Environmental Impact Assessment Report - Volume 2B Addendum

Appendix 8-4:
Benthic Ecology 2025 Survey Report

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OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report – Addendum
Appendix 8-4: Benthic Ecology 2025 Survey Report

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Benthic Ecology 2025 Survey Report

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AQUAFACT APEM Group

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AQUAFACT APEM Group

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms/Glossary

DDV	Drop down video
ECC	Export Cable Corridor
JNCC	Joint Nature Conservation Committee
LOI	Loss On Ignition
NMBAQC	Northeast Marine Biological Analytical Quality Control
PSA	Particle Size Analysis
RPS	RPS Group
TOC	Total Organic Carbon

1. Introduction

Oriel Windfarm Ltd. commissioned AQUAFACT to undertake a benthic subtidal ecology survey covering the Oriel Offshore Wind Farm Export Cable Corridor (ECC) with optional sampling within the Offshore Wind Farm Area (*i.e.* the Array Area).

The survey has been commissioned in response to a request for further information from An Bord Pleanála on the planning application (case reference 319799) for the Oriel Wind Farm Project. It is intended that this survey will provide additional data infill to characterise the benthic subtidal ecology baseline within the ECC and, optionally, to verify that there have been no significant changes to the 2019 baseline within the Array Area. The development site covers 24 km² in the Irish Sea**,** 22 km off the coast of Dundalk, Ireland (see **Figure 1.1**)

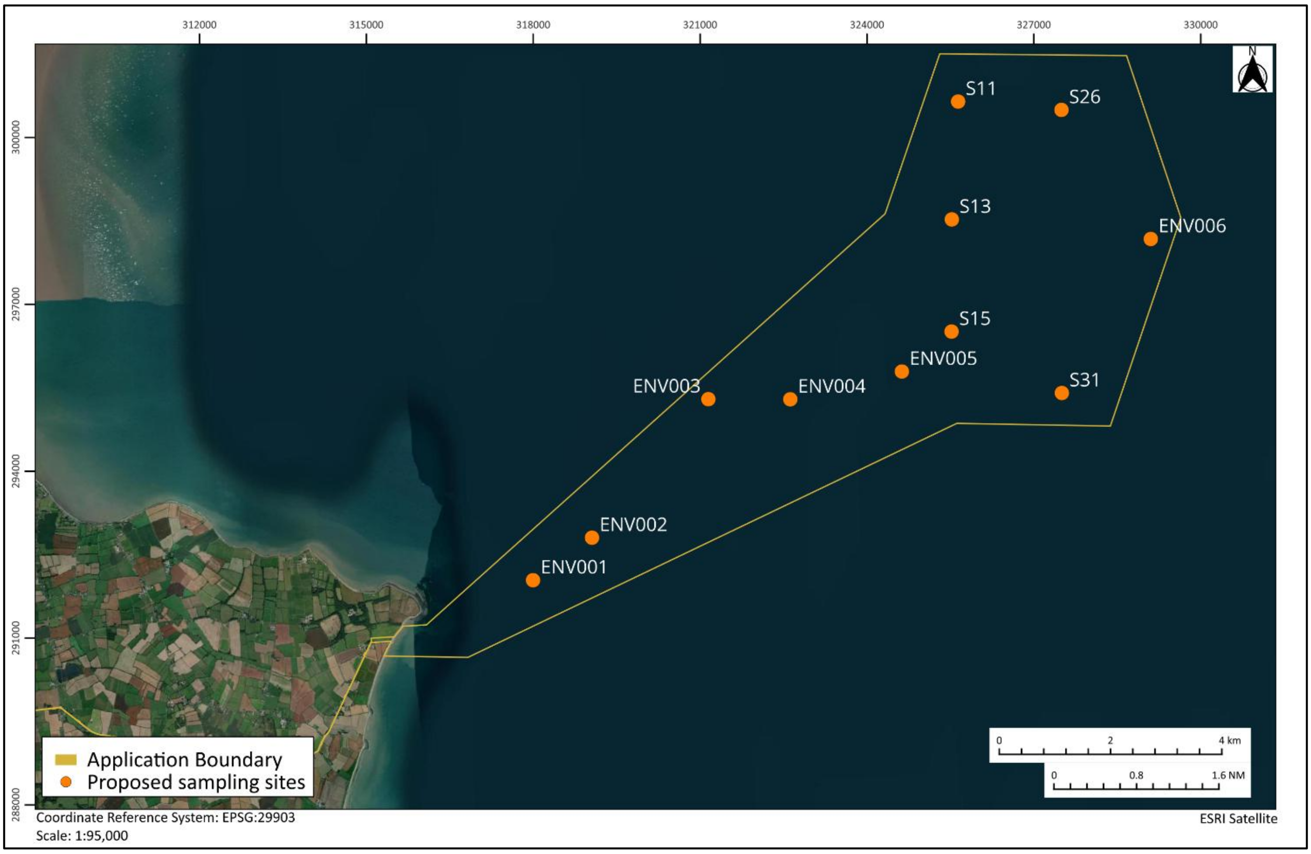


Figure 1.1: Proposed sampling sites within Oriel, Co. Louth.

2. Materials & Methods

The scope of work required to carry out the subtidal benthic survey of the Oriel Wind farm and cable route as presented in **Table 2-1**.

Table 2-1: Scope of survey work for the subtidal benthic ecology survey of the Oriel Wind farm and cable route.

Task	Requirement	Objective	Sampling sites	Data	Station IDs
1	Benthic Ecology Drop Down Video survey	Record benthic habitats (for sites in EEC). To determine substrate type in advance of grab survey campaign (for sites in EEC and Array Area)	11	11 x drop down video station footage and high-quality stills	ENV001, ENV002, ENV003, ENV004, ENV005, ENV006, S11, S13, S15, S26, S31
2	Benthic Ecology Grab Survey	Record benthic habitats and infauna species populations	6	6 grabs (0.1 m^2) for faunal analysis	ENV001, ENV002, ENV003, ENV004, ENV005, ENV006
3	Sediment PSA	To understand sediment classification in the EEC and to repeat sampling in the Array Area to compare to 2019 results.	11	11 grabs (0.1 m^2) for sediment analysis	ENV001, ENV002, ENV003, ENV004, ENV005, ENV006, S11, S13, S15, S26, S31

2.1 Video Survey (Drop-Down Video)

Offshore still and video seabed photographic data were acquired at each of the 11 (grab station locations using a high-resolution underwater camera. AQUAFACT follows the NMBAQC and JNCC guidelines for the best practice acquisition of video stills imaging of benthic substrata and epibenthic species, ensuring that the data collected is fit for purpose in relation to the needs and requirements of the proposed survey.

A STR SeaSpyder HD (manufactured by STR www.str-subsea.com) drop-down video camera was used for the survey. The SeaSpyderHD is designed for operation in water depths down to 3000m depth utilising coaxial or fibre-optic umbilicals. The standard system offers simultaneous uninterrupted recording of low latency live video footage with high resolution stills photography, along with interfacing to a wide range of sensors and dataloggers. The stills camera is fitted with a high quality 18 mega pixel digital SLR Camera offering full control of all photographic parameters including manual focus, shutter speed and aperture. The stills camera is housed within a robust 3000 m depth rated aluminium enclosure along with a water corrected lens and also forms the mounting point for HD video camera and quad scaling lasers. Laser scaling is essential for conducting an assessment of reef size and to determine the percentage cover *etc*.

Video footage was captured by the STR Sea Spectrum HD camera offering high quality 1080P video feed via HD-SDI over dedicated high speed fibre optic link. All data is transferred directly to the surface unit for live interpretation, this includes HD video, stills photos, serial sensor data and Ethernet data such as an imaging sonar. A 19” rack mount Surface Control Unit and powerful topside processor give full remote control of the camera via the easy-to-use GUI software. As standard, the purpose designed camera deployment frame is fitted with a subsea electronics and camera housing, high power underwater flash, an array of four high intensity LED lamps, quad scaling lasers, altimeter, depth sensor and a heading sensor. Many other sensors are easily integrated via serial & Ethernet data channels.

Prior to the deployment of grab equipment, DDV transects were conducted to check the suitability of the substrate at each station to ensure no protected or sensitive species or habitats were present. As outlined above, if protected or sensitive species were present, the sampling location was restricted to DDV sampling only.

Short drifts were used at each station, with video recorded within the vicinity (5-10 m) of the station location with the camera approximately 50 cm to 1 m above the seabed. The camera was landed on the seabed at a minimum of 5 times to capture still images a few metres apart in order to enable an assessment of spatial variability. If a site was found to have no appropriate substrate to perform a benthic grab using the DDV, a 25m DDV transect was carried out at the site to get a more comprehensive understanding of the station following analysis of DDV footage.

From the DDV footage for each station, benthic habitat assessments were undertaken using the current guidance notes *i.e.,* Gubbay (2007) and Limpenny *et al.* (2010) for *Sabellaria* reefs, and Irving (2009) for potential cobble reefs.

Surveys were undertaken during appropriate tides/weather conditions to allow optimum video capture. At each station the immediate survey area was checked for obstructions such as static gear.

Notes on visible sediment conditions, seabed features, flora and fauna, notable sensitive and protected species were made *in-situ* together with DGPS position, water depth, date and time.

The locations of the 11 stations completed for the DDV survey are provided in **Table 2-2**.

Table 2-2: Coordinate of Drop-Down Video stations based on the WGS 84 (EPSG:4326) datum.

Station	Latitude (N)	Longitude (W)
ENV001	53.86453	-6.20714
ENV002	53.87115	-6.19074
ENV003	53.89303	-6.15796
ENV004	53.89266	-6.13557
ENV005	53.89667	-6.10487
ENV006	53.91697	-6.03582
S11	53.94	-6.0875
S13	53.921	-6.0901
S15	53.9029	-6.091
S26	53.9382	-6.05929
S31	53.8925	-6.0613

2.2 Benthic Grab Survey

All benthic grabs were undertaken on the same day as the DDV survey on 16th October 2025. The potential grab stations were confirmed with inference from the drop-down video survey.

From the DDV survey, each station was assessed for suitability for grab sampling based on the standard operating procedure for station selection for benthic sampling using drop-down video survey (T2-SOP-Field Methods-04 - **Appendix 1**). The standard operating procedure 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 (see **Table 2-3**).
  Areas with biogenic and non-biogenic reefs identified during the video survey would not be sampled and sampling would be redirected to suitable areas identified during the video survey as per the MARA licence conditions. Where reef habitats are identified, sampling would be restricted to video surveying only. No deployment of survey equipment was conducted in those areas of reef habitats.
- Sampling would also not be carried out in areas where the presence of fauna or flora could be adversely impacted by the sampling (see **Table 2-4**).
- The suitability of sediment type for grab sampling.
- Selection of stations for sediment sampling is based on sediment type suitability which is outlined in**Table 2-5.**

Any other considerations that could impact the surrounding environment or affect benthic sampling (see **Table 2-6**).

Table 2-3: Station Selection Based on Reef Classification.

Feature	Feature Description	Suitability for Benthic Sampling
Biogenic Reef	Any reef made by a living organism.	NOT SUITABLE
Non-Biogenic Reef	The structure of reefs varies from bedrock to boulders or cobbles while topography ranges from horizontal to vertical and the reefs may have numerous ledges and crevices. The geology includes limestone, shale, granite, schists and gneiss. Brown fucoid algae generally dominate the intertidal down to shallow subtidal areas. The latter are characterised by kelp species, frequently with an understorey of red foliose algae. Below the kelp and down to about 30 m, red algae characterise the substratum	NOT SUITABLE

Feature	Feature Description	Suitability for Benthic Sampling
	with very few brown algae. Below this, the habitat is characterised by faunal species; very few foliose or filamentous red algae occur although encrusting red algae may be common.	
Serpula Reefs	The polychaete worm *Serpula vermicularis* secretes a calcareous tube and is common as a solitary worm. The worms aggregate and form structures which may be up to 1 m in height and about 2 m in diameter.	NOT SUITABLE
Sabellaria Reef	These are constructed by the polychaete worm *Sabellaria spinulosa* and *Sabellaria alveolata.* The reefs are constructed of sand grains by the worm and form a substrate for many other species that would not normally be present in the area in the absence of the reefs. The reefs can be up to a metre in thickness.	NOT SUITABLE
Bivalve Reefs	Reefs caused by accumulations of bivalve populations.	NOT SUITABLE
Cold Water Coral Reefs	Cold water coral reefs are from 200–1600 m, where the water temperature is 4–8ºC and the salinity is 32–36%. Coral reefs found to date are generally associated with carbonate mounds, features that rise up to 300-500 m above the sea floor.	NOT SUITABLE

Table 2-4: Station Selection Based on Identifiable Fauna/Flora.

Feature	Feature Description	Suitability for Benthic Sampling
Fauna	• Any bottom fixing fauna species. • Any large populations or accumulations of benthic species.	NOT SUITABLE
Flora	Any bottom fixing flora species.	NOT SUITABLE
Drift Flora	Any non-attached drift flora.	SUITABLE

Table 2-5: Station Selection Based on Sediment Classification.

Feature	Feature Description	Suitability for Benthic Sampling
Boulders/Cobbles/Pebbles	• Boulders (>256 mm) • Cobbles (64 – 256 mm) • Pebbles (4-64 mm)	NOT SUITABLE
Small Granules	• Shell/Gravel (*c.* 4 mm)	SUITABLE
Coarse Sediments	• Gravel(G) • sandy Gravel (s-G) • gravelly Sand (G-s)	SUITABLE
Mixed Sediments	• muddy Gravel (m-G) • muddy sandy Gravel (m-s-G) • gravelly Mud (g-m) • gravelly muddy Sand (g-m-S)	SUITABLE
Mud	• Mud	SUITABLE
Sand	• Sand	SUITABLE

Table 2-6: Other Considerations that Influence Station Selection.

Feature	Feature Description	Suitability for Benthic Sampling
Man Made Structures	• Any visible mad man structure	NOT SUITABLE
Wrecks or Similar Archaeological Material	• Any visible archaeological material.	NOT SUITABLE
Large Accumulation of Marine Litter	• Any visible large accumulation of marine litter.	NOT SUITABLE

The benthic survey was undertaken aboard the ICCB vessel ‘*Ros Áine’.* This vessel is fully licensed and equipped with all materials necessary to conduct the survey as per the tender specifications. The survey vessel operated out of Clogherhead Harbour for the Oriel project. The faunal grab samples were collected from the pre-determined stations based on the Benthic Subtidal Ecology – Survey Plan provided by RPS (MDR1520C).

AQUAFACT has in-house standard operating procedures for benthic sampling, and these were followed for this project. These were in accordance with those outlined in Coggan *et al.,* 2007, Limpenny *et al.,* 2010, and the Marine Monitoring Handbook procedural guidance 3.5. Additionally, the NMBAQC 'Guidelines for processing marine macrobenthic invertebrate samples' (Worsfold *et al.,* 2010) were adhered to.

The benthic sampling for infauna was undertaken using a 0.1 m^2 stainless steel Day Grab sampler. The grabs were mounted on a common pivot, and each bucket has the capacity to collect a sample of approximately 0.1 m^2. Windows on the top of the grab were used to allow inspection of the grab contents. Samples were sieved on a series of nested sieves to prevent damage from cobbles and ultimately sieved on a 1 mm mesh sieve prior to preservation. At each faunal station the drop-down video survey was conducted first and assessed prior to deployment and the suitability of the station for grab sampling was determined (*i.e.* presence of sensitive features, such as *Sabellaria* reef or presence of large boulders that would prevent a successful grab sample being collected).

On arrival at each pre-selected survey station, the location was recorded using differential Global Positioning Satellite (dGPS) (Latitude/Longitude & Irish National Grid (ING)). Additional information (such as date, site name, sample code, water depth at each replicate, type and specification of the sampling device used, anchorage, weather, sea state, quality of the sample, penetration depth, description of the sediment and mesh size) were recorded.

The DDV survey revealed unsuitable substrate and/or the presence of geogenic reefs at multiple stations that instead of the 6 planned stations for faunal sampling, only 2 faunal stations were sampled and of 11 planned stations for sediment sampling, 5 stations were successfully sampled for sediment analysis (see **Table 2-7** for list of final samples taken vs planned samples and reasoning for each.

Figure 2.1 below also shows the locations where sediment was successfully taken for sediment analysis and macroinvertebrate community analysis.

Table 2-7: Grab survey suitability reassessment following DDV survey.

Station	Latitude (N)	Longitude (W)	Dropdown video	Sediment analysis	Fauna	Grab suitability
ENV001	53.86453	-6.20714	Y	-	-	Not suitable large boulders, geogenic reef
ENV002	53.87115	-6.19074	Y	-	-	Not suitable large boulders, geogenic reef
ENV003	53.89303	-6.15796	Y	-	-	Not suitable large boulders and cobble, geogenic reef
ENV004	53.89266	-6.13557	Y	Y	Y	Sand/muddy - all samples taken
ENV005	53.89667	-6.10487	Y	Y	Y	Sand/muddy - all samples taken
ENV006	53.91697	-6.03582	Y	-	-	Hard rock and cobble, not suitable for sampling
S11	53.94	-6.0875	Y	-	Not Designated for Fauna Sampling	Cobbles present throughout
S13	53.921	-6.0901	Y	Y	Not Designated for Fauna Sampling	Sand - PSA samples taken as requested
S15	53.9029	-6.091	Y	Y	Not Designated for Fauna Sampling	Sand/Muddy - PSA samples taken as requested
S26	53.9382	-6.05929	Y	-	Not Designated for Fauna Sampling	Not suitable large boulders and cobble, biogenic reef
S31	53.8925	-6.06130	Y	Y	Not Designated for Fauna Sampling	Sand/muddy - PSA samples taken as requested

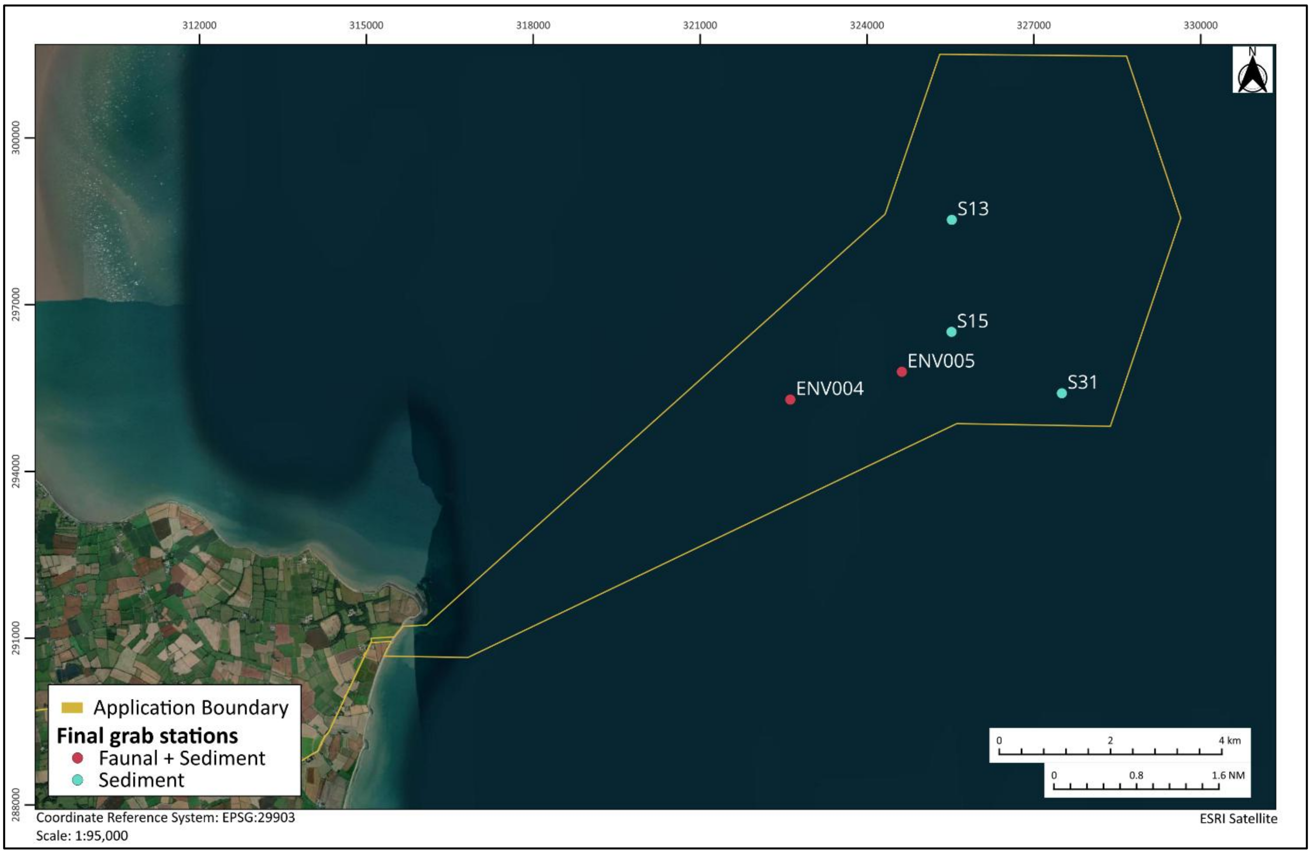


Figure 2.1: Successful sediment grab locations, Oriel, Co. Louth. The DDV survey revealed unsuitable substrate and/or the presence of geogenic reefs at other planned stations, explained in detail in Table 2-7.

2.2.1 Biological Sampling

Grab deployment and recovery rates did not exceed 1 m/s and were <0.5 m/s for the last 5 metres for water depths up to 30 m and for the last 10 m for depths greater than 30 m. This gentle lowering and hauling of the grab reduced the risk of loss of surficial sediment (particularly fines). The winch wire was kept as vertical as possible to ensure the grab was set down and lifted vertically. Upon retrieval of the grab, penetration depth (thickness of the material at the centre of the grab) was measured and recorded in the sample data sheet. To ensure adequate material was retained for analysis, sample volume of less than 5L or those with jaws not fully closed or otherwise deemed incomplete (*e.g.,* due to grab not landing on a flat surface) were discarded and a repeat sample was taken.

Following a successful grab, photographs of the sample (including sample label) were taken and notes on sediment type, texture, grain size, colour, odour (H_2S), residues, layering, volume, presence of fauna/tubes, algae, surface features etc were also recorded. A sample of 500ml was collected for PSA using a plastic scoop and labelled to be stored in a cool box prior to PSA analysis in the AQUAFACT laboratory.

A digital image of each sample was taken in the grab. The contents of the grab was then emptied into a container and the grab washed down into the container to avoid any loss of the sample. The sample was then transferred to a nested sieve with an ultimate 1mm mesh sieve as a sediment water suspension.

