The Great Grid Upgrade

Eastern Green Link 5 (EGL 5)

Preliminary Environmental Information Report

Volume 2
Part 3
Appendix 18.B Environmental Baseline Survey Report

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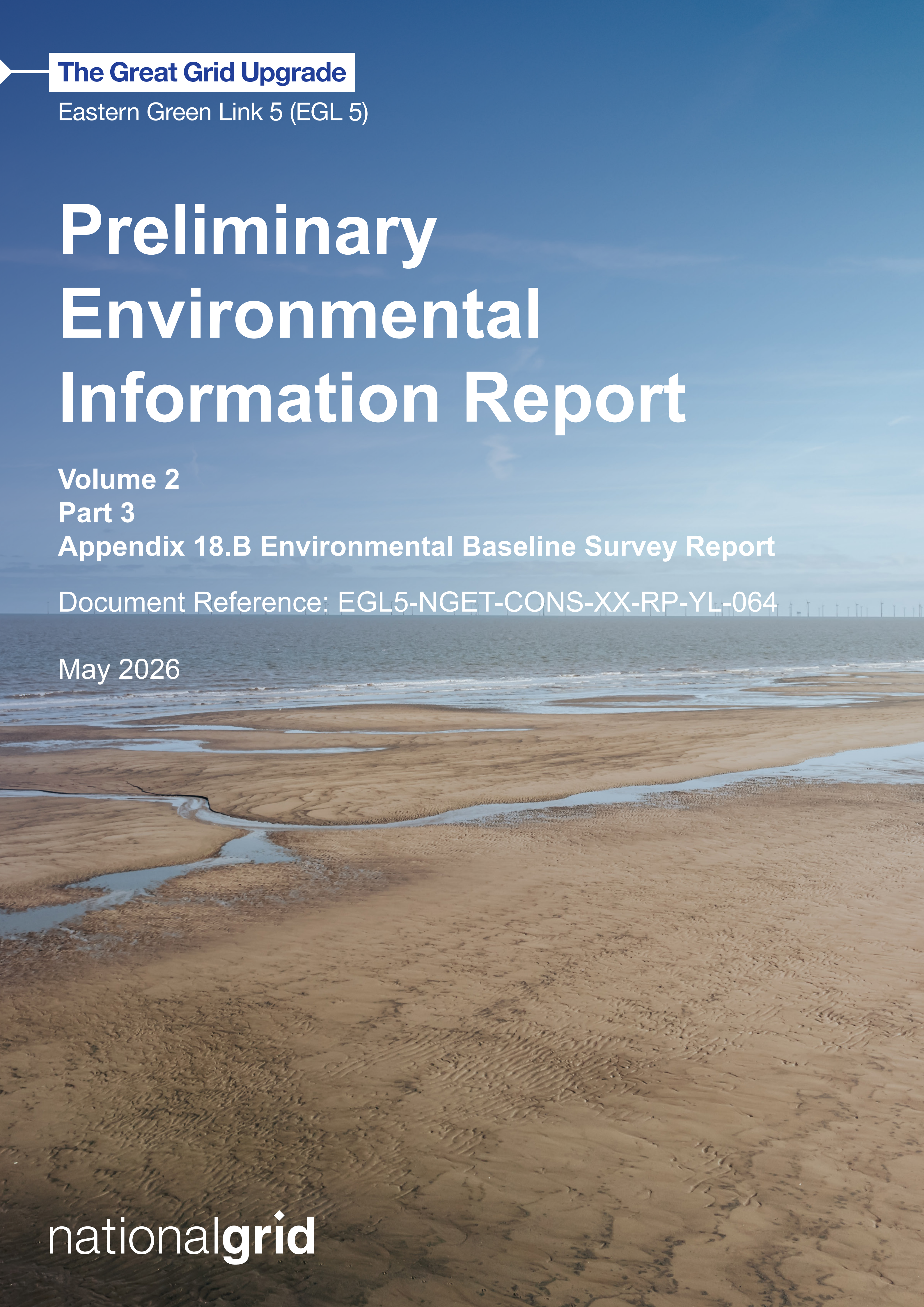

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National Grid EGL5 Environmental Survey

Southern North Sea
Volume 2 of 4 Environmental Baseline Survey
Survey Period: 28 May to 25 June 2025

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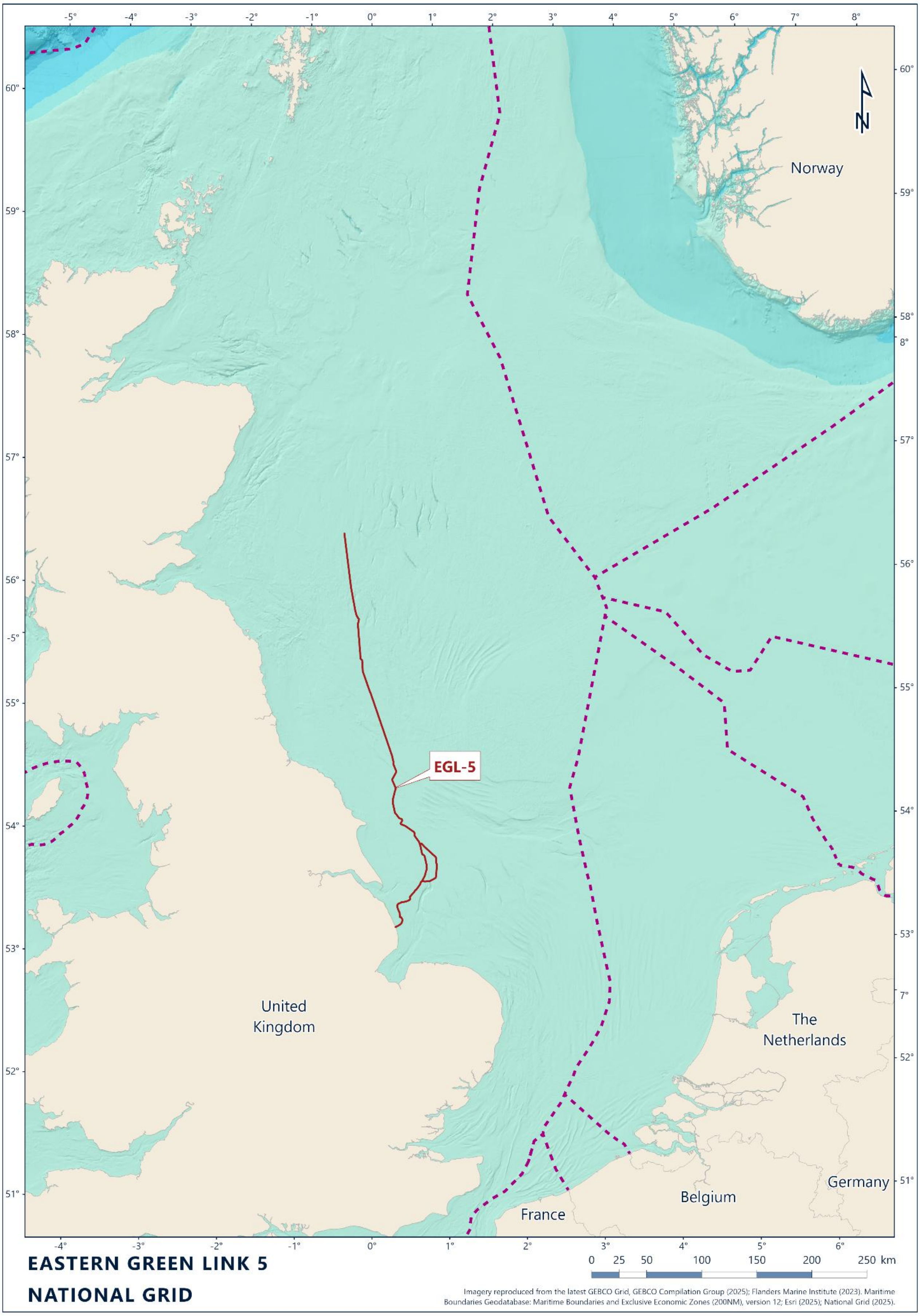
Frontispiece



Executive Summary

Introduction

National Grid contracted Fugro to perform and environmental baseline survey (EBS) along the proposed Eastern Green Link 5 (EGL5) cable route. The proposed cable route runs from the east coast of Scotland to the Lincolnshire coast in the southern North Sea (SNS). Operations were conducted onboard the MJM Enterprise during the survey period 28 May to 25 June 2025.

The aims of the EBS included the assessment of any existing contamination of the natural environment by pollutants and a detailed description and mapping of the physico-chemical and biological characteristics of the study area, including the description of any sensitive habitats and species.

The aim of the study was fulfilled through acquisition of sediment samples which were subsequently analysed for sediment particle size distribution (PSD) and macrofaunal analysis. Results were used to derive habitats and biotopes in line with the European Nature Information System (EUNIS) habitat classification. Focus was placed 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. Sediment and water samples for environmental deoxyribonucleic acid (eDNA) taxonomic classification of fish, invertebrates, eukaryotes and bacteria taxa were also collected.

Survey Strategy and Field Operations

Three hundred stations were selected along the proposed cable route, and after review of geophysical data, environmental scientists finalised the locations for grab sampling and camera investigations; these were reduced to 260 sampling stations. Emphasis was placed on locating areas of potential conservation value (e.g. Annexe I-listed habitats), on boundaries between regions of differing sonic reflectivity, bathymetric highs and lows, and areas characteristic of the general background conditions along the proposed cable route. Following the revision, 260 stations were targeted for camera investigation, 124 stations for physico-chemical samples collection, 101 for PSD only samples collection, 115 for faunal samples collection, 23 for sediment and water eDNA (SeDNA, WeDNA) samples collection and 20 for pre-sweeping contaminant samples collection. EBS stations were sampled for fauna and physico-chemistry roughly every 4 km, spawning ground stations were sampled for particle size analysis (PSA) approximately every 2 km, and eDNA stations were sampled approximately every 10 km. Additional sampling was done at stations within the Holderness Offshore Marine Conservation Zone (MCZ). Water eDNA samples included near-surface (TOP) and near-seafloor (BOT) samples.

Photographic data were successfully acquired along all 260 proposed stations. Grab samples were successfully acquired at all 207 proposed grab stations. Two macrofaunal samples (FA, FB) were collected at 104 of the proposed 115; two physico-chemical sample (PCA, PCB) were collected at 108 of the 124 proposed stations; three replicates for macrofauna and physical chemical samples were collected at 11 of the 14 proposed stations located within the Holderness Offshore MCZ. Single PSD samples were collected from all proposed 101 stations. SeDNA samples were collected at 22 of the 23 proposed stations and WeDNA samples were collected form all 23 proposed stations. Partial suites were collected at stations ST020, ST022, and ST037, whereas no samples were collected at the remaining 15 unsuccessful grab stations.

Sediment Characteristics

Results of the PSD analysis of replicate samples from the 208 stations along the proposed cable routes survey area generally comprised two main sediment types. The sediments along the offshore section of the cable route comprised predominantly sand, whilst the nearshore section of the cable to the shore comprised a more mixed coarser sediment. Varying percentages of gravel and fines were recorded in most samples, with fines becoming more predominant in the offshore section of the proposed cable and gravel being recorded in higher proportions in the nearshore section of the proposed cable route to the shore. The highest proportion of fines was, however, recorded at station ST005, near the coast, indicating the heterogeneous nature of the sediments in the area.

The sediment descriptions based on the relative proportions of sediment fractions such as gravel, sand, and fines resulted in 10 classes defined by the Folk (British Geological Survey [BGS] modified) classification. These included muddy sandy gravel (19 stations), slightly gravelly sand (28 stations), gravelly muddy sand (11 stations), gravelly mud (1 station), gravel (2 stations), sandy gravel (22 stations), gravelly sand (16 stations), sand (61 stations), slightly gravelly muddy sand (3 stations), and muddy sand (44 stations). In the MCZ, the sediments were mainly described as sandy gravel, muddy sandy gravel, gravelly sand, and gravelly muddy sand.

The sediment description based on coarseness, as defined by the Wentworth (1922) scale resulted in nine sediment descriptions being identified, including fine sand (99 stations), medium sand (36 stations), coarse sand (20 stations), very fine gravel (18 stations), very coarse sand (15 stations), fine gravel (4 stations), medium gravel (3 stations), and coarse gravel (1 station).

Most stations had unimodal distributions. Sixty-six stations had bimodal, trimodal or polymodal distributions and the sorting coefficient described largely poorly sorted and very poorly sorted sediments. These characteristics are indicative of different sources of sediment, likely associated with sediment disturbance in a high energy environment, such as that of the study area.

The total organic carbon (TOC) did not show any spatial pattern along the proposed cable route (Route B and Route C).

The multivariate analysis showed the presence of four main sediment groups. Group A was characterised by poorly sorted sand (Folk BGS modified), with median particle size values ranging from 113 µm (very fine sand) to 358 µm (medium sand), with a mean of 201 µm (fine sand). The mean sand content at the stations within Group A was 90.25 %, with all stations having > 70 % sand. The fines content was ≥ 5.00 % at most stations, whilst the mean gravel content was 0.57 %.

Group B comprised was characterised by very poorly sorted sand/gravel (Folk BGS modified), with median sediment particle size values ranging from 51 µm (very fine sand) to 7 885 µm (fine gravel), with a mean of 1 557 µm (very coarse sand). The mean sand content at the stations within Group B was 56.11 %, whilst the mean gravel content was 35.98 % and the mean fines content was 7.91 %.

Group C was characterised by poorly sorted sand (Folk BGS modified), with median sediment particle size values ranging from 392 µm (medium sand) to 1 189 µm (very coarse sand), with a mean of 620 µm (coarse sand). Gravel and fines contents varied from station devoid of both fraction to stations with content up to 18.87 % to 18.86 %, respectively.

Group D was characterised by very poorly sorted muddy sandy gravel (Folk BGS modified), with median sediment particle size values ranging from 1 227 µm (very coarse sand) to 47 229 µm (coarse gravel), with a mean of 15 212 µm (gravel). Sand and fines were present at all stations and had mean values of 29.15 % and 4.93 %, respectively. Gravel content > 36 % was recorded at all stations, which were classified as muddy sandy gravel, sandy gravel or gravel. The stations located within the Holderness Offshore MCZ all grouped within this sediment group.

Station ST063 separated from the other stations and was characterised by very poorly sorted sandy gravel (Folk BGS modified), with median sediment particle size of 1 987 µm (very coarse sand) and had comparable proportions of gravel and sand content of 49.91 % and 49.77 %, respectively.

Sediment Hydrocarbons

Overall, the gas chromatograms are typical of background conditions across the region. The profiles show a range of low-level, well-resolved n-alkanes, with a slight prevalence of the odd-numbered heavier n-alkanes (those from nC_{25}), which is indicative of plant waxes originating from terrestrial run-off.

Some gas chromatography flame ionisation detector (GC-FID) profiles observed across the survey area (e.g., at station ST111) suggest a low-level petrogenic input, most likely attributable to shipping activities. The distribution of n-alkanes was also characteristic of background conditions. Additionally, the presence of high-molecular-weight unresolved complex mixture (UCM) in some profiles indicates contributions from sediment containing weathered hydrocarbon material, likely originating from anthropogenic activities.

The total hydrocarbon content (THC) at all stations along the proposed routes was below the Centre for Environment, Fisheries and Aquaculture Science (Cefas) Action Level 1 (AL1) limit.

Generally, total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) concentrations were elevated along the nearshore section of the proposed routes and within the MCZ compared to stations located to the north of the survey area. Most samples collected from the southern and central sections of the proposed routes exceeded the AL1 value. PAHs detected along the proposed routes likely originate from both pyrolytic and petrogenic sources. Notably, samples from the northern section of the cable route were primarily of pyrolytic origin.

When normalised to 2.5 % TOC, the individual United States Environmental Protection Agency's 16 priority PAH pollutants (US EPA 16 PAH) concentrations exceeded the background assessment concentration (BAC) value. BAC values were exceeded for naphthalene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(ghi)perylene at most stations.

All individual and total 2 to 6 ring PAH concentrations for all stations were below their respective effects range low (ERL) values.

Sediment Metals

Generally, the levels of bioavailable metals, as determined by aqua regia digest, were below their respective OSPAR ERL and Cefas AL1 values along the proposed routes. However, lead at station ST163 exceeded both the ERL and Cefas AL1 values. Overall, the metal analysis indicates that no significant adverse impacts on the macrofaunal community were present.

Macrofauna

Infauna and Solitary Epifauna

The macrofaunal community comprised infaunal and epifaunal taxa, the latter being represented by solitary and colonial organisms. Annelida and Arthropoda represented most of the community structure and composition of the enumerated fauna, which also comprised solitary epifauna.

Four main assemblages were identified by the multivariate analysis along the proposed cable routes were identified through the multivariate analysis and were associated with the sediment type. One of these was further divided as differences in the sediment composition suggested the presence of a slightly different faunal group. Overall, the macrobenthic communities recorded in this study are indicative of habitats subject to a degree of surface sediment disturbance. The presence of coarse sediment, such as shell fragments and pebbles, increases the complexity of the habitats and offers suitable substrate for the attachment of epifauna, thus increasing biodiversity. This was reflected in the values of faunal diversity which ranged from ‘poor’ to ‘high’, with most samples having ‘high’ and ‘good’ diversity.

Group A was divided in two subgroups. Group A1 was characterised by poorly sorted ‘muddy sand’ (Folk BGS), with the polychaetes *Galathowenia oculata*, *Ampharete falcata*, *Scoloplos armiger*, *Spiophanes kroyeri*, *Sthenelais limicola* and the genus *Terebellides*, along with the echinoderm *Amphiura filiformis*, the bivalve *Papillicardium minimum*, species of the genus *Phoronis* and the amphipod *Harpinia antennaria* being the amongst the top ten characterising taxa. The assemblage occurred in mean water depth of 74.8 m below sea level (BSL). Group A2 was characterised by ‘very poorly sorted ‘to ‘moderately well sorted’ ‘sand’ (Folk BGS), with the polychaetes *Spiophanes bombyx, S. armiger*, *Lanice conchilega*, *G. oculata*, *Goniada maculata* and *S. limicola* along with the bivalve *Phaxas pellucidus* and the amphipod *Bathyporeia elegans* being amongst the top ten characterising taxa. The assemblage occurred in mean water depth of 59.8 m BSL.

Group B was characterised by ‘very poorly sorted ‘sandy gravel’ (Folk BGS), with the polychaetes *Syllis garciai*, *Spio armata*, *Glycera lapidum*, species of the genera *Notomastus* and *Polycirrus*, *Mediomastus fragilis*, along with the bivalve *Timoclea ovata*, the echinoderm *Echinocyamus pusillus* and the barnacle *Balanus crenatus* were amongst the top ten characterising taxa. The stations located within the

Holderness Offshore MCZ all grouped within this faunal assemblage group. The assemblage occurred in mean water depth of 31.7 m BSL.

Group C was characterised by moderately sorted 'sand' (Folk BGS) with the echinoderm *E. pusillus*, along with the polychaetes *S. armiger*, *Nephtys longosetosa*, *G. oculata* and *Ophelia borealis*, the amphipod *B. elegans*, scaphopods of the genus *Antalis* and cnidarians of the family Edwardsiidae and the order Ceriantharia were amongst the top ten characterising taxa. The assemblage occurred in mean water depth of 63.4 m BSL.

Group D was characterised by very poorly sorted 'muddy sandy gravel/gravelly muddy sand' (Folk BGS) with the bivalves *Abra alba* and *Nucula nucleus*, along with the polychaetes *S. lamarcki*, *L. conchilega*, *S. spinulosa*, *C. zetlandica*, species of the genus *Notomastus*, *Pholoe inornata* and *Lumbrineris* cf. *cingulata* were amongst the top ten characterising taxa. The assemblage occurred in mean water depth of 15.8 m BSL.

Station ST002 was characterised by well sorted 'slightly gravelly sand' (Folk BGS) and an impoverished faunal assemblage which included the polychaete *Nephtys cirrosa* and *Ohelia borealis*, the arthropods *Gastrosaccus spinifer* and *Crangon crangon* and the bivalve *Ensis magnus*. The station was located at water depth of 11.8 m BSL.

Echinodermata and Mollusca comprised most of the infaunal biomass, the former owing to the size of invertebrates, notably urchins, the latter owing to their numerical dominance and, to a lesser extent, the size of selected bivalves.

When analysed in conjunction with physico-chemical data, depth was the single variable which best explained the multivariate pattern of macrofaunal distribution. When three variables were considered, depth, concentration of strontium and percentage of mud best explained the multivariate pattern of macrofaunal distribution.

Colonial Epifauna

Colonial epifauna was recorded across most of the survey area and was represented mainly by low-lying bryozoans and cnidarians, Ciliophora of the family Folliculinidae and Entoprocta, including species of the genera *Barentsia* and *Pedicellina*.

Sediment Environmental DNA (eDNA)

Sediment eDNA samples were collected from the grab samples using 10 cm^3 sediment cores.

Marine Sediment Invertebrate

A total of 165 invertebrate taxa was detected within the SeDNA samples. the class Gastropoda contributed the highest proportion of operational taxonomic units (OTUs) and it was the most frequent taxon, as it occurred at all stations. This was followed by the class Polychaeta, the order polychaete Amphinomida, the urchin genus *Echinocardium* and the polychaete family Spionidae.

Marine Sediment Eukaryote

A total of 986 eukaryote taxa was detected within the SeDNA samples. Amongst the Animalia, the phylum Polychaeta contributed the highest proportion of OTUs followed by the classes Ascidiacea, Echinoidea and Bivalvia, although these taxa did not occur at all stations. The most frequently occurring taxa, detected at all stations, were the cnidarian class Hydrozoa and the nematode phylum Nematoda.

Marine Sediment Bacteria

A total of 1076 bacteria taxa was detected within the SeDNA samples. The classes Gammaprotobacteria and Planctomycetes, together with the phyla Protbacteria and Actinobacteriata were amongst the top 5 taxa contributing the highest proportions of OTUs and were detected within each eDNA sediment sample.

Seawater Environmental DNA (eDNA)

Water eDNA samples were collected from approximately 1 m below sea surface (TOP) and approximately 5 m from the seafloor (BOT).

Marine Water Fish

A total of 69 fish taxa was detected within the WeDNA samples. The Atlantic mackerel (*Scomber scombrus*) was the taxon contributing the highest OTUs in both TOP and BOT samples and was detected from all samples, followed by the family Ammodytidae; however, the latter was detected within the samples collected at the nearshore stations. The lesser weever (*Echiichthys vipera*), the northern rockling (*Ciliata septentrionalis*) and the European sprat (*Sprattus sprattus*) were amongst the top ten taxa contributing high proportions of OTUs in the TOP samples, whilst the haddock (*Melanogrammus aeglefinus*), the whiting (*Merlangius merlangus*), the European sprat (*S. sprattus*) and the common dab (*Limanda limanda*) were amongst the top ten taxa contributing high proportions of OTUs within the BOT samples.

Marine Water Vertebrates

A total of 56 vertebrate taxa was detected within the WeDNA samples. Within the TOP samples, the fish taxa within the top five contributing the highest proportion of OTUs included the Atlantic mackerel (*S. scombrus*), the lesser weever (*E. vipera*) the genus *Ammodytes* and the families Clupeidae and Gadidae. OTUs from bird taxa were sporadic, whilst the porpoise *Phocena phocena* and the family Delphinidae contributed high proportions of vertebrate OTUs within the WeDNA samples located further offshore along the proposed cable route.

Within the BOT samples, the fish taxa within the top five contributing the highest proportion of OTUs included the families Gadidae and Triglidae, the genus *Ammodytes*, the dragonet *Callionymus lyra* and the lesser weever (*E. vipera*). OTUs from birds and marine mammal taxa were sporadic.

Habitats and Species Assessments

Seafloor Habitat Classification

Four biotopes and seven biotope complexes were identified along the proposed cable route (Route B) and the proposed cable variation (Route C).

The biotopes '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' (MC5212) was assigned to 36 stations, located from the circalittoral (Routes B and C) to the offshore section of the proposed cable route (Route B), where the sediment was described on average as 'fine sand'.

The biotope '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5241) was assigned to five stations along the nearshore section of the proposed cable route (Route B), where the sediment was described as ranging from 'medium sand' to 'coarse sand', 'granule' and 'pebbles'.

The biotope '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) occurred at a single station on the nearshore section of the route (Route B). As it was associated with the presence of potential reef habitat, it was assessed from the video analysis only.

The biotope '*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand' (MD5212) was assigned to 37 stations, located in the offshore section of the proposed cable route (Route B) where the sediment was described as 'fine sand' with 'very fine sand'.

The biotope complexes 'Faunal communities in full salinity Atlantic infralittoral coarse sediment' (MB523), 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321), 'Faunal communities of Atlantic circalittoral mixed sediment' (MC421), 'Faunal communities in Atlantic circalittoral sand' (MC521), 'Faunal communities of Atlantic circalittoral mud' (MC621), 'Faunal communities in Atlantic offshore circalittoral mixed sediment' (MD421) and 'Faunal communities in Atlantic offshore circalittoral sand' (MD521) were assigned to stations where the faunal composition did not allow description of the community to a lower biotope level. Classifications are largely based on depths, ranging from infralittoral through circalittoral to offshore circalittoral, and sediment type (ranging from mud through sand and coarse to mixed).

The biotope complex 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) was assigned to all stations within the Holderness Offshore MCZ along the proposed cable route (Route B) and the majority along the proposed cable variation (Route C). The biotope complex 'Faunal communities of Atlantic circalittoral mixed sediment' (MC421) was assigned to one station within the Holderness Offshore MCZ on Route C.

The biotopes and biotope complexes identified for the description of National Grid EGL5 are in line with those expected to occur along the proposed cable routes (Route B and Route C).

Sensitive Habitats and Species

Aggregation of cobbles observed at 38 stations were assessed for the potential of these aggregations to constitute Annex I habitat geogenic 'Reef' (specifically stony reef). Sections (or the entirety) of 35 stations were assessed as resemblance to ‘Low reef’ or ‘Medium reef’, the majority of which were in the nearshore sections of the proposed cable routes (Routes B and C). Of the 5 stations where resemblance to ‘Medium reef’ was assessed, one was within the MCZ on each of the proposed cable routes.

At one station (ST231) both *Nephrops norvegicus* and other megafauna burrows abundance were assessed as at least ‘frequent’; therefore, the OSPAR listed threatened and/or declining habitat 'Sea pen and burrowing megafauna communities' may be present.

Two transects were assessed for the presence of the Annex I habitat ‘Reef’ biogenic, *Sabellaria spinulosa* reef. Only at station ST011, located in the section of the proposed cable route approaching the coast (Route B), were the tubes aggregations assessed as ‘Low reef’ and ‘Medium reef’.

The Ocean Quahog *Arctica islandica*, a species on the OSPAR list of threatened and declining species, was recorded along the proposed cable routes. Five adult individuals were recorded at five different grab sampling locations, and 38 juveniles were identified at 19 grab sampling stations. The eDNA analysis of water samples identified *A. islandica* OTUs at 3 additional survey stations.

Results of sediment PSD analysis were used to assess the ground preference for sandeel spawning habitat. Of the 207 sampling locations along the proposed cable routes, 104 were assessed as ‘Preferred’ grounds and 22 were assessed as ‘Marginal’ grounds. The remaining 81 stations were deemed ‘Unsuitable’ as sandeels’ spawning grounds. Of the 207 stations sampled, 25 were located within the Holderness Offshore MCZ, largely on the proposed route variation (Route C, with just 3 on Route B). Of these 25, 3 were assessed as ‘Preferred’ grounds, 13 were assessed as ‘Marginal’ grounds, whilst the remaining 9 were assessed as ‘Unsuitable’. Sandeel species of the family Ammodytidae were detected from 29 eDNA water samples targeting fish taxa and one individual of *Ammodytes marinus* was recorded at the grab station ST059, located within the Holderness Offshore MCZ, along the proposed cable variation (Route C).

Results of the PSD analysis were also used to assess the ground preference for herring spawning. Of the 207 sampling locations along the proposed cable routes, 24 were assessed as ‘Preferred’ grounds and 16 were assessed as ‘Marginal’ grounds. The remaining 167 stations were deemed ‘Unsuitable’ as herring’ spawning grounds. Of the 25 stations located within the Holderness Offshore MCZ, 13 were assessed as ‘Preferred’ grounds, 3 were assessed as ‘Marginal grounds’, whilst the remaining 9 were assessed as ‘Unsuitable’.

The broad scale habitats (BSHs) ‘Subtidal sands and gravels’ encompass most of the habitat types recorded throughout the survey area and are Habitats of Conservation Importance (HOCI) in MCZs, including Holderness Offshore MCZ. Illustrative habitat complexes encountered along the proposed exporting cable corridor (ECC) included the ‘Faunal communities of full salinity Atlantic infralittoral sand’ (MB523), ‘Faunal communities of Atlantic circalittoral coarse sediment’ (MC321), ‘Faunal communities in Atlantic circalittoral sand’ (MC521) and ‘Faunal communities in Atlantic offshore circalittoral sand’ (MD521).

The potential presence of the UK Biodiversity Action Plan (UK BAP) habitat ‘Mud Habitats in Deep Water’ was considered around stations ST009 and ST231 due to the potential presence of the illustrative biotope complex ‘Faunal communities of Atlantic circalittoral mud’ (MC621) at the former station, and the biotope ‘Sea pens and burrowing megafauna in circalittoral fine mud’ (MC6216) and associated biological communities at the latter.

UK BAP species recorded in this study included the fish *Gadus morhua*, *Merlangius merlangus*, *Molva molva*, *Lophius piscatorius*, *Scomber* scombrus, *Pleuronectes platessa*, *Solea solea* and *Trachurus trachurus*. *Gadhus morhua* is also on the OSPAR list of threatened and/or declining habitats and species for regions II and III and on the International Union for Conservation of Nature (IUCN) red list of threatened species as ‘vulnerable’, along with the fish *T. trachurus* and *M. aeglefinus*.

Anemones of the family Edwardsiidae were recorded; therefore, there is the potential for the UK BAP species *Edwardsia timida* to be present in the survey area.

Non-indigenous and Cryptogenic Species

Amongst all taxa identified by the analysis of the samples collected by all applied sampling methods, the non-indigenous species (NIS) the polychaete *Goniadella gracilis* and the mollusc *Crepidula fornicata* were recorded at four and three stations, respectively. The polychaete *G. gracilis* was recorded from the grab sample analysis whilst the mollusc *C. fornicata* was recorded from both the grab sample and photographic data analysis.

Document Arrangement

Volume 1	EBS Field Report
Volume 2	**Environmental Baseline Survey**
Volume 3	Intertidal Field Report
Volume 4	Intertidal Habitat Report

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Appendices

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Abbreviations

AFDW	Ash free dry weight
AL	Action level
BAC	Background assessment concentration
BAP	Biodiversity Action Plan
BC	Background concentration
BGS	British Geological Society
BS	British Standards
BOT	Near-bottom water sample
BRIG	Biodiversity Reporting and Information Group
BSH	Broad scale habitat
BSL	Below sea level
CBD	Convention on Biological Diversity
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Coordinated Environmental Monitoring Programme
CM	Central meridian
CPI	Carbon preference index
DAISIE	Delivering Alien Invasive Species Inventories for Europe
DCM	Dichloromethane
DTI	Department of Trade and Industry
DVV	Dual van Veen grab
EBS	Environmental baseline survey
ECC	Exporting cable corridor
EET	Ecological effects threshold
ED	Evolutionary diversity
eDNA	Environmental deoxyribonucleic acid
EEA	European Environment Agency
EGL5	Eastern Link 5
EMODnet	European Marine Observation Data Network
EOL	End of line
ERL	Effects range low
ETRS89	European Terrestrial Reference System 1989
EU	European Union
EUNIS	European Nature Information System
FA/FB/FC	Faunal sample A, B or C
FGBL	Fugro GB Limited
FID	Flame ionisation detection
FOCI	Feature of Conservation Interest
GBIF	Global Biodiversity Information Facility
GC	Gas chromatography
GC-FID	Gas chromatography – flame ionisation detection
GC-MS	Gas chromatography - mass spectrometry
GDS	Government Digital Service
GES	Good environmental status
HCA1/HCA2/HCA3	Hydrocarbon replicate sample A1, A2 and A3
HOCI	Habitats of Conservation Importance
HMA1/HMA2/HMA3	Heavy metal replicate sample A1, A2 and A3

HVDC	High Voltage Direct Current
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 Organisation for Standardisation
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LED	Light-emitting diode
LOI	Loss on ignition
MCZ	Marine Conservation Zone
MICA1/MICA2	Microbial sample replicates
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPS	Marine Policy Statement
MRV	Minimum reporting value
MSL	Mean Sea Level
MV	Motor vessel
NBN	National Biodiversity Network
nC_{12-36}	n-alkane carbon number range
NCBI	National Centre for Biotechnology Information
NERC	Natural Environment and Rural Communities
NEMESIS	National Exotic Marine and Estuarine Species Information System
NF	No fix
NG	National Grid
NIS	Non-indigenous species
NMBAQC	NE Atlantic Marine Biological Analytical Quality Control
nMDS	Non-metric multi-dimensional scaling
NNS	Non-native species
NNSS	Non-native Species Secretariat
NPD	Naphthalenes, phenanthrenes/anthracenes and dibenzothiophenes
NS	No sample
NSTF	North Sea Task Force
OSPAR	Oslo and Paris Commission
OTU	Operational taxonomic unit
PAH	Polycyclic aromatic hydrocarbon
PCA	Principal component analysis
PCA/PCB/PCC	Physico-chemical replicate sample A, B and C
PCR	Polymerase chain reaction
Ph	Phytane
Pr	Pristane
Pr/Ph	Ratio of pristane to phytane
PRIMER	Plymouth Routines in Multivariate Ecological Research
PSA	Particle size analysis
PSD	Particle size distribution
PSD1/PSD2/PSD3	Particle size distribution replicate 1, 2 or 3
rRNA	Ribosomal ribonucleic acid
RSD	Relative standard deviation

SAC	Special Area of Conservation
SACFOR	Superabundant, abundant, common, frequent, occasional and rare (semi-quantitative abundance scale)
SBL	Scottish Biodiversity List
SD	Species directory
SeDNA	Sediment environmental DNA sample
SIMPER	Similarity percentage (analysis)
SIMPROF	Similarity profiling
SNS	Southern North Sea
SOL	Start of line
SPA	Special Protection Area
SSS	Side scan sonar
SSSI	Site of Special Scientific Interest
TBa	Total barium
THC	Total hydrocarbon content
TOC	Total organic carbon
TOP	Near-surface water sample
UCM	Unresolved complex mixture
USBL	Ultra short baseline
US EPA	United 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
v	Version
VHF	Very high frequency
WeDNA	Seawater environmental DNA sample
WoRMS	World Register of Marine Species
WS	Water sample

1. Introduction

1.1 General Project Description

On the instruction of National Grid, Fugro performed an environmental baseline survey (EBS) along the proposed Eastern Green Link 5 (EGL5) cable route. The proposed cable route runs from the Scottish border of the east coast of Scotland to the Lincolnshire coast in the southern North Sea (SNS). Operations were conducted onboard the MJM Enterprise during the survey period 28 May to 25 June 2025.

National Grid (NG) are developing a High Voltage Direct Current (HVDC) electricity transmission link from the Maritime Boundary between Scotland and England to Lincolnshire. The cable presents a main route (Route B) which goes around the Holderness Offshore Marine Conservation Zone (MCZ) and an alternative section (Route C) which runs across the Holderness Offshore MCZ, departing from Route B at the south of the MCZ and rejoining Route B at the northern side of the MCZ.

This report presents the results of the EBS and describes the seafloor conditions and the habitats observed within the survey area, including any sensitive habitats, particularly with regard to those listed under Annexe I of the European Union (EU) Habitats Directive and by the Oslo and Paris Commission (OSPAR) as threatened and/or declining habitats (Oslo and Paris Commission [OSPAR], 2008). This was achieved by the analysis of photographic data and of grab samples, collected to establish physico-chemical and biological properties of the sediment within the project area. Sediment samples were also collected for environmental deoxyribonucleic acid (eDNA) analysis. Water samples were collected for eDNA analysis.

Appendix A outlines the guidelines for the use of this report.

1.2 Scope of Work

The aims of the EBS included assessing any existing contamination of the natural environment by pollutants and providing a detailed description and mapping of the physico-chemical and biological characteristics of the study area, including sensitive habitats and species.

The EBS required the acquisition of seafloor photographic data, water and sediment samples. Acquisition of:

- Seafloor photographic data allows evaluation of the habitat types across the survey area, with focus on habitats of conservation importance, such as those listed under Annex I of the of the Conservation of Habitats and Species Regulations 2019, on the OSPAR list of threatened and/or declining habitats and species (OSPAR, 2024) and on the UK Biodiversity Framework 2024, formerly Biodiversity Action Plan [BAP] (Biodiversity Reporting and Information Group [BRIG], 2011);

- Sediment samples allow evaluation of the physico-chemical and biological properties of the seafloor and the characterisation of the biotic communities, including the identification of species of conservation importance and potential non-indigenous species (NIS);
- Sediment and water samples allow eDNA taxonomic classification of vertebrates, invertebrates, eukaryotes and bacterial taxa detected along the proposed cable routes. Additionally, taxa detected in eDNA samples would be compared to those detected by other methods as these may complement each other in detecting mobile taxa within the survey area.

1.3 Environmental Legislation

Table 1.1 summarises the UK's marine nature conservation legislation and Table 1.2 summarises the biodiversity features of the Marine Protected Area (MPA). Together, the tables guide the identification of habitats and species of conservation importance in the study area.

Table 1.1: 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 listed in Annex I and species listed in Annex II of the Directives 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 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 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
The UK Marine Policy Statement (MPS)	Provides a framework for achieving sustainable development in the marine environment.

Legislation	Key Aims
National Policy Statement for Renewable Energy Infrastructure (EN-3)	Guidance for developing renewable energy infrastructure
North East Inshore and North East Offshore Marine Plan	Introduces a strategic approach to planning within the English inshore and offshore waters between the Scottish border and Flamborough Head, in Yorkshire. It provides a clear, evidence-based approach to inform decision-making by marine users and regulators on where, when or how activities might take place within the north east inshore and north east offshore marine plan areas.

Table 1.2: Marine Protected Areas Biodiversity Features

Biodiversity Feature	Description
Broad-scale habitats (BSH)	Represent the main types of seafloors and associated biota in the UK; their conservation ensures preservation of the full range of marine biodiversity.
Features of conservation importance (FOCI)	Represent habitats and/or species that 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 Biodiversity Framework 2024, under the CBD. The new framework does not provide a new list. The habitats and species are those from the NERC Act 2006 for England, the Scottish Biodiversity List (SBL), Section 7 List of the Environment (Wales) Act 2016 and Northern Ireland Official Priority Species List.
OSPAR list of threatened and/or declining species and habitats	Allows setting priorities for further conservation and protection of marine biodiversity.

1.4 Regional Habitats, Species and Protected Areas

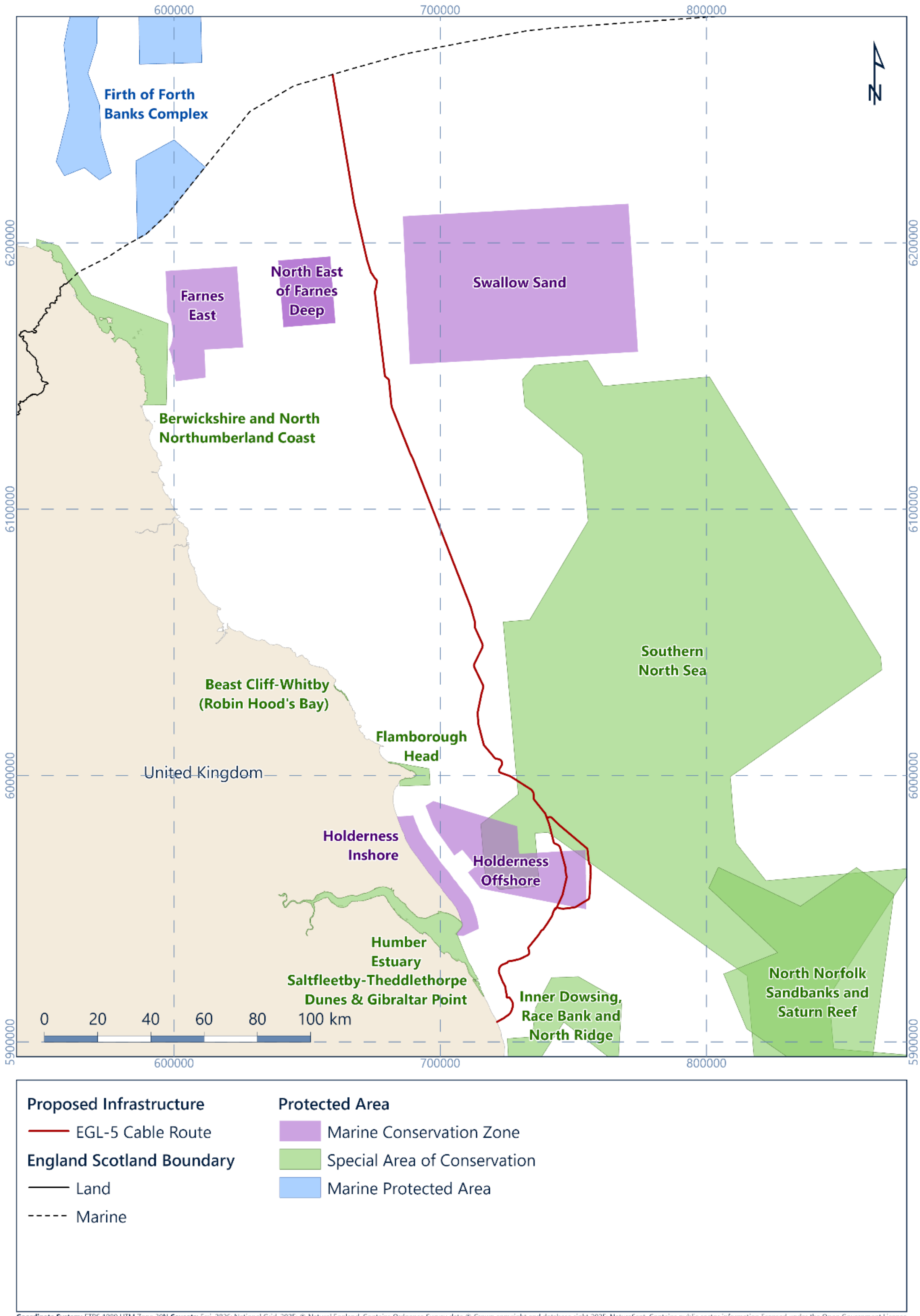
Based on the European Marine Observation and Data Network (EMODnet) seafloor habitats map (European Marine Observation and Data Network [EMODnet], 2026), the National Grid EGL5 lies in an area likely to comprise the European Nature Information System (EUNIS) habitat 'MB32: Atlantic infralittoral coarse sediment', 'MC32: Atlantic circalittoral coarse sediment', 'MC42: Atlantic circalittoral mixed sediment', 'MC52: Atlantic circalittoral sand', 'MD32: Atlantic offshore circalittoral coarse sediment', 'MD42: Atlantic offshore circalittoral mixed sediment', 'MD52: Atlantic offshore circalittoral sand', 'MD12: Atlantic offshore circalittoral rock'. Therefore, habitats of conservation importance such as Annexe I Reefs or 'Offshore subtidal sands and gravels' could occur within the survey area.

Table 1.3 lists the relevant protected areas within 50 km of the survey area, summarising the sensitive habitats and species for which they were designated to protect. Figure 11.15 spatially displays the protected areas in relation to the National Grid EGL5 Survey area.

Table 1.3: Summary of nearby protected areas

Protected Area	Status	Distance* [km]	Direction *	Protected Habitats/Species
Holderness Offshore	Marine Conservation Zone	Overlap	Overlap	Broadscale Habitat: 'Subtidal coarse sediment' 'Subtidal sand' 'Subtidal mixed sediments' OSPAR Threatened and declining species: Ocean quahog (*Arctica islandica*)
Swallow Sand	Marine Conservation Zone	10	E	Broadscale Habitat: 'Subtidal coarse sediment' 'Subtidal sand'
North East of Farnes Deep	Marine Conservation Zone Highly Protected Marine Area	14	W	Broadscale Habitat: 'Subtidal coarse sediment' 'Subtidal sand' 'Subtidal mixed sediments' 'Subtidal mud' OSPAR Threatened and declining species: Ocean quahog (*Arctica islandica*)

Notes
* = Distance (to nearest kilometre) and direction from the closest sampling station



Coordinate System: ETRS 1989 UTM Zone 30N **Caveats:** Esri, 2026; National Grid, 2025; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2025; NatureScot, Contains public sector information licensed under the Open Government Licence v3.0; Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation.

Figure 1.1: Protected areas relevant to the survey area

1.5 Environmental Quality Standards for Sediment Chemical Concentrations

Selected data have been compared to the OSPAR effects range low (ERL) concentrations (OSPAR, 2014), where available. The ERL thresholds represent the low point (10th percentile) and are therefore indicative of concentrations below which adverse effects rarely occur (OSPAR, 2009, 2014).

Selected data have been compared to the Centre for Environment, Fisheries and Aquaculture Science (Cefas) Action Levels (AL) when appropriate. These levels serve as proxies for assessing potential risks to marine life, such as fish and benthic organisms. Each contaminant has two thresholds; this report uses AL1, the lower threshold. Concentrations below AL1 are generally considered not detrimental to the marine environment and unlikely to affect licensing decisions.

Selected data have also been compared to the Coordinated Environmental Monitoring Programme (CEMP) Assessment Criteria (OSPAR, 2014) background concentration (BC) and background assessment concentration (BAC) for select hydrocarbons (see Appendix E.3).

1.6 Coordinate Reference System

All coordinates detailed in this report are referenced to the ETRS89 datum, projected in UTM Zone 30N, with a central meridian at 3° West longitude. 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:	European Terrestrial Reference System 1989
Ellipsoid:	ETRS89
Semi-major axis:	a = 6 378 137.000 m
Inverse flattening:	I/f = 298.257 222 101
Project Projection Parameters	
Grid Projection:	Universal Transverse Mercator (UTM)
UTM Zone:	30N
Central Meridian:	3°W
Latitude of Origin:	00° 00′ 00″ North
Longitude of Origin:	003° 00′ 00″ West
False Easting:	500 000 m
False Northing:	0 m
Scale factor on Central Meridian:	0.9996
Units:	metre

Notes
* = Fugro Starfix® navigation software always uses World Geodetic System 1984 geodetic parameters as a primary datum for any geodetic calculations and was converted to ETRS89.

2. Survey Strategy

Three hundred stations were originally predetermined by the client along the proposed cable routes. After review of geophysical data environmental scientists, to finalise the locations for grab sampling and camera investigations, the initially proposed 300 stations were reduced to 260 sampling stations, with some relocated to locations considered more representative of the route. Emphasis was placed on locating areas of potential conservation value (e.g. Annex I listed habitats), on boundaries between areas of differing sonic reflectivity, bathymetric highs and lows, and areas characteristic of the general background conditions of the survey area.

Following revision, 98 of the 260 stations were targeted to assess the potential of herring and sandeel spawning grounds. EBS stations were sampled for fauna and physico-chemistry roughly every 4 km, spawning ground stations were sampled for particle size analysis (PSA) roughly every 2 km, and eDNA stations being sampled roughly every 10 km. Additional sampling was done for stations within the Holderness Offshore MCZ (Route C). Water eDNA samples included near-surface (TOP) and near-seafloor (BOT) samples.

Sample acquisition was to consist of:

- 102 stations with approximately 200 m transects, and 158 stations with approximately 50 m transects completed by drop-down camera operations.
- 124 physico-chemical analysis samples (which included particle size distribution PSD1, PSD2, heavy metals HMA1, HMA2 and hydrocarbons HCA1, HCA2, with PSD3, HMA3 and HCA3 for 14 stations within the Holderness Offshore MCZ);
- 101 PSD samples were collected and included 98 targeted stations for herring and sandeels spawning grounds assessment along the proposed routes;
- 115 faunal samples (FA, FB) and an additional sample (FC) for 14 stations within the Holderness Offshore MCZ;
- 23 sediment eDNA samples (SeDNA);
- 23 water column eDNA samples (WeDNA);
- 20 pre-sweeping contaminant samples, with 10 being analysed and the other 10 being stored in case of additional testing requirements.

Acceptable accuracy for sediment sampling was agreed with the client representative as within 25 m of the target location.

Tables 2.1 provide the coordinates, data to be acquired and rationale for each proposed survey location. Figures 2.1 to 2.9 spatially displays the proposed survey locations overlaid on bathymetry data, available from EMODnet (2026), from south to north along the length of the proposed cable routes.

Table 2.1: Proposed sampling stations

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST001	723 116.7	5 908 505.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST002	724 782.5	5 909 599.4	Route B	FA, FB, PCA, PCB, Video
ST003	726 546.5	5 911 227.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST004	727 081.2	5 912 707.6	Route B	FA, FB, PCA, PCB, Video
ST005	727 183.6	5 914 669.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST006	726 231.0	5 916 576.4	Route B	FA, FB, PCA, PCB, Video
ST007	724 897.3	5 918 047.6	Route B	FA, FB, PCA, PCB, Video
ST008	724 530.0	5 920 370.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST009	725 852.0	5 910 264.0	Route B	Video
ST010	723 267.5	5 923 082.7	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST011	727 366.0	5 913 510.3	Route B	Video
ST012	722 067.5	5 926 857.5	Route B	FA, FB, PCA, PCB, Video
ST013	722 837.6	5 928 649.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST014	724 619.8	5 929 527.8	Route B	FA, FB, PCA, PCB, Video
ST015	726 301.6	5 930 432.3	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST016	728 232.4	5 930 955.6	Route B	FA, FB, PCA, PCB, Video
ST017	730 151.7	5 931 508.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST018	731 944.3	5 932 396.1	Route B	FA, FB, PCA, PCB, Video
ST019	733 433.7	5 933 598.2	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST020	732 619.4	5 935 553.7	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST021	734 434.9	5 937 097.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST022	735 699.8	5 938 647.5	Route B	FA, FB, PCA, PCB, Video
ST023	737 146.0	5 940 153.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST024	738 087.3	5 941 842.7	Route B	FA, FB, PCA, PCB, Video
ST025	739 408.7	5 943 311.3	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST026	740 529.2	5 944 968.3	Route B	FA, FB, PCA, PCB, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST027	741 436.8	5 946 400.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST028	742 529.4	5 948 874.2	Route B	FA, FB, PCA, PCB, Video
ST029	743 769.0	5 951 301.8	Route C, Herring and Sandeel spawning habitat	PSD, Video
ST030	744 206.5	5 952 436.8	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video, WeDNA, SeDNA
ST031	744 389.7	5 952 870.9	Route C, MCZ	Video, Video
ST032	744 502.4	5 953 355.7	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST033	744 747.6	5 954 229.4	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST034	744 615.1	5 953 837.7	Route C, MCZ	Video
ST035	745 088.7	5 954 677.6	Route C, MCZ	Video
ST036	745 083.0	5 955 077.8	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST037	745 083.0	5 955 323.0	Route C, MCZ, Pre-Sweeping Area	PCA, PCB, Video
ST038	745 384.6	5 955 610.5	Route C, MCZ	Video
ST039	745 556.5	5 956 092.5	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST040	745 691.8	5 956 529.4	Route C, MCZ	Video
ST041	745 886.3	5 957 014.2	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST042	746 235.8	5 957 473.6	Route C, MCZ	Video
ST043	746 323.2	5 957 958.4	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST044	746 693.8	5 958 420.4	Route C, MCZ	Video
ST045	746 809.1	5 958 907.1	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST046	746 924.4	5 959 393.8	Route C, MCZ	Video
ST047	747 039.7	5 959 880.5	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST048	747 155.0	5 960 367.2	Route C, MCZ	Video
ST049	747 270.2	5 960 853.9	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST050	747 385.5	5 961 340.6	Route C, MCZ	Video
ST051	747 469.9	5 961 831.5	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST052	747 442.2	5 962 326.9	Route C, MCZ	Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST053	746 698.8	5 962 758.3	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST054	746 744.5	5 963 285.2	Route C, MCZ	Video
ST055	747 140.5	5 963 793.4	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST056	747 110.8	5 964 292.7	Route C, MCZ	Video
ST057	747 081.1	5 964 792.0	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST058	747 051.3	5 965 291.3	Route C, MCZ	Video
ST059	746 979.8	5 965 783.8	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST060	746 849.6	5 966 266.7	Route C, MCZ	Video
ST061	746 719.4	5 966 749.7	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST062	746 589.2	5 967 232.6	Route C, MCZ	Video
ST063	746 459.1	5 967 715.5	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video, WeDNA, SeDNA
ST064	746 328.9	5 968 198.5	Route C, MCZ	Video
ST065	746 168.3	5 968 581.0	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST066	746 068.5	5 969 164.3	Route C, MCZ	Video
ST067	745 991.1	5 969 451.7	Route C, Pre-Sweeping Area, Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST068	745 938.4	5 969 647.3	Route C, MCZ	Video
ST069	745 808.2	5 970 130.2	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST070	722 516.0	5 924 928.0	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST071	745 678.0	5 970 613.1	Route C, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST072	722 273.0	5 927 823.0	Route C, MCZ	Video
ST073	745 547.8	5 971 096.1	Route C, MCZ	Video
ST074	745 417.7	5 971 579.0	Route C, MCZ, Herring and Sandeel spawning habitat	PSD, Video
ST078	744 877.4	5 973 283.1	Route C, Pre-Sweeping Area,	PCA, PCB, Video
ST079	744 415.7	5 973 806.0	Route C, Herring and Sandeel spawning habitat	PSD, Video
ST081	742 716.5	5 974 810.2	Route C	PSD, FA, FB, PCA, PCB, Video
ST082	742 179.5	5 976 731.7	Route C, Herring and Sandeel spawning habitat	PSD, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST084	741 694.8	5 978 672.8	Route C	FA, FB, PCA, PCB, Video
ST085	741 531.0	5 979 328.7	Route C, Herring and Sandeel spawning habitat	PSD, Video
ST087	746 740.0	5 950 113.0	Route C	FA, FB, PCA, PCB, Video
ST088	741 021.6	5 981 368.8	Route C, Pre-Sweeping Area	PCA, PCB, Video
ST089	740 791.1	5 982 087.1	Route C, Herring and Sandeel spawning habitat	PSD, Video
ST090	740 630.0	5 982 525.5	Route C	FA, FB, PCA, PCB, Video
ST091	740 307.0	5 983 446.0	Route C, Herring and Sandeel spawning habitat	PSD, Video
ST092	739 450.0	5 985 774.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST093	743 318.1	5 950 213.4	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST094	745 723.0	5 950 059.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST095	747 207.3	5 950 183.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST096	749 062.5	5 950 288.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST097	750 662.0	5 950 743.6	Route B, MCZ	FA, FB, FC, PCA, PCB, PCC, Video, WeDNA, SeDNA
ST098	751 105.7	5 950 970.5	Route B, MCZ, Herring and Sandeel Spawning habitat	Video
ST099	751 546.1	5 951 207.5	Route B, MCZ	PSD, Video
ST100	751 986.6	5 951 444.6	Route B, MCZ	Video
ST101	752 427.0	5 951 681.7	Route B, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST102	752 867.5	5 951 918.7	Route B, MCZ	Video
ST103	753 307.9	5 952 155.8	Route B, MCZ, Herring and Sandeel Spawning habitat	PSD, Video
ST104	753 748.4	5 952 392.8	Route B, MCZ	Video
ST105	754 188.8	5 952 629.9	Route B, MCZ	FA, FB, FC, PCA, PCB, PCC, Video
ST106	754 629.3	5 952 866.9	Route B, MCZ	Video
ST107	756 128.1	5 954 064.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST108	756 279.6	5 956 051.0	Route B	PSD, Video
ST109	756 387.9	5 958 048.9	Route B, Herring and Sandeel spawning habitat	PSD, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST110	756 496.2	5 960 046.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST111	756 498.0	5 961 728.0	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST112	756 703.5	5 964 042.2	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST113	756 434.0	5 966 024.8	Route B	PSD, Video
ST114	755 831.1	5 967 864.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST115	756 456.0	5 958 939.0	Route B	Video
ST117	755 714.5	5 969 696.9	Route B, Pre-Sweeping Area	PCA, PCB, Video
ST118	755 704.0	5 969 861.6	Route B	FA, FB, PCA, PCB, Video
ST119	755 576.9	5 971 858.4	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST121	754 571.0	5 973 429.1	Route B	FA, FB, PCA, PCB, Video
ST122	753 015.4	5 974 687.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST123	751 459.8	5 975 945.7	Route B	FA, FB, PCA, PCB, Video
ST124	749 904.3	5 977 204.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST125	748 348.8	5 978 462.3	Route B	FA, FB, PCA, PCB, Video
ST126	746 793.3	5 979 720.6	Route B, Herring and Sandeel spawning habitat	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST127	746 253.8	5 980 156.9	Route B	PSD, Video
ST128	745 240.9	5 980 982.6	Route B, Herring and Sandeel spawning habitat	FA, FB, PCA, PCB, Video
ST129	744 887.8	5 981 280.6	Route B,	PSD, Video
ST130	744 309.0	5 981 752.0	Route B Pre-Sweeping Area, Herring and Sandeel spawning habitat	PCA, PCB, Video
ST132	742 962.0	5 982 886.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST133	742 160.1	5 983 535.7	Route B	FA, FB, PCA, PCB, Video
ST136	740 610.9	5 984 801.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST138	740 130.8	5 985 193.9	Route B, Pre-Sweeping Area	PCA, PCB, Video
ST139	739 135.4	5 986 140.4	Route B	FA, FB, PCA, PCB, WeDNA, SeDNA
ST140	738 941.0	5 986 383.3	Route B, Herring and Sandeel spawning habitat	PSD, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST143	737 648.9	5 987 997.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST146	736 957.7	5 988 861.1	Route B, Pre-Sweeping Area	PCA, PCB, Video
ST147	736 635.1	5 989 264.1	Route B	FA, FB, PCA, PCB, Video
ST148	736 375.0	5 989 593.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST149	735 178.0	5 991 195.0	Route B	PSD, Video
ST150	735 060.0	5 993 034.0	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST151	734 911.1	5 993 733.0	Route B, Pre-Sweeping Area	PCA, PCB, Video
ST152	734 331.6	5 994 548.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST154	732 696.8	5 995 685.9	Route B	FA, FB, PCA, PCB, Video
ST156	731 009.8	5 996 761.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST157	714 272.0	6 021 375.0	Route B	Video
ST158	729 166.0	5 997 940.0	Route B	FA, FB, PCA, PCB, Video
ST159	728 479.1	5 998 374.1	Route B, Pre-Sweeping Area	PCA, PCB, Video
ST160	727 635.9	5 998 911.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST161	725 913.4	5 999 914.0	Route B	FA, FB, PCA, PCB, Video
ST162	724 029.0	6 000 585.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST163	722 522.9	6 001 636.0	Route B	FA, FB, PCA, PCB, Video
ST164	722 590.0	6 003 871.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST165	721 866.1	6 005 374.5	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST166	719 310.0	6 008 011.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST167	719 261.9	6 008 082.7	Route B	FA, FB, PCA, PCB, Video
ST168	717 964.4	6 009 604.9	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST169	716 665.2	6 011 125.9	Route B	FA, FB, PCA, PCB, Video
ST170	715 983.5	6 012 969.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST171	715 479.1	6 014 904.8	Route B	FA, FB, PCA, PCB, Video
ST172	714 861.0	6 017 332.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST173	714 470.2	6 018 776.2	Route B	FA, FB, PCA, PCB, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST174	714 226.0	6 020 309.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST175	714 105.8	6 022 748.8	Route B	FA, FB, PCA, PCB, Video
ST176	714 274.5	6 024 725.7	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST177	714 671.7	6 026 686.1	Route B	FA, FB, PCA, PCB, Video
ST178	715 069.0	6 028 646.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST179	715 466.2	6 030 607.1	Route B	FA, FB, PCA, PCB, Video
ST180	716 004.8	6 032 533.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST181	715 837.5	6 034 444.6	Route B	FA, FB, PCA, PCB, Video
ST182	714 963.4	6 036 243.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST183	713 904.0	6 038 465.0	Route B	FA, FB, PCA, PCB, Video
ST184	712 894.0	6 040 529.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST185	712 750.4	6 041 716.5	Route B	FA, FB, PCA, PCB, WeDNA, SeDNA, Video
ST186	713 583.3	6 043 530.7	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST187	714 470.1	6 045 323.8	Route B	FA, FB, PCA, PCB, Video
ST188	715 356.8	6 047 116.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST189	715 939.8	6 048 990.8	Route B	FA, FB, PCA, PCB, Video
ST190	715 208.0	6 050 847.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST191	714 371.0	6 052 663.8	Route B	FA, FB, PCA, PCB, Video
ST192	713 534.0	6 054 480.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST193	713 016.0	6 056 051.0	Route B	FA, FB, PCA, PCB, Video
ST194	712 835.3	6 058 343.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST195	712 304.1	6 060 271.6	Route B	FA, FB, PCA, PCB, WeDNA, SeDNA, Video
ST196	711 773.0	6 062 200.1	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST197	711 148.8	6 064 097.7	Route B	FA, FB, PCA, PCB, Video
ST198	710 492.0	6 065 670.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST199	709 694.2	6 067 824.5	Route B	FA, FB, PCA, PCB, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST200	709 009.0	6 069 581.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST201	707 997.0	6 072 225.0	Route B	FA, FB, PCA, PCB, Video
ST202	707 512.4	6 073 414.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST203	706 785.1	6 075 277.9	Route B	FA, FB, PCA, PCB, Video
ST204	706 057.8	6 077 141.3	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST205	705 330.6	6 079 004.6	Route B	FA, FB, PCA, PCB, WeDNA, SeDNA, Video
ST206	704 603.3	6 080 868.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST207	703 876.0	6 082 731.3	Route B	FA, FB, PCA, PCB, Video
ST208	703 148.8	6 084 594.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST209	702 421.5	6 086 457.9	Route B	FA, FB, PCA, PCB, Video
ST210	701 520.0	6 088 744.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST211	700 967.0	6 090 184.5	Route B	FA, FB, PCA, PCB, Video
ST212	700 239.8	6 092 047.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST213	699 512.5	6 093 911.1	Route B	FA, FB, PCA, PCB, Video
ST214	698 689.0	6 096 056.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST215	697 977.0	6 097 817.0	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST217	696 603.6	6 101 364.2	Route B	FA, FB, PCA, PCB, Video
ST218	696 128.0	6 102 553.0	Route B	Video
ST219	695 149.1	6 105 090.7	Route B	FA, FB, PCA, PCB, Video
ST221	693 694.7	6 108 817.2	Route B	FA, FB, PCA, PCB, Video
ST223	692 240.2	6 112 543.6	Route B	FA, FB, PCA, PCB, Video
ST225	690 785.8	6 116 270.0	Route B	FA, FB, PCA, PCB, WeDNA, SeDNA, Video
ST227	689 052.0	6 120 322.0	Route B	FA, FB, PCA, PCB, Video
ST228	688 404.8	6 121 768.6	Route B	Video
ST229	687 665.6	6 123 627.1	Route B	FA, FB, PCA, PCB, Video
ST231	686 187.1	6 127 343.9	Route B	FA, FB, PCA, PCB, Video
ST233	684 708.7	6 131 060.8	Route B	FA, FB, PCA, PCB, Video
ST235	683 230.2	6 134 777.6	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST236	682 491.0	6 136 636.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST237	681 751.8	6 138 494.4	Route B	FA, FB, PCA, PCB, Video
ST238	681 536.2	6 140 480.3	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST239	681 338.0	6 142 470.4	Route B	FA, FB, PCA, PCB, Video
ST240	681 139.7	6 144 460.6	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST241	680 941.5	6 146 450.8	Route B	FA, FB, PCA, PCB, Video
ST242	680 719.5	6 148 436.2	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST243	679 160.0	6 150 590.0	Route B	FA, FB, PCA, PCB, Video
ST244	679 008.2	6 151 788.7	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST245	678 768.1	6 153 774.2	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST246	678 528.0	6 155 759.7	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST247	678 287.9	6 157 745.3	Route B	FA, FB, PCA, PCB, Video
ST248	678 047.8	6 159 730.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST249	677 807.7	6 161 716.3	Route B	FA, FB, PCA, PCB, Video
ST250	677 567.6	6 163 701.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST251	677 327.5	6 165 687.3	Route B	FA, FB, PCA, PCB, Video
ST252	677 087.4	6 167 672.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST253	676 847.2	6 169 658.3	Route B	FA, FB, PCA, PCB, Video
ST254	676 607.1	6 171 643.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST255	676 367.0	6 173 629.3	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST256	676 126.9	6 175 614.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST257	675 886.8	6 177 600.3	Route B	FA, FB, PCA, PCB, Video
ST258	675 693.0	6 179 614.0	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST259	675 457.7	6 181 575.0	Route B	FA, FB, PCA, PCB, Video
ST260	675 937.6	6 183 507.8	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST261	676 173.2	6 185 490.3	Route B	FA, FB, PCA, PCB, Video

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Rationale	Data and Sample Acquisition
ST262	675 164.3	6 187 111.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST263	674 071.7	6 188 786.6	Route B	FA, FB, PCA, PCB, Video
ST264	673 404.6	6 190 662.5	Route B, Herring and Sandeel spawning habitat	PSD, Video
ST265	672 678.0	6 192 663.0	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST267	671 845.8	6 196 451.4	Route B	FA, FB, PCA, PCB, Video
ST269	670 955.9	6 200 350.9	Route B	FA, FB, PCA, PCB, Video
ST270	670 514.0	6 201 797.0	Route B	Video
ST271	670 066.0	6 204 250.5	Route B	FA, FB, PCA, PCB, Video
ST273	669 176.1	6 208 150.1	Route B	FA, FB, PCA, PCB, Video
ST275	668 286.1	6 212 049.6	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST277	667 491.6	6 215 968.0	Route B	FA, FB, PCA, PCB, Video
ST279	666 830.0	6 219 912.7	Route B	FA, FB, PCA, PCB, Video
ST280	666 499.2	6 221 885.0	Route B	Video
ST281	666 168.4	6 223 857.3	Route B	FA, FB, PCA, PCB, Video
ST283	665 506.8	6 227 802.0	Route B	FA, FB, PCA, PCB, Video
ST285	664 845.3	6 231 746.6	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST287	664 183.7	6 235 691.3	Route B	FA, FB, PCA, PCB, Video
ST289	663 522.1	6 239 635.9	Route B	FA, FB, PCA, PCB, Video
ST290	663 191.3	6 241 608.2	Route B	Video
ST291	662 860.5	6 243 580.5	Route B	FA, FB, PCA, PCB, Video
ST293	662 199.0	6 247 525.1	Route B	FA, FB, PCA, PCB, Video
ST295	661 537.4	6 251 469.7	Route B	FA, FB, PCA, PCB, Video, WeDNA, SeDNA
ST297	660 875.8	6 255 414.3	Route B	FA, FB, PCA, PCB, Video
ST299	660 214.3	6 259 358.9	Route B	FA, FB, PCA, PCB, Video
ST301	678 592.0	6 156 110.0	Route B	Video

Notes
MCZ = Marine Conservation Zone
PCA/PCB/PCC = Physico-chemical sample A, B or C
PSD = Particle size distribution
FA/FB/FC = Macrofaunal sample A, B, C
WeDNA = Water environmental deoxyribonucleic acid sample
SeDNA = Sediment environmental deoxyribonucleic acid sample

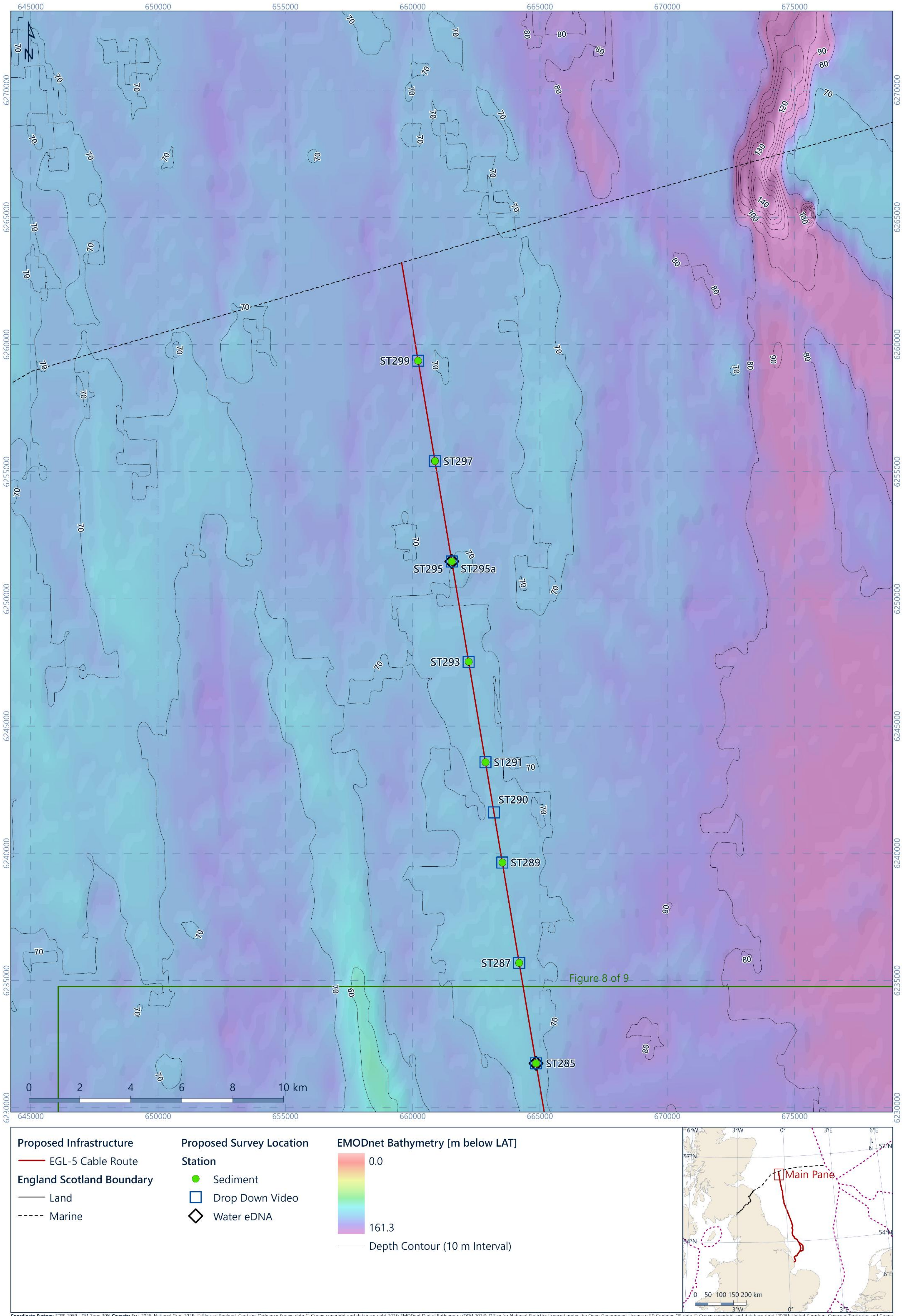


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Figure 2.1: Proposed survey locations overlaid on bathymetry, station ST285 to station ST299

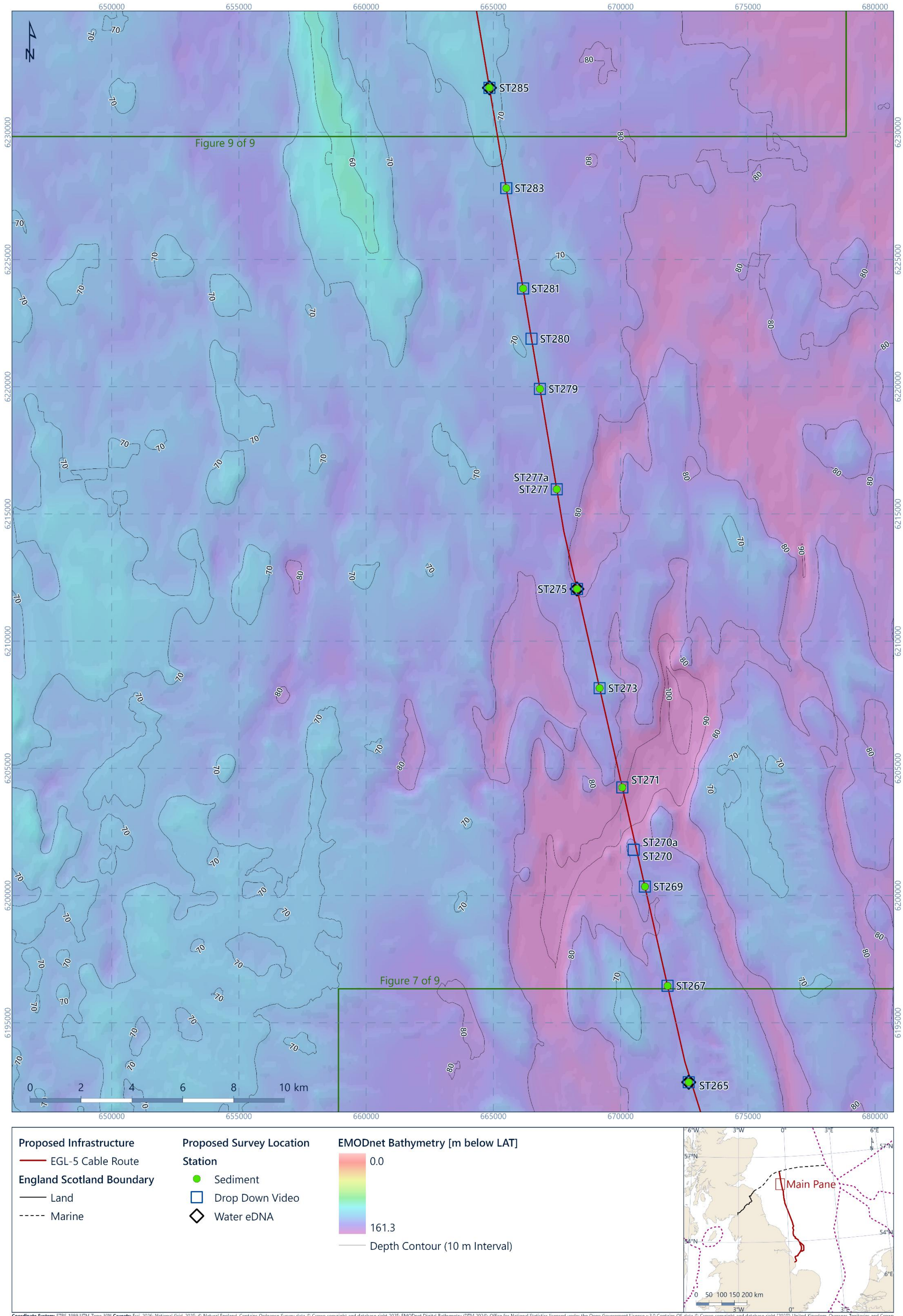

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Figure 2.2: Proposed survey locations overlaid on bathymetry, station ST265 to station ST285

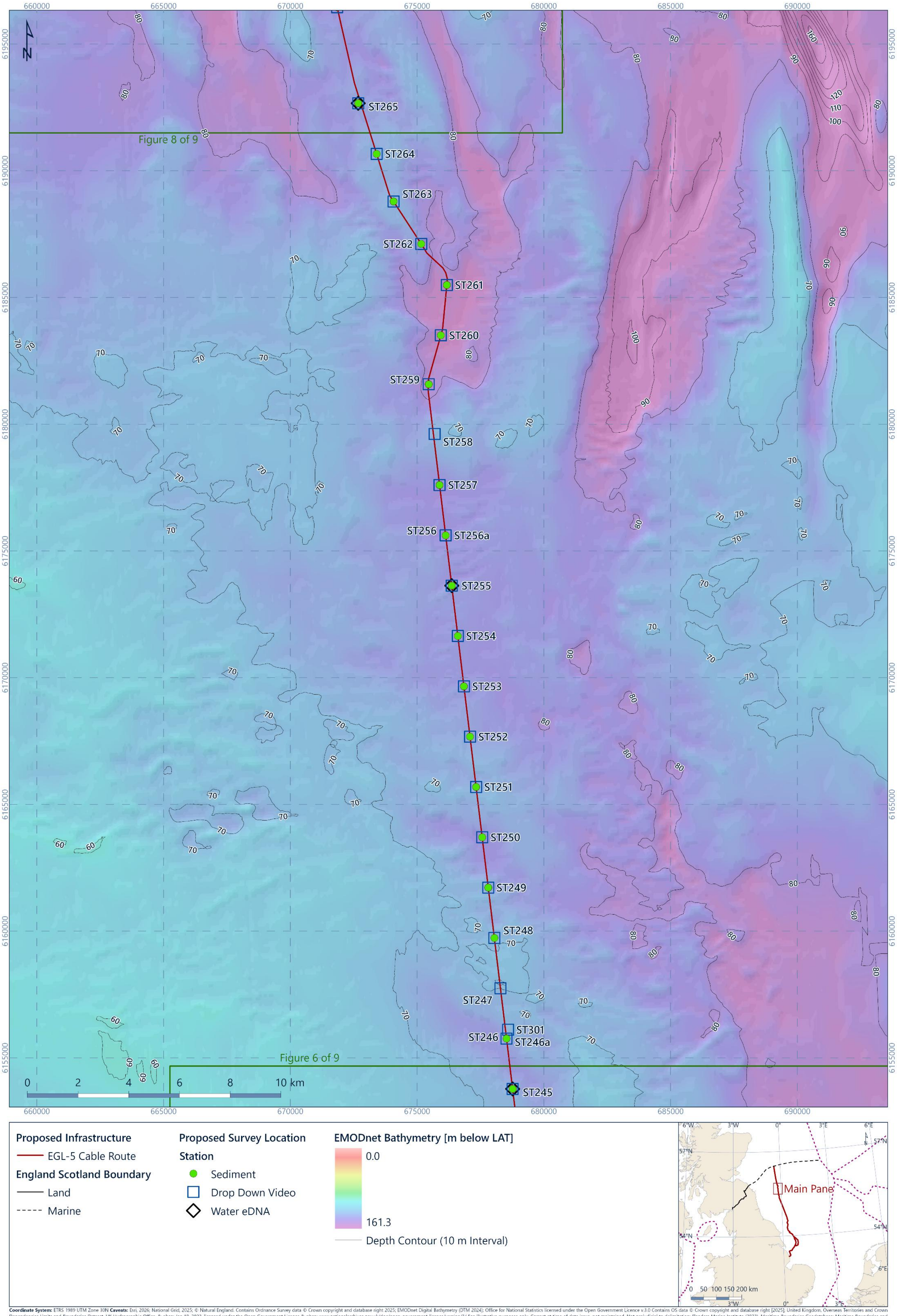

Figure 2.3: Proposed survey locations overlaid on bathymetry, station ST245 to station ST265

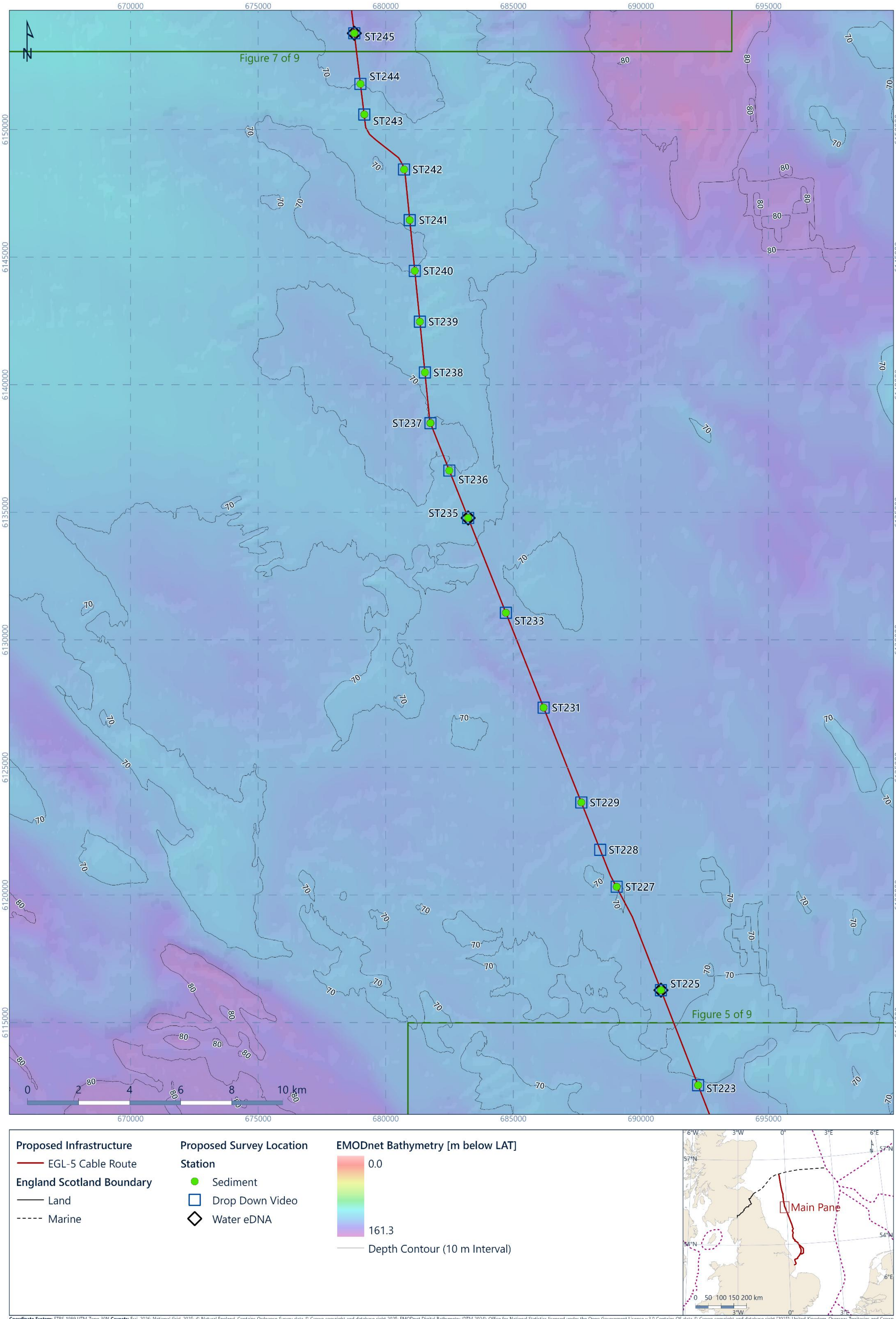

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Figure 2.4: Proposed survey locations overlaid on bathymetry, station ST223 to station ST245

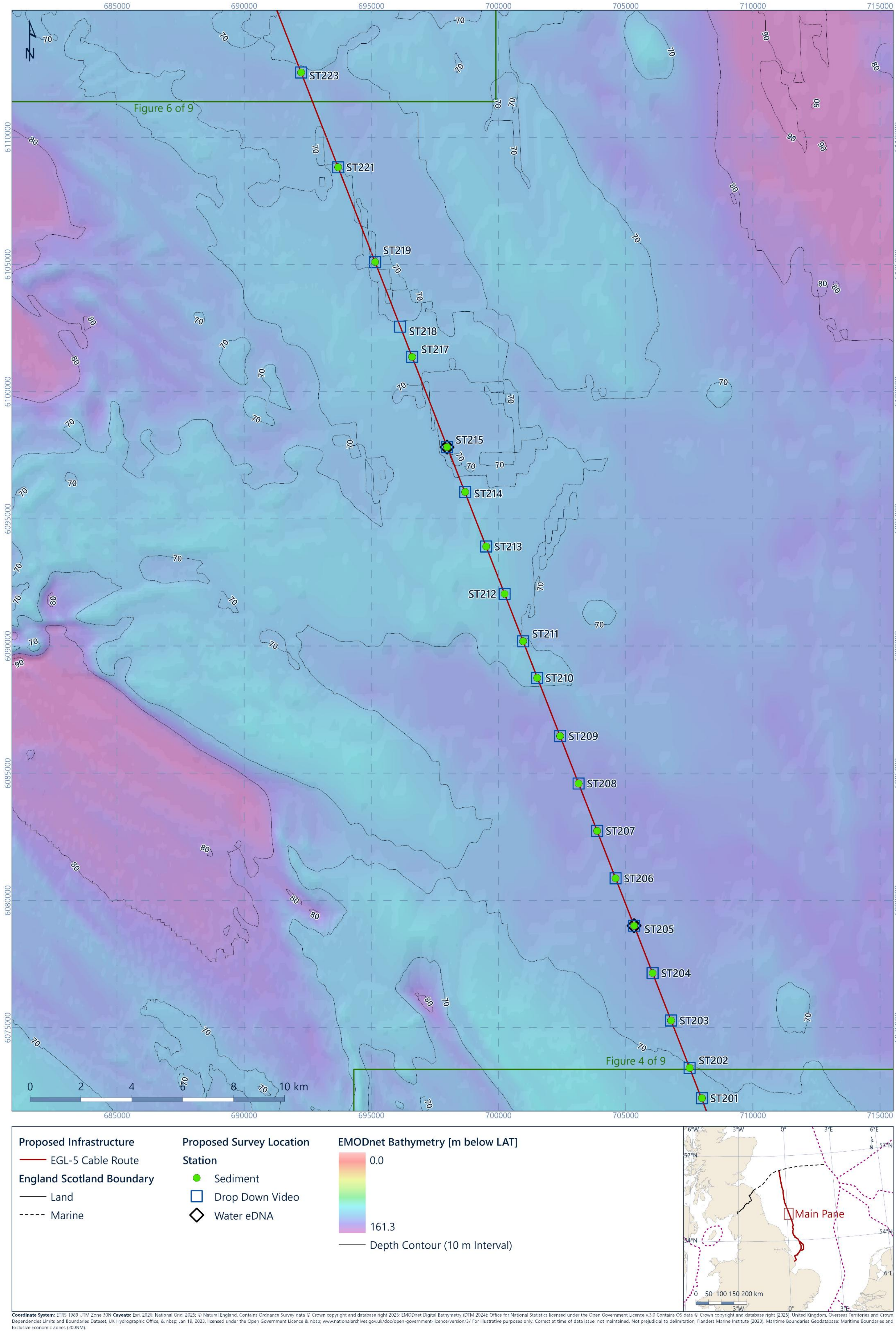

Figure 2.5: Proposed survey locations overlaid on bathymetry, station ST201 to station ST223

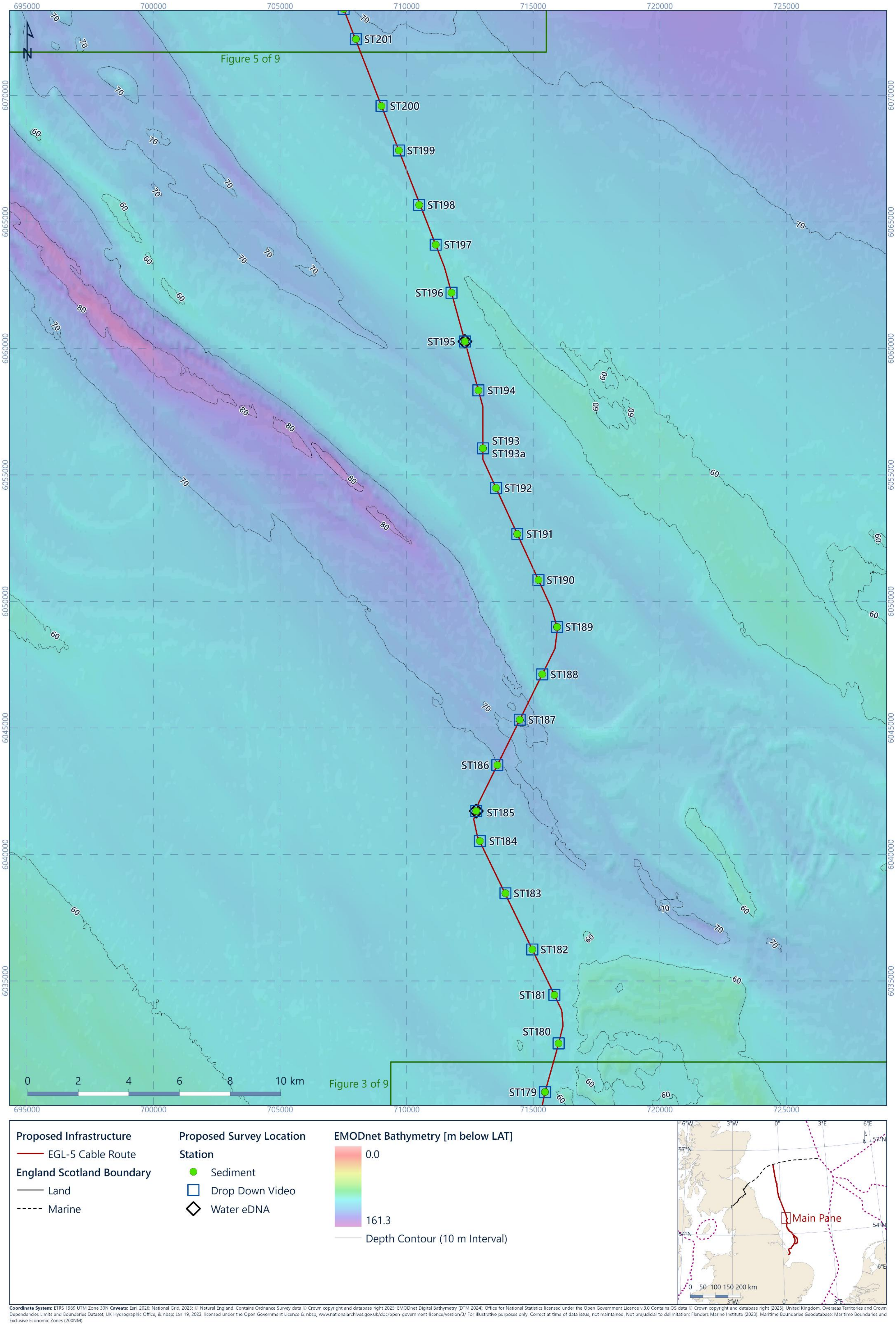

Figure 2.6: Proposed survey locations overlaid on bathymetry, station ST179 to station ST201

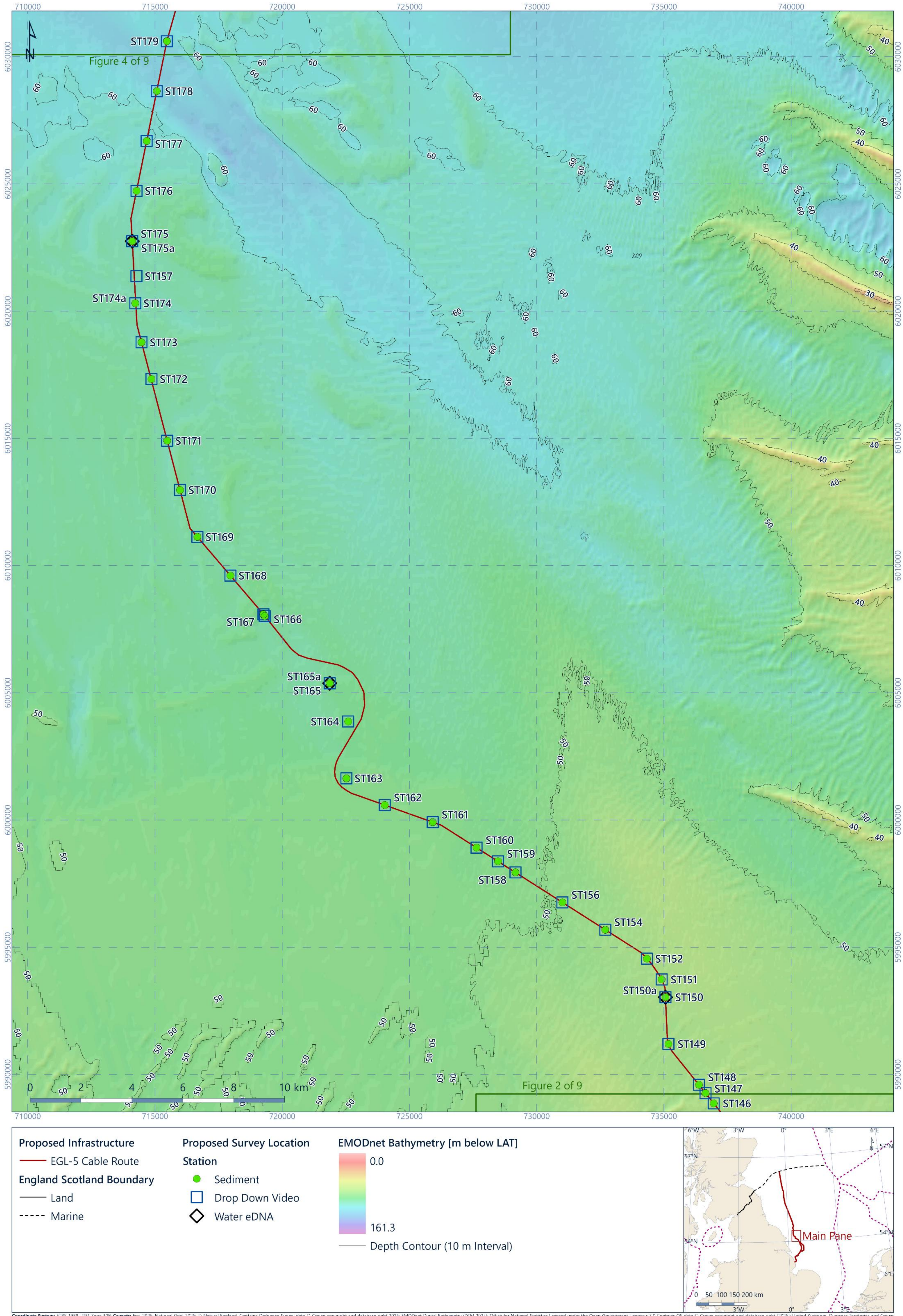

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Figure 2.7: Proposed survey locations overlaid on bathymetry, station ST146 to station ST179

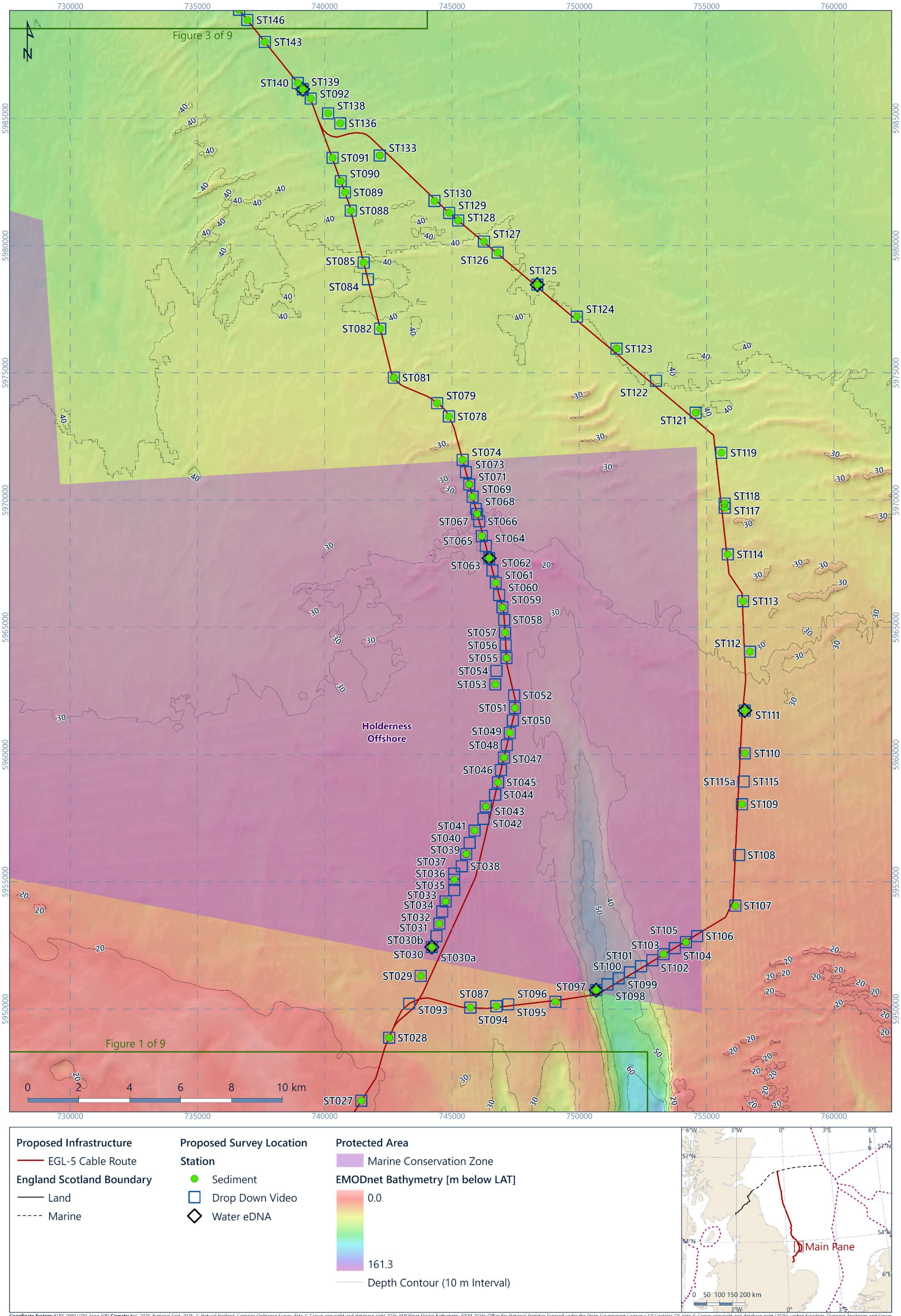

Figure 2.8: Proposed survey locations overlaid on bathymetry, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

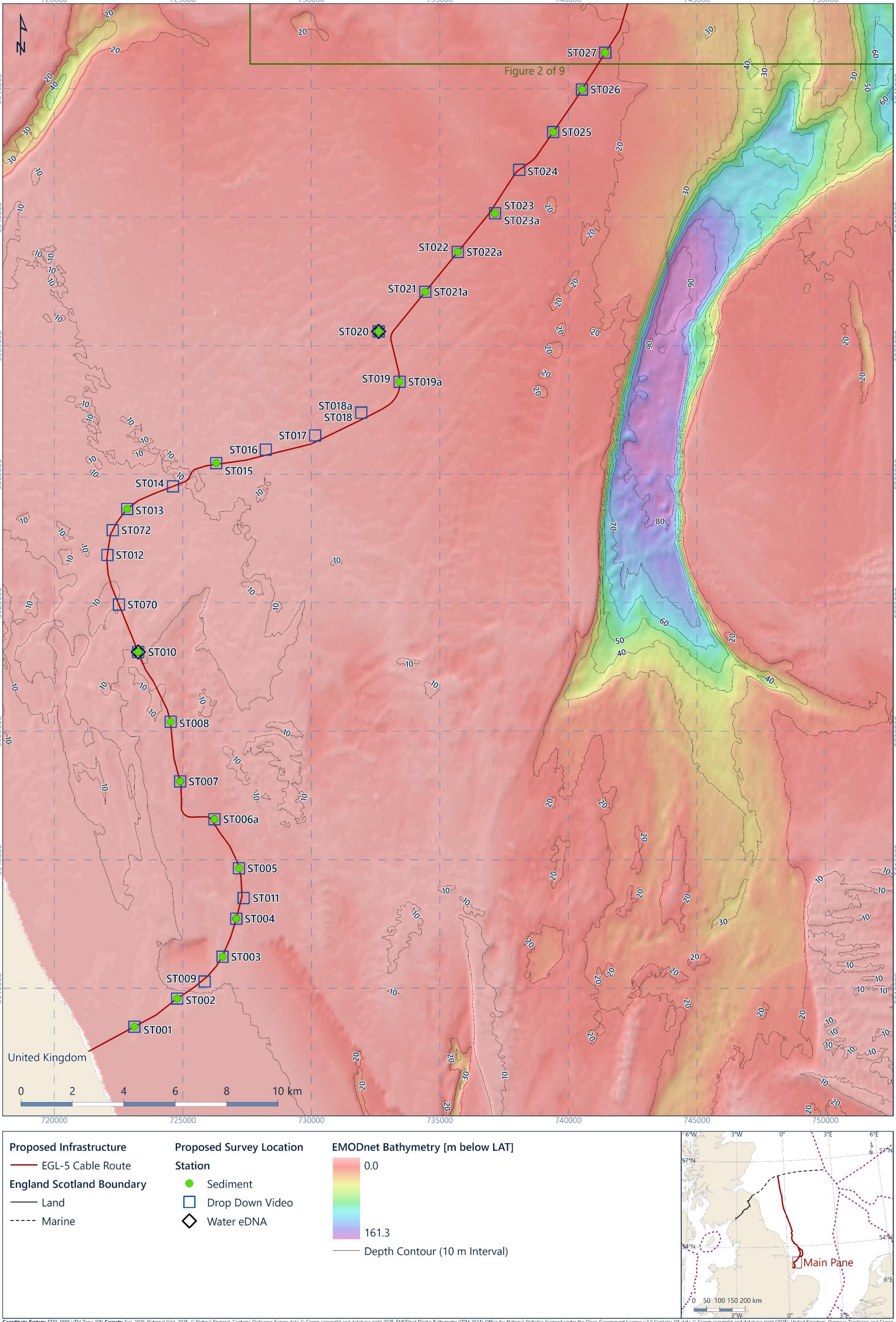

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Figure 2.9: Proposed survey locations overlaid on bathymetry, station ST001 to station ST027

3. Methods

3.1 Survey Methods

Seafloor photography was acquired using a RayFin deep-sea camera system, mounted within a purpose-built camera frame, complete with a high-definition video camera and high-resolution stills camera. A separate high-power strobe and two high-intensity LED lamps provided illumination, whilst duo scaling lasers set 10 cm wide provided a scale. The camera system was equipped with an ultra short baseline (USBL) beacon for subsea positioning.

Seafloor video was displayed on a computer monitor and recorded directly onto the server. Position (easting and northing) derived from the attached USBL beacon including time, date and depth were overlain on the video. 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 an umbilical cable, assisting in the control of the camera in the water.

Seafloor samples were acquired using either a 0.1 m^2 dual van Veen (DVV) grab, 0.1 m^2 Day grab, or a 0.1 m^2 mini Hamon grab in areas of coarser sediment. Within the pre-sweeping areas, a Day grab was used in place of a Hamon grab to comply with Marine Management Organisation (MMO) sampling procedures.

Water eDNA samples were collected using a five litre Niskin bottle attached to a metal arm trigger and attached to the winch wire with a weight on the bottom. The bottle was armed before deployment. An USBL beacon was attached to the wire below the Niskin bottle. The Bridge communicated to the deck via a VHF radio when the vessel was steady and on location. Water eDNA samples were collected from approximately 1 m below sea surface (TOP) and approximately 5 m from the seafloor (BOT).

Further details on survey methodology are available within the National Grid EGL5 Environmental Survey field report (Fugro, 2025).

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 would be addressed and resolved at this stage in line with Fugro's Quality Assurance Management System.

Brief analytical methodologies are described in the following subsections. Further descriptions of the analytical methodologies are detailed in Appendix B.

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 Fugro GB Limited (FGBL) in-house methods based on the North-East Atlantic Marine Biological Association Quality Control (NMBAQC) scheme's best practice guidance document – PSA for Supporting Biological Analysis, and British Standards ([BS] 1377: Parts 1: 2016 and 2: 1990).

Laser diffraction PSD analysis was undertaken in accordance with FGBL in-house methods based on Mason (2022), and BS International Organisation for Standardisation ([ISO] 13320: 2020).

See Appendix B.1.1 for further details on the laboratory methods conducted.

3.2.1.2 Total Organic Carbon

Sediment samples were analysed for total organic carbon (TOC) by Element Materials Technology. Pre-sweeping stations were analysed by SOCOTEC following MMO methodologies. See Appendix B.12 for further details on the laboratory methods conducted.

3.2.2 Sediment Chemistry

3.2.2.1 Sediment Hydrocarbons

See Appendix B.1.3 for further details on the laboratory methods conducted. A summary of the methods is highlighted below.

3.2.2.1.1 Total Hydrocarbons by Gas Chromatography–Flame Ionisation Detection (GC-FID)

The total hydrocarbon material present was quantified using response factors calculated from the analysis of mixed oil standard solutions over an appropriate range. The unresolved complex mixture (UCM) was determined by subtracting the area of all the resolved peaks from the total hydrocarbon area and applying the total hydrocarbon response factor. The minimum reporting value (MRV) is 0.5 µg/g dry weight.

Pre-sweeping stations were analysed by SOCOTEC following MMO methodologies. See Appendix B.1.4.3 for further details on the laboratory methods conducted.

3.2.2.1.2 n-Alkanes, Pristane and Phytane

Calibration was undertaken using a range of n-alkane standard solutions containing the even carbon number compounds between nC_{12} and nC_{36}, and a range of suitable internal standards. Individual response factors were calculated for each of the n-alkanes present in the calibration solution. Response factors for the non-calibrated n-alkanes (and pristane and phytane) were taken to be equivalent to closely eluting compounds. The MRV of individual n alkanes is 0.1 ng/g dry weight.

The n-alkanes between nC_{12} and nC_{36} were reported, as were the ranges between nC_{12} and nC_{20} and nC_{21} and nC_{36}. Carbon preference index (CPI) values (the ratio of odd to even carbon numbered compounds) for the same ranges were also calculated. Pristane and phytane (and associated ratio) were also determined.

3.2.2.1.3 Polycyclic Aromatic Hydrocarbons (PAHs)

A full range of polycyclic aromatic hydrocarbon (PAH) and alkylated PAH were quantified as specified by Department of Trade and Industry [DTI] regulations (1993).

Calibration was undertaken using a range of PAH standard solutions, a number of alkylated PAH, dibenzothiophene and a range of suitable internal standards. Individual response factors were calculated for each of the compounds present in the calibration solution. Response factors for the non-calibrated alkylated PAH were taken to be equivalent to closely related compounds. The MRV of individual and alkylated PAHs is 0.1 ng/g.

Pre-sweeping stations were analysed by SOCOTEC following MMO methodologies. See Appendix B.1.4.5 for further details on the laboratory methods conducted.

3.2.2.2 Sediment Metals

Sediment samples were analysed by Fugro and RPS using the methods highlighted below.

Sediment samples were dried at 40 °C and then sieved to the required size fraction (2000 µm). Samples were subjected to microwave digestion in aqua regia. This acid mixture allows a partial dissolution of metals and does not release those associated with the alumino-silicate matrix of the sediment. The resulting digests were then analysed by inductively coupled plasma – mass spectrometry (ICP-MS) for As, Cr, Cu, Fe, Hg, Mn, Ni, P, Pb, Sr, V and Zn.

RPS analysed the sediment samples for Be. Samples were dried at 40 °C and then sieved to the required size fraction (2000 µm). Samples were subjected to a microwave digestion using aqua regia, with the resulting digests analysed by ICP-MS and/or inductively coupled plasma–optical emission spectrometry (ICP-OES).

Pre-sweeping stations were analysed by SOCOTEC. See Appendix B.1.5 for further details on the laboratory methods conducted.

3.2.3 Sediment Macrofauna

Samples were analysed for macrofaunal content by Fugro Laboratories in accordance with the requirements of the NMBAQC scheme (Worsfold et al., 2010) and the relevant ISO standards for macrobenthic analysis.

Macrofaunal samples were sieved over a 1.0 mm mesh sieve and taxa were identified to the lowest possible taxonomic level and enumerated. Sessile colonial epifauna was recorded as present (P). Nomenclature follows the World Register of Marine Species [WoRMS] (WoRMS Editorial Board, 2025), or more recent literature where applicable. The taxonomic order is based on Species Directory (SD) codes (Howson & Picton, 1997).

Biomass was undertaken following identification and enumeration. The infauna from each sample was sorted into: Annelida, Cnidaria (only burrowing taxa), Crustacea, Mollusca, Echinodermata, and other phyla. Biomass was weighted using the wet blot method.

3.2.4 Environmental DNA

Water and sediment samples were analysed for eDNA by NatureMetrics.

Environmental DNA comprises DNA fragments shed from any living form into the environment. Environmental DNA is currently considered to persist in temperate marine environments for approximately 48 h before degradation in aqueous form; sediment eDNA decay rates vary but are generally lower and can persist longer in the environment (Holman et al., 2022); (Sakata et al., 2020). Therefore, the results of this study generally cover this temporal window. Cartilaginous fish (e.g. sharks and rays) were not included in this analysis.

Consensus taxonomic assignments were made for each operational taxonomic unit (OTU) using sequence similarity searches against the National Centre for Biotechnology Information (NCBI) nucleotide (GenBank) reference database. Assignments were made to the lowest possible taxonomic level. Minimum similarity thresholds of 99 %, 97 %, and 95 % were used for species, genus, and higher-level taxonomic classification, respectively. In instances where equally good matches to multiple species occurred, public records from the Global Biodiversity Information Facility (gbif) (Chamberlain et al., 2025) were used to assess which were most likely to be present. Higher-level taxonomic identifications or multiple potential identifications were reported when uncertainty existed.

The eDNA was extracted using a protocol modified to boost DNA yields, and an extraction blank was included in the batch. Full details of the eDNA methods are available in Appendix B.1.6.

3.3 Data Analysis

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

Relative standard deviation (RSD) indicates the extent of variability in a dataset in relation to the mean value. The RSD value expresses the standard deviation as a percentage of the mean. For this report, RSD of less than 30 % will be considered low variability, 30 % to 70 % moderate variability, and more than 70 % high variability.

To facilitate interpretation, nearshore stations are considered those located at water depths of < 65 m below sea level (BSL) and offshore stations those located at greater depths.

3.3.1 Sediment Particle Size Distribution Statistics

Sediment samples were analysed for their PSD using a combination of two techniques: sieve analysis for all material retained by a 1.0 mm sieve, followed by laser diffraction analysis of the finer material. The PSD parameters include the descriptive statistics derived in Gradistat (Blott, 2010; Blott & Pye, 2001) and based on the Folk and Ward (1957) method. The sediment descriptions are based on the Wentworth (1922) scale and Folk (1954). Further details are presented in Appendix B.2.1.

3.3.2 Sediment Macrofauna Data Rationalisation

Prior to analysis, the macrofaunal dataset was rationalised, to avoid spurious enhancement of the species list. Further details are presented in Appendix B.2.2.

3.3.3 Sediment Macrofaunal Univariate Analysis

The univariate statistics applied to the macrofaunal dataset were derived from the Plymouth Routines in Multivariate Ecological Research (PRIMER) version 7 (v7), particularly a selection of those included in the DIVERSE routine. Further details are presented in Appendix B.2.3.

3.3.4 Multivariate Analysis

Various multivariate statistical techniques were applied to the sediment data and the macrofauna (abundance) to investigate patterns of similarity in PRIMER v7 after applying a suitable transformation.

Data transformation was undertaken prior to multivariate analysis, where deemed necessary. Transformation applied to sediment particle size data reduces the degree of skewness and allows optimal performance of the multivariate analysis (detailed in Section 6.2). Transformation applied to macrofaunal data matrix reduces the influence of the numerically dominant taxa, which may mask the underlying community composition (detailed in Section 8.1.3) (Clarke et al., 2014). Further details are presented in Appendix B.2.4.

3.3.5 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). Further details are presented in Appendix B.2.5.

3.3.6 Environmental DNA Analysis

NatureMetrics carried out the original data analysis. The results are presented for the sediments (section 9) and water (section 9). Further details are presented in Appendix B.2.6.

Fugro GB Limited carried out additional data analysis and the interpretation. To evaluate taxonomic assignment completeness, the percentage of OTUs identified to a taxonomic level was categorised as low (< 30 %), moderate (30-70 %) or high (> 70 %). Values below high indicate low taxonomic resolution.

3.3.6.1 Environmental DNA Comparative Analysis

As the eDNA analysis targeted groups of taxa collected by other methods within this study, data were analysed by means of in-house data analysis (within R v. 2023.12.1 environment) to generate a Venn diagram. Venn diagrams are used to investigate the relationships between two or more datasets, highlighting their similarities and/or differences (Joyce, 2008). The proportion of overlapping taxa, those detected by both eDNA analyses, is shown at the intersection of the Venn diagram circles.

3.3.7 Seafloor Habitats and Biotopes

3.3.7.1 Seafloor Photographic Data Analysis

To assess the habitats, present within the survey area, a detailed analysis of video and still photographic data was undertaken, noting the locations of any observed changes in sediment type and/or associated faunal community.

Appendix B.2.7 provides details of the methodologies applied.

3.3.7.2 Seafloor Habitat Classification

Habitats within the survey area have been classified in accordance with the EUNIS habitat classification (European Environment Agency [EEA], 2022). Table 3.1 summarises the EUNIS hierarchy and provides an example of the coding system. The EUNIS classification system is designed to incorporate small-scale temporal variations (e.g. seasonal) into the biotope/habitat categories. The equivalent classification from 'The Marine Habitat Classification for Britain and Ireland – Version 22.04' (Joint Nature Conservation Committee [JNCC], 2022) was also noted. The JNCC classification formed the basis of the marine section of the EUNIS habitat classification scheme (Davies et al., 2004).

EUNIS classifications were coded for each habitat type observed from video data. Although, theoretically, a biotope can be assigned to any sized area of seafloor, for the purposes of this assessment, the commonly accepted minimum habitat size of 25 m^2 was adopted (Parry, 2019).

Table 3.1: EUNIS (EEA, 2022) biotope classification hierarchy example

Level	Example Classification Name	Example Classification Code
1. Environment	Marine benthic habitats	M
2. Biological zone and substrate	Circalittoral sand	MC5
3. Biogeographical marine region	Atlantic circalittoral sand	MC52
4. Biotope complex	Faunal communities of Atlantic circalittoral sand	MC521
5 & 6. Biotope and sub-biotope	*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand	MC5215

3.3.7.3 Sensitive Habitats and Species

Following on from the photographic data analysis the presence of sensitive habitats and species was detected. The habitats assessed included the UK BSH 'Subtidal sands and gravels, the OSPAR habitat 'Sea pens and burrowing megafauna', the 2019 Regulations (EU Annex I) habitats 'Reef' (stony reef) and *Sabellaria spinulosa* (biogenic reef) and the methodologies applied are presented in Appendix B.2.8.

Sand and gravel were assessed to identify the presence of preferred spawning grounds for sandeels (*Ammodytes marinus*) and Atlantic herring (*Clupea harengus*), two priority species under the UK BAP.

All taxa detected across all survey methods were queried against the International Union for Conservation of Nature (IUCN) Red List to obtain global threat status (International Union for Conservation of Nature [IUCN], 2025). Species were also assessed for their conservation status using the OSPAR list of threatened and/or declining species and habitats (OSPAR, 2008).

Species of conservation importance observed included the OSPAR threatened and/or declining species '*Arctica islandica*'.

The presence of any other habitat or species of conservation importance, for which a full assessment was not needed, was noted along with and their location along the proposed cable route.

3.3.8 Non-Indigenous Species (NIS)

Several sources were used to assess the NIS (Cottier-Cook et al., 2017; Harrower et al., 2021; Hill et al., 2009; Roy et al., 2012), and databases: National Biodiversity Network (NBN) (2025; Non-native Species Secretariat, 2021), Delivering Alien Invasive Species Inventories for Europe (DAISIE) (David Roy et al., 2020) and WoRMS (2025).

4. Field Operations

Appendix C.1 presents the detailed survey logs, whilst Appendix C.2 presents the detailed grab logs, which includes a preliminary sediment description based on Folk (1954).

4.1 Seafloor Photography

Photographic data were successfully acquired along all 260 proposed stations. Table 4.1 collates all the stations where video and stills were collected. From this, at 103 stations the length of the transects were over 150 m. Of these, 86 stations were over 196 m long and 82 over 200 m long. Therefore, 86 transects were acquired of approximately 200 m in length. The other stations were sampled to ensure clearance before deploying other gear (e.g. the grab). These are shorter but were analysed to provide supplementary data to inform the habitat assessment. Figures 4.1 to 4.9 spatially displays the completed survey locations overlaid on bathymetric data (EMODnet, 2026).

