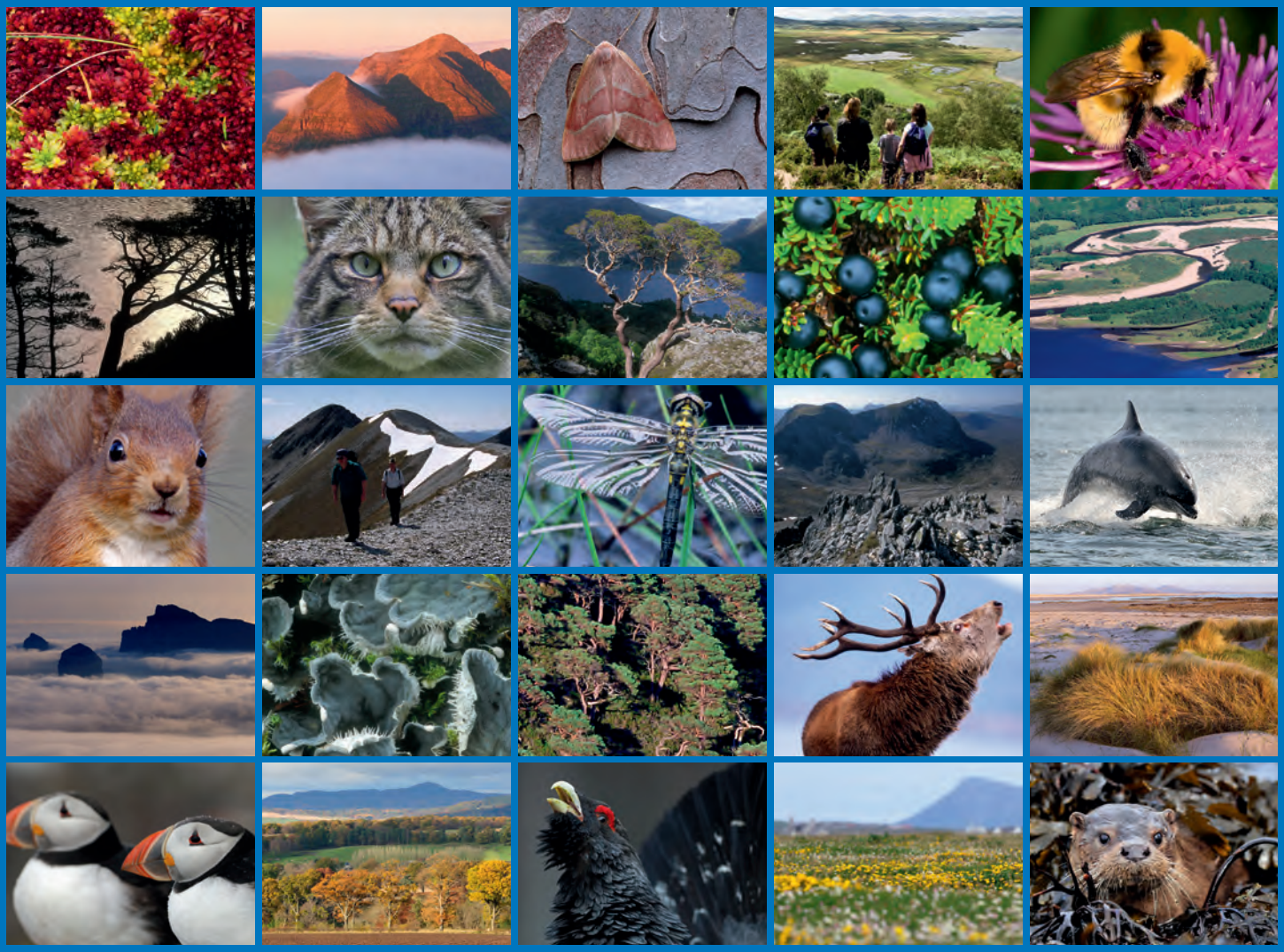
Scottish Natural Heritage
Commissioned Report No. 940

Biological analysis of underwater video and infaunal data from surveys of the Moray Firth SAC



Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

COMMISSIONED REPORT

Commissioned Report No. 940

Biological analysis of underwater video and infaunal data from surveys of the Moray Firth SAC

For further information on this report please contact:

Morven Carruthers
Scottish Natural Heritage
Great Glen House
INVERNESS
IV3 8NW
Telephone: 01463 725018
E-mail: morven.carruthers@snh.gov.uk

This report should be quoted as:

Moore, C.G. 2016. Biological analysis of underwater video and infaunal data from surveys of the Moray Firth SAC. *Scottish Natural Heritage Commissioned Report No. 940.*

COMMISSIONED REPORT

Summary

Biological analysis of underwater video and infaunal data from surveys of the Moray Firth SAC

Commissioned Report No. 940
Project No: 15846
Contractor: Dr Colin Moore
Year of publication: 2016

Keywords

Benthos; Moray Firth; SAC; video; grab; infauna; biotope.

Background

The aim of the current work was to increase understanding of the marine benthic habitats within the Moray Firth SAC through analysis of seabed video and still imagery collected at 30 sites in 2015 and by reanalysis of video footage from 228 sites and infaunal grab data from 30 sites collected in 2004.

Main findings

- For each survey site the physical nature of the habitat and the species assemblage is described, together with ascription of the biotope.
- The distribution of biotopes throughout the survey area is briefly described.
- Agreement with the previous analysis of the 2004 video and infaunal data was low in terms of biotope identity, with revised biotopes being recorded at 133 of the 228 video sites. A major factor in the causation of interpretational differences was considered to have resulted from the greater weight attributed to the presence of key characterising taxa in the original analysis and the lower emphasis on the physical habitat conditions. This led to the original ascription of sandy mud biotopes at many sites, where sand biotopes were recognised by the reanalysis.

For further information on this project contact:
Morven Carruthers, Scottish Natural Heritage, Great Glen House, Inverness, IV3 8NW.
Tel: 01463 725018 or morven.carruthers@snh.gov.uk
For further information on the SNH Research & Technical Support Programme contact:
Knowledge & Information Unit, Scottish Natural Heritage, Great Glen House, Inverness, IV3 8NW.
Tel: 01463 725000 or research@snh.gov.uk

Table of Contents **Page**

1. INTRODUCTION

In 2005 an area of the Moray Firth in north-east Scotland was designated as a Special Area of Conservation (SAC) under the EC Habitats Directive (92/43 EEC) principally to provide protection to the population of bottlenose dolphins (an Annex 2 species of the Directive), but also to aid in conservation of the Annex 1 feature 'Sandbanks which are slightly covered by sea water all the time' (Figure 1). This feature is defined as consisting of sandy sediments that are permanently covered by shallow sea water, typically at depths of less than 20 m below chart datum, but sometimes including channels or other areas greater than 20 m deep. The feature can include the following habitats: gravelly and clean sands, muddy sands, eelgrass beds and maerl beds.

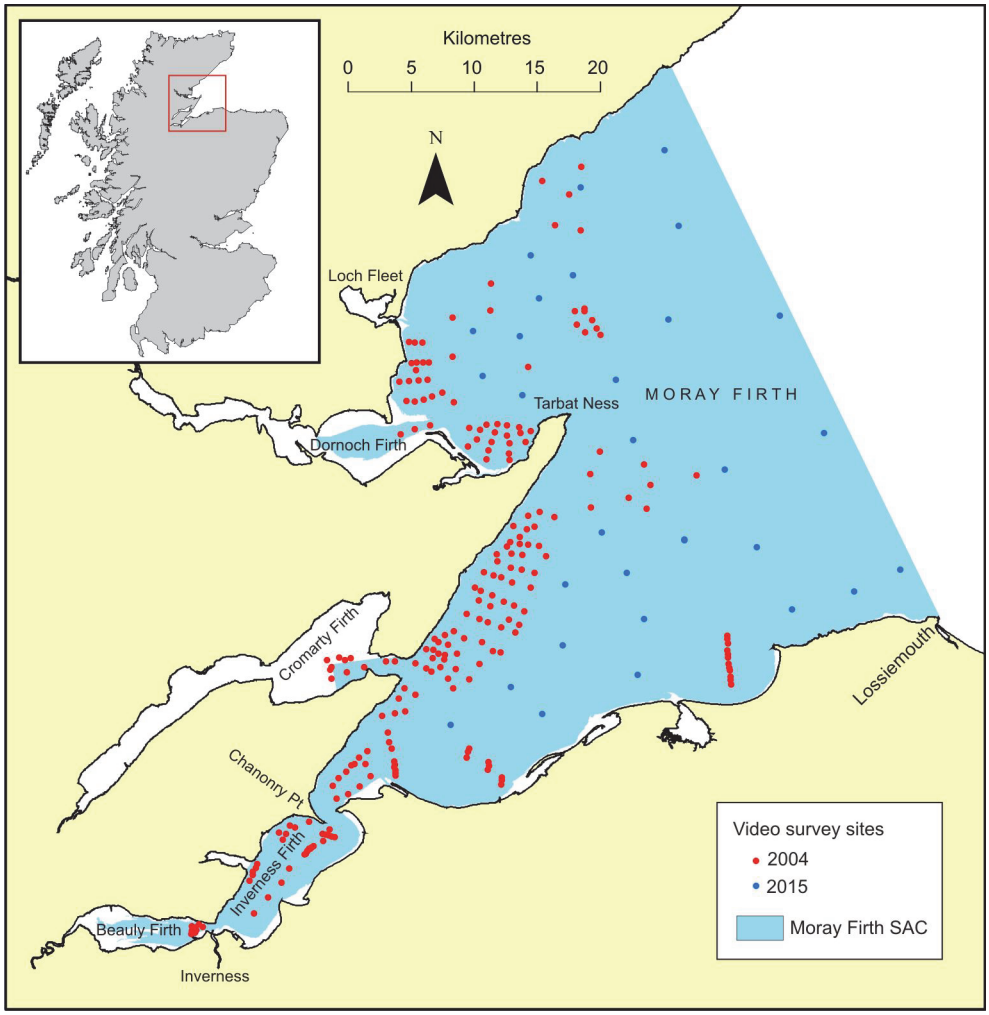


Figure 1. The location of Moray Firth SAC and the video sites surveyed in 2004 and 2015. See inset for location of main map.

Mapping of the benthic habitats of the SAC above the 30 m depth contour was carried out in 2004 by Envision Mapping Ltd (Newcastle upon Tyne) using acoustic remote sensing techniques combined with groundtruthing by dropdown video sampling at 228 sites (Figure 1) and quantitative infaunal sampling at a subset of 30 sites, where single 0.1 m^2 Van Veen grab samples were taken and subsampled for particle size analysis (Foster-Smith *et al*., 2009). The video samples consisted largely of brief drifts of 1 - 2 minutes duration, with the depth recorded at the start of the run and the positional information and time displayed as a video overlay.

To improve understanding of the distribution of benthic habitats within the SAC, particularly beyond the 30 m depth contour, a further dropdown video survey was carried out in 2015 by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) on behalf of SNH. Video runs were undertaken at 30 sites (Figure 1) of approximately 10 minutes duration using a vertically-orientated video camera with a laser scaling system comprising an array of four lasers located at the corners of a rectangle of side 17 cm. A video overlay provided positional and time information, with depth readings at 5 second intervals available from the vessel's track data. To aid identification of the biota, still photographs were also taken at intervals throughout the video run.

The aim of the current work was to increase understanding of the marine benthic habitats within the Moray Firth SAC and in particular to aid SNH in the identification of the distribution of the feature 'Sandbanks which are slightly covered by sea water all the time'. This was to be achieved by identification of the biotopes present through analysis of the video and still imagery from the 2015 CEFAS survey and by reanalysis of the video footage and infaunal data from the 2004 Envision Mapping Ltd video and grab surveys. The requirement for reanalysis was driven chiefly by the reporting of many sites exhibiting sand-dominated habitats (and hence possibly falling within the definition of 'Sandbanks which are slightly covered by sea water all the time') as cohesive sandy mud biotopes in the original report (Foster-Smith *et al*., 2009).

2. METHODS

Video imagery from the 228 sites sampled in 2004 (Foster-Smith *et al*., 2009) and the 30 sites sampled in 2015 was examined in order to describe the nature of the sea bed in terms of the physical structure and the species assemblages. Species present were, as far as possible, identified and quantified using the semi-quantitative MNCR SACFOR scale (Hiscock, 1996). Based on the physical and biological attributes, biotopes were allocated (Connor *et al*., 2004). Still photography available from the 2015 video runs was employed to aid species identification and habitat characterisation. For the 2004 survey particle size analysis data and the infaunal data provided in the original survey report (Foster-Smith *et al*., 2009) for 30 of the 228 sites was employed to aid biotope identification. Similarities and trends in infaunal composition between sample sites, based on logged species abundance data, were analysed using non-metric multidimensional scaling (employing Primer - Primer-E, Ivybridge) and detrended correspondence analysis (employing MVSP - Kovach Computing Services, Pentraeth). Depths recorded during the 2015 survey were converted to depths below chart datum employing TotalTide software (Admiralty, Taunton) to determine tidal rise at the most appropriate secondary port (Golspie, Burghead or Nairn). Depths for the 2004 survey were taken from Foster-Smith *et al*. (2009).

3. RESULTS

3.1 Infaunal data analysis

The infaunal species abundance data at the 30 grab sites are tabulated by Foster-Smith *et al.* (2009, Annex 3). Figure 2 shows a non-metric multidimensional scaling (MDS) plot of the logged data. Samples lying outside the ellipse have all been previously classified as constituting very mixed sediment habitats or coarse sand and gravel habitats (Foster-Smith *et al*., 2009). All samples within the ellipse are from sites with sediments ranging from fine-medium sand, through muddy sand to sandy mud. It is principally these habitats that provide the contentious biotope allocations, so these have been selected for further detailed multivariate analysis.

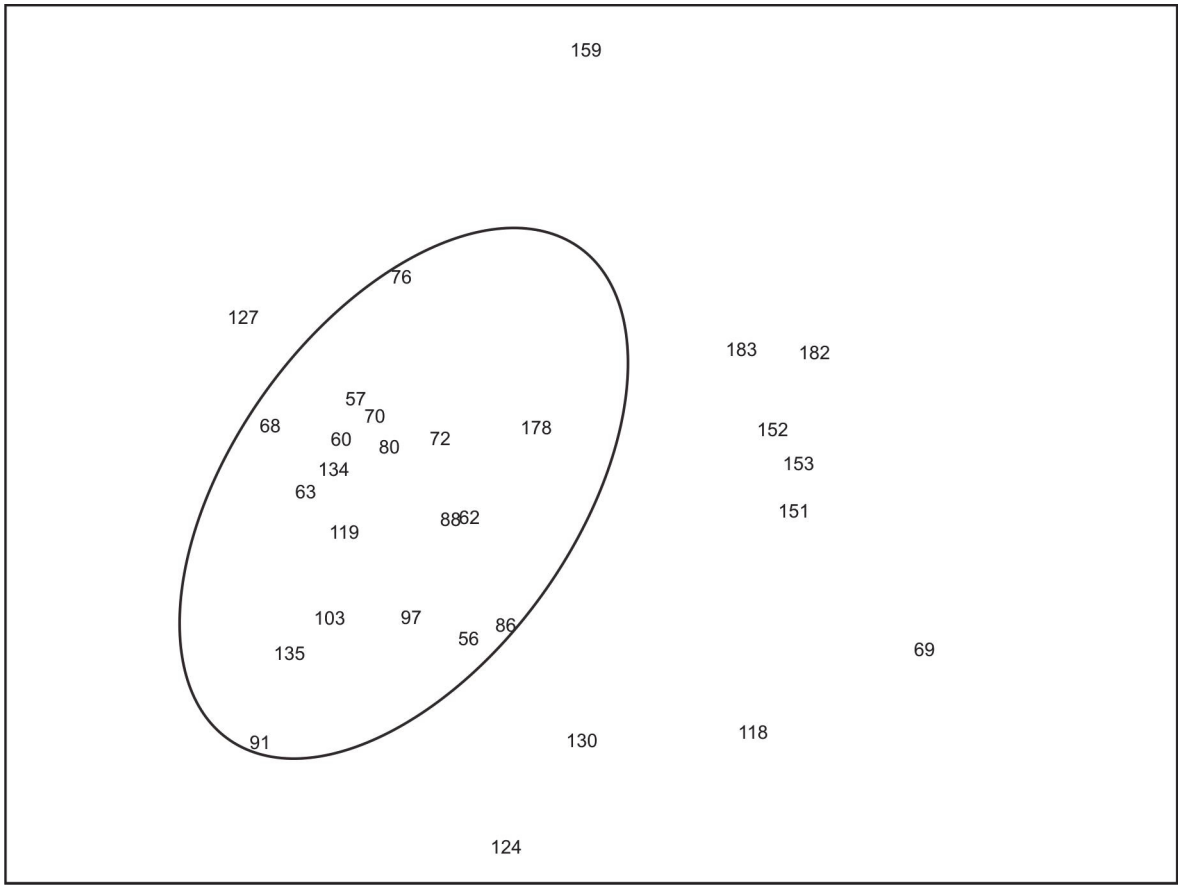


Figure 2. MDS plot of infaunal species abundance data from the 2004 Envision Mapping Ltd survey of 30 grab sites (Foster-Smith et al., 2009). Numbers in the plot indicate site names. Ellipse encloses sites subject to further analyses. Stress = 0.18.

Figure 3 shows an MDS analysis of the reduced data set (excluding singleton species - i.e. species only found at one site) and clearly illustrates a compositional pattern correlating with mud content, with low values to the bottom right and high values top left. The correlation is not perfect with some sites having a close faunal similarity but with disparate mud content.

Different multivariate techniques can produce different results, reflecting different characteristics of the data. Partly for this reason, but also because it offers a convenient means of seeing compositional patterns in the raw data, detrended correspondence analysis (DCA) was also applied to the logged species abundance data (Figure 4). This attributes site or species scores along axes, such that axis 1 represents the major trend in the data, axis 2 a subsidiary trend, etc. The results of the analysis are very similar to those of MDS.

Axis 1 reflects a response in community composition to changing mud content, with sandy muds to the left and clean and muddy sands to the right.

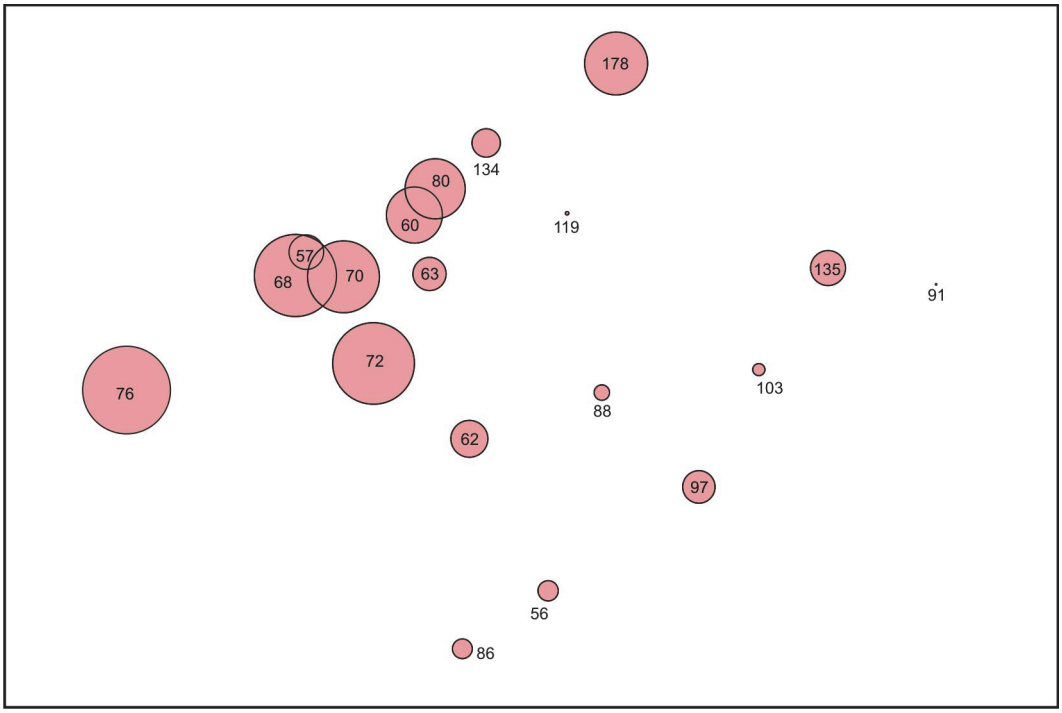


Figure 3. MDS plot of infaunal species abundance data from fine-medium sand, muddy sand and sandy mud grab sites from the 2004 Envision Mapping Ltd survey (Foster-Smith et al., 2009). Bubble size proportional to silt/clay content (max. 54%, min. 1%). Stress = 0.14.

To facilitate the use of the species abundance data in biotope allocation, the raw data have been reordered using the scores along the first ordination axis. DCA can produce ordinations of samples and species, with the latter revealing which species are responsible for the trends in the ordination of the samples - in other words which species characterise groupings of similar sites. The result is shown in Table 1. A pattern can be seen in the raw data running from the top left (species characteristic of the sandy and slightly muddy sand sites) to the bottom right (species characteristic of the muddy sites). Species towards the middle of the table tend to be more generally distributed.

Biotope allocation of the sites for which infaunal data were available has been based not only on the infaunal species abundance data but also the physical and biological characteristics obtained from analysis of the video footage. Note from the table that some taxa are widely distributed and are not very good characterisers of particular biotopes, the principal example being *Amphiura filiformis*, which is abundant or superabundant at all sites apart from one.

