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THE UNIVERSITY OF HULL
Institute of Estuarine and Coastal Studies (IECS)

Biotope Mapping of the Intertidal Reef Feature at Flamborough Head Special Area of Conservation

Report to Natural England

Institute of Estuarine and Coastal Studies
University of Hull

15th November 2010

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Report: ZBB739-2010

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For and on behalf of the Institute of Estuarine and Coastal Studies	
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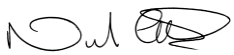
Signed:	
Position:	Deputy Director
Date:	26 September 2012

EXECUTIVE SUMMARY

The Institute of Estuarine and Coastal Studies (IECS) were commissioned by Natural England to carry out a biotope survey of 8 monitoring transects around Flamborough Head first surveyed by Howson in 2001. The data gathered from the surveys was used to compare to the original biotopes recorded in 2001, and provide an assessment of the Reef Feature using advice from Regulation 33. The survey found that most of the transects were broadly similar to the original surveys in terms of the presence and diversity of biotopes recorded. The main notable differences were the loss off *Mytilus* biotopes from transects 2 and 4, and a expansion in *Mytilus* biotopes in transect 9. The first target set by Regulation 33, of no decrease in extent and diversity of rocky shore biotopes has been met, with Flamborough Head still notable for its range of rocky shore biotopes. The second target set by Regulation 33 is to ensure that the distribution of characteristic chalk cliff biotopes, LR.FLR.CvOv.ChrHap, LR.FLR.Lic.Bli and LR.FLR.Lic.UloUro does not significantly decrease from the original baseline survey. This could not be assessed as none of these biotopes were present along the monitoring transects in the original or subsequent survey. Recommendations for future surveying of the transects around Flamborough Head are; to have a consistent survey methodology for greater inter-survey comparability, more regular targeted surveying of transects where significant biotope change has occurred (i.e. *Mytilus* biotopes of transects 2, 4, and 9) incorporated within a less frequent comprehensive survey programme, and surveying to occur during late summer/early autumn when seaweeds are at greatest diversity.

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1. INTRODUCTION

1.1 Background Information

The Institute of Estuarine and Coastal Studies (IECS), were commissioned by Natural England (NE), to carry out a biotope survey of 8 rocky shore monitoring transects around Flamborough Head. These transects were initiated and surveyed by Howson in 2001, the biotope data from which, was compared to the current survey to give an indication of the biotope change and the general status of the reef feature (with NE guidance).

Flamborough Head on the North Yorkshire coast projects eastward close to the biogeographic boundary between two North Sea water bodies, forming a major peninsula of the English coast (Figure 1). It is the most northerly chalk outcrop in Britain and also represents the most southerly area of extensive bedrock in the North Sea. The site represents 14% of the UK and 9% of European coastal chalk exposure. The hardness of the chalk means that erosion is slow, the chalk being harder on the northern side compared to the southern side of the headland. The shore is relatively steep, rugged and exposed to wave action. Erosion has formed caves, arches and stacks, and there are small sandy coves between rocky headlands (Figure 2). On the southern side from Stacks Pinnacle to Sewerby Steps, the cliffs lead down to boulders and broader shore platforms which provide a more sheltered habitat.

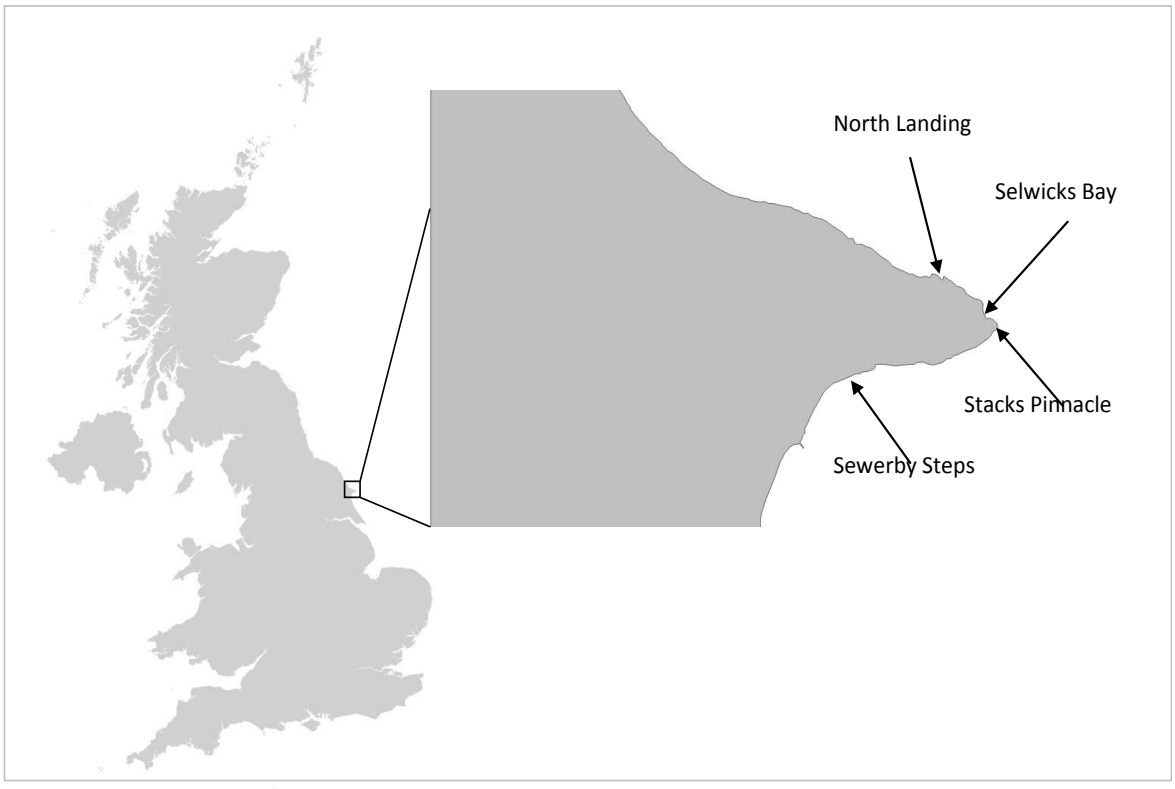


Figure 1. Location of Flamborough Head on the East Yorkshire coast.

a)  b) 

c)  d) 

Figure 2. Erosion of the chalk cliffs around Flamborough Head has led to the formation of sea caves (a), arches (b) and stacks (c). Sandy coves like North Landing (d) provide boat departure points and are popular with visitors to the area.

1.2 Site Designations

The Flamborough Head European Marine Site (EMS) is part of the Heritage Coast network and is a Site of Special Scientific Interest (SSSI). It is designated as a Special Protection Area (SPA) under article 4.2 of the Birds Directive (79/409/EEC) for its large numbers of breeding seabirds including Kittiwake *Rissa tridactyla* and auks, as well as the only mainland-breeding colony of Gannet *Morus bassanus* in the UK. The site has also been nominated as a UK Important Plant Area (IPA) for its threatened or rare marine algal species (Brodie *et al.,* 2007). The area qualifies for Special Area of Conservation (SAC) status under the Habitats Directive (92/43/EEC) because of the Annex I habitats that are represented, including its reefs, vegetated sea cliffs and sea caves. For each it is considered to be one of the best areas in the United Kingdom.

Integrated management of the site was initially sought through a management scheme published in 2000. A reviewed plan was released in 2007 and subsequently named the 'Flamborough Head Management Plan'. The new plan adopted the ecosystem approach to underpin the sustainable

management of Flamborough Head, while providing an opportunity for dialogue between stakeholders, interest groups and the relevant authorities.

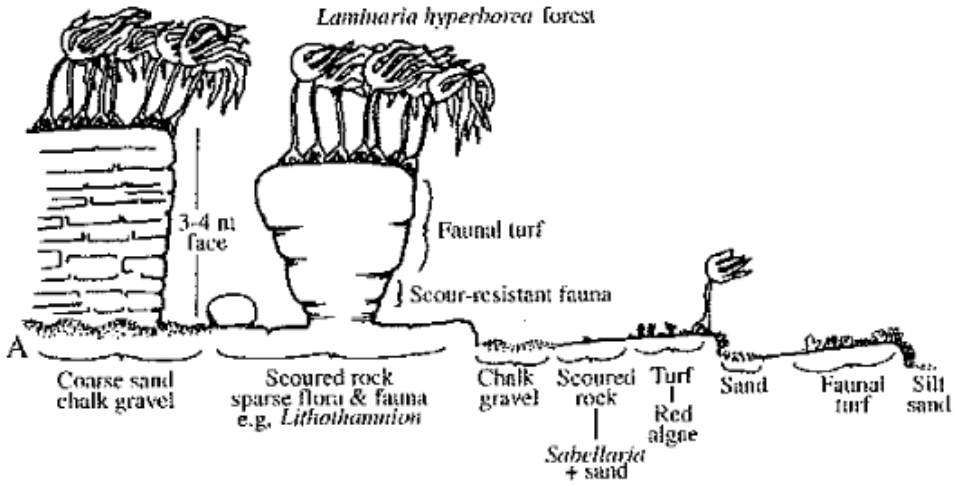
1.3 Geology and Ecology

Rising to a height of 135m at Bempton Cliffs, the chalk cliffs extend for 16km around the headland. The algal communities on the cliffs have been described by Tittley (1988) and Fowler and Tittley (1993) while the maritime cliff vegetation was described by Milliken and Pendry (2002). There are more than 200 sea caves on the headland the majority of which are concentrated in the indented, broken chalk platforms between Little Thornwick and Stacks Pinnacle and were described by Howson (2000).

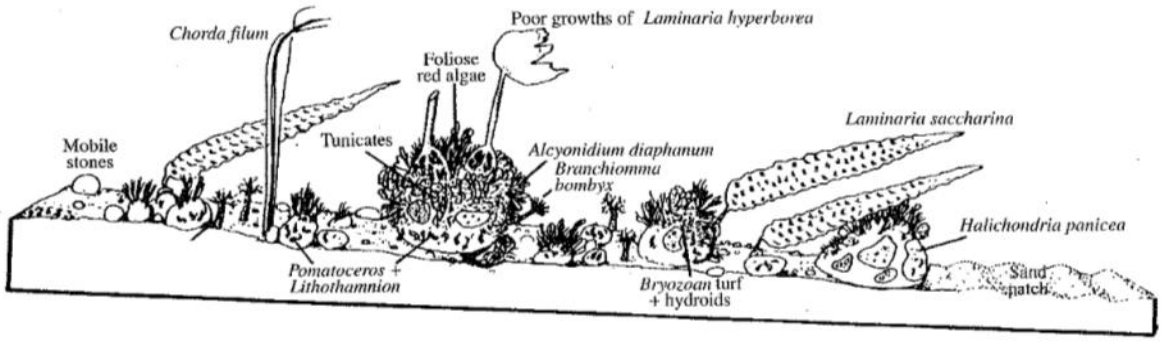
The bedrock and boulder reefs of Flamborough Head extend up to 6km offshore and into waters more than 30m deep, giving one of the most extensive areas of sublittoral chalk in Europe (McLeod *et al*., 2005). The importance of the site is due to the substrate type, the biogeographic position of the headland and the influence of hydrodynamic processes on reef topography and community structure (English Nature, 2000). A key ecological factor is the position of the site at the western end of the 'Flamborough front'. As cold, deeper, stratified waters of the northern North Sea meet warmer, shallower, well-mixed waters of the southern North Sea a strong offshore frontal system is formed (Pingree & Griffiths, 1978) resulting in increased plankton growth and secondary productivity (Institute of Estuarine and Coastal Studies, 1992) contributing to the diverse composition of biological communities on the reef.

Various species reach their northern or southern biogeographical limits at Flamborough Head. For instance the algaes *Ptilota plumosa* and *Callithamnion sepositum* reach their southern biogeographic limits at the headland, while other species are not found further north on the east coast, e.g. the Sea mare's tail *Halurus equisetifolius* (McLeod, 2005; English Nature, 2000). Plants and animals found boring into the rock further increase the diversity of the communities on the reef. Chalk-boring species such as the lichen *Eugomontia sacculata,* the wrinkled rock borer *Hiatella arctica*, the oval piddock *Zirfaea crispata* and particularly *Polydora* spp. have been observed (Howson, 2001; Brazier *et al*., 1998; Tittley, 1988). Those species that are unique to chalk are consequently rare in the UK.

Variation in both hydrological regimes and the hardness of the chalk between the north and south coasts of the headland is highlighted by the sublittoral topography (Figure 3). The harder, more erosion resistant chalk of the north coast results in sublittoral overhangs and vertical faces. This feature is not commonly found at similar chalk reef sites in the UK (English Nature, 2000).



a) North coast sublittoral habitat showing overhangs and vertical faces.



b) South coast sublittoral habitat.

Figure 3. Comparison of seabed profiles between the north and south coasts of Flamborough Head illustrating the differences in sublittoral topography. From Bennett and Foster-Smith (1998). Drawings by Bob Foster-Smith.

1.4 Biotopes

The first comprehensive intertidal biotope mapping survey was carried out during 2000 (Howson, 2001) as part of a report to English Nature (now Natural England) to inform the development of conservation objectives and future management of the site. The monitoring transects established as part of this survey encompass a representative range of the rocky intertidal biotopes. The author indicates that the major exclusions would be difficult to include in any other transects due to their accessibility. Similarly, the boulder beaches and cliff face shore types would be very difficult to work while the sand shores are not relevant in an assessment of the rocky shore. They suggest that in future surveys the inclusion of the fucoid and mussel dominated area east of North Landing, which is accessible by tunnel, be considered as a possible further transect location. This could be assessed once in the field. The location of the monitoring transects established in 2000 is given in Figure 4. The key intertidal biotopes as listed by English Nature (2000) are given in Table 1. From this list the only omission from Howson (2001) is the freshwater-influenced green algal biotope UloUro.

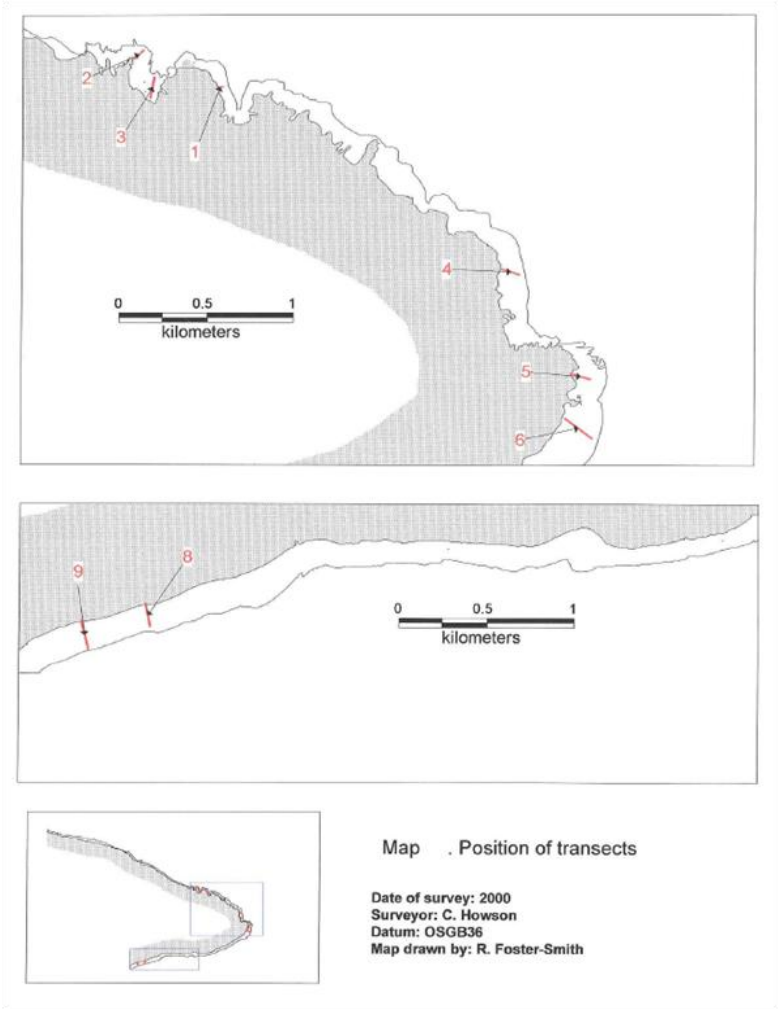


Figure 4. Monitoring transects established during the 2000 intertidal biotope survey (Howson, 2001).

Table 1. Summary of key intertidal biotopes recorded in the Flamborough Head European Marine Site. (English Nature, 2000)

MNCR Biotope	Brief description (Connor and others 1997)	Frequency of occurrence in Britain
LITTORAL ROCK (LR.L)	**Lichens or algal crusts**	
Ver.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock	Very common
Chr	Chrysophyceae on vertical upper littoral fringe soft rock	Rare
Bli	*Blidingia* spp., on vertical littoral fringe soft rock	Rare
UloUro	*Ulothrix flacca* and *Urospora* spp., on freshwater-influenced vertical littoral fringe soft rock	Rare
EXPOSED LITTORAL ROCK (ELR.MB)	***Mytilus* (mussels) and barnacle shores**	
MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock	Common
BPat	Barnacles and *Patella* spp on exposed or moderately exposed, or vertical sheltered, eulittoral rock	Very common
BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered eulittoral rock	Very common
(ELR.FR)	**Robust fucoids or red seaweeds**	
Him	*Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock	Common
MODERATELY EXPOSED LITTORAL ROCK (MLR.BF)	**Barnacles and fucoids (moderately exposed shores)**	
FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed and mid eulittoral rock	Very common
Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	Very common
Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	Very common
Fser.Fser.Bo	*Fucus serratus* and under-boulder fauna on lower eulittoral boulders	Common
(MLR.R)	**Red seaweeds (moderately exposed shores)**	
Mas	*Mastocarpus stellatus* and *Chondrus crispus* on very to moderately exposed lower eulittoral rock	Scarce
(MLR.Eph)	**Ephemeral green or red seaweeds (freshwater or sand-influenced)**	
Ent	*Enteromorpha* spp on freshwater-influenced or unstable upper eulittoral rock	Uncommon
EntPor	*Porphyra purpurea* or *Enteromorpha* spp on sand-scoured mid or lower eulittoral rock	Scarce
Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	Uncommon
(MLR.MF)	***Mytilus* (mussels) and fucoids (moderately exposed shores)**	
MytFves	*Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock	Scarce
MytFR	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Rare
SHELTERED LITTORAL ROCK (SLR.F)	**Dense fucoids (Stable rock)**	
Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock	Very common

The rocky shores around Flamborough Head can be divided into three major sections. These consist of (1) the narrow boulder beaches beneath the cliffs of the north coast, (2) the complex broken rock platforms between Little Thornwick and Stacks Pinnacle and (3) the broad rock platforms of the south coast. The boulder beaches are animal dominated, with limpets and barnacles over most of the shore, ephemeral green algae at the top of the shore and a narrow band of red algae in the sublittoral fringe. In contrast, the rock platforms of the south coast are fucoid dominated with *Fucus vesiculosus* in the mid shore and a wide band of *Fucus serratus* in the lower shore.

The north coast of the headland from Speeton sands to Sanwick Brig is primarily wave exposed boulder beaches. Access to some parts of this area is problematic and two stretches were not surveyed in 2000. Narrow beaches below the cliffs with large, rounded chalk boulders stretch uniformly along much of its length with the occasional bedrock outcrop. Boulders at the top of the shore are covered with *Prasiola stipitata*. Below this is a zone of *Enteromorpha*, *Porphyra* and *Palmaria*. At the bottom of the shore a band of red algae is situated above a *Laminaria digitata* zone. Much of the shore is covered with limpets, barnacles and tufts of red algae.

The coast between Little Thornwick and Stacks Pinnacle provides a transition zone between the uniform boulder beaches and the bedrock platforms of the south coast. Mussel beds described by Howson (2001) extending from the lower mid shore to the shallow infralittoral primarily along the north coast were not found to the same extent in previous surveys, suggesting that they may be a transient feature of the shore. The upper shore is dominated by limpets, barnacles and the green film *Pseudendoclonium subarinum*, and on the boulders, *Fucus serratus* with rich red algal communities beneath.

There are three bays in this area and the east facing shore of each of these consists of relatively unbroken bedrock with an extensive fucoid zone in Selwicks Bay and barnacles and limpets in Thornwick Bay and North Landing. Monitoring transects (MT) 1-3 were located in Thornwick Bay and North Landing. MT1 was a short transect on the west side of North Landing. MT2 ran from the western tip of Thornwick Bay while MT3 covered the inner part of the Bay. MT4 was located in Selwicks Bay. Ducrotoy and Simpson (2001) assigned biotopes to an area of Selwicks Bay south of MT4 while developing a photographic method of ecological modelling. The authors designate Bpat.Sem with FvesB in the mid eulittoral and Ldig.Ldig in the sublittoral fringe. The designation of FvesB to the mid eulittoral conflicts with Hastings (2001) who describe the predominant fucoid in this area as *Fucus serratus*, however *Fucus vesiculosus* was not absent from the description.

The south coast from Stacks Pinnacle is characterised by wide wave-cut rock platforms where the softer chalk has been eroded. There are boulders in the upper shore and the rock is interrupted by sand at South Landing and Danes Dyke. The area is dominated by brown fucoid wracks, with *Fucus vesiculosus* in the mid shore and a wide band of *Fucus serratus* in the lower shore. An extensive zone of the sand-binding red algae *Rhodothamniella floridula* (Rho) in the sublittoral fringe indicates the considerable influence of sand in this area. Howson (2001) states that while large areas of this biotope are relatively unusual, they are a feature of other parts of the east coast.

The highly pitted nature of the chalk platforms resulting in small coralline rockpools was a characteristic feature observed during multiple surveys (Hastings, 2001; Brazier, 1998; George, 1988). Rockpools, crevices, steps in the rock platforms and boulder communities of the intertidal rocky shores around the headland all enhance the species richness of the site. They provide ideal habitats for *Fucus* spp., red algae *Porphyra* spp., pink coralline crusts, coral weed *Corallina officinalis*, the less common china limpet *Patella ulyssiponensis*, kelps *Laminaria* spp., and shannies *Lipophrys pholis*. The littorinid *Melaraphe neritoides* was noted in crevices several metres above the high tide mark by Howson (2000, 2001) and George (1988).

2. SURVEY METHODOLOGY

2.1 Biotope Surveying

The surveys were scheduled during spring tides, so the maximum intertidal area was exposed. Transects were located using the coordinates given in Howson (2001)(Tab. 2). A rope was run between the start and finish points to guide the biotope mapping and any belt transects carried out. The profiles from 2001 were consulted to ensure that any characteristic shore features were present along the transect before the survey began, and the transect aligned appropriately. Some of the previous coordinates proved to be incorrect, and there were also problems with GPS signal interference under the cliffs. New start and finish positions taken using the Thales CX mapper, with a bearing from the start position listed in Table 3.

Table 2. Initial transect coordinates in WGS84.

Transect	Start (WGS84)		Finish (WGS84)	
	Latitude	Longitude	Latitude	Longitude
North Landing (MT1)	54.131372	-0.107492	54.131422	-0.107008
Thornwick Nab (MT2)	54.133006	-0.114825	54.133436	-0.113892
Thornwick Bay (MT3)	54.131606	-0.113392	54.132039	-0.113008
Selwicks Bay(MT4)	54.121542	-0.082959	54.121212	-0.081398
Mathon Nook (MT5)	54.115972	-0.077111	54.115639	-0.075361
South of Stacks Pinnacle (MT6)	54.113656	-0.077708	54.112575	-0.075341
South Cliff (MT8)	54.101171	-0.155310	54.099997	-0.154965
Sewerby Rocks (MT9)	54.100385	-0.160943	54.098876	-0.160398

The transect was subdivided into what were considered to be different biotopes based on the flora, fauna and sediment/substratum present. The boundaries of each perceived biotope were mapped along the transect using a Thales CX mapper. For each biotope a separate proforma, specifically designed for the survey, was used to record transect no., biotope no., date, time, weather, and a general biotope description including the position on the shore (See Appendix IV). The quadrat proformas was used in conjunction with the JNCC biotope proformas. Within each biotope a 1m quadrat (subdivided into nine equal squares) was randomly placed, and the flora and fauna present recorded on the proforma in the SACFOR scale (Fig. 6). Any species unable to be identified in the field were sampled or photographed for identification back at the lab. The presence of each flora/fauna species within the nine sub-squares of the quadrat was also recorded in the proforma, giving a score out of nine. A position was recorded along with a geo-tagged photo (Garmin Oregon 550t) and a conventional photo (Pentax Optio) for the quadrat. This was repeated twice more, resulting in each biotope having 3 quadrats taken within it. Where time constraints and/or safety issues restricted the sampling of all the biotopes along a transect, biotopes which could be easily be assigned a classification in the field were not surveyed (e.g rockpools, Rho, Ldig), in preference for those where classification was more difficult. A summary of survey dates for each transect is shown in Table 3.

A broad scale Phase 1 style biotope survey was also undertaken in the vicinity of the transect and mapped using the Thales CX mapper.

Table 3. New transect coordinates, bearing and summary of survey dates.

Transect	Start (WGS84)		Finish (WGS84)		Bearing Grid North (BNG)	Date Surveyed
	Latitude	Longitude	Latitude	Longitude		
MT1	54.131363	-0.107529	54.131500	-0.106497	77°	08/08/2010 & 09/09/2010
MT2	54.133141	-0.115013	54.133474	-0.113747	66°	12/08/2010
MT3	54.131018	-0.113385	54.132007	-0.112854	195°	07 & 09/09/2010
MT4	54.121575	-0.082971	54.121106	-0.081033	111°	12 & 13/09/2010
MT5	54.115906	-0.077057	54.115486	-0.074658	106°	11, 13, & 14/09/2010
MT6	54.113653	-0.077709	54.112300	-0.074701	126°	8, 11, & 14/09/2010
MT8	54.101154	-0.155320	54.099898	-0.154893	167°	10/08/2010
MT9	54.100362	-0.160901	54.098384	-0.160225	167°	11/08/2010

The data gathered during the quadrat survey was compiled into site specific Excel spreadsheets. The SACFOR scale (Figure 6) was then converted into a score S = 6 to R = 1, the average score of each faunal and floral species was calculated over the 3 replicate quadrats of a biotope. The relative dominance of each species found, was used in conjunction with Connor et al (2004) to classify each of the biotopes. Using the mapping data also gathered during survey the biotopes were then mapped in closed filled polygons in Mapinfo and presented on aerial photos.

The biotopes recorded were then compared to those recorded in the original survey by Howson in 2001, and used to give an indication of the Reef feature status.

Growth form	Size of individuals/colonies							
% cover	**Crust/meadow**	**Massive/Turf**	**<1cm**	**1-3 cm**	**3-15 cm**	**>15 cm**	**Density**	
>80%	S		S				>1/0.001 m2 (1x1 cm)	>10,000 / m2
40-79%	A	S	A	S			1-9/0.001 m2	1000-9999 / m2
20-39%	C	A	C	A	S		1-9 / 0.01 m2 (10 x 10 cm)	100-999 / m2
10-19%	F	C	F	C	A	S	1-9 / 0.1 m2	10-99 / m2
5-9%	O	F	O	F	C	A	1-9 / m2	
1-5% or density	R	O	R	O	F	C	1-9 / 10m2 (3.16 x 3.16 m)	
<1% or density		R		R	O	F	1-9 / 100 m2 (10 x 10 m)	
					R	O	1-9 / 1000 m2 (31.6 x 31.6 m)	
						R	<1/1000 m2	

Figure 6. SACFOR scale.

2.2 Beach Profiling

Shore profiles were determined using an optical theodolite and levelling staff, beginning at the top of the shore and moving down to the water line for low water. The theodolite was mounted on a tripod and levelled using the built in spirit level and fine adjustment knobs, then oriented towards the finishing point. If the theodolite was moved it was moved to a point along this line and re-oriented towards the finishing point. The height of the theodolite was measured and a measuring tape was run out along the line of the transect.

To calculate the shore profile, readings were taken from the levelling staff as it was moved progressively further from the theodolite. The distance between each measurement was determined by taking into account the variability in the height of the substrate, however the shorter the distance between them the more accurate the profile. For dramatic changes in height (e.g. ledges, rockpools), multiple readings in quick succession gave a detailed picture of these features. Once readings from the levelling staff were collected down to low water, the shore profile was determined.

The rise/fall between the original theodolite position and the first staff measurement was calculated by subtracting the theodolite height from the staff measurement. The rise/fall between this point and the next staff measurement was calculated by subtracting the first staff measurement from the second staff measurement. This process was continued down the shore; i.e. by subtracting the second measurement from the third, the third from the fourth, and so on. Since the height above chart datum at low water and the distance travelled down the shore was known, the profile could be determined by working backwards and adding the rise/fall of each measured section to the low water height. The profile was then drawn in Excel given the height above chart datum at known distances along the shore.

3. RESULTS.

3.1 Monitoring Transect 1 – North Landing

SITE AND BIOTOPE DESCRIPTIONS

MT1 is at the western side of the North Landing and is a narrow moderately exposed bedrock shore, and its profile can be seen in Figure 7. At the top of the transect is a small shallow cave (0.8m deep) in the cliff base, the wall of which supports the littorinids *Merlaphe neritoides* and *Littorina arcana/saxatilis*, as well as the lichen *Verrucaria maura* (Biotope 1 - LR.FLR.Lic.Ver.Ver). The flat bedrock platform from the cave to the first vertical wall is initially dominated by *Ulva intestinalis* (Biotope 2 LR.FLR.Eph.Ent) for the first 2m and then replaced by a thick layer of *Verrucaria maura* (Biotope 3 LR.FLR.Lic.Ver.Ver) to the vertical wall. The vertical bedrock wall which is approximately 2.5m high supports high numbers of *Patella vulgata*, *Merlaphe neritoides*, as well as *Littorina saxatilis* and *Semibalanus balinoides* (Biotope 4 - LR.HLR.MusB.Sem.Sem). At the bottom of the vertical bedrock wall are large boulders on bedrock, which are dominated by *S. balanoides* as well as *P. vulgata* and *L. saxatilis* (Biotope 5 LR.HLR.MusB.Sem.Sem). The boulders occupy a 7m wide belt along the transect, and are replaced by horizontal bedrock dominated by *S. balanoides*, *P. vulgata* with *U. intestinalis* with occasional *Corallina officianalis* (Biotope 6 - LR.HLR.MusB.Sem.FvesR). Within Biotope 6 are two rockpools, the shallow area of rockpool 1 is dominated by *C. officinalis* (Biotope 7 - LR.FLR.Rkp.Cor.Cor), with the deeper area dominated by *Ulva spp* with *Fucus* and *C. officianalis* along the vertical sides. The second deeper rockpool floor is dominated by *Ulva spp*. with *Fucus* and *Laminaria* growing on the vertical sides of the pool (Biotope 8 - LR.FLR.Rkp.G). Biotope 6 ends when the bedrock forms a vertical wall of around 2m dominated by *S. balanoides*, with *P. vulgata* (Biotope 9 – LR.HLR.MusB.Sem.Sem). At the base of the bedrock wall, *Rhodothamniella floridula* and *Fucus serratus* are the dominant flora (Biotope 10 - LR.MLR.BF.Rho) on uneven bedrock, which is intern replaced into the sublittoral by *Laminaria digitata* (Biotope 11 – IR.MIR.KR.Ldig.Ldig). A summary of the biotopes found on MT1 are shown in Table 4 and an aerial photo of the mapped biotopes in Figure 8.

Table 4. Biotopes and descriptions found at MT1.

Biotope No.	Biotope Code	Description
1 & 3	LR.FLR.Lic.Ver.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock.
2	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
4, 5 & 9	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
6	LR.HLR.MusB.Sem.FvesR	Semibalanus balanoides, Fucus vesiculosus and red seaweeds on exposed to moderately exposed eulittoral rock.
7	LR.FLR.Rkp.Cor.Cor	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools
8	LR.FLR.Rkp.G	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools
10	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.

11	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

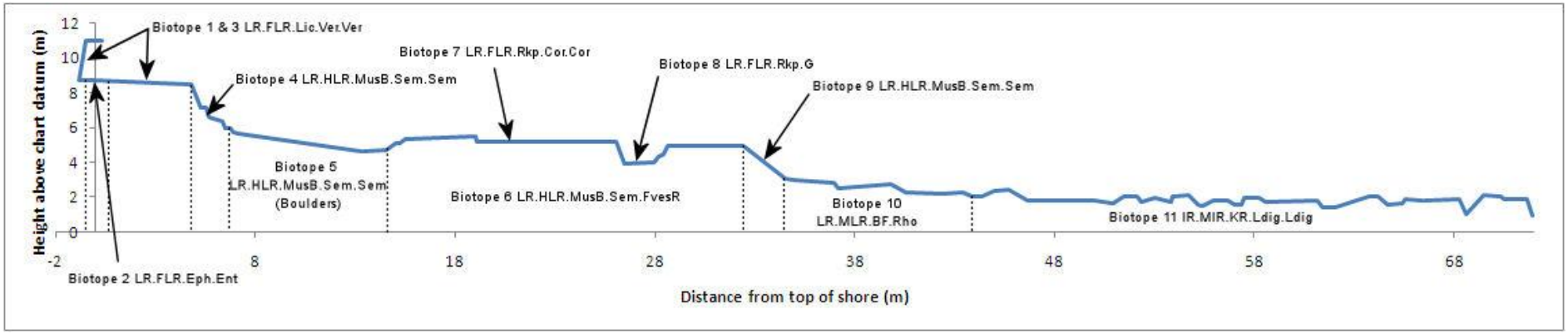


Figure 7. MT1 shore profile.

