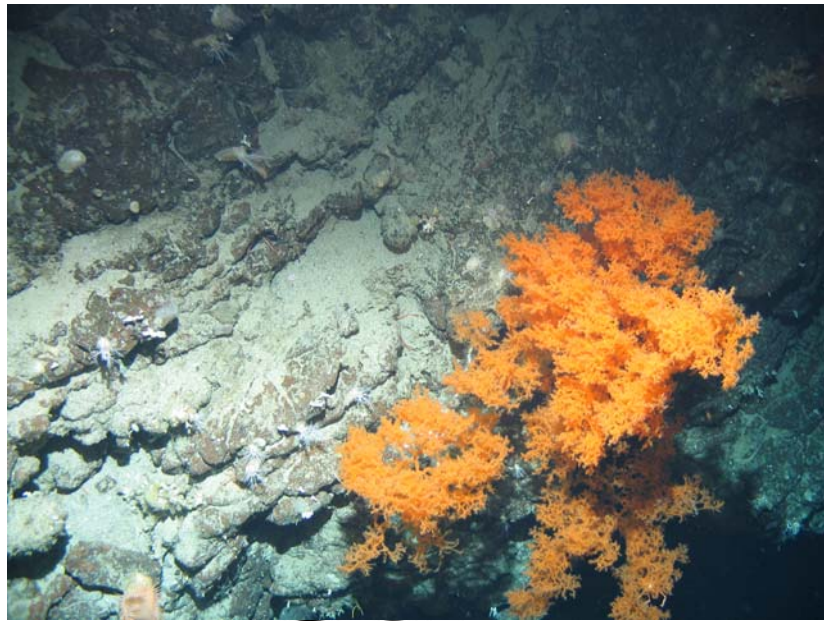




Strategic Environmental Assessment Area 7

Photographic Analysis - Report



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Strategic Environmental Assessment Area 7

Photographic Analysis Report

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SUMMARY

Two photographic sea bed surveys were undertaken in the Strategic Environmental Assessment Area 7 in 2005. One under the auspices of the DTI, the second by Fisheries Research Services and the Joint Nature Conservation Committee in conjunction with the SEA 7 survey. During the two surveys a total of 86 stations were sampled covering the Hebrides Slope, Anton Dohrn Seamount, Rockall Bank, Hatton Bank and George Bligh Bank. The sampling sites also spanned a range of water depth (141 – 2180 m) as well as habitat types from fine grained mud through to exposed bedrock.

Visible megafaunal diversity was found to be high on George Bligh, Hatton Bank and areas of Rockall Bank compared to Anton Dohrn and the Hebrides Slope. Extensive areas of reef framework created by the scleractinian corals *Lophelia pertusa* and *Madrepora oculata* were found at 500-900 m on the Hatton and George Bligh banks and 270 – 630 m on Rockall Bank. These coral-dominated areas supported a rich associated sessile epifauna. Steep slopes and terraces of bedrock at 1000-1300 m on the eastern side of the George Bligh bank supported a sparse sessile epifauna of encrusting sponges, solitary scleractinians and antipatharian corals. The broad summits of the Anton Dohrn seamount, Rockall and George Bligh Bank were covered by extensive sand plains with a low diversity epifauna dominated by echinoids. Localized exposures of bedrock on the Anton Dohrn were colonized by barnacles, brachiopods and encrusting bryozoans but appeared to lack scleractinian corals, massive sponges or other large sessile epifauna. The southeast soft sediment areas of Rockall Bank were dominated by echinoids and *Nephrops norvegicus* burrows. Hard substrata on the eastern flank of Rockall Bank was colonised by encrusting sponges and bryozoans with areas of live *L. pertusa* reef. The northwest and western regions also supported *L. pertusa* reef. The visible epifauna of fine muddy substrata on the Hebrides Slope and the bed of the northern Rockall Trough were dominated by xenophyophores, solitary scleractinians, ophiuroids and echinoids. Demersal fish seen in all regions included morids (*Lepidion eques*), rabbitfish (*Chimaera monstrosa*) and the bluemouth red fish (*Helicolenus dactylopterus*). Evidence of bottom trawling was seen on the Rockall Bank but not at any of the other localities surveyed.

CONTENTS

1 INTRODUCTION	4
2 METHODS	7
2.1. Shipboard photographic sampling	7
2.1.1. Camera system at SEA 7 stations	7
2.1.2. Camera systems used at FRS/JNCC stations	8
2.2. Image analysis and standardisation.....	9
2.2.1. Video Analysis.....	9
2.2.2. Stills analysis	10
3 RESULTS	13
3.1. Hebrides Continental Slope	13
3.2. Anton Dohrn Seamount	16
3.2.1. Anton Dohrn SEA 7 stations.....	17
3.2.2 Anton Dohrn FRS/JNCC stations	30
3.3. Rockall Bank.....	34
3.3.1. Rockall Bank SEA 7 stations.....	34
3.3.2 Rockall Bank FRS/JNCC stations	47
3.4. Hatton Bank	67
3.5. George Bligh Bank	78
4 SUMMARY	92
4.1. Hebrides Continental Slope	92
4.2. Anton Dohrn Seamount	93
4.3. Rockall Bank.....	93
4.4. Hatton Bank	94
4.5. George Bligh Bank	95
5 CONCLUSIONS.....	96
6 ACKNOWLEDGEMENTS	97
7 REFERENCES	97
APPENDIX I	99
Hebrides Continental Slope	99
Anton Dohrn Seamount	102
Rockall Bank SEA 7 Stations	111
Rockall Bank FRS Scotia Stations.....	132

Hatton Bank Stations	153
George Bligh Bank Stations.....	169
APPENDIX II.....	178

FIGURES

Figure 1. Chart of the SEA 7 area with major topographical features labelled.	4
Figure 2. Chart showing sampling stations undertaken on the Kommandor Jack cruise (purple) and on the Scotia cruise (yellow).....	6
Figures 3. a) Drop frame camera system b) Sledge camera system.....	8
Figures 4 a-d. Images selected by Colin Jacobs (NOCS) to illustrate different types of hydrodynamic activity.	11

1 INTRODUCTION

Deep-sea ecosystems to the West of Scotland are subject to increasing anthropogenic pressures arising from the expansion of demersal fisheries as well as hydrocarbon exploration (Gage 2001). Despite importance in development of deep sea biology, little modern information is available describing the sea bed conditions or the benthic habitats.

As part of a comprehensive Strategic Environmental Assessment of the UK territorial seabed, the Department of Trade and Industry has implemented a regional sea bed environmental survey in an area to the West of Scotland. The Strategic Environmental Assessment Area 7 encompasses a region from 6 - 24° W and from 54 - 60° N (Figure 1) and has the largest area of deep water (>500 m) of any other SEA area explored. Within this region there are a variety of habitats ranging from continental slopes to almost abyssal plain like expanses of sea bed as well as a number of seamounts and

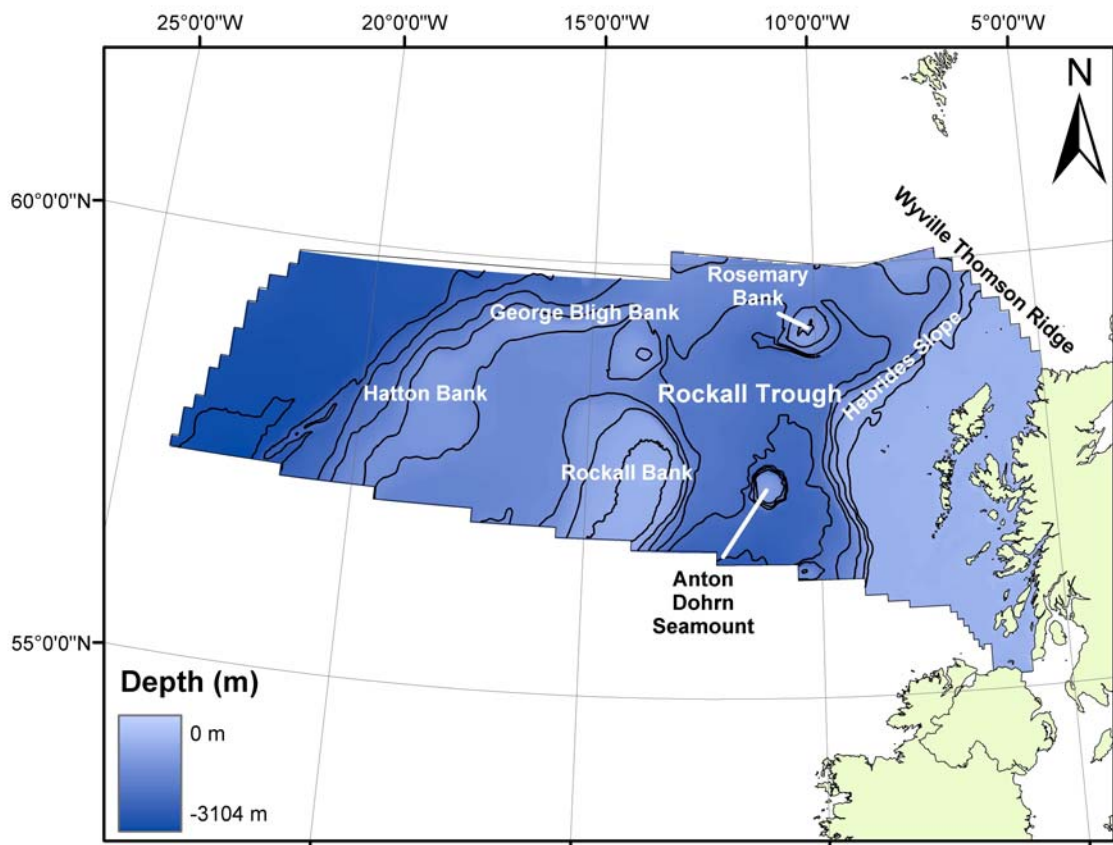


Figure 1. Chart of the SEA 7 area with major topographical features labelled.

Several research programmes have already sampled parts of the SEA 7 area. These include the Land Ocean Interaction Study – Shelf Edge Study (LOIS-SES) transect on the Hebrides Slope (Mitchell et al. 1997), the Scottish Association for Marine Science’s Station “M” (Gage 1986), the Benthic Boundary Layer Experiment (BENBO) (Hughes & Gage 2004), stations sampled during the AFEN 1998 survey (AFEN 2000) and stations in the Enterprise (Jones et al. 1998), Statoil and Agip (Black 1998) blocks (NW Hebrides). Some stations from these sampling programmes were included in the 2005 SEA 7 survey.

The aim of the SEA 7 survey was to survey as large an area as possible with some specific targeted sites. These target areas included the UK’s largest seamounts, Anton Dohrn and Rosemary Bank as well as Rockall, Hatton and George Bligh banks. In order to aid the geophysical survey which was undertaken prior to the biological survey four transect lines were created. These transect lines incorporated some of the pre-existing stations sampled in previous programmes (mentioned above), the target sites as well as some additional stations to provide greater background information.

The work undertaken was not a routine environmental impact survey but more a specific research project which was guided by two main factors: a) the potential hydrocarbon exploration along this area of the United Kingdom Continental Shelf (UKCS), and b) the need of the Joint Nature Conservation Committee (JNCC) to explore areas which they regard as potentially qualifying under Annex I of the EU Habitats Directive for designation as offshore marine Special Areas of Conservation (SAC), on the basis of the possible occurrence of reefs (biogenic or otherwise).

A second survey in the area was undertaken by Fisheries Research Services (FRS) as part of their routine monitoring of fish populations on Rockall Bank. On this survey FRS allowed the JNCC to conduct video surveys of the area in tandem with the SEA 7 survey. This second survey undertook further sampling on Anton Dohrn and Rockall Bank (Figure 2). All stations with the prefix DW or COR were sampled by FRS in collaboration with JNCC and the University of Plymouth. The images and video relating to those stations are Crown Copyright FRS/JNCC. The data pertaining to these stations have been presented here in this report with respect to the needs and purpose of the Strategic Environmental Assessment process. A further analysis of this

data in respect of the needs and requirements of the JNCC is continuing and will be available in the near future.

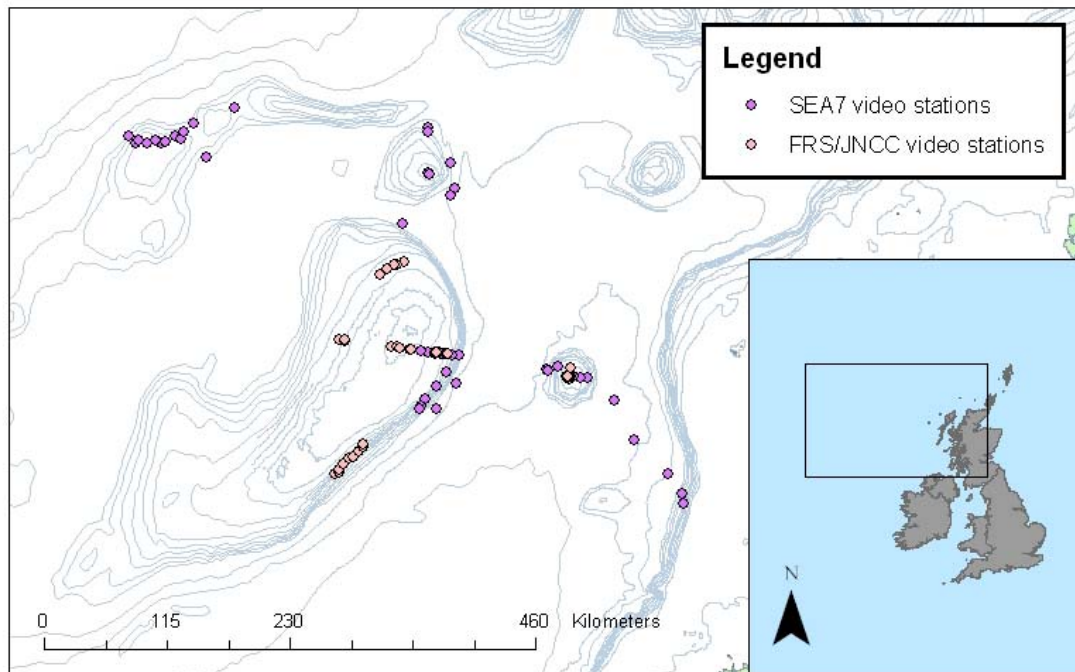


Figure 2. Chart showing sampling stations undertaken on the Kommandor Jack cruise (purple) and on the Scotia cruise (yellow).

Not all areas were sampled during the SEA 7 survey, namely Rosemary Bank and the sampling of some of the Statoil/Agip/AFEN stations as a result of frequent poor weather and technical problems with equipment.

This report presents the biological results of the photographic sampling undertaken in the SEA 7 area and observed geological and interpreted physical nature of the sea bed.

2 METHODS

2.1. Shipboard photographic sampling

Three different photographic systems were used to collect still and video images. A Seatronics camera system was used on the SEA 7 Kommandor Jack cruise and a drop frame system and a sledge system was used on the FRS Scotia cruise. Both the sledge and drop frame system on Scotia were deployed from an A-frame at the stern of the ship, the Seatronics system was deployed at the side of the ship. The aim was for each station to be videoed for a minimum of 30 minutes; however this varied considerably from several minutes to several hours, depending on weather conditions, the environment being surveyed and any technical problems experienced with the camera systems. Where possible images were taken every 2 minutes and/or where major habitat changes or interesting fauna were observed. For stations prefixed DW fewer images were taken and the focus was on interesting fauna. Still images were taken at the same time as the video was being run and were not taken in a separate tow.

2.1.1. Camera system at SEA 7 stations

A single deep water drop camera system was used on the SEA 7 Kommandor Jack Survey. The camera system comprised a Seatronics DTS 6000 digital video telemetry system which gave real time video link to the surface as well as a 5 mega pixels digital stills camera from Kongsberg and Imenco. Sensors had also been fitted to allow for monitoring of depth, altitude, temperature etc. and a USBL beacon was used so that exact positions for each individual stills image could be recorded. Although the camera system is a drop down system the actual camera was mounted so it had an oblique view of the sea bed. Where possible, images were taken when the camera frame was touching the sea bed, however exceptions were, 1) when the substratum was extremely soft, huge silt clouds formed, thus the aim was to take the still image before it touched the sea bed, and 2) when the substratum was extremely rocky, uneven, or descending a cliff face, still images were taken when the camera frame was suspended above the sea bed. The size of the field of view of images is unknown as no scaling device was used.

2.1.2. Camera systems used at FRS/JNCC stations

Two camera systems were utilised by the Scotia survey. A drop frame system (Figure 3a) and a sledge system (Figure 3b). Both consisted of a separate video and stills camera, an altimeter, and depth gauge. The video camera used was a Kongsberg-Simrad 14 - 366 Colour Zoom Camera 1/2" CCD 560 Lines Resolution. The stills camera was a Benthos 35mm Model 378. No USBL beacon was used; as a result all navigation data are ships position. For the Drop frame system, ships position is likely to be sufficient, for the sledge system, the camera is towed some distance behind the vessel. Calculation of layback in deep-water is too inaccurate. Both cameras on the drop frame system were mounted looking vertically down at the seabed. A 10 cm diameter drop weight attached to the frame via a 1 m length of rope. This acted as a scaling device and an indicator of the ideal distance off the sea bed for taking stills images (camera in focus, lighting optimal). The drop frame was towed in the water column just off the sea bed. Where possible, images were taken when the drop weight just touched the sea bed (i.e. camera 1 m off the sea bed). The size of the field of view of images taken at 1m off the sea bed is approximately 1.2 m² (1.35 x 0.9 m). The sledge system was substantially larger than the drop frame system. The video and stills cameras were mounted approximately 1m off the seabed at a 45° angle. The size of the field of view remains constant, although actual size is unknown as no scaling device was used. The image is trapezoid in shape.



Figure 3. a) Drop frame camera system
(Courtesy FRS)



b) Sledge camera system
(Courtesy K. Howell, Uni. of Plymouth)

2.2. Image analysis and standardisation

A selection of still images and video tows were selected and analysed by all contributors to ensure that the analytical procedure was standardised. Each person reviewed the selected tows/still images and noted changes in habitat. Observed boundaries were compared for consistency of interpretation. In addition a series of photographs with differing sediment types were jointly categorised using the Wentworth scale, again to ensure consistency in interpretation of sediment types within the project. Identification of different types of hydrodynamic activity was undertaken using four images sent by Colin Jacobs (National Oceanography Centre - Southampton) (see Figure 4a-d).

Faunal identification and standardisation was undertaken in the same way as for sediment types with the exchange of images. It is impossible to accurately identify to species level all the fauna seen in these images. Some taxonomic groups are more difficult than others, but where possible, the lowest taxonomic level has been ascribed to the fauna seen.

There were several problems: It is impossible at present to determine the abundance of fauna as photographs were not taken at a standard height off the seabed (irregular substrata does not help this). The use of visible laser scaling points would be essential for future work. Also changing the field of view makes it difficult to know how large an area is being viewed; it was possible to zoom in close to an object using the camera on the Kommandor Jack cruise.

2.2.1. Video Analysis

Video analysis was mainly used to identify the boundaries between habitats as well as to broadly describe the habitats and biotopes that were viewed.

- 1) The entire video was viewed, with major changes in the sea bed and habitat type being noted. Habitat type was identified using Greene et al.'s (1999) classification scheme for deep seafloor habitats; biotope classification was undertaken using the European Nature Information System (EUNIS) scheme

(Table 1). This allowed boundaries between habitat types to be highlighted and more in-depth analysis to be undertaken.

- 2) Distinct habitats identified on the video were analysed in depth with regards to the biology. The still images were also used in conjunction with the video as the quality was much higher.
- 3) The substratum type was qualified using the Wentworth Scale in conjunction with the still images. Additionally a record was made of burrows and any trawl marks seen.

2.2.2. Stills analysis

Each photograph was categorised in terms of sediment type, evidence of hydrodynamic activity, visible fauna (maximum zoom of 200% to ensure that the same level of detail was being analysed and to reduce over/under estimation of fauna), abundance of individual taxa, habitats, as well as evidence of human activities.

Estimations for abundance of individual taxa were undertaken where possible. Generally, large individual megafauna have been counted and an estimate given for the entire distance covered in one camera run. However, these estimates have to be viewed with some caution as camera height above the sea bed varied considerably. Abundance of fauna was also examined and compared either side of any boundaries that were crossed within a station.



a) Ripple 1



b) Ripple 2



c) Ripple 3



d) Ripple 4

Figure 4 a-d. Images selected by Colin Jacobs (NOCS) to illustrate different types of hydrodynamic activity.

Table 1. European Nature Information System Database version 2 – Habitat classification categories.

Level 1	Level 2	Level 3	Level 4	Description
A				Marine Habitats
	6			Deep-sea bed
		A6.1		Deep-sea rock and artificial substrata
			A6.11	Deep-sea bedrock
			A6.12	Deep-sea artificial hard substrata
			A6.13	Deep-sea manganese nodules
			A6.14	Boulders on the deep-sea bed
		A6.2		Deep-sea mixed substrata
			A6.21	Deep-sea lag deposits
			A6.22	Deep-sea biogenic gravels (shells, coral debris)
			A6.23	Deep-sea calcareous pavements
			A6.24	Communities of allochthonous material
		A6.3		Deep-sea sand
			A6.31	Communities of bathyal detritic sands with <i>Grypheus vitreus</i>
		A6.4		Deep-sea muddy sand
		A6.5		Deep-sea mud
			A6.51	Mediterranean communities of bathyal muds
			A6.52	Communities of abyssal muds
		A6.6		Deep-sea bioherms
			A6.61	Communities of deep-sea corals
			A6.62	Deep-sea sponge aggregations

3 RESULTS

The results are presented by area surveyed, i.e. Anton Dohrn, Rockall Bank etc. A general overview of each region is given followed by more in-depth analysis of each station. All video images are in colour unless otherwise stated. Selected still images are given in Appendix I and analyses of individual still images are given in Appendix II.

3.1. Hebrides Continental Slope

On the Hebrides continental slope, only a single mesohabitat is generally seen comprising fine sediment. At the shallower stations (~650 – 1000 m) there is evidence of hydrodynamic activity and Type 4 ripples are seen. Faunal density and diversity is also low with fauna present mainly belong to the Echinodermata group. At the deeper stations (~1400 – 2200 m) there is no evidence of hydrodynamic activity. Again megafaunal diversity is low, and is dominated by echinoderms, however unlike the shallower stations there is evidence of burrows.

LOIS-SES1#4 (677 – 700 m) Duration 08:00 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality of this brief tow is very poor, with visibility frequently obscured by silt clouds raised by contact with the sea bed. At close range the video image also suffers from overexposure caused by excessive or badly-positioned lighting (image quality is better when the video camera is elevated higher above the bed). The limited observations and the brevity of the tow suggest that only a single habitat is represented. The bed consists of fine sediment, possibly muddy sand, with clear evidence of hydrodynamic activity (Type 4 ripples, best seen on still photos 09 and 11). There is no sign of burrowing, but a linear echinoid trail is visible (with its maker) on photo 05.

The most commonly observed organism (five individuals counted) is a reddish-orange echinoid, probably *Echinus acutus*. This species is visible on the video tow at 03:47

min and is also represented on still photos 05, 06 and 11. Individuals of a small, unidentified asteroid species are seen on photos 01, 06 and 08, while unidentified small ophiuroids are present on photos 01 and 10. A single individual neogastropod, possibly *Colus jeffreysianus*, was also seen and photographed ([photo 09](#)).

LOIS-SES2#2 (980 – 1004 m) Duration 21:00 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality of the video tow is poor for much of the time, with lengthy stretches of the first ~ 10 minutes obscured by silt clouds. During the latter ~ 10 minutes the camera is elevated higher, resulting in a more consistent view of the sea bed. However the higher elevation and the monochrome image make it difficult to observe fine detail of the surface. The sea bed consists of fine sediment, either mud or sandy mud. There are occasional small pebbles on the surface but no larger stones. There is no evidence of burrowing. At the outset the sea bed appears flat, but by 06:27 min (photo 10). Type 4 ripples are evident on the still photographs. Clear ripples persist until the end of the tow ([photos 16](#) and 19) and are also visible on the video images by 14:54 min. There are no distinct habitat boundaries but it is possible that the tow covers a gradient of increasing hydrodynamic activity.

Density and diversity of observed benthic life is low. Nine xenophyophores were counted but this should be considered a minimum estimate as the poor resolution of the monochrome video image makes it difficult to distinguish these organisms from the background sediment. Xenophyophores are visible on still photos 04 and 08. The only other epibenthic organisms are unidentified ophiuroids, five of which were seen. Again, these animals are difficult to distinguish on the video image, especially from a high camera elevation. Ophiuroids are recorded on still photos 08, 09, 20 and 21, with the latter two giving the best images. An elongate fish casts a shadow on the sea bed in photo 02. An unidentified fish is also briefly in view on the video footage at 18:29 min.

LOIS-SES3#1 (1457 – 1536 m) Duration 18:42 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is very poor, with frequent camera impacts raising clouds of silt which completely obscure the sea bed for much of the time. Small unidentified swimming organisms are abundant in the near-bed water column. The rare and brief views of the sea bed show a flat, fine sediment (probably mud) bottom. There is no evidence of hydrodynamic activity and no stones are visible. Fine-scale biogenic relief is apparent on the close-up still photos of the surface (e.g. [photo 11](#)). A cluster of four large burrow openings is briefly visible at 17:20 on the video footage.

A tiny orange asteroid is visible on photo 04, but no other benthic organisms can be distinguished on either the still or video images.

LOIS-SES4#1 (2025 m) Duration 42:15 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is very poor, with infrequent and brief views of the sea bed. Frequent camera impacts raise clouds of silt which completely obscure the visibility for much of the time. When visible, the sea bed can be seen to consist of largely featureless fine sediment, probably mud. There is no sign of hydrodynamic activity. Possible burrow openings are distinguishable on the video footage at 35:09 and 40:57 min.

The only epibenthic organisms visible are a white, long-spined echinoid, probably *Echinus affinis*, and the large ophiuroid *Ophiomusium lymani*. Three individuals of *E. affinis* were observed (recorded on still photos 04, 13), and four *O. lymani* (photos 15, 16, 17, [22](#)).

Station M#1 (2180 m) Duration 35:30 min

Eunis habitats: A6.5

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is generally poor, partly as a result of the erratic vertical motion of the camera frame. Frequent contact with the sea bed generates a haze of fine particles and visibility is greatly reduced. As a result clear views of the sea bed are brief and infrequent. The benthic environment appears to be uniform throughout the station, with no evidence of habitat transitions. The bottom sediments are a pale whitish mud with the general appearance of deep-sea biogenic ooze. There is no evidence of hydrodynamic activity but fine-scale biogenic surface relief is visible on some of the close-up still photographs. Biogenic features consist of overlapping linear striations (photos 03, 13), an asteroid trace (photo 15) and micro-scale rugosity (e.g. [photo 12](#)) probably formed by the tube endings and faecal deposits of infaunal macrobenthos. Larger burrow openings can occasionally be seen in the clearer stretches of the video footage, for example at 00:41 min and 11:34 min. Burrow openings are also visible on still photographs 02, 06 and 09.

The diversity of observed megafauna is very low, the most common being the large ophiuroid *Ophiomusium lymani* (examples visible at 02:39, 08:30, 11:34 min., and on still photos 04 and 18). Isolated individuals are seen quite frequently throughout the tow but the limited and patchy visibility precludes a more precise estimate of abundance. Arm movements of this ophiuroid are likely to be the cause of the linear surface striations noted earlier. The only other visible organisms are single individuals of a tiny asteroid (photo 01) and a red anthozoan polyp (photo 09), likely to be either an anemone or a solitary coral (possibly *Flabellum* sp.).

3.2. Anton Dohrn Seamount

On Anton Dohrn seamount there are several mesohabitats seen ranging from fine sand/mud with some pebbles/cobbles present through to bedrock. Hydrodynamic activity also appears to vary from not recordable using the ripple key to type 1 and 4 ripples being present. Density and diversity of mobile epifauna was generally low, the

echinoids *Calveriosoma* cf. *fensetratum* and *Cidaris cidaris* tend to dominate, whereas sessile epifauna was dominated by large barnacles (possibly *Bathylasma hirsutum*) and brachiopods (probably *Dallina septigera*).

3.2.1. Anton Dohrn SEA 7 stations

AD_J#1 (530 m) Duration 59:00 min

Eunis habitats: A6.3, A6.11,

Greene et al., 1999 mesohabitats: one (patchy) present, described below

Image quality is generally good with the exception of one short stretch (approximately 12:20 – 14:20 min) when the camera motion is very jerky and the image badly-focused. Small unidentified swimming organisms are abundant in the near-bed water column. The tow begins with the camera apparently descending a slope of fissured, reddish-brown bedrock. After only 00:45 min the base of this slope is reached on a sea bed of coarse sand with abundant biogenic debris, mostly barnacle plates and brachiopod valves but including some coral fragments (photo 03). At 02:20 min biogenic debris still dominates the sea bed but the abundance of shelly material gradually declines until by 04:07 ([photo 04](#)) the sediment consists of coarse sand mixed with gravel and small pebbles. From approximately 10:30 min the gravel/pebble content increases, with cobbles and occasional small boulders appearing from approximately 19:00 min. From approximately 21:40 – 25:00 min the camera crosses a field of boulders and possibly some bedrock with coarse sand in the gaps between them. A stretch of coarse pebbly sand with rare boulders continues until approximately 29:20 min, when another dense boulder field is encountered, extending to approximately 34:00 min. Coarse sand with a patchy mix of gravel and small pebbles and scattered small boulders continues to approximately 48:40 min when boulder density increases, leading on to flat, fissured bedrock at 50:35 min. This bedrock outcrop, with boulders also present, continues to 54:20 min when the camera passes back to coarse gravelly sand once again. More boulders appear just before the end of the tow at 59:00 min.

The sea bed at this station is clearly very patchy, with the greater part consisting of coarse, gravelly or pebbly sand interspersed with boulder fields and at least one low outcrop of bedrock. This can probably be regarded as one patchy mesohabitat, with the sloping bedrock seen briefly at the start of the tow perhaps constituting another. Barnacles (possibly *Bathylasma hirsutum*), brachiopods (probably *Dallina septigera*), serpulid polychaete tubes and patchy encrusting bryozoans and/or sponges are visible on the bedrock ([photo 35](#)) at the start of the tow and also appear on the isolated outcrop crossed at 50:35 – 54:20 min. Mobile epibenthic megafauna are sparse and of low diversity, and do not show any differentiation between sandy and rocky substrata. The most frequently seen animal (28 individuals) is the echinoid *Calveriosoma* cf. *fenestratum*, which occurs throughout the tow both on the sandy and rocky areas. Two individuals of the echinoid *Cidaris cidaris* are also seen. The decapod *Paromola cuvieri* is seen at 02:27 min and possibly at 13:56 min (the second sighting is out-of-focus). A flattened, short-armed asteroid (possibly *Peltaster placenta*) is seen in small numbers (five individuals).

AD_B#1 (525 – 546 m) Duration 39:00 min

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: 2 present, described below

The video images are recorded in black and white. Image quality is generally good, with a smooth, even rate of passage across the sea bed. The initial substratum is coarse sand with a high content of gravel and small pebbles. The sea bed is flat and without ripples. By 03:10 min a shelly component becomes visible in the sediment, and at 03:16 min the camera passes onto grey bedrock with a dense accumulation of barnacle plates at its edge. The rock appears not to be elevated much above the surrounding sandy sea bed. Hollows and channels are filled with coarse sand and biogenic debris. This area of bedrock appears to be quite limited in extent as by 06:06 min the camera is again moving over coarse, pebbly sand with occasional cobbles. This substratum type continues until approximately 16:55 min when bedrock (or a large boulder) is again encountered. From approximately 16:55 to 24:00 min the camera passes over a mixed substratum of boulders and (possibly) bedrock outcrops interspersed with coarse sand ([photo 25](#)) with abundant pebbles and shelly debris

(mostly barnacle plates). Close-up still photos show both dark grey and brick-red rocks. At approximately 24:28 min the elevation increases sharply as the camera appears to be traversing a higher outcrop of bedrock. The topography is rugged and irregular, with projecting bedrock masses and accumulations of barnacle plates in the channels and hollows between them. In the still photographs (e.g. photo 39) the bedrock here appears reddish brown with grey mottling. This extensive area of irregular bedrock continues until 34:35 min, when the camera crosses back onto flat, coarse sand with a low gravel/pebble content and no biogenic debris. This sandy substratum continues until the end of the tow.

The substratum at this station is quite varied and definition of mesohabitat boundaries is to some extent arbitrary. The large expanse of elevated bedrock (24:28 – 34:35 min) clearly represents a different mesohabitat from the surrounding plain of coarse sand, but the division between them is not sharp, with an extensive boulder field forming a transitional zone between the sedimentary and hard substrata. The only epibenthic megafauna visible on the coarse sand substratum are the echinoids *Calveriosoma* cf. *fenestratum* and *Cidaris cidaris*. Both species also occur on the boulder field and on the drifts of biogenic debris filling the hollows between bedrock outcrops, and it is likely that they are able to move freely across the full range of substrata observed at this station. Considering the entire tow, *Calveriosoma* cf. *fenestratum* is more common than *Cidaris cidaris* (28 and four individuals seen respectively). Large mobile epifauna seen as single individuals in the boulder or bedrock zones were the decapod *Paromola cuvieri* (23:46 min, photo 29), an unidentified hermit crab (23:21 min, photo 27), an unidentified galatheid decapod (25:17 min, photo 33), and an echinoid, probably *Echinus elegans* (34:07 min). Two individuals of a flattened, short-armed orange asteroid (possibly *Peltaster placenta*) are visible on the bedrock at 32:39 min ([photo 43](#)) and 33:20 min (photo 44).

The small bedrock outcrop seen early in the tow (03:16 – 06:06 min) has a sparse cover of brachiopods (probably *Dallina septigera*) and occasional barnacles (possibly *Bathylasma hirsutum*). Small greyish patches visible in close-up still photos may be encrusting bryozoan colonies, but this cannot be confirmed at the resolution available. An extensive patch of an unidentified grey encrusting sponge was also seen and photographed (04:56, photo 08). Brachiopods and barnacles are also the most

conspicuous visible epifauna on the extensive area of elevated bedrock seen later in the tow. Quantitative assessments are impossible owing to the irregular topography and inconsistent field of view but both taxa are abundant in some areas (e.g. 27:00 min, photo 36). At close range (e.g. photos 39, 47), the rock surfaces can be seen to support smaller taxa such as encrusting bryozoans, small unidentified ophiuroids and the sessile holothurian *Psolus squamatus*. Large erect sessile epifauna such as corals, stylasterids, gorgonians, antipatharians and massive sponges appear to be absent from this station.

AD_C#1 (556 - 565 m) Duration 35:42 min

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: two present, described below

The video images are of good quality with almost uninterrupted views of the sea bed. The tow begins on a sea bed of flat sand (possibly medium texture) with a low gravel/small pebble content. Some projecting macrofaunal tube endings are visible in close-up still photos (e.g. photos 01, 02). There are occasional scattered cobbles and rare small boulders on the sediment surface, but no signs of hydrodynamic activity. The tow traverses this substratum type for approximately 17:30 min. The gravel and pebble component is patchy but no major habitat boundaries are observed within this zone. At approximately 17:30 min there is a noticeable increase in the pebble content of the sediment and shelly debris (some of which clearly consists of disaggregated barnacle plates) begins to appear. At approximately 18:30 min the camera passes onto a substratum of bedrock outcrops and boulders, with dense drifts of barnacle plates and other shelly material filling the gaps, channels and hollows between the rocks (e.g. photos 13, 14). The bedrock is dark grey, rough in texture, and 'dusted' with sediment in places. Elevation above the surrounding sea bed is difficult to estimate. The camera continues over bedrock and boulder fields with intervening stretches of shelly debris until approximately 25:00 min, when flat sediment is encountered again. As in the first 17 min of the tow, the substratum is sand with variable amounts of gravel and pebbles. Photo 21 shows some small mounds towards the right of the frame, which may be evidence of burrowing activity. This sandy sea bed continues until the end of the tow.

This tow can be considered to cover two mesohabitats, a sandy sea bed with mixed gravel, pebbles and occasional cobbles/small boulders, and a localized area of bedrock and larger boulders interspersed with accumulations of biogenic debris. Epifaunal diversity on the sandy sea bed is low, with no obvious difference between the areas on either side of the bedrock/boulder zone. The echinoid *Calveriosoma* cf. *fenestratum* (e.g. [photo 04](#)) is the most common large animal (14 individuals seen), with a single individual of the echinoid *Cidaris cidaris* also seen. An unidentified short-armed asteroid is visible at 13:13 min, and a different small asteroid with longer arms can be seen on photo 20. Brachiopods (probably *Dallina septigera*) can be seen in small numbers attached to pebbles on some of the close-up still photos (e.g. [photo 11](#)).

The community of the bedrock/boulder mesohabitat is similar to that observed at AD_B#1 and includes a variety of sessile epifauna encrusting the rock surfaces. These are more easily observed on the still photos than on the video footage, owing to the small size of most of the species. As at AD_B#1, large conspicuous taxa such as corals, gorgonians, antipatharians and massive sponges appear to be absent. Brachiopods (probably *Dallina septigera*) and barnacles (possibly *Bathylasma hirsutum*) are the most conspicuous epifauna (e.g. photos 18, 19). Densities seem to be relatively low, but no quantitative estimates are possible. Patches of unidentified blue (22:29 min, and photo 15) and orange (photo 13) encrusting sponges are also occasionally visible. Smaller epifauna visible at close range include holothurians (probably *Psolus squamatus*, 22:29 min) and the erect bryozoan *Reteporella* sp. (photo 18). Mobile epifauna were rarely seen in the bedrock/boulder zone and were limited to the echinoids *Calveriosoma* cf. *fenestratum* (three individuals) and *Cidaris cidaris* (one individual). A possible cerianthid anemone is visible among the accumulated shelly debris in photo 16.