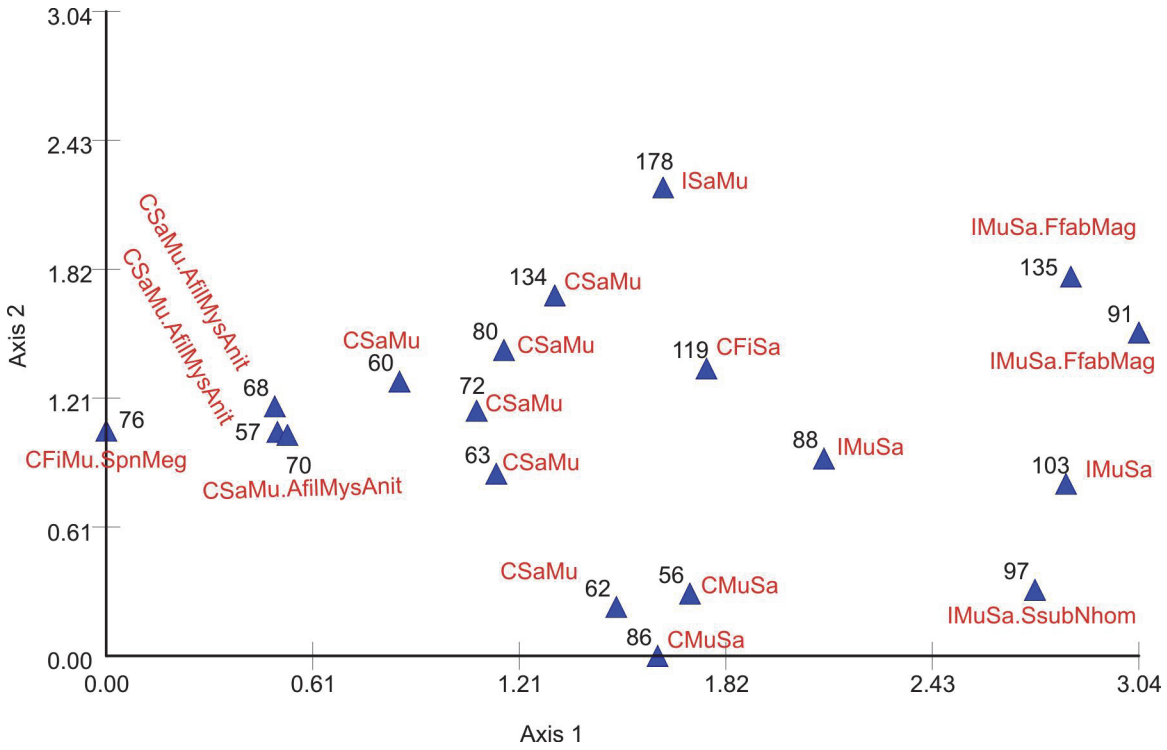


Figure 4. Detrended correspondence analysis plot of species abundance data from fine-medium sand, muddy sand and sandy mud grab sites from the 2004 Envision Mapping Ltd survey (Foster-Smith et al., 2009) with allocated biotopes.

The group of sites in yellow on the left of Table 1 (91, 135, 103 and 97) have a similar infaunal composition (see also Figure 4), are shallow (9 - 15 m), and have a relatively low mud content (1 - 22%). They have characteristic **SS.SSa.IMuSa** taxa (*Fabulina fabula*, *Chamelea gallina, Magelona* spp.). Despite the difference in mud content, sites 91 and 135 have a very similar infauna and can be referred to **SS.SSa.IMuSa.FfabMag**. Site 97 has been tentatively referred to **SS.SSa.IMuSa.SsubNhom**, having the characteristics of dense *Ophiura ophiura*, as well as *Spisula subtruncata* (not shown in Table 1 as it was a singleton species). Site 103 is intermediate between these biotopes (see also Figure 4). It should be noted that all these **IMuSa** sites displayed signs of sand rippling, indicative of non-cohesive sandy sediments. The muddy sand site 88 was located between an inshore band of **SS.SSa.IMuSa** and offshore **SS.SMu.CSaMu** (Figure 6) and this is reflected in its intermediate infaunal composition (Table 1, Figure 4). It has been referred to the biotope **SS.SSa.IMuSa** on account of its apparently non-cohesive, faintly rippled sediment. The deep (27 m), fairly clean (2% silt/clay), faintly rippled, fine sand site 119 has been tentatively referred to **SS.SSa.CFiSa**. Note that it has dense *Amphiura filiformis*, but this is not untypical for the biotope (Connor *et al*., 2004).

Site 76 (right hand side of Table 1) is readily attributed to **SS.SMu.CFiMu.SpnMeg** through its megafaunal burrows and high mud content.

Table 1. Species abundance data from fine-medium sand, muddy sand and sandy mud grab sites from the 2004 Envision Mapping Ltd survey (Foster-Smith et al.*, 2009) with sites and species ordered by the axis 1 scores of detrended correspondence analysis.*

Site	**91**	**135**	**103**	**97**	**88**	**119**	**56**	**178**	**86**	**62**	**134**	**80**	**63**	**72**	**60**	**70**	**57**	**68**	**76**
Silt & clay (%)	1	22	7.5	20	10	2.2	13	39	12	23	18	37	21	50	35	44	21	51	54
Depth (m)	9	13	15	13	15	27	24	10	27	17	26	20	21	17	23	22	28	27	31
Fabulina fabula	14	16	5	4															
Acrocnida brachiata		3	1	1															
Ensis ensis			1	1															
Euspira nitida			2	4															
Magelona johnstoni	2	9	1			1													
Sigalion mathildae	4	11	1	1							1								
Magelona filiformis	2				1														
Chaetozone christiei	2	1		1			1												
Ophiura ophiura				3	1														
Ophiura albida	2	2	2	1	1		1		1										
Abra prismatica	1					1													
Nucula nitidosa			5	17	14			1		1									
Chamelea gallina	15	23	3	3	7	1					2	1	1		1		1		
Ampelisca brevicornis		5				1					1								
Cochlodesma praetenue				1			1												
Abra nitida		1						1											
Eumida juv. indet.	1	1										2							
Phtisica marina		3															1		
Liocarcinus juv. indet.	1												1						
Nephtys assimilis		1	2	1		3				4									
Pectinariidae juv. indet.	25	3	1			1						3	4	1		1			
Goniada maculata			1	1	2				1			1							
Thracia phaseolina	4	2	2		3	3		1		1	3	3	1		1				
Dosinia lupinus	1	1	2	1	2	4					2		2		2			1	
Sthenelais limicola	1	2	1	1			1			1			1	2		1		2	
Diastylis laevis				1			1		1				2						
Corbula gibba			1		1			1			1						1		
Galathowenia oculata			11	6		3				2	1		1	3	1	2	5		
Kurtiella bidentata		3	1	1	1	5		3			33	2			1	1		1	
Echinocardium cordatum		3	2			6	1		1		7		2		5		1		
Ampharete baltica						1		1											
Abra alba		2			1			1	1			1		2					1
Spiophanes bombyx	1	2									4	1	1	5		1			
Diastylis bradyi	1														1			1	
Prionospio fallax		1			2					2	1	5		2					
Hilbigneris gracilis					1	1	2		1	5	1			1					
Cylichna cylindracea					2						2	2							
Nephtys cirrosa									1	1									
Pholoe inornata		2	1	1	5	2		1		4	10	4		11	4	4	1		
Nephtys hombergii	2			1	1		1	3	1	1	4	2	2	1	2	3	1	1	
Cerianthus lloydii		1										1		2				1	
Ampelisca tenuicornis						2		2			2				1				
Amphiura filiformis		5	26	8	72	45	16	24	4	51	96	63	50	89	60	60	49	48	5
Nephtys juv. indet.						3		1			1		1		1				
Scoloplos (Scoloplos) armiger								6						2					

Table 1 continued

Site	91	135	103	97	88	119	56	178	86	62	134	80	63	72	60	70	57	68	76
Harpinia antennaria						1					2			1					
Phoronis muelleri	6	1	1	3	1	1	1	1	1	3	1	13	12	7	10	29	13	12	1
Iphinoe serrata		1									1				3			1	
Nephtys kersivalensis	1						1	2			2	2	1		2	1	1		
Leiochone johnstoni		1				1		2			1	2	1		2	1	1		
Thyasira flexuosa						4		1			5				1			1	
Phaxas pellucidus						1	1						1					1	
Scalibregma inflatum				1	1				1	2				1		1			4
Lagis koreni							1	2											1
Diplocirrus glaucus					3	1	5			1	3	2		5	2	10	2		
Owenia fusiformis				2	1	1			1	2		1	3	2	3	1	2	3	1
Notomastus latericeus				1	1					1				2		1	1		2
Tubulanus polymorphus										1	2		2				1		
Astrorhiza limicola						3	1		2	3			3		2	1	6	1	
Nemertea indet.		2							1	1			1	1	1	2	7	2	1
Euclymene oerstedi												8	1	1		2			
Eunereis longissima													1		1				
Mangelia attenuata													1		1				
Levinsenia gracilis												2		3			1		
Leptosynapta bergensis											1	1	1			1	1		
Magelona alleni						2				1	2	1	2			5		2	2
Pholoe pallida											1							1	
Amphictene auricoma										1			1						1
Peresiella clymenoides											1	2	1	1		1	2	1	
Antalis entalis											3		1	1	5		7	1	
Rhodine gracilior											1	5	6	8	11	15	4	5	
Lucinoma borealis												1						1	
Chaetoderma nitidulum					1						5		1	7	2	4	3	3	3
Trichobranchus roseus											2				1				1
Turritella communis						3					18	7	2		7	5	14	7	30
Leptopentacta elongata											1		1	1	3	19	11	2	
Anobothrus gracilis												1		2	2	2		4	1
Labidoplax buskii												1			2	9	4		
Phascolion strombus strombus												2	1		2				6
Edwardsiidae indet.																1		2	
Amphiura chiajei															1	12	9	3	10
Spiophanes kroyeri																	3	2	1
Ampharete falcata																	1	1	1
Glycera unicornis																1			1
Glycera alba																	1		1
BIOTOPE	SS.SSa.IMuSa.FfabMag	SS.SSa.IMuSa.FfabMag	SS.SSa.IMuSa	SS.SSa.IMuSa.SsubNhom	SS.SSa.IMuSa	SS.SSa.CFiSa	SS.SSa.CMuSa	SS.SMu.ISaMu	SS.SSa.CMuSa	SS.SMu.CSaMu	SS.SMu.CSaMu	SS.SMu.CSaMu	SS.SMu.CSaMu	SS.SMu.CSaMu	SS.SMu.CSaMu	SS.SMu.CSaMu.AfilMysAnit	SS.SMu.CSaMu.AfilMysAnit	SS.SMu.CSaMu.AfilMysAnit	SS.SMu.CFiMu.SpnMeg

Sites in light orange in Table 1 form a loose cluster on the left side of Figure 4. They are all muddy sand and sandy mud sites (18 - 51% mud) of moderate depth (17 - 28 m) and give the appearance of unrippled, probably cohesive sediment. They mostly support large numbers of *Turritella communis*. Site 68 lacks the characterising *Abra nitida*, but otherwise is in reasonable agreement with the biotope **SS.SMu.CSaMu.AfilMysAnit**, with dense *Amphiura filformis*, as well as *Mysella bidentata*, *Thysanocardia procera* and *Phoronis* spp. Sites 57 and 70 are very similar faunally (see Figure 4 and Table 1) and so have been referred to the same biotope. The remaining sites (62, 134, 80, 63, 72, 60) are relatively dissimilar faunally and have been referred to the higher biotope **SS.SMu.CSaMu**, although site 62 appears intermediate between **SS.SMu.CSaMu** and **SS.SSa.CMuSa** (see Figure 3).

Sites 56, 178 and 86 lie in the centre of Table 1, although sites 56 and 86 are widely separated from 178 by the second ordination axis (Figure 4), reflecting the presence of a suite of species only recorded at site 178. Sites 56 and 86 are non-cohesive, slightly muddy (12 - 13% silt/clay) relatively deep sites (24 - 27 m) and have been ascribed to **SS.SSa.CMuSa**, whereas site 178 is a shallow (10 m), very muddy (39% silt/clay) site and is referred to **SS.SMu.ISaMu**.

3.2 Biotope distribution

Locational and temporal details of the video sites examined during the Envision Mapping Ltd 2004 survey and the 2015 CEFAS survey are provided in Table 1.1 (Annex 1) and Table 2.1 (Annex 2) respectively. Physical and biological descriptions of the sites, together with allocated biotopes, are given in respectively Table 1.2 (Annex 1) and Table 2.2 (Annex 2). This section provides a brief summary description of the distribution of principal biotopes within the SAC.

In the embayment at the mouth of the Dornoch Firth, between Loch Fleet and Tarbat Ness (Figure 5), rippled fine sand was found to be extensively distributed between depths of 3 and 20 m. The presence of *Ensis* spp. was indicated at most sites in the form of shells or possibly withdrawal plumes or craters, and *Ophiura ophiura* was widely recorded, often in large numbers. These fine sand sites have been largely ascribed to **SS.SSa.IMuSa**, although with an improved understanding of the infaunal community it is possible that some of the shallower sites may be better referred to **SS.SSa.IFiSa**. With increase in depth the visible indications of the presence of *Ensis* spp. disappeared and fine-medium sand, with at most a slight silt content and generally faint rippling, at depths of 23 - 33 m, has been referred to **SS.SSa.CFiSa**. However, beyond the 30 m depth contour muddy sand appears to be the most widespread sediment type within the surveyed area (Figures 5 - 7), except in the more sheltered approaches to Inverness Firth (Figure 6). These muddy sands appeared in part as non-cohesive sediments at depths of 24 - 50 m, with the infaunal community indicated by small holes and mounds, with at most occasional, small megafaunal burrows (**SS.SSa.CMuSa**). Cohesive muddy sands were observed in slightly deeper waters (46 - 52 m) with similar visible infaunal characteristics, but with the addition of Occasional - Frequent *Pennatula phosphorea* (**SS.SMu.CSaMu**). The megafaunal burrowing community, including *Nephrops norvegicus*, was better developed in offshore, deeper waters (59 m), but was also recorded at a site (MRF007) in shallower sandy mud in more sheltered conditions to the north of Tarbat Ness (**SS.SMu.CFiMu.SpnMeg**).

An area of coarser sediments was recorded to the north of Tarbet Ness at around the 30 m contour (Figure 5), with a patch of shelly, medium - coarse sand (**SS.SCS.CCS**), locally accompanied by dense shell material, pebbles and cobbles supporting hydroids and serpulid worms (**SS.SMx.CMx**). A shallower area of coarser sediment was also present at 17 - 30 m depth off Brora Point (Figure 5). This included medium - coarse sand, locally in the form of waves (**SS.SCS.CCS**) and mixed coarse sediment with dense *Ascidiella aspersa* (**SS.SMx.CMx**). Rock substrata were also present here in the form of boulders supporting a

bed of *Ophiothrix fragilis* (**CR.MCR.EcCr.FaAlCr.Bri**) and bedrock ledges encrusted with dense *Spirobranchus* spp. (**CR.MCR.EcCr.FaAlCr.Pom**). Three sites were located in the tide-swept channel at the entrance to the Dornoch Firth, where the habitat consisted of dense shelly, mixed sediments (**SS.SMx.IMx**, **SS.SMx.CMx**) and probably highly mobile, rippled, fine - medium sand (**SS.SSa.IFiSa** - probably **IFiSa.IMoSa**).

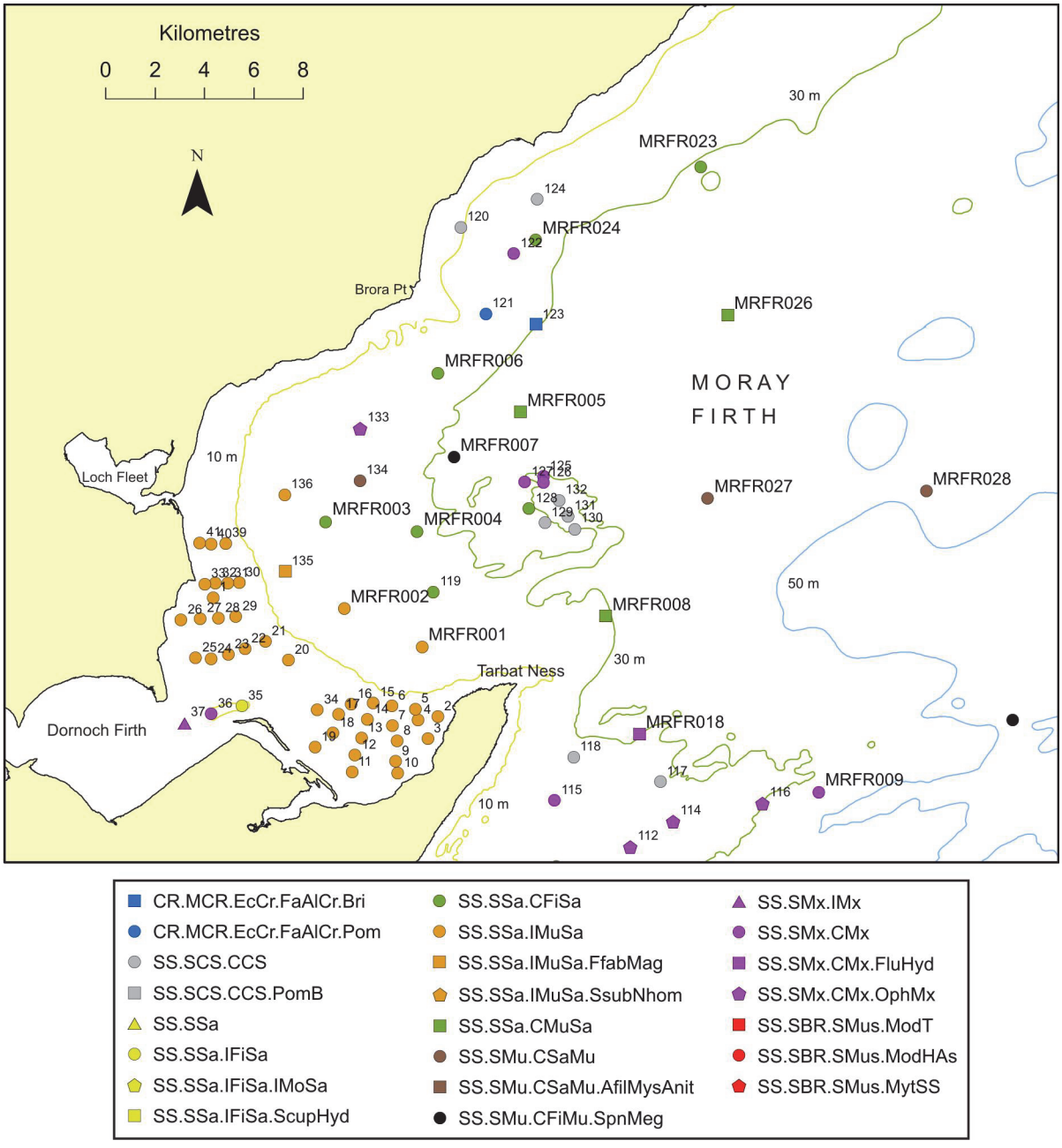


Figure 5. Distribution of revised biotope records in the northern region of the survey area.

Turning to the approaches to Inverness Firth, west of a line from Tarbat Ness to Lossiemouth (Figure 6), most sites beyond a depth of 25 m displayed mixed gravelly sediments with pebbles and cobbles supporting a fauna of serpulid worms and hydroids (**SS.SMx.CMx**, **CMX.FluHyd**), accompanied by dense *Ophiothrix fragilis* south-east of Tarbat Ness (**SS.SMx.CMx.OphMx**). Megafaunally-burrowed mud (**SS.SMu.CFiMu.SpnMeg**) was recorded at the deepest sites (>54 m), but also in shallower

waters (23 - 38 m) in the more sheltered, inner region of the approaches. Rippled fine sand was extensively distributed along the southern coastline of the approaches, west of Lossiemouth, from at least 7 m to 25 m depth, generally with evidence of the presence of *Ensis* spp. (ascribed to **SS.SSa.IMuSa** and probably **IMuSa.EcorEns**). *Ophiura ophiura* was widely recorded at sites from the 2004 survey (Foster-Smith *et al*., 2009) but was apparently absent at the 2015 survey sites. A similar rippled fine sand habitat with *Ensis* shells and *O. ophiura* was also widely recorded along the western coastline of the approaches from depths of 6 - 22 m (**SS.SSa.IMuSa**). This was interrupted by a patch of unrippled and probably cohesive muddy sand and sandy mud north of the Cromarty Firth from 17 - 28 m depth. This supported dense *Amphiura* spp. and also *Turritella communis* at several sites (**SS.SMu.CSaMu**). Infaunal data available at three of the sites were indicative of the biotope **SS.SMu.CSaMu.AfilMysAnit**.

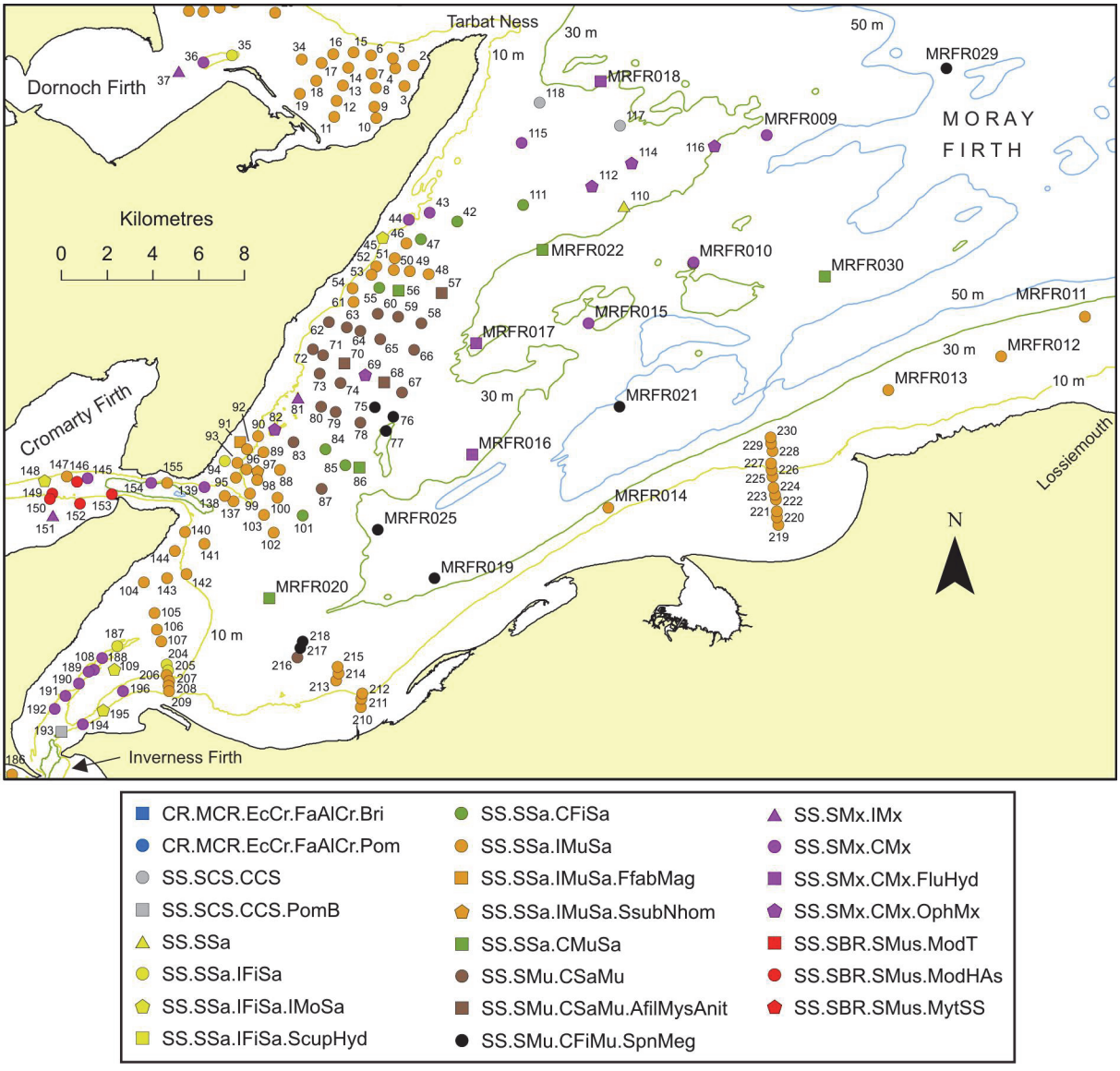


Figure 6. Distribution of revised biotope records in the central region of the survey area.