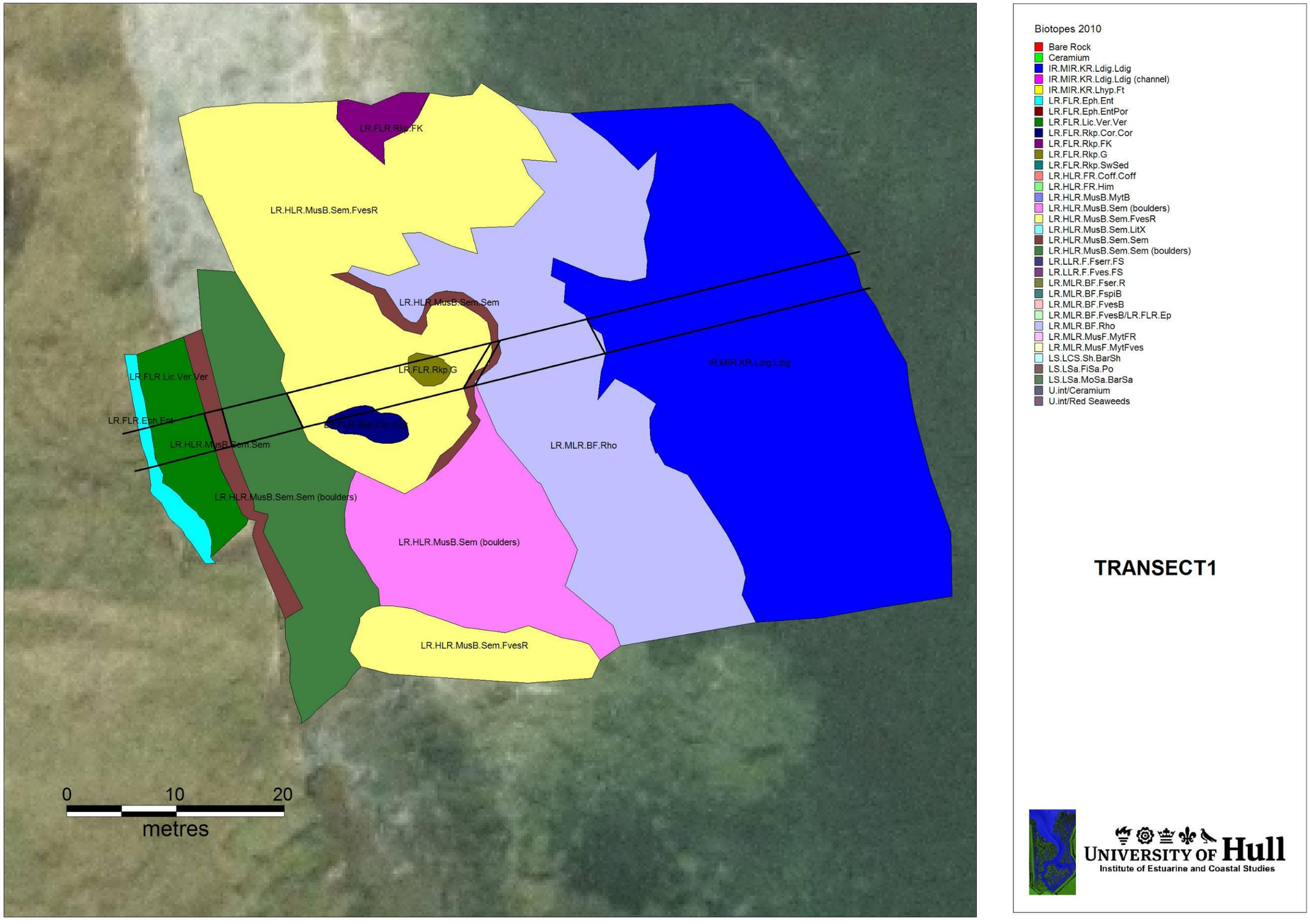


Figure 8. Biotope map of MT1 and vicinity.

3.2 Monitoring Transect 2 – Thornwick Nab

SITE AND BIOTOPE DESCRIPTIONS

MT2 at Thornwick Nab is on the north western edge of Thornwick Bay and is a wave exposed bedrock platform shore. The beach profile for MT2 can be seen in Figure 9. The supralittoral zone of the transect is dominated by *Ulva intestinalis* covered cliff face (Biotope 1 - LR.FLR.Eph.Ent) mixing with *S.balanoides*, *P. vulgata*, *L. arcana/saxatilis*, *Mytilus edulis*, and *M. neritoides* at its lower extremities, which then become the dominant life forms to the base of the cliff (Biotope 2 – LR.HLR.MusB.Sem.Sem). From the base of the cliff for 23m horizontal bedrock is interspersed with several steps down, this area is dominated by *S. balanoides*, *P. vulgata* with *Actinia equine* (Biotope 3 – LR.HLR.MusB.Sem.Sem). The bedrock becomes more pitted, supporting more algae species such as *C. officinalis*, however *S. balanoides* is still dominant with *P. vulgata*, *Polydora/Boccardiella* (Biotope 4 – LR.HLR.MusB.Sem.FvesR). Within Biotope 4 are several rockpools dominated by *C. officinalis* and *Ulva lactuca* (Biotope 5 – LR.FLR.Rkp.Cor.Cor). Biotope 4 continues along MT2 for around 48m, where the bedrock steps down into *L. digitata*, interspersed with mats of *R. floridula*, the encrusting *Lithothamnion glaciale*, and *Fucus serrate.* Juvenile *M. edulis* dominate the fauna in rock crevices with *Tectura testudinalis* also common (Biotope 6 – IR.MIR.KR.Ldig.Ldig). *L. digitata* is replaced by a *L. hyperborea* biotope at the end of the transect (Biotope 7 – IR.MIR.KR.Lhyp). A summary of the biotopes found on MT2 are shown in Table 5, and an aerial photo of the mapped biotopes in Figure 10.

Table 5. Biotopes and descriptions found at MT2

Biotope No.	Biotope Code	Description
1	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
2 & 3	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
4	LR.HLR.MusB.Sem.FvesR	Semibalanus balanoides, Fucus vesiculosus and red seaweeds on exposed to moderately exposed eulittoral rock.
5	LR.FLR.Rkp.Cor.Cor	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools
6	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock
7	IR.MIR.KR.Lhyp	*Laminaria hyperborea* on tide-swept, infralittoral rock

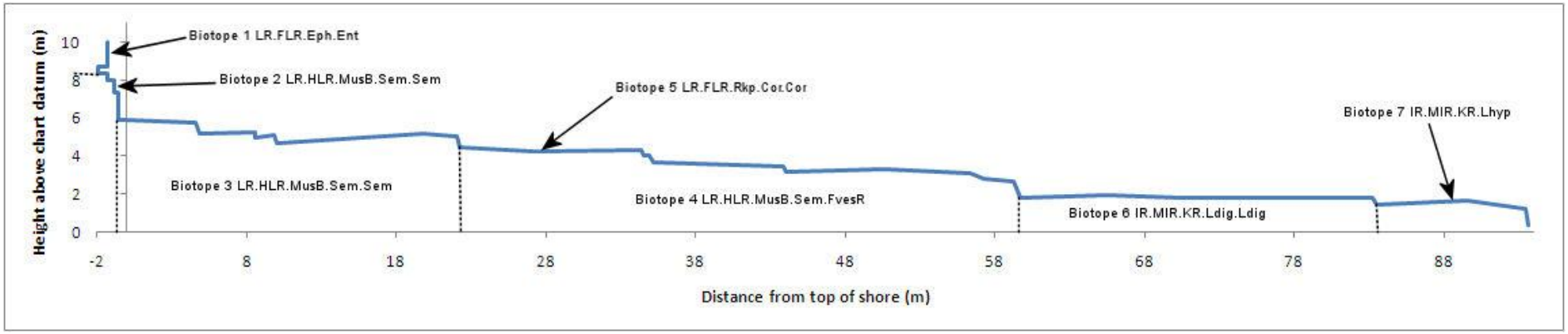
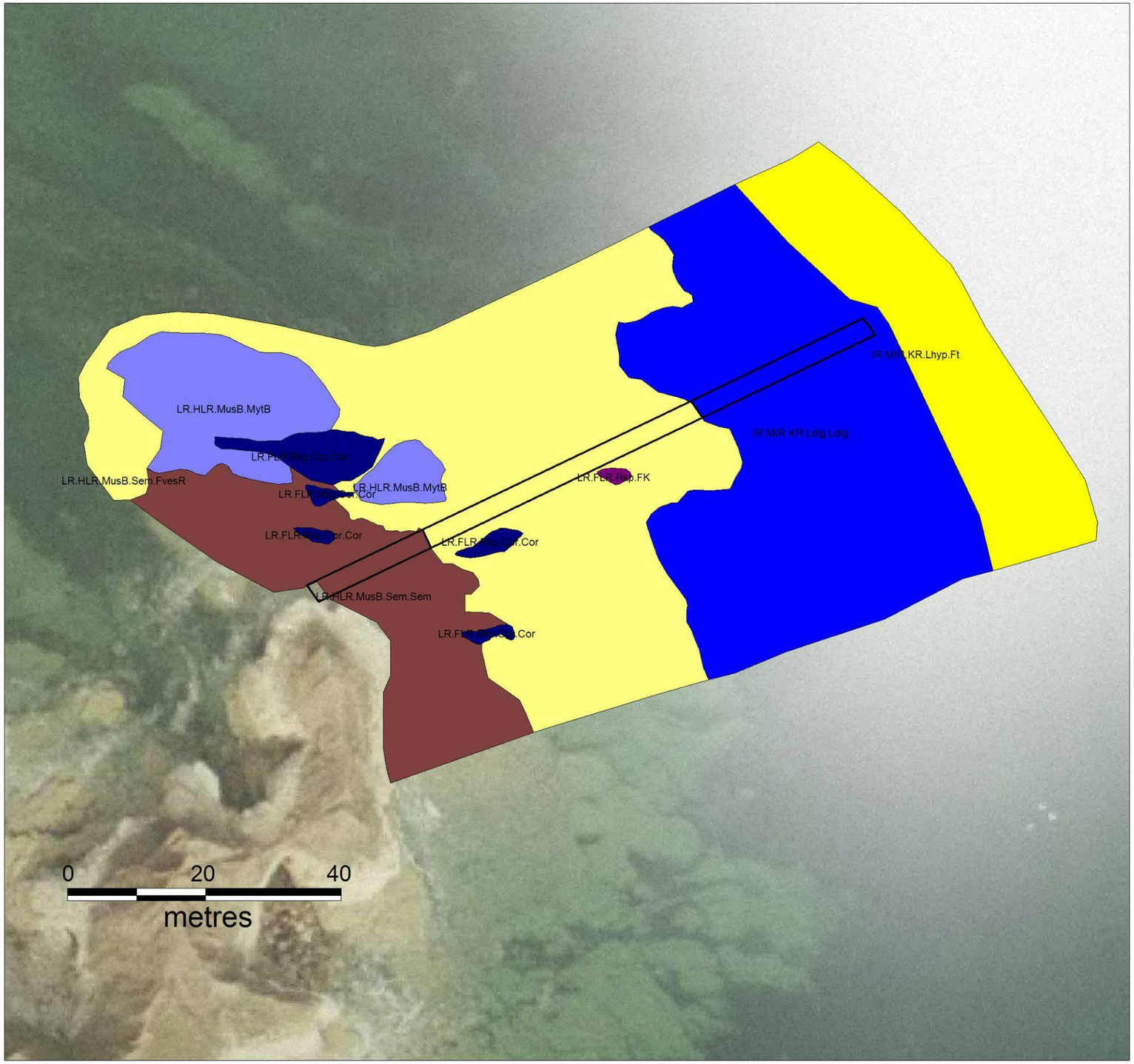


Figure 9. MT2 shore profile.



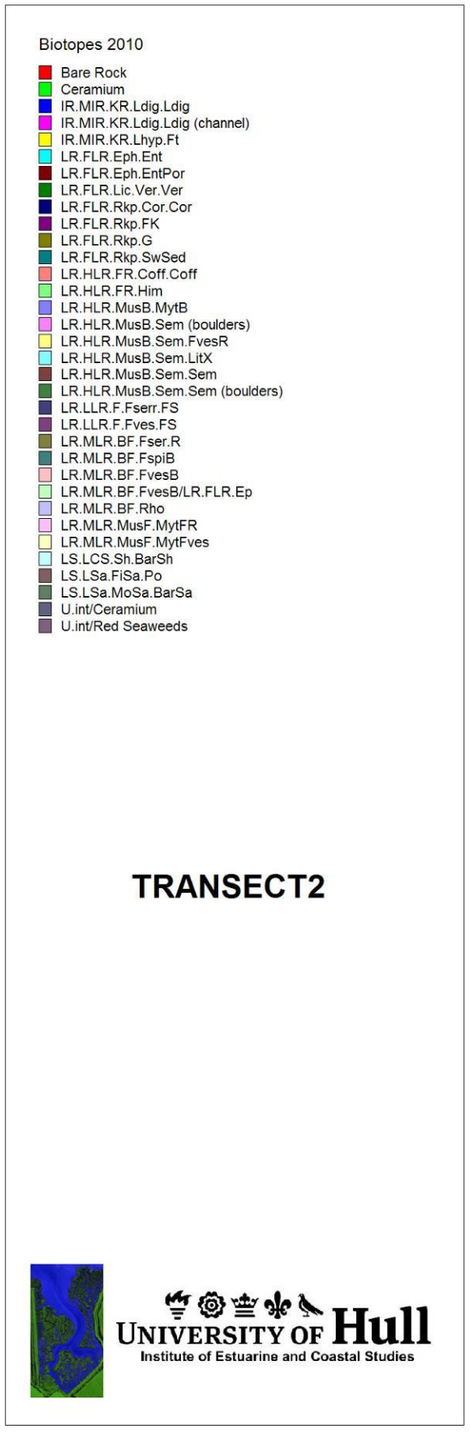


Figure 10. Biotope map of MT2 and vicinity.

3.3 Monitoring Transect 3 – Thornwick Bay

SITE AND BIOTOPE DESCRIPTIONS

MT3 is at the centre of Thornwick Bay, which is a moderately exposed bedrock platform shore, the profile of which can be seen in Figure 11. The first 35m of MT3 is a fine sand beach, with no obvious fauna or flora (Biotope 1 – LS.LSa.MoSa.BarSa). This is replaced by a band of *U. intestinalis* covered chalk cobbles and boulders on bedrock and sand (Biotope 2 – LR.FLR.Eph.EntPor). Also found in this biotope were *L. obtusata*, *P. vulgata*, *Polydora/Boccardiella*, *F. vesiculosus*, with occasional *R. floridula*. Below this *F. vesiculosus* with *U. intestinalis* are the dominant flora on horizontal bedrock, *Poldora/Boccardiella* with *P. vulgata* and *L. obtusata* dominating the fauna (Biotope 3 – LR.MLR.BF.FvesB). This is replaced by an area with a high abundance of *Polydora/Boccardiella*, *S. balanoides*, and increased diversity of red seaweeds such as *Osmundia pinnatifidula*, though *F. vesiculosus* is still frequent (Biotope 4 – LR.MLR.BF.FvesB). The bedrock takes a step down into a slightly sheltered narrow gully dominated by abundant *F. serratus*, and *L. littorina*, *L. obtusata/mariae* and *P. vulgata* (Biotope 5 – LR.LLR.F.Fserr.FS). The bedrock then rises, resulting in another area *F. vesiculosus* (Biotope 6 LR.MLR.BF.FvesB) sandwiched between the *F. serratus* gully and a rockpool containing fucoids and kelp (Biotope 7 – LR.FLR.Rkp.FK). Below the fucoid and kelp rockpool, *F. serratus* is common on the heavily fissured more exposed bedrock. However it is combined with a higher diversity of red seaweeds such as the encrusting *Phymatolithon lenormandii* found over the surface of the bedrock, and *O. pinnatifidula*, *C. officinalis* and *Palmaria palmata* found growing in the fissures and crevices (Biotope 8 – LR.MLR.BF.Fser.R). The dominant fauna found in this biotope are *P. vulgata/ulyssiponesis*, the boring spionid polychaetes *Polydora ciliata/Boccardiella cf. polybrachia*, the anemone *A. equine*, *L. mariae/obtusata* and *S. balanoides*. The mat forming *R. floridula* then becomes the dominant algae with *F.serratus*, on the surface of the bedrock with red seaweeds and kelp present in the fissures and crevices. *P. vulgata/ulyssiponesis* and *Balanus crenatus* were the dominant fauna found in this biotope (Biotope 9 – LR.MLR.BF.Rho). The *R.floridula* biotope is replaced by *L. digitata* as the transect verges on the sublittoral (Biotope 9 – IR.MIR.KR.Ldig.Ldig). A summary of the biotopes found on MT3 are shown in Table 6, and an aerial photo of the mapped biotopes in Figure 12.

Table 6. Biotopes and descriptions found at MT3.

Biotope No.	Biotope Code	Description
1	LS.LSa.MoSa.BarSa	Barren littoral coarse sand.
2	LR.FLR.Eph.EntPor	*Porphyra purpurea* and *Enteromorpha* spp. On sand-scoured mid or lower eulittoral rock.
3, 4 & 6	LR.MLR.BF.FvesB	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
5	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
7	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
8	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
9	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.
10	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

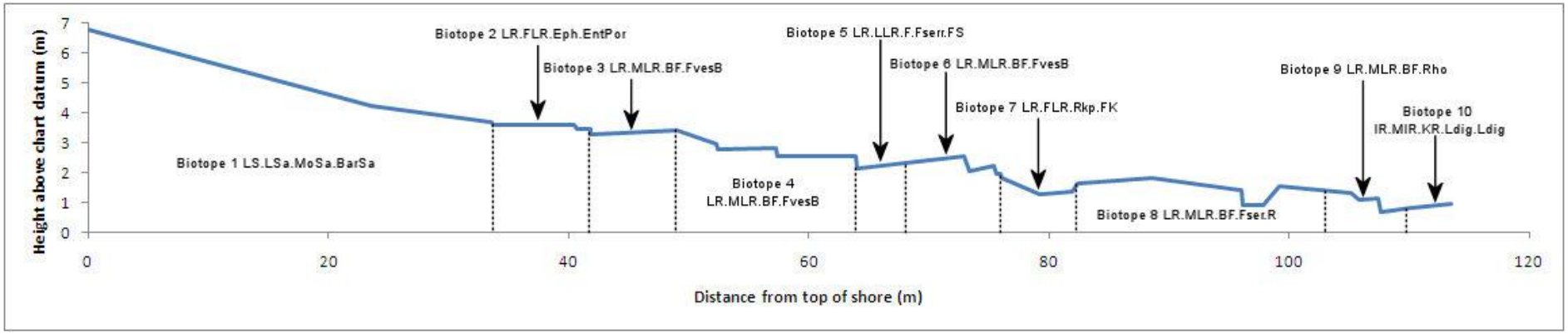
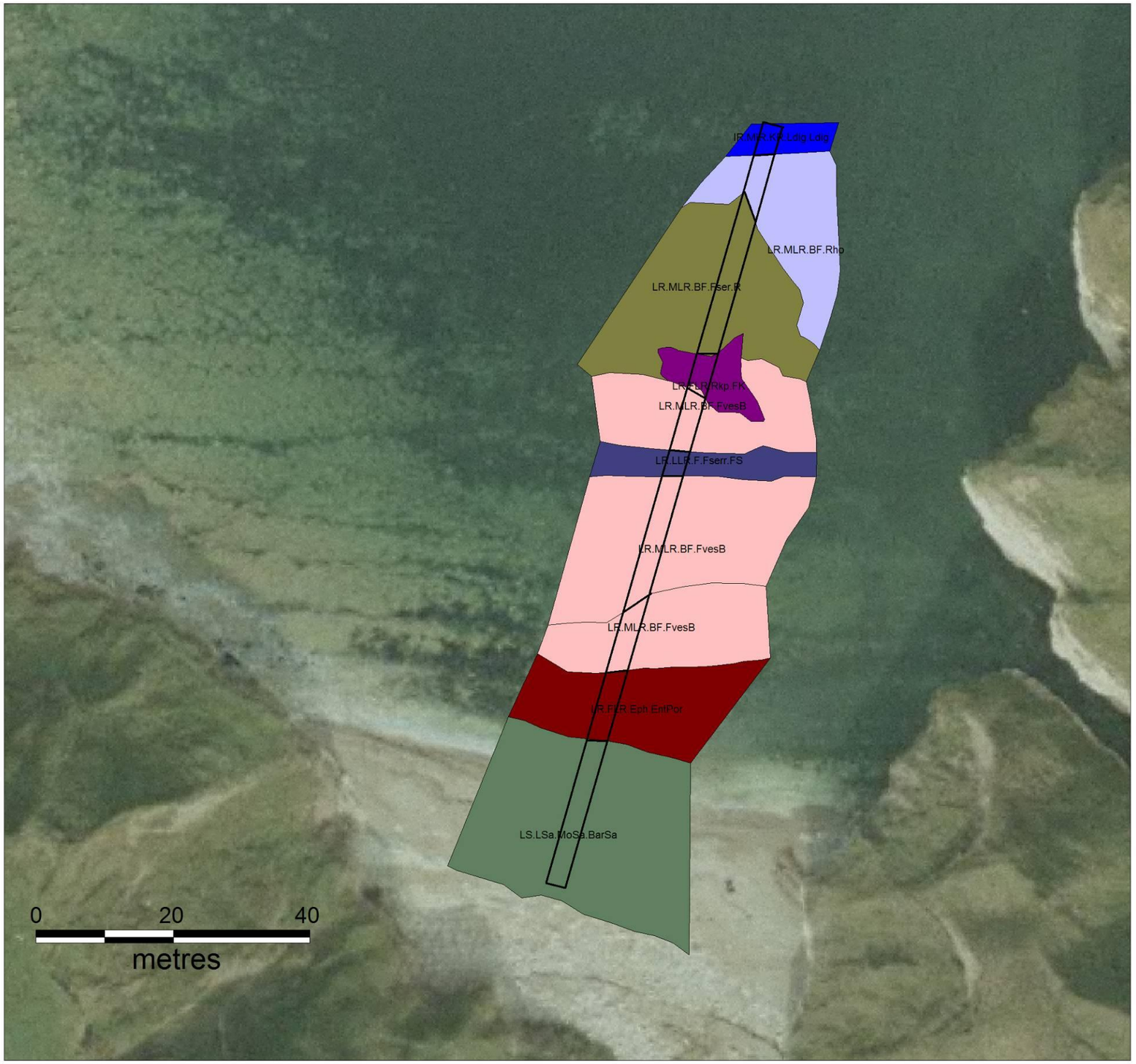


Figure 11. MT3 shore profile.



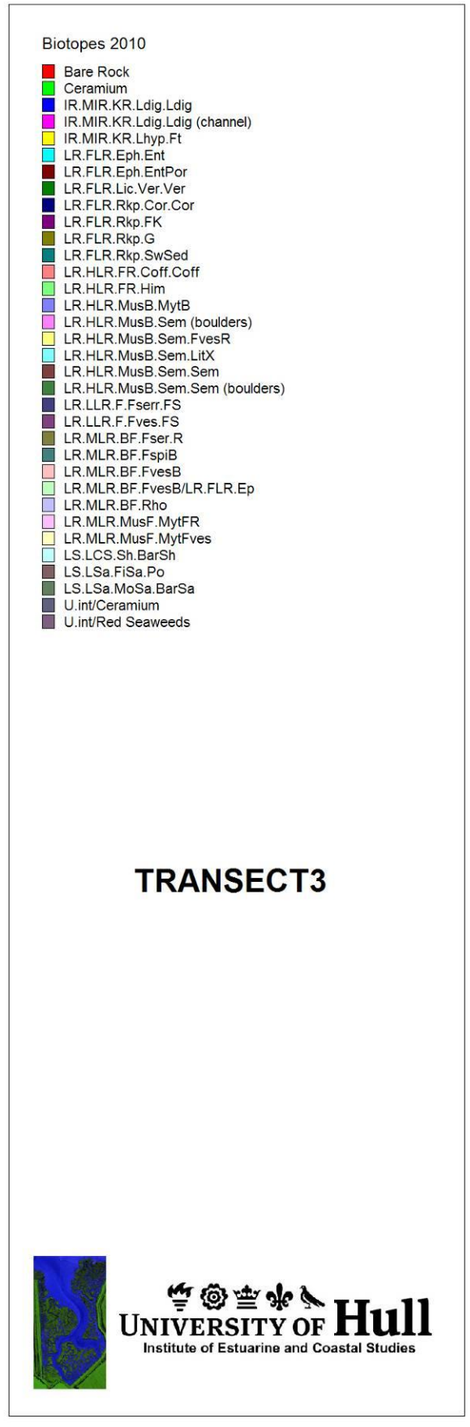


Figure 12. Biotope map of MT3 and vicinity.

3.4 Monitoring Transect 4 – Selwicks Bay

SITE AND BIOTOPE DESCRIPTIONS

MT4 at Selwicks Bay is a moderately exposed bedrock platform shore, the profile of which can be seen in Figure 13. The transect starts in a cave, the upper walls of which are covered in green slime type algae (Biotope 1 – LR.FLR.GvOv.GCv). Below this, *P.vulgata*, *M.neritoides* and *S.balanoides* occur on the caves walls and floor, with *L.arcana/saxatilis* and *M. edulis* in the crevices of the rock (Biotope 2 – LR.HLR.MusB.Sem.Sem). *Algaothamnion*, *Ceramium shuttleworthanium*, and *U. intestinalis* are also present on the walls and crevices of the cave. The bedrock steps down from the cave into an area of smooth bedrock dominated by *U. intestinalis*, *S. balanoides*, *P. vulgata*, and *L. littorea* and *L. saxatilis* (Biotope 3 – LR.FLR.Eph.Ent). A ridge of rock with *S. balanoides* and *P. vulgata* (Biotope 2 – LR.HLR.MusB.Sem.Sem) is sandwiched between Biotope 3 and a bedrock platform with *U. intestinalis* and *F. vesiclosus* (Biotope 4 - LR.MLR.BF.FvesB). *S. balanoides* and *P.vulgata* are common along with *Polydora/Boccardiella*, *L. littorea* and *L. obtusata* within this biotope. Two Raised bedrock platforms of superabundant *S. balanoides*, with abundant *P. vulgata* and sparse red seaweeds (Biotope 5 – LR.HLR.MusB.Sem.FvesR) are found within Biotope 4 and Biotope 7. Below the first rock platform *U. intestinalis* becomes much reduced, and is replaced by a greater diversity of red seaweeds such as *O. pinnatifidula, C.officinalis*, *P. lenormandii* and *C. virgatum*, though *F. vesiculosus* is the most common seaweed. *S. balanoides*, *P.vulgata* and *L.littorea* were found to be abundant with *L. mariae/obtusata* and *Polydora/Boccardiella* being common (Biotope 7 - LR.MLR.BF.FvesB). Below the second raised bedrock platform shallow rockpools dominated by *C.officinalis* (Biotope 6 – LR.FLR.Rkp.Cor.Cor) are present in Biotope 7. Below the largest Corallina pool there is a short area of bedrock where *F. serratus*, *C.officinalis* and *P. lenormandii* are frequent (Biotope 8 – LR.MLR.BF.Fser.R). *Polydora/Boccardiella* are abundant, with *P. vulgata/ulyssiponensis*, *S.balanoides L. mariae/obtusata* and *Thais lapillus* being common in this *F. serratus* biotope. The mat forming *R. floridula* becomes increasingly common moving down the shore mixed with abundant *F. serratus* (Biotope 9 – LR.MLR.BF.Rho), *P. vulgata/ulyssiponensis* and the small gastropods *Lacuna vincta* and *Rissoa parva* being common. A small rockpool containing *L. digitata* is at the lower end of the *Rhodamthamniella* biotope (Biotope 10 - LR.FLR.Rkp.FK), and is in turn replaced by *L. digitata* (Biotope 11 – IR.MIR.KR.Ldig.Ldig) at the end of the transect. A summary of the biotopes found on MT4 are shown in Table 7, and an aerial photo of the mapped biotopes in Figure 14.

Table 7. Biotopes and descriptions found at MT4.

Biotope No.	Biotope Code	Description
1	LR.FLR.GvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
3	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
4 & 7	LR.MLR.BF.FvesB	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
5	LR.HLR.MusB.Sem.FvesR	*Semibalanus balanoides, Fucus vesiculosus* and red seaweeds

		on exposed to moderately exposed eulittoral rock.
6	LR.FLR.Rkp.Cor.Cor	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools
8	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
9	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.
10	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
11	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

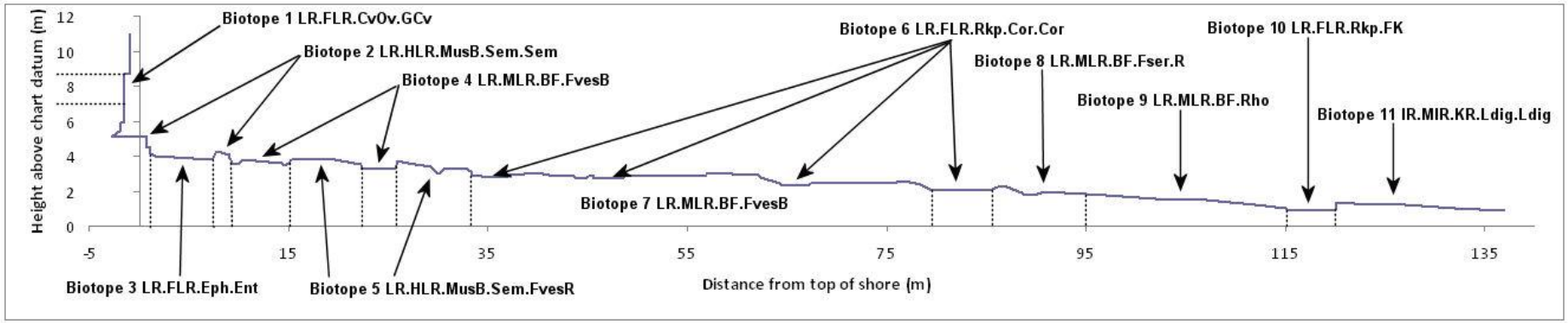


Figure 13. MT4 shore profile.

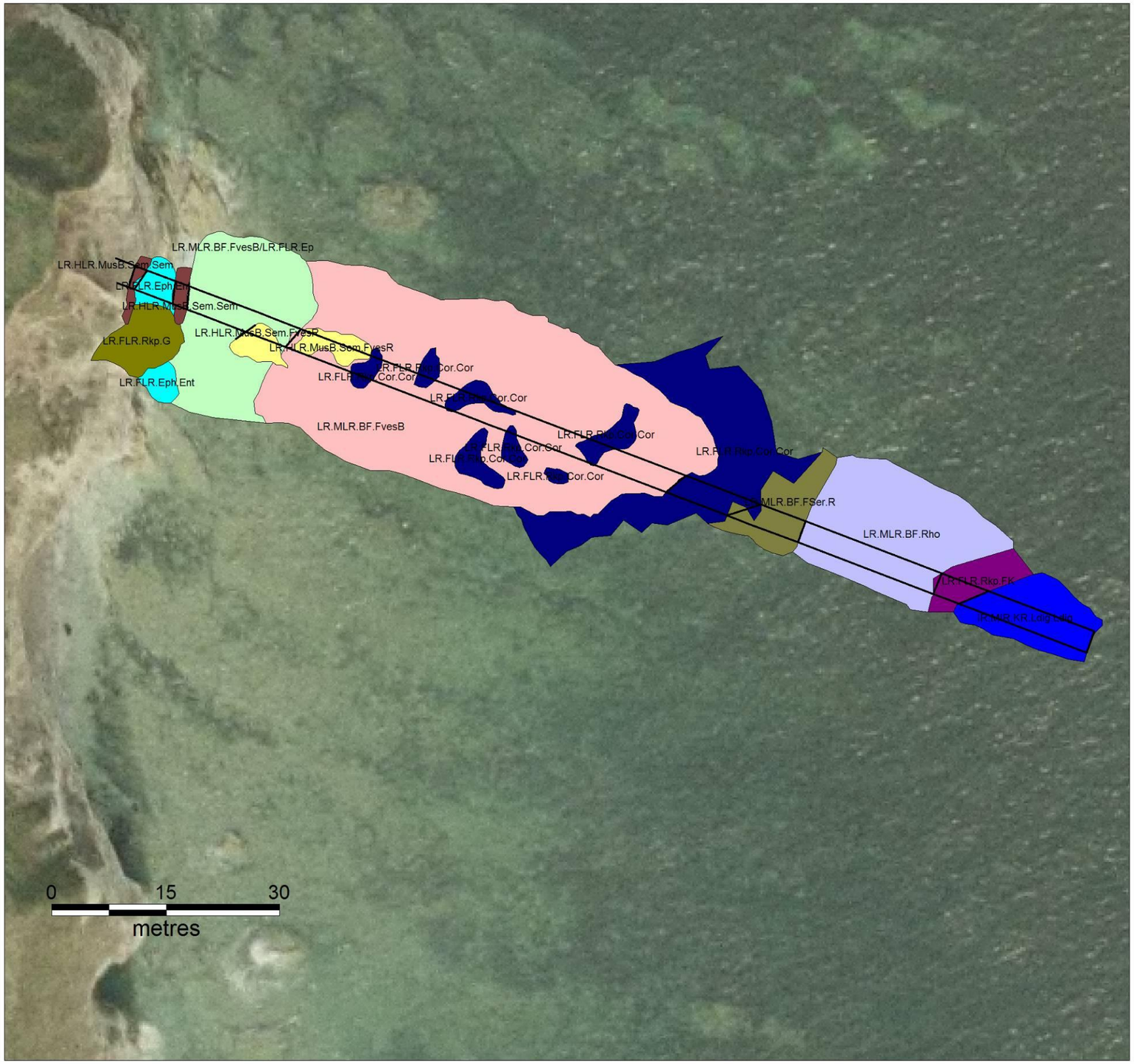


Figure 14. Biotope map of MT4 and vicinity.

