Alexandra Basin Redevelopment 2

Bringing Dublin Port To 2040

Environmental Impact Assessment Report

Appendix 7-1 Benthic Ecological Survey Report

Volume 3



CALAFORT ÁTHA CLIATH
DUBLIN PORT

TETRA TECH

Tetra Tech RPS

Alexandra Basin

Benthic Ecological Survey Report

Tracy Paul, Maeve Glynn, Amber Devaney, Caitríona McMahon, Jake Shiel, Aisling Hearty, & Eddie McCormack

AQUAFACT Ref: P00017778

February 2026

COMMERCIAL IN CONFIDENCE

Client: Tetra Tech RPS

Address: Elmond House,

74 Boucher Road,

Belfast BT12 6RZ

Reference no: P17778

Date of issue: 26 February 2026

AQUAFACT contact: Dr Eddie McCormack

Position: Associate Director

E-mail: eddie@aquafact.ie

Telephone: +353 (0) 91 756812

Website: www.aquafact.ie

Address: AQUAFACT International Services Ltd,

9A Liosban Business Park,

Tuam Road,

Galway,

Ireland.

H91 K120

Registered in Ireland: No. 493496

Tax Reference Number: 9773384O

Tax Clearance Number: 559674

Report Approval Sheet

Client	**Tetra Tech RPS**
Report Title	**Alexandra Basin Benthic Ecological Survey Report**
Job Number	**JN1880/P00017778**
Report Status	**Final**
Issue Date	**26 February 2026**

Rev	Status	Issue Date	Document File Name	Author (s)	Approved by:
1	Draft 1	21/08/2024	JN1880 P17778 RPS Alexandra Basin Benthic Ecological Survey Report_draftv1	Tracy Paul	E. McCormack
2	Draft 2	04/12/2025	JN1880 P17778 RPS Alexandra Basin Benthic Ecological Survey Report_draftv2	Tracy Paul	E. McCormack
3	Draft 3	10/12/2025	JN1880 P17778 RPS Alexandra Basin Benthic Ecological Survey Report_draftv3	Tracy Paul	S. O'Boyle
4.	Draft 4	13/02/2026	JN1880 P17778 RPS Alexandra Basin Benthic Ecological Survey Report_draftv4	Tracy Paul	E. McCormack

Table of Contents

1. Introduction **1**

2. Materials & Methods **4**

2.1 Video Survey (Drop-Down Video) 4

2.1 Remote Operated Vehicle (ROV) Survey 6

2.2 Benthic Grab Survey 7

2.2.1 Benthic Grab Survey 9

2.3 Lab Analysis 10

2.3.1 Sediment Processing.....10

2.4 Data Analysis 12

2.4.1 Sediment Data 12

2.4.2 Faunal Data.....12

2.4.3 Video & Image Stills Data.....15

2.4.4 Assigning Biotopes (JNCC) & EUNIS Assemblage.....15

3. Results **18**

3.1 Drop-Down Video 18

3.1.1 Station 1 (navigational channel adjacent to Thomas Clarke Bridge).....20

3.1.2 Station 9 (Alexandra Basin East).....22

3.1.3 Station 11 (Navigational channel adjacent to Poolbeg Yacht Club Marina).....25

3.1.4 Station 12 (Navigational channel just outside Alexandra Basin East and before West Oil Jetty) 27

3.1.5 Station 13 (Alexandra Basin West) 30

3.1.6 Station 14 (East Oil Jetty).....33

3.2 Remote Operated Vehicle (ROV) Survey (Berth 52/53) 35

3.2.1 Station 1a 36

3.2.2 Station 1b 37

3.2.3 Station 2 40

3.2.4 Station 7 41

3.2.5 Station 9 44

3.2.6 Station 12 46

3.3 Benthic Fauna Results 49

3.3.1 Univariate Results 49

3.3.2 Multivariate Results 51

3.4 Sediment Results 54

4. Comparison of survey results (2020 & 2025) 58

5. Discussion 60

5.1 Impacts of Capital Dredging at Alexandra Basin West and infilling at Berth 52/53 61

6. Conclusion 65

7. References 66

8. Appendices 68

Table of Figures

Figure 1.1: Stations surveyed within the Project area, Dublin Bay Port, Dublin, Co. Dublin. 3

Figure 2.1: DDV transects surveyed within Dublin Port, Co. Dublin. 5

Figure 2.2: Location of ROV transects surveyed within infill area of Berth 52/53. 6

Figure 2.3: Planned and final grab sample locations in Dublin Port, Co. Dublin. 8

Figure 3.1: Biotope from DDV survey within Dublin Port, Co. Dublin. 19

Figure 3.2: Transect 1 – Soft muddy substrate with crinoids and litter. 20

Figure 3.3: Transect 1 – Soft muddy substrate with crinoids and shore crab (*Carcinus maenus*) 20

Figure 3.4: Transect 1 – Soft muddy substrate with infaunal burrows. 21

Figure 3.5: Transect 1 – Soft muddy substrate with burrowing tube anemone (*Synarachnactis lloydii).* 21

Figure 3.6: Transect 9 – Soft muddy substrate with hydroids and drift green algae. 22

Figure 3.7: Transect 9 – Soft muddy substrate with swimming crab (*Polybius* sp.). 23

Figure 3.8: Transect 9 – Soft muddy substrate with fish (Gobidae) and drift green algae. 23

Figure 3.9: Transect 9 – Soft muddy substrate with fish (Gobidae). 24

Figure 3.10: Transect 9 – Soft muddy substrate with burrowing tube anemone (*Synarachnactis lloydii*). 24

Figure 3.11: Transect 11 – Soft muddy substrate with leaf detritus. 25

Figure 3.12: Transect 11 – Soft muddy substrate. 26

Figure 3.13: Transect 11 – Soft muddy substrate with infaunal burrows. 26

Figure 3.14: Transect 12 – Soft muddy substrate with drift red and green algae. 27

Figure 3.15: Transect 12 – Soft muddy substrate with tunicates (*Ascidiella* sp.) 28

Figure 3.16: Transect 12 – Cobble substrate with soft muddy sediment. Cobbles with Serpulid worms, sponges, and hydroids. 28

Figure 3.17: Transect 12 – Soft muddy substrate with scattered cobbles covered with Serpulid worms, hydroids, and tunicates (*Ascidiella* sp.). 29

Figure 3.18: Transect 13 – Soft muddy substrate. 30

Figure 3.19: Transect 13 – Soft muddy substrate with edible crab (*Cancer pagurus*). 31

Figure 3.20: Transect 13 – Soft muddy substrate with crabs and crinoids moving along with a drifting kelp frond. 31

Figure 3.21: Transect 13 – Soft muddy substrate with crinoids and *Macropodia spp*. on drift macroalgal debris. 32

Figure 3.22: Transect 13 – Soft muddy substrate with a crinoid. 32

Figure 3.23: Transect 14 – Soft muddy substrate with some drifting debris/litter. 33

Figure 3.24: Transect 14 – Soft muddy substrate with crab. 34

Figure 3.25: Transect 14 – Soft muddy substrate with some drift Kelp fronds. 34

Figure 3.26: Transect 14 – Soft muddy substrate with crab (*Polybius* sp.). 35

Figure 3.27: ROV Transect 1a - Muddy sediment with draft algae. 36

Figure 3.28: ROV Transect 1a - Muddy sediment with tube anemone (*Synarachnatis lloydii*). 36

Figure 3.29: ROV Transect 1a - Mixed sediment with sparse cobbles and pebbles. 37

Figure 3.30: Transect 1b - Rock armour with growth of macroalgae. 38

Figure 3.31: Transect 1b - Boulder with drift macroalgae on muddy sediment. 38

Figure 3.32: Transect 1b - Muddy sediment infauna burrows. 39

Figure 3.33: Transect 2 - Quay wall with bryozoan and hydroid growths. 40

Figure 3.34: Transect 2 - Quay wall with bryozoan and hydroid growth. 40

Figure 3.35: Transect 2 - Muddy sediment fauna transects and litter in the background. 41

Figure 3.36: Transect 7 – Section of quay wall with growth of bryozoans and hydroids. 42

Figure 3.37: Transect 7 – Boulders with barnacle colonies (possibly dead). 42

Figure 3.38: Transect 7 – Mixed sediment with cobbles, pebbles, sand, and mud. 43

Figure 3.39: Transect 9 – Muddy sediment with fauna burrows. 44

Figure 3.40: Transect 9 – Solitary crab with macroalgae. 44

Figure 3.41: Transect 9 – Silt covered macroalgae. 45

Figure 3.42: Transect 12 – Muddy sediment with drift algae and a swimming Goby fish. 46

Figure 3.43: Transect 12 – High turbidity and a solitary crab. 46

Figure 3.44: Transect 12 – High siltation and boulders/unidentified structure. 47

Figure 3.45: Spatial distribution of broadscale habitats from DDV and ROV surveys. 48

Figure 3.46: Subtidal community indices. Diversity is expressed in Effective Number of Species (ENS), Shannon-Wiener Diversity Index and Simpson's Diversity Index. 50

Figure 3.47: Dendrogram produced from Cluster analysis of the data. 52

Figure 3.48: MDS Plot produced from analysis of the data. 52

Figure 3.49: Distribution of biotopes from grab sample faunal analysis. 53

Figure 3.50: A breakdown of sediment type fraction (%) at each of the station sampled. 56

Figure 3.51: Sediment Classification across stations sampled according to Folk (1954). 57

List of Tables

Table 2.1: Locations of Drop-Down Video stations. 4

Table 2.2: Grab station locations 7

Table 2.3: The classification of sediment particle size ranges into size classes (adapted from Buchanan, 1984). 10

Table 3.1: The biotope classifications (JNCC 2024) identified for each Drop-down video station. 18

Table 3.2: The habitat classification (EUNIS) identified for each ROV station. 35

Table 3.3: Univariate measures of community structure for the subtidal samples. 50

Table 3.4: Sediment characteristics of the benthic subtidal faunal stations sampled. LOI refers to the % organic carbon loss on ignition 55

Table 5.1: Sensitivity Assessment of Biotopes based on potential impacts from ABR2 Project. 62

List of Appendices

Appendix 1: Standard Field Operating Procedure (T2-SOP-Field Methods-04)

Appendix 2: Species List (2025)

1. Introduction

The Alexandra Basin Redevelopment (ABR) Project was the first major capital development project application submitted to An Coimisiún Pleanála (ACP) by Dublin Port Company (DPC) from the Dublin Port Masterplan 2040 (PL 29N.PA0034). The application for permission was lodged with ACP on 6th March 2014 as prescribed under Section 37E of the Planning and Development Act 2000, as amended, in accordance to plans and particulars, including an Environmental Impact Statement (EIS) and Natura Impact Statement (NIS). The Planning Application was subject to a 'Request for Further Information' (RFI) and Oral Hearing. Permission for development was granted for the ABR Project on 8th July 2015 for a period of 10 years. For numerous factors, including the Covid-19 global pandemic, the construction phase is yet to be fully completed. A new planning application (including Environmental Impact Assessment Report (EIAR) and NIS) will be submitted for the remaining elements of the ABR2 project to be completed. The planning application will request a duration of 10 years and will be in line with the conditions imposed under the current IE Licence and Foreshore Licence.

The ABR2 Project comprises capital dredging of Alexandra Basin West, to facilitate necessary berthing depth and navigational requirements, together with the treatment and reuse of dredged sediment to infill the basin at Berth 52/53. These works represent capital development activities rather than routine maintenance dredging and will be undertaken in accordance with the existing Industrial Emissions (IE) Licence and Foreshore Licence held by DPC.

Alexandra Basin is located in the north-eastern part of Dublin Bay which is a significantly modified section of Dublin Port. It is bordered by quay walls and artificial shoreline. The seabed composition is predominantly fine sediments (silt and sand) with elevated levels of organic content, reflecting low hydrodynamic energy conditions and historic organic enrichment. Bathymetry data indicates that the basin has relatively uniform depth profiles within the dredged channel and turning basin, with typical depths ranging from -7 m to -10 m Chart Datum (INFOMAR) depending on previous dredging phases. Tidal influence is dominant, with semi-diurnal tides producing strong bidirectional flows. The area is exposed to moderate wind and wave action, though relatively sheltered by surrounding port infrastructure. INFOMAR data suggests limited natural bedforms due to historical dredging and sediment disturbance.

Extensive benthic ecological surveys have previously been undertaken within Alexandra Basin to support earlier planning applications and dredging programmes, most notably, surveys carried out by the Aquatic Services Unit (ASU) in 2013 (to support the original ABR EIS), 2020, and subsequent maintenance dredging assessments. These studies included benthic grab sampling within Alexandra Basin West, the main navigation channel, and importantly within the Berth 52/53 basin, which is now proposed for infilling under ABR2. The findings of these surveys consistently identified a limited number of benthic biotopes characterised by

organically enriched sediments and opportunistic infaunal assemblages, with no Annex I habitats or benthic species of conservation concern recorded within the basin.

In 2025, a further benthic ecological survey was commissioned by Tetra Tech RPS on behalf of Dublin Port Company and undertaken by AQUAFACT to provide an updated and comparative assessment of benthic conditions within Alexandra Basin. The purpose of this survey was not to provide a full standalone characterisation of all ABR2 impact areas, but rather to:

- confirm the continued presence and condition of benthic habitats previously recorded within the basin,
- assess whether any material change in benthic community structure has occurred since earlier surveys, and
- provide updated data to support the Biodiversity, Flora and Fauna chapter of the EIAR.

The 2025 survey comprised a drop-down video (DDV) survey across Alexandra Basin and associated channels, together with targeted benthic grab sampling for faunal analysis and sediment characterisation (particle size analysis and organic carbon). Grab sampling coverage within Alexandra Basin West was necessarily limited due to navigational constraints and the disturbed nature of the seabed, and no grab sampling was undertaken within the Berth 52/53 basin itself. Accordingly, the assessment of benthic conditions within the infill area relied primarily on the robust baseline established by the 2013 ASU survey, supplemented by comparative analysis of the 2020 and 2025 datasets to demonstrate the persistence and stability of benthic habitat types across the wider basin.

While the revised report now clearly acknowledges this limitation and relies on the robust 2013 dataset to inform the EIAR assessment for the infill area, we recognise the value of providing updated confirmation of current conditions at Berth 52/53. To address this, a targeted ROV survey was conducted of the infill area in January 2026. This survey would provide visual confirmation that seabed conditions and habitat characteristics remain consistent with those previously recorded. A total of 6 transects were surveyed representing a relatively good coverage of the benthic community assemblage within the infill area of Berth 52/53 (see **Section 2.1**).

This report therefore presents the results of the 2025 and 2026 surveys in the context of previous benthic investigations and provides a comparative, evidence-based assessment of benthic habitats and communities relevant to the ABR2 Project. The findings are intended to inform the EIAR by confirming baseline conditions, identifying the sensitivity of the benthic environment to the proposed capital dredging and infilling works, and

supporting conclusions regarding the absence of sensitive habitats or species that would constrain the proposed development.

This benthic ecological report provides the results of these surveys which took place on the 30th of May 2025 (DDV and grab survey) and 30th January 2026 (ROV survey). The study area is illustrated in **Figure 1.1.**

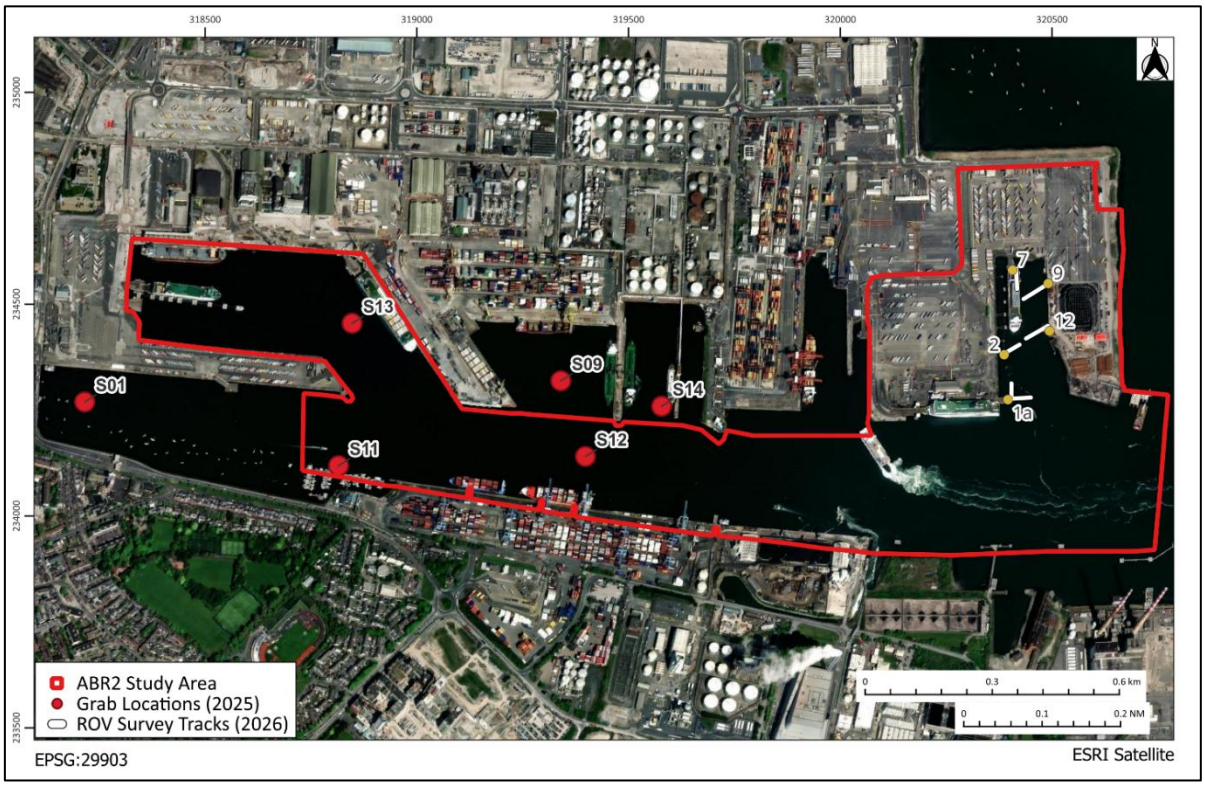


Figure 1.1: Stations surveyed within the Project area, Dublin Bay Port, Dublin, Co. Dublin.

2. Materials & Methods

2.1 Video Survey (Drop-Down Video)

The DDV survey was conducted to assess the suitability of the subtidal substrate for a benthic faunal and sediment contaminants survey. The video survey also served to complement the faunal community assessment in classifying the biotopes present in the survey area.

The video survey was carried out on the 30th of May 2025 from the Ros Áine vessel using the STR SeaSpyder Nano Underwater Drop Camera System. The equipment, consisting of camera, umbilical, and video overlay software was deployed through a snatchblock attached to the A-frame of the vessel and was lowered manually. The live footage was monitored and instruction given on whether to raise or lower the unit.

At each location the camera was lowered on approach to the proposed sampling position. The vessel would then pass over the point and continue along its transect line. The visibility was relatively poor but six DDV transects were carried out, with a second attempt at Station 11.

The start locations of each DDV survey are provided in **Table 2.1** and the DDV transects are displayed in **Figure 2.1.**

Table 2.1: Locations of Drop-Down Video stations.

Station	Latitude (N)	Longitude (W)
1	53.34497637	6.22232202
9	53.34582425	6.20930428
11	53.34545856	6.20937942
12	53.34534574	6.20936538
13	53.34545841	6.2092339
14	53.34530633	6.20932347



Figure 2.1: DDV transects surveyed within Dublin Port, Co. Dublin.

2.1 Remote Operated Vehicle (ROV) Survey

The infill area at Berth 52/53 was surveyed in 2026 to provide visual confirmation that seabed conditions and habitat characteristics remain consistent with those previously recorded. A total of 6 transects out of 13 were surveyed representing a relatively good coverage of the benthic community assemblage within the infill area of Berth 52/53 (see **Figure 2.2**). Various constraints including working around vessel activity in the berths limited the number of transects that could be surveyed at the time.



Figure 2.2: Location of ROV transects surveyed within infill area of Berth 52/53.

2.2 Benthic Grab Survey

All benthic grab samples were undertaken on the same day. The potential grab stations were confirmed during the drop-down video surveys on the 30th of May 2025. From the video survey, each station was assessed for suitability for grab sampling based on the standard operating procedure (SOP) for station selection for benthic sampling using drop-down video survey (T2-SOP-Field Methods-04 - **Appendix 1**). The SOP was followed on the vessel to identify and assess suitability of substrates prior to benthic sampling. Decisions on whether sampling was to be carried out at a location was based on the following criteria:

- Presence or absence of biogenic and non-biogenic reefs (**No Reef present in survey area)**
- Sampling would also not be carried out in areas where the presence of fauna or flora could be adversely impacted by the sampling
- The suitability of sediment type for grab sampling.
- Any other considerations that could impact the surrounding environment or affect benthic sampling

The grab station coordinates are provided in **Table 2.2**. The 0.1 m^2 Day Grab was used to sample the stations. **Figure 2.3** below also shows the locations where sediment was taken for sediment chemistry and macroinvertebrate community analyses.

Table 2.2: Grab station locations

Station	Latitude	Longitude	Sediment analysis	Fauna
1	53.34567667	-6.225701667	Yes	Yes
9	53.34587167	-6.208808333	Yes	Yes
11	53.34419167	-6.216760000	Yes	Yes
12	53.34425667	-6.208003333	Yes	Yes
13	53.34720333	-6.216155000	Yes	Yes
14	53.34528	-6.205258333	Yes	Yes

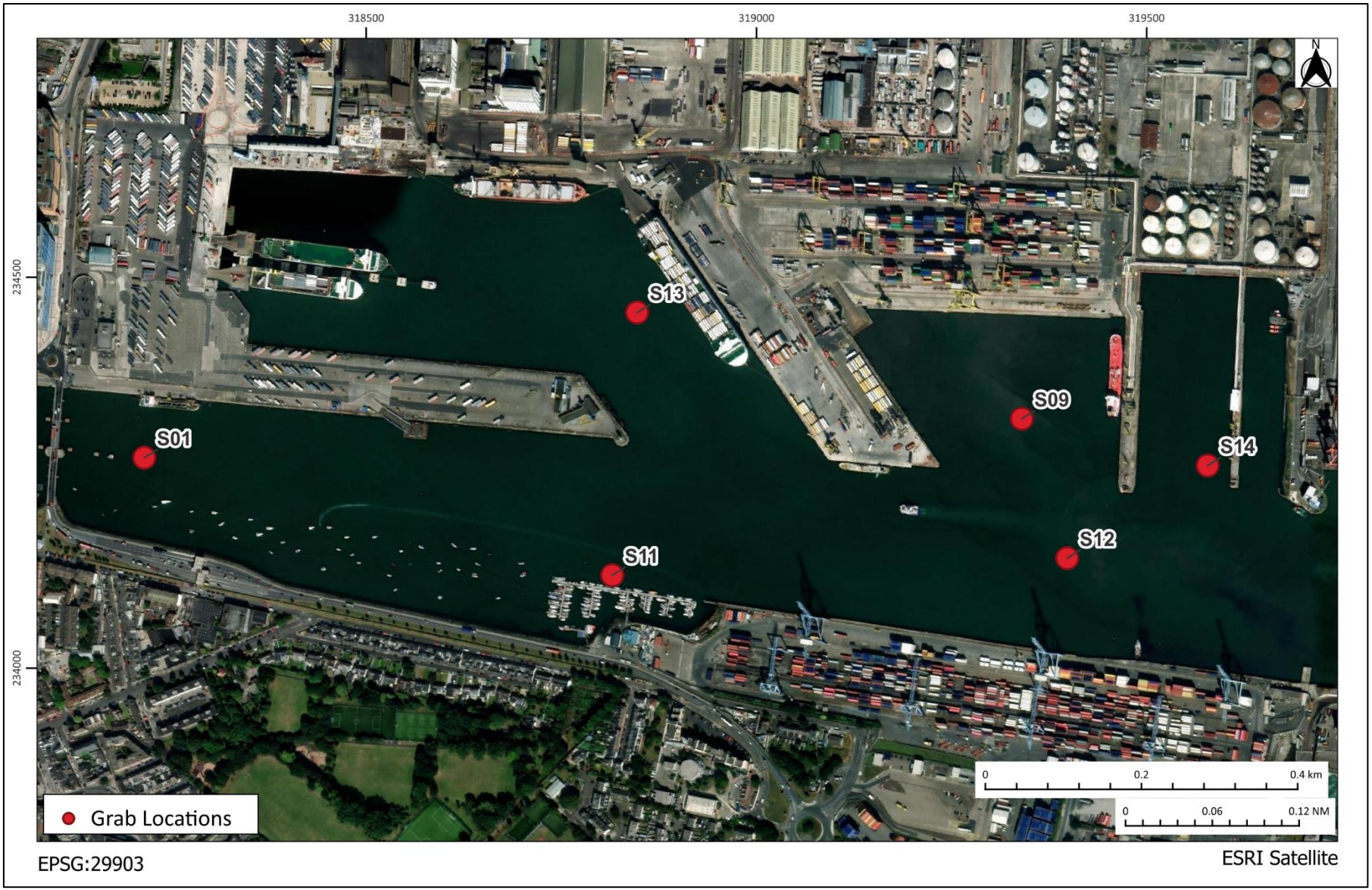


Figure 2.3: Planned and final grab sample locations in Dublin Port, Co. Dublin.

