



Side-scan-sonar survey of the Horse mussel (*Modiolus modiolus*) beds off the Point of Ayre (August 2008)

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INTRODUCTION

Modiolus modiolus (horse mussels) can occur locally in high abundances leading to the formation biogenic reef structures. These structures have a rich associated fauna, in particular emergent epifauna such as soft corals, sponges, anemones, ascidians, hydroids and bryozoans. Also tubeworms, brittlestars, urchins, starfish, barnacles, crabs, whelks and scallops commonly occur in elevated abundance on *Modiolus* reefs (Holt et al. 1998 and references therein).

Due to the occurrence of scallops among the *Modiolus* reef matrix, scallop dredging has been identified as a major threat to this complex habitat. *Modiolus* beds are considered to have been eroded by fishing in other parts of the Isle of Man such as the *Modiolus* beds off Dreswick Point. Furthermore aggregate extraction may be a potential thread to the *Modiolus* beds through direct physical disturbance or indirectly via changes in local hydrodynamic conditions that affect food supply and larval recruitment. Within UK waters *Modiolus* reefs are of conservation interest and are protected within Special Areas of Conservation (SAC). No bylaws are in place to protect *Modiolus* reefs around the Isle of Man.

The *Modiolus* (*Modiolus modiolus*) bed off the Point of Ayre was surveyed with side-scan-sonar and video/stills camera tows as part of a larger habitat mapping survey conducted by the School of Ocean Sciences onboard the R.V. Prince Madog in August 2008. The main objectives of the survey were to establish the current **extent** and **general status** of the *Modiolus* bed. Previously, the site had been surveyed using a multi-beam sonar system. However uncertainties existed over the full extent of the reef structure. A further aim of the survey was to detect any potential damage caused to the reef by fishing operations for king scallops (*Pecten maximus*) or queen scallops (*Aequipecten opercularis*).

METHODS

Side-scan-sonar survey

A C-Max 800 side-scan-sonar system was used to survey the *Modiolus* bed off the Point of Ayre. The side-scan-sonar tow fish was set at high frequency (325 kHz) and with a total swath width of 200 m. The tow fish was towed at a speed of approximately 4 Knots at an altitude of 4–7 m above the seabed.

Due to the size of the area chosen for survey (30 km²), and the limited time available (36 hours) 8 parallel lines of 7.5 km length were surveyed. Individual lines were spaced 300 meters apart (Fig. 1). The resultant grey scale images of the tow lines were subsequently visually analyzed and classified within ArcView GIS.

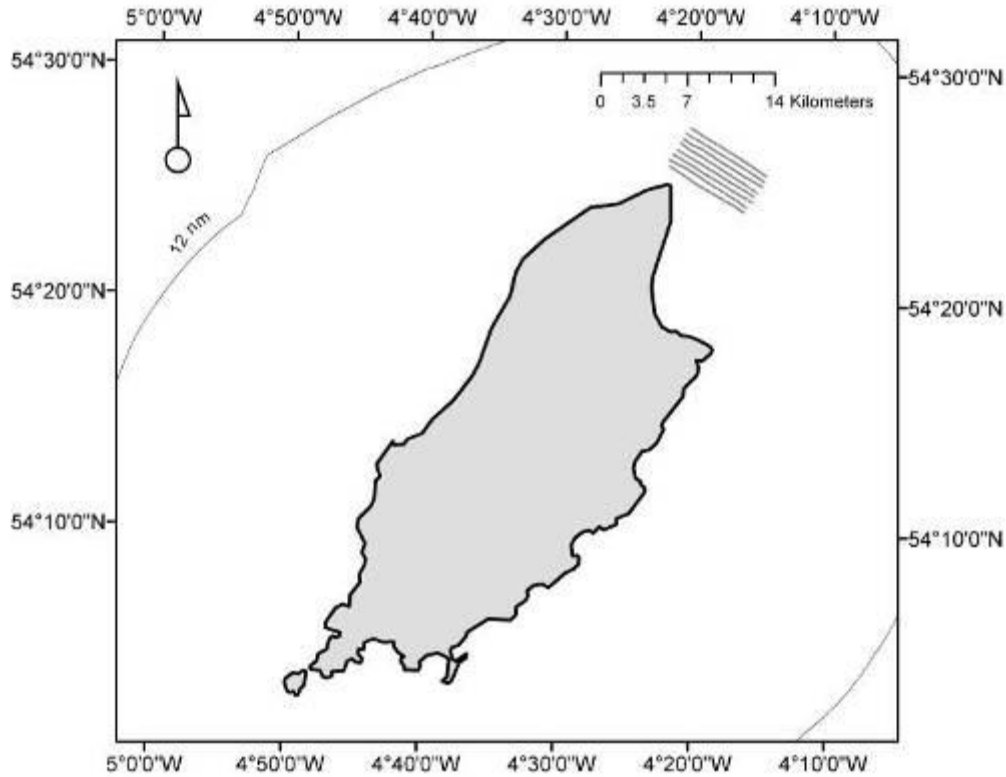


Fig. 1 Map of the Isle of Man and the survey lines north of the Point of Ayre

Video and stills camera survey

At selected sites a video/stills camera tow was conducted for ground-truthing and to assess the status of the reef. The camera sledge was equipped with a Rovtech video and digital stills camera system and was towed at a speed of 1 to 1½ knots. On each occasion, the sledge was deployed and towed for 15 minutes on the seafloor. Geographical positions were recorded once the sledge landed on the seafloor and once it lifted off the ground during retrieval. Tow length varied between 12 and 478 m (see Table 1). Overall 13 video/stills camera tows were conducted. While the video delivered a live image that was recorded to DVD the stills camera system simultaneously took images of the sea floor every 10 s. The field of view of each photograph covered an area of 0.13

m² (30 cm height and 45 cm width) Images were downloaded onto an external hard drive after every tow.

Stills images were analyzed for a general description of the habitat characteristics and associated fauna. Numbers of live *Modiolus modiolus* were counted within all images available for a tow. *Modiolus* individuals were judged to be alive if the shell was clearly gaping and/or the shell was found in an upright position. Similarly if the shell was in good condition and had emergent fauna attached to it, it was assumed to be alive. It should be noted that the abundance figures are, due to the difficulty of accurately identifying all living mussels, only estimations, but these provide a useful comparative dataset for assessing the relative density of *Modiolus* in a spatial context.

