



# **BERWICK BANK WIND FARM OFFSHORE ENVIRONMENTAL IMPACT ASSESSMENT**

## **APPENDIX 8.1: BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY TECHNICAL REPORT**



### Document Status

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## 1. INTRODUCTION

1. RPS was commissioned by Berwick Bank Wind Farm Limited (BBWFL), a wholly owned subsidiary of SSE Renewables (SSER) Limited (hereafter 'the Applicant') to undertake a benthic subtidal and intertidal ecology characterisation of the Berwick Bank Wind Farm (hereafter referred to as "the Proposed Development"), and surrounding area to inform the Environmental Impact Assessment (EIA) Report. The Proposed Development array area is located in the outer Firth of Forth and Firth of Tay, 37.8 km east of the Scottish Borders coastline (St Abb's Head) and 47.6 km to the East Lothian coastline from the nearest boundary. It covers an area of approximately 1,178.1 km<sup>2</sup>. Up to eight export cables will connect the Proposed Development to the mainland, via a cable landfall. The export cables which form part of the Proposed Development will make landfall on the East Lothian coast, specifically at Skateraw Harbour (hereafter referred to as the 'Skateraw landfall'). From here, the Project will connect to a Scottish Power Energy Networks (SPEN) Transmission 400kV Grid Substation located at Branxton, which is located southeast of Torness Power station.
2. This Benthic Subtidal and Intertidal Ecology Technical Report provides an up-to-date benthic subtidal and intertidal ecology baseline characterisation for the Proposed Development using the most recent desktop data and site-specific survey data.
3. This report is structured as follows:
  - section 2 - study area;
  - section 3 – methodology and baseline characterisation, including details of desk-based sources and site-specific survey data; and
  - section 4 – summary, including identification of Important Ecological Features (IEFs).

## 2. STUDY AREA

4. For the purposes of the benthic subtidal and intertidal ecology assessment, two study areas have been defined:
  - The Proposed Development benthic subtidal and intertidal ecology study area has been defined with reference to the Proposed Development boundary that existed prior to the boundary refinement in June 2022. As the refinements resulted in a reduction of the Proposed Development array area, the benthic subtidal and intertidal ecology study area is considered to remain representative and presents a conservative baseline against which the benthic and subtidal ecology assessment is undertaken. The Proposed Development benthic subtidal and intertidal ecology study area has not therefore been realigned to the current Proposed Development boundary. This includes intertidal habitats within the Proposed Development export cable corridor (between Mean Low Water Springs (MLWS) and Mean High Water Springs (MHWS) mark). It is the area within which the site specific benthic subtidal and intertidal surveys were undertaken (Figure 2.1). Data collected from areas outside the Proposed Development benthic subtidal and intertidal ecology study area were analysed and included in the baseline characterisation as they provide further context to the data collected within the Proposed Development benthic subtidal and intertidal ecology study area.
  - The regional benthic subtidal and intertidal ecology study area encompasses the wider northern North Sea habitats and includes the neighbouring consented offshore wind farms (and their associated export cable corridors) and designated sites (Figure 2.1). It has been characterised by desktop data and provides a wider context to the site-specific data.

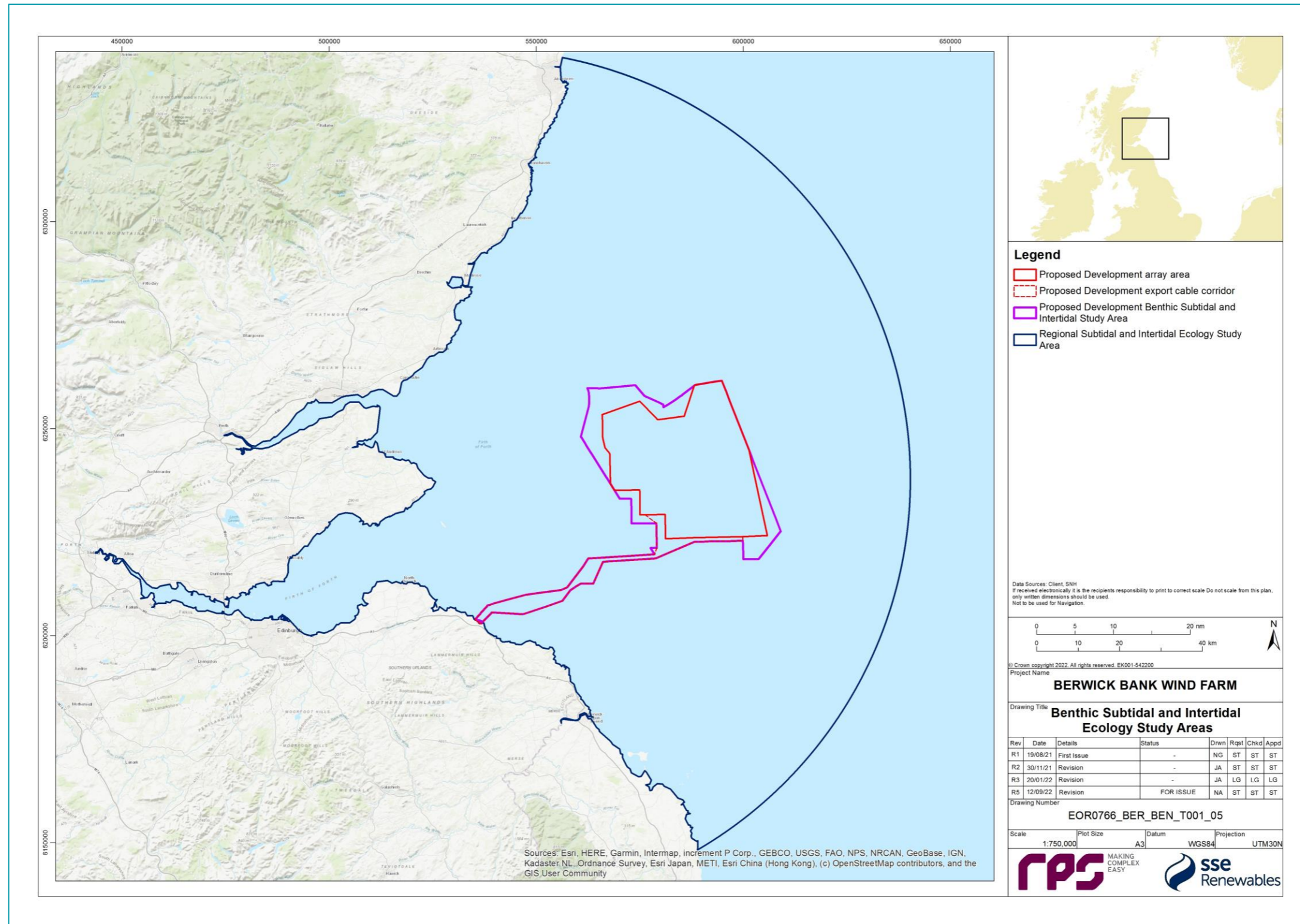


Figure 2.1: Benthic Subtidal and Intertidal Ecology Study Areas

### 3. BASELINE

#### 3.1. METHODOLOGY

5. A desktop review has been undertaken to inform the baseline for benthic subtidal and intertidal ecology, including a review of a number of academic reports, reports from surveys undertaken to support other project consents and surveys to support the designation of Marine Protection Areas (MPAs) for offshore habitats located in the vicinity of the Proposed Development (Table 3.1). These provide further context to the site-specific surveys (Table 3.2).
6. A benthic subtidal survey and a benthic intertidal survey have been undertaken to characterise the Proposed Development benthic subtidal and intertidal ecology study area for the purposes of informing the benthic subtidal and intertidal ecology EIA Report (volume 2, chapter 8). The subtidal ecology survey consisted of grab sampling, drop down video (DDV) sampling and epibenthic trawls. Analysis of results included multivariate and univariate statistical analyses as well as descriptions of the raw data. Data collection and analysis to inform various site-selection options resulted in areas being analysed that ultimately did not fall within the Proposed Development, however they have been included to provide further context.
7. The intertidal survey involved a Phase 1 walkover and sediment sampling at the proposed landfall location. Detailed notes were taken along with waypoint locations at habitat changes and photographs of the habitats. These were reviewed to provide a biotope map of the proposed landfall location.
8. Detailed methodologies for each survey are presented in section 3.4.

#### 3.2. DESKTOP STUDY

9. Information on benthic subtidal and intertidal ecology within the regional benthic subtidal and intertidal ecology study area and the Proposed Development benthic subtidal and intertidal ecology study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 3.1.

**Table 3.1: Summary of Key Desktop Reports**

Title	Source	Year	Author
The Marine Scotland National Marine Interactive (NMPI) maps	Marine Scotland	2019	Marine Scotland for the Scottish Government
EMODnet broadscale seabed habitat map for Europe (EUSeaMap)	EMODnet-Seabed Habitats	2019	EMODnet-Seabed Habitats
Marine Environmental Data and Information Network (MEDIN)	<a href="https://www.medin.org.uk/">https://www.medin.org.uk/</a>	Accessed April 2021	<a href="https://www.medin.org.uk/">https://www.medin.org.uk/</a>
The National Biodiversity Network (NBN) Gateway	<a href="https://nbnatlas.org/">https://nbnatlas.org/</a>	Accessed April 2021	<a href="https://nbnatlas.org/">https://nbnatlas.org/</a>
SeaSearch Marine Surveys in Scotland	NBN Atlas	2017	SeaSearch
A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed	Centre for Environment, Fisheries and Aquaculture Science (Cefas)	2017	Cooper and Barry
Descriptions of Scottish Priority Marine Features (PMFs)	NatureScot (previously Scottish Natural Heritage (SNH))	2016	Tyler-Walters <i>et al.</i>

Title	Source	Year	Author
Firth of Forth Banks Complex MPA: Assessment against MPA Selection Guidelines	Joint Nature Conservation Committee (JNCC)	2014	JNCC
Biotope Assignment of Grab Samples from Four Surveys Undertaken in 2011 Across Scotland's Seas (2012)	JNCC	2014	Pearce, B., Grubb, L., Earnshaw, S., Pitts, J. and Goodchild, R.
Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 IBTS Quarter 4 (Q4) survey and additional deep-water sites from Marine Scotland Science surveys	JNCC	2014	Axelsson, M., Dewey, S. and Allen, C.
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish waters	JNCC	2013	Sotheran, I. and Crawford-Avis, O.
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish waters – Phase 2	JNCC	2014	Sotheran, I. and Crawford-Avis, O.
Characterising Scotland's marine environment to define search locations for new MPA s. Part 2: The identification of key geodiversity areas in Scottish waters	SNH	2013	Brooks, A.J. Kenyon, N.H. Leslie, A., Long, D. and Gordon, J.E.
EIA baseline characterisation data for Seagreen Alpha/Bravo	Seagreen	2012	Seagreen Wind Energy Limited
Seagreen DDV Benthic Monitoring and Annex I Reef Survey	Seagreen	2020	APEM
EIA baseline characterisation data for Inch Cape offshore wind farm	Inch Cape Offshore Limited	2011	Inch Cape Offshore Limited
EIA baseline characterisation data for Neart na Gaoithe offshore wind farm	Neart na Gaoithe Offshore Wind Ltd	2010	EMU
Barns Ness Coast Site of Special Scientific Interest (SSSI) citation	NatureScot (Previously SNH)	2011	SNH
The Marine Nature Conservation Review (MNCR) Area Summary for south-east Scotland and north-east England	JNCC	1998	Brazier <i>et al.</i>
Benthic subtidal ecology validation survey undertaken for the Seagreen (Alpha) export cable corridor Marine Licence application	Seagreen	2021	Seagreen Wind Energy Limited
Environmental Appraisal for the Marine Licence Application for Seaweed removal at Torness Power Station	EDF Energy Ltd	2019	ABPmer

### 3.2.1. REGIONAL BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY STUDY AREA

#### Subtidal sediments

10. The seabed sediments of the regional benthic subtidal and intertidal ecology study area have been recorded as being dominated by circalittoral sand with patches of circalittoral coarse sediment, which is characteristic of the North Sea (EMODnet, 2019). The EMODnet (European Marine Observation and Data Network) broad-scale seabed habitat map for Europe (EUSeaMap) and the Marine Scotland National Marine Plan Interactive (NMPI) map present the European Nature Information System (EUNIS) habitat classifications for the northern North Sea (Figure 3.1). The most common sediment types noted in the regional benthic subtidal and intertidal ecology study area were deep circalittoral sand, followed by deep circalittoral coarse sediment and deep circalittoral mud (Figure 3.1), all identified as low energy habitats by EMODnet, 2019. Based on the EUSeaMap data, regions of higher topography and those associated with the bank complexes within the Firth of Forth approaches were dominated by deep circalittoral coarse sediments whereas those in deeper water and in the flanks of the banks were dominated by deep circalittoral sands (Figure 3.1). Finer sediments were recorded in the nearshore areas of the regional benthic subtidal and intertidal ecology study area. There were large areas of circalittoral fine sand or circalittoral muddy sand, deep circalittoral mud and circalittoral sandy mud recorded at the entrance to the Firth of Forth and Firth of Tay. Further inshore, these fine sediments give way to moderate energy circalittoral rock, mixed and coarse sediments (Figure 3.1; EMODnet, 2019).
11. The Firth of Forth Banks Complex (FFBC) MPA has been strongly influenced by water currents with a mosaic of different types of sand and gravels, which create a unique range of habitats (JNCC, 2021a). Although these sediments were found to be relatively common around Scotland, the dynamic currents in the Firth of Forth Banks area influence the distribution of the sands and gravels (JNCC, 2014a). Axelsson *et al.* (2014) analysis of the video and still photography from surveys within the FFBC MPA undertaken in 2011 as part of the Scottish MPA Project, reported three broad habitat types: soft sediments with ripples; mixed sediment; and coarse sediments with some rocky outcrops. Gravelly sand sediments were more frequently recorded towards the north of the FFBC MPA with gravelly muddy sands and mixed sediments present to the south and west of the FFBC MPA (Axelsson *et al.*, 2014). Acoustic data from surveys within the FFBC MPA undertaken in 2011 as part of the same project, reported sandy gravel, sand, gravelly sand and slightly gravelly sand in the approaches to the Firth of Forth and Wee Bankie to Gourdon areas (Sotharan and Crawford-Avis, 2013).
12. The Wee Bankie moraine formation feature of the FFBC MPA occurs within the regional benthic subtidal and intertidal ecology study area. A large proportion of the Wee Bankie moraine formation can be found within the Wee Bankie (including Scalp Bank) part of the FFBC MPA and is considered to be a Key Geodiversity Area in Scotland's seas. This formation comprised a series of prominent (20 m high) submarine glacial ridges, composed of poorly sorted sediments (boulders, gravels, sands and clays) (JNCC, 2020a). Brooks *et al.* (2013) regarded the moraine geodiversity features as being scientifically important due to their key role in improving our understanding of the glacial retreat history of the last British Irish ice sheet.
13. The surveys conducted in 2011 to support the EIA benthic baseline characterisation for what were known at the time as the Seagreen Alpha/Bravo offshore wind farms (located immediately to the north of the Proposed Development array area, Figure 3.2) also provided an overview of the sedimentary habitats present within the regional benthic subtidal and intertidal ecology study area. In 2018, the Seagreen Alpha and Bravo projects were combined to form Seagreen in the same sea-area, which now comprises the Seagreen 1 and Seagreen Project 1A. This report refers to the superseded Seagreen (Alpha) and (Bravo) projects which were under development when the survey data was collected. The sediments present across the Seagreen (Alpha) array area ranged from cobbles with sand and gravelly sand in the west, to sandy gravel in the east. There was a greater predominance of fine sediments recorded across the Seagreen (Bravo) array compared with Seagreen (Alpha) array area, with sediments ranging from slightly gravelly sand in the west, sandy gravel in the central section and gravelly sand in the east of the Seagreen (Bravo) offshore wind farm. The majority of the seabed across both the Seagreen (Alpha and Bravo) array areas was level or undulating with occasional linear sediment waves (Seagreen, 2012).
14. The baseline characterisation surveys for the nearby Inch Cape offshore wind farm array area (Inch Cape Offshore Limited, 2011) reported the sediments to be characterised primarily by circalittoral sands and gravelly sands, with smaller areas of muddy mixed sediment.
15. The nearshore subtidal zone from North Berwick in Lothian to Flamborough Head in the East Riding of Yorkshire has been studied as part of the MNCR. Seabed sediments recorded in the nearshore subtidal zone of the regional benthic subtidal and intertidal ecology study area were sublittoral muddy sands, sublittoral fine sand, circalittoral rock and small areas of circalittoral mixed sediments (Brazier *et al.*, 1998). The sediments recorded in the nearshore subtidal zone near the proposed landfall location were kelp forest with red algae and mobile sand shores (Brazier *et al.*, 1998). The coastline at the Skateraw proposed landfall has experienced small amounts of accretion across the last 100 years (The Scottish Government, 2017).



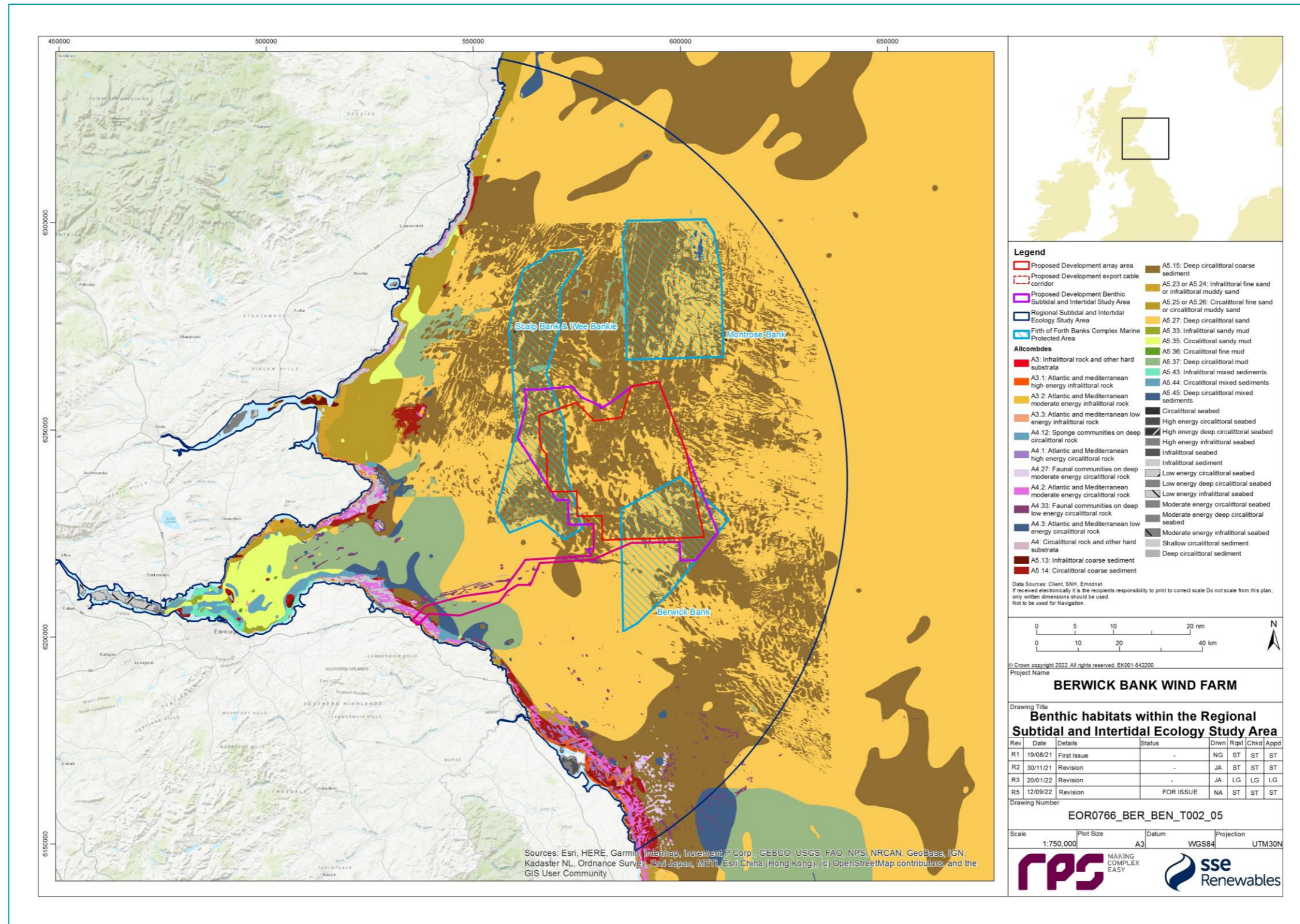


Figure 3.1: Benthic Habitats (EMODNet, 2019) within the Regional Benthic Subtidal and Intertidal Ecology Study Area

### Subtidal benthic ecology

16. Cooper and Barry (2017) described the results of a baseline assessment of the UK's subtidal macrobenthic infauna, with a particular focus around sites and regions of marine aggregate dredging. Although aggregates were the focus of the study, a "big data" approach was taken, collating data from across UK waters from various industries including offshore wind farms, oil and gas, nuclear and port and harbour sectors. This also included samples from the Neart na Gaoithe wind farm, within the regional benthic subtidal and intertidal ecology study area. Benthic infaunal communities were reported to be mainly polychaete and bivalve rich communities.
17. The northern North Sea contains a variety of benthic ecology habitats but is mainly characterised by polychaete dominated communities (*Spionidae*, *Glyceridae*, *Terebellidae*, *Capitellidae*, *Phyllodoceidae* and *Nemertea*), sparse faunal communities (*Nephtyidae*, *Spionidae*, *Opheliidae*) and diverse faunal communities (including the polychaetes: *Spionidae*, *Nephtyidae*, *Lumbrineridae*, *Oweniidae*, *Cirratulidae*, *Capitellidae*, *Ampharetidae*, the echinoderm *Amphiuridae*, the bivalve *Semelidae* and *Nemertea*) (Cooper and Barry, 2017).
18. The MNCR study of the nearshore subtidal zone from North Berwick in Lothian to Flamborough Head in Yorkshire recorded nearshore seabed habitats in the regional benthic subtidal and intertidal ecology study area. Five seabed habitats were recorded (Brazier *et al.*, 1998):
- SS.SMx.CMx.MysThyMx/SS.SMu.CSaMu.AfilMysAnit: Sublittoral muddy sand with echinoderms;
  - IR.MIR.KR.Lhyp.Ft: Kelp forest with red algae;
  - LS.LSa.MoSa.AmSco: Mobile sand shores with amphipods and polychaetes;
  - SS.SSa.IFiSa.NcirBat: Sublittoral fine sand with polychaetes and bivalves; and
  - CR.MCR.EcCr.FaAlCr.Bri: Circalittoral rock with brittlestars and hydroids.
19. Analysis was undertaken on the data from seabed acoustic surveys that were carried out in 2013 to contribute to the evidence base for the presence and extent of MPA search features in Scottish waters (Southeran and Crawford-Avis, 2013). Phase 1 of the MPA search project surveys included the approaches to the Firth of Forth which overlaps with the regional benthic subtidal and intertidal ecology study area. Habitats ranged from sand sediments to coarse and mixed sediments in the inshore regions, and back to sand sediments in the offshore region. The biotope SS.SSa.CMuSa Circalittoral muddy sand was recorded in the nearshore subtidal area close to St. Andrews with circalittoral rock habitats, CR.HCR.XFa Mixed faunal turf communities/CR.MCR.EcCr Echinoderms and crustose communities recorded in the nearshore subtidal area off Craighead. SS.SSa.OSa Offshore subtidal sand was recorded across the approaches to the Firth of Forth and the Wee Bankie to Gourdon areas however it was more frequently recorded in the regions further offshore. SS.SCS.OSC Offshore circalittoral coarse sediment was also recorded across the approaches to the Firth of Forth and Wee Bankie to Gourdon areas. SS.SMx.CMx Circalittoral mixed sediments and SS.SMx.OMx Offshore mixed sediments were recorded in areas further inshore. Occasional patches of circalittoral rock were also recorded across the approaches to the Firth of Forth and Wee Bankie to Gourdon areas (Southeran and Crawford-Avis, 2013).
20. The following biotopes were reported within the regional benthic subtidal and intertidal ecology study area (Southeran and Crawford-Avis, 2013):
- kelp with cushion fauna and/or foliose red seaweeds: IR.HIR.KFaR.FoR.Dic Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock/IR.HIR.KFaR.LhypRVt *Laminaria hyperborea* and red seaweeds on exposed vertical rock;
  - mixed faunal turf communities on circalittoral rock: CR.HCR.XFa.FluCoAs.X *Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata/CR.HCR.XFa.FluCoAs.SmAs *Flustra foliacea*, small solitary and colonial ascidians on tide-swept circalittoral bedrock or boulders/CR.HCR.XFa.FluCoAs *Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock;
  - circalittoral coarse sediment: SS.SCS.CCS.PomB *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles/SS.SCS.CCS;
  - deep circalittoral coarse sediment: SS.SCS.OCS/SS.SCS.OCS.(PoGintBy)/SS.SCS.OCS.(Sbom);
  - circalittoral muddy sand: SS.SSa.CMuSa.AalbNuc *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment/SS.SSa.CMuSa;
  - deep circalittoral sand: SS.SSa.OSa/SS.SSa.OSa.(Sbom);
  - circalittoral mixed sediments: SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment/SS.SMx.CMx.(FluHyd)/SS.SMx.CMx.MysThyMx *Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment/SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment;
  - deep circalittoral mixed sediments: SS.SMx.OMx.(PoGintBy);
  - SS.SBR.SMus.ModMx: *Modiolus* beds on open coast circalittoral mixed sediment;
  - CR.MCR.EcCr.FaAlCr.Adig *Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock/CR.MCR.EcCr.FaAlCr.Flu *Flustra foliacea* on slightly scoured silty circalittoral rock; and
  - SS.SMu.CFiMu.SpnMeg: Seapens and burrowing megafauna in circalittoral fine mud.
21. Phase 2 of the MPA Project survey focused on the data from seabed acoustic surveys on the eastern approaches to the Firth of Forth, the western tip of which overlaps with the regional benthic subtidal and intertidal study area (Southeran and Crawford-Avis, 2014). The following biotopes were reported within the eastern approaches to the Firth of Forth area:
- SS.SCS.CCS: Circalittoral coarse sediment/deep circalittoral coarse sediment;
  - SS.SSa.CMuSa: Circalittoral muddy sand; and
  - SS.SSa.OSa: Deep circalittoral sand.
22. With regards to protected species, the National Biodiversity Network (NBN) Atlas and the SeaSearch database include records of *Sabellaria* spp. and ocean quahog *Arctica islandica* in the regional benthic subtidal and intertidal ecology study area (NBN, 2021). NatureScot publications have been searched to understand the presence of Scottish PMFs in the regional benthic subtidal and intertidal ecology study area. Tyler-Walters *et al.*, (2016) reported blue mussel (*Mytilus edulis*) and horse mussel (*Modiolus modiolus*) beds, burrowed mud, kelp beds, ocean quahog *A. islandica* aggregations, maerl or coarse shell gravel with burrowing sea cucumbers, seagrass beds and offshore subtidal sands and gravels within the regional benthic subtidal and intertidal ecology study area.
23. *S. spinulosa* has been recorded within the regional benthic subtidal and intertidal ecology study area. *S. spinulosa* records in Scotland are limited to Lue Bay, the Solway Firth and the North Sea of Rattray Head. There are very few records of *S. spinulosa* from Scotland and even fewer extant records of reefs. This is thought to be due to low sampling effort to date and therefore it is expected that more records of species and reefs will be made as the offshore industry progresses in the region (Pearce and Kimber, 2020).
- Seagreen Alpha/Bravo offshore wind farm
24. The Seagreen Alpha/Bravo baseline characterisation surveys conducted in 2011 comprised infaunal grab sampling, beam trawl sampling and DDV sampling. The benthic habitats mapped for the EIA characterisation were divided into the following benthic community classes for each site:
- Seagreen (Alpha) wind farm:
- western area: 'Sabellaria' (SS.SBR.PoR.SspiMx), 'sparse polychaetes and bivalves' (SS.SCS.ICS.MoeVen) and 'faunal turf' (SS.SMX.CMx.FluHyd); and

- central and eastern areas: dominated by the sabellid polychaete classes, 'dense Chone' (SS.SMx.OMx.(Chone)) and 'sparse Chone'.

Seagreen (Bravo) wind farm:

- western half: 'Sabellaria', 'rich polychaetes and bivalves' and 'epifauna with polychaetes' (SS.SMx.OMx.PoVen); and
- eastern half: 'dense Chone' and 'rich polychaetes' (SS.SMx.OMx.PoVen).

25. There was a clear divide between the two areas however 'polychaete and bivalve' habitats were also present in the most northern part of the eastern section of Seagreen (Bravo). There was also a patch of raised sandy gravel characterised by the brittlestar 'Ophiothrix spp.' (SS.SMx.CMx.OphMx) habitats located on or near the boundary between the western, central and eastern areas of Seagreen (Bravo).
26. The number of species and individuals within the Seagreen (Bravo) wind farm site was generally lower than within the Seagreen (Alpha) wind farm site, which was likely to be a result of a predominance of finer sediments in the Seagreen (Bravo) wind farm site. Epifauna and encrusting fauna were common where the sediment contained gravel, shell or cobble. The distribution of epifauna was related to sediment type, with sandy gravels and gravelly sands supporting rich epifauna while gravelly sands were low in epifauna (Seagreen, 2012).
27. High species richness was recorded in association with areas of *Sabellaria* habitat, although there was no evidence from the DDV surveys of extensive or well developed aggregations of *Sabellaria* within the Seagreen (Alpha) or Seagreen (Bravo) wind farm survey areas (Seagreen, 2012).
28. Pre-construction benthic monitoring and Annex I reef surveys within the Seagreen array areas and export cable corridor were undertaken in 2020. Benthic habitats were recorded as circalittoral mixed sediments, SS.SMx.CMx.FluHyd and SS.SMx.CMx.OphMx, with patches of moderate energy circalittoral rock and circalittoral coarse sediment (APEM, 2020). The Annex I reef assessment reported that biogenic reefs (e.g. Annex 1 *Sabellaria*) were not present at any locations. Patches of medium resemblance stony reef were recorded among larger areas of cobble and sand in the export cable corridor, close to the Seagreen array area and within the north-east of the Seagreen array area. Patches of low resemblance stony reef were recorded in the export cable corridor, close to the Seagreen array area and within the north-east and central areas of the Seagreen array area (APEM, 2020). This is in line with the habitats mapped in the baseline characterisation presented in the Environmental Statement (Seagreen, 2012).
29. A benthic validation survey was undertaken in 2020 and 2021 to support the marine licence application for an additional export cable corridor for Seagreen Project 1A (Figure 3.2). The benthic subtidal survey comprised grab and DDV sampling and was undertaken to the north and north-west of the Proposed Development array area and around the subtidal areas off North Berwick. Sediments recorded ranged from sand to mixed sediments with sample stations closer to the coast containing a higher percentage of mud and those further offshore containing a higher percentage of sand. The Seagreen (Alpha) benthic validation survey recorded sandy mud biotopes (SS.SMu.CSaMu and SS.SMu.CSaMu.AfilMysAnit *Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud) across the mid-section of the export cable corridor survey area. Mixed sediment biotopes (SS.SMx.OMx.PoVen Polychaete-rich deep *Venus* community in offshore mixed sediments and SS.SMx.OMx.OphMx) were recorded in the furthest offshore samples within the export cable corridor survey area. The inshore sections of the export cable corridor

survey area were dominated by muddy sediment biotopes (SS.SMu.CFiMu.SpnMeg and SS.SMu.ISaMu.MeIMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud). The Seagreen (Alpha) benthic validation survey recorded SS.SMu.CSaMu.AfilMysAnit, SS.SMu.CSaMu, SS.SMx.OMx.PoVen and SS.SMx.OMx.OphMx overlapping with the north-west corner of the Proposed Development array area (Figure 3.2). No Annex I reefs were recorded during the Seagreen (Alpha) benthic validation surveys.

#### Inch Cape offshore wind farm

30. The Inch Cape wind farm is located 7.7 km to the west of the Proposed Development and within the regional benthic subtidal and intertidal ecology study area (Figure 3.2). The baseline characterisation surveys for the Inch Cape wind farm showed that the array area was dominated by circalittoral sands and gravelly sands with areas of mixed sediment. The epifaunal surveys recorded epibenthic species that were typical for these sediments and included dead man's fingers (*Alcyonium digitatum*), horned wrack (*Flustra foliacea*), brittlestar (*Ophiothrix fragilis*), hydroids (e.g. *Hydrallmania falcata*) and a number of small fish and mobile benthic invertebrates. The DDV survey recorded a number of similar species; the key species recorded were: *A. digitatum*, *Pomatoceros triqueter*, *Munida rugosa*, *F. foliacea*, and *Asterias rubens*. The brittlestar *O. fragilis* occurred in high densities, but only at two stations (Inch Cape Offshore Limited, 2011).
31. The dominating biotopes within the array were SS.SMx.CMx.MysThyMx covering 65% of the array area, SS.SCS.OCS covering 31% of the area and SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel covering 4% of the area (Inch Cape Offshore Limited, 2011). A number of reef forming polychaetes (i.e. *Sabellaria*) were recorded; however, no evidence of Annex I reef features were recorded.

#### Near na Gaoithe offshore wind farm

32. The Near na Gaoithe array area is approximately 16.3 km west of the Proposed Development and within the regional benthic subtidal and intertidal ecology study area (Figure 3.2). The baseline characterisation surveys for the Near na Gaoithe array area reported slightly gravelly sands with areas of coarser sediments (e.g. sandy gravels and gravelly sand). Analysis of the grab samples mainly characterised the array area as SS.SMu.CSaMu.AfilNten *Amphiura filiformis* and *Nuculoma tenuis* in circalittoral and offshore sandy mud and a mosaic of SS.SCS.CCS/SS.SSa.OSa. Small patches of SS.SMu.CSaMu.ThyNten were reported in the east, SS.SSa.CFiSa.ApriBatPo *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand in the south and SS.SSa.OSa.OfusAfil *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand in the north and west of the array area (EMU, 2010). No protected or rara species were recorded (EMU, 2010).
33. Analysis of the DDV data mainly characterised the array area as SS.SMu.CFiMu.SpnMeg with regular patches of SS.SMx.CMx throughout the array area. SS.SMx Sublittoral mixed sediments, SS.SMx.CMx.OphMx and CR.MCR.EcCr (on boulders) were also recorded in small patches in the array area (EMU, 2010).

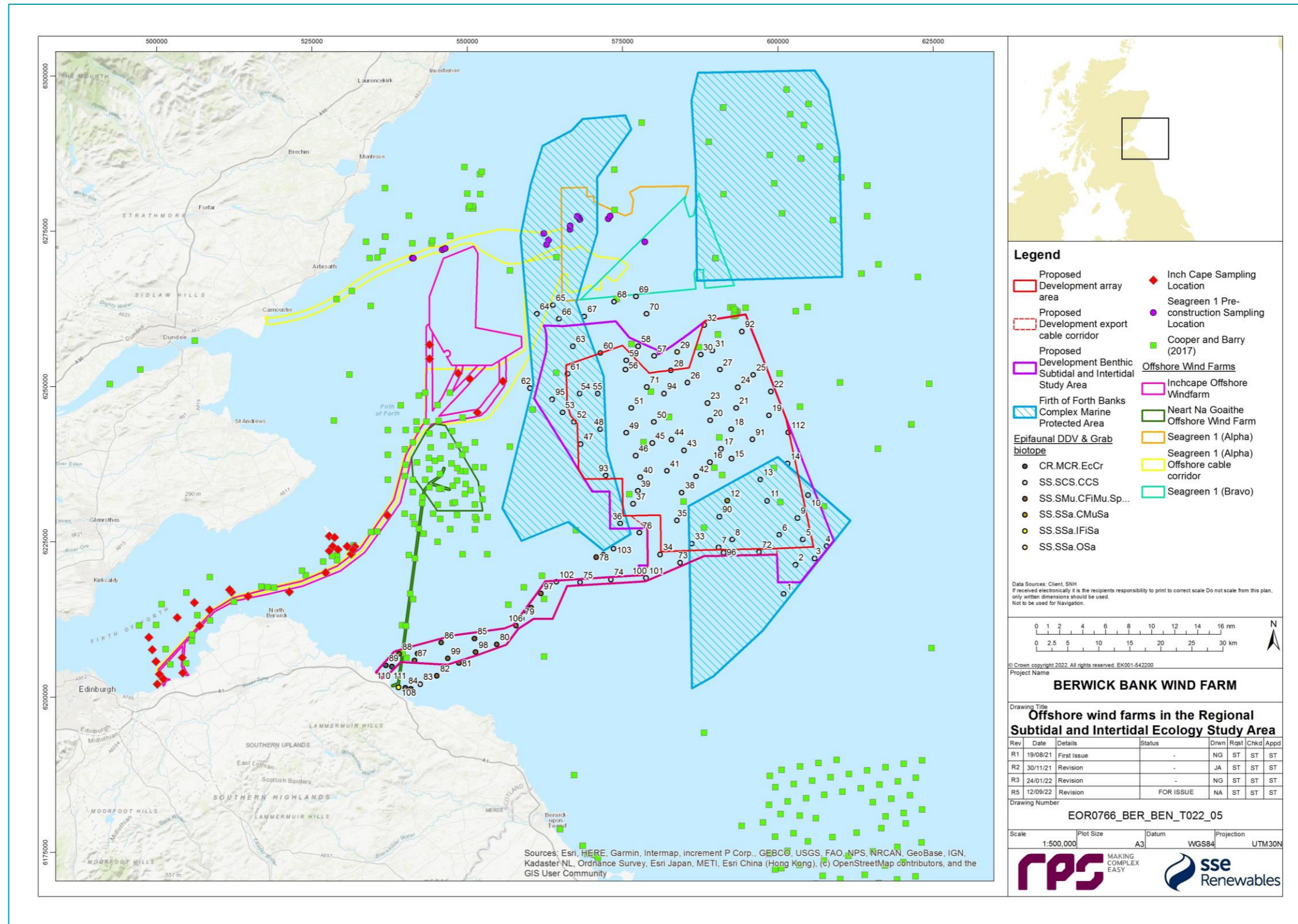


Figure 3.2: Offshore Wind Farms in the Regional Benthic Subtidal and Intertidal Ecology Study Area

### 3.2.2. PROPOSED DEVELOPMENT BENTHIC SUBTIDAL AND INTERTIDAL STUDY AREA

#### Subtidal sediments

34. Based on the EUSeaMap data, seabed sediments of the Proposed Development benthic subtidal and intertidal ecology study area have been recorded as being dominated by low energy deep circalittoral sand and low energy deep circalittoral coarse sediment (EMODnet, 2019). Deep circalittoral sands have been recorded in the offshore section of the export cable corridor with sediments becoming more variable in the inshore section of the export cable corridor; circalittoral sand sediments grade into deep circalittoral muds, deep circalittoral mixed sediments and deep circalittoral coarse sediments with increasing proximity to the landfall. Discrete areas of faunal communities on deep low energy circalittoral rock have been recorded throughout the inshore regions of the export cable corridor (Figure 3.1).
35. The Proposed Development benthic subtidal and intertidal ecology study area overlaps with the FFBC MPA, designated for offshore subtidal sands and gravels, shelf banks and mounds, and moraines representative of the Wee Bankie Key Geodiversity Area (JNCC, 2021a). The FFBC MPA comprises the large-scale morphological bank features Berwick, Scalp and Montrose Banks and the Wee Bankie (Figure 3.1). The Proposed Development overlaps the Berwick Bank and the southern section of the Scalp Bank and Wee Bankie aspects of the FFBC MPA. Habitat maps (Sotheran and Crawford-Avis, 2013 and 2014) and biotope assignment of 2011 still and grab sample data (Axelsson *et al.*, 2014; Pearce *et al.*, 2014) reported offshore subtidal sand and gravel habitats in the FFBC MPA. Axelsson *et al.* (2014) reported gravelly muddy sands and sands within the area overlapping the Proposed Development array area.

#### Subtidal benthic ecology

36. Cooper and Barry (2017) reported that the majority of benthic samples coinciding with the eastern section of the Proposed Development array area were characterised by benthic infaunal communities of polychaetes (Spionidae, Nephtyidae, Lumbrineridae, Oweniidae, Cirratulidae, Capitellidae and Ampharetidae), echinoderms (Amphiuridae) and nemerteans. The western section of the Proposed Development array area was characterised by the same communities, with the addition of a species poor group (Nephtyidae, Spionidae and Opheliidae). The other main community types recorded in the Proposed Development benthic subtidal and intertidal ecology study area were rich communities of polychaetes (Spionidae, Nephtyidae, Capitellidae, Cirratulidae, Oweniidae and Pholoidae), bivalve molluscs (Montacutinae, Semelidae and Nuculidae) and nemerteans as well as a second group, also rich in polychaetes (Spionidae, Terebellidae, Serpulidae, Syllidae, Capitellidae, Cirratulidae, Lumbrineridae, Sabellariidae and Glyceridae) and nemerteans (Cooper and Barry, 2017).
37. The NBN Atlas and the SeaSearch database have been searched for the presence of protected species in the Proposed Development benthic subtidal and intertidal ecology study area. The common star fish (*Asterias rubens*), dead man's fingers (*Alcyonium digitatum*), the strawberry anemone (*Urticina eques*) and several hydroids (*Ectopleura larynx*, *Nemertesia ramosa*) were recorded within the west of the proposed Development array area (NBN, 2021).
38. Surveys of the area now designated as the FFBC MPA were undertaken by JNCC in 2011 for the MPA search project, with sediments and biotopes identified in Pearce *et al.* (2014). These sampling locations were also included in the Cooper and Barry (2017) dataset. Pearce *et al.* (2014) identified the following biotope classifications within the east of the Proposed Development array area from the benthic grab data:
- SS.SSa.OSa [Sbom]: *Spiophanes bombyx* aggregations in offshore sands; and

- SS.SMx.OMx.[PoGintBy]: Polychaete-rich *Galathea* community with encrusting bryozoans and other epifauna on offshore circalittoral mixed sediment.
39. The biotopes presented within the west of the Proposed Development array area were the same, with the addition of the following biotopes:
- SS.SBR.PoR.SspiMx: *Sabellaria spinulosa* on stable circalittoral mixed sediment; and
  - SS.SCS.OSC.[Sbom]: *Spiophanes bombyx* aggregations in offshore coarse sands.
40. Analysis of seabed imagery from the MPA search project survey of the area now designated as the FFBC MPA reported that the habitats characterised by mixed sediment were dominated by varied fauna including ophiuroids (*O. fragilis* and *O. nigra*), *F. foliacea* or the bivalve *M.modiolus* (Axelsson *et al.*, 2014). The habitats characterised by coarse sediments were dominated by soft coral *Alcyonium digitata* and ascidians. In general, many of the stations were transitions between two biotopes, usually soft sediment into mixed sediment. The SS.SSa.CMuSa biotope was the most widespread with CR.HCR.XFa.FluCoAs.X, SS.SMx.CMx, SS.SMx.CMx.(FluHyd) and SS.SMx.CMx.OphMx also commonly recorded.
41. The biotopes recorded in the east of the Proposed Development array area were (Axelsson *et al.*, 2014):
- SS.SMx.CMx;
  - SS.SMx.CMx.[FluHyd]: *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment; and
  - CR.MCR.EcCr.FaAlCr.Adig.
42. The biotopes recorded within the west of the Proposed Development array area were:
- SS.SSa.CMuSa;
  - SS.SMu.CSaMu;
  - SS.SMu.CFiMu.Spnmeg;
  - SS.SMx.CMx.OphMx;
  - SS.SBR.SMus.ModMx; and
  - CR.HCR.XFa.FluCoAs.X.
43. Analysis of acoustic data from the MPA search project survey of the area now designated as the FFBC MPA reported that biotopes within the east of the Proposed Development array area included SS.SSa.CMuSa, SS.SSa.OSa and circalittoral mixed sediments with one record of CR.MCR.EcCr (Sotheran and Crawford-Avis, 2013).
44. The biotopes reported with the west of the Proposed Development array area were dominated by SS.SCS.OSC with additional records of SS.SSa.OSa, and circalittoral and offshore mixed sediments (Sotheran and Crawford-Avis, 2013).
45. In summary, the different analyses of the surveys carried out to characterise the area around the Firth of Forth to identify MPA features in Scottish Waters reported similar results. They reported sand, mud with coarse and mixed sediment, and some areas of rock. Sandy and muddy sands were the most commonly recorded seabed habitats. Faunal communities were generally polychaete dominated however high energy hydrozoan/bryozoan, brittlestar and bivalve dominated communities were also recorded. Recorded biotopes of conservation importance included:
- SS.SMu.CFiMu.Spnmeg (OSPAR habitat);
  - SS.SBR.PoR.SspiMx (characterising biotope of an Annex I habitat, OSPAR habitat); and
  - SS.SBR.SMus.ModMx (characterising biotope of an Annex I habitat, OSPAR habitat, Scottish PMF).
46. The abundance of *S. spinulosa* and the diversity of fauna present recorded in the MPA search project survey was indicative of *S. spinulosa* reef. However, no information regarding the topographical height,

the extent and the longevity of the aggregation were recorded therefore no Annex I reef assessment was conducted.

47. A subtidal DDV survey was conducted in the nearshore subtidal area of Torness Nuclear Power Station (within the regional benthic subtidal and intertidal ecology study area) in September 2014. The survey indicated that the shallow subtidal was dominated by the biotope IR.MIR.KR.Lhyp *L. hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock. As water depth increased, the coverage of kelp reduced, and red seaweeds increased (IR.MIR.KR Kelp and red seaweeds (moderate energy infralittoral rock)). An area of rock occasionally covered by a veneer of coarse sand, and with patches of macroalgae attached could be seen marking the lower boundary of the infralittoral rock (IR.MIR Moderate energy infralittoral rock). Below this region, the deeper circalittoral bedrock was dominated by CR.MCR.EcCr.FaAICr Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock with pink faunal crusts, *Spirobranchus triqueter* and the urchin, *Echinus esculentus*, interspersed with CR.MCR.EcCr, areas of rock with a sparse appearance due to increasing grazing by echinoderms (ABPmer, 2019).

#### Intertidal benthic ecology

48. The intertidal surveys undertaken at the initial proposed landfall locations for Neart na Gaoithe and for the Torness Nuclear Power Station cover the Skateraw Landfall and are broadly consistent with each other. The surveys recorded a high energy sandy beach with extensive areas of bedrock, and complex, seaweed dominated, rock habitats.

#### Neart Na Gaoithe offshore wind farm

49. The proposed landfall locations for the Neart na Gaoithe offshore wind farm included Skateraw beach. A Phase 1 intertidal walkover survey with sediment sampling was undertaken at each landfall site in 2009 (EMU, 2010).
50. The Skateraw proposed landfall for the Neart na Gaoithe offshore wind farm consisted of a high energy sandy beach with extensive areas of bedrock and a deep-water channel dissecting the site. Uneven cobbles/pebbles/gravel areas were present to the south of the channel, overlying bedrock. Artificially placed large clean boulders were located within the upper shore to the south of the landfall, grading into clean small boulders/cobbles. Interesting features included the 'natural' large, erratic boulders, particularly in the north of the landfall survey area; the superficial sand on rock areas with an associated red algae community either side of the *Arenicola/Lanice* sand area; and the numerous patches of rock overlain with a thin layer of barren sand south of the central water channel. The rocky habitats at Skateraw were very complex; much of the shore the rock was broken into various heights from the upper shore to the lower shore. On the north side of the channel, the upper shore area consisted of raised bare bedrock with patches of typical upper shore algal species, *Pelvetia canaliculata* and *Fucus spiralis*, LR.MLR.BF.PelB *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock. Below this area the horizontal surfaces were covered by LR.MLR.BFFvesB *Fucus vesiculosus* dominated communities on both the raised dry rock and the wet rock areas. LR.MLR.BF.Fser *Fucus serratus* dominated communities, were nearest to the deep-water channel, adjacent to the *Laminaria digitata* zone in the sublittoral fringe. The *F. serratus* dominated area was dissected by a wet area with a concentration of pools, LR.FLR.Rkp.Cor.Cor Coralline crusts and *Corallina officinalis* in shallow eulittoral rockpools. A large area of mussels on bedrock present to the north of the channel was assigned the biotope LR.HLR.MusB.MytB *Mytilus edulis* and barnacles on very exposed eulittoral rock. Adjacent to this, an area of rock overlain with superficial sediment and an associated red algae community, assigned as a biotope mosaic: LR.HLR.FR.Osm *Osmundea pinnatifida* on moderately exposed mid eulittoral rock and IR.MIR.KR.XFoR Dense foliose red seaweeds on silty

moderately exposed infralittoral rock, occurred on either side of the lower shore *Arenicola/Lanice* sand area (EMU, 2010).

51. The soft sediments at Skateraw comprised fine sand, with differing proportions of fine-medium gravel. Sandy embayments in the upper shore were characterised by barren sand with the LS.LSa.St strandline debris biotope. Below this, mobile species-poor sand, dominated by the polychaete *Scolelepis* spp., LS.LSa.MoSa.AmSco.Sco *Scolelepis* spp. in littoral mobile sand, was present in the mid shore. In the lower shore, clean sand with *Arenicola* and scattered *Lanice conchilega* occurred, representative of the SS.SSa.IMuSa.ArelSa *Arenicola marina* in infralittoral fine sand or muddy sand biotope (EMU, 2010).

#### Torness Nuclear Power Station

52. The Skateraw proposed landfall is directly north of the Torness Nuclear Power Station. Phase 1 walkover surveys were carried out in 2014 for the Torness Nuclear Power Station, located to the north of the Skateraw proposed landfall (ABPmer, 2019). At the northern extent of the Skateraw proposed landfall, the intertidal area consisted mainly of exposed, high energy rock (LR.HLR.MusB.Sem.LitX *Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles, LR.LLR.F.Fves.FS *Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock and LR.MLR.BF.Fser.Bo *Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders), but also included characteristic species indicative of sheltered, low energy coastlines, such as the egg wrack *Ascophyllum nodosum*. *F. vesiculosus* observed on the more exposed aspects of the bedrock, lacked twin air bladders, which is indicative of a more exposed, high energy environment. The Skateraw beach was surrounded by moderate energy littoral rock (LR.LLR.F.Fves.FS, LR.MLR.BF.FvesB *Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock, LR.MLR.BF.Fser.R *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock and IF.MIR.KR.Ldig). A steeply angled shore was present at the Skateraw proposed landfall, with barren, well-drained sands in the upper and mid shore areas LS.LSa.MoSa.BarSa, and polychaete dominated sediments lower on the shore, LS.LSs.FiSa.Po Polychaetes in littoral fine sand (ABPmer, 2019).

### 3.3. DESIGNATED SITES

53. Designated sites within one tidal excursion (12 km) of the Proposed Development array area and Proposed Development export cable corridor (therefore at the maximum range of the impacts of the Proposed Development) have been identified for benthic subtidal and intertidal ecology. On the basis of advice received from NatureScot, the Firth of Forth SSSI and the Berwickshire Coast (Intertidal) SSSI have been screened out on the basis of no spatial overlap. With regards to European sites, as per the Likely Significant Effects (LSE) Screening Report, only the Berwickshire and North Northumberland Coast Special Area of Conservation (SAC) is screened in.
54. The Proposed Development array area overlaps with the FFBC MPA and the Proposed Development export cable corridor overlaps, to a lesser extent with the FFBC MPA and with the Barns Ness Coast SSSI in the intertidal zone.
55. The FFBC MPA covers 2,130 km<sup>2</sup> and is split into the three sections of Berwick Bank, Montrose Bank and Scalp Bank and Wee Bankie (Figure 3.3). The FFBC MPA is designated for ocean quahog *A. islandica* aggregations, offshore subtidal sands and gravels, shelf banks and mounds, and moraines. The conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status (FCS) of its qualifying features.

56. The Barns Ness Coast SSSI is located approximately 1 km east of Dunbar in East Lothian and covers an area of 2.5 km<sup>2</sup>. It is designated for lower carboniferous geological features, saltmarsh, sand dunes and shingle. Barns Ness beach had a sequence of sedimentary rocks which were formed during the Carboniferous geological period around 340 million years ago. Two major groups of sedimentary rocks were exposed on the coast: the limestone beds and a group consisting of sandstones, mudstones and occasional coal seams. An almost complete, though heavily faulted, section through the whole lower limestone group was exposed. The site was of importance as it demonstrates the succession of Lower Carboniferous Limestone, rich in fossils, and allows correlation between the Scottish Lower Carboniferous and the Lower Carboniferous of Northumbria (SNH, 2011a). These sediments, together with the marine and terrestrial fossils, provide a detailed picture of the changing Lower Carboniferous environment and the ancient ecology of the area (SNH, 2011b). Barns Ness Coast SSSI contained a variety of biological coastal habitats including shingle and sandy shores, sand dunes and a large area of mineral enriched dune grassland which all occur above MHWS and therefore were not considered further. The relevant objectives for management include: 'to maintain the visibility of the geological features of interest' and 'to maintain recreational access within the area, particularly to the geological features of interest'. The 2000 site condition monitoring assessment of the 'Lower Carboniferous Dinantian-Namurian' feature found it to be in favourable condition. The extent, composition and structure of the rocks have been maintained, and they remain visible and accessible (SNH, 2011b).
57. The Berwickshire and North Northumberland Coast SAC is located 4.1 km south-east of the Proposed Development export cable corridor and covers an area of 652.26 km<sup>2</sup> (Figure 3.3). It is designated for the Annex I habitats: Mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, reefs and submerged or partially submerged sea caves. The conservation objectives are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the FCS of its qualifying features (JNCC, 2021c).