2.2.1 Benthic Grab Survey

2.2.1.1 Biological Sampling

In-house SOPs were followed for benthic fauna sampling. Macroinvertebrate analyses were carried out as per the Northeast Atlantic Marine Biological Analytical Quality Control (NMBAQC) standard for benthic sampling and analysis (Worsfold *et al.,* 2010). The subtidal biological samples were collected using the 0.1 m^2 Day Grab sampler**.** The stations deemed suitable for sampling with AQUAFACT's Day Grab are listed in **Table 2.2** which also lists the types of samples collected.

On arrival at each sampling station, the vessel location was recorded using DGPS (Lat/Long & ING). A total of six sites were sampled for faunal analysis with two faunal grabs (total of 12 fauna samples) and one sediment grab collected for sediment physical and chemical characteristics at each site (total of six sediment grabs). The grab deployment and recovery rates did not exceed 1 metre/sec and were <0.5 m/sec for the last 5 metres for water depths up to 30 m and for the last 10 m for depths greater than 30 m.

A digital image of each sample (including the sample label) was taken, and its reference number was entered in the sample data sheet. These images can be made available on request. The grab sampler was cleaned between stations to prevent cross contamination.

Each grab sample was carefully and gently sieved on a 1 mm mesh sieve as a sediment water suspension for the retention of fauna. Great care was taken during the sieving process in order to minimise damage to taxa such as spionids, scale worms, phyllodocids and amphipods. The sample residue was carefully flushed into a pre-labelled (internally and externally) container from below. Each label contained the sample code and date. The samples were stained immediately with Rhodamine 110 (biological staining agent) and fixed with 4% w/v buffered formaldehyde solution (10% w/v buffered formaldehyde solution for very organic mud).

All grab returns were sieved on a 1 mm mesh sieve and fixed in 6% w/v buffered formalin solution upon returning to the laboratory (within 24 hours).

2.2.1.2 Sediment Sampling

For the sediment samples, a sample was retrieved from the grab for granulometric analysis. A further sediment subsample was retrieved from the grab for Loss on Ignition (LOI) organic carbon content analysis. The samples were placed in plastic sampling bags and labelled internally and externally. These samples were frozen (<-18°C) as soon as possible after acquisition.

2.3 Lab Analysis

2.3.1 Sediment Processing

2.3.1.1 Sediment Processing

The sediment Particle Size Analysis (PSA) was carried out in AQUAFACT Labs, as described in **Section 2.3.1.2** below, while sediment organic carbon content analysis was carried out by ALS Ltd., Loughrea, Co. Galway, using the LoI technique (see **Section 2.3.1.3** below for further details).

2.3.1.2 Particle Size Analysis

The PSA was carried out in-house using the following methodology:

1. Frozen sediment samples (collected in freezer bags/tubs) were left to defrost in the lab area/wet area overnight before processing began. Ambient samples were processed upon arrival to the lab.
2. Each collected sediment sample (wet) was carefully transferred to a small dish and labelled with the individual sample code and project number. Dishes were placed in a dehydrator/oven for drying at approximately 50˚C for 24 – 48 hours until no moisture remained in the samples.
3. The dried sediment from each sample was then passed through a Retsch EasySieve - a Wentworth series of analytical sieves (>8000 to 63 µm; single phi units). The weight of material retained in each sieve was weighed and recorded. Note: If the sample is particularly coarse, the sample is first passed through an 8 mm sieve and the weight of the material retained is recorded. The remainder of the sample (<8 mm) is then passed through the EasySieve.
4. The following range of particle sizes: <63 µm, 63<125 µm, 125<250 µm, 250<500 µm, 500<1000 µm, 1000<2000 µm, 2000<4000 µm and 4000<8000 µm were reported and results were analysed using the Folk Classification method (Folk, 1954).

Table 2.3 shows the classification of sediment particle size ranges into size classes. Sieves, which corresponded to the range of particle sizes, were used in the analysis.

Table 2.3: The classification of sediment particle size ranges into size classes (adapted from Buchanan, 1984).

Range of Particle Size	Classification	Phi Unit
<63µm	Silt/Clay	>4 Ø
63-125 µm	Very Fine Sand	4 Ø, 3.5 Ø
125-250 µm	Fine Sand	3 Ø, 2.5 Ø
250-500 µm	Medium Sand	2 Ø, 1.5 Ø
500-1000 µm	Coarse Sand	1 Ø, 1.5 Ø
1000-2000 µm (1 – 2mm)	Very Coarse Sand	0 Ø, -0.5 Ø

Range of Particle Size	Classification	Phi Unit
2000 – 4000 µm (2 – 4 mm)	Very Fine Gravel	-1 Ø, -1.5 Ø
4000 -8000 µm (4 – 8 mm)	Fine Gravel	-2 Ø, -2.5 Ø
8 -64 mm	Medium, Coarse & Very Coarse Gravel	-3 Ø to -5.5 Ø
64 – 256 mm	Cobble	-6 Ø to -7.5 Ø
>256 mm	Boulder	< -8 Ø

2.3.1.3 Loss On Ignition (Total Organic Carbon)

The methodology outlined below was followed. All organic matter samples were sent to ALS Laboratory (Loughrea) for analysis. The following methodology was used:

1. Each collected sediment sample was transferred to a small dish and dried in a food dehydrator/oven at 50˚C for 24 – 48 hours.
2. The sample of dried sediment was placed in a mortar and pestle and ground down to a fine powder. This powder was transferred to a small vial and labelled with the sample code, project code, and LOI analysis. Sample vials were delivered to ALS Loughrea with relevant documentation.
3. Upon arrival at ALS, 1 g of each sediment sample was weighed into a pre-weighted crucible and placed in a muffle furnace at 450˚C for a period of 6 hours.
4. The sediment samples were then allowed to cool in a desiccator for 1 hour before being weighed again.
5. The organic content of the sample was determined by expressing, as a percentage, the weight of the sediment after ignition over the initial weight of the sediment.

2.3.1.4 Fauna Sample processing

All faunal samples were placed in an illuminated shallow white tray and sorted first by eye to remove large specimens and then sorted under a stereo microscope (x10 magnification). Following the removal of larger specimens, the samples were placed into Petri dishes, approximately one-half teaspoon at a time and sorted using a binocular microscope at x25 magnification.

The faunal samples were sorted into four main groups: Annelida, Mollusca, Arthropoda, and others. The ‘others’ group consisted of echinoderms, nematodes, nemerteans, cnidarians, and other lesser phyla. The fauna was maintained in stabilised 70% industrial methylated spirit (IMS) following retrieval and identified to

species level where practical using a binocular microscope, a compound microscope and all relevant taxonomic keys. After identification and enumeration, specimens were pooled and stored station level.

2.4 Data Analysis

2.4.1 Sediment Data

Organic content of sediment samples was determined for each sample by expressing it as a percentage the sediment weight loss following combustion over the initial weight of the sediment. In general, Loss of carbon Ignition (LOI) correlates with sediment particle size with fine-grained sediments typically containing higher levels of organic matter than coarse sediments.

For the granulometric analysis of sediment samples, the <63 µm (Silt-Clay) fraction was determined by weight loss following wet sieving. Coarser fractions comprising the sediment samples were determined by mechanical dry sieving through a series of Wentworth sieves; >4 mm (Fine Gravel), 2-4 mm (Very Fine Gravel), 1-2 mm (Very Coarse Sand), 0.5-1 mm (Coarse Sand), 0.25-0.5 mm (Medium Sand), 125-250 µm (Fine Sand), 62.5-125 µm (Very Fine Sand). For each station, the weight of each fraction of the sediment retained on the sieve was expressed as a percentage of the total sample. The relative proportion of sediments in each fraction was used to classify sediments at the station *sensu* Folk (1954).

2.4.2 Faunal Data

Uni- and multi-variate statistical analysis of the faunal data was undertaken using PRIMER v.6 (Plymouth Routines in Ecological Research).

2.4.2.1 Univariate Analysis

Using PRIMER, the faunal data was used to produce a range of univariate indices. Univariate indices are designed to condense species data in a sample into a single coefficient that provides quantitative estimates of biological variability (Heip *et al.*, 1998; Clarke and Warwick, 2001). Univariate indices can be categorised as primary or derived indices.

Primary biological indices used in the current study include:

- number of taxa (S) in the samples and
- number of individuals (N) in the samples.

Derived biological indices, which are calculated based on the relative abundance of species in samples, used in the study include:

- Margalef's species richness index (D) (Margalef, 1958),

$$D = \frac{S-1}{\log_2 N}$$

where: N is the number of individuals and S is the number of species

Margalef's species richness (D) is a measure of the total number of species present for a given number of individuals.

- Pielou's Evenness index (J) (Pielou, 1977)

$$J = \frac{H'(observed)}{H'_{max}}$$

where: H'_{max} is the maximum possible diversity, which could be achieved if all species were equally abundant (= $\log_2 S$)

Pielou's evenness is a measure of how evenly the individuals are distributed among different species.

- Shannon-Wiener diversity index (H') (Pielou, 1977)

$$H' = -\sum_{i=1}^{S} p_i (\log_2 p_i)$$

where: p_I is the proportion of the total count accounted for by the i^{th} taxa

Shannon-Wiener diversity index takes both species abundance and species richness into account quantify diversity (Shannon & Wiener, 1949).

- Simpson's Diversity Index (Simpson, 1949)

$$1-\lambda' = 1-\{\Sigma_i N_i(N_i-1)\} / \{N(N-1)\}$$

where N is the number of individuals of species i.

- The Shannon-Wiener based Effective Number of Species (ENS) (Hill, 1973; Jost, 2006)

$$H = \exp(H')$$

where H' is the Shannon-Wiener diversity index.

The Shannon-Wiener index diversity index is converted to ENS to reflect 'true diversities' (Hill, 1973, Jost, 2006) that can then be compared across communities (MacArthur, 1965; Jost, 2006). The ENS is equivalent to the number of equally abundant species that would be needed in each sample to give the same value of a diversity index, *i.e.,* Shannon-Wiener Diversity index. The ENS behaves as one might intuitively expect when diversity is doubled or halved, while other standard indices of diversity do not (Jost, 2006). If the ENS of one community is twice that of another, then it can be said that the community is twice as diverse as the other.

2.4.2.2 Multivariate Analysis

The PRIMER programme (Clarke & Warwick, 2001) was used to carry out multivariate analyses on the station-by-station faunal data. All species abundance data from the grab surveys was square root transformed and used to prepare a Bray-Curtis similarity matrix in PRIMER. The square root transformation allows some of the less abundant species to play a part in the similarity calculation. Various ordination and clustering techniques can then be applied to the similarity matrix to determine the relationship between the samples.

Multidimensional scaling (MDS) is a technique that ordinates samples as points in 2D or 3D space based on similarity in species distribution data. MDS performed on the Bray-Curtis similarity matrix produce ordination maps whereby the placement of samples reflects the similarity of their biological communities, rather than their simple geographical location (Clarke & Warwick, 2001).

An indication of how well the similarity matrix is represented by the ordination is given by stress values calculated by comparing the interpoint distances in the similarity matrix with the corresponding interpoint distances on the ordinations. Perfect or near perfect matches are rare in field data, especially in the absence of a single overriding forcing factor such as an organic enrichment gradient. Stress values increase, not only with the reducing dimensionality (lack of clear forcing structure), but also with increasing quantity of data (it is a sum of the squares type regression coefficient). Clarke & Warwick (2001) have provided a classification of the reliability of MDS plots based on stress values, having compiled simulation studies of stress value behaviour and archived empirical data.

This classification generally holds well for ordinations of the type used in this study. Their classification is given below:

- Stress value < 0.05: Excellent representation of the data with no prospect of misinterpretation.
- Stress value < 0.10: Good representation, no real prospect of misinterpretation overall structure, but very fine detail may be misleading in compact subgroups.
- Stress value < 0.20: This provides a useful picture, but detail may be misinterpreted, particularly nearing 0.20.

- Stress value 0.20 to 0.30: This should be viewed with scepticism, particularly in the upper part of the range, and discarded for a small to moderate number of points such as < 50.
- Stress values > 0.30: The data points are close to being randomly distributed in the ordination and not representative of the underlying similarity matrix.

Each stress value must be interpreted both in terms of its absolute value and the number of data points. In the case of this study, the moderate number of data points indicates that the stress value can be interpreted more or less directly. While the above classification is arbitrary, it does provide a framework that has proved effective in this type of analysis.

Hierarchical Agglomerative Clustering (HAC) is used to cluster samples based on between-sample similarities into groups in dendrograms. Similarity Profiling (SIMPROF) is used to test if differences between HAC derived similarity-based clusters are significant. Similarity Percentages (SIMPER) analysis can be used to determine the characterising species of each cluster of stations identified either arbitrarily (by eye) from HAC dendrograms or statistically using SIMPROF testing (Clarke and Warwick, 2001; Clarke and Gorley, 2006; Anderson *et al*., 2008).

The species, which are responsible for the grouping of samples in CLUSTER analyses, were identified using the PRIMER programme SIMPER (Clarke & Warwick, 1994). This programme determined the percentage contribution of each species to the dissimilarity/similarity within and between each sample group.

2.4.3 Video & Image Stills Data

The video and stills data were analysed following the JNCC Guidance on Assigning Benthic biotopes using EUNIS or the Marine Habitat Classification of Britain and Ireland (Parry, 2019). However, statistical analyses are not applied to species identified from video and still images data as the species identification and number is usually of low resolution. The video data provides a broader picture of the habitat while the image stills allow identification of smaller and less conspicuous species over smaller areas. The video and stills data capture different sections of the community and as a result they are analysed separately. Generally, for each species identified from the video or stills, both abundance and SACFOR is provided per video section or per still, but sometimes only presence/absence is used.

2.4.4 Assigning Biotopes (JNCC) & EUNIS Assemblage

After analysis, the data from the infauna identified are then matched with the broadscale habitats (EUNIS) data derived from particle size analysis and video/still data and a biotope is assigned according to the Marine Habitat Classification of Britain and Ireland (Parry, 2019). The biotope name assigned to data should accurately

describes the physical environment as well as the biological community. The following steps are followed to assign biotope:

(i) Select physical zone for each sampling point based on depths, light, indicator species, geospatial maps (EMODnet Seabed Habitats Map Viewer).

(ii) Define substrate category (rock, coarse, sediment, missed sediment, sand and muddy sand, and mud and sandy mud). The four sediment categories depend on the relative proportions of mud, sand, and gravel as defined in Folk classification (Folk, 1954).

(iii) Check physical samples based on

- PSA.
- Grab images and deck logs to get a broader picture of the sediment retained in the whole grab.
- Cross-check any visual samples taken at the same station (including video footage).

(iv) Check visual samples based on:

- Notes logs.
- Raw data -video footage.
- PSA results.
- Functional traits of species present giving an indication of the substrate type.

(v) Select energy /mobility category for each sample.

For rock samples:

- Check energy regime on field notes.
- Energy category should reflect types of communities present. Select energy category which best fits community present.
- If energy regime cannot be determined from field data, sample points can be overlain onto EUSeaMap energy class layer from EMODnet Seabed Habitats map viewer.

For sediment samples:

- Check mobility of samples.
- Video footage to gauge mobility of sediment.
- Features such as sand ripples can indicate the mobility of sediment.

(vi) Select salinity category for each sample based on notes in logs, geographic location or any salinity readings taken.

For each sample, the faunal communities are identified which is used to refine the description of the biotope. In the situation where there is any mismatch between the biological community and the habitat type, a number of approaches are taken to clearly indicate that the physical environment differs from the description of the biological community present (Parry, 2019).

3. Results

3.1 Drop-Down Video

The DDV survey identified areas suitable for grab survey (for fauna and sediment contaminants). Station numbering is non-sequential as sampling locations were selected to align with historic benthic surveys undertaken within Alexandra Basin, allowing direct temporal comparison of results.

The Alexandra Basin within Dublin Bay is a turbid environment with considerable suspended solids. As a result, visibility was often poor in the video footage. There were only a few images captured to assess the characteristics of the substrate and biotopes along the transects surveyed.

Images of the seabed were captured from the video footage recorded at each of the stations where DDV was deployed. Analysis of the epibenthic communities based on the video footage along with representative still images is presented below. The distance between the green lasers in each image is 20 cm. Full video footage from each recording is available upon request. The photo stills captured from the video transects are poor in resolution due to very high turbidity during the survey. Only usable image stills are presented in this section.

The DDV survey provided sufficient visual details to determine the biotope existing at Alexandra Basin (see **Table 3.1**). The biotope assigned throughout all the stations is 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26). The biotope distribution is illustrated in **Figure 3.1.**

Table 3.1: The biotope classifications (JNCC 2024) identified for each Drop-down video station.

Station	Biotope Code	Biotope Classification
DDV01	SS.SSA.CMuSa	Circalittoral muddy sand
DDV09	SS.SSA.CMuSa	Circalittoral muddy sand
DDV011	SS.SSA.CMuSa	Circalittoral muddy sand
DDV012	SS.SSA.CMuSa	Circalittoral muddy sand
DDV013	SS.SSA.CMuSa	Circalittoral muddy sand
DDV014	SS.SSA.CMuSa	Circalittoral muddy sand



Figure 3.1: Biotope from DDV survey within Dublin Port, Co. Dublin.

3.1.1 Station 1 (navigational channel adjacent to Thomas Clarke Bridge)

Station 1 was composed of muddy sand substrate with drifting red and green algae. Noticeable fauna included shore crabs (*Carcinus maenus*), crinoids, burrowing tube anemone (*Synarachnactis lloydii,* formerly *Cerianthus lloydii*), and fish (Gobidae). Litter was also present along the transect (**Figure 3.2** to **Figure 3.5**). The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).



Figure 3.2: Transect 1 – Soft muddy substrate with crinoids and litter.



Figure 3.3: Transect 1 – Soft muddy substrate with crinoids and shore crab (*Carcinus maenus*)

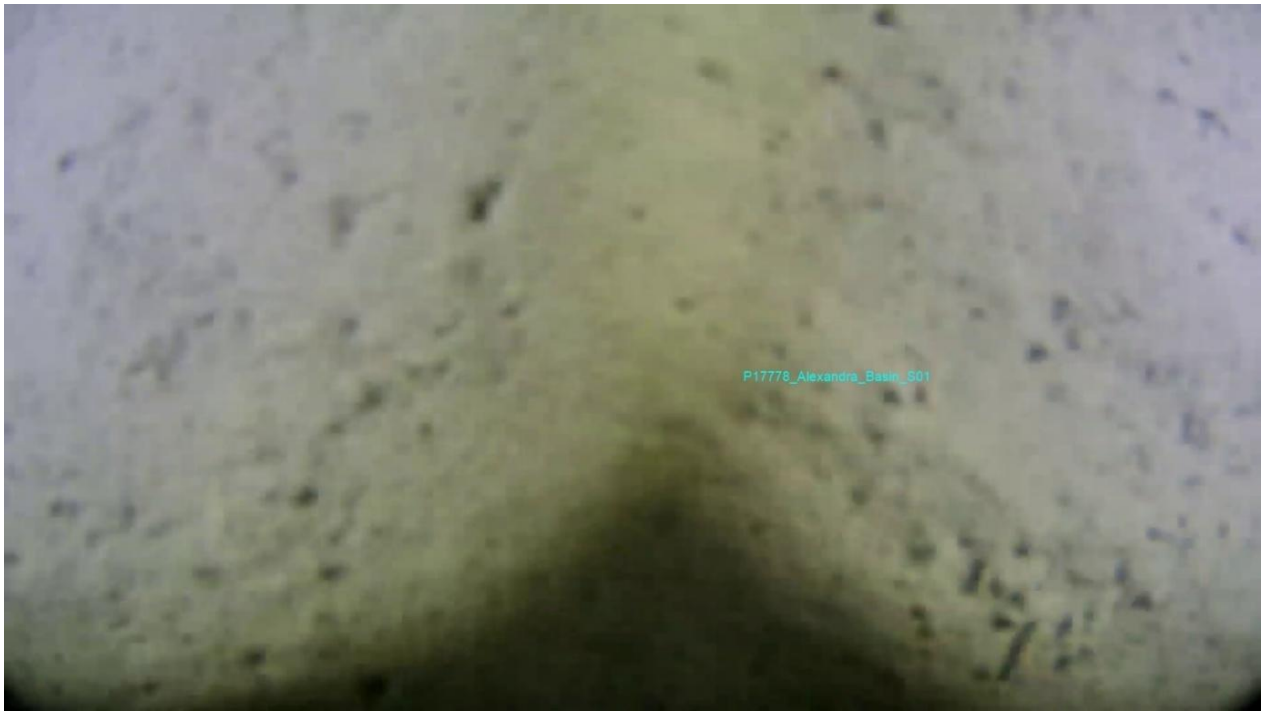


Figure 3.4: Transect 1 – Soft muddy substrate with infaunal burrows.



Figure 3.5: Transect 1 – Soft muddy substrate with burrowing tube anemone (*Synarachnactis lloydii).*

3.1.2 Station 9 (Alexandra Basin East)

Station 9 was composed of muddy sand substrate with drift red and green algae. Noticeable fauna included swimming crabs (*Polybius* spp.), hydroids, burrowing tube anemone (*Synarachnactis lloydii*), and fish (Gobidae) (**Figure 3.6** to **Figure 3.10**). The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).



Figure 3.6: Transect 9 – Soft muddy substrate with hydroids and drift green algae.



Figure 3.7: Transect 9 – Soft muddy substrate with swimming crab (*Polybius* sp.).