3.5 Monitoring Transect 5 – Mathon Nook, Flamborough Head

SITE AND BIOTOPE DESCRIPTIONS

MT5 at Mathon Nook on Flamborough Head is a wave exposed bedrock shore, the profile of which can be seen in Figure 15. The start of the transect backs onto overhanging cliffs, which are covered in green slime type algae from 2.6m to 4.6m above the base of the cliff (Biotope 1 – LR.FLR.CvOv.GCv). Below this to the base of the cliff is a belt dominated by abundant *S. balanoides* and *P.vulgata* with *L. arcana/saxatilis* and *M. neritoides* found to be common (Biotope 2 - LR.HLR.MusB.Sem.Sem). From the base of the cliff along the transect for a couple of metres is smooth bare rock with no flora or fauna, this gives way to a band of *U. intestinalis* covered bedrock with *S.balanoides*, *P. vulgata*, *L. littorea* being common (Biotope 3 – LR.FLR.Eph.Ent). The *U. intestinalis* band is narrow and is replaced by a wider area of flat bedrock dominated by superabundant *S. balanoides*, and abundant *P. vulgata* and *L. littorea* (Biotope 4 – LR.HLR.MusB.Sem.Sem). *O. pinnatifidula* and occasional *F. vesiculosus* occurs on flat but pitted bedrock further down the transect, along with abundant *S. balanoides* and *P. vulgata* (Biotope 5 – LR.HLR.MusB.Sem.FvesR). *L. littorea*, *L. obtusata*, and *Polydora/Boccardiella* were found to be common in Biotope 5. *F. serratus* replaces *F. vesiculosus* as the dominant fucoid as you move down the shore, red seaweeds such as *O. pinnatifidula*, *R. floridula* are frequent. The dominant fauna from this area are the abundant Polydora/Boccardiella and *P.vulgata* and common *L. mariae/obtusata* (Biotope 6 & 7 - LR.MLR.BF.Fser.R). The bedrock raises up to a short platform dominated by *Himanthalia elongata* (Biotope 8 – LR.HLR.FR.Him), with *O. pinnatifidula* frequent. The tiny bivalve *Lasaea adansoni* and gastropod *R. parva* were found to be common with the limpet *Helcion pellucidum* frequent. The bedrock drops back down from the H. elongate platform to an area of abundant *R. floridula* (Biotope 9 – LR.MLR.BF.Rho), then into a sandy floored channel with sparse *L. digitata*. The bedrock rises out of the channel, with the transect running along the edge of another raised bedrock platform. The edges of the platform are dominated by *L. digitata* (Biotope 10 - IR.MIR.KR.Ldig.Ldig), giving way to another area of *R. floridula* on top of the platform (LR.MLR.BF.Rho), before returning to *L.digitata* towards the end of the transect. A summary of the biotopes found on MT5 are shown in Table 8, and an aerial photo of the mapped biotopes in Figure 16.

Table 8. Biotopes and descriptions found at MT5.

Biotope No.	Biotope Code	Description
1	LR.FLR.GvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2 & 4	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
3	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
5	LR.HLR.MusB.Sem.FvesR	Semibalanus balanoides, Fucus vesiculosus and red seaweeds on exposed to moderately exposed eulittoral rock.

6 & 7	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
8	LR.HLR.FR.Him	*Himanthalia elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock
9	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.
10	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

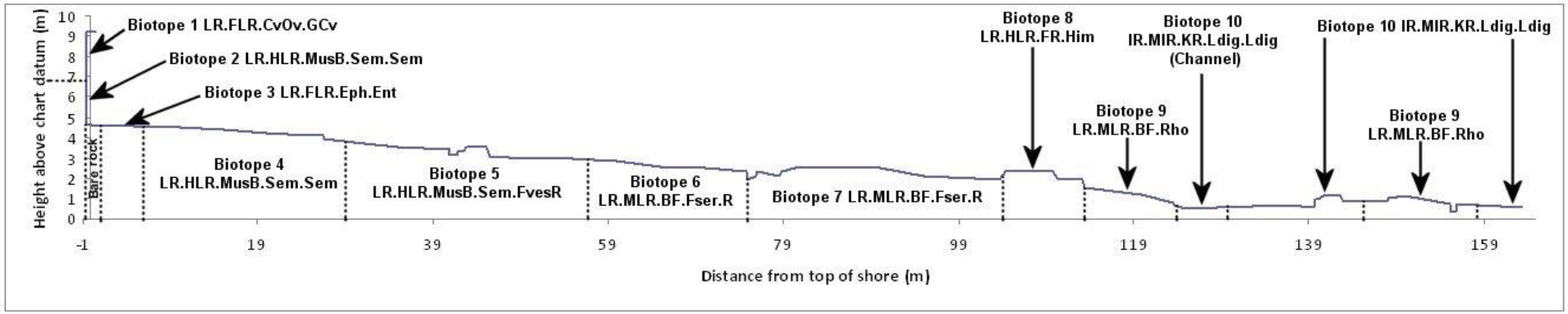
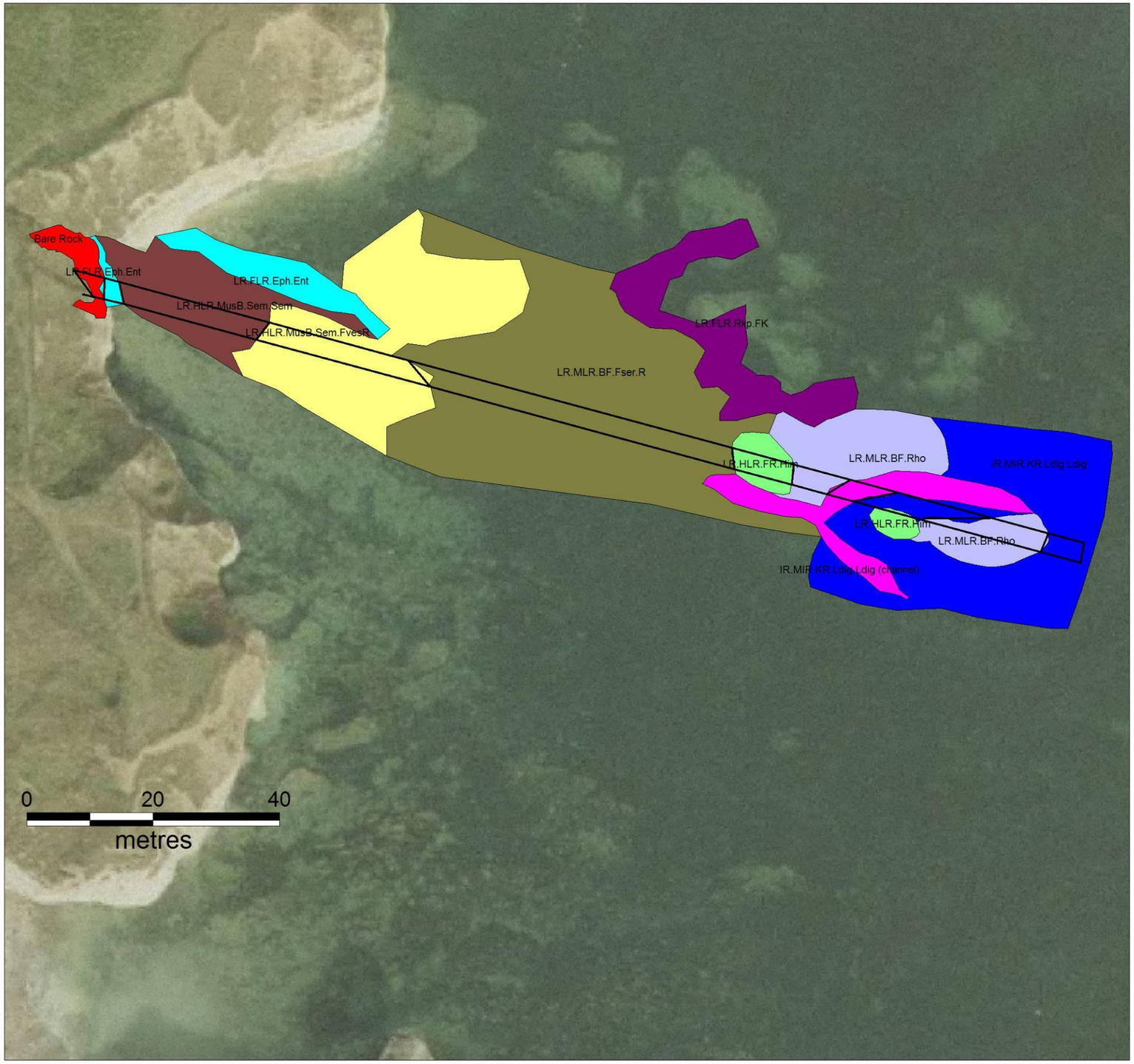


Figure 15. MT5 shore profile.



Biotopes 2010

- Bare Rock
- Ceramium
- IR.MIR.KR.Ldig.Ldig
- IR.MIR.KR.Ldig.Ldig (channel)
- IR.MIR.KR.Lhyp.Ft
- LR.FLR.Eph.Ent
- LR.FLR.Eph.EntPor
- LR.FLR.Lic.Ver.Ver
- LR.FLR.Rkp.Cor.Cor
- LR.FLR.Rkp.FK
- LR.FLR.Rkp.G
- LR.FLR.Rkp.SwSed
- LR.HLR.FR.Coff.Coff
- LR.HLR.FR.Him
- LR.HLR.MusB.MytB
- LR.HLR.MusB.Sem (boulders)
- LR.HLR.MusB.Sem.FvesR
- LR.HLR.MusB.Sem.LitX
- LR.HLR.MusB.Sem.Sem
- LR.HLR.MusB.Sem.Sem (boulders)
- LR.LLR.F.Fserr.FS
- LR.LLR.F.Fves.FS
- LR.MLR.BF.Fser.R
- LR.MLR.BF.FspiB
- LR.MLR.BF.FvesB
- LR.MLR.BF.FvesB/LR.FLR.Ep
- LR.MLR.BF.Rho
- LR.MLR.MusF.MytFR
- LR.MLR.MusF.MytFves
- LS.LCS.Sh.BarSh
- LS.LSa.FiSa.Po
- LS.LSa.MoSa.BarSa
- U.int/Ceramium
- U.int/Red Seaweeds

TRANSECT 5

UNIVERSITY OF Hull
Institute of Estuarine and Coastal Studies

Figure 16. Biotope map of MT5 and vicinity.

3.6 Monitoring Transect 6 – South of Stacks Pinnacle, Flamborough Head

SITE AND BIOTOPE DESCRIPTIONS

MT6 is south of Stacks Pinnacle at Flamborough Head on a moderately exposed bedrock platform shore. The profile of MT6 can be seen in Figure 17. The start of the transect backs onto a shallow cave/overhanging cliff with walls partially covered in green slime type algae and occasional *V. maura* (Biotope 1 - LR.FLR.CvOv.GCv). From the base of the cliff, barren shingle and chalk cobbles with no obvious flora or fauna is present for the first 9m of the transect (Biotope 2 - L LS.LCS.Sh.BarSh). This is replaced by bedrock with a thin layer of sand and shingle, with common *U. intestinalis*, and *P.vulgata* and frequent *F. spiralis*, *L.littorea* and *L. saxatilis* (Biotope 3 – LR.MLR.BF.FspiB). Biotope 3 forms a narrow band above a much broader area of flat bedrock dominated by abundant *L. littorea*, and *S. balanoides* and common *P. vulgata* (Biotope 4 & 5 - LR.HLR.MusB.Sem.FvesR). *F. vesiculosus*, *O. pinnatifidula* and *P. lenormandii* were the most common sea weed species and were found occasionally within the biotope. Within Biotope 4 & 5 shallow rockpools dominated by *C. officinalis* were present (Biotope 6 - LR.FLR.Rkp.Cor.Cor), and the seaward edge of this biotope is delimited by a very large shallow *C. officinalis* pool. Below the large *Corallina* rockpool *F. vesiculosus* becomes common and along with abundant *Polydora/Boccardiella*, and *S. balanoides* and the common *P. vulgata*, *L. littorea* and *L. obtusata* forms Biotope 7 LR.MLR.BF.FvesB. *F. serratus* supersedes *F. vesiculosus* and forms Biotope 8 LR.MLR.BF.Fser.R. The biotope is present on horizontal bedrock and in a shallow channel which the transect then runs through. Dominant faunal species occurring in this biotope are the abundant *L. littorea* and the common *L. mariae/obtusata*, *Pagurus bernhardus* and *P. vulgata/ulyssiponensis*. The dominant flora found in this biotope was *O. pinnatifidula* (frequent), and *C. officinalis*, *F.serratus* (both occasional), along with a high diversity of other seaweeds. The transect then raises up along the edge of a rock platform dominated by abundant *S. balanoides*, common *P. vulgata*, *Polydora/Boccardiella*, *L. littorea*, *L. maria/obtusata* and *Thais lapillus*. Occasional floral species present were *F. vesiculosus*, *O. pinnatifidula*, and *U. intestinalis* and coupled with the fauna forms Biotope 9 LR.HLR.MusB.Sem.FvesR biotope. The transect then drops back into *F. serratus* channel (LR.MLR.BF.Fser.R), and then on to a flat area of bedrock with abundant *U. intestinalis* and very sparse *F. serratus* with red seaweeds such as *C. virgatum* and *C. officinalis*. Dominant fauna were abundant *L. adansoni*, and *Polydora/Boccardiella*, and *P. vulgata/ulyssiponensis* which were common. This area doesn't fit a specific biotope, though is marked as Biotope 10, it is bisected by another *F.serratus*/red seaweed channel (LR.MLR.BF.Fser.R). The *R. floridula* biotope LR.MLR.BF.Rho is found between Biotope 10 and a sand floored rockpool containing red seaweeds and *Laminaria* (Biotope 12 – LR.FLR.Rkp.SwSed). The *R. floridula* is dominant for short distance below the rockpool but replaced by abundant *C. officinalis* and common *L. digitata* and *Lithothamnion glaciale* giving Biotope 13 LR.HLR.FR.Coff.Coff. Below the *Corallina* biotope, at the end of the transect, the *L. digitata* Biotope 14. IR.MIR.KR.Ldig.Ldig is present. A summary of the biotopes found on MT6 are shown in Table 9, and an aerial photo of the mapped biotopes in Figure 18.

Table 9. Biotopes and descriptions found at MT6.

Biotope No.	Biotope Code	Description
1	LR.FLR.GvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2	LS.LCS.Sh.BarSh	Barren littoral shingle.
3	LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock
4, 5 & 9	LR.HLR.MusB.Sem.FvesR	Semibalanus balanoides, Fucus vesiculosus and red seaweeds on exposed to moderately exposed eulittoral rock.
6	LR.FLR.Rkp.Cor.Cor	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools
7	LR.MLR.BF.FvesB	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
8	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
10	?	*U. intestinalis and mixed red seaweeds on bedrock.*
11	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.
12	LR.FLR.Rkp.SwSed	Seaweeds in sediment-floored eulittoral rockpools
13	LR.HLR.FR.Coff.Coff	*Corallina officinalis* and *Mastocarpus stellatus* on exposed to moderately exposed lower eulittoral rock
14	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

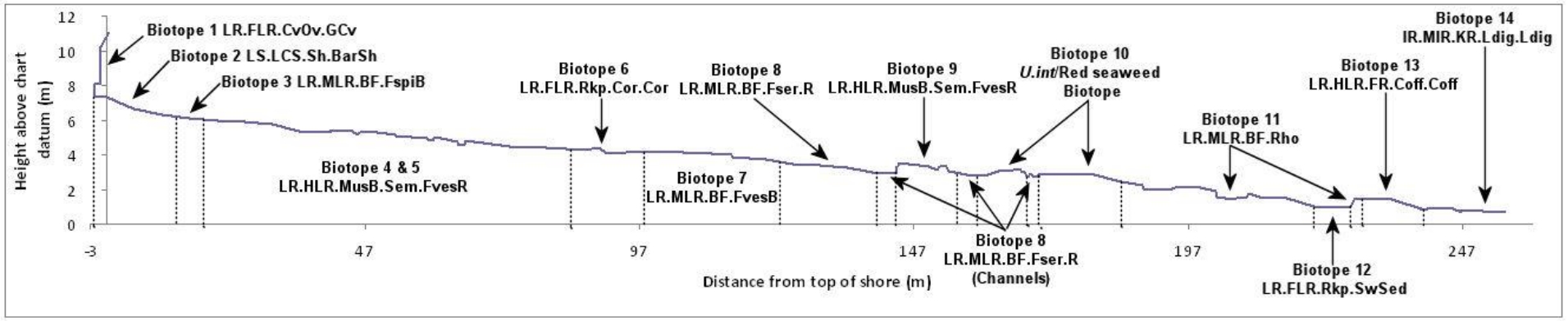
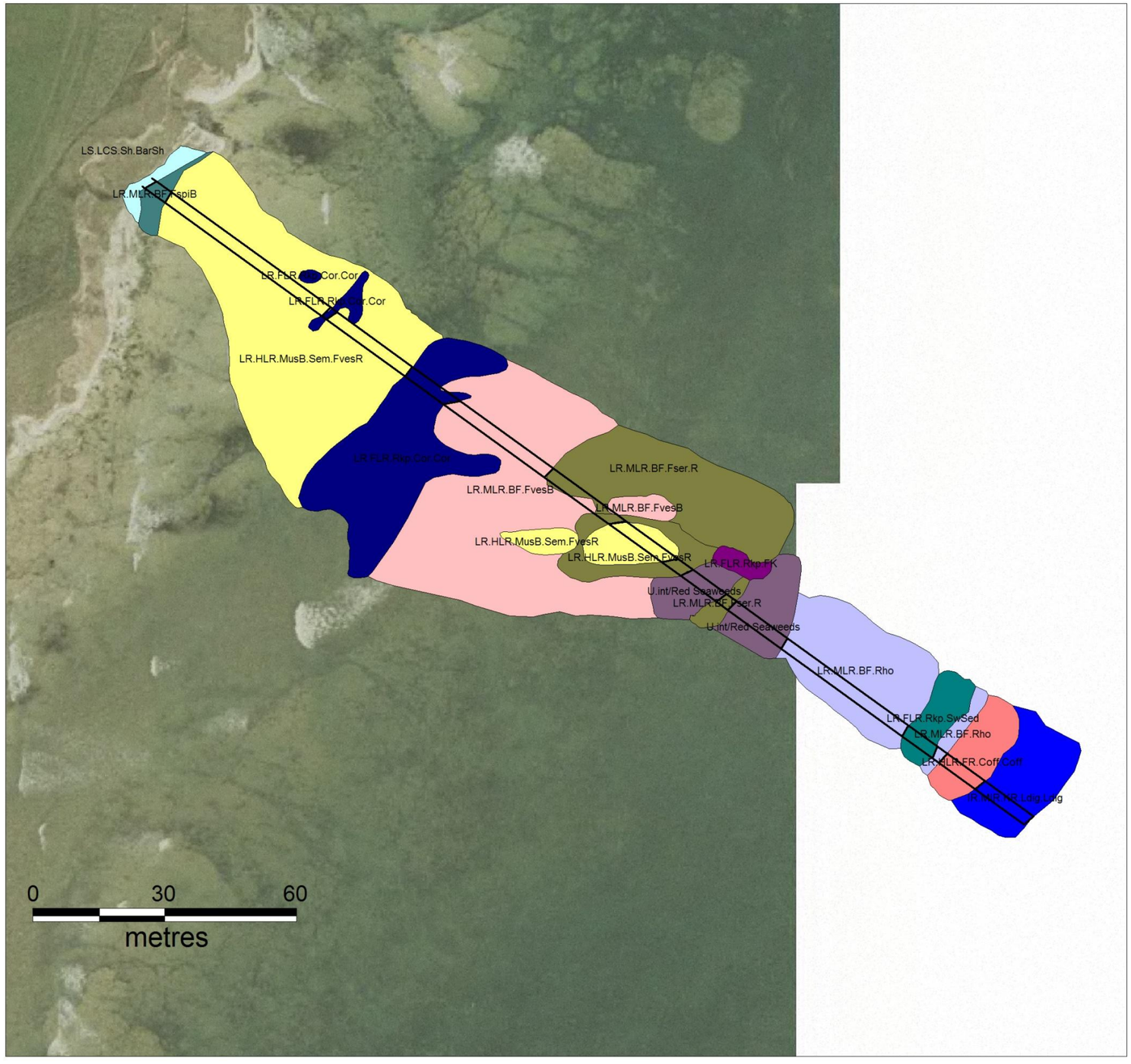


Figure 17. MT6 shore profile.



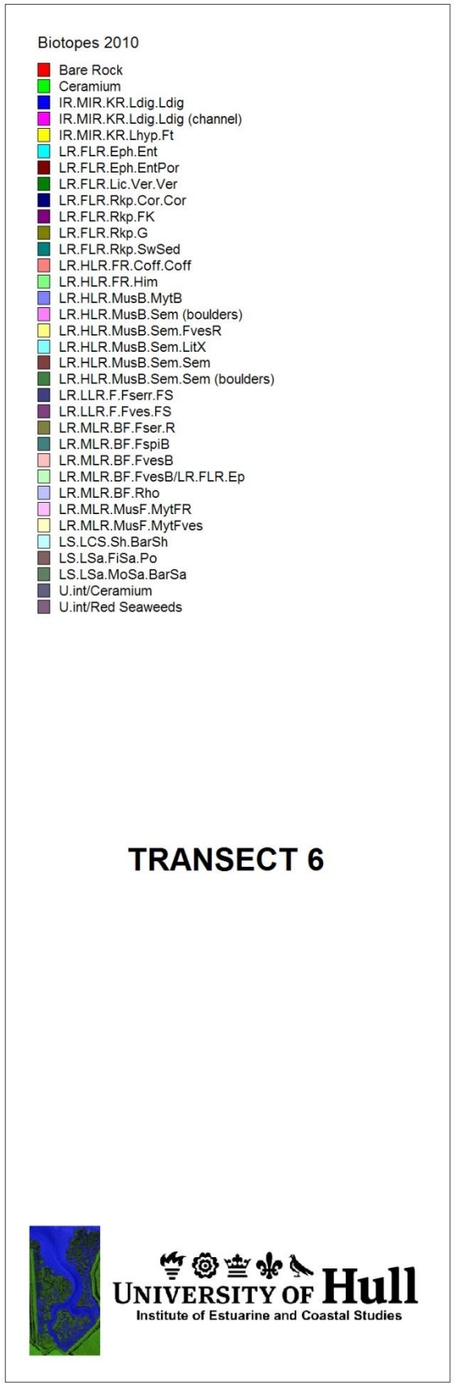


Figure 18. Biotope map of MT6 and vicinity

3.7 Monitoring Transect 8 – South Cliff, Sewerby

SITE AND BIOTOPE DESCRIPTIONS

MT8 at South Cliff, Sewerby is a moderately exposed bedrock platform shore. The profile of MT8 can be seen in Figure 19. The first 10m of the transect is a barren shingle beach with chalk cobbles, with amphipoda occurring rarely (Biotope 1 - LS.LCS.Sh.BarSh). This is followed by a narrow band of *U. intestinalis* on cobbles, and sand covered bedrock (Biotope 2 – LR.FLR.Eph.Ent). Below this an area of sand covered bedrock with frequent *F. vesiculosus* and occasional *U. intestinalis*, *Gammarus* and *L. obtusata* is present (Biotope 3 – LR.MLR.BF.FvesB). Moving down the shore, less sand smothers the bedrock allowing *Polydora/Boccardiella* to become abundant and *S. balanoides* and *P. vulgata* and *U. intestinalis* to become common (Biotope 4 – LR.HLR.MusB.Sem.Sem). Below Biotope 4, *S. balanoides* becomes superabundant, and along with common *P. vulgata* and *Polydora/Boccardiella* and rare *F. vesiculosus* and red seaweeds, form Biotope 5 LR.HLR.MusB.Sem.FvesR. *F. vesiculosus* becomes abundant on the flat bedrock, and along with *S. balanoides* and *P. vulgata* numbers dropping to frequent, forms Biotope 6 LR.LLR.Fves.FS. The lower limit of Biotope 6 is a green algae dominated rockpool, within which *L. littorea*, *U. intestinalis* and *C. virgatum* were common and *U. lactuca* frequent (Biotope 7 – LR.FLR.Rkp.G). The green algae rockpool forms the upper limit of a *F. serratus* biotope LR.LLR.F.Fserr.FS (Biotope 8), characterised by superabundant *F. serratus* and low diversity and abundance of red seaweed. Below the dense *F.serratus* biotope is an area of bedrock covered in mixed sediment, where *C. virgatum*, *L. littorea* and *Polydora/Boccardiella* are common, with *Chondrus crispus* frequent. This does not fit a specific biotope description though is recorded as Biotope 9. The mat forming red algae *R. floridula* is then the dominant algae species along with *C. virgatum* forming Biotope 10 LR.MLR.BF.Rho. *Polydora/Boccardiella* were found to be superabundant in this biotope, with *L. littorea* and *A. equine* frequent. The *Rhodothamniella* biotope continues into the sublittoral zone at the end of the transect. A summary of the biotopes found on MT8 are shown in Table 10, and an aerial photo of the mapped biotopes in Figure 20.

Table 10. Biotopes and descriptions found at MT8.

Biotope No.	Biotope Code	Description
1	LS.LCS.Sh.BarSh	Barren littoral shingle.
2	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
3	LR.MLR.BF.FvesB	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
4	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
5	LR.HLR.MusB.Sem.FvesR	Semibalanus balanoides, Fucus vesiculosus and red seaweeds on exposed to moderately exposed eulittoral rock.
6	LR.LLR.Fves.FS	*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock

7	LR.FLR.Rkp.G	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools
8	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
9	?	*Ceramium on bedrock.*
10	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock.

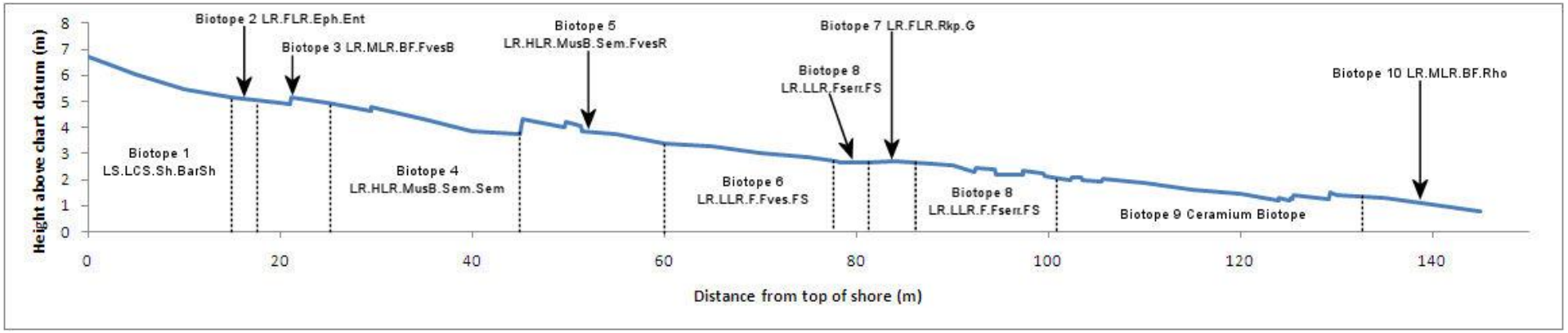
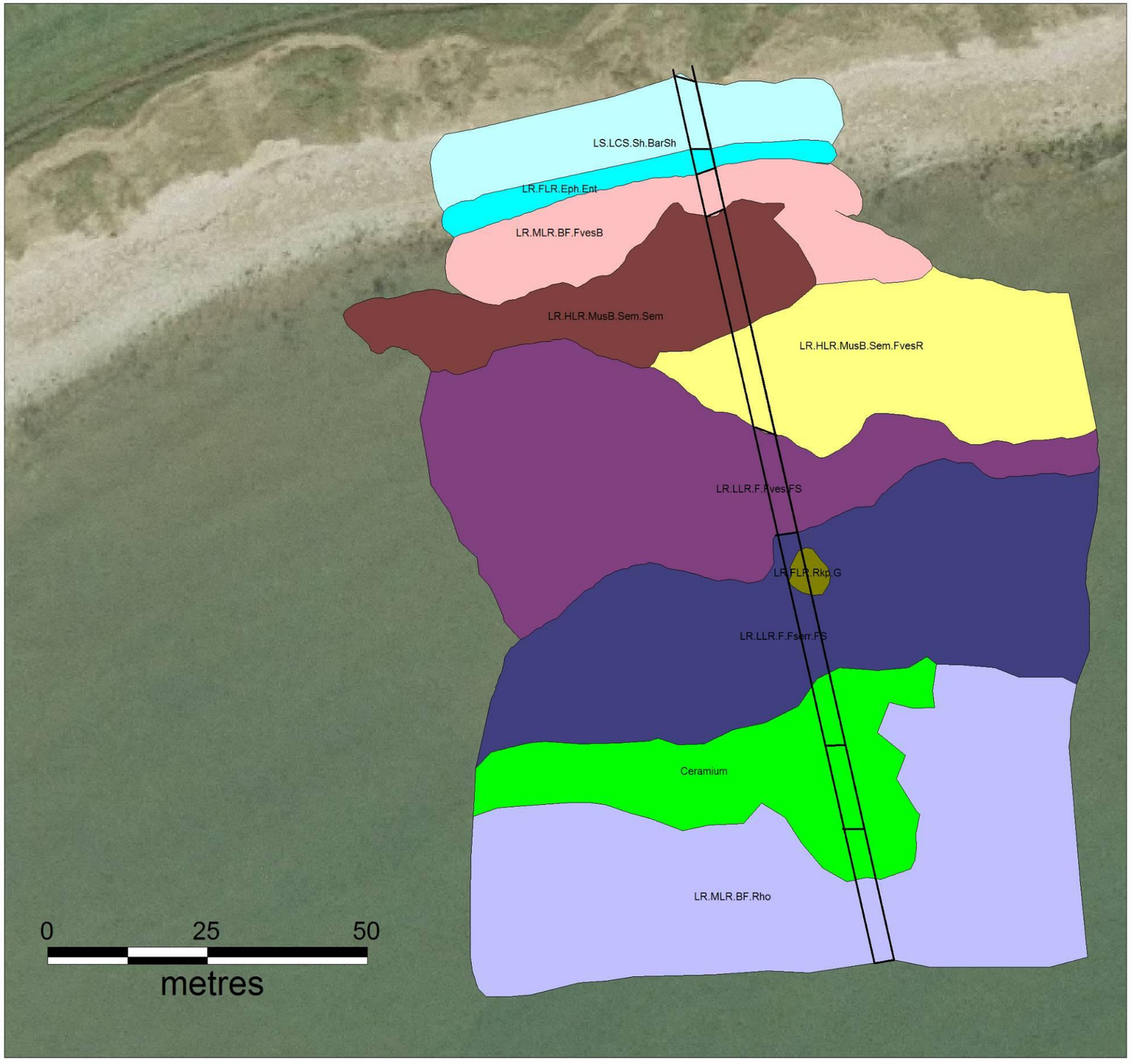


Figure 19. MT8 shore profile.



Biotopes 2010

- Bare Rock
- Ceramium
- IR.MIR.KR.Ldig.Ldig
- IR.MIR.KR.Ldig.Ldig (channel)
- IR.MIR.KR.Lhyp.Ft
- LR.FLR.Eph.Ent
- LR.FLR.Eph.EntPor
- LR.FLR.Lic.Ver.Ver
- LR.FLR.Rkp.Cor.Cor
- LR.FLR.Rkp.FK
- LR.FLR.Rkp.G
- LR.FLR.Rkp.SwSed
- LR.HLR.FR.Coff.Coff
- LR.HLR.FR.Him
- LR.HLR.MusB.MytB
- LR.HLR.MusB.Sem (boulders)
- LR.HLR.MusB.Sem.FvesR
- LR.HLR.MusB.Sem.LitX
- LR.HLR.MusB.Sem.Sem
- LR.HLR.MusB.Sem.Sem (boulders)
- LR.LLR.F.Fserr.FS
- LR.LLR.F.Fves.FS
- LR.MLR.BF.Fser.R
- LR.MLR.BF.FspiB
- LR.MLR.BF.FvesB
- LR.MLR.BF.FvesB/LR.FLR.Ep
- LR.MLR.BF.Rho
- LR.MLR.MusF.MytFR
- LR.MLR.MusF.MytFves
- LS.LCS.Sh.BarSh
- LS.LSa.FiSa.Po
- LS.LSa.MoSa.BarSa
- U.int/Ceramium
- U.int/Red Seaweeds

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Figure 20. Biotope map of MT8 and vicinity.

