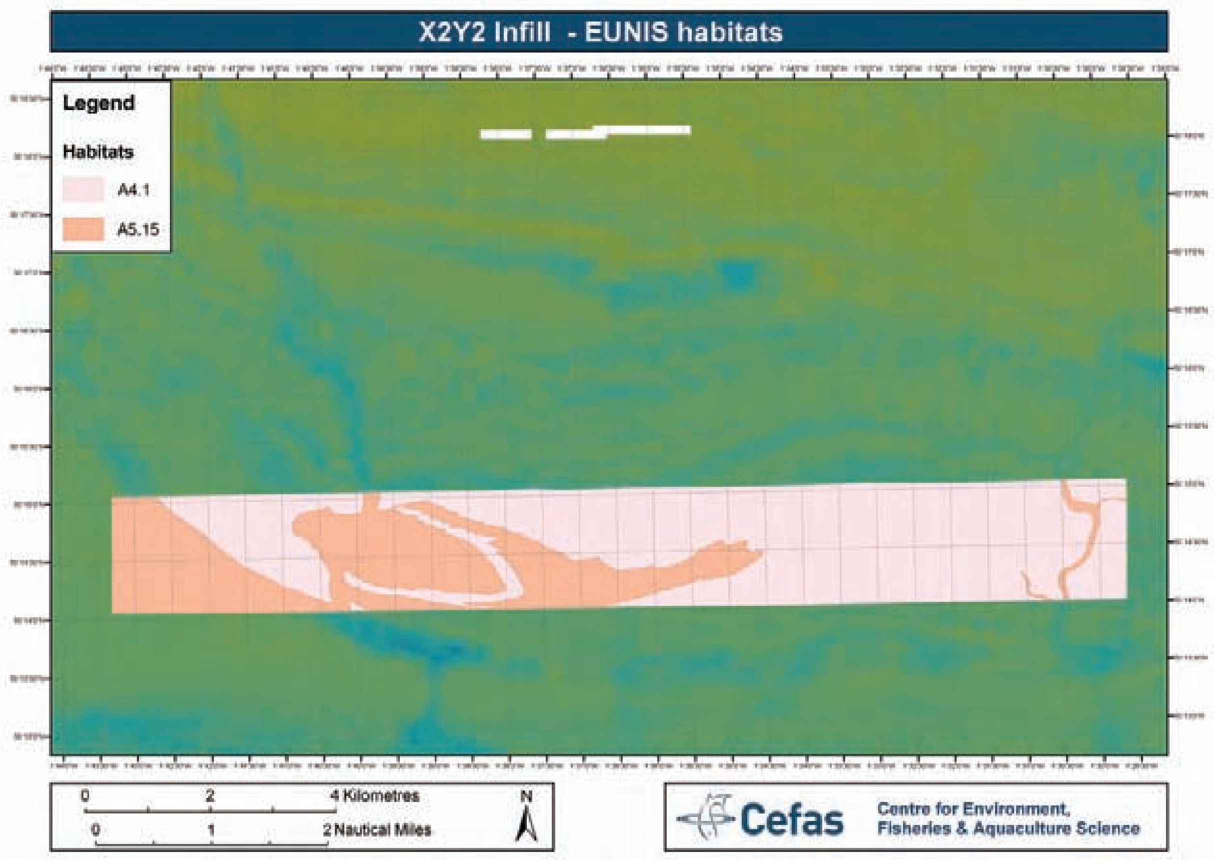


Figure 34: Modelled distribution of boulder reefs in the Wight site.

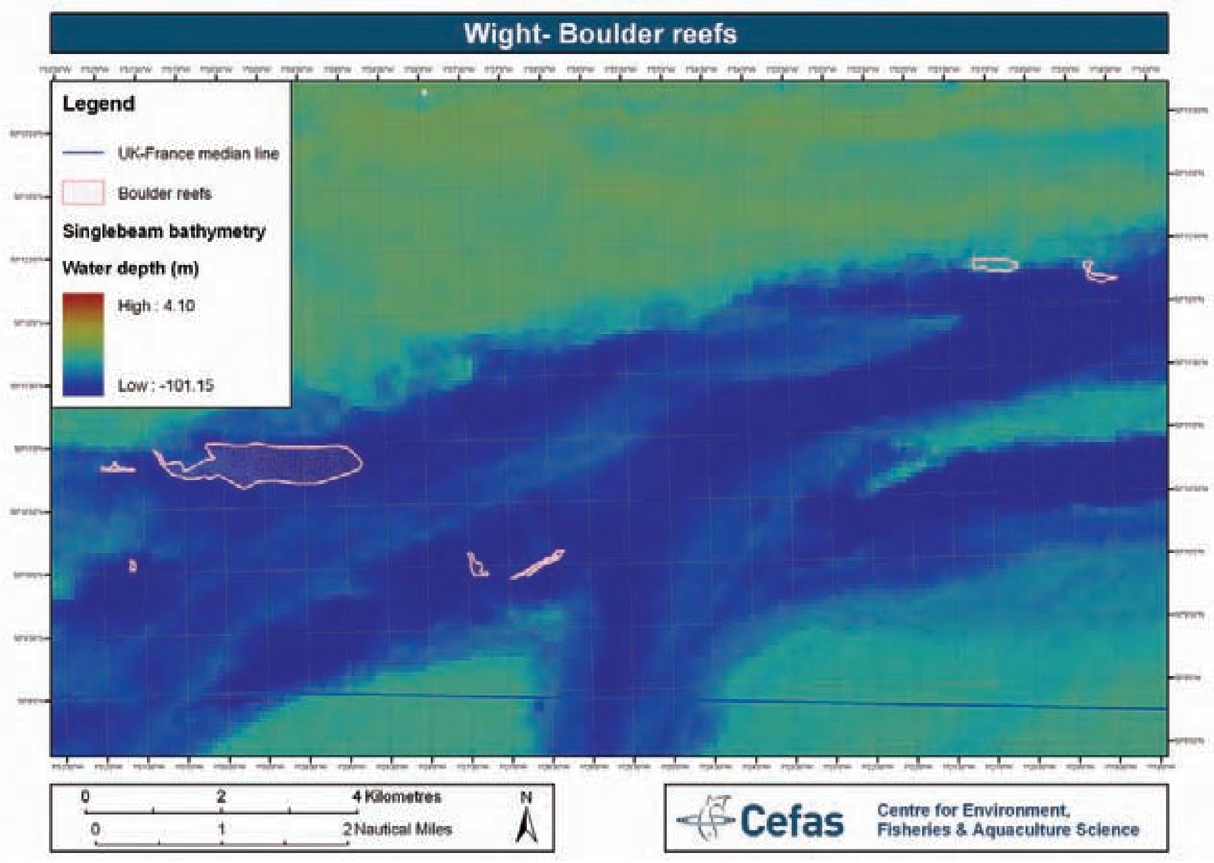


Figure 35: Example of typical rock exposure in the Portland Area of Search. More frequently covered by gravel, this small section has been exposed and is clearly scoured by the coarse substrate, so supports very little in the way of attached life-forms.

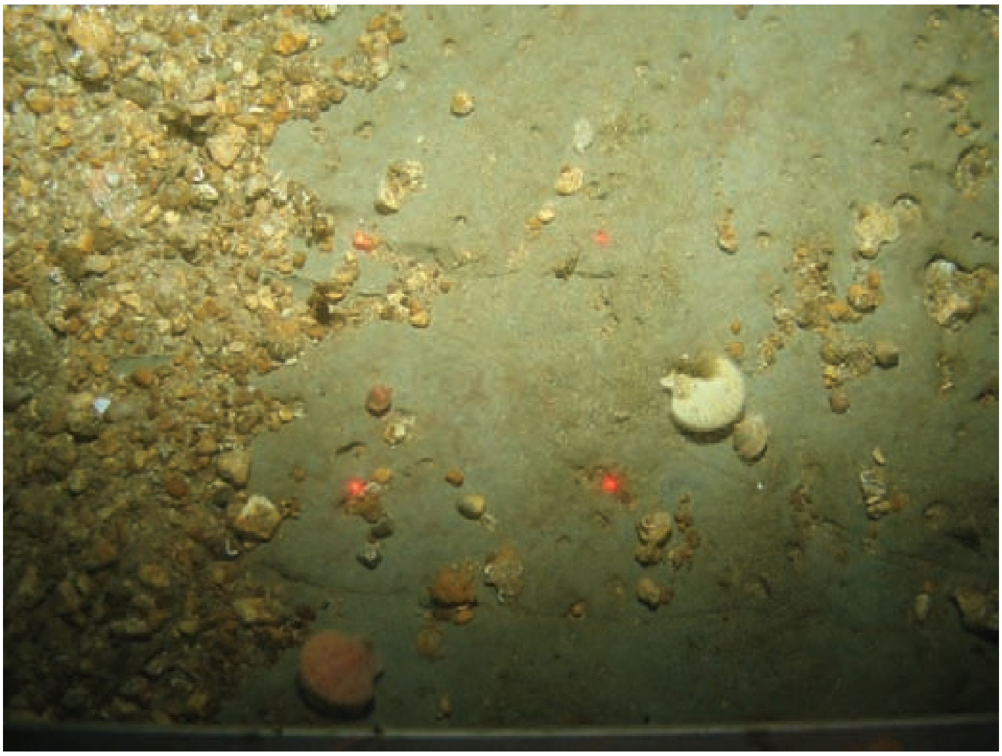


Figure 36: Video stations in the Portland Area of Search (and nearby) labelled by station code and colour by EUNIS habitat class.

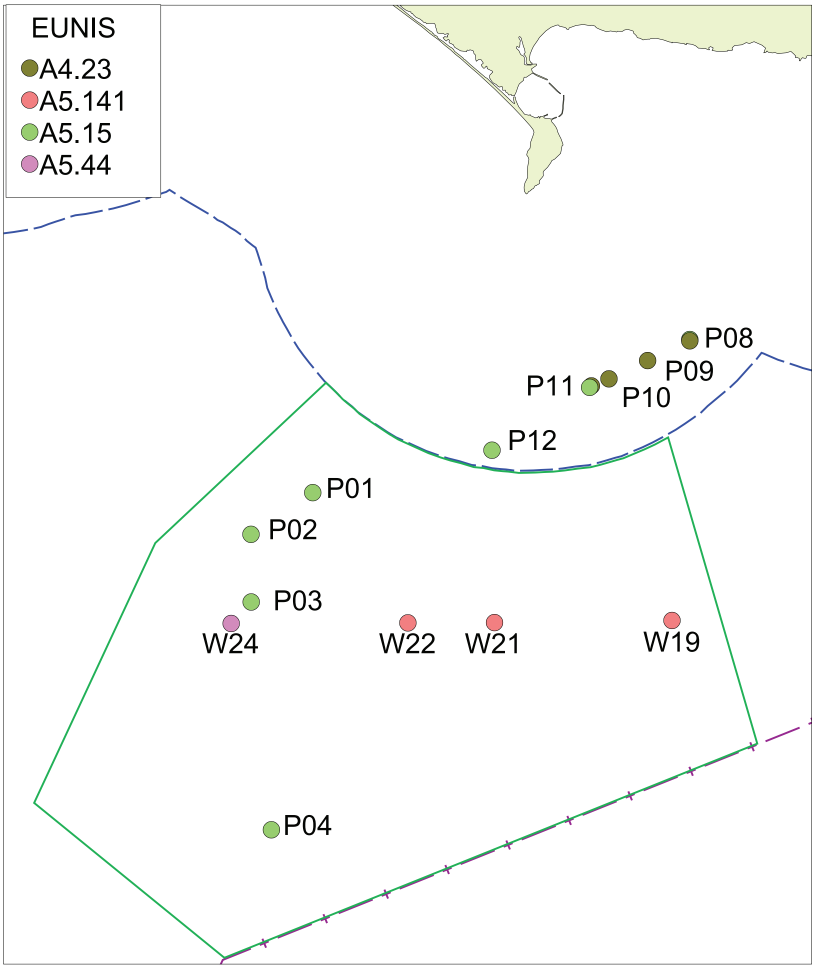


Table 2: Biotope codes for video stations in the Portland Area of Search.

Station	Video Segment	EUNIS	MNCR	Annex-I
P01	P01_S1	A5.15	SS.SCS.OCS	NONE
P02	P02_S1	A5.15	SS.SCS.OCS	NONE
P03	P03_S1	A5.15	SS.SCS.OCS	NONE
P04	P04_S1	A5.15	SS.SCS.OCS	NONE
W19	W19_S1	A5.141	SS.SCS.CCS.PomB	NONE
W21	W19_S1	A5.141	SS.SCS.CCS.PomB	NONE
W22	W22_S1	A5.141	SS.SCS.CCS.PomB	NONE
W24	W24_S1	A5.44	SS.SMx.CMx	NONE

calcareous tube worm, *Pomatoceros* sp., and so assigned them to the SCS.CCS.PomB (circalittoral coarse sediment, with Pomatoceros and barnacles). This ambiguity is inherent in applying a categorical classification to a system where gradients exist between different classes. Five stations slightly north of the Portland AoS were sampled opportunistically and four were found to contain 'moderate energy circalittoral rock' habitats (station P11 also had sediment habitats).

5.3.2 Wight

Thirty stations were sampled with video in or around the Wight AoS; namely WV01 – WV22 and W1, 3, 5, 7, 11, 13, 15 and 17. Rock habitats were found at all of the 'WV' station but none of the 'W' stations (on the long transect, targeting gravel biotopes). The rock habitats supported substantial coverage of fauna and are consistent with the definitions of Annex I habitats. A full list of biotopes recorded is given in Table 3.

Bedrock was typically well exposed over the majority of the video record, frequently in a series of ridges up to ~4 m high with some sediment in the troughs between ridges. This pattern was evidently the surface expression of bedding planes with a low dip angle, such that a series of small 'escarpments' was covered during the video tow. There was therefore frequently an alternating pattern of two or three biotopes as the camera passed from the sediment filled trough, up the steeper irregular scarp face and down the (less steep) planar, dip slope. The exposed rock surfaces were typically entirely covered in fauna, except in the lower reaches adjacent to mobile sediments where the rock was subject to significant scour. Scarp slopes and dip slopes sometimes supported slightly different biotopes, the scarp slopes featuring taxa frequently associated with faster moving water, such as the hydroid *Tubularia indivisa*. The dip slopes were most typically characterised by the bryozoan *Flustra foliacea* and encrusting communities comprising sponges, hydroids and bryozoa. Scour tolerant communities, typified by anemones *Urticina felina* and *Sagartia* spp. occurred near the interfaces between sediment and exposed rock. Taxa normally associated with rock or hard surfaces were commonly found among some of the sediments, which evidently laid thinly over underlying rock and were formed into ripples and/or waves.

At deeper stations, sponges became more prevalent, encrusting forms giving way to cushion and erect forms, such as *Polymastia boletiformis* and ultimately the massive forms such as *Pachmatisma johnstonia*. The more fragile bryozoan *Pentapora foliacea* was also frequently recorded. Boulder fields and steep rock faces associated with the palaeovalley supported similar fauna.

The floor of palaeochannels and the palaeovalley were typically of cobble and gravel substrates. In places the larger pebble and cobble particles appeared stable and supported a dense covering of encrusting sponge and faunal turf to the extent that the sediment had become accreted and was essentially a 'rock' habitat. In places the cobbles and pebbles were less stable, and supported a far reduced fauna characterised by fast colonising taxa such as barnacles and the tube-worm *Pomatoceros*. Patches of smaller 'fluvial' gravel could lie immediately adjacent to accreted or non-accreted cobbles, and gave the impression of being the remnants of more recent streams laying within larger and older river valleys. These gravel 'streams' were generally devoid of epifauna.

A few stations had significant amounts of sand (usually deep red in colour) but it was clearly mobile and could be formed into sand waves of up to 4 m high. No fauna were found to be associated with such waves.

There was a notable **absence** of some species and taxa commonly associated with rocky habitats in the western channel, such as the urchin *Echinus esculentus*, the holothurain *Holothuria forskali*, the sea fan *Eunicella verrucosa*, and the cup coral *Caryophyllia smithii*. Large crabs (*Cancer, Liocarcinus, Necora*) were rare, but smaller stone crabs (e.g. *Ebalia*) relatively common. No biogenic reefs were encountered (e.g *Sabellaria, Modiolus*). No alga was recorded, even the encrusting forms like *Lithothamnion* were absent.

As a whole, it was noticeable that the faunal growth seemed far less profuse than at other rock habitats in the Channel such as Eddystone, Scillies and Lands End.

Table 3: Extract from JNCC's EUNIS-MNCR habitat correlation table, listing the biotopes recorded at Wight video stations. EUNIS codes shown in red font are copied from the EUNIS web site and replace erroneous codes published in the JNCC's correlation table at the time of writing (Feb 2009).

EUNIS level	EUNIS code	EUNIS name	JNCC 04.05 code	JNCC 04.05 name
1	A	Marine habitats		Marine habitats
2	A4	Circalittoral rock and other hard substrata	CR	Circalittoral rock (and other hard substrata)
3	A4.1	Atlantic and Mediterranean high energy circalittoral rock	CR.HCR	High energy circalittoral rock
4	A4.11	Very tide-swept faunal communities on circalittoral rock	CR.HCR.FaT	Very tide-swept faunal communities
5	A4.111	*Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock	CR.HCR.FaT.BalTub	*Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock
5	A4.112	*Tubularia indivisa* on tide-swept circalittoral rock	CR.HCR.FaT.CTub	*Tubularia indivisa* on tide-swept circalittoral rock
6	A4.1121	*Tubularia indivisa* and cushion sponges on tide-swept turbid circalittoral bedrock	CR.HCR.FaT.CTub.CuSp	*Tubularia indivisa* and cushion sponges on tide-swept turbid circalittoral bedrock
4	A4.12	Sponge communities on deep circalittoral rock	CR.HCR.DpSp	Deep sponge communities
4	A4.13	Mixed faunal turf communities on circalittoral rock	CR.HCR.XFa	Mixed faunal turf communities
5	A4.131	Bryozoan turf and erect sponges on tide-swept circalittoral rock	CR.HCR.XFa.ByErSp	Bryozoan turf and erect sponges on tide-swept circalittoral rock
6	A4.1313	Mixed turf of bryozoans and erect sponges with Sagartia elegans] on tide-swept ciraclittoral rock	CR.HCR.XFa.ByErSp.Sag	Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept ciraclittoral rock
5	A4.134	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	CR.HCR.XFa.FluCoAs	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock
6	A4.1342	*Flustra foliacea,* small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders	CR.HCR.XFa.FluCoAs.SmAs	*Flustra foliacea,* small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders
6	A4.1343	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata	CR.HCR.XFa.FluCoAs.X	*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata
3	A4.2	Atlantic and Mediterranean moderate energy circalittoral rock	CR.MCR	Moderate energy circalittoral rock
4	A4.21	Echinoderms and crustose communities on circalittoral rock	CR.MCR.EcCr	Echinoderms and crustose communities
5	A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock
6	A4.2141	*Flustra foliacea* on slightly scoured silty circalittoral rock	CR.MCR.EcCr.FaAlCr.Flu	*Flustra foliacea* on slightly scoured silty circalittoral rock
6	A4.2144	Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr.Bri	Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock
2	A5	Sublittoral sediment	SS	Sublittoral sediment
3	A5.1	Sublittoral coarse sediment	SS.SCS	Sublittoral coarse sediment (unstable cobbles and pebbles, gravels and coarse sands)
4	A5.14	Circalittoral coarse sediment	SS.SCS.CCS	Circalittoral coarse sediment
5	A5.141	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	SS.SCS.CCS.PomB	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
4	A5.15	Deep circalittoral coarse sediment	SS.SCS.OCS	Offshore circalittoral coarse sediment
3	A5.2	Sublittoral sand	SS.SSa	Sublittoral sands and muddy sands
4	A5.27	Deep circalittoral sand	SS.SSa.OSa	Offshore circalittoral sand
3	A5.4	Sublittoral mixed sediments	SS.SMx	Sublittoral mixed sediment
4	A5.44	Circalittoral mixed sediments	SS.SMx.CMx	'Circalittoral mixed sediments
5	A5.44	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	SS.SMx.CMx.FluHyd	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment
5	A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment
4	A5.45	Deep mixed sediments	SS.SMx.OMx	Offshore circalittoral mixed sediment

A list of biotopes found at each station is presented in Table 4 for 'W' stations and Table 5 for 'WV' stations. In some of the 'WV' stations, the video had multiple segments, with an alternating or repeating pattern of the same biotopes (e.g., when crossing a series of rock ridges). The table only presents the first instance of each biotope found at the station.

The distribution of each of the rock biotopes is mapped in Figure 37 and Figure 38, while that for the sediment biotopes is mapped in Figure 39.

Table 4: Biotope list for 'W' stations in the Wight AoS.

Station	Video Segment	EUNIS	MNCR	Annex-I
W01	W01_S1	A5.141	SS.SCS.CCS.PomB	NONE
W03	W03_S1	A5.445	SS.SMx.CMx.OphMx	NONE
W05	W05_S1	A5.445	SS.SMx.CMx.OphMx	NONE
W07	W07_S1	A5.445	SS.SMx.CMx.OphMx	NONE
W11	W11_S1	A5.141	SS.SCS.CCS.PomB	NONE
W13	W13_S1	A5.444	SS.SMx.CMx.FluHyd	NONE
W15	W15_S1	A5.445	SS.SMx.CMx.OphMx	NONE
W17	W17_S1	A5.444	SS.SMx.CMx.FluHyd	NONE

Table 5: Biotope list for 'WV' stations in the Wight AoS.

Station	Video Segment	EUNIS	MNCR	Annex-I
WV01	WV01 S1	A4.12	CR.HCR.DpSp	Reef
WV02	WV02 S1	A4.12	CR.HCR.DpSp	Reef
WV02	WV02 S2	A5.15	SS.SCS.OCS	NONE
WV03	WV03_S1	A5.15	SS.SCS.OCS	NONE
WV03	WV03_S2	A4.131	CR.HCR.XFa.ByErSp	Reef
WV03	WV03_S4	A4.12	CR.HCR.DpSp	Reef
WV03	WV03_S5	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV04	WV04_S1	A5.15	SS.SCS.OCS	NONE
WV04	WV04_S2	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV05	WV05_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV05	WV05_S2	A5.141	SS.SCS.CCS.PomB	NONE
WV06	WV06_S1	A4.2144	CR.MCR.EcCr.FaAlCr.Bri	Reef
WV06	WV06_S2	A4.214	CR.MCR.EcCr.FaAlCr	Reef
WV06	WV06_S3	A5.14	SS.SCS.CCS	NONE
WV07	WV07_S1	A5.141	SS.SCS.CCS.PomB	Reef
WV07	WV07_S2	A5.14	SS.SCS.CCS	NONE
WV08	WV08_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV08	WV08_S2	A4.131	CR.HCR.XFa.ByErSp	Reef
WV08	WV08_S3	A5.14	SS.SCS.CCS	NONE

Continued

Table 5: Biotope list for 'WV' stations in the Wight AoS. (continued)

Station	Video Segment	EUNIS	MNCR	Annex-I
WV09	WV09_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV10	WV10_S1	A5.14	SS.SCS.CCS	NONE
WV10	WV10_S2	A4.1121	CR.HCR.FaT.CTub.CuSp	Reef
WV10	WV10_S3	A4.2141	CR.MCR.EcCr.FaAlCr.Flu	Reef
WV11	WV11_S1	A4.1313	CR.HCR.XFa.ByErSp.Sag	Reef
WV12	WV12_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV12	WV12_S2	A4.1342	CR.HCR.XFa.FluCoAs.SmAs	Reef
WV12	WV12_S3	A5.14	SS.SCS.CCS	NONE
WV13	WV13_S1	A5.141	SS.SCS.CCS.PomB	NONE
WV13	WV13_S2	A5.14	SS.SCS.CCS	NONE
WV13	WV13_S3	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV14	WV14_S1	A5.141	SS.SCS.CCS.PomB	NONE
WV14	WV14_S2	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV15	WV15_S1	A4.12	CR.HCR.DpSp	Reef
WV15	WV15_S2	A5.141	SS.SCS.CCS.PomB	NONE
WV15	WV15_S3	A4.111	CR.HCR.FaT.BalTub	Reef
WV16	WV16_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV16	WV16_S2	A5.15	SS.SCS.OCS	NONE
WV17	WV17_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV17	WV17_S2	A5.27	SS.SSa.OSa	NONE
WV18	WV18_S1	A5.15	SS.SCS.OCS	NONE
WV18	WV18_S2	A4.12	CR.HCR.DpSp	Reef
WV18	WV18_S3	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV19	WV19_S1	A4.12	CR.HCR.DpSp	Reef
WV19	WV19_S2	A5.141	SS.SCS.CCS.PomB	NONE
WV20	WV20_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV20	WV20_S2	A4.131	CR.HCR.XFa.ByErSp	Reef
WV21	WV21_S1	A5.141	SS.SCS.CCS.PomB	NONE
WV21	WV21_S2	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV21	WV21_S3	A5.14	SS.SCS.CCS	NONE
WV22	WV22_S1	A4.134	CR.HCR.XFa.FluCoAs	Reef
WV22	WV22_S2	A4.12	CR.HCR.DpSp	Reef
WV22	WV22_S3	A5.45	SS.SMx.OMx	Reef

Figure 37: Distribution of EUNIS rock biotopes at video sampling stations in Wight (1 of 2).

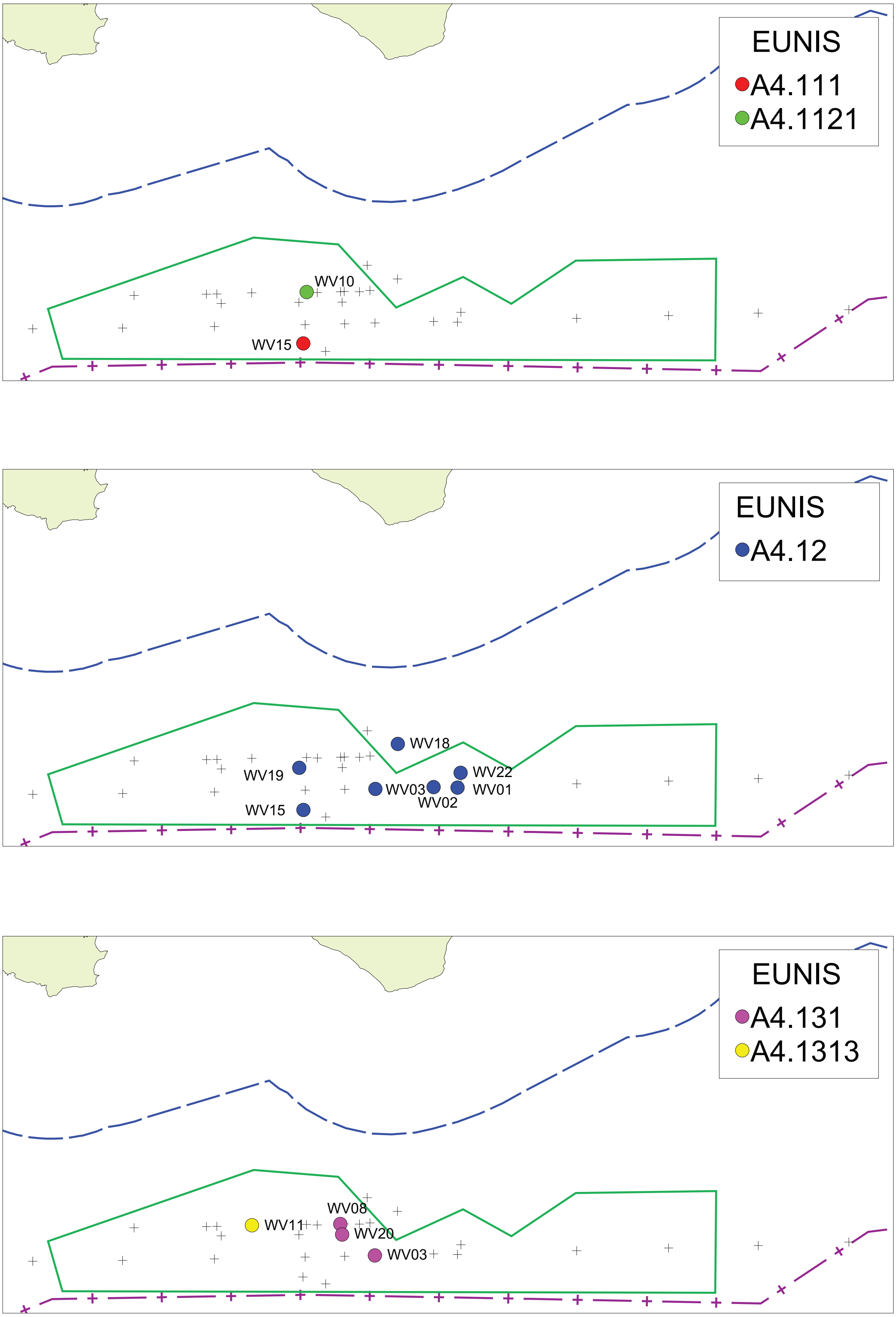
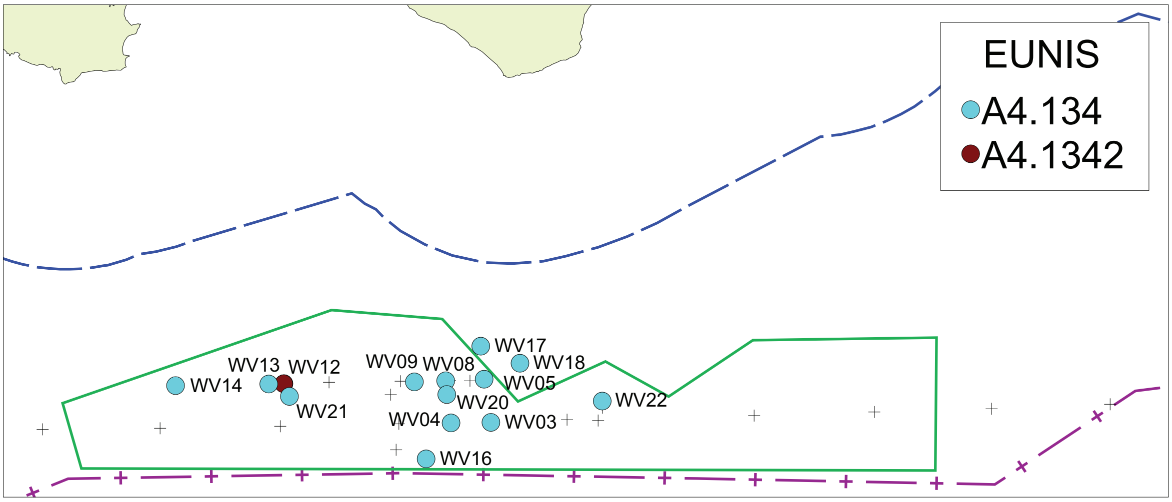


