Strategic Environmental Assessment / Special Area for Conservation

Photographic Analysis Report

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Summary

A collaborative survey programme between the Department of Trade and Industry (DTI) and the Department of Food and Rural Affairs (DEFRA) was set up in the summer of 2006 with the aim of obtaining biological and oceanographic data from the deep-water areas to the north-west of the UK to enable broad-scale assessment of the impacts of current and possible future human activities. Photographic sea bed survey was undertaken in the Strategic Environmental Assessment Area 7 (SEA7) as well as parts of SEA5 and SEA4.

A total of 128 stations were sampled with over 5000 images obtained from Hatton Bank, George Bligh Bank, Rosemary Bank, Wyville-Thompson Ridge, West Shetland Channel, Papa Bank and Pobie Bank. The sampling sites spanned a range of water depth (60 – 1000 m) as well as habitat types from fine grained mud through to exposed bedrock.

The fauna of Papa and Pobie Banks were distinctly different to all other stations sampled. These were the shallowest stations sampled and lay on the continental shelf. The faunal communities of Hatton Bank, George Bligh Bank, Rosemary Bank and the summit and Rockall Trough flank of the Wyville-Thompson Ridge were broadly similar to each other and to the shallow, warmer stations sampled in the Faeroe-Shetland Channel. The faunal communities of the cold waters of the Faeroe-Shetland Channel were distinct from all other areas sampled and appeared to be the most diverse of all communities observed supporting large numbers of feather stars, zoanthids, soft corals and dense brittle star beds. Structural sponge communities were present at approximately 500m depth at the West-Shetland Channel sites and may be present in a continuous band along the continental slope in this basin. Cold water coral reef communities were notably absent from the West Shetland Channel but present on Hatton Bank and the Wyville Thompson Ridge and were observed on Hatton Bank, George Bligh Bank and Rockall Bank in the 2005 surveys. Cold water coral reefs were in general associated with rock outcrop, pinnacle and rock terrace (ledge) features. Large sea fans (Gorgonacea) were observed on all features in the Rockall Trough as well as many other coral species (Antipatherians, Pennatulaceans, Alcyonaceans). Evidence of human activities (trawl marks and discarded fishing gear) was observed at all sites.
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1. Introduction
1.1 Background
The Department of Trade and Industry’s (DTI) Strategic Environmental Assessment process is the process of appraisal through which environmental protection and sustainable development may be considered, and factored into national and local decisions regarding Government (and other) plans and programmes – such as oil and gas licensing rounds. The process aims to help inform Ministerial decisions through consideration of the environmental implications of the proposed action. The DTI, as the principal regulator of the offshore oil and gas industry, has taken a proactive stance on the use of SEA as a means of striking a balance between promoting economic development of the UK’s offshore oil and gas resources and effective environmental protection. In 1999 the DTI began a sequence of sectoral SEAs of the implications of further licensing of the UK Continental Shelf (UKCS) for oil and gas exploration and production. For this purpose the UKCS was subdivided into 8 areas (Fig. 1). The present SEA is SEA7.

![Figure 1: The UK Continental Shelf divided into 8 Strategic Environmental Assessment (SEA) units.](image)

The Department of Agriculture Food and Rural Affairs (DEFRA) through their advisors the Joint Nature Conservation Committee (JNCC) are taking steps to identify areas in the UK offshore environment (beyond 12nm) for possible notification as Special Areas for Conservation (SACs) under the EC Habitats
Directive. The initial stages of this process involved the identification of the location and extent of areas of possible Annex I habitat in offshore waters. These were mapped using existing British Geological Society (BGS) geological seabed map interpretations. Biological and other data available for potential Annex I habitat in UK offshore waters were collated and reviewed. Following this process it became apparent that limited biological data were available for a number of areas of potential Annex I habitat, and for some areas there were no biological data available.

This was particularly true for reef habitat. Johnston et al. (2002), provide the official definitions of reef under the terms of the Directive. Within UK offshore waters a number of different types of reef with a range of biological communities were identified and are summarised below:

- **Bedrock reef** - pinnacles, offshore banks.
- **Stony reefs** - cobble and boulder reefs, iceberg plough marks
- **Biogenic reefs** – cold water corals (e.g. *Lophelia pertusa*) and *Sabellaria spinulosa* (*Modiolus modiolus* reef occurs primarily within 12 nm of the coast).

The distribution of bedrock and stony reef types within UK offshore waters have been mapped using BGS data (Fig. 2). These data are at a resolution of 1:250,000 and are therefore not of sufficient resolution to inform a site selection process although they do provide a base from which to investigate further. There are no data on the distribution of biogenic reef in offshore waters. The bulk of the mapped UK reef resource is located in the deep-water areas west and north of Scotland, and is associated with the continental slope, offshore banks and seamounts. This region corresponds to the DTI SEA7 region.

Given both the DTI and Defra's interest in the deep-water areas of the NW coast of Scotland (SEA7) a collaborative survey programme was set up in the summer of 2006 with the aim of obtaining biological and oceanographic data to satisfy the needs of both Government departments while minimising the cost to the UK taxpayer. This followed a more loose collaboration in survey work undertaken by each department in 2005.

The following report details the broad biological findings of the 2006 collaborative survey.
1.2 Area descriptions
1.2.1 Hatton Bank
Hatton Bank is located towards the outer limits of the SEA 7 boundary (Fig. 3). It is one of several large topographic highs that rise up from deep water (>1500m) west of the British Isles. Hatton Bank forms a narrow arc stretching over 400 km from 57˚N, 19˚ 48’W to 59˚30’N, 14˚W, rising in some areas to less than 500 m water depth. Seismic profiling, undertaken by the British Geological Survey, has shown that mound structures are fairly common features on Hatton Bank (Long et al 2006). Their height and width vary from 30 – 40 m high and about 100 – 300 m across. The mounds on Hatton Bank have been found to be acoustically similar to the biogenic mounds found on Rockall Bank and the Porcupine Seabight.

Hydrographically little is known about this area however, three water masses have been identified at the edge of Hatton Bank. The upper water column is composed of a modified form of North Atlantic Central Water, at intermediate depths there is a mix of Eastern North Atlantic Water and subducted sub-Arctic Intermediate Water, whilst below 1500 m low salinity Labrador Sea Water overlies North Atlantic Deep Water (Inall & Sherwin, 2006).
Prior to the SEA 7 survey in 2005 very little biological research had been undertaken on this bank. However this area is known to be an important fisheries area and there have been many reports of fishing vessels dredging up the coldwater coral *Lophelia pertusa* (Wilson 1979; Frederiksen et al 1992). In 2005 a total of 13 stations were sampled on Hatton Bank. The biological results from 2005 found that Hatton Bank had a number of different habitats ranging from fine grained sediment at the deeper stations through to coral debris and exposed bedrock at the shallower stations (Narayanaswamy et al 2006). On the hard substrate crinoids, gorgonians and the large sea anemone *Phelliactis* sp. were dominant. At the deeper stations white vase-shaped sponges and xenophyophores were more common.

1.2.2 George Bligh Bank
George Bligh Bank is situated at the north-eastern end of the Rockall Plateau at 59˚N, 14˚W (Fig. 4). It rises from over 1000 m to a summit at 450 m, and has a diameter of roughly 75 km. Very little is known regarding the hydrography of George Bligh Bank, it is thought, however, to lie at the boundary between two water masses; Eastern North Atlantic Water and Western North Atlantic Water (T Sherwin pers comm.).
Like Hatton Bank very little is known about the biology of George Bligh Bank. In 2005 a total of 7 stations were sampled. Analysis of the 2005 images found that there were many different habitats on George Bligh Bank including coral framework mainly comprising Madrepora oculata and Lophelia pertusa. A highly diverse fauna was also associated with this framework including soft corals, hexactinellid sponges and again the large anemone Phelliactis sp. Echinoids were the most abundant mobile fauna whilst rarer species included the basket star Gorgonocephalus. A number of Chimaera monstrosa, the rabbit fish, were also seen at the shallower stations.

1.2.3 Rosemary Bank
Rosemary Bank is the most northerly (58° 10’ N, 10° 10’W ) of the three seamounts found in the SEA 7 region of the Rockall Trough, 120 km west of the UK mainland (Fig. 5). It is broadly domed and elongate in shape with a diameter of 70 km. It rises from 1700 m - 2300 m to a peak at 321 m below sea level. Excluding the eastern flank of the seamount, the flanks of the seamount are steep (~ 20°) to about 1400 m on the southern flank and 900 m on the northern one where topographically upper and lower summits areas are quite distinct. The upper summit has dozens of small parasitic cones, some of which are up to 150 m high and with a base of 300 m. The lower summit also has dozens of small parasitic cones mostly on the extreme western and eastern flanks. A narrow moat encircles Rosemary Bank and on some areas it forms a trough over 300 m deep. From multibeam images not only are the volcanic parasitic cones visible, but also terraced slopes and concave slide scars (Howe et al 2006).
Rosemary Bank is located at the junction of two currents; the Western North Atlantic Water which has travelled through the Iceland Basin from the western side of the Atlantic and the Eastern North Atlantic Water which is derived mainly from the sub-tropical gyre which originates to the south of the Rockall Trough. Cold water entering the Rockall Trough that has occasionally cascaded over the Wyville-Thomson Ridge sometimes forms an eddy that gets trapped between Rosemary and Bill Bailey’s Banks.

Very little is known about the biology of Rosemary Bank. Up until 2006, only one Agassiz trawl and one box core have been taken on the east side of Rosemary Bank at a depth of 1600 m. The trawl was found to be dominated by two species of ophiuroid, *Ophiacantha bidentata* and *Ophiomusium lymani*. Concentrations of the commercially valuable fish *Aphanopus carbo* occur around the site (McCormick 1992) and VMS data show the feature has been fished (ICES 2006). At least 4 records of *Lophelia pertusa* are known to exist but the current status of coral on Rosemary Bank is unknown.

### 1.2.4 Wyville-Thomson Ridge

The Wyville-Thomson Ridge is situated at the northern end of the Rockall Trough at about 59°50’ - 60°30’ N, 6°20’ - 8°40’ W (Fig. 6). The ridge is more than 200 m long and formed of Palaeogene basalts and sediments. It also has a relatively narrow summit, which occurs at water depths of less than 400 m in some areas. On its flanks, the average slope angles range between 2° and 6° and on its lower slope contourite mounds are formed (Stoker et al. 1993).
The oceanographic regime for this area can be divided into two regions which are separated by the Wyville-Thomson Ridge. Warm North Atlantic Water is able to cross the Ridge and enter into the Faeroe-Shetland Channel, and colder Norwegian Sea Deep Water is able to flow out of the Channel across the Ridge and into the Ymir trough.

Biological investigations on the ridge itself have been somewhat limited as a result of the strong currents in the area.

1.2.5 West Shetland Channel
The Faeroe-Shetland Channel is situated to the North of the Wyville-Thomson Ridge between 59°- 63°N, 3° E - 6°W (Fig. 7). It is a narrow deep-water trough which lies between the Faeroe-Islands and the west Shetland shelf. The channel widens northward from about 90 km width at 60°N to 190 km wide at 62° 30′N. Over this distance the water depth also increases from 1000 m to >1700 m (Masson et al 2000). The continental slope on the eastern parts of the Faeroe-Shetland Channel comprises large quantities of glacigenic material (Stoker 1995; Stoker et al. 1991; Stoker & Holmes 1991). However, since the last glaciation sediment input has been relatively low, although much of the glacial sediments have been re-distributed as a result of the strong currents. This has resulted in a relatively smooth sedimented seafloor with gentle slope gradients. Small channels are seen in the area, and iceberg plough marks are also present.
This is one of the most well studied oceanographic areas in the world having been studied regularly since 1983 (Turrell 1995). The hydrography of this region is quite complex with several different water masses flowing into and out of the Channel. On the Shetland side of the channel the inflowing current occupies the upper 500 m and comprises North Atlantic Water, whereas on the Faroese side the surface water is occupied by Modified North Atlantic Water, which is cooler and fresher. This water originates to the west of the Rockall Plateau and enters the Faeroe-Shetland Channel from the North. Below the surface water masses there is cooler/fresher water which originates in the Nordic Seas and Arctic Ocean. These water masses are Arctic Intermediate/North Icelandic Water and Norwegian Sea Arctic Intermediate Water, and below these a mixture of the two, which forms Faeroe-Shetland Channel bottom water.

The water temperature in the Channel is known to fluctuate at depths of 350 m – 650 m. Recordings have found that the temperature can change by as much as 7°C in the space of one hour (Bett 2000) and this is thought to be a result of internal tides moving the intermediate waters vertically by as much as 100 m during a six hour period (Bullough et al 1998). During one ten-month period there were 15 recorded observations of such changes in temperature (Bett pers comm.)

As a result of the work undertaken through the Atlantic Margin Environmental Surveys in 1996 and 1998, and the subsequent Strategic Environmental Assessment of Area 4, a large amount of biological work has been conducted in this area (AFEN 2000; Narayanaswamy 2000; Axelsson, 2003; Hughes et al 2003) although much of it consisting of infaunal sampling. In total 5 large-scale seabed surveys have been undertaken in this region, comprising over 350 sampling sites for macrofauna and environmental variables ranging in water depth from 96 m - 2315 m. The West of Shetland Transect comprising
15 stations from 150 m – 1000 m has been sampled for macrofauna on 3 occasions; 1996, 1998 and 2000 (Narayanaswamy 2000). Epifaunal data from this region is much sparser. In general, the hydrography of this area has been found to exert a strong influence on the benthic fauna. The deeper waters of the SEA 4 area are also found to be rich in habitat types.

1.2.6 Papa Bank
Papa Bank is located to the west of the Orkney Islands at about 59° 15' - 59° 40'N, 3° 16’ W - 3° 21’W (Fig. 8). The Fair Isle Current is the main body of water flowing over Papa Bank. This current is usually completely homogenous throughout the year and is a mixture of Atlantic water, which is entrained along the northern coast of Scotland, and low salinity water, which originates along the western coast of Scotland (Turrell et al 1990).

![Figure 8: Papa Bank](image)

1.2.7 Pobie Bank
Pobie Bank is situated to the east of the Shetland Islands in Strategic Environmental Assessment Area 5 (Fig. 9). The bank is about 20 km wide and 70 km long running south-west to north-east and rises from a depth of 110 m to less than 80 m along the crest (Holmes et al. 2004). The sediments on the southern and western margins as well as the southern crest of Pobie Bank comprise slightly gravely muddy sand, whilst the northern and eastern flanks of the Bank comprise mainly of sand/gravely sand.

The east Shetland Atlantic inflow is the main water mass that flows over Pobie Bank (Turrell 1992). The water is more saline than the northern North Sea water which is found further offshore.
Figure 9: Pobie Bank
2. Methods
2.1 Survey
The commercial research vessel Franklin was used to undertake the collection of biological and geophysical data over a two month period (Aug – Oct 2006) from the SEA7 area as well as other areas of interest to both the DTI and DEFRA (Fig. 10) As Annex I reef was Defra’s primary interest and many of the areas of interest to the DTI were topographically complex the primary biological sampling method chosen for use was that most appropriate to the terrain, video and stills image sampling. A total of 128 video tows and over 5000 images were obtained across 8 sites in the SEA7 and neighbouring areas representing the largest survey of the UK’s offshore banks and seamounts ever undertaken (Fig. 11)

Figure 10: The Franklin

Figure 11: Overview of study area
2.2 Equipment
Acoustic survey was achieved using EM1002 hull mounted multibeam. Both bathymetry and backscatter data were collected.

The Seatronics drop frame system was deployed from side of the vessel (Fig. 12). It comprised an integrated DTS 6000 digital video telemetry system, which provided a real time video link to the surface, and a 5 mega pixel Kongsberg and Imenco digital stills camera. Both video and stills cameras were mounted at an oblique angle to the seabed to aid in species identification. Sensors monitored depth, altitude and temperature, and a USBL beacon provided exceptionally accurate position data.

![Figure 12: The Seatronics drop-frame camera system ready for deployment.](image)

2.3 Sampling
Acoustic survey provided an accurate base-map of the topography, and, as a derivative, a seafloor acoustic reflectivity map, which in turn allowed large-scale differentiation of the varying habitats within selected areas of study. Interpretation of these acoustic data is not within the scope of this report. However, preliminary interpretation of these data and expert judgement were used to select biological sampling sites.

Biological sampling, using both video and stills cameras, was stratified by interpreted ground-type / seabed features and depth, although hard substrate habitat was sampled preferentially. Each tow was approximately 500m long, although there were exceptions to this. Depending on the speed of the vessel tows lasted 0.5-1.5 hrs. The drop frame was towed in the water column just off the sea bed. At approximately 1 minute intervals the camera was landed on the seabed and a still image taken, exceptions were, 1) when the substratum was extremely soft (silt clouds) 2) when the substratum was extremely rocky, uneven, delicate (coral), or descending a cliff face; here the camera was not landed and images were taken off the seabed. The 1 minute spaced images ensured a degree of random biological sampling; these
images are described throughout as ‘statistical’ images. In order to achieve representation of the biological communities present, images were also taken where habitat boundaries occurred. In addition opportunistic images were taken to aid in species identification.

2.4 Video and image analysis
For each tow the video was reviewed and a brief description given of the main seabed types (habitats) and dominant species observed.

Selected statistical images and images taken at habitat boundaries were quantitatively analysed (Appendix, Table 1, ). All organisms >1cm were identified to the lowest possible taxonomic level and counted. For encrusting and globose forms percentage cover was calculated using a calibrated grid superimposed over the image (Fig. 13). Image data was stored in an access database prior to multivariate statistical analysis.

Biological data obtained from image analysis was analysed using PRIMER (Clarke and Warwick, 2001). Cluster analysis with group averaged linking was performed on P/A data to investigate patterns in community structure both within and between geological features (seamounts, ridge, continental slope, banks). Derived patterns were analysed in combination with available environmental parameters to elucidate those factors driving community structure. Environmental data were gained from CTD data and image analysis and included depth, temperature and sediment type.

![Figure 13: Calibration grid](image-url)
3. Results
3.1 Station summaries
3.1.1 Hatton Bank

Hatton_C1 (Appendix, Fig. 1)
The target was a shallow channel at the base of the area covered by the multibeam (~1000m). The channel was approximately 30m deep. The transect began on a coarse sand habitat with pebbles and occasional cobble dropstones. Visible fauna included small (>10mm disc diameter) ophiuroids, the occasional urchin (possibly Calveriosoma sp.), cerianthid anemones, fish (grenadiers) and occasional Xenophyophores. Fauna on the drop stones included anemones (Phelliactis sp. and sp. indet.), encrusting and globose sponge forms, and corals (Caryophyllia sp., Madrepora occulata). As the camera descended the channel xenophyophores and the sponge (Pheronema carpenteri) became more abundant. Large sponge growth forms were present occasionally. As the camera ascended the other side of the channel the sediment became finer and appeared rippled, xenophyophores and Pheronema were no longer visible but small ophiuroids again became dominant visible fauna.

Hatton_C2 (Appendix, Fig. 2)
The target was a typical slope environment. Habitat was a coarse sand that appeared rippled. Very few visible epifauna except small (>10mm disc diameter) ophiuroids, small cone shaped gelatinous organisms and occasional fish (Chimaera monstrosa).

Hatton_C3 (Appendix, Fig. 3)
Target was a small mid-slope scarp feature that descended approximately 25m. Video transect began on a medium sand habitat that appeared rippled with occasional dropstones. Visible fauna included holothurians (Stichopus tremulus), urchins (Cidaris cidaris, Calveriosoma sp) cerianthid anemones and fish (Chimaera monstrosa, blue-mouth red fish Helicolenus dactylopterus). As the camera approached the edge of the scarp feature the seabed became rockier with boulders, cobbles and pebbles. Fauna present on cobbles and boulders included brachiopods, encrusting and globose sponge forms, holothurians (Psolus squamatus), coral (small growths of Lophelia pertusa) and ascidians. The seabed then became bedrock encrusted with sponge, holothurians (Psolus squamatus), Serpulid worms, small growths of the corals Madrepora occulata and Lophelia pertusa, ascidians, brachiopods. At the scarp edge there were denser growths of Lophelia pertusa, Madrepora occulata and a distinct yellow sponge growth. At the base of the scarp slope the sediment again became a medium rippled sand habitat with few visible epifauna except occasional small cone shaped gelatinous organisms.