3.8 Monitoring Transect 9 – Sewerby Rocks, Sewerby

SITE AND BIOTOPE DESCRIPTIONS

MT9 at Sewerby Rocks is a mixed sand and sand scoured rock shore, the profile of which can be seen in Figure 21. Barren shingle and cobbles (Biotope 1 LS.LCS.LSh.BarSh) are at the top of the shore for the first 10m followed by a 2m strip of barren sand (Biotope 2 – LS.LSa.MoSa.BarSa). Below this outcrops of bedrock from the sand are populated by *F. vesiculosus* and *L. obtusata*, both common with amphipoda frequent. *M. edulis*, *P. vulgata*, *S. balanoides* and *L .littorea* were all occasional in abundance (Biotope 3 LR.MLR.BF.FvesB). The bedrock below Biotope 3 becomes much less smothered in sand, and *M. edulis*, and *S. balanoides* become abundant (Biotope 4 - LR.MLR.MusF.Myt.Fves) then common (Biotope 5 – LR.MLR.MusF.MytFves). There are sparse red seaweed and *F. vesiculosus* in both Biotope 4 and 5. Moving down the transect the red seaweed and *F. vesiculosus* disappear and *M. edulis* becomes abundant resulting in Biotope 6 LR.HLR.MusB.MytB. Sparse red seaweed *O. pinnatifidula* and *C. crispus* then become occasional on the bedrock with superabundant *M. edulis*, and abundant *Polydora/Boccardiella*, *S. balanoides* and *L. littorea* forming Biotope 7 - LR.MLR.MusF.MytFR. Biotope 7 forms the lower limit of the extensive mussel bed on the transect, and is replaced by a small area of bedrock and cobbles covered in a thin layer of fine sand/silt. *Polydora/Boccardiella* were found to abundant, and *L*. *littorea* and *S. balanoides* common to give Biotope 8 LR.HLR.MusB.Sem.LitX. Below Biotope 8 is an area of boulders, cobbles on bedrock dominated by the abundant *Polydora/Boccardiella*, and the common *Balanus crenatus*, *U. intestinalis* and *C. virgatum* (Biotope 9?). A rippled sand biotope (Biotope 10 - LS.Lsa.FiSa.Po).extends from the lower limit of Biotope 10 to the end of the transect. A summary of the biotopes found on MT9 are shown in Table 11, and an aerial photo of the mapped biotopes in Figure 22

Table 11. Biotopes and descriptions found at MT9.

Biotope No.	Biotope Code	Description
1	LS.LCS.Sh.BarSh	Barren littoral shingle.
2	LS.LSa.MoSa.BarSa	Barren littoral coarse sand.
3	LR.MLR.BF.FvesB	*Semibalanus balanoides, Patella vulgata* and *Littorina* spp.on exposed to moderately exposed or vertical sheltered eulittoral rock.
4 & 5	LR.MLR.MusF.Myt.Fves	*Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock
6	LR.HLR.MusB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock
7	LR.MLR.MusF.MytFR	*Mytilus edulis, Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
8	LR.HLR.MusB.Sem.LitX	*Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles

9	?	*U.intestinalis and Ceramium on cobbles and bedrock.*
10	LS.LSa.FiSa.Po	Polychaetes in littoral fine sand

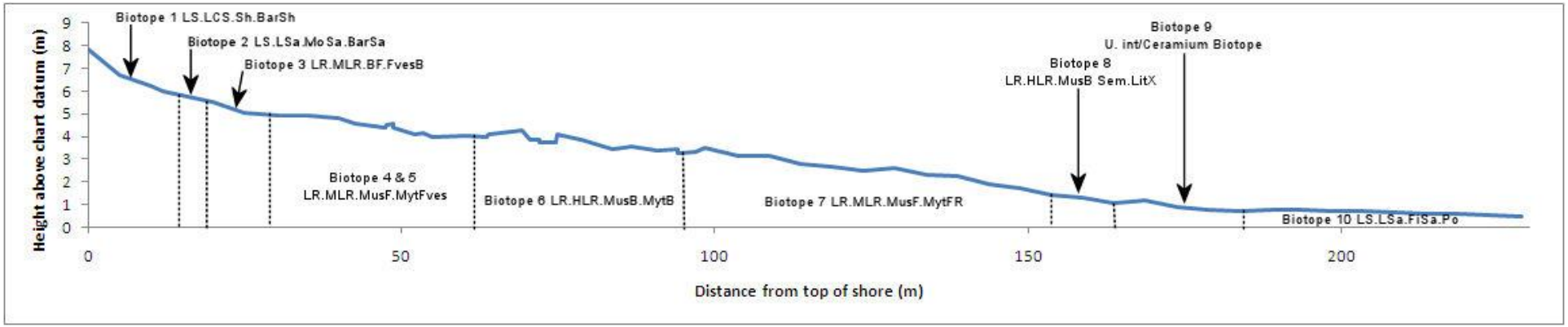

Figure 21. MT9 shore profile.

Biotopes 2010

- Bare Rock
- Ceramium
- IR.MIR.KR.Ldig.Ldig
- IR.MIR.KR.Ldig.Ldig (channel)
- IR.MIR.KR.Lhyp.Ft
- LR.FLR.Eph.Ent
- LR.FLR.Eph.EntPor
- LR.FLR.Lic.Ver.Ver
- LR.FLR.Rkp.Cor.Cor
- LR.FLR.Rkp.FK
- LR.FLR.Rkp.G
- LR.FLR.Rkp.SwSed
- LR.HLR.FR.Coff.Coff
- LR.HLR.FR.Him
- LR.HLR.MusB.MytB
- LR.HLR.MusB.Sem (boulders)
- LR.HLR.MusB.Sem.FvesR
- LR.HLR.MusB.Sem.LitX
- LR.HLR.MusB.Sem.Sem
- LR.HLR.MusB.Sem.Sem (boulders)
- LR.LLR.F.Fserr.FS
- LR.LLR.F.Fves.FS
- LR.MLR.BF.Fser.R
- LR.MLR.BF.FspiB
- LR.MLR.BF.FvesB
- LR.MLR.BF.FvesB/LR.FLR.Ep
- LR.MLR.BF.Rho
- LR.MLR.MusF.MytFR
- LR.MLR.MusF.MytFves
- LS.LCS.Sh.BarSh
- LS.LSa.FiSa.Po
- LS.LSa.MoSa.BarSa
- U.int/Ceramium
- U.int/Red Seaweeds

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Figure 22. Biotope map of MT9 and vicinity

4. DISCUSSION AND RECOMMENDATIONS

4.1 Monitoring Transect 1 – North Landing

COMPARISON WITH 2001 SURVEY.

Table 12. Biotopes recorded at MT1 in 2001 and there updated codes.

Habitat	Old Descriptions			New Descriptions	
1	LR.OV.GCv	Green algal films on upper and mid-shore cave walls and ceilings	=	LR.FLR.CvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2	LR.SLR.F.Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock	>	LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock
3	LR._.L.Ver.Ver	*Verrucaria maura* on moderately exposed to very sheltered upper littoral fringe rock	=	LR.FLR.Lic.Ver.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock
4,5,6	LR.ELR.MB.BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	>	LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
6a	LR._.Rkp.Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools	=	LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools
6b	LR._.Rkp.FK	Fucoids and kelps in deep eulittoral rockpools	=	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
6c	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
7	LR.MLR.Eph.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	=	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock
8	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock	=	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

The map of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 23. and Table 12. A direct comparison to the biotopes from

2010 based on distance along the shore transect can be seen in Table 13. The 2001 biotopes recorded from MT1 in 2010 are generally very similar to 2001. The main differences found were the lichen biotope LR.FLR.Ver.Ver replaced the green slime cave biotope LR.FLR.CvOv.GCv, and the ephemeral *Enteromorpha* biotope LR.FLR.Eph.Ent replaced the *Fucus spiralis* biotope LR.MLR.BF.FspiB. The deeper rockpool was recorded as a fucoid/kelp pool LR.FLR.Rkp.FK in 2001, whereas in 2010 it was dominated by green algae *Ulva lactuca*, giving a biotope of LR.FLR.Rkp.G. The *Semibalanus* biotope LR.HLRMusB.Sem was subdivided into the sub biotopes Sem.FvesR and Sem.Sem in 2010 whereas only Sem.Sem was recorded in 2001.

Table 13. Comparison of biotopes found in 2010 and 2001 at MT1.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LR.FLR.Lic.Ver.Ver	LR.FLR.CvOv.GCv (Biotope 1)
2	LR.FLR.Eph.Ent	LR.MLR.BF.FspiB (Biotope 2)
3	LR.FLR.Lic.Ver.Ver	LR.FLR.Lic.Ver.Ver (Biotope 3)
4	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 4)
5	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 5)
6	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem (Biotope 6)
7	LR.FLR.Rkp.Cor.Cor	LR.FLR.Rkp.Cor (Biotope 6a)
8	LR.FLR.Rkp.G	LR.FLR.Rkp.FK (Biotope 6b)
9	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem.Sem (Biotope 6c)
10	LR.MLR.BF.Rho	LR.MLR.BF.Rho (Biotope 7)
11	IR.MIR.KR.Ldig.Ldig	IR.MIR.KR.Ldig.Ldig (Biotope 8)

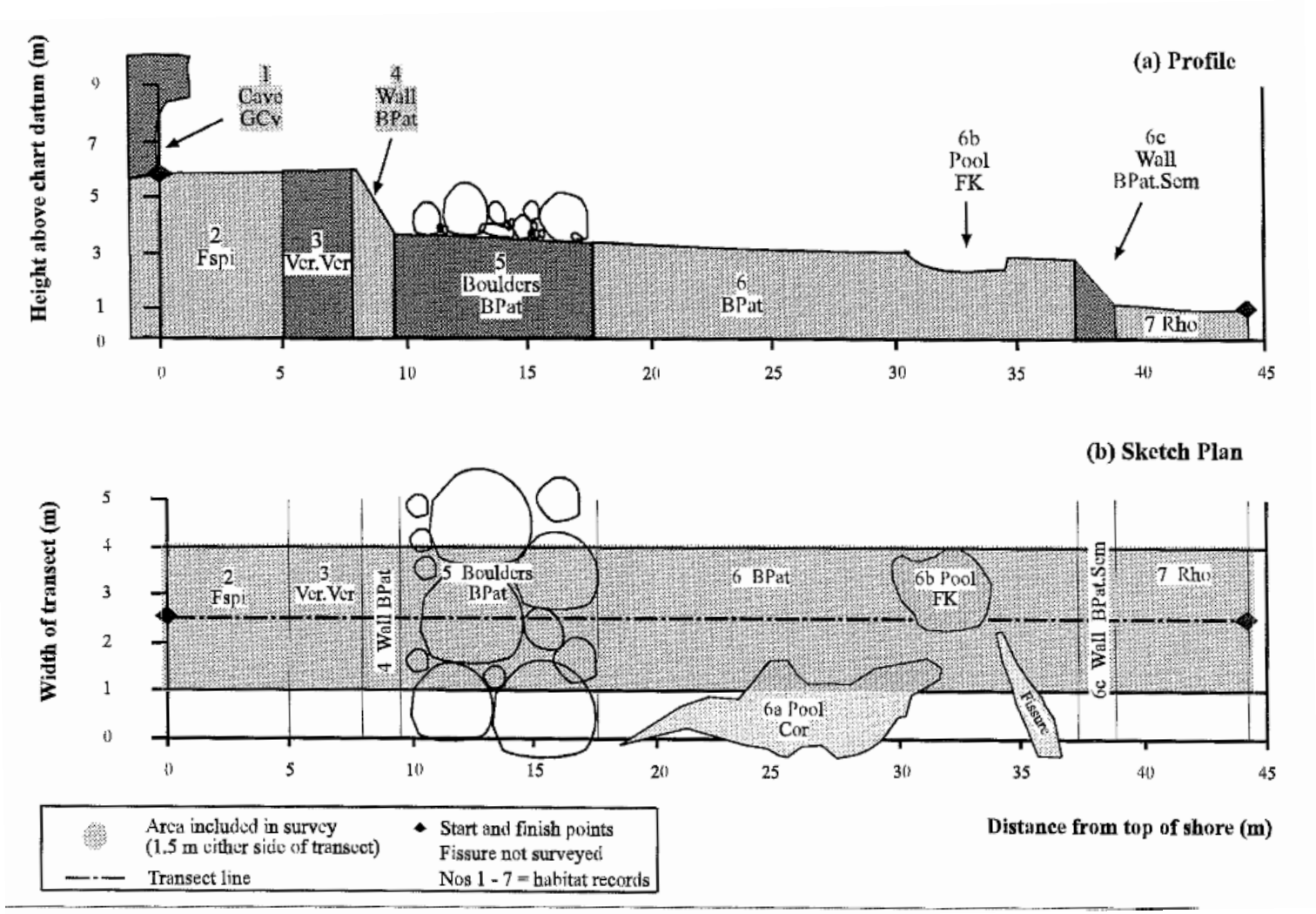

Figure 23. MT1 shore profile from 2001.

4.2 Monitoring Transect 2 – Thornwick Nab

COMPARISON WITH 2001 SURVEY.

Table 14. Biotopes recorded at MT2 in 2001 and there updated codes.

Habitat	Old descriptions			New Descriptions	
1	LR.MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
2,4	LR.ELR.MB.BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	>	LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
3	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
5,6	LR.ELR.MB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock	=	LR.HLR.MusB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock
5a	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
5b	LR._.Rkp.Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools	=	LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools
7	LR.MLR.MytFR	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	=	LR.MLR.MusF.MytFR	*Mytilus edulis, Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
7a	IR.EIR.KFaR.Ala.Ldig	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock	=	IR.HIR.KFaR.Ala.Ldig	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock

The map of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 24, and Table 14. A direct comparison to the biotopes from 2010 based on distance along the shore transect can be seen in Table 15. The biotopes recorded at the top of the shore in 2010 were broadly similar to the biotopes recorded in 2001with LR.FLR.Eph.Ent, LR.HLR.MusB.Sem, LR.HLR.MusB.Sem.Sem, LR.HLR.MusB recorded in 2001, compared with LR.FLR.Eph.Ent and LR.HLR.Sem.Sem recorded over the same area. Below this the *Mytilus* biotope LR.HLR.MusB.MytB was recorded in 2001, whereas the *Semibalanus* biotope LR.HLR.Sem.FvesR was recorded in 2010 over the same area along the transect. However, LR.HLR.MusB.MytB was recorded adjacent to the transect in a raised rock area as in 2001. In 2001 the LR.HLR.MusB.MytB biotope is replaced by a vertical wall of *L. digitata* (IR.MIR.KR.Ldig.Ldig?), followed by the *Mytilus*/red seaweed biotope LR.MLR.MusF.MytFR and subsequently by the *A. esculenta* biotope IR.HIR.KFaR.Ala.Ldig. Over the same area of the transect in 2010, the *L. digitata*

biotope IR.MIR.KR.Ldig.Ldig was recorded and subsequently replaced by a *L. hyperborea* biotope LR.MIR.KR.Lhyp into the sublittoral zone.

Table 15. Comparison of biotopes found in 2010 and 2001 at MT2

Biotope No.	2010 Biotopes	2001 Biotopes
1	LR.FLR.Eph.Ent	LR.FLR.Eph.Ent (Biotope 1)
2	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 2)
		LR.HLR.MusB.Sem.Sem (Biotope 3)
3	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 4)
4	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.MytB Biotope 5 & 6)
5	LR.FLR.Rkp.Cor.Cor	LR.FLR.Rkp.Cor (Biotope 5b)
6	IR.MIR.KR.Ldig.Ldig	LR.MLR.MusF.MytFR (Biotope 7)
		IR.HIR.KFaR.Ala.Ldig (Biotope 8)
7	IR.MIR.KR.Lhyp	IR.HIR.KFaR.Ala.Ldig (Biotope 8)

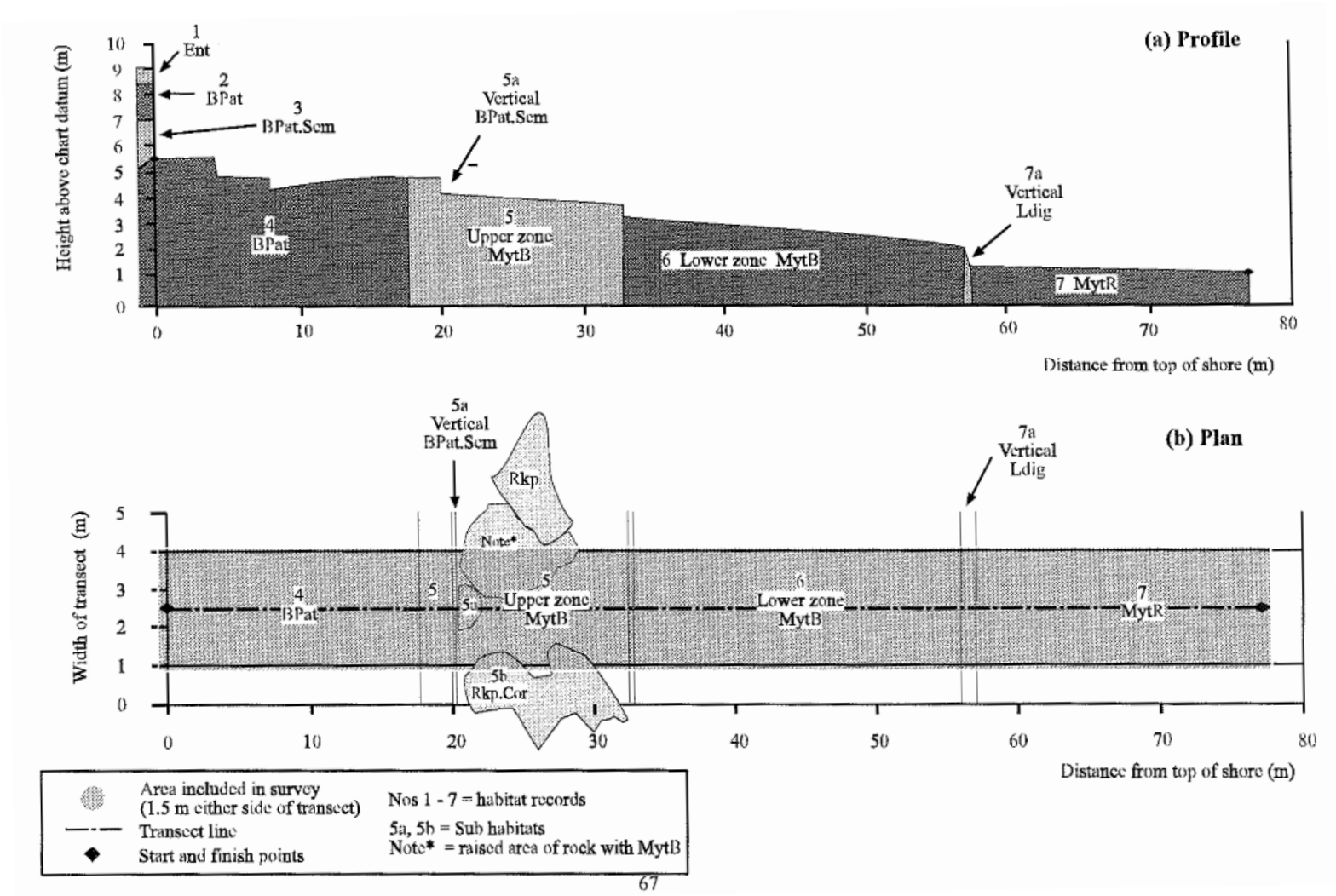

Figure 24. MT2 shore profile from 2001.

4.3 Monitoring Transect 3 – Thornwick Bay

COMPARISON WITH 2001 SURVEY.

Table 16. Biotopes recorded at MT3 in 2001 and there updated codes.

Habitat	Old descriptions			New Descriptions	
10,9,8	LR.MLR.Eph.Ent	*Enteromorpha* spp. On freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. On freshwater-influenced and/or unstable upper eulittoral rock
9,8,7,4	LR.SLR.F.Fves	*Fucus vesiculosus* on sheltered mid eulittoral rock	>	LR.LLR.F.Fves	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock
6	LR._.Rkp.FK	Fucoids and kelps in deep eulittoral rockpools	=	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
5, 3	LR.MLR.BF.Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	≈	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
2	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	=	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
1	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock	=	IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 25, and Table 16. A direct comparison to the biotopes from 2010 based on distance along the shore transect can be seen in Table 17. Transect 3 showed similar biotopes in 2010 as it did in 2001. A sandy beach (biotope not recorded in 2001) followed by a band of *U. intestinalis* on bedrock and cobbles, and *F. vesiculosus* was recorded in both years. In 2001 the biotopes recorded were LR.FLR.Eph.Ent, LR.FLR.Eph.Ent/LR.LLR.F.Fves and LR.LLR.F.Fves, when compared to the same area of the transect in 2010 the similar biotopes LR.FLR.Eph.EntPor, and LR.MLR.BF.FvesB were recorded. In 2010 the *F. vesiculosus* is split by a narrow band of the *F. serratus* biotope LR.LLR.F.Fserr.FS in a sheltered gully above the fucoid dominated rockpool, whereas in 2001 the same biotope splits the *F.vesiculosus* below the rockpool. Below the *F.vesiculosus*, in the 2010 survey is the *F. serratus*/red seaweed biotope LR.MLR.BF.Fserr.R, which also occurs in 2001 but a band of the biotope LR.LLR.F.Fserr.FS is sandwiched in between. The *F. serratus*/red seaweed biotope is replaced by the *L. digitata* biotope IR.MIR.KR.Ldig.Ldig in the 2001 survey, however in 2010 there was a band of the *R.floridula* biotope LR.MLR.BF.Rho below the *F. serratus* and above the *L. digitata* biotope.

Table 17. Comparison of biotopes found in 2010 and 2001 at MT3.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LS.Lsa.MoSa.BarSa	No Biotope
2	LR.FLR.Eph.EntPor	LR.FLR.Eph.Ent (Biotope 10)
		LR.LLR.F.Fves/LR.FLR.Eph.Ent (Biotope 9)
3	LR.MLR.BF.FvesB	LR.LLR.F.Fves/LR.FLR.Eph.Ent (Biotope 8)
4	LR.MLR.BF.FvesB	LR.LLR.F.Fves (Biotope 7)
5	LR.LLR.F.Fserr.FS	LR.LLR.F.Fves (Biotope 7)
6	LR.MLR.BF.FvesB	LR.LLR.F.Fves (Biotope 7)
7	LR.FLR.Rkp.FK	LR.FLR.Rkp.FK (Biotope 6)
8	LR.MLR.BF.Fser.R	LR.LLR.F.Fserr.FS (Biotope 5)
		LR.LLR.F.Fves (Biotope 4)
		LR.LLR.F.Fserr.FS (Biotope 3)
9	LR.MLR.BF.Rho	LR.MLR.BF.Fser.R (Biotope 2)
10	IR.MIR.KR.Ldig.Ldig	IR.MIR.KR.Ldig.Ldig (Biotope 1)

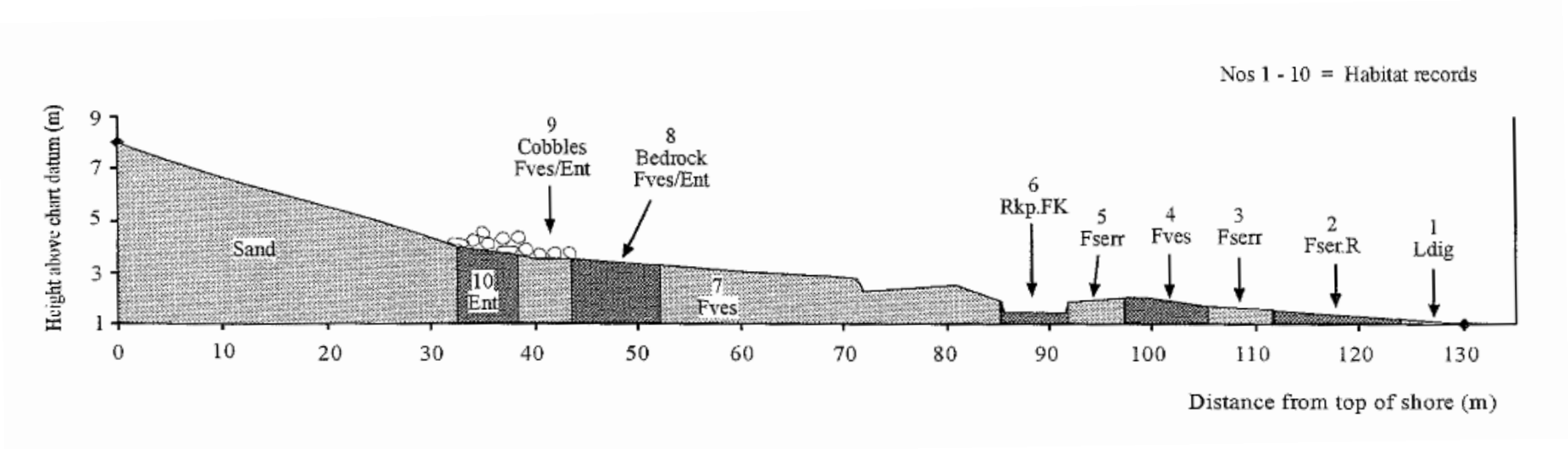

Figure 25. MT3 shore profile from 2001.

4.4 Monitoring Transect 4 – Selwicks Bay

COMPARISON WITH 2001 SURVEY.

Table 18. Biotopes recorded at MT4 in 2001 and there updated codes.

Habitat	Old descriptions			New Descriptions	
1	LR.OV.GCv	Green algal films on upper and mid-shore cave walls and ceilings	=	LR.FLR.CvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2,4	LR.MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
3,6,8	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
5,7	LR.ELR.MB.BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	>	LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
5a,7a	LR._.Rkp.G	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in upper shore rockpools	=	LR.FLR.Rkp.G	Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools
9,10a,11	LR._.Rkp.Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools	=	LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools
10,12,14	LR.ELR.MB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock	=	LR.HLR.MusB.MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock
13,15a	LR._.Rkp.FK	Fucoids and kelps in deep eulittoral rockpools	=	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
15	LR.MLR.Eph.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	=	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 26, and Table 18. A direct comparison to the biotopes from 2010 based on distance along the shore transect can be seen in Table 19. The cave biotope LR.FLR.GvOv.GCv was found in both year's, as was the *Semibalanus* biotope LR.HLR.MusB.Sem.Sem and *U. intestinalis* biotope LR.FLR.Eph.Ent. However, in 2001 another band of LR.FLR.Eph.Ent between LR.FLR.GvOv.GCv and LR.HLR.MusB.Sem.Sem was recorded. A *Semibalanus* biotope is then recorded for both years, LR.HLR.MusB.Sem in 2001 and Sem.Sem in 2010, but is replaced by the LR.MLR.BF.FvesB in 2010. LR.MLR.BF.FvesB is also recorded instead of LR.HLR.MusB.Sem between the rocky outcrops. The 2001 survey recorded two green algae rockpools (LR.FLR.Rkp.G), however these were considered too small to record in 2010, although a large green algae rockpool was adjacent to the transect. The two outcrops of rock recorded as the sub-biotope LR.HLR.MusB.Sem.FvesR were recorded as the similar LR.HLR.MusB.Sem.Sem in 2001. Both surveys recorded several *Corallina* rockpools LR.FLR.Rkp.Cor.Cor. The *Corallina* pools occur within the LR.MLR.BF.FvesB biotope in 2010, however the *Mytilus* biotope LR.HLR.MusB.MytB was recorded for the same area of the transect in 2001. Below this a relatively large fucoid kelp pool, LR.FLR.Rkp.FK was recorded in 2001, though this pool was dominated by *Corallina* in 2010. The

Mytilus biotope is below this pool in the 2001 survey, whereas the *F. serratus* biotope LR.MLR.BF.Fser.R was surveyed over the same area of the transect. Both surveys then report the *R. floridula* biotope LR.MLR.BF.Rho and a fucoid pool LR.FLR.Rkp.FK. The *Rhodothamniella* biotope continues to the end of the transect in 2001, but is replaced below the fucoid pool, in 2010, by the *L. digitata* biotope IR.MIR.KR.Ldig.Ldig.

Table 19. Comparison of biotopes found in 2010 and 2001 at MT4.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LR.FLR.GvOv.GCv	LR.FLR.GvOv.GCv (Biotope 1)
2	LR.HLR.MusB.Sem.Sem	LR.FLR.Eph.Ent (Biotope 2)
		LR.HLR.MusB.Sem.Sem (Biotope 3)
3	LR.FLR.Eph.Ent	LR.FLR.Eph.Ent (Biotope 4)
	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 5)
4	LR.MLR.BF.FvesB	
	Not considered large enough to record.	LR.FLR.Rkp.G
5	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem.Sem (Biotope 6 & 8)
6	LR.FLR.Rkp.Cor.Cor	LR.FLR.Rkp.Cor (Biotope 9 & 11)
7	LR.MLR.BF.FvesB	LR.HLR.MusB.Sem (Biotope 7)
		LR.HLR.MusB.MytB (Biotope 10 & 12)
6	LR.FLR.Rkp.Cor.Cor	LR.FLR.Rkp.FK (Biotope 13)
8	LR.MLR.BF.Fser.R	LR.HLR.MusB.MytB (Biotope 14)
9	LR.MLR.BF.Rho	LR.MLR.BF.Rho (Biotope 15)
10	LR.FLR.Rkp.FK	LR.FLR.Rkp.FK (Biotope 15.1)
11	IR.MIR.KR.Ldig.Ldig	2001 transect not long enough to reach this biotope.

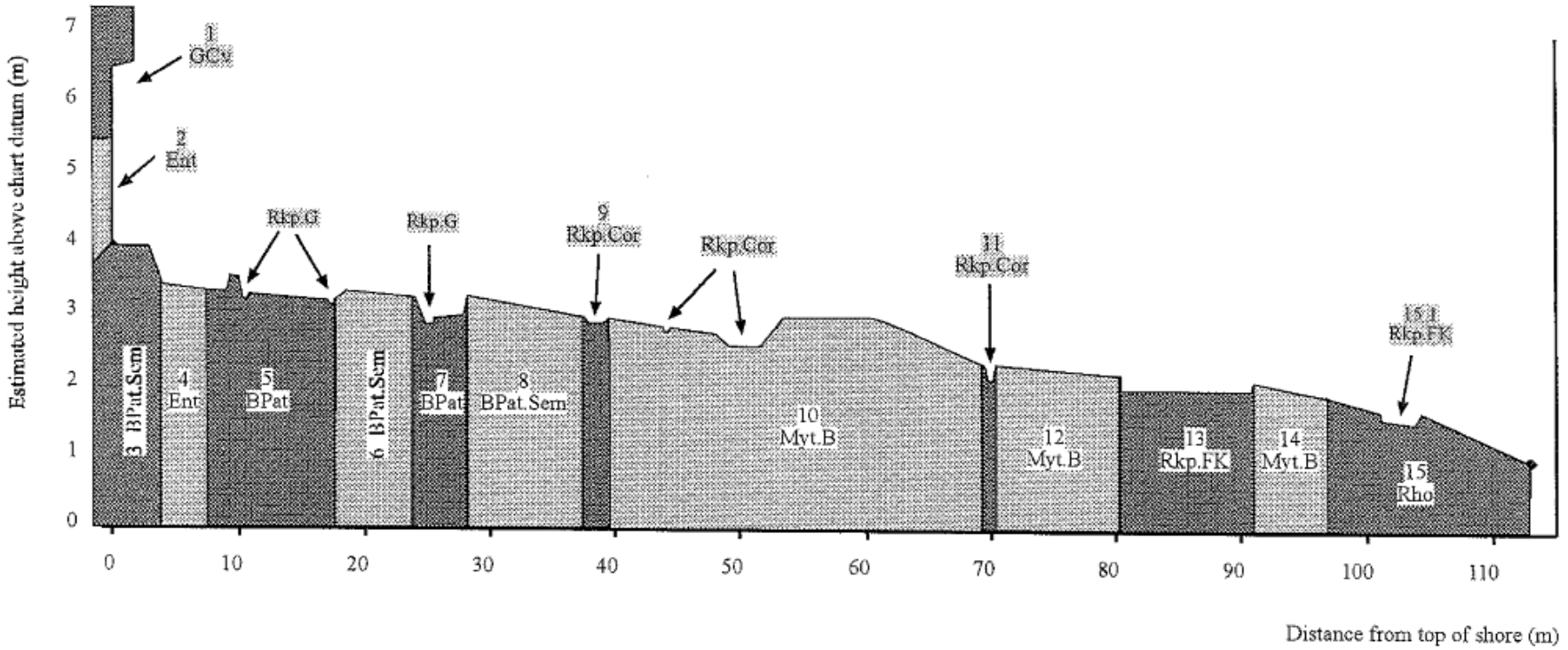

Figure 26. MT4 shore profile from 2001.

4.5 Monitoring Transect 5 – Mathon Nook, Flamborough Head

COMPARISON WITH 2001 SURVEY.

Table 20. Biotopes recorded at MT5 in 2001 and there updated codes.

Habitat	Old Descriptions			New Descriptions	
1	LR.OV.GCv	Green algal films on upper and mid-shore cave walls and ceilings	=	LR.FLR.CvOv.GCv	Green algal films on upper and mid-shore cave walls and ceilings
2	LR.ELR.MB.BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	>	LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
3	LR.MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
4	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	=	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
5	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
6,8,10	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	=	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
7	LR.MLR.BF.Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	≈	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
7a	LR._.Rkp.FK	Fucoids and kelps in deep eulittoral rockpools	=	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools
9	LR.MLR.Eph.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	=	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 27, and Table 20. A direct comparison to the biotopes from 2010 based on distance along the shore transect can be seen in Table 21. The first three biotopes recorded from each survey are virtually identical, the first major difference being a narrow band of the *F. vesiculosus* biotope LR.MLR.BF.FvesB, recorded in 2001, which was absent in 2010, replaced by LR.HLR.MusB.Sem.Sem. Both surveys recorded this biotope down the shore similar areas of the transect, though it is replaced by the similar biotope LR.HLR.MusB.Sem.FvesR in the 2010 survey as you move down the shore. The *F. serratus* biotope, LR.MLR.BF.Fser.R. supercedes the LR.HLR.MusB.Sem biotopes in both years, though in 2001 it started higher up the transect. The 2010 survey recorded LR.MLR.BF.Fser.R all the way down the shore to a raised rock platform of *H. elongata* LR.HLR.FR.Him. The previous survey records the biotopes LR.LLR.F.Fserr, LR.MLR.BF.Fser.R, and LR.MLR.BF.Rho over the same area of the transect, with LR.MLR.BF.Fser.R recorded in the area now dominated by *H. elongata*. The 2001 transect did not go any further down the shore than the *F. serratus*/red seaweed biotope.