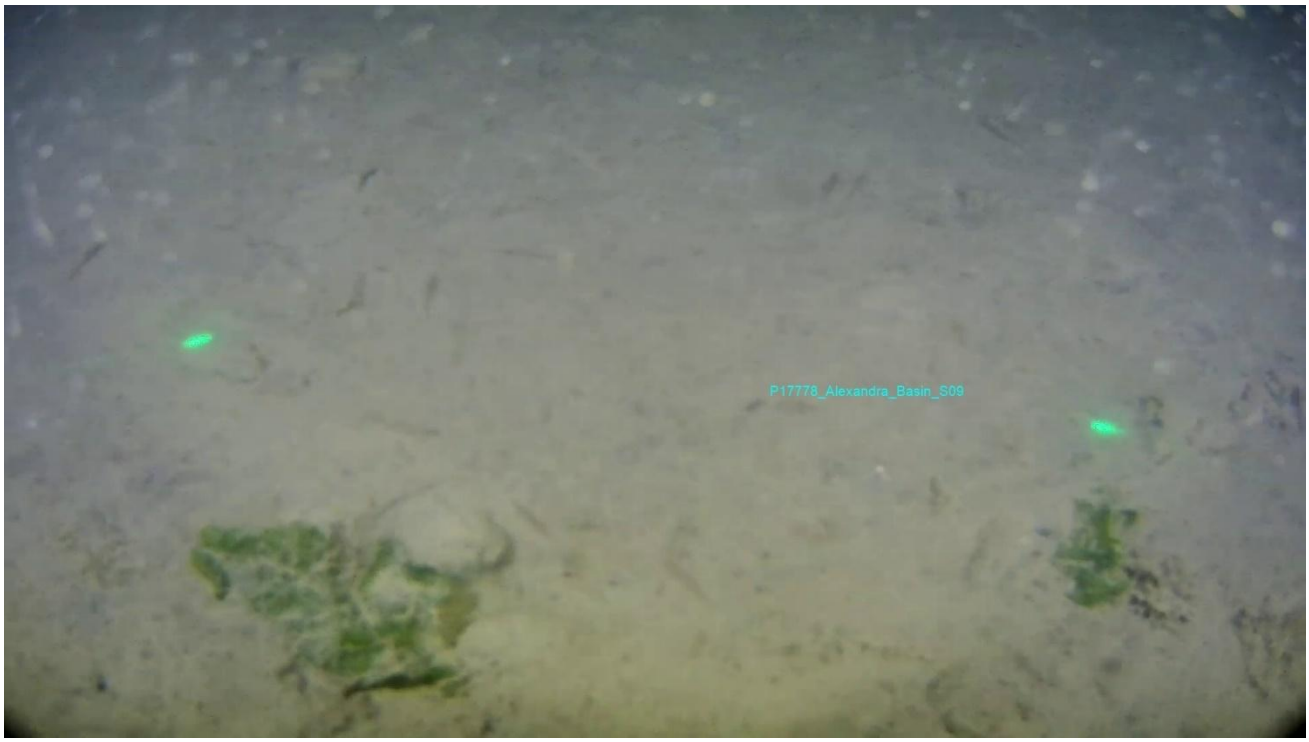


Figure 3.8: Transect 9 – Soft muddy substrate with fish (Gobidae) and drift green algae.



Figure 3.9: Transect 9 – Soft muddy substrate with fish (Gobidae).

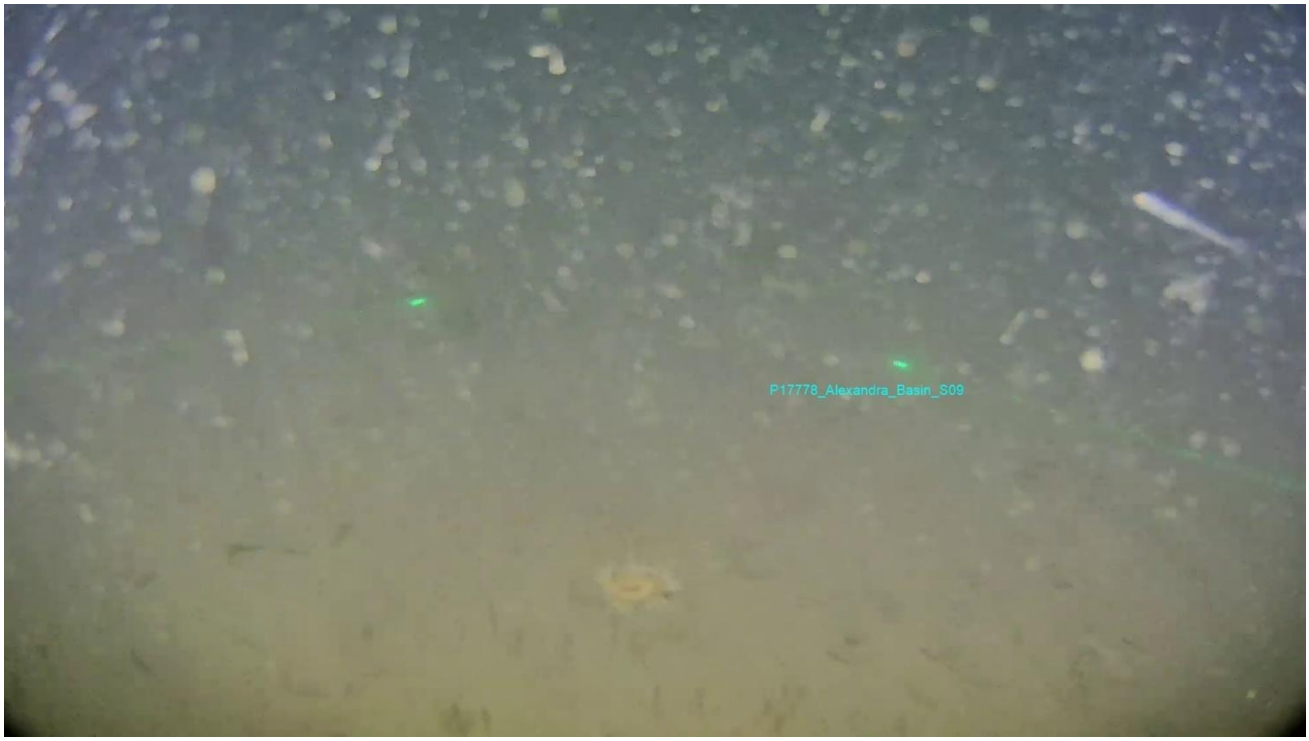


Figure 3.10: Transect 9 – Soft muddy substrate with burrowing tube anemone (*Synarachnactis lloydii*).

3.1.3 Station 11 (Navigational channel adjacent to Poolbeg Yacht Club Marina)

Station 11 was composed of muddy sand substrate and leaf detritus. Noticeable fauna included crabs and fish (Gobidae). The openings of burrows of infauna and the transects of mobile surface fauna were also visible (**Figure 3.11** to **Figure 3.13**). The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).



Figure 3.11: Transect 11 – Soft muddy substrate with leaf detritus.



Figure 3.12: Transect 11 – Soft muddy substrate.

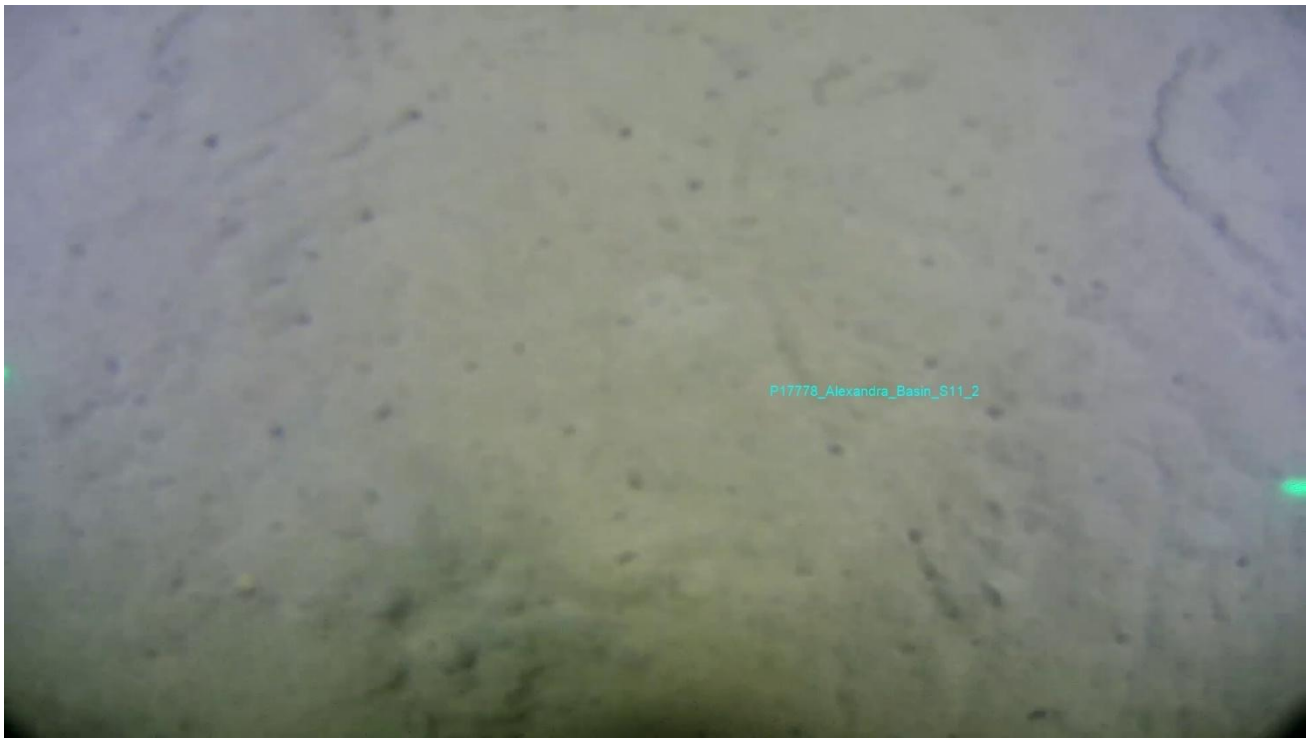


Figure 3.13: Transect 11 – Soft muddy substrate with infaunal burrows.

3.1.4 Station 12 (Navigational channel just outside Alexandra Basin East and before West Oil Jetty)

Station 12 was composed of muddy sand substrate some scattered cobbles encrusted with with Serpulid worms (Serpulidae) and drift red and green algae. Noticeable fauna included crabs (*Polybius* sp.), hydroids, sponges, tunicates (*Ascidiella* spp.), burrowing tube anemone (*Synarachnactis lloydii),* and fish (Gobidae). Litter could also be observed along the transect (**Figure 3.14** to **Figure 3.17**). The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).

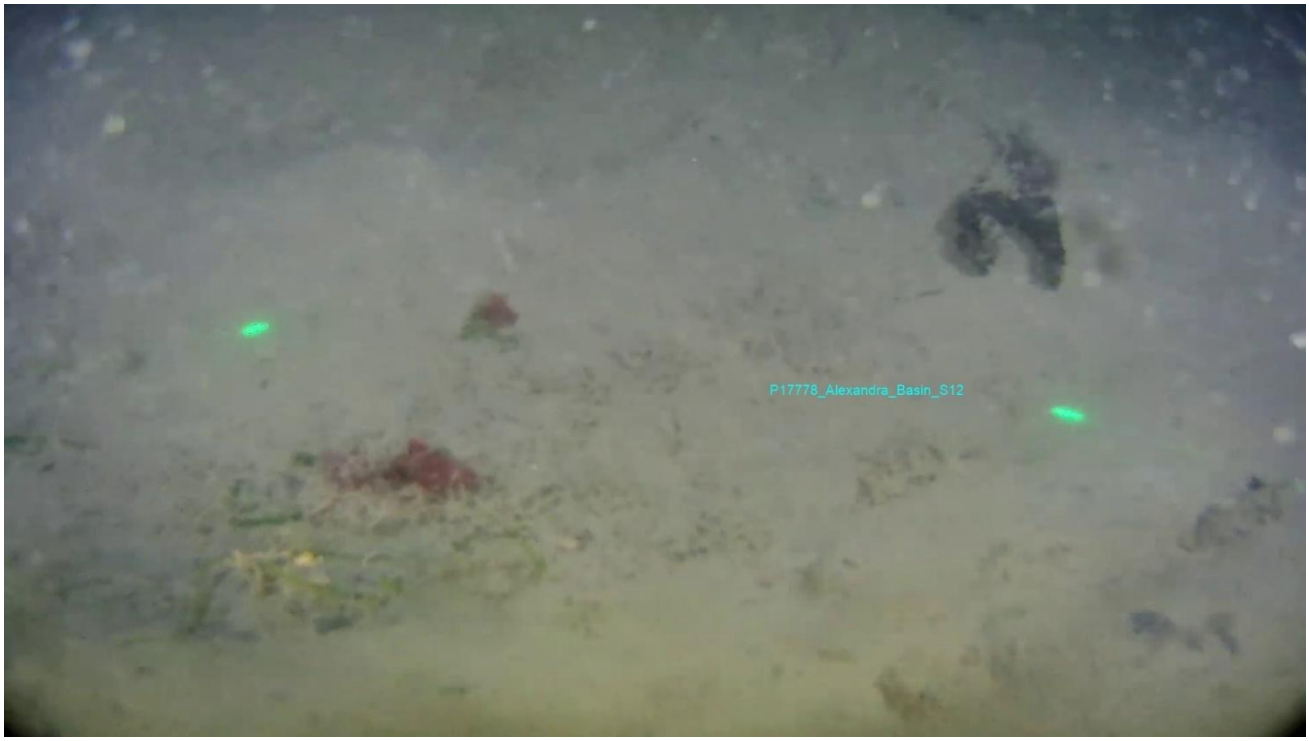


Figure 3.14: Transect 12 – Soft muddy substrate with drift red and green algae.



Figure 3.15: Transect 12 – Soft muddy substrate with tunicates (*Ascidiella* sp.)

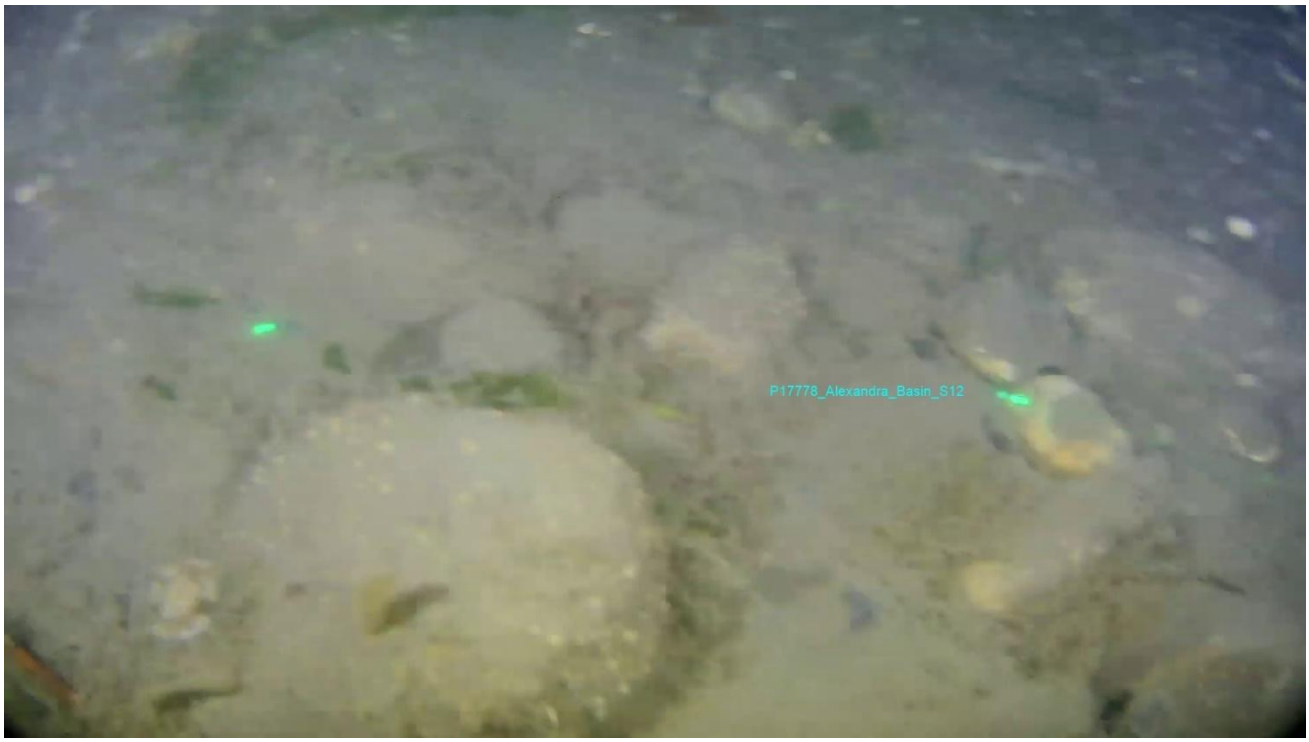


Figure 3.16: Transect 12 – Cobble substrate with soft muddy sediment. Cobbles with Serpulid worms, sponges, and hydroids.



Figure 3.17: Transect 12 – Soft muddy substrate with scattered cobbles covered with Serpulid worms, hydroids, and tunicates (*Ascidiella* sp.).

3.1.5 Station 13 (Alexandra Basin West)

Station 13 was composed of muddy sand substrate with sparse cobbles and drift red and green algae. Noticeable fauna included the edible crab (*Cancer pagurus*), spider crabs (*Macropodia* spp.), crinoids, and burrowing tube anemone (*Synarachnactis lloydii*), bryozoa, openings of infaunal polychaete tubes, and fish (Gobidae). Litter was also present along the transect (**Figure 3.18** to **Figure 3.22**). The habitat type can be assigned to the JNCC 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).

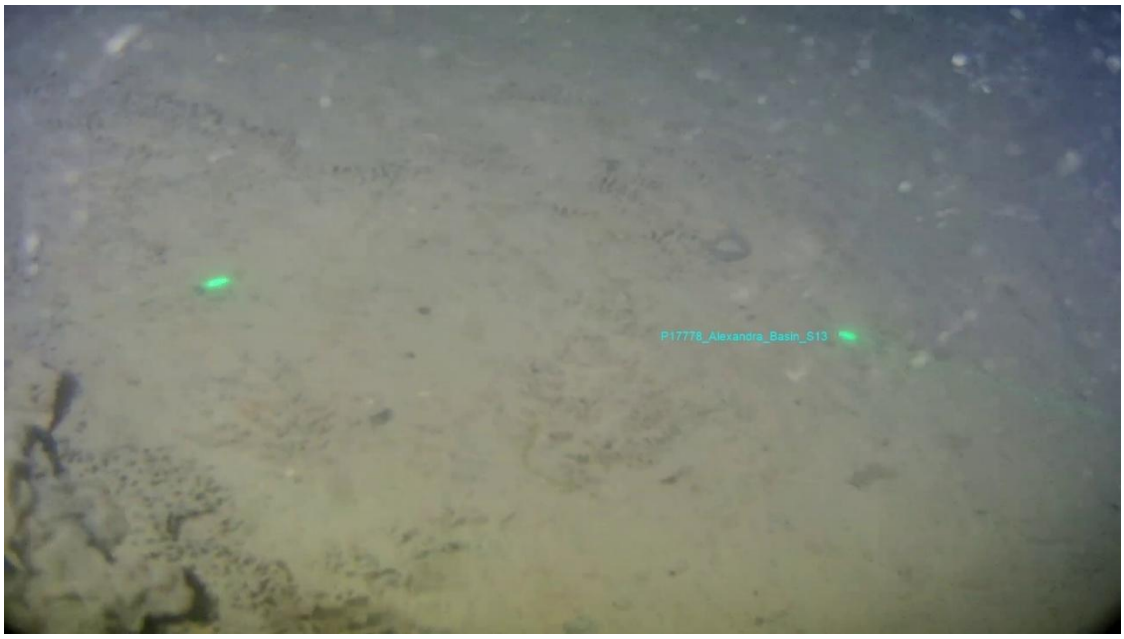


Figure 3.18: Transect 13 – Soft muddy substrate.

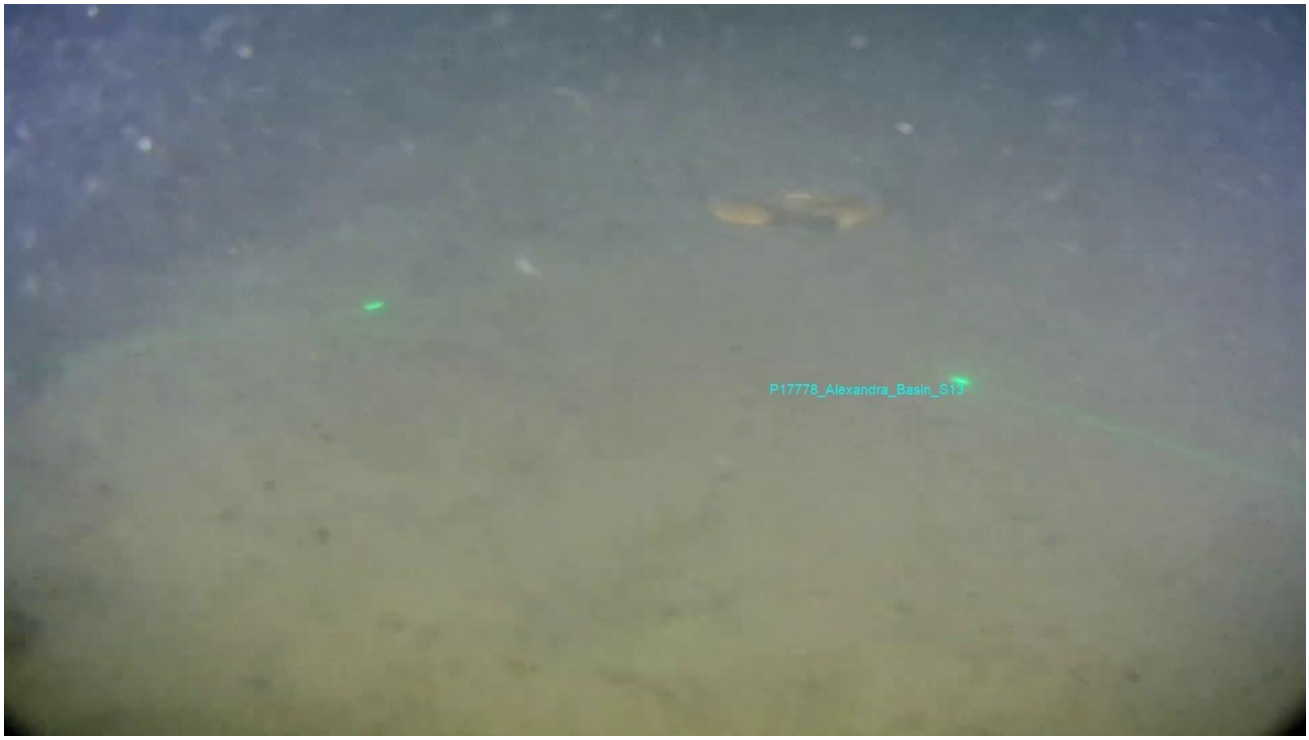


Figure 3.19: Transect 13 – Soft muddy substrate with edible crab (*Cancer pagurus*).