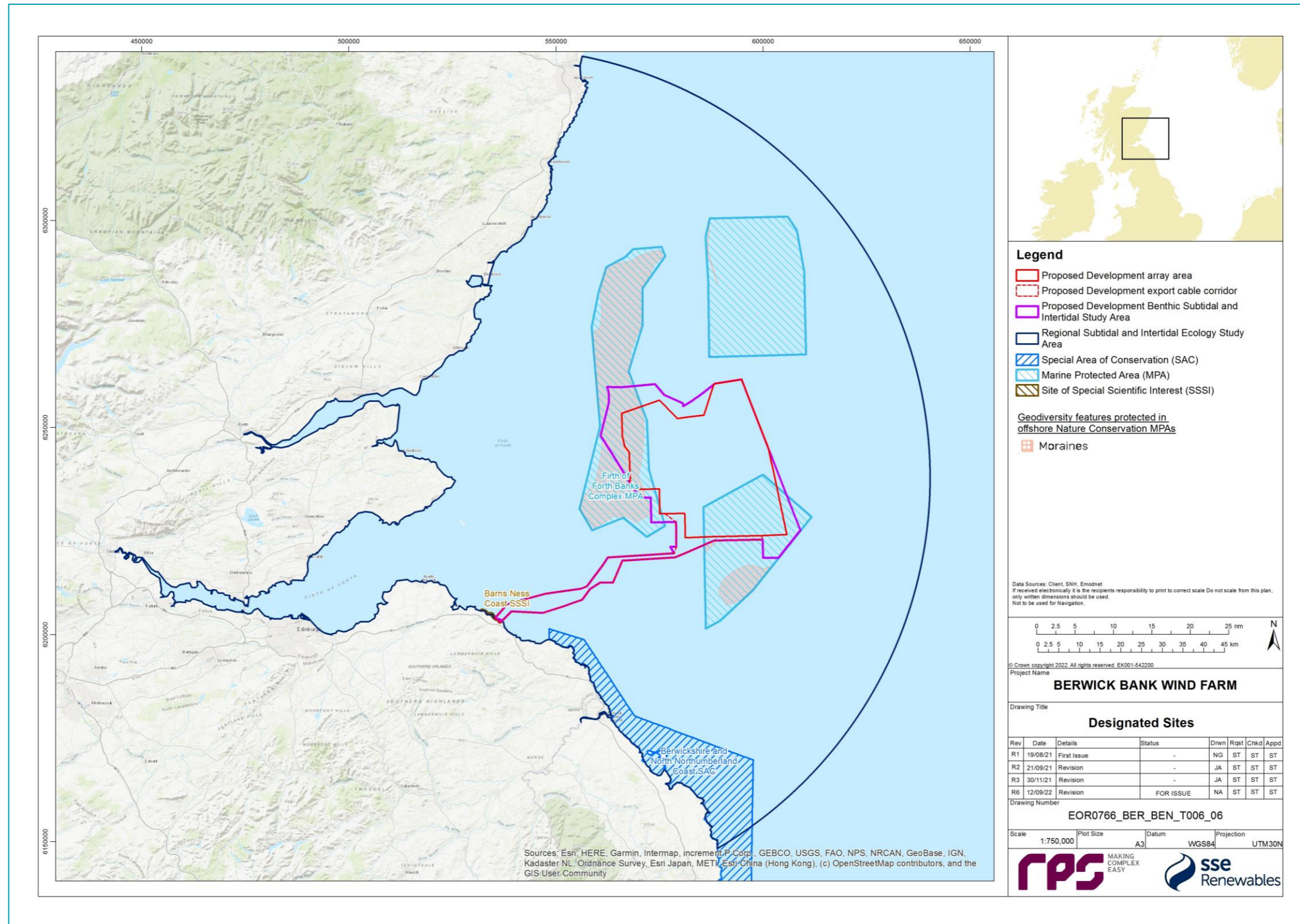


Figure 3.3: Designated Sites with Benthic Habitat Features that Overlap with the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area



### 3.4. SITE SPECIFIC SUBTIDAL SURVEYS

58. A benthic subtidal survey and a benthic intertidal survey were undertaken to characterise the Proposed Development benthic subtidal and intertidal ecology study area. A summary of these surveys is outlined in Table 3.2 with full detailed results presented in paragraphs 99 to 197.

**Table 3.2: Summary of Surveys Undertaken to Inform Benthic Subtidal and Intertidal Ecology**

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference to Further Information
Geophysical survey campaign	Across the Proposed Development	High resolution side scan sonar and multibeam bathymetry	Fugro Ltd.	2019	Fugro, 2020a and Fugro, 2020b
Benthic intertidal survey	Across the proposed landfall	Phase 1 intertidal walkover surveys with on-site dig over macrofauna sampling.	RPS Ltd.	2020	Section 3.5
Benthic subtidal survey	Across the Proposed Development	Grab samples, DDV sampling and epibenthic trawls	Ocean Ecology Ltd.	2020	Section 3.4
Geophysical survey campaign	Proposed Development export cable corridor	Geophysical study to establish bathymetry, seabed geology, morphology and sediments	XOCEAN Ltd.	2021	XOCEAN, 2021

#### 3.4.1. METHODOLOGY

##### Sample collection

59. The site-specific subtidal survey was undertaken across the Proposed Development benthic subtidal and intertidal ecology study area. As discussed in section 2, some benthic subtidal sampling was also undertaken in areas which, due to refinements to the boundary of the Proposed Development, extended beyond the boundary of Proposed Development benthic subtidal and intertidal ecology study area. This resulted in some subtidal sampling of areas to the north-west, south-west and south-east of the Proposed Development array area, and also the inshore area to the south of the Proposed Development export cable corridor (see Figure 3.4). The data collected from these areas were, however, analysed and included in the baseline characterisation as they provide further context to the data collected within the Proposed Development benthic subtidal and intertidal ecology study area. The subtidal survey combined DDV and 0.1 m<sup>2</sup> mini Hamon grab sampling with epibenthic trawls. The sampling strategy was designed to adequately sample the area to provide data for baseline characterisation. The survey design was discussed and agreed with NatureScot, Marine Scotland Licensing Operations Team (MS-LOT) and Marine Scotland Science (MSS) during a meeting (30 June 2020) and via subsequent email correspondence (09 July 2020 with NatureScot and 15 July 2020 with MSS).

60. The benthic subtidal survey was undertaken by Ocean Ecology Ltd. (OEL) in September 2020. All sampling was conducted aboard the 22 m Category 2 survey vessel 'MV Marshall Art'. The vessel mobilised from

Hartlepool on the east coast of England and operated on a 24-hour operations basis, primarily from the port of Leith and Montrose due to proximity to the Proposed Development.

##### Grab sampling

61. The subtidal survey included 92 combined DDVs and 0.1 m<sup>2</sup> mini Hamon grab sampling locations to ensure adequate data coverage for both infaunal and epifaunal communities at each location (Figure 3.4). Day grab (with stainless steel jaws) samples for sediment chemistry were also collected at nine of the 92 combined DDV/grab sampling locations. DDV was deployed prior to the deployment of the grab at every combined grab/DDV sample location to determine whether Annex I reef was present, such that grab sampling could be avoided in these areas. A number of mini Hamon grab stations were removed from the scope following an initial review of the seabed imagery, see paragraph 70. All grab sample collection and processing was undertaken in line with version eight of the Regional Seabed Monitoring Programme (RSMP) protocol (Cooper and Mason, 2019).

62. Initial processing of all mini Hamon grab samples was undertaken aboard the survey vessel in line with the following methodology:

- Assessment of sample size and acceptability made.
- Photograph of sample with station details and scale bar taken.
- 10% of sample removed for subsequent Particle Size Analysis (PSA) analysis and transferred to labelled container.
- Sample emptied onto 1 mm sieve net laid over 4 mm sieve table and washed through using gentle rinsing with seawater hose.
- Remaining sample for sorting and identification backwashed into a suitably sized sample container using seawater and diluted 10 % formalin solution added to fix sample prior to laboratory analysis.
- Sample containers clearly labelled internally and externally with date, sample identification and project name.

63. Initial processing of all Day grab samples was undertaken on board the survey vessel in line with the following methodology:

- Assessment of sample size and acceptability made.
- Photograph of drained sample showing undisturbed sediment surface with station details and scale bar taken.

64. Sub samples were then taken from the surface of the sample while retained in the grab for sediment chemistry analysis.

##### Drop Down Video

65. In addition to the 92 DDV deployments at each of the grab sample location, the subtidal survey included 15 additional DDV only transects within the Proposed Development array area, Proposed Development export cable corridor and just outside the Proposed Development export cable corridor (Figure 3.4). These additional DDV locations were planned into the survey design to target areas of hard substrate where grab sampling was unlikely to be successful and where there was the potential for habitats of conservation importance to be present as well as included during the survey in areas where grab sampling was unsuccessful. Sample stations were numbered in the order in which they were sampled. The DDV only sample stations are interspersed among the combined sample stations therefore the combined sample stations numbers go up to ST112.

66. All DDV sampling was undertaken in line with the JNCC epibiota remote monitoring operational guidelines (Hitchin *et al.*, 2015). A minimum of five images were taken from each DDV station along with approximately five minutes of video. Along the transects, images were taken every 10 – 20 m over heterogeneous habitat types, at the interface between different habitats and of any notable features along the transects. All video footage was reviewed *in situ* by the lead marine ecologist.
67. The camera system was deployed as follows:
- Vessel approached target location and alerted deck personnel to prepare camera and umbilical.
  - Sea fastening on camera frame was released to allow deployment from the deck.
  - Umbilical released overboard with sufficient length paid out to cover water depth.
  - Camera raised and lowered into the water column to within 5 m of the seabed.
  - Ecologist switched on video recording and the camera was lowered until gently landing on the seabed at which point a positional fix was taken.
  - The ecologist then waited for any suspended sediments in the field of view to disperse before taking an image and confirming with the skipper to move on.
  - The camera was then raised from the seabed and moved to obtain more images of the surrounding area or, when sampling transects, the camera was moved along the transect at approximately 1 - 2 knots; Where possible the seabed was maintained in view at all times.
  - Following the capture of the final image, the camera was lifted, video recording was stopped, and the camera was retrieved to the surface.
  - The winch operator then took tension on the winch cable and the ecologist ensured the camera umbilical was free for recovery.
  - Once the camera was at the surface, the vessel was positioned to minimise pitch and roll (e.g. into wind/tide).
  - The vessel skipper then confirmed sea conditions were suitable for retrieval and the camera system was recovered aboard.
  - The camera frame was then lowered onto the vessel deck and the tension released.

#### Epibenthic trawls

68. The benthic subtidal survey included 15 epibenthic beam trawls distributed across representative sediment types to characterise epibenthic communities. Six of these sampling locations were within the FFBC MPA (Figure 3.4). Beam trawl tows were undertaken in line with the guidelines set out by Cooper and Mason (2019) and Curtis and Coggan (2007). Tows were undertaken for a duration of 15 minutes on the seabed, at a speed of 1.5 – 2.0 knots. The approximate length of each tow was between 600 – 1,100 m. The direction of each tow was dependent on tide and wind conditions, where tow direction was always against the prevailing direction of the tide. Epibenthic beam trawls were undertaken using a 2 m scientific beam trawl with 0.5 mm mesh cod end insert.

#### Survey limitations

69. An adjustment to the boundary of the Proposed Development export cable corridor, following the completion of the site-specific benthic subtidal surveys, resulted in a small part of the mid-section of the Proposed Development export cable corridor not being sampled during the site-specific benthic surveys (Figure 3.4; Figure 3.6). Desktop data was therefore used to extrapolate the biotope map to cover the whole Proposed Development export cable corridor.
70. Due to the presence of dense fishing gear (potting buoys) across some of the survey area, three mini Hamon grab stations (ST47, ST52 and ST84) and two DDV locations (ST52 and ST84) were relocated to

minimise the risk of snagging. The orientation of one beam trawl (BT09) was also adjusted to avoid fishing gear whilst another (BT10) was relocated due to both fishing gear and its proximity to a wreck.

71. Six mini Hamon grab stations were abandoned due to there being an insufficient quantity of sediment within the grab jaws after multiple attempts due to coarse or hard ground (ST25, ST39, ST66, ST67, ST75 and ST84 from with the east of the Proposed Development array area and the Proposed Development export cable corridor). DDV was deployed prior to the deployment of the grab at every combined grab/DDV sample location to determine whether Annex I reef was present, so that grab sampling could be avoided in these areas. As a result, mini Hamon grab stations were removed from the scope following an initial review of the seabed imagery from seven stations (ST02, ST04, ST20, ST38, ST56, ST69 and ST89). Additional grabs were added following the Annex I assessment as the DDV imagery showed soft sediments therefore grab sampling was possible (ST102, ST104, ST105, ST106, ST108, ST109 from with the Proposed Development export cable corridor and ST112 from the east of the Proposed Development array area).
72. One mini Hamon grab station (ST01), one Day grab station (ST01) and three beam trawls were left outstanding at the point that survey operations were stood down due to an unfavourable long-term weather forecast.
73. Overall, 92 combined DDVs and 0.1 m<sup>2</sup> mini Hamon grab sampling locations, 12 additional DDV only transects and 15 epibenthic beam trawls were taken.

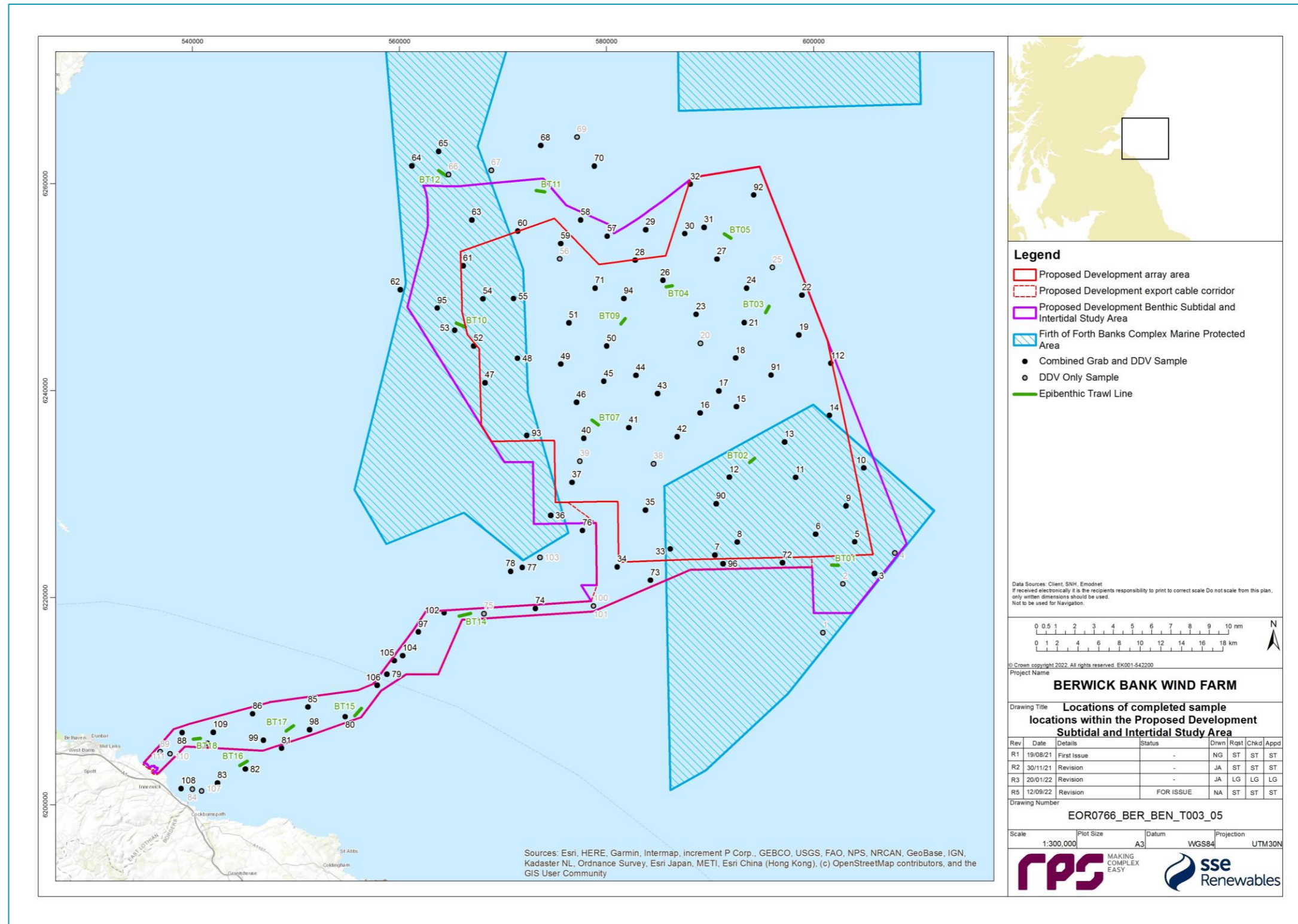


Figure 3.4: Completed Site Specific Sample Locations within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

## Sample analysis

### Benthic infaunal analysis

74. Sediment samples for benthic infaunal analysis were processed through a 1 mm sieve and the retained material transferred to an appropriate container and preserved immediately in 4% buffered saline formalin solution. The samples were analysed at OEL's benthic laboratory which participates in the North East Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC scheme) for identification (to species level), enumeration and biomass determination. Biomass of the infaunal component was recorded from the ash free dry mass, in grams (g). The retained infauna was separated into the following phyla: Polychaeta; Crustacea; Echinodermata; Mollusca; and Others.
75. The epifaunal component of each sample was analysed separately with identification to species level. Where possible each component was enumerated and presented as discrete counts or in the case of colonies, recorded as present and given a P (present) value.

### Particle Size Analysis (PSA)

76. Sediment samples were analysed for particle size distribution at OEL's benthic laboratory. Representative sub samples of each sediment sample were oven dried to a constant weight and sieved through a series of mesh apertures over the range 64 mm to 63 µm (0.063 mm) on the Wentworth scale. The weight of the sediment fraction retained on each mesh was measured and recorded. This method was in accordance with NMBAQC Best Practice Guidelines (Mason, 2016). Laser diffraction techniques were also used for samples where sediments of less than 63 µm accounted for more than 5% by weight of the sample.

### Drop Down Video (DDV) analysis

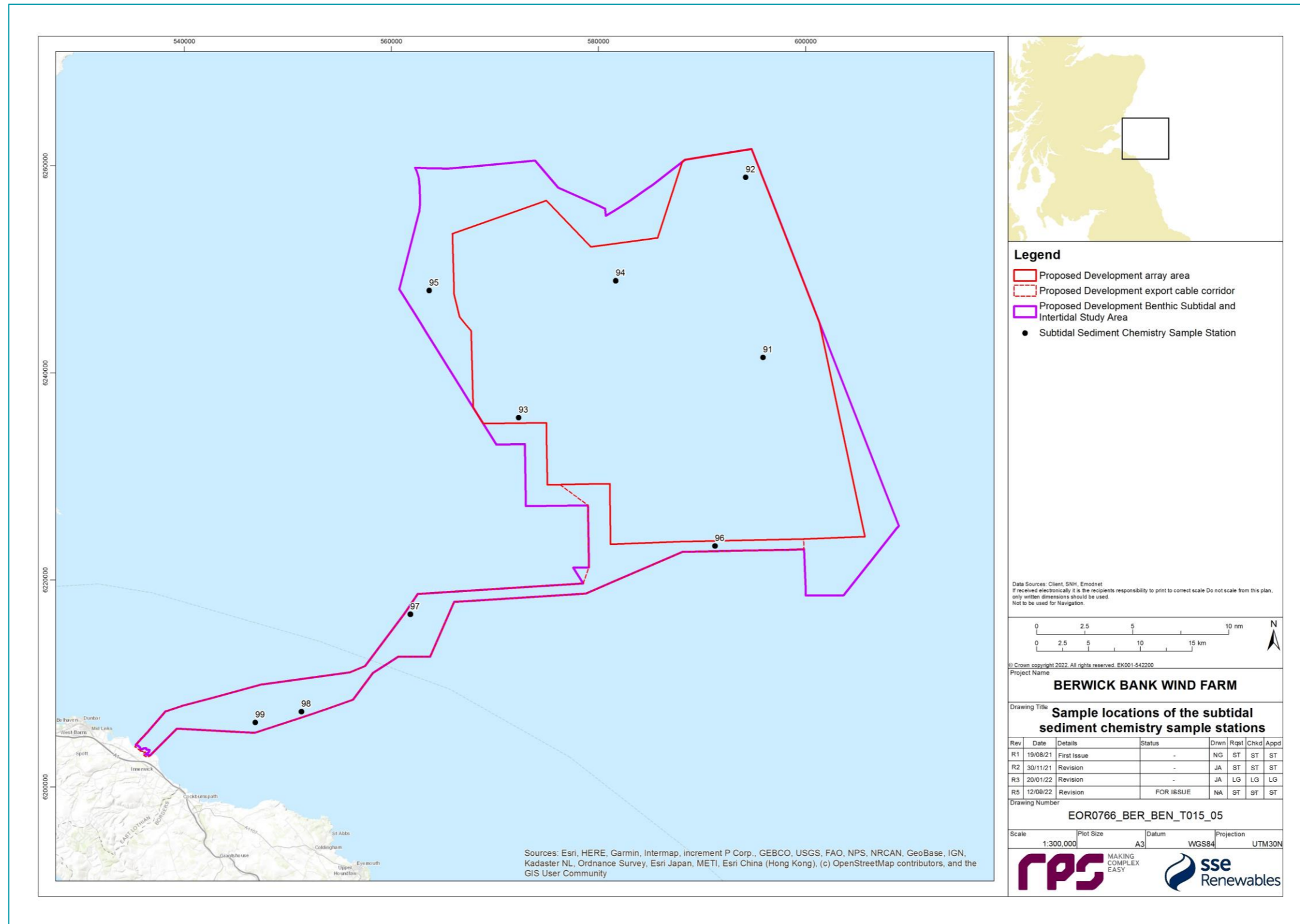
77. All images were reviewed by OEL's environmental scientists *in situ* to ensure a minimum of five representative images per station. Any stations that did not fit these criteria were revisited to obtain more imagery. Digital photographic stills and video footage were successfully obtained along all transects and subsequently analysed to aid in the identification and delineation of European Nature Information System (EUNIS) habitats and potential Annex I habitats. Seabed images were enhanced prior to analysis using the open-source image editing software GNU Image Manipulation Program ([www.gimp.org](http://www.gimp.org)). All seabed imagery analysis was undertaken using the Bio-Image Indexing and Graphical Labelling Environment (BIIGLE1) annotation platform (Langenkämper *et al.*, 2017) and in line with JNCC epibiota remote monitoring interpretation guidelines (Turner *et al.*, 2016).
78. Analysis of still images was undertaken in two stages. The first stage, "Tier 1", consisted of labels that referred to the whole image being assigned, providing appropriate metadata for the image. The second stage, "Tier 2", was used to assign percentage cover of habitat types by drawing polygons to inform the habitat assessment process. This analysis produced a list of discrete taxa identified and their abundance (number of individuals), or percentage cover for colonial organisms, within each image at each sample station. It also identified burrows, grouping them into size categories to give number and size of burrows per image at each sample station, this is discussed further in paragraph 97 and section 3.4.7.

### Epibenthic trawls analysis

79. Epibenthic trawl samples were processed in line with the guidelines set out by Cooper and Mason (2019) and Curtis and Coggan (2007) as follows:
- A photograph of the entire catch, prior to sorting, with station details was taken.
  - All fish and epibenthic fauna were sorted for identification and enumeration (presence/absence for colonial/encrusting species) in the field.
  - Length measurements (to the nearest mm) were taken for all commercial fish and shellfish species and further photographs taken of cryptic specimens.
  - Epibenthic invertebrate species were identified to the lowest taxonomic resolution possible and commercial shellfish were measured using the methods set out in EC Regulation 850/983 (i.e. carapace length for lobsters *Homarus gammarus* and carapace width for edible and velvet crabs *Cancer pagurus* and *Necora puber* respectively, mantle length for all cephalopods, shell height for whelk *Buccinum undatum* and shell width for king scallop *Pecten maximus* and queen scallop *Aequipecten opercularis*). Measurements and age estimations were also taken for ocean quahog *A. islandica in situ* with the specimens then returned to the sea.
  - Where identification required clarification, individuals were transferred to a labelled sample container and fixed in 4-5% buffered formalin solution and identified on return to OEL's laboratory.
  - The entire sample was then returned to the water once all individuals were identified, enumerated, and measured (where required). No fish were retained following processing other than those required for subsequent laboratory identification.

### Sediment chemistry

80. As part of the subtidal survey, sediment samples were taken for the purpose of sediment chemistry analysis (Figure 3.5). Samples were transferred to an appropriate sample container, labelled and sent to a suitable qualified laboratory for analysis. The RPS laboratory has United Kingdom Accreditation Service (UKAS) accreditation to carry out tests for all the contaminants listed. Samples were analysed for the following contaminants:
- metals;
  - polychlorinated biphenyl (PCB) congeners;
  - total Hydrogen Content (THC) by fluorescence spectrometry;
  - total organic Carbon (TOC);
  - organotins;
  - polycyclic aromatic hydrocarbons (PAH);
  - physical parameters; and
  - PSA.



**Figure 3.5: Locations of the Sediment Chemistry Samples**

## Data analysis

### Sediment characteristics analysis

81. The PSA data were categorised using the Folk classification which groups particles into mud, sand and gravel (mud <63 µm = mud; sand <2 mm; gravel >2 mm) and the relative proportion of each used to ascribe the sediment to one of 15 classes (e.g. slightly gravelly sand, muddy sand etc.) (Folk, 1954; Long, 2006). These classifications were then used to describe the data in the analysis. Proportions of mud, sand and gravel, as well as the Folk and Ward sorting coefficient, were also used to describe the sediment data. The Folk and Ward sorting coefficient describes the extent of deviation from lognormality of the particle size distribution (i.e. the variation in particle size with a sample).

### Sediment chemistry analysis

82. The results of the sediment chemistry analysis have been compared to the Marine Scotland chemical guideline Action Levels (ALs), administered by MS-LOT (Marine Scotland, 2017). Action Level 1 (AL1) and Action Level 2 (AL2) give an indication of how suitable the sediments are for disposal at sea. Contaminant levels which are below AL1 are of no concern and are unlikely to influence the marine licensing decision while those above AL2 are considered unsuitable for disposal at sea. Those between AL1 and AL2 would require further consideration before a licensing decision can be made. Sediment chemistry data were also compared to the Canadian Sediment Quality Guidelines (CSQG; CCME, 2001), which give an indication on the degree of contamination and the likely impact on marine ecology. For each contaminant, the guidelines provide threshold effects levels (TEL), which is the minimal effect range at which adverse effects rarely occur and a probable effect levels (PEL), which is the probable effect range within which adverse effects frequently occur.

### Macrofaunal analysis

#### Data Rationalisation

83. The benthic infaunal dataset was initially square root transformed to down-weight the species with the highest abundances for multivariate community analysis. The analysis of the infaunal community was made using the enumerated taxa only dataset to avoid skewing the results with the encrusting/colonial taxa recorded as 'present'; these taxa were combined with the DDV data and analysed separately. Juvenile data were included in the data analysed however the multivariate analysis was also run on the infaunal data which excluded the juvenile data to check for any differences in patterns or groupings. Within all dataset, all fish species were removed prior to analysis and discussed separately and within volume 3, chapter 9.1.
84. Colonial/encrusting taxa within the grab samples, which were recorded only as present, were combined with the DDV data and given an abundance of 1 or 0 respectively to enable them to be included in a separate multivariate analysis. Within the DDV data, taxa recorded as percentage cover were also transformed into presence/absence data for analysis. The combined DDV and grab epifaunal dataset was square root transformed.
85. Multivariate analyses were also run separately on the DDV percentage cover data alone to ensure that the proportions of the taxa present were captured and considered in the biotope allocations. Percentage cover estimates was allocated using the BIIGLE1 software. For taxa where percentage cover could not be

estimated by the BIIGLE1 software, the marine ecologist identified areas of taxa coverage during the review of the DDV images. The software calculated the proportion of the image which was covered by the taxa area identified. Where an area of taxa coverage could not be allocated, percentage cover was identified directly by the marine ecologist to the nearest 10%.

86. The epibenthic trawl dataset was initially standardised by total abundance per sample across all variables (species) to account for the slightly varied lengths of the trawls, and therefore sampling effort. The epibenthic trawl data was also fourth root transformed to down-weight the species with the highest abundances for multivariate community analysis. A fourth root transformation was used in comparison to the square root transformation used for the other analysis due to the very high abundances of the brown shrimp *Crangon crangon* in three of the epibenthic trawls.

#### Univariate analysis

87. The untransformed benthic infaunal data, epibenthic trawl data and combined DDV and grab epifaunal data were summarised to highlight the number of individuals and number of taxa recorded. Analysis was also undertaken to identify the percentage composition of the major taxonomic groups within each sample station, the percentage contribution of each taxonomic group to the total number of taxa and to the total number of individuals.
88. A number of univariate indices were calculated to further describe the untransformed infaunal and epifaunal data, including: S = number of species; N = abundance; B = Biomass (ash free dry mass); d = Margalef's index of Richness; J' = Pielou's Evenness index; H' = Shannon-Wiener Diversity index; λ = Simpson's Dominance index for each identified biotope.

#### Multivariate community analysis

89. The benthic infaunal grab data, epibenthic trawl data and combined DDV and grab epifaunal data were analysed using the PRIMER v6 software (Clarke and Gorley, 2006).
90. To determine the relative similarities between stations, the benthic infaunal and epifaunal community structure were investigated using CLUSTER analysis (hierarchical agglomerative clustering). Separate multivariate analyses were undertaken on the infaunal, epifaunal and epibenthic trawls dataset however the same methodology was used. This used the Bray Curtis similarity coefficient to assess the similarity of sites based on the faunal components. The procedure produces a dendrogram indicating the relationships between sites based on the similarity matrix and uses a Similarity Profile (SIMPROF) test (at a 5% significance level) to test whether the differences between the clusters are significant.
91. Similarity Percentages (SIMPER) analyses were subsequently undertaken on the infaunal and two epifaunal datasets to identify which species best explained the similarity within groups and the dissimilarity between groups identified in the cluster analysis. The similarity matrix was also used to produce a multi-dimensional scaling (MDS) ordination plot to show, on a two or three-dimensional representation, the relatedness of the communities (at each site) to one another. Full methods for the application of both the hierarchical clustering and the MDS analysis are given in Clarke and Warwick (2001).

#### Biotope allocation

92. The results of the cluster analyses and associated SIMPER were reviewed alongside the raw, untransformed data to assign preliminary biotopes (Connor *et al.*, 2004). Using the clusters identified, several sites within a cluster and, where appropriate several clusters, were assigned to a single biotope,

where possible, based on relatedness and presence/absence of key indicator species for a particular biotope. The infaunal and epifaunal biotopes were plotted out over the results of the geophysical survey for the Proposed Development subtidal and intertidal ecology study area to map the area and extent of each habitat across sediment types/features and presented in the biotope map. The infaunal and epifaunal biotope allocations were combined to provide a combined biotope map.

Annex I reef assessment

93. As discussed in paragraph 65, DDV was deployed prior to the deployment of the grab at every combined grab/DDV sample location to determine whether Annex I reef was present, such that grab sampling could be avoided in these areas. Seven mini Hamon grab stations were removed from the scope following an initial review of the seabed imagery (ST02, ST04, ST20, ST38, ST56, ST69 and ST89). Potential Annex I reef was observed during the DDV sampling at ST02, ST04, ST20, ST38, ST56, ST69 and ST89 sample locations, therefore a full Annex I reef assessment has been undertaken for these locations (Annex B: Annex I Reef Assessments).
94. Where *Sabellaria spinulosa* aggregations were observed in the DDV footage of the Proposed Development benthic subtidal and intertidal ecology study area, a reefiness assessment with reference to relevant guidance documents (i.e. Jenkins *et al.*, 2015; Gubbay, 2007; Limpenny *et al.*, 2010), was undertaken to determine whether or not a potential *S. spinulosa* reef was present. To ensure that the assessment was transparent, it comprised a measure of elevation and patchiness, as outlined in Table 3.3. The scoring system proposed by Gubbay (2007) and the 'reefiness' matrix described in Jenkins *et al.*, 2015 was used to draw together all the information to interpret the 'reefiness' of *S. spinulosa* aggregations (Table 3.4).

**Table 3.3: Summary of the Analysis and Scoring of *S. Spinulosa* Reef Characteristics (based on Gubbay, 2007)**

Characteristic	Reef Characterisation			
	Not a Reef	Low	Medium	High
Elevation (cm) Average tube height	<2	2-5	5-10	>10
Extent (m <sup>2</sup> )	<25	25-10,000	10,000-1,000,000	>1,000,000
Patchiness (% cover)	<10	10-20	20-30	>30

**Table 3.4: *Sabellaria spinulosa* Reef Assessment Matrix (based on Gubbay, 2007 and Jenkins *et al.*, 2015)**

'Reefiness' Matrix	Elevation (cm)				
	<2	2 to 5	5 to 10	>10	
	Not a reef	Low	Medium	High	
Patchiness (% cover) <10	Not a reef	NOT A REEF	NOT A REEF	NOT A REEF	NOT A REEF
10 to 20	Low	NOT A REEF	LOW	LOW	LOW
20 to 30	Medium	NOT A REEF	LOW	MEDIUM	MEDIUM
>30	High	NOT A REEF	LOW	MEIDUM	HIGH

95. Where coarse/stony and/or rocky substrate was observed in the DDV footage of the Proposed Development benthic subtidal and intertidal ecology study area, a stony reef assessment according to the appropriate guidance (Irving, 2009; Golding *et al.*, 2020) was undertaken to determine if a potential stony

reef was present. The assessment comprised of a measure of elevation and patchiness, and extent where possible, as outlined in Table 3.5. The scoring system proposed by Irving (2009) and the 'reefiness' matrix described in Jenkins *et al.* (2015) was used to draw together all the information to interpret the 'reefiness' of stony features (Table 3.5). The conclusion of the Irving (2009) guidance was that a reef should be elevated above flat sea floor, have an area of at least 25 m<sup>2</sup> and have a composition of no less than 10% coverage of the seabed (Irving, 2009). Irving (2009) also recommended that, when determining whether an area of the seabed should be considered as Annex I stony reef, if a 'low' is scored in any of the four characteristics (composition, elevation, extent or biota), then a strong justification would be required for this area to be considered as contributing to the Marine European Sites with qualifying reef features. Golding *et al.* (2020) provides further guidance on the interpretation of the guidance set out in Irving (2009) and has therefore been reviewed alongside Irving (2009).

96. Where bedrock was observed in the DDV footage, a rocky reef assessment was undertaken. Unlike biogenic and stony reef, there is little guidance of classifying bedrock reef. The elevation assessment criteria do not apply to bedrock reef; bedrock reef was therefore assessed based on cover and extent alone, using the same thresholds as for stony reef, listed in Table 3.5.

**Table 3.5: Stony Reef Assessment Matrix (based on Irving, 2009 and Jenkins *et al.*, 2015)**

Characteristic	Resemblance to being a stony reef			
	Not a stony reef	Low	Medium	High
Composition (% cover)	<10%	10-40% Matrix supported	40-95%	>95% Clast supported
Elevation	Flat Seabed	<64mm	64mm-5m	>5m
Extent	<25m <sup>2</sup>		>25m <sup>2</sup>	
Biota:	Dominated by infaunal species			>80% of species present composed of epifaunal species.

Notes: Diameter of cobbles/boulders being greater than 64mm. Percentage cover relates to a minimum area of 25m<sup>2</sup>. This 'composition' characteristic also includes 'patchiness'.  
 Notes: Minimum height (64mm) relates to minimum size of constituent cobbles. This characteristic could also include 'distinctness' from the surrounding seabed. Note that two units (mm and m) are used here.

Seapen and burrowing megafauna community assessment

97. The seapens and burrowing megafauna habitat is described by OSPAR as 'Plains of fine mud, at water depths ranging from 15-200 m or more, which are heavily bioturbated by burrowing megafauna with burrows and mounds typically forming a prominent feature of the sediment surface. The habitat may include conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*'. At stations where burrows were sufficiently large enough to indicate the presence of burrowing megafauna, an assessment was undertaken to determine whether the OSPAR Seapens and Burrowing Megafauna communities habitat was present. As detailed in the JNCC (2014b) clarification document for defining this habitat, the following data was required for this assessment:

- video and still imagery to confirm burrows and/or mounds and, where present, seapens;
- infaunal grab samples to confirm relevant fauna; and
- PSA data to confirm a fine mud habitat.

98. The PSA data from the grab samples were initially analysed to determine if fine mud sediments were present. The DDV data were then analysed to determine which images showed burrows and/or mounds

and their locations. The number of burrows within each image were counted, along with the size of the burrows, to produce a matrix of burrow density. The abundance of burrows was then categorised using the SACFOR<sup>1</sup> scale in order to determine whether their density was a 'prominent' feature of the sediment surface and potentially indicative of a sub-surface complex gallery burrow system; burrows are required to be classified as at least frequent on the SACFOR scale for this habitat to be assigned (JNCC, 2014b; Hiscock, 1996). The number of seapens were also counted within each image to produce a matrix of seapen density at each location where burrows were identified. This was used to classify the abundance of seapens using the SACFOR scale. It should be noted, however, that the presence of seapens is not a prerequisite for the classification of this habitat (JNCC, 2014b). Based on the results of the analysis imagery data and PSA data for the presence of seapens, burrows and fine mud habitat, a conclusion was made as to the presence of the Seapens and Burrowing Megafauna communities habitat for each sample station. Based on this, and the overall epifaunal data, the sample stations were assigned a preliminary biotope classification.

#### 3.4.2. RESULTS - SEABED SEDIMENTS

99. In 2019 and 2021, site-specific geophysical survey campaigns were conducted across the Proposed Development (Fugro, 2020a; Fugro 2020b; XOCEAN, 2021). The side scan sonar (SSS) data indicated a heterogeneous sediment across the Proposed Development array area with coarse and cobbly sediments on topographic highs, and sand to gravelly sand in the topographic lows and in the flanks of the banks (Figure 3.6), this correlated with the EUSeaMap data (Figure 3.1). There were also extensive boulder fields present across the broad topographic highs and the banks. Hard and coarse substrates, and rock were present in the nearshore area of the Proposed Development export cable corridor, with sand sediments in the central section grading into more gravelly sands and areas of hard substrate. This geophysical data also showed that the majority of the seabed is 'featureless', however the southern and north-western extent of the Proposed Development array area was dominated by megaripples, sandwaves, ribbons and bars (Figure 3.6). Boulders were also prevalent across the area and were either represented as isolated boulders or as clusters.

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<sup>1</sup> SACFOR classification scale, S=Superabundant, A=Abundant, C=Common, F=Frequent, O=Occasional and R=Rare.



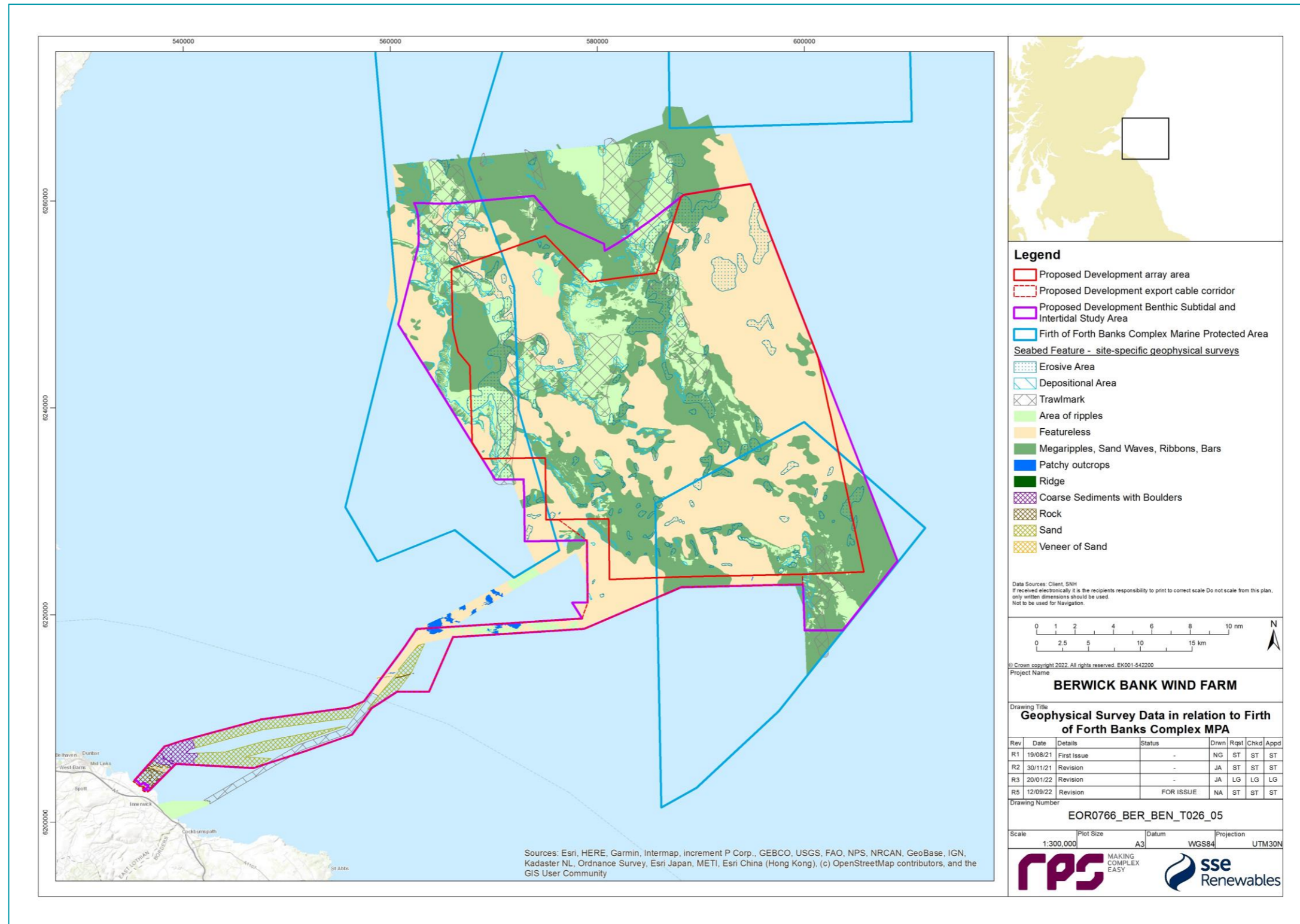


Figure 3.6: Interpreted Geophysical Data from the Site Specific Survey within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

### 3.4.3. RESULTS - PHYSICAL SEDIMENT CHARACTERISTICS

100. The subtidal benthic sediments across the Proposed Development benthic subtidal and intertidal ecology study area were classified into sediment types according to the Folk classification (Figure 3.5 and Annex A: Seabed Sediments). Sediments ranged from sandy gravel to muddy sand with 36% of the samples classified as slightly gravelly sand (Figure 3.7). The only sample station classified as sand was ST108 which was located to the southeast of the nearshore section of the Proposed Development export cable corridor (Figure 3.5). All sediment samples classified as muddy sands were also from the Proposed Development export cable corridor. The sediments within the east of the Proposed Development array area were dominated by slightly gravelly sand with areas of gravelly sand in the north and south. The sediments within the west of the Proposed Development array area were typically slightly coarser and characterised by sandy gravel sediments in addition to slightly gravelly sand and gravelly sand. The sediments within the offshore section of the Proposed Development export cable corridor were characterised by the same sediment types as the Proposed Development array area. The slightly gravelly sand/gravelly sand sediments graded into muddy sand with patches of slightly gravelly muddy sand in the inshore and central sections of the Proposed Development export cable corridor (Figure 3.7). According to the simplified Folk Classification (Long, 2006), most stations were classified as coarse sediments with areas of mud and sandy mud and mixed sediments.

101. The percentage sediment composition (i.e. mud  $\leq 0.63$  mm; sand  $< 2$  mm; gravel  $\geq 2$  mm) at each grab sample station is presented in Figure 3.8 and Annex A: Seabed Sediments. Across all sample stations, the average percentage sediment composition was 9.78% gravel, 82.76% sand and 7.47% mud. Generally, sand made up the highest proportion of the sediment composition, with the exception of a few sites within the western section of the Proposed Development array area which were dominated by gravel, some of which overlap with the Berwick Bank features. As expected, the sediment composition also showed a higher percentage of gravels within the western section of the Proposed Development array area in comparison to the eastern section of the Proposed Development array area. The sample stations with the highest percentage composition of mud were generally found along the inshore section of the Proposed Development export cable corridor (Figure 3.9).
102. Sediments across the Proposed Development benthic subtidal and intertidal ecology study area were typically poorly sorted or moderately sorted. One sample station (ST83) was extremely poorly sorted, this station was classified as muddy sandy gravel with 32.2% gravel, 40.4% sand and 27.4% mud (Figure 3.9 and Annex A: Seabed Sediments).

#### FFBC MPA

103. Sediments from within the FFBC MPA were generally representative of the sediments recorded across the Proposed Development benthic subtidal and intertidal ecology study area. Sediments within the eastern section of the FFBC MPA overlapping with the Proposed Development array area were classified as slightly gravelly sand and gravelly sand. Sediments within the western section of the FFBC MPA were slightly coarser and characterised by sandy gravel and slightly gravelly sand (see Figure 3.8).

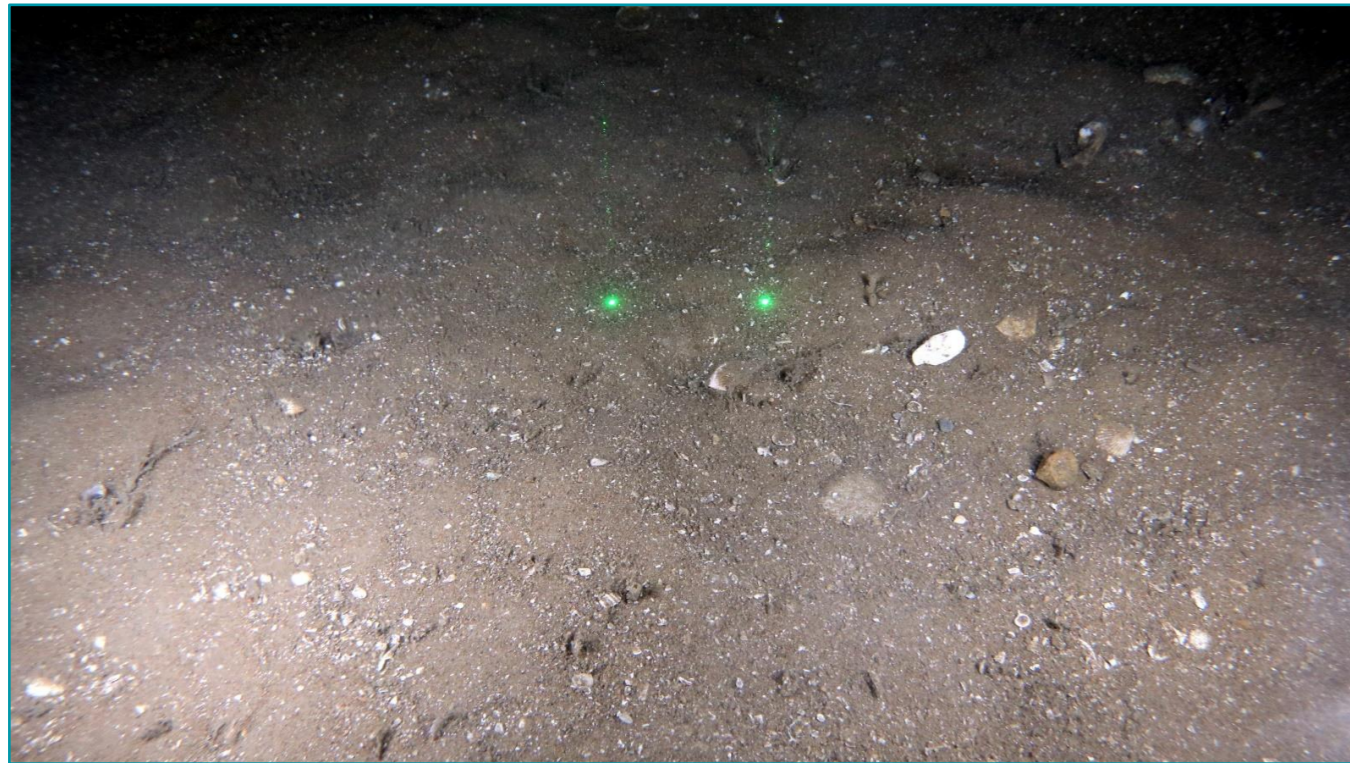


Figure 3.7: Representative Image of Slightly Gravelly Sand (ST06)

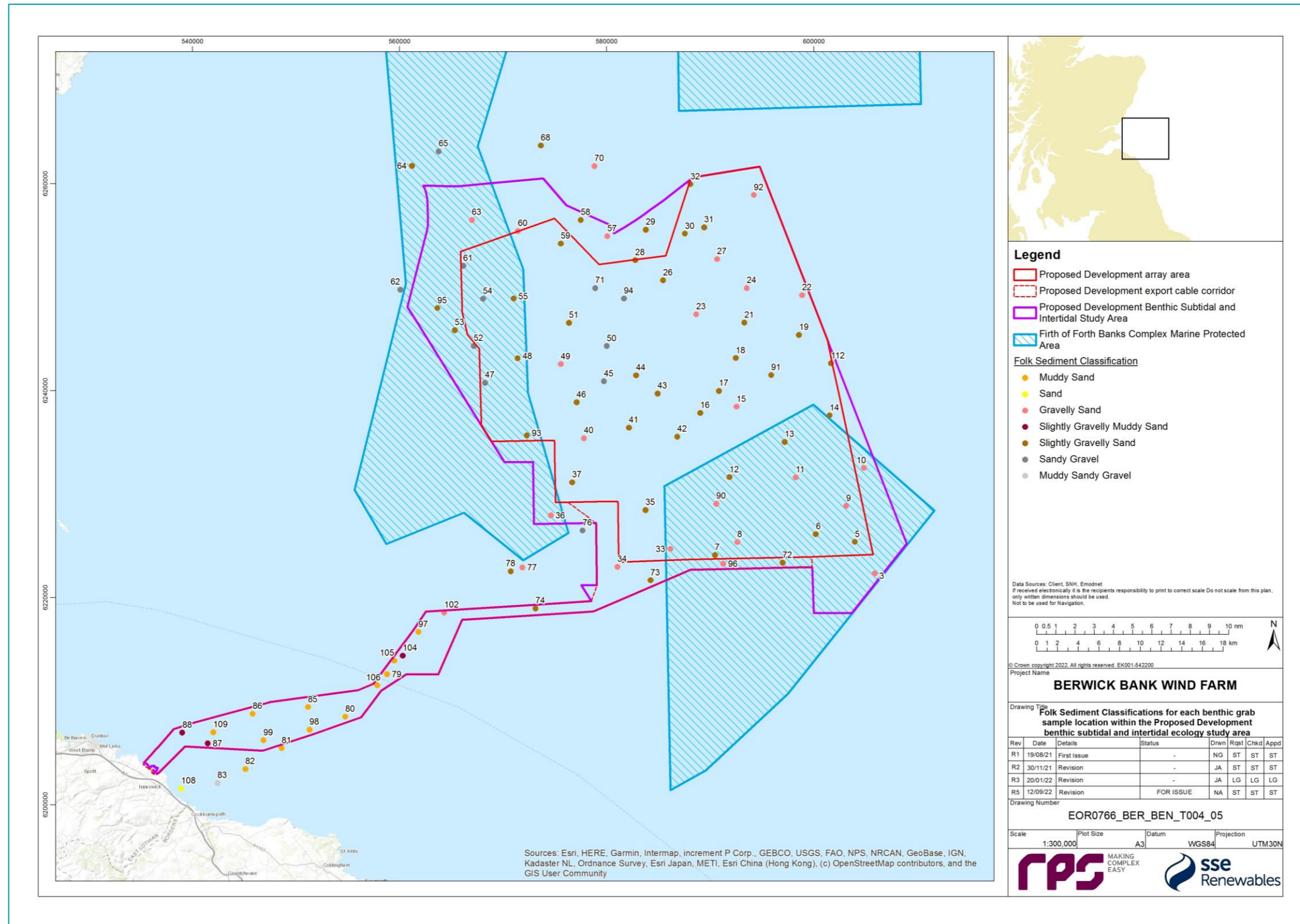


Figure 3.8: Folk Sediment Classifications for Each Benthic Grab Sample

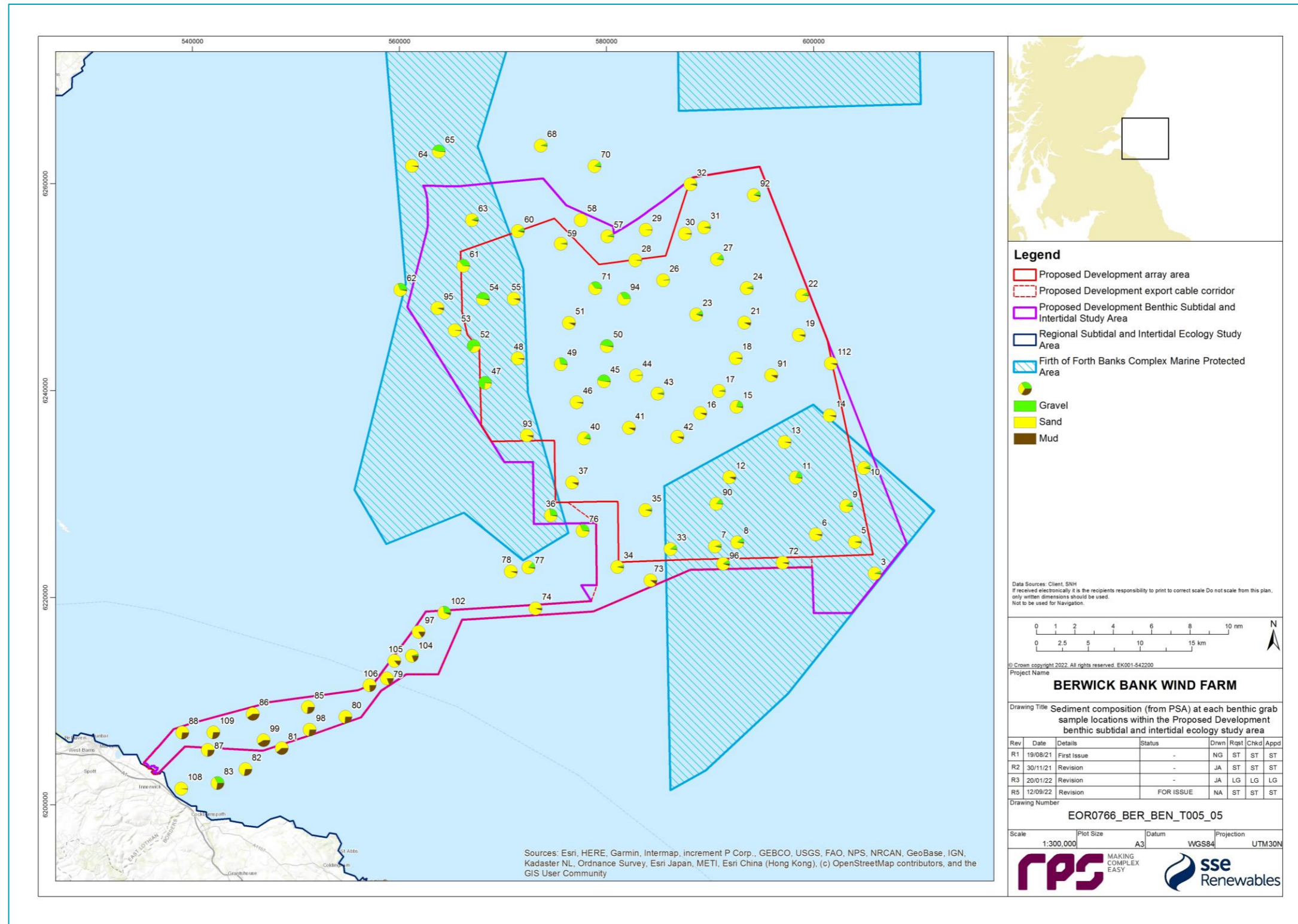


Figure 3.9: Sediment Composition (from PSA) at Each Benthic Grab Sample Location

### 3.4.4. RESULTS - SEDIMENT CONTAMINATION

104. Table 3.6 to Table 3.8 in the following subsections present the levels of contaminants that were recorded in the sediment samples. Where contaminants exceeded the Marine Scotland chemical guideline ALs their cells have been highlighted with the corresponding colour. Where contaminant levels exceed the Canadian TEL the contaminant level has been marked with an asterisk. No contaminants were found to exceed AL1/AL2 or the Canadian PEL with only arsenic at five sample stations exceeding Canadian TEL (Table 3.6).

#### Metals

105. Heavy metals are readily adsorbed by sediments, this can lead to metals accumulating to concentrations far higher than the surrounding environment. These sediments can become re-suspended through bioturbation or through physical processes/disturbances. Metals will tend to accumulate in these fine-grained sediments and can become bioavailable to marine organisms through ingestion. The uptake of heavy metals by marine organisms can lead to bioaccumulation through trophic levels leading to apex organisms accumulating metals to adverse and toxic levels. This could result in significant adverse effects including mortality, impaired reproduction, reduced growth, alterations in metabolism as a result of oxidative stress and disruption to the food chain.

