Anlage 4

N05A-7-10-0-70019-01
“Habitat Assessment Survey Report”

GEO XYZ Offshore

N5a Development

Title	**Habitat Assessment Survey Report**
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2.1	30/10/2019	Final Issue	PC	PC	SD	
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Revision	Date	Description of Revision	Author	Checked	Approved	Approved Client

REVISION HISTORY

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The table on this page can be used to explain the reason for the revision and what has changed since the previous revision.

Rev.	Reason for revision	Changes from previous version
1.0	First Issue	N/A
2.0	Approved by Client	None
2.1	Approved by Client	Comments on EBS report required small adaptions to this report as there is overlapping content. Changes from previous version: • Modifcation of text describing H1110 habitat type in order to correlate the observed faunal communities with the characterising species for the H1110_C habitat subtype. • Reference to Zostera marina beds has been removed from the relevant text.

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ABBREVIATIONS

The abbreviations listed in Table 1 are used within this report. Where abbreviations used in this document are not included in Table 1, it may be assumed that they are either equipment brand names or company names.

Table 1 Abbreviations used in this document

	Description		Description
2DHR	2-Dimensional High Resolution	OSPAR	Oslo/Paris Convention (for the Protection of the Marine Environment of the North-East Atlantic)
BSL	Benthic Solutions Limited	OWF	Offshore Windfarm
CNS	Central North Sea	PC	Physico-chemical grab sample
CPT	Cone Penetrometer Test	PPP	Precise Point Positioning
EBS	Environmental Baseline Survey	PPS	Pulse per second
ED50	European Datum 1950	ROV	Remotely Operated Vehicle
F1/F2/F3	Fauna grab samples 1, 2 and 3	SBP	Sub-Bottom Profiler
GNSS	Global Navigation Satellite System	SSS	Side Scan Sonar
HAS	Habitat Assessment Survey	UHR	Ultra-High Resolution
KP	Kilometre Post	UKCS	United Kingdom Continental Shelf
LAT	Lowest Astronomical Tide	USBL	Ultra-short Baseline
LED	Light Emitting Diode	UTC	Universal Time Coordinated
MAG	Magnetometer	UTM	Universal Transverse Mercator
MBES	Multibeam Echosounder	VC	Vibro-core
NGT	Noordgastransport	VORF	Vertical Offshore Reference Frames
MSL	Mean Sea Level	WGS84	World Geodetic System 1984
ONE	Oranje-Nassau Energie		

1 INTRODUCTION

1.1 PROJECT OVERVIEW

GEOxyz was contracted by Oranje Nassau Energie (ONE) to undertake a range of geophysical, geotechnical and environmental surveys in block N5A of the Dutch Sector, comprising a site survey and two route surveys (Figure 1 and Table 2):

- Site survey (1km x 1km) over the N5A exploration well which will be developed by emplacement of the N5A Platform.
- Cable route survey (9km x 1km) from proposed N5A Platform to Riffgat Offshore Windfarm (OWF) Transformer Station.
- Pipeline route survey (15km x 1km) for proposed gas export pipeline from N5A Platform to with a proposed cable route corridor between the N5A Platform location and the Noordgastransport (NGT) hot tap location.

The geophysical surveys comprised acquisition of multibeam echosounder (MBES), side scan sonar (SSS), magnetometer (MAG) and sub-bottom profiler (SBP) data over the site and routes with Sparker multi-channel seismic data also acquired over the site survey area. An additional 4km x 1km cable route survey and 1km x 1km rig site survey was completed for a potential alternative location of the N5a platform upon request from the client.

The environmental survey work comprised a habitat assessment and environmental baseline survey and was carried out by GeoXYZ Offshore UK Limited, supported by Benthic Solutions Ltd (BSL).

Table 2: Proposed N5A Platform, N5A to Riffgat Cable Route and N5A to NGT Hot Tap Route Locations

ED50, UTM 31N, CM 3° E					
Proposed Location	KP	Easting (m)	Northing (m)	Latitude	Longitude
N5A Platform	0.000	721 607.00	5 954 650.00	53° 41' 32.347" N	06° 21' 23.281" E
End of Route – Riffgat Windpark Transformer Station Location	8.681	730 081.00	5 954 988.00	53° 41' 30.080" N	06° 29' 05.312" E
End of Route – NGT hot tap Location	14.675	718 409.00	5 940 429.00	53° 33' 57.806" N	06°17' 53.314" E

Survey operations were performed onboard the survey vessel Geo-Ocean III (Appendix A) between the 1st and 15th May 2019.

The objectives of the environmental survey were as follows:

- Identify UKCS sensitive environmental habitats and species (e.g. Annex I Habitats).
- Acquire baseline data to assess the sediment physico-chemical and biological characteristics within the survey area.

This report provides the results of the environmental habitat assessment over the N5a site survey areas (original and alternative) and associated cable and pipeline route survey corridors.

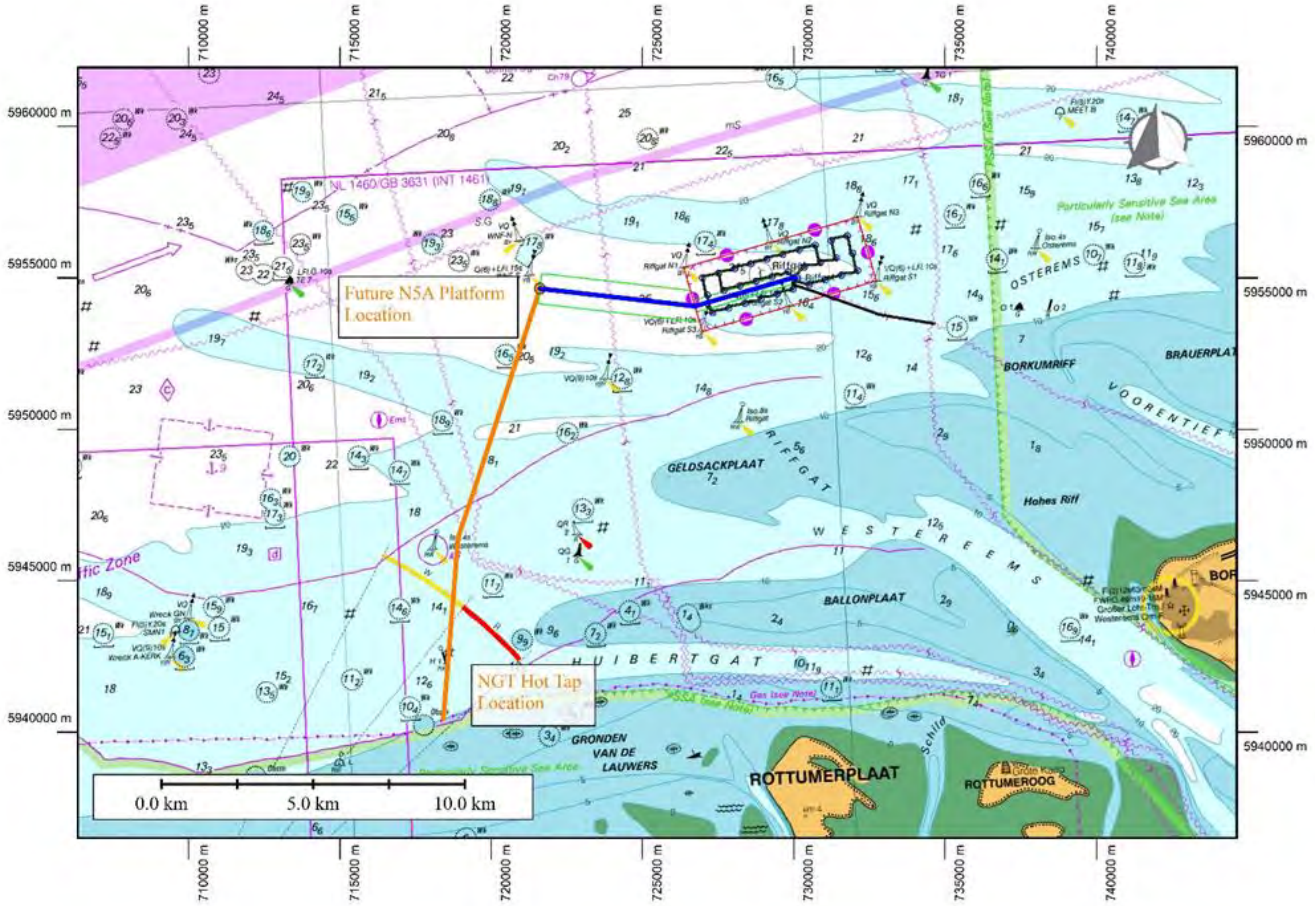

Figure 1: Project location overview

1.2 SCOPE OF WORK

There were three main work areas for geophysical, geotechnical and environmental surveys as described in N5A-7-10-0-70000-01-05 - Pipeline Route and Platform Area Survey Scope. These were:

- Platform Survey Future N5A location;
- Pipeline Route Survey from the future N5A platform location to a subsea hot-tap tie-in at the NGT pipeline near KP 142.1(orange line in Figure 1 above);
- Cable Route Survey from the future N5A platform location to the Riffgat transformer station (blue line in Figure 1 above).

The following surveys were required by ONE and are described in more detail in Table 3:

- Geophysical Pipeline and Power Cable Route Surveys;
- Geotechnical Pipeline and Power Cable Route Surveys;
- Environmental Pipeline and Power Cable Route surveys including the Platform Area;
- Geophysical Platform Area Survey.

Table 3: Detailed scope of work for each area

Scope	N5A Platform site	Hot Tap Pipeline Route	Riffgat Cable Route
Geophysical Analogue	MBES, SSS, MAG, SBP	MBES, SSS, MAG, SBP	MBES, SSS, MAG, SBP
Geophysical Digital	Multi-channel sparker 80 m depth		
Environmental	Two grab samples within the platform site survey area	Grab sampling each km	Grab sampling each km (including within Riffgat OWF)
Shallow Geotechnical		VC each km	VC each km

The geophysical survey works were divided between two vessels, with the Geo Ocean III carrying out operations in water deeper than around 10 to 15m LAT and the Geo Surveyor VIII completing operations in the shallower sections.

The survey areas were further broken down into 5 section where there were natural turning points on routes and separate surveys such as the N5A Site survey.

- Area 1 – Southern part of pipeline route
- Area 2 – Northern part of pipeline route
- Area 3 – Western part of cable route
- Area 4 – Eastern part of cable route
- Area 5 – N5A site survey area
- *Alternative N5A Site (Added workscope)*
- *Alternative Cable Route C3 (Added workscope)*

1.2.1 Objectives

The survey objectives were to:

- Accurately determine water depths and seabed topography;
- Provide information on seabed and sub-seabed conditions to ensure the safe emplacement and operation of the proposed pipeline, cable route and platform;
- Assess the area for the presence of any potential sensitive habitats or species, to include EC Habitats Directive (97/62/EC) Annex I habitats and OSPAR threatened and declining habitats and/or species (OSPAR, 2008);
- Acquire environmental baseline samples across the survey area to establish a benchmark against which potential future impacts could be assessed;
- Assess the route corridor for the possible presence of anomalies and boulders/debris that may impede pipelay or cable installation;
- Identify any seabed and sub-seabed features or obstructions.

1.3 GEODETIC PARAMETERS

1.3.1 Horizontal Reference

Table 4: Geodetic parameters

Geodetic Parameters	
Spheroid	International 1924
Semi-major axis	6378388.297
Semi-minor axis	6356911.946
Datum	European Datum 1950 (ED50)
Projection	Universal Transverse Mercator (UTM)
False Easting	500000.00
False Northing	0.00
Central Meridian	3° East
Central Scale Factor	0.9996
Latitude of Origin	0°
Grid Zone	31 North
Datum Transformation WGS84 – ED50	
dx	+ 89.5m
dy	+93.8m
dz	+123.1m
Rx	0.0
Ry	0.0
Rz	-0.156
Scale	-1.2ppm

1.3.2 Vertical Reference

All water depths have been reduced to LAT using the UKHO VORF model. MSL is 1.6m above LAT within the survey area.

2 SURVEY OPERATIONS AND DATA REVIEW

2.1 SUMMARY OF SURVEY OPERATIONS

Between the 01st April and 15th May 2019, a geophysical, geotechnical and environmental survey was completed for the N5a Development Project – Pipeline Route and Platform Area Survey aboard the Geo Ocean III. An overview of the survey operations is given in Table 5.