Hatton_C4 (Appendix, Fig. 4)
Target was two small areas of high backscatter and mid to upper slope depths. Video transect began in an area of medium sand habitat that appeared rippled. Visible epifauna included urchins (Echinus acutus, Calveriosoma sp), cerianthid anemones, holothurians (Stichopus tremulus) and fish (Chimaera monstrosa, unidentified elasmobranch (possibly black
mouthed dogfish)). The transect then entered the first area of high backscatter, which revealed itself as an area of drop-stones of cobble and pebble size. Fauna present on the stones included small growths of *Lophelia pertusa*, globose and encrusting sponge forms and holothurians (*Psolus squamatus*). The sediment then returned to a medium sand with ripples and few visible epifauna, before crossing onto the second high backscatter target. This again was an area of cobble and boulder drop-stones with species similar to the previous area.

Hatton_C5 (Appendix, Fig. 5)
Target was a small scarp feature at lower slope depths. The scarp descended approximately 20m. The transect began in a medium sand habitat that appeared rippled, with occasional dropstones. Few visible epifauna except small (<10mm disc diameter) ophiuroids and small cone shaped gelatinous organisms. As the camera approached the scarp edge pebbles and cobbles became more frequent and were colonised by encrusting and globose sponges, small growths of *Madrepora occulata*, cup (*Caryophyllia sp.*) and stylasterid corals, serpulid worms, ascidians as well as other unidentified species. At the base of the scarp the sediment was finer sand but quickly returned to habitat similar to that at the start of the run with few visible epifauna except numerous ophiuroids. Toward the end of the transect pebbles became more abundant and xenophyophores were encountered.

Hatton_C6 (Appendix, Fig. 6)
The target was what appeared to be two iceberg plough-marks approximately 10m deep. The transect began in an area of rippled medium sand habitat with few visible epifauna except the occasional urchin (*Calveriosoma sp*). As the camera progressed across the edge of the plough-mark a region of dense cobbles and boulders colonised by encrusting sponges, hydroids, holothurians (*Psolus squamatus*), ophiuroids hidden in the cracks and crevices of stones (possibly *Ophiactis balli*), decapods, stylasterid and solitary corals (*Caryophyllia sp*). Visible mobile epifauna included squat lobsters (probably *Munida rugosa*), and ophiuroids hidden in the cracks and crevices of stones (possibly *Ophiactis balli*). As the tow progressed through the plough-mark area the sediment changed to medium rippled sand with few visible epifauna. Eventually the sediment changed again to pebbles imbedded in compacted sand then cobbles and boulders marking the edge of the plough-mark feature. Here visible fauna included encrusting sponges, holothurians (*Psolus squamatus*), solitary corals (*Caryophyllia sp*), anemones, ophiuroids hidden in the cracks and crevices of stones (possibly *Ophiactis balli*), ascidians, decapods, urchins (*Cidaris sp.*) and brachiopods. Seabed then returned to a medium rippled sand with few visible epifauna. A length of taut rope was visible on the seabed, most likely part of lost fishing gear.

Hatton_C7 (Appendix, Fig. 7)
Target was a transect through a zone of iceberg plough-marks. Transect began on a rippled seabed of medium sand with few visible fauna except urchins (*Cidaris cidaris*), holothurians (*Stichopus tremulus*) and occasional fish (*Chimaera monstrosa*). The camera then passed into an area of sand with occasional cobbles colonised by encrusting sponges, holothurians (*Psolus*
squamatus), solitary corals (Caryophyllia sp), anemones and ophiuroids hidden in the cracks and crevices of stones (possibly Ophiactis balli); before passing back into a rippled sand habitat with few visible epifauna. As the camera approached the edge of a plough-mark the habitat changed to a region of dense cobbles and boulders colonised by a diverse range of species including encrusting and globose form sponges, holothurians (Psolus squamatus), solitary corals (Caryophyllia sp), stylasterid corals (probably Pliobothrus) and small growths of Madrepora occulata and Lophelia pertusa, brachiopods, anemones and hydroids. Mobile epifauna included squat lobsters (probably Munida rugosa), shrimp and ophiuroids hidden in the cracks and crevices of stones (possibly Ophiactis balli). In the trough of the plough mark the habitat returned to a region of rippled medium sand with few visible epifauna. As the camera passed over the opposite edge of the plough-mark feature the habitat again returned to a region of dense cobbles and boulders colonised by a diverse range of fauna as described above and including a large yellow sea-fan (Gorgonian). Off the plough-mark edge the habitat was again rippled medium sand before passing onto another plough-mark edge feature similar in character to those described above.

Hatton_C8 (Appendix, Fig. 8)
Target was typical lower slope habitat. The transect revealed a fairly uniform habitat of rippled medium sand with few visible epifauna. Species encountered included hermit crabs, infaunal polychaete tube worms, small cone shaped gelatinous organisms, and fish (Chimaera monstrosa, and an unidentified ray).

Hatton_C9 (Appendix, Fig. 9)
Target was a typical slope habitat. The transect ran through a single habitat type of rippled medium sand with detritus in the ripple furrows. There were few visible epifauna but they included holothurians (Stichopus tremulus), urchins (Echinus acutus), small (<10mm disc diameter) ophiuroids, small cone shaped gelatinous organisms, a single occurrence of a zoanthid (Epizoanthus sp.), and many fish (Chimaera monstrosa, various grenadiers, unidentified ray, and the blue-mouth red fish (Helicolenus dactylopterus).

Hatton_C10 (Appendix, Fig. 10)
Target was a summit scarp slope that descended approximately 30m. The transect began in an area of dense (>40% cover) cobbles on sand colonised by holothurians (Psolus squamatus), brachiopods, stylasterid corals (probably Pliobothrus) and small growths of Lophelia pertusa. The transect progressed onto an area of rippled medium sand habitat with few visible fauna except occasional holothurians (Stichopus tremulus), urchins (Calveriosoma sp) and fish. A length of taut rope was visible on the seabed, most likely part of lost fishing gear. As the camera progressed toward the scarp slope the habitat changed to an area of occasional cobbles, characterised by similar fauna as described previously. The cobbles became denser and boulder frequent at the edge of the scarp slope; the fauna remained similar to that on the cobbles, but with occasional thickets of Lophelia pertusa, occasional blue-mouth red fish (Helicolenus dactylopterus) and urchins (Cidaris cidaris). In places the underlying sediment appeared to be sand covered bedrock. Once the camera...
had descended the slope summit the habitat again returned to a rippled medium sand sediment. Visible epifauna included holothurians (*Stichopus tremulus*), urchins (*Echinus acutus, Cidaris cidaris*) and fish (grenadiers and occasional flat fish).

Hatton_C11 (Appendix, Fig. 11)
Target was a series of high backscatter regions at the summit of the bank descending a 10m slope. The transect began in an area of medium sand habitat with few visible epifauna including occasional holothurians (*Stichopus tremulus*), urchins (*Calveriosoma sp. Cidaris sp.*) and fish. Occasionally a cobble dropstone was visible and was colonised by holothurians (*Psolus squamatus*), stylasterid corals, encrusting sponges, small growths of coral (*Madrepora occulata*), anemones (*Phelliactis sp.*), ophiuroids hidden in the cracks and crevices of stones (possibly *Ophiactis balli*), squat lobsters (possibly *Munida rugosa*) and serpulid worms. A small piece of fishing net was encountered. As the camera reached the edge and descended the upper part of the slope, the habitat changed to an area of dense boulders and cobbles colonised by similar species to the drop stones with additional small growths of *Lophelia pertusa*, solitary corals (*Caryophyllia sp*), brachiopods, gastropod molluscs, hydroids and rarely Brisingid sea stars. The camera then descended a steep slope that appeared to be composed of rock covered with sand and encrusting sponge growth and colonised by coral (*Lophelia pertusa* and *Madrepora occulata*) thickets, globose sponges, decapods, squat lobsters (possibly *Munida rugosa*) polychaete tube worms, anemones (*Phelliactis sp*), holothurians (*Psolus squamatus*), stylasterid corals (probably *Pliobothrus*), and many ophiuroids hidden in the cracks and crevices of rock (possibly *Ophiactis balli*). On the lower section of the scarp slope was an area of boulders and cobbles again colonised by similar species and including possible colonies of the alcyonacean *Anthomastus grandiflorus*. As the camera reached the base of the scarp slope the seabed again became rippled medium sand characterised by occasional holothurians (*Stichopus tremulus*), urchins (*Calveriosoma sp. Cidaris sp.*) and fish.

Hatton_C12 (Appendix, Fig. 12)
Target was a suspected rock ridge. The tow didn’t start immediately as the drop frame was not behaving normally. Tow started at 00:33:00. Seabed consisted of rippled medium sand with occasional cobbles. Visible fauna were few but consisted of holothurians (*Stichopus tremulus*), urchins (*Calveriosoma sp. Cidaris sp.*) and fish. As the tow progressed toward the ridge cobbles and boulders became more frequent with small growths of coral (*Lophelia pertusa* and *Madrepora occulata*) and encrusting fauna. Patches of dead coral skeleton were also visible and colonised by anemones (*Phelliactis sp*), crinoids, Stylasterid corals (probably *Pliobothrus*), erect and encrusting sponges. After 40 mins the tow was abandoned as the winch system was malfunctioning. The tow was returned to a few days later. Tow began as before on a sand seabed with occasional cobbles colonised by small growths of coral (*Lophelia pertusa* and *Madrepora occulata*) and other typical encrusting fauna. As the camera approached the ridge edge cobbles and boulders became more frequent with larger growths of coral (*Lophelia pertusa* and *Madrepora occulata*) and increasingly lag deposits on the sand between
rocks. Typical encrusting fauna for this area were present on the rocks including \((Psolus squamatus)\), stylasterid corals (probably \(Pliobothrus\)), anemones (\(Phelliactis\) sp, and others), brachiopods, serpulid tube worms and encrusting sponges. At the ridge edge the seabed became bedrock outcrop with dense coral (\(Lophelia pertusa, Madrepora occulata\), and soft corals) colonising the drop-off. The camera descended a steep slope with boulders and cobbles and a diverse range of sessile species and fish including orange roughly. Boulders and cobbles quickly became less frequent and with more typical encrusting fauna. Tow ended on a sand sea bed with typical fauna including urchins (\(Cidaris cidaris\)) and fish. Upon return to the surface it was discovered the camera flash had malfunctioned and many images were unusable.

Hatton_C13 (Appendix, Fig. 13)
Target was a suspected rock ridge. Tow began on a sand sea bed with occasional cobbles. Fauna was typical of the area and depth and included holothurians (\(Stichopus tremulus\)) and urchins (\(Calveriosoma\) sp. and \(Echinus acutus\)). As the tow progressed cobbles and boulders became more frequent and were colonised with small growths of coral (\(Lophelia pertusa, Madrepora occulata\), anemones (\(Phelliactis\) sp), holothurians (\(Psolus squamatus\)), and encrusting sponges. As the camera approached the scarp edge the sea bed became rockier with bedrock and boulders colonised by species mentioned previously and additional coral species including gorgonians (probably \(Callogorgia verticillata\)). Large sponge growths were visible occasionally, and cyclostome bryozoans. In general the fauna appeared more diverse near the ridge edge. At the ridge edge the slope fell away quickly as steep rock/boulder wall colonised by similar fauna as previously but including corkscrew-shaped antipatharian coral (\(Stichopathes\) sp.) and the alcyonacean \(Anthomastus grandiflorus\). As the camera descended the slope the sea bed became coarse sand and coral gravel with occasional lumps of \(Lophelia\) skeleton colonised by \(Psolus\), stylasterid corals, sponge and live \(Lophelia\) and \(Madrepora\), occasional sea pens and brisingid sea stars. Toward the base of the slope the seabed changed to a lag deposits with few visible fauna, but punctuated by sand / coral skeleton patches with similar fauna to that described above.

Hatton_C14 (Appendix, Fig. 14)
Target was a ridge edge and slope. Hatton_C14 was faunally and topographically very similar to Hatton_C13. The tow began on a sand sea bed with occasional cobbles. Fauna was typical of the area and depth and included holothurians (\(Stichopus tremulus\)) and urchins (\(Calveriosoma\) sp. and \(Echinus acutus\)). As the tow progressed cobbles and boulders became more frequent and were colonised with small growths of coral (\(Lophelia pertusa, Madrepora occulata\), anemones (\(Phelliactis\) sp), holothurians (\(Psolus squamatus\)), stylasterid corals, corkscrew-shaped antipatharian coral (\(Stichopathes\) sp.), brachiopods, and encrusting sponges. As the camera approached the scarp edge the sea bed became rockier with bedrock and boulders colonised by species mentioned previously. At the ridge edge the slope fell away quickly as steep rock/boulder wall colonised by similar fauna as previously. As the camera descended the slope boulders and cobbles became less frequent and the sea bed became coarse sand and coral gravel.
with frequent lumps of *Lophelia* skeleton colonised by similar fauna to the rock but including the erect bryozoan *Reteporella* sp. and cyclostome bryozoans, erect sponge growths and anemones. Toward the base of the slope the seabed changed to a lag deposit with few visible fauna, however numerous crabs (possibly *Paramola cuvieri*) were visible in distinct pairs. The sea bed then returned to coarse sand with fauna including *Echinus acutus* and small cone shaped gelatinous organisms.

Hatton_C16 (Appendix, Fig. 15)
Target was again a rock ledge. C16 was very similar to both C13 and C14. Tow began on an area of sand sea bed with occasional cobbles colonised by with small growths of coral (*Lophelia pertusa, Madrepora occulata*), holothurians (*Psolus squamatus*), and encrusting sponges. After approximately 20min tow had to be abandoned as the D.P. system had malfunctioned. The tow restarted at a point beyond the target ledge feature and began on a steep slope composed of sand and coral debris with frequent lumps of *Lophelia* skeleton colonised by small growths of live coral (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp), stylasterid corals, and rarely gorgonians (probably *Callogorgia verticillata*). As the camera descended the slope cobbles and boulders became more frequent and colonised by similar species to those described above but including Psolus and encrusting sponges.

Hatton_C17 (Appendix, Fig. 16)
Target was a rock ledge. Tow began on a sandy seabed with occasional cobbles and boulders and dead *Lophelia* skeleton. Fauna on the sand seabed included holothurians (*Stichopus tremulus*), urchins (*Cidaris cidaris, Echinus acutus, Calveriosoma sp.*), and fish (*Chimaera monstrosa* and Grenadiers). Hard substratum was colonised by similar fauna as in previous tows including small growths of coral (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp), stylasterid corals, holothurians (*Psolus*), brachiopods, and encrusting sponges. Brisingid sea stars were visible occasionally perched on rocks in typical feeding pose. As the camera approached the rock ledge the sea bed became rockier with bedrock and boulders dominating, fauna remained similar to that seen previously. At the rock edge the ground sloped steeply away as a rock/boulder wall sparsely colonised by cyclostome bryozoans, anemones, *Psolus, Lophelia pertusa* and *Madrepora occulata*. The sea bed then quickly became sandy with occasional cobbles and boulders with similar fauna to cobbles earlier in the tow but including rarely gorgonians (probably *Callogorgia verticillata*) and echiuran worms. In places lag deposits dominate the sea floor with few fauna visible. Toward the end of the tow an area of bedrock is encountered colonised by sparse fauna of similar composition to that described earlier.

Hatton_C18 (Appendix, Fig. 17)
Tow began on an area of sand seabed with frequent pebbles. Visible fauna include small (<10mm disc diameter) ophiuroids, occasional cerianthid anemones, and eel pout. As the tow progressed boulders and cobbles became more frequent and were colonised by encrusting sponges, cup sponges, anemones, *Psolus*, cup corals (*Caryophyllia* sp.), *Madrepora*
and stylasterid corals. The camera then passed out of the rock dominated area to a sand sea bed with occasional cobbles. Upon downloading the camera it became clear the camera flash failed and many images were unusable.

Hatton Transit_C1 (Appendix, Fig. 18)
Target was a channel at the base of a steep slope. Tow began on an area of lag gravel and sand seabed that quickly became a sand seabed with occasional cobbles colonised by anemones (*Phelliactis* sp. and others), holothurians (*Psolus squamatus*), stylasterid and corkscrew-shaped antipatharian coral (*Stichopathes* sp.). Mobile epifauna included urchins (*Cidaris cidaris*) and ophiuroids. Seabed then sloped steeply away and appeared to be composed of sandstone. Visible fauna included corkscrew-shaped antipatharian coral (*Stichopathes* sp.), ascidians and ophiuroids. Attempts to land the camera resulted in the camera topping over and loss of orientation, tow was aborted and restarted from the beginning. Restart began on a region of lag gravel seabed with few visible fauna except cup corals, anemones, squat lobsters, and encrusting sponge in places. Seabed change to a slope composed of what appeared to be sandstone with few visible fauna. As the slope descended seabed became sand with occasional cobbles and boulders colonised by species such as anemones (including *Phelliactis* sp), and erect sponge forms. Seabed again becomes composed of sandstone with few visible fauna before returning to lag gravel deposits at the base of the channel. Again few fauna were visible on the lag gravel except anemones, urchins (*Echinus sp.*), small cone-shaped gelatinous organisms, serpulid worms, occasional encrusting sponge, and eel pout. As the camera began to ascend the far slope out of the channel the seabed became sandier with occasional cobbles and boulders colonised by anemones (*Phelliactis* sp.), coral (*Madrepora occulata*, stylasterids, *Caryophyllia* sp, corkscrew-shaped antipatharians (*Stichopathes* sp.)), encrusting sponges, ascidians and brachiopods.

Hatton Transit_C2 (Appendix, Fig. 19)
Target was a rock ridge and steep scarp slope. Tow began on a sand seabed with occasional cobbles. Visible fauna included fish (*Chimera monstrosa*), cerianthid anemones, urchins (*Echinus acutus*), and bivalves of the family Pectinidae. Cobbles were colonised by small growths of coral (*Madrepora occulata*, stylasterids), holothurians (*Psolus squamatus*), and other encrusting species. The substrata became coarser, with coral debris and more frequent cobbles colonised by *Lophelia pertusa*, anemones (*Phelliactis* sp.), gorgonians, stylasterid corals, ascidians, and antipatharian corals (*Stichopathes* sp.). Mobile species include fish, hermit crabs (Paguridae) and sea stars (Brisingidae, *Stichastrella rosea*). At the edge of the ridge feature cup sponges were also visible. As the slope descended the seabed consisted of sand and coral gravel. The fauna became more diverse with additional species apparent including large red soft corals, the alcyonacean *Anthomastus grandiflorus*, plumose anemones, cyclostome bryozoans and erect sponge growths. Seabed then became very steeply sloping and composed of sandstone colonised by *Psolus squamatus*, stylasterid corals, anemones and encrusting sponge. As the slope shallowed the seabed...
became sandy with cobbles, boulders and dead *Lophelia pertusa* framework colonised by similar fauna as described for this habitat previously.

Hatton Transit_C3 (Appendix, Fig. 20)
Target was a typical seabed for the region. The whole tow moved through a single broad habitat of sand seabed with occasional cobbles. Visible fauna included small growths of coral (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp), holothurians (*Psolus squamatus*), stylasterid corals, brachiopods, and encrusting sponges.

Hatton Transit_C4 (Appendix, Fig. 21)
Target was a rock ridge. Tow began on an area of sand seabed with occasional cobbles. Visible mobile fauna included fish (*Chimera monstrosa*), cerianthid anemones and urchins (*Cidaris cidaris*). Visible attached fauna included small growths of coral (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp), holothurians (*Psolus squamatus*), stylasterid corals, brachiopods, and encrusting sponges. Camera descended a small bedrock ridge and shortly after the camera focus jammed and tow was aborted to fix the camera. Tow was resumed and continued through predominantly sand habitat with occasional cobbles and boulders. Cobbles and boulders were colonised by cyclostome bryozoans, anemones (including *Phelliactis* sp.), *Psolus squamatus, Lophelia pertusa* and *Madrepora occulata*, gorgonians (possibly *Callogorgia verticillata*), corkscrew-shaped antipatharians (*Stichopathes* sp.) as well as more general encrusting fauna. Seabed began to slope away and appeared scoured with few visible fauna but still occasional cobbles. Towards the base of the slope cobbles became rare and visible fauna included small (>10mm disc diameter) ophiuroids, small gelatinous organisms and xenophyophores. Urchin’s tests were numerous in places.