AD_H#1 (572 - 580 m) Total duration 03:12:37 h

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is good with a smooth, even progress across the sea bed. The video footage from this station is saved

in three separate files. File AD_H#1_0 finishes abruptly after 32:10 min with the camera still on the sea bed. File AD_H#1_1 (on the same DVD) appears to continue directly on from H#1_0 and runs for 01:04:17 h. File AD_H#1_2 (on a different DVD) appears to continue directly on from H#1_1 and runs for 01:36:10 h.

The still photos from this station are not divided between the video sequences and are arranged in a continuous series of 40 images. These 40 still images can all be matched with exposures on the video files. After photo 40 an additional 10 exposures shown on video file AD_H#1_2 are absent from the still photo series.

Throughout the long total duration of this video tow there is no apparent change in the benthic environment or biological community and only one mesohabitat appears to be represented. Observations from the three successive video files are therefore combined and discussed together. The substratum consists of flat sand with no evidence of hydrodynamic activity. Close-up still photos suggest that the bed may be medium sand. The gravel/pebble content is patchy but generally low. A small amount of shelly debris is visible in some photos. Cobbles and small boulders are rare. One still photo (03) shows two small grey patches of ejected sediment, one with a pinhole burrow opening. Fine surface projections, possibly macrofaunal tube endings, can be seen on photos 34, 37 and 38.

The low-diversity epibenthic megafauna are dominated by the echinoid *Calveriosoma* cf. *fenestratum* (e.g. [photo 15](#)), which occurs throughout all three video sequences. A total of 108 individuals were counted. A single specimen of *Cidaris cidaris* appears at 48:05 min on section H#1_2. Brachiopods (probably *Dallina septigera*) occur in small numbers on some of the close-up still photos but are too small to be resolved on the video footage. Eight unidentified small fish (some possibly morids) appear on the video footage, and a single *Chimaera monstrosa* is seen at 07:57 min on section H#1_2.

AD_A#1 (591 m) Duration 27:30 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is generally good with a slow, relatively even rate of progress across the sea bed. Unidentified small swimming organisms are abundant in the near-bed water column. The sea bed consists of flat, largely featureless sand. Close-up still photos suggest that this is a medium or fine sand ([photo 01](#)) with a low gravel/pebble content. No cobbles or boulders are seen. There is no visible evidence of burrowing or hydrodynamic activity, but photo 17 shows a clear faecal cast on the sediment surface. With no apparent change in substratum type throughout the tow the station can be considered to represent a single mesohabitat.

The epibenthic fauna is sparse and of low diversity. Small brachiopods appear in some of the close-up still photos (e.g. photo 13) but are rare, perhaps reflecting the scarcity of pebbles for attachment. The echinoids *Cidaris cidaris* (13 individuals) and *Calveriosoma cf. fenestratum* (two individuals) are the only invertebrates visible on the video footage. Single specimens of the rabbitfish (*Chimaera monstrosa*) and an anglerfish (*Lophius* sp.) are seen at 06:50 and 14:32 min respectively. A large fish, possibly another *C. monstrosa*, is briefly in view at 01:23 min.

AD_K#2 (595 m) Duration 33:51 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Video image quality is generally good, with only brief intervals of reduced visibility. Small unidentified swimming organisms are abundant in the near-bed water column. Initially the sea bed consists of flat coarse sand with a low content of gravel and small pebbles ([photo 03](#)). There are also occasional isolated cobbles. By approximately 11:30 min the gravel and pebble component becomes more noticeable, and the stone content continues to increase until by 23:45 the substratum can be classed as pebbly sand. The substratum remains very stony until approximately 31:00 min, when there

seems to be a return to coarse sand with a low gravel/pebble component as seen at the beginning of the tow. Boulders are rare, but one was encountered at 17:50 min and photographed (photo 11). There is no evidence of hydrodynamic activity but signs of burrowing appear on some close-up photos of the sea bed. Photo 12 records a small patch of grey ejecta with a pinhole burrow opening, showing up clearly against the pebble-rich background. Another ejecta patch may be present on photo 16.

Brachiopods (probably *Dallina septigera*) are seen in small numbers on the close-up still photos (e.g. photo 03) but are too small to be resolved on the video footage. Two small hermit crabs are visible on photo 09. The only other epibenthic invertebrates recorded are the echinoids *Cidaris cidaris* (8 individuals) and *Calveriosoma* cf. *fenestratum* (15 individuals). Both species occur throughout the tow. Two fish briefly appear on the video footage, a possible morid at 03:17 min and an unidentified small fish at 26:44.

The variable gravel/pebble content of the sediment at this station does not appear to be reflected in any changes in the visible biota and the tow can be considered to cover a single mesohabitat.

AD_K#1 (600 m) Duration 28:35 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Video image quality is generally good, despite occasional contacts with the sea bed raising clouds of silt. The sea bed is a plain of largely featureless coarse sand with a patchy but generally low content of gravel and small pebbles and occasional scattered cobbles. Isolated small boulders are encountered at 18:56, 19:26 and 20:36 min. There are no ripples or other evidence of hydrodynamic activity. The benthic environment is uniform throughout the tow and appears to comprise a single mesohabitat.

Brachiopods (probably *Dallina septigera*) are too small to be resolved on the video footage but are visible in small numbers on close-up photos of the sea bed (e.g. photos 09, [12](#), 14). The boulder seen at 20:36 min (represented in photo 13) has a sparse

epifauna of brachiopods, barnacles and serpulid polychaetes. A small unidentified ophiuroid is present on photo 06. The only epifaunal invertebrates large enough to be seen on the video footage are the echinoids *Cidaris cidaris* (6 individuals) and *Calveriosoma cf. fenestratum* (11 individuals), both of which were seen throughout the tow, and the holothurian *Stichopus tremulus* (only one specimen seen, at 02:08 min).

A single redfish (*Sebastes* sp.) appears on the video footage at 09:17 min. Morid fish are seen at 09:49 and 23:05 min, and unidentified smaller fish at 15:08 and 21:34 min.

SAMS_GEO2#1 (660 m) Duration 20:25 min

Eunis habitats: A6.21

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is generally good for both video and still photographs. The sea bed is a flat plain of very coarse sand mixed with gravel, small pebbles and some shelly debris. The stony content is patchy but there appears to be no consistent gradation and the entire tow can be regarded as covering a single habitat. There are occasional scattered cobbles on the sediment surface but no boulders are seen. There is also no evidence of hydrodynamic activity.

Observed epibenthic diversity is very low. Small brachiopods (probably *Dallina septigera*) can be seen attached to pebbles in most of the still photographs which offer a close-up view of the sea bed (as in photos 04, 06, 07, [16](#)). These animals are too small to be resolved in the video footage. Four individuals of the echinoid *Cidaris cidaris* were counted (photos 17, 18). An unidentified small fish appears on the video footage at 14:28 min.

AD_D#1 and D#2 (725 m) Total duration 29:30 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

These two stations are included on a single video tow with no break in recording between them. Station D#1 covers only the first nine minutes of video footage and is associated with 10 still photos (1_01 to 1_10). The substratum consists of very coarse sand mixed with gravel and small pebbles ([photo 02](#)). The sea bed appears flat with no sign of ripple marks. However at 05:58 a small boulder is seen with an asymmetrical 'trail' of pebbles and cobbles (conspicuous only on one side), which may be evidence of current scour. Very little epibenthic fauna is seen on this brief tow. Three individuals of the echinoid *Cidaris cidaris*, a tiny unidentified asteroid (photo 1_01) and an unidentified small fish (02:57 min) are the only visible organisms.

At 08:55 min the camera frame leaves the sea bed and the video footage records an off-bottom traverse until the sea bed becomes visible again at 10:44 min. This is station D#2, which continues until the end of the tow at 29:30 min. and is associated with 20 still photos (2_01 to 2_20). As at station D#1 the substratum consists of coarse sand with gravel and pebbles, but in contrast to D#1 there is clear evidence of hydrodynamic activity in the form of parallel linear bands of gravel/pebbles alternating with sand of lower stone content. These Type 1 ripples are clearly shown on still photos 2_02 and 2_03. Occasional large cobbles or small boulders are seen with asymmetrical 'trails' of pebbles as noted earlier. The strongly rippled pebbly coarse sand substratum is seen from the beginning of station D#2 (10:44 min) and continues until approximately 23:50 min when the rippling becomes less apparent and seems to fade out by the end of the tow. Coincident with the decrease in ripple features the video image gives the impression that the camera is descending a slope, although it is difficult to be certain whether this is an accurate interpretation or an optical illusion.

Epibenthic density and diversity are both low. The only invertebrates visible on the video footage are the echinoids *Cidaris cidaris* (11 individuals seen) and *Calveriosoma* cf. *fenestratum* (one individual at 21:56 min). The eel

Synphobranchus kaupi (e.g. [photo 11](#)) is seen on four occasions and an unidentified small fish (possibly a morid) appears at 17:26 min.

SAMS_GEO1#1 (795 m) Duration 34:00 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is generally good for both video and still photographic images. The bottom sediment is broadly similar to that of station SAMS_GEO2#1, consisting of sand with a variable mix of gravel and small pebbles. The sand matrix appears to be finer than at the shallower station, and can be classed as coarse rather than very coarse. In contrast to station SAMS_GEO2#1, there is evidence for hydrodynamic activity in the form of faint rippling, with gravel and small pebbles appearing in linear bands (best seen on the video footage between approximately 18:30 and 24:00). Scattered cobbles are present, and small boulders are also encountered at 00:25, 10:10, 23:15 and 31:33 min. The varying gravel/pebble content and the occurrence of boulders creates patchiness on the sea bed but there is no obvious gradation through the tow and the station can be regarded as comprising a single benthic habitat.

The epibenthic megafauna is very sparse. The brachiopods and echinoids seen at SAMS_GEO2#1 were not observed. A single individual of the holothurian *Stichopus tremulus* was encountered (still photos 07, 08, [09](#)). The boulder seen at 23:15 min (photos 17, 18) carries serpulid polychaete tubes and possibly small encrusting bryozoan colonies. An unidentified decapod crustacean is also visible sheltering under this boulder. Two individuals of the eel *Synphobranchus kaupi* can be seen (17:02 min and photo 13; 29:36 min) and an unidentified small fish is visible at 31:03 min.

AD_F#1 (1420 m) Duration 29:25 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below

The video images are recorded in black and white. Image quality is generally poor, with the sea bed frequently obscured by clouds of silt. The single mesohabitat at the station is characterised by a substratum of pale-coloured fine sand or mud (e.g. [photo 07](#)) mixed with small pebbles and gravel. Isolated small boulders appear at 00:49, 17:59, 25:52 and 27:27. There is no sign of burrowing or hydrodynamic activity.

Two species of echinoderm dominate the visible epifauna, the ophiuroid *Ophiomusium lymani* (35 individuals) and a white echinoid, probably *Echinus affinis* (30 individuals). Both these species are sufficiently large and conspicuous to show up on the poor-quality video footage. A benthic anthozoan, possibly a solitary coral, is also occasionally seen (five individuals). Some less common or conspicuous fauna appear on the still photographs. Three small ophiuroids appear on photo 15. One individual has a grey disc and smooth whitish arms and may be a juvenile *O. lymani*. The other two have a brick-red disc and spiny arms and clearly belong to a different (unidentified) species. A colony of the alcyonacean *Anthomastus grandiflorus* appears on photo 01. A translucent soft-bodied organism visible on photo 13 is unidentified but may be an opisthobranch gastropod.

AD_G#1 (1739 – 1763 m) Duration 32:30 min

Eunis habitats: A6.5

Greene et al., 1999 mesohabitats: one present, described below

The video images are variable in quality. For the first 5 min (approximately) of the tow the camera proceeds in a series of ‘bounces’ across the sea bed, raising clouds of silt and frequently obscuring the view. Later the camera frame is kept at a higher elevation for lengthy periods, which solves the turbidity problem but is not ideal for distinguishing features and organisms on the sediment surface. The sea bed is covered with pale greyish mud. The ‘background’ gravel and pebble content is very low, but concentrations of pebbles and small cobbles occur in patches (e.g. [photo 03](#)), some of

which are large enough for the camera to take several minutes to traverse (e.g. 12:56 – 15:00 min). These pebble patches include occasional small boulders (e.g. 13:20 min). A patch of boulders is crossed near the end of the tow (approximately 29:20 – 30:20 min). There are no ripples or other signs of hydrodynamic activity. The video image is generally unfavourable for observation of biogenic traces on the sediment surface, but some can be seen in the close-up still photographs. Two burrow openings are visible below one arm of a ophiuroid in photo 12. Photo 25 is crossed by a broad linear trail and also shows two helical faecal casts. A possible patch of burrow ejecta can be seen in photo 37.

The most frequently seen organisms are xenophyophores (possibly *Syringammina fragilissima*) and solitary coral polyps (probably *Flabellum* sp.). Photo 10 shows a good view of both organisms. The xenophyophores are hard to distinguish against the sediment background at high camera elevation but are visible in most of the still photos taken close to the sea bed (e.g. [photo 28](#)). The coral polyps have bright orange-red tissue and are more conspicuous. Individuals swept up and overturned by the bow wave of the camera frame (e.g. 05:02 min) show the white calcified corallum and confirm the identity of these anthozoans. Coral polyps seem to be common, with three or four at a time frequently in view when the camera is moving at high elevation.

Less common epibenthic organisms include a white long-spined echinoid, probably *Echinus alexandri*, with two individuals seen at 18:10 min (photo 21) and 29:01 (photo 32). A single sea pen (*Pennatula* sp.) is seen and photographed at 09:52 (photo 12), in close association with a specimen of the large ophiuroid *Ophiomusium lymani*. Three more probable *O. lymani* are seen and photographed (photos 15, 22, 30). Smaller unidentified ophiuroids can be seen among the stones in close-up photos taken in the pebble patches (e.g. photos 01, 05, 18, 31). An unidentified stalked crinoid is seen in photo 07. Photo 21 includes an unidentified hermit crab carrying a commensal anemone.

The station can be considered to represent a single mesohabitat characterised by muddy sediment interspersed with patches of pebbles, cobbles and small boulders. The boulders themselves provide attachment surfaces for sessile fauna that are not seen on the sediment. A large, vase-shaped white sponge (unidentified) is seen (but

not photographed) on a cluster of small boulders at 13:21 min. A pair of boulders seen at 29:01 (photos 32, 33) support unidentified solitary coral polyps, small ophiuroids, a white sponge and a pink anemone.

3.2.2 Anton Dohrn FRS/JNCC stations

CORO521 (555 – 559 m) Duration 13:25 min Drop frame system

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: two present, described below

Image quality is consistently good. The first 4 min of the tow cover a substratum of sandy sediment with patchy gravel/pebble content. Scattered cobbles or small boulders are occasionally seen. By approximately 04:40 there is a high density of cobbles and at 04:42 the edge of an expanse of elevated bedrock is encountered. The camera track is parallel to the rock-sediment interface for approximately 2 min, and then crosses an expanse of rugged, dark bedrock which fills the screen from approximately 06:42 – 07:14 min. A short stretch of cobble and boulder-strewn sediment follows, then sediment with a low stone content from approximately 07:30 - 09:30. From 09:30 the density of pebbles and cobbles increases again, leading onto more bedrock and jumbled large boulders from 09:44 – 10:45. Shelly material fills the gaps and hollows between boulders and bedrock masses. From 10:45 to the end of the tow the camera crosses flat sandy sediment with a low gravel/pebble content.

The station can be considered to include two mesohabitats, a flat sandy sea bed with patchy gravel/pebble and occasional larger stones, and a hard substratum habitat of elevated bedrock and boulders. However, since the two alternate over relatively short spatial scales the distinction will not be absolute, particularly for mobile epibenthic megafauna. The resolution of the video image is not good enough to show details of sessile epifauna on the bedrock and boulders, but clusters of white barnacles show up against the dark rock surface in places (e.g. 10:20 min). There are no observations of large sessile epifauna (corals, gorgonians, massive sponges).

The mobile megafauna is dominated (30 individuals) by the echinoid *Calveriosoma* cf. *fenestratum*, which occurs throughout the tow, both on sediment and rocky substrata. Three specimens of *Cidaris cidaris* are also seen, along with single individuals of the holothurian *Stichopus tremulus* (09:30 min), a short-armed asteroid (10:39 min) and a longer-armed asteroid (10:15 min). A morid, possibly *Lepidion eques*, (four individuals) and *Chimaera monstrosa* (one individual at 12:51 min) are the only identified fish. A single specimen of a large pale grey fish, probably a mora (*Mora moro*) is seen over the sandy sea bed at 03:50 min.

CORO522 (576 – 596 m) Duration 30:00 min Drop frame system

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: two present, described below

Image quality is consistently good. The sea bed consists of sediment with a variable content of gravel and small pebbles. Much of the time the camera elevation is too high to identify the sediment texture but occasional close-up views (e.g. 12:03, 17:39, 24:16 min) of the sea bed show the background sediment to be coarse sand. The gravel and pebble content is patchy, but there is no obvious consistent gradient in sediment texture. There are occasional scattered cobbles or small boulders. The boulders are typically seen with a 'tail' of pebbles and cobbles to one side only (e.g. 20:33 min), presumably a current scour feature. This coarse pebbly sand substratum with scattered larger stones continues until approximately 28:11 min, when a rugged, elevated expanse of dark bedrock abruptly comes into view. Clearing this bedrock mass, the tow continues over what appears to be an elevated terrace or plateau covered with coarse sediment containing a high density of pebbles and cobbles. There are frequent boulders, and protruding outcrops of bedrock are visible just before the end of the tow (28:39 min).

The isolated boulders and steep bedrock face will provide a habitat for sessile epifauna. Some encrusting epifauna is visible on the boulder passed at 27:04 min but the resolution of the video image is too poor to provide detail. Large erect taxa such as corals, gorgonians or massive sponges are not seen. Mobile epibenthic megafauna are of low diversity, with no observed differentiation between the elevated terrace and the

slightly deeper sandy sea bed which occupies most of the tow. The echinoid *Calveriosoma* cf. *fenestratum* is seen throughout the station and is by far the most common species (87 individuals seen). Sixteen individuals of the echinoid *Cidaris cidaris* and 19 specimens of a morid fish (possibly *Lepidion eques*) are the only other species seen more than once. One individual of the decapod *Paromola cuvieri* is seen on the open sandy sea bed at 10:58 min. An unidentified organism, possibly a small octopus, is briefly visible on the sea bed next to a *Calveriosoma* at 18:48 min.

CORO520 (601 – 606 m) Duration 17:00 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Image quality is consistently good. The drop-weight makes occasional contact with the sea bed but the visibility is never obscured. The substratum sediment is probably sand with some gravel and small pebbles. The gravel/pebble content is variable with occasional patches of high density, but there is no obvious gradation. Dense scatters of pebbles and small cobbles are seen around small boulders which occur sporadically throughout the tow. There are no ripples or other physical signs of hydrodynamic activity. The station can be considered as a single mesohabitat.

The camera elevation is too high to allow close-up observation of the sea bed, so only epibenthic megafauna are distinguishable. The visible megafauna is dominated (56 individuals seen) by the echinoid *Calveriosoma* cf. *fenestratum*, which occurs throughout the tow. *Cidaris cidaris* is also frequently seen (19 individuals). A single large decapod, probably *Paromola cuvieri*, is seen at 09:27 min. A morid fish, possibly *Lepidion eques*, is seen throughout the tow as isolated individuals (15 seen). In every case the fish is resting on the sea bed with head facing the bottom of the screen, indicating either a response to the approaching camera frame or possibly an orientation relative to bottom current. A single rabbitfish (*Chimaera monstrosa*) is seen at 11:16 min. Unidentified small darting fish are also occasionally seen.

CORO523 (613 – 617 m) Duration 08:00 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Image quality is good on this very brief tow. The substratum consists of flat sediment with a variable component of gravel and small pebbles. Close-up views of the sea bed suggest that the sediment is coarse sand. Scattered cobbles and small boulders are seen. The larger rocks (e.g. at 04:52, 05:24 min) have a distinct ‘tail’ of pebbles and cobbles to one side only, presumably created by current scour. The near-vertical view of the sea bed shows this feature particularly well.

The only epibenthic megafauna seen are the echinoids *Calveriosoma cf. fenestratum* (8 individuals) and *Cidaris cidaris* (5 individuals), and a morid fish, possibly *Lepidion eques* (4 individuals). White objects, possibly barnacle plates, can be seen at the base of the large boulder encountered at 05:24 min.

CORO524 (649 – 653 m) Duration 10:30 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

The video image from this station is initially out-of-focus, but this is corrected shortly after the start of the tow. There is little apparent change from CORO523, with the camera showing a coarse sandy sea bed with patchy content of gravel and small pebbles. As seen at CORO523 there are occasional large cobbles or small boulders with an asymmetrical scatter of pebbles and cobbles to one side. A particularly large, high-standing boulder is seen at 04:03 min. Several clusters of barnacles can be seen on the crest of this boulder. *Cidaris cidaris* is seen more frequently than *Calveriosoma cf. fenestratum* at this station (22 versus 4 individuals respectively). A morid fish, possibly *Lepidion eques*, is visible next to the large boulder at 04:03 min. A larger morid, probably *Mora moro*, appears at 04:27 min. Elongate fish, probably *Synphobranchus kaupii*, are seen briefly at 06:38, 06:50 and 09:50 min.

3.3. Rockall Bank

Rockall Bank has several mesohabitats present, ranging from sands through to sands with cobbles/boulders, to coral reef/rubble as well as exposed bedrock. Some of the *Lophelia pertusa* reef areas appear to have been damaged or destroyed. In one location a “plough” track produced by a trawl door is clearly visible. There is evidence for hydrodynamic activity at many of the stations both from analysing the ripple types, mainly type 3 ripples and some mega-ripples, to evidence of current scour. A variety of densities and diversity is seen at the individual stations on Rockall Bank. Many of the abundant megafauna include the squat lobster *Munida rugosa*, echinoids such as *Echinus acutus*, the holothurian *Stichopus tremulus* and a variety of fish species including the bluemouth red fish *Helicolenus dactylopterus*. Sessile epifauna varied from station to station but includes corals e.g. *Caryophyllia* sp. and *L. pertusa*. as well as a variety of sponges and bryozoans. Cup sponges and erect bryozoans tended to occupy the bedrock and larger, more stable, cobbles and boulders.

3.3.1. Rockall Bank SEA 7 stations

SAMS_2_L#5 (164 - 165 m) Duration 41:00 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. A single broad habitat type is represented within this tow and consists of medium-coarse muddy sand (photos 01 and [13](#)) with evidence of some bioturbation, including: a few small mounds, animal tracks and faecal casts. There is evidence of hydrodynamic activity with both type 3 and 4 ripple patches (not greatly abundant) and shell debris and detritus throughout.

Very few fauna are observed at this station, only the asteroids *Hippasteria phrygiana* (photo 08) and *Stichastrella rosea* (photo 13), a small ophiuroid (possibly *Ophiactis balli*, photo 01), and some gastropod shell debris.

SAMS_2_M#3 (181 - 189 m) Duration 35:00 min

Eunis habitats: A6.3, A6.1, A6.11

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is poor in places, due to erratic movements, close proximity/focus of the camera and silt clouds caused from contact with sea bed. Four habitats are represented within this station: bedrock outcrop; medium sand with pebbles and cobbles; medium sand; and coarse sand with boulders and cobbles. The most common habitat observed is bedrock outcrop ([photo 03](#)). Within this habitat, bedrock covered 50-100% of the sea bed with coarse sand, organic debris (*Cidaris* spines and brachiopod shells) and cobbles/pebbles covering the sea bed between. The second most common habitat is 'medium sand with pebbles and cobbles' ([photo 21](#)). The pebbles and cobbles covered 5-10% (patchy) of the underlying medium sand substratum. The final two habitats are much less abundant than the previous two described. Of the habitat type comprising mainly coarse sand with boulders and cobbles ([photo 08](#)), 30-60% of the underlying medium sand substratum is covered by boulders and cobbles. The 'medium sand' habitat shows little signs of bioturbation ([photo 35](#)).

There is an abundance of fauna throughout both the 'bedrock outcrop' and 'coarse sand with boulders and cobbles' habitats. The most common organisms observed are cup sponges (*Axinella* sp.), erect and encrusting bryozoans (including *Reteporella* sp. and cyclostome bryozoans), encrusting sponges and small coral (or possibly anemone) polyps (photo 02). The mobile epifauna consisted largely of the squat lobster *Munida rugosa* and various asteroids (>10) including *Ceramaster granularis*, *Porania pulvillus* and *Henricia sanguinolenta*. There are significantly less fauna observed in the 'medium sand' and 'medium sand with pebbles and cobbles' habitats. Stylasterid corals are also observed at this station (photo 25).

SAMS_2_M#2 (184 - 188 m) Duration 23:00 min

Eunis habitats: A6.3, A6.14, A6.11

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. There also seems to be a discrepancy between the time at which the video ends (9:52), and the time at which the last photos are taken (continued until 10:03). Four habitat types are represented within this tow: medium sand with little bioturbation ([photo 02](#)), pebbles on sand (no photo), pebbles and cobbles on sand ([photo 11](#)), and sand covered bedrock ([photo 17](#)). The most common habitat is medium sand, with evidence of some bioturbation, including a few small mounds and pits. The pebbles on sand habitat is, in places, characterized by a small amount of organic debris (maximum coverage of <5%). The pebbles and cobbles on sand and sand covered bedrock habitats are not present in the video. There is evidence of some hydrodynamic activity with type 3 ripple patches (not greatly abundant) and shell debris and detritus throughout.

Very few fauna are observed on the medium sand habitat only one asteroid, *Stichastrella rosea*. Most of the fauna observed are associated with the pebbles and cobbles on sand habitat. Characteristic species include the squat lobster *Munida rugosa* and common encrusting forms such as encrusting sponges, bryozoans, serpulid worm tubes and small white unidentified encrusting species (photo 10). The sand covered bedrock is characterized by small coral (or possibly anemone) polyps and encrusting sponges (photo 17). Stylasterid corals are also observed at this station (photo 12).

SAMS_2_O#4 (209 - 211 m) Duration 30:00 min

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. Three habitats are represented within this tow: pebbles and cobbles on sand ([photo 05](#)); boulders and cobbles on sand ([photo 14](#)) and medium sand with bioturbation ([photo 15](#)). The most common habitat consists of pebbles and cobbles on sand, with the pebbles and cobbles covering <5% of the underlying medium sand substratum (patchy). Medium sand is the next most common habitat type, followed by boulders and cobbles on sand habitat. The boulders and cobbles covered 5-20% (patchy) of the underlying medium sand substratum. Little evidence of hydrodynamic activity is observed at this station.

Very few fauna are observed within the 'pebbles and cobbles on sand' habitat, although the asteroid *Hippasteria phrygiana* (3), the squat lobster *Munida rugosa* and solitary corals *Caryophyllia* spp. were characteristic of this habitat (photo 04). Few fauna are observed within the medium sand habitat with the asteroid, *Stichastrella rosea* (1) and ophiuroids being present. The greatest abundance of fauna is associated with the boulders and cobbles on sand habitat, characterised by the erect bryozoans (*Reteporella* and *Cyclostome* bryozoans) and globose and encrusting form sponges (photo 14). Stylasterid corals are also observed at this station (photo 13).

SAMS_2_N#1 (220 - 221 m) Duration 32:00 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. Two habitat types are represented within this tow: cobbles on sand ([photo 08](#)), and sand with

bioturbation ([photo 10](#)). Within the most common habitat (medium sand with bioturbation) small mounds and pits are visible throughout and signs of current scour are visible in places. Within the 'cobbles on sand' habitat the cobbles covered an area of <5% of the underlying medium sand substratum. There is evidence of some hydrodynamic activity with type 3 ripple patches (not greatly abundant) and shell debris present in both habitat types.

Very few fauna are observed at this station, particularly within the 'medium sand' habitat where the only organisms observed are two asteroids *Hippasteria phrygiana* and *Stichastrella rosea* (photo 06). The most commonly observed mobile epifauna within the cobbles on sand habitat are asteroids namely, *Stichastrella rosea* (1), *Hippasteria phrygiana* (2), *Henricia sanguinolenta* (2) and *Astropecten irregularis* (1). A monk fish, *Lophius piscatorius* (1) and an unidentified decapod (probably *Paramola*) are also noted. Other fauna are typical encrusting forms (sponges, bryozoans) although occasional globose form sponges are also visible (photo 15).

SAMS_2_P#1 (237 - 240 m) Duration 25:00 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. There are two habitats represented within this tow: medium sand with bioturbation ([photo 05](#)) and cobbles on sand ([photo 10](#)). The most common habitat, medium sand with bioturbation, is characterised by mounds, depressions, pits and detritus throughout. The second habitat type consists of cobbles covering 10% of the underlying medium sand substratum, which also exhibits signs of faunal activity in the form of mounds. There is some evidence of hydrodynamic activity within this tow (photo 08).

Few fauna are observed at this station, particularly in the medium sand habitat where a monk fish (*Lophius piscatorius*) is the only observed fauna. There is a greater abundance of fauna within the cobbles on sand habitat including encrusting, globose

and erect form sponges (photo 10). Stylasterid corals are again visible at this station (photo 10).

ER-O#1 (391 - 674 m) Duration 03:00:00 h

Eunis habitats: A6.11, A6.22, A6.14, A6.2

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this long tow is fair despite there being minimal silt cloud obscurities; fast and erratic movement of the camera makes accurate faunistic assessments difficult in places. Four habitat types are represented within this tow: boulders and cobbles on sand, rock outcrop with sand, pebbles and cobbles on sand, pebbles on sand. The most common habitat type within this station are areas of boulders with cobbles ([photo 01](#)) covering between 20 - 100% of the underlying coarse sand substrate with an abundance of shell debris. The next most common (almost as abundant) habitat type is areas of pebbles with cobbles ([photo 04](#)) covering between 10 - 50% of the underlying coarse sand substrate with an abundance of shell debris. Pebbles ([photo 75](#)) cover between 5 - 20 % of the underlying coarse sand/biogenic gravel substrate with an abundance of shell debris is the next most common habitat type within the tow, although covering significantly less area. The final habitat type and least abundant within this tow is areas of rock outcrop ([photo 71](#)) covering between 40 - 100%, with areas of cobbles on coarse sand substrate. Each habitat has an abundance of shell debris and clinker throughout. The abundance of organic debris throughout this tow suggests this area experiences a degree of hydrodynamic activity.

Fauna is abundant throughout the tow, although there are obvious fauna rich habitats with the echinoid *Cidaris cidaris* being ubiquitous in this tow. Among the boulder and cobbles the most commonly observed mobile epifauna are: *C. cidaris* (ca. 486), squat lobsters (*Munida* sp.), small ophiuroids (*Ophiactis* sp.), the holothurian *Stichopus tremulus* (15), and fish (10). There are many sessile and encrusting forms on the boulders and cobbles including cup corals (*Caryophyllia* sp.), encrusting sponges (at least 6 morphospecies), large erect sponges (>15), and bryozoans. Stylasterid corals and *Lophelia pertusa* are also visible in places. The pebbles and

cobbles on sand support a similar mobile epifauna with *C. cidaris* (ca. 354), with fish (1) and asteroids (2) present. Sessile and encrusting forms may be less diverse with only encrusting sponges and bryozoans being frequently observed. Similar mobile epifauna are found within the pebbles on sand and rock outcrop habitat types, with *C. cidaris* (32 and 34) and holothurians (5) in both. Encrusting sponges and a large area of live *L. pertusa* is also observed within the pebbles on sand habitat.

ER-M#2 (401 - 621 m) Duration 01:28:00 h

Eunis habitats: A6.21, A6.2, A6.14, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: eight present, described below.

Image quality of this tow is good. Eight habitat types are represented within this long tow: cobbles and pebbles on sand; boulders and cobbles on sand; pebbles on sand; cobbles on sand; coral reef; coral rubble; bedrock outcrop; coral fragments. The most common habitat type consisted of cobbles and pebbles covering between 10 - 40% of the underlying coarse sand substratum (e.g. [photo 01](#)). Areas of boulders and cobbles covering between 5 - 80% of the coarse sand substrate are the next most common habitat type (e.g. [photo 20](#)) followed by areas of shell gravel and pebbles (photo 32). An area of bedrock outcrop is also visible within this tow although is not recorded as a still image. A small clump of the reef forming coral *Lophelia pertusa* is also seen (42 min, [photo 17](#)) with the distinctive rubble areas bordering the habitat. At certain points within this tow a very unusual sediment type is observed within the images that have the appearance of compressed sand or deposited fine sediment. On the video these areas look like bedrock and in places have been interpreted as such. The coarse nature of the substratum within this tow suggests this area experiences a degree of hydrodynamic activity.

Commonly observed organisms within the coarse sand with cobbles and pebbles habitat are mainly unidentifiable encrusting types (particularly bryozoans, at least five morphospecies of encrusting sponge) that cover between 5 - 30% of the exposed hard substratum. Serpulid worms are also characteristic ([photo 32](#)). The boulder and cobble habitat is again characterised by encrusting types (particularly bryozoans, and at least 14 morphospecies of encrusting sponge) with 50 - 80% of the exposed hard

substratum covered. Serpulid worms, brachiopods and various anemones are also characteristic encrusting forms. The squat lobster *Munida* (probably *M. rugosa*) and large numbers of the small ophiuroid *Ophiactis* sp. are characteristic of the mobile epifauna present in this habitat. Massive-globose sponge forms, stylasterid and solitary corals are also notable. The small patch of *Lophelia pertusa* observed supported hydroids, encrusting sponges and a number of small ophiuroids (*Ophiactis* sp.) within the dead reef interior. The unusual sea bed type supported a very large number of ophiuroids (possibly *Ophiactis* sp.) to the point where it could be interpreted as an ophiuroid bed.

ER-N#1 (406 - 639 m) Duration 02:40:00 h

Eunis habitats: A6.11, A6.22, A6.14, A6.2

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is reasonable although some of the associated photos are difficult to interpret as a result of lighting problems. Four habitat types are represented within this tow: medium to coarse sand; coarse sand with cobbles, pebbles and organic debris; coarse sand with cobbles and boulders; and bedrock outcrop. The most common habitat type consists of cobbles and boulders covering between 5 - 100% of the underlying coarse sand substrate (photo 31). Areas of cobbles, pebbles and organic debris (echinoid spines, brachiopod shells) ([photo 32](#)), covering between 3 - 90% of the underlying coarse sand were the next most common habitat ([photo 47](#)) followed by areas of bedrock outcrop (photo 55), with some regions of biogenic gravel habitat also present ([photo 52](#)). The coarse nature of the substratum within this tow and the large amount of collected organic debris suggests this area experiences a degree hydrodynamic activity.

Commonly observed organisms within the cobble and boulder habitat are mainly unidentifiable encrusting types (including encrusting bryozoans and 16 morphospecies of encrusting sponges) that cover between 10 - 80% of the exposed hard substratum. Other characteristic sessile species include solitary corals *Caryophyllia* spp., coral/anemone sp2 and serpulid worm tubes. Squat lobsters (probably *Munida* sp.) were frequently observed within this habitat and large numbers

of small ophiuroids (possibly *Ophiactis balli*) are present, visible only as arms emerging from what appears to be sand encrusted sponge. Stylasterid corals are also noted. The coarse sand with cobbles, pebbles and organic debris habitat is again characterised largely by encrusting types (including bryozoans and at least 10 morphospecies of encrusting sponges) with 10 - 60% of the exposed hard substratum covered. The cobbles on sand habitat differed little from the previous habitat in terms of fauna, however only 3 morphospecies of encrusting sponge are observed. The limited areas of bedrock outcrop viewed within this tow are characterised by encrusting sponges and bryozoans as well as the echinoid *Cidaris*, cup sponges (probably *Axinella* sp.), and corals including Caryophyllids, and *Madrepora oculata*.

ER-B#1 (551 - 582 m) Duration 31:00 min

Eunis habitats: A6.21, A6.2

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is generally poor with visibility frequently obscured by silt clouds raised by contact with the seabed; visibility is also reduced due to the camera being too high off the seabed at times. In addition, as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. There are three habitats represented within this station: pebbles and cobbles on sand; boulders and cobbles on sand; and pebbles on sand. The most common habitat type consisted of pebbles and cobbles ([photo 03](#)) covering between 20 - 60% of the underlying coarse sand and gravel substrate. Areas of pebbles ([photo 22](#)) covering 40% of the underlying coarse sand and gravel substrate are the next most common habitat type followed by areas of boulders, cobbles and pebbles ([photo 06](#)) covering between 20 - 60% of the underlying coarse sand and gravel substrate - the boulders were patchy in coverage with cobbles and pebbles being more abundant. Both small clinker pieces and organic debris (abundant) were present throughout the tow, all pebbles and cobbles were slightly embedded in the substratum. The coarse nature of the substratum within this tow and the large amount of collected organic debris suggests this area experiences a degree of hydrodynamic activity.