Table 5: Overview of survey operations

Survey Operations Geo Ocean III– N5A Site, Cable Route and Pipeline Route Survey		
1	29/04/2019	Alongside Eemshaven Completed demobilisation from previous project commenced mobilisation for One-Dyas project. Completed Survey Positioning, MRU and SVP Comparisons
2	30/04/2019	Completed mobilisation of personnel to vessel Completed all vessel crew inductions Completed kick-off meeting and mobilisation HIRA review Completed transit to work location Completed Vessel DP trials
3	01/05/2019	Completed Recce line through pipeline route and location. MBES calibration location identified Completed MBES calibration SSS verification completed Muster Drill completed Started analogue survey acquisition on northern section of pipeline route (Area 2)
4	02/05/2019	Continued analogue survey acquisition on northern section of pipeline route (Area 2) Started Vibro-coring operations on northern section of pipeline route (Area 2) Continued analogue survey acquisition cross lines only on northern section of pipeline route (Area 2) Carried out 3 Environmental Camera observations on environmental sample locations on northern section of pipeline route (Area 2) Continued analogue survey acquisition cross lines only on northern section of pipeline route and western section of cable route. (Area 2 and Area 3)
5	03/05/2019	Continued analogue survey acquisition cross lines only on western section of cable route. (Area 3) Stopped operations due to increasing weather affecting data. Carried out 5 Environmental Camera observations on environmental sample locations on northern section of pipeline route (Area 2) Stopped due to weather rising out of safe working limits for operations Standing by on weather
6	04/05/2019	Standing by on weather
7	05/05/2019	Standing by on weather
8	06/05/2019	Standing by on weather Completed Drop Camera locations on northern section of pipeline route (Area 2) Commenced Grab Sample locations on northern section of pipeline route (Area 2) Stopped Grab Sampling due to rigging issue
9	07/05/2019	Resumed analogue survey acquisition on northern section of pipeline route (Area 2) Stopped analogue survey acquisition on northern section of pipeline route (Area 2) Thruster Technician onboard to fix thruster issue and returned to shore Completed Vibro-core operations on northern section of pipeline route (Area 2)
10	08/05/2019	Completed Environmental Grab Sampling operations on northern section of pipeline route (Area 2) Completed analogue survey acquisition on northern section of pipeline route (Area 2) Commenced N5A UHR Site Survey (Area 5)
11	09/05/2019	Completed N5A UHR Site Survey (Area 5) Acquired one-line analogue survey acquisition on western section of cable route (Area 3)

Survey Operations Geo Ocean III– N5A Site, Cable Route and Pipeline Route Survey		
		Completed analogue survey acquisition on eastern section of cable route (Area 4) Completed Geotechnical Vibro-cores on eastern section of cable route (Area 4) Completed Environmental Video Photography and Grab Sampling operations on eastern section of cable route (Area 4) Re-commenced analogue survey acquisition on western section of cable route (Area 3)
12	10/05/2019	Completed analogue survey acquisition on western section of cable route (Area 3) Completed Geotechnical Vibro-cores on western section of cable route (Area 3) Completed N5A UHR Site Survey reshoots (Area 5)
13	11/05/2019	Completed additional environmental video and photography transects on N5A Site Survey location. Completed Environmental Video Photography and Grab Sampling operations on western section of cable route (Area 3) Commenced Geotechnical Vibro-cores on southern section of pipeline route (Area 1) Commenced Environmental Video Photography on southern section of pipeline route (Area 1)
14	12/05/2019	Completed Environmental Video Photography and Grab Sampling operations on southern section of pipeline route (Area 1) Completed Geotechnical Vibro-cores on southern section of pipeline route (Area 1) Commenced analogue survey acquisition on southern section of pipeline route (Area 1) and infill on northern pipeline route (area 2)
15	13/05/2019	Completed analogue survey acquisition on southern section of pipeline route (Area 1) and infill on northern pipeline route (area 2) Completed analogue survey acquisition on alternative cable route (C3)
16	14/05/2019	Completed Alternative N5A UHR Site Survey Completed Geotechnical Vibro-cores on alternative N5A site and cable route (C3) Completed Environmental Video Photography and Grab Sampling operations on alternative N5A site and cable route (C3)
17	15/05/2019	Arrived in Eemshaven Demobilisation Completed

2.2 GEOPHYSICAL DATA

Analogue geophysical data acquired by GEOxyz during the survey were used for site selection as no previous geophysical data were available for the survey area. This data was reviewed onboard by BSL and camera transects were selected to target any habitats and boundaries across the survey area, with particular attention paid to the investigation of potential Annex I habitats protected under the EU Habitats Directive. Where features of interest occurred in close proximity to one of the environmental sampling stations, based on the rationale outlined in the scope of work, this station was to be moved slightly to provide additional ground-truthing data for the feature of interest.

The following datasets were available for review during the preparation of this report:

- Bathymetry, reduced and processed offshore to provide a digital terrain model where major bathymetric features and minor bathymetric changes could be identified and highlighted. This included the identification of large features (e.g. linear ridges of cobbles and boulders) and seabed infrastructure (e.g. existing pipelines).
- Side scan sonar (SSS) with data run at both high (400kHz) and low (100kHz) frequencies at ranges varying from 75m to 125m with digital rendering onto a seabed mosaic of the area (100KHz) for review. Changes in sediment type and hardness, along with features observed through low level relief and discrete objects could also be delineated.

2.3 ENVIRONMENTAL GROUND-TRUTHING AND SAMPLING

The environmental sampling strategy was defined by the client prior to the commencement of the survey. Sampling locations along the pipeline and cable routes were positioned every kilometre from the proposed N5a well locations to the shore and to the Riffgat offshore wind farm (Figure 2). Two stations (Grab_P_0 and Grab_P_7) along the pipeline route were repositioned to cover areas of interest identified from the sidescan sonar record (Table 6). At each of these sampling locations a drop-down video assessment was conducted before grab sampling, with video footage acquired at all stations apart from Grab_P_14 where the visibility severely reduced. Additional camera transects were conducted over the proposed N5a well locations and additional areas of interest identified following review of the sidescan sonar record (Table 7).

Seabed video footage was acquired along eight camera transects using a Seabug camera system mounted within a BSL camera sled frame equipped with a separate strobe, and LED lamps. The camera unit itself is capable of acquiring images at 14.7MP resolution but was set to a resolution of 5MP (2592 x 1944 pixels) to optimise image upload times during camera operation.

A BSL Double grab (double Van Veen) was used for seabed sampling, requiring two successful deployments at each location. A maximum of three 'no sample' deployments was allowed at each station before abandoning. A 0.1m^2 Day Grab was used on the first deployment, before switching to the BSL Double grab for all remaining deployments at the client's request.

Table 6: Summary of drop-down camera and grab sampling locations for survey area

ED50, UTM 31N, CM 3° E								
Station	Rationale	Type	Easting (m)	Northing (m)	PC	F1	F2	F3
Grab_P_0	Pipeline Route - Positioned at 1km intervals	EBS/HAS	721619	5954453	Y	Y	Y	Y
Grab_P_1	Moved from KP in order to investigate area of high reflectivity sediment	EBS/HAS	721325	5953791	Y	Y	Y	Y
Grab_P_2	Pipeline Route - Positioned at 1km intervals	EBS/HAS	720981	5952752	Y	Y	Y	Y
Grab_P_3	Pipeline Route - Positioned at 1km intervals	EBS/HAS	720669	5951801	Y	Y	Y	Y
Grab_P_4	Pipeline Route - Positioned at 1km intervals	EBS/HAS	720355	5950850	Y	Y	Y	Y
Grab_P_5	Pipeline Route - Positioned at 1km intervals	EBS/HAS	720041	5949900	Y	Y	Y	Y
Grab_P_6	Pipeline Route - Positioned at 1km intervals	EBS/HAS	719729	5948950	Y	Y	Y	Y
Grab_P_7	Moved from KP to investigate mixed reflectivity sediment	EBS/HAS	719347	5948023	Y	Y	Y	Y
Grab_P_8	Pipeline Route - Positioned at 1km intervals	EBS/HAS	719105	5947052	Y	Y	Y	Y
Grab_P_9	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718861	5945912	Y	Y	Y	Y
Grab_P_10	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718779	5944917	Y	Y	Y	Y
Grab_P_11	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718695	5943920	Y	Y	Y	Y
Grab_P_12	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718614	5942923	Y	Y	Y	Y
Grab_P_13	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718532	5941927	Y	Y	Y	Y
Grab_P_14	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718450	5940930	Y	Y	Y	Y
Grab_P_15	Pipeline Route - Positioned at 1km intervals	EBS/HAS	718366	5939933	Y	Y	Y	Y
Grab_C_0	Original Cable Route and N5a well centre location	EBS/HAS	721610	5954652	Y	Y	Y	Y
Grab_C_1	Original Cable Route – Positioned at 1km intervals	EBS/HAS	722604	5954538	Y	Y	Y	Y
Grab_C_2	Original Cable Route – Positioned at 1km intervals	EBS/HAS	723596	5954425	Y	Y	Y	Y
Grab_C_3	Original Cable Route – Positioned at 1km intervals	EBS/HAS	724588	5954315	Y	Y	Y	Y

ED50, UTM 31N, CM 3° E								
Grab_C_4	Original Cable Route – Positioned at 1km intervals	EBS/HAS	725579	5954203	Y	Y	Y	Y
Grab_C_5	Original Cable Route – Positioned at 1km intervals	EBS/HAS	726575	5954089	Y	Y	Y	Y
Grab_C_6	Original Cable Route – Positioned at 1km intervals	EBS/HAS	727355	5954245	Y	Y	Y	Y
Grab_C_7	Original Cable Route – Positioned at 1km intervals	EBS/HAS	728149	5954477	Y	Y	Y	Y
Grab_C_8	Original Cable Route – Positioned at 1km intervals	EBS/HAS	729107	5954756	Y	Y	Y	Y
Grab_C3_0	Secondary Cable Route and N5a second potential well centre location	EBS/HAS	722288	5953018	Y	Y	Y	Y
Grab_C3_1	Secondary Cable Route – Positioned to investigate mixed reflectivity sediment	EBS/HAS	723809	5953378	Y	Y	Y	Y
Grab_C3_2	Secondary Cable Route – Positioned to investigate high reflectivity sediment	EBS/HAS	725337	5953741	Y	Y	Y	Y

Table 7: Summary of camera transect locations for the survey area

ED50, UTM 31N, CM 3° E								
Transect	Rationale	SOL/ EOL	Date and time	Depth (m)	Easting (m)	Northing (m)	No. Stills	Video footage (mm:ss)
Grab P_0	Investigating area of mixed reflectivity sediment	SOL	02/05/2019 17:15:11	30	721647	595443	27	07:13
		EOL	02/05/2019 17:22:21	31	721591	595447		
North Transect 1	Investigating transition from mixed to high reflectivity sediment	SOL	11/05/2019 00:49:10	29	721486	595468	30	10:11
		EOL	11/05/2019 00:59:10	29	721363	595463		
North Transect 2	Investigating transition from low to mixed reflectivity sediment	SOL	11/05/2019 00:06:17	30	721609	595499	41	12:49
		EOL	11/05/2019 00:18:59	28	721631	595515		
North Transect 3	Investigating transition from mixed to high reflectivity sediment	SOL	11/05.2019 02:04:48	29	721902	595440	50	12:29
		EOL	11/05/2019 02:17:13	29	721802	595455		
N5a Transect 1	Transect across original N5a well location	SOL	11/05/2019 01:38:05	29	721585	595458	35	08:37
		EOL	11/05/2019 01:46:38	29	721626	595470		
N5a Transect 2	Transect across original N5a well location	SOL	11/05/2019 01:16:28	28	721668	595463	39	09:13
		EOL	11/05/2019 01:25:35	29	721544	595466		
Grab_C3_0	Transect across second proposed N5a well location	SOL	14/05/2019 21:51:02	24	722231	595298	36	09:15
		EOL	14/05/2019 22:00:14	25	722335	595304		
Grab_C3_2	Investigating area of high reflectivity sediment	SOL	14/05/2019 20:46:00	25	725366	595361	37	12:36
		EOL	14/05/2019 20:58:53	25	725326	595378		

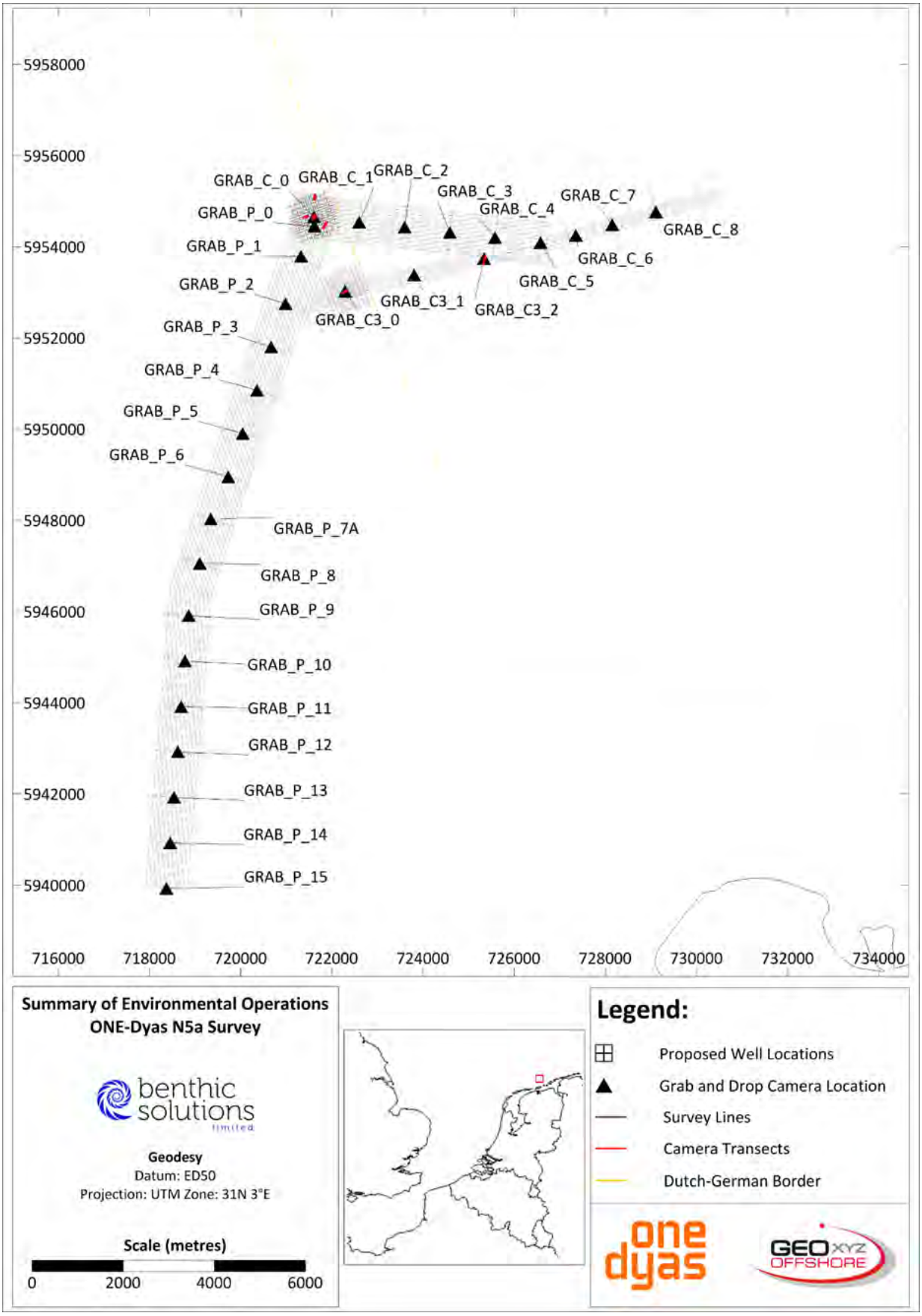

Figure 2: Survey strategy overview

2.4 HABITAT INVESTIGATION

2.4.1 Habitat Classification

A marine biotope classification system for British waters was developed by Connor *et al.* (2004) from data acquired during the JNCC Marine Nature Conservation Review (MNCR) and subsequently revised by Parry *et al.* (2015) to provide improved classification of deep-sea habitats. The resultant combined JNCC (2015) classification system forms the basis of the European Nature Information Service Habitat Classification (EUNIS, 2013), albeit with differing habitat coding nomenclature, which has compiled habitat information from across Europe into a single database. The two classification systems are both based around the same hierarchical analysis. Initially abiotic habitats are defined at four levels. Biological communities are then linked to these (at two lower levels) to produce a biotope classification. (Connor *et al*., 2004; EUNIS, 2013).

Habitat descriptions have been interpreted from the side scan sonar and bathymetric data acquired during the current survey, in conjunction with additional information on seabed sediment types and faunal communities from seabed photography and grab sampling. Global Mapper V20 GIS software was used to review side scan sonar mosaic (Geotiff) and multibeam bathymetry data (Geotiff and xyz) and to delineate areas of different seabed habitats.

2.4.2 Assessment of Sensitive Habitats

The Netherlands is a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979). To meet their obligations under the convention, the European Community Habitats Directive was adopted in 1992. The provisions of the Directive require Member States to introduce a range of measures including the protection of species listed in the Annexes; to undertake surveillance of habitats and species and produce a report every six years on the implementation of the Directive. The 189 habitats listed in Annex I of the Directive and the 788 species listed in Annex II, are to be protected by means of a network of sites. Each Member State is required to prepare and propose a national list of sites, which will be evaluated in order to form a European network of Sites of Community Importance (SCIs). These will eventually be designated by Member States as Special Areas of Conservation (SACs), and along with Special Protection Areas (SPAs) classified under the EC Birds Directive (2009), form a network of protected areas known as Natura 2000. The Directive was amended in 1997 by a technical adaptation Directive and latterly by the Environment Chapter of the Treaty of Accession 2003.

Based on the above, the OSPAR list of threatened and/or declining species and habitats and Annex I habitats of particular relevance to this region of UK waters are:

- Biogenic reefs formed by *Sabellaria spinulosa* (the Ross Worm); and,
- Sandbanks which are slightly covered by sea water all the time

Stony reefs are an Annex I habitat and are protected under the EU habitats directive. Sampling location Grab_C3_2 showed a high proportion of cobbles and boulders, and consequently a stony reef assessment was conducted. The seabed camera ground-truthing data were assessed for potential stony reefs using the criteria proposed by Irving (2009). While the Irving (2009) criteria have been approved by the UK regulators for application in UK waters, they have not been explicitly approved by the Netherlands authorities but are used here as they provide a useful basis for semi-quantitative assessment of potential Annex I stony reef habitat. The Irving (2009) method breaks down the assessment criteria into measures of reef 'quality' or 'reefiness' as outlined in Table 8. This is based on a minimum cobble size of 64mm being present and

indicating relief above the natural seabed where >10% of the matrix are cobble related and a minimum surface area of around 25m^2 is recorded.

The stony reef assessment was based on HD video and stills taken during the camera transects. Stills were acquired when the camera frame landed on the seabed for one or more seconds in order to obtain the best possible image quality, while the changes in coverage and density of cobbles/boulders were estimated during the video data analysis.

Table 8: Summary of resemblance to a stony reef, as summarised in Irving (2009)

Measure of 'reefiness'	NOT a reef	Low(c)	Medium	High
Composition(a)	<10%	10-40%	40-95%	>95%
Elevation(b)	Flat seabed	<64mm	64mm-5m	>5m
Extent (m^2)	<25m^2	>25m^2	>25m^2	>25m^2
Biota	Dominated by infauna			>80% of species are epifauna

(a) Diameter of cobbles / boulders being greater than 64mm. Percentage cover relates to a minimum area of 25m^2. This 'composition' characteristic also includes 'patchiness'.

(b) Minimum height (64mm) relates to minimum size of constituent cobbles. This characteristic could also include 'distinctness' from the surrounding seabed.

(c) When determining if the seabed is considered as Annex I stony reef, a 'low' scored (in any category), would require a strong justification for this area to be considered as contributing to the Marine Natura site network of qualifying reefs in terms of the EU Habitats Directive.

The Irving (2009) stony reef protocol was split into separate assessments of reef 'structure' and 'overall reefiness' using a method developed by BSL staff (Table 9 and Table 10). This provided a reef structure value that could be then assessed against extent, where applicable, to provide a measure of overall 'reefiness' as illustrated in Table 10. As separate thresholds for 'Low', 'Medium' and 'High' stony reef extent were not given in Irving (2009), the overall 'reefiness' is determined by reef structure provided that the extent of the stony reef covers a minimum of 25m^2.

Table 9: Stony Reef Structure Matrix (after Irving, 2009)

Reef Structure Matrix			Elevation			
			Flat	<64mm	64mm-5m	>5m
			Not a Reef	Low	Medium	High
Composition	<10%	Not a reef	NOT A REEF	NOT A REEF	NOT A REEF	NOT A REEF
	10-40%	Low	NOT A REEF	LOW	LOW	LOW
	40-95%	Medium	NOT A REEF	LOW	MEDIUM	MEDIUM
	>95%	High	NOT A REEF	LOW	MEDIUM	HIGH

Table 10: Overall Stony Reefiness matrix (structure vs extent)

Overall Reefiness Matrix			Reef Structure (incl. Composition and Elevation)			
			Not a Reef	Low	Medium	High
Extent (m^2)	<25	Not a Reef	NOT A REEF	NOT A REEF	NOT A REEF	NOT A REEF
	>25	Low - High	NOT A REEF	LOW	MEDIUM	HIGH

In evaluating the ground-truthed stony patches, Irving (2009) also recommended that the associated biota was considered, indicating that areas dominated by infauna should be considered 'Not a Reef' whereas areas where greater than 80% of species were epifaunal should be considered to show 'High' reefiness, but no recommendations were given as to the proportion of infauna and epifauna warranting classification of 'Low'

or ‘Medium’ reefiness. In practise, it is not practical to assess the proportion of infaunal and epifaunal species in a quantitative manner. This cannot be undertaken from seabed camera data (i.e. video footage or still photographs) as only the larger epifauna and emergent infauna are visible. To accurately quantify the proportion of infauna and epifauna species, it would be necessary to take large enough samples to include both the stony material (i.e. cobbles and boulders) and the surrounding sediment matrix, with sufficient replication to provide confidence in the resultant data. This would likely involve sampling with a large volume sampler such as a clam dredge and could significantly impact the integrity of the cobble/boulder patch. As such the biota associated with stony patches from the current survey has been described in a qualitatively.

3 RESULTS AND INTERPRETATION

3.1 BATHYMETRY

The following text was adapted from the survey reports for the N5A site (LU-0022H-553-RR-01), N5A to NGT Hot Tap pipeline route (LU-0022H-553-RR-02) and N5A to Riffgat cable route (LU-0022H-553-RR-07) to provide an overview of the bathymetry across the survey site and route corridors.

Bathymetry data were acquired using an R2 Sonics 2022 multi-beam echo sounder for the site and an R2Sonic 2024 multi-beam echo sounder for the two route surveys. All bathymetry data have been reduced to LAT, which was 1.6m below MSL within the survey area, and are presented at a 0.5m x 0.5m bin size.

3.1.1 N5A to NGT Hot Tap Pipeline Route

Water depths along the proposed N5A to NGT Hot Tap pipeline route ranged between 9.8m LAT at KP0.000 and 26.4m LAT at KP14.675, with the seabed shoaling gently towards the southern end of the proposed pipeline route. A series of natural troughs trending west-north-west to east-south-east occurred within the survey corridor, crossing the proposed pipeline route, the largest of which was approximately 250m wide.

A variety of anthropogenic debris/wreck and areas of disturbed seabed were evident on the bathymetry data:

- Two prominent features interpreted as shipwrecks surrounded by seabed scouring; the largest (40.1m x 12.8m x 1.1m) occurred at approximately KP2.462, 369m west-north-west of the proposed route and the other (19.1m x 12.9m x 0.2m) occurred at approximately KP2.373, 339m west-north-west of the proposed route.
- Three semi-circular features with 1m of positive relief, interpreted as being related to previous drilling activity, were observed on bathymetry data. These were observed at the start of the proposed route between KP0.009 and KP0.089, offset by 90m to the east-south-east at their closest approach. These features lay within a 30m radius of each other and exhibited average dimensions of 30m x 30m.
- Three existing cables and one pipeline were expected to cross the proposed pipeline route but were not observed on the bathymetry data.

3.1.2 N5A to Riffgat Cable Route

The seabed shoaled gently towards the east-north-east end of the proposed N5A to Riffgat cable route with water depths ranging between 26.0m at KP0.280 and 19.6m KP7.941. A series of natural troughs, predominantly trending north-west to south-east, crossed the proposed cable route from approximately KP5.158 to KP8.681 and were interpreted to be related to tidal/current processes.

Three semi-circular features with 1m of positive relief, interpreted as being related to previous drilling activity, were imaged in the bathymetry data. These were positioned at the start of the proposed route between KP0.085 and KP0.168; at their minimum offset from the route they were approximately 27m south-south-west. They were positioned within a 30m radius and had average dimensions of 30m x 30m.

The Norned cable was observed crossing the proposed cable route at KP 2.313 trending north-north-west to south-south-east.

3.2 SEABED FEATURES

The following text was adapted from the survey reports for the N5A site (LU-0022H-553-RR-01), N5A to NGT Hot Tap pipeline route (LU-0022H-553-RR-02) and N5A to Riffgat cable route (LU-0022H-553-RR-07) to provide an overview of the seabed features across the survey area, focussing on features of particular relevance to the environmental baseline and habitat assessment of the survey area.

Side scan sonar data were acquired with an Edgetech 4200 system operating at 100kHz/400kHz with between 75m and 200m per channel range. This was supplemented by swathe bathymetry data gridded to 0.5m bin size.

3.2.1 N5A Site

Seabed sediments across the N5A survey area were expected to comprise 'fine sand with shell fragments'. An area of 'coarse sand and shell with a high density of sand mason worms and razor clams' was evident in the north of the survey area, while an area of 'coarse sand with pebbles and cobbles' was present in the south. The uppermost sand unit was merely a veneer and the boundary between the sand and the underlying clay outcrops was arbitrary with the potential for some clay to outcrop in the areas interpreted as sand.

Outcrops of clay were interpreted within the survey area, showing a positive relief of up to 0.5m above background seabed levels. Elsewhere accumulations of coarse sand and gravel were also observed on the bathymetry as having positive relief above the ambient seabed, with some accumulations likely to be caused by the stabilising effect of high densities of sand mason worms and razor clams on the seabed.

Within the survey area there was no existing infrastructure other than the previously drilled N5 Well. Seabed scars up to 1.1m high from the rig whilst over the N5-Ruby wellsite were observed on the bathymetry and side scan sonar data. Numerous magnetometer anomalies were observed within this area, however no wellhead or other evidence of the drilling location could be observed at seabed.

3.2.2 N5A to NGT Hot Tap Pipeline Route

Seabed sediments along the proposed pipeline route corridor were expected to comprise 'fine sand and shell fragments', with occasional areas of 'coarse sand and shell fragments'.

Bedforms were not imaged in the sonar or bathymetry records. However, photographs taken along the route as part of the environmental survey showed clear seabed rippling over the majority of the survey corridor.

Numerous objects interpreted as boulders and items of debris were observed within the proposed pipeline route corridor. Most of the objects interpreted as boulders occurred towards the north of the survey corridor area and coincided with areas of clay exposure.

The most significant objects identified on the sonar records were two interpreted shipwrecks, the largest (40.1m x 12.8m x 1.1m) occurring at approximately KP2.462, 369m west-north-west of the proposed route and the other (19.1m x 12.9m x 0.2m) at approximately KP2.373, 339m west-north-west of the proposed route.

Three existing cables and one pipeline were expected to cross the proposed pipeline route but were not observed on the bathymetry data.

3.2.3 N5A to Riffgat Cable Route

Seabed sediments along the proposed pipeline route corridor were expected to comprise fine to coarse SAND, with occasional areas of 'coarse sand and clay with pebbles and cobbles' and 'coarse sand with pebbles

and cobbles'. Approaching the Riffgate Wind Park, the seabed sediments were dominated by 'coarse sand and shell fragments' with occasional patches of 'coarse sand with pebbles and cobbles'.

Bedforms were not imaged in the sonar or bathymetry records. However, photographs taken along the proposed route corridor as part of the environmental survey clearly showed ripples covering the majority of the seabed within the survey corridor area.

There were numerous objects interpreted as boulders within the proposed pipeline route corridor. Most of the objects, interpreted as boulders occur towards the north of the survey corridor in an area coinciding with areas of clay exposure.

3.3 SHALLOW SOILS

The following text was adapted from the survey reports for the N5A site (LU-0022H-553-RR-01), N5A to NGT Hot Tap pipeline route (LU-0022H-553-RR-02) and N5A to Riffgat cable route (LU-0022H-553-RR-07) to provide an overview of the shallow soils across the survey area, focussing on the upper layers of relevance to interpretation of the seabed sediment distribution and bathymetric features.

Interpretation of shallow soils across the survey area was based upon pinger and sparker data. Additional information was gained from vibrocore logs and borehole N5-1, 90m south of the proposed Platform Location acquired by Fugro in November 2016. Vibrocore VC_P_0 is at the proposed Platform Location.

3.3.1 N5A Site

The uppermost mappable unit was confirmed as SAND in the vibrocore logs. Where mapped in the western parts of the survey area this unit was under 1.5m thick. This surficial SAND unit was only mappable when thicker than 0.5m and was likely to be present outside the mapped area but at thicknesses below 0.5m.

Three sub units within the Quaternary sequence were interpreted within the area based on the acoustic nature of the sparker data. The uppermost unit, (besides surficial sand mapped from the Pinger data), interpreted within the survey area is a chaotic unit, interpreted to comprise dense to very dense medium to coarse SAND with traces of shell fragments (as sampled within the borehole). Within the survey area, the reflector which correlates with the base of this unit undulates between 1.2m and 18.0m below seabed.

3.3.2 N5A to NGT Hot Tap Pipeline Route

This unit of fine to medium grained SAND generally thicken to the south. It was absent (or less than 0.5m thick) from KP 0.430 to KP 0.450 and KP 0.757 to KP 1.045. South of KP 5.951 the base of the mapped unit becomes indistinct to the point of being unmappable, at this point the unit was approximately 9m thick.

The mapped unit was sub-cropped by a sequence of variable composition. Vibrocore logs show that this sub-crop predominantly comprises silty fine SAND except for the area north of KP 1.246 where the subcrop was more clay prone and was interpreted to be the infill of a broad channel.

3.3.3 N5A to Riffgat Cable Route

This unit of fine to medium grained SAND generally thickened to the east. West of the route AC at KP 5.156 the unit was approximately 0.5 to 1m thick or absent/unmappably thin, east of this point the unit locally exceeds a thickness of 2m.

Vibrocore logs showed that the mapped unit was sub-cropped by clay prone deposits from KP0 to KP 3.357, interpreted to be the infill of a broad channel. From KP 3.357 to the end of the route the mapped unit was subcropped by fine SAND.

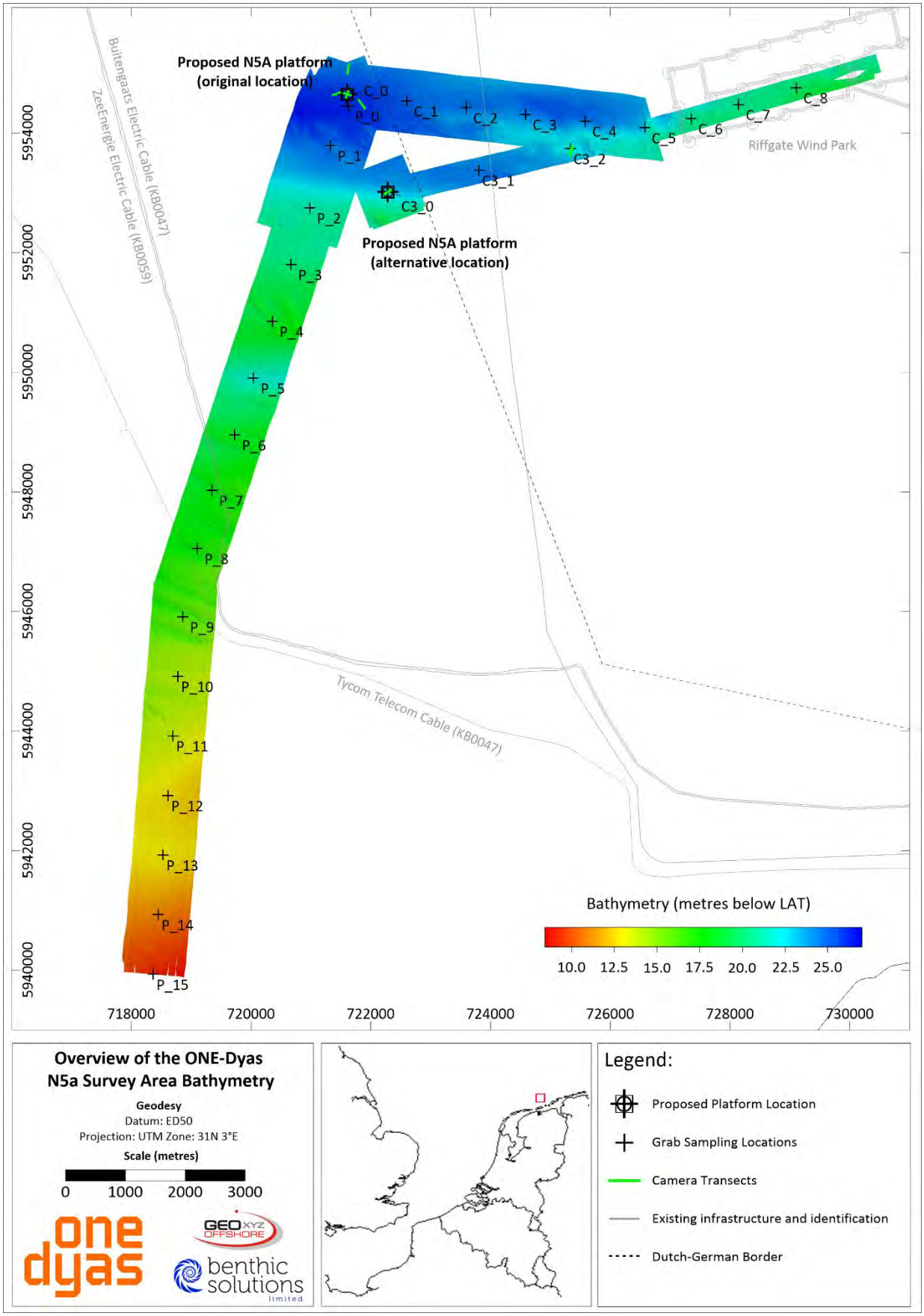

Figure 3: N5A Site and Route Survey Bathymetry

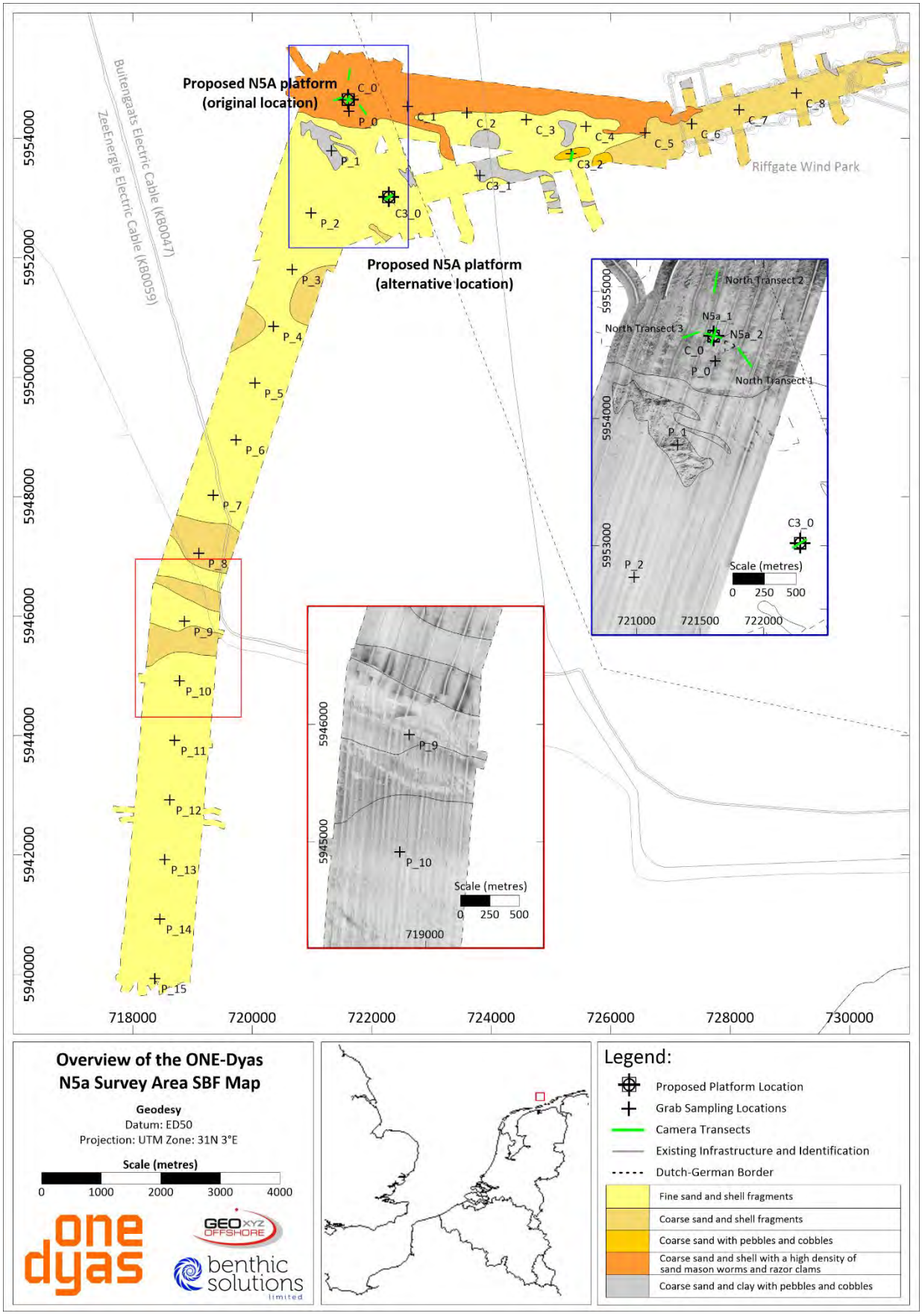

Figure 4: Interpreted N5A Site and Route Seabed Features

3.3.4 N5A Site

The seabed within the N5A site survey area sloped gently to the west. The minimum water depth was 23.7m LAT in the NNE of the survey area, while the maximum depth was 26.6m LAT in the WSW. Small areas with relief of up to 0.4m were observed on the bathymetry data with measured gradients of up 6° on their flanks, which were interpreted to be largely due to outcropping clays.

3.4 HABITAT ASSESSMENT

3.4.1 Video/Photographic Survey

A total of twenty-eight drop-down camera deployments and eight camera transects were conducted within the combined N5A development site and route survey area. The camera ground-truthing was undertaken to investigate the distribution of different seabed habitats and associated fauna, while additionally assessing the presence or absence of potential sensitive habitats and species. Drop-down camera deployments were undertaken to provide additional data on the composition of the seabed sediment and associated visible fauna. In contrast, the camera transects were selected to investigate areas of different acoustic facies on the side scan sonar record and/or bathymetric features evident on the MBES data. The ground-truthing stations and transects are listed in Table 6 and Table 7, respectively, and their locations are shown in Figure 2 to Figure 4, with summary photopages included in Appendix H.

Seabed video and photographic data were acquired using a Seabug camera system mounted within a BSL camera sled frame equipped with a separate strobe, and LED lamps. The Seabug is capable of acquiring images at 14.7MP resolution but was set to a resolution of 5MP (2592 x 1944 pixels) to optimise image upload times during camera operation. (see Appendix B and D).

Video and camera ground-truthing along all of the transects confirmed the presence of sand-dominated substrate throughout the site and route survey areas. While the dominant sediment type was ‘fine sand and shell fragments’, several patches of coarser sediment were present across the survey area. The N5A site and route survey corridor to the Riffgate Wind Park showed increasingly coarse sediment, including areas of gravel (>2mm), pebble (>4mm) and cobble (>64mm) in addition to sporadic clay outcrops. The area of coarser substrate along the northern edge of the N5A site and the route survey corridor to the Riffgate Wind Park also supported significant densities of sand mason worms (*Lanice conchilega*) and razor clams (*Ensis* sp., possibly *E. leei*). Although both *L. conchilega* and *E. leei* were observed elsewhere within the N5A site and along the route to the wind park, they were less numerous and more patchily distributed outside the area of the delineated area of ‘coarse sand and shell with a high density of sand mason worms and razor clams’. Habitat assessment logs for each of the nineteen camera transects locations are included in Appendix E.

Conspicuous epifauna showed moderate diversity and density for a predominantly mobile sandy seabed. Camera ground-truthing stations and transects across all mapped seabed habitats showed a similar species assemblage including frequent observations of sand mason worms (*Lanice conchilega*) and common starfish (*Asterias rubens*). Other species observed more sporadically throughout the combined N5A site and route survey area included razor clams (*Ensis* sp. possibly *E. leei*), burrowing anemones (Cerianthidae), swimming crabs (*Liocarcinus* sp.), masked crabs (*Corystes cassivelaunus*), hermit crabs (Paguridae sp.), edible crabs (*Cancer pagurus*), brittlestars (Ophiuridae), gobies (Gobiidae), dragonets (*Callionymus lyra*), flatfish (Pleuronectiformes) and sandeels (*Ammodytes* sp.).

Areas of coarser substrate, including the delineated area of ‘coarse sand and shell with a high density of sand mason worms (*L. conchilega*) and razor clams (suspected *E. leei*)’, were characterized by higher abundances

of all of the aforementioned fauna with additional observations of plumose anemones (*Metridium senile*), unidentified anemones (Actiniaria), cuttlefish (Sepiidae), European squid (*Loligo vulgaris*), common dab (*Limanda limanda*) and grey gurnard (*Eutriglia gurnardus*).

Example photographs of the common and/or conspicuous faunal groups encountered during the N5A development survey are provided in Appendix F.

3.4.2 General Habitats

Video and still photography ground-truthing from twenty-eight drop-down camera deployments and eight camera transects confirmed the presence of a predominantly sandy seabed with spatial variability in the proportions of shell fragments, coarse substrate (gravel, pebbles and cobbles) and outcropping clay. In addition, an areas of coarse substrate along the northern edge of the survey area supported high densities of sand mason worms (*Lanice conchilega*) and razor clams (suspected *Ensis leei*).

Habitats were identified using a combination of field observations, detailed review of video footage and still images. Based on the ground-truthing data obtained from the N5A development site and route survey area, four EUNIS habitat classifications were assigned: 'Infralittoral fine sand' (A5.23), 'Infralittoral coarse sediment' (A5.13), 'Infralittoral Mixed Sediment' (A5.43) and 'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137). The habitat classifications for the N5A development survey area are illustrated in Figure 9.

'Infralittoral Fine Sand' (A5.23)

Habitats dominated by fine sand with variable levels of shell debris were dominant across the survey area, being observed on the majority of environmental camera drops and transects within the N5A site and route survey area. These areas were represented by relatively smooth and low reflectivity side scan sonar data and were classified as the 'fine sand and shell fragments' seabed features type (Section 3.2 and Figure 4) and the EUNIS level 4 'Infralittoral fine sand' (A5.23) habitat type (Figure 9).

'Infralittoral fine sand' habitat is typically characterised by clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets in water depths of around 0 to 20m. The habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly amphipods (*Bathyporeia*) and robust polychaetes including *Nephtys cirrosa* and *Lanice conchilega*. Within the N5A development survey area, this habitat comprised clean rippled sands in water depths of approximately 13 to 30m, slightly exceeding the typically expected range.

Visible fauna from camera ground-truthing within areas of 'infralittoral fine sand' included low to moderate densities the sand mason worm (*L. conchilega*) throughout, in addition to several other taxa characteristic of this EUNIS habitat, including common starfish (*Asterias rubens*), swimming crab (*Liocarcinus*) and hermit crabs (Paguridae). Other fauna observed within areas of this habitat included lugworms (*Arenicola* sp.), masked crab (*Corystes cassivellaunus*), edible crab (*Cancer pagurus*), razor clams (*Ensis* sp.), brittlestars (Ophiuridae), gobies (Gobiidae), dragonets (*Callionymus lyra*), flatfish (Pleuronectiform). Further taxa evident from grab samples included occasional sandeel (Ammodytidae), heart urchins (*Echinocardium cordatum*), ragworms (*Nereis* spp.), unidentified sea urchins (spatangoid) and porcelain crab (Portunidae).

Review of the seabed camera and grab sample data indicated that the mapped distribution of 'infralittoral fine sand' (A5.23) habitat was fairly accurate. Only station P_9 showing more coarse sandy sediment than would be expected for 'infralittoral fine sand' habitat but, as this sampling station was located within an area of alternating bands of 'infralittoral fine sand' and 'infralittoral coarse sand', it is to be expected that there

will be some discrepancies in this area. Some sporadic patches of higher density *L. conchilega* aggregations were evident on seabed camera data from mapped areas of 'infralittoral fine sand' but these were insufficiently widespread or dense to warrant classification as 'Dense Lanice conchilega and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat.

Example images of 'Infralittoral Fine Sand (A5.23) habitat are given below in Figure 5, the expected extent of the habitat is mapped in Figure 9 and example images for conspicuous fauna and each ground-truthing deployment and are provided in Appendices F and H, respectively.

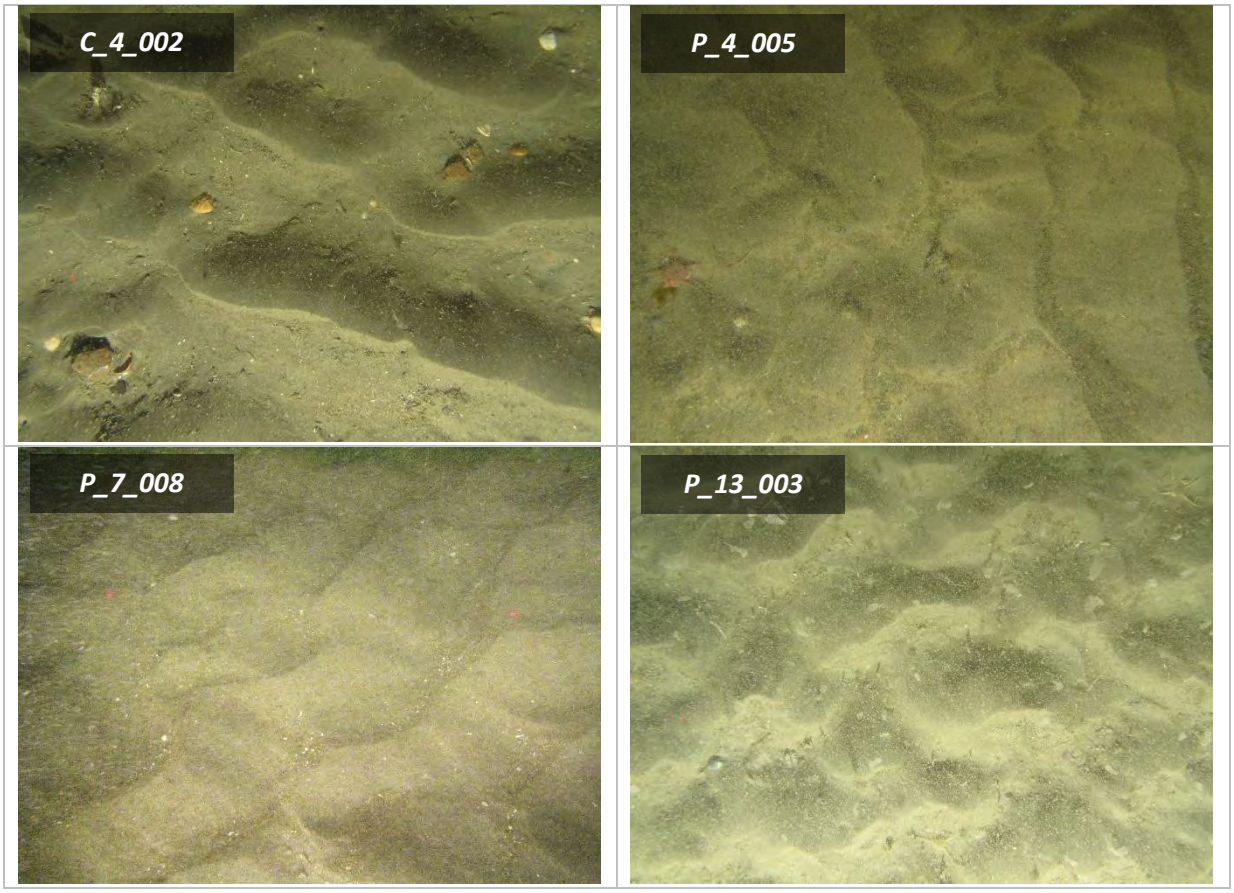

Figure 5: Example images of 'Infralittoral fine sand' (A5.23)

'Infralittoral Coarse Sediment' (A5.13)

Habitats dominated by coarse sand and moderate levels of shell debris and, occasionally, with gravel and pebbles were found in several patches across the combined N5A development site and route survey area, ground-truthed by stations C_5 to C_7, P_8 and P_9. These areas were represented by relatively smooth but low to moderate reflectivity side scan sonar data and were classified as the 'coarse sand and shell fragments' seabed features type (Section 3.2 and Figure 4) and the EUNIS level 4 'infralittoral coarse sediment' (A5.13) habitat type (Figure 9). Seven patches of 'infralittoral coarse sediment' were mapped, including a large patch on the route survey corridor around the Riffgate Wind Park and a further six smaller patches along the N5A to NGT Hot Tap pipeline route.

'Infralittoral coarse sediment' habitat is typically characterised by coarse sand, gravelly sand, shingle or gravel which are subject to disturbance by tidal streams and wave action in water depths of around 0 to 20m. The habitat is characterised by a robust fauna of infaunal polychaetes such as *Chaetozone setosa* and *Lanice*

conchilega, cumacean crustacea such as *Iphinoe trispinosa* and *Diastylis bradyi*, and venerid bivalves. Within the N5A development survey area, this habitat comprised rippled coarse shelly sands, sometimes with a discernible gravel and/or pebble content in water depths of approximately 19 to 30m, slightly exceeding the typically expected range.

Visible fauna from camera ground-truthing within areas of 'infralittoral fine sand' included low to moderate densities the sand mason worm (*L. conchilega*) throughout, in addition to common starfish (*Asterias rubens*), which are both characteristic species for this EUNIS habitat. The majority of other characterising taxa for this habitat are infaunal species are not effectively assessed from seabed camera ground-truthing.

Review of the seabed camera and grab sample data indicated that the mapped distribution of 'infralittoral coarse sediment' (A5.13) habitat was fairly accurate, but with two exceptions. Station C_0 was classified as 'infralittoral coarse sediment' habitat but was located within an area of 'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat, while station C_8 was classified as 'infralittoral fine sand' habitat but was located within an area of 'infralittoral coarse sediment'. Both of these exceptions reflect the heterogenous nature of the seabed habitats within the survey area.

Example images of 'infralittoral coarse sediment (A5.13) habitat are given below in Figure 6, the expected extent of the habitat is mapped in Figure 9 and example images for conspicuous fauna and each ground-truthing deployment and are provided in Appendices F and H, respectively.

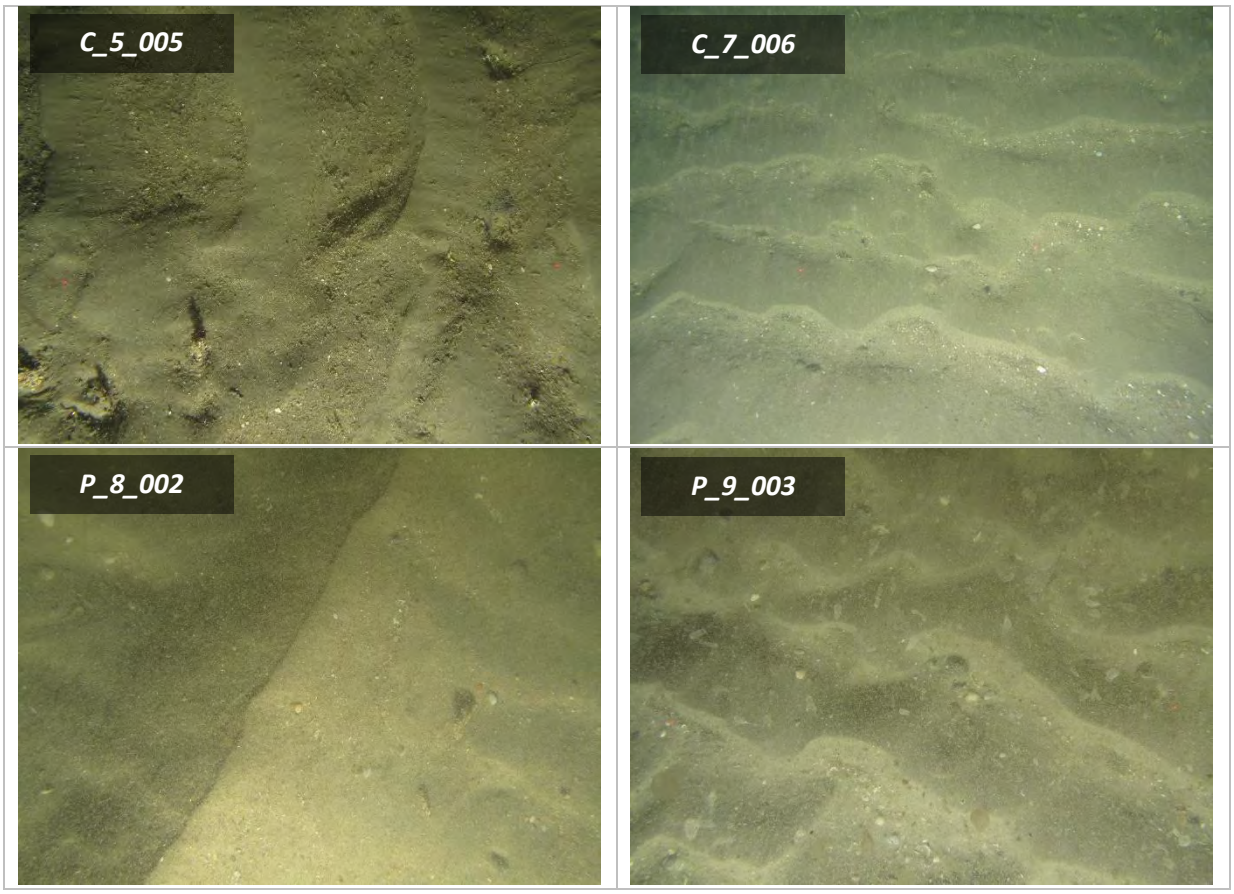

Figure 6: Example images of 'Infralittoral coarse sediment' (A5.13)

‘Infralittoral Mixed Sediment’ (A5.43)

Habitats dominated by coarse gravelly sand with pebbles, cobbles and, in some areas exposed clay clasts, were found delineated in ten patches across the combined N5A development site and N5A to Riffgate route survey area. These areas were classified as the ‘coarse sand with pebbles and cobbles’ seabed features type (Section 3.2 and Figure 4) and the EUNIS level 4 ’infralittoral mixed sediment’ (A5.43) habitat type (Figure 9). Two patches located midway along the N5A to Riffgate cable route showed moderate to high reflectivity side scan sonar signatures but showed no evidence of clay on ground-truthing data from station C3_2. A further ten patches along the N5A to Riffgate route showed similar mottled side scan sonar signatures and may include exposed clay, as evident from ground-truthing at stations P_1 and C3_1 over two of the patches.

‘Infralittoral mixed sediment’ habitat is typically characterised by mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in mud, sand or gravel in water depths of around 0 to 30m. Due to the variable nature of the sediment type, a wide array of communities are reported to be found in areas of mixed sediment, including those characterised by bivalves, polychaetes and file shells. Within the N5A development survey area, this habitat comprised coarse gravelly sand with pebbles, cobbles and sometimes with the addition of exposed clay clasts, in water depths of approximately 24 to 27m, slightly exceeding the typically expected range.

Visible fauna from camera ground-truthing within areas of ‘infralittoral fine sand’ included common starfish (*Asterias rubens*) and burrowing anemones (Cerianthidae) which are both characteristic species for this EUNIS habitat. Seabed ad grab sample photographs from station C3_1 show numerous holes within the exposed clay clasts which may indicate the presence of boring piddock bivalves (typically *Pholas dactylus* or *Barnea candida*), although no live individuals could be discerned from the seabed or grab sample photographs. While piddocks are not protected by legislation, they are not widespread in the marine environment and would therefore be worthy of note if recorded within the macrofaunal analysis dataset at these stations. In the absence of confirmed piddock presence at these stations, the ‘infralittoral mixed sediment’ (A5.43) habitat has been assigned, however, this should be amended to ‘piddocks with a sparse associated fauna in sublittoral very soft chalk or clay’ (A4,231) habitat if piddocks are identified in the grab samples.

Example images of ‘infralittoral coarse sediment (A5.13) habitat are given below in Figure 7, the expected extent of the habitat is mapped in Figure 9 and example images for conspicuous fauna and each ground-truthing deployment and are provided in Appendices F and H, respectively.

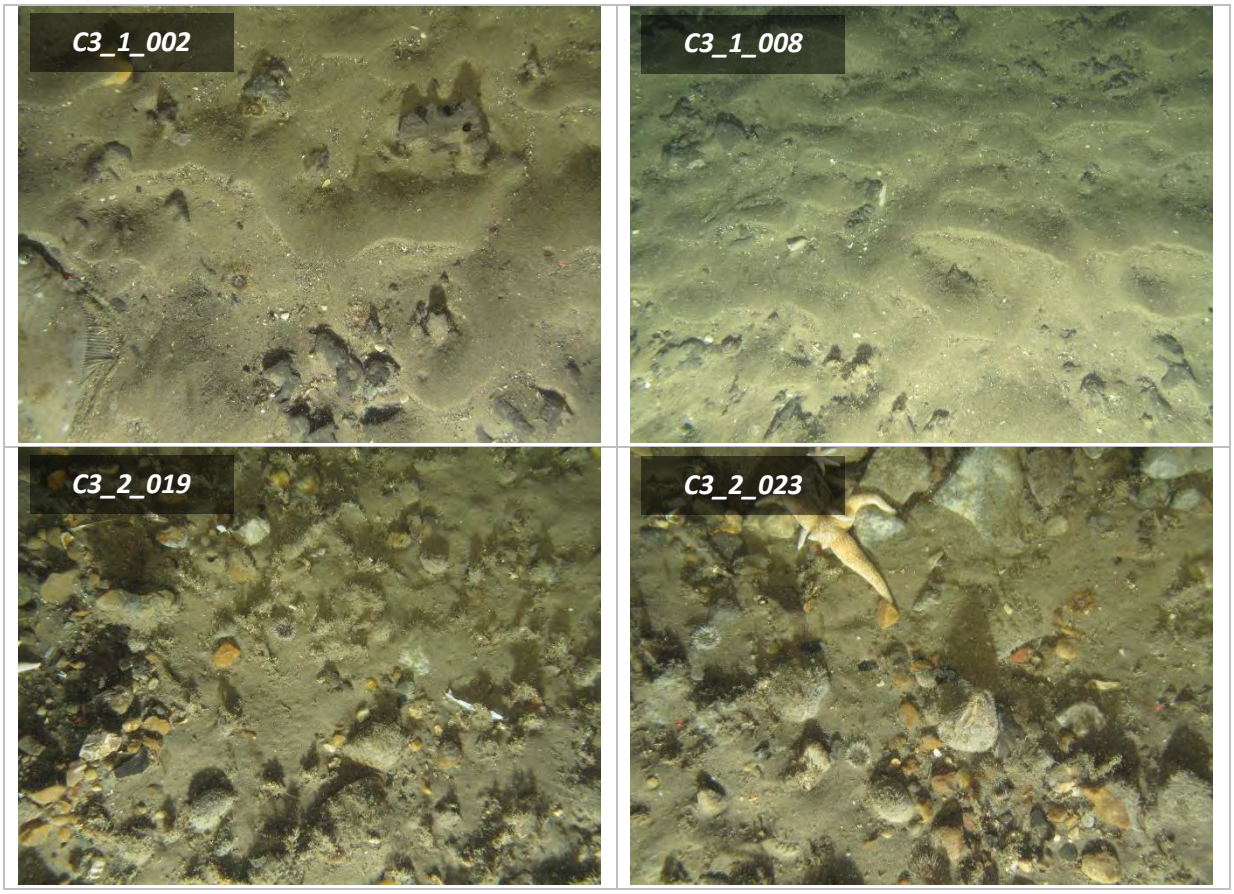

Figure 7: Example images of 'Infralittoral mixed sediment' (A5.43)

'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137)

Habitats dominated by gravelly, shelly coarse sand with moderate to high densities of *Lanice conchilega* were evident at several ground-truthing locations (stations C_1, C_2 and P_0, and transects N5A_1, N5A_2, NT_1, NT_2 and NT_3) within the N5A site and to the east along the N5A to Riffgate Wind Park route. These areas were represented by mottled low to high reflectivity side scan sonar data and were classified as the 'coarse sand and shell with a high density of sand mason worms and razor clams' seabed features type (Section 3.2 and Figure 4) and the EUNIS level 4 'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat type (Figure 9). This habitat was delineated in a single large area along the northern edge of the combined N5A survey area.

'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' habitat is typically characterised by coarse sand, gravelly sand, shingle or gravel which are subject to disturbance by tidal streams and wave action in water depths of around 0 to 20m. The habitat is characterised by high densities of *L. conchilega*, which are thought to stabilise the seabed and allow the development of a more diverse associated faunal community. Within the N5A development survey area, this habitat comprised gravelly, shelly coarse sands in water depths of approximately 28 to 29m, slightly exceeding the typically expected range.

Visible fauna from camera ground-truthing within areas of 'dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' included moderate to high densities the sand mason worm (*L. conchilega*) throughout. Razor clams (*Ensis* sp.) are also associated with this habitat and were seen

in very high densities on the majority of ground-truthing data for this habitat. Preliminary review of macrofaunal sample data indicated that the majority of, if not all, the razor clams are the Atlantic jackknife clam (*Ensis leei* – synonyms include *Ensis arcuatus* and *Ensis americanus*). In addition, a number of other characterising taxa for this EUNIS habitat were observed, including common starfish (*Asterias rubens*), lugworms (*Arenicola* sp.), hermit crabs (Paguridae) and swimming crabs (*Liocarcinus*). The majority of other characterising taxa for this habitat are infaunal species are not effectively assessed from seabed camera ground-truthing.

Review of the seabed camera and grab sample data indicated that the mapped distribution of 'dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat was fairly accurate, with the exception of station C_0 which was classified as 'infralittoral coarse sediment' habitat but was located within an area of 'dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat. However, the mapped area of this habitat is expected to be highly heterogenous and will likely include areas of all other mapped habitats from this survey.

Example images of 'dense Lanice conchilega and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137) habitat are given below in Figure 8, the expected extent of the habitat is mapped in Figure 9 and example images for conspicuous fauna and each ground-truthing deployment and are provided in Appendices F and H, respectively.

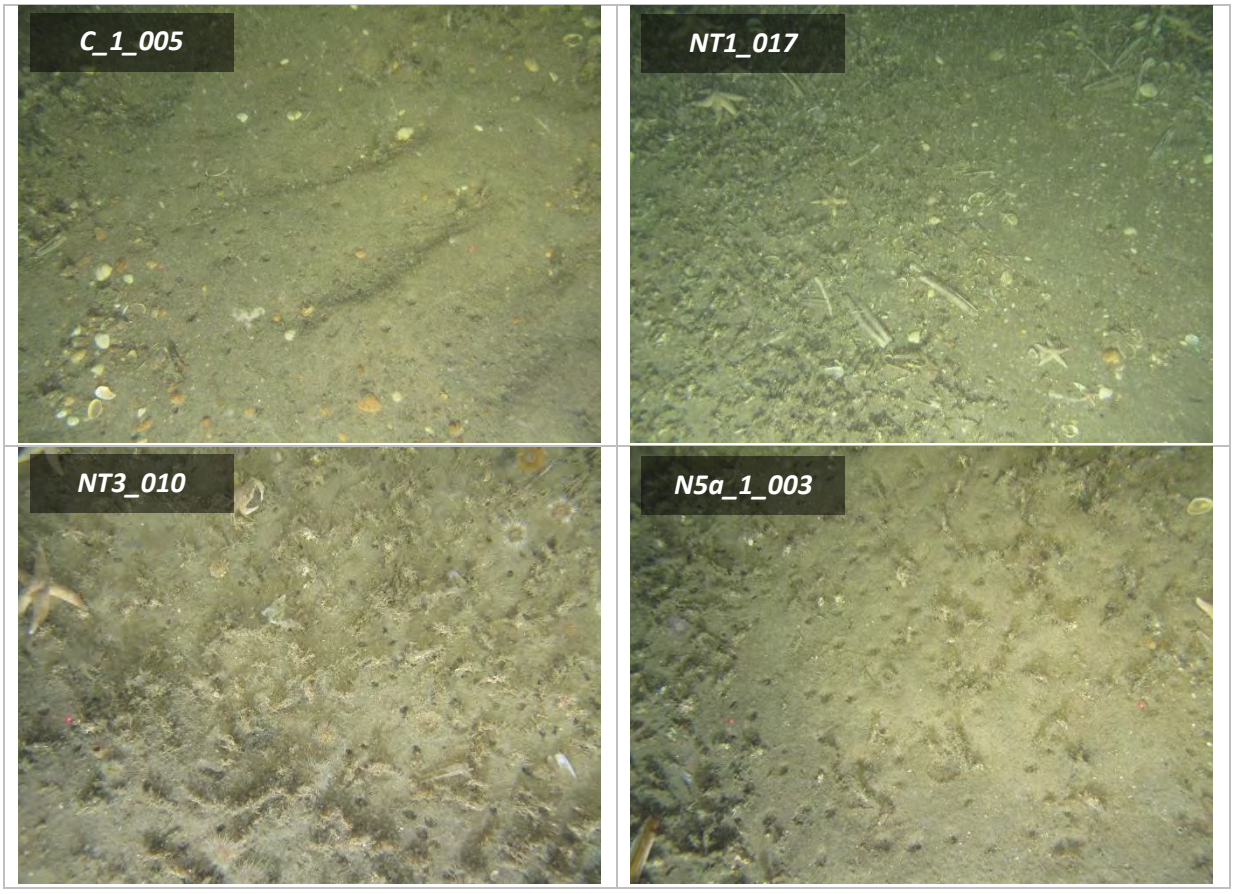

Figure 8: Example images of Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137)

3.4.3 Potential Sensitive Habitats and Species

There are a number of potential sensitive habitats and species which are listed by one or more International Conventions, European Directives or UK Legislation (Appendix G) and are known to occur in the wider region (southern North Sea), including:

- Biogenic reefs formed by the ross worm *Sabellaria spinulosa* (EC Habitats Directive Annex I and OSPAR threatened and declining habitat);
- Stony reefs formed by aggregations of cobbles and/or boulders (EC Habitats Directive Annex I);
- 'Sandbanks which are slightly covered by sea water all the time' (EC Habitats Directive Annex I).

Biogenic Reef Habitat

The most likely biogenic reef habitats to occur in sandy habitats in the southern North Sea are biogenic reefs formed by the polychaete worm *Sabellaria spinulosa*, also known as the ross worm. Ross worms build tubes from sand and shell fragments and where large numbers can form reefs. *Sabellaria spinulosa* form reef-like or agglomerations of sand tubes that act to stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for epibenthic species. The aggregations of the tube-building polychaete worm are solid (albeit fragile), and can form large structures at least several centimetres thick, raised above the surrounding seabed, and persist for many years. A such they provide a biogenic habitat that allows many other associated species to become established (Holt et al., 1998 Foster-Smith and White, 2001, Gubbay, 2007).

These reefs are ecologically important as they provide a habitat for a wide range of other seabed dwelling organisms and as such can support a greater biodiversity than the surrounding area. Due to their conservation importance they are listed as an EC Habitats Directive Annex I habitat (Habitats Directive 1992 & 1997) and an OSPAR (2008) threatened and declining habitat. However, no evidence of *S. spinulosa* aggregations was seen on any of the video transect data from the survey area, including transects over areas of high or variable reflectivity coarse or mixed sediments.

While *Lanice conchilega* beds are not listed by either the EC Habitats Directive (EC, 2013) or OSPAR (2008) as protected habitats, Rabaut et al. (2007) highlighted the role of *L. conchilega* as 'ecosystem engineers' which act to stabilise otherwise mobile seabed substrates and facilitate the development of more diverse macrofaunal communities (Rabaut et al, 2007). Furthermore, it has been suggested that Lanice conchilega beds meet the qualifying criteria for inclusion as EC Habitats Directive Annex I habitats (Rabaut et al, 2009).

Stony Reef Habitat

Stony reefs are defined by the Habitats Directive as comprising 'areas of boulders (>256mm diameter) or cobbles (64mm – 256mm diameter) which arise from the seafloor and provide suitable substratum for the attachment of algae and/or animal species' (EC, 2013).

The seabed video footage was analysed to assess broad habitat changes across the survey area, and to identify areas any with potential for stony reef habitats (See Appendix E). Only one seabed camera transect (Station C3_2) within the N5A development survey area exhibited any potential for consideration as a potential stony reef (EC, 2013). As such, the video footage from station C3_2 was assessed further using the BSL-modified stony reef assessment method (after Irving, 2009). While the Irving (2009) criteria have been approved by the UK regulators for application in UK waters, they have not been explicitly approved by the Netherlands authorities. However, this method has been used here as a useful basis for semi-quantitative assessment of potential Annex I stony reef habitat.

As detailed in Section 2.4.2, there were three criteria that were assessed to estimate the quality of potential stony reef, including composition (%), elevation (mm) and the extent. Video footage and still photographs were first reviewed to assess the 'stony reef structure' using a combination of the composition and elevation measures (Table 11). The results of reef structure analysis are summarised in Table 11, and highlighted the limited potential for the area to be classified as a stony reef due to the low percentage cover and elevation of cobbles (>64mm diameter) in this area. As such, this area is not considered to be sufficiently noteworthy to be classified as an EC Habitats Directive Annex I stony reef.

Table 11: Summary of stony reef structure assessment

Station	Easting	Northing	Length (m)	Sediment type	Stony Reefiness (After Irving 2009)		
					Composition (% cover cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Stony Reef Structure Classification
C3_2	725 366	5 953 610	61.3	Coarse sand ripples with small shell fragments that have accumulated between ripples	Not a Reef	Not a Reef	Not Reef
	725 352	5 953 670					
	725 352	5 953 670	17.7	Cobbles overlying coarse sand with occasional boulders	25	10	Low
	725 347	5 953 687					
	725 347	5 953 688	24.7	Coarse sand with cobbles	10	5	Not a Reef
	725 343	5 953 712					
	725 343	5 953 712	44.2	Occasional cobble overlying coarse sand and infrequent boulders	10	5	Not a Reef
	725 333	5 953 755					
	725 333	5 953 755	30.3	Cobbles overlying coarse sand with occasional boulders	30	20	Low
	725 326	5 953 785					

Shallow Sandbanks Habitat

Sandbanks which are slightly covered by sea water all the time are sandy sediments that are permanently covered by seawater and typically at depths less than 20m (LAT) and are of conservation value as they can host maerl beds as well as being typically colonised by a range of burrowing fauna, epifauna and sand eels, which are an important food source for many birds. Although much of the survey area is shallower than 20m LAT, there were no defined sandbank features in this area (Figure 1).

Due to the variety of H1110 habitat in the Netherlands, the Dutch government decided to subdivide this into three subtypes; H1110_A Wadden Sea, H1110_B North Sea and H1110_C Offshore (Noordzeeloket, 2019). Habitat H1110_C is of most relevance to the current survey area representing permanently flooded sandbanks in water depths of up to 40m, with the Dogger Bank being the main area currently protected under this habitat subtype offshore of the Netherlands. At present, no habitat profile document has been finalised for habitat subtype H1110_C. However, some key characteristics for compiling this profile document are available in Jak et al., (2009), with requirements including the presence of sandy seabed and species characteristic of H1110_C habitat (Table 12).

With the sediments within the survey area being classified within one of three Folk designations of 'sand', 'slightly gravelly sand' and 'gravelly sand', the N5A Development survey sediments can be considered to be sufficiently sandy to meet the requirements of the H1110_C habitat subtype. Review of the macrofauna species dataset together with the grab sample and seabed video logs for the current survey, showed that several of the species characteristic of the H1110_C habitat subtype were present within the survey area. In particular, sandmason worms (*Lanice conchilega*) and bathyporeid amphipods (*Bathyporeia guilliamsoniana*,

B. elegans and *Bathyporeia* spp.) were recorded in almost all grab samples from the survey area. Other characterising species for the permanently flooded sandbank H1110_C habitat subtype present within the survey area included the polychaete *Sigalion mathildae* and sandeels (*Ammodytes marinus*).

With both the sediment type and associated fauna present within the survey area meeting the requirements outlined by Jak et al., (2009), it is possible that the survey area will be considered to represent EC Habitats Directive Annex I habitat subtype H1110_C (permanently flooded sandbank) throughout N5A Development site and route survey areas. However, there is currently insufficient information in the public domain to pre-empt this decision.

Table 12: Species characteristic of permanently flooded sandbank – Netherlands habitat subtype H1110_C

Species Group	Common Name	Species Name	Description
Polychaete	**Sandmason**	***Lanice conchilega***	**Species occurring on sand substrate**
Polychaete	**na**	***Sigalion mathildae***	**Mainly occurring in clean sandy substrates, Dogger Bank one of the areas where the species occurs.**
Crustacea	**Sand digger shrimp**	***Bathyporeia guilliamsoniana***	**Epiphytes in clean sand and on Dogger Bank**
Crustacea	**Sand digger shrimp**	***Bathyporeia elegans***	**Occurring in coarse, clean, low-fines sediments**
Crustacea	Cumacean	*Iphinoe trispinosa*	Specific for sand from Dogger Bank
Echinodermata	Brittlestar	*Acrocnida brachiata*	Occurring in high densities in clean sand up to a depth of 40 m
Echinodermata	Pea urchin	*Echinocyamus pusillus*	Found in coarse sand and fine gravel enriched with detritus
Mollusca	Ocean quahog	*Arctica islandica*	Occurs on edges of the Dogger Bank - long-lived species
Mollusca	Common whelk	*Buccinum undatum*	Occurs on mixed substrate – long-lived species
Mollusca	Bivalve	*Mactra coralina*	Long-lived species that feeds on particles from the water column. Found in fine to coarse sand
Fish	**Lesser sandeel**	***Ammodytes marinus***	**Occurring in fine sand. An important food source for birds, fish and marine mammals**
Fish	Lesser weaver	*Trachinus vipera*	Specific to sand, where they lie buried subsurface
Ray	Thornback ray	*Raja clavata*	Residual population. Long-lived species
Fish	Plaice	*Pleuronectes platessa*	Generally found on sandy substrate. Common species

Note: species occurring within the N5a Development survey area are shown in **bold** font type.

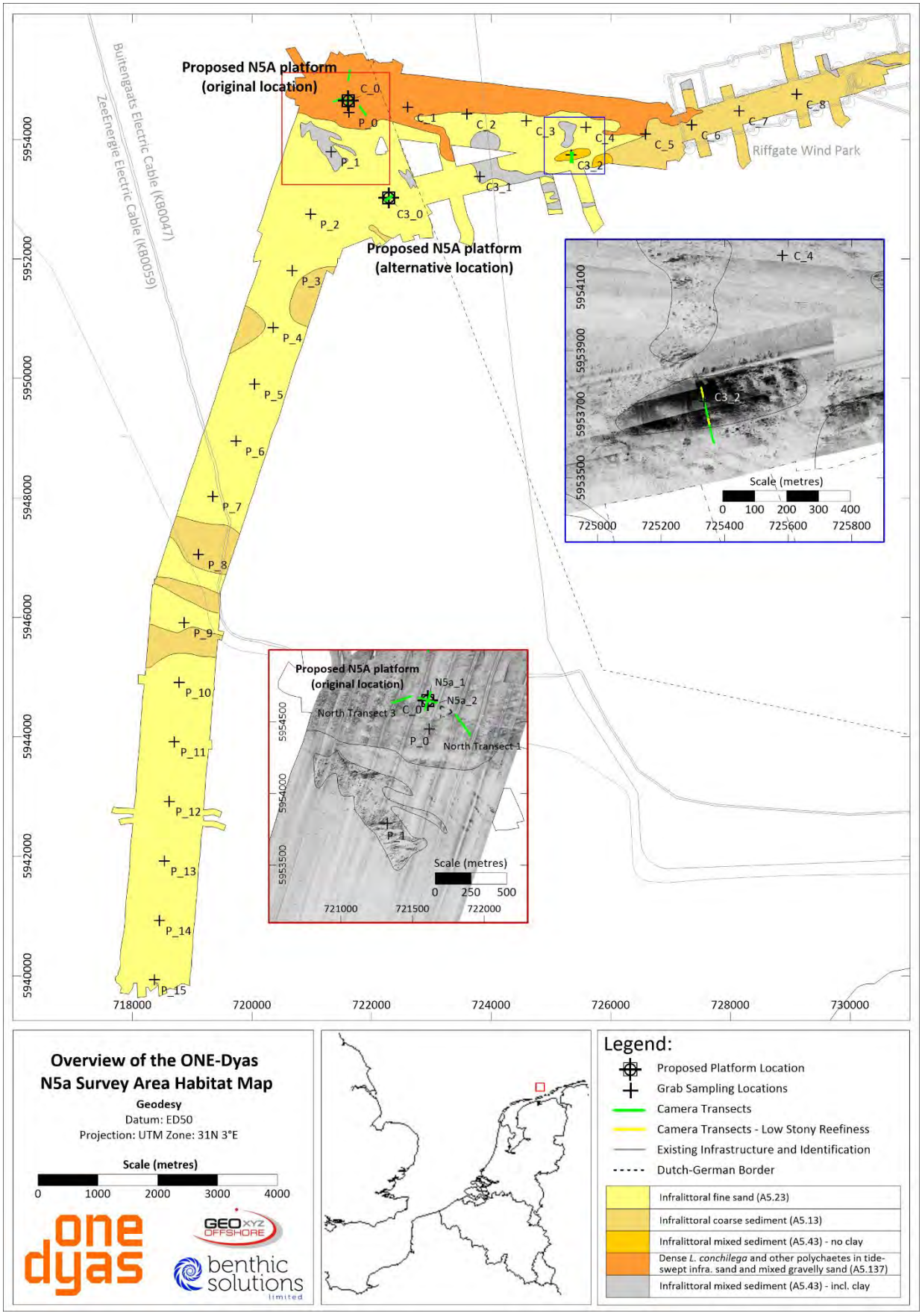

Figure 9: N5A Site and Route Habitat Distribution

4 CONCLUSION

The seabed sediment within the combined N5A site and route survey area ranged from a minimum of approximately 9.8m LAT at KP0.000 on the N5A to NGT Hot Tap pipeline route to a maximum of 26.4m LAT at KP14.675. Both the N5A to NGT Hot Tap pipeline route and N5A to Riffgat cable route were crossed by a series of natural troughs trending west-north-west to east-south-east.

The seabed features within the combined site and route survey area were interpreted from a combination of geophysical and environmental ground-truthing data to comprise five main seabed feature types:

- 'Fine sand and shell fragments' was the dominant sediment type across the combined survey area;
- 'Coarse sand and shell fragments' was delineated in a large area around the Riffgate Wind Park and in six smaller patches along the routes;
- 'Coarse sand with pebbles and cobbles' was present in two small patches midway along the N5A to Riffgate Wind Park cable route;
- 'Coarse sand and shell with a high density of sand mason worms and razor clams' was seen in a single large area along the northern edge of the N5A site and the N5A to Riffgate Wind Park cable route;
- 'Coarse sand and clay with pebbles and cobbles' was interpreted to be present in ten small patches within the N5A site and along the N5A to Riffgate Wind Park cable route.

Based on review of the seabed camera and grab sampling data obtained during the N5A development site and route survey area, four EUNIS habitat classifications were assigned: 'Infralittoral fine sand' (A5.23), 'Infralittoral coarse sediment' (A5.13), 'Infralittoral Mixed Sediment' (A5.43) and 'Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand' (A5.137). Each of the assigned EUNIS habitat types corresponded to one of the interpreted seabed features types, with the exception of the 'infralittoral mixed sediment' (A5.43) EUNIS habitat, which was assigned to two seabed features types – 'Coarse sand with pebbles and cobbles' and 'Coarse sand and clay with pebbles and cobbles'.

Although a single patch of cobbles was observed within the survey area, there was deemed to be insufficient cover or elevation of cobbles to warrant consideration as a potential EC Habitats Directive Annex I stony reef habitat (after Irving, 2009).

The seabed sediments within the survey area were characterised by sand-dominated and supported several species listed by Jak et al., (2009) as being characteristic of the EC Habitats Directive Annex I permanently submerged sandbank habitat (subtype H1110_C). At present there is insufficient publicly available information to confirm classification of the survey area as the H1110_C habitat subtype, but it is possible that the survey area will be classified as such.

While *Lanice conchilega* beds are not currently listed as protected habitats, they are known to act as 'ecosystem engineers' (Rabaut et al., 2007) and have been suggested for inclusion as EC Habitats Directive Annex I habitats (Rabaut et al, 2009).

No other protected habitats or species were observed within the survey area, based on review of the acquired geophysical data and environmental ground-truthing by grab sampling and seabed photography.

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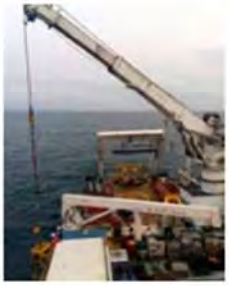
APPENDIX A – GEO OCEAN III

GEO OCEAN III

Offshore Survey & Support Vessel



SUPPORT ACTIVITIES / VESSEL CAPABILITIES

The GEO OCEAN III is a multi-disciplined DP II offshore survey vessel. With her specifically selected equipment and capabilities for the North Sea survey and light construction support activities, she is the ideal candidate for our Oil & Gas and Renewables clients.

The vessel is equipped with 56 berths, Offshore crane, Survey and ROV systems. Equipment can be rapidly deployed using the large Stern A-Frame, crane or through the 6 x6 m moonpool via the dedicated A-frame and 30t AHC winch. All together making the Geo Ocean III a dynamic platform for subsea operations.

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GEO OCEAN III

Offshore Survey & Support Vessel

TECHNICAL SPECIFICATION

General

Name	Geo Ocean III
Flag	Luxembourg
Port Registry	Luxembourg
Call Sign	LXGP
IMO Number	9285586
Classification	LLOYDS - HULL – MACH
Vessel Type	Survey Vessel SV
Special Service:	Fire fighting ship / Fire fighting 1 Waterspray / Oil Recovery / Stand by rescue
Unrestricted navigation	AUT-UMS - ALM - DYNAPOS-AM/AT-R; SDS

Dimensions and Construction

Builder	De Hoop
Built	2004
LOA	77,30 m
Width Moulded	18 m
Depth Moulded	7,40 m
Draft min. / max.	3,80 m/6,10 m
Gross Tonnage	3,722
Moonpool	6 m x 6m

Accommodation

Total Berths	56 persons
Total Cabins	32
Single cabins	8 x 1 person
Double cabins	24 x 2 persons
Offices	1 x Dedicated Online 1 x Dedicated Offline / Conference room 1 x Client Office 1 x OCM Office 1 x 3rd Party Office
Hospital	1 x Hospital
Other Facilities	Galley, Large Mess room, 2 x day room, Gymnasium, Dirty Mess

Capacities & delivery Rates

Main Deck area:	670 m²
Hangar Deck:	290 m²
Mezzanine Deck Area:	268 m²
Max Deck Loading	Main Deck 5t/m² Mezzanine Deck 2t/m²
Max Deck Load	1,300 t @ 1m above deck
Fuel oil (capacity - transfer):	1,105m³ - 100m³/h @ 8bars
Drill or Water ballast (capacity - transfer):	1,350m³ - 40m³/h @ 4.5bars
Antiheeling (capacity - transfer):	250m³ - 2 x 500m³/h
Fresh water (capacity - transfer):	495 m3 - 40 m³/h @ 4.5bars
Oil recovery:	324 m³
Foam:	24 m³

Safety Equipment

Fi-Fi:	Class 1
Pumps:	2 x 1,200m³/h
Monitors:	2 x 1,200m³/h
Fast Rescue Craft:	1 x Seabear 23 MKII
Rescue capacity:	150 persons in tropical area

MACHINERY & PERFORMANCE

Propulsion - Machinery

Main propulsion:	2 x 1,800 kW FP Azimuth thrusters
Main Engines:	4 x 1360kW Caterpillar
Tunnel thrusters:	1 x Insert manufacturer 780 kW
Fwd Azimuth	1 x Rolls Royce 600kW retractable

SPEED & CONSUMPTION (Information only)

Service Speed	10 kts
Max Speed	12 kts

Fuel consumption

Stand-by in port:	2t/day
Survey Speed:	7t/day
DPII:	6t/day

Deck Equipment and Cranes

Main Crane:	SMST telescopic 40t @ 9m - 6t @ 23.5m
Winch Capacity:	40t / 40t - 200m
Deck Crane	4.5t @9m Man-riding
Stern A- Frame :	54t @ 8m outreach
Max launching Dims	8m clearance up / 10m wide opening
Offshore capacity:	54t @ 8m outreach
Winch Capacity	30t / 30t - 1,500m - AHC
Moonpool A-Frame	30t
Winch Capacity	30t / 30t - 1,500m - AHC
Tuggers:	1 x 10t & 1 x 30t
Capstans:	2 x 5t
Deck Service Air Supply:	66 m³/h @ 8 bars
Deck Power Supply:	3 x 265 kW - 480 VAC /60Hz

Navigation and Dynamic Positioning

DP System:	GE DP21 + IJS
Type:	DP 2
Reference 1:	DGPS 1 Fugro Seastar 9205
Reference 2:	DGPS 2 Fugro Seastar 9205
Reference 3:	G4 and XP2 corrections USBL
Reference 4:	Kongsberg Fan Beam
Primary Heading/motion/INS	POSMV 320 Ocean Master
Secondary Heading/motion/INS	POSMV 320 Ocean master
Subsea Positioning	Sonardyne Ranger 2 c/w 6G HPT 5000

Survey Suite and Offline software

Survey Suite	QINSY EIVA
Offline Software	QINSy, NaviSuite, Beamworks, Oasis Montaj (UXO marine), Visual works, Autodesk, Arc GIS,
Video Distribution	4k ultra high definition
Audio comms	Canford clear comms

Survey Sensors

MBES	Hull Mounted (Optional Dual head) R2Sonic 2024 UHR
Single Beam	XXXXXXX
Sound Velocity Sensor	Valeport Swift
Sidescan Sonar	Edgetech 2200
Sub Bottom Profiler	Silas, Depending on requirements

Subsea Equipment

WROV	1 x 150HP WROV
IROV	Mezzanine deck configured for rapid mobilisation 1 x Seaeye Cougar
Vibrocorer	3/6m electric/hydraulic systems as required
CPT	Optional 1.5 – 20t systems (Neptune or Manta type as required)

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APPENDIX B – BSL SAMPLING EQUIPMENT