Modiolus modiolus was recorded at low density on mixed sediments in the narrows at the entrance to Cromarty Firth (**SS.SMx.CMx**) but attained SACFOR densities of Frequent - Common at several sites just inside the mouth of the firth on a sediment of shelly muddy

sand with scattered cobbles and boulders locally (tentatively assigned to **SS.SBR.Mus.ModHAs**).

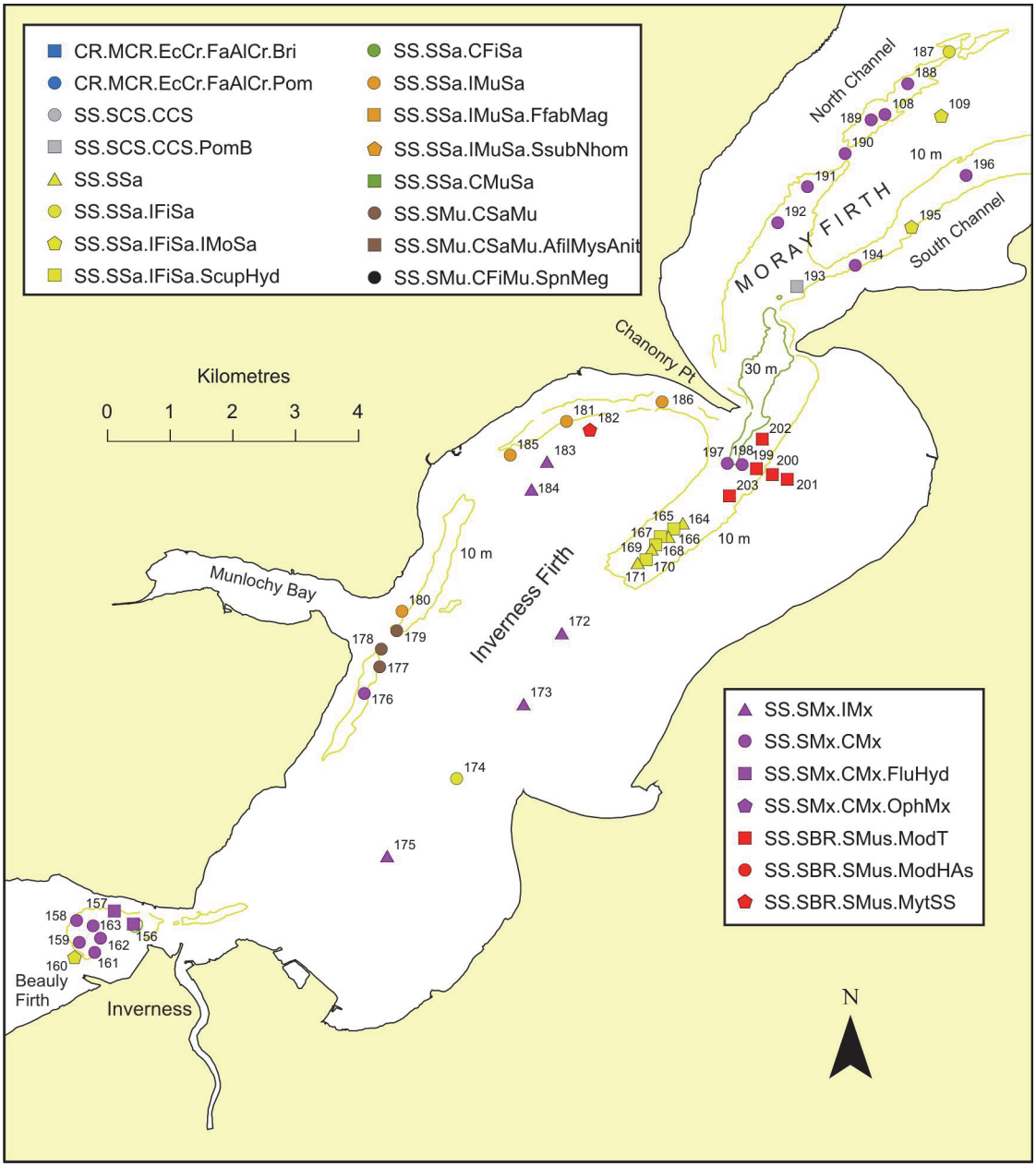


Figure 7. Distribution of revised biotope records in the southern region of the survey area.

Sediments in the tide-swept North Channel and South Channel at the mouth of Inverness Firth (Figure 7) were principally mixed shelly sands with shells, and locally scattered pebbles and cobbles, supporting *Alcyonium digitatum* (**SS.SMx.CMx**). The shells possibly included sparse, live *Modiolus modiolus*. However, in strongly tide-swept conditions just inside the firth off Chanonry Point a substrate of sand with much broken shell material and scattered *Modiolus* shells supported Frequent to locally Abundant live *M. modiolus* with a turf of hydroids in deeper water (7-19 m) and red algae in shallower water (3-7 m) (**SS.SBR.Mus.ModT**). With decreasing current strength this habitat gave way to fine - medium sand with scattered shells, pebbles and cobbles supporting or not supporting hydroid clumps (respectively **SS.SSa.IFiSa.ScupHyd** and **SS.SSa**). However, the dominant

habitat recorded in the shallow waters (<5 m) that occupy most of Inverness Firth was mixed shelly sand with scattered small stones supporting hydroids, serpulid worms and red algae (**SS.SMx.IMx**). Mixed substrates composed of varying proportions of gravel, pebbles, cobbles and boulders on sand were also widely recorded in the tide-swept, deep water channel at the entrance to Beauly Firth at depths of 13 - 30 m. The stones were encrusted with serpulid worms (**SS.SMx.CMx**) and in places supported significant quantities of hydroids and *Flustra foliacea* (**SS.SMx.CMx.FluHyd**).

4. DISCUSSION

The process of biotope allocation is not entirely objective in nature and differences in biotope allocation between analysts can be expected due to the nature of categorising samples taken from essentially continua of physical and biological parameters into often poorly-defined and delimited categories. Notwithstanding this consideration, the degree of difference in interpretation between the current and original biotope allocations (Foster-Smith *et al*., 2009) for the 2004 survey sites is high, with revised biotopes being recorded at 133 of the 228 video sites (Table 1.2, Annex 1).

The principal difference between the analyses lies in the interpretation of fine sand and muddy sand sites, with 55 of those originally ascribed to **CSaMu** biotopes being reassigned by the current analysis. These discrepancies are largely due to the original biotope allocation being strongly based on the use of a set of species which were considered to represent key characterising taxa, while placing less emphasis on the physical habitat conditions, such as depth, sediment type and evidence of sediment mobility. These taxa include *Amphiura filiformis*, *Ophiura ophiura*, and *Turritella communis,* all of which can be associated with a wide range of biotopes. For example *Amphiura filiformis* is widely known from **MuSa** biotopes and can be abundant in circalittoral fine sand (**SS.SSa.CFiSa**). *Ophiura ophiura* is not specific to **CSaMu** biotopes but can be abundant in, for example **IMuSa** biotopes and *Turritella communis* can form high densities in both **CSaMu** and **CFiMu** biotopes. The result of this emphasis on the use of these taxa in the original biotope allocations is that many sites giving the appearance of clean sand or slightly muddy sand habitats, particularly in fairly shallow water, have been ascribed to circalittoral sandy mud biotopes. Most of the 55 sites that have been subject to revision have now been ascribed to **IMuSa**. In every case they exhibit signs, albeit sometimes faint, of rippled sandy sediments, suggestive of non-cohesive sediment and hence not falling within the criteria of **CSaMu**. It should also be noted that the high densities of *Ophiura ophiura* and *Amphiura* spp., widely recorded in the 2004 survey, were not observed in the 2015 survey, suggesting high temporal variability.

Other discrepancies in biotope allocation apparently based on the presence of key characterising taxa include the original ascription of sites supporting clumps of *Ascidiella aspersa* to the sheltered, shallow-water mud biotope **SS.SMu.ISaMu.SundAasp**. These sites actually represent circalittoral (30 - 31 m), exposed habitats of coarse sand and gravel waves, clearly referable to **SS.SCS.CCS**.

In the original sublittoral biotope mapping report (Foster-Smith *et al*., 2009) all *Modiolus* habitats were ascribed to **SS.SBR.SMus.ModMx**. However, in the Marine Recorder database all such records have been switched to **SS.SBR.SMus.ModT**. In general, the Moray Firth *Modiolus* habitats do not fit neatly into the biotope classification scheme and so this leads to uncertainty in the ascription of sample sites to the closest biotope fits. **ModMx** is defined as an open coast, deep water biotope with affinities to the offshore gravel association and deep *Venus* community. Reanalysis of the video footage combined with consideration of the depth, location and grab data suggests that these predominantly fairly sheltered and shallow habitats can possibly be better referred to **SS.SBR.SMus.ModHAs**

(though the fit is not strong), except where they show evidence of being tide-swept off Chanonry Point (**SS.SBR.SMus.ModT**).

In spite of the significant level of disagreement in biotope allocations between the two analyses, there is a reasonably good correlation between the current biotope interpretation and the distribution of benthic substrata mapped by Foster-Smith *et al.* (2009) (Figure 8). **IMuSa** biotopes largely correspond to mapped areas of fine sand, muddy sand and in places shelly, gravelly sand. As noted above, some of these shallower sites may be referable to **IFiSa** biotopes given better faunal data. **CSaMu** and **CFiMu** biotopes very largely correspond to mapped areas of sandy mud. Mixed sediment biotopes (**IMx**, **CMx**) largely correspond to mapped areas of mixed sediment, although such areas also contain patches of more homogeneous substrata, such as fine sand (**SS.SSa.CFiSa**) and coarse sediments (**SS.SCS.CCS**).

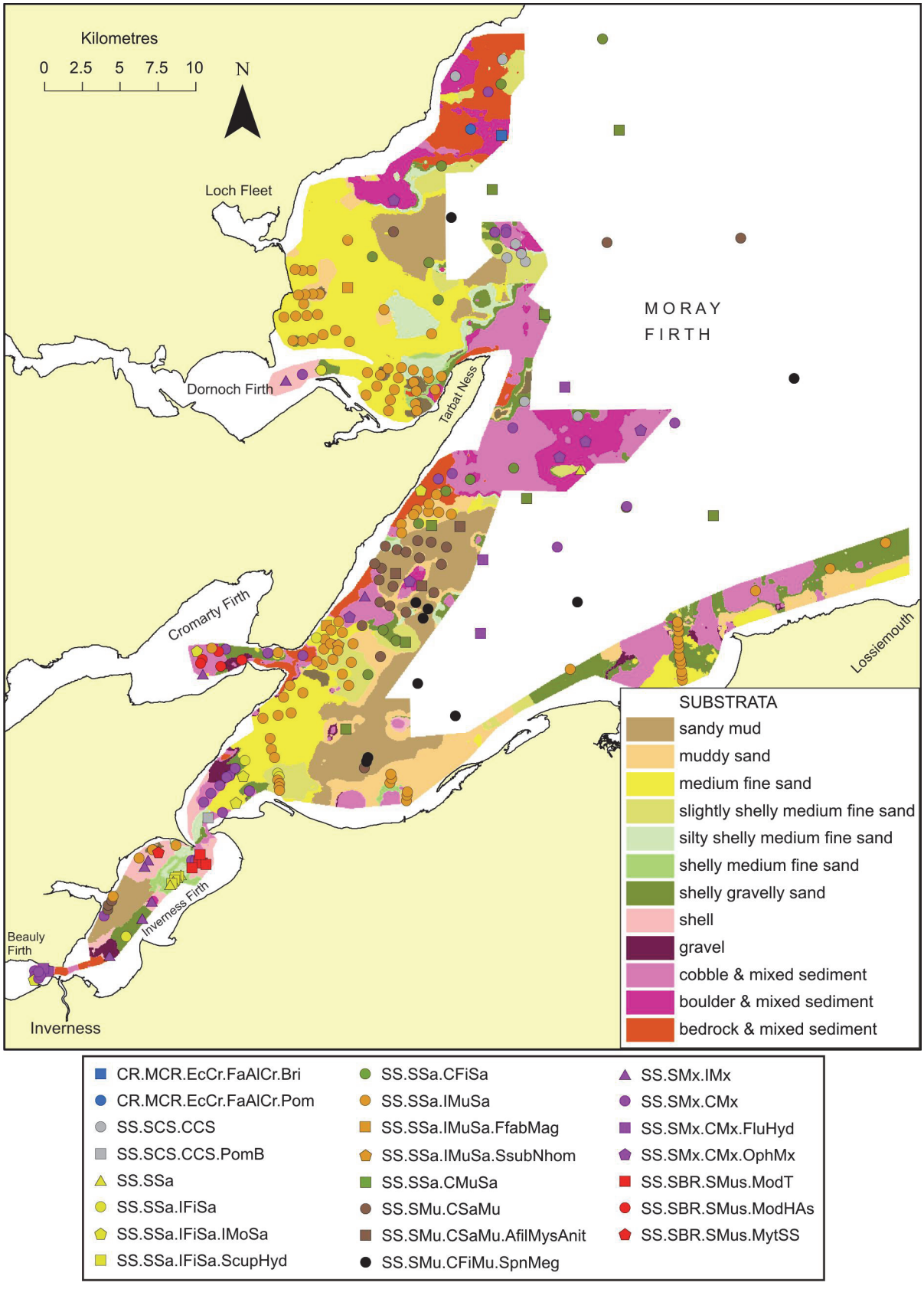


Figure 8. Distribution of revised biotope records in the survey area, together with the mapped distribution of benthic substrata (from Foster-Smith et al., 2009).

5. REFERENCES

Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. & Reker, J.B. 2004. *The National Marine Habitat Classification for Britain and Ireland. Version 04.05.* Peterborough: Joint Nature Conservation Committee. ISBN: 1 861 07561 8 (internet version). Available from http://jncc.defra.gov.uk/page-1584

Foster-Smith, R., Sotheran, I. & Foster-Smith, D. 2009. Sublittoral biotope mapping of the Moray Firth SAC. *Scottish Natural Heritage Commissioned Report No. 378*. Available from http://www.snh.org.uk/pdfs/publications/commissioned_reports/338.pdf

Hiscock, K. (ed.). 1996. *Marine Nature Conservation Review: Rationale and Methods.* Peterborough: Joint Nature Conservation Committee.

ANNEX 1: VIDEO DATA FOR 2004 ENVISION MAPPING LTD SURVEY

Table 1.1. Positional and temporal details of video sequences recorded during the 2004 Envision Mapping Ltd survey of Moray Firth SAC. ND = no data.

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
1	24/07/2004	MF_2004_BROADSCALE_1	20:31:41	20:38:55	00:00:05	00:01:51	57.89700	-3.97950	57.89683	-3.97950	7.0
2	25/07/2004	MF_2004_BROADSCALE_1	11:49:49	11:50:48	00:02:08	00:03:06	57.85483	-3.82500	57.85467	-3.82467	6.1
3	25/07/2004	MF_2004_BROADSCALE_1	11:57:30	11:58:47	00:03:11	00:04:29	57.84683	-3.83183	57.84667	-3.83167	4.6
4	25/07/2004	MF_2004_BROADSCALE_1	12:05:21	12:06:12	00:04:34	00:05:25	57.85350	-3.83867	57.85350	-3.83850	6.2
5	25/07/2004	MF_2004_BROADSCALE_1	12:09:36	12:10:43	00:05:31	00:06:37	57.85750	-3.84050	57.85750	-3.84000	7.1
6	25/07/2004	MF_2004_BROADSCALE_1	12:18:06	12:19:36	00:06:38	00:08:08	57.85850	-3.85650	57.85850	-3.85583	7.6
7	25/07/2004	MF_2004_BROADSCALE_1	12:25:30	12:26:30	00:08:15	00:09:15	57.85133	-3.85600	57.85117	-3.85567	6.1
8	25/07/2004	MF_2004_BROADSCALE_1	12:30:44	12:31:47	00:09:26	00:10:29	57.84583	-3.85250	57.84600	-3.85200	5.6
9	25/07/2004	MF_2004_BROADSCALE_1	12:37:35	12:38:45	00:10:32	00:11:42	57.83850	-3.85350	57.83833	-3.85317	4.0
10	25/07/2004	MF_2004_BROADSCALE_1	12:42:41	12:43:52	00:11:47	00:12:58	57.83417	-3.85217	57.83417	-3.85183	3.2
11	25/07/2004	MF_2004_BROADSCALE_1	12:53:06	12:54:17	00:13:02	00:14:13	57.83417	-3.88317	57.83400	-3.88283	2.9
12	25/07/2004	MF_2004_BROADSCALE_1	13:00:01	13:01:19	00:14:17	00:15:35	57.84050	-3.88133	57.84050	-3.88033	5.0
13	25/07/2004	MF_2004_BROADSCALE_1	13:06:29	13:07:50	00:15:40	00:17:00	57.84667	-3.87700	57.84650	-3.87650	5.7
14	25/07/2004	MF_2004_BROADSCALE_1	13:13:10	13:14:20	00:17:06	00:18:16	57.85350	-3.87300	57.85350	-3.87250	6.7
15	25/07/2004	MF_2004_BROADSCALE_1	13:18:54	13:20:10	00:18:21	00:19:38	57.85967	-3.86933	57.85950	-3.86900	7.9
16	25/07/2004	MF_2004_BROADSCALE_1	13:26:18	13:27:22	00:19:42	00:20:46	57.85900	-3.88433	57.85883	-3.88417	6.5
17	25/07/2004	MF_2004_BROADSCALE_1	13:32:15	13:33:42	00:20:52	00:22:19	57.85533	-3.89267	57.85517	-3.89250	3.7
18	25/07/2004	MF_2004_BROADSCALE_1	13:38:51	13:39:59	00:22:28	00:23:37	57.84850	-3.89650	57.84817	-3.89667	4.4
19	25/07/2004	MF_2004_BROADSCALE_1	13:45:16	13:46:33	00:23:44	00:25:01	57.84317	-3.90867	57.84300	-3.90850	3.8
20	25/07/2004	MF_2004_BROADSCALE_1	14:10:54	14:12:13	00:25:04	00:26:23	57.87483	-3.92767	57.87483	-3.92767	5.8
21	25/07/2004	MF_2004_BROADSCALE_1	14:18:46	14:20:44	00:26:26	00:28:24	57.88133	-3.94350	57.88133	-3.94317	7.5