Figure 38: Distribution of EUNIS rock biotopes at video sampling stations in Wight (2 of 2)



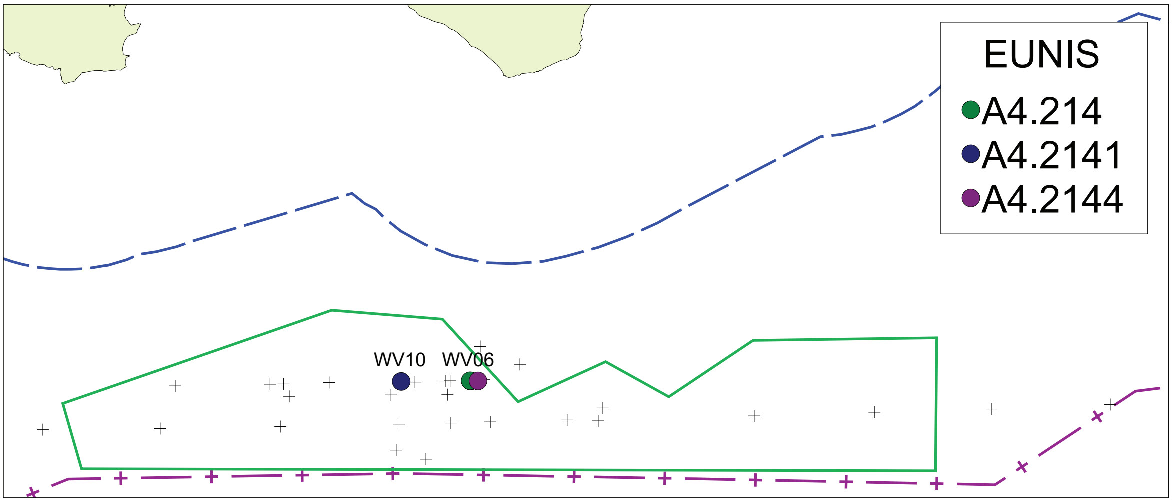
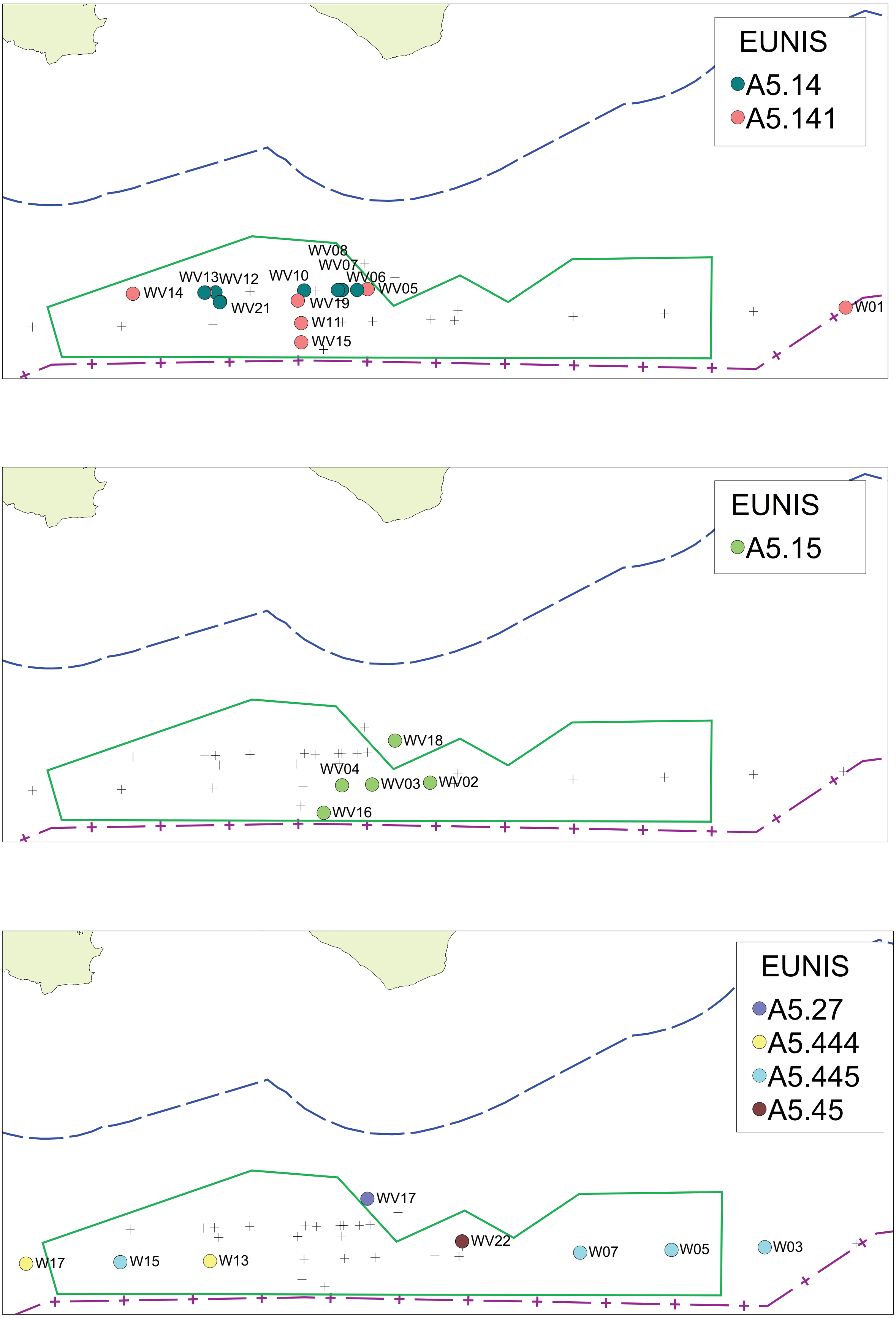


Figure 39: Distribution of EUNIS sediment biotopes at video sampling stations in Wight.



5.4 Integrated interpretation

This integrated analysis brings together the outcomes of the separate geophysical and biological analyses to provide a more holistic view of the study, with particular focus on delineating and characterising Annex I reef habitats. As no such habitats were found in the Portland AoS, and the acoustic surveys there showed no large areas of exposed rock, the following analysis will focus entirely on the White AoS.

For orientation purposes, the location of the video sampling sites are mapped below, overlain on the Digital Survey Bathymetry (Figure 40), the BGS DiGRock 250 solid geology (Figure 41) and the BGS seabed sediment chart (Figure 42). The colour ramp in the bathymetry ranges from white at the shallowest part through red, yellow, green and blue to purple at the deepest (see depth labels in red text in Figure 40). Keys to rock and sediment labels are given in Table 6.

Simple inspection of these Figures 40, 41 and 42 reveals the following:

1. The Area of Search overlays, but does not entirely contain, an area of rough deeper seabed to the south of a shallower smoother seabed. The strong demarcation between the two features corresponds with a change in rock type, from chalk (smooth) to mudstone (rough), and the latter lies entirely beyond the 12 nmi limit.
2. Topographic 'textures' and delineations in the rough area of seabed correspond closely to further demarcations between different types of mudstone. The majority of the video sampling points were on interbedded mudstone and limestone.
3. To the south of this interbedded area, the seabed begins to lose its rough texture to some degree with large flat areas associated with the mudstone south of the monocline.
4. The relationship between topography and rock type breaks down to some extent in the palaeovalley, where the erosional feature becomes dominant in the topography.
5. The upper parts of the palaeovalley bisect the largest area of mudstone, which whose a similar topographical texture one either side of the palaeovalley.
6. There appears to be only a very weak correspondence between the sediment map and either the solid geology or the DSB topography.The seabed surface is an irregular pattern of ridges and troughs of low elevation. (1-2 m high).

5.4.1 Geophysical regions

The close match between the solid geology and the topography enables the area to be mapped into geophysical regions, as illustrated in Figure 43 and Figure 44. The regions have a very low correspondence with mapped distribution of sediments (Figure 45).

Region 1 (polygons 1a, b, c, d)

The rocks here are mostly mudstones of the Wealden Group, ringed in the north by sandstone and mudstone of the Gault-Greensand Group. The Wealden Group has a varied lithology including grey-green, green and pale-green mudstones. Video observations showed a soft blue-green rock that broke easily when impacted by the drop-camera frame, causing clouds of 'clay' to be suspended in the water. The fragility of the rock did not prevent colonisation by encrusting life forms (including sponges) but it was clear that large areas had been scoured clean by mobile sands.

Table 6: Key to class labels for images showing BSG DiGRock 250 solid geology and BGS seabed sediments.

	SOLID GEOLOGY	SEDIMENTS	
CHLK	Chalk	GVSD	Gravelly sand
STMD	Sandstone & mudstone	SDGV	Sandy gravel
MDST	Mudstone	MSGR	Muddy sandy gravel
MDLM	Mudstone & limestone interbedded	GV	Gravel
SDAR	Sandstone & argillaceous rocks, interbedded	ROCK	Rock

Figure 40: Wight video stations overlain on Digital Survey Bathymetry

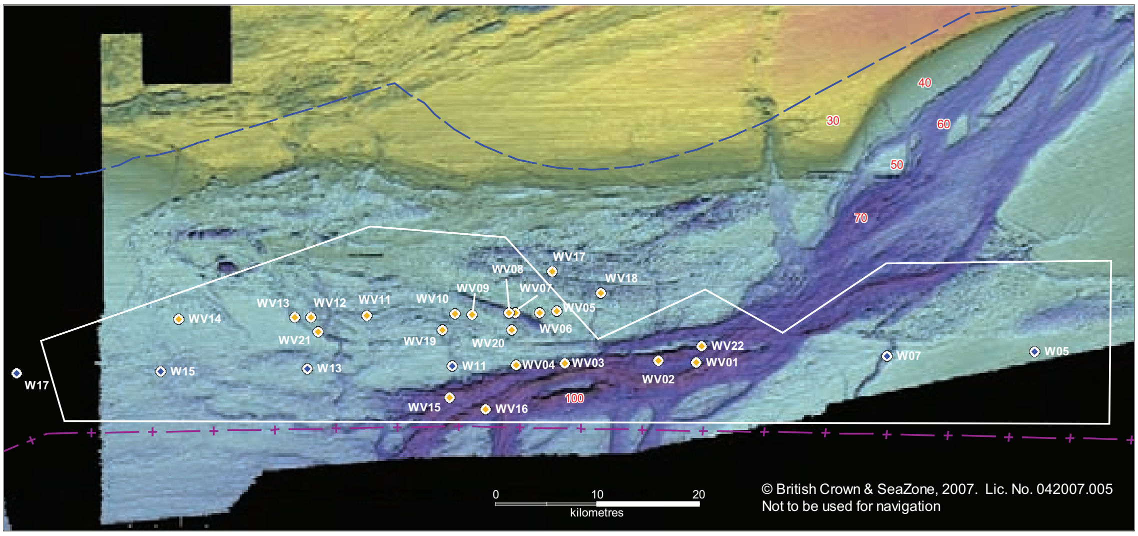


Figure 41: Wight video stations overlain on BGS solid geology map (DiGRock 250)

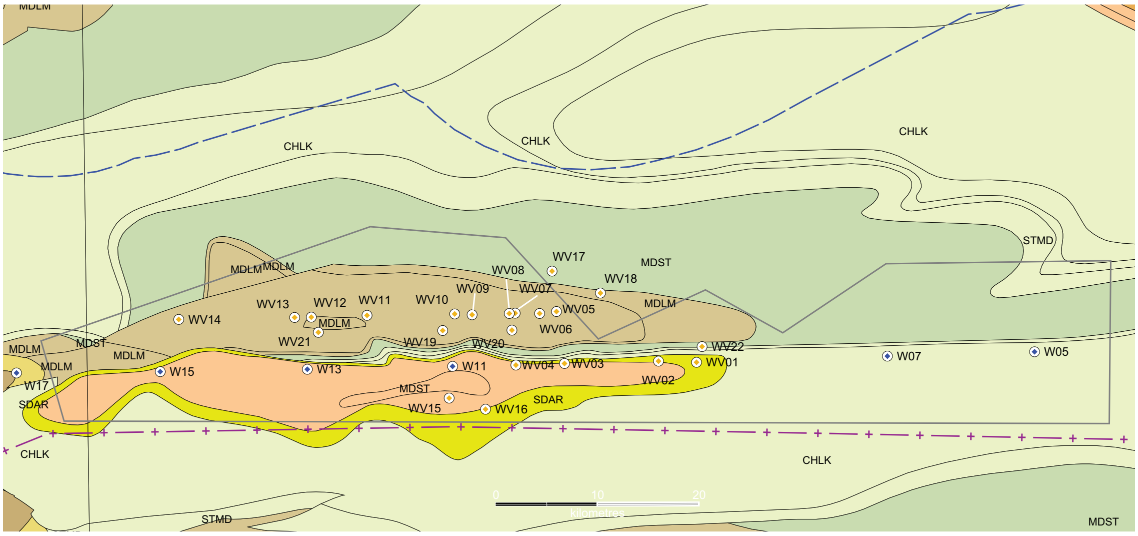


Figure 42: Wight video stations overlain on BGS seabed sediment map.

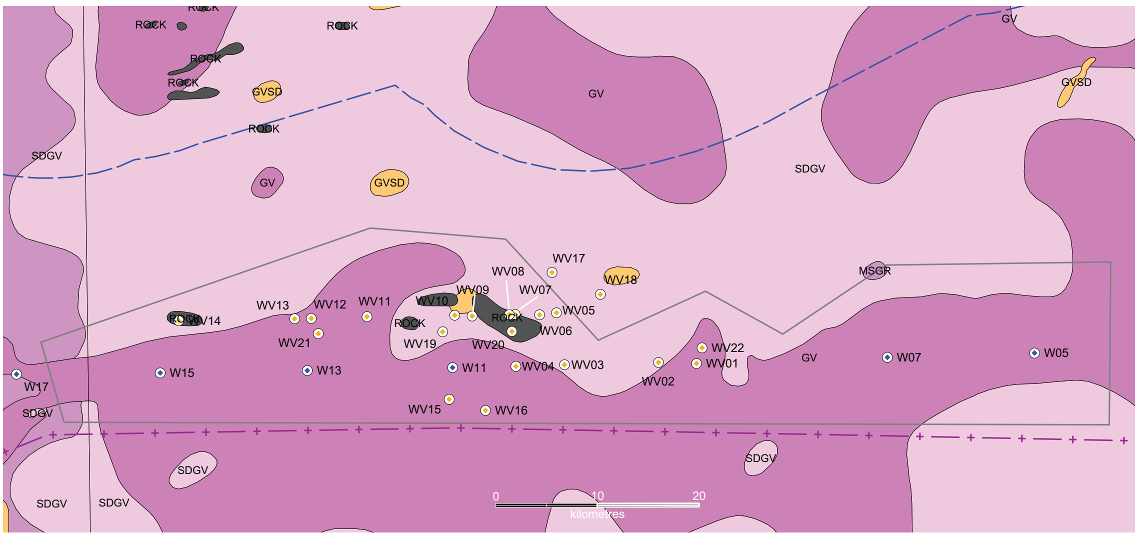


Figure 43: Wight geophysical regions overlaid on Digital Survey Bathymetry

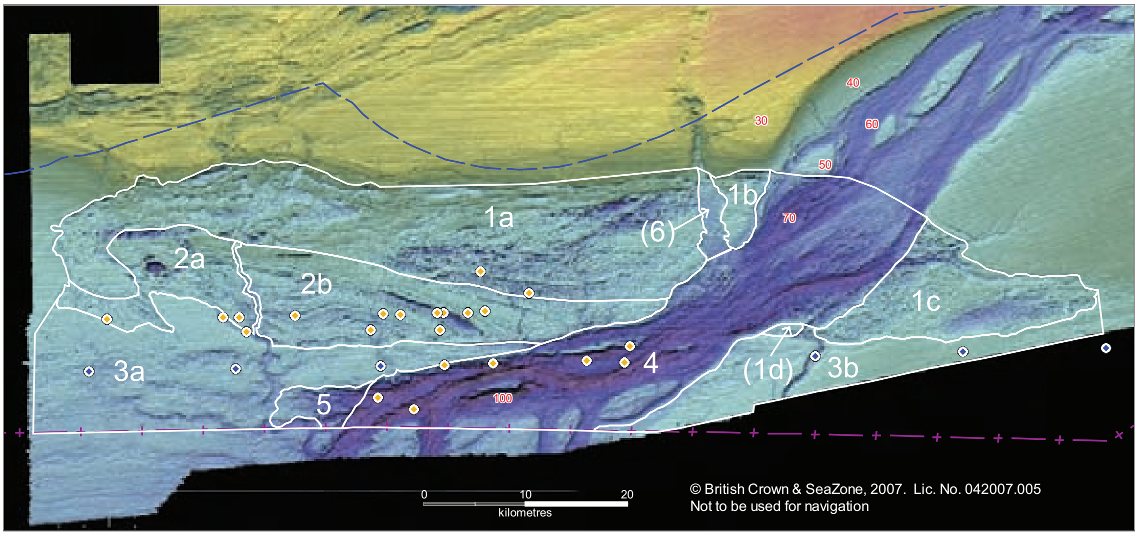


Figure 44: Wight geophysical regions overlaid on BGS solid geology map (DiGRock 250)

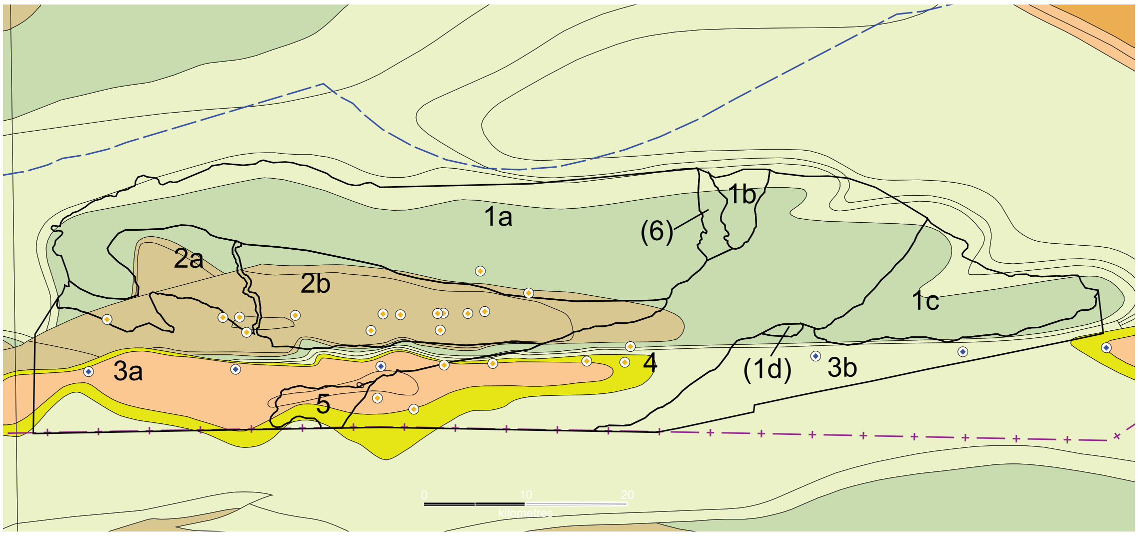
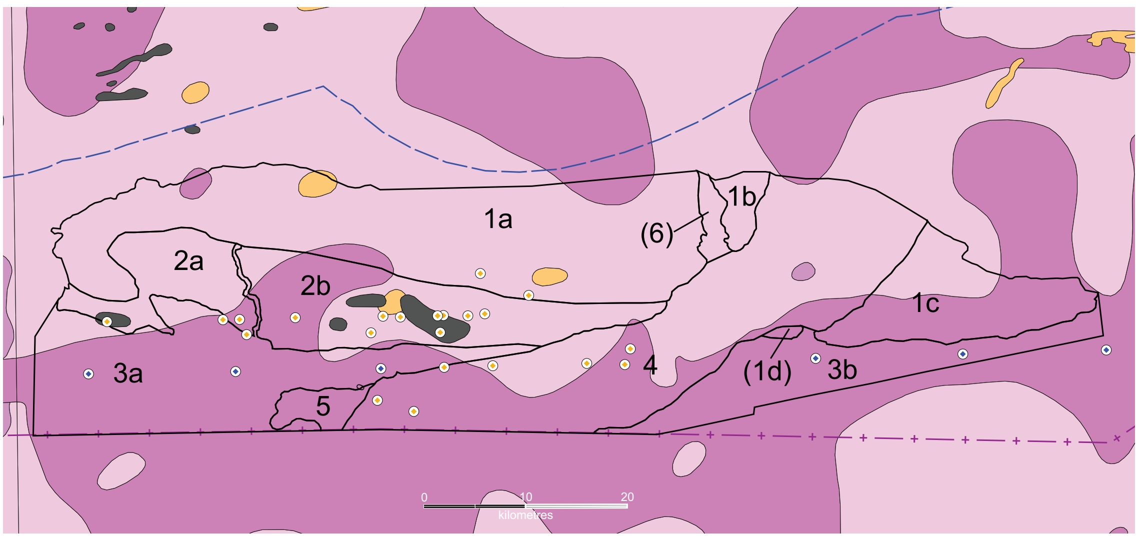


Figure 45: Wight geophysical regions overlaid on BGS seabed sediments map



The seabed surface is an irregular pattern of ridges and troughs of low elevation (1-2 m high).

Only two video stations fell in this region (WV17 & 18), but both showed a similar seabed character with low rock ledges and adjacent large sand waves (indicative of sediment transport) which evidently caused the significant scouring at the base of the rock ridges and in the troughs.

Observed biotopes and Annex I reef assignments were:

MNCR Biotope Code	EUNIS Code	Annex I reef ?
CR.HCR.DpSp	A4.12	Yes
CR.HCR.XFa.FluCoAs	A4.134	Yes
SS.SSa.OSa	A5.27	No

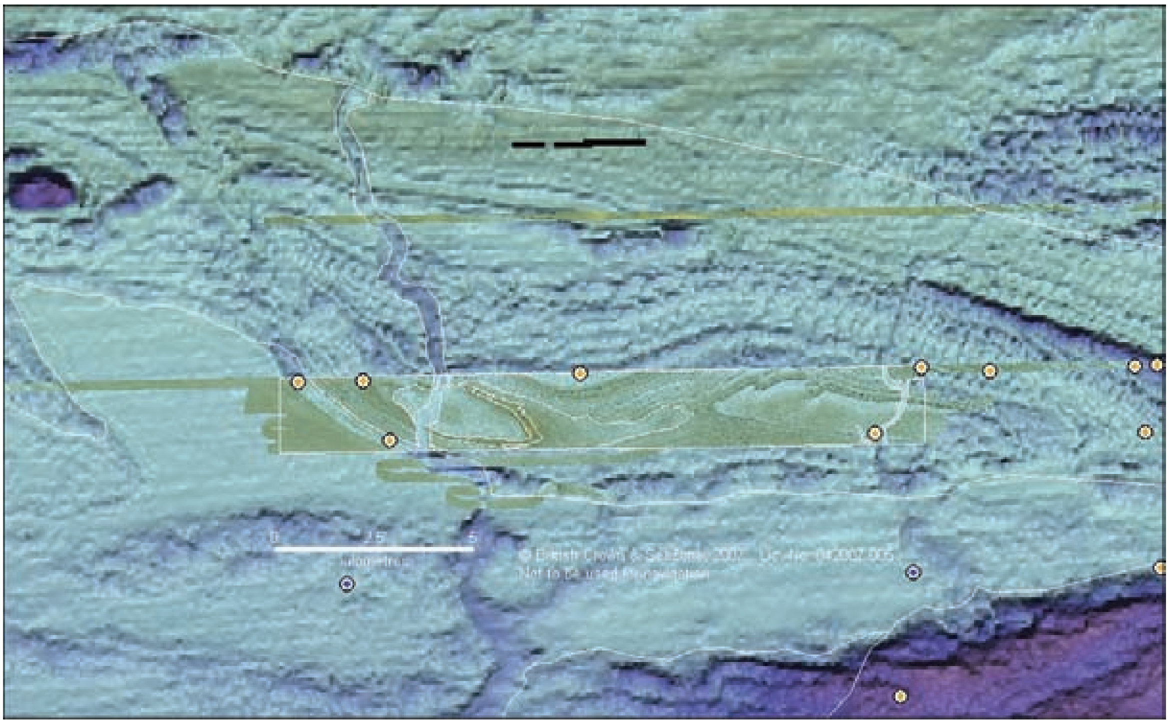
Region 2 (polygons 2a & 2b)

The rocks here are mudstones and limestones of the Kimmeridge Clay Formation and Portland Group. Video observation showed a dark grey/black rock, harder than Wealden Clay that did not break or 'scuff' on contact with the crop-camera frame. However, it was frequently noted as being 'pitted or bored' (presumably by bivalves) or smooth and polished (by scour).

The seabed surface is a series of closely spaced 2 – 4 m high ridges as evidenced by the 'corrugated' features that are apparent in both the multibeam and DSB images of the area. The clear match between the major positive features in the higher resolution multibeam image and those in the lower resolution DSB (Figure 46) justifies extrapolating our interpretation of the limited multibeam coverage to the wider area covered by the DSB. The higher resolution multibeam image shows sediment waves in some of the troughs between the outcropping rock ridges, indicating a moderate supply of mobile sediments that will likely lead to some scouring of the rock habitats.

The bedrock itself has a low dip angle and many faults are evident. The region is bisected by a palaeochannel which, on the evidence of video observations in similar channels, is most likely to have a thin base covering of coarse sediment. The southern border of polygon 2b has a notable east-west linearity and is closely associated with the abrupt change in rock type at the Central English Channel monocline (Hamblin *et al*, 1992).

Figure 46: Spatial matching between seabed features imaged by high resolution multibeam and coarser resolution DSB.



Eleven video stations fell in this Region (WV05, 06, 07, 08, 09, 10, 11, 12, 14, 19 & 20). That in the extreme western arm (WV14) noted far less sediment than the main area. The attribution of the area as 'high energy' is supported by the observed fauna (massive sponges, *Tubularia*, *Flustra*, *Sagartia*, *Urticina*) the rippled nature of sandy sediments and several observations of patches of imbricated bivalve shells.

Observed biotopes and Annex I reef assignments were:

MNCR Biotope Code	EUNIS Code	Annex I reef ?
CR.HCR.FaT.CTub.CuSp	A4.1121	Yes
CR.HCR.DpSp	A4.12	Yes
CR.HCR.XFa.ByErSp	A4.131	Yes
CR.HCR.XFa.ByErSp.Sag	A4.1313	Yes
CR.HCR.XFa.FluCoAs	A4.134	Yes
CR.HCR.XFa.FluCoAs.SmAs	A4.1342	Yes
CR.MCR.EcCr.FaAlCr	A4.214	Yes
CR.MCR.EcCr.FaAlCr.Bri	A4.2144	Yes
SS.SCS.CCS	A5.14	No
SS.SCS.CCS.PomB	A5.141	No

Region 3 (polygons 3a & 3b)

The rocks here are quite mixed, but the main characterising feature of the seabed is that of lag gravel deposit, rather than outcropping rock. Under the gravel in polygon 3a, the rock types are mainly mudstones, some sandstone and a small area chalk. In 3b it is almost exclusively chalk. The two polygons are separated by the palaeovalley, varying in width between about 8 and 30 km.

The seabed surface is mostly flat and featureless lag gravel. Some shallow palaeochannels cross the area but do not significantly change the nature of this surficial layer; at most, isolated patches or narrow lines of rock may be barely exposed around the palaeochannel rim. Consequently, the region as a whole is not considered representative of Annex I reef habitats.

Seven video stations fell in this Region, five in polygon 3a (WV13 & 21 and W11, 13 & 15) and two in polygon 3b (W05 & W07). All showed a flat seabed of lag gravel as the predominant feature.

Observed biotopes and Annex I reef assignments were:

MNCR Biotope Code	EUNIS Code	Annex I reef ?
CR.HCR.XFa.FluCoAs	A4.134	Yes
SS.SCS.CCS	A5.14	No
SS.SCS.CCS.PomB	A5.141	No
SS.SMx.CMx.FluHyd	A5.444	No
SS.SMx.CMx.OphMx	A5.445	No

Region 4 (polygon 4)

This region is the northern palaeovalley. It cuts through Regions 1, 2 & 3, so has a mixture of rock types mentioned previously. The principal feature in terms of Annex I reefs is not rock type, but depth and topography (steep walls). The palaeovalley base is also the only place where boulder fields have been recorded (Figure 34). The origin of boulders is not certain and they could be from the erosion or break up of the valley walls, or they may have been transported from far-field sites if the area was in fact formed by a catastrophic flood event (Gupta *et al*, 2007). Where neither bedrock or boulders, the palaeovalley floor appears to comprise a consolidated cobble 'pavement', with the cobbles held in place by accretions of encrusting life-forms, notably with a high proportion of cushion sponges. The rich fauna and immobile cobble would appear to be consistent with an Annex I 'stony reef'. Other habitats, like boulder fields, steep and vertical rock faces and upper rock surfaces covered in encrusting communities, are indisputably consistent with Annex I reef habitats. Massive and erect sponge forms are a notable feature of the biotopes so far recorded in the palaeovalley.

The northern limit of Region 4 has been traced approximately along a change in solid geology, with chalk to the north and mudstone (Wealden group) to the south, separated by a narrow band of sandstone/mudstone (Gault-Greensand). Beyond this northern limit we have no survey data, so and attempt at assigning biotopes would be entirely speculative.

Seven video stations fell in Region 4, namely WV01, 02, 03, 04, 15, 16, & 22. Although all of these occurred in the south of the region, it is anticipated that the cobble habitat will be a prominent feature of the northern part of the region where there are clear extensions of the seabed topography and apparent 'texture' seen around the video sampling sites in the south (Figure 43).