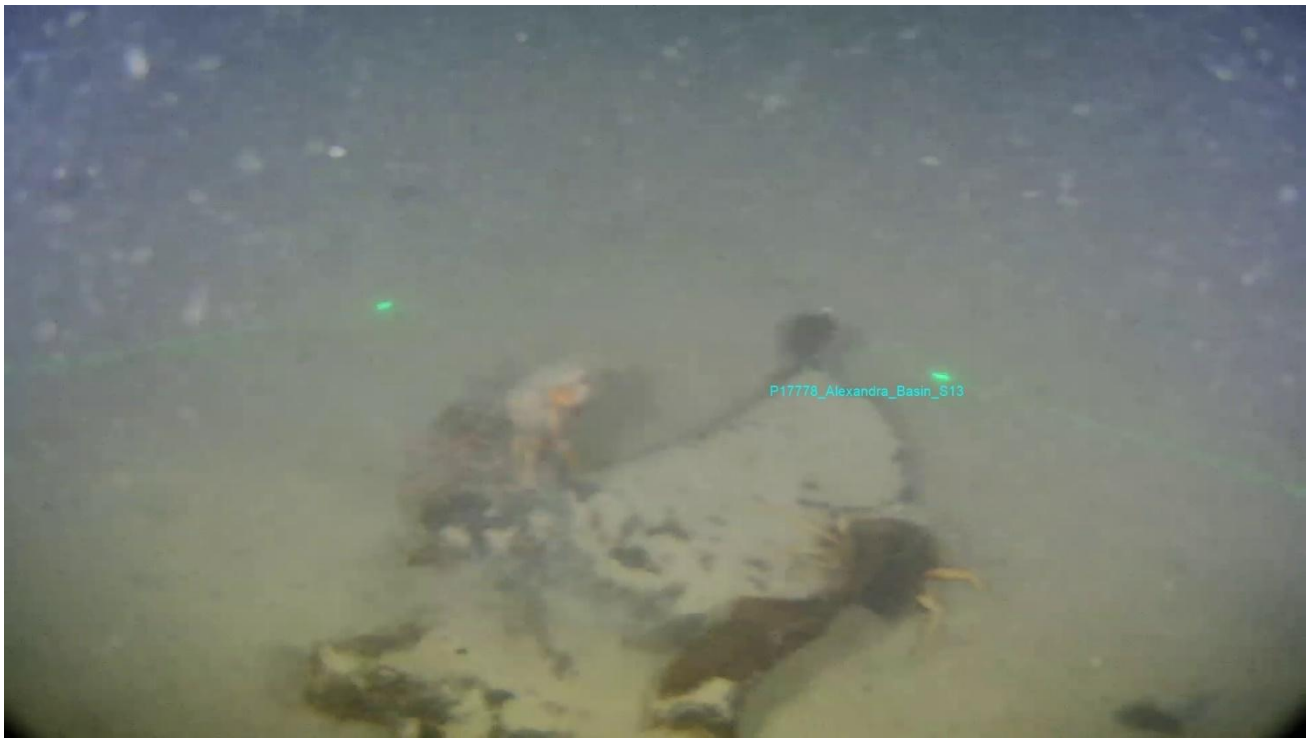


Figure 3.20: Transect 13 – Soft muddy substrate with crabs and crinoids moving along with a drifting kelp frond.

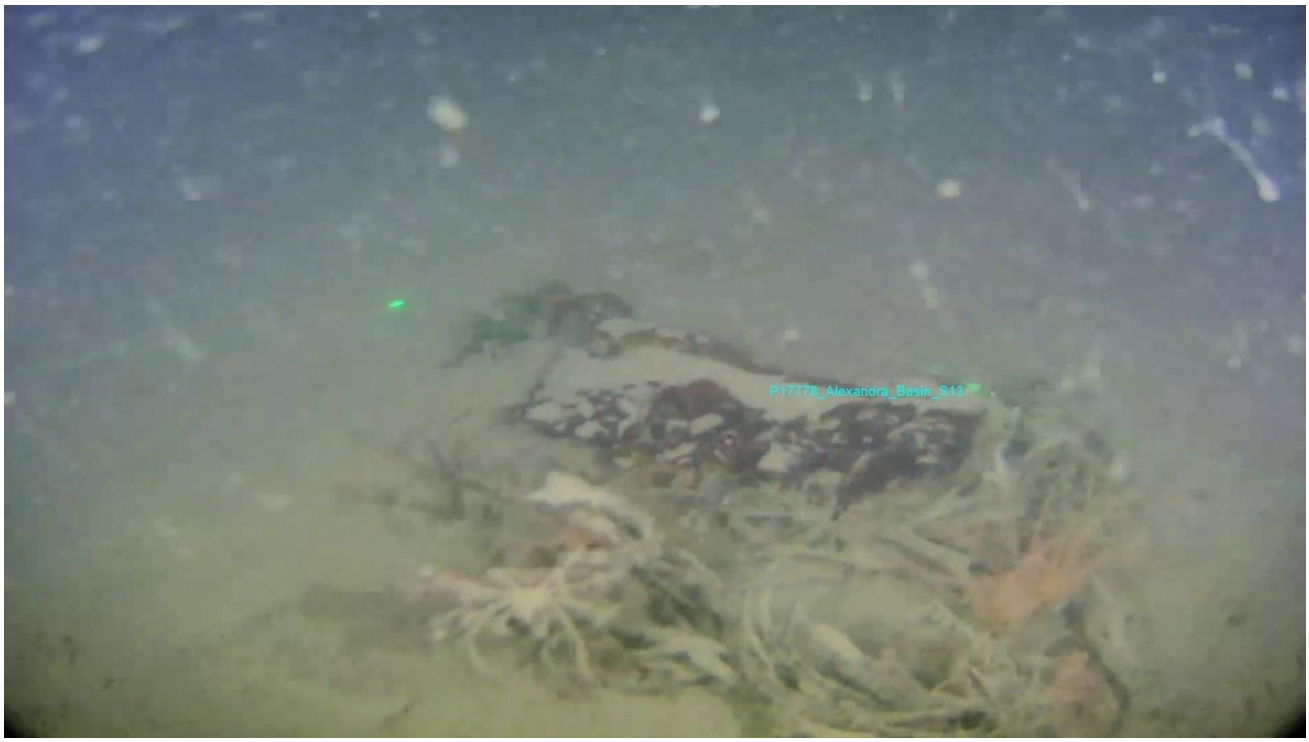


Figure 3.21: Transect 13 – Soft muddy substrate with crinoids and *Macropodia spp.* on drift macroalgal debris.

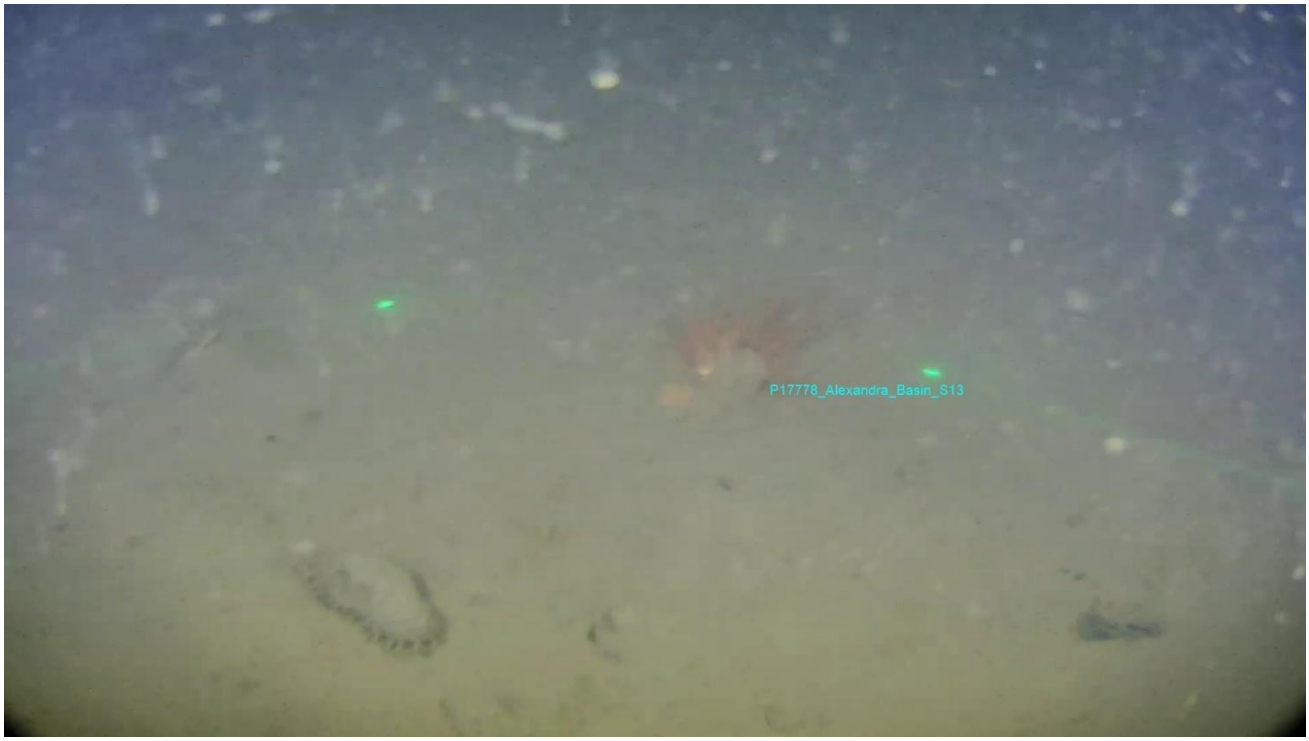


Figure 3.22: Transect 13 – Soft muddy substrate with a crinoid.

3.1.6 Station 14 (East Oil Jetty)

Station 14 was composed of muddy sand substrate with drift red and green algae. Noticeable fauna included crabs, and fish (Gobidae). Kelp fronds were also present along the transect (**Figure 3.23** to **Figure 3.26)**. The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).



Figure 3.23: Transect 14 – Soft muddy substrate with some drifting debris/litter.

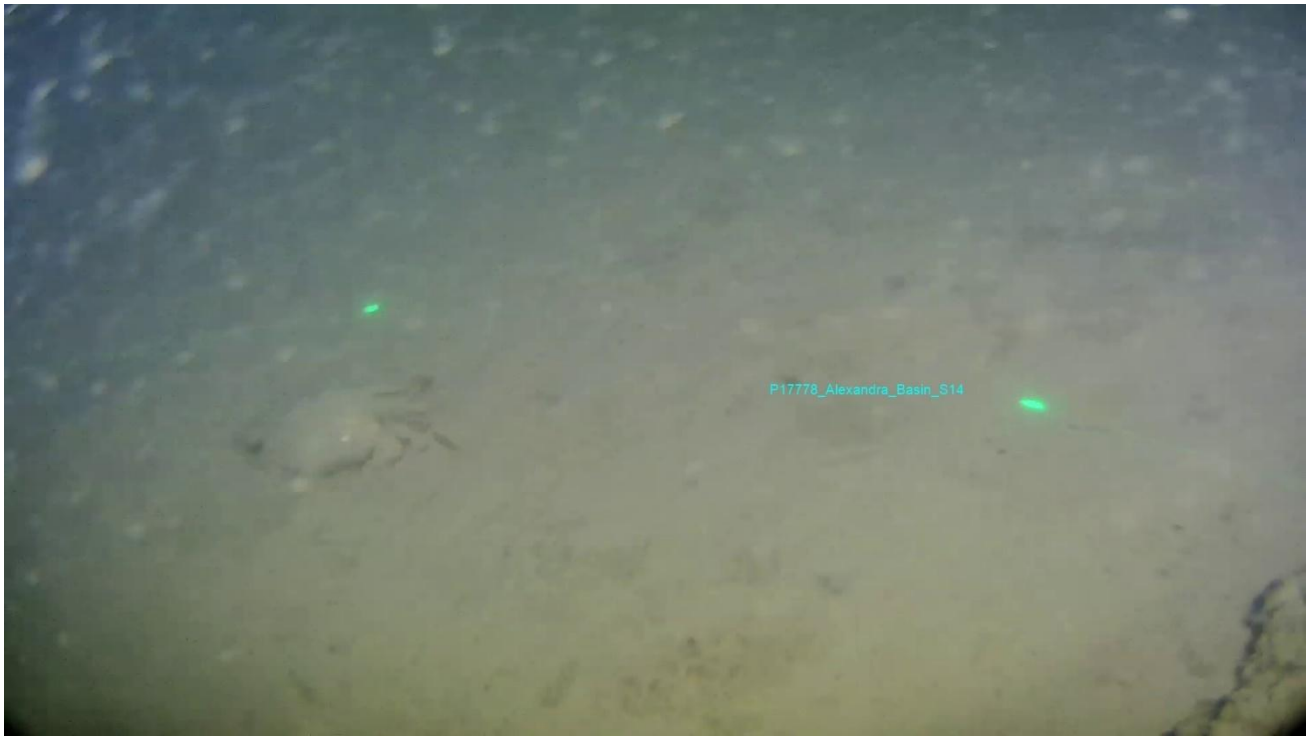


Figure 3.24: Transect 14 – Soft muddy substrate with crab.

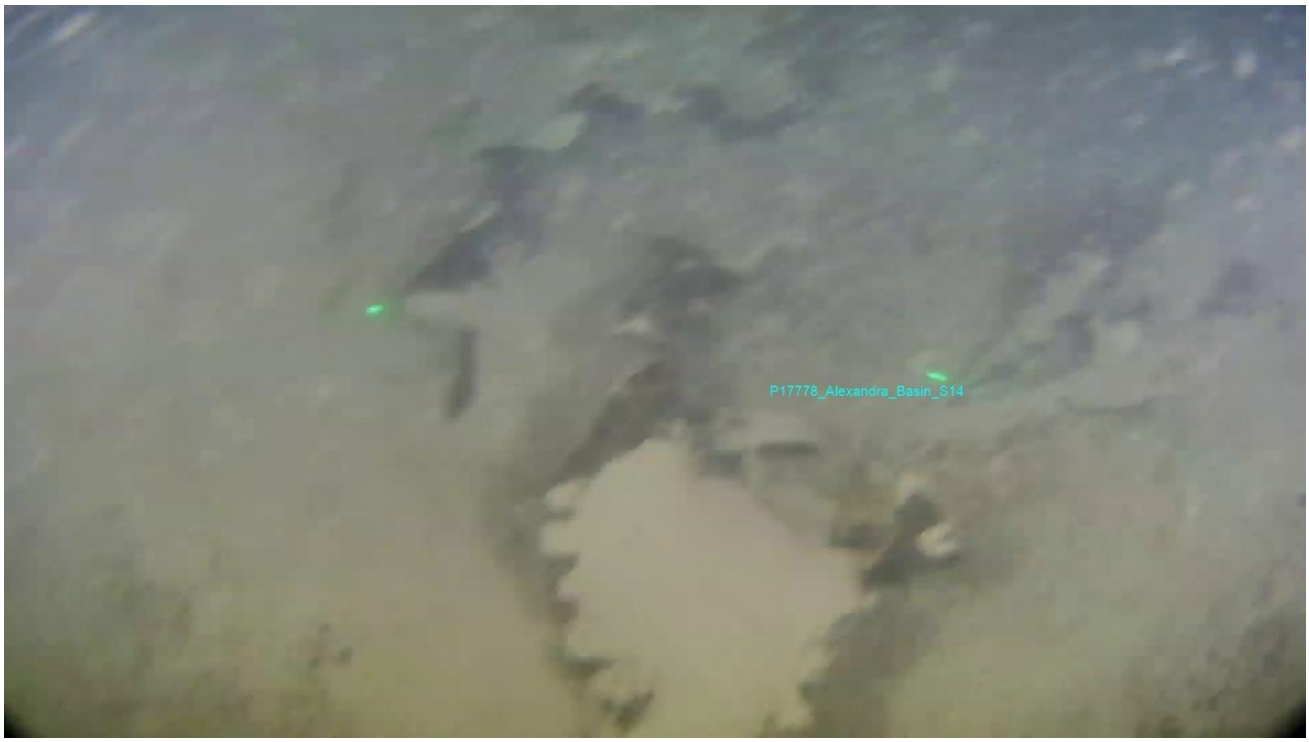


Figure 3.25: Transect 14 – Soft muddy substrate with some drift Kelp fronds.



Figure 3.26: Transect 14 – Soft muddy substrate with crab (*Polybius* sp.).

3.2 Remote Operated Vehicle (ROV) Survey (Berth 52/53)

A qualitative analysis of the ROV survey conducted along the six stations within the Berth 52/53 is presented in the subsections below. The ROV survey provided sufficient visual details to determine the habitats as identified within Berth 52/53 (see **Table 3.2**).

Table 3.2: The habitat classification (EUNIS) identified for each ROV station.

Station	EUNIS Code	Habitat Classification
Station 1a	A5.26	Circalittoral muddy sand
Station 1b	A5.26	Circalittoral muddy sand
Station 2	A5.26	Circalittoral muddy sand
Station 7	A5.44	Circalittoral mixed sediment
Station 9	A5.26	Circalittoral muddy sand
Station 12	A5.26	Circalittoral muddy sand

3.2.1 Station 1a

Station 1a was characterised by muddy sediment with some occasional boulders and sparse cobbles and pebbles at the very end of the transect. Macroalgal drift was observed. Benthic epifauna included the tube anemone (*Synarachnatis lloydii*) (**Figure 3.27** to **Figure 3.29**). The habitat type can be assigned to the broadscale habitat 'Circalittoral muddy sand' (EUNIS code A5.26).

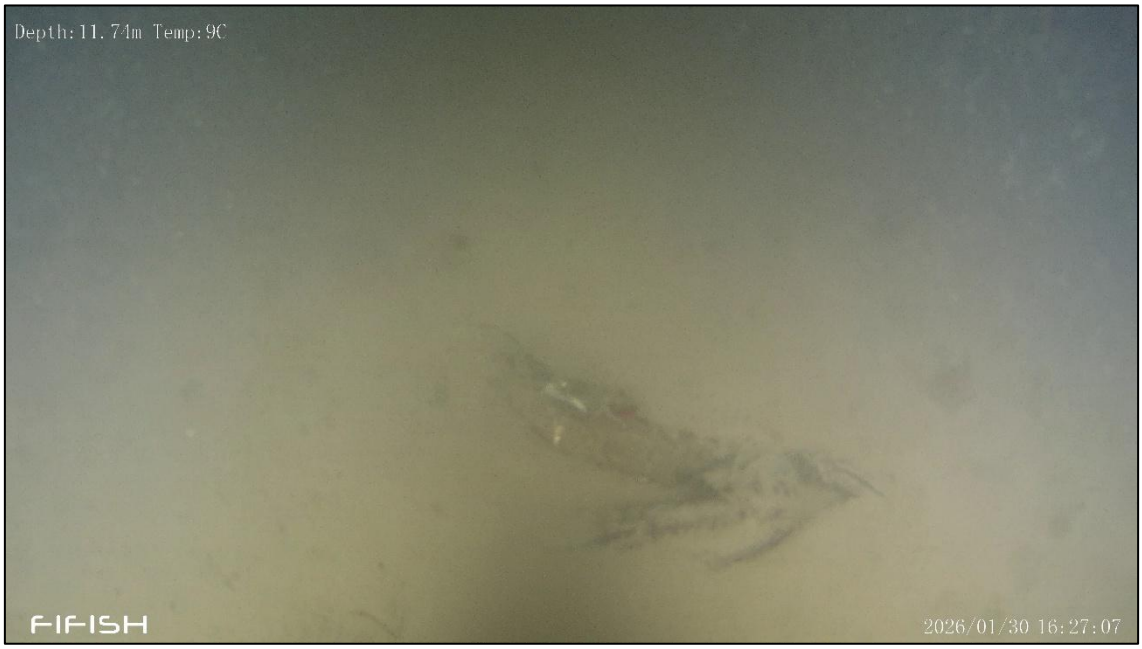


Figure 3.27: Transect 1a - Muddy sediment with draft algae.

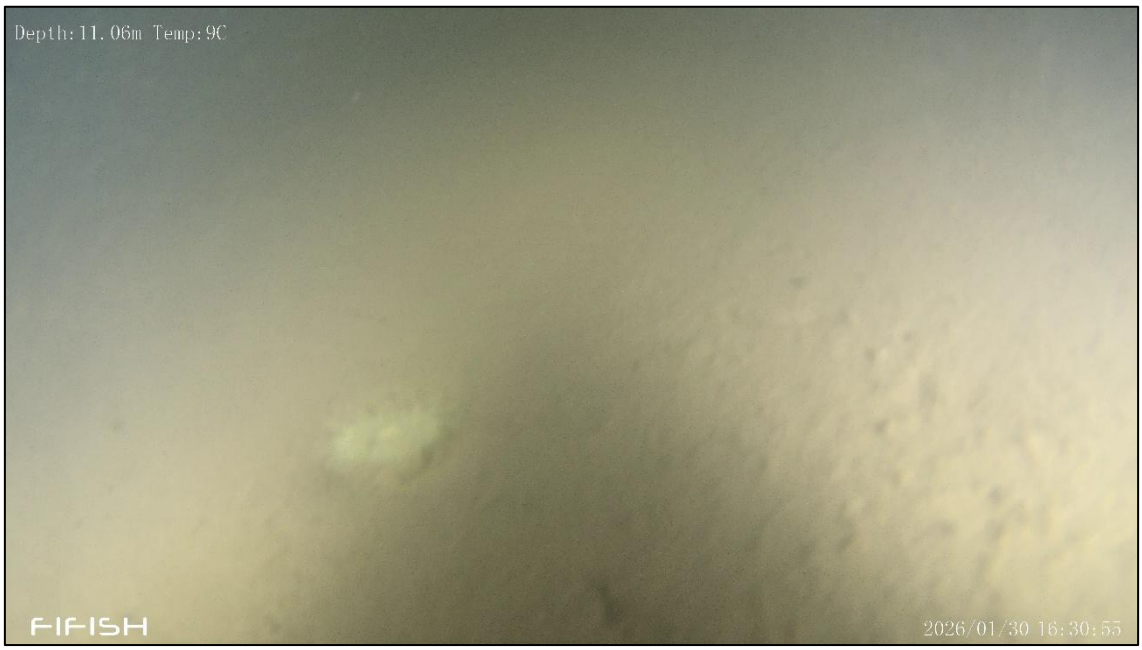


Figure 3.28: Transect 1a - Muddy sediment with tube anemone (*Synarachnatis lloydii*).