The sample was carefully and gently sieved. Great care was taken during the sieving process to minimise damage to taxa such as spionids, scale worms, phyllodocids and amphipods. A direct jet of water against the mesh was not used as the force of the water can damage the fauna. Very stiff clay was fragmented carefully by hand. Fragile animals were picked out by hand to minimise damage and large stones and shells were removed to avoid the grinding effects on organisms against the sieve.

Once the sample was thoroughly washed through, a labelled photograph was taken of the residue retained on the sieve. Additional notes on dominant fauna, presence of dead shells/stones was added to the data sheet.

The residue was then backwashed into a storage bucket pending addition of fixing solution. Spoons or other scraping tools were not used. The sieve was checked for any residual trapped fauna.

The samples were fixed with borax buffered 4-5% saline formalin. The sample was covered by the fixative solution.

Each faunal sample was stored and documented separately. All samples were labelled and the information on the labels were sufficient to identify the sample with certainty (e.g. date, location, station, job number, client, survey name etc). Labels were made of waterproof chemical resistant paper using a soft carbon pencil that prevents fading in the fixing or alcohol solutions. These labels were placed in the bucket with the sample, and the bucket was also be labelled on the outside using a waterproof marker.

The grab and the sieve were washed between stations to prevent cross contamination.

Upon returning to the AQUAFACT laboratory, all samples were registered in a central logbook. Each sample was allocated a unique AQUAFACT ID number (which was written on the bucket) and notes taken on the station ID, survey and job number, date, sampler and who collected and registered the sample. As samples were further processed, the date and person responsible were entered in the logbook.

As the samples were fixed on board the vessel immediately after collection, the next step in the AQUAFACT laboratory was to wash off the formalin and preserve them in 70% alcohol. The samples were in the formalin for a minimum of 72 hours and a maximum of 2 weeks before they were transferred to alcohol. The removal of formalin was necessary to avoid damage to organisms with calcareous structures and alcohol is safer to handle than formalin. In addition, the washing helps in the removal of excess silt and mud balls that may have been broken down during fixation.

2.2.2 Sediment Sampling

A sample was retrieved from each sediment grab sample 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 (<-18ºC) as soon as possible after acquisition.

2.3 Lab Analysis

2.3.1 Sediment Processing

The sediment Particle Size Analysis (PSA) was carried out in AQUAFACT Labs, as described in **Section 2.3.1.1** below, while sediment organic carbon content analysis is to be carried out by ALS Ltd., Loughrea, Co. Galway, using the Loss on Ignition technique (see **Section 2.3.1.2** below for further details).

2.3.1.1 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 63µm; 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 8mm sieve and the weight of the material retained is recorded. The remainder of the sample (<8mm) 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 2-8 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 2-8: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
2000 – 4000 µm (2 – 4mm)	Very Fine Gravel	-1 Ø, -1.5 Ø
4000 -8000 µm (4 – 8mm)	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

2.3.1.2 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.

2.3.1.3 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; >4mm (Fine Gravel), 2-4mm (Very Fine Gravel), 1-2mm (Very Coarse Sand), 0.5-1mm (Coarse Sand), 0.25-0.5mm (Medium Sand), 125-250µm (Fine Sand), 62.5-125µm (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

Univariate 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)

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

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

There was no multivariate analysis undertaken on the faunal data as there were only two sampling sites for fauna and therefore, no sufficient fauna data to make robust comparisons among sampling sites.

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. In situations where *Sabellaria* reef are found, the guidance provided by Gubbay (2007) is followed to cover techniques to map, avoid disturbance and conserve *Sabellaria* reef.

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)].

2.4.5 Reef Assessment

Reef assessments were undertaken using appropriate guidance from Irving (2009) and Golding *et al*. (2020) for potential geogenic reefs (*e.g.* stony reefs) and Gubbay (2007) and Limpenny *et al*. (2010) for potential biogenic reefs (such as *Sabellaria spinulosa* and *Modiolus modiolus* reefs, respectively). Where potential Annex I reef habitat was noted in the still images for a transect, Stony Reef assessments were undertaken using the criteria and methods in Irving (2009) and Golding *et al*. (2020). Boulders and cobbles are generally considered to be greater than 64 mm diameter and the cobble reef assessment criteria are based on this approach. Following Irving (2009), composition, elevation and biota characteristics were considered to assess whether any stills along each transect had an extent of resemblance to stony reef. Characteristics were scored as 'Low', 'Medium' or 'High' resemblance to cobble reef, or 'No resemblance' and the specific criteria for scoring each of these characteristics is indicated in **Table 2-9**.

The Irving (2009) criterion for biota for 'Low' and 'Medium' resemblance reef is less clearly defined than the other criteria due to the difficulty of enumerating epifauna in reef habitats, with emphases on the physical aspects of reef habitat. For each image a score of 'Low', 'Medium', 'High' or 'Infauna' was assigned based on the relative dominance of biotic growth forms present. Where potential stony reef criteria were identified, the coordinates for each still image were used to extrapolate reef assessments onto the adjacent DDV flight path for each transect. The extent of the field of view of the camera was typically 1 m^2. Where consecutive images covered a distance of greater than 25 m they were classified as Annex I geogenic reef

Image stills that were classified as having medium resemblance stony reef were required to fulfil the minimum extent criteria of >25 m^2 cover of the seabed to qualify as Annex I reef habitat (Irving, 2009). The habitat extent, and in particular patchiness, is impossible to assess based on a single still image. Therefore, to provide a conservative estimate of the minimum extent of potential Annex I stony reef habitat, the distances between consecutive images classified as including medium resemblance stony reef habitat were measured in GIS. Where consecutive images covered a minimum transect distance of 25 m, these were considered to represent Annex I stony reef habitat.

Table 2-9: Criteria for Reef Assessment (Irving, 2009). Particle diameter >64 mm represents cobbles/boulders.

Characteristics	Not a Stony Reef	Low	Medium	High
Percentage Composition of Particles >64 mm Diameter	<10%	10-40%	40-95%	>95%
Elevation	Flat Seabed	<64 mm	64 mm – 5 m	>5 m
Extent	<25 m^2	> 25 m^2	> 25 m^2	> 25 m^2
Biota	Dominated by Infauna	Low Epifaunal Dominance	Medium Epifaunal Dominance	80% of Biota Epifaunal

3. Results

3.1 Drop-Down Video

The DDV survey identified areas suitable for grab survey (for fauna and sediment analysis) as well as identifying locations of potential reef habitat.

The Dundalk Bay and the North Irish Sea can be turbid environments with strong currents and 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 biotopes existing at Oriel (see **Table 3-1**). There were five biotopes assigned across the stations - 'SS.SCS.CCS.SpiB *Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles', 'SS.SMx.CMx Circalittoral mixed sediment', 'SS.SSa.CMuSa Circalittoral muddy sand', and 'SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment'. 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
ENV001	SS.SCS.CCS.SpiB	*Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
ENV002	SS.SMx.CMx	Circalittoral mixed sediment
ENV003	SS.SMx.CMx	Circalittoral mixed sediment
ENV004	SS.SSa.CMuSa	Circalittoral muddy sand
ENV005	SS.SSa.CMuSa	Circalittoral muddy sand
ENV006	SS.SMx.CMx	Circalittoral mixed sediment
S11	SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment
S13	SS.SSa.CMuSa	Circalittoral muddy sand
S15	SS.SSa.CMuSa	Circalittoral muddy sand
S26	SS.SMx.CMx	Circalittoral mixed sediment
S31	SS.SSa.CMuSa	Circalittoral muddy sand

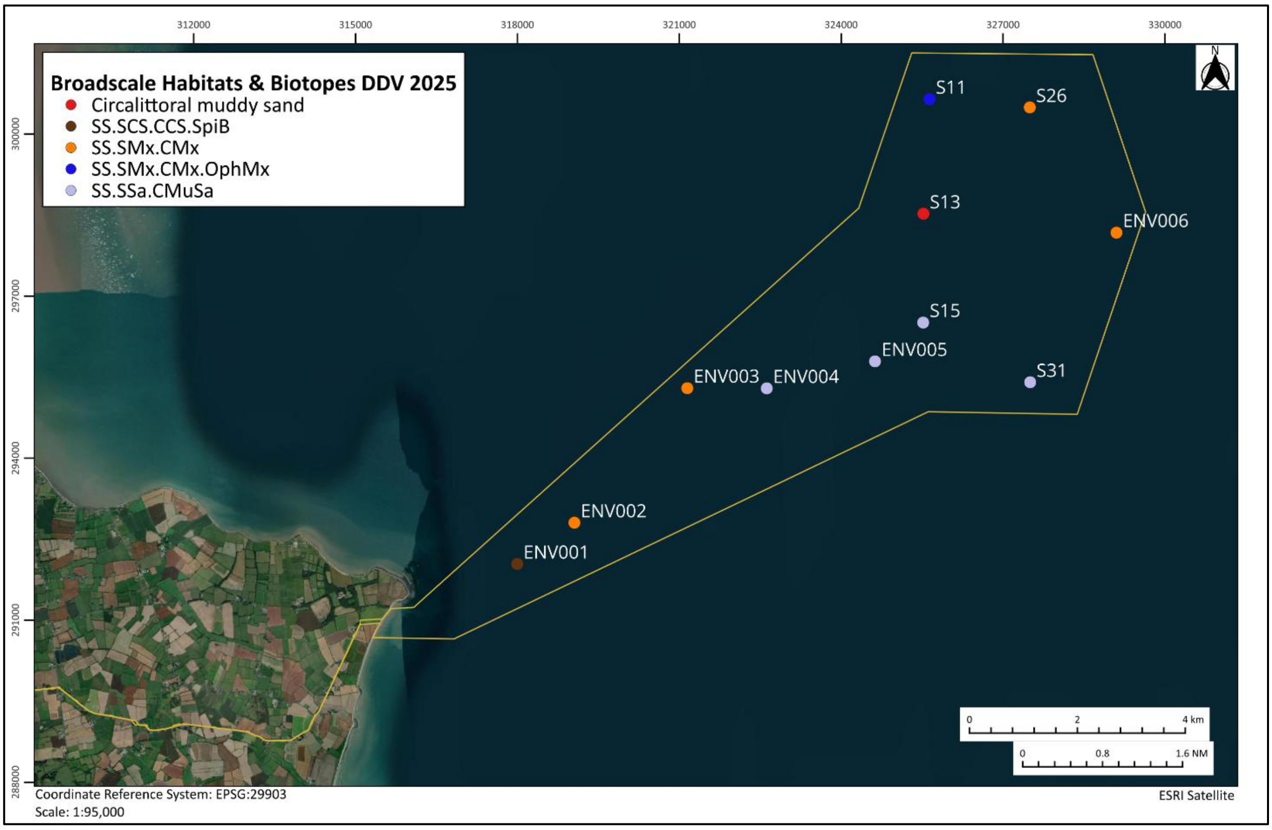


Figure 3.1: Biotope from DDV survey within Oriel, Co. Louth.

3.1.1 Station ENV001

Station ENV001 was composed of a mixture of boulder, cobble, shell and sand. Macroalgae was observed throughout this station, including red foliose seaweed and *Laminaria* sp. Noticeable fauna included the common starfish (*Asterias rubens*), boring sponge (*Cliona celata*), soft coral (*Alcyonium digitatum*) and edible urchin (*Echinus esculentus*) (**Figure 3.2** to **Figure 3.5**). The habitat type can be assigned to the JNCC biotope 'SS.SCS.CCS.SpiB' - *Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (EUNIS code MC3211).

Figure 3.2: ENV001 – Mixed substrate with macroalgae, Serpulid worms, common starfish (*Asterias rubens*) and soft coral (*Alcyonium digitatum*).

Figure 3.3: ENV001 – Mixed substrate with macroalgae, Serpulid worms and boring sponge (*Cliona celata*).

Figure 3.4: ENV001 – Mixed substrate with macroalgae, Serpulid worms, boring sponge (*Cliona celata*), edible urchin (*Echinus esculentus*) and soft coral (*Alcyonium digitatum*).

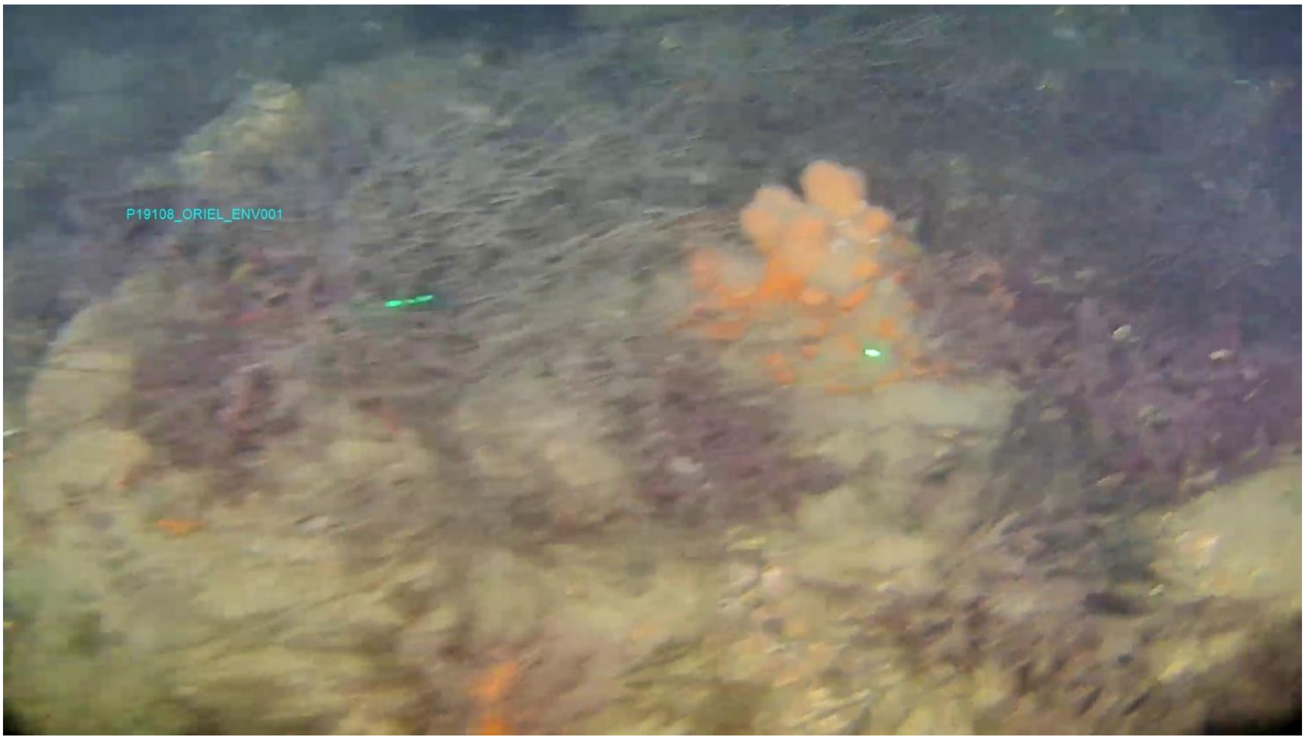


Figure 3.5: ENV001 – Mixed substate with macroalgae, Serpulid worms, and soft coral (*Alcyonium digitatum*).

3.1.2 Station ENV002

Station ENV002 was composed of a mixture of boulder, cobble, shell and sand. Encrusting red algae was observed growing on some of the boulders. Noticeable fauna included serpulid worms and common starfish (*A. rubens*) (**Figure 3.6** to **Figure 3.9**). The habitat type can be assigned to the JNCC biotope 'SS.SMx.CMx Circalittoral mixed sediment' (EUNIS code A5.33).

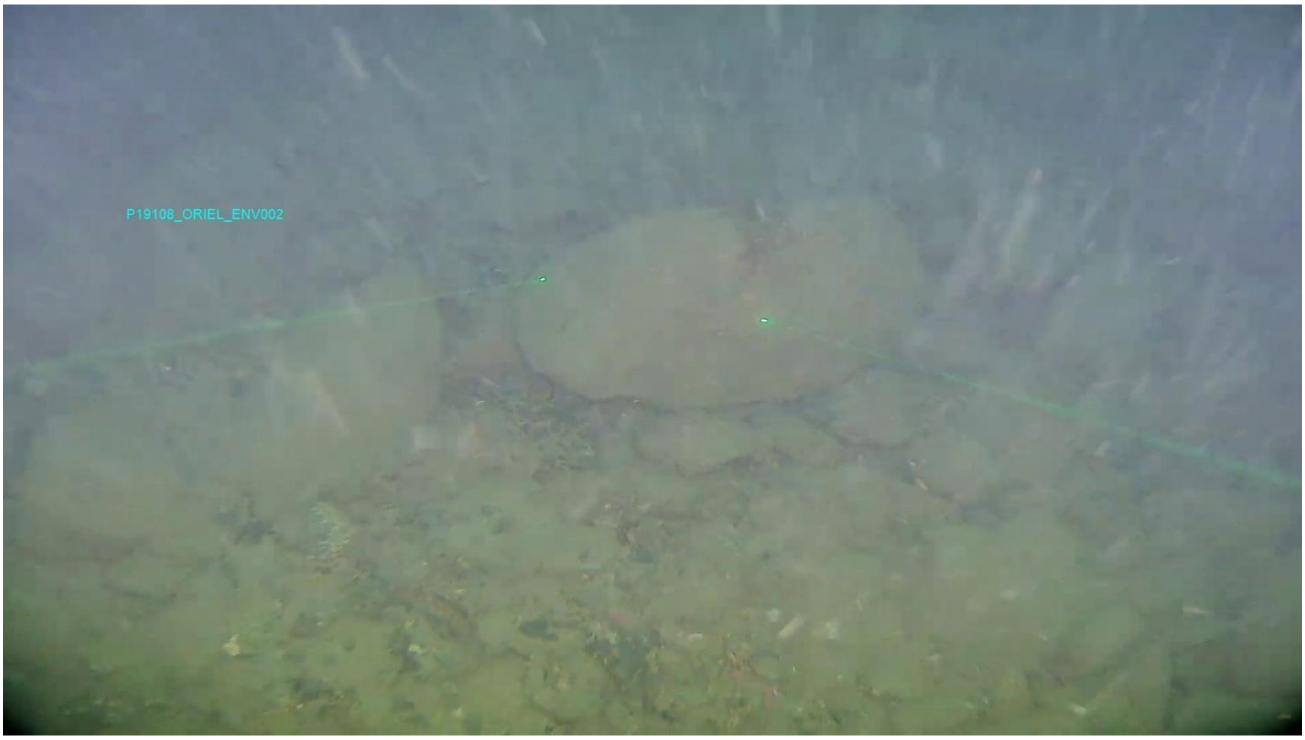


Figure 3.6: ENV002 – Mixed substate of boulders, cobbles, shell, and sand.

Figure 3.7: ENV002 – Mixed substrate with Serpulid worms.

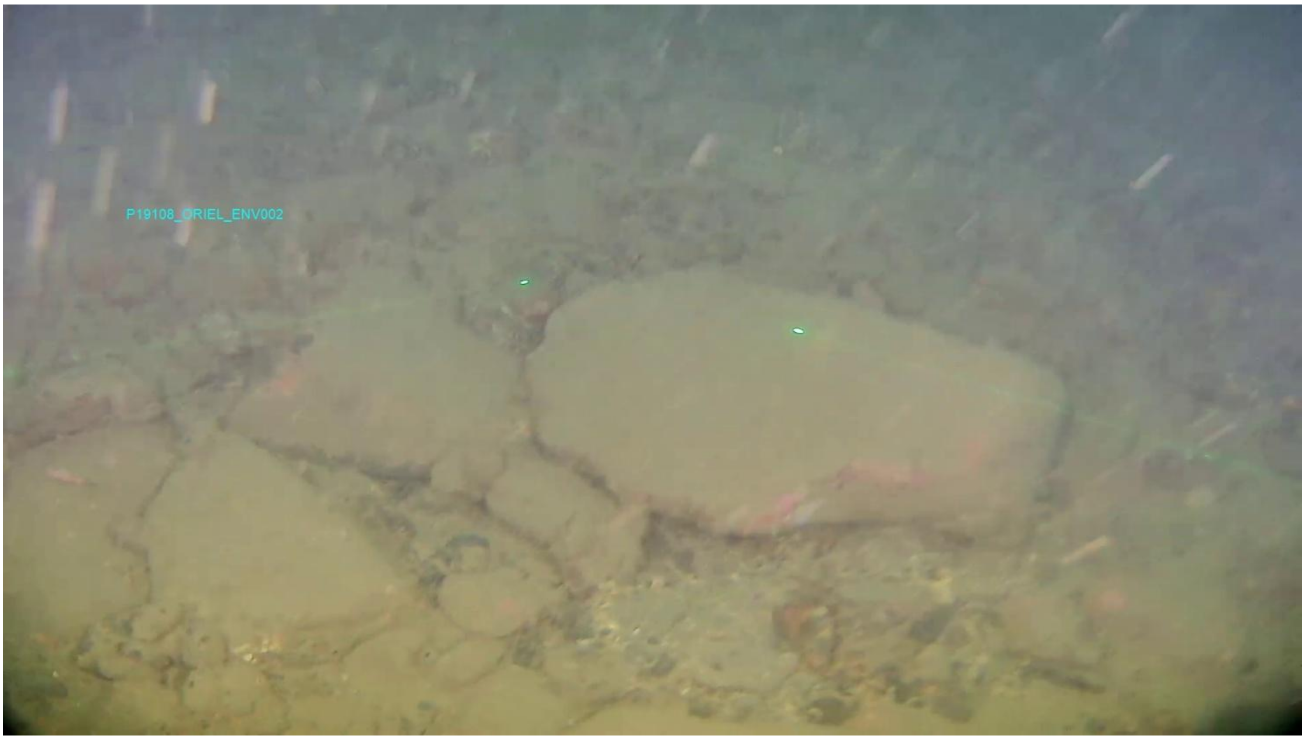


Figure 3.8: ENV002 – Mixed substrate with encrusting red algae on boulders.

Figure 3.9: ENV002 – Mixed substrate of boulders, cobbles, shell, and sand.

3.1.3 Station ENV003

Station ENV003 was composed of a mixture of boulder, cobble and sand. Encrusting red algae was observed growing on some of the boulders and Serpulid worms were observed on cobbles. Noticeable fauna included*,* common starfish (*A. rubens)*, edible urchin *(E. esculentus)*, crabs, and an unidentified fish (likely Gobidae) (**Figure 3.10** to **Figure 3.13**). The habitat type can be assigned to the JNCC biotope 'SS.SMx.CMx Circalittoral mixed sediment' (EUNIS code A5.33).