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
22	25/07/2004	MF_2004_BROADSCALE_1	14:26:02	14:27:55	00:20:31	00:30:15	57.87867	-3.95733	57.87833	-3.95733	5.7
23	25/07/2004	MF_2004_BROADSCALE_1	14:32:21	14:33:56	00:30:20	00:31:54	57.87633	-3.96867	57.87600	-3.96850	4.5
24	25/07/2004	MF_2004_BROADSCALE_1	14:38:24	14:40:02	00:32:00	00:33:38	57.87483	-3.98050	57.87467	-3.98050	4.0
25	25/07/2004	MF_2004_BROADSCALE_1	14:47:45	14:49:22	00:33:42	00:35:19	57.87500	-3.99100	57.87483	-3.99067	2.9
26	25/07/2004	MF_2004_BROADSCALE_1	14:57:40	14:59:32	00:35:22	00:37:14	57.88867	-4.00133	57.88867	-4.00133	3.0
27	25/07/2004	MF_2004_BROADSCALE_1	15:04:15	15:05:40	00:37:27	00:38:52	57.88933	-3.98817	57.88933	-3.98800	5.0
28	25/07/2004	MF_2004_BROADSCALE_1	15:10:24	15:12:00	00:38:58	00:40:34	57.88967	-3.97567	57.88933	-3.97550	6.6
29	25/07/2004	MF_2004_BROADSCALE_1	15:23:32	15:25:29	00:40:37	00:42:34	57.89033	-3.96383	57.89017	-3.96367	8.2
30	25/07/2004	MF_2004_BROADSCALE_1	15:33:13	15:34:34	00:42:38	00:43:58	57.90267	-3.96200	57.90283	-3.96167	8.7
31	25/07/2004	MF_2004_BROADSCALE_1	15:38:19	15:40:02	00:44:04	00:45:47	57.90250	-3.96967	57.90233	-3.96950	7.7
32	25/07/2004	MF_2004_BROADSCALE_1	15:44:09	15:46:09	00:45:52	00:47:51	57.90233	-3.97817	57.90200	-3.97783	6.7
33	25/07/2004	MF_2004_BROADSCALE_1	15:50:13	15:51:32	00:47:58	00:49:18	57.90200	-3.98550	57.90183	-3.98533	5.7
34	25/07/2004	MF_2004_BROADSCALE_1	17:27:32	17:28:41	00:49:22	00:50:31	57.85667	-3.90733	57.85683	-3.90700	4.7
35	25/07/2004	MF_2004_BROADSCALE_1	17:43:09	17:44:32	00:50:36	00:51:59	57.85783	-3.95883	57.85767	-3.95850	15.1
36	25/07/2004	MF_2004_BROADSCALE_1	17:51:55	17:52:56	00:52:03	00:53:04	57.85483	-3.97967	57.85500	-3.97933	14.7
37	25/07/2004	MF_2004_BROADSCALE_1	18:00:02	18:02:36	00:53:09	00:55:43	57.85133	-3.99800	57.85133	-3.99733	8.0
39	25/07/2004	MF_2004_BROADSCALE_1	19:59:11	19:59:57	00:56:52	00:57:38	57.91683	-3.97150	57.91683	-3.97150	10.9
40	25/07/2004	MF_2004_BROADSCALE_1	20:04:42	20:05:46	00:57:42	00:58:46	57.91650	-3.98150	57.91650	-3.98150	7.9
41	25/07/2004	MF_2004_BROADSCALE_1	20:09:11	20:11:32	00:58:52	01:01:12	57.91700	-3.98933	57.91717	-3.98900	4.5
42	26/07/2004	MF_2004_BROADSCALE_2	12:38:47	12:39:57	00:00:10	00:01:21	57.79383	-3.79167	57.79400	-3.79150	19.0
43	26/07/2004	MF_2004_BROADSCALE_2	12:49:21	12:50:36	00:01:24	00:02:39	57.79733	-3.81183	57.79750	-3.81183	15.9
44	26/07/2004	MF_2004_BROADSCALE_2	12:57:15	12:58:25	00:02:42	00:03:52	57.79433	-3.82717	57.79433	-3.82733	11.3
45	26/07/2004	MF_2004_BROADSCALE_2	13:06:43	13:08:16	00:03:54	00:05:27	57.78717	-3.84633	57.78683	-3.84650	10.1
46	26/07/2004	MF_2004_BROADSCALE_2	13:15:54	13:17:08	00:05:30	00:06:44	57.78500	-3.82867	57.78500	-3.82883	16.5

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
47	26/07/2004	MF_2004_BROADSCALE_2	13:22:29	13:23:31	00:06:48	00:07:50	57.78683	-3.81833	57.78683	-3.81833	17.4
48	26/07/2004	MF_2004_BROADSCALE_2	13:32:07	13:33:21	00:07:53	00:09:07	57.77317	-3.81217	57.77300	-3.81300	21.7
49	26/07/2004	MF_2004_BROADSCALE_2	13:39:09	13:40:12	00:09:13	00:10:16	57.77417	-3.82600	57.77417	-3.82617	18.8
50	26/07/2004	MF_2004_BROADSCALE_2	13:45:25	13:47:36	00:10:21	00:11:25	57.77450	-3.83767	57.77450	-3.83800	17.3
51	26/07/2004	MF_2004_BROADSCALE_2	13:53:28	13:54:39	00:11:31	00:12:42	57.77933	-3.83717	57.77950	-3.83760	16.5
52	26/07/2004	MF_2004_BROADSCALE_2	14:01:23	14:02:59	00:12:45	00:13:46	57.77567	-3.85050	57.77567	-3.85083	14.2
53	26/07/2004	MF_2004_BROADSCALE_2	14:07:29	14:09:39	00:13:51	00:15:27	57.77267	-3.85417	57.77233	-3.85500	15.1
54	26/07/2004	MF_2004_BROADSCALE_2	14:21:58	14:25:52	00:15:30	00:16:47	57.76700	-3.86800	57.76667	-3.86767	14.0
55	26/07/2004	MF_2004_BROADSCALE_2	14:34:20	14:36:31	00:16:50	00:18:50	57.76750	-3.84817	57.76750	-3.84917	20.0
56	26/07/2004	MF_2004_BROADSCALE_2	14:44:37	14:46:34	00:18:52	00:20:26	57.76650	-3.83400	57.76650	-3.83533	23.7
57	26/07/2004	MF_2004_BROADSCALE_2	14:58:41	15:01:55	00:20:28	00:22:26	57.76583	-3.80250	57.76533	-3.80333	27.8
58	26/07/2004	MF_2004_BROADSCALE_2	15:13:06	15:14:31	00:22:28	00:23:53	57.75383	-3.81700	57.75417	-3.81767	27.2
59	26/07/2004	MF_2004_BROADSCALE_2	15:22:53	15:25:11	00:23:58	00:26:09	57.75633	-3.83417	57.75650	-3.83483	25.2
60	26/07/2004	MF_2004_BROADSCALE_2	15:31:44	15:33:23	00:26:15	00:27:54	57.75733	-3.84933	57.75750	-3.85000	23.1
61	26/07/2004	MF_2004_BROADSCALE_2	15:40:49	15:42:17	00:27:57	00:29:20	57.76167	-3.86717	57.76183	-3.86783	18.4
62	26/07/2004	MF_2004_BROADSCALE_2	15:53:18	15:54:53	00:29:22	00:30:57	57.75383	-3.88483	57.75383	-3.88567	17.0
63	26/07/2004	MF_2004_BROADSCALE_2	16:03:23	16:05:03	00:31:00	00:32:40	57.75183	-3.87167	57.75150	-3.87200	20.5
64	26/07/2004	MF_2004_BROADSCALE_2	16:11:14	16:12:59	00:32:44	00:33:56	57.75050	-3.86167	57.75017	-3.86167	22.3
65	26/07/2004	MF_2004_BROADSCALE_2	16:20:56	16:22:12	00:33:59	00:35:14	57.74717	-3.84700	57.74700	-3.84733	25.1
66	26/07/2004	MF_2004_BROADSCALE_2	16:33:21	16:35:08	00:35:16	00:36:59	57.74350	-3.82233	57.74317	-3.82267	27.8
67	26/07/2004	MF_2004_BROADSCALE_2	16:46:09	16:47:22	00:37:01	00:38:13	57.72667	-3.83067	57.72667	-3.83100	28.3
68	26/07/2004	MF_2004_BROADSCALE_2	16:55:13	16:56:42	00:38:16	00:39:45	57.73050	-3.84383	57.73067	-3.84417	27.1
69	26/07/2004	MF_2004_BROADSCALE_2	17:04:53	17:07:15	00:39:47	00:42:09	57.73333	-3.85767	57.73350	-3.85817	21.0
70	26/07/2004	MF_2004_BROADSCALE_2	17:14:16	17:16:34	00:42:12	00:44:31	57.73767	-3.87317	57.73800	-3.87317	22.0

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
71	26/07/2004	MF_2004_BROADSCALE_2	17:23:36	17:24:52	00:44:33	00:45:49	57.74083	-3.88900	57.74067	-3.88933	18.6
72	26/07/2004	MF_2004_BROADSCALE_2	17:29:51	17:32:44	00:45:54	00:48:46	57.74317	-3.89650	57.74333	-3.89683	16.6
73	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:00:04	00:00:25	57.73370	-3.89130	57.73370	-3.89130	18.6
74	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:00:25	00:01:23	57.72990	-3.87570	57.72990	-3.87570	22.0
75	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:01:26	00:03:27	57.72060	-3.85037	57.72060	-3.85037	27.9
76	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:03:31	00:05:42	57.71710	-3.83672	57.71710	-3.83672	30.8
77	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:05:45	00:07:30	57.71130	-3.84190	57.71130	-3.84190	31.0
78	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:07:32	00:09:07	57.71470	-3.86100	57.71470	-3.86100	25.7
79	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:09:08	00:10:05	57.71860	-3.87898	57.71860	-3.87898	21.4
80	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:10:10	00:11:13	57.72070	-3.88982	57.72070	-3.88982	19.6
81	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:11:15	00:13:01	57.72400	-3.90697	57.72400	-3.90697	13.3
82	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:13:04	00:14:43	57.71160	-3.92373	57.71160	-3.92373	12.4
83	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:14:46	00:15:52	57.70660	-3.90967	57.70660	-3.90967	17.3
84	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:15:53	00:17:29	57.70410	-3.88638	57.70410	-3.88638	20.7
85	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:17:31	00:19:11	57.69790	-3.87143	57.69790	-3.87143	24.5
86	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:19:15	00:20:41	57.69700	-3.86107	57.69700	-3.86107	27.1
87	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:20:45	00:22:15	57.68850	-3.88887	57.68850	-3.88887	22.1
88	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:22:16	00:23:21	57.69570	-3.91940	57.69570	-3.91940	15.2
89	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:23:21	00:24:48	57.70230	-3.93155	57.70230	-3.93155	12.6
90	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:24:49	00:26:36	57.70870	-3.93570	57.70870	-3.93570	10.4
91	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:26:37	00:28:36	57.70630	-3.94885	57.70630	-3.94885	8.5
92	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:28:41	00:30:12	57.70370	-3.94377	57.70370	-3.94377	9.0
93	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:30:14	00:31:54	57.69820	-3.95077	57.69820	-3.95077	9.2
94	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:31:56	00:33:00	57.69870	-3.95990	57.69870	-3.95990	7.5

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
95	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:33:01	00:34:14	57.69230	-3.95157	57.69230	-3.95157	8.3
96	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:34:18	00:36:16	57.69560	-3.94400	57.69560	-3.94400	11.8
97	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:36:19	00:37:34	57.69490	-3.93573	57.69490	-3.93573	13.2
98	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:37:36	00:39:01	57.69150	-3.93602	57.69150	-3.93602	13.8
99	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:39:06	00:40:28	57.68610	-3.94132	57.68610	-3.94132	11.7
100	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:40:32	00:42:03	57.68480	-3.92097	57.68480	-3.92097	15.0
101	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:42:07	00:44:02	57.67780	-3.90222	57.67780	-3.90222	18.2
102	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:44:05	00:45:53	57.67100	-3.92347	57.67100	-3.92347	15.4
103	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:45:57	00:48:15	57.67780	-3.93078	57.67780	-3.93078	14.9
104	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:48:16	00:49:33	57.65070	-4.01783	57.65070	-4.01783	6.4
105	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:49:41	00:51:43	57.63880	-4.00985	57.63880	-4.00985	9.4
106	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:51:46	00:53:34	57.63230	-4.00798	57.63230	-4.00798	8.5
107	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:53:37	00:55:27	57.62770	-4.00455	57.62770	-4.00455	6.1
108	27/07/2004	MF_2004_BROADSCALE_3	ND	ND	00:55:30	01:00:49	57.61630	-4.05362	57.61630	-4.05362	12.0
109	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:00:09	00:01:07	57.61630	-4.03872	57.61630	-4.03872	6.0
110	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:01:10	00:02:22	57.80060	-3.66922	57.80060	-3.66922	27.0
111	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:02:26	00:03:19	57.80080	-3.74335	57.80080	-3.74335	18.0
112	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:03:30	00:04:22	57.80820	-3.69285	57.80820	-3.69285	22.0
114	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:04:27	00:05:21	57.81760	-3.66405	57.81760	-3.66405	22.0
115	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:05:24	00:06:44	57.82490	-3.74487	57.82490	-3.74487	23.0
116	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:06:49	00:07:49	57.82440	-3.60298	57.82440	-3.60298	32.0
117	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:07:55	00:09:33	57.83210	-3.67280	57.83210	-3.67280	31.0
118	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:09:38	00:10:44	57.84070	-3.73222	57.84070	-3.73222	30.0
119	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:10:49	00:12:12	57.90020	-3.82927	57.90020	-3.82927	27.0

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
120	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:12:20	00:13:34	58.03280	-3.81338	58.03280	-3.81338	16.9
121	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:13:36	00:14:41	58.00160	-3.79555	58.00160	-3.79555	20.0
122	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:14:44	00:16:04	58.02360	-3.77690	58.02360	-3.77690	28.0
123	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:16:07	00:17:32	57.99790	-3.76112	57.99790	-3.76112	30.0
124	06/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:17:34	00:18:37	58.04330	-3.76117	58.04330	-3.76117	25.0
125	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:18:40	00:20:03	57.94260	-3.75492	57.94260	-3.75492	27.0
126	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:20:08	00:21:29	57.94040	-3.75485	57.94040	-3.75485	29.0
127	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:21:33	00:22:59	57.94060	-3.76752	57.94060	-3.76752	33.0
128	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:23:04	00:24:12	57.93090	-3.76457	57.93090	-3.76457	32.0
129	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:24:19	00:25:28	57.92570	-3.75350	57.92570	-3.75350	34.0
130	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:25:37	00:26:25	57.92370	-3.73305	57.92370	-3.73305	33.0
131	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:26:29	00:27:40	57.92820	-3.73775	57.92820	-3.73775	31.0
132	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:27:49	00:28:46	57.93400	-3.74413	57.93400	-3.74413	30.0
133	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:29:03	00:30:04	57.95920	-3.88062	57.95920	-3.88062	20.0
134	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:30:10	00:31:24	57.94020	-3.88040	57.94020	-3.88040	26.0
135	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:31:31	00:32:51	57.90700	-3.93057	57.90700	-3.93057	13.0
136	07/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:33:26	00:35:23	57.93490	-3.93157	57.93490	-3.93157	17.2
137	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:35:29	00:36:30	57.68300	-3.95323	57.68300	-3.95323	15.0
138	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:36:39	00:37:34	57.68510	-3.95948	57.68510	-3.95948	14.0
139	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:37:51	00:39:20	57.68840	-3.97475	57.68840	-3.97475	23.0
140	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:39:24	00:40:26	57.67070	-3.98843	57.67070	-3.98843	10.0
141	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:40:30	00:41:35	57.66620	-3.97412	57.66620	-3.97412	15.0
142	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:41:40	00:42:31	57.65420	-3.98673	57.65420	-3.98673	10.0
143	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:42:35	00:43:54	57.65260	-4.00097	57.65260	-4.00097	9.0

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
144	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:43:57	00:44:56	57.66330	-3.99560	57.66330	-3.99560	8.0
145	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:45:00	00:46:26	57.69130	-4.06022	57.69130	-4.06022	20.0
146	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:46:32	00:47:44	57.68990	-4.06817	57.68990	-4.06817	18.0
147	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:47:49	00:48:51	57.69170	-4.07560	57.69170	-4.07560	18.0
148	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:48:56	00:50:00	57.69000	-4.09195	57.69000	-4.09195	15.0
149	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:50:06	00:51:11	57.68500	-4.08595	57.68500	-4.08595	12.0
150	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:51:18	00:52:25	57.68290	-4.08768	57.68290	-4.08768	10.0
151	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:52:32	00:53:33	57.67650	-4.08545	57.67650	-4.08545	6.0
152	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:53:40	00:54:33	57.68120	-4.06567	57.68120	-4.06567	8.0
153	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:54:40	00:55:39	57.68510	-4.04238	57.68510	-4.04238	16.0
154	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:55:45	00:56:48	57.68970	-4.01373	57.68970	-4.01373	20.0
155	08/08/2004	MF_2004_BROADSCALE_4	ND	ND	00:56:51	00:59:22	57.68990	-4.00188	57.68990	-4.00188	21.0
156	09/08/2004	MF_2004_BROADSCALE_5	11:34:00	11:35:12	00:00:07	00:01:18	57.49850	-4.25033	57.49833	-4.25067	30.0
157	09/08/2004	MF_2004_BROADSCALE_5	11:43:57	11:44:57	00:01:23	00:02:23	57.50033	-4.25550	57.50050	-4.25567	13.0
158	09/08/2004	MF_2004_BROADSCALE_5	11:50:02	11:51:20	00:02:30	00:03:35	57.49883	-4.26550	57.49900	-4.26617	17.0
159	09/08/2004	MF_2004_BROADSCALE_5	11:56:41	11:57:54	00:03:42	00:04:54	57.49567	-4.26467	57.49550	-4.26517	17.0
160	09/08/2004	MF_2004_BROADSCALE_5	12:02:25	12:04:17	00:05:00	00:06:08	57.49350	-4.26583	57.49333	-4.26617	9.0
161	09/08/2004	MF_2004_BROADSCALE_5	12:11:03	12:12:02	00:06:15	00:07:13	57.49433	-4.26050	57.49450	-4.26100	14.0
162	09/08/2004	MF_2004_BROADSCALE_5	12:17:23	12:18:22	00:07:18	00:08:18	57.49633	-4.25900	57.49633	-4.25917	24.0
163	09/08/2004	MF_2004_BROADSCALE_5	12:23:21	12:24:16	00:08:23	00:09:18	57.49817	-4.26100	57.49817	-4.26117	20.0
164	10/08/2004	MF_2004_BROADSCALE_5	10:12:10	10:13:30	00:09:24	00:10:36	57.55733	-4.10583	57.55733	-4.10617	17.7
165	10/08/2004	MF_2004_BROADSCALE_5	10:20:06	10:21:01	00:10:41	00:11:36	57.55650	-4.10833	57.55650	-4.10833	17.0
166	10/08/2004	MF_2004_BROADSCALE_5	10:24:49	10:25:58	00:11:51	00:12:59	57.55533	-4.10967	57.55533	-4.10983	16.0
167	10/08/2004	MF_2004_BROADSCALE_5	10:29:11	10:30:37	00:13:04	00:14:30	57.55533	-4.11183	57.55517	-4.11217	16.1

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
168	10/08/2004	MF_2004_BROADSCALE_5	10:35:54	10:37:10	00:14:34	00:15:51	57.55417	-4.11300	57.55417	-4.11300	15.2
169	10/08/2004	MF_2004_BROADSCALE_5	10:40:34	10:42:17	00:15:56	00:17:39	57.55350	-4.11417	57.55333	-4.11417	14.2
170	10/08/2004	MF_2004_BROADSCALE_5	10:46:01	10:47:34	00:17:43	00:19:15	57.55200	-4.11550	57.55200	-4.11533	13.7
171	10/08/2004	MF_2004_BROADSCALE_5	10:50:52	10:52:04	00:19:20	00:20:31	57.55150	-4.11767	57.55150	-4.11800	12.5
172	10/08/2004	MF_2004_BROADSCALE_5	11:02:25	11:03:35	00:20:34	00:21:45	57.54133	-4.13767	57.54117	-4.13767	4.8
173	10/08/2004	MF_2004_BROADSCALE_5	11:11:24	11:12:34	00:21:49	00:22:59	57.53100	-4.14750	57.53083	-4.14733	5.0
174	10/08/2004	MF_2004_BROADSCALE_5	11:21:57	11:22:59	00:23:04	00:24:06	57.52017	-4.16500	57.52017	-4.16533	4.5
175	10/08/2004	MF_2004_BROADSCALE_5	11:32:14	11:33:18	00:24:10	00:25:14	57.50883	-4.18317	57.50850	-4.18317	5.0
176	10/08/2004	MF_2004_BROADSCALE_5	11:56:44	11:57:53	00:25:20	00:26:29	57.53217	-4.19000	57.53200	-4.19017	14.7
177	10/08/2004	MF_2004_BROADSCALE_5	12:04:14	12:05:20	00:26:32	00:27:38	57.53600	-4.18600	57.53600	-4.18617	10.0
178	10/08/2004	MF_2004_BROADSCALE_5	12:09:32	12:10:39	00:27:41	00:28:48	57.53850	-4.18567	57.53850	-4.18600	10.0
179	10/08/2004	MF_2004_BROADSCALE_5	12:15:56	12:17:01	00:28:52	00:29:56	57.54117	-4.18167	57.54100	-4.18183	11.3
180	10/08/2004	MF_2004_BROADSCALE_5	12:21:18	12:22:23	00:30:01	00:31:05	57.54400	-4.18033	57.54400	-4.18067	8.8
181	10/08/2004	MF_2004_BROADSCALE_5	12:56:20	12:57:23	00:31:08	00:32:11	57.57167	-4.13733	57.57150	-4.13733	12.7
182	10/08/2004	MF_2004_BROADSCALE_5	13:02:07	13:03:35	00:32:16	00:33:17	57.57050	-4.13100	57.57017	-4.13067	3.7
183	10/08/2004	MF_2004_BROADSCALE_5	13:10:55	13:11:55	00:33:24	00:34:24	57.56583	-4.14233	57.56550	-4.14233	3.9
184	10/08/2004	MF_2004_BROADSCALE_5	13:17:51	13:19:16	00:34:28	00:35:36	57.56183	-4.14633	57.56167	-4.14683	3.7
185	10/08/2004	MF_2004_BROADSCALE_5	13:24:00	13:25:07	00:35:40	00:36:47	57.56667	-4.15217	57.56683	-4.15250	9.7
186	10/08/2004	MF_2004_BROADSCALE_5	13:39:46	13:40:55	00:36:52	00:38:01	57.57467	-4.11200	57.57433	-4.11167	23.6
187	10/08/2004	MF_2004_BROADSCALE_5	18:35:36	18:36:40	00:38:05	00:39:09	57.62550	-4.03683	57.62533	-4.03733	12.2
188	10/08/2004	MF_2004_BROADSCALE_5	18:42:26	18:43:31	00:39:13	00:40:18	57.62083	-4.04767	57.62083	-4.04850	12.4
189	10/08/2004	MF_2004_BROADSCALE_5	18:49:06	18:50:03	00:40:23	00:41:20	57.61550	-4.05733	57.61550	-4.05767	12.3
190	10/08/2004	MF_2004_BROADSCALE_5	18:55:42	18:56:41	00:41:25	00:42:24	57.61067	-4.06417	57.61067	-4.06467	12.2
191	10/08/2004	MF_2004_BROADSCALE_5	19:02:44	19:03:49	00:42:28	00:43:33	57.60583	-4.07400	57.60550	-4.07433	13.0