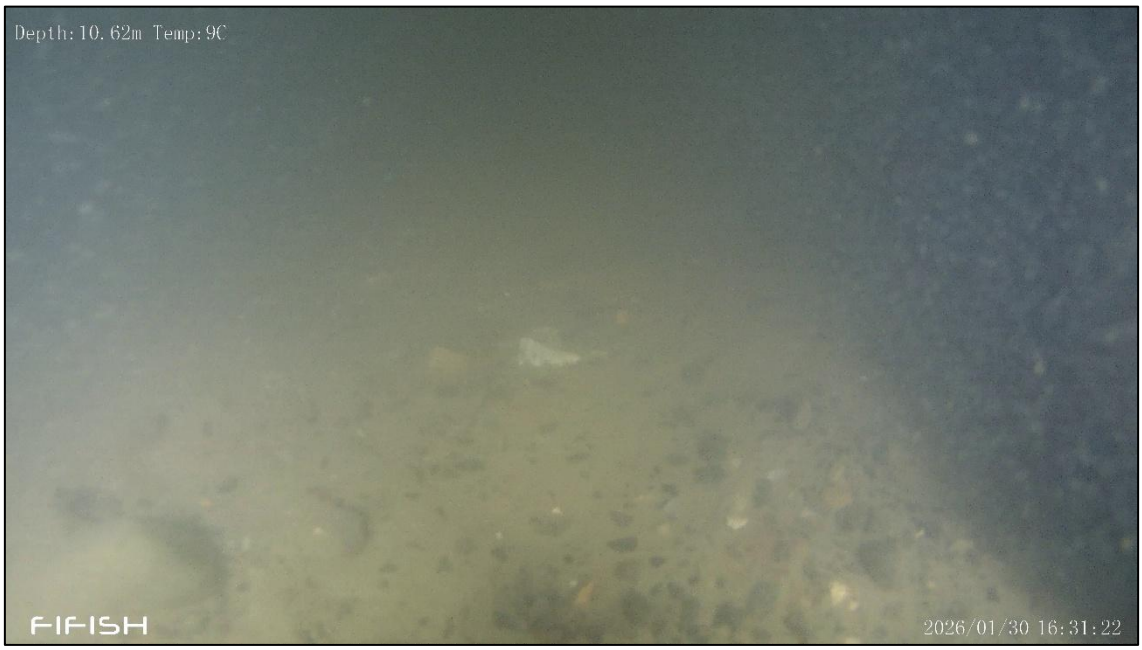


Figure 3.29: Transect 1a - Mixed sediment with sparse cobbles and pebbles.

3.2.2 Station 1b

Station 1b was characterised by muddy sediment, boulders and rock armour with growth of macroalgae (**Figure 3.30** to **Figure 3.32**). No noticeable fauna was observed along this transect but fauna burrows were observed in the muddy sediment. The habitat type can be assigned to the broadscale habitat 'Circalittoral muddy sand' (EUNIS code A5.26).

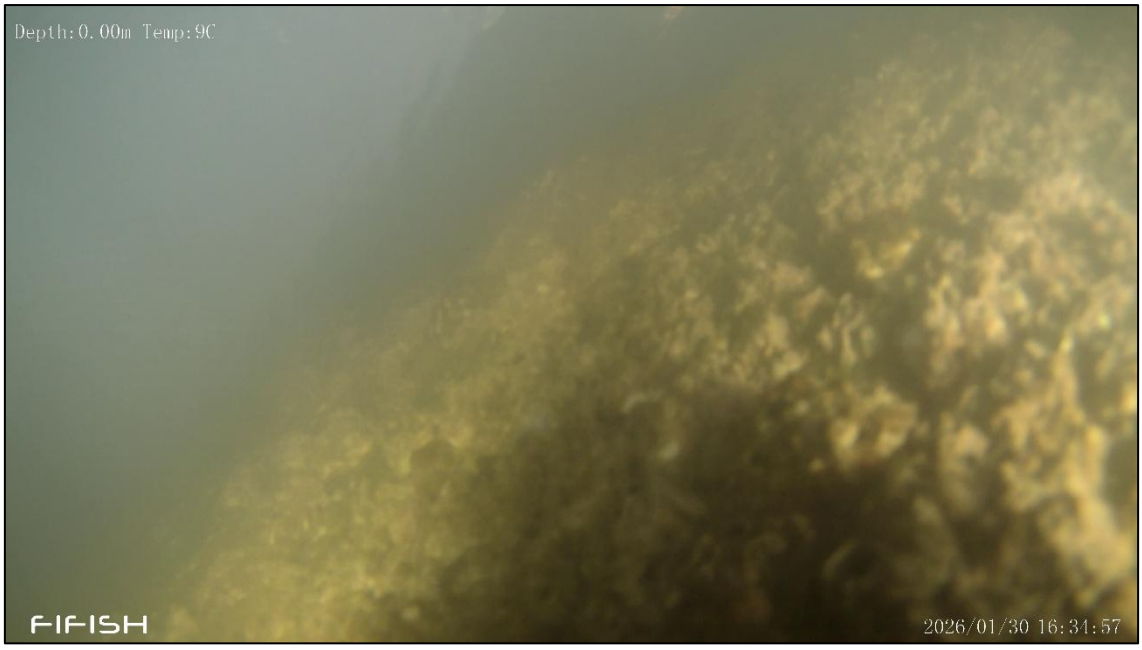


Figure 3.30: Transect 1b - Rock armour with growth of macroalgae.



Figure 3.31: Transect 1b - Boulder with drift macroalgae on muddy sediment.

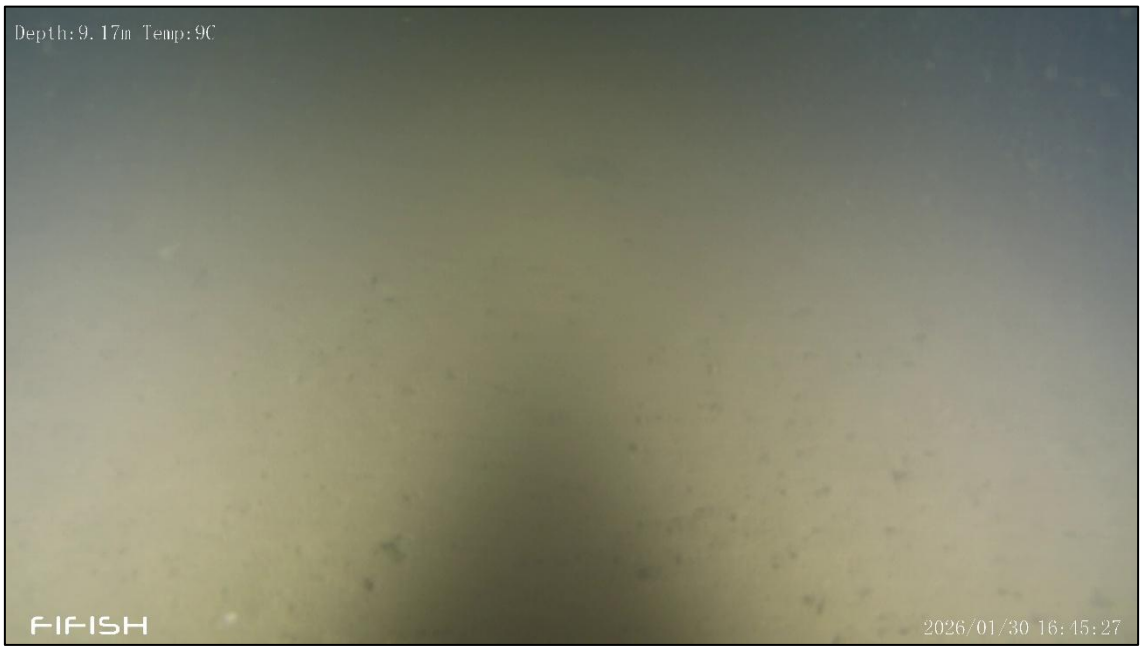


Figure 3.32: Transect 1b - Muddy sediment infauna burrows.

3.2.3 Station 2

Station 2 was characterised by muddy sediment and the presence of quay wall with growth of bryozoans and hydroids. Litter was also present (**Figure 3.3** to **Figure 3.5**). The habitat type can be assigned to the broadscale habitat 'Circalittoral muddy sand' (EUNIS code A5.26).

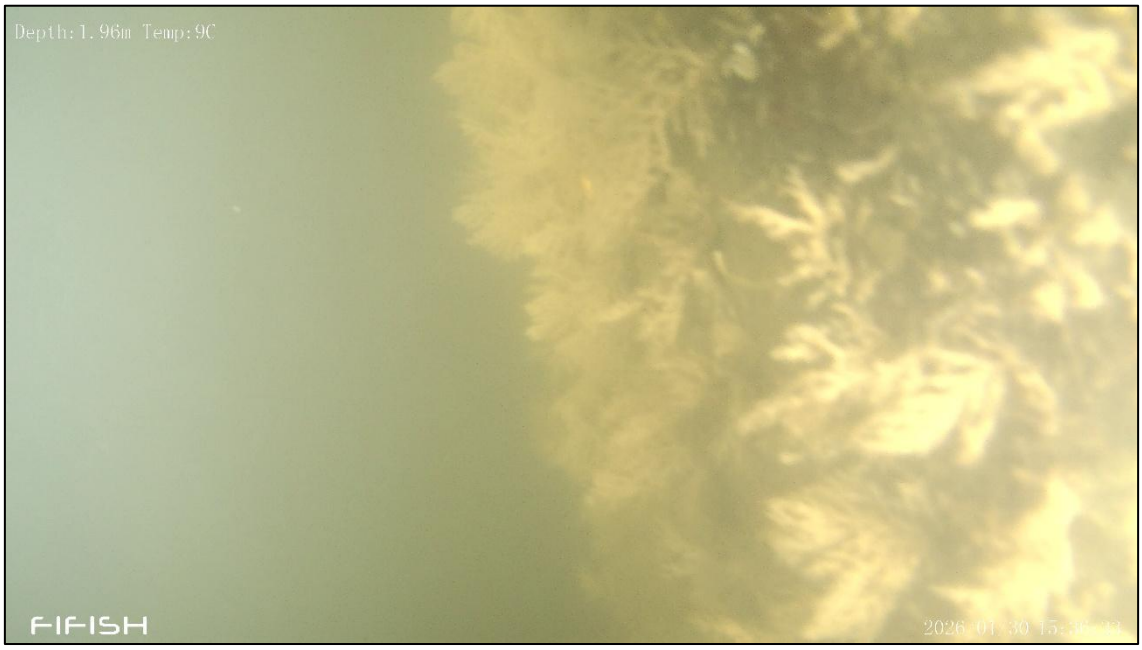


Figure 3.33: Transect 2 - Quay wall with bryozoan and hydroid growths.

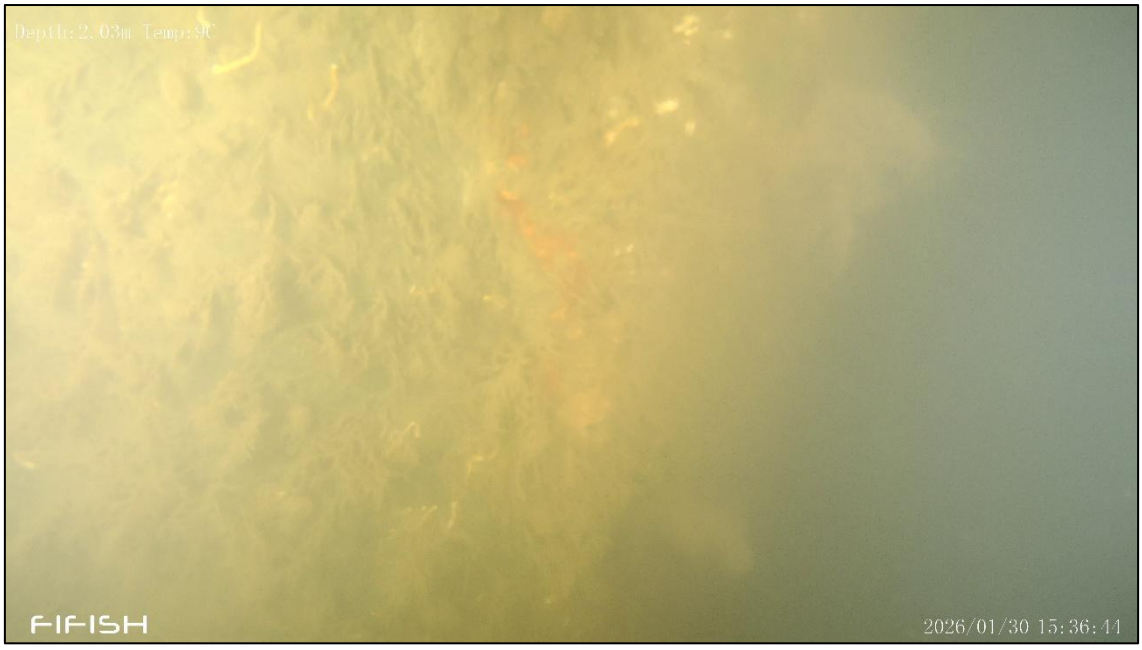


Figure 3.34: Transect 2 - Quay wall with bryozoan and hydroid growth.

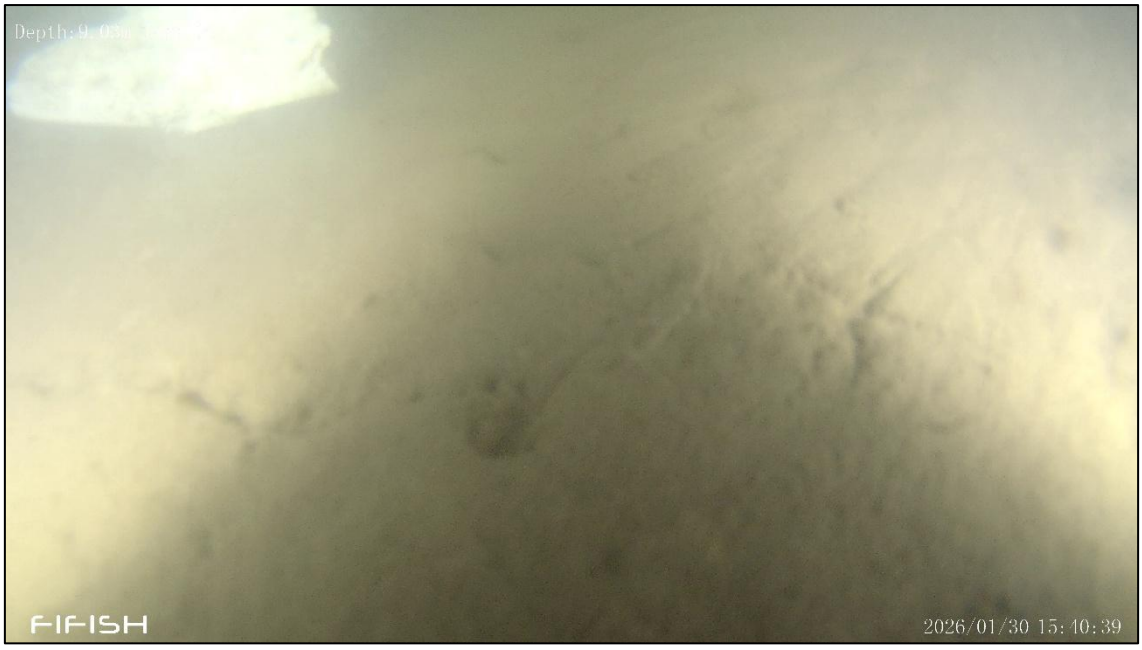


Figure 3.35: Transect 2 - Muddy sediment fauna transects and litter in the background.

3.2.4 Station 7

Station 7 was characterised by mixed sediment with some boulders, cobbles, pebbles, and some mud. A section of the quay wall is visible with growth of bryozoans and hydroids along with some dead barnacles on boulders (**Figure 3.36** to **Figure 3.38**). The habitat type can be assigned to the broadscale habitat 'Circalittoral mixed sediment' (EUNIS code A5.44) but should be interpreted with caution as the transect of the ROV was along the rock amour wall and therefore, sediment characteristics determination was less confident.

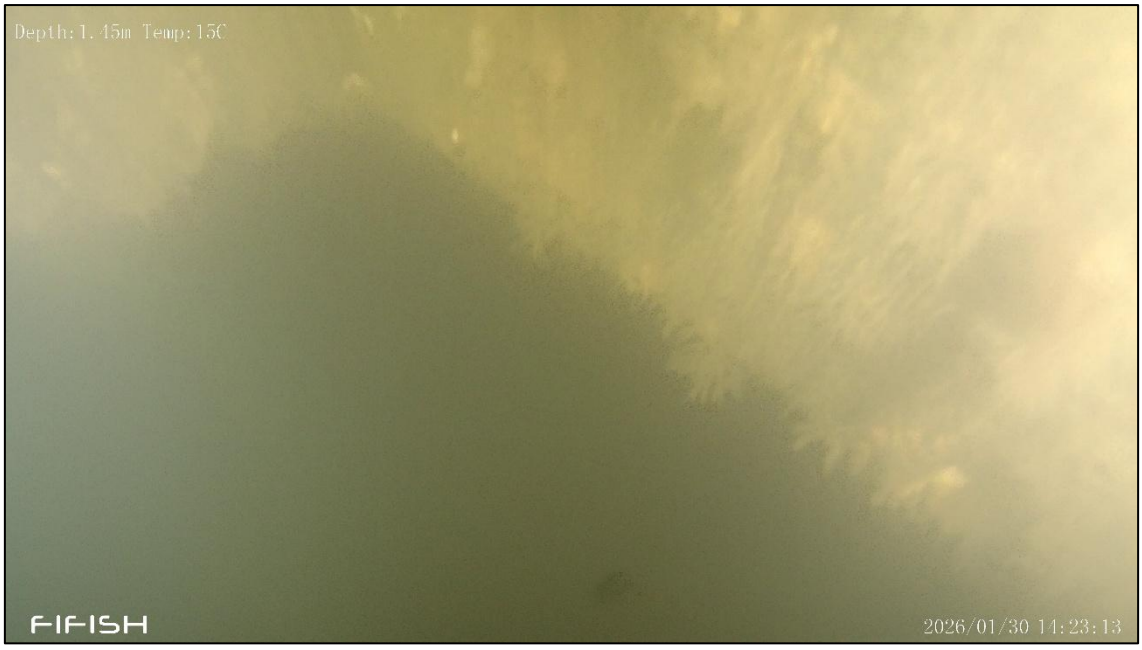


Figure 3.36: Transect 7 – Section of quay wall with growth of bryozoans and hydroids.

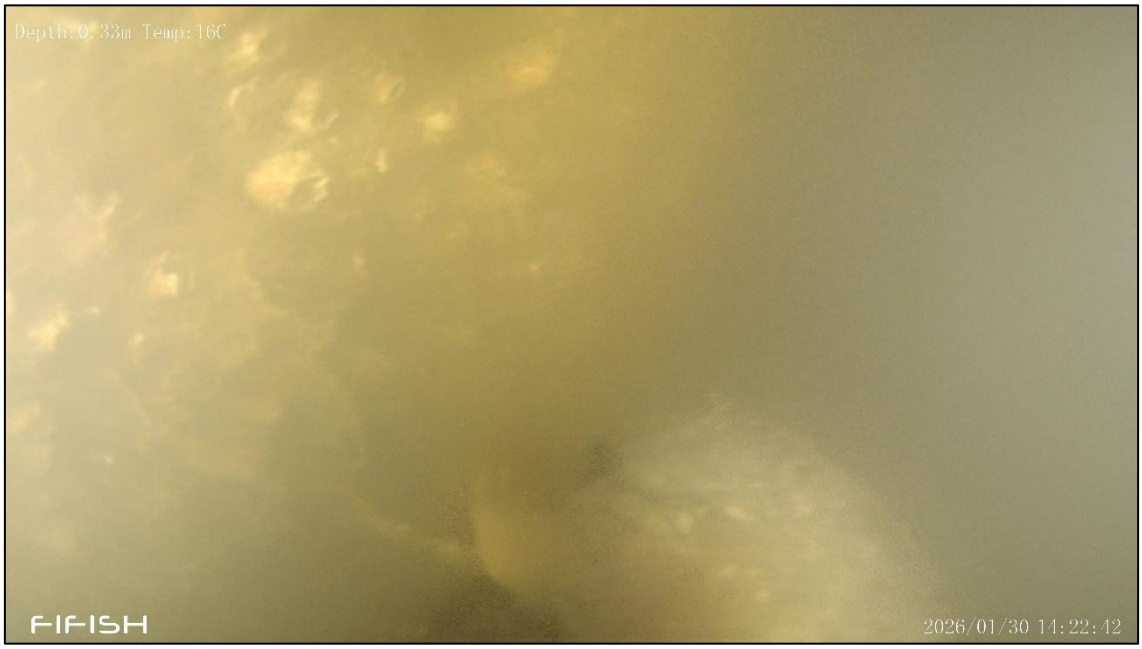


Figure 3.37: Transect 7 – Boulders with barnacle colonies (possibly dead).

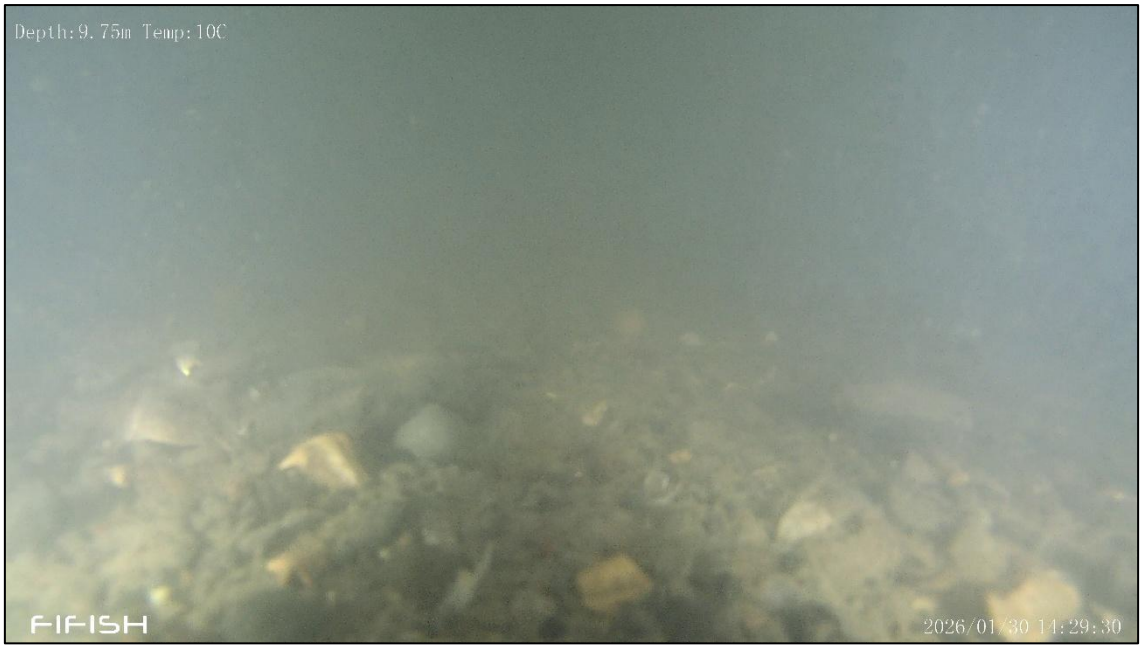


Figure 3.38: Transect 7 – Mixed sediment with cobbles, pebbles, sand, and mud.

3.2.5 Station 9

Station 9 was characterised by muddy sediment with some occasional boulders. Visibility was poor due to high turbidity of the water column. Noticeable fauna included a crab. Macroalgae was present along with some fronds of drifting macroalgae observed. (**Figure 3.39** to **Figure 3.41**). The habitat type can be assigned to the broadscale habitat 'Circalittoral muddy sand' (EUNIS code A5.26).