Table 4.1: Completed transects

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST001	723 050.6	5 908 592.9	723 204.3	5 908 447.1	10.8	211.8	Video: 11 min 40 sec 46 stills
ST002	724 772.4	5 909 623.2	724 806.6	5 909 576.9	11.2	57.5	Video: 03 min 40 sec 12 stills
ST003	726 551.6	5 911 207.4	726 531.6	5 911 260.6	16.7	56.8	Video: 02 min 48 sec 14 stills
ST004	727 080.5	5 912 691.0	727 099.6	5 912 743.3	17.5	55.7	Video: 03 min 04 sec 16 stills
ST005	727 196.3	5 914 568.1	727 145.9	5 914 777.8	17.2	215.6	Video: 12 min 20 sec 46 stills
ST006a	726 192.8	5 916 388.2	726 329.8	5 916 552.2	16.3	213.7	Video: 11 min 40 sec 52 stills
ST007	724 895.2	5 918 064.1	724 886.3	5 918 010.1	14.6	54.7	Video: 11 min 40 sec 52 stills
ST008	724 527.3	5 920 374.3	724 539.3	5 920 328.2	12.8	50.1*	Video: 02 min 16 sec 19 stills
ST009	725 913.5	5 910 184.2	725 796.3	5 910 360.7	16.2	211.8	Video: 10 min 48 sec 35 stills
ST010	723 218.1	5 923 176.4	723 295.0	5 922 982.8	9.8	208.3	Video: 10 min 32 sec 42 stills
ST011	727 379.7	5 913 417.6	727 387.0	5 913 657.5	18.4	240.0	Video: 13 min 17 sec 51 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST012	722 041.4	5 926 866.6	722 091.5	5 926 850.3	10.3	52.7	Video: 02 min 22 sec 15 stills
ST013	722 832.2	5 928 623.9	722 837.0	5 928 677.7	12.2	54.0	Video: 02 min 36 sec 14 stills
ST014	724 631.7	5 929 508.6	724 607.5	5 929 555.7	13.1	52.9	Video: 02 min 24 sec 15 stills
ST015	726 302.8	5 930 407.3	726 299.5	5 930 458.3	14.4	51.1	Video: 02 min 01 sec 14 stills
ST016	728 236.3	5 930 854.5	728 231.3	5 931 068.8	15.6	214.3	Video: 08 min 09 sec 35 stills
ST017	730 156.3	5 931 480.6	730 152.9	5 931 545.4	17.2	64.9	Video: 02 min 22 sec 12 stills
ST018a	732 035.2	5 932 386.5	731 880.2	5 932 388.5	14.2	155.1	Video: 13 min 31 sec 35 stills
ST019a	733 455.7	5 933 583.6	733 414.7	5 933 620.5	18.3	55.1	Video: 02 min 18 sec 18 stills
ST020	732 674.3	5 935 466.3	732 574.9	5 935 637.3	18.9	197.8	Video: 04 min 46 sec 27 stills
ST021a	734 438.8	5 937 125.3	734 417.4	5 937 077.1	15.1	52.7	Video: 05 min 05 sec 16 stills
ST022a	735 701.9	5 938 674.2	735 698.1	5 938 624.4	16.8	85.0*	Video: 06 min 38 sec 17 stills
ST023a	737 167.8	5 940 168.7	737 119.7	5 940 152.7	17.6	50.7	Video: 02 min 15 sec 15 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST024	738 087.7	5 941 814.2	738 097.4	5 941 863.1	20.4	50.9*	Video: 01 min 50 sec 11 stills
ST025	739 438.9	5 943 200.0	739 377.5	5 943 416.2	20.6	224.8	Video: 08 min 40 sec 42 stills
ST026	740 512.8	5 945 034.2	740 540.8	5 944 942.2	17.5	96.2	Video: 02 min 47 sec 6 stills
ST027	741 433.2	5 946 427.6	741 424.6	5 946 375.7	17.9	52.7	Video: 03 min 05 sec 8 stills
ST028	742 526.1	5 948 911.0	742 546.0	5 948 851.5	26.4	62.7	Video: 03 min 47 sec 6 stills
ST029	743 754.8	5 951 345.2	743 778.6	5 951 282.9	26.2	66.7	Video: 02 min 41 sec 9 stills
ST030b	744 318.8	5 952 431.5	744 097.6	5 952 463.1	28.2	223.4	Video: 08 min 25 sec 36 stills
ST031	744 414.4	5 952 751.4	744 387.8	5 952 966.1	28.3	216.3	Video: 09 min 27 sec 26 stills
ST032	744 528.0	5 953 252.8	744 531.9	5 953 454.3	26.1	201.5	Video: 08 min 18 sec 34 stills
ST033	744 782.0	5 954 117.9	744 756.2	5 954 329.8	27.3	213.5	Video: 12 min 08 sec 26 stills
ST034	744 624.8	5 953 712.8	744 604.8	5 953 931.2	27.6	219.3	Video: 11 min 29 sec 36 stills
ST035	745 125.1	5 954 568.6	745 084.5	5 954 780.5	28.4	215.7	Video: 15 min 45 sec 29 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST036	745 059.4	5 955 186.9	745 152.0	5 955 003.5	24.6	205.5	Video: 30 min 11 sec 35 stills
ST037	745 071.6	5 955 433.9	745 056.5	5 955 233.8	25.8	200.7	Video: 30 min 00 sec 23 stills
ST038	745 380.0	5 955 726.7	745 462.0	5 955 549.5	26.4	195.3	Video: 22 min 06 sec 28 stills
ST039	745 561.3	5 956 210.4	745 530.1	5 955 995.6	27.6	217.0	Video: 17 min 39 sec 46 stills
ST040	745 685.5	5 956 452.3	745 731.2	5 956 640.3	20.3	193.5	Video: 07 min 49 sec 38 stills
ST041	745 885.3	5 956 898.2	745 923.5	5 957 098.5	27.5	203.9	Video: 07 min 34 sec 49 stills
ST042	746 256.2	5 957 367.3	746 235.6	5 957 595.0	28.8	228.6	Video: 07 min 26 sec 42 stills
ST043	746 319.4	5 957 852.7	746 351.9	5 958 059.9	30.0	209.8	Video: 07 min 06 sec 44 stills
ST044	746 786.0	5 958 378.6	746 640.3	5 958 492.7	31.4	185.1	Video: 08 min 29 sec 54 stills
ST045	746 913.2	5 958 926.6	746 702.5	5 958 895.6	31.5	213.0	Video: 07 min 54 sec 27 stills
ST046	747 024.1	5 959 456.4	746 824.7	5 959 437.8	31.6	200.3	Video: 08 min 20 sec 35 stills
ST047	747 060.3	5 960 007.2	746 941.8	5 959 866.6	31.4	183.9	Video: 10 min 02 sec 30 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST048	747 128.1	5 960 499.0	747 197.2	5 960 282.6	30.2	227.1	Video: 09 min 40 sec 39 stills
ST049	747 240.1	5 960 962.0	747 300.2	5 960 758.2	30.2	212.5	Video: 07 min 57 sec 26 stills
ST050	747 367.5	5 961 494.8	747 394.9	5 961 260.7	29.5	235.7	Video: 09 min 33 sec 26 stills
ST051	747 443.2	5 961 947.8	747 488.4	5 961 743.4	29.6	209.4	Video: 08 min 11 sec 27 stills
ST052	747 471.2	5 962 221.6	747 450.9	5 962 427.5	31.7	206.9	Video: 11 min 38 sec 30 stills
ST053	746 740.2	5 962 656.0	746 726.3	5 962 856.8	33.1	201.3	Video: 15 min 27 sec 35 stills
ST054	746 789.9	5 963 186.7	746 758.3	5 963 391.3	33.0	207.0	Video: 13 min 48 sec 31 stills
ST055	747 175.4	5 963 691.4	747 088.9	5 963 882.9	32.1	210.1	Video: 12 min 32 sec 30 stills
ST056	747 150.9	5 964 186.4	747 125.0	5 964 396.8	32.4	212.0	Video: 12 min 36 sec 29 stills
ST057	747 120.7	5 964 688.8	747 134.3	5 964 883.6	32.9	195.2	Video: 09 min 01 sec 21 stills
ST058	747 045.5	5 965 180.5	747 069.0	5 965 390.9	33.4	211.6	Video: 09 min 07 sec 20 stills
ST059	746 982.3	5 965 677.4	746 985.0	5 965 886.8	33.3	209.4	Video: 09 min 00 sec 29 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST060	746 836.3	5 966 374.2	746 831.5	5 966 167.2	29.0	207.0	Video: 17 min 02 sec 42 stills
ST061	746 708.1	5 966 857.7	746 634.4	5 966 695.8	28.2	177.9	Video: 17 min 38 sec 36 stills
ST062	746 588.0	5 967 342.2	746 595.5	5 967 133.0	29.4	209.4	Video: 17 min 46 sec 48 stills
ST063	746 468.6	5 967 826.0	746 535.4	5 967 649.6	30.2	188.6	Video: 15 min 08 sec 30 stills
ST064	746 354.0	5 968 104.2	746 256.5	5 968 245.2	32.6	171.5	Video: 09 min 00 sec 38 stills
ST065	746 195.1	5 968 492.6	746 106.1	5 968 635.6	33.1	168.4	Video: 07 min 07 sec 32 stills
ST066	746 119.2	5 969 071.1	746 035.2	5 969 265.1	33.3	211.4	Video: 10 min 09 sec 79 stills
ST067	746 040.8	5 969 353.3	745 886.3	5 969 488.7	32.9	205.5	Video: 10 min 54 sec 62 stills
ST068	746 008.4	5 969 578.8	745 906.8	5 969 752.3	35.8	201.0	Video: 09 min 44 sec 59 stills
ST069	745 801.6	5 970 232.2	745 790.6	5 970 031.7	34.3	200.9	Video: 08 min 50 sec 34 stills
ST070	722 491.1	5 924 947.2	722 504.0	5 924 905.8	10.8	44.0*	Video: 01 min 30 sec 14 stills
ST071	745 691.8	5 970 719.6	745 682.4	5 970 507.3	34.3	212.5	Video: 07 min 08 sec 35 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST072	722 238.7	5 927 724.0	722 314.1	5 927 917.0	10.0	207.2	Video: 09 min 03 sec 32 stills
ST073	745 574.2	5 971 201.2	745 540.1	5 970 991.1	36.5	212.8	Video: 07 min 24 sec 32 stills
ST074	745 522.7	5 971 621.0	745 354.6	5 971 491.2	36.4	212.4	Video: 11 min 02 sec 57 stills
ST078	744 864.3	5 973 348.8	744 909.5	5 973 251.8	33.6	107.0	Video: 05 min 34 sec 24 stills
ST079	744 394.8	5 973 850.2	744 425.3	5 973 786.4	36.9	70.7	Video: 03 min 06 sec 22 stills
ST081	742 715.9	5 974 840.7	742 712.7	5 974 781.9	19.2	58.9	Video: 02 min 13 sec 19 stills
ST082	742 142.1	5 976 841.2	742 093.6	5 976 668.5	40.2	179.3	Video: 09 min 28 sec 42 stills
ST084	741 719.3	5 978 657.5	741 674.1	5 978 689.1	42.4	55.1	Video: 03 min 00 sec 14 stills
ST085	741 555.5	5 979 312.3	741 522.5	5 979 353.8	41.9	53.0	Video: 02 min 35 sec 9 stills
ST087	746 741.5	5 950 077.4	746 759.0	5 950 144.3	29.1	69.2	Video: 03 min 27 sec 22 stills
ST088	741 059.2	5 981 353.7	741 002.5	5 981 382.5	42.9	63.6	Video: 02 min 51 sec 8 stills
ST089	740 821.8	5 982 075.9	740 781.6	5 982 115.8	44.7	56.6	Video: 03 min 09 sec 10 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST090	740 665.7	5 982 521.2	740 602.3	5 982 523.3	45.3	63.4	Video: 02 min 36 sec 11 stills
ST091	740 340.8	5 983 449.4	740 280.8	5 983 439.5	43.4	60.9	Video: 02 min 15 sec 8 stills
ST092	739 466.7	5 985 744.6	739 456.0	5 985 802.9	48.0	59.3	Video: 02 min 43 sec 8 stills
ST093	743 325.6	5 950 185.2	743 329.1	5 950 236.9	28.7	51.7	Video: 04 min 18 sec 15 stills
ST094	745 725.9	5 950 031.6	745 707.0	5 950 080.1	30.1	52.1	Video: 04 min 35 sec 12 stills
ST095	747 209.4	5 950 157.5	747 202.0	5 950 209.7	30.1	52.8	Video: 04 min 02 sec 10 stills
ST096	749 066.1	5 950 261.0	749 070.1	5 950 315.7	27.0	54.8	Video: 03 min 17 sec 10 stills
ST097	750 708.5	5 950 665.7	750 666.7	5 950 868.0	49.1	206.6	Video: 11 min 36 sec 26 stills
ST098	751 057.4	5 950 880.8	751 146.6	5 951 064.3	54.8	204.1	Video: 10 min 38 sec 37 stills
ST099	751 499.0	5 951 284.8	751 575.9	5 951 093.1	51.9	206.7	Video: 09 min 25 sec 36 stills
ST100	751 969.2	5 951 551.5	751 938.7	5 951 352.5	45.2	201.4	Video: 09 min 44 sec 39 stills
ST101	752 414.6	5 951 723.6	752 380.6	5 951 538.2	42.9	188.4	Video: 13 min 14 sec 40 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST102	752 831.2	5 952 004.8	752 811.6	5 951 832.5	29.5	173.4	Video: 09 min 53 sec 34 stills
ST103	753 258.3	5 952 235.3	753 405.1	5 952 093.0	26.9	204.4	Video: 07 min 53 sec 31 stills
ST104	753 680.2	5 952 467.4	753 714.0	5 952 269.1	24.7	201.1	Video: 07 min 37 sec 28 stills
ST105	754 152.6	5 952 728.6	754 246.5	5 952 543.1	24.7	207.9	Video: 08 min 50 sec 35 stills
ST106	754 578.3	5 952 969.7	754 689.9	5 952 785.3	24.9	215.5	Video: 10 min 53 sec 54 stills
ST107	756 163.7	5 954 063.3	756 102.2	5 954 081.5	27.7	64.2	Video: 03 min 33 sec 18 stills
ST108	756 288.4	5 956 067.0	756 273.0	5 956 016.2	28.1	53.0	Video: 02 min 17 sec 17 stills
ST109	756 407.4	5 958 058.6	756 379.1	5 958 011.6	26.9	54.8	Video: 02 min 07 sec 18 stills
ST110	756 506.4	5 960 065.6	756 492.1	5 960 014.0	26.6	53.6	Video: 02 min 25 sec 15 stills
ST111	756 511.4	5 961 848.1	756 467.8	5 961 626.2	29.9	226.2	Video: 13 min 04 sec 36 stills
ST112	756 745.1	5 964 047.4	756 711.9	5 964 015.8	32.4	114.6*	Video: 04 min 06 sec 15 stills
ST113	756 440.7	5 966 013.8	756 460.0	5 966 060.9	34.1	50.9	Video: 03 min 03 sec 12 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST114	755 817.0	5 967 799.2	755 717.5	5 967 917.0	36.4	154.2	Video: 06 min 52 sec 23 stills
ST115a	756 513.6	5 958 865.0	756 393.0	5 959 052.3	27.9	222.8	Video: 06 min 48 sec 49 stills
ST117	755 725.3	5 969 666.6	755 717.5	5 969 731.3	33.5	65.1	Video: 03 min 00 sec 12 stills
ST118	755 713.9	5 969 833.8	755 717.9	5 969 898.9	37.1	65.2	Video: 03 min 04 sec 10 stills
ST119	755 597.5	5 971 749.6	755 623.3	5 971 954.6	41.1	206.5	Video: 09 min 22 sec 18 stills
ST121	754 590.6	5 973 402.8	754 584.1	5 973 470.6	42.5	68.1	Video: 03 min 07 sec 9 stills
ST122	753 026.1	5 974 716.1	753 023.7	5 974 661.7	42.0	54.5	Video: 02 min 53 sec 9 stills
ST123	751 452.3	5 975 974.3	751 467.6	5 975 917.4	41.6	58.9	Video: 03 min 14 sec 9 stills
ST124	749 897.6	5 977 222.7	749 941.0	5 977 211.2	40.6	60.2*	Video: 03 min 20 sec 22 stills
ST125	748 334.7	5 978 557.1	748 400.3	5 978 378.1	41.3	190.6	Video: 08 min 52 sec 53 stills
ST126	746 828.9	5 979 731.4	746 758.5	5 979 702.1	41.1	76.3	Video: 04 min 03 sec 22 stills
ST127	746 275.0	5 980 131.8	746 221.3	5 980 144.1	40.9	55.1	Video: 03 min 07 sec 18 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST128	745 263.0	5 980 961.6	745 214.7	5 981 001.2	43.9	62.5	Video: 03 min 07 sec 20 stills
ST129	744 907.1	5 981 276.3	744 865.0	5 981 263.2	42.2	60.2*	Video: 02 min 32 sec 16 stills
ST130	744 289.3	5 981 782.9	744 322.8	5 981 728.5	40.9	63.9	Video: 02 min 19 sec 11 stills
ST132	742 968.5	5 982 917.1	742 956.6	5 982 859.9	43.5	58.5	Video: 02 min 34 sec 11 stills
ST133	742 136.3	5 983 427.6	742 180.6	5 983 637.6	44.5	214.6	Video: 07 min 41 sec 22 stills
ST136	740 626.0	5 984 774.8	740 598.8	5 984 829.6	47.5	61.2	Video: 02 min 54 sec 9 stills
ST138	740 142.2	5 985 167.3	740 141.5	5 985 223.8	47.0	56.5	Video: 02 min 32 sec 5 stills
ST139	739 152.4	5 986 111.8	739 133.9	5 986 171.2	48.7	62.2	Video: 02 min 35 sec 5 stills
ST140	738 943.6	5 986 352.6	738 950.6	5 986 416.3	47.1	64.1	Video: 02 min 22 sec 8 stills
ST143	737 643.7	5 988 027.4	737 632.5	5 987 977.5	43.7	51.2	Video: 03 min 17 sec 7 stills
ST146	736 964.5	5 988 885.6	736 945.2	5 988 838.9	45.5	50.5	Video: 03 min 09 sec 10 stills
ST147	736 622.0	5 989 287.2	736 670.6	5 989 271.7	46.9	51.0	Video: 02 min 15 sec 9 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST148	736 362.5	5 989 610.7	736 406.0	5 989 591.3	46.9	51.7*	Video: 02 min 16 sec 12 stills
ST149	735 166.0	5 991 204.1	735 168.5	5 991 164.9	46.7	40.4*	Video 02 min 13 sec 10 stills
ST150a	734 986.7	5 993 107.6	735 140.4	5 992 956.9	46.5	215.2	Video 08 min 55 sec 33 stills
ST151	734 928.9	5 993 708.0	734 912.2	5 993 759.9	47.0	54.5	Video 03 min 23 sec 10 stills
ST152	734 347.9	5 994 521.4	734 317.5	5 994 571.8	48.9	58.8	Video 03 min 35 sec 14 stills
ST154	732 709.9	5 995 662.7	732 703.1	5 995 716.6	50.9	54.4	Video 02 min 28 sec 10 stills
ST156	731 029.9	5 996 743.2	730 995.5	5 996 782.4	52.7	52.1	Video 02 min 10 sec 6 stills
ST157	714 206.9	6 021 447.3	714 396.0	6 021 344.2	56.6	215.4	Video 05 min 3 sec4 28 stills
ST158	729 178.4	5 997 938.7	729 137.6	5 997 965.5	53.0	49.7*	Video 02 min 08 sec 11 stills
ST159	728 481.9	5 998 406.3	728 475.6	5 998 346.3	52.0	60.4	Video 02 min 01 sec 10 stills
ST160	727 635.4	5 998 941.6	727 625.3	5 998 884.0	53.1	58.5	Video 02 min 04 sec 9 stills
ST161	725 909.7	5 999 937.2	725 912.2	5 999 876.9	51.9	60.3	Video 02 min 05 sec 9 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST162	724 024.7	6 000 613.3	724 036.0	6 000 557.4	51.9	57.0	Video 02 min 06 sec 8 stills
ST163	722 525.3	6 001 665.1	722 522.6	6 001 602.9	52.5	62.2	Video 02 min 06 sec 7 stills
ST164	722 598.0	6 003 893.7	722 599.7	6 003 842.4	54.6	51.3	Video 01 min 45 sec 8 stills
ST165a	721 880.2	6 005 274.3	721 856.4	6 005 488.5	56.0	215.5	Video 07 min 42 sec 18 stills
ST166	719 326.5	6 007 982.1	719 296.3	6 008 035.4	58.1	61.3	Video 02 min 15 sec 6 stills
ST167	719 272.9	6 008 064.8	719 253.9	6 008 119.1	58.1	57.5	Video 02 min 28 sec 8 stills
ST168	717 946.7	6 009 626.6	717 967.2	6 009 580.1	55.7	50.8	Video 02 min 48 sec 8 stills
ST169	716 651.5	6 011 152.2	716 670.9	6 011 098.8	55.5	56.8	Video 02 min 27 sec 9 stills
ST170	716 008.0	6 012 946.6	715 978.6	6 012 997.3	57.3	58.6	Video 04 min 43 sec 21 stills
ST171	715 489.8	6 014 883.9	715 478.2	6 014 930.9	59.7	52.0*	Video 02 min 18 sec 10 stills
ST172	714 879.1	6 017 301.3	714 846.9	6 017 359.7	58.4	66.6	Video 02 min 41 sec 7 stills
ST173	714 494.4	6 018 753.5	714 463.0	6 018 804.5	59.0	59.9	Video 02 min 20 sec 8 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST174a	714 303.8	6 020 409.0	714 325.6	6 020 217.5	57.9	192.8	Video 08 min 19 sec 25 stills
ST175a	714 089.7	6 022 781.8	714 125.0	6 022 731.3	57.4	61.6	Video 02 min 43 sec 10 stills
ST176	714 250.1	6 024 616.2	714 307.0	6 024 826.0	59.1	217	Video 07 min 34 sec 25 stills
ST177	714 656.7	6 026 663.5	714 675.5	6 026 713.8	62.2	54	Video 02 min 31 sec 9 stills
ST178	715 066.7	6 028 625.3	715 076.5	6 028 672.5	67.9	49.4*	Video 02 min 06 sec 6 stills
ST179	715 472.6	6 030 572.4	715 458.5	6 030 631.9	66.2	61.1	Video 02 min 58 sec 13 stills
ST180	716 033.5	6 032 521.3	715 995.7	6 032 563.5	63.8	56.6	Video 01 min 42 sec 10 stills
ST181	715 911.1	6 034 526.4	715 802.7	6 034 348.4	63.3	208.4	Video 08 min 09 sec 20 stills
ST182	714 960.0	6 036 274.4	714 974.8	6 036 210.7	63.0	65.3	Video 02 min 55 sec 9 stills
ST183	713 897.5	6 038 495.6	713 913.7	6 038 438.6	63.1	59.3	Video 02 min 16 sec 9 stills
ST184	712 891.7	6 040 559.7	712 902.5	6 040 501.2	64.8	59.6	Video 02 min 03 sec 9 stills
ST185	712 763.0	6 041 687.3	712 721.6	6 041 768.4	66.4	91.0	Video 03 min 32 sec 11 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST186	713 641.2	6 043 353.6	713 556.3	6 043 686.4	71.7	343.5	Video 10 min 48 sec 29 stills
ST187	714 485.2	6 045 297.4	714 463.3	6 045 352.0	73.0	58.8	Video 02 min 34 sec 9 stills
ST188	715 372.4	6 047 012.0	715 346.0	6 047 265.3	66.5	254.7	Video 07 min 06 sec 19 stills
ST189	715 957.9	6 049 007.6	715 943.7	6 048 960.3	67.4	51.2*	Video 01 min 46 sec 5 stills
ST190	715 212.3	6 050 868.3	715 166.2	6 050 838.0	66.0	55.14	Video 01 min 49 sec 8 stills
ST191	714 375.7	6 052 694.1	714 351.2	6 052 649.6	65.3	50.82	Video 02 min 41 sec 7 stills
ST192	713 516.3	6 054 504.6	713 574.3	6 054 477.1	64.4	64.24	02 min 19 sec 6 stills
ST193a	713 049.6	6 056 150.4	712 957.2	6 055 965.0	65.1	207.2	Video 06 min 09 sec 13 stills
ST194	712 824.8	6 058 359.6	712 849.1	6 058 316.1	68.5	53.1*	Video 02 min 11 sec 5 stills
ST195	712 291.0	6 060 298.1	712 329.8	6 060 254.4	62.2	58.5	Video 01 min 46 sec 6 stills
ST196	711 768.3	6 062 173.5	711 746.7	6 062 218.9	62.1	50.2	Video 02 min 02 sec 8 stills
ST197	711 165.6	6 064 073.3	711 138.4	6 064 127.7	62.1	60.8	Video 01 min 58 sec 8 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST198	710 530.4	6 065 582.2	710 443.9	6 065 761.6	63.9	199.1	Video 05 min 46 sec 31 stills
ST199	709 712.6	6 067 801.5	709 668.7	6 067 843.4	66.7	60.7	Video 02 min 07 sec 12 stills
ST200	709 029.8	6 069 561.8	708 981.7	6 069 596.2	68.0	59.2	Video 01 min 57 sec 13 stills
ST201	708 000.7	6 072 195.5	707 994.7	6 072 252.3	70.2	57.1	Video 02 min 04 sec 9 stills
ST202	707 510.6	6 073 440.0	707 485.8	6 073 389.7	70.6	56.1	Video 01 min 54 sec 10 stills
ST203	706 793.3	6 075 381.0	706 756.4	6 075 178.1	74.0	206.2	Video 08 min 55 sec 21 stills
ST204	706 054.2	6 077 168.6	706 056.7	6 077 114.4	75.3	54.3	Video 02 min 36 sec 8 stills
ST205	705 316.4	6 079 028.8	705 320.9	6 078 975.2	73.9	53.8	Video 03 min 40 sec 12 stills
ST206	704 587.4	6 080 883.6	704 639.0	6 080 877.4	74.3	52.0	Video 02 min 14 sec 9 stills
ST207	703 852.6	6 082 739.8	703 892.2	6 082 761.8	77.2	67.3*	Video 02 min 22 sec 13 stills
ST208	703 023.5	6 084 605.1	703 190.0	6 084 545.4	76.5	176.8	Video 06 min 19 sec 34 stills
ST209	702 395.4	6 086 471.0	702 429.1	6 086 427.5	74.6	55.0	Video 02 min 12 sec 13 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST210	701 405.8	6 088 771.3	701 623.9	6 088 742.6	68.1	220.0	Video 08 min 23 sec 38 stills
ST211	700 938.9	6 090 166.6	700 974.7	6 090 207.5	72.3	54.3	Video 02 min 28 sec 14 stills
ST212	700 224.7	6 092 024.5	700 258.7	6 092 073.9	70.8	60.0	Video 02 min 04 sec 11 stills
ST213	699 521.1	6 093 890.1	699 508.0	6 093 939.6	71.3	51.2	02 min 12 sec 17 stills
ST214	698 695.3	6 096 011.5	698 691.1	6 096 082.1	71.6	70.7	Video 02 min 28 sec 15 stills
ST215	697 992.9	6 097 685.2	697 954.8	6 097 934.0	72.3	251.7	Video 10 min 33 sec 35 stills
ST217	696 610.5	6 101 397.7	696 603.4	6 101 335.8	70.6	62.3	Video 03 min 54 sec 12 stills
ST218	696 144.3	6 102 667.5	696 159.5	6 102 457.5	70.1	210.5	Video 11 min 28 sec 30 stills
ST219	695 141.4	6 105 116.9	695 146.1	6 105 062.4	71.3	54.7	Video 04 min 06 sec 11 stills
ST221	693 678.1	6 108 841.6	693 701.3	6 108 787.2	71.3	59.1	Video 03 min 29 sec 11 stills
ST223	692 205.1	6 112 645.6	692 180.6	6 112 461.6	70.7	185.7	Video 09 min 40 sec 16 stills
ST225	690 765.3	6 116 291.9	690 820.1	6 116 266.1	71.1	60.6	Video 03 min 02 sec 8 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST227	689 048.2	6 120 296.2	689 049.7	6 120 363.9	71.7	67.7	Video 02 min 40 sec 9 stills
ST228	688 492.5	6 121 637.9	688 348.6	6 121 852.8	72.7	258.7	Video 10 min 01 sec 28 stills
ST229	687 691.8	6 123 617.2	687 659.3	6 123 651.3	73.0	47.5*	Video 01 min 46 sec 10 stills
ST231	686 184.6	6 127 366.6	686 186.5	6 127 314.6	74.3	52.0	Video 02 min 16 sec 13 stills
ST233	684 709.8	6 131 088.8	684 726.3	6 131 032.6	71.3	58.6	Video 02 min 03 sec 11 stills
ST235	683 320.6	6 134 832.1	683 159.1	6 134 702.9	71.4	206.8	Video 07 min 20 sec 28 stills
ST236	682 505.8	6 136 657.0	682 465.0	6 136 645.3	69.8	52.7*	Video 02 min 02 sec 8 stills
ST237	681 756.9	6 138 527.7	681 750.6	6 138 464.9	69.8	63.1	Video 03 min 11 sec 11 stills
ST238	681 533.4	6 140 506.7	681 539.5	6 140 451.9	67.7	55.1	Video 02 min 56 sec 9 stills
ST239	681 356.1	6 142 575.5	681 305.2	6 142 371.0	66.9	210.8	Video 08 min 50 sec 25 stills
ST240	681 150.2	6 144 420.1	681 141.9	6 144 487.4	69.6	67.8	Video 03 min 00 sec 9 stills
ST241	680 938.8	6 146 423.7	680 952.0	6 146 479.2	69.2	57.0	Video 02 min 07 sec 8 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST242	680 729.7	6 148 408.0	680 718.4	6 148 464.9	70.1	58.0	Video 03 min 01 sec 10 stills
ST243	679 357.8	6 149 812.2	679 341.3	6 149 864.1	69.5	54.4	Video 02 min 11 sec 8 stills
ST244	679 022.8	6 151 761.0	678 994.1	6 151 815.0	72.0	61.1	02 min 24 sec 19 stills
ST245	678 724.5	6 153 791.7	678 920.1	6 153 707.7	72.8	212.9	Video 05 min 41 sec 43 stills
ST246a	678 549.9	6 155 740.7	678 532.9	6 155 788.6	74.5	50.8	Video 02 min 37 sec 17 stills
ST247	678 289.1	6 157 774.8	678 272.4	6 157 722.9	69.8	54.6	Video 02 min 40 sec 9 stills
ST248	678 045.0	6 159 756.8	678 039.0	6 159 708.8	70.6	53.6*	Video 02 min 44 sec 11 stills
ST249	677 809.1	6 161 744.4	677 796.0	6 161 693.9	73.0	52.1	Video 02 min 33 sec 10 stills
ST250	677 596.1	6 163 625.5	677 545.9	6 163 820.9	79.0	201.8	Video 07 min 44 sec 26 stills
ST251	677 350.5	6 165 679.6	677 310.9	6 165 710.1	74.5	52.2*	Video 01 min 52 sec 9 stills
ST252	677 100.9	6 167 650.2	677 098.5	6 167 708.0	74.9	57.9	Video 01 min 42 sec 9 stills
ST253	676 859.9	6 169 687.1	676 834.2	6 169 635.8	75.7	57.4	Video 02 min 32 sec 10 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST254	676 627.5	6 171 656.6	676 616.0	6 171 617.2	75.6	43.5*	Video 02 min 11 sec 12 stills
ST255	676 309.6	6 173 710.6	676 412.8	6 173 535.5	78.8	203.3	Video 06 min 54 sec 25 stills
ST256a	676 126.4	6 175 595.6	676 103.5	6 175 630.8	78.7	43.5*	Video 01 min 26 sec 8 stills
ST257	675 866.7	6 177 617.5	675 915.1	6 177 591.8	79.0	54.8	Video 02 min 07 sec 7 stills
ST258	675 683.9	6 179 724.0	675 758.4	6 179 535.1	70.5	203.1	Video 08 min 37 sec 29 stills
ST259	675 463.7	6 181 600.1	675 438.5	6 181 553.3	81.6	53.2	Video 02 min 15 sec 10 stills
ST260	676 032.2	6 183 493.5	675 833.6	6 183 544.4	86.2	205.0	Video 06 min 25 sec 22 stills
ST261	676 195.8	6 185 477.4	676 149.0	6 185 502.4	85.0	53.1	Video 02 min 13 sec 9 stills
ST262	675 191.2	6 187 117.5	675 138.8	6 187 113.4	78.5	52.6	Video 02:14 sec 13 stills
ST263	674 097.7	6 188 780.2	674 045.9	6 188 799.2	73.0	55.2	Video 02 min:31 sec 9 stills
ST264	673 421.5	6 190 642.8	673 380.7	6 190 678.8	73.9	54.4	Video 02 min 05 sec 11 stills
ST265	672 787.5	6 192 656.8	672 562.1	6 192 667.7	75.0	225.7	Video 09 min 21 sec 36 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST267	671 848.7	6 196 476.8	671 875.3	6 196 431.3	77.2	52.7	Video 02 min 44 sec 10 stills
ST269	670 962.0	6 200 375.6	670 929.2	6 200 335.8	75.3	51.6	Video 02 min 16 sec 9 stills
ST270a	670 507.2	6 201 920.3	670 444.2	6 201 592.4	76.2	333.9	Video 16 min 39 sec 57 stills
ST271	670 084.1	6 204 274.2	670 039.3	6 204 240.5	88.4	56.0	Video 04 min 39 sec 10 stills
ST273	669 206.3	6 208 162.7	669 153.2	6 208 127.9	73.8	63.4	Video 04 min 09 sec 11 stills
ST275	668 261.7	6 212 158.4	668 289.7	6 211 950.3	84.6	210.0	Video 13 min 52 sec 20 stills
ST277a	667 501.9	6 215 939.8	667 491.3	6 215 995.7	78.6	56.9	Video 03 min 17 sec 9 stills
ST279	666 822.6	6 219 883.7	666 817.8	6 219 937.4	76.5	53.9	Video 02 min 39 sec 11 stills
ST280	666 468.3	6 221 806.4	666 477.7	6 221 997.8	75.5	191.7	Video 09 min 10 sec 23 stills
ST281	666 158.6	6 223 824.2	666 174.1	6 223 884.5	78.3	62.3	Video 02 min 59 sec 9 stills
ST283	665 505.8	6 227 779.9	665 513.5	6 227 832.7	72.1	53.4	Video 01 min 54 sec 8 stills
ST285	664 860.3	6 231 833.7	664 809.8	6 231 633.0	67.1	207.0	Video 05 min 55 sec 24 stills

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]							
Station	SOL		EOL		Depth [m BSL]	Length [m]	Data Acquisition
	Easting	Northing	Easting	Northing			
ST287	664 185.1	6 235 720.4	664 181.7	6 235 665.4	69.5	55.1	Video 02 min 04 sec 11 stills
ST289	663 529.1	6 239 662.1	663 498.1	6 239 614.0	70.2	57.3	Video 01 min 52 sec 9 stills
ST290	663 251.8	6 241 688.0	663 122.5	6 241 535.9	70.5	199.6	Video 05 min 28 sec 29 stills
ST291	662 880.4	6 243 569.8	662 860.8	6 243 612.6	71.8	46.9*	Video 01 min 18 sec 9 stills
ST293	662 211.1	6 247 501.0	662 185.8	6 247 548.1	71.9	53.5	Video 01 min 48 sec 7 stills
ST295a	661 533.5	6 251 377.5	661 545.6	6 251 577.7	73.0	200.5	Video 07 min 32 sec 29 stills
ST297	660 913.2	6 255 426.1	660 853.5	6 255 453.7	72.1	65.8	Video 03 min 15 sec 10 stills
ST299	660 247.5	6 259 389.7	660 201.7	6 259 334.4	74.1	71.8	Video 02 min 50 sec 8 stills
ST301	678 571.1	6 156 211.2	678 556.2	6 156 014.3	71.1	197.4	Video 07 min 22 sec 34 stills

Notes
*Distances calculated by using the sum of all eastings and northings in the track log data output from the video
**Stations with 'a' have been repeated due to bad quality video data or due to technical issues with the first recording
BSL = Below sea level
SOL = Start of line
EOL = End of line
UTC = Coordinated universal time

4.2 Seafloor Sampling

Grab samples were successfully acquired at all 207 proposed grab stations, as detailed in Section 2. Two macrofaunal samples (FA, FB) were collected at 104 of the proposed 115 and two physico-chemical sample (PCA, PCB) were collected at 108 of the 124 proposed stations; three replicates for macrofauna and physical chemical samples were collected at 11 of the 14 proposed stations located within the Holderness Offshore MCZ. Single PSD samples were collected from all proposed 101 stations. eDNA samples were collected at 22 of the 23 proposed stations. Partial suites were collected at stations ST020, ST022, and ST037 whereas no samples were collected at the remaining 15 unsuccessful grab stations (Table 4.2). This was due to sediment type, with the stations abandoned after at least 3 failed attempts (as agreed by the client). Stations ST016-ST018 were not attempted due to the potential presence of the Annex I habitat 'Stony reef'.

Table 4.2: Completed sediment sampling stations

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST001	723 121.4	5 908 516.2	10.8	PSD
ST002	724 771.4	5 909 617.6	11.8	FA, FB, PC
ST003	726 536.1	5 911 222.5	16.6	PSD
ST004	727 091.9	5 912 689.9	17.8	FA, FB, PC
ST005	727 174.4	5 914 642.4	16.9	PSD
ST006a	726 229.1	5 916 386.0	16.7	FA, FB, PC
ST007	724 888.1	5 918 063.5	14.8	FA, FB, PC
ST008	724 519.4	5 920 385.9	13.2	PSD
ST010	723 262.5	5 923 105.0	10.5	FA, FB, PC, eDNA
ST013	722 827.1	5 928 646.2	13.0	PSD
ST015	726 309.2	5 930 414.7	15.2	PSD
ST019	733 449.9	5 933 602.1	18.9	PSD
ST020	732 618.2	5 935 572.5	16.9	FA, FB, PC, eDNA
ST021	734 431.5	5 937 089.8	19.5	PSD
ST022	735 694.1	5 938 632.3	21.4	PSD
ST023	737 157.0	5 940 141.5	22.0	PSD
ST025	739 412.9	5 943 292.8	22.6	PSD
ST026	740 537.7	5 944 963.6	18.4	FA, FB, PC
ST027	741 449.7	5 946 397.2	19.9	PSD
ST028	742 525.9	5 948 894.7	26.9	PSD
ST029	743 763.5	5 951 321.8	26.7	PSD
ST030	744 198.3	5 952 458.9	17.3	FA, FB, FC, PC, eDNA
ST032	744 505.0	5 953 358.6	28.1	PSD

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST033	744 752.2	5 954 219.3	28.2	FA, FB, PC
ST036	745 073.2	5 955 093.2	24.0	PSD
ST039	745 550.6	5 956 101.8	26.1	FA, FB, FC, PC
ST041	745 887.0	5 956 993.0	30.9	PSD
ST043	746 330.3	5 957 937.4	31.5	FA, FB, FC, PC
ST045	746 810.0	5 958 918.5	29.3	PSD
ST047	747 054.0	5 959 898.5	22.0	FA, FB, FC, PC
ST049	747 282.4	5 960 872.7	30.9	FA, FB, FC, PC
ST051	747 472.1	5 961 824.2	31.3	FA, PC
ST053	746 708.1	5 962 748.2	34.2	PSD
ST055	747 147.4	5 963 787.7	32.7	FA, FB, FC, PC
ST057	747 088.4	5 964 799.7	32.7	PSD
ST059	746 992.7	5 965 789.7	32.4	FA, FB, FC, PC
ST061	746 712.8	5 966 763.3	29.1	PSD
ST063	746 475.0	5 967 713.3	30.7	FA, FB, PC, eDNA
ST065	746 185.3	5 968 585.6	34.6	PSD
ST067	746 000.1	5 969 428.7	32.3	FA, FB, FC, PC
ST069	745 824.6	5 970 127.3	34.7	PSD
ST071	745 690.2	5 970 607.3	33.7	FA, FB, FC, PC
ST074	745 418.5	5 971 576.5	36.8	PSD
ST078	744 874.2	5 973 293.1	36.9	PC, PSD
ST079	744 414.1	5 973 801.9	37.5	PSD
ST081	742 734.7	5 974 822.6	40.5	FA, FB, PC
ST082	742 187.4	5 976 742.2	41.9	PSD
ST085	741 544.8	5 979 318.1	41.1	PSD
ST087	746 738.1	5 950 095.8	32.1	PC
ST088	741 026.4	5 981 360.8	42.1	PC
ST089	740 785.4	5 982 069.7	44.4	PSD
ST090	740 642.5	5 982 534.2	45.4	FA, FB, PC
ST091	740 320.0	5 983 437.6	43.8	PSD
ST092	739 456.5	5 985 763.3	48.1	PSD
ST094	745 738.5	5 950 058.8	31.2	PSD
ST096	749 063.1	5 950 291.9	21.8	PSD
ST097	750 637.2	5 950 825.0	48.8	FA, FB, FC, PC, eDNA
ST103	753 324.0	5 952 164.6	28.5	PSD

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST105*	754 187.9	5 952 627.8	28.4	FA, FB, FC, PC
ST107	756 149.5	5 954 049.1	26.4	PSD
ST109	756 392.5	5 958 047.5	26.9	PSD
ST110	756 514.8	5 960 044.3	27.0	PSD
ST111	756 525.4	5 961 787.0	32.7	FA, FB, PC, eDNA
ST112	756 705.3	5 964 025.4	32.8	PSD
ST113	756 435.7	5 966 016.7	35.0	PSD
ST114	755 813.7	5 967 784.9	36.1	PSD
ST117	755 720.5	5 969 687.2	26.2	PC
ST118	755 709.4	5 969 837.0	38.3	FA, FB, PC
ST119	755 591.1	5 971 853.8	41.4	PSD
ST121	754 584.1	5 973 433.7	42.8	FA, FB, PC
ST123	751 465.5	5 975 965.9	42.0	FA, FB, PC
ST124	749 905.7	5 977 214.6	40.7	PSD
ST125	748 346.8	5 978 477.6	41.5	FA, FB, PC, PSD, eDNA
ST126	746 793.0	5 979 700.3	41.9	PSD
ST127	746 269.6	5 980 156.7	40.0	PSD
ST128	745 246.9	5 980 971.5	44.2	FA, FB, PC
ST129	744 895.8	5 981 257.8	41.1	PSD
ST130	744 305.9	5 981 758.4	41.7	PC
ST132	742 960.2	5 982 889.1	44.3	PSD
ST133	742 169.6	5 983 528.8	42.3	FA, FB, PC
ST136	740 618.7	5 984 798.8	47.7	PSD
ST138	740 138.7	5 985 204.8	47.6	PC
ST139	739 143.8	5 986 134.5	48.5	FA, FB, PC, eDNA
ST140	738 950.3	5 986 381.5	46.9	PSD
ST143	737 652.6	5 988 007.4	45.2	PSD
ST146	736 959.5	5 988 875.6	45.3	PC
ST147	736 644.3	5 989 273.4	46.6	FA, FB, PC
ST148	736 644.3	5 989 273.4	46.6	PSD
ST149	736 384.8	5 989 615.9	45.0	PSD
ST150	735 062.7	5 993 046.9	47.3	FA, FB, PC, eDNA
ST151	734 918.7	5 993 713.7	48.6	PC
ST152	734 329.4	5 994 528.5	49.1	PSD
ST154	732 691.2	5 995 682.1	51.3	FA, FB, PC

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST156	730 995.3	5 996 747.0	53.3	PSD
ST158	729 162.2	5 997 946.2	53.1	FA, FB, PC
ST159	728 492.1	5 998 388.3	52.4	PC
ST160	727 625.2	5 998 906.1	52.8	PC
ST161	725 910.0	5 999 911.3	52.1	FA, FB, PC
ST162	724 035.0	6 000 583.5	52.0	PSD
ST163	722 536.8	6 001 645.6	52.9	FA, FB, PC
ST164	722 600.4	6 003 861.8	55.8	PSD
ST165	721 876.1	6 005 361.5	56.3	FA, FB, PC, eDNA
ST166	719 321.0	6 008 017.7	58.2	PSD
ST167	719 262.6	6 008 068.4	57.7	FA, FB, PC
ST168	717 954.6	6 009 598.9	56.1	PSD
ST169	716 666.2	6 011 127.8	56.8	FA, FB, PC
ST170	715 983.0	6 012 946.2	57.4	PSD
ST171	715 476.5	6 014 881.1	37.3	FA, FB, PC
ST172	714 870.9	6 017 331.7	49.4	PSD
ST173	714 460.9	6 018 767.1	58.9	FA, FB, PC
ST174a	714 281.1	6 020 318.3	57.4	PSD
ST175	714 110.1	6 022 763.3	57.5	FA, FB, PC, eDNA
ST176	714 283.7	6 024 719.1	57.2	PSD
ST177	714 677.6	6 026 667.3	62.7	FA, FB, PC
ST178	715 081.8	6 028 629.1	67.7	PSD
ST179	715 470.1	6 030 590.2	65.6	FA, FB, PC
ST180	716 019.4	6 032 538.4	63.9	PSD
ST181	715 847.4	6 034 441.0	62.7	FA, FB, PC
ST182	714 966.9	6 036 253.4	62.7	PSD
ST183	713 910.8	6 038 467.8	63.6	FA, FB, PC
ST184	712 889.9	6 040 530.4	66.0	PSD
ST185	712 736.9	6 041 711.6	67.4	FA, FB, PC, eDNA
ST186	713 586.6	6 043 518.8	72.8	PSD
ST187	714 482.7	6 045 322.4	73.2	FA, FB, PC
ST188	715 376.0	6 047 118.5	66.9	PSD
ST189	715 935.6	6 048 993.7	67.1	FA, FB, PC
ST190	715 202.1	6 050 869.8	66.0	PSD
ST191	714 374.3	6 052 679.0	65.6	FA, FB, PC

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST192	713 541.3	6 054 490.7	64.7	PSD
ST193	713 022.8	6 056 059.8	66.5	FA, FB, PC
ST194	712 837.4	6 058 358.4	68.5	PSD
ST195	712 303.8	6 060 271.5	63.0	FA, FB, PC, eDNA
ST196	711 760.7	6 062 193.2	62.6	PSD
ST197	711 155.1	6 064 083.7	63.2	FA, FB, PC
ST198	710 442.7	6 065 763.5	65.8	PSD
ST199	709 700.4	6 067 803.5	67.6	FA, FB, PC
ST200	709 016.2	6 069 575.1	68.3	PSD
ST201	708 006.0	6 072 214.8	70.3	FA, FB, PC
ST202	707 506.1	6 073 422.2	71.0	PSD
ST203	706 796.9	6 075 293.0	74.0	FA, FB, PC
ST204	706 060.4	6 077 151.9	75.9	PSD
ST205	705 319.2	6 079 018.8	74.0	FA, FB, PC, eDNA
ST206	704 618.0	6 080 883.3	75.2	PSD
ST207	703 853.4	6 082 730.5	78.7	FA, FB, PC
ST208	703 145.0	6 084 602.1	76.9	PSD
ST209	702 411.5	6 086 470.7	75.1	FA, FB, PC
ST210	701 513.9	6 088 737.8	69.4	PSD
ST211	700 956.9	6 090 183.5	73.0	FA, FB, PC
ST212	700 231.2	6 092 029.6	72.1	PSD
ST113	699 506.6	6 093 903.4	71.4	FA, FB, PC
ST214	698 684.2	6 096 047.3	72.5	PSD
ST215	697 977.6	6 097 826.6	72.5	FA, FB, PC, eDNA
ST217	696 594.4	6 101 365.6	71.2	FA, FB, PC
ST219	695 135.9	6 105 107.2	71.4	FA, FB, PC
ST221	693 687.5	6 108 815.5	70.2	FA, FB, PC
ST223	692 237.9	6 112 555.4	71.6	FA, FB, PC
ST225	690 773.8	6 116 268.1	71.6	FA, FB, PC, eDNA
ST227	689 054.7	6 120 334.5	72.0	FA, FB, PC
ST229	687 668.5	6 123 608.8	73.6	FA, FB, PC
ST231	686 197.7	6 127 362.9	73.2	FA, FB, PC
ST233	684 727.6	6 131 059.4	72.2	FA, FB, PC
ST235	683 240.0	6 134 785.1	71.0	FA, FB, PC, eDNA
ST236	682 512.0	6 136 633.1	70.2	PSD

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST237	681 764.8	6 138 507.6	70.3	FA, FB, PC
ST238	681 537.9	6 140 467.7	67.5	PSD
ST239	681 346.2	6 142 454.5	68.2	FA, FB, PC
ST240	681 146.5	6 144 461.5	70.6	PSD
ST241	680 951.5	6 146 442.1	70.1	FA, FB, PC
ST242	680 724.2	6 148 430.4	71.0	PSD
ST243	679 358.9	6 149 825.9	70.2	FA, FB, PC
ST244	679 025.2	6 151 783.5	72.4	PSD
ST245	678 776.3	6 153 770.4	73.8	FA, FB, PC, eDNA
ST246	678 527.9	6 155 760.2	75.7	PSD
ST248	678 036.9	6 159 738.0	71.3	PSD
ST249	677 808.1	6 161 734.1	73.1	FA, FB, PC
ST250	677 581.4	6 163 688.4	79.0	PSD
ST251	677 342.2	6 165 706.1	72.1	FA, FB, PC
ST252	677 099.9	6 167 670.4	74.8	PSD
ST253	676 849.7	6 169 640.7	76.0	FA, FB, PC
ST254	676 619.6	6 171 651.3	76.2	PSD
ST255	676 363.8	6 173 651.7	77.8	FA, FB, PC, eDNA
ST256	676 118.5	6 175 629.6	80.0	PSD
ST257	675 878.5	6 177 615.8	79.8	FA, FB, PC
ST259	675 456.5	6 181 587.7	81.6	FA, FB, PC
ST260	675 955.1	6 183 505.0	85.9	PSD
ST261[†]	676 175.7	6 185 492.4	84.9	FA, FB, PC
ST262	675 166.3	6 187 105.2	78.3	PSD
ST263	674 077.7	6 188 789.4	72.9	FA, FB, PC
ST264	673 395.7	6 190 655.3	74.4	PSD
ST265	672 687.4	6 192 651.8	75.4	FA, PC, eDNA
ST267	671 863.0	6 196 446.9	77.4	FA, FB, PC
ST269	670 963.6	6 200 339.6	76.4	FA, FB, PC
ST271	670 075.0	6 204 251.4	88.2	FA, FB, PC
ST273	669 194.2	6 208 146.1	74.2	FA, FB, PC
ST275	668 290.5	6 212 070.8	83.2	FA, FB, PC
ST277	667 474.9	6 215 972.0	78.6	FA, FB, PC
ST279	666 834.3	6 219 914.0	76.9	FA, FB, PC
ST281	666 161.3	6 223 848.8	78.7	FA, FB, PC

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]				
Station	Easting	Northing	Depth [m BSL]	Sample Acquisition
ST283	665 498.7	6 227 789.8	72.7	FA, FB, PC
ST285	664 844.4	6 231 741.1	70.1	FA, FB, PC, eDNA
ST287	664 186.0	6 235 711.5	70.0	FA, FB, PC
ST289	663 534.0	6 239 640.9	70.2	FA, FB, PC
ST291	662 872.2	6 243 586.1	71.9	FA, FB, PC
ST293	662 204.4	6 247 514.6	72.0	FA, FB, PC
ST295	661 532.7	6 251 457.5	74.8	FA, FB, PC, eDNA
ST297	660 884.8	6 255 399.0	70.9	FA, FB, PC
ST299	660 229.9	6 259 363.8	74.9	FA, FB, PC

Notes
Coordinates presented for PSD / PC grab samples
BSL = Below sea level
PC = Physico-chemical sample
FA/FB/FC = Faunal sample A, B or C
eDNA = Sediment environmental DNA sample
* = smaller sample accepted
† = Fix for FA

4.3 Seawater Sampling

Seawater samples were successfully acquired at all 23 proposed stations. One WeDNA sample was retained at all 23 stations at two separate depths: near-surface (TOP) and near seafloor (BOT) (Table 4.3).

Table 4.3: Completed seawater sampling stations

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]					
Station	Easting	Northing	Depth [m BSL]		Sample and Data Acquisition
			Top	Bottom	
ST010	723 246.3	5 923 083.7	3.3	7.0	WeDNA
ST020	732 625.8	5 935 580.9	-	8.1	WeDNA
ST030	744 209.3	5 952 427.2	5.1	26.7	WeDNA
ST063	746 452.8	5 967 724.9	5.7	30.0	WeDNA
ST097	750 653.1	5 950 752.8	3.8	46.6	WeDNA
ST111	756 483.5	5 961 711.4	11.0	25.7	WeDNA
ST125	748 368.9	5 978 468.2	3.5	39.5	WeDNA
ST139	739 139.8	5 986 154.5	8.7	45.9	WeDNA
ST150	735 057.5	5 993 030.0	8.9	43.9	WeDNA
ST165	721 873.1	6 005 381.0	13.8	55.2	WeDNA
ST175	714 120.6	6 022 764.7	2.4	52.5	WeDNA

Geodetic Parameters: ETRS89, UTM Zone 30N, CM 3° W [m]					
Station	Easting	Northing	Depth [m BSL]		Sample and Data Acquisition
			Top	Bottom	
ST185	712 756.0	6 041 710.7	-	62.8	WeDNA
ST195	712 305.7	6 060 295.4	4.0	58.3	WeDNA
ST205	705 323.5	6 078 983.3	1.0	69.2	WeDNA
ST215	697 995.5	6 097 818.5	8.1	67.2	WeDNA
ST225	690 787.7	6 116 255.3	4.0	68.9	WeDNA
ST235	683 236.6	6 134 800.4	2.7	67.9	WeDNA
ST265	672 695.1	6 192 667.3	2.9	71.6	WeDNA
ST295	661 533.3	6 251 453.7	2.9	70.3	WeDNA
ST285	664 866.8	6 231 744.4	2.5	67.8	WeDNA
ST275	668 277.3	6 212 064.7	0.6	74.5	WeDNA
ST255	676 363.4	6 173 648.1	3.9	77.1	WeDNA
ST245	678 771.4	6 153 779.0	1.0	69.8	WeDNA

Notes
Coordinates presented for TOP samples
Where the depth is missing, no positional fix was acquired for the USBL. The vessel fix was used for the position but the sampling depth was not available
BSL = Below sea level
WeDNA = Seawater environmental DNA sample

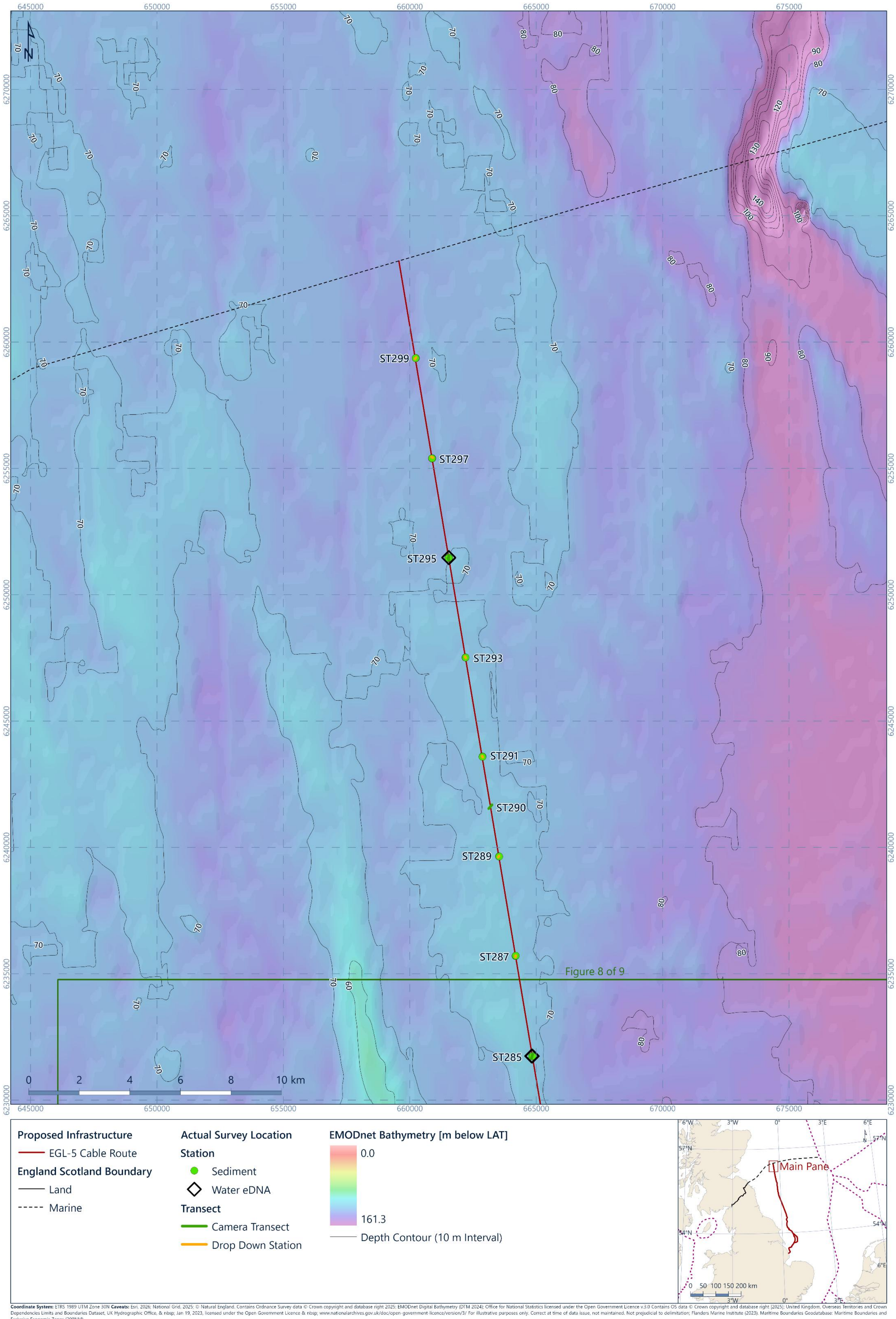


Figure 4.1: Completed survey locations overlaid on bathymetry, station ST285 to station ST299

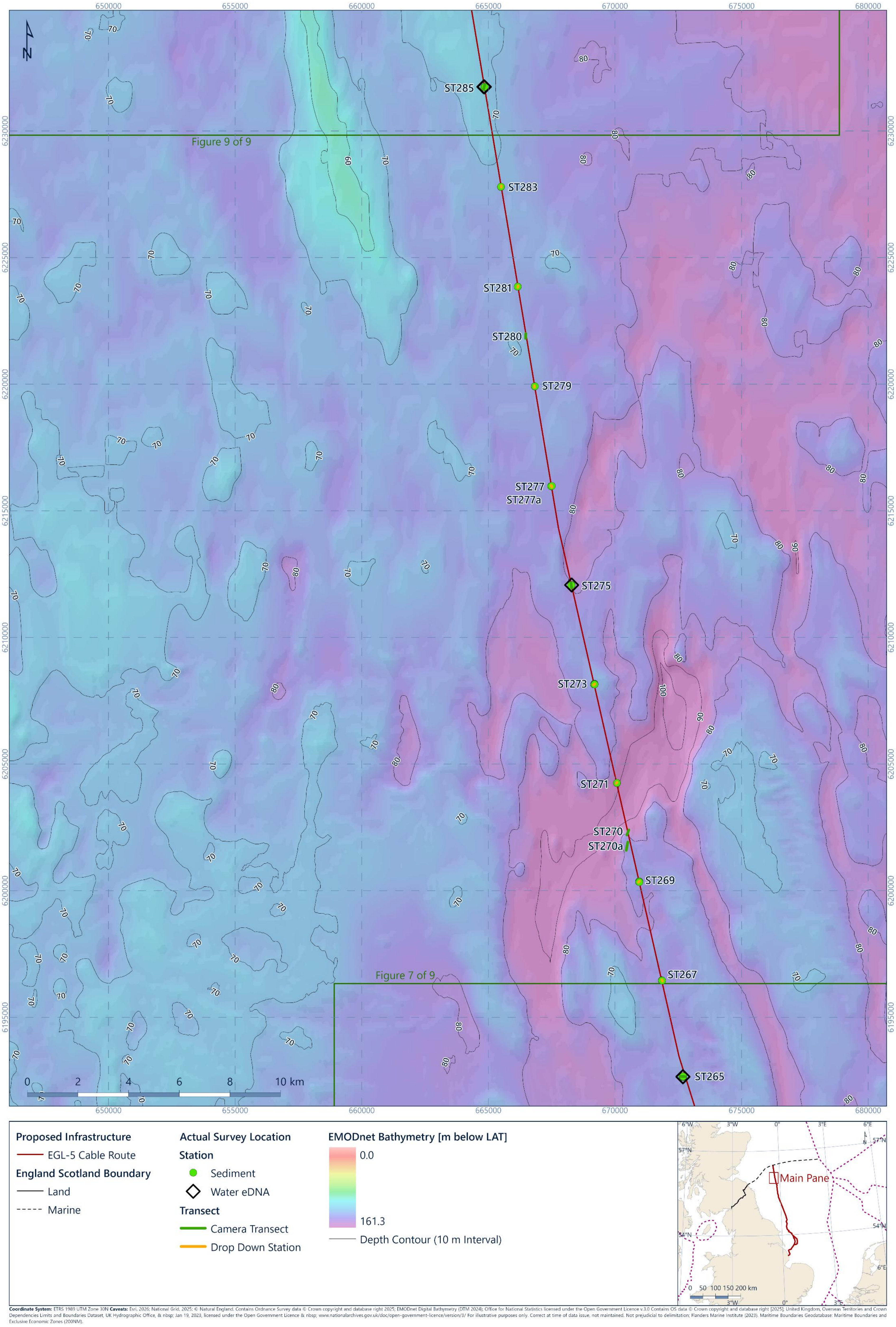


Figure 4.2: Completed survey locations overlaid on bathymetry, station ST265 to station ST285

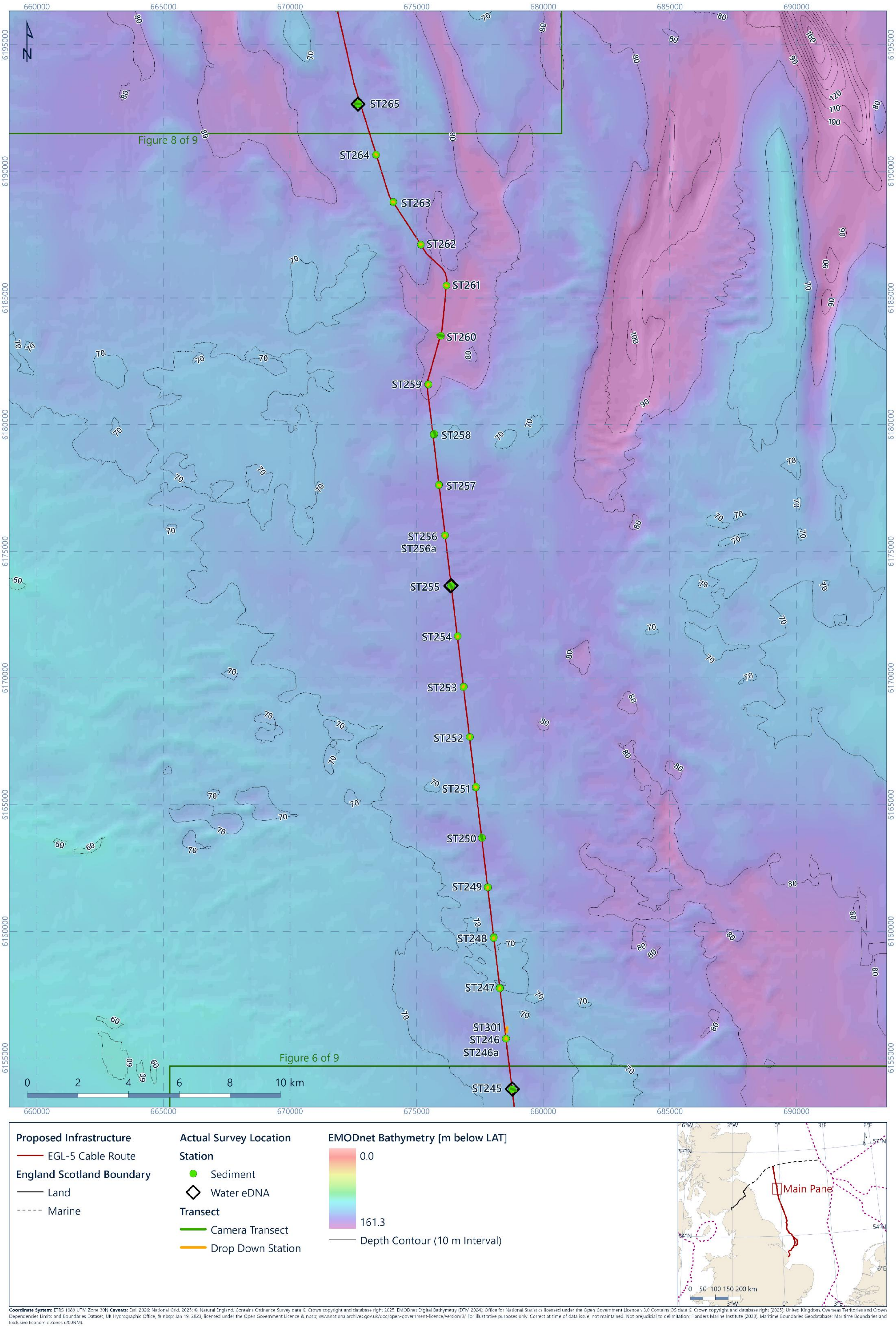
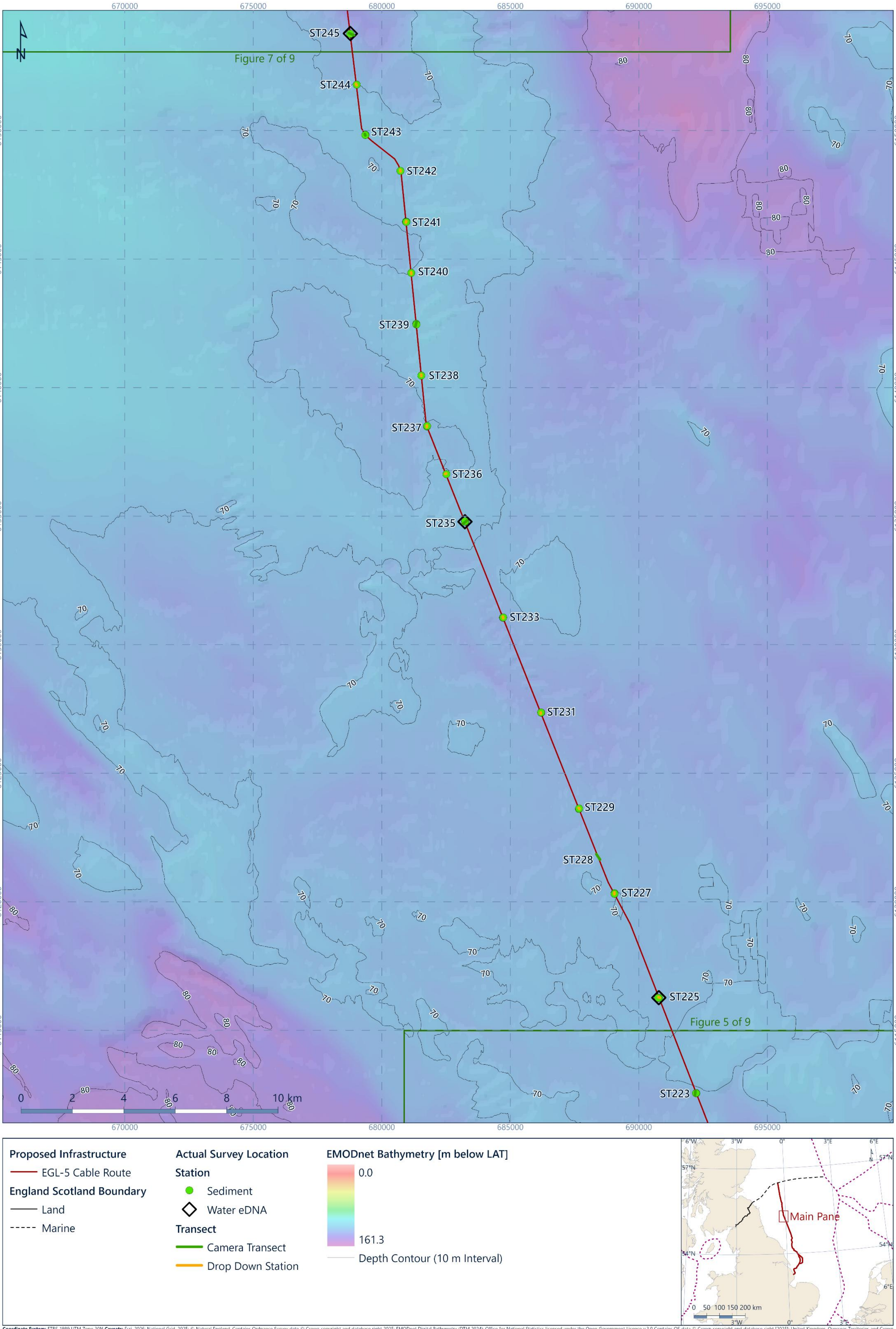


Figure 4.3: Completed survey locations overlaid on bathymetry, station ST245 to station ST265



Coordinate System: ETRS 1989 UTM Zone 30N **Caveats:** Esri, 2026; National Grid, 2025; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2025; EMODnet Digital Bathymetry (DTM 2024); Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM).

Figure 4.4: Completed survey locations overlaid on bathymetry, station ST223 to station ST245

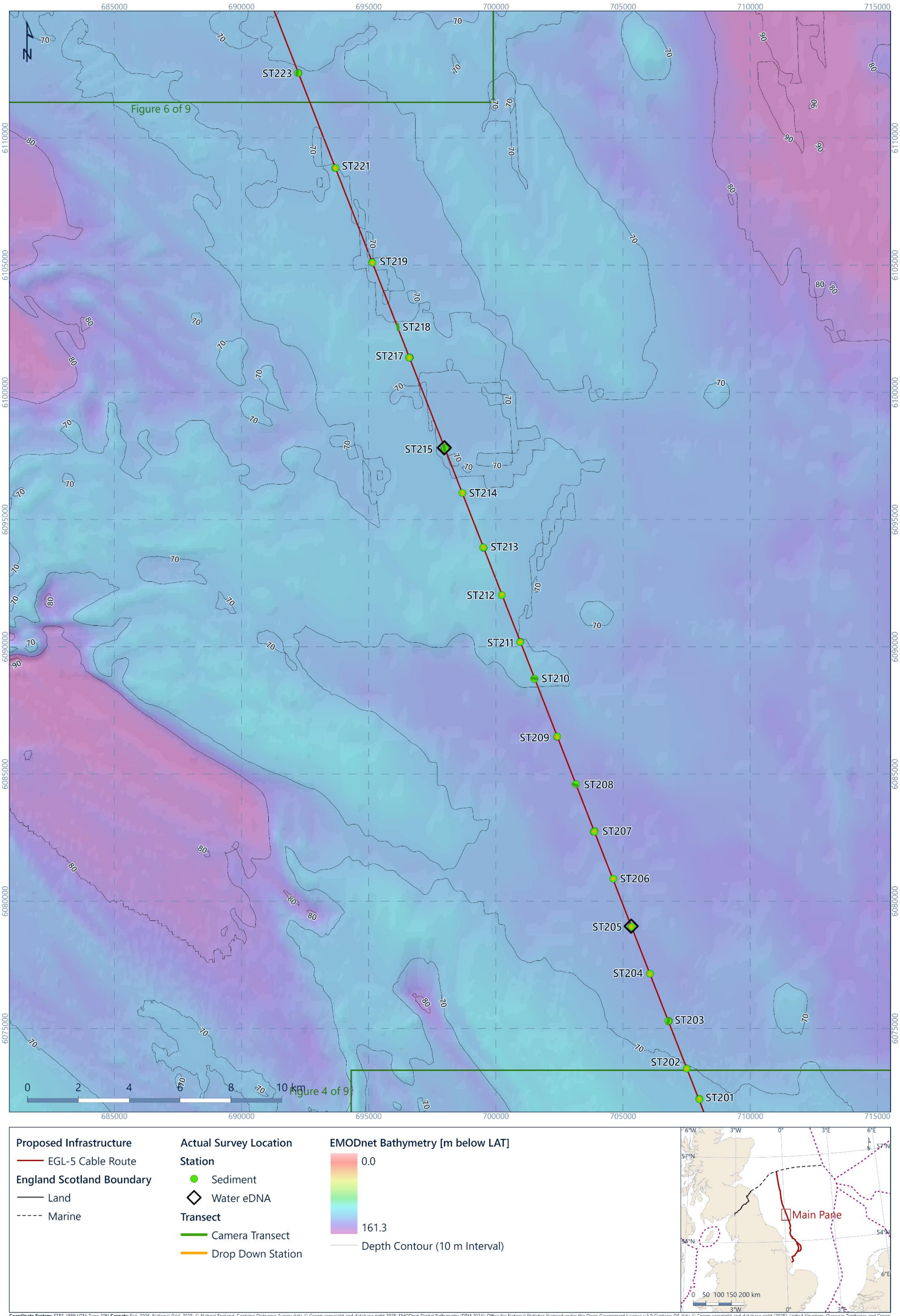


Figure 4.5: Completed survey locations overlaid on bathymetry, station ST201 to station ST223

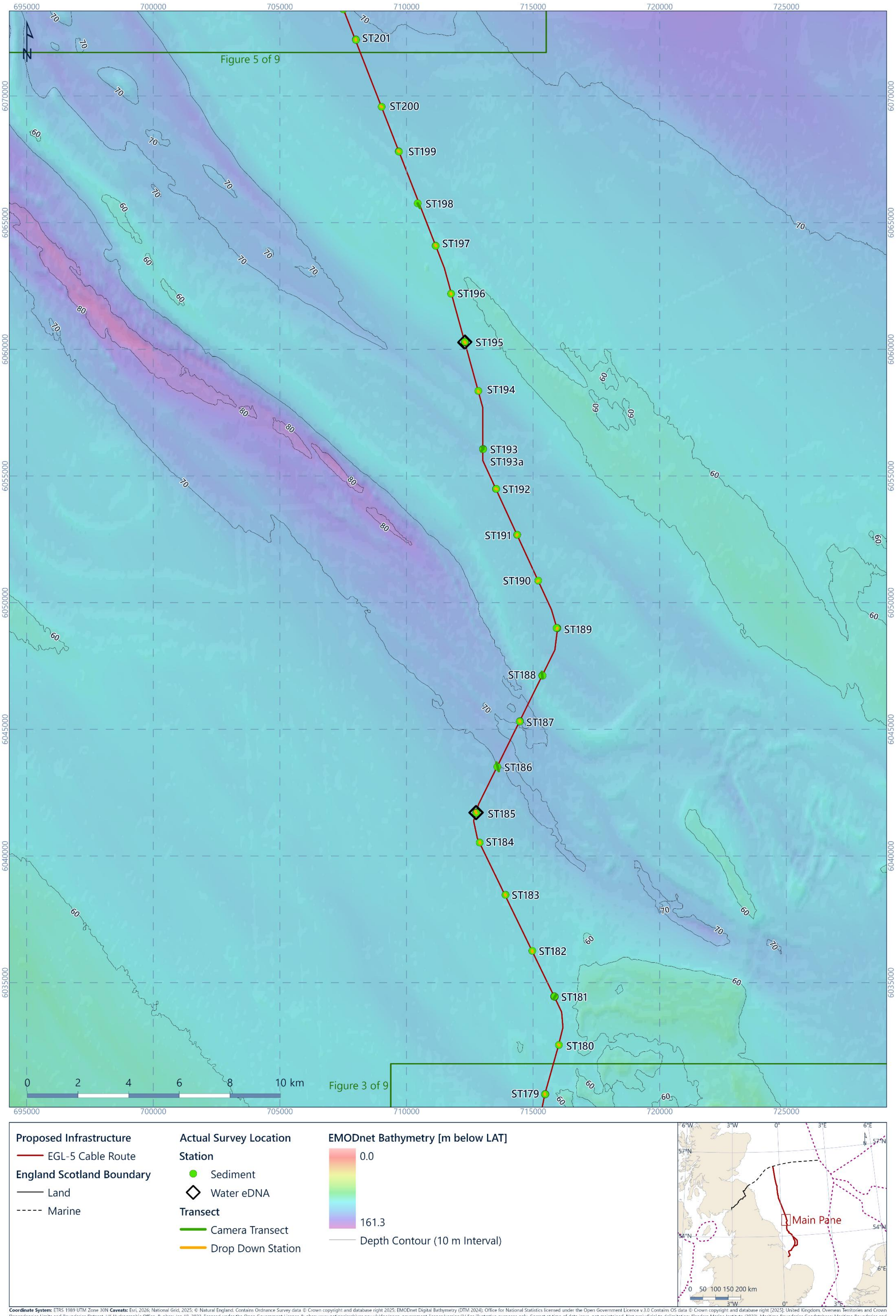


Figure 4.6: Completed survey locations overlaid on bathymetry, station ST179 to station ST201

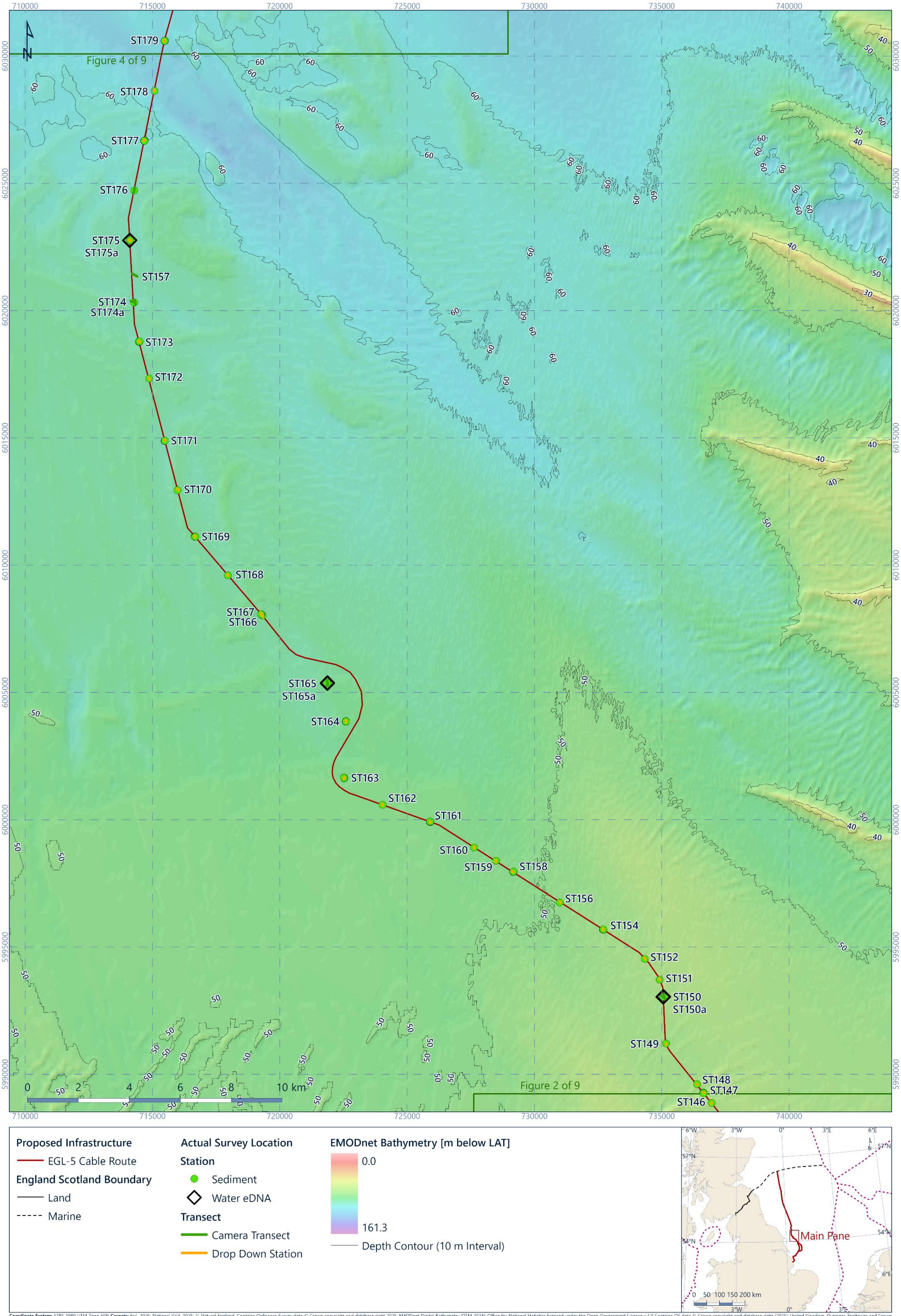


Figure 4.7: Completed survey locations overlaid on bathymetry, station ST146 to station ST179

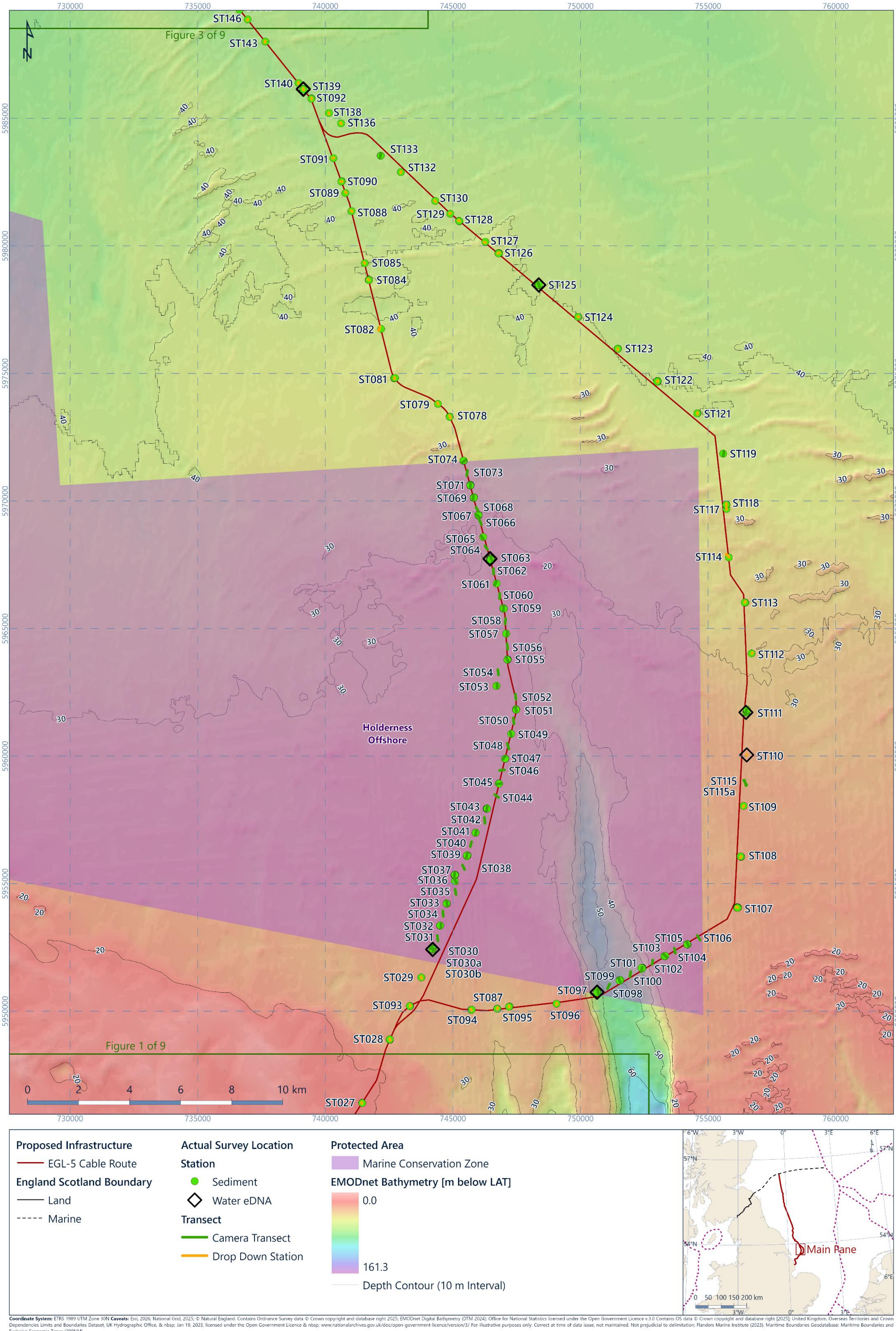
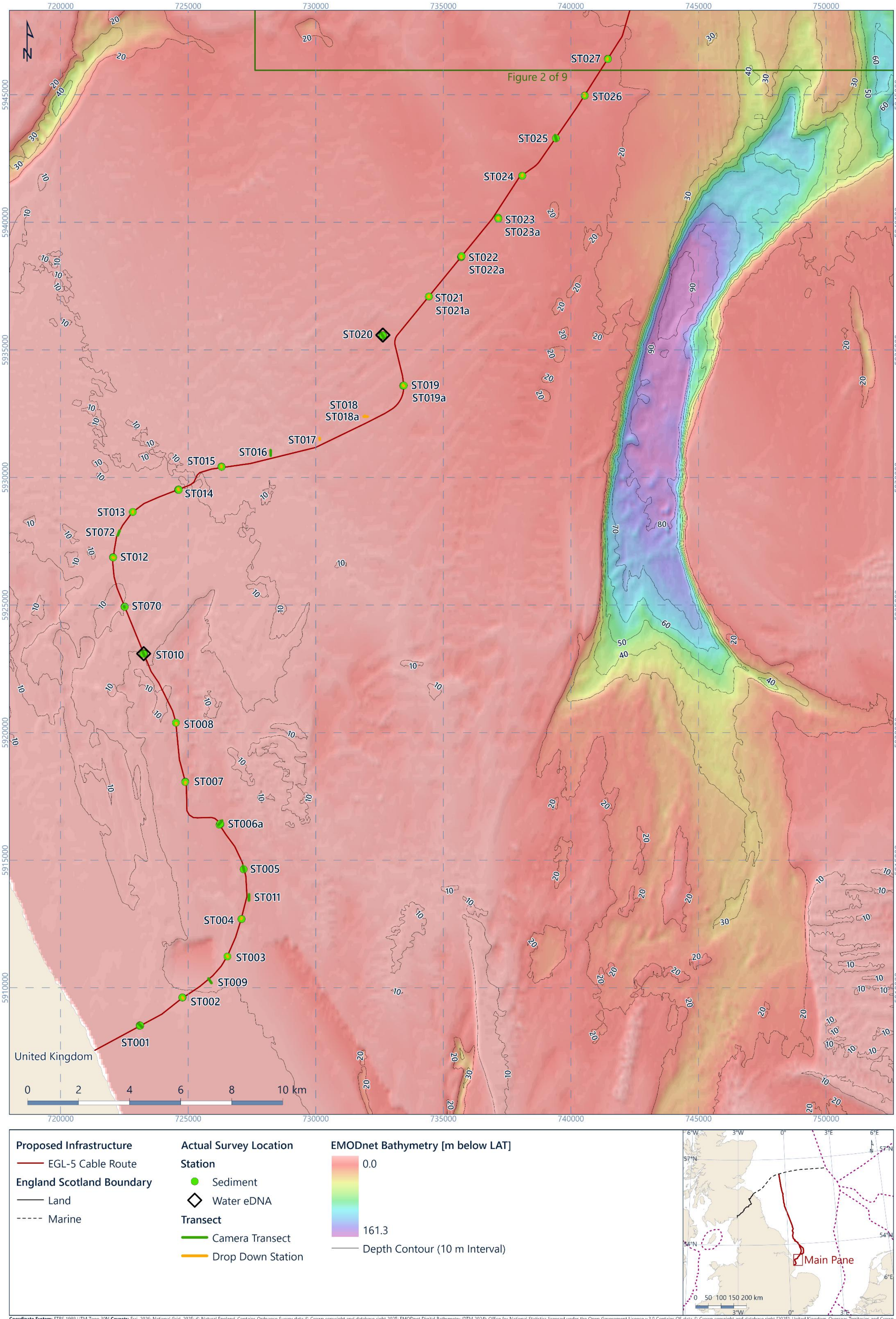


Figure 4.8: Completed survey locations overlaid on bathymetry, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)



Coordinate System: ETRS 1989 UTM Zone 30N Caveats: Esri, 2026; National Grid, 2025; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2025; EMODnet Digital Bathymetry (DTM 2024); Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM).

Figure 4.9: Completed survey locations overlaid on bathymetry, station ST001 to station ST027

5. Bathymetry and Seafloor features

This section presents a summary of the results from finalised multibeam (bathymetry and backscatter), and sub-bottom profiler data collection. Further details of these analysis can be found in XOCEAN (2025).

Bathymetry along the EGL5 proposed cable route ranges from 0.7 m above Lowest Astronomical Tide (LAT) at the cable landfall to 93.5 m below LAT at the bottom of a trench located between ST271 and ST280 (KP350; XOCEAN, 2025). Depths generally showed a deepening towards the northern and offshore section of the proposed cable route, with depths of approximately 75 m below LAT at the very northern end of the proposed cable route.

Backscatter showed a range of intensities along the route characterised by different seabed sediments and associated seabed morphology. The first 80 km appeared characterised predominantly by coarse and mixed seafloor sediments with numerous boulders detected. Beyond ST022 (KP38; XOCEAN, 2025), from depths of approximately 40 m below LAT, the seafloor sediment became predominantly sandy with associated mobile bedforms (waveforms, megaripples, and sand waves). This continued until approximately ST190 (KP206; XOCEAN, 2025), at roughly 70 m below LAT, where the rate of deepening decreases, and the sand seafloor became relatively featureless, intermixed with slightly coarser sediment.

Review of features potentially affecting cable routing highlighted:

- Anthropogenic activity:
- Forty-seven cable crossings, all associated with known infrastructure and observed at varying degrees of burial;
- Three wrecks/debris;
- Evidence of trawling/fishing activity in deeper waters of the route;
- Geological criteria:
- Rock outcrop identified in several sections between KP144 to KP234;
- Areas of shallow sediment cover in several sections between KP144 to KP234;
- Over 12 000 surface boulder contacts, and over 23 000 subsurface boulder contacts, primarily in the south between KP0 and KP116.

The seafloor features classified by the side scan sonar data interpretation included ‘Coarse sediment’, ‘Gravel, ‘Sand’, Rocky’, ‘Mud to Muddy Sand, ‘Mixed Sediment’. These were reviewed and amended accordingly for the habitat mapping presented in Section 11.

6. Sediment Characterisation

Results of the univariate and multivariate analysis of the sediment PSD are presented in Sections 6.1 and 6.2, respectively. Appendix D displays the histograms of particle size class summary for each station and details of particle size distribution for individual stations and the analysis certificates.

6.1 Univariate Analysis

Results of the sediment PSD analysis are presented in tabulated form to provide information on the proportion of the major sediment fractions (gravel, sand and fines) which underpinned the Folk (British Geological Survey [BGS] modified) classification and the PSD statistics derived in Gradistat (details in Section 3.3.1).

Table 6.1 presents the sediment characteristics, including granulometry and TOC, whilst Table 6.2 presents the granulometry of the sediments at each station. Figures 6.1 to 6.9 presents the fractional composition of the sediments along the proposed cable routes, whilst Figures 6.10 to 6.18 present the sediment median particle size spatially along the proposed cable route.

TOC content ranged from 0.07 % at station ST283 to 1.71 % at station ST117, with a mean of 0.32 % and a median of 0.24 %.

Sediment across the survey area comprised gravel, sand and fines (or mud) in varying percentages. Gravel and fines were not recorded from 18 and 10 stations respectively. Gravel, where present, ranged from 0.01 % (at 17 stations) to 89.72 % at station ST021, with a mean of 13.89 % and a median of 0.94 %. The gravel content was higher at those stations in the section of the cable route approaching the coastal areas. Sand content ranged from 8.15 % at station ST021 to 99.75 % at station ST133, with a mean of 78.07 % and a median of 88.14 %. Where present, fines content ranged from 0.19 % at station ST127 to 52.63 % at station ST005, with a mean of 8.03 % and a median of 5.98 %. Of the fines, silt content was consistently higher than the clay content, whilst 3 stations were devoid of fines. Fines content was higher at those stations located towards the offshore end of the cable route in deeper water; however, the station with the highest content of fines was located towards the end of the cable approaching the landing point, where pockets of finer sediments can accumulate (EMODnet, 2026).

The Folk descriptions categorise sediment based on the relative proportions of sediment fractions such as gravel, sand, and fines. The modified Folk classification (BGS) identified the sediments in 10 classes: muddy sandy gravel (19 stations), slightly gravelly sand (28 stations), gravelly muddy sand (11 stations), gravelly mud (1 station), gravel (2 stations), sandy gravel (22 stations), gravelly sand (16 stations), sand (61 stations), slightly gravelly muddy sand (3 stations), and muddy sand (44 stations).

The median sediment particle size ranged from 51 µm (very fine sand) at station ST005 to 47 229 µm (pebble) at station ST021, both along the nearshore section of the proposed cable routes, with a mean of 1533 µm (very coarse sand) and a median of 245 µm (fine sand).

The mean particle size (µm) ranged from 70 µm (very fine sand) at station ST210 to 29 094 µm (pebble) at station ST021, with a mean of 986 µm (coarse sand) and median of 243 µm (fine sand). The mean sediment particle size underpins the Wentworth description, through which nine sediment classes were identified; these included 'fine sand (99 stations), 'medium sand (36 stations), 'coarse sand' (20 station), 'very fine gravel' (18 stations), 'very coarse sand' (15 stations), 'very fine sand' (10 stations), 'fine gravel' (4 stations), 'medium grave' (3 stations) and 'coarse gravel (1 station).

Of the 207 stations investigated, 141 stations had unimodal distributions, 18 stations had bimodal distributions, 29 stations had trimodal distributions, and 19 stations had polymodal distributions.

When the sorting coefficient was considered, the sediments at 92 stations were classified as 'poorly sorted', 58 stations were 'very poorly sorted', 42 stations were 'moderately sorted', 14 were 'moderately well sorted', and 1 station was 'well sorted'.

The skewness of the particle size distribution at 73 stations was 'very fine skewed', at 54 stations it was 'fine skewed', at 49 stations it was 'symmetrical', at 25 stations it was 'coarse skewed', and at six stations it was 'very coarse skewed'.

Table 6.1: Summary of sediment characteristics

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST001	-	62.77	32.16	5.07	4.50	0.57	Muddy sandy gravel
ST002	0.17	0.45	99.01	0.54	0.54	0.00	Sand
ST003	-	8.34	70.43	21.23	19.27	1.95	Gravelly muddy sand
ST004	0.50	41.10	43.06	15.84	14.21	1.63	Muddy sandy gravel
ST005	-	14.21	33.16	52.63	48.28	4.35	Gravelly mud
ST006a	0.43	24.69	64.04	11.27	9.87	1.39	Gravelly muddy sand
ST007	0.30	20.09	63.54	16.37	14.28	2.08	Gravelly muddy sand
ST008	-	12.57	52.89	34.54	29.80	4.74	Gravelly muddy sand
ST010	0.33	56.98	35.50	7.52	6.69	0.83	Gravelly muddy sand
ST013	-	61.32	30.46	8.21	7.34	0.87	Gravelly muddy sand
ST015	-	55.23	35.49	9.28	8.21	1.07	Gravelly muddy sand
ST019	-	57.25	33.52	9.23	8.03	1.19	Gravelly muddy sand
ST020	0.63	82.51	14.23	3.26	2.88	0.38	Gravel
ST021	-	89.72	8.15	2.12	1.87	0.25	Gravel
ST022	-	79.42	15.95	4.64	3.99	0.65	Muddy sandy gravel
ST023	-	69.27	25.99	4.73	4.31	0.43	Muddy sandy gravel
ST025	-	66.35	30.00	3.65	3.38	0.27	Muddy sandy gravel
ST026	0.11	69.26	30.37	0.36	0.36	0.00	Sandy gravel
ST027	-	58.64	38.80	2.56	2.48	0.07	Sandy gravel
ST028	0.27	45.64	47.49	6.87	6.48	0.40	Muddy sandy gravel
ST029	-	75.34	22.64	2.02	1.96	0.06	Sandy gravel
ST030	0.26	34.74	60.11	5.15	5.10	0.05	Sandy gravel
ST032	-	46.23	47.87	5.90	5.81	0.09	Muddy sandy gravel
ST033	0.80	52.85	44.68	2.47	2.44	0.03	Sandy gravel
ST036	-	16.72	81.68	1.60	1.60	0.00	Gravelly sand
ST039	0.19	69.71	27.16	3.13	2.94	0.19	Muddy sandy gravel
ST041	-	47.42	47.17	5.41	5.04	0.38	Muddy sandy gravel
ST043	0.40	72.82	24.38	2.80	2.63	0.17	Muddy sandy gravel
ST045	-	36.83	58.13	5.03	4.74	0.29	Sandy gravel

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST047	0.30	43.38	51.58	5.04	4.63	0.41	Sandy gravel
ST049	-	51.90	43.38	4.72	4.33	0.38	Sandy gravel
ST051	0.37	54.22	42.21	3.57	3.41	0.16	Sandy gravel
ST053	-	47.86	48.47	3.67	3.49	0.18	Sandy gravel
ST055	0.49	47.69	47.83	4.48	4.37	0.11	Sandy gravel
ST057	-	30.82	66.31	2.88	2.80	0.08	Sandy gravel
ST059	0.98	45.69	52.27	2.04	2.02	0.01	Sandy gravel
ST061	-	39.58	57.83	2.58	2.56	0.03	Sandy gravel
ST063	0.24	49.91	49.77	0.32	0.32	0.00	Sandy gravel
ST065	-	9.53	90.47	0.00	0.00	0.00	Gravelly sand
ST067	0.08	25.38	73.65	0.96	0.96	0.00	Gravelly sand
ST069	-	40.02	51.39	8.58	7.94	0.64	Muddy sandy gravel
ST071	1.15	27.22	57.74	15.04	13.49	1.55	Gravelly muddy sand
ST074	-	22.25	65.47	12.28	11.40	0.88	Gravelly muddy sand
ST078	0.30	4.96	95.04	0.00	0.00	0.00	Slightly gravelly Sand
ST079	-	54.20	38.54	7.26	6.69	0.57	Muddy sandy Gravel
ST081	0.45	22.88	65.48	11.64	10.76	0.88	Gravelly muddy Sand
ST082	-	10.55	86.13	3.32	3.31	0.00	Gravelly Sand
ST085	-	4.51	93.37	2.12	2.12	0.00	Slightly gravelly Sand
ST087	0.25	60.64	36.45	2.91	2.85	0.06	Sandy gravel
ST088	0.64	4.68	95.31	0.01	0.01	0.00	Slightly gravelly sand
ST089	-	16.56	80.29	3.15	3.15	0.00	Gravelly sand
ST090	0.17	5.53	89.33	5.13	5.13	0.00	Gravelly sand
ST091	-	1.95	95.21	2.84	2.84	0.00	Slightly gravelly sand
ST092	-	2.04	94.52	3.44	3.44	0.00	Slightly gravelly sand
ST094	-	52.55	39.60	7.85	7.44	0.41	Muddy sandy gravel
ST096	-	59.12	40.07	0.82	0.82	0.00	Sandy gravel
ST097	1.58	36.14	57.52	6.34	6.01	0.33	Sandy gravel
ST103	-	48.08	45.82	6.10	5.75	0.36	Muddy sandy gravel
ST105	0.76	56.22	37.29	6.49	5.95	0.54	Muddy sandy gravel

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST107	-	53.96	43.22	2.83	2.69	0.14	Sandy gravel
ST109	-	46.40	48.83	4.77	4.38	0.39	Sandy gravel
ST110	-	11.04	88.24	0.72	0.72	0.00	Gravelly sand
ST111	1.20	34.18	62.23	3.59	3.54	0.06	Sandy gravel
ST112	-	6.64	92.30	1.06	1.06	0.00	Gravelly sand
ST113	-	18.87	79.36	1.77	1.77	0.00	Gravelly sand
ST114	-	26.51	69.26	4.23	4.17	0.06	Gravelly sand
ST117	1.71	2.64	95.81	1.55	1.55	0.00	Slightly gravelly sand
ST118	0.11	24.20	72.08	3.71	3.66	0.05	Gravelly sand
ST119	-	21.30	67.53	11.17	10.41	0.76	Gravelly muddy sand
ST121	0.22	16.60	69.99	13.41	12.45	0.95	Gravelly muddy sand
ST123	0.11	21.29	66.60	12.11	11.29	0.82	Gravelly muddy sand
ST124	-	7.61	88.24	4.15	4.11	0.04	Gravelly sand
ST125	0.31	10.18	85.77	4.06	4.03	0.02	Gravelly sand
ST126	-	43.94	50.58	5.48	5.11	0.36	Sandy gravel
ST127	-	1.59	98.23	0.19	0.19	0.00	Slightly gravelly sand
ST128	0.14	1.04	96.89	2.07	2.07	0.00	Slightly gravelly sand
ST129	-	3.53	94.49	1.98	1.98	0.00	Slightly gravelly sand
ST130	0.25	1.15	96.87	1.98	1.98	0.00	Slightly gravelly sand
ST132	-	1.23	97.00	1.77	1.77	0.00	Slightly gravelly sand
ST133	0.23	0.25	99.75	0.00	0.00	0.00	Sand
ST136	-	4.12	91.45	4.44	4.44	0.00	Slightly gravelly sand
ST138	0.30	0.83	95.73	3.44	3.44	0.00	Sand
ST139	0.23	2.41	93.27	4.33	4.32	0.01	Slightly gravelly sand
ST140	-	1.22	95.39	3.39	3.39	0.00	Slightly gravelly sand
ST143	-	1.99	96.11	1.90	1.90	0.00	Slightly gravelly sand
ST146	0.13	0.58	96.11	3.31	3.31	0.00	Sand
ST147	0.14	1.90	93.91	4.18	4.18	0.00	Slightly gravelly sand
ST148	-	0.99	95.99	3.03	3.03	0.00	Sand
ST149	-	0.23	96.08	3.69	3.69	0.00	Sand

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST150	0.38	0.20	96.18	3.62	3.62	0.00	Sand
ST151	0.18	0.49	96.04	3.47	3.47	0.00	Sand
ST152	-	0.24	96.74	3.02	3.02	0.00	Sand
ST154	0.09	0.11	96.85	3.04	3.04	0.00	Sand
ST156	-	0.13	95.90	3.97	3.97	0.00	Sand
ST158	0.13	0.53	96.85	2.62	2.62	0.00	Sand
ST159	0.2	4.18	91.89	3.93	3.93	0.00	Slightly gravelly sand
ST160	-	3.03	92.58	4.39	4.37	0.02	Slightly gravelly sand
ST161	0.19	0.75	95.70	3.56	3.56	0.00	Sand
ST162	-	0.13	95.68	4.19	4.19	0.00	Sand
ST163	0.19	0.73	94.39	4.88	4.86	0.02	Sand
ST164	-	1.89	93.19	4.92	4.90	0.02	Slightly gravelly sand
ST165	0.19	0.23	95.07	4.70	4.68	0.02	Sand
ST166	-	1.17	93.70	5.13	5.11	0.02	Slightly gravelly sand
ST167	0.15	0.76	93.95	5.28	5.18	0.10	Sand
ST168	-	0.86	95.02	4.11	4.09	0.02	Sand
ST169	0.12	1.45	92.84	5.71	5.63	0.08	Slightly gravelly sand
ST170	-	1.11	94.44	4.45	4.43	0.02	Slightly gravelly sand
ST171	0.28	0.57	95.47	3.97	3.97	0.00	Sand
ST172	-	2.72	90.90	6.38	6.28	0.09	Slightly gravelly sand
ST173	0.36	0.70	94.58	4.71	4.70	0.01	Sand
ST174a	-	1.02	93.77	5.21	5.18	0.02	Slightly gravelly sand
ST175	0.25	7.29	87.65	5.05	5.01	0.04	Gravelly sand
ST176	-	3.60	89.24	7.15	7.01	0.14	Slightly gravelly sand
ST177	0.35	2.13	91.96	5.91	5.89	0.02	Slightly gravelly sand
ST178	-	0.45	93.51	6.04	6.01	0.03	Sand
ST179	0.57	14.49	77.67	7.83	7.67	0.17	Gravelly sand
ST180	-	0.26	94.35	5.40	5.39	0.01	Sand
ST181	0.22	9.11	85.06	5.83	5.72	0.11	Gravelly sand
ST182	-	0.51	93.69	5.80	5.78	0.02	Sand

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST183	0.24	0.10	94.57	5.33	5.27	0.06	Sand
ST184	-	0.24	94.07	5.70	5.59	0.11	Sand
ST185	0.13	0.05	93.97	5.99	5.88	0.10	Sand
ST186	-	0.00	95.50	4.50	4.49	0.01	Sand
ST187	0.21	0.77	92.11	7.12	6.97	0.15	Sand
ST188	-	0.24	94.07	5.69	5.59	0.09	Sand
ST189	0.60	0.44	93.97	5.59	5.58	0.01	Sand
ST190	-	0.00	93.69	6.31	6.28	0.02	Sand
ST191	0.12	0.02	93.25	6.73	6.71	0.02	Sand
ST192	0.13	0.01	94.88	5.11	5.11	0.00	Sand
ST193	-	0.01	93.40	6.59	6.57	0.02	Sand
ST194	0.14	0.00	93.30	6.70	6.68	0.02	Sand
ST195	-	0.08	94.72	5.20	5.19	0.01	Sand
ST196	0.14	3.42	89.63	6.95	6.86	0.09	Slightly Gravelly Sand
ST197	-	0.10	93.94	5.95	5.93	0.02	Sand
ST198	0.17	0.07	89.34	10.59	10.32	0.27	Muddy Sand
ST199	-	0.03	91.38	8.60	8.48	0.11	Sand
ST200	0.27	0.00	91.61	8.39	8.21	0.18	Sand
ST201	-	0.00	90.67	9.33	9.18	0.15	Sand
ST202	0.29	0.07	91.75	8.18	8.03	0.14	Sand
ST203	-	0.00	89.79	10.21	9.80	0.41	Muddy Sand
ST204	0.32	0.00	88.14	11.86	11.30	0.55	Muddy Sand
ST205	-	0.01	88.45	11.54	11.02	0.53	Muddy Sand
ST206	0.44	0.01	87.48	12.52	12.22	0.30	Muddy Sand
ST207	-	0.18	85.57	14.25	13.53	0.71	Sand
ST208	0.21	0.01	85.79	14.21	13.53	0.67	Muddy Sand
ST209	-	0.27	84.65	15.08	14.33	0.75	Muddy Sand
ST210	0.24	3.79	72.33	23.88	22.60	1.28	Slightly Gravelly Muddy Sand
ST211	-	0.02	88.68	11.30	10.87	0.43	Muddy Sand
ST212	0.41	0.32	86.54	13.14	12.79	0.35	Muddy Sand

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST213	-	0.15	83.98	15.87	14.78	1.09	Muddy Sand
ST214	0.30	0.25	86.70	13.06	12.52	0.54	Muddy Sand
ST215	0.36	0.12	84.68	15.19	14.63	0.57	Muddy Sand
ST217	0.24	0.05	85.90	14.05	13.63	0.42	Muddy Sand
ST219	0.32	0.07	83.58	16.35	15.76	0.59	Muddy Sand
ST221	0.46	0.05	83.73	16.22	15.66	0.56	Muddy Sand
ST223	0.54	0.04	82.62	17.35	16.76	0.59	Muddy Sand
ST225	0.30	0.05	82.41	17.53	16.98	0.55	Muddy Sand
ST227	0.45	0.04	83.49	16.48	16.12	0.36	Muddy Sand
ST229	0.35	0.21	81.01	18.79	18.28	0.51	Muddy Sand
ST231	0.19	0.01	75.91	24.09	23.21	0.88	Muddy Sand
ST233	0.53	0.01	86.68	13.31	13.16	0.15	Muddy Sand
ST235	-	0.00	78.80	21.20	20.75	0.45	Muddy Sand
ST236	0.19	0.04	70.74	29.23	28.38	0.85	Muddy Sand
ST237	-	0.01	83.89	16.10	15.90	0.20	Muddy Sand
ST238	0.48	0.00	89.70	10.30	10.24	0.06	Muddy Sand
ST239	-	0.05	94.83	5.12	5.12	0.00	Sand
ST240	0.22	0.01	87.28	12.71	12.61	0.10	Muddy Sand
ST241	-	0.00	89.73	10.27	10.21	0.06	Muddy Sand
ST242	0.14	0.00	87.55	12.45	12.35	0.10	Muddy Sand
ST243	-	0.03	92.10	7.87	7.86	0.01	Sand
ST244	0.25	0.51	85.73	13.76	13.63	0.13	Muddy Sand
ST245	-	0.02	88.26	11.72	11.63	0.09	Muddy Sand
ST246	-	0.02	85.25	14.73	14.52	0.21	Muddy Sand
ST248	0.15	0.16	89.99	9.85	9.83	0.02	Sand
ST249	-	1.07	80.07	18.86	18.56	0.31	Slightly Gravelly Muddy Sand
ST250	0.31	0.00	80.08	19.91	19.29	0.63	Muddy Sand
ST251	-	0.35	87.82	11.83	11.77	0.06	Muddy Sand
ST252	0.27	0.01	82.63	17.36	17.12	0.24	Muddy Sand
ST253	-	1.61	80.98	17.41	17.28	0.12	Slightly Gravelly Muddy Sand

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
ST254	0.13	3.90	88.50	7.60	7.60	0.00	Slightly Gravelly Sand
ST255	-	0.01	90.92	9.07	9.05	0.02	Sand
ST256	0.23	0.01	84.44	15.55	15.27	0.27	Muddy Sand
ST257	0.31	0.01	85.16	14.84	14.56	0.27	Muddy Sand
ST259	-	0.09	84.45	15.45	15.02	0.43	Muddy Sand
ST260	0.34	0.03	82.56	17.41	16.83	0.58	Muddy Sand
ST261	-	0.03	82.64	17.33	16.67	0.66	Muddy Sand
ST262	0.12	0.05	86.56	13.39	13.20	0.19	Muddy Sand
ST263	-	0.01	93.38	6.61	6.59	0.02	Sand
ST264	0.31	0.01	90.17	9.82	9.70	0.11	Sand
ST265	0.14	20.53	70.05	9.42	8.94	0.49	Gravelly Muddy Sand
ST267	0.22	0.04	89.88	10.08	9.82	0.26	Muddy Sand
ST269	0.34	0.35	90.08	9.57	9.07	0.50	Sand
ST271	0.14	0.00	84.22	15.78	14.60	1.18	Muddy Sand
ST273	0.12	0.94	88.32	10.74	10.42	0.32	Muddy Sand
ST275	0.18	0.00	89.55	10.45	10.02	0.43	Muddy Sand
ST277	0.19	0.07	90.42	9.51	9.28	0.23	Sand
ST279	0.22	0.03	90.56	9.41	9.25	0.16	Sand
ST281	0.07	0.00	90.15	9.85	9.61	0.24	Sand
ST283	0.11	0.00	94.01	5.98	5.98	0.00	Sand
ST285	0.21	0.00	94.43	5.57	5.56	0.01	Sand
ST287	0.16	0.01	94.71	5.28	5.28	0.00	Sand
ST289	0.25	0.02	93.00	6.98	6.98	0.00	Sand
ST291	0.13	0.01	92.18	7.81	7.81	0.00	Sand
ST293	0.15	0.00	93.84	6.16	6.16	0.00	Sand
ST295	1.08	0.42	90.63	8.95	8.94	0.01	Sand
ST297	0.22	0.20	91.94	7.86	7.86	0.00	Sand
ST299	-	0.02	92.61	7.37	7.37	0.00	Sand
Minimum	**0.07**	**0.00**	**8.15**	**0.00**	**0.00**	**0.00**	-
Maximum	**1.71**	**89.72**	**99.75**	**52.63**	**48.28**	**4.74**	

Station	TOC [%]	Fractional Composition			Fines		Folk Description (BGS Modified)
		Gravel [%]	Sand [%]	Fines [%]	Silt [%]	Clay [%]	
Mean	0.32	13.89	78.07	8.03	7.74	0.30	
Median	0.24	0.94	88.14	5.98	5.89	0.09	
Standard Deviation	0.276	22.33	21.67	6.49	6.08	0.56	
Relative Standard Deviation	85	161	28	81	79	189	
Pre-sweeping stations							
ST067	0.26	-	-	-	-	-	-
ST078	0.29	-	-	-	-	-	-
ST088	0.28	-	-	-	-	-	-
ST117	0.24	-	-	-	-	-	-
ST130	0.33	-	-	-	-	-	-
ST138	0.22	-	-	-	-	-	-
ST146	0.12	-	-	-	-	-	-
ST151	0.12	-	-	-	-	-	-
ST154	0.13	-	-	-	-	-	-
ST159	0.1	-	-	-	-	-	-

Notes
BGS = British Geological Survey
TOM = Total organic matter
TOC = Total organic carbon
Fines = Silt and clay content Silt = +4.0 to +8.0 ø units or 3.9 µm to 62.5 µm Clay = +8.0 to +10.0 ø units or 0.98 µm to 3.9 µm

Table 6.2: Summary of particle size distribution

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST001	5 147	Trimodal	3 158	-1.66	Granule	7.12	Very poorly sorted	-0.41	Very fine skewed
ST002	408	Unimodal	408	1.29	Medium sand	1.41	Well sorted	0.00	Symmetrical
ST003	339	Unimodal	152	2.72	Fine sand	7.06	Very poorly sorted	-0.49	Very fine skewed
ST004	487	Trimodal	685	0.55	Coarse sand	11.91	Very poorly sorted	0.02	Symmetrical
ST005	51	Polymodal	73	3.77	Very fine sand	13.59	Very poorly sorted	0.21	Coarse skewed
ST006a	295	Trimodal	719	0.48	Coarse sand	9.53	Very poorly sorted	0.34	Very coarse skewed
ST007	293	Polymodal	374	1.42	Medium sand	8.53	Very poorly sorted	0.02	Symmetrical
ST008	179	Polymodal	104	3.26	Very fine sand	12.54	Very poorly sorted	-0.20	Fine skewed
ST010	3 559	Trimodal	2 163	-1.11	Granule	8.65	Very poorly sorted	-0.44	Very fine skewed
ST013	6 344	Polymodal	3 909	-1.97	Granule	12.00	Very poorly sorted	-0.42	Very fine skewed
ST015	3 166	Polymodal	2 809	-1.49	Granule	13.06	Very poorly sorted	-0.23	Fine skewed
ST019	3 598	Polymodal	2 302	-1.20	Granule	9.85	Very poorly sorted	-0.43	Very fine skewed
ST020	29 458	Bimodal	13 203	-3.72	Pebble	5.98	Very poorly sorted	-0.72	Very fine skewed
ST021	47 229	Unimodal	29 094	-4.86	Pebble	3.54	Poorly sorted	-0.84	Very fine skewed
ST022	20 447	Bimodal	9 337	-3.22	Pebble	6.25	Very poorly sorted	-0.71	Very fine skewed
ST023	22 477	Bimodal	7 115	-2.83	Pebble	7.94	Very poorly sorted	-0.79	Very fine skewed
ST025	9 930	Trimodal	5 203	-2.38	Pebble	7.55	Very poorly sorted	-0.45	Very fine skewed
ST026	5 540	Trimodal	3 738	-1.90	Granule	4.19	Very poorly sorted	-0.38	Very fine skewed
ST027	3 386	Polymodal	3 224	-1.69	Granule	5.74	Very poorly sorted	-0.09	Symmetrical
ST028	1 438	Trimodal	1 602	-0.68	Very coarse sand	7.60	Very poorly sorted	-0.09	Symmetrical
ST029	26 547	Unimodal	8 720	-3.12	Pebble	6.07	Very poorly sorted	-0.81	Very fine skewed
ST030	918	Bimodal	1 117	-0.16	Very coarse sand	4.23	Very poorly sorted	0.04	Symmetrical
ST032	1 527	Polymodal	2 210	-1.14	Granule	8.65	Very poorly sorted	0.05	Symmetrical
ST033	2 449	Trimodal	2 202	-1.14	Granule	4.93	Very poorly sorted	-0.09	Symmetrical
ST036	860	Unimodal	918	0.12	Coarse sand	2.19	Poorly sorted	0.15	Coarse skewed
ST039	7 885	Trimodal	4 355	-2.12	Pebble	5.41	Very poorly sorted	-0.47	Very fine skewed
ST041	1 697	Polymodal	1 710	-0.77	Very coarse sand	5.93	Very poorly sorted	-0.13	Fine skewed
ST043	23 223	Trimodal	7 994	-3.00	Pebble	6.32	Very poorly sorted	-0.77	Very fine skewed
ST045	1 227	Polymodal	1 350	-0.43	Very coarse sand	6.10	Very poorly sorted	0.07	Symmetrical

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST047	1 456	Polymodal	1 429	-0.52	Very coarse sand	5.15	Very poorly sorted	-0.10	Symmetrical
ST049	2 303	Trimodal	2 412	-1.27	Granule	8.16	Very poorly sorted	-0.06	Symmetrical
ST051	2 493	Trimodal	2 446	-1.29	Granule	5.53	Very poorly sorted	-0.08	Symmetrical
ST053	1 758	Polymodal	1 716	-0.78	Very coarse sand	5.18	Very poorly sorted	-0.03	Symmetrical
ST055	1 779	Polymodal	1 795	-0.84	Very coarse sand	5.17	Very poorly sorted	-0.05	Symmetrical
ST057	577	Trimodal	810	0.30	Coarse sand	5.18	Very poorly sorted	0.31	Very coarse skewed
ST059	1 605	Bimodal	1 430	-0.52	Very coarse sand	3.92	Poorly sorted	-0.13	Fine skewed
ST061	1 315	Trimodal	1 202	-0.27	Very coarse sand	3.86	Poorly sorted	-0.11	Fine skewed
ST063	1 987	Polymodal	2 633	-1.40	Granule	5.55	Very poorly sorted	0.17	Coarse skewed
ST065	691	Unimodal	732	0.45	Coarse sand	1.81	Moderately sorted	0.30	Very coarse skewed
ST067	755	Bimodal	962	0.06	Coarse sand	2.92	Poorly sorted	0.27	Coarse skewed
ST069	761	Trimodal	934	0.10	Coarse sand	7.82	Very poorly sorted	-0.04	Symmetrical
ST071	544	Trimodal	526	0.93	Coarse sand	7.51	Very poorly sorted	-0.17	Fine skewed
ST074	337	Trimodal	480	1.06	Medium sand	7.55	Very poorly sorted	0.12	Coarse skewed
ST078	842	Unimodal	854	0.23	Coarse sand	1.63	Moderately sorted	0.06	Symmetrical
ST079	3 972	Trimodal	2 785	-1.48	Granule	12.71	Very poorly sorted	-0.30	Fine skewed
ST081	305	Trimodal	469	1.09	Medium sand	6.84	Very poorly sorted	0.14	Coarse skewed
ST082	433	Bimodal	518	0.95	Coarse sand	2.61	Poorly sorted	0.27	Coarse skewed
ST085	689	Unimodal	689	0.54	Coarse sand	2.09	Poorly sorted	-0.10	Symmetrical
ST087	4 724	Trimodal	3 779	-1.92	Granule	6.06	Very poorly sorted	-0.22	Fine skewed
ST088	658	Unimodal	671	0.58	Coarse sand	1.88	Moderately sorted	0.04	Symmetrical
ST089	356	Bimodal	496	1.01	Medium sand	3.39	Poorly sorted	0.37	Very coarse skewed
ST090	307	Unimodal	314	1.67	Medium sand	2.53	Poorly sorted	0.05	Symmetrical
ST091	283	Unimodal	282	1.83	Medium sand	1.81	Moderately sorted	0.03	Symmetrical
ST092	262	Unimodal	264	1.92	Medium sand	1.87	Moderately sorted	0.04	Symmetrical
ST094	2 360	Polymodal	2 010	-1.01	Granule	7.83	Very poorly sorted	-0.27	Fine skewed
ST096	3 433	Trimodal	3 032	-1.60	Granule	4.62	Very poorly sorted	-0.14	Fine skewed
ST097	1 352	Unimodal	1 234	-0.30	Very coarse sand	4.39	Very poorly sorted	-0.30	Fine skewed
ST103	1 746	Polymodal	2 212	-1.15	Granule	11.08	Very poorly sorted	0.00	Symmetrical
ST105	3 976	Trimodal	2 552	-1.35	Granule	9.98	Very poorly sorted	-0.37	Very fine skewed

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST107	2 763	Polymodal	2 640	-1.40	Granule	6.60	Very poorly sorted	-0.07	Symmetrical
ST109	1 480	Trimodal	1 259	-0.33	Very coarse sand	6.12	Very poorly sorted	-0.10	Fine skewed
ST110	1 189	Unimodal	1 062	-0.09	Very coarse sand	1.87	Moderately sorted	-0.28	Fine skewed
ST111	841	Polymodal	1 056	-0.08	Very coarse sand	4.87	Very poorly sorted	0.22	Coarse skewed
ST112	750	Unimodal	770	0.38	Coarse sand	1.80	Moderately sorted	0.10	Symmetrical
ST113	945	Unimodal	1 023	-0.03	Very coarse sand	2.13	Poorly sorted	0.15	Coarse skewed
ST114	545	Bimodal	636	0.65	Coarse sand	3.86	Poorly Sorted	0.11	Coarse skewed
ST117	984	Bimodal	790	0.34	Coarse sand	2.17	Poorly Sorted	-0.46	Very fine skewed
ST118	539	Trimodal	644	0.64	Coarse sand	3.61	Poorly Sorted	0.17	Coarse skewed
ST119	248	Trimodal	403	1.31	Medium sand	6.45	Very poorly sorted	0.20	Coarse skewed
ST121	218	Trimodal	327	1.61	Medium sand	6.33	Very poorly sorted	0.16	Coarse skewed
ST123	269	Trimodal	397	1.33	Medium sand	6.33	Very poorly sorted	0.12	Coarse skewed
ST124	353	Bimodal	423	1.24	Medium sand	2.73	Poorly Sorted	0.23	Coarse skewed
ST125	414	Bimodal	479	1.06	Medium sand	2.99	Poorly Sorted	0.14	Coarse skewed
ST126	887	Polymodal	1 141	-0.19	Very coarse sand	6.84	Very poorly sorted	0.08	Symmetrical
ST127	524	Unimodal	526	0.93	Coarse sand	1.65	Moderately sorted	0.04	Symmetrical
ST128	453	Unimodal	450	1.15	Medium sand	1.76	Moderately sorted	-0.06	Symmetrical
ST129	486	Bimodal	530	0.92	Coarse sand	2.14	Poorly sorted	0.13	Coarse skewed
ST130	406	Unimodal	402	1.32	Medium sand	1.78	Moderately sorted	-0.05	Symmetrical
ST132	392	Unimodal	392	1.35	Medium sand	1.69	Moderately sorted	0.01	Symmetrical
ST133	565	Unimodal	562	0.83	Coarse sand	1.45	Moderately well sorted	-0.07	Symmetrical
ST136	236	Unimodal	248	2.01	Fine sand	2.23	Poorly sorted	0.20	Coarse skewed
ST138	341	Unimodal	337	1.57	Medium sand	1.91	Moderately sorted	-0.05	Symmetrical
ST139	218	Unimodal	223	2.16	Fine sand	1.87	Moderately sorted	0.15	Coarse skewed
ST140	297	Unimodal	312	1.68	Medium sand	2.21	Poorly sorted	0.12	Coarse skewed
ST143	345	Bimodal	376	1.41	Medium sand	2.14	Poorly sorted	0.18	Coarse skewed
ST146	245	Unimodal	244	2.03	Fine sand	1.72	Moderately sorted	-0.02	Symmetrical
ST147	212	Unimodal	212	2.24	Fine sand	1.65	Moderately sorted	-0.01	Symmetrical
ST148	275	Unimodal	274	1.87	Medium sand	1.86	Moderately sorted	0.02	Symmetrical
ST149	212	Unimodal	217	2.21	Fine sand	1.74	Moderately sorted	0.10	Symmetrical

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST150	206	Unimodal	205	2.28	Fine sand	1.53	Moderately well sorted	-0.05	Symmetrical
ST151	210	Unimodal	209	2.26	Fine sand	1.55	Moderately well sorted	-0.04	Symmetrical
ST152	226	Unimodal	223	2.16	Fine sand	1.52	Moderately well sorted	-0.05	Symmetrical
ST154	223	Unimodal	221	2.18	Fine sand	1.48	Moderately well sorted	-0.05	Symmetrical
ST156	209	Unimodal	207	2.27	Fine sand	1.49	Moderately well sorted	-0.10	Fine skewed
ST158	229	Unimodal	227	2.14	Fine sand	1.51	Moderately well sorted	-0.02	Symmetrical
ST159	220	Unimodal	219	2.19	Fine sand	1.56	Moderately well sorted	-0.01	Symmetrical
ST160	219	Unimodal	218	2.20	Fine sand	1.81	Moderately sorted	0.15	Coarse skewed
ST161	235	Unimodal	234	2.09	Fine sand	1.61	Moderately well sorted	-0.01	Symmetrical
ST162	213	Unimodal	211	2.25	Fine sand	1.52	Moderately well sorted	-0.08	Symmetrical
ST163	220	Unimodal	219	2.19	Fine sand	1.62	Moderately well sorted	-0.04	Symmetrical
ST164	230	Unimodal	230	2.12	Fine sand	1.82	Moderately sorted	0.11	Coarse skewed
ST165	211	Unimodal	210	2.25	Fine sand	1.52	Moderately well sorted	-0.10	Fine skewed
ST166	279	Unimodal	289	1.79	Medium sand	2.30	Poorly sorted	-0.09	Symmetrical
ST167	215	Unimodal	214	2.23	Fine sand	1.95	Moderately sorted	-0.26	Fine skewed
ST168	214	Unimodal	213	2.23	Fine sand	1.53	Moderately well sorted	-0.06	Symmetrical
ST169	212	Unimodal	211	2.25	Fine sand	1.95	Moderately sorted	-0.27	Fine skewed
ST170	218	Unimodal	217	2.21	Fine sand	1.56	Moderately well sorted	-0.05	Symmetrical
ST171	219	Unimodal	218	2.19	Fine sand	1.63	Moderately sorted	0.03	Symmetrical
ST172	220	Unimodal	219	2.19	Fine sand	2.31	Poorly sorted	-0.13	Fine skewed
ST173	242	Unimodal	249	2.00	Fine sand	1.83	Moderately sorted	0.09	Symmetrical
ST174‡	220	Unimodal	218	2.20	Fine sand	1.89	Moderately sorted	-0.24	Fine skewed
ST175	245	Unimodal	260	1.94	Medium sand	2.89	Poorly sorted	0.19	Coarse skewed
ST176	220	Unimodal	218	2.20	Fine sand	2.48	Poorly sorted	-0.12	Fine skewed
ST177	204	Unimodal	203	2.30	Fine sand	1.92	Moderately sorted	-0.28	Fine skewed
ST178	210	Unimodal	209	2.26	Fine sand	2.03	Poorly sorted	-0.25	Fine skewed
ST179	222	Unimodal	324	1.62	Medium sand	5.13	Very poorly sorted	0.37	Very coarse skewed
ST180	241	Unimodal	243	2.04	Fine sand	2.08	Poorly sorted	-0.17	Fine skewed
ST181	251	Unimodal	285	1.81	Medium sand	3.68	Poorly sorted	0.21	Coarse skewed
ST182	225	Unimodal	228	2.13	Fine sand	2.20	Poorly sorted	-0.18	Fine skewed

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST183	212	Unimodal	212	2.24	Fine sand	2.02	Poorly sorted	-0.24	Fine skewed
ST184	203	Unimodal	205	2.29	Fine sand	2.14	Poorly sorted	-0.21	Fine skewed
ST185	190	Unimodal	189	2.40	Fine sand	1.94	Moderately sorted	-0.32	Very fine skewed
ST186	358	Unimodal	346	1.53	Medium sand	1.90	Moderately sorted	-0.15	Fine skewed
ST187	197	Unimodal	197	2.34	Fine sand	2.14	Poorly sorted	-0.28	Fine skewed
ST188	209	Unimodal	210	2.25	Fine sand	2.11	Poorly sorted	-0.20	Fine skewed
ST189	223	Unimodal	227	2.14	Fine sand	2.12	Poorly sorted	-0.16	Fine skewed
ST190	244	Unimodal	247	2.02	Fine sand	2.30	Poorly sorted	-0.19	Fine skewed
ST191	220	Unimodal	221	2.18	Fine sand	2.18	Poorly sorted	-0.22	Fine skewed
ST192	201	Unimodal	202	2.31	Fine sand	2.06	Poorly sorted	-0.23	Fine skewed
ST193	195	Unimodal	196	2.35	Fine sand	2.00	Poorly sorted	-0.26	Fine skewed
ST194	198	Unimodal	201	2.32	Fine sand	1.94	Moderately sorted	-0.16	Fine skewed
ST195	198	Unimodal	200	2.32	Fine sand	2.40	Poorly sorted	-0.11	Fine skewed
ST196	197	Unimodal	198	2.34	Fine sand	2.06	Poorly sorted	-0.20	Fine skewed
ST197	156	Unimodal	151	2.73	Fine sand	2.12	Poorly sorted	-0.38	Very fine skewed
ST198	168	Unimodal	162	2.62	Fine sand	2.05	Poorly sorted	-0.36	Very fine skewed
ST199	157	Unimodal	153	2.70	Fine sand	1.97	Moderately sorted	-0.37	Very fine skewed
ST200	150	Unimodal	147	2.77	Fine sand	1.98	Moderately sorted	-0.37	Very fine skewed
ST201	148	Unimodal	145	2.79	Fine sand	1.93	Moderately sorted	-0.36	Very fine skewed
ST202	139	Unimodal	136	2.88	Fine sand	2.03	Poorly sorted	-0.37	Very fine skewed
ST203	132	Unimodal	125	3.00	Fine sand	2.13	Poorly sorted	-0.41	Very fine skewed
ST204	137	Unimodal	132	2.92	Fine sand	2.28	Poorly sorted	-0.33	Very fine skewed
ST205	133	Unimodal	126	2.99	Fine sand	2.23	Poorly sorted	-0.36	Very fine skewed
ST206	128	Unimodal	122	3.04	Very fine sand	2.39	Poorly sorted	-0.34	Very fine skewed
ST207	132	Unimodal	126	2.98	Fine sand	2.49	Poorly sorted	-0.31	Very fine skewed
ST208	130	Unimodal	125	3.00	Very fine sand	2.59	Poorly sorted	-0.28	Fine skewed
ST209	113	Trimodal	70	3.84	Very fine sand	5.09	Very poorly sorted	-0.30	Very fine skewed
ST210	150	Unimodal	153	2.71	Fine sand	2.71	Poorly sorted	-0.16	Fine skewed
ST211	182	Unimodal	180	2.47	Fine sand	3.05	Poorly sorted	-0.21	Fine skewed
ST212	185	Unimodal	165	2.60	Fine sand	3.24	Poorly sorted	-0.35	Very fine skewed

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST213	210	Unimodal	193	2.37	Fine sand	2.89	Poorly sorted	-0.34	Very fine skewed
ST214	197	Unimodal	172	2.54	Fine sand	3.04	Poorly sorted	-0.37	Very fine skewed
ST215	211	Unimodal	188	2.41	Fine sand	2.83	Poorly sorted	-0.39	Very fine skewed
ST217	211	Unimodal	166	2.59	Fine sand	3.17	Poorly sorted	-0.48	Very fine skewed
ST219	180	Unimodal	161	2.64	Fine sand	3.28	Poorly sorted	-0.31	Very fine skewed
ST221	192	Unimodal	138	2.86	Fine sand	3.33	Poorly sorted	-0.52	Very fine skewed
ST223	203	Unimodal	145	2.79	Fine sand	3.76	Poorly sorted	-0.45	Very fine skewed
ST225	203	Unimodal	151	2.72	Fine sand	3.20	Poorly sorted	-0.50	Very fine skewed
ST227	195	Unimodal	126	2.99	Fine sand	3.55	Poorly sorted	-0.56	Very fine skewed
ST229	162	Bimodal	92	3.44	Very fine sand	4.18	Very poorly sorted	-0.56	Very fine skewed
ST231	259	Unimodal	226	2.14	Fine sand	2.67	Poorly sorted	-0.45	Very fine skewed
ST233	229	Unimodal	127	2.97	Fine sand	3.96	Poorly sorted	-0.64	Very fine skewed
ST235	212	Bimodal	101	3.31	Very fine sand	4.86	Very poorly sorted	-0.64	Very fine skewed
ST236	247	Unimodal	180	2.48	Fine sand	2.95	Poorly sorted	-0.59	Very fine skewed
ST237	266	Unimodal	255	1.97	Medium sand	2.18	Poorly sorted	-0.41	Very fine skewed
ST238	303	Unimodal	300	1.74	Medium sand	1.80	Moderately sorted	-0.23	Fine skewed
ST239	228	Unimodal	216	2.21	Fine sand	2.27	Poorly sorted	-0.40	Very fine skewed
ST240	245	Unimodal	233	2.10	Fine sand	2.15	Poorly sorted	-0.40	Very fine skewed
ST241	232	Unimodal	219	2.19	Fine sand	2.25	Poorly sorted	-0.41	Very fine skewed
ST242	253	Unimodal	246	2.02	Fine sand	2.05	Poorly sorted	-0.33	Very fine skewed
ST243	236	Unimodal	217	2.21	Fine sand	2.60	Poorly sorted	-0.38	Very fine skewed
ST244	237	Unimodal	225	2.15	Fine sand	2.65	Poorly sorted	-0.30	Fine skewed
ST245	209	Unimodal	187	2.42	Fine sand	2.58	Poorly sorted	-0.43	Very fine skewed
ST246	415	Unimodal	373	1.42	Medium sand	2.68	Poorly sorted	-0.43	Very fine skewed
ST248	416	Trimodal	236	2.08	Fine sand	5.35	Very poorly sorted	-0.50	Very fine skewed
ST249	193	Bimodal	127	2.98	Fine sand	3.94	Poorly sorted	-0.49	Very fine skewed
ST250	254	Unimodal	232	2.11	Fine sand	2.51	Poorly sorted	-0.39	Very fine skewed
ST251	207	Unimodal	152	2.72	Fine sand	3.39	Poorly sorted	-0.47	Very fine skewed
ST252	541	Unimodal	273	1.87	Medium sand	4.47	Very poorly sorted	-0.68	Very fine skewed
ST253	394	Unimodal	369	1.44	Medium sand	2.41	Poorly sorted	-0.36	Very fine skewed

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
ST254	419	Unimodal	401	1.32	Medium sand	2.33	Poorly sorted	-0.42	Very fine skewed
ST255	190	Unimodal	178	2.49	Fine sand	3.23	Poorly sorted	-0.27	Fine skewed
ST256	185	Unimodal	169	2.57	Fine sand	2.95	Poorly sorted	-0.31	Very fine skewed
ST257	149	Unimodal	136	2.88	Fine sand	2.55	Poorly sorted	-0.38	Very fine skewed
ST259	124	Unimodal	104	3.27	Very fine sand	2.57	Poorly sorted	-0.48	Very fine skewed
ST260	129	Unimodal	102	3.29	Very fine sand	2.70	Poorly sorted	-0.51	Very fine skewed
ST261	207	Unimodal	187	2.42	Fine sand	2.60	Poorly sorted	-0.39	Very fine skewed
ST262	281	Unimodal	277	1.85	Medium sand	1.91	Moderately sorted	-0.34	Very fine skewed
ST263	241	Unimodal	230	2.12	Fine sand	2.21	Poorly sorted	-0.38	Very fine skewed
ST264	261	Bimodal	661	0.60	Coarse sand	8.71	Very poorly sorted	0.39	Very coarse skewed
ST265	229	Unimodal	217	2.20	Fine sand	2.61	Poorly sorted	-0.32	Very fine skewed
ST267	161	Unimodal	161	2.64	Fine sand	2.36	Poorly sorted	-0.22	Fine skewed
ST269	118	Unimodal	110	3.18	Very fine sand	2.31	Poorly sorted	-0.42	Very fine skewed
ST271	240	Unimodal	227	2.14	Fine sand	2.76	Poorly sorted	-0.30	Very fine skewed
ST273	158	Unimodal	159	2.66	Fine sand	2.46	Poorly sorted	-0.22	Fine skewed
ST275	148	Unimodal	146	2.78	Fine sand	2.12	Poorly sorted	-0.28	Fine skewed
ST277	164	Unimodal	160	2.64	Fine sand	2.12	Poorly sorted	-0.30	Fine skewed
ST279	153	Unimodal	149	2.74	Fine sand	2.11	Poorly sorted	-0.32	Very fine skewed
ST281	271	Unimodal	260	1.94	Medium sand	1.96	Moderately sorted	-0.28	Fine skewed
ST283	286	Unimodal	284	1.82	Medium sand	1.85	Moderately sorted	-0.28	Fine skewed
ST285	268	Unimodal	266	1.91	Medium sand	1.79	Moderately sorted	-0.25	Fine skewed
ST287	209	Unimodal	206	2.28	Fine sand	1.84	Moderately sorted	-0.32	Very fine skewed
ST289	197	Unimodal	195	2.36	Fine sand	1.87	Moderately sorted	-0.32	Very fine skewed
ST291	257	Unimodal	250	2.00	Medium sand	1.92	Moderately sorted	-0.29	Fine skewed
ST293	229	Unimodal	223	2.17	Fine sand	2.18	Poorly sorted	-0.30	Very fine skewed
ST295	206	Unimodal	203	2.30	Fine sand	1.99	Moderately sorted	-0.27	Fine skewed
ST297	190	Unimodal	186	2.42	Fine sand	1.94	Moderately sorted	-0.28	Fine skewed
Minimum	**51**		**70**	**-4.86**		**1.41**		**-0.84**	
Maximum	**47 229**	-	**29 094**	**3.84**	-	**13.59**	-	**0.39**	-
Mean	**1 533**		**986**	**1.35**		**3.65**		**-0.19**	

Station	Median	Modality	Mean Particle Size			Sorting Coefficient		Skewness	
	[µm]		[µm]*	[phi]*	Wentworth (1922) Description†	[µm]*	Description*	[µm]*	Description‡
Median	245		243	2.04		2.48		-0.22	
Standard Deviation	5 040		2 550	1.62		2.59		0.25	
RSD	329		259	120		71		135	

Notes
RSD = Relative standard deviation
* = Folk and Ward method (Gradistat statistics)
† = Wentworth description (Wentworth, 1922)
‡= Sorting and skewness based on geometric Folk and Ward (1957) graphical measures (Gradistat statistics)

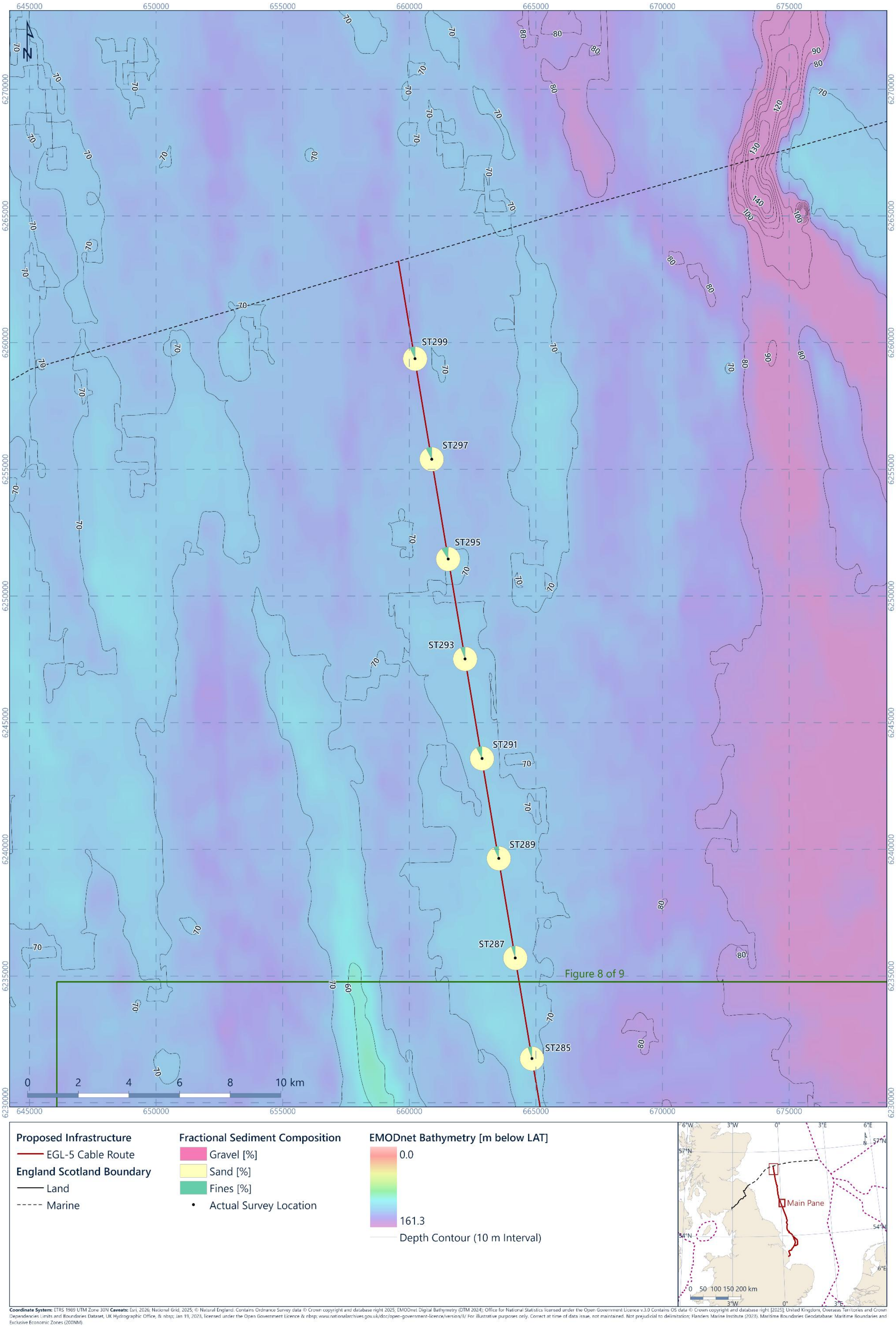


Figure 6.1: Sediment fractional composition overlaid on bathymetry, station ST285 to station ST299

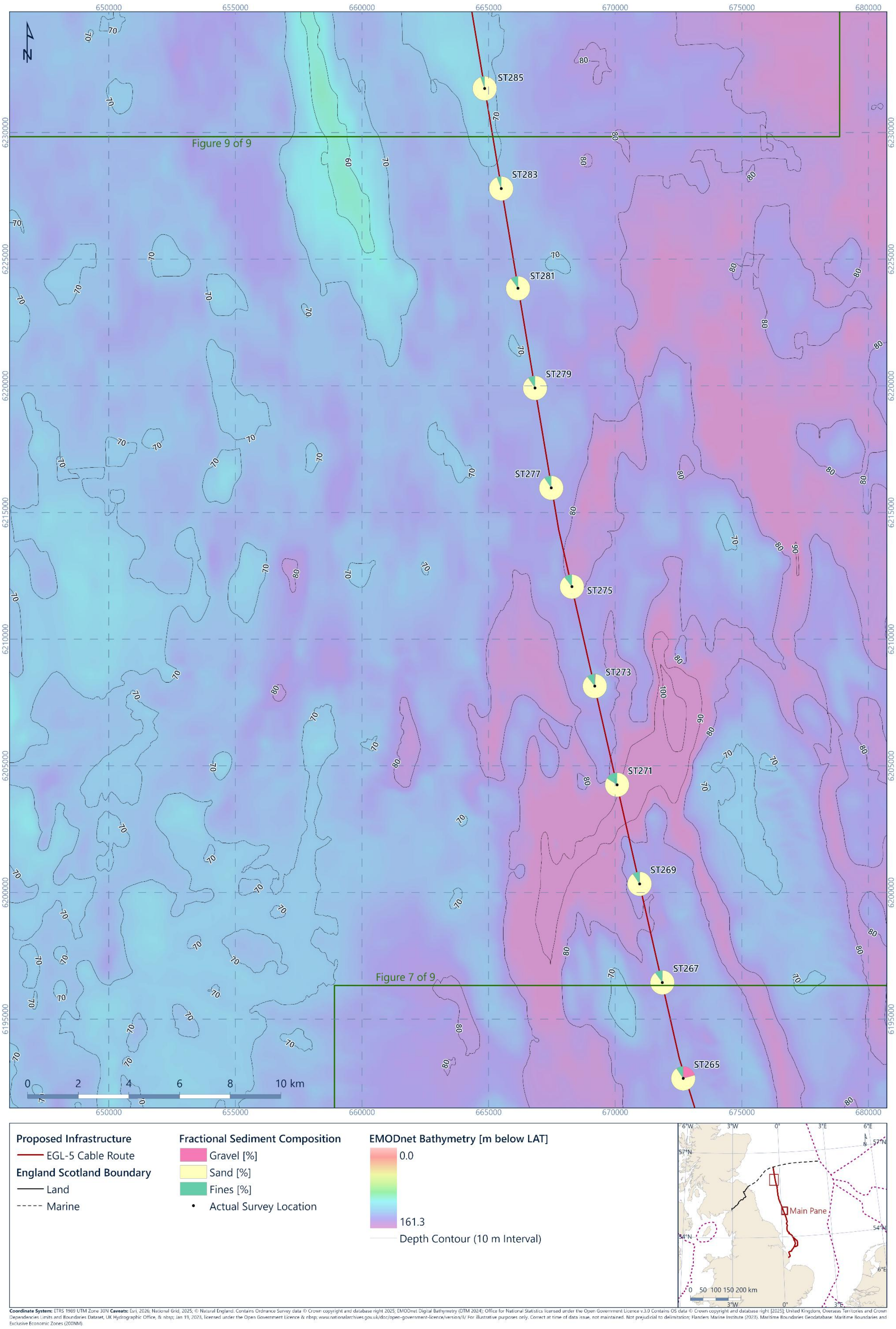


Figure 6.2: Sediment fractional composition overlaid on bathymetry, station ST265 to station ST285

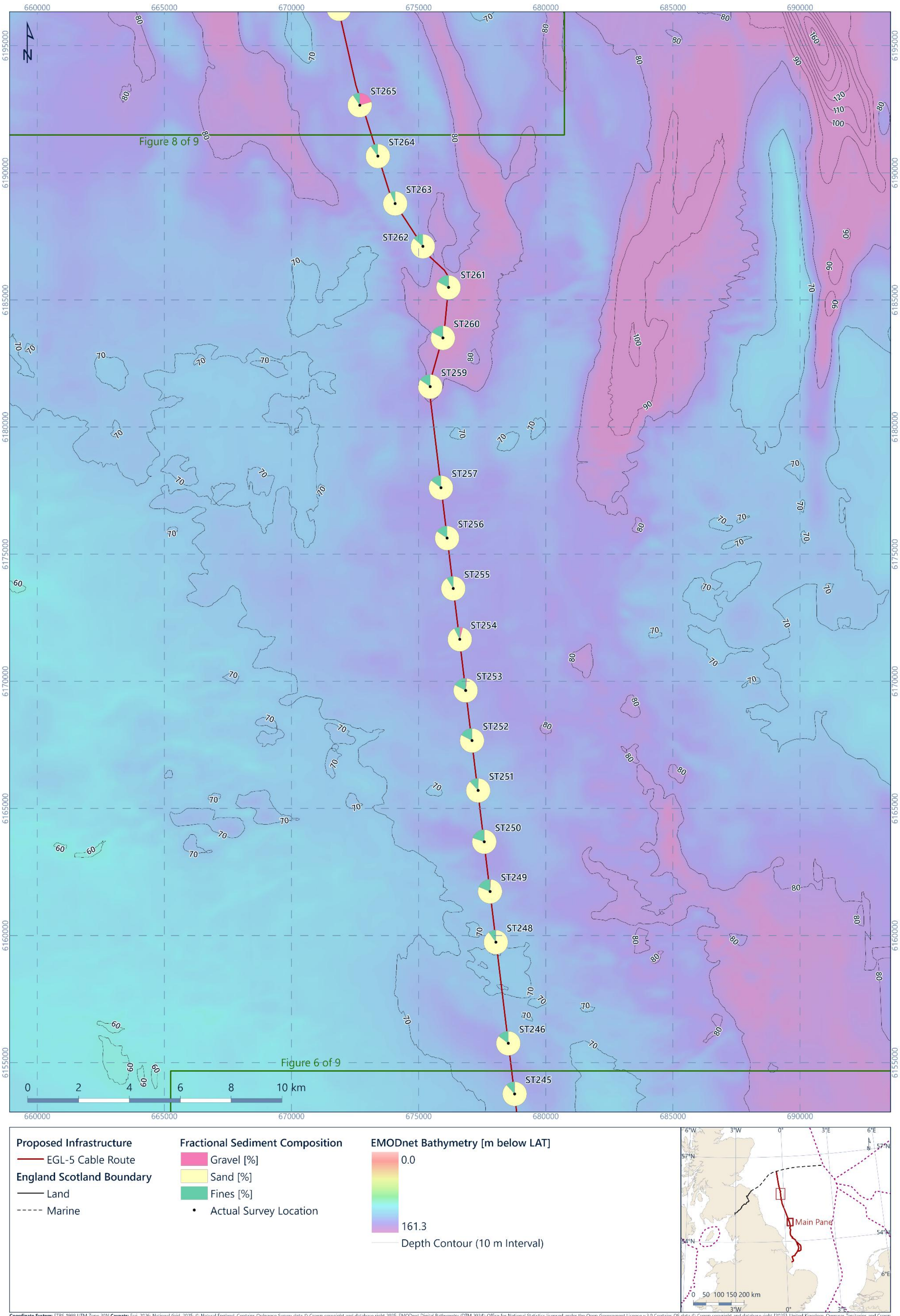


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Figure 6.3: Sediment fractional composition overlaid on bathymetry, station ST245 to station ST265