Table 21. Comparison of biotopes found in 2010 and 2001 at MT5.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LR.FLR.GvOv.GCv	LR.FLR.CvOv.GCv (Biotope 1)
2	LR.HLR.MusB.Sem.Sem	LR.HLR.MusB.Sem (Biotope 2)
3	LR.FLR.Eph.Ent	LR.FLR.Eph.Ent (Biotope 3)
4	LR.HLR.MusB.Sem.Sem	LR.MLR.BF.FvesB (Biotope 4)
		LR.HLR.MusB.Sem.Sem (Biotope 5)
5	LR.HLR.MusB.Sem.Fves.R	LR.HLR.MusB.Sem.Sem (Biotope 5)
		LR.MLR.BF.Fser.R (Biotope 6)
6	LR.MLR.BF.Fser.R	LR.MLR.BF.Fser.R (Biotope 6)
7	LR.MLR.BF.Fser.R	LR.LLR.F.Fserr.FS (Biotope 7)
		LR.MLR.BF.Fser.R (Biotope 8)
		LR.MLR.BF.Rho (Biotope 9)
	Not considered large enough to record.	LR.FLR.Rkp.FK (Biotope 7a)
8	LR.HLR.FR.Him	LR.MLR.BF.Fser.R (Biotope 10)
9	LR.MLR.BF.Rho	2001 transect not long enough to reach this biotope.
10	IR.MIR.KR.Ldig.Ldig	2001 transect not long enough to reach this biotope.

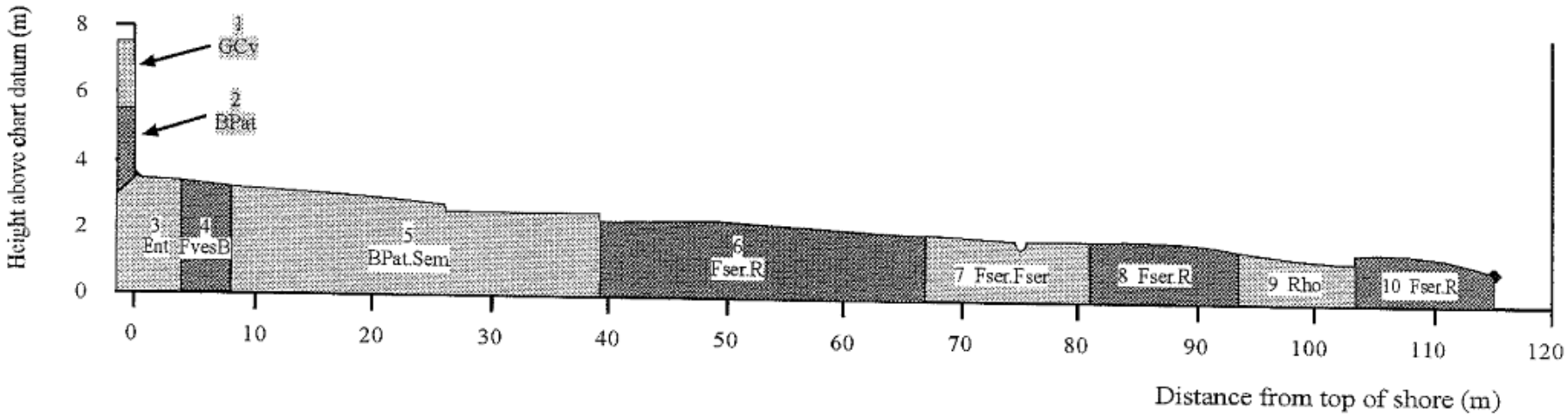

Figure 27. MT5 shore profile from 2001.

4.6 Monitoring Transect 6 – South of Stacks Pinnacle, Flamborough Head

COMPARISON WITH 2001 SURVEY.

Table 22. Biotopes recorded at MT6 in 2001 and there updated codes.

Habitat	Old Descriptions			New Descriptions	
1	LS.LGS.Sh.BarSh	Barren shingle or gravel shores	=	LS.LCS.Sh.BarSh	Barren littoral shingle
2,12	LR.MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
3	LR.SLR.F.Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock	>	LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock
4,10	LR.ELR.MB.BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	>	LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock
5,7	LR.SLR.F.Fves	*Fucus vesiculosus* on sheltered mid eulittoral rock	>	LR.LLR.F.Fves	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock
6	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	=	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
8	LR.MLR.BF.Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	≈	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
9,11,12	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	=	LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock
13,15	LR.MLR.Eph.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	=	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock
14	LR._.Rkp.SwSed	Seaweeds in sediment (sand or gravel)-floored eulittoral rockpools	=	LR.FLR.Rkp.SwSed	Seaweeds in sediment-floored eulittoral rockpools

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 28, and Table 22. A direct comparison to the biotopes from 2010 based on distance along the transect can be seen in Table 23. The biotopes found in the 2010 survey are broadly similar to the biotopes from 2001. Biotopes recorded from 2010 but not present in the 2001 survey were the green slime cave biotope LR.FLR.CvOv.GCv being found on the cliff base; and the *C. officinalis rockpool* biotope. Biotopes present in 2001 but not recorded in 2010 were the ephemeral *U. intestinalis* biotope LF.FLR.Eph.Ent; the *F. vesiculosus* biotope LR.LLR.F.Fves found on the rocky *Semibalanus* platform. Other changes found predominantly were either differences in sub-biotopes, for example LR.HLR.MusB.Sem and LR.HLR.MusB.Sem.FvesR, or slight shifts in the density of the dominating flora or fauna and/or there associated flora/fauna resulting in a slightly different biotope, for example LR.LLR.F.Fserr.FS replaced by LR.MLR.BF.Fserr.R. The 2010 survey also recorded two biotopes, LR.HLR.FR.Coff.Coff and IR.MIR.KR.Ldig.Ldig, beyond the 2001 transect finish point.

Table 23. Comparison of biotopes found in 2010 and 2001 at MT6.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LR.FLR.GvOv.GCv	Not recorded in 2001
2	LS.LCS.Sh.BarSh	LS.LCS.Sh.BarSh (Biotope 1)
3	LR.MLR.BF.FspiB	LR.FLR.Eph.Ent (Biotope 2)
		LR.MLR.BF.FspiB (Biotope 3)
4	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem (Biotope 4)
5	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem (Biotope 4)
6	LR.FLR.Rkp.Cor.Cor	Not recorded in 2001.
7	LR.MLR.BF.FvesB	LR.LLR.F.Fves (Biotope 5)
		LR.MLR.BF.FvesB (Biotope 6)
		LR.LLR.F.Fves (Biotope 7)
8	LR.MLR.BF.Fser.R	LR.LLR.F.Fserr.FS (Biotope 8)
8 (Channels)	LR.MLR.BF.Fser.R	LR.MLR.BF.Fser.R (Biotope 9 & 11)
9	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem (Biotope 10)
		LR.LLR.F.Fves (Biotope 7)
10	U. intestinalis/red seaweeds Biotope	LR.MLR.BF.Fser.R/LR.FLR.Eph.Ent (Biotope 12)
11	LR.MLR.BF.Rho	LR.MLR.BF.Rho (Biotope 13 & 15)
12	LR.FLR.Rkp.SwSed	LR.FLR.Rkp.SwSed (Biotope 14)
13	LR.HLR.FR.Coff.Coff	2001 transect not long enough to reach this biotope.
14	IR.MIR.KR.Ldig.Ldig	2001 transect not long enough to reach this biotope.

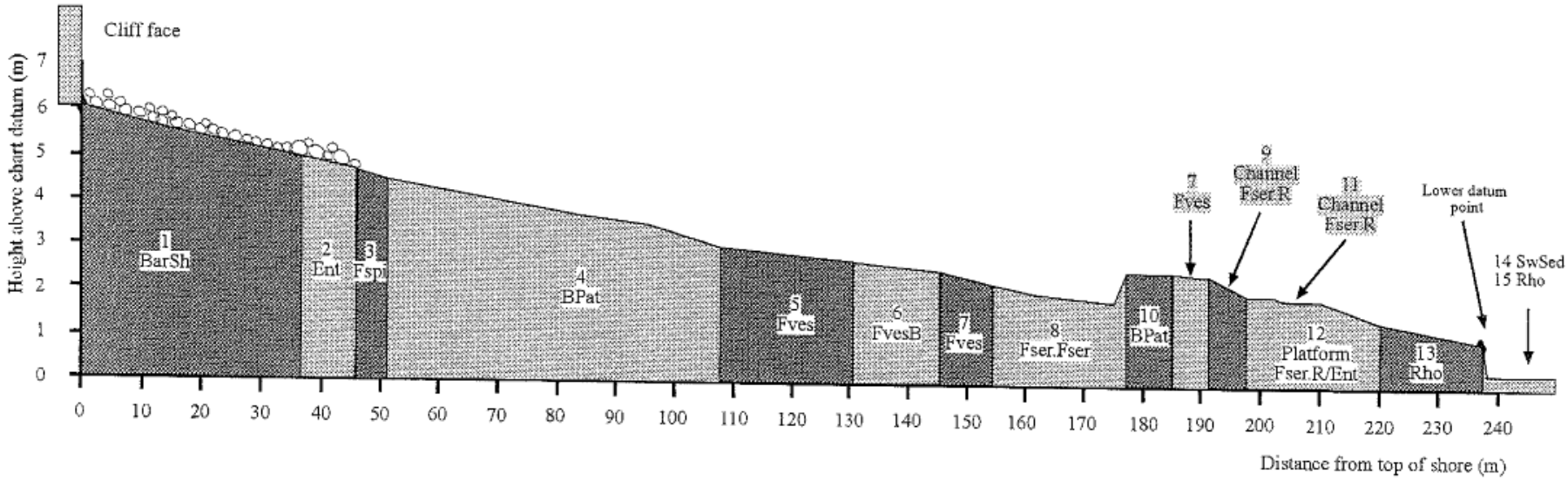

Figure 28. MT6 shore profile from 2001.

4.7 MonitoringTransect 8 – South Cliff, Sewerby

COMPARISON WITH 2001 SURVEY.

Table 24. Biotopes recorded at MT8 in 2001 and there updated codes.

Habitat	Old Descriptions			New Descriptions	
1	LS.LGS.Sh.BarSh	Barren shingle or gravel shores	=	LS.LCS.Sh.BarSh	Barren littoral shingle
2	LR.MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	=	LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced and/or unstable upper eulittoral rock
3,4,6,7	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	=	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
5	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈		*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
8	LR._.Rkp.Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools	=	LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools
9	LR.MLR.BF.Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	≈	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity sheltered lower eulittoral rock
10	LR.MLR.R.XR	Mixed red seaweeds on moderately exposed lower eulittoral rock			Discontinued; records reassigned mostly to FR types (particularly Coff), MusB & Sem
11	LR.MLR.Eph.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	=	LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 29, and Table 24. A direct comparison to the biotopes from 2010 based on distance along the shore transect can be seen in Table 25. The biotopes recorded in 2010 are very similar to the original 2001 survey, the main differences being the *Semibalanus* biotope LR.HLR.MusB.Sem.Sem replacing the *F. vesiculosus* biotope LR.MLR.BF.FvesB in biotope 4, and the rockpool changing from the *C. officinalis* dominated LR.FLR.Rkp.Cor, to the green algae dominated LR.FLR.Rkp.G. The 2001 survey also recorded LR.MLR.R.XR which is now not used as a biotope classification, mainly being replaced by LR.HLR.FR biotopes. The biotope found from the same area in 2010 did not fit a specific classification, but was also a mixed red seaweed biotope dominated by *C. virgatum*. Other differences found were either slight shifts in sub biotope, for example LR.HLR.MusB.Sem.Sem to Sem.FvesR, or whole biotope change due to dominating flora/fauna or the associated flora/fauna altering in density, for example LR.MLR.BF.FvesB changing to LR.LLR.F.Fves.FS.

Table 25. Comparison of biotopes found in 2010 and 2001 at MT8.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LS.LCS.Sh.BarSh	LS.LCS.Sh.BarSh (Biotope 1)
2	LR.FLR.Eph.Ent	LR.FLR.Eph.Ent (Biotope 2)
3	LR.MLR.BF.FvesB	LR.MLR.BF.FvesB (Biotope 3)
4	LR.HLR.MusB.Sem.Sem	LR.MLR.BF.FvesB (Biotope 4)
5	LR.HLR.MusB.Sem.FvesR	LR.HLR.MusB.Sem.Sem (Biotope 5)
6	LR.LLR.Fves.FS	LR.MLR.BF.FvesB (Biotope 6 & 7)
7	LR.FLR.Rkp.G	LR.FLR.Rkp.Cor (Biotope 8)
8	LR.LLR.F.Fserr.FS	LR.LLR.F.Fserr.FS (Biotope 9)
9	Ceramium Biotope	LR.HLR.FR? (Biotope 10)
10	LR.MLR.BF.Rho	LR.MLR.BF.Rho (Biotope 11)

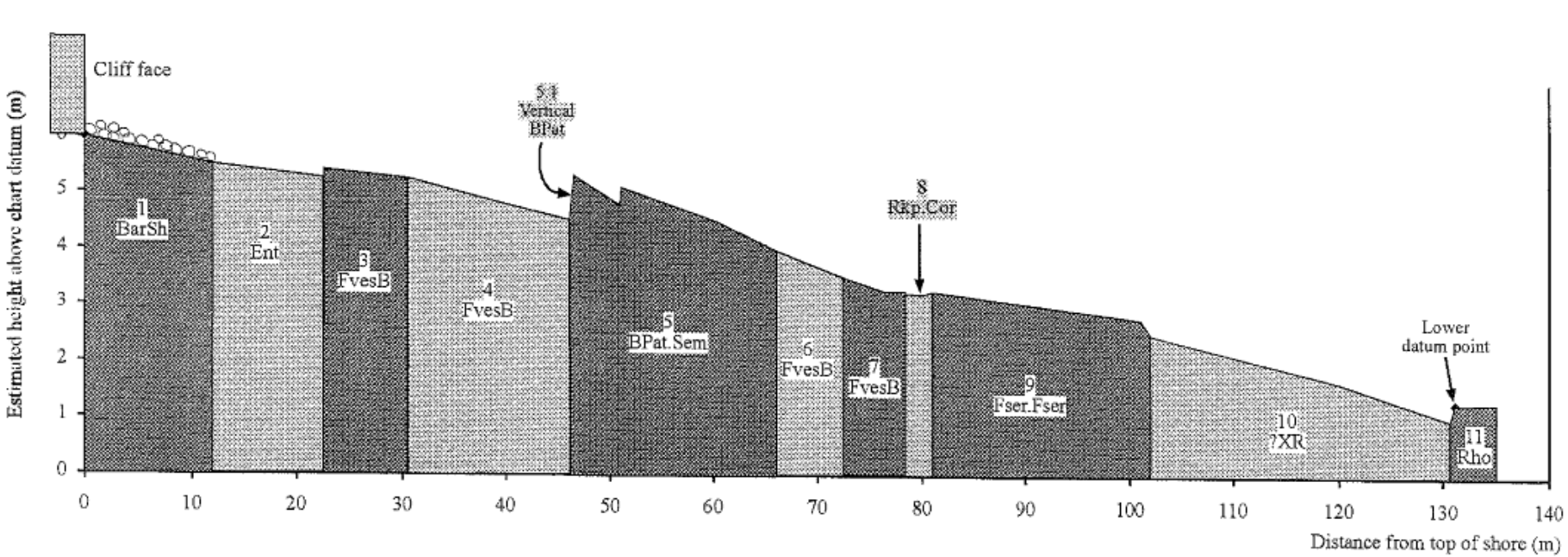

Figure 29. MT8 shore profile from 2001.

4.8 Monitoring Transect 9 – Sewerby Rocks, Sewerby

COMPARISON WITH 2001 SURVEY.

Table 26. Biotopes recorded at MT9 in 2001 and their updated codes.

Habitat	Old Descriptions			New Descriptions	
1	LS.LGS.Sh.BarSh	Barren shingle or gravel shores	=	LS.LCS.Sh.BarSh	Barren littoral shingle
2,4,6	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	=	LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock
3,5	LR.ELR.MB.BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered, eulittoral rock	≈	LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock
7	LR.MLR.MytFR	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	=	LR.MLR.MusF.MytFR	*Mytilus edulis, Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock

The profile of the transect, and the biotopes found in the 2001 survey, with the new description and updated codes can be seen in Figure 30, and Table 26. A direct comparison to the biotopes from 2010 based on distance along the transect can be seen in Table 27. The upper shore biotopes are initially very similar, however the 2010 transect is dominated by *Mytilus* biotopes below the first band of *F. vesiculosus*, as opposed to *Semibalanus/F. vesiculosus* biotopes in 2001. The Mytilus/red seaweed biotope LR.MLR.MusF.MytFR is the only biotope common to both surveys, below the initial *F. vesiculosus* band. However in the original survey this biotope occurs further down the shore, overlapping the biotopes LR.HLR.MusB.Sem.LitX, and the *U. intestinalis/Ceramium* biotope below the MytFR band. The fine sand polychaete biotope, LS.LSa.FiSa.Po, was not recorded on the original survey as the original transect did not go far enough down the shore.

Table 27. Comparison of biotopes found in 2010 and 2001 at MT9.

Biotope No.	2010 Biotopes	2001 Biotopes
1	LS.LCS.Sh.BarSh	LS.LCS.Sh.BarSh (Biotope 1)
2	LS.LSa.MoSa.BarSa	LS.LCS.Sh.BarSh (Biotope 1)
3	LR.MLR.BF.FvesB	LR.MLR.BF.FvesB (Biotope 2)
4	LR.MLR.MusF.Myt.Fves	LR.HLR.MusB.Sem.Sem (Biotope 3)
5	LR.MLR.MusF.Myt.Fves	LR.MLR.BF.FvesB (Biotope 4)
6	LR.HLR.MusB.MytB	LR.HLR.MusB.Sem.Sem (Biotope 5)

7	LR.MLR.MusF.MytFR	LR.MLR.BF.FvesB (Biotope 6)
		LR.MLR.MusF.MytFR (Biotope 7)
8	LR.HLR.MusB.Sem.LitX	LR.MLR.MusF.MytFR (Biotope 7)
9	*U.intestinalis* and *Ceramium* on cobbles and bedrock.	LR.MLR.MusF.MytFR (Biotope 7)
10	LS.Lsa.FiSa.Po	2001 transect not long enough to reach this biotope.

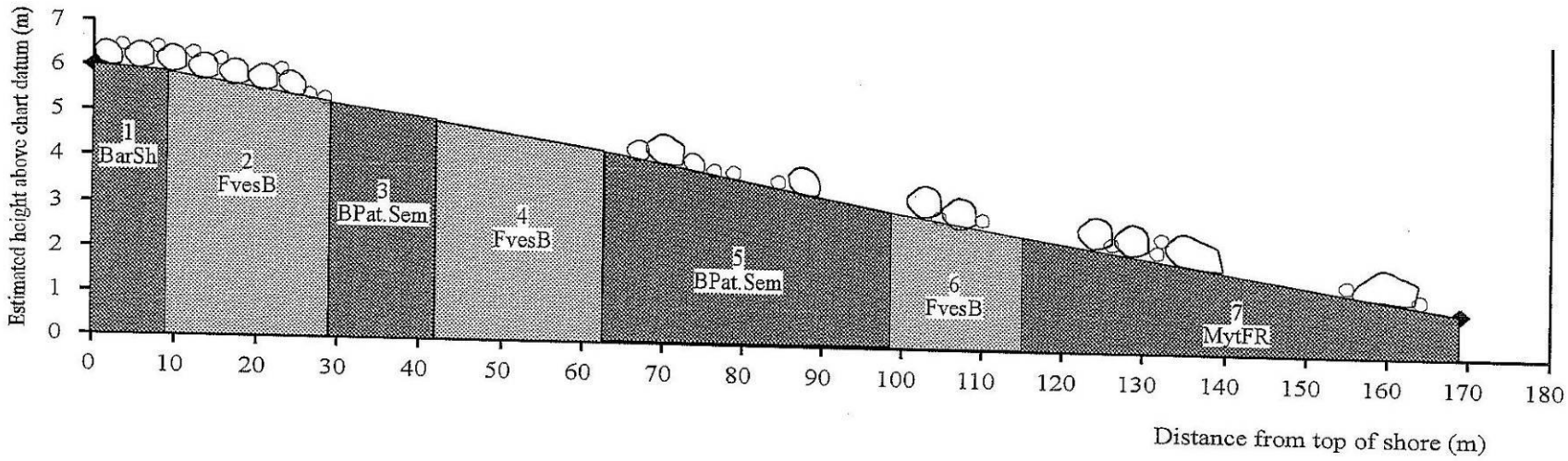

Figure 30. MT9 shore profile from 2001.

4.9 *Mytilus* Beds

In general, most transects showed a broad similarity in habitats (biotopes) between the two survey years, taking into account the changes in biotope nomenclature between the two survey periods.

However, a few differences of note were made, between the biotopes in some of the transects (composition and extent). In particular, a difference between *Mytilus* habitats and associated biotopes was noted on several transects.

The *Mytilus* biotope (LR.MLR.MUsF.MytFR) recorded on Transect 9 from the 2010 survey is considered to be a nationally rare biotope and of note, with other *Mytilus* biotopes appearing to have expanded considerably up the shore from the 2001 to the 2010 surveys.

However, the 2010 survey recorded Transects 2 & 4 as exhibiting a considerable loss of *Mytilus* biotopes when compared to the 2001 distribution data, and it would appear that in 2010, the *Mytilus* beds in these areas have been replaced by *Semibalanus* and *F. vesiculosus* biotopes.

Whether or not these changes in *Mytilus* density, and indeed presence absence in some instances, is a significant change in habitat composition, or an artefact of recording etc is difficult to identify with any surety.

Whilst it is entirely possible for change in composition and/or extent of the beds to have occurred, such populations are also known to be subject to natural variation and cycling, and as such, changes in status and extent can readily occur between individual surveys, particularly, when there is a relatively long gap between survey recording. However, recording and assessment artefacts can also occur.

The abundance of *Mytilus* (and other organisms that comprise many biotopes will depend somewhat on an assessment of exposure (system energy), in conjunction with an assessment of relevant abundance (effectively a SACFOR assessment). As such, slight differences in quantification of one of these attributes can have an effect on how a biotope is coded for key characterising species. This is a particular issue when survey programmes are conducted by different individuals/groups, with slight different 'baseline' experiences, and despite a relatively well defined and prescribed assessment routine.

As such, small scale inter-annual differences in biotope composition and extent can occur, as an artefact of differing surveyors, despite best practice and experience. At a wider system scale, such differences are generally of little significance, but become more noticeable, when individual transects are analysed and compositions compared.

4.10 Other Fauna & Flora

Despite a broad comparison in biotope extent and composition across most of the transects between the two survey programmes, some slight differences in biotopes and their position on the shore profile were also noted.

As above, whilst there is the likelihood that some of these differences reflected a natural change, again, at this detailed level of analysis, recording and analysis artefacts may have also contributed to some of the variation. For instance, small scale variations in relative abundances can mean that a habitat falls into one rather than another biotope when comparing relative composition between the two different versions of the classification system. It is known that shores can naturally cycle over the years between several similar biotopes, for example from the *Semibalanus/Patella* dominated LR.HLR.MusB.Sem.FvesR, to the *Semibalanus/F.vesiculosus* mosaic LR.MLR.BF.FvesB, through to the *F. vesiculosus* dominated LR.LLR.F.Fves (Connor et al 2004).

Indeed, in many instances (and this is also the case for working within a single classification version), the relative attributes of the assemblage means that there is no 'perfect match' to a described biotope, and so a 'best fit' approach is required. This means that subtle variations in composition or abundance (as well as other external physical factors) can lead to marginally different allocations of an assemblage to a specific biotope, and in particular create difficulties when comparing between the two versions of the system.

Furthermore, the 2010 used a quadrat survey approach with a series of quadrats sampled in detail along the transect, with abundance levels calculated to SACFOR, but assessed in the context of a series of physical factors including system energy. This appears to be a slightly different technique to that applied in 2001, where a more visual *in situ* assessment approach was followed, which may have led to slight differences in biotope allocation

The 2010 survey record the presence of *Ulva spp* in great frequency. This may have been an artefact of survey timing, but may also have reflected differences in the *Ulva* crop between years, reflecting differences in environmental conditions, e.g. weather conditions. As such the high abundance of *Ulva spp* were considered to be highly ephemeral in some areas and as such the presence and abundance were considered of secondary importance when defining the biotope classification when compared to other flora or fauna e.g. *F.vesiculosus.*

4.11 Reef Feature Status

The Reef feature status of Flamborough Head was assessed using advice targets provided by Regulation 33 (Table 28) and Howson's 2001 survey. In terms of the first attribute, the distribution and range of intertidal biotopes, there appears to have been very little change in the diversity of biotopes found since 2001. As such, it is evident that the target of no decrease in the extent and range of biotopes has been met, making Flamborough Head still notable for its range of rocky shore biotopes. However the changes in range and distribution of *Mytilus* biotopes, such as LR.HLR.MusB.MytB, may require surveying at more regular intervals to put these changes into context. The second attribute, the distribution of characteristic rocky shore communities, which is the case of Flamborough Head are intertidal chalk cliff algae and lichen biotopes LR.FLR.CvOv.ChrHap, LR.FLR.Lic.Bli and LR.FLR.Lic.UloUro could not be assessed. This was because none of the relevant biotopes were recorded from the monitoring transects during either the 2010 or 2001 survey.

Table 28. Regulation 33 advice for Flamborough Head.

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
Reefs	**Rocky Shore Communities**	Distribution and range of all intertidal biotopes	Distribution of intertidal rocky shore communities, using littoral extent, in particular those biotopes listed at Appendix III. Measured during summer, twice during reporting cycle	No decrease in littoral extent and range of biotopes from the established baseline (Brazier *et al.* 1998), subject to natural change	Flamborough Head intertidal is notable for its high number of biotopes. The relative distribution of rocky shore biotopes is an important structural aspect of the European marine site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site

		Distribution of characteristic rocky shore communities	Distribution of intertidal chalk cliff algal and lichen biotopes Chr; Bli;UloUro. Measured in summer months twice during report cycle	Distribution should not deviate significantly from the established baseline (Tittley 1988), subject to natural change	Presence of Chr; Bli; UloUro are a structural component of the reef, but are particularly important due to their rarity. Also suggested that they may be useful indicators and therefore changes in extent and distribution may indicate long term changes in physical conditions at the European marine site

4.12 Recommendations

It is assumed that the current version of the classification scheme will remain largely unchanged going forward, and this will assist in any inter-annual comparisons of biotope extent, composition and quality in the future.

As such, there are few recommendations in terms of the general approach, other than to emphasise that in order to maximise inter survey comparability, the methods employed in the survey and assessment work should be rigorously described.

However, it is considered that the 9 year period between survey programmes is perhaps too long for some groups, in particular biogenic communities of conservation importance such as *Mytilus* beds, and other habitats that are readily influenced by anthropogenic impacts, either through *ad hoc* damage (e.g. non-targeted damage from visitor footfall), or from more specific activities targeting species for collection (e.g. as bait, or for commercial harvest).

As such, a more frequent monitoring programme might be of value, particularly targeted at certain transects (in order to minimise programme time and costs etc.). This targeted survey might then be incorporated into a more comprehensive programme undertaken at a greater frequency, say every 10 years.

It is also recommended that any future survey programme be scheduled for the summer/early autumn, when the presence of a range of seaweeds can be best identified. Surveys should not be undertaken during the winter period.

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APPENDIX I RAW DATA

MT1 Raw data.

MT1 North Landing	Habitat 1 Verrucaria/Merlaphe						Habitat 2 Enteromorpha						Habitat 4 Patella, Semibalanus						Habitat 5 Patella, Semibalanus on Boulders						Habitat 6 Patella, Semibalanus					
	Upper Shore, Supralittoral, Vertical cliff face/Cave						Upper Shore, Littoral fringe, horizontal bedrock						Upper Shore, Littoral fringe, vertical bedrock						Mid, Littoral fringe, boulders						Mid Shore, Eulittoral, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13152		54.13136		54.13136		54.13142		54.13149				54.13137		54.13145		54.13142		54.13135		54.13136		54.13137		54.13139		54.13142		54.13142	
Longitude W (WGS 84)	0.10745		0.10739		0.10743		0.10755		0.10730				0.10745		0.10742		0.10741		0.10697		0.10709		0.10730		0.10710		0.10720		0.10714	
	Suggested Biotope: LR.FLR.Lic.Ver.Ver						Suggested Biotope: LR.FLR.Eph.Ent						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.FvesR					
Taxa	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																														
Dynamena pumila																														
Actinia equina																														
Eulalia viridis																														
Polydora/Boccardiella																									C	9			O	2
Semibalanus balanoides													F	4	C	9	C	9	S	9	A	9	S	9	A	9	A	9	A	9
Balanus crenatus																														
Idotea granulosa																														
Carcinus maenas																														
Gibbula cineraria																														
Tectura testudinalis																														
Patella vulgata													C	9	A	9	A	9	A	9	C	9	A	9	A	9	A	9	A	9
Patella uly/vul																														
Helcion pellucidum																														
Lacuna pallidula																														
Lacuna vincta																														
Littorina arcana			F	3	F	1																								
Littorina littorea																														
Littorina saxatilis													C	9	F	9	C	9	F	9	F	7	F	7						
Melarhaphe neritoides	A	9	C	9	A	9							A	9	C	9	C	9												
Rissoa parva																														
Thais lapillus																							F	2	F	2			O	1
Mytilus edulis juv																														
Mytilus edulis																									C	3				
Membranipora membranacea																														
Electra pilosa																														
Lipophrys pholis																														
Erythrotrichia carnea																														
Audouinella floridula																														
Palmaria palmata																														
Hildenbrandia rubra					R	4																								
Corallinaceae sp. Indet																														
Corallina officinalis																									F	6			O	1
Lithothamnion glaciale																														
Phymatolithon lenormandii																														
Dumontia contorta																														
Chondrus crispus																														
Mastocarpus stellatus																														
Gracilaria gracilis																														
Lomentaria articulata																														
Aglaothamnion																														
Ceramium virgatum																									R	1				
Plumaria plumosa																														
Delesseria sanguinea																														
Membranoptera alata																														
Osmundea pinnatifida																									O	1				
Polysiphonia fucoides																														
Polysiphonia stricta																														
Rhodomela confervoides																														
Ectocarpus fasciculatus																														
Elachista spp.																														
Cladostephus spongiosus																														
Laminaria digitata																														
Fucus serratus																														
Fucus spiralis																							R	2						
Pelvetia canicula ta																	O	2												
Enteromorpha intestinalis							A	9	S	9									O	7					C	9	C	8	F	9
Ulva lactuca																														
Cladophora rupestris																														
Verrucaria maura	S	9	A	9	C	9	C	9	O	2			O	1																
Green Slime					A	6																								
Red mat																							R	2						

MT1 North Landing	Habitat 7 Corallina/Fucoid Pool						Habitat 8 Deep Ulva Pool						Habitat 10 Fucus serratus/Audouinella					
	Mid Shore, Eulittoral, rockpool						Mid Shore, Eulittoral, deep rockpool						Lower Shore, Eulittoral, Boulder and horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13136		54.13137				54.13139		54.13134		54.13136		54.13145		54.13142		54.13145	
Longitude W (WGS 84)	0.10716		0.10712				0.10722		0.10722		0.10718		0.10694		0.10693		0.10690	
	Suggested Biotope: LR.FLR.Rkp.Cor.Cor						Suggested Biotope: LR.FLR.Rkp.G						Suggested Biotope: LR.MLR.BF.Rho					
Taxa	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																	R	6
Dynamena pumila																	R	2
Actinia equina													F	2	F	2		
Eulalia viridis													F	1			F	1
Polydora/Boccardiella	C	4	C	9			F	2										
Semibalanus balanoides	F	2	O	1														
Balanus crenatus													F	2			F	3
Idotea granulosa	C	9											O	2	O	1	O	2
Carcinus maenas															F	3		
Gibbula cineraria															F	2		
Tectura testudinalis													F	4	O	1	F	4
Patella vulgata	F	2	F	5			F	1			F	1						
Patella uly/vul													F	4	F	2	F	2
Helcion pellucidum													F	9	F	7	F	5
Lacuna pallidula													F	9	F	3	F	5
Lacuna vincta													F	6	C	6	C	8
Littorina arcana																		
Littorina littorea																	F	2
Littorina saxatilis																		
Melarhaphe neritoides																		
Rissoa parva													C	9	C	9	C	9
Thais lapillus																		
Mytilus edulis juv													F	4	F	7	F	5
Mytilus edulis																		
Membranipora membranacea															O	7	R	2
Electra pilosa													R	3	O	8	O	9
Lipophrys pholis											F	1						
Erythrotrichia carnea															R	1		
Audouinella floridula													S	9	S	9	S	9
Palmaria palmata													O	9	F	6	O	5
Hildenbrandia rubra																		
Corallinaceae sp. Indet							R	1										
Corallina officinalis	A	9	A	9			R	1	R	1	R	2			O	2		
Lithothamnion glaciale									R	1	O	1	O	2	C	5		
Phymatolithon lenormandii	O	3	O	4							O	2			R	1	F	4
Dumontia contorta																	R	1
Chondrus crispus													O	6	C	9	F	9
Mastocarpus stellatus													O	1				
Gracilaria gracilis															R	2	R	1
Lomentaria articulata													O	5	R	2	R	1
Aglaothamnion													R	1				
Ceramium virgatum	A	7	S	9			O	3	R	2	O	6	O	4	R	1	O	3
Plumaria plumosa													R	1	O	2	O	1
Delesseria sanguinea													R	1				
Membranoptera alata													O	3	R	1	O	6
Osmundea pinnatifida	R	1													R	1	O	2
Polysiphonia fucoides													R	1	R	3	O	2
Polysiphonia stricta															R	1		
Rhodomela confervoides															O	2	R	1
Ectocarpus fasciculatus													R	1				
Elachista spp.													R	1	R	2	R	2
Cladostephus spongiosus													F	9	O	9	O	2
Laminaria digitata	O	1	O	2											F	3	O	1
Fucus serratus	F	3									F	2	A	9	A	9	A	9
Fucus spiralis																		
Pelvetia caniculata																		
Enteromorpha intestinalis			O	2			F	4	C	4	O	1	R	2				
Ulva lactuca	A	9	F	9			A	9	A	7	C	6	R	2			R	1
Cladophora rupestris													O	3	O	2	O	3
Verrucaria maura																		
Green Slime																		
Red mat																		

MT2 Raw data.