106. The sediment chemistry results, presented in Table 3.6, concluded that all the metal contaminants did not exceed the AL1. The majority of the metal contaminants also did not exceed the Canadian TEL, with the exception of Arsenic at five sample stations (ST92, ST93, ST94, ST95, ST96). Metal concentrations within the sediment across the Proposed Development benthic subtidal and intertidal ecology study area were well below the Canadian PEL and AL2.

**Table 3.6: Concentrations of Metals Recorded in Sediments within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area**

Description (metals)	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	0.5	0.1	0.5	0.5	0.5	0.01	0.5	3
MS AL1 (mg/kg)	20	0.4	50	30	50	0.25	30	130
MS AL2 (mg/kg)	70	4	370	300	400	1.5	150	600
Canadian TEL (mg/kg)	7.2	0.7	52.3	18.7	30.2	0.13	15.9	124
Canadian PEL (mg/kg)	41.6	4.2	160	108	112	0.7	-	271
<b>Sample No.</b>								
ST91	4.50	<0.10	22.40	2.80	9.30	<0.1	5.40	13.50
ST92	11.30*	<0.10	24.50	3.00	11.60	<0.01	4.90	14.90
ST93	7.50*	<0.10	24.00	3.20	9.40	<0.01	5.20	14.80
ST94	11.30*	<0.10	15.40	3.10	8.60	<0.01	6.00	14.40
ST95	10.70*	<0.10	26.20	3.30	11.20	<0.01	6.70	11.20
ST96	7.90*	<0.10	23.60	3.20	10.70	<0.01	5.50	17.60
ST97	4.40	<0.10	20.90	3.10	9.90	<0.01	6.20	46.00
ST98	6.30	0.20	35.20	4.60	13.80	<0.01	11.30	27.80
ST99	6.30	0.20	37.30	5.20	14.90	<0.01	11.70	30.60

#### Organotins

107. Organotin compounds are based on tin with hydrocarbon substitutes, these include the historically used biocides dibutyltin (DBT) and tributyltin (TBT). Primarily used as antifungal and antifouling agents to improve the efficiency, performance and longevity of marine structures and vessels, concerns over toxicity of these compounds to biological organisms led to the International Maritime Organisation (IMO) introducing a worldwide ban. Adverse biological effects are comparable to hydrogen cyanide, whereby the compound halts cellular respiration within the mitochondria leading to cell and organism death. Legacy trace TBT and DBT can still be present within sediments in harbours and low energy environments. Total organic carbon (TOC) is the amount of carbon found in a sediment sample and is often used as a non-specific indicator of water quality. TOC is important when detecting contaminants in drinking water and manufacturing cooling water, including monitoring run off water into the marine environment. Levels of TOC were low (<1%) across all samples except ST94, however the TOC at ST94 was still <5%. Total hydrocarbon content (THC) is used to describe the quantity of the measured hydrocarbon impurities present. This can be used as an indicator of anthropogenic pollution. Levels of TOH were generally in the region of 1,000-6,000 mg/kg with the exception of ST99 and ST89 which had higher levels of TOH. These sample stations were closest to shore and therefore are likely to have experienced higher levels of vessel traffic and/or contaminated effluent from coastal/onshore works.

108. Levels of DBT and TBT for all samples were found to be below the Marine Scotland ALs (

Annex J: Sediment Contamination Results).

**Table 3.7: Concentrations of Organotins Recorded in Sediment within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area**

Description (Organotins)	Dry Solids (at 105°C)	Total Organic Carbon	Total Hydrocarbon Content by Fluorescence	Dibutyltin (DBT)	Tributyltin (TBT)
Detection Limit	n/a	0.3	0.0001	0.005	0.002
Units	%	%	mg/kg	mg/kg DW	mg/kg DW
MS AL1 (mg/kg)	-	-	-	-	0.10
MS AL2 (mg/kg)	-	-	-	-	0.50
<b>Sample No.</b>					
ST91	77.50	0.30	3,160.00	<0.005	<0.002
ST92	80.70	0.70	3,690.00	<0.005	<0.002
ST93	81.10	0.30	3,760.00	<0.005	<0.002
ST94	78.00	3.50	1,780.00	<0.005	<0.002
ST95	79.70	0.40	6,040.00	<0.005	<0.002
ST96	81.40	0.50	2,800.00	<0.005	<0.002
ST97	78.30	0.40	2,920.00	<0.005	<0.002
ST98	75.30	0.60	8,630.00	<0.005	<0.002
ST99	71.10	0.70	17,400.00	<0.005	<0.002

Polychlorinated biphenyls (PCBs)

- 109. PCBs are toxic to fish and other aquatic organisms. Reproductive and developmental problems have been observed in fish at low PCB concentrations, with the early life stages being most susceptible. There is growing evidence linking PCBs and similar compounds with reproductive and immuno-toxic effects in wildlife, including effects on seals and other marine mammals. Due to their persistence and lipophilic nature, PCBs have the potential to bioaccumulate, particularly in lipid rich tissue such as fish liver. Bioaccumulation of PCBs is recorded in fish, birds and marine mammals with known sublethal toxicological effects. Accumulation of PCBs in sediments poses a potential hazard to sediment-dwelling organisms.
- 110. Levels of PCBs, for all samples, were found to be under the respective Marine Scotland ALs and were below the limit of detection for each PCB at each sample station (

Annex J: Sediment Contamination Results).

Polycyclic Aromatic Hydrocarbons (PAHs)

- 111. PAHs enter the environment through a number of sources, these include road run-off, sewage, atmospheric circulation and from historical industrial discharge. Once in the environment, PAHs exert a strong affinity for organic carbon and as such organic sediment in rivers can act as a substantial sink. Due to the high affinity for organic carbon, once ingested by fauna the PAHs cause oxidative stress and lead to adverse effects in the organism. Most species have a limited ability to metabolise PAHs and as a result can bioaccumulate to toxic levels.
- 112. Across all PAHs, levels were higher in sample stations ST98 and ST99 with some registering over ten times the levels at other stations but still below AL1 (

Annex J: Sediment Contamination Results). These sample stations were closest to shore and therefore are likely to have experienced higher levels of vessel traffic and/or contaminated effluent from coastal/onshore works. In addition, seabed habitats closer to the coast had higher proportions of fine sand and mud (paragraph 101) which contaminants such as metals and hydrocarbons are typically bound to. Moreover, seabed habitats closer to the coast represent a lower energy environment which will reduce the likelihood of dilution and dispersal of any contaminants. However, PAH levels were consistently very low (mostly below the limit of detection) and levels for all samples were found to be under AL1 and the CSQGs (

Annex J: Sediment Contamination Results).

### 3.4.5. RESULTS - INFAUNAL ANALYSIS

#### Summary statistics

113. A total of 518 taxa were recorded from the 92 infaunal grab samples collected across the Proposed Development benthic subtidal and intertidal ecology study area. Of these, 57 taxa were colonial or taxa whose abundance could not be enumerated, and therefore were recorded as present (P). These taxa were removed from the infaunal numerical and statistical analysis but were included in the epifaunal numerical analysis (section 3.4.6). A total of 9,093 individuals representing 461 enumerated taxa were recorded across the Proposed Development benthic subtidal and intertidal ecology study area. Of these, juveniles accounted for 1,386 individuals from 49 taxa representing 15% of the total number of individuals and 10% of the total number of taxa recorded. Two of the recorded taxa were bony fish species (turbot *Scophthalmus maximus* and lesser sandeel *Ammodytes tobianus*) and represented 23 individuals. As they are highly mobile species, they were removed from the statistical analysis but are discussed in paragraph 116.
114. Of the 461 total taxa enumerated throughout the Proposed Development benthic subtidal and intertidal ecology study area, none were observed at all stations. A total of 114 taxa (25%) were recorded as single individuals; these rarely recorded taxa were distributed across the Proposed Development benthic subtidal and intertidal ecology study area. A total of 312 taxa (68%) were represented by <10 individuals. It is generally accepted that ecological communities which are frequently subjected to local disturbance or contamination events will be dominated by a limited number of tolerant taxa, which will be represented in high individual abundances (Clarke and Warwick, 2006). The relatively high numbers of single and low abundance species recorded in this survey could suggest a reasonably diverse community that has been subjected to relatively limited disturbance or contamination.
115. Juveniles were recorded from stations across the Proposed Development benthic subtidal and intertidal ecology study area from taxa including Mollusca, Crustacea, Echinodermata, Annelida, Sipunculidea and Tunicata. The five most abundant juvenile taxa were within the Echinodermata (*Amphiuridae* juveniles and *Ophiuridae* juveniles) and Mollusca (*Abra* juveniles, *Mytilidae* juveniles and *Thracioidea* juveniles). These five juvenile taxa made up 62% of the total number of juvenile individuals. ST32 (in the north-east of the Proposed Development array area; Figure 3.4) was the only sample station that recorded all five of the highest abundance juvenile taxa. ST50 recorded the highest numbers of juvenile individuals (114; mainly *Amphiuridae*, *Leptochiton*, *Mytilidae* and *Ophiuridae*) with ST71 recording the highest number of juvenile taxa (16). In addition to juvenile taxa, *Decapoda* megalopa and zoea were recorded; these larval stages were recorded at ST11, ST54, ST55, ST58, ST60, ST71 and ST104.
116. As previously mentioned, 56 taxa were recorded only as present; these taxa were dominated by Bryozoa and Hydrozoa. Epifaunal/colonial/encrusting taxa across the Proposed Development benthic subtidal and intertidal ecology study area included: *Folliculinidae*, *Enteroprocta*, *Phoronidaea* and *Porifera*. Of these taxa, *Folliculinidae* were present across the greatest number of sample stations ST50, ST54, ST71 (within the west of the Proposed Development array area) and ST36, ST70 (outside the Proposed Development array area to the southwest and north respectively). ST83 (outside the Proposed Development export cable corridor, nearshore to the south-east) recorded the highest number of epifauna/colonial/encrusting taxa. One individual turbot was recorded at ST83 and multiple individuals of the lesser sand eel were recorded at stations across the Proposed Development benthic subtidal and intertidal ecology study area.
117. Initially the dataset was divided into the five major taxonomic groups: Annelida (*Polychaeta*), Crustacea, Mollusca, Echinodermata and 'Others'. The 'Other' group comprised of:

- Eight taxa of Sipunculidea (*Aspidosiphon (Aspidosiphon) muelleri*, *Golfingia (Golfingia) elongata*, *Golfingia (Golfingia) vulgaris*, *Nephasoma (Nephasoma) minutum*, *Onchnesoma squamatum*, *Phascolion (Phascolion) strombus*, *Sipuncula*, *Thysanocardia procera*).
- Five taxa of Anthozoa (*Cerianthidae*, *Cerianthus lloydii*, *Edwardsiidae*, *Pennatula phosphorea* and *Virgularia mirabilis*).
- Four taxa of Tunicata (*Asciadiacea*, *Ciona intestinalis*, *Corella parallelogramma*, and *Dendrodoa grossularia*).
- Two taxa of Pycnogonida (*Anoplodactylus petiolatus* and *Nymphon brevistre*).
- One taxa of the following taxa groups: Chaetognatha, Enteropneusta, Molgulidae, Nematoda, Nemertea, Owenia, Plyatyhelminthes, Phoronis Brachiostomatidae (*Branchiostoma lanceolatum*) and Foraminifera (*Astrorhiza*).

118. The absolute and proportional contributions of these five taxonomic groups to the overall community structure is summarised in Table 3.8 whilst biomass values by gross taxonomic groups are presented in Annex E: Benthic Infaunal Contribution of Biomass to Gross Taxonomic Groups.

**Table 3.8: Contribution of Gross Taxonomic Groups Recorded in the Infaunal Grab Samples**

Group	Individuals		Taxa	
	Abundance	Proportional Contribution %	Abundance	Proportional Contribution %
Annelida	3,392	37	178	38
Crustacea	1,215	13	136	30
Mollusca	1,850	20	90	20
Echinodermata	1,235	15	25	5
Others	1,401	15	32	7
<b>Total</b>	<b>9,093</b>	<b>100</b>	<b>461</b>	<b>100</b>

119. Across the Proposed Development benthic subtidal and intertidal ecology study area, the faunal communities were generally dominated by Annelida (n=3,392) and Mollusca (n=1,850) which contributed 37% and 20% of the total number of individuals respectively (Figure 3.10). Number of taxa were also dominated by Annelida; however, Crustacea provided a higher proportion of taxa than Mollusca, suggesting that the dominance of Mollusca individuals is provided by a small number of taxa. At individual sample stations, gross taxonomic group proportions reflected these results, however Annelida had a higher proportion, with Annelida making up the highest proportion of the taxa in 60% of sample stations and Mollusca making up the highest proportion of the taxa in 17% of sample stations. Annelida made up the highest proportion of individuals at 55 sample stations with proportion ranging from 27-73% of the total individuals. Mollusca made up the highest proportion of individuals at 16 sample stations with proportion ranging from 28-58% of the total individuals. Echinodermata made up the highest proportion of individuals at 15 sample stations with proportion ranging from 30-49% of the total individuals. Crustacea made up the highest proportion of individuals at seven sample stations with proportion ranging from 25-44% of the total individuals.

120. The biomass data did not reflect the dominance of Annelida with respect to the number of individuals and number of taxa, with Annelida providing the highest proportion of the biomass at only 18% of sample stations. Mollusca contributed the highest proportion of biomass at the greatest number of sample stations (n=41, 45%) with Echinodermata making up the highest proportion of biomass at the next highest number of sample stations (n=26, 28%). Mollusca contributed the highest proportion of the biomass at the sample

stations with the highest total biomass. This may a result of Mollusca and Echinodermata being able to grow to a larger body size than most Annelida therefore are likely to have a higher weight per individual. Several stations where Echinodermata made up the highest proportion of the biomass, sea urchins (e.g. *Echinocardium cordatum* and *Echinocyamus pusillus*) were recorded.

121. The most abundant individuals generally belonged to Mollusca and Annelida although the tunicate *D. grossularia* was overall the most abundant species with a total of 523 individuals recorded. However, all 523 individuals were recorded from a single station (ST83 outside the nearshore section of the Proposed Development benthic subtidal and intertidal ecology study area, Figure 3.4). The species with the second highest abundance was *S. spinulosa* with 456 individuals; 336 of those individuals were also recorded at ST83. ST83 also had a much higher abundance of the polychaete *Lumbrineris cingulata* compared with the rest of the sample stations. ST83 recorded the highest total number of individuals (1,296) across only 77 taxa. ST54 recorded the highest number of taxa (95) with the next highest being ST50 (92 taxa) and ST71 (85 taxa).

#### FFBC MPA

122. Sample stations within the FFBC MPA were dominated by a range of taxa from the main taxonomic groups. Annelida provided the highest proportion of taxa at eleven sample stations, Mollusca at four sample stations, Crustacea at six sample stations and Echinodermata at seven sample stations. Sample stations within the FFBC MPA contained high abundances of juvenile Amphiridae, as well as high abundances of juveniles *A. filiformis*, *E. pusillus*, *S. spinulosa*, *D. grossularia* and *Astrorhiza*. Sample stations within the FFBC MPA contained generally high numbers of individuals, with ST36 within the Scalp Bank and Wee Bankie section of the FFBC MPA containing 332 individuals however, ST07 in the section of the FFBC MPA overlapping with the east of the Proposed Development array area containing the lowest with 18 individuals.

#### Multivariate community analysis

123. The results of the cluster analyses, SIMPROF tests and SIMPER analyses were used, together with the raw untransformed infaunal data, to assign preliminary infaunal biotopes to each sample station. In several instances, clusters that were identified as significantly different from each other in the SIMPROF tests were assigned the same biotope code. This was based on a review of the SIMPER results which indicated that the differences between the groups could be explained by differences in abundances of characterising species rather than the presence/absence of key species.

124. The results of the hierarchical clusters analysis of the square root transformed infaunal dataset (including juveniles) together with the SIMPROF test identified 16 faunal groups that were statistically dissimilar, based on the SIMPROF test. Of these faunal groups, six contained only a single sample station (Figure 3.10). The 3D MDS plot is presented in Figure 3.11 and the low stress value (0.15) indicates that this is a good representation of the data. The 2D MDS plot has not been presented as the 3D MDS plot presents a clearer representation of the data. Faunal group A (SIMPROF a; ST108) showed clear clustering away from all the other faunal groups with a Bray-Curtis similarity of 36.62%. The other single sample faunal groups include B (ST83), G(ST90), H(ST94), I(ST44), L(ST07). Faunal group P (SIMPROF p) showed the lowest Bray-Curtis similarity of 27.74%, while faunal group C (SIMPROF c) showed the highest Bray-Curtis similarity (52.78%) of all Faunal groups that contained more than one sample station. Faunal groups M, N, O and P (SIMPROF m, n, o, p) showed clustering with more similarity to each other than to the other groups. Within this cluster, Faunal groups N and O showed the lowest Bray-Curtis dissimilarity (71.18%). Faunal groups J and K (SIMPROF j and k) also showed a higher similarity with each other than with the other Faunal groups with Bray-Curtis dissimilarity of 71.79%. Faunal groups C and D (SIMPROF c and d)





also showed a higher similarity with each other than with the other Faunal groups, with Bray-Curtis dissimilarity of 54.96%.

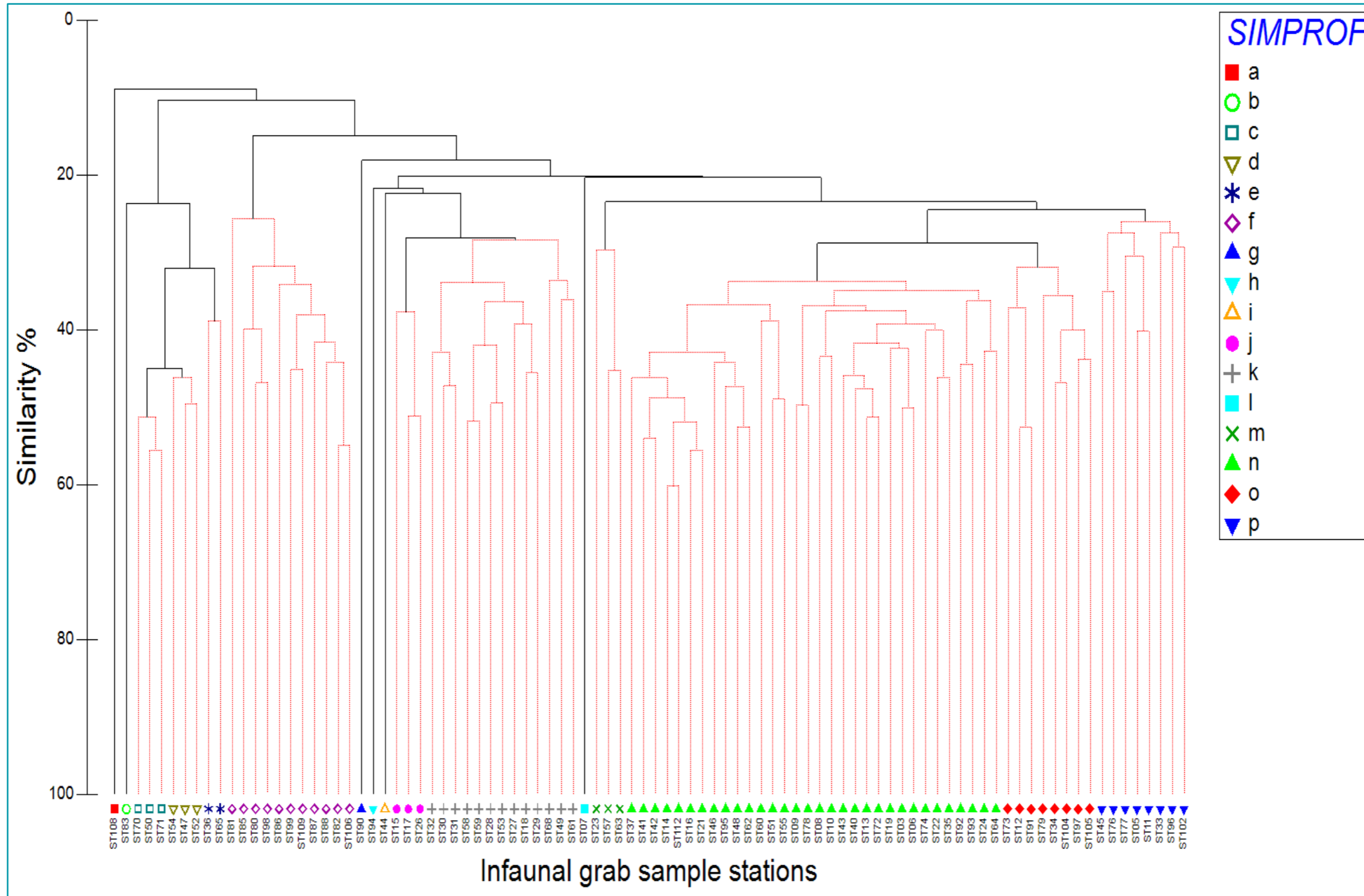


Figure 3.10: Dendrogram of Infaunal Communities from Benthic Grab Samples within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

125. Multivariate community analysis was also undertaken on the infaunal data excluding the juveniles to understand the impact of these largely ephemeral taxa. The results of the hierarchical clusters analysis of the square root transformed infaunal dataset together with the SIMPROF test identified 22 Faunal groups, six more than for the data including the juveniles. These Faunal groups are discussed in comparison to the Faunal groups for the infaunal dataset which included juveniles in the following paragraphs.
126. Faunal group C comprised three sample stations (ST50, ST70, ST71) located across the eastern and just outside the northern boundaries of the Proposed Development array area. Faunal group C was associated with sandy gravel and gravelly sand sediments. It was characterised by high abundances of Nematoda, the polychaetes *Syllis parapari*, *Glycera lapidum* and *Hydroides norvegica*, juvenile Mytilidae juveniles, *Nemertea* and the brittlestar *Amphipholis squamata*. All characterising species, with the exception of *A. squamata* were recorded in their highest abundance at a sample station within Faunal group C. It was distinct from the other Faunal groups due to the presence and abundance of the characterising species as well the absence of *Astrorhiza* and *L. cingulata* which separated it from Faunal group E as well as *B. crenatus* which separated it from Faunal group I. Faunal group C showed the highest Bray-Curtis dissimilarity with Faunal group F (95.97%) due to the presence of 12 species including the characterising species *Leptochiton*, the bivalve *Clausinella fasciata* and *U. marina* which were not present in Faunal group F. Faunal group C was allocated a preliminary biotope based on the infaunal data of SS.SMx.OMx.PoVen.
127. Faunal group D comprised three sample stations (ST47, ST52, ST54) located across the western section of the Proposed Development array area, within the FFBC MPA. Faunal group D was associated with sandy gravel sediments. It was characterised by high abundances of Nematoda, *Nemertea*, *A. squamata*, *Cheirocratus*, the amphipod *Nototropis vedlomensis*, juvenile Ophiuridae and juvenile Mytilidae and the polychaete *Psamathe fusca*. *Amphipholis squamata*, *Cheirocratus* and *N. vedlomensis* were recorded in their highest abundance in a sample station within Faunal group D. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well as the absence of *Astrorhiza* which distinguished it from Faunal group P, as well as *A. filiformis* which distinguished it from Faunal group O. Faunal group D showed the lowest Bray-Curtis dissimilarity with Faunal group C (54.96%). Faunal group D was allocated a preliminary biotope based on the infaunal data of SS.SMx.OMx.PoVen.
128. Faunal group E comprised two sample stations (ST36, ST65), one from outside the northern and one from outside the southern border of the western section of the Proposed Development array area. Faunal group E was associated with slightly gravelly sand and sandy gravel sediments. It was characterised by *Astrorhiza*, the polychaetes *S. spinulosa*, *Pholoe inornata*, *H. norvegica*, *L. cingulata*, *Scalibregma inflatum*, *Cirratulus cirratus* and *Nemertea*. The polychaetes *P. inornata* and *S. inflatum* were recorded in their highest abundance from sample stations within Faunal group E. It was distinct from the other Faunal groups due to the presence and abundance of the characterising species as well as the absence of *D. grossularia* which distinguished it from Faunal group B and *U. marina* which distinguished it from Faunal group H. Faunal group E was allocated a preliminary biotope based on the infaunal data of a non-reef forming version of SS.SBR.PoR.SspiMx.
129. Faunal group F comprised 11 sample stations (ST80, ST81, ST82, ST85, ST86, ST87, ST88, ST98, ST99, ST106, ST109) located at the inshore section and just outside of the Proposed Development export cable corridor. Faunal group F was associated with muddy sand and slightly gravelly muddy sand sediments. It was characterised by the bivalves *Thyasira flexuosa* and *Abra nitida*, the polychaetes *L. cingulata*, *Chaetozone* and *Glycera unicornis*, the amphipod *Harpinia antennaria*. *Thyasira flexuosa*, *H. antennaria* and *A. nitida* were recorded in their highest abundance from sample stations within Faunal group F. Notably, Norway lobster *Nephrops norvegicus* was also recorded at two stations within Faunal group F (ST81 and ST109). It was distinct from the other Faunal groups due to the presence and abundance of the characterising species as well as the absence of the polychaete *Paradoneis lyra*, which distinguished it from Faunal group P and the scaphopoda *Antalis entails*, which distinguished it from Faunal group O.
- Faunal group F was allocated a preliminary biotope based on the infaunal data of SS.SMu.CSaMu.ThyNten: *Thyasira* spp. and *Nuculoma tenuis* in circalittoral sandy mud.
130. Faunal group J comprised three sample stations (ST15, ST17, ST26) across the eastern section of the Proposed Development array area. Faunal group J was associated with slightly gravelly sand and gravelly sand sediments. It was characterised by *E. pusillus*, *O. borealis*, *A. pygmaea*, Nematoda, *G. lapidum* and *Nemertea*. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well the absence of the Decapoda *Galathea intermedia*, which distinguished it from Faunal group D and Mytilidae juveniles, which distinguished it from Faunal group C. Faunal group J showed lowest Bray-Curtis dissimilarity (71.79%) with Faunal group K with the top three species contributing 8.96% of dissimilarity due to the differing abundances of these species. Faunal group J was allocated a preliminary biotope based on the infaunal data of SS.SSa.CFiSa.EpusOborApri *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.
131. Faunal group K comprised 13 sample stations (ST18, ST27, ST28, ST29, ST30, ST31, ST32, ST49, ST53, ST58, ST59, ST61, ST68) across the north and outside of the Proposed Development array area. Faunal group K was associated with slightly gravelly sand, gravelly sand and sandy gravel sediments. It was characterised by *O. borealis*, *Abra* juveniles, *A. prismatica*, *E. pusillus*, *Thracioidea* juveniles and *Amphiuridae* juveniles. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well as the lack of *G. intermedia*, which distinguished it from Faunal group D and *Leptochiton*, which distinguished it from Faunal group C. Faunal group K showed the lowest dissimilarity (71.79%) with Faunal group J. Faunal group K was allocated a preliminary biotope based on the infaunal data of SS.SSa.CFiSa.EpusOborApri. Sample stations ST49 and ST68 were reclassified to SS.SMx.OMx. due to the sediment type present, the high proportion of polychaetes, and the low abundance of *E. pusillus* and *O. borealis*.
132. Faunal group M comprised three sample stations (ST23, ST57, ST63) from the north and outside of the Proposed Development array area. Faunal group M was associated with gravelly sand sediments. It was characterised by *Astrorhiza*, *P. lyra*, *S. spinulosa*, *Nothria*, *Ophiuridae* juveniles, *Polycirrus* and *Scoloplos armiger*. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well the absence of *Amphiuridae* juveniles, which distinguished it from Faunal group N, L and O. Faunal group M showed the least Bray-Curtis dissimilarity to Faunal group P with the top four species contributing 10.3% of dissimilarity due to the differing abundances of these species. Faunal group M was allocated a preliminary biotope based on the infaunal data of SS.SMx.OMx.PoVen.
133. Faunal group N comprised 32 sample stations (ST03, ST06, ST08, ST09, ST10, ST13, ST14, ST16, ST19, ST21, ST22, ST24, ST35, ST37, ST40, ST41, ST42, ST43, ST46, ST48, ST51, ST55, ST60, ST62, ST64, ST72, ST78, ST74, ST92, ST93, ST95, ST112) from across the south and outside of the eastern section of the Proposed Development array area and across the western section of the Proposed Development array area. Faunal group N was associated with gravelly sand, slightly gravelly sand and sandy gravel sediments. It was characterised by *Amphiuridae* juveniles, *A. filiformis*, *Spiophanes bombyx*, *Scoloplos armiger*, *Astrorhiza*, *Abra* juveniles, *Kurtiella bidentata* and *E. pusillus*. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well the absence of *H. norvegica*, which distinguished it from Faunal group E and *S. parapari*, which distinguished it from Faunal group C. Faunal group N showed the lowest Bray-Curtis dissimilarity (71.18%) with Faunal group O, with the top 16 species contributing 32.03% of dissimilarity due to the differing abundances of these species. Faunal group N was allocated a preliminary biotope based on the infaunal data of SS.SMu.CSaMu.AfilMysAnit: *Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud. The overall community reflected this biotope, and the biotope description contains the Faunal group characterising species *S. bombyx*, *S. armiger* or *E. pusillus* however the sediments were generally coarser than are described for this biotope. Sample station ST92 was reclassified as SS.SMx.OMx due to the sediments present. Sample stations ST62 and ST95 were reclassified to SS.SSa.CFiSa.ApriBatPo due to

- the characterising species at these sample stations. ST21 was reclassified to SS.SMx.CMx.MysThyMx due to the characterising species at this sample station.
134. Faunal group O comprised eight sample stations (ST12, ST34, ST91, ST73, ST79, ST97, ST104, ST105) from across the south of the Proposed Development array area and offshore section of the Proposed Development export cable corridor. Faunal group O was associated with slightly gravelly sand and muddy sand sediments. It was characterised by *A. filiformis*, Amphiuroidae juvenile, *T. flexuosa*, *Lagis koreni*, *S. bombyx* and *A. entails*. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well as the absence of *O. borealis* and *Thracioidea* juvenile which distinguished it from Faunal group K. Faunal group O showed the lowest dissimilarity (71.18%) with Faunal group N. Faunal group O was allocated a preliminary biotope based on the infaunal data of SS.SMu.CSaMu.AfilNten based on the community present, however *Nunculoma tenuis* was not recorded in Faunal group O therefore this group represented a species poor version of this habitat.
135. Faunal group P comprised eight sample stations (ST05, ST11, ST33, ST45, ST76, ST77, ST96, ST102) from across the south and outside of the Proposed Development array area and offshore section of the Proposed Development export cable corridor. Faunal group P was associated with slightly gravelly sand, gravelly sand and sandy gravel sediments. It was characterised by *Astrorhiza*, *E. pusillus*, Nemertea, Amphiuroidae juveniles, *P. lyra*, *S. bombyx* and the bivalve *Ennucula tenuis*. It was distinct from the other Faunal groups due to the presence and abundance of these characterising species as well the absence of *A. pygmaea*, which distinguished it from Faunal group J and *B. crenatus*, which distinguished it from Faunal group I. Faunal group P showed least Bray-Curtis dissimilarity (74.49%) with Faunal group N with the top nine species contributing to 19.06% of dissimilarity due to the differing abundances of these species. Faunal group P was allocated a preliminary biotope based on the infaunal data of SS.SSa.OSa: Offshore circalittoral Sand. ST05 was reclassified as SS.SSa.OSa [*Echinocyamus pusillus*]: *Echinocyamus pusillus* dominated offshore circalittoral sand due to the high proportion of *E. pusillus*. Sample station ST45 was reclassified to SS.SMx.OMx.PoVen due to the sediment type present, the high proportion of polychaetes. Sample stations ST76 and ST77 were reclassified as SS.SMx.OMx due to the sediments present.
136. Faunal group A (ST108), Faunal group B (ST83), Faunal group G (ST90), Faunal group H (ST94), Faunal group I (ST44), and Faunal group L (ST07) were represented by a single sample station each. Details of characterising species, sediment classification and geographic location are presented in Table 3.9. Faunal group A was allocated a preliminary biotopes based on the infaunal data of SS.SSa.IFiSa.NcirBat: *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand. This sample stations showed clear separation from the other sample stations within the MDS plot (Figure 3.11). Faunal group B was allocated a preliminary biotope based on the infaunal data of SS.SMx.OMx: Offshore circalittoral mixed sediments. Faunal group G was allocated a preliminary biotope based on the infaunal data of SS.SCS.CCS: Circalittoral coarse sediments. Faunal group H was allocated a preliminary biotope mosaic based on the infaunal data of SS.SMx.OMx.PoVen and SS.SSa.CFiSa.EpusOborApri, on the basis that it was located at the transition between two distinct areas of either biotope and contained the characterising taxa of both biotopes. Faunal group I was allocated a preliminary biotope based on the infaunal data of SS.SCS.CCS [*Balanus crenatus*]: *Balanus crenatus* dominated Circalittoral coarse sediments due to the sediment type and low number of taxa and individuals. Faunal group L was allocated a preliminary biotope based on the infaunal data of SS.SSa.OSa.
137. When the analysis was repeated without juveniles, some sample stations within Faunal groups were split across new Faunal groups (e.g. Faunal group N was mostly split over three faunal groups with ST09, ST24, ST78 grouped with ST33 (Faunal group P) with a higher degree of similarity to each other than with the other sample stations in Faunal group N). This highlighted the importance of juveniles in grouping samples stations within the Faunal groups. The statistical analysis grouped the sample stations differently however it did not result in any different biotopes being allocated.
138. The Faunal groups presented in the SIMPER analysis and the raw data were used to assign 15 preliminary biotopes within the Proposed Development benthic subtidal and intertidal ecology study area (Table 3.9; Figure 3.11). Although *S. spinulosa* was a characterising species at Faunal group E, no aggregations qualifying as a reef forming structure were recorded. The full Annex I reef assessment is presented in Annex B: Annex I Reef Assessments. Ocean quahog *A. islandica* was also recorded in the benthic grabs; details are presented in section 3.4.8. The full SIMPER analysis results are presented in Annex C: Benthic Infaunal Data Multivariate Analysis Results.
139. The east of the Proposed Development array area was dominated by SS.SMu.CSaMu.AfilMysAnit in the south and east and SS.SSa.CFiSa.EpusOborApri in the north. Small areas of SS.SSa.OSa and SS.SSa.OSa [*Echinocyamus pusillus*] were present in the south with small areas of SS.SMx.CMx.MysThysMx, SS.SMu.CSaMu.AfilNten and SS.SCS.CCS [*Balanus crenatus*] in the central section. The west of the Proposed Development array area was dominated by SS.SMu.CSaMu.AfilMysAnit in the south and SS.SMx.OMx.PoVen in the west and central sections. There were small areas of SS.SBR.PoR.SspiMx in the south, SS.SMx.OMx in the central section and SS.SMu.CSaMu.AfilNten in the south. The Proposed Development export cable corridor was dominated by SS.SMu.CSaMu.AfilMysAnit and SS.SSa.OSa near the Proposed Development array area (Figure 3.12).

#### FFBC MPA

140. The FFBC MPA overlaps with the western edge and south-east sections of the Proposed Development benthic subtidal and intertidal ecology study area. Preliminary infaunal biotopes recorded from within the section of the FFBC MPA overlapping with the east of the Proposed Development array area included: SS.SMu.CSaMu.AfilMysAnit, SS.SSa.CFiSa.EpusOborApri, SS.SSa.OSa and SS.SSa.OSa [*Echinocyamus pusillus*]. Preliminary infaunal biotopes recorded from within the section of the FFBC MPA overlapping with the west of the Proposed Development array area included: SS.SMx.OMx.PoVen, SS.SMu.CSaMu.AfilMysAnit, SS.SBR.PoR.SspiMx, SS.SSa.CFiSa.ApriBatPo, SS.SSa.OSa and SS.SSa.CFiSa.EpusOborApri (Figure 3.12).

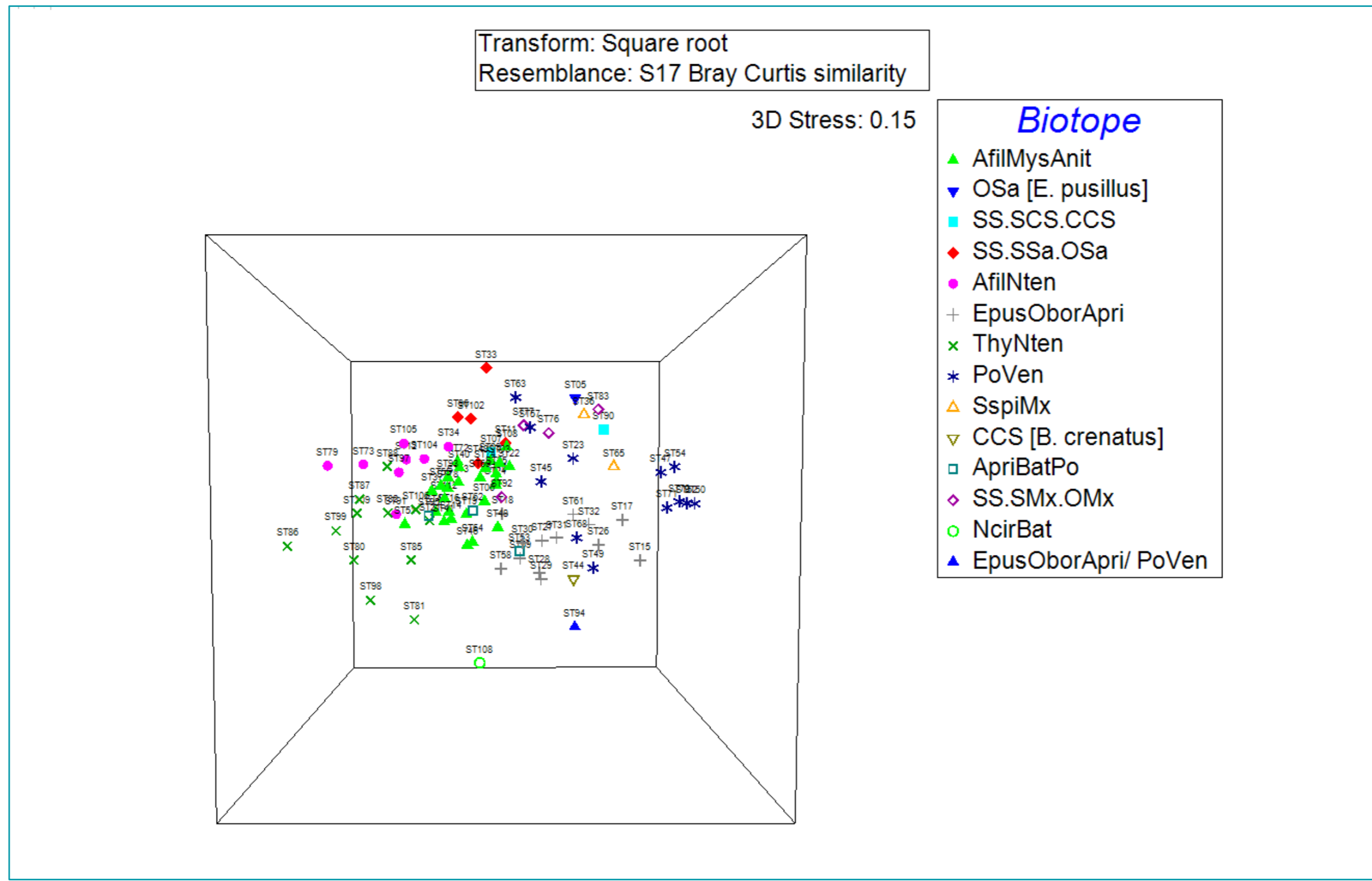


Figure 3.11: 3D MDS Plot of Infaunal Communities from Grab Samples (with biotope Groupings) within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

**Table 3.9: Infaunal Biotopes Identified from Grab Samples within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area**

Preliminary Infaunal Biotope	Grab Sample Station	Water Depth Range (m)	Sediment Classification	Characterising Species	Geographic Location	Sample Stations within the FFBC MPA
SS.SMx.OMx: Offshore mixed sediments.	ST49, SST68, ST83, ST76, ST77	35	Muddy Sandy Gravel	<i>Ampelisca</i> juveniles, <i>Ampelisca diadema</i> , <i>Dendrodoa grossularia</i> , <i>Dipolydora saintjosephi</i> , <i>Lumbrineris cingulata</i> , <i>Mediomastus fragilis</i> , Ophiuridae juveniles, <i>Pisidia longicornis</i> , <i>Sabellaria spinulosa</i>	Nearshore subtidal of the Proposed Development export cable corridor and the Proposed Development array area (south-west).	none
SS.SSa.IFiSa.NcirBat: <i>Nephtys cirrosa</i> and <i>Bathyporeia</i> spp. in infralittoral sand.	ST108	10	Sand	<i>Abra prismatica</i> , <i>Bathyporeia guilliamsoniana</i> , <i>Chamelea striatula</i> , <i>Fabulina fabula</i> , <i>Iphinoe trispinosa</i> , <i>Magelona johnstoni</i> , <i>Nephtys cirrosa</i> , <i>Tellimya ferruginosa</i>	Outside the nearshore Proposed Development export cable corridor.	none
SS.SBR.PoR.SspiMx: <i>Sabellaria spinulosa</i> on stable circalittoral mixed sediment.	ST36, ST65	48	Slightly Gravelly Sand	<i>Astrorhiza</i> , <i>Sabellaria spinulosa</i> , <i>Pholoe inornata</i> , <i>Hydroides norvegica</i> , <i>Lumbrineris cingulata</i> , <i>Scalibregma inflatum</i> , <i>Cirratulus cirratus</i> , Nemertea, <i>Amphipholis squamata</i> , <i>Dipolydora caulleryi</i> , <i>Eumida sanguinea</i> , <i>Galathowenia oculata</i> , <i>Hydroides</i>	Outside the Proposed Development array area (west)	ST36, ST65
SS.SMx.OMx.PoVen: Polychaete-rich deep Venus community in offshore mixed sediments.	ST50, ST70, ST71, ST45, ST47, ST52, ST54, ST53, ST57, ST63, ST23	38-70	Sandy Gravel, Gravelly Sand, Muddy Sand, Slightly Gravelly muddy sand	Nematoda, Nemertea <i>Syllis parapari</i> , Mytilidae juveniles, Nemertea, <i>Hydroides norvegica</i> , <i>Amphipholis squamata</i> , <i>Glycera lapidum</i> , <i>Gari</i> , <i>Leptochiton</i> , <i>Clausinella fasciata</i> , <i>Galathea intermedia</i> , <i>Verruca stroemia</i> , <i>Nephasoma (Nephasoma) minutum</i> , <i>Nototropis vedlomensis</i> , <i>Urothoe marina</i> , <i>Aonides paucibranchiata</i> , <i>Apherusa bispinosa</i> , <i>Laonice bahusiensis</i> , <i>Amphipholis squamata</i> , <i>Cheirocratus</i> , Ophiuridae juveniles, <i>Psamathe fusca</i> , <i>Clausinella fasciata</i> , <i>Verruca stroemia</i> , <i>Leiochone</i> , Ascidiacea, <i>Macrochaeta</i> , <i>Thracioidea</i> juveniles, <i>Paradoneis lyra</i> , <i>Sabellaria spinulosa</i> , <i>Nothria</i> , Ophiuridae juveniles, <i>Polycirrus</i> , <i>Scoloplos armiger</i>	Proposed Development array area (centre, north).	ST47, ST52, ST54, ST63, ST53
SS.SMx.OMx.PoVen/ SS.SSa.CFiSa.EpusOborApri	ST94	44	Sandy Gravel	<i>Abra prismatica</i> , Nemertea, <i>Urothoe marina</i>	Proposed Development array area (centre).	none
SS.SSa.CFiSa.EpusOborApri: <i>Echinocyamus pusillus</i> , <i>Ophelia borealis</i> and <i>Abra prismatica</i> in circalittoral fine sand.	ST15, ST17, ST26, ST18, ST28, ST27, ST29, ST30, ST31, ST32, ST58, ST59, ST61	45-56	Slightly Gravelly Sand, Gravelly Sand, Sandy Gravel	<i>Echinocyamus pusillus</i> , <i>Ophelia borealis</i> , <i>Asbjornsenia pygmaea</i> , Nematoda, <i>Glycera lapidum</i> , Nemertea, <i>Abra</i> juveniles, <i>Abra prismatica</i> , <i>Thracioidea</i> juveniles, Amphiuroidae juveniles	Proposed Development array area (centre, north).	ST53, ST61
SS.SCS.CCS: Circalittoral Coarse sediment	ST90,	52	Gravelly Sand	<i>Astrorhiza</i> , <i>Balanus crenatus</i> , <i>Echinocyamus pusillus</i> , <i>Verruca stroemia</i> ,	Proposed Development array area (centre, south).	ST90
SS.SCS.CCS [ <i>Balanus crenatus</i> ]: <i>Balanus crenatus</i> dominated Circalittoral coarse sediments	ST44	51	Slightly Gravelly Sand	<i>Anomiidae</i> juveniles, <i>Balanus crenatus</i> , <i>Hiatella arctica</i> , Mytilidae juveniles, <i>Ophelia borealis</i>	Proposed Development array area (centre)	none
SS.SMu.CSaMu.AfilMysAnit: <i>Amphiura filiformis</i> , <i>Mysella bidentata</i> and <i>Abra nitida</i> in circalittoral sandy mud	ST03, ST06, ST08, ST09, ST10, ST13, ST14, ST16, ST19, ST22, ST24, ST35, ST37, ST40, ST41, ST42, ST43, ST46, ST48, ST51, ST55, ST60, ST64, ST72, ST78, ST74, ST92, ST93, ST112	56	Gravelly Sand, Slightly Gravelly Sand, Sandy Gravel	<i>Amphiuridae</i> juveniles, <i>Amphiura filiformis</i> , <i>Spiophanes bombyx</i> , <i>Scoloplos armiger</i> , <i>Astrorhiza</i> , <i>Abra</i> juveniles, <i>Kurtiella bidentata</i> , <i>Echinocyamus pusillus</i>	Proposed Development array area (south, west).	ST03, ST06, ST08, ST09, ST10, ST13, ST14, ST48, ST55, ST62, ST64, ST72, ST93, ST95
SS.SMu.CSaMu.AfilNten: <i>Amphiura filiformis</i> and <i>Nuculoma tenuis</i> in circalittoral and offshore sandy mud	ST12, ST34, ST73, ST79, ST91, ST97, ST104, ST105,	55-60	Slightly Gravelly Sand, Muddy Sand	<i>Amphiura filiformis</i> , <i>Amphiuridae</i> juveniles, <i>Thyasira flexuosa</i> , <i>Lagis koreni</i> , <i>Spiophanes bombyx</i> , <i>Antalis entalis</i>	Proposed Development array area (south) and offshore section of the Proposed Development export cable corridor	ST12
SS.SMu.CSaMu.ThyNten: <i>Thyasira</i> spp. and <i>Nuculoma tenuis</i> in circalittoral sandy mud	ST80, ST81, ST82, ST85, ST86, ST87, ST88, ST98, ST99, ST106, ST109	53-70	Muddy Sand, Slightly Gravelly muddy sand	<i>Thyasira flexuosa</i> , <i>Abra nitida</i> , <i>Lumbrineris cingulate</i> , <i>Chaetozone</i> , <i>Harpinia antennaria</i> , <i>Glycera unicornis</i> , <i>Diplocirrus glaucus</i> , <i>Spiophanes bombyx</i>	Proposed Development export cable corridor	none
SS.SSa.CFiSa.ApriBatPo: <i>Abra prismatica</i> , <i>Bathyporeia elegans</i> and polychaetes in circalittoral fine sand	ST53, ST62, ST95	44-53	Slightly Gravelly Sand, Sandy Gravel	<i>Abra prismatica</i> , <i>Amphiuridae</i> juveniles, <i>Chamelea striatula</i> , <i>Phaxas pellucidus</i> , <i>Lagis koreni</i> , <i>Lumbrineris cingulate</i> , <i>Bathyporeia elegans</i>	Proposed Development array area (west).	ST95, ST53

Preliminary Infaunal Biotope	Grab Sample Station	Water Depth Range (m)	Sediment Classification	Characterising Species	Geographic Location	Sample Stations within the FFBC MPA
SS.SMx.CMx.MysThyMx: <i>Mysella bidentata</i> and <i>Thyasira</i> spp. in circalittoral muddy mixed sediment	ST21	60	Slightly Gravelly Sand	<i>Amphiuridae</i> , <i>Amphiura filiformis</i> , <i>Abra</i> juveniles, <i>Kurtiella bidentata</i> ,	Proposed Development array area (centre).	none
SS.SSa.OSa: Offshore Circalittoral Sand	ST05, ST07, ST11, ST33, ST96, ST102	43-56	Slightly Gravelly Sand, Gravelly Sand, Gravelly Sand, Sandy Gravel	<i>Astrorhiza</i> , <i>Echinocyamus pusillus</i> , <i>Nemertea</i> , <i>Amphiuridae</i> juveniles, <i>Paradoneis lyra</i> , <i>Spiophanes bombyx</i> , <i>Ennucula tenuis</i> , <i>Copepoda</i>	Proposed Development array area (south) and offshore section of the Proposed Development export cable corridor	ST07, ST11, ST33, STT96
SS.SSa.OSa [ <i>Echinocyamus pusillus</i> ]: <i>Echinocyamus pusillus</i> dominated offshore circalittoral sand	ST05	43	Slightly Gravelly Sand	<i>Echinocyamus pusillus</i> , <i>Astrorhiza</i> , <i>Nemertea</i> , <i>Phtisica marina</i>	Proposed Development array area (south).	ST05

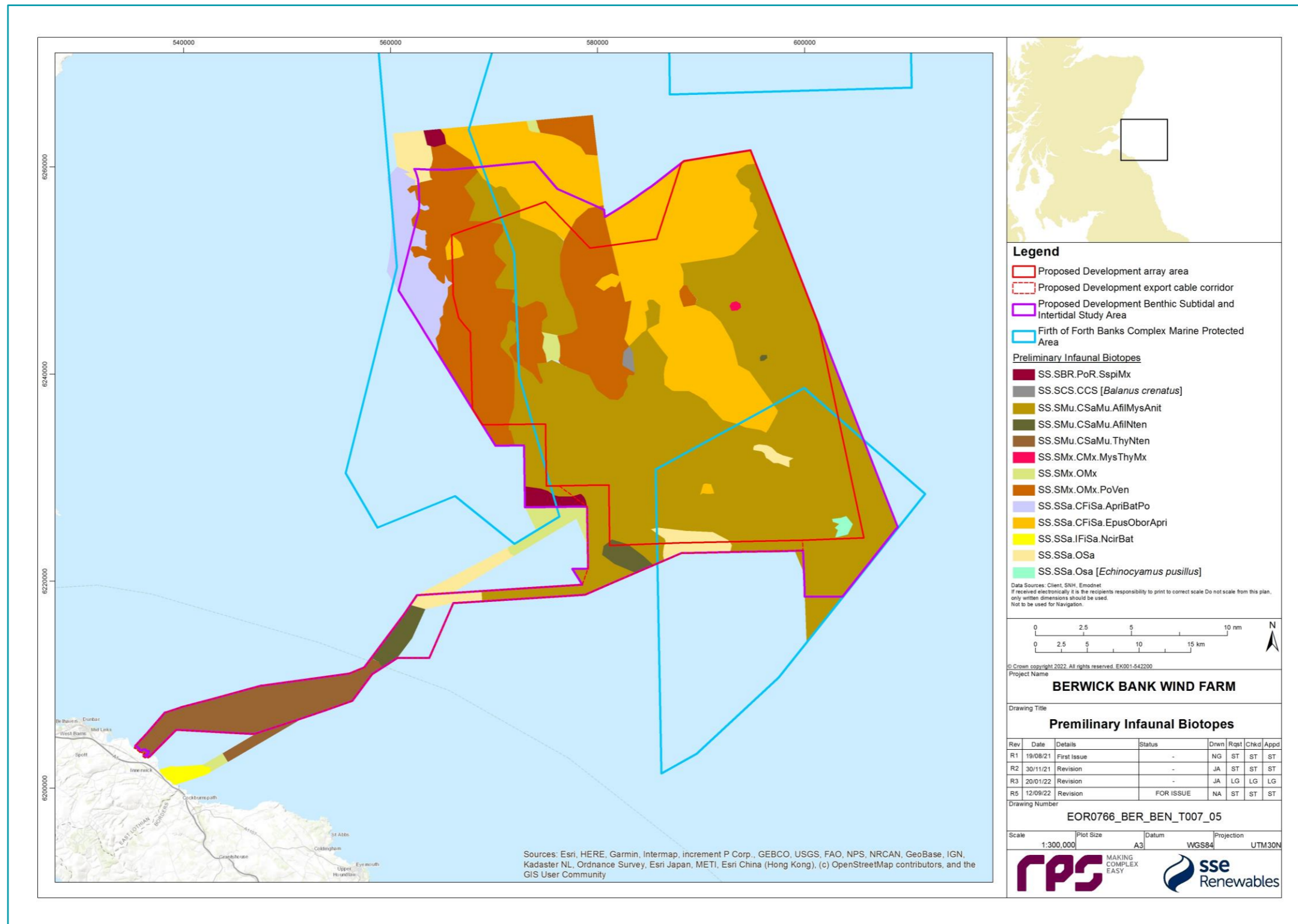


Figure 3.12: Preliminary Infaunal Biotopes Recorded from Grab Samples Across the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area



Univariate analysis

141. The following univariate statistics were calculated for each benthic infaunal grab sample station: number of species (S), abundance (N), ash free dry mass in grams (g), Margalef's index of Richness (d), Pielou's Evenness index (J'), Shannon-Wiener Diversity index (H') and Simpson's index of Dominance (λ). The mean of each of these indices was then calculated for each of the preliminary infaunal biotopes identified from the infaunal data and these are summarised in Table 3.10 with univariate statistics for individual sites presented in Annex D: Benthic Infaunal Data Univariate Analysis Results.
142. The univariate statistics indicate that the SS.SBR.PoR.SspiMx biotope, had the highest number of taxa (76± 11.31). The biotope SS.SSa.IFiSa.NcirBat, which was represented by one sample station had the lowest number of taxa (17). The highest mean number of individuals was recorded in SS.SMx.OMx (293.8± 560.31; Table 3.10); this was expected as it contained one of the highest number of taxa. The high number of individuals in this biotope was due to high abundances of *D. grossularia*, *L. cingulata* and *S. spinulosa* at ST83. The lowest mean number of individuals (39) was recorded in the SS.SSa.IFiSa.NcirBat biotope which is aligned with the low number of taxa recorded within this biotope.
143. The highest mean diversity score of all the identified communities was associated with the biotope SS.SBR.PoR.SspiMx (d = 13.50 ± 1.09 and H' = 3.72 ± 0.20) which was expected as this biotope had the highest number of taxa. The SS.SMx.OMx.PoVen biotopes had the next highest mean diversity score (d = 12.10 ± 3.10, H' = 3.70 ± 0.30). The lowest diversity recorded was associated with the SS.SSa.IFiSa.NcirBat biotope. This was expected as this biotope had the lowest number of taxa and individuals. The SS.SSa.IFiSa.NcirBat biotope was recorded at one of the most inshore samples within the Proposed Development benthic subtidal and intertidal ecology study area and as such was likely to have been exposed to greater disturbance from wave action than those communities in the deeper waters, potentially explaining the reduced diversity in these communities. This biotope is known to have considerably reduced faunal diversity compared to less disturbed biotopes (JNCC, 2021). Overall, the coarse and mixed sediment habitats had higher diversity than the sandy sediment habitats; this was expected due to the greater habitat complexity of coarse sediments supporting a higher number of species.
144. Pielou's evenness scores (J') and the Simpson's index of Dominance (λ) scores varied across the biotopes. Values of J' were highest for SS.SMu.CSaMu.ThyNten, SS.SSa.Osa, SS.SMx.OMx.PoVen, SS.SSa.IFiSa.NcirBat (J' = 0.91). This indicated an even distribution of abundances among taxa and that these biotopes were not dominated by a high number of individuals within a small number of species. Values of J' were lowest at SS.SCS.CCS [*Balanus crenatus*] which indicated that this biotope was more dominated by a high number of individuals within a small number of taxa than the other biotopes (e.g. *S. spinulosa*). The biotopes SS.SBR.PoR.SspiMx and SS.SMx.OMx.PoVen and SS.SCS.CCS had slightly lower values for λ compared with the other biotopes. This indicated that these biotopes were not dominated by a small number of species.