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
192	10/08/2004	MF_2004_BROADSCALE_5	19:08:52	19:10:04	00:43:37	00:44:49	57.60067	-4.08183	57.60067	-4.08233	16.1
193	10/08/2004	MF_2004_BROADSCALE_5	19:19:34	19:20:41	00:44:53	00:45:59	57.59150	-4.07650	57.59133	-4.07683	23.8
194	10/08/2004	MF_2004_BROADSCALE_5	19:31:35	19:32:42	00:46:02	00:47:08	57.59467	-4.06100	57.59467	-4.06133	16.3
195	10/08/2004	MF_2004_BROADSCALE_5	19:40:38	19:41:28	00:47:12	00:48:02	57.60033	-4.04617	57.60033	-4.04633	13.2
196	10/08/2004	MF_2004_BROADSCALE_5	19:49:41	19:50:50	00:48:08	00:49:17	57.60783	-4.03183	57.60800	-4.03217	20.4
197	11/08/2004	MF_2004_BROADSCALE_5	06:50:08	06:51:14	00:49:19	00:50:25	57.56600	-4.09433	57.56550	-4.09500	29.3
198	11/08/2004	MF_2004_BROADSCALE_5	06:57:46	06:58:51	00:50:28	00:51:30	57.56583	-4.09033	57.56550	-4.09083	13.8
199	11/08/2004	MF_2004_BROADSCALE_5	07:03:25	07:04:29	00:51:34	00:52:38	57.56533	-4.08650	57.56500	-4.08683	13.2
200	11/08/2004	MF_2004_BROADSCALE_5	07:08:34	07:09:38	00:52:42	00:53:46	57.56450	-4.08217	57.56417	-4.08250	7.3
201	11/08/2004	MF_2004_BROADSCALE_5	07:13:17	07:14:21	00:53:50	00:54:54	57.56383	-4.07817	57.56350	-4.07850	3.4
202	11/08/2004	MF_2004_BROADSCALE_5	07:21:15	07:22:17	00:54:58	00:56:01	57.56950	-4.08500	57.56917	-4.08517	19.2
203	11/08/2004	MF_2004_BROADSCALE_5	07:29:22	07:30:35	00:56:05	00:57:17	57.56133	-4.09350	57.56100	-4.09417	14.3
204	11/08/2004	MF_2004_BROADSCALE_6	10:41:09	10:42:11	00:00:07	00:01:08	57.61850	-4.00050	57.61683	-4.00067	5.8
205	11/08/2004	MF_2004_BROADSCALE_6	10:46:24	10:47:36	00:01:13	00:02:24	57.61633	-3.99933	57.61617	-3.99917	3.2
206	11/08/2004	MF_2004_BROADSCALE_6	10:50:24	10:51:27	00:02:28	00:03:31	57.61433	-4.00033	57.61433	-4.00050	8.5
207	11/08/2004	MF_2004_BROADSCALE_6	10:56:03	10:57:08	00:03:37	00:04:41	57.61217	-3.99850	57.61200	-3.99833	13.1
208	11/08/2004	MF_2004_BROADSCALE_6	11:01:03	11:02:20	00:04:15	00:06:02	57.61017	-3.99883	57.61017	-3.99883	18.8
209	11/08/2004	MF_2004_BROADSCALE_6	11:06:32	11:07:35	00:06:06	00:07:09	57.60833	-3.99817	57.60833	-3.99817	18.4
210	11/08/2004	MF_2004_BROADSCALE_6	11:58:47	11:59:50	00:07:12	00:08:14	57.60317	-3.85800	57.60300	-3.85800	8.0
211	11/08/2004	MF_2004_BROADSCALE_6	12:04:27	12:05:31	00:08:21	00:09:25	57.60633	-3.85767	57.60633	-3.85800	10.3
212	11/08/2004	MF_2004_BROADSCALE_6	12:09:30	12:10:41	00:09:29	00:10:40	57.60833	-3.85717	57.60817	-3.85700	11.3
213	11/08/2004	MF_2004_BROADSCALE_6	12:20:42	12:21:52	00:10:41	00:11:51	57.61350	-3.87633	57.61333	-3.87650	13.4
214	11/08/2004	MF_2004_BROADSCALE_6	12:26:44	12:27:50	00:11:55	00:13:01	57.61617	-3.87467	57.61600	-3.87467	15.2
215	11/08/2004	MF_2004_BROADSCALE_6	12:32:44	12:33:51	00:13:05	00:14:12	57.61883	-3.87550	57.61883	-3.87583	16.3

Table 1.1 continued

Site	Date	Video medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longitude start	Latitude end	Longitude end	Depth CD (m)
216	11/08/2004	MF_2004_BROADSCALE_6	12:45:07	12:46:17	00:14:15	00:15:24	57.62217	-3.90483	57.62217	-3.90517	20.9
217	11/08/2004	MF_2004_BROADSCALE_6	12:52:15	12:53:23	00:15:30	00:16:37	57.62600	-3.90267	57.62583	-3.90283	23.3
218	11/08/2004	MF_2004_BROADSCALE_6	12:59:01	13:00:12	00:16:42	00:17:53	57.62850	-3.90117	57.62833	-3.90150	24.3
219	12/08/2004	MF_2004_BROADSCALE_6	13:12:17	13:13:24	00:17:55	00:19:02	57.67615	-3.55400	57.67600	-3.55433	7.1
220	12/08/2004	MF_2004_BROADSCALE_6	13:17:07	13:18:11	00:19:06	00:20:10	57.67917	-3.55483	57.67900	-3.55517	7.7
221	12/08/2004	MF_2004_BROADSCALE_6	13:21:41	13:22:44	00:20:14	00:21:16	57.68133	-3.55500	57.68133	-3.55533	8.1
222	12/08/2004	MF_2004_BROADSCALE_6	13:27:42	13:28:50	00:21:21	00:22:29	57.68617	-3.55567	57.68617	-3.55600	8.9
223	12/08/2004	MF_2004_BROADSCALE_6	13:32:18	13:33:22	00:22:34	00:23:38	57.68800	-3.55650	57.68800	-3.55683	9.1
224	12/08/2004	MF_2004_BROADSCALE_6	13:36:49	13:38:02	00:23:42	00:24:55	57.69067	-3.55767	57.69083	-3.55767	9.4
225	12/08/2004	MF_2004_BROADSCALE_6	13:42:30	13:43:40	00:25:00	00:26:09	57.69517	-3.55833	57.69533	-3.55850	10.4
226	12/08/2004	MF_2004_BROADSCALE_6	13:47:05	13:48:12	00:26:14	00:27:17	57.69767	-3.55900	57.69767	-3.55917	10.7
227	12/08/2004	MF_2004_BROADSCALE_6	13:51:50	13:52:58	00:27:21	00:28:29	57.70017	-3.55950	57.70000	-3.55950	11.2
228	12/08/2004	MF_2004_BROADSCALE_6	13:57:47	13:58:52	00:28:33	00:29:39	57.70517	-3.55867	57.70533	-3.55900	12.7
229	12/08/2004	MF_2004_BROADSCALE_6	14:03:08	14:04:18	00:29:44	00:30:54	57.70817	-3.55950	57.70817	-3.55967	14.0
230	12/08/2004	MF_2004_BROADSCALE_6	14:08:34	14:09:42	00:30:58	00:32:06	57.71050	-3.56000	57.71050	-3.56000	16.0

Table 1.2. Physical and biological details of video sequences recorded during the 2004 Envision Mapping Ltd survey of Moray Firth SAC. Details relate to the reanalysis of imagery, except for the original biotope determination (from Foster-Smith et al.*, 2009).*

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
1	Rippled fine sand	*Ophiura ophiura* (C), *Asterias rubens* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
2	Slightly rippled/dimpled, fine sand with dense surface scatter of comminuted shell material and possibly coarse sand	*Asterias rubens* (O), *Ensis* shells P).	SS.SSa.IMuSa	SS.SSA.CMuSa	Uncertain biotope
3	Rippled, shelly fine sand with scattered boulders, cobbles and pebbles	Stones support filamentous algae, including Ectocarpaceae sp. (P), *Chorda filum* (O), hydroids (R), serpulid worms (R). *Asterias rubens* (P).	SS.SSa.IMuSa	SS.SMP.KSwSS.LsacCho	
4	Slightly rippled, shelly fine sand	Sparsely scattered filamentous algae (R) and *Ensis* shells (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
5	Slightly shelly, slightly rippled/dimpled, fine sand	Scattered *Ensis* shells, Paguridae sp. (P), *Lanice conchilega*? (R), small infaunal holes.	SS.SSa.IMuSa	SS.SSA.IMuSa.SsubNhom	Uncertain biotope. Could be IFiSa
6	Slightly rippled fine sand with shells and broken shell material	*Ensis* shells and possibly *Ensis* depressions (P), *Asterias rubens* (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
7	Slightly rippled, slightly shelly, fine sand	Possibly *Ensis* depressions (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
8	Slightly rippled fine sand with shell material	Sparsely scattered filamentous algae (R). Possible *Ensis* depressions (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.SsubNhom	
9	Slightly rippled, slightly shelly, fine sand	No biota discernible.	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope. Could be IFiSa
10	Slightly rippled, slightly shelly, fine sand	*Ophiura ophiura* (O).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
11	Rippled fine-medium sand	Sparsely scattered filamentous algae (O), *Lanice conchilega*? (P), *Ensis* shells (P) and possible *Ensis* depression (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope. Could be IFiSa
12	Slightly shelly fine sand	Possible *Ensis* withdrawal plume (P), Paguridae sp.? (R), *Ophiura* sp. (R).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope. Could be IFiSa
13	Slightly rippled, slightly shelly, fine sand	*Asterias rubens* (P), Paguridae sp. (R).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
14	Slightly rippled, slightly shelly, fine sand	*Asterias rubens* (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
15	Slightly rippled, fine sand with shell material	Small teleost (P), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
16	Slightly rippled, slightly shelly, fine sand	*Ensis* shells (P) and possibly *Ensis* depressions (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.SsubNhom	
17	Apparently slightly silty fine sand	Paguridae spp. (O), *Ophiura* sp. (R), scattered clumps of	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
		filamentous algae (R).			
18	Slightly rippled, slightly shelly, fine sand	Naticidae sp. (R), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
19	Slightly rippled, slightly shelly, fine sand	*Ophiura ophiura* (C), Paguridae sp. (R), small teleost (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
20	Rippled fine sand with scattered shells	Possible *Ensis* withdrawal plumes (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.FfabMag	Uncertain biotope. Could be IFiSa
21	Slightly rippled, slightly shelly, fine sand	Paguridae sp. (R), possible *Ensis* shells (P) and depressions (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
22	Slightly rippled, slightly shelly, fine sand	*Liocarcinus depurator* (P), filamentous algae (R).	SS.SSa.IMuSa	SS.SSA	
23	Slightly rippled, slightly shelly, fine sand	Paguridae sp. (O), filamentous algae (R).	SS.SSa.IMuSa	SS.SSA	
24	Rippled, slightly shelly, fine sand	*Ophiura ophiura* (O), Paguridae sp. (R), filamentous algae (R).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
25	Slightly rippled fine sand with much shell material including *Ensis* shells	Shell material supports filamentous algae (F), although much of it drift. *Chorda filum* (P).	SS.SSa.IMuSa	SS.SSA	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
26	Slightly rippled, slightly shelly, fine sand	*Ophiura ophiura* (F), filamentous algae (R), Paguridae sp. (R), small holes and depressions possibly of *Ensis* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
27	Slightly rippled, slightly shelly, fine sand	*Ophiura ophiura* (F), possible *Ensis* depressions (P), sparse diatom film? (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
28	Slightly dimpled/rippled fine sand, possibly slightly silty	*Ophiura ophiura* (F), Paguridae sp. (R), Naticidae sp. (P), *Asterias rubens* (P), possible *Ensis* depressions (P), small emergent infaunal tubes (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
29	Slightly rippled, shelly, fine sand	*Ophiura ophiura* (C), filamentous algae (R), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation. Sediment also appears too clean
30	Slightly rippled, slightly shelly, fine sand	*Lanice conchilega* (P), Paguridae sp. (R), filamentous algae (R), possible *Ensis* depressions (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
31	Slightly rippled, slightly shelly, fine sand	*Lanice conchilega* (P), Paguridae sp. (O), filamentous algae (R), possible *Ensis* depressions (P), sparse diatom film? (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
32	Slightly rippled fine sand, possibly slightly silty	*Ophiura ophiura* (C), *Asterias rubens* (P), Paguridae sp. (O), *Ensis* shells (P) and possible *Ensis* depressions (P), diatom film (F).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
33	Slightly rippled, slightly shelly, fine sand	*Ophiura ophiura* (C), sparse *Arenicola marina* (P), *Lanice conchilega* (O), Paguridae sp. (R), possible *Ensis* depressions (P), diatom film (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
34	Rippled fine sand	Paguridae sp. (R), filamentous algae (R, possibly drift).	SS.SSa.IMuSa	SS.SSA	Uncertain biotope. Could be IFiSa
35	Well-rippled, probably highly mobile, fine - medium sand with much shell material	No life discernible.	SS.SSa.IFiSa	SS.SCS	Possibly IMoSa
36	Dense shells and broken shell material on apparently coarse mixed sediment	Shells supporting serpulid worms (C); *Asterias rubens* (P), Paguridae sp. (P).	SS.SMx.CMx	SS.SSA.CMuSa	Could also be SS.SMx.IMx
37	Dense shell and broken shell	*Alcyonium digitatum* (A), Paguridae sp. (P), *Carcinus maenas* (O), *Asterias rubens* (F), *Psammechinus miliaris* (P). Shells support serpulid worms (C) and short hydroid/algal turf (F). *Modiolus modiolus* apparently present but at low density (O).	SS.SMx.IMx	SS.SCS	Biotope uncertain. Could be SS.SMx.CMx

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
39	Flat fine sand	*Ophiura ophiura* (C), Paguridae sp. (P), *Asterias rubens* (P), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
40	Very faintly rippled fine sand with isolated boulders	Boulders support hydroid turf and possibly algae; also sparsely scattered hydroids/filamentous algae on sediment. *Ophiura ophiura* (C).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
41	Rippled fine sand	*Lanice conchilega* (R), *Liocarcinus depurator* (R), dense patches of drift algae, although small clumps of filamentous algae possibly present (R).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
42	Large ripples/waves of fine - medium sand with surface scatter of coarse sand/gravel and isolated cobbles and boulders	Stones support sparse *Alcyonium digitatum* (R), *Urticina* sp. (R), hydroids (R), Polyplacophora sp. (R) and pink coralline algae (R). *Asterias rubens* (O), *Echinus esculentus* (P), *Ophiocomina nigra* (R).	SS.SSa.CFiSa	SS.SMx.CMx	Biotope uncertain
43	Low waves of mixed sandy sediment with scattered pebbles, cobbles and boulders, locally dense	Stones support pink coralline algae (R), *Alcyonium digitatum* (O), hydroids (R) and serpulid worms (P). *Echinus esculentus* (P), *Ophiocomina nigra* (C), *Ophiothrix fragilis* (locally A), Paguridae sp. (P).	SS.SMx.CMx	SS.SMx.CMx	Biotope approaches OphMx

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
44	Waves of mixed gravelly sand with patches of bedrock, boulders and cobbles	Rock encrusted with pink coralline algae (P) and serpulid worms (P) and supporting park of *Laminaria hyperborea?* (F) and algal turf (F-C), hydroids (P), *Alcyonium digitatum* (R) and *Urticina* sp.? (P). *Echinus esculentus* (F), *Asterias rubens* (R).	SS.SMx.CMx IR.HIR.KSed	IR.MIR.KR.Lhyp.GzPk	KSed highly uncertain due to poor visibility
45	Large ripples/small waves of slightly gravelly fine - medium sand with area of dense boulders and possibly bedrock	Rock encrusted with pink and brown algae (P) and supporting park of *Laminaria hyperborea (F)*, hydroids (P) and algal turf (locally A) including filamentous red algae, *Dictyota dichotoma* (P) and possibly *Halidrys siliquosa* (O). *Echinus esculentus* (locally C), *Asterias rubens* (P), *Alcyonium digitatum* (R).	SS.SSa.IFiSa.IMoSaIR.HIR.KSed	IR.MIR.KR.Lhyp.GzPk	Both biotopes highly uncertain
46	Rippled fine sand with sparse surface scatter of gravel	*Liocarcinus depurator*? (R).	SS.SSa.IMuSa	SS.SMU	Uncertain biotope
47	Rippled fine sand with sparse surface scatter of gravel	No life discernible.	SS.SSa.CFiSa	SS.SMU	Uncertain biotope
48	Rippled and locally waved fine sand	*Asterias rubens* (F), Paguridae sp. (R), *Ensis* shells (P), diatom film? (F).	SS.SSa.IMuSa	SS.SMU	Biotope uncertain - very little biological data
49	Rippled fine sand	*Asterias rubens* (F). Diatom film or possibly algal detritus in ripple troughs.	SS.SSa.IMuSa	SS.SMU	Uncertain biotope
50	Rippled fine sand	*Asterias rubens* (F). Diatom film or possibly algal detritus in ripple troughs (F).	SS.SSa.IMuSa	SS.SMU	Uncertain biotope

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
51	Rippled fine sand	*Asterias rubens* (F). *Lanice conchilega*? (R). Diatom film or possibly algal detritus in ripple troughs (C).	SS.SSa.IMuSa	SS.SMU	Uncertain biotope
52	Large ripples/waves of fine sand, possibly silty	Visibility poor. Fine algal debris or possibly diatom film concentrated in troughs. Paguridae sp. (R), *Alcyonium digitatum* (R), *Asterias rubens* (P), possibly sparsely scattered spatangid tests.	SS.SSa.IMuSa	SS.SMU	
53	Rippled fine sand, possibly slightly silty	*Asterias rubens* (O). Diatom film or possibly algal detritus (A).	SS.SSa.IMuSa	SS.SMU	Uncertain biotope
54	Rippled fine sand, possibly slightly silty	*Asterias rubens* (C). Diatom film or possibly algal detritus (A).	SS.SSa.IMuSa	SS.SMU	Uncertain biotope
55	Slightly rippled fine sand	*Asterias rubens* (F). *Lanice conchilega*? (P), *Cerianthus lloydii* (P), *Ophiura ophiura* (O).	SS.SSa.CFiSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope
56	Slightly muddy sand	*Asterias rubens* (O). *Cerianthus lloydii* (P), Paguridae sp. (P), small mounds (P).	SS.SSa.CMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope
57	Muddy sand	*Asterias rubens* (F), *Turritella communis* shells (C), though some at least occupied by Paguridae sp. (P). Small mounds (P).	SS.SMu.CSaMu.AfilMysAnit	SS.SMU.CSaMu.AfilMysAnit	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
58	Sandy mud or possibly muddy sand	Dense *Turritella communis* (A) and *Amphiura* spp. (S). Sediment with small mounds and emergent infaunal tubes and one possible *Nephrops norvegicus* burrow. Paguridae spp. (O), *Asterias rubens* (O).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Probably AfilMysAnit but infaunal data required for verification
59	Sandy mud or possibly muddy sand	*Asterias rubens* (F), *Liocarcinus depurator*? (P), small mounds (P), small burrows (R).	SS.SMu.CSaMu	SS.SMU.CFiMu.SpnMeg	Uncertain biotope
60	Muddy sand	*Asterias rubens* (F), *Cerianthus lloydii* (P), *Turritella communis* shells (R, but possibly unoccupied), small mounds (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	
61	Slightly silty, rippled fine sand	*Ophiura ophiura (C), Asterias rubens* (O). *Amphiura* spp. (P), *Ensis* shells (P). Diatom film or possibly algal detritus in ripple troughs (C).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope
62	Muddy sand	*Amphiura* spp. (S), *Asterias rubens* (F), *Arenicola marina* (P), *Liocarcinus depurator*? (P), diatom film (A), small mounds (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IMuSa or CMuSa
63	Muddy sand	*Amphiura* spp. (S), *Asterias rubens* (F), *Arenicola marina?* (P), *Lanice conchilega* (P), *Liocarcinus depurator*? (P), diatom film (A), dense small mounds (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IMuSa or CMuSa

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
64	Muddy sand	*Amphiura* spp. (P), *Ophiura ophiura* (O), *Asterias rubens* (F), diatom film (C), Paguridae sp. (P), *Turritella communis* shells (O, though possibly unoccupied), dense small mounds (P).	SS.SMu.CSaMu	SS.SMU.CFiMu.SpnMeg	Uncertain biotope. Could be CMuSa
65	Muddy sand	Small sediment mounds and possibly very sparse small burrows. *Amphiura* spp. (S), *Ophiura ophiura* (O), *Asterias rubens* (F), *Turritella communis* (R), diatom film (F), Paguridae sp. (R).	SS.SSa.CSaMu	SS.SMU.CFiMu.SpnMeg	Uncertain biotope. Could be CSaMu
66	Muddy sand or sandy mud	*Turritella communis* (C-A), *Cerianthus lloydii* (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CMuSa
67	Muddy sand or sandy mud	*Turritella communis* (C), *Amphiura* spp. (S), *Asterias rubens (P), Alcyonium digitatum* (R), Bryozoa sp. (R).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CMuSa
68	Sandy mud	Dense *Amphiura* spp. (S) and *Turritella communis* (C), although latter could be largely unoccupied shells. Sparse emergent infaunal tubes (P), hydroid tufts? (R), *Alcyonium digitatum* (R) and *Liocarcinus depurator* (P). *Callionymus lyra* (P).	SS.SMu.CSaMu.AfilMysAnit	SS.SMU.CSaMu.AfilMysAnit	Lacks characterising *Abra nitida* but otherwise in reasonable agreement with biotope with dense *Amphiura filformis*, as well as *Mysella bidentata*, *Thysanocardia procera and Phoronis muelleri*