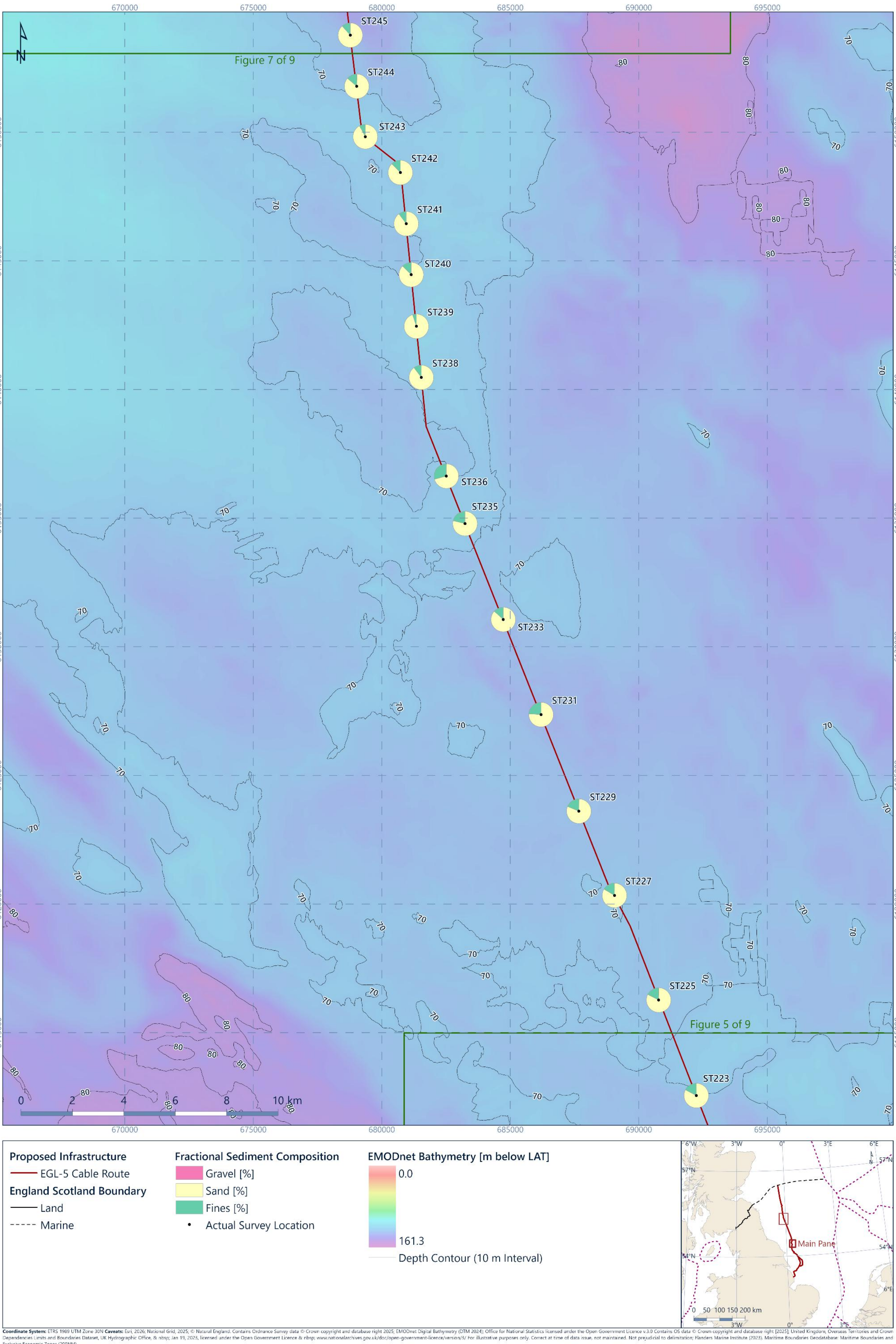

Figure 6.4: Sediment fractional composition overlaid on bathymetry, station ST223 to station ST245

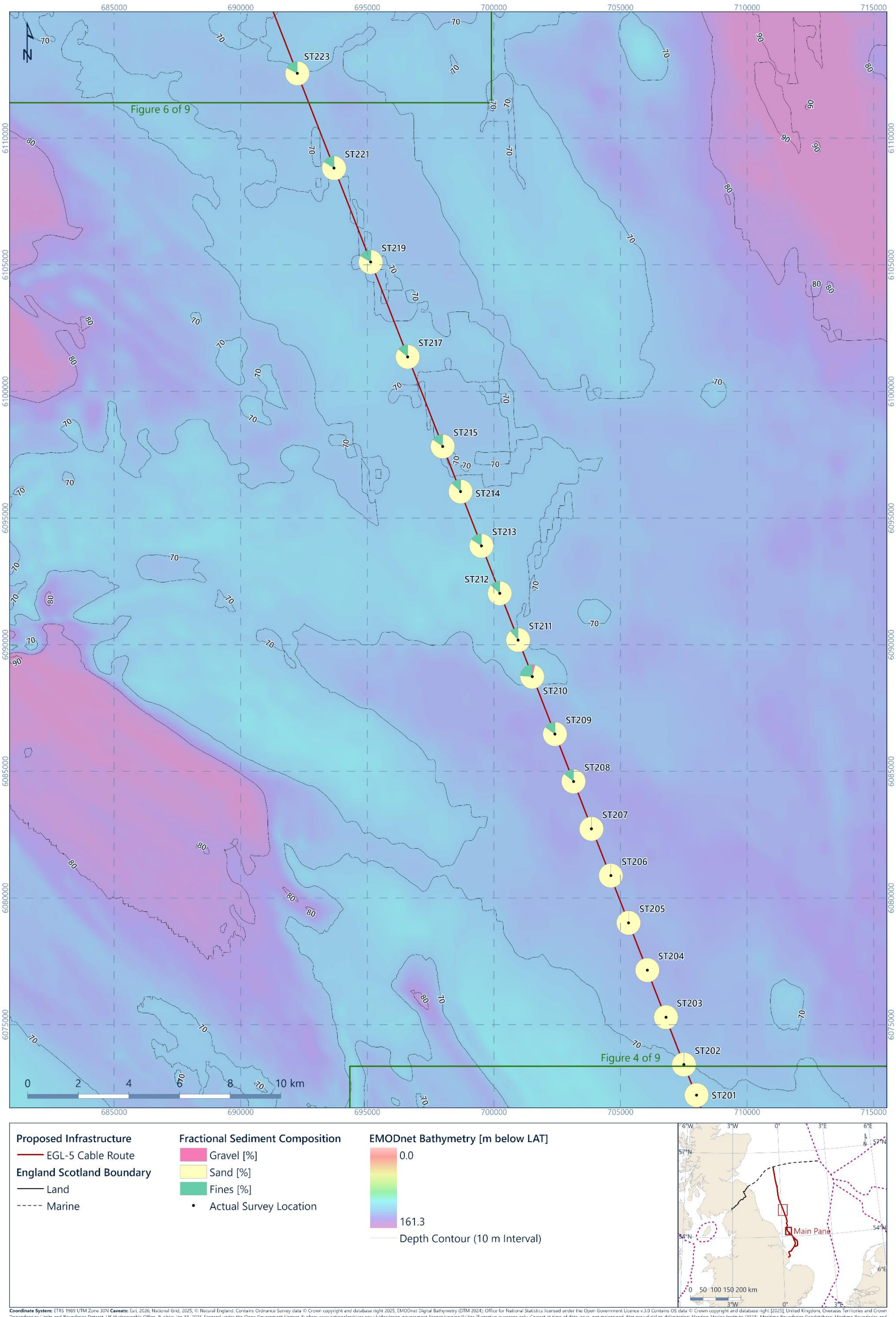

Figure 6.5: Sediment fractional composition overlaid on bathymetry, station ST201 to station ST223

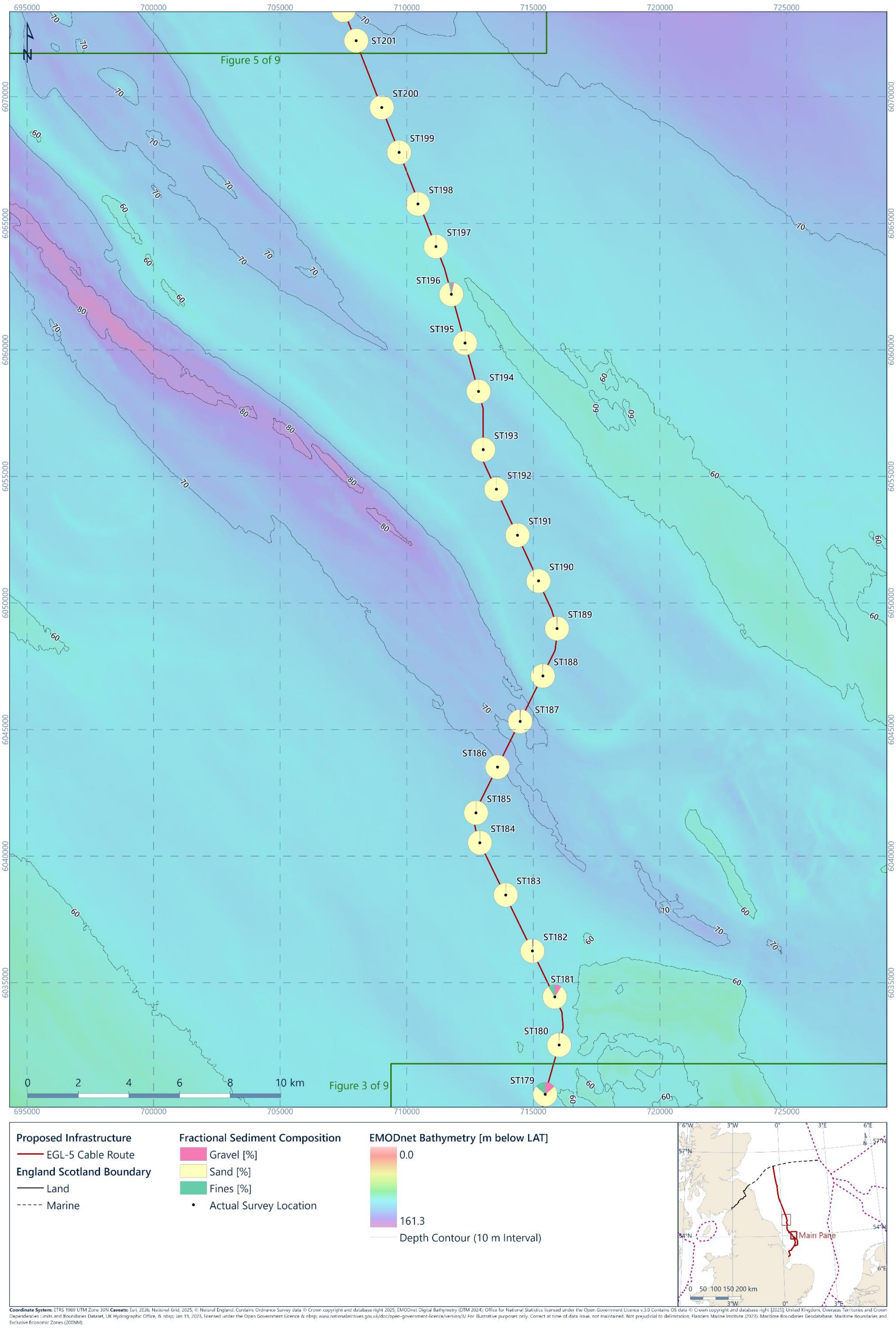

Figure 6.6: Sediment fractional composition overlaid on bathymetry, station ST179 to station ST201

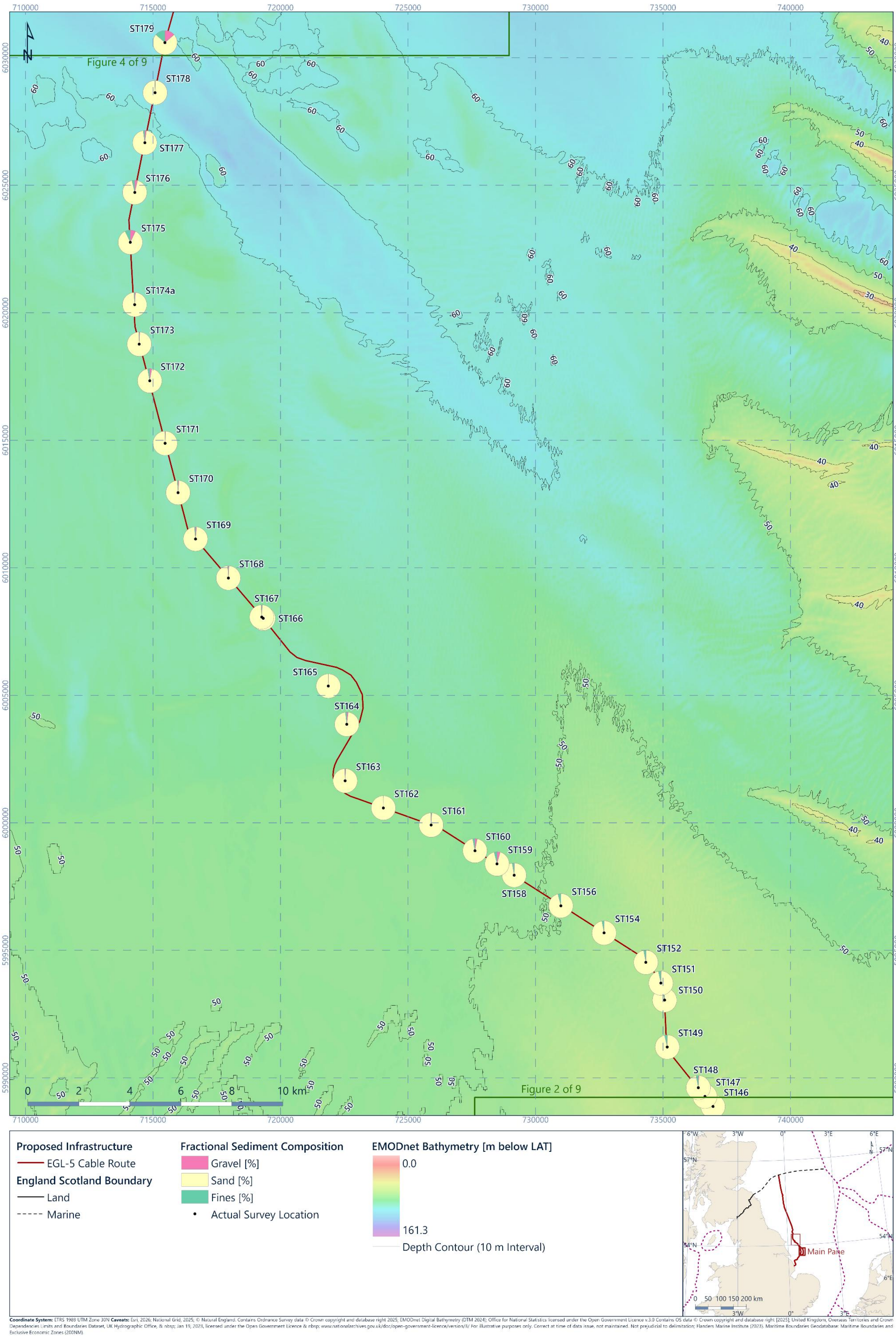

Figure 6.7: Sediment fractional composition overlaid on bathymetry, station ST146 to station ST179

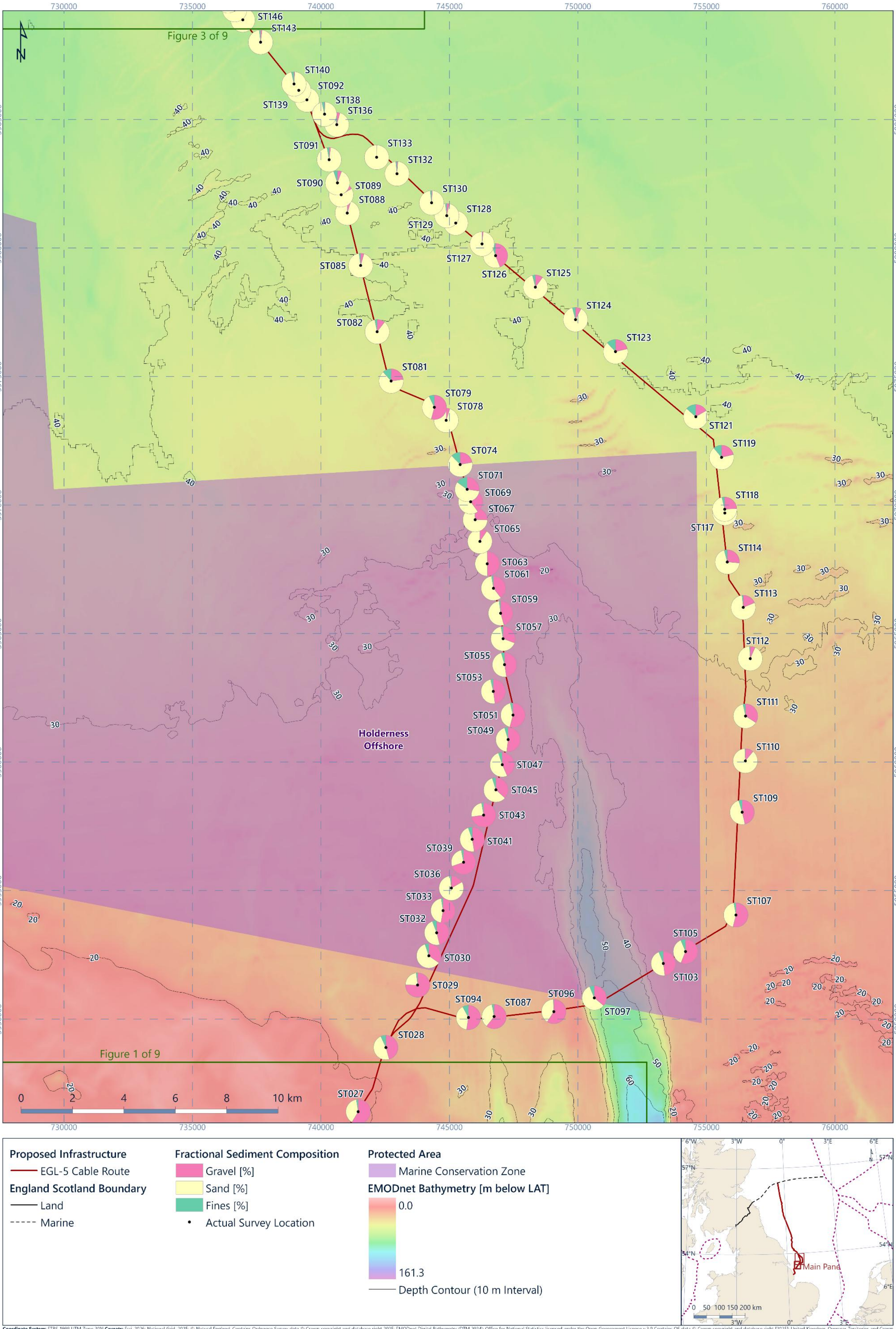

Figure 6.8: Sediment fractional composition overlaid on bathymetry, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

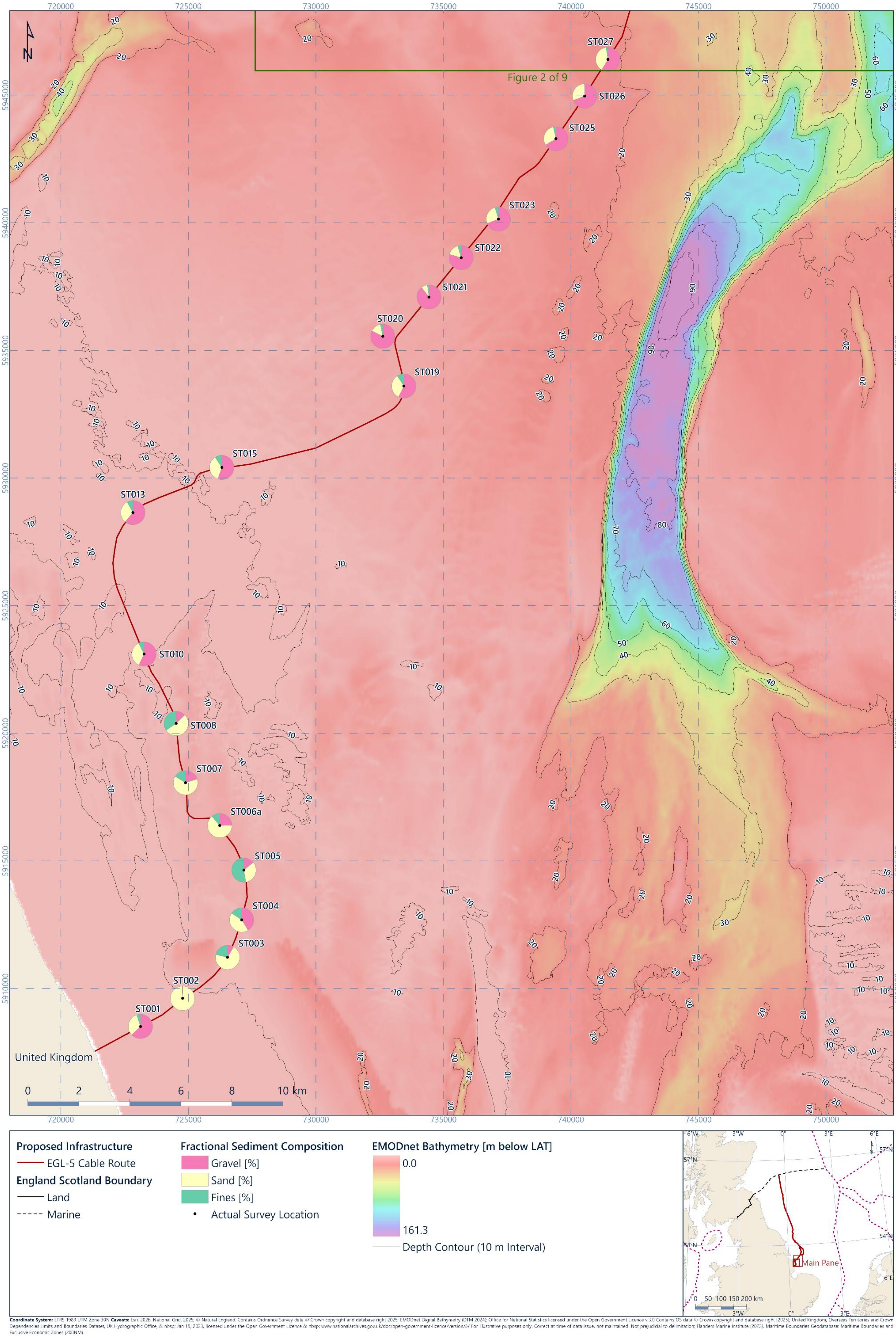

Figure 6.9: Sediment fractional composition overlaid on bathymetry, station ST001 to station ST027

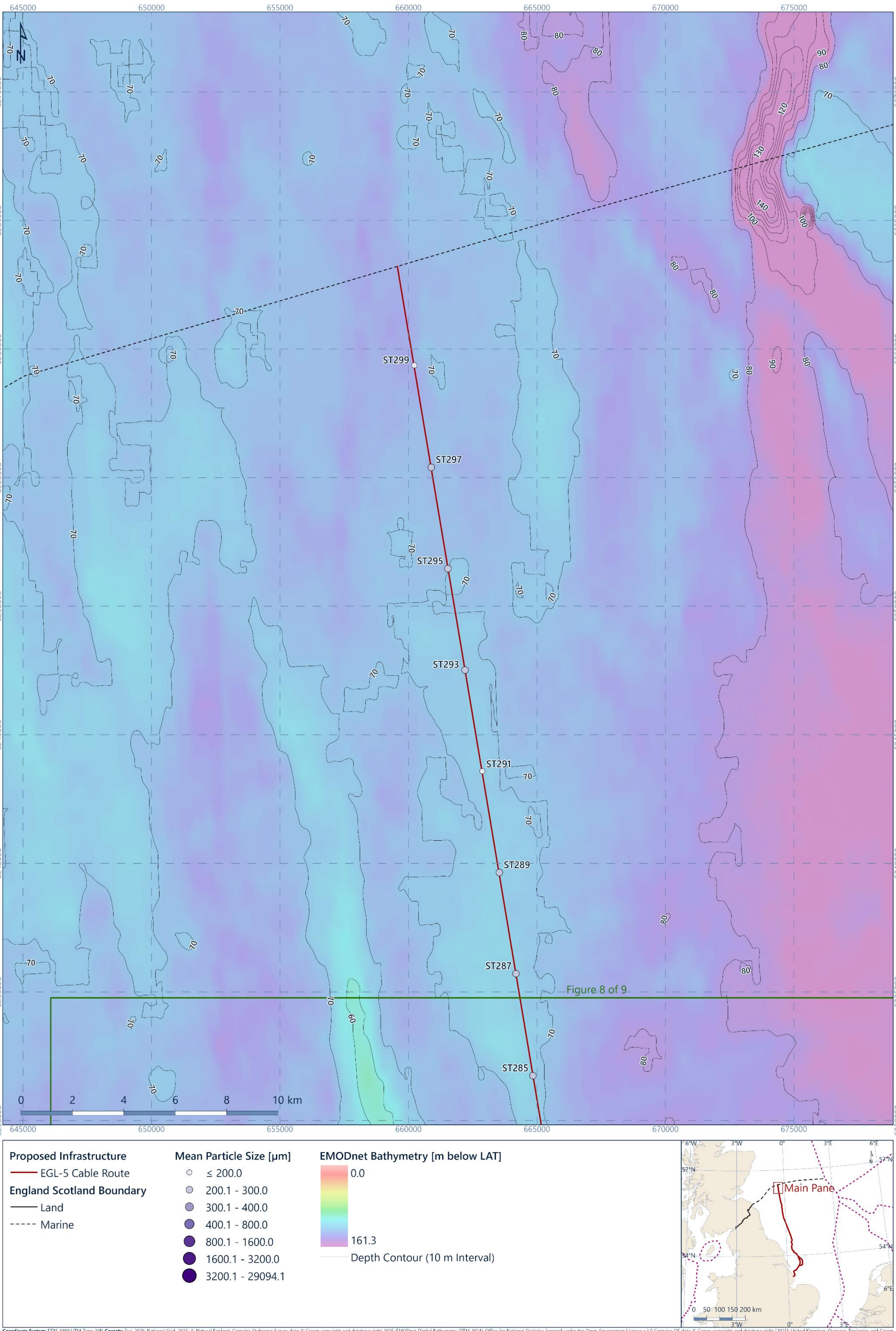

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Figure 6.10: Sediment median particle size (µm) overlaid on bathymetry, station ST285 to station ST299

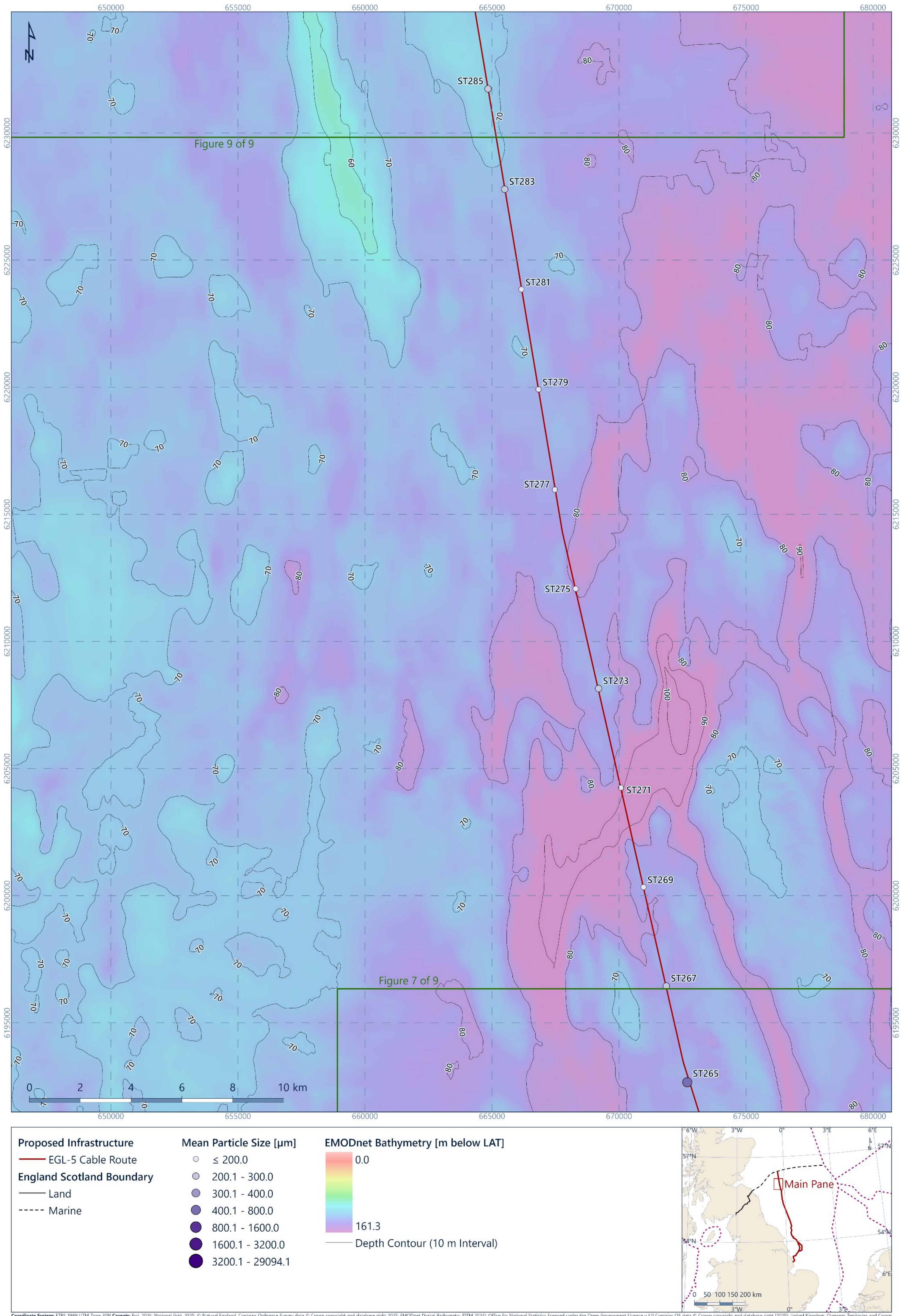

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Figure 6.11: Sediment median particle size (µm) overlaid on bathymetry, station ST265 to station ST285

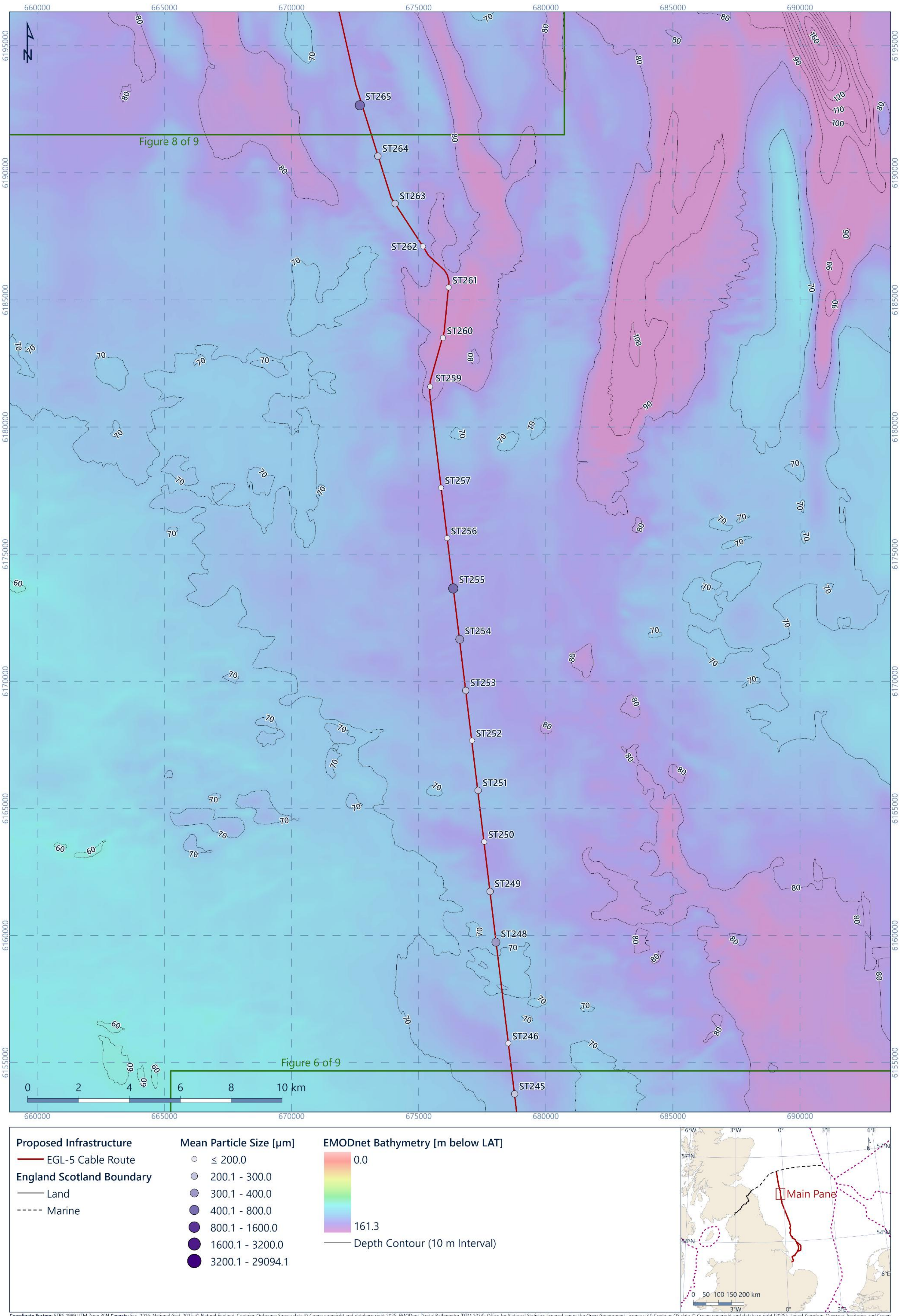

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Figure 6.12: Sediment median particle size (µm) overlaid on bathymetry, station ST245 to station ST265

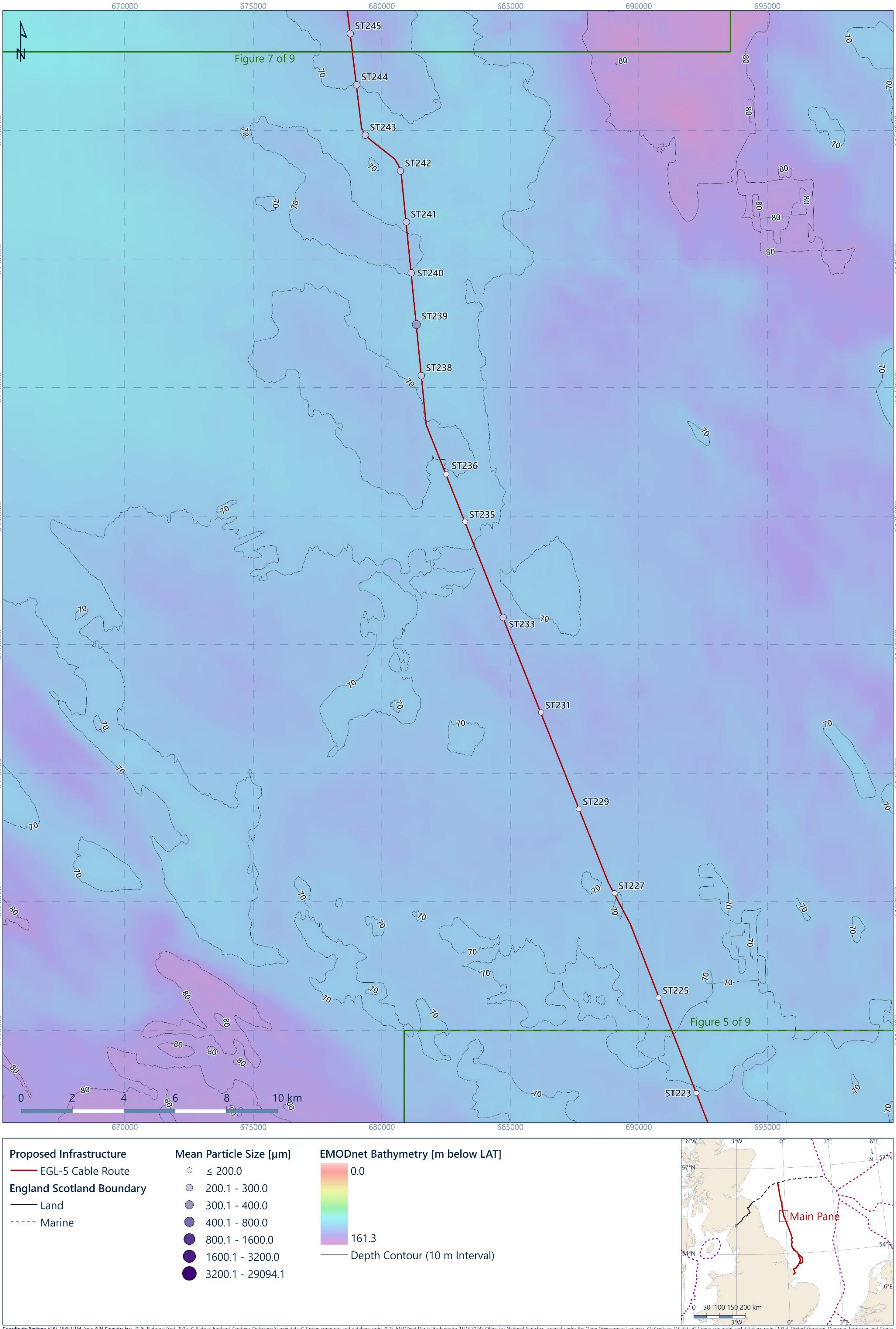

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Figure 6.13: Sediment median particle size (µm) overlaid on bathymetry, station ST223 to station ST245

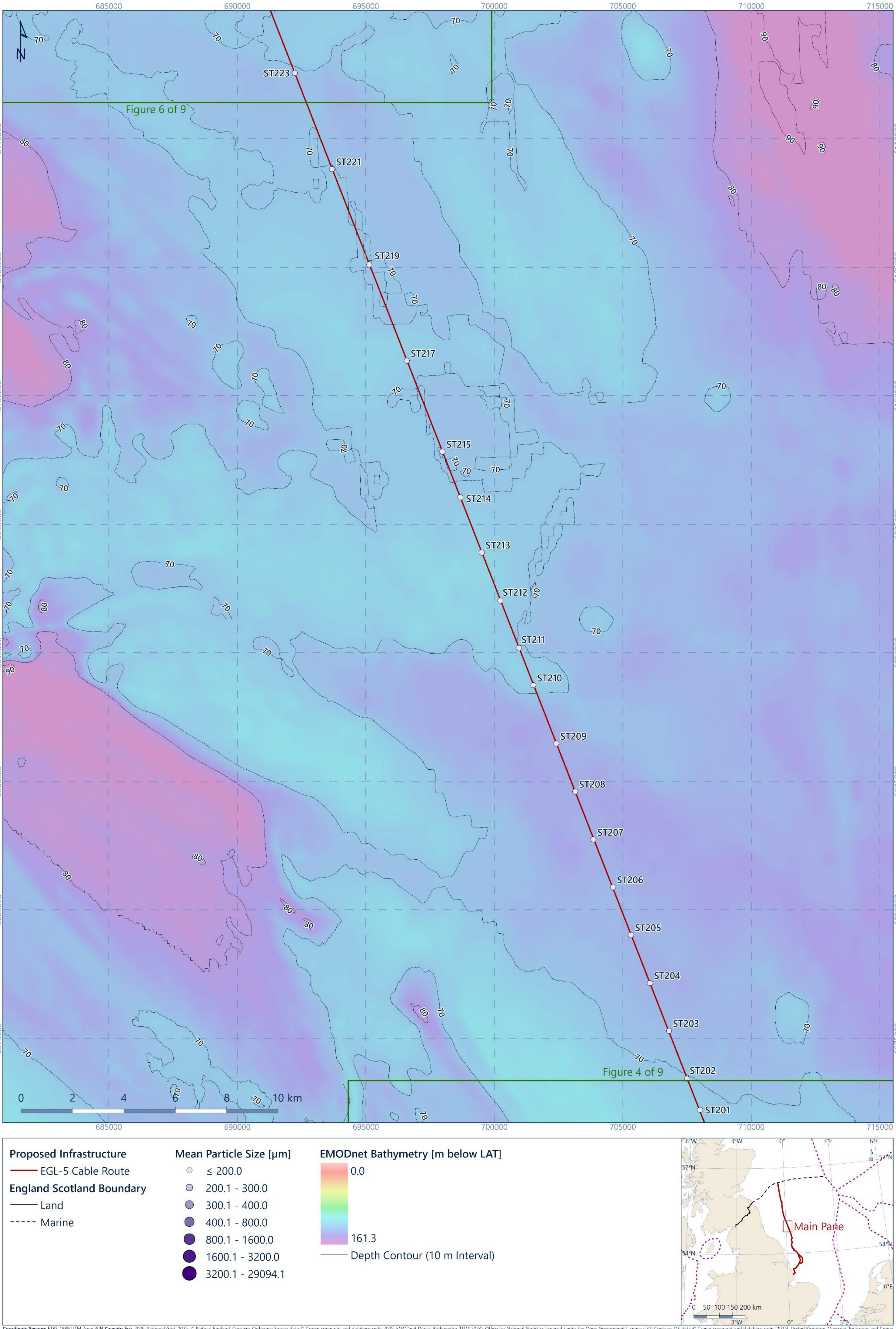

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Figure 6.14: Sediment median particle size (µm) overlaid on bathymetry, station ST201 to station ST223

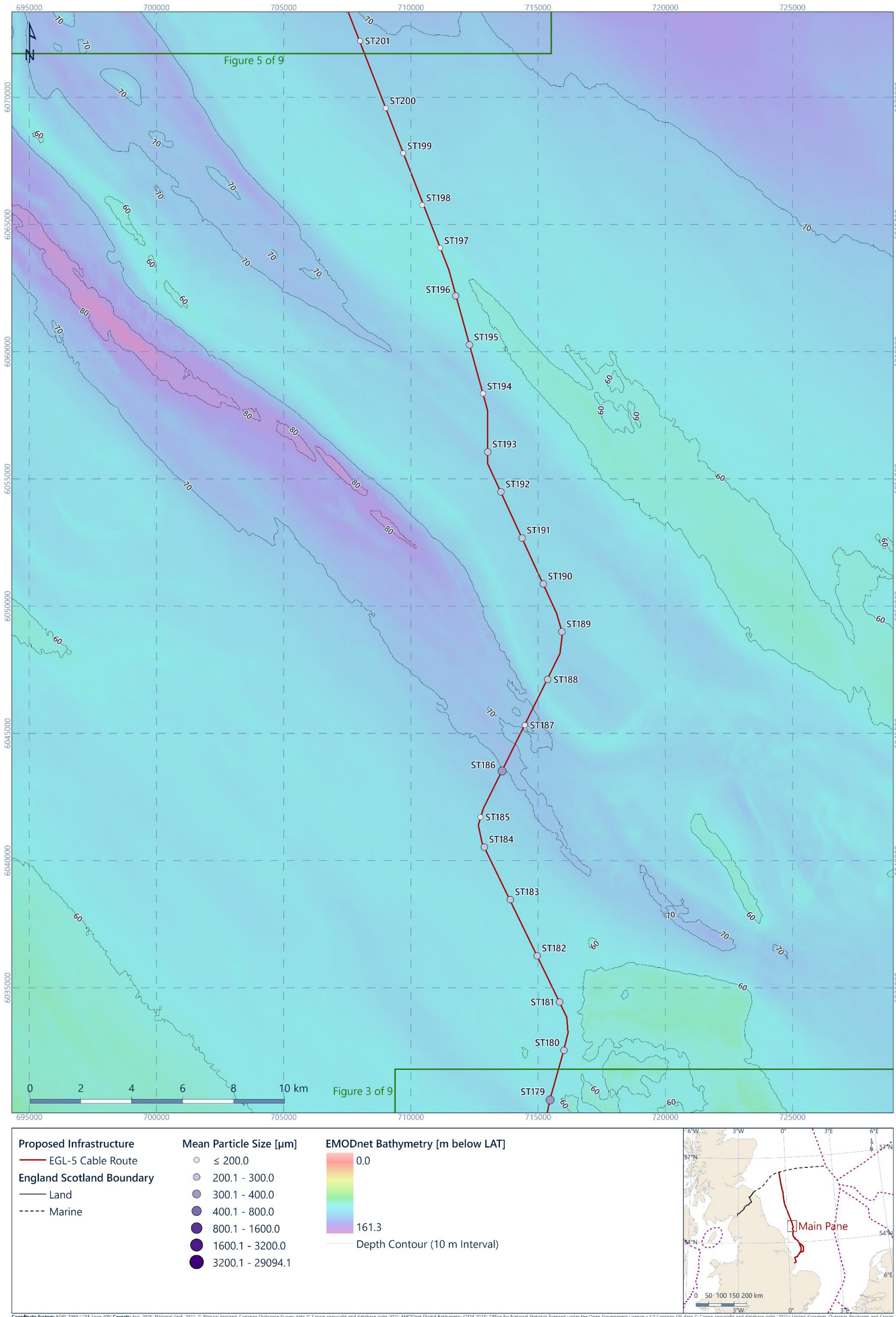

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Figure 6.15: Sediment median particle size (µm) overlaid on bathymetry, station ST179 to station ST201

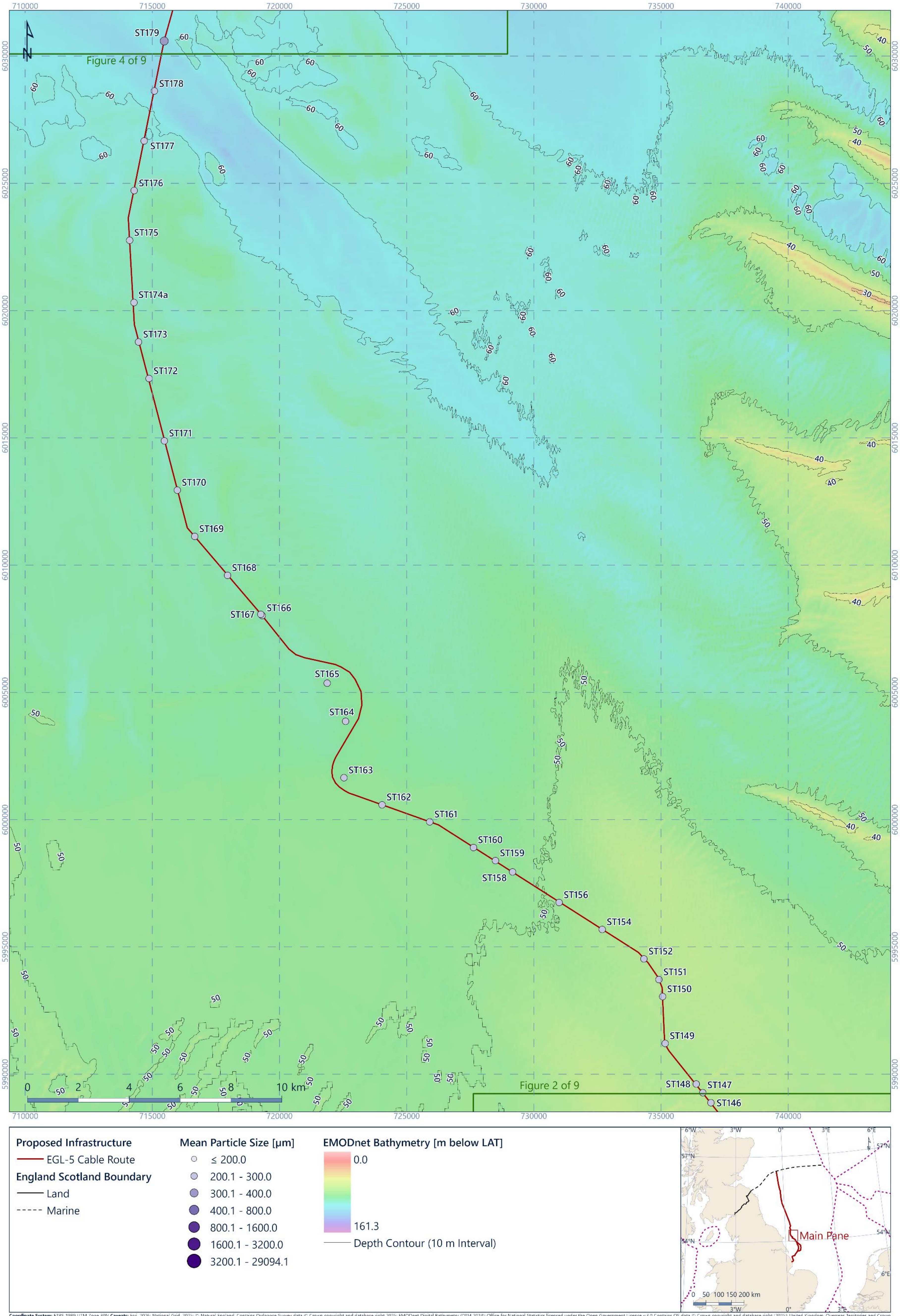


Figure 6.16: Sediment median particle size (µm) overlaid on bathymetry, station ST146 to station ST179

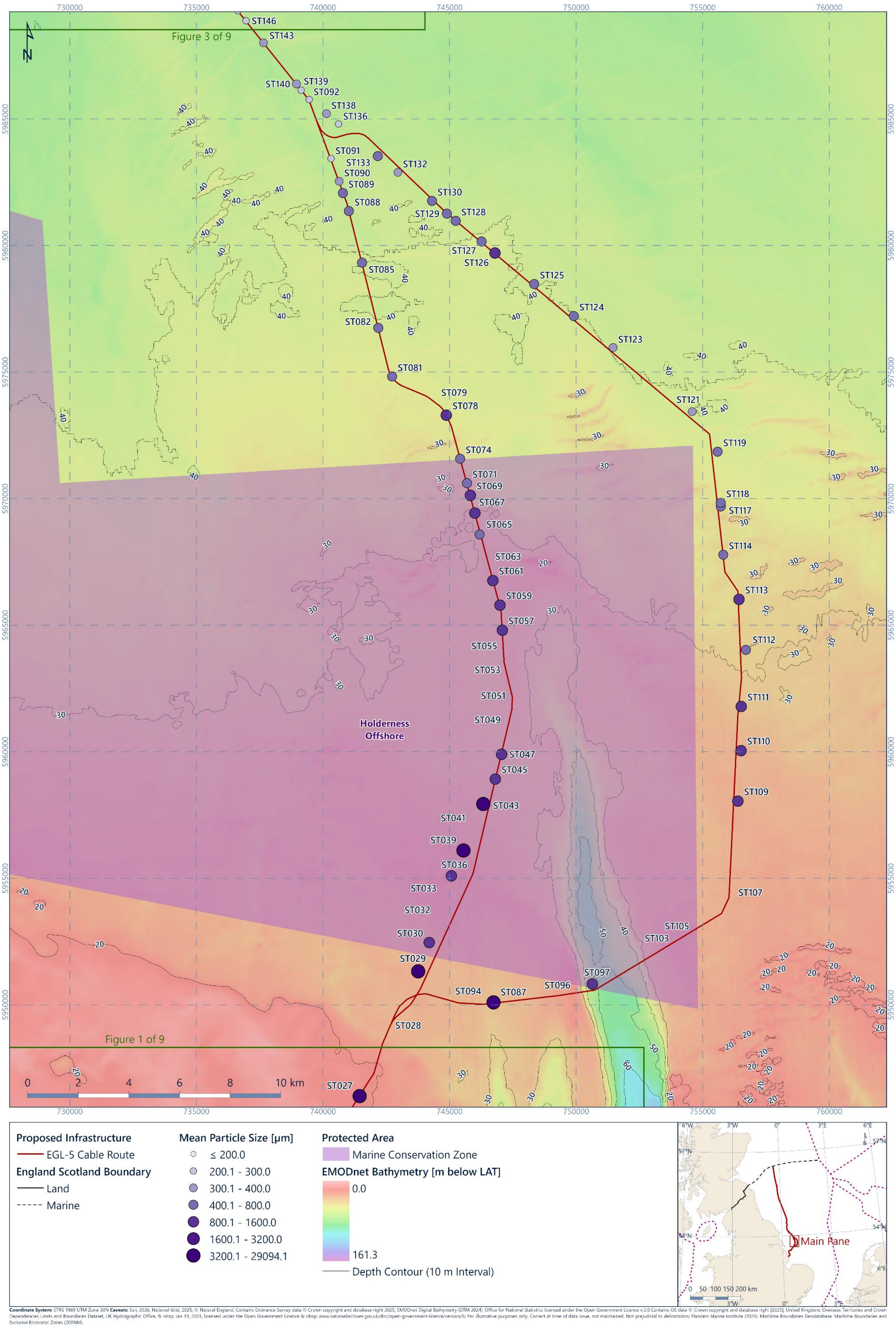


Figure 6.17: Sediment median particle size (µm) overlaid on bathymetry, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

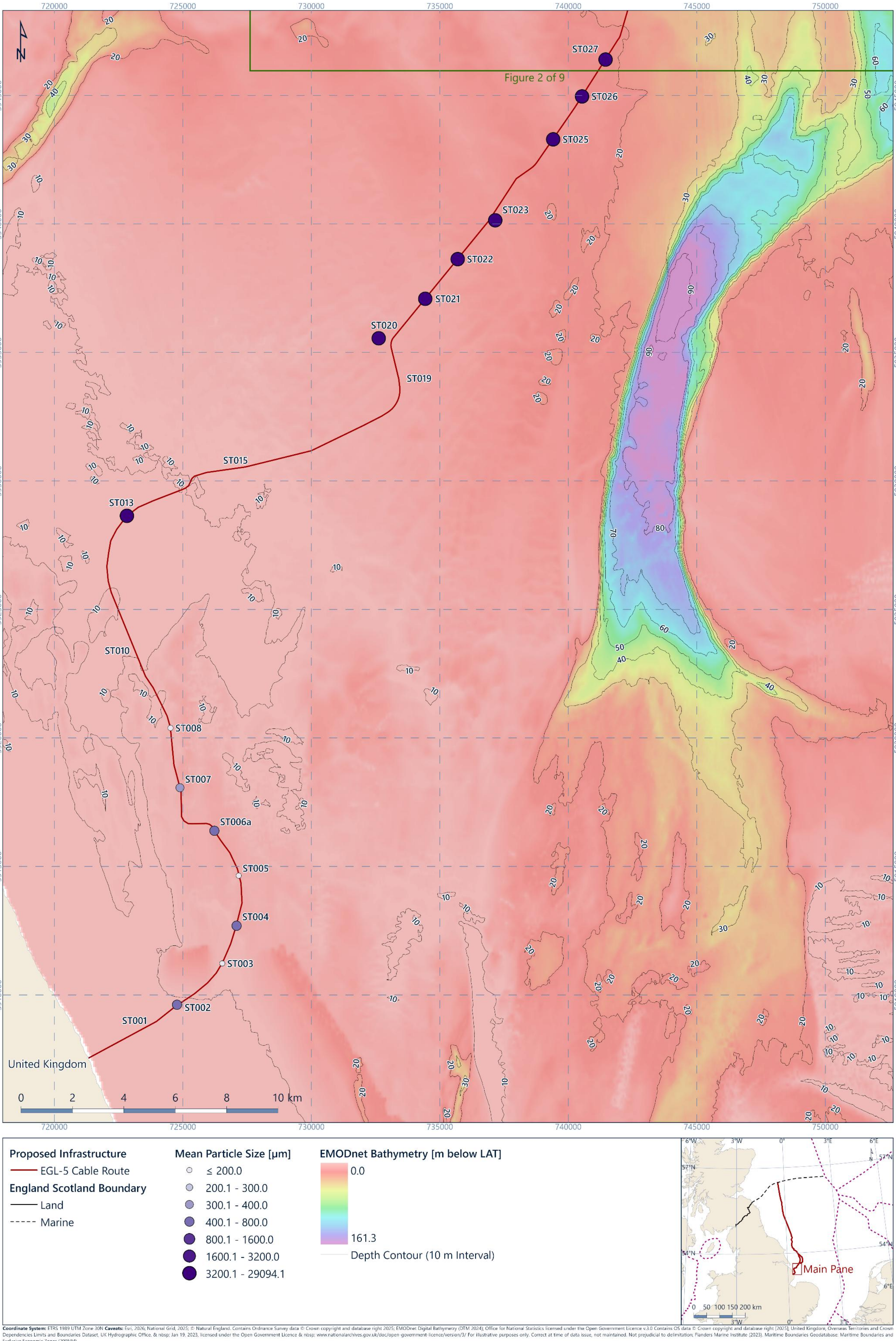


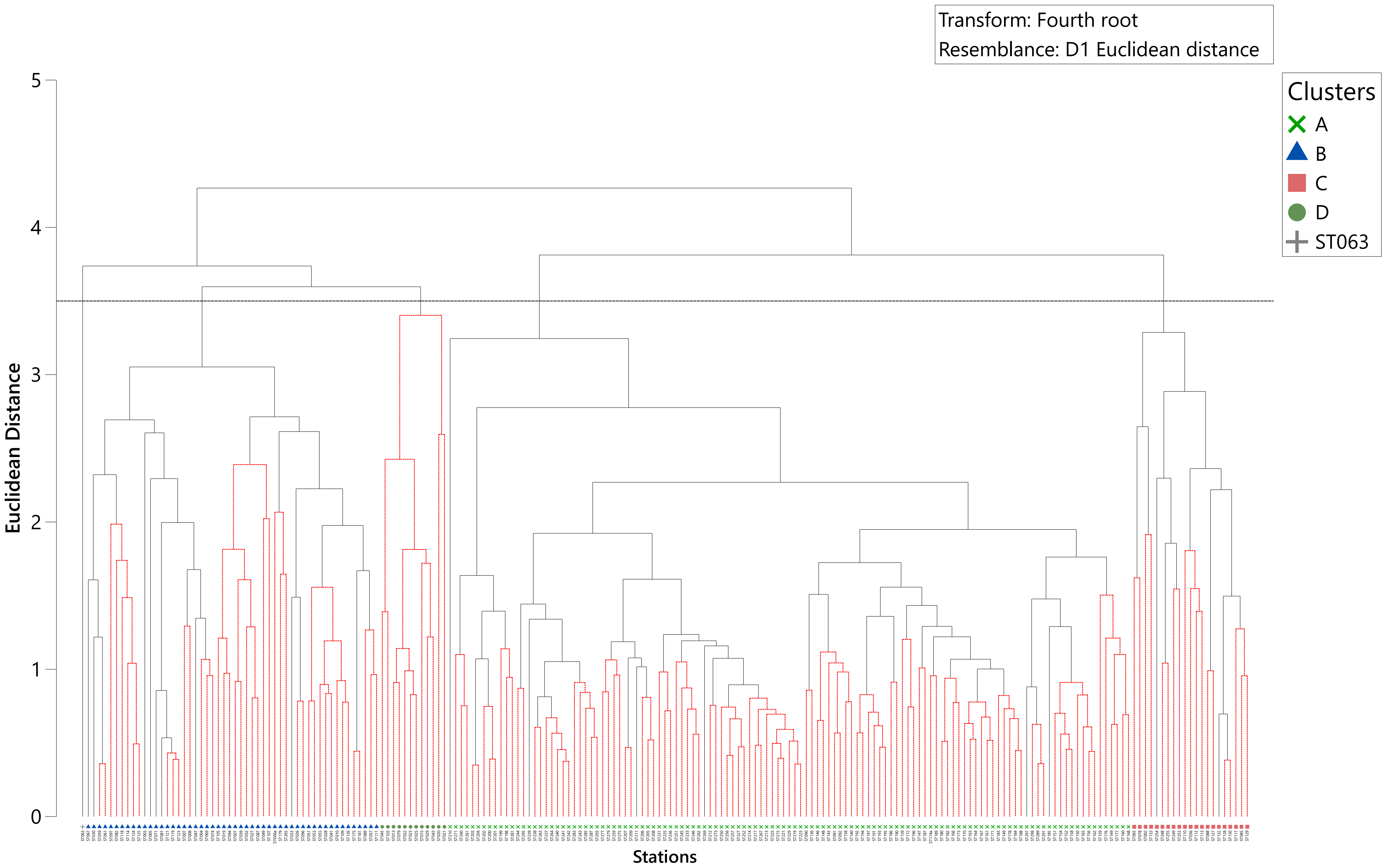
Figure 6.18: Sediment median particle size (µm) overlaid on bathymetry, station ST001 to station ST027

6.2 Investigation of Granulometric Similarities

6.2.1 Cluster Analysis

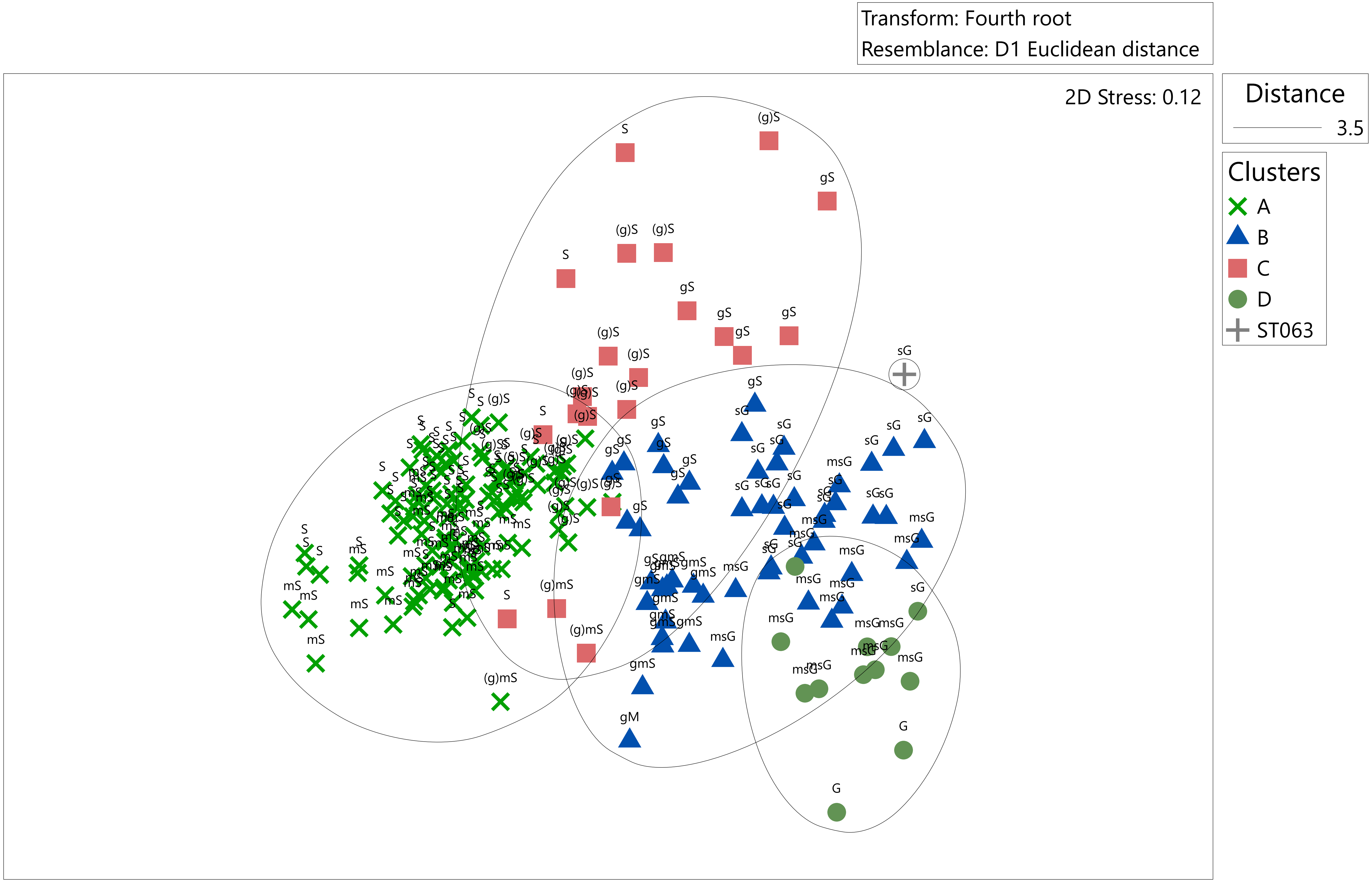
The cluster analysis, using Euclidean distance, was applied to the sediment PSD dataset to investigate sedimentological characteristics. Data were fourth root transformed and the SIMPROF test applied with the cluster analysis to identify ecologically relevant groups.

Figure 6.19 and Figure 6.20 present the dendrogram and the non-metric multi-dimensional scaling (nMDS) of the Euclidean distance matrix of sediment PSD, respectively. Table 6.3 summarises the physical characteristics of the sediment groups identified in multivariate analysis.



Note
Slice at 3.5 based on Euclidean distance

Figure 6.19: Dendrogram of hierarchical clustering of sediment characteristics data



Note
Slice at 3.5 based on Euclidean distance superimposed to the clusters

Figure 6.20: Non-metric Multidimensional Scaling (nMDS) of hierarchical clustering of sediment characteristics data

Four multivariate groups (A, B, C and D) and station ST063 were identified at the Euclidean distance of 3.5.

Group A comprised 121 stations with an average Euclidean distance of 2.45. Group A was characterised by poorly sorted sand (Folk BGS modified) with median sediment particle size values ranging from 113 µm (very fine sand) to 358 µm (medium sand), with a mean of 201 µm (fine sand), in water depth of 37.3 m to 88.2 m, with a mean of 66.0 m. The mean sand content was 90.25 %, with all stations having > 70 % sand. The fines content was ≥ 5.00 % at most stations, whilst it was < 5 % at 29 stations only. As the fines content decreased, the sediment changed from muddy sand/sand to slightly gravelly sand/gravelly sand. The mean gravel content was 0.57 %, with station ST090 having > 5 % gravel. Station ST090 also had the highest gravel content.

Group B comprised 52 stations and had an average Euclidean distance of 3.91. Group B was characterised by very poorly sorted sand/gravel (Folk BGS modified), with a median sediment particle size ranging from 51 µm (very fine sand) to 7 885 µm (fine gravel), with a mean of 1 557 µm (very coarse sand), in water depths of 10.5 m to 75.4 m, with a mean of 32.2 m. The mean sand content was 56.11 %. The gravel content ranged from 7.29 % to 69.71 %, with a mean of 35.98 %, most stations having > 10 % gravel and classified as mixed sediment of gravelly sand, sandy gravel or muddy sandy gravel/gravelly muddy sand and only four stations had < 10 % gravel content. The fines content ranged from 0.36 % to 52.63 % with a mean of 7.91 %.

Group C comprised 21 stations and had an average Euclidean distance of 3.97. Group C was characterised by poorly sorted sand (Folk BGS modified), with median sediment particle size values ranging from 392 µm (medium sand) to 1 189 µm (very coarse sand), with a mean of 620 µm (coarse sand), in water depths of 11.8 m to 77.8 m, with a mean of 44.7 m. The gravel content varied from stations devoid of this fraction to stations with gravel content up to 18.87 %. The fines contents varied from stations devoid of this fraction to stations with fines content up to 18.86 %.

Group D comprised 12 stations and had an average Euclidean distance of 3.11. Group D was characterised by very poorly sorted muddy sandy gravel (Folk BGS modified), with median sediment particle size values ranging from 1 227 µm (very coarse sand) to 47 229 µm (coarse gravel), with a mean of 15 212 µm (gravel), in water depths of 13.0 m to 37.5 m, with a mean 23.7 m. Sand and fines were present at all stations and had mean values of 29.15 % and 4.93 %, respectively. Gravel content > 36 % was recorded at all stations, which were classified as muddy sandy gravel, sandy gravel or gravel.

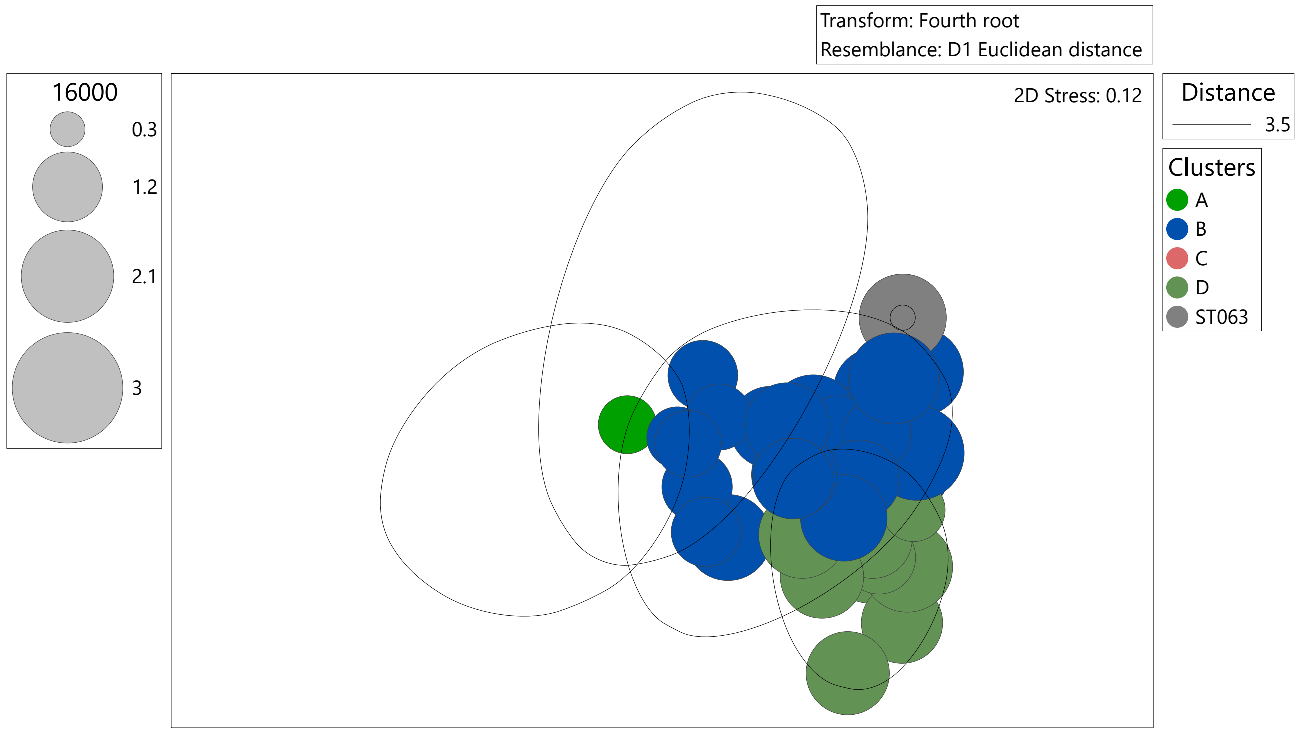
Station ST063 was characterised by very poorly sorted ‘sandy gravel’ (Folk BGS modified), with median sediment particle size of 1 987 µm (very coarse sand) in water depth of 30.7 m and had comparable proportions of gravel and sand content of 49.91 % and 49.77 %, respectively.

The sediment particle sizes mainly responsible for the separation of the multivariate groups included the 16 000 µm sediment particle size (medium pebble), the 5 600 µm sediment particle size (fine pebbles), the 44.2 µm sediment particle size (coarse silt) and the 1 400 µm sediment particle size (very coarse sand) (Figure 6.21).

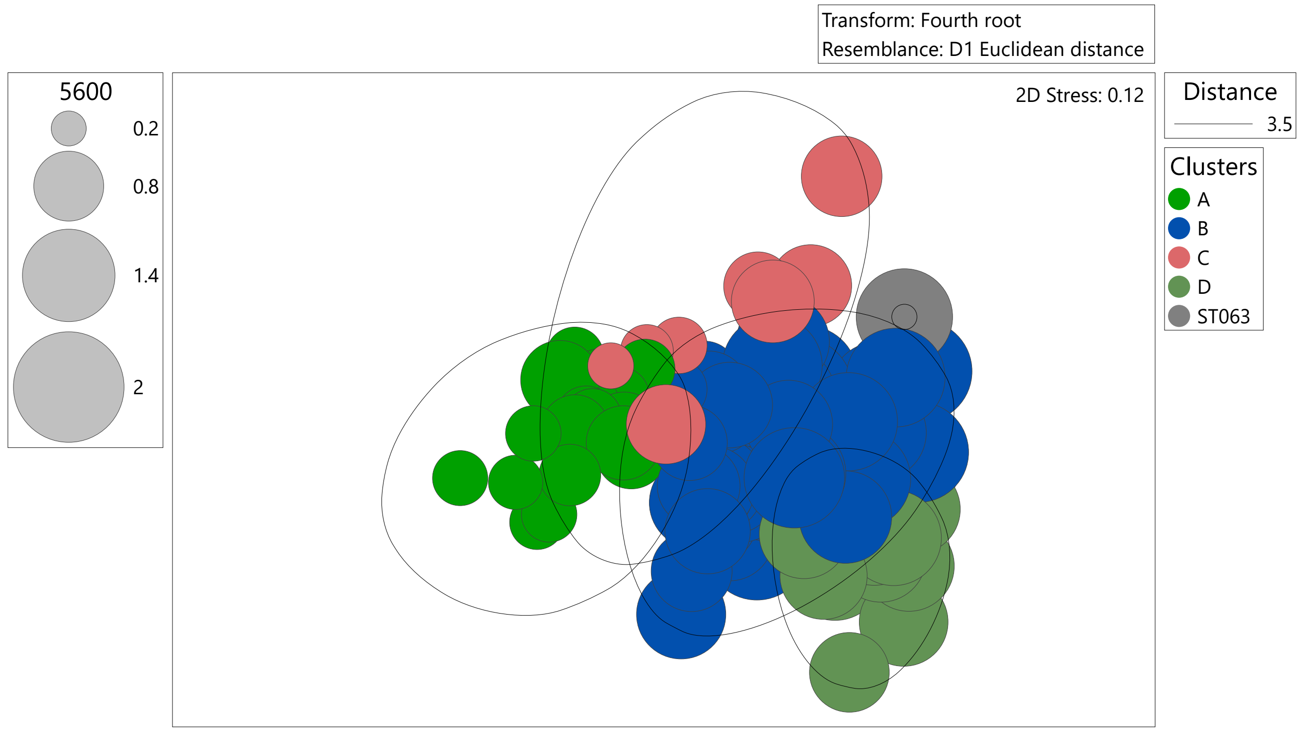
Table 6.3: Summary of physical characteristics of sediment groups identified in multivariate analysis

Sediment Group	Stations	Depth* [m]	Median Particle Size* [µm]	Sorting*,†		Fractional Composition* [%]			Folk Description (BGS modified)†
				[µm]	Description	Gravel*	Sand*	Fines*	
A [✕] Average squared distance = 2.45	ST090, ST091, ST092, ST136, ST138, ST139, ST140, ST143, ST146, ST147, ST148, ST149, ST150, ST151, ST152, ST154, ST156, ST158, ST159, ST160, ST161, ST162, ST163, ST164, ST165, ST166, ST167, ST168, ST169, ST170, ST171, ST172, ST173, ST174a, ST176, ST177, ST178, ST180, ST182, ST183, ST184, ST185, ST186, ST187, ST188, ST189, ST190, ST191, ST192, ST193, ST194, ST195, ST196, ST197, ST198, ST199, ST200, ST201, ST202, ST203, ST204, ST205, ST206, ST207, ST208, ST209, ST210, ST211, ST212, ST213, ST214, ST215, ST217, ST219, ST221, ST223, ST225, ST227, ST229, ST23, ST233, ST235, ST236, ST237, ST238, ST239, ST240, ST241, ST242, ST243, ST244, ST245, ST246, ST250, ST251, ST252, ST256, ST257, ST259, ST260, ST261, ST262, ST263, ST264, ST267, ST269, ST271, ST273, ST275, ST277, ST279, ST281, ST283, ST285, ST287, ST289, ST291, ST293, ST295, ST297, ST299	Mean: 66.0 ± 11.0	Mean: 211 ± 47	Mean: 2.30 ± 0.66	Mean: poorly sorted	Mean: 0.57 ± 1.03	Mean: 90.25 ± 5.20	Mean: 9.19 ±5.39	Sand
B [▲] Average squared distance = 3.91	ST001, ST003, ST004, ST005, ST006a, ST007, ST008, ST010, ST019, ST026, ST027, ST028, ST030, ST032, ST033, ST039, ST041, ST047, ST049, ST051, ST053, ST055, ST057, ST059, ST061, ST067, ST069, ST071, ST074, ST081, ST082, ST087, ST089, ST094, ST096, ST097, ST105, ST107, ST109, ST111, ST114, ST118, ST119, ST121, ST123, ST124, ST125, ST126, ST175, ST179, ST181, ST265	Mean: 32.2 ± 13.6	Mean: 1 557 ± 1 666	Mean: 6.27 ± 2.52	Mean: very poorly sorted	Mean: 35.98 ± 18.20	Mean: 56.11 ± 16.66	Mean: 7.91 ± 8.64	Sandy Gravel
C [■] Average squared distance = 3.97	ST002, ST036, ST065, ST078, ST085, ST088, ST110, ST112, ST113, ST117, ST127, ST128, ST129, ST130, ST132, ST133, ST248, ST249, ST253, ST254, ST255	Mean: 44.7 ± 19.0	Mean: 620 ± 232	Mean: 2.22 ± 0.96	Mean: poorly sorted	Mean: 4.55 ± 5.33	Mean: 91.63 ± 6.42	Mean: 3.82 ± 5.57	Slightly gravelly Sand
D [●] Average squared distance = 3.11	ST013, ST015, ST020, ST021, ST022D, ST023, ST025, ST029, ST043, ST045, ST079, ST103	Mean: 23.7 ± 7.2	Mean: 15 212 ± 14 232	Mean: 8.21 ± 3.16	Mean: very poorly sorted	Mean: 65.93 ± 15.40	Mean: 29.15 ± 14.02	Mean: 4.93 ± 2.37	Muddy sandy Gravel
ST063 [+]	ST063	30.7	1 987	5.56	very poorly sorted	49.91	49.77	0.32	Sandy Gravel

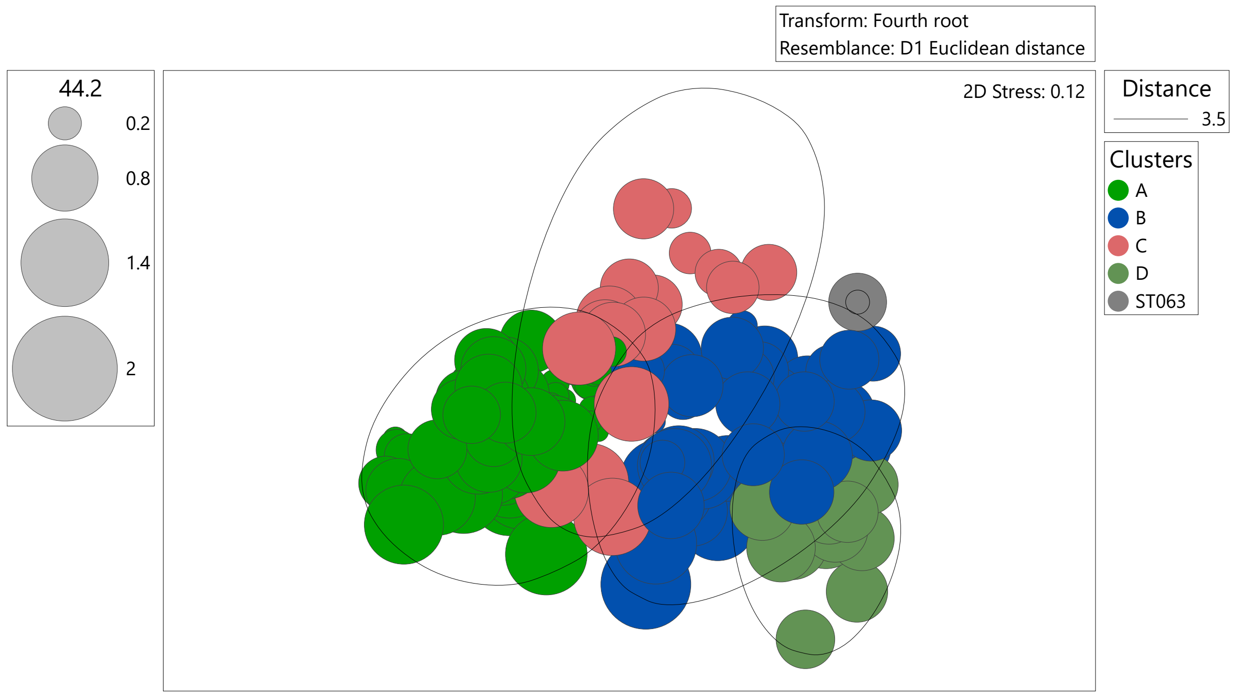
Notes
* = Mean ± standard deviation within each sediment group
† = Sediment sorting coefficient descriptions
= Folk descriptions (BGS modified) within each group



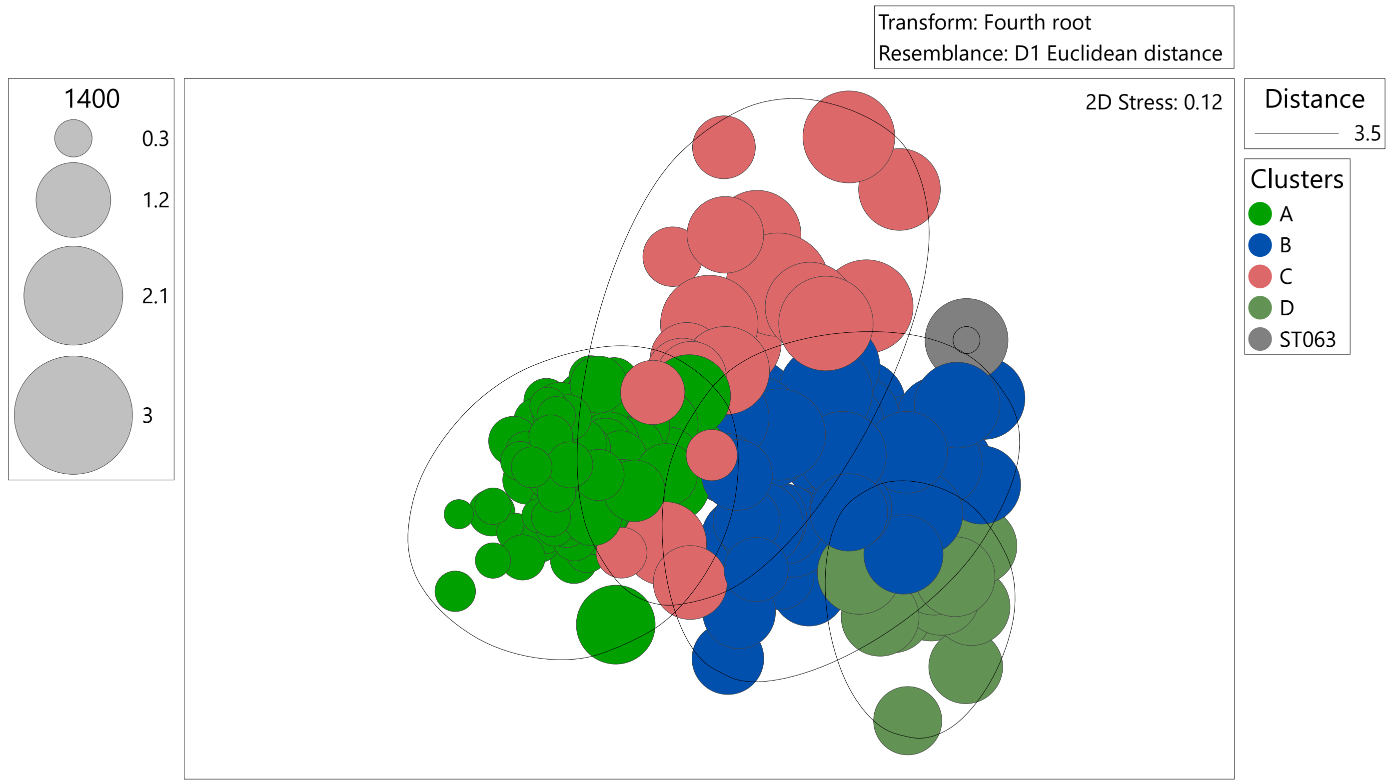
Notes
Circles proportional in diameter to the 16 000 µm sediment % particle size (medium pebble)



Notes
Circles proportional in diameter to the 5 600 µm % sediment particle size (fine pebbles)



Notes
Circles proportional in diameter to the 44.2 µm sediment % particle size (coarse silt)



Notes
Circles proportional in diameter to the 1 400 µm % sediment particle size (very coarse sand)

Figure 6.21: nMDS ordination of hierarchical clustering analysis of PSD with superimposed circles proportional in diameter to percentage of particles driving the separation of groups

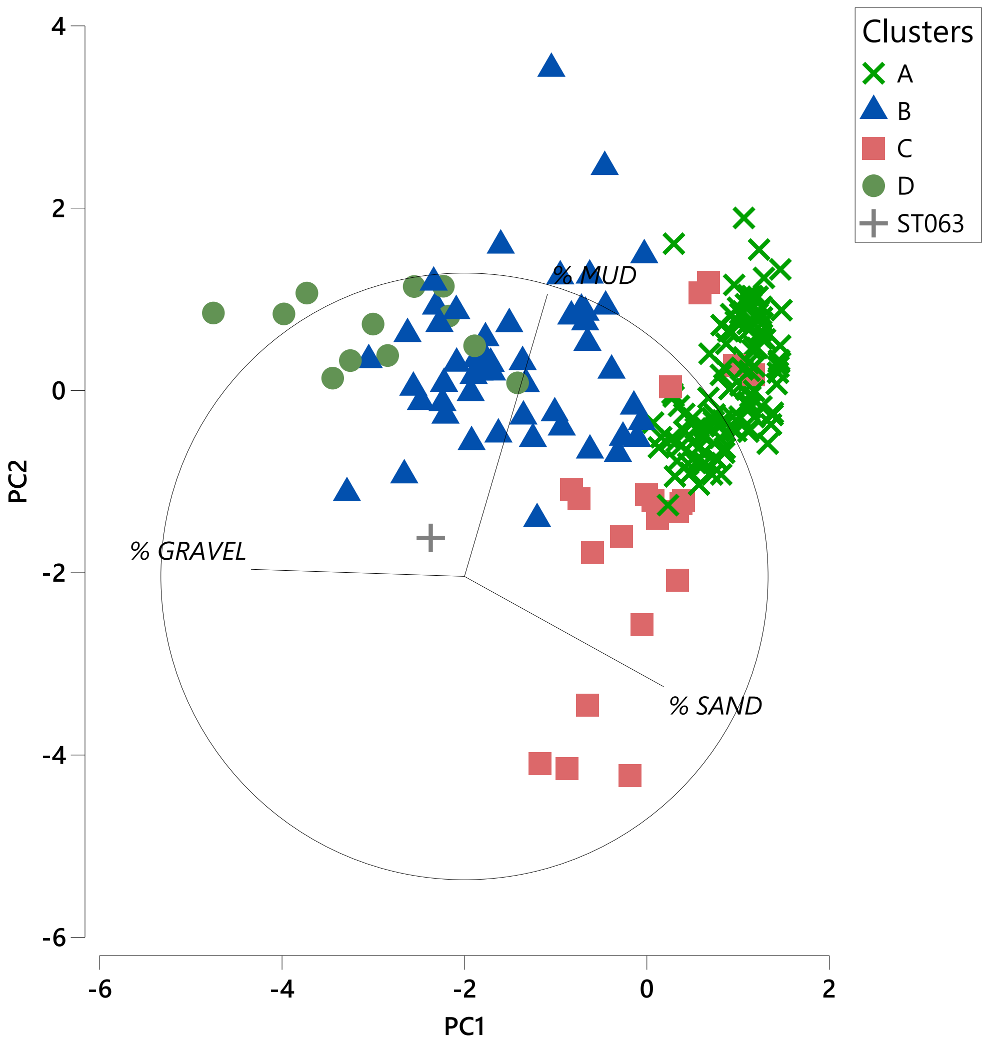
6.2.2 Principal Components Analysis

The PCA was used to reduce the sediment PSD across all samples into a smaller number of key variables (percentage of main components). This highlighted the main sediment fractions driving the variability of sediment distribution while highlighting the importance of the less represented sediment fractions.

Figure 6.22 presents a PCA ordination plot of the percentage of the main sediment fraction across the survey area with the identified clusters superimposed. Figure 6.23 presents the stations grouped by depth bands, with the Folk (BGS modified) classification superimposed.

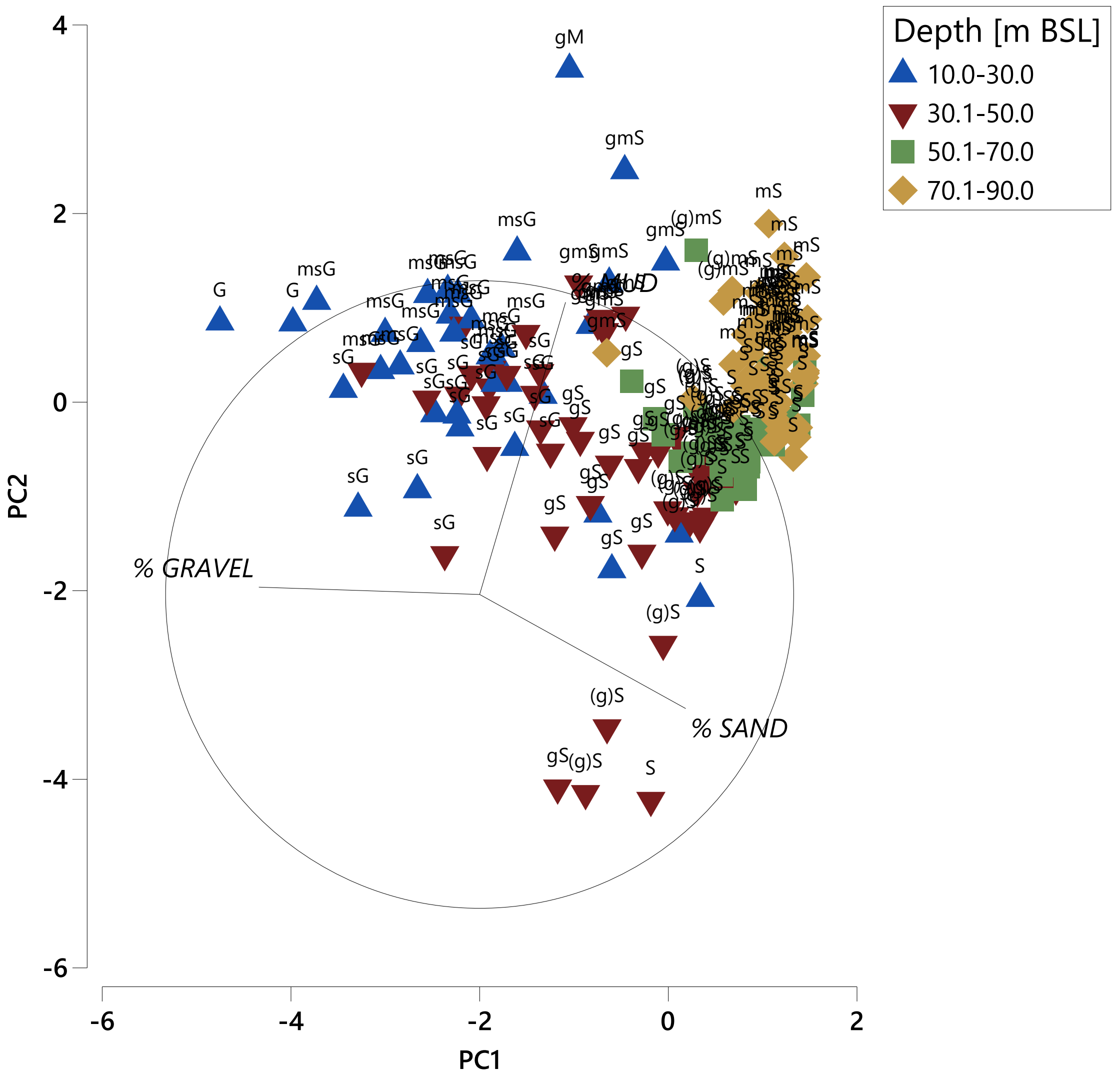
The principal component (PC) axis PC1 represents the percentage of the gravel fraction, with a variance of 62.5 %, the principal component axis PC2 represents the percentage of the mud fraction with a variance of 32.7 %. The first two axes explain a total variance of 95.2 %, as such the PCA is likely to describe the overall sediment distribution well.

Gravelly sediments were predominant at shallow stations, whilst the deeper stations were dominated by sand and muddy sand.



Notes
PC = Principal component

Figure 6.22: Principal components analysis (PCA) ordination of fractional composition (gravel, sand and mud), identified by clusters



Notes
PC = Principal component

Figure 6.23: Principal components analysis (PCA) ordination of % of gravel, sand and mud grouped by depth bands with BGS modified classification superimposed

7. Sediment Chemistry

7.1 Sediment Hydrocarbons

7.1.1 Introduction

The sediment samples were analysed for hydrocarbon content, including total hydrocarbon content (THC), total n-alkanes (nC_{12} to nC_{36}) and PAHs, specifically the United States Environmental Protection Agency's 16 priority PAH pollutants (US EPA 16 PAHs) and alkylated PAHs.

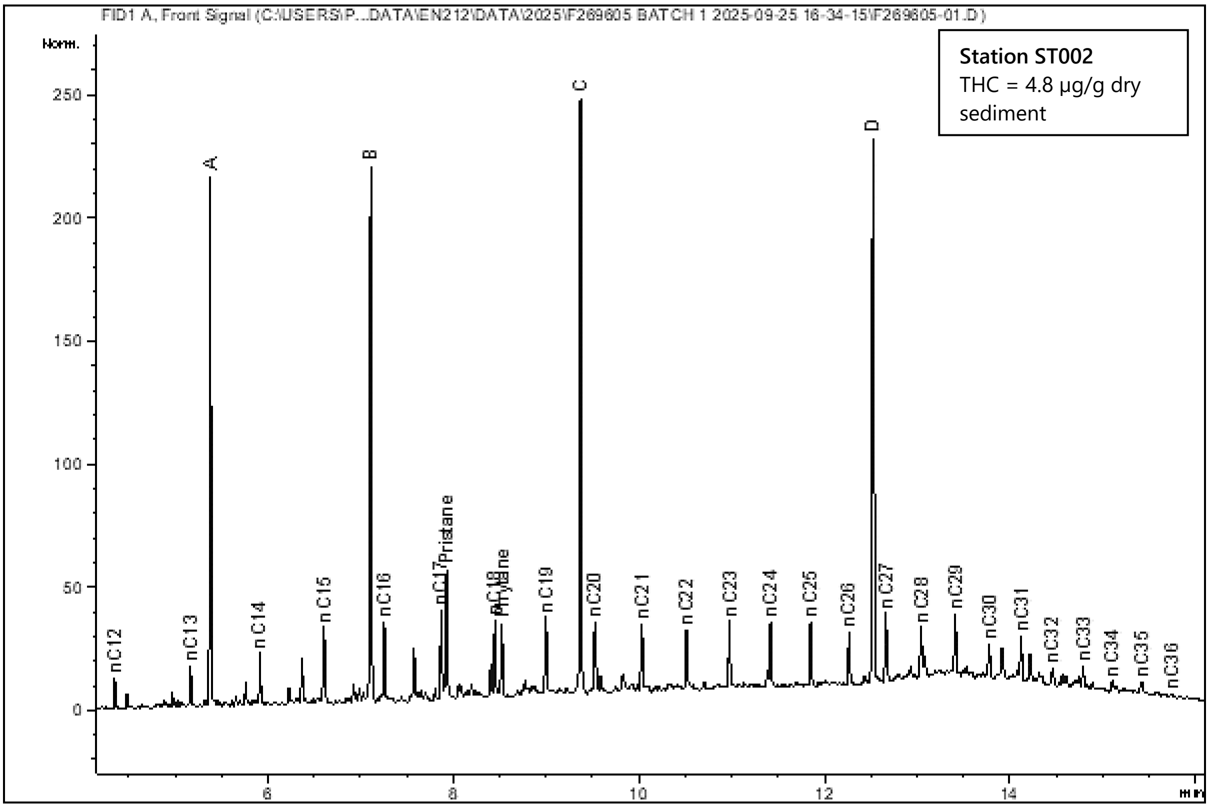
Appendix B provides full details of the analytical techniques employed.

7.1.2 Results

7.1.2.1 Gas Chromatography–Flame Ionisation Detection (GC-FID) Hydrocarbon Profiles

A visual comparison of GC-FID profiles can provide information on the potential sources of the hydrocarbons present in marine sediment samples. The GC-FID profiles illustrating the hydrocarbon components detected in each of the sediment samples are provided in Appendix E.1.

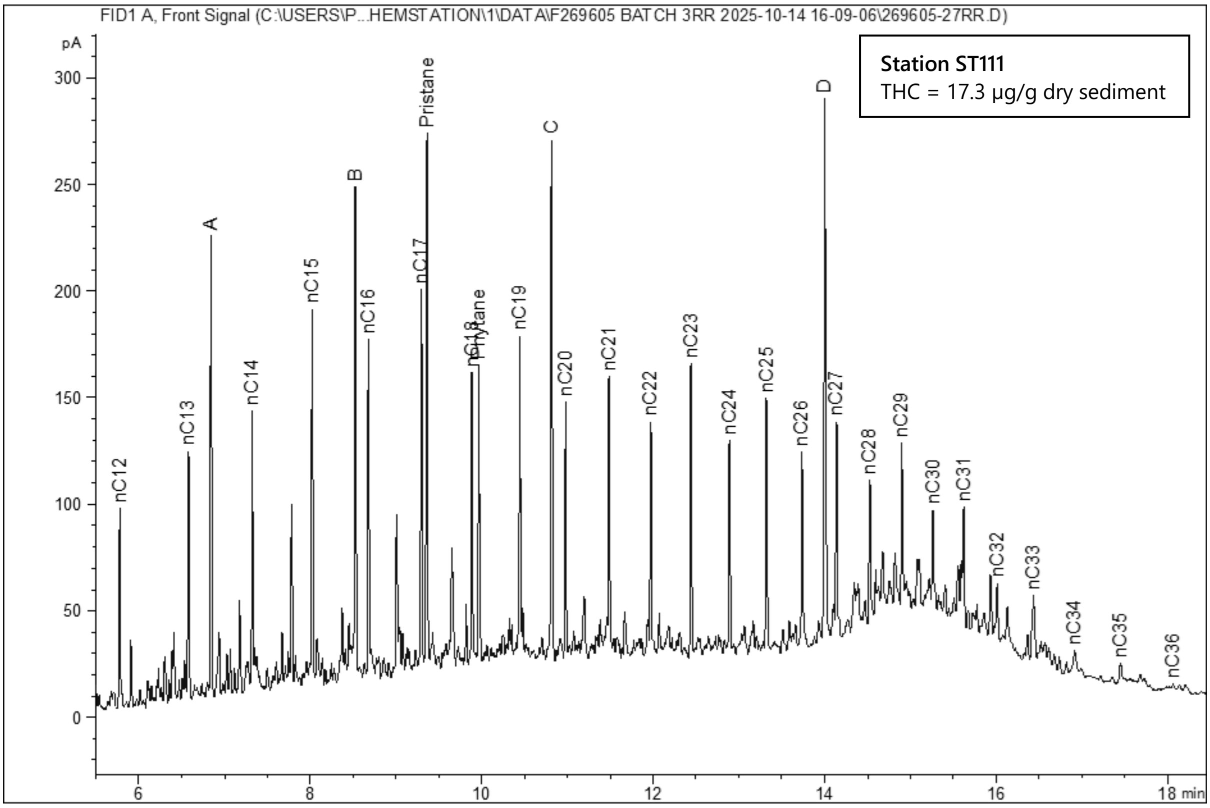
To support more detailed discussions (Section 12.2.1) regarding the hydrocarbon components identified by GC-FID analysis of the sediments, Figure 7.1 displays an example gas chromatogram typically observed across the cable route. This profile is characterised by a small 'hump' of unresolved material (UCM) peaking late in the chromatogram window and a homologous series of low-level resolved n-alkanes. The profile shows a series of n-alkanes from nC_{12} to nC_{26}. The slight prevalence of the odd-numbered heavier n-alkanes (those from nC_{25}) is indicative of plant waxes originating from terrestrial runoff.



Notes
THC = Total hydrocarbon content
A, B, C and D peaks refer to the internal standards added for quantification

Figure 7.1: Gas chromatographic profile for typical surface sediment (station ST002)

Figure 7.2 highlights another GC-FID profile found across the survey area (station ST111). This profile indicates a petrogenic input, most likely from shipping activities. This is frequently observed in sediments across the region. The input is characterised by a low-level UCM between nC_{12} and nC_{26}, with a corresponding series of n-alkanes over a similar carbon-number range. This profile is also characterised by a second, more prominent UCM peaking late (ca. nC_{29}) within the chromatogram window and a homologous series of low-level, well-resolved n-alkanes.



Notes
THC = Total hydrocarbon content
A, B, C and D peaks refer to the internal standards added for quantification

Figure 7.2: Gas chromatographic profile for typical surface sediment (station ST111)

7.1.2.2 Total Hydrocarbon and n-Alkanes (nC_{12} to nC_{36}) Content

Table 7.1 presents the concentrations of total hydrocarbons, UCM and total n-alkanes along with the CPI (nC_{12} to nC_{36}) and pristane/phytane ratios reported from the surface sediment across the National Grid EGL5 area. Figures 7.3 to 7.11 present the spatial distribution of the concentration of THC along the proposed cable route (Route B and C). Appendix E.2 presents individual n-alkane concentrations for the sediments analysed.

The mean THC value (5.5 µg/g) was lower than the Cefas Guideline Action Levels (AL1; 100 µg/g), with values ranging from 1.0 µg/g at station ST251 to 19.8 µg/g at station ST020. Variability in THC values across the survey area was moderate (RSD 66 %). All values were below the ecological effects threshold (EET) of 50 µg/g (OSPAR, 2006). For the pre-sweeping stations, values ranged from 2.70 µg/g at station ST146 to 10.9 µg/g at station ST078. THC values were also lower than the AL1 limit for the pre-sweeping stations.

The UCM concentrations ranged from < 0.5 µg/g at station ST251 to 15.1 µg/g at station ST111, with a mean of 3.3 µg/g. Variability in UCM concentrations across the cable route was high (RSD 79 %).

The total n-alkane (nC_{12} to nC_{36}) concentrations ranged from 0.08 µg/g at station ST251 to 1.94 µg/g at station ST047, with a mean of 0.50 µg/g. Variability in total n-alkane (nC_{12} to nC_{36}) concentrations along the proposed cable route was high (RSD 83 %).

The CPI ratio (nC_{12} to nC_{36}) reflects the relationship between odd- and even-carbon n-alkanes and can indicate the source of hydrocarbon inputs. The mean CPI ratio value ranged from 1.06 at station ST055 to 3.64 at station ST257, with a mean of 2.09. Variability in the CPI ratio across the entire cable route was moderate (RSD 37 %).

The mean pristane/phytane (Pr/Ph) ratio (11.0) ranged from 1.22 at station ST138 to 90.9 at station ST285. Variability in the pristane/phytane (Pr/Ph) ratio across the cable route was high (RSD 106 %).

Table 7.1: Summary of sediment hydrocarbon analysis

Station	THC*	UCM*	n-alkanes*			CPI Ratio			Pristane*	Phytane*	Pr/Ph Ratio
			nC_{12-20}	nC_{21-36}	nC_{12-36}	nC_{12-20}	nC_{21-36}	nC_{12-36}			
ST002	4.8	3.3	0.23	0.28	0.51	0.96	1.31	1.13	0.0539	0.0315	1.71
ST004	11.7	7.8	0.34	0.90	1.24	0.91	3.10	2.11	0.138	0.0382	3.61
ST006	13.9	9.2	0.48	0.85	1.33	0.90	1.92	1.44	0.161	0.0569	2.83
ST007	14.0	9.8	0.48	0.79	1.27	0.93	1.83	1.40	0.168	0.0512	3.27
ST010	8.4	5.8	0.28	0.46	0.74	0.90	1.80	1.37	0.101	0.0307	3.30
ST020	19.8	11.6	0.50	0.69	1.19	1.11	1.22	1.17	0.120	0.0780	1.54
ST026	3.5	1.5	0.48	0.60	1.08	0.95	1.23	1.09	0.0394	0.0194	2.03
ST028	5.4	3.5	0.24	0.33	0.57	0.88	1.43	1.16	0.0755	0.0294	2.57
ST030	4.4	2.8	0.23	0.27	0.49	0.92	1.44	1.17	0.0580	0.0299	1.94
ST033	3.1	1.9	0.17	0.35	0.52	0.94	1.22	1.12	0.0355	0.0232	1.53
ST039	3.8	2.5	0.20	0.25	0.45	0.95	1.30	1.13	0.0482	0.0241	2.00
ST043	8.6	5.2	0.62	0.56	1.18	0.92	1.36	1.10	0.118	0.0729	1.61
ST047	17.6	11.8	1.07	0.88	1.94	0.98	1.34	1.13	0.229	0.137	1.67
ST051	11.9	7.4	0.79	0.80	1.60	0.92	1.38	1.12	0.150	0.0706	2.12
ST055	10.9	7.3	0.72	0.54	1.26	0.91	1.30	1.06	0.130	0.0725	1.79
ST059	7.2	4.6	0.44	0.41	0.84	0.93	1.32	1.10	0.0910	0.0443	2.05
ST063	4.2	2.5	0.22	0.28	0.50	0.88	1.36	1.12	0.103	0.0210	4.92
ST067	2.9	1.8	0.12	0.16	0.28	0.79	1.35	1.08	0.0386	0.0119	3.24
ST071	4.8	3.2	0.23	0.31	0.54	0.93	1.41	1.18	0.0724	0.0260	2.78
ST078	7.3	4.6	0.50	0.48	0.98	0.93	1.30	1.09	0.106	0.0547	1.93
ST081	16.2	10.5	0.88	0.98	1.86	0.95	1.51	1.21	0.265	0.0925	2.87
ST087	8.8	5.8	0.44	0.67	1.11	0.92	1.49	1.23	0.0992	0.0531	1.87
ST088	4.0	2.5	0.20	0.36	0.56	0.89	1.30	1.13	0.0497	0.0268	1.85
ST090	8.2	5.2	0.23	0.37	0.59	0.89	1.71	1.32	0.107	0.0382	2.80
ST097	3.3	1.9	0.17	0.21	0.38	1.05	1.31	1.18	0.0743	0.0179	4.16
ST105	11.7	9.9	0.55	0.63	1.18	1.01	1.41	1.20	0.124	0.0537	2.30
ST111	17.3	15.1	1.02	0.83	1.85	1.03	1.44	1.20	0.223	0.128	1.74
ST117	3.0	1.7	0.22	0.32	0.55	0.92	1.32	1.14	0.0310	0.0170	1.82
ST118	7.2	4.3	0.43	0.56	1.00	0.99	1.39	1.20	0.0853	0.0450	1.89

Station	THC*	UCM*	n-alkanes*			CPI Ratio			Pristane*	Phytane*	Pr/Ph Ratio
			nC_{12-20}	nC_{21-36}	nC_{12-36}	nC_{12-20}	nC_{21-36}	nC_{12-36}			
ST121	10.6	6.2	0.48	0.50	0.98	1.02	1.62	1.28	0.199	0.0696	2.86
ST123	8.6	5.3	0.34	0.50	0.85	1.04	1.62	1.35	0.111	0.0537	2.07
ST125	13.8	7.0	0.71	0.95	1.66	0.99	1.38	1.20	0.191	0.108	1.78
ST128	7.8	3.9	0.30	0.41	0.71	1.36	1.35	1.36	0.0741	0.0257	2.88
ST130	8.8	4.9	0.31	0.56	0.87	0.99	1.24	1.15	0.0989	0.0514	1.93
ST133	7.8	5.0	0.37	0.49	0.86	0.99	1.39	1.20	0.106	0.0688	1.53
ST138	5.4	3.5	0.20	0.28	0.48	1.00	1.45	1.25	0.0638	0.0522	1.22
ST139	5.5	3.5	0.14	0.25	0.39	1.14	1.89	1.57	0.0567	0.0205	2.76
ST146	3.7	2.2	0.10	0.19	0.28	1.02	2.27	1.71	0.0344	0.0083	4.16
ST147	5.9	3.5	0.12	0.26	0.38	1.04	2.37	1.81	0.140	0.0162	8.67
ST150	3.7	2.2	0.06	0.16	0.22	1.05	2.80	2.11	0.0308	0.0080	3.86
ST151	4.2	2.4	0.07	0.19	0.26	1.08	2.52	1.94	0.0345	0.0095	3.64
ST154	4.0	2.4	0.06	0.18	0.24	1.13	2.69	2.11	0.0345	0.0090	3.84
ST158	3.9	2.4	0.06	0.17	0.23	1.09	2.94	2.21	0.0270	0.0057	4.69
ST159	4.6	2.7	0.08	0.21	0.28	0.93	2.72	1.98	0.0530	0.0085	6.26
ST161	6.4	3.8	0.15	0.32	0.47	1.04	2.37	1.79	0.0703	0.0137	5.13
ST163	5.3	3.4	0.14	0.25	0.39	1.01	2.21	1.64	0.0450	0.0184	2.45
ST165	4.9	3.0	0.14	0.23	0.37	0.84	2.78	1.69	0.0332	0.0061	5.48
ST167	8.1	5.1	0.18	0.35	0.53	0.88	2.38	1.66	0.0801	0.0206	3.89
ST169	6.5	3.9	0.12	0.29	0.41	0.92	2.89	1.98	0.0747	0.0115	6.49
ST171	6.4	4.4	0.23	0.33	0.55	1.00	1.99	1.48	0.0694	0.0281	2.47
ST173	6.7	4.0	0.14	0.25	0.39	0.99	1.81	1.45	0.0465	0.0130	3.58
ST175	7.6	4.6	0.11	0.34	0.45	1.13	2.40	1.96	0.0357	0.0095	3.77
ST177	5.0	2.8	0.06	0.19	0.24	1.10	2.61	2.09	0.0395	0.0041	9.55
ST179	6.6	3.2	0.05	0.20	0.25	1.23	2.04	1.82	0.0369	0.0033	11.1
ST181	4.3	2.8	0.06	0.19	0.25	1.11	2.44	1.96	0.0264	0.0088	3.00
ST183	3.5	2.1	0.03	0.15	0.19	1.07	3.13	2.49	0.0276	0.0048	5.75
ST185	4.6	2.5	0.05	0.21	0.26	1.18	2.63	2.23	0.0467	0.0036	12.8
ST187	4.7	2.8	0.05	0.20	0.25	1.13	2.72	2.22	0.0478	0.0090	5.33
ST189	3.1	1.7	0.03	0.16	0.19	1.05	2.30	1.98	0.0288	0.0025	11.5

Station	THC*	UCM*	n-alkanes*			CPI Ratio			Pristane*	Phytane*	Pr/Ph Ratio
			nC_{12-20}	nC_{21-36}	nC_{12-36}	nC_{12-20}	nC_{21-36}	nC_{12-36}			
ST191	3.0	1.7	0.03	0.18	0.22	1.02	2.67	2.25	0.0342	0.0015	23.2
ST193	3.4	1.9	0.04	0.19	0.24	0.91	2.84	2.26	0.0281	0.0025	11.4
ST195	3.8	1.9	0.04	0.17	0.21	1.10	2.47	2.10	0.0345	0.0021	16.8
ST197	3.2	1.4	0.02	0.16	0.19	1.00	2.26	2.02	0.0162	0.0012	13.3
ST199	2.7	1.6	0.03	0.21	0.24	1.16	3.89	3.20	0.0242	0.0015	16.0
ST201	3.3	1.9	0.04	0.24	0.28	1.19	3.72	3.06	0.0384	0.0020	19.4
ST203	4.0	2.3	0.05	0.28	0.33	1.26	3.74	3.06	0.0724	0.0030	24.3
ST205	4.2	2.5	0.06	0.30	0.36	1.12	3.50	2.82	0.0415	0.0035	11.8
ST207	5.0	3.1	0.07	0.40	0.47	1.13	3.44	2.83	0.0312	0.0038	8.14
ST209	5.3	2.9	0.07	0.38	0.45	1.09	3.31	2.69	0.0750	0.0044	17.2
ST211	4.8	2.7	0.07	0.37	0.44	1.14	3.32	2.72	0.0494	0.0035	14.3
ST213	4.7	2.7	0.06	0.37	0.42	1.15	3.65	3.01	0.0607	0.0029	20.7
ST215	4.9	2.8	0.06	0.40	0.46	1.12	3.47	2.94	0.0332	0.0030	11.2
ST217	3.8	2.1	0.04	0.31	0.35	1.18	3.43	2.94	0.0248	0.0019	13.4
ST219	4.1	2.4	0.05	0.37	0.41	1.05	3.24	2.76	0.0280	0.0027	10.4
ST221	3.8	2.2	0.04	0.31	0.35	1.10	3.30	2.83	0.0221	0.0023	9.61
ST223	6.0	3.2	0.05	0.76	0.81	1.28	2.16	2.08	0.0495	0.0034	14.7
ST225	4.7	2.6	0.04	0.32	0.36	1.24	3.02	2.68	0.0359	0.0012	29.2
ST227	3.8	2.2	0.04	0.27	0.30	1.17	2.95	2.61	0.0167	0.0019	8.76
ST229	4.8	2.7	0.03	0.31	0.35	1.11	3.30	2.90	0.0387	0.0014	27.2
ST231	4.2	2.5	0.04	0.30	0.34	1.12	3.16	2.75	0.0185	0.0020	9.40
ST233	3.0	1.7	0.02	0.21	0.24	1.23	3.38	3.00	0.0119	0.0013	8.90
ST235	2.4	1.4	0.02	0.17	0.19	1.03	3.10	2.71	0.0136	0.0009	14.5
ST237	3.0	1.8	0.02	0.21	0.23	1.18	3.58	3.19	0.0134	0.0009	14.5
ST239	2.7	1.4	0.02	0.19	0.22	1.08	3.01	2.66	0.0195	0.0010	19.8
ST241	2.2	1.2	0.02	0.15	0.17	1.18	3.70	3.23	0.0059	0.0007	8.37
ST243	2.0	1.0	0.01	0.14	0.16	1.16	3.64	3.20	0.0094	0.0007	14.0
ST245	3.0	1.6	0.02	0.19	0.21	1.09	3.14	2.73	0.0119	0.0011	10.7
ST249	2.9	1.4	0.02	0.21	0.24	0.96	2.90	2.53	0.0233	0.0008	27.5
ST251	1.0	< 0.5	0.01	0.07	0.08	0.95	3.15	2.47	0.0189	0.0005	36.2

Station	THC*	UCM*	n-alkanes*			CPI Ratio			Pristane*	Phytane*	Pr/Ph Ratio
			nC_{12-20}	nC_{21-36}	nC_{12-36}	nC_{12-20}	nC_{21-36}	nC_{12-36}			
ST253	2.4	1.4	0.03	0.23	0.26	1.05	3.41	2.94	0.0113	0.0011	10.2
ST255	1.5	0.8	0.02	0.13	0.14	0.96	3.04	2.63	0.0055	0.0006	9.74
ST257	3.0	1.6	0.02	0.24	0.26	1.27	4.06	3.64	0.0172	0.0007	23.2
ST259	3.5	2.0	0.04	0.30	0.34	1.08	3.79	3.21	0.0135	0.0012	11.1
ST261	5.5	3.1	0.04	0.50	0.54	1.22	3.75	3.39	0.0200	0.0016	12.9
ST263	1.6	0.8	0.02	0.12	0.14	0.94	3.51	2.81	0.0103	0.0006	18.1
ST265	2.2	1.2	0.01	0.18	0.19	0.95	3.86	3.37	0.0108	0.0003	32.2
ST267	2.5	1.3	0.02	0.20	0.22	1.06	4.10	3.54	0.0101	0.0005	21.8
ST269	3.5	1.4	0.02	0.23	0.25	0.93	3.12	2.83	0.0144	0.0006	22.6
ST271	5.7	2.5	0.03	0.42	0.45	1.05	3.80	3.42	0.0335	0.0012	27.1
ST273	1.8	0.9	0.01	0.14	0.15	0.96	3.70	3.24	0.0080	0.0003	25.0
ST275	3.2	1.6	0.03	0.25	0.28	1.07	4.07	3.42	0.0111	0.0011	10.5
ST277	4.8	1.7	0.02	0.23	0.25	1.05	3.85	3.42	0.0135	0.0006	21.0
ST279	4.3	1.3	0.02	0.17	0.19	1.34	2.30	2.17	0.0083	0.0004	22.1
ST281	4.4	1.5	0.02	0.22	0.24	1.33	2.55	2.43	0.0096	0.0004	23.6
ST283	1.8	0.8	0.01	0.08	0.09	1.14	3.06	2.75	0.0062	0.0003	22.5
ST285	1.8	0.7	0.01	0.09	0.10	1.18	1.99	1.89	0.0317	0.0003	90.9
ST287	1.9	0.8	0.01	0.09	0.10	1.22	2.79	2.58	0.0118	0.0003	40.3
ST289	2.9	1.0	0.01	0.11	0.12	1.27	2.39	2.26	0.0044	0.0004	12.2
ST291	3.5	1.0	0.01	0.16	0.17	0.69	1.67	1.55	0.0045	0.0004	11.7
ST293	3.8	1.5	0.02	0.18	0.20	1.05	3.60	3.05	0.0134	0.0006	23.6
ST295	3.2	1.0	0.01	0.17	0.19	1.18	2.14	2.05	0.0070	0.0004	17.5
ST297	4.6	1.3	0.01	0.19	0.21	1.40	2.01	1.96	0.0101	0.0006	15.9
ST299	3.8	1.1	0.01	0.17	0.19	1.39	2.21	2.13	0.0077	0.0004	20.9
Minimum	**1.0**	**< 0.5**	**0.01**	**0.07**	**0.08**	**0.69**	**1.22**	**1.06**	**0.0044**	**0.0003**	**1.22**
Maximum	**19.8**	**15.1**	**1.07**	**0.98**	**1.94**	**1.40**	**4.10**	**3.64**	**0.265**	**0.137**	**90.9**
Mean	**5.5**	**3.2**	**0.17**	**0.33**	**0.50**	**1.05**	**2.49**	**2.09**	**0.0553**	**0.0190**	**11.0**
Standard Deviation	**3.59**	**2.59**	**0.224**	**0.205**	**0.411**	**0.131**	**0.889**	**0.772**	**0.0529**	**0.0280**	**11.7**
RSD [%]	66	80	133	63	83	12	36	37	96	148	106

Station	THC*	UCM*	n-alkanes*			CPI Ratio			Pristane*	Phytane*	Pr/Ph Ratio
			nC_{12-20}	nC_{21-36}	nC_{12-36}	nC_{12-20}	nC_{21-36}	nC_{12-36}			
Pre-sweeping stations											
ST067	3.34	-	-	-	-	-	-	-	-	-	-
ST078	10.9	-	-	-	-	-	-	-	-	-	-
ST088	3.91	-	-	-	-	-	-	-	-	-	-
ST117	2.77	-	-	-	-	-	-	-	-	-	-
ST130	6.97	-	-	-	-	-	-	-	-	-	-
ST138	10.2	-	-	-	-	-	-	-	-	-	-
ST146	2.70	-	-	-	-	-	-	-	-	-	-
ST151	4.57	-	-	-	-	-	-	-	-	-	-
ST154	5.22	-	-	-	-	-	-	-	-	-	-
ST159	4.50	-	-	-	-	-	-	-	-	-	-
Cefas Guideline Action Levels†											
AL1	**100**	-	-	-	-	-	-	-	-	-	-
EET (OSPAR, 2006)											
EET	**50**	-	-	-	-	-	-	-	-	-	-

Notes

THC = Total hydrocarbon content
UCM = Unresolved complex mixture
CPI = Carbon preference index
Pr/Ph = Ratio of pristane to phytane
RSD = Relative standard deviation
EET = Ecological effects threshold
Cefas = Centre for Environment, Fisheries and Aquaculture Science
Where values were < MRV, summary stats were calculated using absolute values assigned as MRV/2
* = Concentrations expressed as µg/g of dry sediment
† = Centre for Environmental Fisheries & Aquaculture Science

Key	Below Cefas Guideline Action Level 1	Above Cefas Guideline Action Level 1	Above EET

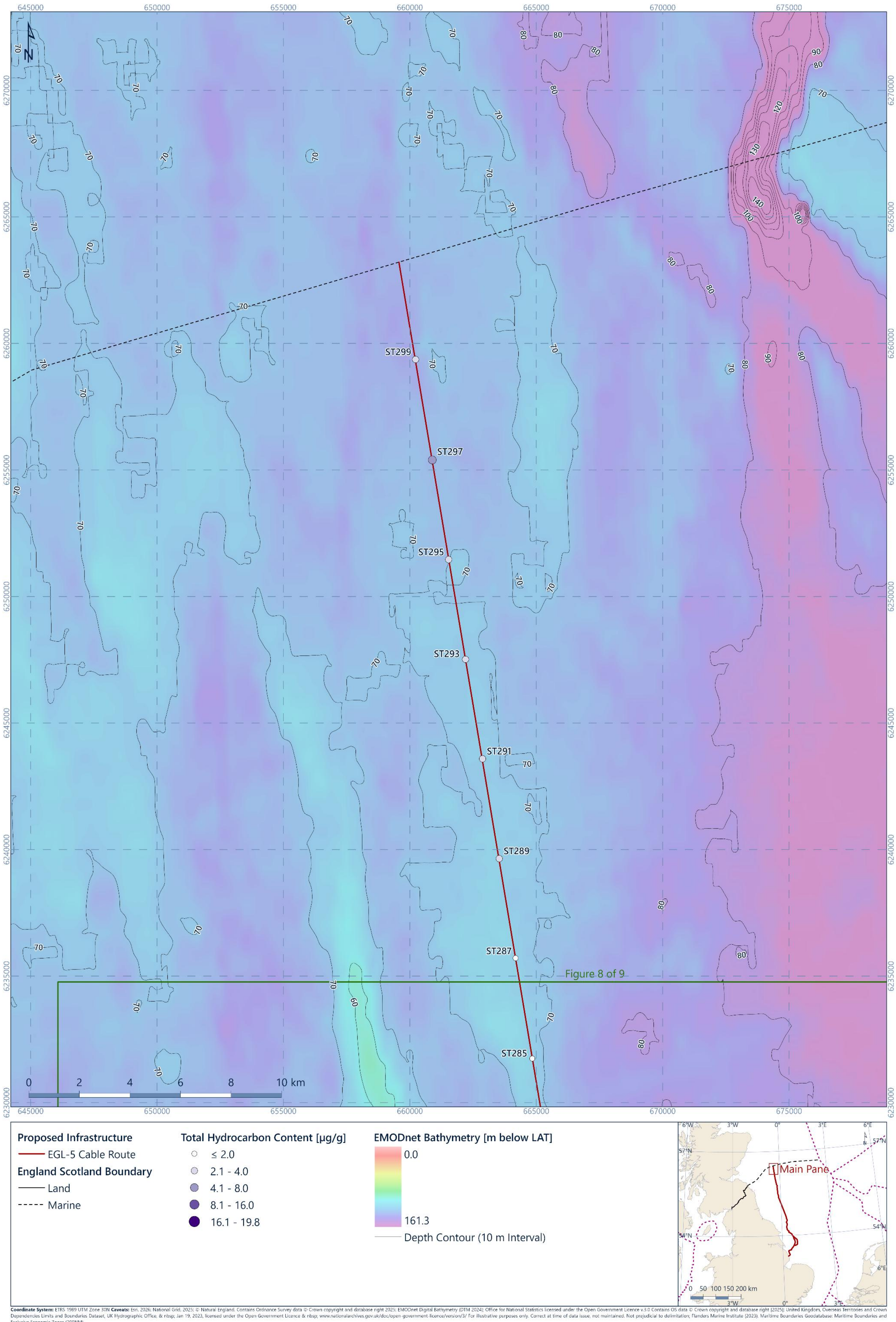


Figure 7.3: Sediment total hydrocarbon content overlaid on bathymetry, station ST285 to station ST299

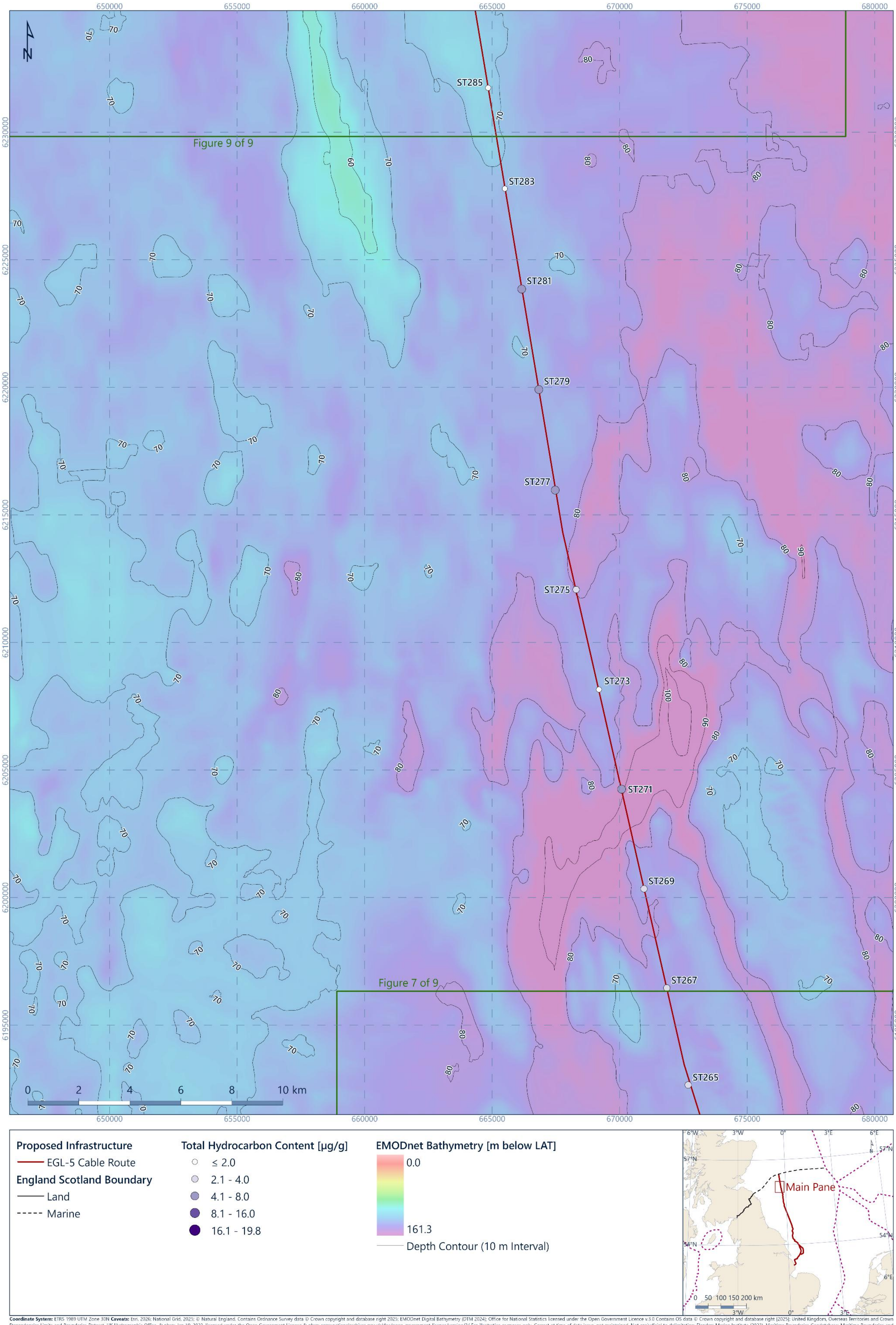


Figure 7.4: Sediment total hydrocarbon content overlaid on bathymetry, station ST265 to station ST285

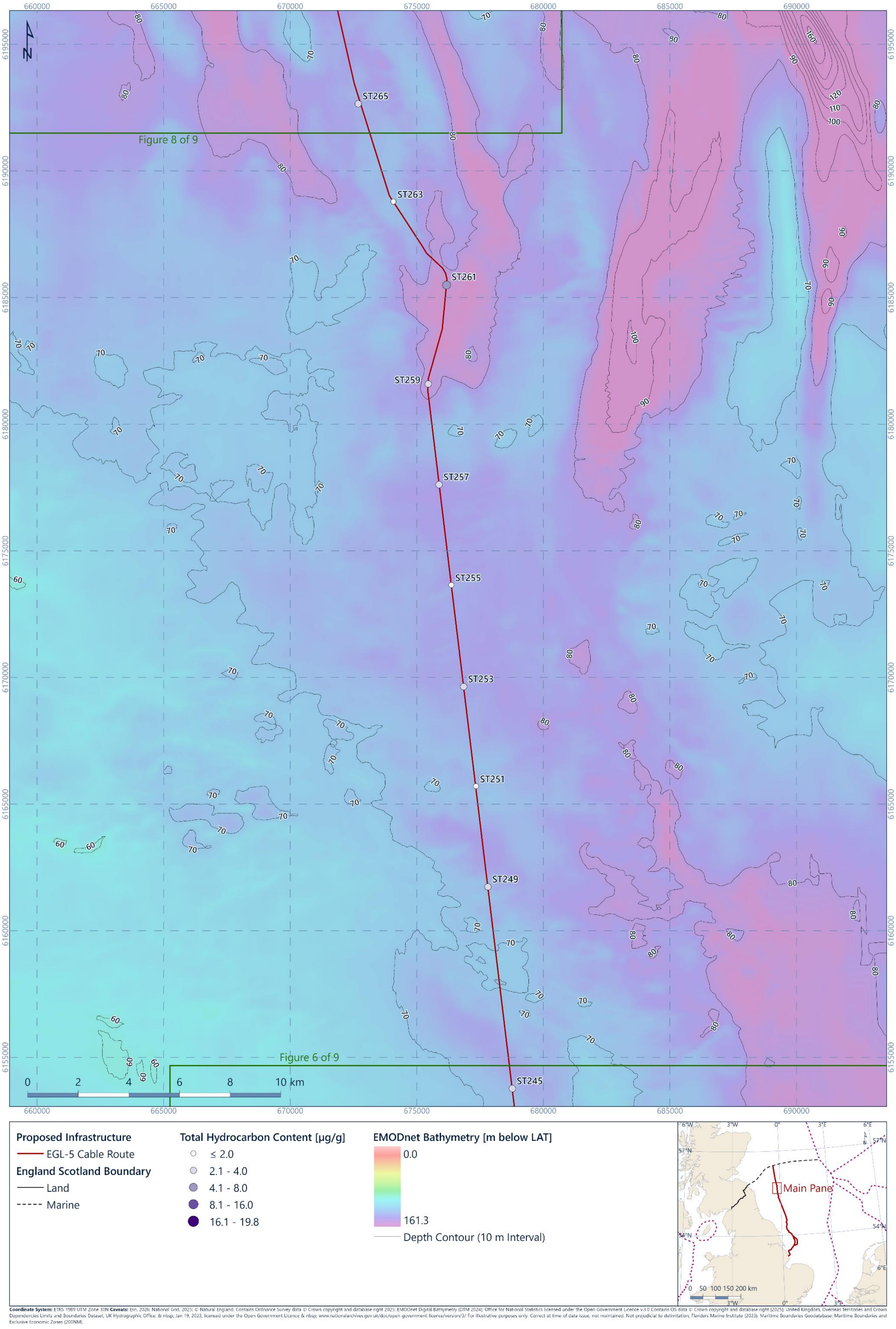


Figure 7.5: Sediment total hydrocarbon content overlaid on bathymetry, station ST245 to station ST265

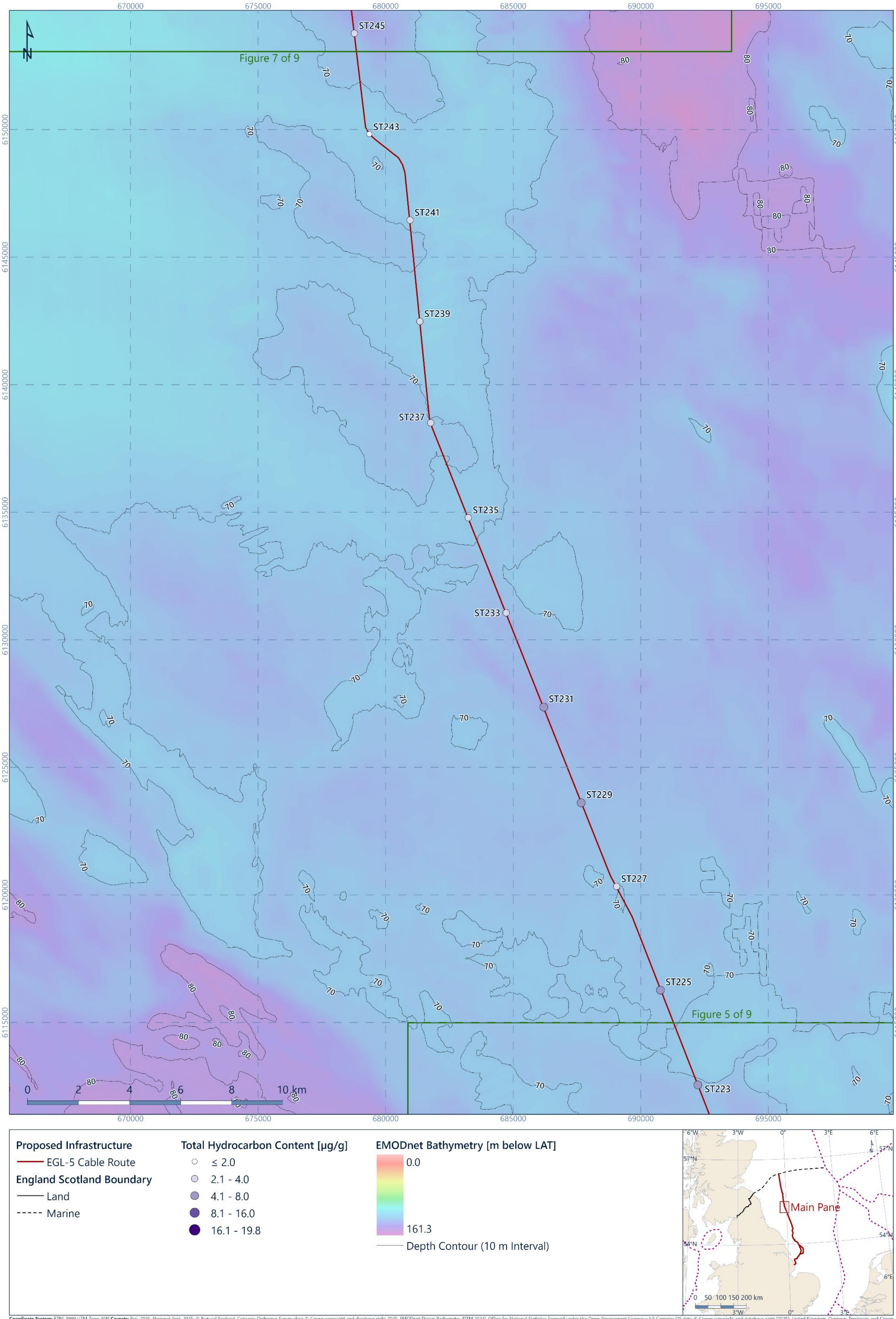


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Figure 7.6: Sediment total hydrocarbon content overlaid on bathymetry, station ST223 to station ST245

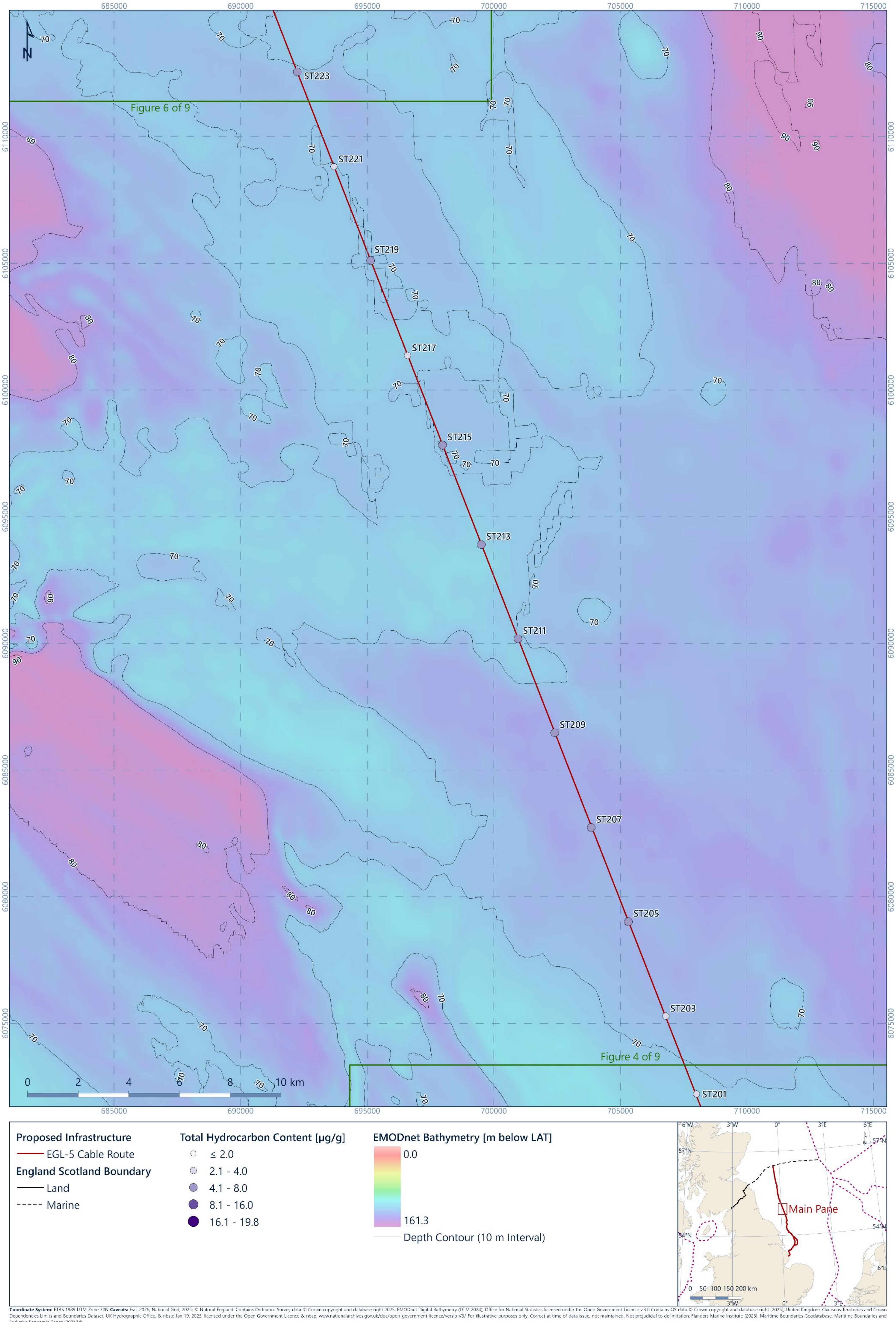

Figure 7.7: Sediment total hydrocarbon content overlaid on bathymetry, station ST201 to station ST223

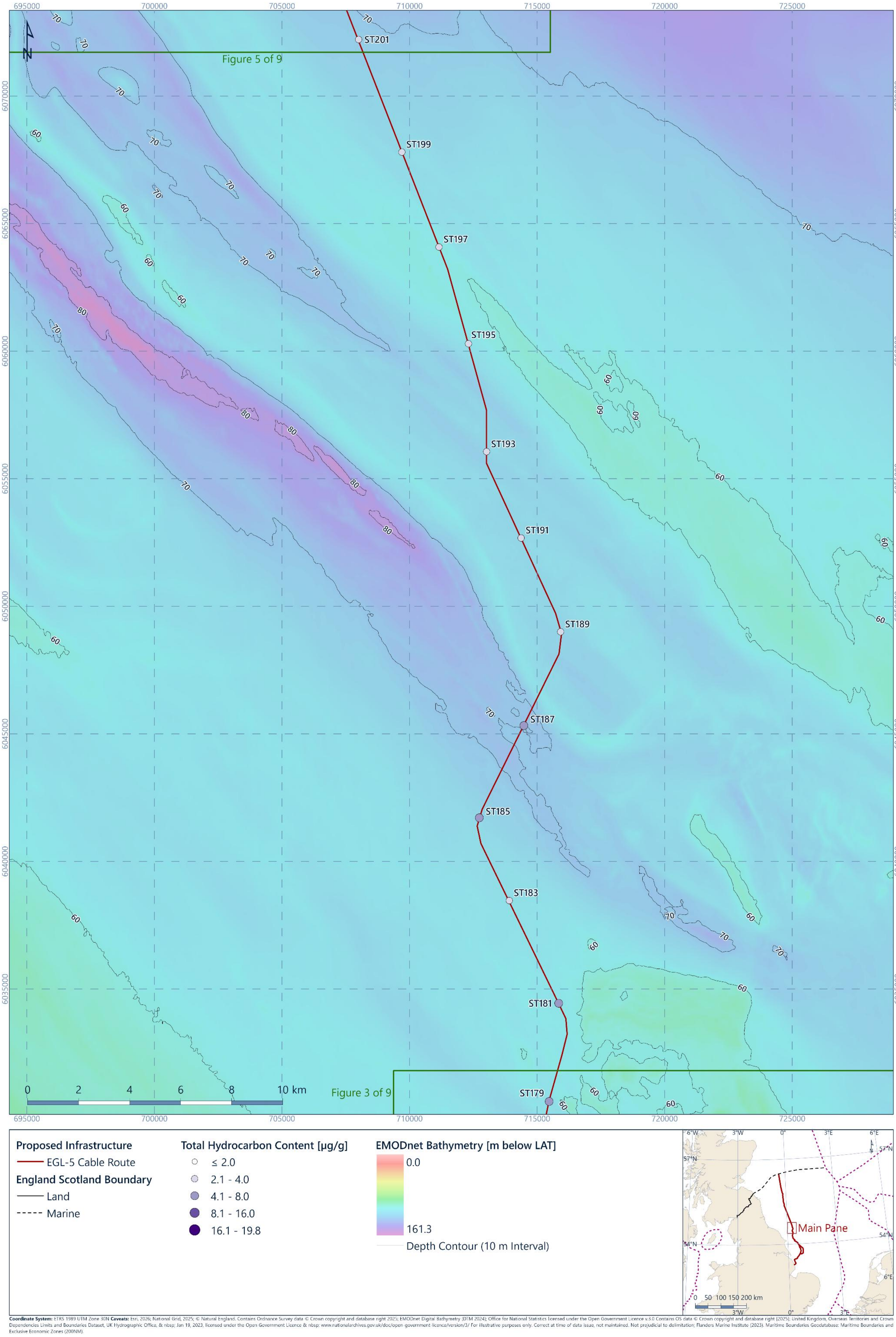

Figure 7.8: Sediment total hydrocarbon content overlaid on bathymetry, station ST179 to station ST201

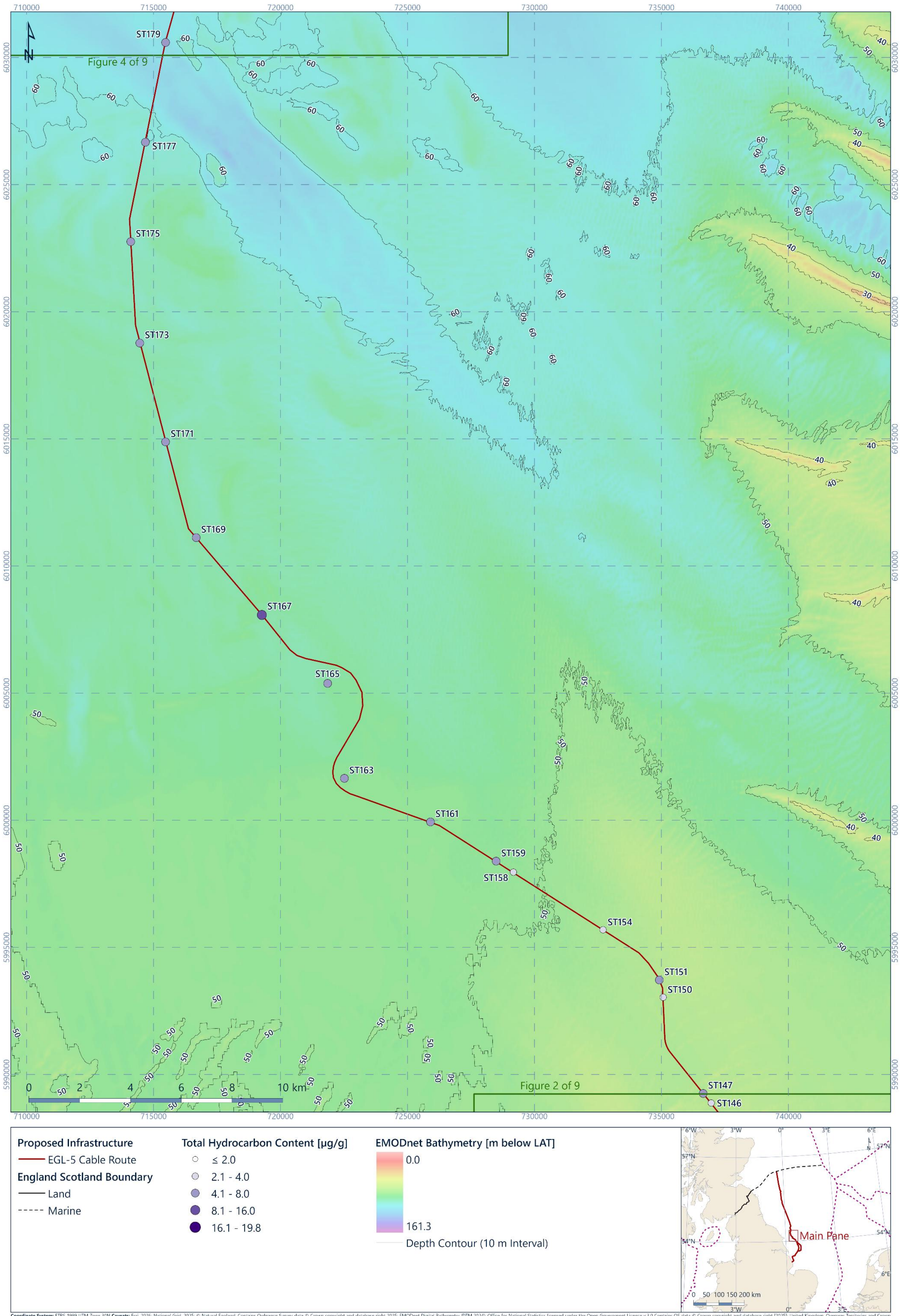

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Figure 7.9: Sediment total hydrocarbon content overlaid on bathymetry, station ST146 to station ST179

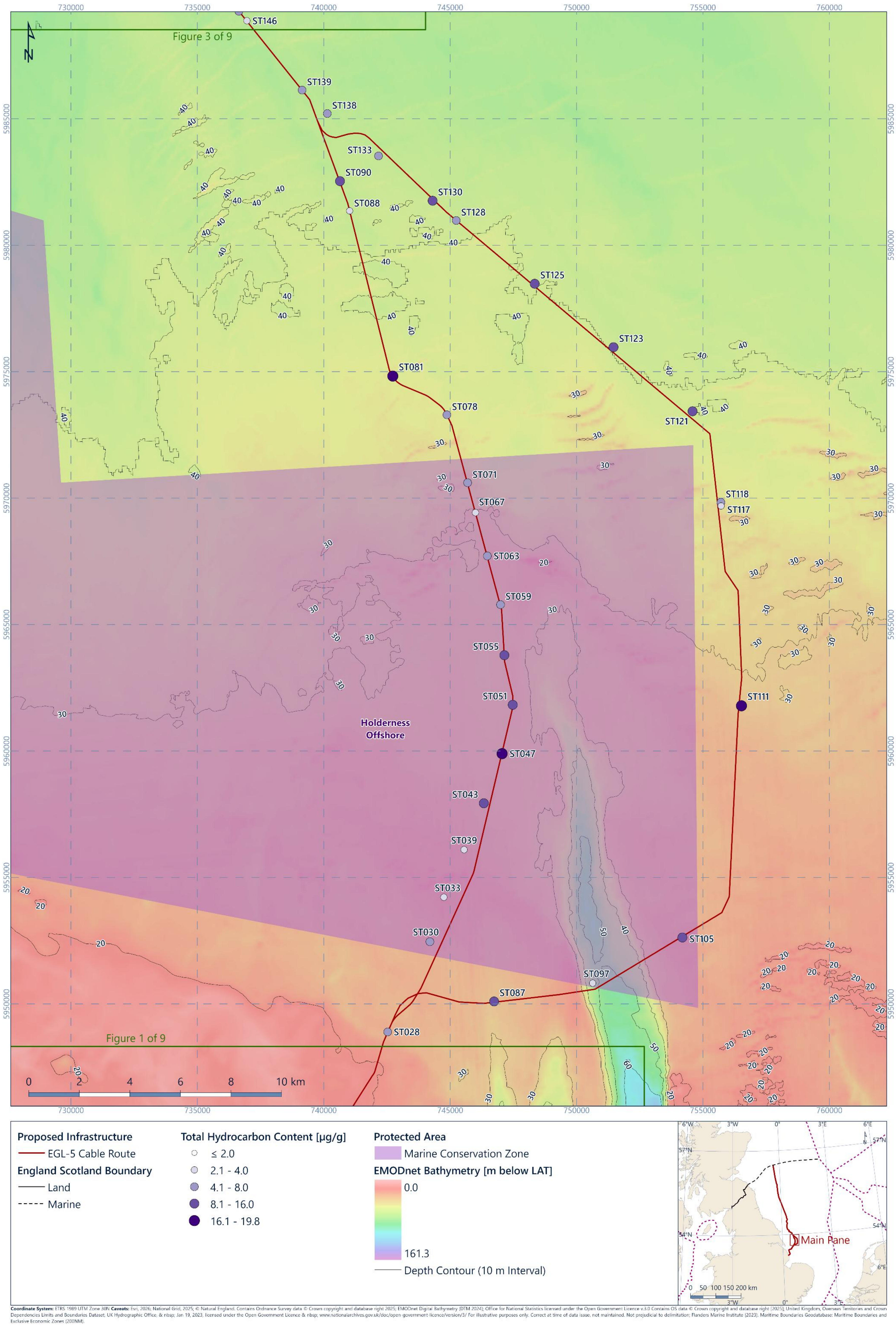

Figure 7.10: Sediment total hydrocarbon content overlaid on bathymetry, station ST028 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

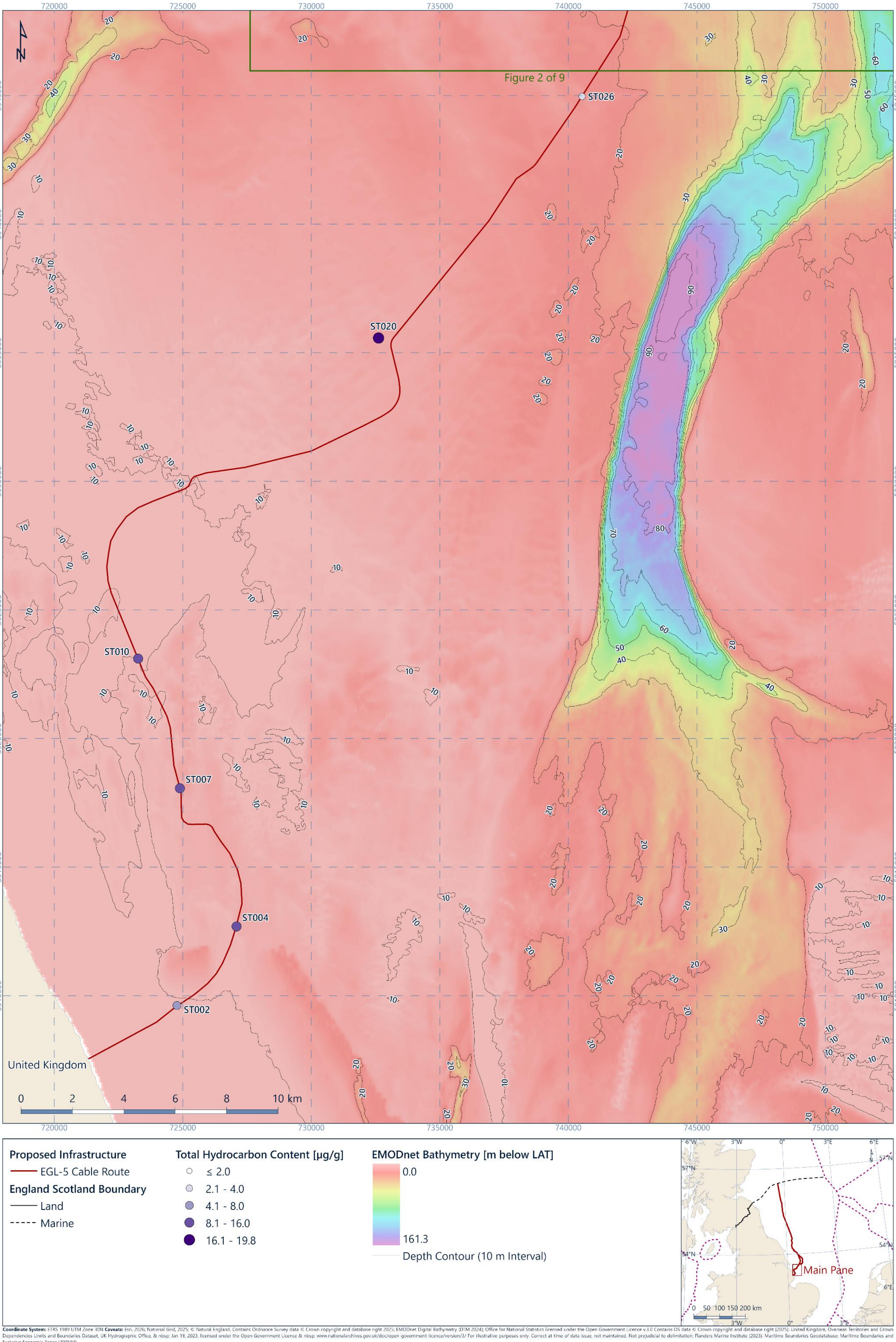

Figure 7.11: Sediment total hydrocarbon content overlaid on bathymetry, station ST002 to station ST026

7.1.2.3 Aromatic Hydrocarbon Content

GC-MS analysed the distribution and concentration of aromatic compounds in seafloor sediments. Table 7.2 summarises the total concentrations of aromatic hydrocarbons, including the US EPA 16 PAHs, naphthalenes, phenanthrenes/anthracenes, and dibenzothiophenes (NPD). Figures 7.12 to 7.20 present the spatial distribution of total 2 to 6 ring PAH concentrations.