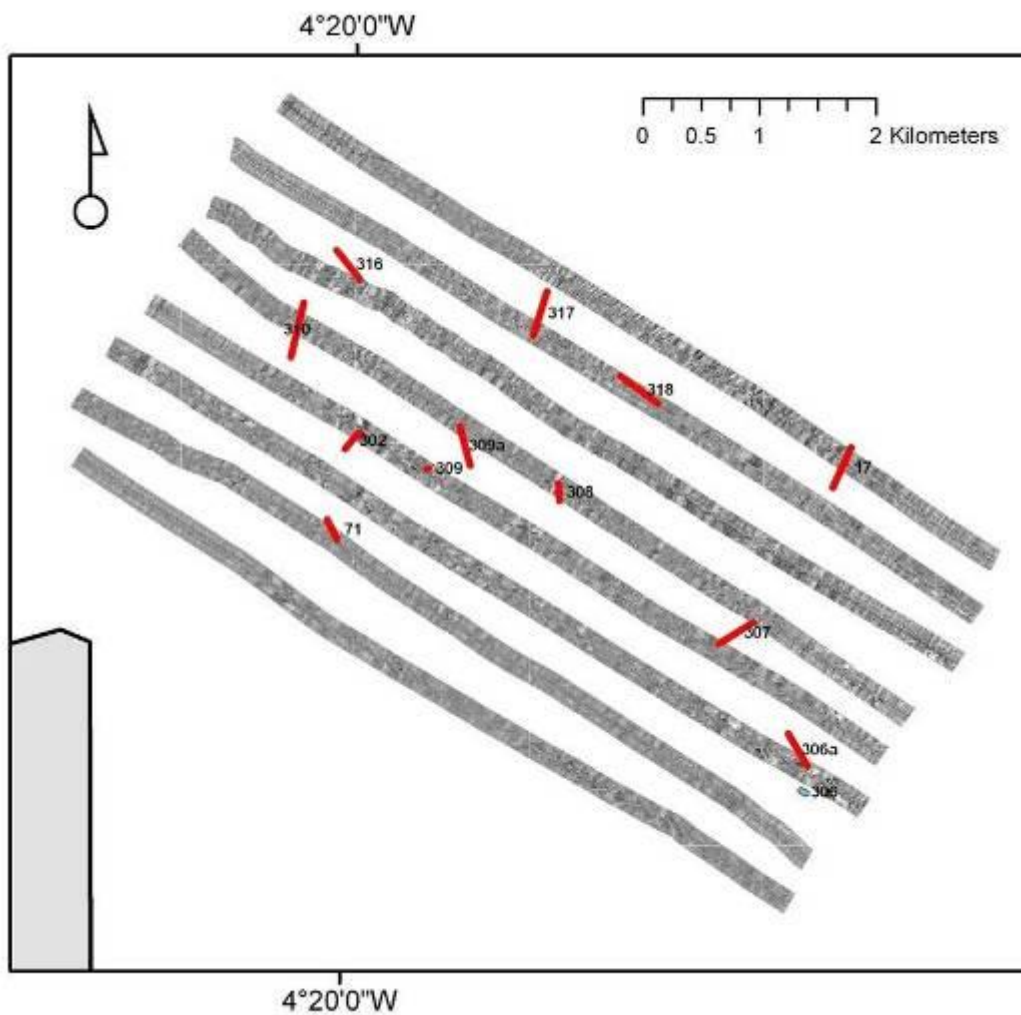


Fig. 2 Map showing side-scan track images (grey) and video/still camera tow tracks (red)

RESULTS

Working conditions off the Point of Ayre

Weather and strong tidal conditions made surveying the Point of Ayre difficult. The quality of the side-scan-sonar images was therefore not optimal and images contained a lot of artifacts (induced by waves) that reflected these conditions. Due to strong tidal currents, deployments of the camera were only possible two hours either side of slack water. In currents above 2.5 knots working with the camera sledge had to be terminated as the strain on the umbilical of the video camera was too great. Due to these conditions tows at the stations 306 and 309 were very short and only a few images were taken. Due to technical problems no still images could be attained for station 302 and only a two minute video was available to describe the habitat at this station.

Side scan sonar habitat classification

Substratum types were classified by visual inspection of side-scan-sonar tow tracks within a GIS. The following four substratum categories could be identified (see also Fig 3):

- 1) Smooth surface indicating a level substratum of similar type
- 2) Clear wave structures indicating sand waves
- 3) Some structured substratum present most likely *Modiolus* beds
- 4) Extensive structural substratum present most likely *Modiolus* beds

Each tow line was assessed and selected positions along the line (approximately every 100-150 m) were allocated to one of the four substratum types to allow a rapid analysis of the extend of the *Modiolus* reef (see Fig 4).

Overall, categories 3 and 4 covered an area of 16 km² (53% of the area surveyed). The extent and limits of the *Modiolus* reef (transition from reef substratum into another substratum type) could clearly be established for the northern and southern parts of the reef. The southeastern limit was also found, however, the northwestern limit of the reef could not clearly be established and it is possible that the reef extends further to the northwest.

Stills image analysis and ground-truthing of side-scan image classification

The results of the stills image analysis in most instances verified the side-scan-sonar image classification. Station 306 and 316 both lay close to

areas identified as category 1. Station 306 clearly showed uniform sandy sediments with few stones present (Fig. 24). Station 316 had even gravel with interspersed shelly sand (Fig. 6). Station 17 was the only station in the vicinity of habitat category 2 (Clear wave structures indicating sand waves) and stills images showed clean sand with sand ripples. All other stations fell within category 3 and 4 substratum type. Images of all these stations showed gravel with sand interspersed between stones (Figs. 8, 10, 12, 14, 16, 18, 22 and 25).

At all sites old *Modiolus* shells were present. Live *Modiolus* were counted at all sites of habitat category 3 and 4 (see Table 1). The sites with the highest estimated abundance were station 307 with 75 individuals, and station 317 with 14 individuals.

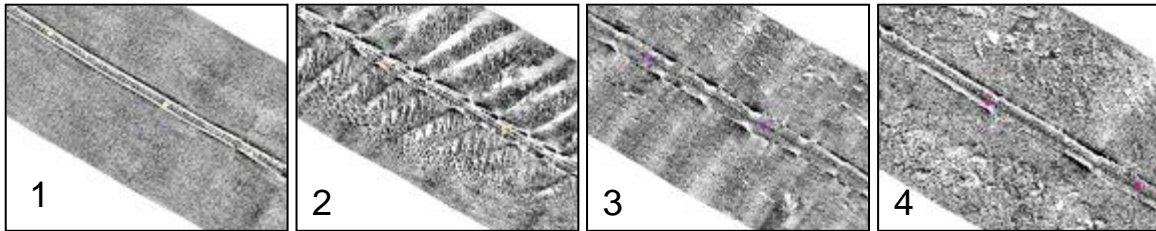


Fig 3. The four habitat categories identified from side-scan-sonar images of the survey area.

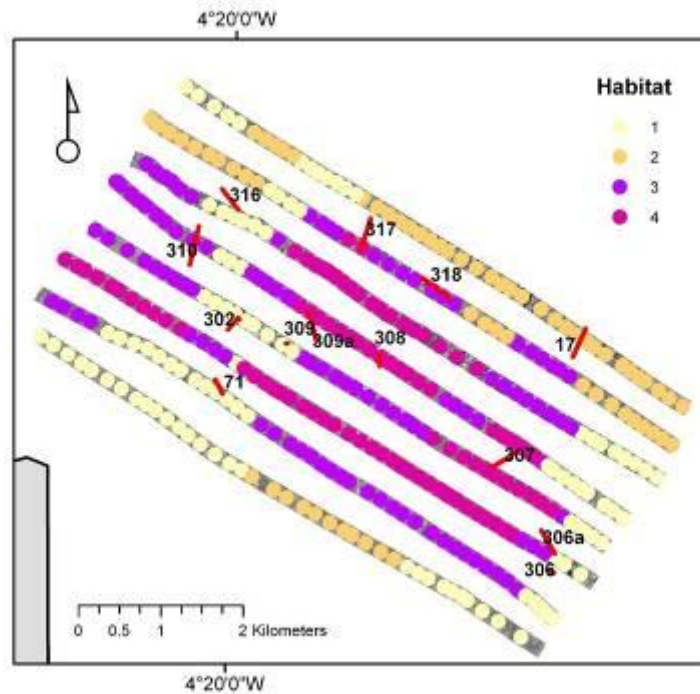


Fig 4 Substratum categories identified along each side-scan-sonar line.

Table 1. Summary of video tow positions (Decimal Degrees), length and habitat characteristics described from stills image analysis