MT2 Thornwick Nab	Habitat 1 Enteromorpha						Habitat 2 Patella, Litt sax						Habitat 3 Patella, Semibalanus						Habitat 4 Patella, Semibalanus					
	Upper Shore, Littoral fringe, Vertical cliff face						Upper Shore, Eulittoral upper, Vertical cliff face						Upper Shore, Eulittoral upper, vertical/horizontal bedrock						Upper-Mid shore, Eulittoral mid-lower, horizontal pitted bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13312		54.13312				54.13312		54.13312				54.13319		54.13319		54.13317		54.13321		54.13325		54.13327	
Longitude W (WGS 84)	0.11503		0.11502				0.11503		0.11503				0.11477		0.11482		0.11487		0.11469		0.11461		0.11450	
	Suggested Biotope: LR.FLR.Eph.Ent						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.FvesR					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																								
Grantia compressa																								
Halichondria panicea																								
Actinia equina													F	2	F	1	F	1	F	3	C	7	C	9
Urticina felina																								
Sagartia elegans																								
Boccardiella																								
Polydora															O	1	F	4	A	9	C	9	C	9
Pomatoceros																								
Semibalanus balanoides	C	6	C	9			C	9	A	9			S	9	S	9	S	9	S	9	S	9	S	9
Balanus crenatus																								
Amphipoda spp.													O	1										
Pagurus bernhardus																								
Cancer pagurus																								
Lepidochitona cinereus																								
Tectura testudinalis																								
Patella vulgata	C	7	C	8			A	9	A	9			A	9	A	9	A	9	C	9	C	9	C	9
Patella uly/vul													F	2					C	9	C	9	C	9
Helcion pellucidum																								
Littorina arcana	C	6	C	6																				
Littorina littorea															F	2	F	2						
Littorina saxatilis							F	3	F	3														
Melarhaphe neritoides	F	8	F	9			C	9	C	9														
Rissoa parva																								
Thais lapillus							F	3	F	1			F	1			F	1					F	4
Mytilus edulis juv																							A	4
Mytilus edulis	C	6	F	2			C	4	C	3					F	2								
Hiatella arctica																								
Electra pilosa																								
Molgulidae																								
Porphyra																							R	1
Porphyra umbilicalis																								
Audouinella floridula																								
Gelidium																								
Palmaria palmata																								
Corallina officinalis															R	1			R	1	O	5	O	4
Lithothamnion glaciale																								
Phymatolithon lenormandii																			R	1				
Mastocarpus stellatus																								
Cystoclonium purpureum																								
Plocamium cartilagineum																								
Lomentaria articulata																								
Aglaothamnion							O	2	O	1														
Ceramium virgatum																					O	3	R	3
Ceramium nodulosum															R	1								
Membranoptera alata																								
Phycodrys rubens																								
Osmundea pinnatifida																							R	1
Polysiphonia fucoides/stricta																								
Ectocarpus fasciculatus																					R	1		
Elachista fucicola																			R	1				
Cladostephus spongiosus																								
Laminaria digitata																					O	2		
Fucus serratus																								
Fucus vesiculosus																			O	1				
Ulothrix speciosa													R	1										
Enteromorpha intestinalis	C	9	F	7									O	8	O	8	O	6	O	9	O	9	O	9
Ulva lactuca																								
Chaetomorpha melagonium																								
Cladophora rupestris																								
Verrucaria maura	O	9	O	5																				

MT2 Thornwick Nab	Habitat 5 Corallina rockpool						Habitat 6 Mytilus, L dig, Audouinella					
	Mid Shore, Eulittoral mid, rockpool						Lower Shore, Sublittoral fringe, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13320		54.13320				54.13341		54.13339		54.13337	
Longitude W (WGS 84)	0.11466		0.11463				0.11396		0.11405		0.11410	
	Suggested Biotope: LR.FLR.Rkp.Cor.Cor						Suggested Biotope: IR.MIR.KR.Ldig.Ldig					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA									O	2	O	2
Grantia compressa							R	1	R	2	R	1
Halichondria panicea							R	1				
Actinia equina							F	1				
Urticina felina							F	2			F	4
Sagartia elegans							F	2				
Boccardiella									O	1		
Polydora	C	4	F	2								
Pomatoceros							F	9	O	1		
Semibalanus balanoides	C	6	F	2								
Balanus crenatus							C	9	F	9	F	4
Amphipoda spp.												
Pagurus bernhardus									O	1		
Cancer pagurus											F	1
Lepidochitona cinereus									O	2		
Tectura testudinalis							C	9	C	9	F	4
Patella vulgata	C	7	F	1								
Patella uly/vul							C	6	F	1		
Helcion pellucidum							F	6	F	6	F	5
Littorina arcana												
Littorina littorea												
Littorina saxatilis												
Melarhaphe neritoides												
Rissoa parva									F	1	F	2
Thais lapillus									F	2	F	1
Mytilus edulis juv												
Mytilus edulis							C	9	A	9	A	9
Hiatella arctica											O	1
Electra pilosa									O	9	O	6
Molgulidae									O	1		
Porphyra									R	1	O	2
Porphyra umbilicalis							R	1				
Audouinella floridula							R	1	A	7	S	9
Gelidium			R	1					R	1		
Palmaria palmata			R	1			O	4	R	1	O	2
Corallina officinalis	A	9	S	9			A	9	R	3	O	4
Lithothamnion glaciale							A	9	F	4	F	5
Phymatolithon lenormandii			O	2			O	4	R	4		
Mastocarpus stellatus									C	9	F	7
Cystoclonium purpureum									R	1	R	3
Plocamium cartilagineum							R	1	O	4	R	3
Lomentaria articulata											R	3
Aglaothamnion											R	1
Ceramium virgatum	O	6	F	9			O	9	R	1	O	9
Ceramium nodulosum												
Membranoptera alata							O	4	R	2	O	1
Phycodrys rubens									R	1		
Osmundea pinnatifida							O	9				
Polysiphonia fucoides/stricta							R	6	F	6	R	4
Ectocarpus fasciculatus							O	4				
Elachista fucicola											O	3
Cladostephus spongiosus									O	3	O	4
Laminaria digitata			O	2			A	9	C	7	C	5
Fucus serratus							F	2	F	6	C	5
Fucus vesiculosus	O	1	O	1								
Ulothrix speciosa												
Enteromorpha intestinalis	O	1	O	1			R	3			R	2
Ulva lactuca	A	9	A	9			R	1			R	1
Chaetomorpha melagonium									R	3	R	1
Cladophora rupestris									R	3	R	1
Verrucaria maura												

MT3 Raw Data

MT3 Thornwick Bay	Habitat 2 Enteromorpha, F. ves on cobbles						Habitat 3 Patella, F. ves, Ent on Bedrock						Habitat 4 F ves, Semibalanus, Patella on bedrock						Habitat 5 F. serr on bedrock.					
	Upper Shore, Littoral lower, cobbles on sand and bedrock						Mid Shore, Eulittoral upper, horizontal bedrock						Mid Shore, Eulittoral mid, horizontal bedrock						Mid shore, Eulittoral lower, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13122		54.13124		54.13121		54.13132		54.13136		54.13139		54.13143		54.13144		54.13152		54.13156		54.13157		54.13155	
Longitude W (WGS 84)	0.11321		0.11321		0.11323		0.11315		0.11311		0.11313		0.11310		0.11309		0.11304		0.11300		0.11306		0.11302	
	Suggested Biotope: LR.FLR.Eph.EntPor						Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.LLR.F.Fserr.FS					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Halichondria panicea																								
Actinia equina			F	2			F	1	F	1	F	1	F	2	F	2	F	1	F	1	F	3		
Polydora/Boccardiella	F	2	A	9			A	9	A	9	S	9	A	9	S	9	A	8			F	1	A	7
Sabellaria spinulosa																								
Semibalanus balanoides							F	9	F	3	C	8	A	9	A	9	C	6						
Balanus crenatus																								
Gammarus			O	1	O	1					O	1												
Idotea granulosa							O	1	O	2	O	1	O	2					O	2			O	1
Carcinus maenas			F	2	F	1									F	1	F	1	F	3	F	1		
Gibbula cineraria																								
Tectura testudinalis																								
Patella vulgata	F	3	C	6			C	9	C	7	C	9	A	9	C	9	A	9						
Patella ulyvul																			C	9	C	9	C	5
Helcion pellucidum																							O	1
Lacuna pallidula																								
Lacuna vincta																								
Littorina littorea			F	1			F	3	F	3	C	6	A	9	C	9	C	9	A	9	A	9	C	7
Littorina mariae/obtusata																			A	9	A	9	C	7
Littorina obtusata	F	1	C	3	F	1	F	1	C	7	C	8	C	5	C	8	C	8						
Littorina saxatilis			O	2			O	1					O	1										
Rissoa parva																								
Thais lapillus											F	1												
Mytilus edulis																								
Electra pilosa																								
Porphyra umbilicalis																								
Porphyra					R	1			O	1														
Audouinella															R	3	R	1						
Audouinella floridula	O	3	O	4	O	2									R	1							R	1
Gelidium pusillum									O	5	O	6												
Palmaria palmata													O	1			O	1	O	8	O	4	F	6
Ahnfeltia plicata																								
Hildenbrandia rubra																								
Corallina officinalis													R	2			R	1	R	3	O	6	R	2
Lithothamnion glaciale											R	2												
Melobesia membranacea																								
Phymatolithon lenormandii			O	2					R	2	F	6	R	3	O	2			O	9	C	9	F	6
Chondrus crispus											O	2												
Callophyllis laciniata																								
Mastocarpus stellatus																								
Gracilaria verrucosa																							R	1
Plocamium cartilaginum																	R	1						
Lomentaria articulata															R	1	R	1						
Aglaothamnion													R	3	R	1	R	1	R	1				
Ceramium virgatum											R	2	O	2	O	1	R	1	R	1			R	1
Ceramium shuttleworthanium															O	1								
Plumaria plumosa																			O	3	O	3		
Cryptopleura ramosa																								
Membranoptera alata																								
Osmundea pinnatifida							O	2	O	5	O	6	C	9	F	9	C	9	F	9	F	9		
Polysiphonia stricta																								
Polysiphonia fucoides															R	1	R	1	R	1	O	3	R	1
Rhodomela confervoides																					R	1	R	1
Ectocarpus fasciculatus													R	3										
Elachista fucicola																	R	2						
Ralfsia verrucosa																			R	2	R	1		
Cladostephus spongiosus																					R	1		
Sphacelaria															R	3	R	1						
Dictyota dichotoma																								
Laminaria digitata																								
Fucus serratus											O	1							A	9	A	8	A	8
Fucus vesiculosus	F	4	C	6	O	5	O	3	C	9	A	8	F	6	F	7	C	9	R	2	O	3		
Enteromorpha intestinalis	A	9	A	9	S	9	F	9	F	9	F	8	O	5	O	6	R	4	O	5	R	1	R	1
Ulva lactuca			O	3															R	2			O	3
Chaetomorpha mediterranea													R	1	R	1	R	1						
Chaetomorpha																								
Cladophora sericea															R	1								
Cladophora rupestris																			O	3	O	8	O	5

MT3 Thornwick Bay	Habitat 8 F. serr, Osmundia on bedrock.						Habitat 9 F. serr, red seaweeds.					
	Lower Shore, Eulittoral lower, horizontal bedrock						Lower Shore, Eulittoral lower, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.13178		54.13180		54.13173		54.13190		54.13186		54.13189	
Longitude W (WGS 84)	0.11297		0.11297		0.11297		0.11289		0.11291		0.11291	
	Suggested Biotope: LR.MLR.BF.Fser.R						Suggested Biotope: LR.MLR.BF.Rho					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Halichondria panicea							O	1				
Actinia equina	F	2	F	1	F	2					F	1
Polydora/Boccardiella	C	8	C	9	C	6			C	8	F	2
Sabellaria spinulosa											F	2
Semibalanus balanoides	A	8			F	4						
Balanus crenatus							F	3	C	6	F	1
Gammarus												
Idotea granulosa							F	3	C	6	F	1
Carcinus maenas	F	1					F	2				
Gibbula cineraria			F	1								
Tectura testudinalis							O	1	O	1		
Patella vulgata												
Patella uly/vul	A	9	A	9	A	9	C	5	A	8	A	7
Helcion pellucidum							F	4	F	1	F	2
Lacuna pallidula							C	9	F	1	F	1
Lacuna vincta							C	9			F	2
Littorina littorea			F	2	F	6						
Littorina mariae/obtusata	F	1	F	1	F	1			F	2	F	1
Littorina obtusata												
Littorina saxatilis												
Rissoa parva									C	5	C	4
Thais lapillus			F	4			F	2	F	3		
Mytilus edulis							F	1			F	1
Electra pilosa							O	6			R	1
Porphyra umbilicalis	O	4									O	3
Porphyra					O	3			O	3		
Audouinella												
Audouinella floridula	R	1			R	1	S	9	C	4	A	9
Gelidium pusillum							R	1			R	2
Palmaria palmata	O	4	O	6	O	6	O	6	O	5	O	9
Ahnfeltia plicata			R	1								
Hildenbrandia rubra	R	2	R	1								
Corallina officinalis	O	5	O	6	O	5	O	2	O	7	R	3
Lithothamnion glaciale	O	2	O	3			O	4	O	4	O	2
Melobesia membranacea					R	1						
Phymatolithon lenormandii	F	9	A	9	A	9	O	4	F	9	C	9
Chondrus crispus					R	2	O	2	R	2	O	4
Callophyllis laciniata											R	1
Mastocarpus stellatus							C	6				
Gracilaria verrucosa												
Plocamium cartilaginum												
Lomentaria articulata	O	8			O	5	O	6	O	7	O	9
Aglaothamnion												
Ceramium virgatum	R	1			R	1	R	1	R	1	O	7
Ceramium shuttleworthanium												
Plumaria plumosa	O	5	O	6	O	4	R	2	O	2	O	9
Cryptopleura ramosa			R	1								
Membranoptera alata	R	1	R	1	R	1	R	2	R	2	R	1
Osmundea pinnatifida	C	9	C	9	C	9	O	9	F	9	O	9
Polysiphonia stricta							O	9				
Polysiphonia fucoides	R	1	R	2	O	1	O	9	O	3		
Rhodomela confervoides	R	1					R	1				
Ectocarpus fasciculatus												
Elachista fucicola					R	1						
Ralfsia verrucosa			R	1					O	2		
Cladostephus spongiosus	O	3			R	1	O	4	O	3	O	9
Sphacelaria	R	1										
Dictyota dichotoma							R	1	R	1		
Laminaria digitata	R	1					O	3	O	1		
Fucus serratus	C	3	A	9	C	8	C	8	C	8	C	9
Fucus vesiculosus	O	2										
Enteromorpha intestinalis	F	9	O	9	O	9			O	8	R	1
Ulva lactuca	R	2					O	5	R	1	R	6
Chaetomorpha mediterranea												
Chaetomorpha			R	1								
Cladophora sericea												
Cladophora rupestris	O	3	R	6	R	2	O	7	O	3	O	6

MT4 Raw Data

MT4 Selwicks Bay	Habitat 2 Patella, L. sax, on cave wall						Habitat 3 Enteromorpha						Habitat 4 Enteromorpha, F. ves on bedrock						Habitat 5 Semibalanus, Patella on bedrock					
	Upper Shore, Littoral , vertical bedrock						Upper Shore, Littoral , horizontal bedrock						Upper shore, Eulittoral, horizontal bedrock						Mid Shore, Eulittoral, bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.12151		54.12158		54.12154		54.12155		54.12156		54.12157		54.12152		54.12156		54.12147		54.12144		54.12146		54.12146	
Longitude W (WGS 84)	0.08277		0.08254		0.08279		0.08291		0.08298		0.08283		0.08282		0.08331		0.08277		0.08263		0.08265		0.08252	
	Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.FLR.Eph.Ent						Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.HLR.MusB.Sem.FvesR					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Dynamena pumila																								
Polydora/Boccardiella							C	7	C	9	C	4	C	7	C	7	C	8	F	5	F	5	C	9
Semibalanus balanoides	C	3	C	9	A	9	C	5	C	7	C	4	C	4	F	4	A	9	S	9	S	9	S	9
Balanus crenatus																								
Idotea granulosa																								
Pagurus bernhardus																								
Carcinus maenas																								
Gibbula cineraria																								
Tectura testudinalis																								
Patella vulgata	A	9	A	9	A	9	C	6	C	6	C	7	C	8	F	4	C	9	A	9	A	9	A	9
Patella uly/vul																								
Helcion pellucidum																								
Lacuna pallidula																								
Lacuna vincta																								
Littorina arcana/sax	A	9	A	9	C	9																		
Littorina littorea							C	4	F	3	C	6	C	7	F	3	C	6	A	9	A	9	C	9
Littorina mariae/obtusata																								
Littorina obtusata							F	2	F	1			C	5	C	5	C	9	F	2	F	2		
Littorina saxatilis							O	1	F	5	F	4			F	6	F	3	F	9	F	9	F	9
Melarhaphe neritoides	A	9	A	9	C	9																		
Rissoa parva																								
Thais lapillus																							F	1
Mytilus edulis juv																			F	3				
Mytilus edulis	C	7	C	4	C	4			F	1														
Electra pilosa																								
Porphyra							R	2	R	1			R	1	O	2	R	1	R	3	R	4		
Audouinella floridula																								
Gelidium pusillum																								
Palmaria palmata									R	3	R	1	O	3	O	2	R	1						
Hildenbrandia rubra																								
Corallina officinalis					R	1																	R	3
Lithothamnion glaciale																								
Phymatolithon lenormandii																					R	1		
Chondrus crispus																	R	1					R	1
Mastocarpus stellatus																								
Lomentaria articulata																								
Aglaothamnion	O	9	O	9	O	6																		
Ceramium shuttleworthanium	O	9	O	9	O	6													R	3	O	4	O	6
Ceramium virgatum																							O	6
Plumaria plumosa																								
Membranoptera alata																								
Osmundea pinnatifida			R	3	R	3											O	4					R	1
Polysiphonia stricta																								
Polysiphonia fucoides																								
Polysiphonia nigra																								
Rhodomela confervoides																								
Elachista spp.													R	1	R	1					R	1		
Scytosiphon																							R	1
Cladostephus spongiosus																								
Laminaria digitata																								
Laminaria saccharina																								
Fucus serratus																								
Fucus spiralis					R	2																		
Fucus vesiculosus							R	2	R	4	R	2	F	9	F	9	F	9	O	4	O	2		
Himanthalia elongata																								
Enteromorpha intestinalis	O	9	O	9	O	6	A	9	A	9	O	9	C	9	C	9	O	2	O	9	O	9	O	6
Ulva lactuca															R	2								
Chaetomorpha mediterranea																								
Cladophora rupestris																							R	2
Bryopsis plumosa																								
Verrucaria maura					R	1																		

MT4 Selwicks Bay	Habitat 7 F. ves, Patella, Semibalanus on bedrock.						Habitat 8 F. serr, Patella						Habitat 9 F. serr, Audouinella					
	Mid Shore, Eulittoral mid, horizontal bedrock						Mid-Lower Shore, Eulittoral lower, horizontal bedrock						Lower Shore, Eulittoral lower, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.12146		54.12139		54.12133		54.12126		54.12129		54.12127		54.12122		54.12123		54.12125	
Longitude W (WGS 84)	0.08243		0.08228		0.08193		0.08166		0.08174		0.08168		0.08145		0.08153		0.08158	
	Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.MLR.BF.Fser.R						Suggested Biotope: LR.MLR.BF.Rho					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Dynamena pumila													R	2				
Polydora/Boccardiella	C	9	C	9	A	9	C	7	A	9	A	9	C	8			F	3
Semibalanus balanoides	A	9	A	9	C	9	C	6	C	9	C	9						
Balanus crenatus													O	2				
Idotea granulosa					O	2	F	5	F	7	F	3	F	8	F	9	O	5
Pagurus bernhardus													F	1	F	1	F	1
Carcinus maenas															F	2	F	1
Gibbula cineraria							O	1										
Tectura testudinalis													O	1				
Patella vulgata																		
Patella uly/vul	A	9	A	9	A	9	C	8	A	8	C	8	F	2	C	4	C	4
Helcion pellucidum					O	1	F	3	F	1	F	1	F	9	F	7	F	5
Lacuna pallidula							F	6	F	9	F	5	F	6	F	6	F	7
Lacuna vincta							C	9	F	5	F	5	C	9	C	8	C	7
Littorina arcana/sax																		
Littorina littorea	A	9	A	9	C	7	F	1			F	1						
Littorina mariae/obtusata	C	3	C	1	A	9	C	7	C	7	C	3	F	1				
Littorina obtusata																		
Littorina saxatilis	O	1																
Melarhaphe neritoides																		
Rissoa parva													C	9	C	9	C	9
Thais lapillus			F	4	F	2	F	2	C	8	C	7					F	2
Mytilus edulis juv					F	2	F	1			F	2	F	6	F	7	F	5
Mytilus edulis																		
Electra pilosa													O	7	R	4	R	2
Porphyra							R	1	R	1	R	1						
Audouinella floridula			R	1			R	1			R	2	A	9	O	5	S	9
Gelidium pusillum															R	3	R	1
Palmaria palmata					O	4	F	8	O	5	O	7	O	6	F	7	O	6
Hildenbrandia rubra											R	1						
Corallina officinalis	O	7	O	9	O	9	F	9	C	9	F	9	R	2	F	9	O	7
Lithothamnion glaciale													O	3	O	1	O	4
Phymatolithon lenormandii	O	7	R	2	O	9	F	9	O	9	F	9			C	7	O	5
Chondrus crispus	R	2											R	1	R	3	R	3
Mastocarpus stellatus											R	1					R	1
Lomentaria articulata	R	2	R	2	R	1	R	2	R	2	R	1	R	1			O	4
Aglaothamnion																		
Ceramium shuttleworthanium	R	2																
Ceramium virgatum	R	2	R	4	O	4	R	1	O	5	R	2	O	5	O	6	O	5
Plumaria plumosa													O	2			O	3
Membranoptera alata					R	1							R	2	1	1	R	1
Osmundea pinnatifida	F	9	O	9	O	7	O	7	O	9	O	9	R	1	O	5	O	7
Polysiphonia stricta							R	1					R	1				
Polysiphonia fucoides							R	1							R	1	R	1
Polysiphonia nigra													R	1				
Rhodomela confervoides													R	1	O	2	O	1
Elachista spp.					R	3											R	1
Scytosiphon																		
Cladostephus spongiosus							O	3			R	2	O	4	O	4	O	7
Laminaria digitata							R	1					O	2	O	3	O	3
Laminaria saccharina													R	1			R	1
Fucus serratus							C	9	O	2	F	5	A	6	A	9	A	6
Fucus spiralis																		
Fucus vesiculosus	O	8	O	4	C	7			F	4								
Himanthalia elongata											R	1	R	1				
Enteromorpha intestinalis	R	2			O	9	O	3	O	9	O	9					R	1
Ulva lactuca					R	1	R	2	R	4	R	2	O	3	R	2	O	6
Chaetomorpha mediterranea	R	3	O	7	R	1												
Cladophora rupestris			R	3	R	1	O	3					O	5	O	9	O	9
Bryopsis plumosa																	R	1
Verrucaria maura																		

MT5 Raw Data

MT5 Flamborough Head	Habitat 2 Patella, Semibalanus, on cliff face						Habitat 3 Enteromorpha						Habitat 4 Patella, Semibalanus on bedrock						Habitat 5 F. ves, Patella on bedrock						Habitat 6 F. serr, Patella on bedrock.						Habitat 7 F. serr, Audouinella on bedrock					
	Upper Shore, Eulittoral upper, vertical bedrock						Upper Shore, Eulittoral upper, horizontal bedrock						Upper shore, Eulittoral upper, horizontal bedrock						Mid Shore, Eulittoral mid, bedrock						Mid Shore, Eulittoral mid, horizontal bedrock						Mid-Lower Shore, Eulittoral lower, horizontal bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.11591		54.11576		54.11586		54.11586		54.11588		54.11584		54.11588		54.11588		54.11587		54.11580		54.11582		54.11591		54.11580		54.11580		54.11581		54.11566		54.11568		54.11569	
Longitude W (WGS 84)	0.07693		0.07688		0.07690		0.07686		0.07673		0.07669		0.07684		0.07676		0.07669		0.07637		0.07652		0.07651		0.07608		0.07618		0.07613		0.0755		0.07566		0.07575	
	Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.FLR.Eph.Ent						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.FvesR						Suggested Biotope: LR.MLR.BF.Fser.R						Suggested Biotope: LR.MLR.BF.Fser.R					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																																				
Halichondria panicea																																				
Dynamena pumila																															R	3			R	1
Actinia equina	F	1			C	4													F	2			F	1							F	1			F	1
Polydora					F	3	C	5	C	7	C	6	C	4	C	6	A	6	C	9	A	8	C	9	A	9	A	9	A	9	F	4	F	3	C	6
Sabellaria spinulosa																															O	1	O	1		
Semibalanus balanoides	A	9	A	9	A	9	F	4	F	4	F	2	A	9	S	9	S	9	A	9	A	9	A	9			F	5								
Balanus crenatus																																				
Idotea granulosa											O	2							O	1	O	1	O	1			O	1			O	3	F	5	O	3
Pagurus bernhardus																																				
Gibbula cineraria																																				
Tectura testudinalis																																				
Patella vulgata	A	9	A	9	A	9	C	5	C	6	C	5	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9						
Patella uly/vul																																	C	6	C	9
Helcion pellucidum																									O	1	O	2			F	8	F	3	F	6
Lacuna pallidula																			O	1									0	1	F	6	O	2	F	8
Lacuna vincta																															O	2			F	3
Littorina arcana/sax	C	9	C	9	C	9																														
Littorina littorea			F	1	F	4	C	8	C	8	C	6	A	9	C	9	A	9	F	4	C	8	C	8												
Littorina mariae/obtusata																									C	7	C	4	C	4			F	2		
Littorina obtusata																			C	6	C	3	C	3												
Littorina saxatilis											O	1	O	3			F	6																		
Melarhaphe neritoides	C	9	C	9	F	3																														
Rissoa parva																															F	3	F	2	F	3
Thais lapillus															F	2	F	1	C	4					F	1			F	1						
Mytilus edulis juv					F	4			O	1	O	1	O	1	O	2																				
Mytilus edulis																															F	3	F	2		
Lasaea adansoni																															C	7	C	4	F	1
Alcyonidium hirsutum																											R	1								
Membranipora membranacea																																				
Electra pilosa																															O	6	R	4	R	1
Porphyra							O	2					O	1							R	1														
Audouinella floridula																			R	2	R	1			F	9	F	4	O	4	A	9	C	5	C	7
Nemalion helminthoides																																				
Gelidium																			R	2																
Palmaria palmata																													O	3	O	4	O	5	O	6
Ahnfeltia plicata																																				
Hildenbrandia rubra																																			R	1
Corallina officinalis															O	2	R	1	O	6	R	1	O	4	O	9	O	5	O	4	O	5	A	9	R	1
Lithothamnion glaciale																									R	1							R	2	R	1
Melobesia membranacea																																				
Phymatolithon lenormandii															R	2			O	6	O	4	O	3	O	5	O	2	O	5	R	2	O	4	C	9
Chondrus crispus																															R	2				
Mastocarpus stellatus																			R	1																
Polyides rotundus																																	R	1		
Gracilaria verrucosa																															R	1			R	1
Plocamium cartilaginum																															R	1	R	1		
Lomentaria articulata																									R	4			R	3			R	1	R	1
Aglaothamnion																							R	1												
Ceramium shuttleworthanium																			R	3																
Ceramium virgatum																			R	3	R	1	R	3	O	3	O	4	O	6			O	6	R	2
Plumaria plumosa																									R	2			R	1	O	2	O	3	O	4
Membranoptera alata																									R	2			R	1	O	4	R	2	R	2
Phycodrys rubens																													R	1			R	1		
Osmundea pinnatifida	O	5	O	4	O	6							R	1			R	1	C	9	O	5	O	6	O	9	F	9	C	9			O	4	O	9
Polysiphonia															O	2																				
Polysiphonia elongata																																				
Polysiphonia fucoides																					R	1			O	5			R	1			R	1	R	1
Polysiphonia stricta																																			R	1
Rhodomela confervoides																											R	1	R	1						
Red leaf																																	R	2		
Herponema velutinum																																				
Elachista spp.																			R	6																
Scytosiphon lomentaria																																				
Cladostephus spongiosus																									O	6					O	5	R	1	R	3
Laminaria digitata																																	O	3		
Laminaria saccharina																																				
Fucus serratus																									A	8	C	5	A	7	A	9	A	7	C	9
Fucus spiralis	R	1																																		
Fucus vesiculosus							R	5	O	3	R	1	O	2			O	1	F	9	O	6	O	4	O	1			O	1						
Himanthalia elongata																															R	1	<	2		
Enteromorpha intestinalis	R	1					A	9	A	9	A	9	O	9	O	9	O	9	O	9	O	9	O	7	O	3	O	9	O	9	R	1			R	1
Ulva lactuca																													O	2			O	3	R	3
Cladophora																									R	1	R	1								
Cladophora rupestris																									O	5	R	1	R	1	O	6	O	7	O	4
Cladophora sericea																					R	2	R	3												
Rhizoclonium riparium																							R	1												
Green Mat																																				
Verrucaria maura	R	2	R	1																																
Red mat	O	6	O	6	O	5																	R	1												

MT5 Flamborough Head	Habitat 8 Himanthalia on raised areas						Habitat 9 Audouinella/red sea weed					
	Lower Shore, Eulittoral lower, raised horizontal bedrock						Lower Shore, Eulittoral lower, bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.11563		54.11564		54.11564		54.11562		54.11562		54.11563	
Longitude W (WGS 84)	0.07535		0.07543		0.07548		0.07579		0.07526		0.07526	
	Suggested Biotope: LR.HLR.FR.Him						Suggested Biotope: LR.MLR.BF.Rho					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA	R	1										
Halichondria panicea	O	2										
Dynamena pumila	R	3	R	2	R	3						
Actinia equina												
Polydora	F	1			F	1						
Sabellaria spinulosa	O	2	O	2								
Semibalanus balanoides												
Balanus crenatus	O	1	F	4	F	4						
Idotea granulosa	F	9	O	1	O	1			O	3	F	5
Pagurus bernhardus							F	1	F	1		
Gibbula cineraria	O	1					O	2			O	1
Tectura testudinalis	O	2	F	4	O	3						
Patella vulgata												
Patella uly/vul			F	4	F	4						
Helcion pellucidum	F	9	F	4	F	7					F	9
Lacuna pallidula	O	2	O	1	F	3					F	6
Lacuna vincta	O	1	F	2	O	1	F	2	C	6	C	7
Littorina arcana/sax												
Littorina littorea												
Littorina mariae/obtusata					F	1					F	1
Littorina obtusata												
Littorina saxatilis												
Melarhaphe neritoides												
Rissoa parva	C	9	C	9	C	9	C	9	C	9	C	9
Thais lapillus					F	4						
Mytilus edulis juv	F	3	F	3			F	8	F	1	F	2
Mytilus edulis												
Lasaea adansoni	C	9	C	9	C	9						
Alcyonidium hirsutum	R	1										
Membranipora membranacea											R	3
Electra pilosa	O	9	O	9	R	1			R	2	R	2
Porphyra												
Audouinella floridula	F	4	O	6	O	2	C	9	C	9	S	9
Nemalion helminthoides							R	1				
Gelidium												
Palmaria palmata	R	1			R	1						
Ahnfeltia plicata			R	6	R	1						
Hildenbrandia rubra												
Corallina officinalis	O	6	O	7	F	9			O	9	O	4
Lithothamnion glaciale	F	9	O	4	O	2			F	4		
Melobesia membranacea			R	2	R	3						
Phymatolithon lenormandii			O	6	C	7						
Chondrus crispus	O	6	R	4					O	4		
Mastocarpus stellatus									R	1		
Polyides rotundus							A	9	O	2	O	5
Gracilaria verrucosa	O	3			R	2						
Plocamium cartilagineum	R	1					R	1	R	1		
Lomentaria articulata	O	3	O	9	R	1					R	1
Aglaothamnion	R	2			R	1						
Ceramium shuttleworthanium												
Ceramium virgatum	O	4			O	7	O	3	O	5	O	5
Plumaria plumosa	O	6	C	9	O	2						
Membranoptera alata	O	4									R	2
Phycodrys rubens											R	2
Osmundea pinnatifida	O	3	C	9	C	9					R	1
Polysiphonia	R	1										
Polysiphonia elongata							R	1				
Polysiphonia fucoides					R	1	R	1	R	1	R	3
Polysiphonia stricta					R	1						
Rhodomela confervoides									R	1	O	4
Red leaf												
Heronema velutinum	R	1	R	1								
Elachista spp.												
Scytosiphon lomentaria									R	1		
Cladostephus spongiosus	F	4	O	3	O	4					R	2
Laminaria digitata	O	5	O	1								
Laminaria saccharina									O	2	O	1
Fucus serratus	C	4	O	1					R	1	C	7
Fucus spiralis												
Fucus vesiculosus												
Himanthalia elongata	C	7	C	9	C	9			O	1		
Enteromorpha intestinalis			R	2					R	1		
Ulva lactuca	R	2	O	6	R	6	R	1	R	3		
Cladophora												
Cladophora rupestris	C	8	O	3	R	7	R	2	O	2	O	4
Cladophora sericea												
Rhizoclonium riparium												
Green Mat			R	2								
Verrucaria maura												
Red mat												