Appendix E.3.1 and E.3.4 presents the concentrations of individual aromatic hydrocarbons and their alkyl homologues across the survey area, and Appendix E.3.2 and E.3.5 presents the US EPA 16 PAH concentrations, including reference values where available. The distributions of aromatic hydrocarbons are displayed as three-dimensional plots for ease of interpretation in Appendix E.4.1 to E.4.5.

Total 2 to 6 ring PAH concentrations are calculated as the sum of individual PAHs, some of which were less than the MRV. For the purposes of calculating the total 2 to 6 ring and US EPA 16 PAH concentrations, values below the MRV have been treated as absolute values, with the total 2 to 6 ring PAH and total US EPA 16 PAH concentrations assigned a less-than value. For the purposes of this report, the total 2 to 6 ring PAH, US EPA 16 PAH and total NPD concentrations are treated as absolute values to provide comparison between stations and with previous datasets.

The total 2 to 6 ring PAH concentrations (mean 0.244 µg/g) displayed high variability (RSD 96 %). The total US EPA 16 PAH concentrations (mean 63.4 ng/g) also exhibited high variability (RSD 77 %). Most stations exceeded the AL1 threshold (0.1 µg/g) for total 2 to 6 ring PAH concentrations, with the majority of exceedances occurring in the northern section of the survey route.

Total NPD concentrations (mean 0.128 µg/g) exhibited high variability (RSD 118 %). The proportion of petrogenically derived NPD to total 2 to 6 ring PAH material (mean 43 %) featured moderate variability (RSD 37 %).

All individual US EPA 16 PAH concentrations were below their respective ERL values (Appendix E.3.2 and E.3.5). When normalised to 2.5 % TOC, all individual US EPA 16 PAH concentrations, except for chrysene, exceeded their BAC values at most stations (Appendix E.3.3 and E.3.6).

The assignment of PAH sources indicated a combination of pyrolytic and petrogenic origins for the aromatic materials. Stations located in the southern area, including those within the MCZ, showed evidence of having a mixed source of aromatic compounds. In contrast, the stations along the northern sections of the route indicated a pyrolytic source.

Figure 7.21 displays the concentrations of the total 2 to 6 ring PAH graphically in relation to THC across the survey area.

Table 7.2: Summary of sediment aromatic hydrocarbon analysis

Station	Total 2 to 6 Ring PAH*	Total US EPA 16 PAH†	NPD	
			Total*	[%]
ST002	0.115	< 28.8	0.0534	47
ST004	0.915	198	0.522	57
ST006	1.09	221	0.678	62
ST007	1.08	239	0.642	59
ST010	0.602	132	0.349	58
ST020	1.40	329	0.824	59
ST026	0.0789	< 14.9	0.0453	57
ST028	0.347	70.1	0.208	60
ST030	0.215	< 36.9	0.139	65
ST033	0.101	< 18.9	0.0562	56
ST039	0.148	< 24.2	0.0892	60
ST043	0.403	< 64.2	0.248	62
ST047	0.552	< 85.6	0.350	63
ST051	0.505	< 88.4	0.327	65
ST055	0.277	< 46.7	0.162	58
ST059	0.216	< 37.7	0.127	59
ST063	0.190	< 35.4	0.121	64
ST067	0.232	< 42.2	0.183	79
ST071	0.199	< 37.5	0.116	58
ST078	0.211	< 37.5	0.127	60
ST081	0.785	143	0.485	62
ST087	0.253	< 43.5	0.154	61
ST088	0.0874	< 22.2	0.0423	48
ST090	0.359	89.9	0.182	51
ST097	0.263	62.5	0.174	66
ST105	0.697	130	0.439	63
ST111	0.735	125	0.503	68
ST117	0.0805	< 17.8	0.0427	53
ST118	0.318	< 73.0	0.192	61
ST121	0.460	100	0.276	60
ST123	0.454	105	0.262	58
ST125	0.616	111	0.413	67
ST128	0.365	121	0.222	61
ST130	0.206	< 60.8	0.0895	43
ST133	0.282	63.8	0.168	60

Station	Total 2 to 6 Ring PAH*	Total US EPA 16 PAH†	NPD	
			Total*	[%]
ST138	0.138	45.4	0.0513	37
ST139	0.302	68.2	0.180	60
ST146	0.161	< 37.4	0.0867	54
ST147	0.312	68.9	0.174	56
ST150	0.160	38.3	0.0819	51
ST151	0.214	< 47.4	0.120	56
ST154	0.178	42.0	0.0940	53
ST158	0.190	46.6	0.105	55
ST159	0.243	54.8	0.142	58
ST161	0.416	90.2	0.243	58
ST163	0.184	43.1	0.0976	53
ST165	0.261	76.3	0.153	59
ST167	0.548	110	0.353	64
ST169	0.414	96.7	0.244	59
ST171	0.186	47.7	0.0910	49
ST173	0.275	72.1	0.147	54
ST175	0.496	127	0.278	56
ST177	0.202	54.6	0.105	52
ST179	0.218	60.8	0.111	51
ST181	0.186	53.1	0.0910	49
ST183	0.140	40.9	0.0686	49
ST185	0.195	57.7	0.0907	46
ST187	0.209	61.4	0.0966	46
ST189	0.0912	28.9	0.0386	42
ST191	0.109	34.7	0.0490	45
ST193	0.135	42.8	0.0594	44
ST195	0.156	43.8	0.0799	51
ST197	0.0924	31.4	0.0366	40
ST199	0.119	41.3	0.0430	36
ST201	0.151	49.5	0.0586	39
ST203	0.212	66.7	0.0873	41
ST205	0.245	76.4	0.101	41
ST207	0.304	102	0.119	39
ST209	0.318	103	0.129	41
ST211	0.276	98.6	0.100	36
ST213	0.253	91.4	0.0883	35

Station	Total 2 to 6 Ring PAH*	Total US EPA 16 PAH†	NPD	
			Total*	[%]
ST215	0.271	102	0.0856	32
ST217	0.190	67.6	0.0710	37
ST219	0.212	76.6	0.0733	35
ST221	0.215	83.2	0.0715	33
ST223	0.329	126	0.106	32
ST225	0.284	126	0.0824	29
ST227	0.165	65.7	0.0521	32
ST229	0.202	80.2	0.0624	31
ST231	0.206	80.4	0.0684	33
ST233	0.114	46.8	0.0324	28
ST235	0.0776	32.6	0.0225	29
ST237	0.104	43.7	0.0270	26
ST239	0.0796	34.6	0.0198	25
ST241	0.0676	29.5	0.0162	24
ST243	0.0580	< 24.8	0.0150	26
ST245	0.0913	34.0	0.0279	31
ST249	0.0793	34.9	0.0199	25
ST251	0.0507	< 21.2	0.0130	26
ST253	0.103	45.8	0.0255	25
ST255	0.0486	< 21.9	0.0099	20
ST257	0.104	47.1	0.0238	23
ST259	0.111	48.9	0.0258	23
ST261	0.207	98.6	0.0472	23
ST263	0.0457	< 20.9	0.0083	18
ST265	0.0699	< 33.5	0.0127	18
ST267	0.0789	37.1	0.0155	20
ST269	0.0872	40.7	0.0193	22
ST271	0.174	80.9	0.0364	21
ST273	0.0453	< 20.3	0.0088	19
ST275	0.0987	44.7	0.0239	24
ST277	0.0816	36.5	0.0184	23
ST279	0.0502	< 22.6	0.0108	22
ST281	0.0632	27.2	0.0147	23
ST283	< 0.0230	< 9.4	< 0.0057	< 25
ST285	< 0.0196	< 8.9	< 0.0042	< 22
ST287	< 0.0204	< 9.3	< 0.0044	< 22

Station	Total 2 to 6 Ring PAH*	Total US EPA 16 PAH†	NPD	
			Total*	[%]
ST289	< 0.0291	< 13.4	< 0.0053	< 19
ST291	< 0.0338	< 15.4	< 0.0071	< 22
ST293	< 0.0233	< 10.6	< 0.0047	< 21
ST295	0.0341	< 14.6	0.0083	24
ST297	0.0587	27.4	0.0135	23
ST299	< 0.0356	< 15.8	< 0.0077	< 22
Minimum	**< 0.0196**	**< 8.9**	**< 0.0042**	**18**
Maximum	**1.40**	**329**	**0.824**	**79**
Mean	**0.244**	**63.4**	**0.128**	**43**
Standard Deviation	**0.234**	**48.8**	**0.150**	**16.1**
RSD [%]	**96**	**77**	**118**	**37**
Cefas Guideline Action Levels‡				
AL1	**0.1**	-	-	-

Notes
Total 2 to 6 ring PAH = Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH), including alkyl homologues
Total US EPA 16 PAH = Total United States Environmental Protection Agency's 16 (US EPA PAH) polycyclic aromatic hydrocarbons
Total NPD = Total naphthalenes, phenanthrenes/anthracenes and dibenzothiophenes
NPD [%] = Percentage of total 2 to 6 ring PAH concentration comprised of NPD
AL1 = Action Level 1 (mg/kg dry weight (ppm))
Cefas = Centre for Environment, Fisheries and Aquaculture Science
* = Concentrations expressed as µg/g of dry sediment
† = Concentrations expressed as ng/g of dry sediment
‡ = Centre for Environmental Fisheries & Aquaculture Science

Key	Below Cefas Guidance Action Level 1	Above Cefas Guidance Action Level 1

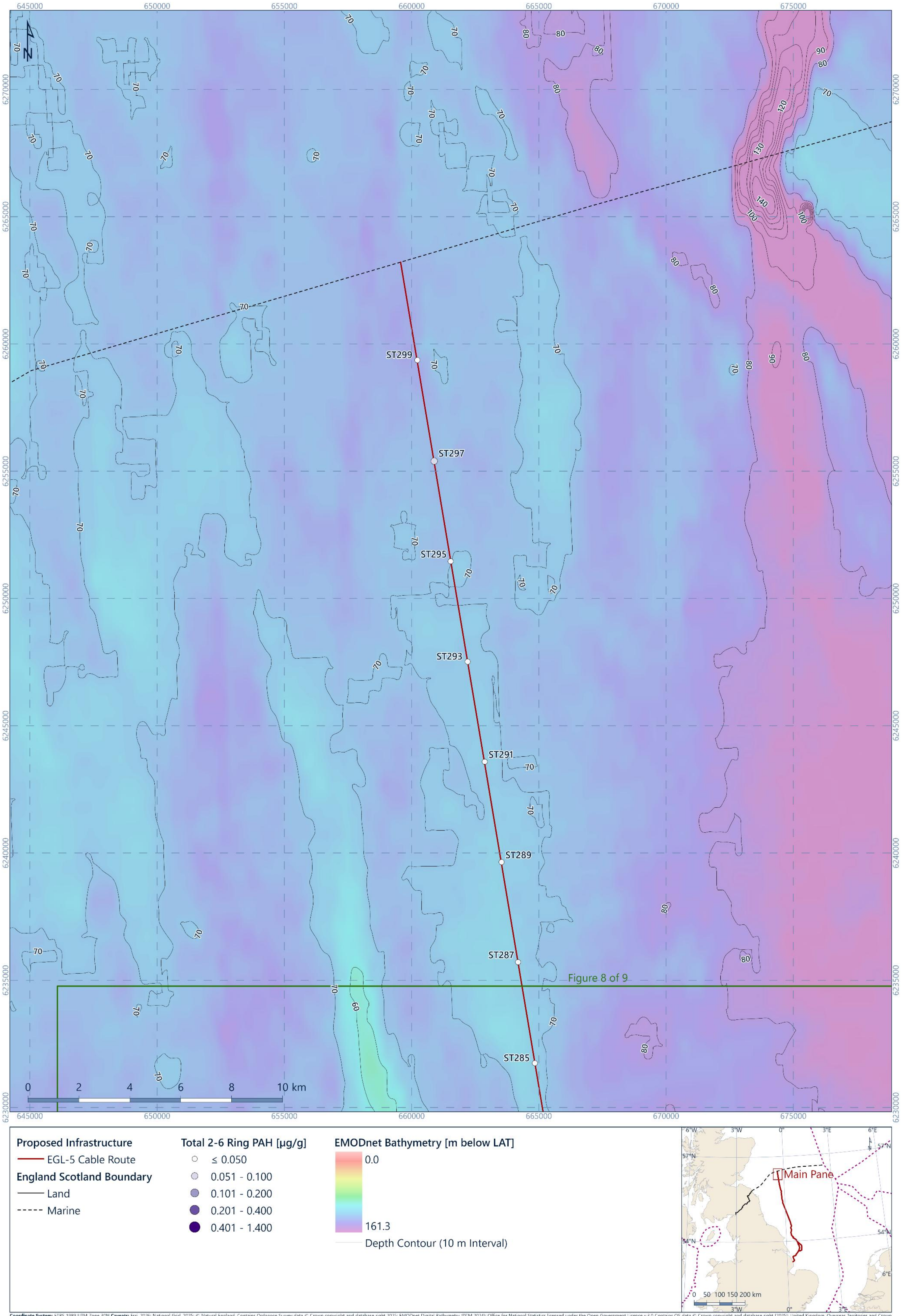

Figure 7.12: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST285 to station ST299

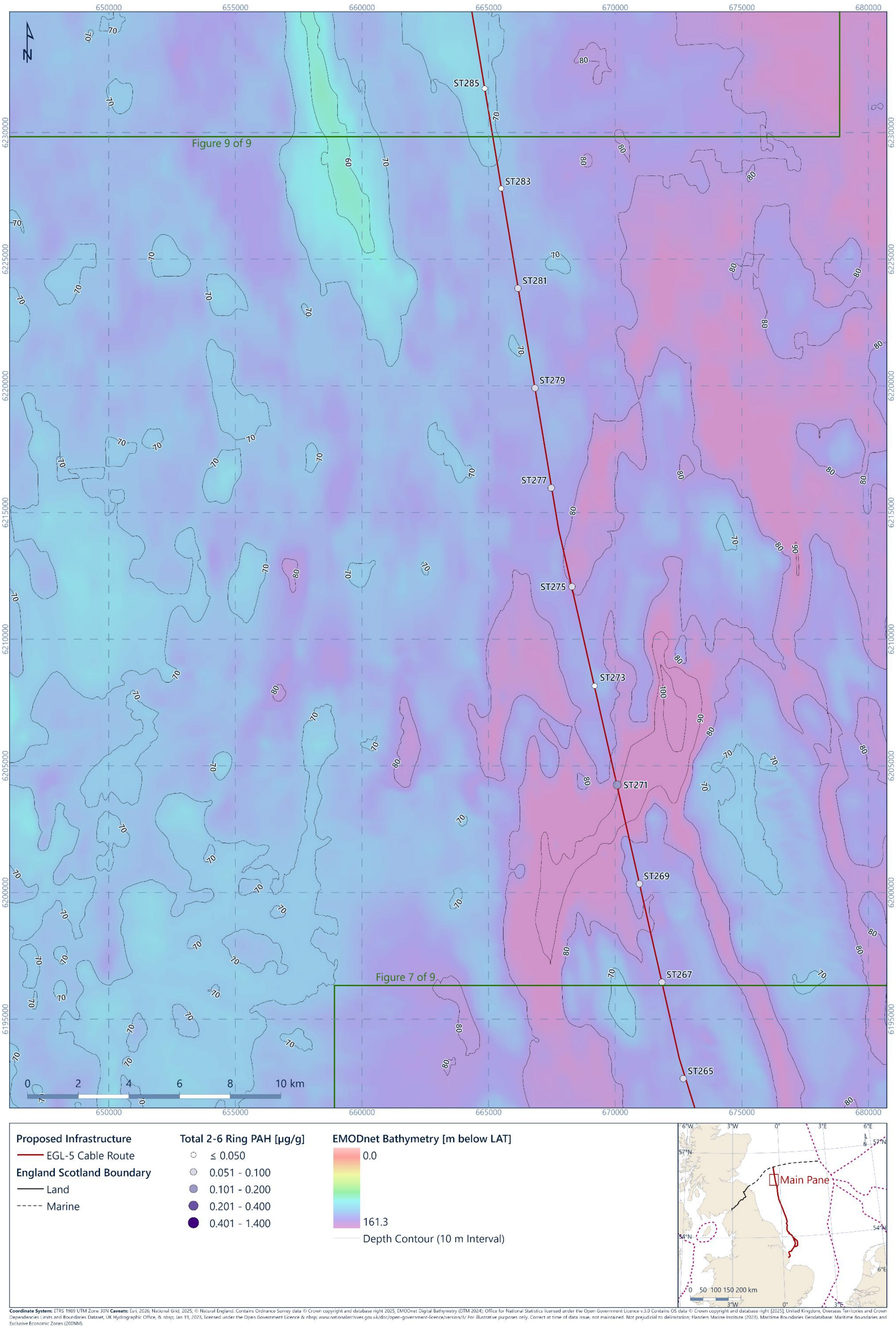

Figure 7.13: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST265 to station ST285

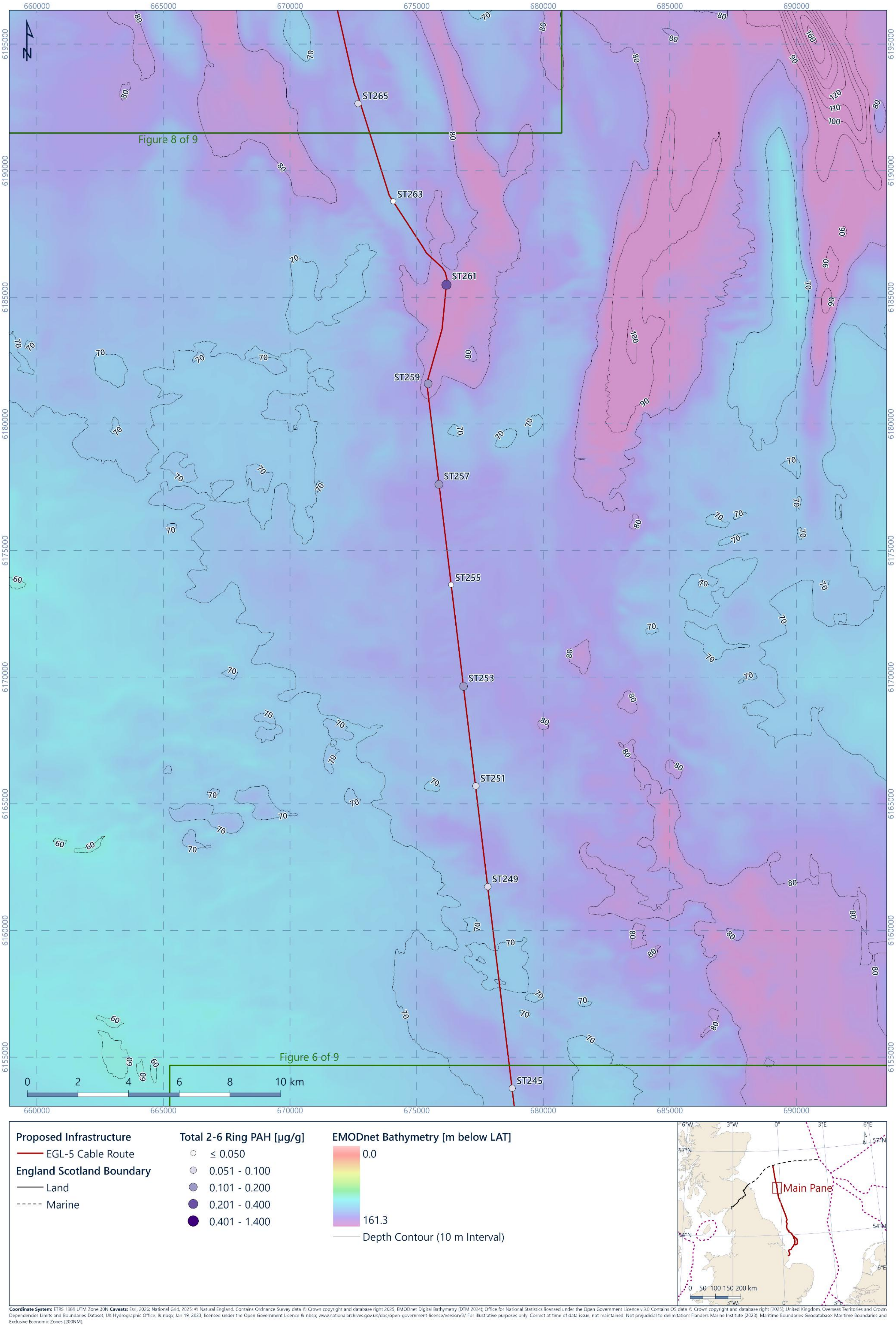

Figure 7.14: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST245 to station ST265

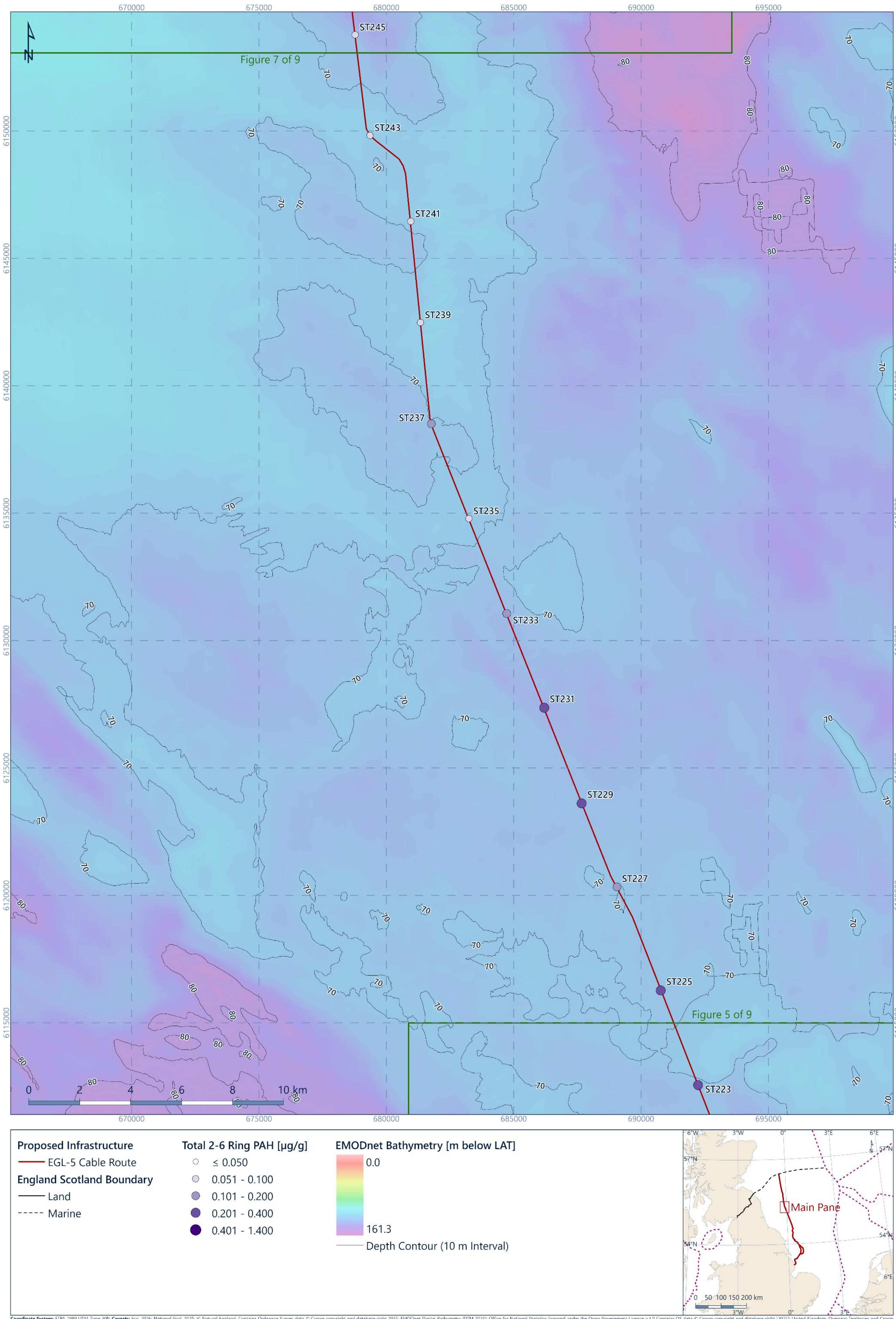

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Figure 7.15: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST223 to station ST245

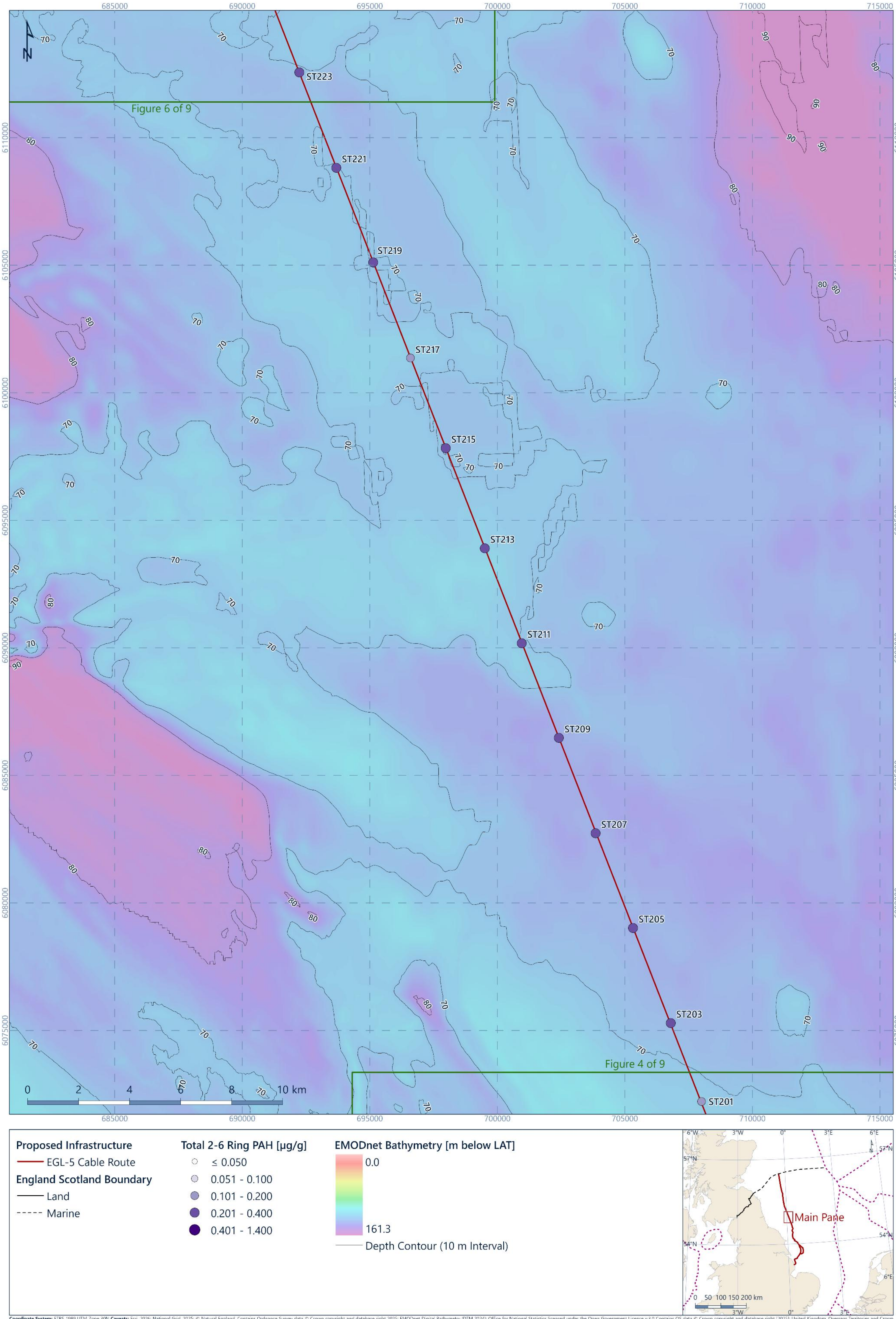

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Figure 7.16: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST201 to station ST223

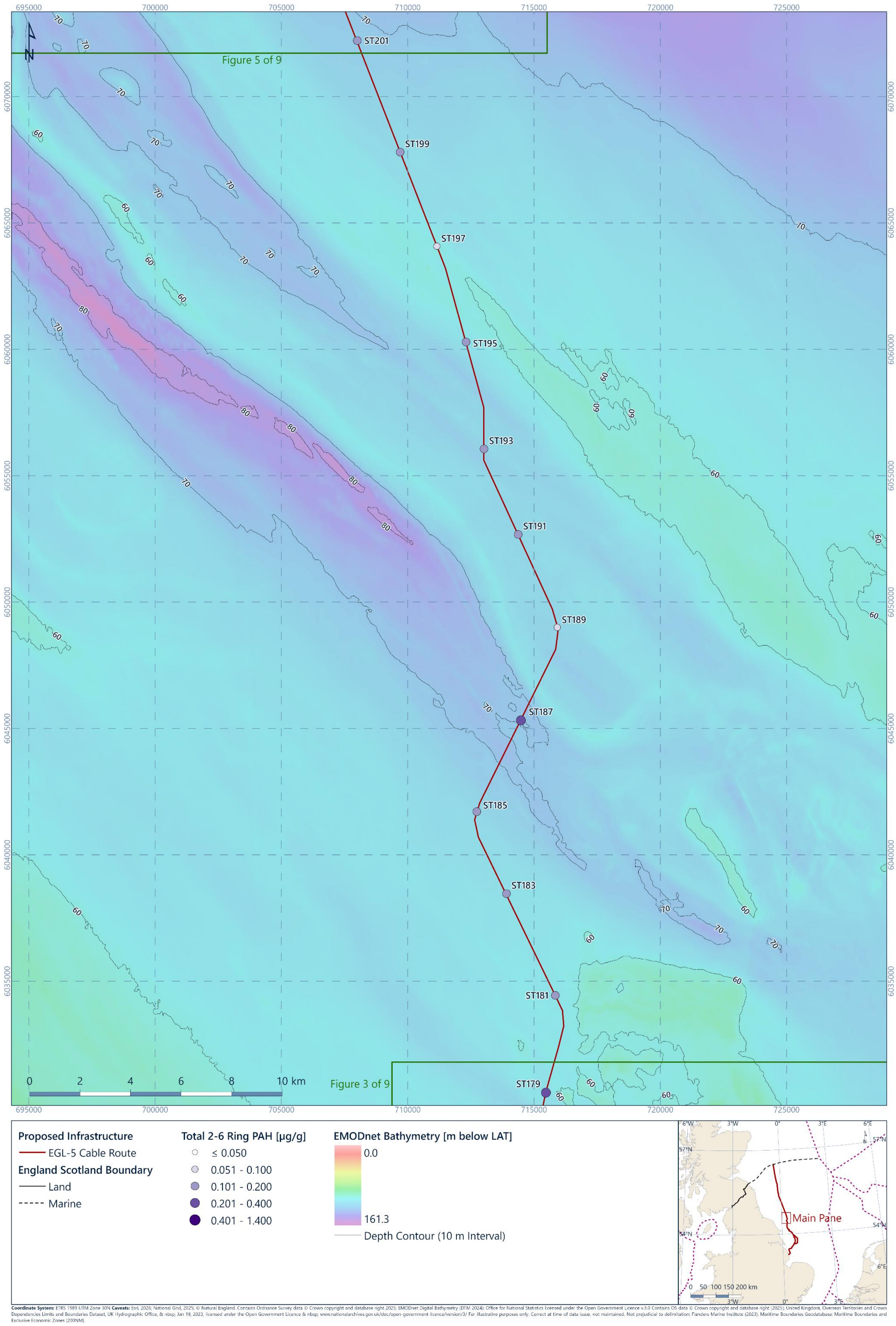
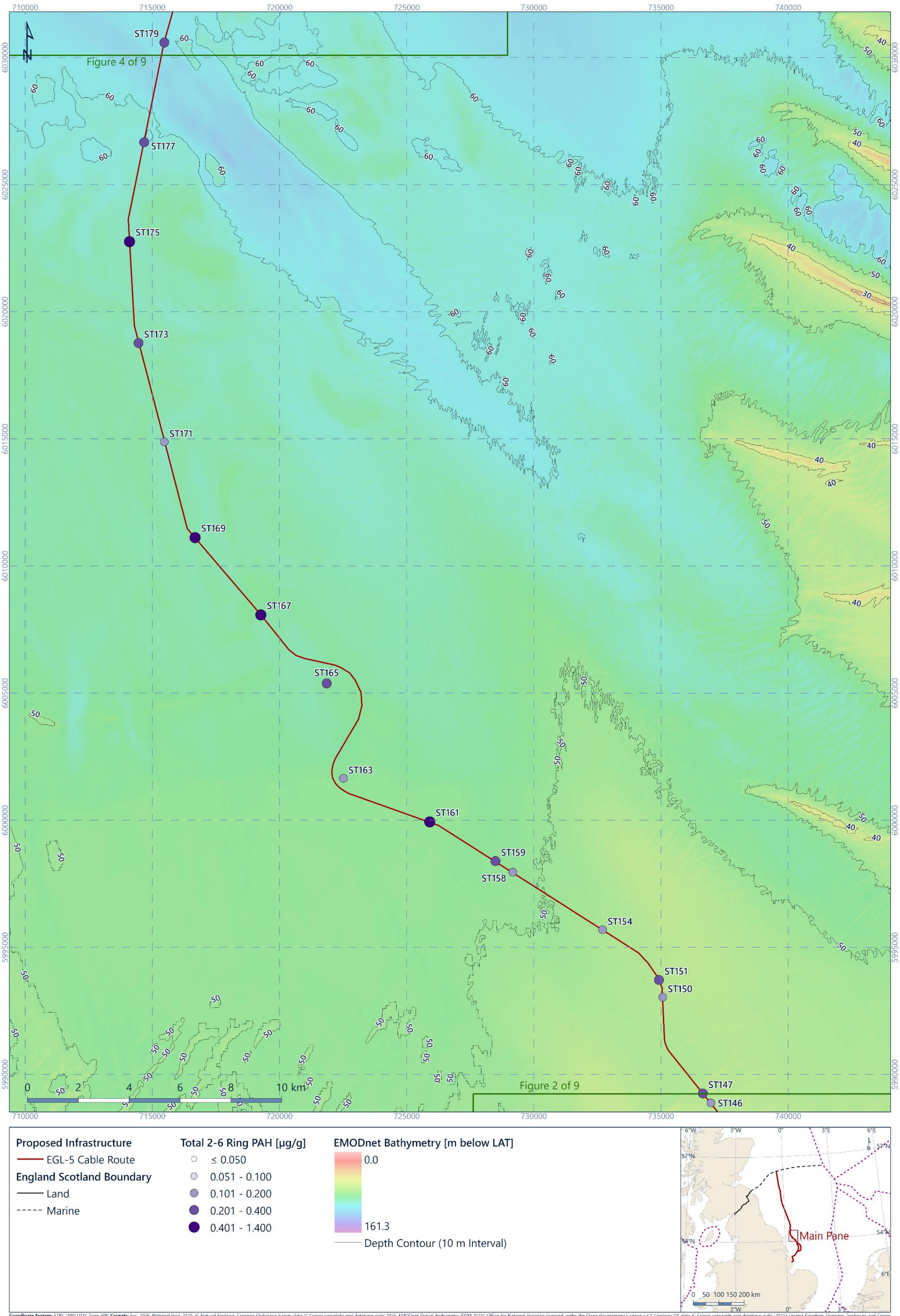


Figure 7.17: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST179 to station ST201



Coordinate System: ETRS 1989 UTM Zone 30N Caveats: Esri, 2026; National Grid, 2025; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2025; EMODnet Digital Bathymetry (DTM 2024); Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right (2025); United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation; Flanders Marine Institute (2023): Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM).

Figure 7.18: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST146 to station ST179

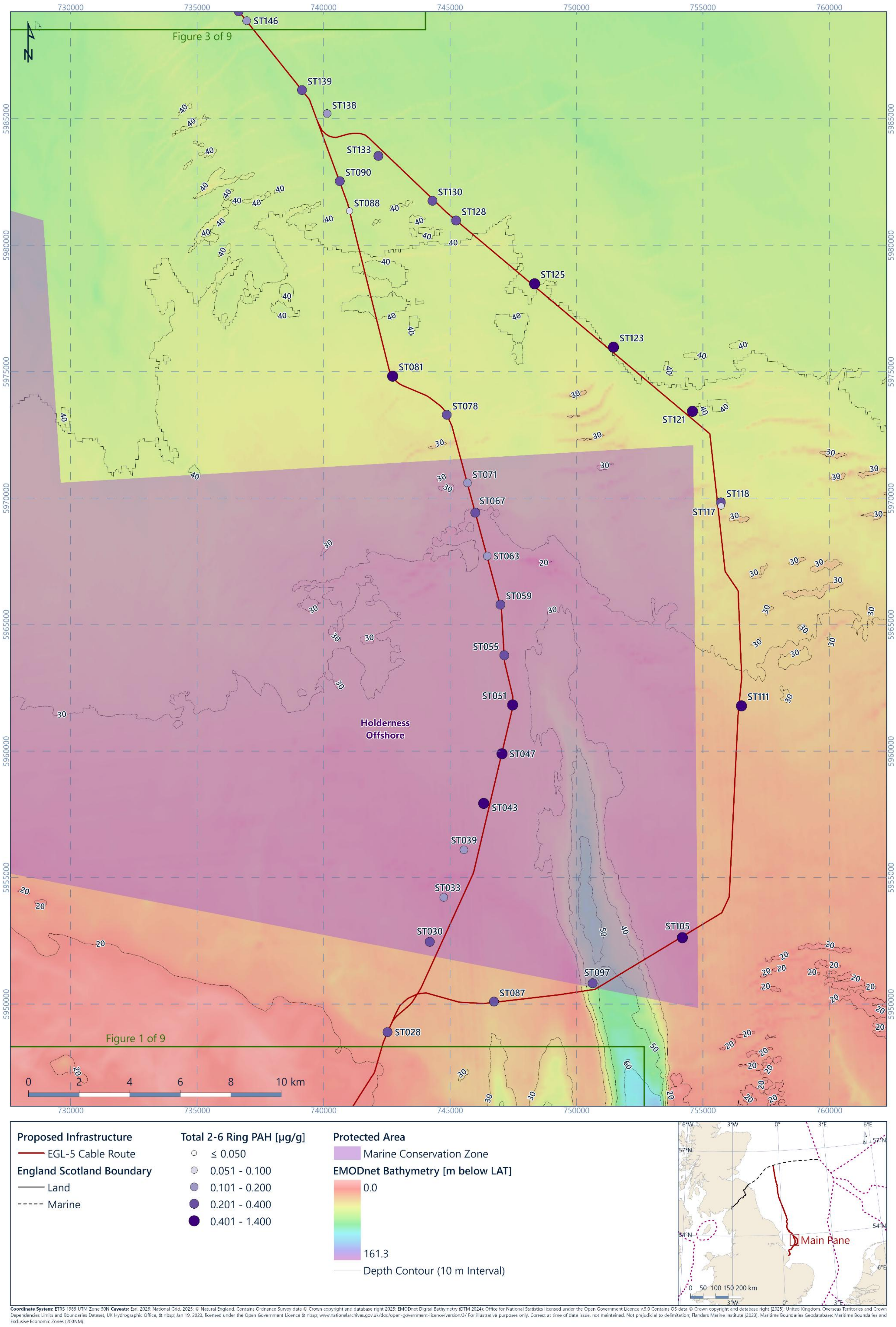


Figure 7.19: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST028 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

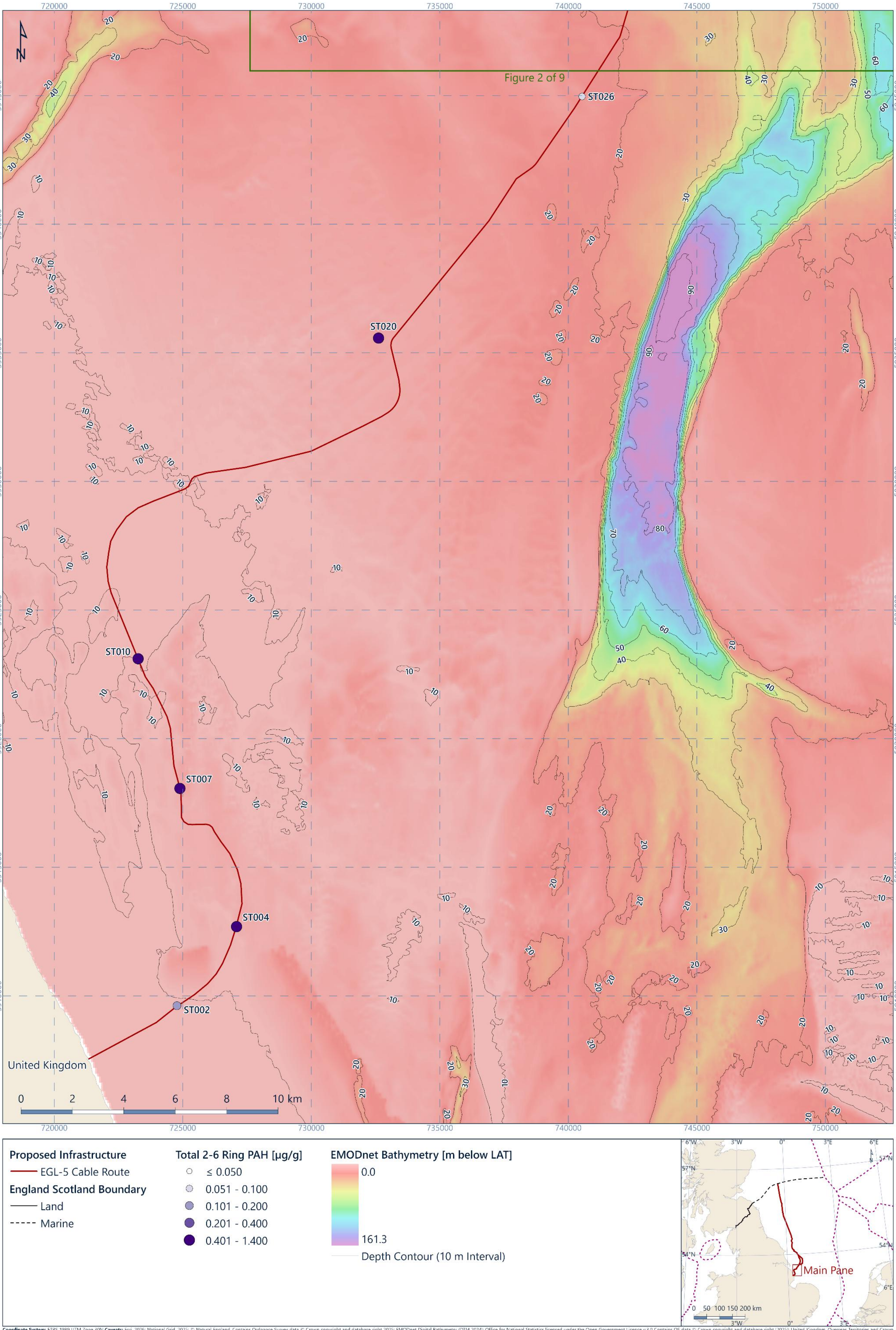


Figure 7.20: Total 2 to 6 ring polycyclic aromatic hydrocarbons (PAH) overlaid on bathymetry, station ST002 to station ST026

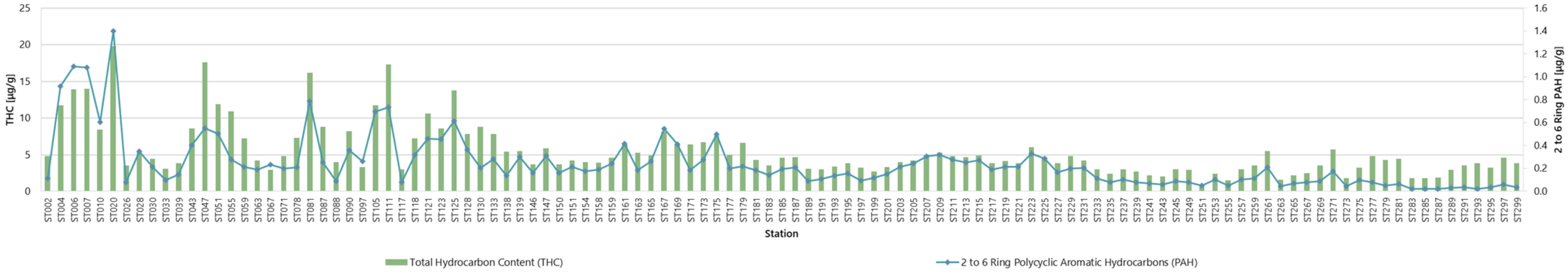


Figure 7.21: Comparison of sediment total hydrocarbon content (THC) and total 2 to 6 ring polycyclic aromatic hydrocarbon (PAH) concentrations

7.2 Sediment Metals

7.2.1 Introduction

Sediments collected within the survey area were analysed for major and trace metals.

The sediment samples underwent an aqua regia digest followed by multi-element analysis by ICP-MS (As, Cd, Cr, Cu, Hg, Ni, Pb, Sr and Zn) and ICP-OES (Al, Ba, Fe, Mn, P, and V). This provides a strong partial digest, releasing into solution all metals associated that are not tightly bound within silicate matrices, and therefore considered to be more bioavailable to receptors.

SOCOTEC analysed the pre-sweeping stations using the methodology highlighted in Appendix B.1.5 for As, Cd, Cr, Cu, Hg, Ni, Pb and Zn.

The normalisation of heavy metals against aluminium content is typically undertaken to account for natural variations derived from differences in sediment characteristics. The data presented in this report have not been normalised as the aluminium content was below the pivot point detailed in OSPAR (2015), precluding normalisation by pivot values and co-factors.

Appendix B provides full details of the analytical techniques employed.

7.2.2 Results

7.2.2.1 Major and Trace Metals

Table 7.3 summarises the concentrations of the extractable CEMP metals in the sediment samples from an aqua regia digest.

The mean cadmium concentration (0.02 µg/g) was lower than the AL1 (0.4 µg/g) and the ERL value (1.20 µg/g). Variability in cadmium values across the cable route was high (RSD 72 %). All pre-sweeping stations had concentrations of cadmium below the AL1 value and ERL.

The mean chromium concentration (12.3 µg/g) was lower than the AL1 (40 µg/g). All values were below the AL1 and the ERL values (81.0 µg/g). Variability in chromium values across the cable route was low (RSD 29 %). All pre-sweeping stations had concentrations of chromium below the AL1 and ERL value.

The mean copper concentration (2.1 µg/g) was lower than the AL1 value (40 µg/g). All values were below the AL1 and the ERL value (34.0 µg/g). Variability in copper values across the cable route was high (RSD 75 %). All pre-sweeping stations had concentrations of copper below the AL1 and ERL value.

Mercury concentrations across the survey area were below the MRV (< 0.03 µg/g) at all stations. All values were below the AL1 (0.3 µg/g) and the ERL value (0.150 µg/g). All pre-sweeping stations had concentrations of mercury below the AL1 and ERL value.

The mean nickel concentration (6.0 µg/g) was below the AL1 value (20 µg/g). Variability in nickel values across the cable route was moderate (RSD 54 %). All pre-sweeping stations had concentrations of nickel below the AL1 value, except for station ST117. Station ST117 was analysed in-house by Fugro with a nickel concentration of 16. µg/g (below AL1). However, it was also analysed as a pre-sweeping station, by SOCOTEC, with a concentration of 21.0 µg/g (above AL1).

The mean lead concentration (11.4 µg/g) was below the AL1 (50 µg/g) and ERL (47.0 µg/g) values. Across the proposed routes, only one station (ST163) exceeded both the AL1 and ERL values. Variability in lead values across the cable route was high (RSD 70 %). All pre-sweeping stations had concentrations of lead below the AL1 and ERL value.

The mean zinc concentration (20.6 µg/g) was lower than the AL1 (130 µg/g) and the ERL value (150 µg/g). All stations had concentrations below the AL1 and ERL values. Variability in zinc values across the cable route was moderate (RSD 61 %). All pre-sweeping stations had concentrations of zinc below the AL1 and ERL value.

All metals had concentrations below their representative Cefas AL2 values.

Table 7.3: Summary of sediment metals analysis

Station	Al	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	P	Pb	Sr	V	Zn
ST002	3330	21.0	23.4	< 2.00	0.02	7.23	5.2	14500	< 0.03	625	7.3	389	16.4	128	23.9	36.5
ST004	11200	9.82	76.7	< 2.00	0.05	19.0	9.6	17800	< 0.03	463	12.3	366	13.5	129	34.6	37.4
ST006	6580	12.5	145	< 2.00	0.04	16.0	4.6	19500	< 0.03	294	9.4	390	15.6	141	40.0	39.3
ST007	7830	9.04	100	< 2.00	0.03	14.8	4.1	15000	< 0.03	299	9.3	394	12.1	126	29.1	32.4
ST010	6610	12.0	64.5	< 2.00	0.04	14.4	4.2	16000	< 0.03	285	10.0	433	14.8	316	26.5	36.5
ST020	11600	18.2	73.1	< 2.00	0.04	23.1	7.0	41900	< 0.03	349	15.4	654	22.0	416	37.2	102
ST026	3810	9.29	29.6	< 2.00	0.03	8.42	3.9	12200	< 0.03	227	8.6	424	8.9	744	23.8	24.0
ST028	3650	7.03	49.2	< 2.00	0.02	8.38	2.1	8660	< 0.03	186	5.5	354	10.6	520	19.5	23.1
ST030	3430	6.95	15.9	< 2.00	0.02	6.86	1.5	9450	< 0.03	223	5.0	255	8.4	606	18.1	13.5
ST033	4370	7.30	35.0	< 2.00	0.02	11.3	2.8	12200	< 0.03	257	7.3	285	8.8	418	21.6	16.4
ST039	3850	7.89	48.3	< 2.00	0.03	9.20	3.8	1800	< 0.03	356	9.6	401	7.9	534	28.5	29.8
ST043	7490	10.5	87.2	< 2.00	0.03	13.9	3.0	16300	< 0.03	300	8.7	333	9.3	417	31.5	21.7
ST047	10200	15.9	32.6	< 2.00	0.04	17.3	4.6	27500	< 0.03	429	13.8	490	12.3	395	47.4	32.6
ST051	6180	13.5	41.9	< 2.00	0.03	15.9	4.9	16800	< 0.03	363	9.8	560	11.4	498	37.5	27.6
ST055	6000	13.9	42.2	< 2.00	0.02	13.2	3.5	17900	< 0.03	357	9.1	489	10.9	410	38.7	25.5
ST059	5200	14.7	15.7	< 2.00	0.04	14.4	3.2	21800	< 0.03	354	8.5	575	9.8	447	37.8	31.1
ST063	2400	9.3	9.2	< 2.00	0.02	5.97	1.7	6930	< 0.03	177	4.3	292	6.2	614	16.4	13.1
ST067	2780	11.7	8.9	< 2.00	0.02	6.11	1.6	10800	< 0.03	223	6.3	340	6.0	399	21.7	13.8
ST071	9690	11.3	45.3	< 2.00	0.04	20.2	4.8	20000	< 0.03	421	13.2	439	12.2	189	39.9	29.2
ST078	7330	28.8	27.2	< 2.00	0.04	14.9	2.7	33900	< 0.03	735	16.1	862	19.7	295	70.2	54.9
ST081	7600	20.1	101	< 2.00	0.02	20.5	8.0	14800	< 0.03	348	8.4	731	10.7	148	32.8	22.6
ST087	5660	10.8	15.3	< 2.00	0.03	13.6	3.7	22500	< 0.03	329	10.7	525	15.0	317	34.8	33.9
ST088	6510	63.8	19.9	< 2.00	0.04	17.3	2.7	26600	< 0.03	1500	14.6	1280	21.6	266	81.9	43.6
ST090	4220	21.7	23.9	< 2.00	0.02	9.64	2.0	14200	< 0.03	539	6.4	407	13.1	64.2	38.9	20.6
ST097	4920	10.5	26.3	< 2.00	0.03	10.0	2.0	18200	< 0.03	391	7.7	463	7.2	540	35.6	21.8
ST105	7950	9.25	48.2	< 2.00	0.03	13.4	3.6	14700	< 0.03	249	9.1	516	10.2	275	32.1	23.1
ST111	10300	12.4	40.7	< 2.00	0.03	20.6	3.8	18800	< 0.03	332	14.1	510	10.5	177	47.8	29.9
ST117	8150	19.0	17.5	< 2.00	0.04	14.9	4.0	26200	< 0.03	717	16.2	581	9.2	188	48.4	54.4
ST118	7630	18.9	61.6	< 2.00	0.04	15.3	3.6	22900	< 0.03	438	12.0	562	11.3	122	47.9	31.9

Station	Al	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	P	Pb	Sr	V	Zn
ST121	9310	19.4	86.0	< 2.00	0.03	17.5	6.4	23000	< 0.03	316	10.7	609	12.6	80.8	49.7	30.6
ST123	8970	13.3	59.0	< 2.00	0.02	21.4	4.3	18400	< 0.03	336	12.6	466	10.8	120	42.5	27.8
ST125	6620	23.9	37.1	< 2.00	0.02	13.1	2.3	17400	< 0.03	347	8.8	597	12.5	146	45.8	28.2
ST128	3880	21.3	17.5	< 2.00	0.02	9.52	2.4	13400	< 0.03	511	5.8	358	12.1	116	36.3	20.0
ST130	3310	27.3	11.5	< 2.00	0.02	9.55	1.6	135400	< 0.03	888	6.2	402	18.4	121	42.2	22.4
ST133	5090	46.4	13.7	< 2.00	0.02	12.0	2.0	23300	< 0.03	1320	8.5	697	26.5	110	71.0	36.4
ST138	3340	23.5	9.1	< 2.00	0.02	9.22	1.2	13400	< 0.03	408	5.0	657	12.9	55.2	38.6	18.3
ST139	3480	12.4	18.5	< 2.00	0.02	9.67	1.0	9700	< 0.03	187	5.0	354	9.1	36.8	25.7	18.7
ST146	2960	13.2	8.6	< 2.00	0.01	9.39	1.1	9230	< 0.03	241	4.0	300	9.2	86.5	24.3	17.2
ST147	2850	8.08	10.1	< 2.00	0.01	9.02	1.2	6780	< 0.03	216	4.3	234	7.9	30.8	19.1	14.9
ST150	2520	6.59	15.1	< 2.00	< 0.01	7.68	0.7	5940	< 0.03	164	3.0	198	7.6	20.8	16.5	14.1
ST151	2400	10.2	7.2	< 2.00	< 0.01	7.29	0.7	7070	< 0.03	161	3.1	254	7.9	32.7	20.8	13.3
ST154	2140	7.00	9.0	< 2.00	< 0.01	10.8	1.3	6240	< 0.03	226	5.2	198	9.5	19.9	16.3	17.6
ST158	1630	5.83	4.1	< 2.00	< 0.01	7.31	0.7	4410	< 0.03	111	3.1	152	7.4	18.5	11.5	12.7
ST159	2130	6.08	7.6	< 2.00	< 0.01	9.49	0.8	5510	< 0.03	202	3.4	213	9.3	24.9	14.7	15.8
ST161	2890	13.2	12.6	< 2.00	0.01	9.28	1.1	9470	< 0.03	390	4.5	266	15.9	30.9	24.2	21.7
ST163	3460	46.2	17.4	< 2.00	0.02	11.3	1.3	21500	< 0.03	2100	6.6	669	65.0	129.0	68.3	46.4
ST165	2410	9.72	10.4	< 2.00	< 0.01	8.22	0.8	8450	< 0.03	451	4.2	240	16.5	59.0	21.3	23.0
ST167	3050	13.2	13.0	< 2.00	< 0.01	9.55	1.0	10400	< 0.03	475	4.2	287	20.0	48.2	28.1	26.4
ST169	2570	9.90	11.6	< 2.00	< 0.01	11.1	0.9	8390	< 0.03	403	3.7	238	14.6	40.9	22.7	19.8
ST171	3210	19.3	17.4	< 2.00	< 0.01	11.2	1.0	14100	< 0.03	782	5.5	481	25.5	76.0	37.7	29.5
ST173	3890	30.6	20.4	< 2.00	< 0.01	15.2	1.4	19900	< 0.03	1620	8.0	539	45.6	112	60.5	42.5
ST175	2850	17.2	9.7	< 2.00	< 0.01	12.6	1.1	10900	< 0.03	659	4.5	327	27.0	146	35.7	25.3
ST177	2630	4.79	9.5	< 2.00	< 0.01	9.58	0.7	6420	< 0.03	318	3.9	181	13.0	15.7	17.0	18.8
ST179	2390	8.07	8.4	< 2.00	< 0.01	9.35	0.9	6540	< 0.03	510	3.5	199	17.8	35.8	22.6	18.6
ST181	2970	13.8	12.4	< 2.00	< 0.01	11.1	1.0	10500	< 0.03	424	4.7	308	20.9	33.9	33.9	21.6
ST183	2530	8.58	7.3	< 2.00	< 0.01	11.6	0.9	9110	< 0.03	546	4.4	238	16.9	19.0	26.8	20.9
ST185	2480	5.47	9.1	< 2.00	< 0.01	9.45	0.7	6050	< 0.03	385	4.0	166	14.1	22.2	16.6	16.5
ST187	2960	6.69	12.0	< 2.00	< 0.01	11.6	0.8	9090	< 0.03	363	3.9	238	14.7	18.3	22.3	19.2
ST189	3460	20.7	8.5	< 2.00	< 0.01	16.2	1.3	17000	< 0.03	662	7.7	445	24.9	23.9	52.8	31.3
ST191	2880	12.1	10.0	< 2.00	< 0.01	13.4	0.8	12300	< 0.03	435	5.5	273	16.8	20.5	35.4	21.0

Station	Al	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	P	Pb	Sr	V	Zn
ST193	3110	6.32	12.2	< 2.00	< 0.01	11.7	1.0	8360	< 0.03	415	4.4	216	13.0	18.6	21.9	17.5
ST195	2860	10.8	18.1	< 2.00	< 0.01	13.5	1.3	10300	< 0.03	515	4.2	281	16.5	20.2	29.5	21.0
ST197	3180	8.09	14.8	< 2.00	< 0.01	14.4	1.3	8600	< 0.03	400	4.1	222	13.0	19.5	23.3	19.8
ST199	3480	4.77	18.0	< 2.00	< 0.01	10.9	1.3	6550	< 0.03	205	3.9	192	10.2	18.8	18.3	15.5
ST201	3780	4.27	13.6	< 2.00	< 0.01	11.1	1.3	5280	< 0.03	164	4.0	186	9.0	18.4	15.0	12.0
ST203	4060	3.79	15.2	< 2.00	0.01	10.7	1.6	5340	< 0.03	216	4.1	177	8.6	18.7	15.0	12.1
ST205	4400	4.55	27.8	< 2.00	< 0.01	13.1	1.5	6720	< 0.03	287	5.9	210	8.9	25.6	17.4	14.2
ST207	4090	4.54	16.7	< 2.00	< 0.01	12.1	1.6	6380	< 0.03	158	5.2	217	8.5	20.9	15.6	12.6
ST209	4300	4.62	22.9	< 2.00	0.01	12.9	1.8	7460	< 0.03	216	5.4	245	8.8	21.4	17.4	13.8
ST211	4720	5.73	18.6	< 2.00	0.01	15.0	1.8	11400	< 0.03	226	6.4	286	10.2	25.6	23.5	18.3
ST213	5090	8.73	21.8	< 2.00	0.01	19.5	1.8	13700	< 0.03	264	6.4	323	11.5	26.5	28.8	19.6
ST215	4900	7.52	14.9	< 2.00	0.01	16.0	1.8	12700	< 0.03	316	5.9	270	12.0	28.3	26.9	19.5
ST217	4550	10.0	17.3	< 2.00	0.02	21.5	1.7	15600	< 0.03	285	6.2	326	11.9	28.5	33.7	21.0
ST219	4550	5.26	14.3	< 2.00	0.01	15.5	1.8	9820	< 0.03	279	5.6	263	9.5	29.2	20.5	17.3
ST221	4940	5.36	24.7	< 2.00	0.02	15.2	1.7	10400	< 0.03	204	5.6	253	9.7	24.9	22.3	16.6
ST223	4640	5.61	18.0	< 2.00	0.04	14.5	1.5	9230	< 0.03	249	5.2	247	9.6	28.7	21.5	16.9
ST225	5140	6.33	15.0	< 2.00	0.02	16.7	1.8	10300	< 0.03	252	6.3	297	10.0	33.8	21.6	19.7
ST227	3880	5.03	29.0	< 2.00	0.02	13.5	1.5	8460	< 0.03	145	5.2	234	9.0	23.9	18.0	15.3
ST229	4200	4.90	19.0	< 2.00	0.02	14.6	1.4	7850	< 0.03	189	4.8	241	8.8	24.6	18.4	14.3
ST231	4480	4.16	21.6	< 2.00	0.02	13.3	1.8	7820	< 0.03	154	6.0	265	9.2	32.2	18.3	15.4
ST233	3190	4.55	10.1	< 2.00	0.02	11.3	1.1	6570	< 0.03	129	4.5	202	6.8	21.0	15.2	12.9
ST235	3830	6.40	13.0	< 2.00	0.02	13.4	1.6	8440	< 0.03	177	5.5	257	9.0	29.2	21.1	16.3
ST237	2590	3.80	12.2	< 2.00	0.02	8.30	1.9	5120	< 0.03	174	3.6	181	6.0	17.9	12.8	10.0
ST239	3060	6.80	20.2	< 2.00	0.02	10.3	1.3	8370	< 0.03	153	4.2	241	7.1	30.1	20.6	13.9
ST241	2550	4.67	10.8	< 2.00	0.01	10.6	1.0	6380	< 0.03	125	3.4	169	6.1	16.9	15.2	10.7
ST243	2340	5.61	5.9	< 2.00	0.02	11.7	1.0	6940	< 0.03	138	3.4	191	7.0	14.9	19.0	10.8
ST245	3900	5.02	10.9	< 2.00	0.02	15.5	1.8	8900	< 0.03	142	5.5	224	6.9	43.0	18.8	14.9
ST249	3820	14.3	14.6	< 2.00	0.02	11.6	2.1	13900	< 0.03	181	7.4	384	9.4	38.2	49.0	17.7
ST251	3080	5.21	8.9	< 2.00	0.01	13.3	1.3	7380	< 0.03	130	3.9	189	6.0	21.7	16.2	13.2
ST253	4190	7.13	16.3	< 2.00	0.02	11.3	2.7	9090	< 0.03	194	7.0	362	8.0	71.0	25.3	19.5
ST255	1940	9.02	6.3	< 2.00	< 0.01	6.85	1.4	6620	< 0.03	91.5	3.8	232	6.9	21.4	19.7	11.3

Station	Al	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	P	Pb	Sr	V	Zn
ST257	3540	3.76	12.0	< 2.00	0.01	12.8	1.6	6110	< 0.03	121	4.7	208	6.7	32.5	14.5	13.0
ST259	3090	4.04	13.3	< 2.00	0.02	11.3	1.6	5370	< 0.03	206	4.8	227	6.5	34.8	12.1	11.4
ST261	4230	3.70	18.4	< 2.00	0.02	14.5	2.1	5780	< 0.03	140	6.1	259	7.4	46.2	13.9	14.0
ST263	1770	4.65	4.9	< 2.00	< 0.01	8.76	0.9	5220	< 0.03	83.7	2.9	161	5.4	16.5	13.7	9.3
ST265	2530	4.32	8.2	< 2.00	< 0.01	10.4	1.2	5660	< 0.03	112	3.4	188	6.2	36.0	12.5	10.0
ST267	3000	3.76	10.4	< 2.00	< 0.01	13.0	1.2	5930	< 0.03	121	4.1	205	5.5	26.3	13.4	10.4
ST269	3090	3.23	11.2	< 2.00	0.02	11.7	1.5	5320	< 0.03	102	4.4	221	6.0	85.4	12.3	10.6
ST271	3800	3.71	18.5	< 2.00	0.02	13.2	1.8	5450	< 0.03	122	5.3	284	6.7	51.8	12.6	12.6
ST273	2380	4.63	7.2	< 2.00	< 0.01	12.0	1.1	5800	< 0.03	115	3.3	194	5.7	43.9	13.2	9.0
ST275	3100	3.46	13.8	< 2.00	0.02	11.3	1.4	4570	< 0.03	107	4.4	210	5.4	37.1	10.7	10.1
ST277	3220	3.11	15.3	< 2.00	< 0.01	10.9	1.4	4800	< 0.03	131	2.8	189	4.8	31.8	11.5	9.2
ST279	3230	2.97	13.9	< 2.00	< 0.01	11.3	0.9	4870	< 0.03	139	2.5	185	4.4	25.4	11.4	8.4
ST281	2620	2.37	9.6	< 2.00	< 0.01	10.6	1.1	4320	< 0.03	86.5	2.5	165	4.3	23.8	10.3	8.3
ST283	1780	3.46	4.9	< 2.00	< 0.01	7.98	0.6	4470	< 0.03	98.9	1.5	155	4.1	14.0	11.9	6.8
ST285	1440	7.41	4.1	< 2.00	< 0.01	10.9	1.8	5980	< 0.03	63.8	1.7	203	5.3	13.4	22.1	8.3
ST287	1640	4.21	4.7	< 2.00	< 0.01	9.27	1.2	4690	< 0.03	64.7	2.3	168	4.2	13.3	14.3	9.0
ST289	1870	2.59	5.8	< 2.00	< 0.01	9.17	1.0	3600	< 0.03	67.7	1.8	127	3.5	30.2	9.1	10.1
ST291	1960	2.50	6.1	< 2.00	< 0.01	9.84	1.5	3520	< 0.03	87.9	1.9	134	3.5	14.0	8.8	7.5
ST293	1550	3.69	4.4	< 2.00	< 0.01	8.84	2.3	4180	< 0.03	68.4	1.7	168	4.0	15.1	12.2	7.7
ST295	1780	3.01	5.4	< 2.00	< 0.01	9.31	1.8	4270	< 0.03	69.8	2.1	152	3.5	17.4	11.4	7.3
ST297	2050	2.76	6.1	< 2.00	< 0.01	10.5	1.1	4520	< 0.03	94.1	2.9	143	3.8	14.9	11.3	8.0
ST299	2160	2.43	6.9	< 2.00	< 0.01	10.3	1.1	3840	< 0.03	65.6	2.3	143	3.7	18.2	8.8	8.1
Minimum	**1440**	**2.37**	**4.1**	**< 2.00**	**< 0.01**	**5.97**	**0.6**	**1800**	**< 0.03**	**63.8**	**1.5**	**127**	**3.5**	**13.3**	**8.8**	**6.8**
Maximum	**11600**	**63.8**	**145**	**< 2.00**	**0.05**	**23.1**	**9.6**	**135000**	**< 0.03**	**2100**	**16.2**	**1280**	**65.0**	**744**	**81.9**	**102**
Mean	**4150**	**10.6**	**22.5**	**-**	**0.02**	**12.3**	**2.1**	**12200**	**-**	**327**	**6.0**	**325**	**11.4**	**116**	**26.3**	**20.6**
SD	**2200**	**9.38**	**23.2**	**-**	**0.0118**	**3.53**	**1.55**	**13600**	**-**	**308**	**3.29**	**178**	**7.95**	**162**	**14.6**	**12.6**
RSD [%]	**53**	**89**	**104**	**-**	**72**	**29**	**75**	**111**	**-**	**94**	**54**	**55**	**70**	**139**	**55**	**61**
Pre-sweeping stations																
ST067	-	13.0	-	-	0.08	9.0	5.2	-	0.01	-	10.8	-	7.2	-	-	24.3
ST078	-	29.8	-	-	0.15	14.5	5.3	-	0.01	-	17.5	-	15.8	-	-	43.3

Station	Al	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Ni	P	Pb	Sr	V	Zn
ST088	-	65.8	-	-	0.15	12.9	3.8	-	< 0.01	-	15.6	-	21.8	-	-	40.7
ST117	-	31.7	-	-	0.18	18.3	6.8	-	< 0.01	-	21.0	-	11.7	-	-	53.3
ST130	-	38.9	-	-	0.07	9.3	3.1	-	0.03	-	8.5	-	24.0	-	-	28.6
ST138	-	51.7	-	-	0.07	12.0	2.8	-	0.02	-	10.2	-	21.4	-	-	34.9
ST146	-	17.5	-	-	0.05	9.2	2.8	-	0.01	-	5.9	-	10.1	-	-	20.4
ST151	-	8.6	-	-	0.04	8.1	2.3	-	< 0.01	-	5.9	-	8.2	-	-	16.5
ST154	-	6.1	-	-	< 0.04	7.6	2.7	-	< 0.01	-	4.7	-	7.8	-	-	17.9
ST159	-	5.8	-	-	0.04	8.5	2.8	-	< 0.01	-	6.0	-	8.6	-	-	17.2
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**

Notes

Concentrations expressed in µg/g dry sediment

Al = Aluminium; As = Arsenic; Ba = Barium; Be = Beryllium; Cd = Cadmium; Cr = Chromium
Cu = Copper; Fe = Iron; Hg = Mercury; Mn = Manganese; Ni = Nickel
P = Phosphorus; Pb = Lead; Sr = Strontium; V = Vanadium; Zn = Zinc
RSD = Relative standard deviation; ERL = Effects Range Low; OSPAR = Oslo and Paris Commission; CEMP = Coordinated Environmental Monitoring Programme
Cefas = Centre for Environment, Fisheries and Aquaculture Science; SD = Standard deviation; AL1 = Action Level 1 (mg/kg dry weight (ppm))
AL2 = Action Level 2 (mg/kg dry weight (ppm))

Key	Below Cefas Guideline Action Level 1	Above Cefas Guideline Action Level 1	Above ERL

8. Sediment Macrofauna

This section presents the results of the macrofaunal analysis of samples collected along the proposed cable route. At all stations, one 0.1 m^2 samples was processed for analysis (FA). Appendix B provides full details of the analytical techniques employed.

The sediment macrofauna is defined as those animals living in or on the seafloor that are retained on a sieve mesh of 1 mm.

Prior to rationalisation the enumerated macrofaunal dataset comprised 622 taxa and 27 236 individuals. Before the analysis, the raw data were rationalised (see details in Section 3.3) and 221 taxa were excluded. These included colonial taxa, juveniles, damaged, fish (*Ammodytes marinus* and Gobiidae), pelagic or parasitic fauna. In addition, two species of *Leiochone*, four species of *Cheirocratus*, two species of *Gnathia* and two species of *Astacilla* were aggregated to their respective genera and the species *Autonoe longipes* and *Aora gracilis* were aggregated to their family level (Aoridae). Sessile colonial epifauna was recorded as present, and assessed separately from the enumerated fauna, which comprised infaunal and solitary epifaunal taxa.

Juveniles comprised 68 taxa and 13 541 individuals, of which echinoderms of the order Spatangoida (10 772 individuals) was the most abundant along the entire proposed cable route. The echinoderm families Ophiuridae (793 individuals) and Amphiuridae (508 individuals) and the order Ascidiacea (312 individuals) were also abundant along the proposed cable route. Juveniles of the bivalve *Arctica islandica* were also present along the proposed cable route within the survey area, with 38 individuals recorded.

Various multivariate statistical techniques were applied to the data and the macrofauna (abundance) to investigate patterns of similarity in PRIMER v7 after applying a suitable transformation. For optimal performance of multivariate analysis, a 4th root transformation was applied to macrofaunal data. Further details are presented in Section 3.3.

The results of the macrofaunal analysis are presented in the form of figures and tables; the main features of the communities identified are highlighted in the text. A full list of taxa identified, enumerated (individuals per 0.1 m^2) from the survey area, along with biomass per Phylum and other supplementary material, are presented in Appendix GG.

8.1 Infaunal and Solitary Epifauna

8.1.1 Phyletic Composition

Table 8.1 summarises the abundance of taxonomic groups identified along the proposed cable route and Figures 8.1 to and 8.2 illustrate the phyletic composition of taxa and individuals for each station (per 0.1 m^2), respectively, facilitating spatial comparison.

When rationalised data were considered, Annelida comprised most of the enumerated taxa composition (43.1 %), followed by Arthropoda (26.9 %) Mollusca (21.9 %), and Echinodermata

(4.0 %). Other phyla comprised 4.0 % of the enumerated taxa and were represented by Chordata (*Branchiostoma lanceolatum*, Perophoridae, *Ascidiella scabra*, *Molgula manhattensis*, *Dendrodoa grossularia* and *Polycarpa*), Cnidaria (species of the order Actiniaria, Ceriantharia and the family Edwardsiidae, *Pennatula phosphorea* and *Halcampa chrysanthellum*), Nemertea, Hemichordata (Enteropneusta), Phoronida and Platyhelminthes.

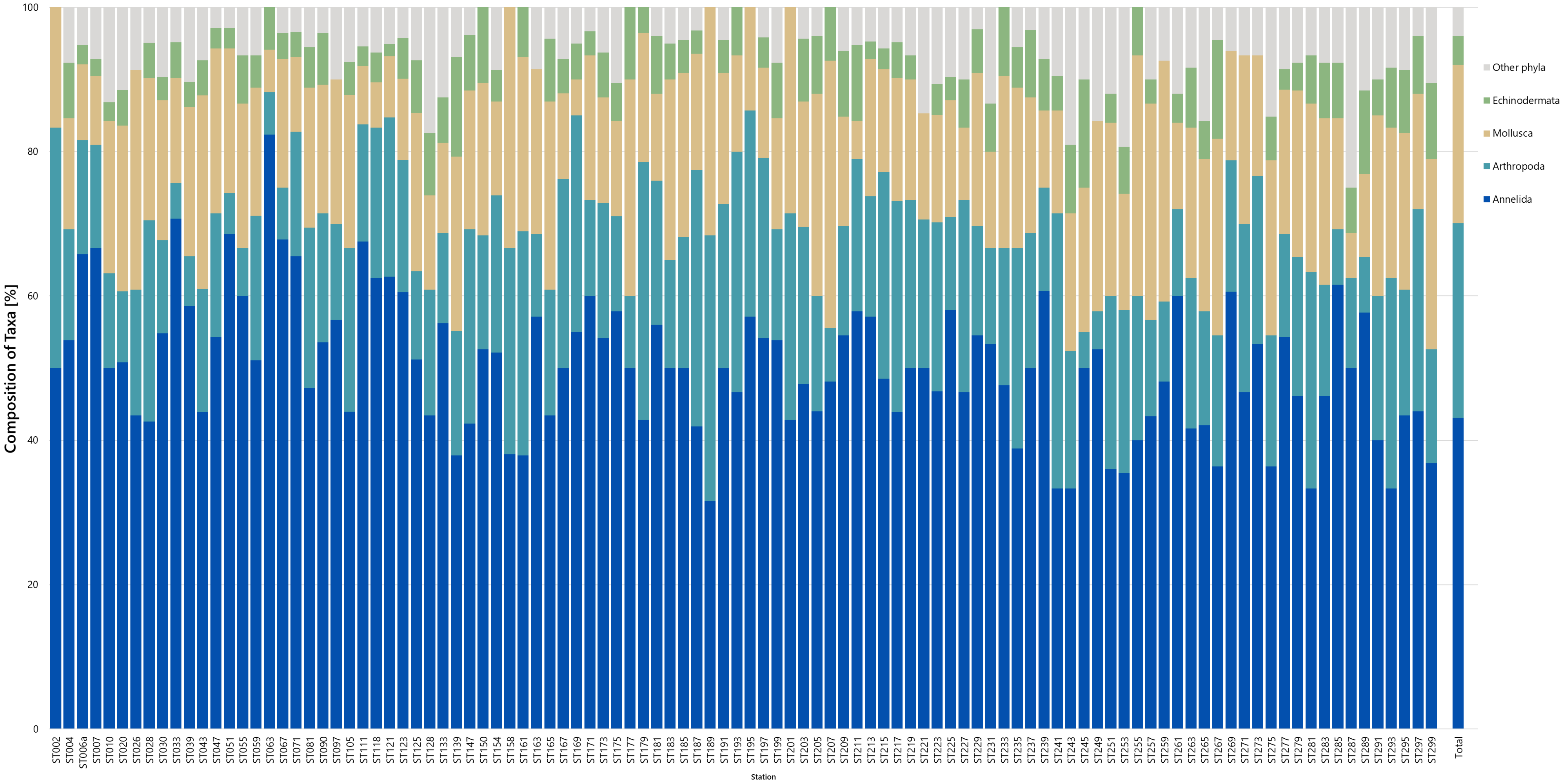
Annelida comprised also most of the enumerated macrofaunal abundance (50.7 %), followed by Mollusca (25.8 %), Arthropoda (16.3 %), and Echinodermata (3.0 %), whereas other phyla comprised 4.3 % of the enumerated macrofaunal abundance.

Table 8.1: Taxonomic groups

Taxonomic Group	Number of Taxa	Composition of Taxa [%]*	Abundance	Composition of Individuals [%]*
Annelida	173	43.1	6822	50.7
Arthropoda	108	26.9	3477	25.8
Mollusca	88	21.9	2189	16.3
Echinodermata	16	4.0	398	3.0
Other phyla	16	4.0	575	4.3
Total	**401**	**100**	**13461**	**100**

Notes
Macrofaunal samples were processed through a 1.0 mm sieve
Other phyla include: Cnidaria, Phoronida, Platyhelminthes, Nemertea, Hemichordata and Chordata
Total = Rationalised data along the proposed cable route
* = Percentages expressed to 1 decimal place and, due to numerical rounding, values presented may not equate to 100 %

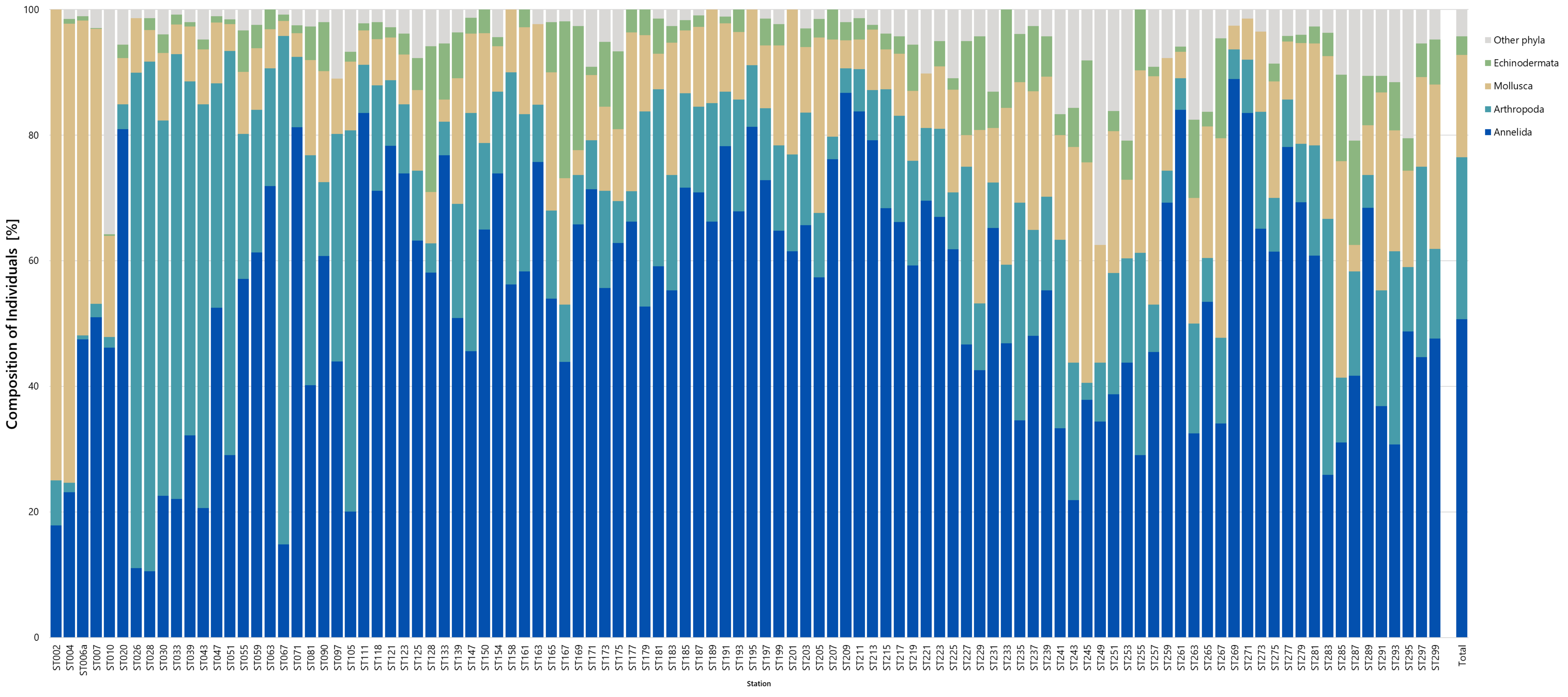
When assessed on a station basis, Annelida were dominant in terms of taxa composition at most stations along the proposed cable route, with Arthropoda taxa recorded in higher numbers at station ST189. Annelida were also numerically dominant at most stations. However, Arthropoda had highest abundances at nine stations (ST026, ST028, ST030, ST033, ST039, ST043, ST051, ST067 and ST105) whilst Mollusca had highest abundances at three stations (ST002, ST004 and ST006a) followed by Echinodermata and other phyla.



Notes

Total = Rationalised data along the proposed cable route

Figure 8.1: Phyletic composition of taxa



Notes
Total = Rationalised data along the proposed cable route

Figure 8.2: Phyletic composition of individuals

8.1.2 Community Statistics

Table 8.2 presents the number of taxa and individuals identified from each station along with several commonly used diversity and evenness statistics.

Figures 8.3 to 8.11 illustrate the spatial distribution of the number of taxa and Figures 8.12 to 8.20 illustrates the spatial distribution of the number of individuals along the proposed cable routes.

The number of taxa ranged from 6 (station ST002) to 71 (station ST123) with a mean of 30, a median of 29, and moderate interstation variability (RSD 38 %). The number of individuals ranged from 24 (station ST287) to 1 137 (station ST006a) with a mean of 129, a median of 77, and high interstation variability (RSD 129 %).

Values of richness reflected the number of individuals per taxa recorded, with values ranging from 1.50 at station ST002 to 11.73 at station ST123, with a mean of 6.31 and a median of 6.18.

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

- High ($H'Log_2$ > 4.00) at 46 stations;
- Good ($H'Log_2$ of 3.00 to 4.00) at 46 stations;
- Moderate ($H'Log_2$ of 2.00 to 3.00) at 8 stations;
- Poor ($H'Log_2$ of 1.00 to 2.00) at 4 stations.

The mean Shannon-Wiener diversity index (3.82) was indicative of 'good' diversity. The Shannon-Wiener diversity index demonstrated low variability (RSD 20 %) along the proposed cable route. At the stations falling within the MCZ, the Shannon-Weiner diversity index ranged from poor (one station) to high (4 stations) (Table 8.2), reflecting a similar patter to that observed for the proposed cable route.

The Pielou's evenness index (J') is a measure of the distribution of individuals between taxa. The evenness ranged from 0.315 (station ST067) to 0.992 (station ST293) with a mean of 0.800 and a median of 0.841. The low value of evenness at station ST067 was associated with a numerical dominance of barnacle *Balanus crenatus*, which comprised 311 individuals, representing 81 % of the faunal abundance at this station. The high value of evenness at station ST293 was associated with the low number of individuals, i.e. 26, in relation to the number of taxa, i.e. 24, where the ratio was almost even.

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.

Table 8.2: Macrofaunal community statistics (0.1 m^2)

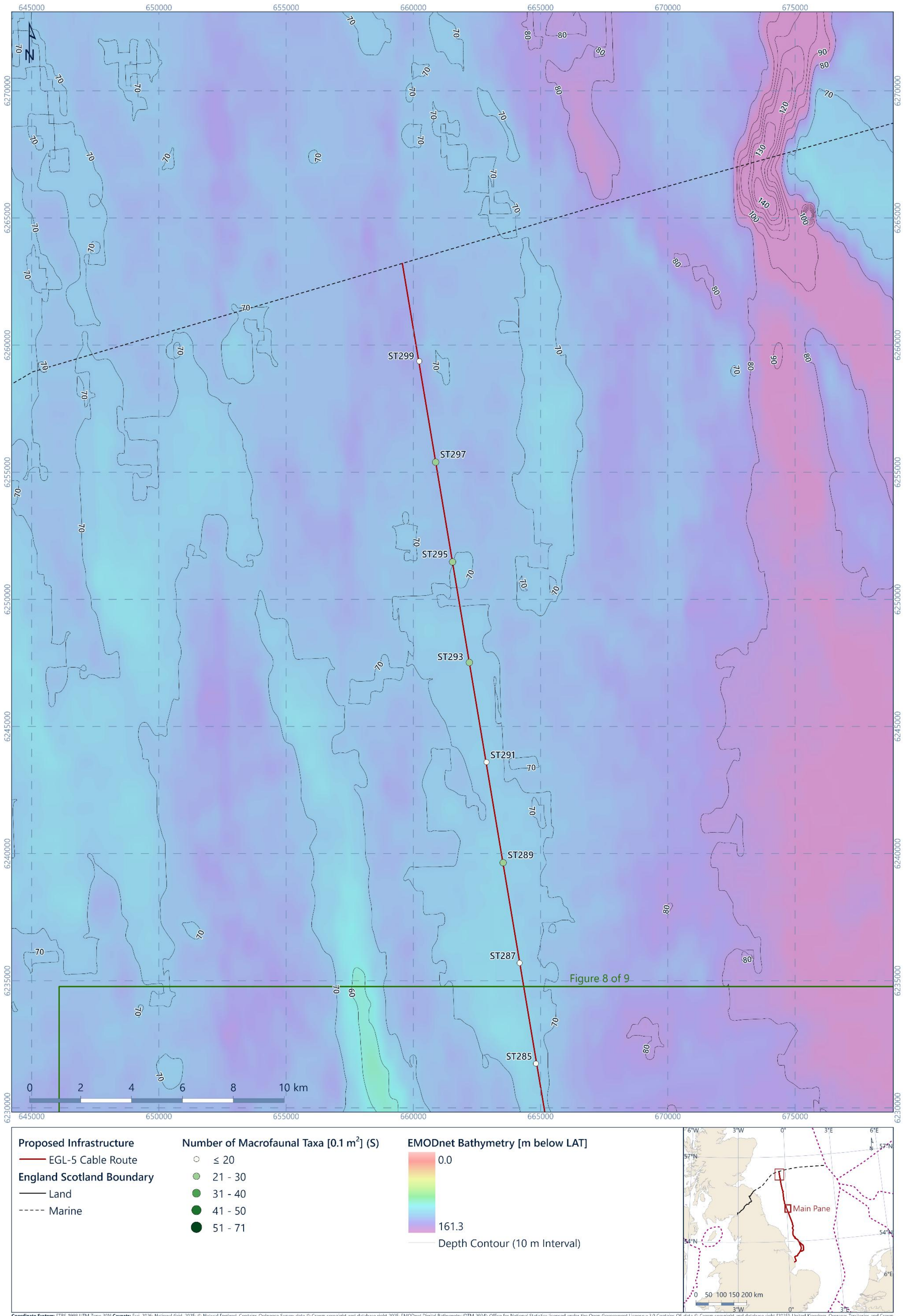
Station	Numbers		Richness	Diversity	Evenness	Dominance
	Taxa	Individuals	Margalef [d]	Shannon-Wiener ($H'Log_2$)	Pielou (J')	Simpson [λ]
ST002	6	28	1.50	1.34	0.520	0.579
ST004	13	134	2.45	1.83	0.494	0.429
ST006a	38	1137	5.26	2.74	0.522	0.221
ST007	42	651	6.33	3.17	0.588	0.173
ST010	38	355	6.30	3.30	0.629	0.171
ST020	61	504	9.64	3.50	0.590	0.288
ST026	23	299	3.86	1.58	0.349	0.613
ST028	61	892	8.83	2.22	0.375	0.533
ST030	31	204	5.64	2.93	0.592	0.324
ST033	41	381	6.73	2.79	0.520	0.326
ST039	29	149	5.60	3.20	0.658	0.252
ST043	41	252	7.23	3.41	0.637	0.251
ST047	35	196	6.44	3.77	0.735	0.116
ST051	35	258	6.12	3.04	0.593	0.250
ST055	30	91	6.43	4.13	0.842	0.090
ST059	45	163	8.64	4.61	0.840	0.067
ST063	17	32	4.62	3.78	0.925	0.090
ST067	28	385	4.54	1.51	0.315	0.655
ST071	29	80	6.39	4.08	0.841	0.102
ST081	36	112	7.42	4.75	0.919	0.046
ST090	28	51	6.87	4.55	0.946	0.051
ST097	30	91	6.43	4.05	0.824	0.111
ST105	66	494	10.48	3.37	0.558	0.309
ST111	37	91	7.98	4.62	0.887	0.063
ST118	48	149	9.39	4.81	0.861	0.062
ST121	59	249	10.51	5.01	0.851	0.053
ST123	71	391	11.73	5.22	0.849	0.039
ST125	41	117	8.40	4.87	0.909	0.045
ST128	23	86	4.94	3.38	0.748	0.156
ST133	16	56	3.73	3.10	0.774	0.180
ST139	29	55	6.99	4.41	0.907	0.066
ST147	26	79	5.72	3.94	0.839	0.102
ST150	19	80	4.11	3.07	0.722	0.212
ST154	23	69	5.20	3.41	0.754	0.192

Station	Numbers		Richness	Diversity	Evenness	Dominance
	Taxa	Individuals	Margalef [d]	Shannon-Wiener ($H'Log_2$)	Pielou (J')	Simpson [λ]
ST158	21	80	4.56	3.16	0.720	0.203
ST161	29	72	6.55	3.93	0.809	0.131
ST163	35	132	6.96	3.84	0.748	0.154
ST165	23	50	5.62	4.22	0.933	0.065
ST167	42	164	8.04	4.18	0.775	0.105
ST169	20	76	4.39	3.35	0.774	0.156
ST171	30	77	6.68	4.09	0.833	0.106
ST173	48	97	10.27	5.24	0.938	0.034
ST175	38	105	7.95	4.77	0.908	0.050
ST177	30	83	6.56	4.11	0.838	0.099
ST179	28	74	6.27	4.26	0.885	0.080
ST181	25	71	5.63	3.79	0.817	0.125
ST183	20	38	5.22	3.79	0.876	0.111
ST185	22	60	5.13	3.41	0.764	0.196
ST187	31	110	6.38	3.71	0.750	0.161
ST189	19	74	4.18	3.16	0.745	0.197
ST191	22	92	4.64	2.78	0.624	0.316
ST193	15	28	4.20	3.45	0.883	0.125
ST195	21	102	4.32	2.75	0.627	0.327
ST197	24	70	5.41	3.71	0.809	0.134
ST199	26	88	5.58	3.78	0.804	0.134
ST201	21	52	5.06	3.67	0.835	0.128
ST203	23	67	5.23	3.84	0.848	0.109
ST205	25	68	5.69	4.28	0.921	0.062
ST207	27	84	5.87	3.73	0.784	0.140
ST209	33	204	6.02	3.13	0.621	0.245
ST211	38	148	7.40	3.65	0.695	0.196
ST213	42	125	8.49	3.93	0.728	0.186
ST215	35	79	7.78	4.53	0.882	0.071
ST217	41	71	9.38	4.88	0.911	0.052
ST219	30	54	7.27	4.67	0.952	0.046
ST221	34	69	7.79	4.52	0.888	0.068
ST223	47	100	9.99	4.92	0.885	0.057
ST225	31	55	7.49	4.62	0.933	0.054
ST227	30	60	7.08	4.48	0.913	0.060

Station	Numbers		Richness	Diversity	Evenness	Dominance
	Taxa	Individuals	Margalef [d]	Shannon-Wiener (H'Log2)	Pielou (J')	Simpson [λ]
ST229	33	47	8.31	4.77	0.945	0.048
ST231	30	69	6.85	4.34	0.885	0.074
ST233	21	32	5.77	4.14	0.943	0.068
ST235	18	26	5.22	3.95	0.946	0.080
ST237	32	77	7.14	4.55	0.910	0.056
ST239	28	47	7.01	4.61	0.958	0.048
ST241	21	30	5.88	4.15	0.945	0.069
ST243	21	32	5.77	3.98	0.905	0.096
ST245	20	37	5.26	3.97	0.918	0.087
ST249	19	32	5.19	3.83	0.901	0.102
ST251	25	31	6.99	4.54	0.978	0.047
ST253	31	48	7.75	4.69	0.946	0.050
ST255	15	31	4.08	3.43	0.879	0.126
ST257	30	66	6.92	4.42	0.901	0.066
ST259	27	78	5.97	3.80	0.799	0.132
ST261	25	119	5.02	3.22	0.692	0.203
ST263	24	40	6.24	4.33	0.943	0.060
ST265	19	43	4.79	3.74	0.881	0.103
ST267	22	44	5.55	4.26	0.956	0.059
ST269	33	236	5.86	2.84	0.564	0.280
ST271	30	213	5.41	2.65	0.540	0.347
ST273	30	86	6.51	4.02	0.820	0.111
ST275	33	70	7.53	4.36	0.864	0.079
ST277	35	119	7.11	3.77	0.735	0.147
ST279	26	75	5.79	3.45	0.734	0.220
ST281	30	74	6.74	3.94	0.803	0.132
ST283	13	27	3.64	3.12	0.843	0.169
ST285	13	29	3.56	3.34	0.904	0.123
ST287	16	24	4.72	3.84	0.959	0.080
ST289	26	38	6.87	4.43	0.943	0.060
ST291	20	38	5.22	4.02	0.930	0.076
ST293	24	26	7.06	4.55	0.992	0.044
ST295	23	39	6.01	4.27	0.943	0.064
ST297	25	56	5.96	4.31	0.928	0.061
ST299	19	42	4.82	4.01	0.943	0.071

Station	Numbers		Richness	Diversity	Evenness	Dominance
	Taxa	Individuals	Margalef [d]	Shannon-Wiener ($H'Log_2$)	Pielou (J')	Simpson [λ]
Minimum	6	24	1.50	1.34	0.315	0.034
Maximum	71	1137	11.73	5.24	0.992	0.655
Mean	30	129	6.31	3.82	0.800	0.147
Median	29	77	6.18	3.93	0.841	0.108
SD	11	167	1.737	0.773	0.149	0.123
RSD [%]	38	129	28	20	19	83

Notes
RSD = Relative standard deviation
SD = Standard deviation



Coordinate System: ETRS 1989 UTM Zone 30N Caveats: Esri, 2026; National Grid, 2025; © Natural England. Contains Ordnance Survey data © Crown copyright and database right 2025; EMODnet Digital Bathymetry (DTM 2024); Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2026, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/. For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation; Flanders Marine Institute (2023). Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM)

Figure 8.3: Number of macrofaunal taxa [S], station ST285 to station ST299

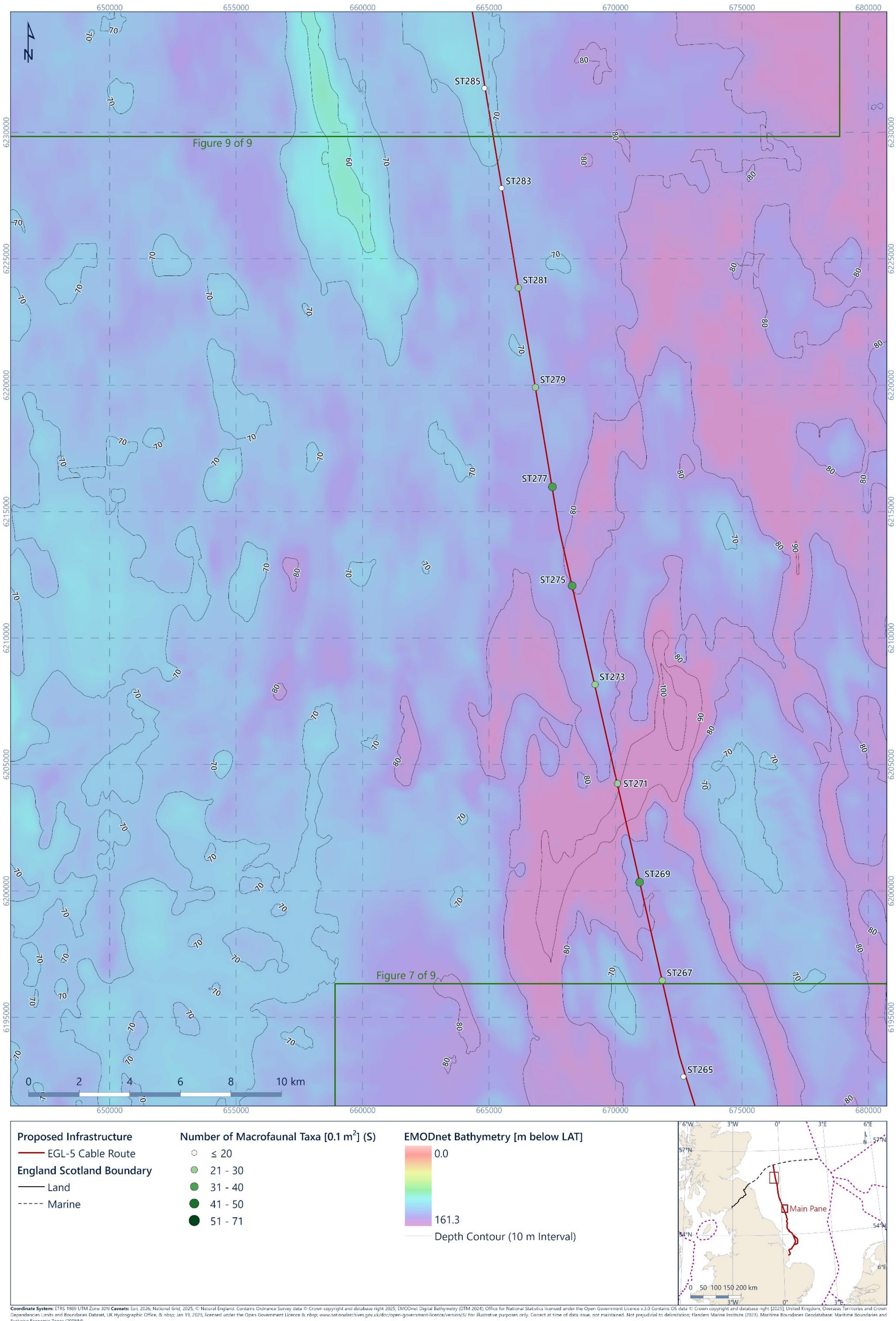


Figure 8.4: Number of macrofaunal taxa [S], station ST265 to station ST285

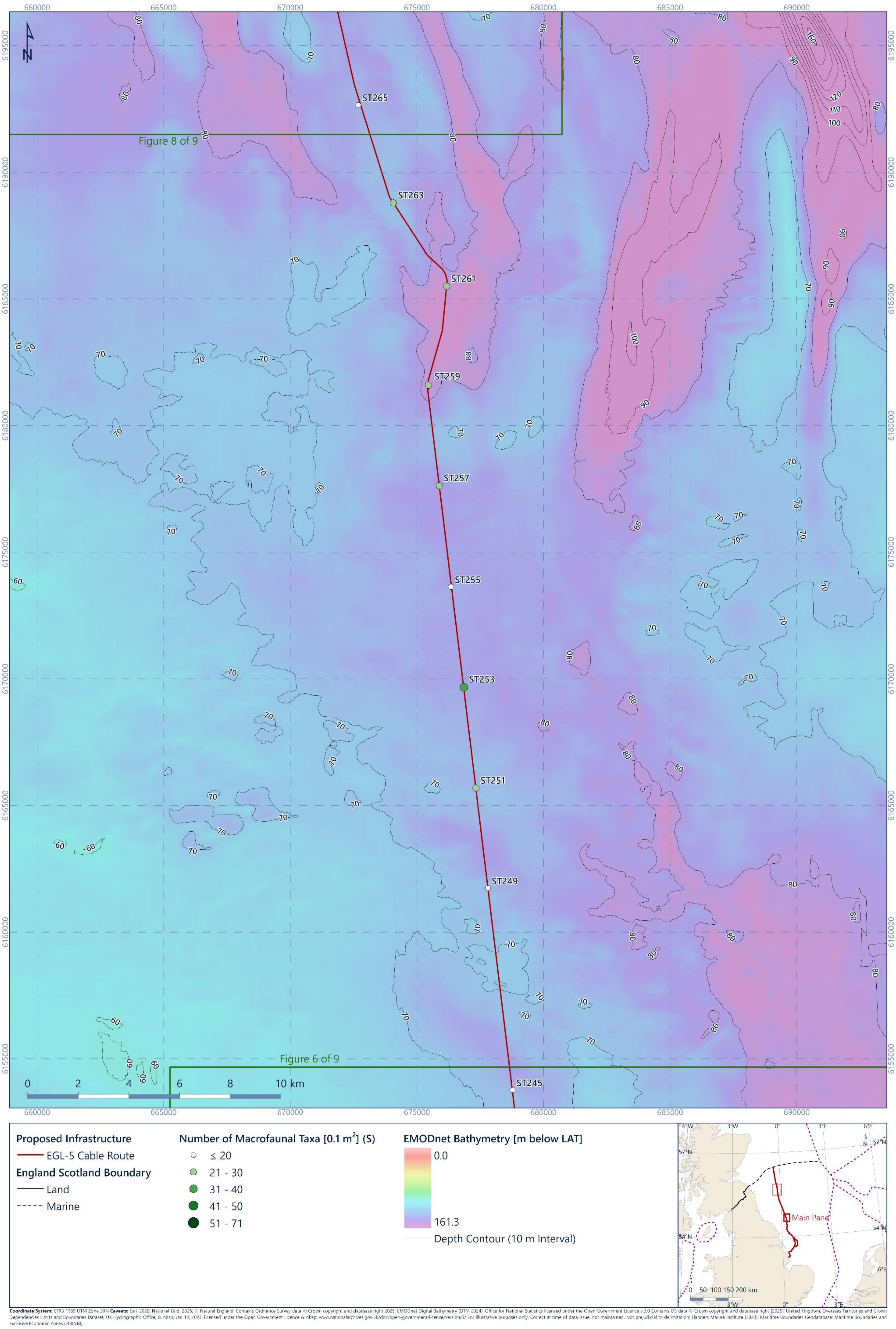


Figure 8.5: Number of macrofaunal taxa [S], station ST245 to station ST265

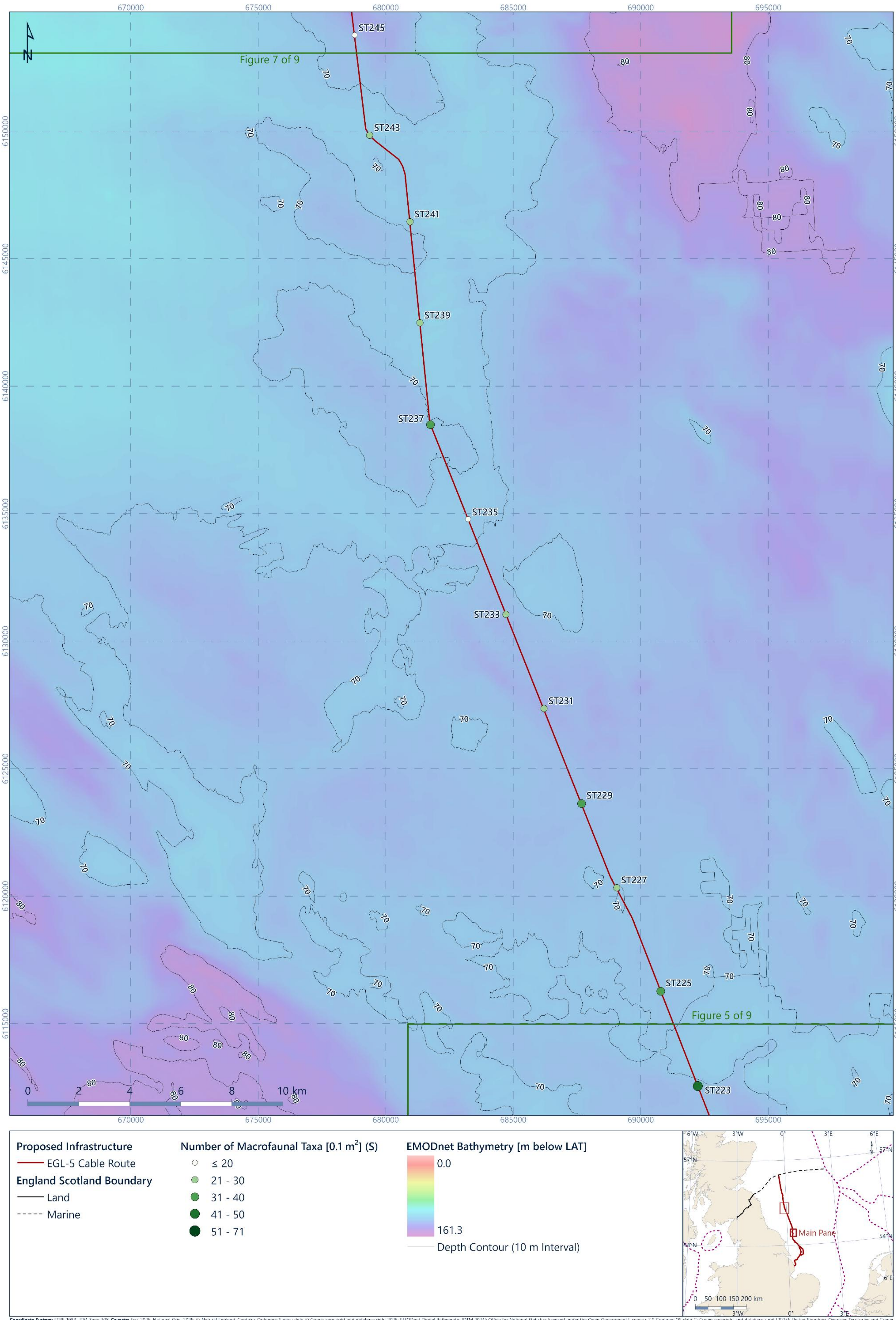


Figure 8.6: Number of macrofaunal taxa [S], station ST223 to station ST245

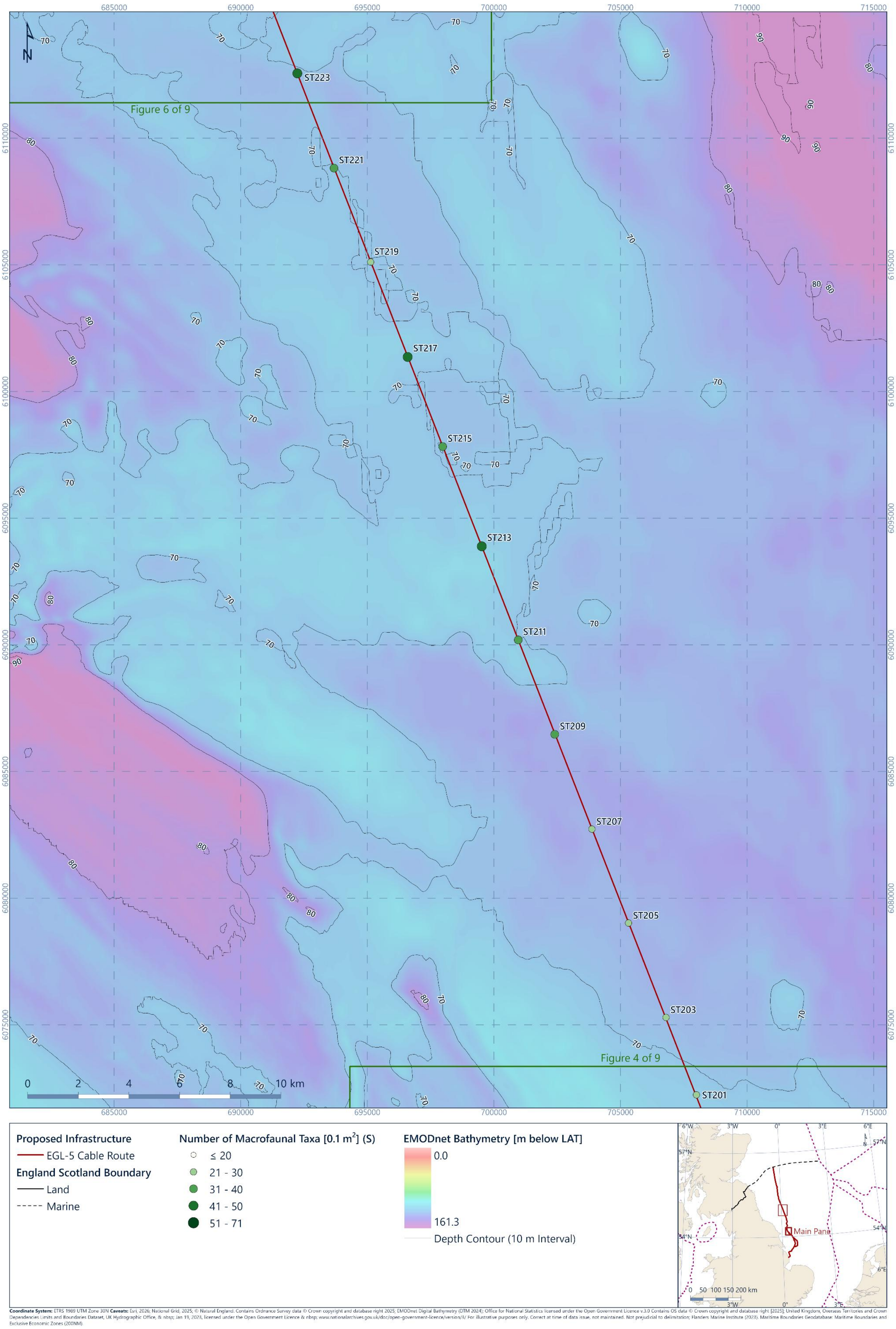


Figure 8.7: Number of macrofaunal taxa [S], station ST201 to station ST223

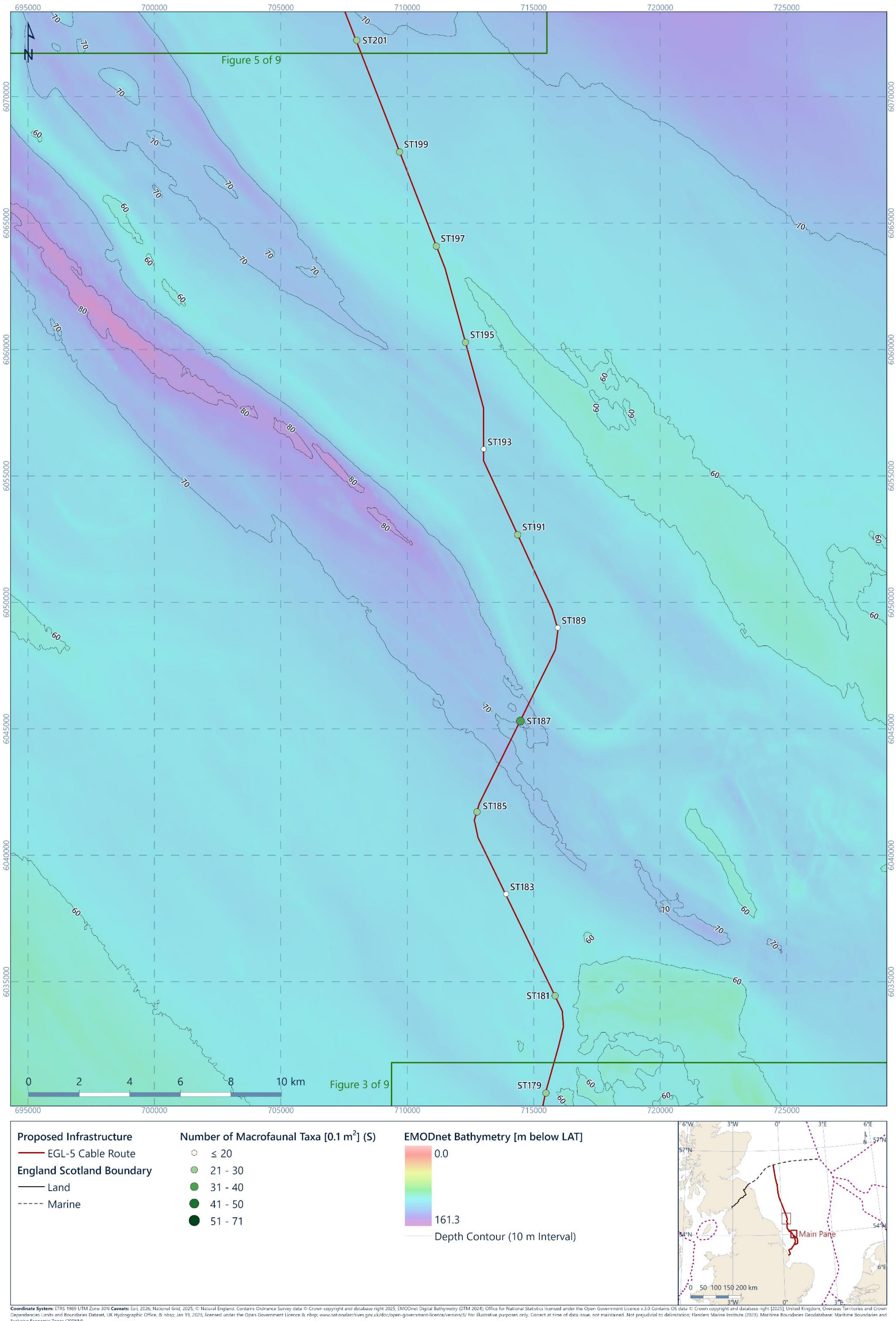


Figure 8.8: Number of macrofaunal taxa [S], station ST179 to station ST201

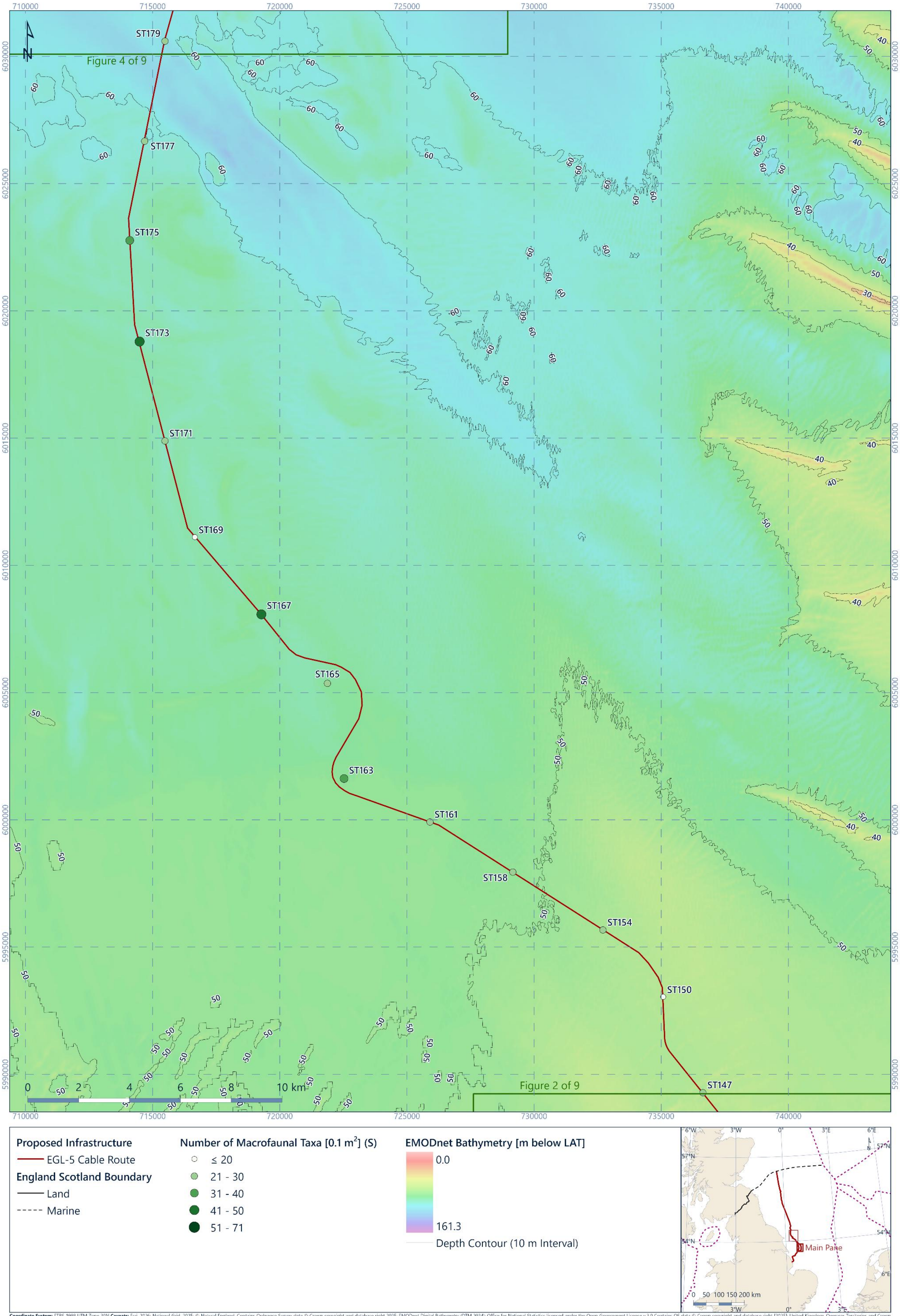


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Figure 8.9: Number of macrofaunal taxa [S], station ST147 to station ST179