As a result of the poor visibility, an accurate abundance of organisms could not be achieved with the video. The most commonly observed organisms are the echinoid *Cidaris*, with approximately 72 observed throughout the tow, the highest abundance occurring within the areas of pebbles covering sand. Fish are the next most commonly observed organisms, with 8 in total: *Chimaera monstrosa* (3) Rat-tails (2) and 3 unidentified. All hard substrate are encrusted to a lesser or greater degree with organisms including sponges, bryozoans, hydroids and serpulid worm tubes. The pebbles on sand tend to support a smaller number of species with encrusting bryozoans and serpulid worm tubes being characteristic. The pebbles and cobbles on sand habitat (and most likely the boulders and cobbles on sand habitat (no images)) support a greater number of species with at least seven morphospecies of encrusting sponge identified, occasional brachiopods and solitary corals, bryozoans, serpulid worm tubes and hydroids present. Large numbers of a small ophiuroid (*Ophiactis* sp.) are commonly observed hiding in the cracks and crevices among cobbles with just their arms visible protruding into the water column.

ER-C#1 (645 - 657 m) Duration 30:00 min

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is generally poor with visibility frequently obscured by silt clouds raised by contact with the seabed, with the camera moving erratically at times. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. Three habitat types are represented within this station: pebbles and cobbles on sand ([photo 09](#)); boulders, cobbles and pebbles on sand ([photo 03](#)); and pebbles on sand ([photo 10](#)). The most common habitat type consists of pebbles and cobbles covering between 5 - 10% of the underlying coarse sand substrate with little evidence of bioturbation. Pebbles covering between 2 - 8% of the underlying coarse sand substrate with little evidence of bioturbation are the next most common habitat type. The final habitat type consists of sparse boulders with more abundant cobbles and pebbles, covering between 5 -15% of the underlying coarse sand substrate, again with little evidence of bioturbation. The coarse nature of the substratum within this tow and the presence of the less prominent type 1 ripples

(linear deposition of pebbles) suggest this area experiences a degree of hydrodynamic activity.

There was not a great abundance of fauna observed throughout this tow; accurate abundances could not be achieved from the video due to poor visibility. The most commonly observed fauna is *Cidaris* (approximately 24) and encrusting organisms. At least seven morphospecies of encrusting sponges were present on the cobbles and boulders, with serpulid worm tubes and encrusting bryozoans also characteristic. Ophiuroids (sp. indet.) are also of note.

ER-D#1 (731 - 736 m) Duration 30:00 min

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is generally poor with visibility frequently obscured by silt clouds raised by contact with the seabed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. Four habitat types are represented within this station: pebbles on sand; boulders and cobbles on sand; pebbles and cobbles on sand; and coral fragments on sand. The most common habitat consists of pebbles and cobbles covering between 5 - 15% of the underlying medium to coarse sand substrate ([photo 13](#)). Areas of pebbles covering between 5 - 10% of the underlying coarse sand substrate ([photo 01](#)) are the next most common habitat type. An area of coral (*Lophelia*) fragments covering less than 5% of the underlying medium sand substrate with occasional cobbles ([photo 03](#)) is the next most common habitat followed by boulders and cobbles covering 15% of the underlying coarse sand substrate ([photo 04](#)). The nature of the substratum within this tow and the presence of the less prominent type 1 ripples (linear deposition of pebbles) and signs of current scour in places suggest this area experiences a degree of hydrodynamic activity, although small patches of detritus present in some areas suggest less activity (slower currents) than at the previous station.

Commonly observed fauna at this station were the echinoid *Cidaris* (6) and fish (rat-tails (2)). The cobbles and pebbles on sand were encrusted with at least four

morphospecies of sponge, encrusting bryozoans and other unidentified species. The boulders and larger cobbles support more sessile forms including coral/anemone sp2., serpulid worm tubes and small white encrusting organisms. Areas of pebbles on sand support fewer visible epifauna.

ER-F#1 (1025 - 1029 m) Duration 42:00 min

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is poor due to visibility frequently being obscured by silt clouds raised by contact with the sea bed. At close range the video image also suffers from overexposure caused by excessive or badly-positioned lighting (image quality is better when the video camera is elevated higher above the bed). Two habitat types are represented within this tow, fine sand, and cobbles and pebbles on sand. The majority of the tow covers an area of medium to fine sand ([photo 05](#)) with some evidence of bioturbation including depressions and animal tracks, although these are not visible in any of the stills images. Little evidence of hydrodynamic activity is observed. Small areas of cobbles and pebbles on sand ([photo 14](#)) punctuated the otherwise continuous habitat.

Few fauna are observed at this station. However, the most commonly observed organisms within the fine sand habitat included xenophyophores (photo 27) with associated *Galathea* sp. squat lobsters, the sponge *Pheronema carpenteri* (photo 05), and burrowing anemones possibly *Bolocera tuediae* (photo 10). Solitary corals (*Desmophyllum* sp.) and small clumps of reef forming corals *Lophelia pertusa* and *Madrepora oculata* are occasionally visible (photo 10) although no reef structure is present. Within the areas of cobbles and pebbles on sand burrowing anemones are again commonly viewed.

ER-L#1 (1124 - 1129 m) Duration 24:00 min

Eunis habitats: A6.5

Greene et al., 1999 mesohabitats: one present, described below.

Image quality of this tow is extremely poor. For almost the entire duration of the tow observations of the sea bed were hindered by silt clouds from contact with the seabed and excessive lighting. The only habitat type observed in the infrequent visible areas and photos is fine mud with some bioturbation and lebenspuren in the form of burrows and mounds ([photo 12](#)). Few fauna are observed within this station, although evidence of infaunal activity is clear, with tubes or siphons observed protruding the sediment surface.

ER-G#1 (1546 - 1553 m) Duration 26:00 min

Eunis habitats: A6.5

Greene et al., 1999 mesohabitats: one present, described below.

Image quality of this tow is poor in places with visibility frequently obscured by silt clouds raised by contact with the sea bed. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. A single broad habitat type is represented within this tow and consists of fine mud with evidence of bioturbation including animal tracks, depressions, faecal casts, mounds and burrows ([photo 10](#)). Little evidence of hydrodynamic activity was observed. A large boulder is present within the tow.

Very few fauna are observed at this station only occasional fish and ophiuroids. No organisms are present in any of the images taken. It is likely the majority of the biomass in this area is infaunal.

ER-E#4 (1598 - 1600 m) Duration 12:00 min

Eunis habitats: A6.5, A6.14

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is generally poor with visibility frequently obscured by silt clouds raised by contact with the seabed, with the camera moving erratically at times. In addition as a result of the inadequate lighting used for some of the tow, the video is difficult to view in places. Two habitat types are represented within this station: fine mud ([photo 01](#)) and boulders on sand ([photo 04](#)). The most common habitat consisted of fine mud with some bioturbation including *Nephrops* burrows (not highly abundant). The other habitat type consists of a single boulder on the underlying mud substratum. This has been classed as a separate habitat despite only one large boulder being observed as the faunal composition of the boulder is very different to the surrounding fine mud habitat. Little evidence of hydrodynamic activity is observed.

Few fauna are observed at this station and only 2 images were taken. A single Brisingid asteroid (possibly *Freyastera* sp.) is visible on the fine mud habitat. While the boulder supported fauna typical of hard substrata including hydroids, at least nine morphospecies of encrusting sponges, encrusting bryozoans, brachiopods and a number of small ophiuroids (*Ophiactis* sp.) hidden in the cracks in the boulder.

3.3.2 Rockall Bank FRS/JNCC stations

COR0510 (141 m) Duration 20:00 min Drop frame system

Eunis habitats: A6.3, 6.11

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow was poor, despite limited silt cloud obscurities. Camera elevation high above the seabed at times, poor lighting and erratic camera movements makes it difficult to observe faunistic detail. Three habitat types are represented within this tow: boulders and cobbles on sand, rock outcrop, and sand. The most common habitat consists of boulders and cobbles covering between 5 - 30% of the underlying medium to coarse sand substratum ([photo 177](#)). Areas of medium sand

substratum with detritus in places and little bioturbation are the next most common habitat type ([photo 181](#)) followed by rock outcrop, covering between 20 - 100% of the field of view ([photo 182](#)). Throughout the tow, distinct mega-ripples of detritus and gravel clinker are apparent suggesting this area experiences some degree of hydrodynamic activity.

Commonly observed organisms within the sand habitat are fish (9), including grenadiers, flatfish and other unidentified species; and asteroids (2). Within the boulders/cobbles habitat, commonly observed organisms are asteroids (7), globose form sponges and fish (9) including flatfish and other unidentified species. Sessile organisms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), erect bryozoans (*Reteporella* sp., and cyclostomes), encrusting sponges and bryozoans are also characteristic of this habitat. Stylasterid corals are also present. The area of bedrock outcrop differed little from the boulders and cobbles habitat in terms of faunal composition with a similar sessile and encrusting fauna as well as asteroids (3) and fish (4) including grenadiers, flatfish and other unidentified species.

COR0511 (144 - 145 m) Duration 30:00 min Drop frame system

Eunis habitats: A6.3, A6.11, A6.21

Greene et al., 1999 mesohabitats: five present, described below.

No photos are available from this tow. Image quality of this tow is moderately good, with limited silt cloud obscurities. However, camera elevation high above the seabed at times makes it difficult to observe faunistic detail. Five habitats are represented within this tow: pebbles on sand, cobbles on sand, boulder with cobbles on sand, rock outcrop, and sand substratum. The most common habitat within this station is cobbles covering between 5 - 60% of the underlying medium to coarse sand substratum, followed by rock outcrop covering between 40 - 100% which borders the boulder/cobble areas. The remaining three habitats (least significant) are boulders with cobbles covering between 30 - 100% of the underlying medium to coarse sand substratum, followed by pebbles covering 40% of the underlying medium to coarse sand substratum with clinker; and medium to coarse sand substratum with detritus, clinker and some bioturbation. Cobbles within this station are well rounded and

distinct linear bands (mega-ripples) are visible, which suggests this area experiences a degree of hydrodynamic activity.

An abundance of fauna are observed from the rock outcrop and boulders/cobbles habitats. The most commonly observed organisms within the rock outcrop are asteroids (*ca.* 15), cup sponges (possibly *Axinella* sp. or *Phakiella* sp.) and encrusting sponges. The same fauna are present within the boulder/cobbles habitat: asteroids (8), cup sponges (possibly *Axinella* sp. or *Phakiella* sp.) and encrusting sponges. The cobbles on sand again exhibited the same faunal composition as the previous habitats although abundance is slightly lower, asteroids (13), some cup sponges (possibly *Axinella* sp. or *Phakiella* sp.) and encrusting sponges. Fauna are sparse within the sand habitat, with only a few asteroids and fish observed.

COR0512 (146 m) Duration 30:00 min Drop frame system

Eunis habitats: A6.3, A6.11, A6.2

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities, although erratic camera movements and elevation high above the seabed at times makes it difficult to observe faunistic detail. Three almost equally abundant habitat types are represented within this tow: Sand, rock outcrop and cobbles on sand. The most common habitat within this station is medium to coarse sand substratum with detritus, clinker and little bioturbation ([photo 206](#)). Cobbles covering between 5 - 30% of the underlying medium to coarse sand substratum is the next most common habitat (no photo) followed by rock outcrop covering between 20 - 100% of the surrounding coarse sand substratum ([photo 201](#)). Signs of current scour and the presence of linear bands (mega-ripples) of clinker and pebbles ([photo 208](#)) within this station suggest this area experiences a degree of hydrodynamic activity.

The most commonly observed organisms within the rock outcrop habitat are asteroids (*Henricia* sp. and *Stichastrella rosea*) and sessile or encrusting forms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), globose and encrusting sponges, and

erect bryozoans (*Reteporella* sp., and cyclostomes). The cobbles on sand habitat and medium sand habitat support few fauna.

COR0513 (151 - 153 m) Duration 31:00 min Drop frame system

Eunis habitats: A6.3, A6.11, A6.2

Greene et al., 1999 mesohabitats: five present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities. Although the elevation of the camera high above the seabed at times makes it difficult to observe faunistic detail. Five habitats are represented within this tow: pebbles on sand, cobbles on sand, boulder with cobbles on sand, rock outcrop, and sand substratum. The most common habitat within this tow is medium sand with some lebenspurren including mounds and burrows ([photo 213](#)). Pebbles covering between 5 - 60% of the underlying medium to coarse sand substratum with distinct linear bands (mega-ripples) of clinker throughout are the next most common habitat ([photo 215](#)). Areas with boulders with cobbles covering between 5 - 35% of the underlying medium to coarse sand substratum are the next most common habitats ([photo 216](#)) followed by rock outcrop, covering between 30 - 60% of the surrounding medium to coarse sand substratum ([photo 220](#)); and cobbles covering 5% of the underlying medium to coarse sand substratum (no photo). The presence of linear bands (mega-ripples) within this tow suggests this area experiences a degree of hydrodynamic activity.

The most commonly observed organisms within the rock outcrop habitat are asteroids (*Henricia* sp.) and sessile or encrusting forms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), globose and encrusting sponges, and erect bryozoans (*Reteporella* sp., and cyclostomes). Areas of boulders/cobbles differed little from the bedrock out crop areas although the squat lobster *Munida* (probably *Munida rugosa*) is more common. Areas of cobbles on sand support fewer sessile forms but again the squat lobster *Munida* (probably *M. rugosa*) is quite common. The pebbles on sand habitat and medium sand habitat support few fauna.

COR0514 (154 - 155 m) Duration 16:00 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below.

Image quality of this tow is fair due to silt cloud obscurities and poor lighting. Also the elevation of the camera high above the seabed at times makes it difficult to observe faunistic detail. One habitat is represented within this tow: pebbles with cobbles covering between 5 - 80% of the underlying medium to medium to coarse sand substratum ([photo 238](#)). Cobbles only occur occasionally with predominately clinker and pebbles throughout. This habitat has detritus with little bioturbation. Type 4 ripples are present at the start of the tow and signs of current scour are present throughout, which suggests this area experiences a degree of hydrodynamic activity.

Few fauna are observed within this station, and the most commonly observed organisms are asteroids (19) including *Luidia ciliaris* and *Hippasteria phrygiana* and fish (5), which included grenadiers (1) and flatfish (1).

COR0515 (219 - 222 m) Duration 30:00 min Drop frame system

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities. Although the elevation of the camera high above the seabed at times makes it difficult to observe faunistic detail. Three habitat types are represented within this tow: boulders with cobbles on sand, cobbles on sand, sand. The most common habitat areas are boulders with cobbles covering between 5 - 30% of the underlying medium to coarse sand substratum (no photo). Area of fine to medium sand substratum with shell, coral debris and lebenspuren in the form of mounds and depressions, are the next most common habitat type ([photo 50](#)). The final habitat type covers less than 50% of the area surveyed and comprises areas of cobbles on sand covering between 5 - 10% of the underlying medium to fine sand substratum ([photo 51](#)). The presence of shell and coral debris suggests that this area may experience a degree of hydrodynamic activity.

Epifauna are not highly abundant within this tow. Commonly observed organisms within the boulders/cobbles and cobbles habitat are sessile and encrusting forms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), globose and encrusting sponges, solitary corals (*Caryophyllia* sp.) and erect bryozoans (*Reteporella* sp., and cyclostomes). The sand habitat is characterised by asteroids (2) and fish (3) including Haddock (*Melanogrammus aeglefinus*) and flatfish.

COR0516 (221 - 222 m) Duration 31:00 min Drop frame system

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities. However, the elevation of the camera high above the seabed at times makes it difficult to observe faunistic detail. Three habitat types are represented within this tow: boulders with cobbles on sand, cobbles on sand, and sand. The most common habitat type consists of fine to coarse sand substratum with lebensspuren including mounds and depressions with some area of coral fragments ([photo 66](#)). The next most common habitat consists of cobbles covering between 5 - 25% of the underlying medium sand substratum ([photo 69](#)). The final habitat consists of boulders and cobbles covering between 5 - 20% of the underlying medium sand substratum ([photo 71](#)). Although there is little sign of current scour, the presence of coarse substratum suggests this area may experience a degree of hydrodynamic activity.

Fauna are moderately abundant within this tow. The most commonly observed organisms within the sand habitat are asteroids (6) including *Stichastrella rosea*, fish including 1 flatfish and 2 which are unidentifiable, and burrowing anemones. The most commonly observed organisms within the cobbles on sand habitat are asteroids (12) including *Stichastrella rosea*, squat lobsters (*Munida rugosa*) and erect globose form white sponges. Sessile and encrusting forms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), globose and encrusting sponges, solitary corals (*Caryophyllia* sp.) and erect bryozoans (*Reteporella* sp.) are also characteristic of this substratum type. The boulders and cobbles habitat type differs little from the cobbles on sand habitat with asteroids (5), fish (3) and similar sessile species.

COR0517 (221 - 227 m) Duration 30:00 min Drop frame system

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

Image quality was generally good within this tow, although there are areas of silt cloud obscurities and camera elevation being too high to observe faunistic detail. Three habitat types are represented within this tow: Boulders with cobbles on sand, cobbles on sand and sand. The most common habitat consisted of medium to coarse sand substratum with some bioturbation (mounds) ([photo 82](#)). Boulders with cobbles covering between 5 - 50% of the underlying medium to coarse sand substratum is the next most common habitat type ([photo 83](#)). Cobbles covering between 5 - 15% of the underlying medium to coarse sand substratum are the final habitat type within this tow ([photo 86](#)). There are signs of current scour which suggest this area experiences a degree of hydrodynamic activity.

Fauna is not highly abundant; the two most commonly observed groups of organisms, which were observed across all habitat types within this station, are fish and asteroids. The asteroids have the highest abundance (10 individuals) and include: *Porania pulvillus*, *Hippasteria phrygiana*, *Henricia sanguinolenta* and other unidentified species. The fish fauna (8) include flat-fish (6), bluemouth red fish *Helicolenus dactylopterus* (1) and 1 which was unidentifiable. Within the boulders/cobbles and cobbles habitats the fauna are typical of this region although not highly abundant, with cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), encrusting sponges, solitary corals (*Caryophyllia* sp.) and erect bryozoans (*Reteporella* sp.).

COR0518 (263 - 264 m) Duration 8:00 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: two present, described below.

No photos are available for this station. Image quality within this tow is fair; however there are silt clouds caused from contact with the seabed and erratic camera movements at times. Two habitat types are represented within this tow: sandy mud and cobbles on sand. The most common habitat type encountered is sandy mud with

gravel, signs of bioturbation and lebenspuren in the form of mounds and animal tracks. The other habitat type is areas of cobbles covering 5% of the underlying sandy mud substratum. There are signs of current scour and areas with type 3/4 ripples which suggests this area experiences a degree of hydrodynamic activity.

Very few fauna are observed within this tow and none of the photographs taken are useable.

COR0509 (271 m) Duration 31:00 min Drop frame system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: three present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities and erratic camera movements. Three habitat types are represented within this tow: boulders with cobbles on sand, cobbles on sand, and sand. The most common habitat encountered is medium to fine sand substratum with detritus, some coral debris, and lebenspuren in the form of mounds, depressions and tracks ([photo 11](#)). Cobbles covering between 5 - 10% of the underlying medium sand substratum are the other significant habitat within this station ([photo 20](#)). The final and least significant habitat is boulders with cobbles covering 10 - 20% of the underlying medium sand substratum (no photo).

The medium sand habitat is characterised by the holothurian *Stichopus tremulus* and swimming worms. The cobbles on sand habitat is also characterised by the holothurian *Stichopus tremulus*, as well as sessile organisms including cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), erect bryozoans (*Reteporella* sp., and cyclostomes), solitary corals (*Caryophyllia* sp.) and encrusting sponges and bryozoans. The boulder and cobbles areas differed little from the cobble areas.

COR0519 (272 - 275 m) Duration 31:00 min Drop frame system

The image quality of this tow is so poor that it is unusable.

COR0508 (272 - 276 m) Duration 23:00 min Drop frame system

Eunis habitats: A6.3, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

No photos are available for this tow. Image quality of this tow is moderately good, with limited silt cloud obscurities. Three habitat types are represented within this tow: cobbles on sand, coral rubble and sand. The most common habitat consists of medium to fine sand substratum with detritus, coral debris and signs of bioturbation, with lebenspuren in the form of burrows and mounds. Cobbles covering between 2 - 35% of the underlying medium sand substratum are the next most common habitat within this station, followed by a significantly less abundant habitat: *Lophelia pertusa* rubble, which covers between 40 - 80% of the underlying medium sand substratum.

The medium sand habitat is characterised by the holothurian *Stichopus tremulus* and swimming worms. The cobbles on sand habitat is characterised by sessile organisms including solitary corals (*Caryophyllia* sp.), encrusting sponges and bryozoans, serpulid worm tubes and other unidentified forms. As with the previous station *L. pertusa* reef rubble areas are characterised by the squat lobster *Munida rugosa*, the holothurian *Stichopus tremulus* and a yellow encrusting sponge species.

COR0507 (273 - 280 m) Duration 50:00 min Drop frame system

Eunis habitats: A6.3, A6.611

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities. However, the elevation of the camera high above the seabed at times makes it difficult to observe faunistic detail. Four habitat types are represented within this tow: cobble on sand, boulders with cobbles on sand, *Lophelia pertusa* reef and sand areas. The most common habitat within this station is medium to fine sand with detritus and coral fragments ([photo 181](#)). Signs of bioturbation and lebenspuren in the form of mounds, depressions and burrows are visible throughout. Large areas of live *L. pertusa* reef with adjacent characteristic rubble areas account for approximately 20% of the tow. Cobbles covering between 5 - 30% of the underlying medium sand

substratum with coral debris are the next most encountered habitat ([photo 182](#)). Boulders and cobbles covering between 5 - 40% of the underlying medium sand substratum are the least common habitat type within this tow (no photo). Signs of current scour throughout this station would suggest that this area experiences a degree of hydrodynamic activity.

Few fauna are observed on the medium sand habitat. However swimming worms, *Echinus acutus* echinoids, hermit crabs (Paguridae) and the occasional macrourid are noted. Areas of cobbles on sand are more diverse with many sessile forms including the erect bryozoans (*Reteporella* sp. and cyclostomes), solitary corals (*Caryophyllia* spp.), and cup sponges (possibly *Axinella* sp and *Phakiella* sp.). The bluemouth red fish (*Helicolenus dactylopterus*) is also characteristic of this area. The reef rubble areas are characterised by the squat lobster *Munida rugosa*, the holothurian *Stichopus tremulus* and a yellow encrusting sponge species. A large number of small ophiuroids (possibly *Ophiactis* sp.) are often visible living within the dead coral at this station.

COR0502 (289 - 290 m) Duration 31:00 min Sledge system

Eunis habitats: A6.3, A6.611, A6.14

Greene et al., 1999 mesohabitats: six present, described below.

The image quality of this tow is good. Six habitat types are represented in this short tow highlighting the heterogeneity of the sea bed in this region. The presence of iceberg ploughmarks and *Lophelia pertusa* mean the sea bed alternates between areas of medium sand, cobbles on sand, cobbles and boulders on sand, boulders on sand, *L. pertusa* reef (rubble borders) and destroyed or damaged reef areas. The medium sand habitat is fairly uniform with signs of bioturbation and lebenspuren in the form of pits, mounds, burrows, faecal casts, and tracks visible throughout ([photo 52](#)). There are frequent clear occasions where the camera traverses an iceberg ploughmark and an area of cobbles, boulders or boulders and cobbles alternates with a medium sand area. Within the 'cobbles and boulders on sand' habitat the cobbles and boulders cover between 5 - 90% of the medium sand substratum (generally 40%) ([photo 71](#)). Within the boulders on sand habitat, boulders have between 5-40% coverage ([photo 67](#)). Within the cobbles on sand habitat, cobbles have 5 - 25% coverage ([photo 63](#)). There

are distinct areas where the seabed is covered (85 – 100 %) with dense coral rubble possibly resulting from reef destruction rather than natural degradation. Other areas of coral rubble characteristic of areas surrounding intact reef are also present. Here small fragments of both dead and live *L. pertusa* are present.

As with the previous station the medium sand habitat is characterised by swimming worms, the echinoid *Echinus acutus* and hermit crabs (Paguridae) although a number of fish species including Macrourids were noted. The boulders and cobbles on sand habitat is characterised by the appearance of squat lobsters (*Munida rugosa*) which are frequently found partially concealed beneath the cobbles and boulders, the holothurian *Stichopus tremulus*, and the bluemouth red fish (*Helicolenus dactylopterus*). The cobbles and boulders themselves are encrusted with sponges (encrusting, erect-globose), bryozoans (encrusting forms), solitary corals (*Caryophyllia* sp.) and serpulid worm tubes. The areas of destroyed or damaged reef, as with the previous station are characterised by the squat lobster *Munida rugosa* and a yellow encrusting sponge species. A large number of small ophiuroids (possibly *Ophiactis* sp.) are often visible living within the dead coral at this station.

COR0503 (300 - 302 m) Duration 21:00 min Sledge system

Eunis habitats: A6.3, A6.14

Greene et al., 1999 mesohabitats: three present, described below.

The image quality of this tow is good. Three habitat types are represented at this station, the distribution of, which are related to the presence of iceberg ploughmarks in this region. The medium sand habitat is punctuated by brief areas of cobbles on sand, and boulders and cobbles on sand, specifically where the camera crosses an iceberg ploughmark track. The medium sand habitat is fairly uniform with signs of bioturbation and lebenspuren in the form of pits, mounds, burrows, faecal casts, and tracks visible throughout ([photo 87](#)). Within the cobbles on sand habitat the cobbles cover between 5 - 50% of the underlying sand substratum ([photo 84](#)). Boulders and cobbles cover between 5 - 50% of the sandy substratum ([photo 86](#)). There are signs of hydrodynamic activity at this station.

There is not a high abundance of fauna at this station. As with the previous stations the medium sand habitat is characterised by swimming worms and hermit crabs (Paguridae), although burrowing anemones are also of note. The cobbles on sand habitat is characterised by encrusting organisms (sponges, bryozoans, serpulid worm tubes and other unidentified forms), as is the boulders and cobbles on sand habitat.

COR0501 (306 - 315 m) Duration 20:00 min Sledge system

Eunis habitats: A6.3, A6.611.

Greene et al., 1999 mesohabitats: five present, described below.

Image quality of this tow is good. Five habitat types are represented in this tow, the most common of which is medium sand ([photo 25](#)). This habitat is fairly uniform but with some areas showing increased faunal activity. Signs of bioturbation and lebenspuren in the form of pits, mounds, burrows and tracks are visible throughout. In places the medium sand habitat gives way to areas of cobbles on sand habitat where the cobbles cover 5 - 10% of the underlying substratum (no photo). The other three habitats present are all variations of the *Lophelia pertusa* reef habitat. A small area of live intact reef (*ca.* 1 m wide, 2 m long and 0.6 m high) is present at this station with characteristic areas of coral rubble habitat either side of the main reef. There are, however, significant areas of destroyed or damaged reef with, in one area, a large prominent trawl mark clearly visible.

There is not a great abundance of fauna at this station. The medium sand habitat is characterised by swimming worms, the echinoid, *Echinus acutus* and hermit crabs (Paguridae), although toward the end of the tow there were a significant number (17) of the echinoid *Spatangus raschi*. Where cobbles are present, they are only sparsely populated with epifauna. In the live reef habitat, erect sponges and the echinoid *Cidaris cidaris* are visible. In the destroyed and damaged reef areas the squat lobster *Munida rugosa*, the holothurian *Stichopus tremulus* and the echinoid *Cidaris cidaris* are frequently visible. In addition a yellow encrusting sponge species often occurred growing on the dead coral fragments.

COR0506 (316 - 319 m) Duration 30:00 min Drop frame system.

Eunis habitats: A6.3, A6.611

Greene et al., 1999 mesohabitats: four present, described below.

Image quality of this tow is moderately good, with limited silt cloud obscurities. However, poor lighting and camera elevation high above the seabed, at times, makes it difficult to observe faunistic detail. Four habitats are represented within this tow: sand, cobbles on sand, boulders with cobbles on sand, and areas of the reef-forming coral *Lophelia pertusa*. The most common habitat type within this station consists of fine to medium sand substratum with detritus. Signs of bioturbation and lebenspurren in the form of depressions, animal tracks, mounds and burrows are visible throughout ([photo 149](#)). The next most common habitat type is cobbles covering between 5 - 50% of the underlying medium sand substratum ([photo 161](#)), followed by: boulders with cobbles covering 20% of the underlying medium sand substratum (no photo). Two areas of the reef forming coral *L. pertusa* are observed. An area of live coral and an area of coral rubble (25 - 50%) are characteristic of the fringes of a reef area. As the two areas are not adjacent to one another it is likely that other areas of live *L. pertusa* are present near by.

Fauna are not consistent throughout this tow, with obvious difference in relative abundance between habitats. The most commonly observed organism within the sand substratum habitat are the echinoid *Spatangus raschi* (ca. 56) and 18 fish. In contrast to the DW stations only 2 *Echinus acutus* echinoids and 5 *Stichopus tremulus* holothurians are observed within this habitat. Boulders with cobbles on sand areas are probably the most species rich habitat within this tow, with an abundance of sessile forms including the erect bryozoan *Reteporella* sp., serpulid worms, solitary coral polyps (*Caryophyllia* sp.) and many morphospecies of sponge including orange globose, yellow tubular and encrusting types. In addition a single fish (Macrourid) and 2 *Stichopus tremulus* holothurians were present. The areas of the reef forming coral *L. pertusa* also supported a rich fauna. However, in contrast to the boulders/cobbles habitat, cobbles on sand have significantly less fauna.

COR0505 (318 - 320 m) Duration 16:00 min Sledge system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is generally good, with limited silt cloud obscurities. However, the elevation of the camera high above the seabed, at times, makes it difficult to observe faunistic detail. Two almost equally abundant habitats types are represented within this tow: sand, and cobbles on sand. The most common habitat consists of fine to medium sand substratum with coral debris and detritus. Bioturbation and lebenspuren in the form of mounds, animal tracks, burrows, depressions and faecal casts are visible throughout ([photo 114](#)). Cobbles covering between 10 - 40% of the underlying medium sand substratum are the other habitat type found within this tow ([photo 116](#)). There are signs of current scour which suggests that this area experiences a degree of hydrodynamic activity.

Fauna are moderately abundant within this station. A greater abundance of epifauna is observed within the sand with bioturbation habitat. The commonly observed organisms are Echinoderms, although in this instance the echinoid, *Echinus acutus* (2) is less dominant by comparison to *Cidaris cidaris* where 39 individuals are recorded. The next most commonly observed organisms within this habitat type are the holothurian *Stichopus tremulus* (13) and fish (6) including grenadier (1), flatfish (1) and others (4). In places emergent fauna are clearly visible ([photo 111](#)). The commonly observed organisms within the cobbles on sand areas include: the holothurian *Stichopus tremulus* (12) and fish (5) including flatfish (2), the bluemouth red fish *Helicolenus dactylopterus* (2) and (1) grenadier. Sessile and encrusting forms are visible on the cobbles and include encrusting sponges and bryozoans, solitary corals, serpulid worm tubes and hydroid turf.

COR0504 (337 - 342 m) Duration 20:00 min Sledge system

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: two present, described below.

The image quality of this tow is generally good although in places the camera sledge (and therefore the video recording) loses contact with the sea bed and dust clouds form where it regains contact. Two habitat types are represented at this station. The majority of the tow is represented by a single medium sand habitat which is punctuated by a brief area of cobbles on sand. The habitat distribution is most likely related to the presence of iceberg ploughmarks in the region. As with the previous stations the medium sand habitat is fairly uniform with detritus and signs of bioturbation and lebenspuren in the form of pits, mounds, burrows, faecal casts, and tracks visible throughout ([photo 106](#)). Cobbles cover 10 - 15% of the underlying sand in the cobbles on sand habitat (no photo). There is some evidence of hydrodynamic activity at this station and a small amount of clinker is present throughout.

The medium sand habitat is characterised by hermit crabs (Paguridae), the holothurian *Stichopus tremulus* and swimming worms. Palaemonid shrimps and the echinoid *Spatangus raschi* are also of note. The cobbles on sand habitat is characterised by encrusting organisms (sponges, bryozoans, serpulid worm tubes and other unidentified forms).

DW05909 (407 - 414 m) Duration 21:00 min Sledge system

Eunis habitats: A6.4. A6.3

Greene et al., 1999 mesohabitats: two present, described below.

Image quality of this tow is generally good despite some silt cloud obscurities and the inability to observe the seabed when the sled lifts off the seabed. Two habitat types are represented within this station: sandy mud ([photo 68](#)) and cobbles on sand. The most common habitat type consists of muddy sand with detritus, shell debris and some clinker. There are signs of bioturbation and lebenspuren, including *Nephrops* burrows (not abundant) and echinoid tracks. Small areas of cobbles on sand covering less than 10% of the underlying sandy mud substrate punctuated the otherwise

continuous habitat. The presence of type 3 ripples throughout the tow suggests this area experiences a degree of hydrodynamic activity.

Fauna is abundant within this station, and the most commonly observed organisms are the echinoid *Echinus acutus* (ca. 1600) fish (18) including bluemouth red fish (3) flatfish (3) grenadiers (1) *Chimaera monstrosa* (4) and others (7). The other commonly observed organisms are the holothurian *Stichopus tremulus* (7) and hermit crabs (Paguridae). Emergent fauna are visible throughout with small cerianthid anemones and polychaete tube worms identified.

DW05908 (437 - 445 m) Duration 20:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

No photos are available for this tow. Image quality is generally good within this tow despite some silt cloud obscurities throughout as well as speed and elevation of the camera (unable to see the seabed). One habitat is represented within this station: sandy mud substrate with detritus, shell debris and bioturbation. *Nephrops* burrows, smaller burrows, pits and depressions are visible throughout. There are signs of current scour in places and shell debris is present throughout, suggesting the area experiences a degree of hydrodynamic activity.

The most commonly observed organisms within this station are the echinoid *Echinus acutus* (ca. 345), burrowing cerianthid anemones (ca. 10), the holothurian *Stichopus tremulus* (3) the echinoid *Spatangus raschi* and fish (2) including one *Chimaera monstrosa* and one which is unidentifiable.

DW05903 (444 - 477 m) Duration 30:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

Image quality is generally good within this tow despite some silt cloud obscurities throughout and the elevation of the camera (unable to see the seabed). One habitat is represented within this station: fine-medium sand substrate with detritus and signs of bioturbation ([photo 49](#)). *Nephrops* burrows (old and active) and animal tracks are visible throughout. There are signs of current scour which suggests this area experiences a degree of hydrodynamic activity.

The most commonly observed organisms are the echinoderms with one dominant species; the echinoid *Echinus acutus* (ca. 258). Fish (22) are the next most commonly observed organisms, including the bluemouth red fish *Helicolenus dactylopterus* (7), *Chimaera monstrosa* (1), grenadier (4), monk fish *Lophius piscatorius* (1), flatfish (probably Megrim) (2) and others 7. The remaining organisms are of almost equal abundance and include burrowing anemones (Cerianthids) (>20), the echinoids *Spatangus raschi* (18) and *Cidaris cidaris* (10) and the holothurian *Stichopus tremulus* (10). Emergent fauna are visible throughout with small ceranthid anemones and polychaete tube worms being identified.

DW05904 (448 - 481 m) Duration 30:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

Image quality is generally good within this tow despite some silt cloud obscurities throughout and the elevation of the camera (unable to see the seabed). One habitat is represented within this station: medium to fine sand substrate with detritus ([photo 63](#)). Small coral fragments (*Lophelia pertusa*) and signs of bioturbation are visible, with mounds, depressions, animal tracks and *Nephrops* burrows (abundant) observed throughout. There are signs of current scour and shell debris which suggests this area experiences a degree of hydrodynamic activity.

Most commonly-observed organisms within this tow are burrowing anemones (cerianthids) (92) and the holothurian *Stichopus tremulus* (35). Fish are abundant with a total of 12 being observed including the bluemouth red fish *Helicolenus dactylopterus* (4), flatfish (3), grenadier (3) and others (2). Echinoids are not as abundant as other stations, with only 10 *Echinus acutus* and 3 *Spatangus raschi* being seen. Emergent fauna are visible throughout with small ceranthid anemones and polychaete tube worms being identified.

DW05907 (461 - 481 m) Duration 25:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

No photos are available for this tow. Image quality is generally good within this tow despite some silt cloud obscurities throughout and the elevation of the camera (unable to see the seabed). One habitat is represented within this station: medium sand substrate with detritus, shell debris and little bioturbation. There are signs of current scour and shell debris throughout, which suggests this area, may experience a degree of hydrodynamic activity.

The most commonly observed fauna within this station are the echinoid *Echinus acutus* (ca. 626), the holothurian *Stichopus tremulus* (8) and fish (12) including *Chimaera monstrosa* (1), flatfish (6), grenadiers (2) and others (3). Other, less abundant organisms observed are burrowing anemones (cerianthids) (4) and the echinoid *Spatangus raschi* (3).

DW05905 (469 - 488 m) Duration 20:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

Image quality is generally good within this tow despite some silt cloud obscurities throughout and the elevation of the camera (unable to see the seabed) at times. One habitat is represented within this station: fine to medium sand substrate with detritus ([photo 67](#)). Shell debris, signs of bioturbation and lebenspuren are visible throughout

with animal tracks and *Nephrops* burrows (abundant). There are signs of current scour and shell debris throughout which suggests this area may experience some hydrodynamic activity.