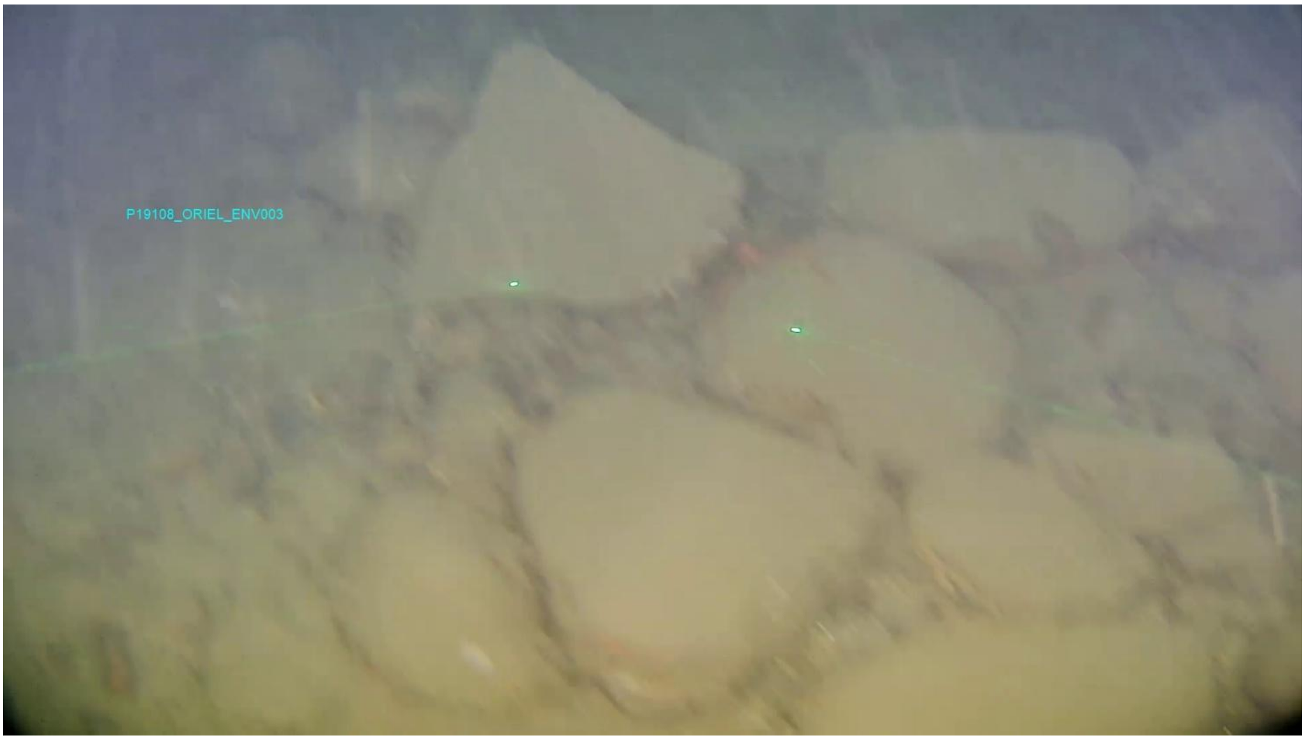


Figure 3.10: ENV003 – Mixed substrate with Serpulid worms.

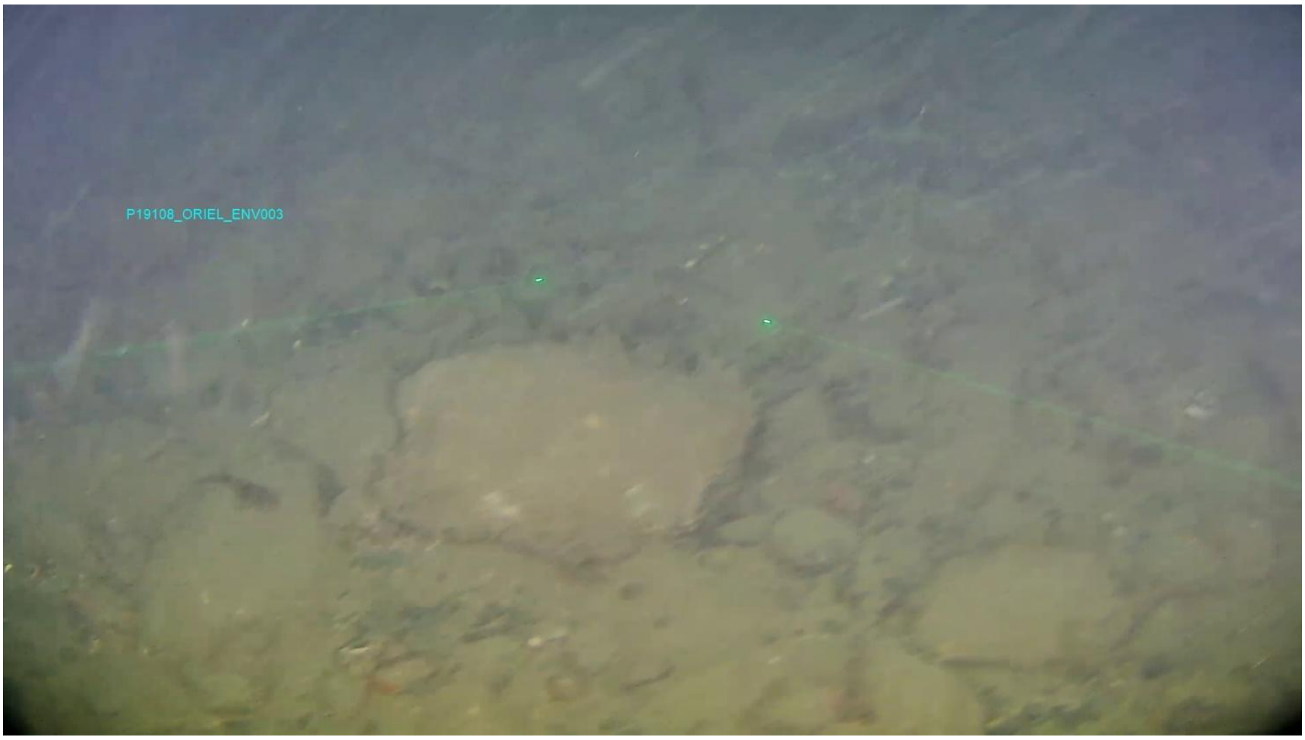


Figure 3.11: ENV003 – Mixed substrate with Serpulid worms.

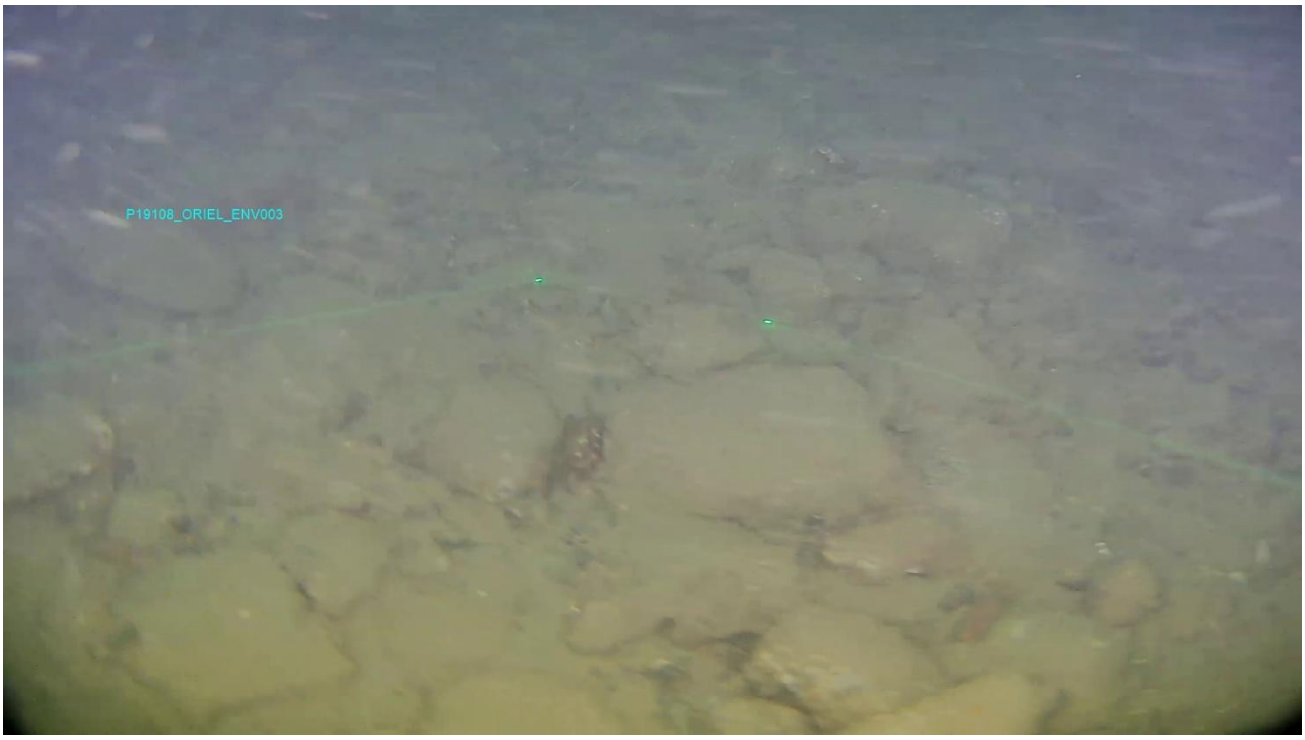


Figure 3.12: ENV003 – Mixed substrate with serpulid worms and a crab.

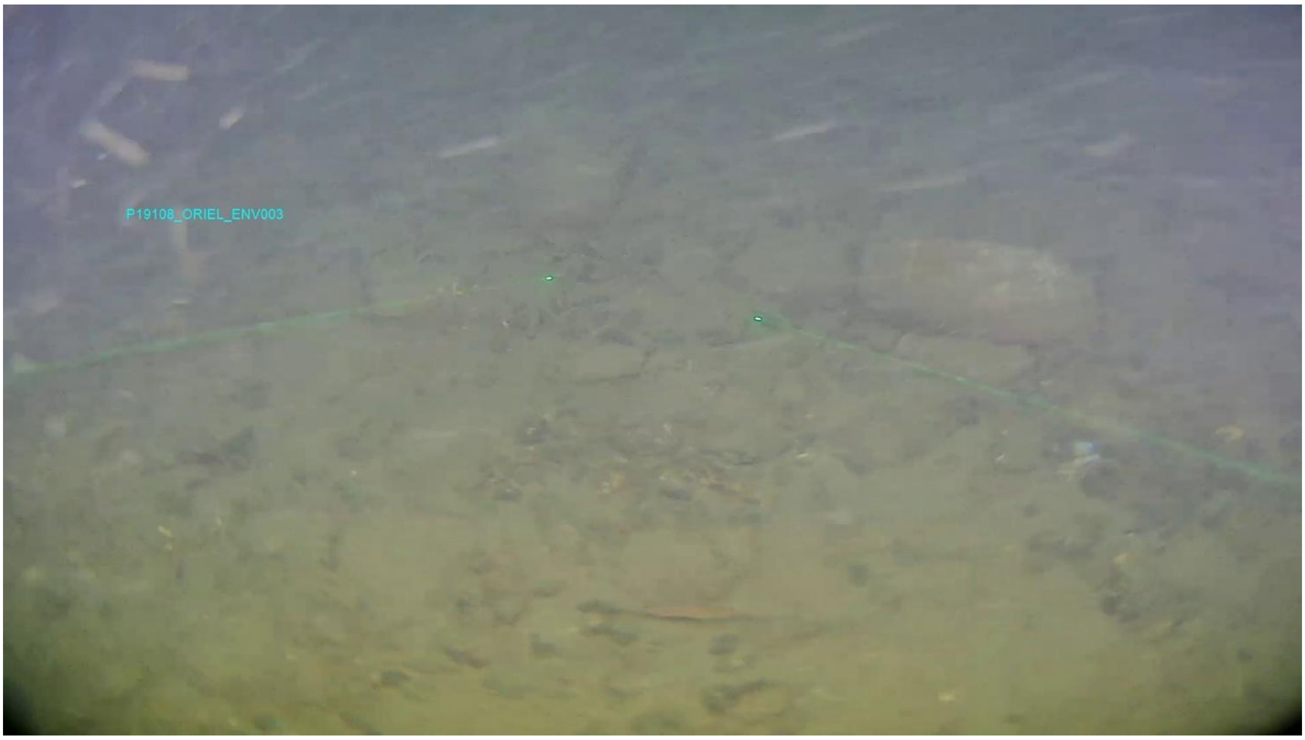


Figure 3.13: ENV003 – Mixed substrate of boulders, cobbles, shell, and sand.

3.1.4 Station ENV004

Station ENV004 was composed of muddy sand with sparse shell material and *Nephrops* burrows throughout. Noticeable fauna included auger shells (*Turritellinella tricarinata*) and Dublin Bay prawns (*Nephrops norvegicus*) (**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).

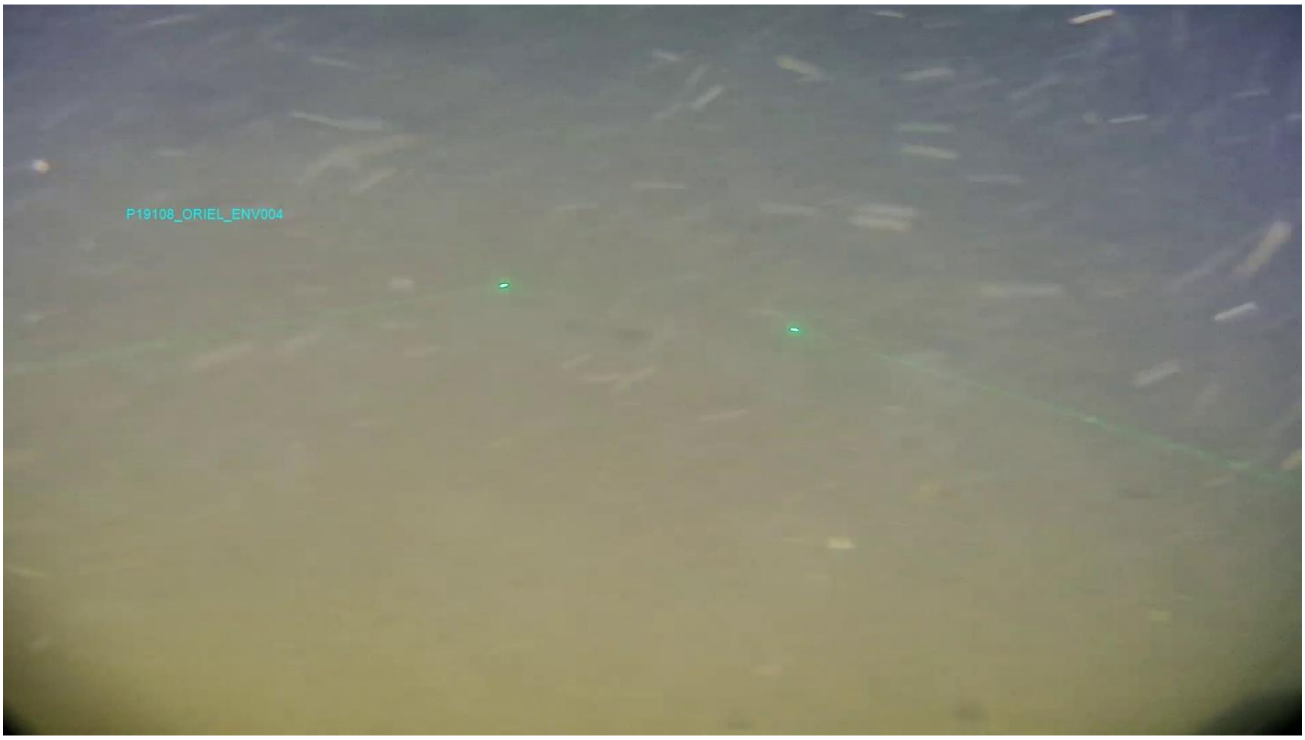


Figure 3.14: ENV004 – Muddy sand with sparse shell material.

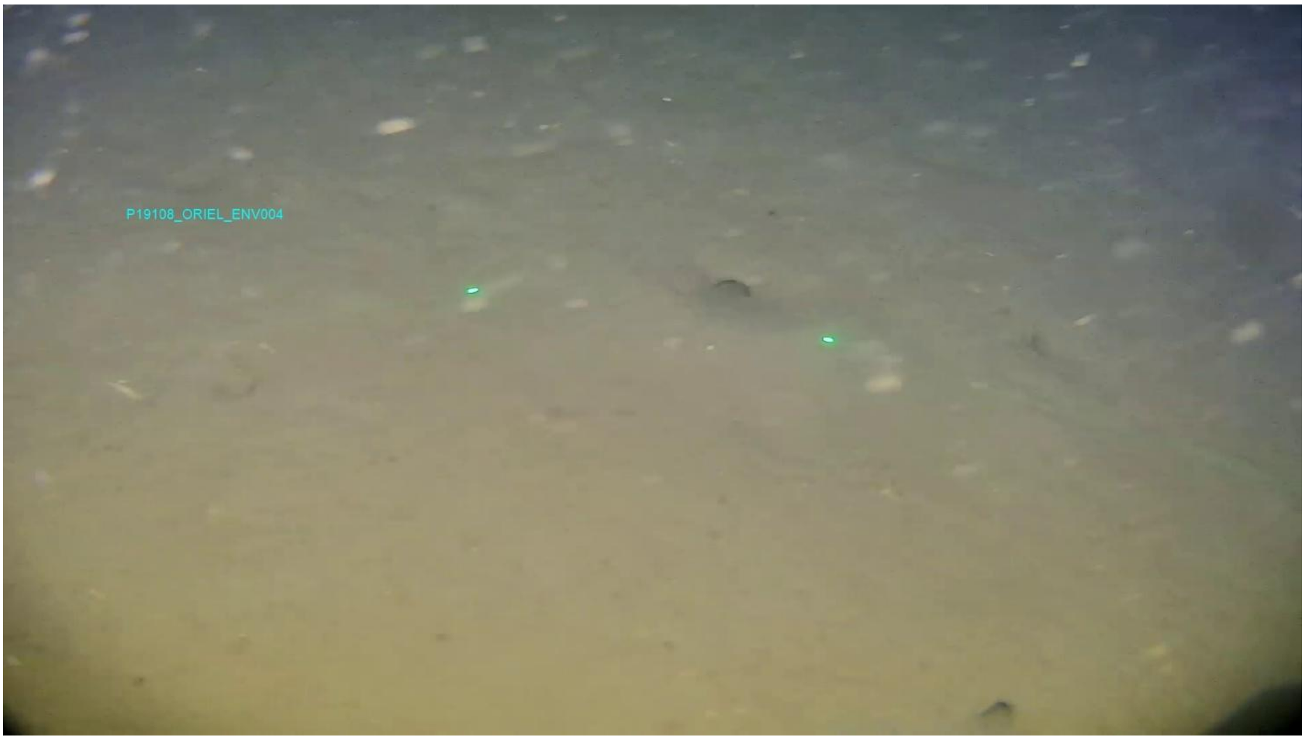


Figure 3.15: ENV004 – Muddy sand with sparse shell material and *Nephrops* burrows.

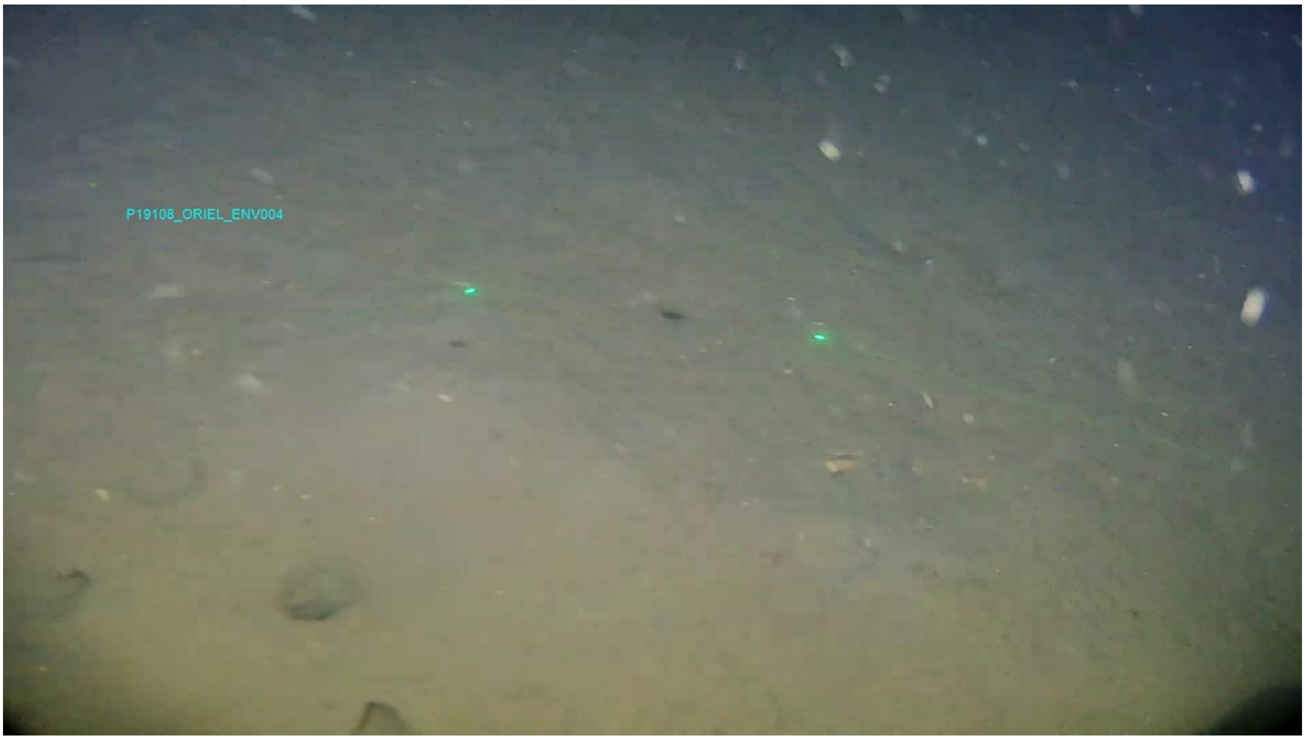


Figure 3.16: ENV004 – Muddy sand with sparse shell material and *Nephrops* burrows.