Hatton Transit_C5 (Appendix, Fig. 22)
Target was a rock ridge. Tow began on a sand seabed with occasional pebbles and cobbles. Visible mobile fauna included fish, and urchins (*Cidaris cidaris*). Visible attached fauna included small growths of coral (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp and others), holothurians (*Psolus squamatus*), stylasterid corals, brachiopods, and encrusting sponges. Camera progressed over a rock ledge with a large overhang and down a steep sandy slope. Visible fauna similar to that described above. Cobbles and boulders became more frequent and were colonised by small growths of reef forming corals (*Lophelia pertusa, Madrepora occulata*), anemones (*Phelliactis* sp and others), corkscrew-shaped antipatharian corals (*Stichopathes* sp.), holothurians (*Psolus squamatus*), stylasterid corals, brachiopods, and encrusting sponges. Mobile fauna included hermit crabs (Paguridae) and sea stars (*Stichastrella rosea*). Cobbles and boulders became more frequent with gorgonians, erect sponges (*Aphrocallistis* sp.) and cup corals visible and echiuran worms (*Bonellia viridis*). Toward the base of the slope the sediment became lag gravel and sand with few visible fauna except ascidians, ophiuroids, anemones, squat lobsters (*Munida rugosa*), urchins (*Echinus* sp.).
Hatton South_C1 (Appendix, Fig. 23)
The target was an area of suspected rock outcrop. The tow began over a medium sand sea bed with few visible fauna except occasional cerianthid anemones. As the camera progressed, occasional cobbles, boulders and coral debris were encountered, becoming more frequent as the camera neared the rock outcrops. Cobbles and boulders were colonised by typical encrusting fauna and holothurians (Psolus squamatus), rarely sea pens were visible. The camera then encountered the target rock outcrop region. Rock outcrop was fringed by coral rubble, boulders and cobbles and interspersed with areas of medium sand. Rock was sparsely colonised by typical encrusting fauna (Serpulid worms, saddle oysters, encrusting sponge, occasional anemones, and holothurians (Psolus squamatus)), and a diverse array of coral species including Lophelia pertusa, Madrepora occulata, corkscrew-shaped antipatharian corals (Stichopathes sp.), stylasterids (probably Pliobothrus) and gorgonians (possibly Callogorgia verticillata). Anemones (Phelliactis sp.) and erect sponge growths were also observed on the bedrock habitat. Fauna inhabiting the coral rubble fringing included small growths of live corals, anemones, encrusting and erect sponge forms, squat lobsters (possibly Munida rugosa), ophiuroids (probably Ophiactis balli) and ascidians.

Hatton South_C2 (Appendix, Fig. 24)
The target was a boundary between areas of low and high backscatter. The entire tow passed through a single medium sand habitat with obvious cause for the difference in backscatter. Visible fauna were those typical of this type of habitat and included urchins (Calveriosoma sp.), small cone shaped gelatinous organisms and fish.

Hatton South_C3 (Appendix, Fig. 25)
The target was an area of suspected rock outcrop. The tow began over a large area of rock outcrop, fringed by coral rubble. Rock was sparsely colonised by typical encrusting fauna (Serpulid worms, saddle oysters, encrusting sponge, occasional anemones, and holothurians (Psolus squamatus)), and a diverse array of coral species including Lophelia pertusa, Madrepora occulata, corkscrew-shaped antipatharian corals (Stichopathes sp.), alcyonaceans (Anthomastus grandiflorus), stylasterids (probably Pliobothrus) and gorgonians. Anemones (Phelliactis sp.) and erect sponge growths were also observed on the bedrock habitat. Fauna inhabiting the coral rubble fringing included small growths of live corals, anemones, encrusting and erect sponge forms, squat lobsters (possibly Munida rugosa), ophiuroids (probably Ophiactis balli), decapods (Paramola cuvieri) and ascidians. The camera passed between large rock outcrops throughout the tow, passing through areas of medium sand habitat with few visible fauna, before moving into regions of frequent cobbles and boulders as the camera approached the next rocky outcrop. Cobbles and boulders were colonised by typical encrusting fauna and holothurians (Psolus squamatus). Two separate lengths of taut rope/wire were visible on the seabed, most likely part of lost fishing gear.
Hatton South_C4 (Appendix, Fig. 26)
Targets were areas of high backscatter. Tow began over an area of medium sand seabed with occasional cobbles and lumps of coral rubble. Visible mobile fauna included urchins (Cidaris cidaris) and fish. Cobbles were colonised by typical encrusting fauna (Serpulid worms, saddle oysters, encrusting sponge, occasional anemones, and holothurians (Psolus squamatus)) and small growths of live coral as well as occasional large gorgonians. Tow progressed into an area of dense coral (Lophelia) rubble reef in-filled with sand and colonised by a diverse array of species including Lophelia pertusa, Madrepora occulata, corkscrew-shaped antipatharian corals (Stichopathes sp.), alcyonaceans (Anthemastus grandiflorus), stylasterids (probably Pliobothrus), gorgonians, anemones (Phelliactis sp. and others) and many erect sponge growths. The tow then crossed an area of bedrock outcrop sparsely populated with typical encrusting fauna listed above and corals before passing back onto an area of sand seabed with fauna typical of this habitat (holothurians (Stichopus tremulus), urchins (Cidaris cidaris)).

Hatton South_C5 (Appendix, Fig. 27)
Tow began over an area of bed rock out crop sparsely colonised by typical encrusting fauna (Serpulid worms, saddle oysters, encrusting sponge, occasional anemones, and holothurians (Psolus squamatus)) and a diverse array of coral species including Lophelia pertusa, Madrepora occulata, corkscrew-shaped antipatharian corals (Stichopathes sp., Leiopathes sp.), alcyonaceans (Anthemastus grandiflorus), stylasterids (probably Pliobothrus), gorgonians, and sea pens. Visible mobile fauna included numerous fish species, decapod crustaceans (Chaceon affinis) and sea stars (Brisingidae). In places the bedrock gave way to large areas of coral rubble framework in-filled with sand and colonised by a diverse range of fauna as described for the rock areas but including many erect sponge growths (including Aphrocallistes sp), ascidians, squat lobsters and other coral species. As the camera left the bedrock / coral reef region the seabed returned to a medium sand habitat with occasional cobbles and patches of lag gravel. Visible fauna were typical of sand habitat at this depth and included holothurians (Stichopus tremulus) and urchins (Cidaris cidaris, Calveriosoma sp.).

Hatton South_2_1 (Appendix, Fig. 28)
The target was an area with a change in backscatter response. The tow revealed one continuous habitat of medium muddy sand, with bioturbation seen throughout (urchin tracks and large U-shaped depressions). The transect began on a slightly rippled seabed, and as the transect neared the end there was an increase in ripple intensity. The faunal assemblage was generally consistent throughout; with an abundance of xenophyophores and small ophiuroids (sp 1). Other fauna regularly encountered were echinoids (3 species) and fish: Chimera monstrosa, grenadiers (probably Coryphaenoides rupestris) and eel-like fish (possibly Lycodonus flagellicauda).

Hatton South_2_2 (Appendix, Fig. 29)
The target was the Northern pinnacle (box 1), with an approximate elevation of 35m above the ridge (25m above seabed) and probably igneous in origin. The video track began at the base of the pinnacle with an area of medium
sand substrate with few conspicuous epifauna other than small ophiuroids (sp 1). The substrate then gradually changed to coarser sand with organic debris, and abundance of epifauna increased with the presence of xenophyophores and fish: grenadiers (probably Coryphaenoides rupestris) and eel-like fish (possibly Lycoodon flagellicauda). The camera then passed over a brief area of pebbles and cobbles with biogenic debris, covering approximately 20% of the seabed. Little epifauna were observed within this area, with the exception of a few anemones and a large unidentified coral (possibly a Stylasterid). As the camera continued it encounters a medium-coarse sand substrate with some biogenic debris coverage. Conspicuous epifauna included xenophyophores, unidentified fish (due to camera elevation) and a few cup corals (Caryophyllia sp.). The sand gradually became more gravely before changing into a biogenic gravel (predominantly coral) habitat, covering approximately 75% of the underlying seabed, with few visible epifauna. As the camera continued up the flanks of the pinnacle it crossed a brief cobbles area covering approximately 25% of the seabed with lumps of the scleractinian coral Lophelia pertusa visible, although little other epifauna were observed. As the camera proceeded along the tow, the cobbles area graduated into an area of coral rubble with some cobbles and biogenic gravel, covering between 50 and 80% of the seabed; conspicuous fauna observed were fish. As the camera neared the summit of the pinnacle a biogenic reef, with a typical dead Lophelia framework (50-100% coverage) edge was evident, which also had live L. pertusa, gorgonians, crinoids and hydroids. As the camera traversed the reef, the framework became a more structured reef (covering 100%) with a diverse assemblage of corals, crinoids, echinoids and other fauna. In addition to the L. pertusa framework, the reef consisted of a diverse mixture of corals (live): scleractinians (Madrepora oculata and cup corals - Caryophyllia spp); gorgonians, including Bamboo corals (probably Keratoisis sp.); soft corals; corkscrew-shaped antipatharian coral (Stichopathes sp.) and a purple encrusting octocoral was abundant on the Lophelia. Other conspicuous fauna were asteroids (Peltaster placenta and Henricia sp.) pencil urchins (Cidaris cidaris), ascidians, Galathea sp., sponges (blue encrusting sponges and globose sponges) and fish (although unidentified due to difficulty with observation). Other less frequently observed fauna included antipatharians (possibly Parantipathes sp.). The reef continued as the camera transverse the edge of the pinnacle summit and continues down the flanks. As the camera continued to descend down the flanks of the pinnacle, Lophelia framework with a rubble boarder was encountered again, covering between 80 and 100% of the seabed. Conspicuous fauna included live and dead L. pertusa, live M. oculata, hydroids, sponges, solitary corals and occasional fish. The rubble graduated into an area of biogenic gravel (coral fragments) with a coverage of between 30-60% of the seabed. Little epifauna were visible, only a few cup corals (Caryophyllia sp) and fish were observed. The habitat then changed into a brief cobbles area with 5-10% coverage, with some epifauna attached to the cobbles (predominantly Caryophyllia sp.) and fish. As the camera progressed to the end of the transect, off the flanks on to the seabed the cobbles become more frequent with pebbles (40% coverage), but little epifauna were visible.
Hatton South_2_3 (Appendix, Fig. 30)
The target was a ridge south of the 3rd pinnacle (box 1). The transect began on a slightly rippled coarse sand substrate. Fauna frequently observed throughout were fish: grenadiers (probably *Coryphaenoides rupestris*), eel-like fish (possibly *Lycodon flagellicauda*) and unidentified fish; small ophiuroids (sp 1) and polychaetes. The pencil urchin (*Cidaris cidaris*) and the holothurian *Stichopus tremulus* were occasionally observed. After the camera traversed the long sand habitat it passed over a brief cobbles (5% coverage) habitat characterised by fish: eel-like (possibly *Lycodon flagellicauda*), *Lepidon* sp. and other unidentified fish. Subsequently, another sand habitat was encountered, with little epifauna other than xenophyophores and the occasional pencil urchin (*Cidaris cidaris*), holothurians (*Stichopus tremulus*) and fish. As the camera progressed along the ridge toward the pinnacle, areas of patch coral rubble with intermittent sand were continuous until the end of the transect. The rubble areas consisted of dead *L. pertusa* covering between 10-60% of the seabed. These areas were characterised by live corals (including *M. oculata*) crinoids, fish and occasional echinoids. The intermittent coarse sand areas were characterised by eel-like fish (possibly *Lycodon flagellicauda*) occasional holothurians (*Stichopus tremulus*) pencil urchins (*Cidaris cidaris*) and xenophyophores.

Hatton South_2_4 (Appendix, Fig. 31)
The target was the summit of a pinnacle (box 1). The transect began on the summit of the pinnacle where biogenic reef (coral) covering 100% of the seabed with a high elevation was encountered. The reef consisted of a *L. pertusa* framework (mostly dead) with a diverse assemblage of other corals, including: scleractinians (*M. oculata* and solitary corals); antipatharians, including corkscrew-shaped antipatharian coral (*Stichopathes* sp.); gorgonians (*Callogorgia* sp.); and a purple octocoral encrusting the *Lophelia*. Other conspicuous fauna included crinoids (sp 1) bryozoan, ascidians, *Porania* sp. and occasional fish. As the camera progressed down the flanks of the pinnacle on to flat seabed, the framework became less elevated and with less coverage (80-95%) until it graduated into distinctive rubble (50-85%), with little visible epifauna. As the camera traversed the rubble area, it gradually became sparser (10-30%) but the faunal assemblage changed: there were live corals within the rubble, including *L. pertusa*, *M. oculata*, solitary corals, gorgonians (probably *Callogorgia* sp.) and antipatharians (*Leiopathes* sp.). The glass sponge *Aphrocallistes* sp. was also frequently observed. As the camera neared the end of the transect, the rubble changed into a broad stone habitat (5-30%), with both a boulder/cobbles and pebbles on sand habitat. Typical epifauna included encrusting fauna and fish, although not highly abundant. Towards the end of the transect there were corals attached to the rocks and burrowing ophiuroids.

Hatton South_2_5 (Appendix, Fig. 32)
The target was a hollow in box 1. The video track showed a continuous coarse sand substrate habitat with gravel in areas. As the camera traversed the area, ophiuroids (sp 1) were abundant throughout, and other fauna occasionally observed were echinoids (*Echinus* sp.) fish (Molva sp., *Lepidon*
sp. and possibly *Lycodonus flagellicauda* and holothurians (*Stichopus tremulus*).

Hatton South_3_1 (Appendix, Fig. 33)
The target was the Northern most pinnacle in box 2. The transect began near the summit of the pinnacle, with a biogenic reef (coral) covering between 80 and 100% of the seabed. The reef consisted of both dead and live *Lophelia pertusa* framework with a diverse range of other corals, including: other scleractinians, *Madrepora oculata* and cup corals (probably *Caryophyllia sp.*); a number of bamboo corals (probably *Acanella sp.*, *Isidella sp.* and *Keratoisis sp.*); corkscrew-shaped antipatharian corals (*Stichopathes sp.*) and possibly *Parantipathes sp.*; soft corals and a purple encrusting octocoral. Other fauna included basket stars (probably *Gorgonocephalus sp.*) bryozoan, fish (*Lepidon sp.* and *Sebastes sp.*) crinoids (at least 2 species) sponges (including the glass sponge *Aphrocallistes sp.*) hydroids, ascidians and echinoids (*Echinus sp.*). As the camera continued down the flanks towards the topographical low, patch coral rubble/framework was present, with less abundant but similar fauna as to that found on the reef. The rubble graduated into biogenic debris, with abundant ascidians, xenophyophores and sponges. As the flat area was traversed, the biogenic debris gave way to an area of mixed rock substrate (cobbles, pebbles and occasional boulders) with biogenic gravel infill. Epifauna were not highly abundant, with only a few species of anemones and erect sponges attached to the rocks.

Hatton South_3_2 (Appendix, Fig. 34)
The target was a pinnacle in box two. The tow was spilt into two, the first (HS_3_2a) was an identification run on the summit of the pinnacle where the ship was stationary to allow slow movement of the camera, thus allowing better quality images that may aid in the identification. Once the identification run was complete the transect commenced from the summit of the pinnacle (HS_3_2b) to the base.

The transect (HS_3_2b) began on the summit of the pinnacle with mostly dead *Lophelia pertusa* framework with areas of rubble, and unlike the other pinnacle the coral is more low lying. Despite this, there was 100% coverage of the seabed and a diverse array of organisms present. Conspicuous species included crinoids (sp 1) echinoids, pencil urchins (*Cidaris cidaris*) fish (*Lepidon sp.*) and corals: soft corals, scleractinians (possibly *Flabellum sp* and *Madrepora oculata*) and bamboo corals. As the camera descended the flanks of the pinnacle towards the topographical low, the coral framework became sparser (50% coverage) with sand patches. Although fauna were less abundant within this area, still a diverse range of organisms were present. These included: corals, antipatharians (*Stichopathes sp.*) scleractinians (*Madrepora oculata*) soft corals and bamboo corals; fish (*Lepidon sp.*); ascidians, crinoids (sp 1) and the sea star Porania sp. As the camera continued down the flanks, the rubble gradually gave way to more distinctive patch rubble with biogenic material present. Fauna were less abundant, with the glass sponge (*Aphrocallistes sp.*) ascidians and cup corals (*Caryophyllia sp.*) dominating. As the tow neared the end (a far distance from the pinnacle)
the habitat became a coarse gravel/biogenic substrate with very little visible epifauna.

Hatton South 3 3 (Appendix, Fig. 35)
The target was a circular depression that was highlighted on the multibeam in box 2. The tow began on flat seabed of rippled medium sand with detritus substrate; little epifauna were visible within this habitat. As the camera descended into the hollow, the habitat remained continuous until the base where the substrate became coarse with biogenic material and graduated into a pebble habitat. This habitat was very different to that of the other habitats, with an abundance of pebbles, detritus and biogenic material. There appears to be numerous tube worms (possibly sabellids) present, as well cup corals (*Caryophyllia sp.*). As the camera progressed out of the base of the hollow, the pebble habitat became for gravely until it gave way to a mixed rock substrate of boulders and cobbles on coarse gravely sand. Conspicuous fauna were anemones (*Phelliactis sp.*), cup corals (*Caryophyllia sp.*), erect sponges and squat lobsters. As the camera neared the end of the tow (out of the hollow and onto flat seabed) medium sand substrate with detritus and very little epifauna were apparent.

Hatton South 3 4 (Appendix, Fig. 36)
The target was the terraces (scarps) of the Western area of box 2. The transect began with a coarse gravely sand area with pebbles. Fauna included abundant polychaetes and solitary corals. As the camera continued along the tow, a brief bedrock outcrop is encountered with a higher abundance of fauna, including cup corals (*Caryophyllia sp.*), and cup sponges (*Axinella sp.*). Towards the end of the transect, the habitat changed to medium sand substrate with an abundance of polychaetes (sabellids), and other less abundant fauna (solitary corals, anemones and xenophyophores).

Hatton South 3 5 (Appendix, Fig. 37)
The target was the within the Northern area of box 2, this was a random tracks to see if there were any other habitats within this area. The tow began on an area of slight topographical high. Two distinct habitats were present: medium-coarse sand and coral rubble (10-30% cover). The tow began with a sand habitat which then had intermittent rubble and sand habitats throughout. Fauna present within the sand habitat were ophiuroids (sp 1) while those observed from the rubble habitat were: corals (*Stichopathes sp.*, *Madrepora oculata* and soft corals) crinoids, pencil urchin (*Cidaris cidaris*) and glass sponges (*Aphrocallistes sp.*).

3.1.2. George Bligh Bank
George_Bligh_C1 (Appendix, Fig. 38)
Target was a scarp slope. Tow began on a sand seabed. Visible fauna include cerianthid anemones, urchins (*Calveriosoma sp.*), fish, and small growths of *Lophelia pertusa* on occasional pebbles and cobbles. As the tow progressed cobbles and boulders became more frequent and were colonised by fauna typical of this depth and region (encrusting sponges, serpulid tube worms, holothurians (*Psolus squamatus*)) and in places *Lophelia pertusa*, rarely soft corals and gorgonians. As the camera neared the edge of the scarp
slopes the sediment became coarser with lag gravel, cobbles and, in places, bedrock. Fauna included anemones (*Phelliactis sp.*), antipatharian and stylasterid corals, and more typical encrusting fauna. Off the edge of the scarp slope the seabed descended onto a sandy slope with boulders and cobbles colonised by holothurians (*Psolus squamatus*), antipatharian corals, and rarely brisingid sea stars in typical feeding pose. At the base of the slope the seabed again became predominantly sand seabed with few visible fauna except fish (eel pout) and urchins. Upon downloading the image files it was apparent that the camera flash had failed resulting in loss of many images.

George Bligh_C2 (Appendix, Fig. 39)
The tow began ascending a slope of sand and coral gravel with larger dead coral fragments, and occasional cobbles colonised by small growths of live *Lophelia pertusa* and *Madrepora oculata*, antipatharian, stylasterid and cup corals, anemones (*Phelliactis sp.* and others), ascidians, squat lobsters, small concealed ophiuroids (possibly *Ophiactis balli*). As the camera reached the top of the slope the sediment changed to sand with sparse cobbles and pebbles before becoming a clean fine sand on the descending slope. Visible fauna on the fine sand habitat were cerianthid anemones, eel pout, grenadiers and urchins (*Calveriosoma sp.*). Upon downloading the image files it was apparent that the camera flash had failed resulting in loss of many images.

3.1.3 Rosemary Bank
RB_1_1 (Appendix, Fig. 40)
The target was a change in topography, a ridge of 40m elevation from the seabed. The transect began on an area of flat seabed which consisted of a coarse gravely sand with pebbles habitat (with an approximate coverage of 20-25%). The conspicuous fauna were pencil urchins (*Cidaris cidaris*) - which were abundant throughout the tow. As the video progressed up the slope of the ridge the substrate changes to a brief cobbles and pebbles area, still with *C. cidaris*, but also with anemones (*Phelliactis sp.*) and fish present. As the video continued to proceed up the slope of the ridge, an area of bedrock (basaltic) was observed – but with little epifauna visible. After the brief bedrock habitat, the substrate changed back to intermittent areas of pebbles with cobbles, and coarse sand with pebbles, both with coverage of between 30-60%. Conspicuous fauna of these areas included *Cidaris* (both habitats) and *Phelliactis sp.* , *Psolus sp.* and sponges within the cobble habitat. The transect ended at the top of the ridge with a coarse sand with pebbles area, again with abundant *C. cidaris*.