**Table 3.10: Mean (± Standard Deviation) Univariate Statistics for the Preliminary Infaunal Benthic Biotopes**

Biotope	S	N	Biomass (g)	d	J'	H'	λ
SS.SBR.PoR.SspiMx	76± 11.31	262± 98.99	11.32± 13.70	13.50± 1.09	0.86± 0.07	3.72± 0.20	0.01± 0.0003
SS.SCS.CCS	45	113	0.63	9.30	0.84	3.20	0.029
SS.SCS.CCS [ <i>Balanus crenatus</i> ]	52	208	2.00	9.55	0.63	2.51	0.03
SS.SMu.CSaMu.AfilMysAnit	30.20± 8.88	64.27± 23.00	2.49± 2.04	7.01± 1.61	0.90± 0.03	3.04± 0.26	0.04± 0.01

Biotope	S	N	Biomass (g)	d	J'	H'	λ
SS.SMu.CSaMu.AfilNten	26.12± 9.52	57.5± 35.40	3.46± 5.53	6.25± 1.61	0.87± 0.06	2.8± 0.29	0.05± 0.01
SS.SMu.CSaMu.ThyNten	23.72± 7.72	44.63± 18.77	1.91± 1.37	5.9 ± 1.38	0.91± 0.02	2.85± 0.27	0.05± 0.01
SS.SMx.CMx.MysThyMx	26	70	2.56	5.88	0.85	2.79	0.04
SS.SSa.Osa	26.6± 13.37	47.8± 29.81	8.40± 17.53	6.56± 2.48	0.91± 0.02	2.88± 0.47	0.05± 0.02
SS.SSa.Osa [ <i>Echinocyamus pusillus</i> ]	26	68	2.54	5.92	0.73	2.38	0.05
SS.SMx.OMx	39.4± 21.7	293.8± 560.31	6.06± 5.53	8.27± 1.67	0.86± 0.20	3.00± 0.52	0.03± 0.006
SS.SMx.OMx.PoVen	63.8± 25.01	204.2± 168.02	10.08± 14.33	12.10± 3.10	0.91± 0.03	3.70± 0.30	0.02± 0.007
SS.SSa.CFiSa.ApriBatPo	37± 9	95± 16.82	8.65± 3.12	7.89± 1.76	0.88± 0.04	3.06± 0.31	0.03± 0.008
SS.SSa.CFiSa.EpusOborApri	34.53± 12.07	87.07± 44.90	22.88± 52.25	7.53± 1.97	0.88± 0.04	3.06± 0.31	0.03± 0.01
SS.SMx.OMx.PoVen/ SS.SSa.CFiSa.EpusOborApri	31	66	5.00	7.16	0.88	3.02	0.03
SS.SSa.IFiSa.NcirBat	17	39	17.72	4.36	0.91	2.59	0.06

145. Figure 3.13 to Figure 3.15 show the mean number of taxa, individuals and biomass for each of the major faunal groups (i.e. Annelida, Crustacea, Mollusca, Echinodermata and Other) in each of the biotopes identified, within the Proposed Development benthic subtidal and intertidal ecology study area, from the benthic infaunal grabs. The biotope SS.SMx.OMx contained the highest number of individuals, which is aligned with the univariate statistics in Figure 3.10 for the single station represented by this biotope. The high number of individuals in the SS.SMx.OMx biotope were dominated by Annelida and Other taxa, as mentioned before this was due to the high abundances of *D. grossularia*, *L. cingulata* and *S. spinulosa*. The biotopes SS.SBR.PoR.SspiMx, SS.SCS.CCS [*Balanus crenatus*], SS.SCS.CCS and SS.SMx.OMx.PoVen also had high numbers of individuals. Soft sediment habitats: SS.SMu.CSaMu.AfilMysAnit, SS.SMu.CSaMu.AfilNten, SS.SMu.CSaMu.ThyNten and SS.SSa.IFiSa.NcirBat generally showed low numbers of individuals. Crustacea and Annelida made up a high percentage of the individuals in each biotope. Other taxa were generally poorly represented across all biotopes, making up the smallest proportion of individuals in each biotope with the exception of SS.SMx.OMx.PoVen and SS.SMx.OMx.
146. As shown in Figure 3.14, the proportions of the number of taxa in each major taxonomic groups are similar across the biotopes, with Crustacea and Annelida making up the highest proportion of the taxa present in each biotope. All major taxonomic groups were represented in all biotopes. The dominance of Crustacea in the number of taxa in each biotope is greater than the dominance of Crustacea in the number of individuals for all biotopes, highlighting that each of the Crustacea taxa are represented by a small number of individuals.
147. Biomass was highest at the biotopes SS.SSa.CFiSa.EpusOborApri and SS.SSa.IFiSa.NcirBat which were dominated by Mollusca and Echinodermata respectively. This may be due to the high abundance of the mollusc *A. prismatica* in SS.SSa.CFiSa.EpusOborApri and the presence of a single adult specimen of *E. cordatum* in SS.SSa.IFiSa.NcirBat. Annelida made up a small proportion of the total biomass in each biotope, which is expected due to the small size of Annelida. Biomass per taxonomic group for each sample station is presented in Annex E: Benthic Infaunal Contribution of Biomass to Gross Taxonomic Groups.

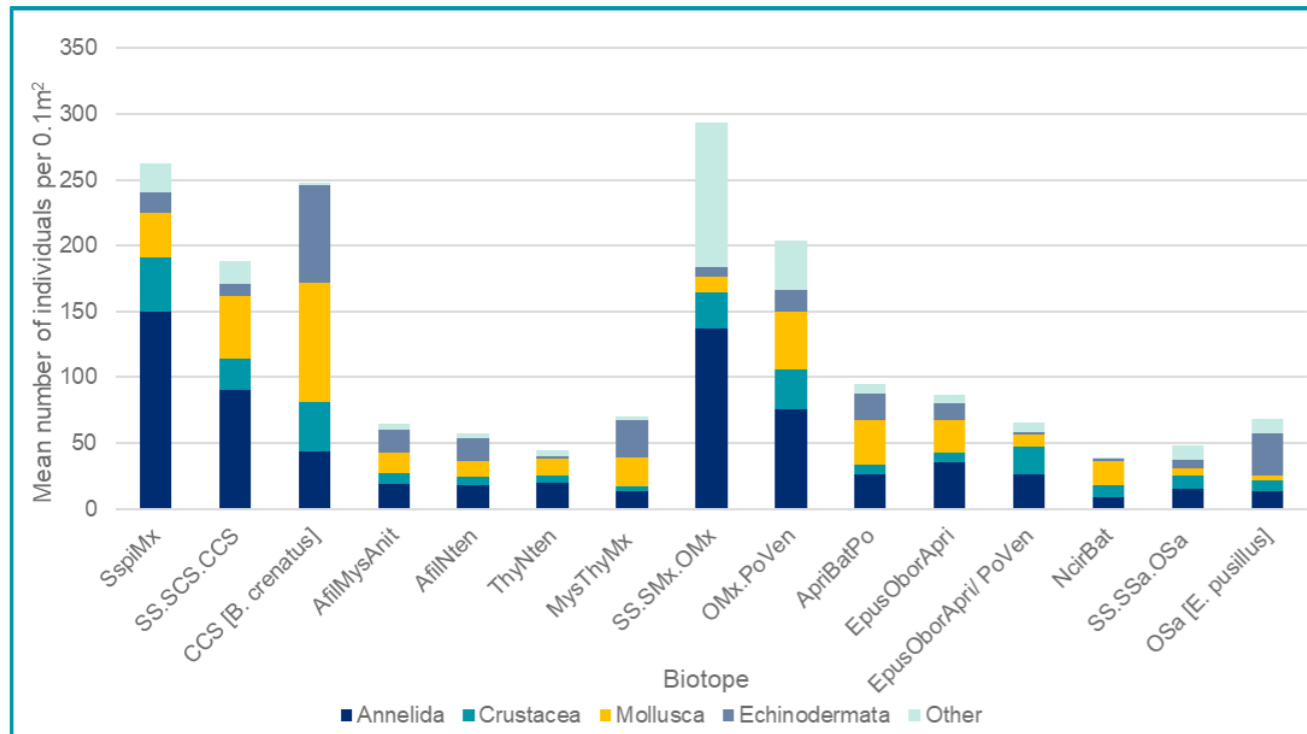


Figure 3.13: Mean Abundance of Individuals (per 0.1 m²) per Taxonomic Group for Each Infaunal Biotope

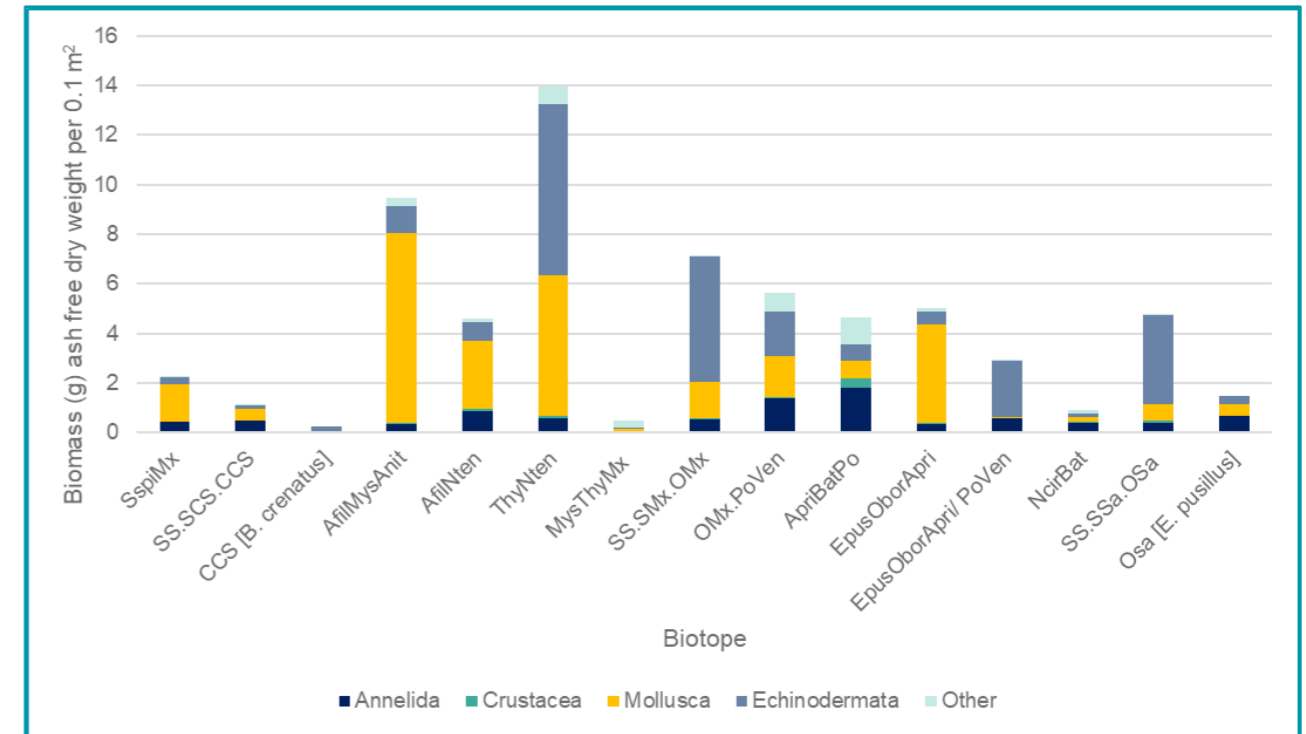


Figure 3.15: Mean Biomass (per 0.1 m²) per Taxonomic Group for each Infaunal Biotope

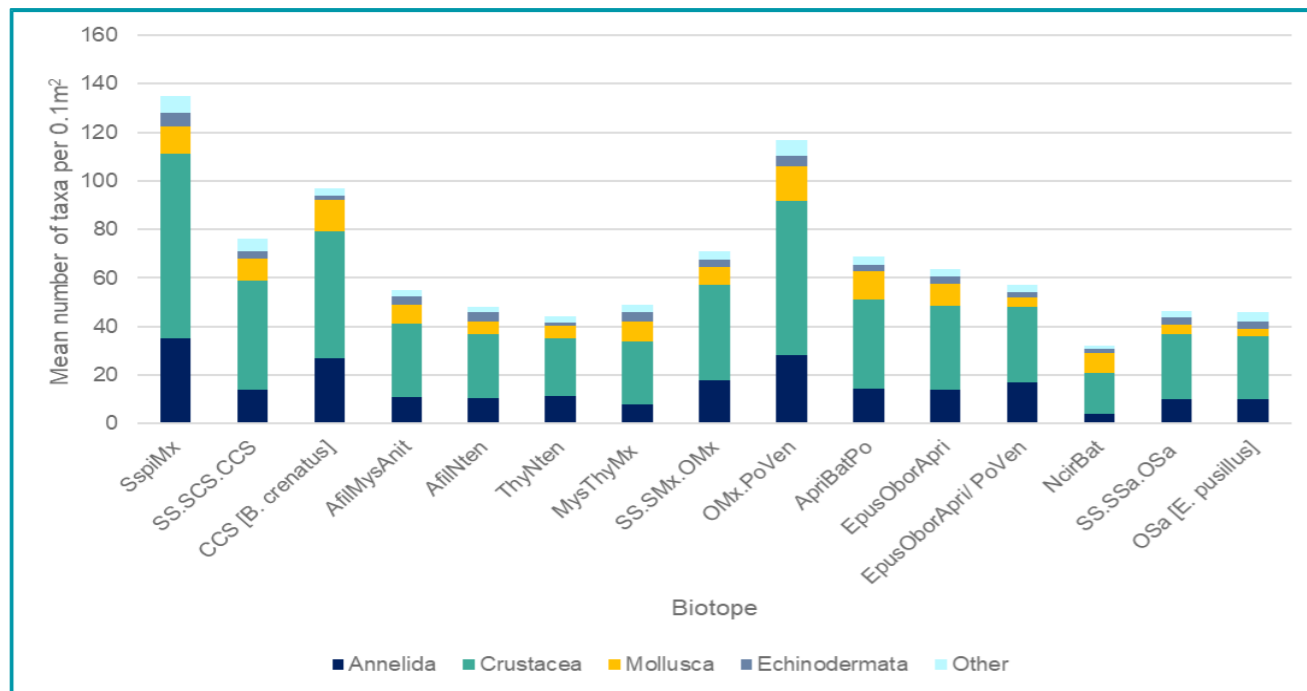


Figure 3.14: Mean Number of Taxa (per 0.1 m²) per Taxonomic Group Identified for Each Infaunal Biotope

### 3.4.6. RESULTS - EPIFAUNAL ANALYSIS

#### Seabed imagery

148. The sediments recorded in the seabed imagery largely comprised of subtidal coarse sediments, especially at the offshore sample stations within the Proposed Development array area. Softer sediments (i.e. sands and muds) were more common across the Proposed Development export cable corridor, although circalittoral rock and subtidal coarse sediments were recorded at some of the furthest inshore sample stations. In general, high numbers of epifaunal species were recorded in association with the coarser sediments (coarse and mixed sediments). Epifaunal species recorded were dominated by Crustaceans and Cnidarians with low numbers of Molluscs and Polychaetes, however this may be due to the nature of video sampling, as most polychaetes are infaunal species therefore would not be visible to DDV sampling. The bryozoan *F. foliacea* was among the most abundant species and was associated with every sediment type with the exception of mud sediments (**Error! Reference source not found.**).
149. Sample stations with rock substrate were associated with the presence of the hydroid *Nemertesia ramosa*, the squat lobster *M. rugosa*, the common star fish *A. rubens* and the sea urchin *Echinus esculentus*. Samples with coarse and mixed sediments were associated with the presence of dead man's fingers *Alcyonium digitatum*, acorn barnacles *Semibalanus balanoides*, *A. rubens* and the polychaete *Spirobranchus* sp. Sand sediments were associated with the presence of dead man's fingers and polychaete tube worms. Mud sediments were associated with the presence of the seapens *P. phosphorea* and *V. mirabilis*, as well as the gastropod *Turritella* sp. Taxa that were recorded at a single station included true crabs *Goneplax rhomboides* (ST99) and *N. puber* (ST107; Figure 3.17), sea star *Crossaster papposus* (ST50) and brittlestar *Ophiura albida* (ST96).



Figure 3.16: *Flustra foliacea* on Mixed Sediments at ST01

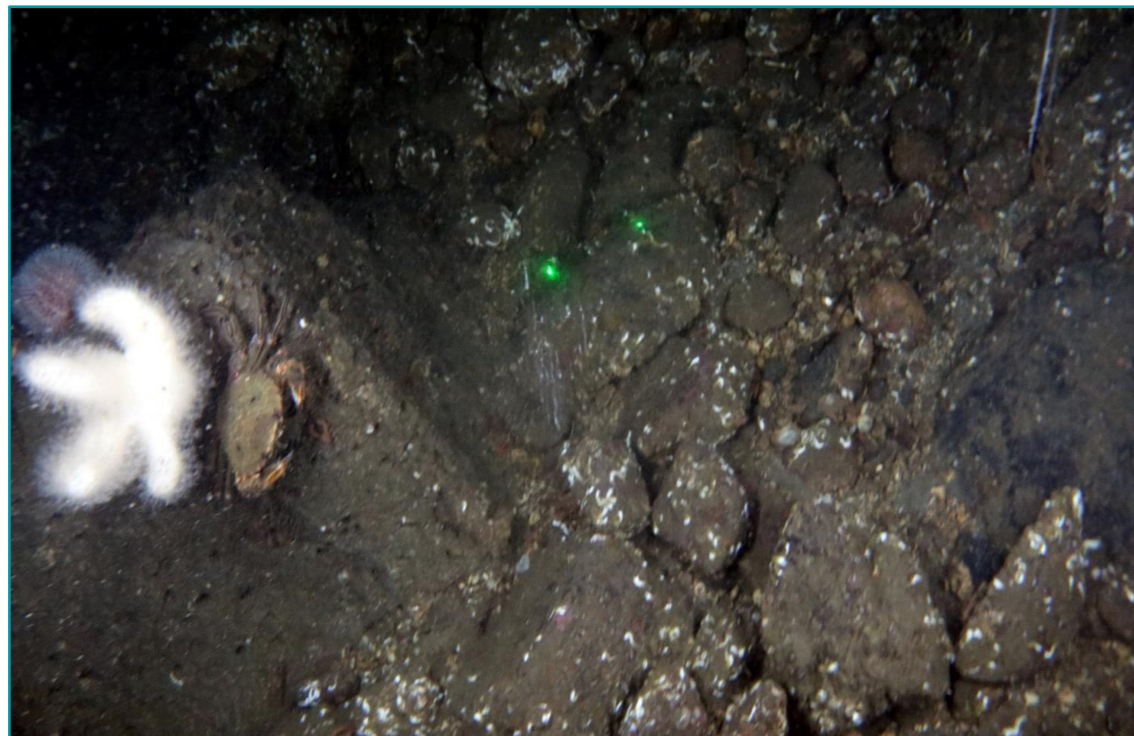


Figure 3.17: *Necora puber*, *Alcyonium digitatum* and *Echinus esculentus* on Coarse Sediments at ST107

#### Summary statistics

150. The epifaunal data that were recorded as present/absent, and therefore removed from the infaunal grab data analysis, were combined with the epifaunal data from the DDV. A total of 147 taxa and 10 categories of burrows and waste casts were recorded from the 112 infaunal grabs and DDV within the Proposed Development benthic subtidal and intertidal ecology study area. Of the total 147 taxa, none were recorded across all sample stations however *F. foliacea* was recorded at 74 (50%) sample stations and faunal turf was recorded at 89 (60%) sample stations. Tube worms were also relatively common, with 73 sample stations recording *S. spinulosa* and/or *Spirobranchus* sp. A total of 72 taxa were recorded at only one sample station, these were distributed across the Proposed Development benthic subtidal and intertidal ecology study area. Sample station ST90 recorded the highest number of epifaunal taxa, with ST20 recording the highest number of burrows and waste casts. The majority of the burrows recorded were 6 - 9 cm and from sample stations within the Proposed Development export cable corridor.

#### Multivariate Community Analysis

151. The results of the cluster analysis, SIMPROF test and SIMPER analysis were used, together with the raw untransformed data, to assign preliminary epifaunal biotopes to sample stations based on the dataset which combined the DDV data and the epibenthic component of the grabs. In several instances, clusters that were identified as significantly different from each other in the SIMPROF tests were assigned the same biotope code. This was based on a review of the SIMPER results which indicated that the differences between the groups could be explained by differences in abundances of characterising species rather than the presence/absence of key species. Full results of the multivariate analysis are presented in Annex F: Benthic Grab and DDV Epifaunal Data Multivariate Analysis Results.
152. The results of the hierarchical cluster analysis of the square root transformed epifaunal dataset together with the SIMPROF test identified 13 Faunal groups that were statistically dissimilar, based on the SIMPROF test (Figure 3.18). The 3D MDS plot is presented in Figure 3.19 and the low stress value (0.13) indicates that this is a good representation of the data. The 2D MDS plot has not been presented as the 3D MDS plot presents a clearer representation of the data. Faunal groups E, G, H and M contained the majority of the sample stations, with the other faunal groups represented by a few or a single sample station.
153. Faunal group A (ST29) showed distinct clustering away from the other Faunal groups. Faunal groups I, J, K, L and M showed a higher degree of similarity with each other than they do to the other Faunal groups. Faunal groups I (ST21), J (ST108), K (ST16) and L (ST73) were all single sample station Faunal groups and Faunal group M contained 17 sample stations, mainly from within the Proposed Development export cable corridor. Faunal group D showed tight clustering with a Bray-Curtis similarity of 60.44%. Faunal group H contained the highest number of sample stations (51) with Bray-Curtis similarity of 40.67%. Multivariate analysis was also run on the epifaunal data without the burrows and waste casts to determine the influence of these categories. The SIMPROF test identified 16 Faunal groups that were statistically dissimilar. The difference in Faunal groups is discussed in the following paragraphs.
154. Faunal group E (ST01, ST02, ST04, ST20, ST33, ST34, ST38, ST39, ST40, ST45, ST56, ST65, ST67, ST69, ST75, ST100, ST101, ST103, ST110) comprised sample stations located across the centre of the Proposed Development benthic subtidal and intertidal ecology study area and was associated with mixed sediments (gravelly sand, slightly gravelly sand and sandy gravel). Characterising taxa included faunal turf, *Spirobranchus* sp., *F. foliacea* and branching hydroids. Faunal group E showed high Bray-Curtis dissimilarity with Faunal group M (94.86%). Faunal group M did not record *Spirobranchus* sp., *F. foliacea* or branching hydroids which were present in Faunal group E. Faunal group E showed low Bray-Curtis dissimilarity with Faunal groups G (67.70%) and Faunal group H (67.55%). Faunal group E did not record *Follicundidae*, *Escharella ventricose*, *Escharella immersa* or *Phoronis ovalis* which were present in Faunal



group G. Faunal group E recorded higher abundances of *Spirobranchus* sp., branching hydroids and acorn barnacles than were recorded in Faunal group H. Faunal group E was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SCS.CCS.

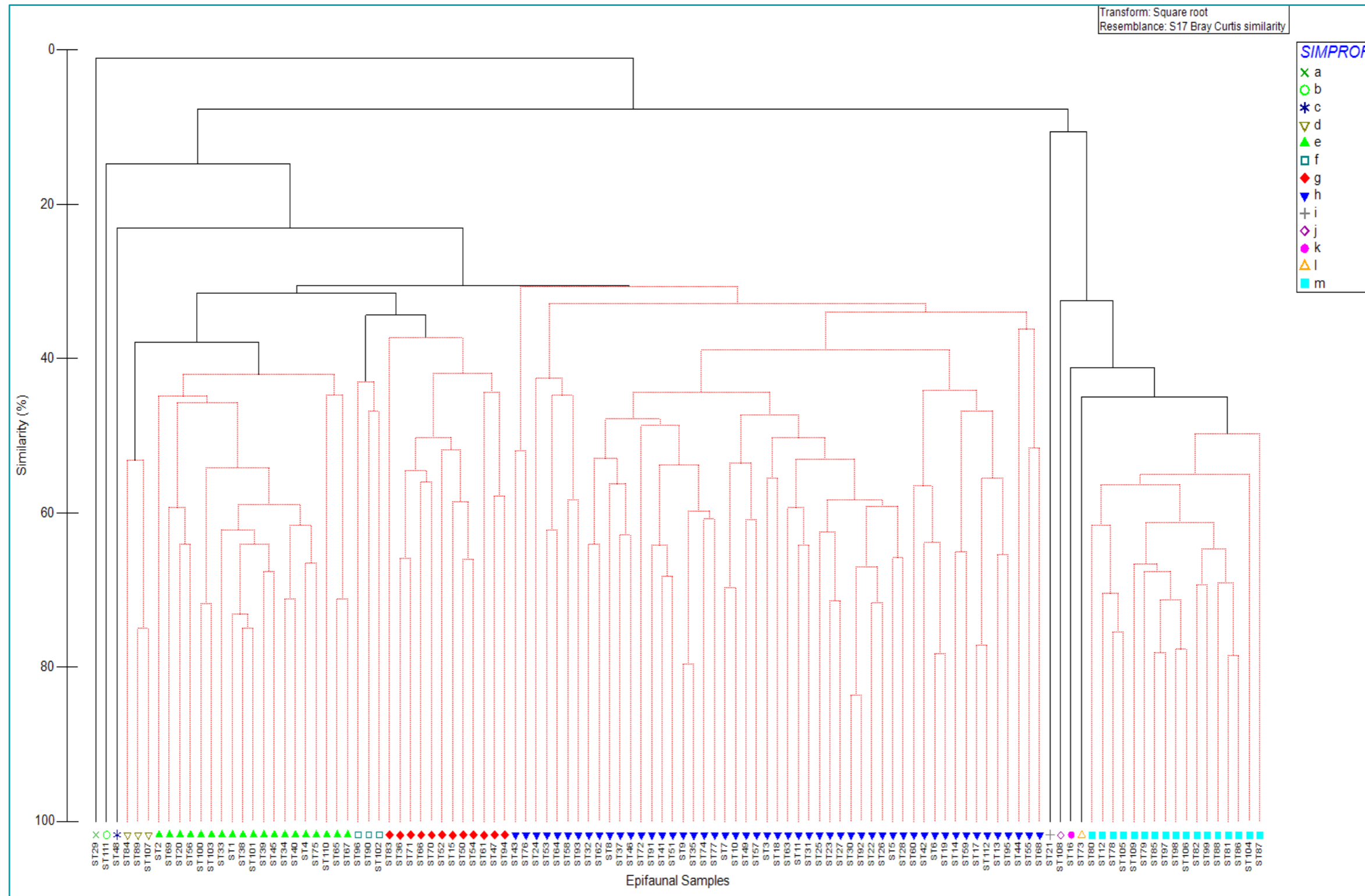


Figure 3.18: Dendrogram of Epifaunal Communities within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

155. Faunal group G (ST15, ST36, ST47, ST50, ST52, ST54, ST61, ST66, ST70, ST71, ST83, ST94) comprised sample stations located across the Proposed Development benthic subtidal and intertidal ecology study area and was associated with gravelly sand, sandy gravel and muddy sandy gravel sediments. Characterising taxa included the polychaete *Spirobranchus* sp., the anthozoan *A. digitatum*, the bryozoans *F. foliacea*, *Escharella ventricosa*, *Escharella immersa*, *Alcyonidium parasiticum*, and *Amphiblestrum auritum*, the hydrozoa *Sertulariidae*, the heterotrichida *Folliculinidae*, *Phoronis ovalis*, the echinoderm *A. rubens*, branching hydroids, faunal turf and Porifera. Faunal group G showed high Bray-Curtis dissimilarity with Faunal group M (96.98%) due to the presence of *Spirobranchus* sp., *A. digitatum*, *F. foliacea*, *Folliculinidae* and *E. ventricosa* in Faunal group M which were absent from Faunal group G. Faunal group G showed the lowest Bray-Curtis dissimilarity with Faunal group F (65.61%) as both Faunal groups recorded *T. thuja*, *F. foliacea*, *Folliculinidae* and bushy hydroids. Faunal group G was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SCS.CCS.
156. Faunal group H (ST03, ST05, ST06, ST07, ST08, ST09, ST10, ST11, ST13, ST14, ST17, ST18, ST19, ST22, ST23, ST24, ST25, ST26, ST27, ST28, ST30, ST31, ST32, ST35, ST37, ST41, ST42, ST43, ST44, ST46, ST49, ST51, ST53, ST55, ST57, ST58, ST59, ST60, ST62, ST63, ST64, ST68, ST72, ST74, ST76, ST77, ST91, ST92, ST93, ST95, ST112) comprised sample stations located across the Proposed Development benthic subtidal and intertidal ecology study area and was associated with mixed sediments (gravelly sand, slightly gravelly sand and sandy gravel). Characterising taxa included faunal turf, *Folliculinidae*, *F. foliacea* and *A. digitatum* with faunal turf and *Folliculinidae* making up nearly 50% of the Bray-Curtis similarity within this group. Faunal group H showed high Bray-Curtis dissimilarity with Faunal group M (90.82%) due to the absence of *Folliculinidae* and *F. foliacea* in Faunal group M but presence in Faunal group M. In addition, 1 cm and 2 cm burrows were recorded in higher abundances in Faunal group M compared to Faunal group H. Faunal group H showed the lowest Bray-Curtis dissimilarity with Faunal group E (67.55%) as both Faunal groups recorded *Spirobranchus* sp., *A. digitatum*, *Balanomorpha*, *Sertulariidae*, *M. rugosa* and branching hydroids. Faunal group H was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SCS.CCS.
157. Faunal group F (ST96, ST90, ST102) comprised sample stations located from the south of the eastern section of the Proposed Development array area and was associated with gravelly sand sediments. Characterising taxa included *A. parasiticum*, *A. digitatum*, branching hydroids, bushy hydroids, faunal turf and the hydrozoa *Thuiaria thuja*. Faunal group F showed high Bray-Curtis dissimilarity with Faunal group M (92.60%) due to the presence of *A. parasiticum*, *A. digitatum*, branching hydroids and bushy hydroids in Faunal group F that were absent from Faunal group M. Faunal group F showed the lowest Bray-Curtis dissimilarity with Faunal group E (65.59%) as both Faunal groups recorded *A. parasiticum*, *T. thuja*, *F. foliacea*, *A. digitatum*, *Ophiothrix fragilis/Ophiocolina nigra* and bushy hydroids. Faunal group F was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SCS.CCS. A review of the results of the SIMPER analysis showed that Faunal groups E, F, G and H were only distinct from each other due to differing abundances of similar characterising species (faunal turf, *A. digitatum*, *F. foliacea* and branching hydroids) rather than the presence/absence of key species.
158. Faunal group M (ST12, ST78, ST79, ST80, ST81, ST82, ST85, ST86, ST87, ST88, ST97, ST98, ST99, ST104, ST105, ST106, ST109) comprised sample stations located within the Proposed Development export cable corridor and was associated with muddy sand. Characterising features included burrows of 1-5 cm with burrows of 1 cm providing 42.06% of similarity between sample stations in Faunal group M. Several of the sample stations within Faunal group M recorded the seapens *P. phosphorea* and *V. mirabilis*. Faunal group M showed high Bray-Curtis dissimilarity with Faunal group G, as discussed above for Faunal group G. Faunal group M recorded lower Bray-Curtis dissimilarity with Faunal group H as they both contained the 1 cm and 2 cm burrows as characterising features. When the multivariate analysis was repeated without the burrows data, Faunal group M was split among the Faunal groups, however ST79, ST81, ST82, ST85, ST88, ST97, ST98, ST99, ST104, ST106, ST109 remained grouped together as one Faunal group. Faunal group M was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SMu.CFiMu.SpMmeg. ST12 had a lower number of burrows and did not recorded and seapens therefore was allocated a separate biotope of SS.SSa.CMuSa. The sample stations within this Faunal Group are clearly shown in the MDS plot (Figure 3.19) as clustering away from the other Faunal groups.
159. Faunal group D (ST84, ST89, ST107) comprised sample stations located within and outside the Proposed Development export cable corridor and was associated with moderate energy infralittoral rock. Characterising taxa included encrusting orange sponges, encrusting red calcareous algae, encrusting yellow sponges and faunal turf. Faunal group D showed high Bray-Curtis dissimilarity with Faunal group M (95.39%) due to the absence of Faunal group D's characterising species in this Faunal group as well as the absence of 1 cm burrows which were recorded in Faunal group M. Both Faunal groups recorded faunal turf, *M. rugosa* and prawns/shrimps/mysids. Faunal group D showed the lowest Bray-Curtis dissimilarity with Faunal group E (62.15%) as both Faunal groups recorded *M. rugosa*, *A. digitatum*, *Sertularidae*, *Balanomorpha*, branching hydroids and erect hydroids. When the multivariate analysis was run without the burrows data, ST84 was its own Faunal group separate from the other stations within Faunal group D, highlighting the importance of the burrows in grouping these sample stations. Faunal group D was allocated a preliminary biotope based on the epifaunal DDV and grab data of: CR.MCR.EcCr. The sample stations within this Faunal Group are clearly shown in the MDS plot (Figure 3.19) as clustering together with the closest similarity with the sample stations classified as SS.CSS.CCS; a similar hard substrate habitat.
160. Faunal group A (ST29), Faunal group B (ST111), Faunal group C (ST48), Faunal group I (ST21), Faunal group J (ST108), Faunal group K (ST16) and Faunal group L (ST73) were each represented by a single sample station. Faunal group A was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SSa.OSa: Offshore circalittoral sand. This sample station is clearly shown in the MDS plot (Figure 3.19) as clustering away from the other sample stations. Faunal group C was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SCS.CCS: Circalittoral coarse sediment. Faunal group I, Faunal group K and Faunal group L were allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SSa.CMuSa. Faunal group J was allocated a preliminary biotope based on the epifaunal DDV and grab data of SS.SSa.CFiSa. This sample station is clearly shown in the MDS plot (Figure 3.19) as clustering away from most of the other sample stations with the closest similarity to sample stations classified as SS.SSa.CMuSa; a similar fine soft sediment habitat.

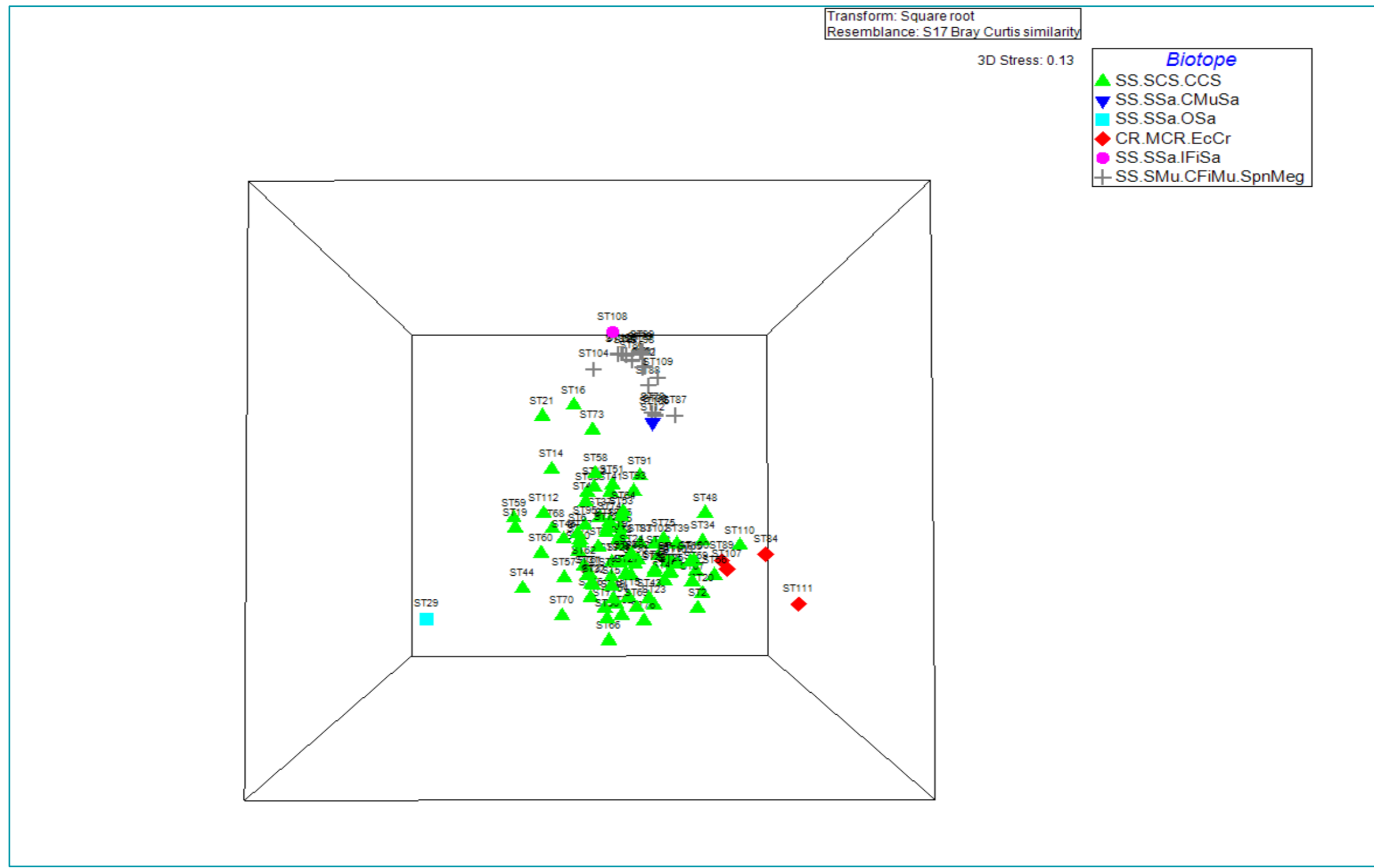


Figure 3.19: 3D MDS Plot of Epifaunal Communities from Grab Samples (with biotope Groupings) within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

161. Multivariate analysis was also run separately on the epifaunal data recorded as percentage cover. The SIMPROF test identified 20 Faunal groups that were statistically dissimilar (Figure 3.20). The majority of the sample stations were placed in one Faunal group by the percentage cover data, this included sample stations from epifaunal data Faunal group D, E, F and G. These sample stations were grouped due to their similar percentage cover of faunal turf, *Spirobranchus* sp. and acorn barnacles. Faunal turf provided 56.14% Bray Curtis similarity between sample stations. The majority of the sample stations within Faunal group E recorded 0.01-5.6% cover of *F. foliacea* and 1.4-10% cover of *Spirobranchus* sp. Sample stations within Faunal group F were characterised by 0.01-0.9% cover of *A. digitatum* and 0.88-10.7% cover of faunal turf. Sample stations within the epifaunal enumerated taxa Faunal group H were not grouped together in the epifaunal percentage cover Faunal group data analysis. They were split between the two largest epifaunal percentage cover Faunal groups, interspersed with sample stations from other Faunal groups in the epifaunal enumerated taxa. Multivariate analysis of the percentage cover data placed ST111, ST109, ST108, ST106, ST104, ST99, ST98, ST97, ST88, ST86, ST85, ST82, ST81, ST79, ST21, ST16 and ST29 in single station Faunal groups (Figure 3.20). This is similar to the enumerated epifaunal data which placed ST29 as Faunal group A, ST111 as Faunal group B, ST48 as Faunal group C, ST21 as Faunal group I, ST108 as Faunal group J, ST16 as Faunal group K and ST73 as Faunal group L. Sample stations ST21, ST108 and ST16 as well as a large number of sample stations from Faunal group M (ST79, ST82, ST85, ST86, ST88, ST97, ST98, ST99, ST104, ST106, ST109) were placed in their own single sample Faunal group due to the lack of epifaunal percentage cover data. This was expected due to the muddy sediment at these sample stations.
162. The Faunal groups presented in the SIMPER analysis and the raw data were used to assign five preliminary epifaunal biotopes within the Proposed Development benthic subtidal and intertidal ecology study area (Table 3.11; Figure 3.21). Figure 3.21 presents the preliminary epifaunal biotopes assigned across the Proposed Development benthic subtidal and intertidal ecology study area from the analyses of the epifaunal component of the grab data and DDV. The biotope SS.SCS.CCS was recorded across the Proposed Development array area, with a small area of SS.SSa.OSa just outside the north of the eastern section of the Proposed Development array area and a small area of SS.SSa.CMuSa in the centre of the eastern section of the Proposed Development array area. The Proposed Development export cable corridor was also dominated by SS.SCS.CCS and SS.SMu.CFiMu.SpMmeg with areas of CR.MCR.ECcR in the nearshore subtidal area (Figure 3.21).

#### FFBC MPA

163. All sample stations within the FFBC MPA were allocated the preliminary biotope SS.SCS.CCS, with the exception of ST12, which was allocated SS.SSa.CMuSa and was located within the eastern section of the FFBC MPA (Table 3.11).



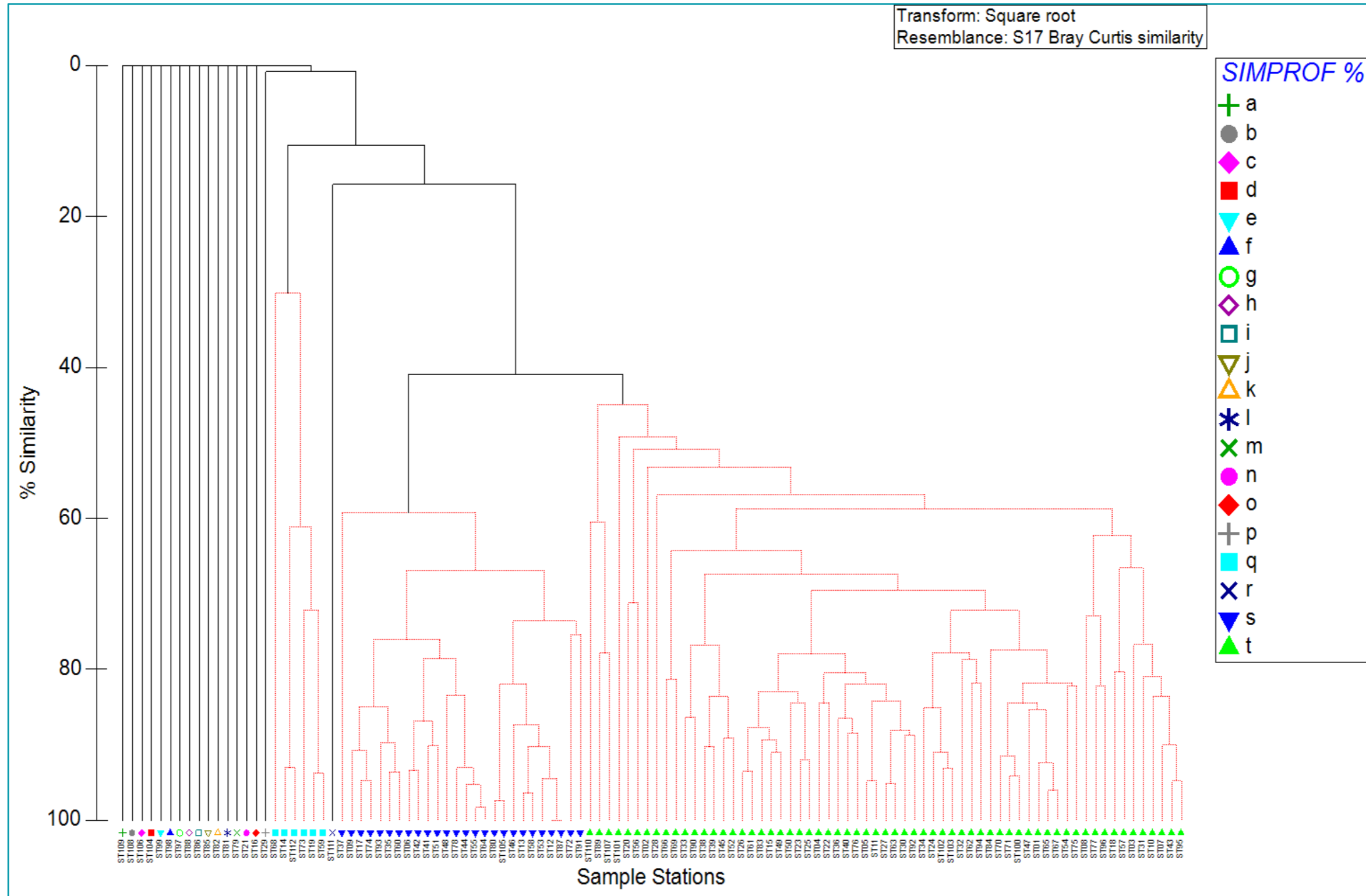


Figure 3.20: Dendrogram of Epifaunal Communities Recorded as Percentage Cover within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

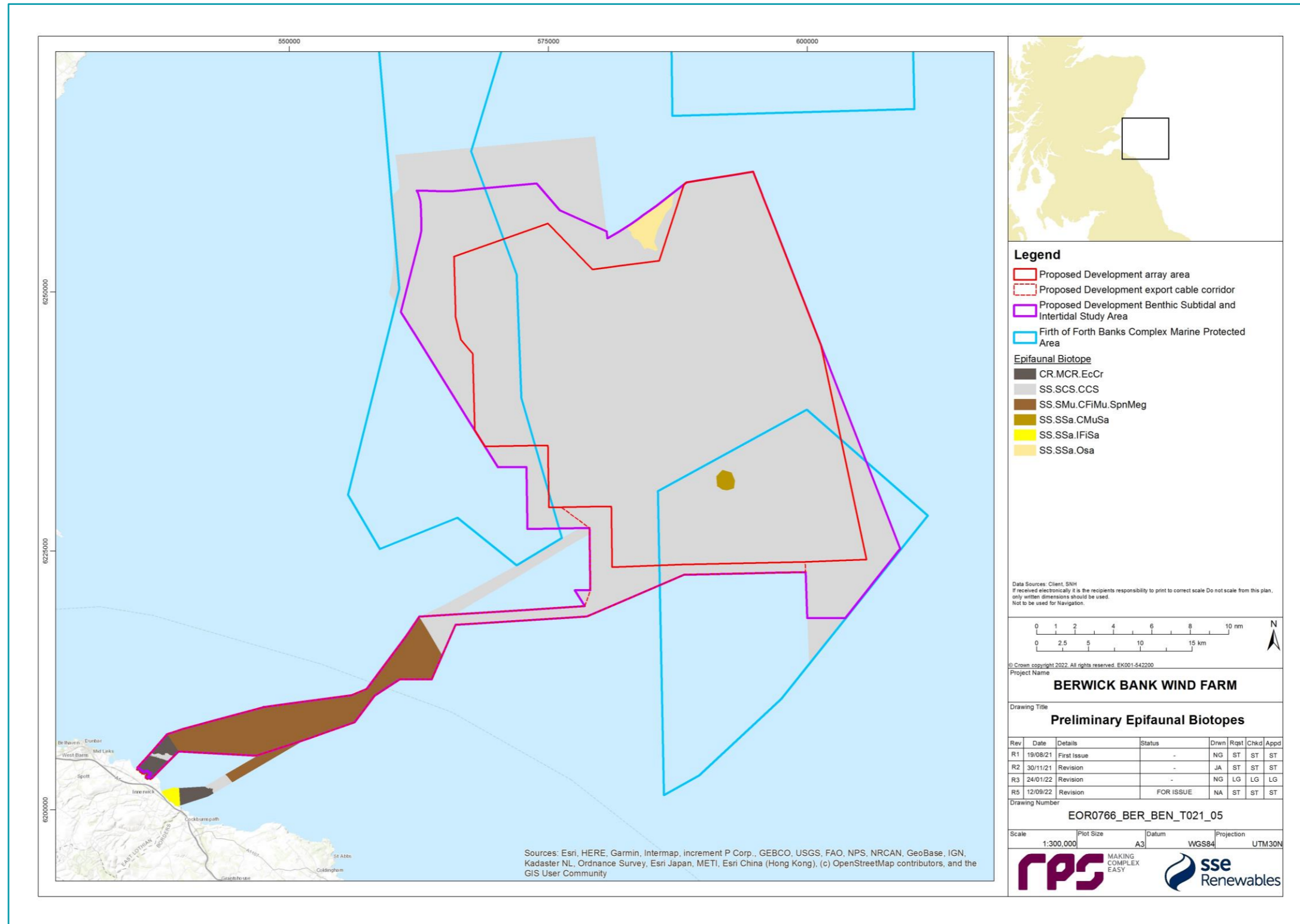


Figure 3.21: Preliminary Epifaunal Biotopes Identified from DDV and Epifaunal Component of the Grab Samples within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

**Table 3.11: Epifaunal Biotopes Identified from DDV and Epifaunal Component of the Grab Samples within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area (from DDV and Grab Data)**

Preliminary Epifaunal Biotope	Sample Station	Water Depth Range (m)	Sediment Classification	Characterising Taxa Accounting for up to 75% of Cumulative Similarity (SIMPER)	Geographic Location	Sample Stations within the FFBC MPA
SS.SSa.OSa: Offshore Circalittoral sand	ST29	45.6	Slightly gravelly sand	<i>Ophiura ophiura</i>	Outside the Proposed Development array area (north).	None
SS.SSa.IFiSa: Infralittoral fine sand	ST108	10	Sand	1 cm burrows	Outside the nearshore area of the Proposed Development export cable corridor	None
CR.MCR.EcCr: Echinoderms and crustose communities	ST111, ST84, ST89, ST107	56-35	Moderate Energy and High Energy Infralittoral Rock	<i>Asterias rubens</i> , <i>Echinus esculentus</i> , <i>Asteroidea</i> , brown and red erect fine and coarse branching algae, encrusting red calcareous algae, large canopy forming brown algae, membranous brown and red algae and red filamentous algae, <i>Aplysia punctata</i> , <i>Spirobranchus</i> sp. <i>Thuiaria thuja</i> , Faunal turf.	Inshore section of the Proposed Development export cable corridor	None
SS.SMu.CFiMu.SpMmeg: Seapens and burrowing megafauna in circalittoral fine mud	ST78, ST79, ST80, ST81, ST82, ST85, ST86, ST87, ST88, ST97, ST98, ST99, ST104, ST105, ST106, ST109	54-70	Gravelly sand, muddy sand and slightly gravelly muddy sand	1-5 cm burrows	Proposed Development export cable corridor	None
SS.SSa.CMuSa: Circalittoral muddy sand	ST12	60	Muddy sand	Faunal turf, tube worms, 1-3 cm burrows	Proposed Development array area	ST12
SS.SCS.CCS: Circalittoral coarse sediment	ST01, ST02, ST04, ST20, ST33, ST34, ST38, ST39, ST40, ST45, ST48, ST56, ST65, ST67, ST69, ST75, ST100, ST101, ST103, ST110, ST90, ST96, ST102, ST15, ST36, ST47, ST50, ST52, ST54, ST61, ST66, ST70, ST71, ST83, ST94, ST03, ST05, ST06, ST07, ST08, ST09, ST10, ST11, ST13, ST14, ST17, ST18, ST19, ST22, ST23, ST24, ST25, ST26, ST27, ST28, ST30, ST31, ST32, ST35, ST37, ST41, ST42, ST43, ST44, ST46, ST49, ST51, ST53, ST55, ST57, ST58, ST59, ST60, ST62, ST63, ST64, ST68, ST72, ST74, ST76, ST77, ST91, ST92, ST93, ST95, ST112, ST21, ST16, ST73	10-70	Gravelly sand, slightly gravelly sand, muddy sandy gravel and sandy gravel	Faunal turf, <i>Spirobranchus</i> sp., <i>Flustra foliacea</i> , branching hydroids, <i>Alcyonidium parasiticum</i> , bushy hydroids, faunal turf, Folliculinidae, <i>Alcyonium digitatum</i> , <i>Thuiaria thuja</i> , <i>Escharella ventricosa</i> , <i>Escharella immersa</i> , <i>Phoronis ovalis</i> , <i>Sertularidae</i> , <i>Asterias rubens</i> , Porifera, <i>Amphiblestrum auritum</i> , <i>Astropecten irregularis</i> , <i>Hydractiniidae</i> , <i>Phialella quadrata</i> , tube worms, <i>Ophiura ophiura</i>	Proposed Development array area and export cable corridor.	ST01, ST02, ST04, ST33, ST65, ST48, ST90, ST96, ST36, ST47, ST52, ST54, ST61, ST66, ST03, ST05, ST06, ST07, ST08, ST09, ST10, ST11, ST13, ST14, ST53, ST55, ST62, ST64, ST93, ST92, ST93, ST95

### Univariate analysis

164. The following univariate statistics were calculated for the combined epibenthic dataset (i.e. epibenthic components of the grabs and DDV data) for each sample station: number of species (S), abundance (N), ash free dry mass in grams (g), Margalef's index of Richness (d), Pielou's Evenness index (J'), Shannon-Wiener Diversity index (H') and Simpson's index of Dominance ( $\lambda$ ). The mean of each of these indices was then calculated for each of the biotopes identified from the epifaunal data and these are summarised in Table 3.12, with univariate statistics for individual sites presented in Annex G: Benthic Grab and DDV Epifaunal Data Univariate Analysis Results.
165. The biotope CR.MCR.EcCr had the highest number of taxa ( $14.25 \pm 5.56$ ). The biotopes SS.SSa.IFiSa and SS.SSa.OSa were represented by a single sample station each and had particularly low number of taxa (Table 3.12). The highest mean number of individuals was recorded in CR.MCR.EcCr ( $11.62 \pm 3.96$ ; Table 3.12); this was expected due to the nature of hard sediments. The high number of individuals in this biotope was due to the high abundance of algae and sponge species as well as faunal turf. The lowest mean number of individuals was recorded in biotope SS.SSa.OSa as this sample station only recorded *O. ophiura*. Overall, the highest number of individuals and taxa were recorded at biotopes with hard substrate and the lowest numbers were recorded in sand sediment habitats.
166. The highest mean diversity score of all the identified communities was identified in the biotope CR.MCR.EcCr ( $d = 5.48 \pm 1.76$  and  $H' = 2.41 \pm 0.42$ ), which was expected, as this biotope had the highest number of taxa and was characterised by hard substrate. The biotope SS.SCS.CCS had the next highest mean diversity score ( $d = 4.91 \pm 1.78$ ,  $H' = 2.20 \pm 1.53$ ). The biotopes SS.SSa.IFiSa and SS.SSa.OSa recorded zero for diversity, this was expected as only a single species was recorded in association with SS.SSa.OSa and only burrows were associated with SS.SSa.IFiSa. Overall, the highest diversity was recorded at biotopes with hard substrate and the lowest was recorded in sand sediment habitats.
167. Pielou's evenness scores (J') varied across the biotopes, where these indices were able to be calculated. J' was 0.94 and 0.93 at CR.MCR.EcCr and SS.SCS.CCS respectively however it was zero at SS.SSa.IFiSa and SS.SSa.OSa; indicating a very low evenness of distribution of abundances among taxa in these biotopes. This was expected, as only a single species was recorded in association with SS.SSa.OSa and only burrows were associated with SS.SSa.IFiSa. The Simpson's index of Dominance ( $\lambda$ ) was highest at SS.SSa.IFiSa and SS.SSa.OSa, indicating that these biotopes were dominated by a small number of taxa. Simpson's index of Dominance was lowest at CR.MCR.EcCr indicating that this biotope had an even distribution of taxa.