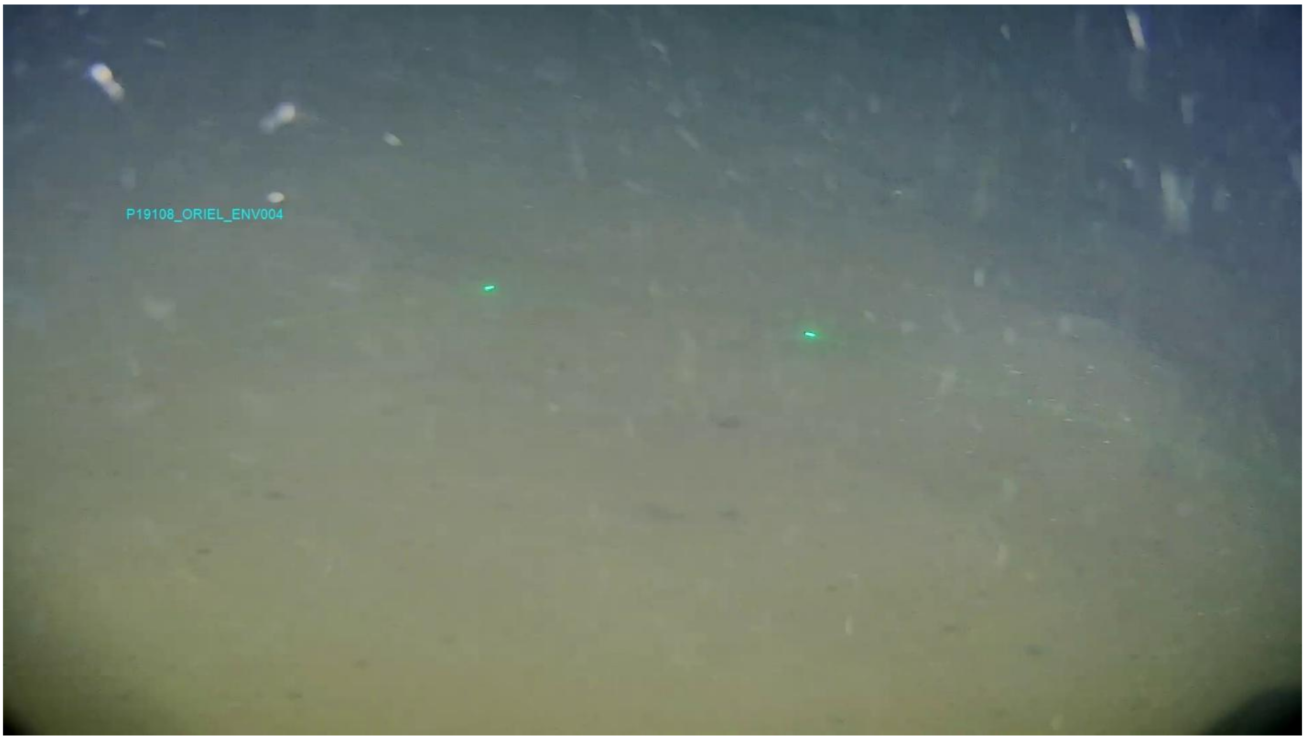


Figure 3.17: ENV004 – Muddy sand with sparse shell material.

3.1.5 Station ENV005

Station ENV005 was composed of muddy sand with sparse shell material and *Nephrops* burrows throughout. Noticeable fauna included auger shells (*T. tricarinata*), Dublin Bay prawns (*N. norvegicus*) and a small solitary fish (Gobidae) (**Figure 3.18** to **Figure 3.21**). The habitat type can be assigned to the JNCC 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).

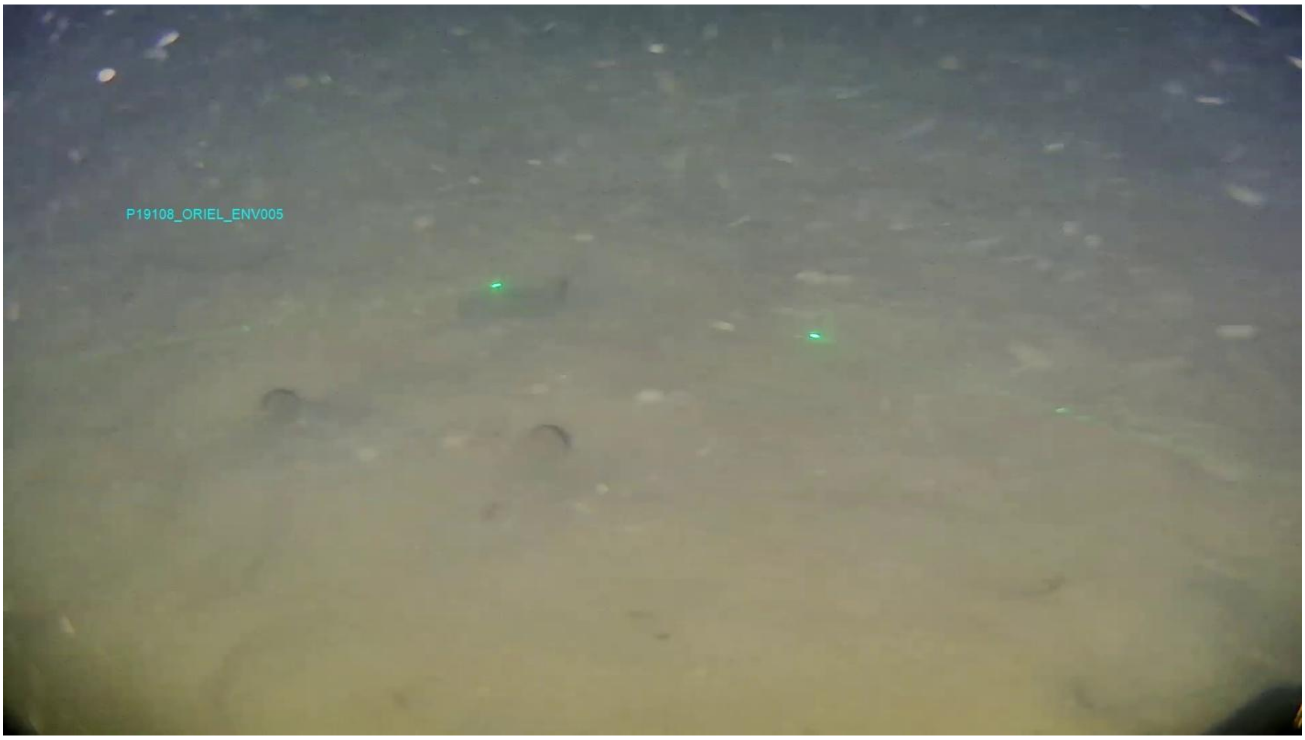


Figure 3.18: ENV005 – Muddy sand with sparse shell and *Nephrops* burrows.

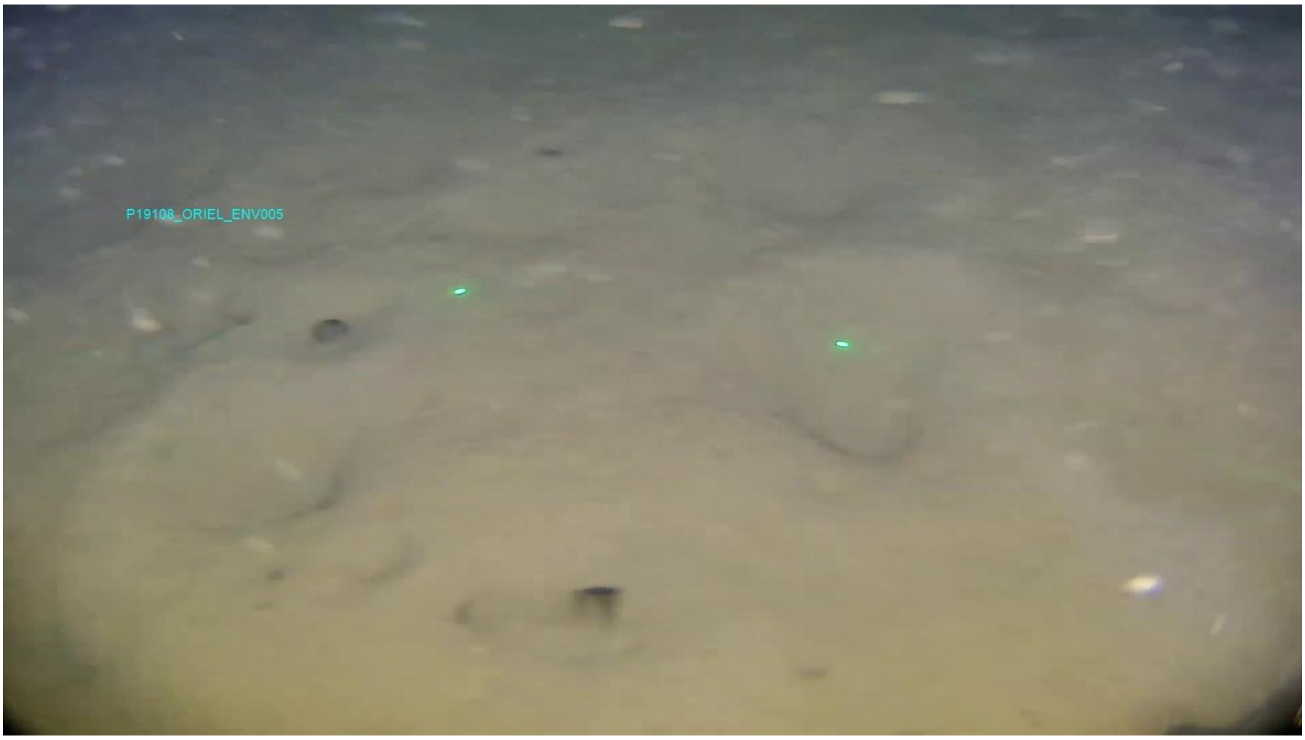


Figure 3.19: ENV005 – Muddy sand with sparse shell and *Nephrops* burrows.

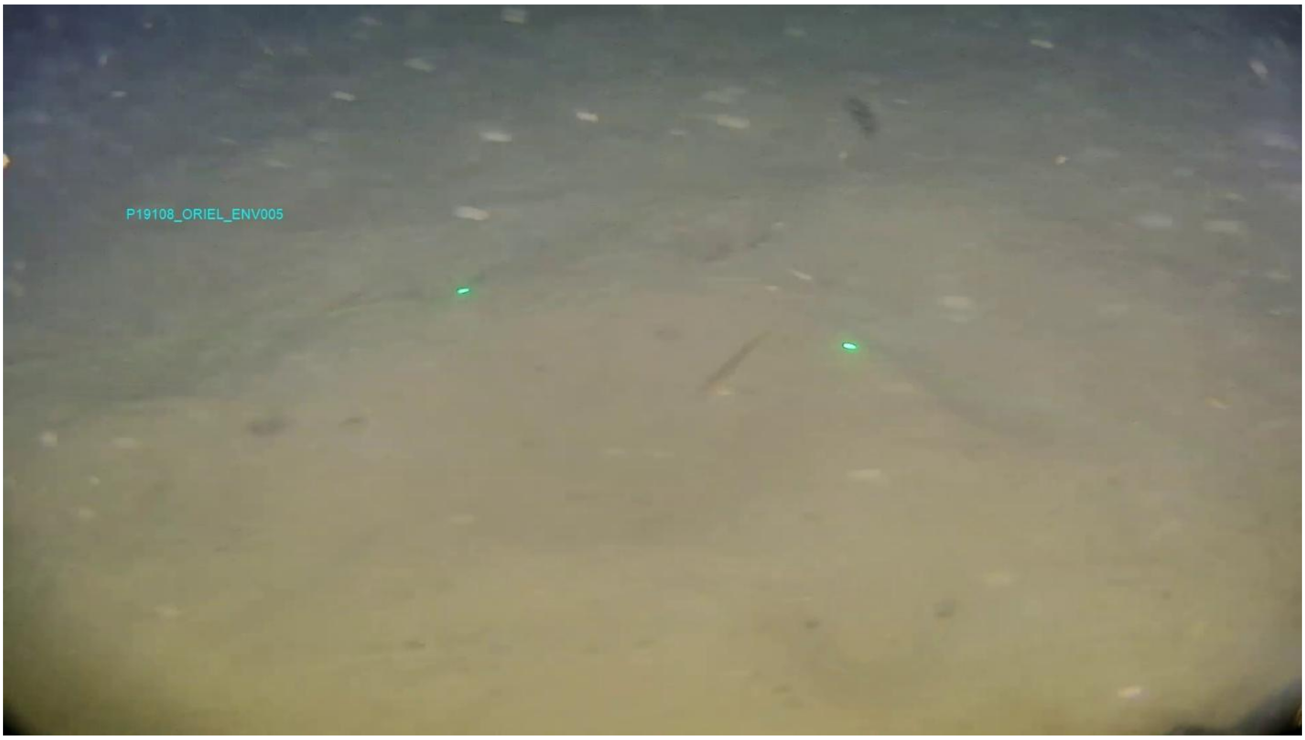


Figure 3.20: ENV005 – Muddy sand with sparse shell and small fish (Gobidae).

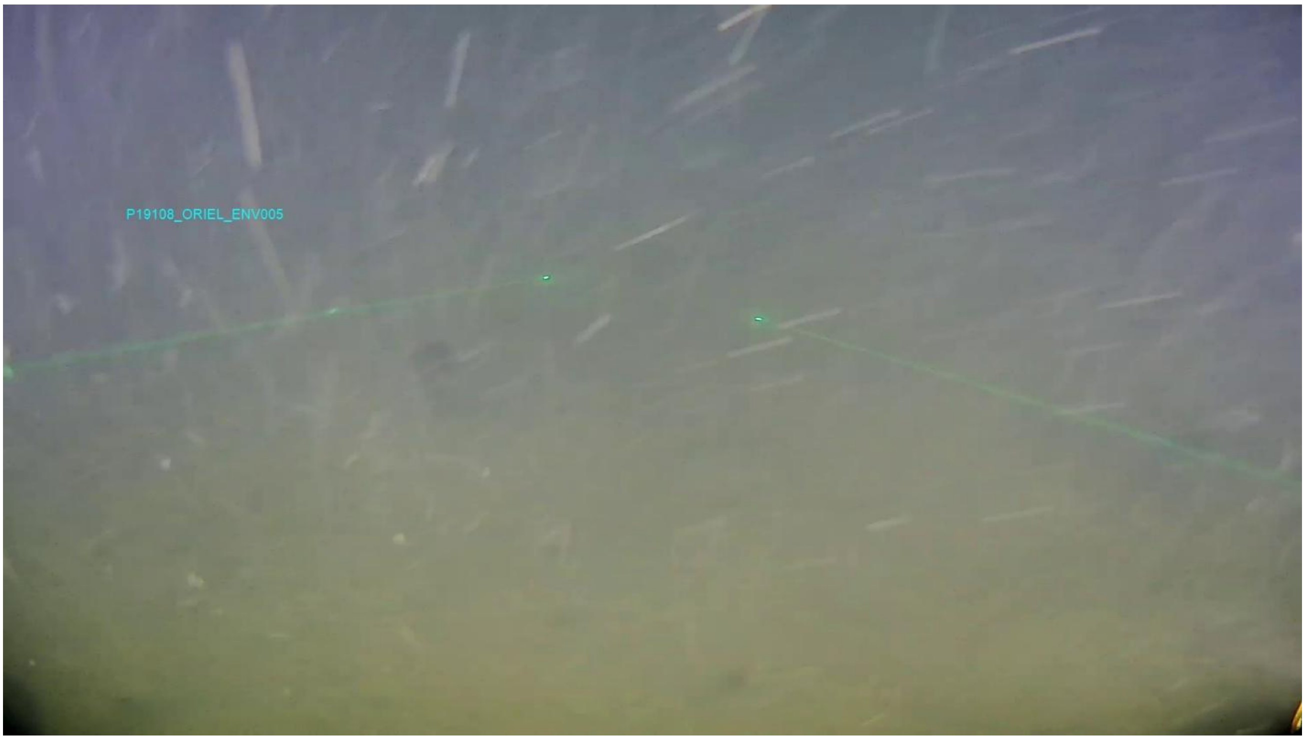


Figure 3.21: ENV005 – Muddy sand with sparse shell.

3.1.6 Station ENV006

Station ENV006 was composed of a mixture of boulder, cobble, shell, and sand. Noticeable fauna included Serpulid worms on cobbles, edible urchin (*E. esculentus*), crabs, common starfish (*A. rubens*) and fish (Gobidae) (**Figure 3.22** to **Figure 3.25)**. The habitat type can be assigned to the JNCC biotope 'SS.SMx.CMx Circalittoral mixed sediment' (EUNIS code A5.33).

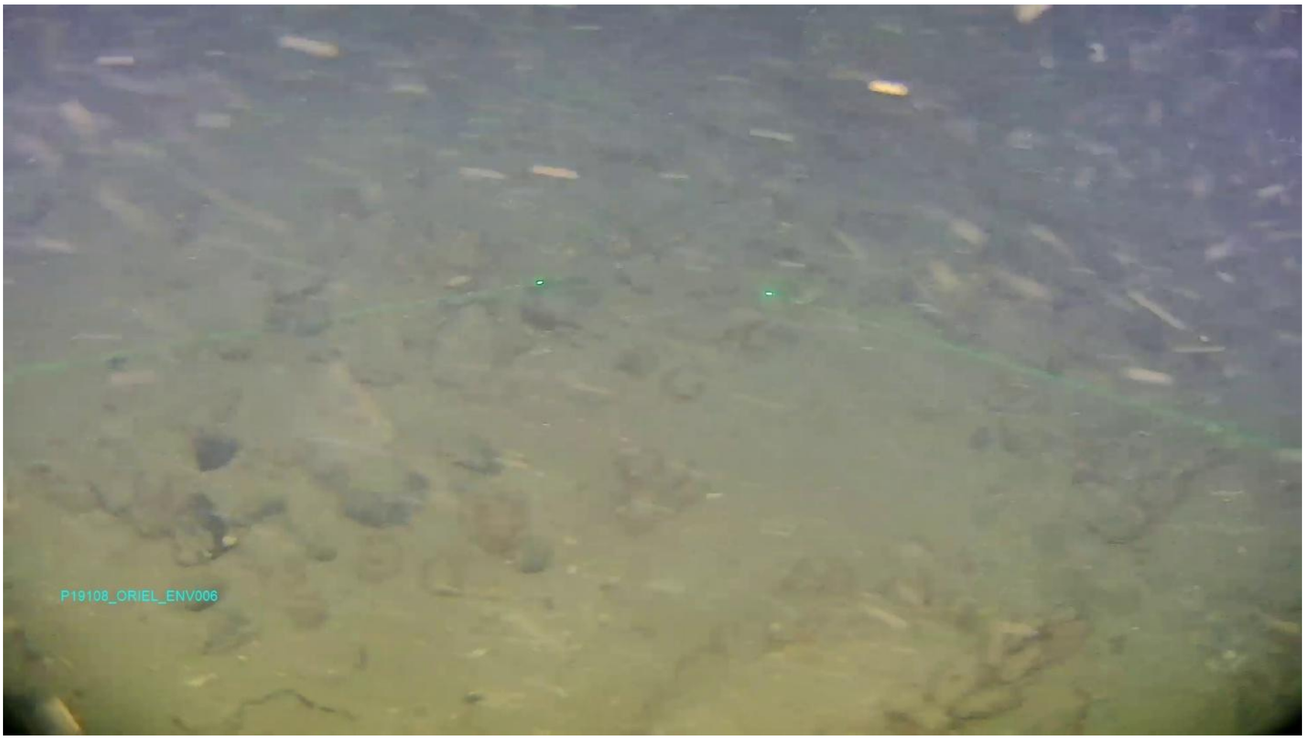


Figure 3.22: ENV006 – Mixed substrate of cobbles, shell, and sand.

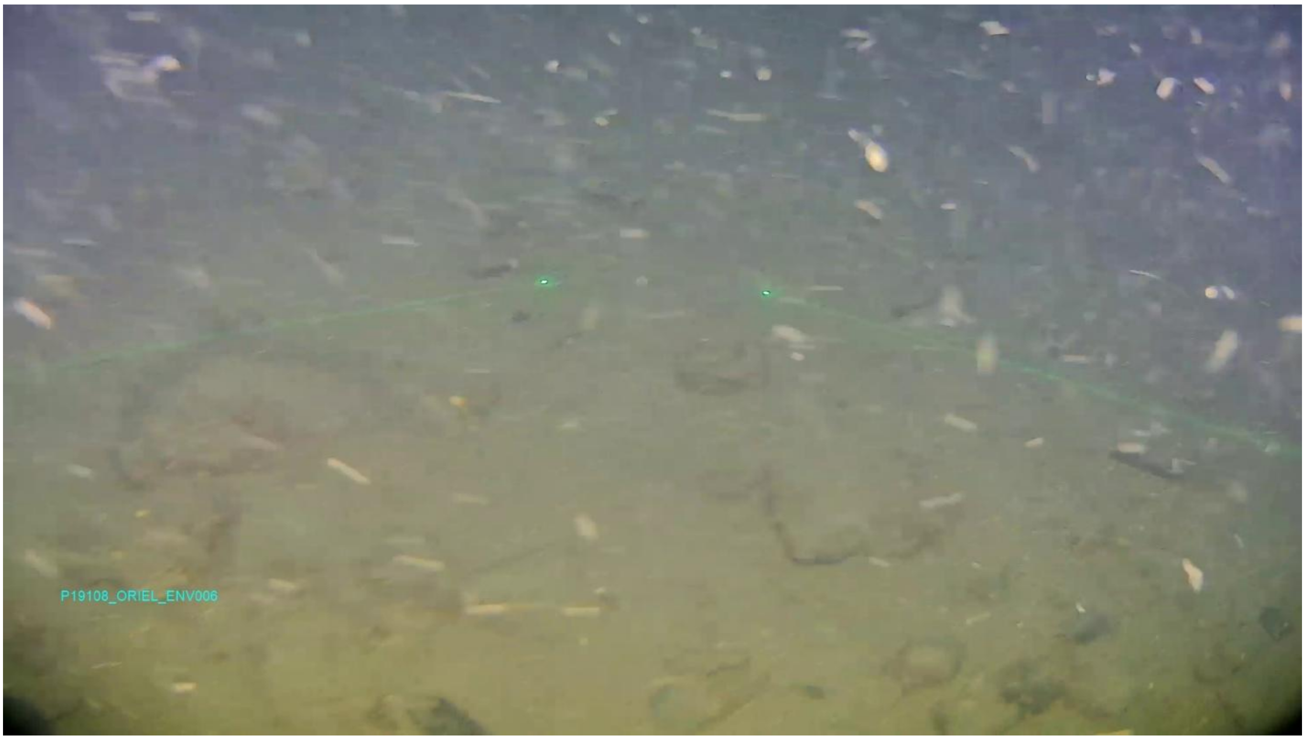


Figure 3.23: ENV006 – Mixed substrate of boulders, cobbles, shell, and sand.