Fauna is moderately abundant within this station. The most commonly observed organisms include the echinoid *Echinus acutus* (56) and burrowing anemones (cerianthids) (23). Fish are the next most common organisms, with 11 in total including grenadiers (2), *Chimaera monstrosa* (2), bluemouth red fish *Helicolenus dactylopterus* and others (6). The holothurian *Stichopus tremulus* (6) and *Spatangus raschi* (4) are also observed within this tow. Emergent fauna are visible throughout with small cerianthid anemones and polychaete tube worms identified.

DW05906 (492 - 507 m) Duration 17:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

No photos are available for this tow. Image quality is generally good within this tow despite some silt cloud obscurities throughout, and the times where the camera is moving fast thus making it difficult to identify organisms. One habitat is represented within this station, sandy mud substrate with some evidence of bioturbation. Echinoid tracks, detritus and shell debris are visible throughout. There are signs of current scour throughout the tow which suggests this area experiences some hydrodynamic activity.

There is a high abundance of fauna within this tow. The most commonly observed organisms are the echinoids *Echinus acutus* (ca. 811) and *Spatangus raschi* (ca. 89). The next most commonly observed organisms are hermit crabs (Paguridae) (>8) and fish (4) including *Chimaera monstrosa* (2) bluemouth red fish *Helicolenus dactylopterus* (1) and a grenadier (1).

DW05901 (475 - 508 m) Duration 30:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

Image quality was generally good, although silt clouds occurred throughout they did not obscure the view significantly. One habitat type is represented within this station: fine-medium sand with signs of bioturbation ([photo 37](#)). Echinoid tracks and *Nephrops* burrows occur throughout. There is some evidence of hydrodynamic activity throughout the tow with shell debris and signs of current scour.

Fauna are highly abundant within this tow; the most commonly observed fauna are two species of echinoids: *Echinus acutus* with ca. 950 individuals and *Spatangus raschi* 85. In addition, decapods (ca. 23) including *Paramola cuvier* and *Bathynectes maravigna*, fish (ca. 12) and the holothurian *Stichopus tremulus* (5) also occurred. Emergent fauna are visible throughout with small ceranthid anemones and polychaete tube worms identified. A lost fishing net was also observed during this tow.

DW05902 (526 - 548 m) Duration 26:00 min Sledge system

Eunis habitats: A6.4

Greene et al., 1999 mesohabitats: one present, described below.

No photos are available for this tow. Image quality is generally good within this tow despite some silt cloud obscurities throughout. One habitat is represented within this station: muddy sand with detritus. Some shell debris is visible throughout and there are signs of bioturbation (not abundant), with old *Nephrops* burrows and echinoid tracks also visible in places. There are signs of current scour and type 2 and 3 ripples throughout which suggests this area experiences some hydrodynamic activity.

Fauna are fairly abundant within this tow. The most commonly observed organisms are the echinoids *Echinus acutus* (approx 162) and *Spatangus raschi* (ca. 25) with fish including *Chimaera monstrosa* (1) grenadier (1) bluemouth red fish *Helicolenus dactylopterus* (3) flatfish (1) and others (4).

3.4. Hatton Bank

Hatton Bank has several mesohabitats present, ranging from fine grained sediment at the deepest station (1096 – 1108 m) to coarse sediment with pebbles and cobbles to coral debris and exposed bedrock, many of them appearing within one station. Hydrodynamic activity was positively recorded at two stations with type 3 ripples seen at a depth band of 518 – 525 m, and type 2 ripples seen at a deeper station spanning 622 – 642 m. Epifaunal diversity and density (mostly the sessile fauna) is quite high, especially where there is exposed rock for them to attach to. The sessile epifauna ranges from holothurians, sea anemones (*Phelliactis* sp.), sponges and various coral including *Lophelia pertusa*, whilst the mobile fauna include members of the echinoderm group through to various fish species.

HB_H#1 (465 – 481.7 m) Duration 39:03 min

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: three present, described below.

Note still image files are labelled incorrectly with station reference 'B' (i.e. HB_B#1_xx, not HB_H#1_xx). Image numbers have been adjusted here to give the correct station letter reference (H).

The video initially shows a rock sea bed covered in places by sediment (01:15 min), first still photograph taken. Fish seen and photographed (04:00 min). Sediment thickness varies across sea bed and occasional large rocks can be seen resting on the bottom (e.g. 04:27 min). These rocks are colonised by various epifaunal organisms that are hard to resolve on the video but are described from the still photographs. As the camera approaches closer to the sea bed, epifauna that can be resolved include stylasterid corals (probably *Pliobothrus*) and holothurians (probably *Psolus squamatus*) ([photo 06](#)). Occasional mobile holothurians (probably *Stichopus*) and conspicuous echinoids (probably *Calveriosoma*) are seen ([photo 16](#)). A fish (probably *Helicolenus dactylopterus*) is briefly visible (15:44 min). There is a gradual transition from sea bed with abundant exposed rock and stones to one composed of apparently coarse sediment with scattered smaller stones (15:30 min). Fish (probably *Lepidion*) is

seen and photographed (17:28 min). Patches of small stones are present, perhaps associated with sediment scouring related to the presence of larger boulder such as the one seen and photographed at 18:27 min. A fish (probably *Helicolenus dactylopterus*) is briefly visible (20:13 min) with another species, perhaps *Lepidion*, is visible a few minutes later (23:06 min). The camera frame frequently makes contact with the sea bed, disturbing sediment and limiting resolution. Hard substrata are now almost entirely absent though a few small stones can be seen (27:28 min). However in a short distance, rock is again visible, surrounded by sediment (28:52 min). The last ten minutes of the video survey show a predominantly sediment-covered sea bed ([photo 34](#)) with occasional stones and small rocks present. Fish (probably *Lepidion*) seen and photographed (32:11 min).

HB_C-D#1 (476 – 538.8 m) Duration 30:00 min

Eunis habitats: A6.3, A6.22, A6.11

Greene et al., 1999 mesohabitats: three present, described below.

The sea bed initially shows sandy substratum with frequent, scattered stones and larger boulders all heavily colonised by epifauna. More extensive rocky substratum is quickly visible (05:45 min). Steeply sloped rock ledges ([photo 14](#)) with crevices and ledges are seen (10:55 min) and photographed. Sea bed appears to be composed of rock with draped sandy sediment covering (12:00 min). After 14 minutes the video shows sandy sea bed with scattered rocks and stones ([photo 25](#)) but it is difficult to know whether this material is draped over rock or represents deeper sediment accumulation. Transition to sea bed composed of finer, sandy material ([photo 27](#)) with fewer and smaller stones (17:30 min). More stones and coral rubble again become visible (18:35) and a large spider crab is seen and photographed. Similar sea bed continues with scattered fragments of coral skeleton (*Lophelia pertusa*), each heavily colonised and some with live polyps. At the end of the video more frequent small stones are seen with the occasional larger boulder, again heavily colonised by epifauna.

HB_M#1 (513.8 – 581.5 m) Duration 45:15 min

Eunis habitats: A6.3, A6.22, A6.11

Greene et al., 1999 mesohabitats: three present, described below.

Sea bed initially shows an apparently sandy sea bed with several mobile holothurians (probably *Stichopus*) ([photo 02](#)). When the camera frame makes contact with the sea bed, clouds of fine sediment are disturbed. Occasional small rocks are present often with patches of small stones nearby. On one such rock, a dead colony of *Lophelia pertusa* is seen and photographed (02:26 min). These rocks are heavily colonised by sessile holothurians (probably *Psolus squamatus*) but the video resolution is too low to describe the fauna in detail. The numbers of rocks present in the field of view increases (06:50 min) with expanses of rock visible within a short distance (07:15 min). This rock is slightly fissured and in places has a light sediment drape ([photo 14](#)). The rock is colonised by epifauna described in detail in the still photograph captions. Patches of coral framework are visible on the rock surface (09:17 min). While difficult to gauge from the perspective of a down-facing camera, there appear to be ledges and overhangs present (10:05 min), some of which are colonised by scleractinian corals. The survey video then drops down a steep slope (interpretation supported by increase in depth of around 10 m) with frequent epifauna including sessile holothurians and stylasterid coral colonies (probably *Pliobothrus*). After this the survey shows a greater cover of sediment with abundant rocks and what appears to be exposed underlying rock. Occasional coral patches are present (12:17 min). This is followed by a transition to shell debris-rich sediment with far fewer rocks but scattered small stones present (13:00 min). Occasional sediment-dwelling anemones are present (probably *Cerianthus* sp.). Density of scattered small stones is variable across sea bed (16:00 – 22:00 min). Large rock visible (23:16 min) again colonised by epifauna with coral debris present surrounding base of rock. Video survey now shows expanses of rock with a sediment drape. A fish, probably *Lepidion*, is seen and photographed (27:57 min) ([photo 28](#)). Video survey shows steeply sloping cliff-like rock face with abundant epifauna (notably holothurians and stylasterid corals), an interpretation again supported by the increase in depth of around 10 m recorded at this point (28:45 min). At the base of this slope the cover of sediment increases with either exposed underlying rock or isolated rocks present, both heavily colonised. The video is obscured by disturbed sediment for periods of time (33:00 min) but at around this

point there is a transition from a rock-dominated to a sediment-dominated sea bed. The number of scattered pebbles/cobbles increases and there are distinct patches of such stones visible (40:20 min). The density of pebbles/cobbles diminishes (41:53 min) and the sea bed is composed of relatively coarse sediment with scattered small stones and occasional mobile holothurians present.

HB_R#1 (518 – 525.8 m) Duration 01:14:35 h

Eunis habitats: A6.3, A6.22, A6.11

Greene et al., 1999 mesohabitats: two present, described below.

The video initially shows a type 3 rippled sea bed composed of relatively coarse sediment with few scattered pebbles ([photo 07](#)). Occasional echinoids and mobile holothurians are present. Exposed rock is seen with small patches scleractinian coral and other epifauna including holothurians (24:52 min). There is a transition back to sediment-dominated sea bed with mobile holothurians (25:42 min). Patches of small epifauna-colonised rocks seen on sediment (27:31 min) ([photo 16](#)) followed shortly by greater expanses of rock with fine sediment drape (28:18 min). A large gorgonian coral colony is seen and photographed (29:24 min). Transition back to sediment-dominated sea bed with occasional mobile holothurians (30:00 min). Occasional patches of coarser material (pebbles/cobbles) are seen forming patches on sediment (35:50 min). The sea bed remains unchanged from this point until the end of the video record (1 h 14:35 min). Note that the last two still images show rock substratum with gorgonian coral (faint images) that were not evident on the video.

HB_N#1 (530.3 – 649.8 m) Duration 01:01:14 h

Eunis habitats: A6.3, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

The sea bed initially appears relatively coarse with scattered pebbles and a few echinoids visible (e.g. [photo 05](#)). A *Chimaera* is seen and photographed (05:30 min). Isolated rocks with epifauna are visible as are occasional *Cidaris* echinoids (06:50 min). Another fish, probably *Lepidion*, is seen briefly (08:30 min). A large rock

colonised by scleractinian corals and a large *Phelliactis* sp. sea anemone is seen with a surrounding 'moat' of far coarser sediment with many pebbles/cobbles. These stones appear to form a scour feature presumably upstream of the rock. The rock and stones are photographed and described below (photos 11, 12 and 13). A small shark (*Galeus malastomas*) is also seen (10:00 min). The sea bed remains predominantly composed of relatively coarse sediment with scattered small stones and occasional mobile holothurian (probably *Stichopus*). Another rock colonised by scleractinian corals with a tail of coarse stony sediment is seen and photographed (12:00 min). There is a gradual transition to sea bed with higher cover of pebbles/cobbles and exposed rock (15:00 min) followed by another transition to sea bed with coral rubble and small patches of dead coral framework (17:00 min). Conspicuous fauna are now more abundant with large anemones (*Phelliactis* sp.) and live scleractinian coral present (probably *Lophelia pertusa*). Low video resolution limits faunal description. Transition to sea bed apparently composed of fissured rock draped with sediment with the exposed rock colonised by epifauna. There is another transition from rock-dominated sea bed to sediment-dominated sea bed but still with abundant exposed rock and pebbles/cobbles (26:39 min) ([photo 24](#)). Exposed rock still colonised by epifauna including scleractinian corals. Between expanses of rock the sea bed is now rich in coral rubble with abundant epifauna (28:33 min). Transition to coarse sediment with sparser coral rubble (33:08 min) and a 'mottled' appearance produced by variable distribution of coarser material across bottom (cause unknown). Rapid transition to a patch of coral reef framework with abundant dead scleractinian coral and patches of live coral present (35:20 min) ([photo 57](#)). Other epifauna also abundant with detailed descriptions provided in still photograph captions. Rapid transition from sea bed with abundant coral framework to sea bed composed of coarse sediment (perhaps a thin veneer on underlying rock) with abundant scattered pebbles/cobbles (43:15 min). The density of these stones varies with some distinct boundaries evident (e.g. 45:12 min) and some areas covered in pebbles and cobbles (49:43 min).

HB_A#1 (537.3 – 590.8 m) Duration 1:10:11 h

Eunis habitats: A6.3, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

Video initially shows a sandy, shelly sea bed ([photo 03](#)) but vertical camera movement obscures detail and limits resolution. Initially the frame is periodically obscured by overlays displaying still camera settings. Hard substrata comprising rock and small patches of coral rubble first appear (13:00 min) and live coral colonies (*Lophelia pertusa*) visible slightly later (19:00 min). A *Chimaera* fish is visible at 20:44 min. Sea bed remains composed of shelly sand (27:24). Small epifauna-colonised boulder is visible at 30:32 min and occasionally *Cidaris* echinoids are also visible (35:10 min). Transition to sea bed with abundant scattered coral rubble (41:48 min) and sessile epifauna including noticeable large anemones (*Phelliactis* sp.) ([photo 44](#)). Solitary fish photographed (42:34 min). Live *L. pertusa* colonies and abundant epifauna are seen at 43:50 min. Another transition to shelly sea bed with scattered, small stones (45:00 min). A heavily colonised boulder is visible (46:37 min) and a corresponding still photograph taken. Rock substrata becoming more common and all are heavily colonised by abundant epifauna (47:50 min). Between rock substrata there is sand with scattered small stones. Rock is colonised by gorgonian or antipatharian coral (50:41 min) and again corresponding still images taken. Expanses of rock provide some areas of near vertical and steeply sloping bottom (51:00 min) some of which are colonised by hard corals (*L. pertusa* and *Madrepora oculata*). Substratum remains dominated by coral rubble and abundant epifauna with solitary fish photographed (55:00). Sediment-draped rock substratum visible and photographed (58:35 min) ([photo 61](#)). Sandy sea bed with frequent small stones. Coral rubble still present but somewhat less abundant (1:03:30). At time 1:05:50 video record is apparently disrupted with both pauses and pixellation evident. Sandy, shelly sea bed with frequent *Cidaris* echinoids (1:07:30).

HB_P#1 (556.3 – 643.3 m) Duration 01:05:52 h

Eunis habitats: A6.3, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

Sea bed initially composed of coarse sediment with frequent pebbles/cobbles and occasional boulders. Large boulders with rich epifauna including scleractinian corals seen and photographed (05:48 min) ([photo 05](#)). Transition to sea bed with abundant coral rubble and some dead coral framework (06:22 min). Abundant epifauna present on coral material including conspicuous *Phelliactis* sp. anemones. Occasional boulders with abundant epifauna present (07:05 min). Transition to sea bed dominated by expanses of rock with sediment drape, abundant coral rubble and coral reef framework present. Exposed rock is colonised by abundant epifauna with both scleractinian and antipatharian corals present. Video survey shows steeply sloping rocky topography (18:45 min) ([photo 18](#)) with sediment at the base of a cliff-like rock face (21:40 min). There is a transition to a sediment-dominated sea bed (or sediment drape on rock and coral debris) followed by another transition to a sea bed with abundant coral debris (24:50 min) and increasing occurrence of dead reef framework (25:52 min) ([photo 37](#)). There is a greater abundance of live scleractinian coral and other epifauna, including bamboo coral colonies (27:00 min). The sea bed is now dominated by extensive reef framework formed by *Lophelia pertusa* skeletons with significant trapped sediment and abundant epifauna (see still image captions for detailed descriptions). This habitat persists over the next half hour of video survey followed by a sharp transition from coral reef framework to sediment with scattered coral rubble (1 h 01:00 min). There is then another sharp transition from coral rubble-dominated sea bed to textured sediment (possibly sediment veneer on rock).

HB_Q#1 (622.3 – 642 m) Duration 59:50 min

Eunis habitats: A6.3, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

Sea bed initially coarse ([photo 05](#)) with a few, scattered pebbles and occasional *Cidaris* echinoids and mobile holothurians (probably *Stichopus*) present. Faint ripple marks (Type 2) evident (06:00 min). Increasing abundance of coral rubble scattered

on sediment (09:30 min) followed shortly by patches of reef framework with live scleractinian coral colonies present (09:45 min). Epifauna is abundant on patches of coral framework. There is a transition to a sediment-dominated sea bed with few coral patches or rubble (13:00 min). Five minutes later the density of coral rubble present on sea bed gradually begins to increase. Echiuran worm proboscides visible extending from burrows in sediment (19:00 min). A bright red squid swims close quickly past the camera (20:17 min). Sea bed now shows abundant coral material including patches of reef framework (21:00 min). Once again, epifauna are abundant on coral framework patches but video resolution too low to provide detailed description. Video signal briefly lost (26:12 min). Transition from sea bed with abundant coral material to sea bed apparently composed of sediment drape on rock (26:30 min) followed shortly by a clear transition between the latter and a thicker sediment deposit apparently at the base of sediment-draped rock (26:47 min). Sea bed remains dominated by sediment cover with occasional echiuran proboscides visible and type 2 ripple marks apparent (32:12 min). Small shark seen, probably *Galeus malastomas* (32:57 min). Isolated patches of dead coral seen (35:01 min). Coral material no longer visible and sea bed composed of type 2 rippled sediment with occasional *Cidaris* echinoids, other types of echinoids and echiuran proboscides visible (36:00 – 40:00 min). Density of coral debris on sea bed begins to increase and patches of coral framework become visible (42:00 min) ([photo 50](#)). Many echiuran proboscides can be seen. Small patches of live scleractinian coral are present and the diversity of epifauna increases. Transition from sea bed with abundant coral to sea bed dominated by sediment cover with scattered small coral patches (44:56 min). The density of coral material gradually drops until the sea bed is composed of coarse type 2 rippled sediment with *Cidaris* echinoids and occasional mobile holothurians (47:45 min). Coral framework and echiuran proboscides are again visible (49:10 min) with abundant epifauna on coral material. Small patches live scleractinian coral present. Transition from sea bed with scattered coral framework to sea bed composed solely of coarse rippled sediment (53:10 min). *Chimaera* seen and photographed (57:27 min). A *Galeus malastomas* is seen and photographed (57:38 min).

HB_L#1 (645.3 – 652.2 m) Duration 20:33 min

Eunis habitats: A6.3, A6.22

Greene et al., 1999 mesohabitats: two present, described below.

The sea bed is composed of relatively coarse sediment with shell debris and scattered coral rubble ([photo 02](#)). Occasional holothurians (probably *Stichopus*) were visible. Patches of coral framework become visible (05:00) and this framework is more heavily colonised by epifauna. This remains unchanged with patches of coral framework surrounded by coarse sediment throughout tape ([photo 17](#)). However, frequent contact with the sea bed disturbs the sediment limiting interpretation of last five minutes.

HB_S#1 (681.8 – 730.0 m) Duration 56:15 min

Eunis habitats: A6.3, A6.22, A6.11, A6.611

Greene et al., 1999 mesohabitats: three present, described below.

The sea bed is initially composed of relatively coarse sediment with scattered coral rubble. A few *Cidaris* echinoids are visible. Echiuran worm proboscides are also visible (03:42 min). During the first ten minutes of video record, the camera frame frequently contacts the sea bed, disturbing sediment and obscuring the view. Transition to sea bed with greater amount of coarse material, probably both shelly material and coral rubble (09:50 min). Small patches of dead coral framework with some live polyps (*Lophelia pertusa*) visible and colonising epifauna including *Phelliactis* sp. anemones (11:45 min). Video resolution is too low to describe epifauna but detailed descriptions are given for each still image. The sea bed now dominated by coral rubble-rich sediment ([photo 21](#)) with scattered patches of dead coral framework and colonising epifauna (13:10 min). Small patches of epifauna-colonised rock become visible (32:50 min). Transition from sediment-dominated sea bed to sea bed composed of fissured rock with sediment drape and exposed rock colonised by epifauna, see still photograph captions for details (44:29 min) ([photo 31](#)). Rock sea bed appears to slope relatively steeply with patches of scleractinian coral (46:36 min). Sea bed slope increases with rock colonised by a diverse epifauna, resolution limited by high backscatter from particles in water column (50:00 min). At the base of the

rock slope there is accumulated sediment (51:48 min) and fragments of coral material. The video continues to show exposed rock colonised by epifauna with fissures and hollows filled by sediment and coral rubble.

HB_K#1 (739.5 – 772.3 m) Duration 49:20 min

Eunis habitats: A6.3, A6.22, A6.611

Greene et al., 1999 mesohabitats: two present, described below.

The sea bed is initially composed of sediment and exposed coral framework. A large sea pen is visible. The first five minutes of video suggest that the sea bed is composed of a sediment-clogged coral reef framework (formed by *Lophelia pertusa*) ([photo 02](#)). Camera frame contacts the bottom disturbing sediment and obscuring view (10:15 min). Amongst areas of exposed coral framework and sediment infill are expanses of sediment littered with coral rubble (11:25 min). Xenophyophore is visible on video (13:15 min). A large antipatharian (*Bathypathes*) is seen and also photographed (16:00). Structurally complex reef framework with abundant antipatharians and bamboo corals were seen at 17:50 min. A gorgonian coral, possibly *Paragorgia arborea*, is seen and photographed (28:20 min). There is a consistent reef framework and sediment in-filled reef framework habitats throughout this deployment (e.g. [photo 35](#)). Video freezes and pixellates (47:51 min).

HB_E-F#1 (798 – 834.5 m) Duration 01:06:15 h

Eunis habitats: A6.5, A6.21, A6.11

Greene et al., 1999 mesohabitats: three present, described below.

Sea bed initially shows soft sediment with xenophyophores present ([photo 01](#)). When the camera frame makes contacts with the sea bed, ophiuroids can be seen but when higher off the sea bed the video resolution is too low to show these. Camera frame frequently makes contact with the sea bed disturbing clouds of sediment (03:00 min). A red schyphozoan is seen in the water column and photographed (07:20 min) and a few minutes later a synaphobranchid eel is also seen and photographed (09:50 min). Camera frame frequently contacts bed disturbing sediment and obscuring view (14:00

min). Eel-like fish are visible briefly (16:35 min), the sea bed is still composed of fine sediment with frequent xenophyophores. A few small stones scattered on the sea bed are now visible (20:20 min). The sea bed is still composed of fine-grained sediment with frequent xenophyophores (25:20 min) but scattered small stones are evident. A *Cidaris* echinoid is seen and photographed (26:15 min). Sea bed composed of fine-grained sediment but with more abundant small scattered stones (30:30 min). There has been a gradual transition with increasing frequency of stones and some evidence of ripple marking. Boulders visible (32:20 min) and photographed along with conspicuous red echinoid. Video shows rapid transition from sea bed dominated by fine-grained sediment with scattered small stones to sea bed with frequent larger stones and boulders, the latter colonised by rich epifauna. Camera frame contacts sea bed disturbing sediment and obscuring view (33:10 min). Transition to rock draped with sediment. The edge of a rock ledge is seen and photographed (33:30 min) ([photo 20](#)). Sediment now appears coarser grained such that when camera frame contacts bed, less clouds of sediment obscure the view (34:40 min). The sea bed now comprises relatively smooth rock colonised by epifauna and with draped sediment (35:00 min). Corkscrew-shaped antipatharian corals seen (*Stichopathes* sp.) (e.g. [photo 27](#)) with larger antipatharian colony (*Bathypathes*-like morphology) seen (35:58 min). Fish seen (36:54 min) but camera moving too quickly to provide clear image. Large crab (probably *Chaceon affinis*) seen and photographed (37:16 min). Transition to sea bed composed of sediment with many rocks or possibly deeper sediment draping over rock (37:20 min). Echiuran proboscis seen (38:13 min). Transition to sea bed with sediment, many small stones and fewer large rocks (38:38 min), sediment may be a veneer on rock. Clear view of echiuran proboscis, photographed (42:10 min). Transition to sea bed composed of rocks surrounded by sediment, latter may be a veneer on underlying rock (49:00 min). Transition to greater expanses of exposed rock with possibly an antipatharian coral colony seen and photographed (50:15 min). Several distinctive vase-shaped white sponges seen and photographed (54:56 min). These sponges are abundant in this area with many seen (57:50 min). Camera frequently contacts sea bed, image obscured (1:04:00) but there is a transition to sea bed with many small stones and apparently finer-grained sediment.

HB_G#1 (1096 – 1108 m) Duration 34:50 min

Eunis habitats: A6.5

Greene et al., 1999 mesohabitats: one present, described below.

Sea bed composed of soft sediment ([photo 01](#)). DVD pixellates and repeatedly freezes (02:00 min) and does not play normally again for one minute (03:00). Lack of still pictures from this period indicates camera problem during survey. Sea bed is obscured by disturbed sediment or video freezes until 09:50 minutes when linear marks in the sediment are seen, perhaps caused by the camera frame contacting the bottom. When visible, the sea bed is seen to be composed of fine-grained sediment and conspicuous xenophyophores can be seen. Most of the video footage from this deployment is obscured by clouds of sediment but there are several minutes of clear video footage (from 22:40 min). A large echinothurid echinoid was seen at 34:00 min. Despite limited video coverage there is no evidence for any transitions in sea bed type during this survey.

3.5. George Bligh Bank

A range of depths were surveyed on George Bligh Bank and as a result appears to host several mesohabitats. The shallowest stations ~400 m comprise a mixture of coarse and fine sediments with very low epifaunal diversity. The middle depth range of stations (~ 780 – 1000 m) had a variety of sediments ranging from various sands to dense live coral as well as coral debris. This region had a high diversity of sessile epifauna including sea pens, orange helical antipatharians, soft corals and hexactinellid sponges. The proboscides of echiuran worms were the only infauna were detected. At the deeper stations (>1000 m) more steep bedrock was encountered with some fine pebbly sand. Various epifauna were recorded including xenophyophores on the sand as well as the echinoids *Echinus elegans* and *Cidaris cidaris*. No hydrodynamic activity could be inferred from the sediments at this station.

GB_C#1 (430 m) Duration 01:09:30 h

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Image quality is consistently good, with almost uninterrupted views of the sea bed. The sea bed is initially flat, almost featureless and covered in sediment. Close-up views of the surface (e.g. photo 03) suggest a fine sand substratum. Compared to the majority of the Anton Dohrn stations there is very little stony material, only a few small gravel particles being visible. This substratum type continues throughout the entire tow with only minor variation. There are occasional small patches of coarser gravelly or pebbly sand, and scattered, partly-buried cobbles are sometimes visible (e.g. photos 20, 21). A denser field of stones, extending up to large cobble/small boulder size is crossed from approximately 51:00 – 53:15 min. An isolated larger boulder is seen at 58:21 min ([photo 40](#)). There are no ripples or other evidence of hydrodynamic activity. There are also no obvious signs of burrowing, but some close-up photos (e.g. photos 22, 23, 24) show a surface marked by shallow circular pits or depressions, which may be biogenic in origin. A fine, meandering linear trail can be seen in photo 23.

The most conspicuous animals at this station are fish, in particular the rabbitfish *Chimaera monstrosa*. This species is seen in large numbers from the beginning of the tow, with up to six or seven individuals being present in a single still photograph (e.g. photos 09, 18). The numbers of *Chimaera* decline from approximately 30:00 min, but they continue to appear sporadically until the end of the tow. Several less common fish species are also seen. A single blackmouth dogfish (*Galeus melastomus*) appears at 06:21 min (photo 07) and a ling (either *Molva molva* or *M. dypterygia*) at 1:00:14 h (photo 41). Two specimens of bluemouth (*Helicolenus dactylopterus*) are seen at 55:05 min (photo 35) and 57:19 min (photo 39). Unidentified small darting fish are also occasionally encountered.

Very few epibenthic invertebrates are seen at this station. The cobbles and occasional small boulders are generally silt covered or partly buried and carry little visible epifauna. A few brachiopods are visible in photos 33 and 34, with serpulid polychaete tubes present in photos 31 and 33. Small hermit crabs sometimes occur around the

cobbles and small boulders (e.g. photos 33, 39, 40). Seven individuals of the echinoid *Cidaris cidaris* are seen (e.g. [photos 18](#), 34).

GB_M#1 (430 m) Duration 35:45 min

Eunis habitats: A6.3

Greene et al., 1999 mesohabitats: one present, described below

Image quality is good throughout this tow. Benthic topography and substratum type are little different to those described for GB_C#1. The sea bed is largely featureless fine sand with rare coarser patches and a single boulder encountered at 20:32 min. Small circular pits or depressions are visible in some close-up photographs (e.g. photos 08, 14, 19). These shallow pits appear to be filled with dark floc in some cases (e.g. photo 17).

Observed faunal diversity is very low. *Chimaera monstrosa* ([photo 09](#)) is seen throughout the tow but mainly as single individuals, and the large numbers seen at GB_C#1 are not apparent. No other fish species are observed. Small hermit crabs are occasionally seen (e.g. photos 10, 15). An unidentified reddish prawn, possibly a pandalid, is seen and photographed at 23:25 min (photo 13).

GB_B#1 (780 – 800 m) Duration 46:17 min

Eunis habitats: A6.22

Greene et al., 1999 mesohabitats: one present, described below

Image quality on this tow is variable owing to the erratic and sometimes violent vertical motion of the camera frame. The field of view continually changes and is sometimes obscured by silt clouds raised by contact with the sea bed. The tow begins on a flat substratum of medium sand. The gravel/pebble content is very low but in close-up views (e.g. photo 09) the sand is seen to be filled with white flecks, presumably tiny fragments of biogenic carbonate. The camera continues across this sea bed type for the first few minutes of the tow. By 04:02 min the gravel and small pebble content has increased and small fragments of coral skeleton begin to appear

(e.g. [photo 05](#)). Small coral fragments and unidentifiable debris gradually increase in frequency and scattered larger pieces of dead coral are visible by 17:55 min. From approximately 18:00 to 25:30 min the camera passes over patches of relatively dense coral debris (e.g. photo 16) interspersed with stretches of sand with much less calcareous material (e.g. photo 13). Sightings of living coral are rare, but the occasional small patches of white skeleton with living polyps appear to represent *Madrepora oculata* rather than *Lophelia pertusa* (e.g. photos 15, 18).

From approximately 25:30 min to the end of the tow the sea bed varies mainly in the coverage of dead coral skeleton and smaller rubble fragments. Estimated dead coral cover is up to 80% of the substratum in places (e.g. photo 31), comprising pieces of grey, sediment-in filled framework among a dense scatter of smaller rubble fragments. During this stretch of the tow the camera is clearly following a downward-sloping sea bed. The small patches of living coral occasionally visible all seem to belong to *Madrepora oculata* (e.g. photo 38). Coverage of dead coral is still high at the end of the tow.

This station can be considered to represent a single mesohabitat of sand with variable amounts of dead coral (gradually increasing with water depth) and patchy occurrences of living *Madrepora oculata*. Although most of the coral is dead and in-filled with sediment there are no obvious trawl marks or other signs of disturbance.

Prior to the appearance of significant amounts of coral debris, few animals are seen on the sandy sea bed. A dark red sea pen, possibly *Anthoptilum* sp., is visible at 11:28 min (photo 06), but this is the only specimen encountered. Small unidentified ophiuroids are visible among the fragments of coral rubble on photo 08. The echinoid *Cidaris cidaris* is the most frequently seen and photographed mobile invertebrate and is visible at intervals throughout the tow. Galatheid squat lobsters, *Munida* sp. (either *M. sarsi* or *M. tenuimana*) can be seen among the dead coral skeletons at 27:58 min (photo 20) and 38:09 min (photo 32). Unidentified hermit crabs and comatulid crinoids are rarely visible but are likely to be inconspicuous among the dead coral frameworks. An orange-red squid swims across the field of view at 45:52 min.

The distinctive bifurcated proboscides of bonelliid echiuran worms (probably *Bonellia viridis*) can occasionally be seen extending from burrows throughout the zone of dead coral (e.g. 19:24 min, photo 14 and 39:09 min, photo 32).

Besides the sporadic occurrence of small patches of living *Madrepora oculata*, a variety of other sessile invertebrates can be seen attached to dead coral framework and patches of rubble. The most frequently seen are large grey solitary ascidians (possibly *Ascidia* sp.), examples being visible at 27:58 min (photo 20) and 40:20 min (photo 34). A bright orange helically-coiled organism (probably the antipatharian coral *Stichopathes* sp.) ([photo 35](#)) is highly conspicuous against the greyish background of dead coral and sediment. This is fairly common, with two or three individuals being represented on several of the still photographs (e.g. 33:23 min, photo 27; 35:24 min, photo 29). The nephtheid soft coral *Capnella* sp. is occasionally seen, both in expanded (e.g. 28:36 min, photo 21) and contracted state (e.g. 22:12 min, photo 16). The largest sessile animal observed is a dark brown branched anthozoan, probably the antipatharian *Bathypathes* sp. This species is relatively rare, with only three colonies being seen and photographed (30:50 min, photo 24; 38:32 min, photo 33; 42.31 min, photo 37). Other sessile epifauna, including an unidentified white sponge, are rare and only seen once or twice. In general terms the non-scleractinian sessile epifauna make a relatively minor contribution to the appearance of the biotope, which is dominated by dead coral framework and skeletal fragments.

GB_A#7 (803 – 921 m) Duration 1:01:52 h

Eunis habitats: A6.3, A6.22

Greene et al., 1999 mesohabitats: two present, described below

Image quality on this tow is variable. For approximately the first 15 minutes the motion of the camera is quite smooth, and seems to involve little horizontal movement across the sea bed. After this, the tow progresses in a more consistent direction and the motion of the camera frame becomes more erratic and occasionally violent, with rapid and frequent changes in the field of view. Occasional contact is made with the sea bed, but visibility is only affected for brief spells.

The tow begins on a flat bed of medium or coarse sand with a high content of tiny gravel particles. Scattered cobbles can occasionally be seen. There are no ripples or other signs of hydrodynamic activity. This sea bed type continues until approximately 09:35 min, when tiny fragments of coral debris begin to appear, gradually increasing in abundance (shown very clearly on photo 16). An isolated boulder (with large sessile epifauna) is seen at 15:20 min (photos 19, 20). The substratum of gravelly sand with pebbles, cobbles and coral fragments continues until approximately 23:00 min, when larger pieces of dead coral skeleton become noticeable. The occurrence of coral fragments is quite patchy but their frequency and size gradually increase, and from approximately 23:00 min onwards clusters of living polyps can occasionally be seen (e.g. [photo 33](#)). Both *Lophelia pertusa* and *Madrepora oculata* are represented. From approximately 28:30 to 37:00 min the camera crosses a zone of dense coral, with local coverage approaching 100% in places (e.g. photo 49). The coral is a mixture of free-standing framework and abundant rubble. Most of the framework is grey, sediment-laden and obviously dead, but small patches of living polyps (both *L. pertusa* and *M. oculata*) are also frequently seen (e.g. photos 54, 58, 60). The relative contributions of the two scleractinian species to the overall cover are difficult to estimate, but patches of living coral seem to be more common than at GB_B#1. There is a rich associated sessile epifauna (see below).

Coral cover appears to be relatively sparse from approximately 37:00 to 45:00 min, and is then variable, with the tow crossing patches of low and high density. The camera motion is still very erratic at this stage of the tow, making it difficult to estimate coverage. When visible in close-up (e.g. photo 83), the surrounding substratum appears to be finer than at the start of the tow, possibly consisting of muddy sand with gravel and small coral fragments. Living coral is last noted at approximately 51:38 min (photo 76) but debris fragments continue to the end of the tow.

The gravelly sand sea bed covered on the first 10 – 15 minutes of the tow can be regarded as a separate mesohabitat from the subsequent zone characterized by coral framework and associated epifauna. However, the transition between them is gradual rather than abrupt, marked by the increasing frequency and size of coral fragments on the sediment surface.

The most conspicuous organism on the gravelly sand habitat is a large, dark red sea pen (possibly *Anthoptilum* sp.), which occurs as isolated individuals a few metres apart (e.g. [photos 11](#), 13). These sea pens are present for approximately the first 10 minutes of the tow, and disappear at a point roughly coincident with the first appearance of coral debris on the sediment surface. Individuals of the same species are also seen much later in the tow at 26:50 min (photo 39) and at 43:00 – 45:00 min, in areas of sparse coral cover. Apart from the sea pens, organisms visible in the gravelly sand mesohabitat (0 – 10 min) are confined to possible cerianthid anemones (photo 12) and small epifauna encrusting the occasional cobbles (e.g. photos 02, 06, 10). The boulder seen at 15:20 min (photos 19, 20) supports a colony of the bright orange bushy antipatharian coral *Leiopathes* sp. and a different, dark brown antipatharian, possibly *Bathypathes* sp. A morid fish, possibly *Lepidion eques*, can be seen on the sea bed next to this boulder, with a second individual partly hidden by the branches of *Leiopathes*.