Observed biotopes and Annex I reef assignments were:

MNCR Biotope Code	EUNIS Code	Annex I reef ?
CR.HCR.FaT.BalTub	A4.111	Yes
CR.HCR.DpSp	A4.12	Yes
CR.HCR.XFa.ByErSp	A4.131	Yes
CR.HCR.XFa.FluCoAs	A4.134	Yes
SS.SCS.OCS	A5.15	No
SS.SMx.OMx	A5.45	Yes

Region 5 (polygon 5)

This is a small area to the southeast of polygon 3a where the Cefas acoustic surveys and the Digital Survey Bathymetry give strong indications that rock may be exposed at the seabed and so the habitats will be consistent with Annex I rocky reefs. The rock types are the same as in polygon 3a (mainly mudstone and sandstone) but the steeper incline and generally greater rugosity of the seabed here suggests exposed rock will be prominent at the seabed surface rather than the lag-gravel that is characteristic in polygon 3a. No video stations occurred in this area, so assigning biotopes has not been possible.

Region 6 (polygon 6)

This small region delineates a palaeochannel separating polygons 1a and 1b and is unsurveyed. It marks the southern end of a channel cut through the chalk strata to the north and it is therefore anticipated that the bed of the channel will be of 'fluvial' gravel and so not consistent with Annex I reef habitats. Further sampling will be required to confirm this.

Spatial area of each Region

The division of the study area into geophysical regions is a useful stage in the process of selecting areas for consideration as SACs. The division used here offer the potential to include or exclude certain areas, according to their perceived conservation priority, enabling several boundary options to be considered. To help inform these decisions, the spatial area of each region and sub region is given in Table 7.

Regions 1 and 2 are considered to be consistent with rock outcropping at the seabed surface and 'arising from the seabed' (one term used in the definition of Annex I reef given by Aish *et al*, 2007). The two Regions represent a total area of 1,104 sq km. This compares to an area of 26 sq km for the 'undifferentiated rock' mapped in the Wight AoS on the seabed sediment chart (Figure 1, Figure 45) and nearly 28,000 sq km for the large area of gravel referred to by Graham *et al* (2001) as "reef feature R1312" that covers much of the Wight AoS and beyond.

Table 7: Spatial areas of geophysical Regions and sub regions

Region	Total Area (sq km)	Sub-regions	Area (sq km)
1	758	1a	565
2	346	1b	26
3	513	1c	163
4	513	1d	4
5	29	2a	109
6	18	2b	237
Sum	2177	3a	340
		3b	173

5.4.2 Correlation between physical regions and biotopes

It was of interest to see if certain biotopes encountered in the Wight area were restricted to certain rock types, as such a correlation would help predictive mapping in areas not yet sampled by video. The geophysical regions reflect both rock type and topography/texture of the seabed, so it is informative to see the distributing of biotopes in respect to the DSB and geophysical regions. Accordingly plots have been prepared showing the distributions of the biotopes observed, grouped by the major hierarchical levels in the EUNIS classification:

A4.1 'High Energy Circalittoral Rock' (Figure 47)
A4.2 'Moderate Energy Circalittoral Rock' (Figure 48)
A5.1 'Sublittoral coarse sediments' (Figure 49)
A5.2 + A5.4 'Sublittoral sands and mixed sediments' (Figure 50)

Figure 47: EUNIS 'high energy' circalittoral rock biotopes overlaid on DSB

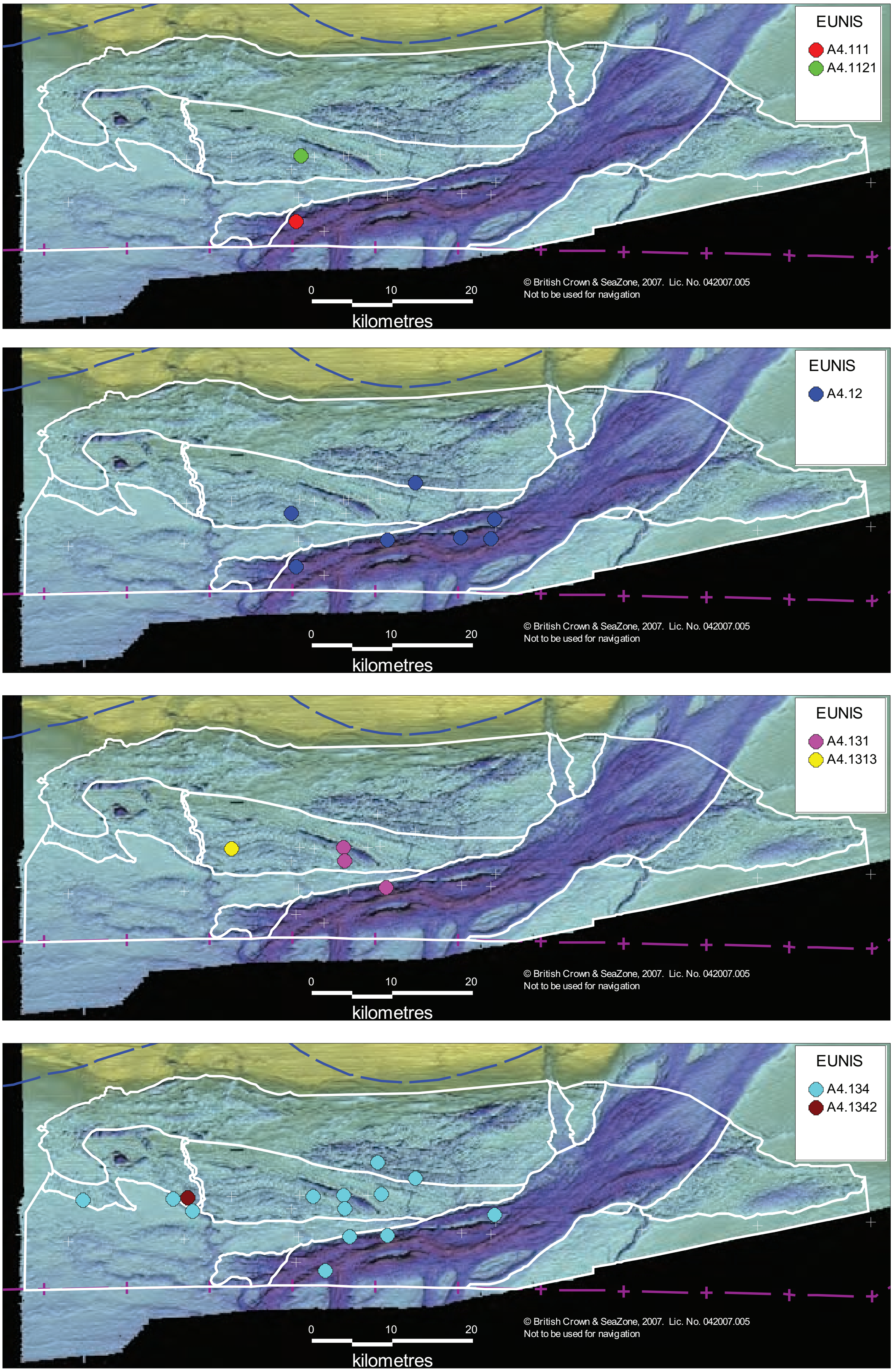


Figure 48: EUNIS 'moderate energy' circalittoral rock biotopes overlaid on DSB

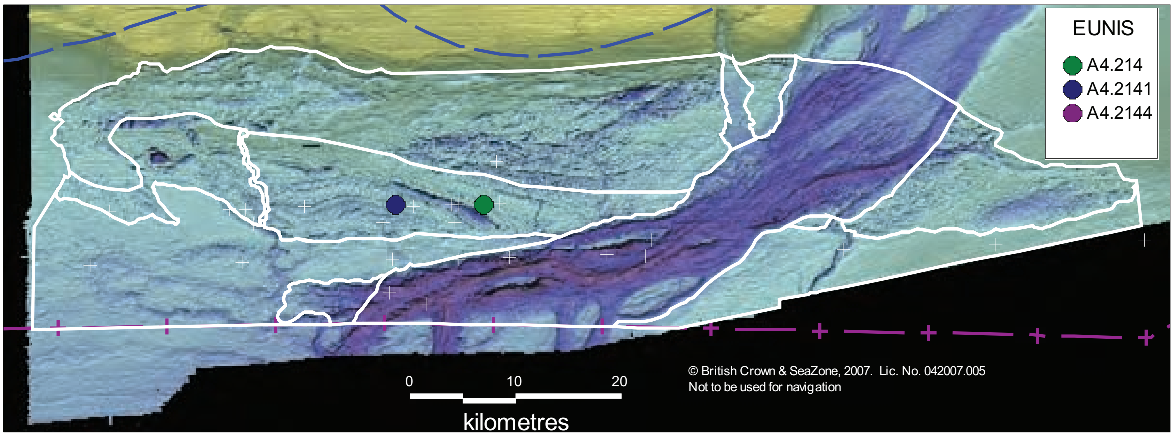


Figure 49: EUNIS 'sublittoral coarse sediment' biotopes overlaid on DSB

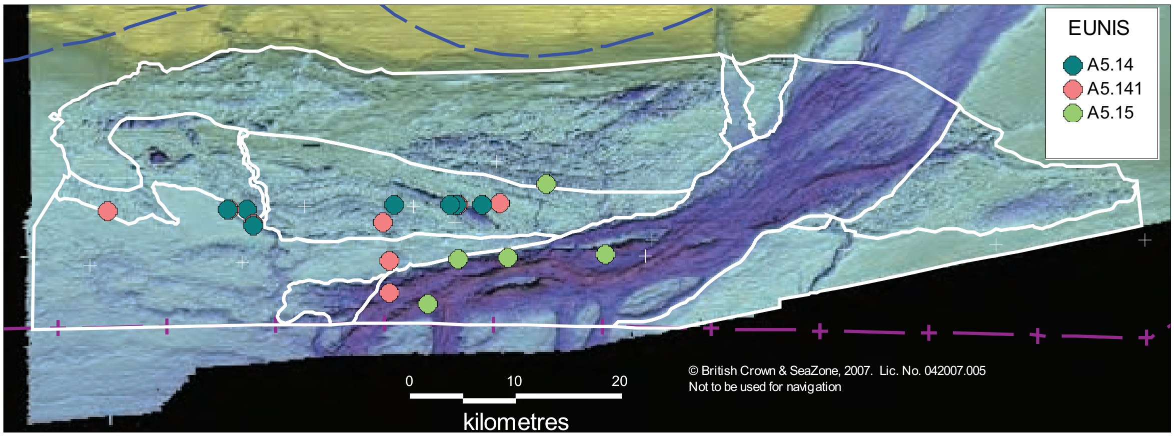
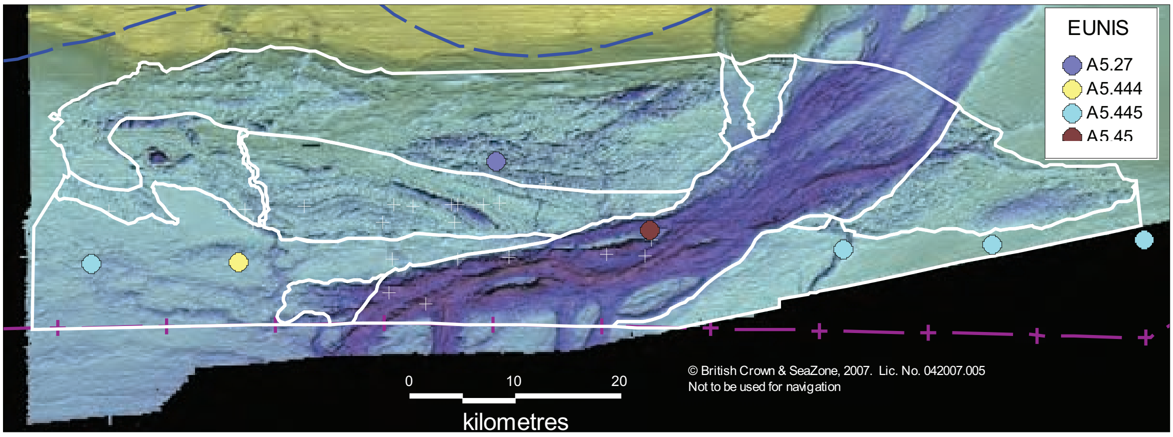


Figure 50: EUNIS ''sublittoral sand' and 'sublittoral mixed sediment' biotopes overlaid on DSB



There is no apparent correlation between the rock biotopes and the rock types, which initially may be contra to expectations. However, it is noted that the majority of the rock types sampled by video on this survey were mudstones of one sort or another, with very limited amounts of chalk or limestone occurring in the sampled area. It would appear the rock types are not sufficiently dissimilar that they support grossly different faunal communities. Substrate type remains the principal environmental factor governing the distribution and occurrence of biotopes. The 'energy status' of an area was also seen to be important, even at a local level. There was some compelling evidence among the rocky ridges that there was a difference in higher level biotope class between adjacent scarp and dip slopes. At WV10 in Region 2, the steeper scarp slopes had communities typical of fast moving currents (A4.1121 = CR.HCR.FaT.CTub.CuSp) while their dip slopes supported communities characteristic of only moderate energy environments (A4.2141 CR.MCR.EcCr.FaAlCr.Flu; compare Figure 47 and Figure 48).

Depth zoning

There was some evidence that certain biotopes tended to be found at greater depth, In particular these were the 'deep sponge' communities (A4.12; CR.HCR.DpSp) which were mostly associated with the walls and floor of the palaeovalley. The physical habitat here was rough and rugged rocks and cobbles, unlikely to be impacted by any anthropogenic physical disturbance, and this may be a contributing factor in allowing such sponge communities to persist, and even to develop on cobble grounds

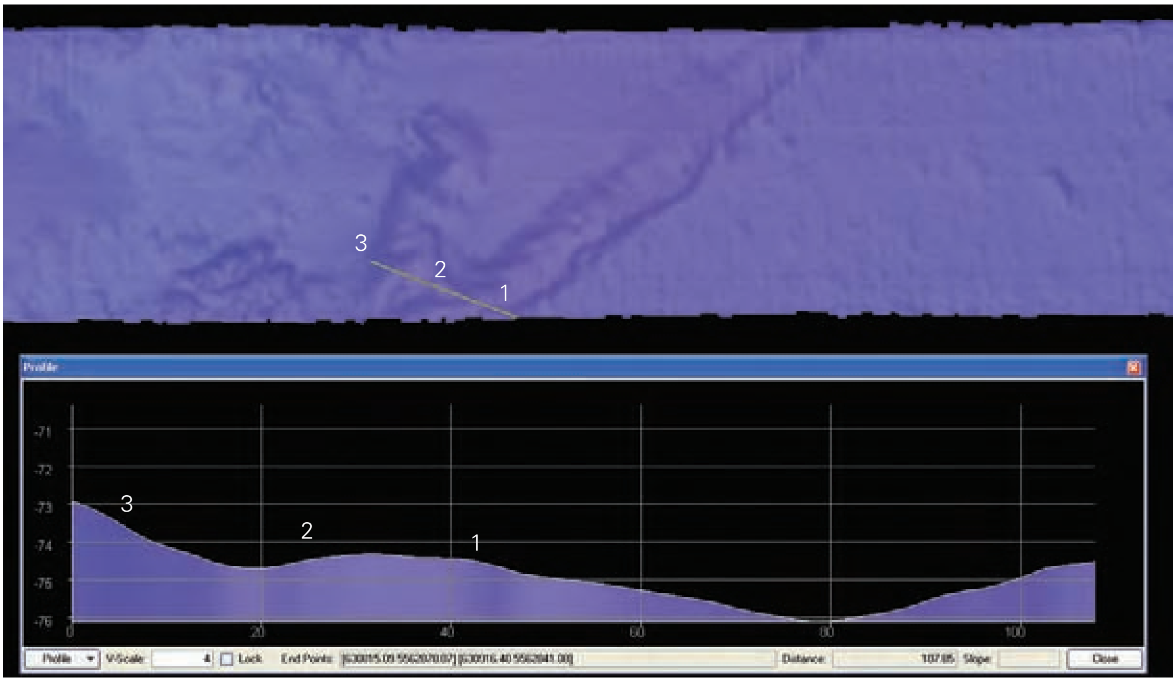
5.4.3 Integrated assessment for WV stations

As there was frequently a great deal of variability within sampling stations, rather than between them, it is informative to make an integrated assessment for each sampling station in turn. This has been competed for the 22 WV stations which targeted rock habitats but not for the 'W' stations which targeted gravel and showed no within station variability (Table 4)

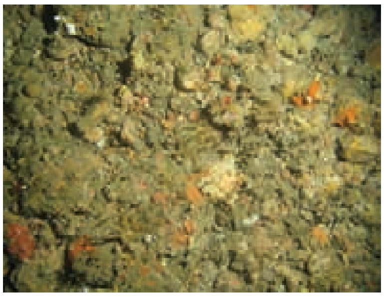
Stations are summarised, one per page in the following section Each summary shows a Fledermaus screenshot of the multibeam bathymetry surface at the station, complete with a profile along the video tow, showing the topography of the seabed. Still images from the video tow have been selected to show the variety of biotopes encountered at each site and their position along each tow is indicated by numbered target points (i.e. point 1 refers to photo 1). Direction of tow can be determined from the number sequence, so photo 1 was taken before photo 2. Each photo is labelled with the biotope code assigned to the segment of video from which it was taken. Below the table presenting the images, there is a narrative describing the site, why it was selected and how each segment/biotope appeared on video. Notes are also included (when warranted) relating to

i) the biotope assignment
ii) potential development of the MNCR biotope classification scheme and
iii) general biological observation.

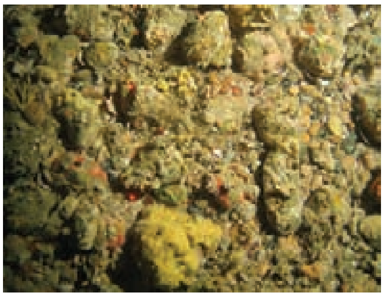
WV01: Palaeovalley floor. Cobbles consolidated by encrusting sponge



1. CR.HCR.DpSp



2. CR.HCR.DpSp



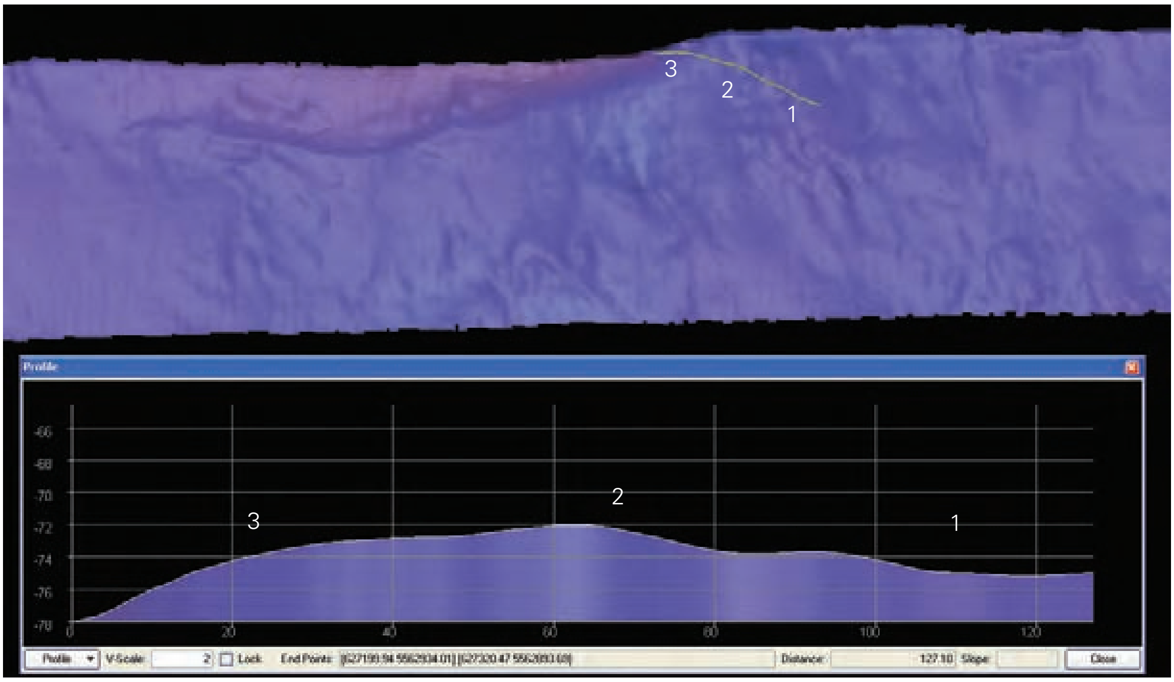
3. CR.HCR.DpSp

Palaeovalley floor (approx 70 m depth). Flat consolidated cobble with some gravel & small boulders.

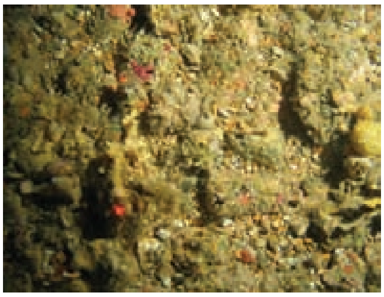
Cobbles typically in a stable, consolidated pavement, accreted by profuse covering of cushion-morph sponges and other encrusting fauna. Some arborescent and massive cushion forms present. Community features hydroids, anemones, tube worms, *Pentapora*, *Corynactis*.

Consistent with Annex I 'Stony reef'

WV02: Palaeovalley floor. Cobbles consolidated by encrusting sponge, deepening to clean 'fluvial' gravel. (**NB pictures 4-6 lie to the north of the multibeam track**)



1. CR.HCR.DpSp



2. CR.HCR.DpSp

3. CR.HCR.DpSp

4. SS.SCS.OCS

5. SS.SCS.OCS

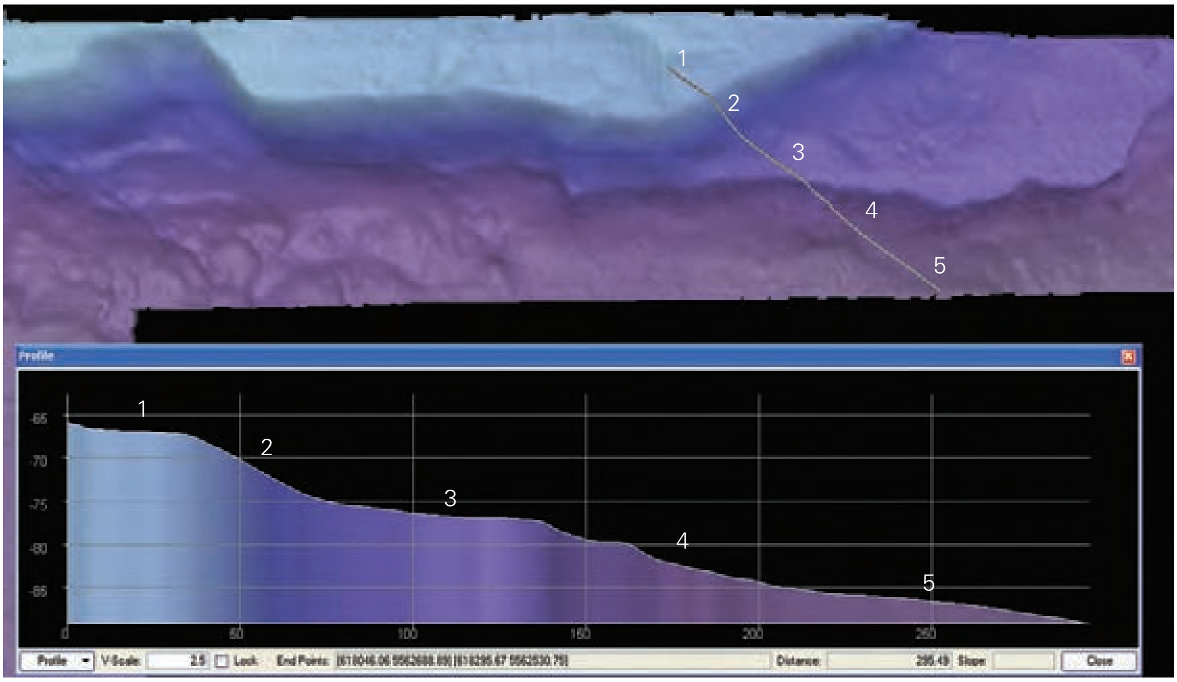
6. SS.SCS.OCS

Palaeovalley floor at approx 70m. Targeting sharp transition in sidescan backscatter, just outside the multibeam swath (see separate acoustic images Annex). Observations show transition was from a consolidated cobble 'reef' (as in WV01) to a topographic depression filled with clean 'fluvial' gravel.

1st biotope. Stable, consolidated cobble pavement heavily encrusted & accreted with cushion sponges & hydroids. Frequent anemones & *Pentapora*. Consistent with Annex I 'Stony reef'.

2nd biotope. Gravel with hydroids & anemones. Not consistent with Annex I reef.

WV03: Palaeovalley rim, wall & floor

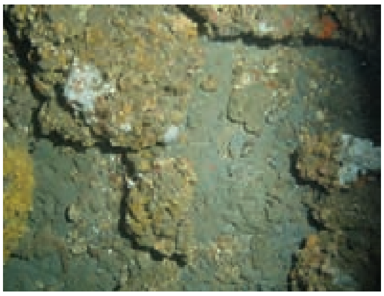


1. SS.SCS.OCS

2. CR.HCR.XFa.ByErSp

3. CR.HCR.XFa.ByErSp

4. CR.HCR.DpSp



5. CR.HCR.XFa.FluCoAs

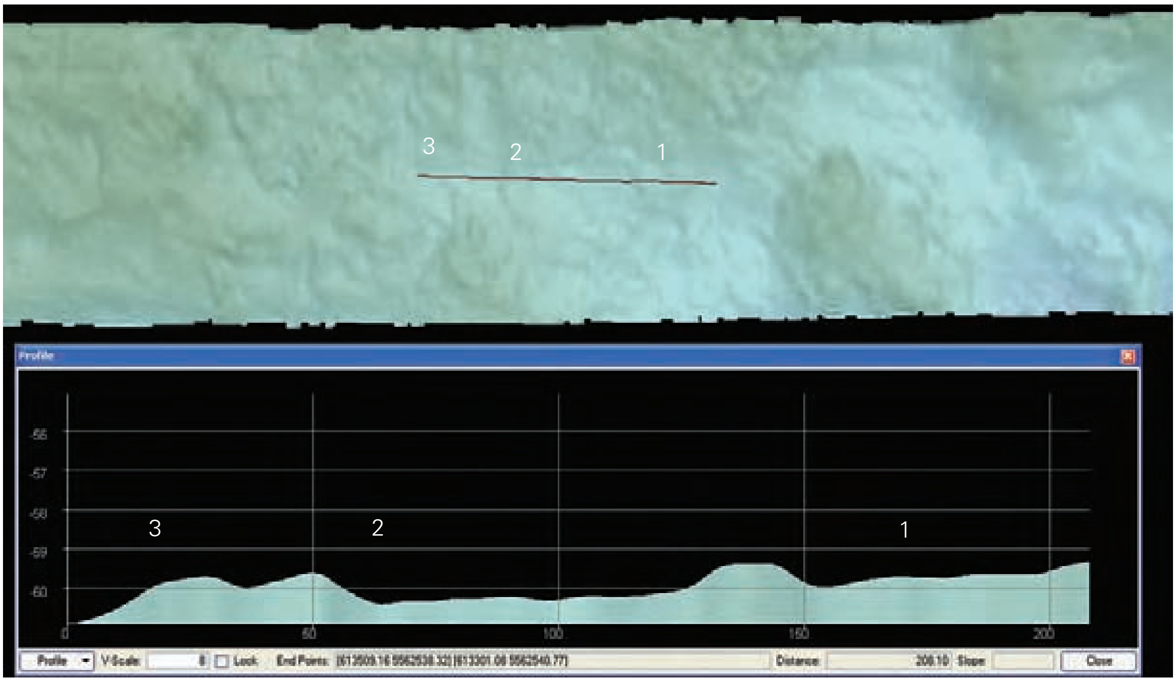
NB 1, 2 & 3 have red bedrock (as in WV13) but 4 and 5 have grey bedrock (as in WV5 to WV11).

Bryozoan : Sponge ratio differentiates ByErSp from DpSp

Transit down the northern wall of the palaeovalley, (65 to 85 m depth). Fledermaus profile shows the edge is not as steep as anticipated from plan view of multibeam.

Five video segments with four biotopes. Valley rim (1) comprised coarse cobble & gravel, thinly overlaying red bedrock. *Flustra* and encrusting sponge. 'Bluff slope' (2) of boulder and broken bedrock with massive, cushion & arborescent sponges in a hydroid crust. 'Ledge' (3) was a boulder field on coarse cobble & gravel, with *Flustra*, arborescent & cushion sponges. Lower slope (4) was boulder on smooth grey bedrock with cushion, massive and arborescent sponges, but only minor hydroid cover (rejected XFa.ByErSp as non-scoured surfaces were almost 100% covered with sponge. *cf* segments 2&3). Palaeovalley floor (5) was a thin layer of coarse cobble & gravel overlaying bedrock. Dominance of *Flustra*, some ascidians & bryozoan/hydroid crust.

WV04: London Clay. Flat coarse sediment changing to barely exposed bedrock with large & small boulders in a field of cobble & pebble rich coarse sediment.