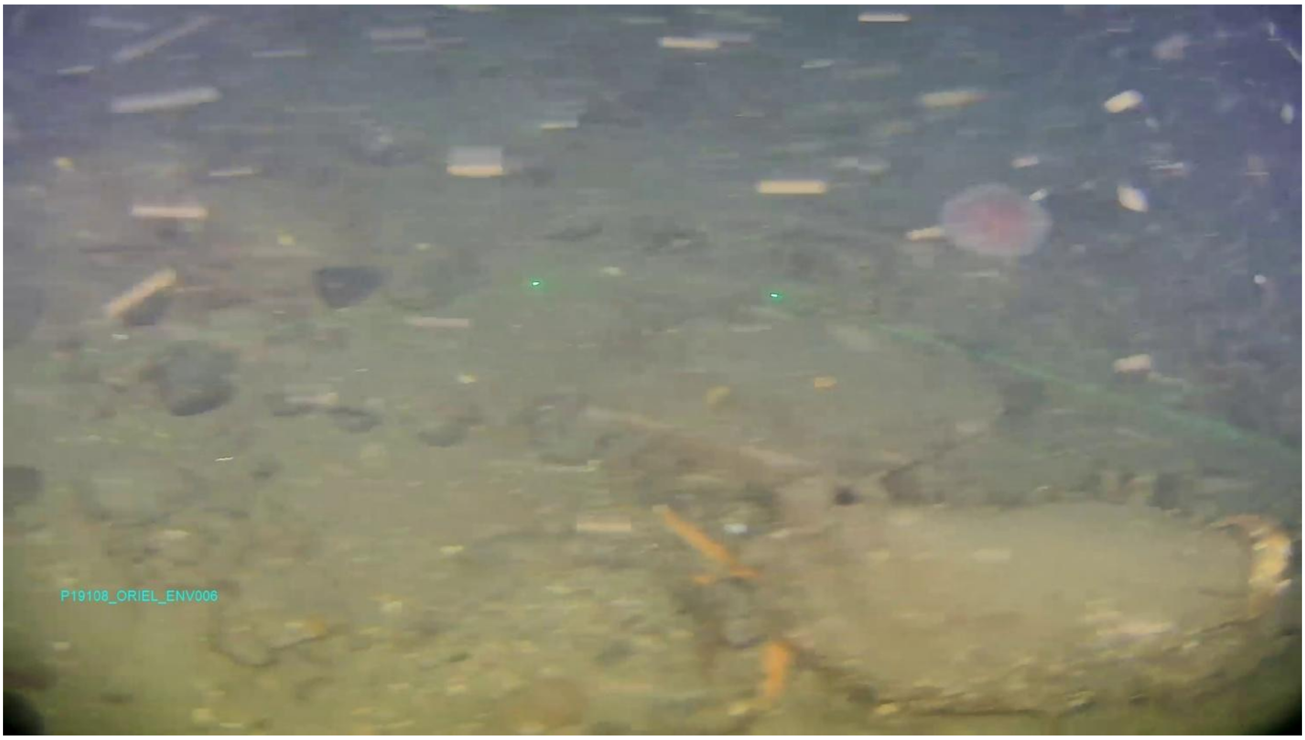


Figure 3.24: ENV006 – Mixed substrate with urchin (*Echinus esculentus*) and a crab.

Figure 3.25: ENV006 – Mixed substrate of boulders, cobbles, shell, and sand.

3.1.7 Station S11

Station S11 was composed of a mixture of boulder, cobble, shell and sand. Encrusting red algae was observed on some boulders. Noticeable fauna included an abundance of common brittlestars and black brittlestars (*Ophiothrix fragilis* and *Ophiocomina nigra,* respectively), common starfish (*A. rubens*), and Serpulid worms on cobbles (**Figure 3.26** to **Figure 3.29)**. The habitat type can be assigned to the JNCC biotope 'SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment' (EUNIS code A5.445).

Figure 3.26: S11 – Mixed substrate of boulders, cobbles, and sand with brittlestars.

Figure 3.27: S11 – Mixed substrate of boulders, cobbles, shell, and sand with brittlestars.

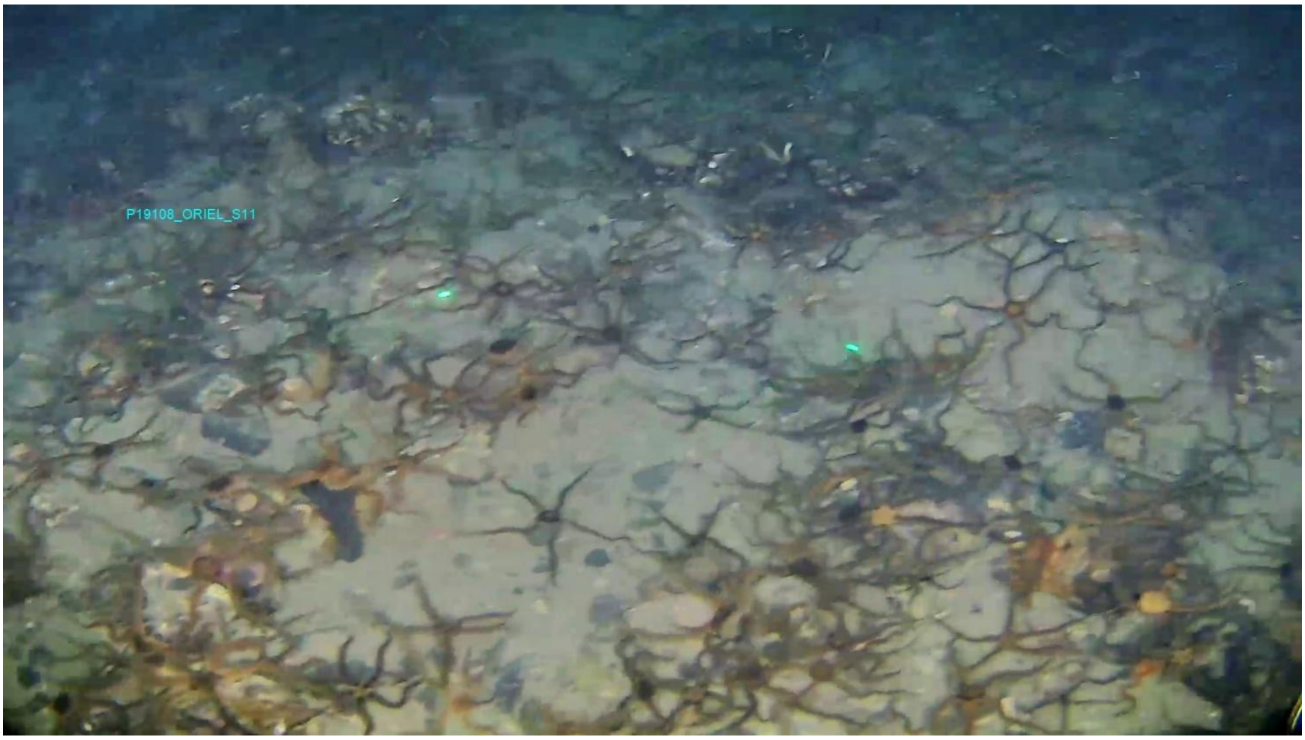


Figure 3.28: S11 – Mixed substrate of boulders, cobbles, shell, and sand with brittlestars.

Figure 3.29: S11 – Mixed substrate of boulders, cobbles, shell, and sand with brittlestars.

3.1.8 Station S13

Station S13 was composed of fine waveform sand with sparse shell material interspersed throughout. The was no visible surface fauna (**Figure 3.30** to **Figure 3.33)**. The habitat type can be assigned to the JNCC biotope The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).

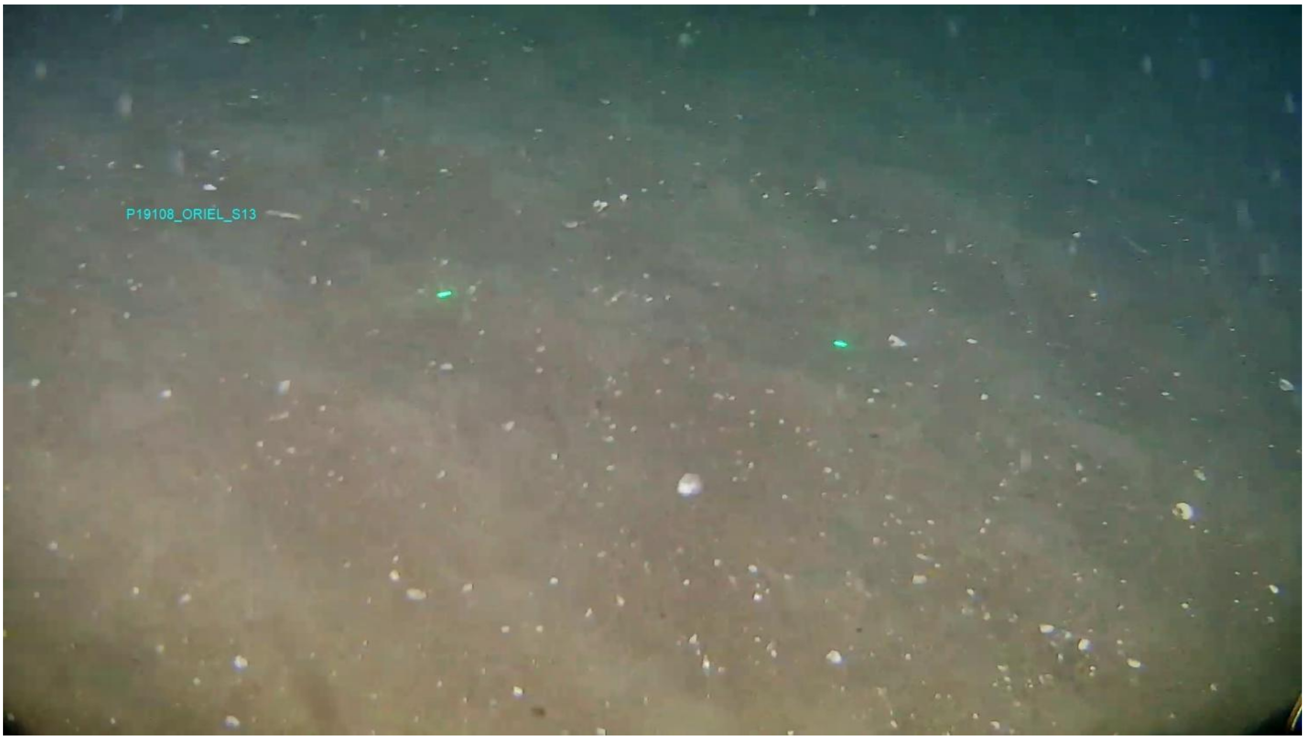


Figure 3.30: S13 – Fine waveform sand with sparse shell material.

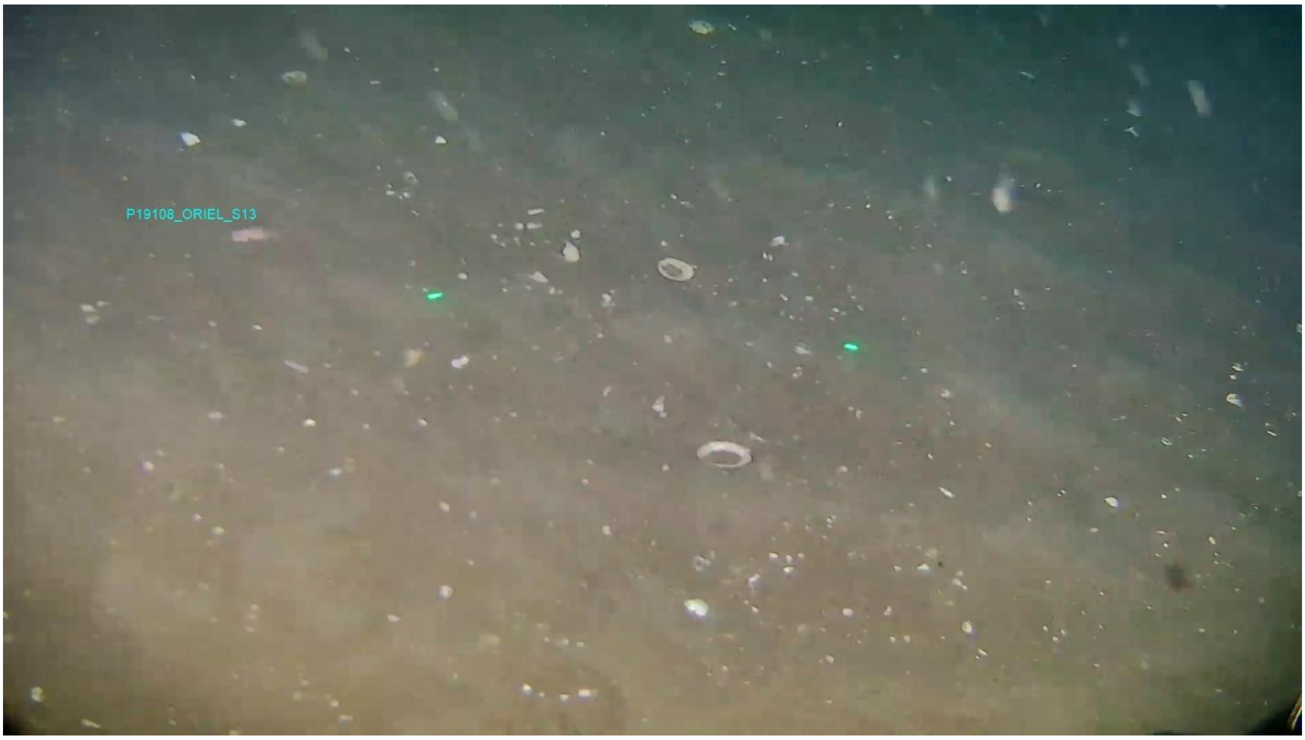


Figure 3.31: S13 – Fine waveform sand with sparse shell material.

Figure 3.32: S13 – Fine waveform sand with sparse shell material.

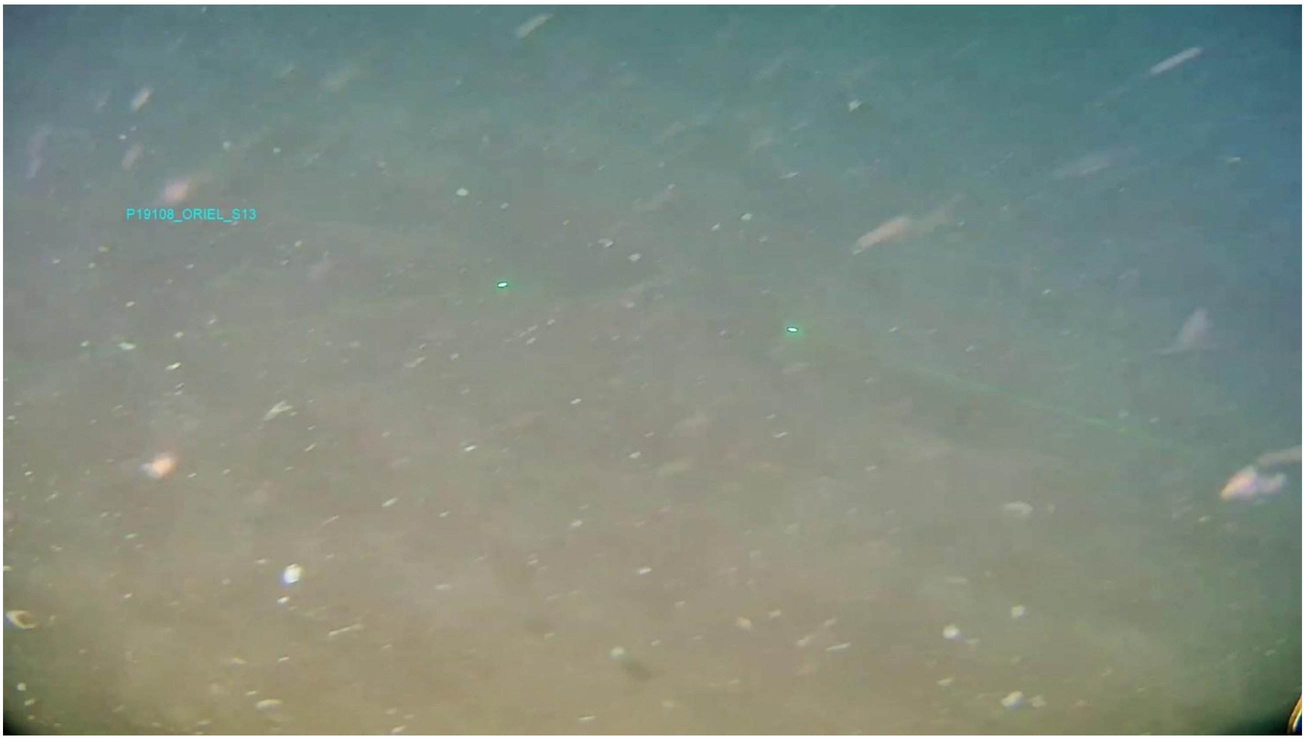


Figure 3.33: S13 – Fine waveform sand with sparse shell material.

3.1.9 Station S15

Station S15 was composed of fine-muddy sand with shell material and *Nephrops* burrows throughout. Noticeable fauna included auger shells *(T. tricarinata*) and fish (Gobidae) (**Figure 3.34** to **Figure 3.37)**. The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26).

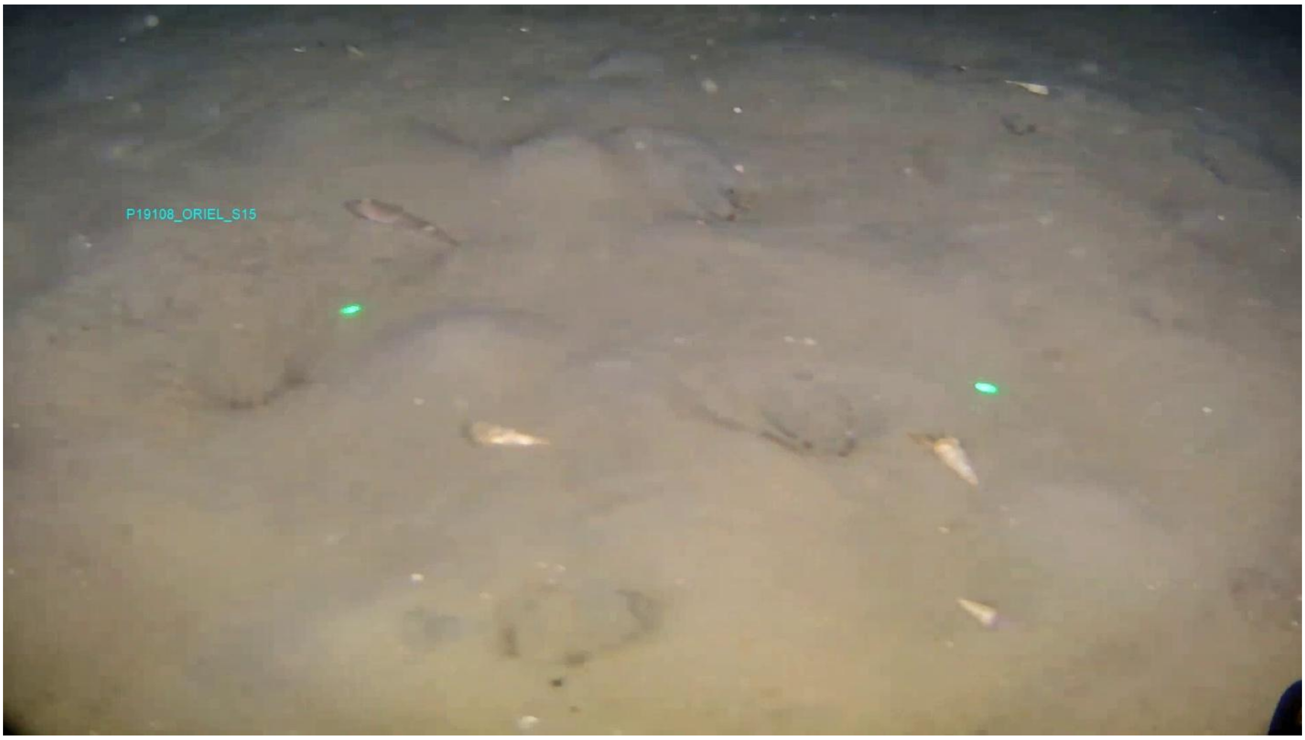


Figure 3.34: S15 – Fine-muddy sand with auger shells (*Turritellinella tricarinata*), *Nephrops* burrows and a solitary fish (Gobidae).

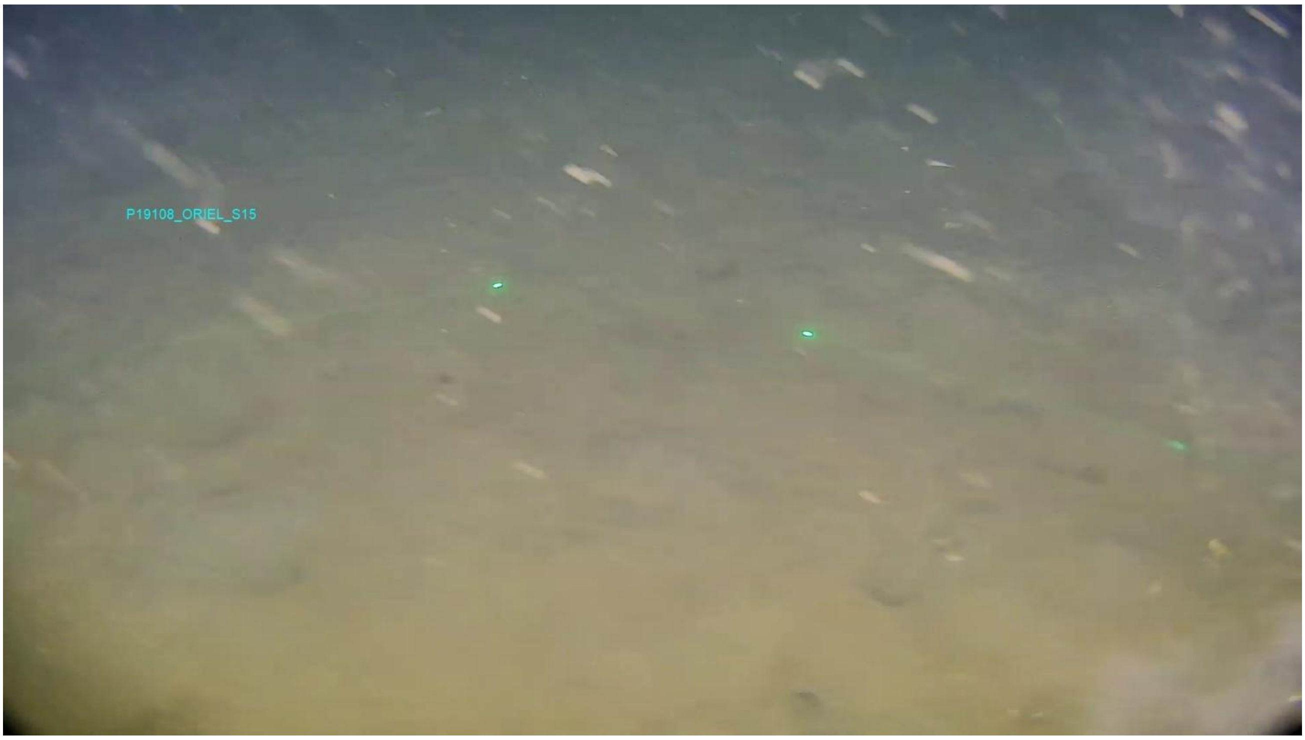


Figure 3.35: S15 – Fine-muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows.

