Stranraer Marina Expansion

Benthic Ecology Technical Report

Eco Marine Consultants Ltd

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Eco Marine Consultants Document & Quality Control

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Non-technical Summary

Eco Marine Consultants Limited (Eco Marine) was commissioned by EcoNorth on behalf of Fairhurst Consulting Engineers to conduct a benthic survey in support of an Environmental Impact Assessment (EIA) relating to the upgrading of Stranraer Marina, southwest Scotland. The data collected as part of this programme will be used to establish the benthic communities present as a baseline assessment.

The survey completed in May 2025 included deployment of a drop-down video (DDV) subtidal survey, an intertidal Phase I survey, and a benthic grab survey to identify the benthic and epibenthic communities present in the vicinity of Stranraer. Benthic grab sampling using a day grab was conducted to obtain sediment particle size analysis (PSA) and macrofaunal analysis samples. DDV images, macrofaunal samples, and PSA samples were targeted at 21 stations both within and outside the marina boundary, covering the zone of likely secondary impacts arising from the proposed development. The survey plan for the works was submitted to NatureScot for comments and agreement prior to mobilisation.

The data collected has allowed identification of the existing habitats and features across the study area, which have been quantified and mapped where possible in line with the agreed methodology. The key findings of this report are as follows:

- Substrate type varied greatly across the survey area, with boulders, cobbles, shells, pebbles, gravel, sand, and mud all being recorded. However, finer sediments such as sand and mud showed a dominance over much of the survey area. Stations within the marina and surrounding subtidal area were classified as one of eight different Folk categories, further demonstrating the variety of sediments present.

- From the macrofaunal samples, a total of 3,865 individuals from 98 distinct taxa were identified, with a total biomass of 8.93 g AFDW. Variation in faunal communities between samples collected from across the site was apparent. The most frequently occurring taxa within the survey area was the phylum Nematoda, followed by the polychaetes *Capitella* spp. and *Chaetozone gibber,* the bivalve *Abra alba,* and the polychaete *Malacoceros vulgaris.*

- Multivariate analysis of infaunal community composition identified the presence of four distinct faunal groups, including one outlier, across the survey area. The characteristics of these faunal groups evidenced the existence of a relationship between community composition, sediment types, and the physical location across the stations.

- The intertidal areas to the west and east of Stranraer Marina showed a high diversity of epifauna, partially driven by the complexity of the habitats present. Fucoids dominated the intertidal macroalgal communities, beneath which a high diversity of characteristically coarse sediment shore epifaunal species were observed. Areas of the shore characterised by soft sediments were often dominated by populations of annelids.

- In total 22 biotopes were assigned across the survey area; nine were identified from the intertidal survey, 11 at stations within the marina and surrounding subtidal area, and three biotopes were determined from the DDV transect survey.

- Two specimens of the Priority Marine Feature (PMF), Native Oysters *Ostrea edulis* were identified in the macrofaunal analysis. Additionally, a patchy but widespread distribution of the PMF seagrass *Zostera noltii* beds were recorded on the intertidal area to the east of Stranraer Marina.

Contents

1. Introduction

Eco Marine Consultants Limited (Eco Marine) was commissioned by EcoNorth on behalf of Fairhurst Consulting Engineers to conduct a benthic survey in support of an Environmental Impact Assessment (EIA) relating to the upgrading of Stranraer Marina, southwest Scotland.

The works to the marina involve a series of upgrades and expansions to the existing infrastructure at Stranraer, including installation of additional berths and an extension to the current breakwater. As part of the development, it is understood that there will be an element of land reclamation, capital dredging works, and subsequent habitat loss in the marine environment, in addition to secondary level or indirect impacts. As such, the data collected as part of this programme will be used to establish the benthic communities present as a baseline assessment.

1.1. Project Aim and Objectives

The main aim of the Stranraer Marina survey was to acquire high quality biological data of suitable resolution from the area of interest and to examine the present condition of the marine environment surrounding the proposed development.

The principal objectives of the survey programme were:

- To collect information on and describe the benthic biological communities and habitats that occur within the survey area, along with the characterising taxa for each community type.
- To describe the distribution of sediment types within the survey area and their relation to biological community composition.
- To identify and document the occurrence of any species or communities of conservation importance.

In order to fulfil the aims and objectives for this project, intertidal and subtidal surveys were completed across Stranraer Marina. Subtidal data collection was completed using drop-down video (DDV) techniques and benthic grabs, while the intertidal survey involved a Phase I survey across the exposed intertidal areas at low water. Following the collection of samples, the physical sediment characteristics and the benthic macrofaunal communities at each station were processed at the Eco Marine analytical laboratory.

This report outlines the findings and implications of these survey elements.

2. Methodology

2.1. Survey Methodology

2.1.1. Study Area

The design for this survey was informed by the survey plan (Eco Marine, 2025). The survey plan was submitted to NatureScot for consultation and the recommendations made incorporated into the survey design. The recommendations from NatureScot included the addition of DDV transect surveys to assess for the presence of PMFs, intertidal surveys, and advice that the survey should take place between late May and September in order to ensure the presence of any seasonal seagrass beds was captured. Comments were also requested on the placement of sampling stations, though those specified in the survey plan were deemed sufficient by NatureScot.

An initial plume modelling exercise was undertaken by RPS, during the survey design phase in November 2024. Mapping of the sediment plume model allowed the determination of the likely range of impacts on benthic fauna arising from the project, and the placement of sampling stations within this area in order to characterise the benthic faunal communities present. The model assumed a worse-case scenario, based on previously understood hydrodynamic patterns in the area. This model was utilised for survey design as the timeframes for the project necessitated the benthic survey to be planned prior to the final sediment plume modelling exercise. This was agreed with NatureScot as part of the survey design consultation process.

Since completion of the surveys, an updated final sediment plume model has been completed by RPS as part pf the EIA works. This also captures and takes account of adjustments to the design of the proposed project and updated dredging volumes. The survey design presented in this report has been mapped relative to a total predicted sedimentation depth of 0.05 – 1mm deposited over the survey area due to the dredging operations. This is more conservative than the initial model and with a handful of stations in the survey array now located outside of the predicted sedimentation area (Figure 1).

The stations and transects in the original benthic survey design were deemed to provide adequate coverage to successfully determine the present condition of the marine environment within the area of interest using either model. The locations of stations within the primary impact zone (PIZ), which covers areas to be affected directly by dredging and land reclamation, and those within the secondary impact zone (SIZ), which covers areas which will be indirectly affected e.g. within the dredge plume, can be seen in Figure 1.

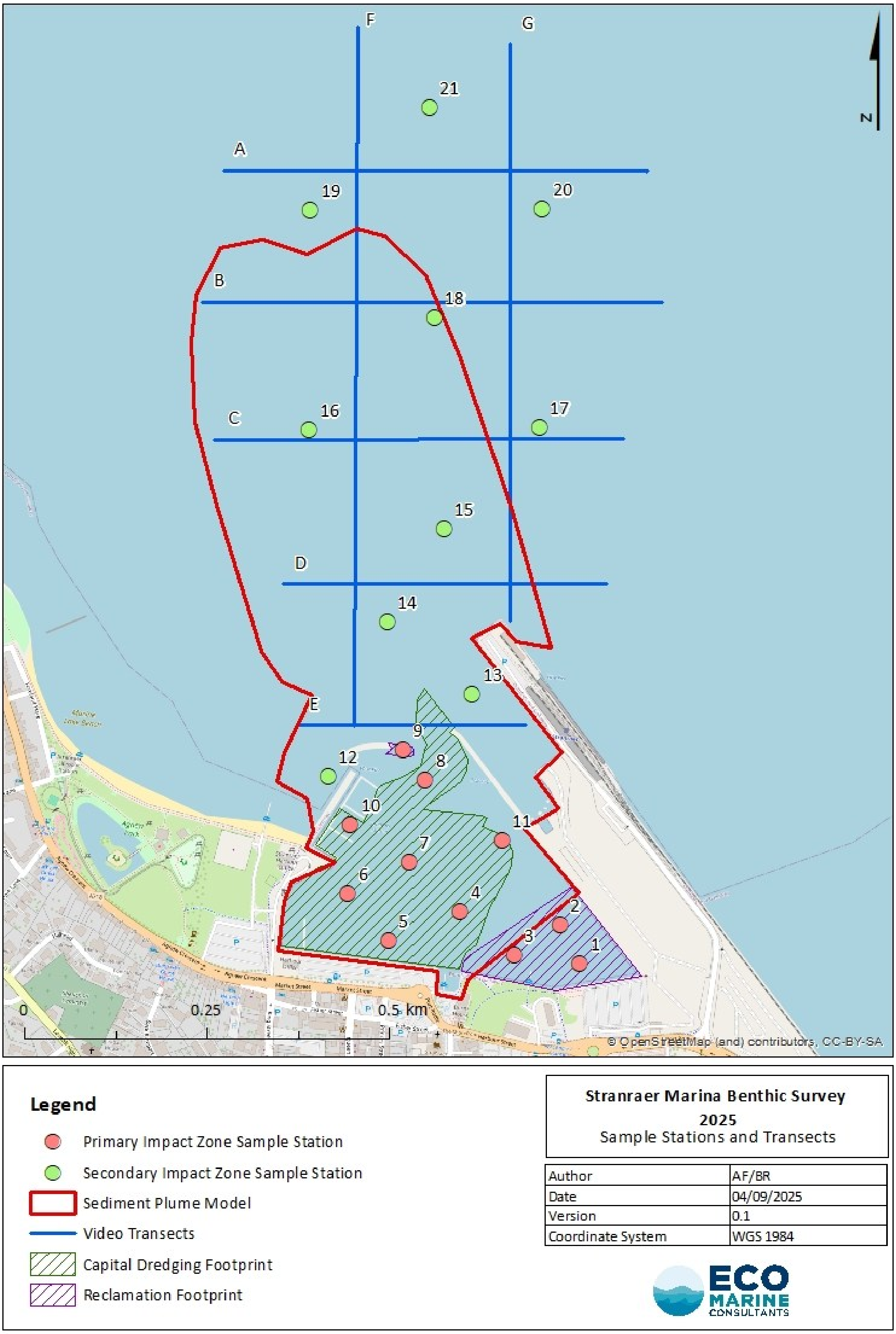


Figure 1. The location of the grab sample stations, and video transect locations for the benthic survey at Stranraer Marina in 2025, with reference to the final sediment plume model produced by RPS, as well as the capital dredging and land reclamation area footprints.

2.1.2. Intertidal Survey

The intertidal survey allowed an assessment of the intertidal zone areas to the east and west of Stranraer Marina that have been identified as being potentially affected by the proposed works. The survey covered the intertidal areas one kilometre to the east and west of Stranraer Marina. These surveys were carries out on a spring tide to ensure that a maximum area was covered from the upper limit of the intertidal zone to the mean low water springs mark (Figure 2).

All intertidal survey work was carried out in accordance with the technical methods outlined in the CSM Guidance, Marine Monitoring Handbook (JNCC, 2004) and the CCW Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn *et al*., 2006).

Phase I mapping comprised of a walkover survey of the foreshore, characterising the habitats, and recording any conspicuous boundaries using a Garmin handheld GPS device (accurate to 3-5m). As part of this process, the range and distribution of broadscale habitats and any species of conservation interest were identified and reported accordingly. Any invasive, non-native species (INNS), or species/habitats of conservation importance encountered during the Phase I intertidal survey were also recorded and reported accordingly.

As a minimum, field notes included the date and time, fix numbers along with their latitude and longitude and the presence of algae and fauna. Biotopes were assigned during the Phase I surveys using the EUNIS classification system to the highest possible level (minimum level 3). Photographs of alongside a ‘survey ruler’ were taken in each biotope, along with a position fix of their location to allow for later species identification.

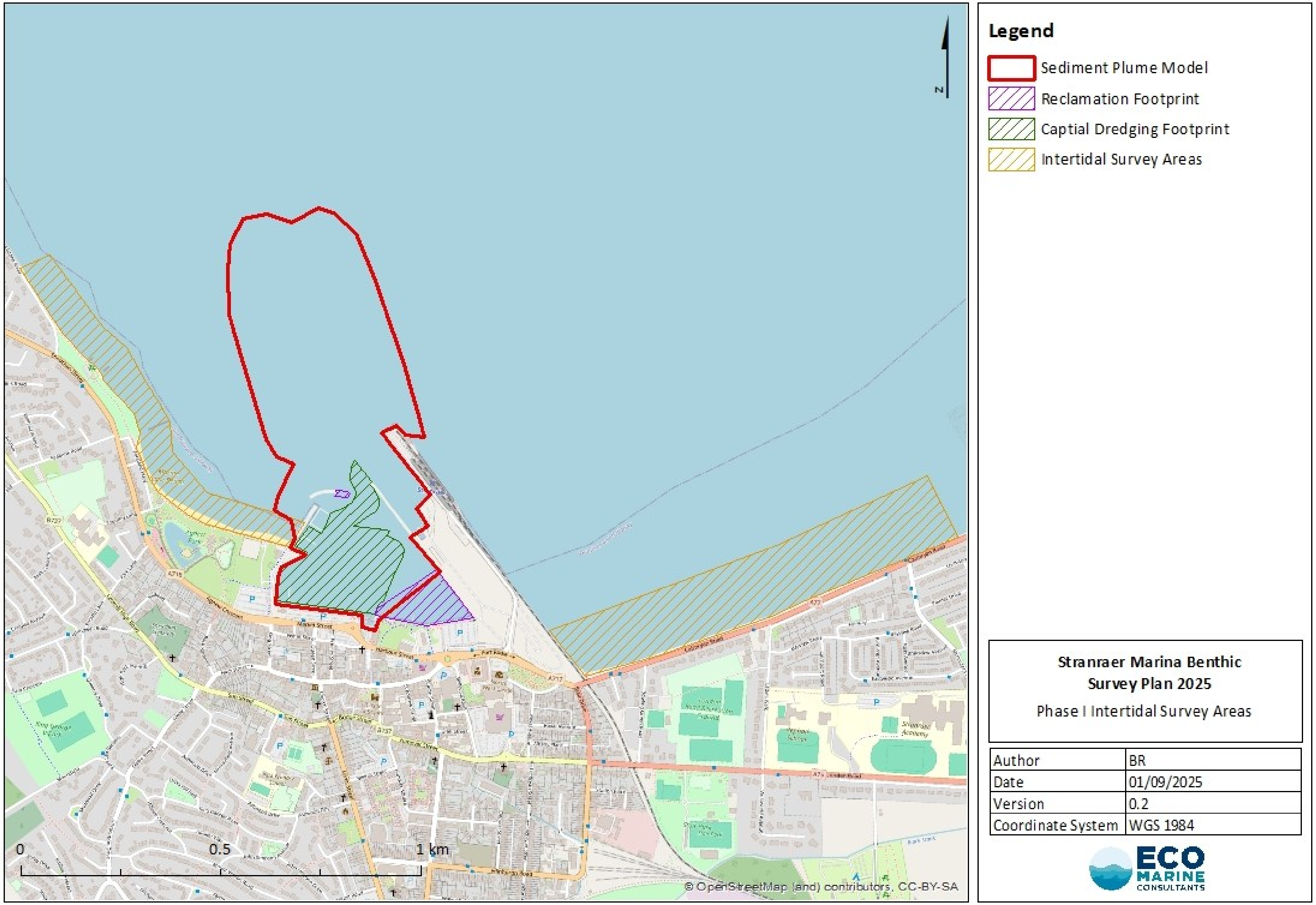


Figure 2. The location of the intertidal survey area to the east and west of Stranraer Marina, with reference to the final sediment plume model produced by RPS, as well as the capital dredging and land reclamation area footprints.

2.1.3. Drop Down Video Survey

Prior to the collection of sediment samples, seabed (epibenthic) photographs and video footage were collected from across the survey area. A total of 21 stations were sampled alongside seven DDV transects (Figure 1). The PIZ comprised 11 stations, while 9 stations were located within the SIZ.

Video from the DDV was initially reviewed on board in real-time to enable surveyors to collect data while broadly determining the nature of the seafloor to ground truth for the presence of any Priority Marine Features (PMFs) or Features of Conservation Interest prior to grab sample collection. The images were also reviewed in order for the surveyors to assess which stations were likely to be suitable for the acquisition of benthic grab samples. Of the sampling locations, Station 4 was deemed unsuitable for benthic grabbing due to the mixed and coarse nature of the sediments that may have damaged the sampling equipment.

An STR SeaSpyder Nano drop camera system was utilised to capture seabed images and video. To ensure suitable image quality, the underwater camera was high definition and had two LED Lights installed to enable image collection in low light conditions. An overlay was added to the camera footage, which included the time, station number and GPS coordinates to allow for accurate positioning of the stills taken. The camera system was deployed once the vessel reached the station or the start of each transect, and the video was activated once the camera entered the water. Upon reaching the seabed, the position was recorded. At each station a minimum of three non-overlapping stills were captured per drop.

At the first transect drop, the camera was lowered to the seabed and towed along the line. Video footage was recorded in addition to still images, however due to tidal currents, water column visibility and uneven bathymetry, it was deemed that the still images where the camera settled on the seabed gave the best results as video data was poor quality. As such, up to 11 camera drops were carried out along each transect allowing for an image to be captured at regular intervals, whilst the video feed was reviewed in real-time. At each transect the locations of the drops were recorded. Following the collection of video data, the camera was brought back on board. This methodology allowed for sufficient coverage of the seabed to detect habitats of conservation importance while accounting for the environmental conditions at the time of the survey.

Detailed field notes were made by survey staff which included details of any species or habitats of conservation importance and can be viewed in Appendix 1. As a minimum, field notes included station and start/end co-ordinates of a transect, time of sampling (in UTC), depth of water, sediment type, weather conditions and any notes on the fauna and habitats present within the video stream and images.

Upon return to the Eco Marine lab, image stills and videos were analysed to determine habitat types present at each station and notes were made of any obvious macrobenthic and epifaunal species present. Biotopes have been assigned in accordance with the EUNIS classification scheme.

2.1.4. Grab Survey

A total of 20 stations were successfully sampled during the benthic survey, with the exception of Station 4 which was ruled out for grabbing via the DDV survey (this station was still surveyed using

DDV techniques). Additionally, at Station 11 only a PSA sample was acquired due to inadequate sediment volumes being acquired for macrofaunal analysis.

Samples were taken at each station with a 0.1 m^2 Day grab deployed from a survey vessel. Each sample was taken from as close as possible to the station coordinates and three attempts were made to retrieve a sample of at least 5L in volume at each station. Where small samples of less that 5L were obtained, these were kept to one side and processed if a suitably large sample could not be obtained.

Following deployment, samples were discharged int a plastic collection box below the grab stand. A photograph was taken of each sample as evidence of collection. A sub-sample of sediment of approximately 0.5L in volume was taken for PSA from each sample and carefully labelled with the appropriate internal and external labels and stored in cool conditions in the dark. The remainder of the sample was transferred into a labelled plastic bucket, preserved with buffered 4% formalin solution, and sealed with a tight-fitting lid. Samples were labelled inside and out and were retained for subsequent analysis of the benthic infauna in the laboratory.

Detailed field notes were taken during the grabbing operations. This included, as a minimum, the grab co-ordinates, time of sampling, depth of water, sample volume, sediment type, weather conditions, and any notes on the fauna present within the grab.