**Table 3.12: Mean ( $\pm$  Standard Deviation) Univariate Statistics for Epifaunal Biotopes (from DDV and Grab Data)**

Biotope	S	N	d	J'	H'	$\lambda$
CR.MCR.EcCr	14.25 $\pm$ 5.56	10.77 $\pm$ 3.54	5.48 $\pm$ 1.76	0.94 $\pm$ 0.03	2.41 $\pm$ 0.42	0.09 $\pm$ 0.04
SS.SCS.CCS	12.14 $\pm$ 6.62	9.63 $\pm$ 5.96	4.91 $\pm$ 1.78	0.93 $\pm$ 0.05	2.20 $\pm$ 1.53	0.13 $\pm$ 0.07
SS.SSa.CMuSa	5	5.25	2.41	0.59	0.95	0.51
SS.SMu.CFiMu.SpnMeg	8.31 $\pm$ 2.57	6.21 $\pm$ 1.72	4.07 $\pm$ 1.25	0.75 $\pm$ 0.08	1.57 $\pm$ 0.36	0.28 $\pm$ 0.10
SS.SSa.IFiSa	1	1.26	0	0	0	1
SS.SSa.OSa	1	1	0	0	0	1

### Epibenthic trawl analysis

#### Summary

168. A total of 69 taxa were recorded from the 15 epibenthic trawls undertaken across the Proposed Development benthic subtidal and intertidal ecology study area. Of these, nine taxa were colonial or taxa whose abundance could not be enumerated, and therefore were recorded as present (P). These taxa were assigned a nominal abundance of 1, where present, for the purposes of the multivariate analysis. One Nudibranchia egg was recorded in BT14 which was removed from the statistical analysis. Twenty-one of the taxa were bony fish and represented 553 individuals. As fish taxa are highly mobile, they were removed from the statistical analysis but are discussed in paragraph 184. A total of 5,362 individuals representing 47 taxa were recorded across the Proposed Development benthic subtidal and intertidal ecology study area. Of these, juveniles accounted for 46 individuals from two taxa.
169. Of the 47 total taxa throughout the Proposed Development subtidal and intertidal ecology study area, none were observed at all stations. The brown shrimp *C. crangon* was observed in the highest abundances at BT15, BT17 and BT18 within the Proposed Development export cable corridor; in total, *C. crangon* made up 51% of individuals recorded across all trawls. A total of eight taxa (17%) were recorded as only one individual. These rarely recorded taxa were distributed across the Proposed Development benthic subtidal and intertidal ecology study area, however four of the eight were recorded in BT09 in the centre of the Proposed Development benthic subtidal and intertidal ecology study area.
170. As previously discussed, nine taxa were recorded only as present; these taxa were dominated by Anthozoa and Hydrozoa. Epifauna/colonial/encrusting taxa across the Proposed Development benthic subtidal and intertidal ecology study area included: one Nudibranchia egg, the bryozoan *F. foliacea* and the polychaete *Spirobranchus sp. F. foliacea* was recorded in the greatest number of trawls; present in 11 out of the 15. The hydrozoan *T. thuja* was only present in BT09 and the anthozoan *Actiniaria* was only recorded in BT14, BT17 and BT18 across the Proposed Development export cable corridor.
171. Initially the dataset was divided into the five major taxonomic groups: Annelida (Polychaeta), Crustacea, Mollusca, Echinodermata and 'Others'. The 'Other' group comprised of:
- three taxa of Anthozoa (*Actiniaria*, *Adamsia palliata* and *A. digitatum*);
  - three taxa of Hydrozoa (*Hydrozoa*, *Sertulariidae* and *T. thuja*);
  - one taxa of Bryozoa (*F. foliacea*); and
  - one taxa of Ctenophora (*Pleurobrachia pileus*).
172. The absolute and proportional contributions of these five taxonomic groups to the overall community structure is summarised in Table 3.13.

**Table 3.13: Contribution of Gross Taxonomic Groups Recorded in the Epibenthic Trawls**

Group	Individuals		Taxa	
	Abundance	Proportional Contribution %	Abundance	Proportional Contribution %
Annelida (polychaeta)	13	0.25	2	4.26
Crustacea	3,961	73.87	19	40.42
Mollusca	119	2.22	9	19.15
Echinodermata	932	17.38	9	19.15
Others	337	6.28	8	17.02
<b>Total</b>	<b>5,362</b>	<b>100</b>	<b>47</b>	<b>100</b>

173. Across the Proposed Development benthic subtidal and intertidal ecology study area, the epibenthic trawl communities were generally dominated by *Crustacea* (n=3,961) which contributed 73.87% to the total number of individuals (Table 3.13). Number of taxa was also dominated by Crustacea which made up 40.42% of the total taxa. At individual stations, gross taxonomic group dominance reflected the whole survey dominance results with crustacea dominating 11 (73%) benthic trawls. All other trawls were dominated by Echinodermata with the exception of BT17 which was dominated by Other taxa, specifically 200 individuals of *P. pileus*.

174. The most abundant taxonomic group was Crustacea, which included the most abundant individual, *C. crangon* and the second most abundant individual Pandalidae; the highest abundances of both these taxa were recorded in BT11, BT12, BT14, BT15, BT16, BT17, BT18. The Echinodermata *A. rubens* and the Ctenophora *P. pileus* were recorded in high abundances. In general, epibenthic trawls in the Proposed Development export cable corridor recorded in higher number of individuals than those across the Proposed Development array area; BT18 recorded the highest number of individuals (1,294). However, number of taxa recorded was relatively evenly distributed across the Proposed Development benthic subtidal and intertidal ecology study area, with BT12 recording the highest number of taxa (21) and BT11 and BT13 both with 19 taxa.

175. The most abundant fish recorded in the trawls were common dab *Limanda* (167 individuals), long rough dab *Hippoglossoides platessoides* (56 individuals), lesser sandeel *Ammodytes tobianus* (47 individuals) and gobies *Pomatoschistus* sp (51 individuals). This was consistent with the infaunal data which also recorded lesser sandeel (section 3.4.5). Lesser sandeel, common dab and long rough dab were recorded in trawls across the Proposed Development benthic subtidal and intertidal ecology study area. *Pomatoschistus* sp. was only recorded in trawls at BT14, BT16 and BT18 within the Proposed Development export cable corridor and nearshore area of the Proposed Development benthic subtidal and intertidal ecology study area, with most individuals recorded at BT18. Two four-bearded rockling *Enchelyopus cimbrius* and angler fish *Lophius piscatorius* were recorded across all trawls.

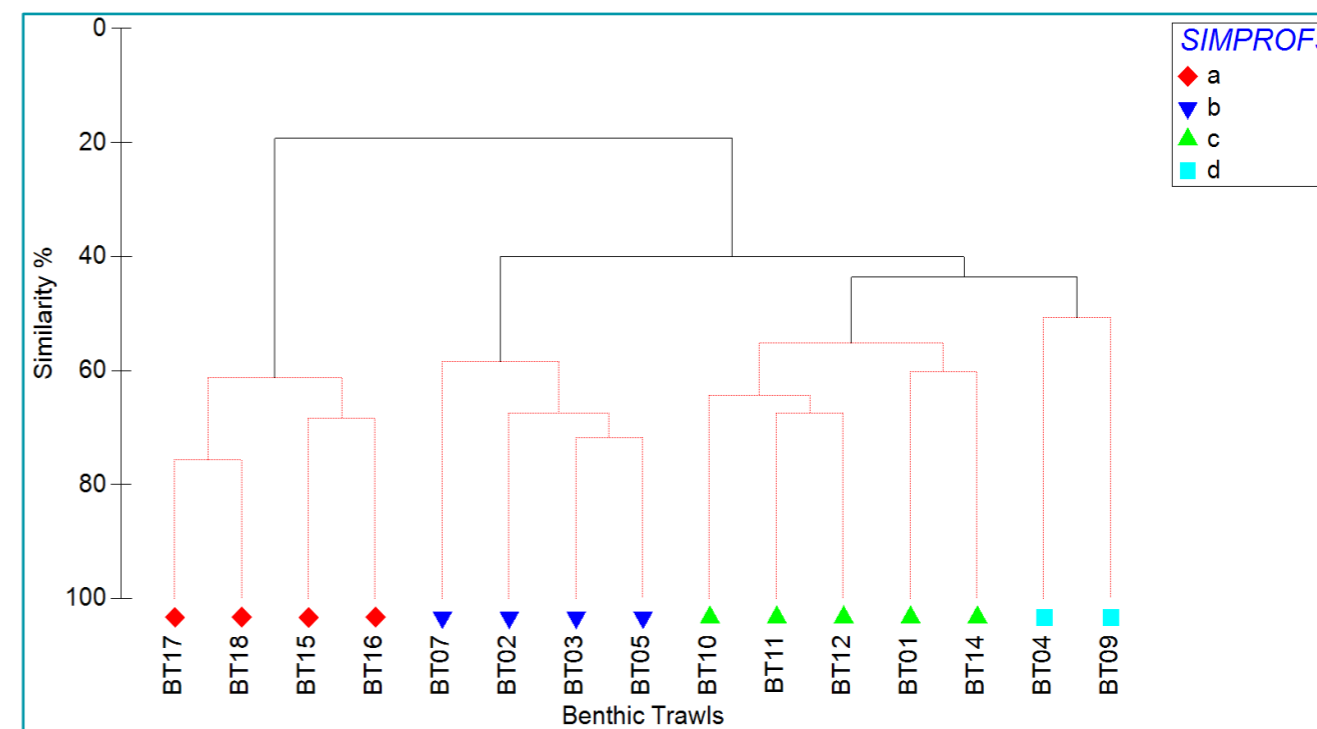
176. Horse mussel *M.modiolus* was recorded in five of the benthic trawls (BT01, BT04, BT05, BT09, BT11). They were recorded in low numbers (<4 individuals) in each of these trawls with the exception of BT09 which recorded 31 individuals. Further information of the fish and shellfish species in the Proposed Development benthic subtidal and intertidal ecology study area is presented in volume 3, chapter 9.1.

Multivariate community analysis

177. The results of the cluster analyses, SIMPROF test and SIMPER analyses were used, together with the raw untransformed data, to assign epifaunal biotopes to each epibenthic trawl. In several instances, clusters that were identified as significantly different from each other in the SIMPROF tests were assigned the same biotope code. This was based on a review of the SIMPER results which indicated that the

differences between the groups could be explained by differences in abundances of characterising species rather than the presence/absence of key species. Full results of the multivariate analysis are presented in Annex H: Benthic Trawls Epifaunal Data Multivariate Analysis Results.

178. The results of the hierarchical clusters analysis of the fourth root transformed epifaunal dataset together with the SIMPROF test identified four faunal groups that were statistically dissimilar. The raw data was transformed using the fourth root due to the high abundance of *C. crangon* compared to other taxa. The 3D MDS plot is presented in Figure 3.23 and the low stress value (0.05) indicates that this was a good representation of the data. Faunal group A (SIMPROF a; BT15, BT16, BT17, BT18) showed clear clustering away from all the other faunal groups with a Bray-Curtis similarity of 64.83% (Figure 3.22). Faunal group C and D showed greater similarity with each other than with any other faunal group with a Bray-Curtis dissimilarity of 56.40%.



**Figure 3.22: Dendrogram of Epifaunal Communities in the Epibenthic Trawl Samples**

179. Figure 3.24 to Figure 3.27 show representative images of the epibenthic trawl samples associated with each of the Faunal groups. The abundance of *F. foliacea* varied across the trawls but, as discussed in paragraph 186, this species was recorded only as presence/absence and so the occurrence of this species may have been underrepresented in the statistical analysis. The images of the benthic trawl catch showed that BT02, BT03, BT05, BT07 and BT12 recorded very high abundance of *F. foliacea*. These benthic trawls are mostly in Faunal group B (BT02, BT03, BT05, BT07) with BT12 in Faunal group C. The occurrence of *F. foliacea* in these faunal groups has been considered when assigning preliminary epifaunal biotopes to the faunal groups.

180. Faunal group A (BT15, BT16, BT17, BT18) included trawl locations within the Proposed Development export cable corridor and was associated with sand sediments (muddy sands, sands and slightly gravelly muddy sand). Characterising species included *C. crangon* (making up 29.26% of the similarity between trawls within Faunal group A), Pandalidae, the Atlantic bobtail *Sepiola atlantica*, Paguridae and *A. rubens* (Figure 3.24). *Crangon crangon* was recorded in very high numbers (>830) in BT15, ST17 and ST18 while being recorded in lower numbers (61) in BT16. Atlantic bobtail *Sepiola atlantica* was only recorded in these four epibenthic trawls. Review of the individual epibenthic trawl data also highlighted that the bony fish *Glyptocephalus cynoglossus* and *Enchelyopus cimbrius* removed from the multivariate analysis were also only recorded in these four epibenthic trawls. Faunal group A was distinct from the other Faunal groups due to the presence and abundance of the characterising species as well as the absence of *O. fragilis* and *E. esculentus*, which distinguished it from Faunal group C. It also did not record *M. modiolus* which distinguished it from Faunal group D. Faunal group A showed the highest Bray-Curtis dissimilarity with Faunal group B (84.28%) due to the high abundance of *C. crangon* in Faunal group A but not B and due to the absence of hermit crab *Pagurus prideaux* and *Ophiura* in Faunal group A that were present in Faunal group B. Faunal group A was allocated a preliminary biotope based on the epibenthic trawls data of SS.SSa.CMuSa [*C. crangon*]: *C. crangon* aggregations on Circalittoral Muddy Sand (Table 3.18).
181. Faunal group B (BT02, BT03, BT05, BT07) included trawl locations across the eastern section of the Proposed Development array area and was associated with gravelly sand and slightly gravelly sand sediments. Characterising species included *P. prideaux*, *Ophiura*, *A. palliata* and *A. irregularis* (
182. Figure 3.25). *P. prideaux* was recorded in its highest abundance at BT03 (n=36). Faunal group B was distinct from the other Faunal groups due to the presence and abundance of the characterising species. It showed a low Bray-Curtis dissimilarity (56.12%) with Faunal group C and was distinct due to the differing abundances of the characterising species, rather than the present/absence of key species. Faunal group B showed the highest Bray-Curtis dissimilarity with Faunal group A. As discussed above in paragraph 179, the abundance of *F. foliacea* in trawls within Faunal group B was also high. Faunal group B was allocated a preliminary biotope based on the benthic trawls epifaunal data of SS.SCS.CCS (Table 3.14).
183. Faunal group C (BT01, BT10, BT11, BT12, BT14) included trawl locations outside the western section of the Proposed Development array area and offshore section of the Proposed Development export cable corridor and was associated with mixed sediments (sandy gravel, gravelly sand and slightly gravelly sand sediments). Characterising species included: *A. rubens*, *Munida*, *Liocarcinus*, *A. irregularis*, *P. maximus*, *E. esculentus* and *O. fragilis* (Figure 3.26). *A. rubens*, *A. irregularis*, *O. fragilis* and *P. maximus* were all recorded in their highest abundances in an epibenthic trawl within Faunal group C (BT10-outside the western section of the Proposed Development array area). Faunal group C was distinct from the other faunal groups due to the presence and abundance of the characterising species. Faunal group C showed the highest Bray-Curtis dissimilarity with Faunal group A (79.00%) due to the high abundance of *O. fragilis* and *E. esculentus* in Faunal group C but not A and due to the lack of *C. crangon* in Faunal group C that was present in Faunal group A. As discussed above in paragraph 179, the abundance of *F. foliacea* in trawls within Faunal group C was also high. Faunal group C was allocated a preliminary biotope based on the benthic trawls epifaunal data of SS.SCS.CCS: Circalittoral coarse sediment. BT11 and BT12 were allocated SS.SMx.CMx.FluHyd: *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment based on the high density faunal turf and dense *F. foliacea* associated with these sites (Table 3.14).
184. Faunal group D (BT04, BT09) included trawl locations within the centre of the Proposed Development array area and was therefore associated with sandy gravel and slightly gravelly sand sediments. Characterising species included: *Munida*, *M. modiolus* and *Liocarcinus* (Figure 3.27). *M. modiolus* was recorded in its highest abundance at BT09 (n=31) with other benthic trawls only recording a few individuals. Faunal group D was distinct from the other faunal groups due to the presence and abundance of the characterising species as well as the absence of *Ophiura* which distinguishes it from Faunal group C and

*P. prideaux* which distinguishes it from Faunal group B. Faunal group D showed the highest Bray-Curtis dissimilarity with Faunal group A (78.04%), due to the high abundance *M. modiolus* in faunal group D but not A and due to the absence of Pandalidae, which was present in Faunal group A but not D. Faunal group D was allocated a preliminary biotope based on the benthic trawls epifaunal data of SS.SCS.CCS (Table 3.11).

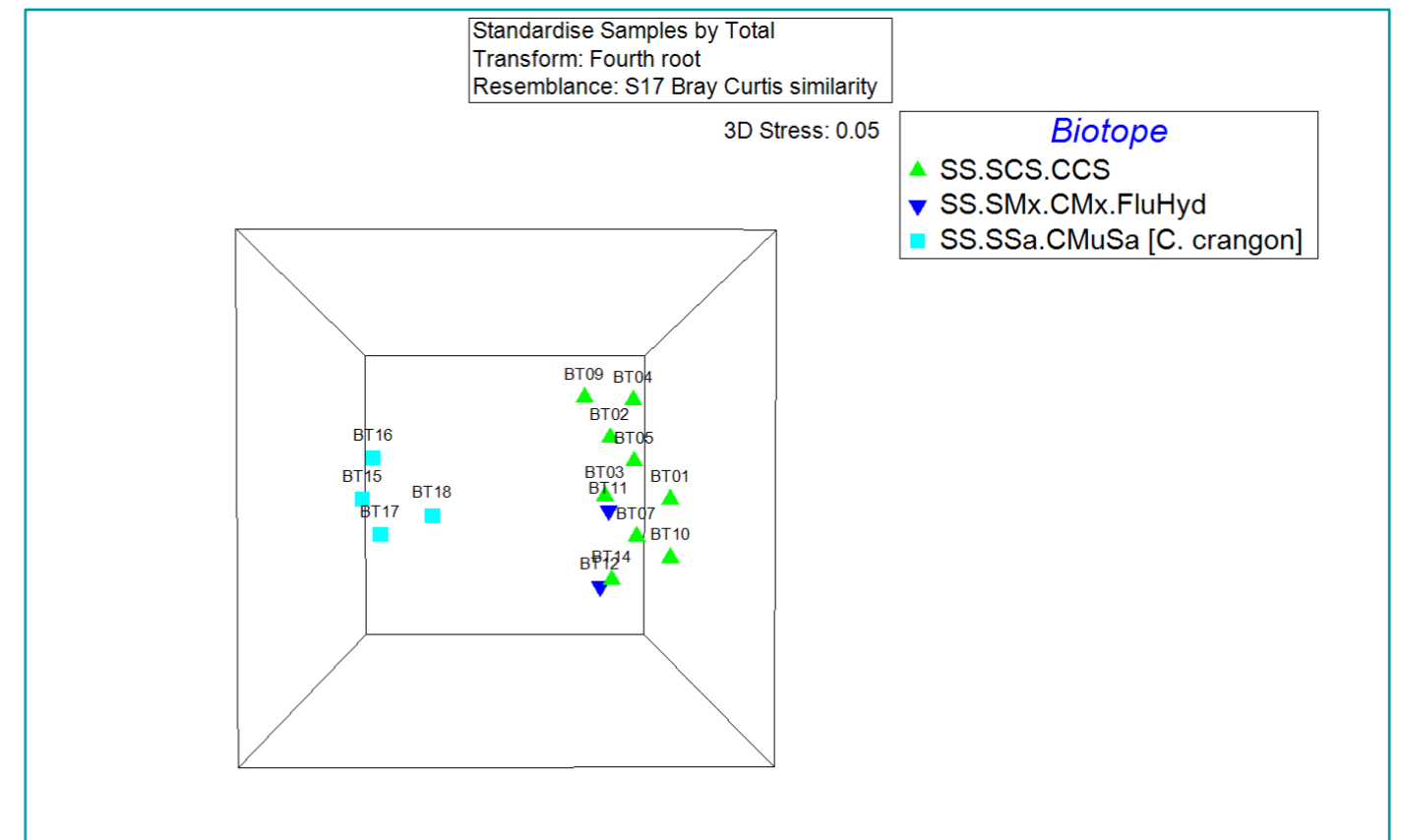


Figure 3.23: 3D MDS Plot for the Epibenthic Trawl Samples (with biotopes)



Figure 3.24: Representative Image of Epibenthic Trawl Catch for Faunal Group A (BT15)



Figure 3.26: Representative Image of Epibenthic Trawl Catch for Faunal Group C (BT11)



Figure 3.25: Representative Image of Epibenthic Trawl Catch for Faunal Group B (BT07)



Figure 3.27: Representative Image of Epibenthic Trawl Catch for Faunal Group D (BT09)

185. The preliminary epifaunal biotopes from the DDV/grab data were not combined with the epibenthic trawls biotopes as the epibenthic trawls cover a wider area compared to the grab and DDV data and therefore are not suitable for combining. However, they provide a broad indication of species present across a wider area. The DDV/grab epibenthic data was used as the primary dataset with the trawls providing a broad overview. The epibenthic trawls within the eastern section of the Proposed Development array area were classified as SS.SCS.CCS with two trawls within the western section of the Proposed Development array area classified as SS.SMx.CMx.FluHyd. The epibenthic trawls in the central section of the Proposed Development export cable corridor were characterised as SS.SSa.CMuSa [*C. crangon*].

#### FFBC MPA

186. Two epibenthic trawls (BT01 and BT02) overlapped with the FFBC MPA in the eastern section of the Proposed Development array area. Two epibenthic trawls (BT10 and BT12) overlapped with the FFBC MPA in the western section of the Proposed Development array area. Epibenthic trawls within the FFBC MPA contained high abundances of Crustacea (*Liocarcinus*, *A. rotundatus*) and *Echinodermata* (*E. esculentus*, *A. rubens*, *A. irregularis* and *O. nigra*). From the images of the epibenthic trawl catch BT02 and BT12 showed very high abundance of *F. foliacea*. They were all allocated the biotope SS.SMx.CMx.FluHyd (Table 3.14).



**Table 3.14: Epifaunal Groups Identified from the Epibenthic Trawls**

Preliminary Epifaunal Biotope	Epibenthic Trawl	Water Depth Range (m)	Sediment Classification (from the PSA Analysis)	Characterising Species Accounting for up to 50% of Cumulative Simper Similarity (SIMPER)	Geographic Location	Epibenthic Trawls within the FFBC MPA
SS.SSa.CMuSa [ <i>C. crangon</i> ]: <i>C. crangon</i> on Circalittoral muddy sand sediments.	BT15, BT16, BT17, BT18	52-70	Muddy sand, sand and slightly gravelly muddy sand	<i>Crangon crangon</i> , Pandalidae, <i>Sepiola atlantica</i>	Proposed Development export cable corridor	none
SS.SCS.CCS: Circalittoral coarse sediment	BT01, BT02, BT03, BT05, BT07, BT10, BT14, BT04, BT09	39-61	Gravelly sand, sandy gravel and slightly gravelly sand	<i>Pagurus prideaux</i> , <i>Ophiura</i> , <i>Adamsia palliata</i> , <i>Astropecten irregularis</i> , <i>Asterias rubens</i> , <i>Munida</i> , <i>Liocarcinus</i> , <i>Pecten maximus</i> , <i>Ophiothrix fragilis</i> , <i>Munida</i> , <i>Modiolus modiolus</i> , <i>Liocarcinus</i>	Proposed Development array area	BT02, BT01, BT10
SS.SMx.CMx.FluHyd: <i>Flustra foliacea</i> and <i>Hydrallmania falcata</i> on tide-swept circalittoral mixed sediment	BT11, BT12	48	Sandy gravel and gravelly sand with cobbles.	<i>Flustra foliacea</i> , <i>Ophiocomina nigra</i> , <i>Asterias rubens</i> , <i>Pandalidae</i>	Proposed Development array area (west).	BT12

Univariate analysis

187. The following univariate statistics were calculated for each epibenthic trawl: number of species (S), abundance (N), ash free dry mass in grams (g), Margalef's index of Richness (d), Pielou's Evenness index (J'), Shannon-Wiener Diversity index (H') and Simpson's index of Dominance ( $\lambda$ ). The mean of each of these indices was then calculated for each of the epifaunal biotopes and these are summarised in Table 3.15 with univariate statistics for individual sites presented in Annex I: Benthic Trawls Epifaunal Data Univariate Analysis Results.
188. The univariate statistic showed that the biotope SS.SMx.CMx.FluHyd had the highest number of taxa ( $20 \pm 1.41$ ). This biotope did not have the highest number of individuals ( $262 \pm 90.50$ ) however, it was the next highest, with the highest occurring in the SS.SSa.CMuSa biotope ( $965 \pm 447.60$ ). This high number of individuals in the SS.SSa.CMuSa biotope was due to the very high abundance of *C. crangon*. The biotope SS.SCS.CCS had lowest number of taxa and individuals (Table 3.15).
189. The highest mean diversity score of all the identified communities was associated with the SS.SMx.CMx.FluHyd biotope ( $d = 3.42 \pm 0.03$  and  $H' = 1.53 \pm 0.10$ ) which was expected as this biotope had the highest number of taxa due to the nature of the mixed sediments with a high density of faunal turf. The biotope SS.SCS.CCS had the next highest mean diversity score ( $d = 3.25 \pm 0.34$ ,  $H' = 1.04 \pm 0.27$ ). The lowest diversity recorded was at the biotope SS.SSa.CMuSa. This is consistent with this biotope having the lowest numbers of taxa and individuals. The biotope was recorded within the Proposed Development export cable corridor which had finer sediments than the coarse sediments recorded in the western section of the Proposed Development array area. The coarse sediments create a more complex and diverse habitat than the finer sediments in the eastern section of the Proposed Development array area and Proposed Development export cable corridor, supporting a higher diversity and number of taxa and individuals.
190. Pielou's evenness scores (J') and the Simpson's index of Dominance ( $\lambda$ ) scores varied across the biotopes. J' was highest and  $\lambda$  was lowest at SS.SCS.CCS indicating an even distribution of taxa and that these communities are not dominated by a small number of species. The biotope SS.SSa.CMuSa [*C. crangon*] had the lowest J' and highest  $\lambda$  indicating that this biotope was dominated by a high number of individuals from a small number of taxa. From the raw data this is likely to be the effect of high numbers of *C. crangon* in the epibenthic trawls assigned to this biotope.

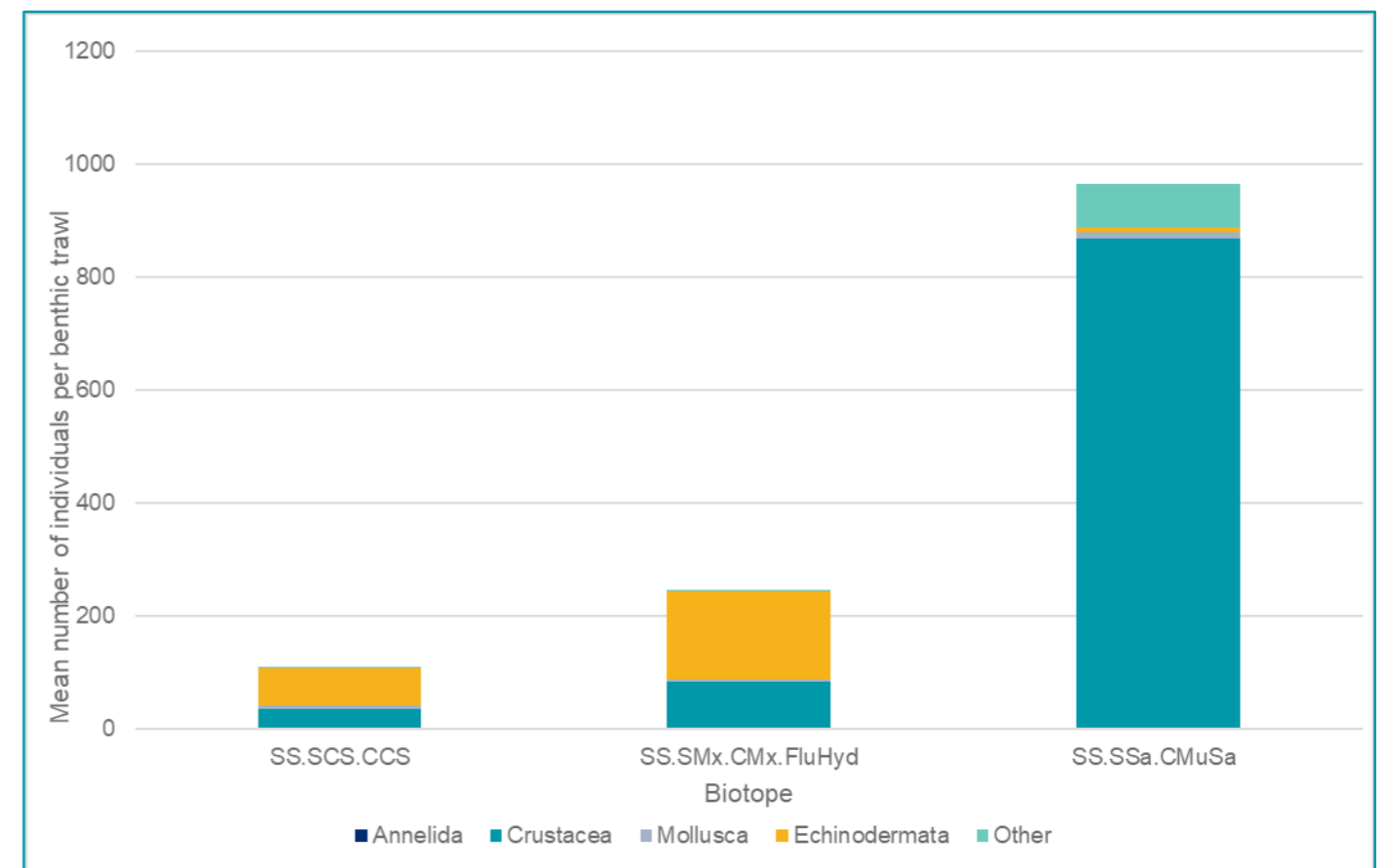
**Table 3.15: Mean ( $\pm$  Standard Deviation) Univariate Statistics for the Preliminary Epibenthic Biotopes Recorded from the Epibenthic Trawls**

Biotope	Epibenthic Trawl	S	N	d	J'	H'	$\lambda$
SS.SCS.CCS	BT01, BT02, BT03, BT05, BT07, BT10, BT14, BT04, BT09	14.88 $\pm$ 2.71	108.66 $\pm$ 113.93	3.25 $\pm$ 0.34	0.76 $\pm$ 0.11	1.04 $\pm$ 0.27	0.22 $\pm$ 0.11
SS.SMx.CMx.FluHyd	BT11, BT12,	20 $\pm$ 1.41	262 $\pm$ 90.50	3.42 $\pm$ 0.03	0.51 $\pm$ 0.02	1.53 $\pm$ 0.10	0.26 $\pm$ 0.17
SS.SSa.CMuSa [ <i>C. crangon</i> ]	BT15, BT16, BT17, BT18	11.5 $\pm$ 3.41	965 $\pm$ 447.60	1.53 $\pm$ 0.38	0.38 $\pm$ 0.10	0.89 $\pm$ 0.18	0.57 $\pm$ 0.10

191. Figure 3.28 and Figure 3.29 show the mean number of taxa and individuals within each of the major taxa group (Annelida, Crustacea, Mollusca, Echinodermata and Other) for each of the biotopes identified within

the Proposed Development benthic subtidal and intertidal ecology study area from the epibenthic trawls. As previously discussed, the univariate analysis showed that SS.SSa.CMuSa contained the highest number of individuals, this is reflected in Figure 3.28. Figure 3.29 shows that the dominance of Crustacea in the number of taxa in SS.SSa.CMuSa was not as great as the dominance of Crustacea in the number of individuals, further highlighting that the high number of individuals was due to a small number of taxa. This was also shown in the univariate analysis which highlighted SS.SSa.CMuSa as the biotope most dominated by a small number of taxa. This reflects the dominance of Crustacea in the biotopes recorded from the infaunal grab samples from the Proposed Development benthic subtidal and intertidal ecology study area. Annelida were generally poorly represented across all faunal groups, making up the smallest proportion of individuals in each faunal group. This may be due to the nature of epibenthic trawl sampling as annelids live within the seabed sediments and therefore may be underrepresented.

192. As shown in Figure 3.29, the proportions of the number of taxa in each major taxonomic group are similar across the biotopes, with Crustacea and Echinodermata dominating the taxa present in each biotopes. All major taxonomic groups were represented in all biotopes despite the section for Annelida being too small to see on the graph.



**Figure 3.28: Mean Abundance of Individuals per Taxonomic Group Identified for Each Biotope from the Epibenthic Trawls**

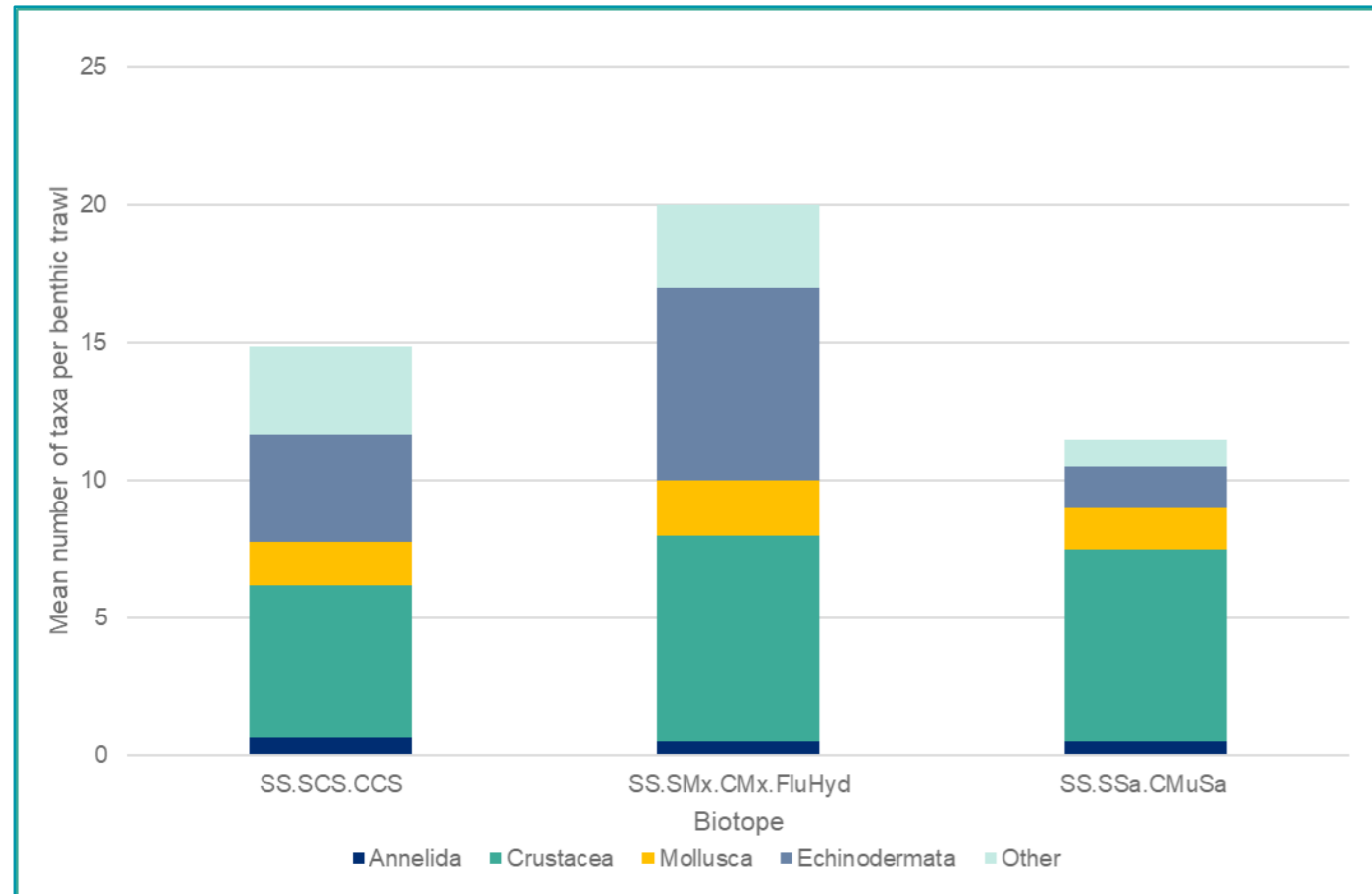


Figure 3.29: Mean Number of Taxa per Taxonomic Group Identified for Each Biotope from the Epibenthic Trawls

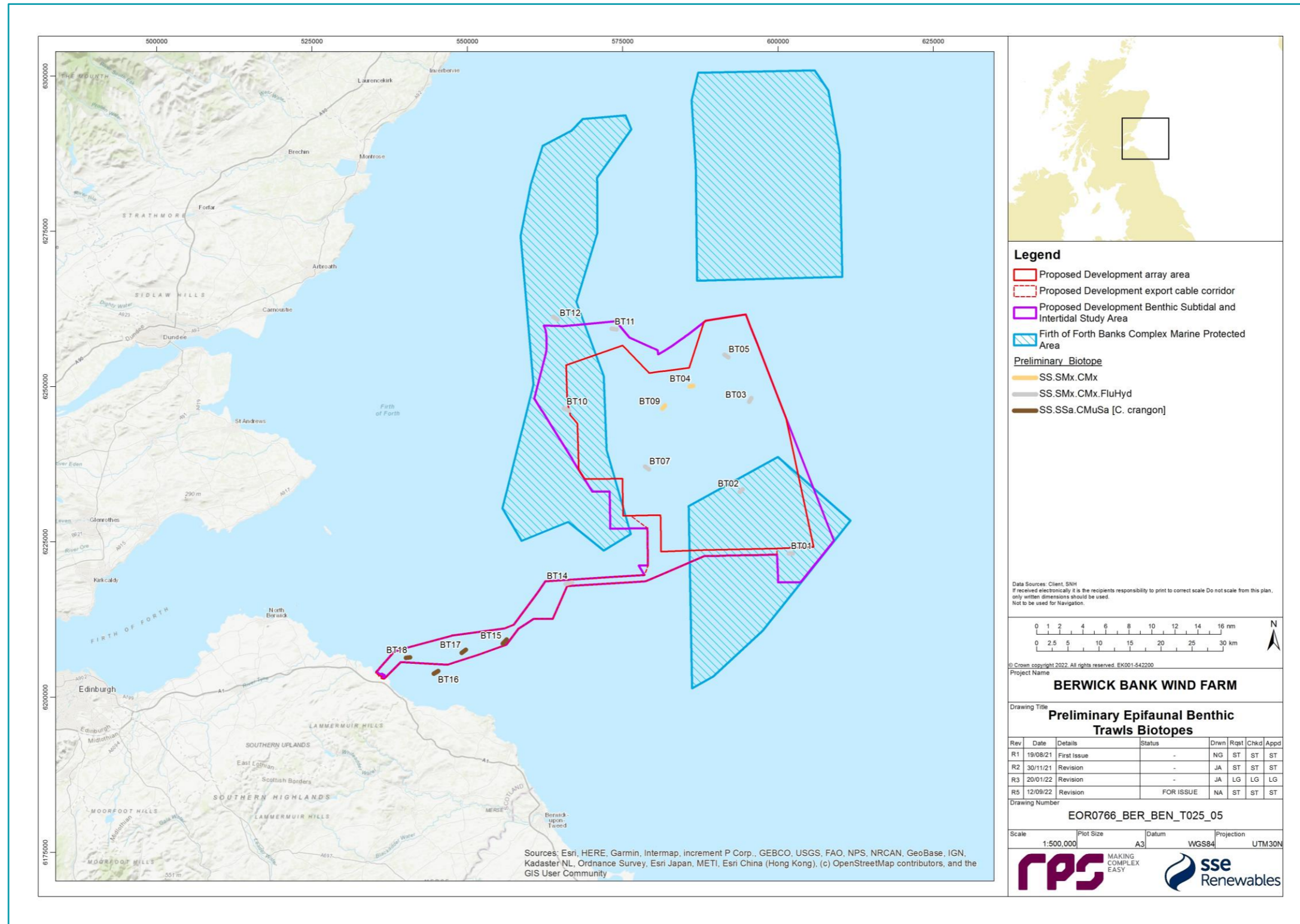


Figure 3.30: Preliminary Epifaunal Benthic Trawl Biotopes Identified within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

### 3.4.7. RESULTS - COMBINED INFAUNAL AND EPIFAUNAL SUBTIDAL BIOTOPES

193. Figure 3.30 presents the combined infaunal and epifaunal biotopes identified across the Proposed Development benthic subtidal and intertidal ecology study area. The method of classifying combined, holistic biotope codes was informed by the preliminary infaunal and epifaunal biotopes, the characterising species for these biotopes (as highlighted by the SIMPER analysis) and environmental variables (e.g. sediment type and water depth) at each site. The quantitative benthic infaunal grab dataset was prioritised when combining the datasets, due to this being the most standardised dataset. The DDV footage, the results of the analysis of the epifaunal component of the grabs and the trawl data were then used to identify subtle differences in epifaunal communities.
194. The infaunal and epifaunal biotopes have been combined to form one single biotope, due mainly to the typically sparse epifaunal communities characterising these areas. Where DDV data only was taken, these epifaunal biotopes have been taken as the final biotopes.
195. The epifaunal data identified SS.SCS.CCS across the eastern section of the Proposed Development array area however the infaunal data identified sandy mud and fine sand habitat across the eastern section of the Proposed Development array area and sandy mud and mixed sediments in the western section of the Proposed Development array area. The infaunal biotopes were taken forward to the combined biotope map as they were derived from more detailed data with the epifaunal data providing further context. The epifaunal data analysis classified much of the central and inshore parts of the Proposed Development export cable corridor as SS.SMu.CFiMu.SpnMeg. This area was classified as SS.SMu.CSaMu.ThyNten from the infaunal data and was therefore described as a similar mud habitat. SS.SMu.CFiMu.SpnMeg was taken forward as the final biotope, as this biotope was allocated as a result of detailed analysis of the DDV which identified the characteristic burrows of this habitat which are not recorded in grab sampling. The DDV data also recorded CR.MCR.EcCr in the nearshore environment and this was taken forward as the final biotope as there was sufficient data in the DDV data to allocate a detailed biotope description. The trawls data recorded *C. crangon* dominated circalittoral muddy sand in this part of the Proposed Development export cable corridor, further supporting the presence of the SS.SMu.CFiMu.SpnMeg habitat.
196. The final biotope map shown in Figure 3.31 confirms many of the patterns described previously for the subtidal communities present in the Proposed Development benthic subtidal and intertidal ecology study area. The eastern section of the Proposed Development array area is characterised by the SS.SMu.CSaMu.AfilMysAnit and SS.SSa.CFiSa.Epus.OborApri biotopes with the SS.SSa.OSa and SS.SSa.OSa [*Echinocyamus pusillus*] biotopes in the south and small area of SS.SMx.CMx.MysThyMx in the centre of the Proposed Development array area. The western section of the Proposed Development array area is characterised by the SS.SMx.OMx.PoVen, SS.SMu.CSaMu.AfilMysAnit, and SS.SSa.CFiSa.Epus.OborApri biotopes with two patches of non-reef forming SS.SBR.PoR.SspiMx biotope in the south. The Proposed Development export cable corridor is characterised by the SS.SSa.OSa and SS.SMu.CSaMu.AfilNten near the boundary of the Proposed Development array area and by the SS.SMu.CFiMu.SpnMeg biotope in the central section. The CR.MCR.EcCr biotope was recorded in the inshore areas adjacent to the landfall.
197. The location of the sample sites where ocean quahog *A. islandica* and *M. modiolus* were recorded are also noted on Figure 3.31. *M. modiolus* were recorded in several of the benthic trawls and therefore the full extent of the benthic trawls is presented in Figure 3.31 as the exact location of the *M. modiolus* is unknown.

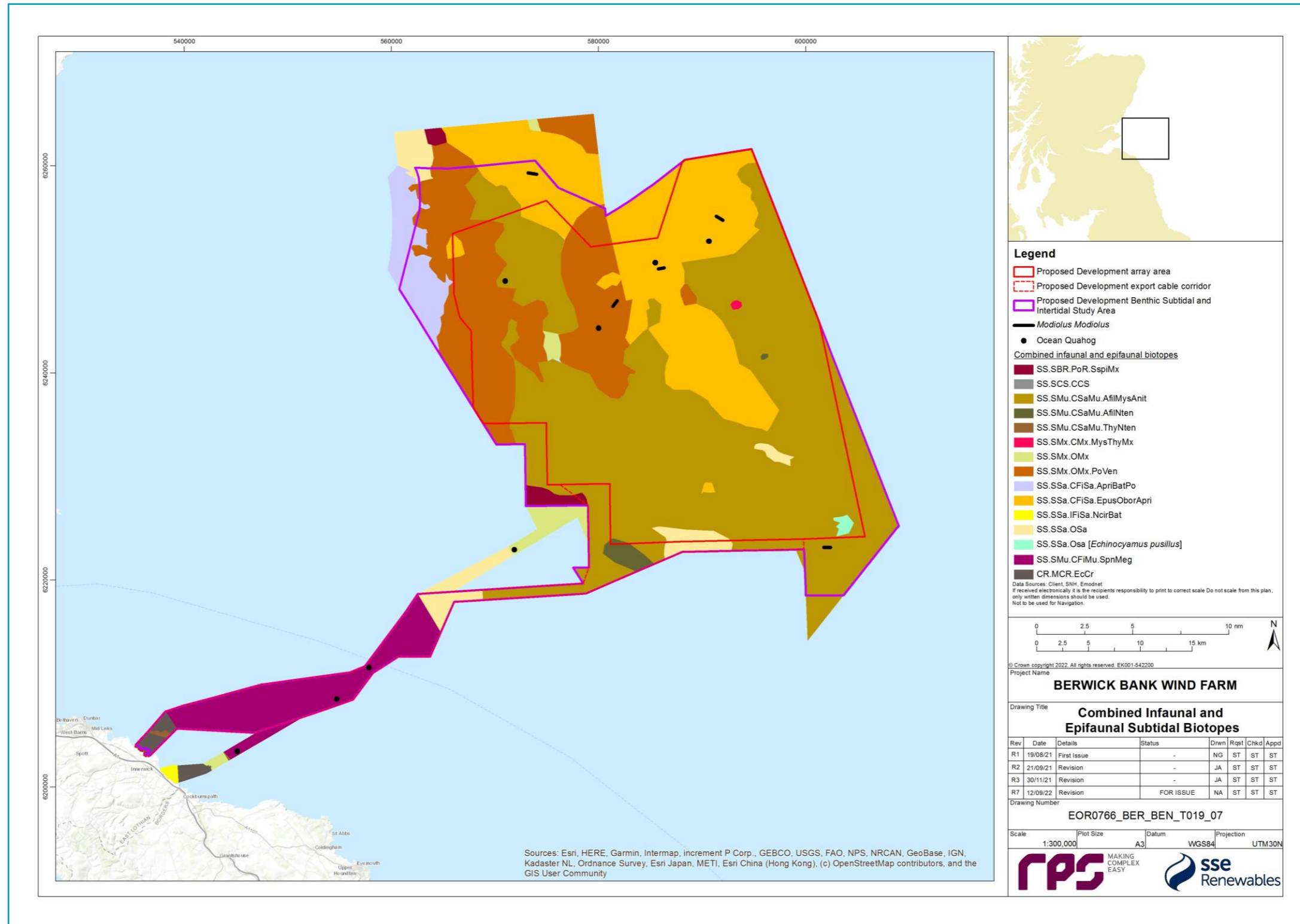


Figure 3.31: Combined Infaunal and Epifaunal Biotope Map of the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

### 3.4.8. RESULTS- HABITAT ASSESSMENT

#### Seapen and burrowing megafauna communities assessment

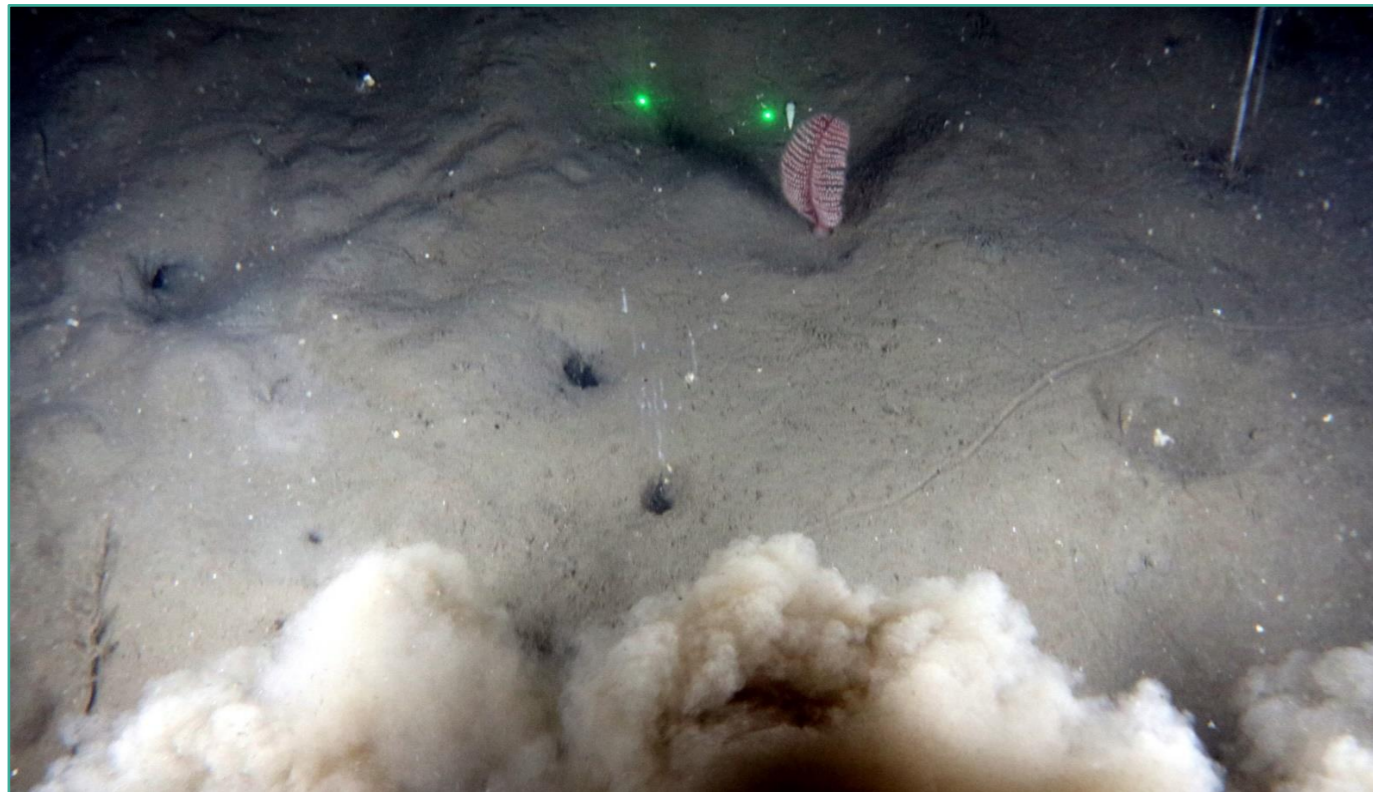


Figure 3.32: Seapen *Pennatula phosphorea* at ST82

198. The seapen and burrowing megafauna communities assessment was conducted on the sample stations where DDV data identified the presence of the SS.SMu.CFiMu.SpMg biotope and indicated the habitat aligned with the OSPAR habitat (i.e. due to the presence of fine mud and burrows). The PSA data also confirmed the presence of sandy mud and slightly gravelly muddy sand at these stations, as typical for the 'seapen and burrowing megafauna communities' habitat. Other sample stations recorded seapens and burrows however there was no indication of megafauna being present as all the burrows in the images and burrows from these sample stations were small in size (<1 cm). Burrows were observed at 14 sample stations within the seabed stills and DDV footage. Seapens (*Pennatulacea*) were also observed at 11 of these sample stations (Table 3.16; Figure 3.32); *V. mirabilis* and *P. phosphorea* were also both observed. The sediment type recorded at the sample stations listed in Table 3.16, across the Proposed Development export cable corridor, were consistent with the mud and muddy sand sediments required for the 'seapen and burrowing megafauna communities' habitat as defined by OSPAR (2010). The densities of burrows and seapens at all stations where present, were analysed and their abundance categorised using the JNCC's SACFOR classification, to assess if the station habitat should be classified as a 'seapen and burrowing megafauna communities' habitat. Table 3.16 presents the burrows and seapen abundance data and analysis for each sample station where burrows were recorded.

199. The density of burrows was assessed to consider if this was a prominent feature of the sediment surface and indicative of a sub-surface complex burrow system. Stations with burrows with densities considered 'frequent' or more under the SACFOR scale were considered likely to constitute the 'seapen and burrowing megafauna communities' OSPAR habitat. However, as recommended in the JNCC report (2014b), interpretation of the density of burrows should be treated with a degree of caution as it can be difficult to identify species based on burrow alone. Burrow density was calculated for each station using the total area covered by the photographs as calculated from laser scale lines (average image swathe x camera transect length).
200. The presence of seapens is not a prerequisite for the classification of this OSPAR habitat however seapens were also recorded in the grab samples, *V. mirabilis* at ST63 and ST44, and *P. phosphorea* at ST97. This somewhat correlated with the DDV seabed imagery which recorded *P. phosphorea* at ST97, however this species was also recorded within the Proposed Development export cable corridor at ST105, ST106, ST79, ST80, ST82 and ST98. *V. mirabilis* was recorded within the Proposed Development export cable corridor at ST106, ST109, ST85, ST87 and ST99.
201. For most of the sample stations where burrows were present in the DDV footage, burrow density was classified as 'common' according to the SACFOR scale. In accordance with the JNCC (2014b) guidance they were, therefore, classified as a prominent feature of the site (frequent on the SACFOR scale is required for burrows to be classified as a prominent feature). Several sample stations (ST105, ST85, and ST87) recorded burrows present in frequent abundance and were therefore considered to be a prominent feature of the sample station. Only ST82 and ST99 DDV stations recorded *N. norvegicus*, which is one of the species known to be responsible for creating the characteristic burrows of the 'seapen and burrowing megafauna communities' habitat. The presence of seapens is not a prerequisite for the classification of this habitat however where they were recorded, they were classified as occasional or frequent. It was therefore concluded that the 14 stations within the mid-section of the Proposed Development export cable corridor which were identified as SS.SMu.CFiMu.SpMg from the epifaunal data, were representative of the 'seapen and burrowing megafauna communities' OSPAR habitat (Table 3.16). Two other sample stations (ST104 and ST78) were classified as SS.SMu.CFiMu.SpMg from the epifaunal data however the data did not indicate the presence of the OSPAR habitat. They were located on the edge of the area of SS.SMu.CFiMu.SpMg habitat therefore were poorer examples of this habitat as it graded into another biotope.