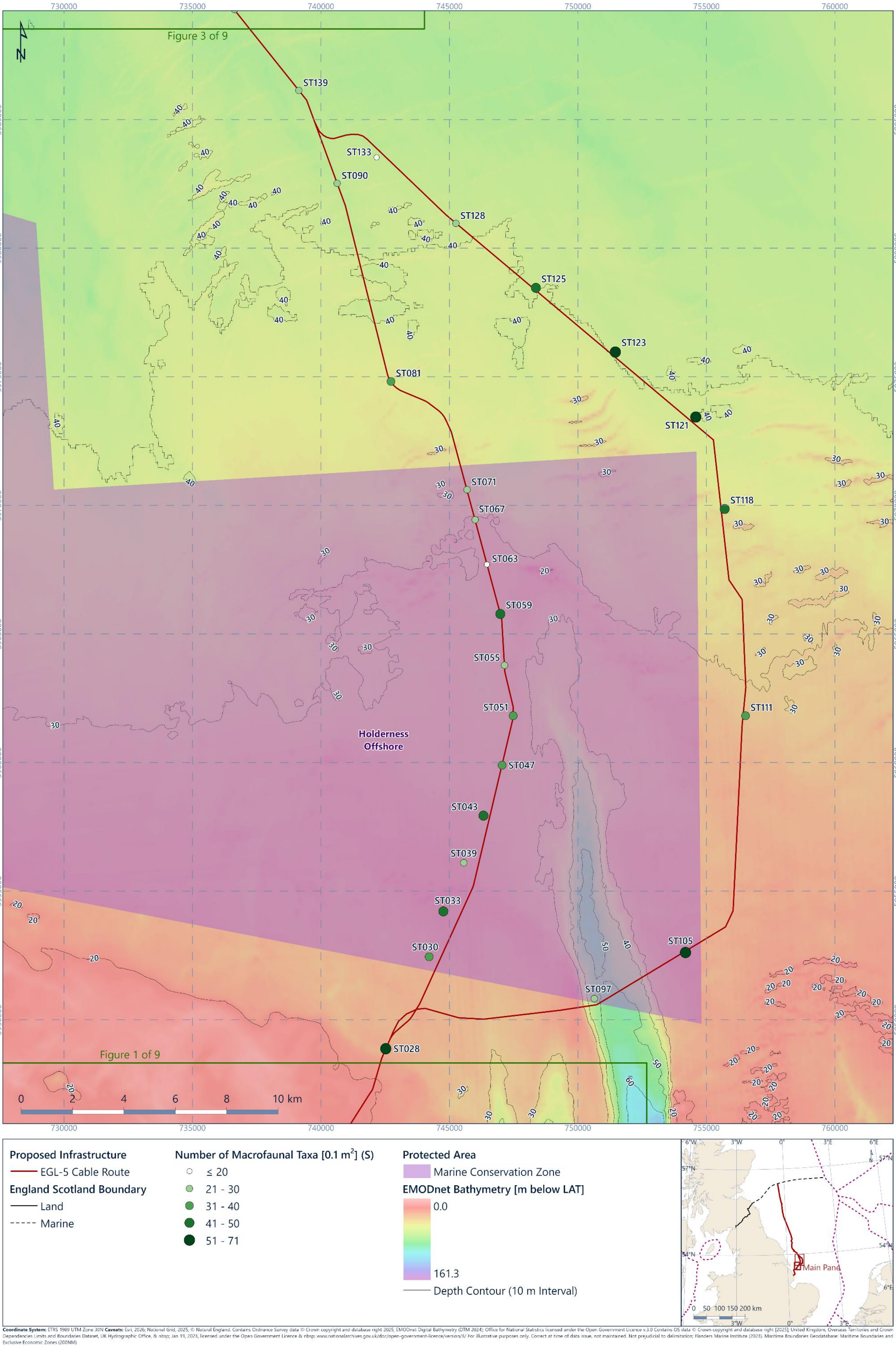

Figure 8.10: Number of macrofaunal taxa [S], station ST028 to station ST139 (inclusive of all in Holderness Offshore marine conservation zone)

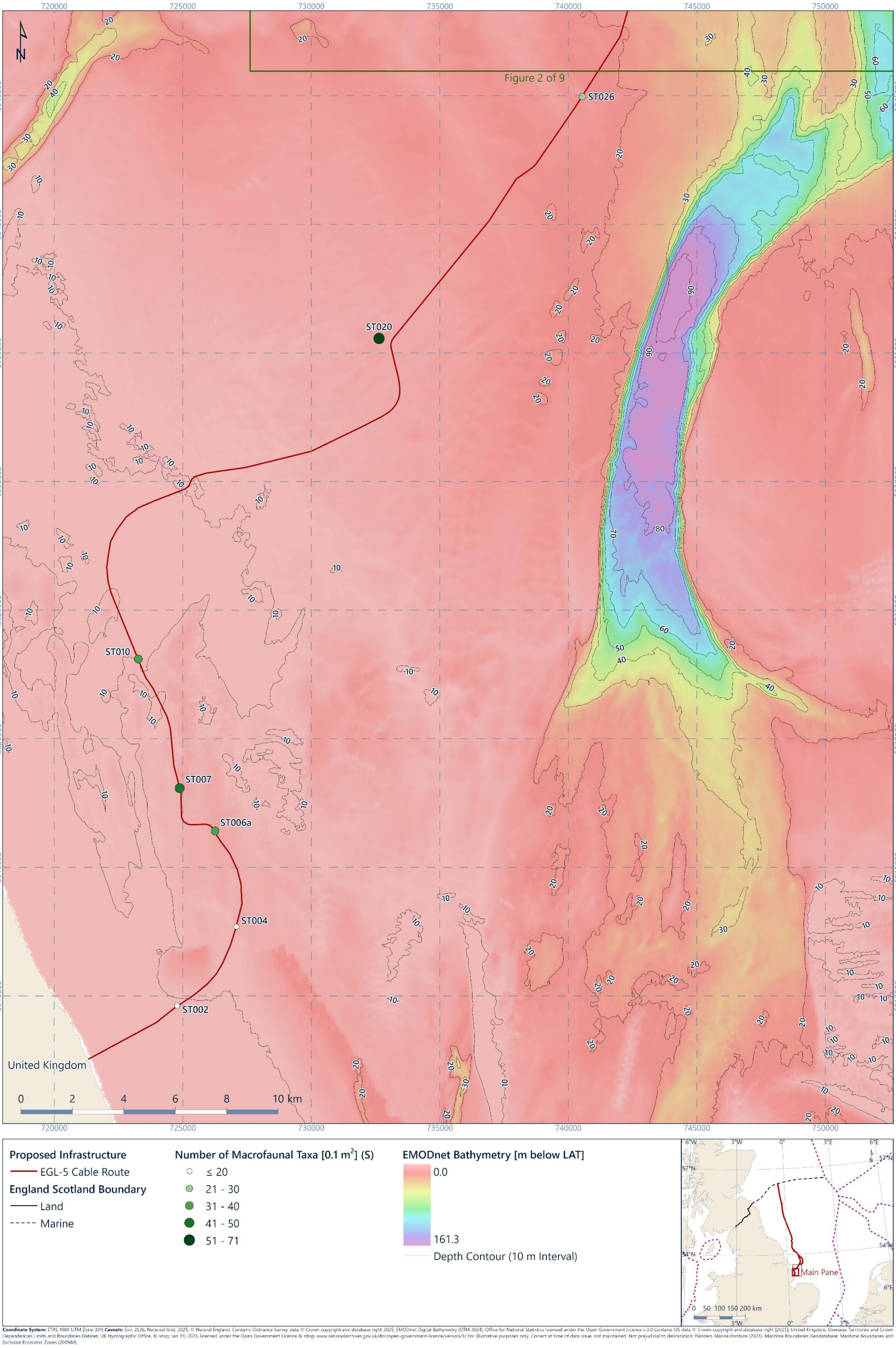

Figure 8.11: Number of macrofaunal taxa [S], station ST002 to station ST026

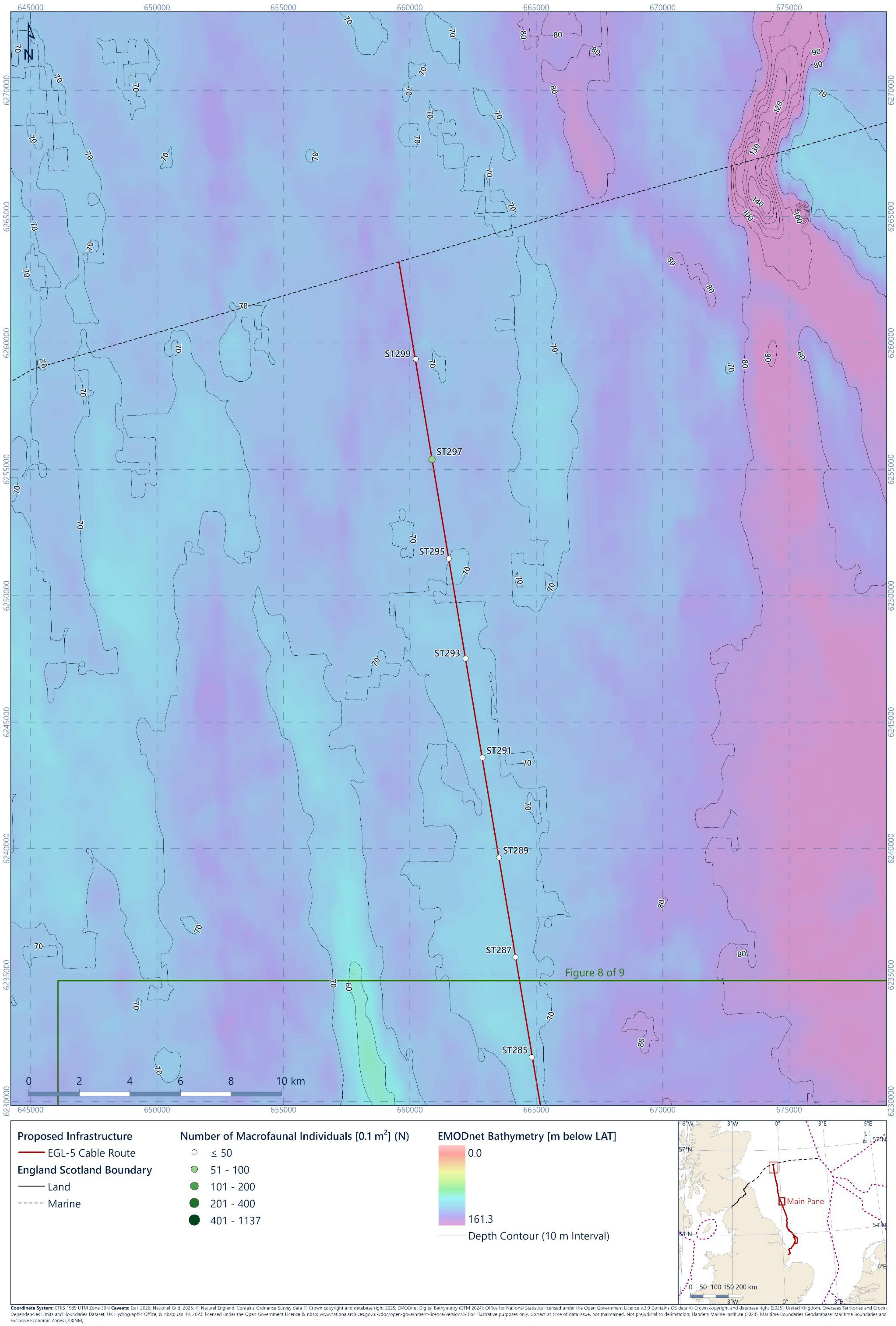

Figure 8.12: Number of macrofaunal individuals [N], station ST285 to station ST299

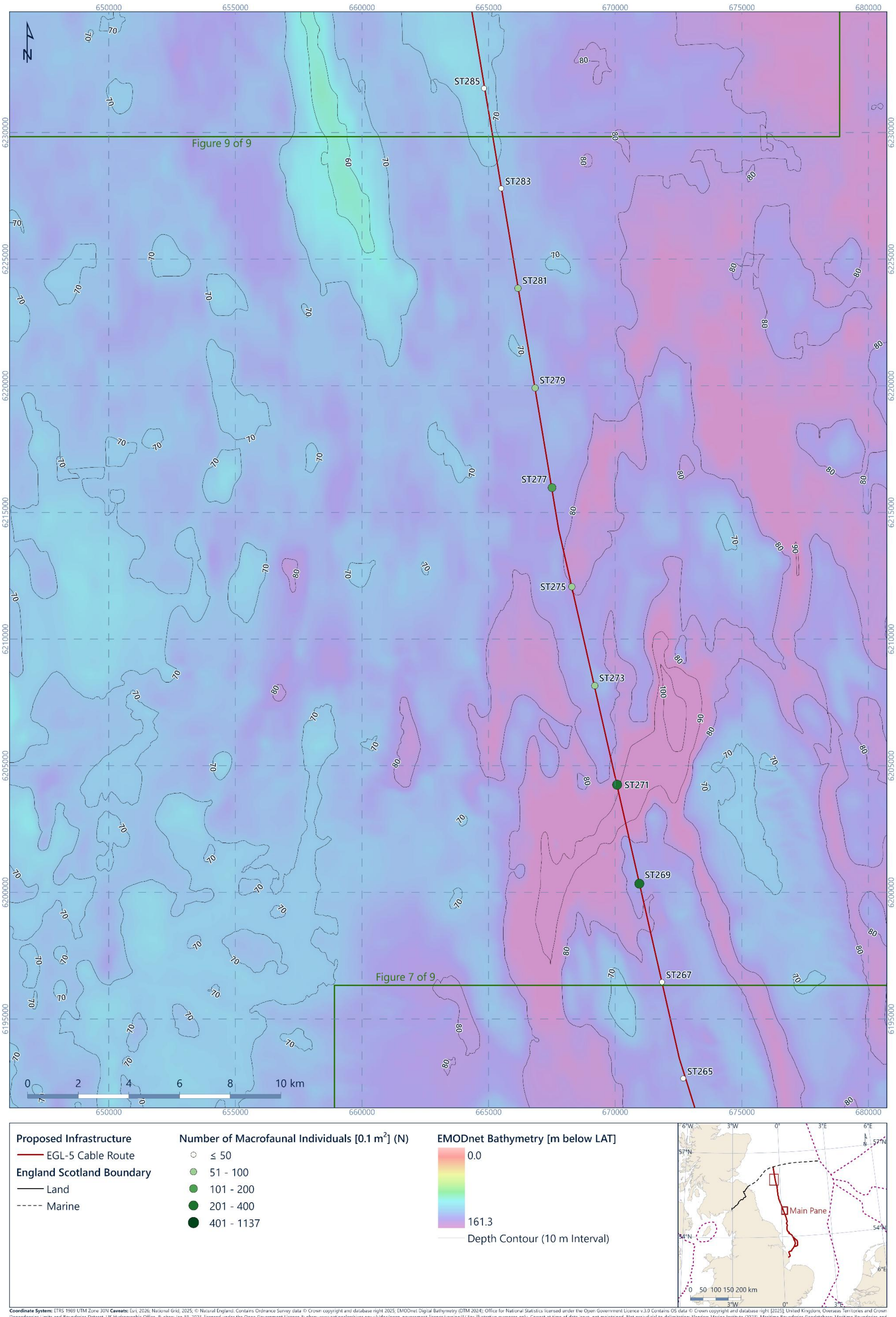

Figure 8.13: Number of macrofaunal individuals [N], station ST265 to station ST285

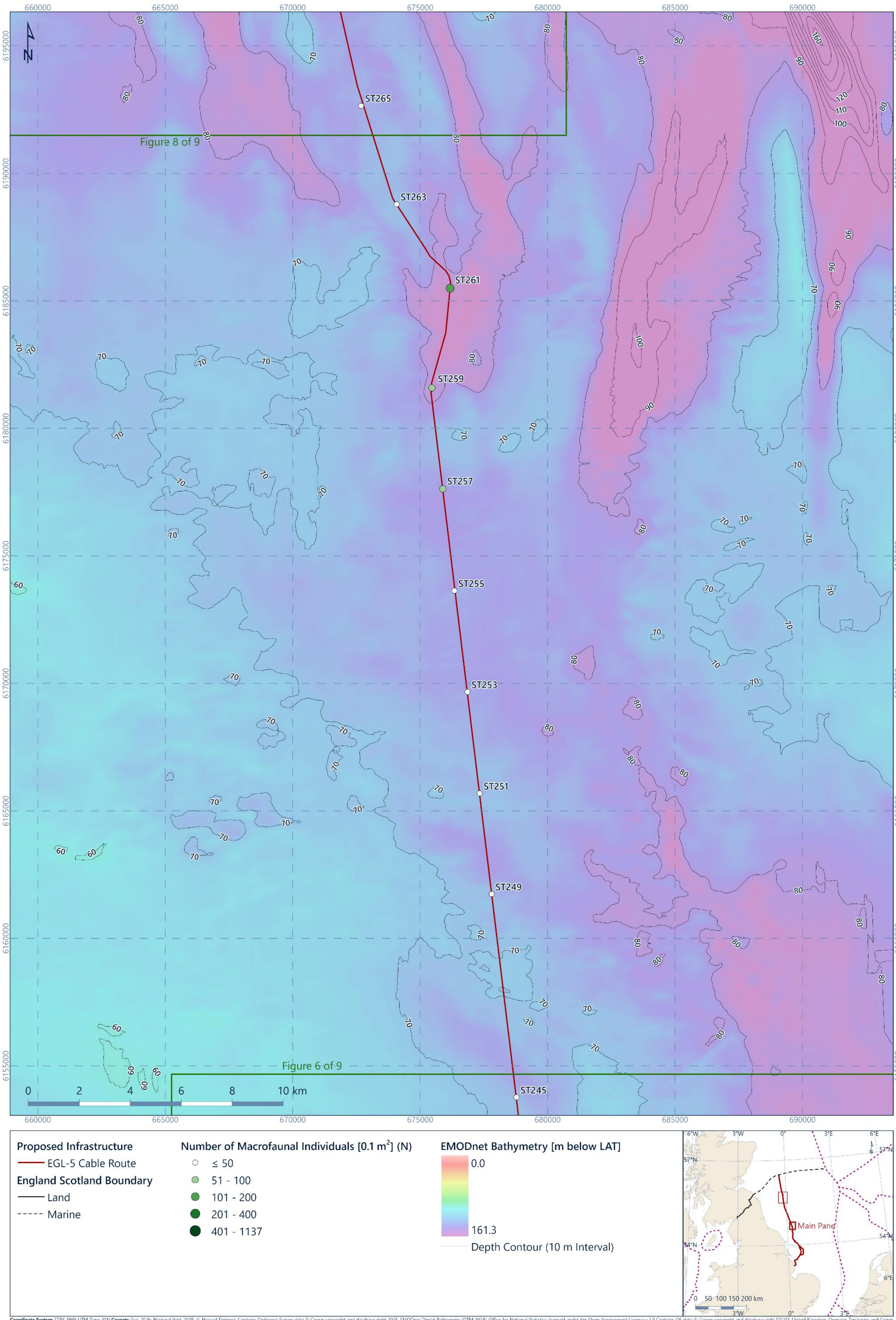

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Figure 8.14: Number of macrofaunal individuals [N], station ST245 to station ST265

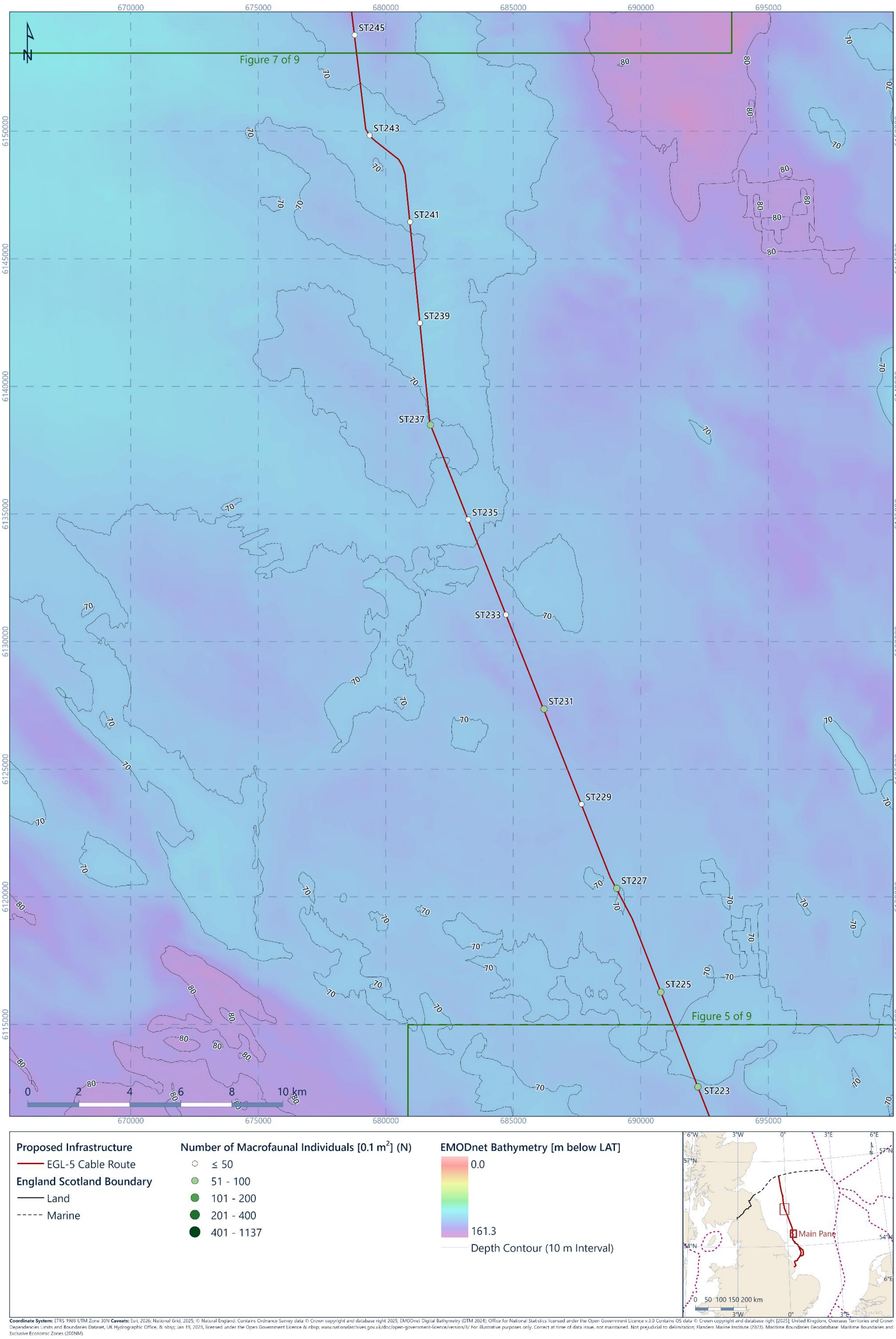

Figure 8.15: Number of macrofaunal individuals [N], station ST223 to station ST245

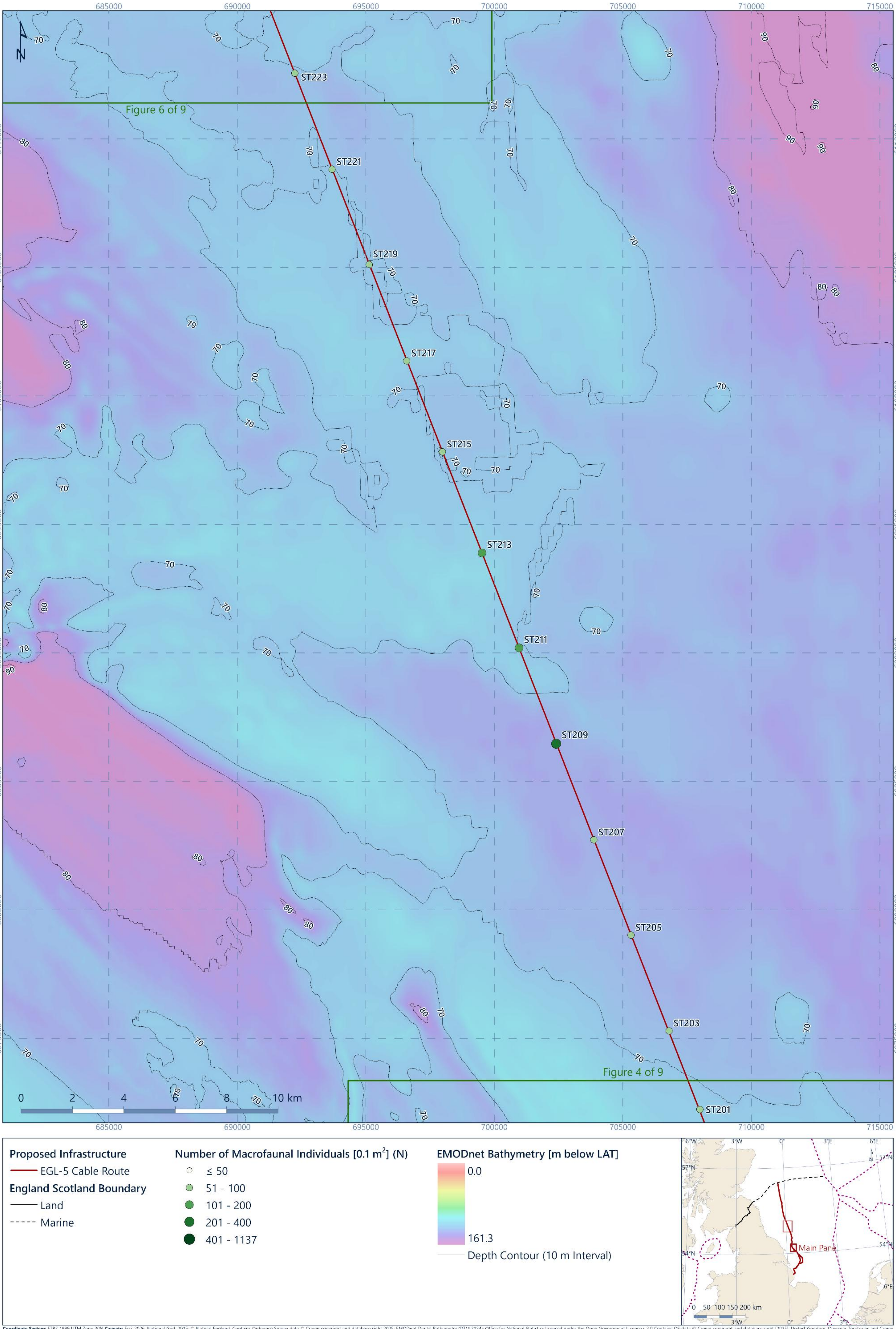

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Figure 8.16: Number of macrofaunal individuals [N], station ST201 to station ST223

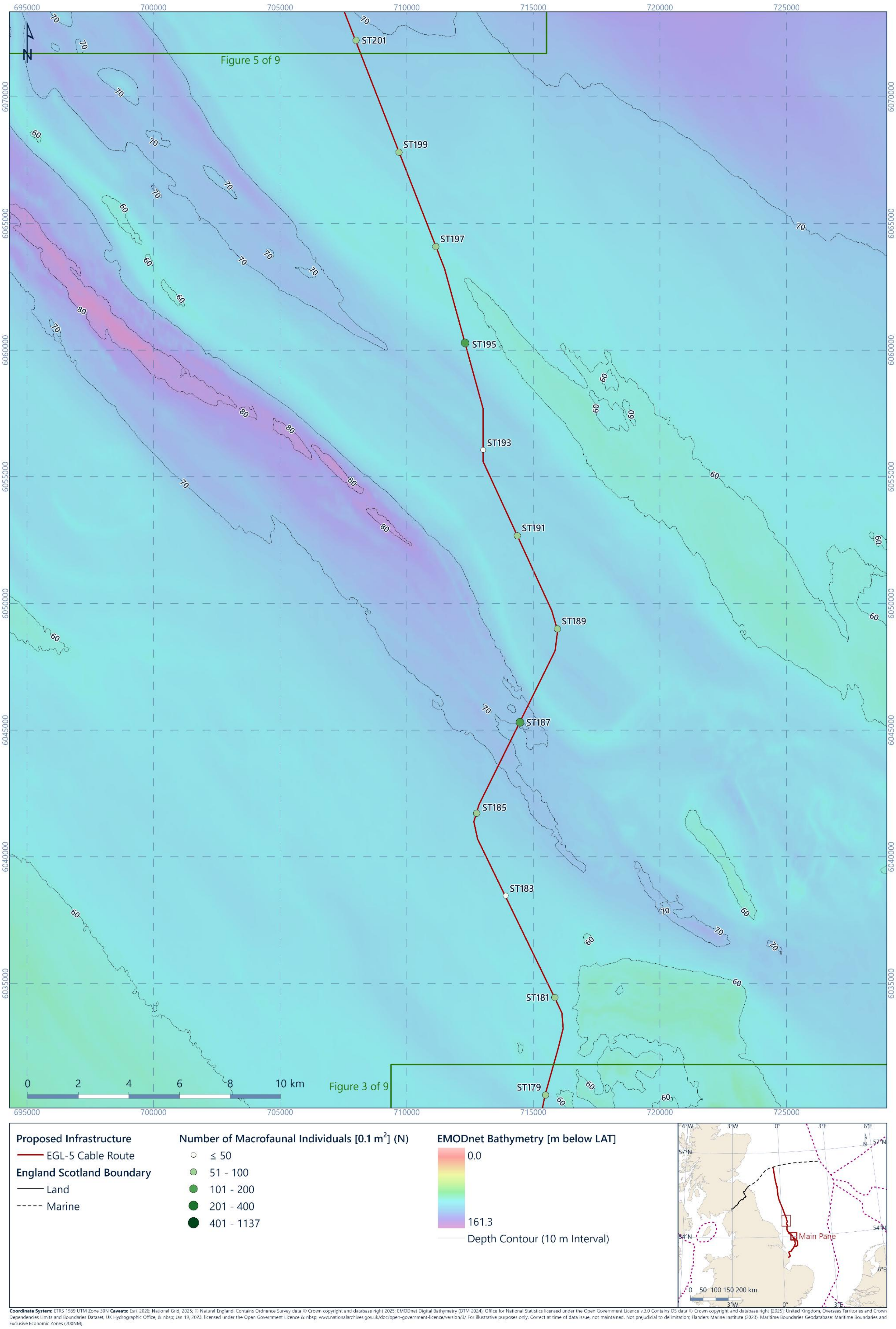


Figure 8.17: Number of macrofaunal individuals [N], station ST179 to station ST201

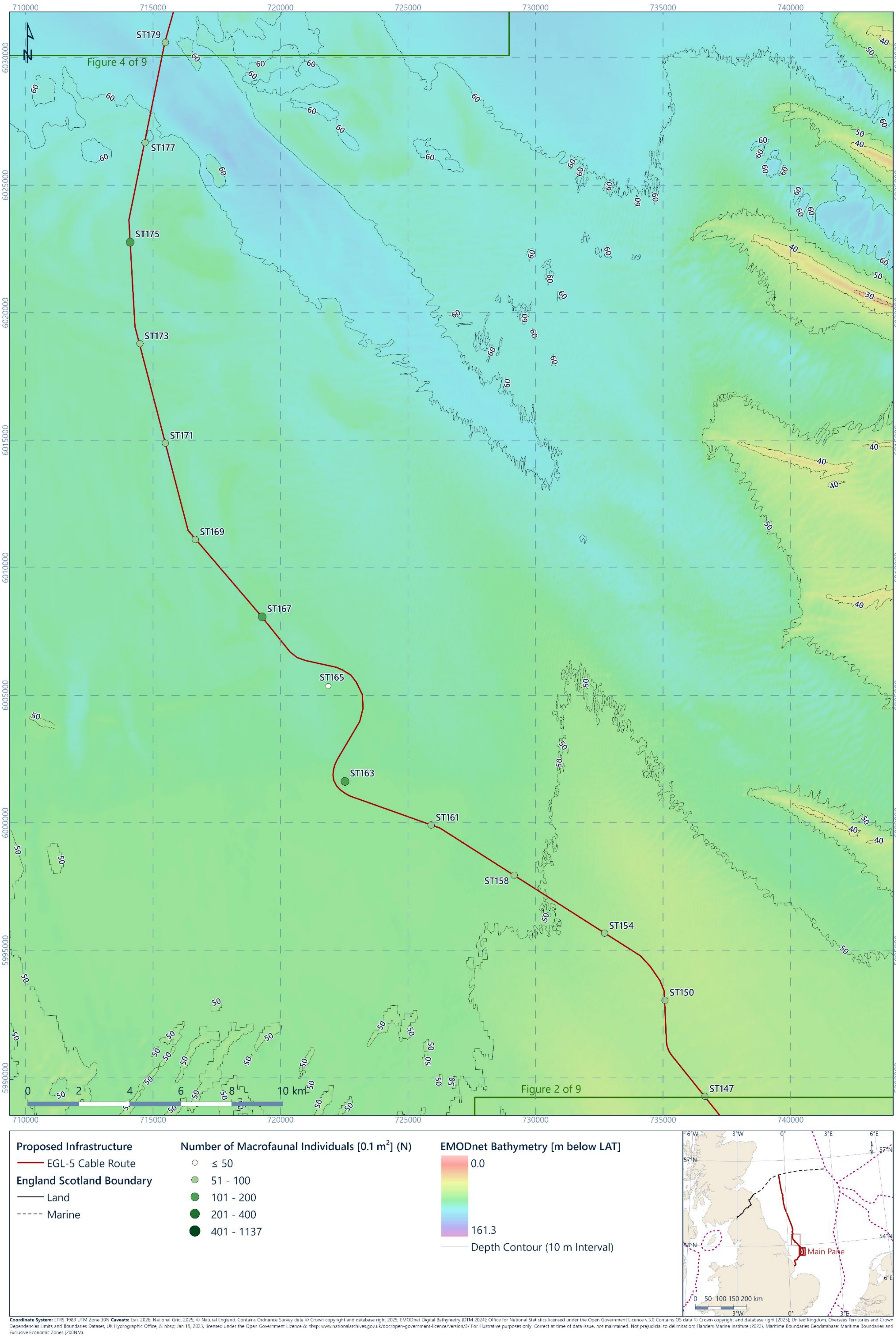


Figure 8.18: Number of macrofaunal individuals [N], station ST147 to station ST179

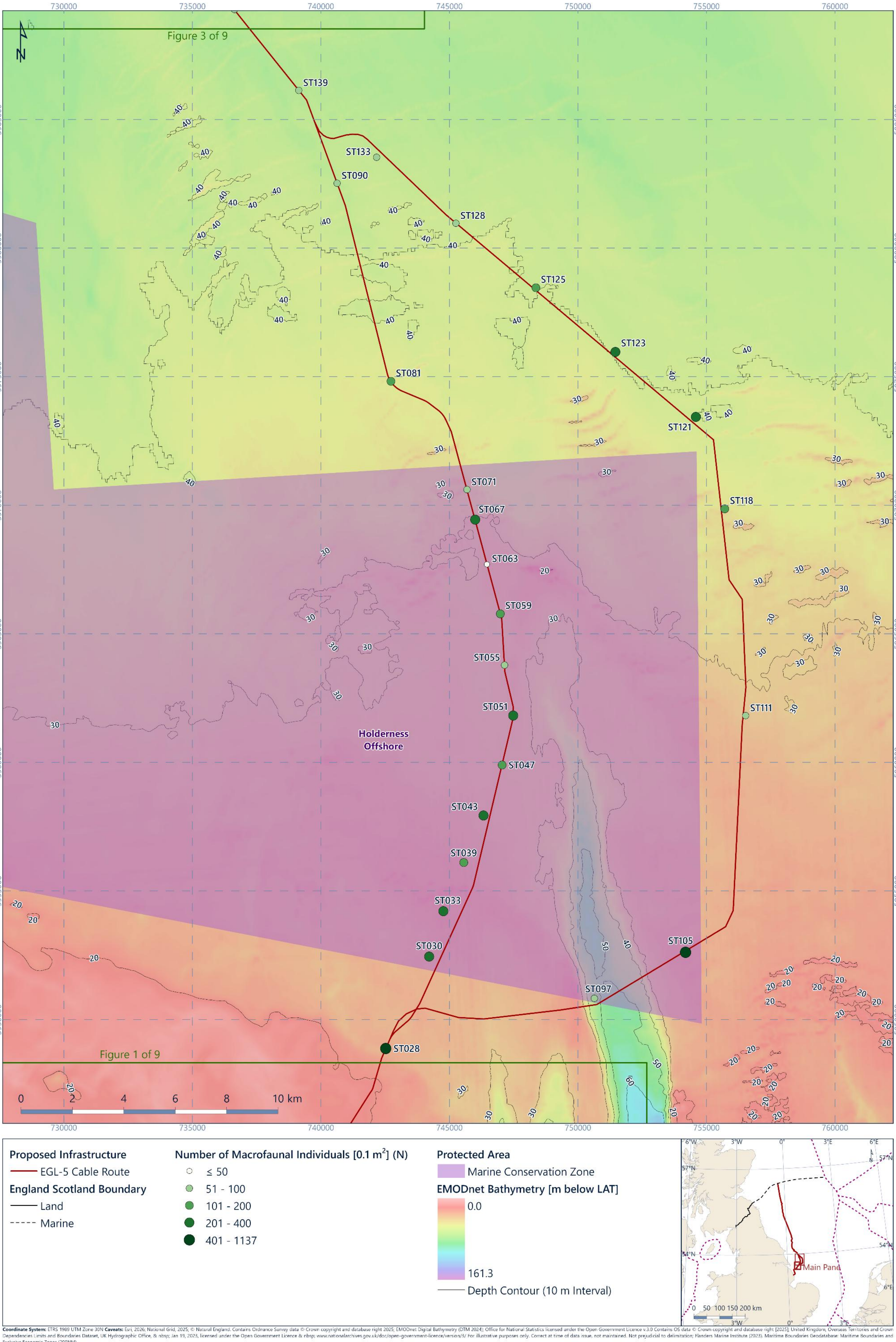


Figure 8.19: Number of macrofaunal individuals [N], station ST028 to station ST139 (inclusive of all in Holderness Offshore marine conservation zone)

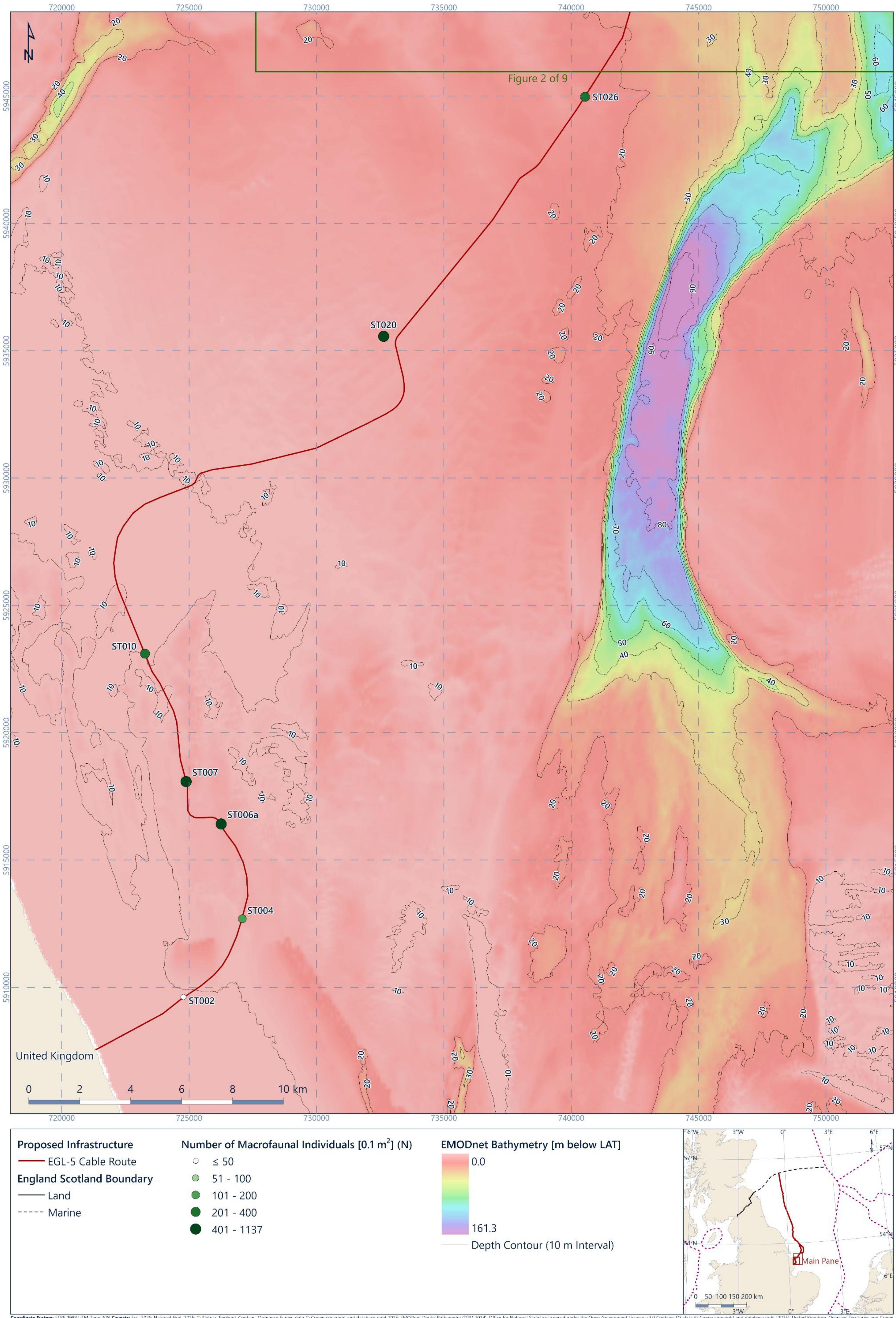


Figure 8.20: Number of macrofaunal individuals [N], station ST002 to station ST026

8.1.3 Investigation of Faunal Similarities

The enumerated macrofaunal dataset acquired for baseline assessment 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 and nMDS, results of which are presented in Figure 8.21 and Figure 8.22. The SIMPROF test, undertaken in conjunction with the cluster analysis, was interpreted in ecological terms and, where appropriate, coarser groups were created (details in Section 3.3.4).

Table 8.3 summarises the physical and biological characteristics of each multivariate group. Figure 8.23 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.

Four clusters of samples were identified at a similarity of 20 %. The nMDS representation has a relatively high stress coefficient (details in Section 3.3.4); however, there is good correspondence between dendrogram (Figure 8.21) and nMDS, as indicated by the similarity level superimposed on the nMDS, and, as such, the nMDS is deemed representative of the stations’ two-dimensional ordination. The nMDS in Figure 8.22 presented with superimposed the Folk (BGS modified) sediment classification. Due to slight differences in the sediment composition, one of the groups was further divided for faunal assessment and biotope description.

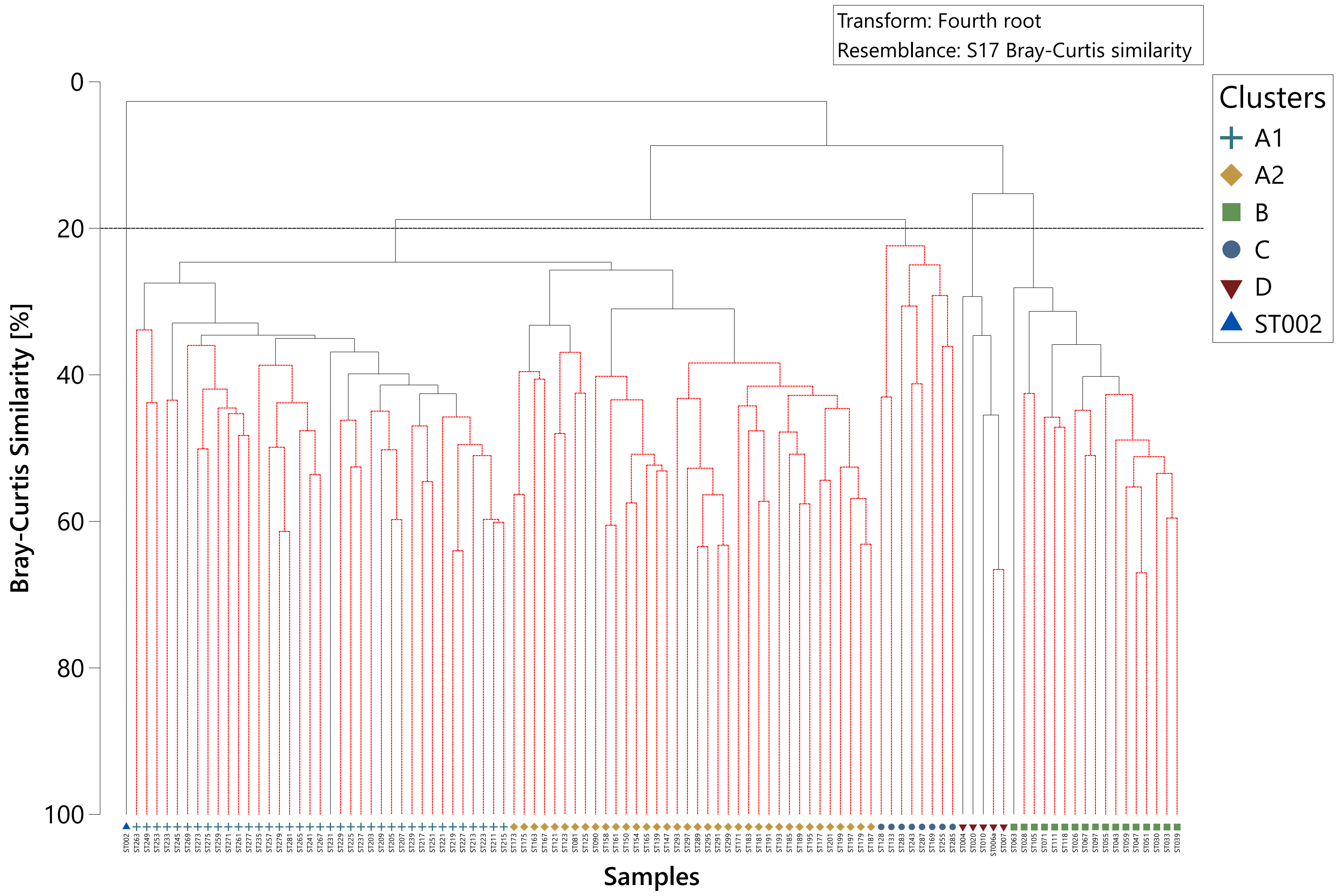


Figure 8.21: Dendrogram of hierarchical clustering of macrofaunal station (0.1 m²) abundance data

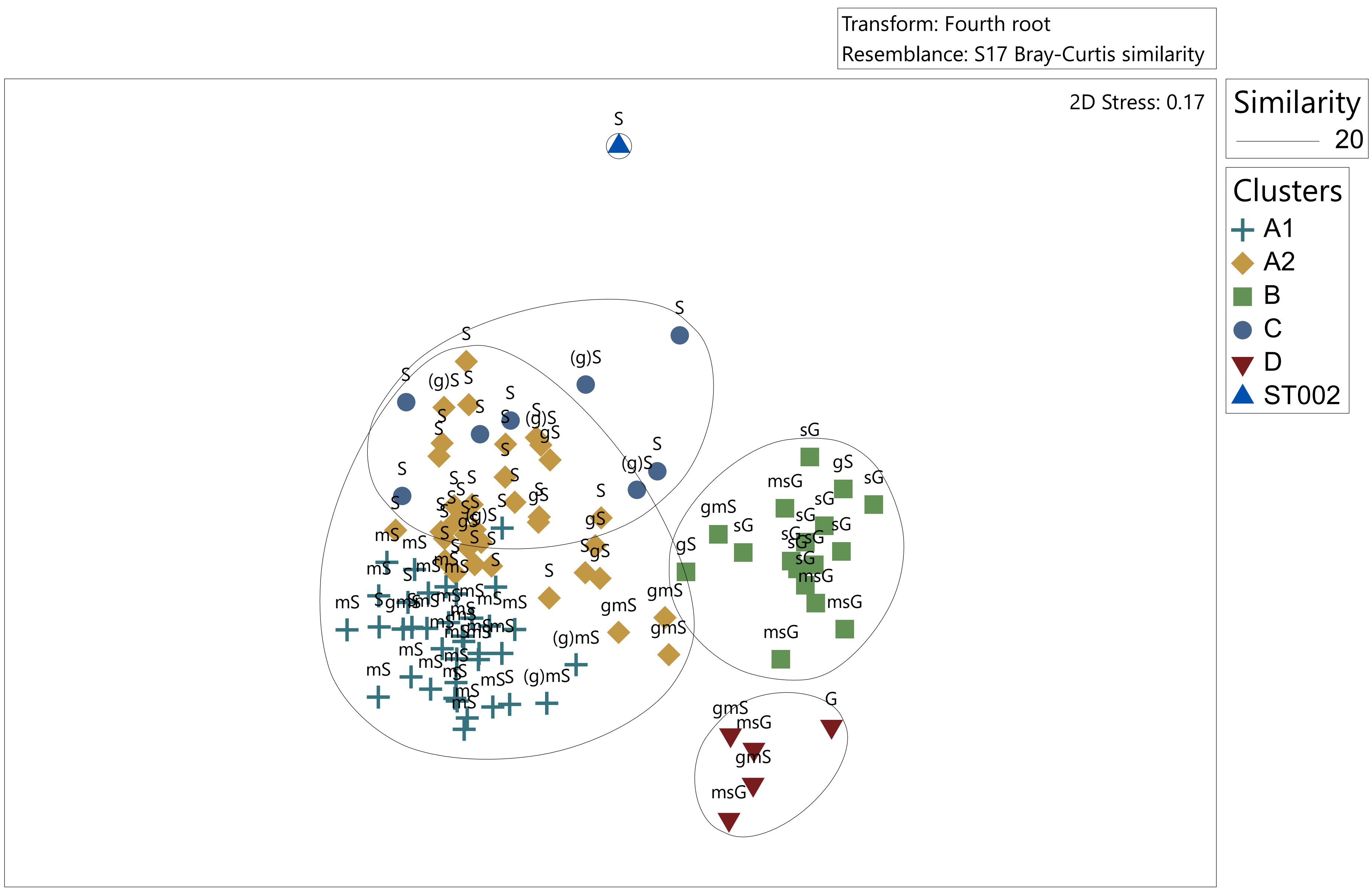


Figure 8.22: Non-metric multi-dimensional scaling ordination of macrofaunal station (0.1 m²) abundance data

The groups identified through the multivariate analysis were further assessed by means of the SIMPER analysis. Table 8.3 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.

Group A1 comprised 37 stations and had an average similarity of 35.8 %. Group A1 was characterised by poorly sorted 'muddy sand' (Folk BGS modified), with mean median sediment particle size of 209 μm (fine sand), in mean water depth of 74.8 m BSL. Group A had 185 taxa and 2 923 individuals, of which the polychaetes *G. oculata*, *A. falcata*, *S. armiger*, *S. kroyeri*, *S. limicola* and the genus *Terebellide*s were amongst the top ten characterising taxa, along with the echinoderm *Amphiura filiformis*, the bivalve *P. minimum*, the amphipod *Harpinia antennaria* and species of the genus *Phoronis*.

Group A2 comprised 36 stations and had an average similarity of 33.4 %. Group A2 was characterised by very poorly sorted to moderately well sorted 'sand' (Folk BGS modified), with mean median sediment particle size of 225 μm (fine sand), in mean water depth of 59.8 m BSL. Group A2 had 216 taxa and 3 161 individuals, of which the polychaetes *S. bombyx*, *S. armiger, L. conchilega*, *G. oculata*, *G. maculata and S. limicola* were amongst the top ten characterising taxa, along with the bivalves *Abra prismatica*, *Phaxas pellucidus* and the amphipod *Bathyporeia elegans*.

Group B comprised 17 stations and had an average similarity of 38.2 %. Group B was characterised by very poorly sorted 'sandy gravel' (Folk BGS modified), with mean median sediment particle size of 3 458 μm (granule), in mean water depth of 31.7 m BSL. Group B had mean numbers of 179 taxa and 1 207 individuals, of which the polychaetes *S. garciai*, *Spio armata*, *G. lapidum*, *Notomastus*, *Polycirrus*, *M. fragilis* were amongst the top ten characterising taxa, along with Nemertea, the bivalve *T. ovata*, the echinoderm *E. pusillus* and the barnacle *Balanus crenatus*. The stations falling within the Holderness Offshore MCZ were amongst the 17 stations in Group B (Figure 8.24).

Group C comprised 8 stations and had an average similarity of 26.2 %. Group C was characterised by moderately sorted 'sand' (Folk BGS modified), with mean median sediment particle size of 341 μm (medium sand), in mean water depth of 63.4 m BSL. Group C had 80 taxa and 261 individuals, of which the echinoderm *E. pusillus* was the first of the top ten characterising taxa along with the polychaetes *S. armiger*, *N. longosetosa*, *G. oculata* and *O. borealis*, the amphipod *B. elegans*, scaphopods of the genus *Antalis*, Nemertea and cnidarians of the family Edwardsiidae and the order Ceriantharia.

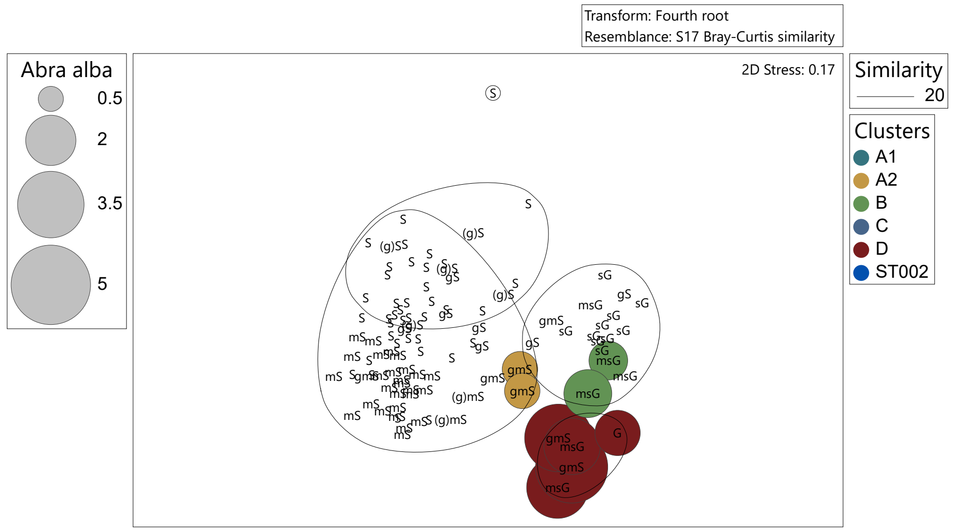
Group D comprised 5 stations and had an average similarity of 37.9 %. Group D was characterised by very poorly sorted 'muddy sandy gravel/gravelly muddy sand' (Folk BGS modified) with mean median sediment particle size of 6 818 µm (fine pebbles), in mean water depth of 15.8 m BSL. Group D had 107 taxa and 2 781 individuals, of which the bivalves *A. alba* and *N. nucleus* were amongst the top ten characterising taxa, along with the polychaetes *Spirobranchus lamarcki, L. conchilega, S. spinulosa*, *C. zetlandica*, *Notomastus, Pholoe inornata* and *L* cf. *cingulata*, and Nemertea.

Station ST002 separated at a similarity of 20 % and was characterised by well sorted 'slightly gravelly sand' (Folk BGS modified), with median sediment particle size of 408 µm (medium sand), in water depth of 11.8 m BSL. Station ST002 had 6 taxa and 28 individuals which included the polychaete *N. cirrosa* and *Ophelia borealis*, the shrimps *G. spinifer* and *Crangon crangon* and the bivalve *Ensis magnus*.

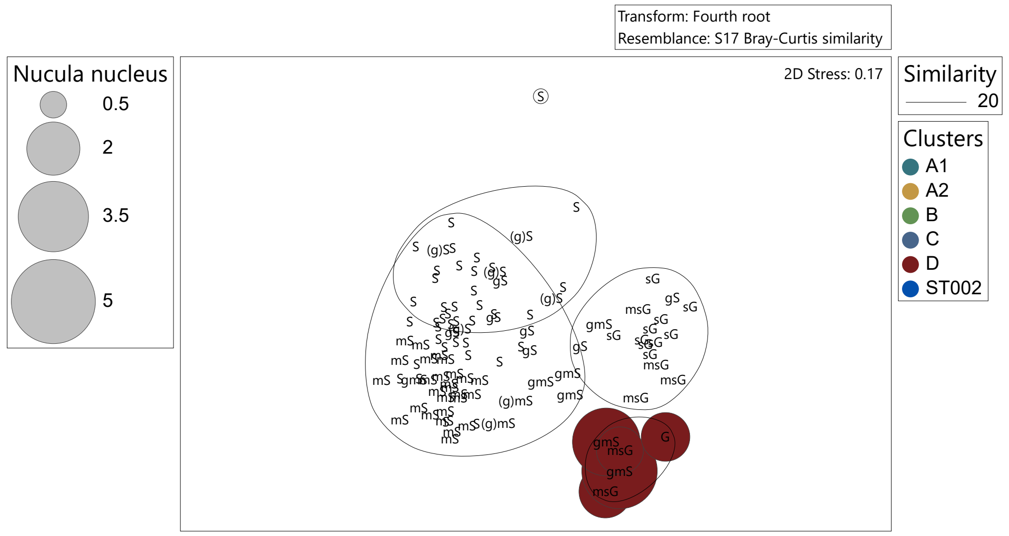
Table 8.3: Multivariate macrofaunal groups

Group	Station	Characterising Features	Characterising Taxa	Av. Abundance [N]	Frequency [%]
A1 + Average similarity: 35.81 %	ST203, ST205, ST207, ST209, ST211, ST213, ST215, ST217, ST219, ST221, ST223, ST225, ST227, ST229, ST231, ST233, ST235, ST237, ST239, ST241, ST245, ST249, ST251, ST253, ST257, ST259, ST261, ST263, ST265, ST267, ST269, ST271, ST273, ST275, ST277, ST279, ST281	Taxa: 185 Individuals: 2 923 Depth [m]: 74.8 ± 4.4 Gravel [%]: 0.70 ± 3.32 Sand [%]: 85.38 ± 4.86 Fines [%]: 13.92 ± 4.15 Median [µm]: 209 ± 82 Sorting [µm]: 3.02 ± 1.22	*Galathowenia oculata*	21	100
			Ampharete falcata	8	94.6
			Scoloplos armiger	3	83.8
			Phoronis	2	75.7
			Amphiura filiformis	2	73.0
			Spiophanes kroyeri	3	70.3
			Terebellides	2	62.2
			Harpinia antennaria	3	59.5
			Papillicardium minimum	2	59.5
			Sthenelais limicola	2	56.8
A2 ◆ Average similarity: 33.43 %	ST081, ST090, ST121, ST123, ST125, ST139, ST147, ST150, ST154, ST158, ST161, ST163, ST165, ST167, ST171, ST173, ST175, ST177, ST179, ST181, ST183, ST185, ST187, ST189, ST191, ST193, ST195, ST197, ST199, ST201, ST289, ST291, ST293, ST295, ST297, ST299	Taxa: 216 Individuals: 3 161 Depth [m]: 59.8 ± 10.5 Gravel [%]: 3.35 ±6.20 Sand [%]: 90.33 ± 7.95 Fines [%]: 6.32 ± 2.48 Median [µm]: 225 ± 45 Sorting [µm]: 2.48 ± 1.40	*Spiophanes bombyx*	17	97.2
			Scoloplos armiger	4	69.4
			Lanice conchilega	4	94.4
			Galathowenia oculata	7	77.8
			Bathyporeia elegans	3	22.2
			Phaxas pellucidus	2	66.7
			Goniada maculata	1	52.8
			Sthenelais limicola	2	58.3
			Abra prismatica	2	33.3
			Spiophanes kroyeri	3	47.2
B ■ Average similarity: 38.19 %	ST026, ST028, ST030, ST033, ST039, ST043, ST047, ST051, ST055, ST059, ST063, ST067, ST071, ST097, ST105, ST111, ST118	Taxa: 179 Individuals: 1 207 Depth [m]: 31.7 ± 6.4 Gravel [%]: 46.43 ± 15.17 Sand [%]: 49.32 ± 14.23 Fines [%]: 4.26 ± 3.43 Median [µm]: 3 458 ± 5 451 Sorting [µm]: 5.40 ±1.72	*Polycirrus*	8	17.0
			Syllis garciai	7	17.0
			Balanus crenatus	167	13.0
			Timoclea ovata	3	16.0
			Echinocyamus pusillus	3	15.0
			Spio armata	8	14.0
			Glycera lapidum	3	14.0
			Notomastus	10	13.0
			Nemertea	2	14.0
			Mediomastus fragilis	3	13.0

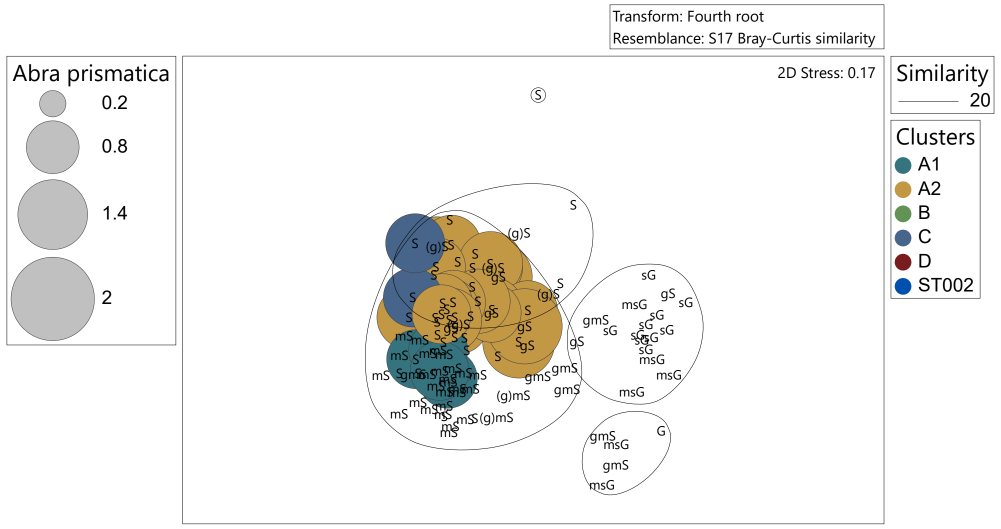
Group	Station	Characterising Features	Characterising Taxa	Abundance [N]	Frequency [%]
C ● Average similarity: 26.2 %	ST128, ST133, ST169, ST243, ST255, ST283, ST285, ST287	Taxa: 80 Individuals:261 Depth [m]: 63.4 ± 12.9 Gravel [%]: 0.35 ± 0.57 Sand [%]: 94.46 ± 2.80 Fines [%]: 5.20 ± 2.93 Median [µm]: 341 ± 123 Sorting [µm]: 1.90 ± 0.25	*Echinocyamus pusillus*	7	100
			Bathyporeia elegans	3	87.5
			Antalis	4	62.5
			Scoloplos armiger	3	62.5
			Nephtys longosetosa	1	62.5
			Nemertea	1	62.5
			Ophelia borealis	15	50.0
			Edwardsiidae	2	50.0
			CERIANTHARIA	1	50.0
			Galathowenia oculata	2	37.5
D ▼ Average similarity 37.9 %	ST004, ST006a, ST007, ST010, ST020	Taxa: 107 Individuals:2 781 Depth [m]: 15.8 ± 3.3 Gravel [%]: 45.07 ± 25.49 Sand [%]: 44.07 ± 20.87 Fines [%]: 10.85 ± 5.57 Median [µm]: 6 818 ± 12 732 Sorting [µm]: 8.92 ± 2.13	*Abra alba*	119	100
			Spirobranchus lamarcki	29	100
			Nucula nucleus	81	100
			Lanice conchilega	109	100
			Nemertea	4	100
			Sabellaria spinulosa	110	80.0
			Chaetozone zetlandica	3	100
			Notomastus	3	80.0
			Pholoe inornata	9	80.0
			Lumbrineris cf. cingulata	5	80.0
ST002 ▲	Single station	Taxa: 6 Individuals: 28 Depth [m]: 11.8 Gravel [%]: 0.45 Sand [%]: 99.01 Fines [%]: 0.54 Median [µm]: 408 Sorting [µm]: 0.50	*Nephtys cirrosa*	3	-
			Nephtys longosetosa	1	-
			Ophelia borealis	1	-
			Gastrosaccus spinifer	1	-
			Crangon crangon	1	-
			Ensis magnus	21	-



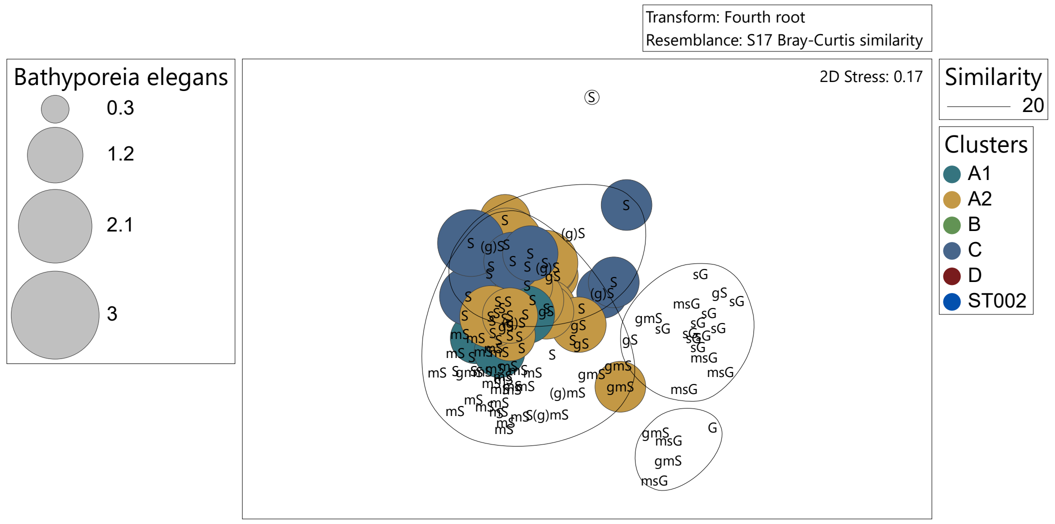
Notes
Circles proportional in diameter to the abundance of *Abra alba*



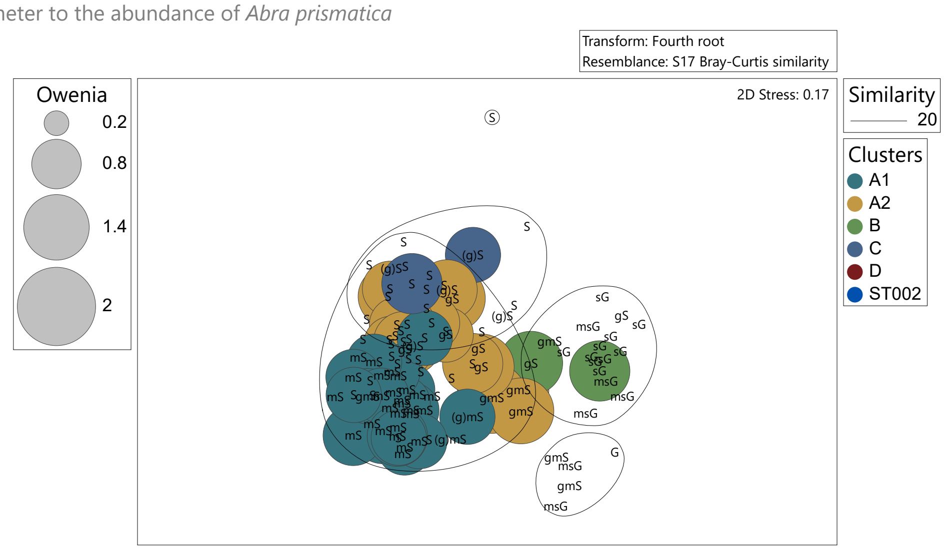
Notes
Circles proportional in diameter to the abundance of *Nucula nucleus*



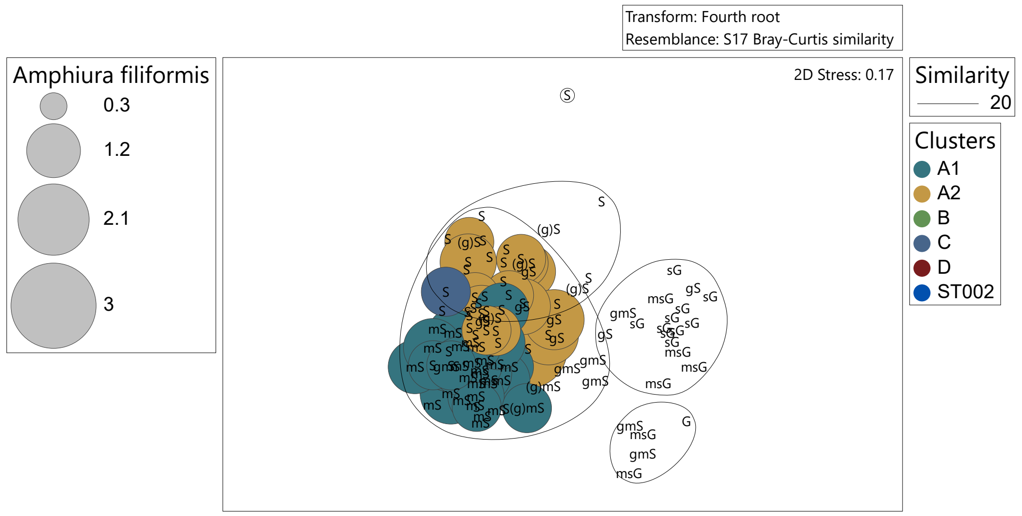
Notes
Circles proportional in diameter to the abundance of *Abra prismatica*



Notes
Circles proportional in diameter to the abundance of *Bathyporeia elegans*



Notes
Circles proportional in diameter to the abundance of *Owenia*



Notes
Circles proportional in diameter to the abundance of *Amphiura filiformis*

Figure 8.23: nMDS of hierarchical clustering analysis with superimposed multivariate groups and circles proportional in diameter to the transformed abundance of taxa responsible for the separations of the clusters

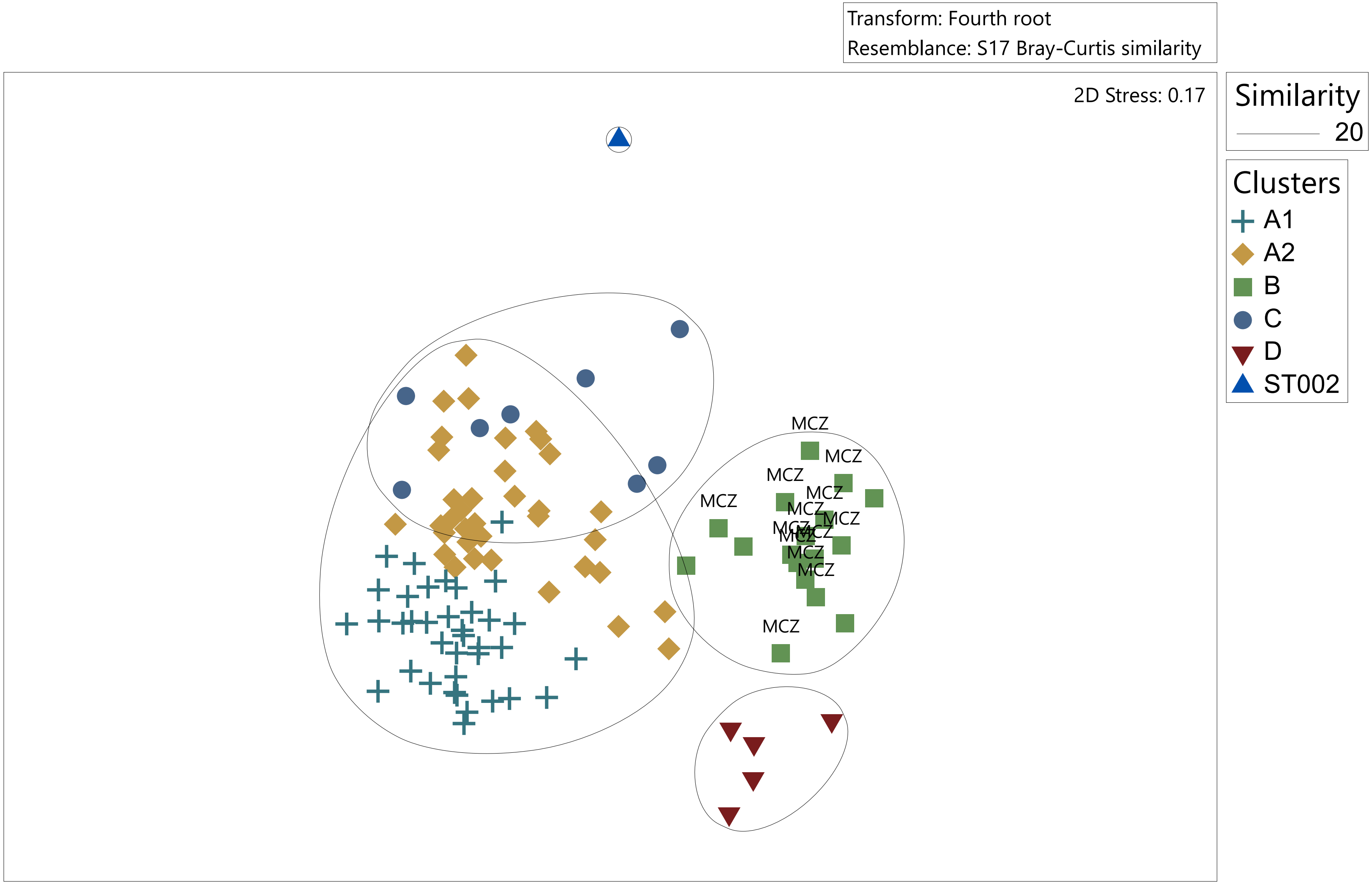


Figure 8.24: Non-metric multi-dimensional scaling ordination of macrofaunal station (0.1 m^2) abundance data. Holderness Offshore stations grouped in Cluster B

8.1.4 Relationships between Physico-chemical and Biological Parameters

The BIOENV analysis identified 'depth' as the single variable which best explained the multivariate pattern of macrofaunal distribution, with a value of rho of 0.748 at a significant level of 1 %. When three variables were considered, 'depth', 'percentage of mud' and the metal 'strontium' returned the highest value of rho of 0.815 at a significance level of 1 % for these three variables combined.

8.1.5 Biomass

Table 8.4 presents the percentage contribution of phyla to the total biomass (AFDW g/0.1 m^2) along the proposed cable route. Table 8.5 presents the biomass of major taxonomic groups at each station. Figure 8.25 illustrate the phyletic composition of the biomass at each station and Figure 8.26 shows the distribution of the biomass of the four major phyla according to the sediment type and water depth. Figures 8.27 to 8.35 show the distribution of the biomass along the proposed cable route.

Mollusca comprised most of the macrofaunal biomass (48 %), followed by Echinodermata (33.3 %), Annelida (11.3 %) and Arthropoda (4.6 %), whereas other phyla comprised 2.7 %.

Table 8.4: Taxonomic groups of macrofaunal biomass

Phylum	Biomass [AFDW g/0.1 m^2]	Biomass [%]
Annelida	7.2648	11.3
Arthropoda	2.9354	4.6
Mollusca	30.9335	48.1
Echinodermata	21.4164	33.3
Other phyla	1.7638	2.7
Total	**64.3139**	**100**

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

The total biomass ranged from 0.0122 AFDW g/0.1m^2 at station ST063 to 9.3399 AFDW g/0.1m^2 at station ST257, with a mean of 0.6184 AFDW g/0.1 m^2 and a median of 0.1326 AFDW g/0.1m^2. The high value of biomass at station ST257 was associated with Mollusca and analysis of the species list indicated the presence of the bivalves *Abra alba* (292 individuals) and *Nucula nucleus* (265), as well as 35 juveniles of the genus *Nucula*. Annelida biomass was highest at station ST006a, with a value of 0.6450 AFDW g/0.1 m^2. At this station, the biomass was associated with the presence of the tubicolous polychaete *L. conchilega* (352 individuals) as well as *Sabellaria spinulosa* (55), *Lagis koreni* (44) and *Spirobranchus lamarki* (33). Echinodermata biomass was highest at station ST299, with a value of 2.5550 AFDW g/0.1 m^2. At this stations it was associated with the presence of *Echinocardium flavescens* (2 individuals). Annelida biomass was higher in correspondence of coarser grounds and shallower depths, whilst Mollusca and Echinodermata biomass was higher in correspondence of finer and deeper grounds. Arthropoda biomass was higher in finer sediments, but it was also noticeable on coarser grounds (Figure 8.26).

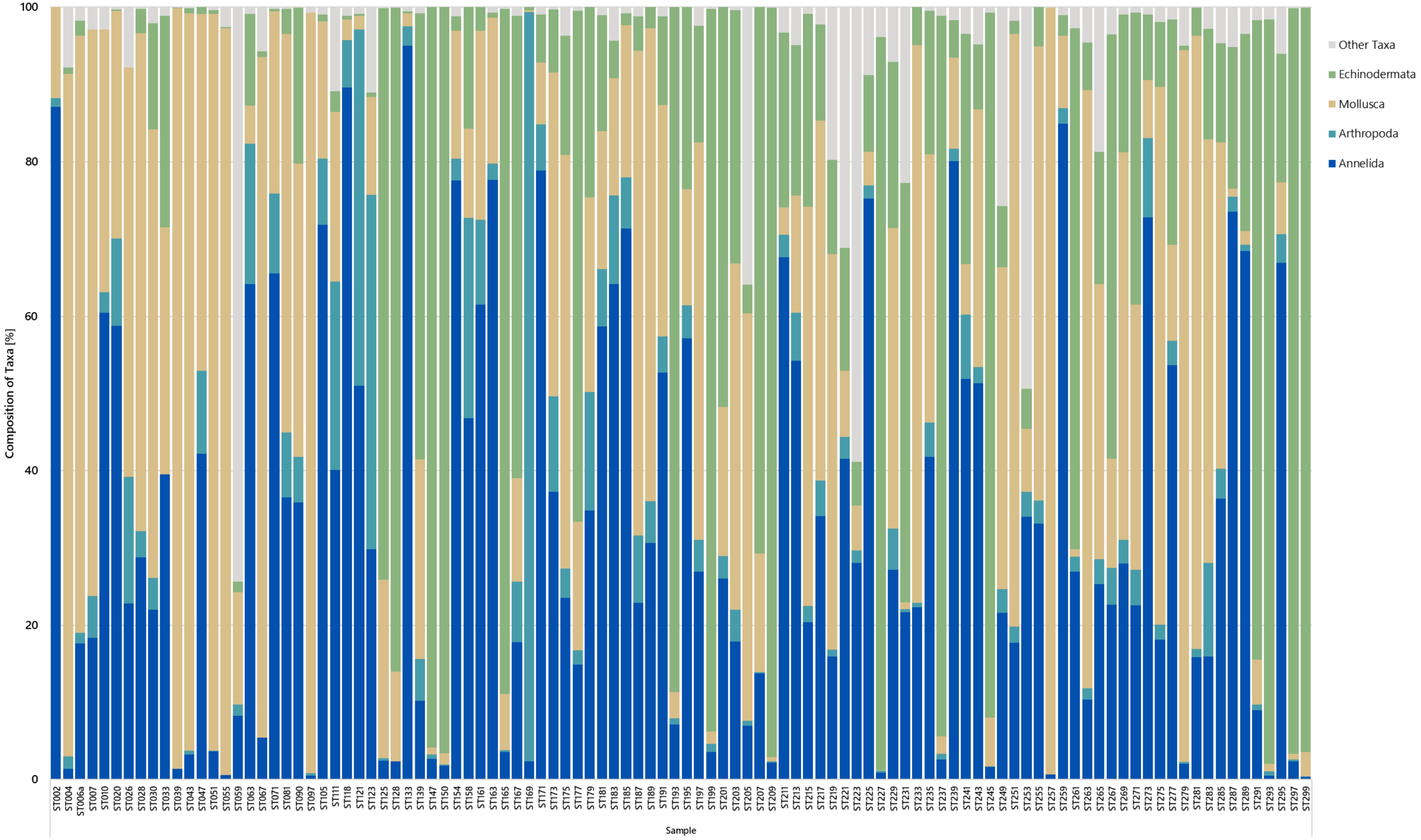
Table 8.5: Phyletic composition of macrofaunal biomass (0.1 m^2)

Station	Biomass					Total
	Annelida	Arthropoda	Mollusca	Echinodermata	Other Phyla	
ST002	0.4023	0.0054	0.0542	-	-	**0.4619**
ST004	0.0137	0.0159	0.8788	0.0079	0.0774	**0.9937**
ST006a	0.6450	0.0494	2.8218	0.0716	0.0642	**3.6521**
ST007	0.4465	0.1304	1.7828	0.0003	0.0696	**2.4296**
ST010	0.1930	0.0086	0.1083	0.0001	0.0092	**0.3193**
ST020	0.4620	0.0887	0.2319	0.0013	0.0024	**0.7864**
ST026	0.0087	0.0063	0.0203	-	0.0030	**0.0382**
ST028	0.3066	0.0360	0.6869	0.0335	0.0021	**1.0651**
ST030	0.0289	0.0054	0.0763	0.0181	0.0027	**0.1314**
ST033	0.0189	-	0.0153	0.0132	0.0005	**0.0479**
ST039	0.0222	-	1.5520	0.0020	0.0004	**1.5766**
ST043	0.0441	0.0064	1.2778	0.0086	0.0023	**1.3392**
ST047	0.1705	0.0433	0.1866	0.0035	0.0000	**0.4039**
ST051	0.0316	0.0007	0.8163	0.0045	0.0031	**0.8563**
ST055	0.0147	0.0002	2.5369	0.0041	0.0674	**2.6232**
ST059	0.0471	0.0082	0.0833	0.0079	0.4244	**0.5710**
ST063	0.0078	0.0022	0.0006	0.0014	0.0001	**0.0122**
ST067	0.0462	0.0004	0.7502	0.0061	0.0486	**0.8515**
ST071	0.0315	0.0050	0.0113	0.0002	0.0001	**0.0480**
ST081	0.0498	0.0115	0.0704	0.0044	0.0003	**0.1363**
ST090	0.0465	0.0076	0.0491	0.0261	0.0001	**0.1294**
ST097	0.0146	0.0083	2.5952	-	0.0188	**2.6369**
ST105	0.6263	0.0752	0.1550	0.0072	0.0084	**0.8720**
ST111	0.0365	0.0222	0.0201	0.0024	0.0099	**0.0912**
ST118	0.2110	0.0143	0.0064	0.0010	0.0027	**0.2355**
ST121	0.1994	0.1804	0.0069	0.0009	0.0034	**0.3910**
ST123	0.3555	0.5467	0.1508	0.0068	0.1317	**1.1914**
ST125	0.0520	0.0058	0.4833	1.5474	0.0033	**2.0918**
ST128	0.0649	0.0013	0.3218	2.3817	0.0021	**2.7717**
ST133	0.0813	0.0021	0.0015	0.0002	0.0004	**0.0855**
ST139	0.0170	0.0090	0.0429	0.0959	0.0013	**0.1661**
ST147	0.0409	0.0090	0.0129	1.4486	0.0000	**1.5114**
ST150	0.0353	0.0021	0.0285	1.8443	-	**1.9102**
ST154	0.0602	0.0022	0.0128	0.0014	0.0009	**0.0776**
ST158	0.0180	0.0100	0.0044	0.0060	-	**0.0384**
ST161	0.0426	0.0076	0.0170	0.0021	-	**0.0694**
ST163	0.0908	0.0025	0.0221	0.0008	0.0008	**0.1169**
ST165	0.0170	0.0014	0.0345	0.4218	0.0010	**0.4757**
ST167	0.0264	0.0116	0.0198	0.0885	0.0016	**0.1479**
ST169	0.0335	1.3870	0.0035	0.0053	0.0001	**1.4294**

Station	Biomass					
	Annelida	Arthropoda	Mollusca	Echinodermata	Other Phyla	Total
ST171	0.0596	0.0045	0.0061	0.0047	0.0007	**0.0756**
ST173	0.0394	0.0131	0.0443	0.0086	0.0003	**0.1058**
ST175	0.0376	0.0061	0.0855	0.0246	0.0059	**0.1598**
ST177	0.0204	0.0025	0.0228	0.0903	0.0007	**0.1366**
ST179	0.0141	0.0062	0.0102	0.0100	-	**0.0405**
ST181	0.0227	0.0029	0.0069	0.0058	0.0004	**0.0388**
ST183	0.0207	0.0037	0.0049	0.0016	0.0014	**0.0322**
ST185	0.0745	0.0069	0.0207	0.0015	0.0009	**0.1045**
ST187	0.0187	0.0072	0.0513	0.0036	0.0010	**0.0818**
ST189	0.0140	0.0025	0.0279	0.0012	-	**0.0456**
ST191	0.0239	0.0021	0.0136	0.0052	0.0005	**0.0453**
ST193	0.0095	0.0011	0.0044	0.1170	-	**0.1320**
ST195	0.0219	0.0017	0.0058	0.0090	-	**0.0384**
ST197	0.0152	0.0023	0.0291	0.0085	0.0014	**0.0564**
ST199	0.0173	0.0050	0.0076	0.4489	0.0009	**0.4797**
ST201	0.0153	0.0017	0.0114	0.0304	-	**0.0588**
ST203	0.0151	0.0035	0.0380	0.0278	0.0003	**0.0846**
ST205	0.0200	0.0019	0.1520	0.0109	0.1034	**0.2882**
ST207	0.1197	0.0009	0.1332	0.6143	-	**0.8680**
ST209	0.0381	0.0031	0.0095	1.6929	0.0011	**1.7448**
ST211	0.0774	0.0033	0.0040	0.0259	0.0037	**0.1144**
ST213	0.0507	0.0058	0.0141	0.0182	0.0046	**0.0935**
ST215	0.0257	0.0026	0.0650	0.0314	0.0010	**0.1257**
ST217	0.0426	0.0058	0.0581	0.0155	0.0028	**0.1247**
ST219	0.0259	0.0014	0.0834	0.0198	0.0322	**0.1626**
ST221	0.0861	0.0060	0.0178	0.0329	0.0646	**0.2074**
ST223	0.0736	0.0043	0.0152	0.0149	0.1545	**0.2625**
ST225	0.0481	0.0011	0.0028	0.0064	0.0056	**0.0640**
ST227	0.0208	0.0065	0.0009	2.1609	0.0874	**2.2766**
ST229	0.0278	0.0054	0.0399	0.0220	0.0072	**0.1025**
ST231	0.1017	0.0020	0.0043	0.2544	0.1068	**0.4692**
ST233	0.0429	0.0011	0.1387	0.0095	-	**0.1922**
ST235	0.0157	0.0017	0.0131	0.0070	0.0002	**0.0377**
ST237	0.0189	0.0055	0.0163	0.6731	0.0079	**0.7218**
ST239	0.0608	0.0012	0.0090	0.0037	0.0012	**0.0760**
ST241	0.0151	0.0024	0.0019	0.0086	0.0010	**0.0290**
ST243	0.0351	0.0014	0.0228	0.0057	0.0033	**0.0684**
ST245	0.0246	0.0006	0.0948	1.3636	0.0099	**1.4935**
ST249	0.0060	0.0009	0.0116	0.0022	0.0071	**0.0277**
ST251	0.0341	0.0040	0.1476	0.0033	0.0033	**0.1923**

Station	Biomass					
	Annelida	Arthropoda	Mollusca	Echinodermata	Other Phyla	Total
ST253	0.0264	0.0025	0.0063	0.0041	0.0383	**0.0776**
ST255	0.0189	0.0017	0.0335	0.0029	-	**0.0570**
ST257	0.0654	0.0017	9.2690	0.0020	0.0018	**9.3399**
ST259	0.0967	0.0023	0.0107	0.0031	0.0011	**0.1139**
ST261	0.0369	0.0026	0.0013	0.0924	0.0038	**0.1370**
ST263	0.0089	0.0013	0.0667	0.0053	0.0040	**0.0862**
ST265	0.0111	0.0014	0.0156	0.0075	0.0082	**0.0438**
ST267	0.0133	0.0028	0.0083	0.0322	0.0020	**0.0586**
ST269	0.0302	0.0032	0.0540	0.0192	0.0011	**0.1077**
ST271	0.0264	0.0054	0.0402	0.0444	0.0008	**0.1172**
ST273	0.0399	0.0056	0.0041	0.0047	0.0005	**0.0548**
ST275	0.0242	0.0025	0.0928	0.0113	0.0025	**0.1333**
ST277	0.0649	0.0038	0.0150	0.0353	0.0019	**0.1209**
ST279	0.0345	0.0038	1.5237	0.0102	0.0817	**1.6539**
ST281	0.0523	0.0035	0.2616	0.0119	0.0002	**0.3295**
ST283	0.0025	0.0019	0.0085	0.0022	0.0004	**0.0154**
ST285	0.0048	0.0005	0.0056	0.0017	0.0006	**0.0133**
ST287	0.0366	0.0010	0.0005	0.0091	0.0026	**0.0498**
ST289	0.0424	0.0005	0.0011	0.0158	0.0021	**0.0619**
ST291	0.0144	0.0011	0.0092	0.1324	0.0026	**0.1598**
ST293	0.0040	0.0043	0.0083	0.7617	0.0128	**0.7911**
ST295	0.0449	0.0025	0.0045	0.0111	0.0041	**0.0671**
ST297	0.0433	0.0044	0.0136	1.7680	0.0020	**1.8313**
ST299	0.0096	0.0028	0.0820	2.5550	0.0011	**2.6505**
Minimum	**0.0025**	**0.0002**	**0.0005**	**0.0001**	**0.0000**	0.0122
Maximum	**0.6450**	**1.3870**	**9.2690**	**2.5550**	**0.4244**	9.3399
Mean	**0.0699**	**0.0288**	**0.2974**	**0.2120**	**0.0192**	0.6184
Median	**0.0343**	**0.0035**	**0.0214**	**0.0090**	**0.0022**	0.1326
SD	**0.1171**	**0.1479**	**1.0362**	**0.5479**	**0.0528**	1.1629

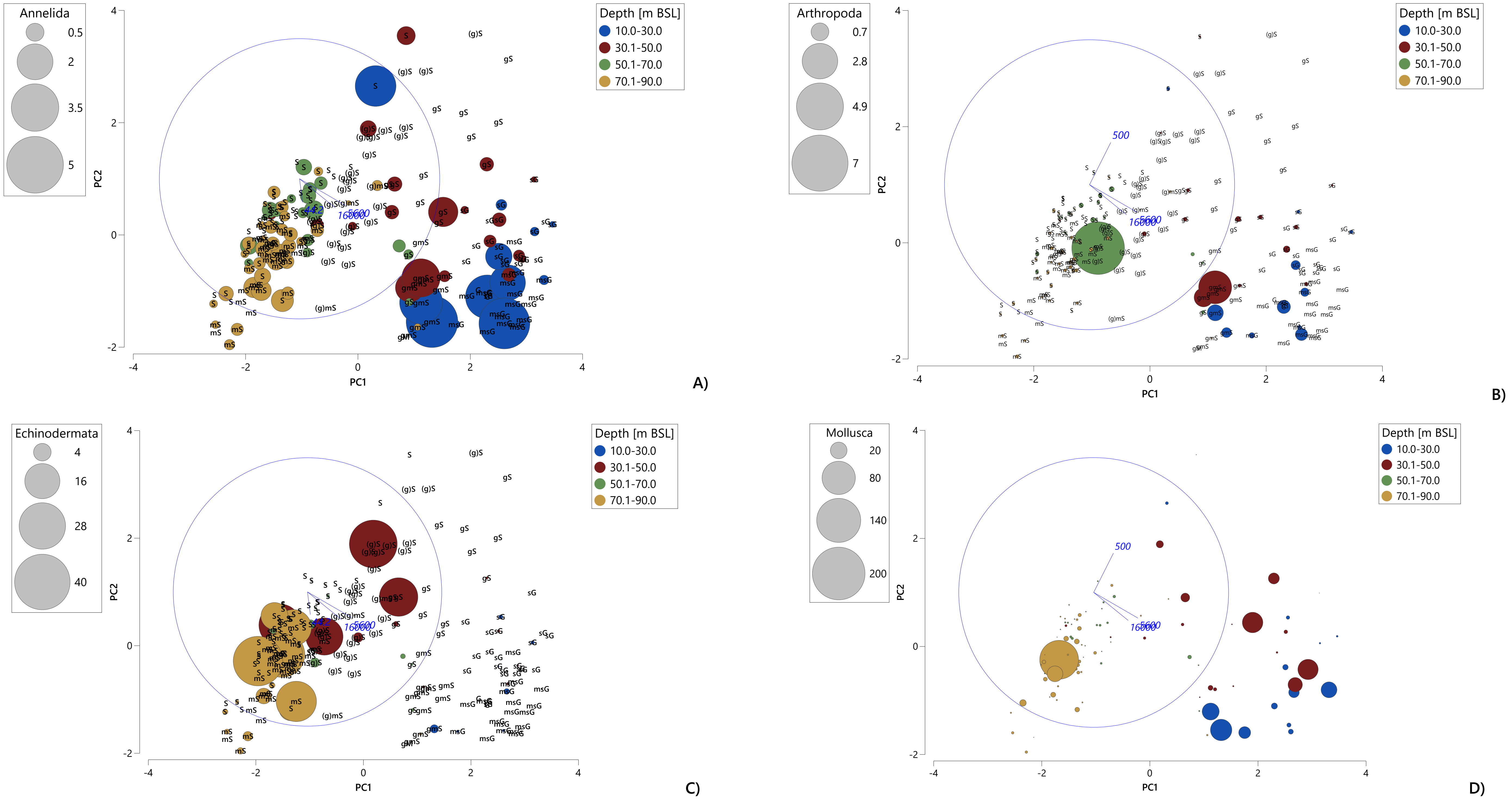
Notes
Biomass expressed as ash free dry weight [AFDW] g/0.1 m^2 grab sample
Other phyla included: Chordata, Cnidaria
SD = Standard deviation



Notes

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

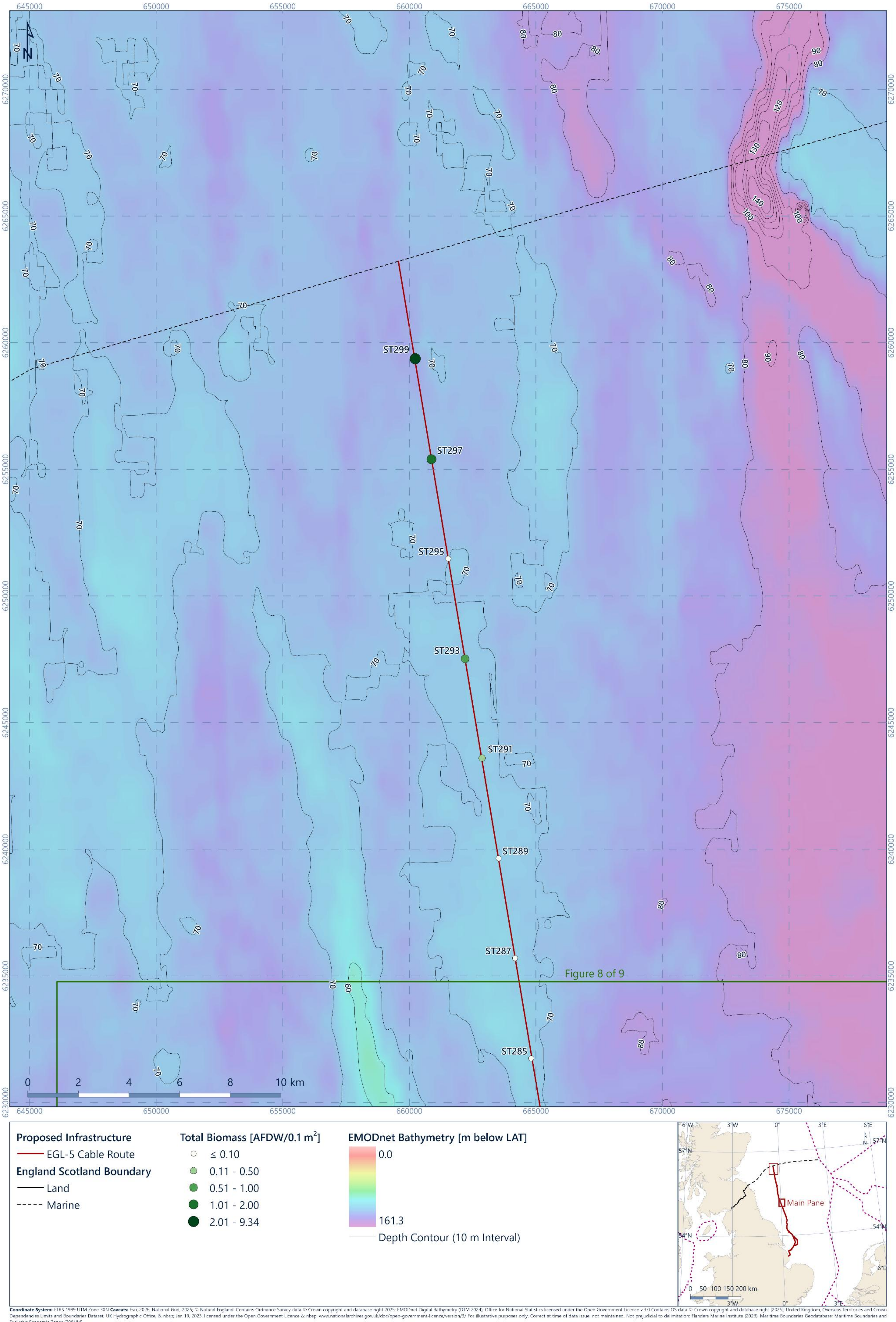
Figure 8.25: Phyletic composition of macrofaunal biomass



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

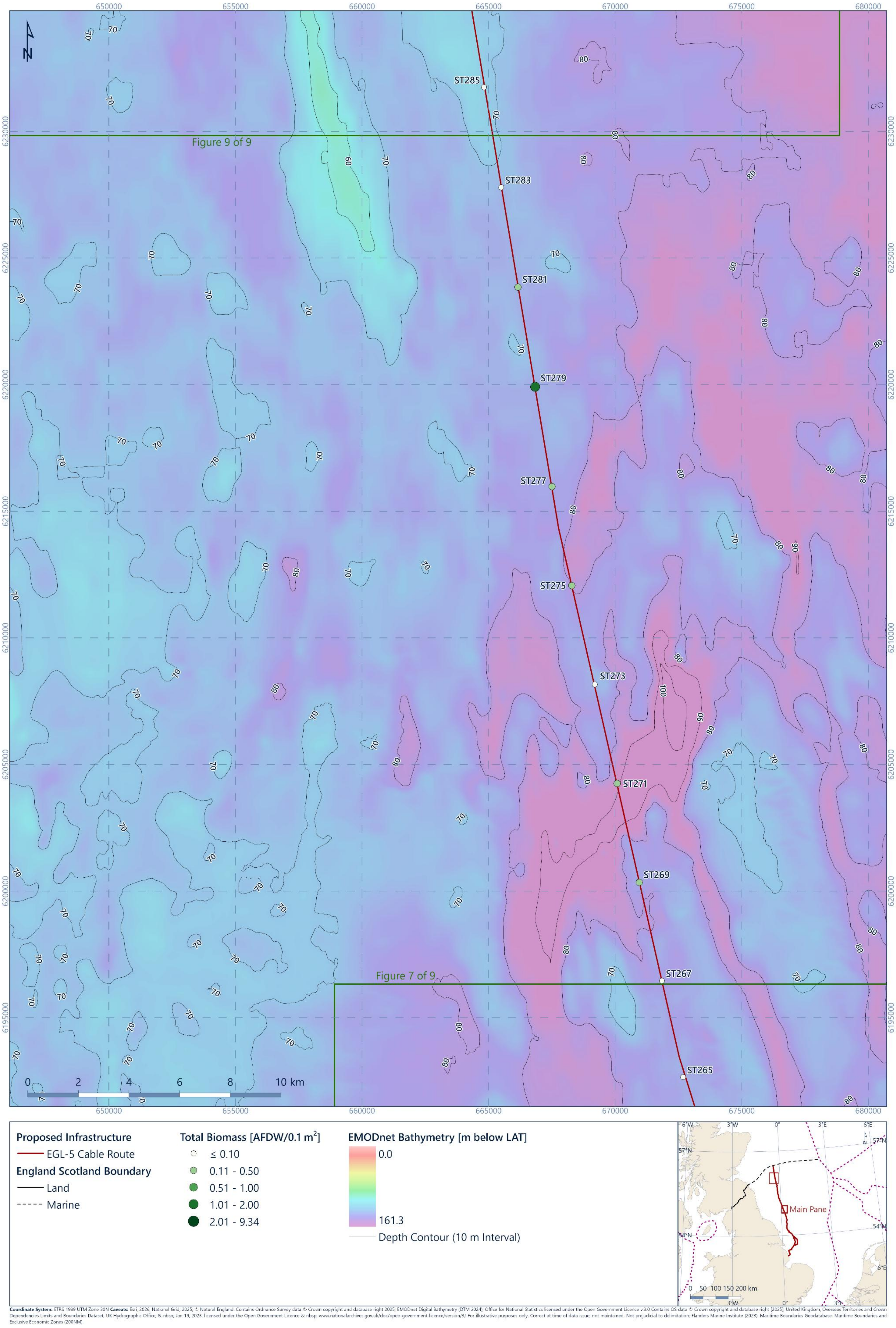
Figure 8.26: Distribution of Annelida (A), Arthropoda (B), Echinodermata (C) and Mollusca (D) biomass in relations to the sediment composition and depth



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

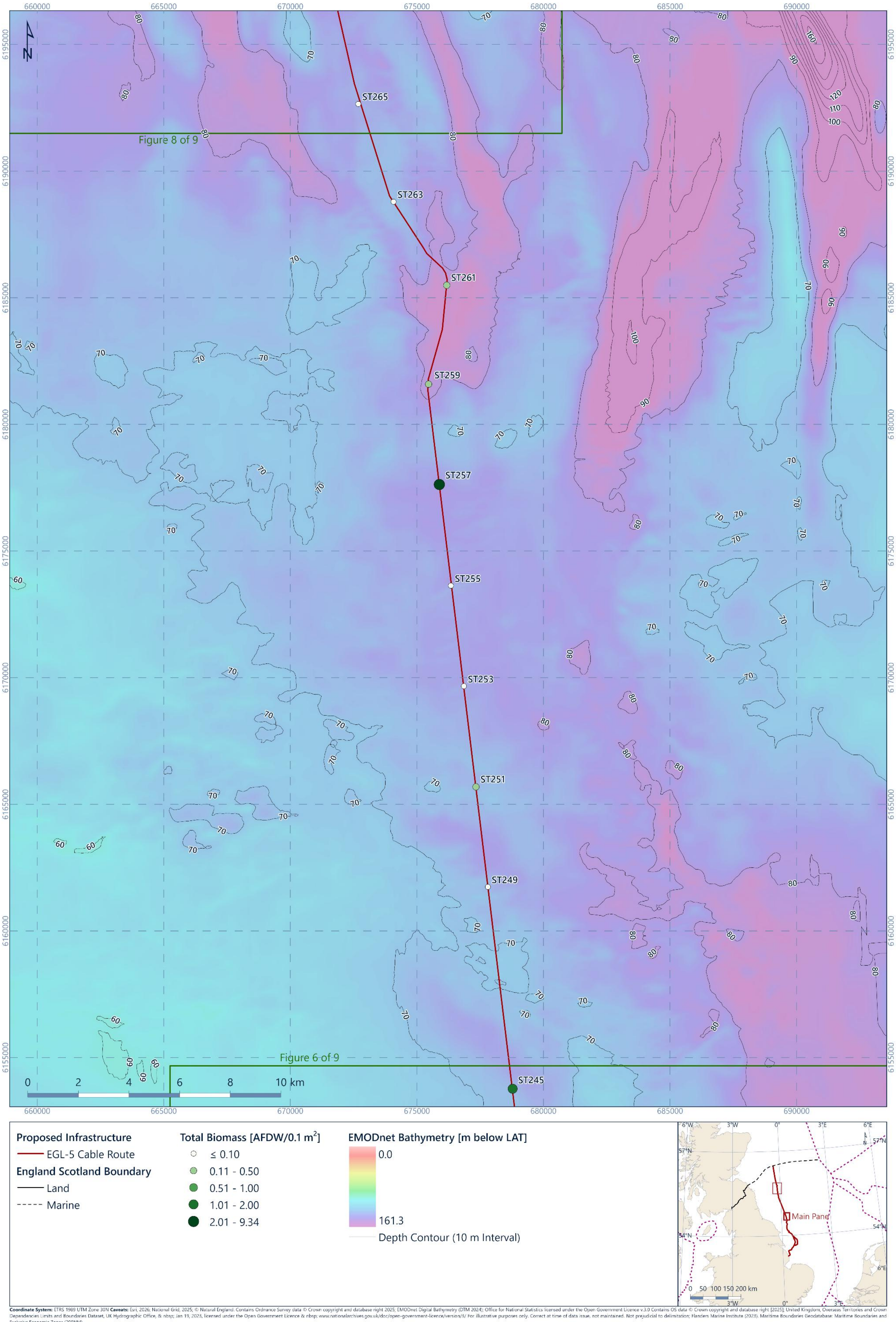
Figure 8.27: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST285 to station ST299



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

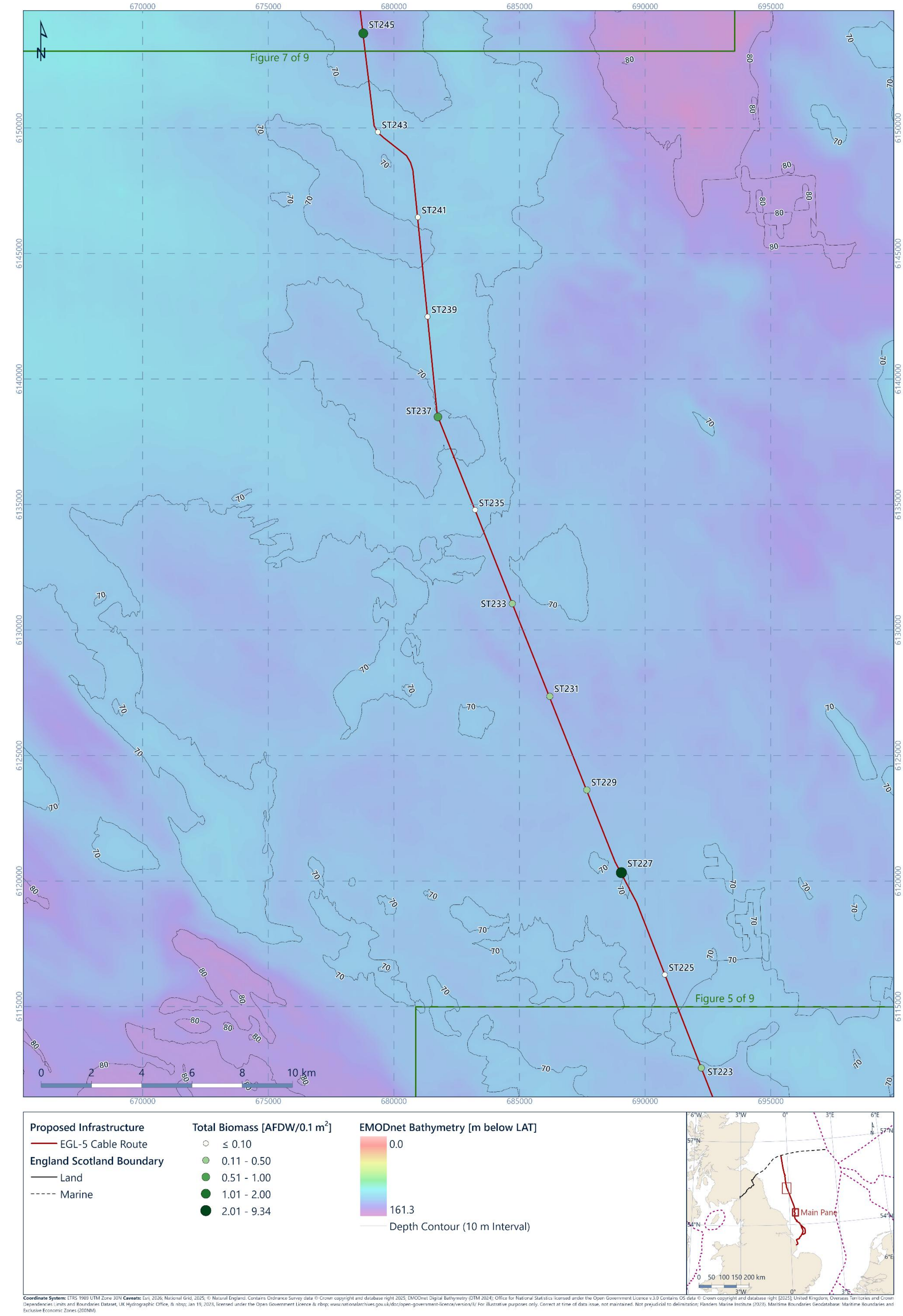
Figure 8.28: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST265 to station ST285



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

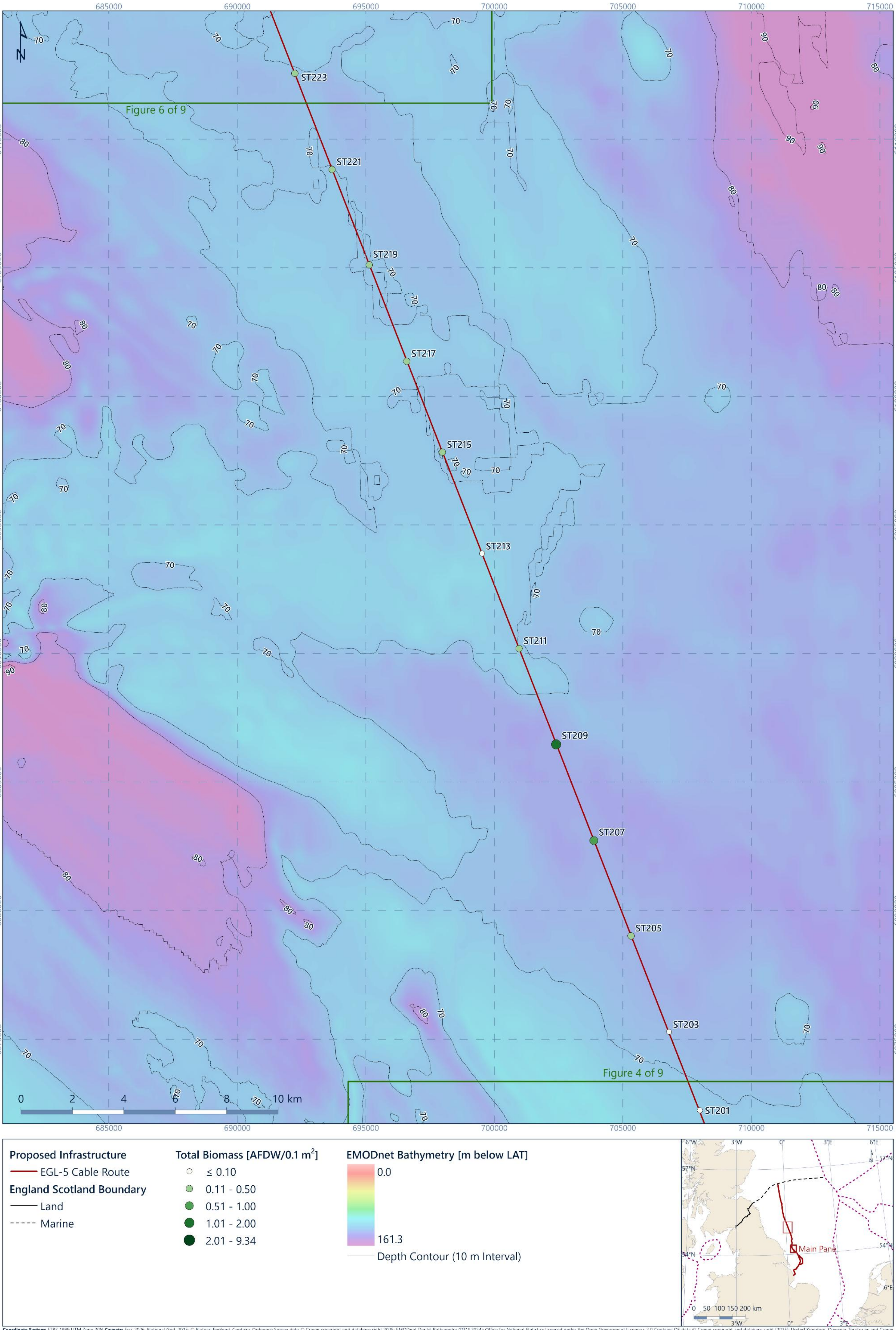
Figure 8.29: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST245 to station ST265



Notes

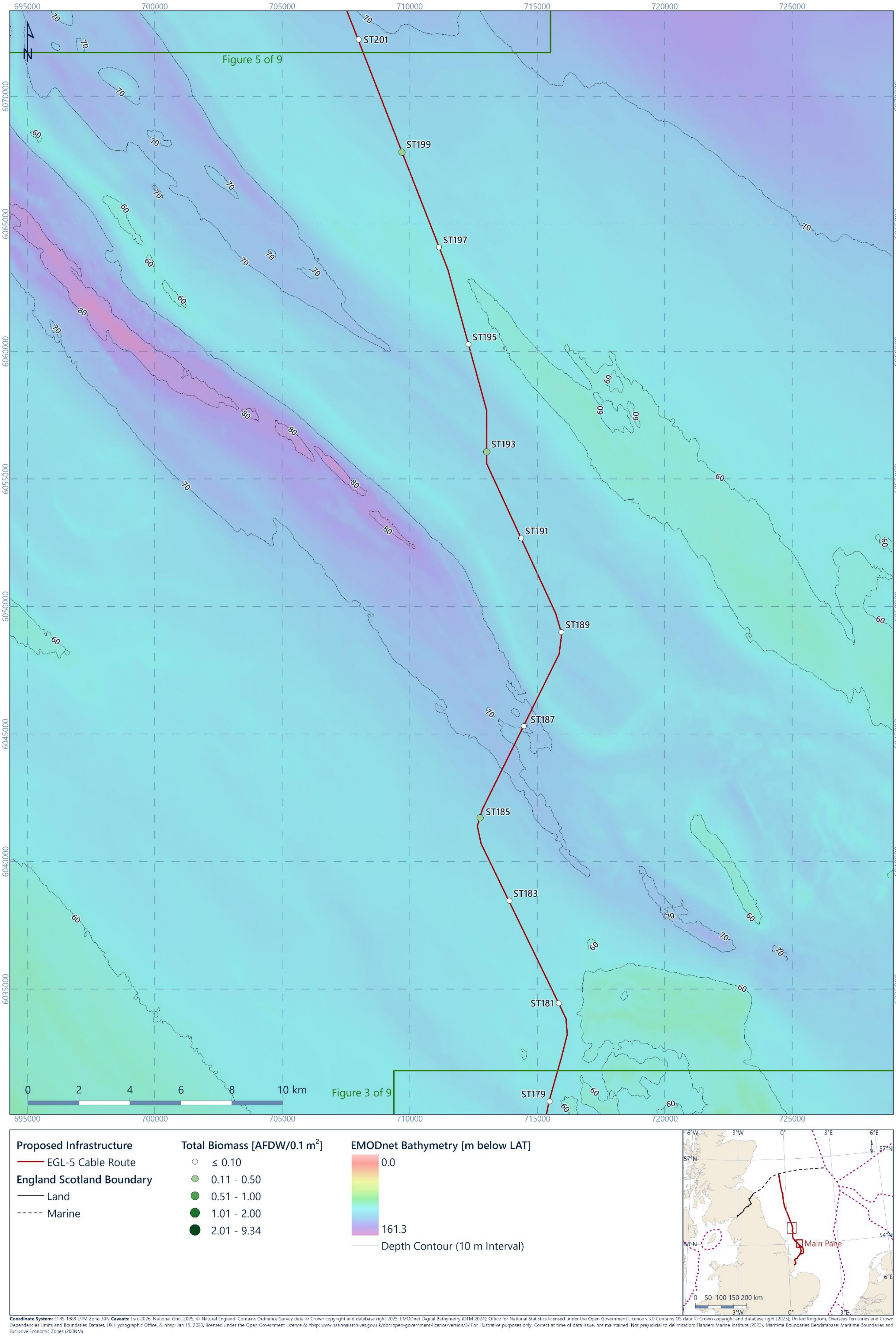
Biomass expressed as ash free dry weight in g/0.1 m^2 grab sample

Figure 8.30: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST223 to station ST245



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

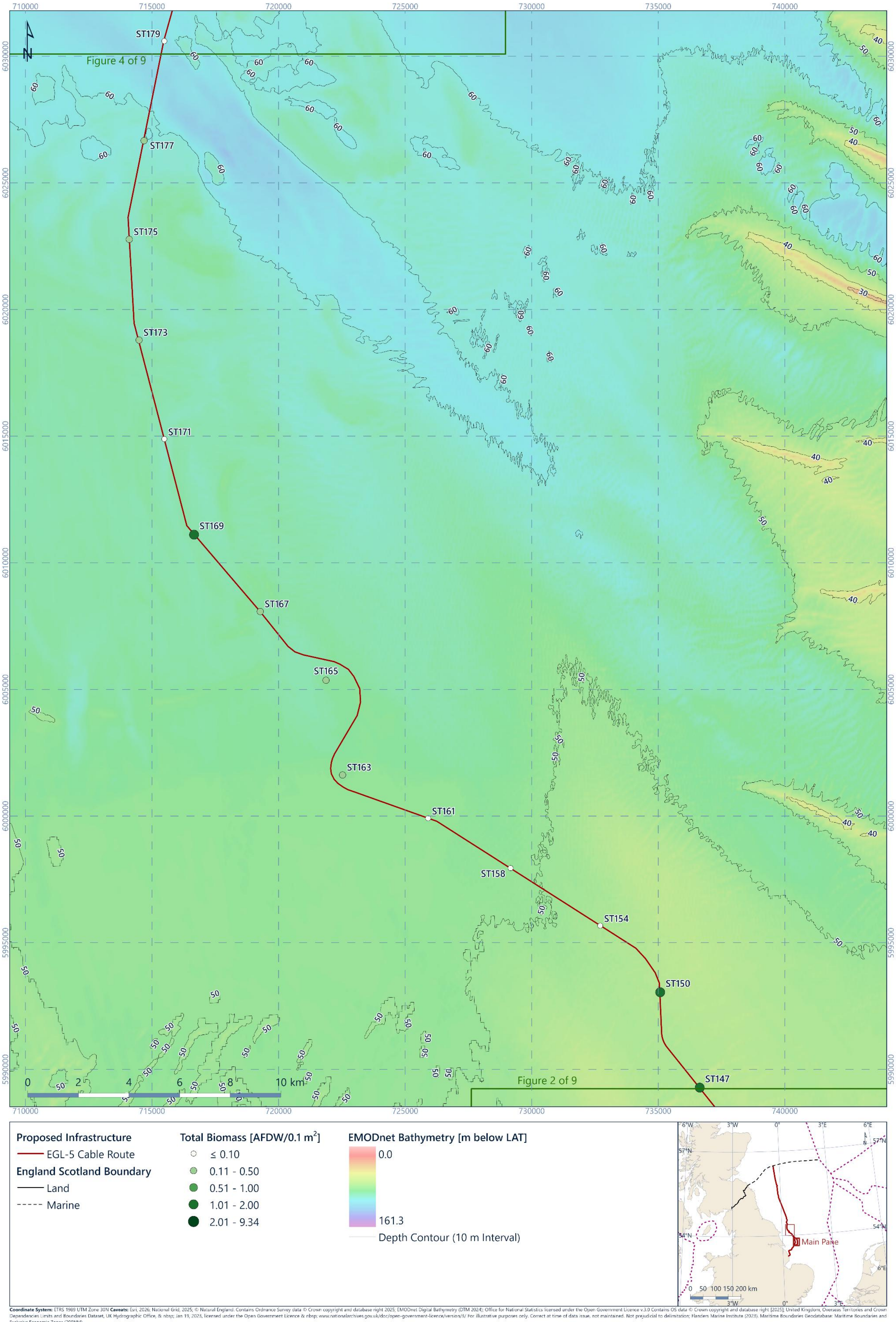
Figure 8.31: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST201 to station ST223



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

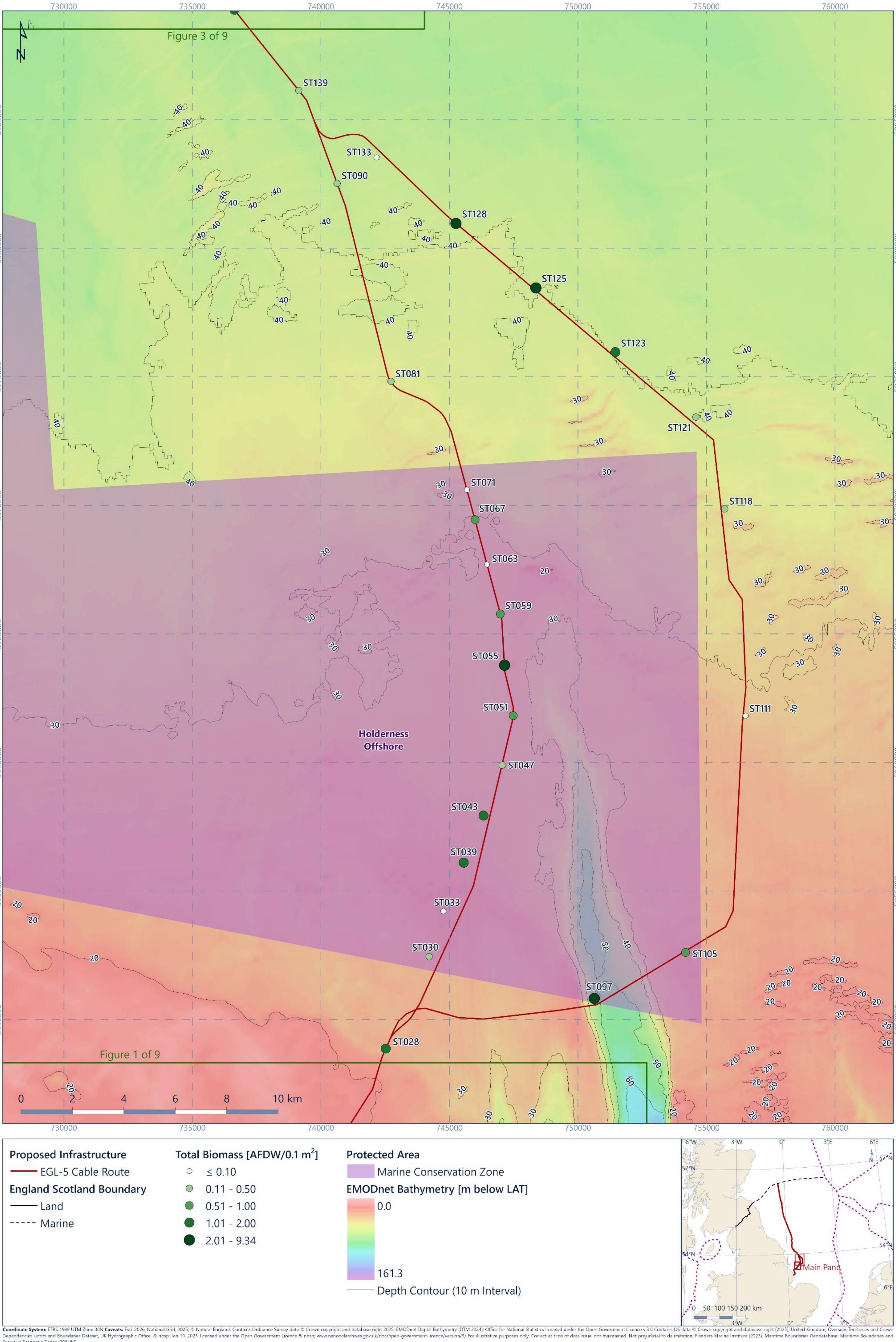
Figure 8.32: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST179 to station ST201



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

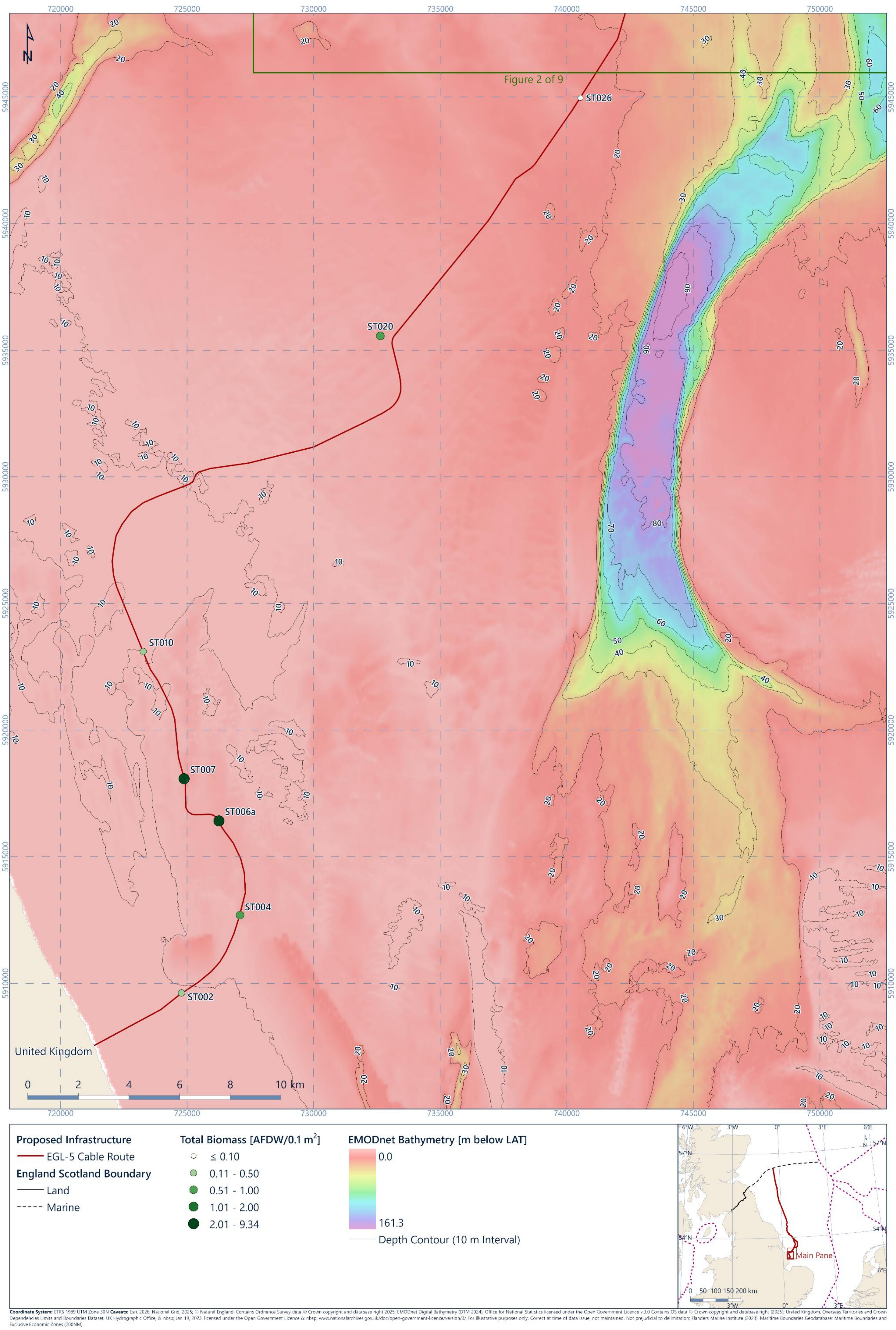
Figure 8.33: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST147 to station ST179



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

Figure 8.34: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST028 to station ST139 (inclusive of all in Holderness Offshore marine conservation zone)



Notes

Biomass expressed as ash free dry weight in g/0.1 m² grab sample

Figure 8.35: Spatial distribution of macrofaunal biomass along the proposed cable route, station ST002 to station ST026

8.2 Epifaunal Results

Colonial epifauna was recorded in 84 of the 104 grab samples.

Table 8.6 presents the community structure of sessile colonial epifauna, Table 8.7 presents the top ten most frequently occurring colonial epifaunal taxa and Figure 8.36 illustrates the colonial epifaunal community in relation to water depth and sediment composition, whilst Figure 8.37 illustrates the phyletic composition of colonial epifauna along the proposed cable route.

Table 8.6: Taxonomic groups of colonial epifauna from the grab samples

Taxonomic Group	Number of Taxa	Composition of Taxa [%]
Porifera	3	3.6
Cnidaria	26	31.0
Bryozoa	50	59.5
Chordata	2	2.4
Other Phyla	3	3.6
Total	**84**	**100**

Notes
Macrofaunal samples were processed through a 1 mm mesh sieve
Other phyla include: Ciliophora, Entoprocta
* = Percentages expressed to 1 decimal place and, due to numerical rounding, values presented may not equate to 100 %

Five main phyla of colonial epifauna were recorded across the survey area; of these, Bryozoa comprised most of the taxa composition (59.5 %), followed by Cnidaria (31.0 %), Porifera (3.6 %) and Chordata (2.4 %). Other phyla comprised 3.6 % of the colonial epifauna and were represented by Ciliophora, including family Folliculinidae, and Entoprocta, including species of the genera *Barentsia* and *Pedicellina*.

The family Fulliculinidae was also the most frequently occurring, along with the bryozoans *Flustra foliacea* and *Escharella immersa* and cnidarians of the order Anthoathecata as well as *Lovenella clausa*.