RB_1_2 (Appendix, Fig. 41)
The target was a scour (2m change in height) within the seabed. The transect began with a medium sand substrate with little epifauna other than the pencil urchin *Cidaris cidaris* and occasional *Chimera sp.* As the video progressed along the tow, a possible iceberg plough mark was apparent, where the substrate changed to a boulders with cobbles (20-40%) on medium sand habitat, with conspicuous fauna including Psolus sp., *Cidaris, Phelliactis sp.*, sponges and the blue-mouth redfish (*Helicolenus dactylopterus*). As the video crossed the plough mark, typical medium sand habitat with occasional pebbles was observed, with conspicuous fauna including cup corals (probably
Caryophyllia sp.) and abundant Cidaris. The camera continued to transverse the plough mark until reaching the final habitat of the tow – medium sand with abundant Cidaris. Other less abundant fauna includes fish and cup corals (probably Caryophyllia sp.).

RB_1_3 (Appendix, Fig. 42)
The target was a pinnacle, the transect was split into three due to the sheer size of the pinnacle.

RB_1_3a
The Target was the summit of pinnacle 1. The transect began with a mixed substrate habitat of well rounded cobbles, pebbles and biogenic material with a coverage of approximately 80%. There were little epifauna, with the exception of occasional Chimera monstrosa, squat lobsters and echinoids. As the video continued along the summit, boulders appeared amongst the mixed substrate, with sponges attached to the boulders. The transect continued with mixed pebbles and cobble substrate with little epifauna until the end.

RB_1_3b
The target was the upper slope of the Western flank of pinnacle 1. The transect began with a coarse sand with gravel and pebbles habitat. There were few conspicuous fauna, although there were an abundance of sea pens present throughout the tow. As the video continued down the flank, a brief cobbles area was encountered which graduated into a boulder habitat; again little epifauna other than fish were seen. The transect ended with a pebble (80% coverage) with sand habitat, with little epifauna.

RB_1_3c
The target was the lower slope of pinnacle 1. The transect began with a coarse gravel and pebbles habitat with a coverage of between 50-80%. Occasional boulders were also present. Little epifauna were visible; Cidaris cidaris and Chimera monstrosa were the most frequently observed fauna. As the video traversed the slope, it encountered a mixed substrate habitat comprising boulders with cobbles and pebbles, with small sponges and little other fauna. The tow continues onto a pebbles area with few visible epifauna.

RB_1_4 (Appendix, Fig. 43)
The target was a suspected iceberg plough marks. The transect began on a medium sand and pebbles habitat with little epifauna other than Cidaris cidaris and Chimera monstrosa (which were abundant throughout the sand habitats of the tow). As the camera crossed the plough mark, the substrate changed to a cobbles (30%) area, with abundant Phelliactis sp. attached. As the camera continued along the plough mark, another sand habitat with occasional pebbles and abundant C. cidaris was encountered. As the video continued to cross the plough mark, another mixed substrate area of boulders/cobbles with abundant Phelliactis sp. was observed. The video then crossed two more intermittent mixed substrate areas of boulders and cobbles. Sand areas were dominated by C. cidaris and the mixed substrate by Phelliactis sp. and Psolus sp.
RB_1_5 (Appendix, Fig. 44)
The target was a change in backscatter. The transect began with an area of medium sand substrate, conspicuous fauna included *Cidaris cidaris* and Caryophyllids, with occasional fish. As the video progressed along the transect, a broad mixed rock substrate area was encountered, ranging from pebbles to boulders. Conspicuous fauna within this habitat were the holothurian *Psolus sp.* attached to the rocks and *C. cidaris* on the seabed. The transect continue into another medium-sand habitat with an abundance of *C. cidaris* and some Caryophyllids.

RB_1_6 (Appendix, Fig. 45)
The target was a pinnacle, the transect began at the top of the pinnacle with bedrock outcrop. The bedrock consisted of patch areas with sand cover and very little visible epifauna. This habitat graduated into an area of pebbles and cobbles (almost 100% coverage) with little epifauna. As the video continued down the flanks of the pinnacle, a steep bedrock outcrop was encountered, and dominant fauna included *C. cidaris*, echinoids and *Helicolenus dactylopterus*. This area then graduates into a large mixed rock area with pebbles and cobbles predominantly, but also with patches of bedrock. This area was characterised by *Cidaris cidaris* and echinoids. The remaining tow had intermittent areas of pebble substrate and area of mixed rock (pebbles-boulders). Typical fauna of both substrate types were the echinoid *Cidaris cidaris* and the holothurian *Psolus sp.*

RB_1_7 (Appendix, Fig. 46)
The target was a hollow on the North West flank of pinnacle 2. The transect began with an abundant pebble substrate with little epifauna other than echinoid (including *Cidaris cidaris*) and blue-mouth redfish (*Helicolenus dactylopterus*). As the camera traversed the hollow, a steep bedrock outcrop with boulders was visible. Epifauna were not particularly abundant, although a large gorgonian, possible stylasterids and pennatulids were present. As the camera moved up the steep ledge, the dominant bedrock gave way to boulders with patches of bedrock. Conspicuous fauna were *Psolus sp.* and encrusting fauna. The remaining transect consists of intermittent mixed substrate of cobble and boulders bordered with abundant pebbles with sand. The first substrate had an abundance of *Psolus sp.* and occasional *Helicolenus dactylopterus*, whereas the latter generally had little epifauna with the exception of *Cidaris cidaris* and echinoids. As the transect neared the end, prominent mega-ripples with abundant pebbles were apparent.

RB_1_8 (Appendix, Fig.47)
The target was an area between two pinnacles. The transect began with an area of abundant pebbles (50%) with some biogenic material. Fauna observed throughout the tow were *Psolus sp.* and *Cidaris cidaris*. The substrate graduated into pebbles (10%) with biogenic material, with dominant fauna including *C. cidaris* and Caryophyllids. As the video continued along the transect an area of directional mega-ripples composed of pebbles was apparent. This habitat had little epifauna present. The substrate then continued to change to a broader pebble and cobbles habitat, with slight sand
ripples with an abundance of *Psolus sp.*, *C. cidaris* and the biscuit urchin *Echinus acutus*. Finally, the transect finished with another mega-ripple habitat (with pebbles), characterised by biscuit urchins.

**RB_1_9 (Appendix, Fig. 48)**
The target was the top of a pinnacle, the transect began with an area of abundant pebbles (80%) with biogenic material. Little epifauna were visible with the exception of the echinoid *Cidaris cidaris*. As the transect continued, the substrate changed to less coverage of mixed cobbles and pebbles, again characterised by *Cidaris*, but also by an unidentified echinoid. As the video continued it passed another abundant pebbles habitat (100%) with typical *C. cidaris* and other echinoid species. The substrate graded into another mixed pebbles and cobbles area before reaching a mixed boulders and cobbles area, with 70-100% coverage and *C. cidaris* and *Helicolenus dactylopterus* present. The end of the tow sees a bedrock outcrop (60%) with little fauna before the final habitat: mixed pebbles and cobbles area (80-100), with typical *C. cidaris* and *Helicolenus dactylopterus*.

**RB_1_10 (Appendix, Fig. 49)**
The target was a small pinnacle, beginning with bedrock substrate with biogenic in-fill (100%). Conspicuous fauna were barnacles, asteroids, holothurians (*Psolus sp.*), pencil urchins (*Cidaris cidaris*), corals (*Madrepora oculata*), and fish (*Chimera sp.*). As the video continued, the bedrock gave way to a mixed boulder, cobbles and pebbles substrate, with 20-45% coverage. Typical fauna were holothurians (*Psolus sp.*), echinoids (*Echinus sp.*), blue-mouth redfish (*Helicolenus dactylopterus*) and ling (*Molva sp.*). As the camera continued to the end of the tow, a pebbles substrate (30% cover) was encountered, although with little epifauna.

**RB_2_1 (Appendix, Fig. 50)**
The target was a North facing slope on a terrace in box 2. The tow began with an area of mixed cobbles and pebbles, with coverage of between 50-80%. Fauna were not highly abundant, although a few decapods, holothurians (*Psolus sp.*), crinoids and encrusting fauna (blue encrusting sponge) were observed. As the transect continued down the slope, boulders became more frequent. Fauna within this mixed substrate were encrusting organisms, cup sponges, anemones, corals (*Madrepora oculata, Pliobothrus sp.*, soft coral and what maybe bamboo coral) and fish (*Lepidon sp.*). As the camera continued to the end of the tow, a pebble habitat was encountered, with distinctive ripples and little epifauna.

**RB_2_2 (Appendix, Fig. 51)**
The target was a gully. The transect began with an abundant pebbles covered area (95%). Typical fauna included fish (eel-like, possibly *Lycodonus flagellicauda*), red echinoids and blue encrusting sponge. As the video passed through the gully, the pebbles area became coarser with cobbles present; conspicuous fauna included encrusting sponges, holothurians (*Psolus sp.*) fish (unidentified) and corals (*Stichopathes sp.*, *Lophelia pertusa, Madrepora oculata* and solitary corals). As the tow continued another pebble habitat was present, with the same fauna as the previous pebble habitat. A
brief bedrock outcrop habitat was then encountered with mostly (although not highly abundant) corals: the corkscrew-shaped antipatharian (*Stichopathes sp*) *Lophelia pertusa* and an unidentified gorgonian. As the camera continued to the end of the tow, the final habitat encountered was a pebble substrate with very little visible epifauna.

**RB_3_1** (Appendix, Fig. 52) Qualities of some of the habitat images are poor due to the topography and thus difficulty landing the camera. The target was a trench in box 3, the transect began on the ridge where a mixed rock substrate of cobbles, pebbles and gravel was found. Epifauna were not highly abundant, although some anemones and encrusting sponges were evident. As the camera proceeded towards the edge of the ridge a brief bedrock outcrops with mixed rock substrate (boulders and cobbles) was present - with encrusting fauna. As the camera continued down the trench, an abundant pebbles habitat (90% cover) was encountered with little epifauna visible. Towards the end of the tow the substrate graduated to the same habitat as that at the beginning (cobbles and pebbles) with some encrusting fauna and sea stars present.

**RB_3_2** (Appendix, Fig. 53) The target was a slope, the transect began at the slope edge with a mixed rock substrate (cobbles and pebbles). Directional ripples (pebbles) were dominant, indicating the presence of a strong current. Fauna present were, abundant ophiuroids (sp 1) and encrusting fauna on the cobbles. As the camera descended the slope, the same habitat was observed, although the rock substrate was less abundant and the ripples were sand rather than pebbles, little visible epifauna other than the fish *Lepidon sp.* were observed. At the base of the slope few cobbles were present, it was predominantly abundant pebbles (90% cover); ophiuroids (sp 1) were abundant in this habitat.

### 3.1.4 Wyville-Thompson Ridge

**WTR_1** (Appendix, Fig. 54) The target was the upper slope of a crevice. One continuous habitat of mixed rock substrate with boulders, cobbles and biogenic/ gravel infill (total coverage of 100%) occurred. Bedrock may also be present, although visibility is poor in places due to the speed of the camera – thus this is uncertain. Throughout the tow, the habitat did not significantly change, and for the most part the same was true of the faunal assemblage. Dominant fauna were encrusting and erect sponges, hydroids, pencil urchins (*Cidaris cidaris*), anemones (possibly *Bolocera sp.*) squat lobsters and fish, including blue-mouth redfish (*Helicolenus dactylopterus*) and ling (*Molva spp.*). Stylasterids (*Pliobothrus sp.*) and soft corals (*Capnella glomerata*) and were also abundant.

**WTR_2** (Appendix, Fig. 55) The target was the lower slope of a crevice. The tow began on an area of bedrock outcrop with cobbles. Conspicuous fauna observed were corals, including scleractinians (*Lophelia pertusa and Madrepora oculata*) soft coral (*Capnella glomerata*) and stylasterids (*Pliobothrus sp.*). Other fauna present were squat lobsters, pencil urchins (*Cidaris cidaris*), encrusting sponges, and
anemones (*Phelliactis sp*). As the camera descended the slope of the crevice, the substrate changed to a mixed rock area with pebbles, cobbles and the occasional boulders (75-100% cover). Epifauna included, pencil urchins (*Cidaris cidaris*) globose and encrusting sponges, anemones (*Phelliactis sp* and unidentified) fish (*Lepidon sp.*) and corals (*L. pertusa* and *M. oculata*).

WTR_3 (Appendix, Fig. 56)
This run was terminated after 300m. The fast currents present in the region made it difficult to control the camera safely. Another tow in the same region was attempted at a better angle to the prevailing current (WTR_14). The tow traversed an area of the lower slope on the edge of a headland on the Faeroe-Shetland Channel side of the Wyville-Thompson Ridge. The seabed was composed of cobble and boulders lag with, in places, a very thin sand covering. The habitat changed very little during the tow although toward the end of the run as the camera approached a gully feature in the headland the substratum became cleaner and the fauna were showing signs of possible change in the dominant species. The sea floor was dominated by two species, an ophiuroid and an anemone. A brittle star bed (Ophiuroidea) covered much of the substratum throughout the transect at an estimated density of 900 individuals per m$^2$. A zoanthid anemone also dominated the seabed with polyps at similar estimated densities. Other numerically dominant species included sabellid tube worms which formed dense aggregations on boulders, and soft corals (possible Nephtheic octocoral). Other species present included yellow feather stars (*Crinoidea*), tubularid hydroids, many morphospecies of encrusting and erect sponges, actinid anemones (possibly *Urticina* sp), burrowing anemones, cup corals (*Caryophyllia* sp), sea pens (*Pennatulacea*), sea stars (*Crossaster* sp.) and rarely octopus and fish.

WTR_4 (Appendix, Fig. 57)
This transect lay on the same headland as WTR_3 and 11 but up slope and in a less exposed region. As a result the fauna is similar to that described in these transects. The target of this transect was a boundary between high and low backscatter observed in the multibeam data. Strong currents were present throughout the tow and it was difficult to control the camera. The transect began at approximately 700m depth and proceeded up slope. The seabed was composed of cobble and pebble lag gravel with occasional boulders. A brittle star bed (Ophiuroidea) covered much of the substratum within this habitat at an estimated density of 1000 individuals per m$^2$. In addition a species of soft coral, not observed at other stations in the area, was prominent. Other fauna observed included sabellid tube worms, tubularid hydroids, many morphospecies of encrusting and erect sponges, actinid anemones (possibly *Urticina* sp), burrowing anemones, and cup corals (*Caryophyllia* sp). As the camera began to ascend a steeper region of the slope the fauna abruptly changed. This corresponded with the change in backscatter observed on the multibeam. Here cup corals (*Caryophyllia* sp.) carpeted the sea floor, live corals packed in with the skeletons of dead corals. Within the dead skeletons the brittle stars were visible suggesting the continuation of the brittle star bed in this habitat. In addition colonies of the soft coral observed previously were clustered throughout the habitat. In places
other species were visible and included large porous white sponges, erect porous yellow sponges, stylasterid corals, urchins (Echinus sp.), tubularid hydroids, branching hydroids and encrusting sponges. Toward the end of the transect the habitat abruptly changed again corresponding with a change in the multibeam backscatter. The cup corals (Caryophyllia sp.) all but vanished and the lag gravel and cobble seabed was once again visible. Ophiuroids still dominated the faunal assemblage, with stylasterid corals, brachiopods, soft corals, large erect sponges, encrusting sponges and small crinoids also observed. Discarded fishing gear was observed during this transect.

WTR_5 (Appendix, Fig. 58)
The transect was divided into two parts (WTR_5 and WTR_6) as the run had to be terminated part way through as a result of the current regime. The target was a distinct area of low backscatter towards the base of a slump or sediment fan at the base of the Wyville-Thompson Ridge on the Faeroe-Shetland Channel side, at approximately 800m water depth. The transect began on the lower slope in an area of dense cobble and boulder cover on lag gravel. The cobbles and boulders were covered with a fine layer of sand. As the camera progressed down-slope there was little change in habitat. Within this habitat the biology was dominated by the presence of a brittle star bed (Ophiuroidea), which covered much of the substratum at an estimated density of 250 individuals per m$^2$. Other species frequently observed included many morphospecies of encrusting sponge (>10), many morphospecies of erect sponge (>10), erect bryozoans (Reteporella sp. and cyclostomes), anemones, soft corals (Alcyonacea, including possible Nephtheic octocorals), hydroids, and sea stars (Henricia sp., Crossaster sp.). At the base of the slope there was an abrupt change in habitat, indicated by the appearance of deposited whelk shells. Here the substratum changed to rippled sand habitat as the camera crossed onto a sand bar deposited at the base of the slope. The biology of the sand bar was dominated by a single species of burrowing anemone (possibly a Halcampid anemone), that occurred at a density of 30-50 individuals per m$^2$. The only other visible fauna were fish, which were rarely observed. The run was terminated early.

WTR_6 (Appendix, Fig. 58)
This transect began where WTR_5 finished, on a sand bar deposited at the base of the Wyville-Thompson Ridge, faunally dominated by a single species of burrowing anemone (possibly a Halcampid anemone), that occurred at a density of 30-50 individuals per m$^2$. As the camera moved off the sand bar the habitat changed to sandy gravel with rare cobbles and boulders. The single species of burrowing anemone initially still dominated the biology at a similar density as on the sand bar, however the density of cobbles and boulders increased corresponding with a decrease in density of the anemone and other species became visible. These included tubularid hydroids, erect sponges, actinid anemones (possibly Urticina sp), cup corals (Caryophyllia sp), soft corals (Alcyonacea, including possible Nephtheic octocorals) and ophiuroids. Other more typical encrusting forms were also observed attached to the cobbles.

WTR_7 (Appendix, Fig. 59)
The transect was approximately 550m long and crossed two iceberg plough marks on the summit of the Wyville-Thompson Ridge. The seabed alternated between a medium sand with some exposed lag gravel between and within the furrows of the plough marks, areas of dense (approx 50% coverage) cobbles and occasional boulders demarking the edges of the plough mark features and a mix of the two where more the one plough mark met. The Transect began on an area where more than one plough mark had met and hence the habitat was composed of a sandy lag gravel with occasional cobbles. As the tow progressed the camera passed over the edge of the first plough mark (cobble and boulder habitat), into the trough of the plough mark (sandy lag gravel habitat), on to the far edge of the first plough mark and the starting edge of the second plough mark (cobble and boulder habitat), into the trough of the second plough mark (sandy lag gravel habitat), finally ending on the far edge of the second plough mark (cobble and boulder habitat). Visible epifauna in the sand/lag gravel habitat were sparse but included those typical of the depth and substratum type in the Rockall Trough and included urchins (Cidaris cidaris and Echinus acutus), holothurians (Stichopus tremulus) and fish (Chimaera monstrosa). Within the dense cobble and boulder habitat at the edge of the plough mark features characteristic fauna included typical encrusting and attached species (saddle oysters, globose erect, cup and encrusting sponges (many morphospecies), cup corals (Caryophyllia sp) and mobile species (squat lobsters (Munida rugosa) blue mouth red fish (Helicolenus dactylopterus).

WTR_8 (Appendix, Fig. 60)
The target was an area on the summit of Wyville-Thompson Ridge where overflow of water from the Faeroe-Shetland Channel was expected to occur. In addition the transect also crossed a boundary from high to low multibeam backscatter. The transect began on a medium sand rippled seabed. Visible fauna were sparse and composed of those species typical of the depth, substrate and location, and included urchins (Cidaris cidaris and Echinus acutus), fish (Chimaera monstrosa), hermit crabs (Paguridae) and holothurians (Stichopus tremulus). As the camera moved off the area of high backscatter gravel became a more conspicuous component of the substratum and occasional cobbles were visible. The ripples eventually disappeared and the substratum changed to sandy lag gravel. The fauna within this habitat differed little from that described previously. However, the blue mouth red fish (Helicolenus dactylopterus) and squat lobsters (Munida rugosa), species typical of more cobbled areas were observed, while the occasional cobbles were colonised by encrusting and erect sponge forms, particularly cup sponges.