The coral framework provides a substratum for a diverse associated fauna of sessile invertebrates. The erratic camera movement prevents any precise density estimates but most frequently-seen taxa appear to be the orange helical antipatharian *Stichopathes* sp. (e.g. photos 44, 45, 59), the nephtheid soft coral *Capnella* sp. (e.g. photos 69, 78, 81), the hexactinellid sponge *Aphrocallistes* sp. (e.g. photos 51, 72, 80) and an unidentified solitary ascidian, possibly *Ascidia* sp. (e.g. photos 42, 75, 90). Less common large sessile organisms include the large antipatharians *Bathypathes* sp. (photos 47, 52, 62) and *Leiopathes* sp. (photo 46), and several gorgonacean species provisionally identified as *Isidella* sp. ([photos 52](#), 56), *Keratoisis* sp. (photo 53) and *Callogorgia verticillata* (photos 40, 52). Anemones include the large *Phelliactis* sp. (photos 67, 68), and unidentified smaller orange (photos 42, 48) and red (photos 50, 56) species. An unidentified massive white sponge is seen at 34:23 min (photo 58), and small patches of an encrusting blue sponge are also occasionally visible (e.g. photos 80, 81). A large and distinctive bushy organism seen at 36:13 min (photo 60) is unidentified but may be an antipatharian coral. Many of the sessile organisms are seen too rarely to give any indication of their distribution, but the relatively common *Stichopathes* sp., *Aphrocallistes* sp. and ascidians are seen throughout the coral zone from approximately 28:00 min onwards, while *Capnella* sp. is first seen from approximately 40:00 min.

The most frequently seen mobile epifauna in the coral-dominated mesohabitat are the echinoids *Cidaris cidaris* (e.g. photos 48, 63, 80) and *Calveriosoma* sp. (e.g. photos 45, 46, 65), and a morid fish, possibly *Lepidion eques* (e.g. photos 45, 63). Less common or conspicuous mobile epifauna include comatulid crinoids (e.g. photos 40, 43) and galatheid decapods (e.g. photos 42, 48, 56). Several large species are seen only once: the crab *Chaceon affinis* at 44:22 min (photo 67), the basket-star *Gorgonocephalus caput-medusae* at 31:44 min (photo 53), an unidentified red squid at 43:22 min (photo 66), and a ling, either *Molva molva* or *M. dypterygia* at 57:05 min (not photographed). In still photographs at high magnification small ophiuroids and asteroids are often visible among the coral rubble, but these animals are too small to be firmly identified.

GB_J#1 (1112 – 1154 m) Duration 41:50 min

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: two present, described below

Video image quality is generally good. The progress of the camera is smooth and without the erratic vertical motion seen at some other stations. The tow begins on a bed of flat sediment, shown in close-up to be fine sand or muddy sand containing very little stony material. The surface is marked by small patches of amorphous floc slightly darker than the underlying sediment. There are no ripples, but some photos show evidence of biological activity in the form of pinhole burrow openings surrounded by small patches of ejected sediment (e.g. photo 05). This substratum type continues until approximately 11:05 min, when occasional pebbles and small cobbles, some with encrusting epifauna, start to appear. The frequency of pebbles and cobbles gradually increases, with scattered small boulders being seen from approximately 12:15 min onwards. From approximately 23:00 – 27:00 min larger boulders surrounded by pebbles and cobbles are quite frequently seen (e.g. photos 27, 28) although these are spatially separated and not part of a continuous boulder field. A low outcrop of undercut, heavily silted bedrock is seen at 27:30 min (photo 30), followed by a continued expanse of pebbly fine sand (photo 31). Sediment-draped bedrock outcrops are encountered again at 29:11 min (photo 32) and 29:00 min (photo

33). The 'background' sediment is now very stony, with abundant pebbles and cobbles. A field of jumbled, silty boulders is crossed at 37:20 – 37:30 min, followed by a descent down a steeply-sloping or perhaps near-vertical cliff of rugged, irregular bedrock (photo 44). The height of this rock face is difficult to estimate but the camera takes approximately one minute to reach its base of heavily-silted bedrock (photo 45). From approximately 39:00 min to the end of the tow at 41:50 min the substratum is again fine sand or muddy sand with a small component of gravel and pebble. Pinhole burrow openings and patches of sediment ejecta are again visible at close range (photo 48).

Much of this tow can be considered as a single mesohabitat of fine pebbly sand, with patchiness created by the occurrence of cobbles, boulders and small bedrock outcrops. No sharp boundaries are encountered until the steep bedrock cliff at approximately 37:40 min, which is followed by a continuation of the muddy sand substratum seen earlier.

Visible epifauna on the muddy sand substratum is quite sparse. A small ray (probably a blue ray, *Neoraja caerulea*) is seen at the beginning of the tow (photo 02). Other fish encountered at the station are occasional specimens of the cut-throat eel *Synaphobranchus kaupi*, a small unidentified shark (14:16 min), and small unidentified fish, possibly juvenile morids. Xenophyophores are the most frequently seen benthic organisms and are observed throughout the tow except where the substratum is boulder or bedrock (e.g. [photos 04, 22](#)). Cerianthid anemones are occasionally seen (e.g. [photos 07, 48](#)). The distinctive spiral egg cocoons of fecampid flatworms can be seen in [photos 06 and 24](#). Isolated observations of sediment epifauna are of a pink holothurian, possibly *Benthogone rosea*, at 06:48 min (photo 06), an unidentified comatulid crinoid at 18:19 min (photo 18), and an unidentified small decapod crustacean at the entrance to a burrow at 08:38 min (photo 07).

Encrusting epifauna are visible on some of the cobbles which begin to appear after 11:05 min (e.g. [photos 10, 22](#)). Precise identification is not possible, but grey encrusting sponges, unidentified small anemones and solitary coral polyps can be seen. The larger boulders seen from 23:00 – 27:00 min are also heavily encrusted by sponges and/or bryozoans, serpulid polychaetes and solitary coral polyps. Small

numbers of the echinoid *Echinus elegans* are seen on and around these boulders (e.g. photos 25, [27](#)).

Rare specimens of the hexactinellid sponge *Pheronema carpenteri* are seen from approximately 34:00 min onwards. At close range, these sponges are seen to be surrounded by many individuals of an unidentified tiny orange anemone (e.g. photo 39). The same anemone species is seen in large numbers on and around the silty bedrock outcrops at 27:30 and 29:11 min.

Boulders in the dense field crossed at 37:20 – 37:30 min support patchy encrusting sponges and/or bryozoans, solitary coral polyps and the tiny orange anemone noted above (photo 43). Larger sessile animals are sparse but include the anemone *Phelliactis* sp. (photo 43), the alcyonacean soft coral *Anthomastus grandiflorus* ([photo 43](#)), an unidentified foliose white sponge (photo 42), and the antipatharian *Leiopathes* sp. (photo 41). The steep rock face following the boulder field is not in view for very long and only one still photograph is taken ([photo 44](#)). The few large epifauna visible are an unidentified white sponge, an unidentified yellow-green soft coral, a small crinoid, and one colony of *Anthomastus grandiflorus*. Large numbers of tiny orange anemones and unidentified brittlestars can be seen at high magnification.

Apart from the solitary polyps growing on cobbles and boulders, no scleractinian corals are seen at this station and there appears to be no coral debris in the sediment.

GB_E#1 (1072 – 1260 m) Duration 1:13:28 h

Eunis habitats: A6.22, A6.11

Greene et al., 1999 mesohabitats: two present, described below

Image quality is good throughout the tow. The tow begins on a substratum of coarse sediment dominated by biogenic debris, including barnacle plates, echinoid spines and probable coral fragments (e.g. photo 04). For approximately the first 25 minutes the camera crosses a mixed sea bed of boulder fields with thick accumulations of shelly material between the individual rocks (e.g. photo 02), interspersed with stretches of coarse shelly sand with fewer boulders. The sea bed appears to be level or gently

shelving. From approximately 25:00 min onwards outcrops of dark grey bedrock begin to appear among the boulders. Rock surfaces are often heavily silted. Bedrock masses become larger and more prominent, and at approximately 30:00 min the camera is clearly descending a steep slope consisting of broad expanses of silty dark grey bedrock (e.g. photos 30, 31). The foot of this steep slope appears to be reached at approximately 35:00 min, and from then until approximately 49:30 min the camera records a broad expanse of much more gentle inclination, with a substratum of coarse sediment again dominated by shelly material (e.g. [photos 35](#), 36). This may be a thin veneer of sediment covering a terrace or gentle slope of underlying bedrock. Bedrock reappears at approximately 52:00 min and by 52:30 min the camera is descending another steep slope of silted bedrock. There is a brief levelling of the slope from approximately 55:00 – 59:00 min, followed by another steep declination which continues to the end of the tow. The last observed section (from approximately 1:00:00 h onwards) seems to include some sediment-filled channels or small canyons running parallel to the slope (e.g. photos 49, 50).

This station appears to cover two distinguishable sea bed types: steeply-sloping bedrock walls and flat or gently-sloping shelly sediment with variable densities of boulders and some bedrock outcrops. Although there are some differences in the observed epifauna (see below) the two sea bed types alternate in a series of steps or terraces and it is a matter of definition whether they should be regarded as separate mesohabitats.

Boulders on the flat shelly sand bed (0 – 25 min) carry encrusting sponges and/or bryozoans, with occasional solitary coral polyps and patches of barnacles, possibly *Bathylasma hirstutum* (e.g. photo 02). The most conspicuous larger sessile animal is the hexactinellid sponge *Aphrocallistes* sp., which is most commonly seen growing on the accumulated shelly deposits between the boulders (e.g. photos 28, 29). Another hexactinellid *Pheronema carpenteri*, is also present (e.g. photos 04, 17, [21](#)), but is less common than *Aphrocallistes*. These two hexactinellid species are frequent as far as the edge of the first steep bedrock slope (approximately 31:30 min) but are not seen beyond this point. Large arborescent sessile epifauna are rare. Two specimens of an unidentified gorgonacean, possibly the ‘bamboo coral’ *Keratoisis* sp. are seen at 07:20 min (photo 06) and 26:34 min (photo 24). Small living patches of the coral *Lophelia*

pertusa occur on a boulder at 10:03 min (photo 10) and near the top of the first bedrock slope at 32:39 min (photo 31). The echinoids *Echinus elegans* and *Cidaris cidaris* are the most conspicuous mobile epifauna (e.g. photos 13, 19, 23). Small unidentified orange ophiuroids are numerous in the biogenic drifts between boulders (e.g. photo 28). An unidentified brisingid asteroid is seen at 21:33 min, and two more at 30:55 min at the top of the first bedrock slope. Two small sharks (possibly *Centroscymnus coelolepis*) at 12:33 and 19:20 min, and a morid (possibly *Lepidion eques*) at 17:07 min (photo 15) are the only fish observed over the mixed shelly sand/boulder sea bed.

Epifauna on the steep bedrock walls is quite sparse, although small patches of encrusting sponge are usually visible in close-up still photographs. Large sessile epifauna are rare. The orange antipatharian coral *Leiopathes* sp. is the largest and most conspicuous species, and is occasionally present (10 colonies seen) on steep bedrock from 32:27 min (e.g. photos 30, [42](#)) to the end of the tow at 1:12:27 h (photo 58). An unidentified massive vase-shaped sponge is seen at 53:36 min (photo 41) and at 1:06:30 h. Sinuous orange sessile organisms seen near the end of the tow at 1:05:13 min (photos 50, 51) may be bamboo whip-corals (*Lepidisis* sp.). An isolated patch of *Lophelia pertusa* is seen at 52:52 min (photo 39). Mobile epifauna on the bedrock slopes are mostly seen in crevices and hollows, and are limited to small unidentified ophiuroids, asteroids and galatheid decapods (e.g. photos 51, 52). Small ophiuroids and decapod crustaceans are also sometimes seen in large numbers among the branches of *Leiopathes* (e.g. photos 32, 58). An oreosomatid fish (*Neocyttus helgae*) is seen swimming in mid-water over the sediment-draped bedrock terrace at 39:40 min (photo 34). A shark (probably a Portuguese dogfish *Centroscymnus coelolepis*) and an unidentified ray are seen at 1:03:08 h (photo 49).

GB_F#1 (1076 – 1338 m) Duration 44:44 min

Eunis habitats: A6.3, A6.11

Greene et al., 1999 mesohabitats: two present, described below

Image quality is good throughout this tow. The benthic environment is very similar to those observed at GB_E#1, differing mainly in the steepness of the depth gradient

traversed by the camera. The tow begins on a mixed substratum of boulders and (possibly) bedrock outcrops on an underlying sea bed of coarse sand containing abundant gravel and biogenic debris (e.g. photo 05). Gaps between boulders are filled with accumulations of barnacle plates and other calcareous material (e.g. photo 02). From approximately 08:30 min the substratum changes to a continuous expanse of dark grey bedrock, which is followed for most of the tow. The bedrock is heavily silted in most areas, and has a relatively uniform topography of broad, smooth expanses, undercut in places to form overhangs (e.g. photos 27, 29, 30). In contrast to the distinctly terraced topography of GB_E#1, this station appears to follow a continuous slope of more uniform inclination. Silty sloping bedrock continues until approximately 37:00 min, when the substratum changes to fine sediment (possibly muddy sand) mixed with gravel and biogenic debris (e.g. photo 39). This may be a sediment veneer covering bedrock at the base of the slope. The sea bed of gravelly fine sand continues to the end of the tow. A few isolated small boulders appear immediately before the end.

The epifaunal community closely resembles that seen at GB_E#1. In the boulder/shelly sediment zone crossed in the first minutes of the tow the most characteristic sessile animals are patchy encrusting sponges and /or bryozoans, and the larger hexactinellid sponges *Aphrocallistes* sp. and *Pheronema carpenteri* (e.g. [photos 06](#), 07). As at station GB_E#1 *Aphrocallistes* is more common than *Pheronema*. Large barnacles, possibly *Bathylasma hirsutum*, are present in small clusters on some boulders (e.g. photo 04). The antipatharian *Leiopathes* sp. and a possible bamboo coral (*Keratoisis* sp.) are the only large arborescent colonial animals seen. Both are only occasionally seen. Mobile epifauna include the echinoids *Echinus elegans* (e.g. photo 02) and *Cidaris cidaris* (e.g. photo 04), unidentified galatheid decapods and small ophiuroids (photos 03, 04). A small shark is seen at 06:25 min (photo 08).

Essentially the same community is seen across the wide expanse of sloping silty bedrock that makes up most of the station. This is characterised by a sparse epifauna of patchy encrusting sponges and solitary coral polyps (e.g. [photos 23](#), 28, 31). Barnacles and *Aphrocallistes* sp. appear to be confined to the upper part of the bedrock slope (*Aphrocallistes* is last seen at 24:16 min). The antipatharian *Leiopathes*

sp. and an unidentified vase-shaped sponge (e.g. photo 20) are occasionally seen (12 *Leiopathes* colonies and 5 sponges are seen). Mobile epifauna are mostly small and relatively inconspicuous, with small cidarid echinoids and unidentified ophiuroids (e.g. photo 25) being the most frequently seen taxa. Brisingid asteroids are seen at 21:21 min (photo 21) and 23:13 min. Fish are rare. A single individual of *Chimaera monstrosa* is seen at 14:39 min. A fish swimming over bedrock at 35:36 min may be a spear-snouted grenadier *Caelorinchus labiatus*. A sculpin-like fish resting on the rock surface at 32:06 min (photo 33) is a psychrolutid, either *Cottunculus thomsonii* or *Psychrolutes subspinosus*. An unidentified small shark is seen at 33:49 min.

A grey solitary ascidian is present on photo 41 but otherwise no epifauna are visible on the gravelly fine sand at the base of the bedrock slope.

4 SUMMARY

A total of 86 stations were sampled on the two cruises. Just over 54 hours of video footage were viewed and a total of 2071 images categorised of which 2014 were usable. About 50% of the stations sampled were located on Rockall Bank, with almost 50% of the total video footage coming from this area as well (see table 2).

Table 2. Break down of the number of stations sampled at each location along with total duration of video footage viewed and number of images categorised.

Location	No. Stations	Total video (h)	Images	
			Total	Usable
Hebrides Slope	5	2:07:07	84	75
Anton Dohrn	17	10:39:30	343	334
Rockall Bank	44	25:27:00	684	646
Hatton Bank	13	9:46:01	634	633
George Bligh Bank	7	6:12:06	326	326

As the results indicate, a number of distinct habitats have been identified in the five areas surveyed.

4.1. Hebrides Continental Slope

The Hebrides continental slope (~650 – 2200 m) is mainly composed of fine sediment with some evidence of hydrodynamic activity at the shallower stations. Visible megafaunal density and diversity in area was relatively low. The most frequently seen species were the echinoid *Echinus acutus* and the ophiuroid *Ophiomusium lymani*. At the LOIS-SES#2 station (980 – 1004 m) a number of Xenophyophores were also seen.

4.2. Anton Dohrn Seamount

On the broad, level summit plateau of the Anton Dohrn seamount, the substratum varied from sediment containing biogenic material through to pebbles/cobbles and bedrock. There was evidence of hydrodynamic activity and current scour: some of the larger rocks appeared to have distinct trails of pebbles and cobbles on one side. The sessile fauna were dominated by brachiopods (probably *Dallina septigera*) as well as large barnacles, which are possibly *Bathylasma hirsutum*. The barnacles were mainly seen at the shallower stations and correspondingly large drifts of barnacle plates and brachiopod valves were also seen at these stations. Although the echinoderms still dominated the mobile megafauna, there was a subtle change in the dominant species. At the shallower stations, the echinoids *Calveriosoma* cf. *fenestratum* and *Cidaris cidaris* were most abundant with *C.* cf. *fenestratum* appearing 28 times at station AD-J#1 (530 m; 59:00 mins) and 87 times at station COR0522 (576 – 596 m; 30 mins). The difference is possibly an artefact due to the way the cameras were set up to view the sea bed. A few fish were seen in this area such as the morid *Lepidion eques*, a mora *Mora moro* and the rabbitfish *Chimaera monstrosa*. However, throughout the two surveys there were no observations of large sessile epifauna such as gorgonians, corals and massive sponges. At the deeper stations ca. 1400 m, situated off the plateau and into the Rockall Trough, there was a change in species dominance to the ophiuroid *Ophiomusium lymani* and the echinoid *Echinus affinis*.

4.3. Rockall Bank

The number of different habitats seen on Rockall Bank increased vastly compared to Anton Dohrn. This is a result of the complexity of the geomorphology on Rockall Bank and that a high proportion of sampling sites were located in this region covering a wide area. The area sampled in southeast region of the bank was mainly is known *Nephrops* ground and as such is mainly composed of very fine muddy sand where the urchin *Echinus acutus* were the most common mobile megafauna. A discarded fishing net was visible in one tow in this area. Sampling the eastern side of the Bank revealed extensive exposed bedrock areas and some *Lophelia pertusa* reef areas. Where sand occurred it was possible to see that current scour was taking place and there was

evidence of lag-deposits and also mega-ripples. The areas sampled towards the west and northwest revealed live reef framework comprising *Lophelia pertusa* and *Madrepora oculata*. In the northwest region there was evidence of trawling in reef areas.

Mobile epifauna often seen included the squat lobster *Munida rugosa*, the holothurian *Stichopus tremulus*, the bluemouth red fish *Helicolenus dactylopterus* and the echinoids *Cidaris cidaris* (at shallower sites) and *Echinus acutus* (at the slightly deeper stations). In one tow alone lasting just 21 minutes at station DW05909 using the sledge system, ca. 1600 *E. acutus* were counted (407 – 414 m). There was a large number of different fish species seen at Rockall Bank, including, Grenadiers, flatfish and *Chimaera monstrosa*. Common sessile invertebrates included the cup sponges (possibly *Axinella* sp. or *Phakiella* sp.), the erect bryozoan *Reteporella* sp., the solitary corals *Caryophyllia* spp., encrusting sponges (unidentifiable) and bryozoans. In some areas, both active and inactive *Nephrops norvegicus* burrows were extremely common.

4.4. Hatton Bank

Hatton Bank also demonstrated a variety of habitats ranging from fine grained sediment at the deeper stations through to coral debris and exposed bedrock at the slightly shallower stations. Current scouring is evident with “tails” of pebbles/cobbles associated with one side of the larger boulders. Epifaunal diversity in this region is high. From about 530 – 800 m there are extensive areas of coral debris as well as live coral. The extensive reef framework in places is often dead and infilled with sediment. Inhabiting the reef framework, made up of *Madrepora oculata* and *Lophelia pertusa*, are a variety of epifauna including the large and striking sea anemone *Phelliactis* sp., the corkscrew shaped antipatharian coral *Stichopathes* sp., hydroids/bryozoans as well as mobile epifauna such as crustaceans and ophiuroids. Also evident are many encrusting sponges, crinoids, gorgonians, glass sponges (*Aphrocallistes* sp.), octocorals and serpulid polychaetes, at depths of <800 m. The steep slopes, ledges and rock overhangs seen at a depth range of 476 – 730 m, are often colonised by stylasterid corals (probably *Pliobothrus* sp.), antipatharian coral (e.g. *Leiopathes* sp.

and *Stichopathes* sp.) scleractinian and bamboo corals as well as the holothurian *Psolus squamatus*. Throughout these stations, the only infauna seen is the proboscides of bonelliid echiuran worms. At the deeper stations where there is no coral framework, sessile epifauna are readily found attached to boulders. Vase-shaped white sponges are more common at the deeper stations (>800 m), and on the fine sediment, xenophyophores are more abundant.

4.5. George Bligh Bank

George Bligh Bank again has a number of different habitats. On the summit of George Bligh Bank, the camera was left in the same location for about 30 minutes as high numbers of the rabbitfish *Chimaera monstrosa* were seen, with about seven being caught in one photograph. For the remainder of the tow, *C. monstrosa* were still very much in evidence, but not at the same density as seen at the beginning of the tow. The other station at this depth was very similar, but *C. monstrosa* were only seen singly. Very little epifauna was seen on this mainly sandy substratum. Below about 800 m there was a mixture of sand cobbles and coral rubble. The coral framework consisted mainly of *Madrepora oculata* and *Lophelia pertusa* and there was a highly diverse fauna associated with this framework. These sessile fauna included *Stichopathes*, nephtheid soft coral *Capnella* sp. as well as hexactinellid sponges and the large anemone *Phelliactis* sp. The most abundant mobile fauna were the echinoids *Cidaris cidaris* and *Calveriosoma* sp, whilst rarer species included the basket star *Gorgonocephalus caput-medusae* and some fish species. Below 1000 m, bedrock slopes and terraces are seen, which have characteristic fauna associated with them such as *Leiopathes* sp., an orange antipatharian coral, bamboo whip corals (*Lepidisis* sp.), large numbers of unidentified orange anemones and small patches of *Lophelia pertusa*. White vase-shaped sponges similar to those seen on Hatton Bank (ca. 800 m) are also seen on George Bligh Bank below 1000 m. No coral debris occurred in this area, but the hexactinellid sponge *Pheronema carpenteri* was seen and was often surrounded by very small unidentifiable orange anemones, different to the ones seen on the slopes and terraces. On the hard substratum, barnacles, possibly the same species as seen on Anton Dohrn, were seen here at George Bligh Bank. There was

also a change in one of the echinoid species from *Calveriosoma* sp. to *Echinus elegans*.

5 CONCLUSIONS

- George Bligh Bank, Hatton Bank and some areas of Rockall Bank were found to have high epifaunal diversity, compared to the areas sampled on Anton Dohrn seamount and the Hebrides slope.
- Hatton Bank and George Bligh Bank had very similar coral-dominated biotopes with characteristic associated fauna.
- Precise depth ranges of species and communities are not possible to determine from point surveys. However, it can be said that of the mobile fauna seen, the echinoids generally dominated and there were clear changes in species dominance with depth.
- Of the areas surveyed only Rockall Bank appeared to show any signs of trawling.
- These results provide the first detailed visual survey of these areas. Some rich habitats were observed with high species diversity. It would be useful, and scientifically interesting to undertake further photographic sampling of some of the target sites sampled during the two cruises in the SEA 7 area, and to extend the survey to cover the Rosemary Bank, where topographic complexity (Howe et al. 2006) is likely to be reflected in a high diversity of benthic habitats and communities. Additional stations should also be surveyed on northern and western regions of Rockall Bank as well as its flanks and on the George Bligh and Hatton Banks in order to more fully map the distribution of sea bed habitats in these areas. Two differing camera systems (with scaling devices) would be required; 1) to photograph/video sizeable areas of seabed allowing for large features such as iceberg ploughmarks to be visualised e.g. a sledge system, 2) to undertake more detailed work collecting close up images of the different fauna e.g. the Seatronics system. Investigation of the steep flanks of the Anton Dohrn seamount will pose particular technical challenges, and may require the use of an ROV system.

6 ACKNOWLEDGEMENTS

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APPENDIX I

Hebrides Continental Slope



[LOIS-SES1#4_09](#). Bed of fine sand or muddy sand with distinct ripples. Gastropod (cf. *Colus jeffreysianus*) at lower left.



[LOIS-SES2#2_16](#). Clearly rippled muddy sea bed with particles of floc or debris on surface, also some scattered pebbles. No animals visible.



[LOIS-SES3#1_11](#). Close-up of soft mud with sediment clods and brownish floc particles on surface. No animals visible.



[LOIS-SES4#1_22](#). Ophiuroid (*Ophiomusium lymani*) on flat muddy sea bed.

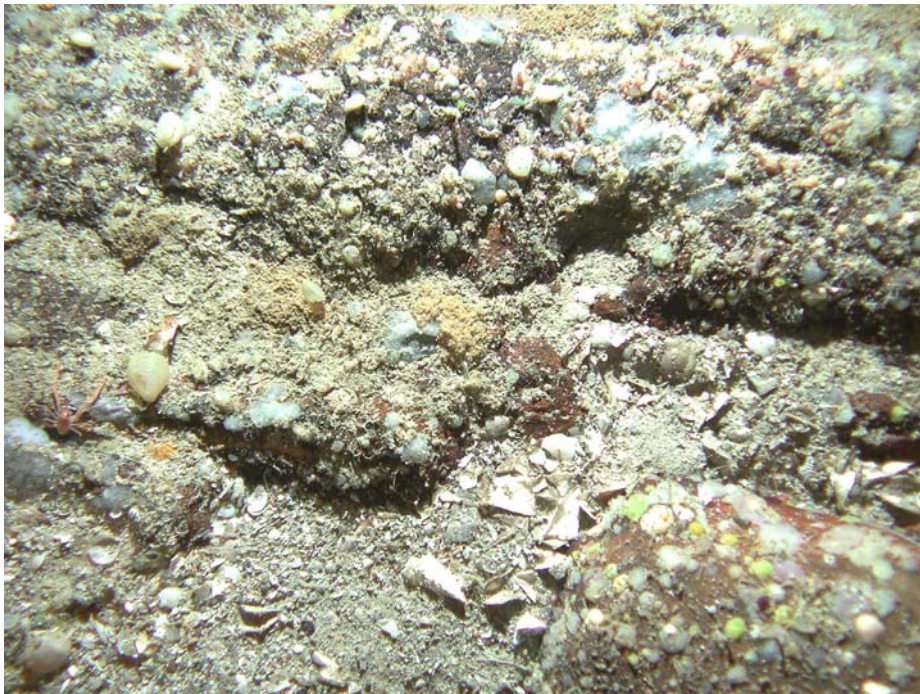


[Station M #1_12](#). Flat muddy sea bed, largely featureless. Arm of an ophiuroid (*Ophiomusium lymani*) entering frame at top right.

Anton Dohrn Seamount



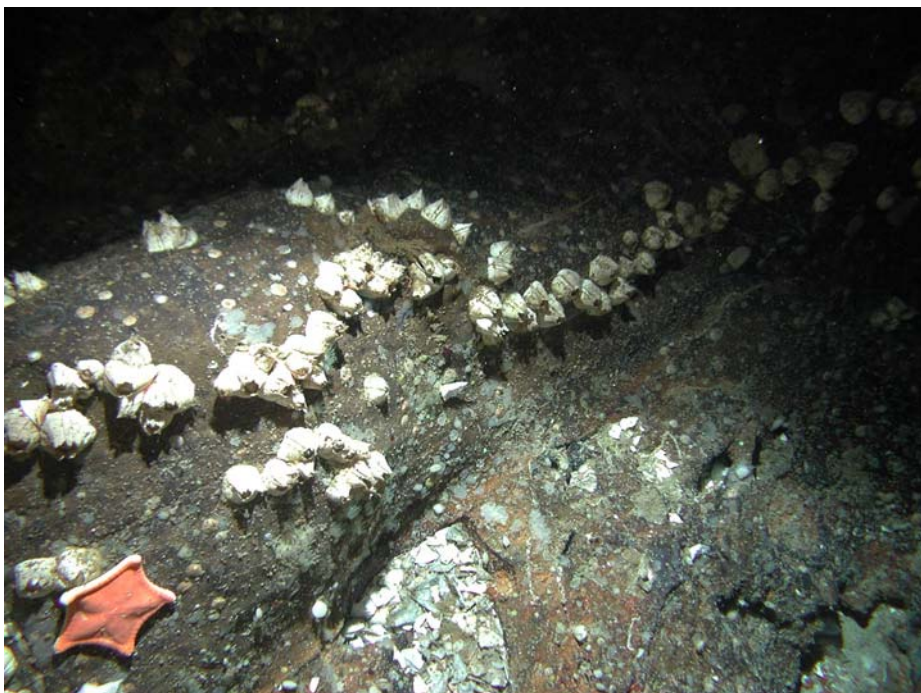
[AD J#1 04](#). Close-up of coarse sand with gravel and small pebbles. Few brachiopods on surface.



[AD J#1 35](#). Close-up of reddish bedrock/boulder surface with cover of sand and shelly debris. Abundant encrusting bryozoans/sponges. Brachiopod and tiny galatheid decapod at far left.



[AD B#1_25](#). Coarse gravelly sand with area of flat bedrock at upper right. Brachiopod at lower right.



[AD B#1_43](#). Vertical expanse of reddish-grey bedrock with abundant barnacles (cf. *Bathylasma hirsutum*). Pink asteroid at lower left may be *Peltaster placenta*.



[AD C#1_04](#). Close-up of flat medium sand with low gravel component. Good view of echinoid *Calveriosoma* cf. *fenestratum*.



[AD C#1_11](#). Close-up of flat grey bedrock with veneer of coarse sand and shelly material. Many brachiopods (cf. *Dallina septigera*) attached to rock surface.



[AD_H#1_15](#). Good view of *Calveriosoma* cf. *fenestratum* on flat medium sand.



[AD_A#1_01](#). Close-up of flat medium or fine sand with very low gravel content. No animals visible.



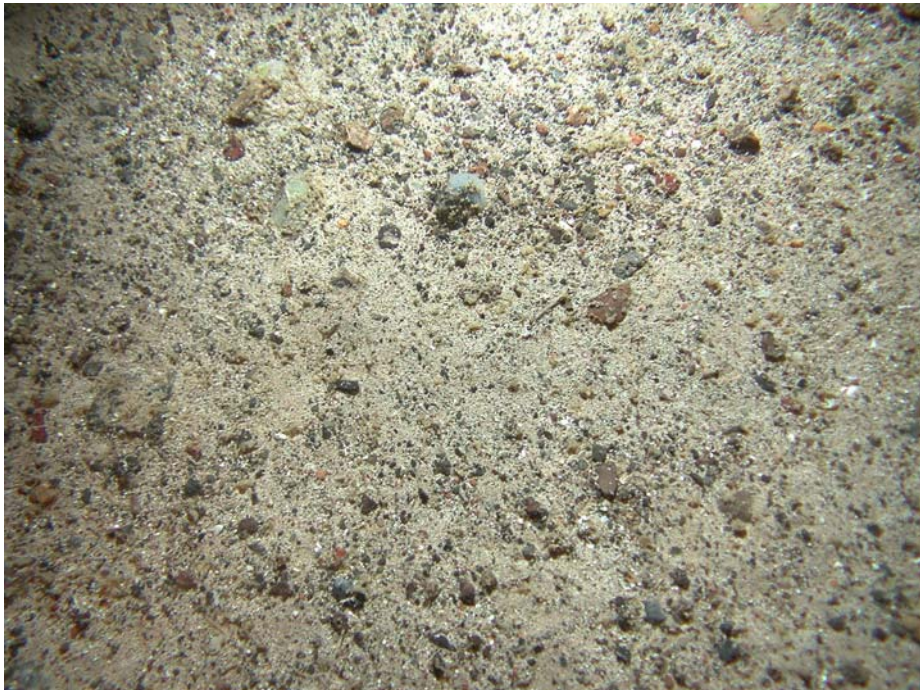
[AD K#2_03](#). Close-up of flat medium or fine sand with very low gravel content. Two brachiopods visible.



[AD K#1_12](#). Close-up of grey cobble on bed of medium or fine pebbly sand. At least 15 brachiopods visible.



[SAMS_GEO2#1_16](#). Close-up of coarse sand with low gravel content. Large pebble or small cobble to left of centre. Several brachiopods visible.



[AD_D#1_02](#). Close-up of flat coarse gravelly sand. No animals visible.



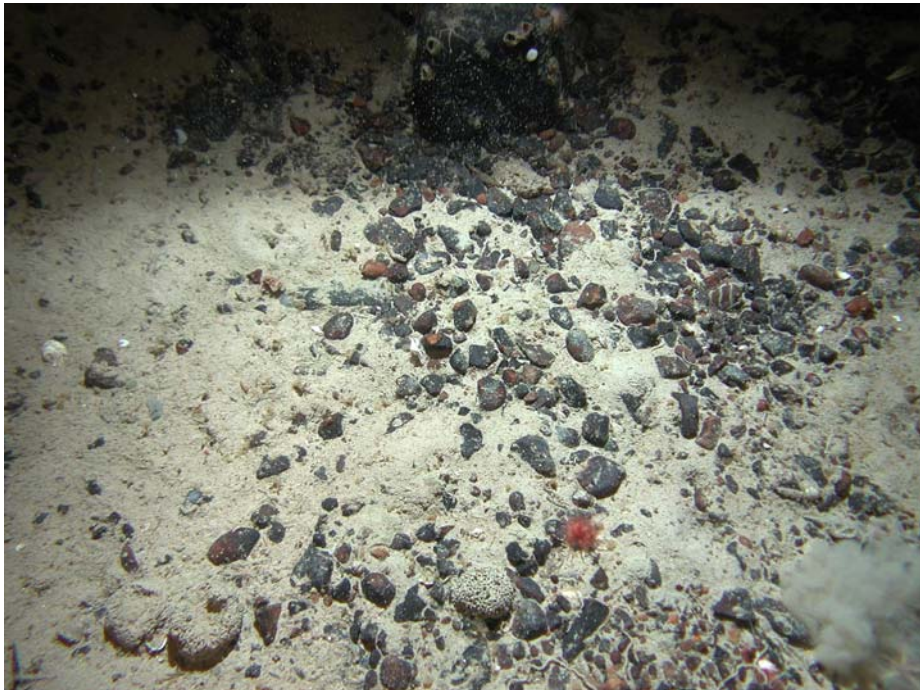
[AD D#2 11](#). Eel (*Synaphobranchus kaupi*) over bed of rippled gravelly sand with scattered pebbles/cobbles.



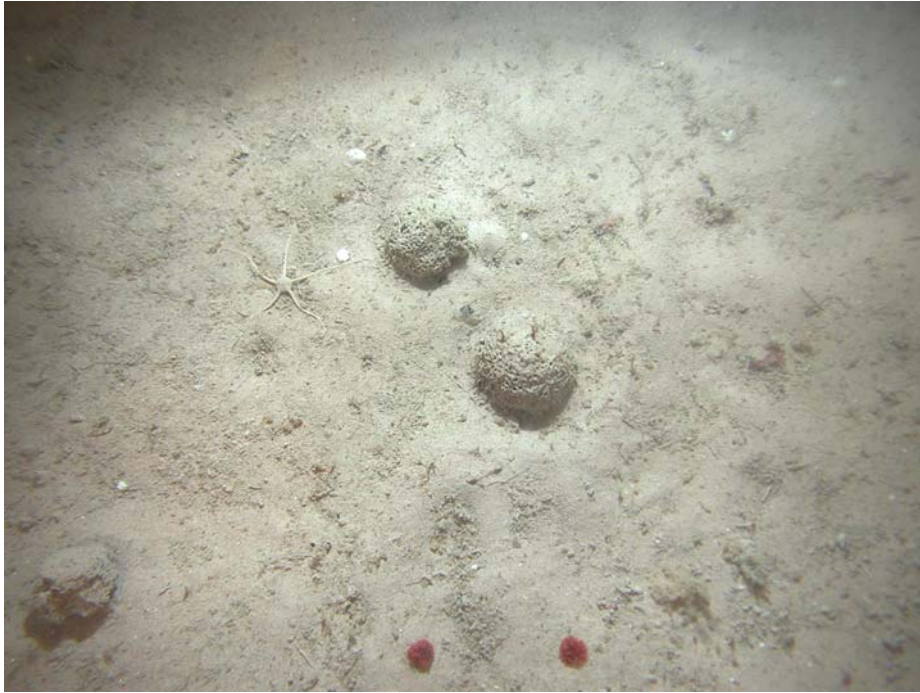
[SAMS GEO1#1 09](#). Holothurian (*Stichopus tremulus*) on coarse sand with scattered pebbles. Whole animal clearly visible.



[AD F#1 07](#). Echinoid (*Echinus affinis*) and unidentified small ophiuroid on fine sand or mud with scattered gravel particles.



[AD G#1 03](#). Dense patch of cobbles and pebbles on muddy sea bed. Larger boulder at top edge. Three xenophyophores and a pink solitary coral polyp (cf. *Flabellum* sp.) in lower half of frame.