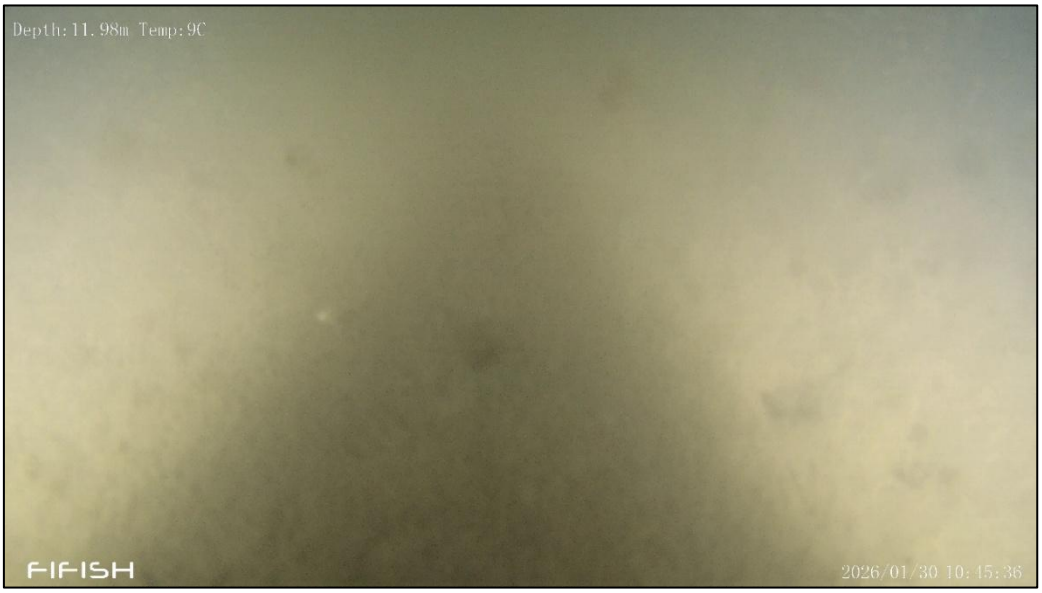


Figure 3.39: Transect 9 – Muddy sediment with fauna burrows.



Figure 3.40: Transect 9 – Solitary crab with macroalgae.

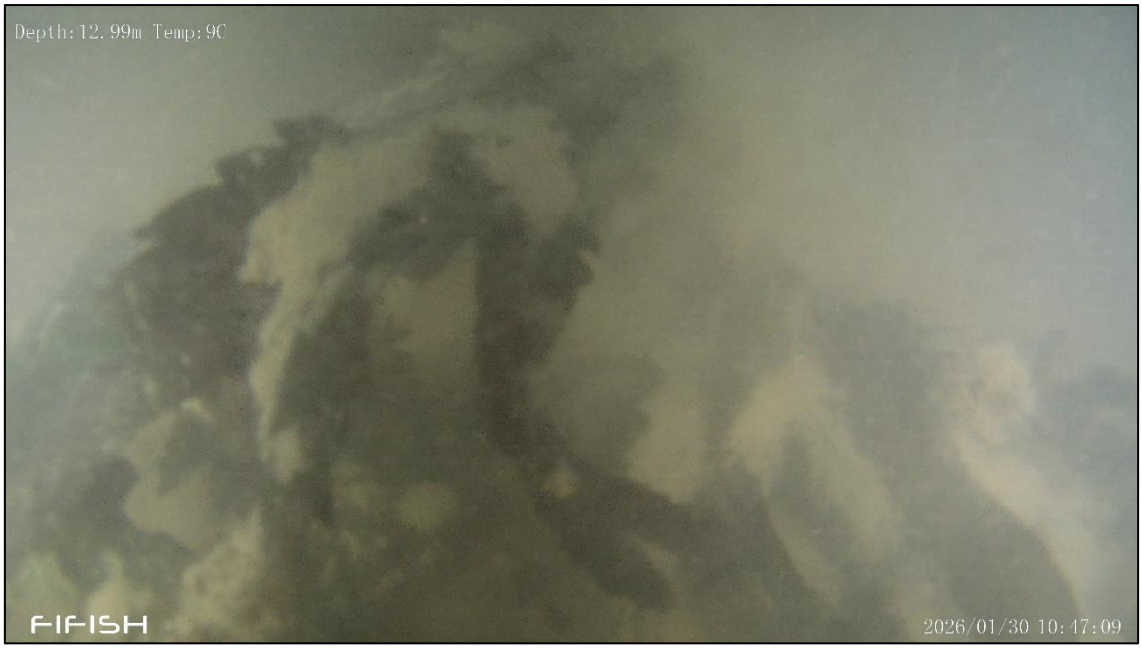


Figure 3.41: Transect 9 – Silt covered macroalgae.

3.2.6 Station 12

Station 12 was characterised by muddy sediment, with some occasional boulders and unidentified structure/feature. Macroalgal drift was observed. Benthic epifauna included a Goby fish and a solitary crab (indeterminate) (**Figure 3.42** to **Figure 3.44**). The habitat type can be assigned to the broadscale habitat 'Circalittoral muddy sand' (EUNIS code A5.26).

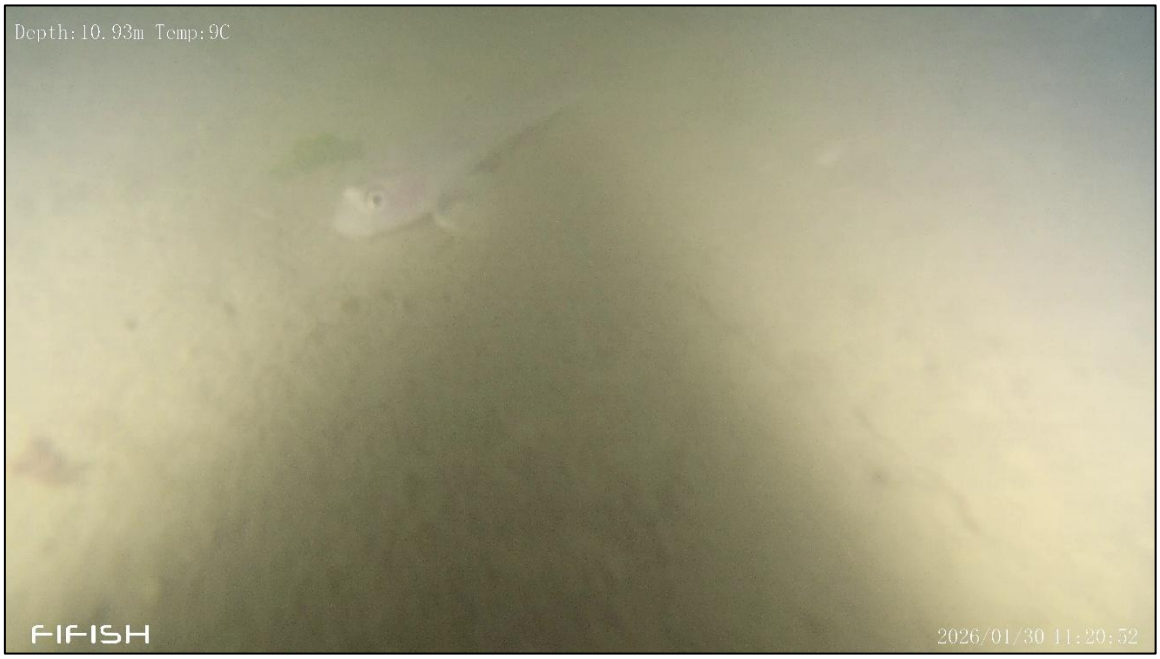


Figure 3.42: Transect 12 – Muddy sediment with drift algae and a swimming Goby fish.

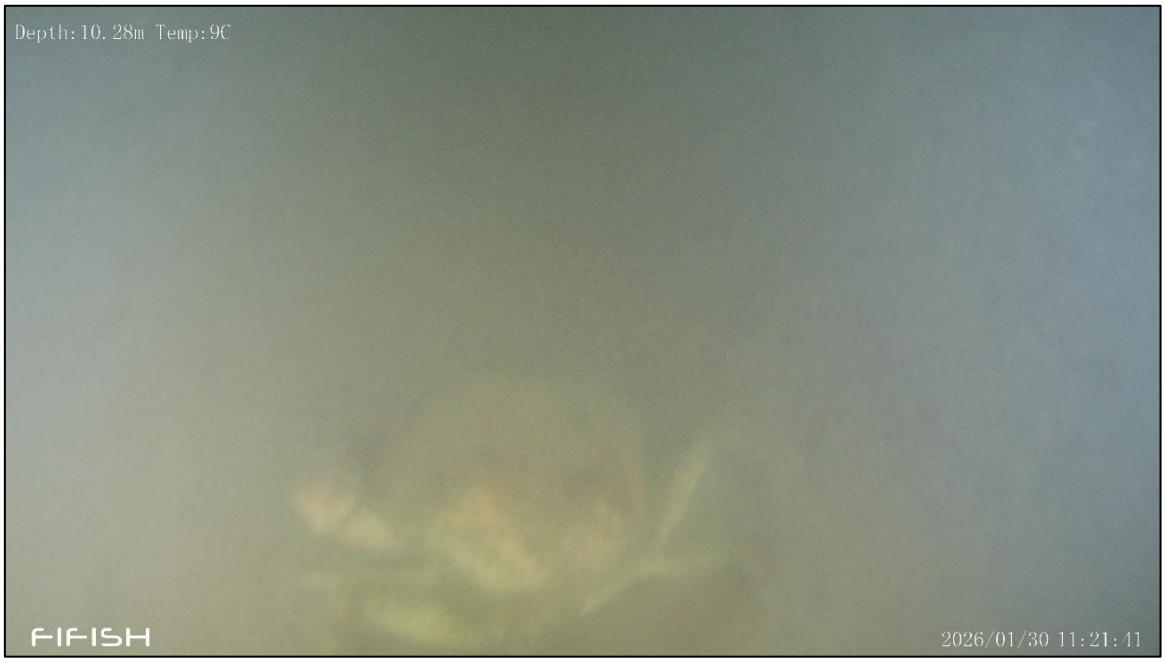


Figure 3.43: Transect 12 – High turbidity and a solitary crab.

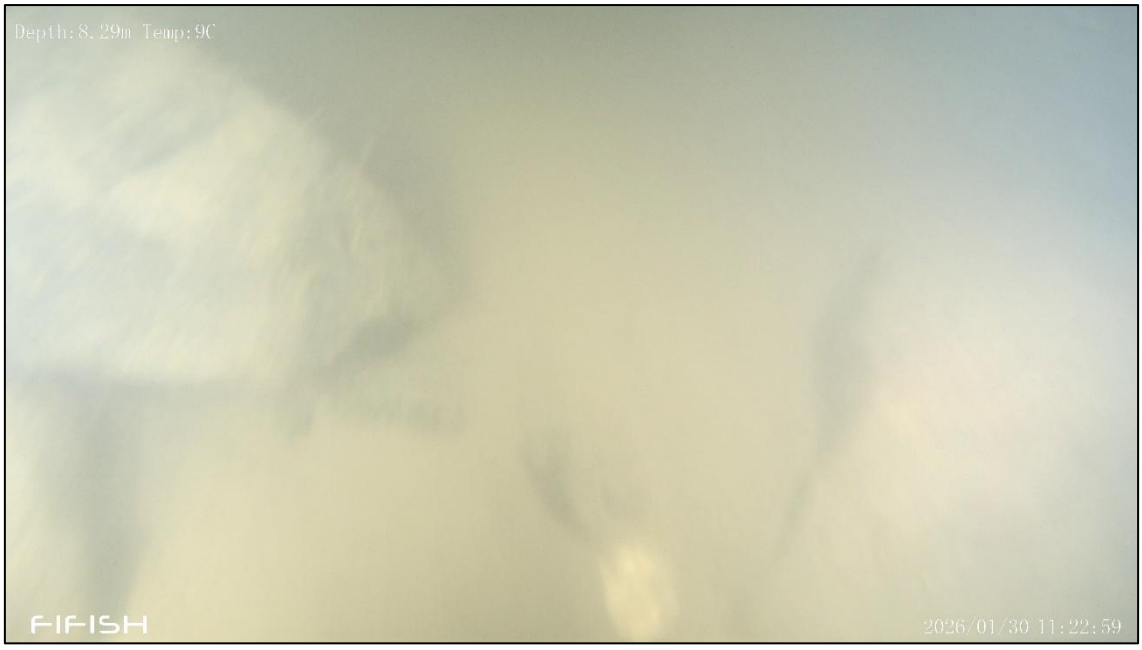


Figure 3.44: Transect 12 – High siltation and boulders/unidentified structure.

The spatial distribution of the broadscale habitats as identified from the DDV and ROV video and still analysis is illustrated in **Figure 3.45**.

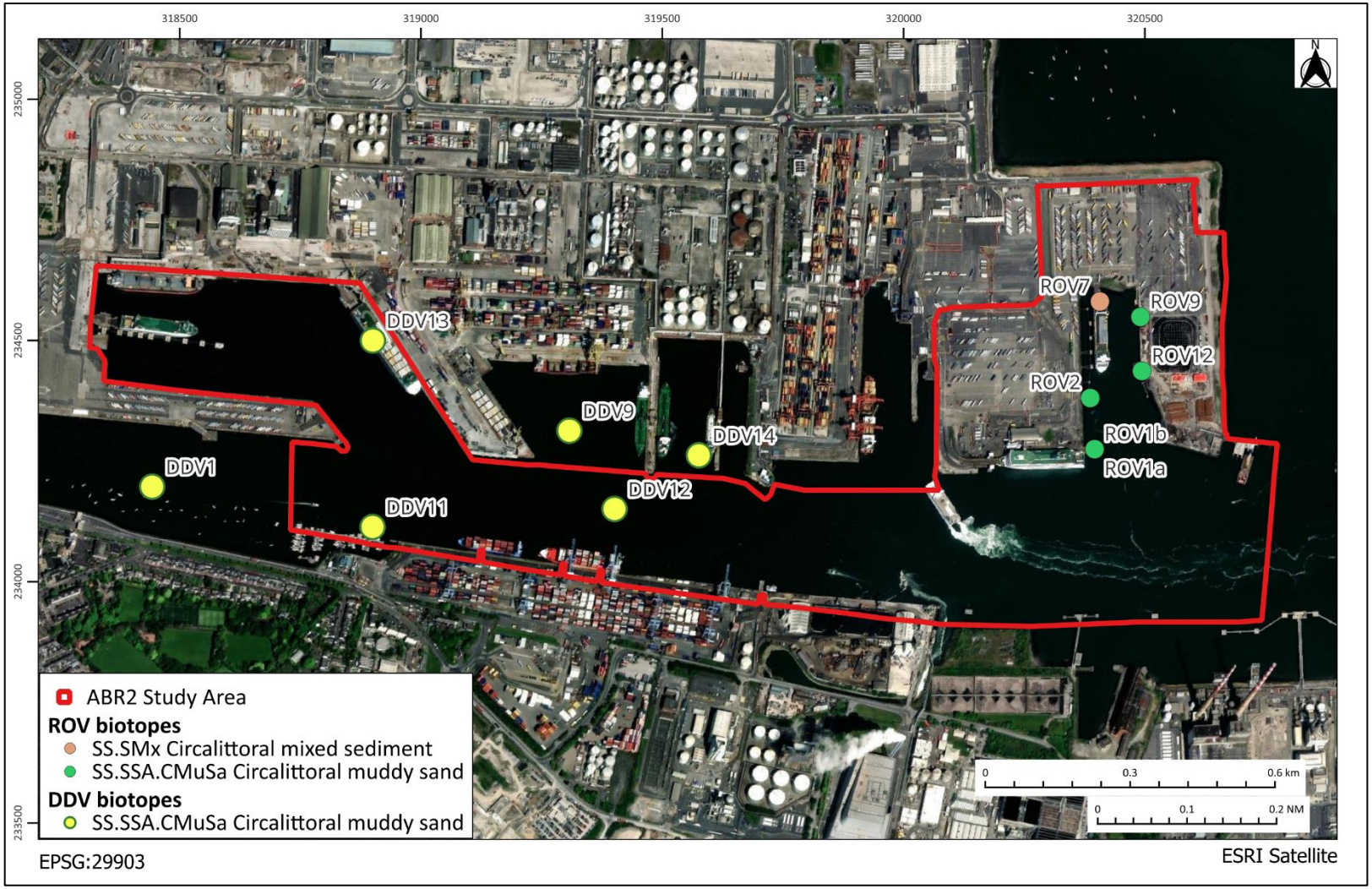


Figure 3.45: Spatial distribution of broadscale habitats from DDV and ROV surveys.

3.3 Benthic Fauna Results

The taxonomic identification of the benthic infauna across all six benthic stations surveyed within the ABR2 Project area yielded a total count of 104 taxa, comprising 576 individuals for countable taxa ascribed to eight phyla. Of the 104 taxa identified, 60 were identified to species level. The remaining 44 taxa could not be identified to species level because they were juveniles, damaged, or indeterminate. The full faunal abundance species list can be seen in **Appendix 2**.

Of the 104 taxa recorded one was a cnidarian (sea anemone), one was a nematode, 54 were annelids (segmented worms), 21 were arthropods (crabs, shrimps, insects *etc.*), 21 were molluscs (mussels, cockles, snails *etc.*), 2 were bryozoan (encrusting/colonising animals); one was a phoronid (horseshoe worm), and 3 were echinoderms (brittle stars, star fish, sea urchins, *etc.*).

No species of conservation concern, protected species, or species listed under Annex II or Annex V of the EU Habitats Directive were recorded during the benthic surveys. The benthic assemblage was dominated by taxa typical of organically enriched, disturbed sediments commonly found within port and estuarine environments. The species recorded are considered tolerant of physical disturbance and periodic sediment reworking, and their presence is consistent with findings from previous benthic surveys undertaken within Alexandra Basin.

3.3.1 Univariate Results

Univariate statistical analyses were carried out on the combined replicate station-by-station faunal data. Colonial and epifaunal taxa were removed from the infaunal dataset prior to analysis. The following parameters were calculated and can be seen in **Table 3.3**: Total number of taxa, Total number of Individuals, Richness, Evenness, Shannon-Wiener diversity, Effective Number of Species (ENS), and Simpson's Diversity.

The number of taxa ranged from 21 (Station 12) to 51 (Station 9). The number of individuals ranged from 312 (Station 12) to 1,667 (Station 1). Richness ranged from 3.48 (Station 12) to 6.97 (Station 9). Evenness ranged from 0.48 (Station 1) to 0.66 (Station 13). Shannon-Wiener diversity ranged from 1.73 (Station 1) to 2.41 (Station 9). Simpson's diversity ranged from 0.70 (Station 1) to 0.87 (Station 13). Effective number of species ranged from 5.61 (Station 1) to 11.14 (Station 9) indicating that Station 9 is approximately 1.98 times more diverse than Station 1. **Figure 3.46** shows these community indices in graphical form.

Table 3.3: Univariate measures of community structure for the subtidal samples.

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon-Wiener Diversity	Effective Number of Species	Simpson's Diversity
	S	N	d	J'	H'(loge)	EXP(H')	1-Lambda
1	37	1667	4.85	0.48	1.73	5.61	0.70
9	51	1307	6.97	0.61	2.41	11.14	0.83
11	36	1332	4.86	0.53	1.90	6.65	0.75
12	21	312	3.48	0.60	1.82	6.15	0.74
13	36	686	5.36	0.66	2.38	10.79	0.87
14	30	560	4.58	0.61	2.08	7.99	0.80

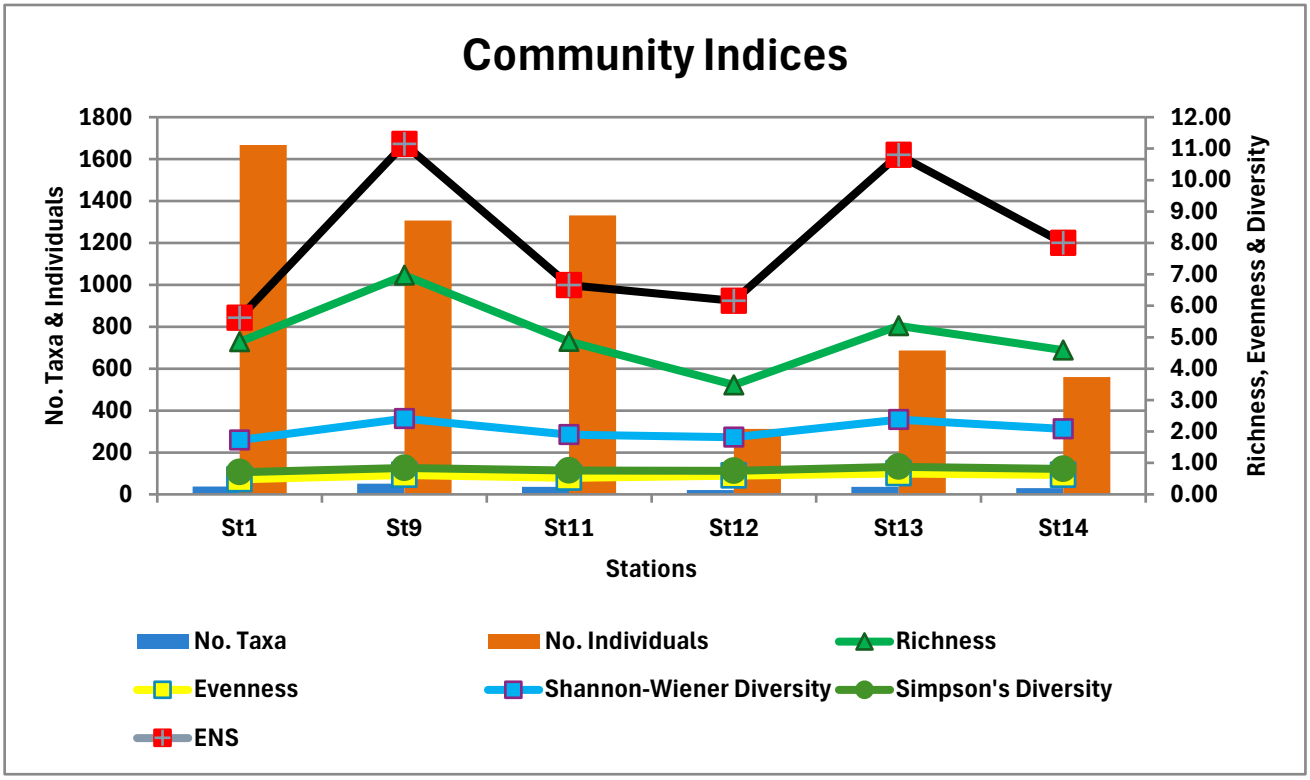


Figure 3.46: Subtidal community indices. Diversity is expressed in Effective Number of Species (ENS), Shannon-Wiener Diversity Index and Simpson's Diversity Index.

3.3.2 Multivariate Results

The same data set used above for the univariate analyses was also used for the multivariate analyses. The dendrogram and the MDS plot can be seen in **Figure 3.47** and **Figure 3.48**, respectively. SIMPROF analysis revealed no statistically significant groupings between the six stations (the samples connected by red lines cannot be significantly differentiated). The stress level (0.01) on the MDS plot indicates excellent representation of the data with no prospect of misinterpretation.

All stations were assigned to the same group (Station 1, 9, 11, 12, 13 & 14) which contained 96 taxa comprising 5,864 individuals. Fifty-two taxa were present twice or less. Six taxa accounted for over 75% of the faunal abundance: the polychaetes *Scalibregma inflatum* (1,360 individuals, 23.19% abundance), *Capitella* spp. (833 individual, 14.20% abundance), Cirratulidae (756 individual, 12.89% abundance), *Chaetozone gibber* (369 individual, 6.29% abundance) and *Tharyx* sp. (214 individual, 3.64% abundance), and the gastropod *Peringia ulvae* (911 individual, 15.53% abundance).

SIMPER analysis revealed similar characterising taxa for this group but with two additional characterising taxa: the bivalves *Abra alba* and *Abra nitida*.