2.2. Image Data and Sample Analysis

2.2.1. Seabed Imagery Analysis

All image analysis has been undertaken in-line with Joint Nature Conservation Committee (JNCC) guidance given in the Marine Monitoring Handbook (JNCC, 2001) and the JNCC guidance on analysing benthic imagery data (Rein *et al*., 2019) and assigning benthic biotopes (Parry, 2019). Biotopes have been assigned to each DDV station and across the transects sampled in the Stranraer Marina study area by an experienced ecologist using a standardised recording format. This enabled the identification of biotopes through record of substrate type, habitats, and species present as well as the identification of energy regimes locally (through video footage and field notes).

The data resulting from macrofaunal sample analysis has been used to ground truth the image and observation data at a higher resolution where possible. European Nature Information System (EUNIS) categories for each of the assigned biotopes have been checked against descriptions and the JNCC hierarchy and confirmed by a second ecologist in every case (Moss, 2008). By combining the data available on sediment type with depth and visible epibenthic fauna and flora, a sufficient level of biotope designation was achieved across the survey array (minimum EUNIS level 3).

2.2.2. Sediment Particle Size Analysis

Each sediment PSA sample was stored in the dark and frozen where possible before transport to the analytical lab.

All sediment analysis was undertaken by Kenneth Pye Associates. Kenneth Pye Associates is a participant in the National Marine Biological Analytical Quality Control Scheme (NMBAQC) for PSA.

PSA samples were initially wet screened at 2mm. The <2mm wet sediment was then wet screened at 63µm to separate it into two fractions (<2mm to >63µm and <63µm). The >2mm fraction and the <2mm to >63µm fraction was oven dried at between 80°Cand 110°C for a period of 24 hours, or until completely dried. The weight of both dried fractions (>2mm fraction, and the <2mm to >63µm fraction) were recorded prior to any sieving.

All the dried >2mm fraction was then sieved on a stack of sieves at 0.5[1] Phi intervals from 2mm to 63mm for a minimum period of 10 minutes. Any sediment passing through the 2mm sieve into the collecting pan at the bottom of the stack was weighed and then combined with the <2mm to >63µm fraction. The <2 mm to >63µm fraction was representatively subsampled as necessary. A collecting pan at the bottom of the stack retained the fraction passing through the 63µm sieve and the weight of the sediment in each sieve and bottom pan was recorded in grams to 2 decimal places.

A minimum dried sample weight of 150g was analysed where possible, although if this sediment fraction was composed of particles with a narrow range of sizes, then 75g was considered to be acceptable.

After wet screening, the fine fraction was left to settle out for 24 hours, or until the water was clear (maximum of 48 hours). The overlying water was removed using a siphon pump, taking care not to lose any of the fines. The fine fraction was then dried by oven, before weighing.

To describe the substrate types recorded across the study area, sediment samples have been classified according to Folk (1954). The Folk classification thresholds are illustrated in Figure 3.

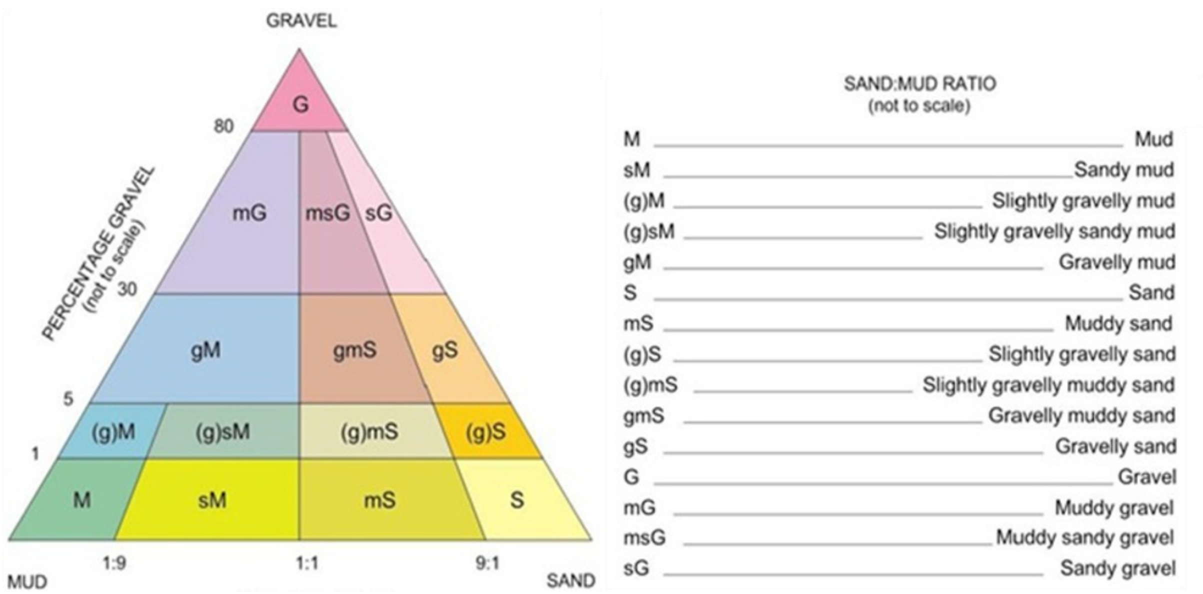


Figure 3. Folk triangle used to classify sediments.

[1] Phi = $-\log_2 D/D_0$ (D is the diameter of the particle, D_0 is a reference diameter, equal to 1mm).

2.2.3. Macrofaunal Sample Analysis

On arrival at the Eco Marine laboratory the samples were checked against the field notes in accordance with standard operating procedures and signed against the list of samples collected. Samples were initially sieved to remove the preservative formalin, which was collected for licensed disposal. The cleaned residue was subsequently placed in IMS ready for taxonomic analysis.

Each macrofaunal sample was gently passed through a 1mm sieve to extract the low-density components (Crustacea and Polychaeta). The sediments were then sorted under a magnifier to remove small higher density macrofauna (small Echinodermata, Mollusca etc.) and then under a stereomicroscope to extract remaining fauna.

The entire sample of separated fauna was preserved in industrial methylated spirit (IMS) for subsequent analysis. Each of the extracted samples was sorted into major faunal groups before being analysed to species level, where practicable, by experienced taxonomists who sign a log sheet on completion of the analysis of each individual sample. Taxonomic nomenclature was compliant with the World Register of Marine Species (WoRMS) database. Taxonomic identification was checked throughout the process by following strict internal QA procedures, and against a reference collection held for ease of use in the analytical laboratory.

Eco Marine Consultants are part of the NE Atlantic Marine Biological Analytical Quality Control (NMBAQC) scheme. Eco Marine has developed in-house standard operating procedures that cover all aspects of our operations, supplementing those established within recognised quality control schemes. Eco Marine's quality management system is accredited to ISO 9001.

Following the identification of extracted macrofauna, specimens were blotted dry and weighed (grams wet weight) according to major taxonomic group i.e., Annelida, Crustacea, Mollusca, Echinodermata, and Miscellanea (remaining miscellaneous fauna).

The blotted wet weight of major groups recorded from the faunal samples was measured. These data were then used to estimate total biomass as Ash-Free Dry Weight (AFDW) in grams using conventional conversion factors for each of the faunal groups. The wet weight conversion factors are as follows in accordance with Eleftheriou & Basford (1989):

- Annelida = x 0.155
- Crustacea = x 0.225
- Mollusca = x 0.085
- Echinodermata = x 0.08
- Miscellaneous groups including the major groups shown below = x 0.155
    - Turbellaria
    - Nemertea
    - Nematoda

Note that biomass was not measured for encrusting fauna found on substrate as separating encrusting and colonial specimens from their anchor point or substrate is highly damaging to the specimen and makes identification difficult. Additionally, many bryozoan forms, as well as some crustacean forms such as barnacles are encrusting and as such cannot be weighed accurately or with ease.

2.3. Statistical Analysis

2.3.1. Univariate Analysis

Basic faunal abundance, diversity and biomass trends across the stations were examined to determine the nature of infaunal communities present and the nature of any variations present within the dataset.

2.3.2. Multivariate Analysis

Statistical Analysis was conducted using the PRIMER V6 software package (with reference to Anderson *et al*. (2008), Clarke & Gorley (2006) and Clarke and Warwick (2001)) and MS Excel. Routines employed included the following:

Hierarchical Cluster Analysis
Cluster analysis aims to find "natural groupings" such that samples within a group are more similar to each other than samples in different groups. The results of hierarchical clustering are represented by a tree diagram or dendrogram, with the x-axis representing the full set of samples and the y-axis representing the similarity level at which the groups are considered to have fused.

The SIMPROF Test
A similarity profile permutation test (SIMPROF) looks for statistically significant evidence of genuine clusters in samples. Tests are performed at every node of a completed dendrogram, testing whether the group that has been subdivided has 'significant' internal structure.

Multidimensional Scaling (MDS) Ordination
This technique allows the construction of a configuration of the samples in multidimensional space to position the samples as accurately as possible to reflect their similarity. For example, if sample 1 has a greater similarity to sample 2 than it does to sample 3 then sample 1 will be positioned more closely to sample 2 than it is to sample 3. This "map" of the relative similarities between samples is then plotted in two dimensions.

The SIMPER routine
The SIMPER routine allows comparisons between groups of samples to be made. Following the comparison of similarities between groups the taxa (or particle size fractions) responsible for the dissimilarities between sites are sub-listed in decreasing order of importance in order to facilitate the discrimination of the groups. This routine also provides information on the species responsible for within-site similarities and their contribution to the internal similarity of the group.

The RELATE routine
The RELATE routine provides a means of testing for correlations between two multivariate patterns, which in this case was a test for correlations between the distribution of biological communities and the distribution of sediment types. It is a non-parametric form of Mantel test which can be applied to two independently derived datasets to define the relationship between matching sample sets – in this case the faunal and sediment samples.

The BIO-ENV routine

The BIO-ENV subroutine enables the user to identify high-rank correlations between a secondary fixed sample similarity matrix (such as a species assemblage dataset) and a primary matrix generated from (such as a PSA data set where grain size is considered the variable). The routine carries out a search of all the possible combinations of primary matrix variables to determine at an optimal correlation between the two datasets.

2.3.3. Biotope Determination

The dominant biotopes for each station were identified using sediment, faunal abundance and DDV data. Where possible, biotopes were identified to Level 6 but where a biotope did not fit or there was not enough information available, biotopes were only taken as far as confidently possible. As in previous reports, biotopes were recorded in the EUNIS 2022 format (EUNIS, 2025).

3. Results

3.1. The Nature of Epifauna at Stranraer Marina

Western Intertidal Area

The foreshore of the intertidal area to the west of Stranraer Marina was largely made up of mixed sediments comprising of boulders, cobbles, pebbles, shells, sand, and mud in varying proportions across the shore. On the upper shore, a mix of cobbles, shells (largely comprising oyster shells), and pebbles dominated which were embedded in sand. On the mid and lower shore, past the strandline, sand became more dominant with a lower proportion of cobbles, shells, and pebbles present and with the appearance of boulders dispersed across the mid to lower shore. In an area of lower shore to the south of the survey area, a patch was delineated as a mosaic of mixed sediments and sand due to the increased dominance of sand in this area.

No visible macroalgae or fauna were recorded on the upper shore of the western intertidal area, however macroalgal and faunal communities were well established across the mid and lower shore, with the macroalgal species present being characterising features of the designated biotopes. Across the vast majority of the western intertidal area, the brown wracks *Fucus vesiculosus* and *Fucus serratus* dominated the macroalgal community, being anchored to boulders and cobbles present on the mid and lower shore. Other species such as the red macroalgae *Chondrus crispus* and *Mastocarpus stellatus* were also widespread across the shore, with green sheet and tube form macroalgae and brown feathery macroalgae also being recorded. In an area of mid shore centrally within the survey area and an area of low shore to the south, two patches of mixed sediment dominated by ephemeral green macroalgae were recorded; these areas showed few to no fucoids present which differentiated them from the rest of the shore.

Fauna recorded on the mid and lower shore showed a high diversity. Taxa such as the green shore crab *Carcinus maenas*, hermit crabs Paguridae, the periwinkles *Littorina littorea* and *Littorina obtusata*, the dog whelk *Nucella lapillus,* the common limpet *Patella vulgata*, the sponges *Hymeniacidon perleve* and *Halichondria panicea*, the keel worm *Spirobranchus* spp., barnacles Cirripedia, the leathery sea squirt *Styela clava*, and the star ascidian *Botryllus schlosseri* being recorded on harder substrates. The peacock worm *Sabella pavonina* and the lug worm *Arenicola marina* were recorded in the softer sediments on the lower shore and in crevices between boulders and cobbles.

Eastern Intertidal Area

The foreshore of the intertidal area to the east of Stranraer Marina showed more zonation is terms of sediments when compared to the western intertidal area. The upper shore of the eastern intertidal area largely consisted of boulders embedded in sand, which also continued at the base of the pier in the west of this survey area. The exceptions to this were two stretches of mixed sediment along the upper shore where there were no boulders and sediments consisted largely of cobbles and pebbles lying on sand, as well as a stretch of upper shore where boulders had been placed artificially in lines perpendicular to the shore, in between which coarse sediments were recorded which consisted of cockle shells and coarse sand. These coarse sediments occurred again on the upper shore of the eastern most extent of the survey area. On the mid shore in the west of this survey area, the boulders continued to be present in a lower density out onto the sand flats observed throughout the rest of the mid and across the lower shore.

In contrast to that observed on the foreshore of the intertidal area to the west of Stranraer Marina, the upper shore and mid shore on the eastern intertidal area showed established faunal and macroalgal communities. In terms of the macroalgal community, *F. vesiculosus* dominated boulders on the upper and mid shore in the west of the site, whilst on the artificially placed boulders in the east *Fucus spiralis* dominated, and on the boulders along the northern edge of the pier *F. serratus* was the dominant species, though each taxon was largely also found in each area. In addition, macroalgal species such as *C. crispus, M. stellatus,* and ephemeral green sheet and tube form macroalgal species were observed across the site, however, they had a dominating presence on hard substrates along the northern portion the pier.

In terms of the faunal community, a similar composition to that seen across the majority of the foreshore of the western intertidal area was also observed along the northern portion the pier. Taxa including *L. littorea*, *L. obtusata*, *N. lapillus, P. vulgata*, *H. perleve*, and *S. pavonina* were observed in this area. A more impoverished faunal community was observed on boulders across the rest of the upper and mid shore, with communities largely being dominated by barnacles, *P. vulgata*, and *N. lapillus.* On the sand flats which covered a majority of the mid and lower shore, *A. marina*, *L. littorea*, the sand mason worm *Lanice conchilega,* and the Laver spire shell *Peringia ulvae* were also recorded.

In addition to macroalgal and faunal communities, the eastern intertidal area also supported an established but patchy seagrass (marine angiosperm) community. The dwarf eelgrass *Zostera noltii* was recorded across a large swathe of the sandflats on the foreshore in variable densities. Seagrass beds are listed as a Priority Marine Feature in Scotland and as a Priority Habitat under the UK Biodiversity Action Plan. They are important habitats due their ability to stabilise sediments (Widdows *et al.,* 2008) and provide habitats for juvenile fish and other faunal species of commercial and conservation importance (Polte *et al.*, 2005; Polte and Asmus, 2006; Tyler-Walters, 2005).

Stranraer Marina and Outer Subtidal Area

Within Stranraer Marina, DDV images showed sediments largely dominated by sand, which was supported by the PSA data. A greater proportion of muddy sediments was observed around the pontoons and current berthing areas, and in the east of the Marina the presence of cobbles, pebbles, and shells embedded in the sand was also noted.

Macroalgal communities were found to be established in the areas dominated by mixed sediments, with relatively sparse coverings of *F. vesiculosus*, *C. crispus, M. stellatus,* the sea lace *Chorda filum*, the brown seaweeds *Dictyota dichotoma* and *Mesogloia vermiculata*, and a range of green, red, and brown feathery macroalgal species being recorded in these areas. Agal turf communities were also recorded in some areas of sand and mud sediments

Epifaunal communities within the marina also appeared the most diverse in the areas of mixed sediments where *L. littorea*, *N. lapillus, P. vulgata*, *H. perleve*, *S. pavonina, L. conchilega, Spirobranchus* spp., *Macropodia* spp., and turf species were recorded. Elsewhere within the marina *A. marina, L. conchilega,* and turf species were also recorded.

In the subtidal survey area outside of Stranraer marina macroalgal and epifaunal communities were relatively impoverished. The macroalgal taxa recorded comprised primarily of indeterminate algal turf which was recorded across the study site, as well as single records of *C. filum,* the sugar kelp *Saccharina latissimi,* and green sheet form macroalgae. The epifaunal community was characterised by sparse records of turf species, *C. maenas*, the barnacle *Balanus crenatus*, *L. conchilega, A. marina*, and indeterminate annelid tubes, ascidians, porifera, and hydrozoans.

The infaunal community identified in these areas is discussed in Section 3.3.

No evidence of any subtidal seagrass beds or oyster reefs were documented in any of the still images or video recording made across the whole survey area.

3.2. Composition of the Seabed Sediments

Sediment PSA samples were collected from a total of 20 stations within and adjacent to Stranraer Marina. The full PSA data from each station are provided in Appendix 2. No sample could be recovered from Station 4 due to the mixed sediments present at that location which made the seabed unsuitable for grab sampling.

A total of eight different Folk categories were identified within the survey area during the May 2025 survey, highlighting the diversity of sediments present: sandy gravel (sG), slightly gravelly sand ((g)S), slightly gravelly muddy sand ((g)mS), gravelly muddy sand (gmS), slightly gravelly sandy mud ((g)sM), gravelly mud (gM), slightly gravelly mud ((g)M), and mud (M). Sediment composition varied across the survey area, with stations inside the marina showing a greater range of sediment classifications than those further offshore, which had a propensity towards homogeneity of slightly sandy mud (Figure 4).

The predominant Folk category sampled in the survey area was slightly gravelly sandy mud, followed by slightly gravelly muddy sand. The frequency of each Folk category record is outlined in Table 1. The average values of gravel, sand, and mud across the site (5.8%, 38.7%, and 55.5% respectively) placed the study area as a whole as sandy mud within the Folk classification system, highlighting the dominance of the mud and sand fractions.

Table 1. The frequency of each Folk category recorded at each station.

Folk Category	Frequency of Record
sG	1
(g)S	2
(g)mS	3
gmS	2
(g)sM	8
gM	1
(g)M	2
M	1

Figure 4 illustrates the split in stations into two apparently distinct sedimentary areas, with stations outside the marina being largely dominated by mud, whilst those inside can be seen to contain an overall higher proportion of sands and gravels. The exceptions to this were Station 12 outside of the marina which was dominated by sand and Station 10 within the marina which was dominated by muddy sediments. Station 11 recorded the highest gravel fraction throughout the site, which was notably near to Station 4 at which mixed sediments were observed. Stations 1 and 3 in the southeast corner of the marina showed the highest variety of sediments contributing to their composition, with mud, sand and gravel all recording notable percentages.

The differences in sediment types across the site are likely to be attributable to variations in local hydrodynamic conditions, which are highly influential on sediment characteristics.