[AD G#1_28](#). Flat muddy sea bed with three xenophyophores, two coral polyps and small ophiuroid. Image partly obscured by haze of fine particles.

Rockall Bank SEA 7 Stations



[SAMS 2 L#5 13](#). Coarse sandy sea bed with some shell gravel and detritus. No signs of bioturbation. The only visible fauna is the asteroid *Stichastrella rosea*, and an unidentified organism (possibly a tube worm).



[SAMS 2 M#3 03](#). Bedrock (100%) with some sand cover. Conspicuous species include erect bryozoans (*Reteporella* sp.) and cup sponges (possibly *Axinella* sp.), with a small ophiuroid (possibly *Ophiactis* sp.) taking shelter beneath a *Reteporella* growth. Encrusting sponges and serpulid worm tubes are also present.



[SAMS_2_M#3_08](#). Coarse sandy sea bed with pebbles and cobbles (39%). Conspicuous species include erect bryozoans (*Reteporella* sp. and cyclostome bryozoans) and cup sponges (possibly *Axinella* sp.). Encrusting sponges are also present. An unidentified decapod and two *Munida* (probably *M. rugosa*) are just visible via their claws.



[SAMS_2_M#3_21](#). Medium sandy sea bed with the odd pebble, no signs of bioturbation. An unidentified spider crab (Majidae) is the only visible fauna.



[SAMS 2 M#3 35](#). Medium sandy sea bed with the odd pebble (<1), no signs of bioturbation. No visible fauna.



[SAMS 2 M#2 11](#). Medium sandy sea bed with cobbles (70%) and areas of sand covered bedrock. Visible mobile species include holothurians *Stichopus tremulus* and an unidentified species, the squat lobster *Munida* (probably *M. rugosa*) with individuals characteristically concealed beneath cobbles, and an unidentified fish species. Attached and encrusting species of note are the erect bryozoans *Reteporella* sp. and Cyclostomes, several small growths of cup sponge (possibly *Axinella* sp.) and clusters of possible zoanths or corals. Encrusting sponges, bryozoans and unidentified small white encrusting species are also present.



[SAMS_2_M#2_02](#). Medium sandy sea bed. No signs of bioturbation and no visible fauna



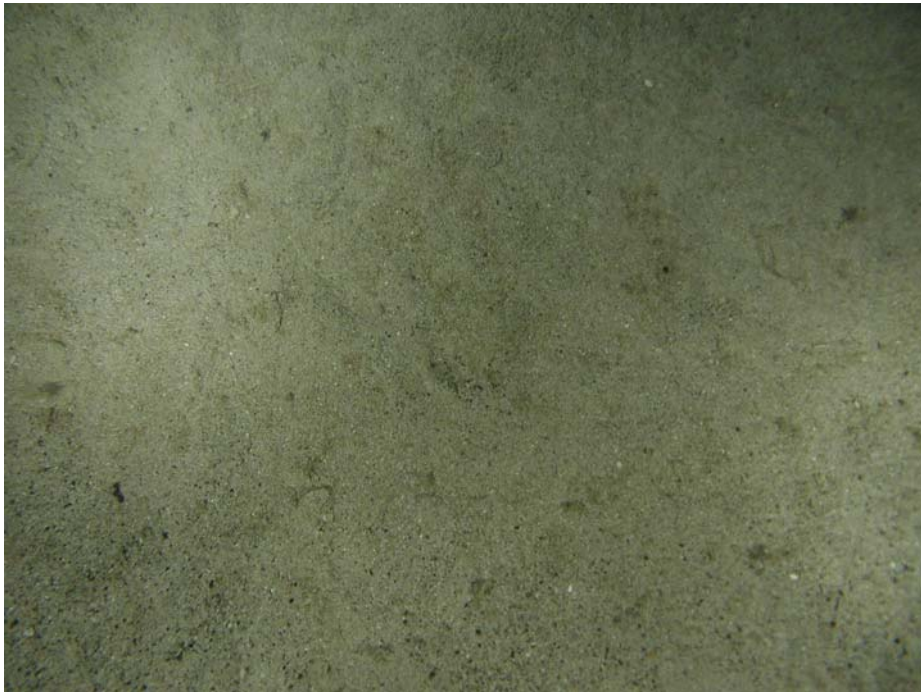
[SAMS_2_M#2_17](#). Bedrock sea bed with a thin covering of sand (2% exposed hard ground). Conspicuous species include the erect bryozoan *Reteporella* sp. and several individuals of possible zoanthids. Cup sponges (possibly *Axinella* sp.), globose form sponges and very small growths of cyclostome bryozoans are also present as well as encrusting sponges and bryozoans. A flatfish is just visible in the centre of the image.



[SAMS 2 O#4 05](#). Medium sandy sea bed with the odd pebble (<1%) and clinker. Three *Caryophyllia* sp 5 are the only visible fauna.



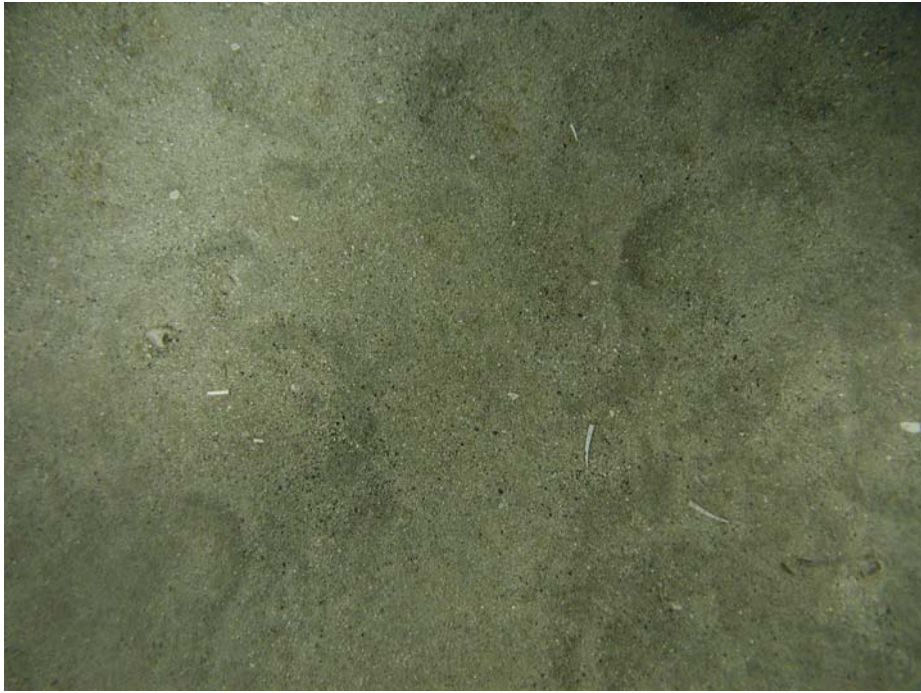
[SAMS 2 O#4 14](#). Medium sandy sea bed with clinker and a large boulder (44%). The boulder is heavily encrusted with organisms including large growths of *Reteporella* and cyclostome bryozoans, encrusting sponges, *Pheronema carpentrii* and a large yellow globose sponge, as well as many other unidentified species. *Caryophyllia* sp 5 and *Munida rugosa* are visible on the sediment near the boulder.



[SAMS 2 O#4 15](#). Medium sandy sea bed with some detritus and clinker. No visible fauna.



[SAMS 2 N#1 08](#). Medium sandy sea bed with the odd cobble (2%) and type 3 ripples. The only visible fauna, *Caryophyllia* sp. a globose form sponge and hydroids are attached to a cobble.



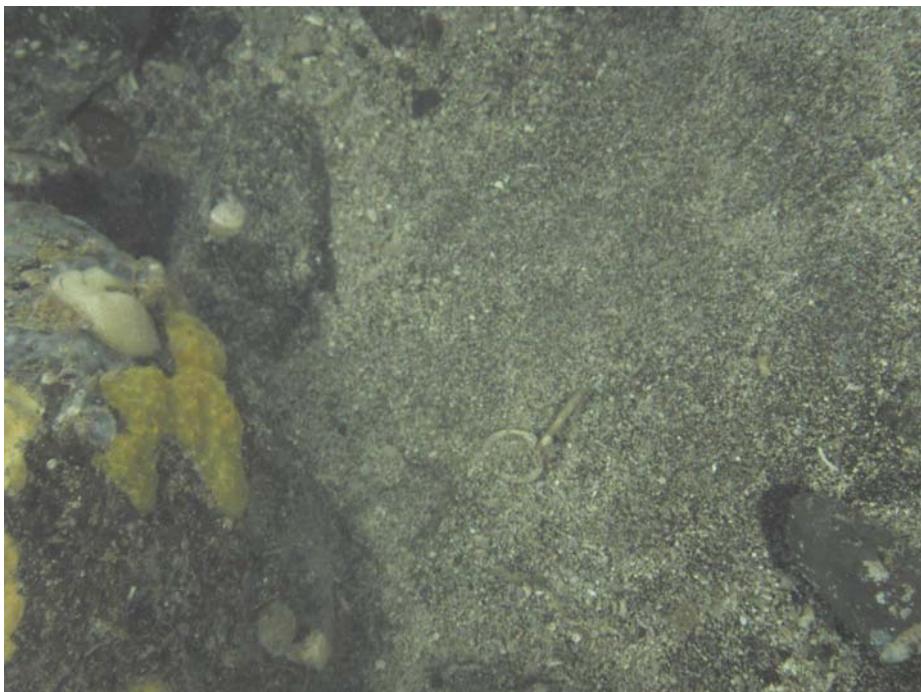
[SAMS_2_N#1_10](#). Medium sandy sea bed with clinker and signs of current scour. No visible fauna.



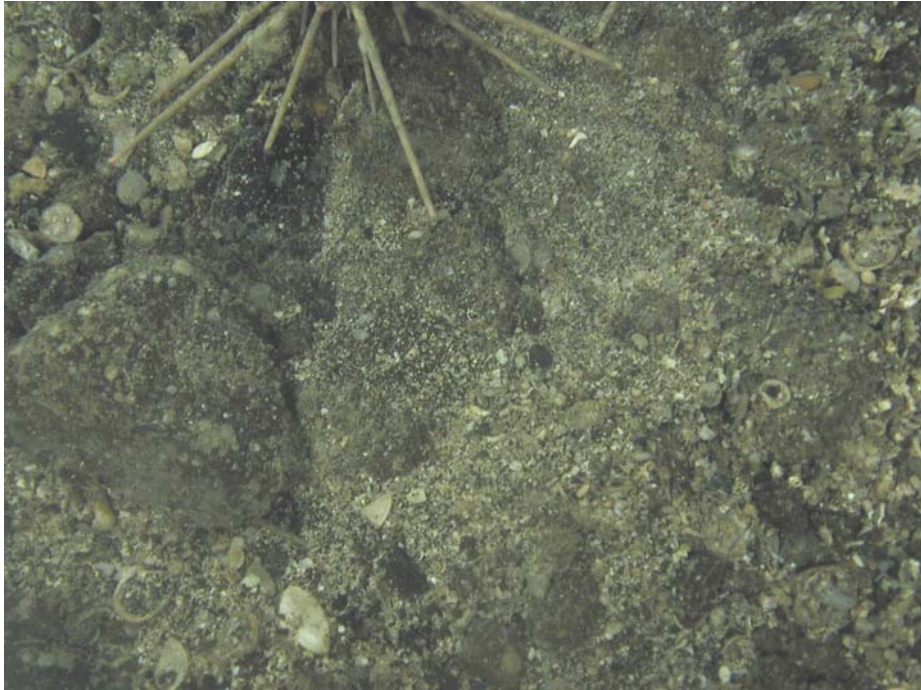
[SAMS_2_P#1_05](#). Medium sandy sea bed with clinker and some detritus. Some signs of bioturbation and/or current movement. No visible fauna.



[SAMS_2 P#1_10](#). Medium sandy sea bed with the occasional cobble (7%) and clinker. Signs of current movement, possible type 3 ripples. All fauna are associated with the cobble and include a small growth of Stylasterid coral, yellow globose sponge forms, encrusting bryozoans, hydroids.



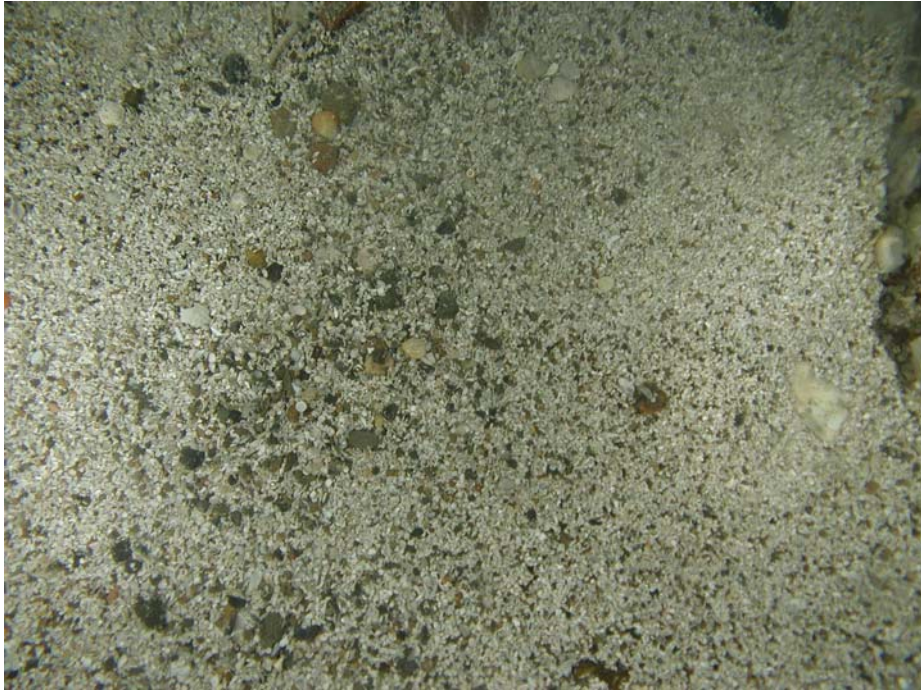
[ER-O#1_01](#). Coarse sandy sea bed and boulders (30%). At least 4 morphospecies of encrusting sponge are visible in this image. A possible solitary coral (Caryophyllid) and encrusting bryozoans can also be seen.



[ER-O#1 04](#). Shell gravely sea bed largely covered with pebbles and cobbles (55%). The spine of a single *Cidaris cidaris* can be seen in this image with encrusting bryozoans present on the cobbles.



[ER-O#1 71](#). Bedrock (100%). The most conspicuous faunal elements of this image are patches of the coral *Lophelia pertusa* and growths of a yellow globose sponge form, both of which are attached to the bedrock substratum. A palaemonid shrimp and solitary coral polyp (Caryophyllia) are also of note. Encrusting sponges, bryozoans, small white unidentified encrusting organisms and others are also present.



[ER-O#1 75](#). Very coarse sandy sea bed with pebbles (2%). Few visible fauna. On the far right of the image there seems to be an area of hard substratum just out of shot with encrusting species present.



[ER M#2 01](#). Coarse sand, gravel, pebbles and cobbly sea bed. Few encrusting organisms on the cobbles, only encrusting bryozoans and serpulid worm tubes.



[ER_M#2_17](#). Dead *Lophelia pertusa* with *Reteporella* sp., small ophiuroids (possibly *Ophiactis* sp.), encrusting sponges and hydroid growth on dead frame work.



[ER_M#2_20](#). Coarse sand, shell gravel, cobbles and boulder (31%) sea bed with organic debris (brachiopod shells, cidaris spines, echinoid test, *Lophelia pertusa* fragments). The mobile epifauna are represented by the echinoid *Cidaris cidaris* and a small number of the small ophiuroid (<10, possible *Ophiactis* sp.) sheltering in the crack between two cobbles. Attached fauna include brachiopods, an unusual globose form sponge, serpulid worm tubes and encrusting sponges and bryozoans. A number of other unidentified encrusting species are present.



[ER_M#2_32](#). Shell gravelly sea bed with organic debris (brachiopod shells, cidaris spines) becoming more pebbly toward the top left of the image. Visible fauna much the same as previous images for this station including the ophiuroid (probably *Ophiopholis aculeata*), encrusting bryozoans, serpulid worm tubes and unidentified hydroids.



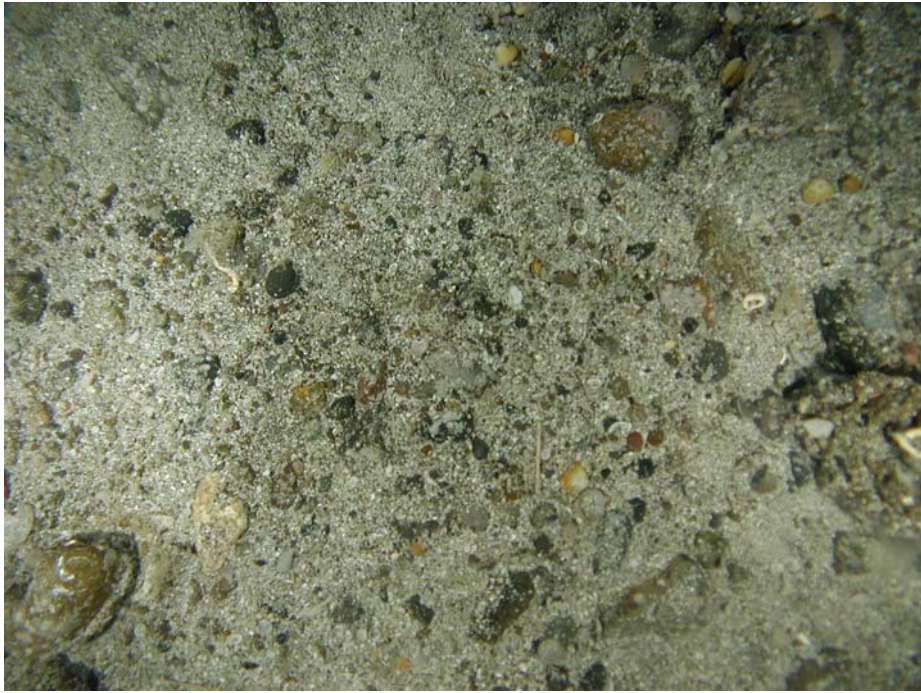
[ER-N#1_32](#). Coarse sandy sea bed partially covered with pebbles and cobbles (33%) and organic debris (brachiopod shells and *Cidaris* spines). Conspicuous fauna include the echinoid *Cidaris cidaris* and a large red anemone. Other fauna are largely encrusting or attached and include serpulid worm tubes, brachiopods, encrusting sponges, bryozoans, small white unidentified encrusting species and other encrusting species. A single small ophiuroid of the type usually found (in this study) in large numbers hidden in crevices (possibly *Ophiactis* sp.) is present.



[ER-N#1_47](#). Coarse sandy pebbly seabed with cobbles (20%). All visible fauna are attached or encrusting forms, the most conspicuous of which is a small stylasterid coral growth and three individuals of a possible solitary coral (Caryophyllid). Other fauna include serpulid worm tubes, encrusting sponges, bryozoans, and other unidentified species. A small number of small ophiuroids (possibly *Ophiactis* sp.) are present on the stylasterid and within old serpulid tubes.



[ER-N#1_52](#). Sea bed is covered in organic debris. Only visible fauna is a red cerianthid anemone.



[ER-B#1_03](#). Coarse sand, gravel and pebbly sea bed. No visible mobile epifauna. Pebbles are encrusted with unidentified sponges, bryozoans and other unclassified organisms, with a serpulid worm tube and patch of unidentified hydroid visible.



[ER-B#1_06](#). Coarse sand, gravel, pebble and cobble (60%) sea bed. Mobile epifauna include two *Munida* (probably *M. rugosa*) concealed beneath the cobbles with only claws visible; and an undetermined number of ophiuroids (<10, possibly *Ophiactis* sp.) hiding in the crevices of what appears to be sponge covered cobbles. All other fauna are sessile or encrusting and include a single anemone, a brachiopod, unidentified hydroids, encrusting sponge, bryozoan and other unidentified fauna. Serpulid worm tubes and whole bivalve shells are also visible and may contain individuals.



[ER-B#1 22](#). Coarse sand, gravel, shell gravel and pebbly sea bed (1%). A blurred line at the top of the image may be a sea pen. Very few visible fauna accept a single anemone, brachiopods and encrusting bryozoans and sponges. A polychaete tube / bivalve siphon is also visible.



[ER-C#1 03](#). Coarse sand sea bed on the edge of an area of gravel, cobbly pebbly sea bed (9%). On the sand area visible fauna include an ophiuroid (indet.) and an unidentified asteroid. All other fauna is present on the cobbled area of sea bed. The pencil echinoid (*Cidaris cidaris*) and sessile forms including possible caryophyllids?, encrusting bryozoans and sponges, and anemones are present. Serpulid worm tubes are also visible.



[ER-C#1_09](#). Coarse sand seabed with clinker and the odd cobble (4%), no signs of bioturbation. All visible fauna are sessile or encrusting on the cobble and include serpulid worm tubes and encrusting sponge species. Other unidentifiable encrusting fauna are also present.



[ER-C#1_10](#). Coarse sand sea bed with clinker, no signs of bioturbation. Visible fauna include the asteroid *Astropecten irregularis*, a polychaete worm with tentacles extended into the water column, and an encrusting sponge.



[ER-D#1 01](#). Coarse sand sea bed with clinker and some detritus. No visible fauna.



[ER-D#1 03](#). Medium sand sea bed with clinker, pebbles, a cobble and fragments of dead *Lophelia pertusa* and dead Caryophyllids. There is a fine layer of sand deposited on the cobble obscuring the view of encrusting species. However two anemones and a serpulid worm tube are visible. Other encrusting fauna are present but could not be identified.



[ER-D#1_04](#). Medium sandy sea bed with clinker, pebbles and a boulder (11%) and small fragments of dead *Lophelia pertusa*. Few visible fauna on the sand only the ophiuroid (possibly *Ophiactis* sp.). All other fauna is encrusting or attached and includes serpulid worm tubes, possible caryophyllids, encrusting sponges and other unidentified encrusting species.



[ER-D#1_13](#). Coarse sand sea bed with pebbles and the odd cobble (7%). Type 3 ripples visible. All visible fauna is attached to or encrusting on the cobble and includes encrusting sponge species and a brachiopod. Other unidentified encrusting species are also present.



[ER F#1 05](#). Medium to fine muddy sand sea bed with occasional gravel. Visible fauna includes what appears to be either the sponge *Pheronema carpenteri* or a dead Xenophyophore with epifaunal tufted growths.



[ER F#1 14](#). Medium muddy sand sea bed with some gravel, pebbles and the occasional cobble 2%. Encrusting bryozoans on pebbles. Some of the image obscured by sediment clouds.



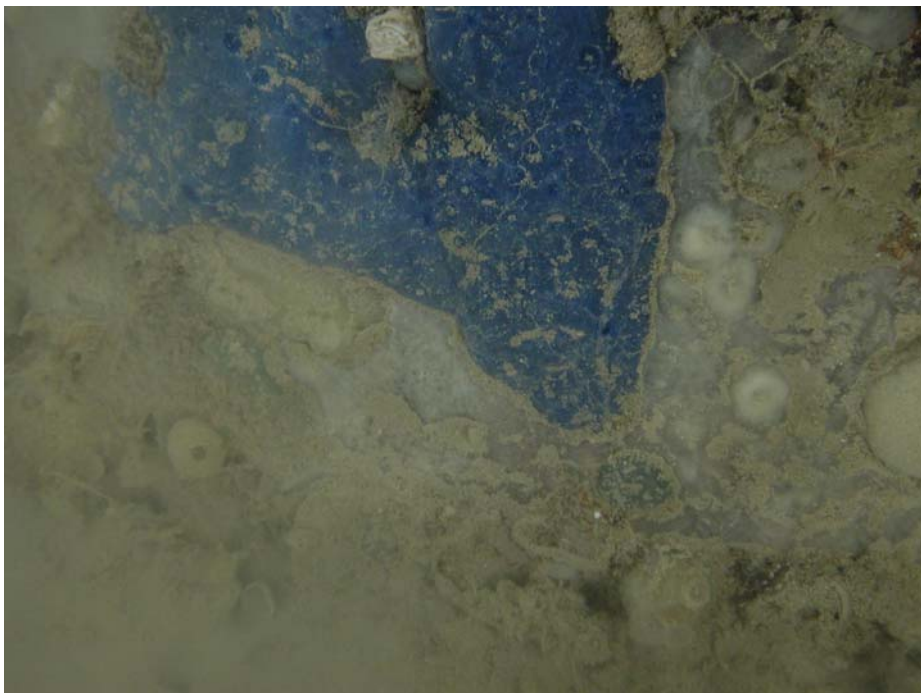
[ER L#1 12](#). Very fine muddy, silty sea bed. Some lebenspuren including 2 holes of various sizes in the sediment, most likely animal burrows. A number of tubes can also be seen both within and protruding from the sediment.



[ER-G#1 10](#). Fine mud sea bed with signs of faunal activity. A single burrow opening. No visible fauna.



[ER-E#4 01](#). Fine mud sea bed with signs of faunal activity. Brisingid asteroid visible (possibly *Freyaster* sp.)



[ER-E#4 04](#). Fine mud sea bed with a large solid structure present (39%), sediment shows signs of faunal activity with burrows visible. All visible fauna is attached to or encrusting on solid substratum and includes hydroids, encrusting sponges, and brachiopods. An undetermined number (<10) of ophiuroids (possibly *Ophiactis* sp.) are hidden in crevices in the solid substratum, visible only by their protruding arms.

Rockall Bank FRS Scotia Stations



[COR0510-177Cnv00038-194835](#). Medium sandy sea bed with cobbles, pebbles and clinker. Image taken high in the water column. As a result few fauna are visible and those that are, are difficult to identify. Six growths of yellow erect-globose sponge, two asteroids, at least 12 cup sponges (most likely both *Phakellia* sp. and *Axinella* sp.), *Reteporella*, encrusting sponges, possible stylasterid coral or erect branching sponge, and a large possible sea spider or spider crab are all visible fauna. Other encrusting or attached fauna are present but cannot be identified.



[COR0510-181Cnv00034-195750](#). Medium sandy sea bed with some detritus. No signs of bioturbation although sediment surface appears grainy. No visible fauna.



[COR0510-182Cnv00033-195939](#). Medium to coarse sandy sea bed with bedrock outcrops 69%. The bedrock outcrop is dominated by cup form and encrusting sponge species, 13 cup sponges (both *Axinella* sp and *Phakellia* sp.) and at least three encrusting forms are visible, as well as a small yellow globose form and a possible erect branching form (although this may be a Cyclostome bryozoan). *Reteporella* and cyclostome bryozoans are also present, and a single asteroid (*Stichastrella rosea*).



[COR05012-201Cnv00047-204056](#). Coarse sandy sea bed with bedrock outcrops 67%. Bedrock heavily encrusted. Many unidentified fauna. Eight cup sponges (*Axinella* sp. and *Phakellia* sp.), a white globose form sponge, many encrusting sponge forms, clusters of small anemones (possibly zoanthids), *Reteporella* and cyclostome bryozoans, are all visible. Also a single unidentified asteroid.



[COR0512-206Cnv00052-225147](#). Medium sandy sea bed with pebbles (7%). No visible fauna.



[COR0512-208Cnv00050-225809](#). Possible mega ripples?of gravel/clinker and cobbles. Image taken high in the water column, as a result only the asteroid *Stichastrella rosea* is visible.



[COR0513-213Cnv00057-000820](#). Medium sandy sea bed with some detritus. No visible fauna.



[COR0513-215Cnv00055-001109](#). Possible mega ripples. Coarse sand/clinker and gravel/pebbles in alternate bands. No visible fauna.



[COR0513-216Cnv00054-001307](#). Medium to coarse sandy sea bed with boulders 27%. Visible fauna include a cup sponge (*Axinella* sp.), at least three encrusting sponge forms, *Reteporella* and cyclostome bryozoans, and a possible hydroid turf. Other unidentified encrusting forms are likely to be present.



[COR0513-220Cnv00062-001749](#). Coarse sandy sea bed with bedrock outcrops 85%. Bedrock out crop is densely covered with encrusting and attached fauna. Visible mobile epifauna include a squat lobster (probably *Munida rugosa*) concealed beneath a cobble, three hermit crabs (Paguridae), a Palaemonid shrimp and the asteroid *Asterias rubens*. Attached or encrusting forms include 16 cup sponges (*Axinella* sp. and *Phakellia* sp.), a yellow globose sponge form, an erect sponge (possibly *Raspailia ramosa*), at least four encrusting sponge forms, two colonies of *Reteporella* and four colonies of cyclostome bryozoans. There are many small clustered anemones (possibly zoanthids), serpulid worm tubes, and many other unidentified attached forms including a large patch of hydroid growth.



[COR0514-238Cnv00077-012933](#). Coarse sandy sea bed with pebbles (17%), some detritus. A small purple organism is present in this image but cannot be identified as it is too distant.



[COR0515-50Cnv00193-033508](#). Medium to fine sandy sea bed with signs of bioturbation. No visible fauna.



[COR0515-51CNV00192-033749](#). Medium to coarse sandy sea bed with pebbles and cobbles (12%). Visible fauna include the asteroid *Stichastrella rosea*. All other fauna are attached or encrusting forms and include a zoanthid (possibly *Parazoanthus anguicomus*), cup sponges (possibly *Phakellia ventilabrum*), erect bryozoans (eight cyclostome bryozoans and two *Reteporella* sp.), serpulid worm tubes, and encrusting sponges (yellow morphospecies present) and bryozoans. Other attached forms are present but could not be identified.



[COR0516-66CNV00007-181938](#). Medium to fine sandy sea bed with signs of bioturbation. No visible fauna.



[COR0516-69Cnv00016-182314](#). Medium sandy sea bed with pebbles and cobbles (36%). Signs of bioturbation. Visible epifauna include a haddock (*Melanogrammus aeglefinus*), the asteroid *Stichastrella rosea*, and nine squat lobsters (*Munida* sp.), which are largely concealed among the cobbles. Erect bryozoans (one Cyclostome and one *Reteporella* sp. colony), at least two morphospecies of encrusting sponges, serpulid worm tubes, encrusting bryozoans and a small cluster of anemones (zoanthids?) are attached to the cobbles.



[COR0516-71Cnv00014-182519](#). Medium sandy sea bed with cobbles and boulders (15%) and coral fragments (*Lophelia pertusa* <1% cover). The cobbles are partially sand covered but support six small cup sponges (possibly *Axinella* sp.), and two possible solitary corals (*Caryophyllia* sp.). Few fauna are visible on the boulder except three erect bryozoan colonies (*Reteporella* sp.), serpulid worm tubes, and encrusting sponges and bryozoans. Two squat lobsters (*Munida* sp.) are partially concealed beneath the cobbles and boulders.



[COR0517-82CNV00171-195007](#). Medium to coarse sandy sea bed with signs of bioturbation and animal tracks. No visible fauna.



[COR0517-83CNV00170-195055](#). Medium sandy sea bed bordering an area of cobbles and boulders (38%). All visible fauna are associated with the cobbles and boulders and include two squat lobsters (*Munida* sp.), a palaemonid shrimp and an asteroid (*Porania pulvillus*). Attached to the cobbles and boulders are 14 cyclostome bryozoans, serpulid worm tubes, encrusting sponges (at least 2 morphospecies), bryozoans and small unidentified white encrusting forms. A stylasterid coral may also be present.



[COR0517-86CNV00167-195607](#). Medium sandy sea bed with cobbles (22%). All visible fauna are associated with the cobbles. Three squat lobsters (*Munida* sp.) represent the mobile epifauna. Three cup sponges (possibly *Phakellia ventilabrum*), three solitary corals (*Caryophyllia* sp.), erect bryozoans (three *Reteporella* colonies), encrusting sponges (at least 3 morphospecies), bryozoans, and other unidentified attached fauna are present. A stylasterid coral is also visible.



[COR0509-11CNV00160-020657](#). Medium to fine sandy sea bed with some detritus and clinker. Signs of bioturbation. No visible fauna.



[COR0509-20Cnv00081-023351](#). Medium sandy sea bed with cobbles 4% and some detritus. At least eight solitary coral polyps (*Caryophyllia* sp.) are visible with other unidentified encrusting fauna also present.



[COR0507-181CNV00030-231946](#). Medium sandy sea bed with occasional coral (*Lophelia pertusa*) fragments. Signs of bioturbation including pit and mound structures. The only visible fauna is a swimming worm and possible small ophiuroids (*Ophiactis* sp.?) within the small coral fragments.



[COR0507-182CNV00038-232054](#). Medium sandy sea bed with some detritus and cobbles 19%. A bluemouth red fish (*Helicolenus dactylopterus*) is the only mobile epifauna visible. All other fauna are encrusting on or associated with the cobbles and include erect bryozoans (*Reteporella* (2 large colonies) and a cyclostome bryozoan), two *Caryophyllia* spp., 11 zoanths? and a cup sponge (*Axinella* sp.). Other encrusting species are present but are unidentified.



[COR0502-52CNV00083-231018](#). Medium to fine sandy sea bed. No visible fauna except possibly a growth of the erect bryozoan *Reteporella* (image is not clear). Signs of bioturbation including a mound and pit formation.



[COR0502-63CNV00084-231838](#). Medium sandy sea bed with cobbles (30%) Visible fauna include the holothurian *Stichopus tremulus*, a swimming worm, a sea biscuit echinoid, and an unidentified crustacean concealed beneath a cobble (probably *Munida rugosa*). The cobbles have many attached and encrusting forms including six ?Caryophyllids, polyps, serpulid worm tubes, encrusting sponges and bryozoans as well as other unidentified forms. Two small fragments of dead *Lophelia pertusa* support a number (<20) of small ophiuroids (possibly *Ophiactis* sp.) hidden within the coral skeleton. Signs of bioturbation including mounds and animal tracks are present. Possible emergent structures visible.



[COR0502-67CNV00092-232120](#). Medium sandy sea bed with cobbles and a boulder 75%. All visible fauna are attached or associated with the cobbles and boulders. A colony of the erect bryozoan *Reteporella* sp., two small red anemones and two unidentified crustaceans are present. The cobbles and boulders are heavily encrusted with sponges, bryozoans, serpulid worm tubes and other unidentified forms.



[COR0502-71CNV00100-232431](#). Medium sandy sea bed largely covered with cobbles 85%. Visible species include the asteroid *Porania pulvillus*, three squat lobsters (*Munida rugosa*) concealed among the cobbles, a bluemouth red fish (*Helicolenus dactylopterus*) and a holothurian *Stichopus tremulus*. Another 13 unidentified crustaceans are present, many of which are likely to be *Munida rugosa*. The cobbles are encrusted with sponges, bryozoans, serpulid worm tubes and other unidentified species.



[COR0503-84CNV00110-002953](#). Medium sandy sea bed with cobbles 35%. Visible fauna include a holothurian (*Stichopus tremulus*), two swimming worms and a polychaete tube worm. There are encrusting fauna present on the cobbles including encrusting sponges, bryozoans, serpulid worm tubes, small white unidentified encrusting organisms and other unidentified species. There are signs of bioturbation and emergent structures are present.



[COR0503-86CNV00108-003133](#). Medium sandy sea bed with cobbles 50%. Visible fauna include a small red anemone. Other fauna are encrusting on the cobbles and include encrusting sponges, bryozoans, serpulid worm tubes and other unidentified encrusting forms. An unidentified number of small ophiuroids (possibly *Ophiactis* sp.) are present in the cracks within a cobble. Emergent structures are present.



[COR0503-87CNV00107-003231](#). Medium to fine sandy sea bed with some detritus. The only visible fauna is a holothurian (*Stichopus tremulus*). Signs of bioturbation with animal tracks, faecal casts and depressions in the sediment.



[COR0501-25CNV00133-214847](#). Medium to fine sandy sea bed. The only visible fauna are the asteroid *Stichastrella rosea* and a Palaemonid shrimp. Signs of bioturbation including two pit and mound structures, animal tracks and depressions.



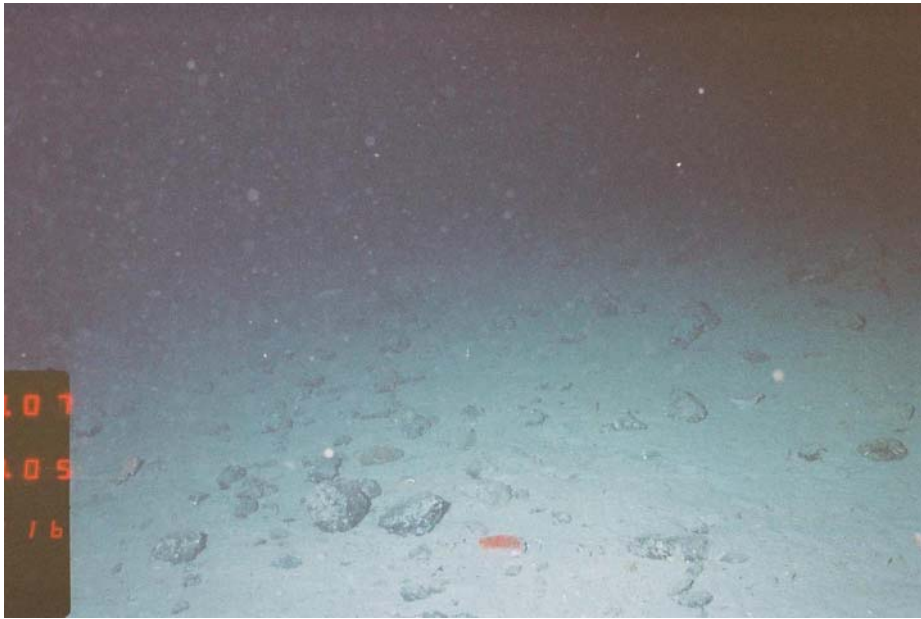
[COR0506-149CNV00004-215811](#). Medium to fine sandy sea bed with some detrital matter. Signs of bioturbation. One hermit crab (Paguridae) is visible.