WTR_9 (Appendix, Fig. 61)
The target was a down slope gully in the lower slope on the edge of a headland on the Faeroe-Shetland Channel side of the Wyville-Thompson Ridge. The transect cut a transverse section through the gully at approximately 800m depth. The seabed habitat and fauna were very similar to that observed in WTR_4, WTR_3 and WTR_14, which were adjacent to this transect. The seabed was composed of cobble and pebble lag gravel with occasional boulders. A brittle star bed (Ophiuroidea) covered much of the
substratum within this habitat at an estimated density of 600-800 individuals per m$^2$. A zoanthid anemone was also dominant at an estimated density of 300-600 polyps per m$^2$. Other numerically dominant species included sabellid tube worms which formed dense aggregations on boulders, and soft corals (possible Nephtheic octocoral). Other species present included, yellow feather stars (Crinoidea), tubularid hydroids, many morphospecies of encrusting and erect sponges, actinid anemones (possibly *Urticina* sp), burrowing anemones (possibly a Halcampid), basket stars (*Gorgonocephalus* sp.), sea slugs (nudibranch) octopus and fish (*Lycodes* sp. and others). As the camera descended into the gully the faunal composition changed although the substratum remained lag gravel with cobbles and occasional boulders. The dominant zoanthid all but disappeared, and the ophiuroid bed became less dense with a general apparent reduction in all species biomass. Part of the way through the gully corresponding with a small rise in topography the faunal composition returned to that observed previously, with the zoanthid again dominant, however it quickly disappeared again as the camera moved away from the base of the topographic high. In this second section of the gully burrowing anemones became more frequent and the substratum appeared cleaner. As the camera moved toward the far edge of the gully actinid anemones and the dominant zoanthid increased in abundance. Crinoids also became more abundant and there appeared to be a general increase in species biomass. Throughout the tow the current was very slack as evidenced by the slow speed of the camera and the persistence in the water column of disturbed sediment. Given the faunal composition of the region it would be expected that fast flowing currents, as seen in the adjacent transects would be present. This suggests that current flow may be episodic.

WTR_10 (Appendix, Fig. 62)
The transect was approximately 500m long and ran down slope from 800m depth to the base of the Faeroe-Shetland Channel. The transect was positioned between WTR_9 and WTR_14. The slope seabed was composed of cobble and pebble lag gravel with occasional boulders and areas of rock outcrop as a result of the steep incline. The fauna of the slope was similar to that observed at WTR_9 and 11. Actinid anemones (possibly *Urticina* sp) were relatively abundant and in places densely colonised available rock outcrop. Other numerically dominant species included sabellid tube worms which formed dense aggregations on boulders yellow feather stars (Crinoidea), and in places ophiuroids. Several species of soft corals, tubularid hydroids, zoanthid anemones, sea stars (*Henricia* sp. and *Crossaster* sp.), burrowing anemones and encrusting and erect sponges were also common. Occasionally observed species included basket stars (*Gorgonocephalus* sp.), sea spiders (Pycnogonida) whelks (Gastropoda), octopus (Cephalopoda) and fish. As the camera progressed from the slope onto the base of the Faeroe-Shetland Channel the abundance of cobbles and boulders within the lag gravel decreased and rock outcrop was no longer observed. There was, however, no noticeable change in fauna.
The transect was approximately 700m long and crossed at least three distinct iceberg plough marks on the Rockall Trough side of the summit of the Wyville-Thompson Ridge. The seabed alternated between a medium sand with some exposed lag gravel between and within the furrows of the plough marks, areas of dense (approx 50% coverage) cobble and boulder coverage demarking the edges of the plough mark features and a mix of the two where more the one plough mark met. Visible epifauna in the sand/lag gravel habitat were those typical of the depth and substratum type in the Rockall Trough and included urchins (*Cidaris cidaris* and *Echinus acutus*), holothurians (*Stichopus tremulus*) and fish (*Chimaera monstrosa*). Within the dense cobble and boulder habitat at the edge of the plough mark features characteristic fauna included typical encrusting and attached species (saddle oysters, globose erect, cup and encrusting sponges, stylasterid and cup corals (*Caryophyllia* sp)) and mobile species (squat lobsters (*Munida rugosa*) blue mouth red fish (*Helicolenus dactylopterus*)). The intermediate habitat as expected supported a mixture of the two faunas.

The transect was approximately 650m long and crossed two iceberg plough marks on the summit of the Wyville-Thompson Ridge. As with WTR_11 the seabed alternated between a sand-exposed lag gravel habitat observed between and within the furrows of the plough marks, areas of dense (approx 50% coverage) cobble and boulder coverage demarking the edges of the plough mark features, and a mix of the two where more the one plough mark met. The transect began in the furrow of an iceberg plough mark within the sand and lag gravel habitat. Visible epifauna were sparse but included those typical of the region, substrata and depth (urchins (*Echinus acutus*), holothurians (*Stichopus tremulus*) and fish (*Chimaera monstrosa*). Within the cobble and boulder habitat of the plough mark edges visible species included numerous morphospecies of encrusting sponge of many colours, erect sponge growths, cup corals (*Caryophyllia* sp.), anemones, small stylasterid corals (), cyclostome bryozoans, sea stars (*Stichastrella rosea*) squat lobsters (*Munida rugosa*) and the blue mouth red fish (*Helicolenus dactylopterus*). As with WTR_11 the transition region between the two habitats supported a mixture of the two faunas.

The target was an anomalous hole on the summit of the Wyville-Thompson Ridge approximately 10m deep and 100m in diameter at a depth of 450m. Transect began on a sand and lag gravel seabed with occasional cobbles. Visible fauna were those typical of this region, depth and habitat and included urchins (*Cidaris cidaris* and *Echinus acutus*) and holothurians (*Stichopus tremulus*), with squat lobsters (*Munida rugosa*), erect sponges (*Phakellia sp.* and *Axinella sp.*) and numerous encrusting sponges, stylasterid and cup corals (*Caryophyllia* sp.), and cyclostome bryozoans attached to the cobbles and boulders. As the camera approached the edge of the hole the cobbles became more frequent but then the whole seabed changed becoming a rippled sand habitat. Few fauna were visible in this habitat although the rabbit fish (*Chimaera monstrosa*) and the urchin (*Cidaris cidaris*) were occasionally
observed. As the camera descended into the hole the seabed habitat abruptly changed to a dense cobble and lag gravel coverage with similar species to those observed outside the hole. As the camera reached the base of the hole the habitat again changed to rippled sand with few visible fauna. The habitat then gradually changed into lag gravel, with distinct piles of whelk shells presumably sorted by the currents. Here the only visible fauna were urchin shells (*Cidaris cidaris* and *Echinus acutus*). As the camera began to ascend the slope out of the hole the seabed was again densely covered by cobbles, lag gravel and occasional boulders. Here the visible fauna was as described previously for this habitat but with the addition of occasional Brisingid sea stars.

WTR_14 (Appendix, Fig. 66)
The tow traversed an area of the lower slope on the edge of a headland on the Faeroe-Shetland Channel side of the Wyville-Thompson Ridge, passing over a small gully in the headland and descending an exposed slope onto the base of the Faeroe-Shetland Channel. The current was very strong making filming difficult. The seabed was composed of cobble and boulder lag. The transect began on the lower slope in an area adjacent to WTR_3. As with WTR_3 the sea floor was dominated by two species, an ophiuroid and an anemone. A brittle star bed (Ophiuroidea) covered much of the substratum throughout the transect at an estimated density of 900 individuals per m$^2$. A zoanthid anemone also became dominant as the camera descended the slope to the gully at similar estimated densities. Other numerically dominant species included sabellid tube worms which formed dense aggregations on boulders, and soft corals (possible *Nephtheic* octocoral). Other species present included, tubular hydroids, many morphospecies of encrusting and erect sponges particularly a yellow globular porous species, actinid anemones (possibly *Urticina* sp), cup corals (*Caryophyllia* sp), sea stars (*Crossaster* sp., *Henricia* sp.), basket stars (*Gorgonocephalus* sp.), yellow feather stars (*Crinoidea*), and fish (Rajidae and others). As the camera passed through the gully there was no noticeable faunal change although the lag gravel was cleaner (no thin sand veneer). However as the camera passed out of the gully onto the exposed edge of the headland a burrowing anemone briefly became numerically dominant, occurring at an estimated density of approximately 200 individuals per m$^2$ on clean lag gravel. As the camera descended the exposed lower slope cobbles and boulders became more frequent and the faunal community changed with yellow feather stars (Crinoidea) becoming abundant (estimated at 3-6 per m$^2$) and the zoanthid anemone and sabellid tube worms being numerically dominant. The ophiuroid bed was still present but at lesser densities (Other prominent species included actinid anemones (possibly *Urticina* sp), soft corals, and erect globose sponges, in addition to all those species already observed previously within the tow. Species of note included pycnogonids and octopus. At the base of the slope the camera passed through a small moat. Here the habitat was composed of clean lag gravel and all fauna were much less abundant. Leaving the moat out onto the floor of the Faeroe-Shetland Channel the fauna were similar to that observed on the exposed slope but there appeared to be less biomass. Boulders and cobbles were rare and the ophiuroids, sabellid tube worms and zoanthids were no longer the dominant fauna. Soft corals appeared more abundant than on the
slopes and the yellow feather stars (Crinoidea) remained present at high densities (3-6 m$^2$).

WTR_15 (Appendix, Fig.67)
The target was the opposite edge of the slump (or sediment fan) targeted in WTR_5. The transect ran from near the base of the slump, down slope and out onto the base of the Faeroe-Shetland Channel. The slump was composed of lag gravel of pebble and cobble size and was essentially a scree slope. The fauna of the scree slope was dominated by a single species of burrowing anemone (the same species observed in high densities on the far side of the slump in WTNR_3) and ophiuroids at estimated densities 100 and 400 individuals per m$^2$ respectively. The yellow feather star (Crinoidea) was also present at relatively high densities (6 individuals per m$^2$). Other identifiable fauna were rare but included sea spiders (Pycnogonida), large white vase shaped sponges, small growths of soft coral, sea stars (Crossaster sp.), actinid anemones, tubularid hydroids, sabellid tube worms, and fish. As the camera reached the transition from scree slope to the base of the Faeroe-Shetland Channel cobbles and boulders became a more frequent component of the lag gravel seabed. The fauna also showed a corresponding change. Burrowing anemones became much less abundant while soft corals and sabellid tube worms became much more abundant. Zoanthid anemones were also visible forming dense patches of polyps, sea pens, ascidians, and sea stars (Crossaster sp.) were also observed. The yellow feather star (Crinoidea) and ophiuroids remained at relatively high densities throughout the transect.

3.1.5 West Shetland Channel
WSC_1 (Appendix, Fig. 68)
The target was the lower slope down a channel, the video transect ran along the base of the channel descending 10m down a small slope. The transect began at the top of the slope with a soft fine sand/mud substrate, sediment was easily disturbed by the camera (thus visibility was poor in places). Epifauna were not highly abundant throughout the tow, but a number of taxa were present, including: ophiuroids (burrowing and Ophiura sp.) sabellid tube worms, hydroids, soft corals and anemones (sp 1). Occasional crinoids, ctenophores, asteroids (Astropecten sp.) sea pens and tubular sponges were also observed within this habitat. As the camera descended the small slope the substratum became coarser initially with small quantities of gravel, but with pebbles and cobbles becoming more evident. Epifauna included tubular sponges, soft corals, anemones (sp 1 and cerianthid) and hydroids (possibly Tubularia sp.). As the camera continued, a brief sand/mud substrate was evident, with little epifauna other than burrowing ophiuroids. Towards the bottom of the slope another mixed pebble and cobble habitat was encountered, with hydroids (possibly Tubularia sp.) soft corals and tubular sponges. As the camera reached the end of the tow, the habitat changed to a mixed boulder substrate, with more abundant epifauna; occasional sea pens, tubular sponges, soft corals and hydroids (possibly Tubularia sp.).
WSC_2 (Appendix, Fig. 69)
The target was a channel; the camera began on the edge of the channel, descended 50m then up the other side. At the beginning of the tow the topography was relatively flat, consisting of a fine sand substrate with lag gravel, with abundant ophiuroids. Other, less abundant epifauna were hydroids, crinoids, anemones (sp 1) soft corals and small sea pens. As the camera continued along the flat seabed toward the edge of the channel the substrate became coarse with a mixed boulder, pebble and cobbles habitat. Epifauna were significantly more abundant, dominant fauna included crinoids (2 sp) anemones (sp 1 and unidentified) echinoids, basket stars (*Gorgonocephalus sp.*) small sea pens and soft corals (2 sp). As the camera reached the edge of the channel, boulders became sparser until the substrate graduated back to pebbles and cobbles, this habitat continued down the slope, less epifauna were present. Toward the bottom of the slope the substrate changed to gravely sand with very little fauna. As the camera began it ascent up the other slope of channel, the gravel graduated into lag gravel with cobble, boulders and bedrock outcrop, the slope is very steep – which is apparent from the angle of the camera. Fauna became more abundant as the camera progressed up the slope, with abundant basket stars (*Gorgonocephalus sp.*) crinoids, soft corals, hydroids, anemones and small sea pens. As the camera reaches the top of the slope, the substrate become less coarse and the fauna less abundant, although toward the end of the tow (plateau) crinoids became very abundant.

WSC_3 (Appendix, Fig. 70)
The target was down a slope of a channel. The tow began on the mid slope of the channel with fine sandy sediment with ripple troughs, and although epifauna were not highly abundant there were obvious signs of infaunal activity (burrows, tracks etc). Epifauna present were rays, anemones (sp 1 and unidentified) gastropods and tube worms. This habitat was continuous as the camera traversed the tow until descended a 10m slope, changing to a mixed cobble/boulder on lag gravel habitat (more abundant epifauna). Conspicuous fauna included hydroids (possibly *Tubularia sp.*) soft corals, small sea pens, crinoids, ophiuroids, sun stars (*Crossaster sp.*) gastropods, basket stars (*Gorgonocephalus sp.*) anemones and abundant rays.

WSC_4 (Appendix, Fig. 71)
The transect revealed one continuous habitat of rippled sand, with occasional cobbles and small amounts of gravel in ripple troughs, the proportion of gravel varied throughout the tow as did the cobbles. Epifauna were not highly abundant, typical fauna observed were, crinoids, anemones, ophiuroids (sp 2) shrimps, erect and encrusting sponges, soft corals and hagfish (*Myxine glutinosa*). Towards the end of the tow, the substrate became more rippled, indicating a change in current.

WSC_5 (Appendix, Fig. 72)
The target was the top part of a slope of a channel. The video transect revealed one continuous habitat of sandy mud with mixed pebbles and cobbles with lag gravel infill. At the start of the tow the topography was relatively flat and as the camera descended the slope, the topography
became quite steep. There were a sparse covering of epifauna within this transect, fauna present included: tubular sponges, anemones, hydroids (possibly *Tubularia sp.*), soft corals, small sea pens and tube dwelling polychaetes.

WSC_6 (Appendix, Fig. 73)
The video tow revealed one broad habitat: flat, coarse sand with occasional pebbles/cobbles. Epifauna were not particularly abundant, species included soft corals, anemones (sp 1), small sea pens, encrusting sponges and white tubular sponges. There were signs of infaunal activity with the presence of burrows.

WSC_7 (Appendix, Fig. 74)
The video tow revealed an area with flat topography with one continuous habitat: gravely sand with pebbles and occasional cobbles. Fauna were generally sparse throughout the tow, including ctenophores, asteroids (*Henricia sp.*), echinoids (*Echinus sp.* and unidentified) ophiuroids (sp 2 and unidentified) bryozoan (*Reteporella sp.*) encrusting sponges and ball sponge (possibly *Suberites sp.*), cushion stars (probably *Peltaster placenta*) and fish (*Myxine glutinosa* and *Myxine glutinosa*).

WSC_8 (Appendix, Fig. 75)
The target was at the bottom of a channel, this tow was undertaken in two stages (8a & 8b). The tow revealed a relatively flat topography. The transect began on a medium-coarse muddy sand/gravel substrate with pebbles and occasional cobbles. The quality of some of the images were poor due to silt cloud obscurities, thus faunal detail was difficult to observe at times. Epifauna were sparse throughout, with tube-dwelling polychaetes (possibly *Sabella sp.*) anemones (sp 1) hydroids and ctenophores observed. As the camera continued toward the end of the first part of the transect, the substrate changed to a boulder and cobbles habitat. At the beginning of the second part (8b) of the tow, a mixed pebble, cobble, with occasional boulders muddy sand/gravel substrate was apparent. Epifauna were more abundant then 8a, with soft corals, tube-dwelling polychaetes (possibly *Sabella sp.*) hydroids, ophiuroids, crinoids, anemones (sp 1 and unidentified) and sea spiders present. As the camera continued toward the end of the transect, the cobbles became sparser while the anemones (sp 1) more abundant.

WSC_9 (Appendix, Fig. 76)
The target was on a plateau parallel to the bottom of a channel. The tow revealed one continuous habitat of medium-coarse sand (muddy sand), with pebbles, cobbles and the occasional boulder throughout. Visibility was poor in places due to silt cloud obscurities, thus observing epifauna was difficult at times. Epifauna were not highly abundant, soft corals, ophiuroids (sp 2 and burrowing) asteroids, burrowing anemones (sp 1 and unidentified) and fish were observed.

WSC_10 (Appendix, Fig. 77)
The target was the top of the channel. The transect began with a medium sand substrate with gravel deposits, pebbles and cobbles (10-25%). Slight
sand ripples were present within this habitat, indicating the presence of a current. As the camera continued along the tow, intermittent mixed boulder habitats (25%) and pebble/cobble habitats were observed. Fauna were fairly consistent throughout the tow, although visibility was obscured at times due to both the camera elevation and silt clouds. An abundance of hagfish (*Myxine glutinosa*) burrowing anemones (sp 1) ophiuroids (sp 2) and sponges (cup-like and encrusting) were present throughout. Less abundant fauna included: sun stars (*Crossaster sp.*) anemones, ctenophores, bryozoan (*Reteporella sp.* and possible *Exidmonea atlantica*) asteroids (*Astropecten sp.* and possibly *Hippasteria sp.*) soft corals, gastropods and tube worms.

**WSC_11 (Appendix, Fig. 78)**
The target was a plateau parallel to the top of the channel. The transect revealed a relatively flat topography with one continuous habitat. The substrate consisted of sandy gravel with pebbles, cobbles and occasional boulders (10% cover). Epifauna appeared sparse from the video tow due to the camera elevation; although the images suggested otherwise. There was not a high abundance of large epifauna, but an abundance of smaller organisms. On the sand there was an abundance of burrowing anemones (sp 1), sea stars, ctenophores, holothurians and hagfish (*Myxine glutinosa*). On the rocks, there were an abundance of ophiuroids (sp 2), encrusting and erect sponges, hydroids, tunicates and bryozoan (*Reteporella sp.* and possible *Exidmonea atlantica*).

**WSC_12 (Appendix, Fig. 79)**
The target was the sponge belt recorded at 500m depth in this region by the AFEN surveys. The transect was approximately 2.5km long and proceeded down slope crossing an iceberg plough mark at approximately 520m depth. The transect was deliberately long in order to act as a scoping transect to locate the sponge belt. The transect began on a seabed of sand with some gravel, pebbles and occasional cobbles. The habitat changed little throughout the tow. Where the camera traversed the plough mark feature the cobble edges, typical of plough mark features, were not immediately obvious although the density of cobbles may have increased in the region of the plough mark. Few mobile fauna were observed and all were typical of the region, depth and habitat including the blue mouth red fish (*Helicolenus dactylopterus*), squat lobsters (*Munida rugosa*), urchins (*Echinus acutus*), sea star (*Henricia sp.*), actinid anemones, holothurians and brittle stars (Ophiuroidea). Sponges were visible throughout the tow but patchily distributed. Many morphospecies of both encrusting and erect forms were observed. However, individuals were small and some appeared partially buried. Distinct trawl marks were visible throughout the tow.

**WSC_13 beginning missing (Appendix, Fig. 80)**
The target was the head of one of the channels in the continental slope at a depth of approximately 600m. The transect began on a seabed of sand with some gravel, pebbles and occasional cobbles. The substratum varied throughout the transect in terms of the density of cobbles, however this variation did not appear to correlate with the topography. Distinct bands of clean sand were observed periodically and could be a result of fast currents or
previous trawling activities. Visible mobile epifauna included squat lobsters (*Munida rugosa*), sea stars (*Henricia* sp.), fish, crustaceans (pagurid crabs and pandalaeid shrimps), ophiuroids and urchins (*Echinus acutus*). Encrusting and attached fauna were dominated by sponges with many morphotypes present including cup, lamellate and globose forms, however cyclostome bryozoans were also observed.

WSC_14 (Appendix, Fig. 81)
The transect was approximately 700m long and crossed an iceberg plough mark at approximately 450m depth. The seabed was composed of sandy gravel with pebbles and occasional cobbles. The substratum did not vary greatly throughout the transect and the cobble edges, typical of plough mark features, were not immediately obvious. However, within the central furrow of the plough mark feature cobbles were largely absent. The fauna of the region was dominated by sponges, most of which were attached to cobbles. Many morphotypes of sponge including branched, cup, lamellate, globose, and encrusting sponges were visible throughout the tow. Some of the erect forms reached an estimated 50-100cm in height, although these were rare. Other encrusting fauna included those more typical of the region and depth (saddle oysters and serpulid worms). The mobile fauna was dominated by squat lobsters (*Munida rugosa*), urchins (*Cidaris cidaris*), blue mouth red fish (*Helicolenus dactylopterus*), holothurians (*Stichopus tremulus*) and rarely sea stars (*Poraniomorpha hispida rosea*).