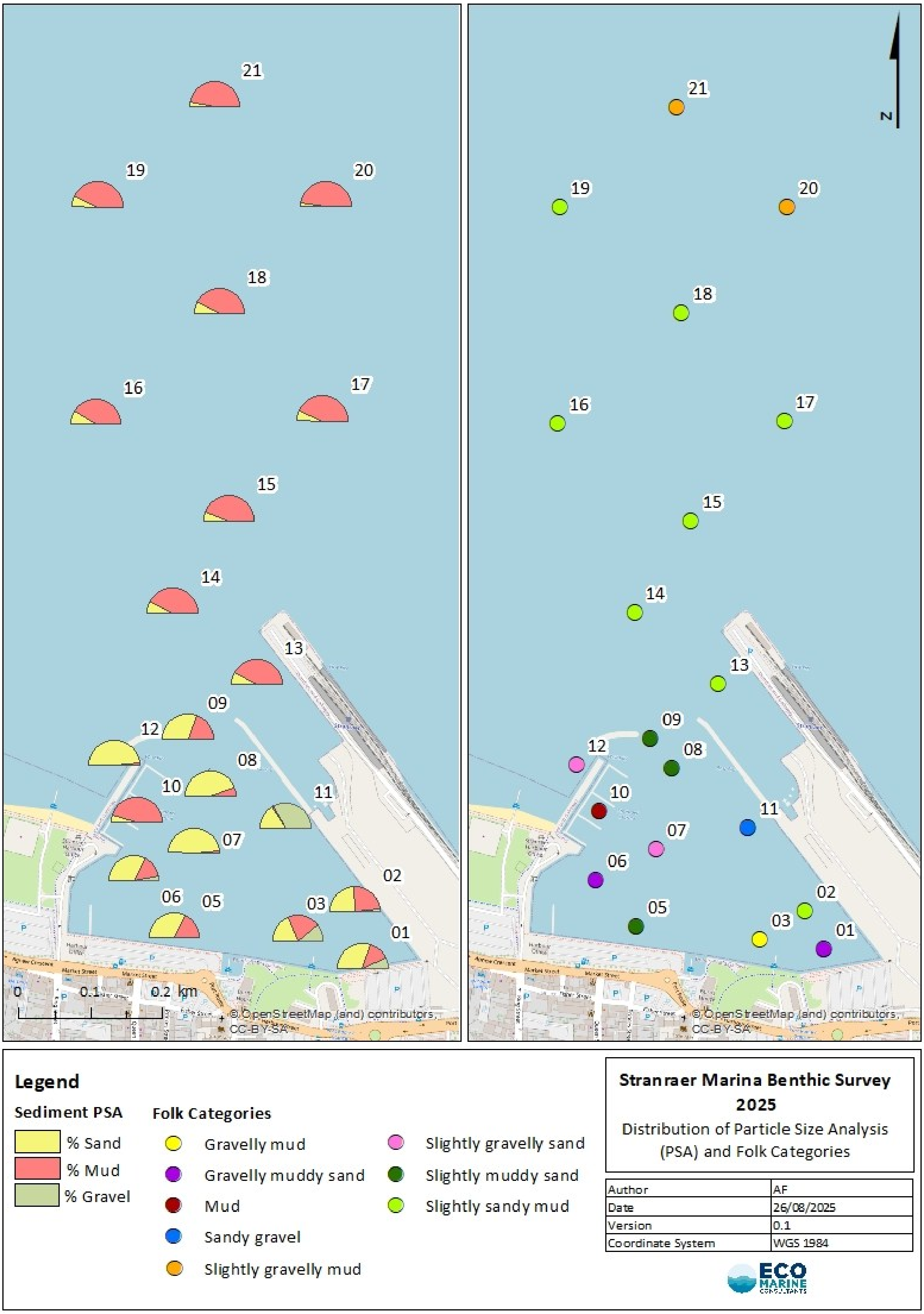


Figure 4. (Left) The relative proportion of gravel, sand, and mud as a percentage contribution to sediment in PSA samples collected at Stranraer Marina in 2025. Pie diagrams represent approximate locations of sampling stations only. (Right) Sediment PSA samples collected at Stranraer Marina in 2025 classified using the Folk classification system.

3.3. The Nature of Infauna at Stranraer Marina

A total of 3,865 individual specimens were identified in the 19 macrofaunal samples collected, with an overall mean number of taxa (± standard deviation) of 203 individuals per station (± 282). Faunal diversity indicated a total of 98 distinct taxa across all samples with an overall mean (± standard deviation) of 19 taxa per station (± 7). Total biomass recorded was 8.9 g AFDW across all samples, with an overall mean (± standard deviation) of 0.5 gAFDW per station (± 0.5).

The relative contributions made to the macrofaunal assemblages by the major groups Annelida, Crustacea, Mollusca, and miscellaneous taxa are shown in Figure 4. Note that no Echinodermata were recorded during the survey. A full taxonomic list, including the numerical abundance by station, is provided in Appendix 3 while major group biomass per sample is provided in Appendix 4.

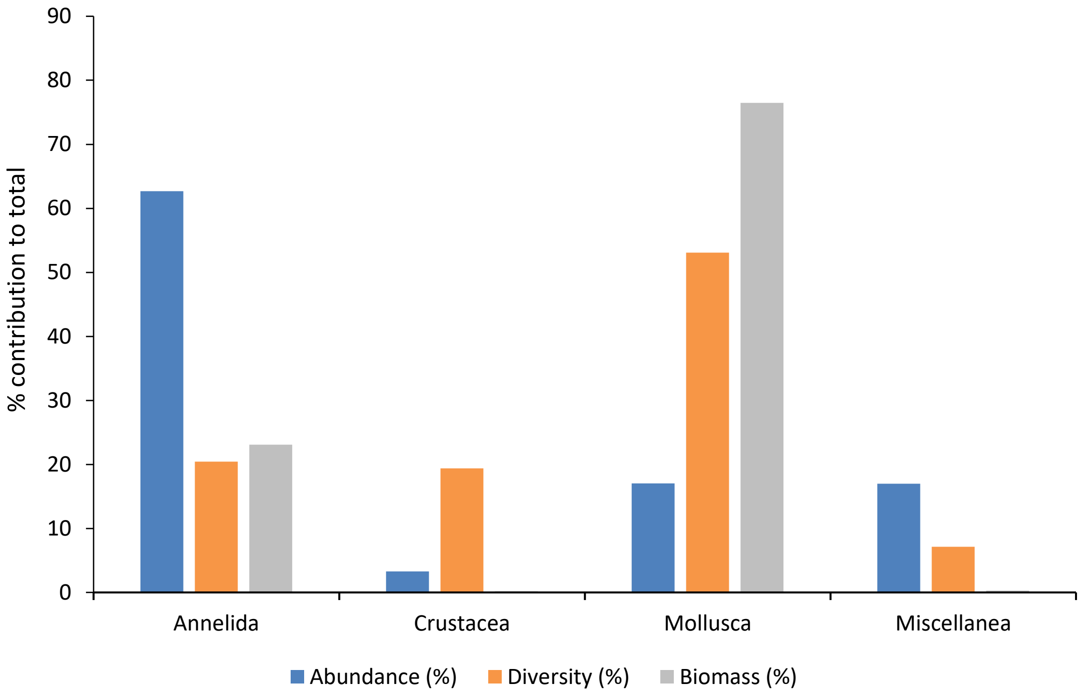


Figure 4. Percentage contribution of the major faunal groups to total abundance, species diversity, and biomass.

Taxa belonging to Annelida dominated the overall abundance of the benthic faunal communities, contributing 62.7% to the total abundance recorded. Mollusca and miscellaneous fauna were the second and third most abundant faunal groups (comprising 17.0% of the total abundance recorded each), followed by Crustacea (3.3%). Annelida was also the most diverse faunal group with 52 different species observed, comprising 53.1% of the total diversity. This was followed by Crustacea (20.4%), Mollusca (19.4%) and Miscellanea (7.1%).

Mollusca contributed the most to total biomass recorded across all faunal groups (76.5%). Molluscs are comparatively heavier than other phyla because of their exterior shells and their characteristically larger size; they therefore typically represent a considerable proportion of biomass for the site. After Mollusca, Annelida represented the second highest contribution to biomass (23.1%), then followed by miscellaneous fauna (0.3%) and Crustacea (0.2%).

The contribution of the top ten taxa to overall abundance recorded in the survey area is illustrated in Figure 5. The three most abundant taxa accounted for 41.0% of the total abundance recorded while the 10 most abundant species accounted for 73.3%.

The largest proportion of faunal abundance was accounted for by the phylum Nemtoda, which represented 16.1% of the total abundance and was most abundant at Station 9 (located by the existing breakwater). This was followed by the polychaetes *Capitella* spp. (14.0%) and *Chaetozone gibber* (10.8%), the bivalve *Abra alba* (9.0%), and the polychaete *Malacoceros vulgaris* (7.6%), highlighting the high contribution of Annelida to the total faunal community. The 26.7% of species unaccounted for by the top ten most abundant shown in Figure 6 were made up of a wide variety of Annelida, Crustacea, Mollusca, and miscellaneous fauna.

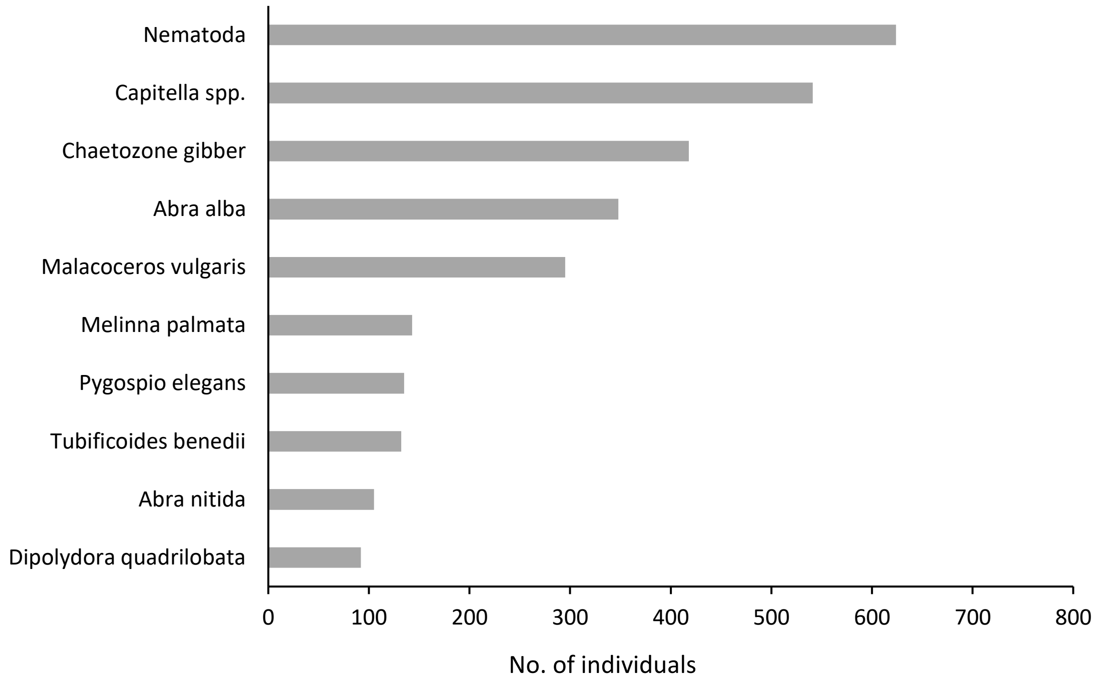


Figure 5. The ten most abundant taxa in sampled across the stations at Stranraer Marina 2025.

Figure 6 illustrates the percentage frequency of taxa that occurred in the highest number of samples collected. The most frequently occurring taxa were *C. gibber*, *A. alba* and the polychaete worms *Melinna palmata*, *Nephtys hombergii* and *Notomastus* spp..

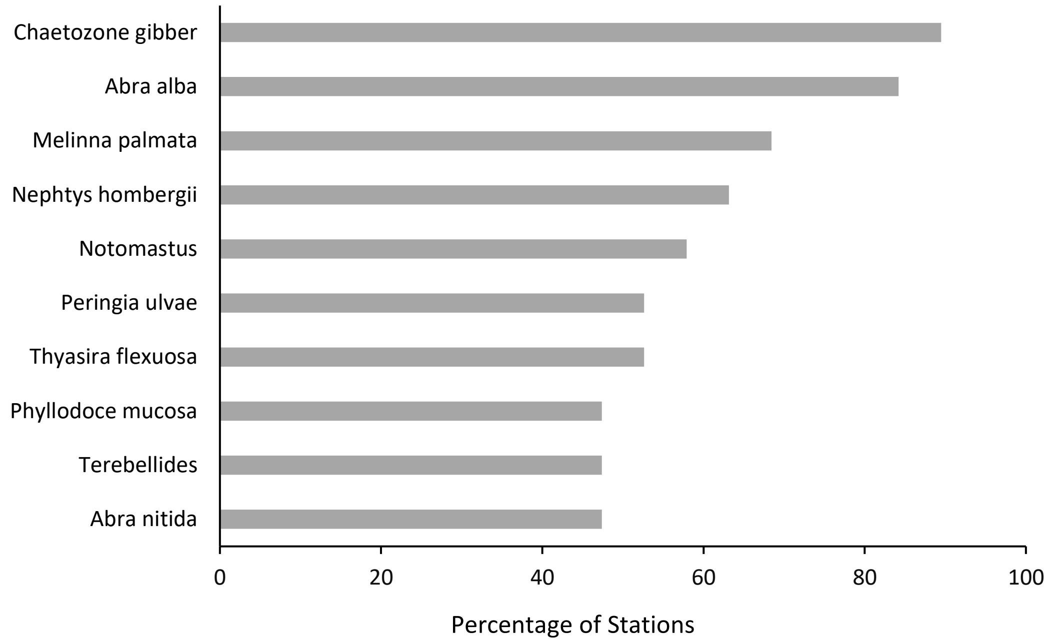


Figure 6. The percentage frequency of the ten most frequently occurring taxa sampled across the stations at Stranraer Marina 2025.

3.3.1. The Spatial Distribution of Benthic Faunal Communities

The spatial distribution of benthic fauna in terms of abundance, species diversity and biomass within the samples collected at Stranraer Marina is shown in Figure 7.

Faunal abundance showed a distinct spatial division in across the survey array, whereby stations within the marina exhibited both the highest and lowest abundance values, suggesting a high degree of variability in this localised area, compared to the more uniform distribution of fauna outside of the marina boundary. The abundance at individual stations was lowest (Stations 5, 10 and 7) and highest (Stations 9, 2 and 6) all within the marina. Stations in this area also showed high variability in sediment composition, and there appeared to be no clear correlation of faunal abundance with Folk categories. Conversely, stations located outside the marina showed moderate faunal abundance levels, with less spatial variation, and displayed faunal communities typically associated with sandy and gravelly mud.

A peak record of 1,322 individuals was present at Station 9, within the marina. In this sample, 614 specimens of Nematoda, 256 *Malacoceros vulgaris,* and 392 *Capitella* spp. were identified. In comparison, Stations 2 6 as the next most abundant samples recorded significantly lower abundances, with 314 and 287 individuals respectively. Sediment characteristics at Station 9 were comparable to adjacent stations, and there was no immediately identifiable feature to be attributed to the comparatively high abundance at this location.

As with abundance, the distribution of species diversity showed variability across the whole survey area, with less spatial segregation between stations within the marina. A maximum of 29 distinct taxa were observed at both Stations 2 and 16; the faunal communities at these locations comprised of a similar variety of polychaetes and bivalves in areas dominated by muddy sediments. Areas of lowest diversity were identified at Stations 9 and 14 centred around the middle of the study area, where slightly gravelly muddy sands and sandy muds were recorded.

Biomass recorded in the samples collected showed a general correlation with abundance; where abundance was low, biomass was typically low too. However, Station 9 showed a clear exception, with the abundance being dominated by the presence of numerous small-bodied Nematoda. Conversely, Station 6 showed a peak in biomass, where a high abundance of Mollusca was recorded, including specimens of the bivalves *Thyasira flexuosa* and *A .alba*, which generally have higher body weight due to their characteristic hard shells.

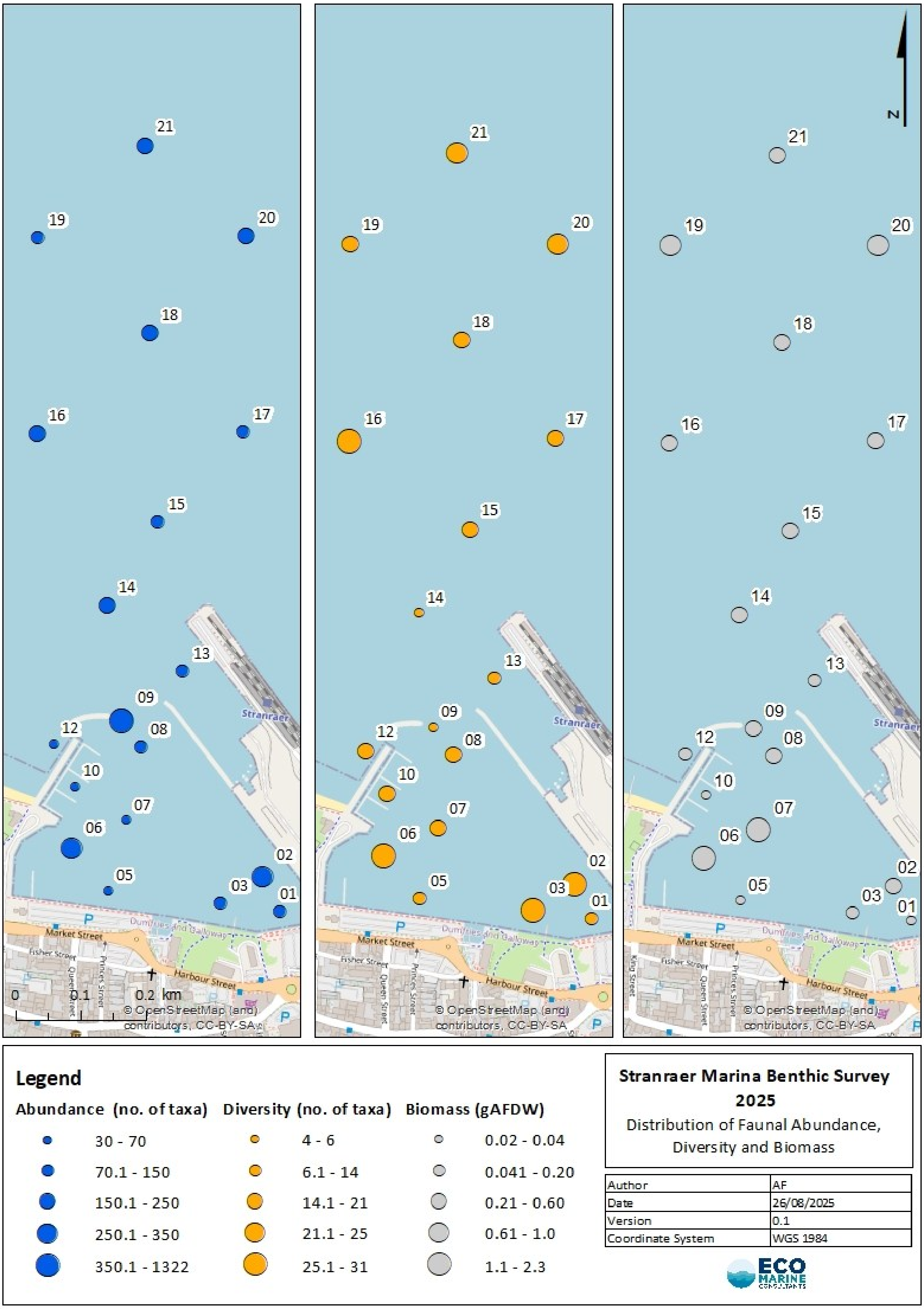


Figure 7. The distribution of abundance (total number of individual specimens), species diversity (total number of taxa) and faunal biomass (gAFDW) recorded in samples collected at Stranraer Marina in 2025.