Table 8.7: Top ten most frequently occurring colonial epifaunal taxa from the grab samples

	Taxon	Frequency [%]
	Folliculinidae	50.0
	ANTHOATHECATA	32.7
	Flustra foliacea	22.1
	Escharella immersa	22.1
	Lovenella clausa	19.2
	Cribrilinidae	18.3
	Sertulariidae	17.3
	Cliona	16.3
	Alcyonidium cf. *diaphanum*	15.4
	Electra pilosa	15.4

Key to Phyla

Porifera	Cnidaria	Bryozoa	Other Phyla

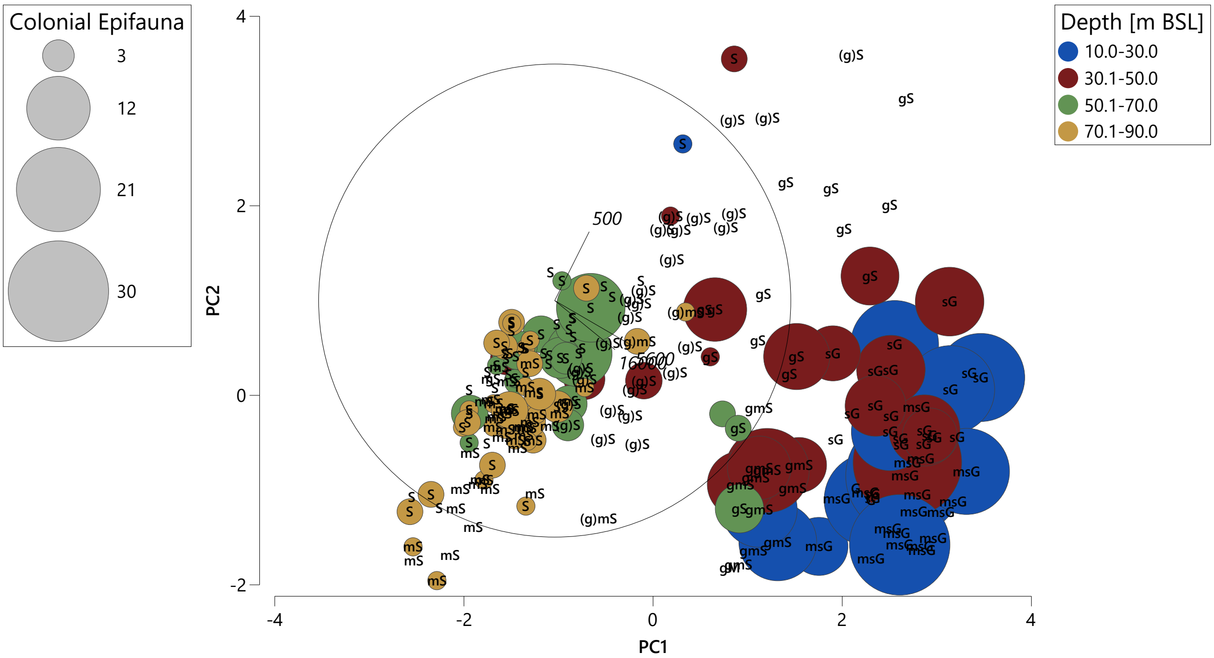


Figure 8.36: Colonial epifauna in relation to depth and sediment type

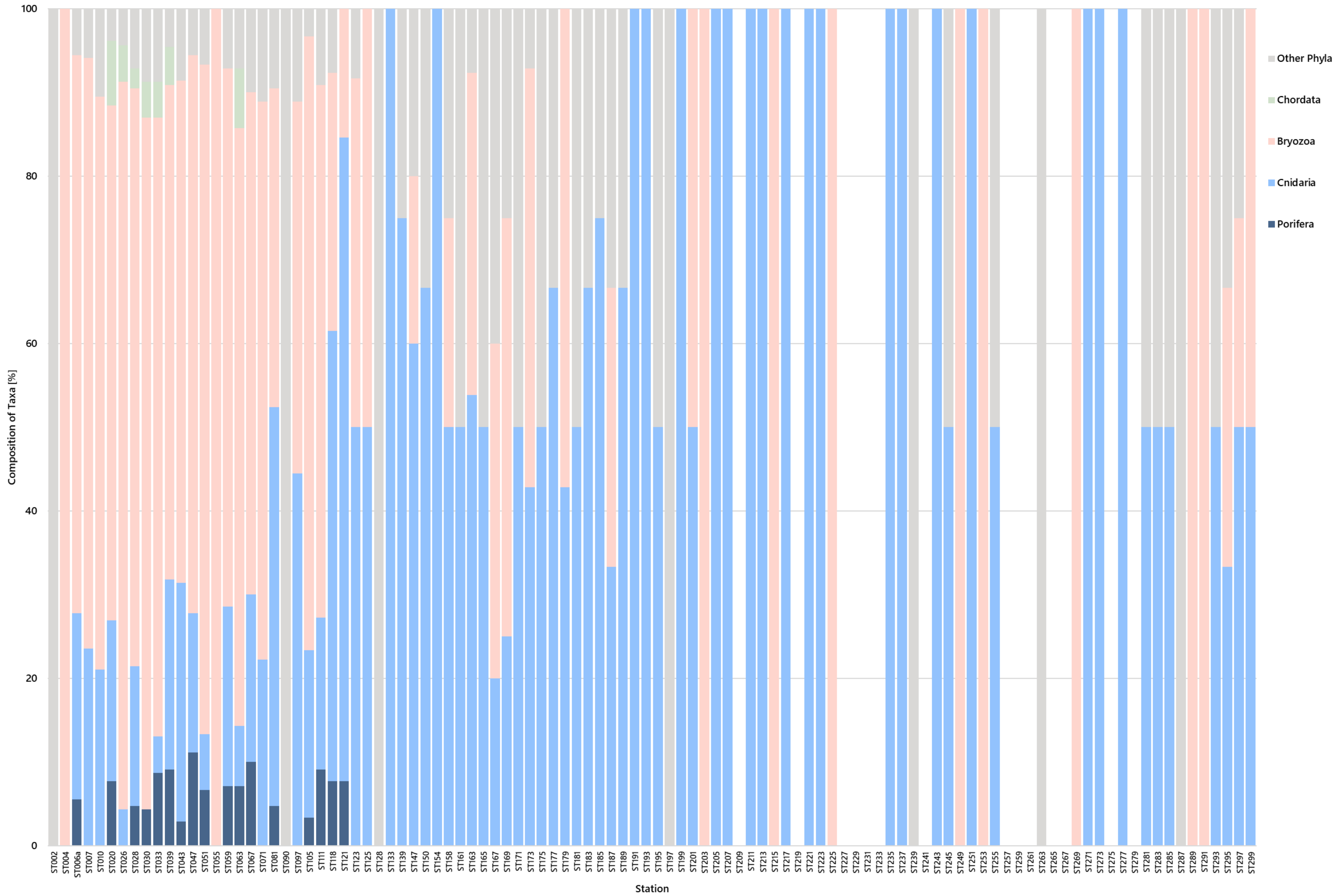


Figure 8.37: Phyletic composition of epifaunal taxa

9. Sediment Environmental DNA (eDNA)

The sediment samples collected at 23 stations were analysed for eDNA taxonomic classification of eukaryote, bacteria and invertebrate taxa.

NatureMetrics carried out laboratory extraction and sequencing. DNA was extracted from the 10 cm^3 sediment cores using a DNeasy Blood and Tissue Kit (Qiagen).

The original eDNA data analyses were carried out by NatureMetrics, with additional eDNA visualisation and interpretation carried out by Fugro GB Limited.

Samples and data analysis methodologies are presented in Sections 3.2.4 and 3.3.6. The proportions of taxa OTUs, their frequency of occurrence, and their proportional relative concentrations are included. These are presented in the form of bar plots and bubble plots. In bubble plots, the bubble size corresponds to the proportion of DNA within a sample, with larger bubbles indicating higher eDNA OTUs concentrations.

The species richness and the evolutionary diversity (ED), calculated and provided by Naturemetrics, are presented in horizontal bar plots where the blue portion of each bar indicates the number of OTUs identified to species level, whilst the red portion of the bar indicates the number of OTUs identified to a higher taxonomic level at each station.

A summary of the results for each taxonomic group is reported below. Appendix B provides full details of the laboratory techniques employed. Complete laboratory reports are presented in Appendix F.

9.1 Marine Sediment Invertebrates

9.1.1 Taxonomic Composition

High-quality invertebrate data were successfully obtained from all 23 eDNA samples (Appendix F). A moderate proportion of OTUs were identified at the species level.

Table 9.1 indicates the percentage of the target OTUs matched at each taxonomic level. A total of 165 OUT taxa were detected, with 45.45 % (75 taxa) matched to species level.

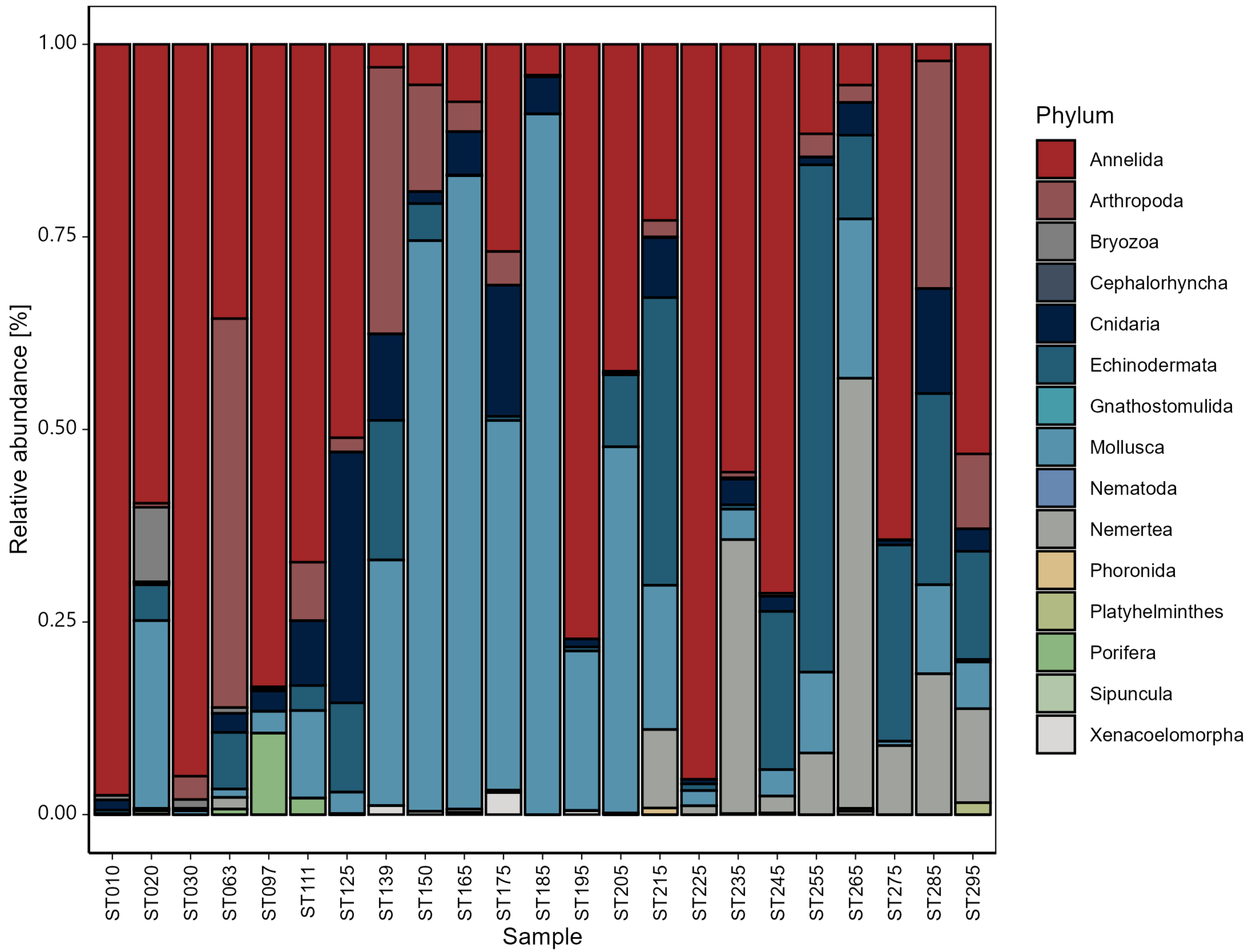
Table 9.1: Proportions of invertebrate taxa OTUs in the sediment samples

Number of OTUs	Phylum [%]	Class [%]	Order [%]	Family [%]	Genus [%]	Species [%]
165	100	100	95.76	87.88	70.30	45.45

Notes
OTU = Operational Taxonomic Unit

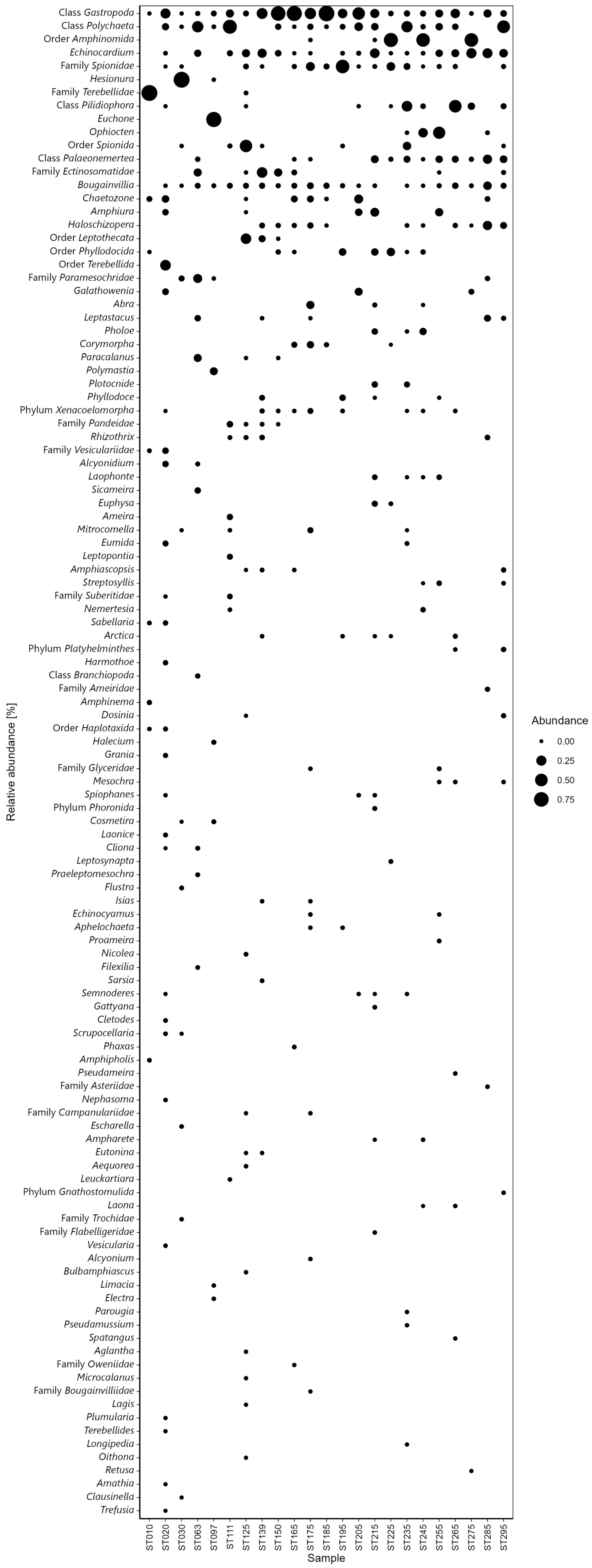
Figure 9.1 presents the bar plot of the relative OTU counts of the invertebrate taxa detected by sediment eDNA sampling, rationalised to the 'phylum' taxonomic level for each sample. Along the proposed cable route, the highest proportions of OTUs were expressed by the phylum Annelida (60.4 %), followed by the phylum Mollusca (15.4 %), and Echinodermata (10.2 %). The other phyla contributed to < 5 % to the total OTUs.

Figure 9.2 lists the invertebrate taxa found in each sediment sample and their relative proportion of DNA OTUs within each sample. From the reviewing of the taxa list, the class Gastropoda contributed the highest proportion of OTUs, and it was the most frequent taxon as it occurred at all stations. This was followed by the class Polychaeta, the order polychaete Amphinomida, the urchin genus *Echinocardium* and the polychaete family Spionidae.



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units
All taxa detected were included in the figure because targeted by the eDNA analysis; however, a subset of these is not part of the macrofaunal community

Figure 9.1: Relative OTU counts of target invertebrate taxa detected at the phylum level in the sediment samples



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units
All taxa detected were included in the figure because targeted by the eDNA analysis; however, a subset of these is not part of the macrofaunal community

Figure 9.2: Taxonomic composition and proportion [%] of invertebrate OTUs within the sediment eDNA samples

9.1.2 Community Statistics

Figure 9.3 presents the total count of OTUs detected in each sediment sample, represented as species richness.

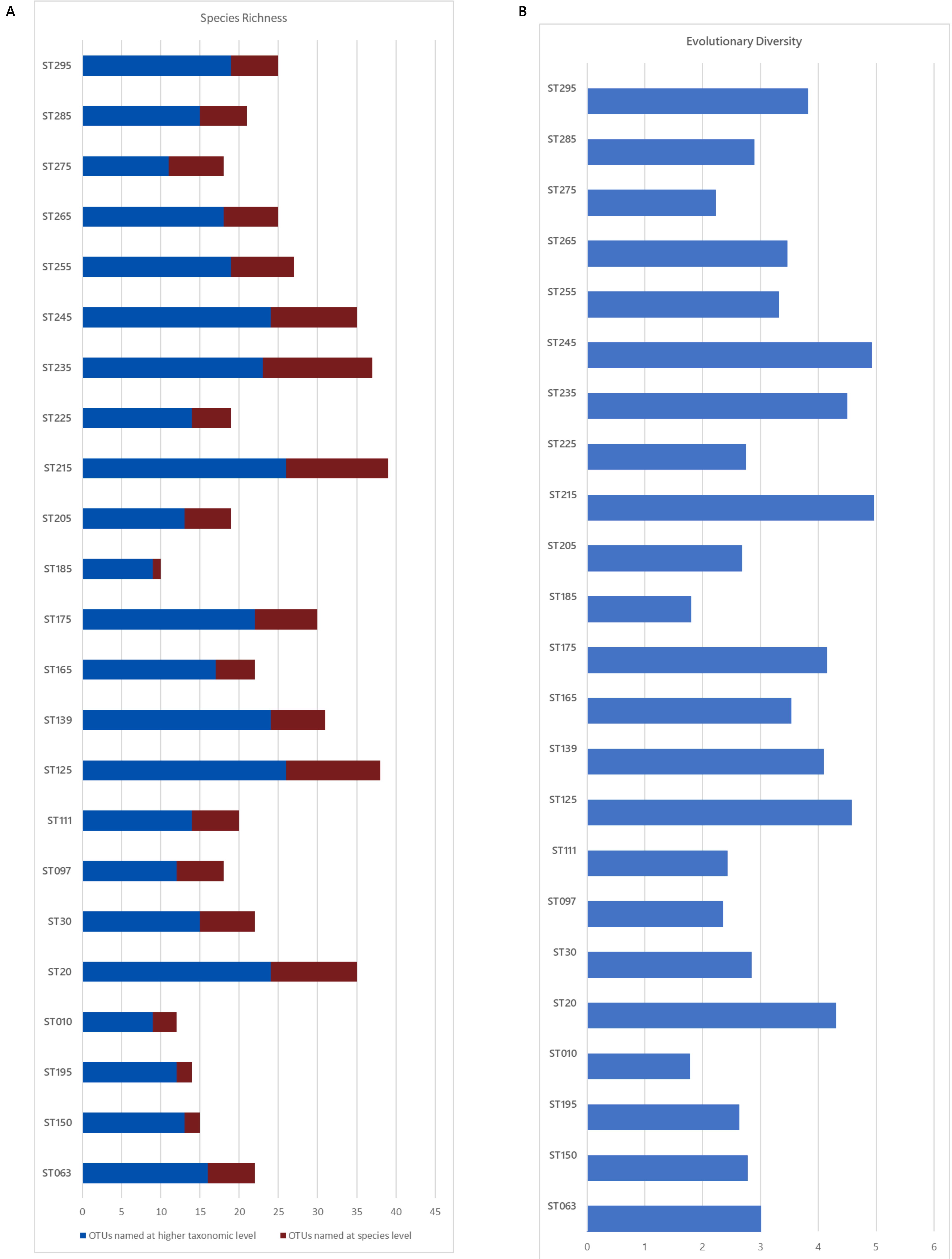
Alpha diversity ranged from 9 (samples ST010 and ST185) to 26 (samples ST125 and ST215), with a mean of 17.2. Of these, the OTUs being named at species level ranged from 1 to 14.

The ED metric is an indication of the presence of a more varied species assemblage, with higher values indicating a more varied community (Section 3.3.6 and Appendix B.2.6). Across the survey area, the ED for invertebrate eDNA results ranged from 1.78 (sample ST010) to 4.96 (sample ST215) (Table 9.2).

Table 9.2: Sediment samples invertebrate OTUs eDNA community statistics

Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST063	16	6	3.01
ST150	13	2	2.77
ST195	12	2	2.63
ST010	9	3	1.78
ST20	24	11	4.3
ST30	15	7	2.84
ST097	12	6	2.35
ST111	14	6	2.43
ST125	26	12	4.57
ST139	24	7	4.09
ST165	17	5	3.53
ST175	22	8	4.15
ST185	9	1	1.8
ST205	13	6	2.68
ST215	26	13	4.96
ST225	14	5	2.75
ST235	23	14	4.5
ST245	24	11	4.92
ST255	19	8	3.32
ST265	18	7	3.46
ST275	11	7	2.22
ST285	15	6	2.89
ST295	19	6	3.82
Minimum	9	1	1.78
Maximum	26	14	4.96
Median	16	6	3.01
Mean	17	7	3.29
SD	5.44	3.44	0.963

Notes
OTU = Operational Taxonomic Unit
SD = Standard deviation
All taxa detected were included in the calculations because targeted by the eDNA analysis; however, a subset of these is not part of the macrofaunal community



Notes
The samples are ordered nearshore to offshore from top to bottom of the chart
OTUs = Operational Taxonomic Units
All taxa detected were included in the calculations because targeted by the eDNA analysis; however, a subset of these is not part of the macrofaunal community

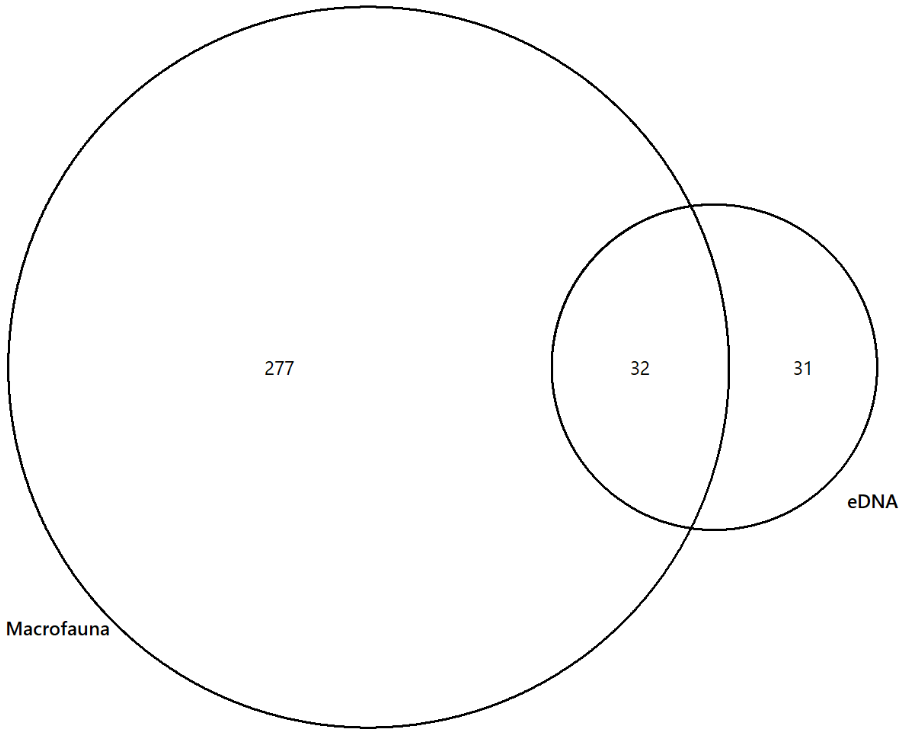
Figure 9.3: Invertebrate Species Richness (A) and Evolutionary Diversity (B) of each sediment eDNA sample

9.1.3 eDNA Comparative Analysis: Marine Sediment Invertebrates Assay vs. Macrofauna Data

As both invertebrate eDNA analysis and macrofaunal analysis identified invertebrate taxa, a Venn diagram was used to investigate the proportion of overlapping invertebrate taxa detected by both methods. Data has been rationalised to remove colonial taxa; however, eDNA will have captured taxa which were not retained for the macrofauna data analysis. It is also important to consider that macrofaunal samples were collected from 107 stations whilst the eDNA sediment samples were only collected from 23 stations.

Of the target macrofauna and eDNA taxa identified, 32 species were recorded by both methods. An additional 31 taxa were identified through eDNA analysis that were not captured by macrofauna grab sampling.

Figure 9.4 illustrates the overlap of invertebrate taxa identified by invertebrate eDNA analysis and macrofaunal analysis, with the number of taxa indicated at the intersection of the Venn diagram circles indicating the overlapping proportion of invertebrate taxa. Taxa were grouped to the taxonomic level 'Species' for comparability.



Notes
OTU = Operation Taxonomic Unit
Arthropods, cnidarians, colonial and non-target taxa have been removed from the Venn diagram

Figure 9.4: Venn diagram comparing macrofauna and invertebrate OTUs at the species taxonomic level in the sediment samples

9.2 Marine Sediment Eukaryotes

9.2.1 Taxonomic Composition

High-quality eukaryotes data were successfully obtained from 23 of the 23 eDNA samples. A high percentage of OTUs were identified at the species level or below.

Table 9.3 indicates the percentage of the target OTUs identified at each taxonomic level. A total of 986 OTU taxa were detected with only 8.62 % (85 taxa) being matched at species level.

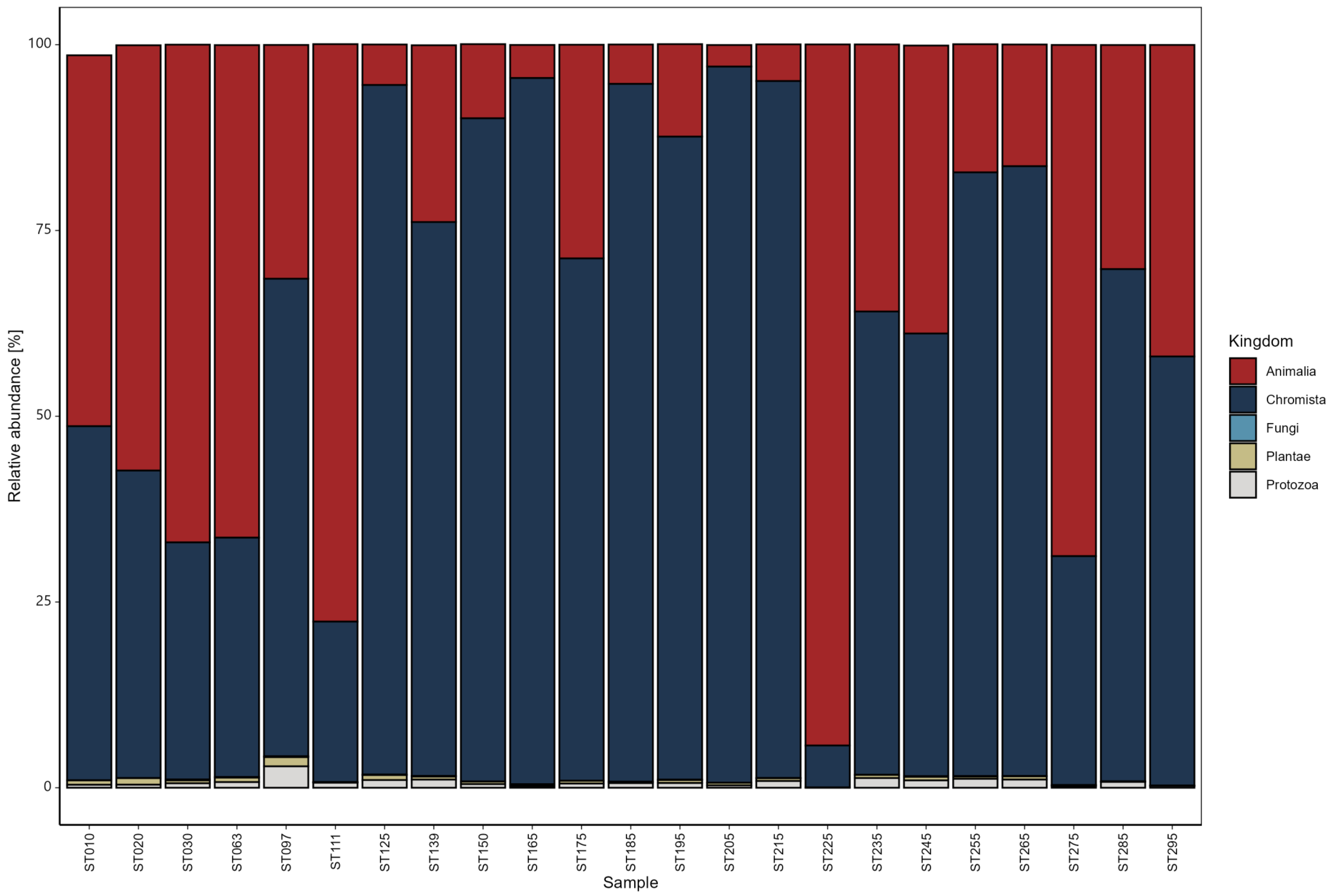
Table 9.3: Proportions of eukaryote taxa OTUs in the sediment samples

Number of OTUs	Phylum [%]	Class [%]	Order [%]	Family [%]	Genus [%]	Species [%]
986	98.38	86.51	72.01	59.74	27.79	8.62

Notes
OTU = Operational Taxonomic Unit

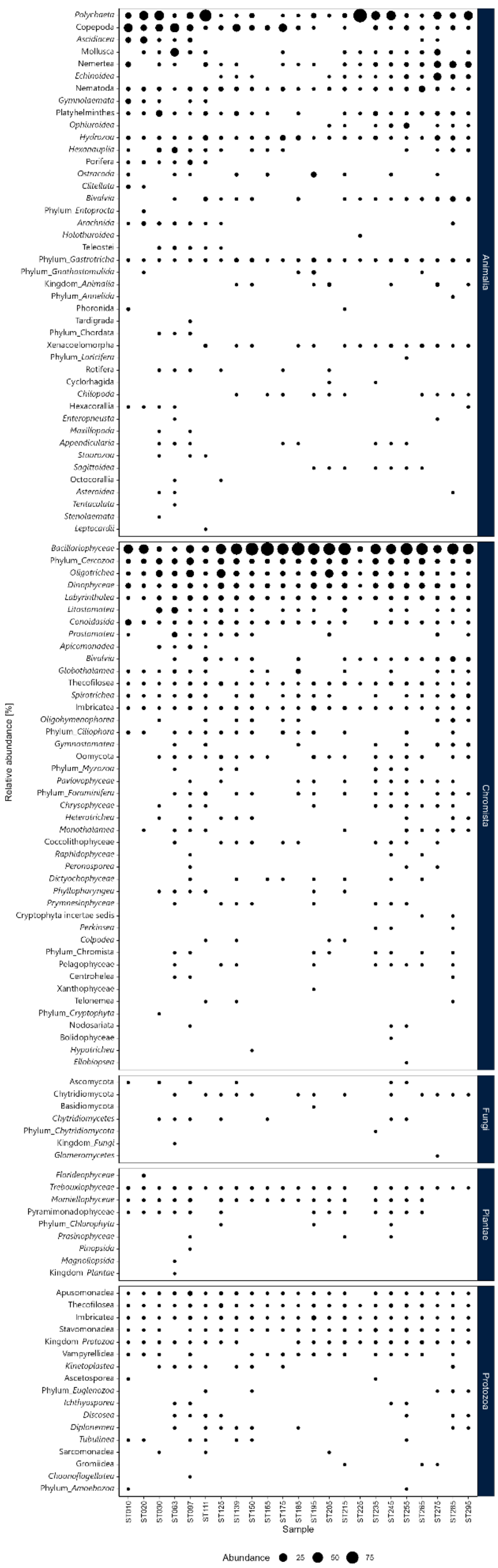
Figure 9.5 presents the bar plot of the relative OTU counts of the eukaryote taxa detected by sediment eDNA sampling, rationalised to the 'kingdom' taxonomic level for each sample. AlonG the proposed cable route, Chromista (63.2 %) and Animalia (35.6 %) were the two dominating kingdoms amongst the eukaryotes from sediment eDNA samples. The remining kingdoms contributed to < 1 %.

Figure 9.6 lists the eukaryote taxa found in each sediment sample and their relative proportion of DNA sequences within each sample. From the reviewing of the taxa list, amongst the Animalia, the phylum Polychaeta contributed the highest proportion of OTUs followed by the classes Ascidiacea, Echinoidea and Bivalvia although these taxa did not occur at all stations. The most frequently occurring taxa, detected at all stations were the cnidarian class Hydrozoa and the phylum Nematoda.



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 9.5: Relative OTU counts of target eukaryote taxa detected to order level in the sediment samples



Notes

Non-target taxa were excluded from the plot

OTUs = Operation Taxonomic Units

Figure 9.6: Taxonomic composition and proportion [%] of eukaryote OTUs within the sediment eDNA samples

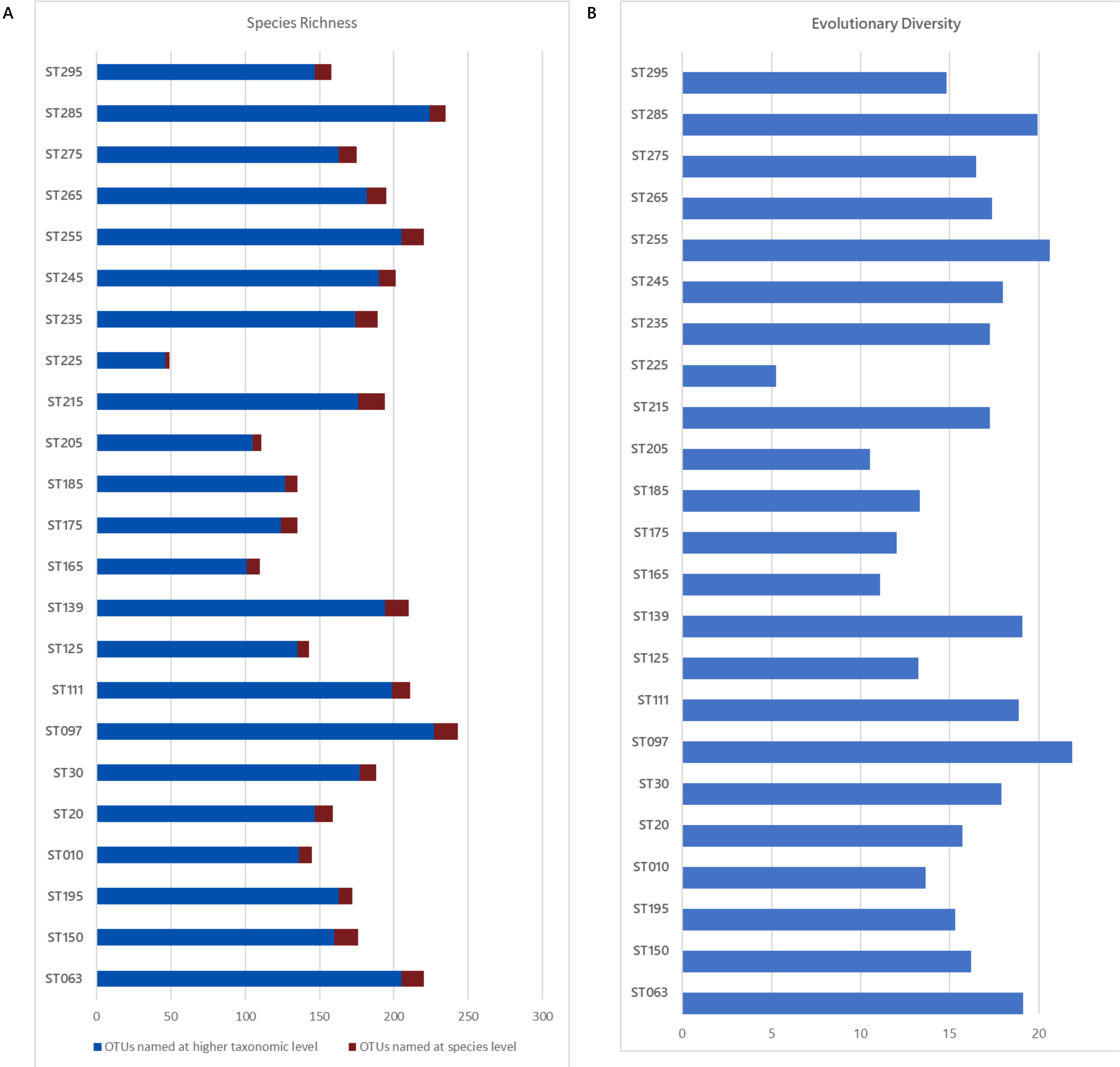
9.2.2 Community Statistics

Figure 9.7 presents the total count of OTUs detected in each seawater sample, represented as species richness. The alpha diversity ranged from 46 (sample ST225) to 227 (sample ST097), with a mean of 161. Of these, the OTUs matched at the species level ranged from 3 to 18. The ED for eukaryotes eDNA ranged from 5.25 (sample ST225) to 21.84 (sample ST097) (Table 9.4).

Table 9.4: Water samples, eukaryote OTUs eDNA community statistics

Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST063	205	15	19.11
ST150	160	16	16.18
ST195	163	9	15.29
ST010	136	9	13.61
ST20	147	12	15.71
ST30	177	11	17.88
ST097	227	16	21.84
ST111	199	12	18.85
ST125	135	8	13.21
ST139	194	16	19.06
ST165	101	9	11.06
ST175	124	11	12.02
ST185	127	8	13.31
ST205	105	6	10.51
ST215	176	18	17.23
ST225	46	3	5.25
ST235	174	15	17.22
ST245	190	11	17.96
ST255	205	15	20.6
ST265	182	13	17.35
ST275	163	12	16.46
ST285	224	11	19.92
ST295	147	11	14.79
Minimum	**46**	**3**	**5.25**
Maximum	**227**	**18**	**21.84**
Median	**163**	**11**	**16.46**
Mean	**161**	**12**	**15.84**
SD	**43.1**	**3.6**	**3.80**

Notes
OTU = Operational Taxonomic Unit SD = Standard deviation



Notes
The samples are ordered nearshore to offshore from top to bottom of the chart
OTUs = Operational Taxonomic Units

Figure 9.7: Eukaryote Species Richness (A) and Evolutionary Diversity (B) of each sediment eDNA sample

9.3 Marine Sediment Bacteria

9.3.1 Taxonomic Composition

High-quality bacteria eDNA data were successfully obtained from 23 of the 23 sediment samples analysed (Appendix F).

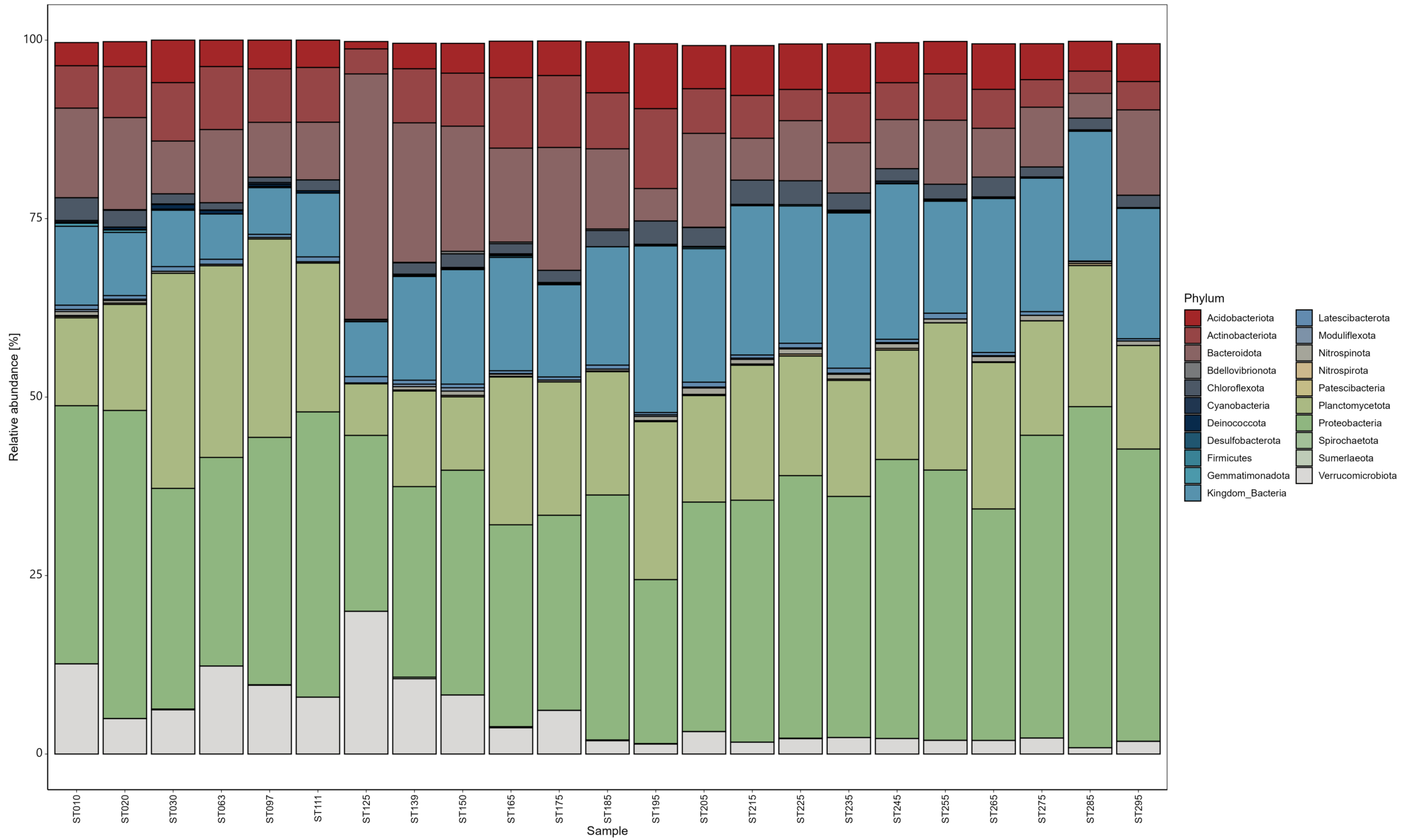
Table 9.5 indicates the percentage of the target OTUs identified at each taxonomic level. A total of 1076 OTU taxa were detected, with nine OTUs being matches at species level.

Table 9.5: Proportions of bacterial taxa OTUs in the sediment samples

Number of OTUs	Phylum [%]	Class [%]	Order [%]	Family [%]	Genus [%]	Species [%]
1076	87.64	72.30	46.84	29	6.78	0.84
Notes OTU = Operational Taxonomic Unit						

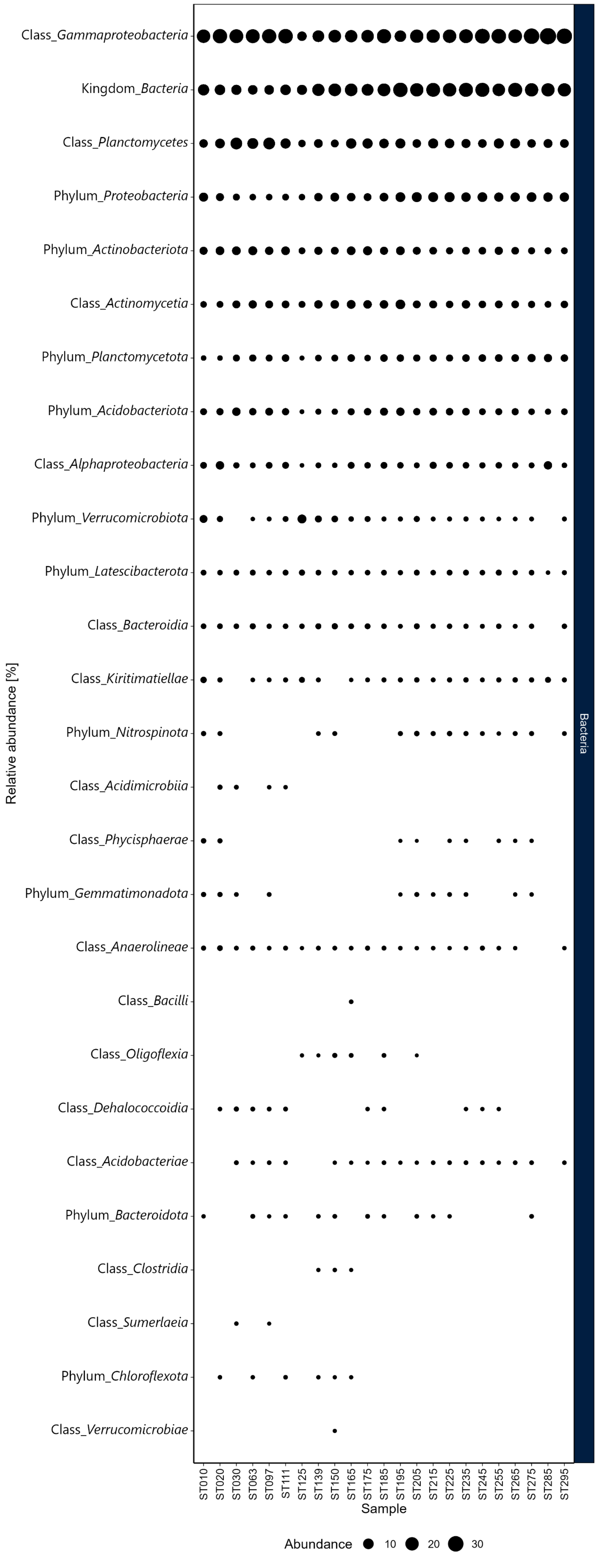
Figure 9.8 presents the bar plot of the relative OTU counts of the bacterial taxa detected by sediment eDNA sampling, rationalised to the 'phylum' taxonomic level for each sample. Along the proposed cable route, Protobacteria contributed the highest proportions of OTUs within each sample.

Figure 9.9 lists the bacterial taxa found in each sediment sample and their relative proportion of DNA sequences within each sample. From the reviewing of the taxa list, the classes Gammaprotobacteria and Planctomycetes, together with the phyla Protbacteria and Actinobacteriata were amongst the top 5 taxa contributing the highest proportions of OTUs. These taxa were also detected within each eDNA sediment sample.



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 9.8: Relative OTU counts of target invertebrate taxa detected at the phylum level in the sediment samples



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 9.9: Taxonomic composition and proportion [%] of bacteria OTUs within the sediment eDNA samples

9.3.2 Community Statistics

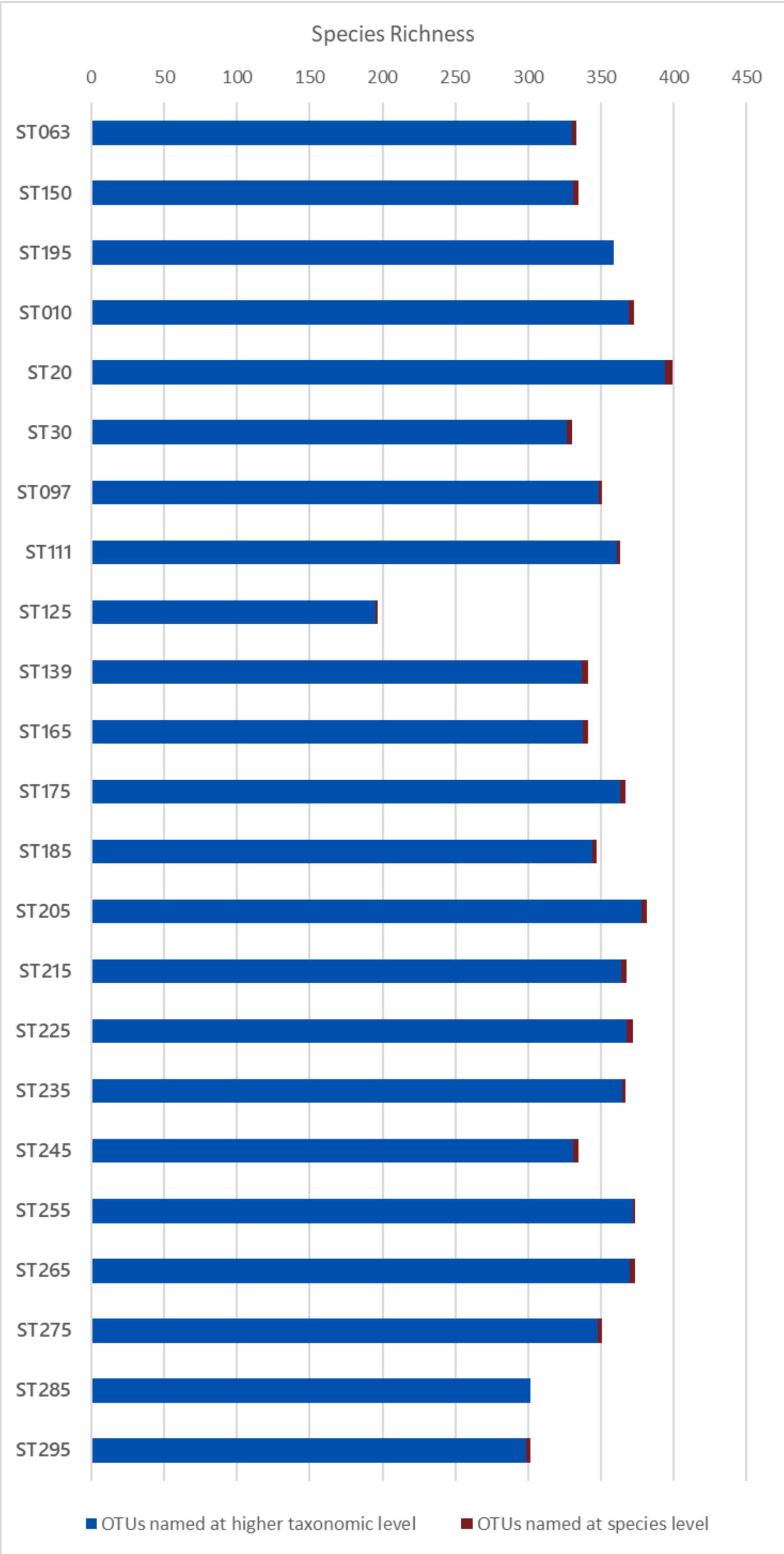
Figure 9.10 presents the total count of OTUs detected in each seawater sample, represented as species richness.

The alpha diversity ranged from 195 (sample ST125) to 394 (sample ST20), with a mean of 343. The number of OTUs named at the species level ranged from 0 (sample ST195 and ST285) to 5 (sample ST020). The ED for bacterial eDNA ranged from 11.13 (sample ST125) to 20.77 (sample ST010) (Table 9.6).

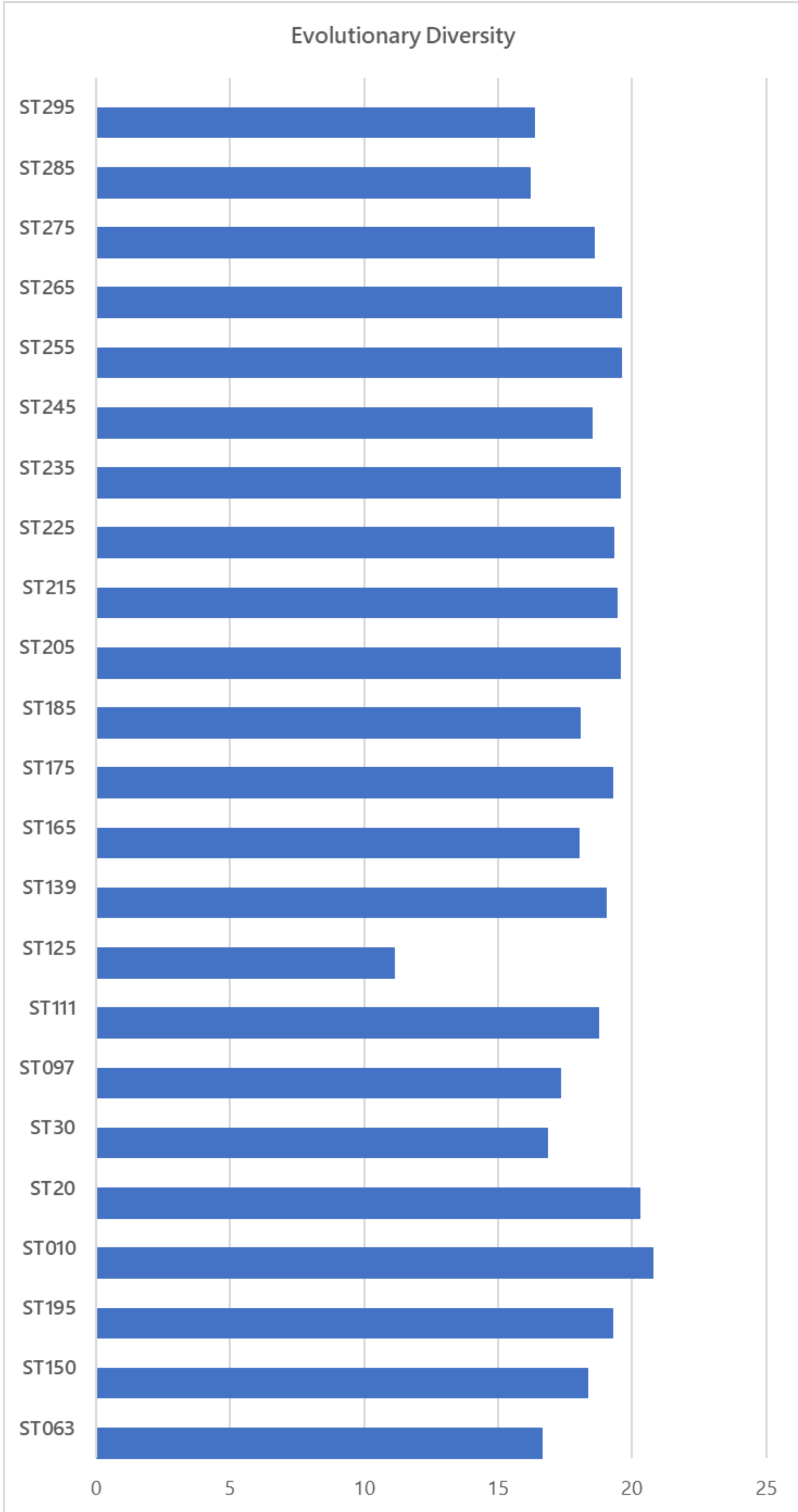
Table 9.6: Water samples bacterial OTUs eDNA community statistics

Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST063	330	3	16.66
ST150	331	4	18.33
ST195	359	0	19.28
ST010	369	4	20.77
ST020	394	5	20.27
ST30	327	3	16.85
ST097	349	2	17.35
ST111	361	2	18.73
ST125	195	2	11.13
ST139	337	4	19.03
ST165	338	3	18
ST175	363	4	19.26
ST185	344	3	18.05
ST205	378	4	19.56
ST215	364	4	19.43
ST225	368	4	19.33
ST235	365	2	19.57
ST245	331	4	18.49
ST255	372	2	19.62
ST265	370	4	19.6
ST275	348	3	18.57
ST285	302	0	16.18
ST295	299	3	16.34
Minimum	195	0	11.13
Maximum	394	5	20.77
Median	349	3	18.73
Mean	343	3	18.28
SD	39.9	1.3	1.991

Notes
OTU = Operational Taxonomic Unit SD = Standard deviation



a)



b)

Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 9.10: Bacteria Species Richness (A) and Evolutionary Diversity (B) of each sediment eDNA sample

10. Seawater Environmental DNA (eDNA)

The TOP and BOT seawater samples collected at 46 stations were analysed for eDNA taxonomic classification of fish and vertebrate taxa. Section 10.1 presents the fish taxa and Section 10.2 presents the vertebrate taxa detected during the analysis of the WeDNA samples.

A summary of the results for each taxonomic group is reported below. Appendix B provides full details of the laboratory techniques employed. Full laboratory reports are presented in Appendix H.

10.1 Marine Water Fish

10.1.1 Taxonomic Composition

High-quality fish data were successfully obtained from 45 of the 46 eDNA samples. Amplification of DNA sequences was not obtained for the BOT sample ST063 WS_BOT owing to insufficient DNA concentration or polymerase chain reaction (PCR) inhibition; therefore, no results were reported for these stations (Appendix H).

Table 10.1 indicates the percentage of the target OTUs matched at each taxonomic level. A total of 69 OTU taxa were detected, with 66.67 % (46 taxa) being matched at species level.

Table 10.1: Proportions of fish taxa OTUs in the seawater samples

Number of OTUs	Phylum [%]	Class [%]	Order [%]	Family [%]	Genus [%]	Species [%]
69	100	100	100	98.55	86.96	66.67

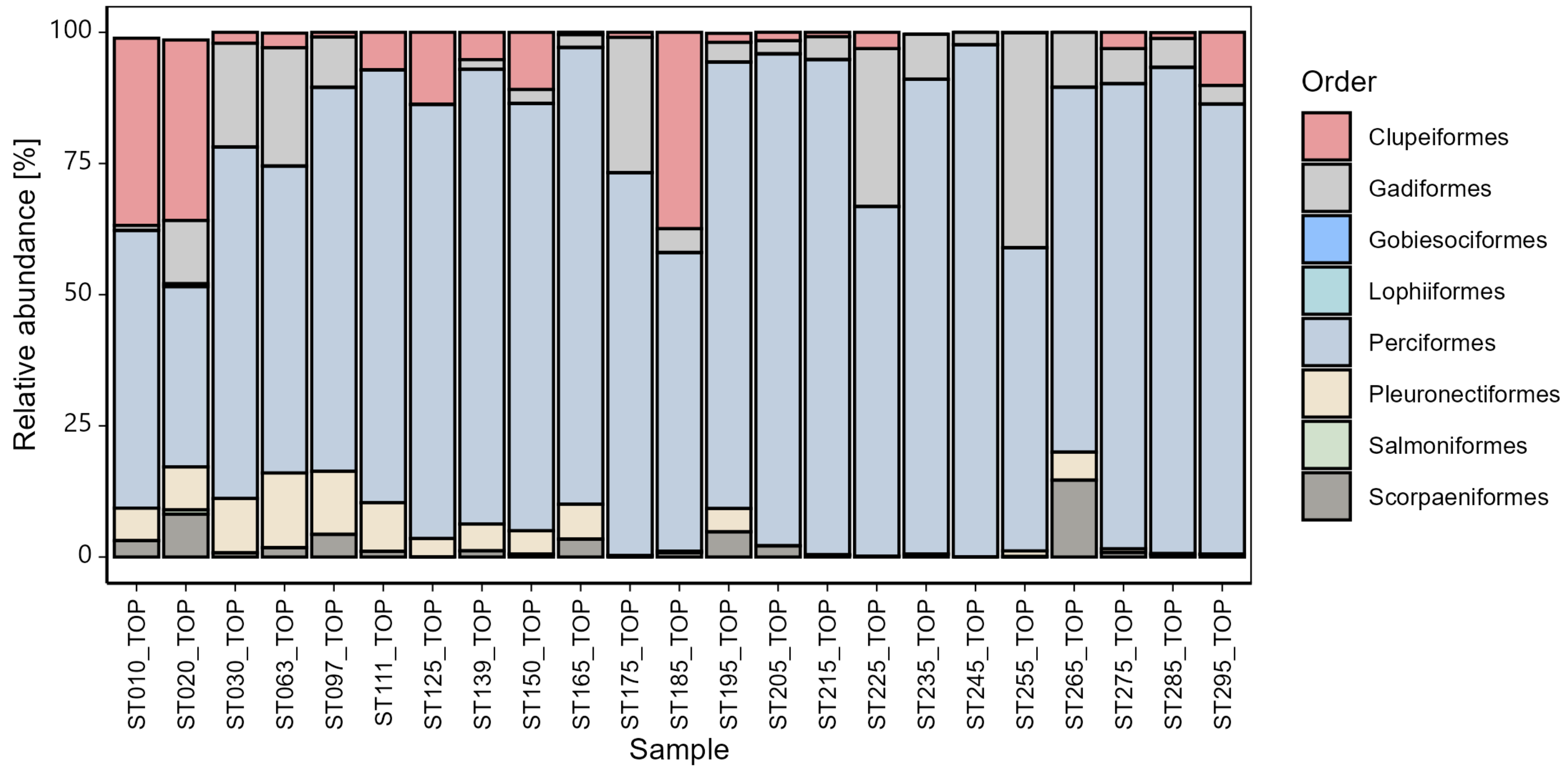
Notes
OTU = Operational Taxonomic Unit

Figure 10.1 presents the bar plot of the relative OTU counts of the fish taxa detected by each WeDNA samples and rationalised to the 'order' taxonomic level for the TOP (a) and the BOT (b) samples.

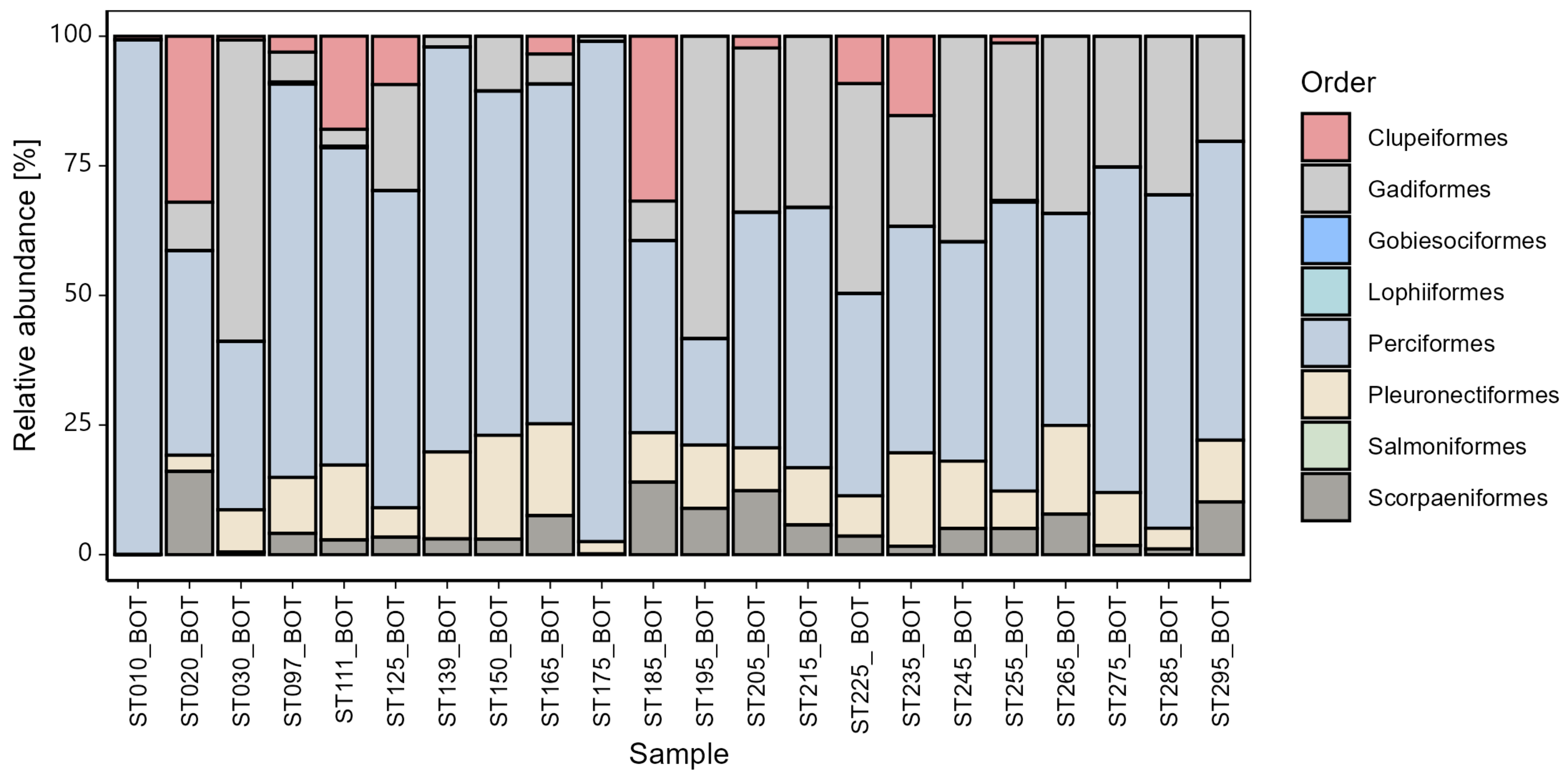
Along the proposed cable route, the order Perciformes contributed the highest proportion of OTUs within all TOP samples, followed by the order Perciformes withing almost all of the BOT samples. Within the BOT samples the order Gadiformes contributed a high proportion of OTUs, particularly at the most offshore stations, whilst the proportion of Pleuronectiformes OTUs were high in the BOT samples.

Figure 10.2 lists the fish taxa found in each WeDNA sample and their relative proportion of DNA sequences within each sample.

From the review of the taxa list, the Atlantic Mackerel (*Scomber scombrus*) was the taxon contributing the highest OTUs in both TOP and BOT samples and was detected from all samples, followed by the family Ammodytidae; however, the latter was detected within the samples collected at the most nearshore stations. The lesser weever (*Echiichthys vipera*), the northern rockling (*Ciliata septentrionalis*) and the European sprat (*Sprattus sprattus*) were amongst the top ten taxa contributing high proportions of OTUs in the TOP samples, whilst the haddock *Melanogrammus aeglefinus*, the whiting (*Merlangius merlangus*), the European sprat (*S. sprattus*) and the common dab (*Limanda limanda*) were amongst the top ten taxa contributing high proportions of OTUs within the BOT samples.



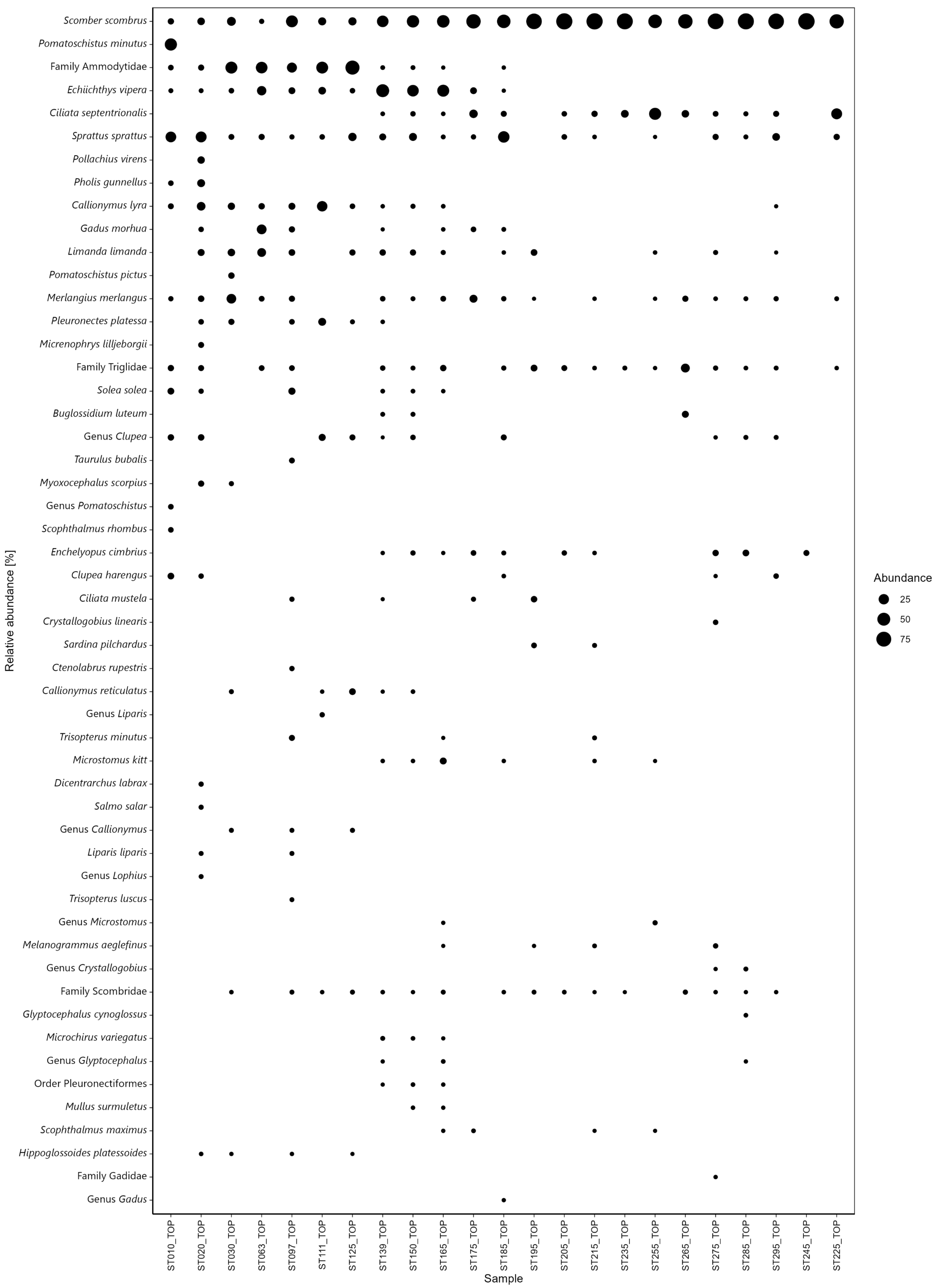
a)



b)

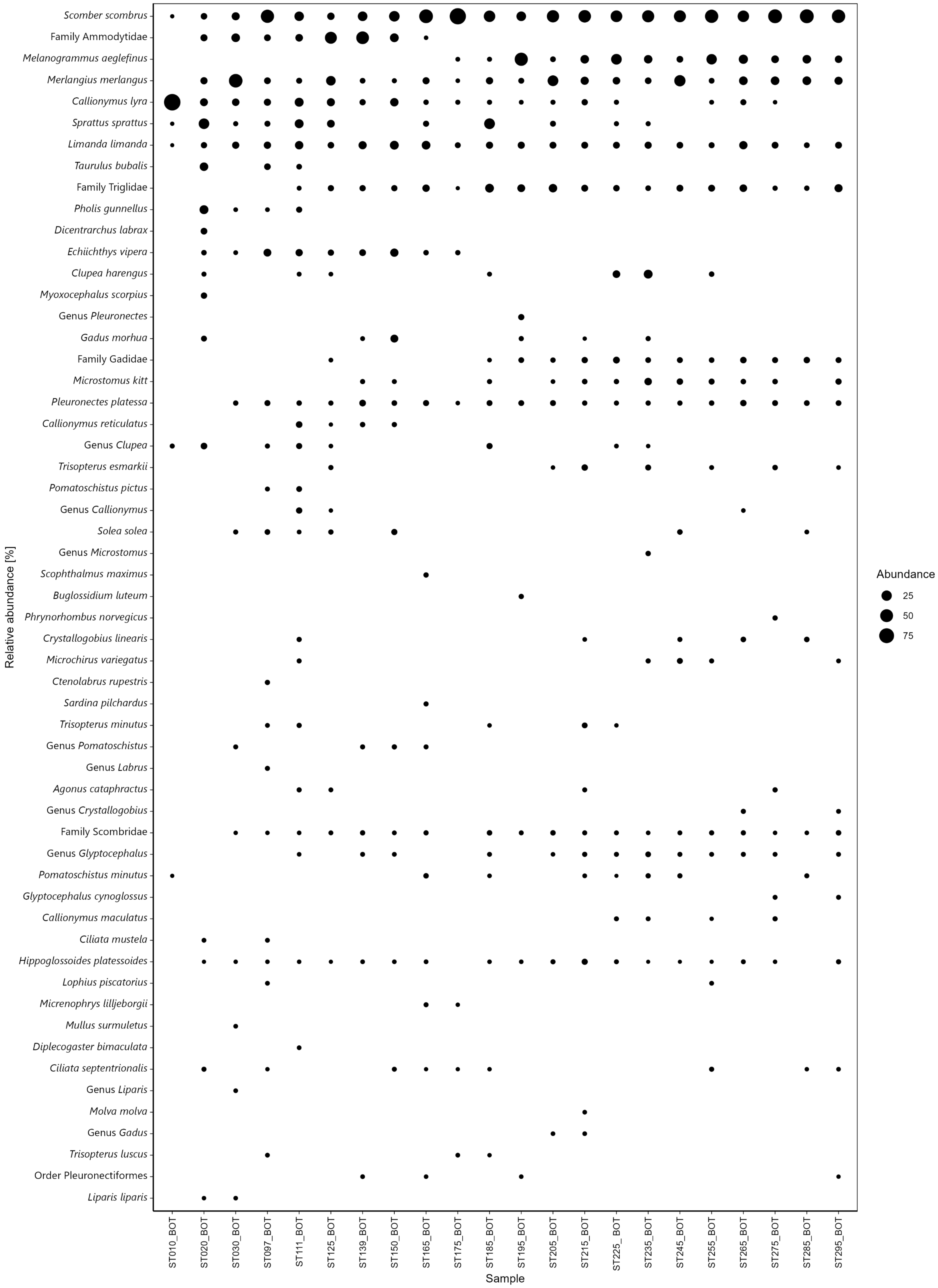
Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.1: Relative OTU counts of target fish taxa detected to order level in (A) TOP and (B) BOT seawater samples



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.2: Taxonomic composition and proportion [%] of fish OTUs within the TOP seawater eDNA samples



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.3: Taxonomic composition and proportion [%] of fish OTUs within the BOT seawater eDNA samples

10.1.2 Community Statistics

Figure 10.4 presents the total count of OTUs detected in each seawater sample, represented as species richness. Table 10.2 presents the results of the taxon richness for samples acquired within the survey area.

The alpha diversity ranged from 2 (samples ST235_TOP and ST245_TOP) to 27 (sample ST111_BOT), with a mean of 15. Of these, the OTUs being matched at the species level ranged from 2 (sample ST235_TOP) to 19 (sample ST20_TOP).

The ED for fish eDNA results ranged from 0.35 (sample ST245_TOP) to 2.84 (sample ST111_BOT).

Table 10.2: Water samples fish OTUs eDNA community statistics

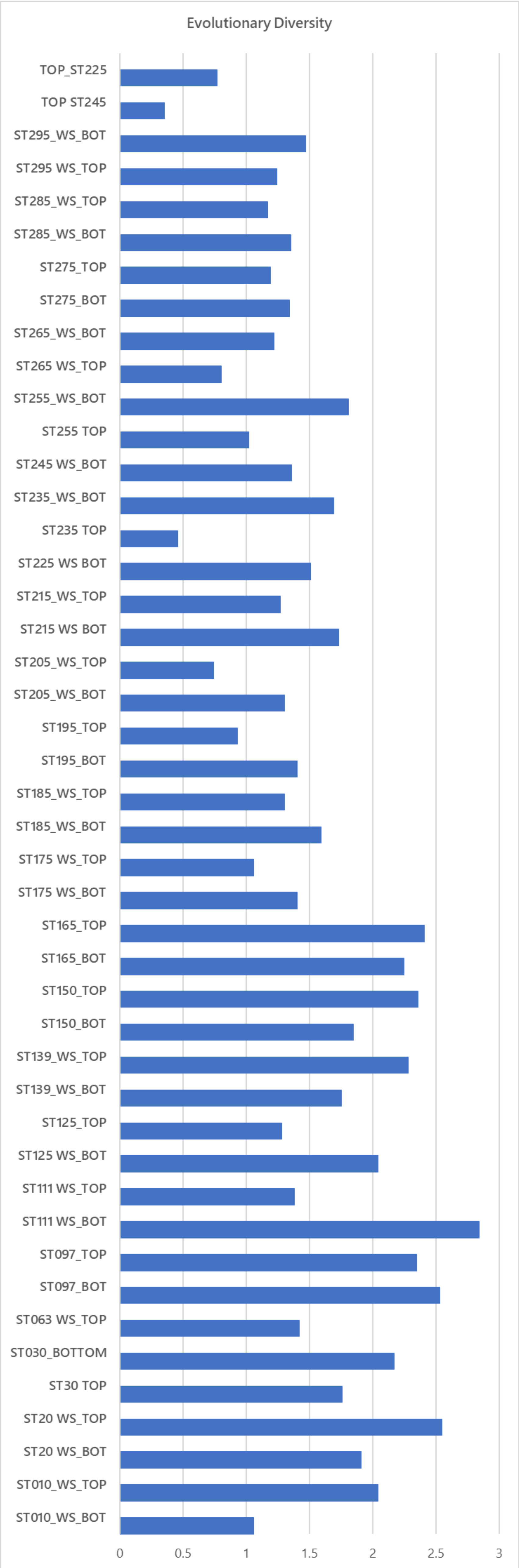
Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST010_BOT	6	5	1.06
ST010_TOP	15	11	2.04
ST020_BOT	18	16	1.91
ST020_TOP	23	19	2.55
ST030_TOP	15	11	1.76
ST030_BOT	18	12	2.17
ST063_TOP	10	7	1.42
ST097_BOT	22	18	2.53
ST097_TOP	23	16	2.35
ST111_BOT	27	19	2.84
ST111_TOP	11	6	1.38
ST125_BOT	22	13	2.04
ST125_TOP	13	8	1.28
ST139_BOT	17	10	1.75
ST139_TOP	22	16	2.28
ST150_BOT	18	12	1.85
ST150_TOP	19	14	2.36
ST165_BOT	18	13	2.25
ST165_TOP	22	16	2.41
ST175_BOT	11	10	1.4
ST175_TOP	9	9	1.06
ST185_BOT	19	14	1.59
ST185_TOP	15	10	1.3
ST195_BOT	14	9	1.4
ST195_TOP	8	6	0.93

Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST205_BOT	15	10	1.3
ST205_TOP	6	4	0.74
ST215_BOT	20	15	1.73
ST215_TOP	12	10	1.27
ST225_BOT	18	13	1.51
ST225_TOP	5	4	0.77
ST235_TOP	4	2	0.46
ST235_BOT	20	14	1.69
ST245_BOT	15	11	1.36
ST245_TOP	2	2	0.35
ST255_TOP	9	7	1.02
ST255_BOT	18	14	1.81
ST265_TOP	6	4	0.8
ST265_BOT	15	9	1.22
ST275_BOT	17	13	1.34
ST275_TOP	14	9	1.19
ST285_BOT	12	9	1.35
ST285_TOP	11	6	1.17
ST295_TOP	10	7	1.24
ST295_BOT	18	11	1.47
Minimum	**2**	**2**	**0.35**
Maximum	**27**	**19**	**2.84**
Median	**15**	**10**	**1.40**
Mean	**15**	**11**	**1.55**
SD	**5.83**	**4.37**	**0.575**

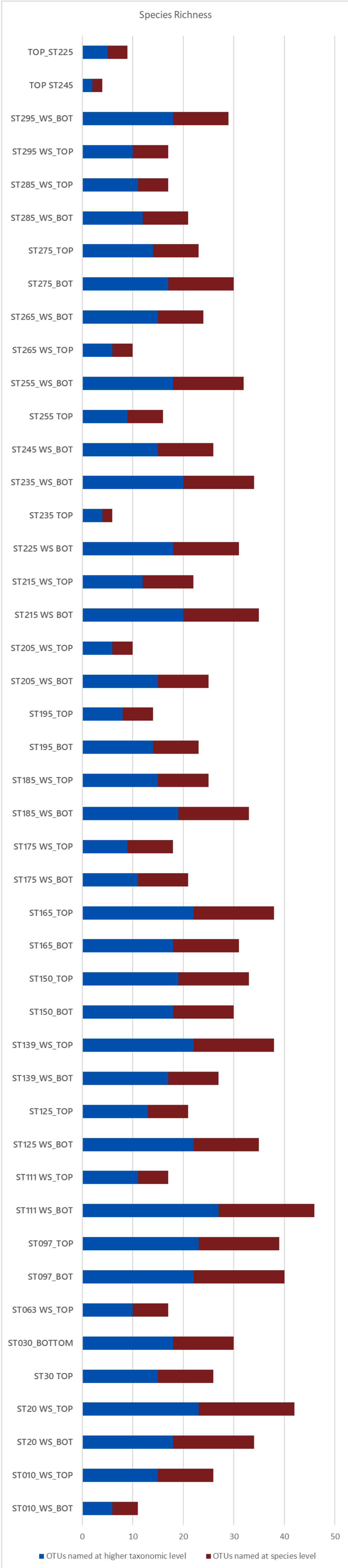
Notes

OTU = Operational Taxonomic Unit

SD = Standard deviation



a)



b)

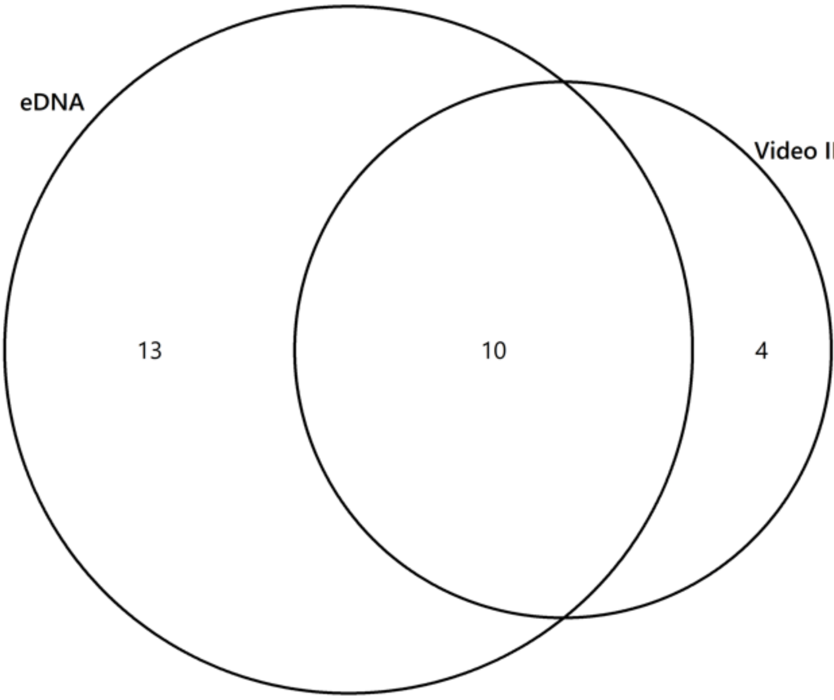
Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.4: Fish Evolutionary Diversity and Species Richness of each seawater eDNA sample

10.2 eDNA Comparative Analysis: Habitat Fish Identification vs. Marine Seawater Fish Assay Data

As both photographic data and WeDNA detected fish taxa, a Venn diagram was generated to determine the number of taxa identified at family level by both methods.

Figure 10.5 illustrates the overlap between the number of fish families matched in each WeDNA sample and those identified by the analysis of the photographic data, with the number of taxa at the intersection of the Venn diagram circles indicating the number of families identified by both methods. Both methodologies identified 10 taxa at the family level, whilst 13 additional taxa were matched form the WeDNA and 4 more were recorded during the analysis of the photographic data.



Notes
OTU = Operation Taxonomic Unit
Non-target taxa removed from Venn diagram

Figure 10.5: Venn diagram comparing fish and vertebrate OTUs at genus taxonomic level in the seawater samples

10.3 Marine Water Vertebrate

10.3.1 Taxonomic Composition

High-quality vertebrate data were successfully obtained from 45 of the 46 eDNA samples. Amplification of DNA sequences could not be obtained in the BOT sample ST063 WS_BOT owing to insufficient DNA concentration or PCR inhibition, and, therefore, no results were reported for these stations.

Table 10.3 indicates the percentage of the target OTUs identified at each taxonomic level. A total of 56 OTU taxa, with 53.57 % (30 taxa) was identified at species level.

Table 10.3: Proportions of vertebrate taxa OTUs in the seawater samples

Number of OTUs	Phylum [%]	Class [%]	Order [%]	Family [%]	Genus [%]	Species [%]
56	100	100	100	92.86	69.64	53.57

Notes
OTU = Operational Taxonomic Unit

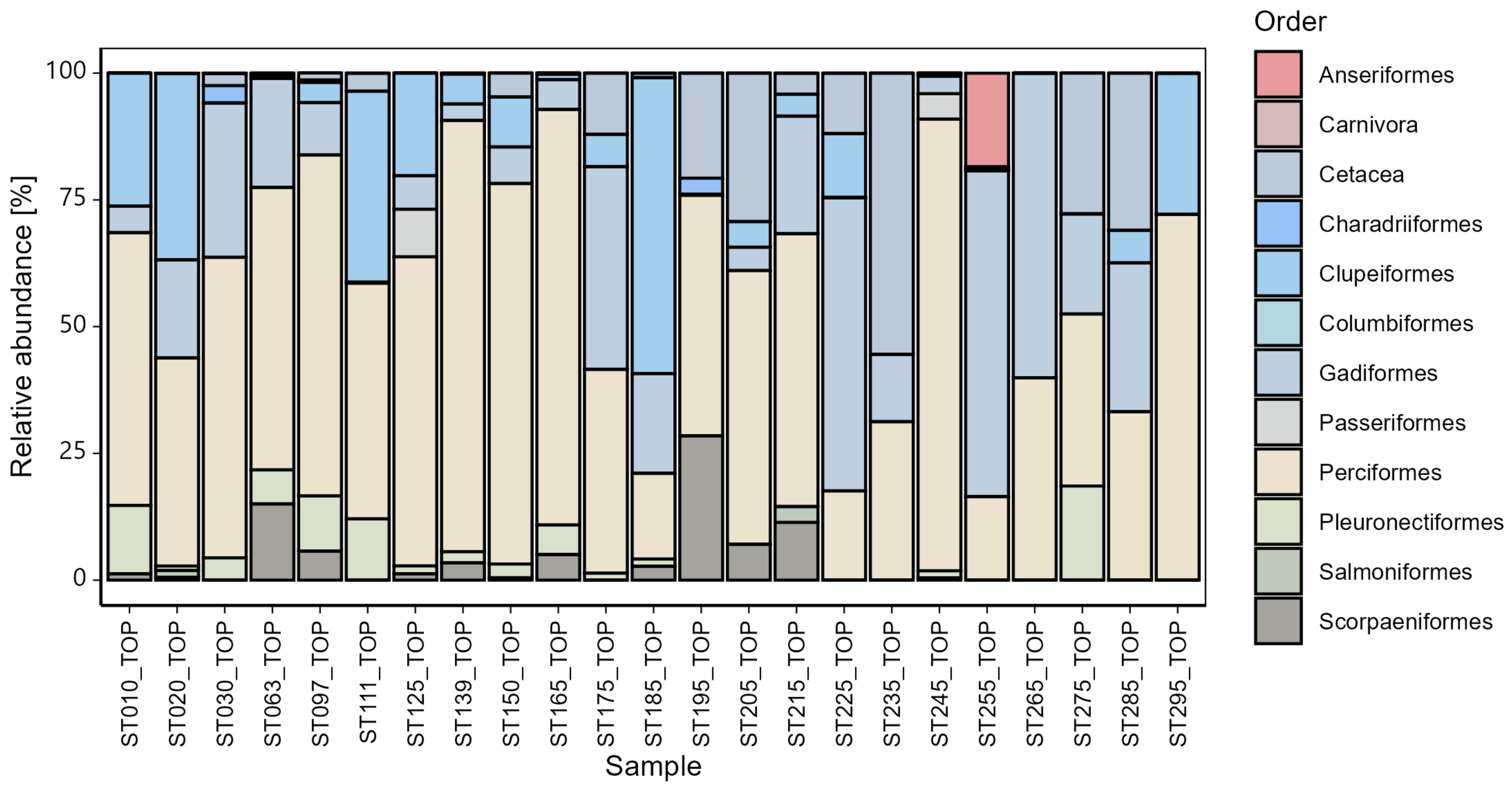
Figure 10.6 presents the bar plot of the relative OTU counts of the vertebrate taxa detected by seawater eDNA sampling, rationalised to the order taxonomic level for each WeDNA sample.

Along the proposed cable route, the fish order Perciformes contributed the highest proportions of vertebrates OTUs at most stations within TOP samples. Within the BOT samples, Perciformes contributed high proportions of vertebrate OTUs from WeDNA samples from the most nearshore stations, whilst Gadiformes contributed high proportions of vertebrate OTUs from WeDNA samples from the samples located further offshore.

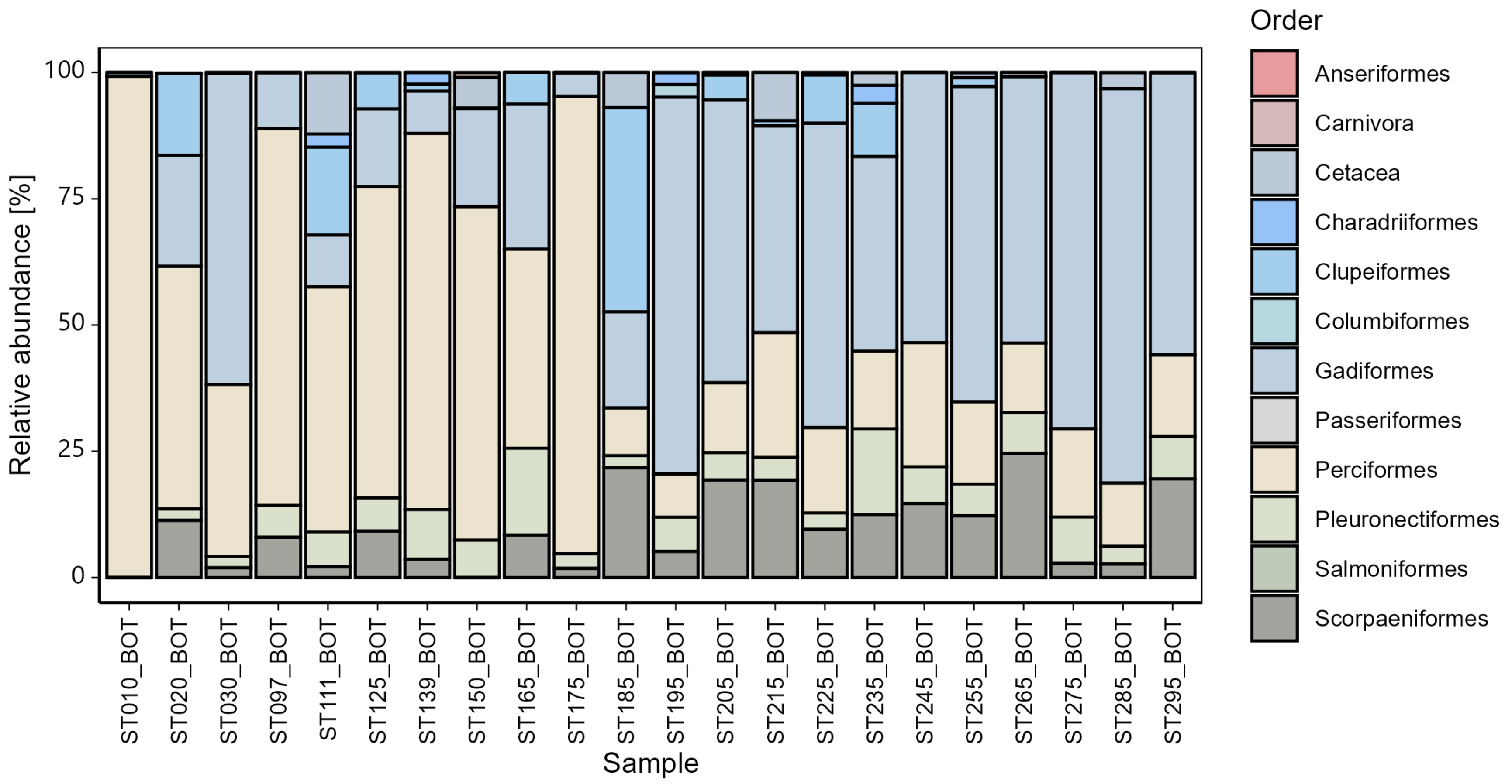
Figure 10.7 lists the vertebrate taxa found in each seawater sample and their relative proportion of DNA sequences within each sample.

From reviewing the taxa list, among the TOP samples the fish taxa within the top five contributing the highest proportion of OTUs included the Atlantic mackerel (*S. scombrus*), the lesser weever (*E. vipera*) the genus *Ammodytes* and the families Clupeidae and Gadidae. OTUs from bird taxa were sporadic, whilst the porpoise *Phocena phocena* and the family Delphinidae contributed high proportions of vertebrate OTUs within the WeDNA samples located further offshore along the proposed cable route.

Among the BOT samples, the fish taxa within the top five contributing the highest proportion of OTUs included the families Gadidae and Triglidae, the genus *Ammodytes* the dragonet *Callionymus lyra* and the lesser weever (*E. vipera*). OTUs from birds and marine mammals taxa were sporadic.



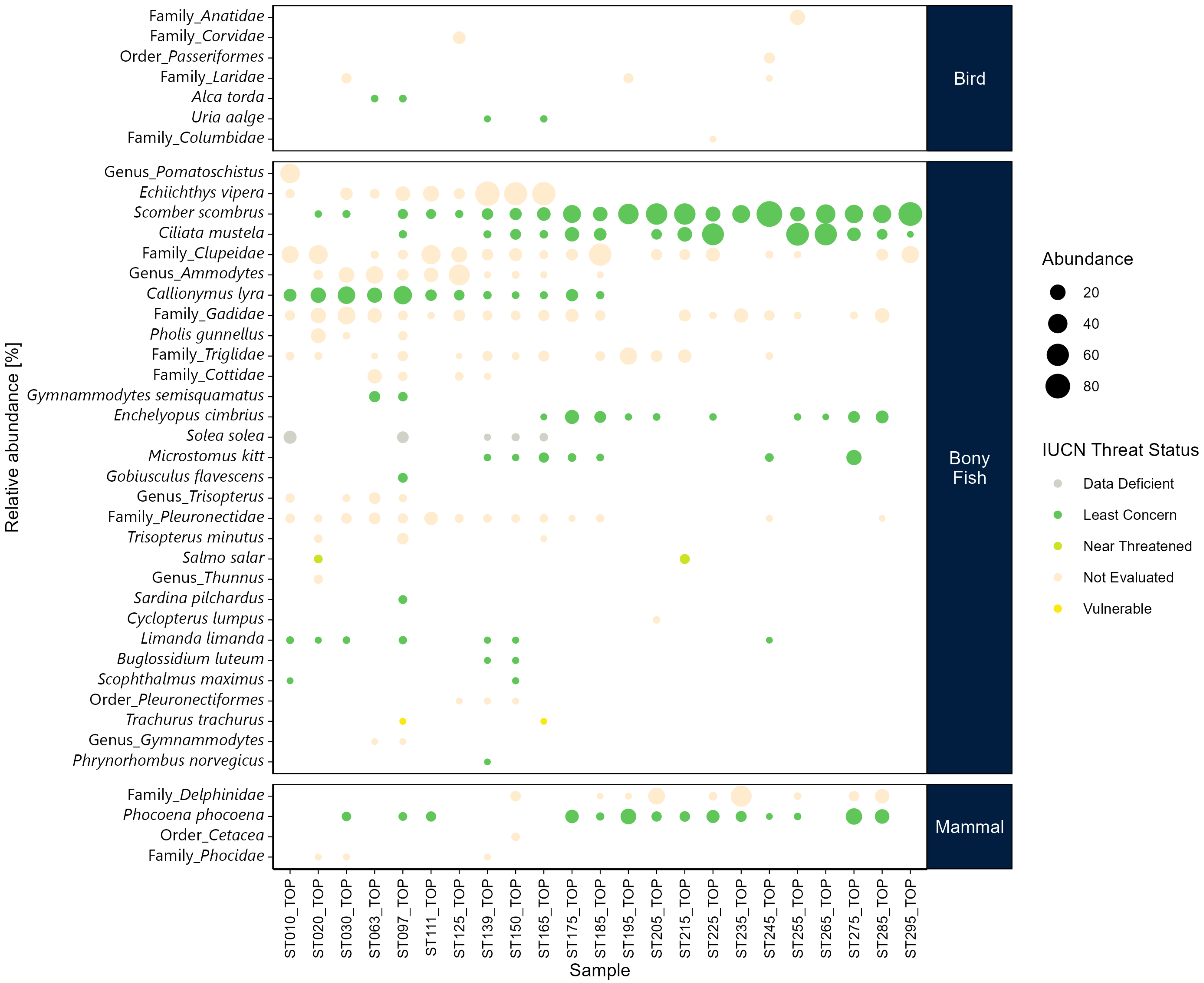
a)



b)

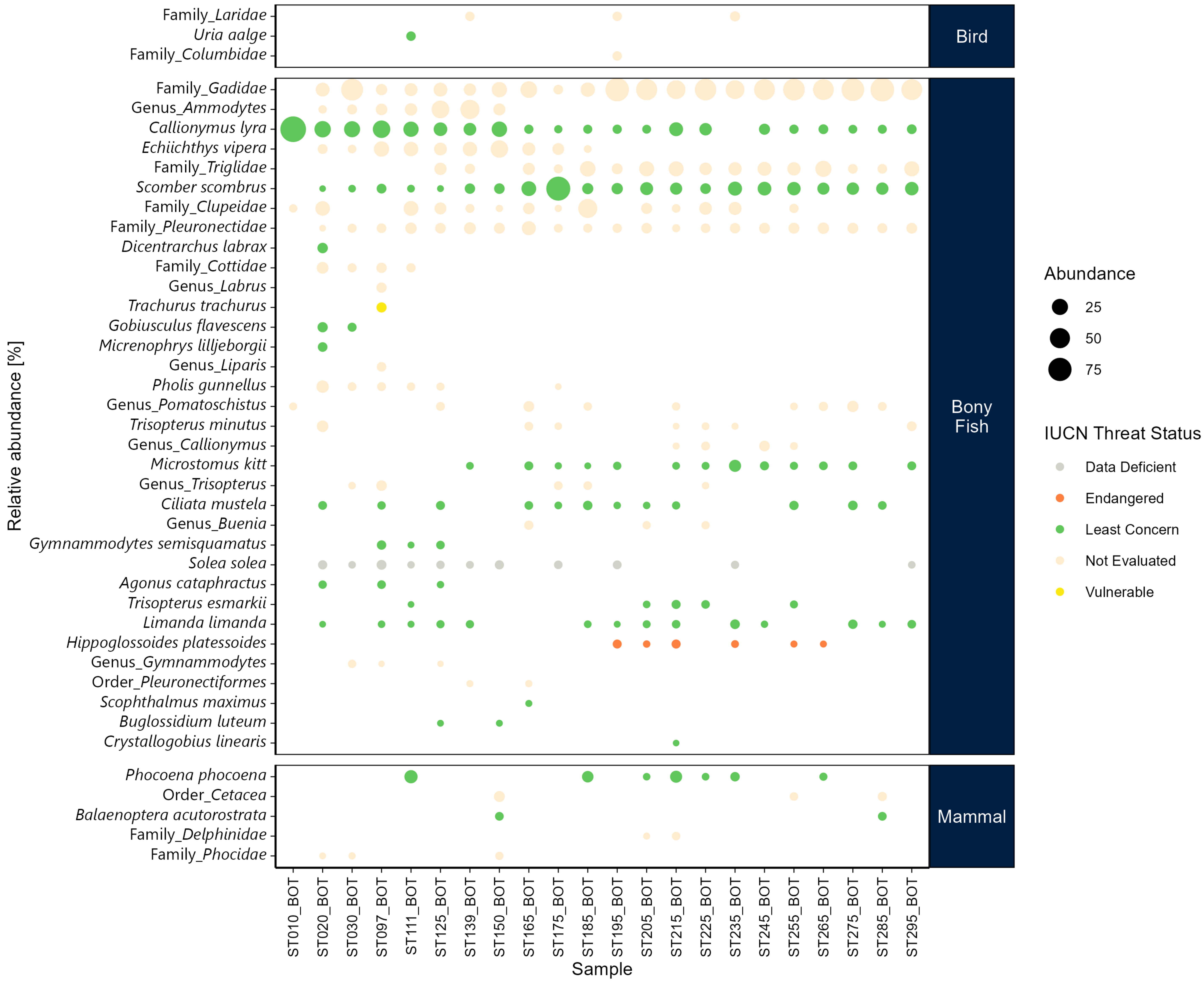
Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.6: Relative OTU counts of target vertebrate taxa detected to order level in (A) TOP and (B) BOT seawater samples



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.7: Taxonomic composition and proportion [%] of vertebrate OTUs within the TOP seawater eDNA samples



Notes

Non-target taxa were excluded from the plot

OTUs = Operation Taxonomic Units

Figure 10.8: Taxonomic composition and proportion [%] of vertebrate OTUs within the BOT seawater eDNA samples

10.3.2 Community Statistics

Figure 10.9 presents the total count of OTUs detected in each seawater sample, represented as species richness.

The alpha diversity ranged from 3 (sample ST010_BOT) to 22 (sample ST097_TOP), with a mean of 12. Of these, the OTUs being named at the species level ranged from 1 to 14 (Table 10.4). Across the survey area, the ED for fish eDNA ranged from 0.3 (sample ST265_TOP) to 1.96 (sample ST139_TOP).

Table 10.4: Water samples, vertebrate OTUs, eDNA community statistics

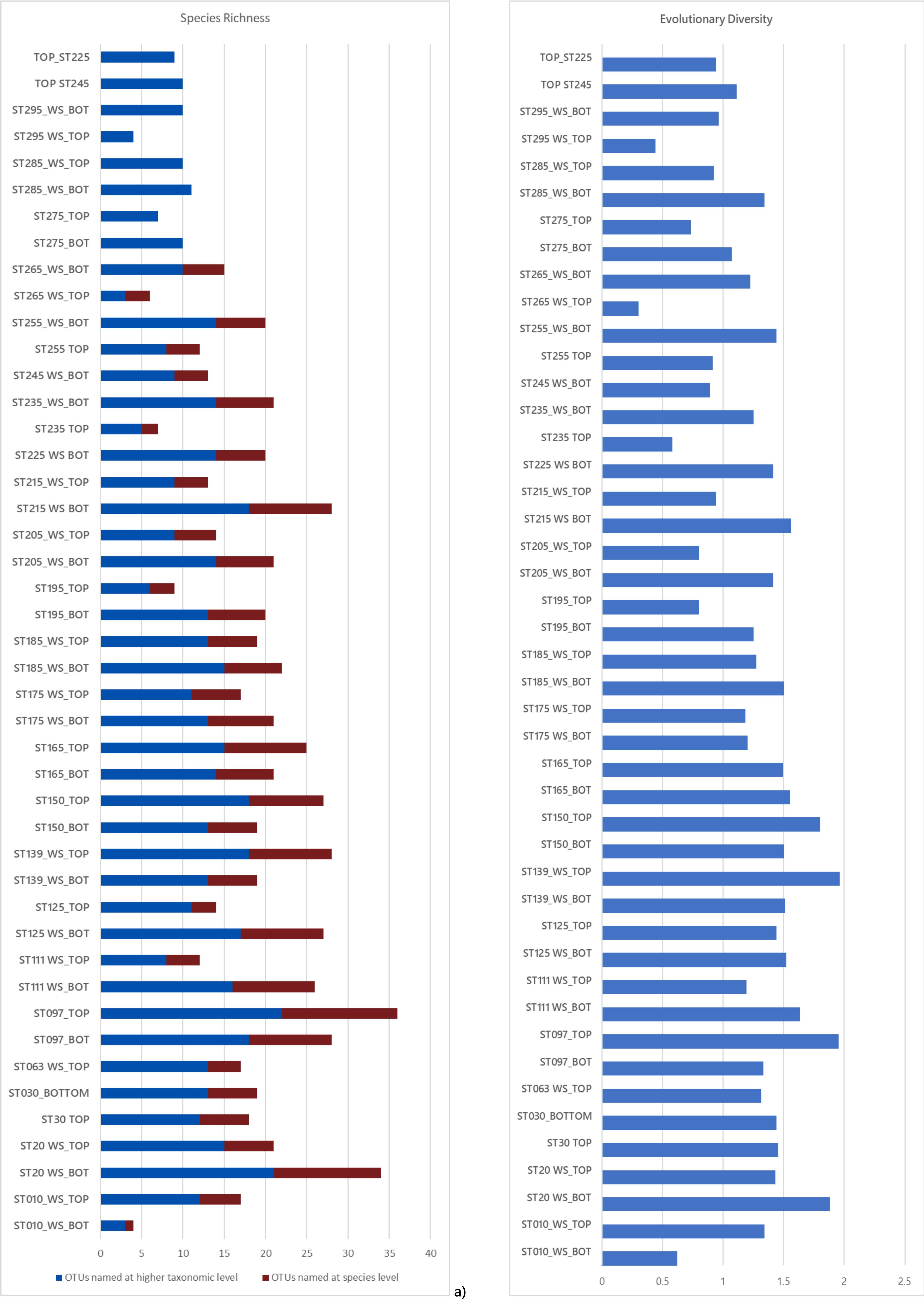
Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST010_BOT	3	1	0.62
ST010_TOP	12	5	1.34
ST020_BOT	21	13	1.88
ST020_TOP	15	6	1.43
ST030_TOP	12	6	1.45
ST030_BOT	13	6	1.44
ST063_TOP	13	4	1.31
ST097_BOT	18	10	1.33
ST097_TOP	22	14	1.95
ST111_BOT	16	10	1.63
ST111_TOP	8	4	1.19
ST125_BOT	17	10	1.52
ST125_TOP	11	3	1.44
ST139_BOT	13	6	1.51
ST139_TOP	18	10	1.96
ST150_BOT	13	6	1.5
ST150_TOP	18	9	1.8
ST165_BOT	14	7	1.55
ST165_TOP	15	10	1.49
ST175_BOT	13	8	1.2
ST175_TOP	11	6	1.18
ST185_BOT	15	7	1.5
ST185_TOP	13	6	1.27
ST195_BOT	13	7	1.25
ST195_TOP	6	3	0.8
ST205_BOT	14	7	1.41
ST205_TOP	9	5	0.8

Station	Species Richness (Number of OTUs)	Number of OTUs (Species level)	Evolutionary Diversity
ST215_BOT	18	10	1.56
ST215_TOP	9	4	0.94
ST225_BOT	14	6	1.41
ST235_TOP	5	2	0.58
ST235_BOT	14	7	1.25
ST245_BOT	9	4	0.89
ST255_TOP	8	4	0.91
ST255_BOT	14	6	1.44
ST265_TOP	3	3	0.3
ST265_BOT	10	5	1.22
ST275_BOT	10	5	1.07
ST275_TOP	7	5	0.73
ST285_BOT	11	5	1.34
ST285_TOP	10	4	0.92
ST295_TOP	4	2	0.44
ST295_BOT	10	6	0.96
ST245_TOP	10	4	1.11
ST225_TOP	9	4	0.94
Minimum	**3**	**1**	**0.3**
Maximum	**22**	**14**	**1.96**
Median	**13**	**6**	**1.31**
Mean	**12**	**6**	**1.24**
SD	**4.39**	**2.81**	**0.381**

Notes

OTU = Operational Taxonomic Unit

SD = Standard deviation



Notes
Non-target taxa were excluded from the plot
OTUs = Operation Taxonomic Units

Figure 10.9: Vertebrate Species Richness (A) and Evolutionary Diversity (B) of each seawater eDNA sample

11. Seafloor Habitats and Biotopes

The results of the photographic data analysis were reviewed in conjunction with the physical and biological characteristics of the groups identified through the multivariate analysis to provide a comprehensive habitat assessment.

The seafloor photographic data provide an overview of the seafloor over a wider area and can identify isolated features such as cobbles and/or boulders and associated epibiota. By comparison, grab sampling provides detailed information of the sediment composition and associated fauna at a single point source and is essential for the biotope classification of sedimentary habitats.

From photographic data, the seafloor observed across the survey area presented a variety of sediment types. Sandy gravel/gravelly sand with shell fragments was regularly noted, mainly with pebbles, cobbles and boulders in varying proportions. Small scale ripples were often observed, either of the main sediment, or as a sandier overlay over a coarser sediment. Within some of the coarser areas, the general appearance of the pebbles, cobbles and boulders suggested sediment consolidation and infrequently formed visibly raised and fragmented sections. Patches of boulder or soft bedrock outcrops were also observed. Additionally, extended areas of slightly muddy sand with small scale ripples were recorded, the mud fraction increasing in some areas to become a notably muddy sand seafloor.

From the analysis of the photographic data also anthropogenic features were noted. Pieces of cables or ropes were observed at four stations (ST060, ST067, ST084, and ST143), whilst other debris were observed at three stations, comprising a possible creel (ST028), an unidentified, possibly plastic, object (ST164) and a possible hammer (ST265). Appendix J.1.1 provides details and photographs of the debris found.

The logs including the results of the seafloor photographic data analysis including the SACFOR scale scores are presented in Appendix J.1. These have been reviewed with the results of the grab multivariate analysis to describe the epifaunal and infaunal biotopes and biotope complexes along the proposed cable routes. Four infaunal level 5 biotopes and six level 4 biotope complexes were assigned and are described in the sections below.

11.1 Habitats and Biotopes

Table 11.1 summarises all the habitats and biotopes described along the proposed cable route. Table 11.2 presents biological and physical components characterising each habitat and biotope described by photographic data only and, for some, PSD data. Table 11.3 describes biological and physical characteristics for those location where photographic PSD and macrofauna data were analysed. Figures 11.1 to 11.14 present the habitats map derived by the review of the geophysical data (section 5) in conjunction with the sediment, photographic and macrofauna data.

11.1.1 Faunal communities of full salinity Atlantic infralittoral sand (MB523)

The biotope complex 'Faunal communities of full salinity Atlantic infralittoral sand' (MB523) is described as clean sand or non-cohesive muddy sand (5 % to 20 % mud) habitat that occurs in shallow water, either on the open coast or in tide-swept channels of marine inlets. Clean sands typically lack a significant seaweed component and are characterised by robust fauna, particularly amphipods (*Bathyporeia* sp.) and robust polychaetes (e.g. *Nephtys cirrosa* and *Lanice conchilega*). Non-cohesive muddy sands support a variety of animal-dominated communities, particularly polychaetes (e.g. *Magelona mirabilis*, *Spiophanes bombyx* and *Chaetozone setosa*), bivalves (e.g. *Fabulina fabula* and *Chamelea gallina*) and the urchin *Echinocardium cordatum* (EEA, 2022).

From both the photographic and grab data analysis, this biotope complex was assigned to station ST002. This station was characterised by well sorted 'slightly gravelly sand' (Folk, 1954), 'medium sand' (Wentworth, 1922). The gravel content at this station was 0.45 % and that of fines was 0.54 %. This station was in water depth of 11.8 m BSL.

No epifauna was noted during the photographic data analysis. The only epifaunal taxon recorded from the grab sample at this station included species of the Ciliophora family Folliculinidae.

The analysis of the grab samples indicated that the infaunal community at this station included robust polychaetes such as *Nephtys cirrosa*, *Nephtys longosetosa*, *Ophelia borealis*, the shrimps *Gastrosaccus spinifer* and *Crangon crangon* and the bivalve *Ensis magnus*.

11.1.2 *Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211)

The biotope '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) is described by the tube-building polychaete *S. spinulosa* at high abundances on mixed sediment. The species typically appears as loose agglomerations of tubes forming a low lying matrix of sand, gravel, mud and tubes on the seabed. The infauna comprises typical sublittoral polychaete species such as *Protodorvillea kefersteini*, *Scoloplos armiger*, *Mediomastus fragilis* and *L conchilega,* together with the bivalve *Abra alba* and amphipods. The epifauna comprises a variety of bryozoans including *Flustra foliacea* and *Alcyonidium diaphanum*, in addition to calcareous tubeworms, hermit crabs and amphipods. The biotope is also associated with reefs formations which consolidate the sediment and allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infauna species (EEA, 2022).

From photographic data, this biotope was assigned to station ST011, which was characterised by mixed sediment comprising 'sandy gravel/gravelly sand', with shell fragments, pebbles, cobbles and patches of exposed clay. No grab samples were acquired at this station.

The fauna recorded at this location included Hydrozoa/Bryozoa turf which included Bryozoa, encrusting fauna, anemones, Echinodermata including starfish, Crustacea including Decapoda and Paguroidea, Mollusca including Gastropoda and Bivalvia and fish Osteichthyes. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

Raised *Sabellaria spinulosa* reef was evident at this station which was assessed for the presence of the protected habitat. Details are presented in Section 11.2.3 and Appendix J.3.

11.1.3 Faunal communities of Atlantic circalittoral coarse sediment (MC321)

The biotope complex 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) is described as circalittoral 'coarse sands', 'gravel' and 'shingle' generally in depths of over 15-20 m, found along exposed coasts and offshore. Robust infaunal polychaetes, mobile crustacea and bivalves are typically found within this habitat.

Photographic data described this biotope complex at 89 stations (Table 11.2). At 52 of these stations, the photographic data analysis was integrated with PSD data. The Folk (1954) sediment description for grab samples acquired at these stations varied to include 'gravelly muddy sand', 'muddy sandy gravel', 'sandy gravel' and 'gravel'. Water depths ranged from 10.8 m BSL to 41.7 m BSL.

From photographic data, the epifauna observed in this biotope complex included turf forms such as Hydrozoa/Bryozoa, low level mixed faunal turf, bryozoans *F. foliacea*, *Securiflustra securifrons* and *Alcyonium digitatum*, Porifera, anemones including *Metridium* and Octocorallia and seaweeds Rhodophyta, along with encrusting forms such as barnacles Cirripedia, algae Corallinaceae, gastropods *Crepidula fornicata*, colonial Ascidiacea including *Dendrodoa grossularia* and the polychaetes *L. conchilega* and *S. spinulosa*. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

The combined analysis of video, PSD and macrofauna data, where available, confirmed the presence of the biotope complex 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321). This biotope complex was assigned to 16 of the 17 macrofaunal grab stations of macrofaunal Group B (Table 8.3). These stations were characterised by very poorly sorted 'sandy gravel' (Folk, 1954), ranging from 'coarse sand' to 'pebble' (Wentworth, 1922) in mean water depth of 31.7 m BSL. The mean gravel content at these stations was 46.43 % and that of fines was 4.26 %.

Characterising taxa included the polychaetes *Syllis garciai*, *Spio armata*, *Glycera lapidum*, *Notomastus*, *Polycirrus*, *Mediomastus fragilis*, along with the bivalve *Timoclea. ovata*, the echinoderm *Echinocyamus pusillus* and the barnacle *Balanus crenatus*. This biotope complex described the infaunal communities of the stations located along the sections of the proposed cable routes within the Holderness Offshore MCZ.

Epibenthic fauna recorded from grab data analysis counted 71 taxa including Bryozoa, Cnidaria, Porifera and Chordata (Appendix J.1).

11.1.4 Faunal communities of Atlantic circalittoral mixed sediment (MC421)

The biotope complex 'Faunal communities of Atlantic circalittoral mixed sediment' (MC421) is described as mixed (heterogeneous) sediment habitats in depths generally below 15-20 m of well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones are often present in such habitat and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established (EEA, 2022).

The biotope complex was described at nine stations, three of which included PSD data (Table 11.2). From photographic data, the Folk (1954) sediment description at these stations was generally 'sandy mud/muddy sand' with gravel including pebbles, cobbles and boulders, with consolidated areas and patches of exposed clay. The Folk (1954) sediment description for grab samples acquired at these stations was 'gravelly muddy sand' or 'muddy sand'. Water depths ranged from 16.5 m BSL to 58.1 m BSL.

From photographic data, the epifauna observed in this biotope complex included Hydrozoa/Bryozoa turf, Echinodermata including Asteroidea, Echinoidea and Ophiuroidea, Crustacea including Decapoda and Paguroidea, Mollusca including Gastropoda and Bivalvia, anemones, colonial ascidians, encrusting fauna, and fish Osteichthyes. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

11.1.5 Faunal communities in Atlantic circalittoral sand (MC521)

The biotope complex 'Faunal communities of Atlantic circalittoral sand' (MC521) is described as non-cohesive muddy sands with a silt content of 5 % to 20 % supporting communities characterised by polychaetes, bivalves and echinoderms. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community (EEA, 2022).

The biotope complex was described at 89 stations (Table 11.2) At some stations, the grab data allowed to assign two level 5 biotopes (Table 11.3), which are described in the subsections below. From photographic data, the Folk (1954) sediment description at these stations was of two types, with some stations described as 'sandy mud/muddy sand' with shell fragments, small scale ripples and sparse cobbles at some stations, and 'gravelly sand/sandy gravel' with shell fragments, pebbles and sparse cobbles' at the remaining stations.

At 86 of these stations, the photographic data analysis was integrated with PSD data. The Folk (1954) sediment description for these stations varied. The majority of stations featured 'slightly gravelly sand'; however, 'gravelly muddy sand', 'muddy sandy gravel', 'gravelly sand,' 'gravel', 'sand' and 'slightly gravelly muddy sand' were also reported. Water depths ranged from 32.0 m BSL to 58.3 m BSL.

From photographic data, the fauna recorded at these stations included anemones, Echinodermata including starfish Asteroidea, urchins Echinoidea, brittlestar Ophiuroidea, Crustacea including crabs Decapoda, Mollusca including Gastropoda, Bivalvia and Pharidae, worms Polychaeta and fish Osteichthyes. At some of the offshore stations where the sediment was finer, the sea pen *Pennatula phosphorea* and those of the family Virgulariidae, as well as small faunal burrows occurred. Where the sediment allowed, Hydrozoa/Bryozoa turf were observes along with the polychaete *L. conchilega* and encrusting fauna. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

Based on bedrock outcrop observed at some stations, in some areas along the proposed cable route this biotope complex appears as an overlay to the habitat complex 'Atlantic circalittoral rock' (MC12).

11.1.5.1 *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand (MC5212)

The biotope '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' (MC5212) is described as circalittoral and offshore medium to fine sands in water depth of 25 m to 100 m, characterised by the bivalve *A. prismatica*, the amphipod *B. elegans* and polychaetes including *S. armiger* and *S. bombyx*. Opheliids including *O. borealis* and the brittlestar *A. filiformis* may also occur. This biotope has been reported in the central and northern North Sea (EEA, 2022).

This biotope was assigned to the 36 stations in the macrofaunal multivariate group A2. These stations were characterised by very poorly sorted to moderately well sorted 'sand' (Folk, 1954), largely 'fine sand' (Wentworth, 1922). The mean gravel content at these stations was 3.35 % and that of fines was 6.32 %. The stations were located at the mean water depth of 59.8 m BSL.

Characterising taxa included the bivalve *A. prismatica*, the amphipod *B. elegans*, the polychaetes *Spiophanes bombyx* (agg.), *Scoloplos armiger* and *L. conchilega*. The opheliid polychaete *O. borealis* and the brittlestar *A. filiformis* were also present. The abundance of *Abra prismatica* and *Bathyporeia elegans* is partially responsible for separating macrofaunal multivariate group A2 from the other multivariate groups identified (Figure 8.23).

Epibenthic fauna included Bryozoa and Cnidaria (Appendix G.1 and J.1).

11.1.5.2 *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214)

The biotope '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214) is described as non-cohesive 'muddy sands' or 'slightly shelly/gravelly muddy sand' characterised by the bivalves *A. alba* and *N. nitidosa*. Other important taxa include *Nephtys* spp., *Chaetozone setosa* and *S. bombyx*. The bivalve *Fabulina fabula* and the echinoderms *Ophiura albida* and *A. rubens* may also be present (EEA, 2022).

This biotope was assigned to the five stations in the macrofaunal multivariate group D. These stations were characterised by very poorly sorted 'muddy sandy gravel/gravelly muddy sand'

(Folk, 1954), ranging from 'medium sand' to 'coarse sand', 'granule' and 'pebbles' (Wentworth, 1922). The mean gravel content at these stations was 45.07 % and that of fines was 1.85 %. The stations were located at the mean water depth of 15.8 m BSL.

Characterising taxa included the bivalves *A. alba* and *N. nucleus*, along with the polychaetes *S. lamarcki, L. conchilega, S. spinulosa*, *C. zetlandica*, *Notomastus, Pholoe inornata* and *L.* cf. *cingulata*. The abundance of *Abra alba* and *Nucula nucleus* is partially responsible for separating macrofaunal multivariate group D from the other multivariate groups identified (Figure 8.23).

Epibenthic fauna counted 38 taxa including Bryozoa, Cnidaria, Porifera and Chordata (Appendix G.1 and J.1).

11.1.6 Faunal communities of Atlantic circalittoral mud (MC621)

The biotope complex 'Faunal communities of Atlantic circalittoral mud' (MC621) is described as sublittoral muds, occurring below moderate depths of 15-20 m on the open coast. Sea pens can characterise this habitat type together with burrowing anemones and ophiuroids.

Photographic data described this biotope complex only at station ST009. No sediment samples for physico chemical characteristics were collected at this station. The seabed was described as 'muddy sand/sandy mud' with shell fragments and areas of soft rock with piddock holes. No live piddocks were observed.

The station was impoverished of visible fauna. The epifauna observed included Hydrozoa/Bryozoa turf, hermit crabs Paguroidea and molluscs Gastropoda. The only fish observed belonged to the family Gobiidae. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

The potential presence of the sensitive habitat Sea pens and burrowing megafauna in circalittoral fine mud' (MC6216), assessed in section 11.2.2, also suggests that this biotope complex could occur around station ST231.

11.1.7 Faunal communities in Atlantic offshore circalittoral mixed sediment (MD421)

The biotope complex 'Faunal communities in Atlantic offshore circalittoral mixed sediment' (MD421) are described as offshore circalittoral habitats with slightly muddy mixed gravelly sand and stones or shell (EEA, 2022).

Photographic data described this biotope complex at stations ST218, ST270a and ST301 where the sediment was 'sandy mud/muddy sand' with shell fragments, gravel, pebbles, cobbles and boulders. No grab samples were acquired at these stations.

Characterising taxa included sea pen *Pennatula phosphorea*, anemones *Urticina* sp., starfish Asteroidea, including *C. papposus*, Goniasteridae, *Hippasteria phrygiana* and *Stichastrella* *rosea*, the urchin *E. esculentus*, brittlestar Ophiuroidea, crabs Decapoda and Paguroidea, the bivalve *Pecten maximus* and fish Osteichthyes.

Epifauna observed included Hydrozoa/Bryozoa turf, including *F. foliacea* and encrusting fauna, such as Porifera. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

11.1.8 Faunal communities in Atlantic offshore circalittoral sand (MD521)

The biotope complex 'Faunal communities in Atlantic offshore circalittoral sand' (MD521) is described as offshore circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf and is generally characterised by robust infaunal polychaete and bivalve species (EEA, 2022).

The biotope complex was described by the analysis of photographic and PSD data at 72 stations (Table 11.2). From photographic data the Folk (1954) sediment description at these stations was largely 'sandy mud/muddy sand', with small scale ripples and, at some stations, shell fragments, gravel, pebbles and sparse cobbles and boulders were also observed. At 66 of these stations the photographic data analysis was integrated with PSD data. The Folk (1954) sediment description for grab samples acquired at these stations varied, with the majority reported as 'slightly gravelly muddy sand' or 'slightly gravelly sand'; however, 'muddy sand', 'sand' and 'gravelly muddy sand' were also reported. Water depths ranged from 57.7 m BSL to 71.0 m BSL.

The sea pen *P. phosphorea* was often encountered on these grounds, with burrows of the Norway lobster *Nephrops norvegicus* and other megafauna, hermit crabs Paguroidea and flatfish of the order Pleuronectiformes reported to a lesser extent. Other taxa observed included anemones and starfish Asteroidea.

Epifaunal taxa observed included Hydrozoa/Bryozoa turf, Porifera and encrusting fauna. The taxa list is presented in Appendix J.1 along with their SACFOR abundances.

11.1.8.1 *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand (MD5212)

The biotope '*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand' (MD5212) is described as slightly muddy sand (generally < 20 % mud) in offshore waters, characterised by the tube building polychaete *O. fusiformis* often associated with the brittlestar *A. filiformis*. Other species often found in this community are the polychaetes *Goniada maculata*, *Diplocirrus glaucus* and *S. kroyeri* and bivalves such as *T. ovata* and *Thyasira* (EEA, 2022).

This biotope was assigned to the 37 stations in the macrofaunal multivariate group A1. These stations were characterised by poorly sorted 'muddy sand' (Folk, 1954), largely 'fine sand' with 'very fine sand' (Wentworth, 1922). The mean gravel content at these stations was 0.70 %

and that of fines was 13.92 %. The stations were located at the mean water depth of 74.8 m BSL.

Characterising taxa included the polychaetes *G. oculata*, *A. falcata*, *S. armiger*, *S. kroyeri*, *S. limicola* and the genus *Terebellide*s, along with the echinoderm *A. filiformis*, the bivalve *P. minimum*, the amphipod *Harpinia antennaria* and species of the genus *Phoronis*. The abundance of *Owenia* and *Amphiura filiformis* is partially responsible for separating macrofaunal multivariate group A1 from the other multivariate groups identified (Figure 8.23).

Epibenthic fauna included Bryozoa and Cnidaria (Appendix G.1 and J.1).