MT6 Raw Data

MT6 Flamborough Head	Habitat 1 Green Slime on cliff face						Habitat 2 Barren coarse sand/shingle						Habitat 3 Enteromorpha, F. spi						Habitat 4 Patella, Semibalanus, F.ves on bedrock						Habitat 5 Osmundia, L. lit, Patella, Corallina pools					
	Upper Shore, Supralittoral, Cliff face						Upper Shore, Littoral , sand/shingle						Upper Shore, Littoral , horizontal bedrock and sand/shingle						Upper shore, Eulittoral upper, horizontal bedrock						Mid Shore, Eulittoral upper, bedrock/rockpools					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.11375		54.11363				54.11367		54.11360		54.11360		54.11365		54.11302		54.11363		54.11362		54.11354		54.11332		54.11329		54.11327		54.11322	
Longitude W (WGS 84)	0.07844		0.07781				0.07770		0.07771		0.07771		0.07787		0.07762		0.07763		0.07757		0.07738		0.07692		0.07685		0.07680		0.07606	
	Suggested Biotope: LR.FLR.CvOv.GCv						Suggested Biotope: LS.LCS.Sh.BarSh						Suggested Biotope: LR.MLR.BF.FspiB						Suggested Biotope: LR.HLR.MusB.Sem.FvesR						Suggested Biotope: LR.HLR.MusB.Sem.FvesR					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																														
Actinia equina																					F	1								
Urticina felina																														
Polydora																			F	4	F	5	C	7	A	9	A	9	A	8
Pomatoceros																														
Semibalanus balanoides																			C	9	A	9	A	9	F	2	C	7	C	9
Amphipoda spp.																	O	2												
Idotea granulosa																					O	1								
Ligia oceanica																	O	2												
Pagurus bernhardus																														
Galathea																							F	1						
Carcinus maenas																					F	1			F	1				
Lepidochitona cinereus																														
Gibbula cineraria																														
Patella vulgata													C	4	C	3	C	4	C	5	C	9	C	9	F	2	C	7	C	9
Patella uly/vul																														
Helcion pellucidum																														
Lacuna pallidula																														
Lacuna vincta																														
Littorina littorea													F	1	F	1	C	6	A	9	A	9	A	9	A	9	A	9	C	8
Littorina mariae/obtusata																														
Littorina obtusata																			F	2	F	1	C	3	C	2	C	4	C	4
Littorina saxatilis													F	4	F	3	F	1	O	1			O	1	O	1				
Thais lapillus																							F	3			F	1		
Aplysia punctata																									C	1				
Mytilus edulis													F	1																
Lasaea adansoni																														
Alcyonidium hirsutum																														
Electra pilosa																														
Henricia																														
Lipophrys pholis																									F	1				
Audouinella floridula																														
Gelidium																														
Palmaria palmata																							R	1						
Hildenbrandia rubra																														
Corallina officinalis																					O	2	O	4	F	9	R	1	O	5
Lithothamnion glaciale																														
Melobesia membranacea																														
Phymatolithon lenormandii																			O	7	O	5	F	5	C	9	A	9	O	6
Catenella caespitosa																			R	1										
Dumontia contorta																	R	1	R	1	<	1								
Chondrus crispus																	R	1							O	2	F	7		
Polyides discoid																														
Plocamium cartilaginum																														
Lomentaria articulata																														
Ceramium shuttleworthianum																														
Ceramium virgatum																									R	1	R	1	R	2
Plumaria plumosa																														
Cryptopleura ramosa																														
Membranoptera alata																														
Osmundea pinnatifida															R	1			O	3	O	5	F	9	C	9	F	9	F	8
Polysiphonia																							R	2						
Polysiphonia fucoides																									O	3	R	2		
Polysiphonia nigra															R	1														
Polsiphonia stricta																														
Ralfsia verrucosa																									R	1				
Scytosiphon lomentaria																	R	1	R	1										
Cladostephus spongiosus																														
Dictyota dichotoma															R	1														
Laminaria digitata																														
Fucus serratus																														
Fucus spiralis													F	8	F	6	O	3	O	3										
Fucus vesiculosus																			O	2	O	3	O	5	O	4	O	5	O	6
Rosenvingiella polyrhiza													R	1																
Enteromorpha intestinalis													F	9	C	9	C	9									R	2	R	2
Ulva lactuca																													R	2
Chaetomorpha mediterranea															R	1			R	1	R	1	O	4	O	9	R	1	R	3
Chaetomorpha melagonium																														
Chaetomorpha																														
Cladophora																							R	3						
Cladophora albida																														
Cladophora rupestris															R	1			R	1			R	1	R	2	R	2	R	2
Cladophora sericea															R	1			R	6					O	9	O	5	R	2
Verrucaria maura	O	9	F	9																										
Green Slime	S	9	S	9																										

MT6 Flamborough Head	Habitat 7 F. ves, Patella on bedrock.						Habitat 8 F. serr, Corallina on bedrock						Habitat 9 Patella, Semibalanus on raised rocky platform						Habitat 10 Enteromorpha, F. serr						Habitat 13 L. dig, Corallina					
	Mid Shore, Eulittoral mid, horizontal bedrock						Mid-Lower Shore lower, Eulittoral, horizontal bedrock/pools						Lower Shore, Eulittoral mid, raised horizontal platform						Lower Shore, Eulittoral lower,on bedrock						Lower Shore, sublittoral on bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.11317		54.11314		54.11305		54.11306		54.11300		54.11297		54.11291		54.11291		54.11291		54.11277		54.11274		54.11275		54.11233		54.11235		54.11237	
Longitude W (WGS 84)	0.07659		0.07653		0.07633		0.07631		0.07618		0.07610		0.07602		0.07598		0.07596		0.07565		0.07559		0.07560		0.07473		0.07474		0.07477	
	Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.MLR.BF.Fser.R						Suggested Biotope: LR.HLR.MusB.Sem.FvesR						Suggested Biotope: ?						Suggested Biotope: LR.HLR.FR.Coff.Coff					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
PORIFERA																											O	1	O	8
Actinia equina											F	1			F	1														
Urticina felina																											F	1		
Polydora	A	9	A	9	C	9							C	9	C	7	C	8	A	9	C	6	A	9						
Pomatoceros									O	1																				
Semibalanus balanoides	A	7	A	9	C	7	F	2					A	9	A	9	A	9	F	4										
Amphipoda spp.							O	1																					O	1
Idotea granulosa							O	1			O	2	O	1																
Ligia oceanica																														
Pagurus bernhardus							C	5	C	6	F	1	F	1																
Galathea																														
Carcinus maenas									F	1											O	1								
Lepidochitona cinereus							F	2	F	3																				
Gibbula cineraria							O	4	F	4																			O	1
Patella vulgata	C	9	C	8	C	9							C	8	C	9	C	8	C	6	C	4	C	6						
Patella uly/vul							C	8	F	2	C	8																		
Helcion pellucidum																									F	5	F	5	F	7
Lacuna pallidula															O	3			F	2	O	1								
Lacuna vincta															O	1														
Littorina littorea	C	7	C	8	C	8	C	8	A	9	A	9	C	8	C	5	F	2			F	1								
Littorina mariae/obtusata	C	8	C	5	C	2	C	7	C	8	A	9	C	3	C	5	C	5	C	3	F	1	F	3						
Littorina obtusata																														
Littorina saxatilis																														
Thais lapillus							F	1					C	5	F	4	C	6			F	1								
Aplysia punctata																														
Mytilus edulis																														
Lasaea adansoni																			A	9	A	9	A	9						
Alcyonidium hirsutum															R	1														
Electra pilosa																									O	9	O	9	O	6
Henricia																									C	1				
Lipophrys pholis							F	1																						
Audouinella floridula	R	1							R	1	R	1	R	2			R	1	<	1	O	7	F	7			R	1	F	2
Gelidium																							R	1						
Palmaria palmata																									O	1			R	1
Hildenbrandia rubra							R	1	R	3																				
Corallina officinalis	C	7	O	9	R	4	O	8	C	9	R	5	O	4	O	3			F	9	O	9	O	5	S	9	S	9	O	6
Lithothamnion glaciale																									C	4	O	4	A	8
Melobesia membranacea									R	1																				
Phymatolithon lenormandii	C	9	F	8	O	7			O	5	F	7	R	2	R	4	R	2	R	1	O	5	O	7						
Catenella caespitosa																														
Dumontia contorta																														
Chondrus crispus							R	2	R	2															F	5	C	9	F	7
Polyides discoid																											R	1	R	1
Plocamium cartilaginum																									R	2	O	2	R	1
Lomentaria articulata									O	2											R	1								
Ceramium shuttleworthanium															O	4														
Ceramium virgatum	O	7	O	9	O	4	O	3	O	5	O	6	O	2			O	3	R	4	O	8	O	6	R	1	R	1	R	1
Plumaria plumosa													O	1															R	1
Cryptopleura ramosa																											R	2	R	1
Membranoptera alata									R	1															R	1	O	3	R	3
Osmundea pinnatifida	C	9	F	9	F	9	F	9	C	9	F	9	O	9	O	9	O	8	O	7	O	9	F	9						
Polysiphonia																														
Polysiphonia fucoides	O	5	R	1			R	1	R	1	R	1	R	1	O	2	R	1	R	3	R	1	O	2						
Polysiphonia nigra							R	1																						
Polsiphonia stricta																									R	1			R	1
Ralfsia verrucosa																														
Scytosiphon lomentaria					R	1																								
Cladostephus spongiosus	R	1							R	1	R	2			R	1			R	1	R	1	O	2						
Dictyota dichotoma																														
Laminaria digitata																									A	4	C	5	C	7
Fucus serratus							F	4	O	2	O	5							F	3			O	1	R	1				
Fucus spiralis																														
Fucus vesiculosus	C	7	C	4	F	6	O	3	O	1	F	1	O	9	O	9	O	9	O	2	R	2	R	1			R	1		
Rosenvingiella polyrhiza																														
Enteromorpha intestinalis	O	9	R	3	R	1	O	6			O	1	F	9	O	9	O	9	C	9	C	9	F	9						
Ulva lactuca	R	2	O	9	R	1	O	2	O	5	O	5			R	1							R	1						
Chaetomorpha mediterranea			R	2																			R	1						
Chaetomorpha melagonium																									R	4	R	4	R	2
Chaetomorpha					O	6																								
Cladophora																														
Cladophora albida													R	5	R	3	R	2	R	5	O	9								
Cladophora rupestris	O	4			F	5	R	2	O	5	F	7			R	2	R	1	O	7	R	1	R	3	R	1	R	2	R	2
Cladophora sericea	O	5	R	2	R	4	R	1	R	5	R	4																		
Verrucaria maura																														
Green Slime																														

MT8 Raw Data

MT8 South Cliff, Sewerby	Habitat 1 Barren shingle/sand						Habitat 2 Enteromorpha covered cobbles on shingle						Habitat 3 F. ves, F. spi on sand covered rock						Habitat 4 Patella, Semibalanus, Enteromorpha on bedrock						Habitat 5 Patella, Semibalanus on bedrock					
	Upper Shore, Littoral upper, coarse sand/shingle						Upper Shore, Littoral lower, sand/shingle/cobbles						Upper Shore, Littoral lower, horizontal bedrock and sand/shingle						Upper shore, Eulittoral upper, horizontal bedrock						Mid Shore, Eulittoral mid, on bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.10113		54.10103		54.10110		54.10105		54.10104		54.10102		54.10097		54.10096		54.10099		54.10089		54.10091		54.10091		54.10068		54.10072		54.10074	
Longitude W (WGS 84)	0.15529		0.1553		0.15529		0.15527		0.15529		0.15528		0.15524		0.15528		0.15526		0.15521		0.15523		0.15522		0.15515		0.15516		0.15516	
	Suggested Biotope: LS.LCS.Sh.BarSh.						Suggested Biotope: LR.FLR.Eph.Ent						Suggested Biotope: LR.FLR.BF.FvesB						Suggested Biotope: LR.HLR.MusB.Sem.Sem						Suggested Biotope: LR.HLR.MusB.Sem.FvesR					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Halichondria panicea																														
Dynamena pumila																														
Actinia equina																														
Polydora													F	2					A	9	C	9	A	9						
Cirratulus cirratus																														
Lanice conchilega																														
Pomatoceros																									C	8	A	9	C	5
Spirorbidae																														
Semibalanus balanoides																			A	9	C	9	C	9	S	9	A	9	S	9
Amphipoda spp.					C	9			O	1																				
Gammarus													O	1	F	3	O	3												
Sphaeroma																														
Idotea granulosa																	O	1												
Cancer pagurus																														
Carcinus maenas																														
Lepidochitona cinereus																														
Patella vulgata																			C	9	C	9	C	5	C	9	C	8	C	9
Littorina littorea																			F	3	F	2	F	4	F	2			C	9
Littorina mariae/obtusata																														
Littorina obtusata							O	1					F	1			C	5					F	1						
Thais lapillus																														
Mytilus edulis											F	1							C	4	F	1	F	1	C	4			C	6
Audouinella floridula																									R	1				
Corallina officinalis																									R	1				
Phymatolithon lenormandii																														
Dumontia contorta																														
Chondrus crispus																														
Aglaothamnion																									R	2				
Ceramium virgatum																					R	1	O	1	O	2				
Osmundea pinnatifida																			O	2					O	6				
Polysiphonia nigra																									R	1				
Ectocarpus fasciculatus																														
Cladostephus spongiosus																														
Fucus spp. (sporelings)																											O	2	O	4
Fucus serratus																														
Fucus spiralis													O	2			O	2	O	1	O	2	O	1						
Fucus vesiculosus									O	2			F	3	F	3	F	4					O	1	F	5				
Ulothrix speciosa																														
Enteromorpha intestinalis							O	2	R	1	F	7	F	3	O	5	O	4	F	9	F	9	A	9	O	9	A	9	O	6
Ulva lactuca																														
Chaetomorpha linum																														
Cladophora																														
Cladophera B																														
Cladophora rupestris																														

MT8 Sewerby	Habitat 6 F. ves, Patella on bedrock.						Habitat 7 Rockpool						Habitat 8 F. serr						Habitat 9 Ceramium on bedrock sand, gravel						Habitat 10 Audouinella, Ceramium					
	Mid Shore, Eulittoral mid, horizontal bedrock						Lower Shore, Eulittoral lower, rockpool						Lower Shore, Eulittoral lower, bedrock						Lower Shore, Eulittoral lower, bedrock, sand, gravel						Lower Shore, Eulittoral lower, on bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.10051		54.10058		54.10063		54.10043		54.10046				54.10030		54.10035		54.10041		54.10013		54.10013		54.10016		54.09984		54.09993		54.09996	
Longitude W (WGS 84)	0.15510		0.15512		0.15513		0.15507		0.15504				0.15502		0.15506		0.15507		0.15495		0.15495		0.15496		0.15489		0.15486		0.15488	
	Suggested Biotope: LR.LLR.F.Fves.FS						Suggested Biotope: LR.FLR.Rkp.G						Suggested Biotope: LR.LLR.F.Fserr.FS						Suggested Biotope: ?						Suggested Biotope: LR.MLR.BF.Rho					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Halichondria panicea																									O	4	O	5	O	6
Dynamena pumila															R	1	O	9												
Actinia equina																									F	1	F	2	F	2
Polydora			A	9	A	9	F	3					C	9	C	9	C	9	C	9	C	9	C	9	S	9	S	9	S	9
Cirratulus cirratus			O	1																										
Lanice conchilega																									O	1	O	2		
Pomatoceros																														
Spirorbidae													O	1																
Semibalanus balanoides			A	9	C	4	O	1	O	1					F	1														
Amphipoda spp.																														
Gammarus															C	5	F	2												
Sphaeroma															O	2														
Idotea granulosa	O	1																												
Cancer pagurus																											F	1		
Carcinus maenas	F	1					F	1					F	1	F	2														
Lepidochitona cinereus																			F	1										
Patella vulgata	F	1	C	9	F	2																								
Littorina littorea	F	2	C	8	F	3	C	3	C	5			C	5	C	5	F	3	C	8	C	6	C	7	F	3	F	2	C	7
Littorina mariae/obtusata													F	1	C	4	C	5												
Littorina obtusata	F	2	F	2	F	2																								
Thais lapillus													F	2									F	1	F	3	F	1	F	2
Mytilus edulis													F	1	C	1									C	2				
Audouinella floridula																					R	1			A	9	A	8	A	9
Corallina officinalis																														
Phymatolithon lenormandii	S	9			C	9	O	2					A	9	A	9	A	9	R	2	R	1	R	1					O	3
Dumontia contorta	R	1											R	1	R	1														
Chondrus crispus	O	9			O	4	O	3	O	1			C	7	C	9	O	9	O	4	F	9	F	4	O	3	O	3	O	5
Aglaothamnion																														
Ceramium virgatum	O	4	R	2	O	5	F	6	C	9			O	7					S	9	C	9	F	9	A	9	A	9	C	9
Osmundea pinnatifida	O	2	O	6	R	2									O	1									R	1	R	2	O	5
Polysiphonia nigra							R	1	R	1											R	1								
Ectocarpus fasciculatus																									R	1	R	1		
Cladostephus spongiosus													R	1							R	1	R	2						
Fucus spp. (sporelings)																														
Fucus serratus	C	6											A	9	S	9	S	9												
Fucus spiralis																														
Fucus vesiculosus	A	9	F	6	S	9							O	2			O	2												
Ulothrix speciosa	R	2	R	6	R	2																								
Enteromorpha intestinalis			O	9	O	3	O	4	A	9			C	4	R	2	R	1	R	1	O	7	O	9	O	9	O	9	O	9
Ulva lactuca							O	2	C	4			O	2					O	4			R	2	O	9	O	8	F	9
Chaetomorpha linum																							R	1						
Cladophora	O	4																												
Cladophera B																	R	1												
Cladophora rupestris					R	2	O	1					R	1	O	4	R	1												

MT9 Raw Data

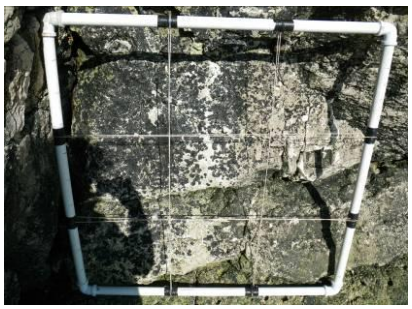
MT9 Sewerby Steps, Sewerby	Habitat 1 Barren shingle/cobbles						Habitat 2 Barren sand						Habitat 3 F. ves, on sand covered rock. Pat, Semi on rock outcrops.						Habitat 4 Patella, Semibalanus, Mytilus on bedrock						Habitat 5 Enteromorpha, Pat, Semi on sand covered bedrock					
	Upper Shore, Supralittoral, shingle/cobbles						Upper Shore, Littoral on coarse sand						Upper Shore, Littoral , horizontal bedrock and sand						Upper shore, Eulittoral, horizontal bedrock						Mid Shore, Eulittoral on sand covered bedrock					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.10031		54.10031		54.10029		54.09919		54.09919		54.10023		54.10022		54.10018		54.10014		54.10008		54.10006		54.10001		54.09996		54.09993		54.09986	
Longitude W (WGS 84)	0.16088		0.16090		0.16087		0.16052		0.16052		0.16086		0.16089		0.16086		0.16085		0.16081		0.16079		0.16081		0.16077		0.16078		0.16075	
	Suggested Biotope: LS.LCS.Sh.BarSh						Suggested Biotope: LS.LSa.MoSa.BarSa						Suggested Biotope: LR.MLR.BF.FvesB						Suggested Biotope: LR.MLR.MusF.MytFves						Suggested Biotope: LR.MLR.MusF.MytFves					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Polydora															F	2			A	9	C	3	C	9			C	6	F	4
Cirratulus cirratus																														
Semibalanus balanoides															O	1	C	4	A	9	C	6	A	9	A	6	C	5	F	3
Balanus crenatus																														
Amphipoda spp.			O	1									F	2	F	3	F	3					F	2						
Carcinus maenas													F	1									F	1			C	2	F	2
Patella vulgata															F	1	C	3	C	9	F	4	C	5	F	1			F	1
Littorina littorea															F	1	F	3	C	8	C	6	C	8	C	3	C	7	C	4
Littorina obtusata													C	5	C	2	F	3			F	1	F	2						
Littorina saxatilis															O	1														
Thais lapillus																							F	1						
Mytilus edulis															F	1	C	3	A	9	C	6	A	9	F	1	C	4	C	6
Erythrotrichia carnea																														
Porphyra purpurea																							R	1					O	3
Porphyra													R	2																
Audouinella																														
Audouinella floridula													R	1																
Phymatolithon lenormandii																														
Chondrus crispus																														
Lomentaria articulata																														
Ceramium virgatum																														
Ceramium shuttleworthianum													R	1																
Osmundea pinnatifida																														
Polysiphonia nigra																														
Ectocarpus fasciculatus																														
Fucus serratus																														
Fucus vesiculosus													A	6	C	7	F	4	O	1	O	1					O	3		
Blidingia minima																											R	1		
Enteromorpha intestinalis													R	1	R	1	O	4	R	1	C	9			F	8	C	8	S	9
Ulva lactuca																														
Ulva prolifera													R	1													R	3		
Chaetomorpha																														
Cladophora sericea																			R	1										
Cladophora rupestris													R	1																
Green Mat																			R	1										
Verrucaria mucosa															F	5	O	4												

MT9 Sewerby Steps, Sewerby	Habitat 6 Mytilus, Semi on bedrock						Habitat 7 Mytilus, Semibalanus, red sea weeds on bedrock						Habitat 8 Semibalanus, L. lit, on rock covered sand						Habitat 9 Enteromorpha, Ceramium on bedrock					
	Mid Shore, Eulittoral, horizontal bedrock						Lower Shore, Eulittoral, bedrock						Lower Shore, Eulittoral, bedrock partially covered in sand						Lower Shore, Eulittoral, bedrock,					
Quadrat	Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3		Q1		Q2		Q3	
Latitude N (WGS 84)	54.09959		54.09964		54.09969		54.09906		54.09917		54.09923		54.09899		54.09843		54.09897		54.09882		54.09887		54.09890	
Longitude W (WGS 84)	0.16065		0.16065		0.16069		0.16046		0.16051		0.16052		0.16042		0.16042		0.16040		0.16038		0.16043		0.16043	
	Suggested Biotope: LR.HLR.MusB.MytB						Suggested Biotope: LR.MLR.MusF.MytFR						Suggested Biotope: LR.HLR.MusB.Sem.BLitX						Suggested Biotope: ?					
Species Name	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9	SACFOR	/9
Polydora	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9	A	9	S	9
Cirratulus cirratus			O	3																				
Semibalanus balanoides	A	9	A	9	S	9	A	9	A	9	A	9	A	9	C	9	C	6						
Balanus crenatus																			C	4	C	6	C	9
Amphipoda spp.					F	5													F	1			C	9
Carcinus maenas			F	1																	F	2	C	9
Patella vulgata	C	8			C	8																		
Littorina littorea	A	9	A	9	A	9	A	9	A	9	A	9	C	9	C	8	C	6						
Littorina obtusata																								
Littorina saxatilis																								
Thais lapillus							F	2			F	1												
Mytilus edulis	S	9	A	9	A	9	S	9	S	9	S	9					C	2	F	1			C	4
Erythrotrichia carnea															R	1								
Porphyra purpurea																								
Porphyra																			C	9				
Audouinella																			R	1				
Audouinella floridula																								
Phymatolithon lenormandii							O	5															R	1
Chondrus crispus							O	3	R	1	O	3	O	3							R	1	R	1
Lomentaria articulata																	R	1						
Ceramium virgatum							O	4					R	1	R	1	R	3	O	9	A	9	A	9
Ceramium shuttleworthianum																								
Osmundea pinnatifida	O	3	O	1			O	4	O	9	F	7												
Polysiphonia nigra													R	1	R	1					R	1		
Ectocarpus fasciculatus																			R	1	F	8	F	8
Fucus serratus																					O	1		
Fucus vesiculosus																								
Blidingia minima																								
Enteromorpha intestinalis															R	1	R	4	A	9	C	9	C	9
Ulva lactuca																					O	3	F	5
Ulva prolifera																			R	1				
Chaetomorpha											R	1												
Cladophora sericea																								
Cladophora rupestris																								
Green Mat																								
Verrucaria mucosa																								

APPENDIX II QUADRAT PHOTOS

MT1

MT1B1Q1



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MT1B1Q3

MT1B2Q1

MT1B2Q2

MT1B4Q1

MT1B4Q2

MT1B4Q3

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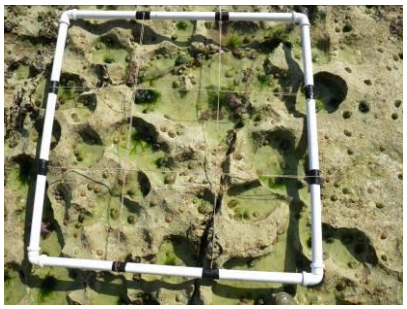
MT1B5Q2

MT1B5Q3



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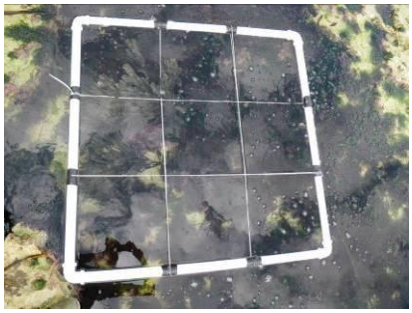

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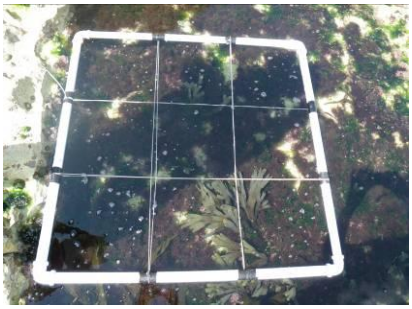

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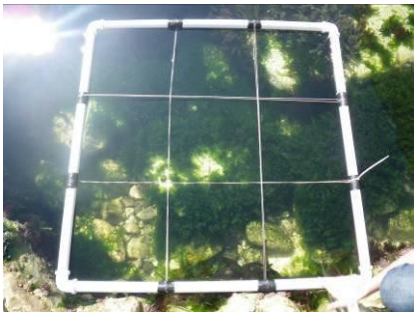

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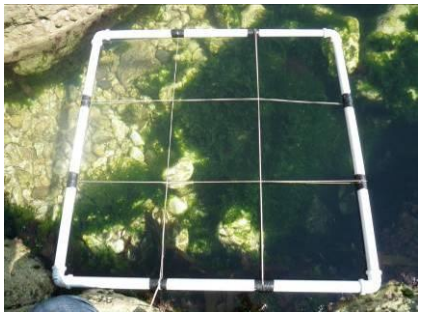

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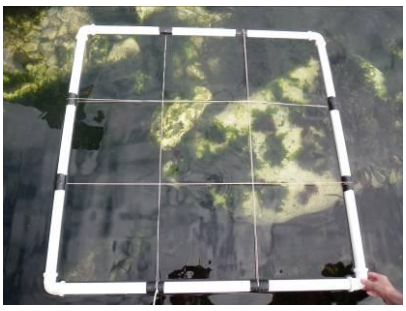

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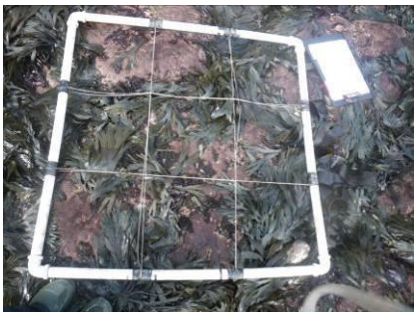

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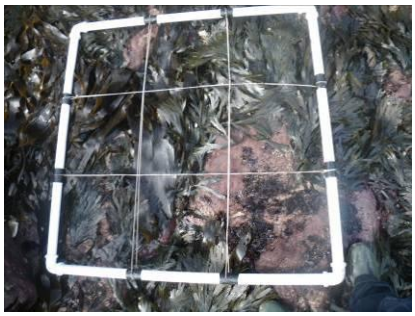

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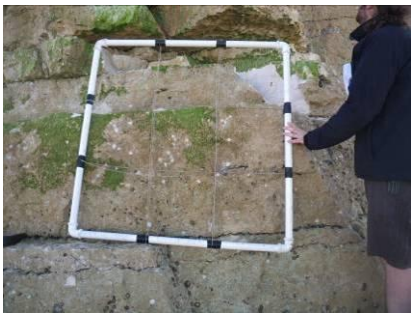

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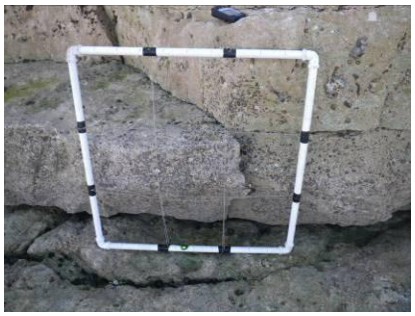

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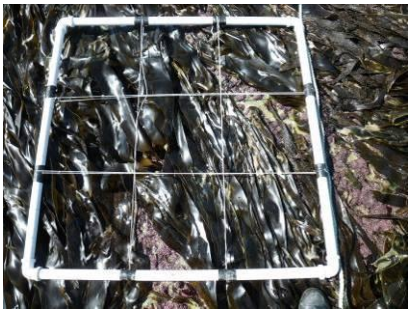

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MT3

MT3B2Q1

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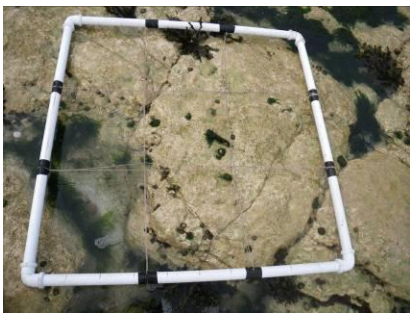

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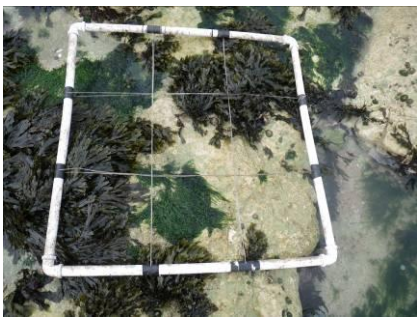

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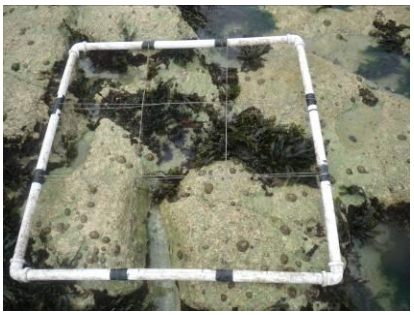

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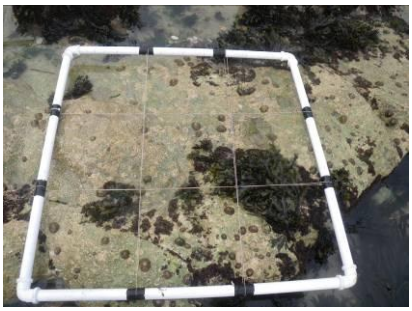

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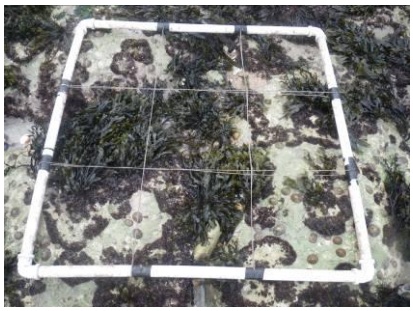

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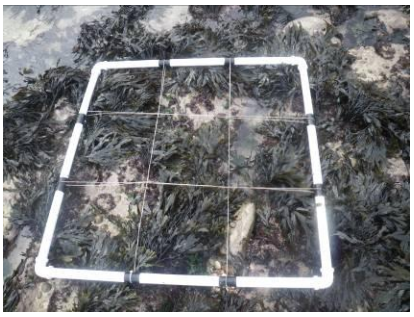

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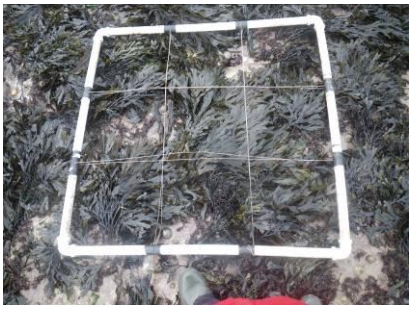