3.3.2. Multivariate Analysis

In addition to the univariate analyses presented above, the composition of the biological communities in the survey area have been analysed using multivariate analyses. These consider the faunal variety and the relative abundance of each taxon within the dataset, allowing interrogation of the data at a community level.

Cluster analysis was initially undertaken to explore the data and to identify those stations which contain a similar faunal community. Figure 8 shows a group average sorting dendrogram (based on Bray-Curtis similarity of square root transformed abundance data), with the accompanying non-metric multidimensional scaling plot shown in Figure 9.

A SIMPROF test was initially utilised to identify statistically similar groupings at the 5% significance level (p = <0.05). However, the SIMPROF groups returned were considered too numerous and often represented communities at a single station which was deemed unhelpful in producing plots to illustrate the geographic spread of similar communities. As such, a manual cut-off of 30% similarity on a cluster dendrogram was run and faunal groups have been assigned to the stations identified as clustering together at this level and thus having a similar faunal community. The cluster analysis and MDS plot show three faunal groups, in addition to one station which did not group with any others and has been labelled as an ‘Outlier’. A spatial plot of the identified faunal groups is shown in Figure 10.

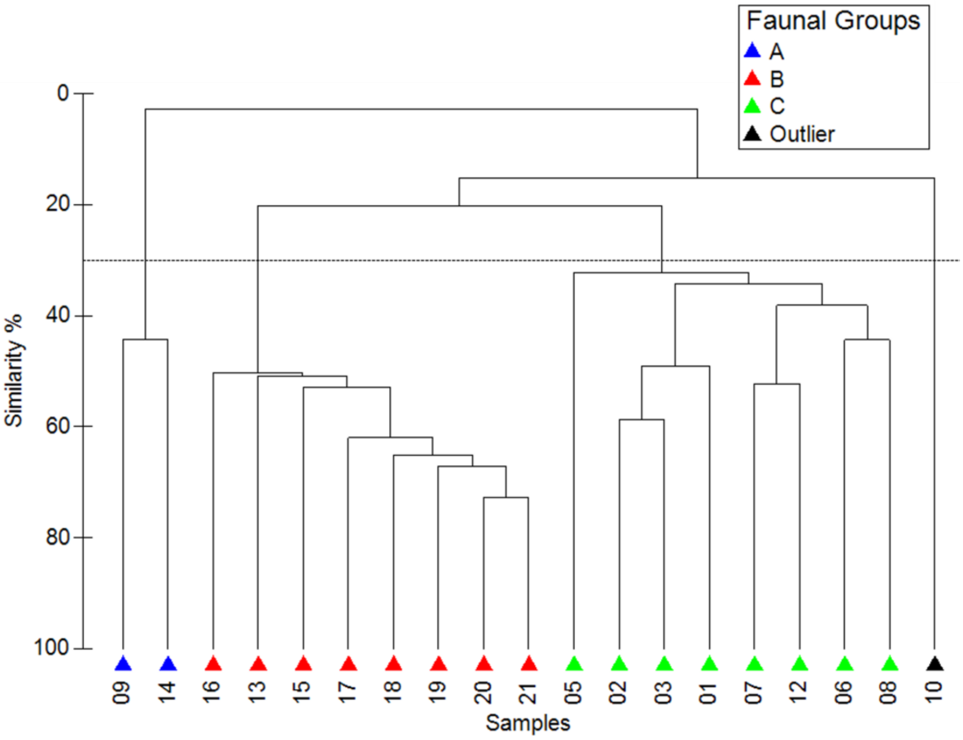


Figure 8. Group average (similarity %) sorting cluster dendrogram based on the square root transformed benthic abundance data (Bray-Curtis similarity) from the Stranraer Maina in 2025, showing faunal groups.

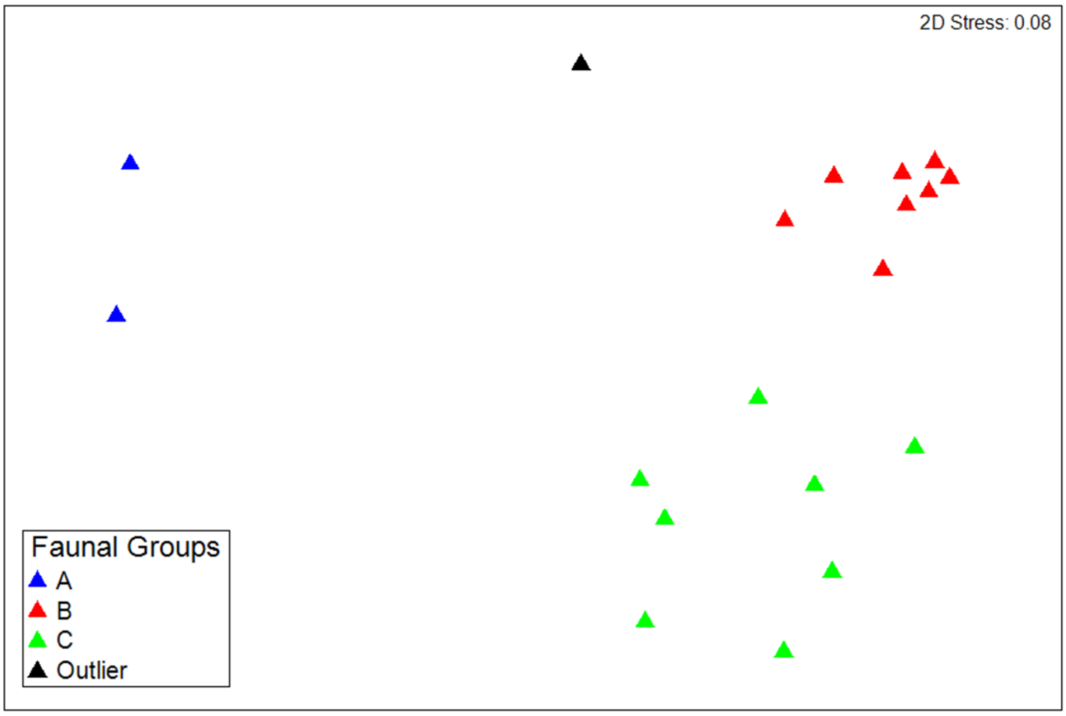
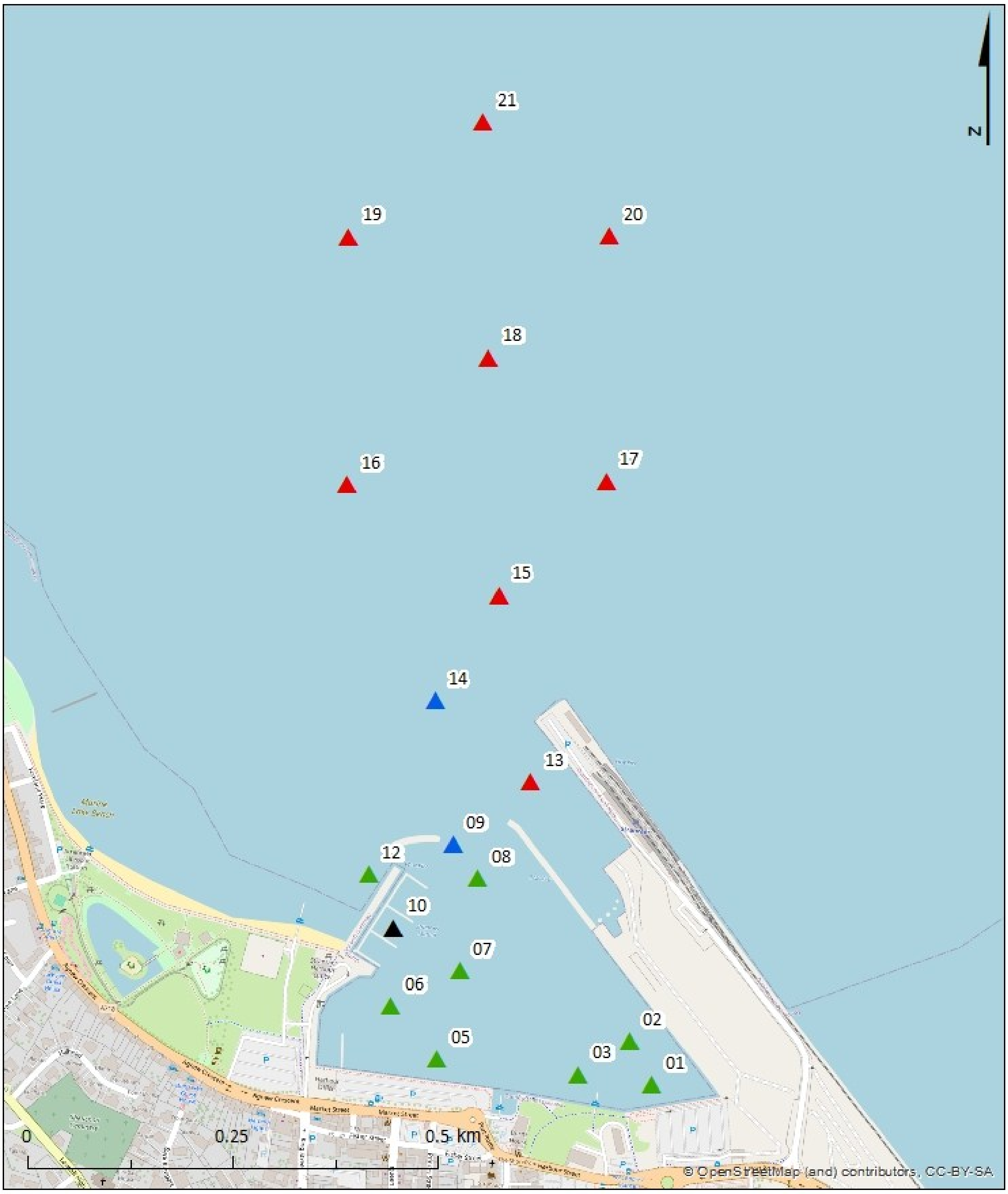


Figure 9. Non-metric multidimensional scaling (MDS) plot, presented in 2D format, based on the square root transformed benthic abundance data (Bray-Curtis similarity) from Stranraer Marina, showing faunal groups.

The average abundance, species diversity, and biomass of each faunal group is shown in Table 3. A description of each of the faunal groups identified is provided below.

Table 3. Average abundance, species diversity and biomass per sample of each of the multivariate faunal groups identified. Note that Outliers are not classed as a faunal group.

Faunal Group	Mean Abundance (±SD)	Mean Number of Taxa (±SD)	Mean Biomass (gAFDW) (±SD)
A	754 (±803.2)	5.0 (±1.4)	0.4 (±0.1)
B	152.3 (±58.4)	20.5 (±5.0)	0.4 (±0.2)
C	136.9 (±106.6)	21.9 (±6.8)	0.6 (±0.8)



Legend

Faunal Groups

- A
- B
- C
- Outlier

Stranraer Marina Benthic Survey 2025
Faunal Groups

Author	AF
Date	07/08/2025
Version	0.1
Coordinate System	WGS 1984

Figure 10. Plot of faunal groups identified from the cluster analysis of data collected at Stranraer Marina 2025.

Faunal Group A
Faunal Group A (average group similarity of 44.4%) was recorded at two stations (Stations 9 and 14), located at the centre of the survey area at the entrance to the marina. Station 9 was positioned inside the marina and within the PIZ whilst station 14 was located outside the marina and in the SIZ. The stations included in Faunal Group A were typified by high abundance, low biomass, and the lowest species diversity of all faunal groups, indicating the presence of a fairly homogeneous faunal community. The folk categories recorded at these stations were characterised by slightly gravelly muddy sands and sandy muds.

The results of the SIMPER analysis indicated that this group was largely characterised by the presence of a combination of the polychaete *Malacoceros vulgaris* and the *Capitella* genus. In combination, these two taxa contributed 90.1% towards group similarity.

Faunal Group B
Faunal Group B (average group similarity of 56.1%) was recorded at eight stations. These stations were all located outside of the Marina, starting at the entrance and spreading further offshore. The folk category identified at the stations were either slightly gravelly sandy mud or slightly gravelly mud. Mean faunal abundance, diversity, and biomass at the stations categorised as Group B were moderate.

SIMPER analysis indicated that the faunal taxa at stations within Group B that contributed most to the group similarity were *A. alba*, *Abra nitida, T. flexuosa*, *C. gibber,* and *Terebellides.* In combination, these five taxa contributed 52.7% similarity within the group.

Faunal Group C
Faunal group C (average similarity of 37.2%) was recorded at eight stations, located within marina, with the exception of Station 12 which was located just outside. Mean faunal abundance, diversity, and biomass at the stations categorised as Group C were moderate. Folk categories differed between stations within Group C, though a high percentage of sandy sediments was common overall.

SIMPER analysis indicted that the characterising species at the stations within Group C were almost all Annelida, with the four highest contributors to group similarity being the polychaetes *Dipolydora quadrilobate, C. gibber, Pygospio elegans, Scoloplos armiger,* followed by the mud snail *Peringia ulvae.* In combination, these five taxa contributed 53.0% towards group similarity.

Outliers
In addition to those groups identified above, the faunal communities at Station 10 did not group with any other stations during the cluster analysis and was hence labelled as an 'Outlier' and not assigned a faunal group.

Station 10 was located within the PIZ, on the western edge of the marina and within the existing pontoons. A folk category of Mud was recorded, positioned within neighbouring muddy sand. Abundance, diversity, and biomass recorded at Station 10 was relatively low when compared to adjacent stations, setting the communities apart.

Despite the low overall faunal abundance, a comparatively high number of Nematoda individuals were recorded at Station 10 relative to other stations in the survey array. The greatest abundance of the Ragworm *Hediste diversicolor* and the only recording of the polychaetes *Harmothoe impar, Ophelina* *acuminata,* and *Eupolymnia nesidensis* were also recorded at Station 10*,* further differing the faunal community at this location to the others

3.3.3. Driving Factors of Community Composition

The data relating to sediment and faunal groupings, presented above, suggest some correspondence between the benthic communities present and the composition of the substrate.

It is well documented that sediment composition is an important factor for determining the distribution of infaunal communities (e.g., Cooper *et al.,* 2011). For example, the presence of coarse sediments provides attachment sites for a diverse assemblage of species including bryozoans, hydroids, sponges, and barnacles, which may not otherwise have suitable attachment surfaces in more muddy substrates.

To establish the robustness of this relationship for the south coast survey, the faunal data were compared with the sediment data using the BIO-ENV and RELATE multivariate statistical routines.

The RELATE routine provides a means for testing correlations between two multivariate patterns, which in this case was a test for relationships between the distribution of biological communities and the distribution of sediment types. The result of this test demonstrates that there is a significant relationship (Rho = 0.377, Significance Level = 0.2%), although only moderate between the multivariate patterns observed in the sediment data and in the faunal communities.

To establish which particle size correlates most strongly with the patterns observed within the faunal communities, the faunal and sediment data were tested using the BEST BIO-ENV routine in PRIMER. The results indicate that the correlation between the multivariate patterns in the sediment and faunal data correspond most strongly with the distribution of course sand of particle size 500-1000 µm (Rho = 0.502). Therefore, it can be said that the presence of these sediment fractions has the greatest influence on the faunal communities present in terms of composition of the seabed.

Other factors, such as water depth, water temperature, bed shear stress, tidal streams, the presence of organic enrichment or contaminants and natural or anthropogenic disturbance may also be considerable controlling factors in the patterns of faunal community composition observed.

3.4. Biotope Designation

On completion of the DDV, intertidal, and benthic sampling survey, the gathered information was transferred to an internal database. Maps of the extent and distribution of the broad-scale habitats along the intertidal regions to the east and west of Stranraer Marina have been produced by analysing field notes, images taken during the survey, and GPS positional data (Table 4). Biotope maps of the subtidal sampling stations have been determined by analysing DDV stills alongside PSA and macrofaunal data from the grab survey (Table 5). Biotope maps of subtidal transects have been determined by analysing DDV stills and video (Table 6).

A total of 22 different biotopes were identified from the survey data, nine of which were identified in the intertidal survey area, 11 from the DDV stations and grab survey and three during the DDV transect survey. In some areas, multiple biotopes were present in combination and have been determined as mosaics. Additionally, epibiotic overlays were also determined at four stations at the eastern edge of the marina. These were identified as two biotopes combined, with one biotope determined from the PSA and macrofauna data and another that existed as a vegetative layer that was identified from DDV and photographs taken during the survey. All biotopes have been digitised to allow the visualisation of biotope distribution and are representative of EUNIS levels 4-6 (Figures 11 and 12). An example photograph of epifaunal biotopes is given in Plate 1a and 1b.

It is worth noting that no PMFs or Features of Conservation Interest were determined during the analysis of DDV data. However, the PMF '*Zostera noltii* beds on Atlantic littoral sand' was identified during the intertidal survey, along the foreshore to the east of the marina.

Table 4. Biotopes identified during the intertidal survey. Site record location refers to whether the biotope was identified on the foreshore on the west or east of Stranraer Marina.

EUNIS Biotope Complex	Habitat Description	Site Record Location
MA123A (Level 5)	*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata	East & West
MA123D2 (Level 6)	*Fucus vesiculosus* on mid eulittoral mixed substrata	East & West
MA1242 (Level 5)	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock	East
MA32 (Level 3)	Atlantic littoral coarse sediment	East
MA4211 (Level 5)	Ephemeral green and red seaweeds (freshwater influenced, or disturbed or organically enriched) on Atlantic littoral mixed substrata	West
MA423 (Level 4)	Unvegetated Atlantic littoral mixed sediment	East & West
MA52 (Level 3)	Atlantic littoral sand	West
MA5222 (Level 5)	*Zostera noltii* beds on Atlantic littoral sand	East
MB5237 (Level 5)	*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand	East

Table 5. Biotopes identified during the DDV station and grab survey. No. of records refers to the number of stations each corresponding biotope was observed at.

EUNIS Biotope Complex	Habitat Description	No. of records
MA123D2 (Level 6)	*Fucus* on mid eulittoral mixed substrata	4 stations
MA421 (Level 4)	Seaweed communities on Atlantic littoral mixed sediments	1 station
MA4233 (Level 5)	*Cirratulids* and *Cerastoderma edule* in Atlantic littoral mixed sediment	3 stations
MA524 (Level 4)	Polychaete/amphipod-dominated Atlantic littoral fine sand	1 station
MA525 (Level 4)	Polychaete/bivalve-dominated Atlantic littoral muddy sand	2 stations
MB32 (Level 3)	Atlantic infralittoral coarse sediment	1 station
MB423 (Level 4)	Faunal communities on full salinity Atlantic infralittoral mixed sediment	1 station
MB523 (Level 4)	Faunal communities on full salinity Atlantic infralittoral sand	1 station
MB624 (Level 4)	Faunal communities on full salinity Atlantic infralittoral mud	2 stations
MB6244 (Level 5)	*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in Atlantic infralittoral sandy mud	7 stations

EUNIS Biotope Complex	Habitat Description	No. of records
MB6246 (Level 5)	*Capitella capitata* in enriched Atlantic infralittoral muddy sediments	2 stations

Table 6. Biotopes identified during the DDV transect survey. No. of records refers to the frequency of records each corresponding biotope was observed at.