Table 11.1: All EUNIS (EEA, 2022) habitat types described along the proposed cable route with the JNCC equivalent

EUNIS (EEA, 2022) Habitat Classification					Equivalent JNCC (2022) Classification
Habitat Group Level 1	Biological Zone and Substrate Level 2	Biogeographical Marine Region Level 3	Biotope Complex Level 4	Biotopes Level 5	
M Marine benthic habitats	MB5 Infralittoral sand	MB52 Atlantic Infralittoral sand	MB523 Faunal communities in full salinity Atlantic infralittoral sand	–	SS.SSa.IFiSa Infralittoral fine sand
	MC1 Circalittoral rock	MC12 Atlantic circalittoral rock	–	–	CR Circalittoral rock
	MC2 Circalittoral biogenic habitat	MC22 Atlantic circalittoral biogenic habitat	MC221 Worm reefs in the Atlantic circalittoral zone	MC2211 *Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment	SS.SBR.PoR.SspiMx *Sabellaria spinulosa* on stable circalittoral mixed sediment
	MC3 Circalittoral coarse sediment	MC32 Atlantic circalittoral coarse sediment	MC321 Faunal communities of Atlantic circalittoral coarse sediment	–	SS.SCS.CCS Circalittoral coarse sediment
	MC4 Circalittoral mixed sediment	MC42 Atlantic circalittoral mixed sediment	MC421 Faunal communities of Atlantic circalittoral mixed sediment	–	SS.SMx.CMx Circalittoral mixed sediment
	MC5 Circalittoral sand	MC52 Atlantic circalittoral sand	MC521 Faunal communities in Atlantic circalittoral sand	–	SS.SSa.CFiSa Circalittoral fine sand
				MC5212 *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand	SS.SSa.CFiSa.ApriBatPo *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand
				MC5214 *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment’	S.SSa.CMuSa.AalbNuc *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment
	MC6 Circalittoral mud	MC62 Atlantic circalittoral mud	MC621 Faunal communities of Atlantic circalittoral mud	–	SS.SMu.OMu Offshore circalittoral mud
	MD4 Offshore circalittoral mixed sediment	MD42 Atlantic offshore circalittoral mixed sediment	MD421 Faunal communities in Atlantic offshore circalittoral mixed sediment	–	SS.SMx.OMx Offshore circalittoral mixed sediment
	MD5 Offshore circalittoral sand	MD52 Atlantic Offshore cicalittoral sand	MD521 Faunal communities in Atlantic offshore circalittoral sand	MD5212 *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand	SS.SSa.OSa.OfusAfil *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand

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

Table 11.2: EUNIS (EEA, 2022) Habitat types described by photographic and particle size distribution data only along the proposed cable route

Distribution		Physical Characteristics		Depth [m BSL]	Representative Photograph(s)
EUNIS Habitat Classification (EEA, 2022)	DDV Stations	Photographic Observations Folk (1954)* with Descriptors	Particle Size Distribution Folk (1954)*		
MC2211 *Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment	ST011	Mixed sediment (sandy gravel/gravelly sand with shell fragments, pebbles, cobbles and boulders with patches of clay or soft sediment deposits). Raised *Sabellaria spinulosa* reef	-	18.4	 269605_ST011_30
MC321 Faunal communities of Atlantic circalittoral coarse sediment	ST012, ST018a, ST024, ST031, ST034, ST035, ST037, ST038, ST040, ST042, ST044, ST046, ST048, ST050, ST052, ST054, ST056, ST058, ST060, ST062, ST064, ST066, ST068, ST070, ST073, ST093, ST095, ST098, ST099, ST100, ST101, ST102, ST104, ST106, ST108, ST115a, ST122	Mixed sediment (sandy gravel/gravelly sand with shell fragments, pebbles, cobbles, boulders)	-	10.8 m – 41.7 m BSL	 269605_ST036_06
	ST001, ST013, ST015, ST019/ST019a, ST21/ST021a, ST022/ST022a, ST023/ST023a, ST025, ST026, ST027, ST028, ST029, ST030/ST030b, ST032, ST033, ST036, ST039, ST041, ST043, ST045, ST047, ST049, ST051, ST053, ST055, ST057, ST059, ST061, ST063, ST065, ST067, ST069, ST071, ST074, ST079, ST082, ST087, ST094, ST096, ST097, ST103, ST105, ST107, ST109, ST110, ST111, ST112, ST113, ST114, ST118, ST119, ST126	Gravelly sandy mud/muddy sand with shell fragments, pebbles and sparse cobbles and boulders Sandy gravel with shell fragments, pebbles and sparse cobbles and boulders	Gravel Gravelly muddy sand Gravelly sand Muddy sandy gravel Sandy gravel		
MC421 Faunal communities of Atlantic circalittoral mixed sediment	ST011, ST014, ST016, ST017, ST072, ST084, ST157	Gravelly sand/sandy gravel with shell fragments, pebbles, and sparse cobbles and boulders	-	16.5 m - 58.1 m BSL	 269605_ST058_06
	ST003, ST005, ST006a, ST008, ST071	Mixed sediment (sandy mud/muddy sand with pebbles, cobbles, sparse boulders, consolidated areas and patches of exposed clay)	Gravelly mud Gravelly muddy sand		

Distribution		Physical Characteristics		Depth [m BSL]	Representative Photograph(s)
		Photographic Observations	Particle Size Distribution		
EUNIS Habitat Classification (EEA, 2022)	DDV Stations	Folk (1954)* with Descriptors	Folk (1954)*		
MC521 Faunal communities of Atlantic circalittoral sand	ST003, ST004, ST006a, ST007, ST010, ST020, ST078, ST081, ST085, ST088, ST089, ST090, ST091, ST092, ST117, ST121, ST123, ST124, ST125, ST127, ST129, ST130, ST132, ST136, ST138, ST139, ST140, ST143, ST146, ST147, ST148, ST149, ST150/ST150a, ST151, ST152, ST154, ST156, ST158, ST159, ST160, ST161, ST162, ST163, ST164, ST165/ST165a, ST166, ST167, ST168, ST170, ST171, ST172, ST173, ST174a, ST175/ST175a, ST176, ST177, ST178, ST179, ST180, ST181, ST182, ST183, ST184, ST185, ST186, ST187, ST188, ST189, ST190, ST191, ST192, ST193/ST193a, ST194, ST195, ST196, ST197, ST198, ST199, ST200, ST201, ST289, ST291, ST293, ST295a, ST297, ST299	Sand with shell fragments	Sand Slightly gravelly sand Gravelly sand Slightly gravelly muddy sand Gravelly muddy sand Gravel, Muddy sandy gravel	32.0 m – 58.3 m BSL	 269605_ST148_09
MC621 Faunal communities of Atlantic circalittoral mud	ST009	Muddy sand/sandy mud with shell fragments and areas of soft rock with piddock holes	-	16.4 m BSL	 269605_ST009_27
MD421 Faunal communities in Atlantic offshore circalittoral mixed sediment	ST218, ST270a, ST301	Sandy mud/muddy sand with shell fragments, gravel, pebbles, cobbles and sparse boulders	-	70.4 m – 76.3 m BSL	 269605_ST301_07

<table>
<tr><th colspan="2">Distribution</th><th colspan="2">Physical Characteristics</th><th rowspan="3">Depth
[m BSL]</th><th rowspan="3">Representative Photograph(s)</th></tr>
<tr><th rowspan="2">EUNIS Habitat Classification (EEA, 2022)</th><th rowspan="2">DDV Stations</th><th>Photographic Observations</th><th>Particle Size Distribution</th></tr>
<tr><th>Folk (1954)* with Descriptors</th><th>Folk (1954)*</th></tr>
<tr><td rowspan="2">MD521
Faunal communities in Atlantic offshore circalittoral sand</td><td>ST218, ST228, ST247, ST258, ST280, ST290</td><td>Sandy mud/muddy sand with shell fragments and small scale ripples</td><td>-</td><td rowspan="2">57.7 m 71 m BSL</td><td rowspan="2">
269605_ST264_08</td></tr>
<tr><td>ST128, ST133, ST169, ST171, ST202, ST203, ST204, ST205, ST206, ST207, ST208, ST209, ST210, ST211, ST212, ST213, ST214, ST215, ST217, ST219, ST221, ST223, ST225, ST227, ST229, ST231, ST233, ST235, ST236, ST237, ST238, ST239, ST240, ST241, ST242, ST243, ST244, ST245, ST246a, ST248, ST249, ST250, ST251, ST252, ST253, ST254, ST255, ST256a, ST257, ST259, ST260, ST261, ST262, ST263, ST264, ST265, ST267, ST269, ST271, ST273, ST275, ST277a, ST279, ST281, ST283, ST285, ST287</td><td>Sandy mud/muddy sand with shell fragments, sparse cobbles and boulders, and small scale ripples</td><td>Slightly gravelly muddy sand
Muddy sand
Gravelly muddy sand
Sand
Slightly gravelly sand</td></tr>
</table>

Notes:
EUNIS = European Nature Information System EEA = European Environment Agency EEA = European Environment Agency
* = Folk (1954) sediment description defined by the proportions of the gravel, sand and mud fractions

Table 11.3: Additional EUNIS (EEA, 2022) habitat types described from photographic, PSD and macrofaunal grab data analysis combined

Distribution		Physical Characteristics		Biological Characteristics			Representative Photograph(s)
EUNIS Habitat Classification (EEA, 2022)	Stations	Photographic Observations Folk (1954)* with Descriptors	Particle Size Distribution Folk (1954)*	Depth [m BSL]	Macrofauna Cluster	Top 10 Characterising Taxa	
MB523 Faunal communities in full salinity Atlantic infralittoral coarse sediment	ST002	Slightly gravelly sand	Slightly gravelly Sand	11.8 m BSL	ST002	*Nephtys cirrosa* *Nephtys longosetosa* *Ophelia borealis* *Gastrosaccus spinifer* *Crangon crangon* *Ensis magnus* - - - -	 269605_ST002_09
MC321 Faunal communities of Atlantic circalittoral coarse sediment	ST026, ST028, ST030b, ST033, ST039, ST043, ST047, ST051, ST055, ST059, ST063, ST067, ST071, ST097, ST105, ST111, ST118	Gravelly sand/sandy gravel with shell fragments, pebbles, cobbles and sparse boulders	Sandy gravel Muddy sandy gravel Gravelly muddy sand Gravelly sand	18.4 m- 49.6 m BSL	Group B	*Polycirrus* *Syllis garciai* *Balanus crenatus* *Timoclea ovata* *Echinocyamus pusillus* *Spio armata* *Glycera lapidum* *Notomastus* Nemertea *Mediomastus fragilis*	 269605_ST063_24
MC5212 *Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand	ST081, ST090, ST121, ST123, ST125, ST139, ST147, ST150, ST154, ST158, ST161, ST163, ST165, ST167, ST171, ST173, ST175, ST177, ST179, ST181, ST183, ST185, ST187, ST189, ST191, ST193, ST195, ST197, ST199, ST201, ST289, ST291, ST293, ST295, ST297, ST299	Sandy mud/muddy sand with shell fragments, sparse cobbles and small scale ripples Gravelly sand/sandy gravel with shell fragments, pebbles and sparse cobbles	Gravelly muddy sand Gravelly sand Slightly gravelly sand Sand	40.5 m to 75.1 m BSL	Group A2	*Spiophanes bombyx* *Scoloplos armiger* *Lanice conchilega* *Galathowenia oculata* *Bathyporeia elegans* *Phaxas pellucidus* *Goniada maculata* *Sthenelais limicola* *Abra prismatica*	 269605_ST167_05

Distribution		Physical Characteristics		Biological Characteristics			Representative Photograph(s)
EUNIS Habitat Classification (EEA, 2022)	Stations	Photographic Observations Folk (1954)* with Descriptors	Particle Size Distribution Folk (1954)*	Depth [m BSL]	Macrofauna Cluster	Top 10 Characterising Taxa	
MC5214 *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment'	ST004, ST006a, ST007, ST010, ST020	Gravelly sandy mud/muddy sand with shell fragments, pebbles and cobbles Sandy gravel with shell fragments, pebbles, cobbles and sparse boulders	Muddy sandy gravel Gravelly muddy sand Gravel	10.7 m to 19.2 m BSL	Group D ▼	*Abra alba* *Spirobranchus lamarcki* *Nucula nucleus* *Lanice conchilega* Nemertea *Sabellaria spinulosa* *Chaetozone zetlandica* *Notomastus* *Pholoe inornata* *Lumbrineris cf. cingulata*	 269605_ST007_12
MD521 Faunal communities in Atlantic offshore circalittoral sand	ST128, ST133, ST169, ST243, ST255, ST283, ST285, ST287	Sandy mud/muddy sand with shell fragments and small scale ripples	Slightly gravelly sand Sand	44.6 m to 77.8 m BSL	Group C ●	*Echinocyamus pusillus* *Bathyporeia elegans* *Antalis* *Scoloplos armiger* *Nephtys longosetosa* Nemertea *Ophelia borealis* Edwardsiidae CERIANTHARIA *Galathowenia oculata*	 269605_ST255_18
MD5212 *Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand	ST203, ST205, ST207, ST209, ST211, ST213, ST215, ST217, ST219, ST221, ST223, ST225, ST227, ST229, ST231, ST233, ST235, ST237, ST239, ST241, ST245, ST249, ST251, ST253, ST257, ST259, ST261, ST263, ST265, ST267, ST269, ST271, ST273, ST275, ST277, ST279, ST281	Sandy mud/muddy sand with shell fragments	Muddy sand Slightly gravelly muddy sand Slightly gravelly sand Sand	68.2 m to 88.4 m BSL	Group A1 +	*Galathowenia oculata* *Ampharete falcata* *Scoloplos armiger* *Phoronis* *Amphiura filiformis* *Spiophanes kroyeri* *Terebellides* *Harpinia antennaria* *Papillicardium minimum* *Sthenelais limicola*	 269605_ST233_06
EUNIS (EEA, 2022)							

Notes:
EUNIS = European Nature Information System EEA = European Environment Agency EMODnet = European Marine Observation and Data Network
* = Folk (1954) sediment description defined by the proportions of the gravel, sand and mud fractions

Key to Phyla	Annelida	Arthropoda	Mollusca	Echinodermata	Other phyla

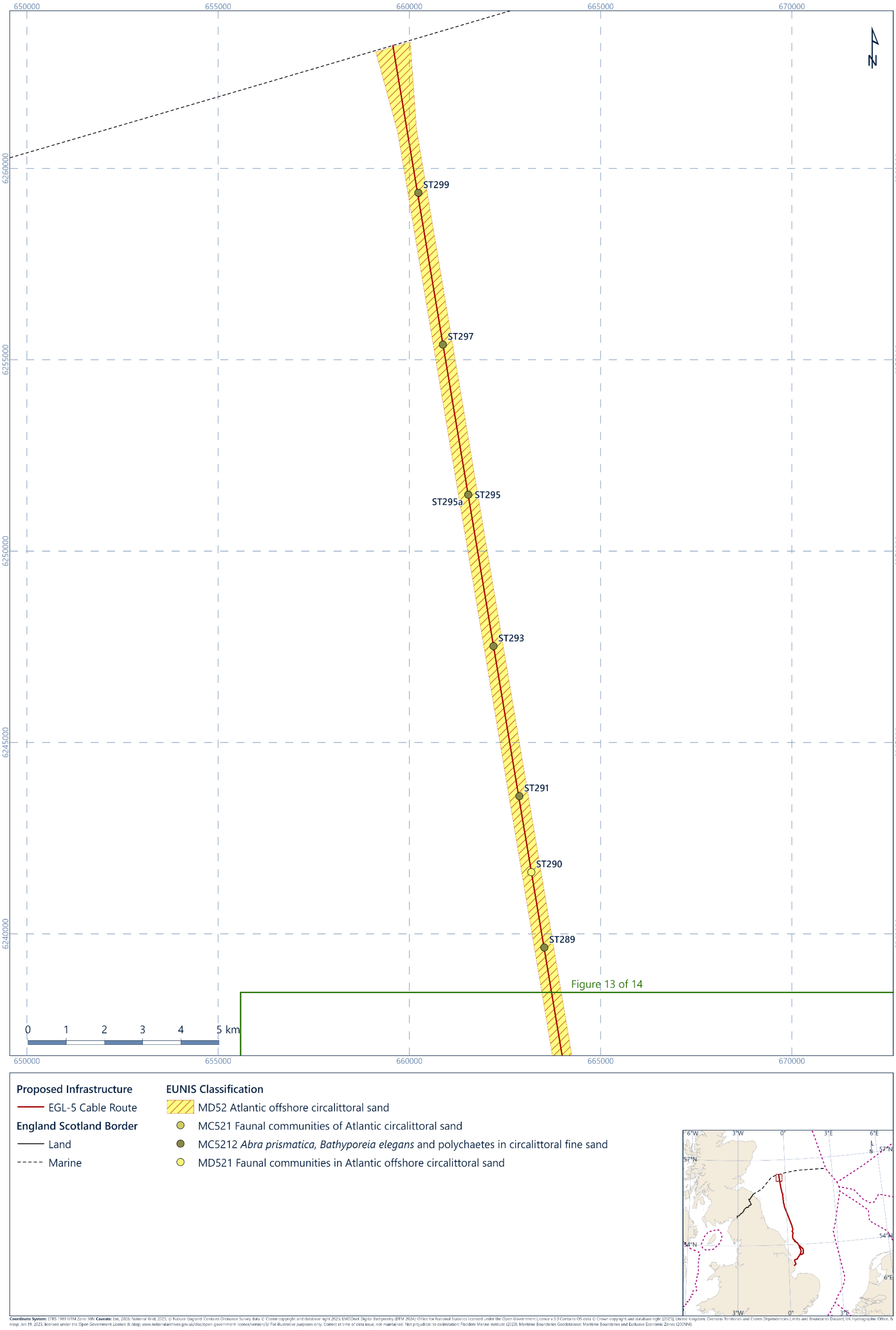


Figure 11.1: Biotopes map along the proposed cable route, station ST289 to station ST299

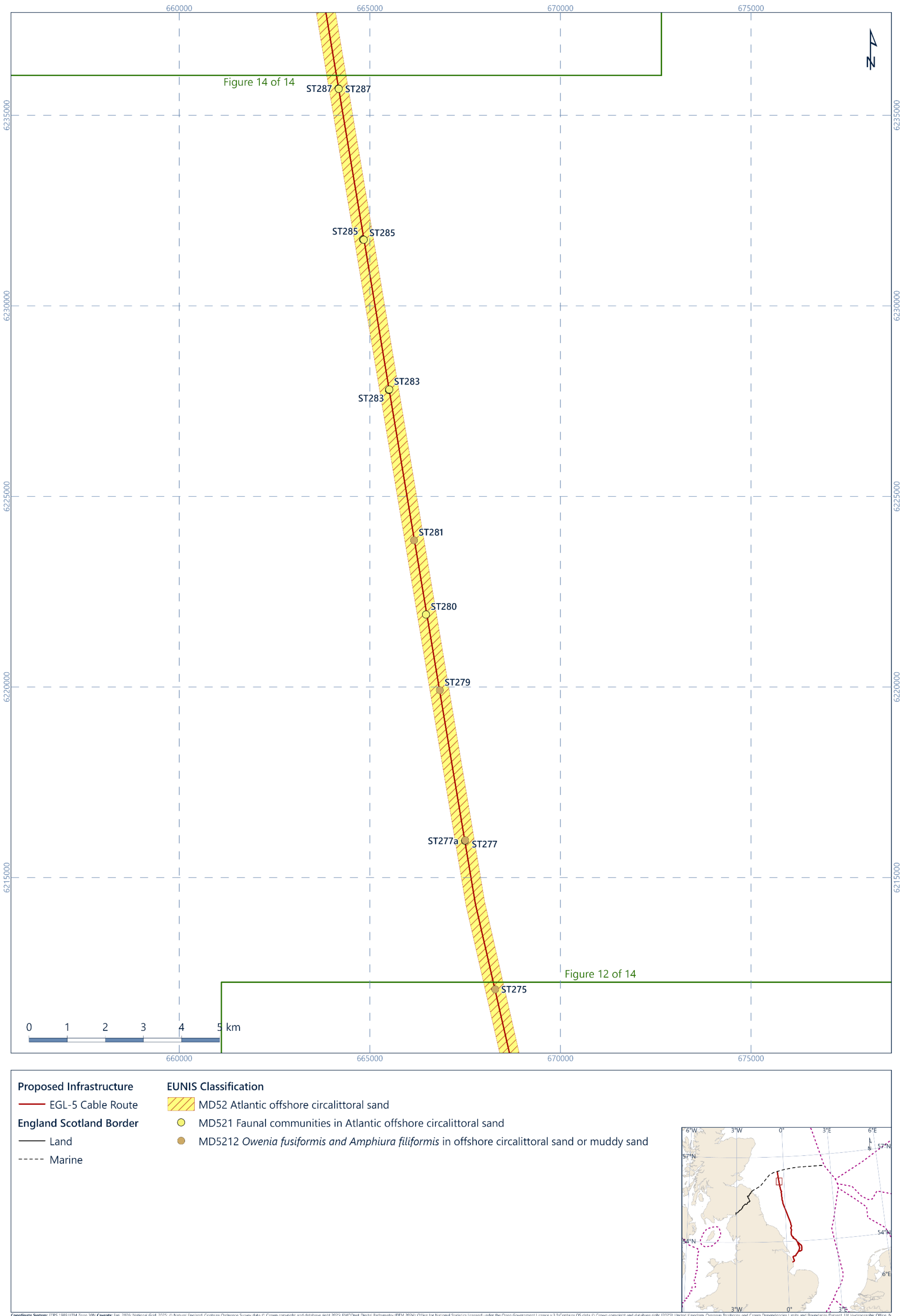


Figure 11.2: Biotopes map along the proposed cable routes, station ST275 to station ST287

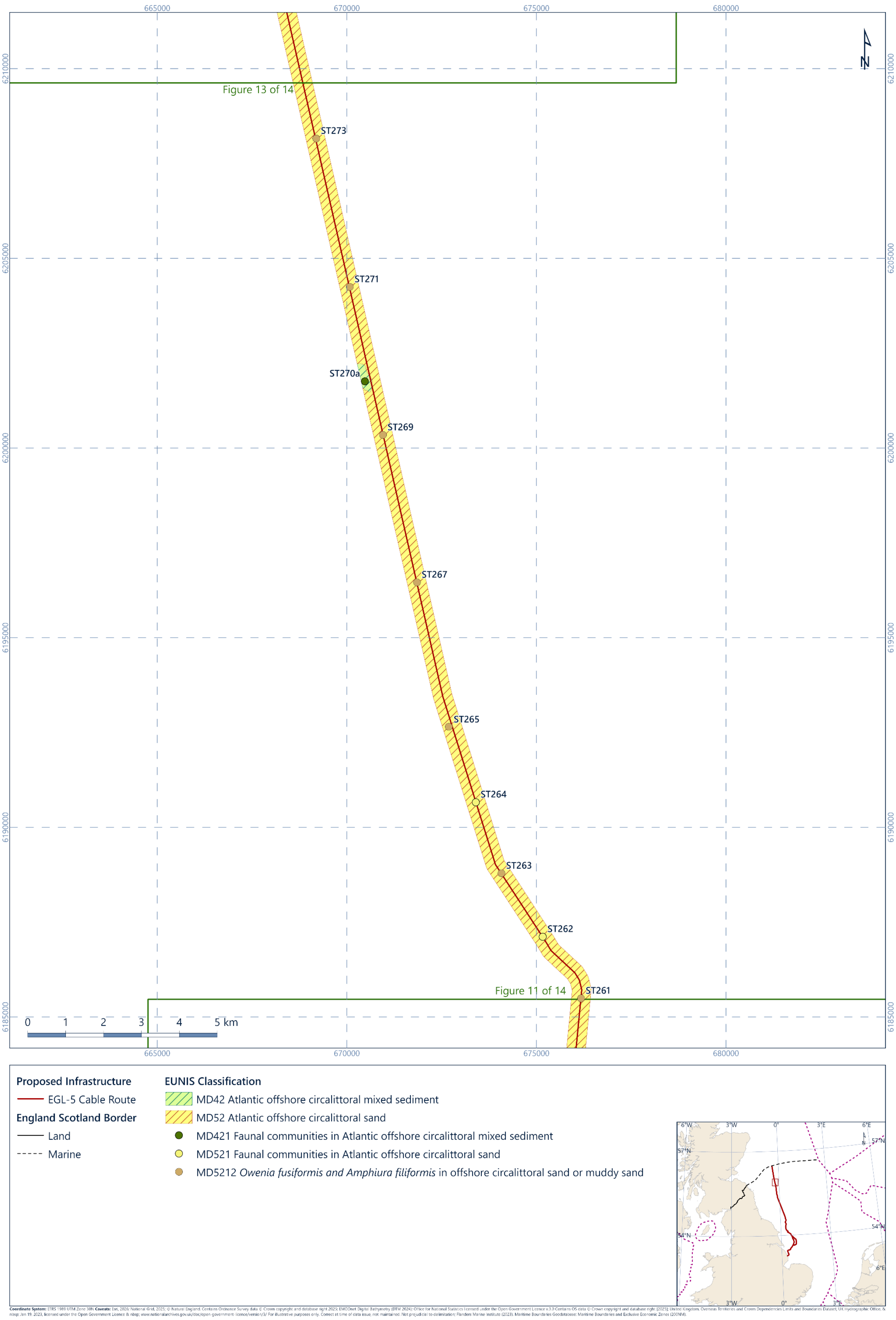


Figure 11.3: Biotopes map along the proposed cable route, station ST261 to station ST273

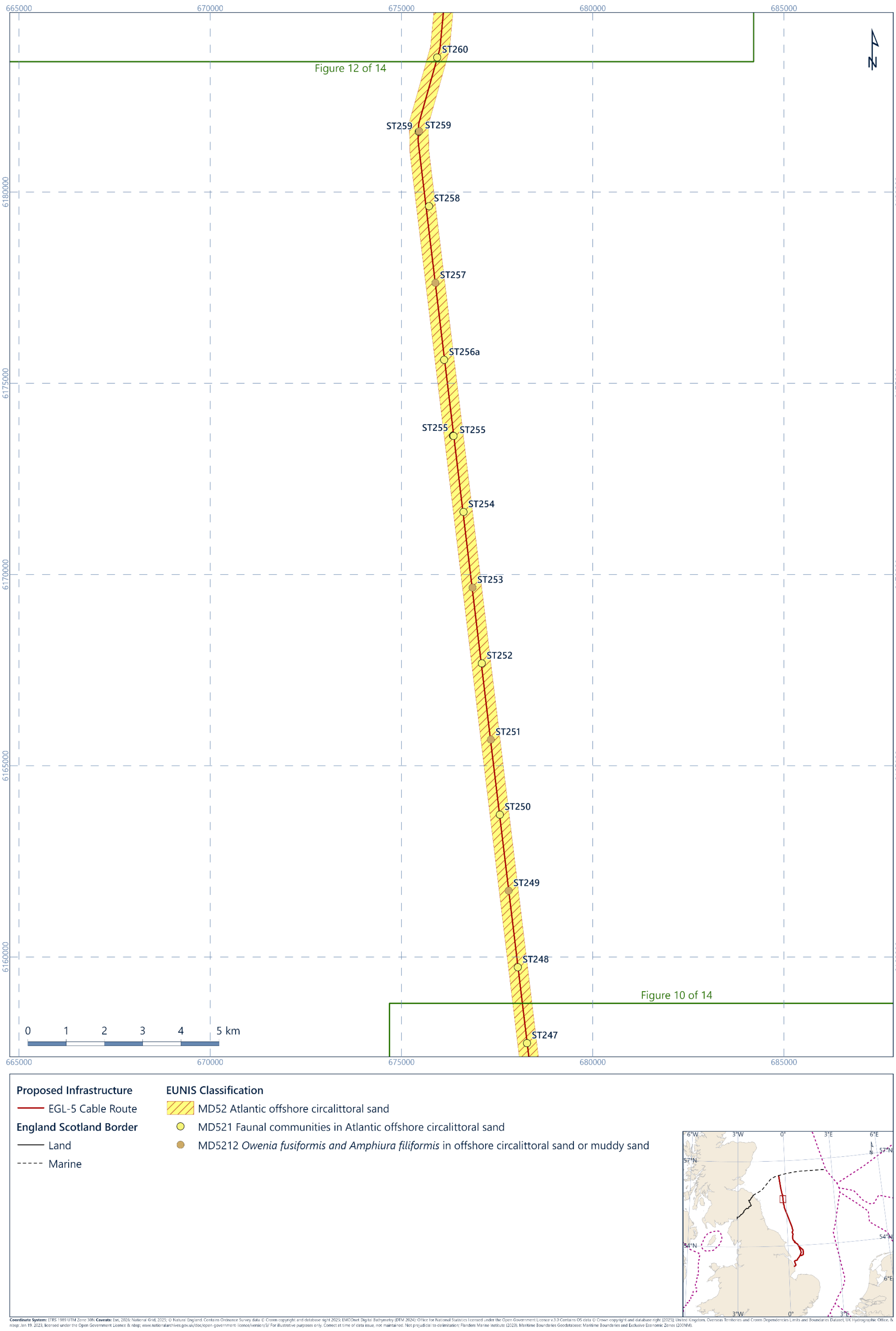


Figure 11.4: Biotopes map along the proposed cable route, station ST247 to station ST260

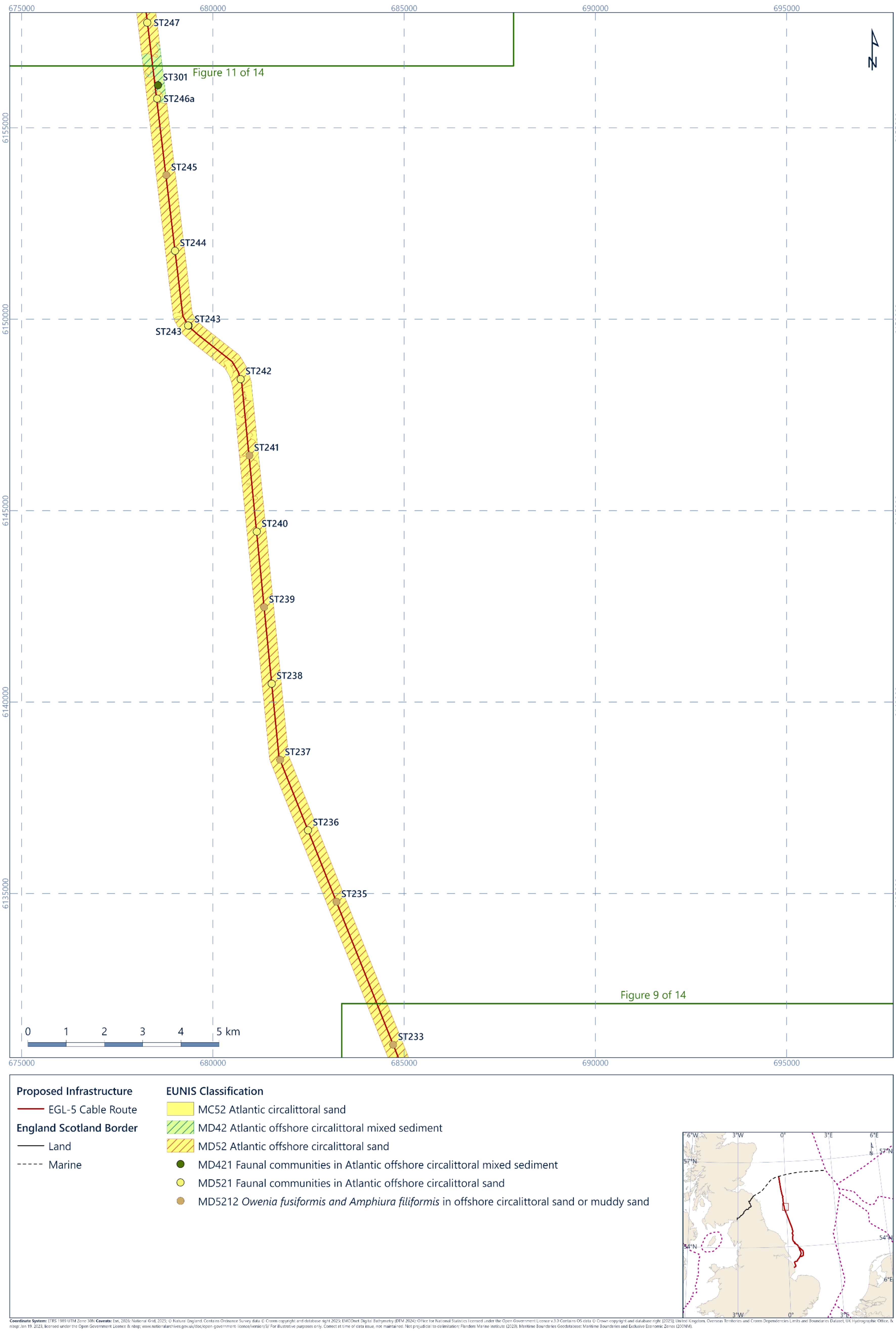


Figure 11.5: Biotopes map along the proposed cable route, station ST233 to station ST247

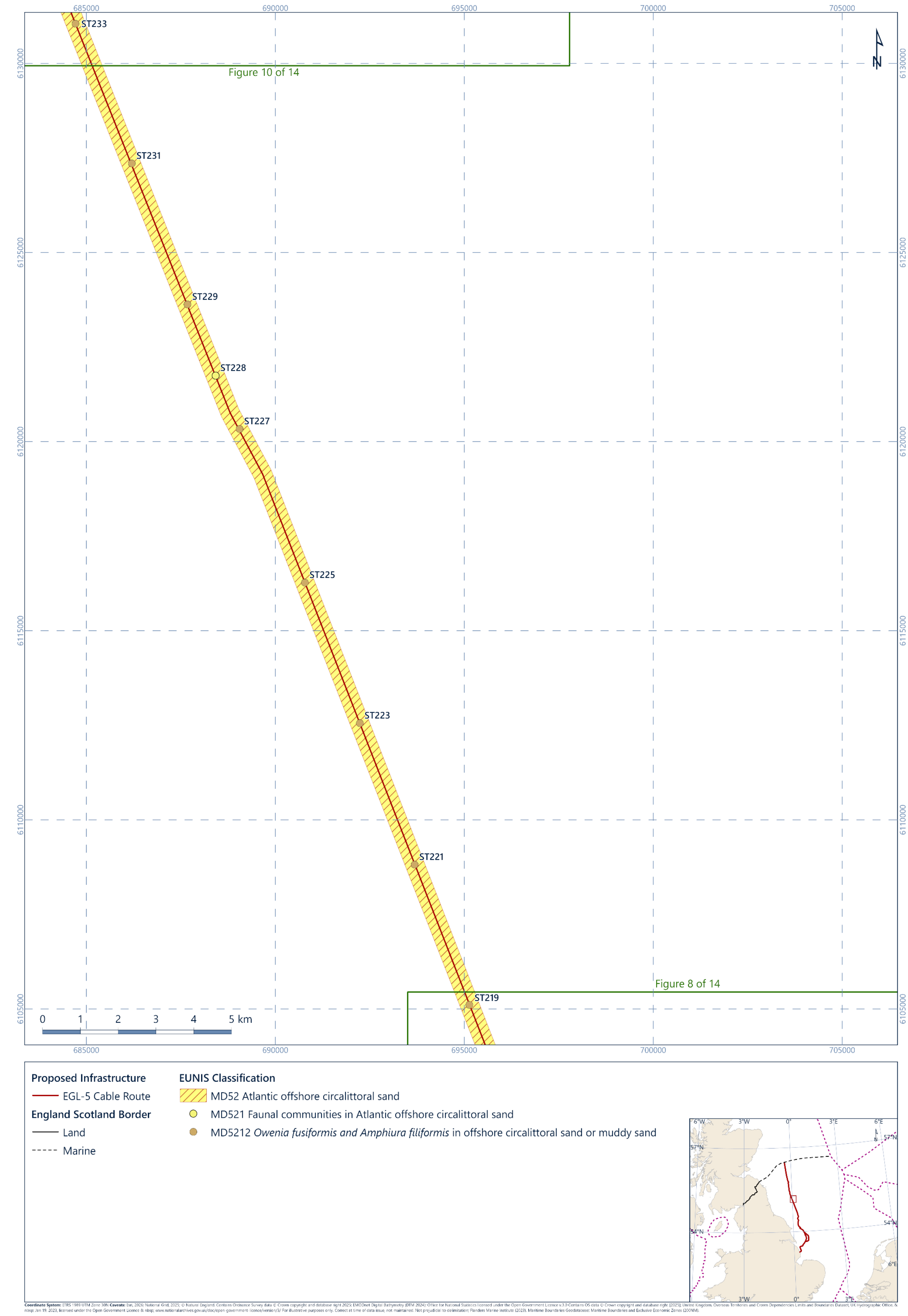


Figure 11.6: Biotopes map along the proposed cable route, station ST219 to station ST233

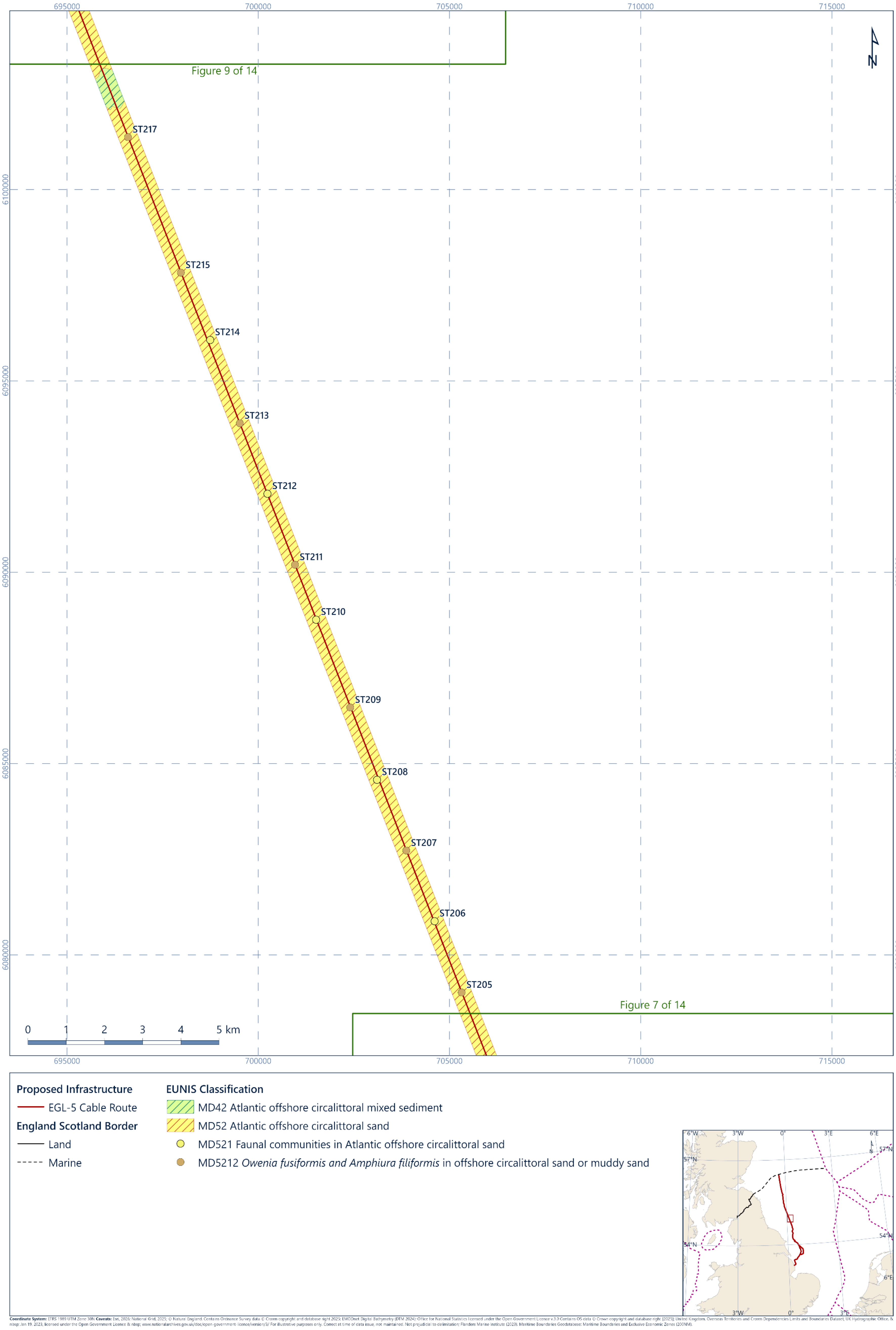


Figure 11.7: Biotopes map along the proposed cable route, station ST205 to station ST217

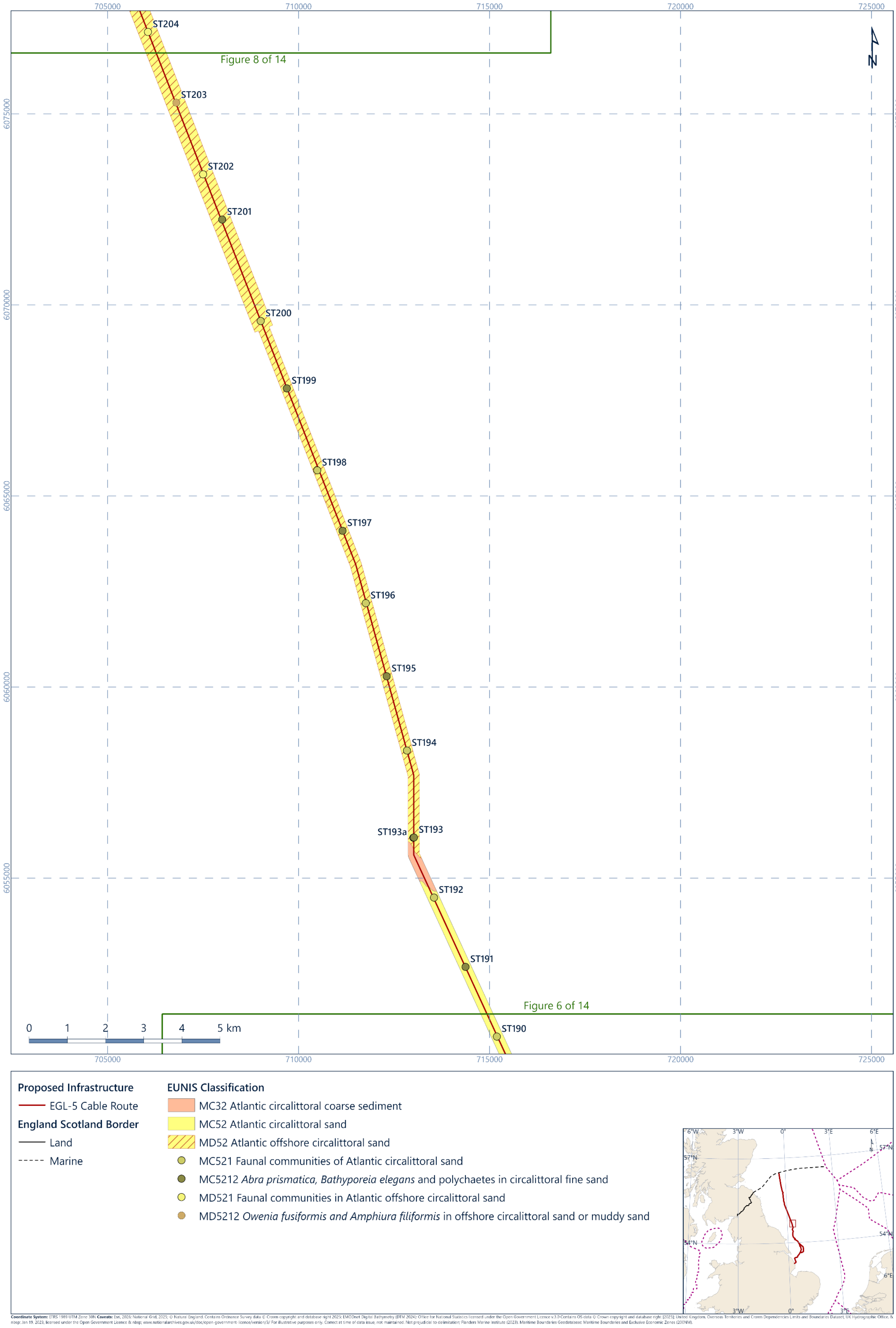


Figure 11.8: Biotopes map along the proposed cable route, station ST190 to station ST204

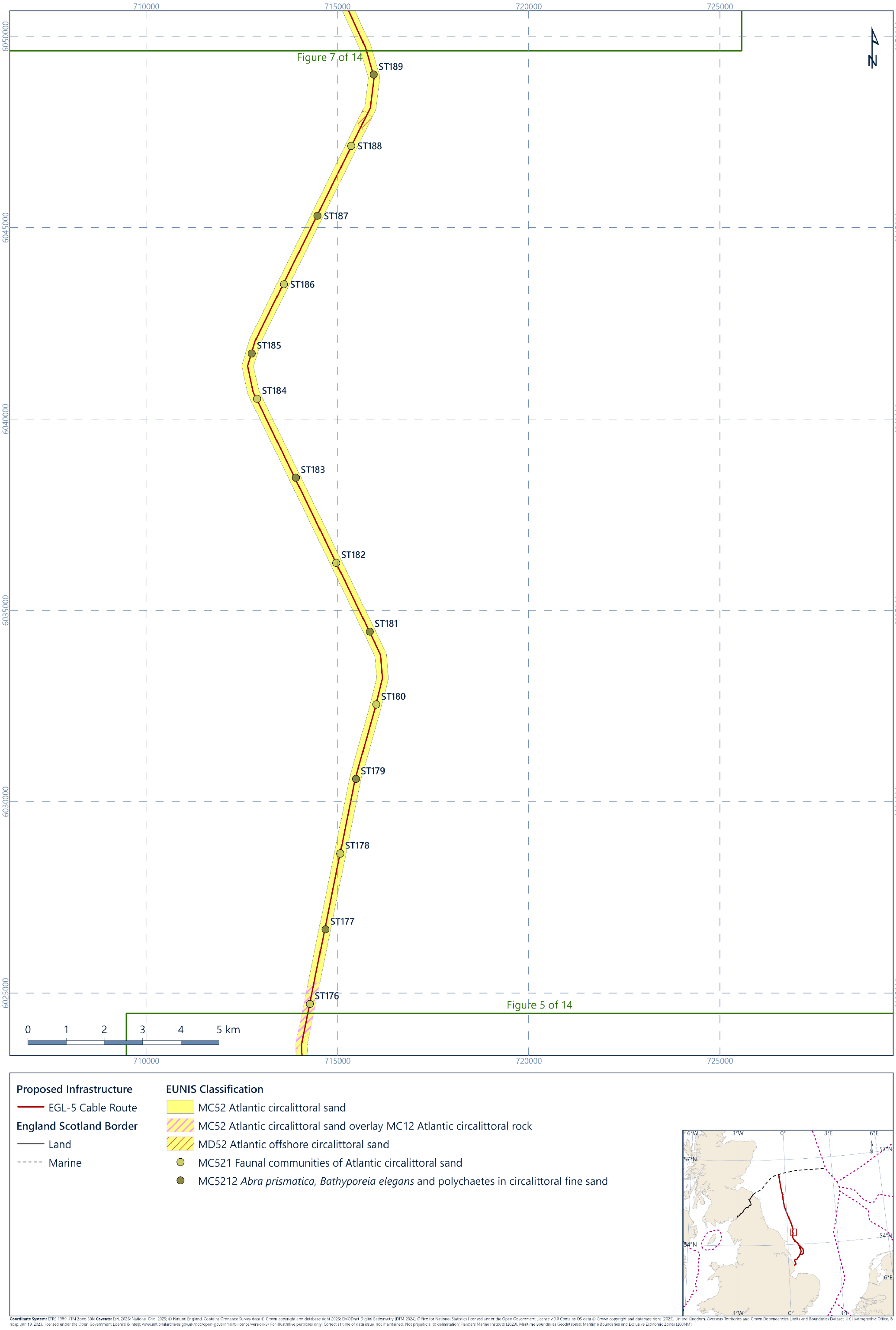


Figure 11.9: Biotopes map along the proposed cable route, station ST176 to station ST189

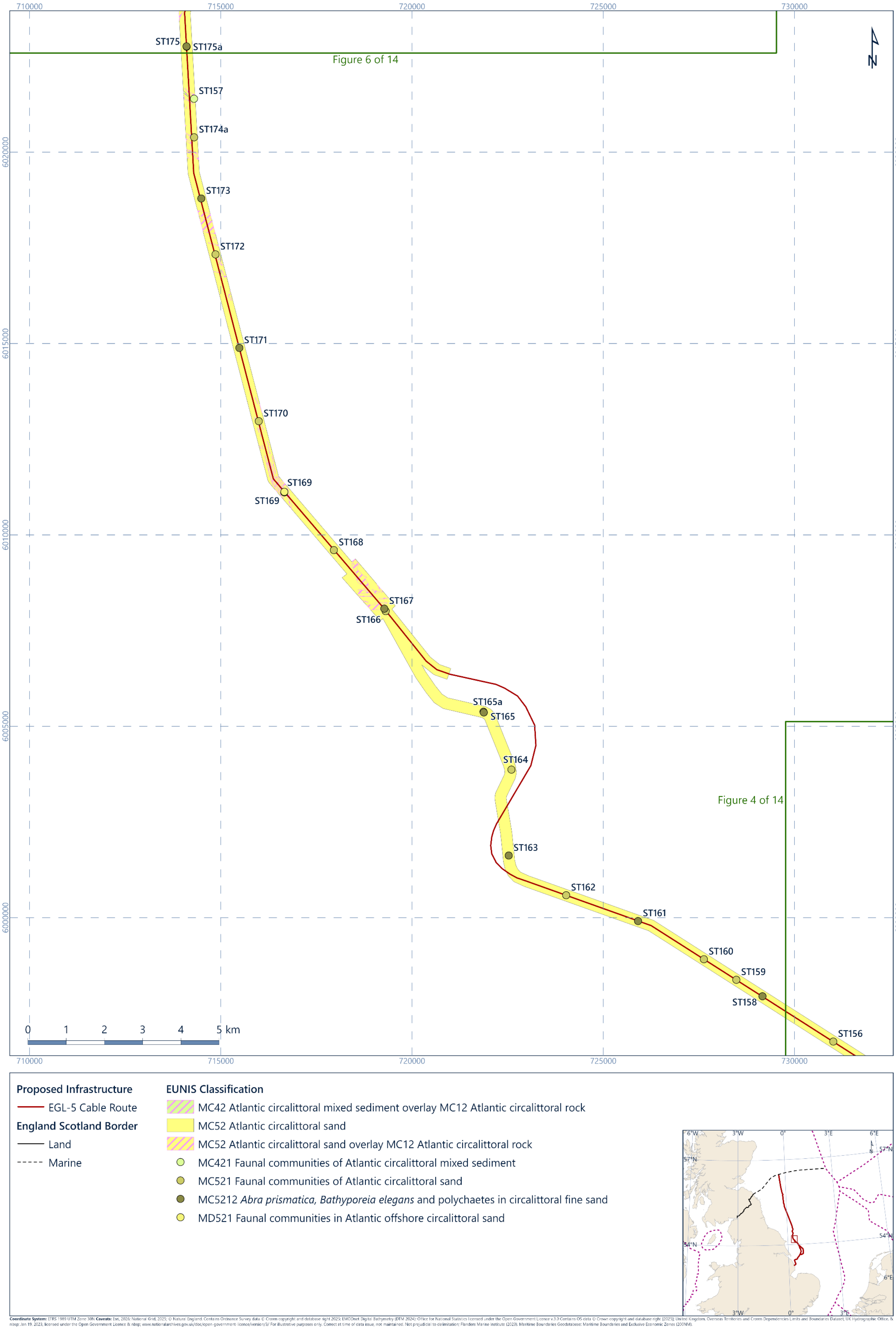


Figure 11.10: Habitat map along the proposed cable route, station ST156 to station ST175

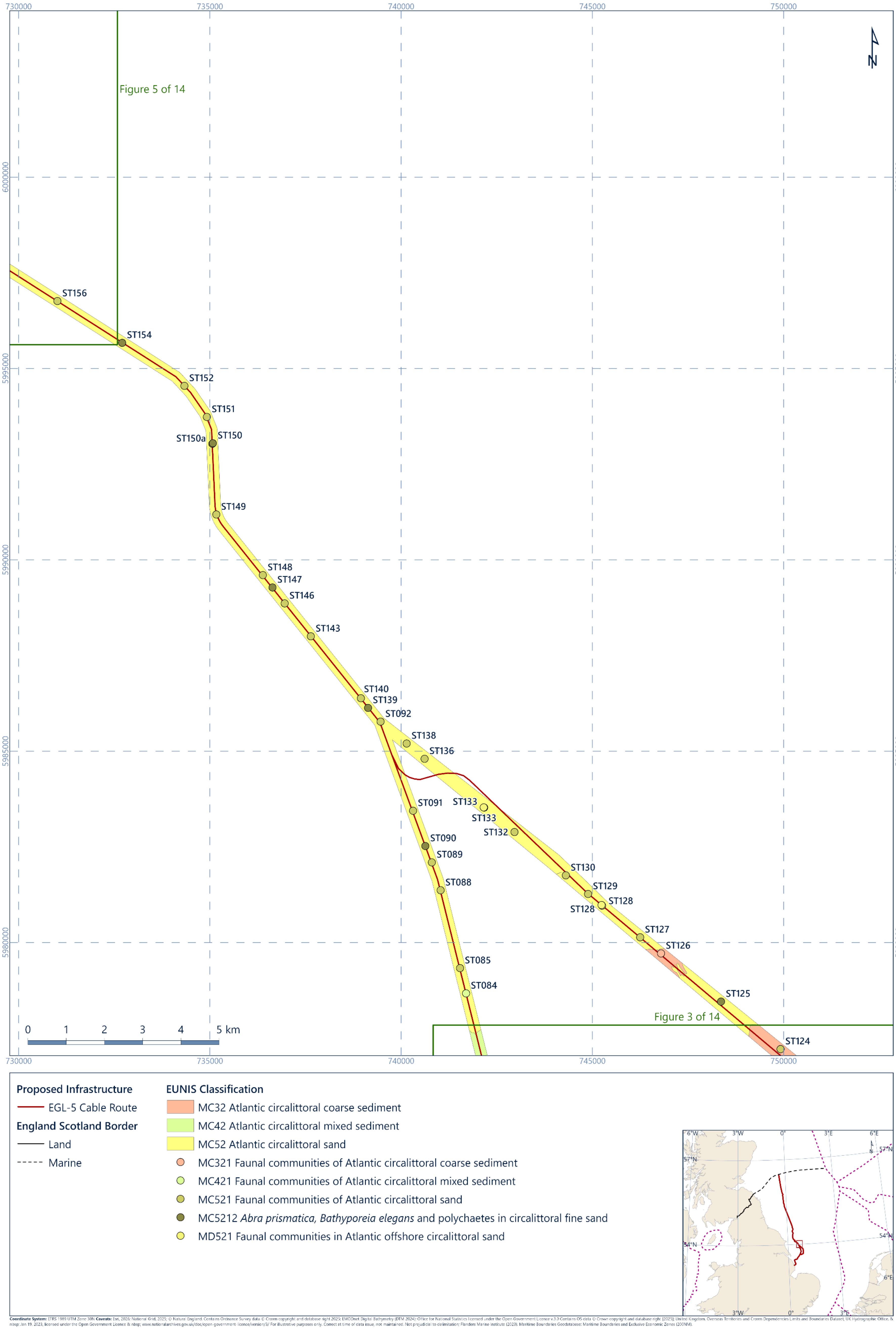


Figure 11.11: Habitat map along the proposed cable route, station ST084 to station ST156

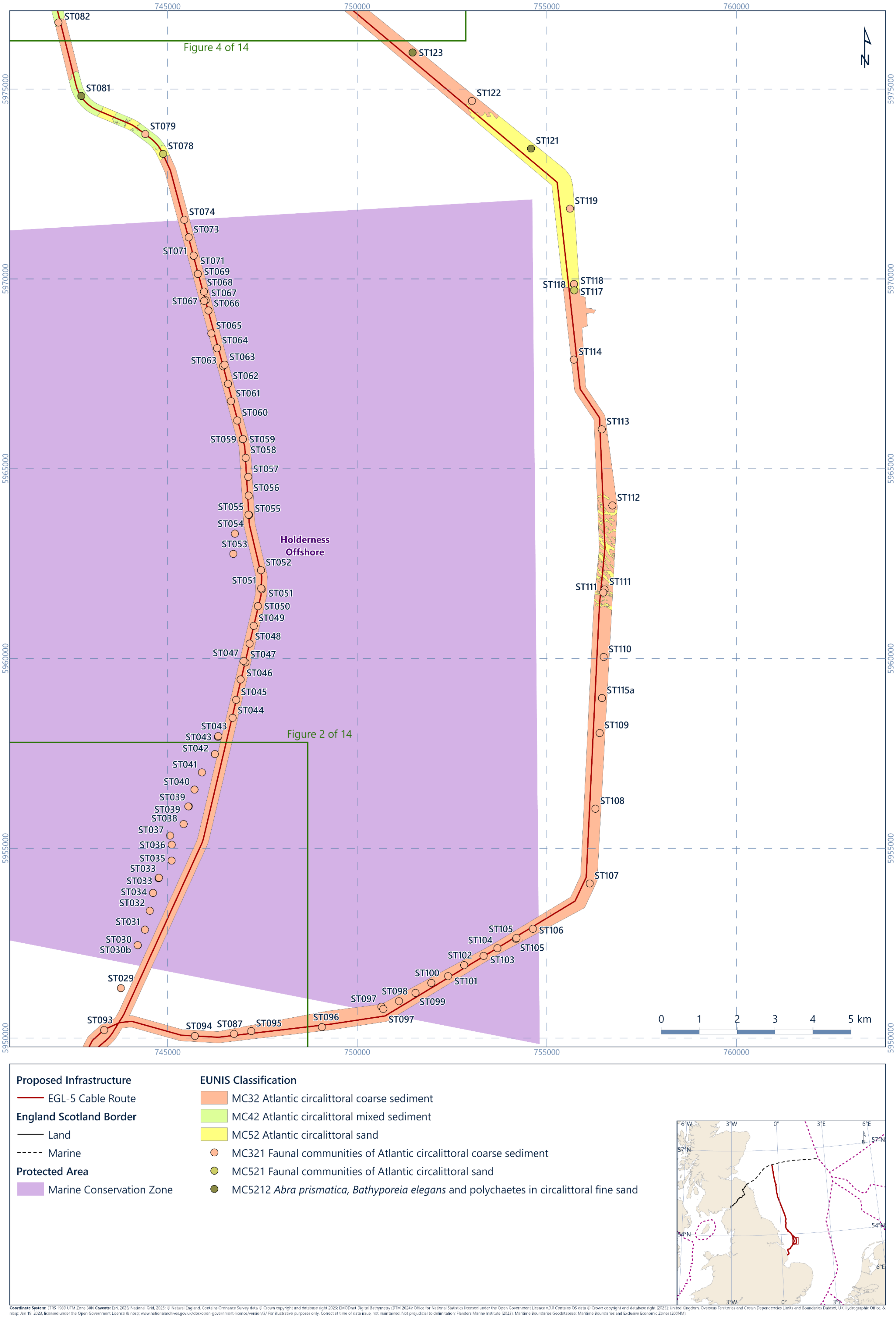


Figure 11.12: Habitat map along the proposed cable route, station ST029 to station ST123 (inclusive of all in Holderness Offshore marine conservation zone)

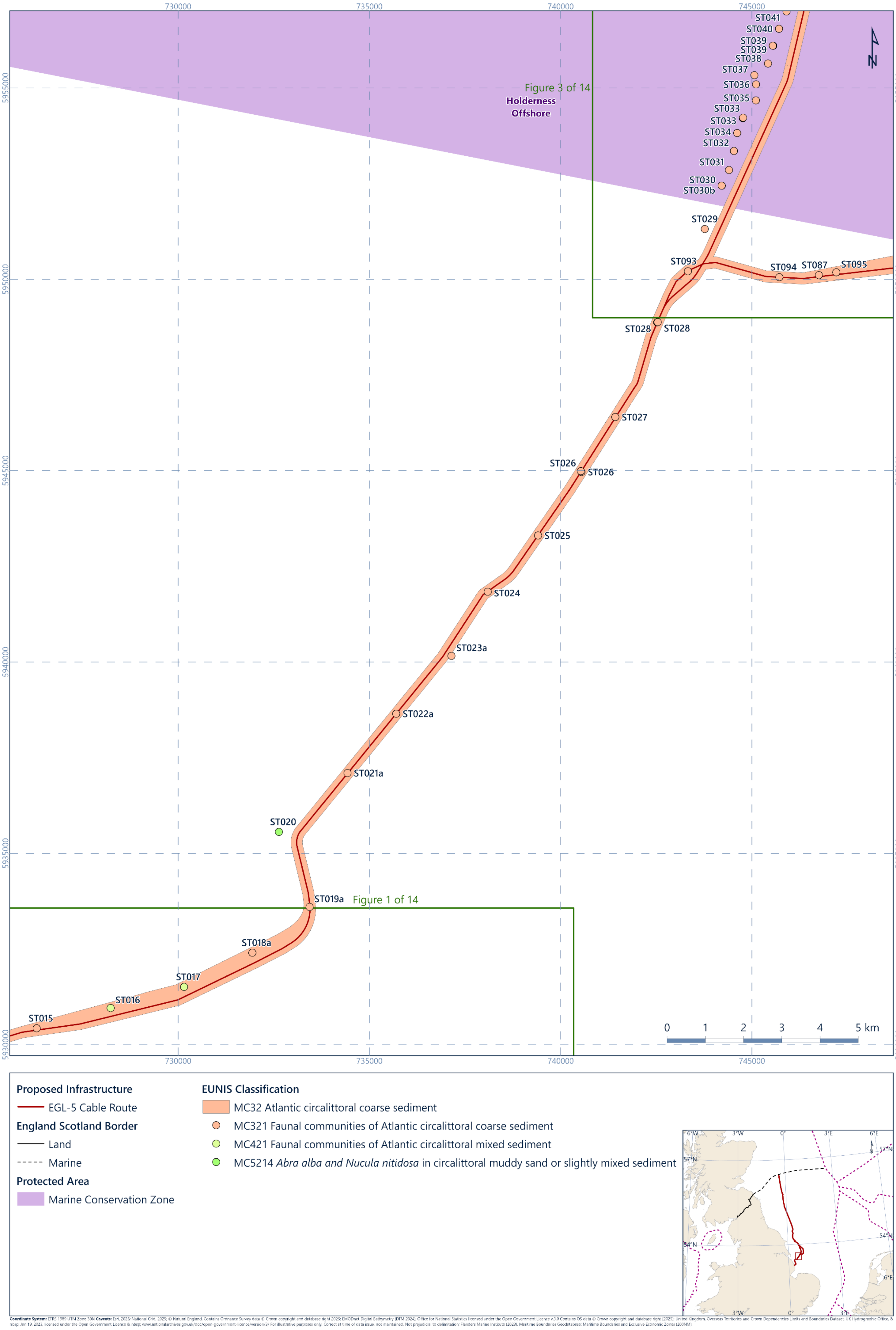


Figure 11.13: Habitat map along the proposed cable route, station ST015 to station ST028 (inclusive of all in Holderness Offshore marine conservation zone)

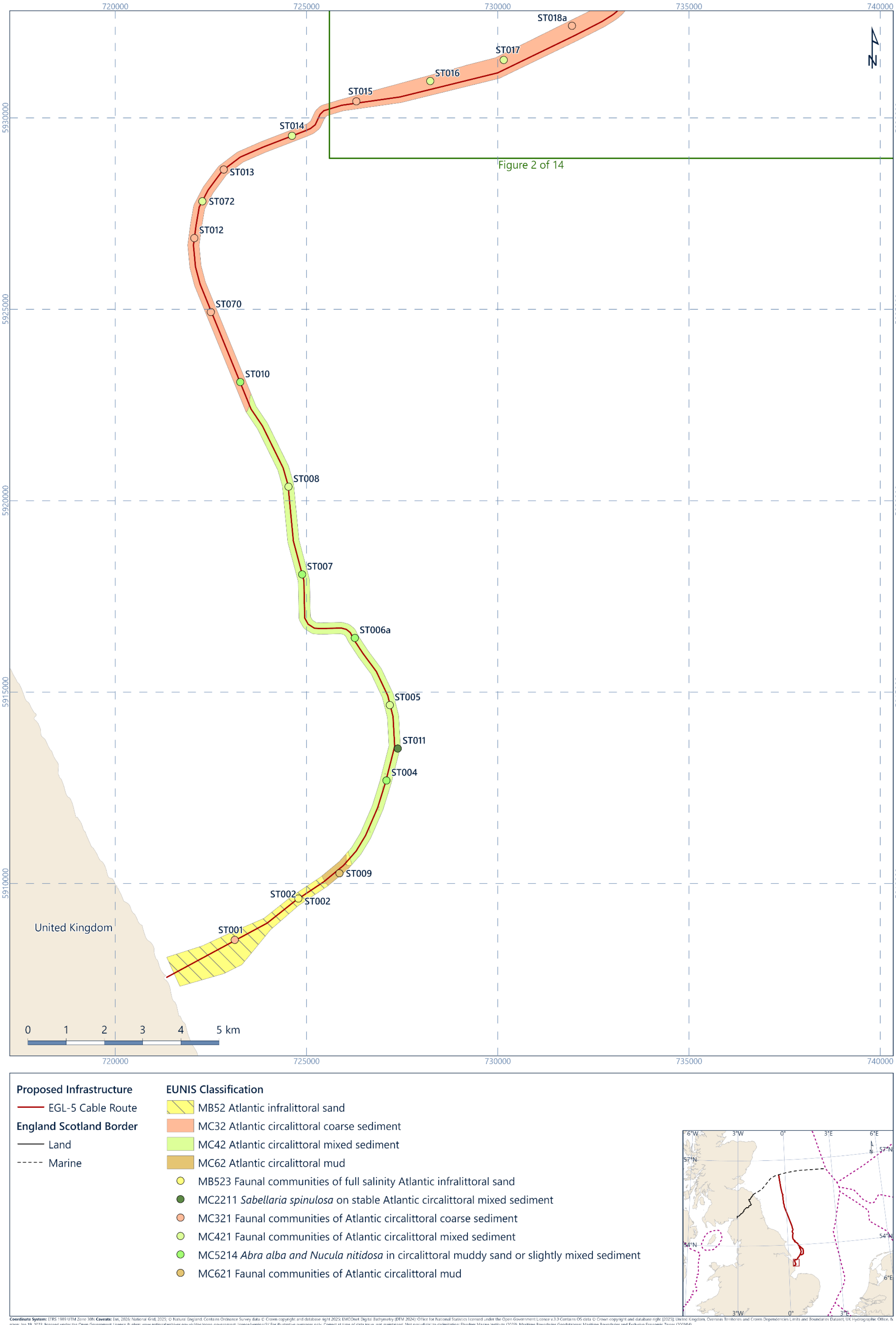


Figure 11.14: Habitat map along the proposed cable route, station ST001 to station ST018a

11.2 Potential Sensitive Habitats and Species

Habitats and biotopes were subsequently assessed for their ecological and conservation importance. Photographic data were reviewed to assess the seafloor and associated faunal communities with regards to the definition of Annex I Stony Reef Assessment, following the assessment criteria in Irving (2009) and Golding et al. (2020), sea pen and burrowing megafauna communities, following the JNCC assessment criteria JNCC (2014) and *Sabellaria spinulosa* Reef Assessment, following Gubbay (2007). See Section 3.3.7.3 for further details on methods.

11.2.1 Potential Stony Reef Assessment

Table 11.4 shows examples of the potential stony reef assessed and Figures Figure 11.15 to 11.17 spatially displays its occurrence along the proposed cable routes.

The assessment was performed at 38 of the survey locations along the proposed cable routes. 'Medium reef' was assessed along the entirety of the photographic data acquired at stations ST013 and ST021a. At stations ST022a, ST072 and ST102 the assessment was an alternating 'Medium reef' and 'Low reef'. At station ST074 and along sections of stations ST044, ST094, ST103 and ST105, due to a more established emerging epifaunal community observed, the assessment was 'Possible reef with veneer'. At the remaining stations investigated the assessment was 'Low reef' or 'Not a reef'. Details for each assessed station is presented in Appendix J.2.

Table 11.4: Examples of potential stony reef assessment

Overall Assessment	Stations	Representative Images		
Resemblance to '[Medium Reef'	ST013, ST021a*, ST022a*, ST072*, ST102*	 269605_ST013_06 722 831.9 mE 5 928 645.9 mN	 269605_ST013_12 722 832.5 mE 5 928 660.8 mN	 269605_ST072_06 722 250.7 mE 5 927 759.7 mN
		 269605__ST022a_04 735 699.7 mE 5 938 664.3 mN	 269605__ST022a_11 735 694.5 mE 5 938 644.8 mN	 269605_ST072_14 722 261.8 mE 5 927 790.8 mN
		 269605_ST21a_04 734 441.6 mE 5 937 114.4 mN	 269605_ST21a_14 734 416.5 mE 5 937 079.5 mN	 269605_ST102_11 752 849.3 mE 5 951 963.6 mN

Overall Assessment	Stations	Representative Images		
Resemblance to 'Low Reef'	ST001, ST012, ST014, ST015, ST016, ST017, ST018a, ST019a, ST020, ST022a*, ST023a, ST024, ST025, ST044*, ST046*, ST072*, ST087*, ST093*, ST094*, ST095, ST098, ST099, ST100, ST101, ST102*, ST103*, ST104, ST105, ST106, ST198, ST210, ST270a, ST301	 269605_ST012_02 722 045.5 mE 5 926 864.7 mN	 269605_ST012_13 722 077.6 mE 5 926 853.7 mN	 269605_ST015_07 726 307.6 mE 5 930 439.9 mN
		 269605__ST022a_08 735 693.8 mE 5 938 657.9 mN	 269605__ST022a_15 735 691.9 mE5 938 633.2 mN	 269605_ST016_07 728 249.0 mE 5 930 880.7 mN
		 269605_ST270a_16 670 496.8 mE 6 201 845.5 mN	 269605_ST270a_22 670 517.7 mE 6 201 814.8 mN	 269605_ST020_15 732 627.8 mE 5 935 553.2 mN

Overall Assessment	Stations	Representative Images		
Possible 'Reef with veneer'	ST044*, ST074, ST094*, ST103*, ST105*, ST176	 269605_ST074_28 745 452.1 mE 5 971 583.6 mN	 269605_ST074_47 745 357.0 mE 5 971 592.6 mN	 269605_ST103_02 753 260.9 mE 5 952 231.6 mN
		 269605_ST105_07 754 164.2 mE 5 952 700.2 mN	 269605_ST176_15 714 280.7 mE 6 024 729.1 mN	 269605_ST103_28 753 369.7 mE 5 952 122.2 mN
'Not a Reef'	ST004, ST044*, ST046*, ST070, ST087*, ST093*, ST094*, ST095*, ST098*, ST099*, ST100*, ST101*, ST102*, ST106*, ST157, ST198*, ST210*, ST270a*, ST301	 269605_ST070_08 722 498.7 mE 5 924 925.1 mN	 269605_ST157_15 714 286.1 mE 6 021 373.8 mN	 269605_ST210_11 701 484.0 mE 6 088 738.4 mN

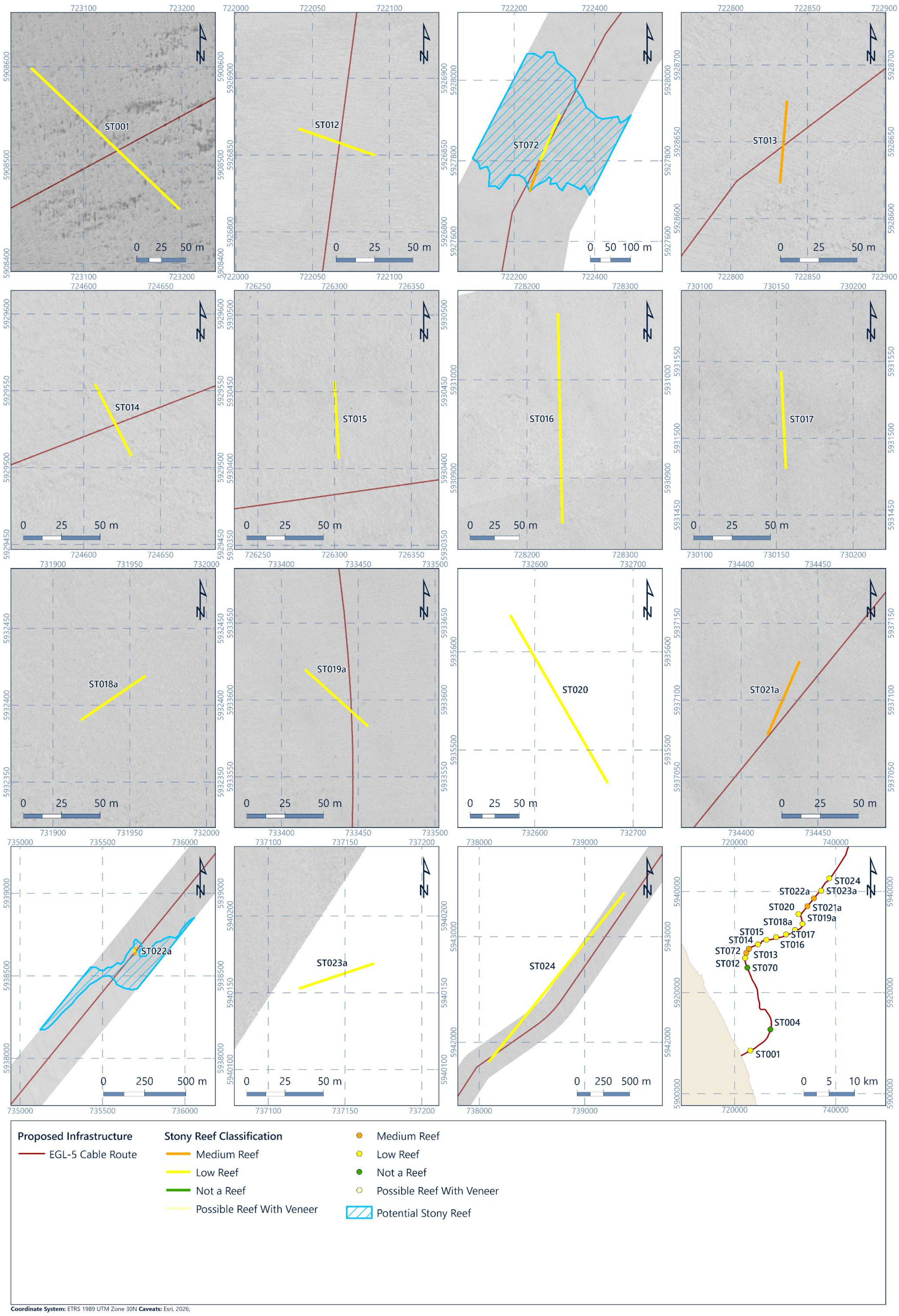


Figure 11.15: Potential stony reef along the proposed cable routes

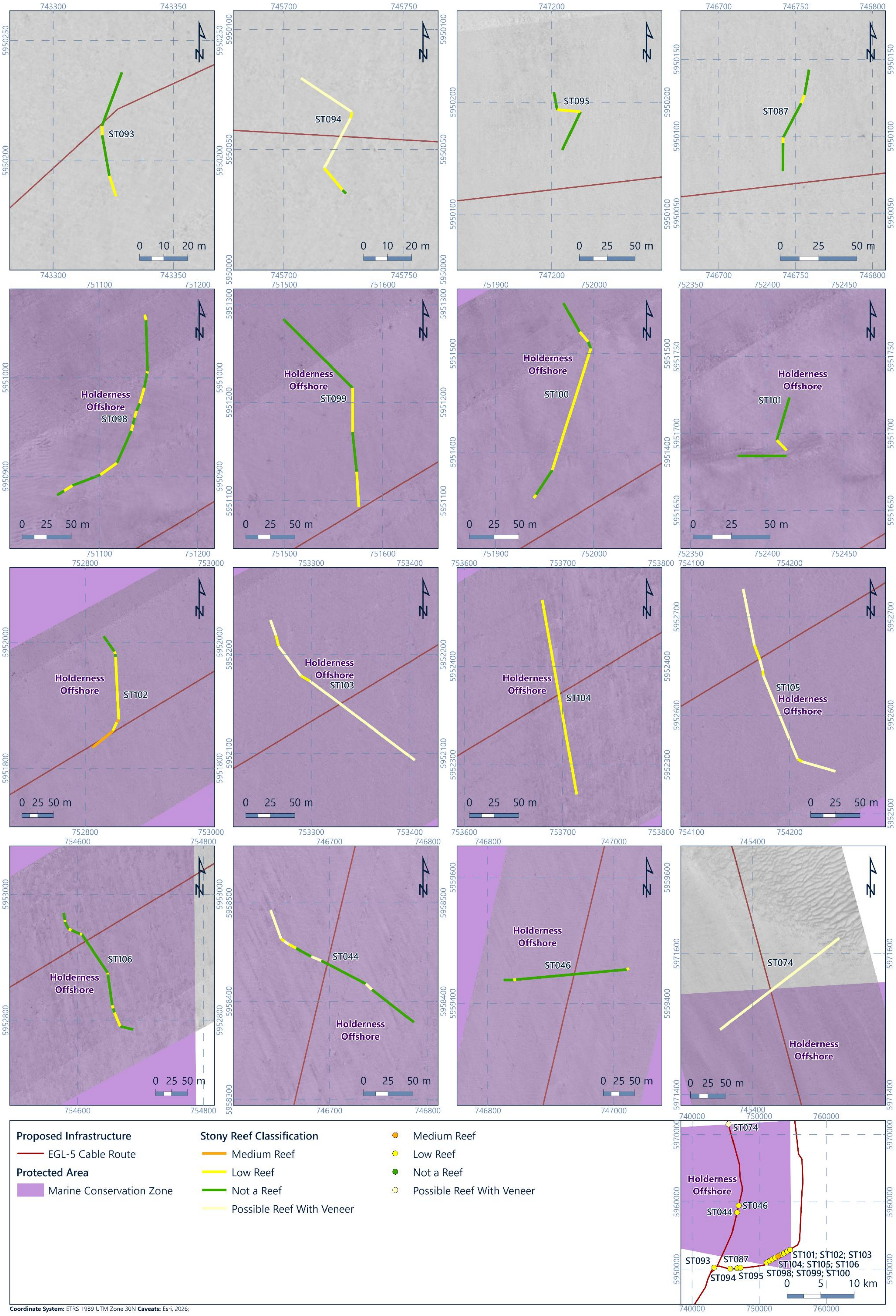


Figure 11.16: Potential stony reef along the proposed cable routes (inclusive of all in Holderness Offshore marine conservation zone)

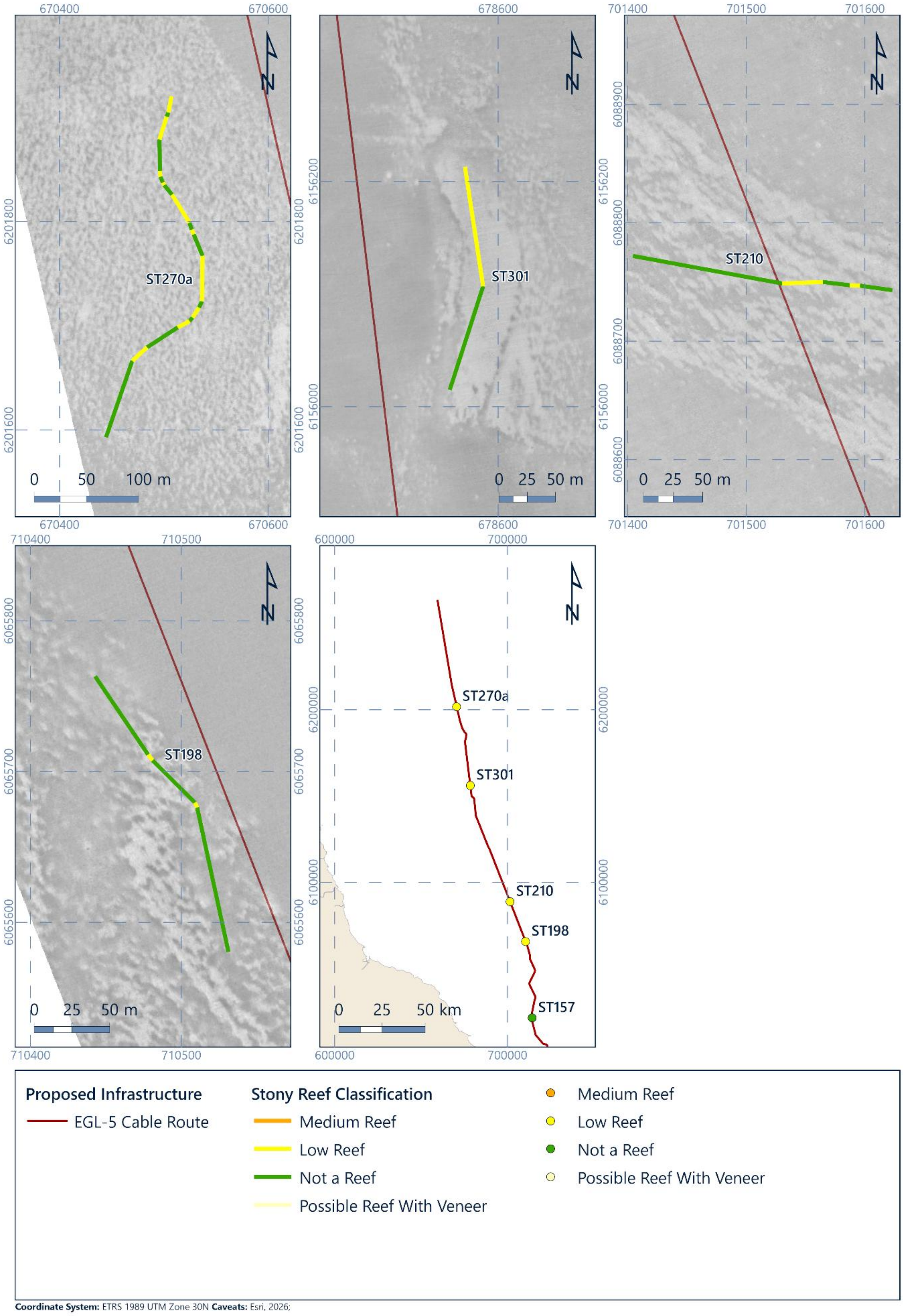


Figure 11.17: Potential stony reef along the proposed cable routes

11.2.2 Sea pen and burrowing megafauna community assessment

Results of the photographic and PSD analysis confirmed seabed sediment comprising predominantly muddy sand at most locations in the offshore section of the proposed cable route, as shown in Figures 6.1 to 6.9. At these stations, shell fragments and gravel were infrequently recorded and often in low proportions.

As burrows were observed along the proposed cable route, the stations were considered for assessment of the presence of the OSPAR listed threatened and/or declining habitat 'Sea pen and burrowing megafauna communities'. Where sediments were suitable (mud fraction comprised roughly 20.00 % or more; (Long, 2006) and burrows and/or mounds were present, the assessment was undertaken following the guidance as per Section 3.3.7.3 and Appendix B.2.6.3. Five stations were assessed by analysing the photographic data using the SACFOR methodology (Appendix B.2.6.3).

Table 11.5 summarises the results of the assessment along the entirety of the photographic data acquired. Figures 11.18 to 11.20 present the location of the assessed stations along the proposed cable route.

At the five stations assessed, the abundance of faunal burrows created by megafaunal taxa of 3 cm to 15 cm in size, ranged between 'occasional' and 'frequent' at four of the five stations, the abundance of faunal burrows created by the Norway lobster (*Nephrops norvegicus*) ranged between 'occasional' and 'common' at three of the five stations and the abundance of sea pens ranged between 'rare' and 'frequent' and they were recorded at all five stations. Faunal mounds were recorded as 'rare' and 'occasional' at two of the five stations.

The habitats and associated biological communities identified from the photographic data have the potential for the presence of the biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' (MC6216; SS.SMu.CFiMu.SpnMeg) at station ST231 where faunal burrows (both those created by *Nephrops norvegicus* and those created by other megafauna) abundance was assessed at least as 'frequent'. Within the survey area, the macrofaunal community at station ST231 was considered more representative of '*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand' (MD5212; Section 11.1.8.1), despite PSD analysis reporting a mud fraction of 24.09 %.

Table 11.5: SACFOR assessment for sea pens and burrowing megafauna

Transect	Length of Transect [m]	Sea pens			Signs of bioturbation		
		Funiculina quadrangularis†	*Pennatula phosphorea**	Virgularidae	Mounds*	*Nephrops norvegicus* Burrows†	Other Burrows*
ST210	221	-	O	-	-	O	-
ST231	52	-	F	-	-	C	F
ST235	206	-	F	-	R	O	O
ST236	43	-	O	-	-	-	O
ST250	202		F	R	O	-	O

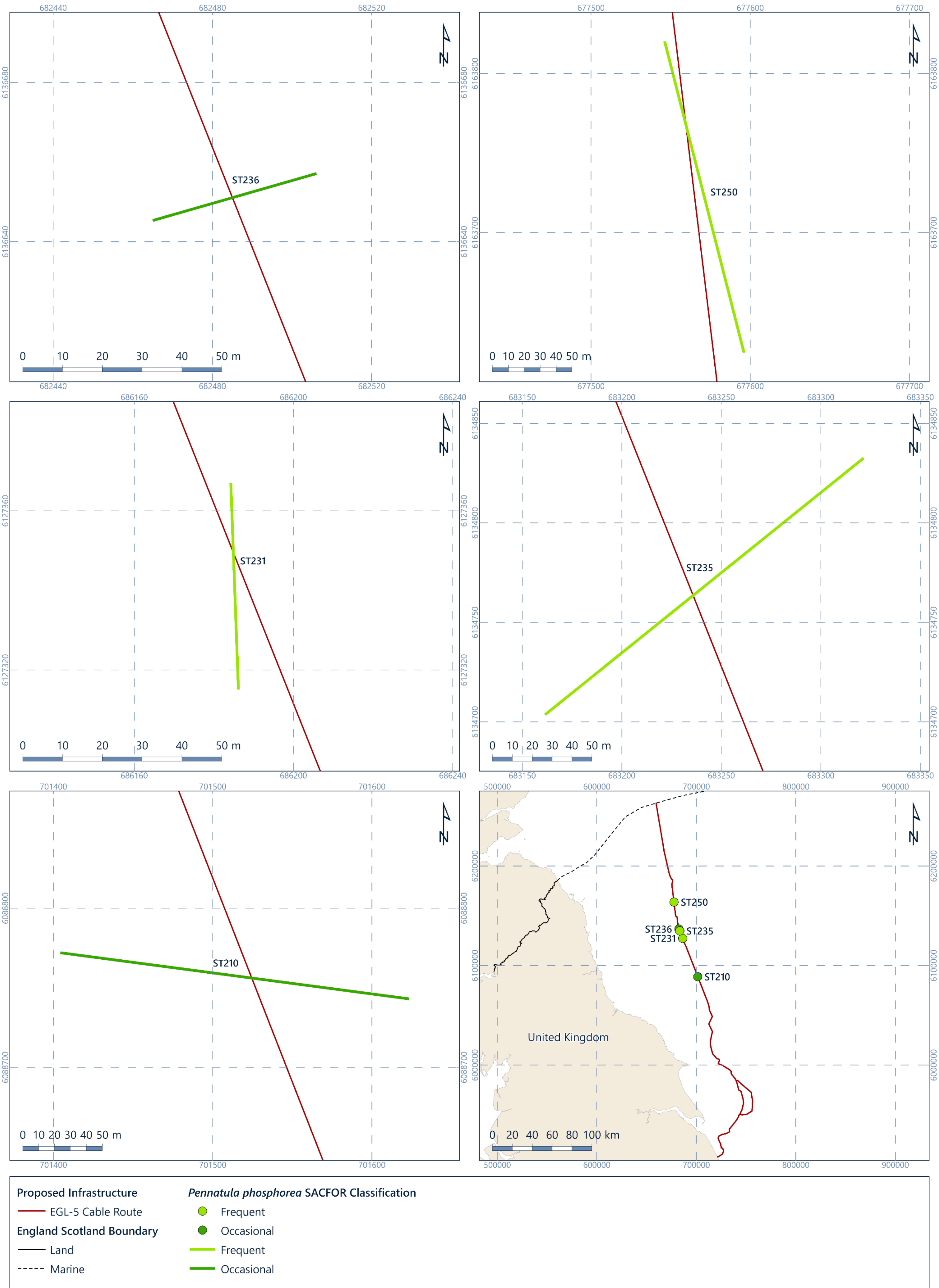
Notes

SACFOR Classifications: (3 cm to 15 cm)
Superabundant = 1 - 9/0.01 m^2
Abundant = 1 - 9/0.1 m^2
Common = 1 - 9/1 m^2
Frequent = 1 - 9/10 m^2
Occasional = 1 - 9/100 m^2
Rare = 1 - 9/1000 m^2

SACFOR Classifications: (> 15 cm)
Superabundant = 1 - 9/0.1 m^2
Abundant = 1 - 9/1 m^2
Common = 1 - 9/10 m^2
Frequent = 1 - 9/100 m^2
Occasional = 1 - 9/1000 m^2
Rare = 1 - 9/< 1000 m^2

SACFOR = semi-quantitative abundance scale from Superabundant, Abundant, Common, Frequent, Occasional to Rare
* = SACFOR Classification based on the assumption that adults achieve a size of 3 cm to 15 cm
† = SACFOR Classification based on the assumption that adults achieve a size of more than 15 cm
‡ = Assessment carried out on the section of the video which showed presence of relevant sedimentary habitat and fauna
# = These stations are within the Swallow Sand MCZ
^ = The stations are within the Fulmar MCZ

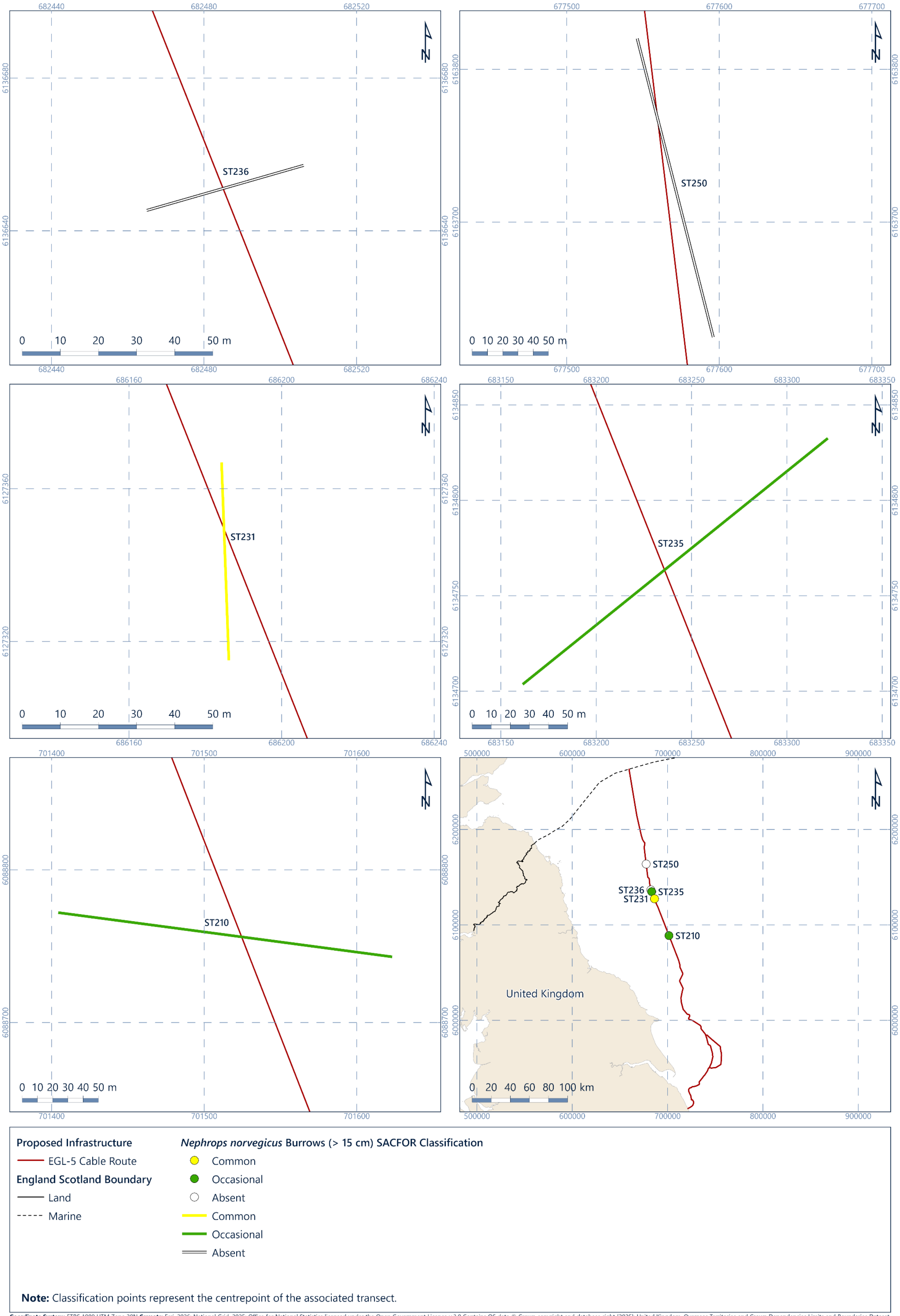
Key	- = Absent	R = Rare	O = Occasional	F = Frequent	C = Common	A = Abundant	S = Super-abundant



Note: Classification points represent the centrepoint of the associated transect.

Coordinate System: ETRS 1989 UTM Zone 30N **Caveats:** Esri, 2026; National Grid, 2025; Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation.

Figure 11.18: *Pennatula phosphorea* abundance along the proposed cable routes



Coordinate System: ETRS 1989 UTM Zone 30N **Caveats:** Esri, 2026; National Grid, 2025; Office for National Statistics licensed under the Open Government Licence v.3.0 Contains OS data © Crown copyright and database right [2025]; United Kingdom, Overseas Territories and Crown Dependencies Limits and Boundaries Dataset, UK Hydrographic Office, & nbsp; Jan 19, 2023, licensed under the Open Government Licence & nbsp; www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ For illustrative purposes only. Correct at time of data issue, not maintained. Not prejudicial to delimitation.

Figure 11.19: *Nephrops norvegicus* burrows abundance along the proposed cable routes

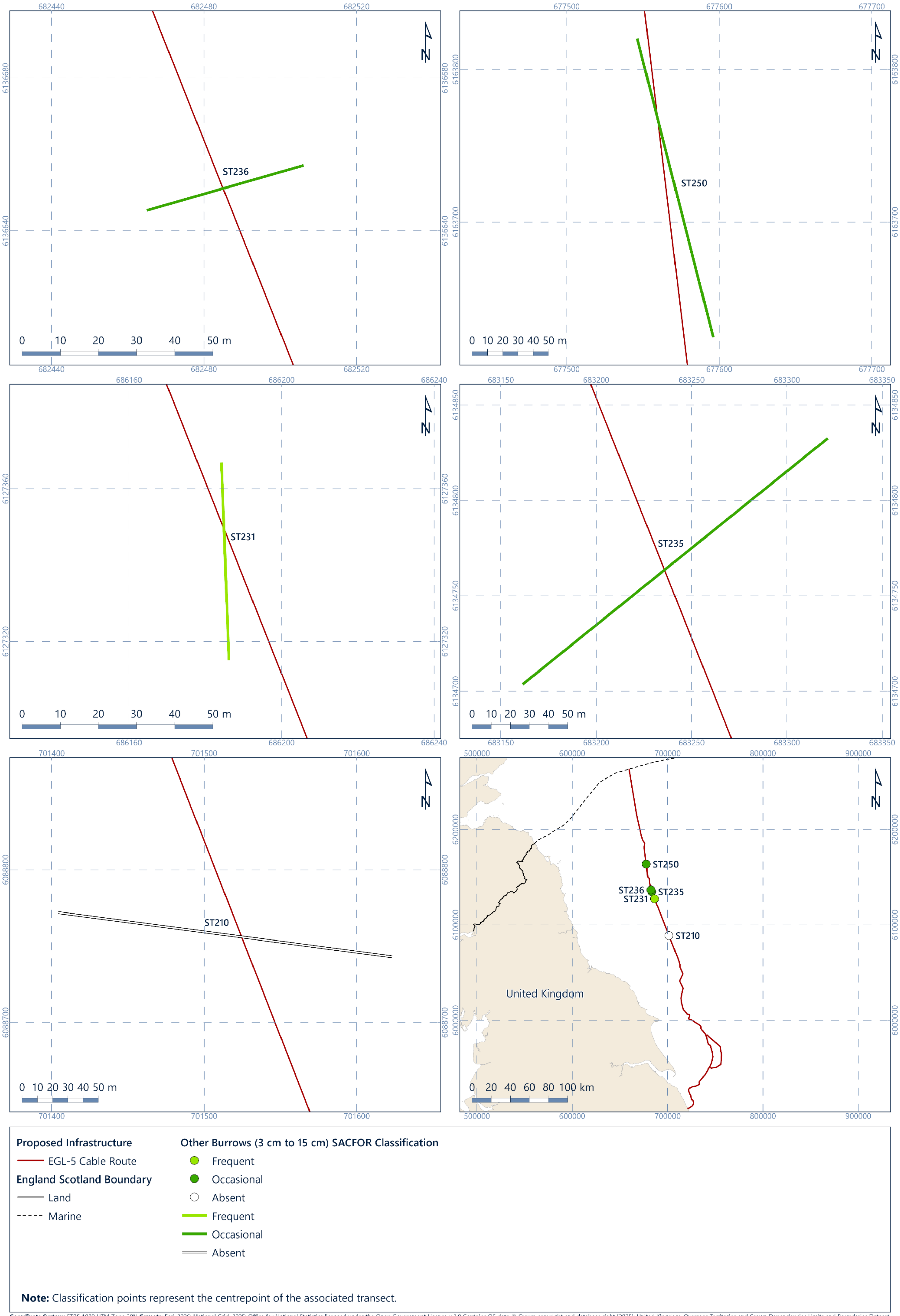


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Figure 11.20: Other burrows abundance along the proposed cable routes

11.2.3 *Sabellaria spinulosa* reef

Sabellaria spinulosa reefs comprise dense subtidal aggregations of this small, tube-building polychaete worm. They are an Annex I habitat and are protected as an OSPAR threatened and/or declining species or habitat.

The reef building tube worm *S. spinulosa* was observed at stations ST008 and ST011, where an assessment was undertaken to investigate the reefiness of the aggregations observed. Table 11.6 summarises the reefiness classification at the stations assessed, with example photographs of the 'Low reef' and 'Medium reef'. Appendix B.2.6.2 provides the detailed *S. spinulosa* reefiness assessment, which is spatially displayed in Figure 11.21.

At station ST011, aggregations resembling to 'low reef' and 'medium reef' were observed. The reef at this station appears as a morphologically diverse *S. spinulosa* aggregation with notable fresh tube growth and associated epifauna. Small patches (< 2 m in length) do exceed 10 cm in height within this mosaic. However, on average, across the section, tube length aligns with the 5 cm to 10 cm category, classified within medium reef on a broad scale.

The *Sabellaria spinulosa* reefs assessed at station ST011 (Section 11.1.2) is also an indication of the potential presence of this UK BAP habitat (BRIG, 2008b).

Table 11.6: *Sabellaria spinulosa* Reef Assessment

Station	Total Length [m]	% No *Sabellaria spinulosa*	% Not a Reef	% Low Reef	% Medium Reef	% High Reef	% Not Usable Sections
ST008	49.1	0.0	49.1 (100)	0.0	0.0	0.0	0.0
ST011	248.8	0.0	26.5 (10.6)	25.4 (10.2)	196.9 (79.2)	0.0	0.0

269605_ST011_18 – Medium Reef

269605_ST011_36 – Low reef

269605_ST008_05 – Not a reef

269605_ST008_08 – Not a reef

Notes

Values indicate the length of the transect for each assessment category.

Values in brackets indicate the proportion of the transect length

* = For the purpose of these calculations the total length of transects have been obtained by summing the lengths of all assessed sections. These were calculated using the real-time position of the camera. Therefore, there might be small differences with the values reported in the field logs, as they were derived considering a straight line from the start to the end of line

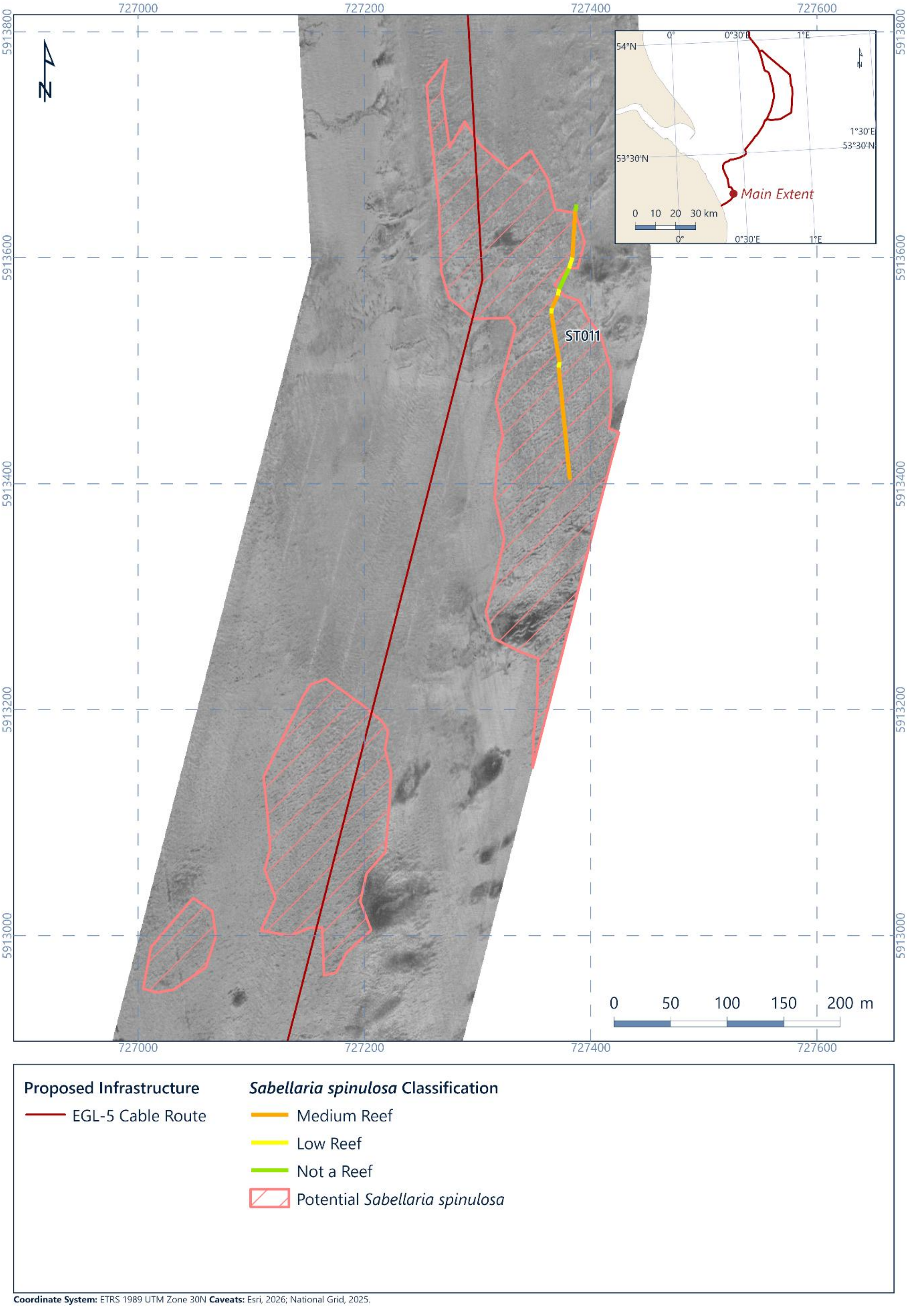

Figure 11.21: Spatial distribution of potential Annex I *Sabellaria spinulosa* reef at station ST011

11.2.4 *Arctica islandica*

The Ocean Quahog *Arctica islandica* is a species listed in the OSPAR list of threatened and declining species. From the macrofauna identified from the grab data, one adult individual of *A. islandica* of 30 mm length was recorded at station ST257, another individual measuring 50 mm in length was recorded at each of the stations ST287 and ST291 (Figure 11.22). One individual measuring 32.5 m in length was recorded at station ST261. These were measured in the field and returned to the sea. Two further adult individuals were identified during the grab samples analysis at stations ST279 and ST281.

From the macrofauna data analysis, juvenile individuals (38 in total) of this species were recorded at stations ST185, ST187, ST189, ST193, ST197, ST211, ST213, ST215, ST217, ST219, ST225, ST233, ST239, ST259, ST261, ST267, ST271, ST275 and ST279.

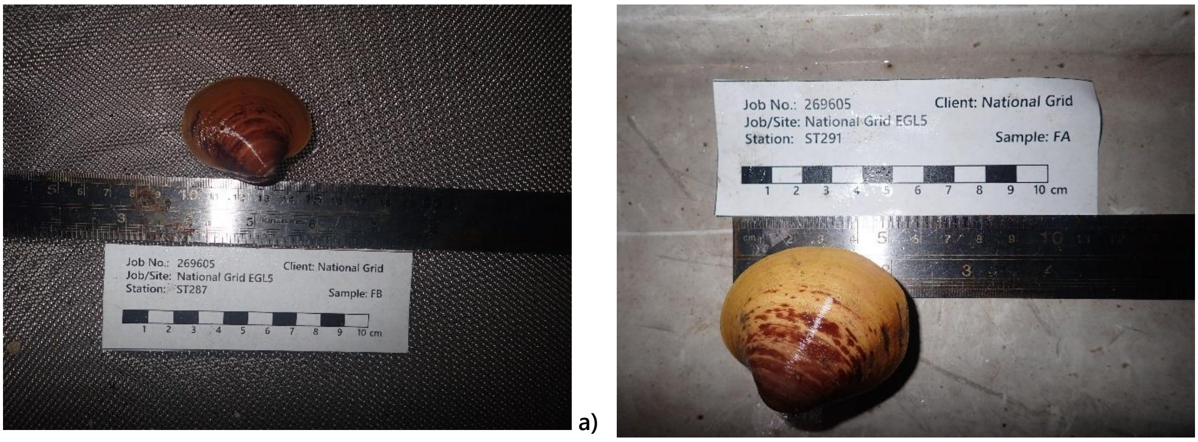

Figure 11.22: *Arctica islandica* at stations ST287 (a) and ST291 (b), both measuring approximately 50 mm in length

Where sediment samples for eDNA analysis were collected, Ocean Quahog *A. islandica* OTUs were recorded at stations ST195, ST193, ST215, ST225 and ST265 (Appendix F).

None of the stations where *A. islandica* was recorded were located within the Holderness Offshore MCZ.

11.2.5 Sandeels Preferred Grounds

Table 6.1 and Appendix D present the details the Folk BGS modified and the Folk (1954) classifications alongside the Latto et al. (2013) habitat preference for each sample. Figures 11.23 to 11.31 spatially displays the preferred sandeel habitats along the proposed cable routes.

Table 11.7 summarises the number of samples along the proposed cable routes within each sandeel preference category, when the Folk (1954) original sediment classification (and associated fractional composition) were considered.

The sediment composition of the survey area indicated the presence of 'Preferred', 'Marginal' and 'Unsuitable' sandeel grounds. The potential presence of a 'Preferred' habitat was assessed at 104 stations for sandeels due to the high composition of coarse sand and low percentage of fine sand and silt. The grounds preference was assessed as 'Marginal' at 22 stations and the remaining 81 were assessed as 'Unsuitable'.

Where grab samples were collected on the proposed cable variation (Route C), within the Holderness Offshore MCZ, 3 were assessed as 'Preferred' grounds, 12 were assessed as 'Marginal' grounds and 7 were assessed as 'Unsuitable' grounds. One individual of *Ammodytes marinus* was recorded at the grab station ST059 (assessed as 'Marginal'), located within the Holderness Offshore MCZ, along the proposed cable variation (Route C). For the grab stations located on the proposed cable route (Route B) within the Holderness Offshore MCZ, 2 were assessed as 'Unsuitable' grounds and 1 was assessed as 'Marginal' grounds (Figure 11.31). *A. marinus* is a UK BAP species.

Those stations assessed as 'Unsuitable' comprised coarser grounds (mostly located to the south of Holderness Offshore MCZ along the section of the proposed cable route approaching the coast) and grounds with higher proportions of fines (mostly located along the offshore segment of the proposed cable route). The 'Preferred grounds were largely located along the segment of the proposed cable route located to the north of the Holderness Offshore MCZ.

Table 11.7: Sandeel preference sediment categories

Fractional Composition	Folk (1954) Description	Folk (BGS Modified) Description	Sand Eel Preference (Latto et al, 2013)	Number of Samples
≤ 10 % mud and ≤ 30 % gravel	Sand (S), slightly gravelly sand ((g)S) and gravelly sand (gS)	Sand (S) and gravelly sand (gS)	Preferred	104
≤ 10 % mud and > 30 % to < 80 % gravel	Sandy gravel (sG)	Sandy gravel (sG)	Marginal	22
> 10 % mud or ≥ 80 % gravel	All other sediment types	All other sediment types	Unsuitable	81

The family Ammodytidae was detected within the TOP and BOT eDNA water samples at stations ST020, ST030, ST097, ST111, ST125, ST139, ST150, ST165 and within the TOP samples at stations ST010, ST063 and ST185. The family Ammodytidae was also detected from the sediment eDNA eukaryotes samples from 33 stations (ST030, ST063, ST097, ST111 and ST125. From the video analysis this family was detected at stations ST036, ST037, ST038, ST043, ST052, ST054, ST058, ST060, ST061, ST064, ST065, ST066, ST067, ST067, ST068, ST069, ST071, ST073, ST074, ST082, ST088, ST089, ST097, ST110, ST122, ST126, ST127, ST128, ST129, ST143, ST146, ST151 and ST152).

The genus *Ammodytes* was detected within the TOP and BOT eDNA water samples at stations ST020, ST030, ST097, ST111, ST125, ST139, ST150 and TOP water samples at stations ST165 and ST185.

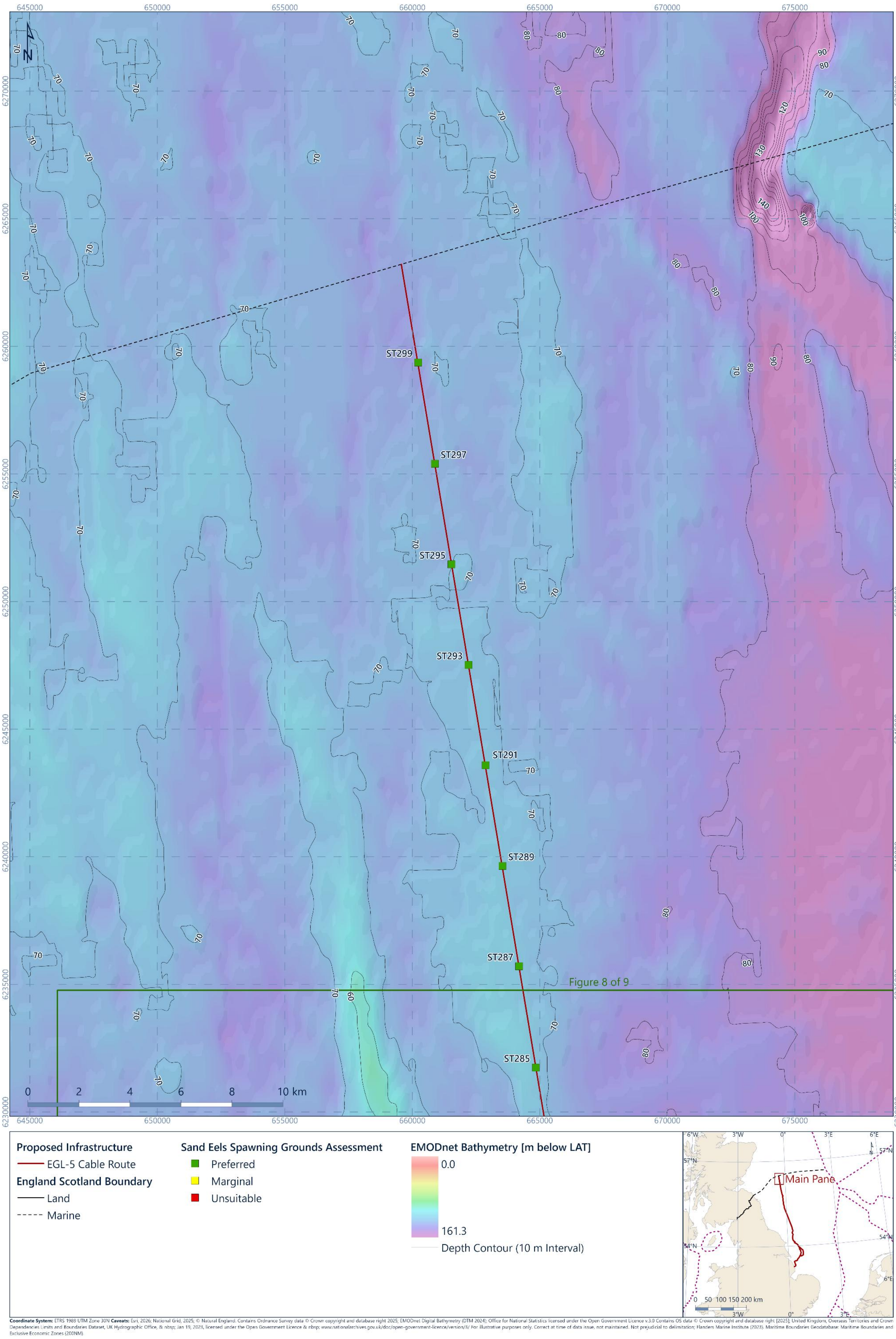

Figure 11.23: Spatial distribution of sandeels preferred grounds, station ST285 to station ST299

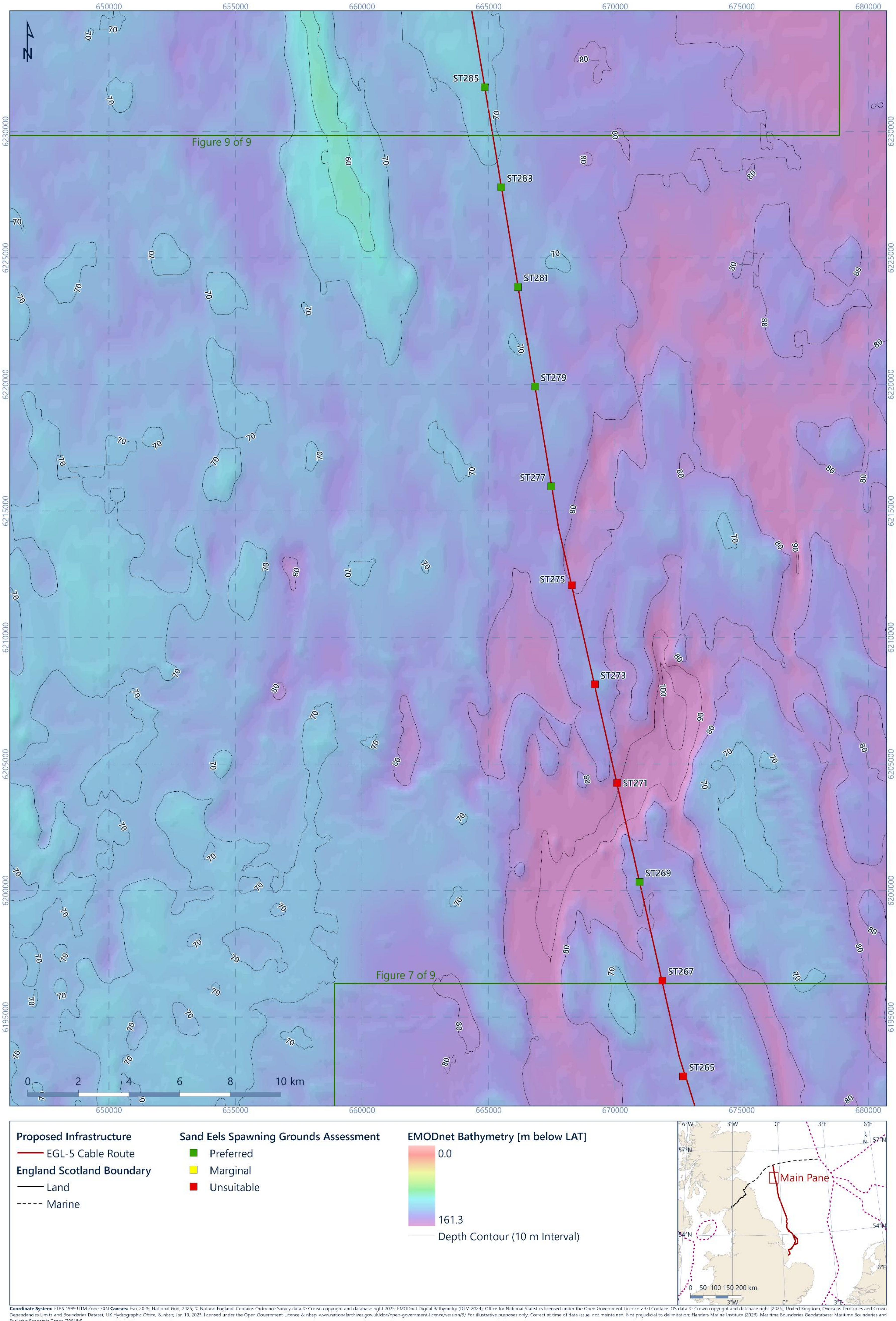

Figure 11.24: Spatial distribution of sandeels preferred grounds, station ST265 to station ST285

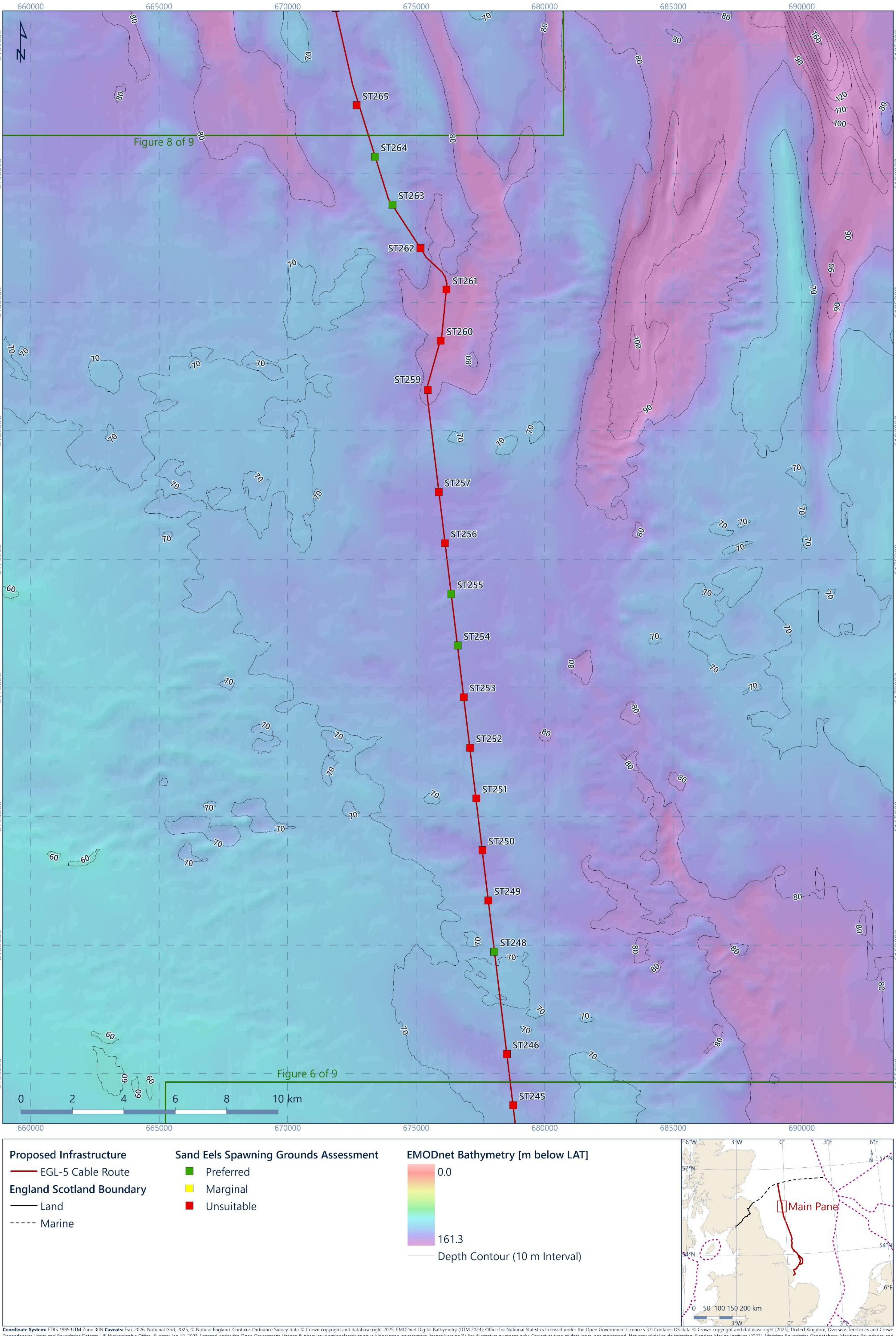

Figure 11.25: Spatial distribution of sandeels preferred grounds, station ST245 to station ST265

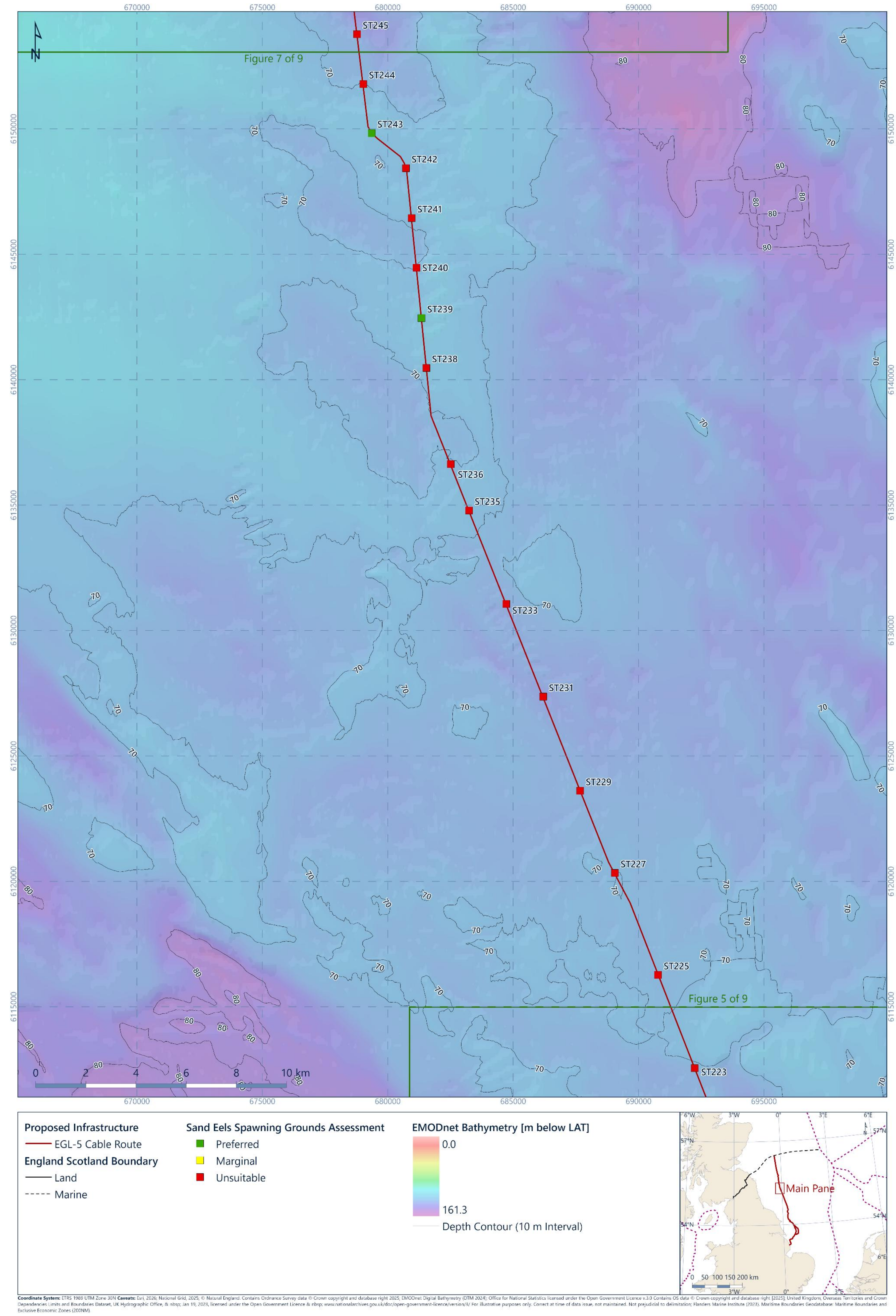

Figure 11.26: Spatial distribution of sandeels preferred ground, station ST223 to station ST245

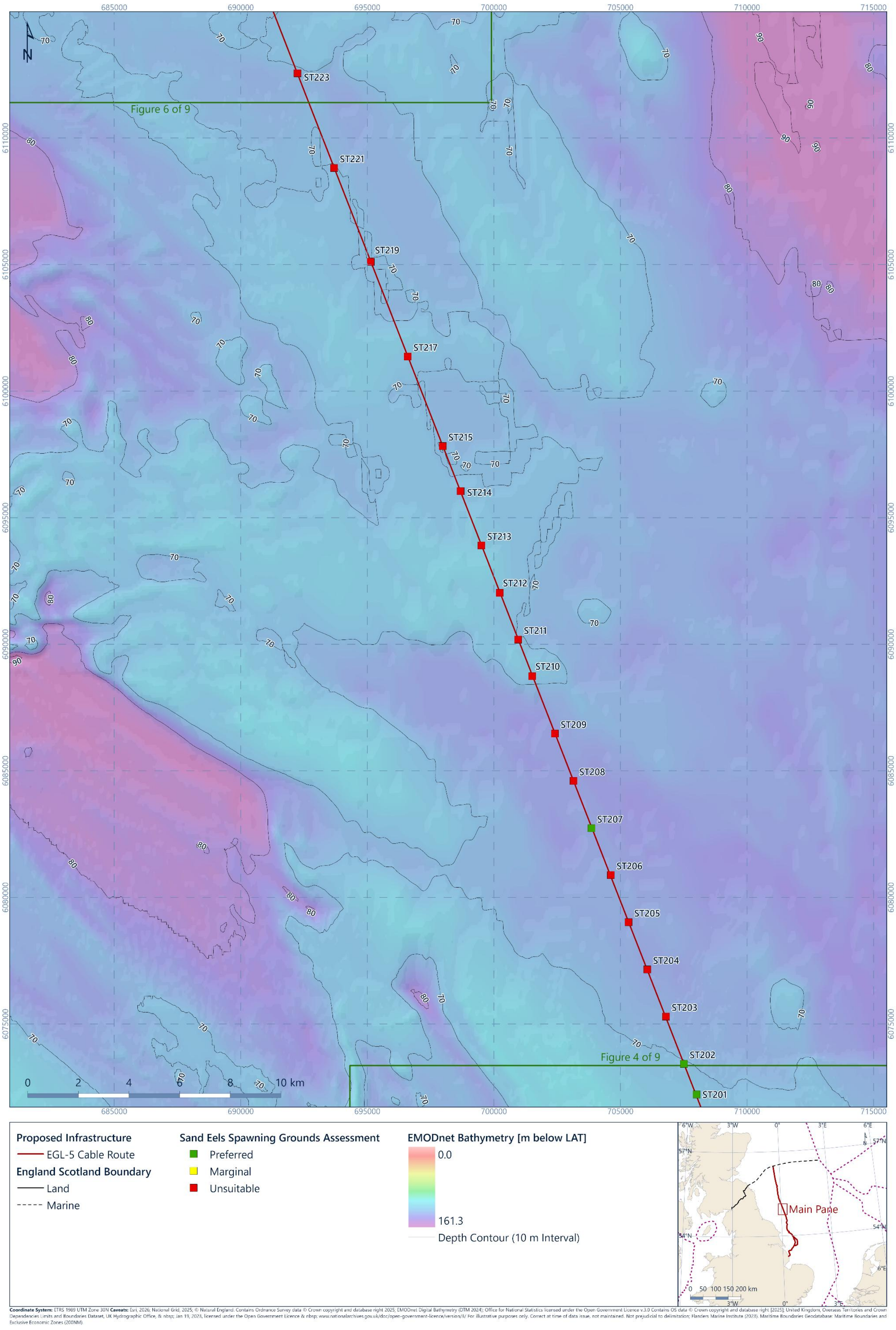

Figure 11.27: Spatial distribution of sandeels preferred ground, station ST201 to station ST223

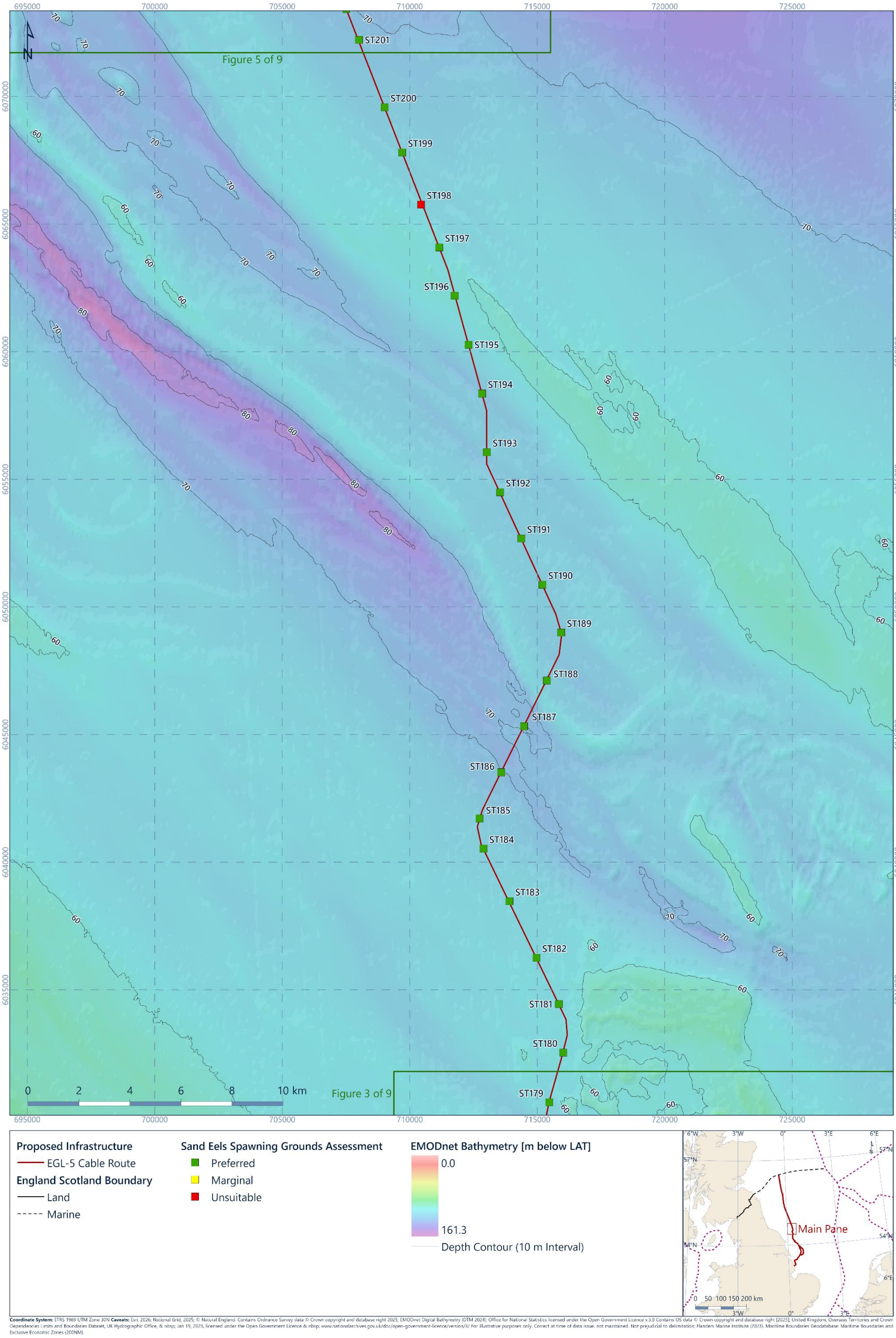

Figure 11.28: Spatial distribution of sandeels preferred ground, station ST179 to station ST201

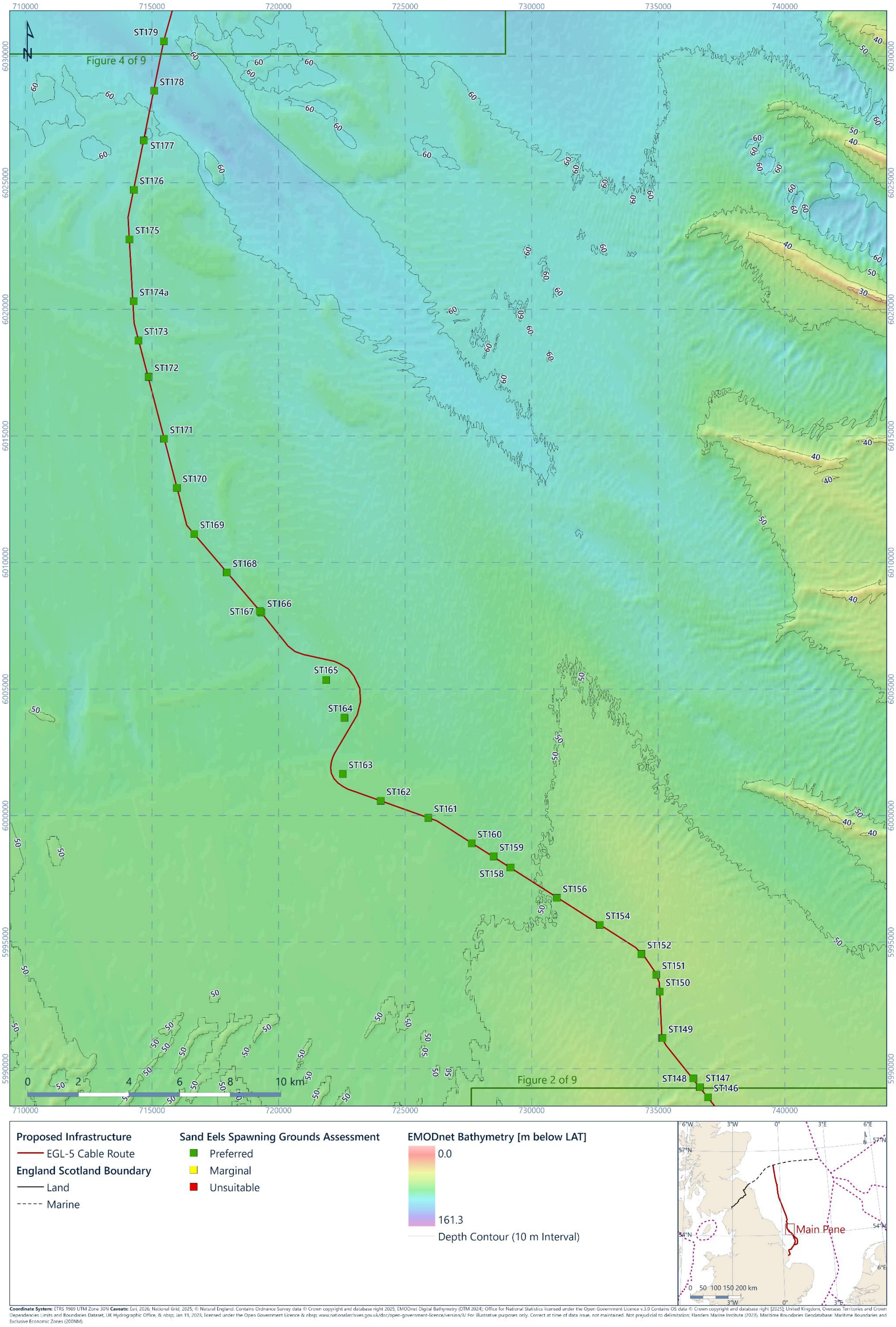

Figure 11.29: Spatial distribution of sandeels preferred ground, station ST146 to station ST179

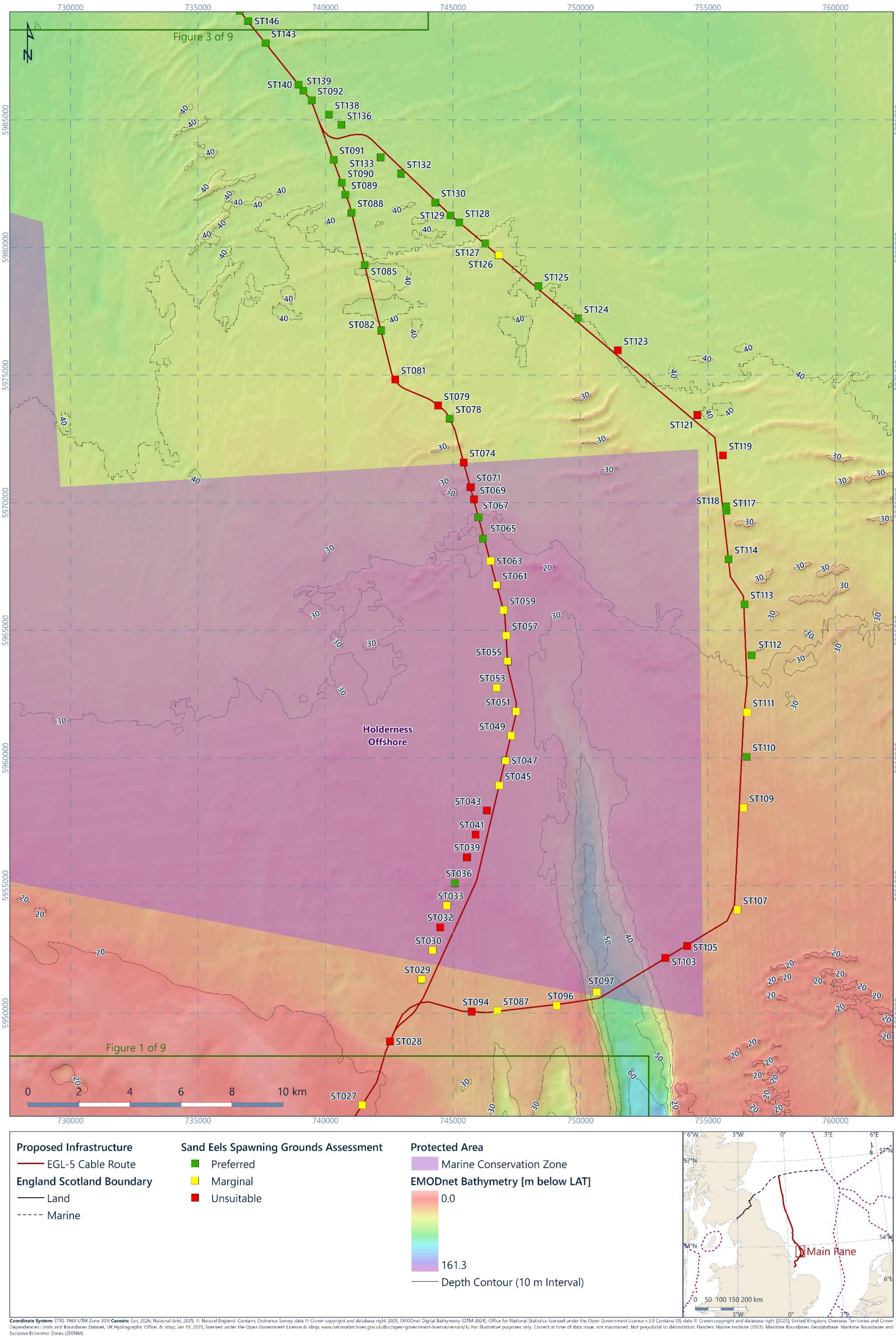

Figure 11.30: Spatial distribution of sandeels preferred ground, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

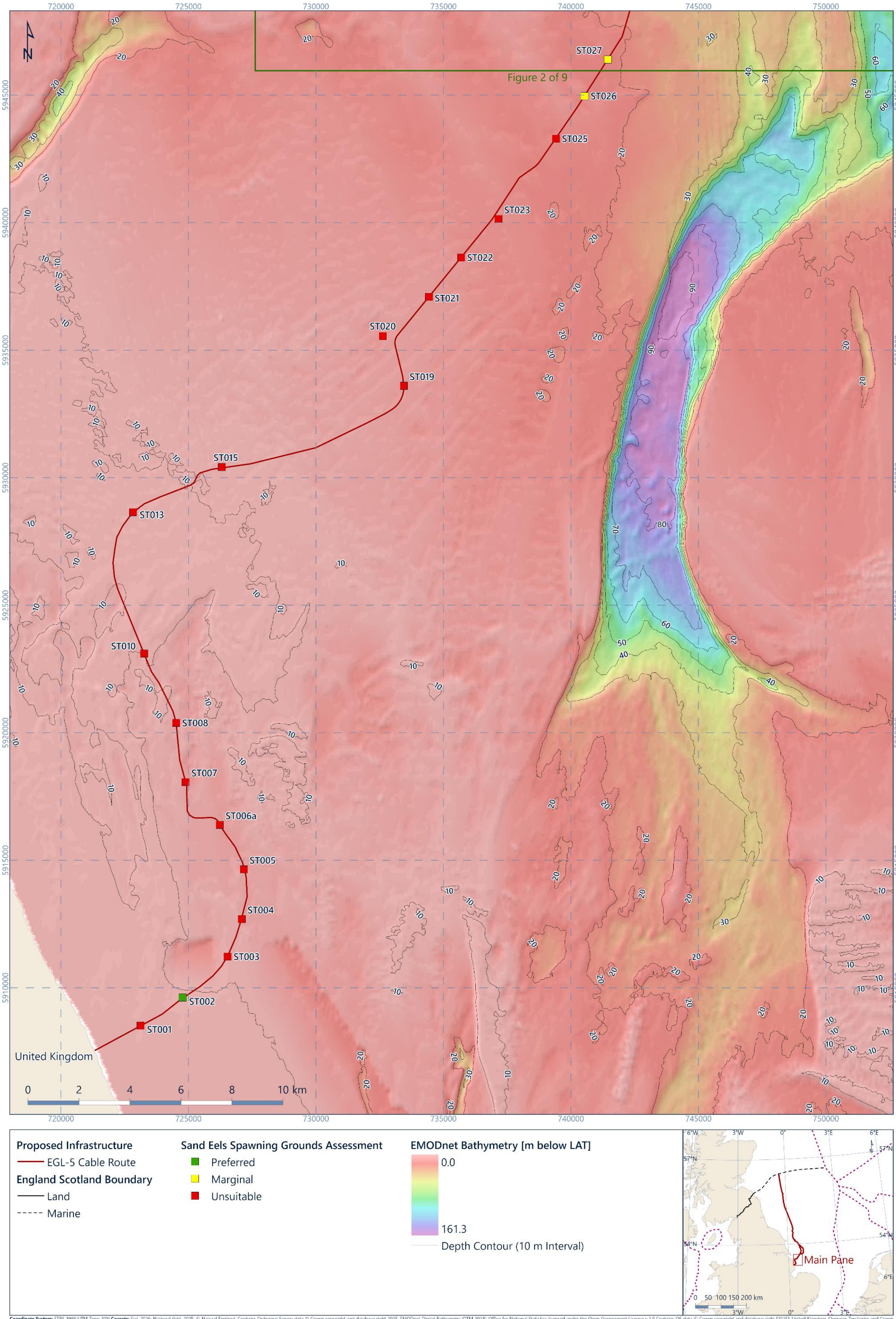

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Figure 11.31: Spatial distribution of sandeels preferred grounds, station ST001 to station ST027

11.2.6 Herring Spawning Preferred Grounds

The Folk 1954 original classification (Appendix D) applied to the sediment particle sizes for the locations was used to describe the herring preference sediment categories as indicated by Reach et al. (2013). Table 11.8 summarises the number of stations along the proposed cable routes falling under each category. Figures 11.32 to 11.40 spatially displays the preferred herring spawning grounds along the proposed cable routes

The sediment composition of the survey area indicated the presence of ‘Preferred’, ‘Marginal’ and ‘Unsuitable’ herring spawning grounds. The potential presence of a ‘Preferred’ habitat was assessed at 24 stations due to the high composition of gravel. The grounds preference was assessed as ‘Marginal’ at 16 stations and the remaining 167 were assessed as ‘Unsuitable’.