1. SS.SCS.OCS

2. CR.HCR.XFa.FluCoAs

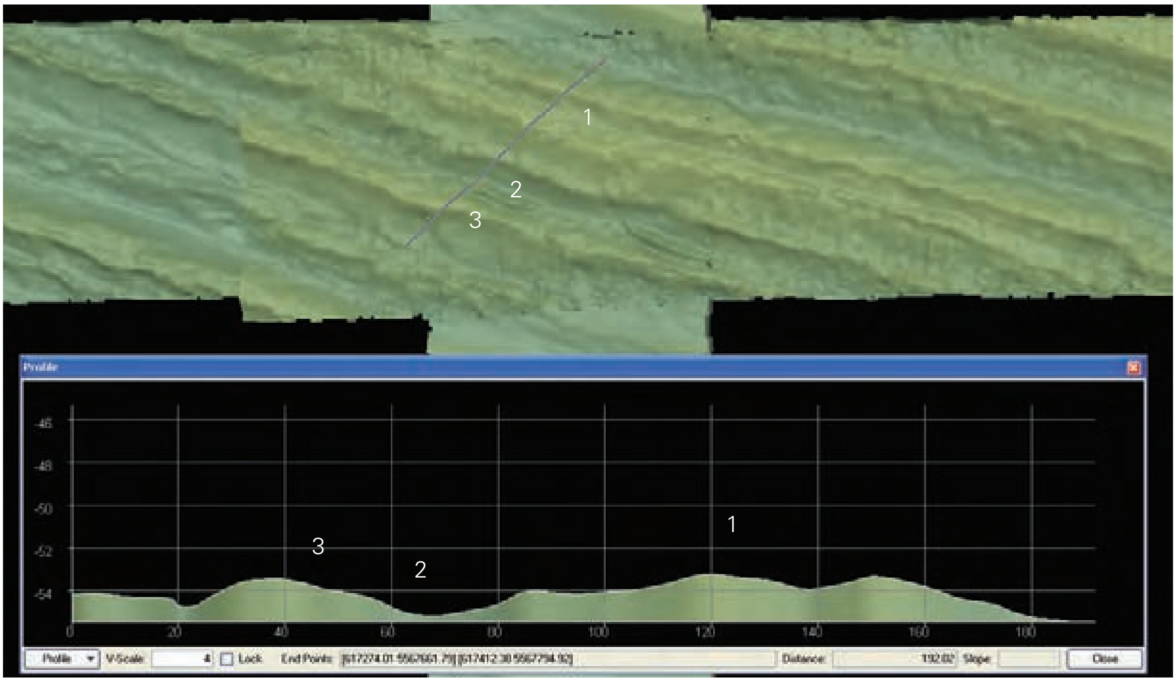
3. CR.HCR.XFa.FluCoAs

Relatively flat and smooth seabed with only minor textural features on multibeam & sidescan. Approx . 60 m depth. Transition from flat, coarse sediment to barely exposed bedrock. Two video segments, two biotopes

1st biotope. Flat coarse sediment (cobble, pebble & gravel) with fine hydroid crust & *Pomatoceros* on larger particles. Some consolidated areas with anthozoa, sponges & tunicates. *Botryllus* prominent.

2nd biotope. (Pics 2 & 3). Barely exposed bedrock patches (some red, some grey) with large & small boulders in a field of cobble & pebble-rich coarse sediment. Flustra, hydroids & sponge (encrusting & cushion forms) on stable rock. Tide swept.

WV05: Kimmeridge clay. Grey bedrock & boulders in bedding plains with low dip angle. Moderate sediment supply. Some scour. Alternating pattern of two biotopes.



1. CR.HCR.XFa.FluCoAs

2. SS.SCS.CCS.PomB

3. CR.HCR.XFa.FluCoAs

Relatively flat seabed floor with low relief ridges giving 'corrugated' appearance on multibeam & sidescan. Alternating pattern of exposed rock crests with bands of coarse sediment (mainly cobbles) lying in the troughs.

1st biotope. Flat silted smooth bedrock ridges entirely covered with mixed hydroid/bryozoan turf with ascidians (solitary & gregarious), *Flustra* and Anemones.

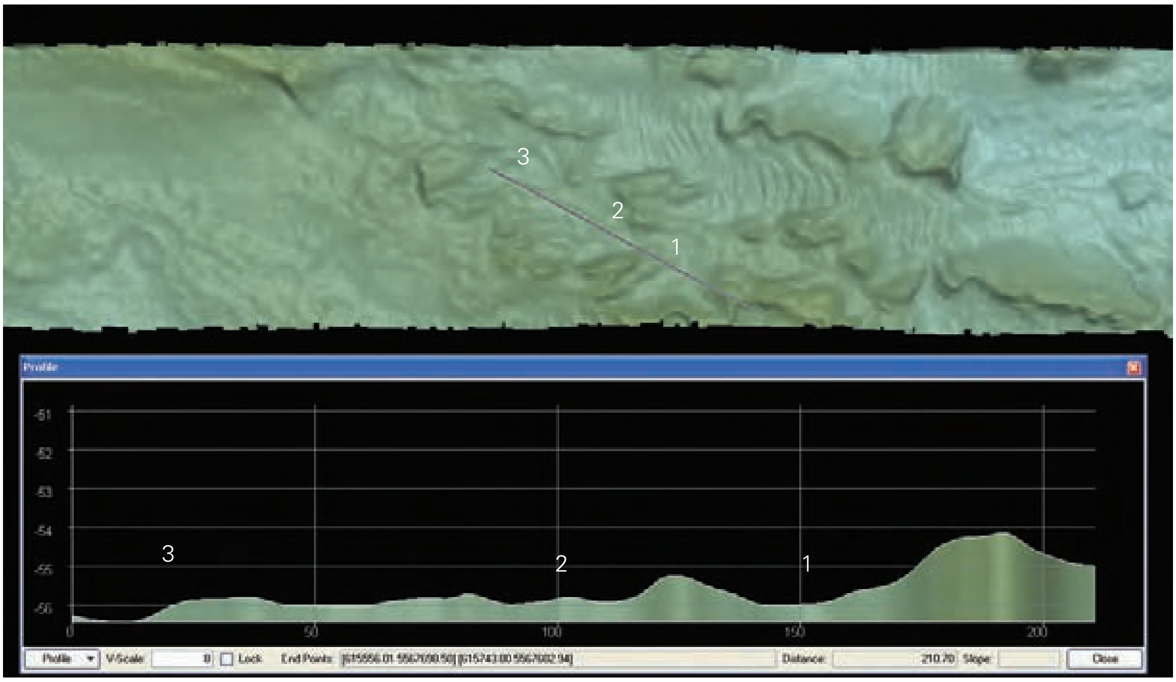
2nd biotope. Cobble, pebble & gravel, with some bryozans and encrusting sponge, *Pomatoceros* & *Nemertesia*

Biotope assignment notes

Opted for HCR.XFa.FluCoAs over MCR.EcCr.FaAlCr (could be either).

Opted for CCS.PomB over SMx.CMx.FluHyd as little finer sediment (sands & mud) was present.

WV06: Grey smooth bedrock. Low dip angle. Good sediment supply. Alternating mosaic of three biotopes



1. CR.MCR.EcCr.FaAlCr.Bri

2. SS.SCS.CCS

3. CR.MCR.EcCr.FaAlCr

Selected an area on the multibeam & sidescan where the regular 'corrugated ridges' seen in WV05 appeared to be distorted and broken. These features, seen clearly on the multibeam, coincide with a 30 km long WNW-ESE trending linear feature on the Digital Survey Bathymetry that may be the surface expression of a change in rock strata from the Purbeck group on the north side of the line to Kimmeridge Clay on the south side (strata coded as 'jpkz' and 'jd' respectively on BGS solid geology chart).

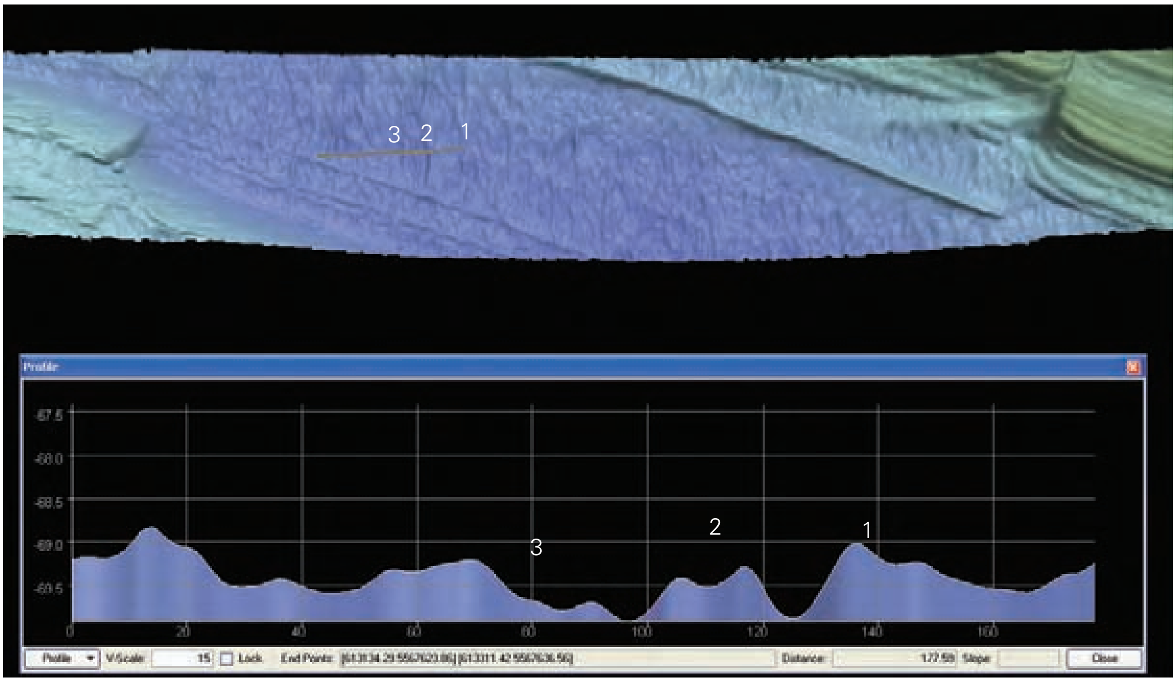
The three biotopes occurred in a repeated sequence over the course of the 20 minute drop-camera tow, each one appearing for of just a few minutes duration at a time, but generally in the following order.

1st biotope (Pic 1). Flat, smooth, low elevation (1m) outcrops of silted grey bedrock, with superabundant ophiuroids (mostly *Ophiothrix fragilis* with some *Ophiocomina nigra*). Also supporting *Urticina* & *Pomatoceros*.

2nd biotope (Pic 3). Broken bedrock & boulders (likely being around the crests of ridges) covered with a faunal crust in which encrusting and cushion sponges were prominent.

3rd biotope (Pic 2). Cobbles and coarse sediment largely devoid of epifauna. Notable for flat discoid cobbles.

WV07: Palaeochannel floor. Smooth, flat, black, pitted bedrock (scoured clean) overlain by coarse sediment of cobbles (with epifauna) and clean 'fluvial' gravel. Mosaic of two biotopes.



1. SS.SCS.CCS.PomB

2. SS.SCS.CCS.PomB

3. SS.SCS.CCS

Targeted a broad but shallow deepening of the seafloor reminiscent of a 'palaeochannel', which is now also seen as a prominent feature on the Digital Survey bathymetry, with a length of ~15 km. Multibeam and sidescan showed a slight irregular texture but no indication of mobile (regular) sand ripples. In general the video showed smooth flat, black bedrock overlain by coarse sediment, apparently moving from cobble to clean 'fluvial' gravel (as if in a stream-bed) and then back to cobble. Notably, much of the dark bedrock was heavily pitted. Close inspection of photographs could not determine if the pits were biogenic or geogenic in origin, being filled with both shell fragments and small pieces of gravel. No live/dead rock-boring bivalves were seen, but the pattern of pits is reminiscent of their 'signature'. Patches of imbricated dead shells suggest strong currents.

1st biotope. (Pics 1 & 2). Flat palaeochannel floor with smooth, black, pitted bedrock overlain by thin cover of stable cobbles, many having hydroid/bryozoan crusts and encrusting and/or cushion sponges. No erect sponge forms; cobbles not accreted by sponge (as seen at WV01). Notable presence of barnacles, with colonial and solitary ascidians.

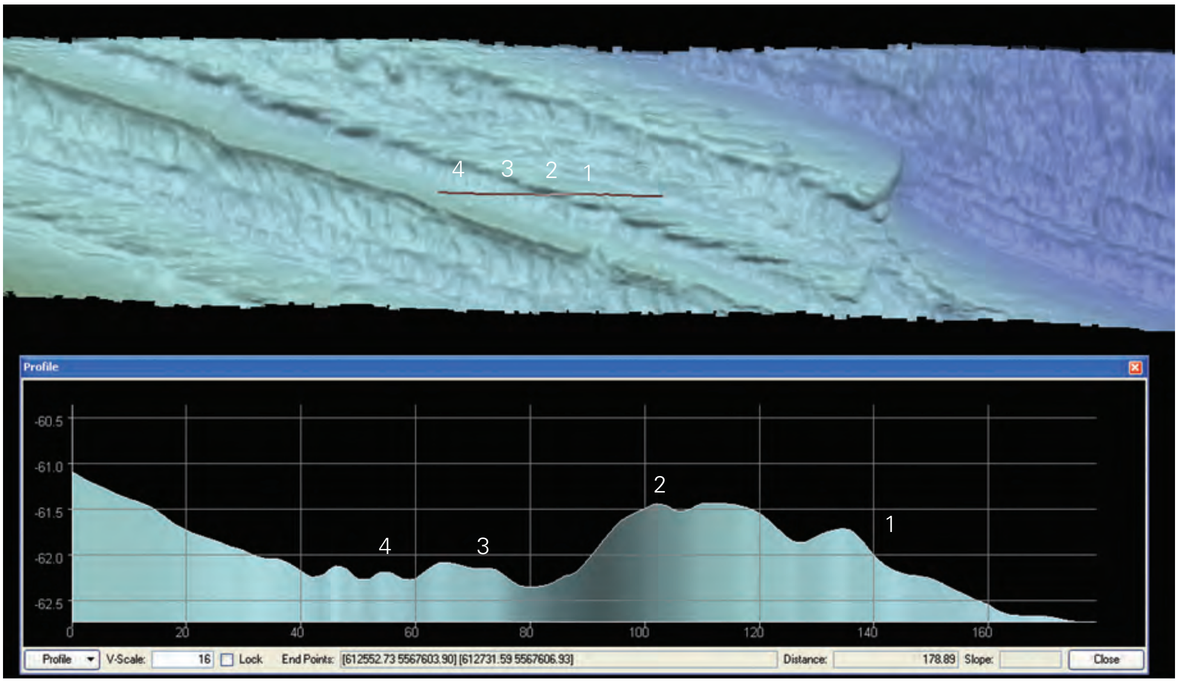
2nd biotope (Pic 3). Clean fluvial gravel, barren, as if from a stream running along the palaeochannel.

Notable rapid transitions (over just a few metres) between the cobble and stream-like fluvial gravel.

Biotope assignment notes

Rejected XFa.ByErSp as no erect sponges were seen.

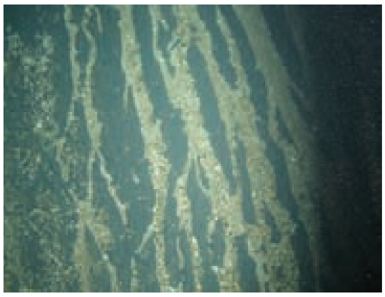
WV08: Smooth flat black bedrock with low dip angle. Fauna on elevated parts, but lower parts scoured clean. Some 'fluvial' gravel in channels. Alternating mosaic of three biotopes



1. CR.HCR.XFa.FluCoAs

2. CR.HCR.XFa.ByErSp

3. Scoured rock (afaunal)



4. SS.SCS.CCS

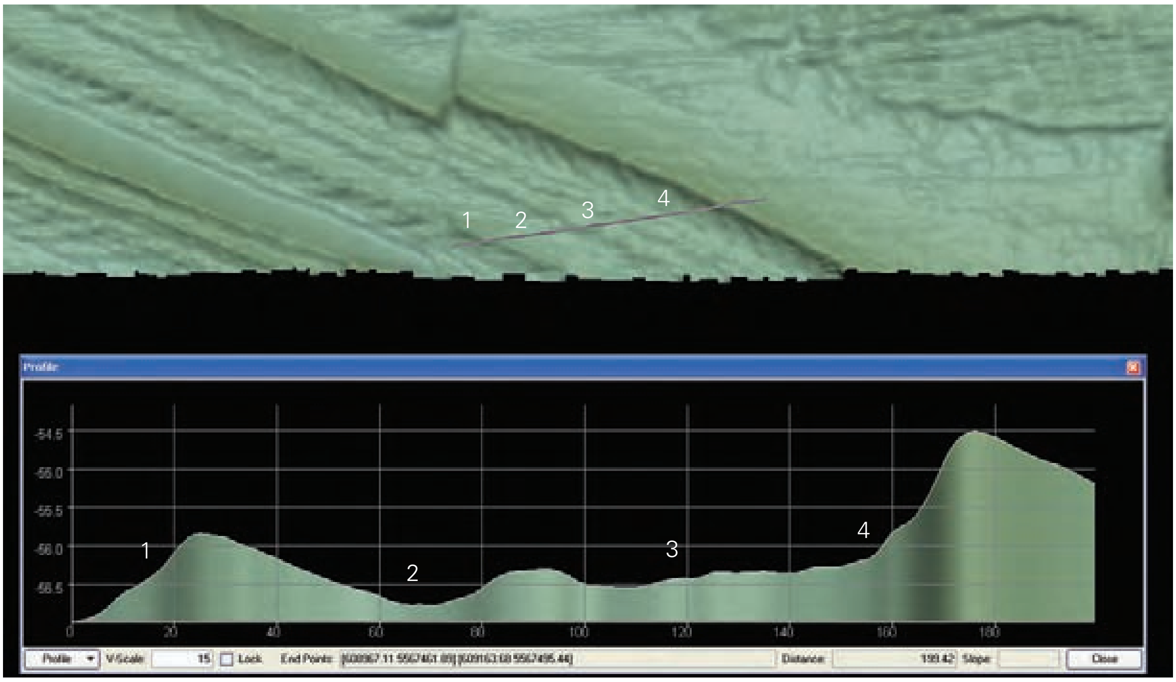
Just west of WV07, targeting low elevation rock ridges having strong backscatter on sidescan. Very smooth black bedrock, in ridges about 2 metres high, scoured and polished in channels where there is good sediment supply. Encrusting communities away from scoured regions.

1st biotope. (Pic 1). Smooth, slightly inclined flat black bedrock slopes, with Flustra, *Botryllus* and encrusting sponge. Heavy sand & gravel scour abrades all life in places (Pic 3).

2nd biotope (Pic 2). Smooth flat inclined black bedrock slopes (away from scour) with mixed encrusting community of sponges (encrusting, cushion, globose & arborescent forms), hydroid/bryozoan crust and anemones.

3rd biotope (Pic 4). Clean stone gravel, devoid of epifauna (restricted to troughs between ridges).

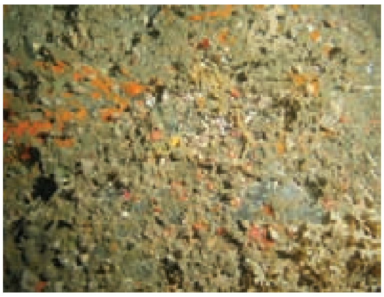
WV09: Smooth flat black bedrock with low dip angle. Discoid cobbles in channels, moderate scouring. Fauna on elevated parts. Single biotope



1. CR.HCR.XFa.FluCoAs

2. Discoid cobbles

3. CR.HCR.XFa.FluCoAs



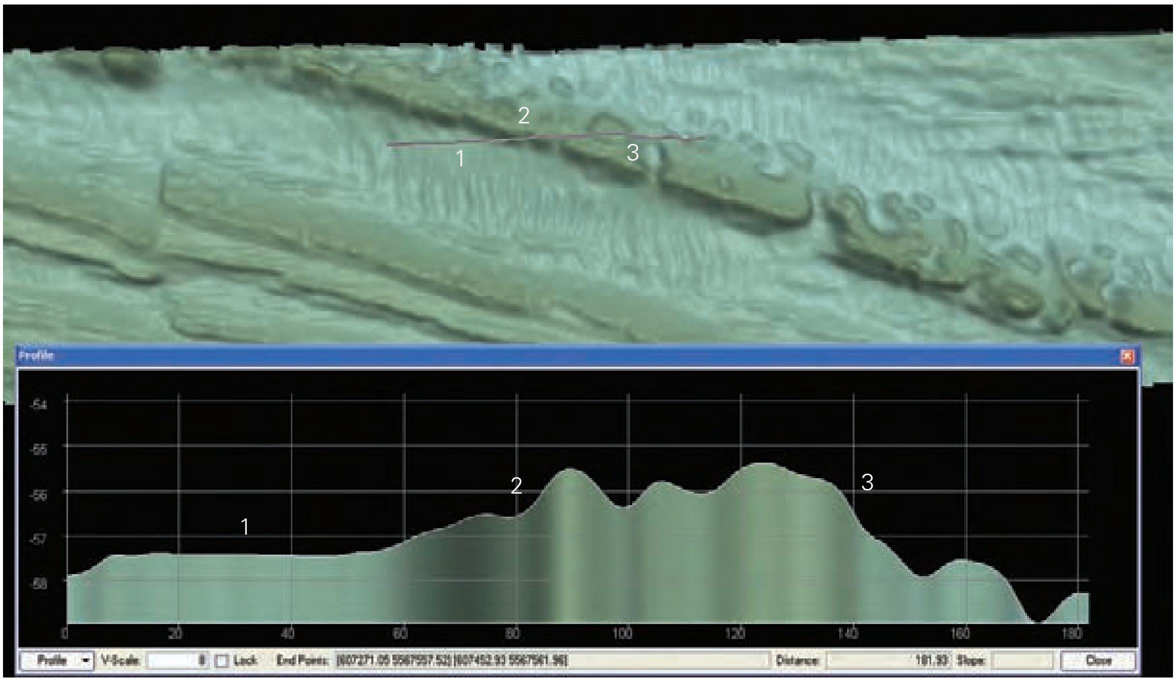
4. CR.HCR.XFa.FluCoAs

Targeting low elevation rock ridges having strong backscatter on sidescan. Smooth black bedrock in ridges about 2 metres high. Moderate scour in channels from mobile shell gravel & coarse sand. Encrusting communities away from scoured regions.

Single biotope. (Pics 1, 3 & 4) Smooth, slightly inclined flat black bedrock, sometimes fissured or broken. Strongly scoured in places. Faunal crust of hydrids/bryozoans, with *Flustra*, ascidians, encrusting sponges, *Urticina*, tunicates (*Botryllus*) and *Pomatoceros*.

NB. **Very** brief patches of steeper rock/boulder occur (possibly CR.HCR.XFa.ByErSp) and patches of discoid cobbles (Pic 2), but these are not essentially different from XFa.FluCoAs.

WV10: Sediment filled channel leading to flat black & grey bedrock scarp broken vertically into angular fissures & boulders. Moderate dip angle, scoured. Rock habitats in alternating mosaic



1. SS.SCS.CCS

2. CR.HCR.FaT.CTub.CuSp

3. CR.MCR.EcCr.FaAlCr.Flu

Targeting low elevation rock ridges having strong backscatter on sidescan. Linear form notably disturbed/deformed/eroded in places, in contrast to adjacent ridges. This signature/pattern is just about discernable on Digital Survey bathymetry. Smooth black bedrock, polished when scoured, Some grey bedrock. Moderate dip angle. High level of scour in places adjacent to channel infilled with sandy gravel (sediment ripples visible on multibeam).

1st biotope. (Pic 1). Flat sandy gravel with pebbles and occasional black discoid cobbles. No epifauna. A few sand ribbons. Gravel appears to be mostly fluvial flints. Possibly old river or stream channel.

2nd biotope. (Pic 2). Steep rock face , broken vertically (rather than horizonatally) giving rock/boulder complex. Heavily sand scoured. Dense *Tubularia & Actinothoe* on the most exposed parts, grading to sponges (massive, arborescent & cushion forms) ascidians & fan worms (*Bispira*) in more sheltered areas.

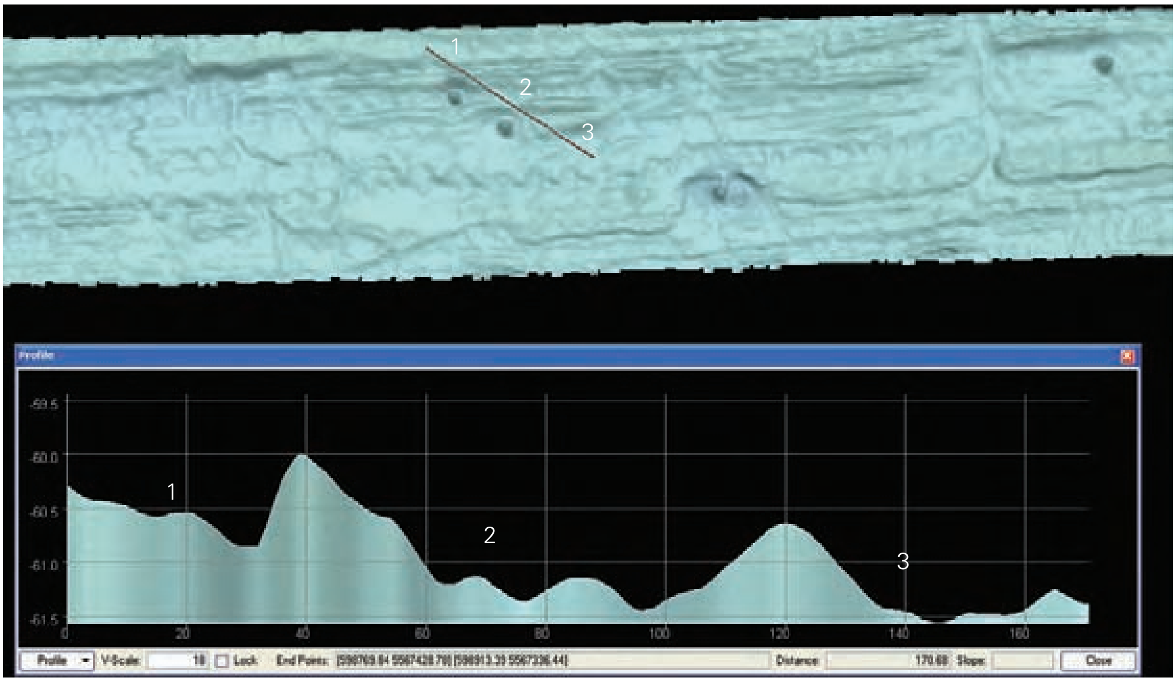
3rd biotope. (Pic 3). Flat smooth bedrock dip-slope with occasional crevices. Dominated by *Flustra* and *Crissia*. Heavily sand scoured, occasional globulose sponges (*Polymastia*).

Bitopes 2 & 3 repeat in sequence, biotope 2 on the (broken) scarp face, biotope 3 on the (smooth) dip slope.

Biotope assignment notes

Biotope 3 had notably less diverse fauna than areas previously assigned to HCR.XFa.FluCoAs, hence assignment of MCR.EcCr.FaAlCr.Flu.

WV11: Flat black bedrock, low dip angle. No sediment supply, not scoured. Single biotope.



1. CR.HCR.XFa.ByErSp.Sag

2. CR.HCR.XFa.ByErSp.Sag

3. CR.HCR.XFa.ByErSp.Sag

Similar fauna to WV10, but no scour or silting here, so community is weighted towards sponges & anemones, with vastly reduced Flustra.

Targeting area of flat bedrock with irregular patterns in multibeam and sidescan, quite dissimilar to the regular ridge formations seen in WV 5, 8, 9 & 10.

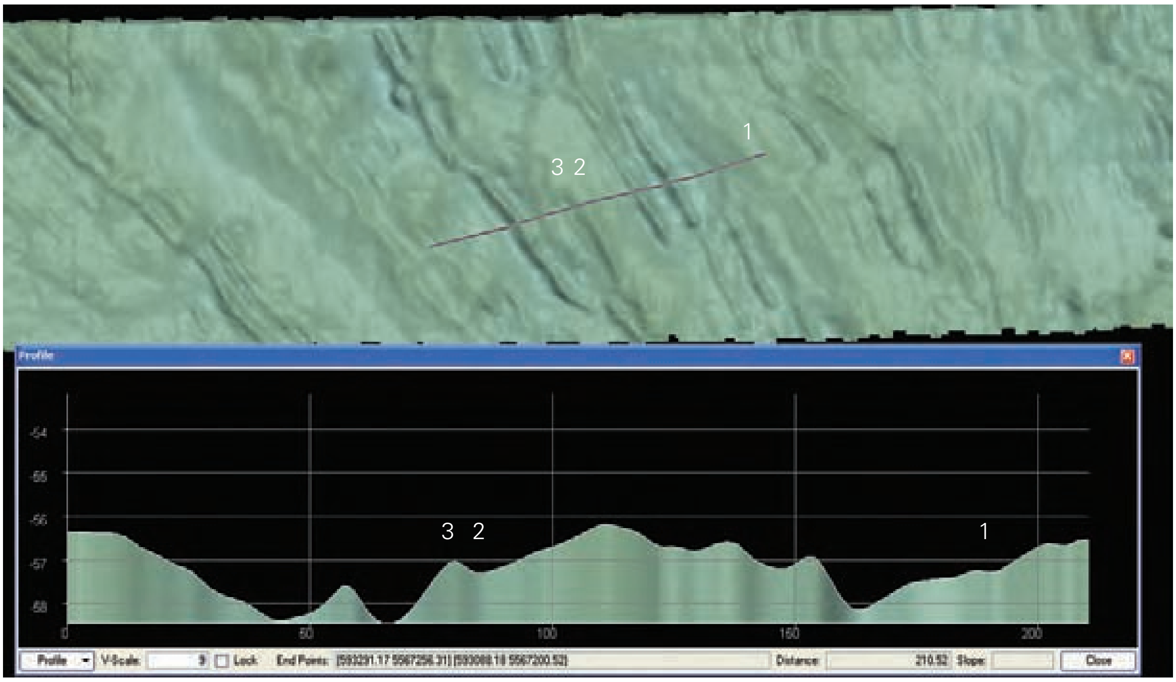
Single biotope. Flat black, pitted bedrock, slight incline. Many anemones (Sagartis & Urticina types) and good cover of encrusting & cushion sponges, amongst hydroid/bryozoan crust.

Biotope assignment notes

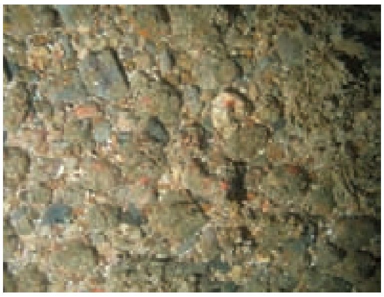
Similar fauna to WV10, but there is no scour or silting at WV11, so the balance of fauna is weighted towards sponges & anemones, with vastly reduced amounts of *Flustra*. Also, notably the first record of *Asterias*, may be associated with the relative shallowness of this station (~60m).

