Filey to Red Cliff Intertidal Survey 2022

Phase 1 survey of intertidal rocky shore habitats between Filey Brigg and Red Cliff, East Yorkshire

August 2024

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Foreword

A Phase I and Phase II intertidal survey of specific sites between Filey Brigg and Red Cliff Rocks was undertaken by Seastar Survey Ltd in 2022 to investigate the potential for their inclusion within a Site of Special Scientific Interest (SSSI). This report does not itself make a case for designation, rather it provides an objective record of the survey findings which will be used to support Natural England's independent assessment of special interest.

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Executive summary

Background

In 2022, Natural England wished to collect evidence to support the potential redesignation and expansion of several SSSI's along the Yorkshire coastline which had been previously notified for their biological and/or geological interest. As part of this evidence collection, Seastar Survey Ltd. ('Seastar') were contracted by Natural England to undertake Phase I intertidal surveys at five transects between Filey Brigg and Red Cliff Rocks. The work was intended to be a partial repeat of a 2012 survey conducted by Mieszkowska and Sugden (2013). The primary aim of the 2022 survey was to determine and/or verify the extent and distribution of two 'whole shore' selection units (wave-exposed rock and moderately wave-exposed rock) and the presence and distribution of SSSI Annex I biotopes, as listed in Brazier *et al*. (2019).

Main Findings

- Of the five planned transects, three – Filey Brigg, Castle Rocks and The Nab – were successfully completed.
- The remaining two transects – Chimney Hole and The Wyke – were not attempted due to difficult and unsafe access constraints.
- An additional transect – North Red Cliff – was conducted in a more accessible location at the southern end of Cayton Bay, within the Gristhorpe Bay and Red Cliff SSSI.
- At each transect, all habitat types present within a 60 m wide 'belt' were recorded and assigned a biotope as per the latest iteration of the MNCR Marine Habitat Classification for Britain and Ireland.
- Maps detailing the type, range and distribution of each identified biotope were created for each transect.
- Filey Brigg showed the greatest range of these biotopes, with 10 different wave exposed / moderately wave exposed biotopes present.
- A total of 13 of the 18 recorded biotopes are listed as being representative of wave exposed and/or moderately wave exposed rock.
- Examples of biotopes representative of wave exposed and/or moderately wave exposed rock were present at all transects surveyed.
- One biotope considered nationally or internationally important was recorded during the survey; **LR.FLR.Lic.Bli**, which is listed as a chalk / other soft rock biotope, was present in the very upper shore of the North Red Cliff transect.
- Three rockpool biotopes, which are listed as good examples of biotopes of special interest in Annex I of Brazier *et al*. (2019), were recorded at Filey Brigg, North Red Cliff and The Nab.
- In addition, the surge gully biotope complex **IR.FIR.SG** and two under-boulder biotopes (**LR.MLR.BF.Fser.Bo** and **IR.MIR.KR.Ldig.Bo**) were identified at Filey Brigg and North Red Cliff.
- It is recommended that any future monitoring surveys take place only at locations that are readily accessible; the access issues encountered during this survey indicate that the transects at The Wyke, Chimney Hole and Castle Rocks do not lend themselves to repeatability and are therefore of extremely limited use in condition monitoring.

- It is recommended that future surveys focus on repeat monitoring at North Red Cliff, The Nab and Filey Brigg, i.e., sites which are reasonably accessible, although it is also recommended that additional monitoring transects are established if possible.

Contents

Introduction 9

Site designations 10

Previous relevant survey work 10

Survey aims and objectives 13

Methodology 14

Project plan 14

Achieved survey 15

Tide times 18

Phase I survey methods 18

Opportunistic survey methods 19

GIS mapping 19

Results 21

Filey Brigg 21

North Red Cliff 24

Castle Rocks 27

The Nab 29

Presence of SSSI habitats 32

Anthropogenic influences 34

Notable species 34

Discussion 35

Issues encountered 35

Comparison with previous data 35

Summary and recommendations 39

References 41

Appendices 42

Appendix I: Phase I survey logs (summary) 42

Appendix II: Phase I species matrix 47

Appendix III: MNCR biotope code glossary 67

Introduction

One of the core duties of Natural England is to ensure protection and management of Sites of Special Scientific Interest (SSSIs), which are England's very best wildlife and geological sites and which are legally protected under the Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way (CROW) Act 2000 and the Natural Environment and Rural Communities (NERC) Act 2006.

Natural England wished to collect evidence to support the potential redesignation and expansion of several SSSI's along the Yorkshire coastline which had been previously notified for their biological and/or geological interest. As part of this evidence collection, Seastar Survey Ltd. ('Seastar') were contracted by Natural England to undertake Phase I intertidal surveys at five transects previously surveyed in 2012 (Mieszkowska and Sugden, 2013) between Filey Brigg and Red Cliff Rocks. The locations of the five transects are shown in Figure 1.1.

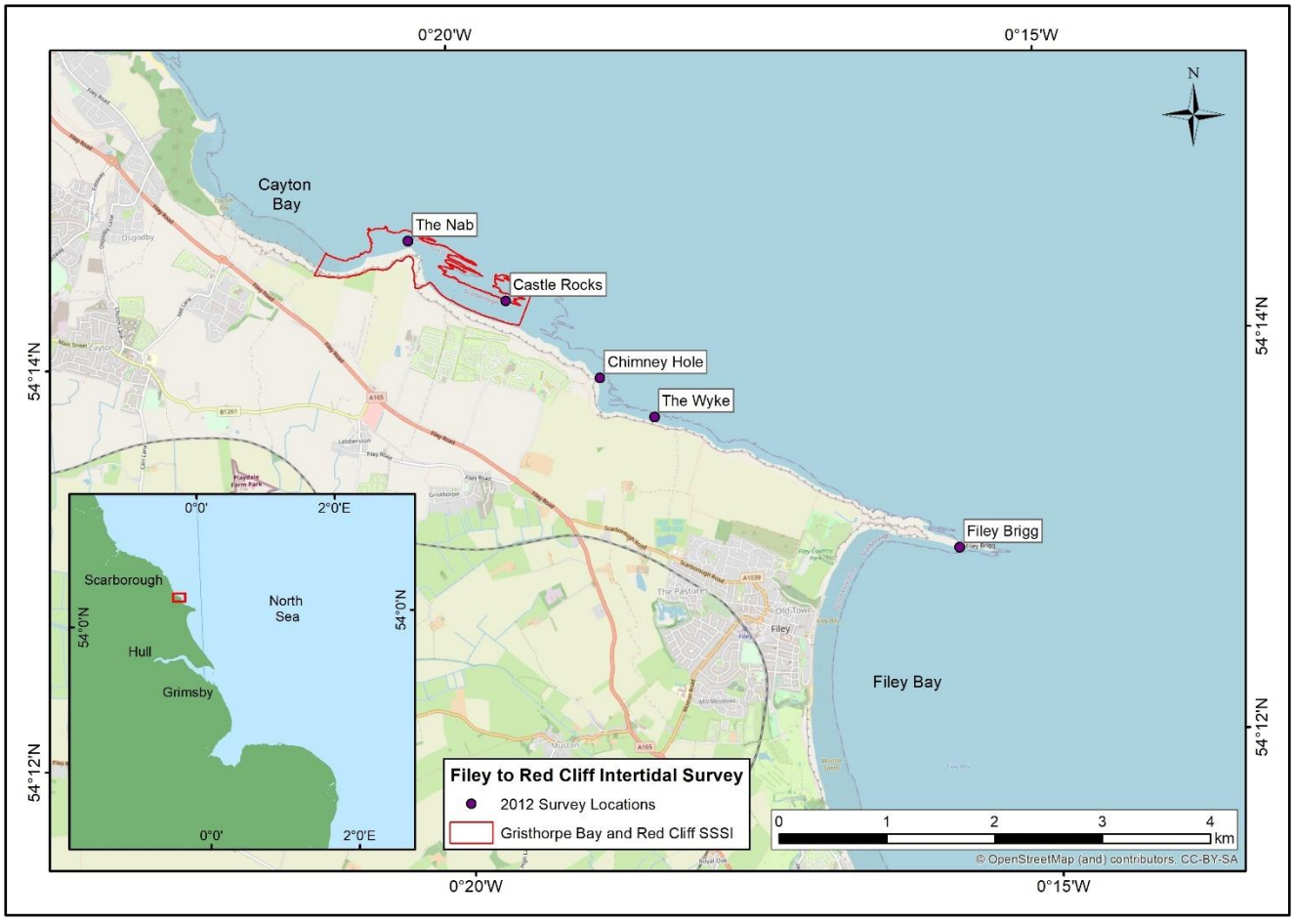

Figure 0.1: Location of the five transects originally surveyed in 2012 which were to be resurveyed in 2022. © OpenStreetMap and contributors CC-BY-SA.

Site designations

The Filey Brigg transect lies within the Filey Brigg SSSI, while the northernmost two transects (The Nab and Castle Rocks) lie within the Gristhorpe Bay and Red Cliff SSSI.

Filey Brigg SSSI encompasses the entire Filey Brigg peninsula, and was first notified in 1985 due to the presence of features of geological and ornithological interest. It is a key Corallian site, showing extensive exposures through Lower Calcareous Grit, Hambleton Oolite and Middle Calcareous Grit. The nodular 'Ball Beds', which are lost further west in Yorkshire, are particularly well exposed at this site. During the winter months, the intertidal areas and rocky shoreline of Filey Brigg support purple sandpiper in nationally significant numbers (Natural England, 2022a). All three units comprising this site are currently assessed as being in favourable condition, with no impacts identified (Natural England, 2022a).

Gristhorpe Bay and Red Cliff SSSI was first notified in 1954 under Section 23 of the National Parks and Access to the Countryside Act, 1949, before being revised and notified as a SSSI in 1983. The site was designated for earth heritage reasons and incorporates three locations listed as nationally important in the Geological Conservation Review; High Red Cliffs, Red Cliff, and Gristhorpe Bay. Gristhorpe Bay is of great historical significance in the development of the study of the Jurassic in Yorkshire. It is the type locality of the Cayton Bay Formation (Millepore and Yon Nab Beds) and the Gristhorpe Plant Bed, and also preserves an important section in the attenuated Scarborough Formation, near the southern limit of its present distribution. The overlying Scalby Formation is also of considerable interest at this locality. High Red Cliff exposes a thick sequence of Callovian rocks from the Cornbrash to the Oxford Clay. The site is considered critical for studies of Callovian palaeogeography and is used extensively for geological study and research (Natural England, 2022b). Gristhorpe Bay and Red Cliff SSSI consists of a single unit and is currently considered as being in favourable condition (Natural England, 2022b).

The Wyke and Chimney Hole transects do not fall within any current designated SSSIs, however the entire survey area (i.e. all five transects) falls within the Flamborough and Filey Coast Special Protection Area (SPA). This SPA is split into two sections; Flamborough to the south, and Filey to the north. Both sections encompass clifftop, sea-cliff and intertidal rock habitats. The site is protected both for its wildlife and the unique chalk cliff habitats present, including numerous ledges, crevices and caves, which provide ideal nesting and roosting sites for seabirds. The site supports the largest mainland seabird colony in England, including the only mainland gannetry in England, the largest kittiwake colony in the UK, and the largest guillemot and razorbill colonies in England (Natural England, 2022c).

Previous relevant survey work

The 2022 survey was a partial repeat of a survey carried out in 2012. A summary of the findings for each transect repeated in 2022, as reported in Mieszkowska and Sugden (2013), is provided below. A glossary of biotope codes is provided in Appendix III.

Filey Brigg

A total of 29 different biotopes were recorded at Filey Brigg, representing the greatest variety of habitats of any of the transects conducted during the 2012 survey. The transect could be broadly split into two sections; the exposed north shore and the far more sheltered south shore. The difference in level of exposure was reflected in the difference in the biotopes recorded in the two sections.

The northern section of the transect was found to be composed of bedrock in a series of vertical ledges and flat extensions. The vertical ledges were dominated by the limpet *Patella vulgata* and the barnacle *Semibalanus balanoides*, while the platforms were primarily characterised by red algae (**LR.HLR.MusB.Sem.FvesR**). At the sublittoral fringe, the rock was dominated by the kelp *Laminaria digitata* (**IR.MIR.KR.Ldig**).

The south shore of Filey Brigg consisted of a gentle rock slope covered by very large (>1 m) boulders. In the upper shore, *S. balanoides* dominated bedrock slopes were present (recorded, perhaps incorrectly, as the biotope **LR.FLR.Lic.Ver**), interspersed with large rockpools (**LR.FLR.Rkp.G**) and patches of bedrock dominated by the wracks *Pelvetia canaliculata* (**LR.LLR.F.Pel**) and *Fucus spiralis* (**LR.MLR.BF.FspiB**). Below this, the area of sheltered boulders in the mid shore were characterised by *S. balanoides* and *P. vulgata* (**LR.HLR.MusB.Sem**), and in the low shore by superabundant *Fucus serratus* (**LR.MLR.BF.Fser.Bo**).

The Wyke

The Wyke is located just north of Filey Brigg on an exposed part of the coast facing a north-northeast aspect. The intertidal area of the Wyke was found to be composed of large boulders and cliff debris and extended for approximately 50 m from the base of the cliff to the low water mark. A total of eight biotopes were recorded at this transect.

Below the cliff face, a 2 m wide high-shore/strandline area consisting of very large boulders was present, dominated by the lichen *Verrucaria maura* (**LR.FLR.Lic.Ver.Ver**); below this, the boulders were covered with a 1 m band of the green alga *Blidingia* spp. (**LR.FLR.Lic.Bli**). Below this, biota was dominated by the spiral wrack *F. spiralis* (**LR.MLR.BF.FspiB**).

The mid shore also consisted of boulders exhibiting a distinct pattern of vertical zonation; first, the wracks *Ascophyllum nodosum* and *Fucus vesiculosus* (recorded, perhaps incorrectly, as the variable salinity biotope **LR.LLR.FVS.AscVs**), followed by *F. serratus* together with thong weed, *Himanthalia elongata* (**LR.MLR.BF.Fser.R**), followed by a zone characterised by superabundant *Mastocarpus stelaltus* with *H. elongata* (**LR.HLR.FR.Him**).

In the low shore, boulders covered by superabundant sand binder, *Rhodothamniella floridula*, were present (**LR.MLR.BF.Rho**). Below this, the sublittoral fringe was recorded as the sediment-affected kelp biotope **IR.HIR.Ksed.XKScrR**.

Chimney Hole

The shore at Chimney Hole is an east-facing exposed shore and was found to consist primarily of boulders, though patches of exposed rock were also observed. The area exhibited clear vertical zonation, with a total of 11 biotopes recorded.