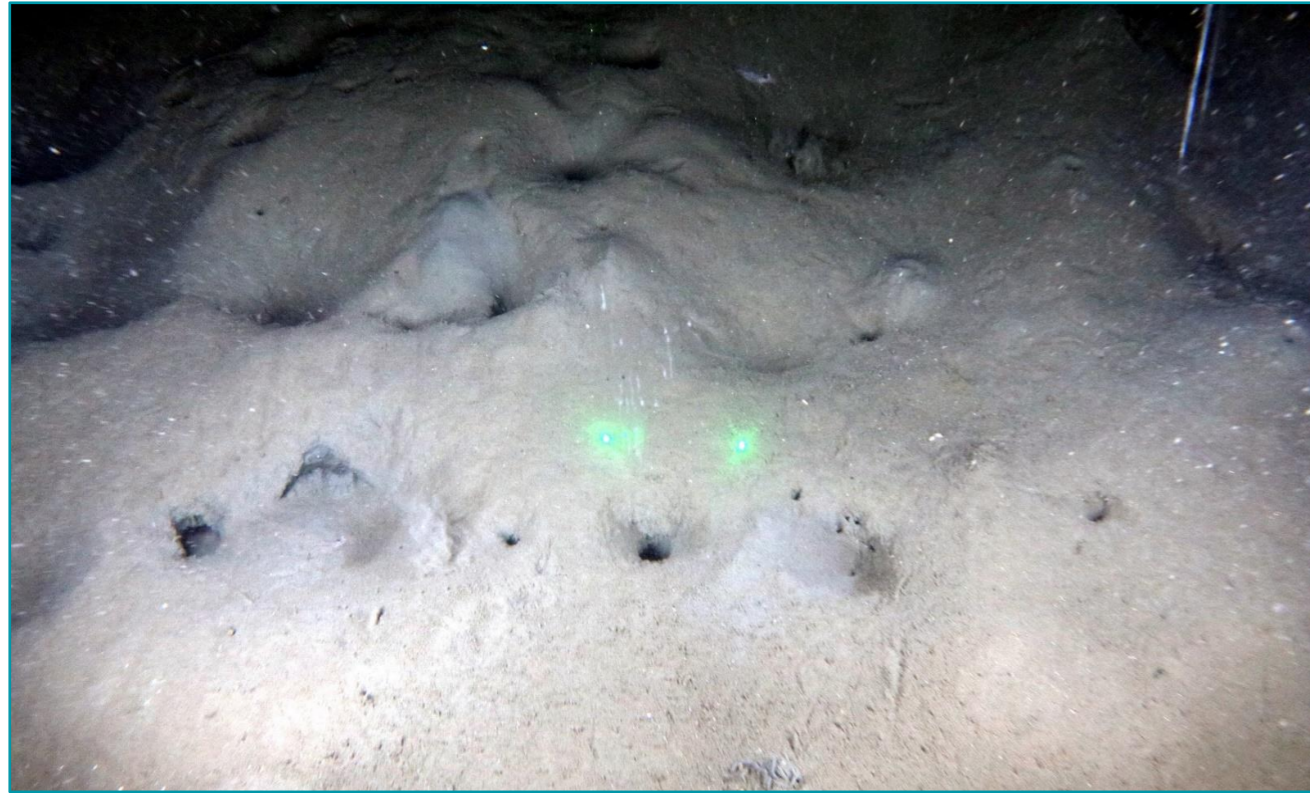


Figure 3.33: Example of Burrows at ST80



**Table 3.16: Analysis of Sample Stations where Burrows and Seapens were Recorded within the Seabed Imagery**

Sample Station	Number of Images Assessed	Estimated Total Area Investigation (m <sup>2</sup> )	Quantity	Burrows			Seapens		Representative of the OSPAR Habitat	
				Size Range (Diameter in cm)	Average Density (Burrows per m <sup>2</sup> )	SACFOR Abundance	Quantity	Average Density (Seapens per m <sup>2</sup> )		SACFOR Abundance
ST105	9	3.51	27	1 to 5	7.7	Frequent	2	0.6	Occasional	Yes
ST106	10	3.90	73	1 to 6	18.8	Common	2	0.5	Occasional	Yes
ST109	11	4.29	45	1 to 5	10.5	Common	1	0.2	Occasional	Yes
ST79	5	1.95	21	1 to 6	10.8	Common	4	2.1	Frequent	Yes
ST80	10	3.90	67	1 to 10	17.3	Common	1	0.3	Occasional	Yes
ST81	14	5.46	119	1 to 10	21.9	Common	0	0	n/a	Yes
ST82	11	4.29	50	1 to 7	11.7	Common	1	0.2	Occasional	Yes
ST85	9	3.51	33	1 to 4	9.5	Frequent	2	0.6	Occasional	Yes
ST86	5	1.95	42	1 to 9	21.6	Common	0	0	n/a	Yes
ST87	6	2.34	23	1 to 5	9.9	Frequent	3	1.3	Frequent	Yes
ST88	8	3.12	57	1 to 7	18.4	Common	0	0	n/a	Yes
ST97	5	1.95	21	1 to 4	10.8	Common	2	1.0	Frequent	Yes
ST98	9	3.51	61	1 to 5	17.5	Common	1	0.3	Occasional	Yes
ST99	12	4.68	84	1 to 7	18.0	Common	1	0.2	Occasional	Yes

#### Annex I reef assessment

202. An Annex I habitat assessment was undertaken on any sampling locations where potential biogenic and/or geogenic reef habitats were identified within the Proposed Development benthic subtidal and intertidal ecology study area. These habitats were identified from the DDV and seabed imagery. A *S. spinulosa* reef assessment was required at three sites (ST20, ST04 and ST56) and a cobble/stony reef assessment was performed at 11 sites (ST02, ST04, ST107, ST20, ST38, ST61, ST69, ST89, ST101, ST110, ST111). The reef assessments at these sites were undertaken with reference to the relevant guidance with details of the assessment criteria outlined in paragraphs 93 to 95.

#### Sabellaria spinulosa reef assessment

203. *S. spinulosa* aggregations at ST20 (in the centre of the eastern section of the Proposed Development array area) were recorded in small mounds generally 5-10 cm in height with a high level of patchiness (maximum percentage cover recorded at ST20 was 21.17%). The images assessed at ST20 recorded reef elevation ranging from high to low, reef extent from low to not a reef and reef patchiness medium to not a reef. The reefiness score for images at ST20 ranged from low to not a reef with a low reefiness score given to five of the six images assessed at ST20. Therefore, ST20 overall was given a reefiness score of low potential reef (Figure 3.34).

204. Only one image was assessed for *S. spinulosa* reef at each of ST04 and ST56 (located south-east outside of the Proposed Development array area and north of the western section of the Proposed Development array area respectively). Elevation was 5-10 cm at both sample stations, and consequently the reef structure at both sample stations were determined as 'not a reef'. Therefore, these sample stations could only achieve a 'not a reef' reefiness score and these could not be considered Annex I *S. spinulosa* reef habitat.

#### Geogenic reef assessment

205. Annex I reef assessment for cobble/stony reef was also conducted at one to three images from ST02, ST04, ST20, ST61, ST83, ST84 and ST101. All sample stations were classified as 'not a reef' or low reef as they all had an extent of <25 m<sup>2</sup> and/or composition of <25%. Therefore, these areas were not considered to be Annex I cobble/stony reef habitat.

206. At ST38 (in the centre of the eastern section of the Proposed Development array area) reef composition was given a score of low, ranging from 6.35 to 15.81%, elevation of 64 mm-5 m was medium, and extent was >25 m<sup>2</sup>. Therefore, ST38 was given an overall reefiness score of low potential reef and it is unlikely that this would be considered Annex I cobble/stony reef habitat.

207. At ST69 (at the north-west outside of the Proposed Development array area) cobble/stony reef elevation was recorded as low (< 64 mm) with an extent of < 25 m<sup>2</sup>, and therefore classified as 'not a reef'.

208. At ST107 (nearshore section outside the Proposed Development benthic subtidal and intertidal ecology study area) cobble elevation was recorded as 64 mm-5 m at each image assessed, and extent was >25 m<sup>2</sup>. Composition ranged from 9.56 to 66.09% therefore ranging from medium to 'not a reef'. In many images where the reef composition was allocated a score of medium, the percentage cover was towards the lower end of the medium criteria. Therefore, ST107 overall was given a reefiness score of low potential reef and it is unlikely that this would be considered Annex I cobble/stony reef.

209. At ST110 (nearshore section of the Proposed Development export cable corridor) elevation was also recorded as 64 mm-5 m in each image assessed (with the exception of one which recorded <64 mm) with

extent recorded as >25 m<sup>2</sup>. Composition ranged from 10.79 to 62.21% therefore ranging from medium to low reefiness score. Only three images out of 11 assessed at ST110 were given a medium reefiness score, therefore overall ST110 was given a reefiness score of low potential reef, and it is unlikely that this would be considered Annex I cobble/stony reef habitat.

210. At ST89 (at the nearshore section of the Proposed Development export cable corridor) medium elevation of 64 mm-5 m and medium extent >25 m<sup>2</sup> was recorded. Potential reef composition ranged from 2.45 to 95.25% with most images recorded as medium composition. ST89 was therefore given an overall reefiness score of medium potential reef. Due to the medium potential reef, a larger number of images were taken at this station to identify its wider extent. Images were taken until the marine ecologist reviewing the images *in situ* deemed the images to show no potential for reef, this was confirmed through subsequent analysis of the images, extent is shown through the reefiness assessment of images taken at ST89 on Figure 3.34.

211. At ST111 (nearshore section of the Proposed Development export cable corridor) an Annex I reef assessment for rocky reef was undertaken. Medium extent >25 m<sup>2</sup> and high 99.54% to low 35.82% composition was recorded. For rocky reef, the reef is not defined by elevation, only that it must arise from the sea floor. ST111 was therefore given an overall reefiness score of medium potential reef. Therefore, there is medium potential for Annex I rocky reef at the nearshore section of the Proposed Development export cable corridor.

212. The results of the Annex I reef assessment are aligned with the JNCC Annex I cobble/stony reef data (Figure 3.34). The Annex I reef assessment recorded medium and low potential Annex I cobble reef in the nearshore sample stations which overlap with the JNCC Annex I reef data. Sample stations in the nearshore section of the Proposed Development export cable corridor and nearshore section of the Proposed Development benthic subtidal and intertidal ecology study area, which were included in the assessment but determined to be not a reef (ST72, ST73, ST74, ST75, ST78, ST79, ST80, ST81, ST82, ST83, ST85, ST86, ST87, ST88, ST96, ST100, ST101, ST102, ST103, ST104, ST105, ST106, ST108, ST109), are located in patches in the JNCC Annex I reef data where reef is not predicted. Sample stations from the Proposed Development array area included in the assessment were almost all classified as 'not a reef' (with the exception of ST20 and ST38 which were classified as low potential reef), the JNCC Annex I reef data shows no Annex I reef recorded in the Proposed Development array area.

213. The results of the Annex I reef assessments alongside the JNCC data of Annex I reef locations is presented in Figure 3.34. The full results (including assessment criteria used) of the reefiness assessments are presented in Annex B: Annex I Reef Assessments.

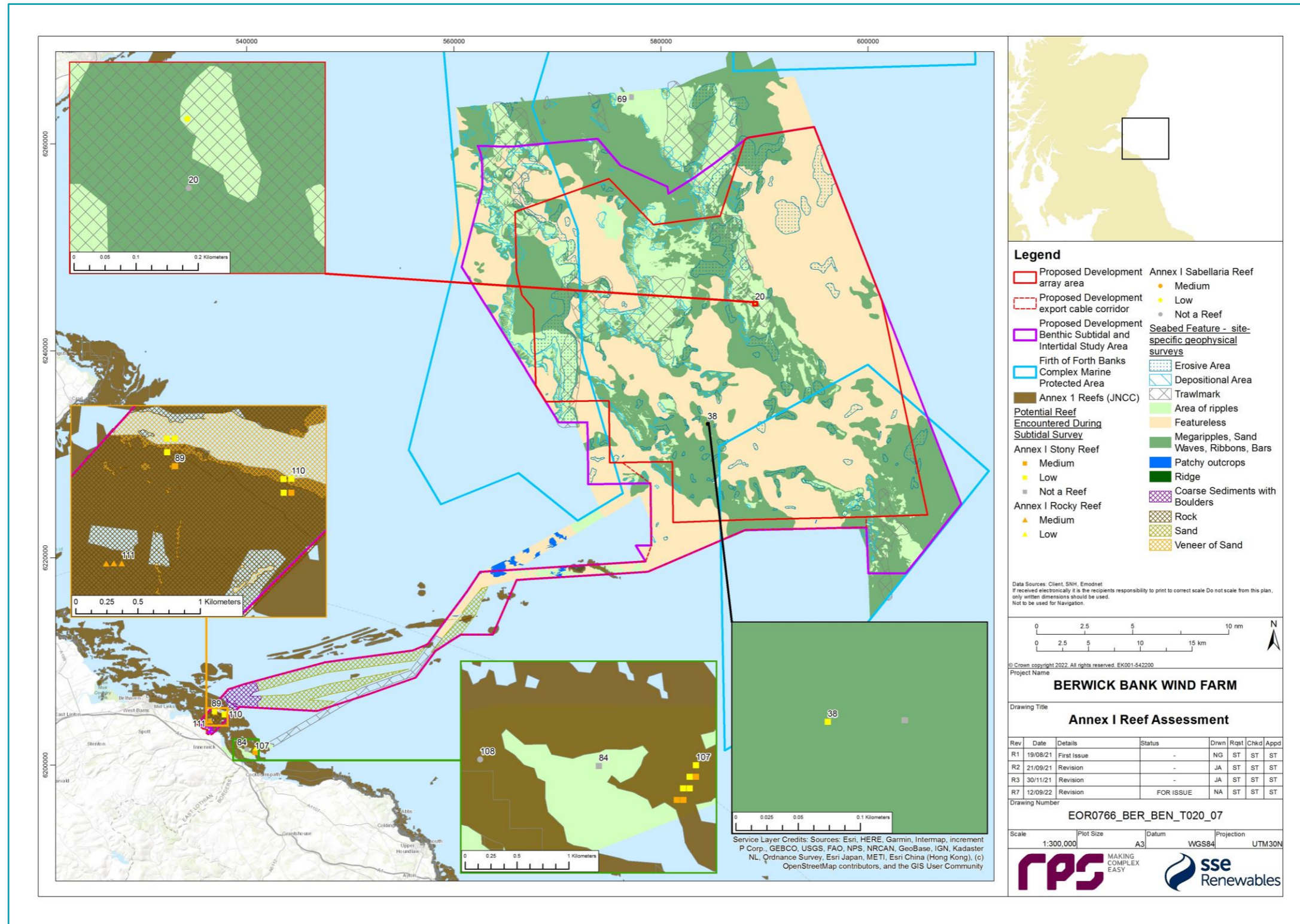


Figure 3.34: Results of the Annex I Reef Assessment within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area

Species of conservation importance

Ocean Quahog

214. As described in the infaunal data analysis above, *S. spinulosa* and ocean quahog *A. islandica* were recorded in the benthic infaunal grab survey. *Sabellaria spinulosa* individuals were recorded across the Proposed Development benthic subtidal and intertidal ecology study area, at ST23, ST27, ST32, ST36, ST45, ST54, ST57, ST63, ST65, ST70, ST83, ST92 and ST102. The highest abundances were recorded at ST36 (n=83) and ST83 (n=336), with all other sample stations recording less than 10 individuals. While *S. spinulosa* themselves are not a species of conservation importance, they can build biogenic reefs through forming tubes in the sand. Within the UK, these biogenic reefs are afforded protection under Annex I of the Habitats Directive. The benthic characterisation for Seagreen (Alpha) and Seagreen (Bravo) offshore wind farms and sampling for the FFBC MPA also recorded *Sabellaria*, but no biogenic reefs in the region. The FFBC MPA is not designated for biogenic reefs. A *S. spinulosa* reef assessment was required at three sites (ST20, ST04 and ST56), but no Annex I reef was recorded (section 3.4.7 and section 6).
215. The FFBC MPA is also designated for ocean quahog *A. islandica* aggregations. Ocean quahog *A. islandica* is listed on the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2008). In addition, ocean quahog *A. islandica* is a species listed as a Scottish PMF (Tyler-Walters *et al.*, 2016). Ocean quahog *A. islandica* was recorded from eight grab samples across the Proposed Development array area and the Proposed Development export cable corridor (Table 3.17). A summary of the ocean quahog *A. islandica* recorded across the Proposed Development benthic subtidal and intertidal ecology study area is provided in Table 3.17. Age estimates were calculated by counting the growth rings on the Ocean quahog *A. islandica* shell. Counting growth bands in the shell is a common method used in the literature for ageing Ocean quahogs (e.g. Strahl *et al.*, 2007; Abele *et al.*, 2008). Most individuals recorded were juveniles (<1 year old) however two were mature specimens. These two ocean quahog *A. islandica* were both recorded from the north of the eastern section of the Proposed Development array area. One juvenile (at ST55) was recorded with the FFBC MPA.

**Table 3.17: Ocean Quahog *A. islandica* Recorded in the Infaunal Grab Survey**

Sample	Abundance	Size (cm)	Size (mm)	Age
ST26	1	8.5	85	192 years
ST27	1	0.6	6	16 years
ST50	1	0.2	2	<1 year
ST55	1	0.2	2	<1 year
ST77	1	0.15	1.5	<1 year
ST80	1	0.2	2	<1 year
ST82	2	0.15	Both 1.5	Both <1 year
ST106	1	0.2	2	<1 year

216. Consistent with the infaunal data, ocean quahog *A. islandica* were recorded in two epibenthic trawls (BT07 and BT12), within the east of the Proposed Development array area, Figure 3.31.
217. A summary of the ocean quahog *A. islandica* recorded in the epibenthic trawls is provided in Table 3.18.

**Table 3.18: Ocean Quahog *A. islandica* Recorded in the Epibenthic Trawls**

Epibenthic trawl	Abundance	Size (cm)	Size (mm)	Age
BT07	1	10	100	166 years
BT12	1	11	110	193 years

*Modiolus modiolus*

218. As described in paragraph 204, *M. modiolus* were recorded in five of the epibenthic trawls (BT01, BT04, BT05, BT09, BT11). They were recorded in low numbers (<4 individuals) in the trawls with the exception of BT09 which recorded 31 individuals. Epibenthic trawl BT09 is from the centre of the Proposed Development benthic subtidal and intertidal ecology study area and was associated with coarse sediments (sandy gravel and gravelly sand).
219. A high volume of boulders and cobbles as well as large *M. modiolus* were observed at BT09 during the survey. *M. modiolus* beds in Scotland are concentrated around Orkney and on the west coast however they have been recorded in the Firth of Forth (paragraph 22). Beds are formed from clumps of *M. modiolus* and shells covering more than 30% of the seabed over an area of at least 5 m x 5 m. *M. modiolus* beds are generally recorded on open coast circalittoral mixed sediments or with hydroids and red seaweeds on tide swept circalittoral mixed substrata. They support a rich diversity of organisms, especially polychaete worms, bivalves and brittlestars. *M. modiolus* beds are a Scottish priority marine feature, an OSPAR threatened and/or declining habitat (OSPAR, 2009) and are recognised as biogenic reefs under the EU Habitats Directive (European Commission, 2013). No *M. modiolus* beds were recorded during the DDV survey and no *M. modiolus* was recorded in the infaunal grab survey.

### 3.5. SITE SPECIFIC INTERTIDAL SURVEY

#### 3.5.1. METHODOLOGY

220. A benthic phase 1 intertidal survey was undertaken at the selected landfall location. The survey was undertaken on a spring tide cycle in August 2020 and focussed on intertidal biotopes from MHWS to approximately MLWS. The survey was undertaken with reference to standard intertidal survey methodologies as outlined in the JNCC Marine Monitoring Handbook (Davies *et al.*, 2001) within Procedural Guidance No 3-1 *in situ* intertidal biotope recording (Wyn and Brazier, 2001 and Wyn *et al.*, 2000) and The Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey (Wyn *et al.*, 2006). The survey was carried out by two suitably qualified ecologists experienced in habitat mapping in intertidal, coastal and terrestrial environments.
221. The intertidal survey comprised both a general walkover, noting changes in ecological and physical characteristics, and on-site dig over macrofauna sampling and analysis in soft sediments, to help characterise the habitats. During the walkover survey, notes were made on the shore type, wave exposure, sediments/substrates present and descriptions of species/biotopes present. The spatial relationships between these features were observed and waypoints were recorded by a hand-held global positioning system (GPS) device, in conjunction with handwritten descriptions and photographs. All biotopes present were identified, and their extents mapped with the aid of aerial photography and a hand-held GPS recorder. Other features within the intertidal zone were also noted including rock pools, man-made structures and any habitats/species of conservation importance. Where present, these features were target noted in the intertidal biotope maps.

222. On-site dig over sampling stations were undertaken in different biotopes, where possible, the locations of which were determined in the field. This involved the collection of four spade loads (approximately 0.02 m<sup>2</sup>) of sediment dug to a depth of 20-25 cm, which were then sieved through a series of stacked sieves, the finest of which was 0.5 mm mesh. All macrofauna species present were identified and enumerated on site, where possible. Field notes were also taken on the physical characteristics, including sediment type and presence of anoxic layers in the sediment.

### 3.5.2. RESULTS

#### Overview

223. The Skateraw Landfall rock platform was predominantly covered by sediments. A sandy bay is present at Skateraw beach which was mainly composed of fine and medium grained sand which becomes muddier at the lower shore. A small proportion of gravel was also present within the lower shore sands. Larger mobile sediments (pebbles, cobbles and boulders) covered the rest of the rock platform with exposed areas of bedrock occurring in places. Rockpools frequently occurred in the rocky zone. Boulders were distributed throughout the rocky vertical shore profile and generally ranged from 10-75% cover in fucoid dominated habitats where bedrock was not extensively outcropping. Boulders accounted for approximately 75% or more of the upper substrate layer in lower shore kelp beds, except where kelp was directly attached to bedrock. Cobbles dominated mixed sediments in the upper fucoid zone with typical percentage coverage of around 75%.
224. Pebbles and cobbles were present throughout the rocky areas of the landfall and were abundant where they formed an extensive shingle bank at the beach head in the northern section of the landfall. Coarser sand was occasionally present at the head of the beach in small patches at the foot of the shingle bank. Freshwater flowed into the intertidal zone from the Dry Burn at National Grid Reference (NGR) NT 73461 75928.
225. The biotopes present at the proposed landfall are mapped in Figure 3.44 and are described with their full JNCC classifications presented in Annex K: Intertidal Biotopes.

#### Upper shore

226. Areas of barren bedrock which were not inhabited by species are mapped as LR: Littoral rock. These habitats mainly occurred at MHWS though extended down the shore into other biotopes particularly where the bedrock occurred at a higher elevation than surrounding habitats. These are therefore mapped as mosaics and their percentage contribution is denoted in Figure 3.44.
227. A medium grained sand occurred at the head of Skateraw Beach with patches of shingle and rocks at the edges of the sand. These habitats were inhabited by talitrid amphipods which occurred super abundantly under the decomposing seaweeds of the drift line though were fairly sparse where the seaweed was absent. These areas were characteristic of the biotope LS.Lsa.St.Tal (Talitrids on the upper shore and strand-line (Figure 3.35) which also occurred fairly extensively on shingle (mobile cobbles and pebbles) and occasionally under larger rocks in other upper shore areas of the site (Figure 3.36).
228. The biotope LR.FLR.Lic.YG (Yellow and grey lichens on supralittoral rock occurred sparsely and was dominated by *Xanthoria parietina*). This habitat occurred in a scattered fringe and is not mapped.
229. LR.FLR.Lic.Ver (*Verrucaria maura* on littoral rock fringe occurred on upper shore bedrock, boulders and cobbles). The black lichen *V. maura* was dominant though a significant amount of rock was uncolonized

and remained bare. *Enteromorpha intestinalis* occurred frequently and *Littorina saxatilis* was occasionally present. This habitat occurred in a scattered fringe and is not mapped.

230. The ephemeral green algae *E. intestinalis* was the dominant species in the biotope LR.FLR.Eph.Ent (*Enteromorpha* spp. on freshwater influenced and or unstable upper eu littoral rock (
231. Figure 3.37)). This habitat occurred on the upper shore on unstable rock and where fresh water from the dry burn flowed into the intertidal zone. Few other species occurred other than sparse patches of *Ulva lactuca* and occasional individuals of *L. saxatilis*. LR.FLR.Rkp.G (Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools) occurred within this biotope and had a similar species assemblage.
232. The biotopes LR.LLR.F.Fspi.B (*Fucus spiralis* on exposed to moderately exposed upper eu littoral rock) and LR.LLR.F.Fspi.X (*Fucus spiralis* on full salinity upper eu littoral mixed substrata) were both dominated by the brown alga *F. spiralis* with abundant black lichen *V. maura*. *E. intestinalis*, *Semibalanus balanoides*, *Patella vulgata*, *L. saxatilis* and *Littorina littorea* occurred occasionally. The brown alga *Pelvetia canaliculata* occurred in occasional patches within this biotope and on its landward fringe occasionally became dominant, forming a thin band of the habitat LR.LLR.FVS.PelVS (*Pelvetia canaliculata* on sheltered variable salinity littoral fringe rock). This biotope contained the same associated species as Fspi.X and was impractical to map.
- 233.



Figure 3.35: Foreshore LS.Lsa.St.Tal; Mid shore LS.LSa.FiSa.Po at Skateraw Landfall



Figure 3.36: Foreground LR.FLR.Eph.Ent; Background LS.Lsa.St.Tal at Skateraw Landfall

#### Mid shore

234. The biotope LR.HLR.MusB.Sem.Sem (*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or sheltered vertical eu littoral rock) occurred on bedrock and boulders and was dominated by the super abundant barnacle *S. balanoides*. limpet *P. vulgata*, winkle *L. littorea*, *L. obtusata* and whelk *Nucella lapillus* occurred occasionally throughout the zone. Black lichen *V. maura* occurred occasionally while the brown algae *Fucus vesiculosus*, red algae *Porphyra purpurea* and *E. intestinalis* were sparse.
235. The biotope LR.MLR.BF.FvesB (*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eu littoral rock) occurred predominantly on mixed rocky sediments dominated by boulders and also on bedrock (
236. Figure 3.37). The biotope was dominated by a scattered canopy of *F. vesiculosus*. The brown seaweed *Ascophyllum nodosum* was occasionally present with the epiphytic red seaweed *Vertebrata lanosa* attached. The red seaweeds *Mastocarpus stellatus* and *Corallina officinalis* were also occasionally present. The invertebrate fauna was dominated by super abundant *S. balanoides* with *P. vulgata*, *L. littorea*, *L. obtusata*, common shore crab *Carcinus maenas* and the anemone *Actinia equina* occasionally present. Juvenile mussel *Mytilus edulis* were rarely observed.
237. A similar suite of species and substrates occurred in the biotope LR.LLR.F.Fves (*Fucus vesiculosus* on moderately exposed to sheltered mid eu littoral rock) however the canopy of *F. vesiculosus* was more continuous and *S. balanoides* were less abundant, occurring only sparsely, and species such as brown crab *Cancer pagurus* and *C. maenas* were occasionally present under rocks. This community was differentiated into two variants which largely had the same species assemblages. LR.LLR.F.Fves.X (*Fucus*

*vesiculosus* on mid eu littoral mixed substrata) which contained a higher proportion of cobbles and pebbles and LR.LLR.F.Fves.FS (*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eu littoral rock) which occurred on boulders and bedrock. Patchworks of these closely related biotopes occurred together across the shore and are mapped as mosaics.

238. The biotope LR.HLR.FR.Coff.Coff (*Corallina officinalis* and *Mastocarpus stellatus* on exposed to moderately exposed lower eu littoral rock) was dominated by *C. officinalis* and coralline crusts with abundant *V. fucooides*. The green algae *Cladophora rupestris* and *F. vesiculosus* occurred commonly while the brown algae *Leathesia difformis* and the red seaweed *M. stellatus* occurred occasionally. *L. littorea* occurred in variable densities from sparse on bedrock to super abundant under flat stones overlying shallow water on bedrock. This biotope contained numerous shallow coralline rock pools with flat rocks under which a diverse assemblage of species occurred.
239. Numerous examples of the biotope LR.FLR.Rkp.Cor.Cor (*Corallina officinalis* and coralline crusts in shallow eu littoral rockpools) occurred from the middle of the shore up to the *F. spiralis* zone (Figure 3.38). *Corallina officinalis* and coralline crusts dominated with frequent green seaweed *C. rupestris* and brown seaweed *Halidrys siliquosa*. The red seaweeds *M. stellatus*, *Chondrus crispus*, *Ceramium* sp. and the green seaweed *U. lactuca* occurred occasionally with a scattering of *F. vesiculosus* and *P. vulgata*. A diverse range of invertebrate animals occurred including occasional *L. littorea*, *C. pagurus*, *Gibbula cineraria*, tubeworm *Spirorbis spirorbis*, hermit crabs *Pagurus bernhardus* and *C. maenas* with the anemone *Urticina felina*, bryozoans *Schizoporella unicornis*, sponges *Leuconia nivea*, sea squirt *Dendrodoa grossularia* and sea slug *Doris pseudoargus* scarce. The intertidal fishes, the two-spotted goby *Gobiusculus flavescens* and worm pipefish *Nerophis lumbriciformis*, were also present. Myriads of these pools occurred within the rocky areas of this landfall and only the largest could be mapped in a timeous fashion.



Figure 3.37: LR.MLR.BF.FvesB at the Skateraw Landfall



Figure 3.38: LR.FLR.Rkp.Cor.Cor at Skateraw Landfall

Lower shore

240. The biotope LR.MLR.BF.Fser (*Fucus serratus* on moderately exposed lower eu littoral rock) occurred commonly on the lower shore of the Skateraw landfall. The biotope contained a canopy of *F. serratus* predominantly on bedrock with frequent green seaweeds underneath such as *C. rupestris*. The invertebrates *S. balanoides*, *P. vulgata* and *N. lapillus* occurred occasionally, particularly in rock crevices. Two variants of this biotope (Fser.R and Fser.Bo) were fairly widespread on site and are described below.
241. The biotope LR.MLR.BF.Fser.R (*Fucus serratus* and red seaweeds on moderately exposed lower eu littoral rock) was characterised by red seaweeds including *M. stellatus*, *Osmundea pinnatifida* *C. officinalis* and *Ceramium* sp. which occurred commonly along. Green seaweeds such as *C. rupestris* and *E. intestinalis* were also occasionally present. Invertebrates included frequent occurrences of *P. vulgata* and *S. balanoides* with occasional specimens of *L. littorea*, *N. lapillus* and *C. maenas*.
242. Areas of the biotope LR.MLR.BF.Fser.Bo (*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eu littoral boulders (
243. Figure 3.40)) were highly species rich with super abundant *F. serratus* and occasionally *F. vesiculosus*. Red seaweeds present included *Palmaria palmata*, *M. stellatus*, *O. pinnatifida*, *Lomentaria articulata*, *Odonthalia dentata*, *C. officinalis* and calcareous encrusters. A rich invertebrate fauna was present with the crustaceans *Necora puber* (
244. Figure 3.40), *Porcellana platycheles*, *C. maenas*, *C. pagurus* and *Galathea squamifera* abundant under most rocks. The echinoderms *Henricia sanguinolenta*, *Asterias rubens*, *Ophiothrix fragilis*, *Psammechinus miliaris* and the anemone *A. equina* were occasionally recorded. Polychaetes occasionally observed included *Eulalia viridis* and *Pomatoceros triqueter*. The gastropod molluscs *P. vulgata*, *N. lapillus*, *L.*

*littoralis* and *G. cineraria* were variously present above and under boulders and the sea slug *D. pseudoargus* occurred infrequently under stones. The sponge *Halichondria panicea* occurred abundantly while epiphytic colonies of the ascidian *Botryllus schlosseri* and the bryozoans *Electra pilosa* and *Membranipora membranacea* were present both on fronds of *F. serratus* and on rocks. Intertidal fishes present included rock gunnel *Pholis gunnellus*, five-bearded rockling *Ciliata mustela* and shanny *Lipophrys pholis*.

245. The same assemblage of associated species and substrate composition occurred at the lowest part of the shore in the biotope LR.MIR.KR.Ldig.Bo (*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders). The kelp *L. digitata* became the dominant seaweed with *F. serratus* occasionally present. Additional species only recorded in this biotope included the seaweeds *Saccharina latissima*, *L. hyperborea*, *Dilsea carnosa*, the gastropod *Trivia monacha* and the intertidal long-spined sea scorpion *Taurulus bubalis*. This biotope was typically only accessible for a few metres width and occurred in places together with a narrow fringe of vertical LR.MIR.KR.Ldig (*Laminaria digitata* on moderately exposed sublittoral fringe rock biotope) where rock platforms dropped off either into lower shore intertidal *L. digitata* boulder fields or directly into the sea. These habitats are mapped as thin dashed lines on Figure 3.44. The seaweed *L. hyperborea* appeared to become dominant in the nearshore subtidal area.
246. *Fucus serratus* and the kelp *L. digitata* dominated the deeper waters of LR.FLR.Rkp.FK (Fucoids and kelp in deep eu littoral rockpools) while *C. officinalis* and coralline crusts dominated the shallow fringes. *Halidryx siliquosa*, *M. stellatus*, *C. crispus*, *P. palmata*, *Ahnfeltia plicata* and *Ceramium* sp. occurred frequently with scattered *N. lapillus*, *P. vulgata* and *A. equina*. Shrimps *Palaemon* sp. occurred occasionally. These pools were present throughout the lower and lower mid shore zones.
247. Depth prevented access to the bottoms of many pools and hampered visibility. Visibility was particularly poor in a small number of large pools where significant amounts of suspended sediments were present in the water column (Figure 3.41). These pools were predominantly characterised by the LR.FLR.Rkp.SwSed (Seaweeds in sediment-floored eu littoral rockpools) biotope and large pools even contained patches of LS.LSa.MuSa.MacAre (*Macoma balthica* and *Arenicola marina* in littoral muddy sand) biotope complete with an anoxic layer.
248. The biotope LS.LSa.MuSa.MacAre occurred in upper shore and mid shore areas within the sandy bay at Skateraw beach (
249. Figure 3.42 and Figure 3.43). *Macoma balthica* and the closely related thin tellin *Macomangulus tenuis* were rarely observed in dig over sampling. The fine muddy sand (Folk, 1966) in these areas contained an anoxic layer within centimetres of the surface and contained a small proportion of gravel.
250. Oligochaete worms and the polychaete worms *Hediste diversicolor*, *Scoloplos armiger* and *Lanice conchilega* were also recorded in low densities during dig over sampling. *Arenicola marina* was more abundant in this biotope than *L. conchilega* in areas where the latter was present. Both of these species could be readily surveyed without digging due to the distinctive casts of *A. marina* and the cases of *L. conchilega* which were easily visible above the surface of the sand.
251. Where dense populations of *L. conchilega* occurred and *A. marina* was less abundant, if present, the biotope LS.LSa.MuSa.Lan (*Lanice conchilega* in littoral sand) was ascribed. This biotope occurred predominantly in clean sand, mainly along the mid and lower shores with polychaetes *Euclymene lumbricoides*, *Nephtys hombergii*, *Scoloplos armiger* and *Arenicola marina* often present. Transitional areas between this habitat and LS.LSa.MuSa.MacAre contained anoxic sand near the surface.
252. A similar array of polychaetes occurred in the biotope LS.LSa.FiSa.Po (Polychaetes in littoral fine sand) with occasional occurrences of the polychaetes *N. hombergii*, *Paraonis fulgens*, *H. diversicolor* and *S. armiger*. *A. marina* was rarely present, and the sand lacked an anoxic layer.



Figure 3.39: Under Boulder Habitat of LR.MLR.BF.Fser.Bo



Figure 3.41: LR.FLR.Rkp.SwSed at Skateraw Landfall



Figure 3.40: Necora puber from LR.MLR.BF.Fser.Bo at Skateraw Landfall



Figure 3.42: Anoxic Layer in Interface Between LS.LSa.MuSa.MacAre and LS.LSa.MuSa.Lan at Skateraw Landfall





Figure 3.43: Gravel Content From  $\sim 0.02 \text{ m}^2$  of LS.LSa.MuSa.MacAre at the Skateraw Landfall

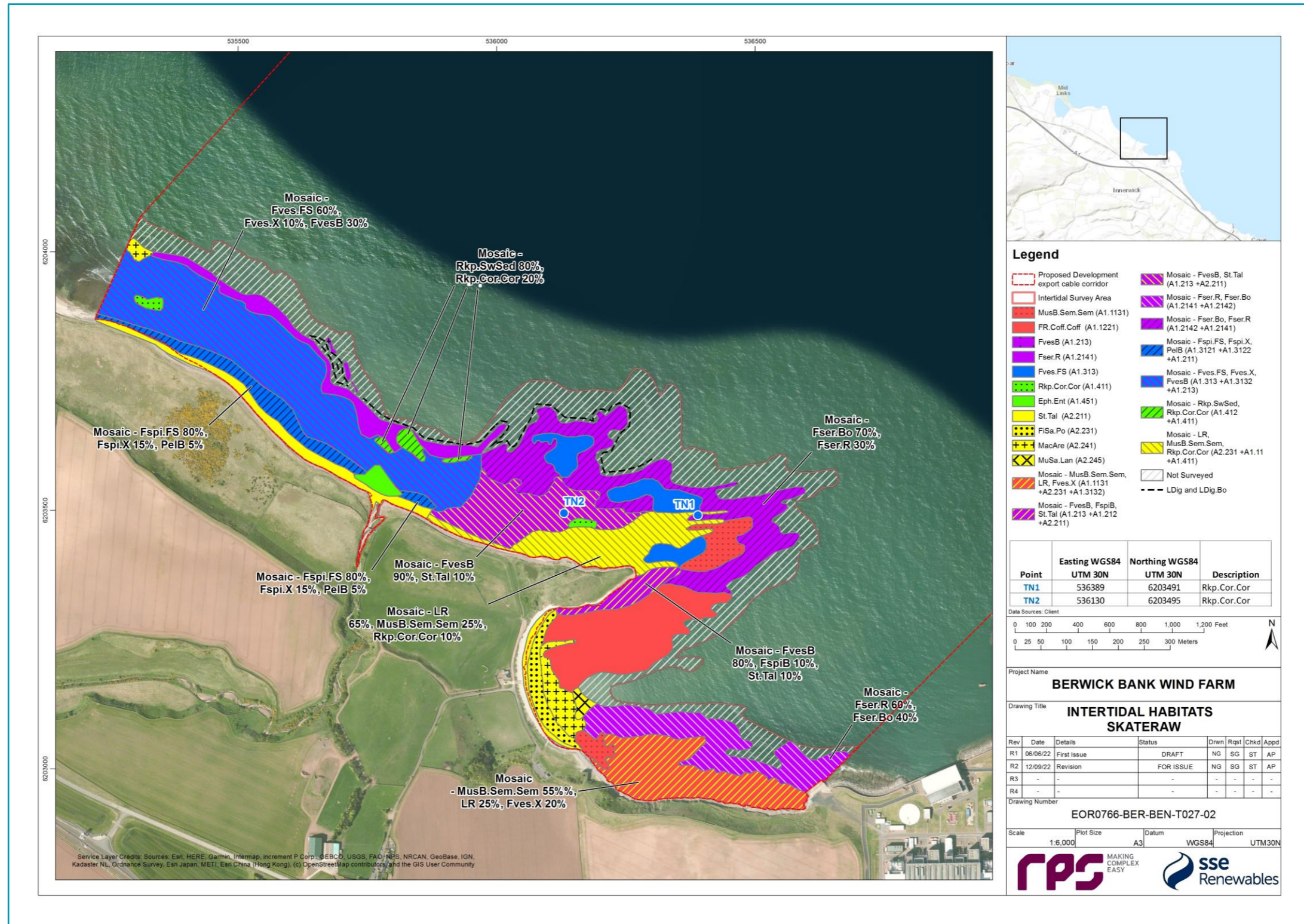


Figure 3.44: Phase 1 Intertidal Biotope Map of the Skateraw Landfall

### 3.5.3. RESULTS - HABITATS OF CONSERVATION IMPORTANCE

#### Intertidal sand and mudflats

253. The following biotopes, recorded at the Skateraw Landfall, are part of the Annex I Habitats Directive habitat – 1140 Mudflats and sandflats not covered by seawater at low tide:
- LS.Lsa.St.Tal: Talitrids on the upper shore and strand-line;
  - LS.LSa.MuSa.Lan: *Lanice conchilega* in littoral sand and
  - LS.LSa.MuSa.MacAre: *Macoma balthica* and *Arenicola marina* in littoral muddy sand. This biotope is also part of the Intertidal Mudflats habitat listed on the Scottish Biodiversity List and is a UK Priority Biodiversity Action Plan.

#### Intertidal boulder communities

254. The following biotopes, recorded at the Skateraw Landfall, form part of the Intertidal Boulder Communities habitat listed on the Scottish Biodiversity List. This biotope is also UK Priority Biodiversity Action Plan habitats and is a representative of Habitats Directive Annex I reefs.
- LR.MLR.BF.Fser.Bo: *Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eu-littoral boulders.
255. These boulder fields are species rich examples of the biotope and contain abundant juveniles of the edible crab *Cancer pagurus* and adult velvet crab *Necora puber* which are commercial species.
256. Other commercial species present were *L. littorea* (which occurs in very variable densities across the site though was locally super abundant under stones in the mid littoral zone) and *M. edulis* which was rarely recorded. *Cerastoderma edule* was not recorded during sampling of the sandflats though could occur within these habitats.

#### Other biotopes

257. Other UK Broad Biodiversity Action Plan habitats are present. The most valuable among these are rockpools which significantly enhance diversity. Large deep rockpools in the mid and lower shore, particularly those with permanently submerged kelp, are essentially subtidal in nature and will extend the range of both subtidal and lower shore plants and animals well into the mid littoral zone.

## 4. SUMMARY

258. The subtidal site-specific survey consisted of infaunal grab samples, DDV survey and epibenthic trawls. Subtidal sediments recorded across the Proposed Development benthic subtidal and intertidal ecology study area ranged from sandy gravel to muddy sand with the most samples classified as slightly gravelly sand. The sediments within the eastern parts of the Proposed Development array area were dominated by slightly gravelly sands with areas of gravelly sand in the north and south. The sediments within the western parts of the Proposed Development array area were typically slightly coarser and characterised by sandy gravel sediments in addition to slightly gravelly sand and gravelly sand. The sediments within the offshore section of the Proposed Development export cable corridor were characterised by the same sediment types as the Proposed Development array area. This is aligned with the desktop data which indicated coarse sediments (gravelly sand) and sand across the proposed Development array area (Pearce *et al.*, 2014; Axelsson *et al.*, 2014; Southeran and Crawford-Avis, 2013). Sand sediments grade into muds, mixed sediments and rocky habitats with increasing proximity to the landfall.
259. Nine sediments samples from across the Proposed Development benthic subtidal and intertidal ecology study area were analysed for sediment chemistry. No contaminants were found to exceed AL1/AL2 or the Canadian PEL. Only arsenic at five sample stations within the north-west of the Proposed Development array area exceeds the Canadian TEL.
260. The site-specific survey data showed that the sediments within the eastern part of the Proposed Development array area were characterised by the SS.SSa.CFiSa.EpusBorApr and SS.SMu.AfilMysAnit biotope with smaller areas of SS.SMx.CMx.MysThyMx, SS.SSa.OSa and SS.SMx.OMx.PoVen. The sediment within the western parts of the Proposed Development array area were characterised by the SS.SMx.OMx.PoVen and SS.SMu.AfilMysAnit biotope with smaller areas of SS.SMx.OMx and SS.SSa.CFiSa.EpusOborApr. This is aligned with the desktop data which recorded SS.SSa.IFiSa.NcirBat, SS.SMx.CMx.MysThyMx and SS.SMu.CSaMu.AfilMysAnit in the nearshore environment (Brazier *et al.*, 1998). The SS.SBR.PoR.SspiMx biotope was also recorded in the western part of the Proposed Development array area but it was not reef forming and did not correspond with any areas identified as potential Annex I *S. spinulosa* reef. The Annex I reef assessment identified ST20 as having low potential for *S. spinulosa* reef in the centre of the Proposed Development array area.
261. The Seagreen (Alpha and Bravo) baseline characterisation surveys recorded SS.SMx.OMx.PoVen and the Seagreen Proposed Development export cable corridor validation survey recorded SS.SMu.CSaMu.AfilMysAnit and SS.SMx.OMx.PoVen in the adjacent areas of the Firth of Forth (Seagreen, 2012). SS.SMu.CFiMu.SpnMeg and SS.SBR.PoR.SspiMx were also previously recorded within the regional benthic subtidal and intertidal ecology study area (EMU, 2010; Southeran and Crawford-Avis, 2013). Surveys undertaken for the FFBC MPA also identified SS.SBR.PoR.SspiMx within the area overlapping with the western Proposed Development array area, although this was not concluded to be Annex I reef (Pearce *et al.*, 2014).
262. The habitats within the Proposed Development export cable corridor were characterised by the SS.SMu.CFiMu.SpnMeg, SS.SMu.CSaMu.AfilNten and SS.SMu.ThyNten biotopes. The seapens and burrowing megafauna assessment showed the areas identified as SS.SMu.CFiMu.SpnMeg within the Proposed Development export cable corridor classified as the OSPAR habitat.
263. The inshore section of the Proposed Development export cable corridor was dominated by muddy sand, slightly gravelly muddy sand and sand sediments. The infaunal data recorded SS.SMu.ThyNten in the section of the Proposed Development export cable corridor by the Skateraw landfall. The epifaunal data

recorded CR.MCR.EcCr in the section of the Proposed Development export cable corridor by the Skateraw landfall.

264. The Annex I reef assessment identified two sample stations as medium and four sample stations as low potential Annex I cobble reef in the inshore section of the Proposed Development export cable corridor. One sample station in the nearshore area of the Proposed Development export cable corridor was classified as medium potential rocky reef. The desktop data reported discrete areas of rock distributed throughout the inshore regions of the Proposed Development export cable corridor (Inch Cape Offshore Limited, 2011; EMODnet, 2019).
265. The site-specific survey recorded Ocean quahog *A. islandica* across the Proposed Development array area and Proposed Development export cable corridor, and *M. modiolus* was recorded across the Proposed Development array area. Axelsson *et al.* (2014) recorded *M. modiolus* to the west of the Proposed Development array area.
266. A site-specific Phase 1 intertidal survey was undertaken at the selected landfall location. The intertidal survey comprised both a general walkover, noting changes in ecological and physical characteristics, and on-site dig over macrofauna sampling and analysis in soft sediments, to help characterise the habitats. A sandy bay was present at the Skateraw landfall which was mainly composed of fine and medium grained sand which became muddier at the lower shore. A small proportion of gravel was also present within the lower shore sands. The Skateraw landfall also had large areas of the bedrock exposed and contained a mosaic of deep pools cut into the sedentary platform by wave action. Rockpools also occurred frequently in other rocky areas between and under seaweeds and stones. Cobbles and boulders dominated the mid shore with fucoid seaweeds. Kelp beds were present in the lower shore, either attached to boulders or direct to bedrock. This is aligned with the habitats recorded at the survey undertaken for the same proposed landfall for the Neart na Gaoithe offshore wind farm which identified a soft sediment beach with the upper shore at Skateraw characterised by barren sand. Torness Nuclear Power Station also surveyed this site and recorded very similar habitats (ABPmer, 2019).

### 4.1. IMPORTANT ECOLOGICAL FEATURES

267. In accordance with the best practice guidelines (CIEEM, 2019), for the purposes of the benthic subtidal and intertidal ecology EIA, IEFs have been identified and all potential impacts of the Proposed Development will be assessed against the IEFs to determine whether or not they are significant. The IEFs of an area are those that are considered to be important and potentially affected by the Proposed Development. Importance may be assigned due to quality or extent of habitats, habitat or species rarity or the extent to which they are threatened (CIEEM, 2019). Species and habitats are considered IEFs if they have a specific biodiversity importance recognised through international or national legislation or through local, regional or national conservation plans (e.g. Annex I habitats under the Habitats Directive, OSPAR, National Biodiversity Plan or the Marine Strategy Framework Directive, Scottish PMFs and the Scottish Biodiversity list). The criteria used to inform the valuation of IEFs is presented in Table 4.1 and the IEFs, their conservation status and valuation is presented in Table 4.2. The biotopes present across the Proposed Development benthic subtidal and intertidal ecology study area have been grouped into broad habitat/community types. The identified IEFs will be taken forward for assessment within the benthic subtidal and intertidal ecology EIA Report (volume 2, Chapter 8) and used to assess impacts associated with the construction, operation and decommissioning of the Proposed Development on benthic subtidal and intertidal ecology.

**Table 4.1: Criteria Used to Inform the Valuation of IEFs in the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area**

Value of IEF	Criteria to Define Value
International	Internationally designated sites. Habitats and species protected under international law (i.e. Annex I habitats within a SAC boundary).
National	Nationally designated sites. Species protected under national law. OSPAR List of Threatened and/or Declining Species and Habitats. Annex I habitats not within a SAC boundary.
Regional	Regionally important habitats/communities within the Proposed Development benthic subtidal and intertidal ecology study area. Habitats or species that provide important prey items for other species of conservation or commercial value.
Local	Habitats and species which are not protected under conservation legislation which form a key component of the benthic ecology within the Proposed Development benthic subtidal and intertidal ecology study area.