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
69	Mixed gravelly sandy sediment with pebbles and scattered cobbles and boulders	Dense *Ophiothrix fragilis* bed (S) with *Ophiocomina nigra* (P). Rock encrusted with pink coralline algae (P), *Parasmittina trispinosa* (P) and *Spirobranchus* spp. (P) and supporting sparse *Alcyonium digitatum* (R) and *Urticina* sp. (R). *Asterias rubens* (P), *Pholis gunnellus* (P).	SS.SMx.CMx.OphMx	SS.SMx.CMx.OphMx	
70	Very muddy sand	Dense *Amphiura* spp. (S), *Asterias rubens* (F), *Turritella communis* shells (O), but at least some of these occupied by pagurids (P), diatom film (C), small mounds (P).	SS.SMu.CSaMu.AfilMysAnit	SS.SMU.CSaMu.AfilMysAnit	
71	Muddy sand	*Amphiura* spp. (S), *Cerianthus lloydii* (P), *Liocarcinus depurator*? (P), diatom film (C), dense small mounds (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CMuSa
72	Sandy mud	Dense *Amphiura* spp. (S) and *Asterias rubens* (C). Diatom film (C), small mounds (P), annelid casts (P), *Buccinum undatum*? tracks, with *B. undatum* shell (possibly unoccupied), *Carcinus maenas* (P), *Ophiura* sp. (R). *Metridium senile* (R) on isolated rock.	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Of the CSaMu biotopes it is closest to AfilMysAnit but lacks many of the characteristic taxa including *Mysella bidentata* and *Abra nitida*
73	Sandy mud or muddy sand	Dense *Amphiura* spp. (S), *Asterias rubens* (F), diatom film (C), small mounds (P), *Virgularia mirabilis* (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
74	Sandy mud or muddy sand	*Virgularia mirabilis* (P), Porifera sp. (R), *Amphiura* spp. (S), *Asterias rubens* (P), *Ophiura ophiura* (P), *Liocarcinus depurator*? (O), diatom film (C), small mounds (P), small burrows (R).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	
75	Sandy mud	Moderate density of megafaunal burrows including those of *Nephrops norvegicus* (P). Terebellidae sp. (P), Paguridae sp. (R), *Turritella communis* (C), *Amphiura* spp. (S), *Asterias rubens* (P), Gobiidae sp. (P).	SS.SMu.CFiMu.SpnMeg	SS.SMU.CFiMu.SpnMeg	
76	Sandy mud	Moderate density of megafaunal burrows including those of *Nephrops norvegicus* (F) and some emergent infaunal tubes. *Turritella communis* (C), *Liocarcinus depurator* (F), *Asterias rubens* (P).	SS.SMu.CFiMu.SpnMeg	SS.SMU.CFiMu.SpnMeg	
77	Sandy mud	Moderate density of megafaunal burrows including those of *Nephrops norvegicus* (P). *Liocarcinus depurator* (P), *Turritella communis* (C), *Amphiura* spp. (S), *Asterias rubens* (O).	SS.SMu.CFiMu.SpnMeg	SS.SMU.CFiMu.SpnMeg	
78	Sandy mud or muddy sand	Dense *Amphiura* spp. (S), *Asterias rubens* (F), *Alcyonium digitatum* (R), *Cerianthus lloydii* (R), *Liocarcinus depurator*? (P), *Turritella communis* (C), Gobiidae sp.? (P), worm casts (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CMuSa
79	Muddy sand or sandy mud	Dense *Amphiura* spp. (S) and *Turritella communis* (C). Hydroid	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CMuSa

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
		clumps? (R).			
80	Muddy sand	Dense *Amphiura* spp. (S) and *Turritella communis* (C). Diatom film (C), *Liocarcinus depurator*? (P), small mounds (P), *Asterias rubens* (P).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	
81	Dense pebbles and cobbles on mixed sandy sediment with scattered boulders	Stones encrusted with pink coralline algae (R) and serpulid worms (P) and supporting *Alcyonium digitatum* (O) and apparently clumps of algae (P) and hydroids (P). *Echinus esculentus* (C), *Asterias rubens* (F), *Ophiothrix fragilis* (P).	SS.SMx.IMx	CR.MCR.EcCr.FaAlCr.Pom	Visibility poor. Uncertain biotope.
82	Dense pebbles and cobbles on mixed sandy sediment with scattered boulders	Stones encrusted with pink coralline algae (O-F), brown algae (P) and serpulid worms (P) and supporting *Alcyonium digitatum* (R), clumps of algae (P) and possibly hydroids (P). *Echinus esculentus* (C), *Ophiocomina nigra* (A), *Ophiothrix fragilis* (P).	SS.SMx.CMx.OphMx	CR.MCR.EcCr.FaAlCr.Pom	
83	Muddy sand	Dense *Amphiura* spp. (S) and diatom film (A), with small sediment mounds, *Asterias rubens* (O) and faunal tracks.	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Could be CMuSa. Biotope uncertain without PSA or infaunal data
84	Faintly rippled, shelly, fine-medium sand	Scattered *Ensis* shells, *Lanice conchilega*? (P), *Liocarcinus depurator* (R), *Pagurus bernhardus* (R), *Alcyonium digitatum* (R), *Asterias rubens* (P).	SS.SSa.CFiSa	SS.SCS	Biotope uncertain - very little biological data

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
85	Shelly fine sand, possibly faintly rippled	*Liocarcinus depurator*? (R), *Arenicola marina*? (R).	SS.SSa.CFiSa	SS.SCS	Biotope uncertain. Could be CMuSa
86	Shelly muddy sand	*Asterias rubens* (O), sparse small mounds (P).	SS.SSa.CMuSa	SS.SMU.CSaMu.AfilMysAnit	
87	Muddy sand	Dense *Amphiura* spp. (S) and small sediment mounds, diatom film (F), *Turritella communis* shells (R - probably unoccupied), *Asterias rubens* (O) and faunal tracks.	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Could be CMuSa. Biotope uncertain without PSA or infaunal data
88	Faintly rippled muddy sand	Dense *Amphiura* spp. (S), *Ophiura ophiura* (A) and diatom film (A), *Asterias rubens* (O), sediment mounds (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope, intermediate between IMuSa and CSaMu. Infauna similar to other IMuSa sites.
89	Rippled silty fine sand	Dense *Amphiura* spp. (S), *Ophiura ophiura* (A) and diatom film (A), *Asterias rubens* (O), sediment mounds (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Biotope uncertain
90	Rippled fine sand, possibly slightly silty	*Amphiura* spp. (A), *Asterias rubens* (O), diatom film (A), filamentous algae (R).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
91	Rippled fine sand	*Asterias rubens* (F), *Arenicola marina*? (P), *Ensis* shells (P), diatom film (A), filamentous algae (R).	SS.SSa.IMuSa.FfabMag	SS.SSA.IMuSa.FfabMag	
92	Rippled fine sand	*Asterias rubens* (O), *Amphiura* spp. (P), *Liocarcinus depurator*? (P), *Ensis* shells (P), diatom film (A), *Ophiura ophiura* (A).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Biotope uncertain

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
93	Well-rippled fine sand	*Ensis* shells (P), *Pleuronectes platessa*? (P), diatom film (C), filamentous algae (O).	SS.SSa.IMuSa	SS.SSA.IMuSa.FfabMag	
94	Well-rippled fine sand with sharp ripple crests	Drift algae (P).	SS.SSa.IFiSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope. Could be IMuSa
95	Well-rippled fine sand	*Asterias rubens* (O), *Liocarcinus depurator*? (P), diatom film (A).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
96	Rippled fine sand with sparse isolated boulders	Diatom film (C), *Asterias rubens* (F), *Ophiura ophiura* (C), *Liocarcinus depurator*? (P), filamentous algae (O). Boulders supporting *Alcyonium digitatum* (P), *Metridium senile* (P) and algal/hydroid turf (P).	SS.SSa.IMuSa	SS.SMx.CMx	
97	Appearance of slightly rippled/dimpled, slightly shelly, firm, slightly silty fine sand. PSA indicates muddy (20%) fine sand	Dense *Ophiura ophiura* (A), with *Amphiura* spp. (A), diatom film (C), *Asterias rubens* (O), small hydroid clumps? (R) and sparsely scattered *Ensis* shells.	SS.SSa.IMuSa.SsubNhom	SS.SMU.CSaMu.AfilMysAnit	Biotope uncertain. Fauna close to FfabMag but has following characteristics of SsubNhom: muddier (20% silt/clay), dense *Ophiura ophiura* (A), *Spisula subtruncata* (F)
98	Slightly rippled fine sand	Dense *Ophiura ophiura* (A), with *Ophiura albida (P)*, diatom film (O), Terebellidae sp. (P), Naticidae sp. (P), *Asterias rubens* (F) and sparsely scattered *Ensis* shells.	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
99	Slightly rippled fine sand	Dense *Ophiura ophiura* (A), diatom film (O), *Asterias rubens* (O), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
100	Faintly dimpled/rippled, slightly shelly, fine sand	Dense *Ophiura ophiura* (A), *Asterias rubens* (P), *Liocarcinus depurator* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
101	Fine sand	Occasional small mounds, *Arenicola marina*? (O), *Liocarcinus depurator*? (P).	SS.SSa.CFiSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IMuSa or CMuSa
102	Slightly shelly fine sand	Dense *Ophiura albida* (A) with *O. ophiura* (F), *Amphiura* spp. (S), *Asterias rubens* (P), spatangid test.	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura spp.* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
103	Appearance of slightly rippled, slightly shelly, firm fine sand. PSA indicates slightly muddy (8%) fine sand	*Ophiura ophiura* (C), *Asterias rubens* (O), *Liocarcinus* sp. (O), *Ensis* shells (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Infaunal data places site close to sites with FfabMag but high abundance of epifaunal *Ophiura ophiura* characteristic of SsubNhom, although *Spisula* and *Nephtys hombergi* lacking. Probably intermediate between the two biotopes
104	Rippled, slightly shelly fine sand	*Ensis* shells (P) and probable *Ensis* withdrawal plume (P), *Ophiura ophiura* (F),filamentous algae (R), Cottidae sp. (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
105	Rippled, slightly shelly fine sand	*Ophiura ophiura* (O), *Asterias rubens* (O), *Liocarcinus depurator*? (P), *Lanice conchilega* (O).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
106	Rippled shelly fine sand	Fairly dense scatter of *Ensis* shells, filamentous algal clumps (O) including reds (P), *Lanice conchilega* (P), Paguridae spp. (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.FfabMag	More detailed biotope identification requires infaunal data
107	Rippled fine sand	*Ophiura ophiura* (F), *Lanice conchilega* (O), *Liocarcinus depurator* (P), filamentous algae (R), Pleuronectiformes sp. (P), spatangid tests (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
108	Fine sand with dense cover of broken shell, gravel, pebbles and occasional cobbles	Shell and stones support *Alcyonium digitatum* (R, locally F), serpulid worms (P) and hydroid clumps (R). *Liocarcinus depurator* (P), *Asterias rubens* (P).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	Uncertain biotope. Could be IMx but video quality too poor to be certain which. Certainly not the previously allocated FaAlCr.Pom
109	Well-rippled (current swept) fine-medium sand	No biota discernible.	SS.SSa.IFiSa.IMoSa	SS.SSA	Uncertain biotope
110	Fine or medium sand	Very poor video quality with minimal view of the seabed.	SS.SSa	SS.SSA	
111	Fine-medium sand, initially with scattered pebbles and cobbles	Stones support *Alcyonium digitatum* (P), serpulid worms (P) and algal turf (P) including foliose reds (R). Paguridae sp. (R).	SS.SSa.CFiSa	CR.MCR.EcCr.FaAlCr.Pom	Uncertain biotope
112	Mixed gravelly, pebbly, sandy sediment with scattered cobbles and boulders	Dense bed of *Ophiothrix fragilis*, with *Asterias rubens* (P) and small gadoid (P). Rock encrusted with pink coralline algae (P) and serpulid worms (P) and supporting *Alcyonium digitatum* (O).	SS.SMx.CMx.OphMx	SS.SMx.CMx.OphMx	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
114	Dense gravel, pebbles and cobbles on coarse sand	Dense bed of *Ophiothrix fragilis* (A) with *Ophiocomina nigra* (C). *Lanice conchilega* (P). Stones encrusted with pink coralline algae (O) and serpulid worms (P) and supporting *Alcyonium digitatum* (F), hydroids (O) and *Urticina felina* (R).	SS.SMx.CMx.OphMx	CR.MCR.EcCr.FaAlCr.Adig	
115	Dense gravel and pebbles with occasional cobbles and boulders	Stones encrusted with pink coralline algae (R) and serpulid worms (P) and supporting *Alcyonium digitatum* (F). Paguridae sp. (P), *Antedon bifida* (R), *Crossaster papposus* (P), *Ophiothrix fragilis* (O), *Echinus esculentus* (O).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	
116	Dense gravel and pebbles with occasional cobbles and boulders	Stones encrusted with serpulid worms (P) and supporting *Alcyonium digitatum* (F). *Ophiothrix fragilis* (A, but patchy), juvenile gadoids (P).	SS.SMx.CMx.OphMx	SS.SMx.CMx.OphMx	
117	Waves of coarse sand and gravel with scattered shells	Dense aggregations of *Ascidiella aspersa (C, locally S)* in wave troughs. Scattered *Ensis* shells.	SS.SCS.CCS	SS.SMU.ISaMu.SundAasp	Original biotope allocation (a shallow mud habitat) clearly erroneous
118	Waves of coarse sand with gravel	Aggregations of *Ascidiella aspersa* (C) in wave troughs. *Asterias rubens* (P).	SS.SCS.CCS	SS.SMU.ISaMu.SundAasp	Original biotope allocation (a shallow mud habitat) clearly erroneous
119	Appearance of faintly rippled fine sand. PSA indicates very fine sand (2% silt/clay)	*Amphiura* spp. (S), *Asterias rubens* (P), *Liocarcinus depurator* (P), occasional small mounds and possible cast of *Arenicola marina*.	SS.SSa.CFiSa	SS.SMU.CSaMu.AfilMysAnit	Biotope highly uncertain. Has physical characteristics and *Amphiura filiformis* of biotope but not otherwise close infaunal similarity

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
120	Waves of coarse sand with pebbles in troughs, then boulders, cobbles and pebbles on coarse sand	Rock encrusted with pink coralline algae (R) and serpulid worms (C) and supporting *Alcyonium digitatum* (R). *Ophiothrix fragilis* (F), *Echinus esculentus* (F).	SS.SCS.CCS CR.MCR.EcCr.FaAlCr	SS.SMx.CMx.OphMx	
121	Bedrock ledges with patch of coarse sand waves	Rock encrusted with pink coralline algae (F) and *Spirobranchus* spp. (A) and supporting *Alcyonium digitatum* (O, locally C).*Echinus esculentus* (C).	CR.MCR.EcCr.FaAlCr.PomSS.SCS.CCS	CR.MCR.EcCr.FaAlCr.Pom	
122	Shelly fine-medium sand with scattered pebbles, cobbles and boulders on mixed coarse sediment at start	Mixed substrate patch supports dense *Ascidiella aspersa* (locally A) and possibly hydroids (P). *Ensis* shells (P).	SS.SMx.CMx SS.SSa.CFiSa	CR.MCR.EcCr.FaAlCr.Bri	Both biotopes uncertain. No lights and visibility poor
123	Boulders on coarse gravelly sediment	Rock supports pink coralline algae (P), serpulid worms (P) and *Alcyonium digitatum* (O). *Ophiothrix fragilis* (S), *Ophiocomina nigra* (P), *Echinus esculentus* (P).	CR.MCR.EcCr.FaAlCr.Bri	CR.MCR.EcCr.FaAlCr.Bri	
124	Shelly medium sand	No clearly discernible biota.	SS.SCS.CCS	SS.SCS.CCS	Biotope uncertain. No lights, poor visibility
125	Dense pebbles and cobbles on sandy sediment	Stones support pink coralline algae (O), serpulid worms (C), *Balanus* spp. (P) and hydroids (F). L*iocarcinus depurator* (P), *Luidia ciliaris* (P).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
126	Dense pebbles and cobbles on shelly sandy sediment	Stones support serpulid worms (F) and hydroids (F). *Echinus esculentus* (P), *Asterias rubens* (P).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	Biotope uncertain. Also close to PomB
127	Medium sand with scattered shells and pebbles and much broken shell material	Visibility very poor. Shells apparently support hydroid clumps (O) and serpulid worms (F). *Asterias rubens* (F).	SS.SMx.CMx	SS.SCS.CCS	Biotope uncertain. Although infaunal data available this indicates a sparse fauna with a total of 18 animals and 13 taxa in the grab, only three of which had >1 individual. The data suggests the biotope is closer to the muddy biotopes than the CCS biotope to which it was previously referred
128	Slightly shelly fine-medium sand	Sparsely scattered *Ascidiella aspersa* (O), *Asterias rubens* (P), *Liocarcinus depurator* (O).	SS.SSa.CFiSa	SS.SSA	Biotope uncertain
129	Shelly medium sand	*Liocarcinus depurator*? (P), *Ensis* shells (P), sparse mounds (P).	SS.SCS.CCS	SS.SSA	Biotope uncertain
130	Shelly medium sand	*Arenicola marina*? (P).	SS.SCS.CCS	SS.SCS.CCS	Biotope uncertain
131	Shelly medium-coarse sand with fairly sparse scatter of shells, pebbles and occasional cobbles; isolated boulder initially	Stones and shells support sparse clumps of *Ascidiella aspersa* (O-F) and hydroids (R). *Liocarcinus depurator* (P), *Asterias rubens* (P).	SS.SCS.CCS	SS.SMx.CMx	Biotope uncertain. Substrate far less mixed than nearby station 127

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
132	Shelly medium sand with scattered pebbles and occasional cobbles	*Asterias rubens* (P), *Echinus esculentus* (P), *Ensis* shells (P).	SS.SCS.CCS	SS.SCS.CCS	Biotope uncertain
133	Dense pebbles, cobbles and occasional boulders on sand	Dense bed of *Ophiothrix fragilis* (S). *Asterias rubens* (P).	SS.SMx.CMx.OphMx	SS.SMX.CMx.OphMx	
134	Muddy sand	*Amphiura* spp. (S), Terebellidae sp. (O), *Liocarcinus depurator*? (P), Paguridae spp. (O), *Turritella communis* shells (P), *Asterias rubens* (F).	SS.SMu.CSaMu	SS.SMU.CSaMu.AfilMysAnit	Biotope uncertain. Only 18% mud but infauna close to other muddier CSaMu sites
135	Appearance of faintly rippled, silty fine sand. PSA indicates muddy (22%) fine sand	*Asterias rubens* (O), *Pagurus bernhardus* (O), Gadidae sp. (P), algal or possibly *Zostera* debris present.	SS.SSa.IMuSa.FfabMag	SS.SSA.IMuSa.FfabMag	
136	Slightly shelly muddy sand	*Amphiura* spp. (S), *Liocarcinus depurator*? (O), *Asterias rubens* (O).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Biotope uncertain. Mud content unclear. Could be CMuSa or CSaMu
137	Firm, slightly rippled, shelly fine-medium sand	No biota discernible.	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Biotope uncertain in view of lack of visible biota and no data on mud content. Could be IFiSa
138	Shelly, rippled, fine-medium sand with scattered surficial shell gravel, locally dense	*Lanice conchilega* (P), *Ensis* shells (P), *Asterias rubens* (O), filamentous algae (R).	SS.SSa.IMuSa	SS.SSA	Biotope uncertain

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
139	Dense broken shell, pebbles, cobbles and scattered *Modiolus* shells	Shells and stones support fairly dense serpulid worm fauna (C) and occasional hydroids and *Alcyonium digitatum*. *Modiolus modiolus* is present but apparently at low density (O, possibly F).	SS.SMx.CMx	SS.SBR.SMus.ModMx	
140	Rippled fine sand	*Ensis* shells (P), *Asterias rubens* (F), drift algae (P).	SS.SSa.IMuSa	SS.SSA	
141	Muddy fine sand, possibly faintly rippled	*Ophiura* spp. (C), *Amphiura* spp. (S), *Asterias rubens* (P), diatom film (A).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be CSaMu or CMuSa
142	Slightly rippled fine-medium sand	*Ophiura* ophiura (A), *Ophiura albida* (P), *Asterias rubens* (P), *Ensis* withdrawal depression? (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
143	Rippled fine sand	*Ophiura ophiura* (C), *Lanice conchilega* (P), *Carcinus maenas* (P), scattered filamentous algal clumps (O), *Ensis* shells and possibly *Ensis* withdrawal craters.	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa - but definitely not original biotope allocation
144	Rippled, slightly shelly fine sand	*Ophiura* spp. (O), *Ensis* shells (P), filamentous algae (R), drift algae (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
145	Mixed sand and shell material	*Asterias rubens* (O), *Ensis* shells (P), *Metridium senile* (O), hydroids (O), Paguridae sp. (P), filamentous algae (O).	SS.SMx.CMx	SS.SMX.CMx	
146	Muddy sand with broken shell and scattered *Modiolus* shells and occasional boulders	Possibly a sparse *Modiolus modiolus* bed (F-C) with shells supporting a fairly sparse hydroid turf (O) and serpulid worms (P). *Asterias rubens* (C), *Echinus esculentus* (F), Didemnidae sp.	SS.SBR.SMus.ModHAs	SS.SBR.SMus.ModMx	uncertain biotope

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
		(R).			
147	Shelly, rippled fine-medium sand	*Ensis* shells (P), *Metridium senile* (P), hydroids (O), *Lanice conchilega* (P), Paguridae sp. (O), *Carcinus maenas*? (P), filamentous algae (O).	SS.SSa.IMuSa	SS.SMX.CMx	
148	Rippled medium sand with shell gravel scatter, formed into dunes	Filamentous algae (O, but possibly drift material).	SS.SSa.IFiSa.IMoSa	SS.SSA	Uncertain biotope
149	Muddy sand with broken shell and scattered *Modiolus* shells	A *Modiolus modiolus* bed of scattered clumps and individuals (C) supporting a mostly short hydroid turf (F) and low diversity fauna. *Ophiothrix fragilis* (R), *Metridium senile* (R), *Alcyonium digitatum* (R), Didemnidae sp. (R), *Asterias rubens* (C).	SS.SBR.SMus.ModHAs	SS.SBR.SMus.ModMx	Uncertain biotope
150	Muddy sand with broken shell and scattered *Modiolus* shells	A *Modiolus modiolus* bed of scattered clumps and individuals (C) supporting a mostly short hydroid turf (F) and low diversity fauna. *Alcyonium digitatum* (O), *Liocarcinus* sp. (O), erect sponge (R), *Asterias rubens* (C).	SS.SBR.SMus.ModHAs	SS.SBR.SMus.ModMx	Uncertain biotope