| Station | Date | Position Lat_DD start | Position Long_DD start | Position Lat_DD end | Position Long_DD end | Tow length in meters | Number of still images | General habitat description from images | Side-scan substratum category | Estimated number of live <i>Modiolus</i> | Characteristic fauna (other than <i>Modiolus</i>) |
|---------|------------|-----------------------|------------------------|---------------------|----------------------|----------------------|------------------------|---|-------------------------------|--|---|
| 310 | 22/08/2008 | 54.4411 | 4.3413 | 54.4453 | 4.3397 | 478 | 121 | Gravel with coarse sand, large worn <i>Modiolus</i> shells present | 3 | 14 | <i>Alcyonium digitatum</i> <i>Metridium senile</i> <i>Urticina felina</i> |
| 316 | 22/08/2008 | 54.4472 | 4.3324 | 54.4494 | 4.3355 | 316 | 105 | Gravel with sand, large worn <i>Modiolus</i> shells present | 1 | 0 | <i>Alcyonium diaphanum</i> <i>Nemertisia antenna</i> <i>Flustra foliacea</i> |
| 302 | 22/08/2008 | 54.4341 | 4.3339 | 54.4353 | 4.3322 | 142 | 0 | Gravel with sand, large worn <i>Modiolus</i> shells present | 1 | 0 | <i>Alcyonium digitatum</i> |
| 317 | 22/08/2008 | 54.4431 | 4.3093 | 54.4465 | 4.3076 | 394 | 109 | Gravel with sand, some sandy patches, large worn <i>Modiolus</i> shells present | 4 | 17 | <i>Alcyonium digitatum</i> <i>Urticina felina</i> <i>Antedon bifida</i> |
| 309 | 22/08/2008 | 54.4327 | 4.3230 | 54.4327 | 4.3228 | 347 | 7 | Gravel with sand, large worn <i>Modiolus</i> shells present | 1 | 0 | <i>Nemertisia antenna</i> <i>Flustra foliacea</i> |
| 309a | 22/08/2008 | 54.4330 | 4.3173 | 54.4360 | 4.3188 | 12 | 93 | Gravel with sand, large worn <i>Modiolus</i> shells present | 4 | 4 | <i>Hydrallmania falcate</i> <i>Alcyonium digitatum</i> <i>Urticina felina</i> |
| 71 | 05/08/2008 | 54.4271 | 4.3347 | 54.4286 | 4.3361 | 190 | 114 | Gravel with coarse sand, large worn <i>Modiolus</i> shells present | 4 | 9 | <i>Hydrallmania falcate</i> <i>Alcyonium digitatum</i> <i>Crossaster papposus</i> |
| 318 | 22/08/2008 | 54.4401 | 4.2977 | 54.4380 | 4.2926 | 405 | 122 | Gravel with sand, large worn <i>Modiolus</i> shells present | 3 | 4 | <i>Alcyonium digitatum</i> <i>Antedon bifida</i> |
| 308 | 22/08/2008 | 54.4304 | 4.3054 | 54.4317 | 4.3056 | 145 | 120 | Gravel with sand, some sandy patches, large worn <i>Modiolus</i> shells present | 4 | 4 | <i>Alcyonium digitatum</i> <i>Urticina felina</i> <i>Metridium senile</i> |
| 17 | 05/08/2008 | 54.4349 | 4.2670 | 54.4318 | 4.2693 | 375 | 104 | Sand, large worn <i>Modiolus</i> shells present | 2 | 0 | <i>Pagurus prideaux</i> |
| 307 | 22/08/2008 | 54.4196 | 4.2840 | 54.4213 | 4.2795 | 347 | 120 | Gravel with coarse sand, large worn <i>Modiolus</i> shells present | 4 | 75 | <i>Alcyonium digitatum</i> <i>Urticina felina</i> <i>Antedon bifida</i> |
| 306 | 22/08/2008 | 54.4084 | 4.2728 | 54.4082 | 4.2721 | 50 | 19 | Sand and Gravel, large worn <i>Modiolus</i> shell present | 1 | 0 | <i>Nemertisia antenna</i> <i>Alcyonium digitatum</i> |
| 306a | 22/08/2008 | 54.4103 | 4.2720 | 54.4128 | 4.2746 | 325 | 111 | Gravel with sand, large worn <i>Modiolus</i> shells present | 4 | 3 | <i>Nemertisia antenna</i> <i>Metridium senile</i> <i>Antedon bifida</i> |