[COR0506-161CNV00015-220918](#). Medium sandy sea bed with cobbles 14%. The cobbles support six large colonies of the erect bryozoan *Reteporella*. In addition there is one cyclostome bryozoan colony, three red anemones, approximately twenty zoanths?, and three ?Caryophyllids growing on the cobbles as well as many unidentified attached and encrusting forms. In the sediment a siphon/tube is visible.



[COR0505-114CNV00061-030034](#). Medium to fine sandy sea bed. Visible fauna is a sea biscuit echinoid. Signs of bioturbation including animal tracks.



[COR0505-116CNV00059-030805](#). Medium sandy sea bed with cobbles 45%. Visible fauna are three holothurians (*Stichopus tremulus*) and a bluemouth red fish (*Helicolenus dactylopterus*). Other visible fauna are encrusting sponges, bryozoans, serpulid worm tubes, small white unidentified encrusting organisms and other unidentified species.



[COR0504-106CNV00056-015123](#). Medium to fine sandy sea bed. Visible fauna is an echinoid (*Spatangus raschi*). Signs of bioturbation including animal tracks.



[DW05909-68Cnv00027-025912](#). Medium to fine sandy sea bed with depressions, detritus and emergent fauna. Emergent fauna are possibly small burrowing anemones or tube worms. Other visible fauna include two echinoids (*Echinus acutus*) and a *Chimaera*.



[DW05903-49Cnv00099-002038](#). Medium to fine sandy sea bed with few emergent structures. A large prawn burrow (*Nephrops norvegicus*) is present with a single occupant visible from one entrance and a characteristic waste pile visible at the other entrance.



[DW05904-63Cnv00023-021515](#). Medium to fine sandy sea bed with mounds, depressions, animal tracks, detritus and emergent fauna. A number of possible old prawn burrows are present, visible as a series of depressions in the sediment. Emergent fauna are possibly small burrowing anemones or tube worms. Other visible fauna include an echinoid (*Echinus acutus*), a small red burrowing anemone, a large burrowing anemone and a serpulid worm tube attached to a single pebble.

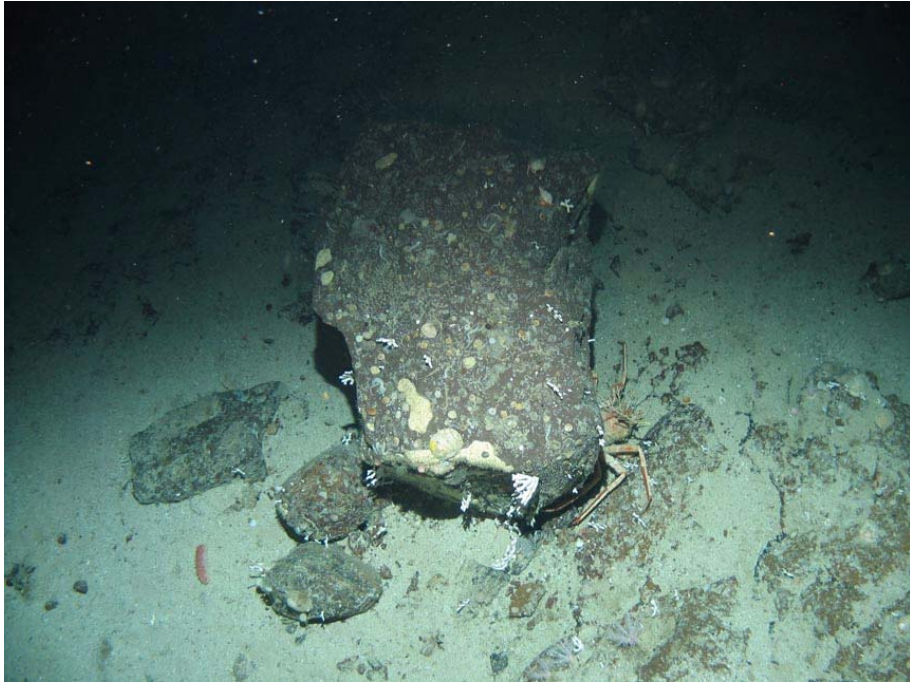


[DW05905-67Cnv00028-205750](#). Medium to fine sandy sea bed with depressions, detritus and emergent fauna. Emergent fauna are possibly small burrowing anemones or tube worms. Other visible fauna include eight echinoids (*Echinus acutus*) and five large burrowing anemones.

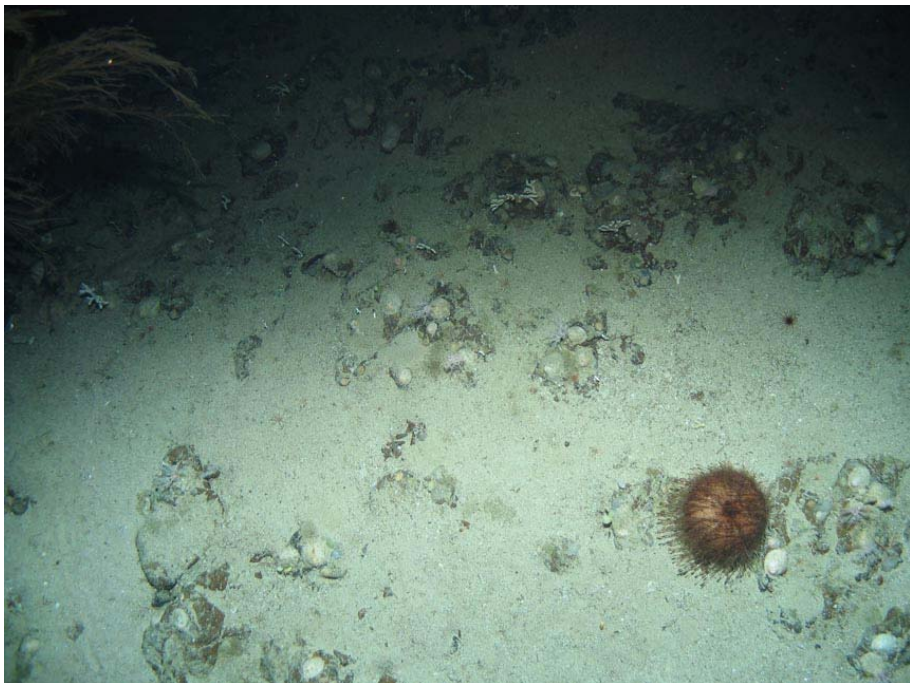


[DW05901-37Cnv00089-211558](#). Medium to fine sandy sea bed with signs of bioturbation and/or currents and lebenspuren in the form of animal tracks. Visible fauna include at least 40 echinoids (*Echinus acutus*) and three crabs (*Paramola cuvieri*).

Hatton Bank Stations



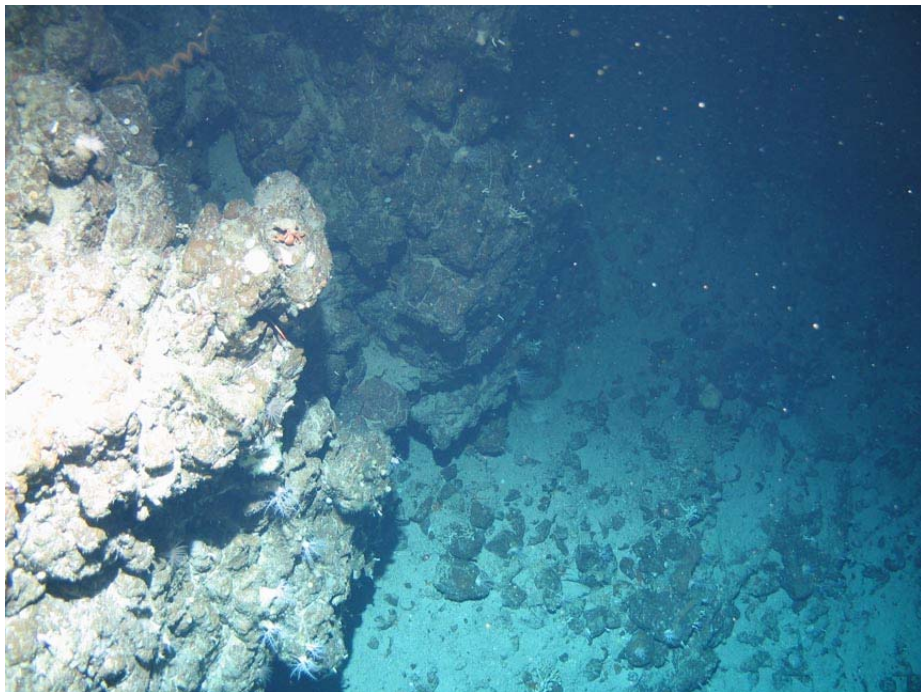
[HB H#1 06](#). Photograph shows same rock as seen in previous image. Rock is heavily colonised with encrusting sponges, holothurians (probably *Psolus squamatus*), stylasterid corals (probably *Pliobothrus*), encrusting sponges and brachiopods. Two hermit crabs can be seen on the rock and a spider crab (probably *Paromola cuvieri*) with a covering of what may be antipatharian coral skeleton.



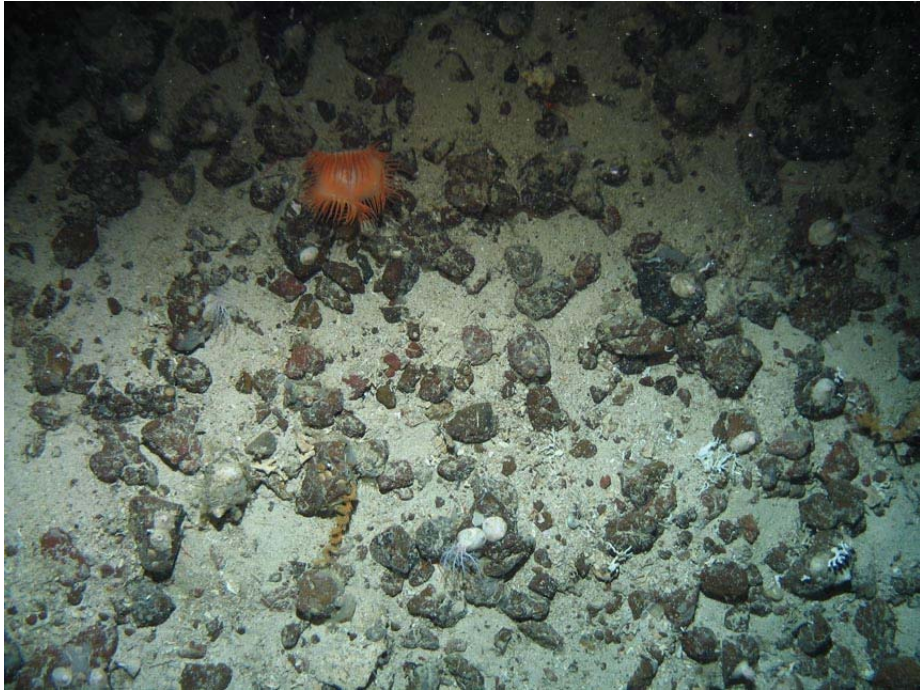
[HB H#1 16](#). Coarse sediment with exposed rock colonised by holothurians (probably *Psolus squamatus*), stylasterid corals (probably *Pliobothrus*) and encrusting sponges. Antipatharian coral just visible in top left corner of image. Sediment colonised by anemones and a large irregular echinoid (probably *Calveriosoma* sp.) can be seen.



[HB H#1 34](#). Apparently finer grained sediment with small burrows and ?polychaete feeding structures. Trace made by echinoid crosses image with partially buried echinoid toward centre of frame.



[HB CD#1 14](#). Photograph taken looking down steep rock wall with many fissures and ledges. Rock colonised by stylasterid corals (probably *Pliobothrus*), sea anemones and holothurians (probably *Psolus squamatus*) with ledges draped in sandy sediment. Corkscrew-shaped antipatharian coral (*Stichopathes* sp.) visible in top left hand corner and single hermit crab can be seen.



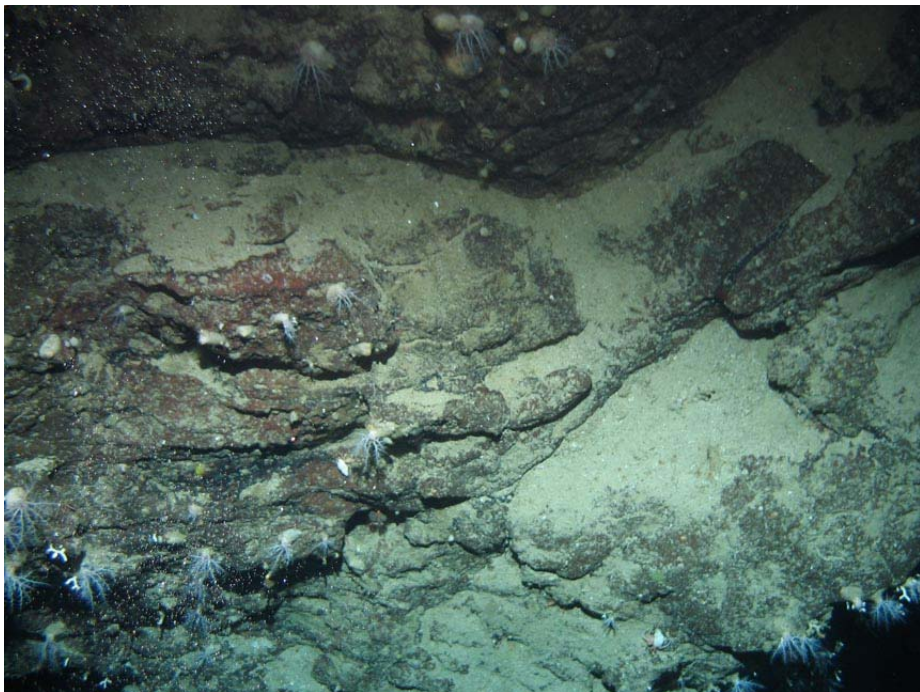
[HB_CD#1_25](#). Seabed covered with many stones separated by shelly sand. Stones colonised by stylasterid corals (probably *Pliobothrus*), holothurians (probably *Psolus squamatus*), antipatharian coral (*Stichopathes* sp.), sea anemones and sponges. Single large anemone (*Phelliactis* sp.) visible.



[HB_CD#1_27](#). Sandy, shelly substratum. Image partially obscured by cloud of sand.



[HB M#1 02](#). Sandy seabed with single mobile holothurian (?*Stichopus*). Burrows and ejected sediment can be seen. Image slightly obscured by disturbed sediment.



[HB M#1 14](#). Fissured rock with sediment drape. Bare rock colonised by holothurians (probably *Psolus squamatus*) and stylasterid corals (probably *Pliobothrus*). Pockets of sediment colonised by anemones. Galatheid crustaceans and hermit crabs visible.



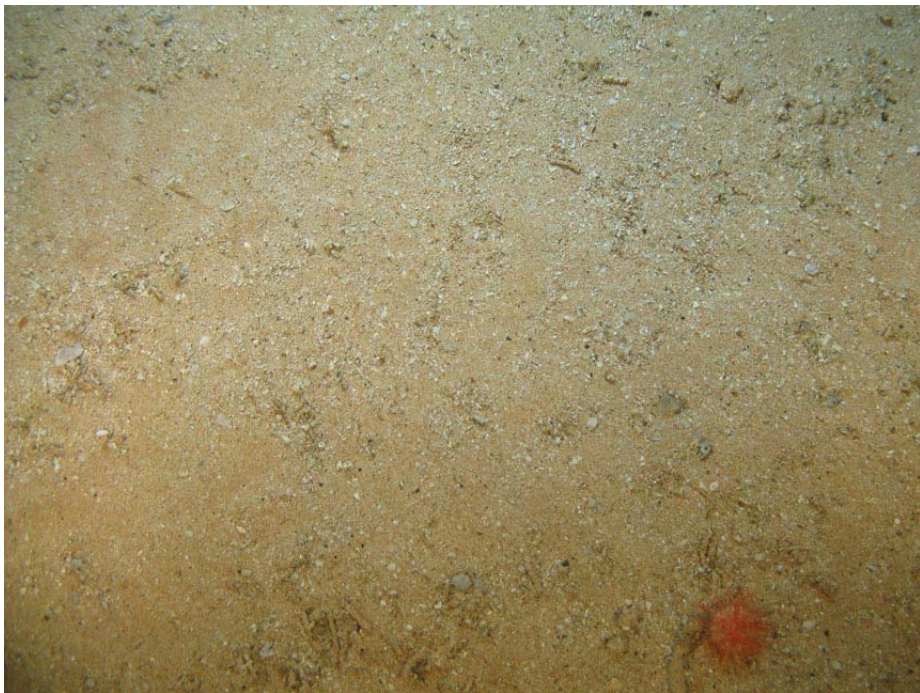
[HB M#1 28](#). Sediment-draped rock. Rock colonised by holothurians (probably *Psolus squamatus*), encrusting sponges and stylasterid corals (probably *Pliobothrus*). Sediment colonised by anemones. Single fish visible (probably *Lepidion*).



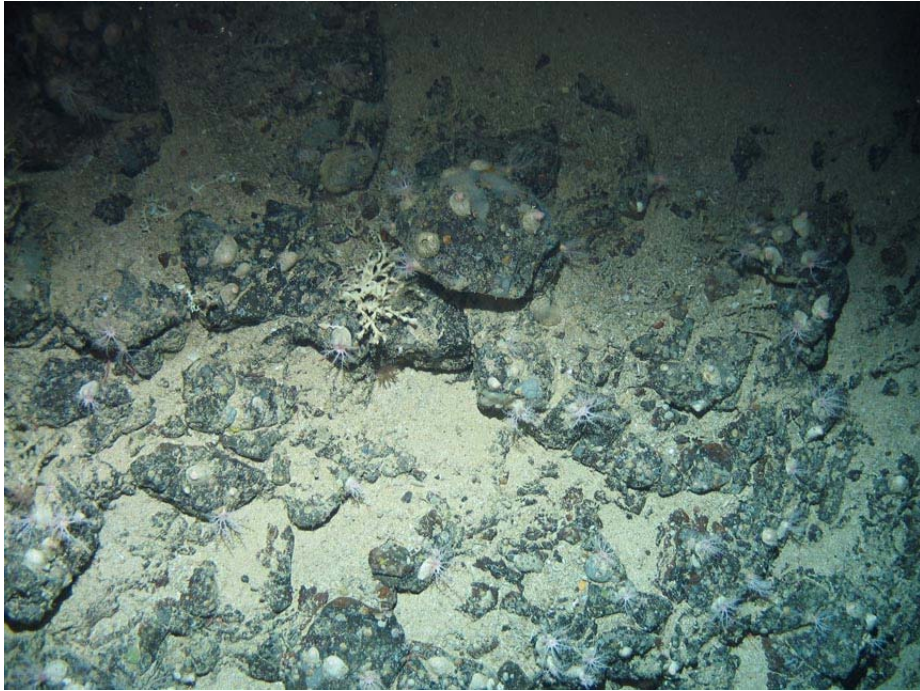
[HB R#1 07](#). Rippled sediment (Type 3) with few, scattered stones. Faecal trace (?holothurian visible).



[HB R#1 16](#). Fissured rock colonised by holothurians (probably *Psolus squamatus*), stylasterid corals (probably *Pliobothrus*), scleractinian coral (*L. pertusa*) with dead coral skeleton present. Latter colonised by hydroids, sabellid polychaetes and encrusting sponges. A mobile holothurian (probably *Stichopus*) and galatheid crustacean also visible.



[HB N#1 05](#). Coarse sediment with abundant shell debris and some coral rubble. Single echinoid visible.



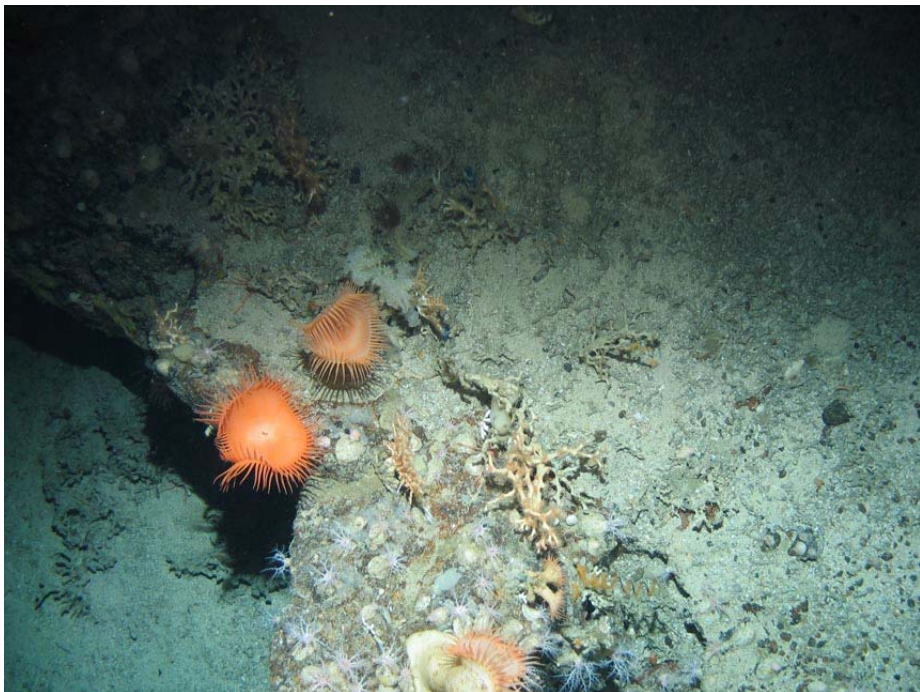
[HB N#1 24](#). Coarse sediment with coral rubble overlying rock. Rock colonised by holothurians (probably *Psolus squamatus*), large barnacle (*Bathylasma hirsutum*) and encrusting sponges. Galatheid crustaceans visible.



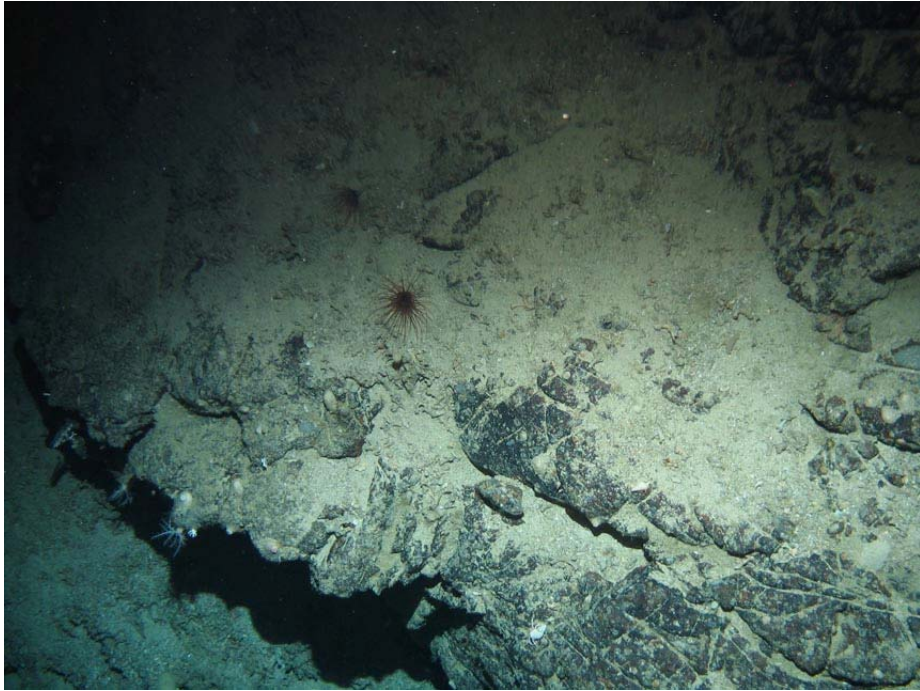
[HB N#1 57](#). Sediment-clogged coral framework with small patches of live scleractinian coral (*M. oculata*) and prominent *Phelliactis* sp. Other epifauna include corkscrew-shaped antipatharians (*Stichopathes* sp.) and small brown anemones. *Cidarid*, galatheid crustaceans and prawn also visible.



[HB A#1 03](#). Sandy substratum, shell debris with tube-like structures visible.



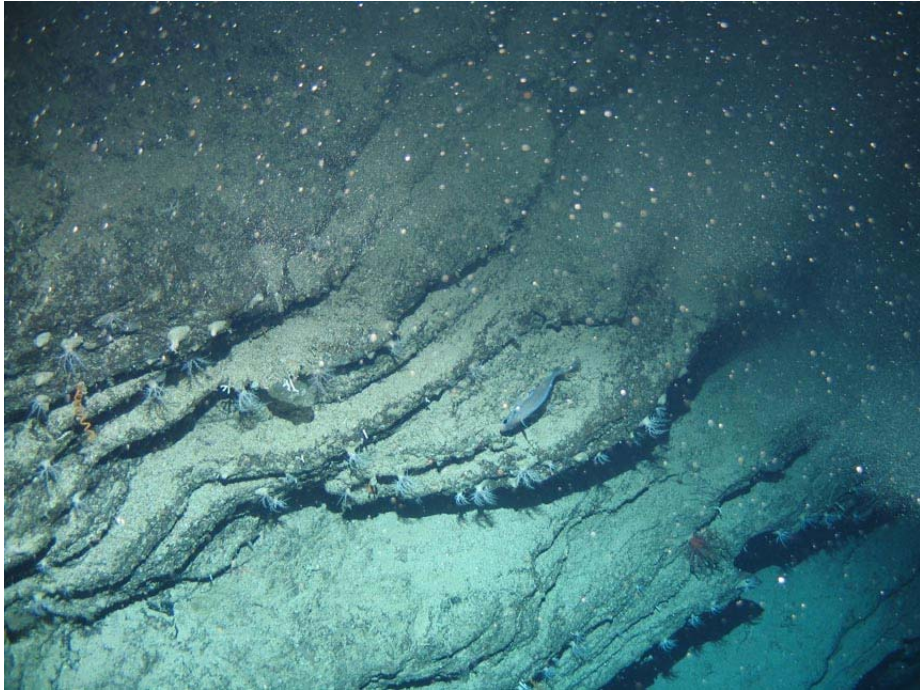
[HB A#1 44](#). Rock on shelly, sandy substratum with coral rubble. Rock colonised by several large anemones (*Phelliactis* sp.), live coral (*L. pertusa*), stylasterid coral (probably *Pliobothrus* sp.), holothurians (probably *Psolus squamatus*). Dead coral colonised by *Aphrocallistes* glass sponges themselves colonised by yellow zoanthid-like animals. Galatheid crustaceans and corkscrew-shaped antipatharian (*Stichopathes* sp.) visible.



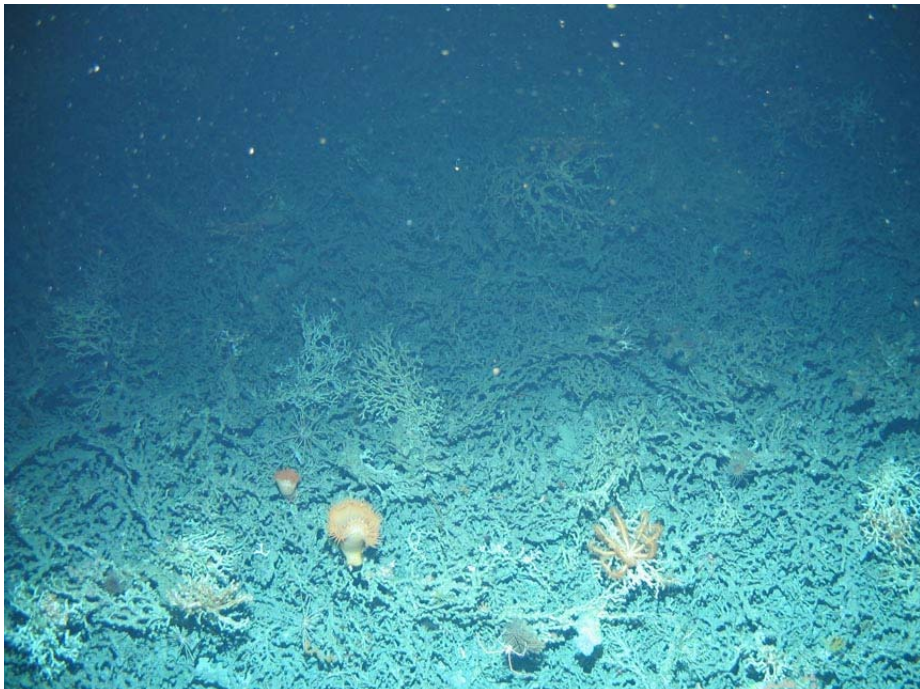
[HB A#1 61](#). Sediment and coral rubble-draped overhanging rock. Two cerianthid anemones visible with holothurians and stylasterid corals projecting from overhang. Single hermit crab visible.



[HB P#1 05](#). Rock surface heavily-colonised by holothurians (probably *Psolus squamatus*), encrusting sponges, anemones, bryozoans and scleractinian coral colonies (apparently now dead). The coral colonies support live anemones (probably *Phelliactis* sp.) and other small epifauna. Resolution limited by disturbed sediment.



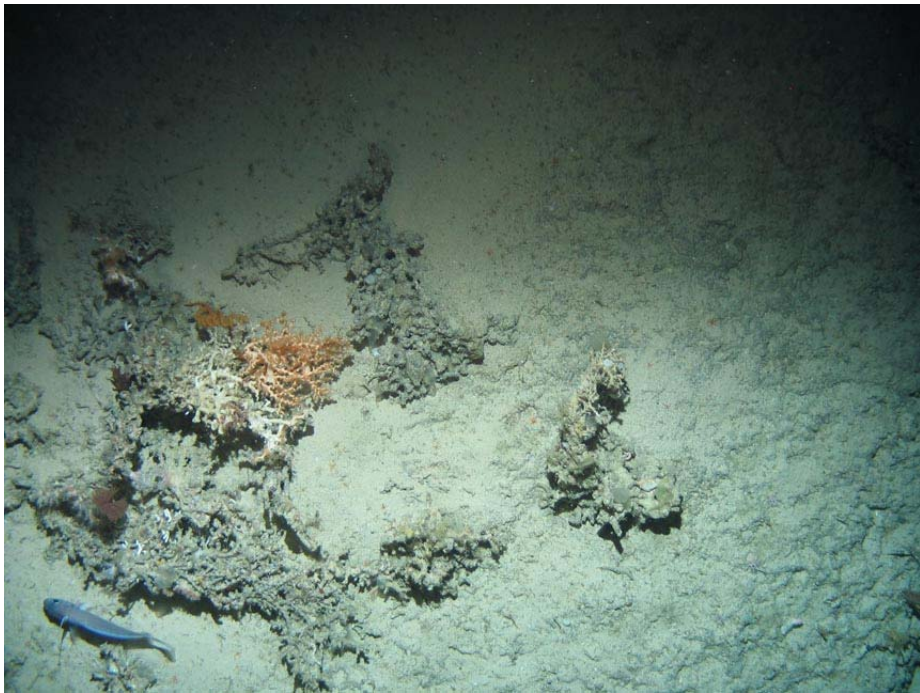
[HB P#1 18](#). Fissured rock with accumulated sediment. Rock colonised by holothurians (probably *Psolus squamatus*), corkscrew-shaped antipatharians (*Stichopathes* sp.), *Anthomastus*, ascidians and stylasterid corals (probably *Pliobothrus*). Single fish (probably *Lepidion*).



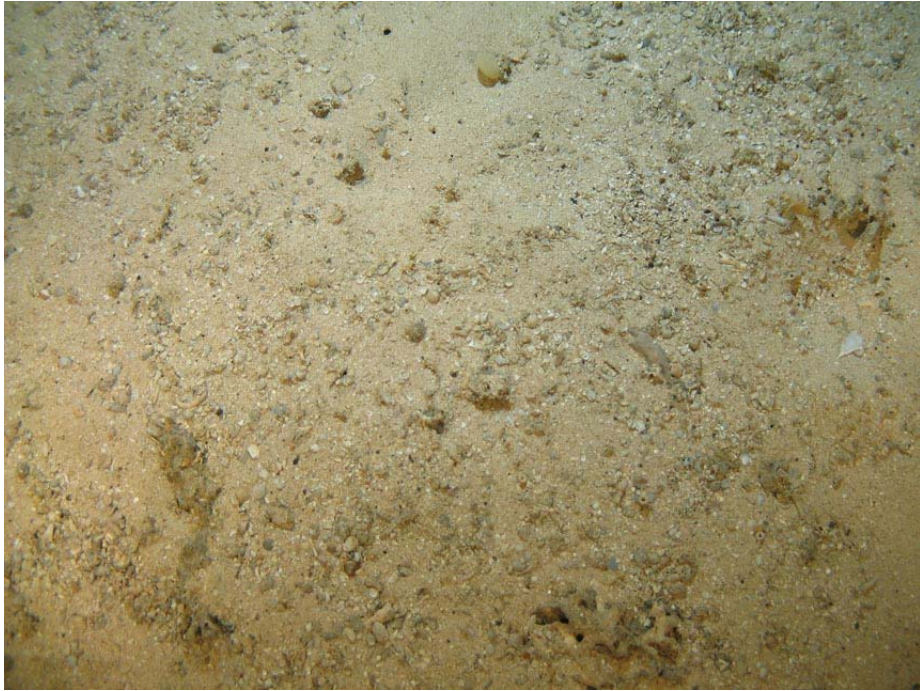
[HB P#1 37](#). Distant view of dense dead coral framework with patches live scleractinians. Other epifauna include *Phelliactis* sp., brisingid and antipatharians.



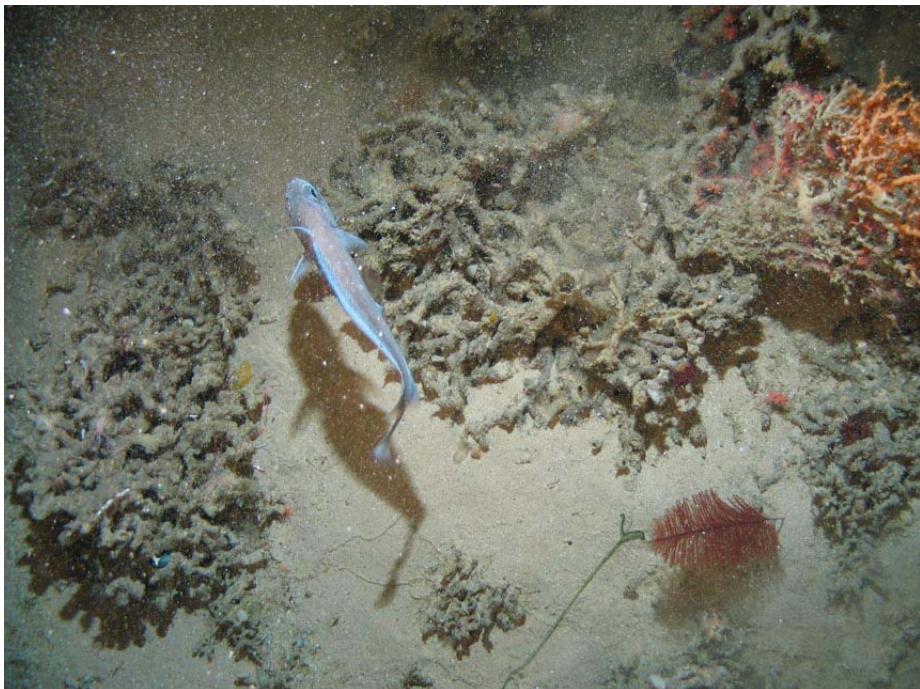
[HB_Q#1_05](#). Coarse sediment with shell debris, coral rubble and portion of rock visible.



[HB_Q#1_50](#). Dead coral skeletons and live coral (probably *M. oculata*) surrounded by apparently sediment-covered rock substratum. Epifauna include corkscrew-shaped antipatharians (*Stichopathes* sp.), holothurians (probably *Psolus squamatus*), sponges and ascidians. Many sediment-dwelling anemones and a single fish (probably *Lepidion*) also visible.



[HB L#1_02](#). Image overlaps with previous picture. Sediment with shell debris and fragments of coral rubble. Sparse fauna with brachiopod visible.