Rock seems very similar to that at WV10.

WV12: Smooth, flat, black bedrock, very low dip angle. Moderate sediment supply & scour. Rapidly alternating mosaic of three biotopes.



1. CR.HCR.XFa.FluCoAs



2. SS.SCS.CCS

3. HCR.XFa.FluCoAs.SmAs

Targeting a pattern of barely elevated, discontinuous ridges seen on both multibeam and sidescan suggesting rock at or near the seabed surface, but dissimilar in form to the ridges at WV 5, 8, 9 & 10. Observations showed very low elevation (~ 1m) outcrops of smooth black bedrock, generally covered by coarse substrate (gravel & cobbles). Little sand, low scour.

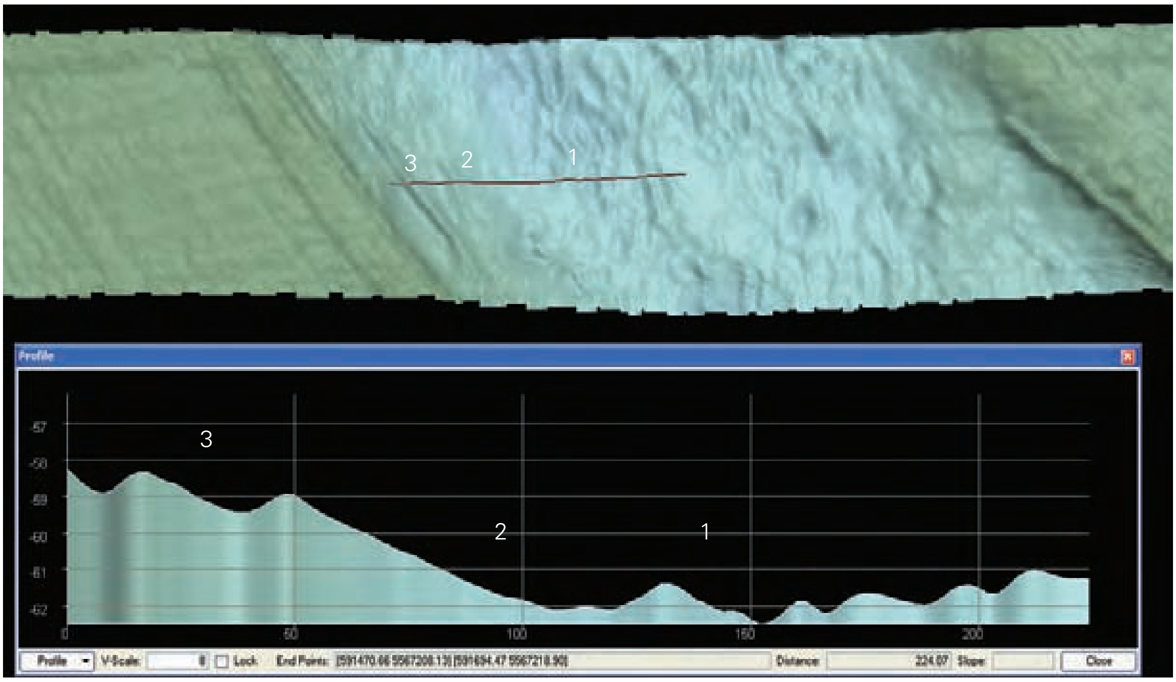
1st biotope. (Pic 1). Consolidated cobbles with small boulders supporting hydroid crust, *Flustra* and encrusting communities (*Corynactis*). Imbricated shell remnants.

2nd biotope. (Pic 3). Outcropping rock steps, interspersed with clean fine gravel/shell. Rocks support hydroid turf, Tubularia, massive & encriusting sponge, dense ascidians and various anemones. Pentapora. Flustra stands with Calliostoma & barnacles. Flat rock patches scoured bare.

3rd biotope. Clean mobile 'fluvial' gravel mixed with black smooth discoid cobbles, no apparent epifauna. Some patches of densely packed, imbricated dead shells (Pic 2) suggesting strong currents.

All three biotopes in a mosaic, in quick succession, making biotope assignment relatively difficult.

WV13: Palaeochannel floor. Cobble in centre, fluvial gravel at edge, low exposed bedrock on rim.



1. SS.SCS.CCS.PomB

2. SS.SCS.CCS

3. CR.HCR.XFa.FluCoAs

Targeting palaeochannel floor obvious on both multibeam, and sidescan. Harder sidescan backscatter at edges of channel suggest a likely low-lying rock 'rim', confirmed by video observation. Centre of main channel has cobble base, which turns to a finer gravel at the western edge just prior to the 'rim'. Very limited rock exposure. Rock is notably red/brown in colour.

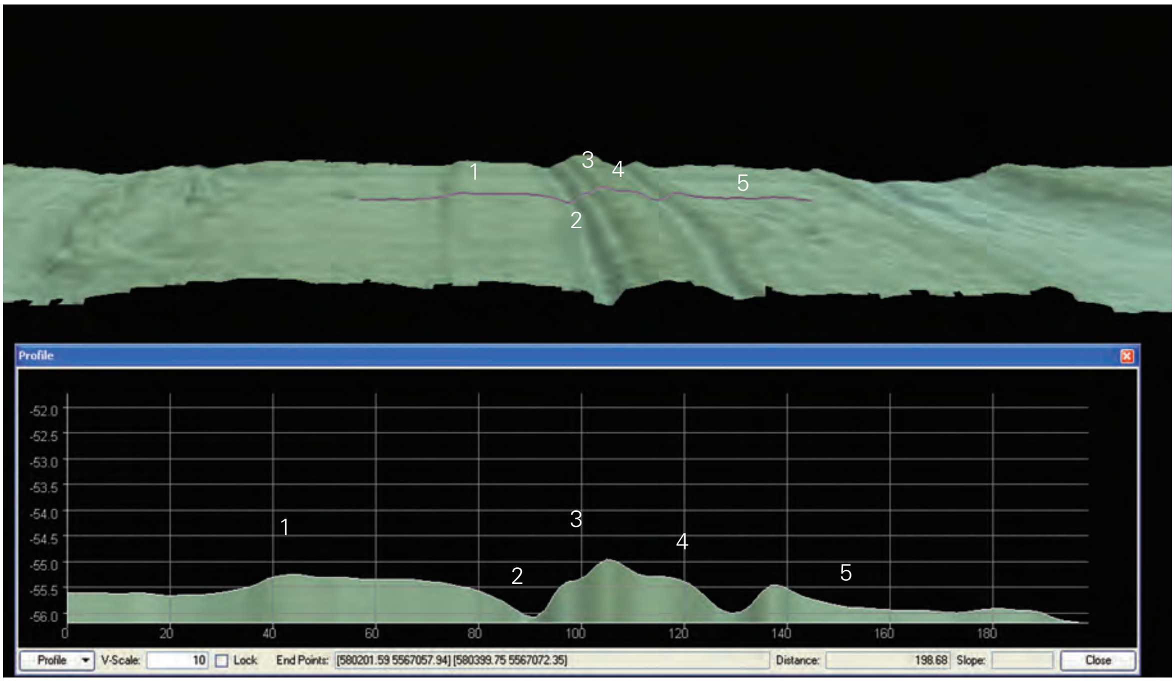
1st biotope. (Pic 1). Mixed coarse sediments of pebbles gravel & dark sand (no mud). Occasional cobbles supporting hydroid turf, frequent *Flustra* patches and anemones. Some cushion sponges and brittle stars (*Ophiocomina nigra*).

2nd biotope. Almost barren, clean uniform sized 'pea' gravel (fluvial?), with occasional cobble.

3rd biotope. outcropping rock steps & small boulders, infilled with gravelly sand. Flustra, Ascidinas & cushion sponges.

Note. Biotope 3 lies within biotope 2. (i.e. biotope 2 occurs again after biotope 3).

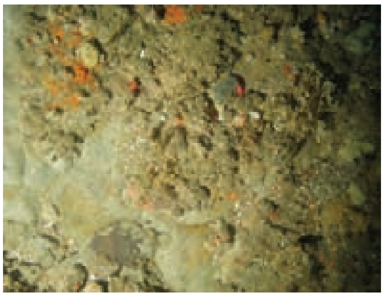
WV14: Flat pebble & gravel field interrupted by central linear hummock of bedrock, skirted by sand-filled palaeostreams.



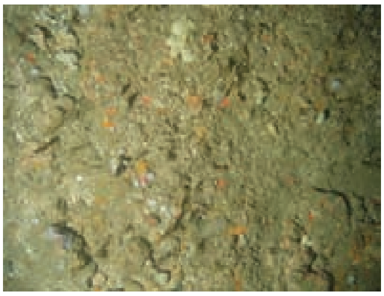
1. SS.SCS.CCS.PomB

2. Sand-filled stream bed

3. CR.HCR.XFa.FluCoAs



4. CR.HCR.XFa.FluCoAs



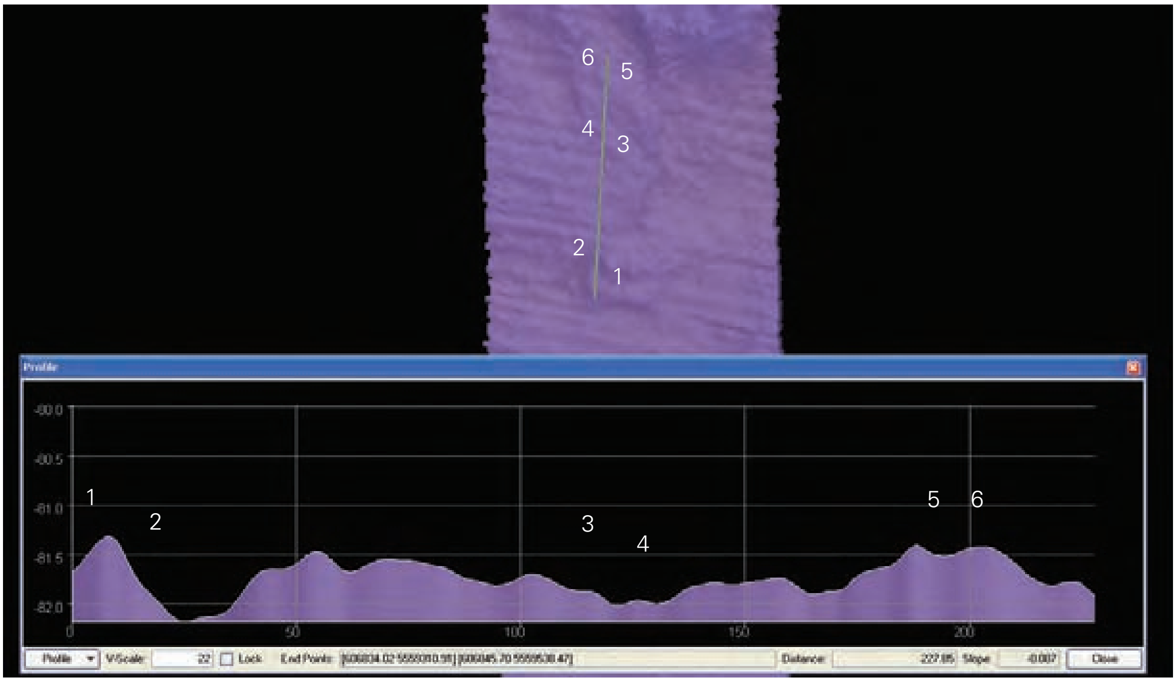
5. SS.SCS.CCS.PomB

Targeting a pair of parallel 'tram-lines' seen by the acoustics. On sidescan, the lines were ripples, suggesting narrow channels infilled with sand. On multibeam, the area between the lines has some obvious but feint texture.. Fledermaus profile shows two channels either side of a central hummock. Video observation showed the channels were sand-filled (Pic 2) and the hummock comprised bedrock & small boulders.

1st biotope (Pics 1 & 5). Flat pebble & gravel, some cobbles. Pomatoceros & encrusting sponge on larger particles. Anemones & hydroids. Occasional *Flustra*.

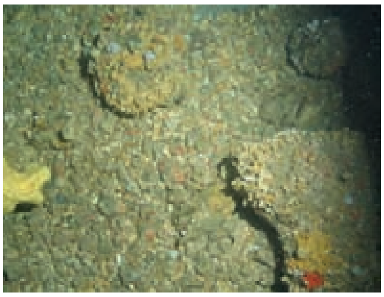
2nd biotope (Pics 3 & 4). Heavily silted bedrock (grey) & small boulders, slightly raised above seabe, with mixed communities, mostly *Flustra*, anemones, ascidians (colonial & gregarious). Hydroids including Abietinaria (hardy, scour resistant).

WV15: Boulder field on deep palaeovalley floor. Series of three biotopes.



1. CR.HCR.DpSp

2. CR.HCR.DpSp



3. SS.SCS.CCS.PomB

4. SS.SCS.CCS.PomB

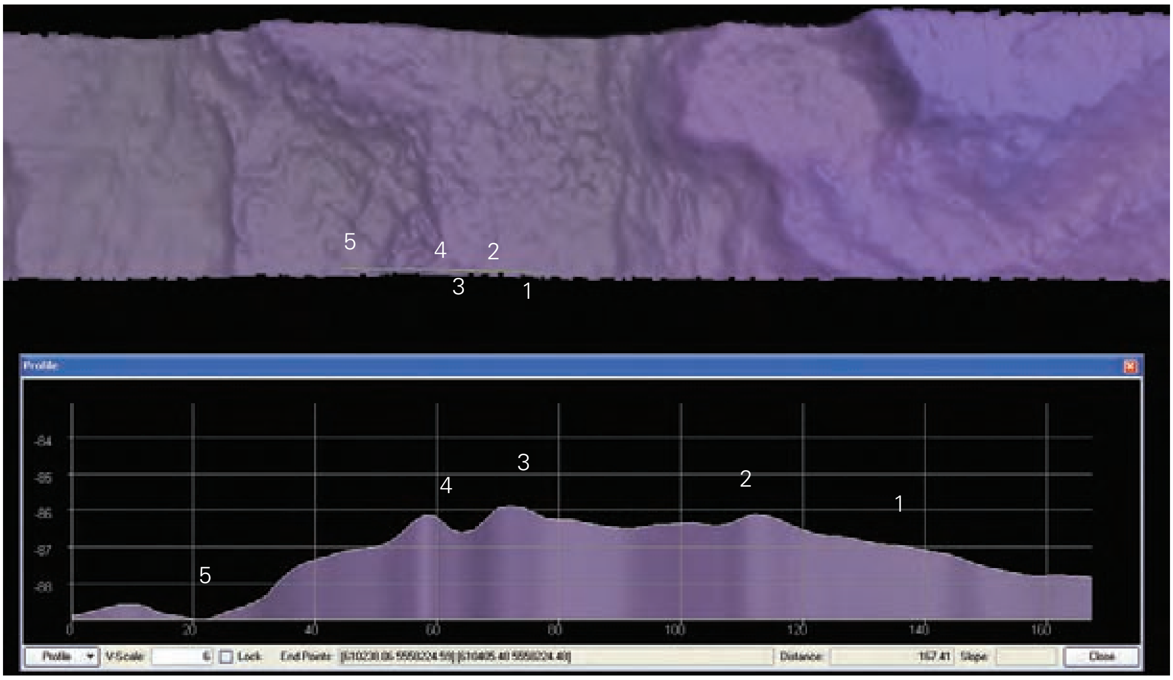
5. CR.HCR.FaT.BalTub

6. CR.HCR.FaT.BalTub

NB. Second rock biotope could also be assigned to HCR.DpSp as fauna on the boulders is representative (but differs to that on the valley floor).

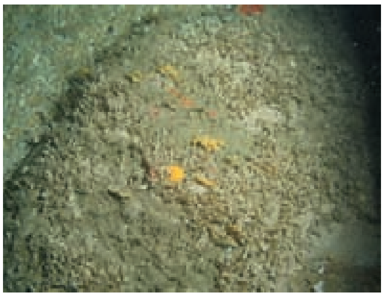
1st biotope (Pics 1 & 2). Boulders on bedrock, with coarse sediment. Stable surfaces with sponges & some barnacles. 2nd biotope (Pics 3 & 4). Coarse lag gravel; barnacles on larger particles. 3rd biotope (Pics 5 & 6). Boulders on exposed smooth pitted dark (grey) bedrock. Latter has no life-forms; former is heavily encrusted with sponges & *Tubularia*.

WV16: Large and very large boulders on deep palaeovalley floor with thin coarse sediment cover. Two biotopes.



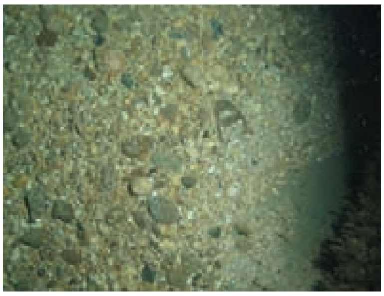
1. HCR.XFa.FluCoAs (deep)

2. HCR.XFa.FluCoAs (deep)



3. HCR.XFa.FluCoAs (deep)

4. SS.SCS.OCS



5. SS.SCS.OCS

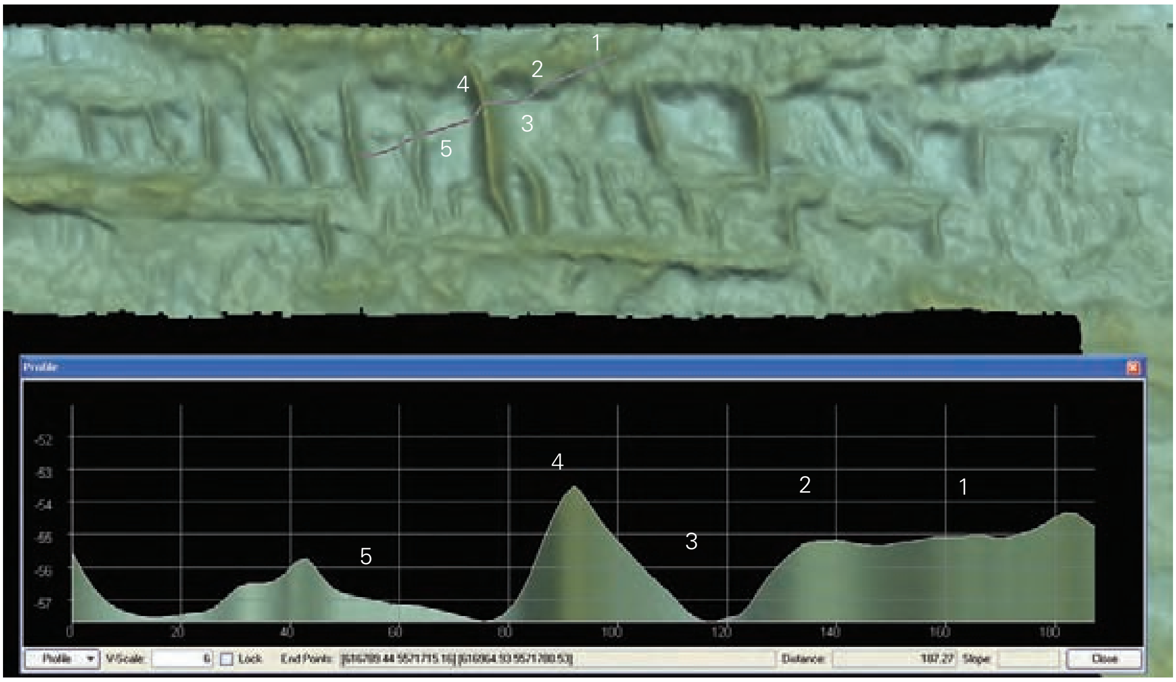
NB. Different boulders tend to have different combinations of fauna and can be considered as 'point representations' of variants of the main biotope class.

1st biotope (Pics 1, 2 & 3). Broken bedrock with large boulders covered mostly by *Flustra*, *Pachymatisma* and some arborescent sponges. *Tubularia* present. Some sand scour & smothering. 2nd biotope. (Pics 4 & 5). Coarse sediment. Pebble & gravel mosaic filling between the boulders of biotope 1. Occasional anemones.

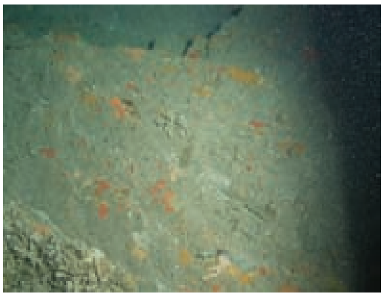
Biotope assignment notes

Biotope 1 could be deep water extension of HCR.DpSp, but need to remove or ignore the existing association with wave exposure. Predominance of *Flustra* is indicative of a variant with reduced sponge cover occurring on low-relief scoured seabed.

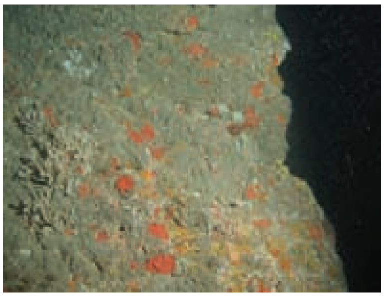
WV17: Low ridges of Wealden Clay (soft, fragile). Heavily scoured bedrock between ridges, characterised by large sand waves



1. HCR.XFa.FluCoAs



2. HCR.XFa.FluCoAs



3. Scoured Wealden Clay

4. SS.SSa.OSa

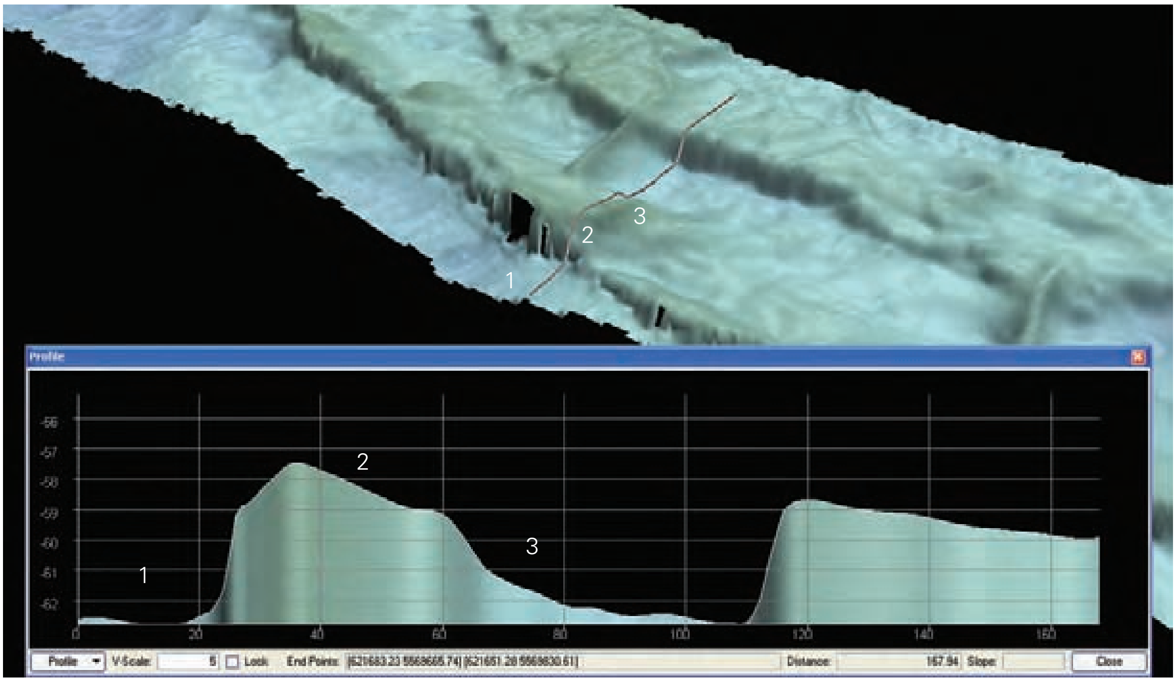
5. SS.SSa.OSa

Targeting low elevation bedrock ridges with prominent sand waves adjacent. Video observations showed very distinctive rock colour (pale blue-green). The edges of the rock ledges were easily broken by the camera frame, emitting voluminous white clouds (re-suspended clay). Good faunal coverage except at base of ridge and in channels (Pic 3), where highly mobile sand provides heavy scour.

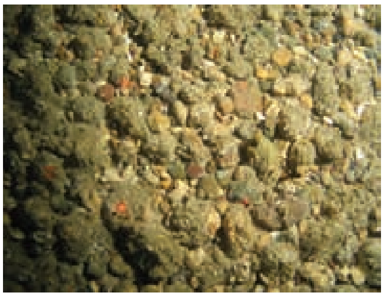
1st biotope. (Pics 1 & 2). Edge of flat but rough bedrock ledge. *Flustra*, encrusting hydroids & sponges, *Bispira*, *Nemertesia* & cushion sponges.

2nd biotope. (Pics 4 & 5). Mobile sand waves overlying bare smooth bedrock, no apparent epifauna

WV18: Four-metre high ridges of Wealden Clay (soft, fragile) with covering of coarse sediment between ridges. Series of 3 biotopes, repeating over the second ridge.



1. SS.SCS.OCS



2. CR.HCR.DpSp.

3. CR.HCR.XFa.FluCoAs

Targeting significant ridges seen on multibeam & sidescan. Linear edges, but far less uniform structure than in WV 5, 8, 9 & 10. Multibeam shows large sand waves (>4 m) over-run the ridge crests.

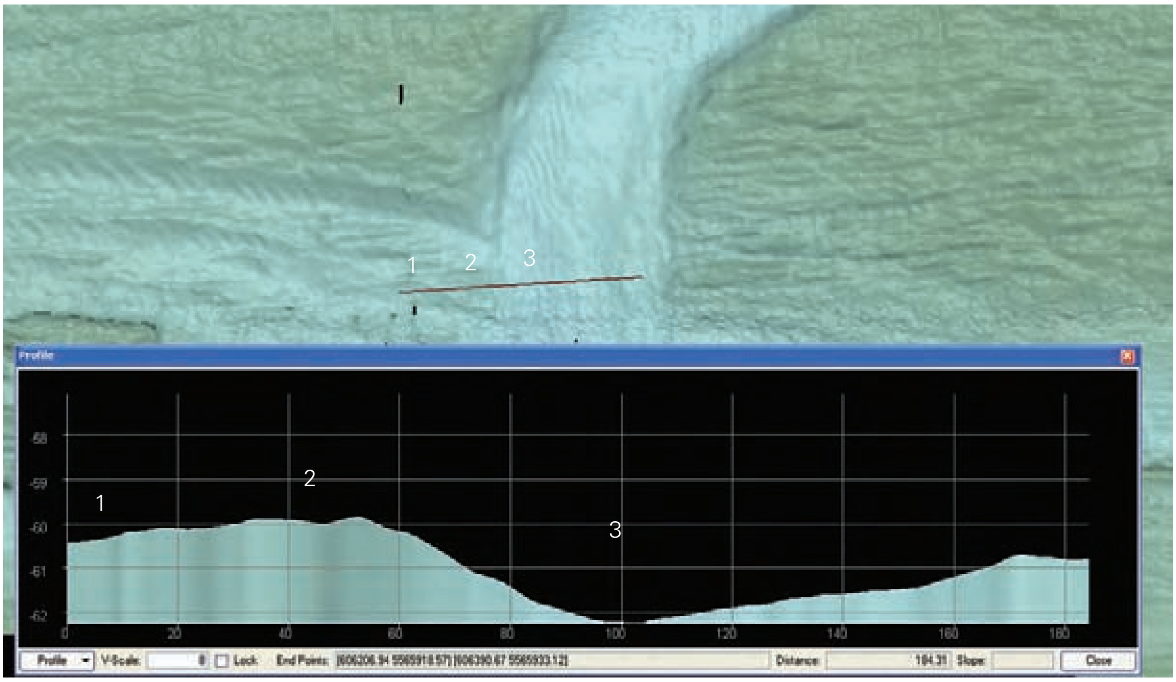
1st biotope. (Pic 1). Pebble & gravel (river bed?). Occasional boulders. Thin cover of pebbles & hydroids on all pebbles & cobbles, but not on gravel. Eventually becomes covered by (red) sand at base of rock ridge.

2nd biotope (Pic 2). Rock outcrop & boulder, Wealden Clay cliff, 4 m high. Upper surface with some sand and luxuriant growth of *Flustra* & hydroids. Abundant sponge (massive cushion, encrusting & arborescent forms). Anemones. Continues as cobble & boulder 'rubble' on dip slope.

3rd biotope (Pic 3). Sand abraded and smothered dip slope of Wealden outcrop. Some bare patches but mostly covered in *Flustra* and hydroids (no sponge). Some small boulders of red rock support barnacles, *Urticina*, hydroids & *Flustra*.

Biotopes 2 & 3 repeat in sequence over both ridges covered by the video tow.

WV19: Edge of shallow palaeochannel with dark pitted/bored bedrock at edge, deepening into coarse pebble & gravel in the channel bed.