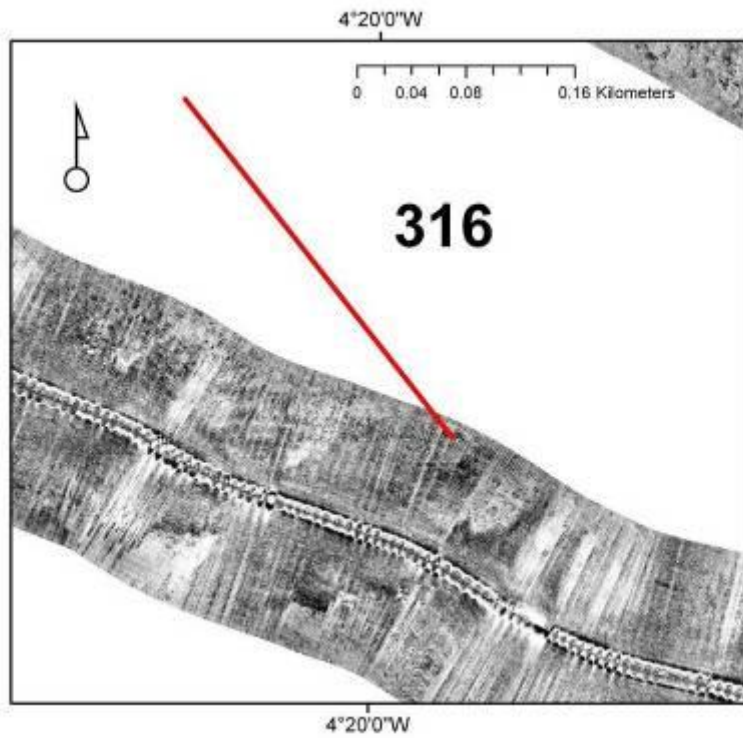


Fig 5 Map showing side-scan image and camera tow track station 316

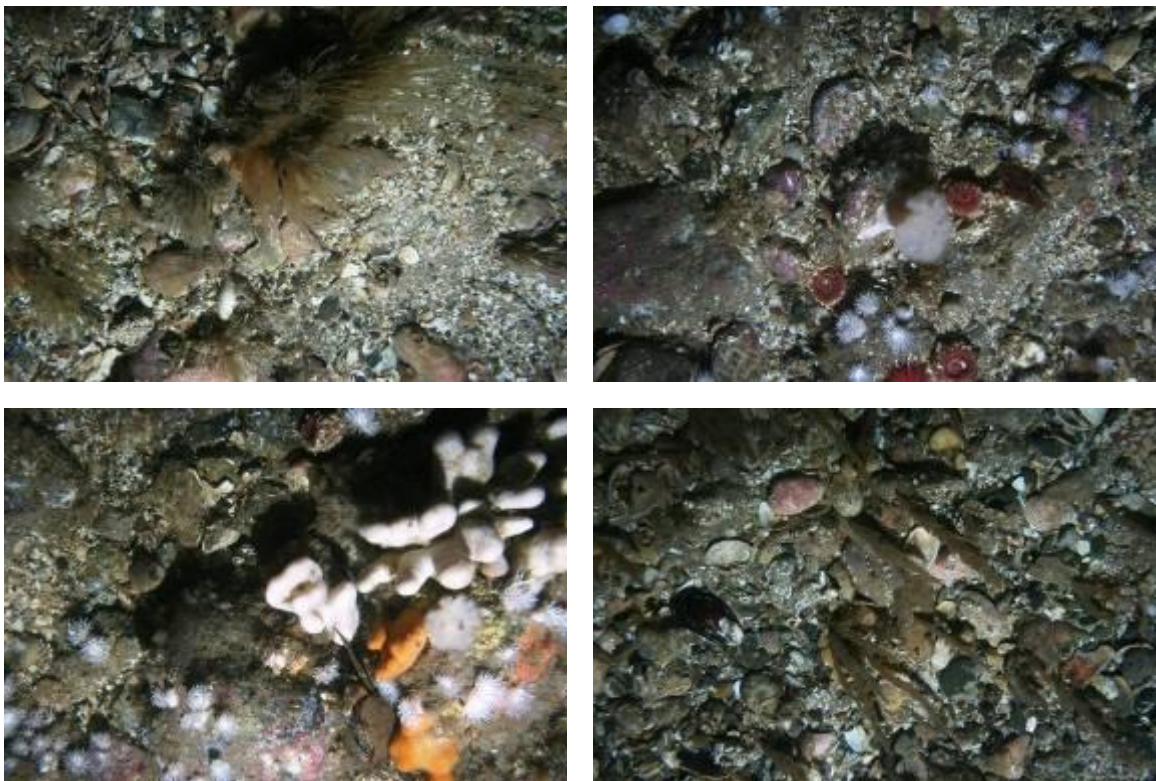


Fig. 6 Images of camera tow 316 showing representative habitat characteristics

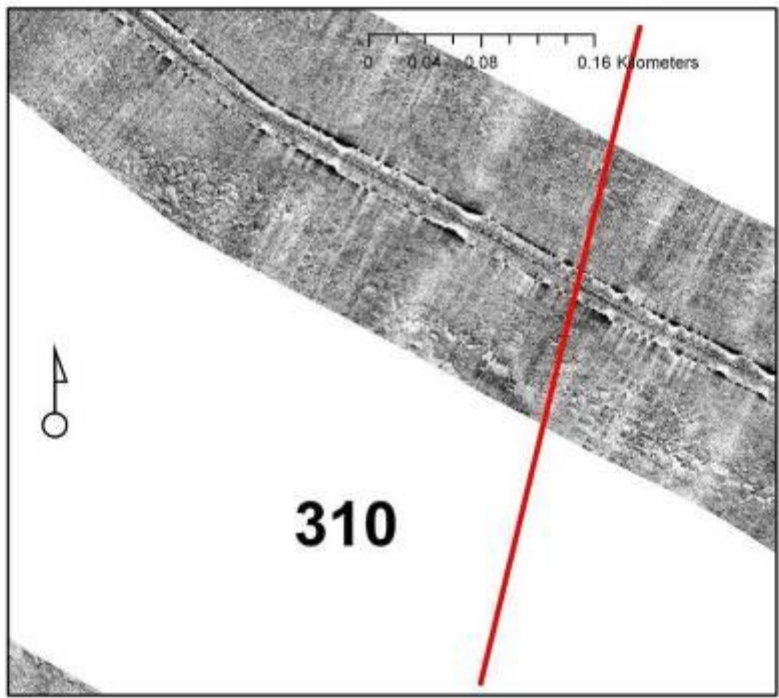


Fig. 7 Map showing side-scan image and camera tow track station 310

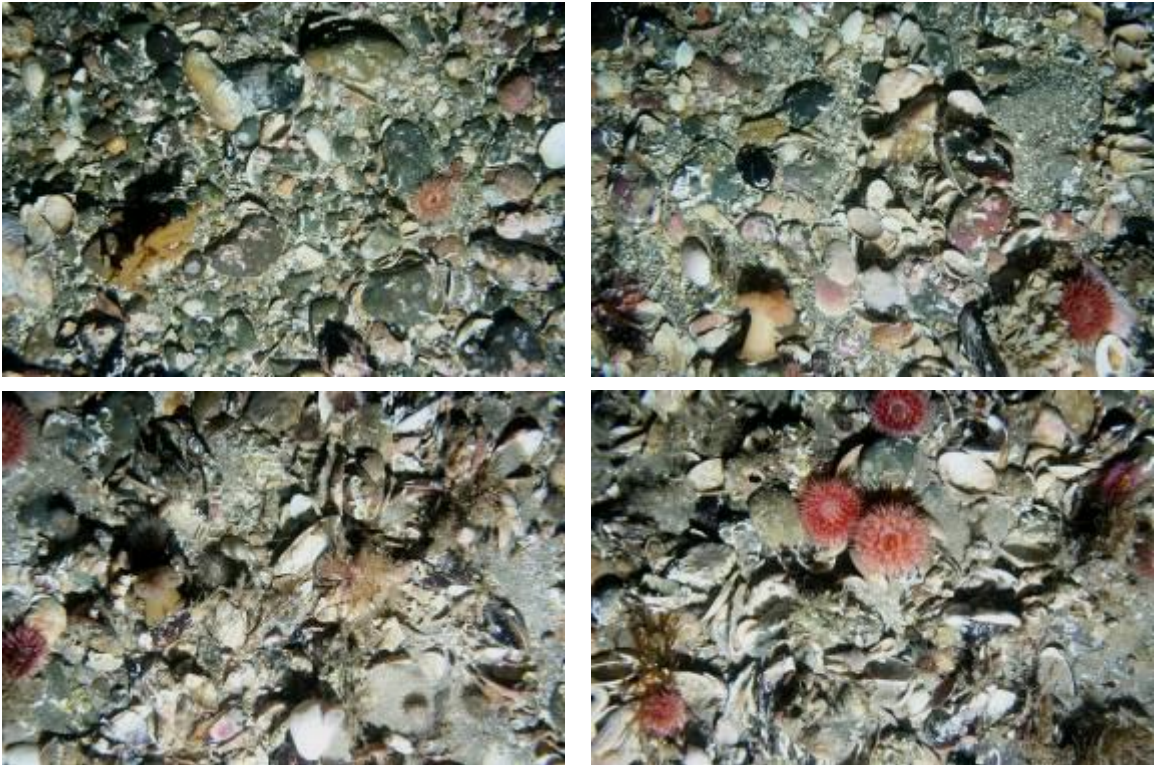


Fig. 8 Images of camera tow 310 showing representative habitat characteristics

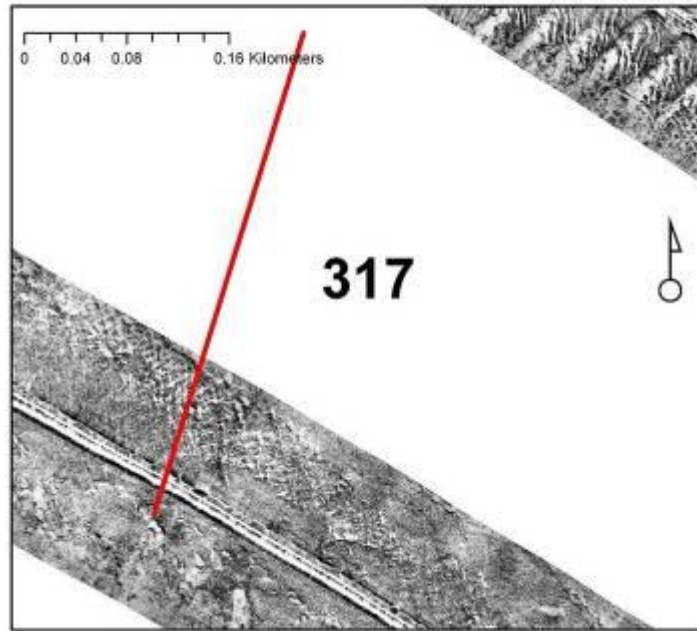


Fig. 9 Map showing side-scan image and camera tow track station 317

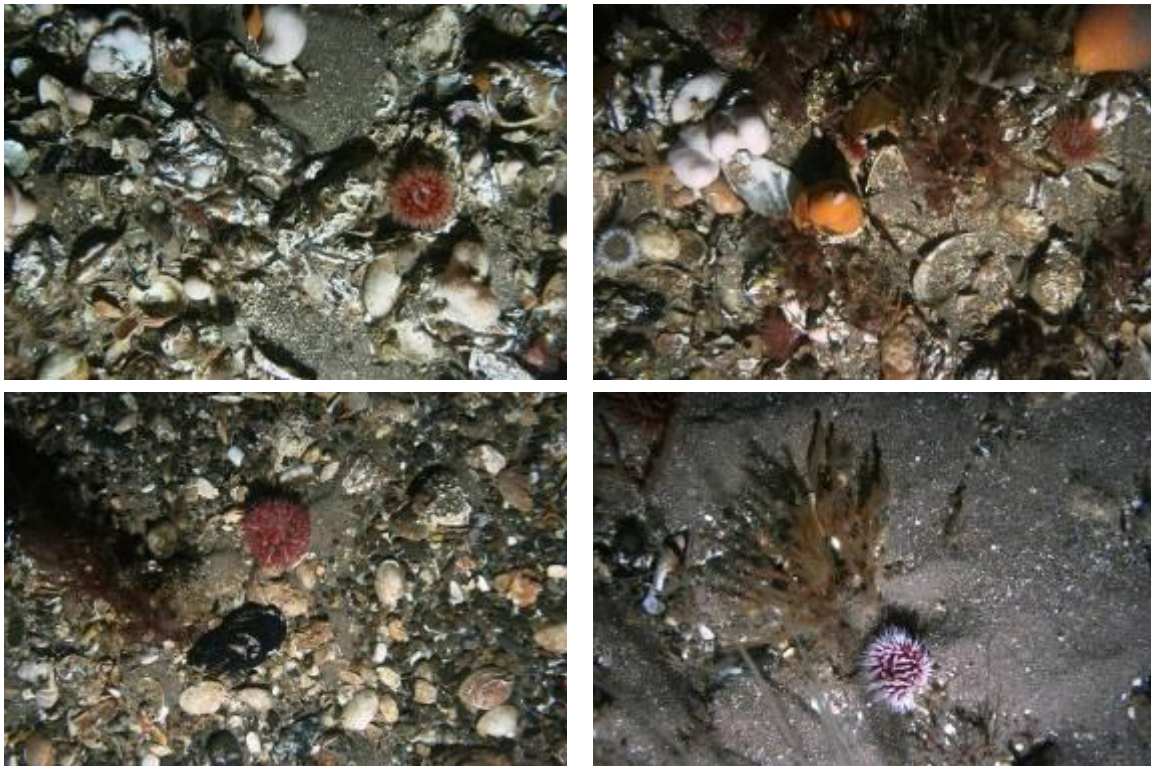


Fig. 10 Images of camera tow 317 showing representative habitat characteristics

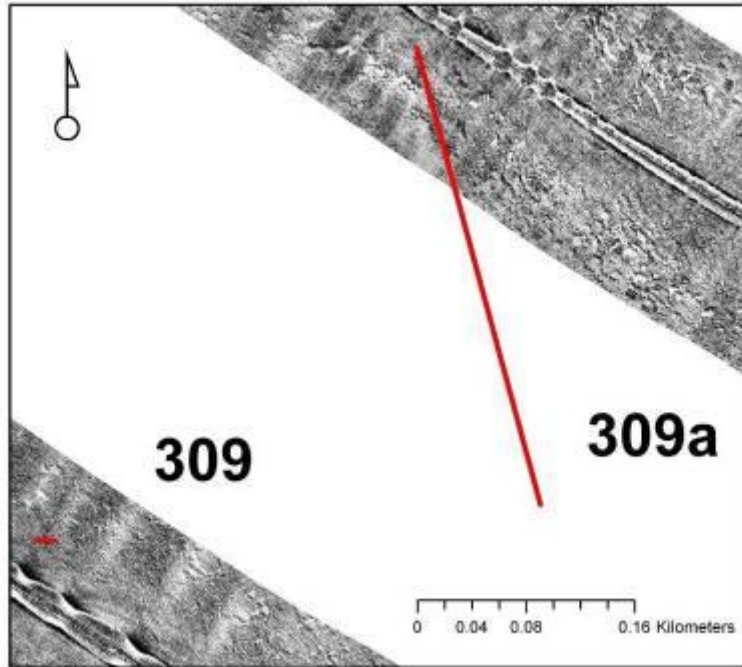


Fig. 11 Map showing side-scan image and camera tow track station 309a

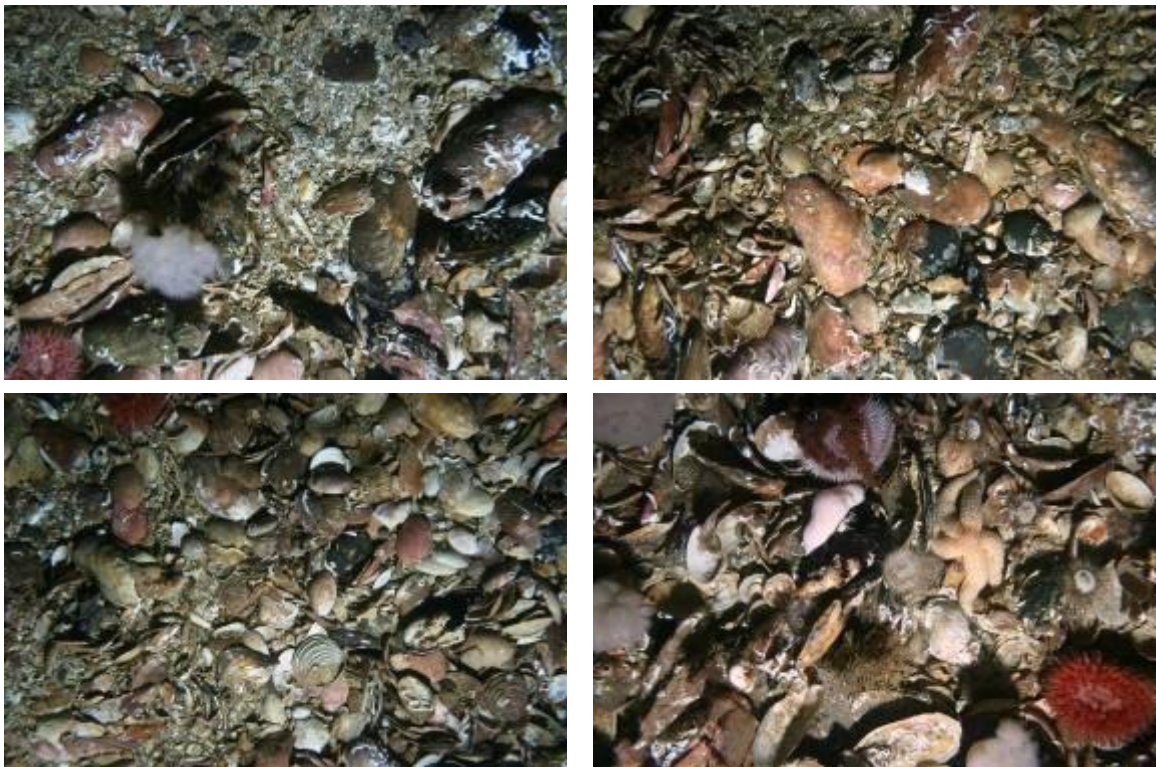


Fig. 12 Images of camera tow 309a showing representative habitat characteristics

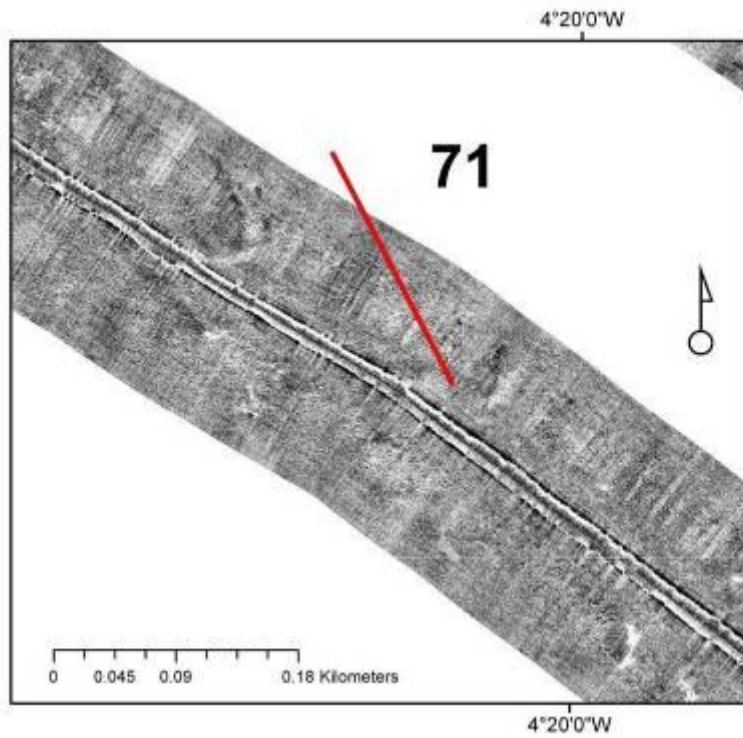


Fig. 13 Map showing side-scan image and camera tow track station 71



Fig. 14 Images of camera tow 71 showing representative habitat characteristics