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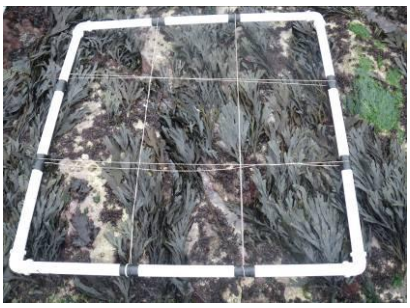

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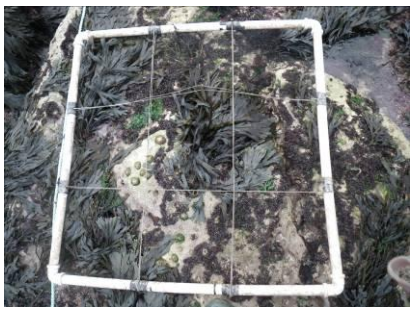

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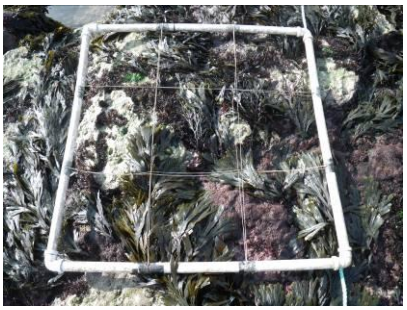

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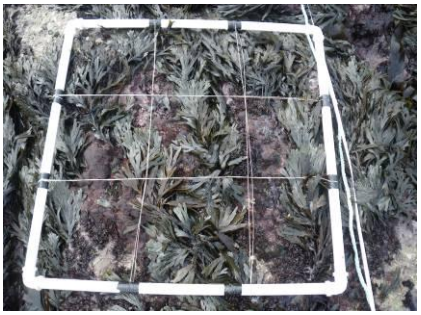

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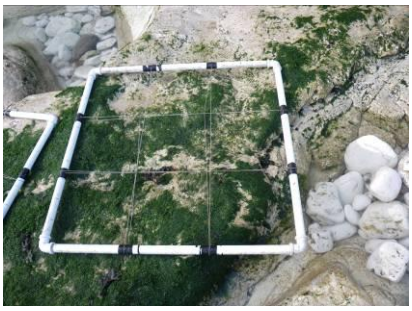

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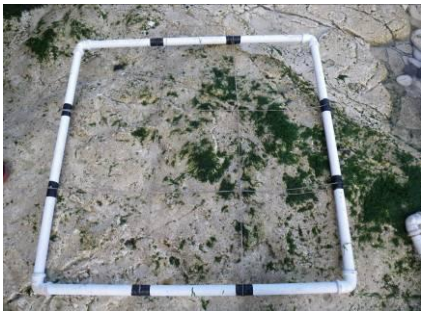

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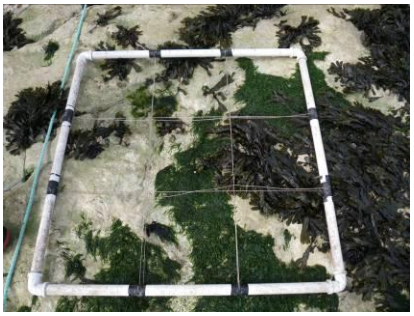

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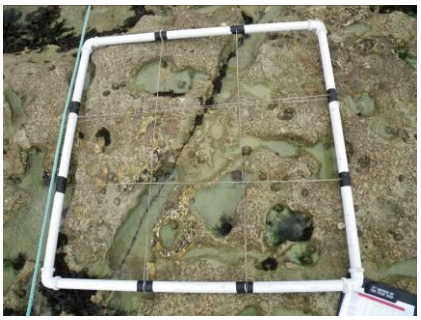

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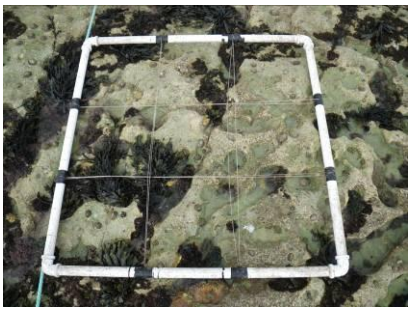

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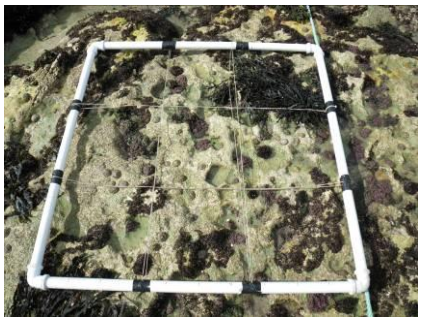

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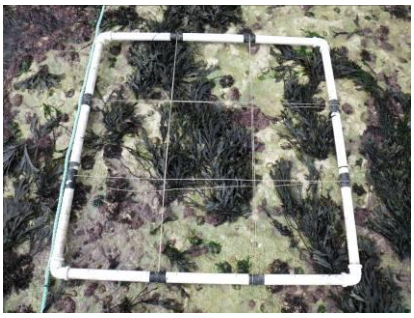

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MT5

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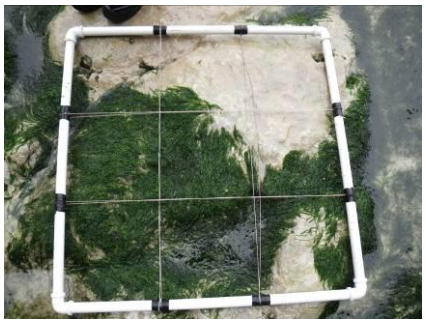

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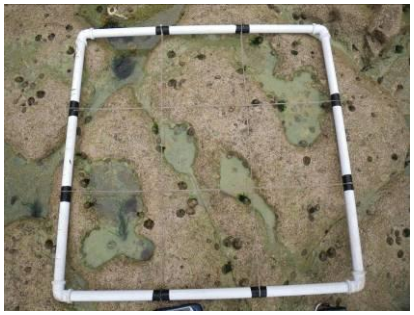

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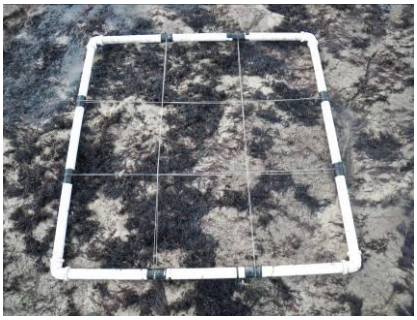

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MT6

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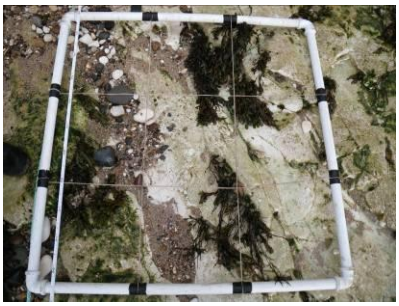

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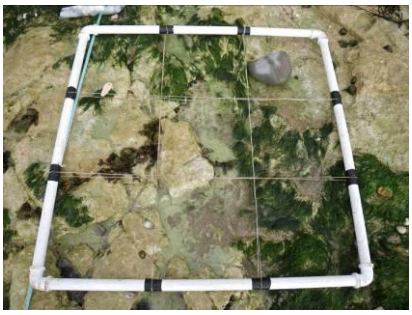

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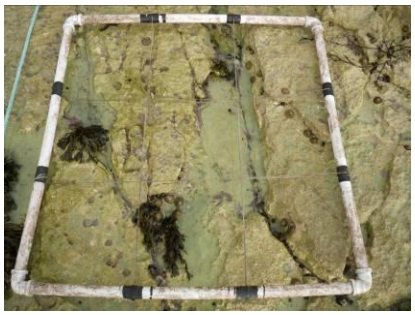

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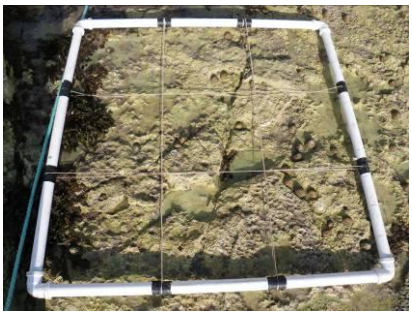

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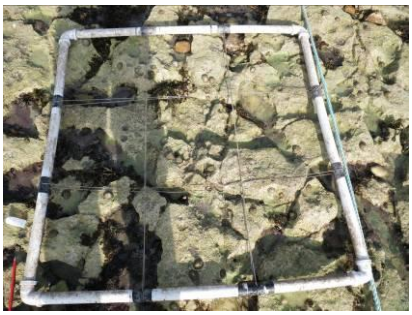

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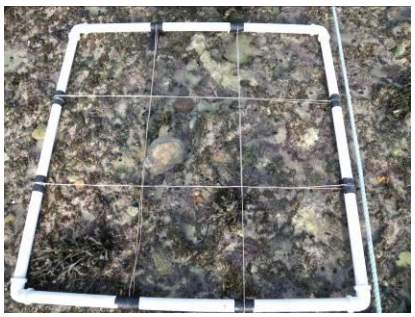

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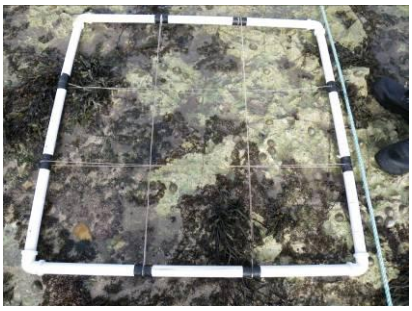

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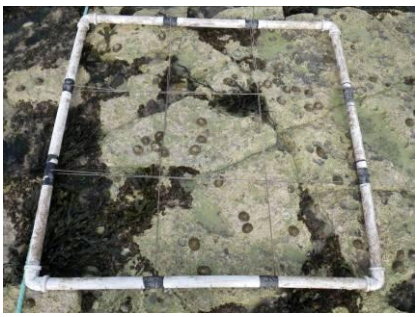

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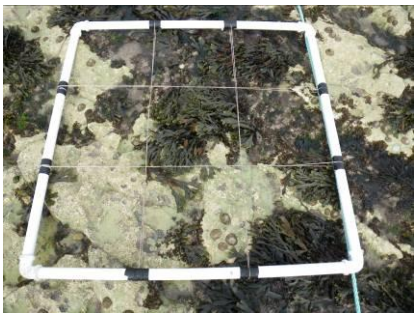

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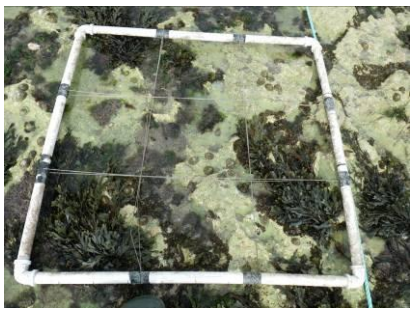

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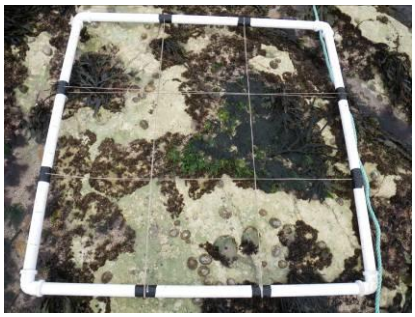
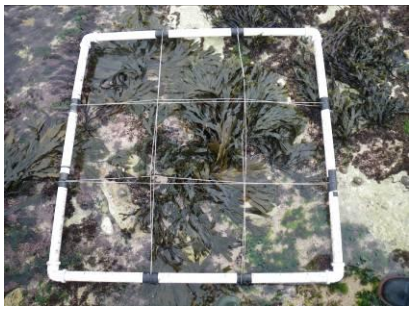
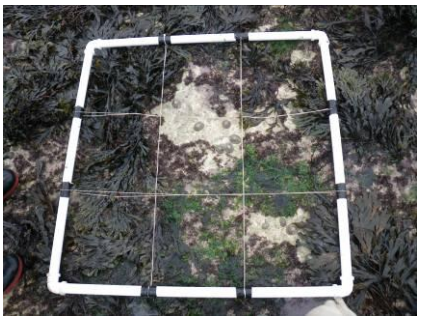


MT6B7Q3



MT6B8Q1

MT6B8Q2



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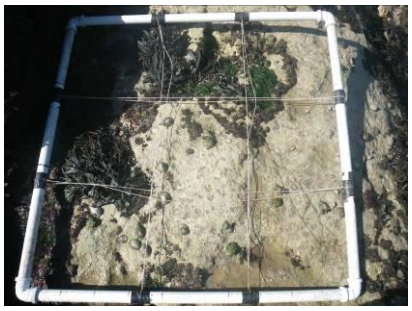
MT6B9Q1



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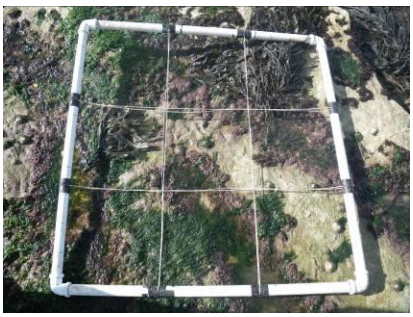

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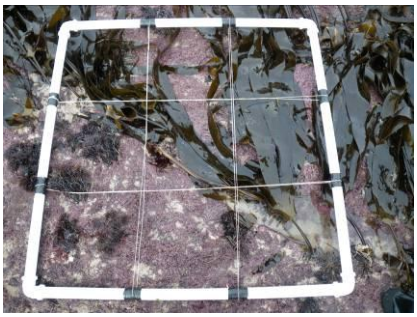
MT6B10Q2

MT6B10Q3



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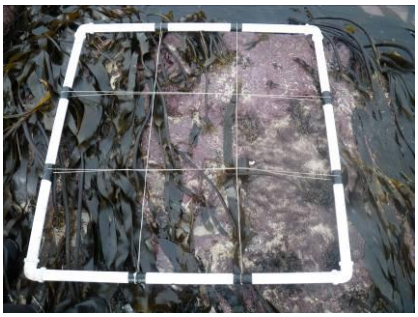


MT6B13Q3

MT8

MT8B1Q1

MT6BQ2

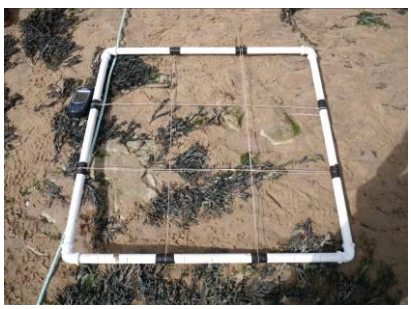
MT8BQ3

MT8B2Q1

MT8B2Q2

MT8B2Q3

MT8B3Q1



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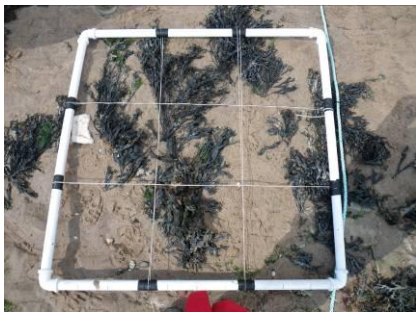

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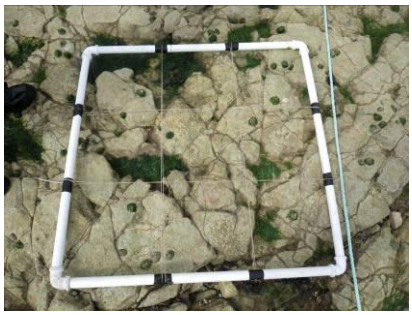

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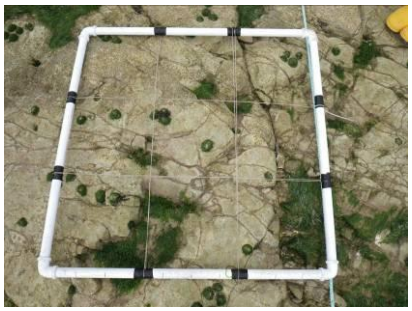

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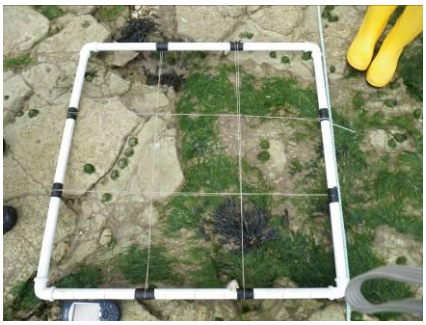

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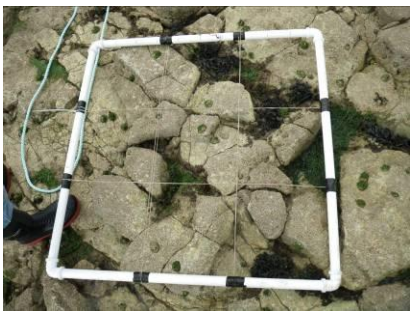

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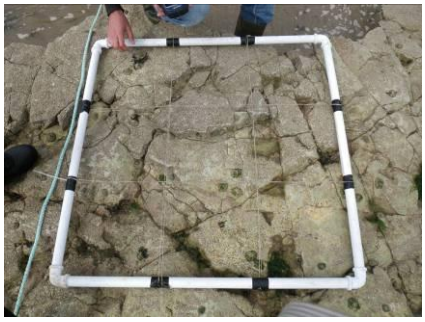

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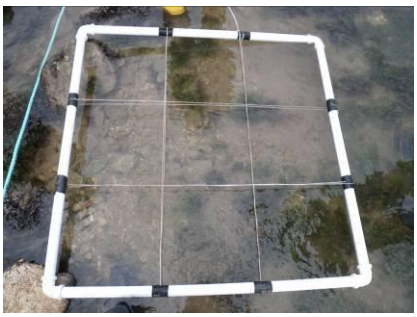
MT8B6Q2

MT8B6Q3



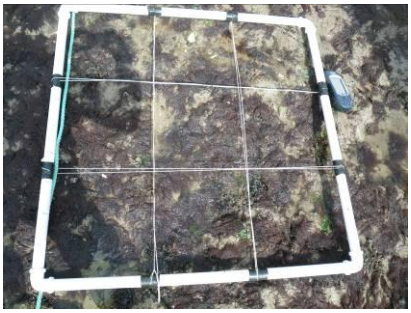
MT8B7Q1

MT8B7Q2

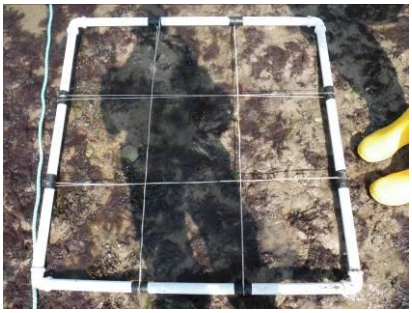
MT8B8Q1

MT8B8Q2

MT8B8Q3



MT8B9Q1



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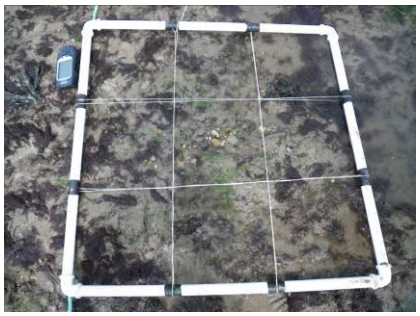

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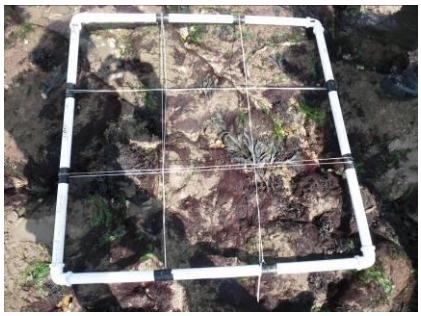
MT8B10Q1

MT8B10Q2



MT8B10Q3

MT9

MT9B1Q1

MT9B1Q2

MT9B1Q3

MT9B2Q1

MT9B2Q2

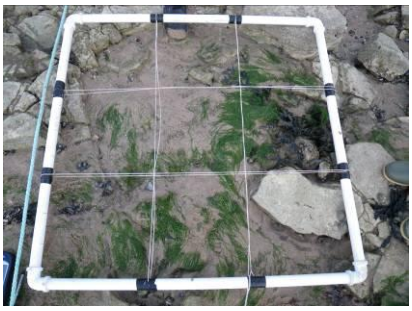
MT9B2Q3

MT9B3Q1

MT9B3Q2

MT9B3Q3

MT9B4Q1



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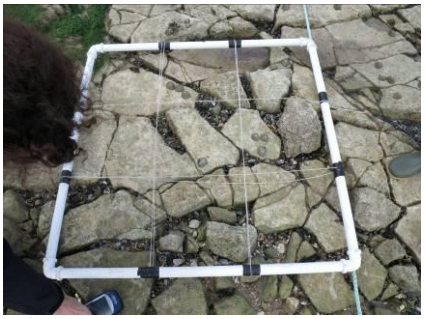

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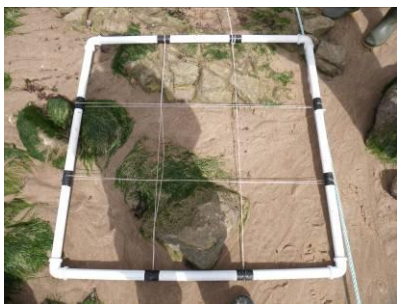

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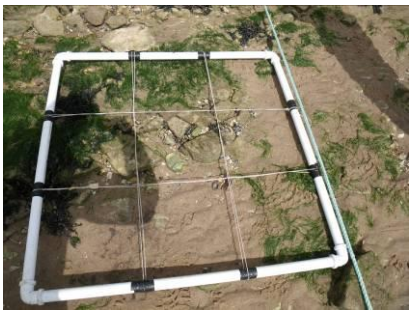

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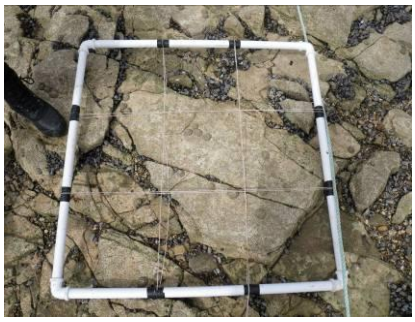
MT9B5Q3

MT9B6Q1

MT9B6Q2



MT9B6Q3

MT9B7Q1

MT9B7Q2

MT9B7Q3

MT9B8Q1

MT9B8Q2

MT9B8Q3

MT9B9Q1

MT9B9Q2

MT9B9Q3

APPENDIX III TRANSECT PHOTOS

MT1

MT1 Photo 1

MT1 Photo 2

MT1 Photo 3

MT1 Photo 4

MT1 Photo 5

MT1 Photo 6

MT1 Photo 7

MT2

MT2 Photo 1

MT2 Photo 2

MT2 Photo 3

MT2 Photo 4

MT2 Photo 5

MT2 Photo 6

MT1 Photo 7

MT1 Photo 8

MT3

MT3 Photo 1

MT3 Photo 2

MT3 Photo 3

MT3 Photo 4

MT3 Photo 5

MT3 Photo 6

MT3 Photo 7

MT3 Photo 8

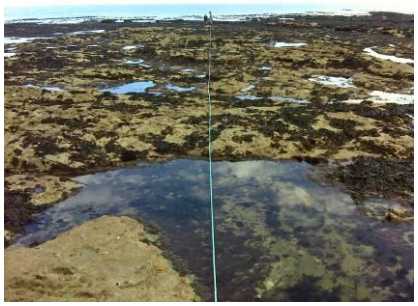
MT4

MT4 Photo 1

MT4 Photo 2

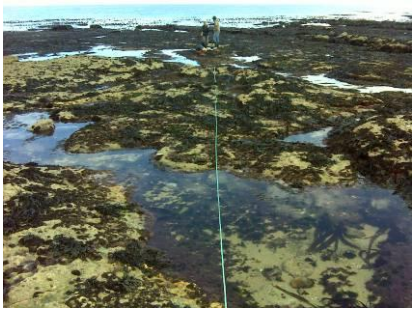
MT4 Photo 3

MT4 Photo 4



MT4 Photo 5

MT4 Photo 6



MT4 Photo 7

MT4 Photo 8

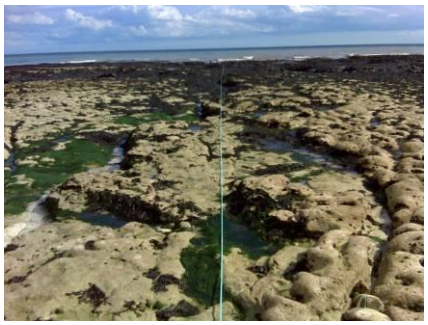
MT4 Photo 9

MT4 Photo 10

MT5

MT5 Photo 1

MT5 Photo 2



MT5 Photo 3

MT5 Photo 4

MT5 Photo 5

MT5 Photo 6

MT5 Photo 7

MT5 Photo 8

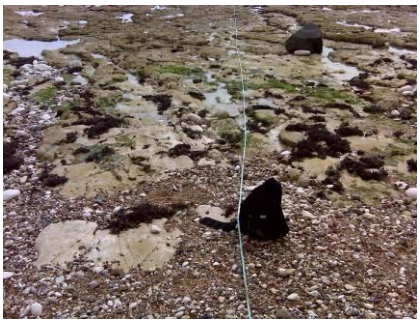
MT5 Photo 9

MT5 Photo 10

MT6

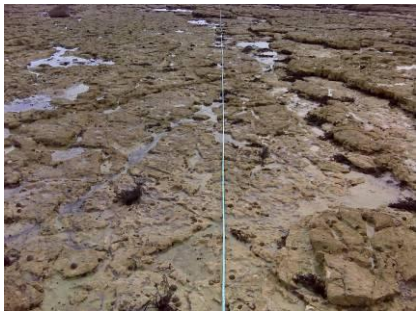
MT6 Photo 1

MT6 Photo 2

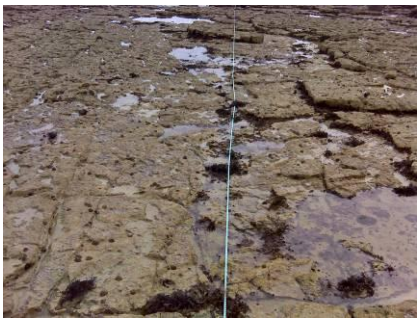


MT6 Photo 3

MT6 Photo 4



MT6 Photo 5



MT5 Photo 6

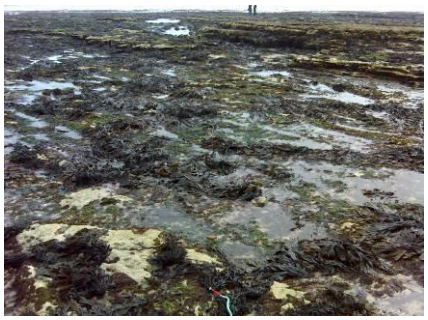
MT6 Photo 7

MT6 Photo 8

MT6 Photo 9

MT6 Photo 10

MT6 Photo 11



MT6 Photo 12

MT6 Photo 13

MT6 Photo 14

MT6 Photo 15

MT6 Photo 16

MT6 Photo 17

MT6 Photo 18

MT6 Photo 19

MT6 Photo 20

MT8

MT8 Photo 1

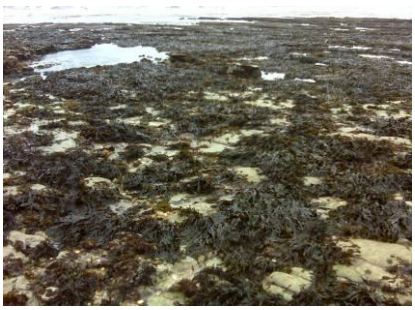
MT8 Photo 2

MT8 Photo 3

MT8 Photo 4

MT8 Photo 5

MT8 Photo 6



MT8 Photo 7

MT8 Photo 8

MT8 Photo 9

MT8 Photo 10

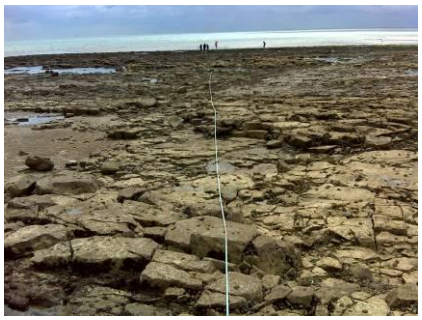
MT9

MT9 Photo 1

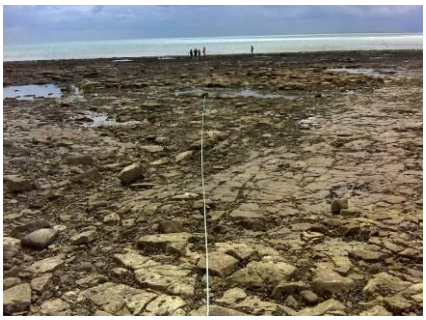
MT9 Photo 2

MT9 Photo 3

MT9 Photo 4



MT9 Photo 5



MT9 Photo 6

MT9 Photo 7

MT9 Photo 8

MT9 Photo 9

MT9 Photo 10

APPENDIX IV PROFORMA

Quadrat Proforma

NE Flamborough Quadrat Proforma						
Transect No:	**Date:**			**Surveyor(s):**		
Habitat No:	**Weather:**					
Biotope Description:						
	Q1		**Q2**		**Q3**	
Latitude						
Longitude						
Species Name	**SACFOR**	**/9**	**SACFOR**	**/9**	**SACFOR**	**/9**
PORIFERA						
Leucosolenia						
Grantia compressa						
Scypha ciliata						
Halichondria panicea						
Hymeniacidon perleve						
Dynamena pumila						
Tubularia						
Actinia equina						
Anemonia viridis						
Urticina felina						
Sagartia elegans						
NEMERTEA						
Polynoidae						
Eulalia viridis						
Boccardiella						
Polydora						
Pomatoceros						
Spirorbidae						
Semibalanus balanoides						
Balanus balanus						
Balanus crenatus						
Elminius modestus						
Amphipoda						
Gammarus						
Idotea granulosa						
Jaera						
Ligia oceanica						
Cancer pagurus						
Carcinus maenas						
Anurida maritima						
Lepidochitona cinereus						
Gibbula cineraria						
Patella vulgata						
Patella ulyssiponensis						
Helcion pellucidum						
Littorina arcana						
Littorina littorea						
Littorina mariae						
Littorina obtusata						
Littorina saxatilis						
Melarhaphe neritoides						
Mytilus edulis						
Anomiacea						
BRYOZOA						
Electra pilosa						
Asterias rubens						
Henricia						
Amphipholis squamata						
Ascidiella						
Dendrodoa grossularia						
Botryllus schlosseri						
Botrylloides leachi						
Sidnyum turbinatum						
Ciliata mustela						
Lipophrys pholis						

Quadrat Proforma - reverse

	Q1		Q2		Q3	
Species Name	% Cover	/9	% Cover	/9	% Cover	/9
Diatom film						
Rhodophycota indet. (enc)						
Porphyra purpurea						
Porphyra umbilicalis						
Audouinella floridula						
Gelidium						
Palmaria palmata						
Hildenbrandia rubra						
Corallinaceae sp. Indet						
Corallina officinalis						
Lithothamnion glaciale						
Phymatolithon lenormandii						
Catenella caespitosa						
Chondrus crispus						
Mastocarpus stellatus						
Gracilaria verrucosa						
Lomentaria articulata						
Ceramium						
Ceramium nodulosum						
Halurus						
Cryptopleura ramosa						
Delesseria sanguinea						
Membranoptera alata						
Phycodrys rubens						
Osmundea hybrida						
Osmundea pinnatifida						
Polysiphonia						
Polysiphonia lanosa						
Ectocarpaceae indet.						
Elachista spp.						
Cladostephus spongiosus						
Dictyota dichotoma						
Laminaria spp. (sporelings)						
Laminaria digitata						
Alaria esculenta						
Ascophyllum nodosum						
Fucus spp. (sporelings)						
Fucus serratus						
Fucus spiralis						
Fucus vesiculosus						
Pelvetia caniculata						
Chlorophycota indet. (film)						
Prasiola stipitata						
Blidingia minima						
Enteromorpha intestinalis						
Ulva lactuca						
Chaetomorpha						
Cladophora						
Cladophora rupestris						
Caloplaca marina						
Caloplaca thallincola						
Lichina pygmaea						
Verrucaria maura						
Verrucaria mucosa						

APPENDIX V OSGB36 POSITIONS

New transect coordinates in OSGB36.

Transect	Start (OSGB36)		Finish (OSGB36)	
	Latitude	Longitude	Latitude	Longitude
North Landing (MT1)	54.131158	-0.105842	54.131295	-0.104809
Thornwick Nab (MT2)	54.132937	-0.113326	54.133269	-0.112060
Thornwick Bay (MT3)	54.130813	-0.111698	54.131802	-0.111167
Selwicks Bay(MT4)	54.121368	-0.081281	54.120900	-0.079343
Mathon Nook (MT5)	54.115699	-0.075367	54.115279	-0.072968
South of Stacks Pinnacle (MT6)	54.113446	-0.076019	54.112092	-0.073010
South Cliff (MT8)	54.100947	-0.153638	54.099691	-0.153211
Sewerby Rocks (MT9)	54.100155	-0.159220	54.098176	-0.158544