Scalibregma inflatum, *Peringia ulvae, Abra alba,* and *Abra nitida* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment. Cirratulidae, *Chaetozone gibber*, and *Tharyx* sp. are second order opportunistic species present in slight to pronounced unbalanced conditions. *Capitella* spp. are first order opportunists that proliferate in reduced sediments.

The group can be classified as exhibiting many of the characteristics of the JNCC biotope 'SS.SMu.ISaMu.Cap *Capitella capitata* in enriched sublittoral muddy sediments' (EUNIS code MB6246) (Tillin *et al.,* 2023). The distribution of the biotope identified within Alexandra Basin West and the navigational channel is illustrated in **Figure 3.49**.

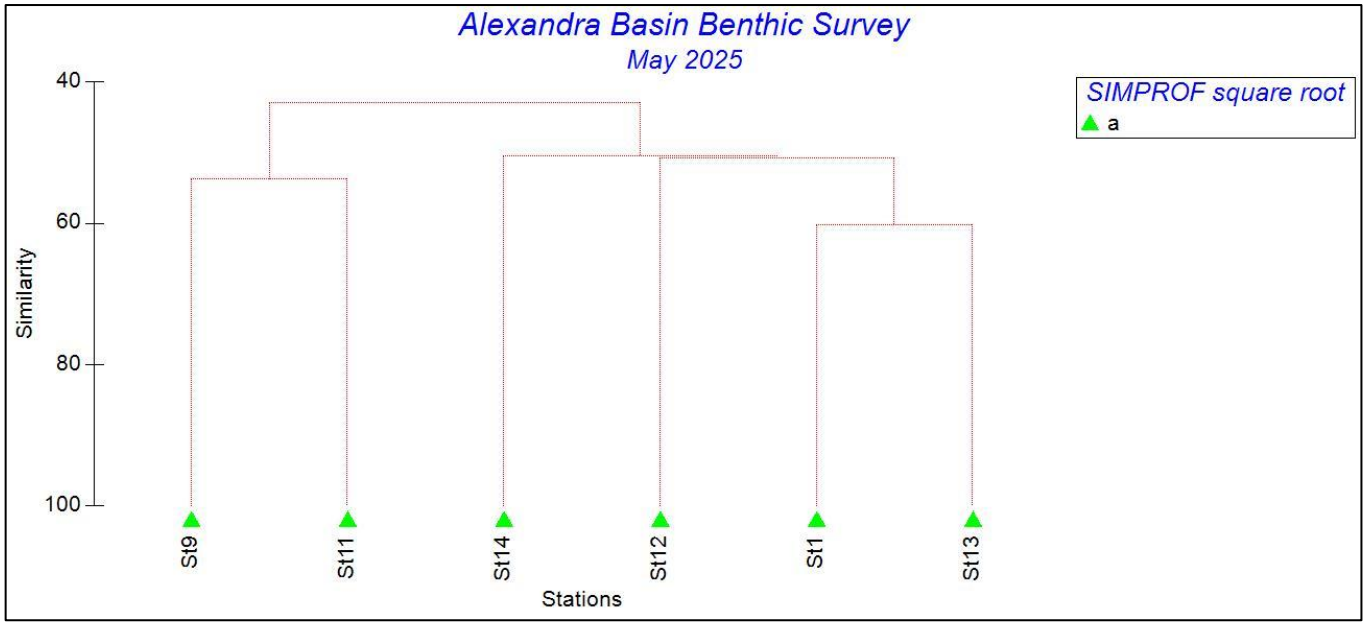


Figure 3.47: Dendrogram produced from Cluster analysis of the data.

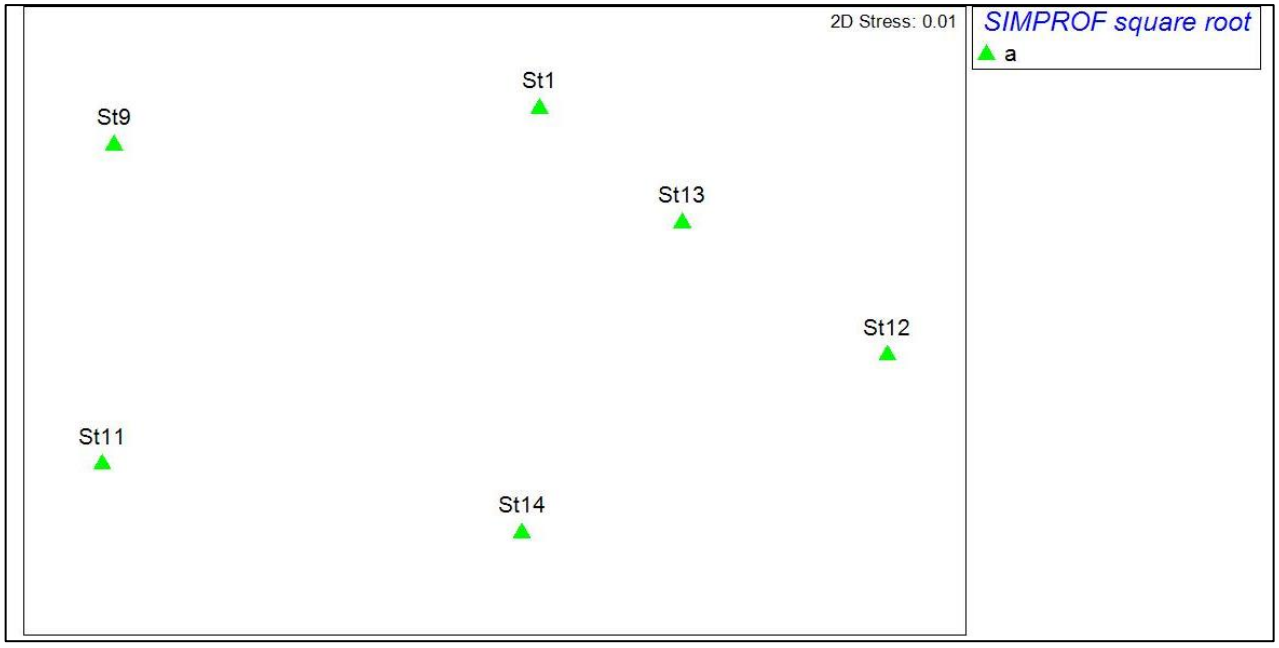


Figure 3.48: MDS Plot produced from analysis of the data.

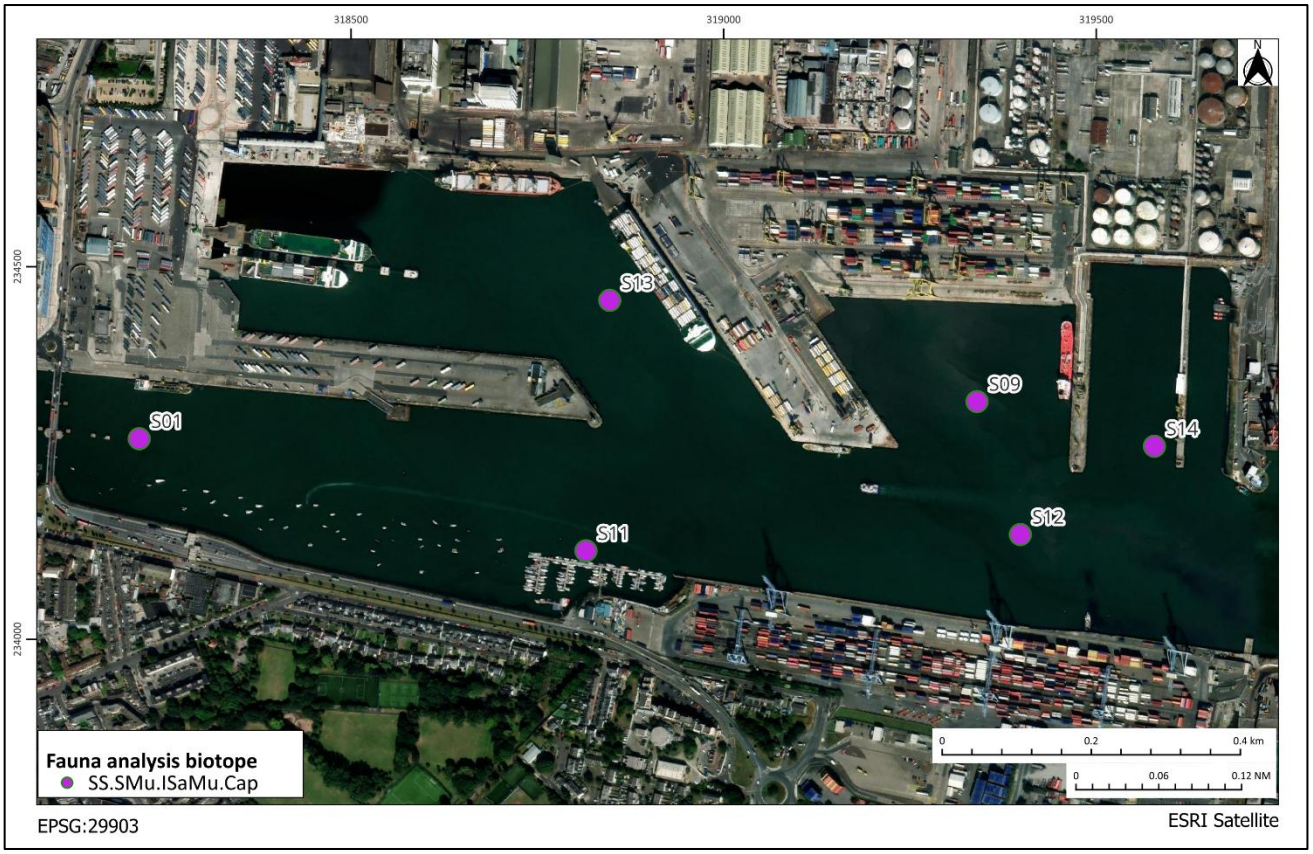


Figure 3.49: Distribution of biotopes from grab sample faunal analysis.

3.4 Sediment Results

The sediment sampled within the study area was classified as 'Slightly Gravelly Muddy Sand' and 'Gravelly Muddy Sand', according to Folk (1954). Station 9 had the highest percentage composition of fine gravel (20.1%) while Station 1 had the lowest amount (0.1%). Station 9 was also shown to have the highest composition of very fine gravel (10.3%) while Station 12 and 14 recorded the lowest percentage (0.9%). The highest composition of very coarse sand was recorded at Station 13 (16.0%) and the lowest composition was recorded at Station 14 (5.8%). The highest composition of coarse sand was recorded at Station 13 (15.6%) and the lowest composition (10.3%) at Station 11. Station 14 recorded the highest composition of medium sand (15.2%) while the lowest composition (10.5%) was recorded at Station 9 and 11. The highest composition of fine sand was recorded at Station 14 (19.4%) and the lowest composition at Station 9 (9.6%). The highest composition of very fine sand (23.3%) was recorded at Station 14 again with Station 9 also with the lowest composition (9.6%). Station 11 recorded the highest silt-clay composition (31.8%) while Station 9 recorded the lowest composition (11.1%). Organic matter values ranged from 8.05% (Station 12) to 12.05% (Station 1) across the stations.

Table 3.4 shows the sediment characteristics of the subtidal stations surveyed including the granulometry and the percentage of organic carbon present.

Table 3.4: Sediment characteristics of the benthic subtidal faunal stations sampled. LOI refers to the % organic carbon loss on ignition

Station	>8mm	Fine Gravel (4-8 mm)	Very Fine Gravel (2-4 mm)	Very Coarse Sand (1-2 mm)	Coarse Sand (0.5-1 mm)	Medium Sand (0.25-0.5 mm)	Fine Sand (125-250 mm)	Very Fine Sand (62.5-125 mm)	Silt-Clay (<63 mm)	Folk (1954)	LOI (%)
1	0.0	0.1	1.0	11.9	12.8	14.0	17.6	16.9	25.7	Slightly gravelly muddy sand	12.05
9	0.0	20.1	10.3	15.9	12.8	10.5	9.6	9.6	11.1	Gravelly muddy sand	8.83
11	0.0	1.2	1.9	12.0	10.3	10.5	14.3	18.1	31.8	Slightly gravelly muddy sand	9.16
12	0.0	1.4	0.9	13.1	13.4	11.6	12.1	17.0	30.5	Slightly gravelly muddy sand	8.05
13	0.0	7.2	9.0	16.0	15.6	12.5	11.7	10.6	17.3	Gravelly muddy sand	10.3
14	0.0	0.7	0.9	5.8	11.1	15.2	19.4	23.3	23.6	Slightly gravelly muddy sand	9.43

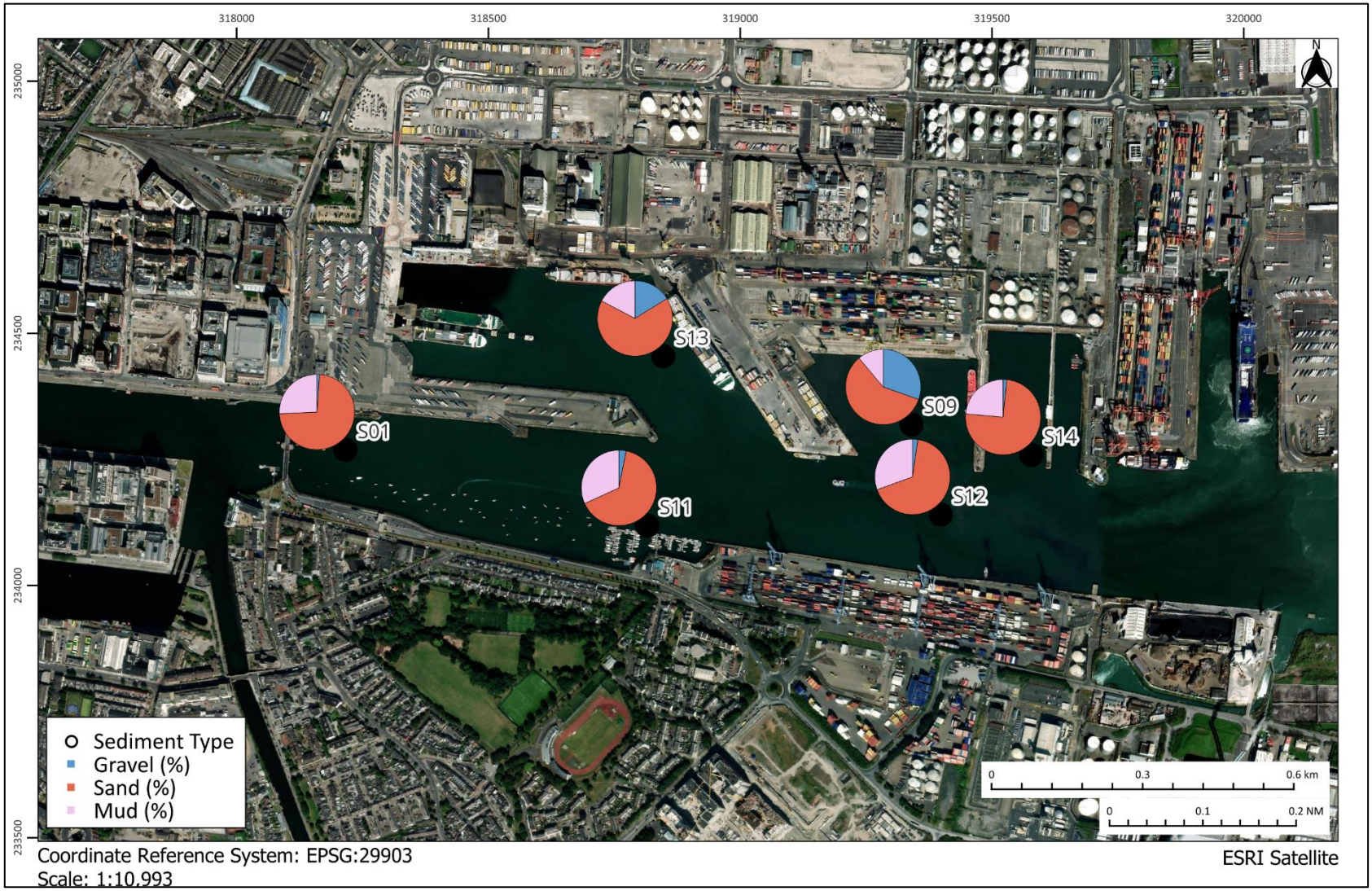


Figure 3.50: A breakdown of sediment type fraction (%) at each of the station sampled.

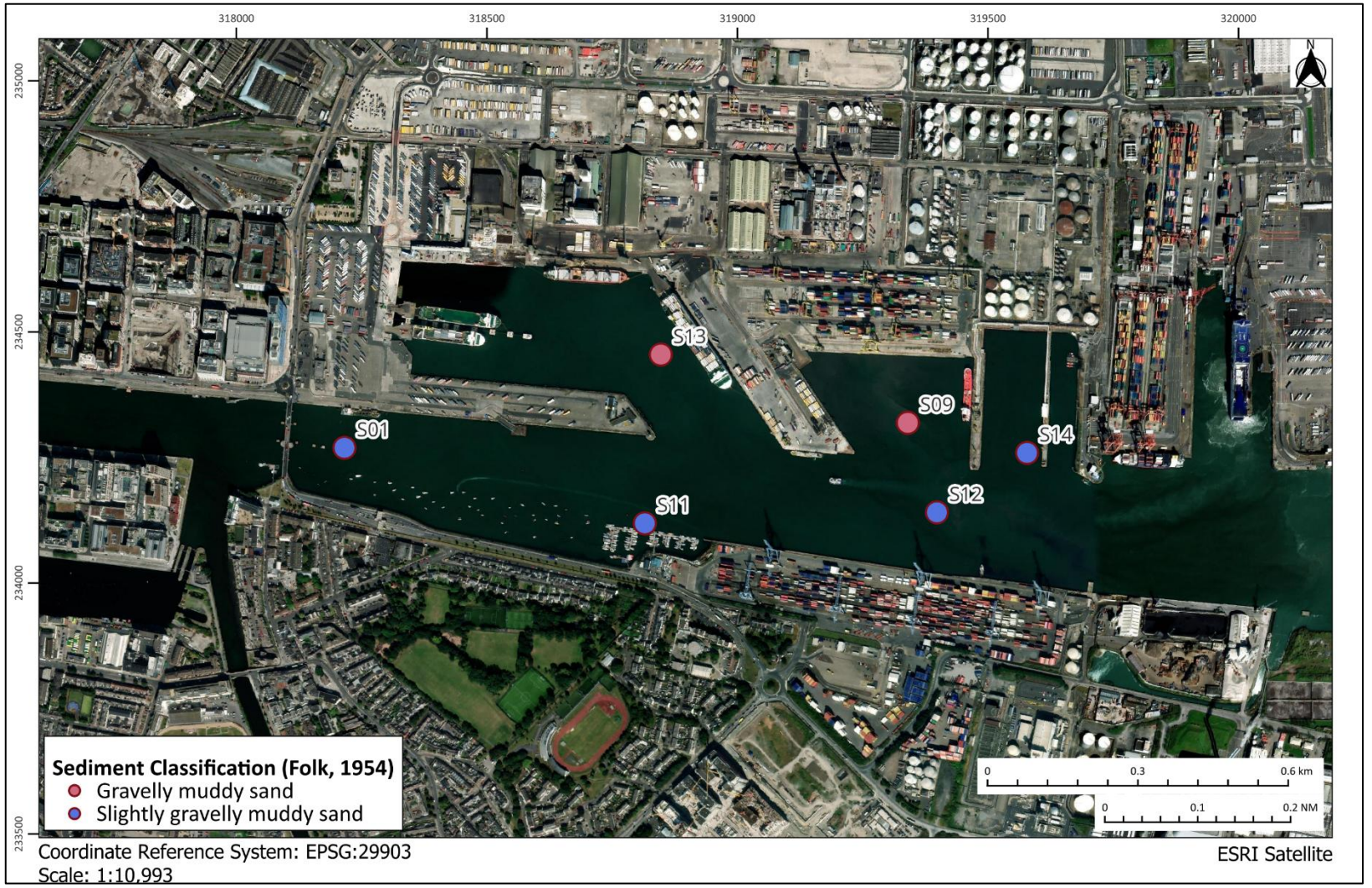


Figure 3.51: Sediment Classification across stations sampled according to Folk (1954).

4. Comparison of survey results (2020 & 2025)

Results from the survey indicated that the sediment characteristics across the main navigation channel (Station 1, 11, 12) and at the East Oil Jetty (Station 14) were classified as a 'Slightly Gravelly Muddy Sand'. Sediments at Alexandra Basin West and Alexandra Basin East were classified as 'Gravelly Muddy Sand' according to Folk (1954). Muddy sand is therefore dominant at the upstream sheltered parts of the survey area adjacent to Tom Clarke Bridge and within the main channel. Muddy sand with more gravelly composition is dominant at the two embayments at Alexandra basins (West and East) (**Figure 3.1**). The high organic content present across the sites corresponds with the muddy sand substrate composition of the area surveyed (**Table 3.4**). In the ASU survey in 2020, the composition of the substrate was described as mud and sandy mud along the upstream sheltered parts of Alexandra basins (East and West) adjacent to Tom Clarke Bridge similar to what was found in this survey. Comparable sediment conditions were also recorded during the ASU benthic survey undertaken in 2013 to support the Environmental Statement for the ABR Project (ASU, 2014), which described organically enriched muddy sand and sandy mud sediments within Alexandra Basin, including within the Berth 52/53 basin. ASU also surveyed the outer area of Alexandra Basin where there was a change in sediment composition further downstream becoming sandier with muddy sand and fine sand dominating more exposed sites. The change in sediment composition was also reflected in the organic carbon analysis, with higher organic content present in the inner sites within Alexandra Basin (ASU, 2020).

The analysis of the DDV and ROV recordings and stills provided enough evidence to infer that the benthic environment surveyed is consistent with the broadscale habitat 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26) consistent with previous ASU findings.

This broadscale habitat is similar to the habitat type previously described by the ASU in 2020 across the stations surveyed, which was characterised as muddy sand and sandy mud supporting biotopes dominated by opportunistic polychaete assemblages consistent with SS.SMu.ISaMu.Cap. The same broad habitat type was also identified during the 2013 ASU survey, indicating a consistent benthic habitat distribution across the ABR2 Project area over more than a decade of port operations and periodic dredging activity.

The dominance and diversity of the faunal community structure across the sites surveyed within the Alexandra Basin are explained from the results of the univariate analysis. The group contained high numbers of opportunistic species, with relatively higher diversity as indicated by a mean ENS value of 8.055 across the inner sites of Alexandra Basin compared to 2020. The diversity across the inner sites in 2020 indicated a high number of opportunistic species with a relatively lower diversity (ENS value 3.21). The inner sites also show a lower mean Pielou's evenness score (0.581) in comparison to ASU results with a higher mean Pielou's evenness score (0.625) indicating higher diversity and fewer species dominating the faunal communities along the inner

sites in 2020. Similar dominance by opportunistic taxa and reduced evenness within inner basin sites was reported during the 2013 ASU survey (ASU, 2014), reflecting long-standing disturbance and organic enrichment within the port environment rather than recent ecological change.

In the survey conducted by ASU in 2020, the outer area of Alexandra Basin was also surveyed. The faunal distribution consisted of a mixed biotope identified along the inner sites (SS.SMu.ISaMu.Cap & SS.SMu.ISaMu.Cap / SS.SMuVS.AphTubi), contained high numbers of opportunistic species, with relatively low diversity. This is reflected in ENS values (3.21) when compared to those indices for the biotope identified in the outer Bay area (SS.SSa.CMuSa.AalbNuc) with ENS of (10.89). The inner sites also show a lower mean Pielou's evenness score (0.625 ± 0.21 Std Dev compared to 0.806 ± 0.15 Std Dev) indicating lower diversity and fewer species dominating the faunal communities along the inner sites when compared to the outer sites. ASU reported the same biotope groups identified and similar relation to the diversity and dominance of species across the area in 2013 (ASU, 2014).