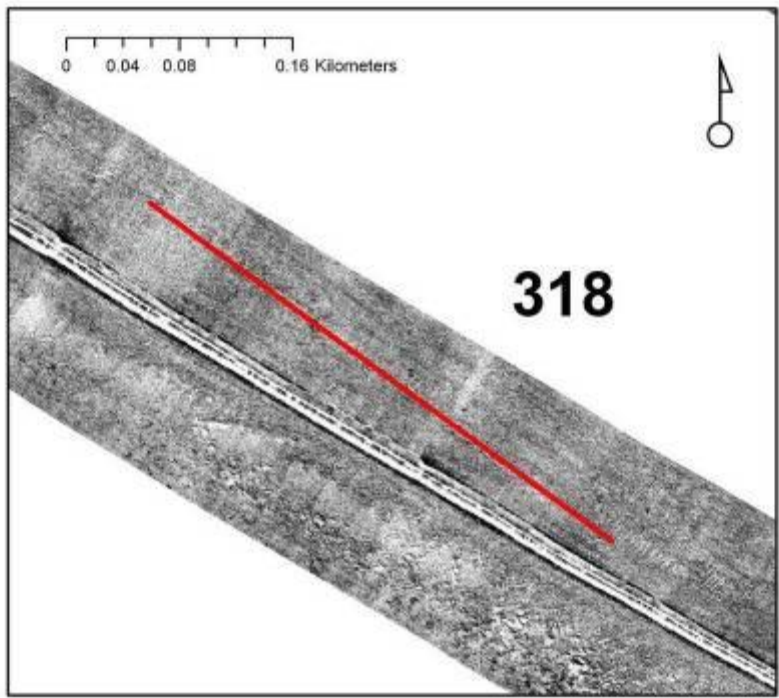


Fig. 15 Map showing side-scan image and camera tow track station 318

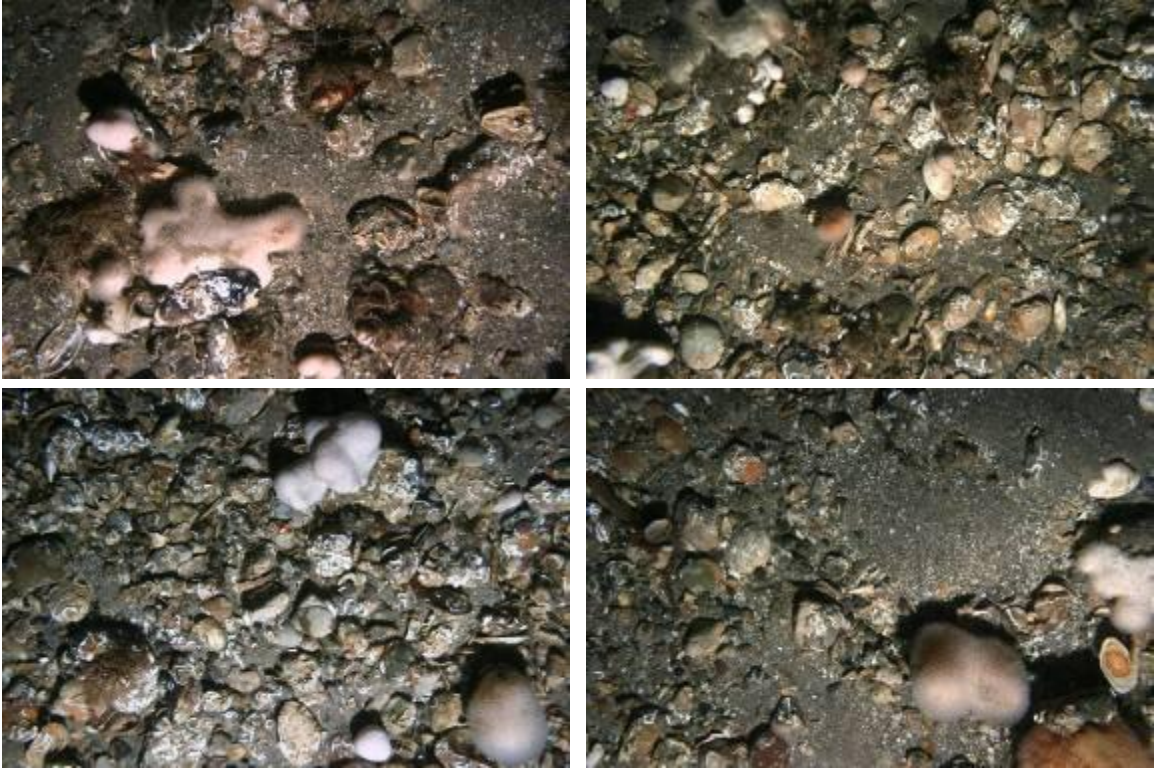


Fig. 16 Images of camera tow 318 showing representative habitat characteristics

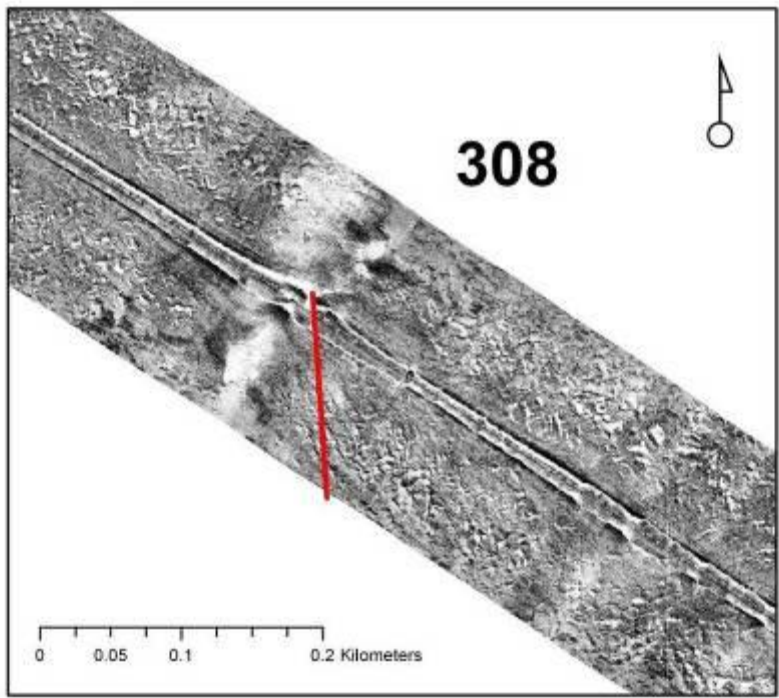


Fig. 17 Map showing side-scan image and camera tow track station 308



Fig. 18 Images of camera tow 308 showing representative habitat characteristics

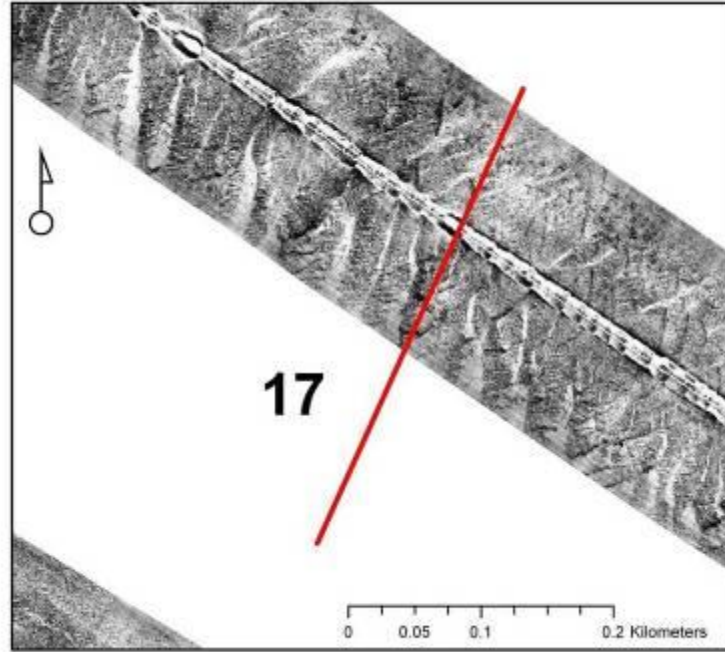


Fig. 19 Map showing side-scan image and camera tow track station 17



Fig. 20 Images of camera tow 17 showing representative habitat characteristics

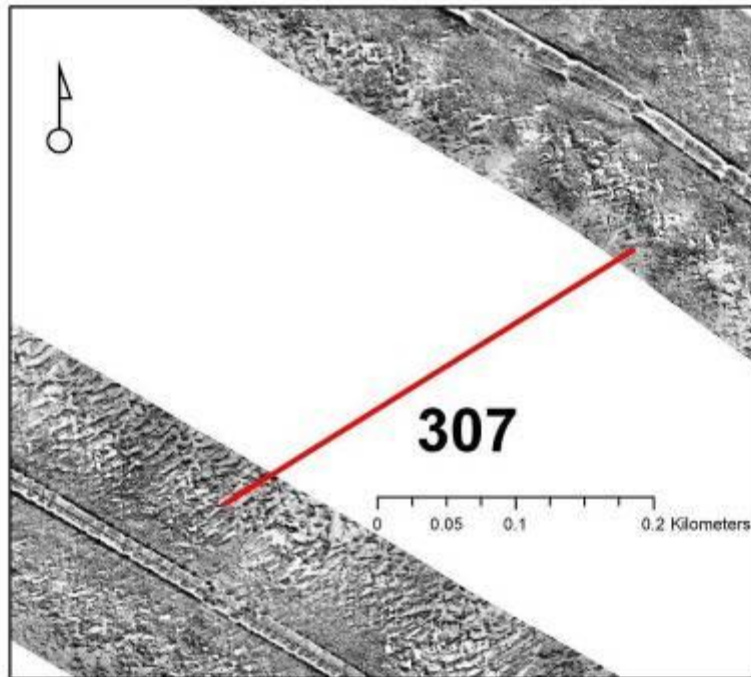


Fig. 21 Map showing side-scan image and camera tow track station 307

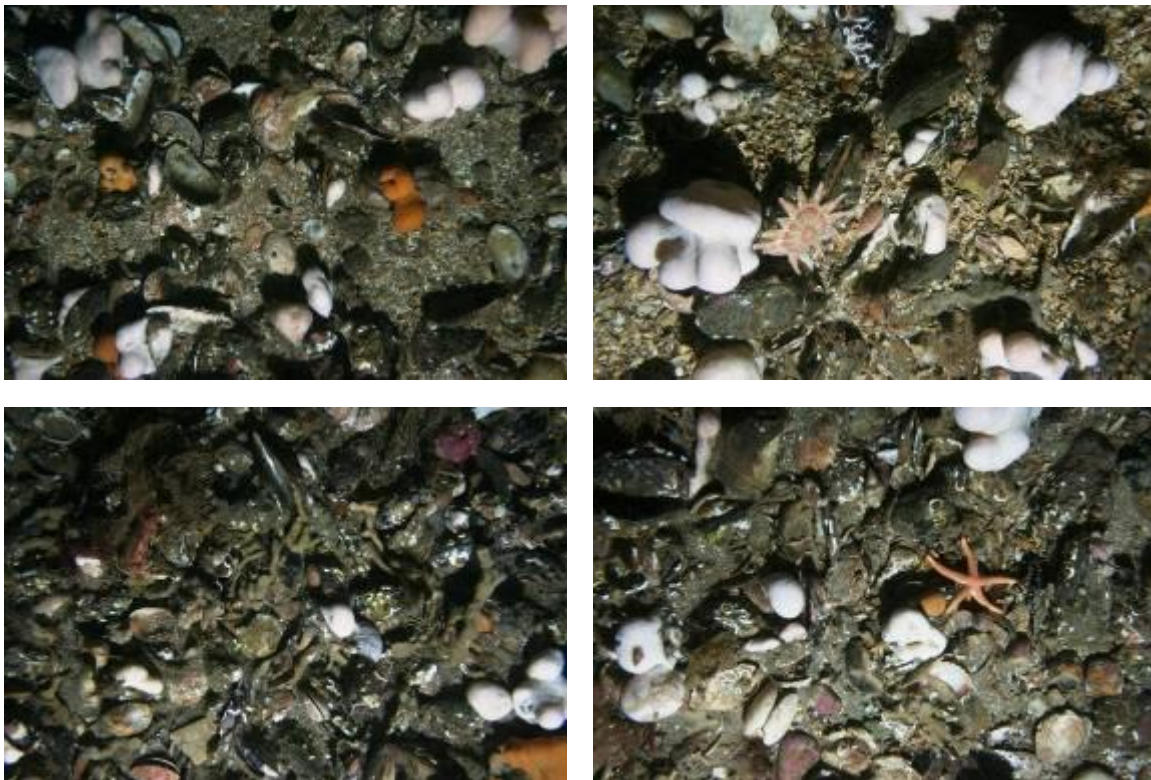


Fig. 22 Images of camera tow 307 showing representative habitat characteristics

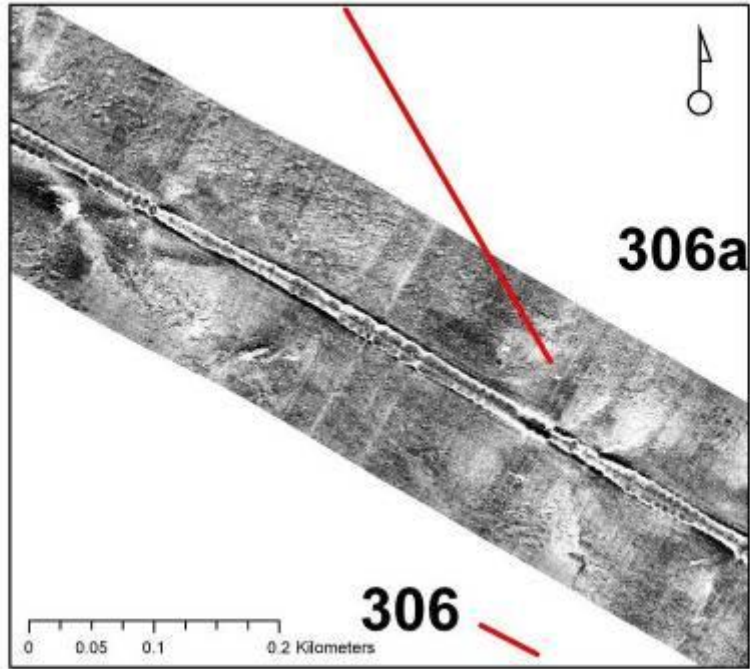


Fig. 23 Map showing side-scan image and camera tow track station 306 and 306a

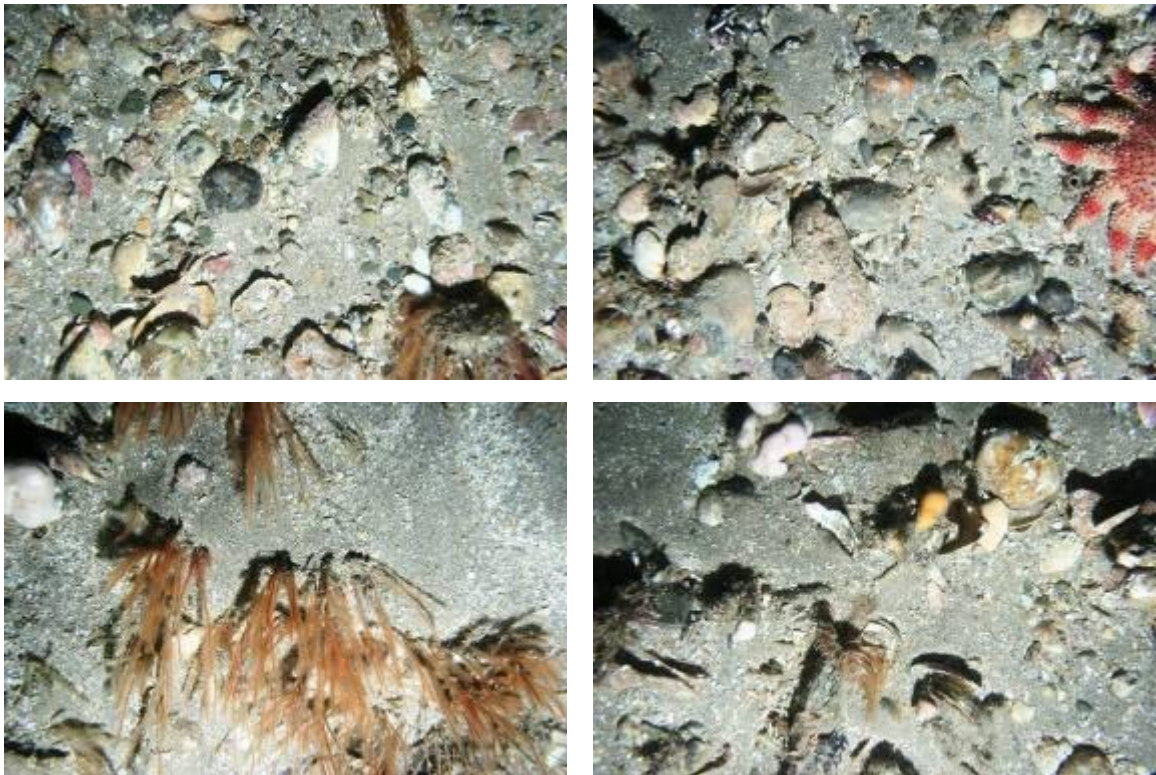


Fig. 24 Images of camera tow 306 showing representative habitat characteristics