EUNIS Biotope Complex	Habitat Description	No. of records
MB5237 (Level 5)	*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand	3
MB62 (Level 3)	Atlantic infralittoral mud	43
MB621 (Level 4)	Vegetated communities on Atlantic infralittoral mud	2

Fucus serratus with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata (MA123A)

Fucus vesiculosus on mid eulittoral mixed substrata (MA123D2)

Fucus spiralis on full salinity exposed to moderately exposed upper eulittoral rock (MA1242)

Atlantic littoral coarse sediment (MA32)

Ephemeral green and red seaweeds (freshwater influenced, or disturbed or organically enriched) on Atlantic littoral mixed substrata (MA4211)

Unvegetated Atlantic littoral mixed sediment (MA423)

Atlantic littoral sand (MA52)

Zostera noltii beds on Atlantic littoral sand (MA5222)

Arenicola marina in Atlantic infralittoral fine sand or muddy sand (MB5237)

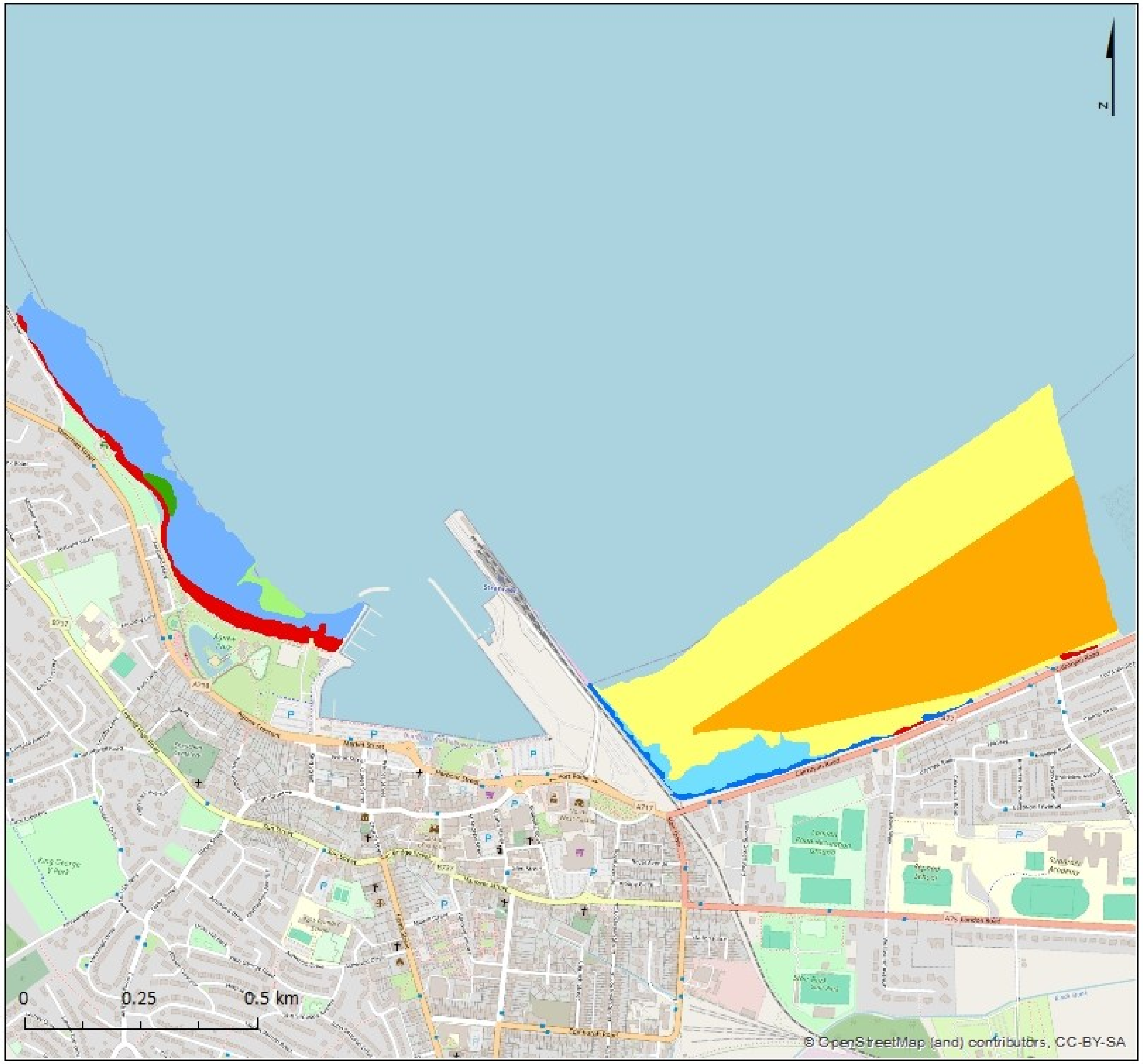
Plate 1a. Photographs of biotopes identified during the intertidal surveys east and west of Stranraer Marina.

Arenicola marina in Atlantic infralittoral fine sand or muddy sand (MB5237)

Vegetated communities on Atlantic infralittoral mud (MB621)

Atlantic infralittoral mud (MB62)

Plate 1b. DDV stills of biotopes identified during the DDV transect survey at Stranraer Marina.



Legend

EUNIS

- MA123A
- MA123D2
- MA123D2 + MA123A
- MA123D2 + MB5237
- MA1242
- MA32
- MA4211
- MA4211 + MA52
- MA423
- MA5222 + MB5237
- MB5237

Stranraer Marina Intertidal 2025

Phase I Biotope Designations

Author	BR
Date	30/06/2025
Version	0.1
Coordinate System	WGS 1984

Figure 11. The distribution of EUNIS biotopes assigned following the intertidal survey east and west of Stranraer Marina.

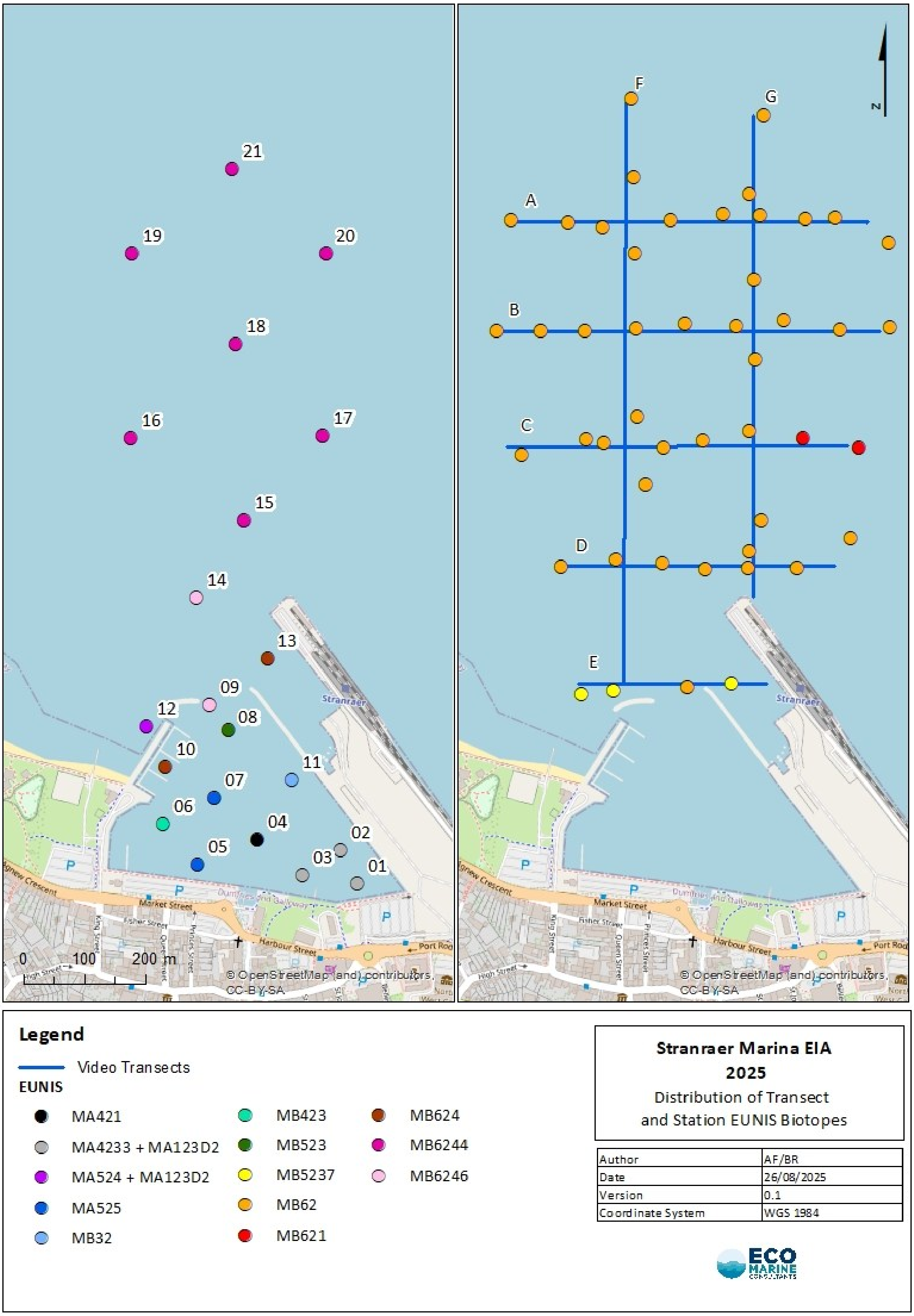


Figure 12. The distribution of EUNIS biotopes assigned at stations and along transects following the DDV and grab survey at Stranraer Marina.

The following sections present descriptions of the various biotopes recorded during the survey at Stranraer Marina;

***Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata (MA123A)**

'*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata' was located in the intertidal areas to both the east and west of the marina as part of the intertidal survey. In the eastern intertidal area it was identified along the northern edge of the marina pier structure and in the western intertidal area it was identified as part of a mosaic with '*Fucus vesiculosus* on mid eulittoral mixed substrata' (MA123D2) across large swathes of the mid and lower shore. The sediments of this biotope were dominated by boulders, cobbles, pebbles, and sand. The biotope was characterised by a macroalgal community comprising of *F. serratus, C. crispus, M. stellatus*, and other feathery red and brown species, as well as a faunal community comprising *H. panicea, H. perleve, S. clava, B. schlosseri, N. lapillus*, barnacles, *Spirobranchus* spp., and *S. pavonina*.

***Fucus vesiculosus* on mid eulittoral mixed substrata (MA123D2)**

The biotope '*Fucus vesiculosus* on mid eulittoral mixed substrata' was recorded in the intertidal areas to both the east and west of Stranraer Marina. During the intertidal survey it was observed most abundantly as part of a mosaic with '*Fucus serratus* with sponges, ascidians and red seaweeds on tide-swept lower eulittoral mixed substrata' (MA123A) across large swathes of the western intertidal area. In the eastern intertidal area it was observed on the upper shore and as part of a mosaic with '*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand' (MB5237) on the mid shore. This biotope was also identified at four stations within the marina as an epibiotic overlay.

This biotope's sediments were comprised of boulders, cobbles, pebbles, and sand, and the designation was primarily determined by the presence of a canopy of *F. vesiculosus*. Other characterising taxa whose presence contributed to the designation included *C. maenas*, barnacles, P*. vulgata, N. lapillus, L. littorea, L. littorina* and green tubular form macroalgae.

Fucus spiralis on full salinity exposed to moderately exposed upper eulittoral rock (MA1242)

'Fucus spiralis on full salinity exposed to moderately exposed upper eulittoral rock' was observed on the artificially placed boulders on the upper shore of the eastern intertidal area. This biotope was characterised by boulders to which *F. spiralis* was anchored, underneath which canopy a community comprising of *N. lapillus, P. vulgata, L. littorea*, and barnacles were observed. The black lichen *Verrucaria maura* and the olive green lichen *Verrucaria mucosa* are key species mentioned in the description for this biotope which were not observed during the intertidal survey.

Atlantic littoral coarse sediment (MA32)

'Atlantic littoral coarse sediment' was identified in two locations on the upper shore in the eastern intertidal area. This biotope was characterised by the presence of cockle shells and coarse sediments with no visible faunal or macroalgal communities.

Seaweed communities on Atlantic littoral mixed sediments (MA421)

'Seaweed communities on Atlantic littoral mixed sediments' was determined at Station 4, located within the marina and PIZ. No grab sample was taken at this station due to the mixed sediments and therefore the biotope assignment was determined by DDV. This biotope was identified by the presence of shells and pebbles overlaying sand, with the macroalgal species *C. filum*, *M. vermiculata, D. dichotoma, C. crispus,* and red and brown feathery macroalgae present in addition to a faunal community comprising *S. pavonina, L. conchilega*, and hydrozoan turf.

Ephemeral green and red seaweeds (freshwater influenced, or disturbed or organically enriched) on Atlantic littoral mixed substrata (MA4211)

The biotope 'Ephemeral green and red seaweeds on Atlantic littoral mixed substrata' was observed in the western intertidal area on the mid shore and as a mosaic with 'Atlantic littoral sand' (MA52) on the lower shore. These areas were characterised by the presence of green sheet form and tubular macroalgae as well as red feathery and foliose macroalgae on cobbles and pebbles embedded in sand.

Unvegetated Atlantic littoral mixed sediment (MA423)

'Unvegetated Atlantic littoral mixed sediment' was recorded in the intertidal areas both east and west of Stranraer Marina. On the western side, this biotope showed a high prevalence across the upper shore, whilst also being present to a reduced degree on the upper shore of the eastern side. This biotope was characterised by the presence of cobbles, pebbles, shells, and sand with no visible faunal or macroalgal communities.

***Cirratulids* and *Cerastoderma edule* in Atlantic littoral mixed sediment (MA4233)**

The biotope '*Cirratulids* and *Cerastoderma edule* in Atlantic littoral mixed sediment' was determined at three stations, located at the eastern corner of the littoral area, within the marina and PIZ at Stations 1, 2, and 3. This biotope was characterised by a mixture of sand, mud, and gravel from PSA, with pebbles and shells also observed in photographs of the stations.

Macrofaunal analysis determined the biotope by the presence of the characterising cirratulid species, including *C. gibber* and *Cirriformia tentaculata,* as well other taxa such as *P. elegans, M. palmata, Capitella* spp, *T. benedii,* Corophiidae, *A. alba*, and *Austrominius modestus*. *Cerastoderma edule* was only present in the macrofaunal samples at Station 2. However, larger bivalves are less likely to be captured in sediment samples and so due to the spatial proximity of the stations and the similarity in infaunal communities to each other as well as the biotope description, this biotope was assigned to all three stations.

At all three stations, this biotope was also found in conjunction with the biotope '*Fucus vesiculosus* on mid eulittoral mixed substrata (MA123D2)' as an epibiotic overlay.

Atlantic littoral sand (MA52)

'Atlantic littoral sand' was located in an isolated patch in the intertidal area of the western side of the marina as part of a mosaic with 'Ephemeral green and red seaweeds on Atlantic littoral mixed substrata'. This biotope was characterised by a dominance of sand sediment which was in a higher proportion than the surrounding mixed sediments, along with no visible faunal or macroalgal communities.

***Zostera noltii* beds on Atlantic littoral sand (MA5222)**

Across the mid shore of the intertidal area to the east of the marina, '*Zostera noltii* beds on Atlantic littoral sand' was identified as part of a mosaic with '*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand'. This area was characterised by muddy sand on the mid to upper shore and the presence of established dwarf eel grass *Z. noltii* alongside *A. marina* casts, *P. ulvae*, and green tubular form macroalgae.

It is worth noting that this survey took place May 2025, at the start of the seagrass growth period (May to August) (Gamble, 2021). Seagrass was therefore somewhat sparse due to the time of year, and denser abundances can be assumed to occur at later months of the year.

Polychaete/amphipod-dominated Atlantic littoral fine sand (MA524)

'Polychaete/amphipod-dominated Atlantic littoral fine sand' was designated at Station 12 which was located within the intertidal zone outside of the marina, on the western edge, and within the SIZ This biotope was characterised by a high sand fraction (97% of sediment composition) and macrofaunal communities of polychaetes including *P. elegans*, *S. armiger,* amphipods including *Gammarus* spp. and gastropods including *P. ulvae.*

Polychaete/bivalve-dominated Atlantic littoral muddy sand (MA525)

'Polychaete/bivalve-dominated Atlantic littoral muddy sand' was identified at two stations within the marina and PIZ. At Stations 5 and 7, using PSA and macrofaunal analysis, this biotope was characterised as muddy sands with macrofaunal communities dominated by the polychaetes *P. elegans and C. gibber,* and the bivalves *T. flexuosa* and *A. alba.* Additionally, at these stations, sparse counts of *A. marina* casts and algal turf were identified from the DDV.

Atlantic infralittoral coarse sediment (MB32)

The biotope 'Atlantic infralittoral coarse sediment' was identified at Station 11, within the PIZ. No macrofaunal sample was available and so the biotope was therefore determined by the high gravel percentage (>65% of sediment composition from PSA

data and a lack of visible characterising macroalgal or faunal community. Sparse species abundance recorded via DDV at this station included *C. filum, L. conchilega, A. marina*, and feathery brown seaweeds.

Faunal communities on full salinity Atlantic infralittoral mixed sediment (MB423)

The subtidal biotope 'Faunal communities on full salinity Atlantic infralittoral mixed sediment' was determined at Station 6, on the western edge inside the marina and within the PIZ. The mixed sediment aspect of this biotope was determined by the varying proportions of gravel, sand, and mud and the presence of dead shells and pebbles observed on the seabed in the DDV.

The macrofaunal community was characterised by a diverse range of species, principally *C. gibber* and *Tubificoides* spp., *P. ulvae* and *A. alba* and amphipods including *Aoridae* spp. and *Phtisica marina.* The encrusting polychaete *Spirobranchus lamarcki* and indeterminate Ascidiacea were also present, highlighting the prevalence of hard substrates observed in the DDV. *Ostrea edulis* was also present but not in sufficient populations to constitute a biotope characterised by this species (two specimens only, see section 3.9). Additionally, despite the high biodiversity, the faunal community did not align closely enough with the named characterising species in the higher level EUNIS biotopes to constitute assigning a more specific biotope

Faunal communities on full salinity Atlantic infralittoral sand (MB523)

'Faunal communities on full salinity Atlantic infralittoral sand' was designated at Station 8 located within the subtidal region within the marina and PIZ. The biotope was determined from the diverse faunal community, including *C. gibber* and *S. armiger, P. ulvae,* and *Chamelea striatula*, on sand. Despite the high biodiversity, the faunal community did not align closely enough with the named characterising species in the higher level EUNIS biotopes to constitute assigning a more specific biotope.

Arenicola marina in Atlantic infralittoral fine sand or muddy sand (MB5237)

'*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand' was identified in the eastern intertidal area across large swathes of the mid and lower shore, as part of a mosaic with '*Fucus vesiculosus* on mid eulittoral mixed substrata' (MA123D2) on the mid shore, and as part of a mosaic with '*Zostera noltii* beds on Atlantic littoral sand' (MA5222) on the mid shore. This biotope was also identified at locations on DDV Transects E and F, near the entrance to the marina.

This biotope was characterised by muddy sand sediments and the presence of the distinctive *A. marina* casts in high abundance as well as *L. conchilega*. However, this biotope does not account for the presence of *N. lapillus* observed throughout the area.