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
151	Shelly muddy sand with sparse surface scatter of shells and possibly stones	Low diversity epibiota with occasional algal tufts. *Asterias rubens* (C).	SS.SMx.IMx	SS.SBR.SMus.ModMx	Uncertain biotope
152	Muddy sand with broken shell and scattered *Modiolus* shells and occasional boulders	*Modiolus modiolus* bed of mostly scattered individuals (C), supporting a hydroid turf (F). *Asterias rubens* (C), *Alcyonium digitatum* (R), *Necora puber* (P), *Liocarcinus* sp.? (P), *Buccinum undatum* (P).	SS.SBR.SMus.ModHAs	SS.SBR.SMus.ModMx	Uncertain biotope
153	Shelly muddy sand with surface scatter of shells and pebbles	Fairly sparse *Modiolus modiolus* (F) with shells and stones supporting a low diversity biota of hydroids (O), Didemnidae sp. (R), serpulid worms (P), red algae (R), *Metridium senile* (O), *Suberites* sp. (R) and *Asterias rubens* (F).	SS.SBR.SMus.ModHAs	SS.SBR.SMus.ModMx	Uncertain biotope
154	Gravel, pebbles, cobbles and shell	Stones support *Alcyonium digitatum* (R), *Metridium senile* (F), *Urticina* sp. (P), *Balanus* spp. (P), serpulid worms (P). *Necora puber* (P), *Asterias rubens* (F).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	
155	Rippled fine sand	*Metridium senile* (O), *Liocarcinus depurator*? (O), *Ensis* shells (P), *Asterias rubens* (O), filamentous algae (R).	SS.SSa.IMuSa	SS.SSA.IMuSa.FfabMag	Uncertain biotope
156	Pebbles, cobbles and possibly boulders on gravelly sediment	Hydroid turf, apparently dominated by *Hydrallmania falcata* (P), with *Flustra foliacea* (P).	SS.SMx.CMx.FluHyd	CR.HCR.XFa.ByErSp	Apparently good example of nominated biotope. Original biotope allocation clearly erroneous

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
157	Pebbles, cobbles and boulders on silty sand	Stones support hydroids (P), serpulid worms (P), *Balanus* spp. (P), *Flustra foliacea* (O), *Molgula* sp.? (C) and filamentous red algae (P). Paguridae spp. (P).	SS.SMx.CMx.FluHyd	CR.MCR.EcCr.FaAlCr.Flu	Uncertain biotope
158	Gravel, pebbles, cobbles and occasional boulders on silty sand	Stones support serpulid worms (P), *Molgula* sp.? (C locally) and filamentous red algae (P). *Pagurus bernhardus* (P), juvenile *Gadus morhua*? (P).	SS.SMx.CMx	SS.SMX.CMx	Uncertain biotope. Could be IMx
159	Shelly silty sand with much surface shell material and pebbles and occasional cobbles	Shells include empty *Mytilus* and *Buccinum undatum*, although no live material observed. Shells encrusted with serpulid worms (O). Paguridae sp. (P), drift algae (P).	SS.SMx.CMx	SS.SBR.SMus.MytSS	Uncertain biotope. Original biotope allocation clearly erroneous
160	Large-rippled, tide-swept, medium sand	Paguridae sp. (R).	SS.SSa.IFiSa.IMoSa	SS.SCS.CCS	Uncertain biotope
161	Dense pebbles and cobbles with scattered boulders on gravelly sediment	Stones support hydroids (P), serpulid worms (P), *Flustra foliacea* (R) and *Porifera sp.* (P).	SS.SMx.CMx	SS.SMX.CMx	
162	Visibility poor but apparently dense shells and pebbles with scattered cobbles on sand	Little epibiota discernible due to poor visibility. *Urticina* sp. (P) *Carcinus maenas*? (P).	SS.SMx.CMx	SS.SMX.CMx	
163	Dense pebbles and cobbles with scattered boulders on silty sediment	Stones support fairly sparse hydroids (P), serpulid worms (P), *Balanus* spp. (P), *Flustra foliacea* (O) and Didemnidae sp. (P).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Flu	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
		Gadus morhua? (P).			
164	Shelly fine-medium sand with scattered shell material	Visibility poor. *Alcyonium digitatum* (R), *Liocarcinus depurator*? (R).	SS.SSa	SS.SSA	Apparently same biotope as sample 165 but no hydroids seen
165	Shelly fine-medium sand with sparsely scattered shells and pebbles	Hydroid clumps *(Sertularia* type - O), *Metridium senile* (R), *Alcyonium digitatum* (R), *Liocarcinus depurator*? (R), *Aequipecten opercularis* (R).	SS.SSa.IFiSa.ScupHyd	SS.SSa.IFiSa.ScupHyd	Uncertain biotope
166	Shelly fine-medium sand with sparsely scattered shells, pebbles and occasional cobbles	Stones support serpulid worms (R). Paguridae sp. (R), *Liocarcinus depurator*? (R).	SS.SSa	SS.SMU	Apparently same biotope as sample 165 but no hydroids seen
167	Shelly fine-medium sand with sparsely scattered shells and occasional cobbles	Hydroid clumps *(Sertularia* type - F), *Metridium senile* (R), *Liocarcinus depurator*? (R).	SS.SSa.IFiSa.ScupHyd	SS.SSa.IFiSa.ScupHyd	Uncertain biotope
168	Slightly rippled, shelly fine-medium sand with sparsely scattered shells and occasional pebbles and cobbles	Hydroid clumps *(O*), *Arenicola marina* (P), *Paguridae sp. (P)*.	SS.SSa.IFiSa.ScupHyd	SS.SMU	Uncertain biotope
169	Shelly fine-medium sand with scattered pebbles and cobbles	*Alcyonium digitatum* (R), Paguridae sp. (R), *Asterias rubens* (F).	SS.SSa	SS.SMU	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
170	Shelly fine-medium sand with scattered shell material	Hydroid clumps (R), Paguridae spp. (O), *Metridium senile* (R).	SS.SSa.IFiSa.ScupHyd	SS.SMU	Uncertain biotope
171	Shelly fine-medium sand with scattered shell material, pebbles and cobbles	Shells and stones support serpulid worms (P) and sparse hydroid tufts? (P). Paguridae sp. (P), bivalve siphons (P), *Alcyonidium diaphanum* (P, but probably drift material).	SS.SSa	SS.SMU	
172	Shelly fine-medium sand with fairly dense scatter of pebbles, cobbles and shells	Stones and shell supports serpulid worms (P), red algae (P) and hydroids (C) including *Nemertesia antennina*? (P). Paguridae sp. (P), *Echinus esculentus* (F).	SS.SMx.IMx	CR.HCR.XFa.ByErSp	Uncertain biotope
173	Highly mixed substrate of sand and shell material with scattered pebbles	Stones and shell supports serpulid worms (P), *Balanus* sp. (P), filamentous red algae (O) and possibly hydroids (R). Paguridae sp. (P), *Aequipecten opercularis* (P).	SS.SMx.IMx	SS.SMX.IMx	
174	Shelly fine sand with scattered pebbles and shells	Shells and stones support serpulid worms (P), hydroid clumps (O) and possibly red algae (R). *Ophiura albida* (R), Cottidae sp. (P).	SS.SSa.IFiSa	SS.SMX.IMx	
175	Shelly fine sand with gravel and shell material, dense for most of run, with scattered pebbles and cobbles	Stones support sparse serpulid worms (P), hydroid clumps? (P), red algae (P) and *Molgula* sp.? (P).	SS.SMx.IMx	SS.SMX.IMx	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
176	Mixed sediment of shell gravel and muddy sand with scattered shells	*Alcyonium digitatum* (R), clumps of red algae (R).	SS.SMx.CMx	SS.SMX.CMx	Uncertain biotope
177	Shelly muddy sand with scattered shells	Paguridae sp. (P), *Liocarcinus depurator*? (P), *Molgula* sp.? (P).	SS.SMu.CSaMu	SS.SMU	Uncertain biotope. Could be CMuSa or IMuSa
178	Slightly shelly, very muddy sand	*Amphiura* spp. (S).	SS.SMu.CSaMu	SS.SMU	Uncertain biotope. Depth indicates possibly ISaMu though infauna closer to CSaMu
179	Slightly shelly, very muddy sand or sandy mud	*Amphiura* spp. (S).	SS.SMu.CSaMu	SS.SSA.IMuSa.EcorEns	
180	Shelly fine sand, possibly slightly silty	*Metridium senile* (O).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope
181	Muddy sand	*Amphiura* spp. (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	Uncertain biotope. Could be CSaMu or CMuSa. Spisula subtruncata in grab suggests IMuSa
182	Sandy mud	*Mytilus edulis* bed (A). Shells support red algae (F) and serpulid worms (C). Gobiidae sp. (P), diatom film (F).	SS.SBR.SMus.MytSS	SS.SBR.SMus.MytSS	
183	Shelly sandy mud with scattered shells	Shells support red algae (F) and hydroid clumps (O). *Aequipecten opercularis* (O).	SS.SMx.IMx	SS.SMX.IMx	Uncertain biotope. Could also possibly be ascribed to ISaMu
184	Shelly muddy sand with scattered shells	Shells support red algae (F) and hydroid clumps (R). *Aequipecten opercularis* (P), *Mytilus edulis*? (R).	SS.SMx.IMx	SS.SBR.SMus.MytSS	Uncertain biotope. Could be IMuSa

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
185	Shelly muddy sand with fairly sparsely scattered shells	Shells support serpulid worms (P), red algae (O), *Alcyonidium diaphanum*? (R) and hydroid clumps (R). *Aequipecten opercularis* (O), Paguridae sp. (P), *Ophiura albida* (O).	SS.SSa.IMuSa	SS.SSA.IMuSa.FfabMag	Uncertain biotope
186	Slightly rippled, slightly shelly, possibly slightly silty, fine sand	Paguridae sp. (R), *Liocarcinus depurator*? (R), *Aequipecten opercularis* (P), *Ensis* shells (P), red algae (R, possibly drift).	SS.SSa.IMuSa	SS.SMX.CMx	Uncertain biotope. A little deep, but *Ensis* shells and apparent low mud content suggests IMusa may be best fit
187	Well-rippled, tide-swept, medium sand with scatter of broken shell	*Alcyonium digitatum* (R), *Lanice conchilega* (F).	SS.SSa.IFiSa	SS.SSA	Uncertain biotope. Could be ICS although gravel component apparently minimal within sediment
188	Dense gravel, shell material and occasional pebbles on sand	*Alcyonium digitatum* (O), hydroid clumps (F), red algal clumps (R), serpulid worms (P).	SS.SMx.CMx	SS.SMX.CMx	
189	Dense gravel and broken shell material on sand	*Alcyonium digitatum* (O), hydroid clumps (F), red algal clumps (R), serpulid worms (P), *Echinus esculentus* (P).	SS.SMx.CMx	SS.SMX.CMx	
190	Broken shell and pebbles	Frequent *Alcyonium digitatum* and occasional hydroids. Possibly some *Modiolus modiolus* though sparse if present. Didemnidae sp.? (R), *Asterias rubens* (P), serpulid worms (P).	SS.SMx.CMx	SS.SBR.SMus.ModMx	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
191	Dense broken and whole *Modiolus* shell material on muddy shelly sediment	Possibly some *Modiolus modiolus* though sparse if present. *Alcyonium digitatum* (F), red algae (R), *Pagurus bernhardus* (P), *Asterias rubens* (P), serpulid worms (P).	SS.SMx.CMx	SS.SBR.SMus.ModMx	
192	Muddy sand with much broken shell material and surface scatter of whole shells, including *Modiolus*	Possibly some *Modiolus modiolus* though sparse if present. *Alcyonium digitatum* (F), Didemnidae sp. (R), *Liocarcinus* sp.? (P).	SS.SMx.CMx	SS.SBR.SMus.ModMx	
193	Dense pebbles and cobbles on fine-medium sand	Stones encrusted with serpulid worms (P) and *Balanus* spp. (P) and supporting small hydroids (O). Paguridae spp. (P), *Liocarcinus depurator* (P), *Asterias rubens* (F).	SS.SCS.CCS.PomB	CR.MCR.EcCr.FaAlCr.Pom	Uncertain biotope. Could also be CMx.
194	Dense pebbles and cobbles on fine-medium sand	Stones encrusted with serpulid worms (P) and *Balanus* spp. (P) and supporting tufts of hydroids (O), red algae (R), *Alcyonium digitatum* (F), *Metridium senile* (F) and *Alcyonidium diaphanum*? (P). *Asterias rubens* (P).	SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	
195	Well-rippled, tide-swept, fine-medium sand, possibly duned	Video very short. No biota discernible.	SS.SSa.IFiSa.IMoSa	SS.SSA	Probably IFiSa but IMoSa uncertain
196	Broken shell material and shells on fine-medium sand	Shells support *Balanus* spp. (P), serpulid worms (P), hydroids (O), *Alcyonium digitatum* (R) and *Metridium senile* (R).	SS.SMx.CMx	SS.SMx.CMx	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
197	Dense broken shell material and shells on fine-medium sand	Shells support serpulid worms (A, though many probably empty tubes), hydroids (P) and *Alcyonium digitatum* (O). *Pholis gunnellus* (P).	SS.SMx.CMx	SS.SMx.CMx	
198	Dense broken and whole *Modiolus* shell material on muddy sand	A clump of live *Modiolus modiolus* initially but thereafter sparse or absent (P). Hydroids initially common but overall occasional. *Alcyonium digitatum* (R), serpulid worms (P), *Pagurus bernhardus* (P), Galatheidae sp. (P).	SS.SMx.CMx	SS.SBR.SMus.ModMx	
199	Slightly silty sand with much broken shell material and dense surface cover of dead *Modiolus* shells	A *Modiolus modiolus* bed with live shells possibly common overall, but locally abundant. Shells support a patchy turf of hydroids (C), including *Kirchenpaueria pinnata*? (P) and *Abietinaria abietina*? (P) and occasional patches of didemnids (*Diplosoma listerianum*?) and *Alcyonium digitatum*, as well as serpulid worms (P). *Ophiothrix fragilis* is abundant between the live and dead *Modiolus* shells. The motile fauna includes *Asterias rubens* (C) and *Echinus esculentus* (C).	SS.SBR.SMus.ModT	SS.SBR.SMus.ModMx	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
200	Medium? sand with broken shell material and scattered cover of dead *Modiolus* shells	*Modiolus modiolus* density difficult to discern amongst the epibiota but possibly common. Clumps are colonised by hydroids (C), including *Kirchenpaueria pinnata*? (P), foliose and filamentous red algae (C), *Ophiothrix fragilis* (A) and serpulid worms (P). The motile fauna includes *Asterias rubens* (C), *Echinus esculentus* (C) and *Necora puber*? (P).	SS.SBR.SMus.ModT	SS.SBR.SMus.ModMx	uncertain biotope
201	Shelly medium sand with scattered *Modiolus* shells	Dense cover of predominantly filamentous red algae (A) which possibly covers a fairly sparse bed of *Modiolus modiolus* (possibly C). Didemnids (O, possibly *Diplosoma listerianum*), *Echinus esculentus* (F), *Asterias rubens* (F).	SS.SBR.SMus.ModT	SS.SBR.SMus.ModMx	uncertain biotope
202	Pebbles and shell	Possibly a sparse *Modiolus* bed with scattered individuals of *M. modiolus* (F, possibly C locally). *Modiolus* shells support frequent hydroids including *Halecium halecinum*? (P), occasional patches of didemnids (*Diplosoma listerianum*?) and frequent *Alcyonium digitatum*. Paguridae spp. (P), *Echinus esculentus* (C), *Asterias rubens* (C).	SS.SBR.SMus.ModT	SS.SBR.SMus.ModMx	uncertain biotope

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
203	Medium sand with broken shell material and scattered cover of dead *Modiolus* shells	Small clumps and single individuals of *Modiolus modiolus* (possibly common overall) with abundant *Ophiothrix fragilis* (locally S). Frequent hydroids include *Abietinaria abietina*? (P) and *Sertularia* sp.? (P). *Asterias rubens* (C), *Echinus esculentus* (C), serpulid worms (P).	SS.SBR.SMus.ModT	SS.SBR.SMus.ModMx	
204	Well-rippled, sharply-crested, fine sand with scattered broken shell	*Ophiura* sp. (A), algal debris and some red algae attached to shell material (R).	SS.SSa.IFiSa	SS.SMU.CSaMu.AfilMysAnit	
205	Well-rippled, sharply-crested, fine sand with scattered broken shell	*Lanice conchilega* (O), *Ophiura* sp. (O), *Ensis* shells (P), algal debris and some attached algae including *Chorda filum* (P).	SS.SSa.IFiSa	SS.SSA	Uncertain biotope. IMuSa also possible
206	Rippled, slightly shelly, fine sand	Hydroids (O-F) including *Sertularia*-type, *Ensis* shells (P), algae (O) including filamentous reds.	SS.SSa.IMuSa	SS.SSa.IFiSa.ScupHyd	Uncertain biotope. Possibly ScupHyd
207	Slightly-rippled, slightly shelly, fine sand	*Ensis* shells (P), *Ophiura albida* (R), hydroids (O), *Metridium senile* (F), *Alcyonium digitatum*? (R), filamentous red algae (R).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
208	Rippled, shelly, fine sand	Hydroids (F) including *Sertularia*-type, *Alcyonium digitatum*? (R), Paguridae sp. (P), *Ensis* shells (P), *Asterias rubens* (P).	SS.SSa.IMuSa	SS.SSa.IFiSa.ScupHyd	Uncertain biotope. Possibly ScupHyd although hydroids will be attached to shells rather than pebbles and cobbles

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
209	Slightly-rippled, slightly shelly, fine sand	*Paguridae sp. (P), Ensis* shells (P), *Ophiura spp.* (F), hydroids (O), *Alcyonium digitatum* (R), *Asterias rubens*? (P).	SS.SSa.IMuSa	SS.SSa.IFiSa.ScupHyd	Uncertain biotope. Could be IFiSa
210	Rippled fine sand	*Ophiura ophiura* (A), spatangid tests (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
211	Slightly rippled fine sand	*Ophiura ophiura* (A), *Asterias rubens* (O), *Amphiura* spp. (S).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
212	Fine sand	*Ophiura ophiura* (A), *Asterias rubens* (P), *Amphiura* spp. (S), *Liocarcinus depurator* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
213	Slightly silty, shelly fine sand	*Ophiura ophiura* (C), *Asterias rubens* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
214	Slightly dimpled/rippled, slightly silty and slightly shelly, fine sand	*Ophiura ophiura* (A), *Asterias rubens* (O), *Arenicola marina* (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
215	Slightly rippled/dimpled, slightly shelly, fine sand	*Ophiura ophiura* (A), filamentous algae (R).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	The density of *Ophiura ophiura* suggests the biotope may be IMuSa.SsubNhom but infaunal data required for confirmation
216	Sandy? mud	*Amphiura* spp. (S), *Liocarcinus depurator*? (P).	SS.SMu.CSaMu	SS.SMU.CFiMu.SpnMeg	Uncertain biotope
217	Mud	Megafaunal mounds and fairly sparse burrows. *Amphiura* spp. (S).	SS.SMu.CFiMu.SpnMeg	SS.SMU.CFiMu.SpnMeg	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
218	Sandy mud	Megafaunal mounds and fairly sparse burrows. *Turritella communis* shells (R - possibly unoccupied).	SS.SMu.CFiMu.SpnMeg	SS.SMU.CFiMu.SpnMeg	
219	Rippled fine sand	*Ophiura ophiura* (O), *Ensis* shells (P), *Lanice conchilega*? (P), Brachyura sp. (P), filamentous algae (R).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	Uncertain biotope. Could be IFiSa
220	Rippled fine sand	*Ophiura* spp. (F), *Ensis* shells (P) and possibly withdrawal craters (P), *Liocarcinus* sp. (P), *Carcinus maenas*? (P), diatom film (F).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
221	Rippled, slightly shelly, fine sand	*Ophiura* ophiura (F), diatom film (F).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
222	Rippled, slightly shelly, fine sand	Spatangid tests? (P).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
223	Rippled, slightly shelly, fine sand	Diatom film? (O).	SS.SSa.IMuSa	SS.SSA.IMuSa.EcorEns	
224	Slightly rippled fine sand with scattered shell material and pebbles	Pebbles with serpulid worms (R). Emergent infaunal tubes (P), diatom film (F), Gobiidae sp. (P). *Amphiura* spp. possibly present (in which case probably S).	SS.SSa.IMuSa	SS.SSA	
225	Slightly rippled, slightly shelly, fine sand with sparsely scattered gravel and pebbles	*Ophiura ophiura* (P), *Ensis* shells (P), diatom film (C), algal tufts (O).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	

Table 1.2 continued

Site	Substrate	Biota	Biotope	Original biotope determination	Comments on revised biotope
226	Slightly rippled, fine sand with scattered shell material, gravel and pebbles	*Ensis* shells (P), *Asterias rubens* (P), diatom film (C), algal tufts (F).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
227	Slightly rippled, fine sand with scattered shell material, gravel and pebbles	*Asterias rubens* (P), diatom film (F), algal tufts (O).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
228	Slightly shelly, slightly rippled fine sand with scattered pebbles and shells	Pebbles and shells support sparsely scattered algal tufts (O) and possibly hydroids. Diatom film (F), spatangid tests? (P), Syngnathidae sp. (P).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
229	Slightly shelly, slightly rippled fine sand with scattered pebbles and gravel	Pebbles and shells support sparsely scattered algal tufts (O). Diatom film (F).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	
230	Slightly shelly, slightly rippled fine sand with sparsely scattered gravel	Paguridae sp. (P), algal clumps (O), diatom film (C).	SS.SSa.IMuSa	SS.SMU.CSaMu.AfilMysAnit	

ANNEX 2: VIDEO DATA FOR 2015 CEFAS SURVEY

Table 2.1. Positional and temporal details of video sequences recorded during the 2015 CEFAS survey of Moray Firth SAC.