1. CR.HCR.DpSp

2. CR.HCR.DpSp.

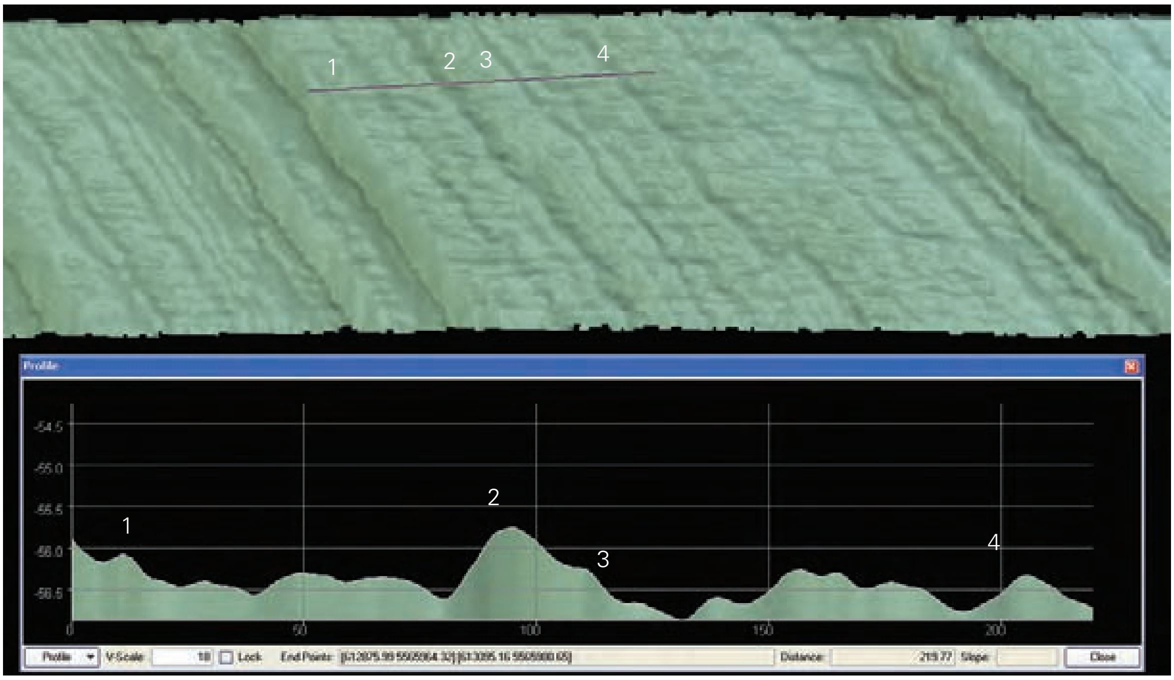
3. SS.SCS.CCS.PomB

Targeting edge of shallow palaeochannels, at point of apparent intersection. Fledermaus profile shows western channel slopes down to meet a more distinct north-shout trending. Video showed western channel was rock-based, north-south channel was gravel based.

1st biotope. (Pics 1 & 2). Balck (dark grey) pitted/bored bedrock plain with occasional small boulders and patches of coarse substrate (pebble/cobble). Mostly covered in encrusting sponge, with a range of cushion and arborescent morphs. Anemones & ascidians present.

2nd biotope. Coarse sediment comprising 'fluvial' gravel & stable cobbles/pebbles. Hydroids & *Pomatoceros* in larger particles. Auquepectedn & ophiuroids (*Ophiocomina nigra*). Some accumulations of dead bivalve shells.

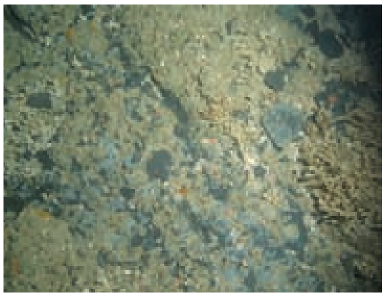
WV20: Smooth black bedrock flats in a pattern of low-relief ridges, with two alternating biotopes.



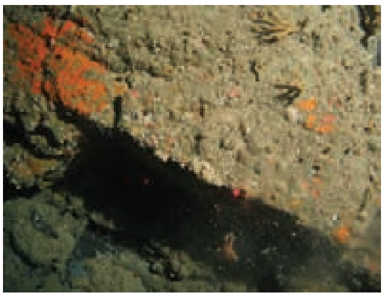
1. HCR.XFa.FluCoAs

2. CR.HCR.XFa.BrErSp

3. HCR.XFa.FluCoAs



4. CR.HCR.XFa.BrErSp



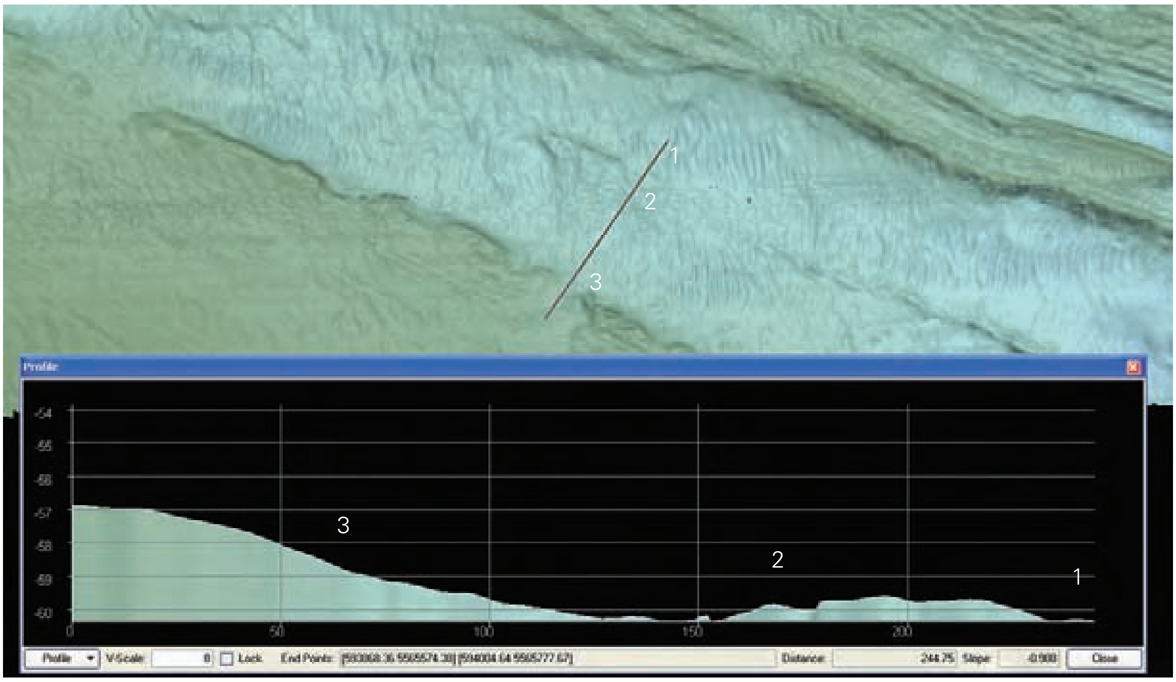
Targeting low relief, linear, rippled texture observed on multibeam and sidescan. High backscatter indicates rock rather than sediment.

1st biotope. (Pics 1 & 3) Smooth black bedrock flats with areas of large discoid cobbles (black) and mobile coarse sands. Some areas scoured clean, but others with *Flustra*, faunal crusts (ascidians) and globose sponges (*Polymastia*/*Tethya*).

2nd biotope. (Pics 2 & 4). Exposed bedding plains of black rock with low dip angle, only slightly raised (1 m) above ambient seabed, but free from scour. Dense faunal crust of encrusting bryozoan and sponges, anemones, Arborescent & massive sponge forms present.

Biotopes 1 & 2 repeat in alternating sequence along the transect

WV21: Shallow palaeochannel filled with coarse substrate, pabbel & cobble at centre, 'fluvial' gravel along the south bank. A thin 'seam' of exposed rock tracks along the mid-channel.



1. SS.SCS.CCS.PomB

2. CR.HCR.XFa.FluCoAs

3. SS.SCS.CCS

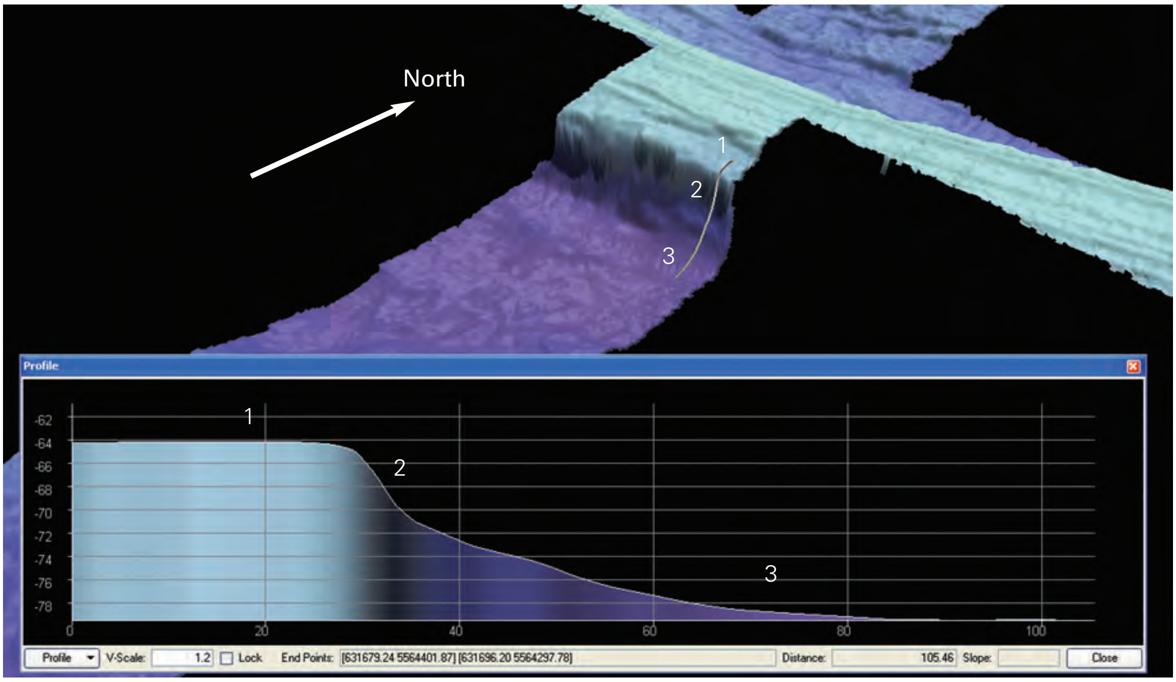
Targeting middle and edge of distinct palaeochannel observed on multibeam and sidescan (similar to WV13). The track-plot overlay on multibeam suggest the transect happened to pass through a small breach in the otherwise distinct channel rim, so this rim was not apparent on the video.

1st biotope (Pic 1). Featureless gravel & pebble substrate, possibly overlaying bedrock. Encrusting communities on consolidated cobble patches, comprising hydroid crust, *Pomatoceros* and barnacles.

2nd biotope (Pic 2). Encrusting communities (*Flustra*, sponge & ascidians) on small/medium sized boulders and exposed, low elevation (<1m) bedrock ridges, frequently scoured by sand.

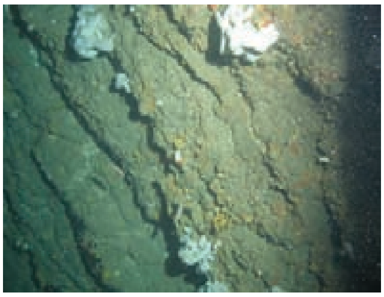
3rd biotope (Pic 3). Featureless stone gravel with occasional mobile sand ribbons. Sparse fauna, occasional anemones.

WV22: Sixteen-metre high rock ridge arising from palaeovalley floor. Ridge walls have some vertical faces; palaeovalley floor has mixed cobble and sand.



1. CR.HCR.XFa.FluCoAs

2. CR.HCR.DpSp



3. SS.SMx.OMx

Targeting a significant topographic ridge observed on multibeam and as a distinct dark band on the N-S oriented sidescan line. When the digital Survey bathymetry became available, this ridge was seen to be the top of one of the 'lenticular' islands in the main palaeovalley.

1st biotope (Pic1). Platform of accreted coarse sediment (cobble, pebble, gravel & some sand) with occasional small boulders. Accreted by crusts of mixed hydroids, bryozoan and sponge. Supports *Flustra* and several sponge morphs (cushion, arborescent, globulose, massive & flabellate).

2nd biotope (Pic 2). Vertical cliff wall with rubble (small boulder & cobble) at base. Encrusting & erect sponge forms (massive & arborescent), with colonial tunicates (*Diazona*).

3rd biotope (Pic 3). Palaeovalley floor. Coarse mixed stable sediment of cobble & pebble with sand. Crusts of hydroids/bryozoans and encrusting sponge, with erect sponge forms (cushion, arborescent, massive & flabellate) and tube-dwelling worms.

Biotope assignment notes

For biotope 3, the 'Mixed Sediment' category was selected as the video showed a visible sand component. No mud was seen. If the definition of 'mixed substrate' requires a positive identification of a mud-fraction, then the biotope could be re-classed as CS.SCS.OCS.

5.4.4 Integrated interpretation: summary spreadsheets

To assist further work referring to the integrated assessment, a spreadsheet has been compiled summarising the biological and geophysical analyses and listing key pieces of information, such as biotope, positions, seabed character, rock type for each of the ground truth sampling sites in the study. There are two sheets, illustrated below, the first drawn entirely from the video observations and the second from both video and geophysical analysis. The spreadsheet is named 'ME1102 Station Summaries 010708.xls' and is supplied with this report

Biology

AoS	Station	Video Segment	EUNIS	MNCR	Annex-I	AnnexIHab Comment	Modifier	S_Lat	S_Long	E_Lat	E_Long
Wight	WV01	WV01 S1	A4.12	CR.HCR.DpSp	Rocky reef	Cobble reef	Palaeovalley floor	50.2031	-1.1636	50.2033	-1.1654
Wight	WV02	WV02 S1	A4.12	CR.HCR.DpSp	Rocky reef	Cobble reef	Palaeovalley floor	50.2047	-1.2161	50.2052	-1.2173
Wight	WV02	WV02 S2	A5.15	SS.SCS.OCS	NONE		Palaeovalley floor	50.2052	-1.2173	50.2056	-1.2186
Wight	WV03	WV03_S1	A5.15	SS.SCS.OCS	NONE		Palaeovalley lip	50.2046	-1.3458	50.2045	-1.3454
Wight	WV03	WV03_S2	A4.131	CR.HCR.XFa.ByErSp	Rocky reef		Palaeovalley edge, upper slope	50.2045	-1.3454	50.2044	-1.3452
Wight	WV03	WV03_S4	A4.12	CR.HCR.DpSp	Rocky reef		Palaeovalley edge, lower slope	50.204	-1.3444	50.2038	-1.344
Wight	WV03	WV03_S5	A4.134	CR.HCR.XFa.FluCoAs	Rocky reef		Palaeovalley floor	50.2038	-1.344	50.2033	-1.3429
Wight	WV04	WV04_S1	A5.15	SS.SCS.OCS	NONE		Lag gravel	50.2043	-1.4125	50.2042	-1.411
Wight	WV04	WV04_S2	A4.134	CR.HCR.XFa.FluCoAs	Rocky reef			50.2042	-1.411	50.2042	-1.4097
Wight	WV05	WV05_S1	A4.134	CR.HCR.XFa.FluCoAs	Rocky reef			50.2507	-1.3537	50.2503	-1.3543
Wight	WV05	WV05_S2	A5.141	SS.SCS.CCS.PomB	NONE		Lag gravel	50.2503	-1.3543	50.2684	-1.3546

The sheet for geophysical information is too wide to display on paper, but has the following columns

Stn Code
Stn No.
Segment
Gear
Lat deg
Lat min
Long deg
Long min
Lat
Long
Bedrock Geology
Seabed character
EUNIS code
EUNIS Level 4
MNCR Code
Annex I Reef
AnnexIHabComment

ME1102 Station Summaries 010708.xls

6 Conclusions and recommendations

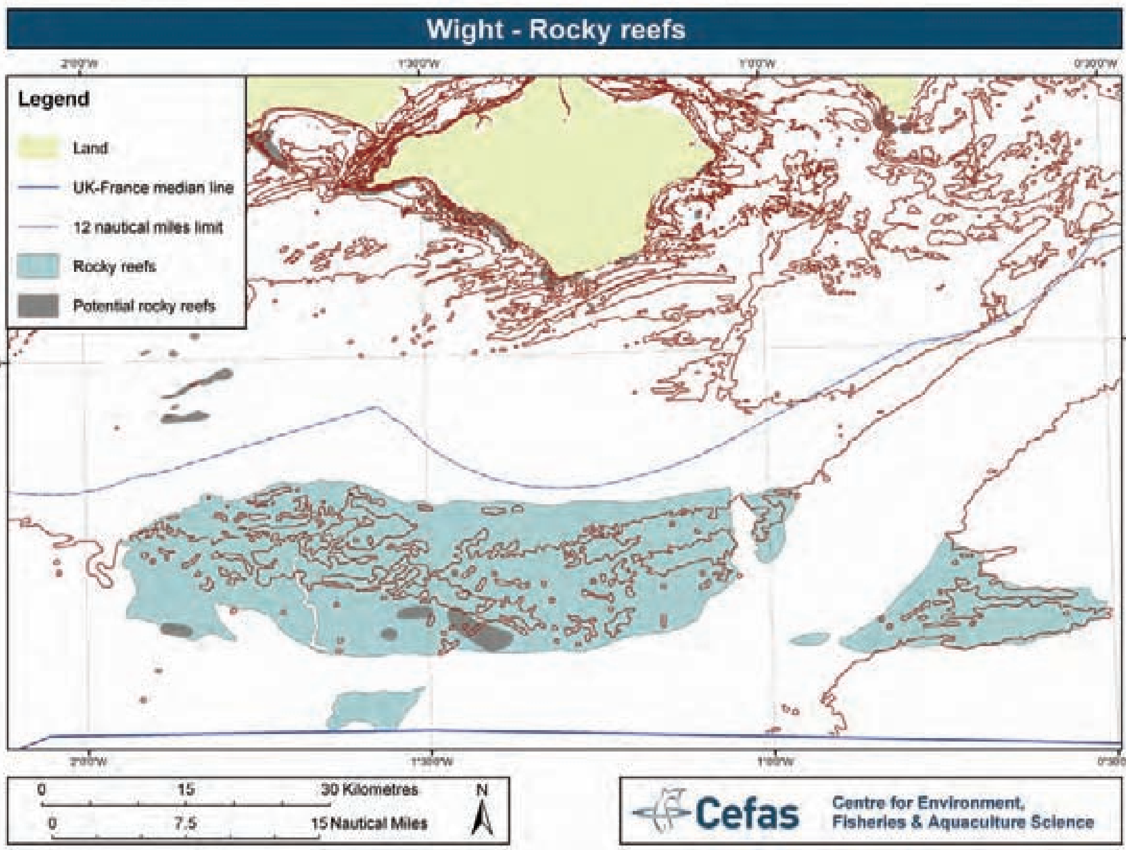
The Portland and Wight areas of Search were selected on the basis of available data, predominantly the BGS seabed sediment maps. These maps were originally compiled on the basis of sediment samples collected with a Shipek grab between 1970 and 1983, with distances between stations on the order of a few kilometres. Grabs are generally suitable to retrieve samples of loose material (mud, sand, partly gravel), but they will not sample rock. The presence of bedrock on the seabed can therefore only be inferred by the absence of sediment in the bucket of the grab.

We have shown that the distribution of bedrock on the seabed as delineated in the BGS seabed sediment maps differs greatly from the distribution as indicated by the interpretation of SeaZone DSB data (Figure 51). Based on our experience, we therefore recommend not using seabed sediment maps for the delineation of rocky reefs.

It is understood that the UK conservation agencies are currently using an estimate of the amount of rocky reef in UK waters derived from an interpretation of the BGS seabed sediment chart. Our work in the central English Channel provides evidence that estimates derived in this way may be far less accurate than was previously though, and we recommend that the procedure is reviewed.

We recommend the use of SeaZone DSB or comparable data to better understand the nature of the seabed prior to any further survey work. The approach to broadscale interpretation outlined in this report can then identify data gaps and both inform and direct survey strategies for a finescale approach targeting specific areas of interest. In this way, ship time and therefore survey costs, can be minimised while ensuring that sufficient data for a thorough interpretation is available. It should however be mentioned, that DSB data of such high quality as shown in this report is not available for the whole UK continental Shelf (see http://www.seazone.com/data-availability.php for availability of SeaZone Digital Survey Bathymetry coverage in UK

Figure 51: Comparison of the distribution of potential rocky reefs based on BGS seabed sediment maps and distribution of rocky reef based on the interpretation of DSB data.



Waters). As a compromise, SeaZone offers the digitisation of so-called fair-sheets, where survey data is absent.

One alternative to the SeaZone data is OLEX. This is a shared bathymetric data set usually collected by vessel not specifically undertaking survey (e.g. fishing vessels on passage). Coverage can consequently be patchy and it is not known if the data is collected to any standard or undergoes and QA testing. However, even rough images of seabed terrain from such bathymetric data sets can be useful in pinpointing areas that may contain reefs.

The interpretations presented in this report demonstrate that at the Wight site, there is a strong link between the nature of the bedrock and its expression at the seabed and this is a strong determinand of the type of habitats and biotopes occurring in the area. Other environmental factors such as current speed act to modify biotopes at a local level.

The fact that bedrock is present at the seabed in the Wight area is due to the fact that the site is largely non-depositional as strong currents effectively prevent the deposition of sediments and therefore the burial of bedrock. A thorough understanding of bedrock geology, sedimentation patterns, sediment thicknesses and hydrodynamic forcing might therefore help to predict possible occurrences of bedrock at the seabed and thus direct new surveys towards the most promising areas.

Based on the modelling techniques, terrain analysis and geophysical interpretations used in our study of the central English Channel, we provide estimates for the area covered by Rocky Reef, Boulder reef and Coarse Sediment for the two areas of Portland and Wight. The figure for boulder reefs should be treated with caution and recognised as an under-estimate, due to the relatively small proportion of the area that was directly surveyed using sidescan sonar. The other seabed character types are more amenable to modelling from the lower resolution Digital Survey Bathymetry. In Portland, the area of 'rocky reef' comprises two small areas with a total of 23 sq km within the AoS, and a single area of 23 sq km to the SW of he AoS, directly on the UK/France median line.

Table 8: Estimated spatial area (sq km) of different seabed types within each Area of Search, based on terrain modelling techniques.

Seabed character	Portland	Wight
Rocky reef	45	1,129
Boulder reef	n/a	1.5
Coarse sediment	2,507	2,097

7 Acknowledgements

We acknowledge the input of all Cefas staff who have participated in this work, particularly Matthew Curtis and Christopher Barrio-Frojan who analysed video material from the Wight and Portland areas, and Bill Meadows and Annie Brown of the Survey Instrumentation, Gear and Systems Group (SIGS) who were crucial to the acquisition and processing of acoustic data and operating and maintaining the underwater camera systems.

We also acknowledge the assistance of JNCC staff members. Charlotte Johnston was instrumental in preparing the project proposal. Vivienne Blyth-Skyrme and Emma Verling participated in field surveys and, with Neil Golding, have provided valuable guidance and consultation during the analysis and interpretation.

Mr Ceri James of the British Geological Survey undertook a quality assurance review of the geological overview and interpretations.

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Appendix 1: Acoustics Technical Information

This appendix provides detail of the acquisition and processing of acoustic data that is considered to be of technical interest, and is presented to document the procedures and quality control used in producing the survey outputs. Greatly abbreviated and simplified 'lay' explanations are provided in the main body of the report, which in turn refers to this appendix

The text has been extracted from original drafts prepared by Koen Vanstaen and Markus Diesing of Cefas.

A1.1 Acoustic data acquisition and processing

Sidescan sonar

For many years, sidescan sonar has been used in seabed characterisation studies (Boyd *et al.*, 2006; Brown *et al.*, 2002; Brown *et al.*, 2004; Friedlander *et al.*, 1999; Humborstad *et al.*, 2004). To produce an image of the seabed, sidescan sonar uses acoustic energy. The emitted acoustic wave will interact with the seabed and the strength of the returned acoustic signal will be used to produce a map of the seabed. The strength of the returned signal will be a result of two main interactions at the seabed surface: direct reflection on features such as rock outcrops or wrecks, and backscattering of energy related to the seabed texture and character. Coarse substrates or features facing the sidescan sonar fish will result in high backscatter intensities, whereas finer sediments or acoustic shadows behind seabed features will result in low backscatter strength (Blondel and Murton, 1997; James, 2007; Seabeam Instruments, 2000).

The ability of the sidescan sonar to resolve fine details of the seabed surface is related to the acoustic pulse length and the sonar's horizontal beam width (Blondel and Murton, 1997). High frequency sidescan sonar systems (e.g. 500 kHz) tend to have a small acoustic footprint, which allows identifying smaller features, but will only have a limited range (e.g. 100 m). The acoustic footprint of a low frequency system (e.g. 100 kHz) is normally larger, limiting its ability to detect small features, but the wider range (e.g. 200 m) allows covering larger areas in the same time.

Multibeam echosounder

Multibeam echosounders were initially developed for hydrographic survey applications, but found a variety of applications in scientific research (Boyd *et al.*, 2006; Butler *et al.*, 2006; Kostylev *et al.*, 2003; Kostylev *et al.*, 2001; Pickrill and Todd, 2003; Roberts *et al.*, 2005; Ryan *et al.*, 2007; Szuman *et al.*, 2006; Todd, 2005). Multibeam echosounders use a large number, typically more than 100, of narrow acoustic beams, which will measure the water depth along a swathe on the seabed. The swathe width is function of the water depth, and manufacturers often provide figures of 10 times water depth for the swathe width. Experience shows that good quality data is only achieved up to 4-5 times the local water depth. Data from a multibeam survey can be combined to produce a digital terrain model of the seabed.

Accurate depth soundings can only be obtained when a number of factors are compensated for: ray bending as a result of sound velocity variations in the water column, tide and vessel movements such as heading, heave, pitch and roll. This can be achieved by taking regular CTD casts to estimate the sound velocity profile in the water column, and integrating a motion reference unit (MRU) and gyrocompass with the multibeam echosounder. To achieve seamless integration of adjacent multibeam swathes, detailed knowledge of the local tidal regime is also required. This can be obtained by deploying local tide gauges or by using tidal predication software.

The ability to resolve fine details of the seabed morphology depends on the frequency and beam angle of the multibeam system. Shallow water, high frequency (e.g. 300 kHz) systems can achieve a resolution at centimetre level, whereas deep water, low frequency (e.g. 12 kHz) multibeam echosounders will only be able to resolve features of several metres (Lurton, 2002; White *et al.*, 2007).

In addition to detailed depth measurements, multibeam echosounders can also record sidescan sonar-like backscatter strengths. However, the hull mounted multibeam system will be less effective in feature detection than a sidescan sonar towed close the seabed surface.

A1.2 Quality Control

Prior to commencement of both surveys a full multibeam calibration was undertaken (4th June 2006 and 14th July 2006 respectively). This allowed confirmation or minor adjustments of pitch, roll and heading settings to achieve accurate depth soundings. During survey, the quality of the acquired multibeam data was monitored continuously using the available QC utilities in the Kongsberg SIS acquisition software. Depth soundings were also compared with depth recordings from an EA600 hydrographic echosounder onboard RV *Cefas Endeavour*. Further data quality checks were carried out using the CARIS HIPS multibeam processing software. All multibeam data was of good quality and no re-surveying was required.

The quality of the acquired sidescan sonar was monitored continuously on-screen as the data was collected. On occasions, strong currents caused deteriorating artefacts to the sidescan imagery and required slowing down of the vessel speed over ground. During the sidescan survey of Portland 1 area during CEND12/06, problems were encountered with the Benthos SIS-1500 sidescan sonar. Port and starboard channels had swapped in the middle of the survey, and became especially noticeable during mosaicing of the data. Software developer Triton Imaging Inc provided a solution to the problem the next day. Overall, sidescan sonar imagery was of good quality.

A1.3 Metadata collection

All survey activities were recorded on Cefas' bespoke metadata database DigiLog. For each survey line a number of fields were recorded:

- Cruise code
- Operator
- System
- Operating frequency
- Survey area
- Project name
- Line name or code
- Start and end date/time
- Start and end position
- Filename
- Swathe width (sidescan only)
- Towed gear positioning (sidescan only)
- Vessel draft (multibeam only)
- Sound velocity profile (multibeam only)

In addition to this, continuous recordings were made of all ship-based sensors, providing information on: position, vessel movement, environmental conditions (salinity, temperature), weather conditions, winch status, drop keel position, draft and water depth.

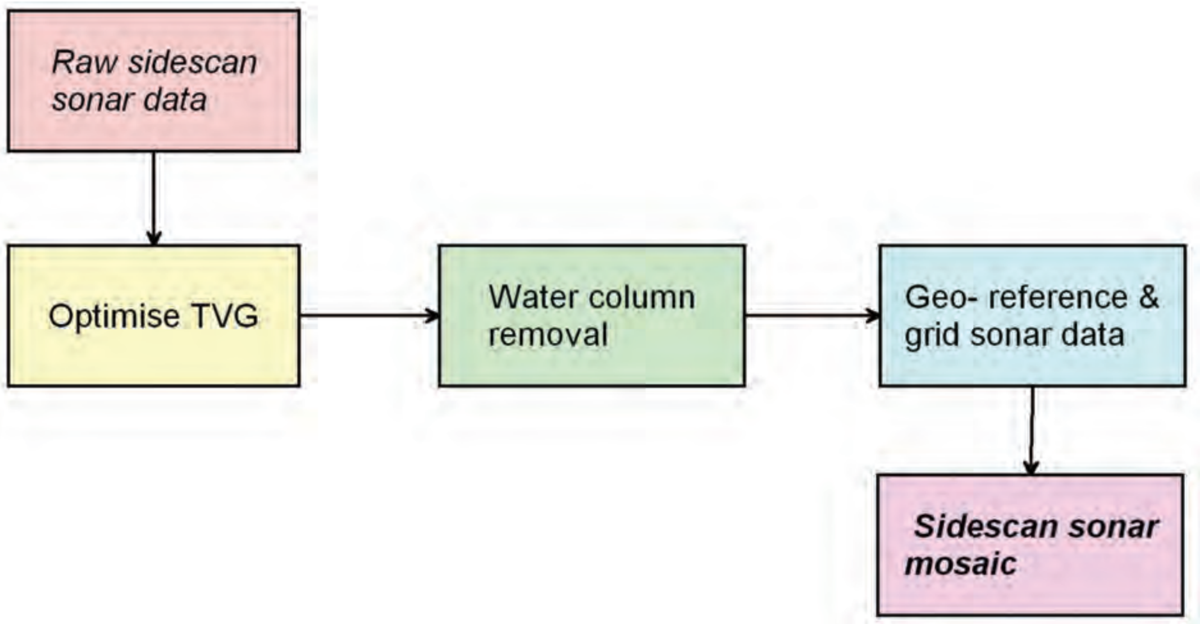
A1.4 Data processing

Sidescan sonar

Processing of sidescan sonar data involves several steps, which are shown in Figure A1. 1.

The raw sidescan sonar data is loaded into the processing software and time varying gain (TVG) settings optimised.

Figure A1.1: Sidescan sonar data processing flow diagram.