WSC_15 (Appendix, Fig. 82)
The transect was approximately 1300m long and proceeded down-slope crossing a distinct iceberg plough mark at approximately 450m depth and a possible 2 relic plough marks (see profile view). The seabed was composed of sandy gravel with pebbles and occasional cobbles. The substratum varied in the density of cobbles and boulders present throughout the tow. At the edges of plough mark features the density of cobbles and associated fauna appeared to increase. However, within the central furrow of the plough mark features cobbles were largely absent. These relationships were by no means obvious and only a thorough analysis of the data would confirm/refute this apparent relationship. The fauna of the region was dominated by sponges, most of which were attached to cobbles. Many morphotypes of sponge including branched, cup, lamellate, globose, and encrusting sponges were visible throughout the tow. Other encrusting fauna included those more typical of the region and depth (saddle oysters and serpulid worms). The mobile fauna was sparse but dominated by squat lobsters (*Munida rugosa*), urchins (*Cidaris cidaris*), blue mouth red fish (*Helicolenus dactylopterus*) and holothurians (*Stichopus tremulus*). Sea stars (*Henricia sp*) and feathers stars (Crinoidea) were observed occasionally. Trawl marks were clearly visible within this transect.

WSC_16 (Appendix, Fig. 83)
The transect was approximately 2200m long and proceeded down slope from 480-520m, over two distinct terraces each 15-20m high. The target was the ‘sponge belt’ recorded at this depth further north during the AFEN project. The seabed was composed of sandy gravel with pebbles and frequent cobbles.
The substratum did not vary greatly throughout the transect. The fauna of the region was dominated by sponges. Many morphotypes of sponge including branched, cup, lamellate, globose, erect and encrusting sponges were visible throughout the tow in high densities. Distinct species include bright blue and bright yellow encrusting sponge forms, and large white erect sponges with multiple chimney like structures. The distribution of sponges was patchy with some areas supporting dense growths of large sponges and others areas supporting less dense growths of small and encrusting forms. There was no obvious relationship between topography (terraces) and sponge distribution, although a thorough analysis is required. Previous studies have suggested sponge distribution may be related to internal wave formation at the boundary between water masses. Other encrusting fauna included those more typical of the region and depth (saddle oysters, serpulid worms and occasionally corals (Caryophyllia sp and Stylasterids), and bryozoans (Reteporella sp.)). The mobile fauna was sparse but dominated by squat lobsters (Munida rugosa) and urchins (Cidaris cidaris). Sea stars (Henricia sp and Peltaster placenta), and ophiuroids were observed occasionally. A length of taut rope was visible on the seabed.

WSC_17 (Beginning missing) (Appendix, Fig. 84)
The transect was approximately 1100m long and proceeded up slope from 490-480m over a possible iceberg plough mark. The seabed was composed of sandy gravel with pebbles and occasional cobbles. The substratum varied in the density of cobbles and boulders present throughout the tow. At the edges of the possible plough mark feature the density of cobbles and associated fauna (particularly sponges) appeared to increase, whereas within the central furrow of the plough mark feature cobbles were rare. These relationships were by no means obvious and only a thorough analysis of the data would confirm/refute these observations. The fauna of the region was dominated by sponges, most of which were attached to cobbles. Many morphotypes of sponge including branched, cup, lamellate, globose, and encrusting sponges were visible throughout the tow. Distinct species include bright blue and bright yellow encrusting sponge forms, and large white erect sponges with multiple chimney like structures. Other encrusting fauna included those more typical of the region and depth (saddle oysters, brachiopods and serpulid worms). The mobile fauna was sparse but dominated by squat lobsters (Munida rugosa), urchins (Cidaris cidaris) and ophiuroids. Sea stars (Henricia sp., Poraniomorpha hispida rosea, and Pterastids) were observed occasionally.

WSC_18 (Appendix, Fig. 85)
The transect was approximately 1100m long and proceeded up slope from 490-480m over the same terrace structures as WCS_16, however here the terraces were less pronounced being only 1-4m in height. The target was the ‘sponge belt’ recorded at this depth further north during the AFEN project. The seabed was composed of sandy gravel with pebbles and frequent cobbles. The substratum did not vary greatly throughout the transect. The fauna of the region was dominated by sponges. Many morphotypes of sponge including branched, cup, lamellate, globose, erect and encrusting sponges were visible throughout the tow in high densities. Distinct species include bright blue and
bright yellow encrusting sponge forms, and large white erect sponges with multiple chimney like structures. The distribution of sponges was patchy with no obvious relationship between topography (terraces) and sponge distribution, although statistical analysis is required. Other encrusting fauna included those more typical of the region and depth (saddle oysters, serpulid worms and occasionally corals (Caryophyllia sp) and brachiopods). The mobile fauna was sparse but dominated by squat lobsters (Munida rugosa) and urchins (Cidaris cidaris). Sea stars (Henricia sp), blue mouth red fish (Helicolenus dactylopterus), other urchin species (Echinus acutus) and ophiuroids were observed occasionally. A length of taut rope and a large tangle of net were visible on the seabed.

WSC_E_1 (Appendix, Fig. 86)
This tow predominantly consisted of pebbles with occasional cobbles (almost 100% cover) substrate on coarse/gravely sand (and biogenic gravel in places), with areas of boulder habitat. Fauna was not abundant as the beginning of the tow where the substrate consisted of pebbles with the occasional cobbles, as the tow continued and the substrate progressed into cobbles/boulder, more erect sponges were observed. Typical fauna encountered throughout the tow were encrusting and globose sponge, hydroids, brachiopods, asteroids and a few soft corals.

WSC_E_2 (Appendix, Fig. 87)
The substrate of the tow consisted of mixed cobbles and pebbles on coarse sand (almost 100% cover). Fauna was similar to that of WSC_E_1, although more diverse and abundant. Dominant fauna were erect, globose and encrusting sponges, hydroids, brachiopods, echinoids (Cidaris cidaris) and squat lobsters. Other less common fauna included fish (Chimera monstrosa and Sebastes sp.).

WSC_E_3 (Appendix, Fig. 88)
The tow consisted of a mixed pebbles and cobbles habitat with inter dispersed boulder habitats on coarse muddy sand. Typical fauna throughout the tow were erect and encrusting sponges, asteroids and polychaetes. A yellow encrusting sponge is common throughout the tow, covering large areas.

WSC_E_4 (Appendix, Fig. 89)
This tow was similar to WSC_E_3, with both the same habitats and fauna observed, although the yellow encrusting sponge was more abundant within this tow.

WSC_E_5 (Appendix, Fig. 90)
Mixed pebbles and cobbles on muddy sand was the continuous habitat of this tow, typical fauna included encrusting sponges, asteroids (including Ceramaster sp.) and ophiuroids, but not particularly abundant.

WSC_E_6 (Appendix, Fig. 91)
This tow consisted of a mixed pebbles and cobbles (with occasional boulders) on muddy sand habitat, with pebbles being the dominant substrate. Fauna was not abundant throughout this tow, with the exception of hag fish. Other
less frequently observed organisms included, hydroids, encrusting sponges and asteroids (including *Ceramaster sp*.).

**WSC_E_7** (Appendix, Fig. 92)
This tow revealed a mixed pebbles and cobbles substrate on muddy sand. Ripples were abundant with gravel deposits, indicating some hydrodynamic activity. Fauna was sparse within this tow, with a few ophiuroids, hag fish and bryozoan visible, although there were signs of infaunal activity with the presence of small burrows.

**WSC_E_8** (Appendix, Fig. 93)
This tow was similar to WSC_E_7, with mixed pebbles and cobbles (predominantly pebbles) with occasional boulders on muddy sand and area of ripples, thus suggesting this area is subject to hydrodynamic activity. Fauna were again sparse, with hydroids, asteroids (*Ceramaster sp*.) and hag fish.

**WSC_E_9** (Appendix, Fig. 94)
The tow revealed a mixed pebbles and cobbles habitat on muddy sand with occasional boulders. Fauna were predominantly encrusting sponges, hydroids, ophiuroids, asteroids (*Stichastrella rosea*) and hag fish.

**WSC_E_10/b** (Appendix, Fig. 95)
The substrate of this tow consisted of pebbles and cobbles on muddy sand with occasional boulders. Fauna were more abundant than the previous tow, particularly with an abundance of sponges. There was a more diverse range of sponges, including abundant globose, encrusting and erect sponges throughout the tow. *Geodia sp* was an abundant sponge observed throughout the tow. Other dominant fauna were the pencil urchin *Cidaris cidaris*, brachiopods, squat lobsters (*Mundia rugosa*), asteroids (including *Stichastrella rosea*) and hydroids.

### 3.1.6 Papa Bank

**Papa1_01** (Appendix, Fig. 96)
The target was a topographic high. The video track began at the summit of the topographic high and traversed down the flanks and onto an area of suspected sand seabed. The video began on a boulder and cobble substratum characterised by encrusting species and occasional possible branching sponges. As the camera descended the flanks hydroids become more frequent but still fairly sparse. Conspicuous epifauna included squat lobsters (possibly *Munida rugosa*) and the sea star *Porania pulvillus*. Toward the base of the feature the seabed becomes more sandy with pebbles, cobbles and few conspicuous fauna, before becoming gravel and pebbly again with few conspicuous fauna. The video track then crosses another small topographic high which appears on video as an area of cobbles characterised by encrusting species, occasional hydroids, and rarely squat lobsters (possibly *Munida rugosa*). The seabed then quite abruptly changes to an area of fine sand substratum with few visible fauna except worm casts from infaunal polychaetes and siphons from infaunal bivalves with associated hydroid growths.
Papa2_01 (Appendix, Fig. 97)
Target was a topographic high suspected rock outcrop. Video track began at
the base of the topographic high on an area of pebble and cobble seabed with
some coarse sand characterised by Flustra sp., hydroids and encrusting
sponges and ascidians. As the drop frame progressed up the flanks of the
topographic high the substratum changed to boulder and cobbles and was
broadly characterised by Flustra, hydroids, aggregations (carpets) of
anemones, cup sponges (possibly Axinella sp.), cup corals (Caryophyllia sp.),
and numerous encrusting species. Conspicuous epifauna include the sea star
Stichastrella rosea. As the camera progressed over the summit Flustra
become less abundant and cup corals (Caryophyllia sp.) and encrusting
species became the most conspicuous fauna. As the camera descended the
summit onto the far flanks the substratum changed again to cobble and
pebble with course sand, Flustra and hydroids again became conspicuous on
the lower flanks and toward the base of the topographic high.

Papa2_02 (Appendix, Fig. 98)
The target was a series of possible sand waves. The video track began on a
course sand seabed characterised by Flustra and hydroid tufts covering
approximately 30% of the seabed. Conspicuous mobile epifauna included
occasional scallops. Evidence of infauna from protruding tubes (Polychaeta)
and siphons (Bivalvia). No noticeable sand wave features, no obvious
changes in habitat.

Papa2_03 (Appendix, Fig. 99)
Target was a suspected rock outcrop taking in the transition to suspected
sand seabed. The video track began on an area of cobbles, boulders and
quickly progressed to bedrock. An ophiuroid bed covered the rocks that were
otherwise characterised by Flustra, hydroids and encrusting species. Other
conspicuous epifauna included squat lobsters (possibly Munida rugosa). The
camera reached the edge of the bedrock/boulder area and the substratum
changed to an area of pebble, shell gravel and coarse sand with little
conspicuous epifauna except serpulid worm tubes and very rarely the sea star
Porania pulvillus.

Papa2_04 (Appendix, Fig. 100)
Target was a suspected habitat boundary. The video track began on an area
of medium sand seabed with little conspicuous epifauna. Quite suddenly the
camera progressed onto an area of sand covered bedrock with boulders and
cobbles in places characterised by Flustra, hydroids and encrusting species.
Conspicuous epifauna included the sea star Stichastrella rosea, squat
lobsters (possibly Munida rugosa) and brittle stars, which in places were
dense enough to constitute a brittle star bed. Toward the end of the video
track the substratum changed again first to a fine sand that very quickly
changed into a substratum of mixed whole shells with little conspicuous
epifauna.

Papa2_05 (Appendix, Fig. 101)
Target was a typical seabed and an area of suspected sand waves. Video
track started with an area of coarse sandy seabed with occasional cobbles
and Flustra covering approximately 40% of the seabed. The camera then passed into an area of sand waves with course sand and shell debris in the sand wave troughs. Few visible epifauna.

### 3.1.7 Pobie Bank

**Pobie_C1 (Appendix, Fig. 102)**
The tow progressed over a substratum of silty bedrock and boulders with accumulations of sand and biogenic debris in depressions. Sessile life was relatively sparse and of low diversity. The most conspicuous species were an erect, rigidly-branched bryozoan, possibly *Omalosecosa ramulosa*, and an orange encrusting bryozoan, probably *Schizomavella* sp. Small encrusting serpulids, probably *Pomatoceros* sp., were also abundant. Rarer sessile taxa included the bryozoan *Reteporella* sp., small globose and axinellid sponges, and an unidentified blue encrusting sponge. Mobile epifauna were rare, but included the sea star *Stichastrella rosea*.

**Pobie_C2 (Appendix, Fig. 103)**
The tow began over broad expanses of heavily-silted bedrock. Sessile epifauna were numerous but individual colonies were small. The most conspicuous taxa were an erect bryozoan, possibly *Omalosecosa ramulosa*, and an unidentified small globular sponge. Close-up images showed that small brittle stars were abundant on the silty rock surface. Other taxa included axinellid sponges, hermit crabs and the sea stars *Hippasteria phrygiana* and *Stichastrella rosea*. Later in the tow the camera moved off bedrock onto a substratum of sand with numerous cobbles and small boulders. Small brittle stars and hermit crabs remained common, and colonies of the erect bryozoan species were present attached to the cobbles.

**Pobie_C3 (Appendix, Fig. 104)**
This tow encountered a mixed substratum of sand interspersed with boulders. Rock surfaces were heavily encrusted with orange and grey sheet bryozoans, with serpulid polychaetes, axinellid sponges and the erect bryozoan cf. *Omalosecosa ramulosa* also present. Squat lobsters (*Munida* sp.) were present amongst the boulders.

**Pobie_C4 (Appendix, Fig. 105)**
Benthic environment and fauna were very similar to those seen at Pobie_C2. Bedrock and boulders with a thick covering of silt bore a sparse sessile fauna of orange encrusting bryozoans, axinellid sponges and serpulid polychaetes. Mobile epifauna included abundant small brittle stars and occasional specimens of *Hippasteria phrygiana*, *Stichastrella rosea* and *Munida* sp.

**Pobie_C5 (Appendix, Fig. 106)**
The substratum here consisted of boulder and bedrock with sand and biogenic debris in the interstices and hollows. Sessile fauna was very sparse and dominated by encrusting bryozoans and serpulid polychaetes. Patches of an unidentified yellow-green encrusting sponge were also present. The sparse mobile epifauna included the urchin *Echinus esculentus* and the blue mouth redfish *Helicolenus dactylopterus*. 
Pobie_C6 (Appendix, Fig. 107)
This station was also characterised by extensive areas of silty bedrock and boulders with sand and biogenic debris in the hollows. Orange sheet bryozoans and yellowish sponges were the most conspicuous encrusting fauna. Colonies of an erect bryozoan, possibly *Omalosecosa ramulosa* were also numerous. Hermit crabs and squat lobsters (*Munida* sp.) were present among the boulders.

Pobie_C7 (Appendix, Fig. 108)
This station was characterised by patches of silty boulders on a bed of pebbly sand. The boulders were heavily encrusted by orange and pinkish sheet bryozoans. The erect bryozoan cf. *Omalosecosa ramulosa*, small barnacles and serpulid polychaetes were also common. Sessile epifauna present at low density included axinellid sponges and the cup coral *Caryophyllia smithii*. Mobile epifauna were rare, the most conspicuous species being the urchin *Echinus esculentus*.

Pobie_C8 (Appendix, Fig. 109)
The tow covered an area of jumbled boulders with coarse sand and debris in hollows and interstices. The rock surfaces were silty with a sparse sessile fauna dominated by serpulid worms (probably *Pomatoceros* sp.) and encrusting bryozoans, of which an orange species (probably *Schizomavella* sp.) was the most conspicuous. Colonies of an erect branching bryozoan, (possibly *Omalosecosa ramulosa*) were also present at low density.

Pobie_C9 (Appendix, Fig. 110)
The seabed here consisted of flat sediment, possibly muddy sand, with a high pebble content. Clumps of hydroids, often heavily silted, were the most conspicuous epifauna. The erect bryozoans *Reteporella* sp. and cf. *Omalosecosa ramulosa* were also present attached to some of the small stones.

Pobie_C10 (Appendix, Fig. 111)
This station was characterised by flat silty sand with patches of pebbles and surface debris. The sparse epifauna consisted of small gobies and hermit crabs. Large tube endings were occasionally visible at the sediment surface.

Pobie_C11 (Appendix, Fig. 112)
The seabed at this station was composed of flat, coarse sand with varying pebble and shell content. Visible epifauna were very sparse and confined to occasional small brittle stars and hermit crabs.

Pobie_C12 (Appendix, Fig. 113)
The seabed consisted of very coarse, gravely sand, with virtually no visible epifauna.

Pobie_C13 (Appendix, Fig. 114)
This station closely resembled Pobie_C1, with a substratum of silty bedrock and boulders, with bryozoan and other biogenic debris accumulating in the
hollows and depressions between rocks. The relatively sparse fauna was also
similar to that of Pobie_C1, with orange encrusting bryozoans and serpulids
being the most characteristic sessile taxa. Less common species included
axinellid sponges, hydroids and erect bryozoans (cf. *Omalosecosa ramulosa*).
Mobile epifauna included the sea star *Stichastrella rosea* and the squat
lobster *Munida* sp.

Pobie_C14 (Appendix, Fig. 115)
The substratum here consisted of flat, coarse shelly sand with occasional
cobbles and small boulders. Visible fauna on the sand was sparse, confined
to hermit crabs and tusk shells (Scaphopoda). Large tube endings were
occasionally visible at the sediment surface. Some of the rare cobbles and
boulders were covered in dense hydroid turf, others bore a sparse cover of
encrusting bryozoans with occasional colonies of an erect bryozoan, possibly
*Omalosecosa ramulosa*.

Pobie_C15 (Appendix, Fig. 116)
Most of this tow covered a sandy seabed with low content of shells and small
pebbles, interspersed with denser patches of accumulated shelly material. At
the beginning and end of the tow the sediment was a much coarser sand with
shell fragments. Epifauna on the sandy seabed was confined to small brittle
stars and occasional hermit crabs. A patch of cobbles and small boulders was
also encountered. Epifauna on these stones included hydroids, serpulid
polychaetes, orange encrusting bryozoans and the zoanthid *Parazoanthus
anguicomus*.

3.2 Image analysis
3.2.1. Within Site Analysis
3.2.1.1. Hatton Bank
Figure 14: Cluster analysis of the faunal composition of images taken on Hatton Bank using Bray-Curtis similarity on presence/absence data.

Cluster analysis (Fig. 14) reveals a number of distinct communities present on Hatton Bank. Available data on environmental variables do not explain well the clusters formed however there is some separation based on sediment type.

3.2.1.2. Rosemary Bank

Figure 15: Cluster analysis of the faunal composition of images taken on Rosemary Bank using Bray-Curtis similarity on presence/absence data.

Cluster analysis (Fig. 15) reveals a number of distinct communities present on Rosemary Bank. Available data on environmental variables do not explain well the clusters formed however there is some separation based on sediment type.

3.2.1.3. Wyville-Thompson Ridge

Cluster analysis (Fig. 15) reveals a number of distinct communities present on the Wyville-Thompson Ridge. Available data on environmental variables suggest that community structure in this region is strongly influenced by temperature, depth and sediment type.
Figure 16: Cluster analysis of the faunal composition of images taken on the Wyville Thompson Ridge using Bray-Curtis similarity on presence/absence data.

3.2.1.4. West-Shetland Channel

Figure 17: Cluster analysis of the faunal composition of images taken in the West-Shetland Channel using Bray-Curtis similarity on presence/absence data.
Cluster analysis (Fig. 17) reveals a number of communities present on the continental slope west of Shetland, although these communities are all related to a single root. Available data on environmental variables suggest that these communities change from one to the next along a gradient of depth and temperature with no obvious sharp divisions. The structural sponge communities observed in this area form a distinct cluster within the wider community.