**Table 4.2: IEFs within the Project Development Benthic Subtidal and Intertidal Ecology Study Area**

IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area
<b>Subtidal Habitats</b>				
Subtidal sand and muddy sand sediments	Subtidal sand and muddy sand, characterised by amphipods, bivalves and <i>Amphiura</i> . <ul style="list-style-type: none"> <li>• SS.SSa.OSa</li> <li>• SS.SSa.IFiSa</li> <li>• SS.SSa.OSa [<i>Echinocyamus pusillus</i>]</li> <li>• SS.SSa.CFiSa.EpusOborApri</li> <li>• SS.SSa.IFiSa.NcirBat</li> <li>• SS.SSa.CMuSa</li> <li>• SS.SSa.CMuSa [<i>Crangon crangon</i>]</li> <li>• SS.SMu.CSaMu.ThyNten</li> <li>• SS.SMu.CSaMu.AfilMysAnit</li> <li>• SS.SMu.CSaMu.AfilNten</li> <li>• SS.SSa.CFiSa.ApriBatPo<sup>2</sup></li> </ul>	None	Scottish PMF, UK Biodiversity Action Plan (BAP) priority habitat	Regional
Subtidal coarse and mixed sediments	Subtidal coarse and mixed sediments characterised by amphipods, bivalves, polychaetes and barnacles. <ul style="list-style-type: none"> <li>• SS.SMx.OMx</li> <li>• SS.SBR.PoR.SspiMx</li> <li>• SS.SMx.OMx.PoVen</li> <li>• SS.SMx.CMx.FluHyd</li> <li>• SS.SCS.CCS</li> </ul>	None	UK BAP habitat, Scottish PMF	Regional
Moderate energy subtidal rock	Subtidal rock with sparse communities within the Proposed Development array area and inshore Proposed Development export cable corridor. <ul style="list-style-type: none"> <li>• CR.MCR.EcCr</li> </ul>	None	Of local conservation interest, Scottish PMF, OSPAR habitat	Regional
Seapens and burrowing megafauna	Muddy sediments with large burrow and sea pens within the Proposed Development export cable corridor. <ul style="list-style-type: none"> <li>• SS.SMu.CFiMu.SpnMeg</li> </ul>	None	OSPAR habitat, Scottish PMF, UK BAP habitat.	National
Cobble/stony reef outside of an SAC	Cobble/stony reef outside an SAC with high epifaunal diversity <ul style="list-style-type: none"> <li>• SS.SCS.CCS</li> <li>• CR.MCR.EcCr</li> </ul>	Representative of Annex I habitat	Annex I habitat outside of an SAC, Scottish PMF	National
Rocky reef outside an SAC	Medium potential rocky reef outside an SAC <ul style="list-style-type: none"> <li>• CR.MCR.EcCr</li> </ul>	Representative of Annex I habitat	Annex I habitat outside of an SAC	National
<i>Sabellaria</i> reef outside of an SAC	Low potential <i>Sabellaria</i> reef outside of an SAC <ul style="list-style-type: none"> <li>• SS.SBR.PoR.SspiMx</li> </ul>	Representative of Annex I habitat	Annex I habitat outside of an SAC, UK BAP priority habitat, OSPAR habitat	National
<b>Qualifying Features of MPAs</b>				

<sup>2</sup> Although the • SS.SSa.CFiSa.ApriBatPo biotope is not within the Proposed Development benthic subtidal and intertidal ecology study area it has been included as an IEF due to its close proximity,

IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area
Subtidal sands and gravels	Subtidal sand and gravels within the FFBC MPA. <ul style="list-style-type: none"> <li>SS.SCS.CCS</li> <li>SS.SSa.OSa</li> <li>SS.SSa.CFiSa.ApriBatPo</li> <li>SS.SSa.CFiSa.EpusOborApri</li> </ul>	MPA	UK BAP habitat Qualifying feature of an MPA, Scottish PMF.	National
Shelf banks and mounds	Banks and mounds on the continental shelf composed of coarse sands and gravels. <ul style="list-style-type: none"> <li>SS.SCS.CCS</li> <li>SS.SSa.OSa</li> <li>SS.SSa.CFiSa.ApriBatPo</li> <li>SS.SSa.CFiSa.EpusOborApri</li> </ul>	MPA	UK BAP habitat, qualifying feature of the FFBC MPA, Scottish PMF	National
Ocean Quahog <i>A. islandica</i>	Ocean Quahog <i>A. islandica</i>	OSPAR protected species	Qualifying feature of an MPA, Scottish PMF	National
<b>Annex I Habitat Features of SACs</b>				
Mudflats and sandflats not covered by seawater at low tide	<ul style="list-style-type: none"> <li>Mobile sand shores with amphipods and polychaetes (AP.P)</li> <li>Mobile sand shores with amphipods and polychaetes (AEur)</li> <li>Mobile sand shores with amphipods and polychaetes (AP.Pon)</li> <li>Muddy sand and mud shores with polychaetes, bivalves and <i>Zostera noltii</i> (HedMac.Are)</li> <li>Muddy sand and mud shores with polychaetes, bivalves and <i>Zostera noltii</i> (Znol)</li> <li>Boulders and cobbles with <i>Mytilus edulis</i> beds (MytX)</li> <li>Muddy sand shores with polychaetes and bivalves (MacAre)</li> <li>Infralittoral fine sand with polychaetes and bivalves (FabMag)</li> </ul> (SNH, 2000)	Annex I Habitats Directive	Scottish PMF, UK BAP habitat, OSPAR habitat  Qualifying feature of the Berwickshire and North Northumberland Coast SAC	International
Large shallow inlets and bays	<ul style="list-style-type: none"> <li>N/A</li> </ul>	Annex I Habitats Directive	Qualifying feature of the Berwickshire and North Northumberland Coast SAC	International
Reefs (subtidal and intertidal rocky reef)	<ul style="list-style-type: none"> <li>Rock with mussels and barnacles (MytB)</li> <li>Boulders and cobbles with <i>Mytilus edulis</i> beds (MytX)</li> <li>Rock with mussels and barnacles (Ala)</li> <li>Rock with mussels and barnacles (Ala.Myt)</li> <li>Tide swept circalittoral rock with dense <i>Alcyonium digitatum</i> (AlcC)</li> <li>Tide swept circalittoral rock with dense <i>A. digitatum</i> and hydroid turf (AlcSec)</li> <li>Tide swept circalittoral rock with <i>A. digitatum</i> and hydroid turf (AlcTub)</li> <li>Rock with mussels and barnacles (Ala.Ldig)</li> <li>Rock with fucoids and barnacles (BPat.Sem)</li> <li>Rock with fucoid algae (Fves)</li> <li>Rock with fucoid algae (Fser.Fser)</li> <li>Rock with fucoids and barnacles (FvesB)</li> <li>Rock with fucoids and barnacles (Ldig.Ldig)</li> <li>Littoral rock with barnacles and mussels (Him)</li> <li>Circalittoral rock with sparse <i>A. digitatum</i> and faunal turf (FaAIC)</li> <li>Circalittoral rock with brittlestars and hydroids (Oph)</li> <li>Circalittoral rock with hydroids and bryzoans (Flu.Flu)</li> </ul>	Annex I Habitats Directive	Qualifying feature of the Berwickshire and North Northumberland Coast SAC	International

IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area
	(SNH, 2000)			
Submerged or partially submerged sea caves	<ul style="list-style-type: none"> <li>• Sparse fauna (barnacles and spirorbids) in scoured mid or lower shore caves (LR.CvOv SFa)</li> <li>• Barren or Coralline crust-covered rock on severely scoured cave walls and floors (LR.CvOv BarCC)</li> <li>• <i>Rhodothamniella floridula</i> on shaded vertical rock in upper and mid shore caves (LR.CvOv RhoCv)</li> <li>• Green algal film (<i>Pseudendoclonium submarinum</i>) on upper shore cave walls and ceilings (LR.CvOv GCv)</li> <li>• Brown algal crusts (<i>Pilinia maritima</i>) on upper shore caves (LR.CvOv Br)</li> <li>• <i>Verrucaria mucosa</i> and <i>Hildenbrandia rubra</i> on shaded vertical or overhanging rock in upper- and mid-shore caves (LR.CvOv Vmuc)</li> <li>• <i>Verrucaria mucosa</i> and <i>Hildenbrandia rubra</i> on shades vertical or overhanging rock in upper and mid shore caves (LR.CvOv FaC)</li> <li>• Faunal encrusted vertical rock on mid or lower shore wave surged caves (LR.CvOv RCv)</li> <li>• Red algal dominated cave entrance on lower shore (LR.CvOv SR)</li> <li>• Sponges and shade tolerant red seaweeds on steep or overhanging lower eulittoral bedrock (LR.CvOv SR.Ov)</li> <li>• Sponges and shade tolerant red seaweeds on open shore overhanging bedrock in lower eulittoral (LR.CvOv SR.Cv)</li> <li>• Sponges and shade tolerant red seaweeds on steep or overhanging wave surged bedrock in aces (LR.CvOv SByAs)</li> <li>• Sponges, bryozoans and ascidians on deeply overhanging lower shore bedrock (LR.CvOv) SByAs.Ov</li> <li>• Sponges, bryozoans and ascidians on deeply overhanging wave surged bedrock in lower shore caves (LR.CvOv SByAs.Cv)</li> <li>• Sponge crusts and anemones on wave surged vertical infralittoral rock (SCAn)</li> <li>• Sponge crusts, anemones and <i>Tubularia indivisa</i> in shallow infralittoral surge gullies (SCAn.Tub)</li> <li>• Sponge crusts and colonial ascidians on wave surged vertical infralittoral rock (SCAs)</li> <li>• <i>Dendrodoa grossularia</i> and <i>Clathrina coriacea</i> on wave surged vertical infralittoral rock (SCAs.DenCla)</li> <li>• Sponge crusts, colonial (polyclonid) ascidians and a bryozoan/hydroid turf on wave surged vertical or overhanging infralittoral rock (SCAs.ByH)</li> </ul>	Annex I Habitats Directive	Qualifying feature of the Berwickshire and North Northumberland Coast SAC	International
	(SNH, 2000)			
<b>Intertidal Habitats</b>				
Intertidal rock	High energy littoral rock and litoral fringe rock within the intertidal zone. <ul style="list-style-type: none"> <li>• LR.FLR.Eph.Ent</li> <li>• LR.FLR.Lic.Ver</li> <li>• LR.FLR.Lic.YG</li> <li>• LR.HLR.FR.Coff.Coff</li> <li>• LR.HLR.MusB.Sem.Sem</li> </ul>	Representative of Annex I habitat	Annex I habitat outside of a SAC, Scottish PMF	Regional



IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance within the Proposed Development Benthic Subtidal and Intertidal Ecology Study Area
Fucus dominated intertidal rock	<ul style="list-style-type: none"> <li>• LR.MLR.BF.Fser.Bo</li> </ul> <p>Low energy littoral rock dominated by Furoid spp.</p> <ul style="list-style-type: none"> <li>• LR.LLR.F.Fspi.B</li> <li>• LR.LLR.F.Fspi.X</li> <li>• LR.LLR.F.Fves</li> <li>• LR.LLR.F.Fves.FS</li> <li>• LR.LLR.F.Fves.X</li> <li>• LR.LLR.FVS.PelVS</li> <li>• LR.FLR.Rkp.Cor.Cor</li> <li>• LR.FLR.Rkp.FK</li> <li>• LR.FLR.Rkp.G</li> <li>• LR.FLR.Rkp.SwSed</li> <li>• LR.MIR.KR.Ldig</li> </ul>	Representative of habitat	Annex I habitat outside of a SAC, Possibly representative of Scottish PMF	Regional
Intertidal sand	<p>Intertidal sand with sparse communities</p> <ul style="list-style-type: none"> <li>• LS.LSa.FiSa.Po</li> <li>• LS.LSa.St.Tal</li> <li>• LS.LSa.MuSa.MacAre</li> <li>• LS.LSa.MuSa.Lan</li> </ul>	None	Representative of an Annex I habitat	Regional

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## 6. ANNEX

### 6.1. ANNEX A: SEABED SEDIMENTS

**Table 6.1: Results of the Particle Size Analysis**

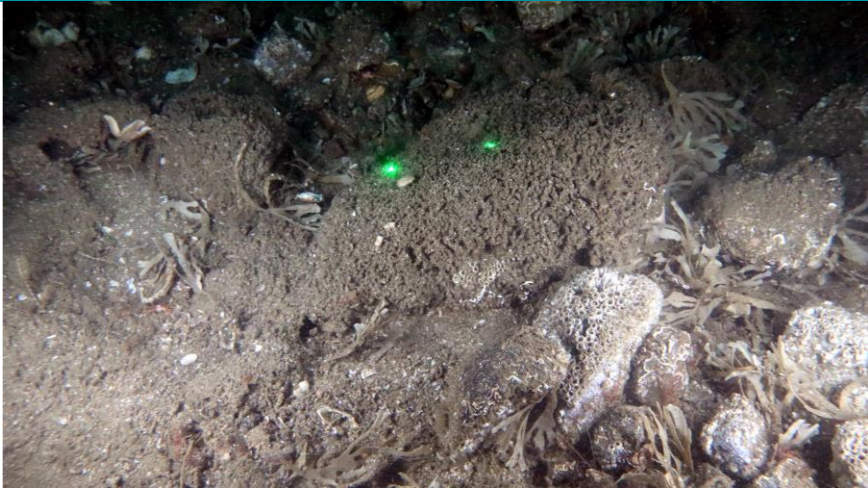

Sample Station	Location	Folk Classification	Folk and Ward Sorting	Major Sediment Fractions		
				% Gravel	% Sand	% Mud
ST03	Outside the Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	6.1%	91.6%	2.2%
ST05	Proposed Development array area (east)*	Slightly Gravelly Sand	Moderately Sorted	2.7%	94.3%	3.0%
ST06	Proposed Development array area (east)*	Slightly Gravelly Sand	Moderately Sorted	0.5%	94.7%	4.8%
ST07	Proposed Development array area (east)*	Slightly Gravelly Sand	Poorly Sorted	4.9%	91.7%	3.4%
ST08	Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	11.0%	85.6%	3.4%
ST09	Proposed Development array area rea (east)*	Gravelly Sand	Poorly Sorted	10.8%	86.5%	2.6%
ST10	Outside the Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	7.2%	89.8%	3.0%
ST11	Proposed Development array area (east)*	Gravelly Sand	Very Poorly Sorted	18.3%	79.2%	2.5%
ST12	Proposed Development array area rea (east)*	Slightly Gravelly Sand	Poorly Sorted	1.7%	91.9%	6.4%
ST13	Proposed Development array area (east)*	Slightly Gravelly Sand	Moderately Sorted	0.2%	96.4%	3.3%
ST14	Proposed Development array area rea (east)*	Slightly Gravelly Sand	Moderately Sorted	0.1%	95.6%	4.3%
ST15	Proposed Development array area (east)	Gravelly Sand	Poorly Sorted	19.7%	78.0%	2.3%
ST16	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.3%	94.2%	5.5%
ST17	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	3.3%	94.9%	1.8%
ST18	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	1.6%	96.2%	2.2%
ST19	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	1.1%	94.2%	4.7%
ST21	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.1%	93.1%	6.8%
ST22	Proposed Development array area (east)	Gravelly Sand	Poorly Sorted	7.2%	90.4%	2.5%
ST23	Proposed Development array area a (east)	Gravelly Sand	Poorly Sorted	10.4%	84.5%	5.2%
ST24	Proposed Development array area (east)	Gravelly Sand	Poorly Sorted	5.5%	90.9%	3.6%
ST26	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	2.8%	96.2%	1.0%
ST27	Proposed Development array area (east)	Gravelly Sand	Poorly Sorted	12.5%	85.4%	2.1%
ST28	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Well Sorted	1.2%	97.4%	1.4%
ST29	Outside the Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Well Sorted	0.3%	98.2%	1.5%
ST30	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	1.8%	96.3%	1.9%
ST31	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	3.6%	94.0%	2.4%
ST32	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	3.4%	93.0%	3.5%
ST33	Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	10.2%	87.6%	2.2%
ST34	Proposed Development array area (west)	Gravelly Sand	Very Poorly Sorted	14.8%	77.5%	7.7%
ST35	Proposed Development array area (east)	Slightly Gravelly Sand	Poorly Sorted	3.5%	92.8%	3.6%
ST36	Outside the Proposed Development array area (west)*	Gravelly Sand	Very Poorly Sorted	27.7%	69.4%	2.9%
ST37	Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Sorted	0.4%	92.6%	7.0%
ST40	Proposed Development array area (west)	Gravelly Sand	Poorly Sorted	12.9%	84.3%	2.8%
ST41	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.2%	92.8%	7.1%
ST42	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.7%	92.6%	6.7%
ST43	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	3.8%	93.3%	2.8%
ST44	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	1.7%	98.3%	0.0%
ST45	Proposed Development array area (west)	Sandy Gravel	Very Poorly Sorted	46.6%	51.7%	1.7%
ST46	Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Sorted	0.5%	96.6%	3.0%
ST47	Proposed Development array area (west)*	Sandy Gravel	Poorly Sorted	73.5%	25.2%	1.3%
ST48	Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Well Sorted	0.6%	95.9%	3.5%
ST49	Proposed Development array area (west)	Gravelly Sand	Very Poorly Sorted	28.4%	70.1%	1.5%


Sample Station	Location	Folk Classification	Folk and Ward Sorting	Major Sediment Fractions		
				% Gravel	% Sand	% Mud
ST50	Proposed Development array area (west)	Sandy Gravel	Poorly Sorted	46.0%	51.7%	2.3%
ST51	Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Sorted	0.3%	92.8%	7.0%
ST52	Outside the Proposed Development array area (west)*	Sandy Gravel	Very Poorly Sorted	65.6%	33.4%	0.9%
ST53	Outside the Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Sorted	0.4%	97.6%	2.0%
ST54	Proposed Development array area (west)*	Sandy Gravel	Very Poorly Sorted	47.1%	49.2%	3.7%
ST55	Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Sorted	1.1%	94.1%	4.8%
ST57	Outside the Proposed Development array area (west)	Gravelly Sand	Poorly Sorted	6.7%	90.9%	2.4%
ST58	Outside the Proposed Development array area (west)	Slightly Gravelly Sand	Well Sorted	0.2%	99.8%	0.0%
ST59	Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Well Sorted	3.1%	94.8%	2.2%
ST60	Proposed Development array area (west)*	Gravelly Sand	Poorly Sorted	8.7%	87.7%	3.7%
ST61	Proposed Development array area (west)*	Sandy Gravel	Very Poorly Sorted	36.2%	62.6%	1.1%
ST62	Outside the Proposed Development array area (west)*	Sandy Gravel	Very Poorly Sorted	31.0%	66.2%	2.9%
ST63	Outside the Proposed Development array area (west)*	Gravelly Sand	Poorly Sorted	8.1%	88.0%	4.0%
ST64	Outside the Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Well Sorted	0.3%	96.8%	3.0%
ST65	Outside the Proposed Development array area (west)*	Sandy Gravel	Very Poorly Sorted	44.7%	53.9%	1.4%
ST68	Outside the Proposed Development array area (west)	Slightly Gravelly Sand	Poorly Sorted	5.0%	93.0%	2.1%
ST70	Outside the Proposed Development array area (west)	Gravelly Sand	Poorly Sorted	10.8%	86.4%	2.8%
ST71	Proposed Development array area (west)	Sandy Gravel	Very Poorly Sorted	35.4%	63.1%	1.6%
ST72	Proposed Development array area (east)*	Slightly Gravelly Sand	Moderately Sorted	1.3%	94.9%	3.9%
ST73	Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Sorted	0.1%	90.0%	9.9%
ST74	Proposed Development export cable corridor	Slightly Gravelly Sand	Moderately Sorted	1.6%	94.0%	4.4%
ST76	Outside the Proposed Development array area (west)	Sandy Gravel	Very Poorly Sorted	31.8%	66.5%	1.7%
ST77	Outside the Proposed Development array area (west)	Gravelly Sand	Poorly Sorted	13.6%	83.6%	2.7%
ST78	Outside the Proposed Development array area (west)	Slightly Gravelly Sand	Moderately Sorted	0.3%	94.7%	5.0%
ST79	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	81.0%	19.0%
ST80	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	73.7%	26.3%
ST81	Outside the Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	60.6%	39.4%
ST82	Outside the Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	71.7%	28.3%
ST83	Outside the Proposed Development export cable corridor	Muddy Sandy Gravel	Extremely Poorly Sorted	32.2%	40.4%	27.4%
ST85	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	73.2%	26.8%
ST86	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	60.0%	40.0%
ST87	Proposed Development export cable corridor	Slightly Gravelly Muddy Sand	Poorly Sorted	0.2%	73.9%	25.9%
ST88	Proposed Development export cable corridor	Slightly Gravelly Muddy Sand	Very Poorly Sorted	0.3%	72.5%	27.2%
ST90	Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	14.0%	84.3%	1.6%
ST91	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.3%	91.5%	8.2%
ST92	Proposed Development array area (east)	Gravelly Sand	Poorly Sorted	10.5%	85.4%	4.1%
ST93	Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Sorted	1.0%	94.0%	5.0%
ST94	Proposed Development array area (west)	Sandy Gravel	Very Poorly Sorted	33.6%	65.5%	0.9%
ST95	Outside the Proposed Development array area (west)*	Slightly Gravelly Sand	Moderately Sorted	1.3%	93.5%	5.1%
ST96	Proposed Development array area (east)*	Gravelly Sand	Poorly Sorted	9.8%	85.3%	4.9%
ST97	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	84.3%	15.7%
ST98	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	73.0%	27.0%
ST99	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	58.7%	41.3%
ST102	Proposed Development export cable corridor	Gravelly Sand	Very Poorly Sorted	27.7%	65.9%	6.4%
ST104	Proposed Development export cable corridor	Slightly Gravelly Muddy Sand	Poorly Sorted	4.0%	76.7%	19.3%
ST105	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	86.8%	13.2%
ST106	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	76.6%	23.4%
ST108	Outside the Proposed Development export cable corridor	Sand	Moderately Sorted	0.0%	97.9%	2.1%
ST109	Proposed Development export cable corridor	Muddy Sand	Poorly Sorted	0.0%	72.6%	27.4%
ST112	Proposed Development array area (east)	Slightly Gravelly Sand	Moderately Sorted	0.8%	94.1%	5.1%

\*Indicates sample station locations within the FFBC MPA.


## 6.2. ANNEX B: ANNEX I REEF ASSESSMENTS

### 6.2.1. ANNEX 1 SABELLARIA SPINULOSA REEF ASSESSMENT

Site	Sediment Description		Sabellaria Characteristics			Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
	Elevation (cm)	Extent (m <sup>2</sup> )	Patchiness (% cover)	Elevation	Extent	Patchiness					
ST20	Moderate Energy	Circalittoral Rock	> 10	25-10000	21.17	High	Low	Medium	Medium	Low	
ST20	Moderate Energy	Circalittoral Rock	5 - 10	25-10000	23.81	Medium	Low	Medium	Low		
ST20	Moderate Energy	Circalittoral Rock	> 10	25-10000	30.00	High	Low	Medium	Medium		
ST20	Moderate Energy	Circalittoral Rock	2 - 5	0	7.07	Low	Not a Reef	Not a Reef	Not a Reef		
ST20	Moderate Energy	Circalittoral Rock	5 - 10	25-10000	16.89	Medium	Low	Low	Low		
ST20	Moderate Energy	Circalittoral Rock	5 - 10	25-10000	10.13	Medium	Low	Low	Low		
ST04	Subtidal Sediment	Mixed	5 - 10	0	8.57	Medium	Not a Reef	Not a Reef	Not a Reef	Not a Reef	

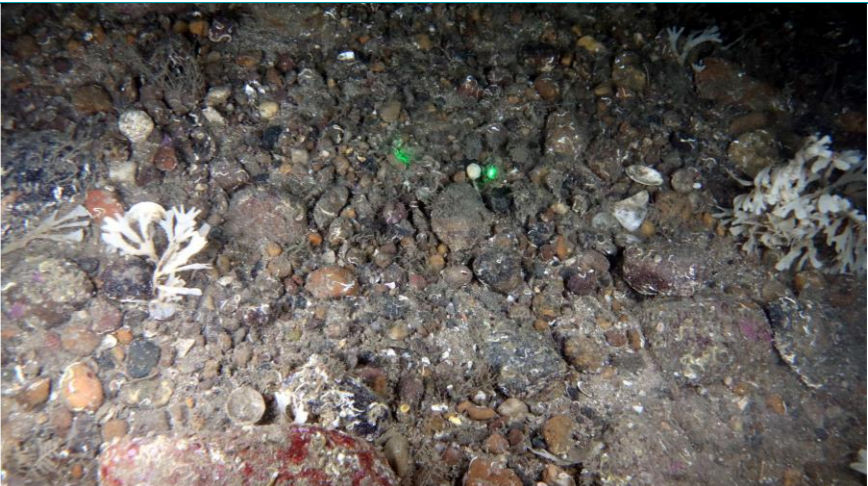
Site	Sediment Description		Elevation (cm)	Sabellaria Characteristics		Elevation	Reef Definition		Reefiness	Sample Station Reefiness Assessment	Representative Image
				Extent (m <sup>2</sup> )	Patchiness (% cover)		Extent	Patchiness			
ST56	Subtidal Reef	Biogenic	5 - 10	<25	14.74	Medium	Not a Reef	Low	Not a Reef	Not a Reef	

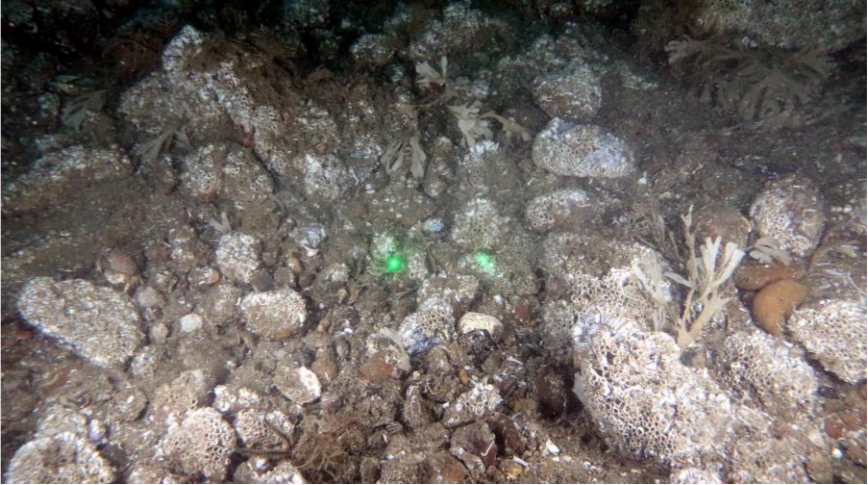

6.2.2. ANNEX 1 STONY REEF ASSESSMENT


Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST101	Moderate Energy Circalittoral Rock	0.064-5	14.58	<25	Medium	Low	Not a Reef	Not a Reef	<b>Not a Reef</b>	
ST101	Moderate Energy Circalittoral Rock	0.064-5	40.57	<25	Medium	Medium	Not a Reef	Not a Reef		
ST107	Moderate Energy Circalittoral Rock	0.064-5	54.48	>25	Medium	Medium	Medium	Medium	<b>Low</b>	
ST107	Moderate Energy Circalittoral Rock	0.064-5	51.85	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	24.46	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	44.79	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	30.86	>25	Medium	Low	Medium	Low		



Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST107	Moderate Energy Circalittoral Rock	0.064-5	34.16	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	9.56	>25	Medium	Not a Reef	Medium	Not a Reef		
ST107	Moderate Energy Circalittoral Rock	0.064-5	40.92	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	36.18	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	0.00	>25	Medium	Not a Reef	Medium	Not a Reef		
ST107	Moderate Energy Circalittoral Rock	0.064-5	45.70	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	0.00	>25	Medium	Not a Reef	Medium	Not a Reef		
ST107	Moderate Energy Circalittoral Rock	0.064-5	31.05	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	19.97	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	38.32	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	66.09	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	25.63	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	32.59	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	30.47	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	36.83	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	27.40	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	34.56	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	31.60	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	57.90	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	50.56	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	52.08	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	30.88	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	53.51	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	66.54	>25	Medium	Medium	Medium	Medium		
ST107	Moderate Energy Circalittoral Rock	0.064-5	37.10	>25	Medium	Low	Medium	Low		
ST107	Moderate Energy Circalittoral Rock	0.064-5	45.88	>25	Medium	Medium	Medium	Medium		




Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST110	Moderate Energy Circalittoral Rock	0.064-5	12.30	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	20.83	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	36.96	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	34.20	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	10.79	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	38.38	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	62.21	>25	Medium	Medium	Medium	Medium		
ST110	Moderate Energy Circalittoral Rock	0.064-5	31.63	>25	Medium	Low	Medium	Low		
ST110	Moderate Energy Circalittoral Rock	0.064-5	44.95	>25	Medium	Low	Medium	Medium		
ST110	Moderate Energy Circalittoral Rock	0.064-5	52.75	>25	Medium	Medium	Medium	Medium		
ST110	Moderate Energy Circalittoral Rock	< 0.064	10.86	>25	Low	Low	Medium	Low		
ST02	Moderate Energy Circalittoral Rock	< 0.064	12.66	<25	Low	Low	Not a Reef	Not a Reef		
ST02	Moderate Energy Circalittoral Rock	< 0.064	17.57	<25	Low	Low	Not a Reef	Not a Reef		

Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST20	High Energy Circalittoral Rock	0.064-5	22.31	>25	Medium	Low	Medium	Low	<b>Low</b>	
ST38	Moderate Energy Circalittoral Rock	0.064-5	10.18	> 25	Medium	Low	Medium	Low	<b>Low</b>	
ST38	Moderate Energy Circalittoral Rock	0.064-5	12.44	> 25	Medium	Low	Medium	Low		
ST38	Moderate Energy Circalittoral Rock	0.064-5	15.81	> 25	Medium	Low	Medium	Low		
ST38	Moderate Energy Circalittoral Rock	0.064-5	11.60	> 25	Medium	Low	Medium	Low		
ST38	Moderate Energy Circalittoral Rock	< 0.064	6.35	> 25	Low	Not a Reef	Medium	Not a Reef		
ST04	Moderate Energy Circalittoral Rock	0.064-5	14.66	< 25	Medium	Low	Not a Reef	Not a Reef	<b>Not a Reef</b>	
ST04	Moderate Energy Circalittoral Rock	0.064-5	15.52	< 25	Medium	Low	Not a Reef	Not a Reef		

Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST61	Moderate Energy Circalittoral Rock	0.064-5	46.91	< 25	Medium	Medium	Not a Reef	Not a Reef	Not a Reef	
ST69	High Energy Circalittoral Rock	< 0.064	10.86	< 25	Low	Low	Not a Reef	Not a Reef		
ST69	High Energy Circalittoral Rock	< 0.064	11.92	< 25	Low	Low	Not a Reef	Not a Reef		
ST69	High Energy Circalittoral Rock	< 0.064	11.99	< 25	Low	Low	Not a Reef	Not a Reef		
ST69	High Energy Circalittoral Rock	< 0.064	18.24	< 25	Low	Low	Not a Reef	Not a Reef		
ST69	High Energy Circalittoral Rock	< 0.064	11.17	< 25	Low	Low	Not a Reef	Not a Reef		
ST69	High Energy Circalittoral Rock	< 0.064	13.56	< 25	Low	Low	Not a Reef	Not a Reef		
ST83	Moderate Energy Circalittoral Rock	0.064-5	26.02	< 25	Medium	Low	Not a Reef	Not a Reef	Not a Reef	

Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST84	Moderate Energy Circalittoral Rock	0.064-5	22.63	< 25	Medium	Low	Not a Reef	Not a Reef		
ST84	Moderate Energy Circalittoral Rock	< 0.064	9.31	< 25	Low	Not a Reef	Not a Reef	Not a Reef		
ST84	Moderate Energy Circalittoral Rock	0.064-5	25.13	< 25	Medium	Low	Not a Reef	Not a Reef		
ST89	Moderate Energy Circalittoral Rock	0.064-5	76.33	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	49.53	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	82.78	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	62.29	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	40.52	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	54.55	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	73.25	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	74.03	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	33.98	>25	Medium	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	0.064-5	41.45	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	51.84	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	85.23	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	54.81	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	58.93	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	65.79	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	38.39	>25	Medium	Medium	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	0.064-5	68.00	>25	Medium	Medium	Medium	Medium		

Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST89	Moderate Energy Circalittoral Rock	0.064-5	67.62	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	36.92	>25	Medium	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	0.064-5	39.00	>25	Medium	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	0.064-5	41.97	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	72.92	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	52.35	>25	Medium	Medium	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	95.25	>25	Medium	High	Medium	Medium		
ST89	Moderate Energy Circalittoral Rock	0.064-5	30.15	>25	Medium	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	15.79	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	30.07	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	2.45	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Moderate Energy Circalittoral Rock	< 0.064	16.06	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	17.21	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	20.23	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	14.72	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	20.61	>25	Low	Low	Medium	Low		
ST89	Moderate Energy Circalittoral Rock	< 0.064	0.00	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Subtidal Coarse Sediment	< 0.064	5.78	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Moderate Energy Circalittoral Rock	< 0.064	5.78	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Moderate Energy Circalittoral Rock	< 0.064	5.78	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Subtidal Coarse Sediment	< 0.064	5.78	>25	Low	Not a Reef	Medium	Not a Reef		
ST89	Moderate Energy Circalittoral Rock	< 0.064	11.24	>25	Low	Low	Medium	Low		
ST111	High Energy Infralittoral Rock		35.82	>25		Low	Medium	Low	<b>Medium</b>	
ST111	High Energy Infralittoral Rock		99.31	>25		High	Medium	Medium		
ST111	Moderate Energy Circalittoral Rock		98.21	>25		High	Medium	Medium		
ST111	Moderate Energy Circalittoral Rock		99.24	>25		High	Medium	Medium		

Site	Sediment Description	Elevation (m)	Composition (% Cover)	Extent (m <sup>2</sup> )	Reef Definition			Reefiness	Sample Station Reefiness Assessment	Representative Image
					Elevation	Composition	Extent			
ST111	Moderate Energy Circalittoral Rock		99.54	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		98.80	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		37.19	>25	Low	Medium	Low			
ST111	Moderate Energy Circalittoral Rock		55.74	>25	Medium	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		99.92	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		99.97	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		42.67	>25	Medium	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		91.30	>25	Medium	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		98.92	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		97.44	>25	High	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		98.72	>25	High	Medium	Medium			
ST111	High Energy Infralittoral Rock		99.98	>25	High	Medium	Medium			
ST111	High Energy Infralittoral Rock		99.97	>25	High	Medium	Medium			
ST111	High Energy Infralittoral Rock		88.43	>25	Medium	Medium	Medium			
ST111	Moderate Energy Circalittoral Rock		99.97	>25	High	Medium	Medium			

### 6.3. ANNEX C: BENTHIC INFAUNAL DATA MULTIVARIATE ANALYSIS RESULTS

SIMPER  
Similarity Percentages - species contributions

One-Way Analysis

Data worksheet  
Name: Square root  
Data type: Abundance  
Sample selection: All  
Variable selection: All

Parameters  
Resemblance: S17 Bray Curtis similarity  
Cut off for low contributions: 90.00%

Factor Groups	SIMPROF
Sample	
ST03	n
ST06	n
ST08	n
ST09	n
ST10	n
ST13	n
ST14	n
ST16	n
ST19	n
ST21	n
ST22	n
ST24	n
ST35	n
ST37	n
ST40	n
ST41	n
ST42	n
ST43	n
ST46	n
ST48	n
ST51	n
ST55	n
ST60	n
ST62	n
ST64	n
ST72	n
ST74	n
ST78	n
ST92	n
ST93	n
ST95	n
ST112	n
ST05	p
ST11	p

ST33	p
ST45	p
ST76	p
ST77	p
ST96	p
ST102	p
ST07	l
ST12	o
ST34	o
ST73	o
ST79	o
ST91	o
ST97	o
ST104	o
ST105	o
ST15	j
ST17	j
ST26	J
ST18	k
ST27	k
ST28	k
ST29	k
ST30	k
ST31	k
ST32	k
ST49	k
ST53	k
ST58	k
ST59	k
ST61	k
ST68	k
ST23	m
ST57	m
ST63	m
ST36	e
ST65	e
ST44	i
ST47	d
ST52	d
ST54	d
ST50	c
ST70	c
ST71	c
ST80	f
ST81	f
ST82	f
ST85	f
ST86	f
ST87	f
ST88	f
ST98	f

ST99	f
ST106	f
ST109	f
ST83	b
ST90	g
ST94	h
ST108	a

Group n  
Average similarity: 36.62

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Amphiuridae	2.54	4.57	2.04	12.48	12.48
Amphiura filiformis	1.99	3.36	1.33	9.17	21.65
Spiophanes bombyx	1.54	2.75	1.74	7.52	29.16
Scoloplos armiger	1.17	1.98	1.25	5.41	34.57
Astrorhiza	1.16	1.72	0.81	4.7	39.28
Abra	1.03	1.62	1.03	4.43	43.71
Kurtiella bidentata	1.04	1.49	0.96	4.06	47.77
Echinocyamus pusillus	1.28	1.38	0.68	3.76	51.53
Ennucula tenuis	0.94	1.27	0.8	3.48	55.01
Diplocirrus glaucus	0.97	1.24	0.85	3.38	58.39
Lagis koreni	0.9	1.22	0.88	3.32	61.71
Chamelea striatula	1.05	1.21	0.74	3.32	65.03
Pholoe baltica	0.85	1.21	0.89	3.3	68.33
Abra prismatica	1.21	1.17	0.71	3.2	71.53
Thracioidea	0.71	0.91	0.69	2.49	74.02
Lumbrineris cingulata	0.85	0.79	0.59	2.17	76.18
Phaxas pellucidus	0.76	0.79	0.64	2.15	78.34
Copepoda	0.64	0.61	0.5	1.66	79.99
Dosinia	0.55	0.47	0.46	1.28	81.28
Ophiuridae	0.49	0.46	0.42	1.26	82.54
Antalis entalis	0.5	0.4	0.46	1.09	83.62
Owenia	0.46	0.37	0.42	1.02	84.64
Spiophanes kroyeri	0.43	0.37	0.42	1	85.64
Ophelia borealis	0.52	0.31	0.34	0.85	86.49
Galathowenia oculata	0.41	0.28	0.34	0.76	87.25
Ampelisca brevicornis	0.41	0.28	0.39	0.75	88.01
Peresiella clymenoides	0.42	0.25	0.34	0.68	88.69
Westwoodilla caecula	0.31	0.21	0.27	0.57	89.26
Nemertea	0.4	0.21	0.3	0.57	89.82
Thyasira flexuosa	0.35	0.2	0.31	0.54	90.36

Group p  
Average similarity: 27.74

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Astrorhiza	2.12	3.98	1.33	14.35	14.35
Echinocyamus pusillus	1.95	2.98	1.2	10.73	25.08
Nemertea	1.32	1.82	1	6.56	31.64
Amphiuridae	1.15	1.69	0.97	6.11	37.74

Paradoneis lyra	1.09	1.6	1	5.77	43.52
Spiophanes bombyx	1.04	1.57	0.99	5.66	49.18
Ennucula tenuis	0.93	1.39	1.01	5.01	54.19
Amphiura filiformis	0.97	1.13	0.7	4.08	58.27
Phtisica marina	0.72	1.11	0.72	4.01	62.28
Westwoodilla caecula	0.84	0.99	0.68	3.55	65.83
Liocarcinus	0.77	0.89	0.71	3.2	69.04
Glycera lapidum	0.77	0.86	0.69	3.09	72.13
Notomastus	0.5	0.56	0.5	2.03	74.16
Ampelisca	0.55	0.56	0.5	2.03	76.18
Scalibregma inflatum	0.5	0.55	0.49	2	78.18
Ophiuridae	0.64	0.52	0.51	1.86	80.05
Glycera alba	0.43	0.31	0.33	1.11	81.16
Pholoe baltica	0.43	0.31	0.34	1.1	82.26
Cochlodesma praetenuis	0.43	0.29	0.34	1.04	83.3
Polycirrus	0.43	0.29	0.34	1.04	84.34
Scoloplos armiger	0.48	0.28	0.33	1.02	85.36
Copepoda	0.38	0.27	0.34	0.98	86.34
Abra	0.38	0.26	0.34	0.93	87.27
Thracioidea	0.38	0.26	0.34	0.93	88.19
Spiophanes kroyeri	0.43	0.26	0.34	0.92	89.11
Nototropis vedlomensis	0.38	0.25	0.34	0.9	90.01

Group l  
Less than 2 samples in group

Group o  
Average similarity: 35.75

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Amphiura filiformis	2.13	4.73	1.33	13.24	13.24
Amphiuridae	2.54	4.46	1.51	12.48	25.72
Thyasira flexuosa	1.66	2.87	1.51	8.02	33.74
Lagis koreni	1.14	2.57	1.53	7.19	40.93
Spiophanes bombyx	1.13	2.2	0.95	6.15	47.08
Antalis entalis	1.04	1.7	0.96	4.77	51.84
Nephtys hombergii	0.75	1.56	0.98	4.36	56.21
Peresiella clymenoides	0.8	1.43	1.01	4.01	60.21
Cylichna cylindracea	1	1.3	0.7	3.63	63.84
Diplocirrus glaucus	0.72	1.2	0.71	3.37	67.21
Galathowenia oculata	0.78	1.02	0.71	2.86	70.07
Westwoodilla caecula	0.83	0.95	0.71	2.65	72.73
Astrorhiza	0.82	0.68	0.5	1.92	74.64
Phoronis	0.5	0.62	0.48	1.72	76.37
Nephtys	0.64	0.58	0.5	1.62	77.99
Echinocyamus pusillus	0.59	0.57	0.5	1.59	79.58
Ophiuridae	0.59	0.54	0.5	1.5	81.08
Chaetoderma nitidulum	0.55	0.51	0.5	1.42	82.5
Sthenelais limicola	0.5	0.51	0.5	1.42	83.93
Chaetozone	0.68	0.49	0.5	1.38	85.31
Nemertea	0.5	0.49	0.5	1.38	86.7



Lucinoma borealis	0.56	0.39	0.29	1.1	87.8
Kurtiella bidentata	0.53	0.38	0.33	1.07	88.87
Harpinia antennaria	0.57	0.37	0.33	1.03	89.89
Spiophanes kroyeri	0.43	0.33	0.34	0.92	90.82

Group j  
Average similarity: 42.19

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Echinocyamus pusillus	4.43	5.39	2.04	12.77	12.77
Ophelia borealis	3.83	4.9	3.21	11.61	24.38
Asbjornsenia pygmaea	2.43	3.03	9.13	7.19	31.57
Nematoda	2.35	2.95	2.37	6.98	38.56
Glycera lapidum	1.95	2.58	4.4	6.13	44.68
Nemertea	1.63	2.44	7.17	5.78	50.47
Abra prismatica	1.47	1.83	4.4	4.33	54.8
Grania	1.38	1.83	4.4	4.33	59.13
Clausinella fasciata	1.14	1.6	24.02	3.8	62.93
Copepoda	1	1.6	24.02	3.8	66.73
Notomastus	1.33	1.6	24.02	3.8	70.53
Goodallia triangularis	1.75	1.14	0.58	2.7	73.23
Nothria	1.56	1.14	0.58	2.7	75.93
Nephasoma (Nephasoma) mir	1.15	0.96	0.58	2.26	78.19
Leiochone	1.15	0.88	0.58	2.09	80.28
Urothoe marina	1.41	0.78	0.58	1.85	82.13
Glycera	0.94	0.77	0.58	1.82	83.95
Branchiostoma lanceolatum	0.67	0.55	0.58	1.31	85.26
Tmetonyx	0.67	0.55	0.58	1.31	86.57
Thracioidea	0.8	0.54	0.58	1.29	87.85
Timodea ovata	0.8	0.54	0.58	1.29	89.14
Abra	0.8	0.51	0.58	1.21	90.34

Group k  
Average similarity: 33.75

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ophelia borealis	2.65	4.46	1.69	13.22	13.22
Abra	1.98	3.01	1.36	8.92	22.14
Abra prismatica	1.61	2.91	1.78	8.61	30.76
Echinocyamus pusillus	1.85	2.86	1.81	8.46	39.22
Thracioidea	1.67	2.66	1.04	7.89	47.11
Amphiuridae	1.2	1.84	1.41	5.46	52.57
Nothria	1.2	1.74	1.01	5.16	57.72
Spiophanes bombyx	1.19	1.25	0.67	3.69	61.42
Nephtys cirrosa	0.9	1.06	0.69	3.14	64.56
Cochlodesma praetenuae	0.98	0.99	0.7	2.92	67.47
Nemertea	0.86	0.9	0.71	2.67	70.15
Glycera lapidum	0.71	0.84	0.7	2.49	72.64
Asbjornsenia pygmaea	0.69	0.75	0.57	2.21	74.85
Chamelea striatula	0.71	0.68	0.56	2.01	76.86
Copepoda	0.59	0.66	0.57	1.96	78.82

Leiochone	0.71	0.61	0.58	1.8	80.62
Dosinia lupinus	0.55	0.36	0.37	1.06	81.68
Bathyporeia gracilis	0.5	0.35	0.37	1.05	82.73
Nephtys	0.49	0.34	0.37	1.01	83.74
Paradoneis lyra	0.5	0.34	0.35	1	84.74
Dosinia	0.45	0.31	0.38	0.93	85.67
Antalis entalis	0.53	0.3	0.36	0.88	86.55
Chaetozone christei	0.44	0.26	0.37	0.76	87.3
Timodea ovata	0.34	0.25	0.29	0.75	88.05
Galathea oculata	0.45	0.24	0.37	0.71	88.77
Phaxas pellucidus	0.31	0.22	0.28	0.64	89.41
Poecilochaetus serpens	0.34	0.19	0.29	0.58	89.99
Centraloecetes kroyeranus	0.31	0.19	0.27	0.55	90.54

Group m  
Average similarity: 34.90

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Astrorhiza	1.61	3.27	15.21	9.37	9.37
Paradoneis lyra	1.82	3.03	2.72	8.69	18.06
Sabellaria spinulosa	1.85	2.84	3.63	8.13	26.19
Nothria	1.33	2.31	15.21	6.62	32.81
Ophiuridae	1.14	2.31	15.21	6.62	39.44
Polycirrus	1.14	2.31	15.21	6.62	46.06
Scoloplos armiger	1.56	1.84	0.58	5.26	51.32
Lumbrineris cingulata	1.39	1.42	0.58	4.07	55.4
Amphiura filiformis	0.67	0.82	0.58	2.35	57.75
Cirratulus cirratus	0.67	0.82	0.58	2.35	60.1
Goniada maculata	0.67	0.82	0.58	2.35	62.45
Nototropis vedlomensis	0.67	0.82	0.58	2.35	64.8
Spiophanes bombyx	0.91	0.82	0.58	2.35	67.16
Spiophanes kroyeri	0.91	0.82	0.58	2.35	69.51
Tanaopsis graciloides	0.8	0.82	0.58	2.35	71.86
Urothoe elegans	0.67	0.82	0.58	2.35	74.21
Ascidacea	0.67	0.77	0.58	2.21	76.42
Balanus crenatus	1	0.77	0.58	2.21	78.64
Edwardsiidae	0.8	0.77	0.58	2.21	80.85
Hiatella arctica	0.67	0.77	0.58	2.21	83.06
Kurtiella bidentata	0.67	0.77	0.58	2.21	85.27
Modiolula phaseolina	0.67	0.77	0.58	2.21	87.48
Timodea ovata	0.67	0.77	0.58	2.21	89.69
Chamelea striatula	0.8	0.72	0.58	2.06	91.75

Group e  
Average similarity: 38.85

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Astrorhiza	3.13	2.16	#####	5.57	5.57
Sabellaria spinulosa	5.78	2	#####	5.15	10.72
Pholoe inornata	2.24	1.83	#####	4.71	15.43
Hydroides norvegica	2.58	1.64	#####	4.21	19.64

Lumbrineris cingulata	3	1.64	#####	4.21	23.84
Scalibregma inflatum	2.41	1.64	#####	4.21	28.05
Cirratulus cirratus	1.87	1.42	#####	3.64	31.7
Nemertea	1.87	1.42	#####	3.64	35.34
Amphipholis squamata	2.21	1.16	#####	2.98	38.32
Dipolydora caulleryi	1.71	1.16	#####	2.98	41.29
Eumida sanguinea	1.71	1.16	#####	2.98	44.27
Galathea oculata	1.93	1.16	#####	2.98	47.24
Hydroides	1.83	1.16	#####	2.98	50.22
Leptochiton	1.41	1.16	#####	2.98	53.2
Spiophanes kroyeri	2.29	1.16	#####	2.98	56.17
Timoclea ovata	1.41	1.16	#####	2.98	59.15
Verruca stroemia	2.29	1.16	#####	2.98	62.12
Abra	1.21	0.82	#####	2.1	64.23
Ampharete lindstroemi	1.37	0.82	#####	2.1	66.33
Anomiidae	1.72	0.82	#####	2.1	68.44
Aonides paucibranchiata	1	0.82	#####	2.1	70.54
Diastylis rugosa	2.08	0.82	#####	2.1	72.65
Echinocyamus pusillus	1.21	0.82	#####	2.1	74.75
Eulalia aurea	1.21	0.82	#####	2.1	76.85
Harmothoe	1	0.82	#####	2.1	78.96
Leptochiton asellus	1.37	0.82	#####	2.1	81.06
Mytilidae	1.21	0.82	#####	2.1	83.17
Nematoda	1.37	0.82	#####	2.1	85.27
Nototropis vedlomensis	1.37	0.82	#####	2.1	87.37
Pholoe baltica	1.37	0.82	#####	2.1	89.48
Phyllodoce maculata	1	0.82	#####	2.1	91.58

Group i  
Less than 2 samples in group

Group d  
Average similarity: 47.32

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Nematoda	3.86	3.11	4.65	6.57	6.57
Nemertea	2.94	2.04	7.62	4.31	10.89
Amphipholis squamata	3.48	1.85	3.62	3.91	14.8
Cheirocratus	2.48	1.6	5.22	3.39	18.19
Nototropis vedlomensis	2.7	1.59	7.64	3.37	21.56
Ophiuridae	1.99	1.54	5.65	3.26	24.82
Mytilidae	2.04	1.47	5.2	3.11	27.92
Psamathe fusca	2.03	1.4	5.57	2.96	30.88
Galathea intermedia	3.08	1.36	4.55	2.87	33.75
Clausinella fasciata	2.51	1.34	7.04	2.84	36.58
Leptochiton	2.1	1.29	5.5	2.72	39.3
Verruca stroemia	1.63	1.29	5.5	2.72	42.02
Ascidacea	1.72	1.28	7.46	2.7	44.72
Macrochaeta	1.49	1.04	3.19	2.2	46.92
Thracioidea	2.16	1.03	4.5	2.17	49.09
Leiochone	1.38	0.99	2.43	2.1	51.18

Hydroides norvegica	2.1	0.96	4.55	2.03	53.21
Laonice bahusiensis	2.01	0.96	4.55	2.03	55.24
Timoclea ovata	1.55	0.96	4.55	2.03	57.26
Eteone longa	1.28	0.95	7.04	2.01	59.27
Nephasoma (Nephasoma) mir	2.01	0.95	7.04	2.01	61.27
Syllis armillaris	1.55	0.95	7.04	2.01	63.28
Aurospio banyulensis	1.33	0.85	5.2	1.8	65.08
Steromphala tumida	1.61	0.85	5.2	1.8	66.87
Grania	1	0.85	5.2	1.8	68.67
Jasmineira	1.24	0.85	5.2	1.8	70.46
Leptochiton asellus	1.33	0.85	5.2	1.8	72.26
Othomaera othonis	1.41	0.85	5.2	1.8	74.05
Pholoe inornata	1.24	0.85	5.2	1.8	75.85
Polycirrus	1.24	0.85	5.2	1.8	77.64
Mya	1.7	0.65	0.58	1.37	79.01
Aonides paucibranchiata	0.94	0.49	0.58	1.03	80.04
Dialychone dunerificta	1.61	0.48	0.58	1.02	81.06
Dipolydora caulleryi	1.15	0.42	0.58	0.88	81.94
Crenella decussata	0.94	0.37	0.58	0.79	82.73
Glycera lapidum	1.14	0.37	0.58	0.79	83.52
Ampelisca spinipes	0.67	0.34	0.58	0.73	84.24
Copepoda	0.67	0.34	0.58	0.73	84.97
Echinocyamus pusillus	0.91	0.34	0.58	0.73	85.7
Gouldia minima	0.67	0.34	0.58	0.73	86.43
Sipuncula	0.91	0.34	0.58	0.73	87.16
Sphaerodorum	0.67	0.34	0.58	0.73	87.88
Cirratulus cirratus	0.94	0.34	0.58	0.72	88.6
Harmothoe	1.05	0.34	0.58	0.72	89.32
Pholoe baltica	1.22	0.34	0.58	0.72	90.04

Group c  
Average similarity: 52.78

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Nematoda	6.1	2.49	5.49	4.71	4.71
Syllis parapari	3.64	2.26	7.78	4.29	9
Mytilidae	3.67	2.25	10.27	4.25	13.25
Nemertea	2.99	1.84	12.25	3.49	16.74
Hydroides norvegica	2.9	1.65	8.1	3.12	19.86
Amphipholis squamata	2.65	1.49	8.89	2.83	22.69
Glycera lapidum	2.37	1.43	11.13	2.7	25.4
Gari	2.57	1.38	12.1	2.62	28.02
Leptochiton	2.87	1.34	5.24	2.54	30.57
Clausinella fasciata	2.86	1.34	8.89	2.53	33.1
Galathea intermedia	2.08	1.34	8.89	2.53	35.63
Verruca stroemia	2.13	1.22	4.99	2.32	37.95
Nephasoma (Nephasoma) mir	2.24	1.21	12.28	2.3	40.24
Nototropis vedlomensis	2.3	1.2	3.2	2.27	42.51
Urothoe marina	2.42	1.15	2.49	2.18	44.69
Aonides paucibranchiata	2.27	1.12	3.9	2.12	46.81
Apherusa bispinosa	2.59	1.07	5.15	2.03	48.84

Laonice bahusiensis	2.43	1.06	6.7	2.02	50.86
Jasmineira	2.43	1.06	1.62	2	52.86
Sipuncula	1.9	0.98	1.6	1.85	54.71
Asbjornsenia pygmaea	2.03	0.98	1.89	1.85	56.56
Ascidia	1.97	0.96	2.07	1.83	58.39
Echinocyamus pusillus	1.69	0.94	8.89	1.79	60.18
Ophiuridae	2.32	0.94	8.89	1.79	61.97
Thracioidea	2.23	0.94	8.89	1.79	63.76
Pisione remota	2.2	0.88	2.5	1.67	65.43
Mediomastus fragilis	1.58	0.82	3.77	1.55	66.98
Gammaropsis maculata	1.47	0.75	6.7	1.43	68.4
Harmothoe	1.28	0.75	6.7	1.43	69.83
Ampharete lindstroemi	1.41	0.67	8.89	1.27	71.09
Amphiuridae	1.87	0.67	8.89	1.27	72.36
Hiatella arctica	1.41	0.67	8.89	1.27	73.63
Malmgrenia	1	0.67	8.89	1.27	74.89
Pholoe baltica	1.33	0.67	8.89	1.27	76.16
Pholoe inornata	1.24	0.67	8.89	1.27	77.42
Polycirrus	1.14	0.67	8.89	1.27	78.69
Thracia villosiuscula	1.14	0.67	8.89	1.27	79.95
Goodallia triangularis	2	0.64	0.58	1.21	81.17
Psamathe fusca	2.1	0.58	0.58	1.09	82.26
Dipolydora caulleryi	1.8	0.56	0.58	1.06	83.32
Grania	1.73	0.37	0.58	0.7	84.02
Polygordius	1.39	0.37	0.58	0.7	84.72
Timoclea ovata	1.32	0.37	0.58	0.7	85.42
Pseudomystides limbata	1.15	0.35	0.58	0.67	86.09
Aurospio banyulensis	1.22	0.3	0.58	0.57	86.66
Laonice	1.14	0.29	0.58	0.55	87.21
Malmgrenia mcintoshi	1.14	0.29	0.58	0.55	87.75
Othomaera othonis	0.94	0.29	0.58	0.55	88.3
Phascolion (Phascolion) storr	1.29	0.29	0.58	0.55	88.84
Pseudosyllis brevipennis	1.29	0.29	0.58	0.55	89.39
Cheirocratus	0.67	0.25	0.58	0.48	89.87
Eulalia bilineata	0.67	0.25	0.58	0.48	90.34

Group f  
Average similarity: 34.10

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Thyasira flexuosa	1.86	4	1.59	11.74	11.74
Abra nitida	1.7	3.76	1.69	11.04	22.78
Lumbrineris cingulata	1.47	3.34	1.75	9.78	32.56
Chaetozone	1.06	2.39	1.26	7	39.56
Harpinia antennaria	1.01	1.93	0.92	5.65	45.21
Glycera unicornis	0.83	1.86	0.95	5.45	50.66
Diplocirrus glaucus	0.91	1.63	0.76	4.77	55.44
Abra	0.93	1.4	0.74	4.1	59.54
Spiophanes bombyx	0.86	1.25	0.76	3.67	63.21
Lagis koreni	0.81	0.97	0.57	2.84	66.05
Praxillella affinis	0.75	0.95	0.57	2.79	68.84

Nephtys	0.69	0.95	0.58	2.78	71.62
Cylichna cylindracea	0.62	0.87	0.57	2.56	74.18
Nemertea	0.65	0.87	0.58	2.54	76.72
Phoronis	0.68	0.66	0.45	1.93	78.66
Scalibregma inflatum	0.53	0.65	0.44	1.9	80.56
Spiophanes kroyeri	0.45	0.59	0.46	1.72	82.28
Copepoda	0.58	0.52	0.33	1.54	83.81
Owenia	0.49	0.52	0.46	1.52	85.33
Leptosynapta bergensis	0.36	0.39	0.33	1.14	86.47
Lucinoma borealis	0.51	0.34	0.34	1	87.47
Thracioidea	0.36	0.33	0.34	0.96	88.43
Nephtys kersivalensis	0.44	0.32	0.34	0.95	89.37
Nephtys hombergii	0.43	0.32	0.34	0.94	90.31

Group b  
Less than 2 samples in group

Group g  
Less than 2 samples in group

Group h  
Less than 2 samples in group

Group a  
Less than 2 samples in group

#### 6.4. ANNEX D: BENTHIC INFAUNAL DATA UNIVARIATE ANALYSIS RESULTS

268. S = number of species; N = abundance; B = Biomass (ash free dry mass in grams); d = Margalef's index of Richness; J' = Pielou's Evenness index; H' = Shannon-Wiener Diversity index; λ = Simpson's Dominance index.