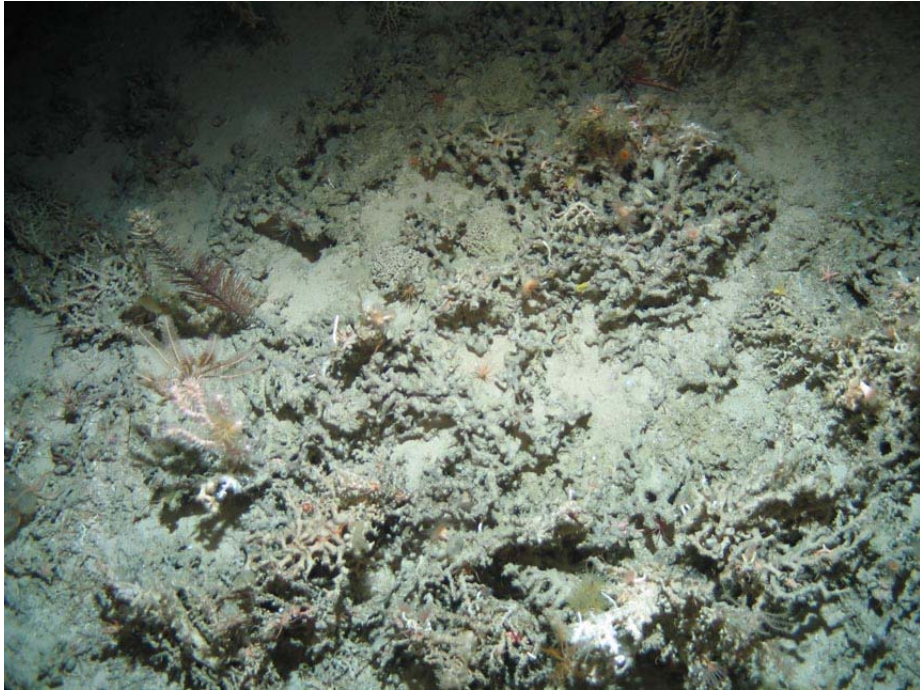
[HB L#1_17](#). Coral framework (including live *M. oculata*) and sediment with single fish (*Lepidion*), an antipatharian coral colony (probably *Bathypathes*) and the proboscis of a bonelliid echiuran worm. Coral framework partially colonised by dark pink octocoral-like animal.



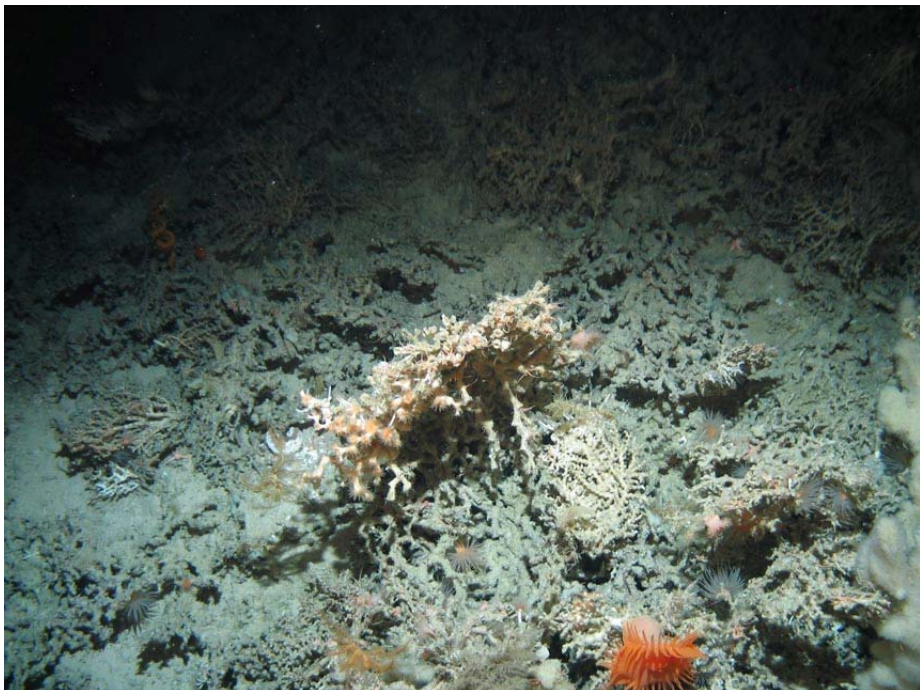
[HB S#1 21](#). Sediment with abundant coral rubble. Sabellid polychaete, ophiuroid and crinoid visible.



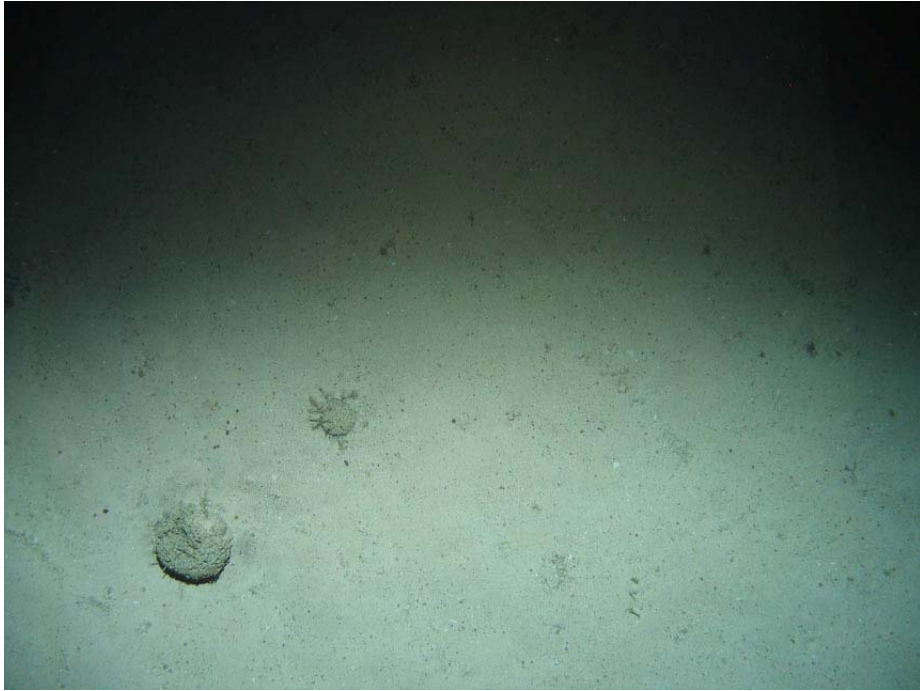
[HB S#1 31](#). Fissured rock with sediment drape. Rock colonised by encrusting sponges and holothurians (probably *Psolus squamatus*). Galatheid crustaceans visible. Patches dead coral present. Backscatter from disturbed sediment limits resolution.



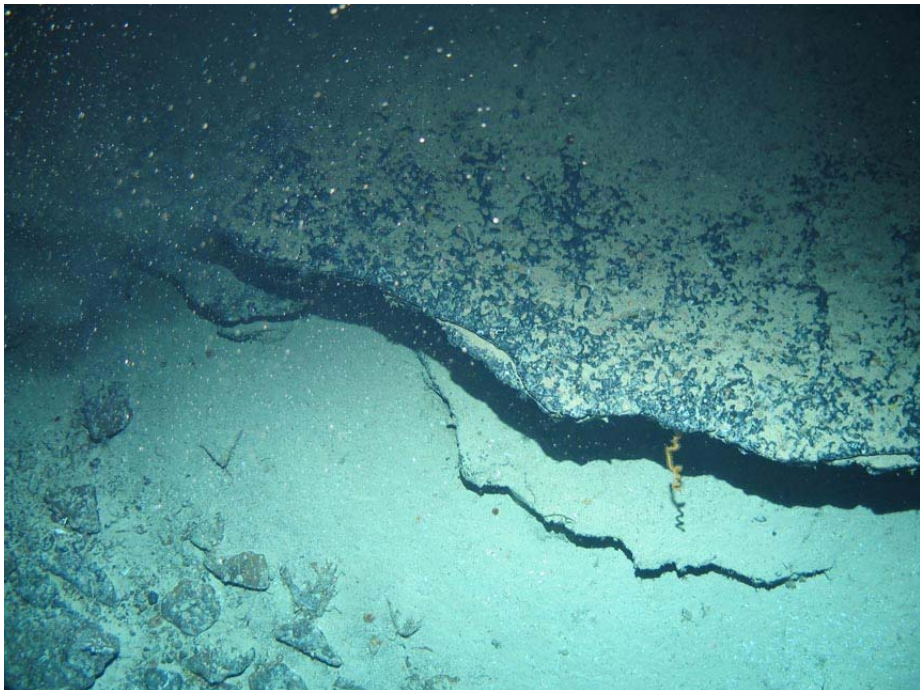
[HB K#1 02](#). Sediment-clogged coral framework (*L. pertusa*) with abundant epifauna including crinoids on an octocoral. A dark red antipatharian coral (possibly *Bathypathes*), anemones and solitary corals can also be seen. Other fauna include galatheid crustacea and numerous ophiuroids.



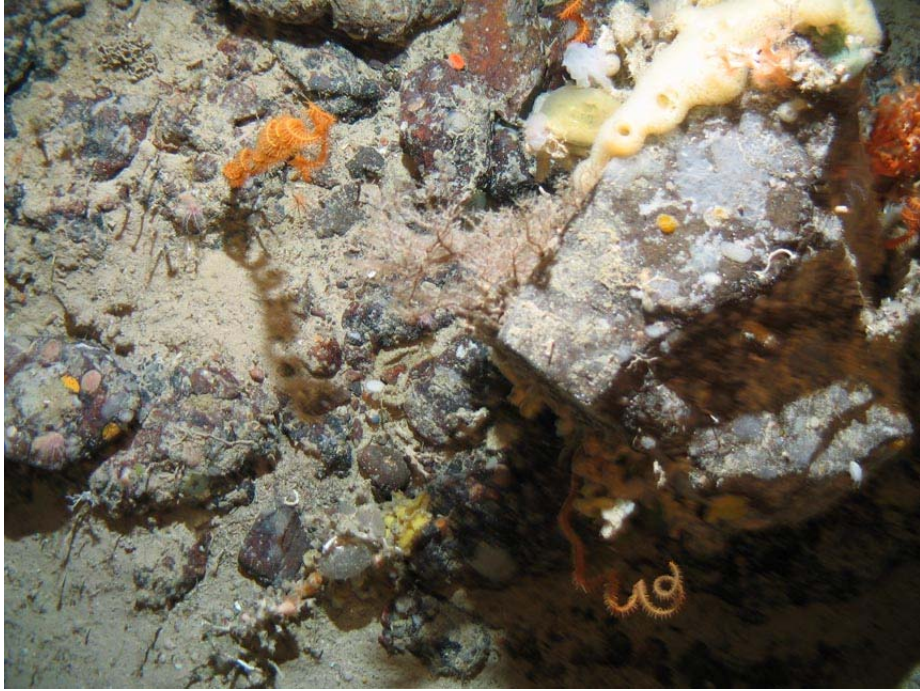
[HB K#1 35](#). Sediment-clogged coral framework (*L. pertusa* and *M. oculata*). Live *L. pertusa* coral colony in centre of image with prominent *Phelliactis* sp. sea anemone on lower edge of picture. Other fauna include corkscrew-shaped antipatharian corals (*Stichopathes* sp.), anemones, crinoids, ascidians, sponges, sabellid polychaetes and ophiuroids.



[HB E&F#1 01](#). Fine-grained sediment covered seafloor. Two large xenophyophores (probably *Syrangammina fragilissima*) and many ophiuroids visible.



[HB E&F#1 20](#). Rock ledge with fine, patchy covering of sediment. Single antipatharian coral (*Stichopathes* sp.)

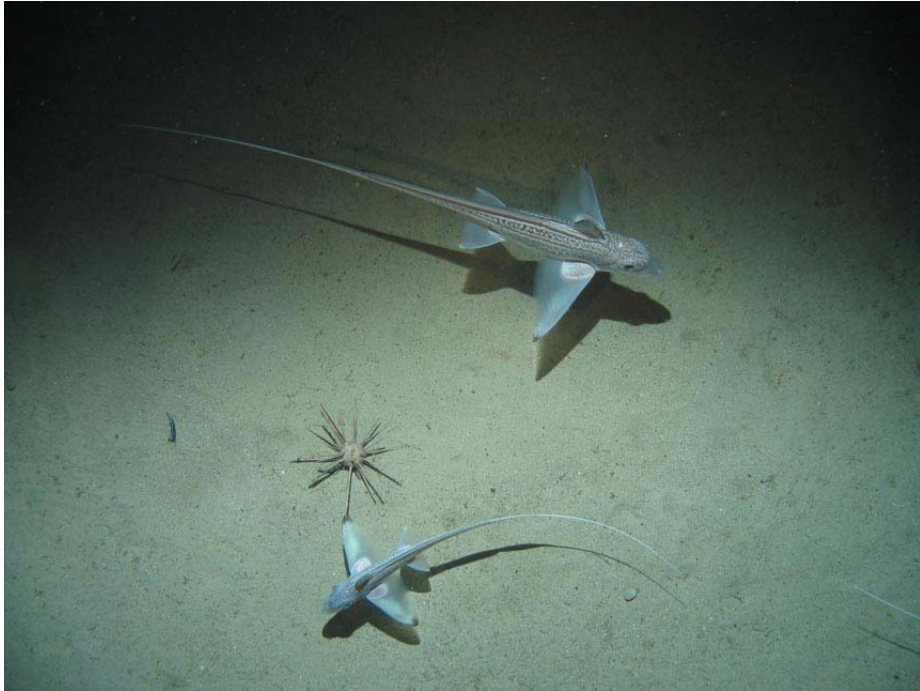


[HB E&F#1 27](#). Rock draped with sediment. Rock heavily colonised with antipatharian coral (*Stichopathes* sp.), attached holothurians (probably *Psolus squamatus*), sponges, large ?hydroid colony and glass sponges (probably *Aphrocallistes* sp.) and small colony *L. pertusa*.

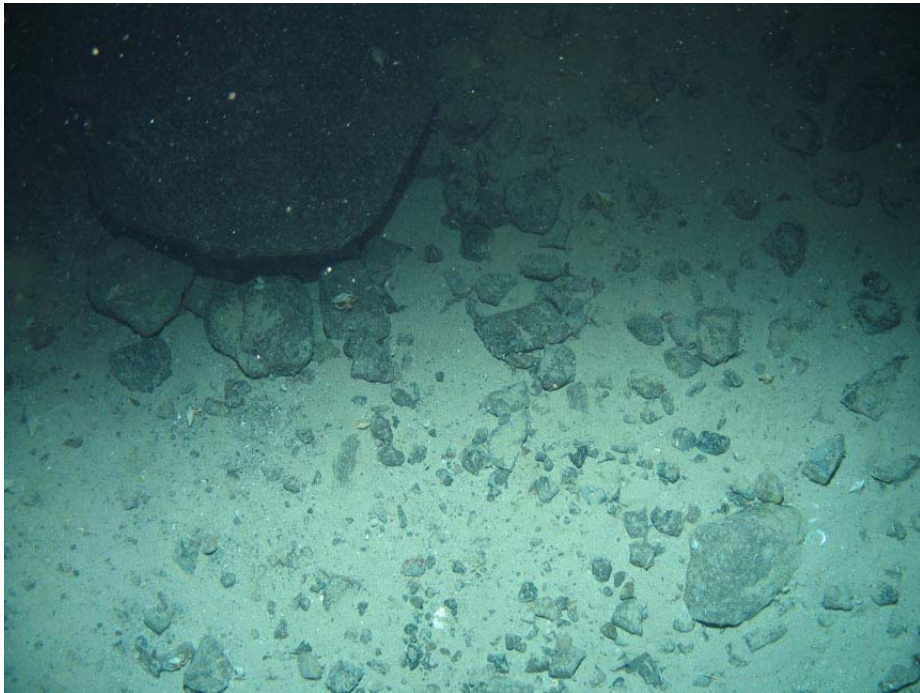


[HB G#1 01](#). Seabed composed of fine-grained sediment with apparently few small scattered stones and other debris. Several anemones and possibly a pycnogonid can be seen.

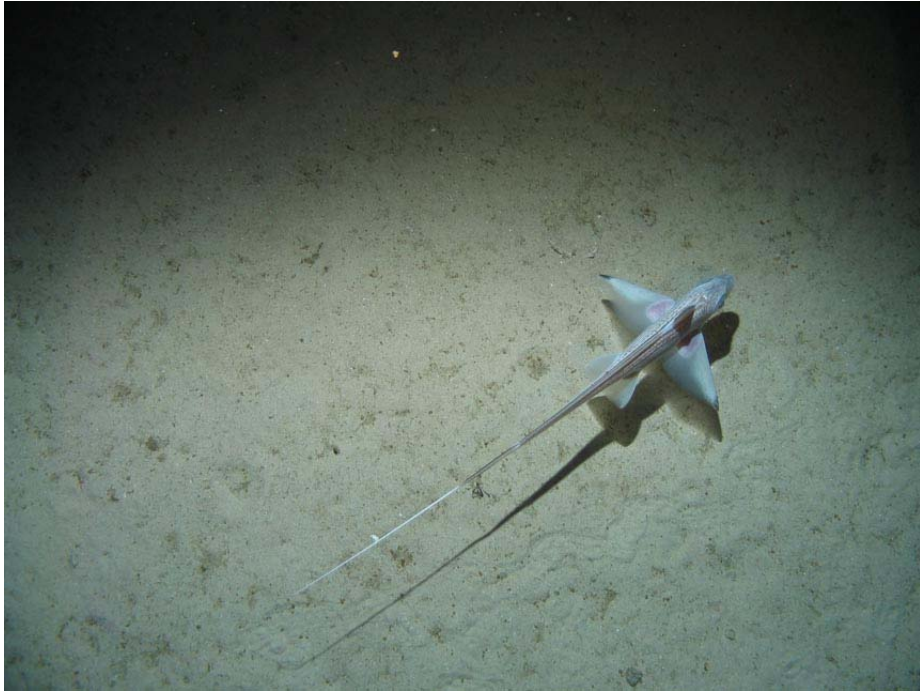
George Bligh Bank Stations



[GB C#1_0018](#). Two *Chimaera monstrosa* swimming over featureless flat sand sea bed (tail of third individual just in view). Echinoid (*Cidaris cidaris*) also visible.



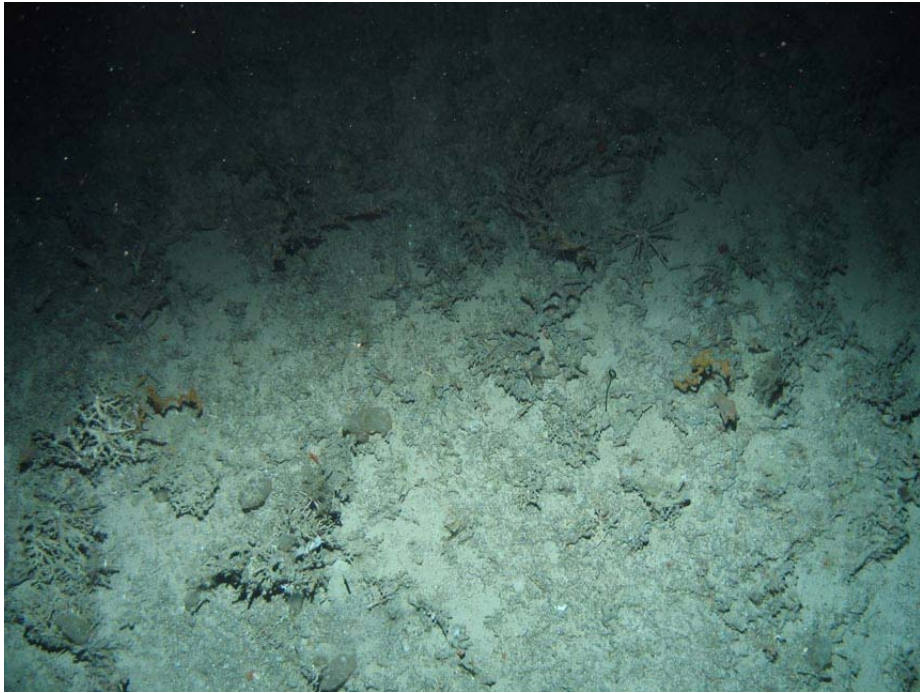
[GB C#1_0040](#). Field of boulders and large cobbles on bed of fine sand. Hermit crab visible near centre of frame. Several small hermit crabs visible.



[GB M#1_0009](#). *Chimaera monstrosa* swimming over flat sea bed of fine sand. Broad epifaunal trail crosses sea bed in lower right corner of frame.



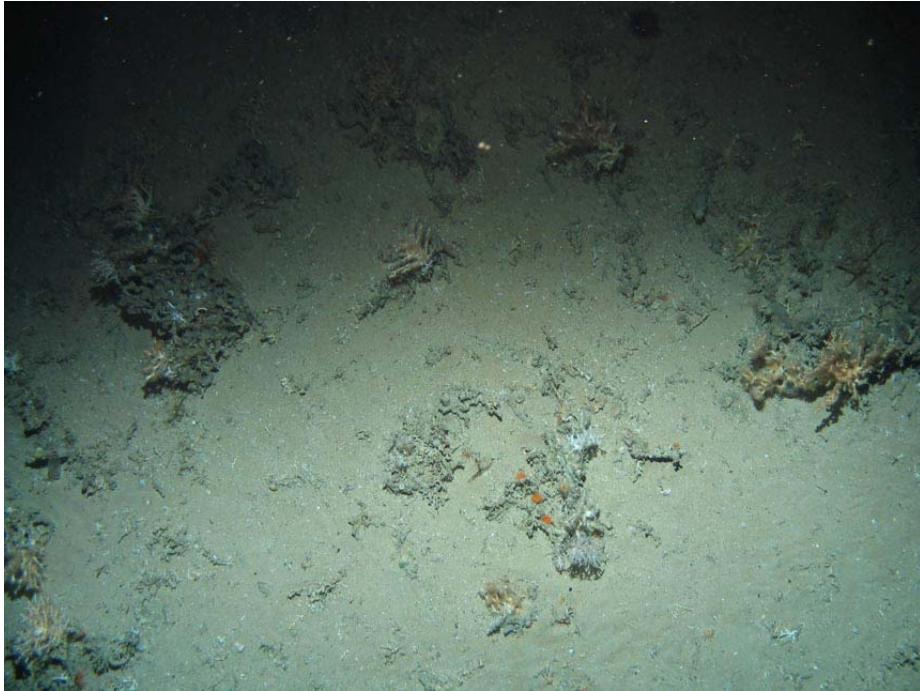
[GB B#1_0005](#). Flat sea bed of medium sand with flecks of biogenic carbonate and dark floc or debris on surface. No animals visible. Fragments of coral skeleton on surface at far left. Reddish anemone visible at centre-right.



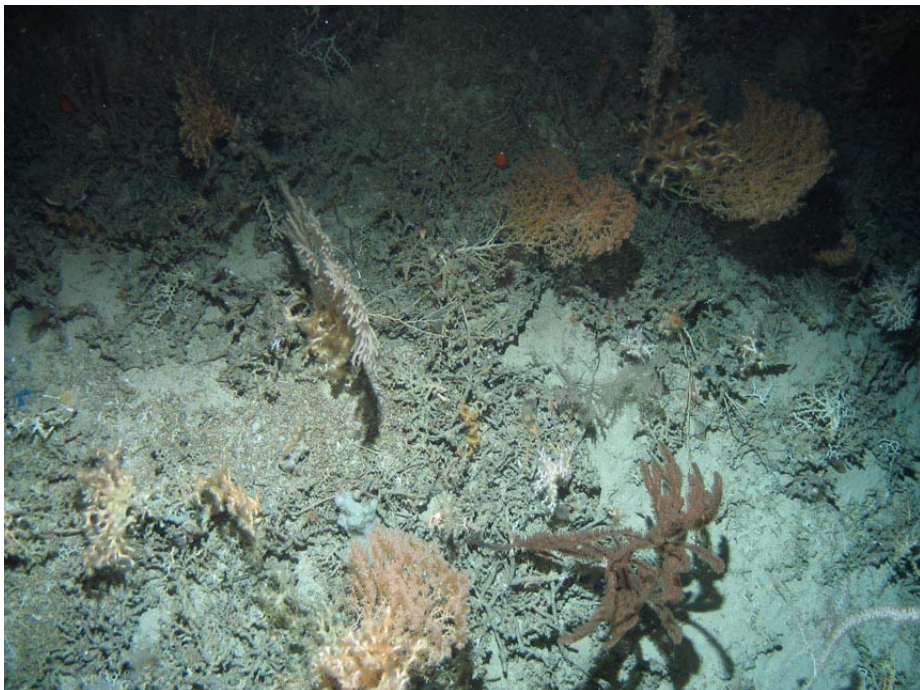
[GB B#1 0035](#). High-elevation view of sandy sea bed with dense cover of dead coral fragments among larger patches of dead coral framework. Two orange coiled antipatharians (*Stichopathes* sp.), echinoid (*Cidaris cidaris*) and several ascidians (cf. *Ascidia* sp.) visible.



[GB A#7 0011](#). Pennatulacean (cf. *Anthoptilum* sp.) on flat bed of coarse sand.



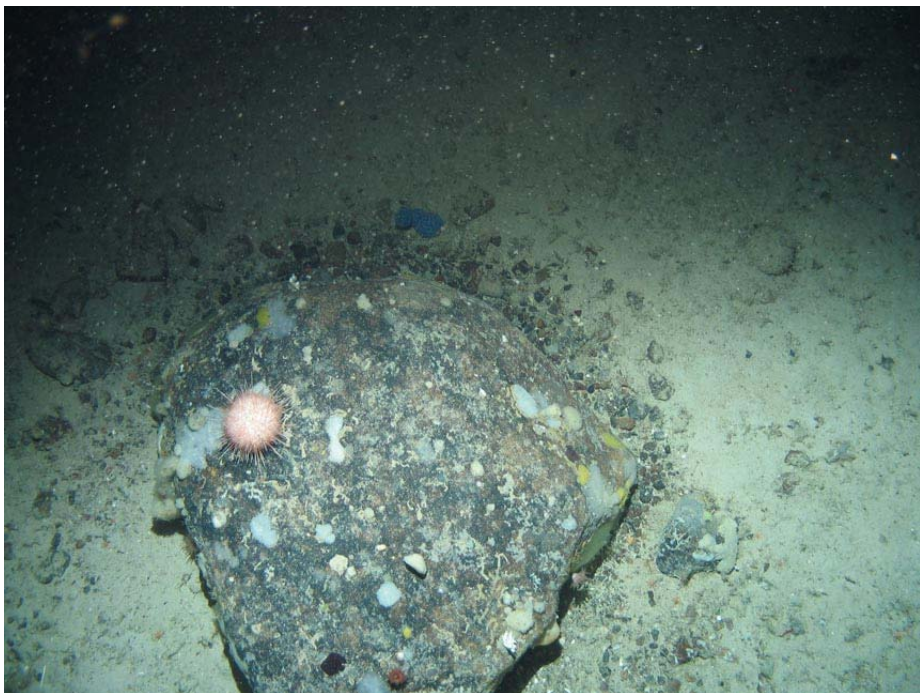
[GB A#7 0033](#). Sandy sea bed with dense cover of dead coral fragments and several larger pieces of dead coral framework. Several patches of living coral visible. Group of small orange anemones on coral fragment at lower centre.



[GB A#7 0052](#). Close-up of bed with almost complete cover of dead coral framework. Patches of living *Madrepora oculata* to right of frame, and living *Lophelia pertusa* at lower left. Rich associated sessile epifauna includes dark bushy antipatharian (*Bathypathes* sp. or *Panatipathes* sp.) at lower centre, pale gorgonacean (cf. *Callogorgia verticillata*) at left of centre, and two 'bamboo coral' colonies (*Isidella* sp.) to upper right.



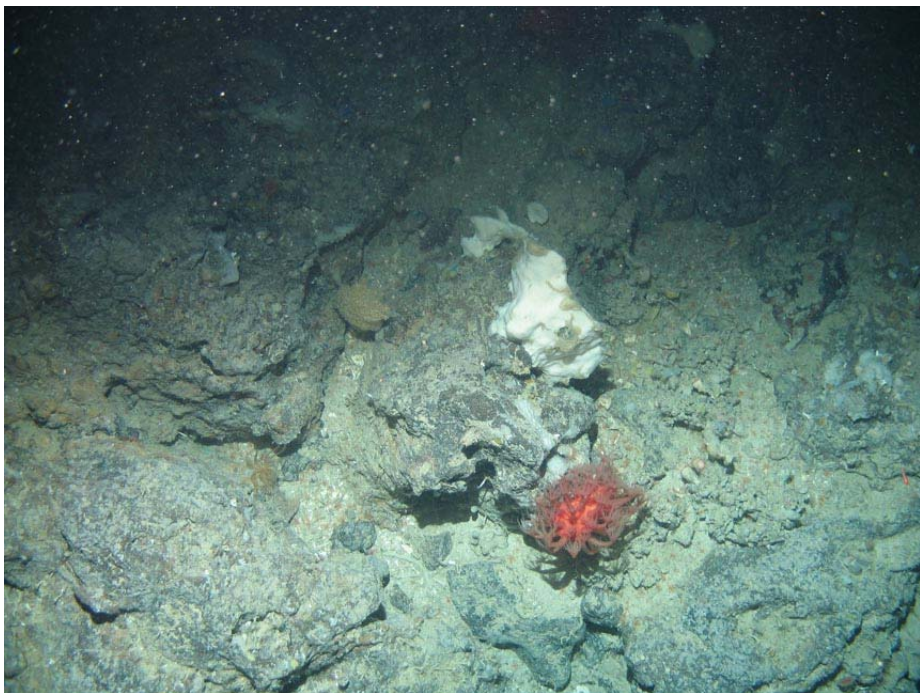
[GB J#1_0004](#). Xenophyophore on bed of flat fine sand or muddy sand with dark floc particles on surface.



[GB J#1_0027](#). Large boulder with surrounding patch of pebbles and cobbles on flat bed of fine sand or muddy sand. Conspicuous encrusting sponges/bryozoans and echinoid (*Echinus elegans*) on boulder. Xenophyophore on sediment to right of boulder.



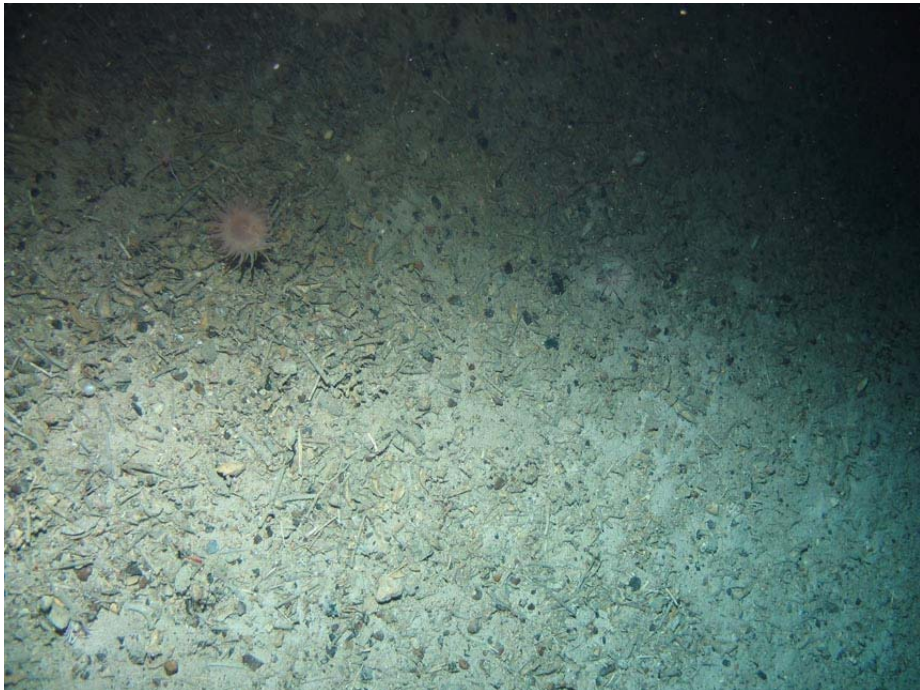
[GB J#1 0043](#). Large anemone (*Phelliactis* sp.) on boulder field. Boulders with conspicuous grey, white and blue encrusting sponges/bryozoans. Several solitary coral polyps and echinoid (*Cidaris cidaris*) also visible. Red alcyonacean soft coral (*Anthomastus grandiflorus*) on boulder to right of *Phelliactis* sp.



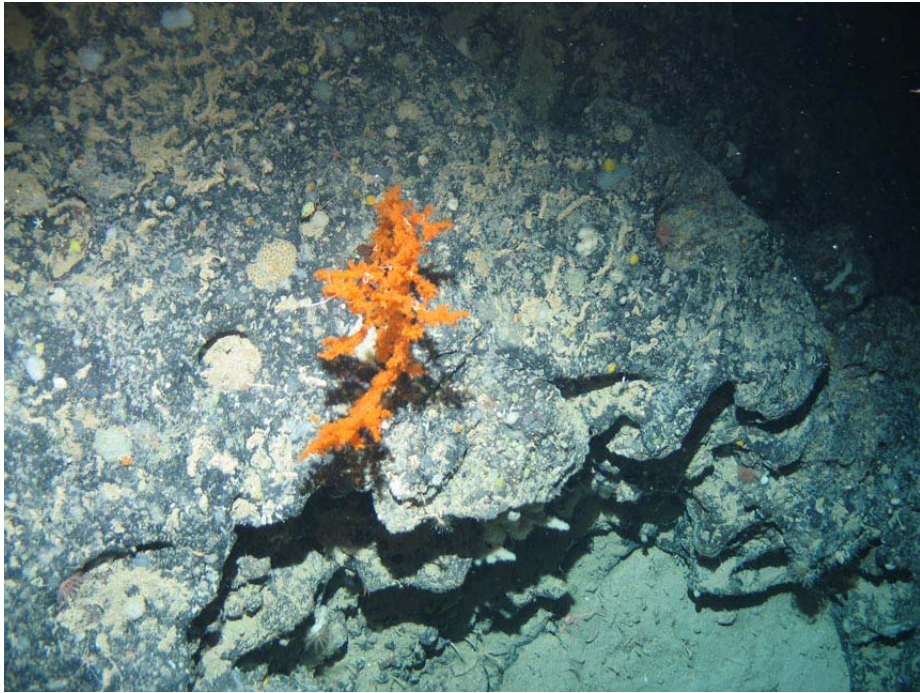
[GB J#1 0044](#). Steeply-sloping wall of rugged grey bedrock. Epifauna sparse, but massive white sponge and red alcyonacean soft coral (*Anthomastus grandiflorus*) are conspicuous. Small unidentified crinoid on rock surface to left of *Anthomastus* colony.



[GB E#1 0021](#). Channel between two boulders filled with coarse sand, pebbles and shelly debris. Encrusting and foliose sponges growing on rock surfaces. Hexactinellid sponges *Pheronema carpenteri* and *Aphrocallistes* sp. in channel between boulders. Two probable ascidians attached to *Pheronema*.



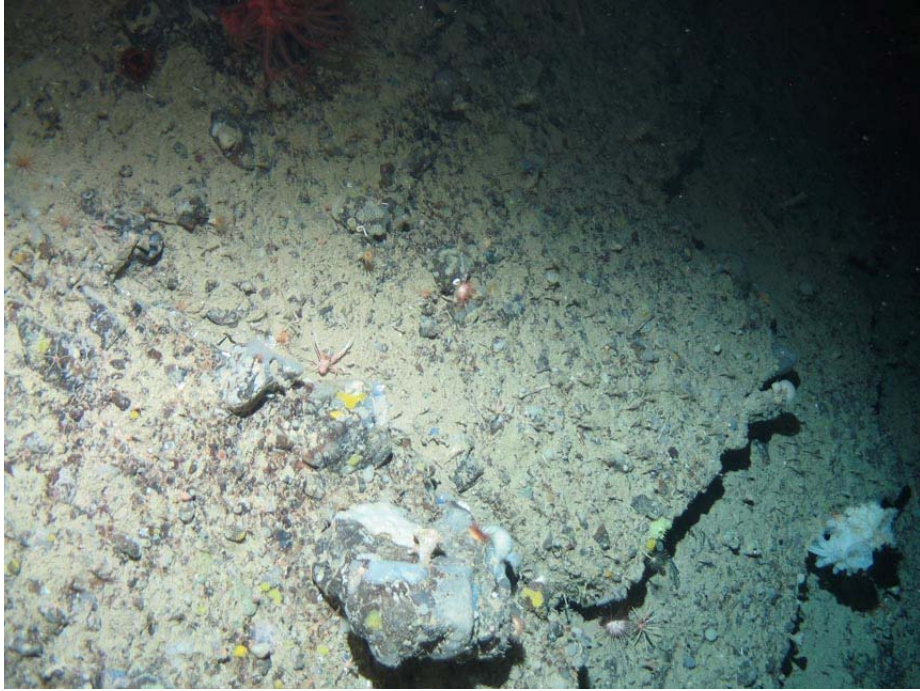
[GB E#1 0035](#). Flat coarse sediment composed mostly of biogenic debris. Unidentified pink anemone at upper left.



[GB E#1_0042](#). Orange bushy antipatharian coral (*Leiopathes* sp.) on silty bedrock face with irregular, overhanging topography. Patchy encrusting sponges and small ophiuroids visible on rock surface.



[GB F#1_0006](#). Large boulder or bedrock mass with coarse pebbly sand at base. Conspicuous sessile epifauna on boulder, including barnacles, hexactinellid sponges (*Aphrocallistes* sp.), foliose white sponges, orange antipatharians (*Leiopathes* sp.), possible 'bamboo coral' (cf. *Keratoisis* sp.) and red alcyonacean (*Anthomastus grandiflorus*).



[GB F#1_0023](#). Heavily-silted bedrock face with overhangs at lower right. Sessile epifauna of patchy encrusting sponges and hexactinellid sponge (*Aphrocallistes* sp.). Echinoids (*Echinus elegans* and *Cidaris cidaris*) and small galatheid decapod also visible.