Atlantic infralittoral mud (MB62)

The biotope 'Atlantic infralittoral mud' was the most frequently observed biotope determined from the DDV, being recorded along the majority of each transect and within the SIZ. This biotope was characterised by the presence of mud dominated sediments and sparse records of taxa such as algal turf, C*. maenas, L. conchilega*, and *A. marina* casts determined from the DDV. However, no characteristic epifaunal communities could be identified from the macrofaunal data in order to determine a more specified biotope.

Vegetated communities on Atlantic infralittoral mud (MB621)

Observed at locations at the eastern extent of Transect C within the SIZ, the biotope 'Vegetated communities on Atlantic infralittoral mud' was characterised by mud dominated sediments and records of the algal taxa *Fucus* spp., *S. latissima*, and algal turf. Other species recorded in these areas included *L. conchilega*, hydrozoan turf, and indeterminate Ascidiacea.

Faunal communities on full salinity Atlantic infralittoral mud (MB624)

The sublittoral biotope ‘Faunal communities on full salinity Atlantic infralittoral mud’ was recorded at two stations within the marina, Stations 10 (PIZ) and 13 (SIZ). The sediment aspects of these stations were characterised by the high (>80% of sediment composition) mud percentage indicated from the PSA data.

The macrofaunal composition at Stations 10 and 13 were largely similar to that of neighbouring stations and comprised primarily of a range of species including *H. diversicolor*, *C. gibber, Terebellides* spp., *T. flexuosa, A. alba* and *P. ulvae*. This biotope was assigned largely due to the subtidal and mud dominated nature of the habitat; as with other assigned biotopes, the faunal community did not align closely enough with the named characterising species in the higher level EUNIS biotopes to constitute assigning a more specific classification.

***Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in Atlantic infralittoral sandy mud (MB6244)**

‘*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in Atlantic infralittoral sandy mud’ was the most observed biotope across the study area. This biotope was determined at seven stations located the furthest offshore from the marina and within the SIZ, each of which was classified as either slightly gravelly sandy mud or slightly gravelly mud. From the DDV data, algal turf dominated, whilst individual records of *C. filum, A. marina* casts, and indeterminate porifera and hydrozoans were also recorded. As such, the biotope was primarily determined from the infaunal and PSA data. A large presence of the characterising species *M. palmata* and *T. flexuosa* were key in designating this biotope, alongside other species named in the biotope description such as *C. gibber*, *Ampharete lindstroemi, Nephtys hombergii, Ampelisca* spp., *Virgularia mirabilis,* and *A. alba.* It is of note that the characterising species of this biotope *Magelona* spp. was not identified at any of the stations assigned this classification. Nonetheless, this biotope was considered the best fit for the habitat present.

***Capitella capitata* in enriched Atlantic infralittoral muddy sediments (MB6246)**

‘*Capitella capitata* in enriched Atlantic infralittoral muddy sediments’ was determined at two stations at the entrance of the marina; Station 9 which lies within the PIZ and Station 14 located within the SIZ. The JNCC biotope description describes the associated sediment as enriched or polluted, which matches with the station being both within or on the edge of the marina and likely to have experienced historic dredging and impacts from vessel movements.

The faunal component of this biotope that could be identified from DDV imagery was limited to faunal turf. Hower, the macrofaunal community from the grab data aligned closely with the named characterising species in the biotope description or characterising JNCC species list, including *Capitella* spp., Nematoda, *Ophryotrocha* spp., and *Tubificoides benedii*. Species of the same genus but differing species were also present, for example, the polychaete *Malacoceros vulgaris* was present in the place of *Malacoceros fuliginosus.* Station 9 (located within the PIZ) was characterised as muddy sand, whilst Station 14, located further offshore was characterised by a high mud percentage (84% of sediment composition). Due to the high similarity of the macrofaunal community at Station 9 with this biotope, it was assigned despite the discrepancy in the sediments

3.4.1. Notes on Biotope Designations

Biotopes are acknowledged to be a useful tool for the assessment and description of coastal habitats though some constraints arise when making designations, especially where faunal data is sparse. Though the biotopes used to describe the species communities are a helpful descriptive tool, the exact character was not fully captured by some of the biotopes and as such, may communicate more or less complexity than is truly present.

Several faunal species listed in the biotope descriptions for habitats identified at Stranraer Marina were not represented in the macrofauna survey or DDV images. Though the biotopes match the sediment and many elements of the faunal communities, the descriptions were not always a perfect fit. For example, the characterising species list for '*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in Atlantic infralittoral sandy mud' included the species *Magelona* spp., which was not observed during the survey. This species may have been present in the surrounding areas within the biotope but were not identified in any of the samples from the stations.

Conversely, many stations showed low biodiversity or the communities did not correlate with any of the EUNIS biotopes descriptions. In these cases, the sediment type and tidal dynamic of the area were used as the characterising features to determine the biotope and as such these biotopes could not be identified to a higher level.

3.5. Species of Conservation Interest

3.5.1. Native Oyster *Ostrea edulis*

Under the OSPAR Convention, the Native Oyster *O. edulis* and *O .edulis* beds are included in the list of 'Threatened and/or Declining Species and Habitats' as under threat and/or in decline in Region II (North Sea), Region III (Celtic Sea) and Region IV (Bay of Biscay and Iberian Coast). *O. edulis* beds are also a Scottish Priority Marine Feature, included in the Scottish Marine Protected Area network and are included in a list of the 11 PMFs regarded as being most vulnerable to seabed disturbance (Donnan *et al*., 2024).

OSPAR define *O. edulis* beds as densities of 5 or more individuals per m^2, colonising mostly sheltered, mixed hard substrates (typically 0 to 10 m depth, but up to 50 m) (OSPAR, 2008).

Within the survey, two specimens of *O. edulis* were recorded at Station 6, occurring in gravelly muddy sand. The frequency of individuals observed therefore does not constitute a bed. No other evidence of any *O.edulis* individuals or beds was documented in either the DDV or intertidal surveys.

3.5.2. Dwarf Eelgrass *Zostera noltii*

The dwarf eelgrass *Zostera noltii* is a marine angiosperm that contributes to the formation of seagrass beds. Seagrass beds are on the OSPAR List of Threatened and/or Declining Species and Habitats (declining in Region II (North Sea) and Region III (Celtic Sea) and threatened in Region V (Wider Atlantic)) (OSPAR commission, 2008). Seagrass beds are also a Scottish Priority Habitat, included in the Scottish Marine Protected Area network and are also included in a list of the 11 PMFs regarded as being most vulnerable to seabed disturbance (Donnan *et al*., 2024).

According to OSPAR, a *Z. noltii* seagrass bed is defined when seagrass provides at least 5% cover (OSPAR, 2009). Seagrass beds were recorded as part of a mosaic with '*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand' during the intertidal survey. The beds were widespread across the eastern intertidal area in large regions over the sandflats on the foreshore. Seagrass was not recorded within the marina or offshore area, in either the PIZ or SIZ as evidenced by the DDV survey.

3.5.3. Rare and Invasive Species

A total of 26 individuals of the non-native barnacle *Austrominius modestus* were identified at Station 2 and 3. Though non-native, *A. modestus* is well established in British waters and known to be relatively widespread along the North coast of the UK.

Additionally, one individual of the leathery sea squirt *Styela clava* was noted in the western intertidal area. As with *A. modestus, S. clava* is well established in British waters and is known to be found in the Stranraer area (Nall *et al*., 2015). The species was first recorded in the UK in 1953 (previously known as *Styela mammiculata*; Carlisle, 1954) and has more recently been recorded at its most northerly point in Orkney, Scotland (Want and Kakkonen, 2021).

No other rare or invasive species were recorded.

4. Conclusions

This report has been prepared to characterise the benthic ecology and environmental conditions in the vicinity of the proposed development at Stranraer Marina. Overall, it can be said that faunal communities observed in the survey area were typical of the environmental conditions, including substrate type, and demonstrated some variability across the survey area.

The following conclusions can be drawn from the baseline characterisation outlined in this report:

Nature of Stranraer Marina Sediments

- Substrate type varied greatly across the survey area, with boulders, cobbles, shells, pebbles, gravel, sand, and mud all being recorded in varied contributions. However, finer sediments such as sand and mud showed a dominance over the vast majority of the survey area.

- The intertidal area to the west of Stranraer Marina showed a widespread dominance of mixed sediments which consisted of each sediment type, from boulders to mud, in slightly variable contributions. In contrast, the intertidal area to the east of the marina showed a dominance of finer sediment types such as sand and mud, though boulders, cobbles, pebbles, and shells were still present on the upper shore.

- Stations within the marina and surrounding subtidal area at which a PSA sample was able to be collected were classified as one of eight different Folk categories. These included: sandy gravel (sG), slightly gravelly sand (g)S, gravelly muddy sand (gmS), slightly gravelly sandy mud (g)sM, gravelly mud (gM), slightly gravelly muddy sand (g)mS, mud (M) and slightly gravelly mud (g)M. The northern portion of stations outside the marina and in the SIZ were dominated by mud, whilst stations within the PIZ and marina showed greater variability and an overall higher percentage of sand and gravel.

Nature of Stranraer Marina Fauna and Flora

- The intertidal areas to the west and east of Stranraer Marina showed a high diversity of epifauna. In the intertidal area to the west of the marina, the macroalgal community was dominated by fucoids such as *F. vesiculosus* and *F. serratus*. Beneath this canopy a high diversity of characteristically intertidal mixed sediment epifaunal species were observed. In the intertidal area to the east of the marina, when boulders were present the macroalgal community was dominated by *F. vesiculosus* and *F. spiralis*. However, the vast majority of the shore in this area was dominated by soft sediments supporting *A. marina* and *Z. noltii* seagrass beds.

- A total of 98 taxa and 3,865 individuals of benthic invertebrates were identified in the 19 subtidal faunal samples collected in the Stranraer Marina study area. The overall diversity and abundance demonstrated irregularity across the survey site, with the area within the marina showing higher variability than the area outside. The total biomass recorded was 8.93 g AFDW with values ranging from 0.024 g to 2.34 g AFDW per sample and largely correlated with the abundance.

- Annelida dominated faunal abundance and diversity, whilst Mollusca dominated the total biomass. The most frequently occurring taxa across the site were the phylum Nemtoda, followed by the polychaetes *Capitella* spp., *C. gibber,* the bivalve *A. alba,* and *M. vulgaris.*

- Multivariate analysis of the infaunal grab data revealed four distinct benthic communities. Faunal Group A was comprised of two stations of slightly gravelly muddy sands and sandy muds that were largely dominated by the polychaete *M. vulgaris* and polychaetes from the *Capitella* genus. Faunal Group B was located outside of the marina and identified as slightly gravelly sandy mud or slightly gravelly mud with moderate faunal diversity and abundance. Faunal Group C was distributed across the marina; stations within this group showed large variation in sediment class but were characterised by Annelida species such as *Dipolydora quadrilobate, C. gibber*, and *P. elegans.* Lastly Station 10 was determined as an Outlier, with the singular Folk category of mud recorded. Faunal abundance and diversity for this group was comparatively low, and community comprised of the single largest abundance of the Ragworm *H. diversicolor.*

- Multivariate analysis of particle size and the patterns of faunal communities determined that there was a moderately significant relationship between sediment data and faunal is communities. This relationship corresponded most strongly with the distribution of course sand of particle size 500-1000 µm.

- Nine different biotopes were identified in the intertidal survey, to the east and west of the marina. Sand dominated areas recorded biotopes such as '*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand' and '*Zostera noltii* beds on Atlantic littoral sand', whilst in areas of coarser sediment, macroalgal dominated biotopes such as *'Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock' and '*Fucus vesiculosus* on mid eulittoral mixed substrata' were present.

- Across the subtidal stations 11 biotopes were identified from the DDV and grab survey data. Within the Marina and PIZ, biotopes varied largely, with biotopes such as 'Polychaete/amphipod-dominated Atlantic littoral fine sand' and '*Cirratulids* and *Cerastoderma edule* in Atlantic littoral mixed sediment' were identified. Offshore to the marina and within the SIZ, the biotope *'Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in Atlantic infralittoral sandy mud' dominated, being recorded at seven stations. The epibiotic overlay '*Fucus vesiculosus* on mid eulittoral mixed substrata' was also present in the southeast corner of the marina.

- Three biotopes were determined from the transect DDV survey: 'Atlantic infralittoral mud', 'Vegetated communities on Atlantic infralittoral mud' and '*Arenicola marina* in Atlantic infralittoral fine sand or muddy sand'. The latter was also identified in the intertidal survey. No evidence of any Priority Marine Features such as subtidal seagrass beds or native oyster reefs were identified in the DDV transect survey.

- Two native oyster *O.edulis* specimens were identified during the survey, both located at one station inside the marina. Native oysters and beds are included in the list of 'Threatened and/or Declining Species and Habitats' under the OSPAR Convention and are a PMF in Scotland. The specimens identified in the macrofaunal analysis were present in too few abundances to constitute a bed (<5 per m^2).

- Seagrass beds of *Z. noltii* were recorded across the intertidal area to the east of Stranraer. The beds were patchy in nature but covered a wide area; the patchiness of the beds may have been due to the timing of the survey early in the growing season. Seagrass beds are on the OSPAR List of 'Threatened and/or Declining Species and Habitats' and a Scottish Priority Marine Feature. Seagrass beds were not recorded within the marina or offshore subtidal area, in either the PIZ or SIZ.

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6. Appendix

Appendix 1 – Summary of field notes and positions for the DDV, grab, and intertidal survey at Stranraer in 2025.

Appendix 2 – Table summarising the PSA major sediment fractions of each benthic sample collected at Stranraer in 2025.

Appendix 3 – Table summarising the abundance and species diversity of each benthic faunal sample collected at Stranraer in 2025.

Appendix 4 – Table summarising the major group biomass of each benthic faunal sample collected at Stranraer in 2025.

Appendix Plate 1 – Intertidal station photographs, subtidal DDV station stills, and subtidal DDV transect stills collected at Stranraer in 2025.

Appendix Plate 2 – Photographs of benthic grab samples collected at Stranraer in 2025.

Appendix 1a. Field notes from the DDV stations at Stranraer in 2025.

Date	Station	Start Time	Fix	Video ID Code	Image Label	Still Location		Depth (m)	Sediment Description	Can the Grab Be Deployed?
						Latitude	Longitude			
27/05/2025	7	14:13	01	2025_05_27_143124275	FHTSTR0525 Station 07_1	54˚54.44161N	005˚01.66050W	1.8	S + Shells	Yes
					FHTSTR0525 Station 07_2	54˚54.44147N	005˚01.65769W	1.8	S + Shells	Yes
					FHTSTR0525 Station 07_3	54˚54.44148N	005˚01.65476W	1.8	S + Shells	Yes
	6	14:37	02	2025_05_27_143710657	FHTSTR0525 Station 06_1	54˚54.41149N	005˚01.72967W	1.3	gS + Shells	Yes
					FHTSTR0525 Station 06_2	54˚54.41207N	005˚01.72847W	1.3	gS + Shells	Yes
					FHTSTR0525 Station 06_3	54˚54.41223N	005˚01.72805W	1.3	gS + Shells	Yes
	4	14:40	03	2025_05_27_144014236	FHTSTR0525 Station 04_1	54˚54.41404N	005˚01.57259W	1.9	gS + Shells	No
					FHTSTR0525 Station 04_2	54˚54.41447N	005˚01.57356W	1.9	gS + Shells	No
					FHTSTR0525 Station 04_3	54˚54.41398N	005˚01.57306W	1.9	gS + Shells	No
	11	14:43	04	2025_05_27_144357333	FHTSTR0525 Station 11_1	54˚54.48472N	005˚01.54808W	1.8	gS	Yes
					FHTSTR0525 Station 11_2	54˚54.48431N	005˚01.54984W	1.8	gS	Yes
					FHTSTR0525 Station 11_3	54˚54.48515N	005˚01.54744W	1.8	gS	Yes
	8	14:47	05	2025_05_27_144703338	FHTSTR0525 Station 08_1	54˚54.52261N	005˚01.65321W	3.9	mS	Yes
					FHTSTR0525 Station 08_2	54˚54.52274N	005˚01.65229W	3.9	mS	Yes
					FHTSTR0525 Station 08_3	54˚54.52400N	005˚01.64822W	3.9	mS	Yes
	9	14:54	06	2025_05_27_145413591	FHTSTR0525 Station 09_1	54˚54.52358N	005˚01.68531W	3.9	mS	Yes
					FHTSTR0525 Station 09_2	54˚54.52416N	005˚01.68366W	3.9	mS	Yes
					FHTSTR0525 Station 09_3	54˚54.52487N	005˚01.68312W	3.9	mS	Yes
	13	14:54	07	2025_05_27_145413591	FHTSTR0525 Station 13_1	54˚54.57198N	005˚01.59718W	8	sM	Yes
					FHTSTR0525 Station 13_2	54˚54.56835N	005˚01.60150W	8	sM	Yes
					FHTSTR0525 Station 13_3	54˚54.57305N	005˚01.59528W	8	sM	Yes
	14	15:02	08	2025_05_27_150245601	FHTSTR0525 Station 14_1	54˚54.64303N	005˚01.71214W	12	sM	Yes
					FHTSTR0525 Station 14_2	54˚54.64450N	005˚01.71045W	12	sM	Yes
					FHTSTR0525 Station 14_3	54˚54.64583N	005˚01.70857W	12	sM	Yes
	15	15:09	09	2025_05_27_150951765	FHTSTR0525 Station 15_1	54˚54.69393N	005˚01.65454W	7.9	sM	Yes
					FHTSTR0525 Station 15_2	54˚54.69433N	005˚01.65210W	7.9	sM	Yes
					FHTSTR0525 Station 15_3	54˚54.69501N	005˚01.64931W	7.9	sM	Yes
	17	15:14	10	2025_05_27_151439880	FHTSTR0525 Station 17_1	54˚54.79892N	005˚01.55238W	4.9	sM	Yes
					FHTSTR0525 Station 17_2	54˚54.80133N	005˚01.54521W	4.9	sM	Yes
					FHTSTR0525 Station 17_3	54˚54.80145N	005˚01.54311W	4.9	sM	Yes
	18	15:19	11	2025_05_27_151911901	FHTSTR0525 Station 18_1	54˚54.86825N	005˚01.70264W	6.9	sM	Yes
					FHTSTR0525 Station 18_2	54˚54.86979N	005˚01.69771W	6.9	sM	Yes
					FHTSTR0525 Station 18_3	54˚54.87019N	005˚01.69573W	6.9	sM	Yes
	20	15:23	12	2025_05_27_152335564	FHTSTR0525 Station 20_1	54˚54.94581N	005˚01.57772W	5.2	sM	Yes
					FHTSTR0525 Station 20_2	54˚54.94607N	005˚01.57590W	5.2	sM	Yes
					FHTSTR0525 Station 20_3	54˚54.94714N	005˚01.57323W	5.2	sM	Yes
	21	15:31	13	2025_05_27_153102885	FHTSTR0525 Station 21_1	54˚55.02088N	005˚01.74431W	7	sM	Yes
					FHTSTR0525 Station 21_2	54˚55.02122N	005˚01.73992W	7	sM	Yes
					FHTSTR0525 Station 21_3	54˚55.02212N	005˚01.73065W	7	sM	Yes
	19	15:37	14	2025_05_27_153723608	FHTSTR0525 Station 19_1	54˚54.91211N	005˚01.87020W	6.2	sM	Yes
					FHTSTR0525 Station 19_2	54˚54.91303N	005˚01.86446W	6.2	sM	Yes
					FHTSTR0525 Station 19_3	54˚54.91368N	005˚01.86096W	6.2	sM	Yes
	16	15:43	15	2025_05_27_154335520	FHTSTR0525 Station 16_1	54˚54.76326N	005˚01.76326W	10	sM	Yes
					FHTSTR0525 Station 16_2	54˚54.76336N	005˚01.80433W	10	sM	Yes
					FHTSTR0525 Station 16_3	54˚54.76406N	005˚01.80178W	10	sM	Yes
	10	16:28	16	2025_05_27_162834874	FHTSTR0525 Station 10_1	54˚54.47099N	005˚01.73815W	2.4	sM	Yes
					FHTSTR0525 Station 10_2	54˚54.46930N	005˚01.73423W	2.4	sM	Yes
					FHTSTR0525 Station 10_3	54˚54.46752N	005˚01.73410W	2.4	sM	Yes

Appendix 1b. Field notes from the DDV transects at Stranraer in 2025.