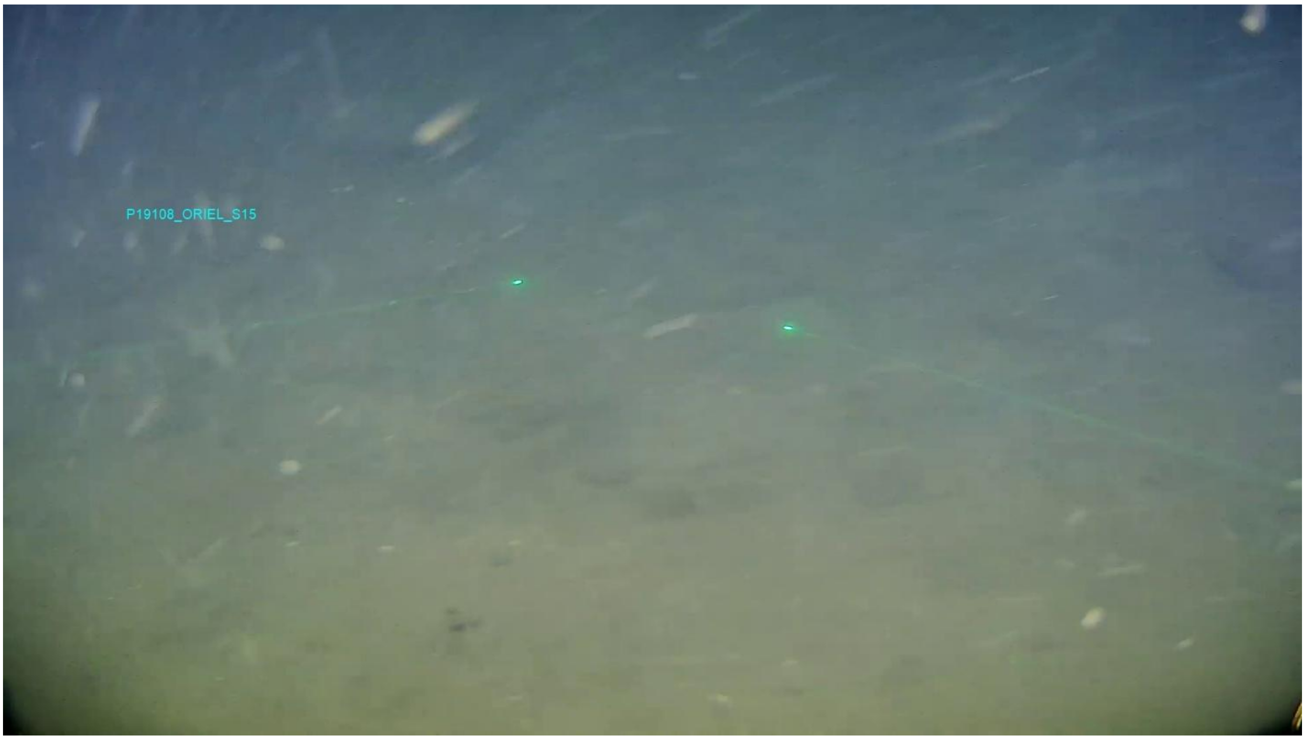


Figure 3.36: S15 – Fine-muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows.

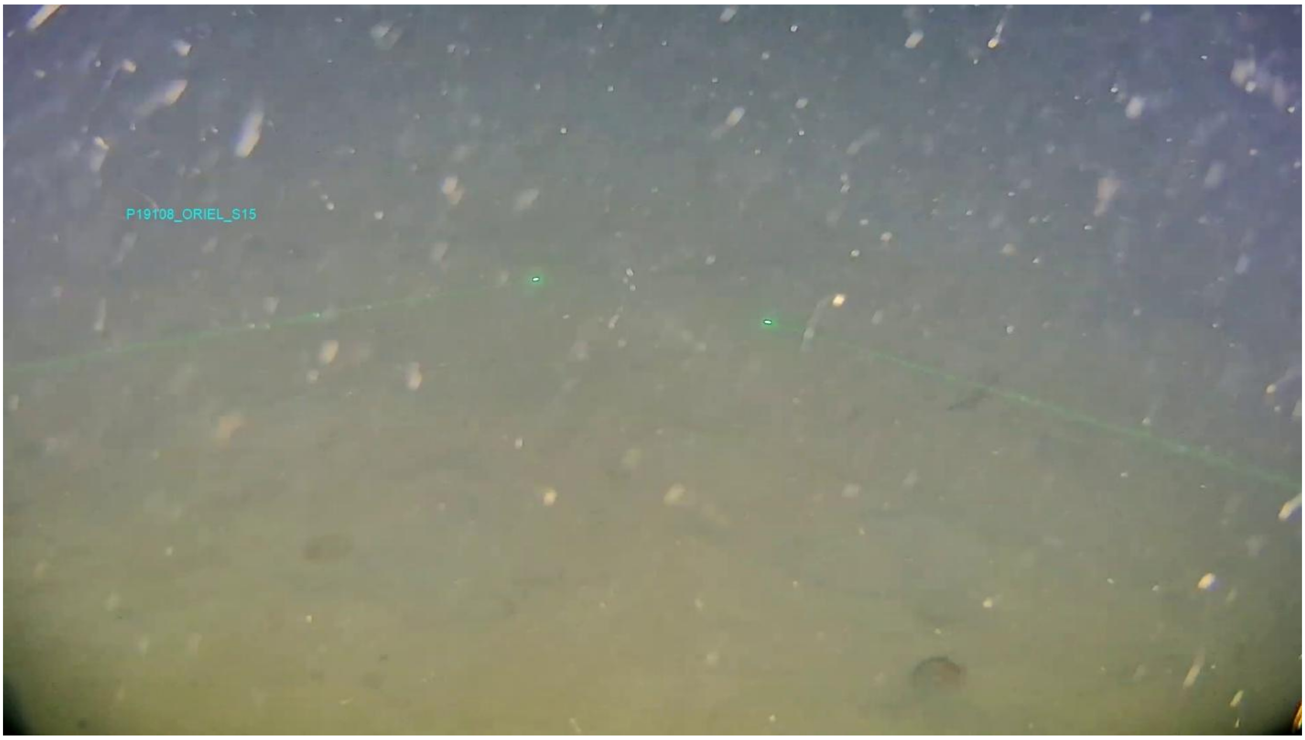


Figure 3.37: S15 – Fine-muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows.

3.1.10 Station S26

Station S26 was composed of a mixture of cobble, shell and sand. Visibility was poor at this station. There was no noticeable fauna present at the time of survey (**Figure 3.38** to **Figure 3.41)**. The habitat type can be assigned to the JNCC biotope 'SS.SMx.CMx Circalittoral mixed sediment' (EUNIS code A5.33).

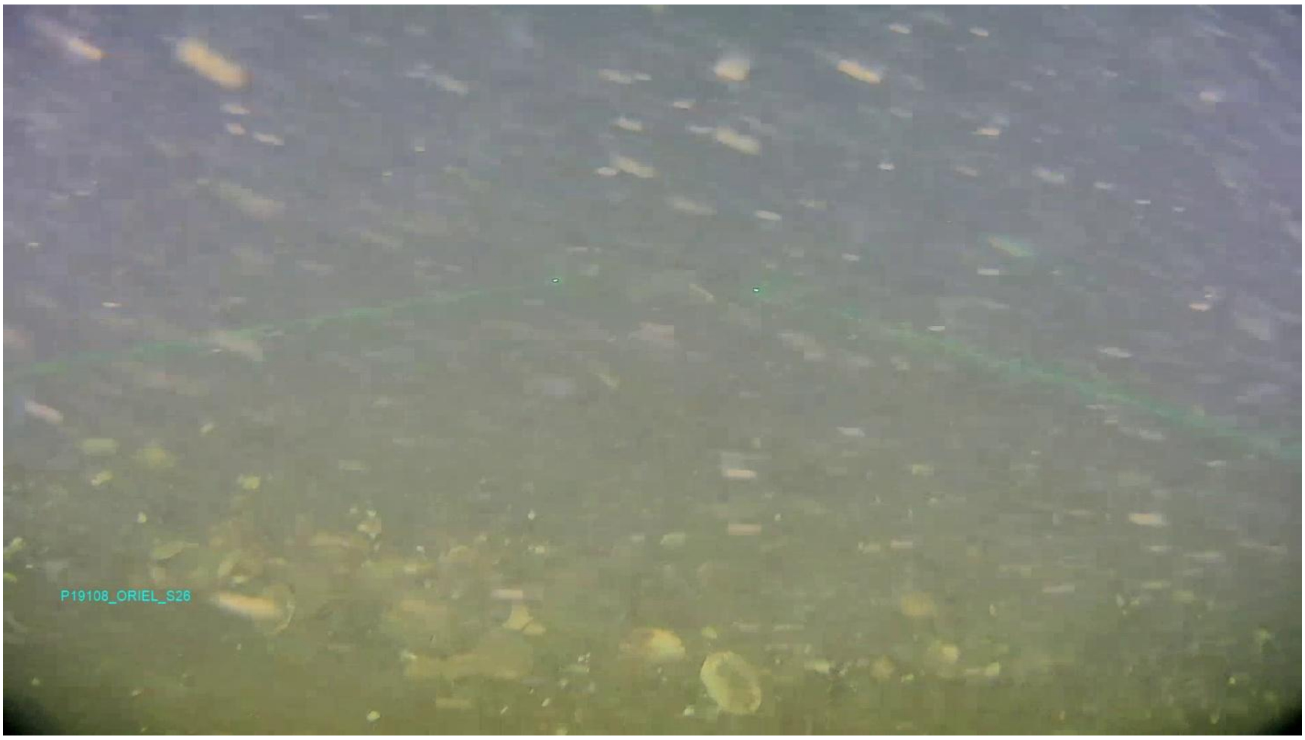


Figure 3.38: S26 – Mixed substrate of cobbles, shell, and sand.

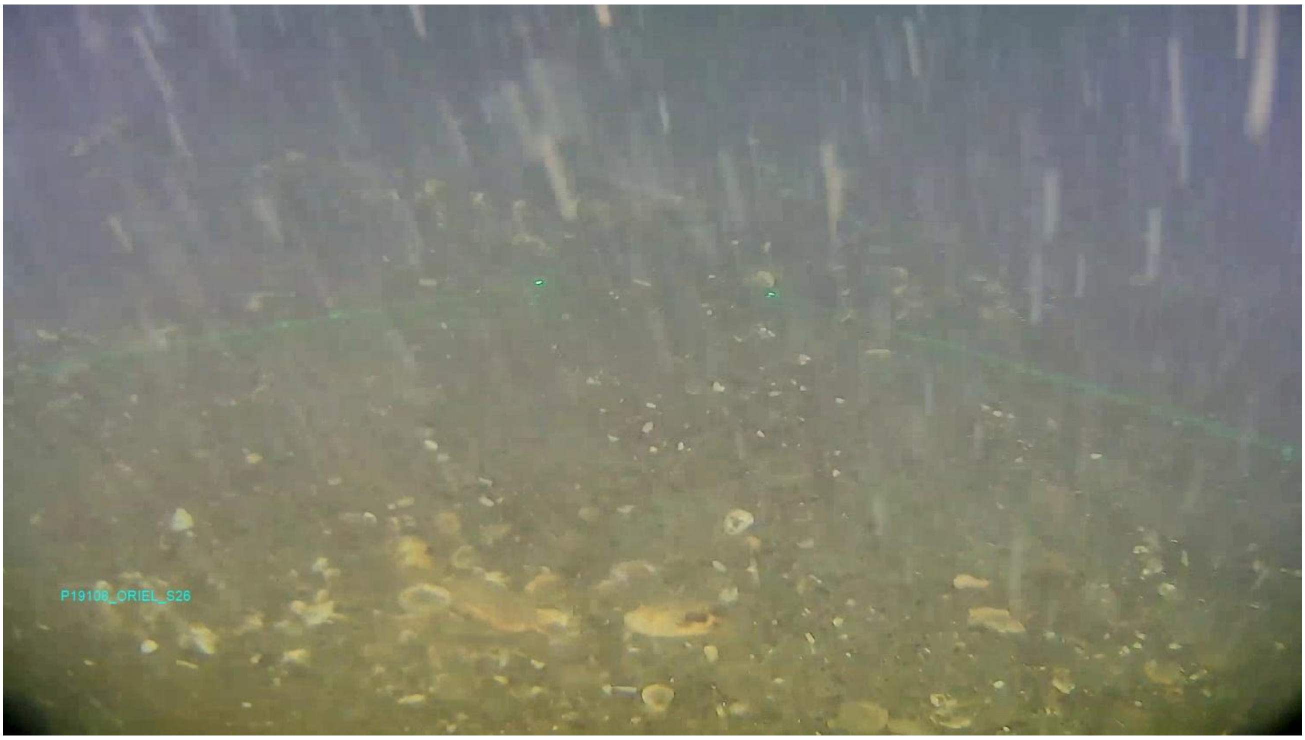


Figure 3.39: S26 – Mixed substrate of cobbles, shell, and sand.

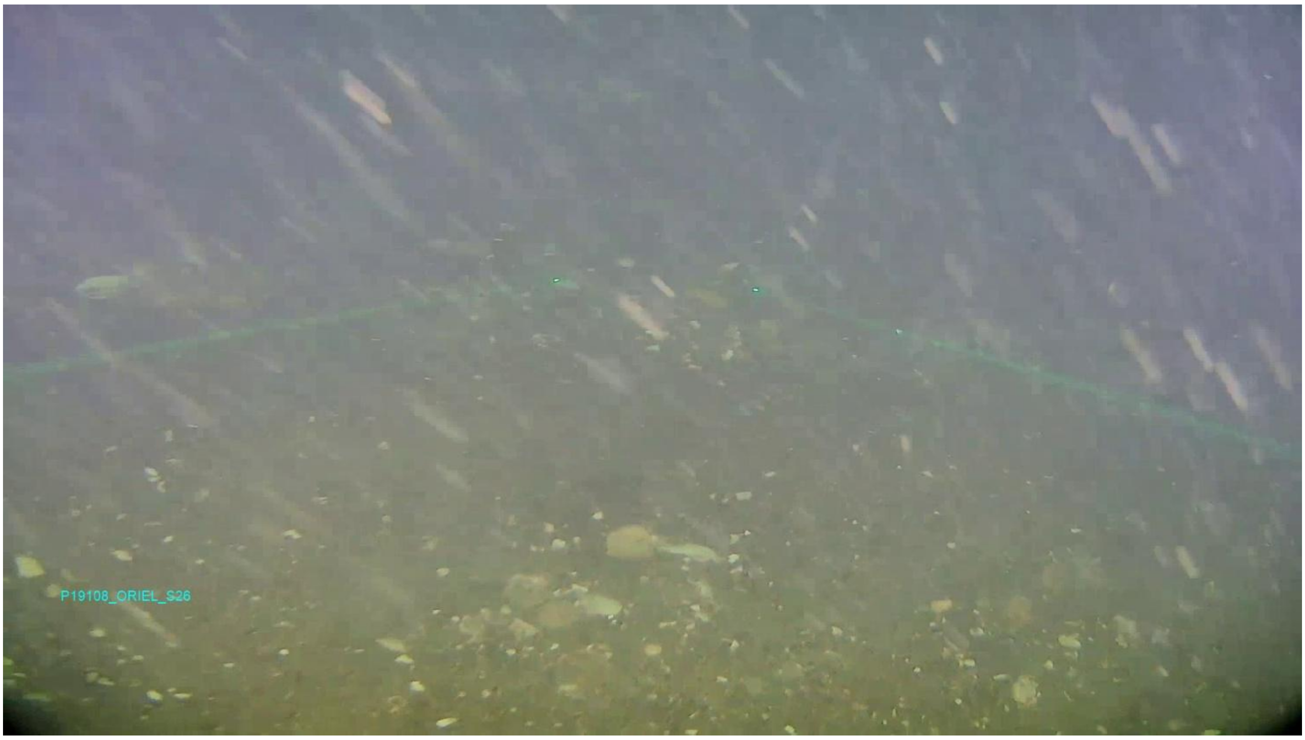


Figure 3.40: S26 – Mixed substrate of cobbles, shell, and sand.

Figure 3.41: S26 – Mixed substrate of cobbles, shell, and sand.

3.1.11 Station S31

Station S31 was composed of fine-muddy sand with shell material and *Nephrops* burrows throughout. Noticeable fauna included auger shells (*T. tricarinata*), and common starfish (*A. rubens*) (**Figure 3.42** to **Figure 3.45)**. The habitat type can be assigned to the JNCC biotope 'SS.SSA.CMuSa Circalittoral muddy sand' (EUNIS code A5.26). **(NB Mislabelled as ENV006 in text overlay).**

Figure 3.42: S31 – Muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows. Note: text overlay mislabelled as ENV006.

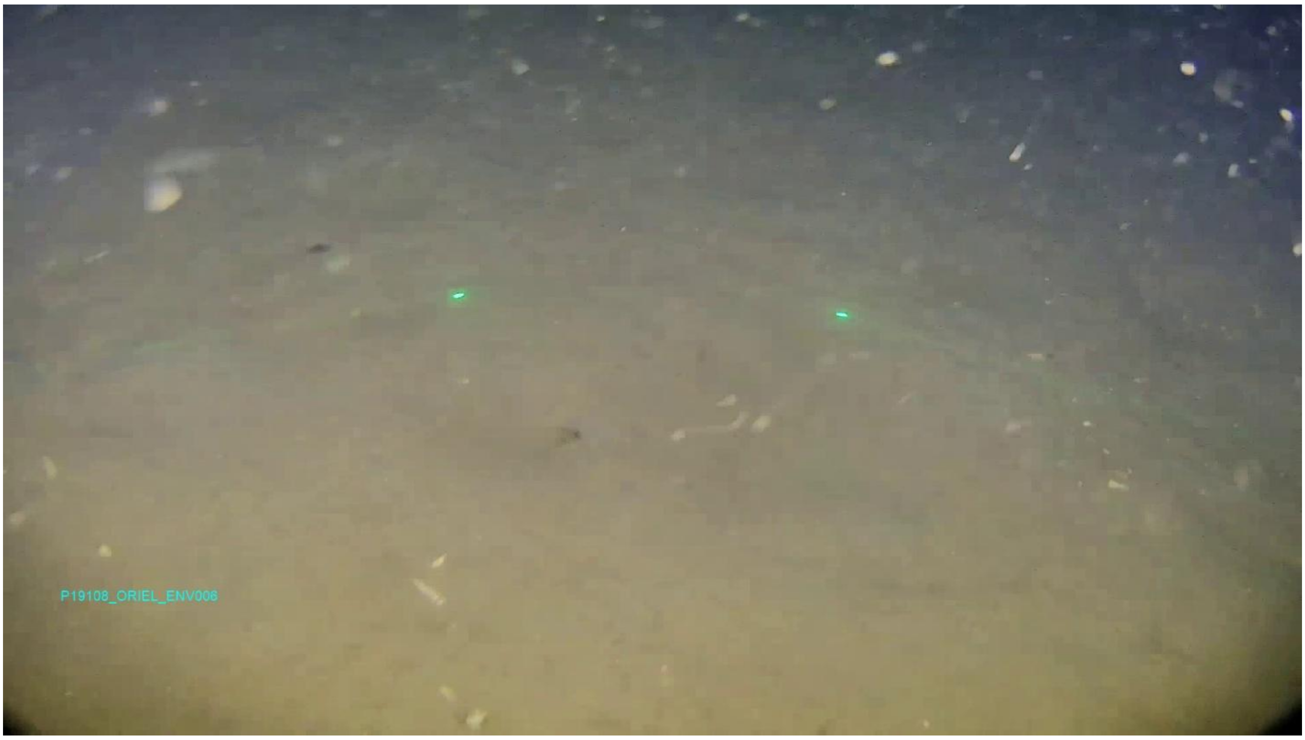


Figure 3.43: S31 – Muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows. Note: text overlay mislabelled as ENV006.

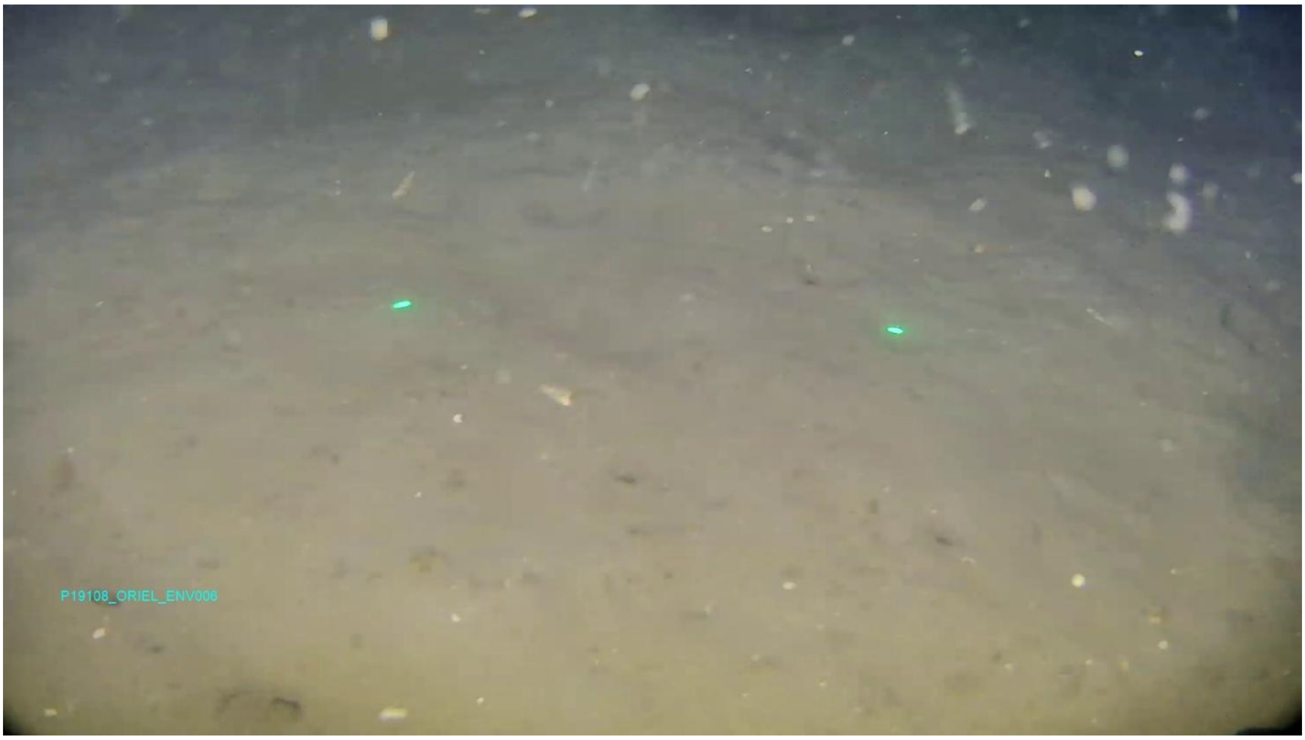


Figure 3.44: S31 – Muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows. Note: text overlay mislabelled as ENV006.

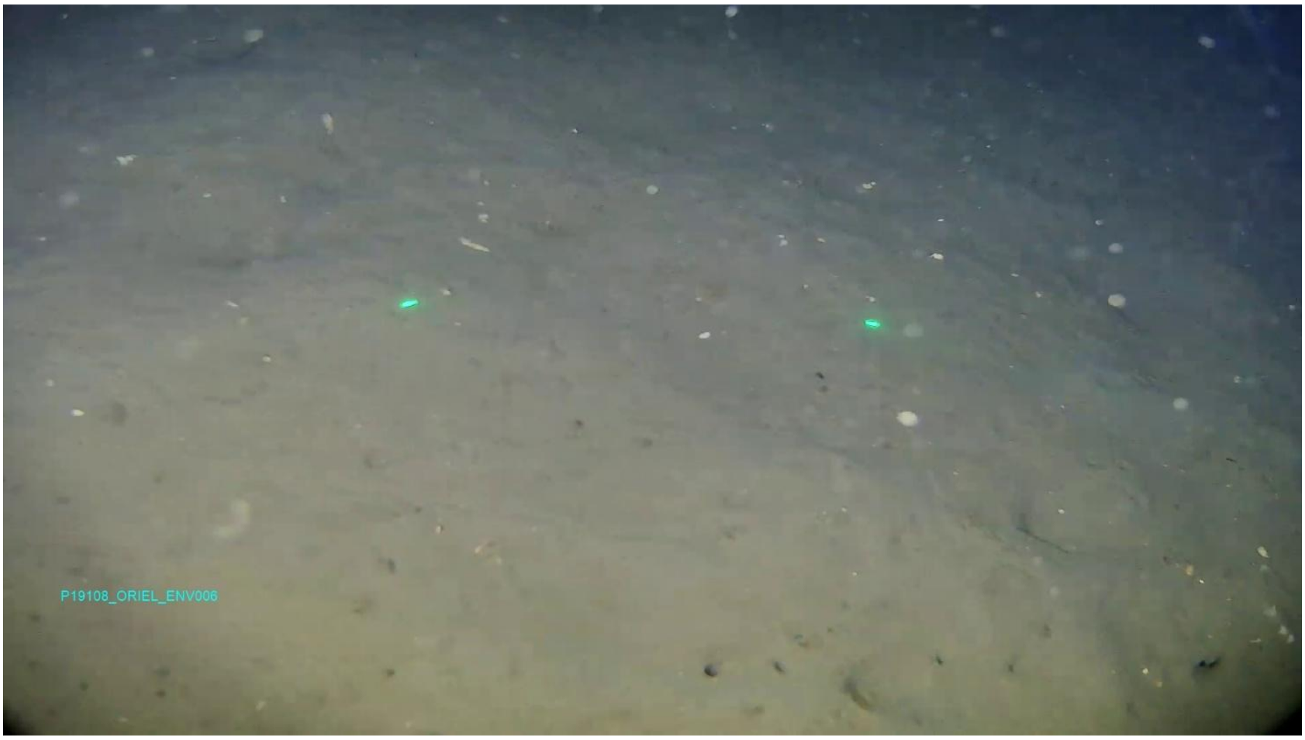


Figure 3.45: S31 – Muddy sand with auger shells (*Turritellinella tricarinata*) and *Nephrops* burrows. Note: text overlay mislabelled as ENV006.

3.2 Reef Assessment Results

Assessment of the surveyed stations against stony reef criteria indicates a clear distinction between reef-like and non-reef-like habitats (see **Table 3-2**). Stations ENV001, ENV002, ENV003, and S11, exhibited high proportions of coarse substrate (40–95% particles >64 mm) combined with reef-like elevation (64 mm–5 m above surrounding seabed) and moderate epifaunal abundance. These characteristics align with Irving's (2009) threshold for Annex I stony reef and correspond to a medium resemblance classification. Under Golding *et al*. (2020), these stations would be considered to show clear resemblance, though not high due to moderate biotic cover.

Station ENV006 met the minimum substrate criterion (10–40% >64 mm) and supported medium epifaunal abundance, resulting in a medium resemblance under Irving but likely low resemblance under Golding due to patchiness. In contrast, stations ENV004, ENV005, S13, S15, S26, and S31 displayed <10% coarse material, flat seabed topography, and infaunal dominance, failing all reef criteria and therefore classified as no resemblance under both frameworks. Overall, the data suggest that reef-like features are concentrated in a subset of stations, with others representing predominantly sedimentary habitats lacking structural complexity.

The majority of stations exhibit characteristics consistent with stony reef habitat, particularly those with cobble/boulder content and moderate epifaunal communities. Stations with <10% coarse substrate and flat topography show no resemblance to Annex I stony reef. Golding's refinements highlight transitional zones (*e.g.,* ENV006) where patchiness reduces overall reefiness.

Table 3-2: Reef Assessment along DDV transects.

Station	Still No.	Stony Reef Criteria (% particle >64 mm diameter)	Stony Reef Criteria (Elevation)	Stony Reef Criteria (Biota dominance)	Stony Reef Assessment
ENV001	1-16	40-95%	64 mm – 5 m	Medium Epifaunal abundance	Medium
ENV002	1-11	40-95%	64 mm – 5 m	Low Epifaunal abundance	Medium
ENV003	1-16	40-95%	64 mm – 5 m	Medium Epifaunal abundance	Medium
ENV004	-	<10%	Flat Seabed	Dominated by infauna	No resemblance
ENV005	-	<10%	Flat Seabed	Dominated by infauna	No resemblance

Station	Still No.	Stony Reef Criteria (% particle >64 mm diameter)	Stony Reef Criteria (Elevation)	Stony Reef Criteria (Biota dominance)	Stony Reef Assessment
ENV006	1-13	10-40%	64 mm – 5 m	Medium Epifaunal abundance	Medium
S11	1-16	40-95%	64 mm – 5 m	Medium Epifaunal abundance	Medium
S13	-	<10%	Flat Seabed	-	No resemblance
S15	-	<10%	Flat Seabed	-	No resemblance
S26	-	<10%	Flat Seabed	-	No resemblance
S31	-	<10%	Flat Seabed	-	No resemblance

3.3 Benthic Fauna Results

The taxonomic identification of the benthic infauna across two benthic sampling sites surveyed within the ORIEL Wind Farm site had a total count of 41 taxa, comprising 245 individuals ascribed to eight phyla. Of the 41 taxa recorded, one was a cnidarian (Actiniaria), one was a nematode (roundworm), one was a nemertean (ribbon worms), 16 were annelids (segmented worms), eight were arthropods (crabs, shrimps, *etc*.), 11 were molluscs (mussels, cockles, snails *etc.*), one was a phoronid (horseshoe worm), and two were echinoderms (brittle stars, star fish, sea urchins, *etc.*).

Of the 41 taxa identified, 29 were identified to species level. The remaining 10 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**.

3.3.1 Univariate Results

Univariate statistical analyses were carried out on the faunal data of the two sampling sites. 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.

A total of 23 taxa were recorded at Station ENV004 and 51 taxa were recorded at Station ENV005. The number of individuals at Station ENV004 was 80 and 165 individuals at Station ENV005. Species richness was lower at Station ENV004 (5.02) compared to Station ENV005 (5.29). Species evenness was higher at Station ENV004 (0.81) compared to Station ENV005 (0.65). Shannon-Wiener diversity index was 2.16 at Station ENV005 and

2.53 at Station ENV004. Simpson's diversity ranged from 0.76 (ENV005) to 0.89 (ENV004). In terms of true diversity (Effective Number of Species), ENV004 had an ENS of 12.61 and 8.71 at ENV005, indicating that Station ENV004 is approximately 1.4 times more diverse than ENV005.

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
ENV004	23	80	5.02	0.81	2.53	12.61	0.89
ENV005	28	165	5.29	0.65	2.16	8.71	0.76

The fauna analysis revealed that sampling sites ENV004 and ENV005, displayed a mosaic of two biotopes based on the characterising taxa recorded across the two sampling sites. The JNCC biotopes identified can be classified as 'SS.SMu.OMu.LevHet' *Levinsenia gracilis* and *Heteromastus filiformis* in offshore circalittoral mud and sandy mud (EUNIS code: MD6217), in combination with 'SS.SMu.CSaMu.AfilKurAnit' *Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud (EUNIS code: MC6211).

The distribution of the mosaic of the two biotopes can be seen in **Figure 3.46** together with the biotopes and broadscale habitats from the video analysis. The biotopes identified previously in 2019 are also presented in **Figure 3.47** for comparison of biotopes across sampling sites.

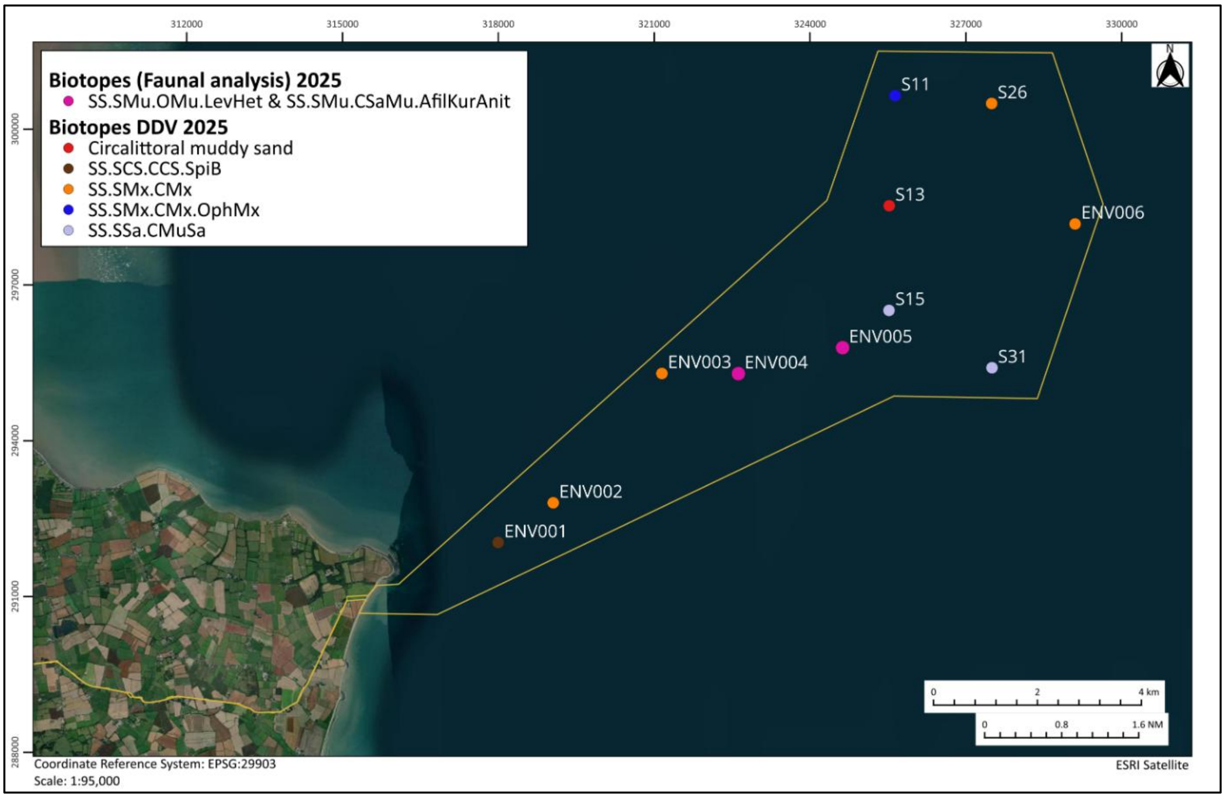


Figure 3.46: Distribution of the mosaic of the two JNCC biotopes at sampling sites ENV004 and ENV005 and biotopes identified using video.

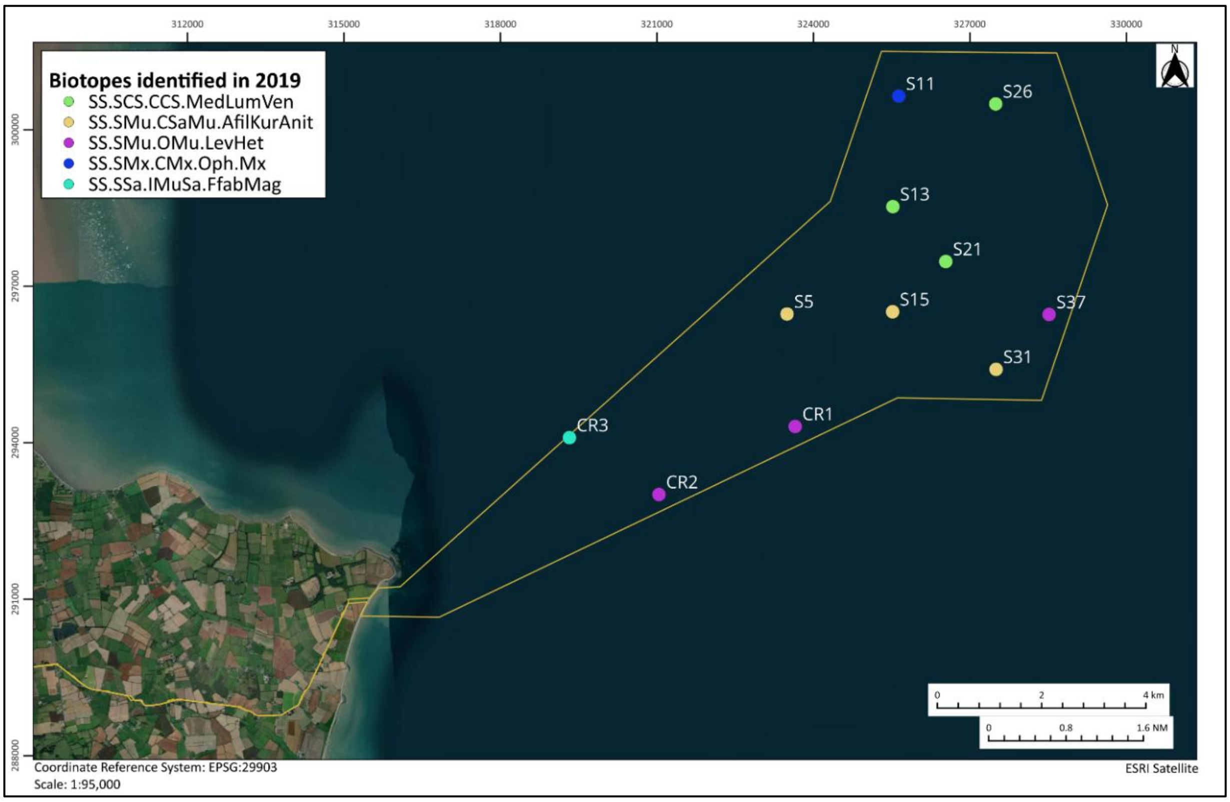


Figure 3.47: Distribution of biotopes in 2019 survey.

3.4 Sediment Results

The sediment sampled within the study area was classified as 'Slightly Gravelly Sand' and 'Gravelly Sand', according to Folk (1954). S31 had the highest percentage composition of fine gravel (4.3%) while S13 had the lowest amount (0.2%). S31 was also shown to have the highest composition of very fine gravel (9.2%) while S13 recorded the lowest percentage (0.9%). The highest composition of very coarse sand was recorded at S31 (9.6%) and the lowest composition was recorded at S13 (1.6%). The highest composition of coarse sand was recorded at ENV004 (15.6%) and the lowest composition (1.5%) at S13. S13 recorded the highest composition of medium sand (35.7%) while the lowest composition (6.7%) was recorded at Station ENV004. The highest composition of fine sand was recorded at S13 (59.5%) and the lowest composition at ENV004 (17.4%). The highest composition of very fine sand (34.6%) was recorded at ENV004 while S13 had the lowest composition of very fine sand (0.6%). S31 recorded the highest silt-clay composition (11.7%) while S13 recorded the lowest silt-clay composition (0.1%). Organic carbon values (% LOI) ranged from 5.75% at Station ENV004 to 7.84% at S13. The level of organic carbon was relatively higher across Stations 13, 15, and 31 compared to the organic content recorded in 2006 and 2019 (see **Table 4-1**:).

A breakdown of sediment type fraction (%) at each of the station sampled is shown in **Figure 3.48** and Sediment Classification across stations sampled in 2019 and 2025 according to Folk (1954) is shown in **Figure 3.49** for comparison.

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 (4-8mm)	Very Fine Gravel (2-4mm)	Very Coarse Sand (1-2mm)	Coarse Sand (0.5-1mm)	Medium Sand (0.25-0.5mm)	Fine Sand (125-250mm)	Very Fine Sand (62.5-125mm)	Silt-Clay (<63mm)	Folk (1954)	LOI (%)
ENV004	-	1.7	5.3	9.5	13.8	6.7	17.4	34.6	11	Gravelly muddy sand	5.75
ENV005	-	2.4	6	9	4.4	7.2	39	20.5	11.5	Gravelly muddy sand	5.81
S13	-	0.2	0.9	1.6	1.5	35.7	59.5	0.6	0.1	Slightly gravelly sand	7.84
S15	-	0.7	1.2	5.1	2.9	15.4	58.1	10.8	5.8	Slightly gravelly sand	6.06
S31	-	4.3	9.2	9.6	8.1	13	21.8	22.2	11.7	Gravelly muddy sand	5.90

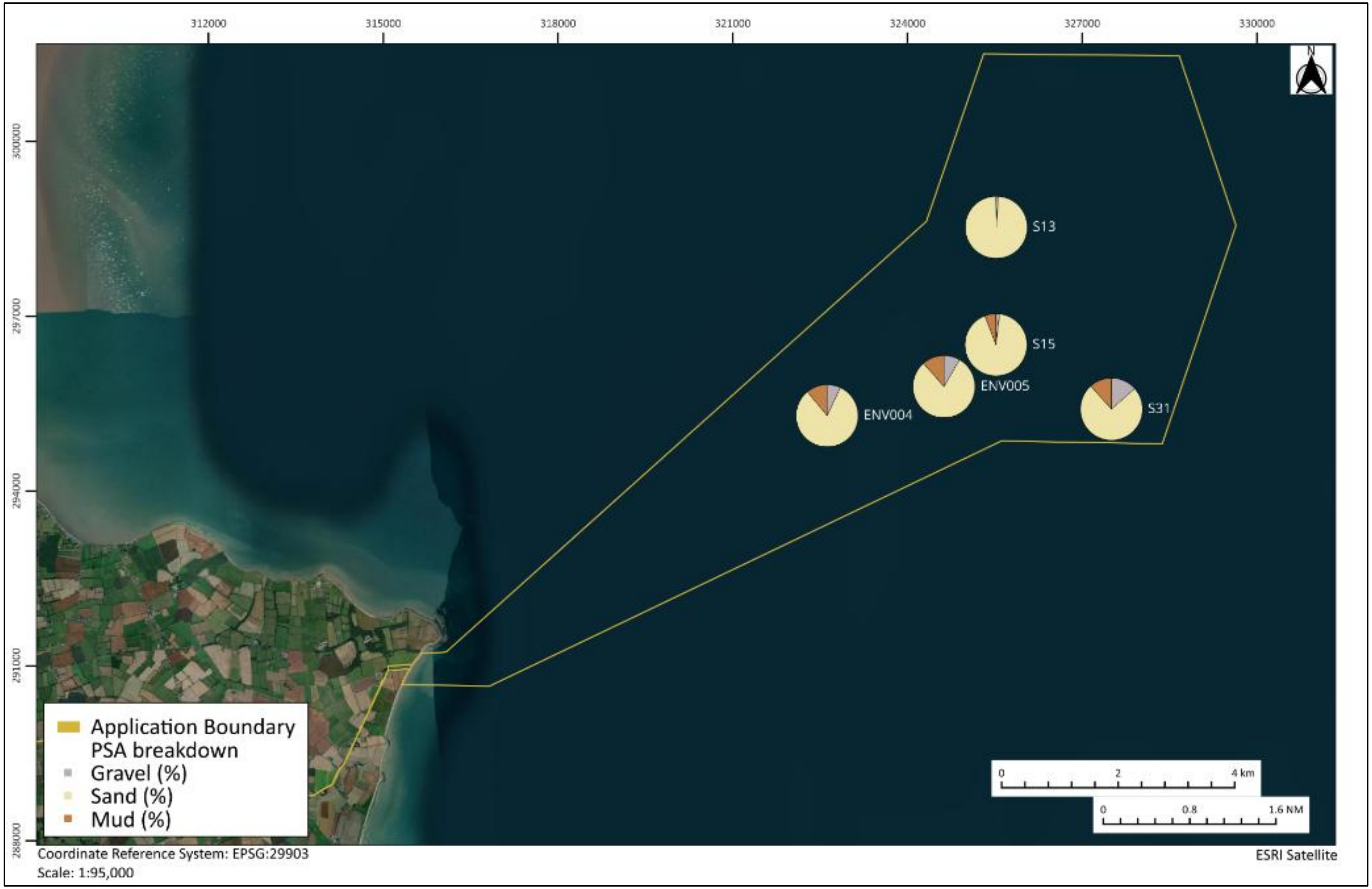
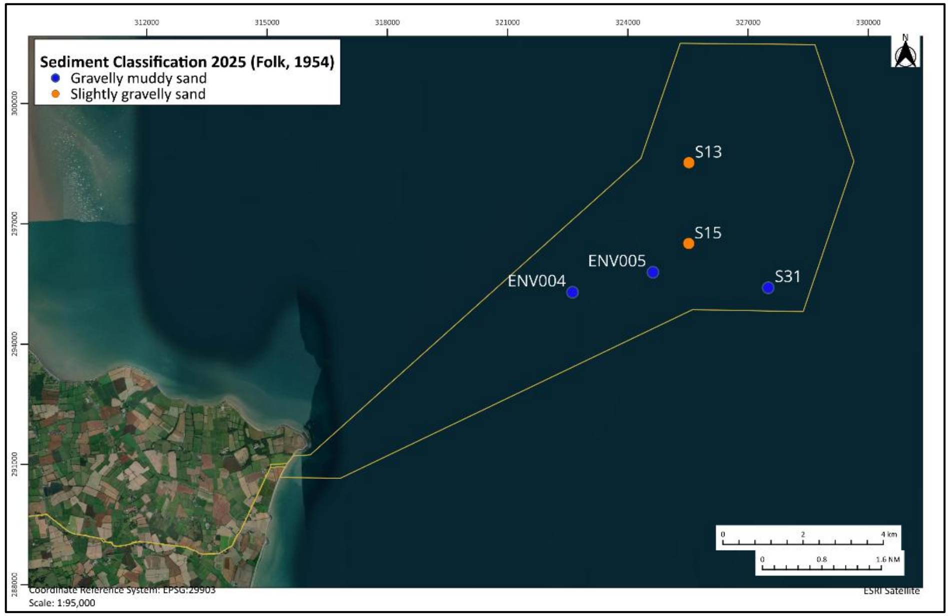


Figure 3.48: A breakdown of sediment type fraction (%) at each of the station sampled.



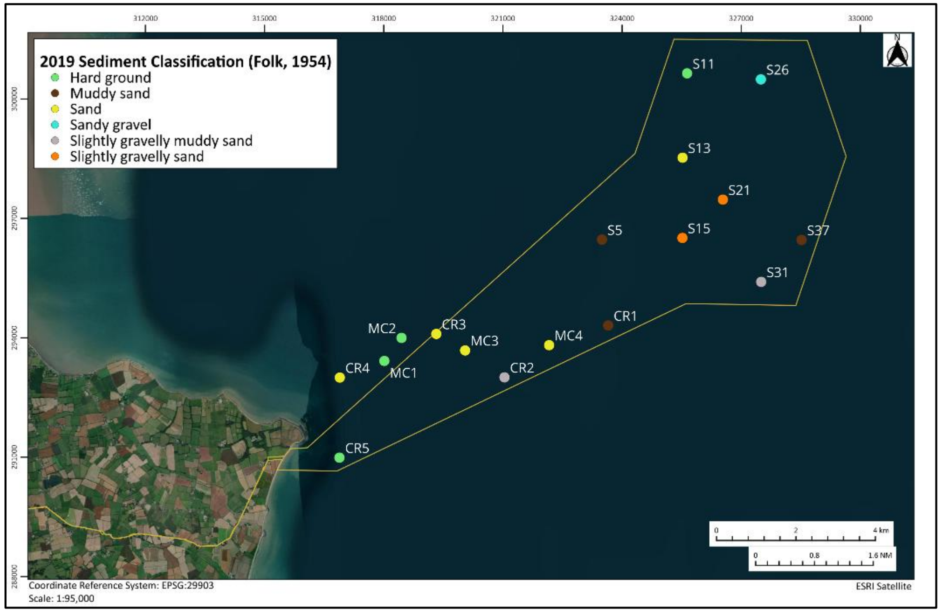


Figure 3.49: Sediment Classification (2019 & 2025) across stations sampled according to Folk (1954).

4. Discussion

4.1 Comparison of survey results (2006, 2019 & 2025)

The faunal analysis within the Oriel Wind Farm site and proposed cable route presented in this report are for the two sampling sites ENV004 and ENV005 only. The remaining of the preselected faunal sampling sites were unsuitable for benthic faunal sampling after DDV footage revealed unsuitable substrates (See **Section 2.2)**. The fauna analysis revealed that sampling sites ENV004 and ENV005, displayed a mosaic of two biotopes classified as 'SS.SMu.OMu.LevHet' *Levinsenia gracilis* and *Heteromastus filiformis* in offshore circalittoral mud and sandy mud, in combination with 'SS.SMu.CSaMu.AfilKurAnit' *Amphiura filiformis*, *Kurtiella bidentata* and *Abra nitida* in circalittoral sandy mud.

On the other hand, video analysis also revealed two additional biotopes at other stations, notably, '*Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles at ENV001, and SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment at Station 11. These findings confirm the persistence of hard-substrate habitats at stations such as ENV001 and S11, consistent with previous observations in 2019 and 2006. Stations with coarse substrates (ENV001–ENV003, S11) exhibited medium resemblance to Annex I stony reef under Irving (2009) criteria, while sediment-dominated stations (ENV004, ENV005, S13, S15, S31) showed no resemblance.

The 'SS.SMu.OMu.LevHet', 'SS.SMu.CSaMu.AfilKurAnit', and 'SS.SMx.CMx.OphMx' were also previously identified in the 2019 survey (AQUAFACT, 2020). Sampling sites ENV004 and ENV005 were located close to S5 and S15 (2019 faunal sampling sites), which were classified as belonging to the same biotope 'SS.SMu.CSaMu.AfilKurAnit'. A comparison of the results from 2006 and 2019 with 2025 is provided in **Table 4-1**.

In both 2019 and 2025, Station 11 showed similar biotope 'SS.SMx.CMx.Oph.Mx'. This also corresponds to the same community identified back in 2006. At Station 13, video analysis seemed to indicate that the substrate type could be classified as the broadscale habitat 'SS.SSA.CMuSa' Circalittoral muddy sand. This station was previously classified under the biotope 'SS.SCS.CCS.MedLumVen' *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel, based on faunal analysis in 2019, similar to the community found in 2006, though with variation in the sediment composition.

Comparative analysis indicates broad stability in biotope distribution since 2019, with some historical shifts linked to sediment changes. For example, stations S15 and S31 previously transitioned from *Abra*-dominated to *Amphiura*-dominated communities as sediment coarsened; the current survey suggests a reversal toward finer sediments, favouring *Abra* once more. Organic carbon levels (LOI) were higher in 2025 (up to 7.84%)

compared to earlier surveys, particularly at stations with finer sediments, which may influence benthic productivity and community structure.

At Station 15, the video analysis corresponds to the biotope type previously assigned to this station, 'SS.SMu.CSaMu.AfilKurAnit'. Sediment type also corresponds to previous analysis back in 2019. At Station 26, video analysis seemed to suggest mixed sediment type and previous faunal grab in 2019 assigned the site to the biotope 'SS.SCS.CCS.MedLumVen', similar to the community found in 2006. Similarly at Station 31, the video analysis suggest muddy sand sediment type and previous faunal grab in 2019 assigned the site to the biotope 'SS.SMu.CSaMu.AfilKurAnit'.

For survey data infill station ENV001, the video analysis seemed to suggest the presence of the biotope 'SS.SCS.CCS.SpiB'. For data infill stations ENV002, ENV003, and ENV006, the video analysis seemed to suggest the presence of the broadscale habitat 'Circalittoral mixed sediment'.

For data infill stations ENV004 and ENV005, the faunal analysis indicate a mosaic of two biotopes based on the characterising taxa recorded. The biotopes identified can be classified as 'SS.SMu.OMu.LevHet' in combination with 'SS.SMu.CSaMu.AfilKurAnit'. Although no *Amphiura* community was recorded within 'SS.SMu.CSaMu.AfilKurAnit', other important characterising taxa of this biotope were present including *Abra nitida*, *Kurtiella bidentata, Thysanocardia procera, and Nephtys incisa*. Stations ENV004 and ENV005 were both classified as 'Gravelly muddy sand' according to Folk (1954). Sediment analysis also revealed a higher percentage composition of mud to gravel at both sites. The ratio of silt-clay content to coarse material has an impact on the species composition favouring an *Abra* dominated community and reducing the suitability for an *Amphiura* community.

Overall, the 2025 survey reinforces the role of sediment composition, particularly the ratio of mud to coarse material in shaping benthic assemblages. Habitat heterogeneity persists across the ECC and array area, with mixed sediment and reef-like features concentrated in discrete zones, while muddy sand habitats dominate elsewhere.

Table 4-1: Comparison of biotopes, sediment and organic carbon results from surveys conducted in 2006, 2019, and 2025.

Station	2006 Survey			2019 Survey			2025 Survey		
	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)
S5	*Amphiura* community	Muddy sand	3.8	SS.SMu.CSaMu.AfilKurAnit (*Amphiura* community)	Muddy sand	3.31	Not sampled	Not sampled	Not sampled
S11	Hard Ground	Not sampled	N.A.	SS.SMx.CMx.Oph.Mx Hard Ground (video survey)	Boulders and cobbles	N.A.	SS.SMx.CMx.Oph.Mx Hard Ground (video survey)	Not sampled	Not sampled
S13	Hydroids, *Edwardsia*, *Thracia* sp., *Lumbrineris* sp.	Sand	1.92	SS.SCS.CCS.MedLumVen (including *Lumbrineris, Thracia, Edwardsia*)	Sand	1.05	SS.SSA.CMuSa Circalittoral muddy sand (video survey)	Slightly gravelly sand	7.84
S15	*Abra* community	Sandy mud	3.91	SS.SMu.CSaMu.AfilKurAnit (*Amphiura* community)	Slightly gravelly sand	3.76	Circalittoral muddy sand (video survey)	Slightly gravelly sand	6.06
S21	Hydroids, *Edwardsia*, *Thracia*, *Lumbrineris*	Not sampled	1.66	SS.SCS.CCS.MedLumVen (including *Lumbrineris, Thracia, Edwardsia*)	Slightly gravelly sand	1.64	Not sampled	Not sampled	Not sampled
S26	Hydroids, *Edwardsia*, *Thracia*, *Lumbrineris*	Sand	1.85	SS.SCS.CCS.MedLumVen (including *Lumbrineris*)	Sandy gravel	6.01	Circalittoral mixed sediment (video survey)	Not sampled	Not sampled
S31	*Abra* community	Muddy sand	5.96	SS.SMu.CSaMu.AfilKurAnit (*Amphiura* community)	Slightly gravelly muddy sand	1.25	Circalittoral muddy sand (video survey)	Gravelly muddy sand	5.90
S37	*Amphiura* community	Gravelly muddy sand	3.9	SS.SMu.OMu.LevHet (broad *Amphiura* community)	Muddy sand	2.92	Not sampled	Not sampled	Not sampled
ENV001	-	-	-	-	-	-	CR.HCR.XFa.FluCoAs.SmAs (video survey)	Not sampled	Not sampled
ENV002	-	-	-	-	-	-	Circalittoral mixed sediment (video survey)	Not sampled	Not sampled
ENV003	-	-	-	-	-	-	Circalittoral mixed sediment (video survey)	Not sampled	Not sampled

Station	2006 Survey			2019 Survey			2025 Survey		
	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)	Community/Biotope	Sediment type (Folk, 1954)	Organic carbon (%)
ENV004	-	-	-	-	-	-	SS.SMu.OMu.LevHet & SS.SMu.CSaMu.AfilKurAnit	Gravelly muddy sand	5.75
ENV005	-	-	-	-	-	-	SS.SMu.OMu.LevHet & SS.SMu.CSaMu.AfilKurAnit	Gravelly muddy sand	5.81
ENV006	-	-	-	-	-	-	Circalittoral mixed sediment (video survey)	Not sampled	Not sampled

5. Conclusion

The faunal analysis conducted within the Oriel Wind Farm site and proposed cable route focused on two viable sampling sites, ENV004 and ENV005, due to substrate limitations at other preselected locations. Both sites exhibited a mosaic of two biotopes: SS.SMu.OMu.LevHet and SS.SMu.CSaMu.AfilKurAnit, with sediment classified as gravelly muddy sand and a higher mud content influencing species composition toward an Abra-dominated community. Comparative analysis with previous surveys (2006 and 2019) indicates consistency in biotope classification at several stations, though some historical shifts in community composition correlate with changes in sediment type.

Video analysis also identified additional biotopes at other stations, including SS.SCS.CCS.SpiB and SS.SMx.CMx.OphMx, highlighting habitat heterogeneity across the study area and the presence of reef-like features at stations with coarse substrates. These findings underscore the spatial complexity of benthic habitats within the Oriel Wind Farm area.

Overall, the results confirm the persistence of key biotopes previously recorded, while sediment variability continues to play a critical role in shaping benthic communities. In summary, the findings provide robust evidence that benthic habitats remain broadly consistent with previous baselines, while emphasizing the ecological importance of sediment dynamics and structural complexity. These insights support ongoing environmental assessments and inform mitigation measures to protect sensitive habitats during project development.

6. References

AQUAFACT. 2020. ORIEL Windfarm Benthic Studies. Parkwind. February 2020.

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

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

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.

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

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

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.

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

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.

7. Appendices

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

8. Contents

• Purpose and scope

Purpose:	The purpose of this SOP is to outline the methodologies used for in field benthic habitat classification from drop down video images/filming.
Scope:	The methods outlined in this SOP can be utilised for benthic habitat classification in field and station selection for benthic habitat sampling.

• Ownership and implementation

Procedure owner:	It is the responsibility of the lead scientist conducting the station selection resulting from the DDV survey to ensure that the methodologies outlined in this SOP are consistent with best practice and any other specific classification requirements as outlined in the scope of works for a specific project.
Procedure user:	Any scientist involved in station selection for benthic habitat sampling resulting from DDV imaging.

- **Process Map**

DDV Imaging

- DDV Image Received for pre-selected Proposed Station

Sediment Classification

- Sediment is Classified and deemed Suitable

Reef Classification/Fauna/Flora

- The absence of any reef/fauna/flora that could be impacted by benthic sampling is confirmed.

Other Disqualifying Features

- The absence of any other disqualifying features such as man made infastructure/wrecks/marine litter is confirmed.

Station Deemed Suitable for Benthic Sampling

• References

- 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 No. 546, JNCC, Peterborough, ISSN 0963-8091.
- 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.
- 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.
- NPWS. (NA). *Reefs*. [Online]. NPWS. Available at: https://www.npws.ie/marine/marine-habitats/reefs#:~:text=Sublittoral%20biogenic%20reefs%20in%20Ireland%20include%3A%201% [Accessed 24 March 2025].
- T2-SOP-FIELD-01-Particle Diameter Classification (Udden-Wentworth), Aquafact 2025
- T2-SOP-FIELD-02-Sediment Type Classification (FOLK), Aquafact 2025

• Benthic Sampling Station Selection Using from Image Analysis

Drop down video (DDV) imaging can be used to determine the following for benthic sampling suitability;

(a) To determine whether the sediment type is suitable for benthic sampling.
(b) To determine whether there is any biogenic or non-biogenic reef present that would be negatively impacted by benthic sampling.
(c) To determine whether there is any present/accumulation of fauna or flora species that would be negatively impacted by benthic sampling.
(d) To determine whether there is any other considerations that could effect or be effected by benthic sampling.

1. Station Selection Based on Sediment Classification		
Feature	Feature Description	Suitability for Benthic Sampling
Boulders/Cobbles/Pebbles	• Boulders (>256 mm) • Cobbles (64 – 256 mm) • Pebbles (4-64 mm)	NOT SUITABLE
Small Granules	• Shell/Gravel (*circa* 4 m)	SUITABLE
Coarse Sediments	• Gravel(G) • sandy Gravel (s-G) • gravelly Sand (G-s)	SUITABLE
Mixed Sediments	• muddy Gravel (m-G) • muddy sandy Gravel (m-s-G) • gravelly Mud (g-m) • gravelly muddy Sand (g-m-S)	SUITABLE

Mud	• Mud	SUITABLE
Sand	• Sand	SUITABLE

2. Station Selection Based on Reef Classification		
Feature	**Feature Description**	**Suitability for Benthic Sampling**
Biogenic Reef	• Any reef made by a living organism.	NOT SUITABLE
Non-Biogenic Reef	• The structure of reefs varies from bedrock to boulders or cobbles while topography ranges from horizontal to vertical and the reefs may have numerous ledges and crevices. The geology includes limestone, shale, granite, schists and gneiss. Brown fucoid algae generally dominate the intertidal down to shallow subtidal areas. The latter are characterised by kelp species, frequently with an understorey of red foliose algae. Below the kelp and down to about 30 m, red algae characterise the substratum with very few brown algae. Below this, the habitat is characterised by faunal species; very few foliose or filamentous red algae occur although encrusting red algae may be common.	NOT SUITABLE
Serpula Reefs	• The polychaete worm *Serpula vermicularis* secretes a calcareous tube and is common as a solitary worm.	NOT SUITABLE

	The worms aggregate and form structures which may be up to 1 m in height and about 2 m in diameter.	
Sabellaria Reef	These are constructed by the polychaete worms *Sabellaria spinulosa* and *Sabellaria alveolata.* The reefs are constructed of sand grains by the worm and form a substrate for many other species that would not normally be present in the area in the absence of the reefs. The reefs can be up to a metre in thickness.	NOT SUITABLE
Bivalve Reefs	• Reefs caused by accumulations of bivalve populations.	NOT SUITABLE
Cold Water Coral Reefs	• Cold water coral reefs are from 200–1600 m, where the water temperature is 4–8ºC and the salinity is 32–36%. Coral reefs found to date are generally associated with carbonate mounds, features that rise up to 300-500 m above the sea floor.	NOT SUITABLE

3. Station Selection Based on Identifiable Fauna/Flora		
Feature	**Feature Description**	**Suitability for Benthic Sampling**
Fauna	• Any bottom fixing fauna species.	NOT SUITABLE

	• Any large populations/accumulations of benthic species.	
Flora	• Any bottom fixing flora species.	NOT SUITABLE
Drift Flora	• Any non-attached drift flora.	SUITABLE

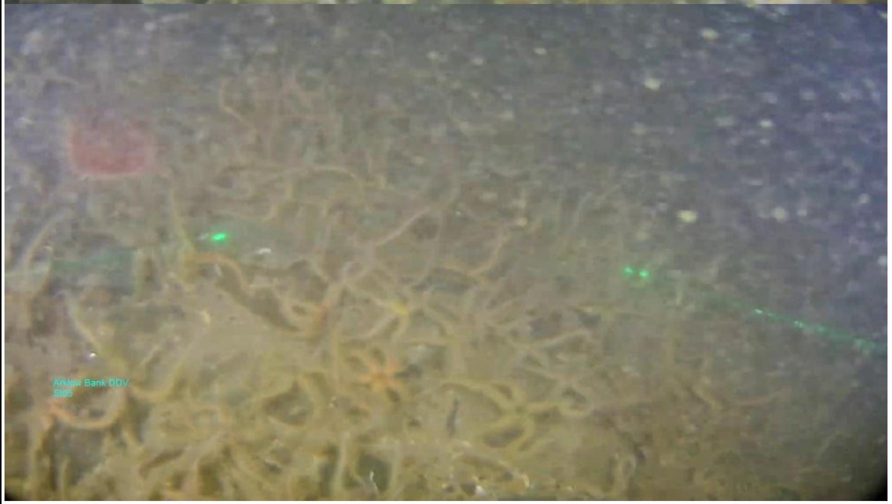
4. Other Considerations that Influence Station Selection		
Feature	**Feature Description**	**Suitability for Benthic Sampling**
Man Made Structures	• Any visible mad man instructor	NOT SUITABLE
Wrecks or Similar Archaeological Material	• Any visible archaeological material.	NOT SUITABLE
Large Accumulation of Marine Litter	• Any visible large accumulation of marine litter.	NOT SUITABLE

Project Name & No. P15458		Survey Team: AR + JS	
Date: 11/10/24		Station Notes	
Time	Station	Depth	Station Observations - Substrate, Fauna etc.
15:46	ST_05	18.5M	
Footage	Received	Saved	
	✓	✓	

SEDIMENT TYPE
- COBBLES

IDENTIFIABLE FAUNA
- SPONGES
- BRITTLE STAR (LARGE AREA COVERED)

NOT SUITABLE FOR BENTHIC SAMPLING



- **Sample Station Elimination for Benthic Sampling from DDV Image Analysis**

Figure 6.1 Sample Station Data Sheet for Eliminated Station for Aquafact job P15458.

The above station was eliminated as the transect revealed cobbles/boulders that are an unsuitable sediment type and there was also a large accumulation of brittle stars present.

Appendix 2 – Species List (2025)

Taxon	AphiaID	ENV05	ENV04
Actiniaria	1360	5	24
Nemertea	152391	1	5
Nematoda	799		2
Thysanocardia procera	136063		1
Phascolion strombus	266489		5
Malmgrenia darbouxi	863197	1	
Pholoe baltica (sensu Petersen)	130599	1	
Pseudomystides limbata	130683		1
Podarkeopsis capensis	130195	1	
Nephtys incisa	130362	4	5
Levinsenia gracilis	130578		1
Prionospio (unidentifiable)	129620	2	
Magelona (unidentifiable)	129341	Fragment	
Magelona minuta	130270		2
Diplocirrus glaucus	130100		3
Notomastus	129220	1	
Scalibregma inflatum	130980	20	1
Polygordius	129472		1
Spirobranchus (juvenile)	129582	1	
Sacculina gonoplaxae	237834	1	
Harpinia crenulata	102963		3
Ampelisca	101445		1

Taxon	**AphiaID**	**ENV05**	**ENV04**
Abludomelita obtusata	102788	1	8
Iphinoe serrata	110460		2
Eudorella truncatula	110535	3	3
Pagurus pubescens	107240		1
Goneplax rhomboides	107292	1	
Turritellinella tricarinata	1381415	16	77
Villiersiella attenuata	1437106		1
Sorgenfreispira brachystoma	847930	1	1
Odostomia (juvenile)	138413	2	
Ondina (juvenile)	138414		1
Cylichna cylindracea	139476	4	7
Kurtiella bidentata	345281	7	2
Tellinidae (juvenile)	235	2	
Abra nitida	141435		1
Mysia undata	140728	1	
Varicorbula gibba	378492	3	3
Phoronis	128545	1	1
Ophiothrix fragilis	125131		Fragment
Amphipholis squamata	125064		2