3.2.1.5. Papa Bank and Pobie Bank

Figure 18: Cluster analysis of the faunal composition of Papa and Pobie Banks, using Bray-Curtis similarity on presence/absence data

Cluster analysis (Fig. 18) reveals a number of communities present on Papa and Pobie Banks. Available data on environmental variables suggest that these communities are related to sediment type with coarse substratum communities forming a distinct cluster to finer substratum communities.

3.2.2. Between site analyses
3.2.2.1. All sites

Cluster analysis (Fig. 19) reveals the faunal composition of the hard substrate at each site to be related but, for a number of sites, distinct. Papa Bank and Pobie Bank are most dissimilar to all other sites forming a cluster at the 20% similarity level. Both sites are also distinct from one another at the 35% similarity level. Two major clusters are identifiable from the deep-water sites
and divide the communities of the cold (sub-zero) regions of the Faeroe-Shetland Channel (those within the influence of Norwegian Sea water mass) from relatively warm regions of the Rockall Trough and shallower areas of the Faeroe-Shetland Channel (those within the N.E Atlantic water mass).

Figure 19: Cluster analysis of the faunal composition of all images from hard substratum (bedrock and dense boulders and cobbles) using Bray-Curtis similarity on presence/absence data.

3.2.2.2. Papa and Pobie banks

Cluster analysis (Fig. 20) reveals a number of communities present on both banks at the 35% similarity level. SIMPER analysis of these clusters identifies those species characteristic of each community.

Cluster 1: bedrock substrate characterised by orange encrusting, stags horn and other erect bryozoans (*Schizomavella* sp., *Porella laevis* or *Omalosecosa ramulosa*, and *Reteporella* sp.), and erect sponges (possibly *Axinella* sp.).

Cluster 2: bedrock, boulder and cobble substrate characterised by orange encrusting, grey encrusting and stags horn bryozoans (*Schizomavella* sp., *Porella laevis* or *Omalosecosa ramulosa*), serpulid tube worms (*Pomatoceros* sp.), squat lobsters (*Munida* sp.) and cup corals (*Caryophyllia smithii*).

Cluster 3: Bedrock, boulder and cobble substrate characterised by orange encrusting bryozoans (*Schizomavella* sp.), erect gelatinous bryozoans
Alcyonidium sp. (diaphanum?), serpulid tube worms (Pomatoceros sp.), Flustra foliacea, hydroids and brittle stars (Ophiothrix fragilis).

Cluster 4: Gravel and pebble substrate characterised by serpulid tube worms (Pomatoceros sp.),

Clusters 5 and 6: too few images to define.

Cluster 7: scattered cobble and pebbles on sand characterised by hydroids.

Cluster 8: Sand, gravel and scattered pebbles characterised by infaunal tube worms

Cluster 9: Sand and scattered pebbles characterised by brittle stars (Ophiura affinis) and hermit crabs (Paguridae).

Cluster 10: Gravel and pebbles characterised by brittle stars (Ophiura albida) and sea stars (Asterias rubens).

Figure 20: Cluster analysis of the faunal composition of images from Papa and Pobie Banks using Bray-Curtis similarity on presence/absence data.
3.2.2.3. Cold stations of the Faeroe-Shetland Channel

Cluster analysis (Fig. 21) reveals a number of communities present within the cold water regions at approximately the 20% similarity level. SIMPER analysis of these clusters identifies those species characteristic of each community.

Cluster 1: Pebbles and cobbles characterised by structural white sponges, globose sponges, encrusting sponges, feather stars (Crinoidea), soft coral (Alcyonacea) and brittle stars (possibly Ophiura sp.).

Cluster 2: Bedrock, boulders, cobbles characterised by encrusting white sponges, sabellid tube worms, cyclostome bryozoans, zoanthids, tubularid hydroids, soft corals (Alcyonacea), hydroids, sea pens (Pennatulacea), halcampid-like anemones, feather stars (Crinoidea), ophiuroids, and sea spiders (Pycnogonida).

Cluster 3: Boulders, cobbles and pebbles characterised by encrusting and globose sponges, brittle stars (possibly Ophiactis balli and Ophiura sp.).

Cluster 4: Cobbles, pebbles and sand characterised by sabellid tube worms, terebellid worms, and encrusting white sponges.

Cluster 5: Only 4 records, outliers
Cluster 6: Only 1 record, outlier

Cluster 7: Pebbles, gravel and sand characterised by brittle stars (possibly Ophiura sp.).

Cluster 8: Sand with occasional pebbles and gravel characterised by large numbers of a single species of burrowing anemone.

Cluster 9: Sand, pebbles characterised by brittle stars (Ophiuroidea) and benthopelagic crustaceans (Mysids).

3.2.2.4. Stations from the Rockall Trough and warm stations of the Faeroe-Shetland Channel

Only a subset (hard substratum) of stations have been analysed here as the data set comprised over 1000 images.

Figure 22: Cluster analysis of the faunal composition of the hard substratum habitat from the Rockall Trough and warm stations of the Faeroe-Shetland Channel, using Bray-Curtis similarity on presence/absence data.

Cluster analysis (Fig. 22) reveals a number of communities present on hard substrate within the warm water regions of the Rockall Trough and Faeroe-Shetland Channel at approximately the 20% similarity level. SIMPER analysis of these clusters identifies those species characteristic of each community.
Cluster 1: Bedrock, boulders, cobbles and reef framework characterised by white and yellow spiked encrusting sponges, burrowing anemones, serpulid worms, sand tube worms (possibly *Lanice* sp.) and brittle stars.

Cluster 2: Bedrock, boulders and cobbles characterised by white, orange and green encrusting sponges, sessile holothurians (*Psolus* sp.), encrusting bryozoans, brittle stars (possibly *Ophiactis balli*), serpulid worms, stylasterid corals, brachiopods, urchins (*Cidaris cidaris*), and squat lobsters (*Munida* sp.)

Cluster 3: Bedrock and coral reef framework characterised by cup corals (*Caryophyllia* sp.), reef forming corals (*Lophelia pertusa, Madrepora occulata*), black corals (*Stichopathes* sp.), soft corals (*Alcyonacea*), squat lobsters (*Munida* sp.), sea stars (*Stichastrella rosea*), brittle stars, sessile holothurians (*Psolus* sp.), ascidians, serpulids worms, encrusting white and yellow sponges, anemones and sabellid tube worms.

Cluster 4: Bedrock, boulders, coral framework and coral rubble characterised by sessile holothurians (*Psolus* sp.), ascidians and squat lobsters (*Munida* sp.).

Cluster 5: Bedrock and coral rubble characterised by spirorbid worms and unidentified encrusting organisms.

Cluster 6: Boulders and cobbles encrusting yellow sponge and brittle stars (Ophiuroidea).

Cluster 7: Boulders and cobbles characterised by encrusting white, blue, orange, green and yellow-spiked sponges, globose yellow sponges, sea stars (*Henricia* sp.), and brittle stars (Ophiuroidea).

Cluster 8: Bedrock characterised by orange, blue and green encrusting sponges, brachiopods and sessile holothurians (*Psolus* sp.).

Cluster 9: Bedrock and coral rubble characterised by urchins (*Cidaris cidaris*).

Cluster 10: Bedrock and coral reef framework characterised by *Lophelia pertusa*, anemones (*Phelliactis* sp), sabellid tube worms and ascidians.

Cluster 11: Bedrock and coral framework and coral rubble characterised by the reef forming corals *Lophelia pertusa* and *Madrepora occulata*, and the anemone *Phelliactis* sp.

Cluster 12: Bedrock and coral rubble characterised by brittle stars (Ophiuroidea) and chaetopterid tube worms.
4. Discussion
4.1 Site Descriptions
4.1.1 Hatton Bank

Survey of Hatton Bank was limited (by time) to the area shallower than 1000m. Hatton Bank is an extremely large offshore feature and as such supports a wide diversity of habitats and species, associated with various seafloor features and seabed types.

The dominant seabed type on Hatton Bank is sand, rippled in places with rare cobble or boulder size drop stones. Much of the faunal component of this habitat is likely to be infaunal with polychaete tube worms observed in places. However, characteristic epifaunal species include urchins (*Calveriosoma sp*, *Cidaris cidaris*, *Echinus acutus*), sea cucumbers (*Stichopus tremulus*), small (>10mm disc diameter) ophiuroids, cerianthid anemones, hermit crabs, and occasional fish (*Chimaera monstrosa*). Dropstones (isolated boulders deposited by glaciers during the last ice age) are colonised by small growths of coral (*Lophelia pertusa*, *Madrepora occulata*), anemones (*Phelliactis sp*), sessile holothurians (*Psolus squamatus*), stylonereid corals, brachiopods, and encrusting sponges (C11, C4, C3). With increasing depth this dominant sand habitat becomes muddier (>850m) (HS_2_1, HC_9) with increased signs of infaunal activity (bioturbation in the form of urchin tracks and large U-shaped depressions). In these deeper areas additional epifaunal species, most notably xenophyophores, zoanthids (*Epizoanthus sp*), and grenadiers (*Coryphaenoides rupestris*) are observed.

In the shallowest region of the bank surveyed (<550m) large iceberg plough-mark features were present (Jacobs & Howell, 2007). These features are composed of parallel lines of cobble and occasionally boulder size stones with an in-filled furrow between. The dense cobbles and boulder borders of these features are colonised by a variety of encrusting and attached species including encrusting and globose form sponges, hydroids, sessile holothurians (*Psolus squamatus*), stylonereid corals, brachiopods, stylonereid and solitary corals (*Caryophyllia sp*), small growths of the reef forming corals *Madrepora occulata* and *Lophelia pertusa*, and rarely large sea fans (*Gorgonacea*). The mobile epifauna observed to be associated with these features includes squat lobsters (probably *Munida rugosa*), decapod shrimp, and ophiuroids, frequently hidden in the cracks and crevices of rocks (possibly *Ophiactis balli*). (C7, C6). The furrows of the plough mark features support a similar fauna to the dominant sand habitat.

On the upper flanks and summit of Hatton Bank distinct terrace features were imaged by the multibeam. These terraces were separated by steep (>25° in places) scarps some of which reached over 100m in height (C5, C10, C13, C14, C16, C17, C18, HT2, HT4, HT5, HS_3_4). The terrace structures were characterised by an increased abundance of cobbles and boulders in close proximity to the terrace edges. In some cases the underlying bedrock was exposed. These cobble/boulder/bedrock fringes are characterised by a diverse encrusting and attached fauna including encrusting, cup and globose sponges, small growths of reef forming coral (*Lophelia pertusa*, *Madrepora occulata*), stylonereid (*Pliobothrus*) and cup corals (*Caryophyllia sp*),
holothurians (*Psolus squamatus*), anemones (*Phelliactis* sp) and brachiopods. The terrace edges consist of exposed bedrock and boulders which in some cases fall away steeply. These edges support a similar fauna to the fringe regions but additional coral species including large sea fans (*Callogorgia verticillata*) and corkscrew-shaped antipatharian corals (*Stichopathes* sp.) may also be present.

The slopes descending from the terrace structures varied in gradient and height and, as a result, the fauna of these areas was also variable. However, in general terrace edge structures gave way to slopes composed of coarse sand and coral gravel with lumps of dead *Lophelia pertusa* reef framework colonised by similar species to those on the terrace edges but including other species such as erect sponges (*Aphrocallistes* sp.), occasional sea pens (*Pennatulacea*), many species of soft coral, brisingid sea stars, erect bryozoans (*Reteporella* sp. and cyclostome bryozoans) and many species of anemone. Cobbles and boulders, colonised by similar species to those on the terrace fringes, are also present and in general become more frequent on the lower slope.

At the base of the scarp slopes the seabed and fauna becomes more typical of the bank proper, being composed of sand and rippled sand or occasionally lag gravel and characterised by species such as sea urchins, mobile sea cucumbers and brittle stars.

In a variety of sites investigated on the bank, channel and ditch features were observed (C1, HT1, HS_2_5, HS_3_3). These features vary in faunal composition. For all there is a noticeable change in fauna, from those species characteristic of the dominant sand habitats to a different suit of species in the base of the channel and ditch features. However, this change is driven by local hydrographic regime, depth and slope of the features and there are no consistent faunal trends or suit of species associated with these features. In shallower areas, with presumably faster currents, the base of some hollows and ditches are characterised by lag gravel sediments colonised by few visible fauna except cup corals, tube worms (sabellids and serpulids), urchins (*Echinus* sp.), anemones, squat lobsters, and encrusting sponges. The flanks of some features consist of bedrock, boulders and cobbles and are characterised by those species typical of this substrate on Hatton Bank (e.g. anemones (*Phelliactis* sp.), coral (*Madrepora oculata*, stylasterids, *Caryophyllia* sp, *Stichopathes* sp.), ascidians, erect sponge forms). In deeper areas fine sediments predominate and species such as xenophyophores and the sponge (*Pheronema carpenteri*) may be observed in the base of channel features.

In the southern area of Hatton Bank a number of pinnacle and mounds were imaged on the multibeam (HS22, HS23, HS24, HS35, HS31, HS32). These features were characterised by extensive biogenic reef structures at their summits (50-100% coverage). Here largely dead *Lophelia pertusa* reef framework supports new live growth at the reef edges. The framework is colonised by a diverse range of species including many other corals: scleractinians (*Madrepora oculata*, *Caryophyllia* spp); gorgonians (*Callogorgia*
sp.), bamboo corals (*Acanella* sp., *Isidella* sp. and *Keratoisis* sp.), antipatharian corals (*Stichopathes* sp., *Parantipathes* sp., *Leiopathes* sp), encrusting octocorals and other soft corals. Other conspicuous fauna associated with the reef framework include feather stars, sea stars (*Porania* sp), basket stars (*Gorgonocephalus* sp.), hydroids, bryozoan, ascidians, sponges (including the glass sponge *Aphrocallistes* sp.), and occasional fish (*Lepidon eques* and *Sebastes* sp.)

The flanks of these features are characterised by extensive reef rubble on biogenic gravel and sand. These rubble fringes support a similar diverse fauna to the reef proper, but with different species dominating in terms of abundance. Small growths of reef forming corals (*L. pertusa, M. oculata*) are frequent. Away from the reef proper the coral rubble gradually becomes less dominant and occasional cobbles and boulders are visible on a biogenic gravel and sand substratum. Here the visible fauna are less abundant and consist of a those species typically observed on cobbles and boulders (described previously) and those typical of the dominant sand habitat on Hatton Bank.

Also in the southern region of Hatton Bank an extensive region of rock outcrop (Lyonesse) was investigated (HS1, 3, 4, 5). This rock outcrop feature is colonised by typical encrusting fauna (Serpulid worms, saddle oysters, encrusting sponge, occasional anemones, and holothurians (*Psolus squamatus*)), as well as a diverse array of coral species including *Lophelia pertusa, Madrepora oculata*, corkscrew-shaped antipatharian corals (*Stichopathes* sp., *Leiopathes* sp.), stylasterids (probably *Pliobothrus*), alcyonaceans (*Anthomastus grandiflorus*) and gorgonians (possibly *Callogorgia verticillata*). Anemones (*Phelliactis* sp.) and erect sponge growths are also present. In places the rock outcrop supports large areas of coral rubble framework in-filled with sand and colonised by a diverse range of fauna including many erect sponge growths (including *Aphrocallistes* sp), ascidians, squat lobsters and other coral species.

The rock outcrop features are fringed by extensive coral rubble regions, in places in-filled with sand, and colonised by a diverse array of species including small growths of live reef forming corals (*Lophelia pertusa, Madrepora oculata*), antipatharian corals (*Stichopathes* sp.), soft corals (*Anthomastus grandiflorus*), stylasterids (probably *Pliobothrus*), gorgonians, anemones (*Phelliactis* sp. and others) and many erect sponge growths. Away from the outcrop and fringe regions, cobbles, boulders and coral debris are common and are colonised by typical encrusting fauna. These become less common further from the rock outcrop and the seabed returns to the dominant sand habitat. Rock outcrop in other regions of Hatton Bank (C12) are similar in character to Lyonesse.

Cluster analysis demonstrated the faunal communities of Hatton Bank are similar to those on Rosemary Bank, and some areas of the Wyville-Thompson Ridge and West Shetland Channel region (Fig 22). Although not analysed, observed communities on George Bligh Bank also appear similar to those on Hatton Bank. Results from the 2005 surveys of this area were comparable
with those reported here. Extensive reef framework was observed associated
with mound and ridge structures and diverse communities including species
such as antipatharian coral (*Stichopathes* sp., *Leiopathes* sp), encrusting
sponges, crinoids, gorgonians, glass sponges (*Aphrocallistes* sp.) and
octocorals were present.

4.1.2 George Bligh Bank
The dominant habitat on George Bligh Bank is again sand with occasional
cobble or boulder dropstones and is similar in character to this habitat on the
neighbouring Hatton Bank. Typical species include cerianthid anemones,
urchins (*Calveriosoma* sp.) and fish. The multibeam survey over this area
revealed a series of erosive sculpted deeps in water depths between 700-900
m. These features were the target of the biological investigation. The scours
were either individual features or they had coalesced forming into sinuous
steep-walled channel systems (Jacobs & Howell, 2007). These features are
calculated by an increase in cobbles and boulders near the edge of the
feature colonised by fauna typical of this depth and region (encrusting
sponges, serpulid tube worms, holothurians (*Psolus squamatus*). In places
anemones (*Phelliactis* sp.), antipatharian, stylasterid and cup corals, small
growth of live *Lophelia pertusa* and *Madrepora occulata*, soft corals and
gorgonians are present, as well as coral (*L. pertusa*) gravel with larger dead
coral fragments. The slopes descending into these deeps are sandy with
boulders and cobbles colonised by fauna typical of the substrate and region
including holothurians (*Psolus squamatus*) and antipatharian corals.

No analysis of images from George Bligh Bank was undertaken as a result of
the camera flash failing on both tows. Results from the survey undertaken in
this area in 2005 are broadly comparable with those reported here. Coral
framework consisting of *Madrepora oculata* and *Lophelia pertusa* was
observed and supported a highly diverse fauna including *Stichopathes*,
nephtheid soft coral (*Capnella* sp.), hexactinellid sponges and the large
anemone *Phelliactis* sp.

4.1.3 Rosemary Bank
The dominant substrate on the region of Rosemary Bank surveyed is medium
sand substrate. This habitat supports a fauna typical of the depth and region
and includes the pencil urchin *Cidaris cidaris* and fish (*Chimera monstrosa*).

On the shallow summit of the bank (<500m), iceberg plough-mark features
are present (Stations RB_1_2, 4). These features are composed of parallel
lines of cobble and occasionally boulder size stones with an in-filled furrow
between. The furrows of the plough mark features support a similar fauna to
the dominant medium sand habitat. Within the dense cobble and boulder
habitat (20-40% cover) at the edge of the plough mark features characteristic
fauna include sessile holothurians (*Psolus* sp.), cup corals (*Caryophyllia* sp.),
pencil urchins (*Cidaris cidaris*), anemones (*Phelliactis* sp.), encrusting
sponges, and the blue-mouth redfish (*Helicolenus dactylopterus*).

The parasitic cones on the banks summit are composed of boulders, cobbles
and bedrock, with regions of coarse sand and pebble. Few epifaunal species
were observed on these structures. Sea urchins (Cidaris cidaris), fish (Chimaera monstrosa, Helicolenus dactylopterus) and squat lobsters (Munida sp.) were common mobile species observed, while encrusting sponges, sessile holothurians (Psolus sp.), barnacles and rarely coral (Madrepora oculata) were observed attached to exposed bedrock.

At approximately 900m depth a series of terrace structures were observed on the multibeam. The summit of these features is characterised by coarse sand and lag gravel with occasional cobbles and in places ripples suggesting current activity. Few fauna were observed in this habitat except squat lobsters (Munida sp.), sessile holothurians (Psolus sp.), urchins (Echinoidea), brittle stars (Ophiuroidea), and encrusting sponges attached to cobbles. On the slope areas of these features boulders are more frequent with some areas of bedrock outcrop. These areas are inhabited by a wider diversity of encrusting organisms, including cup sponges, anemones, hard corals (Madrepora oculata, Lophelia pertusa, Caryophyllia sp.), soft corals, black corals (Stichopathes sp.), sea fans (Gorgonacea), and stylasterid corals (Pliobothrus sp.). At the base of the slope of the terrace features the seabed was principally pebble sized lag gravel with ripples in places, suggesting current activity. Few epifauna, except ophiuroids, were observed in this habitat.

Cluster analysis of image data from Rosemary Bank revealed a number of distinct communities present, related in part to changes in sediment type (Fig. 15). Cluster analysis of data from hard substratum habitats found the faunal communities of Rosemary Bank to be most similar to those of Hatton Bank and related to “warm water” communities present in shallower regions of the Wyville-Thompson Ridge and West Shetland Channel (Fig. 22).