Date	Transect	Start Depth (m)	Start Time	End Time	Sediment Description	Video ID Codes	Still Location	
							Latitude	Longitude
28/05/2025	A	0.6	10:26	10:59	sM	FHTSTR0525 A1	51˚54.93959'N	005˚02.00782'W
					sM	FHTSTR0525 A2	51˚54.94343'N	005˚01.92050'W
					sM	FHTSTR0525 A3	51˚54.94329'N	005˚01.86690'W
					sM	FHTSTR0525 A4	51˚54.95557'N	005˚01.76452'W
					sM	FHTSTR0525 A5	51˚54.96702'N	005˚01.68594'W
					sM	FHTSTR0525 A6	51˚54.96933'N	005˚01.62869'W
					sM	FHTSTR0525 A7	51˚54.97072'N	005˚01.55965'W
					sM	FHTSTR0525 A8	51˚54.97489'N	005˚01.51488'W
					sM	FHTSTR0525 A9	51˚54.95851'N	005˚01.42873'W
28/05/2025	B	5.5	11:01	11:31	sM	FHTSTR0525 B8	51˚54.88341'N	005˚01.41183'W
					sM	FHTSTR0525 B7	51˚54.87672'N	005˚01.48823'W
					sM	FHTSTR0525 B6	51˚54.87956'N	005˚01.57421'W
					sM	FHTSTR0525 B5	51˚54.86939'N	005˚01.64679'W
					sM	FHTSTR0525 B4	51˚54.86610'N	005˚01.72468'W
					sM	FHTSTR0525 B3	51˚54.84952'N	005˚01.87590'W
					sM	FHTSTR0525 B2	51˚54.84498'N	005˚01.94395'W
					sM	FHTSTR0525 B1	51˚54.84058'N	005˚02.01108'W
28/05/2025	C	5.9	11:34	12:09	sM	FHTSTR0525 C1	51˚54.73488'N	005˚01.95150'W
					sM	FHTSTR0525 C2	51˚54.75511'N	005˚01.85570'W
					sM	FHTSTR0525 C3	51˚54.75320'N	005˚01.82692'W
					sM	FHTSTR0525 C4	51˚54.75556'N	005˚01.73656'W
					sM	FHTSTR0525 C5	51˚54.76583'N	005˚01.67702'W
					sM	FHTSTR0525 C6	51˚54.77816'N	005˚01.52462'W
					sM	FHTSTR0525 C7	51˚54.77521'N	005˚01.43706'W
28/05/2025	D	5.2	12:13	12:36	sM	FHTSTR0525 D7	51˚54.69406'N	005˚01.43523'W
					sM	FHTSTR0525 D6	51˚54.66324'N	005˚01.51168'W
					sM	FHTSTR0525 D5	51˚54.67251'N	005˚01.58585'W
					sM	FHTSTR0525 D4	51˚54.65232'N	005˚01.65109'W
					sM	FHTSTR0525 D3	51˚54.65317'N	005˚01.71729'W
					sM	FHTSTR0525 D2	51˚54.65170'N	005˚01.78902'W
					sM	FHTSTR0525 D1	51˚54.64040'N	005˚01.87138'W
28/05/2025	E	2.5	12:43	12:50	sM	FHTSTR0525 E1	51˚54.53017'N	005˚01.81803'W
					sM	FHTSTR0525 E2	51˚54.54713'N	005˚01.65673'W
					sM	FHTSTR0525 E3	51˚54.55497'N	005˚01.59101'W
28/05/2025	F	12.0	12:53	13:35	sM	FHTSTR0525 F8	51˚54.53695'N	005˚01.76992'W
					sM	FHTSTR0525 F7	51˚54.72108'N	005˚01.75749'W
					sM	FHTSTR0525 F5	51˚54.78029'N	005˚01.78067'W
					sM	FHTSTR0525 F4	51˚54.85733'N	005˚01.79933'W
					sM	FHTSTR0525 F3	51˚54.92292'N	005˚01.81407'W
					sM	FHTSTR0525 F2	51˚54.98993'N	005˚01.82963'W
					sM	FHTSTR0525 F1	51˚55.05895'N	005˚01.84583'W
28/05/2025	G	6.9	13:28	13:54	sM	FHTSTR0525 G1	51˚55.05794'N	005˚01.64121'W
					sM	FHTSTR0525 G2	51˚54.98728'N	005˚01.65038'W
					sM	FHTSTR0525 G3	51˚54.91236'N	005˚01.62646'W
					sM	FHTSTR0525 G4	51˚54.8417'N	005˚01.61096'W
					sM	FHTSTR0525 G5	51˚54.77848'N	005˚01.60713'W
					sM	FHTSTR0525 G6	51˚54.70105'N	005˚01.57447'W
					sM	FHTSTR0525 G7	51˚54.65844'N	005˚01.58651'W

Appendix 1c. Field notes from the benthic grab survey at Stranraer in 2025.

Date	Station	Time	Fix	Depth (m)	Latitude (WGS84 UTM 31N)	Longitude (WGS84 UTM 31N)	Sample volume (L)	PSA Volume (L)	Sediment Description	Photos Taken	Anoxic Layer Depth (cm)	Attempts	Notes
25/05/2025	12	17:35	11	0.0	54˚54.503N	005˚01.781W	8	0.5	S	Yes	-	1	
25/05/2025	05	17:48	12	0.0	54˚54.381N	005˚01.720W	8	0.5	mS	Yes	-	1	
25/05/2025	03	18:02	13	0.0	54˚54.400N	005˚01.538W	8	0.5	gmS	Yes	-	1	
25/05/2025	02	18:09	14	0.0	54˚54.420N	005˚01.458W	8	0.5	gmS	Yes	-	1	
25/05/2025	01	18:15	15	0.0	54˚54.386N	005˚01.426W	8	0.5	gmS	Yes	-	1	
28/05/2025	16	17:02	28	10.1	54˚54.764N	005˚01.883W	10	0.5	sM	Yes	1	1	
28/05/2025	19	17:24	31	6.3	54˚54.930N	005˚01.894W	10	0.5	sM	Yes	1	1	
28/05/2025	21	17:35	33	6.5	54˚54.999N	005˚01.728W	10	0.5	sM	Yes	1	1	
28/05/2025	20	17:50	34	4.8	54˚54.943N	005˚01.591W	10	0.5	sM	Yes	1	1	
28/05/2025	18	17:58	35	6.5	54˚54.853N	005˚01.739W	10	0.5	sM	Yes	1	1	
28/05/2025	17	18:11	37	3.8	54˚54.762N	005˚01.567W	10	0.5	sM	Yes	1	1	
28/05/2025	15	18:18	38	9.9	54˚54.692N	005˚01.697W	10	0.5	sM	Yes	1	1	
28/05/2025	14	18:31	39	11.2	54˚54.658N	005˚01.703W	10	0.5	sM	Yes	1	1	
28/05/2025	13	18:40	40	5.7	54˚54.572N	005˚01.602W	10	0.5	sM	Yes	1	1	
28/05/2025	09	18:47	41	3.7	54˚54.520N	005˚01.666W	10	0.5	mS	Yes	1	1	
28/05/2025	08	18:54	42	0.9	54˚54.510N	005˚01.652W	7	0.5	mS	Yes	1	1	
28/05/2025	10	19:00	43	2.3	54˚54.469N	005˚01.736W	10	0.5	sM	Yes	1	1	
29/05/2025	11	13:52	44	2.8	54˚54.474N	005˚01.528W	x	0.5	msG	Yes	x	3	No macrofaunal sample
29/05/2025	07	14:09	45	3.0	54˚54.455N	005˚01.661W	7	0.5	mS	Yes	1	1	
29/05/2025	06	14:17	46	1.4	54˚54.420N	005˚01.740W	6	0.5	mS	Yes	1	1	

Appendix 1d. Field notes from the intertidal survey at Stranraer in 2025.

Date	Site	Fix	Latitude	Longitude	Notes
25/05/2025	West Beach	001	54˚54.470N	005˚01.785W	Start of back line
		B01	54˚54.470N	005˚01.785W	Start of bare mixed substrate boundary
		B02	54˚54.797N	005˚02.502W	End of bare mixed substrate boundary
		002	54˚54.790N	005˚02.509W	End of back line
		007	54˚54.813N	005˚02.472W	Start of low water line . Landward = *Fucus vesiculosus* , annelid evidence, Paguridae, *Carcinus maenas, Littorina littorea* , orange sponge, *Fucus serratus* , brown feathery seaweed, *Spirobranchus* spp., barnacles, *Patella vulgata* , tube worms, *Arenicola marina* , and *Chodrus crispus* . See photos for more detail.
		003	54˚54.799N	005˚02.514W	Photo of bare mixed substrate
		004	54˚54.804N	005˚02.491W	Photo of *Fucus vesiculosus* on mixed substrates biotope described in 007
		005	54˚54.800N	005˚02.491W	Photo mixed substrate. Annelida evidence, *Fucus vesiculosus* , and brown feathery macroalgae.
		006	54˚54.804N	005˚02.478W	Photo of boulders, cobbles, pebbles, *Fucus vesiculosus, Patella vulgata,* and *Nucella lapillus* .
		009	54˚54.665N	005˚02.184W	Photo of mixed substrate and *Fucus* spp., *Chrondrus crispus, Sprirobranchus* spp., and *Mastocarpus stellatus* on lower shore
		B04	54˚54.632N	005˚02.218W	Start of perimeter of area of low *Fucus* spp., green sheet and tubular form macroalgae and mixed substrate, low abundances.
		B05	54˚54.585N	005˚02.157W	End of perimenter of B04
		B06	54˚54.597N	005˚02.151W	Photo of described in B04
		B07	54˚54.597N	005˚02.152W	Photo of *Fucus serratus* , green and brown feathery macroalgae, *Spirobranchus* spp., and orange sponge.
		B08	54˚54.546N	005˚01.983W	Photo of mixed substrate with feathery brown macroalgae
		B09	54˚54.546N	005˚01.980W	Start of perimeter around mosaic of sand and mixed substrate with green algae biotope
		B10	54˚54.492N	005˚01.863W	End of perimeter of B09
		010	54˚54.492N	005˚01.863W	End of low water line
26/05/2025	East Beach	016	54˚54.345N	005˚01.115W	Start of back line
		B09	54˚54.346N	005˚01.114W	Start of *Fucus vesiculosus, Patella vulgata, Nucella lapillus,* barnacles, and *Littorina littorea* on rocks biotope boundary
		B10	54˚54.430N	005˚00.672W	End of B09 boundary and start of bare mixed substrate boundary
		B11	54˚54.430N	005˚00.672W	Photo of bare mixed substrate
		B12	54˚54.453N	005˚00.616W	Start of *Fucus vesiculosus, Patella vulgata, Nucella lapillus,* barnacles, and *Littorina littorea* on rocks biotope boundary
		B13	54˚54.456N	005˚00.614W	Photo of B12
		B14	54˚54.482N	005˚00.520W	End of B12 boundary, start of coarse sediments boundary
		017	54˚54.493N	005˚00.496W	Photo of anthropogenic boulders with barnacles, *Patella vulgata, Nucella lapillus,* and *Fucus spiralis.*
		B15	54˚54.538N	005˚00.351W	End of coarse sediments boundary and start of mixed substrate front perimeter
		018	54˚54.563N	005˚00.281W	End of mixed substrate boundary. Continuation of coarse sediments along the back of the shore
		019	54˚54.578N	005˚00.244W	End of survey area
		020	54˚54.582N	005˚00.250W	Start of seagrass bed presence
		021	54˚54.750N	005˚00.368W	End of seagrass bed presence
		B16	54˚54.619N	005˚00.649W	Start of seagrass bed presence
		B17	54˚54.589N	005˚00.609W	Photo of seagrass bed
		B18	54˚54.494N	005˚00.519W	End of seagrass bed presence
		B19	54˚54.402N	005˚00.797W	Start of *Fucus vesiculosus, Patella vulgata, Nucella lapillus,* barnacles, and *Littorina littorea* on rocks biotope and sand with *Arenicola marina* mosaic boundary
		B20	54˚54.419N	005˚00.895W	Edge of B19 biotope boundary. Start of seagrass bed presence
		B21	54˚54.479N	005˚00.935W	End of seagrass bed presence
		B22	54˚54.469N	005˚00.920W	Photo of sand substrate
		022	54˚54.528N	005˚01.411W	End of low tide line. Start of *Fucus serratus, Littorina littorea, Chondrus crispus,* and orange sponge on mixed substrates boundary.
		023	54˚54.347N	005˚01.114W	End of 022 boundary
		024	54˚54.435N	005˚01.255W	Start of *Fucus* vesiculosus, etc., on rocks biotope and sand with *Arenicola marina* mosaic
		025	54˚54.407N	005˚01.068W	Seagrass presence noted
		026	54˚54.411N	005˚00.947W	Edge of 024 boundary
		027	54˚54.347N	005˚01.106W	End of 024 boundary
		B23	54˚54.524N	005˚00.388W	Photo of coarse sediments

Appendix 2. Table summarising the percentage of major sediment fractions of particle size analysis (PSA) samples collected from Stranraer in 2025.

Station	% Gravel	% Sand	% Mud	Folk
01	14.16	59.81	26.02	gmS
02	3.37	48.22	48.41	(g)sM
03	21.20	38.34	40.45	gM
05	0.50	63.38	36.11	(g)mS
06	6.74	65.35	27.91	gmS
07	1.69	94.99	3.33	(g)S
08	0.13	88.52	11.34	(g)mS
09	0.37	61.10	38.52	(g)mS
10	0.00	9.91	90.09	M
11	66.17	31.78	2.05	sG
12	0.09	97.00	2.91	(g)S
13	0.01	15.49	84.50	(g)sM
14	0.36	14.75	84.89	(g)sM
15	0.04	11.53	88.43	(g)sM
16	0.09	17.09	82.81	(g)sM
17	0.27	13.11	86.62	(g)sM
18	0.24	15.99	83.78	(g)sM
19	0.04	14.96	84.99	(g)sM
20	0.21	4.98	94.81	(g)M
21	1.05	6.60	92.34	(g)M

Appendix 3. Table summarising the abundance of macrofauna identified in the samples collected during the 2025 benthic survey at Stranraer, 2025.

Taxon name	AphiaID	Authority	1	2	3	5	6	7	8	9	10	12	13	14	15	16	17	18	19	20	21
Virgularia mirabilis	128539	Müller, 1776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Nemertea	152391	-	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Nematoda	799	-	0	0	0	0	2	0	0	614	6	0	0	1	0	1	0	0	0	0	0
Priapulus caudatus	101160	Lamarck, 1816	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	9	0	2	1
Polynoidae	939	Kinberg, 1856	0	0	2	0	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0
Harmothoe impar	130770	Johnston, 1839	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Malmgrenia	147006	McIntosh, 1874	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pholoe inornata (sensu Petersen)	130601	Johnston, 1839	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	2	1
Eteone longa (agg)	130616	Fabricius, 1780	3	2	1	0	3	1	2	0	0	8	0	0	0	1	0	0	0	0	0
Phyllodoce mucosa	334512	Örsted, 1843	0	2	4	0	0	1	1	0	1	1	0	0	1	1	0	0	0	0	1
Eumida bahusiensis	130641	Bergstrom, 1914	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Glycera tridactyla	130130	Schmarda, 1861	0	1	3	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0
Oxydromus flexuosus	710680	Delle Chiaje, 1827	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Podarkeopsis capensis	130195	Day, 1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Nereididae	22496	Blainville, 1818	6	12	1	4	4	2	0	1	0	0	0	0	0	0	1	0	0	0	0
Alitta virens	234851	M. Sars, 1835	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hediste diversicolor	152302	O.F. Müller, 1776	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0	0	0	0
Platynereis dumerilii	130417	Audouin & Milne Edwards, 1833	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Nephtys hombergii	130359	Savigny in Lamarck, 1818	0	3	0	0	2	1	0	0	0	1	1	0	2	4	7	11	4	5	8
Lumbrineris cf. cingulata	130240	Ehlers, 1897	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ophryotrocha	129266	Claparède & Mecznikow, 1869	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Leitoscoloplos mammosus	130514	Mackie, 1987	1	2	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0	4
Scoloplos armiger	130537	Müller, 1776	0	3	3	0	12	9	9	0	0	3	0	0	0	0	0	0	0	0	0
Spionidae	913	Grube, 1850	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pygospio elegans	131170	Claparède, 1863	47	41	23	2	3	3	0	0	0	15	0	0	0	1	0	0	0	0	0
Prionospio fallax	131157	Söderström, 1920	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Aonides oxycephala	131106	Sars, 1862	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spio symphyta	596189	Meißner, Bick & Bastrop, 2011	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Malacoceros vulgaris	131134	Johnston, 1827	0	0	0	0	0	0	0	256	1	0	0	38	0	0	0	0	0	0	0
Polydora cornuta	131143	Bosc, 1802	1	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Dipolydora quadrilobata	131121	Jacobi, 1883	9	30	41	0	2	3	4	0	0	3	0	0	0	0	0	0	0	0	0
Chaetozone gibber	129953	Woodham & Chambers, 1994	1	12	5	8	123	12	57	0	1	4	10	0	54	66	9	32	4	8	12
Chaetozone christiei	152217	Chambers, 2000	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
Cirriformia tentaculata	129964	Montagu, 1808	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Aphelochaeta marioni	129938	Saint-Joseph, 1894	0	48	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tharyx killariensis	152269	Southern, 1914	0	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitella	129211	Blainville, 1828	0	1	0	0	0	0	0	392	0	0	1	146	0	1	0	0	0	0	0
Mediomastus fragilis	129892	Rasmussen, 1973	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heteromastus filiformis	129884	Claparède, 1864	4	16	13	1	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Notomastus	129220	M. Sars, 1851	0	2	0	1	1	0	4	0	0	0	2	0	5	0	6	12	6	8	8
Arenicola defodiens	129867	Cadman & Nelson-Smith, 1993	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euclymene (Species A)	129347	Verrill, 1900	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Leiochone	146991	Grube, 1868	0	0	0	0	0	0	1	0	0	12	0	0	0	0	0	0	0	0	0
Ophelina acuminata	130500	Örsted, 1843	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Scalibregma inflatum	130980	Rathke, 1843	0	0	0	0	7	0	0	0	5	0	21	0	1	1	0	0	0	2	0
Galathowenia oculata	146950	Zachs, 1923	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ampharetidae	981	Malmgren, 1866	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Melinna palmata	129808	Grube, 1870	2	20	6	3	17	0	2	0	0	0	0	0	3	12	6	13	3	18	38
Ampharete lindstroemi (agg)	129781	Hessle, 1917	0	0	0	0	3	0	0	0	0	0	0	0	0	6	1	2	1	1	2
Terebellides	129717	Sars, 1835	0	0	0	0	0	0	0	0	1	0	5	0	2	3	6	16	16	8	25
Eupolymnia nesidensis	131490	Delle Chiaje, 1828	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Eupolymnia nebulosa	131489	Montagu, 1819	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Spirobranchus lamarcki	560033	Quatrefages, 1866	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tubificoides benedii	137571	d'Udekem, 1855	11	51	9	0	2	0	0	55	0	0	0	1	0	2	0	1	0	0	0
Tubificoides diazi	137574	Brinkhurst & Baker, 1979	2	0	2	0	6	11	0	0	0	1	0	0	0	0	0	0	0	0	0
Tubificoides galiciensis	137576	Martinez-Ansemil & Giani, 1987	0	0	0	2	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austrominius modestus	712167	Darwin, 1854	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balanus crenatus	106215	Bruguière, 1789	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0
Copepoda	1080	Milne Edwards, 1840	0	0	1	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0
Praunus inermis	120178	Rathke, 1843	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Leucothoe lilljeborgi	102462	Boeck, 1861	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1
Ampelisca	101445	Krøyer, 1842	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0