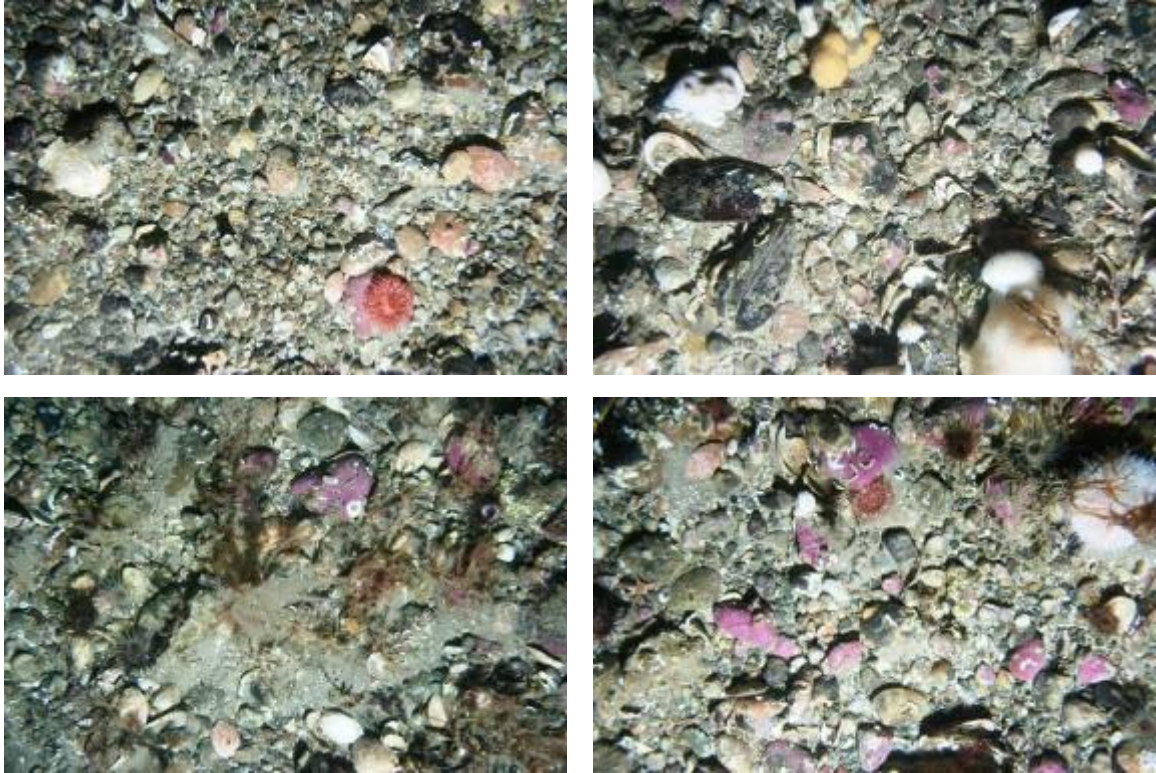


Fig. 25 Images of camera tow 306a showing representative habitat characteristics

DISCUSSION

The still images analyzed verified the extent of the *Modiolus* bed as indicated by the side-scan-sonar images. Tows showing live *Modiolus* corresponded with the substratum categories 3 (some structured substratum present most likely *Modiolus* beds) and 4 (extensive structural substratum present most likely *Modiolus* beds).

Overall, categories 3 and 4 covered 53% of the surveyed area. The *Modiolus* bed's limits could be established for the northern, southern and southeastern parts. The northwestern limit was not found and it is possible that the reef extends further into the northwest. The biotope type of *Modiolus* beds off the Point of Ayre most closely resemble the habitat type describe by the EUNIS code A4.4/B-CMX.ModMx (*Modiolus modiolus* on circalittoral mixed sediment).

Camera tow station 307 and 317 showed dense aggregations of *Modiolus* and most closely resembled a bed or reef structure. At the other sites individual *Modiolus* occurred along the video/stills transects sometimes imbedded into the sediment matrix. Due to the embedded nature, and