This will compensate for the loss of acoustic energy over time, which leads to a reduction in the acoustic energy that can be returned as backscatter from the seabed. The result is an equalisation of the backscatter greyscale across the sidescan sonar swathe, which will allow increasing the contrast between features along the sidescan sonar image.

Raw sidescan sonar data will display a white strip along the sonogram, which represents the time taken for the acoustic energy to travel from the sonar transducer to the seabed. By picking the seabed correctly, this water column can be removed by the software from the sonogram, creating a seamless acoustic image of the seabed.

Finally, the navigational data recorded by the sonar will be merged with the backscatter data, and if necessary, sonar offsets can be applied. The data will be gridded into appropriate cell sizes to produce and export a mosaiced sidescan sonar image that can be interpreted or imported into a GIS package.

All sidescan sonar data was processed using Triton Imaging Inc. ISIS Sonar v7.0 and Delphmap v3.1 software suite. The majority of the sidescan sonar data was processed immediately after completion of a survey/survey line, and used for the planning of ground-truth stations.

Some of the sidescan sonar data was re-processed afterwards because differences in grey-scale existed between lines. This was a result of using different sidescan sonar systems, which require different TVG settings, but also the result of survey by survey processing of the data, which may have led to the use of slightly different setting.

The majority of the sidescan sonar mosaics were produced from 100 or 200 kHz sidescan sonar data and the mosaics were gridded at a resolution of 30 cm. The boulder survey, which made use of the high resolution 400 kHz frequency, was processed at a resolution of 10 cm.

In general, the time required to process sidescan sonar data is a fraction of the time needed to acquire the data. However, the large extent of the surveys meant that the resulting sidescan sonar mosaic file sizes became too big to be exported as a single image. A sidescan sonar mosaic at resolution of 30 cm for the entire survey area would have resulted in a file size of around 285 Gb. This required data to be processed and exported in batches, or line by line, which resulted in significant increases of processing time required.

The time required to process sidescan sonar depends very much on the extent of the survey, the computing power available and the required resolution of the final mosaic. On average, eight hours was required to process the data collected during 24 h of continuous sidescan sonar acquisition. For smaller surveys, the ratio of processing to acquisition time may be smaller, whereas for larger surveys this ratio may increase, due to the increased demand on the computing power.

Multibeam echosounder

The processing of multibeam is a much more lengthy process than the processing of sidescan sonar. To produce a clean and seamless surface, a number of steps are followed, as shown in Figure A1. 2.

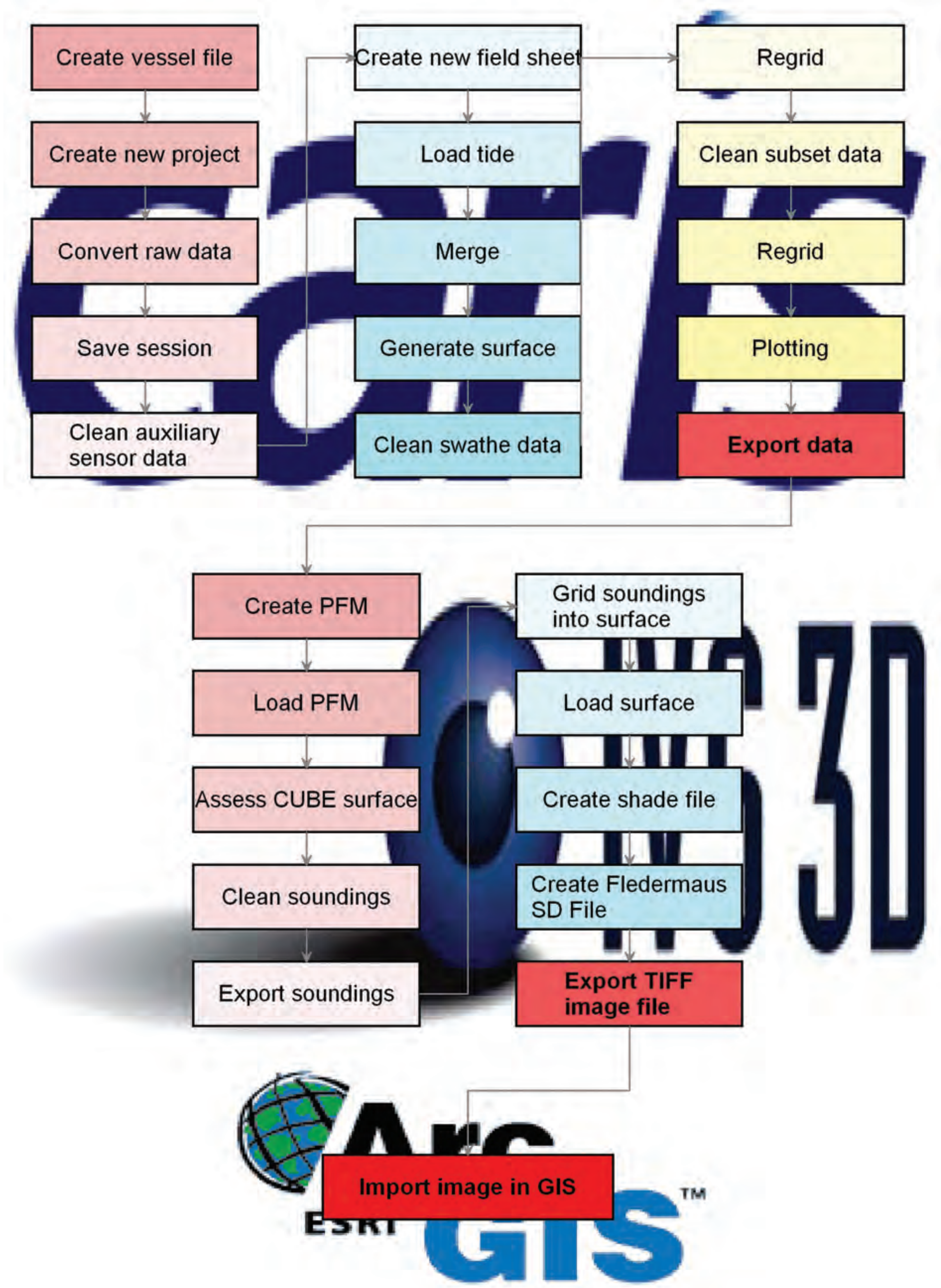
Initial processing is undertaken in the CARIS HIPS hydrographic data processing software. This includes cleaning of auxiliary sensor data, loading of local tidal information and automated and manual cleaning of swathe profiles. When completed, soundings are imported in the IVS3D Fledermaus software suite. The advanced CUBE (Combined Uncertainty and Bathymetry Estimator) algorithm is used for further data cleaning. Finally the data is gridded and a Fledermaus 3D surface is created. This surface can be exported as a GeoTIFF file to be included in the project GIS.

The large extent of the survey area did not allow using a single tidal curve to correct all depth soundings. Therefore, no tide gauge was deployed but tidal predictions were used. The area was split into tide zones around the positions used by the in house developed tidal prediction software TSTide. Stations are separated 10 minutes in a longitudinal direction and every 6 minutes and 40 seconds in a latitudinal direction. The resulting grid of 49 tide zones, each with its own tidal curve, is shown in Figure A1. 3. Using tidal zones made sure geographical changes in the tidal regime were taken into account in the tidal correction of the multibeam data.

From the above it is clear that the processing of multibeam bathymetry data is a long and time-consuming process. Complete processing of the multibeam data was not possible in time for ground truth survey planning. To take benefit of the additional information provided by multibeam data for ground truth survey planning, on top of sidescan sonar, a quick processing was undertaken of the multibeam data. An automatic data-cleaning algorithm was applied to the data to exclude the poorest soundings, no tidal correction was applied and data was gridded at a coarse resolution.

On completion of the survey and cruise, further processing of the multibeam data was undertaken to create fully cleaned and seamless bathymetry data. This involved further cleaning of sounding swathes, applying a tidal correction as discussed above and CUBE processing using the IVS Fledermaus software. All data was gridded at a resolution of 2 m and a colour scale ranging from –20 m to –98 m was applied to all data to provide consistency and allow comparison between surveys.

Figure A1.2: Multibeam data processing flow diagram.



As with sidescan sonar data, the large extent of the survey area required a different processing approach than normally applied in local site surveys. The multibeam bathymetry image of the complete survey area would have resulted in a file size of 42 Gb. Surveys had to be split in blocks to produce smaller, workable files. This led to an increase in the processing time required.

On average, 36 h were required to process the data collected during 24 h of continuous multibeam sonar acquisition. However, the time required to process the data may increase or decrease depending on the quality of depth soundings, which is affected by the weather conditions during survey.

A1.5 QTC Multi View applied to multibeam data

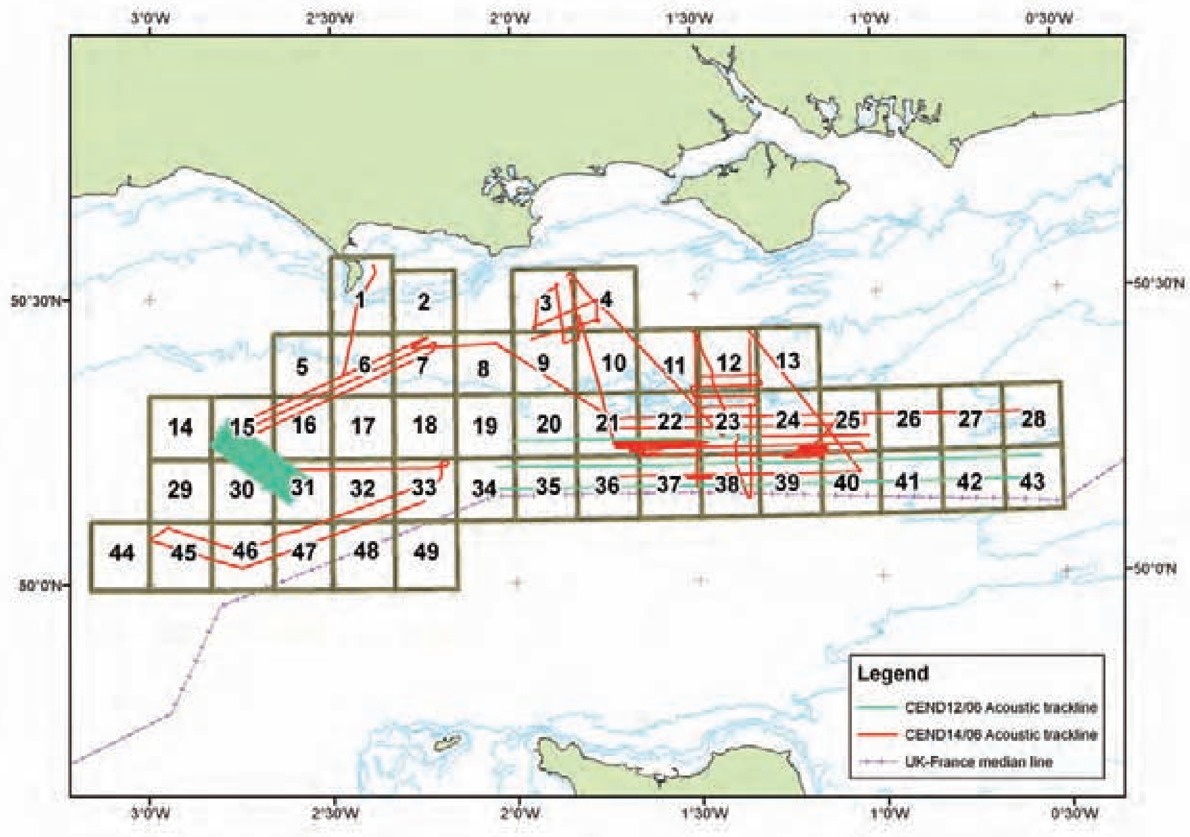
Part of the EM3000D multibeam data collected in the Wight site was processed using QTC's MultiView software (release 3.00). QTC MultiView is a classification software for multibeam backscatter data. Those areas of the seabed with similar characteristics will be grouped into the same classes.

Firstly, all raw multibeam data files were loaded in the software and converted into the appropriate format to allow the software to undertake the analysis. Basic data cleaning was undertaken in the software, to remove erroneous data points from the analysis process. QTC MultiView will analyse the backscatter characteristics within analysis rectangles. The size of rectangles can be defined by the user and in this case was set to be 9 pings high and 129 samples wide. This equates to approximately an area of 8 m by 7 m.

For each rectangle, the software will extract a set of features (backscatter parameters such as mean, standard deviation, range, etc). Using multivariate statistical methods, the features dataset will be analysed using principal components. Afterwards, cluster analysis of the principal components is undertaken. It is assumed that different clusters represent different seabed types.

The classification analysis was undertaken with the number of classes set at 30, and 5 iterations of the analysis were ran to increase the confidence of the results. From the results, it was obvious that it did not make sense to differentiate more than 22 classes. Therefore, the results based on only 22 classes were exported to GIS.

Figure A1.3: Tidal zones created around the survey trackline.



The results were spatially reviewed in a GIS in conjunction with the expert knowledge derived from the bathymetry surface. Two classes were most dominant (combined 82% of aerial coverage) in the area and corresponded to sediment (class 17) and rock (class 9). The remaining classes were very limited in their distribution and did not seem to identify specific seabed types. Generally, it was found that the additional classes were closely related to one of the dominant classes. When grouping the results in just 2 classes, sediment versus rock, it was found that a good correlation could be seen between the QTC classification results and what was expected from expert review of the data.

A1.6 Application of Benthic Terrain Modeler

Benthic Terrain Modeler (BTM) is an ArcGIS extension that was created as part of a cooperative agreement between Davey Jones' Locker Seafloor Mapping and Marine GIS Laboratory, Department of Geosciences at Oregon State University, and the National Oceanic and Atmospheric Administration Coastal Services Center. It can be downloaded free of charge from http://www.csc.noaa.gov/products/btm/. Benthic Terrain Modeler was originally developed to classify benthic terrain around American Samoa based on multibeam data (Lundblad *et al.*, 2006).

The classification into benthic zones and structures relies on the concept of bathymetric position index (BPI). The BPI is a measure of where a location is relative to the locations surrounding it. BPI is derived from an input bathymetric data set and itself is a modification from the topographic position index algorithm that is used in the terrestrial environment. BPI data sets are created through a neighbourhood analysis function. Positive cell values within a BPI data set denote features and regions that are higher than the surrounding area. Therefore, areas of positive values characterise crests (Figure A1. 4). Likewise, negative cell values characterise depressions. BPI values near zero are either flat areas (where the slope is near zero) or areas of constant slope (where the slope is significantly greater than zero). This critical slope is by default set to 5°, based on the experience made in American Samoa (Lundblad *et al.*, 2006). For the analysis of the DSB single-beam bathymetry, the critical slope to separate flats from slopes was however set to 0.5°, based on trials with different slope settings (0.25°, 0.5°, 1° and 5°). This is reasonable, because the relatively coarse grid of 75 m tends to average out steeper slopes.

BPI data sets are created from an input bathymetric data set by applying an algorithm that utilises a neighbourhood function. Neighbourhood functions produce an output raster in which the output cell value at each location is a function of the input cell value and the values of the cells in a specified "neighbourhood" surrounding that location. Bathymetric position is an inherently scale-dependent

Figure A1.4: Left – Positive and negative BPI value derivation for crests and depressions. Right – Areas where the BPI value is near or equal to zero. The slope of the terrain at the given point is used to determine the bathymetric position (Source: BTM software 'help' files).

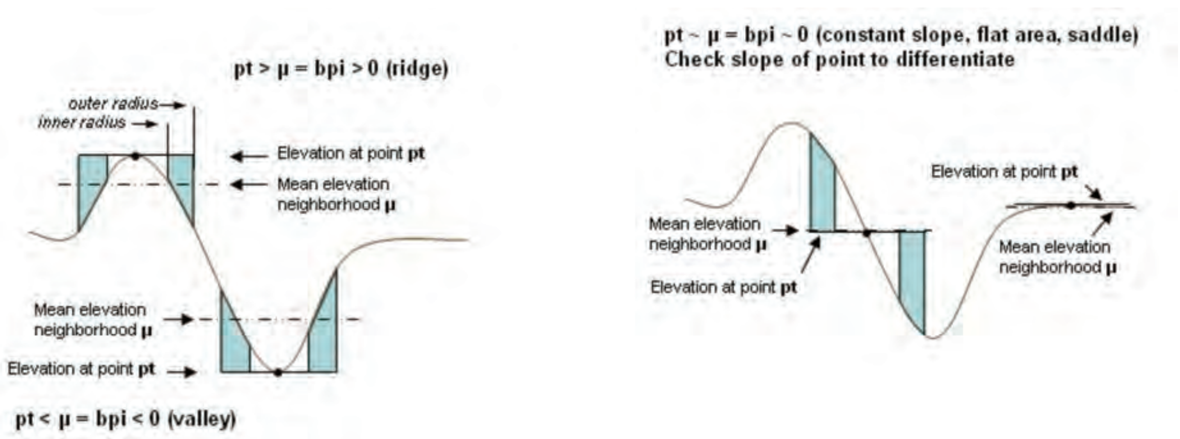
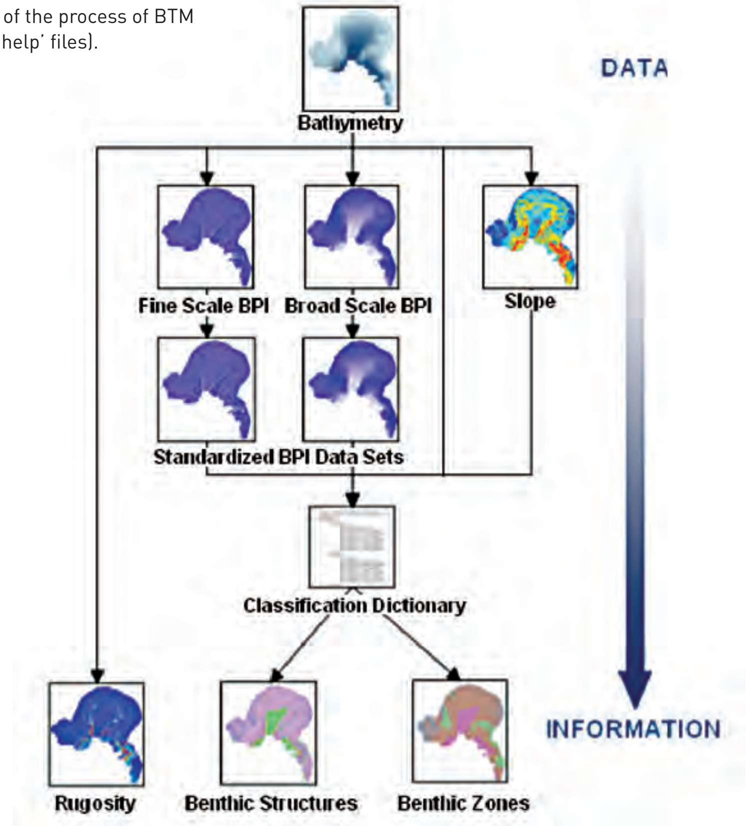


Figure A1.5: Illustration of the process of BTM (Source: BTM software 'help' files).



phenomenon. Therefore, two different BPI datasets, with different scale factors, are created during the benthic terrain classification process. Fine scale BPI data sets have smaller analysis neighbourhoods, and thus a smaller scale factor. Fine scale BPI data sets are useful for identifying smaller benthic terrain features. Broad scale BPI data sets have larger analysis neighbourhoods, and thus a larger scale factor. These data sets are useful in identifying larger benthic terrain regions or areas. Several scale factors were tested in order to achieve the best BPI zone and structure classifications. A scale factor of 3 (equalling 225 m) for the fine scale BPI and a scale factor of 6 (equal to 450 m) for the broad scale BPI were finally selected.

Benthic Terrain Modeler was also applied to classify an area in the Wight site called X2-Y2 Infill (see main report), which was mapped with full multibeam coverage (2 m by 2 m grid size). Again, different slopes (1°, 2°, 3°, 4° and 5°) and scale factors for the fine scale BPI (10, 20 and 30) and the broad scale BPI (50, 70 126 and 250) were tested. The following values were finally chosen: 5°, 30 (60 m) and 250 (500 m).

Once BPI data sets have been created at both fine and broad scales, the next step in the benthic terrain classification process is to standardise the values of these raster data sets (Figure A1. 5). Standardisation of the raw BPI values allows for the classification of BPI data sets at almost any scale. Standardised BPI data sets together with slope data yield two different outputs: benthic zones and benthic structures. Benthic terrain is classified with the help of the classification dictionary into four different benthic zones, which are (1) crests, (2) depressions, (3) flats and (4) slopes (as described above). Benthic structures also include these four basic categories, however, subdivisions have been made to further describe benthic terrain. These are: (1) narrow depression, (2) local depression on flat, (3) lateral midslope depression, (4) depression on crest, (5) broad depression with open bottom, (6) broad flat, (7) shelf, (8) open slopes, (9) local crest in depression, (10) local crest on flat, (11) lateral midslope crest, (12) narrow crest and (13) steep slope. More detailed descriptions are given in Lundblad *et al.*(2006). Besides the adjustment of critical slope mentioned above, the shelf class (originally defined as flat terrain shallower than 22 m) has been included in the broad flat class. Also, steep slopes (> 70°) were not realised.

Finally, Benthic Terrain Modeler yielded rugosity data.

A1. 7 Acknowledgements

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Appendix 2: Video analysis summary report

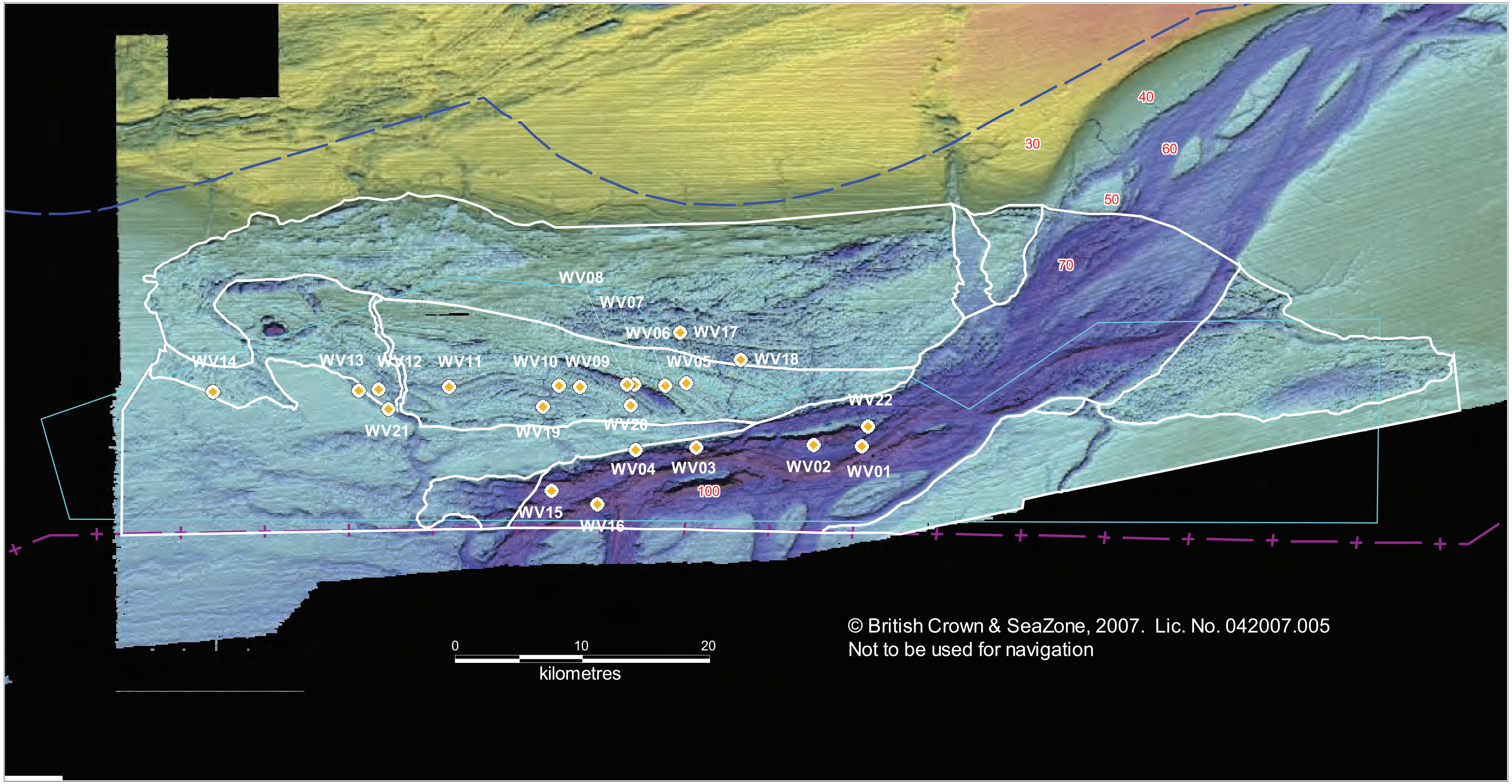
This appendix provides tabulated summary of the video analysis, listing for each segment of each video analyse the EUNIS and MNCR habitat classes, the duration of the segment, and the taxa recorded from video.

The analysis was conducted by:

Roger Coggan:	Wight Video 'WV' stations
Matt Curtis:	Wight Transect 'W' stations
Chris Barrio-Frojan:	Portland stations

The location of the sampling stations is shown overlain on a terrain model derived from Digital Survey Bathymetry.

Wight Video - 'WV' stations



EventName	WV01	WV02	WV02	WV03	WV03
Video SampleKey	WV01 S1	WV02 S1	WV02 S2	WV03_S1	WV03_S2
5.Biotope	A4.12	A4.12	A5.15	A5.15	A4.131
Classification	Deep sponge communities	Deep sponge communities	Offshore Coarse Sediments	Offshore Coarse Sediments	Bryozoan turf and erect sponges on tide-swept circalittoral rock
BiotopeKey	CR.HCR.DpSp	CR.HCR.DpSp	SS.SCS.OCS	SS.SCS.OCS	CR.HCR.XFa.ByErSp
AnnexIHabitat	Rocky reef	Rocky reef	NONE	NONE	Rocky reef
AnnexIHabComment	Cobble reef	Cobble reef			
Modifier	Palaeovalley floor	Palaeovalley floor	Palaeovalley floor	Palaeovally lip	Palaeovalley edge, upper slope
Duration (hh:mm:ss)	00:10:01	00:09:48	00:10:18	00:02:31	00:01:54
Taxa from Video	Aequipecten opercularis Alcyonium digitatum Cliona celata Halichondria bowerbanki Henricia Pentapora foliacea Polymastia boletiformis Sagartia elegans Sagartia troglodytes Tethya U. sponge_arborescent U. sponge_cushion Urticina felina	Crossaster papposus Henricia Pentapora foliacea Sagartia elegans Sagartia troglodytes Tethya Tubularia U. anemone U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_globular	Crossaster papposus Flustra foliacea Ophiocomina nigra Sagartia elegans U. anemone U. hydroid crust U. sponge_arborescent U. sponge_encrusting Urticina felina	Flustra foliacea Henricia U. sponge_encrusting U. sponge_massive	Calliostoma zizyphinum Pachymatisma johnstonia Pentapora foliacea U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_massive

EventName	WV03	WV03	WV03	WV04	WV04
Video SampleKey	WV03_S3	WV03_S4	WV03_S5	WV04_S1	WV04_S2
5.Biotope	A4.131	A4.12	A4.134	A5.15	A4.134
Classification	Bryozoan turf and erect sponges on tide-swept circalittoral rock	Deep sponge communities	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Offshore Coarse Sediments	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock
BiotopeKey	CR.HCR.XFa.ByErSp	CR.HCR.DpSp	CR.HCR.XFa.FluCoAs	SS.SCS.OCS	CR.HCR.XFa.FluCoAs
AnnexIHabitat	Rocky reef	Rocky reef	Rocky reef	/(/.	Rocky reef
AnnexIHabComment					
Modifier	Palaeovalley edge, mid slope	Palaeovalley edge, lower slope	Palaeovalley floor	Lag gravel	
Duration (hh:mm:ss)	00:07:06	00:04:01	00:09:13	00:10:17	00:09:43
Taxa from Video	Crossaster papposus Flustra foliacea Henricia Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Stelligera stuposa U. anemone_white U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting	Henricia Pachymatisma johnstonia U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting	Crossaster papposus Flustra foliacea Henricia Nemertesia Pachymatisma johnstonia Polymastia boletiformis Tethya U. anemone U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting	Crossaster papposus Flustra foliacea Henricia Nemertesia antennina U. anemone U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_globular	Calliostoma zizyphinum Flustra foliacea Henricia Nemertesia antennina Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis U. anemone U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_globular U. sponge_massive

EventName	WV05	WV05	WV06	WV06	WV06
Video SampleKey	WV05_S1	WV05_S2	WV06_S1	WV06_S2	WV06_S3
5.Biotope	A4.134	A5.141	A4.2144	A4.214	A5.14
Classification	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	Circalittoral coarse sediment
BiotopeKey	CR.HCR.XFa.FluCoAs	SS.SCS.CCS.PomB	CR.MCR.EcCr.FaAlCr.Bri	CR.MCR.EcCr.FaAlCr	SS.SCS.CCS
AnnexIHabitat	Rocky reef	NONE	Rocky reef	Rocky reef	NONE
AnnexIHabComment					
Modifier		Lag gravel			
Duration (hh:mm:ss)	00:06:19	00:02:34	00:04:12	00:01:48	00:01:59
Taxa from Video	Abietinaria abietina Alcyonium digitatum Bispira volutacornis Crossaster papposus Dercitus bucklandi Flustra foliacea Henricia Nemertesia antennina Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Stelletta grubii Tethya U. anemone U. ascidian_solitary U. bryozoan_encrusting U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting Urticina felina	Pentapora foliacea Pomatoceros Stelletta grubii U. anemone U. bryozoan_encrusting U. hydroid crust U. sponge_cushion U. sponge_encrusting	Abietinaria abietina Alcyonium digitatum Crossaster papposus Flustra foliacea Ophiocomina nigra Ophiothrix fragilis Pomatoceros U. sponge_encrusting Urticina felina	Abietinaria abietina Actinothoe sphyrodeta Alcyonium digitatum Axinella dissimilis Crossaster papposus Flustra foliacea Henricia Nemertesia antennina Ophiocomina nigra Ophiothrix fragilis Pentapora foliacea Polymastia boletiformis Pomatoceros Tethya U. ascidian_solitary U. bryozoan_encrusting U. hydroid crust U. sponge_cushion U. sponge_encrusting	Crossaster papposus Henricia U. sponge_encrusting Urticina felina