Taxon name	AphiaID	Authority	1	2	3	5	6	7	8	9	10	12	13	14	15	16	17	18	19	20	21
Ampelisca brevicornis	101891	A. Costa, 1853	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ampelisca spinipes	101928	Boeck, 1861	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	0	3	8
Gammarus insensibilis	102280	Stock, 1966	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Microdeutopus versiculatus	102053	Spence Bate, 1857	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Aoridae (female)	101368	Stebbing, 1899	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corophiidae	101376	Leach, 1814	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crassicorophium crassicorne	397383	Bruzelius, 1859	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Phtisica marina	101864	Slabber, 1769	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Pariambus typicus	101857	Krøyer, 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tanaopsis graciloides	136458	Lilljeborg, 1864	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	6	0	3	1
Eudorella truncatula	110535	Bate, 1856	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	13	3	2	6
Diastylis rugosa	110488	Sars, 1865	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Crangon crangon	107552	Linnaeus, 1758	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0
Liocarcinus (juv.)	106925	Stimpson, 1871	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peringia ulvae	151628	Pennant, 1777	6	10	7	2	8	2	2	0	0	1	3	0	1	0	0	0	0	0	0
Alderia modesta	141555	Lovén, 1844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Nucula nitidosa	140589	Winckworth, 1930	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	10	8	9	4
Ostrea edulis	140658	Linnaeus, 1758	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lucinoma borealis	140283	Linnaeus, 1767	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Myrtea spinifera	140287	Montagu, 1803	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Thyasira flexuosa	141662	Montagu, 1803	0	0	0	3	2	0	0	0	0	0	4	0	7	1	5	1	16	20	8
Kurtiella bidentata	345281	Montagu, 1803	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cardiidae (juv.)	229	Lamarck, 1809	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cerastoderma edule	138998	Linnaeus, 1758	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spisula solida	140301	Linnaeus, 1758	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	4	3	1
Ensis (juv.)	138333	Schumacher, 1817	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Fabulina fabula	146907	Gmelin, 1791	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0
Abra alba	141433	W. Wood, 1802	0	1	2	1	6	1	1	0	3	1	38	0	14	40	17	15	43	63	102
Abra nitida	141435	O. F. Müller, 1776	0	0	0	0	0	0	0	0	1	0	11	0	1	37	12	13	13	7	10
Chamelea striatula	141908	da Costa, 1778	0	1	0	0	1	3	2	0	0	0	0	0	0	0	0	0	1	0	0
Ruditapes decussatus	231749	Linnaeus, 1758	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Varicorbula gibba	378492	Olivi, 1792	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	7	6	3
Thracia phaseolina	152378	Lamarck, 1818	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Electra pilosa	1789435	Linnaeus, 1761	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	1839	Blainville, 1824	0	0	0	0	1	0	0	0	2	0	0	0	0	1	0	0	0	0	0
Ascidiella aspersa	103718	Müller, 1776	0	0	0	0	0	0	0	0	2	0	0	0	0	5	0	0	0	0	0

Appendix 4. Table summarising the biomass (gAFDW) of macrofauna identified in the samples collected during the 2025 benthic survey at Stranraer, 2025.

Biomass (gAFDW)	**1**	**2**	**3**	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Annelida	0.0344	0.1316	0.1292	0.0181	0.2475	0.0168	0.0988	0.3552	0.0227	0.1046	0.1455	0.4585	0.0780	0.1082	0.2424	0.1998	0.2301	0.1481	0.3723
Crustacea	0.0000	0.0047	0.0006	0.0000	0.0088	0.0009	0.0008	0.0000	0.0000	0.0066	0.0000	0.0000	0.0006	0.0005	0.0015	0.0021	0.0004	0.0013	0.0045
Echinodermata	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mollusca	0.0010	0.3732	0.0081	0.0056	2.0836	1.0634	0.2397	0.0000	0.0035	0.0001	0.0533	0.0000	0.2217	0.0958	0.0521	0.1164	0.5761	0.6702	0.1473
Miscellania	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0013	0.0003	0.0198	0.0000	0.0000	0.0041	0.0000	0.0069	0.0052	0.0000	0.0010	0.0006

Appendix Plate 1. Intertidal station photographs, subtidal DDV station stills, and subtidal DDV transect stills collected at Stranraer in 2025.


FHTSTR0525 Station 1


FHTSTR0525 Station 2


FHTSTR0525 Station 3

Not Available

FHTSTR0525 Station 5


FHTSTR0525 Station 12


FHTSTR0525 Station 4_1


FHTSTR0525 Station 4_2


FHTSTR0525 Station 4_3


FHTSTR0525 Station 6_1


FHTSTR0525 Station 6_2


FHTSTR0525 Station 6_3


FHTSTR0525 Station 7_1


FHTSTR0525 Station 7_2


FHTSTR0525 Station 7_3


FHTSTR0525 Station 8_1


FHTSTR0525 Station 8_2


FHTSTR0525 Station 8_3

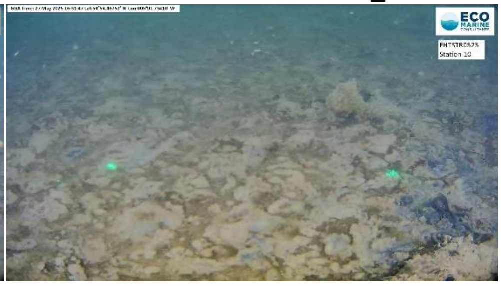

FHTSTR0525 Station 9_1


FHTSTR0525 Station 9_2

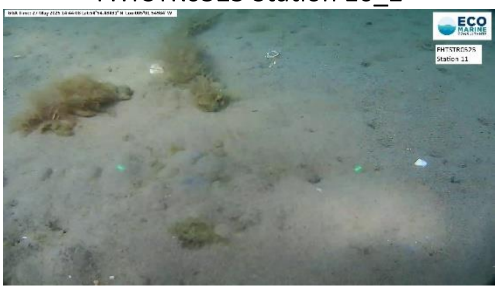

FHTSTR0525 Station 9_3


FHTSTR0525 Station 10_1

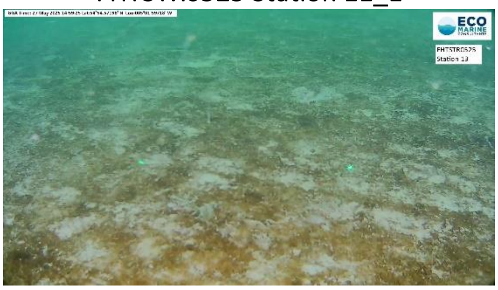

FHTSTR0525 Station 10_2


FHTSTR0525 Station 10_3


FHTSTR0525 Station 11_1


FHTSTR0525 Station 11_2


FHTSTR0525 Station 11_3


FHTSTR0525 Station 13_1


FHTSTR0525 Station 13_2


FHTSTR0525 Station 13_3


FHTSTR0525 Station 14_1


FHTSTR0525 Station 14_2

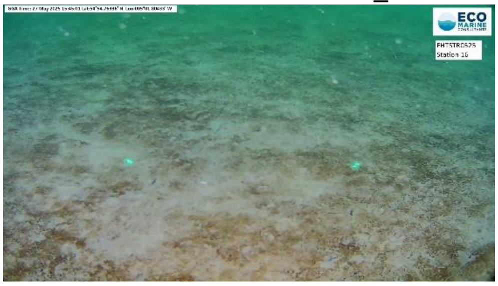

FHTSTR0525 Station 14_3


FHTSTR0525 Station 15_1


FHTSTR0525 Station 15_2


FHTSTR0525 Station 15_3


FHTSTR0525 Station 16_1

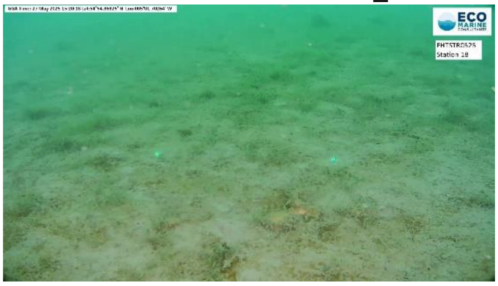

FHTSTR0525 Station 16_2


FHTSTR0525 Station 16_3


FHTSTR0525 Station 17_1


FHTSTR0525 Station 17_2


FHTSTR0525 Station 17_3


FHTSTR0525 Station 18_1


FHTSTR0525 Station 18_2


FHTSTR0525 Station 18_3


FHTSTR0525 Station 19_1


FHTSTR0525 Station 19_2


FHTSTR0525 Station 19_3


FHTSTR0525 Station 20_1


FHTSTR0525 Station 20_2


FHTSTR0525 Station 20_3


FHTSTR0525 Station 21_1


FHTSTR0525 Station 21_2


FHTSTR0525 Station 21_3


FHTSTR0525 Transect A_1


FHTSTR0525 Transect A_2

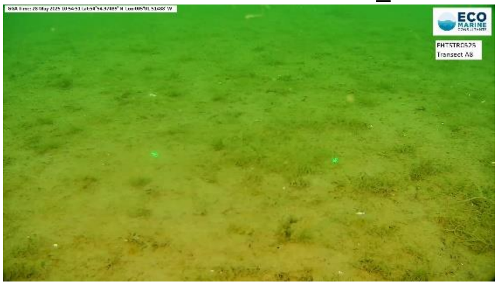

FHTSTR0525 Transect A_3


FHTSTR0525 Transect A_4

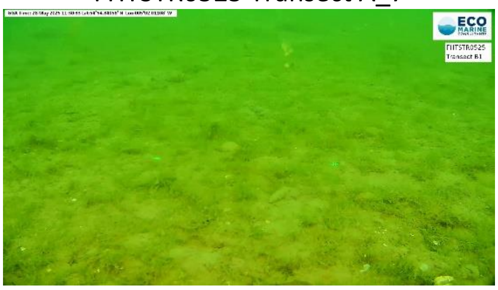

FHTSTR0525 Transect A_5


FHTSTR0525 Transect A_6


FHTSTR0525 Transect A_7


FHTSTR0525 Transect A_8


FHTSTR0525 Transect A_9


FHTSTR0525 Transect B_1

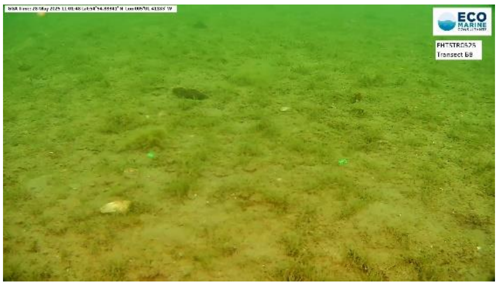
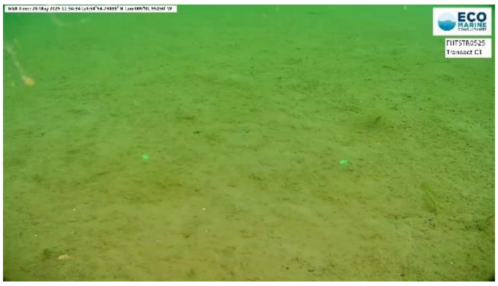

FHTSTR0525 Transect B_2

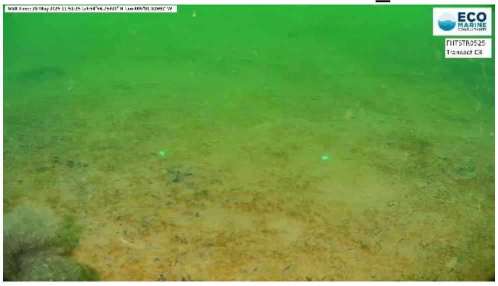
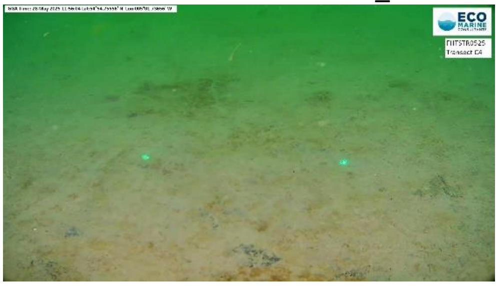

FHTSTR0525 Transect B_3


FHTSTR0525 Transect B_4


FHTSTR0525 Transect B_5


FHTSTR0525 Transect B_6

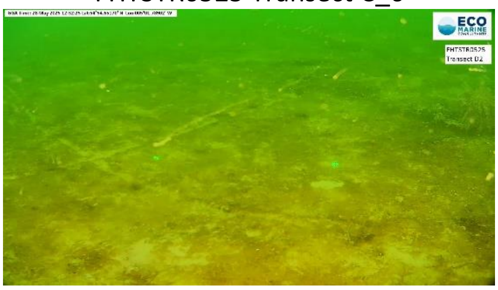
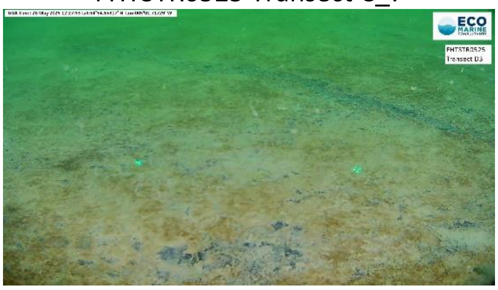
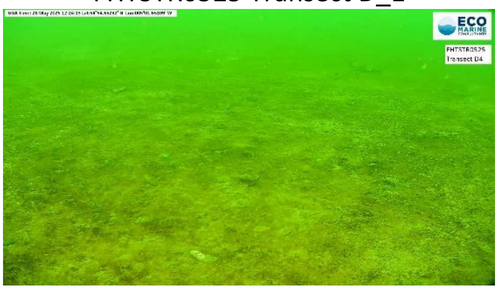

FHTSTR0525 Transect B_7

FHTSTR0525 Transect B_8

FHTSTR0525 Transect C_1

FHTSTR0525 Transect C_2

FHTSTR0525 Transect C_3

FHTSTR0525 Transect C_4

FHTSTR0525 Transect C_5

FHTSTR0525 Transect C_6

FHTSTR0525 Transect C_7

FHTSTR0525 Transect D_1

FHTSTR0525 Transect D_2

FHTSTR0525 Transect D_3

FHTSTR0525 Transect D_4

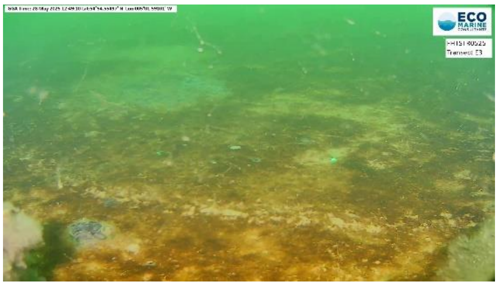
FHTSTR0525 Transect D_5

FHTSTR0525 Transect D_6

FHTSTR0525 Transect D_7

FHTSTR0525 Transect E_1

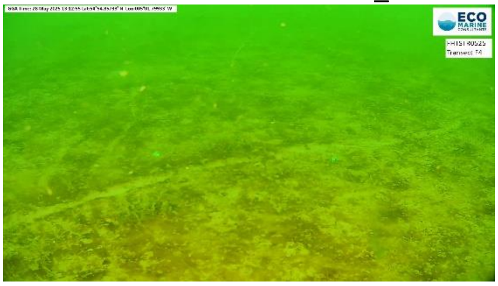
FHTSTR0525 Transect E_2


FHTSTR0525 Transect E_3

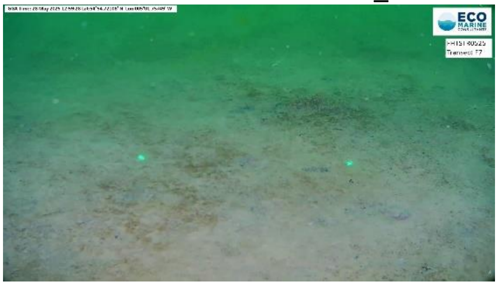

FHTSTR0525 Transect F_1


FHTSTR0525 Transect F_2


FHTSTR0525 Transect F_3

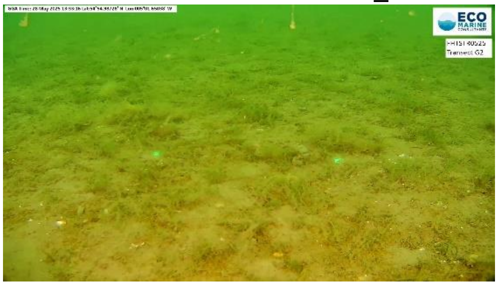

FHTSTR0525 Transect F_4


FHTSTR0525 Transect F_5


FHTSTR0525 Transect F_7


FHTSTR0525 Transect F_8


FHTSTR0525 Transect G_1

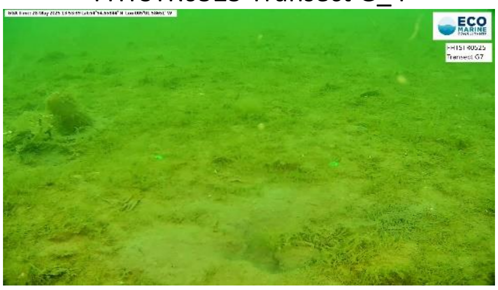

FHTSTR0525 Transect G_2


FHTSTR0525 Transect G_3


FHTSTR0525 Transect G_4


FHTSTR0525 Transect G_5


FHTSTR0525 Transect G_6


FHTSTR0525 Transect G_7

Appendix Plate 2. Photographs of benthic grab samples collected at Stranraer in 2025.


FHTSTR0525 Station 6


FHTSTR0525 Station 7


FHTSTR0525 Station 8


FHTSTR0525 Station 9


FHTSTR0525 Station 10


FHTSTR0525 Station 11


FHTSTR0525 Station 13


FHTSTR0525 Station 14


FHTSTR0525 Station 15


FHTSTR0525 Station 16


FHTSTR0525 Station 17


FHTSTR0525 Station 18


FHTSTR0525 Station 19


FHTSTR0525 Station 20


FHTSTR0525 Station 21