The benthic community identified from the faunal sample analysis is consistent with the JNCC biotope 'SS.SMu.ISaMu.Cap' *Capitella capitata* in enriched sublittoral muddy sediments. A similar biotope was described by ASU in 2020 where the inner sites of Alexandra Basin reflected species characterising the same biotope 'SS.SMu.ISaMu.Cap'. The benthic communities described during the 2013 ASU survey were characterised by similar opportunistic taxa and sediment conditions to those recorded in 2020 and 2025, consistent with the 'SS.SMu.ISaMu.Cap' biotope identified in later surveys. The polychaete *Capitella* species complex (previously described as *Capitella capitata* aggregate) can rapidly thrive in organically enriched polluted sediments (Warren 1977; Pearson & Rosenberg 1978). They are therefore likely to be abundant in areas of high disturbance, including regular dredging sites and in marine inlets, embayment, or estuaries (JNCC, 2022[1]).

The outer sites of Alexandra Basin surveyed by ASU were not currently surveyed this time. They reported a mix of biotopes of 'SS.SMu.ISaMu.Cap' with 'SS.SMuVS.AphTubi' (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud) at sites from the Ferryport Basin to the Poolbeg Lighthouse. Although no *Capitella* sp. complex were recorded at those stations, the remaining fauna in this area were similar to those present further upstream (inner sites of Alexandra Basin). These findings were consistent with those reported during the 2013 ASU survey, which similarly identified transitional faunal assemblages between inner basin and outer bay environments (ASU, 2014).

5. Discussion

From the results of the surveys undertaken in 2020, 2025, and 2026 (ROV) the same conclusion can be drawn in respect to the habitat and biotope found across the main channel and Alexandra basins. A single biotope type was identified at the inner sheltered sites with a dominance of first order opportunist populations of *Capitella* sp. complex characterising the SS.SMu.ISaMu.Cap biotope. Sediment composition varies slightly across the stations between the two surveys, but they reflect the broader sediment that characterise a gravelly muddy sand to muddy sand substrate type in the sheltered areas.

Sediment composition within Alexandra Basin remains broadly consistent with previous assessments, dominated by muddy sand with varying gravel fractions. Inner sheltered sites adjacent to Tom Clarke Bridge and the main navigation channel exhibit slightly gravelly muddy sand, while embayments at Alexandra Basin East and West show gravelly muddy sand characteristics. Organic content (8–12%) correlates with fine-grained substrates, supporting deposit-feeding assemblages. These findings align with ASU's 2020 survey, which reported similar sediment types and organic enrichment patterns, indicating minimal geomorphological change despite intermittent dredging.

The DDV survey confirmed the persistence of the broadscale habitat SS.SSA.CMuSa – Circalittoral muddy sand (EUNIS A5.26) across all stations, consistent with ASU's earlier classification. This continuity suggests that dredging activities have not significantly altered the physical habitat structure at the surveyed inner basin sites.

In respect of the area of the Berth 52/53 basin, findings from the ROV survey conducted in 2026 indicated comparable habitat structure with muddy sediment substrate. There is some degree of variations in sediment composition with pebbles, cobbles and some boulders mostly along rock armours with relatively low epifaunal presence. The indicates similar habitat composition to previous surveys within the basin of Berth 52/23.

The 2025 survey recorded 104 taxa (576 individuals), with diversity indices indicating moderate improvement compared to 2020. Effective Number of Species (ENS) ranged from 5.61 (Station 1) to 11.14 (Station 9), nearly double the ENS reported for inner basin sites in 2020 (mean ENS ≈ 3.21).

Opportunistic polychaetes such as *Capitella* spp., Cirratulidae, and oligochaetes remain abundant, reflecting continued organic enrichment and disturbance. These species are characteristic of stressed environments and exhibit rapid recolonisation following physical disruption, explaining their prevalence in both surveys.

Both surveys confirm the dominance of the SS.SMu.ISaMu.Cap biotope – *Capitella capitata* in enriched sublittoral muddy sediments, indicative of organically enriched conditions and physical disturbance. The persistence of this biotope underscores the resilience of opportunistic assemblages under chronic stress

regimes. While diversity metrics show slight improvement, functional composition remains skewed toward opportunists, persistent organic enrichment.

Observed patterns are primarily driven by cumulative dredging, sediment deposition, and organic loading within the basin. Although dredging has not fundamentally altered sediment type, it has maintained conditions favourable to opportunistic taxa. The slight increase in diversity may reflect recolonisation during periods of reduced disturbance, but full recovery to a balanced community structure is unlikely considering the natural organically enriched environment with the area and the ongoing capital maintenance dredging activities.

5.1 Impacts of Capital Dredging at Alexandra Basin West and infilling at Berth 52/53

A range of potential impacts on benthic biodiversity have been identified which may occur during the Capital Dredging and infilling operations of the ABR2 Project.

The first phase of dredging was completed and involved the dredging of Alexandra Basin West to a depth range of -7 m CD (Chart Datum) to -9.5 m CD. Some of this dredged material has been treated and used as infill at Graving Dock No. 2. The remaining dredged and treated material is currently stockpiled at Berth 53. A second phase of capital dredging is proposed as part of the ABR2 Project, which will involve completion of dredging within Alexandra Basin West to a standard depth of approximately -10.0 m CD to facilitate the proposed redevelopment of the basin. The area of the infilled existing basin of Berth 52/53, the landside area to the immediate east, between this infilled basin and Terminal Road South, and the landside area to the west of this infilled basin, will have the existing levels raised by 1.4 m over an area of 95,000 m^2, using a combination of clean imported materials and where suitable, treated remediated material from dredged sediments originating from Alexandra Basin West.

Sediment consisting of gravelly muddy sand will be dredged from Alexandra Basin West. An estimated 54,500 m^3 of dredged and treated material will be used to infill Berth 52 & 53 of the Terminal 5 Ro-Ro basin. Upon completion of infilling works, existing levels adjacent to the infilled basin will be raised by 1.4 m over an area of 95,000 m^2 to enable the delivery of the Unified Ferry Terminal, as permitted under the MP2 Project.

A sensitivity assessment is presented for the biotope identified from the grab surveys and video transects based on Tyler-Walters *et al.* (2023) (see **Table 5.1**).

Table 5.1: Sensitivity Assessment of Biotopes based on potential impacts from ABR2 Project.

Sensitivity of biotopes to identified likely pressures	Biotope
	SS.SMu.ISaMu.Cap
Physical – Smothering & siltation Light siltation (<5cm)	Low
Physical – Smothering & siltation rate changes (heavy >5cm)	Low
Changes in suspended solids (water clarity)	Low
Abrasion / disturbance of the surface of the substratum or seabed	Low
Penetration or disturbance of the substratum subsurface	Low
Habitat structure changes - removal of substratum (extraction)	Medium

Physical – Smothering & siltation - Light siltation (up to 5 cm fine material deposit in a single discrete event)

Capital dredging and infilling operations are likely to cause light to heavy siltation within a distance of 30 m away from the dredger.

The characterising polychaete *Capitella* sp. complex is categorised as AMBI sedimentation Group V – 'A first-order opportunistic species, that thrives in organic enriched sediment and are relatively insensitive to higher sedimentation. Low level of sedimentation similar to background levels, are unlikely to cause an effect to the population of *Capitella* sp. complex. They have a rapid recovery period, and their population may even thrive post disturbance (Gittenberger & van Loon, 2011). Therefore, the resistance of this biotope to light siltation based on *Capitella* sp. complex is considered to be 'Low' at benchmark threshold of <5 cm. With a rapid recovery rate, biotope resilience is assessed as 'High' and sensitivity is assessed as 'Low' (Tyler-Walters *et al.* 2023).

Physical – Smothering & siltation rate Heavy siltation (up to 30 cm fine material deposit in a single discrete event)

Heavy siltation deposit of 30 cm will prevent feeding of populations of *Capitella* sp. complex and impact oligochaetes such as *Tubificoides benedii* and it is considered unlikely that repositioning may occur. Only recolonisation of the deposit is considered to occur. The biotope resistance is therefore assessed as 'Low' as if vertical migration through the deposit occurs. Recolonisation of *Capitella* sp. complex and oligochaetes is likely to occur within two years. Resilience is therefore assessed as 'High' and biotope sensitivity is assessed as 'Low' (Tyler-Walters *et al.* 2023).

Changes in suspended solids (water clarity)

Dredging and infilling operations are likely to cause large amounts of sediments to be disturbed and stay in suspension. Dredging operations will induce fine sediment suspension that could lead to smothering of benthic communities. It is expected that smothering caused by particle sizes of <125 µm will settle out onto the seabed up to 30 m from the dredger. Macroinvertebrate communities within the immediate footprint of the dredger will therefore be physically impacted. This gives an area of *c* 45,650 m^2 of the basin of Berth 52/53 that is estimated to be affected by sediments deposition. However, the characterising species of this biotope are sub-surface deposit feeders, and it is considered that an increase in suspended solids is unlikely to have an impact. Resistance is assessed as 'High' and resilience as 'High', so the biotope is considered to be 'Not sensitive' (Tyler-Walters *et al.* 2023).

No Annex I habitats or protected benthic species were recorded within the ABR2 Project area during the 2025 benthic survey or during previous benthic surveys undertaken within Alexandra Basin, including those carried out by ASU in 2013 and 2020. In contrast, ecologically valuable Annex I habitats occur elsewhere within Dublin Bay, including intertidal mudflats and sandflats within the South Dublin Bay and River Tolka Estuary SAC and North Dublin Bay SAC, and eelgrass (*Zostera marina*) beds located in the outer parts of Dublin Bay, primarily in intertidal and shallow subtidal areas away from the Port infrastructure. Reef habitats within Dublin Bay are confined to rocky areas such as Howth Head and are not present within or adjacent to the ABR2 Project area. These habitats are located outside the immediate zone of influence of the proposed works.

Abrasion / disturbance of the surface of the substratum or seabed, penetration or disturbance of the substratum subsurface.

Dredging operations are likely to cause abrasive effects to sub surface species of this biotope. Abrasion may physically damage or kill some of the characterising species. More resistant species that are generally buried deeper into the sediment such *as Capitella* sp. complex and *Tubificoides* spp. are likely to be more resistant than *Pygospio elegans* that inhabit fragile tubes that extend above the sediment surface. Biotope resistance is assessed as 'Medium' and resilience as 'High', so sensitivity is assessed as 'Low' (Tyler-Walters *et al.* 2023).

Penetration or disturbance of the substratum subsurface

Penetration or disturbance of the substratum subsurface is related to species and physical damage to structures within the habitat. The characterising species of the biotope is present in the surface layers of sediment and may be damaged, displaced or killed by penetration and disturbance of the sediment. Resistance is assessed as 'Low' and resilience as 'High', so sensitivity is assessed as 'Low' (Tyler-Walters *et al.* 2023).

Habitat structure changes - removal of substratum (extraction)

Dredging operations will cause direct physical removal of benthic habitats and fauna within the dredging footprint. The rate of benthic recovery may vary depending on sediment type and community structure. The proposed dredging of the Alexandra Basin West to a depth of -10 m CD will cause physical disruption of the habitat structure in which macroinvertebrate communities inhabit. This will result in the permanent removal/loss of these characterising species and biotopes within the immediate footprint of the dredging. The *c.* 194,000 m^2 area yet to be dredged within Alexandra Basin West will lose its biotope and associated characterising species.

Extraction of 30 cm of sediment will remove the polychaete assemblage and other species present in the biotope. Recovery of the biological assemblage may take place if the exposed, underlying sediments are similar to those that were removed. Resistance for this biotope is assessed as 'None' and biotope resilience is assessed as 'High''. Biotope sensitivity is therefore 'Medium' (Tyler-Walters *et al.* 2023).

6. Conclusion

The benthic environment within Alexandra Basin exhibits strong continuity with previous assessments, including those undertaken by ASU in 2013 to support the Environmental Statement for the ABR Project (ASU, 2014). Same can be concluded from a recent survey conducted within Berth 52/53. The overall seabed substrate is characterised by muddy sand substrates and opportunistic polychaete assemblage indicative of organic enrichment and physical disturbance. No benthic species of conservation concern, protected species, or Annex I habitats have been recorded within the Project area during the 2025 and 2026 surveys or in previous assessments. Diversity indices show modest improvement since 2020, but community structure remains dominated by stress-tolerant species. Planned capital dredging and infilling under the ABR2 Project will temporarily exacerbate habitat disruption; however, the well-documented disturbance tolerance and high resilience of the SS.SMu.ISaMu.Cap biotope, as recorded consistently in the 2013, 2020, and 2025 surveys, suggests a strong potential for recovery provided sediment characteristics remain broadly unchanged.

To safeguard ecological integrity, continued post-construction monitoring is recommended to transect recovery patterns, assess long-term trends in diversity and biotope composition, and ensure compliance with ecological protection objectives.

7. References

Anderson, M. J., Gorley, R. N., & Clarke, K. R. .2008. PERMANOVA+ for PRIMER: Guide to software and statistical methods. PRIMER-E.

Aquatic Services Unit (UCC). 2020. Dublin Port Maintenance Dredging 2022 – 2029 Benthic and Fisheries Assessment. November 2020.

Aquatic Services Unit (UCC). 2014. Dublin Port Maintenance Dredging 2022 – 2029 Benthic and Fisheries Assessment. 2014.

Clarke, K.R. & R.M. Warwick. 2001. Changes in marine communities: An approach to statistical analysis and interpretation. 2nd Edition. Primer-E Ltd.

Clarke, K. R., & Gorley, R. N. 2006. PRIMER v6: User manual/tutorial. PRIMER-E.

Folk, R.L. 1954. The distinction between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology* **62 (4):** 344-359.

Gittenberger, A. & Van Loon, W.M.G.M., 2011. Common marine macrozoobenthos species in the Netherlands, their characteristics and sensitivities to environmental pressures. GiMaRIS Report no 2011.08. DOI: https://doi.org/10.13140/RG.2.1.3135.7521.

Gubbay, S. 2007. Defining and managing *Sabellaria spinulosa* reefs: Report of an inter-agency workshop 1-2 May, 2007, JNCC Report No. 405, JNCC, Peterborough, ISSN 0963-8091.

Heip, C.H.R., Herman, P.M.J., Soetaert, K., 1998. Indices of diversity and evenness. *Océanis* 24, 61–87.

Hill, M. 1973. Diversity and evenness: a unifying notation and its consequences. *Ecology* 54: 427–432.

Irving, R. 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432, JNCC, Peterborough, ISSN 0963-8091.

JNCC. 2022. The Marine Habitat Classification for Britain and Ireland Version 22.04. [13 August 2025]. Available from: https://mhc.jncc.gov.uk/

Jost, L. 2006. Entropy and diversity. *Oikos* 113: 363–375.

MacArthur, R.H. 1965. Patterns of species diversity. Biological Reviews 40: 510–533.

The Marine Life Information Network: Capitella capitata in enriched sublittoral muddy sediments - MarLIN - The Marine Life Information Network.

Margalef, D.R. 1958. Information theory in ecology. *General Systems* **3:** 36-71.

Parry, M.E.V. 2019. Guidance on assigning benthic biotopes using EUNIS or the marine habitat classification of Britain and Ireland (Revised 2019). JNCC report, 54617.

Perry, F., & Watson, A., 2024. *Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment. In Tyler-Walters H. *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 15-08-2025]. Available from: https://www.marlin.ac.uk/habitat/detail/1091.

Pielou, E.C. 1977. Mathematical ecology. Wiley-Water science Publication, John Wiley and Sons. pp.385.

Pearson, T.H. & Rosenberg, R., 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanography and Marine Biology: an Annual Review, 16, 229-311.

Shannon, C.E. & W. Weiner. 1949. The mathematical theory of communication. University of Illinois Press, Urbana.

Tillin, H.M. & Watson, A., 2023. *Capitella capitata* in enriched sublittoral muddy sediments. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 27-08-2025]. Available from: https://www.marlin.ac.uk/habitat/detail/106.

Tyler-Walters, H., Tillin, H. M., d'Avack, E. A. S., Perry, F., & Stamp, T. (2023). Marine Evidence-based Sensitivity Assessment (MarESA) – Guidance Manual. Marine Life Information Network (MarLIN), Marine Biological Association of the UK. Retrieved from https://www.marlin.ac.uk/publications.

Warren, L.M., 1977. The ecology of Capitella capitata in British waters. Journal of the Marine Biological Association of the United Kingdom, 57, 151-159.

Worsfold, P. J., Worsfold, R. J., & Tucker, D. 2010. The role of the NMBAQC scheme in improving the quality of marine biological analyses. Marine Pollution Bulletin, 60(6), 977-981. https://doi.org/10.1016/j.marpolbul.2010.02.021.

8. Appendices

Appendix 1 - Standard Field Operating Procedure (T2-SOP-Field Methods-04)

Appendix 2 – Species List (2025)

Taxon	AphiaID	Station 1	Station 9	Station 11	Station 12	Station 13	Station 14
Actiniaria	1360	0	13	0	0	0	0
Nematoda	799	1	55	10	22	26	8
Golfingiidae (juvenile)	2032	2	0	0	0	0	0
Pholoe	129439	0	0	1	0	0	1
Pholoe baltica (sensu Petersen)	130599	0	1	0	0	0	0
Pholoe inornata (sensu Petersen)	130601	0	6	0	0	0	1
Phyllodocidae	931	0	0	0	0	1	0
Eteone	129443	0	0	2	0	0	48
Eteone longa	130616	23	6	15	45	78	0
Phyllodoce mucosa	334512	7	2	2	0	4	3
Hesionidae (juvenile)	946	1	0	0	0	0	0
Podarkeopsis capensis	130195	1	3	0	0	0	0
Nereididae (juvenile)	22496	1	0	0	0	0	0
Hediste diversicolor	152302	0	0	1	0	0	3
Alitta virens	234851	0	0	0	0	2	0
Eunereis longissima	130375	0	0	0	0	1	0
Nephtys	129370	0	0	0	0	1	0
Nephtys hombergii	130359	3	8	4	3	0	0
Scoloplos armiger	130537	0	1	0	0	0	0
Spionidae	913	8	0	0	1	6	0
Malacoceros	129614	0	0	1	0	0	0
Polydora cornuta	131143	105	1	1	5	55	0
Prionospio	129620	0	0	1	0	0	0
Pseudopolydora paucibranchiata	131168	0	0	0	0	0	1
Pseudopolydora pulchra	131169	1	1	0	0	3	1
Pygospio elegans	131170	1	1	1	0	0	1
Cirratulidae	919	145	266	84	42	142	77
Caulleriella alata	129943	0	3	0	0	0	0
Chaetozone gibber	129953	0	52	311	0	0	6
Cirriformia tentaculata	129964	0	0	0	0	55	0
Tharyx	129249	0	0	214	0	0	0
Tharyx killariensis	152269	0	0	10	0	0	0
Cossura longocirrata	129984	1	0	0	0	0	0
Capitella	129211	324	89	6	139	98	177
Mediomastus fragilis	129892	1	2	7	0	2	0
Notomastus	129220	0	0	0	1	0	3
Arenicola marina	129868	1	0	0	1	0	0
Ophelina	129414	1	0	0	0	0	0
Ophelina acuminata	130500	2	15	8	3	16	24
Scalibregma	129555	0	0	0	0	0	9
Scalibregma inflatum	130980	119	425	525	33	117	141

Taxon	AphiaID	Station 1	Station 9	Station 11	Station 12	Station 13	Station 14
Scalibregma celticum	130979	0	1	0	0	0	0
Ampharetidae	981	0	0	1	0	0	0
Melinna palmata	129808	2	1	1	0	6	0
Ampharete	129155	0	1	0	0	0	0
Ampharete lindstroemi	129781	0	0	0	0	0	1
Lanice conchilega	131495	0	0	0	0	1	0
Sabellidae	985	0	1	1	0	0	0
Jasmineira	129533	4	0	0	0	4	0
Jasmineira caudata	130920	0	0	0	1	0	0
Jasmineira elegans	130921	3	5	8	0	1	0
Hydroides	129566	0	0	0	0	0	Present
Tubificoides	137393	8	54	9	0	2	3
Tubificoides galiciensis	137576	0	0	1	0	0	0
Tubificoides benedii	137571	0	1	0	2	0	0
Tubificoides brownae	137572	14	80	4	0	0	0
Achelia echinata	134599	0	1	0	0	0	0
Cirripedia	1082	0	277	0	0	0	0
Balanus crenatus	106215	0	25	0	0	0	0
Praunus flexuosus	120177	0	1	0	0	0	0
Perioculodes longimanus	102915	0	2	0	0	0	0
Leucothoe spinicarpa	102470	0	1	0	0	0	0
Socarnes erythrophthalmus	148560	0	1	0	0	0	0
Nototropis swammerdamei	488966	0	11	0	0	1	1
Gammaridae	101383	0	2	0	0	0	0
Gammarus	101537	0	9	0	0	0	0
Gammarus locusta	102281	0	2	0	0	0	0
Jassa herdmani	102432	0	2	0	0	0	0
Aora gracilis	102012	0	1	0	0	0	0
Monocorophium sextonae	148603	0	23	0	0	0	0
Pariambus typicus	101857	1	0	0	0	1	0
Monopseudocuma gilsoni	422916	1	0	0	0	0	0
Pseudocuma longicorne	110627	0	1	0	0	0	0
Brachyura	106673	1	9	0	1	2	0
Polybius	106928	0	3	0	0	1	0
Polybius depurator	1750291	0	1	0	0	0	0
Elmidae		2	0	0	0	1	0
Hydrobiidae	120	0	0	0	0	1	0
Peringia ulvae	151628	819	1	20	1	47	23
Nudibranchia	1762	0	1	0	0	0	0
Bivalvia	105	0	0	0	1	1	0
Nucula (juvenile)	138262	2	0	0	0	1	0
Nucula nitidosa	140589	0	0	1	0	0	0
Mytilidae	211	0	1	0	0	0	0

Taxon	AphiaID	Station 1	Station 9	Station 11	Station 12	Station 13	Station 14
Mytilus edulis	140480	0	0	0	0	0	2
Thyasira	138552	6	0	19	1	1	2
Thyasira flexuosa	141662	0	20	2	0	0	1
Kurtiella bidentata	345281	6	12	9	0	1	2
Parvicardium (juvenile)	137739	1	0	0	0	0	0
Parvicardium pinnulatum	181343	0	1	0	0	1	0
Tellinidae (juvenile)	235	0	0	0	0	1	0
Macomangulus tenuis	878470	0	0	1	0	0	2
Abra	138474	18	28	31	4	0	6
Abra alba	141433	27	44	13	4	4	8
Abra nitida	141435	5	47	5	1	1	3
Veneridae (juvenile)	243	0	0	0	0	0	1
Ruditapes decussatus	231749	0	0	0	0	1	0
Varicorbula gibba	378492	0	1	0	0	0	0
Bryozoa	146142	0	0	0	0	0	Present
Alcyonidium diaphanum	111597	0	Present	0	0	0	0
Phoronis	128545	0	0	0	1	0	0
Amphiuridae (juvenile)	123206	1	0	0	0	0	0
Amphipholis squamata	125064	0	0	0	0	0	1
Leptosynapta	123449	0	0	2	0	0	0