In the upper shore, a band of boulders with the lichen *V. maura* (**LR.FLR.Lic.Ver.Ver**) gave way to a zone characterised by both *Blidingia* spp. and *F. spiralis* (**LR.MLR.BF.FspiB**). Below this, there was a zone dominated by *A. nodosum* and *F. vesiculosus* (recorded as **LR.LLR.FVS.AscVs**). The mid shore was found to consist of a mosaic of *A. nodosum*, *F. vesiculosus* and *F. serratus* on bedrock and boulders (**LR.MLR.BF.Fser** and **LR.MLR.BF.Fser.Bo**).

The low shore area at this transect was dominated by red seaweeds including *R. floridula*, (**LR.MLR.BF.Rho**) and *Mastocarpus stellatus* (**LR.HLR.FR.Mas**), with patches of green ephemeral algae (**LR.FLR.Eph.EphX**) also present. As at the Wyke, the sublittoral fringe was recorded as the biotope **IR.HIR.Ksed.XKScrR**.

Castle Rocks

The Castle Rocks transect site was found to be composed of horizontal bedrock ledges with gullies running in a northwesterly/southeasterly direction. Atop the bedrock outcrops extensive boulder fields were present. A total of nine biotopes were recorded on this transect.

At the top of the shore, at the foot of the steep cliffs, the beach was composed of sand with cobbles/shingle (**LS.LSa**), below which a “lagoon” was present, characterised by abundant *Chorda filum*, *F. serratus* and common *Halidrys siliquosa* (**LR.FLR.Rkp.SwSed**).

Castle Rocks was described as an algal dominated shore with complicated zonation patterns due to the changes in shore height associated with the horizontal ledges. At the base of the cliffs, boulders exhibiting a classic high shore zonation pattern of **LR.FLR.Lic.Ver.Ver** – **LR.FLR.Lic.Bli** – **LR.MLR.BF.FspiB** were present. High shore biotopes were however not limited to the base of the cliff and were found throughout the area on patches of elevated bedrock and boulders where the wrack *P. cannaliculata* was locally abundant (**LR.LLR.F.Pel**).

The majority of the intertidal area was described as being a mosaic of the *F. serratus* dominated biotopes **LR.MLR.BF.Fser** and **LR.MLR.BF.Fser.Bo**, depending on the substrate present.

The Nab

The Nab, located at the south end of Cayton Bay, is an exposed shore with a north/northeasterly aspect. At the Cayton Bay end, the shore was found to be primarily composed of large to very large boulders, while at the headland of The Nab the shore was composed of a series of bedrock ledges. A total of 14 biotopes were recorded on this transect.

The bedrock ledges of The Nab comprised a variety of biotopes which alternated depending on the different heights of the substrate present. These included *P. cannaliculata* on bedrock (**LR.LLR.F.Pel**) and the *F. serratus* dominated **LR.MLR.BF.Fser.Bo**. Large intertidal pools (**LR.FLR.Rkp.FK**) were present in the mid shore region together with patchy ephemeral green algae (**LR.FLR.Eph**), while the low shore was characterised by *F. serratus* on mixed substrate (**LR.LLR.F.Fserr.X**). In the sublittoral fringe kelp forests dominated by *L. digitata* were recorded throughout the transect width.

Survey aims and objectives

The main aim of the 2022 survey was to determine and/or verify the extent and distribution of two 'whole shore' selection units (wave-exposed rock and moderately wave-exposed rock) and the presence and distribution of SSSI Annex I biotopes, as listed in Brazier *et al*. (2019).

The survey objectives were:

- To conduct a Phase I survey of the intertidal rock zone habitats at five belt transects previously surveyed in 2012 (Mieszkowska and Sugden, 2013);
- To identify and map the extent and distribution of intertidal rock habitats within the transects;
- To identify and map the extent and distribution of littoral rock biotopes present;
- To identify any marine intertidal features that qualify for selection as part of a SSSI;
- To collect semi-quantitative data on species composition across the range of intertidal rocky habitat biotopes identified;
- To provide sufficient data to inform a condition assessment of the feature;
- To record the presence and abundance of any non-indigenous species (NIS), and;
- To identify anthropogenic influences impacting on the ability of the features of interest to achieve favourable condition.

Methodology

Project plan

The survey approach focused on developing a cost-effective sampling strategy using Phase I intertidal sampling techniques. In order to ensure analytical consistency within and between datasets, and to allow any spatial and temporal change in habitat condition to be detected, the collection and analysis of the data was completed in accordance with Common Standards Monitoring guidance (JNCC, 2004) and procedural guidelines outlined in the Marine Monitoring Handbook (Davies *et al*., 2001), and with the CCW Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn, *et al*., 2006).

The central positions of the five transects to be surveyed were provided by Natural England. These were input into ArcGIS together with aerial photography data obtained from Channel Coast Observatory (CCO) via coastalmonitoring.org/ and open-source Ordinance Survey (OS) data obtained from osdatahub.os.uk/downloads/open. In addition, the biotope polygons created by Mieszkowska and Sugden (2013) following the 2012 survey were imported into the GIS project to aid planning.

The positions of the planned transects are given in Table 2.1 and Figure 2.1.

Table 0.1: Start of line (SOL) and end of line (EOL) positions of the centre line of each of the five planned belt transects to be surveyed during the 2022 Filey to Red Cliff intertidal survey.

Transect no.	Transect Name	SOL Position WGS84		EOL Position WGS84		Bearing (deg) to EOL
		Latitude	Longitude	Latitude	Longitude	
FRC01	Filey Brigg	54.216544	0.262660	54.215256	0.263340	195
FRC02	The Wyke	54.227271	0.305827	54.228344	0.305260	015
FRC03	Chimney Hole	54.231018	0.313538	54.231292	0.312078	070
FRC04	Castle Rocks	54.236083	0.327006	54.239946	0.324968	015
FRC05	The Nab	54.242443	0.339444	54.244370	0.340194	345

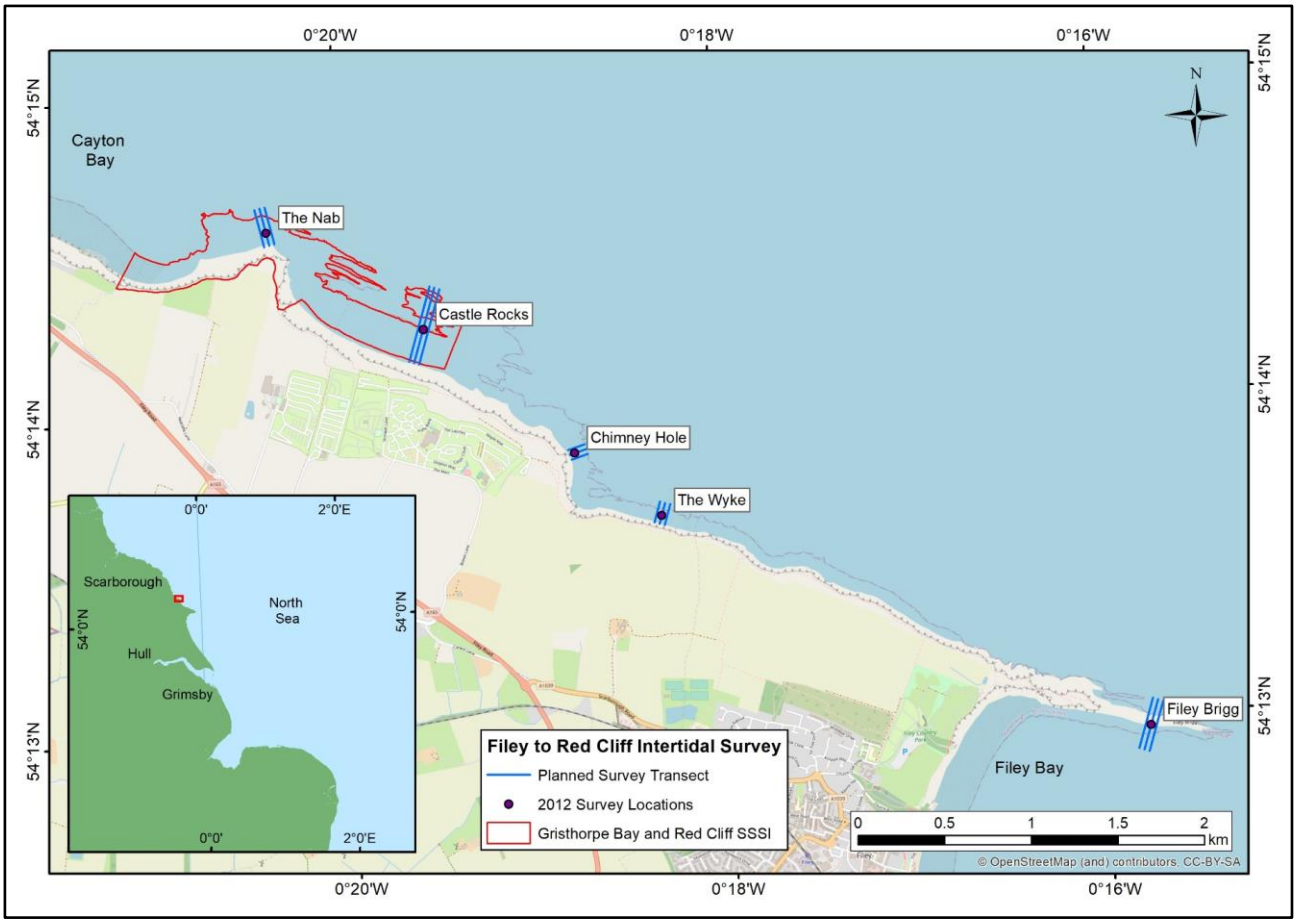

Figure 2.1: Locations of the planned belt intertidal transects to be surveyed during the 2022 Filey to Red Cliff intertidal survey. © OpenStreetMap and contributors CC-BY-SA.

Achieved survey

Of the five planned transects, three – Filey Brigg, Castle Rocks and The Nab – were completed.

The transect at Filey Brigg was successfully completed on 13th October 2022. Access to this site was via the steps to the beach at Filey Bay; from the beach a concrete path (eroded in places) was taken to reach the peninsula itself. It was intended that the remaining four transects would be surveyed over three days in the week commencing 24th October 2022, on and around the spring tide on 26th October in to maximise the intertidal area exposed.

Following information provided in Mieszkowska and Sugden (2013), it was anticipated that access to all four remaining transects would be via the steps to the beach at Cayton Sands. At the southern end of Cayton Bay, however, the sandy beach gives way to a shore composed of very rugged large to very large (>1 m) boulders overlying coarse sediment and/or sand. Traversing this area proved to be very difficult and time consuming. The easiest path around to the headland of The Nab proved to be at the very

top of the beach, under the cliffs, however due to the unstable nature of the cliffs in the area, and with a landslide having occurred close to Castle Rocks in the preceding days (according to an encountered team of geologists who were present investigating the event), it was decided that this route should not be attempted without appropriate personal protective equipment. In order to not lose a day's survey, a new 60 m wide belt transect – named North Red Cliff – was created and surveyed, covering the area of boulder shore at the southern end of Cayton Bay, within the boundary of Gristhorpe Bay and Red Cliff SSSI. The transect location was chosen based on accessibility as well as on the presence of rock and boulder substrate, the investigation of which was the primary aim of the survey.

On the following day (25th Oct), the survey team (with suitable safety gear) were able to access Castle Rocks via The Nab and the Castle Rocks transect was attempted, although access to the mid and lower shore regions was not possible due to the presence of several wide, deep and fast-flowing gullies/inlets (further details are provided in section 3.3). The recent landslide described by the team of geologists was observed by the survey team during transit to Castle Rocks; debris was still falling from the cliffs at this location.

As part of the second survey day, access south along the beach to Chimney Hole and the Wyke was investigated, however past Castle Rocks the beach once again became very rugged and difficult to traverse. Given the rugged nature of the foreshore, the time it would take to reach the furthest transects, complete the survey and return, and the tidal window available to complete this, the decision was taken that access to the Wyke and Chimney Hole constituted a significant risk to field personnel. These transects were therefore not attempted. Alternative access to these locations from the clifftop was investigated, however the potential access route at Chimney Hole was also deemed to be unsafe for field personnel.

The Nab transect was successfully surveyed on 26th October 2022. The locations of the successfully surveyed transects are shown in Figure 2.2, with details provided in Appendix I.

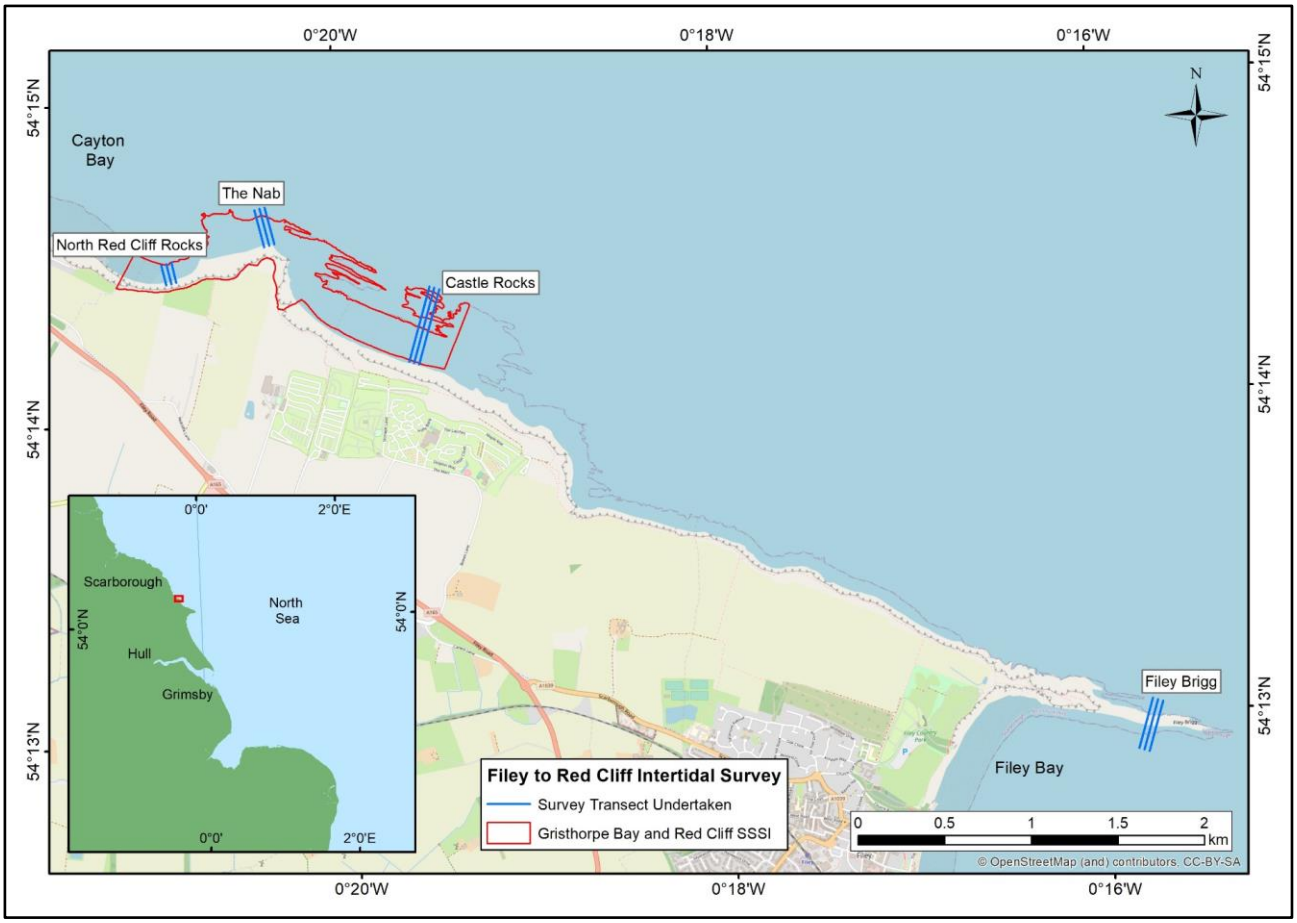

Figure 0.1: Locations of the belt transects successfully surveyed as part of the 2022 Filey to Red Cliff intertidal survey. © OpenStreetMap and contributors CC-BY-SA.