Those stations assessed as ‘Unsuitable’ comprised sandy and muddy grounds, mostly located along the offshore section of the proposed cable route, with several to the south of the Holderness Offshore MCZ. The majority of the ‘Preferred’ grounds were located along the Route C section of the proposed cable route located within the Holderness Offshore MCZ.

Where grab samples were collected at stations located on the proposed cable routes within the Holderness Offshore MCZ, 12 (Route C) and 1 (Route B) were assessed as ‘Preferred’ grounds, 3 (Route C) were assessed as ‘Marginal’ grounds, with ‘Unsuitable’ herring spawning grounds assessed at the remaining stations (Figure 11.39).

Table 11.8: Herring Spawning Preference Sediment Categories

% Particle contribution	Habitat preference	Folk 1954 sediment description	No. of stations
< 5 % muds, > 50 % gravel	Preferred	Gravel (G) and part sandy Gravel (sG)	24
< 5 % muds, > 10 % gravel	Marginal	Part sandy Gravel (sG) and part gravelly Sand (gS)	16
> 5 % muds, < 10 % gravel	Unsuitable	All other sediment types	167

The UK BAP species Atlantic herring (*Clupea harengus*) was detected by the eDNA water samples within 12 samples, including TOP samples at stations ST010, ST20, ST185, ST275 and ST295, and BOT samples at stations ST20, ST111, ST125, ST185, ST225, ST235, and ST255. The video analysis did not detect this species or related higher taxa.

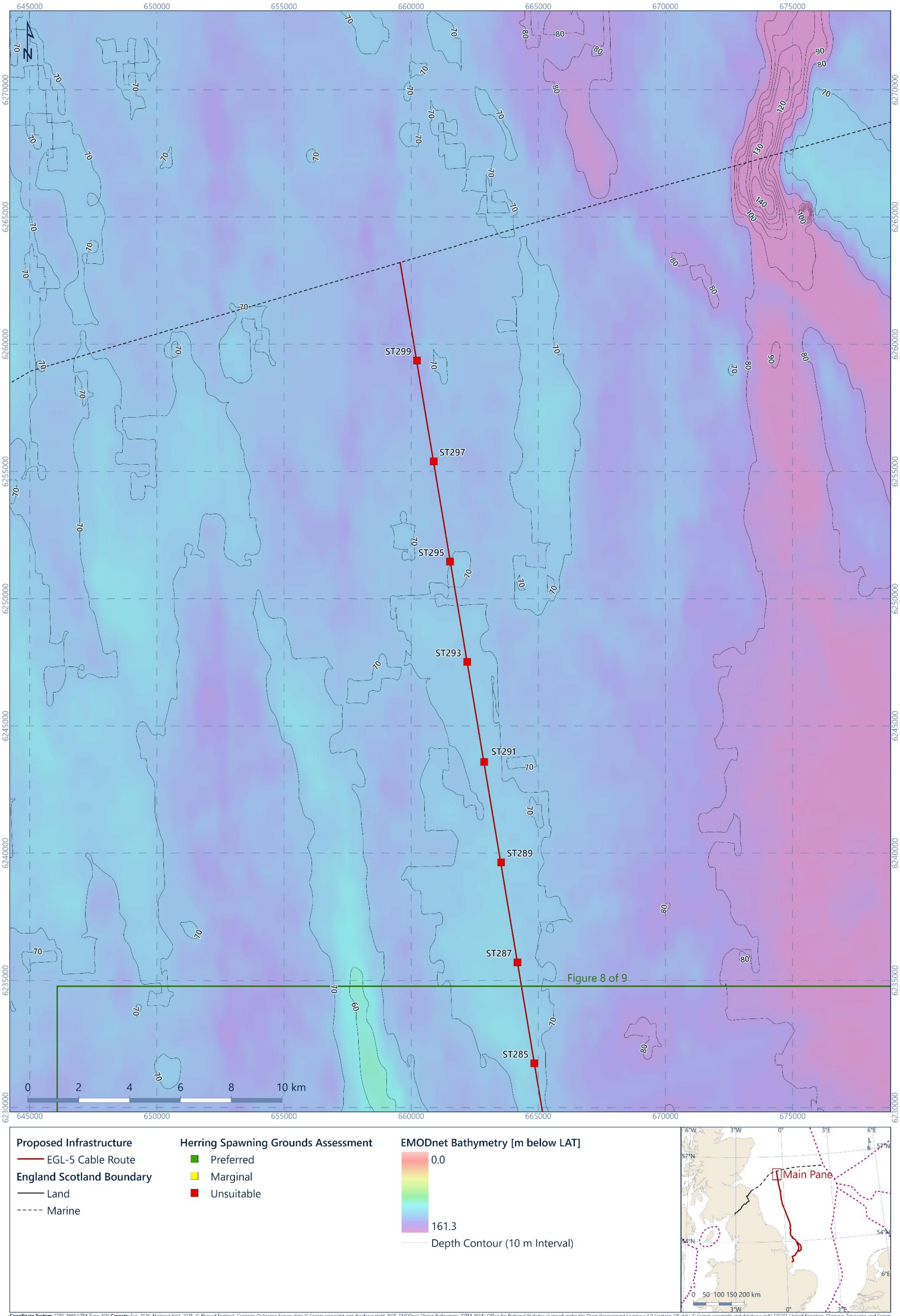

Figure 11.32: Spatial distribution of Herring spawning preferred grounds, station ST285 to station ST299

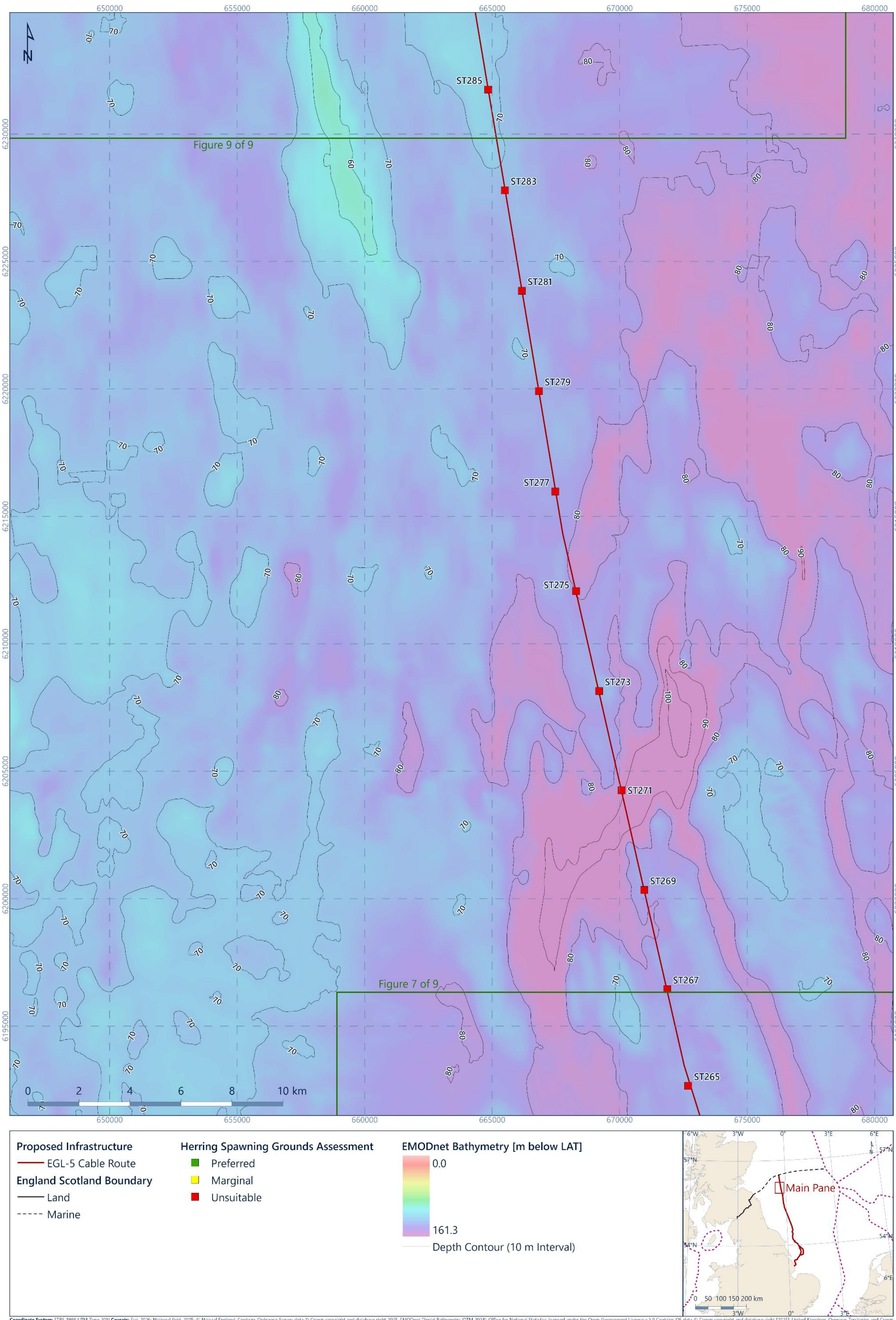

Figure 11.33: Spatial distribution of Herring spawning preferred grounds, station ST265 to station ST285

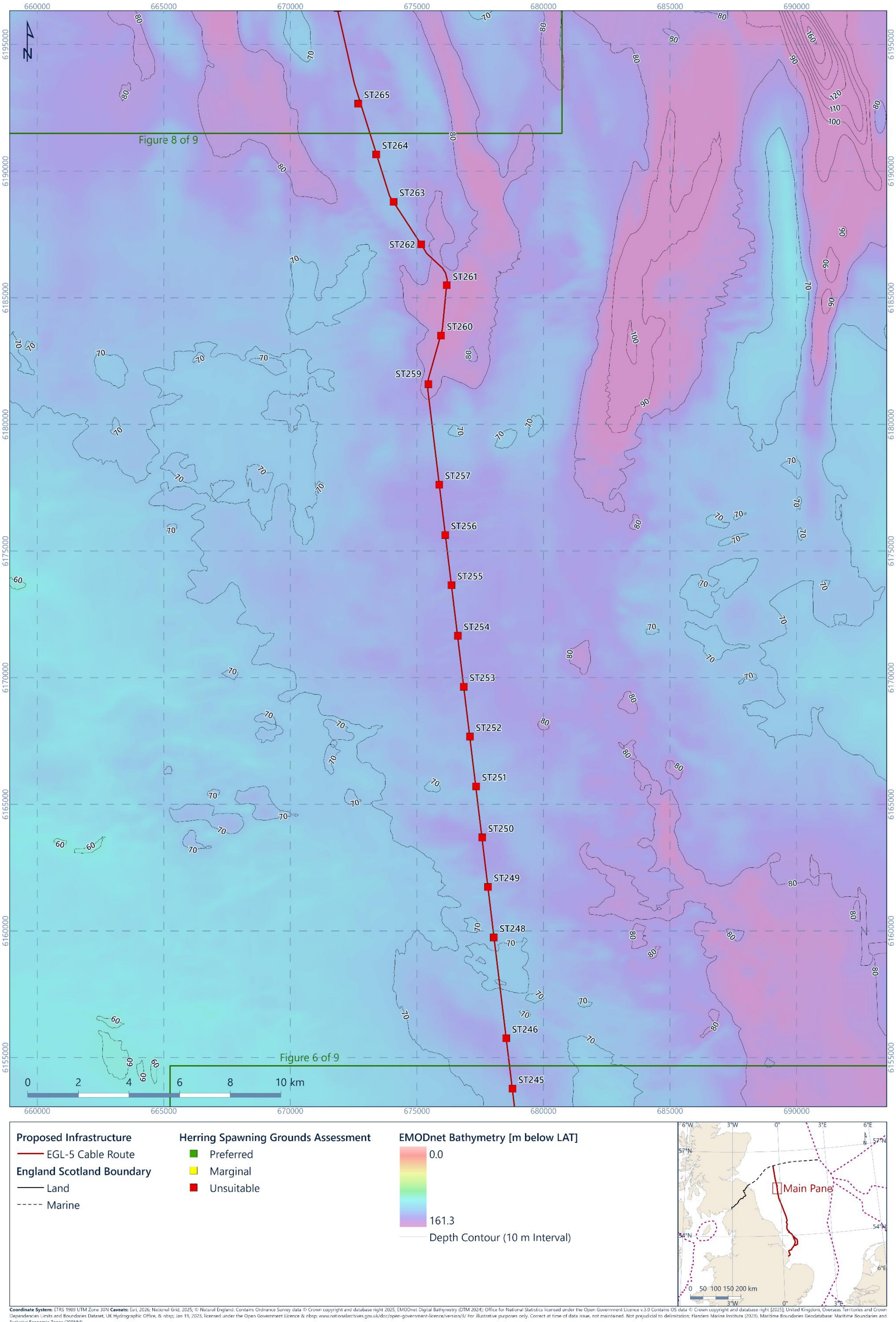

Figure 11.34: Spatial distribution of Herring spawning preferred grounds, station ST245 to station ST265

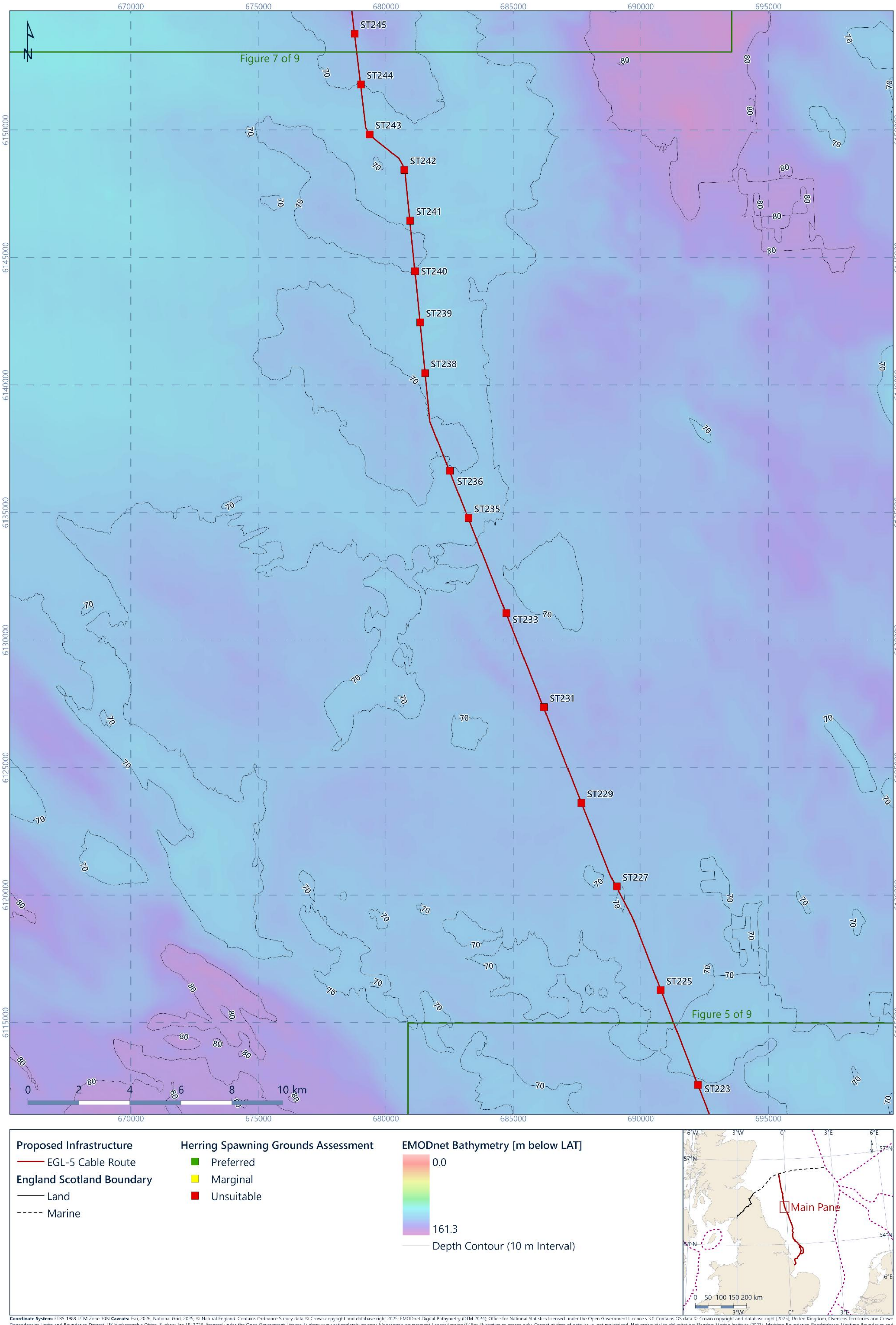

Figure 11.35: Spatial distribution of Herring spawning preferred grounds, station ST223 to station ST245

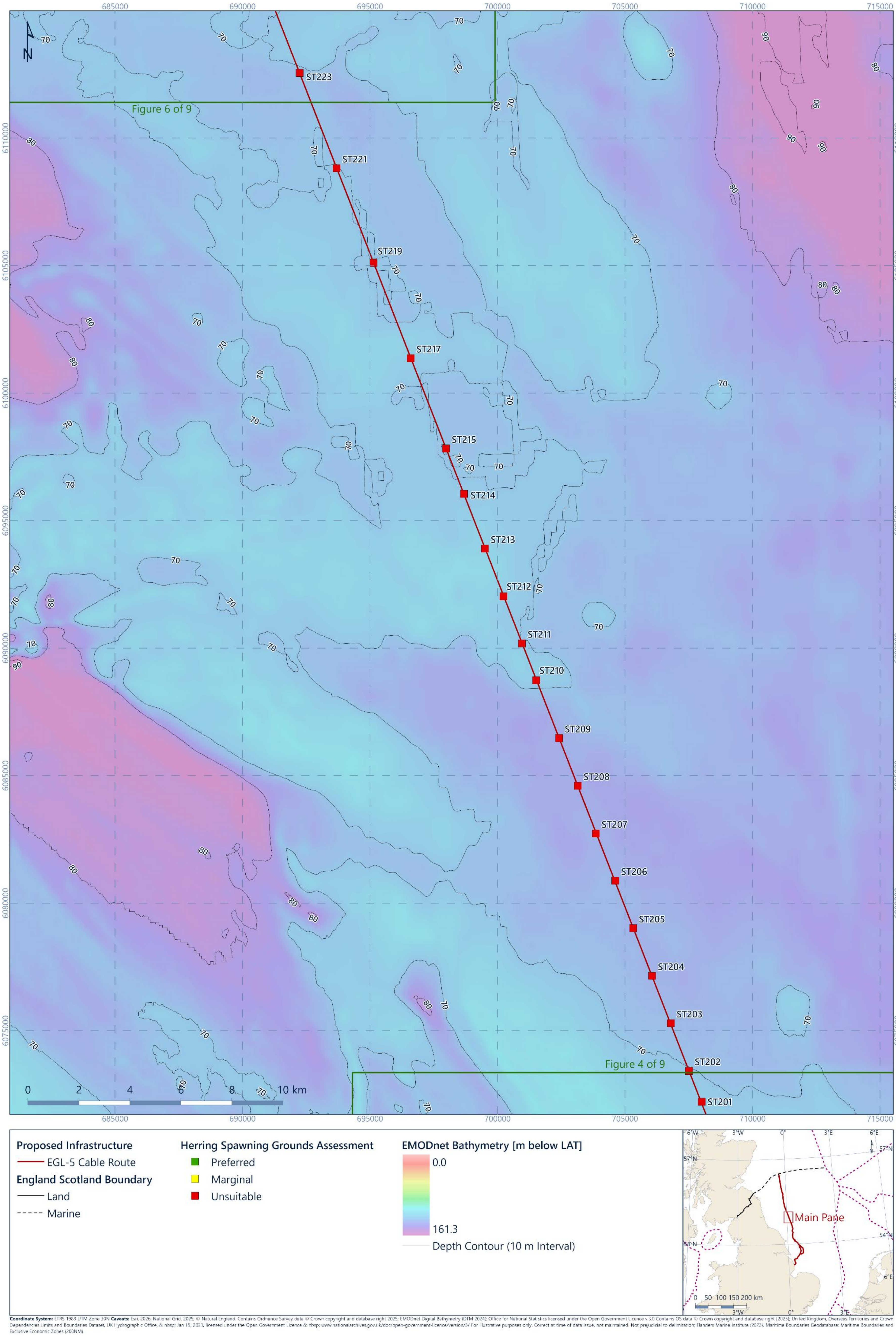

Figure 11.36: Spatial distribution of Herring spawning preferred grounds, station ST201 to station ST223

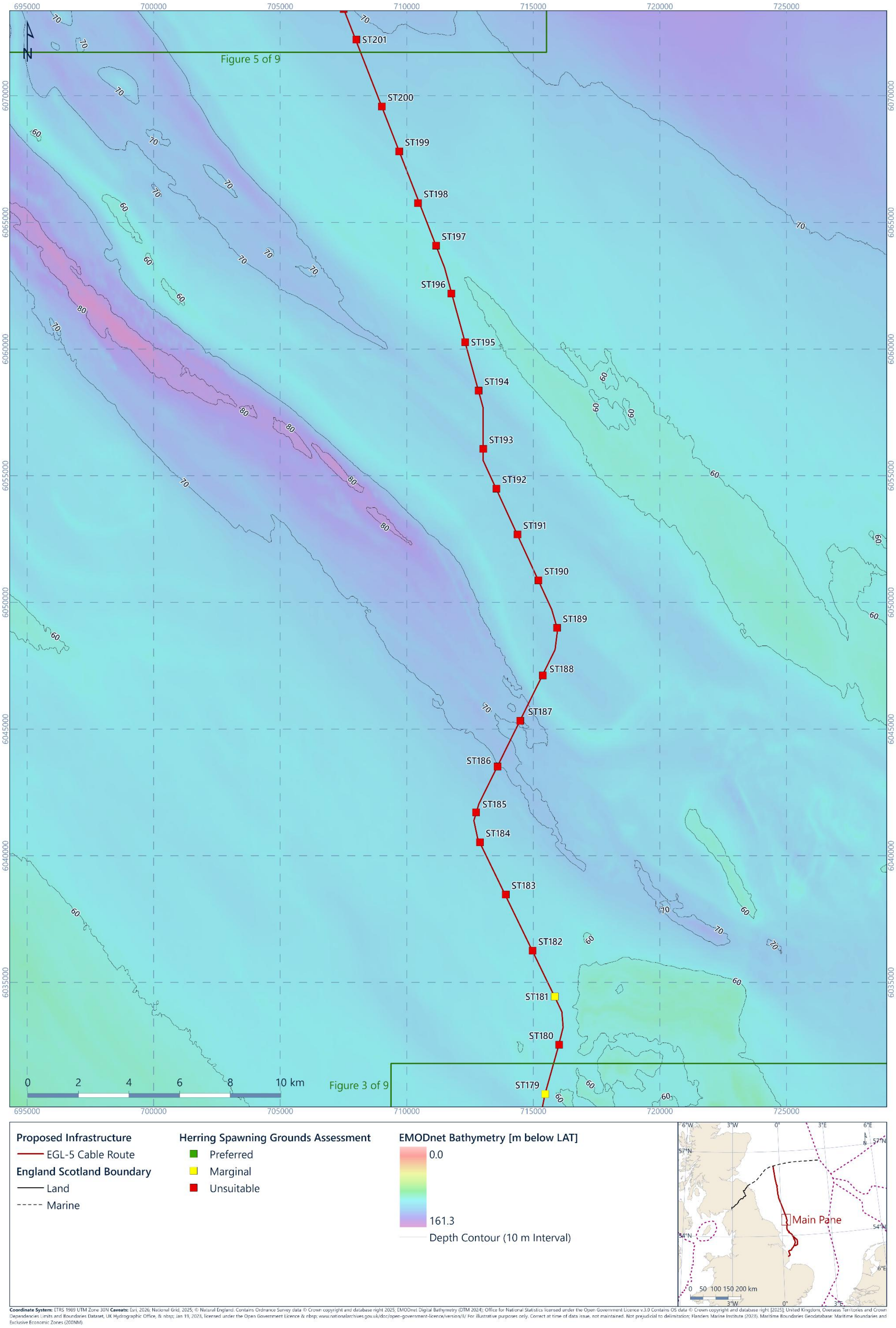

Figure 11.37: Spatial distribution of Herring spawning preferred grounds, station ST179 to station ST201

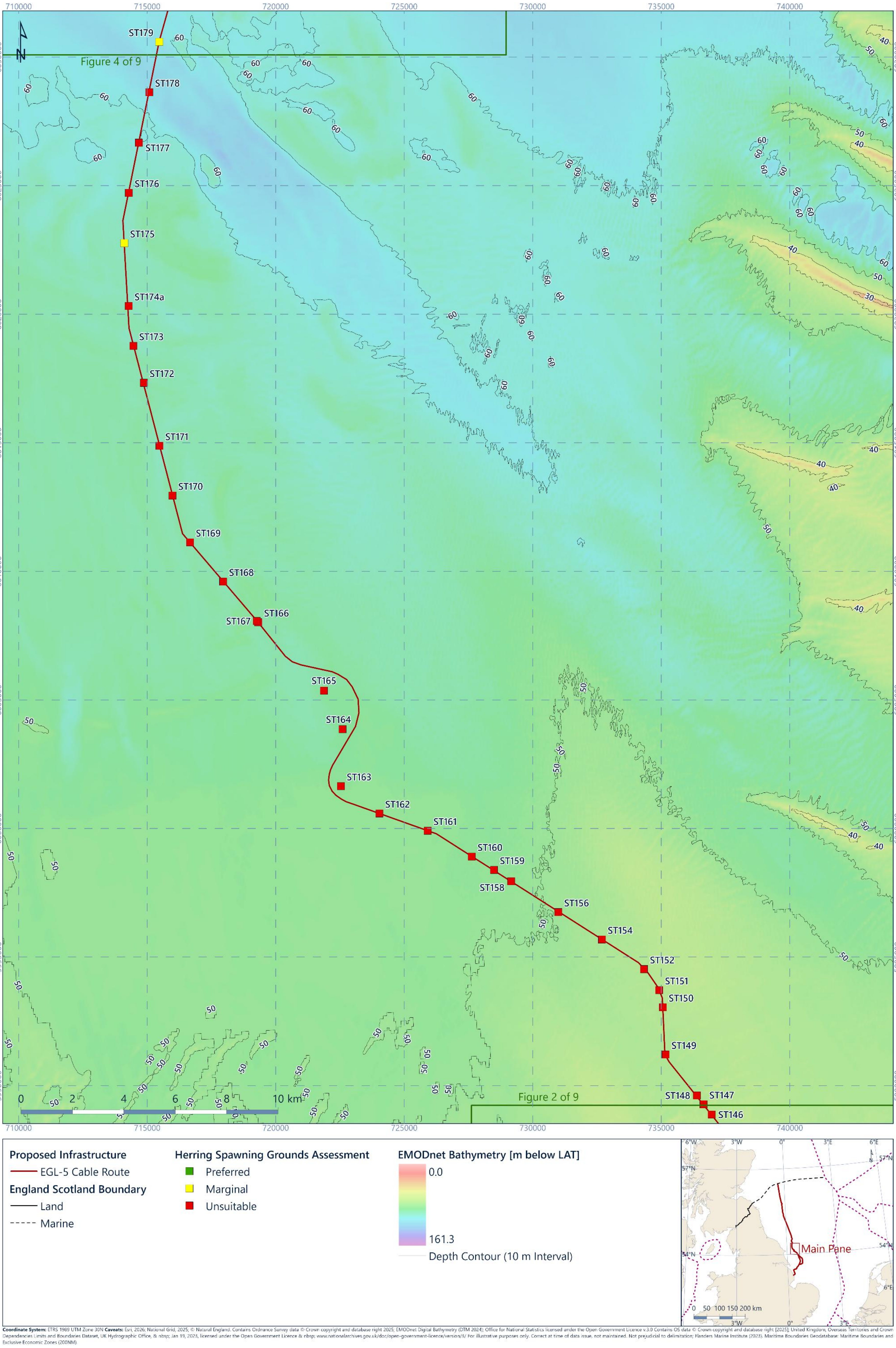

Figure 11.38: Spatial distribution of Herring spawning preferred grounds, station ST146 to station ST179

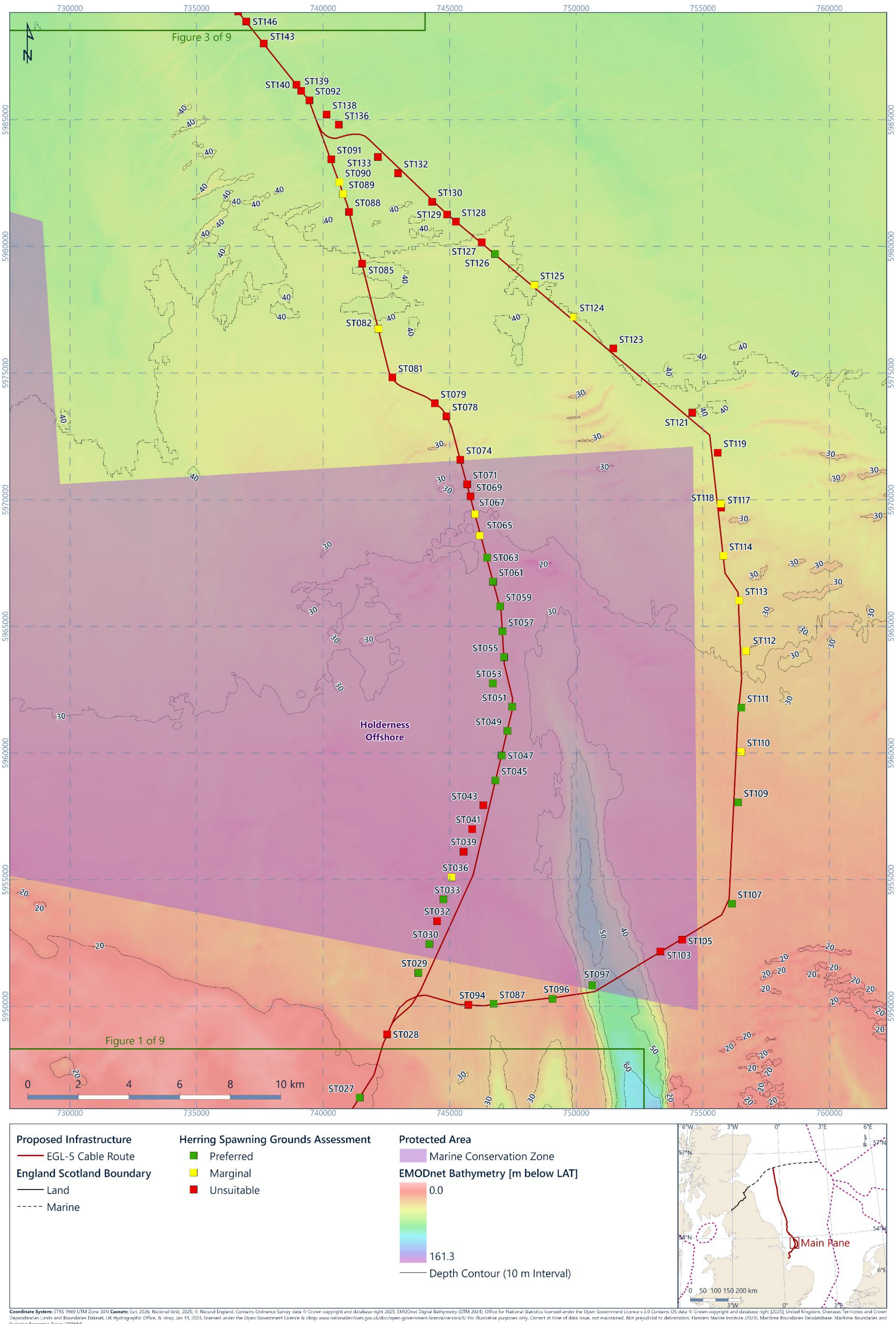

Figure 11.39: Spatial distribution of Herring spawning preferred grounds, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

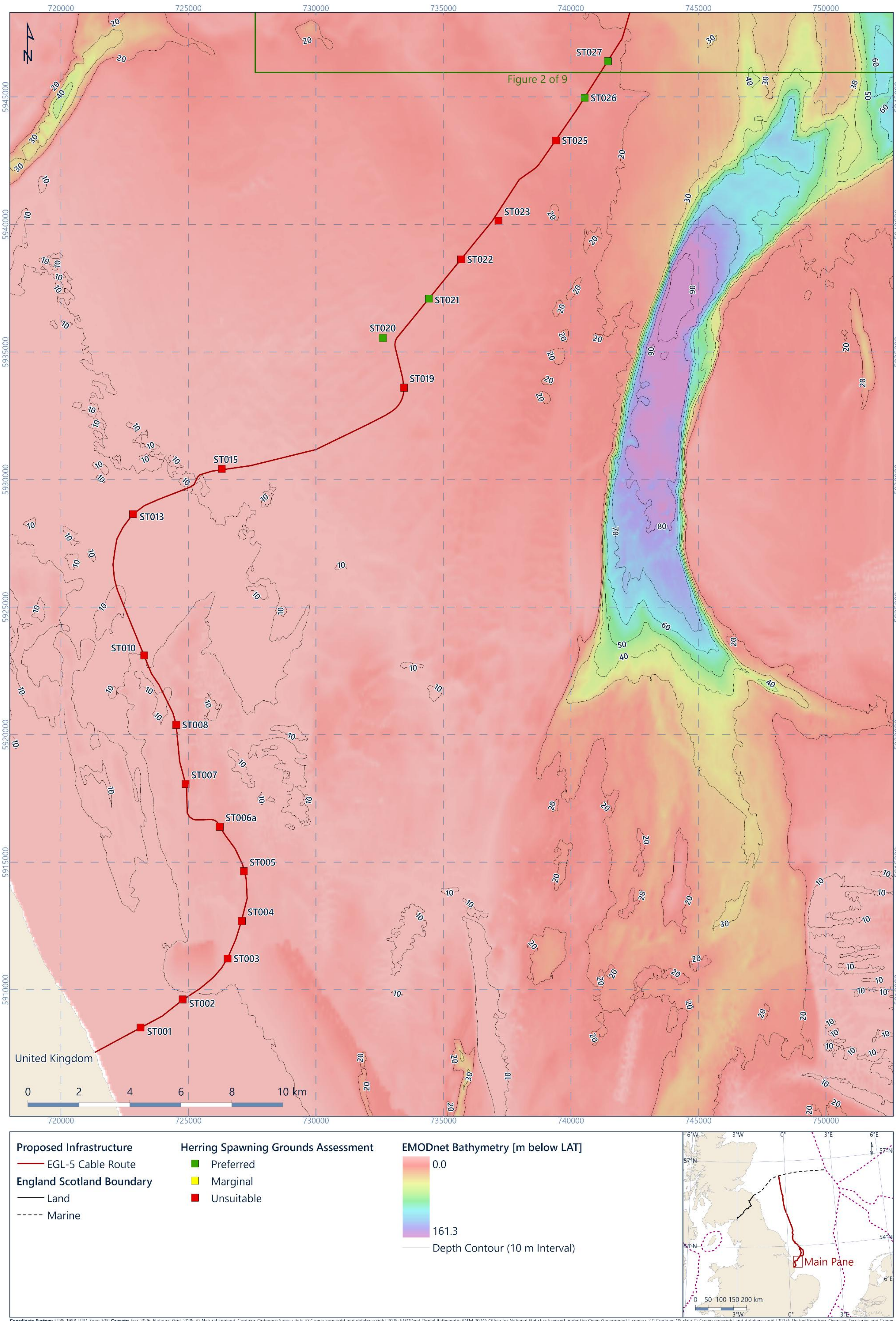

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Figure 11.40: Spatial distribution of Herring spawning preferred grounds, station ST001 to station ST027

11.2.7 Other Potentially Sensitive Habitats and Species

Figures 11.41 to 11.49 present the distribution of the UK BAP habitats potential occurring along the proposed exporting cable corridor (ECC).

The potential presence of the UK BAP habitat 'Mud Habitats in Deep Water' (BRIG, 2008a) was considered in the area of station ST231 due to the potential presence of the biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' (MC6216) and associated biological communities was observed (Section 11.2.2). The biotope complex 'Faunal communities of Atlantic circalittoral mud (MC621) was described at station ST009 and may also fall within this UK BAP habitat (Section 11.1.6).

Patches of exposed clay were observed during the video analysis at stations ST005, ST006a, ST008, ST011, ST014, ST016, ST017 and ST072 whilst clay exposures with piddock holes were observed at station ST009. Piddock holes and dead shells of ?*Barnea* sp. were also observed form the grab samples at stations ST004. These observations may suggest the presence of the UK BAP priority habitat 'Peat and Clay Exposures with Piddocks' along the proposed ECC. However, the exposed areas observed were very small patches (< 5 m in length), below the minimum 25 m^2 which would necessitate a more detailed habitat assessment (Appendix B).

The habitat types described throughout much of the survey area may occur within the broad habitat of 'Subtidal sands and gravels', a UK BAP priority habitat that features sediments ranging from mainly sand, through various proportions of sand and gravel, to mainly gravel (BRIG, 2008c). The biotope complexes assigned along the proposed cable route associated with this UK BAP habitat include 'Faunal communities of full salinity Atlantic infralittoral sand' (MB523), 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321), 'Faunal communities in Atlantic circalittoral sand' (MC521) and 'Faunal communities in Atlantic offshore circalittoral sand' (MD521).

From the video analysis, individuals belonging to the family Gadidae, including the UK BAP species Atlantic cod *Gadus morhua*, were recorded at three stations and the UK BAP species European plaice *Pleuronectes platessa* was recorded at three stations (Appendix J.1.1).

UK BAP species were detected by the eDNA sampling and included sand eels (*A. marinus*) (Section 11.2.5), Atlantic herring (*Clupea harengus*) (Section 11.2.6), Atlantic cod (*G. morhua*) in 13 samples (plus 3 samples and 15 samples where OTUs of the genus *Gadus* and the family Gadidae, respectively, were detected), whiting (*Merlangius merlangus*) in 39 samples, common ling (*Molva molva*) in 1 sample, angler fish (*Lophius piscatorius*) in 2 samples (plus 1 sample where OTUs of the genus *Lophius* where detected), mackerel (*Scomber scombrus*), European plaice (*Pleuronectes platessa*) in 26 samples (plus 1 and 7 samples where OTUs of the genus *Pleuronectes* and the order Pleuronectiformes, respectively, were detected), common sole (*Solea solea*) in 13 samples and Atlantic horse mackerel (*Trachurus trachurus*) in 3 samples.

The Atlantic cod (*G. morhua*) is also listed in the OSPAR threatened and/or declining species list.

Anemones of the family Edwardsiidae were recorded within the survey area by grab sampling at 44 stations, indicating the possible presence of the UK BAP species *Edwardsia timida*.

No other Annex I habitats or Annex II species, OSPAR threatened and/or declining species and habitats, or UK Priority Habitats and Species were observed within the survey areas.

The species lists generate by the different sampling methods were also compared against the IUCN Red List to obtain global threat status (Sections 3.3.7.3). Of the taxa detected by the eDNA water samples analysis (Sections 10.1.1 and 10.3.1), Atlantic cod (*G. morhua*), Haddock (*M. aeglefinus*), Atlantic horse mackerel (*T. trachurus*) and the witch flounder (*Glyptocephalus cynoglossus*) are listed as 'vulnerable' and the American plaice (*Hippoglossoides platessoides*) is listed as 'endangered'.

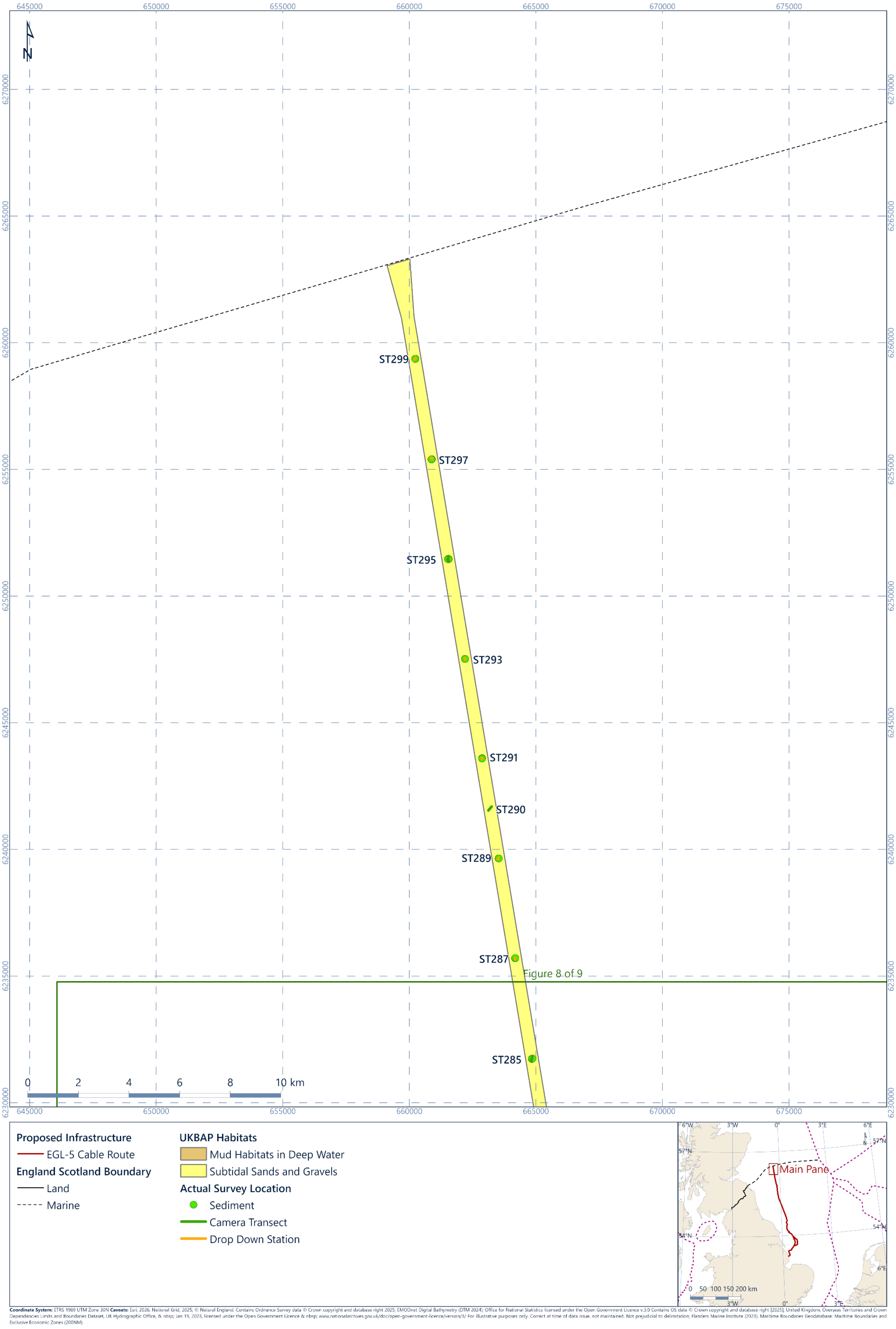

Figure 11.41: Habitat map along the proposed cable route, station ST285 to station ST299

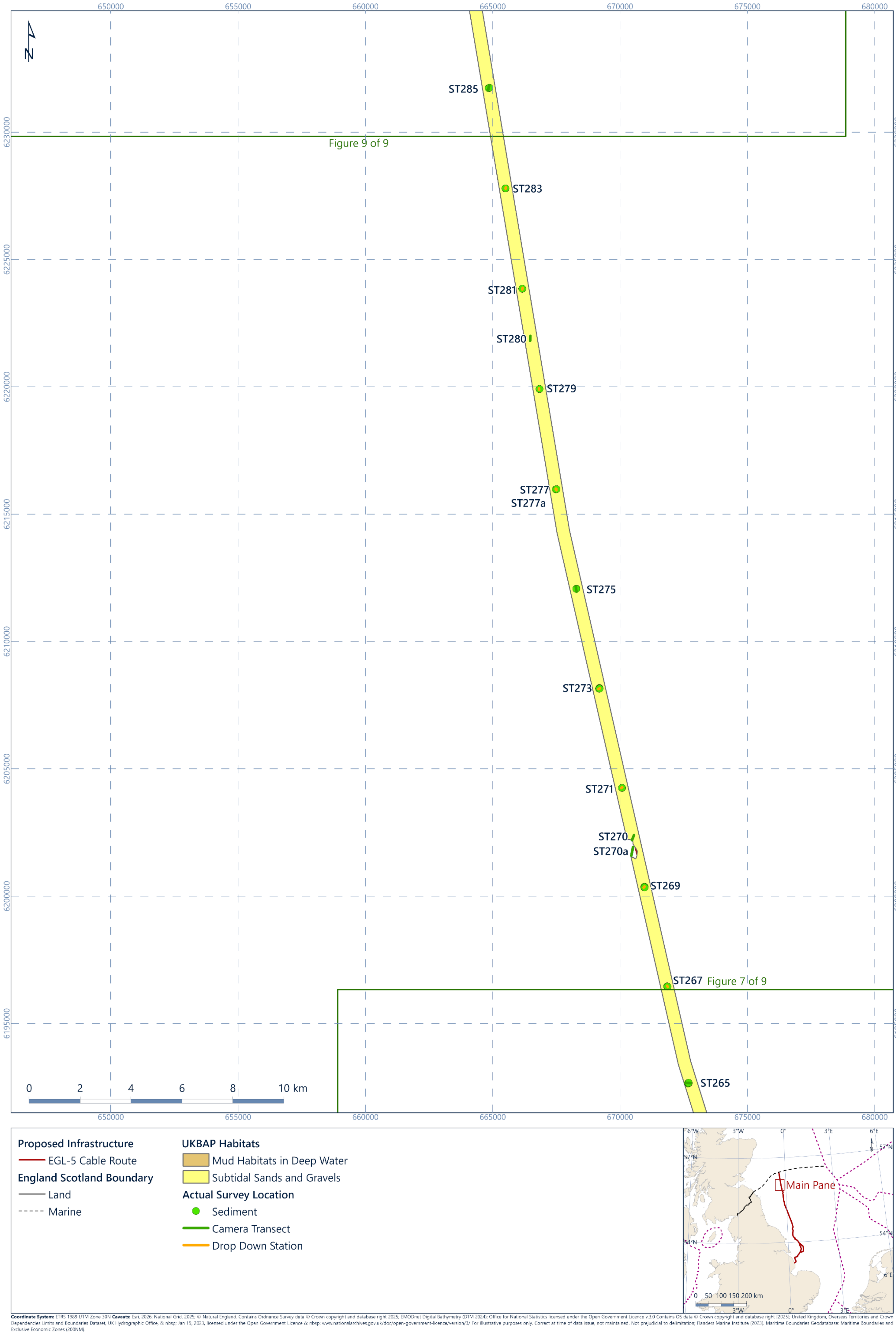

Figure 11.42: Habitat map along the proposed cable route, station ST265 to station ST285

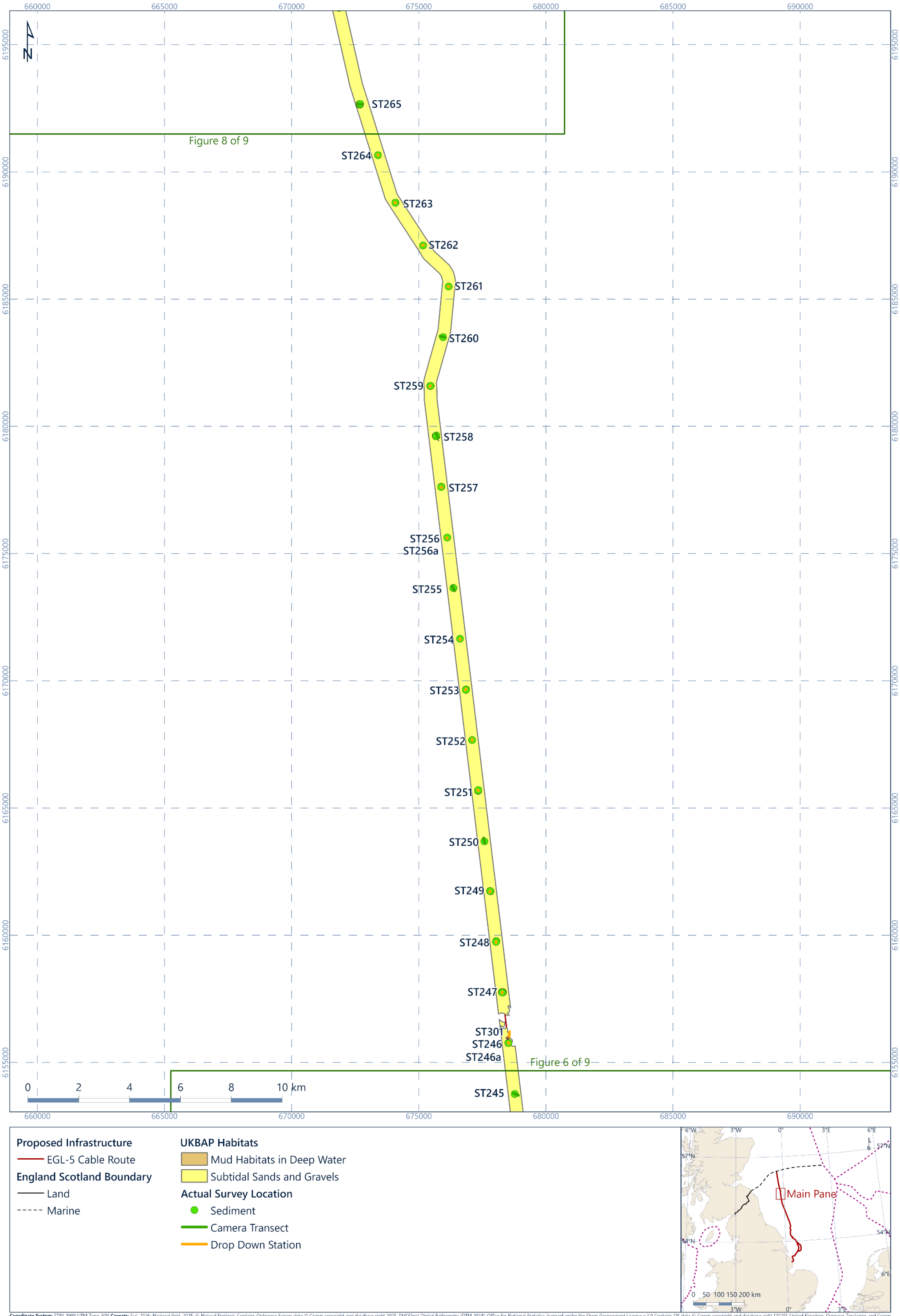

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Figure 11.43: Habitat map along the proposed cable route, station ST245 to station ST265

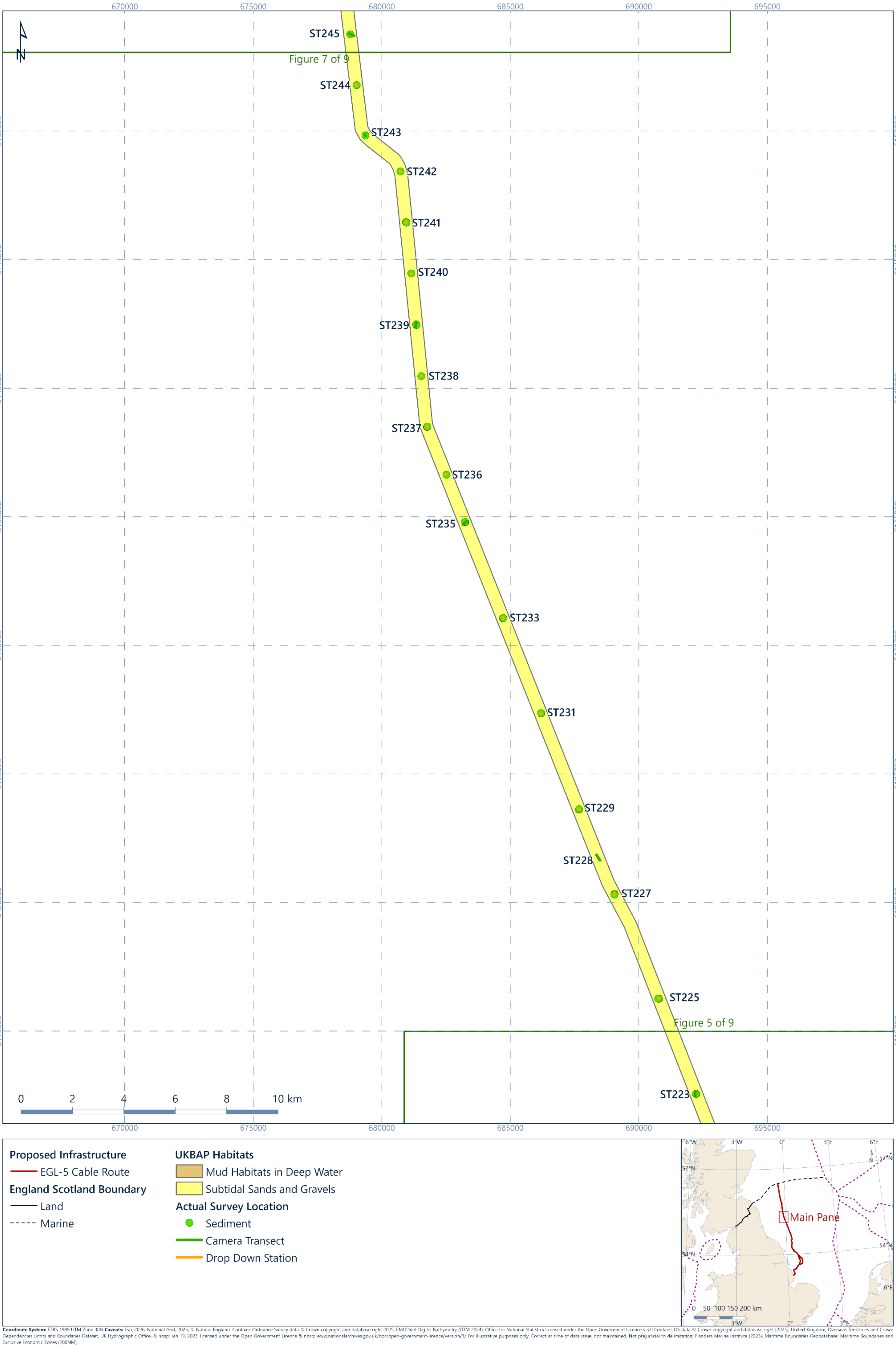

Figure 11.44: Habitat map along the proposed cable route, station ST223 to station ST245

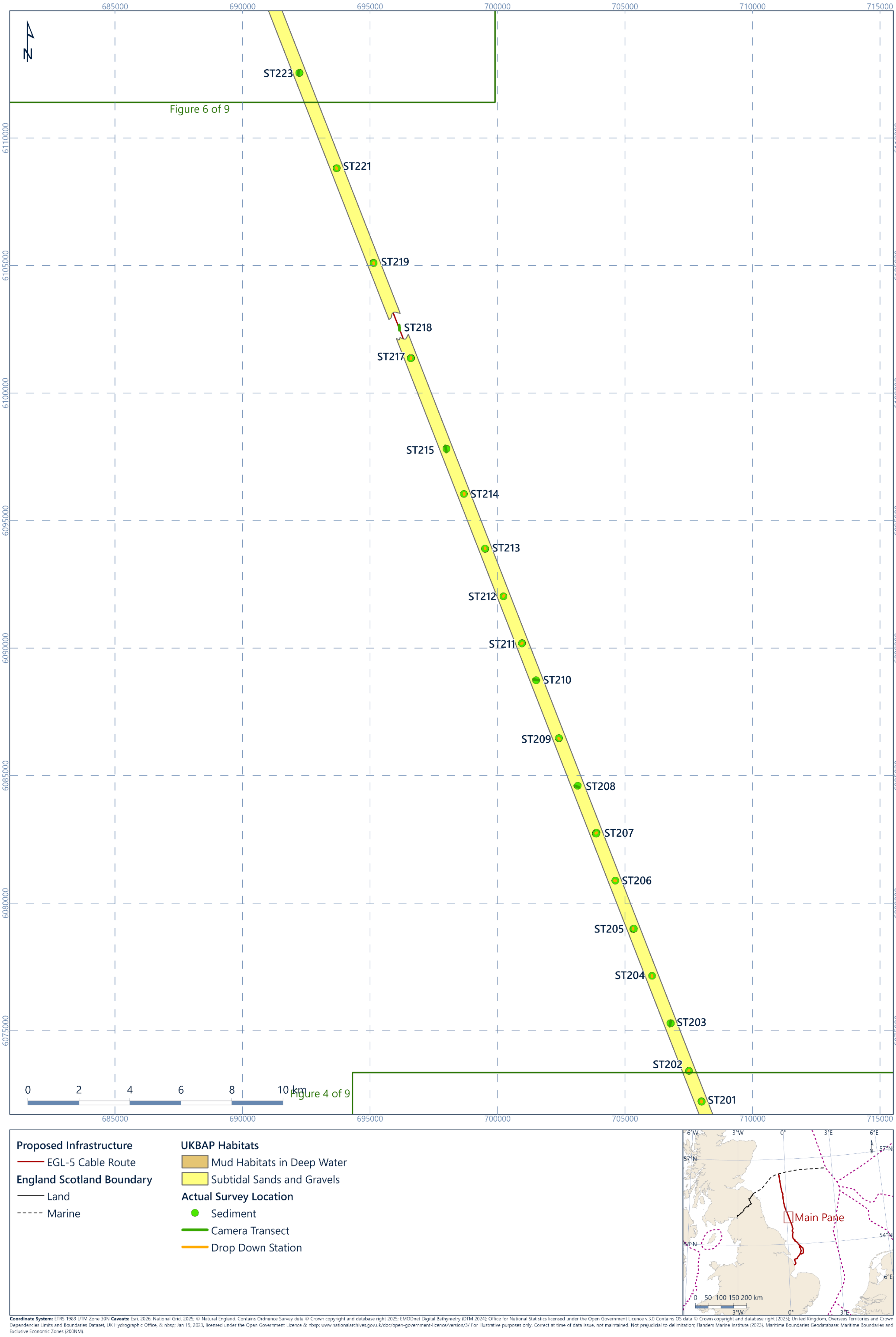

Figure 11.45: Habitat map along the proposed cable route, station ST201 to station ST223

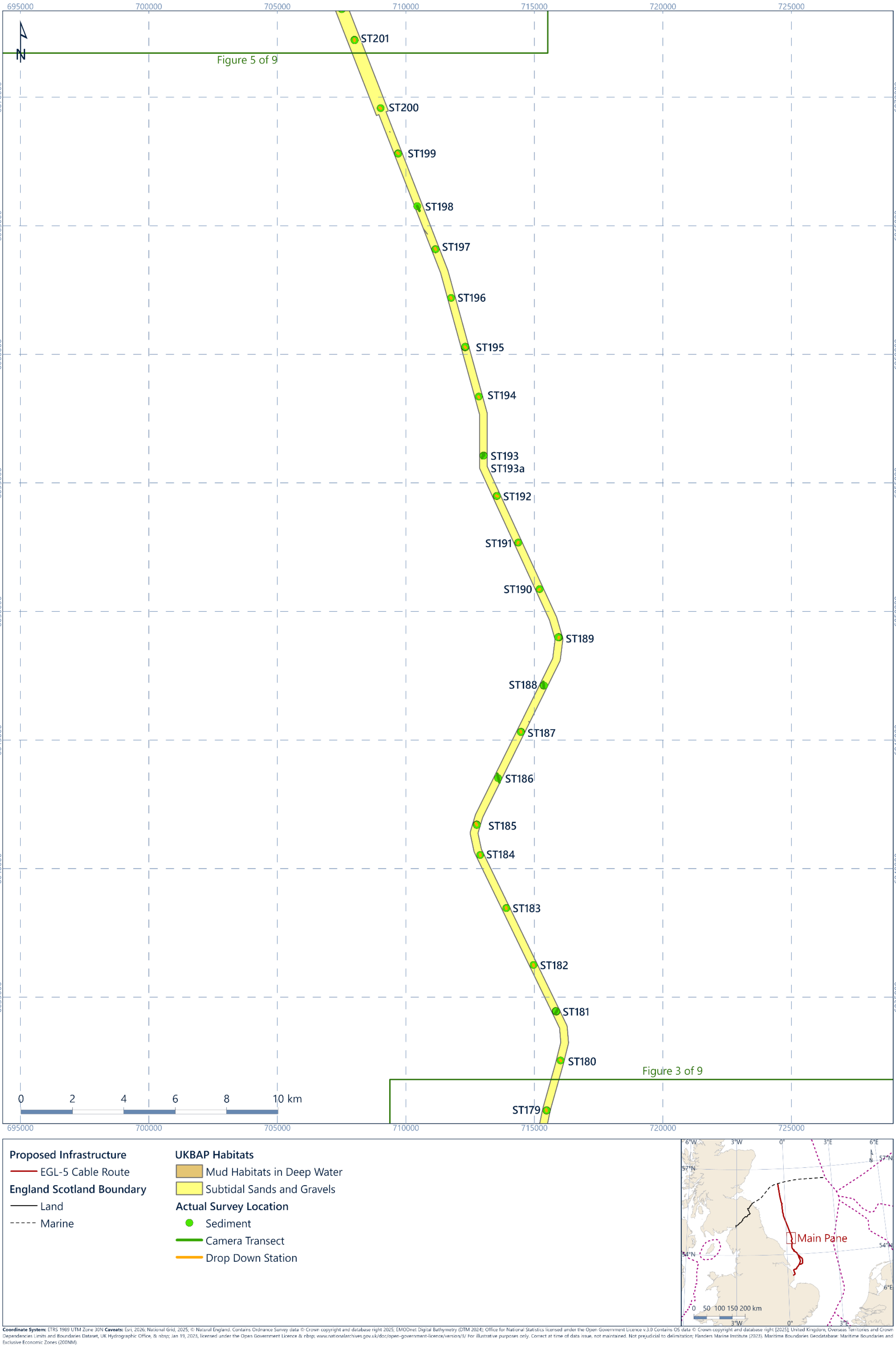

Figure 11.46: Habitat map along the proposed cable route, station ST179 to station ST201

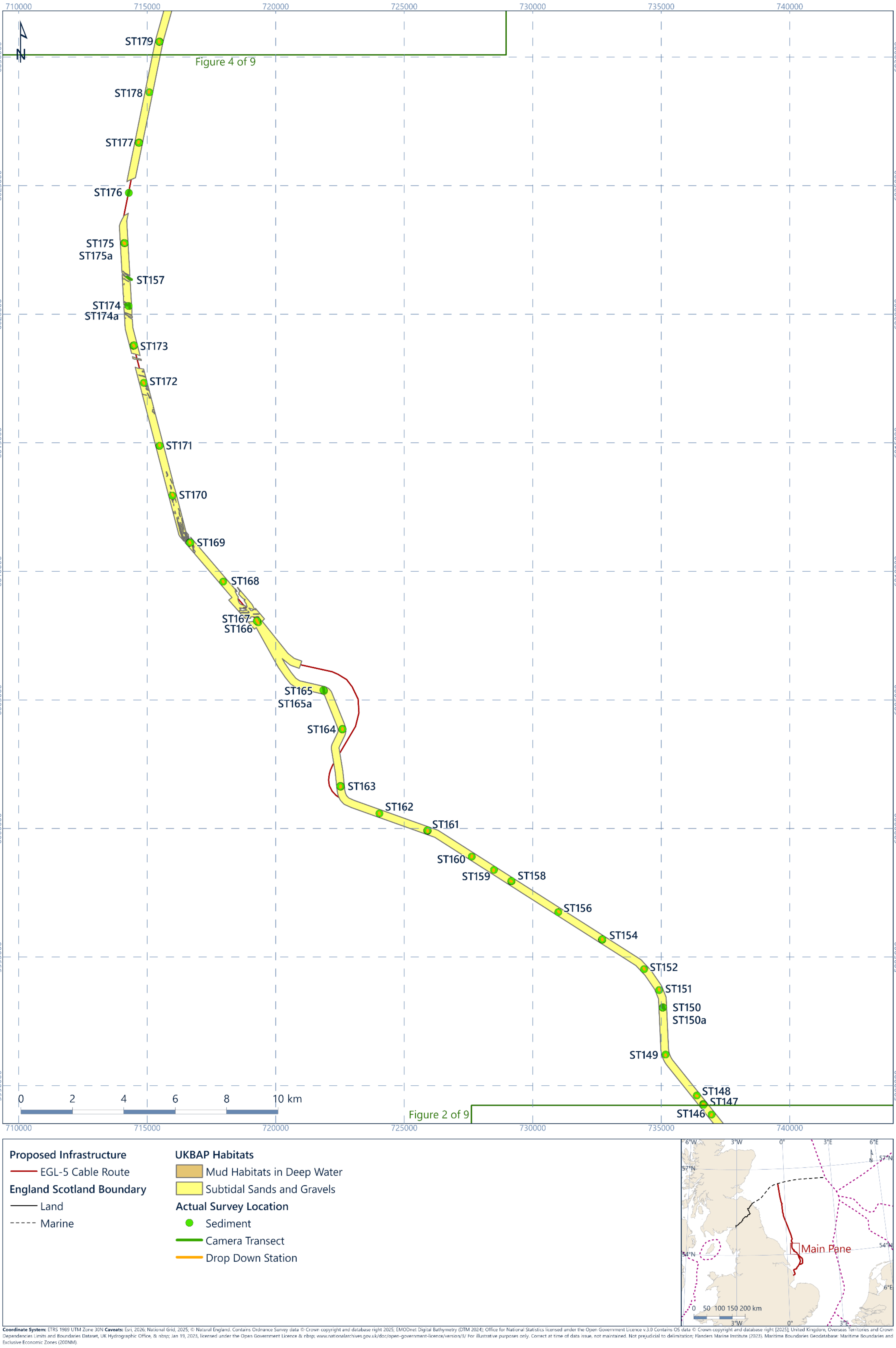

Figure 11.47: Habitat map along the proposed cable route, station ST146 to station ST179

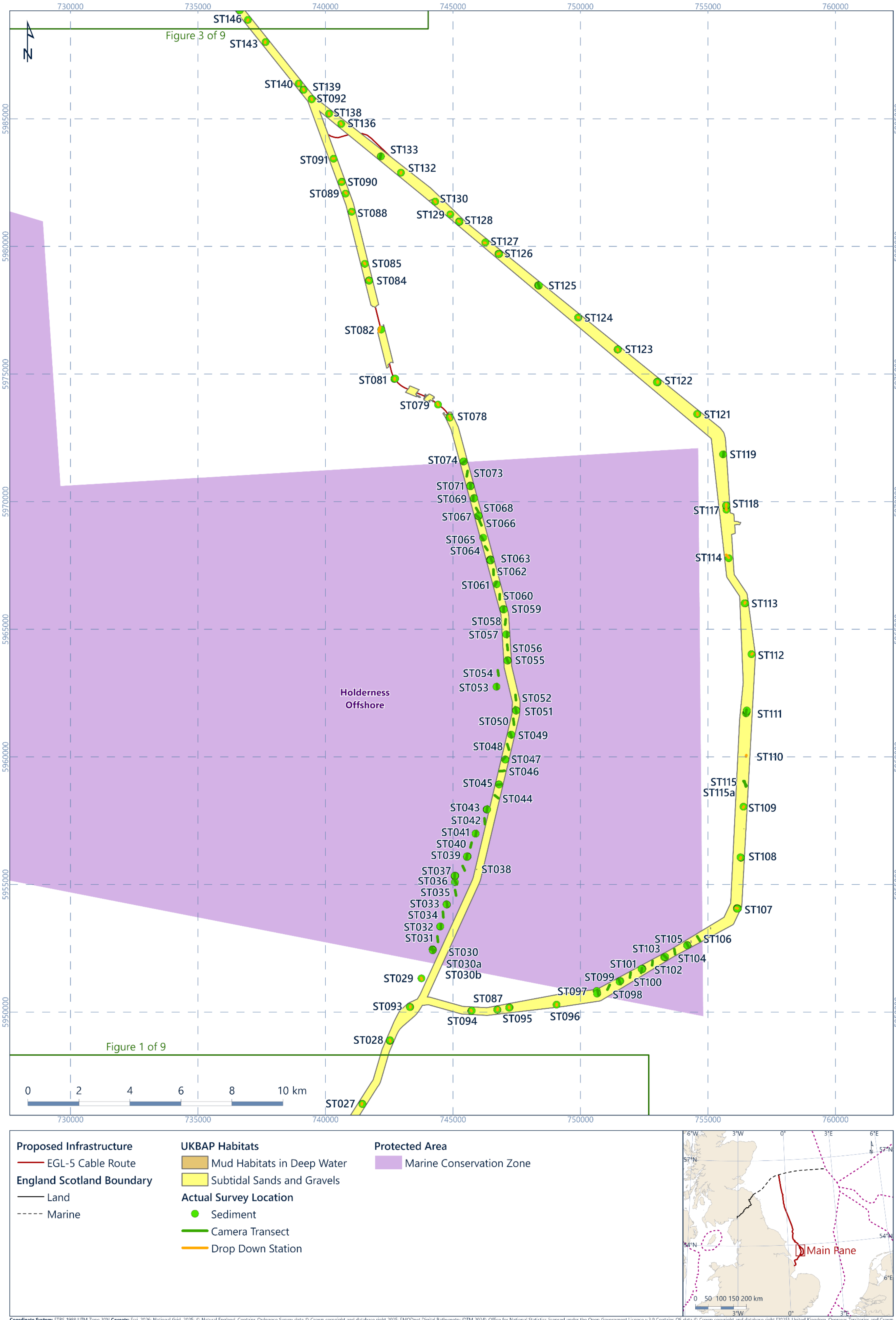

Figure 11.48: Habitat map along the proposed cable route, station ST027 to station ST146 (inclusive of all in Holderness Offshore marine conservation zone)

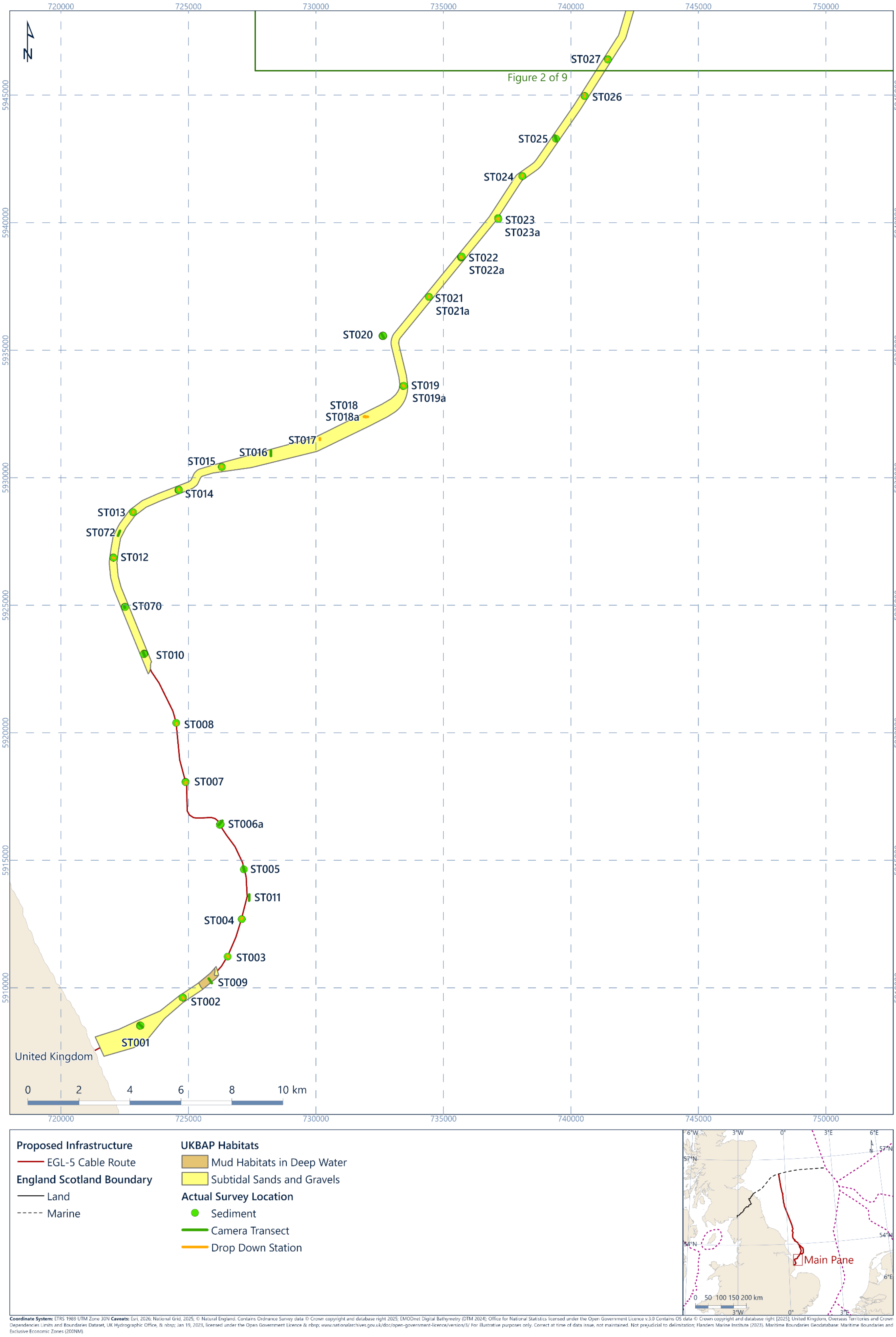

Figure 11.49: Habitat map along the proposed cable route, station ST001 to station ST027

11.2.8 Non-Indigenous Species (NIS)

From the analysis of the grab samples the non-indigenous species (NIS) detected, according to EEA (2024), included the polychaete *Goniadella gracilis* (four individuals at stations ST026, ST039, ST043 and ST063) and the mollusc *C. fornicata* (four individuals at stations ST006a, ST010 and ST020) (Appendix G.1). From the photographic data analysis, *C. fornicata* was also recorded following the SACFOR abundance scale as 'Present' (stations ST008, ST012, ST013, ST016, ST017, ST022a, ST023a and ST072) and as 'Rare' (stations ST010, ST014, ST015, ST018a and ST019a) (Appendix J.1.2).

No other NIS were detected within the survey area.

12. Discussion

12.1 Sediment Characterisation

Organic content was very low along the proposed cable route, with TOC values up to 1.71 %. Organic matter performs an important role in marine ecosystems, providing a source of food for suspension and deposit feeders, leading to the suggestion that variation in benthic communities may influenced to some extent by the availability of organic carbon (Snelgrove & Butman, 1994). In the current study the TOC concentrations present did not play a role in the observed pattern of macrofaunal distribution.

The sediment types recorded along the proposed cable routes were typical of this region of the SNS, where the offshore seafloor is reported to comprise a range of sediment types from fine sand, coarse to very coarse sand and gravel. Natural variations of the sediment types include 'slightly gravelly sand' and 'muddy sand' which typically occur offshore. In the closer inshore areas, the proportion of coarser sediment generally increases and the proportion of mud varies, resulting in areas of 'muddy sand', 'gravelly muddy sand', and 'muddy sandy gravel' (Jones et al., 2004).

The heterogeneity of the survey area was further investigated by multivariate analysis which showed the presence of four main sediment groups along the proposed cable route. Group A was characterised by 'poorly sorted 'sand' (Folk BGS modified), specifically 'fine sand' and 'very fine sand', with fines content ≥ 5.00 % at most stations and mean gravel content of 0.57 %. The stations belonging to this group where all located along the offshore section of the proposed cable route at water depths > 65 m BSL (offshore). Group B was characterised by very poorly sorted 'sand/gravel' (Folk BGS modified), specifically 'very coarse sand', with a mean sand content of 56.11 %, a mean gravel content of 35.98 % and mean fines content of 7.91 %, suggesting coarser to mixed substrate. Group C was characterised by poorly sorted 'sand' (Folk BGS modified), specifically 'coarse sand' with gravel and fines contents up to 18.87 % to 18.86 %, respectively. Group D was characterised by 'very poorly sorted 'muddy sandy gravel' (Folk BGS modified), specifically 'gravel'. Sands and fines were present at all stations and had mean values of 29.15 % and 4.93 %, respectively, suggesting much coarser grounds. The stations belonging to these groups were located at mean water depths ranging between 23.7 m BSL and 44 m BSL (nearshore) and encompassed those stations located within the Holderness Offshore MCZ, specifically those grouped within Group D. The single station ST063 described as 'sandy gravel' (Folk BGS modified), separated from the other stations due to a higher sediment particle size value (1 987 µm; very coarse sand) and had comparable proportions of gravel and sand content of 49.91 % and 49.77 %, respectively.

The principal component analysis of the sediment fractions (% gravel, % sand, % fines) indicated that the gravel fraction showed the highest variability along the proposed cable route, followed by the proportion of mud. However, the proportion of sand also showed high variability, as reflected in the faunal communities supported by both coarser and finer sediments dominated by the sand fraction, as presented in Section 8 and discussed in Section 12.3.

In this study, the nearshore stations were classified as 'gravel', 'muddy sandy gravel', 'muddy gravel' and 'gravelly muddy sand' (Folk BGS) depending on the gravel and mud contents. Particularly at the nearshore locations, a noticeable biogenic contribution to the gravel resulted from shell fragments as indicated by the on-site observations detailed in the grab log.

12.2 Sediment Chemistry

12.2.1 Sediment Hydrocarbons

12.2.1.1 Total and Aliphatic Hydrocarbons

Marine sediments contain hydrocarbons derived from many sources that enter the marine environment via three general processes: biosynthesis (marine and land organisms biosynthesise hydrocarbons), geochemical processes (submarine and coastal/terrestrial oil-seeps) and anthropogenic sources (from accidental or intentional discharge of fossil fuel) (Farrington & Meyer, 1975; Myers & Gunnerson, 1976). Anthropogenic hydrocarbon inputs to the marine environment include marine transportation, offshore oil production, coastal oil refineries, accidental shipping losses, and industrial and municipal waste (which includes sewage and dredged spoils). A significant contribution to the global budget enters the marine environment via urban and river run-off, atmospheric deposition (from combustion sources including PAHs) and natural seepages (Dicks et al., 1986; Johnston, 1980; North Sea Task Force [NSTF], 1993; OSPAR, 2000, 2010).

Biosynthesised hydrocarbons are ubiquitous in the marine environment (Harada et al., 1995; Parinos et al., 2013). Odd carbon number, long-chain n-alkanes are widely distributed in the plant kingdom (Bush & McInerney, 2013; Douglas & Eglington, 1966; Eglinton et al., 1962) as components of cuticle waxes. These are common on the surfaces of leaves, stems, flowers and pollen and their presence in sediment is indicative of terrestrial inputs from adjacent land masses. Relatively high concentrations of nC_{29}, nC_{31} and nC_{33} are therefore a common feature of many marine sediments (Farrington et al., 1977), particularly inshore marine sediments (Bouloubassi et al., 1997), but are also evident in sediments from deepwater regions like the Atlantic Margin/west of Shetland regions of the United Kingdom Continental Shelf (McDougall, 2000) and regions such as the South China Sea and West Africa (Fugro, unpublished data).

The gas chromatographic profiles (Appendix E.1) obtained for sediments collected within the National Grid survey area showed a common underlying hydrocarbon distribution, comprising a homologous series of n-alkanes ranging in carbon number from nC_{12} to nC_{36}. Evidence of terrestrial run-off was present in most of the samples, as shown by the slight prevalence of the odd-numbered heavier n-alkanes (nC_{27}, nC_{29}, nC_{31} and nC_{33}), which are typical of plant cuticular waxes. The GC-FID profiles also contained a low-level UCM covering the nC_{12} to nC_{36} range, peaking late in the profile. The UCM is composed of a wide range of compounds, including cyclo-alkanes, which remain after substantial weathering and biodegradation of petrogenic hydrocarbons (Farrington et al., 1977).

For example, at station ST111, the presence of a high-molecular-weight UCM indicates a contribution to the sediment from weathered hydrocarbon material, likely originating from human activities (e.g. shipping). These sources are mainly linked to terrestrial runoff combined with diffuse fossil-fuel discharges from past or ongoing industrial operations in the marine environment, such as shipping or oil and gas development. A cluster of peaks around nC_{21} was present at some stations. This signature is often observed in sediments from the SNS and is thought to be derived from branched isoprenoids of biogenic origin (Volkman et al., 1992); (Volkman et al., 1994); (Damsté et al., 2005).

The THC values present were indicative of background sediment for the wider region. This is further supported by comparison to the North Sea Quality Status Report (NSTF, 1993), which suggests that typical THC levels (i.e. 'background') in sediments remote from anthropogenic activities range from 0.2 µg/g to 5 µg/g. However, in some areas, values may be as high as 15 µg/g. All stations, including pre-sweeping stations, measured THC concentrations below the Cefas Guideline Action Levels and the EET (OSPAR, 2006). Throughout the survey route, THC concentrations were highest in the northern sections, where sediments were finer and water depths were deeper, and lowest near the southern coastline. No evidence of exceedances or elevated levels was observed within the marine conservation zone, where concentrations were consistent with background levels.

The ratio of odd- to even-numbered normal alkanes is referred to as the CPI and has been calculated across various chain-length ranges. Elevated ratios (i.e. those > 1.00) over the nC_{12} to nC_{36} carbon range are due to the domination of the odd-chain length n-alkanes (nC_{27} to nC_{33}) and are typically associated/observed with inputs from terrestrial run-off (leaf waxes, etc., discussed previously). All CPI (nC_{12} to nC_{36}) ratios recorded were greater than 1.00, demonstrating the influence of odd-chain length n-alkanes (nC_{27} and nC_{33}) and biogenic material in most sediment samples.

The isoprenoidal alkanes pristane (Pr) and phytane (Ph) were reported in low concentrations in each of the sediment samples analysed. These compounds are present in significant concentrations in crude oils (Berthou & Friocourt, 1981). They may also be biosynthesised (Gunkel & Gassmann, 1980), and pristane, a breakdown product of the phytol moiety of chlorophyll, is widespread in the marine ecosystem, probably being derived from zooplankton. Phytane is generally absent or present in only relatively low levels in uncontaminated natural systems (Blumer & Snyder, 1965). The Pr/Ph ratios reported in the sediments ranged from 1.22 to 90.9 (mean 11.0; Table 7.1). These values typically suggest that the higher pristane proportion in the sediments was derived from non-petrogenic sources.

12.2.1.2 Aromatic Hydrocarbons

PAHs contain carbon and hydrogen atoms and consist of two or more fused benzene rings in linear, angular or cluster arrangements (Balmer et al., 2019). Other atoms (e.g. nitrogen, sulphur and oxygen) may be readily substituted into the benzene ring to form heterocyclic compounds that are present in significant concentrations in petroleum and refined products. Petroleum sources are rich in aromatic hydrocarbons, particularly 1 to 3 ring compounds (benzenes, naphthalenes and phenanthrenes); the levels of 4 to 6 ring compounds are relatively low. In addition, significant concentrations of organosulfur compounds (dibenzothiophenes) are generally present (Friocourt et al., 1982). The relative proportion of these compounds will vary between crude oils and refined petroleum.

PAHs are widely spread in the environment (Butler et al., 1984) with natural sources occurring primarily through synthesis by plants (Neff, 1979; Sims & Overcash, 1983), related to natural seeps of petroleum (Kennicutt et al., 1988; National Research Council [NRC], 1983) and to formation during natural forest and prairie fires (Wakeham et al., 1980; Youngblood & Blumer, 1975). By far the highest proportion of PAHs released into the environment are formed during fossil fuel combustion and anthropogenic forest and agricultural fires (Edwards, 1983; Haritash & Kaushik, 2009; Sims & Overcash, 1983). PAHs primarily enter marine sediments from atmospheric and riverine inputs and tend to adsorb to suspended inorganic and organic particulate matter, ultimately settling on the seafloor where they accumulate to relatively high concentrations (Culotta et al., 2006; Latimer & Zheng, 2003).

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 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 anthropogenic combustion sources.

The total concentrations of 2 to 6 ring PAHs showed high variability across the proposed cable route. Generally, the total 2- to 6-ring PAH concentrations across the survey were comparable to, or above, the Cefas Guideline Action Levels, with stations towards the north of the survey routes often exceeding the threshold.

Total 2 to 6 ring PAH concentrations (individual and total) present in the National Grid sediments were assessed by comparison with their assigned ERL threshold values (OSPAR, 2014). All individual PAH concentrations for all stations were below their respective ERL values (Appendix E.3.3 and E.3.6). The highest concentrations, like the THC levels, were observed at stations situated to the north of the survey route, while the lowest values were found near the shoreline. These concentrations align with the background levels commonly recorded throughout the region. Although exceedances were noted within the MCZ, they were comparable to those at stations along the entire route and are believed to reflect typical background conditions.

PAHs are lipophilic and bind strongly to organic matter in sediments (Davies, 2004), therefore, contaminant concentrations will be closely related to the distribution of fine grained and organic material (International Council for the Exploration of the Sea [ICES], 2009, 2012). Normalisation of PAH concentrations to total organic carbon provides a basis for reliable assessment of temporal trends and facilitates a meaningful comparison of sediment substances with OSPAR BC and BAC thresholds (ICES, 2009, 2012; OSPAR, 2014). When normalised to 2.5 % TOC, individual US EPA 16 PAH concentrations exceeded the BAC value. BAC values were exceeded for naphthalene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(ghi)perylene at most stations. Concentrations that exceed BAC values are considered to be 'above background' but at levels where it can be assumed that little or no risks are posed to the environment and its living resources at the population or community level (OSPAR, 2013). OSPAR guidance indicates that such exceedances reflect low-level anthropogenic influence, with little evidence of risk to benthic communities at both population and ecosystem scales. The normalised PAH profile points to moderate enrichment compared to background levels but does not suggest ecologically significant contamination.

The source of the PAHs may be determined by investigation of the relative proportions of individual PAH concentrations (Budzinski et al., 1997; Neff, 1979; Yunker et al., 2002) as well as examining the overall distributions of parent and alkylated PAHs present. Pyrogenically (or pyrolytic) derived PAHs signatures (i.e. forest fires, etc.) are dominated by higher molecular weight compounds (mainly 4 to 6 ring) and are predominantly unsubstituted. In contrast, PAH formed during the slow geological maturation of petroleum are dominated by alkylated, low molecular weight (mainly 1 to 3 ring) compounds (Neff, 1979; Stogiannidis & Laane, 2015).

The distribution of parent 2 to 6 ring PAH compounds also reflects whether the source is petrogenic or pyrolytic. The trend of parent and alkylated PAHs is represented graphically in Appendix E E.2.4 using three-dimensional plots that represent the PAHs concentrations in terms of parent compound and alkyl homologue distribution of the aromatic material in the sediments analysed. The plots suggest that some PAHs detected along the proposed routes originate from both pyrolytic and petrogenic sources. Notably, samples from the northern section of the cable route are primarily of pyrolytic origin.

12.2.2 Sediment Metals

The analysis of samples for metal content can provide further corroboration, in conjunction with the physical characteristics and hydrocarbon content of marine sediments, to assess either background levels or the dispersion of discharged material around offshore installations.

Metals and metalloids occur naturally in the marine environment and are widely distributed in both dissolved and sedimentary forms. Some are essential to marine life, while others have no biological function and therefore are toxic to numerous organisms at certain levels

(Boening, 1999; Páez-Osuna & Ruiz-Fernandez, 1995). Metals can enter the environment via natural methods such as riverine transport, coastal discharges, geological weathering and atmospheric fallout (Brady et al., 2015). Other routes into marine sediments include anthropogenic activities, such as direct discharges from industrial sources. A potential industrial source of metals is the UKCS oil and gas industry, and this is assessed in the OSPAR status reports (Region II, Greater North Sea; OSPAR, 2000, 2010) and the OSPAR CEMP Assessment Report 2013 (OSPAR, 2014).

Trace metal contaminants in the marine environment tend to form associations with the non-residual phases of mineral matter, such as iron and manganese oxides and hydroxides, metal sulphides, clays, organics and carbonates (Dang et al., 2015; Wang et al., 2015; Warren & Zimmerman, 1993). Non-residual trace metals are associated with more reactive and available sediment components through processes such as adsorption onto mineral surfaces and organic complexation. Metals associated with these more reactive phases are prone to various environmental interactions and transformations (physical, chemical and biological), potentially increasing their mobility and biological availability (Tessier et al., 1979)., 1979; Warren & Zimmerman, 1993; (Du Laing et al., 2009). Residual trace metals are defined as those that are part of the crystal structure of the component minerals and are generally unavailable to organisms (de Orte et al., 2018). Therefore, in monitoring trace metal contamination of the marine environment, it is essential to distinguish the more mobile non-residual trace metals from the residual trace metals tightly bound in the sediment lattice (Chester & Voutsinou, 1981) which are of comparatively lesser environmental significance because of their low reactivity and availability.

In this study, an aqua regia partial digestion was employed to analyse the elemental content of the sediments. Aqua regia is an acid mixture that mainly dissolves the non-residual fraction of heavy metals—those not firmly bound within the crystalline mineral matrix. Consequently, it offers an estimate of the potentially bioavailable and environmentally mobile metal content, rather than the total metal concentration.

12.2.2.1 Metals Available for Biological Uptake

The bioavailable metal concentrations in the sediments showed moderate to high variability across the main survey array, except for chromium, which showed low variability.

All measured CEMP metal concentrations were below the Cefas AL1 and AL2 thresholds, except for lead at station ST163, which exceeded the AL1 limit. Metal concentrations increased notably as the route progressed northward along the proposed routes. However, aside from lead at station ST163, all concentrations remained below their respective ERL values, where available. ERLs are defined as the lower tenth percentile of the sediment concentration data associated with observed biological effects (OSPAR, 2017). Concentrations below the ERL are unlikely to cause adverse effects on biota and the lead concentrations present did not appear to influence the composition of macrofaunal communities.

Arsenic concentrations exceeded the Cefas AL1 at 13 stations, including 5 pre-sweeping stations, along the survey route. These exceedances did not follow any clear sediment-type pattern, occurring in areas classified predominantly as muddy sandy gravel, gravelly sand, and slightly gravelly sand. The lack of a grain-size relationship suggests that arsenic enrichment is not driven by sediment composition, which often influences metals that bind preferentially to fine particles or organic fractions. The higher arsenic levels were observed throughout the central and southern sections of the route, indicating a widespread, rather than localised, distribution. This pattern suggests the source is unlikely to be a point-source discharge and may instead reflect natural geological variation or broad-scale anthropogenic influences.

Strontium levels were generally higher toward the north along the survey route, where finer fractions predominated at the stations. This pattern is reinforced by regional hydrodynamics and the redistribution of carbonate-rich material throughout the area. The underlying lithology consists of extensive Upper Cretaceous chalk formations that produce carbonate-rich sediments that serve as important reservoirs for strontium, likely explaining the observed strontium levels across the region ("BGS GeoIndex (Offshore)," 2025)). Calcium carbonate-based shells found in gravel sediments are also known sources of strontium. These shells form due to the bioavailable minerals present in the water column, which are subsequently bioavailable to shellfish. This process results in the incorporation of strontium into the crystalline lattice of their shells.

12.3 Macrofaunal Communities

Macrofaunal communities along the proposed cable routes were represented mainly by Annelida which dominated in terms of taxa composition and abundance and comprised polychaetes such as *G. oculata, L. conchilega, S. bombyx, S. spinulosa, Ampharete falcata and Scoloplos armiger*. The polychaete *S. bombyx* has a short life span, high dispersal potential and reproductive rate, which allows this species to be an early coloniser and withstand habitats disturbance (Ager, 2005). Being a tube-building polychaete, *S. bombyx* can modify the sediment making it suitable for later colonization and succession (Ager, 2005). Similarly, *S. spinulosa* is a tube-building polychaete that was recorded at four stations along the cable sections approaching the coast, the highest abundance of 267 individuals recorded at station ST020. This is of relevance in relation to the habitat reef that this polychaete can build under a given set of environmental conditions as has been reported in areas of the North Sea (Limpenny et al., 2010). However, in the North Sea, *S. spinulosa* occurs mostly solitary or in small groups encrusting pebbles and shells (BRIG, 2011). In this study, both forms have been observed and assessed for the presence of reef structures (see Section 11.2.3).

Arthropoda were the second most represented phylum in terms of taxa composition and the abundance. Arthropoda comprised cirripeds such as *Balanus crenatus*, *Verruca stroemia*, amphipods such as *Bathyporeia elegans, B. tenuipes* and *Harpinia antennaria*. Amphipods of the genus *Bathyporeia* are typical of sandy sediments. Specifically, *B. elegans* is reported to prefer fine and medium sands with mud content < 20 %, whereas *B. tenuipes* is reported to prefer fine sands with mud content < 10 % (Darr et al., 2009).

Mollusca were the third most represented phylum in terms of taxa composition and abundance. Molluscs comprised bivalves such as *A. alba*, *N. nucleus*, *K. bidentata*, particularly abundant in the section of the proposed cable within the coastal areas, as well as bivalves such as *Phaxas pellucidus*, *Timoclea ovata*, *Ennucula tenuis*, *A. prismatica*, *P. minimum*, *Goodallia triangularis*, *Lucinoma borealis*, *Tellimya ferruginosa* and *Thyasira flexuosa* more frequently recorded along the cable toward the offshore section. Some of these molluscs are opportunistic species, notably bivalves of the genus *Abra*, which are reported to be capable of exploiting newly disturbed substratum through larval recruitment, secondary settlement of post metamorphosis juveniles, and/or redistribution of adults (E. S. R. De-Bastos, 2016). Similarly, *K. bidentata* is reported to occur in association with burrows of brittlestar of the order Ophiuroidea (Gofas & Salas, 2008), which were also recorded in this study. Species of *Nucula* are reported to occur in muddy sandy habitats exposed to some wave action (Sabatini, M., & Ballerstedt, S., 2019).

Echinodermata contributed less to the taxa composition and abundance and comprised urchins such as *E. pusillus* and *Echinocardium cordatum* and brittlestars such as *A. filiformis*, *Amphipholis squamata* and *Ophiura albida*. These taxa are reported to be typical of mixed coarse sediments exposed to strong tidal currents (Jackson, 2008), with species such as *E. pusillus* inhabiting the interstices of gravelly substrata (Rees et al., 2007). *A. filiformis* is instead reported to be dominant at deeper depths, where sediment disturbance is less (Wieking, G. & Kröncke, I., 2003) and in line with the results of the study, which recorded *A. filiformis* more frequently at stations along the offshore sections of the proposed cable route.

The macrofaunal composition recorded in this study is in line with that reported to be typical of this region of the North Sea (Reiss et al., 2010). In general, the faunal diversity, calculated through the Shannon-Wiener ($H'Log_2$) and assessed in line with the criteria of Dauvin et al. (2012), ranged from poor to high, with faunal abundances fairly evenly distributed across the taxa recorded as indicated by the Pielou's index of evenness. An exception was highlighted at stations ST064 due to the numerical abundance of the Cirripedia *B. crenatus* in connection with coarser substrate and therefore available settling surface.

Five main macrofaunal assemblages were identified through the multivariate analysis (Table 8.3), each group having an average similarity < 40 %, reflecting the diversity of the sediment. This was further confirmed by the correlation between the observed patterns of macrofaunal distribution and the sediment particle sizes and depth, in line with the literature which report granulometry and depth as the main physical variables influencing the macrofaunal distribution in the North Sea (Callaway et al., 2002; ICES, 2008; Künitzer et al., 1992; Reiss et al., 2010), ICES, 2008). The correlations between the macrofaunal distribution also suggested that the metal strontium influenced the observed pattern. The strontium distribution showed a spatial pattern, with higher concentrations recorded at the coastal station and decreasing along the cable route going offshore (Table 7.3). In the SNS the coast off East Anglia and off the Humber estuary are considered areas of intermediate strontium concentrations, which reflect the sediments originating by the coastal erosion and river input; some studies also suggest a correlation between the concentration of strontium and the gravel fraction which also accounts for most of the shell debris (Stevenson A.G. et al., 1995). Shell debris were notably present in the grab samples and frequently recorded during the video analysis (Appendix J.1) from the nearshore survey locations. The correlation of the macrofaunal distribution pattern with strontium is likely to be linked to its correlation with the gravel fractions and shell debris typical of the sediment composition of the nearshore stations of the proposed route.

The infaunal biomass was represented mainly by Annelida, Mollusca and Echinodermata. Annelida biomass, particularly at some locations, was associated to the large abundance of some species including *L. conchilega*, *S. spinulosa*, *L. koreni* and *S. lamarki*, Mollusca biomass was associated to the large abundance of the bivalves *A. alba* and *N. nucleus*, whilst the Echinodermata biomass was associated to the presence of large abundances of the brittlestar *A. filiformis* as well as the presence of the urchins *E. cordatum* and *E. flavescens*.

Colonial epifauna was recorded across most of the survey area and was represented mainly by Bryozoa, Cnidaria, Porifera and Chordata largely colonising the coarser grounds of the coastal area of the proposed cable route.

12.4 Environmental DNA

The eDNA-based techniques have a great potential for deriving biodiversity information and complementing traditional sampling methods. They are a promising tool particularly with regards to marine biosecurity programmes worldwide. The qualitative information provided by this technique can be effectively used for identifying new arrivals at different temporal and geographic scales (Danziger et al., 2022), guiding possible interventions.

A limitation of eDNA metabarcoding techniques is that they cannot be effectively related to measures of abundance and/or biomass information. However, relative abundance of OTUs of taxa in the community can be inferred from the percentage of sequence reads obtained through metabarcoding (Zaiko et al., 2018). Moreover, the eDNA signal can be impacted by biological (e.g., biomass, life stage, activity, body condition), environmental (e.g. temperature, pH, salinity, conductivity), and technical factors (e.g. primer bias, PCR stochasticity) as shown by some studies (e.g. Danziger et al., 2022).

Unidentified or misidentified taxa can result from incomplete reference databases, and taxa may be missed due to low quality DNA, environmental contaminants, or the dominance of other species in the sample.

Due to the reference databases used to match the genetic sequences for the data, taxa identified to species level in this report are caveated by ‘There is lower support for this taxonomic identification as it is based on fewer than three matches to sequences in the reference database, and/or limited geographic occurrence records for the taxon'. This affects the confidence in this taxonomic resolution and therefore the inferences made from the analysis.

The taxonomic nomenclature used in this report has been compared against the Global Biodiversity Information Facility (GBIF) database of taxonomic nomenclature. Where appropriate, taxonomic nomenclature was also checked against the (WoRMS Editorial Board, 2025) database and the IUCN Red List (IUCN, 2025).

As the eukaryotes encompass the majority of living organisms and, given the river influence in the coastal areas, this analysis is likely to present non-marine taxa which are reported on as the genetic signal is strong enough to validate their presence.

12.4.1 Sediment Environmental DNA (eDNA)

In sediment, eDNA is sampled by extraction from a mini-core and subsequently analysed to detect the taxa present. Environmental DNA is currently considered to persist in temperate marine environments for approximately 48 h before degradation in aqueous form; sediment eDNA decay rates vary but are generally lower and can persist longer in the environment (Holman et al., 2022); (Sakata et al., 2020). The average half-life of eDNA varies depending on environmental conditions such as temperature, UV exposure and whether the eDNA is bound to particles (Collins et al., 2018; Strickler et al., 2015).

Along the proposed cable route, SeDNA samples were collected to detect invertebrates, eukaryotes and bacteria. A moderate proportion of taxa (45.45 %) were identified to species level for sediment invertebrates, whilst smaller percentages of taxa were identified at species level for eukaryotes (8.62 %) and bacteria (0.84 %). This may be due to low eDNA concentrations, low data resolution in the region, or natural inhibitors affecting the analysis.

12.4.1.1 Marine Sediment Invertebrates

Along the proposed cable route, 165 invertebrate taxa were identified. The highest proportions of OTUs were expressed by the phylum Annelida, followed by the phylum Mollusca and Echinodermata, whilst the remaining phyla contributed a minimal proportion of the total OTUs. These taxa composition is consistent with the taxa composition observed by the macrofaunal data analysis (Section 8) and typically occurring within the North Sea.

12.4.1.2 Marine Sediment Eukaryote

Along the proposed cable route, 986 eukaryote taxa were detected and included Chromista, Animalia, Fungi, Plantae and Protozoa. Chromista and Animalia where the kingdoms contributing the highest proportion of OTUs. The phylum Animalia comprised primarily Polychaeta, Ascidiacea, Echinoidea and Bivalvia.

Microbes dominate life in the oceans and play critical roles in ecosystem functioning and biogeochemical processes both on local and global scales ((Logares et al., 2014).

12.4.1.3 Marine Sediment Bacteria

The microbial benthic community is a potentially powerful yet underexplored source of sediment-quality bioindicators, given its role in biogeochemical cycles, carbon sequestration, and pollutant mitigation, and its specific responses to contaminant types (Pawlowski et al., 2018). There is increasing recognition of the value of the microbial fraction of the environment, and the ecosystem services it provides, such as bioremediation of pollutants and plastics, as well as its potential as a reservoir of novel bioprocesses. The direct link between sediment chemistry and microbial metabolic activity means that microbes can be ecosystem indicators, providing additional context for understanding potential environmental processes and sediment chemistry. Microorganisms in marine sediments are usually abundant and exhibit high metabolic diversity; therefore, they are a key factor in nutrient remineralisation and strongly influence the biogeochemical cycles of coastal and marine ecosystems (Aldeguer-Riquelme et al., 2022).

Along the proposed cable route, the classes Gammaprotobacteria and Planctomycetes, the phyla Protbacteria and Actinobacteriata were amongst the top 5 taxa contributing the highest proportions of OTUs and were detected within each eDNA sediment sample.

The class Gammaproteobacteria comprises numerous marine and estuarine bacteria, many of which can degrade hydrocarbons. They play a crucial role in bioremediation and the decomposition of organic matter. These bacteria are widespread in marine environments, including areas contaminated with oil (Gutierrez, 2017).

12.4.2 eDNA Comparative analysis

The comparative analysis between sediment eDNA metabarcoding and traditional macrofaunal sampling showed some differences in the community detected when compared at species level. Data were rationalised to remove colonial taxa; however, eDNA will have captured taxa which were not retained for the macrofauna data analysis. Moreover, macrofaunal samples were collected at a greater number of stations compared to the eDNA sediment samples.

This pattern is consistent with recent studies showing that eDNA metabarcoding often detects a broader range of taxa than morphology-based methods. Hale et al. (2024) demonstrated that eDNA surveys of intertidal sediments identified numerous taxa—including nematodes, platyhelminths, and ascidians—that were overlooked in traditional assessments due to identification challenges.

12.4.3 Seawater Environmental DNA (eDNA)

Along the proposed cable route, SeDNA samples were analysed to identify fish and vertebrates. Considering eDNA taxonomic resolution, a moderate percentage of taxa (> 53 %) were detected at the species level for seawater eDNA fish and invertebrates.

12.4.3.1 Marine Seawater Fish (excl. Sharks and Rays)

The eDNA analysis of bony fish identified a high proportion of OTUs corresponding to Atlantic Mackerel (*S. scombrus*). This species is abundant in cold- and temperate-water shelf regions, where it forms large schools near the surface. It is of significant commercial value (Collette et al., 2011).

The family Ammodytidae was also detected with a high proportion of OTUs. This family includes sandeels, which have been detected by other sampling methods along the proposed cable route (e.g. Section 11.2.5).

Whiting (*M. merlangus*) were detected in the survey area. It is a key piscivore in the North Sea and an essential part of a mixed demersal fishery (González-Irusta & Wright, 2017).

In the TOP samples, the Lesser Weever (*E. vipera*) had a high proportion of OTUs. This species is found in the shallow waters, commonly found in the North Sea and Mediterranean, especially during the spring and summer months (Fezai et al., 2016). Other notable taxa with high OTU proportions include the European Sprat (*S. sprattus*). Sprat is a locally abundant, small pelagic clupeid fish with a nearly pan-European distribution (Limborg et al., 2012).

Among the BOT samples, Haddock (*M. aeglefinus*) is widely distributed, found across the survey area, and is an economically important target species for the fishing industry (Buscaino et al., 2020). Notable taxa with relatively high proportions of OTUs include the Common Dab (*L. limanda*). This is a key species for environmental monitoring in the North Sea, for example, due to its benthic nature, broad geographic distribution, and relatively stationary behaviour. It has been widely used as a bioindicator in studies on heavy metals and organic pollutants, and is recognised by OSPAR CEMP as the preferred flatfish for chemical monitoring (Kammann et al., 2022).

12.4.3.2 Marine Seawater Vertebrate

The eDNA analysis for marine seawater vertebrate, the family Clupeidae was recorded with high proportions of OTUs. The family includes the Atlantic herring and the European sprat which have been recorded during the current study.

Other notable taxa with high OTU proportions include the Five-beard Rockling (*C. Mustela*), an inshore species, frequent in tide pools and subtidal habitats (Robalo et al., 2014), the family Gadidae the common dragonet (*C. lyra*) and the Atlantic mackerel (*S. scombrus*).

OTUs from bird taxa were sporadic in both TOP and BOT WeDNA samples, whilst the porpoise *Phocena phocena* and the family Delphinidae contributed to the proportions of vertebrate OTUs within the TOP WeDNA samples, particularly at those stations located further offshore along the proposed cable route. The harbour porpoise is widespread around the UK, commonly occurring along the west coast of Scotland, where the North Sea populations appear to concentrate in some areas close to the coast between June and September, with some individuals remaining in those regions year-round (JNCC, n.c.). Harbor porpoises feed on energy-rich fish (< 30 cm in length), including sandeels (*Ammodytes* spp.), gobies (Gobiidae), gadoids, such as Atlantic cod (*G. morhua)* and whiting (*M. merlangus)*, clupeids, such as Atlantic herring (*C. harengus)* and sprat (*S. sprattus)*, and flatfish (Pleuronectiformes) (Nachtsheim et al., 2021).

12.4.3.3 eDNA Comparative analysis

The comparative analysis between fish families detected by SeDNA samples and photographic samples showed some differences in the fish community detected along the proposed cable route. Both methods identified 10 genera in common, indicating consistency and validating eDNA as a complementary approach to traditional habitat surveys. However, eDNA detected an additional 13 genera not captured by the photographic samples, underscoring its potentially enhanced sensitivity for detecting cryptic, transient, or low-abundance taxa.

These findings align with recent studies demonstrating that eDNA often captures greater taxonomic richness than conventional methods. In reef ecosystems, Hayes et al. (2025) showed that eDNA identified 44 more tropical fish species than visual surveys across a latitudinal gradient.

The discrepancy between methods can be attributed to differences in sampling principles. eDNA integrates genetic signals over space and time, enabling the detection of species that may not be visually observed due to behavioural patterns, depth preferences, or survey limitations. Conversely, habitat assessments provide direct observations but are constrained by spatial coverage and observer bias. While eDNA excels in presence/absence detection, its quantitative interpretation remains challenging, as read abundance does not reliably correlate with biomass or density (He et al., 2023).

12.5 Seafloor Habitats and Biotopes

Results of the seafloor photographic data analysis indicated the presence of habitats featuring rippled sand with shell fragments and varying amounts of gravel and mud along most of the proposed cable routes. Habitats with coarser and hard substrates such as pebbles and cobbles were recorded, particularly at stations along the nearshore section of proposed cable route. The presence of ripples is indicative of sediment disturbance, such as that associated with hydrodynamics, whilst large areas of rippled sand and other non-cohesive sediment comprising superficial sand and silt with various amounts of gravel are ubiquitous throughout much of the North Sea (British Geological Society [BGS], 2002). Shell fragments were also a predominant feature of the sediment, particularly in in the section of the proposed cable approaching the coastal area.

Characteristic epibenthic species included echinoderms, crustaceans, bivalves, low-lying and turf forms of hydroids and bryozoans and fish, which were observed in most of seafloor photographic data acquired. Sea pens and burrows were also observed in the offshore section of the proposed cable route. The habitat and associated epibiotic communities were comparable to those reported for areas of the southern North Sea with comparable sediment characteristics (Callaway et al., 2002; Jennings et al., 1999).

Four biotopes and seven biotope complexes were identified along the proposed cable route (Route B) and the variation (Route C).

The biotope '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' (MC5212) was assigned to 36 stations. These station where located from the circalittoral (Routes B and C) to the offshore section of the proposed cable route (Route B), where the median sediment particle size was between 150 µm to 413 µm, with a mean of 225 µm (fine sand). This biotope is similar to *'Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211) which it may grade into if finer sediment prevails (EEA, 2022). Features suggesting the possible presence or interchange with this biotope, as the conditions change, were observed, although these were not characterising enough to define the presence of the biotope at the time of the study.

The biotope '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5241) was assigned to five stations along the nearshore section of the proposed cable route (Route B), where the sediment comprised 20.09 % to 82.51 % gravel and 3.26 % to 16.37 % mud. This biotope is reported to be related to the '*Abra* community' and part of the 'infralittoral étage' described by Glemarec (1973, cited in EEA, 2022).

The biotope '*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand' (MD5212) was assigned to 37 stations, located in the offshore section of the proposed cable route (Route B). The species associated to this biotope live buried in muddy sediments and generally occur in lower abundances in offshore grounds. For this reason, their presence, even if not in high abundances, suggests the occurrence of this biotope. As an infaunal tube building polychaete, *Owenia fusiformis* act as good ecosystem engineers, providing protection from hydrodynamics and predators and therefore stability to the benthic community with regard to diversity, abundances and spatial distribution (E. De-Bastos, 2023).

The biotope complexes 'Faunal communities in full salinity Atlantic infralittoral coarse sediment (MB523), 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321), and 'Faunal communities of Atlantic circalittoral mixed sediment' (MC421) where mostly assigned to stations located along the section of the proposed cable route (Route B) approaching the coast. 'Faunal communities in Atlantic circalittoral sand' (MC521), 'Faunal communities of Atlantic circalittoral mud' (MC621), 'Faunal communities in Atlantic offshore circalittoral mixed sediment' (MD421) and 'Faunal communities in Atlantic offshore circalittoral sand' (MD521), featuring finer sediments, were assigned to stations located along the offshore section of the proposed cable route (Route B). The biotope complexes are deemed to represent the broad habitats characterising the habitats crossed by the proposed cable route (Route B) and are all typical of the southern North Sea. From the geophysical data (see Section 5) and the video analysis, part of the proposed cable route is characterised by ‘Faunal communities in Atlantic circalittoral sand’ (MC521) overlying ‘Atlantic circalittoral rock’ (MC12). Also, areas where coarser sediments including gravelly sands are detected by the geophysical data interspaced with coarser or finer sands, the latter would appear to be an overlay as those coarser sediments were not seen from the video analysis or the PSD data at the sampling locations.

The biotope complex ‘Faunal communities of Atlantic circalittoral coarse sediment’ (MC321) described by the grab data was assigned to the majority of the stations that fell within the Holderness Offshore MCZ with the exception of station ST072 along the proposed cable variation (Route C), which was assigned ‘Faunal communities of Atlantic circalittoral mixed sediment’ (MC421) due to visible patches of exposed clay in photographic data.

The biotopes and biotope complexes identified for the description of National Grid EGL5 are in line with those expected to occur along the proposed cable routes (Route B and Route C).

12.6 Potentially Sensitive Habitats and Species

Aggregation of cobbles observed at 38 stations were assessed for resemblance to Annex I habitat ‘Reef’, in line with the criteria detailed in Irving (2009) for stony reefs. The overall assessment indicated ‘Not a reef’ and/or resemblance to ‘Low reef’ at most stations. At station ST074 and along sections of four additional stations, the seafloor was assessed as ‘Possible reef with veneer’ as, despite not satisfying the composition criteria of < 10 % cobbles and/or boulders, an established emerging epifaunal community was observed indicating seafloor stability. Sections (or the entirety of) five stations were assessed as resemblance to ‘Medium reef’. Along the offshore section of the proposed cable route (Route B), aggregations were assessed as ‘Not a reef’ and/or ‘Low reef’, whilst along the nearshore section of the proposed cable route (Route B), and within the MCZ on both proposed cable routes (Route B and C), assessment also comprised ‘Possible reef with veneer’ and ‘Medium reef’. Within the Holderness Offshore MCZ, sections of ‘Medium reef’ were assessed at station ST102 on the proposed cable route (Route B) and station ST072 on the proposed cable variation (Route C). Cobble aggregations are a component part of the mixed sediment seafloor type that characterises this region of the North Sea. At the stations where the assessment was ‘Medium reef’, there is a potential for the presence of Annex I stony reef habitat. Stations of ‘Low reef’ assessment are unlikely to be considered to represent Annex I habitats in line with Irving (2009) guidelines whereby, if a ‘low’ is scored in composition, elevation, extent, or biota, then a strong justification would be required for this area to qualify as Annex I habitat ‘Reefs’ under the current marine nature conservation legislation.

Sea pens and faunal burrows were observed at stations located along the offshore section of the proposed cable route (Route B). Where assessed, the occurrence of faunal burrows ranged from 'absent' to ‘common’ on the SACFOR scale and sea pen occurrences ranged from ‘occasional' to 'frequent'. The habitat guidelines (JNCC, 2014) state that the seafloor must be ‘heavily bioturbated by burrowing megafauna with faunal burrows and mounds forming a prominent feature of the sediment surface’ and that burrows should be at least ‘frequent’ on the SACFOR scale to be classified as a ‘Sea pen and burrowing megafauna community’. Of all the transects assessed, only one station was assessed to have an abundance of faunal burrows as at least ‘frequent’.

Two transects, located along the nearshore section of the proposed cable route (Route B), were assessed for the presence of the Annex I habitat ‘Reef’ biogenic, *Sabellaria spinulosa* reef. Only at one station, located along the nearshore section of the proposed cable route (Route B), the tubes were assessed to align with characteristics of ‘low reef’ and ‘medium reef’. At the other station assessed for the presence of this Annex I reef habitat, the agglomerates were consolidated to a crust form, which could allow a rapid development of a reef in favourable recruitment conditions, due to the reported gregarious settlement of this species. *Sabellaria spinulosa* reefs comprise of dense subtidal aggregations of the tube building polychaete worm which can stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for epibenthic species. These aggregations, despite being fragile and highly affected by natural disturbance, are solid and large structures, raised above the surrounding seabed that can persist for long time. These characteristics make these reefs suitable to support many other associated species to become established in areas where they would normally not been found, enhancing the biodiversity (BRIG, 2008a).

There are five species of sandeel recorded in UK waters (Ellis et al., 2012), of which *Ammodytes marinus* is listed as a UK BAP priority species (BRIG, 2007). As the proportions of silt decreased and coarse sand and medium sand in the sediment increases, so does the increased selection of sandeels for the habitat (Holland et al., 2005). Along the proposed cable route (Route B) and the variation (Route C), most of the stations described as ‘Unsuitable’ were along the nearshore section of the proposed cable route (Route B), where the coarser grounds are prevalent and along the offshore section of the cable route where the fines content was higher. Progressing along the proposed cable route toward the offshore section the stations were assessed as ‘Marginal’ habitats, mostly occurring within the Holderness Offshore MCZ (particularly on Route C). Those described as ‘Preferred’ were mostly found in the offshore sections of the proposed cable route (Route B) where a greater proportion of sand content and little or no mud content in the sediment were recorded. Only three stations located within the MCZ were assessed as ‘Preferred’ grounds (Route C).

Herring spawn on gravel and other coarse sediments and substrate including coarse sand, maerl and shell where there is a low proportion of fine sediment and well-oxygenated water (e.g. Bowers, 1980; Aneer, 1989; Stratoudakis et al., 1998; Maravelias et al., 2000). Along the proposed cable route (Route B), the sediments at most stations were considered ‘Unsuitable’ as herring spawning ground. However, at 24 and 16 stations the sediments were assessed as ‘Preferred’ and ‘Marginal’ herring spawning grounds, respectively. At these preferential spawning areas, there was a large gravel component and very little or no mud content. Within the Holderness Offshore MCZ, twelve stations along the proposed cable route (Route B) and one along the proposed cable variation (Route C) were assessed as ‘Preferred’, whilst three along the proposed cable variation (Route C) were assessed as ‘Marginal’. The remaining stations were deemed 'Unsuitable' due to the mixed nature of the grounds and the occurrence of coarser sediments including pebbles.

Most of the habitat types recorded along the proposed cable routes (Route B and Route C) fall under the BSH 'Subtidal sands and gravel", which is a UK BAP priority habitat (JNCC, 2024) and a habitat of conservation importance (HOCI) in MCZs (JNCC, 2016). Subtidal sands and gravel sediments are the most common habitats found below the level of the lowest low tide around the UK coast. The sands and gravels from the North Sea are largely formed from rock material (Joint Nature Conservation Committee on behalf of the Four Countries' Biodiversity Group [JNCC on behalf of 4CBG], 2024).

The ocean quahog *Arctica islandica*, a protected feature within the Holderness Offshore MCZ, was recorded at 28 stations along the proposed cable routes (Route B and Route C) as adult and juveniles from the grab data and as OTU in the eDNA samples. None of these stations were located within the Holderness Offshore MCZ.

Ammodytes marinus, Solea solea and *Gadus morhua* are UK BAP priority species (JNCC, 2019). In addition, *G. morhua* is also on the OSPAR list of threatened and/or declining habitats and species for regions II and III (OSPAR, 2025), the survey area being part of OSPAR region II. This species is also on the IUCN red list of threatened species as 'vulnerable' (IUCN, 2025). From the photographic data and eDNA of water samples *G. morhua* was recorded along the proposed cable route, along with OTUs for the UK BAP species *Scomber scombrus*, *Merlangius merlangus*, *Clupea harengus*, *Pleuronectes platessa*, *Merluccius merluccius*, and *Trachurus trachurus*. The latter is also listed as 'vulnerable' on the IUCN red list alongside (IUCN, 2025). Other taxa detected by the eDNA technique included the Witch Flounder (*Glyptocephalus cynoglossus*) listed as 'vulnerable' on the IUCN Red List (IUCN, 2025) and the American Plaice (*Hippoglossoides platessoides*) listed as 'endangered'.

The biotope complex 'Faunal communities of Atlantic circalittoral mud' (MC621) and the presence of sea pens and faunal burrows suggest the presence of the UK BAP 'Mud Habitats in Deep Water'.

Due to the presence of clay exposures with piddock holes at four stations along the proposed cable route, the UK BAP priority habitat 'Peat and Clay Exposures with Piddocks' may be present. However, the seafloor at station ST009, which featured the most extensive areas of exposed clay, was considered impoverished of visible fauna and no live piddocks were observed. Additionally, the characteristic piddock taxa of *Pholas dactylus*, *Barnea candida* and *Barnea parva* were not reported within the macrofaunal or eDNA data within the survey area (BRIG, 2008b).

Anemones of the family Edwardsiidae were recorded within the survey area, indicating the possible presence of the UK BAP species *Edwardsia timida*. This burrowing anemone favours sheltered muddy gravel to muddy sand and may be threatened by disturbance (e.g. dredging).

12.7 Non-Indigenous and Cryptogenic Species

Non-indigenous species are those that have reached the UK by accidental human transport, deliberate human introduction, or which have arrived by natural dispersion from a non-indigenous population in Europe (Government Digital Service [GDS], 2021). Once introduced, some NNSs 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).

The NNS recorded in the grab samples included the polychaete *Goniadella gracilis*. This species was first recorded in 1970 in Liverpool Bay and had been previously reported from South Africa and North America, from where it was originally described. Although the method of introduction is unknown, this species is likely to have been introduced from the United States east coast through trans-Atlantic shipping. In the British Isles, this species is common in Liverpool Bay in sandy gravel at a depth of more than 15 m and widespread in the southern Irish Sea (Eno et al., 1997) and, further in Europe, it has been recorded in the Bay of Douarnenez in France (Institut Français de Recherche pour l'Exploitation de la Mer [Ifremer], 2004). In this study, one individual of *G. gracilis* was recorded in the grab samples from four stations.

Another NIS detected was the mollusc *C. fornicata*. This species was first recorded in Europe in 1872 in Liverpool Bay but populations in this area have since reportedly died out. The species is known to have been introduced to Essex between 1887 and 1890 from North America, in association with imported American oysters *Crassostrea virginica*, but it can also be transported by ships' hull and, as larval stages, also in ballast waters. This species is found in the southwest, south and southeast Britain and as far north as Pembrokeshire on the west coast and Yorkshire on the east coast. It generally does not occur at depths greater than 30 m (Eno et al., 1997). In this study, four individuals were recorded at three coastal stations.

13. Conclusions

The aim of this report has been to evaluate the existing physical, chemical and biological components in the marine environment within the survey area. A review of the environmental data in context with other cited studies from the region, and estimated sediment effects threshold values (OSPAR, 2014; United Kingdom Offshore Operators Association [UKOOA], 2001) was also undertaken. Based on the overall assessment of the survey area, the following key conclusions can be stated:

- The sediment along the proposed cable routes heterogeneous, comprising sand, gravel and fines. The sediment heterogeneity resulted in 10 sediment classes being identified under the Folk (BGS modified) classification and 9 sediment classes being described by the Wentworth (1922) classification, by five sorting categories and by the polymodal distribution of the sediments. The nearshore locations also presented a noticeable biogenic contribution to the gravel resulting from shell fragments;
- Four main sediment clusters were identified by the multivariate analysis, ranging from poorly sorted ‘sand’ (fine sand), to very poorly sorted ‘sand/gravel’ (very coarse sand), poorly sorted ‘sand’ (coarse sand) and very poorly sorted ‘muddy sandy gravel’ (gravel);
- The stations located within the Holderness Offshore MCZ all grouped within the sediment group describing coarser grounds (gravel);
- Sediment THC values were typical of background marine sediments. All stations, including pre-sweeping stations, were below the Cefas Guideline Action Levels and the EET;
- All individual US EPA 16 PAH concentrations were below their respective ERL values. When normalised to 2.5 % TOC, all individual US EPA 16 PAH concentrations, except for chrysene, exceeded their BAC values at most stations;
- PAH source attribution suggests a combination of pyrolytic and petrogenic origins of the aromatic compounds. Typically, samples collected from stations located to the north of the proposed cable route aligned with pyrolytic sources;
- All measured CEMP metal concentrations remained below the Cefas AL1 threshold. Lead exceeded both the Cefas AL1 and ERL threshold at station ST163. All metal concentrations were below their representative Cefas AL2 thresholds. Metal concentrations increased northward along the proposed routes;
- Macrofauna from the grab samples comprised infaunal and epifaunal taxa. Annelida represented most of the community structure and composition of the enumerated fauna. Macrofaunal richness and diversity were generally higher at stations with coarse and diverse sediment;
- Five main macrofaunal assemblages were identified through the multivariate analysis, reflecting the heterogeneity of the sediment. This was further confirmed by the correlation between the observed patterns of macrofaunal distribution and the sediment particle sizes and depth;

- The infaunal biomass was represented mainly by Mollusca and Echinodermata. Mollusca biomass was associated to the large abundance of some bivalves, whilst the Echinodermata biomass was associated to the presence of large abundances of the brittlestar and the presence of large urchins;
- Four biotopes and seven biotope complexes were identified along the proposed cable route (Route B) and the variation (Route C). These were:
  - '*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand' (MC5212), assigned to 36 stations;
  - '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5241), assigned to 6 stations;
  - '*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand' (MD5212), assigned to 37 stations;
  - 'Faunal communities in full salinity Atlantic infralittoral coarse sediment' (MB523) assigned to one station;
  - 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) assigned to 88 stations, including the majority of stations on the proposed cable routes (Route B and Route C) within the Holderness Offshore MCZ;
  - 'Faunal communities of Atlantic circalittoral mixed sediment' (MC421) assigned to 12 stations;
  - 'Faunal communities in Atlantic circalittoral sand' (MC521), assigned to 85 stations;
  - 'Faunal communities of Atlantic circalittoral mud' (MC621), assigned to one station;
  - 'Faunal communities in Atlantic offshore circalittoral mixed sediment' (MD421), assigned to three stations, including one station on the proposed cable variation (Route C) within the Holderness Offshore MCZ;
  - 'Faunal communities in Atlantic offshore circalittoral sand' (MD521), assigned to 73 stations;
- The overall assessment for the potential presence of Annex I habitat 'Reef' was 'Not a reef' or 'Low resemblance' to a stony reef at most stations. Resemblance to 'Medium reef' with the potential to be described as Annex I habitat was assessed at five nearshore stations;
- Five stations were assessed for the presence of the OSPAR listed threatened and/or declining habitat 'Sea pen and burrowing megafauna'. Both *Nephrops norvegicus* and other megafauna burrows abundance were assessed as at least 'frequent' at station ST231 only;
- The potential presence of the Annex I habitat and OSPAR threatened and/or declining habitat '*Sabellaria spinulosa* reef' was assessed as 'low reef' to 'medium reef' at station ST011 in the nearshore section of the cable;
- Adult individuals of the Ocean Quahog *Arctica islandica*, listed in the OSPAR list of threatened and/or declining species, were recorded at six stations and 38 juveniles were recorded at 19 stations. The eDNA analysis detected OTUs for this species at further five

stations. None were recorded at the stations located within the MCZ Holderness Offshore;

- The sediments assessed for the presence of sandeel preferred spawning grounds indicated 'Preferred' grounds at 104 stations, 'Marginal' grounds at 22 and 'Unsuitable' grounds at 81. Within the Holderness Offshore MCZ (Route B), 2 were assessed as 'Unsuitable' grounds and 1 was assessed as 'Marginal' ground;
- The sediments assessed for the presence of herring preferred spawning grounds indicated 'Preferred' grounds at 24 stations, 'Marginal' grounds at 16 and 'Unsuitable' grounds at 167. Within the MCZ Holderness Offshore, 12 stations along Route C and 1 station along Route B were assessed as 'Preferred', whilst 3 stations along Route C were assessed as 'Marginal' grounds;
- The habitat types described throughout much of the survey area may occur within the broad habitat of 'Subtidal sands and gravels', a UK BAP habitat;
- UK BAP fish species recorded during this study included Atlantic herring (*C. harengus*), Atlantic cod (*G. morhua*; also an OSPAR threatened and/or declining species), whiting (*M. merlangus*), common ling (*M. molva*), angler fish (*L. piscatorius*), mackerel (*S. scombrus*), European plaice (*P. platessa*), common sole (*S. solea*) and Atlantic horse mackerel (*T. trachurus*);
- Anemones of the family Edwardsiidae were recorded within the survey area, indicating the possible presence of the UK BAP species *Edwardsia timida*;
- The taxa detected, with the highest proportion of OTUs, were typical of those found in the survey area;
- All detected species listed in the water fish eDNA analysis are currently Least Concern on the IUCN Red List, indicating a low conservation priority, except for Haddock (*M. aeglefinus*), which is designated as vulnerable;
- From the analysis of the grab samples, the NIS detected included the polychaete *Goniadella gracilis* and the mollusc *Crepidula fornicata*. No other NIS were detected within the survey area.

In summary, the physico-chemical and biological properties of the seafloor, including the habitat types identified along the proposed cable routes (Route B and Route C) are considered typical of varied sediments in the southern North Sea, and the distribution of both macrofauna and habitat type is primarily influenced by the sediment composition.

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G.4 Macrofaunal Biomass Analysis Certificate

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Appendix A

Guidelines on Use of Report

Appendix B

Methodologies

B.1 Laboratory Analysis for Sediment Samples

Click on icon to open the laboratory analysis methods for the sediment samples.

Appendix B.1 Laboratory Analysis for Sediment Samples

B.2 Data Analysis and Habitat Assessment Methodologies

Click on icon to open the Data Analysis and Habitat Assessment Methodologies.

Appendix B.2 Data Analysis and Habitat Assessment Methodologies

Appendix C

Logs

C.1 Survey Log

Click on icon to open the survey log.

Appendix C.1 Survey Log

C.2 Grab Log

Click on icon to open the grab log.

Appendix C.2 Grab Log

C.3 Photographic Log

Click on icon to open the photographic log.

Appendix C.3 Photographic Log

Appendix D

Sediment Particle Size and Grab Sample Photographs

D.1 Sediment Particle Size Data

Click on icon to open sediment particle size data.

Appendix D.1 Sediment Particle Size Data

D.2 Sediment Particle Size Certificates

Click on icon to open sediment particle size laboratory certificates.

Appendix D.2 Sediment Particle Size Certificates

D.3 Sediment Particle Size

Click on icon to open sediment particle size .

Appendix D.3 Sediment Particle Size

D.4 Sediment Grab Sample Photographs

Click on icon to open sediment grab sample photographs.

Appendix D.4 Sediment Grab Sample Photographs

Appendix E

Hydrocarbon Analysis

FUGRO

E.1 Sediment Gas Chromatography Traces

Click on icon to open the sediment gas chromatography traces.

Appendix E.1 Sediment Gas Chromatography Traces

E.2 Sediment n-alkane Concentrations

Click on icon to open the sediment n-alkane concentrations.

Appendix E.2 Sediment n-alkane Concentrations

E.3 Sediment Aromatic Hydrocarbon Concentrations

E.3.1 Sediment Total 2 to 6 Ring PAH Concentrations

Click on icon to open the sediment total 2 to 6 ring PAH concentrations.

Appendix E.3.1 Sediment Total 2 to 6 Ring PAH Concentrations

E.3.2 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations

Click on icon to open the sediment US EPA and 16 PAH concentrations.

Appendix E.3.2 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations

E.3.3 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations Normalised to 2.5 % Total Organic Carbon (TOC)

Click on icon to open the sediment US EPA and 16 PAH concentrations normalised to 2.5 % TOC.

Appendix E.3.3 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations Normalised to 2.5 % Total Organic Carbon (TOC)

E.3.4 Sediment Total 2 to 6 Ring PAH Concentrations (Pre-Sweeping)

Click on icon to open the sediment total 2 to 6 ring PAH concentrations (pre-sweeping).

Appendix E.3.4 Sediment Total 2 to 6 Ring PAH Concentrations (Pre-Sweeping)

E.3.5 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations (Pre-Sweeping)

Click on icon to open the sediment US EPA and 16 PAH concentrations (pre-sweeping).

Appendix E.3.5 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations (Pre-Sweeping)

E.3.6 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations Normalised to 2.5 % Total Organic Carbon (TOC) (Pre-Sweeping)

Click on icon to open the sediment US EPA and 16 PAH concentrations normalised to 2.5 % TOC (pre-sweeping).

Appendix E.3.6 Sediment United States Environmental Protection Agency (US EPA) 16 Polycyclic Aromatic Hydrocarbon (PAH) Concentrations Normalised to 2.5 % Total Organic Carbon (TOC) (Pre-Sweeping)

E.4 Distribution of Aromatic Hydrocarbons

Click on icon to open the sediment distribution of aromatic hydrocarbons.

Appendix E.4 Distribution of Aromatic Hydrocarbons

Appendix F

Sediment Environmental DNA (eDNA)

F.1 Marine Sediment Sample eDNA – Eukaryotes

Click on icon to open the files for marine sediment sample eDNA eukaryotes analyses

Appendix F.1 Marine Sediment Sample eDNA – Eukaryotes

F.2 Marine Sediment Sample eDNA – Bacteria

Click on icon to open the files for marine sediment sample eDNA eukaryotes analyses

Appendix F.2 Marine Sediment Sample eDNA – Bacteria

Appendix G

Macrofaunal Analysis

G.1 Macrofaunal Abundance Data

Click on icon to open the abundance data.

Appendix G.1 Macrofaunal Abundance Data

G.2 Macrofaunal Abundance Analysis Certificate

Click on icon to open the macrofaunal abundance analysis certificate.

Appendix G.2 Macrofaunal Abundance Analysis Certificate

G.3 Macrofaunal Biomass

Click on icon to open the biomass data.

Appendix G.3 Macrofaunal Biomass

G.4 Macrofaunal Biomass Analysis Certificate

Click on icon to open the macrofaunal biomass analysis certificate.

Appendix G.4 Macrofaunal Biomass Analysis Certificate

Appendix H

Seawater Environmental DNA (eDNA)

H.1 Marine Water Sample eDNA – Vertebrates

Click on icon to open the files for marine water sample eDNA vertebrate analyses

Appendix H.1 Marine Water Sample eDNA – Vertebrates

H.2 Marine Water Sample eDNA – Fish

Click on icon to open the files for marine water sample eDNA fish analyses

Appendix H.2 Marine Water Sample eDNA – Fish

H.3 Marine Water Sample eDNA – Invertebrates

Click on icon to open the files for marine water sample eDNA invertebrate analyses

Appendix H.3 Marine Water Sample eDNA – Invertebrates

Appendix I

Example Seafloor Photographs

Click on icon to open the example seafloor photographs.

Appendix I
Example Seafloor Photographs

Appendix J

Habitat Assessments

J.1 Habitats

J.1.1 Habitats and SACFOR Counts

Click on icon to open habitats and SACFOR percentage cover.

Appendix J.1.1 Habitats and SACFOR Counts

J.1.2 Habitats and SACFOR Percentage Cover

Click on icon to open habitats and SACFOR percentage cover.

Appendix J.1.2 Habitats and SACFOR Percentage Cover

J.2 Stony Reef Assessment

Click on icon to open stony reef assessment.

Appendix J.2 Stony Reef Assessment

J.3 *Sabellaria spinulosa* Reef Assessment

Click on icon to open Sabellaria spinulosa reef assessment.

Appendix J.3 Sabellaria spinulosa Reef Assessment

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