Sample Station	Preliminary Biotope	Infaunal	S	N	Biomass (g)	d	J'	H'	λ
3	SS.SMu.CSaMu.AfilMysAnit		38	51.34462	2.0122	9.394296	0.974647	3.545364	0.927258
5	SS.SSa.Osa [Echinocyamus pusillus]		26	35.04767	2.5463	7.028969	0.95703	3.118096	0.786332
6	SS.SMu.CSaMu.AfilMysAnit		32	45.99503	1.1123	8.097095	0.9696	3.360378	0.907029
7	SS.SSa.OSa		11	13.4641	0.2391	3.846114	0.982419	2.355737	0.87037
8	SS.SMu.CSaMu.AfilMysAnit		27	36.39109	1.3781	7.233627	0.976717	3.219099	0.9239
9	SS.SMu.CSaMu.AfilMysAnit		22	24.97469	0.2346	6.52607	0.991699	3.065384	0.94
10	SS.SMu.CSaMu.AfilMysAnit		31	37.21733	3.9247	8.294683	0.990233	3.400448	0.955729
11	SS.SSa.OSa		21	26.19151	0.9898	6.124758	0.981365	2.987788	0.917458
12	SS.SMu.CSaMu.AfilNten		18	22.66025	0.3696	5.447649	0.981703	2.837488	0.908203
13	SS.SMu.CSaMu.AfilMysAnit		27	34.80651	1.8878	7.324347	0.979834	3.229374	0.928254
14	SS.SMu.CSaMu.AfilMysAnit		33	44.50825	0.577	8.430649	0.977004	3.416101	0.929398
15	SS.SSa.CFiSa.EpusOborApri		39	56.43596	5.4517	9.422017	0.965479	3.537092	0.88759
16	SS.SMu.CSaMu.AfilMysAnit		29	38.63155	4.1692	7.66269	0.976877	3.289435	0.906868
17	SS.SSa.CFiSa.EpusOborApri		45	64.45246	4.7528	10.56187	0.965604	3.675728	0.912195
18	SS.SSa.CFiSa.EpusOborApri		31	44.18516	4.3805	7.918933	0.980778	3.367978	0.947531
19	SS.SMu.CSaMu.AfilMysAnit		33	40.64151	5.404	8.637467	0.989938	3.461326	0.95679
21	SS.SMx.CMx.MysThyMx		26	38.43353	2.5655	6.851323	0.971647	3.165719	0.899592
22	SS.SMu.CSaMu.AfilMysAnit		31	38.92407	1.4494	8.193111	0.986892	3.388973	0.947188

Sample Station	Preliminary Biotope	Infaunal	S	N	Biomass (g)	d	J'	H'	λ
23	SS.SMx.OMx.PoVen		37	48.90884	1.1616	9.254598	0.986272	3.561348	0.955633
24	SS.SMu.CSaMu.AfilMysAnit		26	36.37356	7.604	6.956343	0.983286	3.203641	0.93875
26	SS.SSa.CFiSa.EpusOborApri		45	66.46548	182.2472	10.48447	0.972044	3.700242	0.942248
27	SS.SSa.CFiSa.EpusOborApri		33	39.02337	6.0886	8.733242	0.983923	3.440295	0.931292
28	SS.SSa.CFiSa.EpusOborApri		19	26.78084	1.4872	5.474974	0.97042	2.857342	0.869565
29	SS.SSa.CFiSa.EpusOborApri		16	27.46585	3.4235	4.527696	0.970507	2.690817	0.900496
30	SS.SSa.CFiSa.EpusOborApri		39	53.95271	2.5289	9.528328	0.969128	3.550462	0.920395
31	SS.SSa.CFiSa.EpusOborApri		37	53.90622	2.0032	9.028789	0.971357	3.507492	0.928885
32	SS.SSa.CFiSa.EpusOborApri		60	97.61815	2.0375	12.87911	0.974592	3.990317	0.964963
33	SS.SSa.OSa		21	25.12096	0.1068	6.204047	0.982705	2.991869	0.908304
34	SS.SMu.CSaMu.AfilNten		27	38.3543	2.4715	7.129408	0.959866	3.163563	0.887971
35	SS.SMu.CSaMu.AfilMysAnit		30	41.38426	2.0565	7.789625	0.965643	3.284341	0.866343
36	SS.SBR.PoR.SspiMx		84	139.8801	21.0183	16.79895	0.967588	4.287205	0.923138
37	SS.SMu.CSaMu.AfilMysAnit		33	41.90368	1.988	8.566747	0.983	3.437068	0.939532
40	SS.SMu.CSaMu.AfilMysAnit		20	25.90289	0.449	5.838331	0.984703	2.949908	0.923302
41	SS.SMu.CSaMu.AfilMysAnit		43	62.56973	3.4603	10.15405	0.976003	3.670942	0.934311
42	SS.SMu.CSaMu.AfilMysAnit		25	36.00278	6.5524	6.697183	0.977903	3.147749	0.930556
43	SS.SMu.CSaMu.AfilMysAnit		22	28.00073	0.3541	6.302085	0.982347	3.036477	0.9275
44	SS.SCS.CCS ( <i>Balanus crenatus</i> )		52	76.09881	2.0045	11.77276	0.939357	3.71163	0.798447
45	SS.SMx.OMx.PoVen		42	52.67413	1.5723	10.34276	0.990662	3.702768	0.968062
46	SS.SMu.CSaMu.AfilMysAnit		49	62.60034	5.3344	11.60325	0.986377	3.838803	0.963704
47	SS.SMx.OMx.PoVen		72	109.3956	12.9744	15.12256	0.979765	4.190128	0.967847
48	SS.SMu.CSaMu.AfilMysAnit		45	64.04667	4.6519	10.57791	0.97478	3.710659	0.937365

Sample Station	Preliminary Biotope	Infaunal	S	N	Biomass (g)	d	J'	H'	$\lambda$
49	SS.SMx.OMx		23	27.12096	0.1669	6.666047	0.99083	3.106742	0.942907
50	SS.SMx.OMx.PoVen		92	187.1671	49.0988	17.39296	0.959826	4.340132	0.947091
51	SS.SMu.CSaMu.AfilMysAnit		26	37.86568	3.2046	6.879386	0.972349	3.168005	0.912453
52	SS.SMx.OMx.PoVen		64	84.16584	0.6436	14.21227	0.985154	4.097142	0.969186
53	SS.SSa.CFiSa.ApriBatPo		28	42.48633	6.7778	7.20157	0.975417	3.250291	0.935942
54	SS.SMx.OMx.PoVen		95	167.8776	5.4941	18.34778	0.968792	4.411758	0.970478
55	SS.SMu.CSaMu.AfilMysAnit		42	58.92481	1.3257	10.05823	0.981312	3.667821	0.954861
57	SS.SMx.OMx.PoVen		32	37.47407	2.8504	8.554912	0.988469	3.425772	0.951389
58	SS.SSa.CFiSa.EpusOborApri		22	27.38891	78.8074	6.344146	0.987361	3.051974	0.93645
59	SS.SSa.CFiSa.EpusOborApri		37	48.05719	3.744	9.29658	0.983474	3.551244	0.952589
60	SS.SMu.CSaMu.AfilMysAnit		50	65.51857	1.43	11.71595	0.982275	3.842683	0.9608
61	SS.SSa.CFiSa.EpusOborApri		26	32.81309	0.4954	7.161626	0.988047	3.219152	0.944198
62	SS.SSa.CFiSa.ApriBatPo		46	62.02067	12.274	10.90257	0.977535	3.742631	0.952064
63	SS.SMx.OMx.PoVen		36	43.74541	8.6059	9.263213	0.984726	3.528783	0.952222
64	SS.SMu.CSaMu.AfilMysAnit		22	33.77535	0.4265	5.966364	0.980132	3.029629	0.921574
66	SS.SBR.PoR.SspiMx		68	104.7546	1.6409	14.40358	0.979873	4.13458	0.972059
68	SS.SMx.OMx		31	34.5286	12.5479	8.470298	0.991901	3.406175	0.954194
70	SS.SMx.OMx.PoVen		83	125.4367	9.188	16.9709	0.978426	4.323509	0.972354
71	SS.SMx.OMx.PoVen		85	140.1016	9.2712	16.9959	0.979508	4.351611	0.977987
72	SS.SMu.CSaMu.AfilMysAnit		16	21.62497	0.7253	4.879876	0.975108	2.703574	0.878893
73	SS.SMu.CSaMu.AfilNten		17	22.02458	16.9169	5.174378	0.977128	2.768413	0.883379
74	SS.SMu.CSaMu.AfilMysAnit		32	43.19149	4.866	8.232325	0.971463	3.366836	0.916495
76	SS.SMx.OMx		28	32.11438	0.501	7.782541	0.989012	3.295591	0.94625

Sample Station	Preliminary Biotope	Infaunal	S	N	Biomass (g)	d	J'	H'	$\lambda$
77	SS.SMx.OMx		38	45.10368	7.4843	9.713928	0.990018	3.601277	0.961356
78	SS.SMu.CSaMu.AfilMysAnit		17	22.53517	0.1446	5.136309	0.987874	2.798857	0.923828
79	SS.SMu.CSaMu.AfilNten		26	30.66025	2.0938	7.303605	0.986379	3.213717	0.93625
80	SS.SMu.CSaMu.ThyNten		24	29.7021	5.0775	6.782225	0.984538	3.128914	0.930399
81	SS.SMu.CSaMu.ThyNten		17	21.12096	1.4784	5.245445	0.979286	2.774526	0.886667
82	SS.SMu.CSaMu.ThyNten		26	31.31371	2.7968	7.258883	0.991467	3.230296	0.95
83	SS.SMx.OMx		77	177.9572	9.611	14.66744	0.88242	3.833062	0.756094
85	SS.SMu.CSaMu.ThyNten		24	33.45559	0.6418	6.552298	0.978585	3.109996	0.920439
86	SS.SMu.CSaMu.ThyNten		12	13.56048	1.1603	4.219151	0.991872	2.46471	0.898438
87	SS.SMu.CSaMu.ThyNten		19	25.08104	0.8522	5.586398	0.9787	2.881724	0.903047
88	SS.SMu.CSaMu.ThyNten		36	46.93404	2.1149	9.093878	0.980348	3.513097	0.938272
90	SS.SCS.CCS		45	62.39161	0.6333	10.64491	0.969958	3.692304	0.927089
91	SS.SMu.CSaMu.AfilNten		16	20.55934	0.3065	4.961441	0.973392	2.698816	0.880333
92	SS.SMu.CSaMu.AfilMysAnit		26	31.12096	1.1509	7.27192	0.989734	3.22465	0.9475
93	SS.SMu.CSaMu.AfilMysAnit		24	32.89292	3.141	6.584112	0.978639	3.110168	0.926036
94	SS.SSa.CFiSa.EpusOborApri/ SS.SMx.OMx.PoVen		31	41.39088	5.0003	8.057887	0.977932	3.358205	0.919651
95	SS.SSa.CFiSa.ApriBatPo		37	53.99911	6.9061	9.024892	0.961258	3.471025	0.907579
96	SS.SSa.OSa		35	41.68947	39.7683	9.114674	0.989301	3.51731	0.957476
97	SS.SMu.CSaMu.AfilNten		43	63.49349	3.0148	10.1182	0.961488	3.616347	0.853049
98	SS.SMu.CSaMu.ThyNten		18	22.52056	0.2895	5.458465	0.98486	2.846612	0.913632
99	SS.SMu.CSaMu.ThyNten		19	23.15623	2.9274	5.728354	0.985527	2.901824	0.917794
102	SS.SSa.OSa		45	58.98919	0.9007	10.79131	0.97634	3.716598	0.935764

Sample Station	Preliminary Biotope	Infaunal	S	N	Biomass (g)	d	J'	H'	$\lambda$
104	SS.SMu.CSaMu.AfilNten		36	45.2807	2.0239	9.179411	0.983587	3.524701	0.947692
105	SS.SMu.CSaMu.AfilNten		26	34.06377	0.4904	7.085697	0.98383	3.205412	0.936
106	SS.SMu.CSaMu.ThyNten		35	46.49146	2.5565	8.855854	0.980788	3.487043	0.940586
108	SS.SSa.IFiSa.NcirBat		17	24.21415	17.7244	5.020494	0.978171	2.771368	0.909928
109	SS.SMu.CSaMu.ThyNten		31	41.32174	1.1472	8.061506	0.977411	3.356419	0.919192
112	SS.SMu.CSaMu.AfilMysAnit		25	36.58969	1.4504	6.667099	0.97482	3.137823	0.910156

### 6.5. ANNEX E: BENTHIC INFAUNAL CONTRIBUTION OF BIOMASS TO GROSS TAXONOMIC GROUPS

Sample Station	Sample Biomass (g)					Subtotal (g)
	Annelida	Crustacea	Mollusca	Echinodermata	Other	
3	0.7018	0.0058	0.8025	0.4899	0.0122	2.0122
5	0.1521	0.0304	2.2272	0.0537	0.0829	2.5463
6	0.4721	0.0055	0.4609	0.1326	0.0412	1.1123
7	0.0043	0.0214	0.0000	0.2134	0.0000	0.2391
8	0.1642	0.0126	0.0128	1.1866	0.0019	1.3781
9	0.0917	0.0108	0.1050	0.0271	0.000	0.2346
10	0.4616	0.0135	0.3367	3.1118	0.0011	3.9247
11	0.6550	0.0157	0.1473	0.1693	0.0025	0.9898
12	0.0275	0.0014	0.073	0.2677	0.0000	0.3696
13	0.2278	0.0044	1.0989	0.5526	0.0041	1.8878
14	0.1440	0.0116	0.2355	0.1177	0.0682	0.577
15	0.1605	0.0327	0.0720	0.1921	4.9944	5.4517
16	0.3903	0.0058	0.2061	3.5635	0.0035	4.1692
17	0.5613	0.0984	0.6845	0.1314	3.2772	4.7528
18	0.3852	0.0022	2.3519	1.6411	0.0001	4.3805
19	0.1333	0.0049	0.2512	5.0088	0.0058	5.404
21	0.0912	0.0039	0.1721	2.2813	0.017	2.5655
22	0.0803	0.0289	0.0219	1.3183	0.000	1.4494
23	0.2509	0.0116	0.7941	0.0957	0.0093	1.1616
24	0.2712	0.0120	0.3792	6.9408	0.0008	7.6040

Sample Station	Sample Biomass (g)					Subtotal (g)
	Annelida	Crustacea	Mollusca	Echinodermata	Other	
26	0.2559	0.0170	181.7571	0.2100	0.0072	182.2472
27	0.5398	0.0794	5.4130	0.0547	0.0017	6.0886
28	0.1246	0.0055	1.3441	0.0047	0.0083	1.4872
29	0.0975	0.0002	2.1196	0.0242	1.1820	3.4235
30	0.3649	0.0050	1.9289	0.1961	0.0340	2.5289
31	0.1366	0.0012	1.6235	0.0673	0.1746	2.0032
32	0.8889	0.0343	0.9146	0.1390	0.0607	2.0375
33	0.0878	0.0075	0.0068	0.0047	0.0000	0.1068
34	0.2509	0.0048	0.1204	2.0953	0.0001	2.4715
35	0.1481	0.0068	0.5642	1.2562	0.0812	2.0565
36	1.3071	1.4078	17.9754	0.3212	0.0068	21.0183
37	0.7272	0.0069	0.9620	0.2821	0.0098	1.9880
40	0.0232	0.0064	0.2565	0.1629	0.000	0.4490
41	0.5082	0.0132	1.1848	0.4659	1.2882	3.4603
42	0.0972	0.0036	3.0864	3.3353	0.0299	6.5524
43	0.0495	0.0043	0.1777	0.1210	0.0016	0.3541
44	0.1113	0.0266	1.8543	0.0060	0.0063	2.0045
45	1.2170	0.0380	0.2518	0.0510	0.0145	1.5723
46	0.4595	0.0743	3.4016	1.3990	0.0000	5.3344
47	4.1856	0.1830	8.3976	0.1582	0.0500	12.9744
48	0.3258	0.1818	3.8318	0.3119	0.0006	4.6519
49	0.0660	0.0015	0.0868	0.0101	0.0025	0.1669

Sample Station	Sample Biomass (g)					Subtotal (g)
	Annelida	Crustacea	Mollusca	Echinodermata	Other	
50	0.5659	0.1466	48.2274	0.0472	0.1117	49.0988
51	0.3253	0.3567	2.3617	0.1609	0.0000	3.2046
52	0.1425	0.0504	0.0979	0.0418	0.3110	0.6436
53	2.4638	0.0353	2.2034	0.0058	2.0695	6.7778
54	0.9924	0.4141	3.3846	0.5212	0.1818	5.4941
55	0.3626	0.0464	0.3533	0.5312	0.0322	1.3257
57	0.2618	0.0115	1.4863	1.0504	0.0404	2.8504
58	0.1212	0.0150	0.3202	73.4343	4.9167	78.8074
59	0.1145	0.0132	3.4915	0.0821	0.0427	3.7440
60	0.7603	0.0840	0.3134	0.2485	0.0238	1.4300
61	0.0670	0.0037	0.0900	0.0114	0.3233	0.4954
62	1.5743	0.0139	2.4353	8.2258	0.0247	12.2740
63	0.2349	0.0267	2.5789	5.7654	0.0000	8.6059
64	0.1039	0.0068	0.2554	0.0604	0.0000	0.4265
66	0.5856	0.1157	0.8458	0.0135	0.0803	1.6409
68	0.1155	0.0039	1.1892	11.2381	0.0012	12.5479
70	2.9158	0.0513	0.7238	0.1867	5.3104	9.1880
71	5.8904	0.1656	1.3753	0.0436	1.7963	9.2712
72	0.0291	0.0056	0.0091	0.3001	0.3814	0.7253
73	0.3780	0.0596	2.2957	14.1796	0.0040	16.9169
74	1.4973	0.0046	2.8652	0.4776	0.0213	4.8660
76	0.0315	0.0235	0.1518	0.2928	0.0014	0.5010

Sample Station	Sample Biomass (g)					Subtotal (g)
	Annelida	Crustacea	Mollusca	Echinodermata	Other	
77	0.6333	0.0109	6.7239	0.0863	0.0299	7.4843
78	0.0907	0.0065	0.0294	0.0180	0.0000	0.1446
79	0.6554	0.0102	1.0025	0.4172	0.0085	2.0938
80	1.7262	0.0101	1.2526	2.0769	0.0117	5.0775
81	1.1193	0.3298	0.0138	0.0000	0.0155	1.4784
82	1.0497	0.0178	0.8212	0.8286	0.0795	2.7968
83	3.2615	0.7025	1.3993	1.0723	3.1754	9.6110
85	0.1638	0.0225	0.1681	0.1980	0.0894	0.6418
86	0.1697	0.0032	0.0037	0.9397	0.0440	1.1603
87	0.5015	0.0212	0.0956	0.2338	0.0001	0.8522
88	1.1025	0.0284	0.7185	0.0930	0.1725	2.1149
90	0.0705	0.0951	0.3051	0.1437	0.0189	0.6333
91	0.0899	0.0001	0.0567	0.1466	0.0132	0.3065
92	0.085	0.0002	1.0245	0.0278	0.0134	1.1509
93	0.2754	0.0001	2.5715	0.2937	0.0003	3.1410
94	0.5444	0.0843	3.0666	0.0128	1.2922	5.0003
95	0.3738	0.1726	6.0136	0.3348	0.0113	6.9061
96	0.1087	0.0290	36.8911	2.6621	0.0774	39.7683
97	0.6409	0.0669	0.9750	1.3275	0.0045	3.0148
98	0.2308	0.0017	0.0493	0.0015	0.0062	0.2895
99	0.5726	0.0067	0.0348	2.2915	0.0218	2.9274
102	0.3941	0.0205	0.1869	0.1765	0.1227	0.9007



Sample Station	Sample Biomass (g)					Subtotal (g)
	Annelida	Crustacea	Mollusca	Echinodermata	Other	
104	0.3390	0.2034	1.3232	0.1529	0.0054	2.0239
105	0.0497	0.0343	0.2190	0.1769	0.0105	0.4904
106	0.9911	0.0070	1.0608	0.4436	0.0540	2.5565
108	0.0922	0.0131	0.4766	17.1372	0.0053	17.7244
109	0.5059	0.2449	0.1213	0.0000	0.2751	1.1472
112	0.6593	0.0074	0.4936	0.2901	0.0000	1.4504

## 6.6. ANNEX F: BENTHIC GRAB AND DDV EPIFAUNAL DATA MULTIVARIATE ANALYSIS RESULTS

SIMPER		ST24	h
Similarity Percentages - species contributions		ST25	h
		ST26	h
One-Way Analysis		ST27	h
		ST28	h
Data worksheet		ST30	h
Name: Data4		ST31	h
Data type: Abundance		ST32	h
Sample selection: All		ST35	h
Variable selection: All		ST37	h
		ST41	h
Parameters		ST42	h
Resemblance: S17 Bray Curtis similarity		ST43	h
Cut off for low contributions: 90.00%		ST44	h
		ST46	h
Factor Groups		ST49	h
Sample	SIMPROF EPI	ST51	h
ST1	e	ST53	h
ST2	e	ST55	h
ST4	e	ST57	h
ST20	e	ST58	h
ST33	e	ST59	h
ST34	e	ST60	h
ST38	e	ST62	h
ST39	e	ST63	h
ST40	e	ST64	h
ST45	e	ST68	h
ST56	e	ST72	h
ST65	e	ST74	h
ST67	e	ST76	h
ST69	e	ST77	h
ST75	e	ST91	h
ST100	e	ST92	h
ST101	e	ST93	h
ST103	e	ST95	h
ST110	e	ST112	h
ST3	h	ST12	m
ST5	h	ST78	m
ST6	h	ST79	m
ST7	h	ST80	m
ST8	h	ST81	m
ST9	h	ST82	m
ST10	h	ST85	m
ST11	h	ST86	m
ST13	h	ST87	m
ST14	h	ST88	m
ST17	h	ST97	m
ST18	h	ST98	m
ST19	h	ST99	m
ST22	h	ST104	m
ST23	h	ST105	m

ST106	m										Spirobranchus sp.	0.35	1.27	0.36	3.11	83.74	
ST109	m										Tube worms	0.21	0.89	0.45	2.2	85.93	
ST15	g										Alcyonidium parasiticum	0.27	0.76	0.27	1.87	87.81	
ST36	g										Burrow 1cm	0.23	0.71	0.28	1.73	89.54	
ST47	g										Campanulariidae	0.25	0.63	0.25	1.54	91.09	
ST50	g																
ST52	g																
ST54	g																
ST61	g																
ST66	g																
ST70	g																
ST71	g																
ST83	g																
ST94	g																
ST16	k																
ST21	i																
ST29	a																
ST48	c																
ST73	l																
ST84	d																
ST89	d																
ST107	d																
ST90	f																
ST96	f																
ST102	f																
ST108	j																
ST111	b																
Group e																	
Average similarity: 50.42																	
Species		Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%											
Faunal turf		1	11.57	3.75	22.94	22.94											
Spirobranchus sp.		1	11.57	3.75	22.94	45.88											
Flustra foliacea		0.89	8.45	1.79	16.75	62.63											
Branching Hydroids		0.79	6.3	1.19	12.5	75.13											
Alcyonium digitatum		0.53	3.18	0.58	6.31	81.44											
Munida rugosa		0.42	1.56	0.66	3.1	84.54											
Sertularidae		0.42	1.46	0.43	2.9	87.44											
Asterias rubens		0.29	0.97	0.48	1.93	89.37											
Bushy Hydroids		0.32	0.91	0.31	1.81	91.18											
Group h																	
Average similarity: 40.67																	
Species		Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%											
Faunal turf		0.9	10.19	1.76	25.06	25.06											
Folliculinidae		0.86	9.68	1.45	23.8	48.86											
Flustra foliacea		0.86	9	1.49	22.13	70.99											
Alcyonium digitatum		0.45	2.12	0.49	5.21	76.2											
Acorn Barnacles (Balanomorpha)		0.41	1.8	0.43	4.42	80.62											
Group k																	
Less than 2 samples in group																	
Group i																	
Less than 2 samples in group																	

Group a  
Less than 2 samples in group

Group c  
Less than 2 samples in group

Group l  
Less than 2 samples in group

Group d  
Average similarity: 60.44

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Encrusting Orange Sponges	1	9.65	5.63	15.97	15.97
Encrusting Red Calcareous Algae	1	9.65	5.63	15.97	31.94
Encrusting Yellow Sponges	1	9.65	5.63	15.97	47.92
Faunal turf	1	9.65	5.63	15.97	63.89
Spirobranchus sp.	1	9.65	5.63	15.97	79.86
Alcyonium digitatum	0.67	2.56	0.58	4.24	84.1
Branching Hydroids	0.67	2.56	0.58	4.24	88.34
Hard Encrusting Peach Bryozoa	0.67	2.56	0.58	4.24	92.59

Group f  
Average similarity: 44.30

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Alcyonidium parasiticum	1	6.46	30.25	14.57	14.57
Alcyonium digitatum	1	6.46	30.25	14.57	29.15
Branching Hydroids	1	6.46	30.25	14.57	43.72
Bushy Hydroids	1	6.46	30.25	14.57	58.3
Faunal turf	1	6.46	30.25	14.57	72.87
Thuiaria thuja	0.84	4.44	2.64	10.02	82.89
Diphasia	0.67	2.13	0.58	4.8	87.69
Spirobranchus sp.	0.67	2.1	0.58	4.74	92.43

Group j  
Less than 2 samples in group

Group b  
Less than 2 samples in group

## 6.7. ANNEX G: BENTHIC GRAB AND DDV EPIFAUNAL DATA UNIVARIATE ANALYSIS RESULTS

269. S = number of species; N = abundance; B = Biomass (ash free dry mass in grams); d = Margalef's index of Richness; J' = Pielou's Evenness index; H' = Shannon-Wiener Diversity index; λ = Simpson's Dominance index.

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	λ
1	SS.SCS.CCS	11	6.416667	5.379529	0.842512	2.020256	0.853432
2	SS.SCS.CCS	21	12.42857	7.936514	0.911758	2.775868	0.929845
3	SS.SCS.CCS	10	9	4.096077	0.972424	2.239088	0.89159
4	SS.SCS.CCS	13	7.428571	5.984042	0.892613	2.289506	0.884615
5	SS.SCS.CCS	14	11.6	5.303947	0.955758	2.522301	0.916914
6	SS.SCS.CCS	6	5.166667	3.044645	0.948803	1.700026	0.811655
7	SS.SCS.CCS	15	10	6.080123	0.914818	2.477372	0.908163
8	SS.SCS.CCS	15	11.875	5.657856	0.948759	2.569287	0.919889
9	SS.SCS.CCS	8	6.222222	3.829055	0.916881	1.906599	0.844388
10	SS.SCS.CCS	13	9.8	5.257664	0.931104	2.388234	0.903374
11	SS.SCS.CCS	13	10.66667	5.069444	0.959523	2.461128	0.910807
12	SS.SSa.CMuSa	5	5.25	2.412213	0.5906	0.950534	0.481859
13	SS.SCS.CCS	5	3.5	3.192942	0.896409	1.442715	0.743764
14	SS.SCS.CCS	4	4.333333	2.045914	0.993887	1.37782	0.745562
15	SS.SCS.CCS	22	18.57143	7.187782	0.9547	2.951018	0.944615
16	SS.SCS.CCS	5	3.666667	3.078621	0.929445	1.495884	0.764463
17	SS.SCS.CCS	8	7.142857	3.560325	0.964216	2.005031	0.8624
18	SS.SCS.CCS	10	8	4.328085	0.960358	2.211307	0.885

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	λ
19	SS.SCS.CCS	6	4.333333	3.409857	0.895301	1.604165	0.784024
20	SS.SCS.CCS	18	13.71429	6.49242	0.914834	2.64421	0.921007
21	SS.SCS.CCS	5	2.666667	4.078182	0.83391	1.342126	0.695313
22	SS.SCS.CCS	9	7.285714	4.028369	0.938559	2.062226	0.867359
23	SS.SCS.CCS	10	9.2	4.055509	0.978983	2.254191	0.893195
24	SS.SCS.CCS	6	5.25	3.015267	0.962318	1.724242	0.816327
25	SS.SCS.CCS	5	4.25	2.764495	0.949689	1.528466	0.775087
26	SS.SCS.CCS	9	9	3.640957	1	2.197225	0.888889
27	SS.SCS.CCS	8	7.125	3.564863	0.961841	2.000091	0.861804
28	SS.SCS.CCS	9	9	3.640957	1	2.197225	0.888889
29	SS.SSa.OSa	1	1	-	-	0	0
30	SS.SCS.CCS	9	8.142857	3.814717	0.969987	2.13128	0.87904
31	SS.SCS.CCS	11	9.428571	4.456835	0.963841	2.311191	0.897612
32	SS.SCS.CCS	14	12.28571	5.18251	0.967653	2.553691	0.920227
33	SS.SCS.CCS	19	9.669641	7.933041	0.829467	2.442314	0.903151
34	SS.SCS.CCS	5	4.333333	2.727886	0.963595	1.550846	0.781065
35	SS.SCS.CCS	7	5.4	3.557877	0.927903	1.805617	0.825789
36	SS.SCS.CCS	31	29.6	8.855371	0.964982	3.313736	0.959939
37	SS.SCS.CCS	10	8.333333	4.244755	0.963385	2.218275	0.8872
38	SS.SCS.CCS	14	9.714286	5.717811	0.924008	2.43851	0.905709
39	SS.SCS.CCS	6	5.166667	3.044645	0.948803	1.700026	0.811655
40	SS.SCS.CCS	9	7.333333	4.015197	0.943861	2.073874	0.868802
41	SS.SCS.CCS	10	7.285714	4.531915	0.931276	2.144341	0.875048

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	$\lambda$
42	SS.SCS.CCS	6	5.666667	2.882507	0.994722	1.782303	0.83045
43	SS.SCS.CCS	4	4	2.164043	1	1.386294	0.75
44	SS.SCS.CCS	17	14	6.062771	0.962053	2.725701	0.93192
45	SS.SCS.CCS	11	8.666667	4.630735	0.946936	2.270652	0.891272
46	SS.SCS.CCS	7	7	3.08339	1	1.94591	0.857143
47	SS.SCS.CCS	20	14	7.19954	0.927336	2.778051	0.932945
48	SS.SCS.CCS	3	3	1.820478	1	1.098612	0.666667
49	SS.SCS.CCS	16	14.28571	5.640667	0.973162	2.698178	0.9312
50	SS.SCS.CCS	28	24.71429	8.418082	0.977013	3.255608	0.960473
51	SS.SCS.CCS	13	8.75	5.532366	0.876313	2.247698	0.878776
52	SS.SCS.CCS	24	24.875	7.156496	0.938379	2.982217	0.933966
53	SS.SCS.CCS	6	3.2	4.298669	0.889295	1.593403	0.765625
54	SS.SCS.CCS	29	26.5	8.544023	0.988446	3.328389	0.96349
55	SS.SCS.CCS	12	9	5.006316	0.961492	2.389217	0.902716
56	SS.SCS.CCS	17	11.42857	6.56783	0.931282	2.63852	0.9225
57	SS.SCS.CCS	16	14.33333	5.633617	0.975354	2.704257	0.931585
58	SS.SCS.CCS	5	4.333333	2.727886	0.963595	1.550846	0.781065
59	SS.SCS.CCS	2	2	1.442695	1	0.693147	0.5
60	SS.SCS.CCS	10	10	3.90865	1	2.302585	0.9
61	SS.SCS.CCS	17	13.16667	6.207112	0.95346	2.701356	0.929018
62	SS.SCS.CCS	14	13.16667	5.043278	0.98534	2.600369	0.924852
63	SS.SCS.CCS	10	9.285714	4.038632	0.984556	2.267024	0.894675
64	SS.SCS.CCS	7	4.285714	4.122897	0.905387	1.761801	0.808889

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	$\lambda$
65	SS.SCS.CCS	8	5.833333	3.96918	0.890341	1.851412	0.827755
66	SS.SCS.CCS	24	20.14286	7.659391	0.967236	3.073928	0.952165
67	SS.SCS.CCS	11	5.875	5.647465	0.855298	2.050914	0.851064
68	SS.SCS.CCS	11	9	4.551196	0.963179	2.309603	0.896433
69	SS.SCS.CCS	20	12.75299	7.463373	0.83262	2.494306	0.89336
70	SS.SCS.CCS	29	27.42857	8.455165	0.990341	3.33477	0.963976
71	SS.SCS.CCS	29	28.16667	8.387907	0.99449	3.348741	0.964672
72	SS.SCS.CCS	6	5.111111	3.064821	0.93717	1.679183	0.808129
73	SS.SCS.CCS	10	6.111111	4.972077	0.888929	2.046834	0.856198
74	SS.SCS.CCS	11	5.285714	6.005978	0.854608	2.049261	0.845873
75	SS.SCS.CCS	14	7	6.680678	0.89442	2.360426	0.887963
76	SS.SCS.CCS	12	11.16667	4.558767	0.981798	2.439676	0.911562
77	SS.SCS.CCS	10	6.444444	4.830352	0.874995	2.014751	0.85434
78	SS.SMu.CFiMu.SpnMeg	5	5.888889	2.255977	0.841471	1.354295	0.706301
79	SS.SMu.CFiMu.SpnMeg	9	4.5	5.318875	0.821707	1.805474	0.773663
80	SS.SMu.CFiMu.SpnMeg	12	8	5.289882	0.874064	2.171967	0.858125
81	SS.SMu.CFiMu.SpnMeg	10	8.214286	4.273758	0.802211	1.84716	0.795766
82	SS.SMu.CFiMu.SpnMeg	11	5	6.213349	0.751689	1.802471	0.772893
83	SS.SCS.CCS	19	15.85714	6.513196	0.956794	2.817221	0.936775
84	CR.MCR.EcCr	6	5.666667	2.882507	0.994722	1.782303	0.83045
85	SS.SMu.CFiMu.SpnMeg	6	4	3.606738	0.685	1.227355	0.584877
86	SS.SMu.CFiMu.SpnMeg	8	8.6	3.253148	0.75765	1.575488	0.731206
87	SS.SMu.CFiMu.SpnMeg	13	8.125	5.728072	0.87558	2.245819	0.870533

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	$\lambda$
88	SS.SMu.CFiMu.SpnMeg	9	7.75	3.906836	0.687007	1.509509	0.677419
89	CR.MCR.EcCr	16	11.54286	6.132294	0.924423	2.563045	0.919567
90	SS.SCS.CCS	18	16.125	6.114292	0.975603	2.819856	0.939246
91	SS.SCS.CCS	6	6	2.790553	0.859192	1.539465	0.747166
92	SS.SCS.CCS	9	8.125	3.818715	0.968011	2.126937	0.87858
93	SS.SCS.CCS	5	3.5	3.192942	0.901436	1.450805	0.744898
94	SS.SCS.CCS	11	9.375	4.468182	0.960317	2.30274	0.896711
95	SS.SCS.CCS	9	7.571429	3.951824	0.964367	2.11893	0.875044
96	SS.SCS.CCS	18	13.44444	6.54207	0.940552	2.718546	0.930264
97	SS.SMu.CFiMu.SpnMeg	5	4.6	2.621135	0.66359	1.068006	0.533081
98	SS.SMu.CFiMu.SpnMeg	7	7	3.08339	0.705072	1.372007	0.69035
99	SS.SMu.CFiMu.SpnMeg	10	7.153846	4.573984	0.845113	1.945945	0.820904
100	SS.SCS.CCS	13	7	6.16678	0.85184	2.184927	0.872553
101	SS.SCS.CCS	18	7.866667	8.241887	0.808713	2.337482	0.885665
102	SS.SCS.CCS	23	13.14391	8.540511	0.874795	2.742914	0.929418
103	SS.SCS.CCS	8	7	3.597288	0.958118	1.992351	0.860816
104	SS.SMu.CFiMu.SpnMeg	5	4	2.88539	0.762854	1.227767	0.632653
105	SS.SMu.CFiMu.SpnMeg	6	4.222222	3.471351	0.739821	1.325581	0.66482
106	SS.SMu.CFiMu.SpnMeg	7	7.5	2.977811	0.553213	1.076502	0.538311
107	CR.MCR.EcCr	18	12.0303	6.834367	0.903115	2.610337	0.920937
108	SS.SSa.IFiSa	1	1.266667	0		0	0
109	SS.SMu.CFiMu.SpnMeg	10	4.818182	5.723747	0.726866	1.673671	0.722677
110	SS.SCS.CCS	6	2.941176	4.634738	0.759775	1.361334	0.7088

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	$\lambda$
111	CR.MCR.EcCr	17	13.85	6.087619	0.952986	2.700013	0.93047
112	SS.SCS.CCS	6	5.333333	2.9869	0.972586	1.74264	0.820313

## 6.8. ANNEX H: BENTHIC TRAWLS EPIFAUNAL DATA MULTIVARIATE ANALYSIS RESULTS

SIMPER  
Similarity Percentages - species contributions

One-Way Analysis

Data worksheet  
Name: Fourth root  
Data type: Abundance  
Sample selection: All  
Variable selection: All

Parameters  
Resemblance: S17 Bray Curtis similarity  
Cut off for low contributions: 90.00%

Sample	SIMPROF3
BT01	c
BT10	c
BT11	c
BT12	c
BT14	c
BT02	b
BT03	b
BT05	b
BT07	b
BT04	d
BT09	d
BT15	a
BT16	a
BT17	a
BT18	a

Group c  
Average similarity: 58.72

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Asterias rubens	1.81	6.82	12.99	11.62	11.62
Munida	1.69	6.16	3.43	10.5	22.12
Liocarcinus	1.26	4.98	6.69	8.48	30.6
Astropecten irregularis	1.39	4.91	3.22	8.37	38.97
Pecten maximus	1.04	4.12	11.69	7.02	45.99
Ophiothrix fragilis	1.47	3.52	1	5.99	51.98
Echinus esculentus	1.34	3.4	1.06	5.79	57.77
Alcyonium digitatum	0.83	3.38	11.17	5.76	63.53
Flustra foliacea	0.83	3.38	11.17	5.76	69.29
Ophiura	1.11	3.25	1.14	5.53	74.83
Macropodia	0.87	2.39	1.1	4.07	78.9
Crossaster papposus	0.74	2.3	1.16	3.92	82.82
Hyas araneus	0.82	1.66	0.62	2.84	85.65
Pandalidae	0.88	1.63	0.61	2.78	88.43

Pagurus prideaux	0.88	1.47	0.62	2.5	90.93
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Group b  
Average similarity: 63.65

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pagurus prideaux	2.37	11.08	9.06	17.4	17.4
Ophiura	1.88	9.29	14.77	14.59	31.99
Adamsia palliata	1.27	6.03	22.64	9.47	41.46
Astropecten irregularis	1.27	6.03	22.64	9.47	50.93
Flustra foliacea	1.27	6.03	22.64	9.47	60.41
Liocarcinus	1.48	4.31	0.9	6.76	67.17
Hyas coarctus	1.29	3.95	0.91	6.21	73.38
Macropodia	1.15	3.59	0.91	5.64	79.02
Paguridae	1.13	3.33	0.91	5.22	84.24
Aphrodita aculeata	0.95	3.09	0.91	4.86	89.1
Sertulariidae	0.99	3.02	0.91	4.74	93.84

Group d  
Average similarity: 50.66

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Munida	2.17	10.12	#####	19.98	19.98
Modiolus modiolus	2	8.19	#####	16.16	36.14
Liocarcinus	1.81	8.14	#####	16.07	52.21
Echinus esculentus	1.47	6.32	#####	12.48	64.7
Atelecyclus rotundatus	1.14	4.47	#####	8.83	73.52
Flustra foliacea	1.14	4.47	#####	8.83	82.35
Macropodia	1.14	4.47	#####	8.83	91.17

Group a  
Average similarity: 64.83

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Crangon crangon	2.74	18.97	7.51	29.26	29.26
Pandalidae	1.82	12.84	6.38	19.81	49.07
Sepiola atlantica	0.88	6.17	14.58	9.52	58.59
Paguridae	0.92	5.96	8.52	9.2	67.79
Asterias rubens	0.85	5.17	4.72	7.97	75.76
Liocarcinus	0.79	3.34	0.87	5.16	80.92
Spirontocaris	0.65	2.61	0.9	4.03	84.96
Pleurobrachia pileus	1.15	2.58	0.41	3.97	88.93
Nephrops norvegicus	0.72	2.14	0.87	3.3	92.23



### 6.9. ANNEX I: BENTHIC TRAWLS EPIFAUNAL DATA UNIVARIATE ANALYSIS RESULTS

270. S = number of species; N = abundance; B = Biomass (ash free dry mass in grams); d = Margalef's index of Richness; J' = Pielou's Evenness index; H' = Shannon-Wiener Diversity index; λ = Simpson's Dominance index.

Sample Station	Preliminary Epifaunal Biotope	S	N	d	J'	H'	λ
1	SS.SCS.CCS	15	103	3.020673	0.779095	2.109828	0.837214
2	SS.SCS.CCS	11	21	3.284587	0.935662	2.243619	0.879819
3	SS.SCS.CCS	12	62	2.665288	0.611081	1.51848	0.627992
4	SS.SCS.CCS	13	32	3.462468	0.925512	2.373891	0.888672
5	SS.SCS.CCS	15	41	3.769955	0.839882	2.274442	0.848305
7	SS.SCS.CCS	14	46	3.39546	0.734093	1.937314	0.782609
9	SS.SCS.CCS	17	120	3.342042	0.697672	1.976654	0.813472
10	SS.SCS.CCS	18	384	2.856834	0.610374	1.764207	0.699409
14	SS.SCS.CCS	19	169	3.508841	0.763826	2.249038	0.855992
11	SS.SMx.CMx.FluHyd	21	326	3.456083	0.530509	1.615145	0.60659
12	SS.SMx.CMx.FluHyd	19	198	3.403762	0.497326	1.464345	0.561983
15	SS.SSa.CMuSa	11	1076	1.432458	0.329307	0.789644	0.380936
16	SS.SSa.CMuSa	7	307	1.047697	0.51851	1.008974	0.522637
17	SS.SSa.CMuSa	13	1183	1.695919	0.271659	0.696792	0.289103
18	SS.SSa.CMuSa	15	1294	1.953808	0.407393	1.103241	0.496321

### 6.10. ANNEX J: SEDIMENT CONTAMINATION RESULTS

6.10.1. CONCENTRATIONS OF PCBS RECORDED IN SEDIMENTS WITHIN THE PROPOSED DEVELOPMENT BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY STUDY AREA

Description (PCBs)	28	52	101	118	138	153	180	Sum of ICES 7
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MS AL1 (mg/kg)	-	-	-	-	-	-	-	0.02
MS AL2 (mg/kg)	-	-	-	-	-	-	-	0.18
Sample No.								
ST91	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST92	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST93	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST94	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST95	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST96	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST97	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST98	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013
ST99	<0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0013

6.10.2. CONCENTRATIONS OF PAHS RECORDED IN SEDIMENT WITHIN THE PROPOSED DEVELOPMENT BENTHIC SUBTIDAL AND INTERTIDAL ECOLOGY STUDY AREA

Description (PAH)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MS AL1 (mg/kg)	0.1	0.1	0.1	0.1	0.1	0.1
MS AL2 (mg/kg)	n/a	n/a	n/a	n/a	n/a	n/a
Canadian TEL (mg/kg)	0.0346	0.00587	0.00671	0.0212	0.0867	0.0469
Canadian PEL (mg/kg)	0.391	0.128	0.0889	0.144	0.544	0.245

Sample No.	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene
Sample 91	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 92	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 93	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 94	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 95	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 96	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 97	<0.0026	<0.002	<0.0017	<0.0016	<0.00390	<0.0024
Sample 98	0.00445	<0.002	<0.0017	<0.0016	0.01010	<0.0024
Sample 99	0.00764	<0.002	<0.0017	0.00293	0.01890	0.00377

Description (PAH)	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MS AL1 (mg/kg)	0.1	0.1	0.1	0.1	0.1	0.1
MS AL2 (mg/kg)	n/a	n/a	n/a	n/a	n/a	n/a
Canadian TEL (mg/kg)	0.113	0.153	0.074	0.108	n/a	n/a
Canadian PEL (mg/kg)	1.494	1.398	0.693	0.846	n/a	n/a

Sample No.	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
Sample 91	<0.0024	<0.00280	<0.0016	<0.0017	0.00402	<0.002
Sample 92	<0.0024	<0.00280	<0.0016	<0.0017	0.00223	<0.002
Sample 93	<0.0024	<0.00280	<0.0016	<0.0017	0.00286	<0.002
Sample 94	<0.0024	<0.00280	<0.0016	<0.0017	<0.0016	<0.002
Sample 95	<0.0024	<0.00280	<0.0016	<0.0017	0.00468	<0.002
Sample 96	<0.0024	<0.00280	<0.0016	<0.0017	0.00316	<0.002
Sample 97	0.00429	<0.00280	0.00241	<0.0017	0.00987	0.00267
Sample 98	0.01210	0.01100	0.00725	0.00549	0.02430	0.00766
Sample 99	0.02100	0.01930	0.01300	0.01050	0.04210	0.01150

Description (PAH)	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
Units	mg/kg	mg/kg	mg/kg	mg/kg
MS AL1 (mg/kg)	0.1	0.1	0.01	0.1
MS AL2 (mg/kg)	n/a	n/a	n/a	n/a
Canadian TEL (mg/kg)	0.0888	n/a	0.00622	n/a
Canadian PEL (mg/kg)	0.763	n/a	0.135	n/a

Sample No.	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene
Sample 91	0.00118	0.00388	<0.0016	0.00398
Sample 92	<0.0009	<0.0022	<0.0016	0.00191
Sample 93	<0.0009	<0.0022	<0.0016	0.00254
Sample 94	<0.0009	<0.0022	<0.0016	<0.0014
Sample 95	0.00140	0.00394	<0.0016	0.00397
Sample 96	<0.0009	0.00298	<0.0016	0.00292
Sample 97	0.00329	0.00785	<0.0016	0.00810
Sample 98	0.00883	0.01820	0.00381	0.01890
Sample 99	0.0166	0.02870	0.00610	0.03000

## 6.11. ANNEX K: INTERTIDAL BIOTOPES

### 6.11.1. LITTORAL BIOTOPES AT THE SKATERAW LANDFALL

Shore Position	Biotope	Biotope Name	Biotope Description from the Skateraw Landfall
Upper shore	LR	Littoral rock (and other hard substrata)	Barren bedrock with no species recorded mainly occurring at MHWS and areas of elevated bedrock.
Upper shore	LR.FLR.Lic.YG	Yellow and grey lichens on supralittoral rock	Biotope present at the Skateraw Landfall as a scattered fringe and dominated by the yellow lichen <i>X. parietina</i> .
Upper shore	LR.FLR.Lic.Ver	<i>Verrucaria maura</i> on littoral rock fringe	Biotope recorded as a scattered fringe on upper shore bedrock, boulders and cobbles and dominated by <i>V. maura</i> although a significant amount of rock was uncolonised. <i>Enteromorpha intestinalis</i> and <i>L. saxatilis</i> also present.
Upper shore	LS.LSa.St.Tal	Talitrids on the upper shore and strand-line.	Biotope recorded at Stateraw Beach with talitrid amphipods occurring super abundantly under the decomposing seaweeds of the drift line.
Upper shore	LR.FLR.Eph.Ent	<i>Enteromorpha</i> spp. on freshwater influenced and/or unstable upper eulittoral rock	Biotope recorded on unstable rock in the upper shore and in areas influenced by fresh water from the Dry Burn and was dominated by <i>E. intestinalis</i> . Other species presented included sparse patches of <i>U. lactuca</i> and occasional individuals of <i>L. saxatilis</i> .
Upper shore	LR.FLR.Rkp.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in shallow upper shore rockpools	Biotope recorded in rockpools within the LR.FLR.Eph.Ent biotope and had a similar species assemblage.
Upper shore	LR.LLR.FVS.PelV S	<i>Pelvetia canaliculata</i> on sheltered variable salinity littoral fringe rock	Biotope recorded in occasional patches within the LR.LLR.F.Fspi.X biotope where <i>P. canaliculata</i> was dominant on its landward fringe. This biotope contained the same associate species as Fspi.X (see below).
Upper shore	LR.LLR.F.Fspi.X	<i>Fucus spiralis</i> on full salinity upper eulittoral mixed substrata	Biotope dominated by <i>F. spiralis</i> with abundant <i>V. maura</i> . Other species occurring occasionally were <i>E. intestinalis</i> , <i>S. balanoides</i> , <i>P. vulgata</i> , <i>L. saxatilis</i> and <i>L. littorea</i> . Species assemblage was the same as that associated with the LR.LLR.F.Fspi.B biotope.
Upper shore	LR.LLR.F.Fspi.B	<i>Fucus spiralis</i> on exposed to moderately exposed upper eulittoral rock	Biotope dominated by <i>F. spiralis</i> with abundant <i>V. maura</i> . Other species occurring occasionally were <i>E. intestinalis</i> , <i>S. balanoides</i> , <i>P. vulgata</i> , <i>L. saxatilis</i> and <i>L. littorea</i> . Species assemblage was the same as that associated with the LR.LLR.F.Fspi.X biotope.
Mid shore	LR.LLR.F.Fves	<i>Fucus vesiculosus</i> on moderately exposed to sheltered mid eulittoral rock	Biotope characterised by a continuous canopy of <i>F. vesiculosus</i> and sparse occurrences of <i>S. balanoides</i> . Species including <i>C. pagurus</i> and <i>C. maenas</i> were occasionally present under rocks. This community was differentiated into two variants which largely had the same species assemblages: LR.LLR.F.Fves.X and LR.LLR.F.Fves.FS (see below).
Mid shore	LR.LLR.F.Fves.F S	<i>Fucus vesiculosus</i> on full salinity moderately exposed to sheltered mid eulittoral rock	Biotope occurred on boulders and bedrock with a species assemblage as described above for LR.LLR.F.Fves.
Mid shore	LR.HLR.MusB.Sem	<i>Semibalanus balanoides</i> , <i>Patella vulgata</i> and <i>Littorina</i> spp. on exposed to moderately exposed or sheltered vertical eulittoral rock	Biotope occurred on bedrock and boulders and was dominated by <i>S. balanoides</i> which was present in super abundant numbers. Species recorded occasionally included <i>P. vulgata</i> , <i>L. littorea</i> , <i>L. obtusata</i> , <i>N. lapillus</i> and <i>V. maura</i> . Distributions of algae such as <i>F. vesiculosus</i> , <i>P. purpurea</i> and <i>E. intestinalis</i> were sparse within this biotope.

Shore Position	Biotope	Biotope Name	Biotope Description from the Skateraw Landfall
Mid shore	LR.MLR.BF.Fves.B	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock	Biotope recorded predominantly on mixed rocky sediments dominated by boulders and also on bedrock. Species assemblage dominated by <i>F. vesiculosus</i> and <i>S. balanoides</i> . <i>Ascophyllum nodosum</i> was occasionally present with <i>V. lanosa</i> attached. The red seaweeds <i>M. stellatus</i> and <i>C. officinalis</i> were occasionally present along with fauna including <i>P. vulgata</i> , <i>L. littorea</i> , <i>L. obtusata</i> , <i>C. maenas</i> and <i>A. equina</i> . Juvenile <i>M. edulis</i> were rarely observed.
Mid shore	LR.HLR.FR.Coff.Coff	<i>Corallina officinalis</i> and <i>Mastocarpus stellatus</i> on exposed to moderately exposed lower eulittoral rock	Biotope dominated by <i>C. officinalis</i> and coralline crusts with abundant <i>V. fucooides</i> . Other algae commonly recorded included <i>C. rupestris</i> and <i>F. vesiculosus</i> whilst <i>L. difformis</i> and <i>M. stellatus</i> were only occasionally recorded. Variable densities of <i>L. littorea</i> were also recorded. This biotope contained numerous shallow coralline rock pools with flat rocks under which a diverse assemblage of species occurred.
Mid shore	LR.LLR.F.Fves.X	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata	Biotope occurred on substrate with a higher proportion of cobbles and pebbles with a species assemblage as described above for LR.LLR.F.Fves.
Mid shore	LR.FLR.Rkp.Cor.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral Rockpools	Biotope occurred from the middle of the shore up to the <i>F. spiralis</i> zone within the numerous rockpools present at this landfall. Coralline crusts and <i>C. officinalis</i> were dominant with <i>C. rupestris</i> and <i>H. siliquosa</i> frequently recorded. Other seaweeds including <i>M. stellatus</i> , <i>C. crispus</i> , <i>Ceramium</i> sp. and <i>U. lactuca</i> occurred occasionally with a scattering of <i>F. vesiculosus</i> and <i>P. vulgata</i> . A diverse range of invertebrate animals occurred including <i>L. littorea</i> , <i>C. pagurus</i> , <i>G. cineraria</i> , <i>S. spirorbis</i> , <i>P. bernhardus</i> and <i>C. maenas</i> . Also present in very low abundances were <i>U. felina</i> , <i>S. unicornis</i> , <i>L. nivea</i> , <i>D. grossularia</i> and <i>D. pseudoargus</i> .
Lower shore	LR.MLR.BF.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock	Biotope commonly recorded on the lower shore containing a canopy of <i>F. serratus</i> predominantly on bedrock with frequent green seaweeds underneath such as <i>C. rupestris</i> . Invertebrates recorded included <i>S. balanoides</i> , <i>P. vulgata</i> and <i>N. lapillus</i> , particularly in rock crevices. Two variants of this biotope (Fser.R and Fser.Bo) were fairly widespread (see below).
Lower shore	LR.MLR.BF.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock.	Biotope characterised by common occurrences of the red seaweeds <i>M. stellatus</i> , <i>O. pinnatifida</i> , <i>C. officinalis</i> and <i>Ceramium</i> sp. and occasional green seaweeds such as <i>C. rupestris</i> and <i>E. intestinalis</i> . Invertebrates including <i>P. vulgata</i> and <i>S. balanoides</i> were frequently recorded with occasional specimens of <i>L. littorea</i> , <i>N. lapillus</i> and <i>C. maenas</i> .
Lower shore	LR.MLR.BF.Fser.Bo	<i>Fucus serratus</i> and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	Species rich biotope with super abundant <i>F. serratus</i> and occasionally <i>F. vesiculosus</i> . Red seaweeds included <i>P. palmata</i> , <i>M. stellatus</i> , <i>O. pinnatifida</i> , <i>L. articulata</i> , <i>O. dentata</i> , <i>C. officinalis</i> and calcareous encrusters. The faunal assemblage was also species rich with abundant <i>N. puber</i> , <i>P. platycheles</i> , <i>C. maenas</i> , <i>C. pagurus</i> and <i>G. squamifera</i> under most rocks. Other faunal species occasionally recorded included <i>H. sanguinolenta</i> , <i>A. rubens</i> , <i>O. fragilis</i> , <i>P. miliaris</i> and <i>A. equina</i> . Polychaetes were occasionally observed (e.g. <i>E. viridis</i> and <i>P. triquetra</i> ) and gastropod molluscs (e.g. <i>P. vulgata</i> , <i>N. lapillus</i> , <i>L. littoralis</i> and <i>G. cineraria</i> ) were present above and under boulders. The sea slug <i>D. pseudoargus</i> occurred infrequently under stones. The sponge <i>H. panicea</i> occurred abundantly while epiphytic colonies of the ascidian <i>B. schlosseri</i> and the

Shore Position	Biotope	Biotope Name	Biotope Description from the Skateraw Landfall
Lower shore	LR.MIR.KR.Ldig	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock	bryozoans <i>E. pilosa</i> and <i>M. membranacea</i> were present both on fronds of <i>F. serratus</i> and on rocks. Biotope recorded as a narrow fringe on vertical surfaces where rock platforms dropped off either into lower shore intertidal <i>L. digitata</i> boulder fields or directly into the sea. Biotope characterised by a similar suite of species as recorded in association with the LR.MLR.BF.Fser.Bo biotope (see above).
Lower shore	LR.MIR.KR.Ldig.Bo	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	Biotope characterised by a similar suite of species as recorded in association with the LR.MLR.BF.Fser.Bo biotope (see above) but present lower down the shore and with the kelp <i>L. digitata</i> as the dominant species. Additional species only recorded in this biotope included the seaweeds <i>S. latissima</i> , <i>L. hyperborea</i> , <i>D. carnosus</i> and the gastropod <i>T. monacha</i> .
Lower shore	LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools	Biotope recorded within the rockpools present throughout the lower and lower mid shore zones. <i>Fucus serratus</i> and <i>L. digitata</i> dominated the deeper waters of the pools while <i>C. officinalis</i> and coralline crusts dominated the shallow fringes. Also frequently recorded were <i>H. siliquosa</i> , <i>M. stellatus</i> , <i>C. crispus</i> , <i>P. palmata</i> , <i>A. plicata</i> and <i>Ceramium</i> sp. with scattered <i>N. lapillus</i> , <i>P. vulgata</i> and <i>A. equina</i> . Shrimps <i>Palaemon</i> sp. occurred occasionally.
Lower shore	LR.FLR.Rkp.SwSed	Seaweeds in sediment-floored eulittoral rockpools	Biotope recorded in deep pools although depth and suspended sediments hampered visibility.
Lower shore	LS.LSa.MuSa.MacAre	<i>Limecola (Macoma) balthica</i> and <i>Arenicola marina</i> in littoral muddy sand	Biotope recorded in areas of fine muddy sand with <i>M. balthica</i> and <i>M. tenuis</i> were rarely observed in dig over sampling. Oligochaete worms and <i>H. diversicolor</i> , <i>S. armiger</i> and <i>L. conchilega</i> were recorded in low densities. Patches of this biotope were also recorded in large rockpools containing a layer of sediment at the base.
Lower shore	LS.LSa.MuSa.Lan	<i>Lanice conchilega</i> in littoral sand	Biotope occurred predominantly in clean sand, mainly along the mid and lower shores in areas of dense populations of <i>L. conchilega</i> . Polychaetes <i>E. lumbricooides</i> , <i>N. hombergii</i> , <i>S. armiger</i> and <i>A. marina</i> were often present.
Lower shore	LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	Biotope was characterised by a similar suite of species as recorded within the LS.LSa.MuSa.MacAre and LS.LSa.MuSa.Lan biotopes with occasional occurrences of the polychaetes <i>N. hombergii</i> , <i>P. fulgens</i> , <i>H. diversicolor</i> and <i>S. armiger</i> . <i>Arenicola marina</i> was rarely present.