Tide times

The Filey Brigg transect was surveyed on 13th October 2022, with the remaining transects surveyed on 24th – 26th October 2022 over spring tides in order that the maximum intertidal area was exposed.

The tide times for Filey Bay for the period of survey are given in Table 2.2. It was found that survey could be conducted reliably approximately two hours before and after low water.

Table 0.2: Tide times for the period in which the Filey to Red Cliff intertidal surveys were conducted. All times are in local time (BST).

Date	High Water 1 (am)	HW Height (m)	Low Water	LW Height (m)	High Water 1 (pm)	HW2 Height (m)
Thu 13th Oct 2022	07:01	5.6	12:59	0.9	19:21	5.3
Mon 24th Oct 2022	04:10	5.6	10:35	1.0	16:38	5.6
Tue 25th Oct 2022	04:43	5.7	11:10	0.7	17:10	5.8
Wed 26th Oct 2022	05:17	5.9	11:46	0.6	17:44	5.8

Phase I survey methods

The aim of the Phase I survey was to determine the range, distribution and extent of the habitat present by assigning biotopes *in situ* on vertical (i.e. running from high to low shore) 60 m wide belt transects, in accordance with best practice guidance.

Start of line (SOL) and end of line (EOL) positions for each transect were input into a Garmin GPSMAP 276Cx portable chartplotter prior to the survey. These included a central transect line and two parallel 'boundary' lines, one 30 m either side of the central transect line.

At each transect, all habitat types present within the 60 m wide belt were recorded and assigned a biotope as per the latest iteration of the MNCR Marine Habitat Classification for Britain and Ireland (JNCC, 2022), incorporating information regarding species composition and abundance, position on shore, exposure of the shore and substrate type. The vertical width of each habitat was recorded, and GPS positions were taken using the GPSMAP portable chartplotter (which used both GPS and GLONASS sensors for improved positional accuracy) at each habitat boundary on the central transect line. The distribution of biotopes 30 m either side of the central line were recorded using wireframe map annotations and/or were mapped using the track function in the GPS.

For each identified biotope, a detailed habitat description was recorded using modified MNCR field forms, including information regarding shore position, substrate type and percentage cover, rock type, surface relief, texture and stability, modifiers such as scour, silt and macroalgal mats, and any anthropogenic influences present. In addition, for each identified habitat a list of the dominant/conspicuous biota present was produced with taxa enumerated using the semi-quantitative SACFOR scale. Any additional relevant metadata, including time, state of tide etc., were also recorded.

Photographs documenting the zonation patterns present were taken at three locations (high, mid and low shore) along each central transect line. At each location, the GPS position was recorded, and photographs were taken up-shore, down-shore, and along-shore in both directions.

Opportunistic survey methods

When transiting on foot to, from and between transects, any NIS and anthropogenic influences, such as freshwater outflows and litter or other anthropogenic materials, were documented. In each instance, the position was recorded from the GPS and a photograph was taken. Where anthropogenic influences were clearly impacting the surrounding environment, details of this were recorded. Where NIS were encountered, abundance was recorded using the semi-quantitative SACFOR scale.

GIS mapping

Data obtained during the intertidal surveys were imported into ArcGIS. These included all GPS trackplots and relevant point data (e.g. positions of boundary changes) collected. The data were overlaid on available aerial photography obtained from CCO. Utilising these data together with the wireframe map field sketches created during the Phase I surveys, polygons were created within the GIS in order to map the location of the different biotopes identified within each of the three belt transects.

During post-survey data analysis, it was observed that significant discrepancies were present between the position of features mapped during the survey using the GPS (accurate ±3 m) and the position of the features as seen on the CCO aerial photography used during the survey planning phase. On average, the positional difference observed was approximately 12 m, with the GPS data consistently plotting a feature to the north of the position of the same feature on the aerial photography. The error was investigated by comparison with other sources of aerial photography and with Ordnance Survey charts, however no obvious explanation for the discrepancy was discovered. Following discussions with Natural England, it was decided that, for the purpose of presentation, habitat maps should be produced with reference to the aerial photography. Therefore, whilst habitat polygons that were mapped and measured in the field are accurate in terms of their shape and size, there is a potential positional error of ~12 m between the centre point of the mapped polygon and its actual location. This error has not in any way impacted the validity of the data and the maps presented in this report are correct in respect of size and distribution of the habitats. Furthermore, it appears that Mieszkowska

and Sugden (2013) created the 2012 polygons based on the aerial photography; direct comparisons between the two datasets were therefore possible.

All GIS outputs were generated using ArcGIS v10.2 and were produced in accordance with MEDIN standards using the MESH data exchange format (DEF).

Results

The logs detailing the results of the Phase I surveys are provided in Appendix I and II. A glossary of the MNCR biotope codes mentioned in this report is provided in Appendix III.

Filey Brigg

The path at Filey Brigg runs approximately northwest to southeast along the approximate centre of the peninsula. The Filey Brigg transect was therefore split into north and south sections. The distribution of biotopes at this transect is shown in Figure 3.1.

The 'centre' of the transect, to both sides of the path, consisted of a bedrock platform. The rock here was, overall, relatively flat and sloped downward from north to south. To the north of the path, the biota was dominated by patchy *Fucus spiralis* (frequent) and sparse *Semibalanus balanoides* (occasional), whereas to the south the rock was comparatively barren, with *F. spiralis* recorded as rare. However, the surface of the rock, particularly to the south of the path, was criss-crossed with a series of fissures in which species diversity was comparatively high. Species present in these fissures included the common limpet *Patella vulgata* (common), the beadlet anemone *Actinia equina* (frequent), and the periwinkle *Littorina saxatilis* (common). The fissures also were found to contain a variety of algal taxa, including *Osmundea pinnatifida*, *Mastocarpus stellatus*, *Chondrus crispus*, *Corallina officinalis*, *Ascophyllum nodosum*, *Chordaria flagelliformis* and *Ulva intestinalis*, all in very low (rare) abundance. The area to the north of the path (N01) was assigned the biotope **LR.MLR.BF.FspiB**, however due to the overall lack of conspicuous biota the area to the south of the path was assigned at the habitat complex level (S01: **LR.HLR**). Rockpools were present in both sections of the centre area of the transect. To the north of the path these were generally characterised by *C. officinalis* and *M. stellatus* together with common *P. vulgata* (**LR.FLR.Rkp.Cor.Cor**). To the south, at the lower boundary of S01, was a large, sediment-floored rockpool with dense (superabundant) *U. lactuca* (**LR.FLR.Rkp.SwSed**).

Once beyond the central bedrock platform, there was found to be a considerable difference in general character of the north and south shores. The north section of the transect comprised a series of relatively flat, sloping bedrock platforms with vertical drops of 0.5 – 2 m between each. The first platform below the central upper shore section (Platform 1) was generally characterised by dense *O. pinnatifida* (abundant) and *M. stellatus* (frequent) on bedrock with lesser quantities of other algal taxa including *A. nodosum*, *F. spiralis* and *U. intestinalis* (N02: **LR.HLR.FR.Osm**). At the southern edge of Platform 1, however, against the vertical face leading from the central section of the transect, large rockpools were present. The largest of these measured approximately 30 m long by 6 m wide, and was estimated at 40 cm depth. This rockpool was primarily characterised by common *C. officinalis* and coralline crusts (**LR.FLR.Rkp.Cor.Cor**). A second large rockpool, approximately 10 m long and 4 m wide, was present in the eastern section of the transect. This rockpool was far deeper (>1 m) and was characterised by the

kelp *Laminaria digitata* with coralline crusts visible at the edges of the rockpool (**LR.FLR.Rkp.FK**). At the more exposed northern (seaward) edge of Platform 1, the dense *O. pinnatifida* was replaced by very dense (superabundant) *S. balanoides* together with common *P. vulgata* (N03: **LR.HLR.MusB.Sem.Sem**).

The barnacle-dominated biotope **LR.HLR.MusB.Sem.Sem** was also present throughout the vast majority of the platform below (Platform 2, N04), as well as on the vertical face between Platforms 1 and 2. The rock of Platform 2 was also characterised by large fissures containing a range of algal taxa including the kelps *L. digitata* and *Saccharina latissima*, *F. serratus*, *C. officinalis*, *M. stellatus*, *O. pinnatifida* and *Rhodothamniella floridula*, although given the area of the platform these were all recorded in very low (rare or occasional) abundance. Two rockpools were also recorded on Platform 2; these were both characterised by *L. digitata* and were assigned the biotope **LR.FLR.Rkp.FK**.

Platform 3, situated approximately 1 m below Platform 2, was found to be primarily characterised by dense *O. pinnatifida* together with dense patches of *S. balanoides* and frequent *Himanthalia elongata* (N05: **LR.HLR.FR.Him**). The *H. elongata* was primarily observed as small button-like thalli, however some individuals were observed where the long, strap-like reproductive fronds were present. Below N05, at the sublittoral fringe, the kelp *L. digitata* was visible; this area was therefore tentatively assigned the biotope **IR.MIR.KR.Ldig**.

At the western edge of the northern section of the transect, a 15 m wide inlet/gully was present, extending from the northern edge of Platform 1 down to sea level. Within this gully, a series of micro-habitats were present. In the upper part of the gully, the biota was dominated by *O. pinnatifida* and *M. stellatus*, while further seawards the biota became dominated by *H. elongate*. The lower extent of the gully was characterised mixed kelps on boulders. As the different zones were too small (<25 m^2) to constitute distinct biotopes, the biotope complex **IR.FIR.SG** was assigned to the entire gully feature. A second surge gully was also present in the eastern half of the transect.

In contrast to the north shore, the south shore of Filey Brigg was composed of a gently sloping shore overlain with small to very large boulders. In the upper section of this boulder shore, just below the large seaweed-dominated rockpool (**LR.FLR.Rkp.SwSed**), was a 5 m band of boulders characterised by superabundant *S. balanoides* and abundant *P. vulgata* with frequent *Nucella lapillus* and *L. saxatilis* (**LR.HLR.MusB.Sem.LitX**). Below this was a ~25 m band where the biota was characterised by a patchy mosaic of *F. vesiculosus* and *S. balanoides* (S03: **LR.MLR.BF.FvesB**). This was followed by a narrow (5 m) zone dominated by *F. serratus* together with a variety of red seaweeds including *C. crispus*, *O. pinnatifida*, *R. floridula*, and *Porphyra purpurea* (S04: **LR.MLR.BF.Fser.R**). In the low shore, red seaweeds became more dominant, with *R. floridula*, *C. crispus* and *M. stellatus* all recorded as abundant. In addition, *O. pinnatifida* was recorded as common, particularly on the upper faces of the boulders. While the high density of *C. crispus* and *M. stellatus* combined with *O. pinnatifida* was likely indicative the biotope **LR.HLR.FR.Mas**, the presence of abundant *R. floridula* made assignment of a single biotope to this area somewhat problematic. The habitat (S05) was therefore assigned as a mosaic of the

biotopes **LR.HLR.FR.Mas** and **LR.MLR.BF.Rho**. Below this zone, in the sublittoral fringe, the kelp *L. digitata* was visible on boulders (**IR.MIR.KR.Ldig.Bo**).

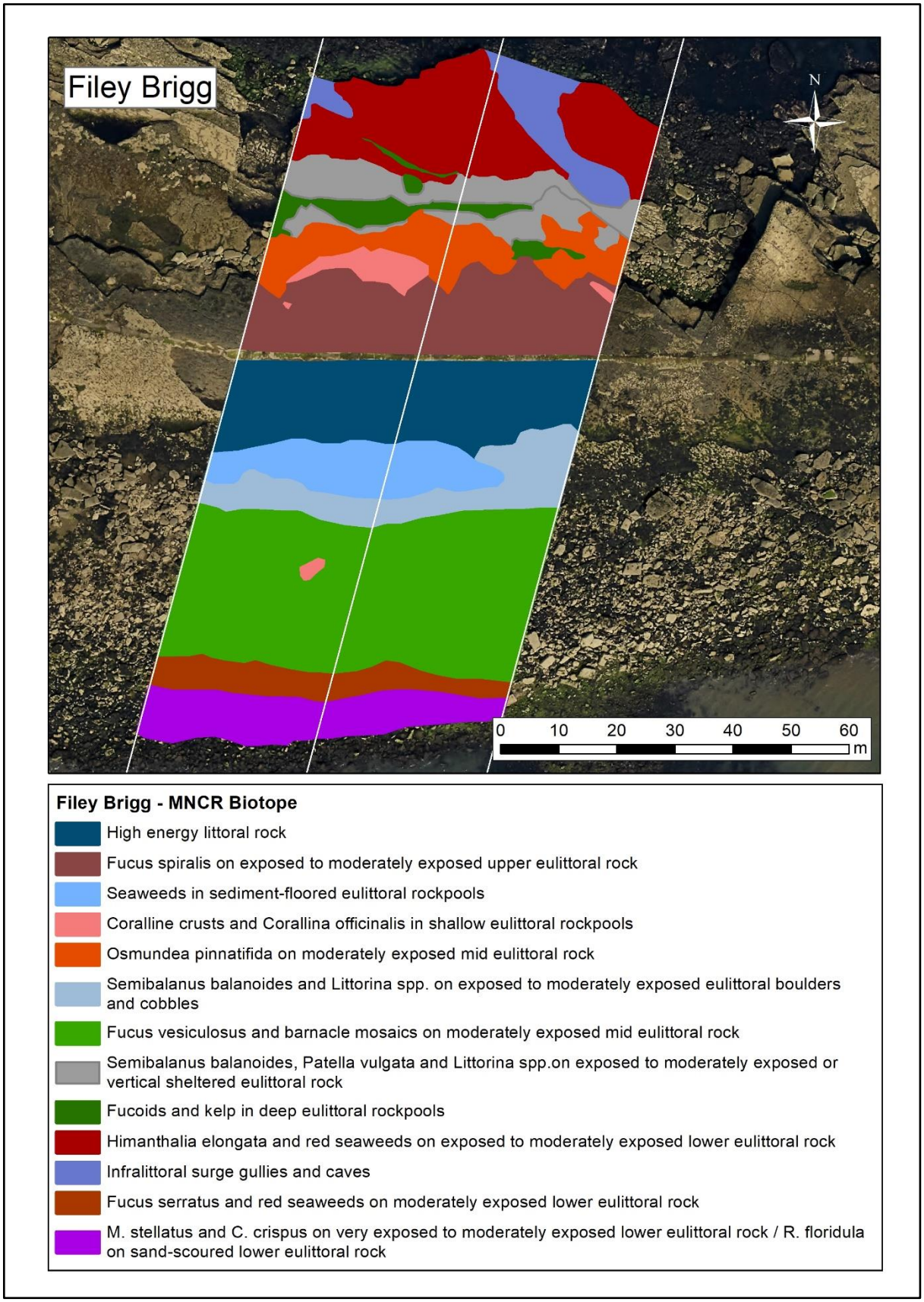

Figure 0.1: distribution of MNCR biotopes (JNCC, 2022) at transect the Filey Brigg transect surveyed as part of the Filey to Red Cliff intertidal survey 2022.Ortho-rectified aerial photography obtained from Channel Coastal Observatory)

North Red Cliff

The shore at the North Red Cliff transect, located at the southernmost part of Cayton Bay, was composed of small to very large boulders and cobbles overlying a mixture of gravel and sand, with some patches of exposed bedrock also present. The shore is moderately exposed, with a north-northwest aspect. The distribution of biotopes at this transect is shown in Figure 3.2.

The very top of the beach was composed of very large (>1 m) boulders apparently eroded from the cliff face. These were mostly devoid of biota, however in the top 3 m small patches of the black lichen *Verrucaria maura* were present (H01: **LR.FLR.Lic.Ver**). Below this was a narrow (1.5 m) band of the green seaweed *Blidingia* sp. (superabundant) with *F. spiralis* also present on the sides of the larger boulders (H02: **LR.FLR.Lic.Bli**). Beneath this zone was an area of dense *A. nodosum* on cobbles and boulders with patchy *F. spiralis* and sparse green seaweeds (H03: **LR.LLR.F.Asc.FS**). In the western half of the transect this zone was interrupted by the presence of a bedrock exposure, approximately 4.5 m wide. The bedrock was relatively bare, with patches of *S. balanoides* (occasional) together with common *P. vulgata* and frequent *Littorina* spp. (H04: **LR.HLR.MusB.Sem.Sem**). Below the bedrock platform was an area of cobbles and boulders overlying slightly sandy gravel. Immediately below the platform the biota was similar to that found on the bedrock, although the density of *S. balanoides* was considerably higher (common) than in the previous zone. Due to the change in substrate type, however, this area (H05) was assigned the sub-biotope **LR.HLR.MusB.Sem.LitX**. Below this biotope, the abundance of barnacles on the cobbles and boulders was reduced and the biological community became algal dominated, characterised by common *A. nodusum* and patchy *F. vesiculosus* (H06: **LR.LLR.F.Asc.X**).

To the east of the mixed substrate area an area of rippled sand was present. The area measured approximately 21 m long and 5 m wide, and worm casts were abundant (H11: **LS.LSa.FiSa.Po**). Just below this area of sand and was a 4 m wide sediment-floored rockpool characterised by sparse mixed seaweeds (**LR.FLR.Rkp.SwSed**). By contrast, to the west of the **LR.HLR.MusB.Sem.LitX**/**LR.LLR.F.Asc.X** zones was an area of very large boulders with sediment infill primarily characterised by superabundant *S. balanoides* (H10: **LR.HLR.MusB.Sem**). This biotope extended through the mid shore down to the low shore, where a very few small *Mytilus edulis* individuals were found to be present within pits and crevices in the surfaces of the boulders.

In the low shore of the transect, a wide (20 m) zone of superabundant *R. floridula* on large to very large boulders overlying rippled sand (H07: **LR.MLR.BF.Rho**) was present. Other taxa were very sparse in this zone, but included the red seaweeds *P. purpurea*, *M. stellatus* and *O. pinnatifida* and the green seaweeds *Ulva* spp. and *Cladophora* sp.. Below this zone, the eastern half of the transect was covered by a large sediment-floored rockpool with patchy mixed seaweeds and sparse *L. digitata* (**LR.FLR.Rkp.SwSed**). By contrast, the western half was composed of firm, well-sorted slightly gravelly shelly medium sand, being the southernmost extent of Cayton Sands. In contrast to the area of

sand higher up the beach, worm casts and other lebensspuren were absent, meaning that the area was assigned at the habitat complex level (H09: **LS.LSa**).

Below the rockpool, and extending into the area of sand that otherwise characterised the low shore, an area of very large boulders (some >2 m) was present. The centre of this area could not be accessed, so the zone was assessed from the edges. The biota was dominated by common *F. serratus* (H08: **LR.MLR.BF.Fser.Bo**), however the sides of the boulders were host to a range of algal taxa including common *O. pinnatifida* and frequent *R. floridula* as well as lower quantities of *M. stellatus*, *U. intestinalis* and *P. purpurea*. On the lower portions of the boulders, fauna was more common, including abundant *S. balanoides* and common *P. vulgata* as well as low numbers of the anemone *A. equina*.

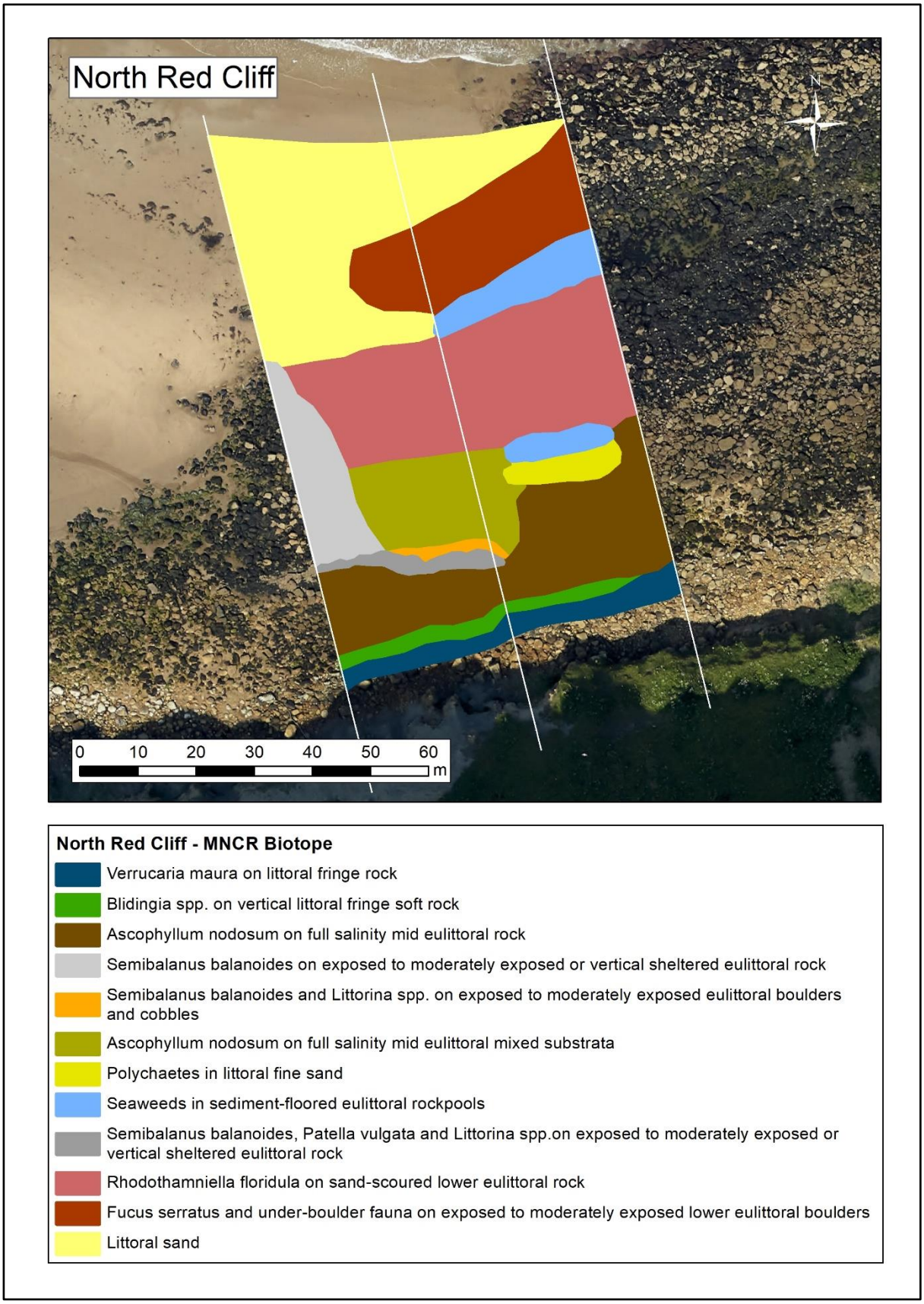

Figure 0.2: distribution of MNCR biotopes (JNCC, 2022) at transect the North Red Cliff transect surveyed as part of the Filey to Red Cliff intertidal survey 2022. Ortho-rectified aerial photography obtained from Channel Coastal Observatory)

Castle Rocks

The shore at the Castle Rocks transect is exposed with a northeasterly aspect. The upper shore is composed of coarse sediments, while the mid and low shore zones are composed of a series of bedrock ledges running northwest/southeast and with large, deep inlets running in between. These inlets remain fast flowing even at low tide, and are too wide and deep to safely cross in order to assess the mid and low shore ridges, which are not continuous. While the upper shore was successfully surveyed, the descriptions of the mid and low shore areas are based on observations made from the upper shore. The distribution of biotopes at this transect is shown in Figure 3.3.

The upper shore of the transect comprised a wide (34 m) band of sandy gravel and pebbles (H01: **LS.LCS.Sh.BarSh**). Within this zone, occasional hard clay exposures were present. While most of these exposures were small (<5 m^2), one patch measured approximately 10 m long and up to 3 m wide. While the clay was very hard and pitted, the only biota present consisted of sparse filamentous green algae (rare).

Below the band of shingle was a zone composed of flat bedrock with a patchy veneer of rippled sand and frequent shallow (<5 cm) pools of standing water. Biota was very sparse; the majority of taxa present, which included small red seaweeds, fucoids, *U. intestinalis* and *P. vulgata*, were recorded in low (rare to occasional) abundances. Due to the lack of biota and the lack of any obvious vertical zonation patterns, no good biotope fit was found for this zone (H02); the broad habitat type **LR** was therefore recorded.

Below this area of bedrock was a very large inlet which could not be fully assessed due to access constraints, however as the area remained at least 0.5 m underwater even at low tide, it is unlikely that this area represented a truly intertidal habitat. From the top of the beach, a series of bedrock ridges could be seen in the mid and low shore areas of the transect, between the inlets. The bedrock was overlain by boulders, and the biota dominated by fucoids, likely *F. serratus*. The ridges were therefore tentatively assigned the biotope **LR.MLR.BF.Fser**.

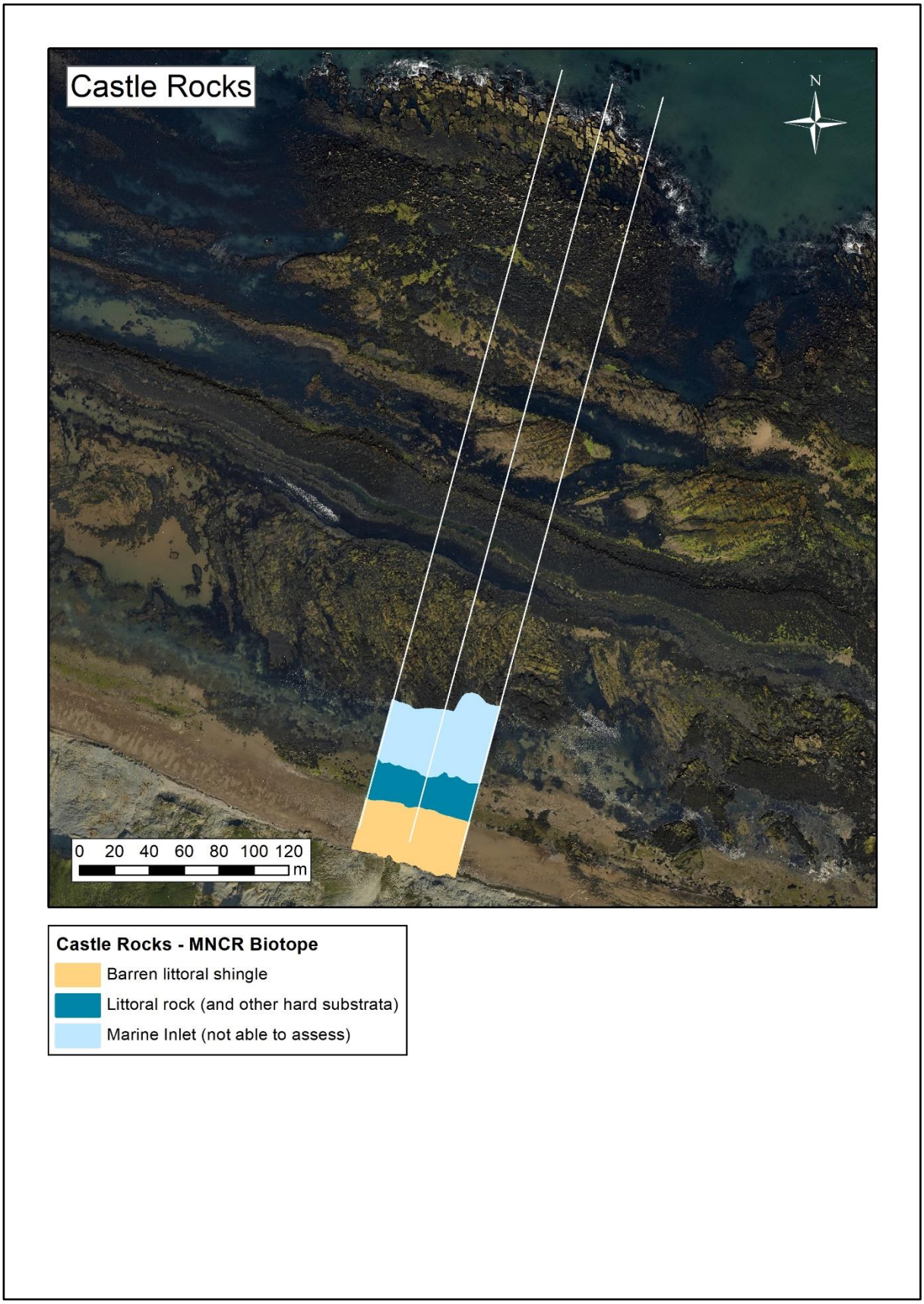

Figure 0.3: distribution of MNCR biotopes (JNCC, 2022) at transect the Castle Rocks transect surveyed as part of the Filey to Red Cliff intertidal survey 2022. Ortho-rectified aerial photography obtained from Channel Coastal Observatory)

The Nab

The Nab transect was situated on the northwest face of the headland, on an exposed stretch of the shore. The distribution of biotopes at this transect is shown in Figure 3.4.

At the very top of the beach, under the cliffs, the shore was composed of an uneven bedrock platform. The rock surface was highly pitted, however biota was extremely sparse, being limited to small patches of the *V. maura* and green lichens (H01: **LR.FLR.Lic.Ver**). The lower boundary of this zone was marked by a short vertical drop, below which the bedrock was overlain by boulders. The biota was dominated by the wracks *Pelvetia canaliculata* and *F. spiralis* (both abundant) with the red seaweed *Catenella caespitosa* recorded as common (H02: **LR.LLR.F.Pel**). Below this zone, there were fewer boulders present, and the bedrock was instead dominated by superabundant *A. nodosum* with sparse *F. spiralis* (H03: **LR.LLR.F.Asc.FS**). The epiphyte *Vertebrata lanosa* was present on the *A. nodosum*, and several other algal taxa were recorded in very low (rare) abundance, including *C. caespitosa*, P*. canaliculata*, *F. vesiculosus*, *U. intestinalis* and *Cladophora rupestris*. Where boulders were present, faunal diversity and abundance were higher, with taxa such as *Spirobranchus* sp., *S. balanoides*, *Steromphala cineraria*, *Littorina* spp. and *Carcinus maenas* all recorded from the undersides of cobbles and boulders.

The lower boundary of habitat 03 was marked by a large, 15 m wide rockpool (H04). The bottom of this rockpool was lined with gravel, pebbles and cobbles, and the biota was characterised by common *Halidrys siliquosa*. Despite the presence of frequent *C. officinalis* and coralline crusts, the abundance of *H. siliquosa* meant that the biotope **LR.FLR.Rkp.FK** was assigned to this zone. The rockpool extended for approximately 45 m across the transect; to the east of the rockpool the preceding habitat (**LR.LLR.F.Asc.FS**) continued, although the abundance of *F. vesiculosus* was significantly higher (abundant) than above the rockpool. This same habitat was also found for approximately 15 m below the rockpool (H05). Below this, a bedrock platform was present that sloped up seawards, creating a ‘high shore’ type environment in which species typical of the upper shore, particularly *P. canaliculata* (abundant) and *F. spiralis* (common), were present (H06: **LR.LLR.F.Pel**).

Below this bedrock platform, the habitat was characterised by dense (abundant) *S. balanoides*, *P. vulgata* (common) and *L. littorea* (frequent) on a mixture of very large boulders and bedrock (H07: **LR.HLR.MusB.Sem.Sem**). Within this area, particularly around the bases of the larger boulders, were several small (<1 m^2) rockpools. While these were too small and numerous to map, the biota in these rockpools was dominated by *C. officinalis* and coralline crusts, generally with a band of *R. floridula* around the edges. The anemone *A. equina* was also frequently observed in these pools, as well as in crevices in the rock. After approximately 42 m there was a ~1 m vertical drop in the height of the bedrock. Below this, running down to the low water mark, the substrate was composed of dominated by boulders which overlaid bedrock and coarse sediment. The biota was somewhat patchy, however the most common taxa included *O. pinnatifida* (abundant) with frequent *F. serratus* (H08: **LR.HLR.FR.Osm**). Patches of dense *S.*

balanoides with *P. vulgata* were also present, as were patches of *R. floridula*. The button-like thalli of *H. elongata* were also frequent in this zone, although this species also exhibited a highly patchy distribution.

In the sublittoral fringe boulders were present with the kelp *L. digitata*. The biotope **IR.MIR.KR.Ldig.Bo** was therefore tentatively assigned to this zone.

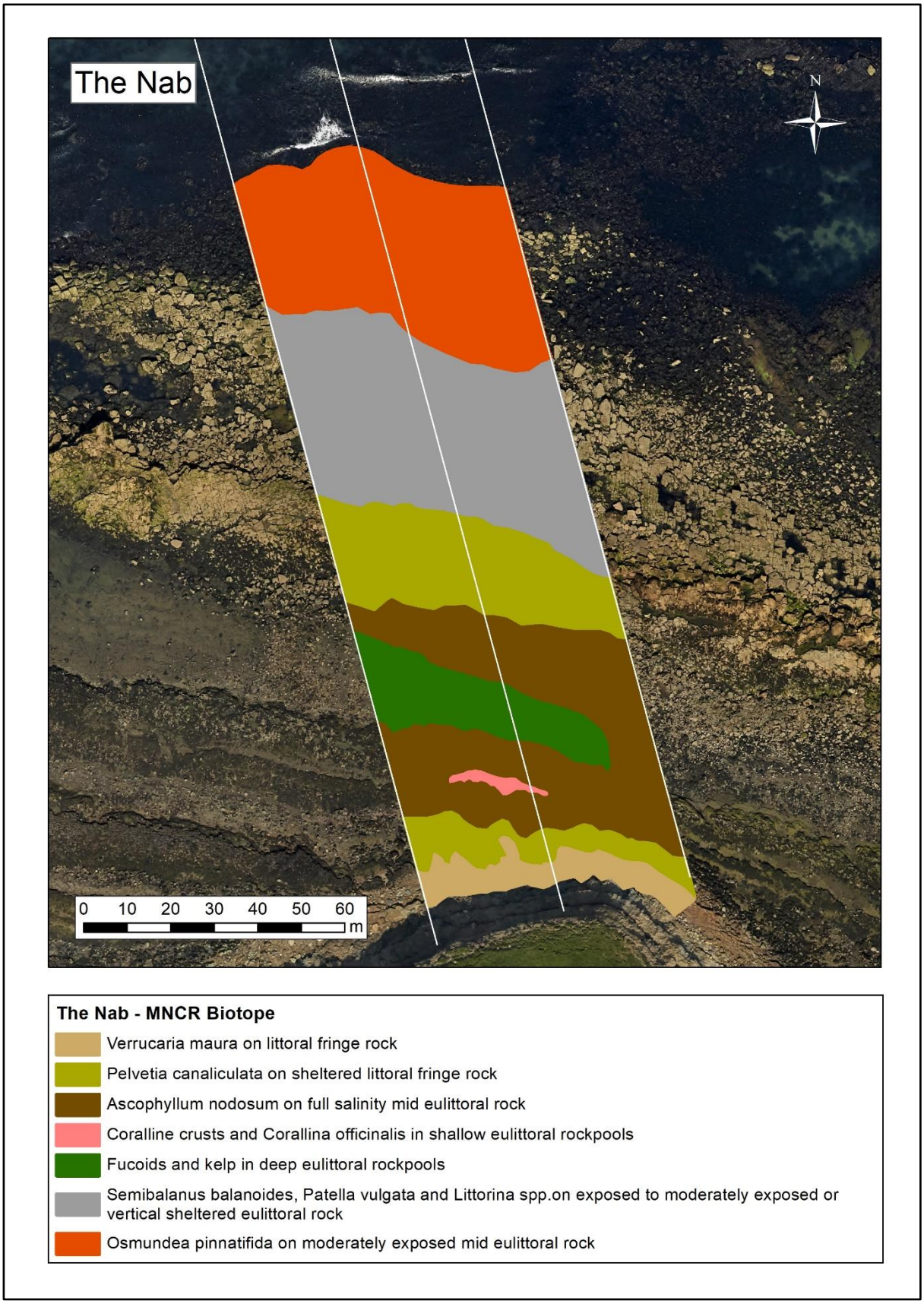

Figure 0.4: distribution of MNCR biotopes (JNCC, 2022) at transect The Nab transect surveyed as part of the Filey to Red Cliff intertidal survey 2022. Ortho-rectified aerial photography obtained from Channel Coastal Observatory)

Presence of SSSI habitats

One biotope considered nationally or internationally important (as listed in Annex I of Brazier *et al*., 2019) was recorded during the survey; this was the biotope **LR.FLR.Lic.Bli**, which is listed as a chalk / other soft rock biotope. This biotope was present at the very upper shore of the North Red Cliff transect.

Three rockpool biotopes, which are listed as good examples of biotopes of special interest in Annex I of Brazier *et al*. (2019), were recorded during the survey. The biotopes **LR.FLR.Rkp.Cor.Cor** and **LR.FLR.Rkp.FK** were recorded at Filey Brigg and The Nab, while the biotope **LR.FLR.Rkp.SwSed** was recorded at Filey Brigg and North Red Cliff. Two under-boulder biotopes were also identified during the survey; **LR.MLR.BF.Fser.Bo**, which was recorded in the low shore area at North Red Cliff, and **IR.MIR.KR.Ldig.Bo**, which was observed in the sublittoral fringe at Filey Brigg. In addition, the sublittoral fringe surge gully biotope complex **IR.FIR.SG** was also assigned to an area in the northern section of the Filey Brigg transect.

A summary of the biotopes identified that are typical of each of the whole shore types that should be represented in the SSSI series as listed in Annex III of Brazier *et al*. (2019) is shown in Table 3.1.

Table 0.1: Biotopes identified during the Filey to Red Cliff intertidal survey 2022 that are typical of each of the whole shore types that should be represented in the SSSI series. Adapted from Brazier *et al*. (2019). (Cells with the character "Y" indicate, that the biotope is classified as part of the corresponding whole shore types, blank cells are left intentionally).

Biotope	Wave exposed rock	Moderately wave exposed rock	Wave sheltered rock	Mixed substrate	Sand and coarse sediment	Sand and muddy sand
LR.HLR.MusB.Sem	Y	Y				
LR.HLR.MusB.Sem.Sem	Y	Y				
LR.HLR.MusB.Sem.LitX	Y	Y				
LR.HLR.FR.Him	Y	Y				
LR.HLR.FR.Mas	Y	Y				
LR.HLR.FR.Osm		Y				
LR.MLR.BF.FspiB		Y				
LR.MLR.BF.FvesB		Y				
LR.MLR.BF.Fser		Y	Y			
LR.MLR.BF.Fser.R		Y				
LR.MLR.BF.Fser.Bo		Y	Y			
LR.MLR.BF.Rho		Y	Y			
LR.LLR.F.Pel			Y			
LR.LLR.F.Asc.FS			Y			
LR.LLR.F.Asc.X				Y		
LS.LCS.Sh.BarSh					Y	
LS.LSa.FiSa.Po					Y	
IR.MIR.KR.Ldig		Y	Y			

A total of 13 of the 18 recorded biotopes are listed as being representative of wave exposed and/or moderately wave exposed rock. Examples of biotopes representative of wave exposed and/or moderately wave exposed rock were found to be present at all transects surveyed. Filey Brigg showed the greatest range of these biotopes, with 10 different wave exposed / moderately wave exposed biotopes present; examples were present in both the north and south sections of the transect. By contrast, only one of the listed biotopes (**LR.MLR.BF.Fser**, which is representative of moderately wave exposed rock) was present at Castle Rocks. At The Nab one biotope was present which is listed as being representative of wave exposed rock, with one other biotope listed as being representative of moderately wave exposed rock also present. However, the upper and mid shore zones at The Nab were generally characterised by biotopes representative of wave sheltered rock. The North Red Cliff transect was highly patchy, with a variety of wave sheltered rock, mixed sediment and sand and coarse sediment biotopes present. However, a total of five biotopes representative of wave exposed and/or moderately wave exposed rock were also present at this location.

Anthropogenic influences

The path to Filey Brigg (and the Brigg itself) were very busy on the day of survey, with numerous walkers present throughout the day. While the beach at Cayton Bay was generally quite busy, no recreational walkers were observed beyond the North Red Cliff transect location, likely due to the difficult terrain present around The Nab. However, two groups of geologists were encountered during the survey, both of which were conducting surveys of the cliffs; one of these groups (encountered on 24th October) was investigating a recent landslide, located between The Nab and Castle Rocks transect locations.

Several examples of litter were observed throughout the survey. At North Red Cliff, various forms of litter were present, including unidentified rusted metal items, a metal mesh (grill or similar), rubber tubing and plastic fragments. At Castle Rocks, both within the transect boundary and outside, several old fishing pots were present at the top of the beach. In addition, on the area of relatively barren flat rock several items were present, including an unidentified rusted metal item and rubber tubing/pipe. No litter was observed at The Nab or at Filey Brigg.

Notable species

Species of note observed during the survey included a grey seal (*Halichoerus grypus*, a species listed in Annex II of the Habitats Directive), which was observed hauled out close to the Castle Rocks transect. No other protected species were observed during the survey. However, the blue mussel *M. edulis*, which is listed as a feature of conservation interest (FOCI), was recorded at the Filey Brigg and North Red Cliff transects, although individuals were typically very small (<1 cm) and were only observed in very low numbers. In addition, the climate change indicator species *Steromphala umbilicalis* was recorded as present at Filey Brigg and The Nab. No NIS were observed during the survey.

Discussion

Issues encountered

The primary issue encountered during the survey was the lack of reasonable access to the transects at The Wyke and Chimney Hole, which meant that the habitats at these locations could not be assessed. In addition, while the Castle Rocks location was accessible, large parts of the transect itself remained underwater even at low tide, meaning that only the upper shore zone could be accurately mapped. This lack of access significantly reduced the efficacy of the survey and meant that feature condition monitoring was not possible at the affected locations. However, the addition of the transect at North Red Cliff offset this issue somewhat, increasing the area of survey coverage and providing baseline data against which future change can be measured at a readily repeatable location.

Comparison with previous data

The biotopes assigned at each transect in 2022 differed significantly from those assigned by Mieszkowska and Sugden (2013), both in terms of biotope type and habitat distribution. Comparisons of the transects repeated in 2022 are presented below.

Filey Brigg

A comparison of the biotopes assigned to the 2022 Filey Brigg transect area by both the current authors and Mieszkowska and Sugden (2013) is presented in Tables 4.1 and 4.2. Note that rockpools are not included in the comparison.

Table 0.1: Comparison of the biotopes assigned to different sections of the northern section of the Filey Brigg transect in 2022 and 2012.

Location*	2022	2012
Centre	LR.MLR.BF.FspiB	LR.FLR.Lic.Ver / LR.MLR.BF.FspiB
Platform 1	LR.HLR.FR.Osm (with LR.FLR.Rkp)	LR.HLR.FR
Platform 1	LR.HLR.MusB.Sem.Sem	LR.HLR.FR
Platform 2	LR.HLR.MusB.Sem.Sem (with LR.FLR.Rkp)	LR.HLR.MusB.Sem
Platform 3	LR.HLR.FR.Him	LR.HLR.FR
Sublittoral fringe	IR.MIR.KR.Ldig	IR.MIR.KR.Ldig

***See Results section for explanation of platform numbers.**

Table 0.2: Comparison of the biotopes assigned to different zones within the southern section of the Filey Brigg transect in 2022 and 2012.

Location	2022	2012
Upper shore	LR.HLR	LR.FLR.Lic.Ver / LR.HLR.FR.Mas
Mid shore	LR.HLR.MusB.Sem.LitX	LR.HLR.MusB.Sem
	LR.MLR.BF.FvesB	LR.HLR.MusB.Sem
Low shore	LR.MLR.BF.Fser.R	LR.MLR.BF.Fser.Bo
	LR.HLR.FR.Mas / LR.MLR.BF.Rho	LR.MLR.BF.Fser.Bo
Sublittoral fringe	IR.MIR.KR.Ldig.Bo	[not recorded]

There were significant differences in the types and distribution of biotopes assigned in both the northern and southern sections of the Filey Brigg transect.

In the centre of the transect, close to the path, the 2012 survey recorded the biotope **LR.FLR.Lic.Ver**, whereas in 2022 the characterising species of this biotope (the lichen *Verrucaria maura*) was present only as very small (<1 cm) patches, covering <1 % of the rock surface, meaning that alternative biotopes were assigned. North of the path, the biotope **LR.MLR.BF.FspiB** was recorded in both years, although in 2012 this biotope was restricted to the edge of the central platform.

In the northern section of the transect, there were similarities in the habitats identified in different years, however it was noted that the biotopes assigned in 2022 were assigned at a more 'detailed' level, i.e. at the biotope and sub-biotope level, than in 2012 (e.g. **LR.HLR.FR.Osm** and **LR.HLR.FR.Him** (2022) vs **LR.HLR.FR** (2012)). However, even accounting for the differences in the level of 'precision', several differences in the distribution of biotopes between years were identified in this section of the transect. For example, the sub-biotope **LR.HLR.MusB.Sem.Sem** (recorded as the biotope **LR.HLR.MusB.Sem** in 2012), which in 2022 covered part of platform 1 as well as the majority of platform 2, was restricted to a relatively small patch in the west of the transect area in 2012. Other differences in biotope distribution, such as the lack of rockpool and surge gully biotopes in the 2012 data, were identified, however it is possible that these were due to the difference in the spatial resolution of the two surveys.

In the southern section of the transect, there was some consistency between the two surveys, with the biotopes **LR.HLR.MusB.Sem** and **LR.MLR.BF.Fser** recorded in both years in the mid and low shore zones respectively. However, the distribution and range of biotopes differed significantly between surveys. While the barnacle-dominated biotope **LR.HLR.MusB.Sem** was recorded as being present throughout the mid-shore in 2012, the 2022 survey found that while the upper part of this zone was barnacle-dominated, the majority of the mid shore was characterised by mosaics of both barnacles and *F.*

vesiculosus (**LR.MLR.BF.FvesB**). Similarly, the low shore, which had been classified as the under-boulder community biotope **LR.MLR.BF.Fser.Bo** in 2012, was found to be characterised by red seaweed communities, particularly in the extreme low shore, with the biotopes **LR.MLR.BF.Fser.R** and **LR.HLR.FR.Mas**/**LR.MLR.BF.Rho** deemed to be more representative of the communities present.

Castle Rocks

A comparison of the biotopes assigned to the 2022 Castle Rocks transect area by both the current authors and Mieszkowska and Sugden (2013) is presented in Table 4.3.

Table 0.3: Comparison of the biotopes assigned to different zones at the Castle Rocks transect in 2022 and 2012.

Location	2022	2012
Upper shore	LS.LCS.Sh.BarSh	LS.LSa
	LR	LR.FLR.Rkp.SwSed
Mid shore	[Marine inlet]	LR.FLR.Rkp.SwSed
	LR.MLR.BF.Fser*	LR.MLR.BF.Fser
Low shore	[Marine inlet]*	IR.HIR.Ksed.XKScrR
	LR.MLR.BF.Fser*	LR.HLR.MusB.Sem / LR.MLR.BF.Fser.Bo

***areas inaccessible; biotopes only tentatively assigned.**

The difference in the biotope assigned to the upper shore is likely due to a difference in interpretation of sediment type. In 2022 the substrate primarily consisted gravel and pebbles with a lower quantity (15 %) of sand present, while the 2013 report lists this area as littoral sand. The area of relatively bare rock below the upper shore shingle was not recorded in 2013. The area below this was described variously by Mieszkowska and Sugden (2013) as either a gully or a lagoon, however the rockpool biotope **LR.FLR.Rkp.SwSed** was assigned to the area. Observations in 2022 indicate that the area in question is neither a lagoon (as it is open to the sea at both ends at all states of the tide) nor a rockpool (the area is very large and water remains flowing at all states of the tide), and is likely best described as an along-shore marine inlet.

While the mid and low shores could not be surveyed in 2022, the biotopes assigned were similar for both surveys, with the biotope **LR.MLR.BF.Fser** (and Fser.Bo) assigned to the areas of rock and boulder visible above the marine inlets. It is considered unlikely, given that large areas of the transect remained underwater even at low tide, that the biotope

assigned in 2012 (**IR.HIR.Ksed.XKScrR**) could have been determined with any real accuracy.

The Nab

A comparison of the biotopes assigned to the 2022 The Nab transect area by both the current authors and Mieszkowska and Sugden (2013) is presented in Table 4.4.

Table 0.4: Comparison of the biotopes assigned to different zones at The Nab transect in 2022 and 2012. (Some cells are left blank intentionally).

Location	2022	2012
Upper shore	LR.FLR.Lic.Ver	LS.LSa
	LR.LLR.F.Pel	LR.MLR.BF.Fser.Bo
Mid shore	LR.LLR.F.Asc.FS (with LR.FLR.Rkp.Cor.Cor)	LR.MLR.BF.Fser.Bo
	LR.FLR.Rkp.FK	LR.LLR.FVS.AscVS
	LR.LLR.F.Asc.FS	LR.LLR.FVS.AscVS / LR.MLR.BF.Fser.Bo
	LR.LLR.F.Pel	LR.MLR.BF.Fser.Bo / LR.FLR.Eph
	LR.HLR.MusB.Sem.Sem	LR.MLR.BF.Fser.X
Low shore	LR.HLR.FR.Osm	IR.HIR.Ksed.XKScrR

Significant differences were evident between the two surveys at The Nab, with very different biotopes recorded, and with significant differences in the distribution of biotopes boundaries.

In the extreme upper shore, the 2012 survey recorded a band of sandy substrate (**LS.LSa**), however no soft sediments were present in this area during the 2022 survey, with the rock biotope **LR.FLR.Lic.Ver** recorded instead. Below this, in habitats 2 and 3, which were recorded as the biotopes **LR.LLR.F.Pel** and **LR.LLR.F.Asc.FS** in 2022, similarly stark differences in biotope assignment were noted, with the 2012 survey having recorded a wide band of the biotope **LR.MLR.BF.Fser.Bo**. It is however thought that the 2012 biotope assignment is likely to be incorrect, as the recorded biotope is generally restricted to the mid- and lower shore regions. Other probable errors in the 2012 biotope assignments were also identified. These included the assignment of the variable salinity biotope **LR.LLR.FVS.AscVS** in the mid shore (despite no noted freshwater inputs) and the assignment of the sub-tidal biotope **IR.HIR.Ksed.XKScrR** to the low shore region, which in 2022 was recorded as **LR.HLR.FR.Osm**. Given these probable inaccuracies, it is thought

that the habitat map of The Nab produced by Mieszkowska and Sugden (2013) is somewhat unreliable. It is therefore recommended that a direct comparison of the two datasets is not untaken at this site.

Possible reasons for discrepancies between surveys

It is possible that changes in composition and/or extent of different biotopes have indeed occurred. Intertidal communities are known to be subject to natural variation and cycling and changes in status and extent can readily occur between survey years, particularly when there is a relatively long interval between assessments. However, recording and assessment artefacts can also occur. For example, slight differences in quantification of key characterising taxa can to lead to assignment of different biotopes. Interpretation of MNCR biotope descriptions can also vary between analysts leading to discrepancies between years. For example, in the previous survey the variable salinity biotope **LR.LLR.FVS.AscVs** was recorded at multiple transects. It is the opinion of the current authors that, unless freshwater inputs were previously present at these sites (and none were noted in the previous report, nor were any pipelines visible on aerial photography or OS maps or nautical charts, except at Filey Brigg), this was an error and that it is inappropriate to assign variable salinity biotopes to habitats in fully marine conditions. It is likely that these areas should have in fact been assigned as an equivalent fully marine biotope (e.g. LR.LLR.F.Asc or LR.LLR.F.Fves). Discrepancies in biotope assignments could also be due to differences in methodology; in the 2022 survey the transects were significantly narrower (60 m) compared to the previous survey (up to several hundred metres). This would have allowed the 2022 field scientists to conduct a more in-depth assessment of the habitats present, albeit in a relatively small area. As a result, the 2022 habitat assessments and biotope maps are likely to be more accurate.

Summary and recommendations

Due to access constraints and safety concerns, the major objective of the survey, i.e. to conduct Phase I surveys at five belt transects, was only partially successful. However, transects were successfully conducted at three of the planned locations and at one additional location (North Red Cliff). At each of the four locations attempted, the identification and characterisation of all intertidal rock habitats and biotopes present was completed in accordance with best practice procedural guidelines, and detailed habitat maps illustrating the extent and distribution of intertidal rock habitats and biotopes were produced for each transect.

The primary aim of the 2022 survey was to determine and/or verify the extent and distribution of two ‘whole shore’ selection units (wave-exposed rock and moderately wave-exposed rock). Biotopes representative of these whole shore selection units were found to be present at each the four locations surveyed. The greatest range of biotopes representative of wave-exposed rock and/or moderately wave-exposed rock was found at Filey Brigg, likely due to the difference in the exposure conditions of the north- and south-facing shores at this location. The North Red Cliff transect was more patchy, with a range of biotopes identified which were variously representative of wave sheltered rock, mixed

sediment, and sand and coarse sediment shores as well as wave exposed and/or moderately wave exposed rock. At The Nab only two biotopes representative of wave exposed rock and/or moderately wave exposed rock were present, both in the lower-mid to low shore region; the upper and mid shore zones at this transect were instead predominantly characterised by biotopes representative of wave-sheltered rock. At Castle Rocks, only one of the recorded biotopes is listed as being representative of moderately wave exposed rock, although this is possibly due to the lack of access to the mid and low shore at this location, which prevented full assessment of the biotopes in these areas.

In addition to the identification of wave-exposed rock and moderately wave-exposed rock biotopes, the surveys identified other marine intertidal features that qualify for selection as part of a SSSI. The nationally/internationally important biotope **LR.FLR.Lic.Bli** was identified at North Red Cliff, and several biotopes listed as good examples of biotopes of special interest (as per Annex I of Brazier *et al*. (2019)) were recorded during the survey. These included three rockpool biotopes, two under-boulder biotopes and the sublittoral fringe surge gully biotope complex **IR.FIR.SG**. The majority of these were present at either Filey Brigg or at the North Red Cliff transect, although rockpool biotopes were also recorded at The Nab.

In order to minimise inter-survey variability and improve comparisons between datasets, it is recommended that the methods employed by any future surveys should follow current guidance for intertidal survey work and that the details of all methods used should be rigorously documented. It is also important that survey locations are readily repeatable; the access issues encountered during this survey indicate that the transects previously selected (particularly at The Wyke, Chimney Hole and Castle Rocks) do not lend themselves to repeatability and are therefore of extremely limited use in condition monitoring. It is recommended that future surveys focus on repeat monitoring at North Red Cliff, The Nab and Filey Brigg, i.e. sites which are reasonably accessible, although it is also recommended that additional monitoring transects are established if possible.

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Appendices

Appendix I: Phase I survey logs (summary)

All positions are WGS84 latitude and longitude, decimal degrees (D.DDDDDD). Times are recorded in local time (BST).

Site Name	Transect Code	Planned SOL Position		Survey Date	Actual SOL Position			Transect Bearing (degrees)	Number of Habitat Zones
		Latitude	Longitude		Latitude	Longitude	GPS Accuracy (± m)		
Filey Brigg	FB	54.216468	-0.262218	13/10/2022	54.216468	-0.262218	3.0	195	15
North Red Cliff	NRC	n/a	n/a	24/10/2022	54.240638	-0.348239	3.0	346	10
Castle Rocks	CR	54.236004	-0.326566	25/10/2022	54.236050	-0.327050	3.0	15	3 (completed)
The Nab	TN	54.242503	-0.338996	26/10/2022	54.242490	-0.339499	3.0	345	8

Site Name	Transect Number	Habitat Number	Shore Position	Habitat width (m)	Habitat Description	MNCR Biotope Code
Filey Brigg	FB	N01	High	13	Patchy *Fucus spiralis* on highly pitted sloped bedrock with fauna in crevices and small pools.	LR.MLR.BF.FspiB
Filey Brigg	FB	Rockpool 1	High	~	Corallina officinalis in shallow bedrock rockpool.	LR.FLR.Rkp.Cor.Cor

Filey Brigg	FB	Rockpool 2	High	~	Corallina officinalis in shallow bedrock rockpool.	LR.FLR.Rkp.Cor.Cor
Filey Brigg	FB	N02	Mid	10	Dense *Osmundea pinnatifida* on bedrock.	LR.HLR.FR.Osm
Filey Brigg	FB	Rockpool 5	Mid	~	Corallina officinalis in shallow rockpool.	LR.FLR.Rkp.Cor.Cor
Filey Brigg	FB	Rockpool 6	Mid	~	*Laminaria digitata* in deep rockpool with *Corallina officinalis*.	LR.FLR.Rkp.FK
Filey Brigg	FB	N03	Mid	3	*Semibalanus balanoides* and *Patella vulgata* on exposed rock.	LR.HLR.MusB.Sem.Sem
Filey Brigg	FB	N04	Mid	5	*Semibalanus balanoides* and *Patella vulgata* on exposed rock with seaweeds in large fissures.	LR.HLR.MusB.Sem.Sem
Filey Brigg	FB	Rockpool 7	Mid	1.5	Dense *Laminaria digitata* in deep rockpool/very large fissure.	LR.FLR.Rkp.FK
Filey Brigg	FB	Rockpool 8	Mid	~	Dense *Laminaria digitata* in r.ockpool with coralline crusts and mixed seaweeds	LR.FLR.Rkp.FK
Filey Brigg	FB	N05	Low	18	*Osmundea pinnatifida* on rock with *Himanthalia elongata* and dense patches of *Semibalanus balanoides*.	LR.HLR.FR.Him
Filey Brigg	FB	Rockpool 9	Low	~	Dense *Laminaria digitata* in rockpool with coralline crusts and mixed seaweeds.	LR.FLR.Rkp.FK
Filey Brigg	FB	N06	Mid-Low	3	Mosaic of algal-dominated habitats in surge gully with *Osmundea pinnatifida* and *Himanthalia elongata*.	IR.FIR.SG (LR.HLR.FR.Osm / LR.HLR.FR.Him)
Filey Brigg	FB	S01	High	14	*Patella vulgata* and patchy *Fucus* spp. on sloping bedrock with fauna present in deep fissures.	LR.HLR [no good fit]

Filey Brigg	FB	Rockpool 3	High	10	Dense *Ulva lactuca* in sediment-floored rockpool.	LR.FLR.Rkp.SwSed
Filey Brigg	FB	S02	Mid	5	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on boulders.	LR.HLR.MusB.Sem.LitX
Filey Brigg	FB	Rockpool 4	Mid	~	Sparse coralline crusts and Corallina officinalis in shallow rockpool with cobbles.	LR.FLR.Rkp.Cor.Cor
Filey Brigg	FB	S03	Mid	25	*Fucus vesiculosus* and barnacle mosaics on boulders.	LR.MLR.BF.FvesB
Filey Brigg	FB	S04	Low	5	*Fucus serratus* and red seaweeds on very large boulders with patchy *Semibalanus balanoides*.	LR.MLR.BF.Fser.R
Filey Brigg	FB	S05	Low	6	*Chondrus crispus* and *Mastocarpus stellatus* on boulders with *Rhodothamniella floridula* and *Osmundea pinnatifida*.	LR.HLR.FR.Mas / LR.MLR.BF.Rho
North Red Cliff	NRC	1	Strandline	3	Barren very large boulders with sparse/patchy *Verrucaria maura*.	LR.FLR.Lic.Ver
North Red Cliff	NRC	2	High	1.5	Dense *Blidingia* sp. on boulders with *Fucus spiralis* on sides of larger boulders.	LR.FLR.Lic.Bli (with LR.LLR.F.Fspi.FS)
North Red Cliff	NRC	3	High	6	Dense *Ascophyllum nodosum* on boulders with patchy *Fucus spiralis* and sparse green seaweeds.	LR.LLR.F.Asc.FS
North Red Cliff	NRC	4	High	4.5	*Patella vulgata* and *Littorina* spp. on bedrock pavement with patchy *Semibalanus balanoides*.	LR.HLR.MusB.Sem.Sem
North Red Cliff	NRC	5	Mid	2.5	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on boulders.	LR.HLR.MusB.Sem.LitX

North Red Cliff	NRC	6	Mid	15	*Ascophyllum nodusum* and patchy *Fucus vesiculosus* on boulders and cobbles over slightly sandy gravel.	LR.LLR.F.Asc.X
North Red Cliff	NRC	7	Mid	20	*Rhodothamniella floridula* on large boulders overlying rippled sand.	LR.MLR.BF.Rho
North Red Cliff	NRC	8	Low	15	*Fucus serratus* on very large boulders overlying sand.	LR.MLR.BF.Fser.Bo
North Red Cliff	NRC	9	Low	15	Slightly gravelly shelly sand.	LS.LSa
North Red Cliff	NRC	10	Low	~	*Semibalanus balanoides*, *Patella vulgata* and *Nucella lapillus* on very large boulders.	LR.HLR.MusB.Sem
North Red Cliff	NRC	Rockpool 1	Low	4	Mixed seaweeds and kelps in sand-floored rockpool.	LR.FLR.Rkp.SwSed
North Red Cliff	NRC	11	Mid	5	Patch of rippled sand with worm casts.	LS.LSa.FiSa.Po
North Red Cliff	NRC	Rockpool 2	Mid	4	Mixed seaweeds and kelps in sand-floored rockpool.	LR.FLR.Rkp.SwSed
Castle Rocks	CR	1	Strandline	34	Barren shingle with clay outcrops.	LS.LCS.Sh.BarSh
Castle Rocks	CR	2	High	18	Flat bedrock with patchy rippled sand veneer and frequent boreholes/small pools of standing water.	LR (no good fit)
Castle Rocks	CR	3	High		Marine inlet.	[cannot assess]
The Nab	TN	1	Strandline	5	Highly pitted uneven bedrock platform with very sparse encrusting biota.	LR.FLR.Lic.Ver

The Nab	TN	2	High	8	*Pelvetia canaliculata* and *Fucus spiralis* on boulders overlying bedrock.	LR.LLR.F.Pel
The Nab	TN	3	High	16	*Ascophyllum nodosum* on bedrock with sparse *Fucus spiralis*.	LR.LLR.F.Asc.FS
The Nab	TN	Rockpool 1	High	2	*Corallina officinalis* and coralline crusts in rockpool with *Cladophora rupestris*.	LR.FLR.Rkp.Cor.Cor
The Nab	TN	4 (Rockpool 2)	Mid	15	*Halidrys siliquosa* in gravel-floored rockpool.	LR.FLR.Rkp.FK
The Nab	TN	5	Mid	15	*Ascophyllum nodosum* and *Fucus vesiculosus* on boulders overlying bedrock.	LR.LLR.F.Asc.FS
The Nab	TN	6	Mid	24	*Pelvetia canaliculata* and *Fucus spiralis* on bedrock platform.	LR.LLR.F.Pel
The Nab	TN	7	Mid	42	*Semibalanus balanoides*, *Patella vulgata* and *Littorina littorea* on very large boulders and bedrock.	LR.HLR.MusB.Sem.Sem
The Nab	TN	8	Low	45	*Osmundea pinnatifida* on boulders overlying bedrock and coarse sediment with *Fucus serratus*.	LR.HLR.FR.Osm

Appendix II: Phase I species matrix

Species recorded during the Phase I habitat surveys at each transect surveyed as part of the Filey to Red Cliff intertidal survey 2022. Species abundances are recorded using the semi-quantitative SACFOR scale. *Note: blank cells indicate absence of taxon in the specified habitat.*

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N01	Rock pool 1	Rock pool 2	N02	Rock pool 5	Rock pool 6	N03	N04	Rock pool 7	Rock pool 8
Verrucaria	sp.	Crust/meadow										
Verrucaria maura		Crust/meadow	R			R		R	R	R		
Porifera	Encrusting yellow	Crust/meadow										
Dilsea carnosa		Massive/turf										
Actinia equina		1-3cm	C	F		F	F		F	F		
Boccardia/Polydora	sp. tubes	Crust/meadow										
Laniceconchilega		1-3cm										
Spirobranchus	sp.	Crust/meadow										
Spirorbinae		Crust/meadow										
Semibalanus balanoides		Crust/meadow	O	R	O	F	R	R	S	S		
Paguridae		3-15cm									P	
Pagurus	sp.	3-15cm										
Carcinus maenas		3-15cm										

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N01	Rock pool 1	Rock pool 2	N02	Rock pool 5	Rock pool 6	N03	N04	Rock pool 7	Rock pool 8
Steromphala cineraria		1-3cm										
Steromphala umbilicalis		1-3cm									P	
Patella vulgate		3-15cm	C	C	C	F	F	F	C	C		P
Littorina	sp.	1-3cm										
Littorina littorea		1-3cm										
Littorina fabalis		1-3cm										
Littorina obtusata		1-3cm										
Littorina saxatilis		1-3cm	C			P				F		
Nucellalapillus		1-3cm										
Mytilus edulis		3-15cm	R									
Bryozoa	Encrusting orange	Crust/meadow										
Membranipora membranacea		Crust/meadow										R
Didemnidae		Crust/meadow										R
Rhodophyta	Dark red crusts	Crust/meadow									R	
Rhodophyta	Finely branching red indet	Massive/turf				R	R				R	
Rhodophyta	Finely branching red sp. A	Massive/turf						O				

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N01	Rock pool 1	Rock pool 2	N02	Rock pool 5	Rock pool 6	N03	N04	Rock pool 7	Rock pool 8
Rhodophyta	Filamentous red	Massive/turf										
Rhodophyta	Very small flat red	Massive/turf					R					R
Porphyra purpurea		Massive/turf										
Rhodotamniella floridula		Massive/turf								R		
Corallinaceae	Indet. red calcareous crusts	Crust/meadow	R	R		R	F	C	R	R	F	S
Corallina officinalis		Massive/turf	R	F	F		C	O		O	F	O
Catenella caespitosa		Massive/turf										
Chondrus crispus		Massive/turf	R				R	R	R	R		
Mastocarpus stellatus		Massive/turf		F	O	F	R		O	O	R	R
Osmundea hybrida		Massive/turf										
Osmundea pinnatifida		Massive/turf	R			A	O	R	R	O	R	R
Vertebrata lanosa	Epiphytic	Massive/turf										
Phaeophyceae	Filamentous	Massive/turf										
Phaeophyceae	c.f. Stypocaulon scoparium	Massive/turf										
Ralfsia verrucosa		Massive/turf	R							P		
Chordaria flagelliformis		Massive/turf	R									

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N01	Rock pool 1	Rock pool 2	N02	Rock pool 5	Rock pool 6	N03	N04	Rock pool 7	Rock pool 8
Laminaria digitata		Crust/meadow		R			O	C		R	S	S
Saccharina latissima		Crust/meadow								R		R
Fucales	Sporelings	Crust/meadow				R		R	R	R		R
Cystoseira	sp.	Crust/meadow										
Halidrys siliquosa		Crust/meadow		R							R	R
Ascophyllum nodosum		Crust/meadow				R						
Fucus	sp. indet	Crust/meadow		R		R						
Fucus serratus		Crust/meadow					R	R		R	R	R
Fucus spiralis		Crust/meadow	F			R			R			
Fucus vesiculosus		Crust/meadow										
Pelvetia canaliculata		Crust/meadow										
Himanthalia elongata		Crust/meadow				R				O	O	O
Chlorophyta	Filamentous green	Massive/turf										
Blidingia	sp.	Massive/turf										R
Ulva intestinalis		Massive/turf	R	R	O	R	R	R	R			
Ulva lactuca		Massive/turf				R	O	R		R	O	R
Cladophora	sp.	Massive/turf	O					R				

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N01	Rock pool 1	Rock pool 2	N02	Rock pool 5	Rock pool 6	N03	N04	Rock pool 7	Rock pool 8
Cladophora rupestris		Massive/turf										

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N05	Rock pool 9	N06	S01	Rock pool 3	Rock pool 4	S02	S03	S04	S05
Verrucaria	sp.	Crust/meadow										
Verrucaria maura		Crust/meadow							R			
Porifera	Encrusting yellow	Crust/meadow	R									
Dilsea carnosa		Massive/turf			R							
Actinia equina		1-3cm	O			F			P	R	P	
Boccardia/Polydora	sp. tubes	Crust/meadow										
Laniceconchilega		1-3cm										
Spirobranchus	sp.	Crust/meadow						R		R	R	
Spirorbinae		Crust/meadow										
Semibalanus balanoides		Crust/meadow	A	R	R	O			S	A	C	F
Paguridae		3-15cm						P				
Pagurus	sp.	3-15cm				P	C					

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N05	Rock pool 9	N06	S01	Rock pool 3	Rock pool 4	S02	S03	S04	S05
Carcinus maenas		3-15cm					P					
Steromphala cineraria		1-3cm						P		P		
Steromphala umbilicalis		1-3cm										
Patella vulgate		3-15cm	F	P	C	C	F	C	A	A	C	C
Littorina	sp.	1-3cm										
Littorina littorea		1-3cm								P		
Littorina fabalis		1-3cm								R		
Littorina obtusata		1-3cm				P	P					
Littorina saxatilis		1-3cm	P			C	F	C	O	O		
Nucellalapillus		1-3cm							F	F	F	
Mytilus edulis		3-15cm										
Bryozoa	Encrusting orange	Crust/meadow	R									
Membranipora membranacea		Crust/meadow		R								
Didemnidae		Crust/meadow										
Rhodophyta	Dark red crusts	Crust/meadow				R						
Rhodophyta	Finely branching red indet	Massive/turf	R	O				F				

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N05	Rock pool 9	N06	S01	Rock pool 3	Rock pool 4	S02	S03	S04	S05
Rhodophyta	Finely branching red sp. A	Massive/turf					O					R
Rhodophyta	Filamentous red	Massive/turf					O			R	R	
Rhodophyta	Very small flat red	Massive/turf										
Porphyra purpurea		Massive/turf							R	R	O	
Rhodotamniella floridula		Massive/turf			O					R	F	A
Corallinaceae	Indet. red calcareous crusts	Crust/meadow	F	C	C	O	R	R	R	R	R	
Corallina officinalis		Massive/turf	O	F	F	O		R				
Catenella caespitosa		Massive/turf										
Chondrus crispus		Massive/turf				R				R	A	A
Mastocarpus stellatus		Massive/turf	O	R	C	R						A
Osmundea hybrida		Massive/turf										
Osmundea pinnatifida		Massive/turf	S		C	R			R	R	C	C
Vertebrata lanosa	Epiphytic	Massive/turf						R				
Phaeophyceae	Filamentous	Massive/turf										
Phaeophyceae	c.f. Stypocaulon scoparium	Massive/turf										
Ralfsia verrucosa		Massive/turf										
Chordaria flagelliformis		Massive/turf						R				

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N05	Rock pool 9	N06	S01	Rock pool 3	Rock pool 4	S02	S03	S04	S05
Laminaria digitata		Crust/meadow		S	R						R	O
Saccharina latissima		Crust/meadow										
Fucales	Sporelings	Crust/meadow							R		R	
Cystoseira	sp.	Crust/meadow	R									
Halidrys siliquosa		Crust/meadow		R	R							
Ascophyllum nodosum		Crust/meadow				R		R				
Fucus	sp. indet	Crust/meadow										
Fucus serratus		Crust/meadow	R	R	R		R				S	R
Fucus spiralis		Crust/meadow				R		R		R		
Fucus vesiculosus		Crust/meadow				R		R	R	C	R	
Pelvetia canaliculata		Crust/meadow										
Himanthalia elongata		Crust/meadow	F	O	F							
Chlorophyta	Filamentous green	Massive/turf		R		R						
Blidingia	sp.	Massive/turf										
Ulva intestinalis		Massive/turf	R	R	R	R				R		
Ulva lactuca		Massive/turf	R	O	R	R	S	R	R	R	R	R
Cladophora	sp.	Massive/turf									R	

Taxon	Qualifier	SACFOR	Filey Brigg habitat									
			N05	Rock pool 9	N06	S01	Rock pool 3	Rock pool 4	S02	S03	S04	S05
Cladophora rupestris		Massive/turf										

Taxon	Qualifier	SACFOR	North Red Cliff habitat											
			1	2	3	4	5	6	7	8	9	10	Rock pool 1	11	Rock pool 2
Verrucaria	sp.	Crust/meadow													
Verrucaria maura		Crust/meadow	F	O	R							R			
Porifera	Encrusting yellow	Crust/meadow													
Dilsea carnosa		Massive/turf													
Actinia equina		1-3cm					P	F	P	P		P	P		
Boccardia/Polydora	sp. tubes	Crust/meadow													
Laniceconchilega		1-3cm													
Spirobranchus	sp.	Crust/meadow					R		R				R		
Spirorbinae		Crust/meadow					C	F	R						
Semibalanus balanoides		Crust/meadow			R	O				A		S			
Paguridae		3-15cm											P		
Pagurus	sp.	3-15cm													

Taxon	Qualifier	SACFOR	North Red Cliff habitat												
			1	2	3	4	5	6	7	8	9	10	Rock pool 1	11	Rock pool 2
Carcinus maenas		3-15cm													
Steromphala cineraria		1-3cm													
Steromphala umbilicalis		1-3cm													
Patella vulgate		3-15cm			O	C	C	C	P	C		C			
Littorina	sp.	1-3cm										P			
Littorina littorea		1-3cm			P	F	C	P	P						
Littorina fabalis		1-3cm													
Littorina obtusata		1-3cm						P	P			P			
Littorina saxatilis		1-3cm													
Nucellalapillus		1-3cm		F	C	F	F	F		F		F	P		
Mytilus edulis		3-15cm										R			
Bryozoa	Encrusting orange	Crust/meadow													
Membranipora membranacea		Crust/meadow													
Didemnidae		Crust/meadow													
Rhodophyta	Dark red crusts	Crust/meadow													
Rhodophyta	Finely branching red indet	Massive/turf													

Taxon	Qualifier	SACFOR	North Red Cliff habitat												
			1	2	3	4	5	6	7	8	9	10	Rock pool 1	11	Rock pool 2
Rhodophyta	Finely branching red sp. A	Massive/turf													
Rhodophyta	Filamentous red	Massive/turf													
Rhodophyta	Very small flat red	Massive/turf													
Porphyra purpurea		Massive/turf							O	R			R		
Rhodotamniella floridula		Massive/turf						R	S	F		O	C		O
Corallinaceae	Indet. red calcareous crusts	Crust/meadow						O				R			
Corallina officinalis		Massive/turf													R
Catenella caespitosa		Massive/turf													
Chondrus crispus		Massive/turf													
Mastocarpus stellatus		Massive/turf				R			R	O		R			
Osmundea hybrida		Massive/turf													
Osmundea pinnatifida		Massive/turf				R		R	R	C		R			
Vertebrata lanosa	Epiphytic	Massive/turf			F		R	F	R			R			
Phaeophyceae	Filamentous	Massive/turf													
Phaeophyceae	c.f. Stypocaulon scoparium	Massive/turf													
Ralfsia verrucosa		Massive/turf													

Taxon	Qualifier	SACFOR	North Red Cliff habitat												
			1	2	3	4	5	6	7	8	9	10	Rock pool 1	11	Rock pool 2
Chordaria flagelliformis		Massive/turf													
Laminaria digitata		Crust/meadow								R			R		R
Saccharina latissima		Crust/meadow													R
Fucales	Sporelings	Crust/meadow										R	R		
Cystoseira	sp.	Crust/meadow													
Halidrys siliquosa		Crust/meadow													
Ascophyllum nodosum		Crust/meadow		R	S	R	R	C	R			R			O
Fucus	sp. indet	Crust/meadow													
Fucus serratus		Crust/meadow								C		R	O		O
Fucus spiralis		Crust/meadow		O	O	R									
Fucus vesiculosus		Crust/meadow						R		R		R			O
Pelvetia canaliculata		Crust/meadow													
Himanthalia elongata		Crust/meadow													
Chlorophyta	Filamentous green	Massive/turf													
Blidingia	sp.	Massive/turf		S	O										
Ulva intestinalis		Massive/turf			O			O	R	O		F			
Ulva lactuca		Massive/turf							R						R

Taxon	Qualifier	SACFOR	North Red Cliff habitat												
			1	2	3	4	5	6	7	8	9	10	Rock pool 1	11	Rock pool 2
Cladophora	sp.	Massive/turf					R	O	O	O		O			O
Cladophora rupestris		Massive/turf													

Taxon	Qualifier	SACFOR	Castle Rocks habitat		
			1	2	3 (Rockpool 1)
Verrucaria	sp.	Crust/meadow			
Verrucaria maura		Crust/meadow			
Porifera	Encrusting yellow	Crust/meadow			
Dilsea carnosa		Massive/turf			
Actinia equina		1-3cm		P	
Boccardia/Polydora	sp. tubes	Crust/meadow		P	
Laniceconchilega		1-3cm			
Spirobranchus	sp.	Crust/meadow			
Spirorbinae		Crust/meadow			
Semibalanus balanoides		Crust/meadow		R	P
Paguridae		3-15cm			
Pagurus	sp.	3-15cm			

Taxon	Qualifier	SACFOR	Castle Rocks habitat		
			1	2	3 (Rockpool 1)
Carcinus maenas		3-15cm			
Steromphala cineraria		1-3cm			
Steromphala umbilicalis		1-3cm			
Patella vulgate		3-15cm		O	
Littorina	sp.	1-3cm			
Littorina littorea		1-3cm			
Littorina fabalis		1-3cm			
Littorina obtusata		1-3cm		P	
Littorina saxatilis		1-3cm			
Nucellalapillus		1-3cm		P	
Mytilus edulis		3-15cm			
Bryozoa	Encrusting orange	Crust/meadow			
Membranipora membranacea		Crust/meadow			
Didemnidae		Crust/meadow			
Rhodophyta	Dark red crusts	Crust/meadow			
Rhodophyta	Finely branching red indet	Massive/turf		R	
Rhodophyta	Finely branching red sp. A	Massive/turf			
Rhodophyta	Filamentous red	Massive/turf		R	
Rhodophyta	Very small flat red	Massive/turf			

Taxon	Qualifier	SACFOR	Castle Rocks habitat		
			1	2	3 (Rockpool 1)
Porphyra purpurea		Massive/turf		R	
Rhodotamniella floridula		Massive/turf		R	
Corallinaceae	Indet. red calcareous crusts	Crust/meadow			
Corallina officinalis		Massive/turf			
Catenella caespitosa		Massive/turf			
Chondrus crispus		Massive/turf			
Mastocarpus stellatus		Massive/turf			
Osmundea hybrida		Massive/turf			
Osmundea pinnatifida		Massive/turf			
Vertebrata lanosa	Epiphytic	Massive/turf		R	
Phaeophyceae	Filamentous	Massive/turf			
Phaeophyceae	c.f. Stypocaulon scoparium	Massive/turf			
Ralfsia verrucosa		Massive/turf			
Chordaria flagelliformis		Massive/turf			
Laminaria digitata		Crust/meadow			P
Saccharina latissima		Crust/meadow			
Fucales	Sporelings	Crust/meadow		R	
Cystoseira	sp.	Crust/meadow			
Halidrys siliquosa		Crust/meadow			

Taxon	Qualifier	SACFOR	Castle Rocks habitat		
			1	2	3 (Rockpool 1)
Ascophyllum nodosum		Crust/meadow		R	P
Fucus	sp. indet	Crust/meadow			
Fucus serratus		Crust/meadow		R	p
Fucus spiralis		Crust/meadow			
Fucus vesiculosus		Crust/meadow		R	
Pelvetia canaliculata		Crust/meadow			
Himanthalia elongata		Crust/meadow			
Chlorophyta	Filamentous green	Massive/turf	R		
Blidingia	sp.	Massive/turf			
Ulva intestinalis		Massive/turf		O	
Ulva lactuca		Massive/turf		R	
Cladophora	sp.	Massive/turf			
Cladophora rupestris		Massive/turf			

Taxon	Qualifier	SACFOR	The Nab habitat								
			1	2	3	Rock pool 1	4 (Rock pool 2)	5	6	7	8
Verrucaria	sp.	Crust/meadow									
Verrucaria maura		Crust/meadow			F			R	R	R	R
Porifera	Encrusting yellow	Crust/meadow									
Dilsea carnosa		Massive/turf									
Actinia equina		1-3cm	P				P	P	P	P	F
Boccardia/Polydora	sp. tubes	Crust/meadow									
Laniceconchilega		1-3cm					P				
Spirobranchus	sp.	Crust/meadow	R				R				
Spirorbinae		Crust/meadow						R			
Semibalanus balanoides		Crust/meadow	C	F			R	R		A	O
Paguridae		3-15cm									
Pagurus	sp.	3-15cm									
Carcinus maenas		3-15cm									
Steromphala cineraria		1-3cm					P			P	
Steromphala umbilicalis		1-3cm						P			
Patella vulgate		3-15cm	C	C		P	P	C	C	C	C
Littorina	sp.	1-3cm									
Littorina littorea		1-3cm				C	P	C	F	F	

Taxon	Qualifier	SACFOR	The Nab habitat								
			1	2	3	Rock pool 1	4 (Rock pool 2)	5	6	7	8
Littorina fabalis		1-3cm									
Littorina obtusata		1-3cm					P				
Littorina saxatilis		1-3cm						P	P	P	
Nucellalapillus		1-3cm	F				P	F	P	O	F
Mytilus edulis		3-15cm									
Bryozoa	Encrusting orange	Crust/meadow									
Membranipora membranacea		Crust/meadow									
Didemnidae		Crust/meadow									
Rhodophyta	Dark red crusts	Crust/meadow							R		
Rhodophyta	Finely branching red indet	Massive/turf								R	
Rhodophyta	Finely branching red sp. A	Massive/turf		R		R	O				
Rhodophyta	Filamentous red	Massive/turf	R								
Rhodophyta	Very small flat red	Massive/turf									
Porphyra purpurea		Massive/turf	O							R	
Rhodotamniella floridula		Massive/turf	F	A			R			O	F
Corallinaceae	Indet. red calcareous crusts	Crust/meadow	R			O	O	R	R	R	R
Corallina officinalis		Massive/turf				P	F		R	O	
Catenella caespitosa		Massive/turf				O	R	R			

Taxon	Qualifier	SACFOR	The Nab habitat								
			1	2	3	Rock pool 1	4 (Rock pool 2)	5	6	7	8
Chondrus crispus		Massive/turf	A	A		R	R				
Mastocarpus stellatus		Massive/turf		A			R		R	O	R
Osmundea hybrida		Massive/turf									R
Osmundea pinnatifida		Massive/turf	C	C						F	A
Vertebrata lanosa	Epiphytic	Massive/turf						R	R	R	
Phaeophyceae	Filamentous	Massive/turf				R					
Phaeophyceae	c.f. Stypocaulon scoparium	Massive/turf				C					
Ralfsia verrucosa		Massive/turf									
Chordaria flagelliformis		Massive/turf									
Laminaria digitata		Crust/meadow	R	O						R	R
Saccharina latissima		Crust/meadow									
Fucales	Sporelings	Crust/meadow	R				R	R	R	R	
Cystoseira	sp.	Crust/meadow									
Halidrys siliquosa		Crust/meadow					C			R	
Ascophyllum nodosum		Crust/meadow				R	R	A	R	R	
Fucus	sp. indet	Crust/meadow									
Fucus serratus		Crust/meadow	S	R		R				R	F
Fucus spiralis		Crust/meadow				R	R		C		

Taxon	Qualifier	SACFOR	The Nab habitat								
			1	2	3	Rock pool 1	4 (Rock pool 2)	5	6	7	8
Fucus vesiculosus		Crust/meadow	R				R	A		R	
Pelvetia canaliculata		Crust/meadow							A		
Himanthalia elongata		Crust/meadow									O
Chlorophyta	Filamentous green	Massive/turf					R		R		
Blidingia	sp.	Massive/turf									
Ulva intestinalis		Massive/turf				O		O	R	O	R
Ulva lactuca		Massive/turf	R	R		R		R		R	R
Cladophora	sp.	Massive/turf	R			R	O		R	R	R
Cladophora rupestris		Massive/turf				O			R		

Appendix III: MNCR biotope code glossary

Definitions of all MNCR biotope codes used in this report, including a summary of the biotopes recorded in the 2022 transect areas in both 2022 and 2012.

Key:

A – biotope recorded in 2022

B – biotope recorded in 2012

MNCR Biotope code (JNCC, 2022)	MNCR biotope name	EUNIS (2007) code	Filey Brigg	North Red Cliff	Castle Rocks	The Nab
LR	Littoral rock (and other hard substrata)	A1	B		A	
LR.HLR	High energy littoral rock	A1.1	A			
LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	A1.113	B	A	B	
LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock	A1.1131	A	A	B	A
LR.HLR.MusB.Sem.FvesR*	*Semibalanus balanoides*, *Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock	A1.1132	B			
LR.HLR.MusB.Sem.LitX	*Semibalanus balanoides* and *Littorina* spp. on exposed to	A1.1133	A	A		

	moderately exposed eulittoral boulders and cobbles					
LR.HLR.FR*	Robust fucoid and/or red seaweed communities	A1.12	B			
LR.HLR.FR.Him	*Himanthalia elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock	A1.123	A			
LR.HLR.FR.Mas	*Mastocarpus stellatus* and *Chondrus crispus* on very exposed to moderately exposed lower eulittoral rock	A1.125	A B			
LR.HLR.FR.Osm	*Osmundea pinnatifida* on moderately exposed mid eulittoral rock	A1.126	A			A
LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock	A1.212	A B			
LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	A1.213	A B			
LR.MLR.BF.Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	A1.214			A B	
LR.MLR.BF.Fser.R	*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	A1.2141	A			
LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	A1.2142	B	A	B	B

LR.MLR.BF.Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	A1.215	A	A		
LR.LLR.F.Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock	A1.311	B			A B
LR.LLR.F.Asc.FS	*Ascophyllum nodosum* on full salinity mid eulittoral rock	A1.3141		A		A
LR.LLR.F.Asc.X	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata	A1.3142		A		
LR.LLR.F.Fserr.X*	*Fucus serratus* on full salinity lower eulittoral mixed substrata	A1.3152				B
LR.LLR.FVS.AscVs*	*Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock	A1.324			B	B
LR.FLR.Lic.Ver	*Verrucaria maura* on littoral fringe rock	B3.113	B	A		A
LR.FLR.Lic.Ver.Ver*	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock	B3.1132				B
LR.FLR.Lic.Bli	*Blidingia* spp. on vertical littoral fringe soft rock	B3.114		A		
LR.FLR.Rkp.G*	Green seaweeds (*Ulva* spp. and *Cladophora* spp.) in shallow upper shore rockpools	A1.421	B			B
LR.FLR.Rkp.Cor.Cor	Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools	A1.4111	A B			A
LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools	A1.412	A			A

LR.FLR.Rkp.SwSed	Seaweeds in sediment-floored eulittoral rockpools	A1.413	A	A	B	
LR.FLR.Eph*	Ephemeral green or red seaweed communities (freshwater or sand-influenced)	A2.82				B
LR.FLR.Eph.EphX*	Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata	A2.821				B
LS.LCS.Sh.BarSh	Barren littoral shingle	A2.111			A	
LS.LSa	Littoral sand	A2.2		A	B	B
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	A2.231		A		
IR.HIR.Ksed.XKScrR*	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	A3.125			B	B
IR.MIR.KR.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock	A3.211	B			A
IR.MIR.KR.Ldig.Bo	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders	A3.2112	A			
IR.FIR.SG	Infralittoral surge gullies and caves	A3.71	A			

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