4.1.4 Wyville-Thompson Ridge
The benthic ecology of this region of the UK Atlantic Margin is dominated by the marked differences in the hydrography of the Faeroe–Shetland Channel and the Rockall Trough (Bett, 2001). Comparatively warm North Atlantic Water is common to the shallow regions (<500-600m) of both areas; however, in the Faeroe–Shetland Channel, cold (subzero) waters occupy the deeper parts of the channel (>600 m). The Wyville–Thomson Ridge represents a significant barrier to the cold waters of the deep Faeroe–Shetland Channel and largely prevents this water mass from entering the Rockall Trough. As a result the deep-water faunas north and south of the ridge are highly distinct (Bett, 2001). Cluster analysis of image data from this region clearly demonstrates these distinct faunal communities (Fig. 16). Analysis of all “cold” water stations (those on the Wyville-Thompson Ridge and in the West Shetland Channel) reveals a number of faunal communities, some of which are very diverse (Fig. 21).

The dominant seabed type on the summit of the ridge is sand with some exposed lag gravel suggesting reasonable current activity over the ridge. The fauna of the ridge summit are typical of the depth and substratum type in the Rockall Trough, differing little from that observed on this habitat type at other sites. The most commonly observed fauna includes urchins (Cidaris cidaris and Echinus acutus), holothurians (Stichopus tremulus) and fish (Chimaera
monstrosa). Seabed features investigated on the summit were an area of suspected water overflow from the Faeroe-Shetland Channel and an anomalous hollow. The fauna of these features differed little from the dominant sand seabed fauna, however isolated cobble and boulders observed on the summit supported growths of erect (*Phakellia* sp. and *Axinella* sp.) and numerous encrusting sponges, stylasterid and cup corals (*Caryophyllia* sp.), and cyclostome bryozoans.

On the shallow summit of the ridge (<500m), as with many features in the region, large iceberg plough-mark features are present (Stations WTR_7, 11, 12). These features are composed of parallel lines of cobble and occasionally boulder size stones with an in-filled furrow between. The furrows of the plough mark features support a similar fauna to the dominant sand-lag gravel habitat. Within the dense cobble and boulder habitat at the edge of the plough mark features characteristic fauna include typical encrusting and attached species (saddle oysters, globose erect, cup and encrusting sponges of many colours, anemones, stylasterid and cup corals (*Caryophyllia* sp), and cyclostome bryozoans. Mobile species such as squat lobsters (*Munida rugosa*), sea stars (*Stichastrella rosea*) and blue mouth red fish (*Helicolenus dactylopterus*) also seem to be common in this habitat. Where plough mark features cross or currents have degraded plough marks the resulting habitat is intermediate between the 'background' sand-lag gravel sea bed and the cobble and boulder plough mark edges. Here, as expected, a mixture of the two faunas was observed.

On the Rockall Trough side of the Wyville-Thompson Ridge a crevice/terrace structure was investigated (Fig.23). The upper reaches of this feature were composed mixed rock substrate with boulders, cobbles and biogenic/ gravel infill (total coverage of 100%) occurred. Dominant fauna were encrusting and erect sponges, hydroids, pencil urchins (*Cidaris cidaris*), anemones (possibly *Bolocera* sp.) squat lobsters and fish, including blue-mouth redfish (*Helicolenus dactylopterus*) and ling (*Molva spp.*). Stylasterids (*Pliobothrus* sp.) and soft corals (*Capnella glomerata*) and were also abundant. The tow began on an area of bedrock outcrop with cobbles. Conspicuous fauna observed were corals, including scleractinians (*Lophelia pertusa* and *Madrepora oculata*) soft coral (*Capnella glomerata*) and stylasterids (*Pliobothrus* sp.). Other fauna present were squat lobsters, pencil urchins (*Cidaris cidaris*), encrusting sponges, and anemones (*Phelliactis* sp.). As the camera descended the slope of the crevice, the substrate changed to a mixed rock area with pebbles, cobbles and the occasional boulders (75-100% cover). Epifauna included, pencil urchins (*Cidaris cidaris*) globe and encrusting sponges, anemones (*Phelliactis* sp. and unidentified) fish (*Lepidon sp.*) and corals (*L. pertusa* and *M. oculata*).

Cluster analysis of the faunal communities of the hard substrate of this region and other sites within the Rockall Trough found the fauna of this area is similar to some areas of Hatton Bank, Rosemary Bank and the West Shetland Channel (Fig. 22).
Figure 23: crevice/terrace structure

On the Shetland side (cold side) of the Wyville Thompson Ridge the fauna differed entirely from that observed in the Rockall Trough. Sampling focused on two areas, a large rocky headland and a slump or sediment fan feature both toward the ridge base (Fig. 24)

Figure 24: a large rocky headland and a slump or sediment fan feature
Water currents around the rocky headland are very strong and undoubtedly influence the faunal composition of the region. Many of the megafaunal species observed in this area are suspension feeders relying on the fast currents for their food supply. The seabed of the headland feature is composed of cobble and pebble lag gravel with occasional boulders. At almost all stations sampled brittle stars (Ophiuroidea) were the most numerically dominant species at estimated densities of 600-1000 individuals per m$^2$. At many sites a zoanthid anemone was almost as dominant at estimated densities of 300-900 polyps per m$^2$. In this region of the ridge sabellid tube worms form dense aggregations on the boulders. Soft corals, cup corals (*Caryophyllia* sp.), yellow feather stars (*Crinoidea*), tubularid hydroids, burrowing anemones, actinid anemones, which in places densely colonise available rock outcrop, and many morphospecies of encrusting, globose and erect sponges all characterise this region as distinctly different to investigated areas of the Rockall Trough. Mobile species observed here are also distinct and include sea stars (*Henricia* sp. and *Crossaster* sp.), basket stars (*Gorgonocephalus* sp.), sea spiders (*Pycnogonida*), whelks (*Gastropoda*), octopus (*Cephalopoda*) and fish.

The exposed lower slope of the headland region is characterised by an abundance of yellow feather stars (*Crinoidea*) (estimated at 3-6 per m$^2$). These spill out onto the floor of the Faeroe-Shetland Channel where the fauna composition changes slightly. On the floor of the channel ophiuroids, sabellid tube worms and zoanthids are no longer the dominant fauna. Instead soft corals are more abundant and yellow feather stars (*Crinoidea*) remain present at high densities (3-6 m$^2$). However, in areas away from the headland feature crinoids are less abundant and tubularid hydroids, erect sponges, actinid anemones (possibly *Urticina* sp.), cup corals (*Caryophyllia* sp.) and soft corals characterise the channel floor.

On the upper slopes of the headland feature an anomalous backscatter signal was recorded corresponding with a slightly steeper section of slope. Here, cup corals carpet the seabed and dense colonies of an unknown species of soft coral, not observed elsewhere on the ridge, can be seen. This area serves to illustrate how small changes in topography can be associated with quite dramatic shifts in faunal composition at highly localised scales. It also suggests the faunal diversity of complex topographic areas like the Wyville-Thompson Ridge may be much higher than expected.

On areas of the lower slope away from the headland feature, where current strengths were substantially less, although seabed type was comparable, the fauna was less diverse and less abundant. Brittle stars (Ophiuroidea) still covered much of the substratum but at lower densities (250 individuals per m$^2$). Other species frequently observed included many morphospecies of encrusting and erect sponges, erect bryozoans (*Reteporella* sp. and cyclostomes), anemones, soft corals, hydroids, and sea stars (*Henricia* sp., *Crossaster* sp.). The dense aggregations of tube worms, crinoids and zoanthid anemones are not present.
At the base of Wyville-Thompson Ridge at one edge of what had been interpreted as a slump or sediment fan feature, a large expanse of rippled sand seabed was present. The biology of this sand habitat was dominated by a single species of burrowing anemone (possibly a Halcampid anemone), that occurred at a density of 30-50 individuals per m$^2$. The only other visible fauna were fish, which were rarely observed. The low faunal diversity of the area and the rippled surface of the sand suggest the sand may be mobile thus preventing the establishment of other species. The presence of sand deposited at this site suggests current speeds here are much slower than those around the headland and thus less favourable to suspension feeding species. At the other edge of the slump feature, near to the headland feature, the seabed was composed of lag gravel of pebble and cobble size and was essentially a scree slope. Again a single species of burrowing anemone at estimated densities 100 per m$^2$ was observed. However, the fauna here showed some similarity to the fauna of the nearby headland feature suggesting conditions here were more similar to those on the headland (e.g. faster currents). Ophiuroids and yellow feather stars (Crinoidea) were present at estimated densities of 400 and 6 individuals per m$^2$ respectively. Other identifiable fauna were those typical of the floor of the Faeroe-Shetland Channel and included soft corals, sabellid tube worms became much more abundant, zoanthid anemones, sea pens, ascidians, and sea stars (Crossaster sp.).

4.1.5 West Shetland Channel
As with the Wyville-Thompson Ridge the benthic ecology of this region is dominated by the marked difference in temperature between the shallower North Atlantic Water and deeper cold (subzero) Norwegian Sea waters. Cluster analysis of image data shows a gradual faunal change between cold and warm stations (Fig. 17).

The dominant seabed type of the continental slope, west of Shetland, is sand with some gravel, pebbles and occasional cobbles. At shallower (warmer) depths the fauna in general is similar to that described previously from comparable depths and seabed type in the Rockall Trough. Commonly observed species are all typical of the region, depth and habitat and include the blue mouth red fish (Helicolenus dactylopterus), squat lobsters (Munida rugosa), urchins (Echinus acutus, Cidaris cidaris), sea stars (Henricia sp, Poraniomorpha hispida rosea), actinid anemones, holothurians (Stichopus tremulus) and brittle stars (Ophiuroidea). However, the sponge fauna of the continental slope west of Shetland is more diverse than that observed in the Rockall Trough, with many different morphotypes present including branched, cup, lamellate, globose, and encrusting forms. At approximately 450m depth, sponges dominate the faunal community forming a structural sponge habitat, described in other areas as ‘ostur’ (Klitgaard & Tendal, 2004). This deep-sea sponge habitat is only found over a very narrow depth range from 400-600m and was not observed on the Wyville-Thompson Ridge or at the Rockall Trough sites. At deeper depths, within the Norwegian deep-water mass the faunal community is most similar to that at comparable depths on the cold side of the Wyville-Thompson Ridge. A number of seabed features were
observed on the multibeam and their faunal composition subsequently investigated. These included iceberg plough marks and channels.

Iceberg plough marks, characteristic of the deep-waters of the UK to depths of ~500m, were clearly visible on the multibeam data from the area. However, unlike the iceberg plough marks observed on Hatton Bank, Wyville-Thompson Ridge, and Rosemary Bank, those on the continental slope west of Shetland were degraded, possibly as a result of intense trawling pressure or local hydrodynamic regime. The distinct plough mark structure of parallel bands of cobbles with a central furrow was not clear on the video transects (WSC 12, 14, 15, WSCE 5, 6, 8, 9) although at the edges of plough mark features (determined from the multibeam) the density of cobbles appeared to increase slightly, while within the central furrow, cobbles were largely absent. The fauna of the plough mark edges (and other cobbles and boulders observed in the area) was again typical of the substratum type and depth, being similar to the fauna associated with these features in the Rockall Trough.

However, a number of plough mark features supported a diverse range of sponge morphospecies. These plough marks were all between 440-483m depth (WSCE 1, 3, 4, 10, and WSC 14). The continental slope east of the Faeroe Islands has been reported to support communities of large structural sponges or Ostur (Klitgaard and Tendal, 2004). During the AFEN surveys of the continental slope west of Shetland, sponge dominated communities were reported over a narrow depth band straddling the 500m contour (Axelsson, 2003). The present survey identified structural sponge communities associated with various seafloor features including iceberg plough marks, terrace structures (WSC16, 17, 18), and ditch features (WSCE 2). The occurrence of sponge communities is not thought to be associated with the presence of seafloor features, but with local hydrodynamic regime.

Klitgaard et al. (1997) extended the theories of Frederiksen et al. (1992) for the distribution of Lophelia pertusa to explain the distribution of structural sponge communities or “ostur”. Accumulations of large suspension feeders show tendency to aggregate near the shelf break in regions with a critical slope where the bottom slope matches the slope of propagation of internal tidal waves. The causal link is thought to be an increase in the supply of food related to the incidence of internal waves which results in resuspension. Rice et al (1990) noted that communities of the sponge Pheronema carpenteri are not found within the areas of enhanced current produced by the critical slope angle but are associated with them, the sponge being particularly abundant along their lower boundaries and downstream of these enhanced current regions. Again the increased food supply was cited as a possible reason. The sponge communities observed here lie within the warmer waters of the Faeroe-Shetland Channel.

The structural sponge communities of the west Shetland Channel are characterised by a high diversity of sponge morphospecies including branched, cup, lamellate, globose, erect and encrusting sponges. Distinct species include bright blue and bright yellow encrusting sponge forms, large white erect sponges with multiple chimney like structures, and Geodid
species. The distribution of sponges is patchy with some areas supporting dense growths of large sponges and others areas supporting less dense growths of small and encrusting forms. Other commonly observed fauna in this areas are those more typical of the region and depth (saddle oysters, serpulid worms, occasional corals (Caryophyllia sp and Stylasterids), and bryozoans (Reteporella sp.)). The mobile fauna was sparse but dominated by squat lobsters (Munida sp.) and urchins (Cidaris cidaris). Sea stars (Henricia sp, Peltaster placenta, Poraniomorpha hispida rosea, and other Pterastids), and ophiuroids were observed occasionally. Cluster analysis of faunal data suggest that the sponge communities are distinct but related to the surrounding faunal communities (Fig.17)

These findings support earlier findings of Axelsson, (2003) describing ‘the sponge-belt’, from stills images of the seabed taken as part of the AFEN survey. Axelsson (2003) describes these sponge communities as supporting a large amount of sponges of a large variety of species, with other megafaunal groups present including Munida sp. (most likely Munida sarsi), cidarid urchins, spatangid urchins and sea stars.

These finding suggest there may be a continuous narrow band of ostur on the UK continental slope north of the Wyville-Thompson Ridge, focused on the 500m contour.

Other features investigated on the continental slope west of Shetland include a series of channels running down-slope. At the heads of the channels, at a depth of ~600m the seabed is composed of sand, with gravel, pebbles, occasional cobbles and rarely boulders. The sediment is rippled in places suggesting current flow through the channels. The epifauna observed here (WSC4, 7, 10, 11, 13) include burrowing anemones, ophiuroids, and hagfish (Myxine glutinosa) with erect, cup and encrusting sponges and soft corals attached to cobbles. Less commonly observed species are crinoids, asteroids (Henricia sp., Peltaster placenta, Crossaster sp), echinoids (Echinus sp.), bryozoans (Reteporella sp. and cyclostomes) gastropods, tube worms and crustaceans (pagurid crabs and pandalaeid shrimps).

The walls of the channels are composed of coarser substratum with pebbles and cobbles more evident and in very steep areas exposed bedrock. Here the epifauna includes tubular sponges, soft corals, small sea pens, anemones and tubularid hydroids.

The floor of the channels varies in substratum type with some areas coarser than others presumably related to the hydrology of the channel systems. On rippled sand habitat epifauna were not highly abundant and resemble the faunal composition at the head of the channels (similar substrate). On mixed cobble/boulder and lag gravel habitat the fauna resembles that of the channel walls (similar substratum type). In very steep areas on the channel walls or floor, abundant basket stars (Gorgonocephalus sp.), crinoids, soft corals, hydroids, anemones and small sea pens are present. All of these species are suspension feeders suggesting fast currents flowing in these steeper areas. Toward the ends of the channels the sediment is muddier, however pebbles
and occasional cobbles may still be present. The fauna here does not differ significantly from that observed within the channel systems.

The most notable feature of the channels was the high abundance of rays (Rajiformes) present on the floor of the channels. This species appeared to be using the channels as a resting area, with all observed individuals being motionless, even with the passing of the camera.

The findings reported here are comparable with those reported within the earlier AFEN study. The presence of a “sponge belt” and notable absence of *Lophelia pertusa* reef were reported in the AFEN study. Seabed sediment types observed from image and video are comparable with the range of seabed types described within that study. No specific analysis of data from channel features was undertaken as part of AFEN and so no comparison can be made.

**4.1.6 Papa Bank**

The Papa Bank site surveyed ranges from 60 to 160m deep and is composed of large bedrock and cobble outcrops standing 40-60m above the seafloor. These outcrops may have channels of coarse sand and biogenic gravel running between them, with areas of cobble strewn sand seabed in the immediate surrounding area. Away from the outcrop areas the sand substrate may be rippled in places suggesting high current activity. The area was geologically diverse.

The bedrock outcrop, boulder and cobble regions were characterised by a diverse range of species. At the summit of outcrop features encrusting sponges were the most conspicuous fauna. However, the flanks of outcrop features together with cobble strewn areas were characterised by *Flustra foliacea*, hydroids, aggregations (carpets) of anemones, cup sponges (possibly *Axinella* sp.), cup corals (*Caryophyllia* sp.), and numerous encrusting species. Conspicuous epifauna include sea stars (*Stichasterella rosea*, *Porania pulvillus*) and squat lobsters (*Munida rugosa*). In places a brittle star bed was present.

Toward the base of the outcrop features the seabed is composed of pebbles, whole shell gravel and coarse sand with few conspicuous epifauna except serpulid worms and very rarely the sea star *Porania pulvillus*. Away from the outcrop features the seabed is composed of sand with few visible epifaunal species, however there is evidence of infaunal activity from protruding tubes (Polychaeta) and siphons (Bivalvia).

Cluster analysis of faunal communities demonstrates that the fauna of both Papa and Pobie Banks are distinct from the faunal communities of the deeper stations sampled in the Rockall Trough (Fig. 18) although similar to each other (Fig. 19). The fauna of Papa Bank is similar to that from comparable depths and substrate west of the Hebrides (Mitchell, 2006). However, Papa Bank appears to support a greater range of erect bryozoan species and fewer sponge species than observed west of the Hebrides.
4.1.7 Pobie Bank

The Pobie Bank site surveyed ranges from 80-165m deep and is composed of bedrock, boulder and cobble banks surrounded by coarse sand and gravel seabed. The rocky banks are sparsely colonised by hydroids, cup, branched and encrusting sponges, solitary corals (*Caryophyllia* sp.) and serpulid worms. Erect bryozoans (cyclostomes) are abundant in places and at the bank edges where rock meets sand, a dense biogenic gravel composed of the hard skeleton of erect bryozoans is often present. Mobile species on the banks include sea stars (*Stichastrella rosea*, *Hippasteria* sp.), squat lobsters (*Munida rugosa*), hermit crabs (Paguridae), and brittle stars (Ophiuroidea).

The seabed away from the rocky areas is composed of gravel and coarse sand. Few visible epifauna are present in this habitat except rarely, hermit crabs (Paguridae). However, signs of infaunal activity are frequently observed in the form of protruding siphons and locally abundant aggregations of tusk shells (Scaphopoda).

As with Papa Bank cluster analysis of faunal communities demonstrates that the fauna of both Pobie and Papa Banks are distinct from the faunal communities of the deeper stations sampled in the Rockall Trough (Fig. 18) although similar to each other (Fig. 19). The fauna of Pobie Bank is similar to that from comparable depths and substrate west of the Hebrides (Mitchell, 2006). However, Pobie Bank appears to support a greater range of erect bryozoan species than observed west of the Hebrides.
5. Conclusions

- The fauna of Papa and Pobie Banks are distinctly different to all other stations sampled.
- The faunal communities of the features of the Rockall Trough are broadly similar to each other and to the shallow, warmer stations sampled in the Faeroe-Shetland Channel.
- The faunal communities of the cold waters of the Faeroe-Shetland Channel are distinct from all other areas sampled.
- Structural sponge communities were present at approximately 500m depth at the West-Shetland Channel sites and may be present in a continuous band along the continental slope in this basin.
- Cold water coral reef communities were notably absent from the West Shetland Channel but present on Hatton Bank and the Wyville Thompson Ridge and were observed on Hatton Bank, George Bligh Bank and Rockall Bank in the 2005 surveys.
- Cold water coral reefs were in general associated with rock outcrop, pinnacle and rock terrace (ledge) features.
- Iceberg plough marks were observed on all features (except Papa and Pobie Banks), and were observed on Anton Dohrn Seamount and Rockall Bank in 2005.
6. References:


Johnston CM, Turnbull CG, Tasker ML (2002) Natura 2000 In UK Offshore Waters, advice to support the implementation of the EC Habitats and Birds Directives in UK offshore waters JNCC Report, No 325 Peterborough, Joint Nature Conservation Committee


7. Appendix
See separate file