the difficulty of distinguishing live *Modiolus* in general, abundance estimates are likely to have underestimated true abundances at the Point of Ayre.

Obvious dredge marks from scallop dredges or otter trawls, indicating fishing disturbance, were not detected within side-scan-sonar images. However, as image quality was very poor in some areas of the side-scan such trawl marks might have remained undetected. Dredge tracks can be very faint and difficult to detect in single side-scan-swath. Faint tracks might have become more visible within a full side-scan coverage of the area.

Overall, the status of the reef and the potential impact from dredging activity is difficult to assess from the results of the current survey. More video tows over the area would have been needed to make a more comprehensive assessment of the status of the *Modiolus* bed. It is interesting to note that the area had few individuals of the target species important for the local scallop fisheries. Within the 1145 images analyzed only 5 queen scallops were identified and counted. Compared to other sites around the Isle of Man abundance of scallops seem to be extremely low in this area. Therefore it seems unlikely that these *Modiolus* reefs would become the target of a focused fishery, although there may be periodic exploratory attempts from vessels outside the Isle of Man that are not familiar with local grounds. Accordingly, it would be useful to understand the level of fishing activity that has occurred in this area in the recent past (Fig. 26).

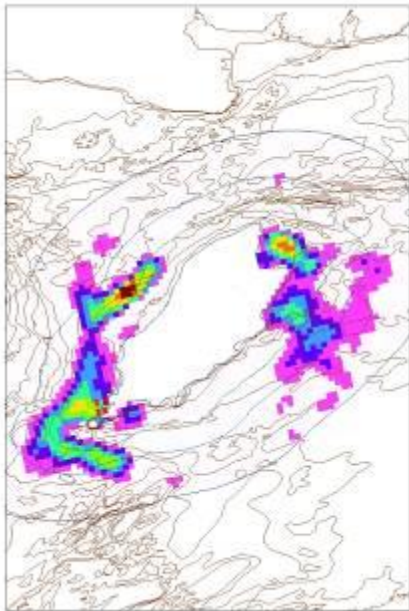


Figure 26: Vessel Monitoring System data for 2007/2008 showing the distribution of fishing activity, which was absent from the area surveyed in this report.

Reference

Holt, T.J., Rees, E.I., Hawkins, S.J. & Seed, R., 1998. Biogenic reefs (Volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. *Scottish Association for Marine Science (UK Marine SACs Project)*, 174 pp.

This comprehensive review of biogenic reefs contains numerous references to research directly relevant to horse mussels and their associated fauna.