Site	Date	Medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longi-tude start	Latitude end	Longi-tude end	Depth CD start (m)	Depth CD end (m)
MRFR001	06/12/2015	MRFR_CEND2615_MRFR001_STN_256_A1	11:44:35	11:54:08	00:00:00	00:09:34	57.88019	-3.83638	57.87954	-3.83553	19.8	19.1
MRFR002	06/12/2015	MRFR_CEND2615_MRFR002_STN_255_A1	11:08:13	11:18:35	00:00:00	00:10:22	57.89377	-3.88992	57.89302	-3.88912	19.7	19.4
MRFR003	06/12/2015	MRFR_CEND2615_MRFR003_STN_253_A1	09:39:03	09:48:57	00:00:00	00:09:55	57.92526	-3.90345	57.92507	-3.90196	22.8	23.0
MRFR004	06/12/2015	MRFR_CEND2615_MRFR004_STN_254_A1	10:20:40	10:30:37	00:00:00	00:09:56	57.92206	-3.84072	57.92134	-3.84002	29.9	30.2
MRFR005	06/12/2015	MRFR_CEND2615_MRFR005_STN_251_A1	08:08:18	08:18:52	00:00:00	00:10:34	57.96588	-3.77106	57.96533	-3.76976	37.7	38.0
MRFR006	06/12/2015	MRFR_CEND2615_MRFR006_STN_250_A1	06:43:59	06:50:45	00:00:00	00:06:46	57.97973	-3.82777	57.97987	-3.82795	24.7	24.7
MRFR007	06/12/2015	MRFR_CEND2615_MRFR007_STN_252_A1	08:44:40	08:55:20	00:00:00	00:10:40	57.94930	-3.81618	57.94873	-3.81487	33.3	33.5
MRFR008	06/12/2015	MRFR_CEND2615_MRFR008_STN_244_A1	00:48:15	00:58:50	00:00:00	00:10:35	57.89209	-3.71127	57.89198	-3.71288	36.8	36.3
MRFR009	05/12/2015	MRFR_CEND2615_MRFR009_STN_241_A1	21:30:35	21:40:35	00:00:00	00:10:00	57.82880	-3.56489	57.82840	-3.56629	36.6	36.2
MRFR010.1	05/12/2015	MRFR_CEND2615_MRFR010_STN_239_A1	19:29:04	19:30:48	00:00:00	00:01:44	57.77837	-3.61813	57.77851	-3.61801	35.1	35.3
MRFR010.2	05/12/2015	MRFR_CEND2615_MRFR010_STN_239_A1	19:30:48	19:34:54	00:01:44	00:05:50	57.77851	-3.61801	57.77883	-3.61770	35.3	35.6
MRFR010.3	05/12/2015	MRFR_CEND2615_MRFR010_STN_239_A1	19:34:54	19:39:17	00:05:50	00:10:12	57.77883	-3.61770	57.77917	-3.61740	35.6	35.9
MRFR011	05/12/2015	MRFR_CEND2615_MRFR011_STN_227_A1	08:28:54	08:39:33	00:00:00	00:10:40	57.75855	-3.32995	57.75858	-3.32837	25.5	25.4
MRFR012	05/12/2015	MRFR_CEND2615_MRFR012_STN_228_A1	09:10:02	09:21:43	00:00:00	00:11:40	57.74279	-3.39131	57.74215	-3.39269	20.2	19.8

Table 2.1

Site	Date	Medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longi-tude start	Latitude end	Longi-tude end	Depth CD start (m)	Depth CD end (m)
MRFR013	05/12/2015	MRFR_CEND2615_MRFR013_STN_229_A1	10:07:29	10:18:19	00:00:00	00:10:51	57.72952	-3.47402	57.72918	-3.47560	18.4	18.4
MRFR014	05/12/2015	MRFR_CEND2615_MRFR014_STN_230_A1	11:33:55	11:46:20	00:00:00	00:12:24	57.68233	-3.67835	57.68183	-3.68001	21.4	22.4
MRFR015	05/12/2015	MRFR_CEND2615_MRFR015_STN_237_A1	17:33:42	17:43:53	00:00:00	00:10:12	57.75461	-3.69438	57.75435	-3.69595	34.0	34.3
MRFR016	05/12/2015	MRFR_CEND2615_MRFR016_STN_234_A1	15:05:09	15:16:07	00:00:00	00:10:58	57.70270	-3.77847	57.70212	-3.77986	25.8	25.6
MRFR017	05/12/2015	MRFR_CEND2615_MRFR017_STN_236_A1	16:46:29	16:56:24	00:00:00	00:09:54	57.74625	-3.77660	57.74574	-3.77783	27.8	28.9
MRFR018	05/12/2015	MRFR_CEND2615_MRFR018_STN_243_A1	23:59:30	00:09:52	00:00:00	00:10:21	57.84942	-3.68749	57.84882	-3.68869	33.6	33.5
MRFR019	05/12/2015	MRFR_CEND2615_MRFR019_STN_231_A1	12:38:18	12:49:03	00:00:00	00:10:46	57.65385	-3.80523	57.65388	-3.80702	38.3	38.2
MRFR020	05/12/2015	MRFR_CEND2615_MRFR020_STN_232_A1	13:33:22	13:44:00	00:00:00	00:10:38	57.64513	-3.92609	57.64468	-3.92758	20.9	20.5
MRFR021	05/12/2015	MRFR_CEND2615_MRFR021_STN_235_A1	15:57:22	16:07:23	00:00:00	00:10:01	57.72202	-3.67105	57.72286	-3.67153	54.1	54.0
MRFR022	05/12/2015	MRFR_CEND2615_MRFR022_STN_240_A1	20:19:39	20:29:59	00:00:00	00:10:20	57.78319	-3.72859	57.78394	-3.72770	33.8	33.4
MRFR023	06/12/2015	MRFR_CEND2615_MRFR023_STN_248_A1	04:51:44	05:02:19	00:00:00	00:10:35	58.05581	-3.64922	58.05573	-3.64753	32.5	33.2
MRFR024	06/12/2015	MRFR_CEND2615_MRFR024_STN_249_A1	05:52:49	06:02:37	00:00:00	00:09:48	58.02848	-3.76203	58.02855	-3.76354	28.0	27.8
MRFR025	05/12/2015	MRFR_CEND2615_MRFR025_STN_233_A1	14:21:59	14:32:02	00:00:00	00:10:03	57.67274	-3.84706	57.67232	-3.84848	34.0	33.6
MRFR026	06/12/2015	MRFR_CEND2615_MRFR026_STN_247_A1	04:00:50	04:11:19	00:00:00	00:10:29	58.00192	-3.62990	58.00152	-3.63135	42.7	42.5
MRFR027	06/12/2015	MRFR_CEND2615_MRFR027_STN_245_A1	01:41:34	01:52:59	00:00:00	00:11:25	57.93532	-3.64242	57.93495	-3.64405	45.6	45.4
MRFR028	06/12/2015	MRFR_CEND2615_MRFR028_	02:44:42	02:56:39	00:00:00	00:11:57	57.93860	-3.49294	57.93835	-3.49472	51.6	51.8

Table 2.1

Site	Date	Medium	Time start (UT)	Time end (UT)	Video code (start)	Video code (end)	Latitude start	Longi-tude start	Latitude end	Longi-tude end	Depth CD start (m)	Depth CD end (m)
		STN_246_A1										
MRFR029	05/12/2015	MRFR_CEND2615_MRFR029_ STN_242_A1	22:32:20	22:42:19	00:00:00	00:10:00	57.85553	-3.43274	57.85528	-3.43114	57.7	58.6
MRFR030	05/12/2015	MRFR_CEND2615_MRFR030_ STN_238_A1	18:43:15	18:53:37	00:00:00	00:10:21	57.77366	-3.52123	57.77430	-3.52003	44.9	45.2

Table 2.2. Physical and biological details of video sequences recorded during the 2015 CEFAS survey of Moray Firth SAC.

Site	Substrate	Biota	Biotope	Comments
MRFR001	Rippled, slightly silty, shelly fine sand	Sand with small infaunal holes and sparse mounds. Hydroids (R), *Cerianthus lloydii* (O), *Lanice conchilega* (P), Paguridae spp. (O), *Liocarcinus depurator*? (O), *Turritella communis* shells (O, but at least some occupied by hermit crabs), *Ensis* shells (P) and possibly *Ensis* withdrawal craters (P), *Asterias rubens* (F).	SS.SSa.IMuSa	Could be EcorEns. Could also be CFiSa
MRFR002	Rippled, slightly silty, very shelly fine sand with scattered shells	Shells support sparse hydroids (R), *Suberites* sp. (R), serpulid worms (P), *Ascidiella aspersa* (F, locally C) and *A. scabra*? (P). *Cerianthus lloydii*? (R), *Lanice conchilega*? (P), Paguridae spp. (O) including *Pagurus bernhardus* (P), *Asterias rubens* (F). Shells include *Ensis* and scaphopods.	SS.SSa.IMuSa	Uncertain biotope. Could be CFiSa or CMuSa. Probably intermediate between biotopes
MRFR003	Rippled, slightly silty, slightly shelly fine sand	Small infaunal holes (P), tubes (*Cerianthus lloydii*) and mounds (P). *Arenicola marina* (F), Paguridae sp. (R), *Liocarcinus depurator* (P), *Turritella communis* shells (R), *Asterias rubens* (F), *Astropecten irregularis* (O), *Ophiura* sp. (O), *Amphiura* sp.? (P).	SS.SSa.CFiSa	Uncertain biotope
MRFR004	Slightly silty, rippled fine sand	Small infaunal holes (P) and mounds (P). *Cerianthus lloydii* (O), *Lanice conchilega*? (P), *Arenicola marina* (O), Paguridae sp. (R), *Liocarcinus depurator*? (P), *Turritella communis* shells (F), *Asterias rubens* (F).	SS.SSa.CFiSa	Uncertain biotope
MRFR005	Apparently muddy sand with faint rippling evident	Small infaunal holes (P) and possibly small megafaunal holes and mounds including possibly *Callianassa subterranea* (P). Emergent infaunal tubes include those of possibly *Cerianthus lloydii* (P) and bivalve siphons (P). *Arenicola marina*? (O), Paguridae spp. (O), *Turritella communis* shells (R), *Asterias rubens* (F), *Astropecten irregularis* (F), small teleosts (O), Pleuronectiformes sp. (P).	SS.SSa.CMuSa	Uncertain biotope. Could be CSaMu
MRFR006	Very shelly fine-medium, faintly-rippled sand with scatter of shells, dense in patches	*Ascidiella aspersa* (C, locally A) and *A. scabra*? (P), hydroid patches (R), *Securiflustra securifrons* (R), small infaunal holes (P) and mounds (P). *Liocarcinus depurator*? (O), *Asterias rubens* (F). Shells include *Ensis* and scaphopods.	SS.SSa.CFiSa	Uncertain biotope
MRFR007	Sandy mud	Mud perforated by small holes and with small mounds and megafaunal burrows including those of *Nephrops norvegicus* (F) and possibly *Calocaris macandreae* (P) and *Callianassa subterranea* (P). *Turritella communis* shells (F), *Asterias rubens* (F).	SS.SMu.CFiMu.SpnMeg	

Table 2.2 continued

Site	Substrate	Biota	Biotope	Comments
MRFR008	Muddy sand with patch covered with gravel and shell material	Small holes and mounds (P), *Arenicola marina* (F), *Liocarcinus depurator* (O), *Turritella communis* shells (R), small teleosts (O), *Pleuronectes* sp. (P).	SS.SSa.CMuSa	Uncertain biotope. Could be CSaMu and gravel patch could be CMx
MRFR009	Dense gravel and pebbles with silty sand and occasional cobbles and boulders	Stones support hydroids (R), serpulid worms (P) and pink coralline algae (R on boulders). *Munida rugosa* (O), *Liocarcinus depurator*? (O), *Asterias rubens* (P), *Crossaster papposus* (P), small teleost (P).	SS.SMx.CMx	
MRFR010.1	Fine sand with dense gravel, coarse sand and scattered pebbles, shells and cobbles	Serpulid worms (P), *Lanice conchilega* (P), *Munida rugosa* (O), *Pecten maximus* (P), Gadidae sp. (O), *Luidia sarsi*? (P), *Echinus esculentus* (P).	SS.SMx.CMx	
MRFR010.2	Rippled fine sand with sparsely scattered gravel and pebbles in transitional areas	Hydroids (R), *Munida rugosa* (P), sparse emergent infaunal tubes (P), *Asterias rubens* (P), *Echinus esculentus* (P), Gadidae sp. (O).	SS.SSa.CFiSa	
MRFR010.3	Fine sand with dense gravel and scattered pebbles	Serpulid worms (P), *Lanice conchilega?* (P), *Munida rugosa* (O), *Aequipecten opercularis* (P), *Asterias rubens* (O), *Crossaster papposus* (P).	SS.SMx.CMx	
MRFR011	Rippled fine sand with scattered gravel, pebbles and shell material	Stones support occasional clumps of hydroids and possibly bryozoans. *Cerianthus lloydii* (P), Terebellidae sp. (P), *Arenicola marina* (O), *Liocarcinus depurator* (O), *Cancer pagurus* (P), *Ensis* shells (P), *Asterias rubens* (F), *Callionymus lyra* (P).	SS.SSa.IMuSa	Uncertain biotope. Could be CFiSa, although *Ensis* more characteristic of IMuSa, especially EcorEns

Table 2.2 continued

Site	Substrate	Biota	Biotope	Comments
MRFR012	Rippled fine sand with scattered gravel, pebbles and shell material	Stones support sparse clumps of hydroids (R). *Cerianthus lloydii* tubes? (P), Terebellidae sp. (P), *Liocarcinus depurator* (P), *Ensis* shells and possibly withdrawal plumes (P), *Asterias rubens* (F), *Astropecten irregularis*? (P), *Pleuronectes platessa* (P), small infaunal holes (P).	SS.SSa.IMuSa	Uncertain biotope. Could be CFiSa, although *Ensis* more characteristic of IMuSa, especially EcorEns
MRFR013	Rippled fine sand with very sparsely scattered gravel, pebbles and shell material	Stones support sparse clumps of hydroids (R). Terebellidae sp. (P), *Ensis* shells (P), *Asterias rubens* (F), *Astropecten irregularis*? (O), sparse small mounds (P).	SS.SSa.IMuSa	Uncertain biotope. Could be CFiSa, although *Ensis* more characteristic of IMuSa, especially EcorEns
MRFR014	Rippled, slightly silty fine sand with scattered shell debris	Stones support clumps of hydroids (O). *Cerianthus lloydii*? tubes (P), *Arenicola marina* (P), Paguridae spp. (O) including *Pagurus bernhardus* (O), *Ensis* shells (P), *Asterias rubens* (F), *Ascidiella aspersa* (P), *Pholis gunnellus* (P), small mounds and infaunal holes (P).	SS.SSa.IMuSa	Uncertain biotope
MRFR015	Silty fine sand with dense stone and shell gravel concentrated on crests of low amplitude waves, with scattered pebbles and shells	*Cerianthus lloydii*? tubes (P), hydroid clumps (R), serpulid worms (P), *Lanice conchilega* (P), *Munida rugosa* (P), *Liocarcinus depurator* (O), *Ensis* shells (P), *Asterias rubens* (P).	SS.SMx.CMx	
MRFR016	Silty fine sand with dense gravel and scattered pebbles, cobbles and boulders	Stones encrusted with pink coralline algae (R) and serpulid worms (P) and supporting hydroids (O), *Alcyonium digitatum* (R), *Stomphia coccinea*? (O), *Ascidiella aspersa*? (O) and *Polycarpa pomaria* (P). *Liocarcinus depurator*? (P), *Munida rugosa* (F), Paguridae spp. (O), *Pecten maximus* (O), *Aequipecten opercularis* (O), *Asterias rubens* (O), *Crossaster papposus* (F), *Ophiothrix fragilis*? (P), *Echinus esculentus* (F), teleost sp. (P).	SS.SMx.CMx.FluHyd	Uncertain biotope. FaAlCr could possibly be recognised for patches of denser cobbles and boulders

Table 2.2 continued

Site	Substrate	Biota	Biotope	Comments
MRFR017	Silty fine sand with gravel, pebbles, cobbles and boulders	Stones encrusted with pink coralline algae (O) and serpulid worms (locally A) and supporting hydroids (F), *Alcyonium digitatum* (R) and *Ascidiella aspersa*? (P). *Munida rugosa* (F), Paguridae spp. (O), *Asterias rubens* (F), *Ophiura albida* (P), *Echinus esculentus* (F), Gadidae spp. (F).	SS.SMx.CMx.FluHyd	Uncertain biotope. FaAlCr could possibly be recognised for patches of denser cobbles and boulders
MRFR018	Silty fine sand with gravel, pebbles, cobbles and boulders and patches of rippled fine sand	Stones encrusted with pink coralline algae (R) and serpulid worms (P) and supporting hydroids (O), *Urticina* sp. (P), *Alcyonium digitatum* (R) and *Ascidiella aspersa*? (P). *Cerianthus lloydii* tubes? (P), *Lanice conchilega* (P), *Munida rugosa* (F), *Pagurus bernhardus* (P), *Liocarcinus depurator* (O), *Pecten maximus*? (P), *Asterias rubens* (O), Gadidae sp. (O).	SS.SMx.CMx.FluHyd SS.SSa.CFiSa	Uncertain biotopes
MRFR019	Mud	Moderate density of megafaunal burrowers including *Nephrops norvegicus* (C) and occasional small mounds. Hydroids (R), *Liocarcinus depurator* (P), *Turritella communis* (F), *Asterias rubens* (F), *Astropecten irregularis* (O), Pleuronectiformes sp. (P).	SS.SMu.CFiMu.SpnMeg	
MRFR020	Slightly silty fine sand	Sand perforated by small infaunal holes (P) and with sparse small mounds (P). Hydroids (R), *Alcyonium digitatum* (R), *Cerianthus lloydii* (O), *Pagurus bernhardus* (P), *Liocarcinus depurator*? (O), *Turritella communis* shells (F, but some occupied by pagurids), *Asterias rubens* (F), *Ophiura albida* (P).	SS.SSa.CMuSa	Uncertain biotope. Could be CFiSa
MRFR021	Mud	Moderate density of megafaunal burrowers including *Nephrops norvegicus* (C, 6 specimens seen) and smaller holes (P). Bivalve siphons? (P), *Liocarcinus depurator* (P), *Turritella communis* (F, but possibly unoccupied), *Asterias rubens* (P), *Astropecten irregularis* (P), Pleuronectiformes sp. (O), small teleosts (P).	SS.SMu.CFiMu.SpnMeg	
MRFR022	Faintly rippled, muddy sand	Sediment perforated by small holes and with occasional small mounds and possibly emergent bivalve siphons (P). Hydroids (R), *Cerianthus lloydii* (P), *Arenicola marina* (O), *Liocarcinus depurator* (F), *Turritella communis* shells (P, but possibly unoccupied), *Asterias rubens* (F), *Astropecten irregularis* (O), Pleuronectiformes spp. (F), other teleosts (P).	SS.SSa.CMuSa	Uncertain biotope. Could be CSaMu
MRFR023	Slightly rippled, slightly shelly, fine-medium sand	*Liocarcinus depurator* (O), *Ensis* shells (P), *Asterias rubens* (P), small teleosts (O) including Gadidae sp. (P).	SS.SSa.CFiSa	

Table 2.2 continued

Site	Substrate	Biota	Biotope	Comments
MRFR024	Slightly shelly, fine sand	*Arenicola marina* (F), *Pagurus bernhardus* (P), *Liocarcinus depurator* (O), *Ensis* shells (P), *Asterias rubens* (F), emergent infaunal tubes (P), small mounds (P).	SS.SSa.CFiSa	
MRFR025	Mud	Moderate density of megafaunal burrowers including *Nephrops norvegicus* (C) and smaller holes (P). *Liocarcinus depurator* (O), *Turritella communis* (O, but possibly unoccupied), *Asterias rubens* (F), *Astropecten irregularis?* (P), Pleuronectiformes sp. (P), emergent infaunal tubes (P), small mounds (P). Evidence of trawl scars.	SS.SMu.CFiMu.SpnMeg	
MRFR026	Faintly rippled, muddy sand	Sediment perforated by small holes and with small mounds, emergent infaunal tubes (P) and possibly bivalve siphons (P). *Toxisarcon alba*? (P), Hexacorallia sp. (P), *Arenicola marina* (F), *Liocarcinus depurator* (O), *Asterias rubens* (O), Gadidae sp. (P), *Eutrigla gurnardus* (P).	SS.SSa.CMuSa	
MRFR027	Muddy sand	Sediment perforated by small holes and with small mounds, emergent infaunal tubes (P) and small burrows (F). *Pennatula phosphorea* (F), *Arenicola marina* (F), *Liocarcinus depurator* (O), *Asterias rubens* (F), Gadidae sp. (P).	SS.SMu.CSaMu	Uncertain biotope. Could be CMuSa or poorly developed SpnMeg
MRFR028	Muddy sand	Sediment perforated by small holes and with small mounds, emergent infaunal tubes (P) and small burrows (F). *Pennatula phosphorea* (O), *Pagurus bernhardus* (O), *Liocarcinus depurator* (P), *Arctica islandica* shells (P), *Asterias rubens* (O), Pleuronectiformes spp. (F), *Eutrigla gurnardus* (P).	SS.SMu.CSaMu	Uncertain biotope. Could be CMuSa or poorly developed SpnMeg
MRFR029	Muddy sand	Sediment perforated by small holes and with small mounds, emergent infaunal tubes (P) and megafaunal burrows including those of *Nephrops norvegicus* (F, 1 specimen seen). *Pennatula phosphorea* (F), Hexacorallia sp. (P), *Arenicola marina* (P), Paguridae sp.? (P), *Munida rugosa* (P), *Asterias rubens* (O), Gadidae sp. (F).	SS.SMu.CFiMu.SpnMeg	Uncertain biotope as megafaunal burrowing community not well-developed. Could be CSaMu
MRFR030	Faintly rippled, muddy sand	Sediment perforated by small holes and with small mounds, emergent infaunal tubes (P) and possibly occasional, small megafaunal burrows. *Arenicola marina*? (F), Caridea sp. (P), *Liocarcinus depurator* (O), *Aequipecten opercularis* (P), *Asterias rubens* (F), Gadidae sp. (O), *Eutrigla gurnardus* (P).	SS.SSa.CMuSa	Uncertain biotope. Could be CSaMu

www.snh.gov.uk

ISBN: 978-1-78391-413-5

Policy and Advice Directorate, Great Glen House,
Leachkin Road, Inverness IV3 8NW
T: 01463 725000

You can download a copy of this publication from the SNH website.

recycle

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad