FIVE ESTUARIES
OFFSHORE WIND FARM

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PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

VOLUME 4, ANNEX 5.1: MAIN ARRAY - BENTHIC ECOLOGY MONITORING REPORT

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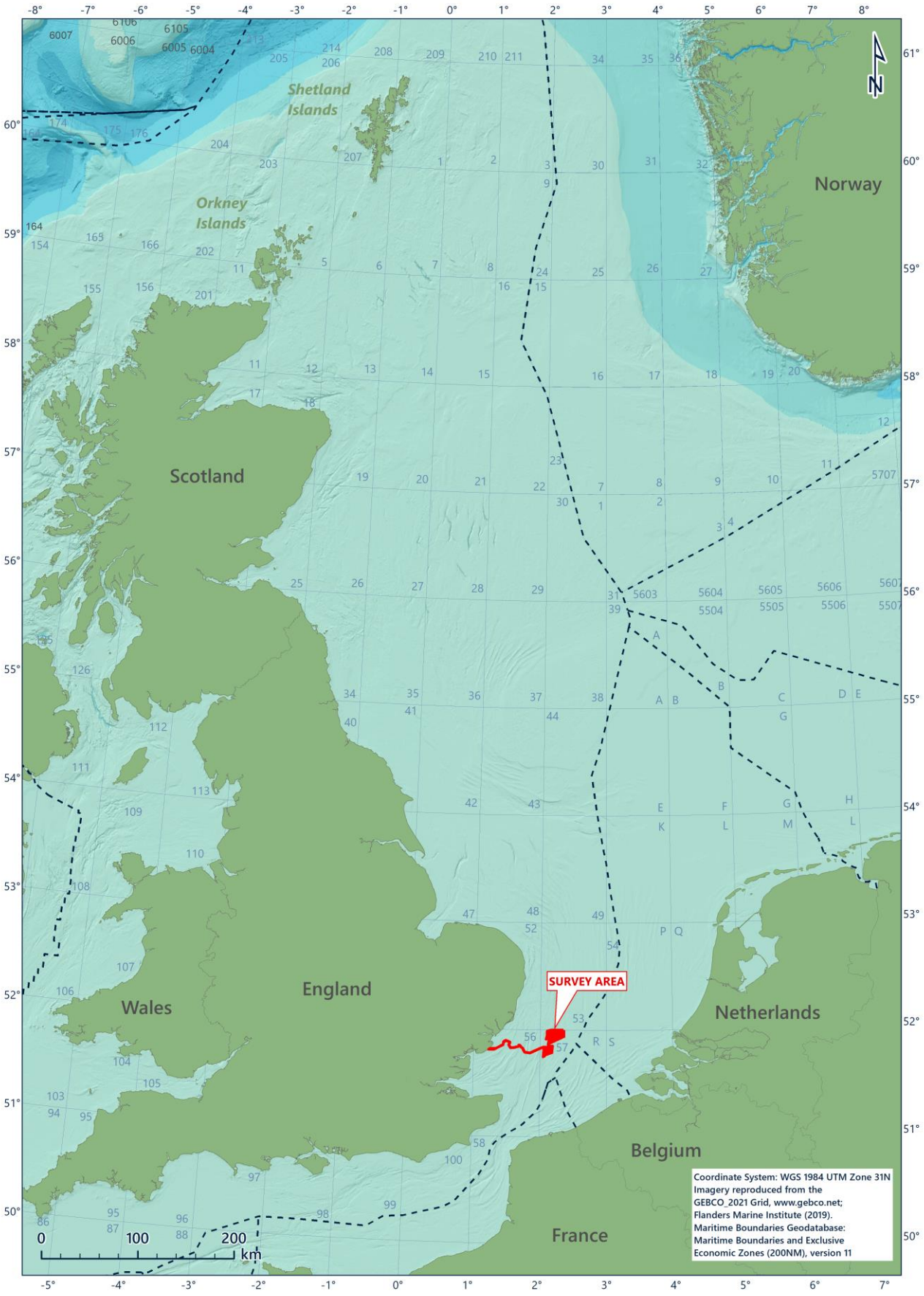
Frontispiece



Executive Summary

Introduction

Five Estuaries Offshore Wind Farm Limited contracted Fugro to undertake a benthic site characterisation survey at the Five Estuaries Offshore Wind Farm (VE) development area. The VE comprises a main array area (north and south arrays with an interconnector in between) and an export cable route (ECR) that will run from the offshore arrays to the landing site. Operations were conducted onboard the MV Marshall Art during the survey period 9 to 16 November 2021. An intertidal survey of the cable landing site, between Holland-on-Sea and Frinton-on-Sea, Essex, was undertaken during the survey period 25 to 27 July 2021.

The results of the study will inform the project final development consent order (DCO) application, the environmental impact assessment (EIA) and the habitats regulation assessment (HRA).

The aim of the benthic survey was to provide a baseline characterisation of the benthic ecology and to supplement the existing data across the area of interest. The aim was fulfilled through acquisition of sediment samples and seabed video and photographic data. Sediment samples were acquired to characterise the benthic environment in terms of physico-chemical features and biological communities. Seabed video and photographic data provided information on habitat types, with focus on habitats of conservation importance, such as those listed under Annex I of the Conservation of Habitats and Species Regulations 2019 and on the Oslo and Paris (OSPAR) list of threatened and/or declining habitats and species. The results of the seabed video and photographic data were integrated with those from the grab samples to further define the habitats and associated biological communities in terms of biotopes in line with the European Nature Information System (EUNIS) habitat classification.

This report presents the results of data acquired across the VE main array survey area.

Survey Strategy

Seventeen environmental sampling stations, to be assessed through drop-down camera and single replicate grab samples, were proposed based on review of available regional and geophysical data. Review of side scan sonar (SSS) data placed emphasis on areas of potential conservation value, boundaries between areas of differing sonic reflectivity, bathymetric highs and lows and areas representative of the general background conditions of the site. Acquisition of grab samples for chemistry analysis was proposed at nine stations. Seabed video and photography were acquired prior to grab sampling to ensure no damage to potential habitats of conservation importance. One drop-down video (DDV) sample was proposed to target areas of hard/coarse substrates and two DDV transects were proposed in areas of potential conservation importance, referred to as ‘areas of focus’.

Seabed video and photography were acquired using a Subsea Technology and Rentals (STR) deep-sea camera system. In areas of poor visibility, seabed video and photography were acquired using a Bowtech SeaKnight underwater camera system mounted within a freshwater frame.

Faunal and sediment PSD samples were acquired using a 0.1 m^2 mini Hamon grab, whereas chemistry samples were acquired using a 0.1 m^2 Day grab.

Grab samples were successfully acquired at all proposed stations.

Sediment Characteristics

Sediments across the VE main array survey area were characterised by coarse sediment comprising mainly sand and gravel. Mud content was on average low, with most stations being devoid of mud. The exception was station FE1_01, in the north array, which had a mud content of 47.10 %. Notable contribution to gravel emanated from shell fragments, as recorded from the qualitative description of the grab samples. The sediment sorting ranged from well sorted to extremely poorly sorted, with most stations having very poorly sorted sediments.

The sediment diversity resulted in five sediment classes being identified through the Folk (British Geological Survey [BGS] modified) classification, of which 'gravelly sand' and 'sandy gravel', typified most stations, whereas 'sand' and 'muddy sandy gravel' each typified three stations and 'gravelly mud' typified one station.

The Wentworth (1922) scale was used to assess the coarseness of the sediment resulting in six sediment descriptions, including 'very coarse sand' and 'coarse sand', each typifying five stations, whereas 'medium sand' and 'very fine sand' typified each one station. Of the remaining stations, three were described as 'granule' and two were described as 'pebble'.

Most stations had bimodal or polymodal distributions, typical of areas with different sources of sediment likely associated with riverine input and sediment disturbance in a high energy environment, such as that of the study area.

Sediment Chemistry

Sediment samples were analysed for total hydrocarbon content (THC), polycyclic aromatic hydrocarbons (PAHs), metal content, polychlorinated biphenyls (PCBs), organotins, and organochlorine pesticides (OCPs). Twenty-two PAHs were analysed, including the United States Environmental Protection Agency (US EPA) 16 PAHs, selected alkyl naphthalenes and phenanthrenes, benzo[e]pyrene and perylene.

Results were compared against marine sediment quality guidelines (SQGs) including the OSPAR effects range low (ERL), the National Oceanic and Atmospheric Administration effects range median (ERM), the Centre for Environment, Fisheries and Aquaculture Science (Cefas) Guideline Action Levels (ALs) and the Canadian threshold effect level (TEL) and probable effect level (PEL).

The concentrations of THC and PAHs were below their respective marine SQGs across the VE main array survey area.

Of the 11 metals analysed, 10 had concentrations below their respective marine SQGs across the VE main array survey area. Arsenic concentrations were above the Canadian PEL at all stations, however,

regional contextualisation indicated that the concentrations of arsenic are within the range reported for the Outer Thames Estuary.

The concentrations of all individual PCB congeners analysed were below the limit of detection (LOD) across the VE main array survey area and the sum of the 25 congeners was below the Cefas ALs.

The organotins analysed were dibutyltin (DBT) and tributyltin (TBT), the concentrations of which were below their respective LOD and below the Cefas ALs across the VE main array survey area.

The OCPs analysed in this study were alpha-hexachlorocyclohexane (AHCH), beta-hexachlorocyclohexane (BHCH), gamma-hexachlorocyclohexane (GHCH), dieldrin, hexachlorobenzene (HCB), p,p'-dichlorodiphenyldichloroethylene (PPTDE), p,p' dichlorodiphenyltrichloroethane (PPDDT) and p,p'-dichlorodiphenyldichloroethane (PPDDE). All OCPs across the VE main array survey area had concentrations below their respective LOD and all values were below the Cefas marine SQGs, which currently include AL1 for dieldrin and DDT.

Macrofauna

The macrofaunal community comprised infaunal and epifaunal taxa, the latter being represented by solitary and colonial organisms. Annelida were dominant in terms of taxa composition and abundance of the enumerated macrofauna, which comprised infauna and solitary epifauna. There was considerable variation in the number of taxa and individuals across the main array survey area, with stations along the interconnector generally having higher values of richness and diversity, likely associated with the coarseness and diversity of the sediment, which featured the highest mean content of gravel. This provides suitable substrate for the attachment of epifauna, while the gravelly interstices provide microhabitats for smaller fauna. This was reflected in the values of faunal diversity, which was on average good, in line with the threshold values descriptions of Dauvin et al. (2012). By comparison, stations in the south array, featuring predominantly sandy sediments, had generally low species richness and diversity, the latter being on average moderate, in line with the threshold values descriptions of Dauvin et al. (2012).

Annelida were represented by polychaetes including *Lumbrineris* cf. *cingulata*, *Pholoe baltica*, *Glycera lapidum*, *Aonides paucibranchiata*, *Notomastus*, *Spirobranchus lamarcki* and *Scalibregma inflatum*. The polychaete *Sabellaria spinulosa* was recorded in grab samples from four stations, with abundances of between one and nineteen individuals.

Mollusca were represented by bivalves such as *Spisula elliptica*, *Kurtiella bidentata*, *Abra alba*, *Diplodonta rotundata* and *Goodallia triangularis* and the chiton *Leptochiton asellus*.

Echinodermata were represented by species typical of habitats exposed to strong tidal currents including brittlestars such as *Ophiura albida* and *Amphipholis squamata*, and the urchin *Echinocyamus pusillus*.

Other taxa were represented mainly by species of Nemertea, non-burrowing anemones of the order Actiniaria, phoronid of the genus *Phoronis* and ascidians.

Four macrofaunal assemblages were identified through the multivariate analysis, each assemblage having <45 % similarity and moderately associated with sediment type.

Annelida comprised most of the infaunal biomass, owing to their numerical dominance, whereas the Echinodermata biomass was associated with the abundance of brittlestars as well as the size of invertebrates, notably sea urchins.

Colonial epifauna included Bryozoa, notably *Schizomavella*, *Aspidelectra melolontha*, *Escharella* immersa and *Disporella hispida*; Cnidaria, notably *Hydrallmania falcata, Alcyonium digitatum* and species of Sertulariidae; Porifera, including species of *Cliona* (agg.) and ciliate of the family Folliculinidae.

Some of these taxa, notably, *A. digitatum* were also recorded through the seabed video and photography. Other characteristic epibenthic taxa recorded through the seabed video and photography included molluscs, notably *Calliostoma zizyphinum* and *Aequipecten opercularis*; echinoderms, notably *Asterias rubens*, *Psammechinus miliaris* and species of Ophiuroidea; anemones, including species of Sagartiidae and *Urticina* and faunal turfs of bryozoans and hydrozoans. Encrusting polychaete tubes and barnacles were also recorded along with fish, albeit less frequently, notably *Scyliorhinus canicula*, and species of the family Triglidae. Overall, epibiotic communities recorded by the seabed video footage were comparable to those reported for the shallower sediment areas of the southern North Sea.

Seabed Habitats and Biotopes

Two biotope complexes and one biotope were identified from the analysis of the grab samples:

- 'Deep circalittoral coarse sediment' (A5.15);
- 'Deep circalittoral sand' (A5.27);
- 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451), which is the only biotope representative of the biotope complex 'Offshore circalittoral mixed sediments' (A5.45).

In addition, the biotope 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231), was assigned to areas of firm clay with round burrows of piddocks recorded at station FE1_01 in the north array, through seabed video and photography.

Potentially Sensitive Habitats and Species

Aggregation of cobbles, along transects at three stations in the north array, were assessed for the potential of these aggregations to constitute Annex I habitat 'Reef'. The overall assessment for these areas was of 'Not a reef', based on assessment in line with relevant guidance.

Two UK Biodiversity Action Plan (BAP) priority habitats were recorded, namely 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231) and the broad scale habitat (BSH) 'Subtidal sands and gravel', which encompass sandy and coarse sediment habitats and biotopes. 'Subtidal sands and gravel' is also a habitat of conservation importance (HOCI) in Marine Protected Zones (MCZs), whereas 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231) may occur in the habitat 'Peat and clay exposure' which is a HOCI in MCZs.

A single specimen of the nationally scarce crab *Thia scutellata* was recorded in the grab sample from station FE2_02, in the south array.

Cryptogenic and Non-native Species (NNS)

None of taxa recorded in this study are reported to be NNS or cryptogenic.

Contents

Appendices

Figures in the Main Text

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Abbreviations

AFDW	Ash free dry weight
AHCH	Alpha-hexachlorocyclohexane
AL1/AL2	Action Level 1 or 2
BAC	Background Assessment Concentration
BC	Background concentration
BGS	British Geological Survey
BHCH	Beta hexachlorocyclohexane

BSH	Broad-scale habitat
BIOENV	Biological and Environmental
BRIG	Biodiversity Reporting and Information Group
BS	British Standards
BSL	Below sea level
CBD	Convention on Biological Diversity
CCME	Canadian Council of Ministers of the Environment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Coordinated Environmental Monitoring Programme
CSEMP	Clean Seas Environmental Monitoring Programme
CM	Central meridian
DAISIE	Delivering Alien Invasive Species Inventories for Europe
DBT	Dibutyltin
DCM	Dichloromethane
DCO	Development Consent Order
DDT	Dichlorodiphenyltrichloroethane
DTI	Department of Trade and Industry
DDV	Drop-down video
DVV	Dual van Veen grab
ECR	Export cable route
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation Data Network
EOL	End of line
EPSG	European Petroleum Survey Group
ERL	Effects range low
ERM	Effects range median
EU	European Union
EUNIS	European Nature Information System
FA	Faunal sample A
FOCI	Feature of Conservation Importance
GC	Gas chromatography
GC-MS	Gas chromatography – mass spectrometry
GC-Ms-MS	Gas chromatography coupled to a triple quadruple mass spectrometer
GES	Good environmental status
GHCH	Gamma-hexachlorocyclohexane
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HCH	Hexachlorocyclohexane
HG	Hamon grab
HOCI	Habitat of Conservation Importance
HRA	Habitats Regulation Assessment
IC	Interconnector
ICES	International Council for the Exploration of the Sea
ICP-MS	Inductively coupled plasma-mass spectrometry
ICP-OES	Inductively coupled plasma-optical emission spectrometry
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee

LAT	Lowest Astronomical Tide
LED	Light-emitting diode
LOD	Limit of detection
MBES	Multibeam echosounder
MCZ	Marine Conservation Zone
MERMAN	Marine Environment Monitoring and Assessment National (database)
MALSF	Marine Aggregate Levy Sustainability Fund
MMO	Marine Management Organisation
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
MV	Motor vessel
NA	North array
NBN	National Biodiversity Network
NEMESIS	National Exotic Marine and Estuarine Species Information System
NERC	Natural Environment and Rural Communities
NF	No fix
NMBAQC	North East Marine Biological Association Quality Control
NNS	Non-native species
NNSS	Non-native Species Secretariat
nMDS	Non-metric multi-dimensional scaling
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NS	No sample
NSTF	North Sea Task Force
NT	Not triggered
OCP	Organochlorine pesticide
OSPAR	Oslo and Paris Commission
OWF	Offshore Wind Farm
PAH	Polycyclic aromatic hydrocarbon
PC	Physico-chemical sample
PCA	Principal component analysis
PEL	Probable effects level
PPDDE	p,p' dichlorodiphenyltrichloroethane
PPDDT	p,p'-dichlorodiphenyldichloroethane
PRIMER	Plymouth Routines in Multivariate Ecological Research
PSA	Particle size analysis
PSD	Particle size distribution
PVC	Polyvinyl chloride
RSD	Relative standard deviation
SA	South array
SAC	Special Area of Conservation
SBP	Sub-bottom profiler
SDC	Species Directory Code
SIMPER	Similarity percentage (analysis)
SIMPROF	Similarity Profile
SOL	Start of line
SPA	Special Protection Area
SQG	Sediment quality guideline
SSS	Side scan sonar

SSSI	Site of Special Scientific Interest
STR	Subsea Technology and Rentals
TBT	Tributyltin
TEL	Threshold effects level
THC	Total hydrocarbon content
TN	Target note
UKAS	United Kingdom Accreditation Service
UK BAP	UK Biodiversity Action Plan
US EPA	Unites States Environmental Protection Agency
US EPA 16	United States Environmental Protection Agency's 16 priority PAH pollutants
UTC	Coordinated Universal Time
UTM	Universal Transverse Mercator
VE	Five Estuaries Offshore Wind Farm
VHF	Very high frequency
WGS 84	World Geodetic System 1984
WoRMS	World Register of Marine Species

Document Arrangement

Fugro - Mobilisation and Calibration Report - Fugro Mercator
Fugro - Mobilisation and Calibration Report - Fugro Seeker
Fugro – Mobilisation and Calibration Report – Marshall Art
Fugro - WPM1 & WPM2 - Acquisition / Operations Report - Fugro Mercator
Fugro - WPM3 - Acquisition / Operations Report - Fugro Seeker
Fugro - WPM1, WPM2 & WPM3 - Acquisition / Operations Report - Marshall Art
Fugro - WPM1 & WPM2 - Processing Report - Fugro Mercator
Fugro - WPM3 - Processing Report - Fugro Seeker
Fugro - WPM1 - Main Array - Seafloor and Shallow Geological Results Report
Fugro - WPM2 & WPM3 - ECR - Seafloor and Shallow Geological Results Report
Fugro - WPM1, WPM2 & WPM3 - Main Array & ECR - Environmental Features Report
Fugro - WPM1 - Main Array - Benthic Ecology Monitoring Report
Fugro - WPM1, WPM2 & WPM3 – ECR and Intertidal - Benthic Ecology Monitoring Report

1. Introduction

1.1 General Project Description

Five Estuaries Offshore Wind Farm Limited contracted Fugro to undertake a benthic site characterisation survey for the development of the Five Estuaries Offshore Wind Farm (VE). Operations were conducted onboard the MV Marshall Art during the survey period 9 to 16 November 2021.

An intertidal survey of the cable landing site, between Holland-on-Sea and Frinton-on-Sea, Essex, was undertaken during the survey period 25 to 27 July 2021.

Five Estuaries Offshore Wind Farm Limited intend to apply for development consent of the VE, in the southern North Sea, off the coast of Suffolk adjacent to the existing Galloper Offshore Wind Farm (OWF). The VE will cover an area of approximately 148.95 km^2 across two areas (north and south arrays) and an inter-array area (interconnector) for a possible cable connection between the two arrays. Water depth in the VE area range from 35 m to 50 m Lowest Astronomical Tide (LAT). An export cable route (ECR) will run from the offshore arrays to the landing site.

As part of the Development Consent Order (DCO) application to the Planning Inspectorate, an offshore site investigation is necessary to collect baseline characterisation data, which will be used to inform the environmental impact assessment (EIA) and the habitats regulation assessment (HRA).

The benthic study included geophysical and environmental surveys, the latter comprising a habitat assessment and a benthic characterisation survey. The Environmental Features Report (Fugro 2022a) details the results of the habitat assessment.

This report details the results of the baseline benthic characterisation survey across the main array (north array, south array and interconnector) survey area.

Results of data acquired across the intertidal survey area and along the ECR are presented in the intertidal and benthic ecology monitoring report (Fugro, in press).

Appendix A outlines the guidelines for use of this report.

1.2 Scope of Work

The aim of the benthic subtidal survey was to investigate the physico-chemical and biological properties of the sediment to provide a baseline characterisation of the site and to supplement the existing benthic ecology data across the area of interest. The aim of the study was fulfilled through acquisition of seabed video and photographic data and sediment samples. The seabed video and photography allowed evaluation of the habitat types across the main array survey area, with particular focus on habitats of conservation importance, such as those listed under Annex I of the of the Conservation of Habitats and Species Regulations

2019 and on the Oslo and Paris (OSPAR) list of threatened and/or declining habitats and species (OSPAR, 2021). Sediment samples allowed evaluation of the physico chemical and biological properties of the seabed for the characterisation of the biotic communities and the identification of potential non-native species (NNS).

1.3 Environmental Legislation

The relevant environmental legislation applying to the VE main array survey area has been detailed in the Environmental Features Report (Fugro, 2022a) and summarised in Tables 1.1 and 1.2. Together they guided the identification of habitats and species of conservation importance in the study area.

Table 1.1: Marine environmental legislation

Legislation	Key aims
Conservation of Habitats and Species (Amendment (EU Exit) Regulations 2019), referred to as the 2019 Regulations	Transposes the requirements of the European Union (EU) Habitats Directive and some elements of the Wild Birds Directive (together forming the Nature Directives) into UK law; aims at conserving biodiversity through measures for protection of habitats and species, through the establishment of a national site network of protected sites, referred to as Special Areas of Conservation (SACs) and Special Protection Area (SPA)
UK Marine Strategy	Provides a framework for community action in the field of marine environmental policy through three components: 1. assessment of the state of UK seas and revised objectives for good environmental status (GES) for 2018 to 2024; 2. monitoring progress against set targets and indicators; 3. measuring the achievement of GES
Marine and Coastal and Access Act 2009	Enables the designation of Marine Conservation Zones (MCZs) in England, Wales and UK offshore waters
Natural Environment and Rural Communities Act 2006 (NERC)	Requires the relevant Secretary of State to compile a list of habitats and species of principal importance for the conservation of biodiversity.
The Wildlife and Countryside Act 1981 (as amended)	Regulates the designation of Site of Special Scientific Interest (SSSIs), which underpins the designation of Ramsar sites
Oslo and Paris (OSPAR) Convention	Establishes Marine Protected Areas (MPAs)
Convention on Biological Diversity (CBD)	Conservation of biological diversity and sustainable use of its components
Ramsar Convention	Aims at the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development

Table 1.2: Marine protected areas biodiversity features

Biodiversity Features	Description
Broad-scale habitats (BSH)	Represent the main types of seabed and associated biota in UK; their conservation ensures preservation of the full range of marine biodiversity

Biodiversity Features	Description
Features of conservation importance (FOCI)	Represent habitats and/or species are particularly threatened, rare or declining and therefore need protection
UK Post-2010 Biodiversity Framework priority habitats and/or species	List of important (priority) habitats and species, produced by the UK Biodiversity Action Plan (BAP), superseded by the UK Post-2010 Biodiversity Framework, under the Convention on Biological Diversity (CBD). Under the NERC Act 2006, the UK BAP priority species and habitats in England are referred to as habitats and species of principal importance
Oslo and Paris (OSPAR) list of threatened and/or declining (T&D) species and habitats	Allows setting priorities for further conservation and protection of marine biodiversity

1.4 Regional Habitats, Species and Protected Areas

Background regional information on protected marine benthic habitats and species, in relation to the survey area, has been detailed in the Environmental Features Report (Fugro, 2022a) and summarised in Table 1.3 and illustrated in Figure 1.1. The survey area also overlaps the southern North Sea Special Area of Conservation (SAC), which is designated for the Harbour porpoise *Phocoena phocoena*, which is an Annex II species. Hamford Water is also designated as SAC for the Fisher's estuarine moth *Gortyna borelii lunata*, which is an Annex II species.

Table 1.3: Summary of nearby protected areas, Five Estuaries Offshore Site Investigation

Protected Area	Status	Distance* [km]	Direction*	Protected Habitats/Species
Margate and Long Sands	SAC	Crossed by export cable route		Annex I habitats ■ Sandbanks which are slightly covered by sea water all the time
Essex Estuaries	SAC	14	SW	Annex I habitats ■ Estuaries ■ Mudflats and sandflats not covered by seawater at low tide ■ *Salicornia* and other annual colonising mud and sand ■ *Spartina* swards (*Spartinion maritimae*) ■ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) ■ Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) ■ Sandbanks which are slightly covered by sea water all the time
Blackwater, Crouch, Roach and Colne Estuaries	MCZ	5.5	SW	UK BAP priority and OSPAR T&D species and habitats ■ Native oyster (*Ostrea edulis*) beds ■ Native oyster (*Ostrea edulis*) Broad-scale habitat ■ Intertidal mixed sediments
Orford Inshore	MCZ	13	NW	Broad-scale habitat ■ Subtidal mixed sediments
Kentish Knock East	MCZ	8	S	Broad-scale habitats ■ Subtidal coarse sediment

Protected Area	Status	Distance* [km]	Direction*	Protected Habitats/Species
				■ Subtidal sand ■ Subtidal mixed sediments
Outer Thames Estuary	SPA	Crossed by export cable route		■ Red-throated diver (Gavia stellata) ■ Common tern (Sterna hirundo) ■ Little tern (*Sternula albifrons*)
Hamford Water	SPA	3	N	■ Avocet (*Recurvirostra avosetta*) ■ Black-tailed godwit (*Limosa limosa islandica*) ■ Dark bellied brent goose (*Branta bernicla bernicla*) ■ Grey plover (*Pluvialis squatarola*) ■ Redshank (*Tringa tetanus*) ■ Ringed plover (*Charadrius hiaticula*) ■ Shelduck (*Tadorna tadorna*) ■ Little tern (*Sternula albifrons*) ■ Teal (*Anas crecca*)
Colne Estuary	SPA	10	SW	■ Little tern (*Sternula albifrons*) ■ Common pochard (*Aythya farina*) ■ Dark bellied brent goose (*Branta bernicla bernicla*) ■ Hen harrier (*Circus cyaneus*) ■ Ringed plover (*Charadrius hiaticula*) ■ Redshank (*Tringa totanus*)
Deben Estuary	SPA	13	N	■ Avocet (*Recurvirostra avosetta*) ■ Dark bellied brent goose (*Branta bernicla bernicla*)
Stour and Orwell Estuaries	SPA	14	W	■ Hen harrier (Circus cyaneus) ■ Black-tailed godwit (Limosa limosa islandica) ■ Dunlin (Calidris alpina alpina) ■ Grey plover (Pluvialis squatarola) ■ Pintail (Anas acuta) ■ Redshank (Tringa totanus) ■ Ringed plover (Charadrius hiaticula) ■ Shelduck (Tadorna tadorna) ■ Turnstone (*Arenaria interpres*)
Alde-Ore Estuary	SPA	14	N	■ Avocet (Recurvirostra avosetta) ■ Lesser black-backed gull ■ (Lucus fuscus) ■ Little tern (Sternula albifrons) ■ Marsh harrier (Circus aeruginosus) ■ Redshank (Tringa totanus) ■ Ruff (Philomachus pugnax) ■ Sandwich Tern (*Sterna sandivicensis*

Notes
* = Distance and direction from closest sampling site
MCZ = Marine Conservation Zone
SAC = Special Area of Conservation
SPA = Special Protection Area
UK BAP = United Kingdom Biodiversity Action Plan
OSPAR T&D = Oslo and Paris List of threatened and/or declining species and habitats
SSSI = Site of Special Scientific Interest

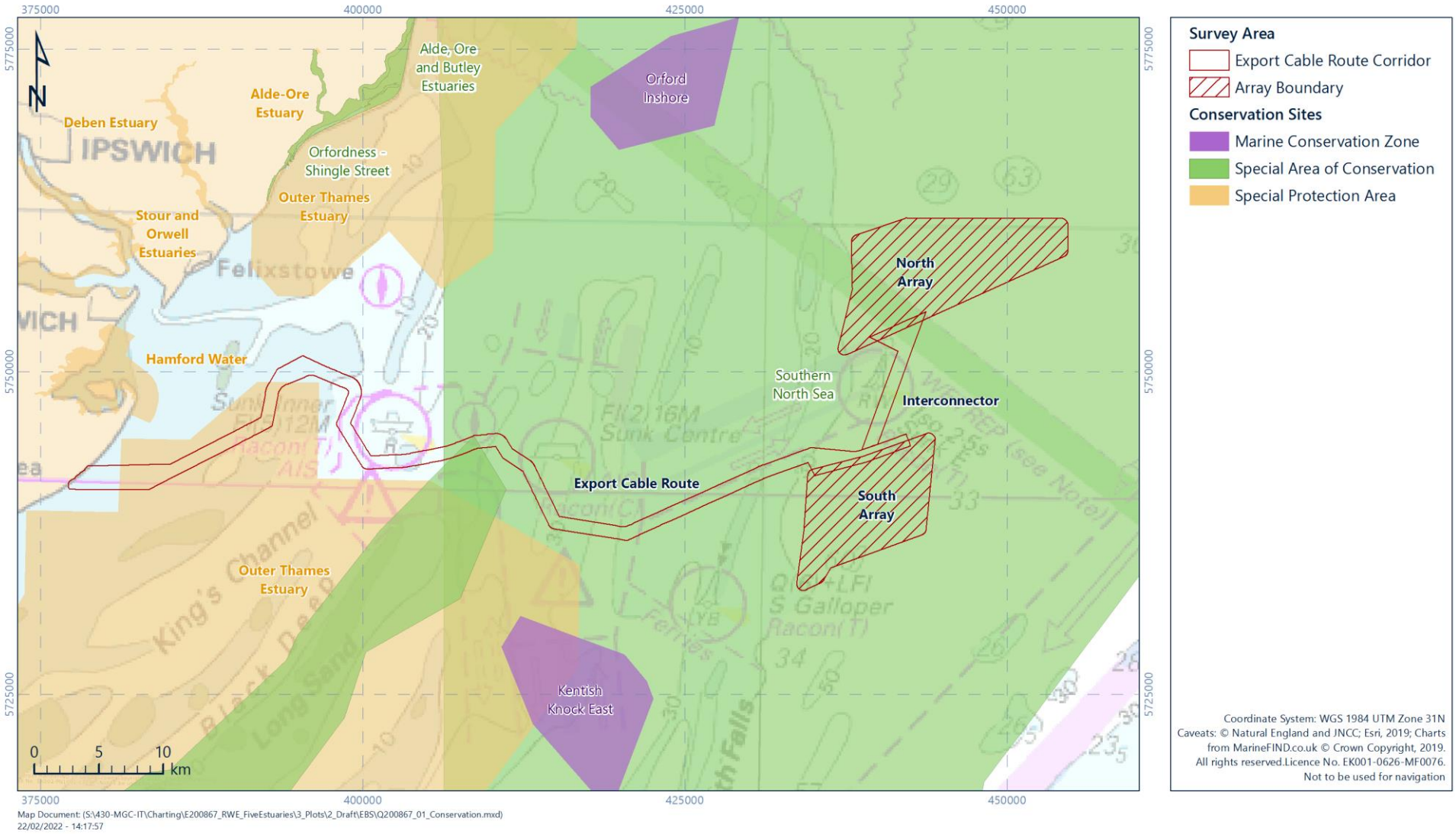


Figure 1.1: Protected areas relevant to the survey area, Five Estuaries Offshore Site Investigation

1.5 Environmental Quality Standards for Sediment Chemical Concentrations

Sediment quality guidelines (SQGs) to evaluate the chemical concentrations included:

- The effects range low (ERL) and effects range median (ERM) concentrations (OSPAR, 2014);
- The Centre for Environment, Fisheries and Aquaculture Science (Cefas) Guideline Action Levels (ALs) for the disposal of dredged material (Marine Monitoring Organisation [MMO], 2015);
- The Canadian SQGs for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment [CCME], 2022).

The ERL value is defined as the lower tenth percentile of the dataset of concentrations in sediments associated with biological effects; the ERM is defined as the median (or 50th percentile) of the concentrations associated with biological effects (OSPAR, 2009). Adverse effects on organisms are rarely observed when concentrations fall below the ERL, whilst are often or always observed at concentrations above the ERM (OSPAR, 2009). The numerical values of ERL and ERM were derived from biological toxicity assays and synoptic sampling and are incorporated in SQGs developed for the National Oceanic and Atmospheric Administration (NOAA) National Status and Trends program, as informal tools to evaluate whether a contaminant concentration in sediment might have toxicological effects (Long et al., 1995).

The UK adopts the ERLs as a signatory of the Oslo and Paris (OSPAR) Convention for the assessment of monitoring data of hazardous substances in the environment (OSPAR, 2014), delivering its commitment through the Clean Seas Environmental Monitoring Programme (CSEMP). Some ERLs, however, have not been used in the OSPAR assessment, because their values are less than the OSPAR Background Assessment Concentration (BAC) used to evaluate the contamination status of marine sediment across the OSPAR maritime area. This is the case of the metals arsenic and nickel (OSPAR, 2009). Background Assessment Concentrations are normalised to 5 % aluminium, while no normalisation is made when deriving the ER values (OSPAR, 2009).

The CSEMP extracts data from the Marine Environment Monitoring and Assessment National (MERMAN) database. Fifteen marine stations around England and Wales are monitored by Cefas as part of the CSEMP programme (Cefas, 2012). Of these, station 475, in the Outer Thames Gabbard area, was referred to for regional contextualisation of this study's results.

The Cefas ALs are non-statutory guidelines to determine whether dredged material is suitable for disposal at sea by providing a proxy risk assessment for potential impacts to biological features such as fish and benthos (Mason et al., 2022). In general, concentrations below Cefas AL1 are of no concern, whilst concentrations above Cefas AL2 indicate that dredged material is unsuitable for disposal at sea. Values between Cefas AL1 and AL2 may require further investigatory work prior to a disposal decision (MMO, 2015).

The Canadian SQGs for the Protection of Aquatic Life are numerical concentrations or narrative statements intended to protect all forms of freshwater and marine (including estuarine) aquatic life for an indefinite period of exposure to substances associated with seabed sediments (CCME, 2022). The guidelines consist of threshold effects levels (TELs) and probable effects levels (PELs). Together, they are used to identify three ranges of chemical concentrations for biological effects:

1. Values below TEL indicate the minimal effect range within which adverse effects rarely occur;
2. Values between TEL and PEL indicate the possible effect range where adverse effects occasionally occur;
3. Values above the PEL indicate the probable effect range within which adverse effects frequently occur.

1.6 Coordinate Reference System

All coordinates detailed in this report are referenced to World Geodetic System 1984 (WGS 84), Universal Transverse Mercator (UTM) projection Zone 31N central meridian 3º East (CM 3° E). Table 1.4 provides the detailed geodetic and projection parameters.

Table 1.4: Project geodetic and projection parameters

Global Navigation Satellite System (GNSS) Geodetic Parameters	
Datum:	World Geodetic System 1984 (WGS 84)
Spheroid:	World Geodetic System 1984
Semi major axis:	a = 6 378 137.000 m
Reciprocal flattening:	1/f = 298.257 223 563
Project Projection Parameters	
Grid Projection:	Universal Transverse Mercator (UTM)
UTM Zone:	31N (EPSG: 32631)
Central Meridian:	3° 00′ 00″ East
Latitude of Origin:	00° 00′ 00″ North
False Easting:	500 000 m
False Northing:	0 m
Scale factor on Central Meridian:	0.9996
Units:	metre
Notes EPSG = European Petroleum Survey Group	

2. Survey Strategy

2.1 Geophysical Data

The geophysical scope of work, detailed in Fugro (2021a; 2022b) comprised acquisition of data in the north and south arrays and along the interconnector and the ECR. Geophysical data were acquired using a multibeam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP), single magnetometer and single-channel sparker.

2.2 Environmental Data

The environmental survey strategy was outlined by Five Estuaries OWF (2021).

A total of 17 environmental sampling stations was predetermined by Fugro environmental scientists and approved by the client. Of these, eight stations were in the north array (denoted with prefix FE1), six were in the south array (denoted with the prefix FE2) and three were along the interconnector (denoted with the prefix FE3).

Acquisition of drop-down video (DDV) and photographic data was proposed prior to obtaining macrofaunal and physico-chemical grab samples. Acquisition of single sediment samples for chemistry analysis was proposed at three stations, one in each of the arrays and one along the interconnector. Selection of stations for chemistry samples considered the spread across the survey area targeting locations with the greatest predicted mud content, through review of geophysical data.

One DDV sample was proposed to target areas of hard/coarse substrates as identified following a review of the geophysical data. Two DDV transects were proposed in areas of potential conservation importance, referred to as 'areas of focus'.

Rationale for the environmental survey strategy was based on an initial review of publicly available regional data and aligned with the approach agreed with Natural England, the Marine Management Organisation and Cefas. The sample locations were further refined based on the findings of the geophysical survey. Additional stations/transects were selected after a review of the SSS and bathymetric data, with emphasis on areas of potential conservation importance (e.g. Annex I listed habitats), as well as boundaries between areas of differing sonic reflectivity, bathymetric highs and lows and areas characteristic of the general background conditions of the site.

Table 2.1 provides the coordinates, proposed data acquisition and rationale for each location. Acceptable sampling accuracy was agreed with the client within 50 m of the target location. If after three attempts, no sample was attained, the station would be relocated by 50 m and sampling re-attempted. If no sample was acquired following the 50 m relocation, the station would be abandoned.

Figure 2.1 presents the proposed survey locations overlaid on the SSS.

Table 2.1: Proposed sampling stations, main array, Five Estuaries Offshore Site Investigation

Geodetic Parameters: WGS 84, UTM 31N, 3°E [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
North Array				
FE1_01	437 904.9	5 754 004.2	Irregular rough seafloor feature to investigate through DDV transect; DG added as likely best option for mud content for FE1 location; ('area of focus')	Video and stills FA, PSD, PC
FE1_02	439 440.8	5 759 631.3	Localised rough feature to investigate through DDV transect; evidence of trawling in area	Video and stills FA, PSD
FE1_03	439 237.0	5 755 430.0	Sand waves on/off ridge	FA, PSD
FE1_04	440 530.0	5 757 411.0	Representative of larger area of FE1_02; mixed rough ground with areas of sand ripples; low potential of hard/coarse substrate to investigate through DDV sample	Video and stills FA, PSD
FE1_05	442 807.0	5 755 913.0	Representative of larger area with rougher signature; sediments potentially less mixed than those of stations to the west, with sand ripples and mega-ripples	FA, PSD
FE1_06	442882.0	5760008.2	Representative of larger area; transitory area of rippled sand, containing FE1_05, FE1_07 & FE1_08, to south and east and area to west	FA, PSD
FE1_07	447 081.0	5 758 229.0	Sand ripples and waves representative of eastern half of FE1	FA, PSD
FE1_08	450 866.0	5 759 026.0	Sand ripples and waves	FA, PSD
South Array				
FE2_01	435 851.0	5 742 898.0	Representative of wider area; section to west of larger sand ripples and waves; potentially mixed sediments interspersed with sand ripples; central to ECR to FE4	FA, PSD, PC
FE2_02	436 225.0	5 741 075.0	Representative of potentially mixed sediments and sand ripples, approximately 700 m wide area running NE/SW, transitional from FE2_01 to larger sand waves and ripples area to the west	FA, PSD
FE2_03	437 540.0	5 737 498.0	Representative of sand waves and ripples, approximately 3 km wide, running centrally NE/SW through FE2	FA, PSD
FE2_04	439 870.0	5 742 101.0	Representative of sand waves and ripples, approximately 3 km wide, running centrally NE/SW through FE2	FA, PSD
FE2_05	442 677.0	5 743 137.0	Representative of area west of sand waves and ripples area; signature similar to that of FE2_02, potentially mixed sediments interspersed with sand ripples	FA, PSD

Geodetic Parameters: WGS 84, UTM 31N, 3°E [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
FE2_06	441 940.3	5 739 316.1	Representative of area west of sand waves and ripples area; signature similar to that of FE2_02, potentially mixed sediments interspersed with sand ripples	FA, PSD
Interconnector				
FE3_01	440 936.2	5 748 447.8	Representative of potentially mixed sediments large area; smoother signature than that of sand ripples and waves located to the north and south of interconnector, interspersed with some rougher signatures and sand ripples; evidence of trawling throughout	FA, PSD, PC
FE3_02	439 733.8	5 745 513.7	Representative rough area with sand waves and ripples to the north and south of interconnector, interspersed with smooth signatures of potentially mixed sediments as those of FE3_02	FA, PSD
FE3_03	442 019.7	5 751 415.1	Representative of transitory area between smooth area as that FE3_01 and area of sand waves and ripples to the west and north; station located in smooth signature, representative of potentially mixed sediments	FA, PSD

Notes
DDV = Drop-down video
DG = Day grab
FA = Faunal sample A
PC = Physico-chemical sample
PSD = Particle size distribution

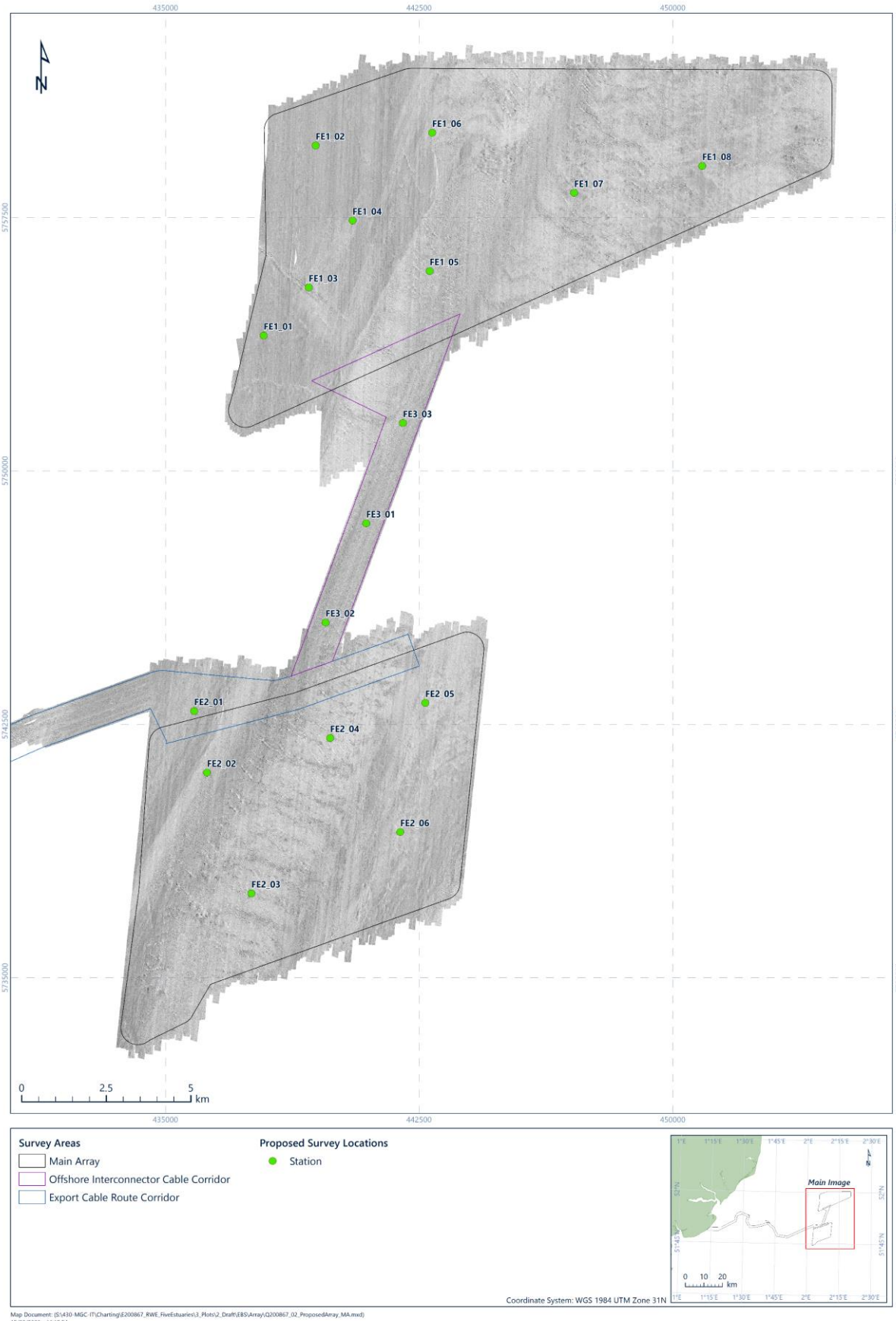


Figure 2.1: Proposed survey locations overlaid on a side scan sonar mosaic, main array, Five Estuaries Offshore Site Investigation

3. Methods

3.1 Survey Methods

Survey methods have been presented in the Acquisition/Operations Report (Fugro, 2021b, 2021c) and are summarised below.

3.1.1 Seabed Video and Photography

Operational procedures for seabed photography followed those outlined in Hitchin et al., (2015). Seabed photography was acquired using a Subsea Technology and Rentals (STR) deep-sea camera system mounted within a purpose-built camera frame complete with one high-definition video camera, one high resolution stills camera, a separate strobe and four light-emitting diode (LED) lamps.

Seabed video photographic data were displayed on a computer monitor and recorded directly onto a local hard drive. A video overlay was used to overlay a navigation string from the Hemisphere differential GPS, including the time, date, depth and location (easting and northing). The survey location and station number were also displayed (manually updated). The stills camera imagery was visible on a second window of the computer. Photographic data were viewed in real time via a sonar cable, assisting in the control of the camera in the water. Two lasers were set up 17 cm apart to provide a scale.

In areas of poor visibility, seabed photography was acquired also using the back-up Bowtech SeaKnight underwater camera system mounted within a freshwater frame.

3.1.2 Sediment Sampling

Samples for faunal and sediment particle size distribution (PSD) analysis were acquired using a 0.1 m^2 mini Hamon grab. Samples for chemistry analysis were acquired using a 0.1 m^2 Day grab.

Appendix B provides further details of survey methods.

3.2 Laboratory Methods

A sample delivery log accompanied the samples to Fugro laboratories as part of the chain of custody. Upon receipt of samples at Fugro laboratories, sample handling and labelling of each sample was inspected to ascertain correct storage in line with the sampling methods. Any potential deviations from sampling methods are addressed and resolved at this stage in line with Fugro's Quality Assurance Management System.

3.2.1 Sediment Characteristics

3.2.1.1 Particle Size Distribution

Sediment samples were analysed by Fugro using dry sieve analysis and laser diffraction.

Dry sieve PSD analysis was undertaken in accordance with FGBML in-house methods based on the North East Atlantic Marine Biological Association Quality Control (NMBAQC) scheme's best practice guidance document – Particle Size Analysis (PSA) for Supporting Biological Analysis: 2016 (Mason, 2016), and British Standards (BS) 1377: Parts 1: 2016 and 2: 1990). Representative material > 1 mm was split from the bulk sub-sample and oven dried before being sieved through a series of sieves with apertures corresponding to 0.5 phi intervals between 63 mm and 1 mm as described by the Wentworth scale (Wentworth, 1922). The weight of the sediment fraction retained on each mesh was subsequently measured and recorded.

Laser diffraction PSD analysis was undertaken in accordance with FGBML in-house methods based on Mason (2016), and BS International Organization for Standardization (ISO) 13320: 2020. Representative material < 1 mm was removed from the bulk subsample for laser analysis, with a minimum of three triplicate analyses performed using the laser sizer at 0.5 phi intervals between < 1 mm to < 0.04 µm. Laser diffraction was carried out using a Malvern Mastersizer 2000 with a Hydro 2000G dispersion unit.

3.2.2 Sediment Hydrocarbons

The sediment samples were analysed for total hydrocarbon content (THC) and polycyclic aromatic hydrocarbons (PAHs) by SOCOTEC.

3.2.2.1 Total Hydrocarbon Content

Anhydrous sodium sulphate, sodium chloride and dichloromethane (DCM) were added to a portion of the sample and vigorously agitated. The sample was placed in an ultrasonic bath and then centrifuged. The extract was then analysed by ultraviolet fluorescence screening and quantified by comparing the results against a forties oil calibration curve.

3.2.2.2 Polycyclic Aromatic Hydrocarbons (PAH)

Methanol and DCM were added to a portion of the sample and mixed on a magnetic stirring plate. The solvent extract was then water partitioned and concentrated to a low volume. A double clean-up stage was employed to remove contaminants that may interfere with the analysis. The extract was then analysed by gas chromatography – mass spectrometry (GC-MS) and quantified by comparing the results against a calibration curve for each of the target analytes.

3.2.3 Sediment Metals

The sediment samples were analysed for trace and heavy metal content by SOCOTEC using an aqua regia digest. The eleven metals analysed were aluminium, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, tin and zinc. A portion of air dried and ground sample was digested with aqua regia. Once cooled, the extract was filtered and pre-diluted before being analysed by inductively coupled plasma-mass spectrometry (ICP-MS) (or by

inductively coupled plasma-optical emission spectrometry (ICP-OES) and quantified by comparing the results against a calibration curve for each of the target analytes.

This analytical technique provides a strong partial digest, releasing into solution metals associated with the fines fraction within the sediments (but does not extract all trace elements associated with the coarse fraction). The concentrations of metals released by an aqua regia digest are considered indicative of those influencing biological interactions, as the released metals are not incorporated into the mineral matrix and are therefore potentially available for biological uptake.

3.2.4 Sediment Polychlorinated Biphenyls

Sediment samples were analysed by SOCOTEC using solvent extraction and clean-up followed by gas chromatography coupled to a triple quadruple mass spectrometer (GC-MS-MS) analysis. A portion of air-dried and sieved sample was spiked with ^{13}C labelled internal standards, ultrasonically solvent extracted and concentrated under nitrogen. A clean-up stage was employed to remove contaminants that may interfere with the analysis. The sample extract was analysed by GC-MS-MS and quantified by comparison with a solution containing each of the targeted compounds, normalised to the ^{13}C labelled internal standards.

3.2.5 Sediment Organotins

Sediment samples were analysed by SOCOTEC using solvent extraction and derivatisation followed by GC-MS analysis. A portion of the sample was digested with hydrochloric acid and methanol before being extracted into toluene. The extract was then derivatised using sodium tetraethylborate before concentration and a copper/silica clean-up was performed. The extract was analysed by GC-MS and quantified by comparing the results against a calibration curve for each of the target analytes.

3.2.6 Organochlorine Pesticides (OCPs)

Sediment samples were analysed by SOCOTEC using solvent extraction and clean-up followed by GC-MS-MS analysis.

3.2.7 Sediment Macrofauna

Samples were analysed at FGBML's benthic laboratory in accordance with Fugro in-house quality assured procedures (EUAF-FGBM-BEN-TM-001), which are consistent with the requirements of the NMBAQC scheme (Worsfold et al., 2010) and the relevant ISO standards for macrobenthic analysis. Fugro's operations are covered by a Procedures Manual and Methods Manual. These documents together with Fugro working practices are routinely audited under ISO 9001:2015 and/or United Kingdom Accreditation Service (UKAS) 17025 as appropriate. Samples were sieved over a 1.0 mm mesh sieve and taxa were identified to the lowest taxonomic level and enumerated. Sessile colonial epifauna was recorded as present (P).

Species nomenclature is consistent with that of World Register of Marine Species (WoRMS Editorial Board, 2022). The taxonomic order is based on Species Directory codes (Howson & Picton, 1997). Taxa of doubtful identification due to damage of specimen or unresolved taxonomic status are indicated by a question mark preceding the genus (e.g. ?*Capitella*) or species (e.g. *Capitella* ?*capitata*) name.

Biomass analysis was undertaken on the infauna from the grab samples, following identification and enumeration. The infauna from each sample was sorted into seven groups, to include Oligochaeta, Polychaeta, Crustacea, Mollusca, Echinodermata, Cnidaria (including only burrowing species) and other phyla. Nematoda, Copepoda and Astrorhiza were not required to be extracted, enumerated or identified. Biomass was undertaken using the wet blot method.

3.3 Data Analysis

Summary statistics (minimum, maximum, mean, standard deviation) for all reported datasets were derived in Excel.

3.3.1 Sediment Particle Size Distribution Statistics

Data from the sieve and laser analysis were merged and entered in Gradistat version 8 (v8) (Blott, 2010) to derive statistics including cumulative percentage of each particle size passing through each sieve, percentage retained on each sieve stack, mean and median grain size, bulk sediment classes (percentage fines, sand and gravel), skewness and sorting coefficients, and Folk (1954) classification. Table 3.1 summarises the sediment PSD statistics that were calculated using Gradistat v8. Statistics are based on the Folk and Ward (1957) method.

The Wentworth (1922) sediment classification is based on mean sediment particle size. The Folk (British Geological Survey [BGS] modified) classification (Long, 2006) is based on percentages of main sediment fractions (fines, sand and gravel). Results are reported in micron (µm) and phi (ϕ) measurement units. Phi is a logarithmic scale which allows particle size data to be expressed in unit of equal value for graphical plotting and statistical calculations; the scale is based on the relationship:

$Phi\ (\phi) = -log2d$, where d is the particle size diameter in mm.

Table 3.1: Sediment particle size distribution statistics

Statistic	Definition and Descriptive Terminology
Mean	The arithmetic mean of all the sediment particles in a sample; expressed in metric and phi units
Median	A measure of central tendency, that is the midpoint of the grain size distribution where half of the sediment grains resides above this point and half below
Mode	The peak of the frequency distribution, that is the particle size (or size range) most commonly found in the distribution
Modality	A measure of the number of peaks in the frequency distribution
Sorting	A measure of the grain size range and magnitude of their spread around the mean, presented as a coefficient and descriptor (as a range of values)

Statistic	Definition and Descriptive Terminology
Skewness	A measure of the degree of symmetry, presented as a coefficient and descriptor (as a range of values)

3.3.2 Sediment Macrofauna Data Rationalisation

Prior to analysis, the macrofaunal dataset was rationalised. To avoid spurious enhancement of the species list, damaged taxa were removed whereas some taxa were merged with a higher corresponding taxon identified. Juveniles were also removed as they represent an ephemeral stage of the macrofaunal community and are, therefore, not representative of prevailing benthic conditions. Sessile colonial epifauna recorded as P was also removed prior to analysis and assessed separately from the enumerated data set.

3.3.3 Sediment Macrofaunal Univariate Analysis

Table 3.2 summarises the univariate statistics derived from PRIMER (v7).

Table 3.2: Macrofaunal univariate statistics

Statistic	Definition
Number of taxa (S)	Count of taxa
Abundance (N)	Count of individuals
Margalef's index of richness (d)	A measure of the number of species present for a given number of individuals
Shannon-Wiener index of diversity ($H'log_2$)	A measure of the number of taxa in a sample and the distribution of abundance across these taxa; results were assessed in line with the threshold values in Dauvin et al. (2012): ■ High diversity ($H'log_2 > 4.00$); ■ Good diversity ($3.00 < H'log_2 < 4.00$); ■ Moderate diversity ($2.00 < H'log_2 < 3.00$); ■ Poor diversity ($1.00 < H'log_2 < 2.00$); ■ Bad diversity ($H'log_2 < 1.00$).
Pielou's index of evenness (J')	A measure of how evenly distributed the individuals are among the different species
Simpson's index of dominance (λ)	A measure of dominance whereby its largest value corresponds to assemblages the total abundance of which is dominated by one or very few of the taxa present

3.3.4 Biomass Analysis

The macrofaunal blotted wet weight biomass dataset was converted to ash free dry weight (AFDW) by applying the appropriate standard corrections, as outlined in Eleftheriou and Basford (1989). Table 3.3 summarises the corrections applied.

Table 3.3: Macrofaunal standard biomass corrections by phyla

Phyla	Standard Biomass Correction [%]
Annelida	15.5
Arthropoda	22.5
Mollusca	8.5

Phyla	Standard Biomass Correction [%]
Echinodermata	8.0
Other Taxa	15.5
Notes Standard biomass corrections to convert blotted wet weight to ash free dry weight, from Eleftheriou & Basford (1989)	

3.3.5 Multivariate Analysis

Table 3.4 summarises the multivariate analysis undertaken for macrofaunal and sediment datasets in PRIMER v7 (Clarke & Gorley, 2015). Data transformation was undertaken prior to multivariate analysis, where deemed necessary. Transformation was applied to sediment particle size data to reduce the degree of skewness and allow optimal performance of the multivariate analysis (detailed in Section 4.2.2). Transformation was applied to macrofaunal data matrix to reduce the influence of the numerically dominant taxa which may mask the underlying community composition (detailed in Section 4.4.1.3) (Clarke et al., 2014).

Table 3.4: Multivariate statistics

Statistic	Definition
Cluster	Hierarchical clustering, 'Cluster' analysis, groups samples based on the nearest neighbour sorting of a matrix of sample similarities using Bray Curtis similarity (for biological datasets) or Euclidean distance measure (for environmental datasets)
Dendrogram and nMDS	Dendrogram and non-metric multidimensional scaling (nMDS) ordination are outputs of Bray Curtis and Euclidean Distance similarity/distance matrices. The dendrogram is a tree-like diagram illustrating the relationships between samples based on their level of similarity. The nMDS ordinates the samples in a two-dimensional plane where the more similar samples are, the nearer they are. The extent to which these relations can be adequately represented in a two-dimensional map is expressed as the stress coefficient statistic, low values (< 0.1) indicating a good ordination with no real prospect of misleading interpretation (Clarke et al., 2014). Used together, dendrogram and nMDS allow checking adequacy and mutual consistency of both representations to ensure correct interpretation
SIMPER	Similarity Percentage analysis gauges the distinctiveness of each of the multivariate groups of samples, by listing the species that most contribute to the multivariate group in terms of abundance and frequency of occurrence
SIMPROF	Similarity profiling (SIMPROF test), to identify statistically significant sample groupings from the cluster analysis, depicted as red lines; the PRIMER default significance level of 5 % was adopted; in ecological terms the statistical relevance of SIMPROF was assessed in line with the recommendation of Clarke et al. (2008), thus '*defining coarser grouping can be appropriate if the resulting groups are always supersets of the similarity profile groups*'
PCA	Principal component analysis (PCA), to identify multidimensional patterns and relationships between variables, subsequently compressed by reducing the number of dimensions without loss of information. The degree to which a 2D PCA succeeds in representing the full multidimensional information is in the percentage of the total variance expressed by the first two principal component axes. A picture which accounts for as much as 70 % to 75 % of the original variation describes the overall structure well (Clarke et al., 2014)

Statistic	Definition
BIOENV	Identifies relationships between biological and environmental variables; available in PRIMER v7 as BEST, which amalgamates the Bio-Env and Stepwise procedures, and allows to evaluate the strength of association between the variables tested and the significance level

3.3.6 Seabed Habitats and Biotopes

Habitats and biotopes within the survey area were classified in line with the hierarchical European Nature Information System (EUNIS) habitat classification (European Environment Agency [EEA], 2019), which has compiled criteria for habitat identification across Europe into a single database. Table 3.5 presents the EUNIS hierarchy, with an example of the coding system. Habitats and biotopes were classified by integrating the results of the grab sampling, detailed in this report, with the results of the video and still image analysis, detailed in the Environmental Features Report (Fugro, 2022a). Habitats and biotopes were subsequently assessed for their ecological and conservation importance drawing upon the current marine nature conservation legislation.

Table 3.5: EUNIS (EEA, 2019) biotope classification hierarchy example

Level	Example Classification Name	Example Classification Code
1. Environment	Marine habitats	A
2. Broad habitat types	Sublittoral sediments	A5
3. Main habitats	Sublittoral sand	A5.2
4. Biotope complexes	Circalittoral muddy sand	A5.26
5. Biotopes	*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand	A5.262

3.3.6.1 Sensitive Habitats and Species Assessments

Habitats were assessed for their conservation status using the Annex I habitat list (Joint Nature Conservation Committee [JNCC], n.d.). Sensitive habitats such as stony reefs were assessed in line with the criteria in Irving (2009) and Golding et al. (2020). Biogenic reefs such as *Sabellaria spinulosa* reefs were assessed in line with the criteria in Gubbay et al. (2007), Hendrick and Foster-Smith (2006) and Limpenny et al. (2010) and the methods in Jenkins et al., (2015). Geogenic and biogenic reefs assessments are detailed in the Environmental Features Report (Fugro 2022a).

Species were assessed for their conservation status using the Annex II species list (JNCC, n.d), the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2021) and the UK BAP priority habitats and species lists (JNCC, 2019). The International Union for Conservation of Nature [IUCN] red list of threatened species (IUCN, 2022) was also consulted, although the latter is not a list of conservation priorities, rather a comprehensive inventory of the global conservation status of species and is used to assist with decision making about conserving biodiversity at local and global levels.

3.3.6.2 Cryptogenic and Non-native Species (NNS)

Species of unknown origin (cryptogenic) and NNS were assessed using pertinent literature and databases including Invasive Species Compendium (CABI, 2022), National Exotic Marine and Estuarine Species Information System [NEMESIS] (Fofonoff et al., 2022), National Biodiversity Network [NBN] (NBN, 2021), Non-native Species Secretariat [NNSS] (NNSS, 2022), Delivering Alien Invasive Species Inventories for Europe [DAISIE] (DAISIE, 2020) and World Register of Marine Species [WoRMS] (WoRMS Editorial Board, 2022).

4. Results

4.1 Field Operations

4.1.1 Bathymetry and Seabed Features

Results of the geophysical study are detailed in Fugro (2022c) with the main findings summarised below:

- Water depths in the north array ranged from 25.6 m to 59 m LAT;
- Water depths in the south array ranged from 22.2 m to 61.0 m LAT;
- Seafloor sediments were assessed by interpreting the reflectivity from the low frequency SSS, cross-correlated to the SBP;
- Three sediment classes were interpreted, namely sand, gravelly sand and muddy sand;
- Sand ripples were present across the main array sites;
- A total of 447 SSS contacts ≥ 2 m was identified and interpreted as boulders;
- A total of 1599 magnetic anomalies ≥ 5 nT peak-to-peak was identified; areas of background fluctuations in the magnetometer data were interpreted from SBP to be of geological origin;
- Three main units were interpreted from the SBP data:
  1. R01 interpreted as Holocene sediments
  2. R02 interpreted as Plio-Pleistocene
  3. R03 interpreted as London Clay Formation
- One additional horizon was picked in the Kingdom project but not gridded due to its limited extent:
  - H01 Pleistocene, likely base Pleistocene channels
- The depth to the top of the London Clay Formation was between 0 m and 19 m below seafloor, although it remained at or just below the seafloor across most of the main array sites.

4.1.2 Seabed Video and Photography

Seabed video data and photographic stills were successfully acquired at all proposed stations (Table 4.1).

Table 4.1: Completed DDV samples and transects, main array, Five Estuaries Offshore Site Investigation

Geodetic Parameters: WGS 84, UTM 31N, 3°E [m]						
Station		Easting	Northing	Depth [m BSL]	Length [m]	Data Acquisition
North Array						
FE1_01	SOL	437 885.3	5 753 933.8	35	104	2 min 55 sec 22 stills
	EOL	437 908.6	5 754 035.4			
FE1_02	SOL	439 412.2	5 759 537.7	39	125	3 min 28 sec 15 stills
	EOL	439 437.1	5 759 660.3			
FE1_04	SOL	440 526.4	5 757 362.2	41	101	3 min 42 sec 24 stills
	EOL	440 537.7	5 757 462.2			
Notes BSL = Below sea level SOL = Start of line EOL = End of line						

4.1.3 Sediment sampling

Grab samples were successfully acquired at all proposed stations across the VE main array survey area (Table 4.2).

Table 4.2: Completed subtidal sampling stations, main array, Five Estuaries Offshore Site Investigation

Geodetic Parameters: WGS 84, UTM 31N, 3°E [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
North Array				
FE1_01	437 900.5	5 754 008.1	35	FA, PSD
FE1_02	439 441.7	5 759 646.8	38	FA, PSD
FE1_03	439 233.4	5 755 425.7	39	FA, PSD
FE1_04	440 540.7	5 757 414.0	40	FA, PSD
FE1_05	442 804.7	5 755 900.6	47	FA, PSD, SC
FE1_06	442 887.4	5 760 017.8	43	FA, PSD
FE1_07	447 079.1	5 758 232.8	48	FA, PSD
FE1_08	450 856.0	5 759 015.6	48	FA, PSD
South Array				
FE2_01	435 857.3	5 742 896.9	37	FA, PSD
FE2_02	436 222.5	5 741 088.0	52	FA, PSD
FE2_03	437 539.7	5 737 482.5	50	FA, PSD, SC
FE2_04	439 887.4	5 742 099.2	50	FA, PSD
FE2_05	442 684.3	5 743 140.8	46	FA, PSD
FE2_06	441 937.1	5 739 315.4	50	FA, PSD

Geodetic Parameters: WGS 84, UTM 31N, 3°E [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
Interconnector				
FE3_01	440 933.5	5 748 446.2	52	FA, PSD, SC
FE3_02	439 736.7	5 745 508.7	50	FA, PSD
FE3_03	442 021.0	5 751 430.3	52	FA, PSD

Notes
BSL = Below sea level
SC = Sediment chemistry
PSD = Particle size distribution
FA = Faunal sample A

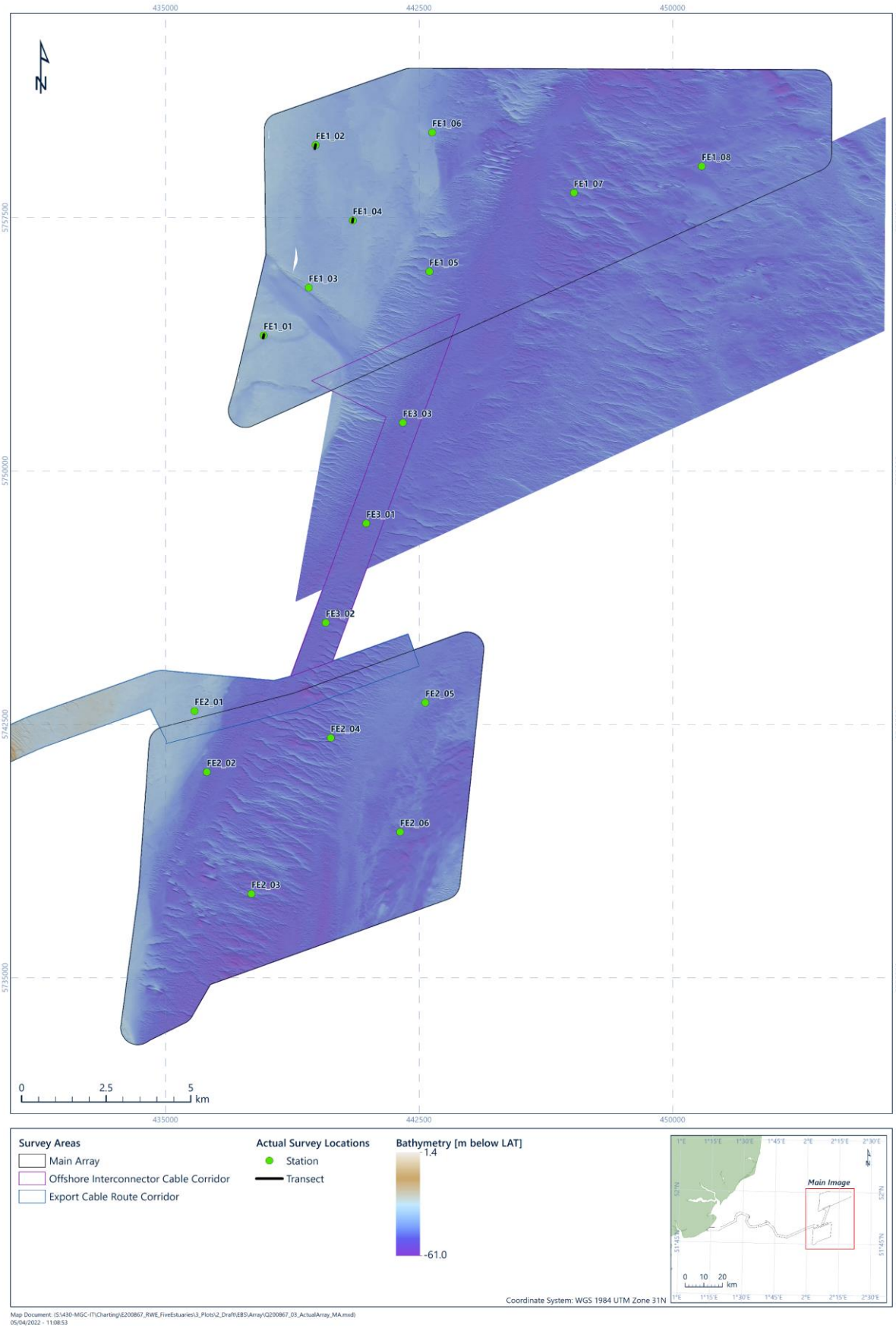


Figure 4.1: Completed survey locations overlaid on bathymetry, main array, Five Estuaries Offshore Site Investigation

4.2 Sediment Characterisation

4.2.1 Univariate Analysis

Table 4.3 presents the sediment particle size characteristics and Table 4.4 presents the sediment particle distribution across the VE main array survey area. Figure 4.2 presents an overview of the variations of the fractional composition of the sediments. Figure 4.3 presents the spatial variations of percentage sand, gravel and fines, whereas Figure 4.4 presents the spatial variation of the median sediment particle size. Figure 4.5 present the Folk (BGS modified) sediment classification and Figure 4.6 presents the Wentworth (1922) sediment descriptions. Appendix D presents the details of particle size distribution for individual stations and the analysis certificates.

Sand was the predominant sediment fraction across the VE main array survey area, with percentages ranging from 26.06 % (station FE3_02) to 98.99 % (station FE2_05), with a mean of 64.87 %. Gravel was recorded at all stations and had a content ranging from 1.01 % (station FE2_05) to 73.94 % (station FE3_02), with a mean of 30.71 %. Fines (or mud) were absent from nine stations and at the remining stations fines content ranged from 0.34 % (station FE1_04) to 47.10 % (station FE1_01) with a mean of 4.41 % (Table 4.3 and Figure 4.3). Of the fines, silt content was consistently higher that the clay content (Table 4.3 and Figure 4.2).

Stations in the south array had the greatest variation of gravel content with a range of 1.01 % to 64.11 %, whereas stations along the interconnector had the lowest variation of gravel content, with a range of 27.83 % to 73.94 %.

Station in the north array, had the largest variation of fines content, with values of up to 47.10 %, compared to maximum values of 6.00 % at stations in the south array and 6.41 % at stations along the interconnector.

Five sediment classes were identified using the Folk (BGS modified) sediment classification (Table 4.3 and Figure 4.5), including:

1. ‘Gravelly sand’, which typified six stations;
2. ‘Sandy gravel’, which typified four stations;
3. ‘Muddy, sandy gravel’, which typified three stations;
4. ‘Sand’, which typified three stations;
5. ‘Gravelly mud’, which typified one station

Of the 17 stations investigated, 5 had unimodal distributions, 2 had bimodal distributions and 10 had polymodal distributions (Table 4.4). Investigation of the particle size cumulative graphs (Appendix D) indicated that the most frequently occurring peak in the first mode was the 603.5 µm sediment particle size (coarse sand) followed by the 426.8 µm (medium sand), the 26 950 µm and the 38 250 µm, both within the coarse pebble range. The 603.5 µm and the 426.8 µm sediment particle sizes were the most frequently occurring also in the second mode, along with the 19 200 µm (coarse pebble). The 9600 µm (medium pebble) and the

6800 µm (fine pebble) sediment particle sizes were the most frequently occurring in the third mode.

The median sediment particle size ranged from 219 µm (fine sand) (station FE1_01) to 18 268 µm (coarse pebble) (station FE3_02) with a mean of 2847 µm (granule) and a median of 672 µm (coarse sand). The median sediment particle size at stations in the north array had the greatest variation, with a range of 219 µm to 8024 µm (Table 4.4).

The mean sediment particle size underpinned the Wentworth (1922) description, through which six grain size classes were identified (Table 4.4 and Figure 4.6), including:

1. 'Coarse sand', which typified five stations;
2. 'Very coarse sand', which typified five stations;
3. 'Granule', which typified three stations;
4. 'Pebble', which typified two stations;
5. 'Very fine sand', which typified one station;
6. 'Medium sand', which typified one station.

Of the 17 stations investigated, 10 had very poorly sorted sediments, 3 had moderately well sorted sediments, 2 had moderately sorted sediments, 1 had poorly sorted sediment and 1 had extremely poorly sorted sediment (Table 4.4).

Sediment particle distribution was very coarse skewed at 6 stations, very fine skewed at 4 stations, coarse skewed at 3 stations, fine skewed at 2 stations and symmetrical at 2 stations (Table 4.4).

Table 4.3: Summary of sediment characteristics, main array, Five Estuaries Offshore Site Investigation

Station	Fractional Composition			Fines		Folk Description (BGS modified)
	Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
North Array						
FE1_01	15.80	37.10	47.10	32.31	14.85	Gravelly mud
FE1_02	59.61	34.62	5.77	4.12	1.66	Muddy, sandy gravel
FE1_03	14.60	85.40	0.00	0.00	0.00	Gravelly sand
FE1_04	42.29	57.38	0.34	0.25	0.09	Sandy gravel
FE1_05	8.51	91.49	0.00	0.00	0.00	Gravelly sand
FE1_06	24.97	73.75	1.28	0.86	0.42	Gravelly sand
FE1_07	33.76	66.24	0.00	0.00	0.00	Sandy gravel
FE1_08	27.65	72.35	0.00	0.00	0.00	Gravelly sand
South Array						
FE2_01	64.11	29.88	6.00	3.62	2.39	Muddy, sandy gravel
FE2_02	3.06	96.94	0.00	0.00	0.00	Sand
FE2_03	10.16	89.84	0.00	0.00	0.00	Gravelly sand
FE2_04	1.64	98.36	0.00	0.00	0.00	Sand
FE2_05	1.01	98.99	0.00	0.00	0.00	Sand
FE2_06	59.23	35.82	4.95	2.68	2.28	Muddy, sandy gravel
Interconnector						
FE3_01	27.83	65.76	6.41	3.97	2.46	Gravelly sand
FE3_02	73.94	26.06	0.00	0.00	0.00	Sandy gravel
FE3_03	53.99	42.85	3.16	2.11	1.05	Sandy gravel
Minimum	**1.01**	**26.06**	**0.00**	**0.00**	**0.00**	-
Maximum	**73.94**	**98.99**	**47.10**	**32.31**	**14.85**	
Median	**27.65**	**66.24**	**0.00**	**0.00**	**0.00**	
Mean	**30.71**	**64.87**	**4.41**	**2.94**	**1.48**	
Standard Deviation	**24.05**	**26.23**	**11.28**	**7.73**	**3.57**	

Notes:
BGS = British Geological Survey
Fines = silt and clay content Silt = < 4.0 phi to +8.0 phi (< 62.5 µm to 3.9 µm) Clay = < 8.0 phi to +10.0 phi (<3.9 µm to < 0.04 µm)

Table 4.4: Summary of particle size distribution, main array, Five Estuaries Offshore Site Investigation

Station	Modality	Median [µm]	Mean Particle Size			Sorting Coefficient		Skewness	
			[µm]	[phi]	Wentworth (1922) Description	[µm]	Description†	[µm]	Description
North Array									
FE1_01	Polymodal	219	122	3.03	Very Fine Sand	16.75	Extremely Poorly Sorted	−0.24	Fine Skewed
FE1_02	Polymodal	8024	5288	−2.40	Pebble	8.85	Very Poorly Sorted	−0.42	Very Fine Skewed
FE1_03	Bimodal	706	848	0.24	Coarse Sand	2.01	Poorly Sorted	0.44	Very Coarse Skewed
FE1_04	Polymodal	696	1914	−0.94	Very Coarse Sand	5.70	Very Poorly Sorted	0.68	Very Coarse Skewed
FE1_05	Unimodal	606	619	0.69	Coarse Sand	1.80	Moderately Sorted	0.30	Coarse Skewed
FE1_06	Polymodal	501	1041	−0.06	Very Coarse Sand	4.29	Very Poorly Sorted	0.66	Very Coarse Skewed
FE1_07	Bimodal	640	1350	−0.43	Very Coarse Sand	4.03	Very Poorly Sorted	0.66	Very Coarse Skewed
FE1_08	Polymodal	688	1294	−0.37	Very Coarse Sand	4.00	Very Poorly Sorted	0.66	Very Coarse Skewed
South Array									
FE2_01	Polymodal	5982	3464	−1.79	Granule	7.19	Very Poorly Sorted	−0.55	Very Fine Skewed
FE2_02	Unimodal	604	609	0.72	Coarse Sand	1.54	Moderately Well Sorted	0.13	Coarse Skewed
FE2_03	Unimodal	595	625	0.68	Coarse Sand	1.79	Moderately Sorted	0.37	Very Coarse Skewed
FE2_04	Unimodal	563	568	0.82	Coarse Sand	1.48	Moderately Well Sorted	0.06	Symmetrical
FE2_05	Unimodal	489	496	1.01	Medium Sand	1.42	Moderately Well Sorted	0.08	Symmetrical
FE2_06	Polymodal	4897	3339	−1.74	Granule	6.45	Very Poorly Sorted	−0.36	Very Fine Skewed
Interconnector									
FE3_01	Polymodal	672	1218	−0.29	Very Coarse Sand	6.03	Very Poorly Sorted	0.27	Coarse Skewed
FE3_02	Polymodal	18268	7733	−2.95	Pebble	5.53	Very Poorly Sorted	−0.64	Very Fine Skewed
FE3_03	Polymodal	4255	3703	−1.89	Granule	5.39	Very Poorly Sorted	−0.14	Fine Skewed
Minimum	-	**219**	**122**	**−2.95**	-	**1.42**	-	**−0.64**	-
Maximum		**18268**	**7733**	**3.03**		**16.75**		**0.68**	
Median		**672**	**1218**	**−0.29**		**4.29**		**0.13**	
Mean		**2847**	**2014**	**−0.33**		**4.96**		**0.11**	
Standard Deviation		**4626**	**2060**	**1.50**		**3.80**		**0.44**	

Notes
Statistics based on Folk and Ward (1957) method derived in Gradistat (Blott, 2010)

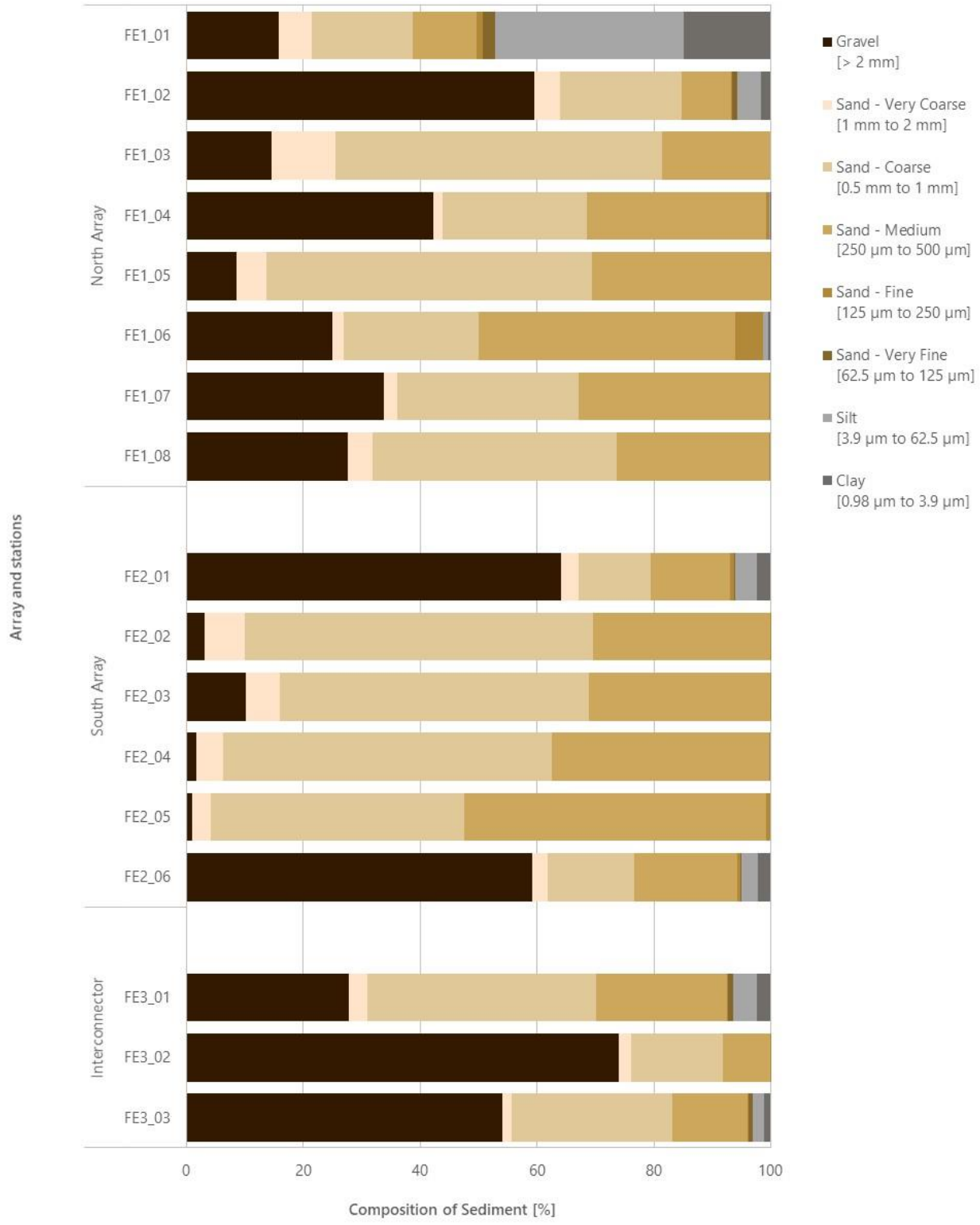


Figure 4.2: Sediment fractional composition, main array, Five Estuaries Offshore Site Investigation

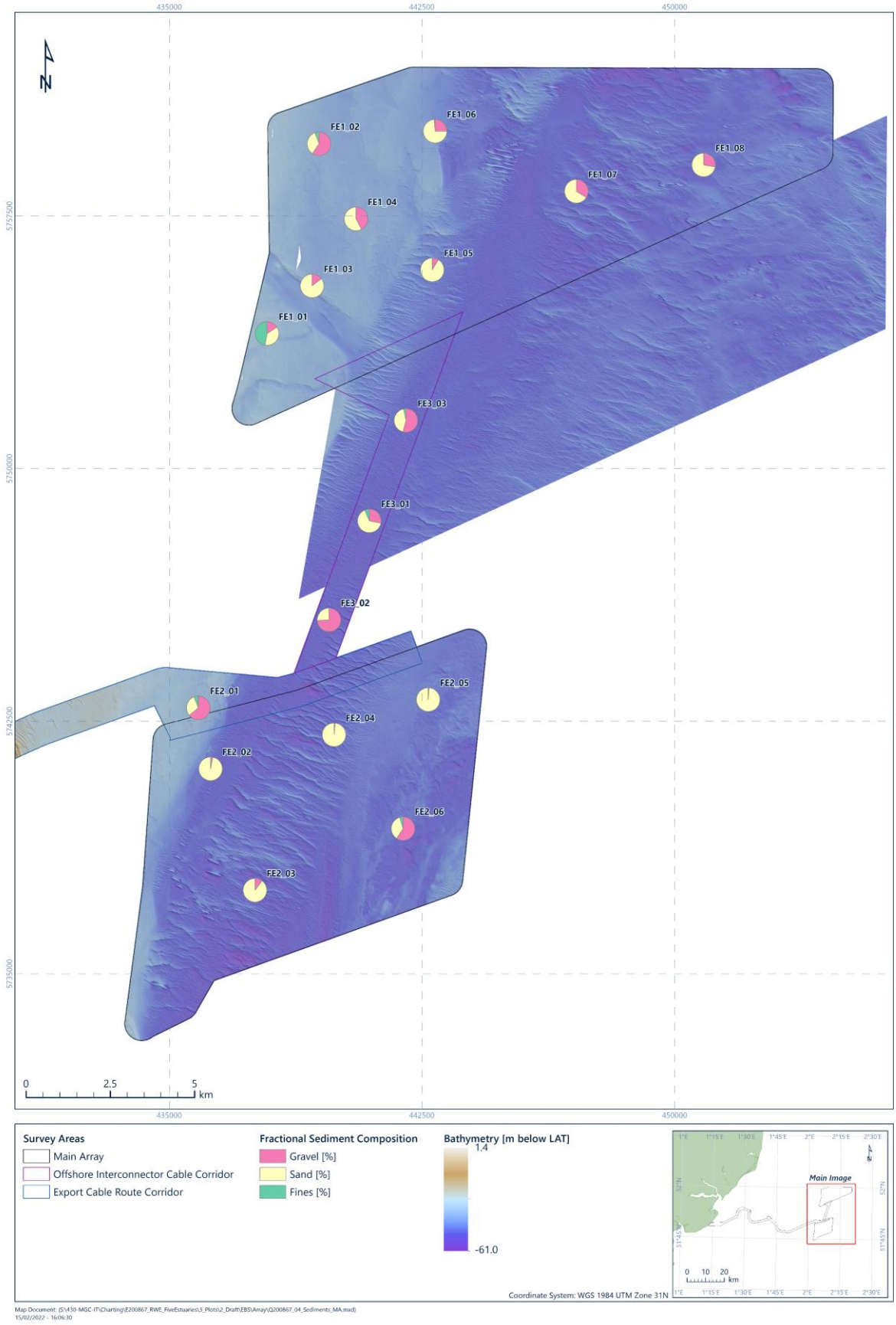


Figure 4.3: Spatial variations of percentage of sand, gravel and fines, main array, Five Estuaries Offshore Site Investigation

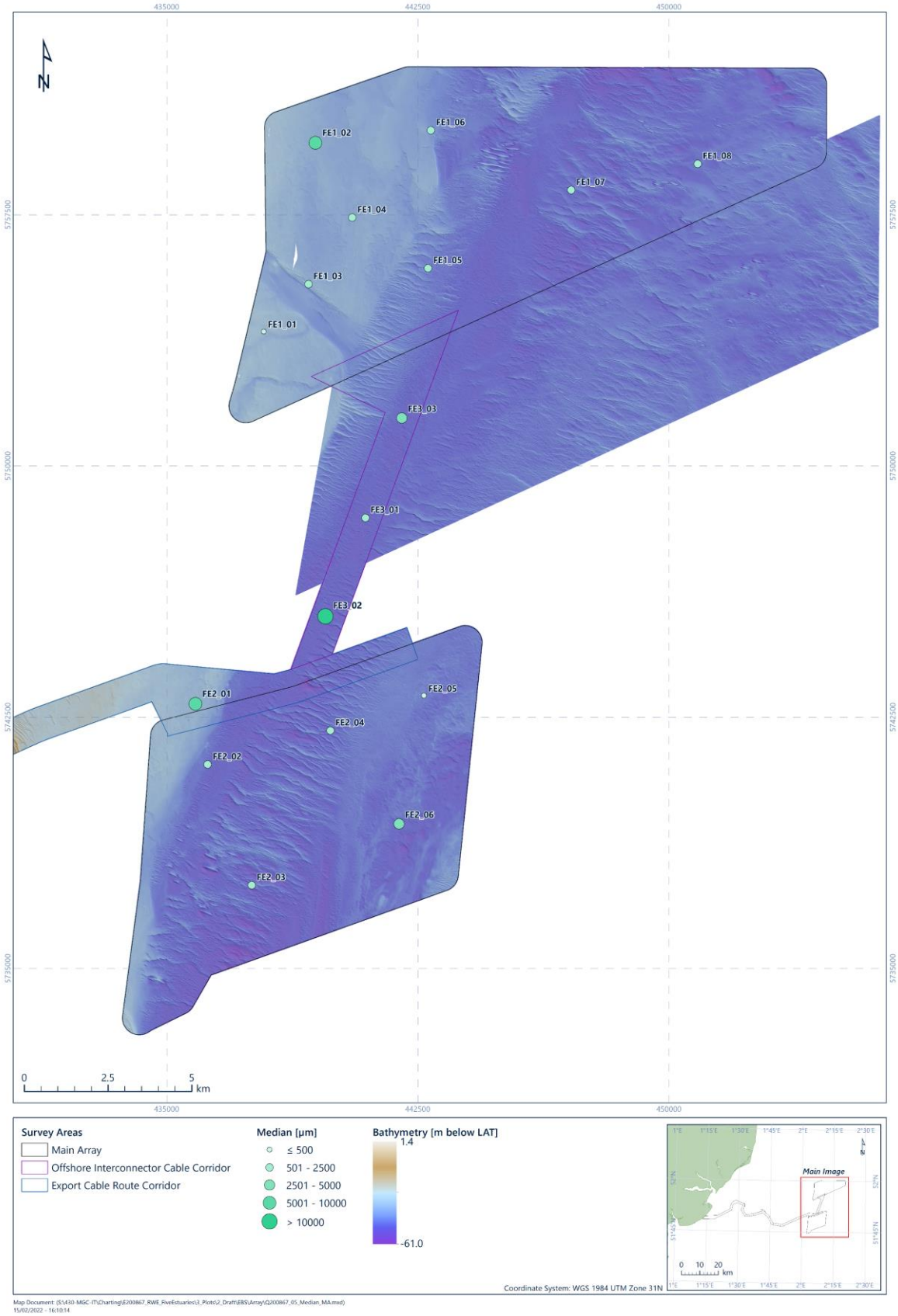
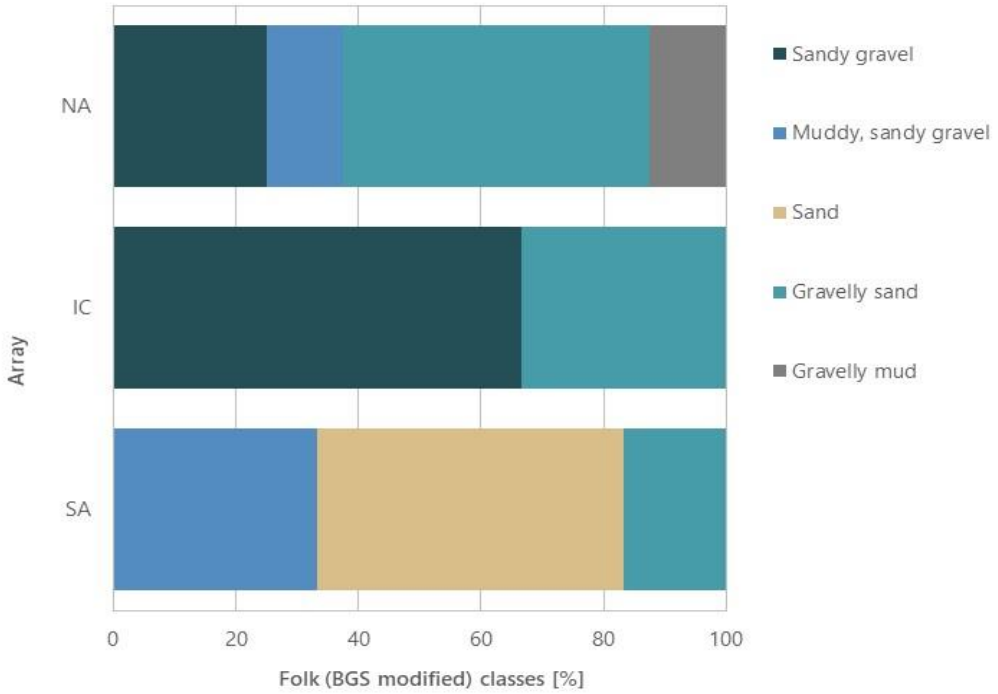
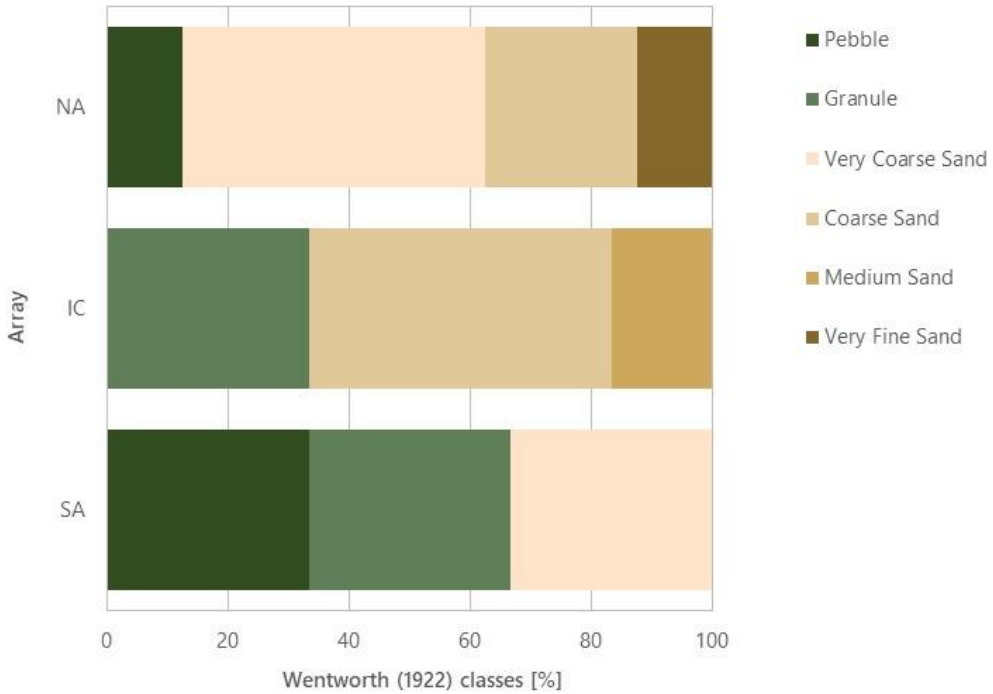


Figure 4.4: Spatial variations of the median [µm] sediment particle size, main array, Five Estuaries Offshore Site Investigation



Notes
BGS = British Geological Survey
NA = North array IC = Interconnector SA = South array

Figure 4.5: Folk (BGS modified) sediment description, main array, Five Estuaries Offshore Site Investigation



Notes
NA = North array IC = Interconnector SA = South array

Figure 4.6: Figure 4.7: Wentworth (1922) sediment description, main array, Five Estuaries Offshore Site Investigation

4.2.2 Investigation of Granulometric Similarities

The cluster analysis, using Euclidean distance, was applied to the sediment PSD to investigate sedimentological characteristics. Data were fourth root transformed. The SIMPROF test, undertaken in conjunction with the cluster analysis, was interpreted in ecological terms and, where appropriate, coarser groups were created (see Section 3.3.5). Figure 4.8 presents the dendrogram and the nMDS of the Euclidean distance matrix of sediment particle size.

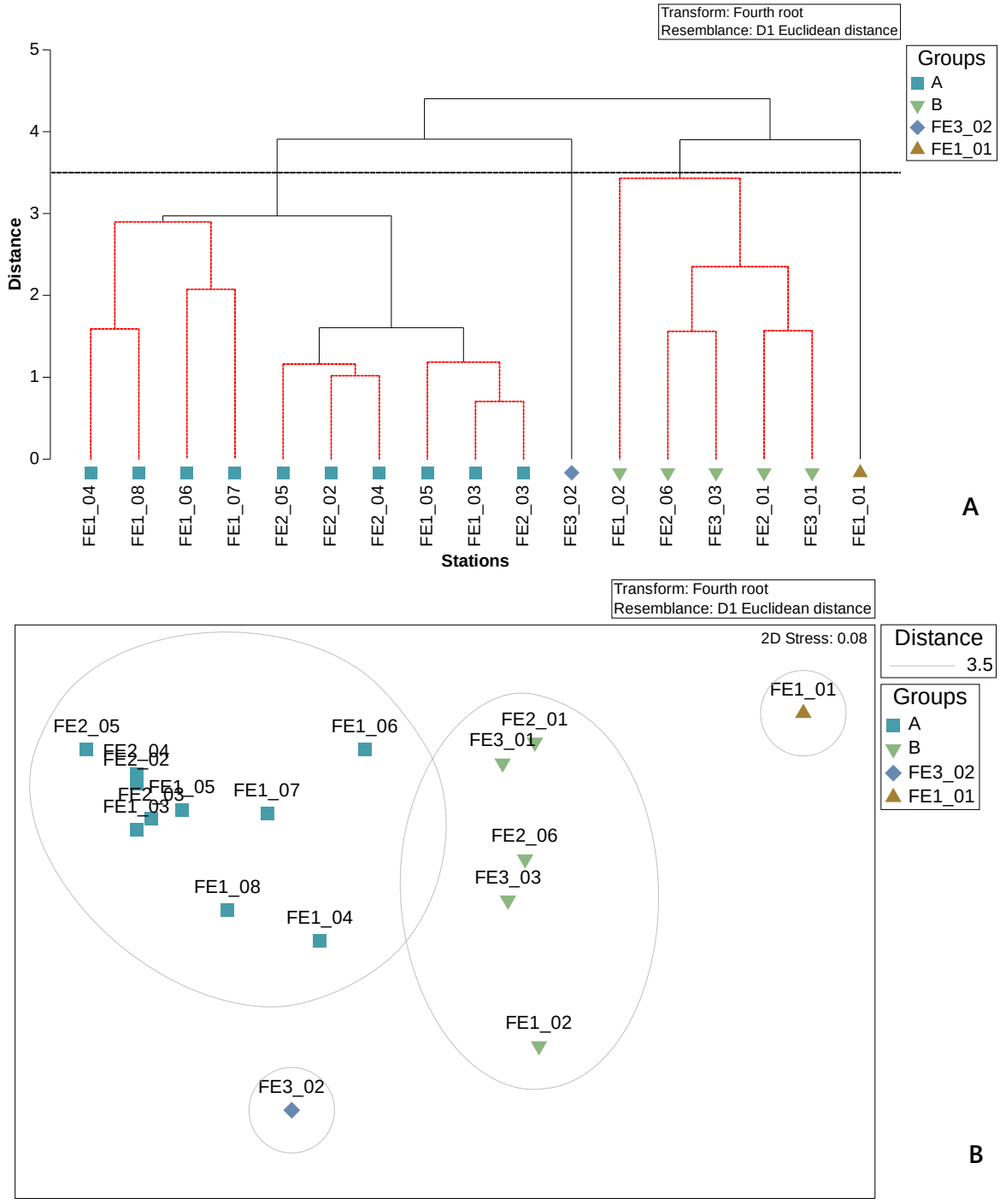


Figure 4.8: (A) dendrogram and (B) nMDS of hierarchical clustering analysis of sediment particle size, main array, Five Estuaries Offshore Site Investigation

Two multivariate groups were identified at the Euclidean distance of 3.5, namely A and B, and two single stations, namely FE1_01 and FE3_02, which were different enough to separate. Groups which separated below the 3.5 Euclidean distance were not deemed of ecological significance. Table 4.5 summarises the physical characteristics of the sediment groups identified through the multivariate analysis which included:

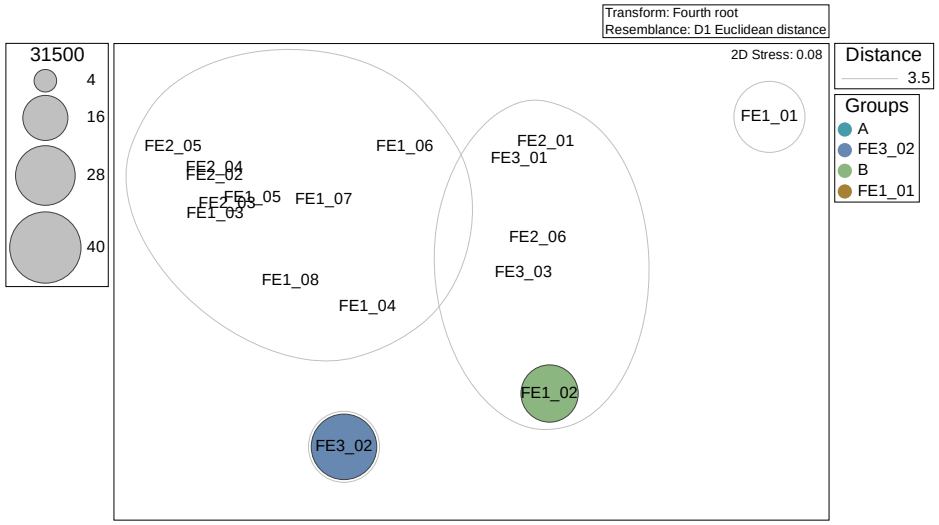
- Group A comprised 10 stations, including 6 from the north array and 4 from the south array. Group A had an average Euclidean distance of 3.23 and was characterised by poorly sorted 'gravelly sand' (Folk BGS modified), with median sediment particle size ranging from 489 µm to 706 µm, mean of 609 µm (coarse sand), in water depth of 39 m to 52 m, mean of 46.3 m (BSL);
- Group B comprised five stations, including one from the north array, two from the south array and two from the interconnector. Group B had an average Euclidean distance of 3.74 and was characterised by very poorly sorted 'muddy sandy gravel' (Folk BGS modified), with median sediment particle size ranging from 672 µm to 8024 µm, mean of 4766 µm (fine pebble), in water depth of 37 m to 52 m, mean of 45.8 m (BSL);
- Station FE3_02, along the interconnector, was characterised by very poorly sorted 'sandy gravel', with a median sediment particle size of 18 268 µm (coarse pebble) in water depth of 50 m (BSL);
- Station FE1_01, from the north array, was characterised by extremely poorly sorted 'gravelly mud', with median sediment particle size of 219 µm (fine sand) in water depth of 35 m (BSL).

The sediment particle size primarily responsible for the separation of the multivariate groups included, the 16 000 µm, the 22 400 µm and the 31 500 µm within the coarse pebble region, the 11 200 µm (medium pebble), the 22.1 µm (coarse silt) and the 15.6 µm (medium silt) sediment particle sizes (Figure 4.9).

Table 4.5: Summary of physical characteristics of sediment groups identified through the cluster analysis, Five Estuaries Offshore Site Investigation

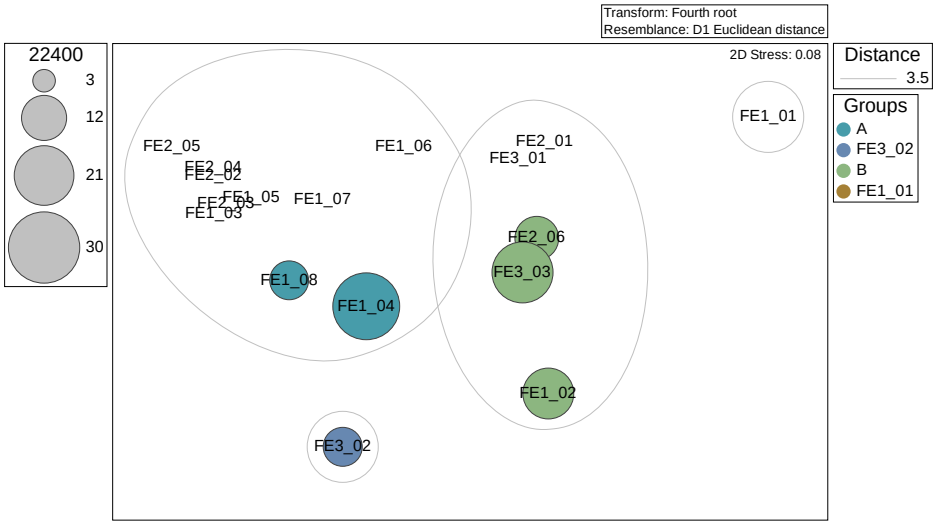
Multivariate Group	Location and stations	Depth [m BSL]	Median Particle Size [µm]	Fractional Composition [%]			Sorting	
				Gravel	Sand	Fines	[µm]	Description
A ■ Average distance[2]: 3.23	North Array (FE1_03, FE1_04, FE1_05, FE1_06 , FE1_07, FE1_08) South Array (FE2_02, FE2_03, FE2_04, FE2_05)	46.3	609	16.76	83.07	0.16	2.81	Poorly sorted
B ▼ Average distance[2]: 3.74	North Array (FE1_02) South Array (FE2_06) Interconnector (FE3_01, FE3_03)	45.8	4766	52.95	41.79	5.26	6.78	Very poorly sorted
FE3_02 ◆	Interconnector	50	18268	73.94	26.06	0.00	5.53	Very poorly sorted
FE1_01 ▲	North Array	35	219	15.80	37.10	47.10	16.76	Extremely poorly sorted

Notes
Data refer to mean values in each multivariate group except for single stations; values are fourth root transformed
BSL = Below sea level



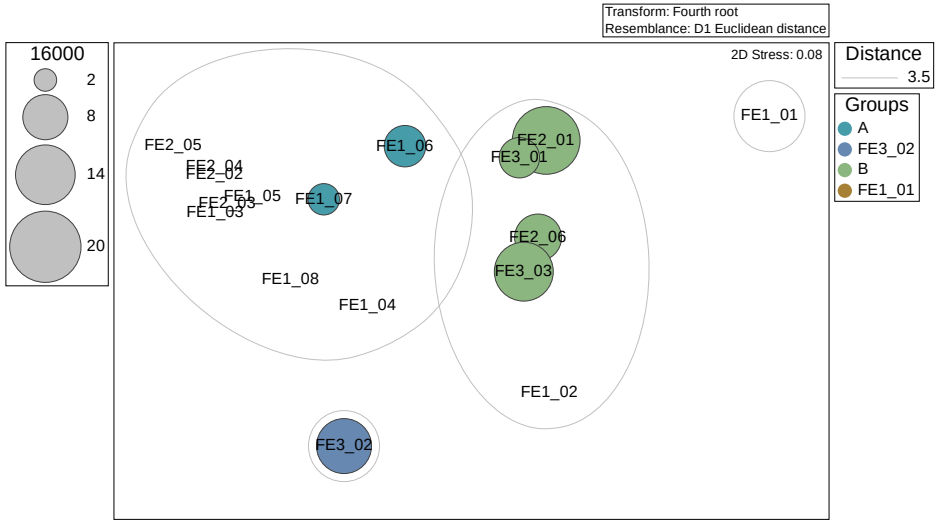
Notes

Circles proportional in diameter to the 31 500 µm sediment particle size (coarse pebble)



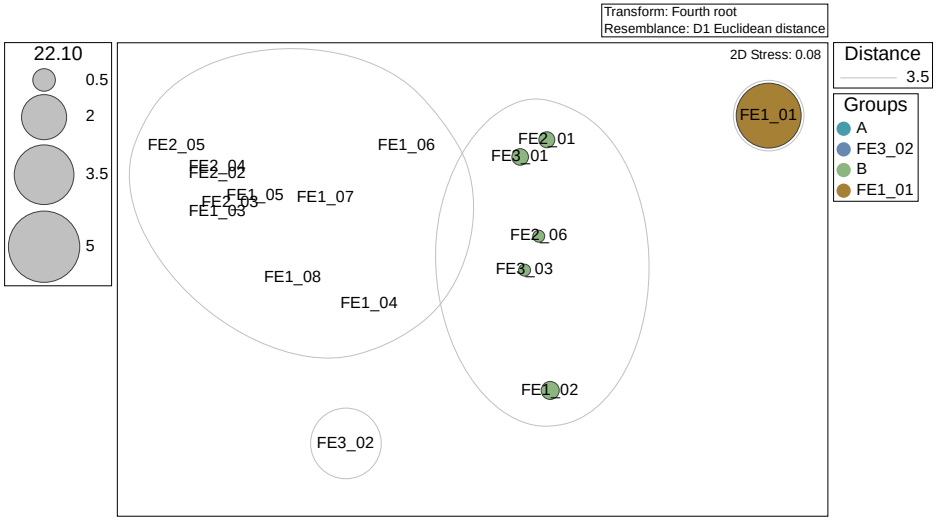
Notes

Circles proportional in diameter to the 22 400 µm sediment particle size (coarse pebble)



Notes

Circles proportional in diameter to the 16 000 µm sediment particle size (coarse pebble)



Notes

Circles proportional in diameter to the 22.1 µm sediment particle size (coarse silt)

Figure 4.9: nMDS ordination of hierarchical clustering analysis of PSD with superimposed circles proportional in diameter to percentage of particles driving the separation of groups Five Estuaries Offshore Site Investigation

4.2.2.1 Principal Components Analysis

The principal component analysis (PCA) was used to reduce the sediment PSD across all samples into a smaller number of key variables (gravel, sand and mud). This highlighted the importance of the less represented sediment fractions in accounting for grain size variations, which are critical factors in determining the associated biological communities. The PCA also allowed visual representation of the association between sediment type and biological variables. Data were fourth root transformed. All data were in percentage and therefore normalisation was not necessary.

Results of the PCA indicated that the first two principal components accounted for 98.6 % of the variation, with the percentage of mud explaining most of the variation (76.3 %) along principal component one and the percentage of gravel explaining most of the variation (22.3 %) along principal component two. Sand explained 1.1 % of the variation along principal component three.

Figure 4.10 presents the results of the PCA with, superimposed location and circles proportional, in diameter, to the percentage of mud. Mud had the greatest variation across the survey area, particularly in the north array, with a peak at station FE1_01, whereas most stations in the south array were devoid of mud. The south array had the greatest variation of gravel content, as illustrated in Figure 4.11, which present the PCA with superimposed location and circles proportional, in diameter, to the percentage of gravel. The varying proportions of mud and gravel resulted in increased heterogeneity of the sediment which was reflected in the sorting coefficient ranging from moderately well sorted for the predominantly sandy stations to extremely poorly sorted, as percentage of gravel and mud increased (Figure 4.12).

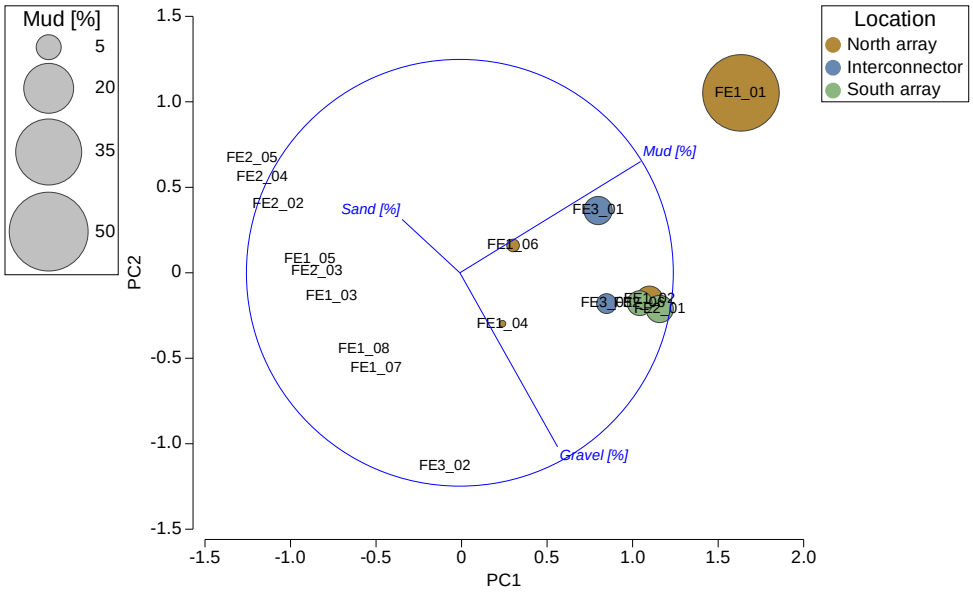


Figure 4.10: 2D PCA of sediment composition with superimposed, arrays and circles proportional in diameter to percentage of mud, Five Estuaries Offshore Site Investigation

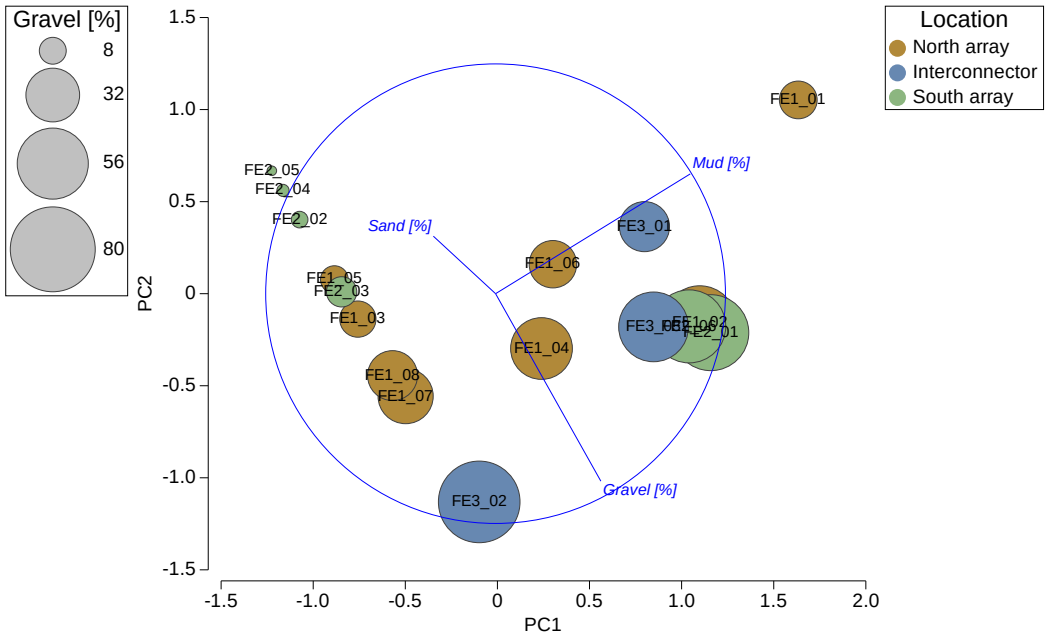


Figure 4.11: 2D PCA of sediment composition with superimposed, arrays and circles proportional in diameter to percentage of gravel, Five Estuaries Offshore Site Investigation

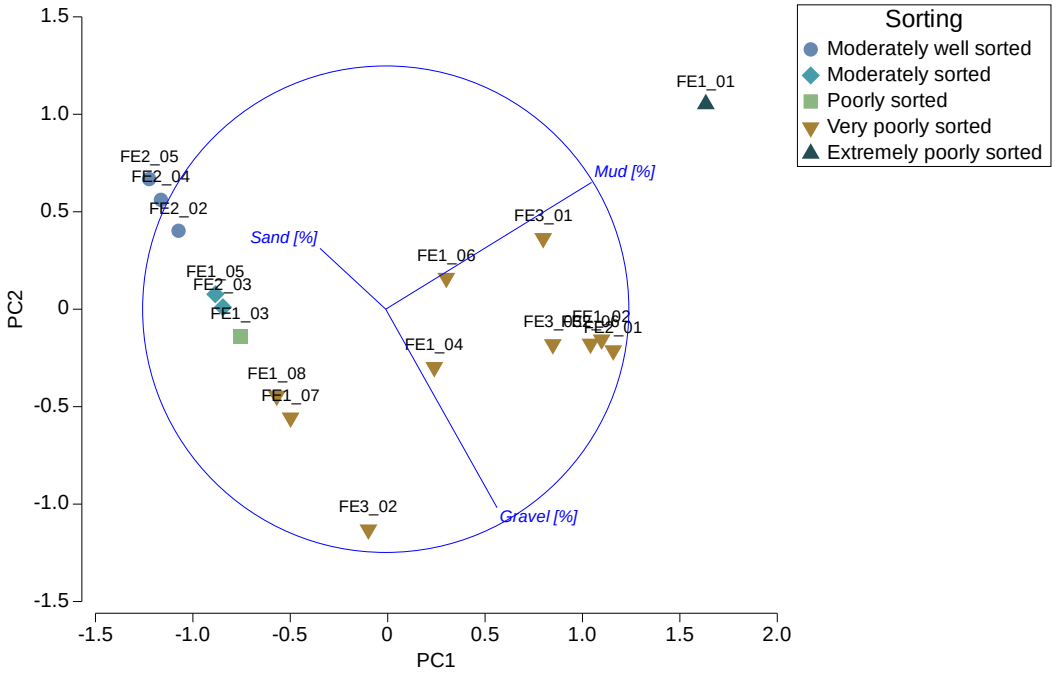


Figure 4.12: 2D PCA of sediment composition with superimposed, sorting coefficient, Five Estuaries Offshore Site Investigation

4.3 Sediment Chemistry

4.3.1 Sediment Hydrocarbons

Results of the sediment chemistry were assessed in terms of descriptive statistics, including the relative standard deviation (RSD) to indicate the extent of variability in the dataset. The RSD is defined as the ratio of the standard deviation to the mean and is expressed as a percentage. For this report, RSD of less than 30 % were considered low variability, 30 % to 70 % were considered moderate variability and more than 70 % were considered high variability.

Appendix E presents the analysis certificates.

4.3.1.1 Total Hydrocarbon Content

Table 4.6 presents the concentrations of total hydrocarbons reported from the surface sediment across the VE main array survey area. In the VE main array survey area, THC content was below the limit of detection (LOD) (1 mg/kg) in the north and south arrays and along the interconnector.

Table 4.6: Summary of sediment hydrocarbon analysis, main array, Five Estuaries Offshore Site Investigation

Station	THC
North Array	
FE1_05	< 1
South Array	
FE2_03	< 1
Interconnector	
FE3_01	< 1
Cefas Guideline Action Levels	
AL1	**100**

Notes
Concentrations expressed in mg/kg
Cefas = Centre for Environment Fisheries & Aquaculture Science
THC = Total hydrocarbon content

4.3.1.2 Sediment Polycyclic Aromatic Hydrocarbons (PAHs)

Table 4.7 presents the results of the polycyclic aromatic hydrocarbons (PAHs) and the marine SQGs (details in Section 1.5). Concentrations of individual PAHs were below the LOD (1 mg/kg) across the entire VE main array survey area.

Table 4.7: Summary of sediment polycyclic aromatic hydrocarbon analysis, main array, Five Estuaries Offshore Site Investigation

Analyte	Station			CEMP (OSPAR, 2014)	NOAA (Long et al., 1995)	Canadian SQGs (CCME, 2022)	
	North Array	South Array	Inter connector	ERL	ERM	TEL	PEL
	FE1_05	FE2_03	FE3_01				
Acenaphthene	< 1	< 1	< 1	-	500	6.71	88.9
Acenaphthylene	< 1	< 1	< 1	-	640	5.87	128
Anthracene	< 1	< 1	< 1	85	1100	46.9	245
Benzo[a]anthracene	< 1	< 1	< 1	261	1600	74.8	693
Benzo[a]pyrene	< 1	< 1	< 1	430	1600	88.8	763
Benzo[b]fluoranthene	< 1	< 1	< 1	-	-	-	-
Benzo[e]pyrene	< 1	< 1	< 1	-	-	-	-
Benzo[ghi]perylene	< 1	< 1	< 1	85	-	-	-
Benzo[k]fluoranthene	< 1	< 1	< 1	-	-	-	-
C1-naphthalenes	< 1	< 1	< 1	155	-	-	-
C1-phenanthrene	< 1	< 1	< 1	170	-	-	-
C2-naphthalenes	< 1	< 1	< 1	150	-	-	-
C3-naphthalenes	< 1	< 1	< 1	-	-	-	-
Chrysene	< 1	< 1	< 1	384	2800	108	846
Dibenzo[ah]anthracene	< 1	< 1	< 1	-	260	6.22	135
Fluoranthene	< 1	< 1	< 1	600	5100	113	1494
Fluorene	< 1	< 1	< 1	-	540	21.2	144
Indeno[1,2,3-cd]pyrene	< 1	< 1	< 1	240	-	-	-
Naphthalene	< 1	< 1	< 1	160	2100	34.6	391
Perylene	< 1	< 1	< 1	-	-	-	-
Phenanthrene	< 1	< 1	< 1	240	1500	86.7	544
Pyrene	< 1	< 1	< 1	665	2600	153	1398
Total	**< 1**	**< 1**	**< 1**	-	-	-	-

Notes
Concentrations expressed in µg/kg dry sediment
CCME = Canadian Council of Ministers of the Environment
CEMP = Coordinated Environmental Monitoring Programme
ERL = Effects range low
ERM = Effects range median
NOAA = National Oceanic and Atmospheric Administration
OSPAR = Oslo and Paris Commission
PEL = Probable effects level
SQG = Sediment quality guidelines
TEL = Threshold effects level

4.3.2 Sediment Metals

Table 4.8 summarises the concentrations of the extractable metals in the sediment samples.

Concentrations of most metals in samples from the VE main array survey area were below their respective SQGs. The exception was arsenic, the concentration of which ranged from 8.7 mg/kg (station FE1_05) to 18.8 mg/kg (station FE3_01), with a mean of 12.6 mg/kg, all values being above the Canadian TEL (7.24 mg/kg).

The highest variability of metal concentration was recorded for barium, which had RSD of 123 % and concentrations ranging from 14.2 mg/kg to 121 mg/kg, with a mean of 49.9 mg/kg.

The lowest variability of metal concentrations was recorded for copper which had RSD of 2 % and concentrations ranging from 5.2 mg/kg to 5.4 mg/kg, with a mean of 5.3 mg/kg.

The remaining metals analysed had low to moderate variability with values of RSD ranging from 12 % (zinc) to 68 % (aluminium).

Table 4.8: Summary of sediment metals analysis, main array, Five Estuaries Offshore Site Investigation

Station	Al	As	Ba	Cd	Cr	Cu	Hg	Ni	Pb	Sn	Zn
North Array											
FE1_05	1400	8.7	14.2	0.08	4.1	5.4	0.02	5.1	3.8	< 0.5	14.0
South Array											
FE2_03	827	10.2	14.6	0.06	3.1	5.4	0.01	5.5	3.1	< 0.5	11.5
Interconnector											
FE3_01	3160	18.8	121	0.08	6.9	5.2	0.02	9.6	4.4	< 0.5	14.4
Mean	**1800**	**12.6**	**49.9**	**0.07**	**4.7**	**5.3**	**0.02**	**6.7**	**3.8**	**-**	**13.3**
Standard deviation	**1220**	**5.45**	**61.5**	**0.012**	**1.97**	**0.12**	**0.006**	**2.49**	**0.65**	**-**	**1.57**
RSD	**68**	**43**	**123**	**16**	**42**	**2**	**35**	**37**	**17**	**-**	**12**
Cefas Guideline Action Levels											
AL1	**-**	**20**	**-**	**0.4**	**40**	**40**	**0.3**	**20**	**50**	**-**	**130**
AL2	**-**	**100**	**-**	**5**	**400**	**400**	**3**	**200**	**500**	**-**	**800**
CEMP Assessment Criteria (OSPAR, 2014)											
ERL	**-**	**-**	**-**	**1.20**	**81.0**	**34.0**	**0.150**	**-**	**47.0**	**-**	**150**
National Oceanic and Atmospheric Administration (NOAA) Effects Ranges (Long et al., 1995)											
ERM	**-**	**70**	**-**	**9.6**	**370**	**270**	**0.71**	**51.6**	**218**	**-**	**410**
Canadian Sediment Quality Guidelines (CCME, 2022)											
TEL	**-**	**7.24**	**-**	**0.7**	**52.3**	**18.7**	**0.13**	**-**	**30.2**	**-**	**124**
PEL	**-**	**41.6**	**-**	**4.2**	**160**	**108**	**0.7**	**-**	**112**	**-**	**271**

Notes
Concentrations expressed in mg/kg dry sediment
Cefas action levels available at https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

Al = Aluminium; As = Arsenic; Ba = Barium; Cd = Cadmium; Cr = Chromium; Cu = Copper
Hg = Mercury; Ni = Nickel; Pb = Lead; Sn = Tin; Zn = Zinc
AL1 = Action level 1; AL2 = Action level 2; ERL = Effects range low; ERM = Effects range median; PEL = Probable effects level
TEL = Threshold effects level; Cefas = Centre for Environment, Fisheries and Aquaculture Science; CEMP = Coordinated Environmental Monitoring Programme
OSPAR = Oslo and Paris Commission

Key	Below Cefas AL1	Above Cefas AL1	Above Cefas AL2

4.3.3 Sediment Polychlorinated Biphenyls

Table 4.9 summarises the concentrations of PCBs in the sediment samples. The concentrations of all individual PCB congeners analysed were below the LOD (< 0.00008 mg/kg), and the sum of the 25 congeners was below the Cefas AL1 (0.02 mg/kg) and AL2 (0.2 mg/kg)

Table 4.9: Summary of polychlorinated biphenyls (PCBs) analysis, main array, Five Estuaries Offshore Site Investigation

Analyte	Station			Cefas Guideline Action Levels	
	North Array	South Array	Interconnector		
	FE1_05	FE2_03	FE3_01	AL1	AL2
PCB 101	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 105	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 110	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 118	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 128	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 138	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 141	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 149	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 151	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 153	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 156	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 158	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 170	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 18	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 180	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 183	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 187	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 194	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 28	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 31	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 44	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 47	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 49	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 52	< 0.00008	< 0.00008	< 0.00008	-	-
PCB 66	< 0.00008	< 0.00008	< 0.00008	-	-
Total	**< 0.00200**	**< 0.00200**	**< 0.00200**	**0.02**	**0.2**

Notes
Concentrations expressed as mg/kg dry weight
Cefas = Centre for Environment, Fisheries and Aquaculture Science
AL1 = Action Level 1
AL2 = Action Level 2
Cefas action levels available at https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

4.3.4 Sediment Organotins

Table 4.10 summarises the concentrations of organotins in the sediment samples. The organotins analysed included dibutyltin (DBT) and tributyltin (TBT), the concentrations of which were below their respective LOD at all stations and below the Cefas AL1 (0.1 mg/kg) and AL2 (1 mg/kg).

Table 4.10: Summary of organotins analysis, main array, Five Estuaries Offshore Site Investigation

Station	Dibutyltin (DBT)	Tributyltin (TBT)
North Array		
FE1_05	< 0.001	< 0.001
South Array		
FE2_03	< 0.001	< 0.001
Interconnector		
FE3_01	< 0.005	< 0.005
Cefas Guideline Action Levels		
AL1	**0.1**	**0.1**
AL2	**1**	**1**

Notes
Concentrations expressed as mg/kg dry weight
Cefas = Centre for Environment Fisheries & Aquaculture Science
AL1 = Action Level 1
AL2 = Action Level 2
Cefas action levels available at https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

4.3.5 Sediment Organochlorine Pesticides

Table 4.11 presents a summary of the OCPs in the sediment samples across the VE main array survey area.

Currently, Cefas AL1 values are established for dieldrin and dichlorodiphenyltrichloroethane (DDT) (0.001 mg/kg). The p,p'-dichlorodiphenyltrichloroethane (PPDDT) is the main isomeric form of DDT and hence can be compared to the Cefas AL1 value for DDT (0.001 mg/kg).

The concentration of all OCPs analysed was consistently below the LOD (0.0001 mg/kg) and below the Cefas AL1 values, where available.

Table 4.11: Summary of organochlorine pesticides (OCP) analysis, main array, Five Estuaries Offshore Site Investigation

Analyte	Station			Cefas Guideline Action Levels	
	North Array	South Array	Interconnector		
	FE1_05	FE2_03	FE3_01	AL1	AL2
AHCH	< 0.0001	< 0.0001	< 0.0001	-	-
BHCH	< 0.0001	< 0.0001	< 0.0001	-	-
GHCH	< 0.0001	< 0.0001	< 0.0001	-	-
Dieldrin	< 0.0001	< 0.0001	< 0.0001	**0.005**	-
HCB	< 0.0001	< 0.0001	< 0.0001	-	-
PPTDE	< 0.0001	< 0.0001	< 0.0001	-	-
PPDDE	< 0.0001	< 0.0001	< 0.0001	-	-
PPDDT	< 0.0001	< 0.0001	< 0.0001	**0.001**	-

Notes
Concentrations expressed as mg/kg dry weight
Cefas = Centre for Environment Fisheries & Aquaculture Science
AL = Action level
AHCH = alpha-Hexachlorocyclohexane
BHCH = beta-Hexachlorocyclohexane
GHCH = gamma-Hexachlorocyclohexane
HCB = Hexachlorobenzene
PPTDE = p,p'-Dichlorodiphenyldichloroethane
PPDDE = p,p'-Dichlorodiphenyldichloroethylene
PPDDT = p,p'-Dichlorodiphenyltrichloroethane
Cefas action levels available at https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans

4.4 Sediment Macrofauna

The macrofauna from the grab samples included infauna and epifauna, the latter comprising solitary and sessile organisms. The infauna and solitary epifauna were enumerated and were analysed together in terms of phyletic composition, species diversity, abundance and distribution. The sessile colonial epifauna, recorded as P, was removed from the enumerated dataset and assessed for taxa composition and distribution. Appendix F presents the full species list.

4.4.1 Infaunal and Solitary Epifauna

4.4.1.1 Phyletic Composition

Following rationalisation (details in Section 3.3.2), the enumerated macrofaunal dataset comprised 141 taxa and 1208 individuals. The excluded taxa included juveniles, pelagic (Chaetognatha), parasitic (Bopyroidea) and damaged fauna. In addition, two species of *Leiochone* and one species of *Ericthonius*, were aggregated to their respective genera, whereas *Leptocheirus hirsutimanus* was aggregated to family level (Aoridae).

Juveniles comprised 22 taxa and 184 individuals, of which species of Ophiuridae, with 96 individuals, and Anomiidae, with 29 individuals, were numerically dominant.

Table 4.12 summarises the phyletic composition of the enumerated fauna across the VE main array survey area and Figure 4.13 presents the phyletic composition of taxa and individuals of the enumerated macrofauna.

Table 4.12: Taxonomic groups of enumerated fauna, Five Estuaries Offshore Site Investigation

Taxonomic Group	Number of Taxa	Composition of Taxa [%]	Abundance	Composition of Individuals [%]
Annelida	79	56.0	713	59.0
Arthropoda	32	22.7	124	10.3
Mollusca	20	14.2	106	8.8
Echinodermata	5	3.5	194	16.1
Other phyla	5	3.5	71	5.9
Total	**141**	**100**	**1208**	**100**

Notes
Macrofaunal samples were processed through a 1 mm sieve
Other phyla included: Chordata, Cnidaria, Nemertea, Phoronida and Platyhelminthes

Annelida comprised most of the enumerated taxa composition (56.0 %), followed by Arthropoda (22.7 %), Mollusca (14.2 %) and Echinodermata (3.5 %). Other phyla comprised 3.5 % of the taxa composition (Table 4.12) and were represented by Cnidaria (non-burrowing anemones of the order Actiniaria), *Phoronis*, Ascidiacea and Nemertea.

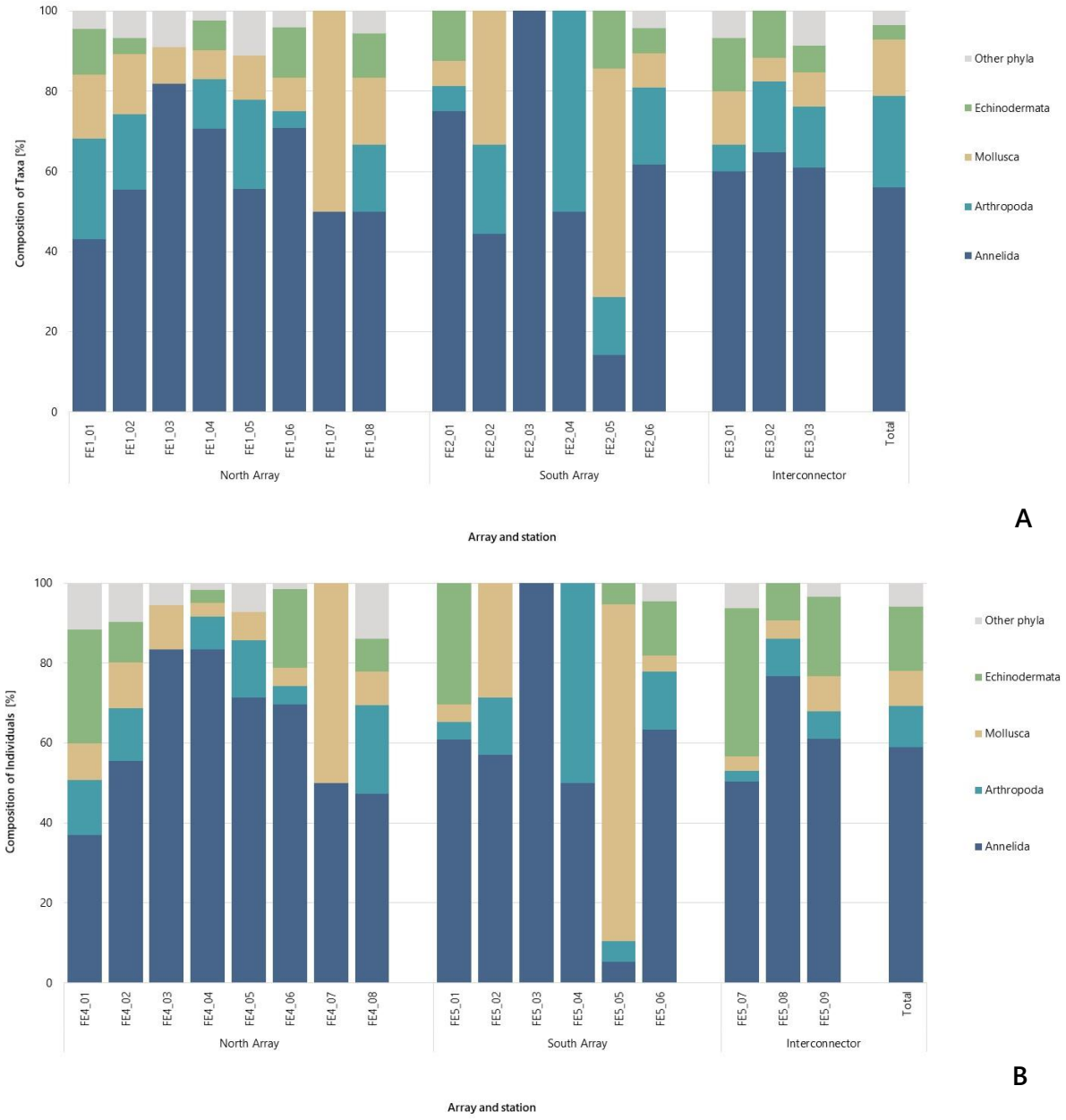


Figure 4.13: Phyletic composition of enumerated macrofaunal (A) taxa and (B) individuals, Five Estuaries Offshore Site Investigation

When assessed on a station basis, Annelida were recorded at all 17 stations sampled and were the only phylum recorded at station FE1_07, in the north array. At the remaining stations, Annelida comprised most of the taxa composition except station FE2_05, in the south array, where Mollusca comprised most of the taxa composition (Figure 4.13). Analysis of the species list indicated that station FE2_05 comprised seven taxa and 19 individuals, including four molluscs, one polychaete and one echinoderm. Station FE2_04 comprised two individuals, represented by the polychaete *Nephtys cirrosa* and the isopod *Eurydice spinigera*, resulting in this station having equal percentages of Annelida and Arthropoda.

Arthropoda were recorded at 14 stations and Molluscs at 15 stations, both having highest mean percentage contributions to taxa composition at stations in the south array

(Figure 4.13). However, analysis of the species list indicated that this was associated with generally low numbers of taxa from all phyla at these stations.

Annelida comprised also most of the enumerated macrofaunal abundance (59.0 %), followed by Echinodermata (16.1 %), Arthropoda (10.3 %) and Mollusca (8.8 %), whereas other phyla comprised 5.9 % of the enumerated faunal abundance (Table 4.12).

When assessed on a station basis, a pattern similar to that for the taxa composition was recorded (Figure 4.13).

4.4.1.2 Community Statistics

Table 4.13 presents the results of the univariate analysis of the enumerated macrofaunal dataset, which provided information on faunal richness and diversity and allow contextualising the results within the geographical context of the study area. Univariate indices included faunal richness (Margalef's index d), diversity (Shannon-Wiener Index H'Log_2), evenness (Pielou's index J') and dominance (Simpson's index λ).

The number of taxa ranged from 2 (station FE2_04) to 74 (station FE1_02), with a mean of 24 and a median of 17 across the VE main array survey area. c

The number of individuals ranged from 2 (station FE2_04) to 256 (station FE1_02) with a mean of 71 and a median of 36 across the VE survey area. Stations in the south array had the highest variation of faunal abundance, with a range of 2 to 172 individuals per station. High variation of faunal abundance was also recorded in the north array, with a range of 6 to 256 individuals per stations. Conversely, stations along the interconnector had the lowest variation with a range of 43 to 172 individuals per stations.

Values of richness reflected the number of individual per taxa recorded, with values ranging from 1.44 (station FE2_04) to 13.2 (station FE1_02) with a mean of 5.38 and a median of 4.74 across the VE main array survey area.

The Shannon-Wiener Diversity, assessed in line with the Dauvin et al., (2012) criteria (details in Section 3.3.3), was:

- high (H'Log_2 > 4.00) at 5 stations;
- good (H'Log_2 of 3.00 to 4.00) at 7 stations;
- moderate (H'Log_2 of 2.00 to 3.00) at 4 stations;
- poor (H'Log_2 of 1.00 to 2.00) at 1 station.

On average the diversity was good at stations in the north array (range of 2.58 to 5.51) and along the interconnector (range of 3.23 to 4.70) and moderate at stations in south array (range 1.00 to 4.82).

The evenness ranged from 0.734 (station FE1_04) to 1.000 (stations FE1_07, FE2_03 and FE2_04) with a mean of 0.885 and a median of 0.892 across the VE main array survey area. Stations FE1_07, FE2_03 and FE2_04 comprised one individual for each taxon recorded, which

resulted in the highest possible evenness value (J' = 1.000). High value of evenness (J' ≥ 0.900) were recorded at four stations which were characterised by low number of individuals relative to the taxa recorded.

In general, values of dominance were inversely related to those of evenness, so that low values of evenness corresponded to high values of dominance and vice-versa as it would be expected.

Table 4.13: Community statistics of enumerated fauna (0.1 m^2), Five Estuaries Offshore Site Investigation

Station	Numbers		Richness	Diversity	Evenness	Dominance
	Taxa	Individuals	Margalef [d]	Shannon-Wiener [H'Log$_2$]	Pielou [J']	Simpson [λ]
North Array						
FE1_01	44	130	8.83	4.54	0.832	0.081
FE1_02	74	256	13.2	5.51	0.887	0.033
FE1_03	11	18	3.46	3.09	0.892	0.160
FE1_04	41	120	8.36	3.93	0.734	0.181
FE1_05	9	14	3.03	3.04	0.959	0.133
FE1_06	24	66	5.49	4.21	0.918	0.066
FE1_07	6	6	2.79	2.58	1.000	0.167
FE1_08	18	36	4.74	3.93	0.943	0.076
South Array						
FE2_01	16	23	4.78	3.68	0.919	0.108
FE2_02	9	14	3.03	2.84	0.894	0.184
FE2_03	4	4	2.16	2.00	1.000	0.250
FE2_04	2	2	1.44	1.00	1.000	0.500
FE2_05	7	19	2.04	2.14	0.761	0.307
FE2_06	47	172	8.94	4.82	0.868	0.053
Interconnector						
FE3_01	30	113	6.13	3.92	0.799	0.124
FE3_02	17	43	4.25	3.23	0.789	0.201
FE3_03	46	172	8.74	4.70	0.851	0.061
Minimum	**2**	**2**	**1.44**	**1.00**	**0.734**	**0.033**
Maximum	**74**	**256**	**13.2**	**5.51**	**1.000**	**0.500**
Median	**17**	**36**	**4.74**	**3.68**	**0.892**	**0.133**
Mean	**24**	**71**	**5.38**	**3.48**	**0.885**	**0.158**
Standard Deviation	**20**	**76**	**3.22**	**1.16**	**0.083**	**0.115**

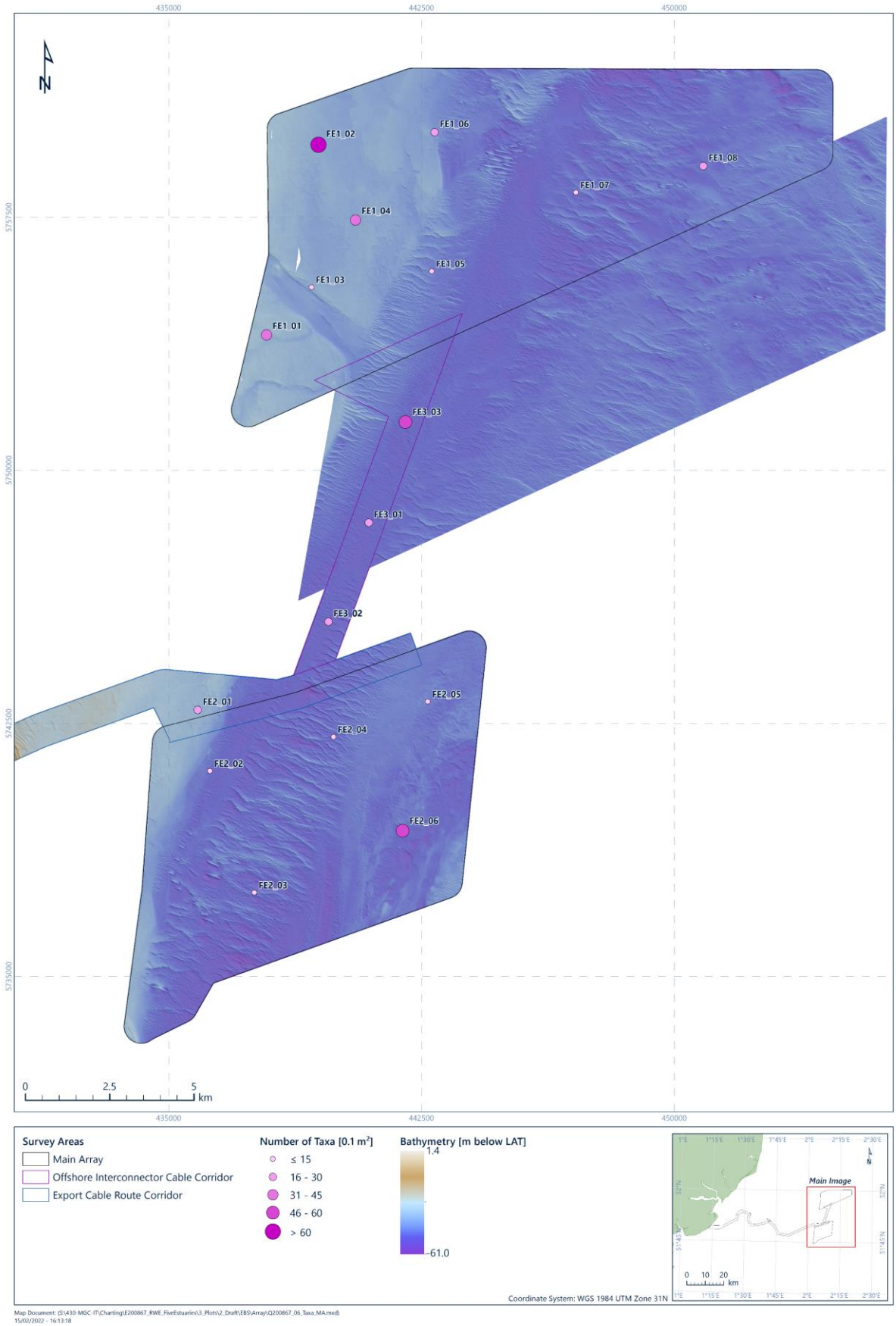


Figure 4.14: Number of macrofaunal taxa (0.1 m^2), main array, Five Estuaries Offshore Site Investigation

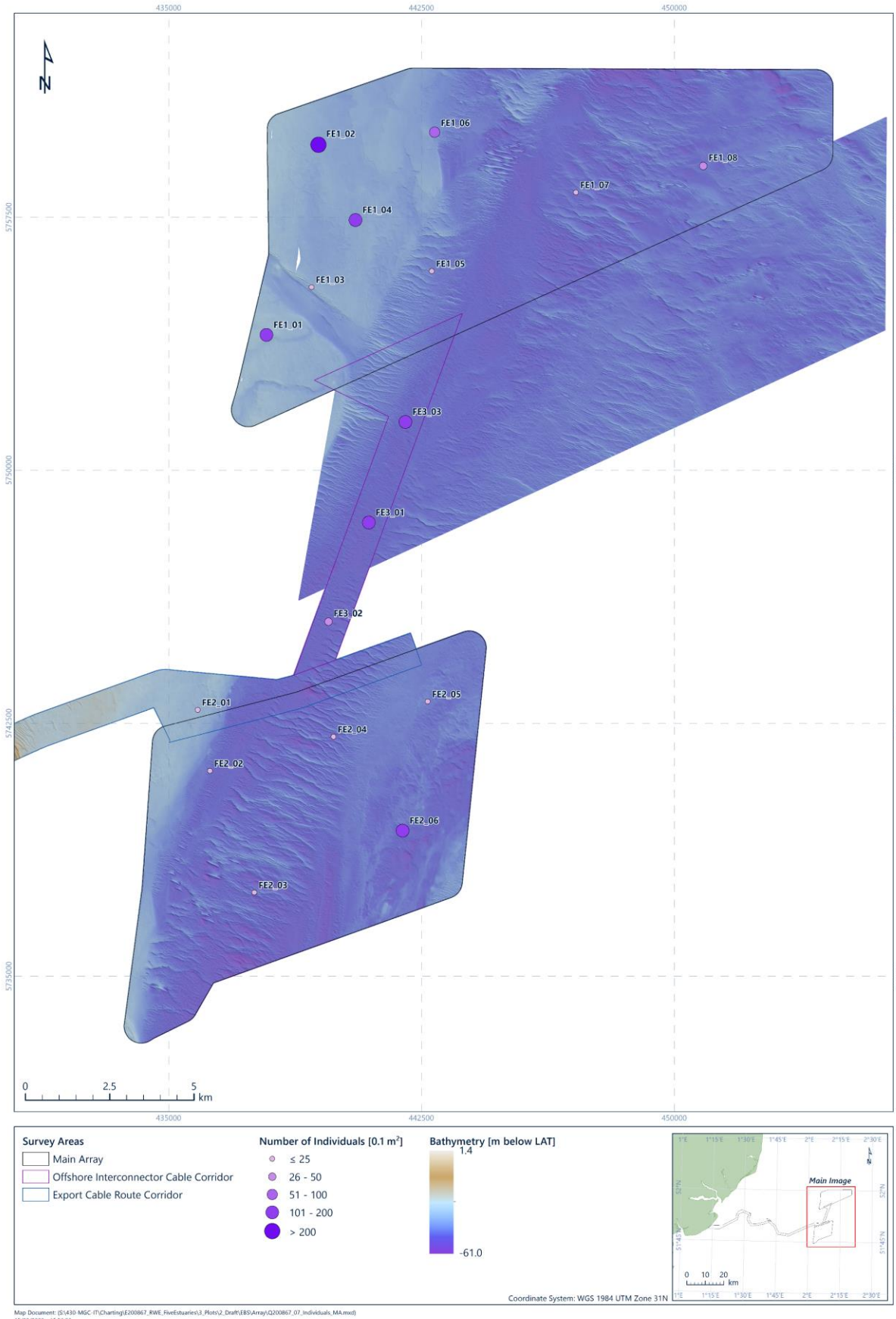


Figure 4.15: Number of macrofaunal individuals (0.1 m^2), main array, Five Estuaries Offshore Site Investigation

4.4.1.3 Investigation of Faunal Similarities

The enumerated macrofaunal dataset was transformed prior to multivariate analysis. A fourth root transformation provided the best assessment, down weighting the numerically dominant species and allowing more detailed interrogation of less abundant taxa and the underlying community.

Faunal similarities were investigated using the hierarchical clustering analysis, results of which are in Figures 4.16 and 4.17 . The SIMPROF test, undertaken in conjunction with the cluster analysis, was interpreted in ecological terms and, where appropriate, coarser groups were created (see Section 3.3.5).

Four groups of samples were identified at a similarity of 19 %. Of these, group C was split into further two groups at a similarity of 33 %.

The nMDS representation has a relatively high stress coefficient (details in Section 3.3.5), however, there is good correspondence between dendrogram and nMDS and as such the nMDS is deemed representative of the stations' two-dimensional ordination.

The groups identified through the multivariate analysis were further assessed by means of the SIMPER analysis. Table 4.14 presents the top ten characterising taxa identified through the SIMPER analysis along with a summary of the physical variables characterising each multivariate group; the average abundance of the characterising taxa refers to untransformed data.

Figure 4.18 presents the nMDS of hierarchical clustering analysis with superimposed multivariate groups and circles proportional in diameter to the abundance of taxa responsible for the separations of the multivariate groups.

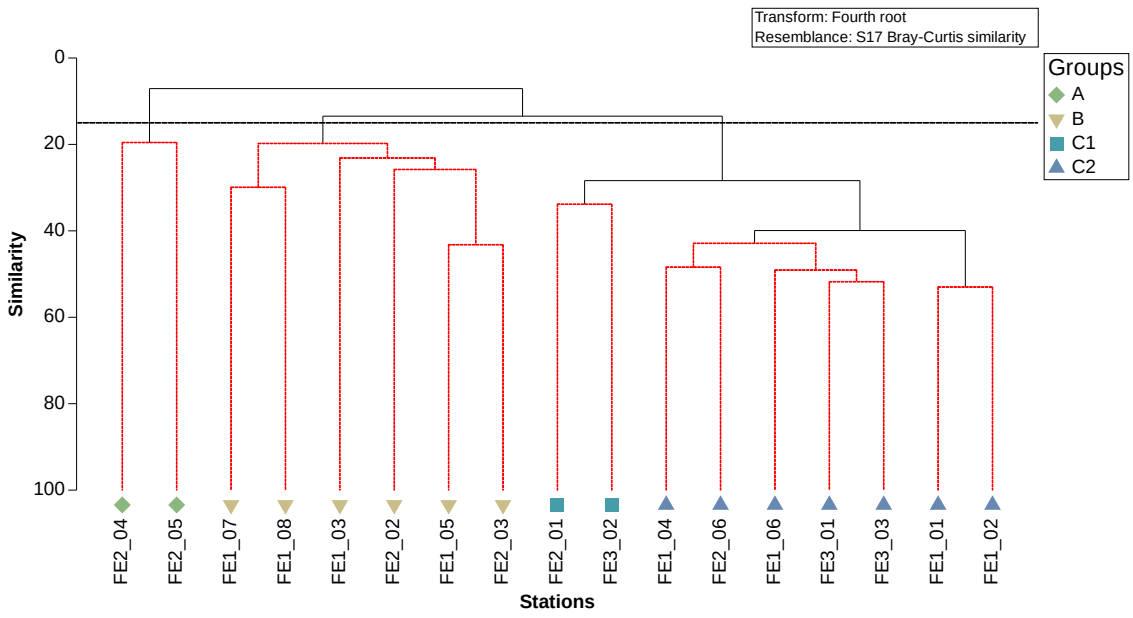


Figure 4.16: Dendrogram of hierarchical clustering analysis of enumerated fauna, main array, Five Estuaries Offshore Site Investigation

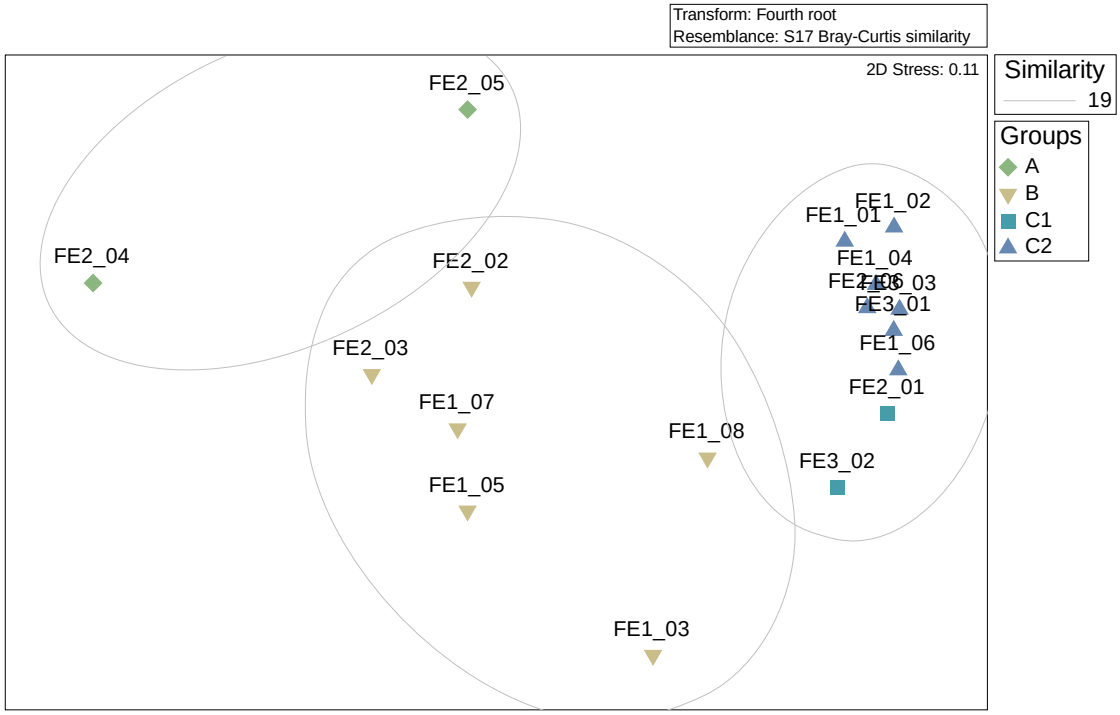


Figure 4.17: nMDS of hierarchical clustering analysis of enumerated fauna, main array, Five Estuaries Offshore Site Investigation

Group A comprised two stations from the south array and had an average similarity of 19.6 %. It was characterised by moderately well sorted 'sand' (Folk BGS modified), with mean median sediment particle size of 526 µm (coarse sand), in mean water depth of 48.0 m BSL. Group A had mean numbers of 5 taxa and 11 individuals, of which the polychaete *Nephtys cirrosa* was recorded at both stations. The other invertebrates included *Eurydice spinigera* at station FE2_04 and *Gastrosaccus spinifer*, *Goodallia triangularis*, *Glycymeris glycymeris*, *Euspira nitida*, *Asbjornsenia pygmaea* and *Echinocyamus pusillus* at station FE2_05.

Group B comprised six stations, including four from the north array and two from the south array and had an average similarity of 23.5 %. It was characterised by poorly sorted 'gravelly sand' (Folk BGS modified), with mean median sediment particle size of 640 µm (coarse sand), in mean water depth of 47.3 m BSL. Group B had mean numbers of 10 taxa and 15 individuals of which bivalves (*Spisula elliptica* and *G. triangularis*), polychaetes (*Aonides paucibranchiata*, *Glycera oxycephala*, *N. cirrosa*, *Notomastus*, *Glycera lapidum*, *Pholoe baltica* and *Pisione remota*) and Nemertea were amongst the characterising taxa.

Group C1 comprised two stations, one from the south array and one from the interconnector and had an average similarity of 33.8 %. It was characterised by very poorly sorted 'sandy gravel' (Folk BGS modified), with mean median sediment particle size of 12 125 µm (medium pebble), in mean water depth of 43.5 m BSL. Group C1 had mean numbers of 17 taxa and 33 individuals, of which polychaetes (*A. paucibranchiata*, *Syllis garciai*, *Lumbrineris* cf. *cingulata*),

bivalves (*G. glycymeris*) and echinoderms (*Ophiura albida* and *E. pusillus*) were the characterising taxa.

Group C2 comprised seven stations, including four from the north array, one from the south array and two from the interconnector and had an average similarity of 43.2 %. It was characterised by very poorly sorted mixed sediment, with mean median sediment particle size of 2752 µm (granule) in mean water depth of 44.3 m BSL. Group C2 had mean numbers of 44 taxa and 147 individuals, of which polychaetes (*L.* cf. *cingulata*, *P. baltica*, *G. lapidum*, *Scalibregma inflatum* and *Spirobranchus lamarcki*), crustacean amphipods (*Ampelisca spinipes*), echinoderms (*E. pusillus*, *Amphipholis squamata* and *O. albida*) and Nemertea were amongst the characterising taxa.

Taxa responsible for the separation of groups included (but were not limited to) *L.* cf. *cingulata*, *S. inflatum*, *S. lamarcki* and *O. albida* (Figure 4.18).

The combination of physical variables (percentages of sediment fractions and depth) that best explained the observed pattern of macrofaunal distribution included percentages of medium gravel, fine gravel and fine silt, as identified through the BIOENV analysis, which returned the highest value of rho of 0.666 at a significance level of 1 % for this combination of variables.

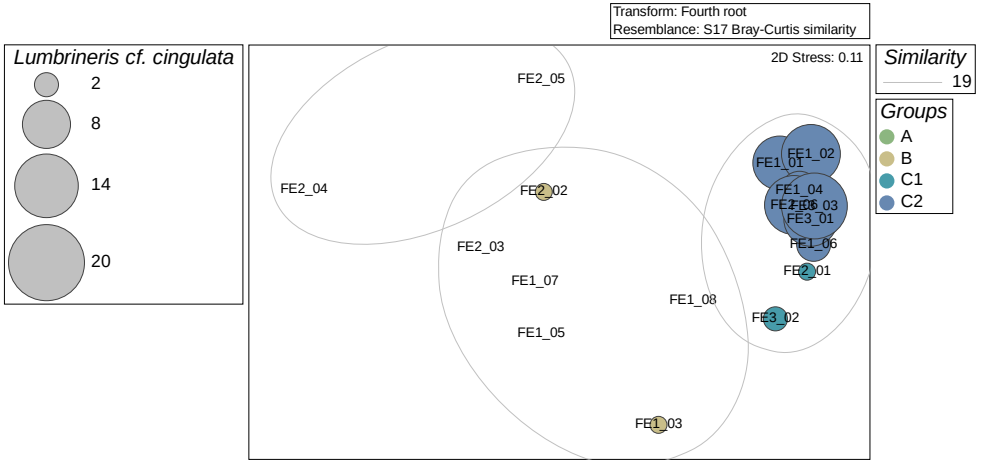
Figure 4.19 illustrates the relationships between sediment type and macrofauna, highlighting an increase in enumerated faunal diversity ($H'Log_2$) with increased sediment coarseness and heterogeneity.

Table 4.14: Summary of attributes of multivariate groups of enumerated macrofauna, Five Estuaries Offshore Site Investigation

Group	Location and Station	Characterising Features	Characterising Taxa	Abundance [N]	Frequency [%]	Contribution to Similarity [%]
A Average similarity: 19.6 %	South Array (FE2_04, FE2_05)	Taxa: 5 Individuals: 11 Depth [m BSL]: 48.0 Gravel [%]: 1.33 Sand [%]: 98.67 Fines [%]: 0.00 Median [µm]: 526 Sorting [µm]: 1.45	*Nephtys cirrosa*	1	100	100
B Average similarity: 23.5 %	North Array (FE1_03, FE1_05, FE1_07, FE1_08) South Array (FE2_02, FE2_03)	Taxa: 10 Individuals: 15 Depth [m BSL]: 47.3 Gravel [%]: 16.29 Sand [%]: 83.71 Fines [%]: 0.00 Median [µm]: 640 Sorting [µm]: 2.53	*Spisula elliptica*	0.8	66.7	15.9
			Aonides paucibranchiata	0.7	66.7	15.1
			Glycera oxycephala	0.7	50.0	13.3
			Nephtys cirrosa	1.3	50.0	11.7
			Notomastus	0.8	50.0	10.3
			Goodallia triangularis	0.5	50.0	7.6
			Glycera lapidum	0.8	50.0	6.2
			Nemertea	1.2	50.0	6.2
			Pholoe baltica	0.3	33.3	4.2
			Pisione remota	0.7	33.3	3.1
C1 Average similarity: 33.8 %	South Array (FE2_01) Interconnector (FE3_02)	Taxa: 17 Individuals: 33 Depth [m BSL]: 43.5 Gravel [%]: 69.03 Sand [%]: 27.97 Fines [%]: 3.00 Median [µm]: 12 125 Sorting [µm]: 6.36	*Aonides paucibranchiata*	2.5	100	19.2
			Syllis garciai	1.0	100	16.2
			Lumbrineris cf. cingulata	1.5	100	16.2
			Glycymeris glycymeris	1.5	100	16.2
			Ophiura albida	3.5	100	16.2
			Echinocyamus pusillus	2.0	100	16.2

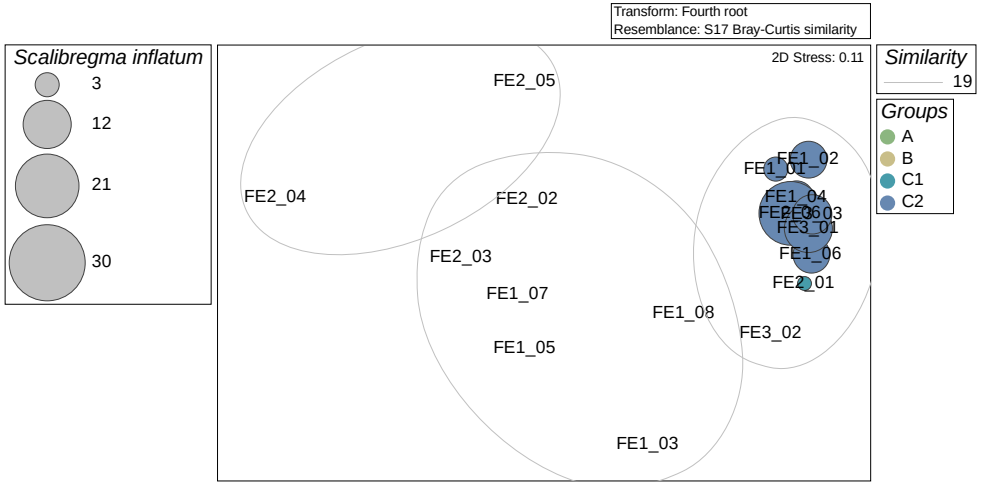
Group	Location and Station	Characterising Features	Characterising Taxa	Abundance [N]	Frequency [%]	Contribution to Similarity [%]
C2 ▲ Average similarity: 43.2 %	North Array (FE1_01, FE1_02, FE1_04, FE1_06) South Array (FE2_06) Interconnector (FE3_01, FE3_03)	Taxa: 44 Individuals: 147 Depth [m BSL]: 44.3 Gravel [%]: 40.53 Sand [%]: 49.61 Fines [%]: 9.86 Median [µm]: Sorting [µm]:	*Lumbrineris* cf. *cingulata*	9.7	100	7.2
			Ophiura albida	17	100	7.2
			Scalibregma inflatum	9.1	100	7.0
			Echinocyamus pusillus	4.7	100	5.9
			Pholoe baltica	3.0	100	5.0
			Nemertea	2.4	100	4.9
			Spirobranchus lamarcki	13	85.7	4.8
			Amphipholis squamata	3.0	85.7	3.9
			Glycera lapidum	3.0	85.7	3.8
			Ampelisca spinipes	3.6	85.7	3.5

Notes
Values refer to mean of untransformed data within each multivariate group
Frequency refers to number of stations within each multivariate group
Taxa listed are the top ten identified by the SIMPER analysis (100 % percentage contribution)
Taxa listed in decreasing order of percentage contribution to similarity
BSL = Below sea level



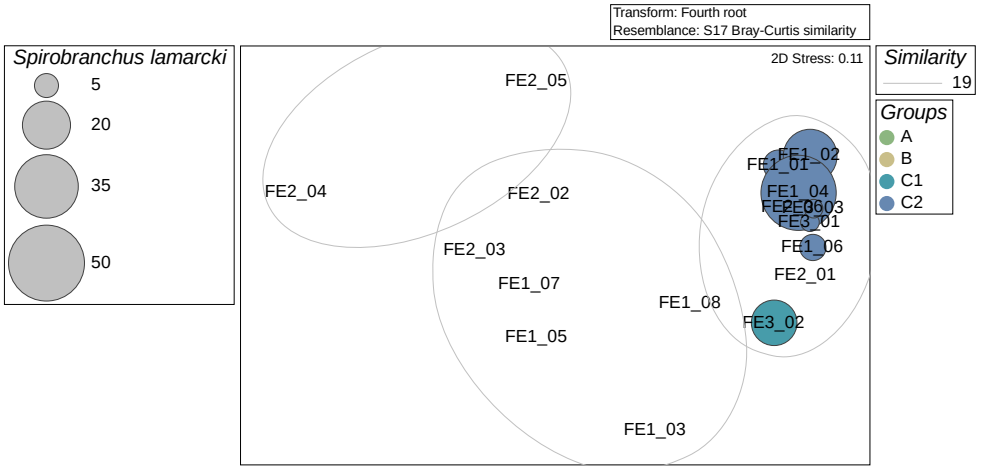
Notes

Circles proportional in diameter to the abundance of *Lumbrineris* cf. *cingulata*



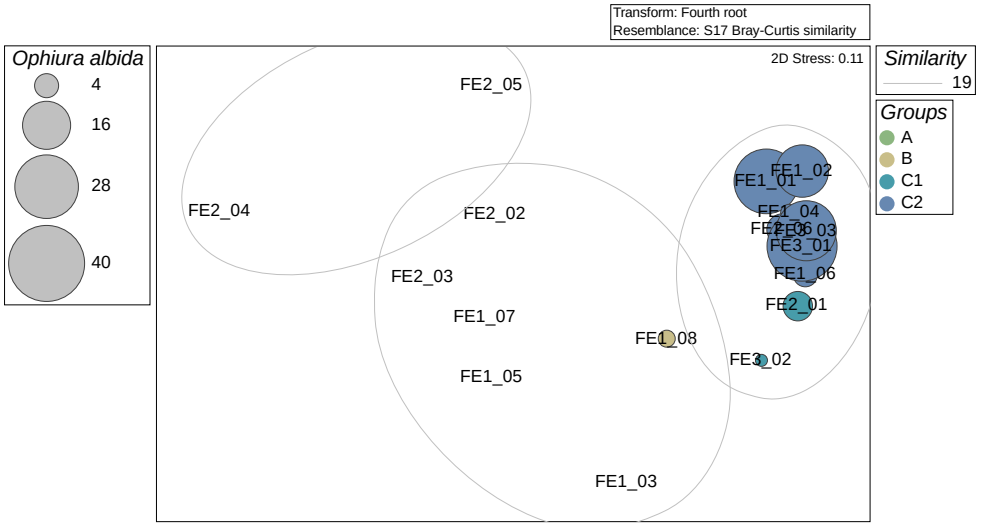
Notes

Circles proportional in diameter to the abundance of *Scalibregma inflatum*



Notes

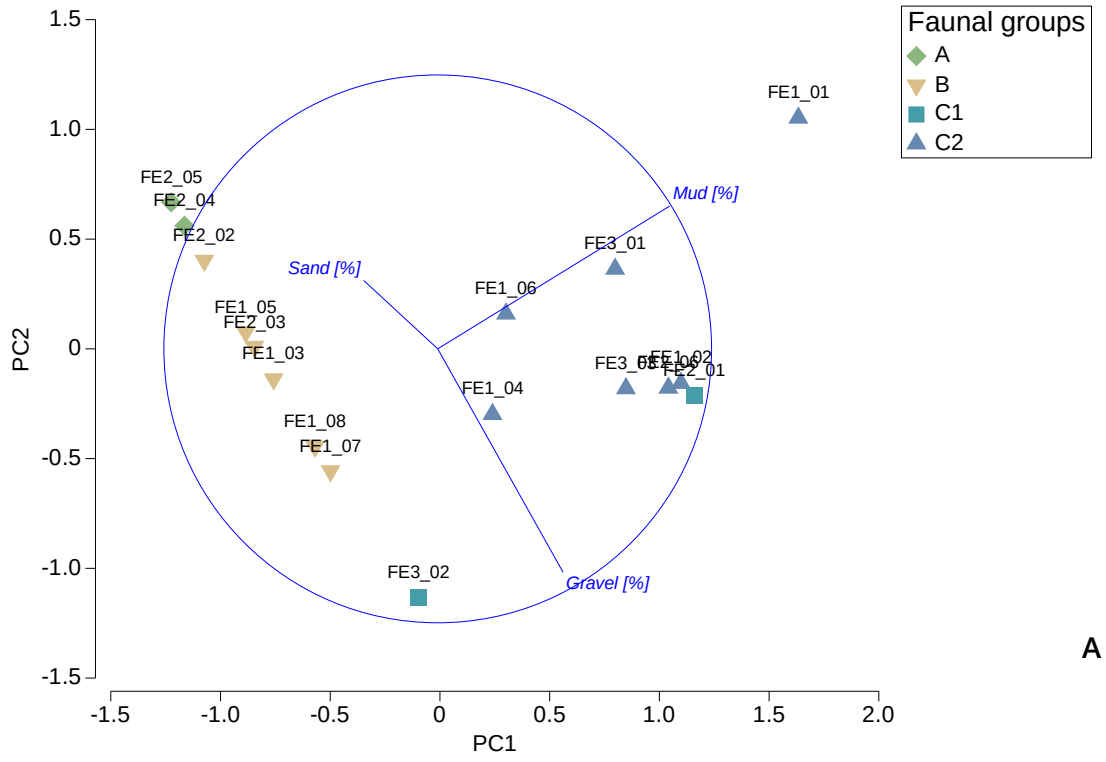
Circles proportional in diameter to the abundance of *Spirobranchus lamarcki*



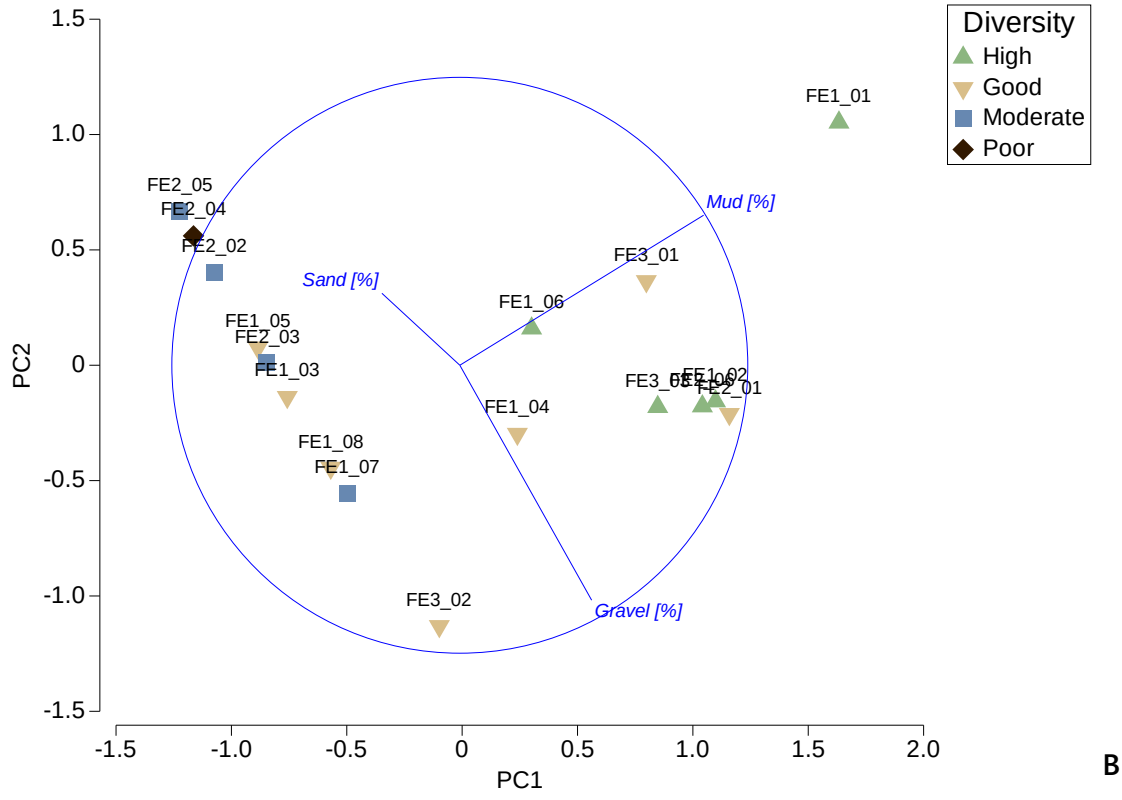
Notes

Circles proportional in diameter to the abundance of *Ophiura albida*

Figure 4.18: nMDS of hierarchical clustering analysis with superimposed multivariate groups and circles proportional in diameter to the abundance of taxa responsible for the separations of groups, Five Estuaries Offshore Site Investigation



A



B

Notes
PC = Principal component

Figure 4.19: 2D PCA of sediment composition with superimposed survey blocks and macrofaunal (A) multivariate groups and (B) Shannon-Wiener [H'Log$_2$] index of diversity, main array, Five Estuaries Offshore Site Investigation

4.4.1.4 Biomass

Table 4.15 presents the percentage contribution of phyla to biomass across the VE array survey area. It is worth noting that the biomass of Arthropoda comprises only invertebrates of the subphylum Crustacea. The biomass of the Arthropoda subphylum Chelicerata is reported within the biomass of other phyla. Table 4.16 presents the biomass of major taxonomic groups at each station. Figure 4.20 presents the phyletic composition of the biomass at each station and Figure 4.21 presents the association of biomass with sediment type highlighting higher values of biomass in more diverse sediments. Figure 4.22 presents the spatial variations of the total macrofaunal biomass across the survey area. Appendix F presents the raw data.

Table 4.15: Taxonomic groups of macrofaunal biomass, main array, Five Estuaries Offshore Site Investigation

Phylum	Biomass [AFDW g/0.1 m^2]	Biomass [%]
Annelida	3.5138	41.6
Arthropoda	1.5455	18.3
Mollusca	1.0210	12.1
Echinodermata	2.3475	27.8
Other phyla	0.0090	0.1
Total	**8.4368**	**100**

Notes
Annelida comprised Oligochaeta and Polychaeta
Other phyla included: Actiniaria, Chelicerata, Nemertea, Phoronida, Platyhelminthes
Arthropoda comprises only invertebrates of the subphylum Crustacea

Annelida comprised most of the macrofaunal biomass (41.6 %), followed by Echinodermata (27.8 %), Arthropoda (18.3 %) and Molluscs (12.1 %), whereas other phyla comprised 0.1 % of the macrofaunal biomass.

The total biomass ranged from 0.0031 AFDW g/0.1m^2 (station FE2_04) to 1.8608 AFDW g/0.1 m^2 (station FE1_02) with a mean of 0.4963 AFDW g/0.1 m^2 and a median of 0.2699 AFDW g/0.1 m^2.

The high value of biomass at station FE1_02 was associated with Annelida and Mollusca, which comprised 55.4 % and 14.9 %, respectively, of the faunal abundance (details in Section 4.4.1.1). Analysis of the species list indicated that the molluscs biomass at this station was associated with abundance of bivalves such as *K. bidentata* and the presence of large species, notably *Aequipecten opercularis*.

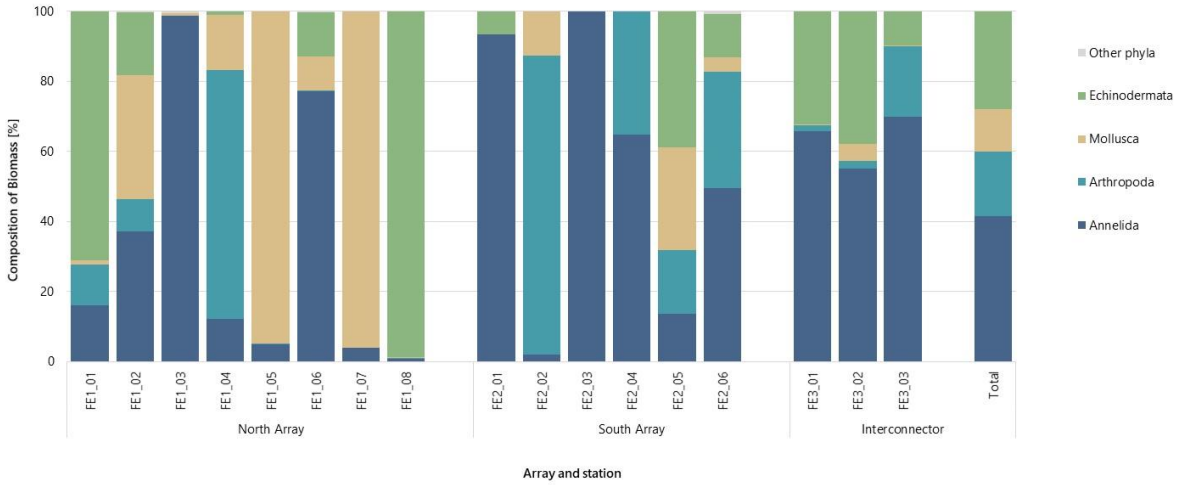
When assessed on a station basis, results indicated that the biomass of most phyla were associated with the abundance (see in Section 4.4.1.1), as well as the presence of large taxa, notably the echinoderms *Psammechinus miliaris* and *E. pusillus* at station FE1_01. At station FE1_08, the high percentage contribution of Echinodermata to the biomass was associated with *Amphipholis squamata* and *Ophiura albida* and the relatively low species richness and

abundance at this station, which comprised 18 taxa and 36 individuals (details in Section 4.4.1.1).

Table 4.16: Phyletic composition of macrofaunal biomass, Five Estuaries Offshore Site Investigation

Station	Biomass					
	Annelida	Arthropoda	Mollusca	Echinodermata	Other Phyla	Total
North Array						
FE1_01	0.1012	0.0723	0.0087	0.4447	0.0007	**0.6276**
FE1_02	0.6899	0.1754	0.6581	0.3339	0.0035	**1.8608**
FE1_03	0.0183	0.0000	0.0001	0.0000	0.0001	**0.0185**
FE1_04	0.1039	0.6036	0.1328	0.0095	0.0001	**0.8497**
FE1_05	0.0054	0.0001	0.1020	0.0001	0.0000	**0.1077**
FE1_06	0.1905	0.0005	0.0239	0.0312	0.0005	**0.2466**
FE1_07	0.0013	0.0000	0.0299	0.0000	0.0000	**0.0312**
FE1_08	0.0077	0.0022	0.0033	0.9946	0.0006	**1.0084**
South Array						
FE2_01	0.4453	0.0004	0.0002	0.0313	0.0000	**0.4772**
FE2_02	0.0058	0.2316	0.0345	0.0000	0.0000	**0.2718**
FE2_03	0.0032	0.0000	0.0000	0.0000	0.0000	**0.0032**
FE2_04	0.0020	0.0011	0.0000	0.0000	0.0000	**0.0031**
FE2_05	0.0027	0.0036	0.0058	0.0077	0.0000	**0.0199**
FE2_06	0.1336	0.0898	0.0111	0.0334	0.0021	**0.2699**
Interconnector						
FE3_01	0.5515	0.0139	0.0028	0.2701	0.0008	**0.8391**
FE3_02	0.0319	0.0012	0.0029	0.0219	0.0000	**0.0578**
FE3_03	1.2197	0.3500	0.0049	0.1691	0.0005	**1.7442**
Minimum	**0.0013**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0031**
Maximum	**1.2197**	**0.6036**	**0.6581**	**0.9946**	**0.0035**	**1.8608**
Median	**0.0319**	**0.0022**	**0.0058**	**0.0219**	**0.0001**	**0.2699**
Mean	**0.2067**	**0.0909**	**0.0601**	**0.1381**	**0.0005**	**0.4963**
Standard deviation	**0.3369**	**0.1666**	**0.1587**	**0.2598**	**0.0009**	**0.5919**

Notes
Biomass expressed as ash free dry weight [AFDW] in g/0.1 m^2 grab sample



Notes
Biomass expressed as ash free dry weight [AFDW] in g/0.1 m^2 grab sample

Figure 4.20: Phyletic composition of macrofaunal biomass, main array, Five Estuaries Offshore Site Investigation

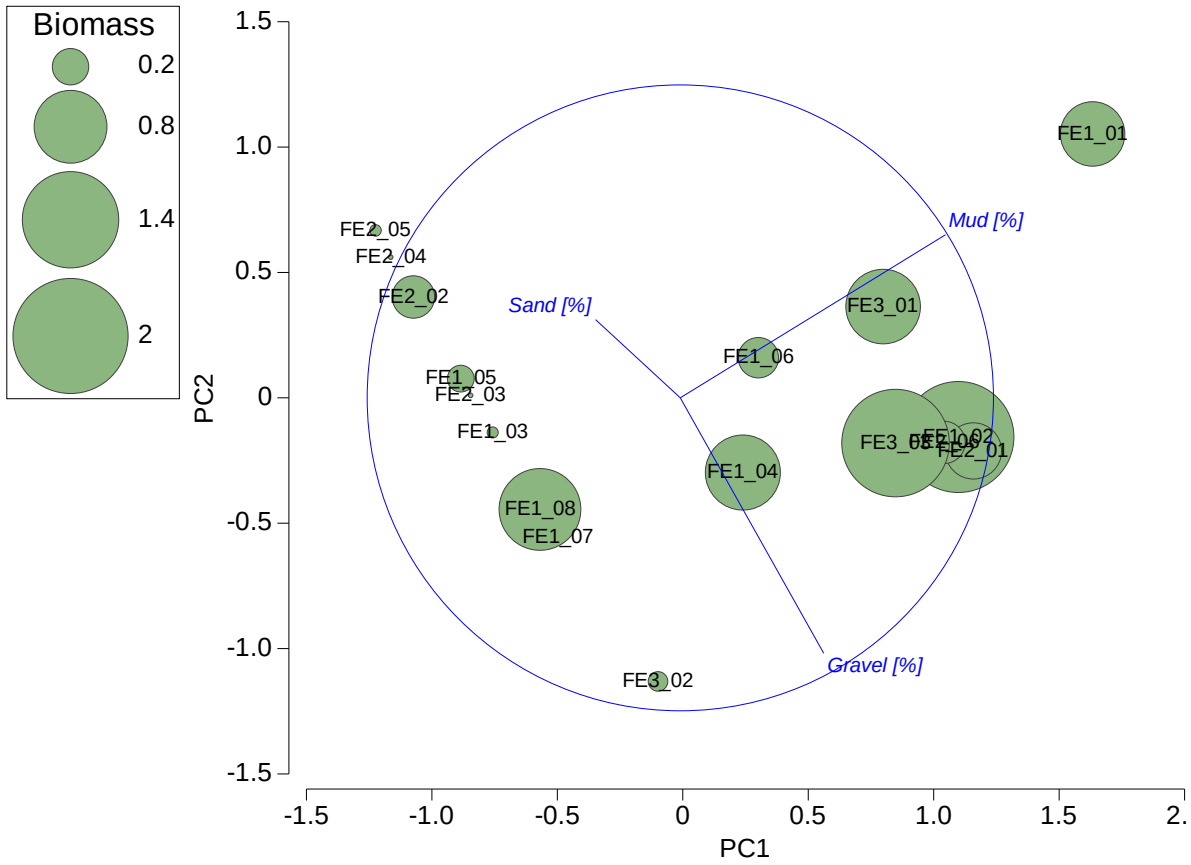
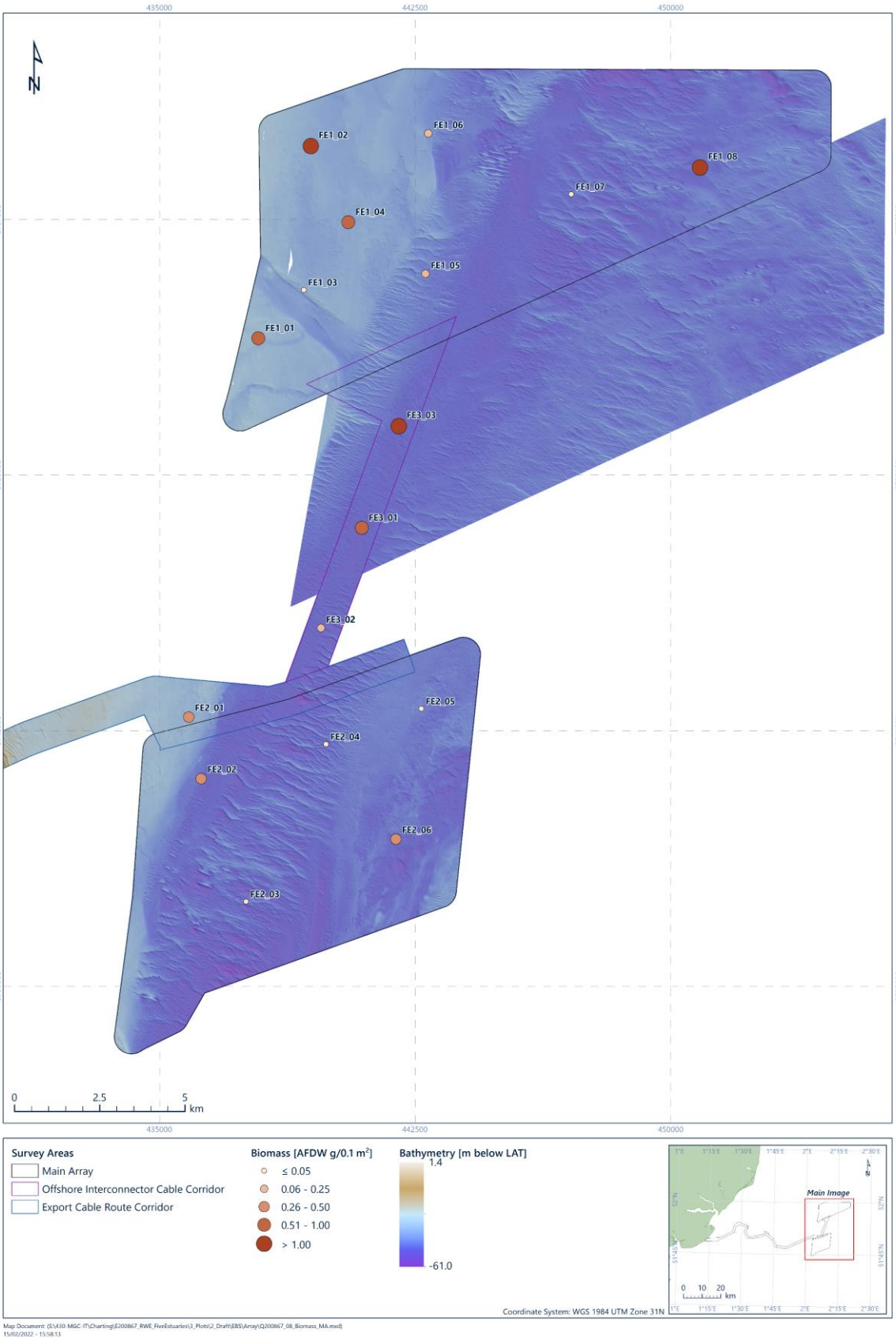


Figure 4.21: 2D PCA of sediment composition with superimposed arrays and circles proportional in diameter to the abundance of macrofaunal biomass expressed as ash free dry weight [AFDW] g/0.1 m^2, main array, Five Estuaries Offshore Site Investigation



Notes

Biomass expressed as ash free dry weight [AFDW] in g/0.1 m^2 grab sample

Figure 4.22: Spatial variation of macrofaunal biomass, main array, Five Estuaries Offshore Site Investigation

4.4.2 Colonial Epifauna

Colonial epifauna was recorded at 15 of the 17 stations sampled. Stations FE2_01 and FE2_05 were devoid of colonial epifauna. These stations were characterised by moderately well sorted 'sand' (Folk BGS modified).

4.4.2.1 Phyletic Composition

Table 4.17 presents the community structure of sessile colonial epifauna and Table 4.18 presents the top ten most frequently occurring colonial epifaunal taxa across the VE main array survey area. Figure 4.23 presents the spatial variations of the number of epifaunal taxa. Figure 4.24 presents the colonial epifauna community structure at single stations and Figure 4.25 illustrates the relationships between sediment type and the occurrence of colonial epifauna.

Table 4.17: Taxonomic groups of colonial epifauna, main array, Five Estuaries Offshore Site Investigation

Taxonomic Group	Number of Taxa	Composition of Taxa [%]
Porifera	2	8.0
Cnidaria	5	20.0
Bryozoa	17	68.0
Other phyla	1	4.0
Total	**25**	**100**

Notes
Macrofaunal samples were processed through a 1 mm sieve
Other phyla included Folliculinidae

Four main phyla of colonial epifauna were recorded at stations across the VE main array; of these, Bryozoa comprised most of the taxa composition (66.7 %), followed by Cnidaria (20.0 %), Porifera (8.0 %) and other phyla (4.0 %) (Table 4.17), the latter being represented by ciliates of the family Folliculinidae.

Folliculinidae were the most frequently occurring. The bryozoans *Aspidelectra melolontha*, *Escharella immersa*, *Disporella hispida* and species of the genus *Schizomavella* and the family Tubuliporidae were amongst the top ten most frequently occurring colonial epifauna, along with the hydroids *Hydrallmania falcata*, *Alcyonium digitatum* and species of the family Sertulariidae. Sponges of the genus *Cliona* (agg.) were also amongst the most frequently occurring colonial epifauna (Table 4.18).

On average, stations in the north array had higher numbers of colonial epifauna, with stations FE1_02 and FE1_01 having 15 and 10 colonial epifaunal taxa, respectively, compared to the remaining stations which had up to seven colonial epifaunal taxa (Figure 4.23). Stations in the north array also had the higher diversity of colonial epifauna (Figure 4.24) likely associated with the coarseness and diversity of the sediment (Figure 4.25).

Table 4.18: Top ten most frequently occurring colonial epifaunal taxa, main array, Five Estuaries Offshore Site Investigation

Taxon	Frequency [%]
Folliculinidae	66.7
Schizomavella	60.0
Aspidelectra melolontha	46.7
Sertulariidae	33.3
Escharella immersa	33.3
Cliona (agg.)	26.7
Hydrallmania falcata	26.7
Disporella hispida	26.7
Alcyonium digitatum	20.0
Tubuliporidae	13.3

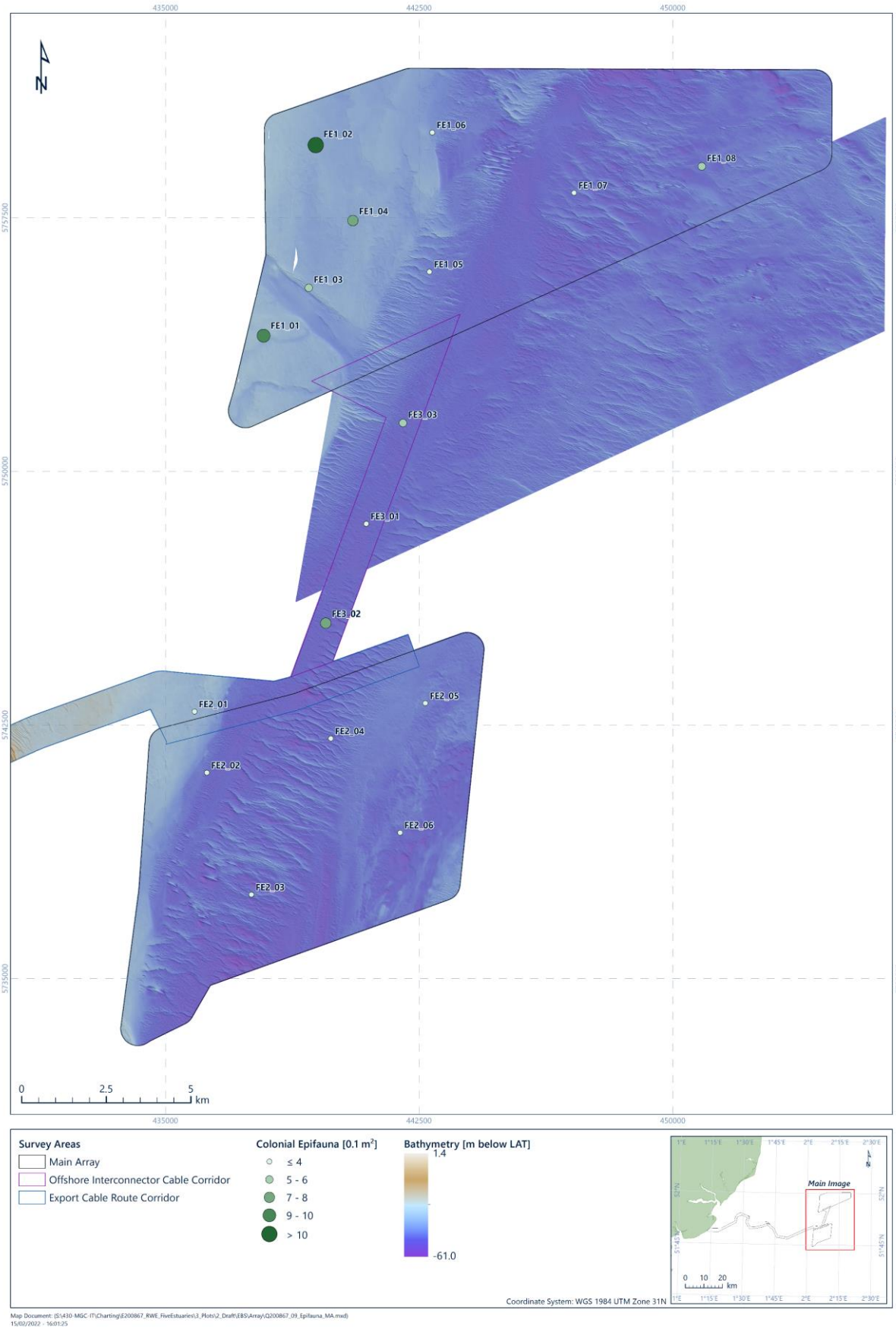


Figure 4.23: Spatial variations of the number of colonial epifauna (0.1 m^2), main array, Five Estuaries Offshore Site Investigation

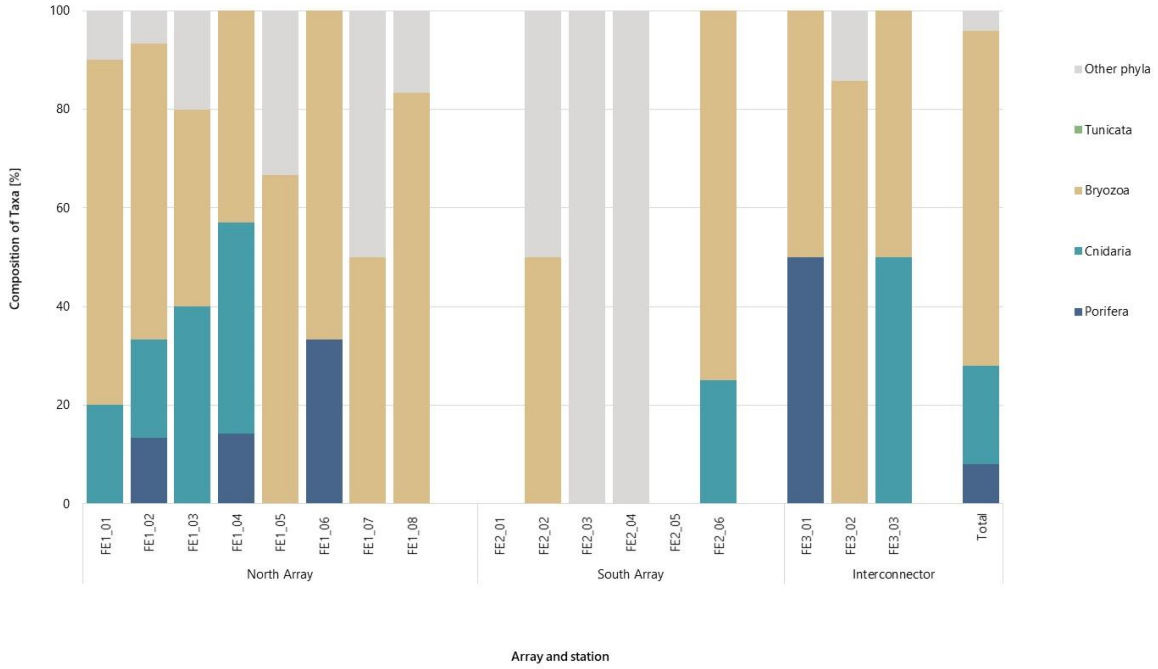
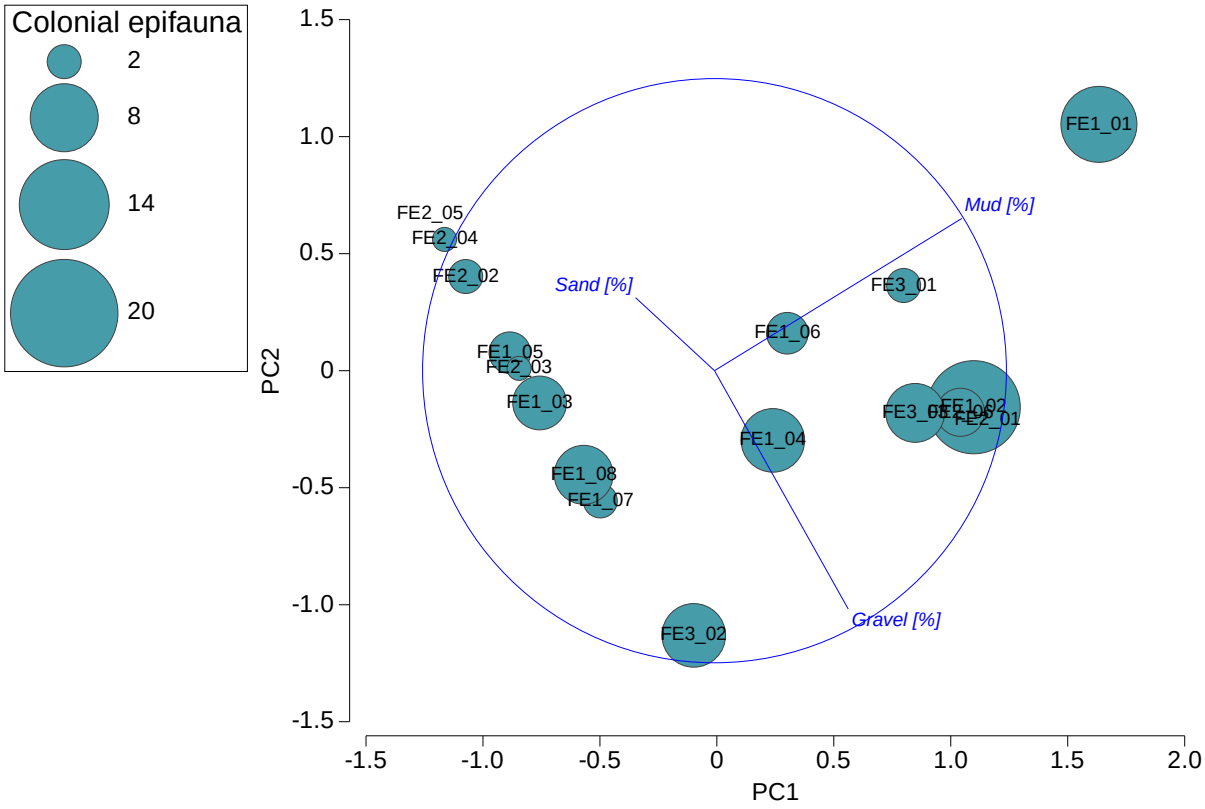


Figure 4.24: Phyletic composition of epifaunal taxa, main array, Five Estuaries Offshore Site Investigation



Notes
PC = Principal component

Figure 4.25: 2D PCA of sediment composition with superimposed circles proportional in diameter to the number of colonial epifauna, main array, Five Estuaries Offshore Site Investigation

4.5 Seabed Habitats and Biotopes

The physical and biological characteristics of the multivariate groups identified through the multivariate analysis of data across the VE main array survey area (Section 4.4.1.3) were evaluated in conjunction with the results of the video and photographic data analysis, detailed in the Environmental Features Report (Fugro 2022a), to provide a comprehensive habitat assessment. The seabed video provides an overview of the seabed over a wider area and can identify isolated features such as cobbles and/or boulders. By comparison, grab sampling provides detailed information of the sediment composition and associated fauna at a single point source and is important for the biotope classification of sedimentary habitats. The average similarity of the multivariate groups ranged from 19.6 % to 43.2 %, therefore, the stations within each multivariate group were assessed also individually when deriving biotopes, which resulted in a combination of biotopes characterising each multivariate group.

Results of the seabed video indicated the presence of the following biotopes and biotope complexes:

- 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231), described as soft chalk or clay in moderately exposed tide-swept conditions, bored by bivalves (EEA, 2019).
  This biotope was assigned to areas of firm clay, amongst areas of mixed sediments, recorded at station FE1_01, in the north array. These firm clay sediments featured round burrows characteristic of piddocks and supported little or no epifauna. Mobile epifauna included the starfish *Asterias rubens*, hermit crabs of the family Paguridae and brittlestars of the class Ophiuroidea including *Ophiura albida*.
- 'Circalittoral coarse sediment' (A5.14), described as coarse sands, gravel and shingle in the circalittoral zone along exposed coasts and offshore. This habitat is characterised by robust infaunal polychaetes, mobile crustacea and bivalves (EEA, 2019).
  This biotope complex was assigned to station FE1_04 in the north array. At this station the geophysical data indicated the presence of mobile sediments owing to presence of ripples, mixed with rough sediments. This was corroborated by the seabed video and photographic data which indicated rippled sands with patches of sandy gravel and cobbles. Epibiota included *A. rubens*, Ophiuroidea including *O. albida*, the sea urchin *P. miliaris* and the queen scallop *A. opercularis*. Low-lying gravel and cobbles, which were subject to sediment disturbance, were colonised by polychaetes tubes of the family Serpulidae including species of *Spirobranchus*. The upper surface of more stable cobbles and pebbles were colonised by encrusting bryozoans, and the soft coral *Alcyonium digitatum*.
- 'Circalittoral mixed sediment' (A5.44), described as habitats in the circalittoral zone featuring mixed sediments including shells, cobbles and pebbles embedded in or lying upon mud, sand or gravel; the variable nature of the seabed results in a variety of biological communities (EEA, 2019).

This biotope complex was assigned to areas of mixed sediments, inclusive of pebbles and cobbles, at stations FE1_01 and FE1_02 in the north array. At station FE1_01 this biotope complex occurred in conjunction with 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231). Epibiota included Ophiuroidea, *A. rubens*, *P. miliaris*, *A. opercularis*, *A. digitatum*, anemones of the genus *Urticina,* faunal turf of Hydrozoa/Bryozoa, and Serpulidae, including *Spirobranchus* sp.

Owing to the presence of cobbles and occasional boulders, three stations in the north array were assessed in relation to the Annex I habitat 'Reef' (geogenic).

The results of the assessments, detailed in the Environmental Feature Report (Fugro, 2022a), are summarised in Table 4.19. Figure 4.26 presents photos representative of areas assessed for potential biogenic and geogenic reef.

All cobbles aggregations were classified as 'Not a reef' owing to a percentage of cobbles < 10 % and an elevation < 64 mm.

Table 4.19: Summary of 'Stony reef' assessment, Five Estuaries Offshore Site Investigation

Station	Length* [m]	% Cover Cobbles and Boulders	Elevation	Epifaunal Coverage	Resemblance to a Stony Reef
FE1_01	69	< 10	< 64 mm	< 80 %	Not a Reef
FE1_02	61	< 10	< 64 mm	< 80 %	Not a Reef
FE1_04	67	< 10	< 64 mm	< 80 %	Not a Reef

Notes
* Refers to section of transect assessed

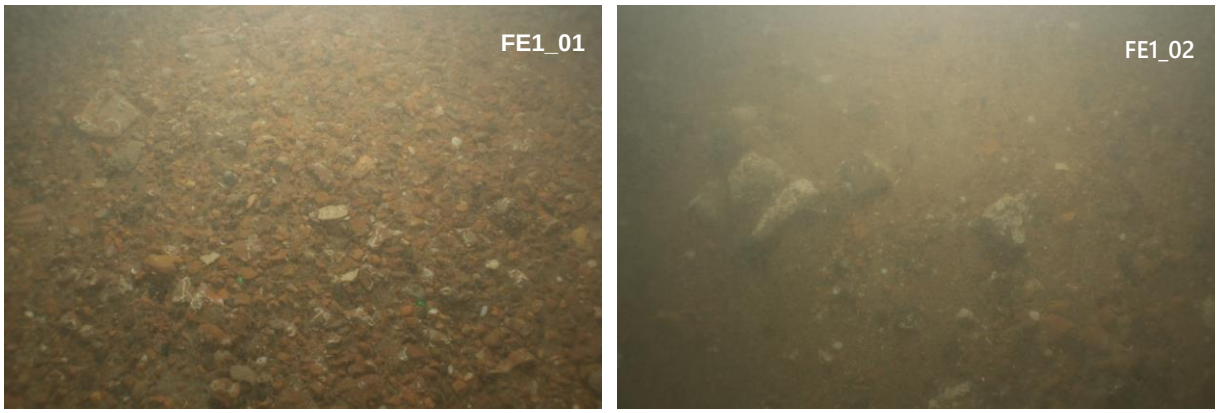


Figure 4.26: Representative photos of habitats assessed for potential Annex I 'Reef' (geogenic), Five Estuaries Offshore Site Investigation

4.5.1 Biotope Classification

Table 4.20 presents the EUNIS hierarchical structure of the habitats and biotopes identified across the VE main array survey area, by integration of the grab samples with the video and photographic data. Reference was also made to the European Marine Observation Data

Network (EMODnet) seabed habitat distribution map (EMODnet, 2022) to verify alignment and/or highlight difference with the available data.

Table 4.21 presents the biotopes identified for each of the multivariate groups (detailed in Section 4.4.1.3).

Table 4.20: Habitat classifications, Five Estuaries Offshore Site Investigation

EUNIS Habitat Classification (EEA, 2019)					Equivalent JNCC (2015) Classification
Environment Level 1	Habitat Complex Level 2	Habitat Level 3	Biotope Complex Level 4	Biotope Level 5	
A Marine	A5 Sublittoral sediment	A5.1 Sublittoral coarse sediment	A5.15 Deep circalittoral coarse sediment	-	SS.SCS.OCS
		A5.2 Sublittoral sand	A5.27 Deep circalittoral sand	-	SS.SSa.OSa
		A5.4 Sublittoral mixed sediment	A5.45 Deep circalittoral mixed sediments	A5.451 Polychaete-rich deep *Venus* community in offshore mixed sediments (A5.451)	SS.SMX.OMx.PoVen

Notes
EEA = European Environment Agency
EUNIS = European Nature Information System
JNCC = Joint Nature Conservation Committee

Table 4.21: Summary of EUNIS habitat classifications, main array, Five Estuaries Offshore Site Investigation

EUNIS Habitat Classification (EEA, 2019)	Multivariate Faunal Group	Sediment description & Depth range	Epibiota (from video and photographs)	Characterising Taxa (from grab samples)		Representative photograph from video and photography
				Infaunal	Epifaunal	
Deep circalittoral sand (A5.27)	A ◆ South Array (FE2_04, FE2_05)	Moderately well sorted (coarse) sand 45 m to 50 m BSL	-	*Nephtys cirrosa*	-	-
Deep circalittoral coarse sediment (A5.15) Deep circalittoral sand (A5.27) Polychaete-rich deep *Venus* community in offshore mixed sediments (A5.451)	B ▼ North Array (FE1_03, FE1_05, FE1_07, FE1_08) South Array (FE2_02, FE2_03)	Poorly sorted gravelly (coarse) sand 48 m to 52 m BSL	-	*Spisula elliptica* *Aonides paucibranchiata* *Glycera oxycephala* *Nephtys cirrosa* *Notomastus* *Goodallia triangularis* *Glycera lapidum* Nemertea *Pholoe baltica* *Pisione remota*	Folliculinidae *Aspidelectra melolontha* *Escharina johnstoni*	-
	C1 ■ South Array (FE2_01) Interconnector (FE3_02)	Very poorly sorted coarse (medium pebble) sediment 37 m to 50 m BSL	-	*Aonides paucibranchiata* *Syllis garciai* *Lumbrineris* cf. *cingulata* *Glycymeris glycymeris* *Ophiura albida* *Echinocyamus pusillus*	Folliculinidae *Disporella hispida* *Conopeum reticulum* *Escharella immersa* *Schizomavella*	-
Deep circalittoral coarse sediment (A5.15) and Polychaete-rich deep *Venus* community in offshore mixed sediments (A5.451)	C2 ▲ North Array (FE1_01, FE1_02, FE1_04, FE1_06) South Array (FE2_06) Interconnector (FE3_01, FE3_03)	Very poorly sorted coarse (granule) sediment 35 m to 52 m BSL	*Aequipecten opercularis* *Alcyonium digitatum* *Asterias rubens* *Psammechinus miliaris* *Spirobranchus* *Ophiura albida* *Calliostoma zizyphinum* Paguridae Sagartiidae *Urticina*	*Lumbrineris* cf. *cingulata* *Ophiura albida* *Scalibregma inflatum* *Echinocyamus pusillus* *Pholoe baltica* Nemertea *Spirobranchus lamarcki* *Amphipholis squamata* *Glycera lapidum* *Ampelisca spinipes*	*Schizomavella* Sertulariidae *Cliona* (agg.) *Escharella immersa* *Hydrallmania falcata* *Alcyonium digitatum* *Disporella hispida* Folliculinidae Tubuliporidae *Aspidelectra melolontha*	

Notes
Multivariate groups identified by hierarchical clustering analysis of enumerated fauna
Sediment classification based on Folk (British Geological Survey [BGS] modified), Description based on Wentworth (1922) scale
Characterising taxa from grab samples are the top ten identified through the similarity percentage analysis [SIMPER]
Epifauna from the grab samples lists the top ten most frequently occurring taxa
BSL = Below sea level
EUNIS = European Nature Information System

4.5.1.1 'Deep circalittoral sands' (A5.27)

The biotope complex 'Deep circalittoral sands' (A5.27) is described as sands or non-cohesive muddy sands (EEA, 2019).

This habitat was assigned to all stations in multivariate group A, and station FE2_02 in multivariate group B. These stations featured moderately well sorted (coarse) sand in water depth of 45 m to 50 m BSL. Stations in this group had no mud content and a gravel content of up to 3.06 %. Faunal richness and abundance were low and represented by the polychaete *N. cirrosa* which was recorded at all stations. Other taxa included the crustaceans *E. spinigera* and *G spinifer*, the molluscs *G. triangularis*, *G. glycymeris*, *A. pygmaea, Abra prismatica* and *E. nitida* and the urchin *E. pusillus*. A single individual of the crab *Thia scutellata* was recorded at station FE2_02.

Colonial epifauna was represented by Ciliophora of the family Folliculinidae.

4.5.1.2 'Deep circalittoral coarse sediment' (A5.15)

The biotope complex 'Deep circalittoral coarse sediment' (A5.15) is described as coarse sand and gravel circalittoral habitats covering large areas of the offshore continental shelf characterised robust infaunal polychaete and bivalve species.

This biotope complex was assigned to all stations in multivariate groups B and station FE3_02 in multivariate group C1, as well as stations FE1_04, FE1_06 and FE3_03 in multivariate group C2. These stations generally featured poorly sorted gravelly sand or sandy gravel, with sediment coarseness ranging from coarse sand to coarse pebble. These stations had higher mean values of faunal richness and abundance than the predominantly sandy stations, with typical taxa including polychaetes such as *L. koreni*, *L.* cf. *cingula*, *A. paucibranchiata*, *S. inflatum*, *Syllis garciai* and species of *Pholoe*, *Glycera* and *Notomastus*; crustacean amphipods such as *Ampelisca spinipes* and species of *Urothoe*; echinoderms such as *O. albida* and *E. pusillus*. Low abundance (< 20 individuals) of the polychaete *S. spinulosa* were recorded at stations FE1_04 and FE3_03.

Colonial epifauna stations included Folliculinidae, bryozoans such as *A. melolontha*, *E. immersa* and *Escharina johnstoni* and species of *Schizomavella*, and hydroids such as *H. falcata* and species of Sertulariidae.

4.5.1.3 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451)

The biotope 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451), is described as a community rich in polychaetes and venerid bivalves. Typical polychaetes include, but are not limited to, *G. lapidum*, *A. paucibranchiata*, *M. fragilis*, *Lumbrineris* and syllid species and bivalves such as *Timoclea ovata* and *Spisula elliptica* (EEA, 2019).

This biotope was assigned to stations FE1_01, FE1_02, FE2_06, in multivariate group C2, station FE2_01 in multivariate group C1 and station FE3_01 in multivariate group C2. These

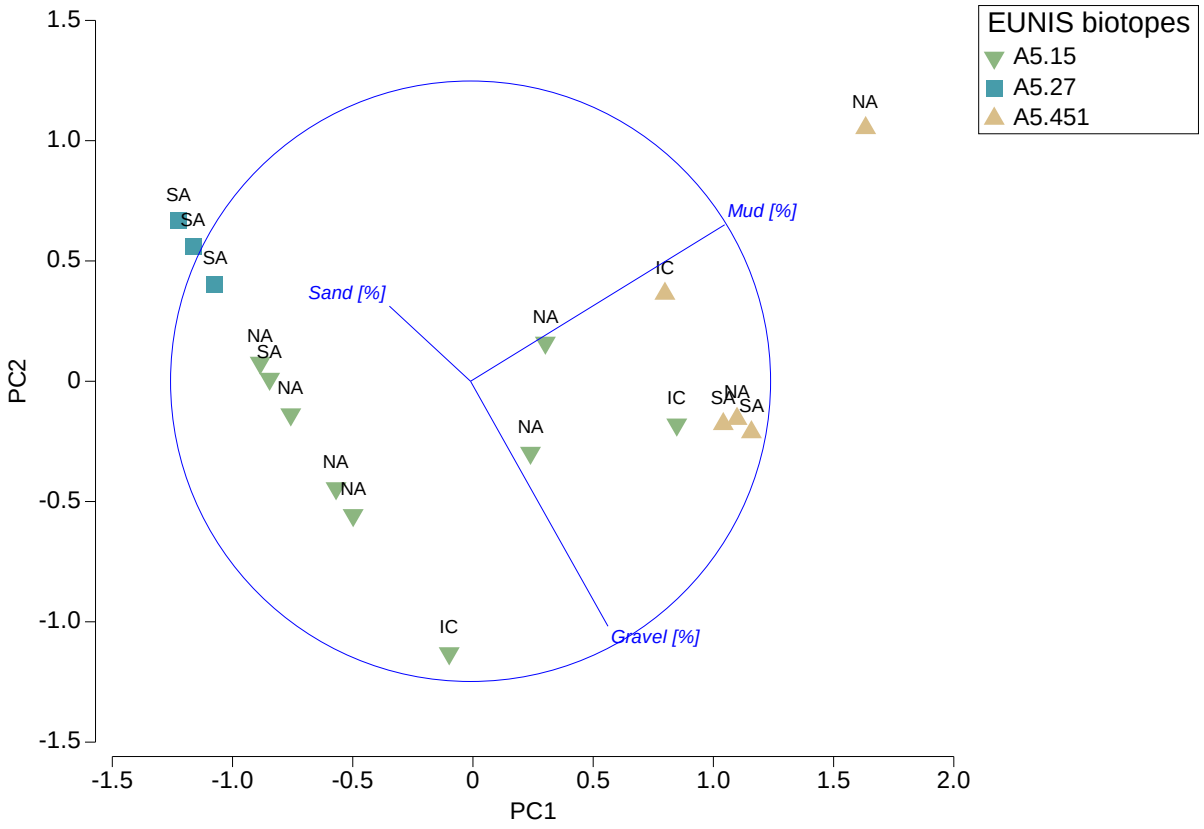
stations featured very poorly to extremely poorly sorted mixed sediments, with typical taxa including polychaetes such as *P. baltica*, *G. lapidum*, *L.* cf. *cingulata*, *Notomastus*, *S. inflatum* and *S. lamarcki*; bivalves such as *Diplodonta* (formerly *Tellina*) *rotundata*, *K .bidentata*, *S. elliptica* and *Abra alba*. The chiton *Leptochiton asellus* was also recorded along with echinoderms such as *O. albida*, *A. squamata*, *E. pusillus* and *P. miliaris* and crustaceans such *A. spinipes*, species of the genera *Ericthonius* and *Jassa* and *P. longicornis*.

Colonial epifauna from the grab samples comprised bryozoans (e.g. *E. immersa*, *D. hispida*, and species of *Schizomavella* and Tubuliporidae) and hydroids (e.g. *A. digitatum* and species of Sertulariidae), many of which were also recorded through the seabed video and photography, as were *Calliostoma zizyphinum*, *A. rubens A. opercularis* species of Paguridae, Sagartiidae and *Urticina*.

4.6 Biotope Classification and Sediment Data

Figure 4.27 illustrates the association between the biotopes recorded and the sediment type and Figure 4.28 illustrates the spatial distribution of biotopes across the VE main array, following extrapolation of single points grab samples based on SSS data.

The predominant biotope complex across the VE main array survey area was 'Deep circalittoral coarse sediment' (A5.15), whereas 'Deep circalittoral sublittoral sand' (A5.27) typified the predominantly sandy habitats in the northern section of the south array. As the proportion of mud increased, the sediment became mixed and the biotope 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451) was assigned to the mixed sediment stations with overall higher faunal richness and diversity.



Notes:
EUNIS = European Nature Information System
IC = Interconnector
NA =North Array
SA = South Array
PC = Principal component
A5.15 = 'Deep circalittoral coarse sediment'
A5.27 = 'Deep circalittoral sublittoral sand'
A5.451 = 'Polychaete-rich deep *Venus* community in offshore mixed sediments'

Figure 4.27: 2D PCA of sediment composition with superimposed locations and EUNIS biotopes, main array, Five Estuaries Offshore Site Investigation

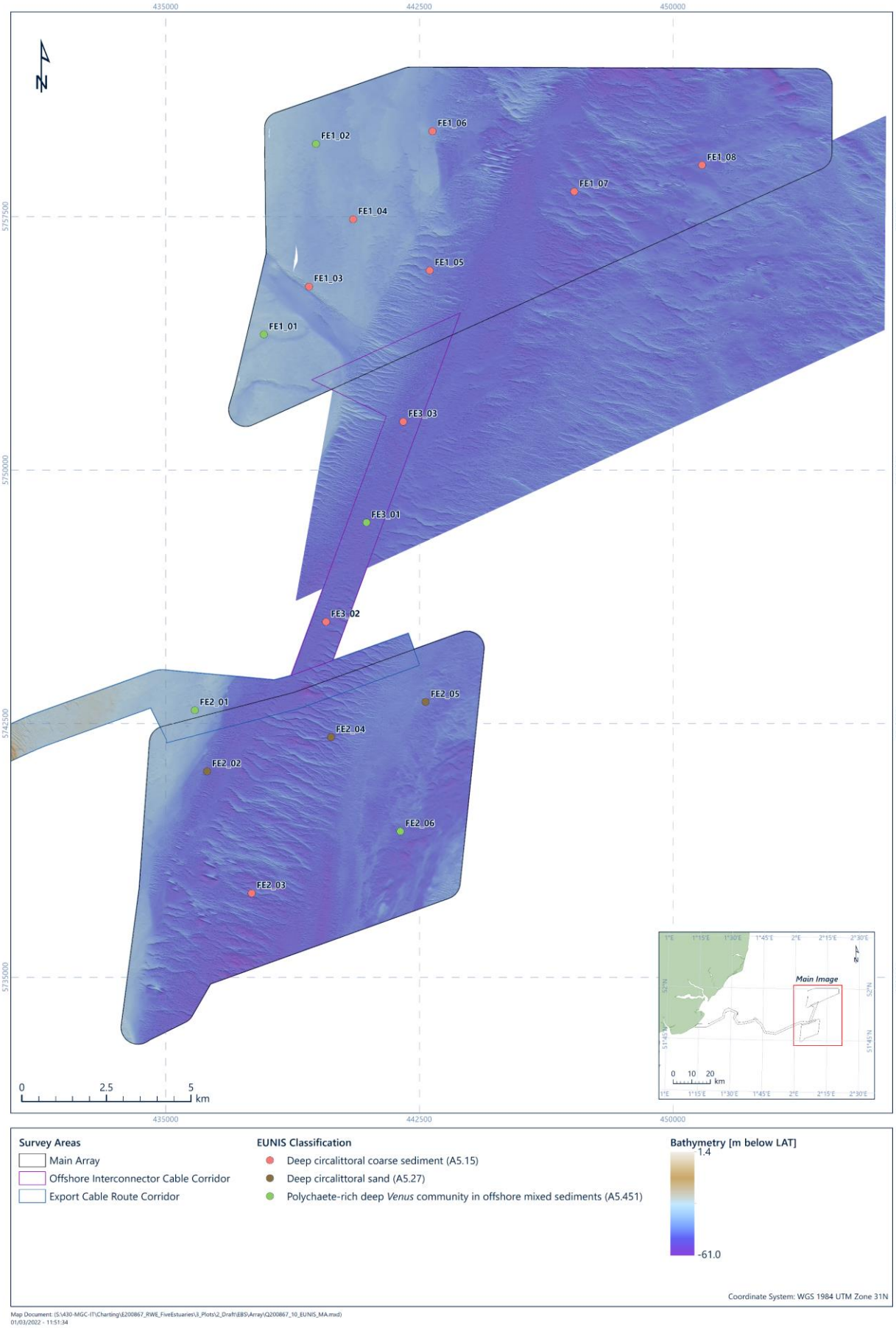


Figure 4.28: Spatial distribution of EUNIS habitats and biotopes, main array, Five Estuaries Offshore Site Investigation

5. Discussion

Physico-chemical and biological analysis of sediment samples provided information for sediment characterisation, potential contamination and biological communities across the VE main array survey area. Data gathered are important components of environmental studies to support engineering design and/or EIA.

5.1 Sediment Characterisation

Results of the seabed video footage described the seabed within the VE main array survey area as sandy muddy gravel with varying proportions of cobbles and shell fragments. Areas of clay with piddock holes were also recorded, as well as areas of rippled sand, the latter being indicative of sediment disturbance associated with hydrodynamics. Large areas of rippled sand and un-cohesive cover comprising superficial sand and/or mud with various proportions of gravel are ubiquitous throughout much of the North Sea (DTI, 2002).

Results of the sediment PSD analysis indicated the presence of coarse sediment comprising mainly sand, the mean content of which was 64.87 %, and, to a lesser extent, gravel, the mean content of which was 30.71 %. A mud content of 47.10 % was recorded at station FE1_01, in the north array, which was high, considering that the mean content of mud across the VE main array survey area was 4.41 % and many stations were devoid of mud. The coarseness of the sediment ranged from 'very fine sand' to 'pebble', with a median in the 'very coarse' sand region, based on the Wentworth (1922) scale. In general, the coarsest sediment was recorded along the interconnector, as indicated by the median sediment particle size.

Five sediment classes were identified using the Folk (BGS modified) sediment classification, of which 'gravelly sand' typified six stations and 'sandy gravel' typified four stations. 'Sand' and 'muddy sandy gravel' typified three stations each, whereas 'gravelly mud' typified one station. The sorting coefficient reflected the heterogeneity of the sediment and ranged from moderately well sorted to extremely poorly sorted, with most stations having very poorly sorted sediments.

The sediments across the VE main array survey area are typical of the southern North Sea, which is reported to comprise predominantly sandy gravel closer to the shore, whereas offshore the sediment is mainly sandy with patches of gravel and mud (Jones et al, 2004). A thin veneer of sediment is reported to often overlay clay bedrock particularly in the Outer Thames Estuary (Marine Aggregate Levy Sustainability Fund [MALSF], 2009). In this study, areas of firm clay were recorded through the seabed video and photography at station FE1_01 in the north array. Variations in the proportions of mud in the Outer Thames Estuary are reported to be associated with the input from the local fluvial sources and differences in depositional and erosion regimes, whereas well sorted mobile sand is associated with the tidally aligned sandbanks, notably the Inner Gabbard, Greater Gabbard, Galloper and North Falls (MALSF, 2009). Pebble, cobble and boulder size classes of seabed gravel are localised

and likely originate from older gravelly formations that have been submerged during rising sea level (DTI, 2002).

Continuous inputs of fines from the estuaries and sediment disturbance associated with hydrodynamics, results in patchy distribution of sediment assemblages (Irving, 1998). Patches of gravel and, to a less extent, mud were recorded within the predominantly sandy sediments across the VE main array survey area. Shell fragments, recorded through in situ observation of the grab samples, are a feature of seabed sediment of this region (MALSF, 2009). This is of relevance as the PSD analysis does not discern between gravel and shells. The different sources of sediment input may result in multimodal distribution of the sediment particle size (Hein, 2007), in line with the results of this study which recorded bimodal and/or polymodal distribution at 12 of the 17 stations sampled.

5.2 Sediment Chemistry

5.2.1 Sediment Hydrocarbons

5.2.1.1 Total Hydrocarbons

Across the VE survey area THC was below the LOD and below the Cefas AL1 (100 mg/kg) (Cefas, 2020). It is worth noting that the Cefas AL1 for THC is currently used as guideline in the absence of full data for PAHs to assess whether dredged material can be disposed of to sea by the regulators and their scientific advisors (Mason et al., 2020). The use of THC is limited in that it provides no indication of toxicity and may be conservative as indicated by most sediment failing this threshold, in addition there is large inter-laboratory method variability (Mason et al., 2020). Results from this study are indicative of low anthropogenic input, as in general, marine sediments are considered unpolluted if the THC is below 10 μg/g (Farrington & Tripp, 1977; Volkman et al., 1992; Readman et al., 2002).

5.2.1.2 Aromatic Hydrocarbons

Monitoring of aromatic hydrocarbon type and content is important due to the particularly toxic nature (mutagenic/carcinogenic) of several PAHs, particularly the heavier weight PAHs. The Unites States Environmental Protection Agency (US EPA) has identified 16 priority PAHs to be monitored (Keith, 2015) and the CEMP specifies 9 PAHs of specific concern (OSPAR, 2014), which primarily reflect inputs from man-made combustion sources.

The PAH concentrations across the VE main array survey area were below the LOD and the marine SQGs.

5.2.2 Sediment Metals

Metal concentrations in sediment samples across the VE main array survey area were below the marine SQGs for all metals except arsenic, the concentration of which was above the Canadian TEL at all stations. It is worth noting that the value of the Canadian TEL for arsenic (7.24 mg/kg) is lower than that of the NOAA ERL (8.2 mg/kg), which has been considered too low (de Mora et al., 2004) particularly as uncontaminated coastal sediments are generally

reported to have arsenic concentrations between 5 mg/kg and 15 mg/kg (Neff, 1997). Importantly, the NOAA ERLs for arsenic has not been adopted for the assessment of contamination status in the OSPAR maritime area, as they are below the BAC (OSPAR, 2009).

Natural sources of arsenic in the marine environment include mineral erosion, volcanic eruptions and forest fires (Neff, 1997; Cempel & Nikel, 2006), whereas anthropogenic sources include mining and smelting, burning of fossil fuel and surface runoff (Neff, 1997; Nriagu, 1990). High arsenic concentrations in the Outer Thames Estuary may be associated with a history of arsenical waste disposal in the Thames estuary (Whalley et al., 1999). The arsenic concentrations recorded in this study (8.7 mg/kg to 18.8 mg/kg) were within the range of < 0.15 mg/kg to 135 mg/kg reported for the southern North Sea (Whalley et al., 1999).

5.2.3 Sediment Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are industrial chemicals used in electrical equipment. Although the use of PCBs has been banned for many years, they can persist in marine sediments owing to their resistance to degradation (Geyer et al., 1984).

The PCBs analysed in this study had concentrations below their respective LODs and the total concentration of all PCBs was below the Cefas marine SQGs.

5.2.4 Sediment Organotins

Organotin compounds have historically been used in marine antifouling products however, their use is now prohibited, following evidence of their toxicity to selected marine organisms. However, TBT, one of the most toxic contaminants, may still enter the marine environment through sources such as wastewater, as TBT is used as biocide in preserving wood, textile, papers and stonework (Díez et al., 2005). Amongst the toxic effects of TBT is imposex, that is the imposition of male characteristics on the female gastropod *Nucella lapillus*, following exposure to concentration levels as low as 1 ng/L, with severe cases resulting in sterilisation of the organisms (Bryan et al., 1987).

The TBT degradation results in the production of DBT and monobutyl tin. These are used as stabilisers in polyvinyl chloride (PVC) production (Díez et al., 2005) and, although found to be less toxic than their parent compound, cause toxicity to some aquatic organisms (Huang et al., 2004).

The organotin compounds analysed in this study, specifically DBT and TBT, had concentrations below their respective LODs and below Cefas ALs across the VE main array survey area.

5.2.5 Sediment Organochlorine Pesticides

Organochlorine pesticides (OCPs) are synthesized pesticides used in agriculture as insecticides and have a long-term residual effect in the environment.

The OCPs analysed in this study included alpha-hexachlorocyclohexane (AHCH), beta-hexachlorocyclohexane (BHCH), gamma-hexachlorocyclohexane (GHCH), dieldrin, hexachlorobenzene (HCB), p,p'-dichlorodiphenyldichloroethane (PPTDE), p,p'-dichlorodiphenyldichloroethylene (PPDDE) and p,p'-dichlorodiphenyltrichloroethane (PPDDT). All OCPs had concentrations below their respective LODs and the Cefas marine SQGs, which currently include AL1 for dieldrin and DDT.

5.3 Macrofaunal Communities

Macrofaunal communities recorded across the VE main array survey area were represented mainly by Annelida which dominated in terms of richness and abundance. Of the annelids, the polychaetes *L. cf. cingulata*, *P. baltica*, *G. lapidum*, *A. paucibranchiata* and *Notomastus* were the top five most frequently occurring taxa recorded across the survey area. Of these, *L.* cf. *cingulata*, *A. paucibranchiata* and *Notomastus* were also amongst the top five most abundant annelids, along with *S. lamarcki* and *S. inflatum*.

The polychaete *S. spinulosa* was recorded at four stations with the highest abundance of 19 individuals recorded at station FE3_03 along the interconnector. This is of relevance in relation to the habitat reef that this polychaete can build under a given set of environmental conditions (Limpenny et al. 2010). In the North Sea, *S. spinulosa* occurs mostly as solitary or in small groups encrusting pebbles, shells and bedrock (Biodiversity Reporting and Information Group [BRIG], 2011).

Mollusca included bivalves, notably *S. elliptica*, *K. bidentata*, *A. alba*, *D. rotundata* and *G. triangularis*, which were the top five most frequently recorded molluscs. These were also the most abundant molluscs along with *L. asellus*. Some of these molluscs are generally opportunistic species, for example, bivalves of the genus *Abra* are reported to be capable of exploiting newly disturbed substratum through larval recruitment, secondary settlement of post metamorphosis juveniles and/or redistribution of adults (De-Bastos, 2016). Similarly, *K. bidentata* is reported to occur in association with burrows of brittlestars of the order Ophiuroidea (Gofas & Salas, 2008), which were also recorded in this study, particularly *O. albida* and *A. squamata*, which were the most frequently and abundant echinoderms, along with *E. pusillus*. The latter is reported to inhabit the interstices of gravelly substrata in area exposed to strong tidal currents (Rees et al., 2007).

Overall, the macrobenthic communities recorded in this study are indicative of coarse sediment habitats subject to a degree of surface sediment disturbance, as indicated by the polychaete composition, notably *A. paucinrabchiata* (Künitzer et al., 1992; Heip and Craeymeersch, 1995) and the occurrence of crustaceans such as *A. spinipes* (Tillin, 2019). The latter was amongst the top five most abundant and frequently occurring arthropods, along with the amphipods *Urothoe marina* and *Urothoe elegans*. The presence of pebbles and cobbles, also recorded through the seabed video and photography, offered suitable substrate for the attachment of solitary epifauna such as the barnacle *Verruca stroemia* and

calcareous tube building polychaetes of the genus *Spirobranchus*, as well as colonial epifaunal taxa, notably bryozoan and hydroids.

There was considerable variability in the number of taxa and individuals across the survey area, which resulted in four macrofaunal assemblages being identified through the multivariate analysis. Each multivariate group had an average similarity < 45 %, reflecting the varying coarseness of the seabed sediment in a high energy environment. This was further confirmed by the moderate correlation between the observed pattern of macrofaunal distribution and the sediment particle sizes, which was interpreted as a reflection of the constant sediment reworking.

The infaunal biomass was represented mainly by Annelida owing to the numerical dominance of this phylum's invertebrates and Echinodermata, the latter associated with the abundance of brittlestars and the size of urchins, typically *E. cordatum*, which can grow up to 9 cm (Hill, 2008), *P. miliaris* which can reach 5.7 cm (Jackson, 2008).

Colonial epifauna from the grab samples was represented by bryozoans, hydroids, sponges and ciliates, the occurrence of which was generally higher at stations featuring coarser and/or mixed sediment, owing to the sediment coarseness and diversity which provide microhabitats and hard substrate for the settlement of epibenthic taxa. This in turn increases the structural complexity of the habitat and may provide additional microhabitats for smaller fauna, thus increasing the overall richness and diversity (BRIG, 2011), as recorded in this study.

Epibenthic taxa recorded through the seabed video and photography included molluscs, notably the gastropod *Calliostoma zizyphinum* and the bivalves *A. opercularis* and *Pecten maximus*. Other notable motile species included the echinoderms *A. rubens* and *P. miliaris* and brittlestars of the class Ophiuroidea. Epifauna was represented by anemones of the order Actiniaria, including species of the family Sagartiidae and the genus *Urticina*, the soft coral *A. digitatum*, polychaete tubes including *Spirobranchus*, barnacles and turfs of hydrozoans and bryozoans. Fish included *Scyliorhinus canicula*, and species of the family Triglidae. Overall, epibiotic communities recorded by the seabed video footage were comparable to those reported for the shallower sediment areas of the southern North Sea (Callaway et al., 2002; Jennings et al., 1999).

5.4 Habitats and Biotopes

Two biotope complexes and one biotope were identified across the VE main array survey area.

The biotope complex 'Deep circalittoral coarse sediment' (A5.15) typified most of the survey area, being assigned at 10 stations. These stations featured coarse sediment comprising varying proportions of (coarse) sand and gravel and little (≤ 3.16 %) or no mud, with most stations being devoid of mud. The macrofaunal richness and diversity at these stations were generally higher than those of the predominantly sandy stations, but lower than those of the mixed sediment, albeit many of the taxa were common to both habitats. Indeed, the

invertebrates communities of this biotope complex are reported to be related to those of offshore mixed sediments (EEA, 2019).

The biotope complex 'Deep circalittoral sand' (A5.27) was assigned to three stations, which featured predominantly sandy sediments, with no fines and a gravel content ≤ 3.06 %. These stations had generally low species richness and diversity with typical taxa including robust and flexible polychaetes and bivalves.

The biotope 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451), typified four stations. These stations had mud content between 4.95 % and 47.10 % and gravel content between 15.80 % and 59.61 % and generally higher mean values of richness and abundance. This biotope is the only representative of the biotope complex 'Offshore circalittoral mixed sediments' (A5.45) (JNCC, 2015), and can be subject to natural temporal variation in species abundance even during the course of a year These variations may not alter the biotope classification especially if the sediment type remain unchanged and many of the characteristic species are present (Tillin, 2016).

The biotopes identified through the video data and single point grab sampling were contextualised with the results of the SSS to attempt extrapolation of the biotopes across the survey area.

Biotope complexes were deemed more representatives for extrapolation as they encompass biotopes that may grade into each other depending on the hydrodynamics and the sediment deposition, which are seasonal, particularly in high energy areas. Figure 5.1 presents the spatial distribution of the biotope complexes across the VE main array survey area.

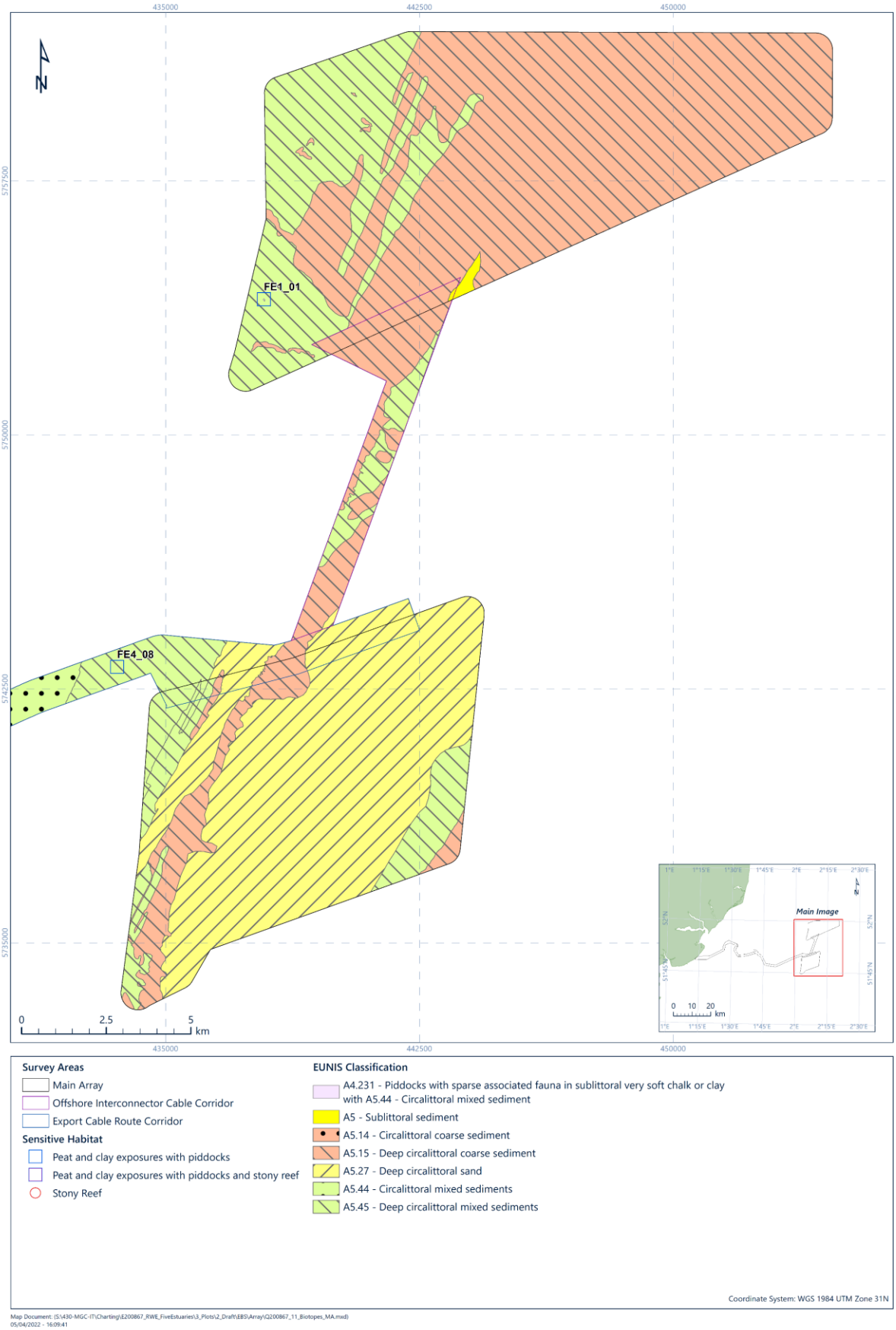


Figure 5.1: Spatial distribution of EUNIS biotope complexes identified through single point grab sampling and side scan sonar data, main array, Five Estuaries Offshore Site Investigation

5.4.1 Potentially Sensitive Habitats and Species

Aggregation of cobbles, along transects at station FE1_01, FE1_02 and FE1_03 in the north array, were assessed for the potential of these aggregations to constitute Annex I habitat 'Reef', in line with the criteria detailed in Irving (2009) and Golding et al., (2020) for geogenic reefs. The overall assessment for these areas was of 'Not a reef'. Areas of heterogeneous coarse sediment inclusive of pebbles and cobbles are a component part of the mixed sediment seabed type that characterises this region of the North Sea.

The biotope 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231), was assigned to areas of firm clay, based on analysis of seabed and photographic data (detailed in Fugro 2022a). This biotope, reported to occur along the east coast of England, is a UK BAP priority habitat for being fragile and irreplaceable (BRIG, 2011) and may occur in the habitat 'Peat and clay exposure' which is a habitat of conservation importance (HOCI) in MCZs (JNCC, 2018).

Sandy and coarse sediment habitats and biotopes recorded across the VE main array survey area, are part of the BSH 'Subtidal sands and gravel', which is a UK BAP priority habitat (BRIG, 2011) and a habitat of conservation importance (HOCI) in MCZs (JNCC, 2016). Biotopes featuring mixed sediments are part of the BSH 'Subtidal mixed sediments' in MCZs (JNCC, 2018).

A single specimen of the nationally scarce crab *Thia scutellata* was recorded in the grab sample from station FE2_02. Small numbers have been reported from Outer Thames Estuary (NBN, 2022). The most abundant known populations for this species are off the North Wales coast, where its preferred habitat has been reported as loose, well sorted medium sands into which it can burrow easily (Rees, 2001).

5.5 Cryptogenic and Non-native Species (NNS)

Non-native species (NNS) are those that have reached the UK by accidental human transport, deliberate human introduction, or which have arrived by natural dispersion from a non-native population in Europe (Government Digital Service [GDS], 2021). Once introduced, some NNS can become established (grow and reproduce successfully) and their subsequent dispersal from the point of introduction can result in environmental and economic impact (Cottier-Cook et al., 2017). The NNS that have a negative impact on biodiversity, through the spread of disease, competition for resources, or by direct consumption, parasitism, or hybridisation, are termed 'invasive' (GDS, 2021).

Cryptogenic species are those of unknown origin, as such they are not demonstrably native nor introduced (Eno et al., 1997).

None of taxa recorded in this study are reported to be NNS or cryptogenic.

6. Conclusions

The benthic environment across the VE main array survey area was characterised through a subtidal survey which comprised acquisition of seabed video and photographic data and grab samples, which were analysed to identify habitats and to evaluate the physico-chemical and biological conditions of the seabed. The results were used to derive biotopes, in line with the EUNIS habitat classification, which were evaluated for conservation importance and contextualised within the geographical setting of the survey area.

The sediment across the VE main array survey area featured mainly sand and to a lesser extent gravel, with small percentage of fines, except for station FE1_01, in the north array which was predominantly muddy. The varying percentages of the main sediment fractions resulted in five sediment classes being identified under the Folk (BGS modified) classification, including 'gravelly sand' and 'sandy gravel', which typified most stations, and 'sand' and 'muddy sandy gravel', each typifying three stations, whereas 'gravelly mud' typified one station. The coarseness of the sediment resulted in six sediment descriptions using the Wentworth (1922) scale including 'very coarse sand' and 'coarse sand', each typifying five stations, 'medium sand' and 'very fine sand' each typifying one station, 'granule' typifying three stations and 'pebble' typifying two stations. The sediments disturbance, likely due to regional hydrodynamics, was reflected in the bimodal and multimodal distribution of sediment particle size recorded at most stations.

The concentrations of total hydrocarbons and the 22 PAHs analysed were below their respective marine SQGs across the VE main array survey area.

Of the metals analysed, arsenic concentrations were above the Canadian PEL at all stations, whereas the remaining metals had concentrations below their respective marine SQGs across the VE main array survey area. Regional contextualisation indicated that the concentrations of arsenic are within the range reported for the Outer Thames Estuary.

The concentrations of all individual PCB congeners analysed were below the limit of detection (LOD) across the VE main array survey area and the sum of the 25 congeners was below the Cefas ALs.

The organotins analysed were DBT and TBT, both having concentrations below their respective LOD and below the Cefas ALs across the VE main array survey area.

The concentrations of all OCPs analysed were below the LOD across the VE main array survey area and below the Cefas marine SQGs which currently include dieldrin and DDT.

Macrofauna from the grab samples comprised infaunal and epifaunal taxa, the latter being represented by solitary and colonial organisms. Annelida represented most of the community structure and composition of the enumerated fauna, which comprised infauna and solitary epifauna. Macrofaunal richness and abundance were variable across the survey area, being

generally higher at stations featuring coarse sediment, notably stations along the interconnector.

The faunal community structure and composition reflected the sediment diversity and associated hydrodynamics, with typical taxa including robust polychaetes and fast swimming crustaceans as well as bivalves, the latter being typical of muddy sediments. Macrofaunal richness and diversity were generally higher at stations with coarse and diverse sediment, which had also higher number of colonial epifaunal taxa, represented mainly by bryozoans, hydroids and sponges.

Two biotope complexes and one biotope were identified from the analysis of the grab samples, namely 'Deep circalittoral coarse sediment' (A5.15) 'Deep circalittoral sand' (A5.27)' and 'Polychaete-rich deep *Venus* community in offshore mixed sediments' (A5.451), the latter being the only biotope representative of the biotope complex 'Offshore circalittoral mixed sediments' (A5.45).

In addition, 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231), was recorded only through the seabed video and photography.

The habitats and biotopes recorded are, or are representative of, UK BAP priority habitats and include 'Subtidal sands and gravel' and 'Piddocks with sparse associated fauna in sublittoral very soft chalk or clay' (A4.231).

A single specimen of the nationally scarce crab *T. scutellata* was recorded.

No NNS or cryptogenic were recorded.

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Appendices

Appendix A

Guidelines on Use of Report

This report (the "Report") was prepared as part of the services (the "Services") provided by Fugro GB Marine Limited ("Fugro") for its client (the "Client") under terms of the relevant contract between the two parties (the "Contract"). The Services were performed by Fugro based on requirements of the Client set out in the Contract or otherwise made known by the Client to Fugro at the time.

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Appendix B

Methodologies

B.1 Survey Methods

B.1.1 Sediment Grab Sampling

Faunal and particle size distribution (PSD) samples were acquired using a 0.1 m^2 mini Hamon grab. Chemistry samples were acquired using a 0.1 m^2 Day grab.

Operational procedures for grab sampling were as follows:

- The grab was prepared for operations prior to arrival on station. The Bridge communicated to the deck via a VHF radio when the vessel was steady and on location, and the grab was deployed from the stern A-frame;
- When the engineer operating the winch observed that the grab had reached the seabed (evidenced through a distinct slackening of the wire rope and snatch block), the environmental surveyor was informed (via VHF radio) and a fix was taken;
- On recovery to the deck, the sample was inspected and judged acceptable or otherwise (see below for rejection criteria);
- One accepted grab sample was retained for faunal analysis and PSD and another grab sample was subsampled for PC analysis;
- Deck logs were completed for each sample acquired (including no samples) with date, time, sample number, fix number, sediment type, depth and colour of strata in the sediment (if any), odour (i.e. H_2S), bioturbation or debris.

Samples were considered unacceptable in the following instances:

- Evidence of sediment washout caused through improperly closed grab jaws or inspection hatch;
- Sediment sample taken on an angle; where the grab jaws have not been parallel to the seabed when the grab fired;
- Disruption of the sample through striking the side of the vessel;
- Sample too small for requirements. Sample represented less than approximately 5 cm bite depth of the dual van Veen grab or Day grab, minimum sample size for 0.1 m^2 Hamon grab;
- Deemed unacceptable by the client representative for any other reason.

B.1.1.1 Physico-chemical Sample Processing

- Particle size distribution (PSD) samples were collected using a plastic scoop and subsampled from the faunal sample obtained by the mini Hamon grab.
- Hydrocarbon samples were collected using a metal scoop to a nominal depth of 2 cm. The samples were preserved in glass jars at approximately −20 ºC;
- Heavy metal samples were collected using a plastic scoop to a nominal depth of 2 cm. The samples were preserved in polythene bags at approximately −20 ºC;

B.1.1.2 Macrofauna Sample Processing

Macrofauna samples were processed as follows:

- Macrofauna samples were processed in their entirety, by opening the spades to drop the grab into a container. All supernatant water was processed along with the sediment;
- The sample was transferred to a chute and stand and washed through a 1.0 mm mesh sieve;
- Once sieved samples were transferred to containers labelled with the job number, station code and fauna code (e.g., FA) and fixed in 10 % buffered formal saline. The sample containers were then sealed, hazard labelled and stored securely on deck.

Appendix C

Logs

C.1 Subtidal Survey Log

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]											
Date	Time [UTC]	Transect	Type	Sample Rep / Still No.	Fix No.	Water Depth [m BSL]	Proposed Location		Actual Location		Offset [m]
							Easting	Northing	Easting	Northing	
10/11/2021	01:46:05	FE2_01	HG	FA	37	37	435 851.0	5 742 898.0	435 857.3	5 742 896.9	6.4
10/11/2021	02:18:12	FE2_02	HG	FA	38	52	436 225.0	5 741 075.0	436 222.5	5 741 088.0	13.2
10/11/2021	03:00:57	FE2_03	HG	FA	39	50	437 540.0	5 737 498.0	437 539.7	5 737 482.5	15.5
10/11/2021	03:52:48	FE2_03	DG	NS	40	50	437 540.0	5 737 498.0	437 543.0	5 737 503.2	6.0
10/11/2021	04:12:57	FE2_03	DG	NS	41	50	437 540.0	5 737 498.0	437 532.9	5 737 498.9	7.1
10/11/2021	04:38:45	FE2_03	DG	NS	42	50	437 540.0	5 737 498.0	437 541.0	5 737 495.6	2.6
10/11/2021	05:00:50	FE2_03	DG	NS	43	50	437 540.0	5 737 498.0	437 539.9	5 737 509.6	11.6
10/11/2021	05:19:56	FE2_03	DG	NS	44	50	437 540.0	5 737 498.0	437 539.0	5 737 500.8	3.0
10/11/2021	05:36:32	FE2_03	DG	NS	45	50	437 540.0	5 737 498.0	437 529.6	5 737 503.4	11.7
10/11/2021	05:39:08	FE2_03	DG	SC	46	50	437 540.0	5 737 498.0	437 495.0	5 737 418.7	91.1
10/11/2021	07:09:26	FE2_06	HG	NS	47	50	441 940.3	5 739 316.1	441 950.9	5 739 312.1	11.3
10/11/2021	07:48:56	FE2_04	HG	FA	48	50	439 870.0	5 742 101.0	439 887.4	5 742 099.2	17.5
10/11/2021	08:15:26	FE2_06	HG	FA	49	50	441 940.3	5 739 316.1	441 937.1	5 739 315.4	3.2
10/11/2021	08:53:29	FE2_05	HG	NS	50	46	442 677.0	5 743 137.0	442 699.4	5 743 135.4	22.4
10/11/2021	09:04:48	FE2_05	HG	NS	51	46	442 677.0	5 743 137.0	442 679.2	5 743 146.0	9.3
10/11/2021	09:12:04	FE2_05	HG	FA	52	46	442 677.0	5 743 137.0	442 684.3	5 743 140.8	8.2
10/11/2021	09:46:08	FE3_02	HG	NS	53	50	439 733.8	5 745 513.7	439 730.0	5 745 522.7	9.8
10/11/2021	10:15:02	FE3_02	HG	NS	54	50	439 733.8	5 745 513.7	439 731.4	5 745 501.1	12.9
10/11/2021	10:24:03	FE3_02	HG	FA	55	50	439 733.8	5 745 513.7	439 736.7	5 745 508.7	5.8

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]											
Date	Time [UTC]	Transect	Type	Sample Rep / Still No.	Fix No.	Water Depth [m BSL]	Proposed Location		Actual Location		Offset [m]
							Easting	Northing	Easting	Northing	
10/11/2021	11:15:40	FE3_01	DG	SC	56	52	440 936.2	5 748 447.8	440 948.2	5 748 452.0	12.7
10/11/2021	11:45:41	FE3_01	HG	FA	57	52	440 936.2	5 748 447.8	440 933.5	5 748 446.2	3.2
10/11/2021	12:30:41	FE3_03	HG	FA	58	52	442 019.7	5 751 415.1	442 021.0	5 751 430.3	15.3
10/11/2021	13:13:36	FE1_01	HG	NS	59	35	437 904.9	5 754 004.2	437 885.1	5 754 002.7	19.8
10/11/2021	13:22:27	FE1_01	HG	FA	60	35	437 904.9	5 754 004.2	437 900.5	5 754 008.1	5.9
10/11/2021	13:59:07	FE1_03	HG	FA	61	-	439 237.0	5 755 430.0	439 233.4	5 755 425.7	5.6
10/11/2021	15:03:19	FE1_05	HG	FA	62	47	442 807.0	5 755 913.0	442 804.7	5 755 900.6	12.6
10/11/2021	15:59:43	FE1_05	DG	SC	63	47	442 807.0	5 755 913.0	442 816.6	5 755 909.9	10.1
10/11/2021	16:33:18	FE1_04	HG	FA	64	40	440 530.0	5 757 411.0	440 540.7	5 757 414.0	11.1
10/11/2021	18:26:35	FE1_02	HG	NS	65	38	439 440.8	5 759 631.3	439 454.1	5 759 646.4	20.1
10/11/2021	18:34:26	FE1_02	HG	FA	66	38	439 440.8	5 759 631.3	439 441.7	5 759 646.8	15.5
10/11/2021	19:12:12	FE1_06	HG	NS	67	43	442 882.0	5 760 008.2	442 889.0	5 760 028.1	21.1
10/11/2021	19:29:53	FE1_06	HG	FA	68	43	442 882.0	5 760 008.2	442 887.4	5 760 017.8	11.0
10/11/2021	20:06:24	FE1_07	HG	FA	69	48	447 081.0	5 758 229.0	447 079.1	5 758 232.8	4.2
10/11/2021	21:36:01	FE1_08	HG	FA	75	48	450 866.0	5 759 026.0	450 856.0	5 759 015.6	14.4
11/11/2021	01:17:45	FE1_02	Video	SOL	76	39	439 440.8	5 759 631.3	439 406.0	5 759 518.7	117.8
11/11/2021	01:43:57	FE1_02	Still	FE1_02_01	77	-	439 440.8	5 759 631.3	439 422.8	5 759 560.7	72.8
11/11/2021	01:44:30	FE1_02	Still	FE1_02_02	78	-	439 440.8	5 759 631.3	439 425.2	5 759 580.0	53.6
11/11/2021	01:44:44	FE1_02	Still	FE1_02_03	79	-	439 440.8	5 759 631.3	439 428.2	5 759 585.9	47.1
11/11/2021	01:45:10	FE1_02	Still	FE1_02_04	80	-	439 440.8	5 759 631.3	439 433.5	5 759 593.7	38.3
11/11/2021	01:45:24	FE1_02	Still	FE1_02_05	81	-	439 440.8	5 759 631.3	439 434.5	5 759 597.8	34.1

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]											
Date	Time [UTC]	Transect	Type	Sample Rep / Still No.	Fix No.	Water Depth [m BSL]	Proposed Location		Actual Location		Offset [m]
							Easting	Northing	Easting	Northing	
11/11/2021	01:45:40	FE1_02	Still	FE1_02_06	82	-	439 440.8	5 759 631.3	439 433.9	5 759 604.4	27.8
11/11/2021	01:45:49	FE1_02	Still	FE1_02_07	83	-	439 440.8	5 759 631.3	439 434.2	5 759 608.2	24.1
11/11/2021	01:45:57	FE1_02	Still	FE1_02_08	84	-	439 440.8	5 759 631.3	439 434.5	5 759 611.8	20.5
11/11/2021	01:46:23	FE1_02	Still	FE1_02_09	86	-	439 440.8	5 759 631.3	439 429.9	5 759 620.0	15.7
11/11/2021	01:46:35	FE1_02	Still	FE1_02_10	87	-	439 440.8	5 759 631.3	439 427.3	5 759 623.0	15.8
11/11/2021	01:46:50	FE1_02	Still	FE1_02_11	88	-	439 440.8	5 759 631.3	439 428.0	5 759 625.4	14.1
11/11/2021	01:46:59	FE1_02	Still	FE1_02_12	89	-	439 440.8	5 759 631.3	439 428.5	5 759 627.7	12.8
11/11/2021	01:47:06	FE1_02	Still	FE1_02_13	90	-	439 440.8	5 759 631.3	439 428.5	5 759 630.1	12.3
11/11/2021	01:47:20	FE1_02	Still	FE1_02_14	91	-	439 440.8	5 759 631.3	439 429.7	5 759 635.7	11.9
11/11/2021	01:47:31	FE1_02	Still	FE1_02_15	92	-	439 440.8	5 759 631.3	439 431.0	5 759 639.0	12.5
11/11/2021	01:47:39	FE1_02	Video	EOL	93	-	439 440.8	5 759 631.3	439 431.5	5 759 641.1	13.5
11/11/2021	02:52:02	FE1_01	Video	SOL	95	35	437 904.9	5 754 004.2	437 890.1	5 753 946.9	59.2
11/11/2021	02:52:11	FE1_01	Still	FE1_01_01	96	-	437 904.9	5 754 004.2	437 892.6	5 753 950.6	55.0
11/11/2021	02:52:18	FE1_01	Still	FE1_01_02	97	-	437 904.9	5 754 004.2	437 893.9	5 753 952.9	52.5
11/11/2021	02:52:28	FE1_01	Still	FE1_01_03	98	-	437 904.9	5 754 004.2	437 895.1	5 753 956.9	48.3
11/11/2021	02:52:35	FE1_01	Still	FE1_01_04	99	-	437 904.9	5 754 004.2	437 896.1	5 753 959.6	45.5
11/11/2021	02:52:42	FE1_01	Still	FE1_01_05	100	-	437 904.9	5 754 004.2	437 897.9	5 753 962.0	42.8
11/11/2021	02:52:50	FE1_01	Still	FE1_01_06	101	-	437 904.9	5 754 004.2	437 900.6	5 753 964.7	39.8
11/11/2021	02:52:56	FE1_01	Still	FE1_01_07	102	-	437 904.9	5 754 004.2	437 901.9	5 753 966.7	37.6
11/11/2021	02:53:04	FE1_01	Still	FE1_01_08	103	-	437 904.9	5 754 004.2	437 902.7	5 753 969.7	34.6
11/11/2021	02:53:13	FE1_01	Still	FE1_01_09	104	-	437 904.9	5 754 004.2	437 902.2	5 753 973.0	31.3

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]											
Date	Time [UTC]	Transect	Type	Sample Rep / Still No.	Fix No.	Water Depth [m BSL]	Proposed Location		Actual Location		Offset [m]
							Easting	Northing	Easting	Northing	
11/11/2021	02:53:25	FE1_01	Still	FE1_01_10	105	-	437 904.9	5 754 004.2	437 898.3	5 753 978.0	27.0
11/11/2021	02:53:31	FE1_01	Still	FE1_01_11	106	-	437 904.9	5 754 004.2	437 896.7	5 753 980.6	25.0
11/11/2021	02:53:37	FE1_01	Still	FE1_01_12	107	-	437 904.9	5 754 004.2	437 895.3	5 753 983.3	23.0
11/11/2021	02:53:44	FE1_01	Still	FE1_01_13	108	-	437 904.9	5 754 004.2	437 895.2	5 753 986.1	20.5
11/11/2021	02:53:49	FE1_01	Still	FE1_01_14	109	-	437 904.9	5 754 004.2	437 895.3	5 753 988.1	18.7
11/11/2021	02:53:58	FE1_01	Still	FE1_01_15	110	-	437 904.9	5 754 004.2	437 896.6	5 753 991.9	14.9
11/11/2021	02:54:07	FE1_01	Still	FE1_01_16	111	-	437 904.9	5 754 004.2	437 897.6	5 753 994.9	11.8
11/11/2021	02:54:16	FE1_01	Still	FE1_01_17	112	-	437 904.9	5 754 004.2	437 898.0	5 753 998.6	8.9
11/11/2021	02:54:21	FE1_01	Still	FE1_01_18	113	-	437 904.9	5 754 004.2	437 897.7	5 754 001.2	7.8
11/11/2021	02:54:24	FE1_01	Still	FE1_01_19	114	-	437 904.9	5 754 004.2	437 897.7	5 754 002.1	7.5
11/11/2021	02:54:30	FE1_01	Still	FE1_01_20	115	-	437 904.9	5 754 004.2	437 898.3	5 754 004.5	6.6
11/11/2021	02:54:38	FE1_01	Still	FE1_01_21	116	-	437 904.9	5 754 004.2	437 899.4	5 754 007.6	6.4
11/11/2021	02:54:52	FE1_01	Still	FE1_01_22	117	-	437 904.9	5 754 004.2	437 902.4	5 754 012.9	9.1
11/11/2021	02:55:00	FE1_01	Video	EOL	118	-	437 904.9	5 754 004.2	437 903.6	5 754 016.1	11.9
11/11/2021	03:30:06	FE1_04	Video	SOL	119	41	440 530.0	5 757 411.0	440 525.7	5 757 342.2	69.0
11/11/2021	03:30:23	FE1_04	Still	FE1_04_01	120	-	440 530.0	5 757 411.0	440 528.9	5 757 347.5	63.6
11/11/2021	03:30:33	FE1_04	Still	FE1_04_02	121	-	440 530.0	5 757 411.0	440 529.3	5 757 351.8	59.3
11/11/2021	03:30:41	FE1_04	Still	FE1_04_03	122	-	440 530.0	5 757 411.0	440 528.0	5 757 354.8	56.2
11/11/2021	03:30:45	FE1_04	Still	FE1_04_04	123	-	440 530.0	5 757 411.0	440 527.5	5 757 356.5	54.6
11/11/2021	03:30:50	FE1_04	Still	FE1_04_05	124	-	440 530.0	5 757 411.0	440 526.6	5 757 358.8	52.3
11/11/2021	03:31:01	FE1_04	Still	FE1_04_06	125	-	440 530.0	5 757 411.0	440 523.0	5 757 364.3	47.3

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]											
Date	Time [UTC]	Transect	Type	Sample Rep / Still No.	Fix No.	Water Depth [m BSL]	Proposed Location		Actual Location		Offset [m]
							Easting	Northing	Easting	Northing	
11/11/2021	03:31:07	FE1_04	Still	FE1_04_07	126	-	440 530.0	5 757 411.0	440 521.4	5 757 367.5	44.4
11/11/2021	03:31:21	FE1_04	Still	FE1_04_08	127	-	440 530.0	5 757 411.0	440 520.4	5 757 374.1	38.1
11/11/2021	03:31:28	FE1_04	Still	FE1_04_09	128	-	440 530.0	5 757 411.0	440 522.9	5 757 376.5	35.3
11/11/2021	03:31:42	FE1_04	Still	FE1_04_10	129	-	440 530.0	5 757 411.0	440 524.6	5 757 381.6	29.9
11/11/2021	03:31:51	FE1_04	Still	FE1_04_11	130	-	440 530.0	5 757 411.0	440 523.0	5 757 385.1	26.8
11/11/2021	03:32:05	FE1_04	Still	FE1_04_12	131	-	440 530.0	5 757 411.0	440 523.1	5 757 389.3	22.8
11/11/2021	03:32:16	FE1_04	Still	FE1_04_13	132	-	440 530.0	5 757 411.0	440 522.3	5 757 394.1	18.6
11/11/2021	03:32:26	FE1_04	Still	FE1_04_14	133	-	440 530.0	5 757 411.0	440 522.8	5 757 398.9	14.1
11/11/2021	03:32:39	FE1_04	Still	FE1_04_15	134	-	440 530.0	5 757 411.0	440 523.4	5 757 405.1	8.8
11/11/2021	03:32:49	FE1_04	Still	FE1_04_16	135	-	440 530.0	5 757 411.0	440 524.3	5 757 410.1	5.7
11/11/2021	03:33:01	FE1_04	Still	FE1_04_17	136	-	440 530.0	5 757 411.0	440 526.9	5 757 415.8	5.8
11/11/2021	03:33:06	FE1_04	Still	FE1_04_18	137	-	440 530.0	5 757 411.0	440 528.0	5 757 417.6	6.9
11/11/2021	03:33:17	FE1_04	Still	FE1_04_19	138	-	440 530.0	5 757 411.0	440 530.4	5 757 422.1	11.1
11/11/2021	03:33:22	FE1_04	Still	FE1_04_20	139	-	440 530.0	5 757 411.0	440 531.6	5 757 424.2	13.3
11/11/2021	03:33:36	FE1_04	Still	FE1_04_21	140	-	440 530.0	5 757 411.0	440 532.9	5 757 430.3	19.5
11/11/2021	03:33:44	FE1_04	Still	FE1_04_22	141	-	440 530.0	5 757 411.0	440 533.0	5 757 433.8	23.0
11/11/2021	03:33:49	FE1_04	Still	FE1_04_23	142	-	440 530.0	5 757 411.0	440 533.3	5 757 435.8	25.1
11/11/2021	03:33:57	FE1_04	Still	FE1_04_24	143	-	440 530.0	5 757 411.0	440 533.4	5 757 439.6	28.8
11/11/2021	03:34:02	FE1_04	Video	EOL	144	-	440 530.0	5 757 411.0	440 534.3	5 757 442.5	31.8

Notes

BSL = Below sea level
DG = Day grab
EOL = End of line
FA = Faunal sample A
HG = Hamon grab
NS = No sample
NT = Not triggered
SC = Sediment chemistry
SOL = Start of line
UTC = Coordinated Universal Time

C.2 Grab Log

Date	Time [UTC]	Station	Sample Rep	Fix No.	Sample Volume / depth* [L / cm]	Sediment Description (including stratigraphy)				Comments (fauna, smell, bioturbation, debris)
						Depth [cm]	Sediment Type	Sediment Description	Colour	
10/11/2021	01:46:05	FE2_01	FA	37	5	-	gsM	Gravelly muddy sand	Brown	Cobbles
10/11/2021	02:18:12	FE2_02	FA	38	7	-	S	Coarse sand	Yellow	Shell fragments
10/11/2021	03:00:57	FE2_03	FA	39	6	-	S	Coarse sand	Yellow	Shell fragments
10/11/2021	03:52:48	FE2_03	NS	40	-	-		-	-	Empty
10/11/2021	04:12:57	FE2_03	NS	41	-	-		-	-	Bungee broke
10/11/2021	04:38:45	FE2_03	NS	42	-	-		-	-	Triggered in water column
10/11/2021	05:00:50	FE2_03	NS	43	-	-		-	-	Triggered in water column
10/11/2021	05:19:56	FE2_03	NS	44	-	-		-	-	Washout
10/11/2021	05:36:32	FE2_03	NS	45	-	-		-	-	Triggered in water column
10/11/2021	05:39:08	FE2_03	SC	46	10	-	S	Sand	Yellow	Shell fragments
10/11/2021	07:09:26	FE2_06	NS	47	-	-		-	-	-
10/11/2021	07:48:56	FE2_04	FA	48	7	-	S	Sand	Yellow	Shell fragments
10/11/2021	08:15:26	FE2_06	FA	49	5	-	(g)mS	Slightly gravelly muddy sand	Yellow	-
10/11/2021	08:53:29	FE2_05	NS	50	1	-		-	-	Low volume
10/11/2021	09:04:48	FE2_05	NS	51	-	-		-	-	Did not trigger
10/11/2021	09:12:04	FE2_05	FA	52	6	-	S	Sand		-
10/11/2021	09:46:08	FE3_02	NS	53	-	-		-	-	Did not trigger
10/11/2021	10:15:02	FE3_02	NS	54	-	-		-	-	Did not trigger

Date	Time [UTC]	Station	Sample Rep	Fix No.	Sample Volume / depth* [L / cm]	Sediment Description (including stratigraphy)				Comments (fauna, smell, bioturbation, debris)
						Depth [cm]	Sediment Type	Sediment Description	Colour	
10/11/2021	10:24:03	FE3_02	FA	55	5	-	gS	Gravelly sand with pebbles	-	Shell fragments. 1 large cobble
10/11/2021	11:15:40	FE3_01	SC	56	7	-	gsM	Gravelly muddy sand	-	-
10/11/2021	11:45:41	FE3_01	FA	57	7	-	gsM	Gravelly muddy sand	-	-
10/11/2021	12:30:41	FE3_03	FA	58	5	-	gsM	Gravelly muddy sand	-	Did not trigger
10/11/2021	13:13:36	FE1_01	NS	59		-			-	-
10/11/2021	13:22:27	FE1_01	FA	60	8	-	(g)sM	Slightly gravelly sandy mud	-	Consolidated clay, brittle stars
10/11/2021	13:59:07	FE1_03	FA	61	7	-	gS	Slightly gravelly sand	-	Shell fragments
10/11/2021	15:03:19	FE1_05	FA	62	7	-	S	Sand	-	-
10/11/2021	15:59:43	FE1_05	SC	63	8	-	S	Sand	-	-
10/11/2021	16:33:18	FE1_04	FA	64	7	-	sG	Sandy gravel	-	Mixed sediment - cobbles and pebbles
10/11/2021	18:26:35	FE1_02	NS	65	2	-	sG	Sandy gravel	-	Stone in jaw
10/11/2021	18:34:26	FE1_02	FA	66	5	-	(g)mS	Slightly gravelly muddy sand	Brown	Encrusting Hydrozoa/Bryozoa, Actiniaria, clay lumps, brittlestars
10/11/2021	19:12:12	FE1_06	NS	67	<1	-		-	-	-
10/11/2021	19:29:53	FE1_06	FA	68	5	-	(g)s	Slightly gravelly sand	Yellow	Shell fragments, faunal tubes
10/11/2021	20:06:24	FE1_07	FA	69	4	-	S	Sand	Yellow	Shell fragments
10/11/2021	21:36:01	FE1_08	FA	75	6	-	gS	Gravelly sand	Yellow/brown	Shell fragments

Notes

UTC = Coordinated Universal Time
FA = Fauna sample A
SOL = Start of line
SC = Sediment chemistry
EOL = End of line
NS = No sample

* Sample depth recorded in cm for Day grab

C.3 Video and Photographic Log

Geodetic Parameters: WGS 84, UTM Zone 31 N [m]							
Station	Point on Line	Video Coordinates		Length [m]	Still Nos.	Sediment Description	Fauna / Bioturbation / Debris
		Easting [m]	Northing [m]				
FE1_01	SOL	437 890.1	5 753 947.0	29	FE1_01_01 - FE1_01_08	Sandy muddy gravel with varying proportions of cobbles and shell fragments	Starfish (*Asterias rubens*), brittlestars (Ophiuroidea), scallops (*Aequipecten opercularis* and *?Pecten maximus*), soft coral (*Alcyonium digitatum*), anemone (*Urticina* sp.), sea urchins (Echinoidea including *Psammechinus miliaris*), faunal tubes (Polychaeta including *Spirobranchus* sp.), encrusting bryozoans (Bryozoa)
	SOL	437 902.5	5 753 973.0				
	EOL	437 902.5	5 753 973.0	42	FE1_01_09 - FE1_01_22	Clay with piddock holes, sandy muddy gravel with varying proportions of cobbles, boulders and shell fragments	Starfish (*Asterias rubens*), brittlestars (Ophiuroidea), hermit crabs (Paguridae), sea urchins (Echinoidea including *Psammechinus miliaris*), scallops (*Aequipecten opercularis* and ?*Pecten maximus*), anemones (Actiniaria including *Urticina* sp.), soft coral (*Alcyonium digitatum*), faunal tubes (Polychaeta including *Spirobranchus* sp.), encrusting bryozoans (Bryozoa), faunal turf (Hydrozoa/Bryozoa)
	EOL	437 903.4	5 754 015.0				
FE1_02	SOL	439 422.8	5 759 561.0	80	FE1_02_01 - FE1_02_15	Gravelly muddy sand/sandy muddy gravel with varying proportions of cobbles and shell fragments	Starfish (*Asterias rubens*), soft coral (*Alcyonium digitatum*), faunal tubes (Polychaeta including *Spirobranchus* sp.), encrusting bryozoans (Bryozoa), faunal turf (Hydrozoa/Bryozoa), barnacles (Sessilia)
	EOL	439 430.8	5 759 641.0				
	EOL	440 533.6	5 757 442.0				

Notes
UTC = Coordinated Universal Time
? = Identification is uncertain

Appendix D

Sediment Particle Size and Grab Sample Photographs

D.1 Sediment Particle Size Distribution Results

Certificate of Analysis

Certificate Number	EP/22/4981	**Revision Number**	1
Job Number	200867		
Job Reference	RWE Five Estuaries		
Prepared For		**Prepared By**	
RWE		**Adam Burtonshaw** **Fugro GB Marine Limited** Trafalgar Wharf (Unit 16) Hamilton Road Portchester Portsmouth PO6 4PX United Kingdom	
		Phone: +44 (0) 2392 205500 **Email:** sediment@fugro.com **Web:** www.fugro.com	

Sampling Undertaken By	FGBML	**Sampling Date**	26/07/2021 – 27/07/2021, 09/11/2021 – 16/11/2021
Date of Receipt	27/07/2021, 18/11/2021	**Date of Analysis**	25/11/2021 – 14/01/2022
Sample Matrix	Marine Sediments		
Method Reference	Particle Size Distribution by Dry Sieving – EUAF-FGBM-SED-TM-001 based on NMBAQC's Best Practice Guidance - Particle Size Analysis (PSA) for Supporting Biological Analysis 2016 and EUAF-FGBM-SED-TM-002 based on BS 1377: Parts 1: 2016 and 2: 1990. Particle Size Distribution by Laser Diffraction using a Malvern Mastersizer 2000 and Hydro 2000G Dispersion Unit – EUAF-FGBM-SED-TM-006 based on NMBAQC's Best Practice Guidance - Particle Size Analysis (PSA) for Supporting Biological Analysis 2016 and BS ISO 13320: 2020.		
Test Results	Refer to pages 2-8 of 8 Refer to Excel results file for laser diffraction metadata.		
Laboratory Comments	**Deviating Codes:** None		
Authorised Signature	J. R. Hut		
Name	James Hutchinson		
Position	Sediment Laboratory Manager		
Issue Date	27/01/2022		

- Further information on methods of analysis may be obtained from the above address
- Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
- Test results reported relate only to those items tested
- Test results reported specifically refer to sample(s) tested as received unless otherwise stated
- [Sub]Indicates subcontracted test
- [DS]Indicates relevant Deviating Code applies to test results

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UKAS TESTING 0919

TEST RESULTS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.04 µm) @ 0.5 Phi Intervals
Job Number: 200867
Job Reference: RWE Five Estuaries

SAMPLE ID:	FE1_01	FE1_02	FE1_03	FE1_04	FE1_05	FE1_06	FE1_07	FE1_08	FE2_01	FE2_02	FE2_03	FE2_04	FE2_05	FE2_06	FE3_01
LAB ID:	WL039831	WL039832	WL039833	WL039834	WL039835	WL039836	WL039837	WL039838	WL039839	WL039840	WL039841	WL039842	WL039843	WL039844	WL039845
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31500	0.00	25.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22400	0.00	15.28	0.00	26.39	0.00	0.00	0.00	8.90	0.00	0.00	0.00	0.00	0.00	11.31	0.00
16000	0.00	0.00	0.00	0.00	0.00	6.76	3.87	0.00	18.04	0.00	0.00	0.00	0.00	8.67	6.42
11200	0.00	4.07	0.00	4.85	0.87	2.99	9.27	2.72	11.45	0.15	0.00	0.00	0.00	17.93	2.79
8000	3.21	4.91	0.30	4.17	0.36	5.42	6.87	3.64	16.21	0.00	0.62	0.20	0.00	5.21	4.37
5600	4.31	2.85	2.16	3.42	2.11	4.03	5.60	4.55	5.28	0.14	2.23	0.12	0.00	5.10	7.30
4000	2.98	2.36	2.57	1.79	1.63	2.95	3.31	2.59	5.01	0.60	1.98	0.24	0.09	4.45	3.16
2800	2.50	2.32	4.35	1.06	1.34	1.58	2.92	2.88	4.73	0.72	2.35	0.42	0.39	4.10	2.21
2000	2.80	2.02	5.21	0.60	2.20	1.23	1.92	2.36	3.40	1.46	2.98	0.65	0.53	2.45	1.56
1400	2.69	2.08	5.44	0.74	2.16	1.04	1.43	2.05	1.86	2.54	2.99	1.29	1.11	1.61	1.30
1000	3.02	2.28	5.44	0.74	2.95	0.85	0.88	2.06	1.07	4.46	2.82	3.33	2.02	1.05	1.81
707.00	7.57	10.02	24.45	5.39	20.75	5.33	7.04	16.17	3.98	23.73	15.32	19.52	9.79	3.74	15.59
500.00	9.58	10.69	31.44	19.36	35.11	17.88	23.94	25.78	8.35	35.75	37.64	36.71	33.64	10.96	23.63
353.60	7.58	6.67	16.42	22.33	24.70	25.96	24.90	19.83	8.93	24.57	26.75	29.19	38.26	12.51	17.23
250.00	3.47	1.95	2.22	8.32	5.74	17.83	7.74	6.22	4.64	5.81	4.30	8.11	13.46	5.26	5.10
176.80	0.77	0.07	0.00	0.49	0.08	4.75	0.31	0.24	0.82	0.07	0.01	0.22	0.71	0.51	0.23
125.00	0.20	0.01	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
88.39	0.64	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
63.00	1.52	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.18	0.64
44.20	2.66	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.31	0.48
31.30	3.52	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.19	0.24
22.10	4.14	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.14	0.27
15.60	4.35	0.45	0.00	0.02	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.20	0.42
11.00	4.35	0.58	0.00	0.06	0.00	0.16	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.30	0.52
7.80	4.30	0.68	0.00	0.06	0.00	0.23	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.40	0.59
5.50	4.51	0.75	0.00	0.06	0.00	0.24	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.53	0.69
3.90	4.49	0.71	0.00	0.05	0.00	0.23	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.61	0.75
2.75	4.20	0.60	0.00	0.05	0.00	0.20	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.64	0.73
1.95	3.34	0.41	0.00	0.04	0.00	0.16	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.54	0.59
1.38	2.47	0.26	0.00	0.00	0.00	0.06	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.42	0.43
0.98	1.84	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.30	0.31
0.69	1.51	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.22	0.24
0.49	1.05	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.14	0.16
0.34	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.02	0.00
0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
< 0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TEST RESULTS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.04 µm) @ 0.5 Phi Intervals
Job Number: 200867
Job Reference: RWE Five Estuaries

SAMPLE ID:	FE3_02	FE3_03	FE4_01	FE4_02	FE4_03	FE4_04	FE4_05	FE4_06	FE4_07	FE4_08	FE5_01	FE5_02	FE5_03	FE5_04	FE5_05
LAB ID:	WL039846	WL039847	WL039848	WL039849	WL039850	WL039851	WL039852	WL039853	WL039854	WL039855	WL039856	WL039857	WL039858	WL039859	WL039860
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31500	33.81	0.00	30.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22400	8.97	21.98	0.00	0.00	28.01	14.35	42.35	0.00	38.71	0.00	0.00	0.00	0.00	0.00	18.03
16000	11.91	13.68	3.90	5.83	0.00	6.66	3.08	5.81	0.00	0.00	10.70	0.00	0.00	0.00	23.05
11200	6.63	2.96	4.23	5.80	8.35	0.00	6.24	0.00	2.40	2.81	2.54	10.24	2.99	4.22	1.21
8000	5.52	2.81	5.13	7.43	2.30	2.23	1.75	1.77	3.78	1.56	6.94	0.84	4.95	7.01	6.01
5600	2.75	5.65	3.86	2.33	3.26	2.98	1.16	3.72	5.92	5.66	3.88	1.76	5.10	10.72	3.92
4000	1.79	3.57	1.95	2.59	2.13	2.58	1.58	5.96	3.05	2.22	3.92	2.14	2.73	2.40	2.16
2800	1.22	2.15	1.54	3.68	1.94	1.57	1.64	6.56	1.71	2.83	1.69	1.17	1.66	2.01	2.66
2000	1.34	1.19	1.19	3.11	1.62	1.80	1.76	6.88	1.84	3.36	1.89	1.01	1.41	2.51	2.90
1400	1.14	0.83	1.03	3.53	1.95	2.37	2.06	7.45	1.76	4.51	1.82	0.53	1.12	2.33	3.05
1000	1.09	0.90	1.11	4.55	2.29	3.15	2.41	8.92	1.39	5.78	1.84	0.49	1.32	2.63	2.84
707.00	6.21	12.27	2.53	10.04	5.26	12.27	8.15	22.82	3.95	11.41	5.05	1.20	5.22	7.60	6.59
500.00	9.38	15.17	3.45	11.51	5.47	14.47	8.61	20.63	6.97	12.75	7.06	2.03	7.38	12.42	7.32
353.60	6.57	9.94	3.80	10.90	4.32	11.40	6.24	8.66	8.34	9.13	7.17	2.52	7.42	12.55	5.55
250.00	1.66	2.89	3.20	8.16	2.60	5.40	2.90	0.82	6.28	3.67	5.51	2.28	5.29	7.38	2.62
176.80	0.01	0.14	1.94	4.23	1.18	1.14	0.75	0.00	2.57	0.51	4.01	1.52	2.80	2.35	0.69
125.00	0.00	0.00	0.91	1.14	0.49	0.02	0.15	0.00	0.31	0.01	3.75	0.97	1.45	0.87	0.37
88.39	0.00	0.28	0.55	0.05	0.45	0.21	0.26	0.00	0.00	0.47	3.72	0.98	1.17	1.47	0.73
63.00	0.00	0.42	0.63	0.29	0.75	0.71	0.37	0.00	0.06	1.08	2.88	1.45	1.33	1.95	0.88
44.20	0.00	0.23	0.93	0.73	1.24	0.96	0.39	0.00	0.37	1.51	1.91	2.36	1.88	1.74	0.79
31.30	0.00	0.10	1.25	0.85	1.62	1.00	0.40	0.00	0.47	1.71	1.34	3.24	2.62	1.19	0.62
22.10	0.00	0.14	1.63	0.88	1.96	1.14	0.49	0.00	0.54	1.96	1.49	4.24	3.50	1.04	0.60
15.60	0.00	0.23	1.98	0.98	2.20	1.30	0.60	0.00	0.69	2.21	1.92	5.32	4.02	1.20	0.69
11.00	0.00	0.29	2.25	1.16	2.38	1.45	0.69	0.00	0.89	2.50	2.36	6.66	4.09	1.45	0.79
7.80	0.00	0.33	2.46	1.34	2.50	1.54	0.78	0.00	1.04	2.82	2.70	7.90	3.96	1.67	0.88
5.50	0.00	0.38	2.83	1.56	2.72	1.67	0.89	0.00	1.20	3.32	3.03	8.92	4.18	1.95	0.98
3.90	0.00	0.40	3.07	1.63	2.77	1.69	0.95	0.00	1.26	3.59	2.99	8.60	4.38	2.07	0.98
2.75	0.00	0.37	3.09	1.56	2.65	1.60	0.92	0.00	1.22	3.54	2.64	7.35	4.41	2.01	0.90
1.95	0.00	0.28	2.60	1.26	2.20	1.31	0.76	0.00	1.01	2.91	1.93	5.25	3.80	1.64	0.69
1.38	0.00	0.19	2.00	0.95	1.72	1.00	0.58	0.00	0.76	2.18	1.29	3.50	3.04	1.23	0.50
0.98	0.00	0.13	1.49	0.71	1.34	0.76	0.42	0.00	0.57	1.57	0.86	2.36	2.38	0.91	0.37
0.69	0.00	0.08	1.24	0.59	1.13	0.63	0.34	0.00	0.46	1.23	0.65	1.78	2.04	0.74	0.31
0.49	0.00	0.00	0.90	0.43	0.81	0.45	0.23	0.00	0.33	0.84	0.42	1.13	1.52	0.53	0.22
0.34	0.00	0.00	0.45	0.20	0.38	0.20	0.10	0.00	0.14	0.34	0.10	0.27	0.81	0.23	0.09
0.24	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
< 0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TEST RESULTS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.04 µm) @ 0.5 Phi Intervals
Job Number: 200867
Job Reference: RWE Five Estuaries

SAMPLE ID:	FE5_06	FE5_07	FE5_08	FE5_09	FE5_10	FE6_01	FE6_02	FE6_04	FE6_06	FE6_07	FE6_08	FE6_09	FE6_10	FE6_11	FE7b_02
LAB ID:	WL039861	WL039862	WL039863	WL039864	WL039865	WL039866	WL039867	WL039868	WL039869	WL039870	WL039871	WL039872	WL039873	WL039874	WL039875
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00	0.00	43.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.88	0.00	0.00
22400	0.00	0.00	0.00	0.00	0.00	20.49	6.63	0.00	0.00	0.00	0.00	0.00	8.60	0.00	0.00
16000	4.91	19.59	0.00	0.00	0.00	11.14	13.65	14.39	0.00	0.00	0.00	9.95	8.14	0.00	1.38
11200	9.04	3.10	6.24	3.86	2.23	18.34	0.87	18.73	0.00	0.00	0.00	10.71	6.29	8.44	6.26
8000	5.00	13.88	7.31	0.00	6.69	8.50	3.82	8.20	0.16	1.90	0.14	10.21	2.63	2.34	4.50
5600	4.80	6.33	5.69	1.39	2.51	6.02	2.80	6.90	1.28	3.39	0.44	3.29	2.07	4.86	1.99
4000	2.11	1.82	3.38	1.18	3.05	2.38	1.76	4.51	4.84	2.94	0.41	1.62	1.22	3.86	3.86
2800	2.56	2.39	2.94	1.14	2.48	1.40	1.97	3.65	7.18	2.64	0.60	1.77	1.49	2.90	2.49
2000	1.37	1.92	2.04	1.69	1.86	1.14	1.55	2.58	14.36	3.66	1.11	1.36	0.90	3.14	2.47
1400	1.12	1.75	1.72	1.62	2.04	0.89	1.38	2.22	17.07	5.89	4.70	1.37	0.78	3.70	2.60
1000	1.15	1.77	1.47	1.90	2.28	0.86	1.36	2.42	20.73	6.86	22.13	1.83	0.71	5.58	2.31
707.00	3.66	5.44	1.42	3.61	7.39	2.30	2.78	7.03	19.23	19.07	31.91	3.68	1.53	14.68	3.27
500.00	9.53	7.42	1.66	3.55	12.33	2.59	3.23	8.89	10.84	23.12	23.08	7.80	2.11	15.52	3.77
353.60	14.60	7.78	1.58	3.07	15.39	2.50	2.73	8.16	2.55	19.04	10.70	13.69	3.87	12.30	3.33
250.00	12.54	5.89	1.25	2.38	12.87	2.62	1.80	5.39	0.05	9.54	2.97	16.27	6.49	7.67	2.28
176.80	5.34	2.88	0.82	1.52	6.12	3.14	1.33	2.60	0.12	1.95	0.71	11.45	7.69	4.34	1.74
125.00	0.64	0.68	0.54	0.72	1.00	3.52	1.49	1.09	0.57	0.00	0.61	3.87	5.90	2.76	2.77
88.39	0.00	0.04	0.62	0.43	0.00	3.13	1.65	0.62	0.40	0.00	0.46	0.18	2.60	1.89	4.97
63.00	0.18	0.33	1.10	0.82	0.08	2.09	1.32	0.47	0.02	0.00	0.04	0.00	0.40	1.07	6.44
44.20	0.94	0.72	1.98	1.86	0.78	1.18	0.80	0.32	0.00	0.00	0.00	0.00	0.00	0.51	6.63
31.30	1.19	0.87	2.77	3.02	1.14	0.62	0.37	0.17	0.00	0.00	0.00	0.00	0.13	0.28	5.12
22.10	1.29	0.99	3.50	4.19	1.24	0.50	0.26	0.12	0.04	0.00	0.00	0.00	0.27	0.31	3.90
15.60	1.49	1.14	4.13	5.08	1.41	0.51	0.30	0.14	0.06	0.00	0.00	0.00	0.18	0.37	3.33
11.00	1.78	1.33	4.92	5.76	1.70	0.52	0.33	0.17	0.07	0.00	0.00	0.05	0.10	0.40	3.30
7.80	2.01	1.52	5.85	6.36	2.01	0.52	0.35	0.19	0.08	0.00	0.00	0.17	0.11	0.42	3.39
5.50	2.28	1.75	7.00	7.36	2.40	0.56	0.38	0.22	0.09	0.00	0.00	0.21	0.16	0.48	3.58
3.90	2.37	1.84	7.35	7.92	2.57	0.58	0.39	0.23	0.10	0.00	0.00	0.20	0.19	0.52	3.50
2.75	2.26	1.79	6.88	7.85	2.48	0.56	0.38	0.21	0.10	0.00	0.00	0.16	0.18	0.51	3.20
1.95	1.83	1.49	5.33	6.54	1.98	0.45	0.31	0.17	0.05	0.00	0.00	0.12	0.14	0.42	2.50
1.38	1.36	1.15	3.78	4.99	1.42	0.34	0.23	0.12	0.00	0.00	0.00	0.02	0.11	0.31	1.81
0.98	1.01	0.88	2.65	3.72	1.01	0.25	0.17	0.08	0.00	0.00	0.00	0.00	0.08	0.22	1.31
0.69	0.83	0.74	2.08	3.08	0.79	0.20	0.13	0.02	0.00	0.00	0.00	0.00	0.04	0.17	1.05
0.49	0.58	0.54	1.42	2.25	0.54	0.14	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.71
0.34	0.25	0.25	0.55	1.10	0.21	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
0.24	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
< 0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TEST RESULTS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.04 µm) @ 0.5 Phi Intervals
Job Number: 200867
Job Reference: RWE Five Estuaries

SAMPLE ID:	FE7b_04	FE7b_05	FE7b_06	FE7c_01	FE7c_02
LAB ID:	WL039876	WL039877	WL039878	WL039879	WL039880
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00
31500	0.00	0.00	0.00	57.52	0.00
22400	0.00	27.02	0.00	17.56	0.00
16000	0.00	0.00	0.00	0.00	22.51
11200	0.00	3.42	0.00	2.52	18.37
8000	0.00	4.70	2.83	1.54	4.05
5600	0.69	3.28	3.20	1.08	3.68
4000	1.21	2.40	2.61	0.78	2.90
2800	0.40	1.24	1.94	0.65	1.24
2000	0.50	1.36	1.15	0.49	1.36
1400	0.41	1.03	1.48	0.40	1.12
1000	0.53	0.90	1.91	0.44	1.22
707.00	0.93	2.06	4.75	1.28	2.69
500.00	1.39	3.20	6.43	1.96	3.56
353.60	1.41	3.56	6.58	1.97	3.46
250.00	1.09	2.86	5.23	1.32	2.57
176.80	0.81	1.93	3.73	0.76	2.02
125.00	0.98	1.88	3.54	0.85	2.64
88.39	1.94	2.85	4.62	1.27	3.74
63.00	3.44	3.82	5.52	1.37	3.92
44.20	5.29	4.31	5.82	1.11	3.22
31.30	6.23	3.74	4.91	0.66	2.00
22.10	6.75	3.13	4.12	0.44	1.37
15.60	7.12	2.74	3.62	0.41	1.25
11.00	7.87	2.64	3.48	0.45	1.34
7.80	8.71	2.65	3.45	0.48	1.42
5.50	9.53	2.75	3.60	0.51	1.53
3.90	9.12	2.62	3.51	0.51	1.53
2.75	7.84	2.32	3.24	0.47	1.45
1.95	5.66	1.77	2.59	0.38	1.17
1.38	3.80	1.28	1.96	0.28	0.88
0.98	2.60	0.96	1.52	0.21	0.67
0.69	2.03	0.81	1.31	0.17	0.56
0.49	1.33	0.57	0.95	0.12	0.40
0.34	0.37	0.21	0.39	0.04	0.16
0.24	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00
< 0.04	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00

TEST RESULTS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.04 µm) @ 0.5 Phi Intervals
Job Number: 200867
Job Reference: RWE Five Estuaries

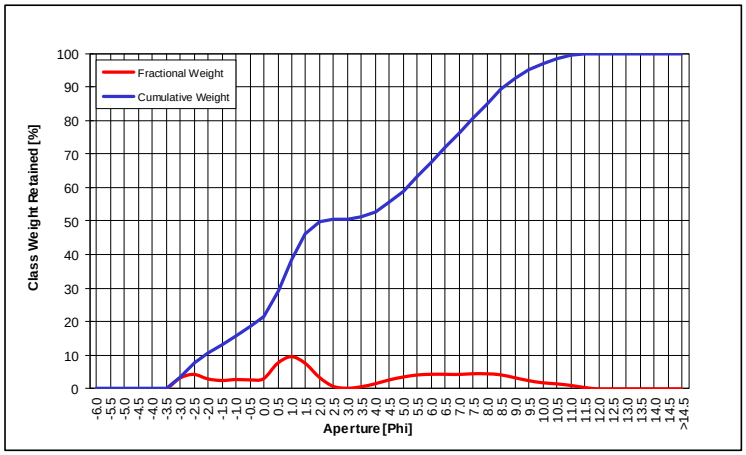
SAMPLE ID:	FE7c_03	FE7c_04	FE7d_01	FE7d_03	FE7e_01	FE7e_02	FE7e_03	FE7f_01	FE7g_01	FE7g_02	FE7g_03
LAB ID:	WL039881	WL039882	WL039883	WL039884	WL039885	WL039886	WL039887	WL039888	WL039889	WL039890	WL039891
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31500	0.00	0.00	0.00	19.93	0.00	0.00	0.00	0.00	29.82	0.00	0.00
22400	22.03	0.00	23.92	32.04	12.55	0.00	37.03	19.27	0.00	0.00	0.00
16000	12.07	0.00	15.00	8.44	28.37	0.00	0.00	9.14	6.52	0.00	0.00
11200	9.16	0.00	2.43	4.04	12.23	0.00	3.60	15.48	10.08	0.00	0.00
8000	4.65	0.00	2.31	1.78	3.12	0.00	4.80	6.34	6.42	0.00	0.00
5600	4.78	0.00	3.46	2.21	0.62	0.00	2.80	3.05	6.94	0.00	0.19
4000	2.68	0.00	2.21	1.65	1.34	0.00	1.28	1.48	3.92	0.00	0.18
2800	2.14	0.04	1.53	1.14	1.34	0.02	1.74	0.80	2.33	0.08	0.01
2000	1.70	0.03	1.06	1.16	1.50	0.05	0.73	0.42	1.99	0.09	0.06
1400	1.39	0.03	1.00	1.26	1.18	0.03	0.58	0.15	1.83	0.20	0.07
1000	1.37	0.05	0.95	1.47	0.88	0.07	0.61	0.09	2.16	0.34	0.07
707.00	3.12	0.14	1.88	4.56	1.57	0.32	1.39	0.00	5.13	2.05	0.21
500.00	3.96	0.09	2.22	6.58	2.40	0.36	4.61	0.58	6.24	7.78	5.05
353.60	3.62	0.01	2.20	6.24	3.33	1.34	8.89	5.54	5.94	14.05	13.86
250.00	2.52	0.28	2.29	3.64	3.94	4.21	10.72	13.85	4.48	15.61	18.94
176.80	1.92	4.22	3.04	1.09	4.06	8.44	8.18	15.02	2.66	11.24	15.44
125.00	2.44	11.77	4.26	0.20	3.94	11.54	3.85	7.28	1.29	5.92	7.86
88.39	3.25	17.65	4.93	0.42	3.56	11.38	1.12	1.07	0.60	3.83	3.08
63.00	3.15	16.42	4.28	0.60	2.72	8.49	0.59	0.00	0.34	4.00	2.20
44.20	2.40	10.88	3.09	0.44	1.85	5.96	0.91	0.00	0.23	4.27	2.81
31.30	1.42	4.88	1.87	0.16	1.09	4.38	0.93	0.00	0.14	3.43	2.88
22.10	1.01	2.85	1.46	0.07	0.82	4.36	0.71	0.00	0.09	2.81	2.86
15.60	0.99	3.27	1.52	0.10	0.81	4.87	0.56	0.00	0.09	2.82	3.08
11.00	1.07	4.09	1.70	0.14	0.86	5.44	0.59	0.00	0.11	3.26	3.47
7.80	1.12	4.37	1.83	0.15	0.90	5.71	0.68	0.07	0.13	3.58	3.64
5.50	1.18	4.41	1.97	0.14	0.96	5.81	0.75	0.14	0.14	3.68	3.60
3.90	1.17	4.03	1.92	0.12	0.96	5.20	0.70	0.13	0.14	3.28	3.14
2.75	1.08	3.42	1.73	0.10	0.89	4.21	0.58	0.09	0.11	2.66	2.53
1.95	0.85	2.47	1.32	0.07	0.70	2.87	0.41	0.02	0.08	1.83	1.76
1.38	0.62	1.67	0.93	0.05	0.52	1.84	0.27	0.00	0.04	1.19	1.15
0.98	0.45	1.16	0.66	0.00	0.38	1.25	0.18	0.00	0.00	0.81	0.77
0.69	0.37	0.95	0.54	0.00	0.31	1.02	0.13	0.00	0.00	0.65	0.60
0.49	0.25	0.64	0.37	0.00	0.22	0.69	0.05	0.00	0.00	0.43	0.39
0.34	0.08	0.15	0.11	0.00	0.06	0.16	0.00	0.00	0.00	0.10	0.08
0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
< 0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

D.2 Subtidal Grab Sample Particle Size Distribution

FE1_01

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.00	0.00
8000	-3.0	3.21	3.21
5600	-2.5	4.31	7.52
4000	-2.0	2.98	10.50
2800	-1.5	2.50	13.00
2000	-1.0	2.80	15.80
1400	-0.5	2.69	18.49
1000	0.0	3.02	21.51
707.00	0.5	7.57	29.08
500.00	1.0	9.58	38.66
353.60	1.5	7.58	46.24
250.00	2.0	3.47	49.71
176.80	2.5	0.77	50.48
125.00	3.0	0.20	50.68
88.39	3.5	0.64	51.32
63.00	4.0	1.52	52.84
44.20	4.5	2.66	55.50
31.30	5.0	3.52	59.02
22.10	5.5	4.14	63.16
15.60	6.0	4.35	67.50
11.00	6.5	4.35	71.85
7.80	7.0	4.30	76.15
5.50	7.5	4.51	80.66
3.90	8.0	4.49	85.15
2.75	8.5	4.20	89.35
1.95	9.0	3.34	92.69
1.38	9.5	2.47	95.16
0.98	10.0	1.84	97.00
0.69	10.5	1.51	98.51
0.49	11.0	1.05	99.57
0.34	11.5	0.43	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	4.07	Extremely Poorly Sorted
Skewness	0.24	Fine Skewed
Kurtosis	0.76	Platykurtic
Mean [µm]	122.01	Very Fine Sand
Mean [phi]	3.03	
Median [µm]	219.08	Fine Sand
Median [phi]	2.19	
Gravel [%]	15.80	Gravelly Mud
Sand [%]	37.04	
Mud [%]	47.16	

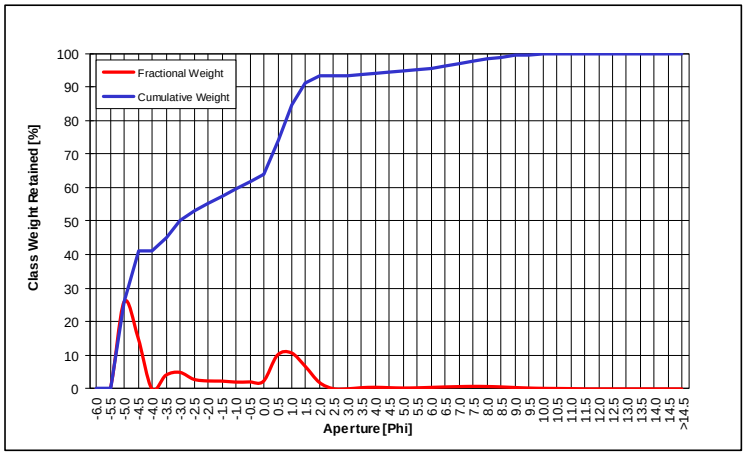


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_02

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	25.79	25.79
22400	-4.5	15.28	41.07
16000	-4.0	0.00	41.07
11200	-3.5	4.07	45.13
8000	-3.0	4.91	50.04
5600	-2.5	2.85	52.90
4000	-2.0	2.36	55.26
2800	-1.5	2.32	57.58
2000	-1.0	2.02	59.61
1400	-0.5	2.08	61.68
1000	0.0	2.28	63.96
707.00	0.5	10.02	73.98
500.00	1.0	10.69	84.67
353.60	1.5	6.67	91.35
250.00	2.0	1.95	93.30
176.80	2.5	0.07	93.37
125.00	3.0	0.01	93.39
88.39	3.5	0.36	93.74
63.00	4.0	0.48	94.22
44.20	4.5	0.36	94.59
31.30	5.0	0.26	94.85
22.10	5.5	0.32	95.17
15.60	6.0	0.45	95.62
11.00	6.5	0.58	96.20
7.80	7.0	0.68	96.88
5.50	7.5	0.75	97.63
3.90	8.0	0.71	98.34
2.75	8.5	0.60	98.94
1.95	9.0	0.41	99.35
1.38	9.5	0.26	99.61
0.98	10.0	0.17	99.78
0.69	10.5	0.13	99.91
0.49	11.0	0.09	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	3.15	Very Poorly Sorted
Skewness	0.42	Very Fine Skewed
Kurtosis	0.79	Platykurtic
Mean [µm]	5288.50	Pebble
Mean [phi]	-2.40	
Median [µm]	8024.40	Pebble
Median [phi]	-3.00	
Gravel [%]	59.61	Muddy Sandy Gravel
Sand [%]	34.62	
Mud [%]	5.78	

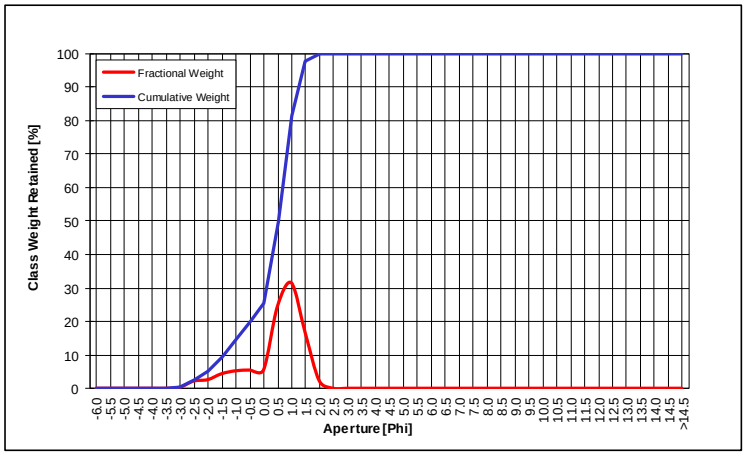


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_03

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.00	0.00
8000	-3.0	0.30	0.30
5600	-2.5	2.16	2.46
4000	-2.0	2.57	5.04
2800	-1.5	4.35	9.38
2000	-1.0	5.21	14.60
1400	-0.5	5.44	20.03
1000	0.0	5.44	25.47
707.00	0.5	24.45	49.92
500.00	1.0	31.44	81.36
353.60	1.5	16.42	97.78
250.00	2.0	2.22	100.00
176.80	2.5	0.00	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	1.01	Poorly Sorted
Skewness	-0.44	Very Coarse Skewed
Kurtosis	1.49	Leptokurtic
Mean [µm]	847.78	Coarse Sand
Mean [phi]	0.24	
Median [µm]	706.37	Coarse Sand
Median [phi]	0.50	
Gravel [%]	14.60	Gravelly Sand
Sand [%]	85.40	
Mud [%]	0.00	

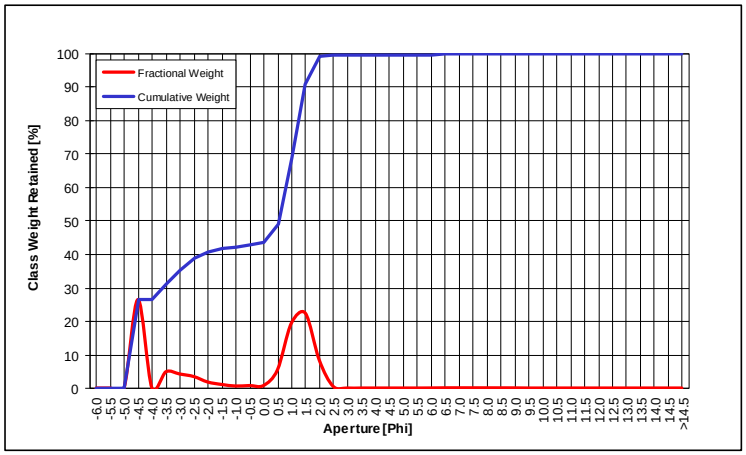


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_04

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	26.39	26.39
16000	-4.0	0.00	26.39
11200	-3.5	4.85	31.24
8000	-3.0	4.17	35.42
5600	-2.5	3.42	38.84
4000	-2.0	1.79	40.63
2800	-1.5	1.06	41.69
2000	-1.0	0.60	42.29
1400	-0.5	0.74	43.03
1000	0.0	0.74	43.77
707.00	0.5	5.39	49.16
500.00	1.0	19.36	68.52
353.60	1.5	22.33	90.85
250.00	2.0	8.32	99.18
176.80	2.5	0.49	99.66
125.00	3.0	0.00	99.66
88.39	3.5	0.00	99.66
63.00	4.0	0.00	99.66
44.20	4.5	0.00	99.66
31.30	5.0	0.00	99.66
22.10	5.5	0.00	99.66
15.60	6.0	0.02	99.68
11.00	6.5	0.06	99.74
7.80	7.0	0.06	99.80
5.50	7.5	0.06	99.86
3.90	8.0	0.05	99.91
2.75	8.5	0.05	99.96
1.95	9.0	0.04	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.51	Very Poorly Sorted
Skewness	-0.68	Very Coarse Skewed
Kurtosis	0.48	Very Platykurtic
Mean [µm]	1914.48	Very Coarse Sand
Mean [phi]	-0.94	
Median [µm]	696.47	Coarse Sand
Median [phi]	0.52	
Gravel [%]	42.29	Sandy Gravel
Sand [%]	57.38	
Mud [%]	0.34	

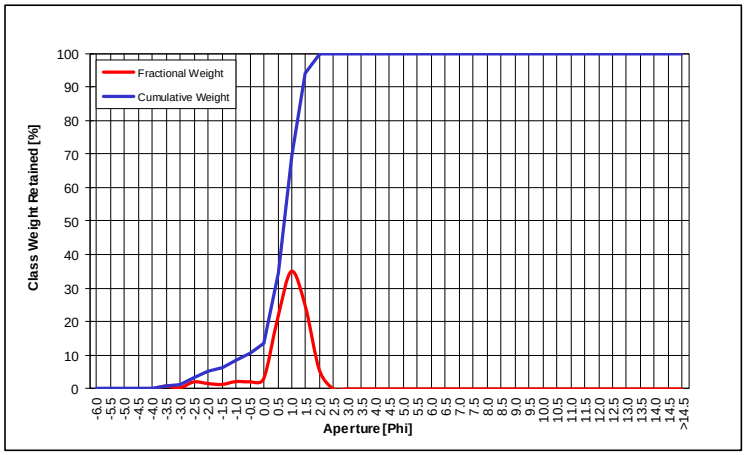


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_05

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.87	0.87
8000	-3.0	0.36	1.23
5600	-2.5	2.11	3.34
4000	-2.0	1.63	4.97
2800	-1.5	1.34	6.31
2000	-1.0	2.20	8.51
1400	-0.5	2.16	10.67
1000	0.0	2.95	13.62
707.00	0.5	20.75	34.37
500.00	1.0	35.11	69.49
353.60	1.5	24.70	94.19
250.00	2.0	5.74	99.92
176.80	2.5	0.08	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	0.85	Moderately Sorted
Skewness	-0.30	Coarse Skewed
Kurtosis	1.74	Very Leptokurtic
Mean [µm]	619.34	Coarse Sand
Mean [phi]	0.69	
Median [µm]	605.99	Coarse Sand
Median [phi]	0.72	
Gravel [%]	8.51	Gravelly Sand
Sand [%]	91.49	
Mud [%]	0.00	

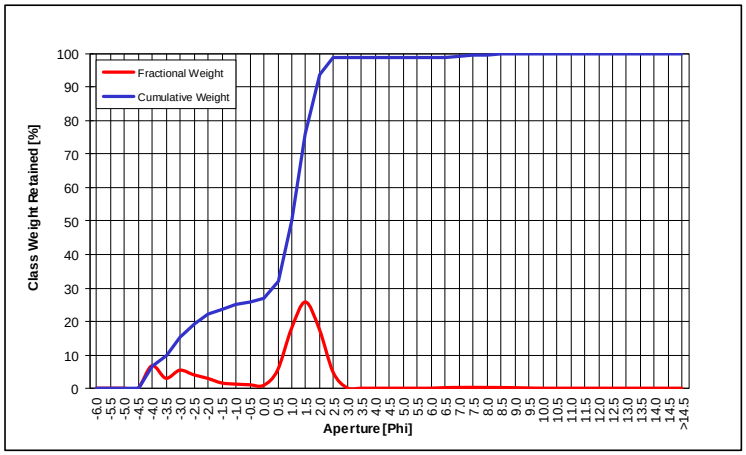


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_06

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	6.76	6.76
11200	-3.5	2.99	9.75
8000	-3.0	5.42	15.17
5600	-2.5	4.03	19.20
4000	-2.0	2.95	22.16
2800	-1.5	1.58	23.74
2000	-1.0	1.23	24.97
1400	-0.5	1.04	26.01
1000	0.0	0.85	26.85
707.00	0.5	5.33	32.18
500.00	1.0	17.88	50.06
353.60	1.5	25.96	76.03
250.00	2.0	17.83	93.86
176.80	2.5	4.75	98.61
125.00	3.0	0.11	98.72
88.39	3.5	0.00	98.72
63.00	4.0	0.00	98.72
44.20	4.5	0.00	98.72
31.30	5.0	0.00	98.72
22.10	5.5	0.00	98.72
15.60	6.0	0.00	98.72
11.00	6.5	0.16	98.88
7.80	7.0	0.23	99.11
5.50	7.5	0.24	99.35
3.90	8.0	0.23	99.58
2.75	8.5	0.20	99.78
1.95	9.0	0.16	99.94
1.38	9.5	0.06	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.10	Very Poorly Sorted
Skewness	-0.66	Very Coarse Skewed
Kurtosis	1.04	Mesokurtic
Mean [µm]	1040.68	Very Coarse Sand
Mean [phi]	-0.06	
Median [µm]	500.60	Coarse Sand
Median [phi]	1.00	
Gravel [%]	24.97	Gravelly Sand
Sand [%]	73.75	
Mud [%]	1.28	

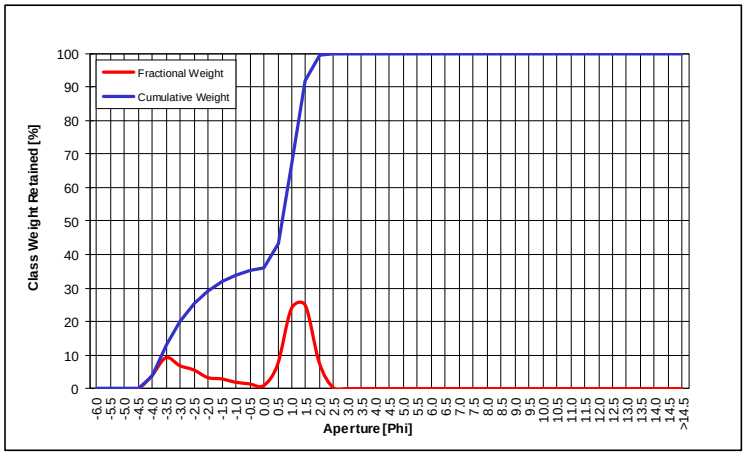


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_07

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	3.87	3.87
11200	-3.5	9.27	13.14
8000	-3.0	6.87	20.02
5600	-2.5	5.60	25.62
4000	-2.0	3.31	28.93
2800	-1.5	2.92	31.84
2000	-1.0	1.92	33.76
1400	-0.5	1.43	35.18
1000	0.0	0.88	36.07
707.00	0.5	7.04	43.11
500.00	1.0	23.94	67.05
353.60	1.5	24.90	91.95
250.00	2.0	7.74	99.69
176.80	2.5	0.31	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.01	Very Poorly Sorted
Skewness	-0.66	Very Coarse Skewed
Kurtosis	0.62	Very Platykurtic
Mean [µm]	1350.16	Very Coarse Sand
Mean [phi]	-0.43	
Median [µm]	639.90	Coarse Sand
Median [phi]	0.64	
Gravel [%]	33.76	Sandy Gravel
Sand [%]	66.24	
Mud [%]	0.00	

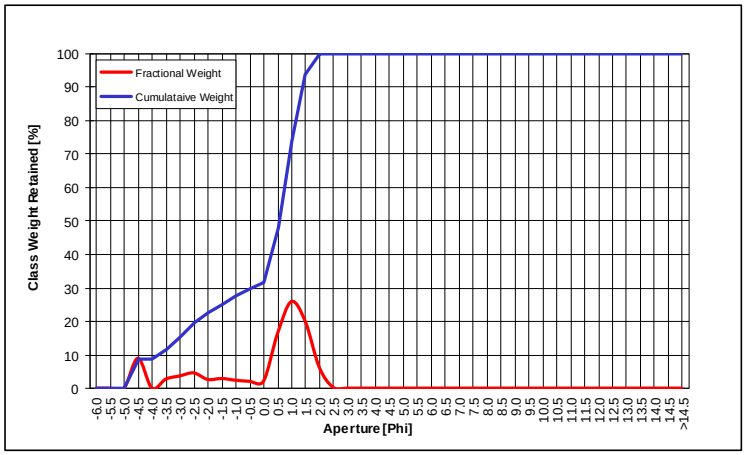


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE1_08

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	8.90	8.90
16000	-4.0	0.00	8.90
11200	-3.5	2.72	11.62
8000	-3.0	3.64	15.27
5600	-2.5	4.55	19.81
4000	-2.0	2.59	22.41
2800	-1.5	2.88	25.28
2000	-1.0	2.36	27.65
1400	-0.5	2.05	29.70
1000	0.0	2.06	31.76
707.00	0.5	16.17	47.93
500.00	1.0	25.78	73.71
353.60	1.5	19.83	93.54
250.00	2.0	6.22	99.76
176.80	2.5	0.24	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.00	Very Poorly Sorted
Skewness	-0.66	Very Coarse Skewed
Kurtosis	1.01	Mesokurtic
Mean [µm]	1294.49	Very Coarse Sand
Mean [phi]	-0.37	
Median [µm]	687.62	Coarse Sand
Median [phi]	0.54	
Gravel [%]	27.65	Gravelly Sand
Sand [%]	70.30	
Mud [%]	0.00	

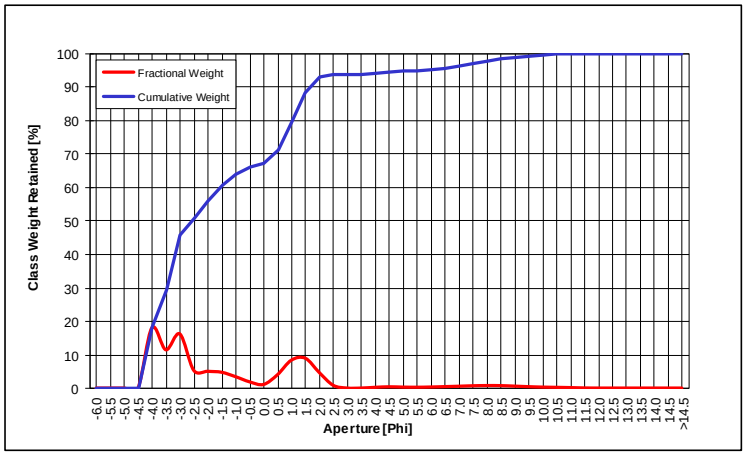


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_01

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	18.04	18.04
11200	-3.5	11.45	29.49
8000	-3.0	16.21	45.70
5600	-2.5	5.28	50.98
4000	-2.0	5.01	55.99
2800	-1.5	4.73	60.71
2000	-1.0	3.40	64.11
1400	-0.5	1.86	65.98
1000	0.0	1.07	67.05
707.00	0.5	3.98	71.03
500.00	1.0	8.35	79.38
353.60	1.5	8.93	88.31
250.00	2.0	4.64	92.95
176.80	2.5	0.82	93.77
125.00	3.0	0.00	93.77
88.39	3.5	0.00	93.77
63.00	4.0	0.22	93.99
44.20	4.5	0.38	94.37
31.30	5.0	0.28	94.65
22.10	5.5	0.25	94.90
15.60	6.0	0.31	95.21
11.00	6.5	0.43	95.64
7.80	7.0	0.55	96.19
5.50	7.5	0.68	96.87
3.90	8.0	0.75	97.61
2.75	8.5	0.73	98.34
1.95	9.0	0.58	98.92
1.38	9.5	0.41	99.33
0.98	10.0	0.28	99.61
0.69	10.5	0.21	99.83
0.49	11.0	0.14	99.97
0.34	11.5	0.03	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.85	Very Poorly Sorted
Skewness	0.55	Very Fine Skewed
Kurtosis	0.93	Mesokurtic
Mean [µm]	3463.80	Granule
Mean [phi]	-1.79	
Median [µm]	5981.78	Pebble
Median [phi]	-2.58	
Gravel [%]	64.11	Muddy Sandy Gravel
Sand [%]	29.88	
Mud [%]	6.01	

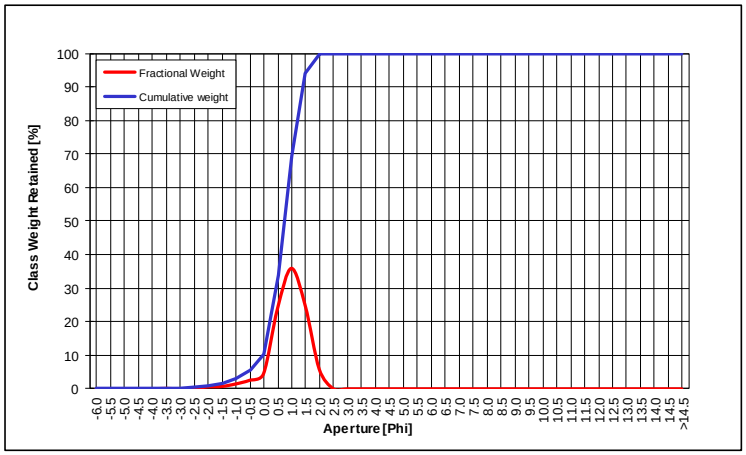


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_02

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.15	0.15
8000	-3.0	0.00	0.15
5600	-2.5	0.14	0.29
4000	-2.0	0.60	0.89
2800	-1.5	0.72	1.61
2000	-1.0	1.46	3.06
1400	-0.5	2.54	5.61
1000	0.0	4.46	10.07
707.00	0.5	23.73	33.80
500.00	1.0	35.75	69.55
353.60	1.5	24.57	94.12
250.00	2.0	5.81	99.93
176.80	2.5	0.07	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	0.62	Moderately Well Sorted
Skewness	-0.13	Coarse Skewed
Kurtosis	1.12	Leptokurtic
Mean [µm]	609.10	Coarse Sand
Mean [phi]	0.72	
Median [µm]	604.27	Coarse Sand
Median [phi]	0.73	
Gravel [%]	3.06	Slightly Gravelly Sand
Sand [%]	96.94	
Mud [%]	0.00	

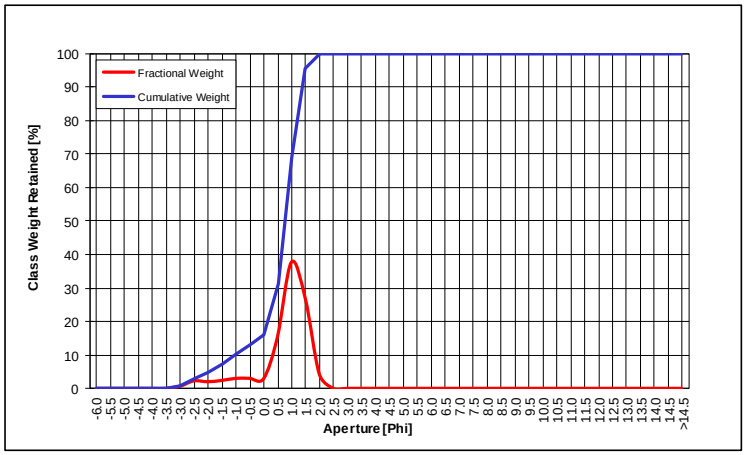


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_03

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.00	0.00
8000	-3.0	0.62	0.62
5600	-2.5	2.23	2.85
4000	-2.0	1.98	4.83
2800	-1.5	2.35	7.18
2000	-1.0	2.98	10.16
1400	-0.5	2.99	13.16
1000	0.0	2.82	15.97
707.00	0.5	15.32	31.30
500.00	1.0	37.64	68.93
353.60	1.5	26.75	95.69
250.00	2.0	4.30	99.99
176.80	2.5	0.01	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	0.84	Moderately Sorted
Skewness	-0.37	Very Coarse Skewed
Kurtosis	1.73	Very Leptokurtic
Mean [µm]	625.48	Coarse Sand
Mean [phi]	0.68	
Median [µm]	595.19	Coarse Sand
Median [phi]	0.75	
Gravel [%]	10.16	Gravelly Sand
Sand [%]	89.84	
Mud [%]	0.00	

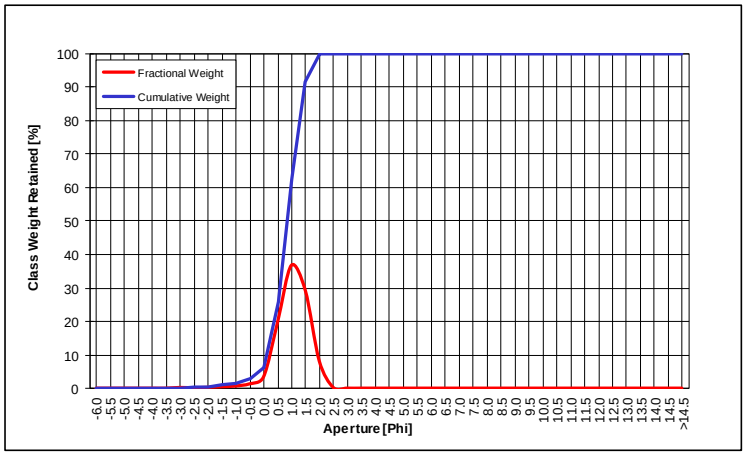


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_04

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.00	0.00
8000	-3.0	0.20	0.20
5600	-2.5	0.12	0.32
4000	-2.0	0.24	0.57
2800	-1.5	0.42	0.99
2000	-1.0	0.65	1.64
1400	-0.5	1.29	2.93
1000	0.0	3.33	6.26
707.00	0.5	19.52	25.78
500.00	1.0	36.71	62.49
353.60	1.5	29.19	91.67
250.00	2.0	8.11	99.78
176.80	2.5	0.22	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	0.57	Moderately Well Sorted
Skewness	-0.06	Symmetrical
Kurtosis	1.05	Mesokurtic
Mean [µm]	568.02	Coarse Sand
Mean [phi]	0.82	
Median [µm]	562.53	Coarse Sand
Median [phi]	0.83	
Gravel [%]	1.64	Slightly Gravelly Sand
Sand [%]	98.36	
Mud [%]	0.00	

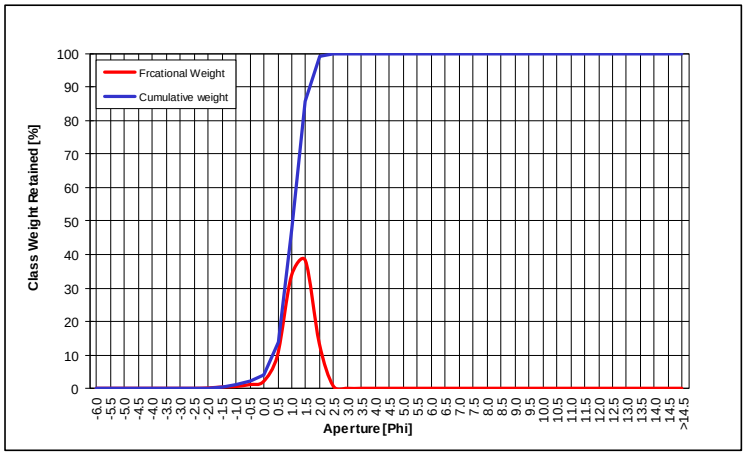


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_05

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	0.00	0.00
11200	-3.5	0.00	0.00
8000	-3.0	0.00	0.00
5600	-2.5	0.00	0.00
4000	-2.0	0.09	0.09
2800	-1.5	0.39	0.48
2000	-1.0	0.53	1.01
1400	-0.5	1.11	2.13
1000	0.0	2.02	4.15
707.00	0.5	9.79	13.94
500.00	1.0	33.64	47.58
353.60	1.5	38.26	85.83
250.00	2.0	13.46	99.29
176.80	2.5	0.71	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	0.51	Moderately Well Sorted
Skewness	-0.08	Symmetrical
Kurtosis	1.06	Mesokurtic
Mean [µm]	495.59	Medium Sand
Mean [phi]	1.01	
Median [µm]	489.15	Medium Sand
Median [phi]	1.03	
Gravel [%]	1.01	Slightly Gravelly Sand
Sand [%]	98.99	
Mud [%]	0.00	

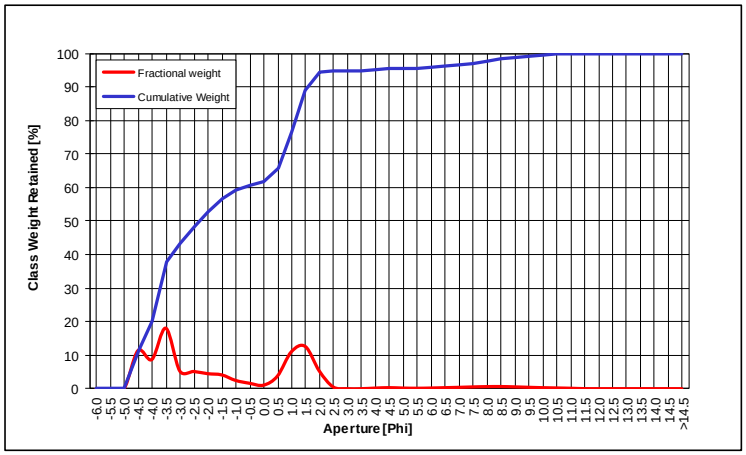


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE2_06

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	11.31	11.31
16000	-4.0	8.67	19.98
11200	-3.5	17.93	37.91
8000	-3.0	5.21	43.13
5600	-2.5	5.10	48.23
4000	-2.0	4.45	52.68
2800	-1.5	4.10	56.77
2000	-1.0	2.45	59.23
1400	-0.5	1.61	60.84
1000	0.0	1.05	61.89
707.00	0.5	3.74	65.62
500.00	1.0	10.96	76.58
353.60	1.5	12.51	89.09
250.00	2.0	5.26	94.35
176.80	2.5	0.51	94.86
125.00	3.0	0.00	94.86
88.39	3.5	0.00	94.86
63.00	4.0	0.18	95.04
44.20	4.5	0.31	95.35
31.30	5.0	0.19	95.54
22.10	5.5	0.14	95.68
15.60	6.0	0.20	95.88
11.00	6.5	0.30	96.18
7.80	7.0	0.40	96.58
5.50	7.5	0.53	97.11
3.90	8.0	0.61	97.72
2.75	8.5	0.64	98.36
1.95	9.0	0.54	98.91
1.38	9.5	0.42	99.32
0.98	10.0	0.30	99.62
0.69	10.5	0.22	99.85
0.49	11.0	0.14	99.98
0.34	11.5	0.02	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.69	Very Poorly Sorted
Skewness	0.36	Very Fine Skewed
Kurtosis	0.74	Platykurtic
Mean [µm]	3339.27	Granule
Mean [phi]	-1.74	
Median [µm]	4897.43	Pebble
Median [phi]	-2.29	
Gravel [%]	59.23	Muddy Sandy Gravel
Sand [%]	35.81	
Mud [%]	4.96	

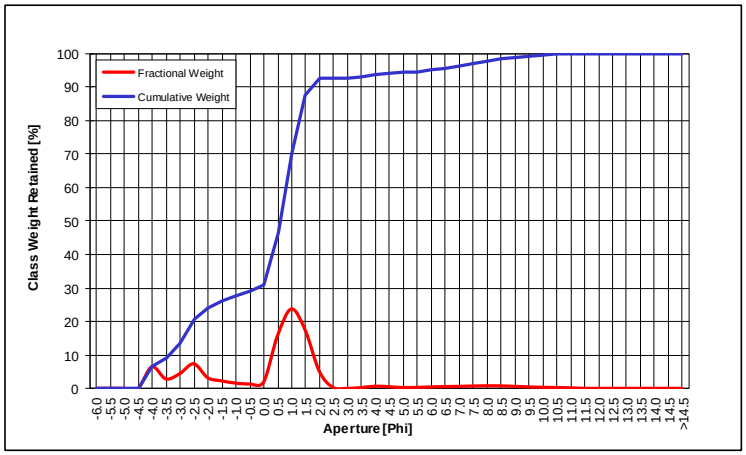


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE3_01

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	0.00	0.00
16000	-4.0	6.42	6.42
11200	-3.5	2.79	9.21
8000	-3.0	4.37	13.59
5600	-2.5	7.30	20.89
4000	-2.0	3.16	24.05
2800	-1.5	2.21	26.26
2000	-1.0	1.56	27.83
1400	-0.5	1.30	29.13
1000	0.0	1.81	30.94
707.00	0.5	15.59	46.53
500.00	1.0	23.63	70.17
353.60	1.5	17.23	87.40
250.00	2.0	5.10	92.50
176.80	2.5	0.23	92.72
125.00	3.0	0.00	92.72
88.39	3.5	0.21	92.94
63.00	4.0	0.64	93.58
44.20	4.5	0.48	94.05
31.30	5.0	0.24	94.29
22.10	5.5	0.27	94.57
15.60	6.0	0.42	94.99
11.00	6.5	0.52	95.51
7.80	7.0	0.59	96.10
5.50	7.5	0.69	96.79
3.90	8.0	0.75	97.54
2.75	8.5	0.73	98.28
1.95	9.0	0.59	98.87
1.38	9.5	0.43	99.30
0.98	10.0	0.31	99.61
0.69	10.5	0.24	99.84
0.49	11.0	0.16	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.59	Very Poorly Sorted
Skewness	-0.27	Coarse Skewed
Kurtosis	1.42	Leptokurtic
Mean [µm]	1218.47	Very Coarse Sand
Mean [phi]	-0.29	
Median [µm]	671.96	Coarse Sand
Median [phi]	0.57	
Gravel [%]	27.83	Gravelly Sand
Sand [%]	65.75	
Mud [%]	6.42	

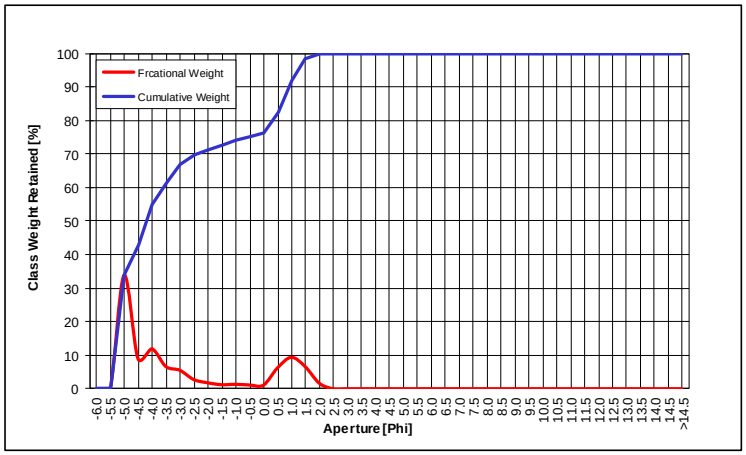


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE3_02

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	33.81	33.81
22400	-4.5	8.97	42.78
16000	-4.0	11.91	54.69
11200	-3.5	6.63	61.32
8000	-3.0	5.52	66.84
5600	-2.5	2.75	69.59
4000	-2.0	1.79	71.38
2800	-1.5	1.22	72.60
2000	-1.0	1.34	73.94
1400	-0.5	1.14	75.08
1000	0.0	1.09	76.17
707.00	0.5	6.21	82.38
500.00	1.0	9.38	91.76
353.60	1.5	6.57	98.33
250.00	2.0	1.66	99.99
176.80	2.5	0.01	100.00
125.00	3.0	0.00	100.00
88.39	3.5	0.00	100.00
63.00	4.0	0.00	100.00
44.20	4.5	0.00	100.00
31.30	5.0	0.00	100.00
22.10	5.5	0.00	100.00
15.60	6.0	0.00	100.00
11.00	6.5	0.00	100.00
7.80	7.0	0.00	100.00
5.50	7.5	0.00	100.00
3.90	8.0	0.00	100.00
2.75	8.5	0.00	100.00
1.95	9.0	0.00	100.00
1.38	9.5	0.00	100.00
0.98	10.0	0.00	100.00
0.69	10.5	0.00	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.47	Very Poorly Sorted
Skewness	0.64	Very Fine Skewed
Kurtosis	0.59	Very Platykurtic
Mean [µm]	7732.83	Pebble
Mean [phi]	-2.95	
Median [µm]	18268.00	Pebble
Median [phi]	-4.19	
Gravel [%]	73.94	Sandy Gravel
Sand [%]	26.06	
Mud [%]	0.00	

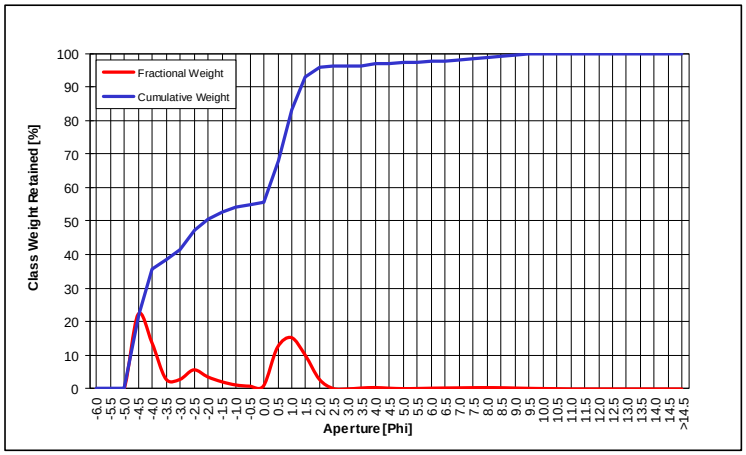


Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

FE3_03

Aperture [µm]	Aperture [Phi]	Fractional [%]	Cumulative [%]
63000	-6.0	0.00	0.00
45000	-5.5	0.00	0.00
31500	-5.0	0.00	0.00
22400	-4.5	21.98	21.98
16000	-4.0	13.68	35.66
11200	-3.5	2.96	38.62
8000	-3.0	2.81	41.44
5600	-2.5	5.65	47.08
4000	-2.0	3.57	50.66
2800	-1.5	2.15	52.80
2000	-1.0	1.19	53.99
1400	-0.5	0.83	54.82
1000	0.0	0.90	55.72
707.00	0.5	12.27	67.99
500.00	1.0	15.17	83.16
353.60	1.5	9.94	93.11
250.00	2.0	2.89	96.00
176.80	2.5	0.14	96.14
125.00	3.0	0.00	96.14
88.39	3.5	0.28	96.42
63.00	4.0	0.42	96.84
44.20	4.5	0.23	97.07
31.30	5.0	0.10	97.17
22.10	5.5	0.14	97.32
15.60	6.0	0.23	97.55
11.00	6.5	0.29	97.83
7.80	7.0	0.33	98.16
5.50	7.5	0.38	98.55
3.90	8.0	0.40	98.95
2.75	8.5	0.37	99.31
1.95	9.0	0.28	99.59
1.38	9.5	0.19	99.79
0.98	10.0	0.13	99.91
0.69	10.5	0.08	100.00
0.49	11.0	0.00	100.00
0.34	11.5	0.00	100.00
0.24	12.0	0.00	100.00
0.17	12.5	0.00	100.00
0.12	13.0	0.00	100.00
0.09	13.5	0.00	100.00
0.06	14.0	0.00	100.00
0.04	14.5	0.00	100.00
< 0.04	>14.5	0.00	100.00
Total		100.00	100.00

Sorting	2.43	Very Poorly Sorted
Skewness	0.14	Fine Skewed
Kurtosis	0.54	Very Platykurtic
Mean [µm]	3703.06	Granule
Mean [phi]	-1.89	
Median [µm]	4254.66	Pebble
Median [phi]	-2.09	
Gravel [%]	53.99	Sandy Gravel
Sand [%]	42.85	
Mud [%]	3.16	



Based on Wentworth (1922) Grain Size Classification
Statistics Based on Folk and Ward (1957)

D.3 Subtidal Grab Sample Photographs

Station FE1_01

Station FE1_02

Station FE1_03

Station FE1_04

Station FE1_05

Station FE1_06

Station FE1_07

Station FE1_08

Station FE2_01

Station FE2_02

Station FE2_03

Station FE2_04


Station FE2_05


Station FE2_06


Station FE3_01

Station FE3_02

Station FE3_03

Appendix E

Chemistry Analysis Certificates

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR01220**
Issue Version	1
Customer	Fugro GB Marine Ltd
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 1
Date Sampled	09-15-Nov-2021
Date Received	25-Nov-21
Date Reported	22-Dec-21
Condition of samples	Frozen Satisfactory

Authorised by:	Marya Hubbard
Position:	Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic (As)**	**Cadmium (Cd)**	**Chromium (Cr)**	**Copper (Cu)**	**Mercury (Hg)**	**Nickel (Ni)**	**Lead (Pb)**
FE3_01	MAR01220.001	Sediment	18.8	0.08	6.9	5.2	0.02	9.6	4.4
FE5_09	MAR01220.002	Sediment	46.1	0.28	42.9	31.3	0.05	55.9	15.6
FE7b_02	MAR01220.003	Sediment	14.2	0.14	19.9	15.1	0.07	16.0	17.3
FE7b_04	MAR01220.004	Sediment	39.3	0.31	20.7	21.5	0.10	56.0	17.1
FE7c_04	MAR01220.005	Sediment	10.7	0.09	13.9	9.6	0.05	11.3	12.7
FE7g_03	MAR01220.006	Sediment	9.7	0.10	12.1	9.5	0.04	9.4	12.3
		Certified Reference Material SETOC 774 (% Recovery)	105	107	102.0	101	10[1]	103	103
		QC Blank	<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	2	10	1	0.5
		Accreditation	UKAS/MMO	N	N	N
Client Reference:	SOCOTEC Ref:	Matrix	Zinc (Zn)	Aluminium as Al	Barium as Ba	Tin as Sn
FE3_01	MAR01220.001	Sediment	14.4	3160	12^	<0.5
FE5_09	MAR01220.002	Sediment	85.6	21100	10^	1.0
FE7b_02	MAR01220.003	Sediment	53.4	8930	62.3	1.1
FE7b_04	MAR01220.004	Sediment	62.3	10500	55.9	1.0
FE7c_04	MAR01220.005	Sediment	37.6	5850	53.9	0.8
FE7g_03	MAR01220.006	Sediment	38.1	4200	48.8	0.7
Certified Reference Material SETOC 774 (% Recovery)			102	95	98	103
QC Blank			<2	<10	<1	<0.5

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	0.001	0.001
		Accreditation	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	Dibutyltin (DBT)	Tributyltin (TBT)
FE3_01	MAR01220.001	Sediment	<0.005	<0.005
FE5_09	MAR01220.002	Sediment	<0.005	<0.005
FE7b_02	MAR01220.003	Sediment	<0.005	<0.005
FE7b_04	MAR01220.004	Sediment	<0.005	<0.005
FE7c_04	MAR01220.005	Sediment	<0.005	<0.005
FE7g_03	MAR01220.006	Sediment	<0.005	<0.005
Certified Reference Material BCR-646 (% Recovery)			114	72
QC Blank			<0.001	<0.001

* See report notes

Certificate of Analysis

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF
FE3_01	MAR01220.001	Sediment	<1	<1	<1	<1	<1	<1
FE5_09	MAR01220.002	Sediment	<1	<1	<1	1.11	<1	1.78
FE7b_02	MAR01220.003	Sediment	5.27	4.48	10.1	24.9	32.1	33.2
FE7b_04	MAR01220.004	Sediment	1.73	1.97	5.06	9.32	10.5	15.3
FE7c_04	MAR01220.005	Sediment	2.80	4.19	8.23	17.9	16.7	25.7
FE7g_03	MAR01220.006	Sediment	2.04	1.87	5.17	11.9	12.5	18.0
Certified Reference Material Quasimeme QPH097MS (% Recovery)			67	102	77	80	80	75
QC Blank			<1	<1	<1	<1	<1	<1

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no Certified Reference Materials are avaliable.
For full analyte name see method summaries

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	MMO	MMO	MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BEP**	**BKF**	**C1N**	**C1PHEN**	**C2N**
FE3_01	MAR01220.001	Sediment	<1	<1	<1	<1	<1	<1
FE5_09	MAR01220.002	Sediment	<1	1.98	1.38	5.93	4.17	7.36
FE7b_02	MAR01220.003	Sediment	33.7	46.5	28.1	129	72.1	10~
FE7b_04	MAR01220.004	Sediment	14.6	18.9	8.00	44.9	27.2	37.7
FE7c_04	MAR01220.005	Sediment	21.2	29.1	18.7	81.3	44.9	61.8
FE7g_03	MAR01220.006	Sediment	15.5	19.5	13.5	53.9	33.0	44.7
Certified Reference Material Quasimeme QPH097MS (% Recovery)			84	82	95	96	75	106
QC Blank			<1	<1	<1	<1	<1	<1

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For full analyte name see method summaries

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	MMO	MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR
FE3_01	MAR01220.001	Sediment	<1	<1	<1	<1	<1	<1
FE5_09	MAR01220.002	Sediment	4.22	1.46	<1	4.38	<1	<1
FE7b_02	MAR01220.003	Sediment	79.9	33.6	3.40	59.6	9.16	25.4
FE7b_04	MAR01220.004	Sediment	28.8	16.5	1.50	24.9	3.59	8.31
FE7c_04	MAR01220.005	Sediment	48.8	28.0	2.78	39.7	5.93	14.9
FE7g_03	MAR01220.006	Sediment	36.4	18.5	1.50	28.7	3.85	10.2
Certified Reference Material Quasimeme QPH097MS (% Recovery)			85	85	69	75	91	88
QC Blank			<1	<1	<1	<1	<1	<1

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For full analyte name see method summaries

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Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	mg/Kg
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/305
		Limit of Detection	1	1	1	1	1
		Accreditation	UKAS/MMO	MMO	UKAS/MMO	UKAS/MMO	MMO
Client Reference:	SOCOTEC Ref:	Matrix	NAPTH	PERYLENE	PHENANT	PYRENE	THC
FE3_01	MAR01220.001	Sediment	<1	<1	<1	<1	<1
FE5_09	MAR01220.002	Sediment	2.31	<1	3.81	4.61	<1
FE7b_02	MAR01220.003	Sediment	42.8	17.9	64.9	54.6	9.56
FE7b_04	MAR01220.004	Sediment	14.7	9.25	22.2	26.1	8.24
FE7c_04	MAR01220.005	Sediment	30.5	12.9	39.2	38.4	10.3
FE7g_03	MAR01220.006	Sediment	20.1	9.33	27.2	27.9	9.78
Certified Reference Material Quasimeme QPH097MS (% Recovery)			98	84	72	80	100~
		QC Blank	<1	<1	<1	<1	<1

~ Indicates result is for an In-house Reference Material as
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For full analyte name see method summaries

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 138	PCB 141	PCB 149
FE3_01	MAR01220.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE5_09	MAR01220.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7b_02	MAR01220.003	Sediment	0.00012	<0.00008	0.00016	0.00016	<0.00008	0.00012	<0.00008	0.00011
FE7b_04	MAR01220.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00008	<0.00008	<0.00008
FE7c_04	MAR01220.005	Sediment	<0.00008	<0.00008	<0.00008	0.00009	<0.00008	<0.00008	<0.00008	<0.00008
FE7g_03	MAR01220.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			96	79	113	101	109~	11'	108	98
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

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Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 151	PCB 153	PCB 156	PCB 158	PCB 170	PCB 18	PCB 180
FE3_01	MAR01220.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE5_09	MAR01220.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7b_02	MAR01220.003	Sediment	<0.00008	0.00022	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7b_04	MAR01220.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7c_04	MAR01220.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7g_03	MAR01220.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			87	98	95	118	75	90	91
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 153	PCB 187	PCB 194	PCB 28	PCB 31	PCB 44	PCB 47
FE3_01	MAR01220.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE5_09	MAR01220.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7b_02	MAR01220.003	Sediment	<0.00008	<0.00008	<0.00008	0.00009	<0.00008	<0.00008	<0.00008
FE7b_04	MAR01220.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7c_04	MAR01220.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7g_03	MAR01220.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			106~	100	81	74	116	93	107~
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

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Certificate of Analysis

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 49	PCB 52	PCB 55
FE3_01	MAR01220.001	Sediment	<0.00008	<0.00008	<0.00008
FE5_09	MAR01220.002	Sediment	<0.00008	<0.00008	<0.00008
FE7b_02	MAR01220.003	Sediment	<0.00008	<0.00008	0.00010
FE7b_04	MAR01220.004	Sediment	<0.00008	<0.00008	<0.00008
FE7c_04	MAR01220.005	Sediment	<0.00008	<0.00008	<0.00008
FE7g_03	MAR01220.006	Sediment	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			107	96	111
QC Blank			<0.00008	<0.00008	<0.00008

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.

Certificate of Analysis

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Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

		Units	mg/Kg (Dry Weight)							
		Method No	ASC/SOP/302							
		Limit of Detection	0.0001							
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	AHCH	BHCH	GHCH	DIELDRIN	HCB	PPTDE	PPDDE	PPDDT
FE3_01	MAR01220.001	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE5_09	MAR01220.002	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE7b_02	MAR01220.003	Sediment	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0002	0.0003	<0.0001
FE7b_04	MAR01220.004	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
FE7c_04	MAR01220.005	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0001	<0.0001
FE7g_03	MAR01220.006	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Certified Reference Material Quasimeme QOR147MS (% Recovery)			123~	99~	122~	108	103	56	83	95~
QC Blank			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.
For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01220
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 1

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR01220.001-006	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ASC/SOP/301	MAR01220.001-006	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR01220.002-006	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved in the PAHSED UKAS accredited method. Chrysene and Triphenylene are resolved for MMO but this is currently not UKAS accredited therefore Chrysene is reported without this acccreditation.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR01220
Issue Version	1
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 1

Method	Sample and Fraction Size	Method Summary
Metals	Air dried	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Ultra-violet fluorescence spectroscopy
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions					
Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorocyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorocyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorocyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCE	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	PPDDE	p,p'-Dichlorodiphenyldichloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	PPDDT	p,p'-Dichlorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	PPTDE	p,p'-Dichlorodiphenyldichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR01229**
Issue Version	1
Customer	Fugro GB Marine Ltd, Unit 16 Trafalgar Wharf, Hamilton Road, Portchester, PO6 4PX
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 2
Date Sampled	25/07 & 09-12/11/2021
Date Received	30-Nov-21
Date Reported	06-Jan-22
Condition of samples	Frozen Satisfactory

Authorised by: Marya Hubbard

Position: Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)
FE1_05	MAR01229.001	Sediment	8.7	0.08	4.1	5.4	0.02	5.1	3.8
FE2_03	MAR01229.002	Sediment	10.2	0.06	3.1	5.4	0.01	5.5	3.1
FE4_02	MAR01229.003	Sediment	73.3	0.28	23.2	11.4	0.03	58.2	8.8
FE4_05	MAR01229.004	Sediment	40.0	0.50	16.5	6.7	0.02	20.9	6.3
FE7e_02	MAR01229.005	Sediment	13.9	0.13	20.1	13.0	0.04	14.2	13.3
T_TR05_HWB	MAR01229.006	Sediment	4.0	<0.04	2.9	5.8	<0.01	3.8	3.4
T_TR05_MWB	MAR01229.007	Sediment	6.2	0.08	5.4	6.7	0.04	6.4	3.6
T_TR05_LWE	MAR01229.008	Sediment	5.4	<0.04	3.1	6.1	0.02	4.2	6.7
Certified Reference Material SETOC 774 (% Recovery)			98	104	103	99	89	113	92
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5

* See Report Notes

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Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	2	10	1	0.5
		Accreditation	UKAS/MMO	N	N	N
Client Reference:	SOCOTEC Ref:	Matrix	Zinc (Zn)	Aluminium as Al	Barium as Ba	Tin as Sn
FE1_05	MAR01229.001	Sediment	14.0	1400	14.2	<0.5
FE2_03	MAR01229.002	Sediment	11.5	827	14.6	<0.5
FE4_02	MAR01229.003	Sediment	43.8	14800	59.6	0.5
FE4_05	MAR01229.004	Sediment	28.2	9690	107	<0.5
FE7e_02	MAR01229.005	Sediment	55.7	8160	62.5	0.7
T_TR05_HWB	MAR01229.006	Sediment	16.2	834	19.1	<0.5
T_TR05_MWB	MAR01229.007	Sediment	13.1	757	68.3	<0.5
T_TR05_LWE	MAR01229.008	Sediment	12.0	606	55.3	<0.5
Certified Reference Material SETOC 774 (% Recovery)			107	112	102	103
QC Blank			<2	<10	<1	<0.5

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR01229
Issue Version	1
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	0.001	0.001
		Accreditation	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	Dibutyltin (DBT)	Tributyltin (TBT)
FE1_05	MAR01229.001	Sediment	<0.001	<0.001
FE2_03	MAR01229.002	Sediment	<0.001	<0.001
FE4_02	MAR01229.003	Sediment	<0.001	<0.001
FE4_05	MAR01229.004	Sediment	<0.001	<0.001
FE7e_02	MAR01229.005	Sediment	<0.001	<0.001
T_TR05_HWB	MAR01229.006	Sediment	<0.001	<0.001
T_TR05_MWB	MAR01229.007	Sediment	<0.001	<0.001
T_TR05_LWE	MAR01229.008	Sediment	<0.001	<0.001
		Certified Reference Material BCR-646 (% Recovery)	74	58
		QC Blank	<0.001	<0.001

* See report notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF
FE1_05	MAR01229.001	Sediment	<1	<1	<1	<1	<1	<1
FE2_03	MAR01229.002	Sediment	<1	<1	<1	<1	<1	<1
FE4_02	MAR01229.003	Sediment	<1	<1	<1	<1	<1	<1
FE4_05	MAR01229.004	Sediment	<1	<1	<1	<1	1.28	1.59
FE7e_02	MAR01229.005	Sediment	2.95	5.24	8.90	23.6	28.3	33.9
T_TR05_HWB	MAR01229.006	Sediment	<1	<1	1.27	5.60	6.29	5.88
T_TR05_MWB	MAR01229.007	Sediment	<1	<1	<1	2.97	3.63	3.11
T_TR05_LWE	MAR01229.008	Sediment	<1	<1	<1	1.67	2.86	2.74
Certified Reference Material Quasimeme QPH097MS (% Recovery)			81	97	86	80	79	76
QC Blank			<1	<1	<1	<1	<1	<1

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.
For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	MMO	MMO	MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BEP**	**BKF**	**C1N**	**C1PHEN**	**C2N**
FE1_05	MAR01229.001	Sediment	<1	<1	<1	<1	<1	<1
FE2_03	MAR01229.002	Sediment	<1	<1	<1	<1	<1	<1
FE4_02	MAR01229.003	Sediment	1.31	1.23	<1	2.05	1.47	2.11
FE4_05	MAR01229.004	Sediment	1.69	1.82	1.14	2.83	1.78	3.03
FE7e_02	MAR01229.005	Sediment	31.6	32.4	18.8	53.3	41.9	46.0
T_TR05_HWB	MAR01229.006	Sediment	4.40	5.10	3.85	<1	2.14	1.50
T_TR05_MWB	MAR01229.007	Sediment	2.49	3.08	2.48	<1	1.53	<1
T_TR05_LWE	MAR01229.008	Sediment	2.25	2.64	1.81	<1	<1	1.49
Certified Reference Material Quasimeme QPH097MS (% Recovery)			86	83	102	91	89	108
QC Blank			<1	<1	<1	<1	<1	<1

~ Indicates result is for an In-house Reference Material as
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For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	MMO	MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR
FE1_05	MAR01229.001	Sediment	<1	<1	<1	<1	<1	<1
FE2_03	MAR01229.002	Sediment	<1	<1	<1	<1	<1	<1
FE4_02	MAR01229.003	Sediment	1.41	<1	<1	1.49	<1	<1
FE4_05	MAR01229.004	Sediment	1.94	1.17	<1	2.11	<1	1.53
FE7e_02	MAR01229.005	Sediment	47.4	27.4	3.56	52.7	6.35	24.8
T_TR05_HWB	MAR01229.006	Sediment	<1	5.90	<1	16.1	<1	4.47
T_TR05_MWB	MAR01229.007	Sediment	<1	3.63	<1	7.91	<1	2.35
T_TR05_LWE	MAR01229.008	Sediment	<1	2.61	<1	3.61	<1	2.13
Certified Reference Material Quasimeme QPH097MS (% Recovery)			81	86	79	76	82	79
QC Blank			<1	<1	<1	<1	<1	<1

~ Indicates result is for an In-house Reference Material as
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For full analyte name see method summaries

Certificate of Analysis

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Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	mg/Kg
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/305
		Limit of Detection	1	1	1	1	1
		Accreditation	UKAS/MMO	MMO	UKAS/MMO	UKAS/MMO	MMO
Client Reference:	SOCOTEC Ref:	Matrix	NAPTH	PERYLENE	PHENANT	PYRENE	THC
FE1_05	MAR01229.001	Sediment	<1	<1	<1	<1	<1
FE2_03	MAR01229.002	Sediment	<1	<1	<1	<1	<1
FE4_02	MAR01229.003	Sediment	1.07	<1	1.18	1.46	<1
FE4_05	MAR01229.004	Sediment	1.31	<1	1.52	1.95	<1
FE7e_02	MAR01229.005	Sediment	19.3	13.8	45.7	45.2	8.76
T_TR05_HWB	MAR01229.006	Sediment	<1	1.72	6.84	13.2	1.26
T_TR05_MWB	MAR01229.007	Sediment	<1	1.22	4.14	6.59	<1
T_TR05_LWE	MAR01229.008	Sediment	<1	<1	1.21	3.27	3.16
Certified Reference Material Quasimeme QPH097MS (% Recovery)			96	89	80	80	99~
QC Blank			<1	<1	<1	<1	<1

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.
For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 138	PCB 141	PCB 149
FE1_05	MAR01229.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE2_03	MAR01229.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_02	MAR01229.003	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_05	MAR01229.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7e_02	MAR01229.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.00012	<0.00008	<0.00008
T_TR05_HWB	MAR01229.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_MWB	MAR01229.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_LWE	MAR01229.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			96	79	113	101	109~	11~	108	98
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 151	PCB 153	PCB 156	PCB 158	PCB 170	PCB 18	PCB 180
FE1_05	MAR01229.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE2_03	MAR01229.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_02	MAR01229.003	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_05	MAR01229.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7e_02	MAR01229.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_HWB	MAR01229.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_MWB	MAR01229.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_LWE	MAR01229.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			87	98	95	118	75	90	91
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB 153**	**PCB 187**	**PCB 194**	**PCB 28**	**PCB 31**	**PCB 44**	**PCB 47**
FE1_05	MAR01229.001	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE2_03	MAR01229.002	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_02	MAR01229.003	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE4_05	MAR01229.004	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
FE7e_02	MAR01229.005	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_HWB	MAR01229.006	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_MWB	MAR01229.007	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
T_TR05_LWB	MAR01229.008	Sediment	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Certified Reference Material Quasimeme QOR147MS (% Recovery)			106~	100	81	74	116	93	107~
QC Blank			<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR01229
Issue Version	1
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.00008	0.00008	0.00008
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	PCB 49	PCB 52	PCB 55
FE1_05	MAR01229.001	Sediment	<0.00008	<0.00008	<0.00008
FE2_03	MAR01229.002	Sediment	<0.00008	<0.00008	<0.00008
FE4_02	MAR01229.003	Sediment	<0.00008	<0.00008	<0.00008
FE4_05	MAR01229.004	Sediment	<0.00008	<0.00008	<0.00008
FE7e_02	MAR01229.005	Sediment	<0.00008	<0.00008	<0.00008
T_TR05_HWB	MAR01229.006	Sediment	<0.00008	<0.00008	<0.00008
T_TR05_MWB	MAR01229.007	Sediment	<0.00008	<0.00008	<0.00008
T_TR05_LWE	MAR01229.008	Sediment	<0.00008	<0.00008	<0.00008
	Certified Reference Material Quasimeme QOR147MS (% Recovery)		107	96	111
	QC Blank		<0.00008	<0.00008	<0.00008

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Test Report ID	MAR01229
Issue Version	1
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 2

		Units	mg/Kg (Dry Weight)							
		Method No	ASC/SOP/302							
		Limit of Detection	0.0001							
		Accreditation	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO	UKAS/MMO
Client Reference:	SOCOTEC Ref:	Matrix	AHCH	BHCH	GHCH	DIELDRIN	HCB	PPTDE	PPDDE	PPDDT
FE1_05	MAR01229.001	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE2_03	MAR01229.002	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE4_02	MAR01229.003	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE4_05	MAR01229.004	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
FE7e_02	MAR01229.005	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
T_TR05_HWB	MAR01229.006	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
T_TR05_MWB	MAR01229.007	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
T_TR05_LWB	MAR01229.008	Sediment	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Certified Reference Material Quasimeme QOR147MS (% Recovery)			123~	99~	122~	108	103	56	83	95~
QC Blank			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

~ Indicates result is for an In-house Reference Material as
no Certified Reference Materials are avaliable.
For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR01229
Issue Version 1
Customer Reference 200867 Five Estuaries MMO Analysis - Batch 2

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR01229.001-008	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ASC/SOP/303/304	MAR01229.004-008	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved in the PAHSED UKAS accredited method. Chrysene and Triphenylene are resolved for MMO but this is currently not UKAS accredited therefore Chrysene is reported without this accreditation.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR01229
Issue Version	1
Customer Reference	200867 Five Estuaries MMO Analysis - Batch 2

Method	Sample and Fraction Size	Method Summary
Metals	Air dried	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Ultra-violet fluorescence spectroscopy
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions					
Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorocyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorocyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorocyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCE	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	PPDDE	p,p'-Dichlorodiphenyldichloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	PPDDT	p,p'-Dichlorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	PPTDE	p,p'-Dichlorodiphenyldichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Appendix F

Macrofaunal Analysis

F.1 Subtidal Grabs Macrofaunal Abundance

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Cerianthus lloydii	D0632	283798	Gosse, 1859	-	-	-	-	-	-	-	-	-	-	-	-
ACTINIARIA	D0662	1360	Hertwig, 1882	-	9	-	-	-	-	-	-	-	-	-	-
Edwardsiidae	D0759	100665	Andres, 1881	-	-	-	-	-	-	-	-	-	-	-	-
PLATYHELMINTHES	F0001	793	Minot, 1876	-	1	-	-	-	-	-	-	-	-	-	-
NEMERTEA	G0001	152391	-	1	6	1	2	1	1	-	5	-	-	-	-
Loxosoma annelidicola	K0006	111811	(Van Beneden & Hesse, 1863)	-	-	-	-	-	-	-	-	-	-	-	-
Golfingia (Golfingia) elongata	N0014	175026	(Keferstein, 1862)	-	-	-	-	-	-	-	-	-	-	-	-
Golfingia (Golfingia) vulgaris vulgaris	N0017	410724	(de Blainville, 1827)	-	-	-	-	-	-	-	-	-	-	-	-
Maxmuelleria lankesteri	O0018	110368	(Herdman, 1897)	-	-	-	-	-	-	-	-	-	-	-	-
Pisione remota	P0015	130707	(Southern, 1914)	-	-	2	-	2	-	-	-	-	-	-	-
Subadyte pellucida	P0032	130833	(Ehlers, 1864)	-	-	-	-	-	-	-	-	-	-	-	-
Gattyana cirrhosa	P0049	130749	(Pallas, 1766)	-	1	-	-	-	-	-	-	-	-	-	-
Malmgrenia Type A	P0050_G@	147006	McIntosh, 1874	-	-	-	-	-	-	-	-	-	-	-	-
Malmgrenia bicki	P0050_G@	1044546	Barnich, Dietrich, Hager & Fiege, 2017	-	3	-	-	-	-	-	-	-	-	-	-
Malmgrenia arenicolae	P0050_G@	152276	(Saint-Joseph, 1888)	-	-	-	1	-	-	-	-	-	-	-	-
Malmgrenia darbouxi	P0050_G@	863197	(Pettibone, 1993)	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe clavigera	P0050_G	130760	(M. Sars, 1863)	-	-	-	-	-	-	-	-	-	-	-	-
Malmgrenia andreapolis	P0051	147008	McIntosh, 1874	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe antilopes	P0052	130754	McIntosh, 1876	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe extenuata	P0058	130762	(Grube, 1840)	-	3	-	-	-	-	-	-	-	-	-	-
Harmothoe impar	P0065	130770	(Johnston, 1839)	-	-	-	-	-	-	-	-	-	-	-	-
Lepidonotus squamatus	P0082	130801	(Linnaeus, 1758)	1	5	-	1	-	-	-	-	-	-	-	-
Polynoe scolopendrina	P0084	130830	Savigny, 1822	-	-	-	-	-	-	-	-	-	-	-	-
Pholoe inornata	P0092	130601	Johnston, 1839	-	4	-	3	-	-	-	-	-	-	-	-
Pholoe baltica	P0095	130599	Örsted, 1843	3	7	-	1	-	1	-	-	1	1	1	-
Sthenelais boa	P0107	131074	(Johnston, 1833)	-	-	-	-	-	-	-	-	-	-	-	-
Eteone longa agg.	P0118	130616	(Fabricius, 1780)	-	-	-	-	-	-	-	-	-	-	-	-
Hesionura elongata	P0122	130649	(Southern, 1914)	-	-	1	-	-	-	-	-	-	-	-	-
Mysta barbata	P0126	147027	Malmgren, 1865	-	-	-	-	-	-	-	-	-	-	-	-
Mysta picta	P0127	147026	(Quatrefages, 1866)	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodoce groenlandica	P0141	334506	Örsted, 1842	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodoce lineata	P0142	334508	(Claparède, 1870)	-	-	-	-	-	2	-	-	-	-	-	-
Phyllodoce longipes	P0143	130673	Kinberg, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Eulalia expusilla	P0153	130625	Pleijel, 1987	-	-	-	-	-	-	-	-	-	-	-	-
Eulalia mustela	P0155	130631	Pleijel, 1987	-	-	-	-	-	-	-	2	-	-	-	-
Eulalia ornata	P0156	130632	Saint-Joseph, 1888	-	-	-	1	-	-	-	-	-	-	-	-
Eumida bahusiensis	P0164	130641	Bergstrom, 1914	-	1	-	-	-	-	-	-	-	-	-	-
Eumida sanguinea agg.	P0167	130644	(Örsted, 1843)	-	-	-	-	-	1	-	-	-	-	-	-
Glycera alba	P0256	130116	(O.F. Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-
Glycera lapidum	P0260	130123	Quatrefages, 1866	2	6	1	-	-	2	-	3	-	1	-	-
Glycera oxycephala	P0262	130126	Ehlers, 1887	-	-	-	-	2	-	1	-	-	-	1	-
Glycinde nordmanni	P0268	130136	(Malmgren, 1866)	-	-	-	1	-	1	-	-	-	-	-	-
Goniada maculata	P0271	130140	Örsted, 1843	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerodorum gracilis	P0291	131100	(Rathke, 1843)	-	-	-	-	-	-	-	-	-	-	-	-
Podarkeopsis capensis	P0319	130195	(Day, 1963)	-	-	-	-	-	-	-	-	-	-	-	-
Syllidia armata	P0321	130198	Quatrefages, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Syllis garciai	P0351	131431	(Campoy, 1982)	-	2	-	2	-	-	-	3	1	-	-	-
Syllis pontxioi	P0358_A	196003	San Martín & López, 2000	-	1	-	1	-	-	-	-	-	-	-	-
Syllis armillaris	P0365	131415	(O.F. Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-
Syllis cf. *armillaris*	P0365	131415	(O.F. Müller, 1776)	-	3	-	1	-	-	-	-	-	-	-	-
Syllis variegata	P0371	131458	Grube, 1860	-	-	-	-	-	-	-	-	-	-	-	-
Amblyosyllis spectabilis	P0374_A	1258721	(Johnston in Baird, 1861)	-	-	-	-	-	-	-	-	-	-	-	-
Eusyllis blomstrandi	P0380	131290	Malmgren, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Odontosyllis fulgurans	P0387	131327	(Audouin & Milne Edwards, 1833)	-	-	-	-	-	1	-	-	-	-	-	-
Streptodonta pterochaeta	P0391	238207	(Southern, 1914)	-	-	-	-	-	-	-	1	-	-	-	-
Streptosyllis campoyi	P0402_G	238248	Brito, Núñez & San Martín, 2000	-	-	-	-	-	-	-	-	-	-	-	-
Syllides japonicus	P0409	131410	Imajima, 1966	-	1	-	-	-	-	-	-	-	-	-	-
Parexogone hebes	P0421	757970	(Webster & Benedict, 1884)	-	-	-	-	-	-	-	-	-	-	-	-
Exogone naidina	P0422	327985	Örsted, 1845	-	-	-	-	-	-	-	-	-	-	-	-
Exogone verugera	P0423	333456	(Claparède, 1868)	-	-	-	-	-	-	-	-	-	-	-	-
Erinaceusyllis erinaceus	P0426	195953	(Claparède, 1863)	-	-	-	-	-	-	-	-	-	-	-	-
Sphaerosyllis taylori	P0430	131394	Perkins, 1981	-	-	-	-	-	-	-	-	-	-	-	-
Myrianida	P0449	129659	Milne Edwards, 1845	-	-	-	-	-	-	-	-	-	-	-	-
Proceraea aurantiaca	P0451_G	131361	Claparède, 1868	-	-	-	-	-	-	-	-	-	-	-	-
Rullierinereis ancornunezi	P0458_A	492034	Núñez & Brito, 2006	-	-	-	-	-	-	-	-	-	-	-	-
Eunereis longissima	P0475	130375	(Johnston, 1840)	-	1	-	-	-	-	-	-	-	-	-	-
Nephtys caeca	P0496	130355	(Fabricius, 1780)	-	-	-	-	-	-	-	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Nephtys kersivalensis	P0502	130363	McIntosh, 1908	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys longosetosa	P0503	130364	Örsted, 1842	-	-	-	-	-	-	-	-	-	-	-	-
Lysidice ninetta	P0562	130071	Audouin & H Milne Edwards, 1833	-	-	-	-	-	-	-	-	-	-	-	-
Paucibranchia totospinata	P0563_B	1305625	(Lu & Fauchald, 1998)	1	-	-	-	-	-	-	-	2	-	-	-
Paucibranchia bellii	P0564	1297885	(Audouin & Milne Edwards, 1833)	-	-	-	-	-	-	-	-	-	-	-	-
Marphysa sanguinea	P0566	130075	(Montagu, 1813)	-	-	-	-	-	-	-	-	-	-	-	-
Lysidice unicornis	P0568	742232	(Grube, 1840)	1	1	-	-	-	-	-	-	-	-	-	-
Hilbigneris pleijeli	P0569_F	396540	Carrera-Parra, 2006	-	-	-	-	-	-	-	-	-	-	-	-
Lumbrineris cf. *cingulata*	P0572_A	130240	Ehlers, 1897	10	12	1	5	-	4	-	-	1	1	-	-
Drilonereis	P0589	129200	Claparède, 1870	-	-	-	-	-	-	-	-	-	-	-	-
Protodorvillea kefersteini	P0638	130041	(McIntosh, 1869)	-	-	1	-	-	-	-	-	-	-	-	-
Schistomeringos neglecta	P0642	130044	(Fauvel, 1923)	-	-	-	-	-	-	-	-	-	-	-	-
Schistomeringos rudolphi	P0643	154127	(Delle Chiaje, 1828)	-	2	-	3	-	-	-	-	-	-	-	-
Orbinia sertulata	P0665	130523	(Savigny, 1822)	-	-	-	-	-	-	-	-	-	-	-	-
Scoloplos armiger	P0672	130537	(Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-
Paradoneis lyra	P0699	130585	(Southern, 1914)	1	1	-	1	-	-	-	-	-	-	-	-
Poecilochaetus serpens	P0718	130711	Allen, 1904	-	1	-	2	-	-	-	-	-	-	-	-
Aonides oxycephala	P0722	131106	(Sars, 1862)	-	1	-	-	-	1	-	-	-	-	-	-
Aonides paucibranchiata	P0723	131107	Southern, 1914	-	3	1	-	1	2	1	1	2	-	-	-
Atherospio guillei	P0724_A	478336	(Laubier & Ramos, 1974)	-	-	-	-	-	-	-	-	-	-	-	-
Laonice irinae	P0731_G	1518242	Sikorski, Radashevsky & Nygren in Sikorski et al, 2021	2	4	-	-	-	-	-	2	-	-	-	-
Dipolydora Species A	P0748_A	129611	Verrill, 1881	-	-	-	-	-	-	-	-	-	-	-	-
Dipolydora Type N	P0748_A	129611	Verrill, 1881	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ciliata Type A	P0752	131141	(Johnston, 1838)	1	-	-	-	-	-	-	-	-	-	-	-
Dipolydora flava	P0754	131118	(Claparède, 1870)	3	12	-	-	-	-	-	-	-	-	-	-
Dipolydora saintjosephi	P0761	131123	(Eliason, 1920)	-	2	-	-	-	-	-	-	-	-	-	-
Pseudopolydora pulchra	P0774	131169	(Carazzi, 1893)	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	P0776	131170	Claparède, 1863	-	-	-	-	-	-	-	-	-	-	-	-
Scolelepis korsuni	P0777_A	131174	Sikorski, 1994	-	-	-	-	-	-	-	-	-	-	-	-
Spio	P0787	129625	Fabricius, 1785	-	-	-	-	-	-	-	-	-	-	-	-
Spiophanes bombyx agg.	P0794	131187	(Claparède, 1870)	-	-	-	1	-	-	-	-	-	-	-	-
Magelona johnstoni	P0803_A	130269	Fiege, Licher & Mackie, 2000	-	-	-	-	-	-	-	-	-	-	-	-
Magelona alleni	P0804	130266	Wilson, 1958	-	-	-	-	-	-	-	-	-	-	-	-
Chaetopterus	P0811	129229	Cuvier, 1830	-	-	-	-	-	-	-	-	-	-	-	-
Aphelochaeta Type A	P0823	129240	Blake, 1991	1	-	-	-	-	-	-	-	-	-	-	-
Aphelochaeta marioni	P0824	129938	(Saint-Joseph, 1894)	-	-	-	-	-	-	-	-	-	-	-	-
Caulleriella alata	P0829	129943	(Southern, 1914)	-	1	-	2	-	1	-	-	1	-	-	-
Chaetozone zetlandica	P0831	336485	McIntosh, 1911	-	-	-	1	-	2	-	-	-	-	-	-
Dodecaceria	P0840	129246	Örsted, 1843	-	-	-	1	-	-	-	-	-	-	-	-
Flabelligera affinis	P0881	130103	M. Sars, 1829	1	1	-	-	-	-	-	-	-	-	-	-
Pherusa plumosa	P0885	130113	(Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-
Mediomastus fragilis	P0919	129892	Rasmussen, 1973	-	-	-	1	-	-	-	-	-	-	-	-
Notomastus	P0920	129220	M. Sars, 1851	5	7	1	1	3	-	-	-	-	-	1	-
Leiochone	**P0951_F**	**146991**	**Grube, 1868**	-	2	-	1	-	5	-	-	1	-	-	-
Euclymene oerstedii	P0964	130294	(Claparède, 1863)	-	-	-	-	-	-	-	-	-	-	-	-
Praxillella affinis	P0971	130322	(M. Sars in G.O. Sars, 1872)	-	3	-	-	-	5	-	-	-	-	-	-
Micromaldane ornithochaeta	P0978	130310	Mesnil, 1897	-	-	-	-	-	-	-	-	-	-	-	-
Nicomache	P0979	129357	Malmgren, 1865	-	1	-	-	-	-	-	-	-	-	-	-
Petaloproctus	P0985	129359	Quatrefages, 1866	-	-	-	-	-	-	-	-	1	-	-	-
Ophelia borealis	P0999	130491	Quatrefages, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Travisia forbesii	P1007	130512	Johnston, 1840	-	-	-	-	-	-	-	-	-	-	-	-
Asclerocheilus intermedius	P1022	130974	(Saint-Joseph, 1894)	-	1	-	-	-	-	-	-	-	-	-	-
Scalibregma celticum	P1026	130979	Mackie, 1991	1	3	-	1	-	-	-	-	-	-	-	-
Scalibregma inflatum	P1027	130980	Rathke, 1843	3	7	-	6	-	7	-	-	1	-	-	-
Sclerocheilus minutus	P1029	130982	Grube, 1863	-	-	-	-	-	-	-	1	-	-	-	-
Polygordius	P1062	129472	Schneider, 1868	-	-	6	-	-	-	-	-	-	-	-	-
Galathowenia oculata	P1093	146950	(Zachs, 1923)	-	-	-	-	-	-	-	-	-	-	-	-
Owenia borealis	P1097_G	329882	Koh, Bhaud & Jirkov, 2003	-	-	-	-	-	-	-	-	-	-	-	-
Lagis koreni	P1107	152367	Malmgren, 1866	2	-	-	4	-	4	-	-	1	-	-	-
Sabellaria spinulosa	P1117	130867	(Leuckart, 1849)	-	3	-	1	-	-	-	-	-	-	-	-
Melinna palmata	P1124	129808	Grube, 1870	-	-	-	-	-	-	-	-	-	-	-	-
Ampharete lindstroemi	P1139	129781	Malmgren, 1867 sensu Hessle, 1917	1	2	-	-	-	-	-	-	-	-	-	-
Amphicteis midas	P1143	129785	(Gosse, 1855)	-	-	-	-	-	-	-	-	-	-	-	-
Terebellides	P1174	129717	Sars, 1835	1	1	-	-	-	-	-	-	-	-	-	-
Loimia ramzega	P1200_G	1036014	Lavesque, Bonifácio, Londoño-Mesa, Le Garrec & Grall, 2017	-	2	-	-	-	1	-	-	1	-	-	-
Nicolea venustula	P1210	131507	(Montagu, 1819)	-	-	-	-	-	-	-	-	-	-	-	-
Amaeana trilobata	P1229	131471	(Sars, 1863)	-	1	-	-	-	-	-	-	-	-	-	-
Lysilla loveni	P1233	131500	Malmgren, 1866	-	1	-	-	-	-	-	-	-	-	-	-
Lysilla nivea	P1234	131501	Langerhans, 1884	-	-	-	-	-	-	-	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Polycirrus	P1235	129710	Grube, 1850	-	-	-	1	-	-	1	3	1	-	-	-
Thelepus parapari	P1253_G	1253692	Jirkov, 2018	-	3	-	1	-	-	-	-	-	-	-	-
Thelepus setosus	P1255	131544	(Quatrefages, 1866)	-	-	-	-	-	-	-	-	-	-	-	-
Jasmineira elegans	P1290	130921	Saint-Joseph, 1894	-	-	-	-	-	-	-	-	-	-	-	-
Perkinsiana rubra	P1307	130948	(Langerhans, 1880)	-	-	-	-	-	-	-	-	-	-	-	-
Pseudopotamilla	P1315	129548	Bush, 1905	-	-	-	-	-	-	-	-	-	-	-	-
Sabella discifera	P1318	130964	Grube, 1874	-	-	-	-	-	-	-	-	-	-	-	-
Sabella pavonina	P1320	130967	Savigny, 1822	-	-	-	-	-	-	-	-	-	-	-	-
Spirobranchus lamarcki	P1340	560033	(Quatrefages, 1866)	8	25	-	49	-	6	-	-	-	-	-	-
Spirobranchus triqueter	P1341	555935	(Linnaeus, 1758)	-	1	-	5	-	-	-	1	-	-	-	-
Tubificoides	P1487	137393	Lastočkin, 1937	-	-	-	-	-	-	-	-	-	-	-	-
Grania	P1524	137349	Southern, 1913	-	-	1	1	-	-	-	-	-	-	-	-
Nymphon brevirostre	Q0005	150520	Hodge, 1863	-	1	-	-	-	-	-	-	-	-	-	-
Achelia echinata	Q0015	134599	Hodge, 1864	-	-	-	-	-	-	-	-	-	-	-	-
Ammothella longipes	Q0018	134614	(Hodge, 1864)	-	-	-	-	-	-	-	-	-	-	-	-
Callipallene	**Q0032**	**134581**	**Flynn, 1929**	-	-	-	-	-	-	-	-	-	-	-	-
Anoplodactylus petiolatus	Q0044	134723	(Krøyer, 1844)	-	-	-	-	-	-	-	-	-	-	-	-
Verruca stroemia	R0041	106257	(O.F. Müller, 1776)	4	8	-	1	-	-	-	4	-	-	-	-
Balanus crenatus	R0077	106215	Bruguière, 1789	-	-	-	-	-	-	-	-	-	-	-	-
OSTRACODA	R2412	1078	Latreille, 1802	-	-	-	-	-	-	-	-	-	-	-	-
Rissoides desmaresti	S0018	136135	(Risso, 1816)	1	-	-	-	-	-	-	-	-	-	-	-
Gastrosaccus spinifer	S0044	120020	(Goës, 1864)	-	-	-	-	-	-	-	-	-	-	-	-
Heteromysis (Heteromysis) microps	S0093	120037	(G.O. Sars, 1877)	-	-	-	-	-	-	-	-	-	-	-	-
Apherusa ovalipes	S0107	102172	Norman & Scott, 1906	-	-	-	-	-	-	-	-	-	-	-	-
Apolochus neapolitanus	S0159	236495	(Della Valle, 1893)	-	-	-	-	-	-	-	-	-	-	-	-
Leucothoe procera	S0179	102466	Spence Bate, 1857	-	-	-	-	-	-	-	-	-	-	-	-
Stenothoe marina	S0213	103166	(Spence Bate, 1857)	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe brevicornis	S0247	103226	Spence Bate, 1862	-	-	-	-	-	-	-	-	-	-	-	-
Urothoe elegans	S0248	103228	Spence Bate, 1857	-	-	-	-	-	3	-	-	-	-	-	-
Urothoe marina	S0249	103233	(Spence Bate, 1857)	-	-	-	5	-	-	-	3	1	-	-	-
Harpinia pectinata	S0257	102972	Sars, 1891	-	-	-	-	-	-	-	-	-	-	-	-
Acidostoma neglectum	S0272_A	102495	Dahl, 1964	-	-	-	-	-	-	-	-	-	-	-	-
Lysianassa ceratina	S0303	102605	(Walker, 1889)	-	-	-	-	-	-	-	-	-	-	-	-
Iphimedia minuta	S0380	102345	G.O. Sars, 1883	-	-	-	-	-	-	-	-	-	-	-	-
Iphimedia nexa	S0381	102346	Myers & McGrath, in Myers, McGrath & Costello, 1987	-	-	-	-	-	-	-	-	-	-	-	-
Iphimedia spatula	S0384	102351	Myers & McGrath, in Myers, McGrath & Costello, 1987	-	-	-	-	-	-	-	-	-	-	-	-
Nototropis guttatus	S0411	488957	Costa, 1853	-	-	-	-	-	-	-	-	-	-	-	-
Ampelisca diadema	S0429	101896	(Costa, 1853)	-	-	-	-	-	-	-	-	-	-	-	-
Ampelisca spinipes	S0438	101928	Boeck, 1861	5	2	-	1	-	-	-	-	-	-	-	-
Haploops	S0446	101447	Liljeborg, 1856	-	-	-	-	-	-	-	-	-	-	-	-
Bathyporeia elegans	S0452	103058	Watkin, 1938	-	-	-	-	-	-	-	-	-	-	-	-
Bathyporeia guilliamsoniana	S0454	103060	(Spence Bate, 1857)	-	-	-	-	-	-	-	-	-	-	-	-
Bathyporeia pelagica	S0456	103066	(Spence Bate, 1857)	-	-	-	-	-	-	-	-	-	-	-	-
Abludomelita obtusata	S0498	102788	(Montagu, 1813)	-	-	-	-	-	-	-	-	-	-	-	-
Cheirocratus (female)	S0503	101669	Norman, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Othomaera othonis	S0519	534781	(H. Milne Edwards, 1830)	1	-	-	-	-	-	-	1	-	-	-	-
Maerella tenuimana	S0521	102831	(Spence Bate, 1862)	-	-	-	-	-	-	-	-	-	-	-	-
Megamphopus cornutus	S0539	102377	Norman, 1869	-	-	-	-	-	-	-	-	-	-	-	-
Gammaropsis maculata	S0541	102364	(Johnston, 1828)	-	-	-	-	-	-	-	-	-	-	-	-
Photis longicaudata	S0552	102383	(Spence Bate & Westwood, 1862)	1	6	-	-	1	-	-	-	-	-	-	-
Ericthonius	**S0561**	**101567**	**H. Milne Edwards, 1830**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Jassa	S0568	101571	Leach, 1814	-	1	-	-	-	-	-	-	-	-	-	-
Microjassa cumbrensis	S0574	102439	(Stebbing & Robertson, 1891)	-	-	-	-	-	-	-	-	-	-	-	-
Aoridae	**S0577**	**101368**	**Stebbing, 1899**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Crassicorophium crassicorne	S0611	397383	(Bruzelius, 1859)	-	-	-	-	-	-	-	-	-	-	-	-
Monocorophium sextonae	S0615	148603	(Crawford, 1937)	-	4	-	-	-	-	-	-	-	-	-	-
Unciola crenatipalma	S0621	102057	(Spence Bate, 1862)	-	-	-	-	-	-	-	-	-	-	-	-
Dyopedos monacanthus	S0628	489646	(Metzger, 1875)	-	-	-	-	-	-	-	-	-	-	-	-
Pariambus typicus	S0651	101857	(Krøyer, 1845)	-	-	-	-	-	-	-	-	-	-	-	-
Phtisica marina	S0657	101864	Slabber, 1769	-	-	-	-	1	-	-	-	-	-	-	-
Pseudoprotella phasma	S0659	101871	(Montagu, 1804)	-	-	-	-	-	-	-	-	-	-	-	-
Gnathia oxyuraea	S0796	118995	(Lilljeborg, 1855)	1	-	-	2	-	-	-	-	-	-	-	-
Anthura gracilis	S0803	118467	(Montagu, 1808)	-	2	-	-	-	-	-	-	-	-	-	-
Eurydice spinigera	S0855	148637	Hansen, 1890	-	-	-	-	-	-	-	-	-	-	-	1
Cleantis prismatica	S0947	119038	(Risso, 1826)	-	-	-	-	-	-	-	-	-	-	-	-
Astacilla longicornis	S0955	119024	(Sowerby, 1806)	-	-	-	-	-	-	-	-	-	-	-	-
Apseudes talpa	S1177	136285	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	-	-	-
Bodotria scorpioides	S1197	110445	(Montagu, 1804)	-	-	-	-	-	-	-	-	-	-	-	-
Diastylis bradyi	S1248	110472	Norman, 1879	-	-	-	-	-	-	-	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Diastylis rathkei	S1253	110487	(Krøyer, 1841)	-	-	-	-	-	-	-	-	-	-	-	-
Eualus cranchii	S1360	156083	(Leach, 1817 [in Leach, 1815-1875])	-	-	-	-	-	-	-	-	-	-	-	-
Axius stirhynchus	S1407	107722	Leach, 1816	-	-	-	-	-	-	-	-	-	-	-	-
Callianassa subterranea	S1415	107729	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	-	-	-
Upogebia deltaura	S1419	107739	(Leach, 1816)	-	-	-	-	-	-	-	-	-	-	-	-
Anapagurus hyndmanni	S1448	107217	(Bell, 1845 [in Bell, 1844-1853])	1	1	-	-	-	-	-	-	-	-	-	-
Galathea intermedia	S1472	107150	Lilljeborg, 1851	1	1	-	-	-	-	-	-	-	-	-	-
Pisidia longicornis	S1482	107188	(Linnaeus, 1767)	1	1	-	-	-	-	-	-	-	1	-	-
Ebalia tuberosa	S1508	107301	(Pennant, 1777)	1	2	-	-	-	-	-	-	-	-	-	-
Ebalia tumefacta	S1509	107302	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	-	-	-
Hyas coarctatus	S1519	107323	Leach, 1815 [in Leach, 1815-1875]	-	1	-	-	-	-	-	-	-	-	-	-
Macropodia rostrata	S1532	107345	(Linnaeus, 1761)	-	-	-	-	-	-	-	-	-	-	-	-
Atelecyclus rotundatus	S1555	107273	(Olivi, 1792)	-	-	-	1	-	-	-	-	-	-	-	-
Thia scutellata	S1559	107281	(Fabricius, 1793)	-	-	-	-	-	-	-	-	-	1	-	-
Pilumnus hirtellus	S1615	107418	(Linnaeus, 1761)	-	1	-	-	-	-	-	-	-	-	-	-
Leptochiton asellus	W0053	140199	(Gmelin, 1791)	3	2	-	-	-	-	-	-	-	-	-	-
Puncturella noachina	W0112	139975	(Linnaeus, 1771)	-	-	-	-	-	-	-	-	-	-	-	-
Steromphala tumida	W0161	1477356	(Montagu, 1803)	-	-	-	-	-	-	-	-	-	-	-	-
Steromphala cineraria	W0163	1039839	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma zizyphinum	W0182	141767	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Crisilla semistriata	W0348	141280	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	-	-	-
Caecum glabrum	W0418	138952	(Montagu, 1803)	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	W0439	138963	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Euspira nitida	W0491	151894	(Donovan, 1803)	-	-	-	-	-	-	-	-	-	-	-	-
Epitonium clathratulum	W0556	139718	(Kanmacher, 1798)	-	2	-	-	-	-	-	-	-	-	-	-
Ocenebra erinaceus	W0685	140405	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Buccinum undatum	W0708	138878	Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-
Brachystomia eulimoides	W0922	491650	(Hanley, 1844)	-	-	-	-	-	-	-	-	-	-	-	-
Philine quadripartita	W1038_A	574582	Ascanius, 1772	-	-	-	-	-	-	-	-	-	-	-	-
Duvaucelia	W1245_F	536858	Risso, 1826	2	-	-	-	-	-	-	-	-	-	-	-
Doto	W1270	137916	Oken, 1815	-	-	-	-	-	-	-	-	-	-	-	-
Acanthodoris pilosa	W1333	140627	(Abildgaard [in Müller], 1789)	-	-	-	-	-	-	-	-	-	-	-	-
Nucula hanleyi	W1568	140588	Winckworth, 1931	2	2	-	-	-	-	-	-	-	-	-	-
Nucula nitidosa	W1569	140589	Winckworth, 1930	-	-	-	-	-	-	-	-	-	-	-	-
Nucula nucleus	W1570	140590	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Striarca lactea	W1676	140571	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Glycymeris glycymeris	W1688	140025	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	1	-	-	-
Mytilus edulis	W1695	140480	Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-
Modiolus adriaticus	W1700	140462	Lamarck, 1819	-	-	-	-	-	-	-	-	-	-	-	-
Modiolus barbatus	W1701	140464	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Modiolula phaseolina	W1708	140461	(Philippi, 1844)	-	-	2	-	-	-	-	1	-	-	-	-
Musculus discors	W1721	140472	(Linnaeus, 1767)	-	-	-	-	-	-	-	-	-	-	-	-
Aequipecten opercularis	W1773	140687	(Linnaeus, 1758)	-	1	-	-	-	-	-	-	-	-	-	-
Heteranomia squamula	W1809	138749	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Diplodonta rotundata	W1864	141883	(Montagu, 1803)	-	1	-	-	-	-	-	-	-	-	-	-
Kellia suborbicularis	W1875	140161	(Montagu, 1803)	-	1	-	-	-	-	-	-	-	-	-	-
Tellimya ferruginosa	W1902	146952	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	-	-	-
Kurtiella bidentata	W1906	345281	(Montagu, 1803)	-	12	-	1	-	2	-	-	-	-	-	-
Epilepton clarkiae	W1911	140366	(W. Clark, 1852)	-	-	-	-	-	-	-	-	-	-	-	-
Goodallia triangularis	W1929	138831	(Montagu, 1803)	-	-	-	-	-	-	1	1	-	1	-	-
Spisula elliptica	W1975	140300	(T. Brown, 1827)	1	1	-	2	1	-	1	1	-	2	-	-
Phaxas pellucidus	W2006	140737	(Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-
Moerella donacina	W2021	147021	(Linnaeus, 1758)	-	5	-	1	-	1	-	-	-	-	-	-
Asbjornsenia pygmaea	W2023	879714	(Lovén, 1846)	-	-	-	-	-	-	1	-	-	-	-	-
Abra alba	W2059	141433	(W. Wood, 1802)	2	1	-	-	-	-	-	-	-	-	-	-
Abra prismatica	W2062	141436	(Montagu, 1808)	-	-	-	-	-	-	-	-	-	1	-	-
Clausinella fasciata	W2100	141909	(da Costa, 1778)	1	-	-	-	-	-	-	-	-	-	-	-
Timoclea ovata	W2104	141929	(Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-
Polititapes rhomboides	W2113	745846	(Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-
Mya truncata	W2147	140431	Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-
Sphenia binghami	W2152	140432	W. Turton, 1822	-	-	-	-	-	-	-	-	-	-	-	-
Varicorbula gibba	W2157	378492	(Olivi, 1792)	-	-	-	-	-	-	-	-	-	-	-	-
Rocellaria dubia	W2162	505249	(Pennant, 1777)	1	-	-	-	-	-	-	-	-	-	-	-
Hiatella	W2165	138068	Bosc, 1801	-	-	-	-	-	-	-	-	-	-	-	-
Saxicavella jeffreysi	W2172	140108	Winckworth, 1930	-	-	-	-	-	-	-	-	-	-	-	-
Barnea parva	W2183	140768	(Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-
Thracia villosiuscula	W2233	141651	(MacGillivray, 1827)	-	1	-	-	-	-	-	-	-	-	-	-
Thracia distorta	W2235	141647	(Montagu, 1803)	-	-	-	-	-	-	-	-	-	-	-	-
Phoronis	ZA0003	128545	Wright, 1856	-	1	-	-	-	-	-	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Ophiothrix fragilis	ZB0124	125131	(Abildgaard in O.F. Müller, 1789)	1	-	-	-	-	-	-	-	-	-	-	-
Acrocnida brachiata	ZB0151	236130	(Montagu, 1804)	-	-	-	-	-	-	-	-	-	-	-	-
Amphiura filiformis	ZB0154	125080	(O.F. Müller, 1776)	-	-	-	-	-	-	-	-	-	-	-	-
Amphipholis squamata	ZB0161	125064	(Delle Chiaje, 1828)	2	-	-	1	-	1	-	1	-	-	-	-
Ophiocten affinis	ZB0167	124850	(Lütken, 1858)	-	-	-	-	-	-	-	-	-	-	-	-
Ophiura albida	ZB0168	124913	Forbes, 1839	29	19	-	2	-	4	-	2	6	-	-	-
Ophiura ophiura	ZB0170	124929	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Psammechinus miliaris	ZB0193	124319	(P.L.S. Müller, 1771)	2	1	-	-	-	-	-	-	-	-	-	-
Echinocyamus pusillus	ZB0212	124273	(O.F. Müller, 1776)	3	6	-	1	-	8	-	-	1	-	-	-
Echinocardium cordatum	ZB0223	124392	(Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-
ENTEROPNEUSTA	ZC0012	1820	Gegenbaur, 1870	-	-	-	-	-	-	-	-	-	-	-	-
ASCIDIACEA	ZD0002	1839	Blainville, 1824	14	8	-	-	-	-	-	-	-	-	-	-
			Number of taxa:	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**288**	**288**
			Abundance:	**130**	**256**	**18**	**120**	**14**	**66**	**6**	**36**	**23**	**14**	**4**	**2**
The following taxa (highlighted below) are merged in rationalised dataset above															
Leiochone	P0951_F	146991	Grube, 1868	-	-	-	1	-	4	-	-	1	-	-	-
Leiochone tricirrata	P0951_F	328694	Bellan & Reys, 1967	-	2	-	-	-	1	-	-	-	-	-	-
Leiochone johnstoni	P0958	221095	McIntosh, 1915	-	-	-	-	-	-	-	-	-	-	-	-
Leiochone	P0951_F	**146991**	**Grube, 1868**	-	2	-	1	-	5	-	-	1	-	-	-
Callipallene	Q0032	134581	Flynn, 1929	-	-	-	-	-	-	-	-	-	-	-	-
Callipallene tiberii	Q0038	134648	(Dohrn, 1881)	-	-	-	-	-	-	-	-	-	-	-	-
Callipallene	Q0032	**134581**	**Flynn, 1929**	-	-	-	-	-	-	-	-	-	-	-	-
Ericthonius	S0561	101567	H. Milne Edwards, 1830	-	2	-	-	-	-	-	-	-	-	-	-
Ericthonius punctatus	S0564	102408	(Spence Bate, 1857)	1	1	-	-	-	-	-	-	-	-	-	-
Ericthonius	S0561	**101567**	**H. Milne Edwards, 1830**	1	3	-	-	-	-	-	-	-	-	-	-
Aoridae	S0577	101368	Stebbing, 1899	-	-	-	-	-	-	-	-	-	-	-	-
Leptocheirus hirsutimanus	S0588	102036	(Spence Bate, 1862)	-	-	-	-	-	-	-	-	-	-	-	-
Aoridae	S0577	**101368**	**Stebbing, 1899**	-	-	-	-	-	-	-	-	-	-	-	-
PRESENCE/ABSENCE DATA															
Folliculinidae	A0003	1692	Dons, 1914	P	P	P	-	P	-	P	P	-	P	P	P
PORIFERA	C0001	558	Grant, 1836	-	P	-	-	-	-	-	-	-	-	-	-
Cliona agg.	C0475	132026	Grant, 1826	-	P	-	P	-	P	-	-	-	-	-	-
Raspailiidae	C1258	131642	Nardo, 1833	-	-	-	-	-	-	-	-	-	-	-	-
Haleciidae	D0389	1608	Hincks, 1868	-	-	-	-	-	-	-	-	-	-	-	-
Halecium	D0390	117103	Oken, 1815	-	-	-	-	-	-	-	-	-	-	-	-
Sertulariidae	D0407	1614	Lamouroux, 1812	P	P	-	P	-	-	-	-	-	-	-	-
Hydrallmania falcata	D0424	117890	(Linnaeus, 1758)	-	P	P	P	-	-	-	-	-	-	-	-
Sertularella	D0427	117233	Gray, 1848	-	-	-	-	-	-	-	-	-	-	-	-
Sertularia	D0433	117234	Linnaeus, 1758	-	-	P	-	-	-	-	-	-	-	-	-
Plumulariidae	D0447	1613	McCrady, 1859	-	-	-	-	-	-	-	-	-	-	-	-
Nemertesia	D0462	117195	Lamouroux, 1812	-	-	-	-	-	-	-	-	-	-	-	-
Plumularia setacea	D0469	117824	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Campanulariidae	D0491	1606	Johnston, 1836	-	-	-	-	-	-	-	-	-	-	-	-
Clytia	D0501	117030	Lamouroux, 1812	-	-	-	-	-	-	-	-	-	-	-	-
Clytia hemisphaerica	D0503	117368	(Linnaeus, 1767)	-	-	-	-	-	-	-	-	-	-	-	-
Alcyonium digitatum	D0597	125333	Linnaeus, 1758	P	P	-	P	-	-	-	-	-	-	-	-
Epizoanthus	D0648	100790	Gray, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Crisia aculeata	Y0014	111690	Hassall, 1841	-	-	-	-	-	-	-	-	-	-	-	-
Oncousoecia dilatans	Y0025	111745	(Johnston, 1847)	-	-	-	-	-	-	-	-	-	-	-	-
Tubuliporidae	Y0026	110814	Johnston, 1837	P	P	-	-	-	-	-	-	-	-	-	-
Plagioecia patina	Y0041	111719	(Lamarck, 1816)	-	-	-	-	-	-	-	-	-	-	-	-
Disporella hispida	Y0066	111730	(Fleming, 1828)	P	P	-	P	-	-	-	-	-	-	-	-
Alcyonidiidae	Y0072	110783	Johnston, 1837	-	-	-	-	-	-	-	-	-	-	-	-
Alcyonidium	Y0073	110993	J.V.F.Lamouroux, 1813	-	-	-	-	-	-	-	-	-	-	-	-
Alcyonidium diaphanum	Y0076	111597	(Hudson, 1778)	-	-	-	-	-	-	-	-	-	-	-	-
Nolella dilatata	Y0092	111632	(Hincks, 1860)	-	-	-	-	-	-	-	-	-	-	-	-
Vesicularia spinosa	Y0131	111669	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Amathia lendigera	Y0135	111659	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Scruparia ambigua	Y0161	111539	(d'Orbigny, 1841)	-	-	-	-	-	-	-	-	-	-	-	-
Conopeum reticulum	Y0172	111351	(Linnaeus, 1767)	-	-	-	-	-	-	-	-	-	-	-	-
Electra monostachys	Y0177	111354	(Busk, 1854)	-	-	-	-	-	-	-	-	-	-	-	-
Electra pilosa	Y0178	111355	(Linnaeus, 1767)	-	-	-	-	-	-	-	P	-	-	-	-
Aspidelectra melolontha	Y0182	111350	(Landsborough, 1852)	-	-	P	-	P	P	P	P	-	P	-	-
Chartella papyracea	Y0192	111365	(Ellis & Solander, 1786)	-	-	-	-	-	-	-	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
Hincksina flustroides	Y0196	111369	(Hincks, 1877)	-	-	-	-	-	-	-	-	-	-	-	-
Amphiblestrum auritum	Y0222	111186	(Hincks, 1877)	-	-	-	-	-	-	-	-	-	-	-	-
Crisularia plumosa	Y0246	834039	(Pallas, 1766)	-	-	-	-	-	-	-	-	-	-	-	-
Bicellariella ciliata	Y0256	111147	(Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-
Puellina	Y0315	110897	Jullien, 1886	-	-	-	-	-	-	-	P	-	-	-	-
Hippothoa divaricata	Y0332	111399	Lamouroux, 1821	-	-	-	-	-	-	-	-	-	-	-	-
Chorizopora brongniartii	Y0344	111304	(Audouin, 1826)	-	-	-	-	-	-	-	-	-	-	-	-
Escharella immersa	Y0364	111484	(Fleming, 1828)	P	P	-	P	-	-	-	-	-	-	-	-
Escharella variolosa	Y0369	111495	(Johnston, 1838)	-	-	-	-	-	-	-	-	-	-	-	-
Escharella ventricosa	Y0370	111496	(Hassall, 1842)	-	P	-	-	-	-	-	-	-	-	-	-
Neolagenipora collaris	Y0376	111509	(Norman, 1867)	-	-	-	-	P	-	-	-	-	-	-	-
Porella concinna	Y0385	111125	(Busk, 1854)	P	P	-	-	-	-	-	-	-	-	-	-
Reptadeonella violacea	Y0401	111061	(Johnston, 1847)	-	P	-	-	-	-	-	-	-	-	-	-
Schizoporella hesperia	Y0427	111528	Hayward & Ryland, 1995	-	-	-	-	-	-	-	-	-	-	-	-
Escharina johnstoni	Y0440	111518	(Quelch, 1884)	-	-	P	-	-	-	-	P	-	-	-	-
Schizomavella	Y0467	110829	Canu & Bassler, 1917	P	P	-	P	-	P	-	P	-	-	-	-
Schizomavella (Schizomavella) linearis	Y0474	862795	(Hassall, 1841)	-	-	-	-	-	-	-	-	-	-	-	-
Microporella ciliata	Y0480	111421	(Pallas, 1766)	P	P	-	-	-	-	-	-	-	-	-	-
Fenestrulina	Y0482	110941	Jullien, 1888	-	-	-	-	-	-	-	-	-	-	-	-
Hagiosynodos latus	Y0520	111391	(Busk, 1856)	P	P	-	-	-	-	-	-	-	-	-	-
Didemnidae	ZD0041	103439	Giard, 1872	-	-	-	-	-	-	-	-	-	-	-	-
The following taxa have been removed from the main data matrix to facilitate analysis															
JUVENILES															
SIPUNCULA	N0001	1268	Stephen, 1964	-	-	-	-	-	-	-	-	-	-	-	-
Aphroditidae	P0017	938	Malmgren, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Polynoidae	P0025	939	Kinberg, 1856	-	-	-	-	-	-	-	-	-	-	-	-
Nereididae	P0458	22496	Blainville, 1818	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys	P0494	129370	Cuvier, 1817	-	1	-	-	-	-	-	-	-	-	-	-
Lumbrineridae	P0569	967	Schmarda, 1861	-	-	-	-	-	-	-	-	-	-	-	-
Laonice	P0731	129613	Malmgren, 1867	-	1	-	-	-	-	-	-	-	-	-	-
Cirratulidae	P0822	919	Ryckholt, 1851	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae	P1257	985	Latreille, 1825	-	-	-	-	-	-	-	-	-	-	-	-
Ampelisca	S0423	101445	Krøyer, 1842	-	-	-	-	-	-	-	-	-	-	-	-
AXIIDEA	S1403_A	477324	de Saint Laurent, 1979	-	-	-	-	-	-	-	-	-	-	-	-
Callianassidae	S1413	106800	Dana, 1852	-	-	-	-	-	-	-	-	-	-	-	-
Upogebia	S1418	107079	Leach, 1814 [in Leach, 1813-1815]	-	-	-	-	-	-	-	-	-	-	-	-
Paguridae	S1445	106738	Latreille, 1802	-	-	-	-	-	-	-	-	-	-	-	-
Ebalia	S1504	106889	Leach, 1817 [in Leach, 1815-1875]	-	-	-	-	-	-	-	-	-	-	-	-
Macropodia	S1529	205077	Leach, 1814 [in Leach, 1813-1815]	-	-	-	-	-	-	-	-	-	-	-	-
Cantharidinae	W0140_F	382171	Gray, 1857	-	-	-	-	-	-	-	-	-	-	-	-
Steromphala	W0162	576164	Gray, 1847	-	-	-	-	-	-	-	-	-	-	-	-
Buccinidae	W0702	149	Rafinesque, 1815	-	-	-	-	-	-	-	-	-	-	-	-
NUDIBRANCHIA	W1243	1762	Cuvier, 1817	-	-	-	-	-	-	-	-	-	-	-	-
Nucula	W1565	138262	Lamarck, 1799	-	-	-	-	-	-	-	-	-	-	-	-
Mytilidae	W1691	211	Rafinesque, 1815	2	1	-	1	-	-	-	-	-	-	-	-
Mytilus	W1693	138228	Linnaeus, 1758	-	3	-	-	-	-	-	-	-	-	-	-
Modiolus	W1698	138223	Lamarck, 1799	-	-	-	-	-	-	-	-	-	-	-	-
Musculus	W1719	138225	Röding, 1798	-	-	-	-	-	-	-	-	-	-	-	-
PECTINOIDEA	W1767	151320	Rafinesque, 1815	-	-	-	-	-	-	-	-	-	-	-	-
Anomiidae	W1805	214	Rafinesque, 1815	3	14	-	10	-	2	-	-	-	-	-	-
Spisula	W1973	138159	Gray, 1837	-	-	-	1	-	-	1	6	-	-	-	-
Abra	W2058	138474	Lamarck, 1818	-	-	-	-	-	1	-	-	-	-	-	-
Mya	W2144	138211	Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-
Pholadidae	W2174	252	Lamarck, 1809	-	-	-	-	-	-	-	-	-	-	-	-
Barnea	W2179	138341	Risso, 1826	-	-	-	-	-	-	-	-	-	-	-	-
THRACIOIDEA	W2225	382318	Stoliczka, 1870 (1839)	-	1	-	-	-	-	-	-	-	-	-	-
Thracia	W2227	138549	Blainville, 1824	-	1	-	-	-	-	-	-	-	-	-	-
Pandoridae	W2248	1787	Rafinesque, 1815	-	-	-	-	-	-	-	-	-	-	-	-
ASTEROIDEA	ZB0018	123080	de Blainville, 1830	-	-	-	-	-	-	-	-	-	-	-	-
OPHIUROIDEA	ZB0105	123084	Gray, 1840	2	1	-	-	-	-	-	-	-	-	-	-
Ophiuridae	ZB0165	123200	Müller & Troschel, 1840	39	4	-	-	1	5	-	-	-	-	-	-
ECHINOIDEA	ZB0181	123082	Leske, 1778	-	2	-	-	-	-	-	-	-	-	-	-
CAMARODONTA	ZB0190	510518	Jackson, 1912	2	-	-	1	-	-	-	-	-	-	-	-
SPATANGOIDA	ZB0213	123106	L. Agassiz, 1840	-	1	-	-	-	-	-	-	-	-	-	-
PELAGIC FAUNA															
CHAETOGNATHA	L0001	2081	-	-	-	-	-	-	-	-	-	-	-	-	-
PARASITIC FAUNA															

Taxon	SDC	AphiaID	Authority	FE1_01FA	FE1_02FA	FE1_03FA	FE1_04FA	FE1_05FA	FE1_06FA	FE1_07FA	FE1_08FA	FE2_01FA	FE2_02FA	FE2_03FA	FE2_04FA
				1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195
BOPYROIDEA	S0956	155727	Rafinesque, 1815	-	-	-	-	-	-	-	-	-	-	-	-
DAMAGED FAUNA															
Polynoinae	P0025_F	155091	Kinberg, 1856	-	-	-	-	-	-	-	-	-	-	-	-
Harmothoe	P0050	129491	Kinberg, 1856	2	-	-	1	-	-	-	-	-	-	-	-
Paucibranchia	P0563_A	1297882	Molina-Acevedo, 2018	-	-	-	-	-	-	-	-	-	-	-	-
Aonides	P0721	129605	Claparède, 1864	-	-	-	-	-	-	-	-	-	-	-	-
Laonice	P0731	129613	Malmgren, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Dipolydora	P0748_A	129611	Verrill, 1881	-	-	-	-	-	-	-	-	-	-	-	-
Maldanidae	P0938	923	Malmgren, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Euclymeninae	P0951	152232	Arwidsson, 1906	-	-	-	-	-	-	-	-	-	-	-	-
Nicomachinae	P0976	154920	Arwidsson, 1906	-	1	-	-	-	-	-	-	-	-	-	-
Scalibregmatidae	P1020	925	Malmgren, 1867	-	-	-	-	-	-	-	-	-	-	-	-
Owenia	P1097	129427	Delle Chiaje, 1844	-	-	-	-	-	-	-	-	-	-	-	-
Ampharetidae	P1118	981	Malmgren, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Ampharetinae	P1125	152252	Malmgren, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Ampharete	P1133	129155	Malmgren, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Terebellinae	P1179_A	322588	Johnston, 1846	-	-	-	-	-	-	-	-	-	-	-	-
POLYCIRRINI	P1227_SF	181512	Malmgren, 1866	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae	P1257	985	Latreille, 1825	-	-	-	-	-	-	-	-	-	-	-	-
Serpulidae	P1324	988	Rafinesque, 1815	-	-	-	-	-	-	-	-	-	-	-	-
Spirobranchus	P1339	129582	Blainville, 1818	-	1	-	-	-	-	-	-	-	-	-	-
Urothoe	S0246	101789	Dana, 1852	-	-	-	-	-	-	-	-	-	-	-	-
Ampeliscidae	S0422	101364	Krøyer, 1842	-	-	-	-	-	-	-	-	-	-	-	-
Anthuridae	S0801	118244	Leach, 1814	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA	W0088	101	Cuvier, 1795	-	-	-	-	-	-	-	-	-	-	-	-
Bodotria	S1193	110387	Goodsir, 1843	-	-	-	-	-	-	-	-	-	-	-	-
Spisula	W1973	138159	Gray, 1837	-	-	-	-	-	-	-	-	-	-	-	-
Abra	W2058	138474	Lamarck, 1818	-	1	-	-	-	-	-	-	-	-	-	-
Ophiuridae	ZB0165	123200	Müller & Troschel, 1840	-	-	-	-	-	-	-	-	-	-	-	-

SDC = Species Directory Code

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Cerianthus lloydii	D0632	283798	Gosse, 1859	-	-	-	-	-
ACTINIARIA	D0662	1360	Hertwig, 1882	-	-	-	-	1
Edwardsiidae	D0759	100665	Andres, 1881	-	-	-	-	-
PLATYHELMINTHES	F0001	793	Minot, 1876	-	-	-	-	-
NEMERTEA	G0001	152391	-	-	3	2	-	2
Loxosoma annelidicola	K0006	111811	(Van Beneden & Hesse, 1863)	-	-	-	-	-
Golfingia (Golfingia) elongata	N0014	175026	(Keferstein, 1862)	-	-	-	-	-
Golfingia (Golfingia) vulgaris vulgaris	N0017	410724	(de Blainville, 1827)	-	-	-	-	-
Maxmuelleria lankesteri	O0018	110368	(Herdman, 1897)	-	-	-	-	-
Pisione remota	P0015	130707	(Southern, 1914)	-	-	-	-	-
Subadyte pellucida	P0032	130833	(Ehlers, 1864)	-	-	-	-	-
Gattyana cirrhosa	P0049	130749	(Pallas, 1766)	-	-	-	-	1
Malmgrenia Type A	P0050_G@	147006	McIntosh, 1874	-	-	-	-	-
Malmgrenia bicki	P0050_G@	1044546	Barnich, Dietrich, Hager & Fiege, 2017	-	-	-	-	1
Malmgrenia arenicolae	P0050_G@	152276	(Saint-Joseph, 1888)	-	-	-	-	1
Malmgrenia darbouxi	P0050_G@	863197	(Pettibone, 1993)	-	-	-	-	4
Harmothoe clavigera	P0050_G	130760	(M. Sars, 1863)	-	-	-	-	-
Malmgrenia andreapolis	P0051	147008	McIntosh, 1874	-	-	1	-	-
Harmothoe antilopes	P0052	130754	McIntosh, 1876	-	-	-	-	-
Harmothoe extenuata	P0058	130762	(Grube, 1840)	-	-	-	-	-
Harmothoe impar	P0065	130770	(Johnston, 1839)	-	-	-	-	-
Lepidonotus squamatus	P0082	130801	(Linnaeus, 1758)	-	-	-	-	-
Polynoe scolopendrina	P0084	130830	Savigny, 1822	-	-	-	-	-
Pholoe inornata	P0092	130601	Johnston, 1839	-	-	-	-	1
Pholoe baltica	P0095	130599	Örsted, 1843	-	2	5	-	2
Sthenelais boa	P0107	131074	(Johnston, 1833)	-	-	-	-	-
Eteone longa agg.	P0118	130616	(Fabricius, 1780)	-	1	1	-	-
Hesionura elongata	P0122	130649	(Southern, 1914)	-	-	-	-	-
Mysta barbata	P0126	147027	Malmgren, 1865	-	-	-	-	-
Mysta picta	P0127	147026	(Quatrefages, 1866)	-	-	-	-	-
Phyllodoce groenlandica	P0141	334506	Örsted, 1842	-	-	-	-	-
Phyllodoce lineata	P0142	334508	(Claparède, 1870)	-	-	-	-	-
Phyllodoce longipes	P0143	130673	Kinberg, 1866	-	-	-	-	-
Eulalia expusilla	P0153	130625	Pleijel, 1987	-	-	-	-	-
Eulalia mustela	P0155	130631	Pleijel, 1987	-	-	1	-	-
Eulalia ornata	P0156	130632	Saint-Joseph, 1888	-	-	-	-	-
Eumida bahusiensis	P0164	130641	Bergstrom, 1914	-	-	-	-	-
Eumida sanguinea agg.	P0167	130644	(Örsted, 1843)	-	-	4	-	2
Glycera alba	P0256	130116	(O.F. Müller, 1776)	-	-	-	-	-
Glycera lapidum	P0260	130123	Quatrefages, 1866	-	7	2	1	2
Glycera oxycephala	P0262	130126	Ehlers, 1887	-	1	-	2	-
Glycinde nordmanni	P0268	130136	(Malmgren, 1866)	-	-	-	-	-
Goniada maculata	P0271	130140	Örsted, 1843	-	-	-	-	-
Sphaerodorum gracilis	P0291	131100	(Rathke, 1843)	-	-	-	-	-
Podarkeopsis capensis	P0319	130195	(Day, 1963)	-	-	-	-	-
Syllidia armata	P0321	130198	Quatrefages, 1866	-	-	-	-	-
Syllis garciai	P0351	131431	(Campoy, 1982)	-	3	-	1	1
Syllis pontxioi	P0358_A	196003	San Martín & López, 2000	-	1	-	1	-
Syllis armillaris	P0365	131415	(O.F. Müller, 1776)	-	-	-	-	-
Syllis cf. *armillaris*	P0365	131415	(O.F. Müller, 1776)	-	-	-	-	-
Syllis variegata	P0371	131458	Grube, 1860	-	-	-	-	-
Amblyosyllis spectabilis	P0374_A	1258721	(Johnston in Baird, 1861)	-	-	-	-	-
Eusyllis blomstrandi	P0380	131290	Malmgren, 1867	-	-	-	-	-
Odontosyllis fulgurans	P0387	131327	(Audouin & Milne Edwards, 1833)	-	-	-	-	-
Streptodonta pterochaeta	P0391	238207	(Southern, 1914)	-	-	-	-	-
Streptosyllis campoyi	P0402_G	238248	Brito, Núñez & San Martín, 2000	-	-	-	-	-
Syllides japonicus	P0409	131410	Imajima, 1966	-	-	-	-	-
Parexogone hebes	P0421	757970	(Webster & Benedict, 1884)	-	-	-	-	-
Exogone naidina	P0422	327985	Örsted, 1845	-	-	-	-	-
Exogone verugera	P0423	333456	(Claparède, 1868)	-	-	-	-	-
Erinaceusyllis erinaceus	P0426	195953	(Claparède, 1863)	-	-	-	-	-
Sphaerosyllis taylori	P0430	131394	Perkins, 1981	-	-	-	-	-
Myrianida	P0449	129659	Milne Edwards, 1845	-	2	-	-	4
Proceraea aurantiaca	P0451_G	131361	Claparède, 1868	-	-	-	-	-
Rullierinereis ancornunezi	P0458_A	492034	Núñez & Brito, 2006	-	-	-	-	-
Eunereis longissima	P0475	130375	(Johnston, 1840)	-	1	1	-	-
Nephtys caeca	P0496	130355	(Fabricius, 1780)	-	1	-	-	-
Nephtys cirrosa	P0498	130357	Ehlers, 1868	1	-	-	-	-
Nephtys hombergii	P0499	130359	Savigny in Lamarck, 1818	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Nephtys kersivalensis	P0502	130363	McIntosh, 1908	-	-	-	-	-
Nephtys longosetosa	P0503	130364	Örsted, 1842	-	-	-	-	-
Lysidice ninetta	P0562	130071	Audouin & H Milne Edwards, 1833	-	-	1	-	-
Paucibranchia totospinata	P0563_B	1305625	(Lu & Fauchald, 1998)	-	-	1	-	-
Paucibranchia bellii	P0564	1297885	(Audouin & Milne Edwards, 1833)	-	-	-	-	-
Marphysa sanguinea	P0566	130075	(Montagu, 1813)	-	-	-	-	-
Lysidice unicornis	P0568	742232	(Grube, 1840)	-	1	-	-	-
Hilbigneris pleijeli	P0569_F	396540	Carrera-Parra, 2006	-	-	-	-	-
Lumbrineris cf. *cingulata*	P0572_A	130240	Ehlers, 1897	-	12	10	2	15
Drilonereis	P0589	129200	Claparède, 1870	-	-	-	-	-
Protodorvillea kefersteini	P0638	130041	(McIntosh, 1869)	-	-	-	-	-
Schistomeringos neglecta	P0642	130044	(Fauvel, 1923)	-	-	-	-	-
Schistomeringos rudolphi	P0643	154127	(Delle Chiaje, 1828)	-	-	-	-	-
Orbinia sertulata	P0665	130523	(Savigny, 1822)	-	-	-	-	-
Scoloplos armiger	P0672	130537	(Müller, 1776)	-	-	-	-	-
Paradoneis lyra	P0699	130585	(Southern, 1914)	-	-	-	-	-
Poecilochaetus serpens	P0718	130711	Allen, 1904	-	2	1	-	-
Aonides oxycephala	P0722	131106	(Sars, 1862)	-	-	2	-	-
Aonides paucibranchiata	P0723	131107	Southern, 1914	-	19	-	3	3
Atherospio guillei	P0724_A	478336	(Laubier & Ramos, 1974)	-	-	-	-	-
Laonice irinae	P0731_G	1518242	Sikorski, Radashevsky & Nygren in Sikorski et al, 2021	-	2	-	1	-
Dipolydora Species A	P0748_A	129611	Verrill, 1881	-	-	-	-	-
Dipolydora Type N	P0748_A	129611	Verrill, 1881	-	-	-	-	1
Polydora ciliata Type A	P0752	131141	(Johnston, 1838)	-	-	-	-	-
Dipolydora flava	P0754	131118	(Claparède, 1870)	-	-	-	-	-
Dipolydora saintjosephi	P0761	131123	(Eliason, 1920)	-	-	-	-	-
Pseudopolydora pulchra	P0774	131169	(Carazzi, 1893)	-	-	-	-	-
Pygospio elegans	P0776	131170	Claparède, 1863	-	-	-	-	-
Scolelepis korsuni	P0777_A	131174	Sikorski, 1994	-	1	-	-	-
Spio	P0787	129625	Fabricius, 1785	-	-	-	-	-
Spiophanes bombyx agg.	P0794	131187	(Claparède, 1870)	-	1	-	-	-
Magelona johnstoni	P0803_A	130269	Fiege, Licher & Mackie, 2000	-	-	-	-	-
Magelona alleni	P0804	130266	Wilson, 1958	-	-	-	-	-
Chaetopterus	P0811	129229	Cuvier, 1830	-	-	-	-	2
Aphelochaeta Type A	P0823	129240	Blake, 1991	-	-	-	-	-
Aphelochaeta marioni	P0824	129938	(Saint-Joseph, 1894)	-	-	-	-	-
Caulleriella alata	P0829	129943	(Southern, 1914)	-	2	3	-	1
Chaetozone zetlandica	P0831	336485	McIntosh, 1911	-	3	-	-	-
Dodecaceria	P0840	129246	Örsted, 1843	-	-	-	-	-
Flabelligera affinis	P0881	130103	M. Sars, 1829	-	-	-	-	-
Pherusa plumosa	P0885	130113	(Müller, 1776)	-	-	-	-	-
Mediomastus fragilis	P0919	129892	Rasmussen, 1973	-	1	-	-	-
Notomastus	P0920	129220	M. Sars, 1851	-	2	5	-	13
Leiochone	**P0951_F**	**146991**	**Grube, 1868**	-	-	-	-	2
Euclymene oerstedii	P0964	130294	(Claparède, 1863)	-	-	-	-	-
Praxillella affinis	P0971	130322	(M. Sars in G.O. Sars, 1872)	-	-	-	-	2
Micromaldane ornithochaeta	P0978	130310	Mesnil, 1897	-	-	-	-	-
Nicomache	P0979	129357	Malmgren, 1865	-	-	-	-	-
Petaloproctus	P0985	129359	Quatrefages, 1866	-	-	-	-	-
Ophelia borealis	P0999	130491	Quatrefages, 1866	-	1	-	-	-
Travisia forbesii	P1007	130512	Johnston, 1840	-	-	-	-	-
Asclerocheilus intermedius	P1022	130974	(Saint-Joseph, 1894)	-	-	-	1	-
Scalibregma celticum	P1026	130979	Mackie, 1991	-	-	-	-	-
Scalibregma inflatum	P1027	130980	Rathke, 1843	-	21	12	-	8
Sclerocheilus minutus	P1029	130982	Grube, 1863	-	-	-	-	-
Polygordius	P1062	129472	Schneider, 1868	-	-	-	-	-
Galathowenia oculata	P1093	146950	(Zachs, 1923)	-	-	-	-	-
Owenia borealis	P1097_G	329882	Koh, Bhaud & Jirkov, 2003	-	-	-	-	-
Lagis koreni	P1107	152367	Malmgren, 1866	-	6	-	-	1
Sabellaria spinulosa	P1117	130867	(Leuckart, 1849)	-	9	-	-	19
Melinna palmata	P1124	129808	Grube, 1870	-	-	-	-	-
Ampharete lindstroemi	P1139	129781	Malmgren, 1867 sensu Hessle, 1917	-	-	1	-	2
Amphicteis midas	P1143	129785	(Gosse, 1855)	-	-	-	-	-
Terebellides	P1174	129717	Sars, 1835	-	-	-	-	1
Loimia ramzega	P1200_G	1036014	Lavesque, Bonifácio, Londoño-Mesa, Le Garrec & Grall, 2017	-	-	3	-	4
Nicolea venustula	P1210	131507	(Montagu, 1819)	-	-	-	-	-
Amaeana trilobata	P1229	131471	(Sars, 1863)	-	-	-	-	-
Lysilla loveni	P1233	131500	Malmgren, 1866	-	-	-	-	-
Lysilla nivea	P1234	131501	Langerhans, 1884	-	-	-	-	4

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Polycirrus	P1235	129710	Grube, 1850	-	1	-	-	4
Thelepus parapari	P1253_G	1253692	Jirkov, 2018	-	3	-	-	1
Thelepus setosus	P1255	131544	(Quatrefages, 1866)	-	-	-	-	-
Jasmineira elegans	P1290	130921	Saint-Joseph, 1894	-	-	-	-	-
Perkinsiana rubra	P1307	130948	(Langerhans, 1880)	-	-	-	-	-
Pseudopotamilla	P1315	129548	Bush, 1905	-	-	-	-	-
Sabella discifera	P1318	130964	Grube, 1874	-	1	-	-	-
Sabella pavonina	P1320	130967	Savigny, 1822	-	-	-	-	-
Spirobranchus lamarcki	P1340	560033	(Quatrefages, 1866)	-	-	3	18	3
Spirobranchus triqueter	P1341	555935	(Linnaeus, 1758)	-	1	-	2	-
Tubificoides	P1487	137393	Lastočkin, 1937	-	-	-	-	-
Grania	P1524	137349	Southern, 1913	-	1	-	1	-
Nymphon brevirostre	Q0005	150520	Hodge, 1863	-	-	-	-	-
Achelia echinata	Q0015	134599	Hodge, 1864	-	-	-	-	-
Ammothella longipes	Q0018	134614	(Hodge, 1864)	-	-	-	-	-
Callipallene	**Q0032**	**134581**	**Flynn, 1929**	**-**	**-**	**-**	**-**	**-**
Anoplodactylus petiolatus	Q0044	134723	(Krøyer, 1844)	-	3	-	-	-
Verruca stroemia	R0041	106257	(O.F. Müller, 1776)	-	-	-	-	-
Balanus crenatus	R0077	106215	Bruguière, 1789	-	-	-	-	-
OSTRACODA	R2412	1078	Latreille, 1802	-	-	-	-	-
Rissoides desmaresti	S0018	136135	(Risso, 1816)	-	-	-	-	-
Gastrosaccus spinifer	S0044	120020	(Goës, 1864)	1	-	-	-	-
Heteromysis (Heteromysis) microps	S0093	120037	(G.O. Sars, 1877)	-	-	-	-	-
Apherusa ovalipes	S0107	102172	Norman & Scott, 1906	-	-	-	-	-
Apolochus neapolitanus	S0159	236495	(Della Valle, 1893)	-	-	-	-	-
Leucothoe procera	S0179	102466	Spence Bate, 1857	-	-	-	-	-
Stenothoe marina	S0213	103166	(Spence Bate, 1857)	-	-	-	-	-
Urothoe brevicornis	S0247	103226	Spence Bate, 1862	-	-	-	-	-
Urothoe elegans	S0248	103228	Spence Bate, 1857	-	1	-	-	1
Urothoe marina	S0249	103233	(Spence Bate, 1857)	-	3	1	-	-
Harpinia pectinata	S0257	102972	Sars, 1891	-	-	-	-	-
Acidostoma neglectum	S0272_A	102495	Dahl, 1964	-	-	-	-	-
Lysianassa ceratina	S0303	102605	(Walker, 1889)	-	-	-	-	-
Iphimedia minuta	S0380	102345	G.O. Sars, 1883	-	-	-	-	-
Iphimedia nexa	S0381	102346	Myers & McGrath, in Myers, McGrath & Costello, 1987	-	-	-	-	-
Iphimedia spatula	S0384	102351	Myers & McGrath, in Myers, McGrath & Costello, 1987	-	-	-	-	-
Nototropis guttatus	S0411	488957	Costa, 1853	-	-	-	-	-
Ampelisca diadema	S0429	101896	(Costa, 1853)	-	-	-	-	-
Ampelisca spinipes	S0438	101928	Boeck, 1861	-	10	2	-	5
Haploops	S0446	101447	Liljeborg, 1856	-	-	-	-	-
Bathyporeia elegans	S0452	103058	Watkin, 1938	-	-	-	-	-
Bathyporeia guilliamsoniana	S0454	103060	(Spence Bate, 1857)	-	-	-	-	-
Bathyporeia pelagica	S0456	103066	(Spence Bate, 1857)	-	-	-	-	-
Abludomelita obtusata	S0498	102788	(Montagu, 1813)	-	-	-	2	-
Cheirocratus (female)	S0503	101669	Norman, 1867	-	1	-	-	-
Othomaera othonis	S0519	534781	(H. Milne Edwards, 1830)	-	-	-	-	-
Maerella tenuimana	S0521	102831	(Spence Bate, 1862)	-	-	-	-	-
Megamphopus cornutus	S0539	102377	Norman, 1869	-	-	-	-	-
Gammaropsis maculata	S0541	102364	(Johnston, 1828)	-	-	-	-	-
Photis longicaudata	S0552	102383	(Spence Bate & Westwood, 1862)	-	-	-	-	-
Ericthonius	**S0561**	**101567**	**H. Milne Edwards, 1830**	**-**	**-**	**-**	**-**	**-**
Jassa	S0568	101571	Leach, 1814	-	1	-	-	-
Microjassa cumbrensis	S0574	102439	(Stebbing & Robertson, 1891)	-	-	-	-	-
Aoridae	**S0577**	**101368**	**Stebbing, 1899**	**-**	**-**	**-**	**1**	**1**
Crassicorophium crassicorne	S0611	397383	(Bruzelius, 1859)	-	-	-	-	-
Monocorophium sextonae	S0615	148603	(Crawford, 1937)	-	-	-	-	1
Unciola crenatipalma	S0621	102057	(Spence Bate, 1862)	-	-	-	-	-
Dyopedos monacanthus	S0628	489646	(Metzger, 1875)	-	-	-	-	-
Pariambus typicus	S0651	101857	(Krøyer, 1845)	-	-	-	-	1
Phtisica marina	S0657	101864	Slabber, 1769	-	-	-	-	-
Pseudoprotella phasma	S0659	101871	(Montagu, 1804)	-	-	-	-	-
Gnathia oxyuraea	S0796	118995	(Lilljeborg, 1855)	-	-	-	-	-
Anthura gracilis	S0803	118467	(Montagu, 1808)	-	-	-	-	-
Eurydice spinigera	S0855	148637	Hansen, 1890	-	-	-	-	-
Cleantis prismatica	S0947	119038	(Risso, 1826)	-	-	-	-	-
Astacilla longicornis	S0955	119024	(Sowerby, 1806)	-	-	-	1	-
Apseudes talpa	S1177	136285	(Montagu, 1808)	-	-	-	-	-
Bodotria scorpioides	S1197	110445	(Montagu, 1804)	-	-	-	-	-
Diastylis bradyi	S1248	110472	Norman, 1879	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Diastylis rathkei	S1253	110487	(Krøyer, 1841)	-	-	-	-	-
Eualus cranchii	S1360	156083	(Leach, 1817 [in Leach, 1815-1875])	-	-	-	-	-
Axius stirhynchus	S1407	107722	Leach, 1816	-	-	-	-	-
Callianassa subterranea	S1415	107729	(Montagu, 1808)	-	2	-	-	-
Upogebia deltaura	S1419	107739	(Leach, 1816)	-	-	-	-	1
Anapagurus hyndmanni	S1448	107217	(Bell, 1845 [in Bell, 1844-1853])	-	-	-	-	-
Galathea intermedia	S1472	107150	Lilljeborg, 1851	-	-	-	-	-
Pisidia longicornis	S1482	107188	(Linnaeus, 1767)	-	3	-	-	2
Ebalia tuberosa	S1508	107301	(Pennant, 1777)	-	-	-	-	-
Ebalia tumefacta	S1509	107302	(Montagu, 1808)	-	-	-	-	-
Hyas coarctatus	S1519	107323	Leach, 1815 [in Leach, 1815-1875]	-	-	-	-	-
Macropodia rostrata	S1532	107345	(Linnaeus, 1761)	-	-	-	-	-
Atelecyclus rotundatus	S1555	107273	(Olivi, 1792)	-	-	-	-	-
Thia scutellata	S1559	107281	(Fabricius, 1793)	-	-	-	-	-
Pilumnus hirtellus	S1615	107418	(Linnaeus, 1761)	-	1	-	-	-
Leptochiton asellus	W0053	140199	(Gmelin, 1791)	-	1	-	-	2
Puncturella noachina	W0112	139975	(Linnaeus, 1771)	-	-	-	-	-
Steromphala tumida	W0161	1477356	(Montagu, 1803)	-	-	-	-	-
Steromphala cineraria	W0163	1039839	(Linnaeus, 1758)	-	-	-	-	-
Calliostoma zizyphinum	W0182	141767	(Linnaeus, 1758)	-	-	-	-	-
Crisilla semistriata	W0348	141280	(Montagu, 1808)	-	-	-	-	-
Caecum glabrum	W0418	138952	(Montagu, 1803)	-	-	-	-	-
Crepidula fornicata	W0439	138963	(Linnaeus, 1758)	-	-	-	-	-
Euspira nitida	W0491	151894	(Donovan, 1803)	1	-	-	-	-
Epitonium clathratulum	W0556	139718	(Kanmacher, 1798)	-	-	-	-	-
Ocenebra erinaceus	W0685	140405	(Linnaeus, 1758)	-	-	-	-	-
Buccinum undatum	W0708	138878	Linnaeus, 1758	-	-	-	-	-
Brachystomia eulimoides	W0922	491650	(Hanley, 1844)	-	-	-	-	-
Philine quadripartita	W1038_A	574582	Ascanius, 1772	-	-	-	-	-
Duvaucelia	W1245_F	536858	Risso, 1826	-	-	-	-	-
Doto	W1270	137916	Oken, 1815	-	-	-	-	-
Acanthodoris pilosa	W1333	140627	(Abildgaard [in Müller], 1789)	-	-	-	-	-
Nucula hanleyi	W1568	140588	Winckworth, 1931	-	-	-	-	-
Nucula nitidosa	W1569	140589	Winckworth, 1930	-	-	-	-	-
Nucula nucleus	W1570	140590	(Linnaeus, 1758)	-	-	-	-	-
Striarca lactea	W1676	140571	(Linnaeus, 1758)	-	-	-	-	-
Glycymeris glycymeris	W1688	140025	(Linnaeus, 1758)	5	-	-	2	-
Mytilus edulis	W1695	140480	Linnaeus, 1758	-	-	-	-	-
Modiolus adriaticus	W1700	140462	Lamarck, 1819	-	-	-	-	-
Modiolus barbatus	W1701	140464	(Linnaeus, 1758)	-	-	-	-	-
Modiolula phaseolina	W1708	140461	(Philippi, 1844)	-	-	-	-	-
Musculus discors	W1721	140472	(Linnaeus, 1767)	-	-	-	-	-
Aequipecten opercularis	W1773	140687	(Linnaeus, 1758)	-	-	-	-	-
Heteranomia squamula	W1809	138749	(Linnaeus, 1758)	-	-	-	-	-
Diplodonta rotundata	W1864	141883	(Montagu, 1803)	-	2	1	-	1
Kellia suborbicularis	W1875	140161	(Montagu, 1803)	-	-	-	-	-
Tellimya ferruginosa	W1902	146952	(Montagu, 1808)	-	-	-	-	-
Kurtiella bidentata	W1906	345281	(Montagu, 1803)	-	-	1	-	11
Epilepton clarkiae	W1911	140366	(W. Clark, 1852)	-	-	-	-	-
Goodallia triangularis	W1929	138831	(Montagu, 1803)	9	-	-	-	-
Spisula elliptica	W1975	140300	(T. Brown, 1827)	-	-	-	-	-
Phaxas pellucidus	W2006	140737	(Pennant, 1777)	-	-	-	-	-
Moerella donacina	W2021	147021	(Linnaeus, 1758)	-	-	-	-	-
Asbjornsenia pygmaea	W2023	879714	(Lovén, 1846)	1	-	1	-	-
Abra alba	W2059	141433	(W. Wood, 1802)	-	2	1	-	1
Abra prismatica	W2062	141436	(Montagu, 1808)	-	2	-	-	-
Clausinella fasciata	W2100	141909	(da Costa, 1778)	-	-	-	-	-
Timoclea ovata	W2104	141929	(Pennant, 1777)	-	-	-	-	-
Polititapes rhomboides	W2113	745846	(Pennant, 1777)	-	-	-	-	-
Mya truncata	W2147	140431	Linnaeus, 1758	-	-	-	-	-
Sphenia binghami	W2152	140432	W. Turton, 1822	-	-	-	-	-
Varicorbula gibba	W2157	378492	(Olivi, 1792)	-	-	-	-	-
Rocellaria dubia	W2162	505249	(Pennant, 1777)	-	-	-	-	-
Hiatella	W2165	138068	Bosc, 1801	-	-	-	-	-
Saxicavella jeffreysi	W2172	140108	Winckworth, 1930	-	-	-	-	-
Barnea parva	W2183	140768	(Pennant, 1777)	-	-	-	-	-
Thracia villosiuscula	W2233	141651	(MacGillivray, 1827)	-	-	-	-	-
Thracia distorta	W2235	141647	(Montagu, 1803)	-	-	-	-	-
Phoronis	ZA0003	128545	Wright, 1856	-	5	5	-	2

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Ophiothrix fragilis	ZB0124	125131	(Abildgaard in O.F. Müller, 1789)	-	-	-	-	-
Acrocnida brachiata	ZB0151	236130	(Montagu, 1804)	-	-	-	-	-
Amphiura filiformis	ZB0154	125080	(O.F. Müller, 1776)	-	-	-	-	-
Amphipholis squamata	ZB0161	125064	(Delle Chiaje, 1828)	-	12	2	-	3
Ophiocten affinis	ZB0167	124850	(Lütken, 1858)	-	-	-	-	-
Ophiura albida	ZB0168	124913	Forbes, 1839	-	7	34	1	25
Ophiura ophiura	ZB0170	124929	(Linnaeus, 1758)	-	-	-	-	-
Psammechinus miliaris	ZB0193	124319	(P.L.S. Müller, 1771)	-	-	1	-	-
Echinocyamus pusillus	ZB0212	124273	(O.F. Müller, 1776)	1	4	5	3	6
Echinocardium cordatum	ZB0223	124392	(Pennant, 1777)	-	-	-	-	-
ENTEROPNEUSTA	ZC0012	1820	Gegenbaur, 1870	-	-	-	-	-
ASCIDIACEA	ZD0002	1839	Blainville, 1824	-	-	-	-	1
			Number of taxa:	**288**	**288**	**288**	**288**	**288**
			Abundance:	**19**	**172**	**113**	**43**	**172**
The following taxa (highlighted below) are merged in rationalised dataset above								
Leiochone	P0951_F	146991	Grube, 1868	-	-	-	-	-
Leiochone tricirrata	P0951_F	328694	Bellan & Reys, 1967	-	-	-	-	2
Leiochone johnstoni	P0958	221095	McIntosh, 1915	-	-	-	-	-
Leiochone	P0951_F	**146991**	**Grube, 1868**	**-**	**-**	**-**	**-**	**2**
Callipallene	Q0032	134581	Flynn, 1929	-	-	-	-	-
Callipallene tiberii	Q0038	134648	(Dohrn, 1881)	-	-	-	-	-
Callipallene	Q0032	**134581**	**Flynn, 1929**	**-**	**-**	**-**	**-**	**-**
Ericthonius	S0561	101567	H. Milne Edwards, 1830	-	-	-	-	-
Ericthonius punctatus	S0564	102408	(Spence Bate, 1857)	-	-	-	-	-
Ericthonius	S0561	**101567**	**H. Milne Edwards, 1830**	**-**	**-**	**-**	**-**	**-**
Aoridae	S0577	101368	Stebbing, 1899	-	-	-	-	-
Leptocheirus hirsutimanus	S0588	102036	(Spence Bate, 1862)	-	-	-	1	1
Aoridae	S0577	**101368**	**Stebbing, 1899**	**-**	**-**	**-**	**1**	**1**
PRESENCE/ABSENCE DATA								
Folliculinidae	A0003	1692	Dons, 1914	-	-	-	P	-
PORIFERA	C0001	558	Grant, 1836	-	-	-	-	-
Cliona agg.	C0475	132026	Grant, 1826	-	-	P	-	-
Raspailiidae	C1258	131642	Nardo, 1833	-	-	-	-	-
Haleciidae	D0389	1608	Hincks, 1868	-	-	-	-	-
Halecium	D0390	117103	Oken, 1815	-	-	-	-	-
Sertulariidae	D0407	1614	Lamouroux, 1812	-	P	-	-	P
Hydrallmania falcata	D0424	117890	(Linnaeus, 1758)	-	-	-	-	P
Sertularella	D0427	117233	Gray, 1848	-	-	-	-	-
Sertularia	D0433	117234	Linnaeus, 1758	-	-	-	-	-
Plumulariidae	D0447	1613	McCrady, 1859	-	-	-	-	-
Nemertesia	D0462	117195	Lamouroux, 1812	-	-	-	-	-
Plumularia setacea	D0469	117824	(Linnaeus, 1758)	-	-	-	-	-
Campanulariidae	D0491	1606	Johnston, 1836	-	-	-	-	-
Clytia	D0501	117030	Lamouroux, 1812	-	-	-	-	-
Clytia hemisphaerica	D0503	117368	(Linnaeus, 1767)	-	-	-	-	-
Alcyonium digitatum	D0597	125333	Linnaeus, 1758	-	-	-	-	-
Epizoanthus	D0648	100790	Gray, 1867	-	-	-	-	P
Crisia aculeata	Y0014	111690	Hassall, 1841	-	-	-	-	-
Oncousoecia dilatans	Y0025	111745	(Johnston, 1847)	-	-	-	-	-
Tubuliporidae	Y0026	110814	Johnston, 1837	-	-	-	-	-
Plagioecia patina	Y0041	111719	(Lamarck, 1816)	-	-	-	-	-
Disporella hispida	Y0066	111730	(Fleming, 1828)	-	-	-	P	-
Alcyonidiidae	Y0072	110783	Johnston, 1837	-	-	-	-	-
Alcyonidium	Y0073	110993	J.V.F.Lamouroux, 1813	-	-	-	-	-
Alcyonidium diaphanum	Y0076	111597	(Hudson, 1778)	-	-	-	-	-
Nolella dilatata	Y0092	111632	(Hincks, 1860)	-	-	-	-	-
Vesicularia spinosa	Y0131	111669	(Linnaeus, 1758)	-	-	-	-	-
Amathia lendigera	Y0135	111659	(Linnaeus, 1758)	-	-	-	-	-
Scruparia ambigua	Y0161	111539	(d'Orbigny, 1841)	-	-	-	-	-
Conopeum reticulum	Y0172	111351	(Linnaeus, 1767)	-	-	-	P	-
Electra monostachys	Y0177	111354	(Busk, 1854)	-	-	-	-	-
Electra pilosa	Y0178	111355	(Linnaeus, 1767)	-	-	-	-	P
Aspidelectra melolontha	Y0182	111350	(Landsborough, 1852)	-	P	-	-	-
Chartella papyracea	Y0192	111365	(Ellis & Solander, 1786)	-	-	-	-	-

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
Hincksina flustroides	Y0196	111369	(Hincks, 1877)	-	-	-	-	-
Amphiblestrum auritum	Y0222	111186	(Hincks, 1877)	-	-	-	-	-
Crisularia plumosa	Y0246	834039	(Pallas, 1766)	-	-	-	-	-
Bicellariella ciliata	Y0256	111147	(Linnaeus, 1758)	-	-	-	-	-
Puellina	Y0315	110897	Jullien, 1886	-	-	-	-	-
Hippothoa divaricata	Y0332	111399	Lamouroux, 1821	-	-	-	P	-
Chorizopora brongniartii	Y0344	111304	(Audouin, 1826)	-	-	-	P	-
Escharella immersa	Y0364	111484	(Fleming, 1828)	-	P	-	P	-
Escharella variolosa	Y0369	111495	(Johnston, 1838)	-	-	-	-	-
Escharella ventricosa	Y0370	111496	(Hassall, 1842)	-	-	-	-	-
Neolagenipora collaris	Y0376	111509	(Norman, 1867)	-	-	-	-	-
Porella concinna	Y0385	111125	(Busk, 1854)	-	-	-	-	-
Reptadeonella violacea	Y0401	111061	(Johnston, 1847)	-	-	-	-	P
Schizoporella hesperia	Y0427	111528	Hayward & Ryland, 1995	-	-	-	-	-
Escharina johnstoni	Y0440	111518	(Quelch, 1884)	-	-	-	-	-
Schizomavella	Y0467	110829	Canu & Bassler, 1917	-	P	P	P	P
Schizomavella (Schizomavella) linearis	Y0474	862795	(Hassall, 1841)	-	-	-	-	-
Microporella ciliata	Y0480	111421	(Pallas, 1766)	-	-	-	-	-
Fenestrulina	Y0482	110941	Jullien, 1888	-	-	-	-	-
Hagiosynodos latus	Y0520	111391	(Busk, 1856)	-	-	-	-	-
Didemnidae	ZD0041	103439	Giard, 1872	-	-	-	-	-
The following taxa have been removed from the main data matrix to facilitate analysis								
JUVENILES								
SIPUNCULA	N0001	1268	Stephen, 1964	-	2	-	-	1
Aphroditidae	P0017	938	Malmgren, 1867	-	-	-	-	-
Polynoidae	P0025	939	Kinberg, 1856	-	1	-	-	-
Nereididae	P0458	22496	Blainville, 1818	-	-	-	-	-
Nephtys	P0494	129370	Cuvier, 1817	-	-	-	-	-
Lumbrineridae	P0569	967	Schmarda, 1861	-	-	-	-	-
Laonice	P0731	129613	Malmgren, 1867	-	-	-	-	-
Cirratulidae	P0822	919	Ryckholt, 1851	-	-	-	-	1
Sabellidae	P1257	985	Latreille, 1825	-	-	-	-	-
Ampelisca	S0423	101445	Krøyer, 1842	-	-	-	-	-
AXIIDEA	S1403_A	477324	de Saint Laurent, 1979	-	-	-	-	-
Callianassidae	S1413	106800	Dana, 1852	-	1	-	-	-
Upogebia	S1418	107079	Leach, 1814 [in Leach, 1813-1815]	-	2	-	-	1
Paguridae	S1445	106738	Latreille, 1802	-	-	-	-	-
Ebalia	S1504	106889	Leach, 1817 [in Leach, 1815-1875]	-	-	-	-	-
Macropodia	S1529	205077	Leach, 1814 [in Leach, 1813-1815]	-	-	-	-	2
Cantharidinae	W0140_F	382171	Gray, 1857	-	-	-	-	-
Steromphala	W0162	576164	Gray, 1847	-	-	-	-	-
Buccinidae	W0702	149	Rafinesque, 1815	-	-	-	-	-
NUDIBRANCHIA	W1243	1762	Cuvier, 1817	-	-	-	-	-
Nucula	W1565	138262	Lamarck, 1799	-	-	-	-	-
Mytilidae	W1691	211	Rafinesque, 1815	-	-	-	-	-
Mytilus	W1693	138228	Linnaeus, 1758	-	-	-	-	-
Modiolus	W1698	138223	Lamarck, 1799	-	-	-	-	-
Musculus	W1719	138225	Röding, 1798	-	-	-	-	-
PECTINOIDEA	W1767	151320	Rafinesque, 1815	-	-	-	-	-
Anomiidae	W1805	214	Rafinesque, 1815	-	-	-	-	-
Spisula	W1973	138159	Gray, 1837	1	1	-	-	-
Abra	W2058	138474	Lamarck, 1818	-	-	-	-	2
Mya	W2144	138211	Linnaeus, 1758	-	-	-	-	-
Pholadidae	W2174	252	Lamarck, 1809	-	1	-	-	-
Barnea	W2179	138341	Risso, 1826	-	-	-	-	-
THRACIOIDEA	W2225	382318	Stoliczka, 1870 (1839)	-	-	-	-	-
Thracia	W2227	138549	Blainville, 1824	-	1	-	-	1
Pandoridae	W2248	1787	Rafinesque, 1815	-	-	-	-	-
ASTEROIDEA	ZB0018	123080	de Blainville, 1830	-	-	1	-	-
OPHIUROIDEA	ZB0105	123084	Gray, 1840	-	2	1	-	7
Ophiuridae	ZB0165	123200	Müller & Troschel, 1840	-	10	14	-	23
ECHINOIDEA	ZB0181	123082	Leske, 1778	-	-	-	-	-
CAMARODONTA	ZB0190	510518	Jackson, 1912	-	1	-	-	-
SPATANGOIDA	ZB0213	123106	L. Agassiz, 1840	-	-	-	-	-
PELAGIC FAUNA								
CHAETOGNATHA	L0001	2081	-	-	**1**	-	-	-
PARASITIC FAUNA								

Taxon	SDC	AphiaID	Authority	FE2_05FA	FE2_06FA	FE3_01FA	FE3_02FA	FE3_03FA
				1196	1197	1198	1199	1200
BOPYROIDEA	S0956	155727	Rafinesque, 1815	**-**	**-**	**-**	**-**	**2**
DAMAGED FAUNA								
Polynoinae	P0025_F	155091	Kinberg, 1856	-	-	-	-	-
Harmothoe	P0050	129491	Kinberg, 1856	-	-	-	-	1
Paucibranchia	P0563_A	1297882	Molina-Acevedo, 2018	-	-	-	-	-
Aonides	P0721	129605	Claparède, 1864	-	-	-	-	-
Laonice	P0731	129613	Malmgren, 1867	-	-	-	-	1
Dipolydora	P0748_A	129611	Verrill, 1881	-	-	-	-	-
Maldanidae	P0938	923	Malmgren, 1867	-	-	-	-	-
Euclymeninae	P0951	152232	Arwidsson, 1906	-	-	-	-	-
Nicomachinae	P0976	154920	Arwidsson, 1906	-	-	-	-	-
Scalibregmatidae	P1020	925	Malmgren, 1867	-	-	-	-	-
Owenia	P1097	129427	Delle Chiaje, 1844	-	-	-	-	-
Ampharetidae	P1118	981	Malmgren, 1866	-	-	-	-	-
Ampharetinae	P1125	152252	Malmgren, 1866	-	-	-	-	-
Ampharete	P1133	129155	Malmgren, 1866	-	-	-	-	-
Terebellinae	P1179_A	322588	Johnston, 1846	-	-	-	-	-
POLYCIRRINI	P1227_SF	181512	Malmgren, 1866	-	-	-	-	-
Sabellidae	P1257	985	Latreille, 1825	-	-	-	-	-
Serpulidae	P1324	988	Rafinesque, 1815	-	-	-	-	-
Spirobranchus	P1339	129582	Blainville, 1818	-	-	-	2	-
Urothoe	S0246	101789	Dana, 1852	-	-	-	-	-
Ampeliscidae	S0422	101364	Krøyer, 1842	-	-	-	-	-
Anthuridae	S0801	118244	Leach, 1814	-	-	-	-	-
GASTROPODA	W0088	101	Cuvier, 1795	-	-	-	-	-
Bodotria	S1193	110387	Goodsir, 1843	-	-	-	-	-
Spisula	W1973	138159	Gray, 1837	-	-	-	6	-
Abra	W2058	138474	Lamarck, 1818	-	-	-	-	-
Ophiuridae	ZB0165	123200	Müller & Troschel, 1840	-	-	-	-	-

SDC = Species Directory Code

F.2 Subtidal Grabs Macrofaunal Biomass

Station	Biomass [g/0.01m^2]					
	Annelida		Arthropoda	Mollusca	Echinodermata	Other phyla
	Polychaeta	Oligochaeta				
FE1_01FA	0.6527	-	0.3215	0.1022	5.5587	0.0048
FE1_02FA	4.451	-	0.7795	7.7423	4.1737	0.0224
FE1_03FA	0.118	0.0001	-	0.0014	-	0.0006
FE1_04FA	0.6699	0.0001	2.6825	1.5619	0.1186	0.0005
FE1_05FA	0.0349	-	0.0006	1.2002	0.0015	0.0001
FE1_06FA	1.2291	-	0.0021	0.2814	0.3895	0.0035
FE1_07FA	0.0082	-	-	0.3517	-	-
FE1_08FA	0.0496	-	0.0096	0.0394	12.4324	0.0039
FE2_01FA	2.8728	-	0.0019	0.0018	0.3914	-
FE2_02FA	0.0373	-	1.0292	0.4057	-	-
FE2_03FA	0.0209	-	-	-	-	-
FE2_04FA	0.0129	-	0.0048	-	-	-
FE2_05FA	0.0177	-	0.016	0.0687	0.0963	0.0001
FE2_06FA	0.8617	0.0001	0.3989	0.13	0.4177	0.0138
FE3_01FA	3.558	-	0.0616	0.0332	3.3768	0.0051
FE3_02FA	0.2057	-	0.0053	0.0341	0.2732	
FE3_03FA	7.8689	-	1.5554	0.0573	2.1141	0.0035

Notes
Arthropoda comprises only invertebrates of the subphylum Crustacea
Other phyla included: Chordata, Cnidaria, Entoprocta, Hemichordata, Nemertea, Phoronida, Platyhelminthes and Sipuncula

FIVE ESTUARIES
OFFSHORE WIND FARM

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