EventName	WV07	WV07	WV08	WV08	WV08
Video SampleKey	WV07_S1	WV07_S2	WV08_S1	WV08_S2	WV08_S3
5.Biotope	A5.141	A5.14	A4.134	A4.131	A5.14
Classification	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Circalittoral coarse sediment	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Bryozoan turf and erect sponges on tide-swept circalittoral rock	Circalittoral coarse sediment
BiotopeKey	SS.SCS.CCS.PomB	SS.SCS.CCS	CR.HCR.XFa.FluCoAs	CR.HCR.XFa.ByErSp	SS.SCS.CCS
AnnexIHabitat	Rocky reef	NONE	Rocky reef	Rocky reef	NONE
AnnexIHabComment	Cobble reef on Rock				
Modifier					
Duration (hh:mm:ss)	00:06:01	00:05:58	00:08:30	00:04:30	00:07:05
Taxa from Video	Abietinaria abietina Aequipecten opercularis Alcyonium digitatum Balanoidea Bispira volutacornis Nemertesia Pentapora foliacea Sagartia Stelligera stuposa Tethya U. ascidian_solitary U. holothurian_burrowing U. hydroid crust U. sponge_cushion U. sponge_encrusting	Balanoidea	Actinothoe sphyrodeta Alcyonium digitatum Botryllus schlosseri Flustra foliacea Morchellium argus Nemertesia antennina Pentapora foliacea Polymastia boletiformis Sagartia U. ascidian_solitary U. bryozoan_encrusting U. sponge_cushion U. sponge_encrusting	Actinothoe sphyrodeta Alcyonium digitatum Botryllus schlosseri Flustra foliacea Henricia Nemertesia antennina Pentapora foliacea Polymastia boletiformis Sagartia Stelligera stuposa U. ascidian_solitary U. bryozoan_encrusting U. sponge_cushion U. sponge_encrusting	Barren

EventName	WV09	WV10	WV10	WV10	WV11
Video SampleKey	WV09_S1	WV10_S1	WV10_S2	WV10_S3	WV11_S1
5.Biotope	A4.134	A5.14	A4.1121	A4.2141	A4.1313
Classification	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Circalittoral coarse sediment	Tubularia indivisa and cushion sponges on tide-swept turbid circalittoral bedrock	Flustra foliacea on slightly scoured silty circalittoral rock	Mixed turf of bryozoans and erect sponges with Sagartia elegans on tide-swept ciraclittoral rock
BiotopeKey	CR.HCR.XFa.FluCoAs	SS.SCS.CCS	CR.HCR.FaT.CTub.CuSp	CR.MCR.EcCr.FaAlCr.Flu	CR.HCR.XFa.ByErSp.Sag
AnnexIHabitat	Rocky reef	NONE	Rocky reef	Rocky reef	Rocky reef
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:20:03	00:08:52	00:00:52	00:00:39	00:28:01
Taxa from Video	Abietinaria abietina Adreus fascicularis Alcyonium digitatum Cliona celata Crossaster papposus Flustra foliacea Henricia Nemertesia antennina Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Pomatoceros Stelletta grubii Tethya U. ascidian_solitary U. bryozoan_encrusting U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_flabellate Urticina felina	Barren	Actinothoe sphyrodeta Alcyonium digitatum Axinella dissimilis Bispira volutacornis Henricia Pachymatisma johnstonia Pentapora foliacea Stelletta grubii Tubularia indivisa U. sponge_cushion U. sponge_encrusting	Flustra foliacea Pachymatisma johnstonia Polymastia boletiformis Stelletta grubii U. ascidian_solitary U. bryozoan_encrusting U. hydroid crust	Abietinaria abietina Actinothoe sphyrodeta Alcyonium digitatum Asterias rubens Flustra foliacea Henricia Nemertesia Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Sagartia Tethya U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting Urticina felina

EventName	WV12	WV12	WV12	WV13	WV13
Video SampleKey	WV12_S1	WV12_S2	WV12_S3	WV13_S1	WV13_S2
5.Biotope	A4.134	A4.1342	A5.14	A5.141	A5.14
Classification	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Flustra foliacea, small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders	Circalittoral coarse sediment	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Circalittoral coarse sediment
BiotopeKey	CR.HCR.XFa.FluCoAs	CR.HCR.XFa.FluCoAs.SmAs	SS.SCS.CCS	SS.SCS.CCS.PomB	SS.SCS.CCS
AnnexIHabitat	Rocky reef	Rocky reef	NONE	NONE	NONE
AnnexIHabComment					
Modifier				Palaeochannel floor	Palaeochannel floor
Duration (hh:mm:ss)	00:03:19	00:01:56	00:01:01	00:17:02	00:05:38
Taxa from Video	Alcyonium digitatum Antho dichotoma Corynactis viridis Flustra foliacea Tethya U. anemone U. hydroid crust U. sponge_cushion U. sponge_encrusting	Alcyonium digitatum Antho dichotoma Dendrodoa grossularia Flustra foliacea Henricia Pachymatisma johnstonia Perophora Sagartia Tubularia U. sponge_cushion U. sponge_encrusting Urticina felina	Barren	Aequipecten opercularis Asterias rubens Flustra foliacea Nemertesia antennina Ophiocomina nigra Pentapora foliacea Sagartia elegans U. anemone U. hydroid crust U. sponge_cushion Urticina felina Versicularia spinosa	Nemertesia antennina

EventName	WV13	WV14	WV14	WV14	WV15
Video SampleKey	WV13_S3	WV14_S1	WV14_S2	WV14_S3	WV15_S1
5.Biotope	A4.134	A5.141	A4.134	A5.141	A4.12
Classification	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Deep sponge communities
BiotopeKey	CR.HCR.XFa.FluCoAs	SS.SCS.CCS.PomB	CR.HCR.XFa.FluCoAs	SS.SCS.CCS.PomB	CR.HCR.DpSp
AnnexIHabitat	Rocky reef	NONE	Rocky reef	NONE	Rocky reef
AnnexIHabComment					Boulder reef
Modifier	Palaeochannel floor				
Duration (hh:mm:ss)	00:01:18	00:10:09	00:06:50	00:06:19	00:03:15
Taxa from Video	Aequipecten opercularis Balanoidea Flustra foliacea Nemertesia antennina Perophora U. hydroid crust U. sponge_cushion	Actinothoe sphyrodeta Aequipecten opercularis Alcyonium digitatum Crossaster papposus Flustra foliacea Henricia Pentapora foliacea Polymastia boletiformis Pomatoceros Sagartia U. anemone U. hydroid crust U. sponge_cushion U. sponge_encrusting	Actinothoe sphyrodeta Alcyonium digitatum Crossaster papposus Flustra foliacea Henricia Nemertesia antennina Pentapora foliacea Polymastia boletiformis Sagartia Serpula vermicularis U. anemone U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting	Actinothoe sphyrodeta Alcyonium digitatum Crossaster papposus Flustra foliacea Henricia Nemertesia antennina Polymastia boletiformis Pomatoceros U. anemone U. ascidian_solitary U. hydroid crust U. sponge_cushion U. sponge_encrusting	Bispira volutacornis Cancer pagurus Cliona celata Diazona violacea Pachymatisma johnstonia U. ascidian_solitary U. sponge_cushion U. sponge_massive

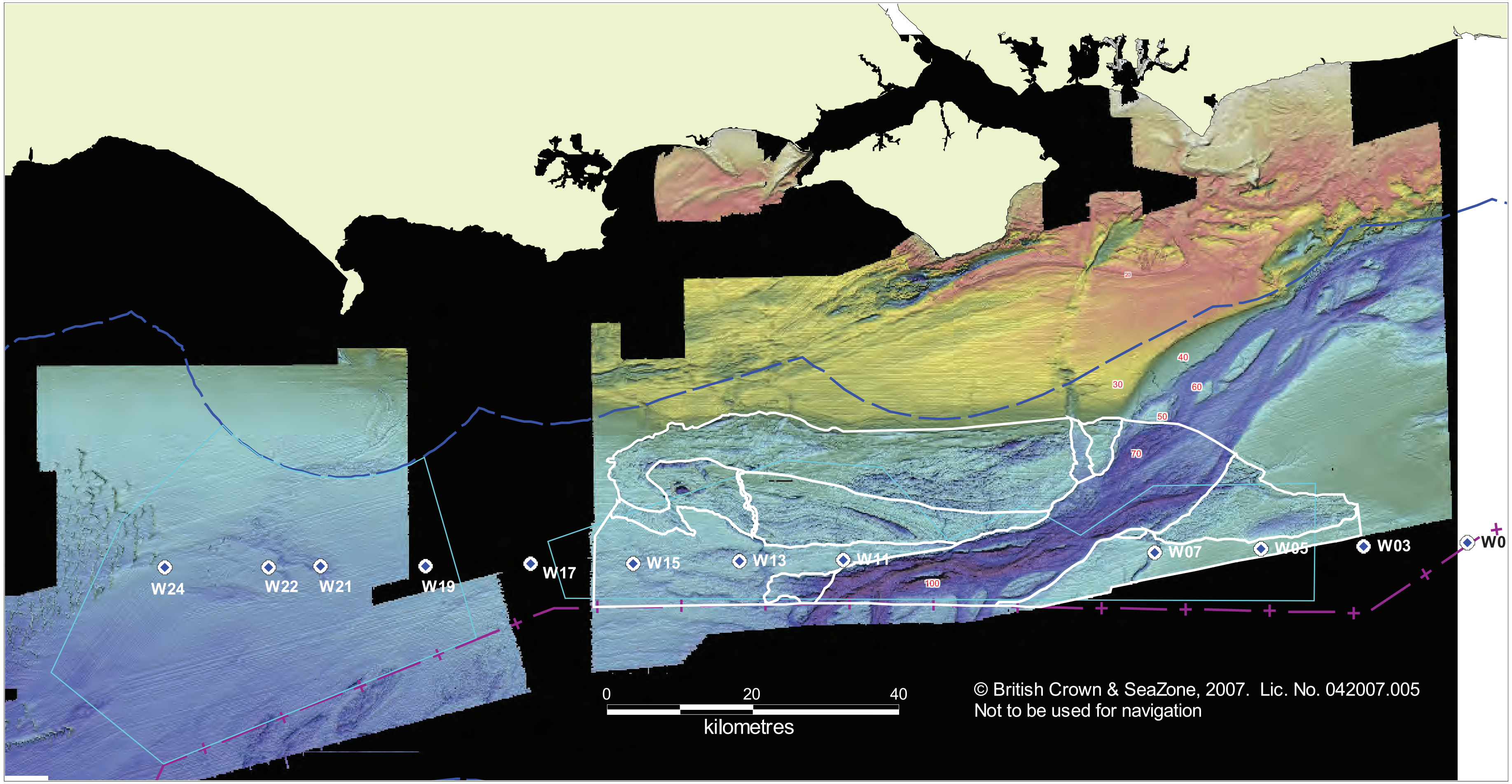
EventName	WV15	WV15	WV16	WV16	WV17
Video SampleKey	WV15_S2	WV15_S3	WV16_S1	WV16_S2	WV17_S1
5.Biotope	A5.141	A4.111	A4.134	A5.15	A4.134
Classification	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Balanus crenatus and Tubularia indivisa on extremely tide-swept circalittoral rock	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Offshore Coarse Sediments	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock
BiotopeKey	SS.SCS.CCS.PomB	CR.HCR.FaT.BalTub	CR.HCR.XFa.FluCoAs	SS.SCS.OCS	CR.HCR.XFa.FluCoAs
AnnexIHabitat	NONE	Rocky reef	Rocky reef	NONE	Rocky reef
AnnexIHabComment		Boulder reef	Boulder reef		
Modifier					
Duration (hh:mm:ss)	00:14:20	00:05:05	00:20:03	00:20:03	00:04:31
Taxa from Video	Bispira volutacornis Dercitus bucklandi Flustra foliacea Henricia Marthasterias glacialis Nemertesia Pachymatisma johnstonia Pentapora foliacea U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_globular U. sponge_massive	Bispira volutacornis Cliona celata Henricia Nemertesia Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Tubularia U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_globular U. sponge_massive	Alcyonium digitatum Calliostoma zizyphinum Cliona celata Corynactis viridis Crossaster papposus Flustra foliacea Henricia Pachymatisma johnstonia Polymastia boletiformis Tubularia U. ascidian_solitary U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_massive	U. sponge_arborescent Urticina felina	Actinothoe sphyrodeta Axinella dissimilis Bispira volutacornis Calliostoma zizyphinum Flustra foliacea Henricia Necora puber Nemertesia Pentapora foliacea Polymastia boletiformis U. sponge_arborescent U. sponge_cushion U. sponge_encrusting

EventName	WV17	WV18	WV18	WV18	WV19
Video SampleKey	WV17_S2	WV18_S1	WV18_S2	WV18_S3	WV19_S1
5.Biotope	A5.27	A5.15	A4.12	A4.134	A4.12
Classification	Offshore circalittoral sand	Offshore Coarse Sediments	Deep sponge communities	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Deep sponge communities
BiotopeKey	SS.SSa.OSa	SS.SCS.OCS	CR.HCR.DpSp	CR.HCR.XFa.FluCoAs	CR.HCR.DpSp
AnnexIHabitat	NONE	NONE	Rocky reef	Rocky reef	Rocky reef
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:15:29	00:06:21	00:04:19	00:02:14	00:09:08
Taxa from Video	Barren	Axinella dissimilis Flustra foliacea Henricia Polymastia boletiformis Protula tubularia U. anemone U. ascidian_solitary U. hydroid crust U. sponge_encrusting Urticina felina	Alcyonium digitatum Axinella dissimilis Axinella infundibuliformis Cliona celata Flustra foliacea Henricia Nemertesia antennina Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Stelletta grubii U. anemone U. hydroid crust U. sponge_cushion U. sponge_encrusting	Crossaster papposus Flustra foliacea Pomatoceros U. anemone U. hydroid crust U. sponge_cushion U. sponge_encrusting Urticina felina	Adreus fascicularis Aequipecten opercularis Alcyonium digitatum Crossaster papposus Henricia Pentapora foliacea Polymastia boletiformis Tethya U. anemone U. ascidian_solitary U. sponge_arborescent U. sponge_cushion U. sponge_encrusting U. sponge_flabellate

EventName	WV19	WV20	WV20	WV21	WV21
Video SampleKey	WV19_S2	WV20_S1	WV20_S2	WV21_S1	WV21_S2
5.Biotope	A5.141	A4.134	A4.131	A5.141	A4.134
Classification	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Bryozoan turf and erect sponges on tide-swept circalittoral rock	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock
BiotopeKey	SS.SCS.CCS.PomB	CR.HCR.XFa.FluCoAs	CR.HCR.XFa.ByErSp	SS.SCS.CCS.PomB	CR.HCR.XFa.FluCoAs
AnnexIHabitat	NONE	Rocky reef	Rocky reef	NONE	Rocky reef
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:09:59	00:05:47	00:05:11	00:06:19	00:02:04
Taxa from Video	Aequipecten opercularis Nemertesia antennina Ophiocomina nigra Pomatoceros U. anemone U. hydroid crust U. sponge_encrusting	Asterias rubens Flustra foliacea Polymastia boletiformis Stelletta grubii U. anemone U. ascidian_solitary U. hydroid crust U. sponge_encrusting	Abietinaria abietina Actinothoe sphyrodeta Adreus fascicularis Alcyonium digitatum Asterias rubens Cliona celata Dercitus bucklandi Flustra foliacea Henricia Pentapora foliacea Perophora Polymastia boletiformis Stelletta grubii U. anemone U. ascidian_solitary U. hydroid crust U. sponge_arborescent U. sponge_cushion U. sponge_encrusting	Balanoidea Calliostoma zizyphinum Flustra foliacea Pomatoceros Sagartia U. hydroid crust U. sponge_cushion Urticina felina	Balanoidea Flustra foliacea Henricia Sagartia U. hydroid crust U. sponge_cushion Urticina felina

EventName	WV21	WV22	WV22	WV22
Video SampleKey	WV21_S3	WV22_S1	WV22_S2	WV22_S3
5.Biotope	A5.14	A4.134	A4.12	A5.45
Classification	Circalittoral coarse sediment	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock	Deep sponge communities	Offshore circalittoral mixed sediment
BiotopeKey	SS.SCS.CCS	CR.HCR.XFa.FluCoAs	CR.HCR.DpSp	SS.SMx.OMx
AnnexIHabitat	NONE	Rocky reef	Rocky reef	Rocky reef
AnnexIHabComment				Stony reef
Modifier				
Duration (hh:mm:ss)	00:15:50	00:01:19	00:01:00	00:04:43
Taxa from Video	Nemertesia Sagartia Urticina felina	Adreus fascicularis Axinella dissimilis Axinella polypoides Dercitus bucklandi Flustra foliacea Nemertesia Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Stelletta grubii U. hydroid crust U. sponge_cushion U. sponge_encrusting U. sponge_globular	Alcyonium digitatum Axinella dissimilis Dercitus bucklandi Diazona violacea Henricia Nemertesia Pachymatisma johnstonia Stelletta grubii U. sponge_cushion U. sponge_encrusting	Adreus fascicularis Axinella dissimilis Bispira volutacornis Diazona violacea Flustra foliacea Nemertesia Pachymatisma johnstonia Pentapora foliacea Polymastia boletiformis Protula tubularia Stelletta grubii U. hydroid crust U. sponge_cushion U. sponge_encrusting

Wight Transect - 'W' stations

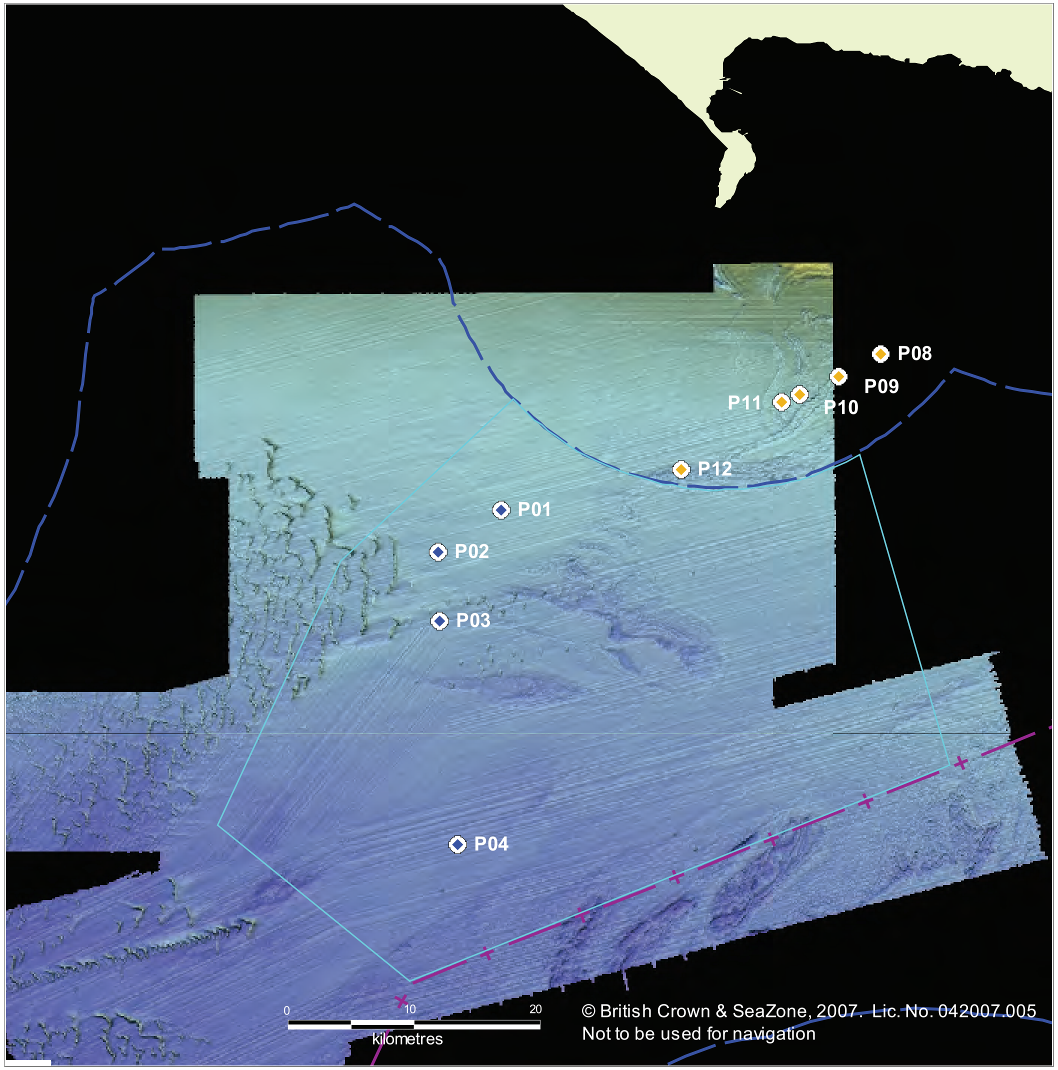


EventName	W01	W03	W05	W07	W11
Video SampleKey	W01_S1	W03_S1	W05_S1	W07_S1	W11_S1
5.Biotope	A5.141	A5.445	A5.445	A5.445	A5.141
Classification	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment	Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment	Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
BiotopeKey	SS.SCS.CCS.PomB	SS.SMx.CMx.OphMx	SS.SMx.CMx.OphMx	SS.SMx.CMx.OphMx	SS.SCS.CCS.PomB
AnnexIHabitat	NONE	NONE	NONE	NONE	NONE
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:20:00	00:20:00	00:20:00	00:22:00	00:20:00
Taxa from Video	Aequipecten opercularis Alcyonium digitatum Aspitrigla cuculus Asterias rubens Crossaster papposus Henricia oculata Maja squinado Mesacmaea mitchellii Paguridae Urticina felina	Aequipecten opercularis Asterias rubens Crossaster papposus Hyas Ophiothrix fragilis Paguridae Urticina felina	Aequipecten opercularis Asterias rubens Crossaster papposus Henricia oculata Hyas Ophiocomina nigra Ophiothrix fragilis Paguridae Pecten maximus Sepiola Urticina felina	Aequipecten opercularis Asterias rubens Crossaster papposus Henricia oculata Hyas Ophiocomina nigra Ophiothrix fragilis Paguridae Pecten maximus Urticina felina	Crossaster papposus Paguridae Urticina felina

EventName	W13	W15	W17	W19	W21
Video SampleKey	W13_S1	W15_S1	W17_S1	W19_S1	W19_S1
5.Biotope	A5.444	A5.445	A5.444	A5.141	A5.141
Classification	Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment	Ophiothrix fragilis and/or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment	Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
BiotopeKey	SS.SMx.CMx.FluHyd	SS.SMx.CMx.OphMx	SS.SMx.CMx.FluHyd	SS.SCS.CCS.PomB	SS.SCS.CCS.PomB
AnnexIHabitat	NONE	NONE	NONE	NONE	NONE
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:18:00	00:20:00	00:19	00:15	00:12
Taxa from Video	Aequipecten opercularis Alcyonium digitatum Crossaster papposus Henricia oculata Paguridae Urticina felina	Crossaster papposus Maja squinado Ophiothrix fragilis Paguridae Sagartia elegans Urticina felina	Aequipecten opercularis Alcyonium digitatum Asterias rubens Atelecyclus rotundatus Cancer pagurus Crossaster papposus Flustra foliacea Henricia oculata Maja squinado Paguridae Pentapora foliacea Urticina felina	Aequipecten opercularis Alcyonium digitatum Anseropoda placenta Asterias rubens Botryllus schlosseri Crossaster papposus Paguridae Urticina felina	Aequipecten opercularis Alcyonium digitatum Asterias rubens Crossaster papposus Liocarcinus Macropodia Paguridae Urticina felina

EventName	W22	W24
Video SampleKey	W22_S1	W24_S1
5.Biotope	A5.141	A5.44
Classification	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Circalittoral mixed sediment
BiotopeKey	SS.SCS.CCS.PomB	SS.SMx.CMx
AnnexIHabitat	NONE	NONE
AnnexIHabComment		
Modifier		
Duration (hh:mm:ss)	00:20	00:23
Taxa from Video	Aequipecten opercularis Alcyonium digitatum Asterias rubens Henricia oculata Paguridae Urticina felina	Aequipecten opercularis Asterias rubens Atelecyclus rotundatus Buccinum undatum Henricia oculata Macropodia Ophiura Paguridae

Portland - 'P' stations



EventName	P01	P02	P03	P04	P08
Video SampleKey	P01_S1	P02_S1	P03_S1	P04_S1	P08_S1
5.Biotope	A5.15	A5.15	A5.15	A5.15	A5.15
Classification	Offshore circalittoral coarse sediment	Offshore circalittoral coarse sediment	Offshore circalittoral coarse sediment	Offshore circalittoral coarse sediment	Offshore circalittoral coarse sediment
BiotopeKey	SS.SCS.OCS	SS.SCS.OCS	SS.SCS.OCS	SS.SCS.OCS	SS.SCS.OCS
AnnexIHabitat	NONE	NONE	NONE	NONE	NONE
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:27:42	00:21:20	00:20:22	00:20:08	00:04:45
Taxa from Video	Aequipecten opercularis Alcyonidium diaphanum Asterias rubens Cerianthus Flustra foliacea Glycymeris glycymeris Liocarcinus Macropodia Nemertesia Ophiura albida Pagurus Pomatoceros Sabella Sertularia	Aequipecten opercularis Alcyonidium diaphanum Alcyonium digitatum Asterias rubens Cerianthus Glycymeris glycymeris Liocarcinus Macropodia Nemertesia Pagurus Pecten maximus Pomatoceros Sabella Sertularia Solaster	Aequipecten opercularis Alcyonidium diaphanum Alcyonium digitatum Asterias rubens Cerianthus Flustra foliacea Nemertesia Pagurus Pomatoceros Sertularia	Aequipecten opercularis Asterias rubens Cerianthus Decapoda Glycymeris glycymeris Nemertesia Pagurus Sertularia Solaster	Flustra foliacea Pomatoceros U. hydroid turf U. sponge_encrusting

EventName	P08	P08	P09	P10	P11
Video SampleKey	P08_S2	P08_S3	P09_S1	P10_S1	P11_S1
5.Biotope	A4.23	A5.15	A4.23	A4.23	A4.23
Classification	Soft rock communities	Offshore circalittoral coarse sediment	Soft rock communities	Soft rock communities	Soft rock communities
BiotopeKey	CR.MCR.SfR	SS.SCS.OCS	CR.MCR.SfR	CR.MCR.SfR	CR.MCR.SfR
AnnexIHabitat	Rocky reef	NONE	Rocky reef	Rocky reef	Rocky reef
AnnexIHabComment					
Modifier					
Duration (hh:mm:ss)	00:12:05	00:03:19	00:29:35	00:24:25	00:15:14
Taxa from Video	Actinothoe sphyrodeta Aequipecten opercularis Alcyonium digitatum Asterias rubens Calliostoma Cancer pagurus Cerianthus Flustra foliacea Henricia oculata Pentapora foliacea Pomatoceros U. hydroid turf U. sponge_encrusting U. sponge_massive	Cerianthus Flustra foliacea Hydrozoa Pomatoceros U. sponge_encrusting	Actinothoe sphyrodeta Aequipecten opercularis Alcyonium digitatum Balanoidea Calliostoma Caryophyllia smithii Decapoda Ebalia Flustra foliacea Hormathia Hydrallmania falcata Macropodia Nemertesia Pagurus Pecten maximus Pentapora foliacea Pomatoceros U. ascidian_colonial U. ascidian_solitary U. hydroid turf U. sponge_arborescent U. sponge_encrusting U. sponge_massive	Actinothoe sphyrodeta Aequipecten opercularis Alcyonium digitatum Axinella Balanoidea Calliostoma Cerianthus Cliona celata Decapoda Ebalia Flustra foliacea Henricia oculata Macropodia Munida rugosa Nemertesia Pagurus Pentapora foliacea Pomatoceros Sabella Tealia felina Tethya aurantium U. ascidian_colonial U. ascidian_solitary U. sponge_encrusting	Actinothoe sphyrodeta Aequipecten opercularis Alcyonium digitatum Axinella Balanoidea Calliostoma Cerianthus Cliona celata Flustra foliacea Henricia oculata Nemertesia Pentapora foliacea Pomatoceros Sabella Solaster Tealia felina Tethya aurantium U. ascidian_colonial U. sponge_encrusting

EventName	P11	P12
Video SampleKey	P11_S2	P12_S1
5.Biotope	A5.15	A5.15
Classification	Offshore circalittoral coarse sediment	Offshore circalittoral coarse sediment
BiotopeKey	SS.SCS.OCS	SS.SCS.OCS
AnnexIHabitat	NONE	NONE
AnnexIHabComment		
Modifier		
Duration (hh:mm:ss)	00:28:08	00:17:11
Taxa from Video	Aequipecten opercularis	Actinothoe sphyrodeta
	Alcyonium digitatum	Aequipecten opercularis
	Axinella	Alcyonium digitatum
	Balanoidea	Anseropoda placenta
	Calliostoma	Axinella
	Cerianthus	Balanoidea
	Ebalia	Caryophyllia smithii
	Flustra foliacea	Cerianthus
	Henricia oculata	Ebalia
	Macropodia	Gibbula
	Nemertesia	Glycymeris glycymeris
	Pagurus	Henricia oculata
	Pentapora foliacea	Macropodia
	Pisidia longicornis	Nemertesia
	Pomatoceros	Ophiocomina nigra
	Protula tubularia	Ophiothrix fragilis
	Solaster	Pagurus
	Tealia felina	Pecten maximus
	Tethya aurantium	Pentapora foliacea
	U. anemone_white	Pisidia longicornis
	U. ascidian_solitary	Pomatoceros
	U. sponge_encrusting	Solaster
	U. sponge_massive	Tealia felina
		U. ascidian_colonial
		U. ascidian_solitary
		U. sponge_encrusting

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