BSL DOUBLE GRAB

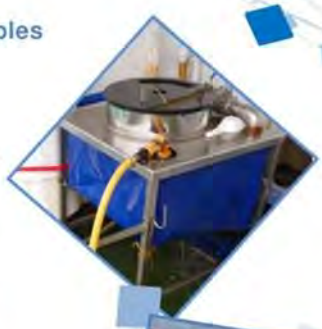
BSL DAY GRAB


Benthic Solutions
BSL MODIFIED DAY GRAB
General Specifications
0.1m² Sample Area
Total Stainless Steel Construction
Adjustable weight
Compact Design
Proven performance in 1000m depth
Modified for One Man Operation
Services
Day grabs comprise of two stainless bucket sections which are mounted within a stainless steel frame. On contact with the seabed, a trigger bar is pushed upwards via pressure plates allowing the buckets to close under the gravity of the unit through a pulley system. This controlled contact and closure once on the seabed helps ensure sample disturbance is minimised. The top of the grab is covered by two catch-closed inspection doors also made of stainless steel. The doors allow direct access to the sample inside the grab when closed, and protect the sample from the grab movement through the water column during recovery.
Our Day grab sampler (offset design) was originally modified by BSL's principle scientist in the early 1990s to improve penetration and reduce sample disturbance and contamination. These grabs are fitted with additional but removable stainless steel coated lead weights which can provide better penetration in more compacted substrates, but can also be removed to prevent over-penetration of the sampler in softer sediments.
A further extended bucket lip reduces sediment washout during retrieval. The unit can be supplied with a stand allowing for easy sample access and handling. A further modification that was made provided an efficient closure system to allow arming by a single person. This modified Day grab has become the standard operating tool for the North Sea.
The grab is relatively simple to operate in almost any water depth. The (0.1m²) grabs have been constructed with stainless steel throughout making this grab ideal for accurate assessment of the chemical properties of sea floor sediments.
Shipping weight 250kg
Shipping dimension 1.5 x 1 x 1m
Specifications 800 x 800 x 850mm
Please contact us for any further information, our team will be happy to help you.
Benthic Solutions, Elanco Works, Marsh Road, Hoveton, Norwich, NR12 8UH, UK
Tel : +44 (0) 1603 784726 Mail: info@benthicsolutions.com www.benthicsolutions.com
ISO 9001 REGISTERED FIRM
Benthic Solutions

BSL WILSON AUTO-SIEVER

WILSON AUTOSIEVER ©

Best practice for benthic samples



- **General Specifications**

The *Wilson* Autosiever is a semi-automated sieving table for reducing benthic sediment samples offshore in a routine and controlled manner.

- Reduces time consuming and laborious sample handling in the field
- Reduces personnel numbers required for benthic processing
- Reduces damage to biological material during processing
- Well proven field performance on benthic surveys worldwide
- Standardises sample processing
- Robust stainless steel construction that dismantles for storage or freighting

- **Services**

The *Wilson* Autosiever (WAS) was initially designed in the late 1980s by Ian Wilson (BSL Director), but was implemented from the early 1990s as the preferred benthic processing tool for all sampling operations by a major UK based environmental survey contractor. The system was subsequently commercialised and made available for purchase to other operators and users following the success of the trial at an NMBAQC workshop in 1997*.

The WAS system was designed to standardise all sieving operations between surveys and personnel, increasing the efficiency of the sample handling and processing without compromising the quality of the biology recovered.

Its simple yet unique and revolutionary design enables its employment from small vessels and large ships alike and in a variety of different sediment conditions, ranging from coarse heterogenic substrates down to soft clays and silts.

Cited as *best practice* for biological processing*, the WAS system has become the preferred tool for a large number of organisations that routinely carry out benthic surveys. Systems are currently being employed around the world (including UK, Ireland, Norway, Netherlands, Germany, France, Australia, Africa and South America) by a multitude of different users including survey companies, fish farms, government institutes and agencies, laboratories, universities and environmental consultancies.

Shipping weight	80kg
Shipping dimension	1 x 0.8 x 0.3m

* Proudfoot, R.K., Elliott, M., Dyer, M.F., Barnett, B.E. Allen, J.H., Proctor, N.L. Cutts, N.D., Nikitik, C., Turner, G. Breen, J. Hemmingway, K.L and Mackie, T., 1997. Collection and Processing of macrobenthic samples from soft sediments; a best practice review. Proceedings of the Humber Benthic Field Methods Workshop, Hull University.

ISO 9001 REGISTERED FIRM

Please contact us for any further information, our team will be happy to help you.
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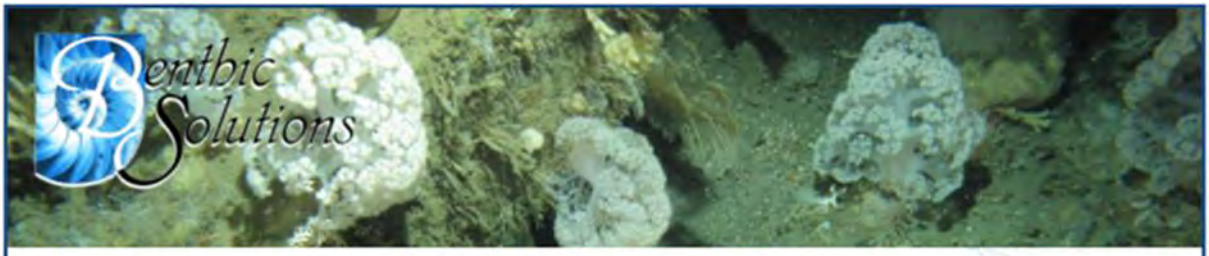
Benthic Solutions

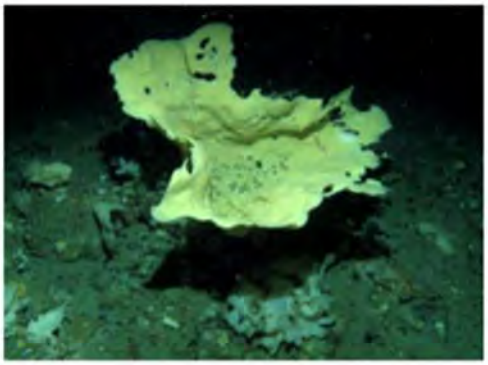
STR SEABUG CAMERA SYSTEM



UNDERWATER CAMERA – Seabug
Seabed Monitoring & Underwater Real-time Footage

- **General Specifications**

  - Flexible deployment scenarios
  - Depth rated to 3500m
  - Digital streaming target video
  - Video overlay on video data
  - Uses vessel existing sonar cabling



- **Services**

The deep water camera system is based on a Sonar Equipment Services Seabug which was developed in conjunction with Benthic Solutions Limited in 2010. The system is based upon 14.7 megapixel digital stills camera operated from the surface via a single armoured coaxial or twisted pair cable. Typically, this utilises an existing sonar cable on the survey vessel through a multiport multiplexer carrier system to a control consol.

The system provides continuous targeting video data streamed to the surface where a computer is used to trigger the stills camera system remotely as required. These systems are fitted with inbuilt strobe units which can be deployed in a drop-down frame mounted configuration, or towed seabed sled (pictured). Seabed video is illuminated by 4 or 6 dedicated LED lamps with the camera orientated at an oblique or a downward looking aspect.

The system provides a very high quality digital image and is an ideal tool for ground truthing, habitat mapping and detailed seabed classification surveys from vessels in water depths in excess of 3km. Examples of previous projects include regional deep water surveys looking at iceberg keel scar, deep water coral and sponge communities and regional environmental habitat mapping assessments.

Shipping weight	200kg *
Shipping dimension	2 x 1 x 0.2m *
Specifications	2 x 1 x 1m *

**as multiple configurations are available, values shown indicate the maximum*

Please contact us for any further information, our team will be happy to help you.
Benthic Solutions, Elanco Works, Marsh Road, Hoveton, Norwich, NR12 8UH, UK
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BSL MOD4 UNDERWATER CAMERA SYSTEM

UNDERWATER CAMERA – MOD4
Seabed Monitoring & Underwater Real-time Footage

- **General Specifications**
  - Flexible deployment scenarios
  - Depth rated to 4500m
  - Superior stills and streaming video quality
  - Near zero-delay shutter release
  - Unattended time lapse photography
  - Solutions for very low visibility environments

- **4 Camera Configurations**
  1. Deepwater real time
  2. Shallow water real time
  3. Ultra deepwater timelapse
  4. Remote timelapse

- **4 Deployment Configurations**
  1. Towed system (deep to shallow)
  2. Bed-hop ultra deep water
  3. Remote mooring timelapse
  4. Poor visibility freshwater lens

- **Services**

Benthic Solutions Ltd have an array of underwater cameras for various deployment scenarious. Our latest development (MOD4) is the most flexible camera to date. For water depths of less than 400m it is capable of communicating with the surface via a multicore umbilical cable, which provides a very high quality live view of the seabed. Zero-delay still images of 24 megapixels can be captured and transmitted to the surface for instant review.

For deeper waters the camera can be controlled via an armoured coax cable, of the type commonly used for towing sidescan sonar. A theoretical maximum cable length of 12km can be used. In this setup, the live feed quality is slightly reduced. To compensate for this an additional 1080p 30fps camera can be added if very high quality seabed video footage is desired.

High output lighting has been developed using the latest LED technology. 2x 2200 lumen lamps provide flood lighting ahead of the camera for video streaming, whilst a multi-head strobe system (up to three heads) can be utilised in TTL configuration to give perfectly exposed under water still images.

Benthic Solutions can also provide different camera frames suitable for seabed towing or 'drop down' use. These can be small and lightweight, or larger with increased ballast for deep water scenarios.

Shipping weight	200kg *
Shipping dimension	2 x 1 x 0.2m *
Specifications	2 x 1 x 1m *

**as multiple configurations are available, values shown indicate the maximum*

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APPENDIX C – LOG SHEETS

Cast	Station	Sampler Used	Water Depth (m)	Time	Date	Volume Recovered (mm box depth)	Sample Name	Container Type and Quantity	Comments	Sediment Description/Stratification	Conspicuous Fauna/Comments
1	GRAB_P_0	Day grab	29	17:43:00	06/05/2019	85%	F1	2 x 3L bucket		shells, sand	*Lanice. conchilega*, *Asterias rubens*, *Nereis*
2	GRAB_P_0	DVV	29	18:20:00	06/05/2019	60% 50%	F2 PC	2 x 3L bucket Bags and jars		sand, small pieces of shells	*L. conchilega*, *A. rubens*, *Nereis*
3	GRAB_P_0	DVV	29	18:45:00	06/05/2019	60%	F3	3 x 3L bucket		sand, small pieces of shells	*L. conchilega*, *A. rubens*, *Nereis*
4	GRAB_P_1	DVV	27	20:12:00	06/05/2019	50% 50%	PC F1	1 x 3L bucket Bags and jars		clay	*L. conchilega*
5	GRAB_P_1	DVV	27	20:26:00	06/05/2019	N/S	N/S	N/S	Cobbles		
6	GRAB_P_1	DVV	27	20:40:00	06/05/2019	70% 50%	F2 F3	1 x 3L bucket 1 x 3L bucket		sand and clay	Polychaetes, Shell debris
7	GRAB_P_2	DVV	24	21:15:00	06/05/2019	50% 50%	PC F1	1 x 1L bucket Bags and jars		fine sand	*Echinocardium cordatum*, sandeel
8	GRAB_P_2	DVV	24	21:50:00	06/05/2019	60% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket	Flatfish in grab jaws, photo taken, discarded overboard. Grab seal not compromised so used for fauna	fine sand	Sandeel, polychaetes, flatfish poss. turbot
9	GRAB_P_3	DVV	23	22:56:00	06/05/2019	N/S	N/S	N/S	Block came down, strops broken, operations stopped		
10	GRAB_P_3	DVV	24	02:05:00	08/05/2019	50% 50%	PC F1	1 x 1L bucket Bags and jars	Weight added to arms	fine sand	*E. cordatum*
11	GRAB_P_3	DVV	24	02:15:00	08/05/2019	60% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		fine sand	Sandeel, *E. cordatum*
12	GRAB_P_4	DVV	22	02:45:00	08/05/2019	60% 50%	PC F1	1 x 1L bucket Bags and jars		fine sand	*L. conchilega*
13	GRAB_P_4	DVV	21	03:03:00	08/05/2019	50% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		fine sand	*L. conchilega*

Cast	Station	Sampler Used	Water Depth (m)	Time	Date	Volume Recovered (mm box depth)	Sample Name	Container Type and Quantity	Comments	Sediment Description/Stratification	Conspicuous Fauna/Comments
14	GRAB_P_5	DVV	20	03:31:00	08/05/2019	50% 50%	PC F1	1 x 1L bucket Bags and jars		Sand and shell	*E. cordatum*, razor clam
15	GRAB_P_5	DVV	20	03:42:00	08/05/2019	50% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		Sand and shell	*L. conchilega*
16	GRAB_P_6	DVV	21	04:29:00	08/05/2019	50% 50%	PC F1	1 x 1L bucket Bags and jars		Fine sand	*E. cordatum* (damaged)
17	GRAB_P_6	DVV	22	04:41:00	08/05/2019	50% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with minor shell fragments	Polychaetes, *Nereis*, *L. conchilega*, fish (damaged)
18	GRAB_P_7	DVV	22	05:09:00	08/05/2019	N/S	N/S	N/S	No sample, triggered but empty		
19	GRAB_P_7	DVV	22	05:22:00	08/05/2019	N/S	N/S	N/S	No sample, did not trigger		
20	GRAB_P_7	DVV	21	05:25:00	08/05/2019	N/S	N/S	N/S	No sample, did not trigger		
21	GRAB_P_7	DVV	21	05:27:00	08/05/2019	50% 50%	PC F1	1 x 1L bucket Bags and jars		Fine sand with minor shell debris	*L. conchilega*, polychaetes
22	GRAB_P_7	DVV	21	05:37:00	08/05/2019	50% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with minor shell debris, small amounts of mud/clay	Abundant *L. conchilega*, polychaetes
23	GRAB_P_8	DVV	21	06:01:00	08/05/2019	N/S	N/S	N/S			
24	GRAB_P_8	DVV	21	06:03:00	08/05/2019	N/S	N/S	N/S			
25	GRAB_P_8	DVV	20	06:04:00	08/05/2019	70% 70%	PC F1	1 x 5L bucket Bags and jars		Coarse sand with shell fragments	Polychaetes
26	GRAB_P_8	DVV	21	06:12:00	08/05/2019	70% 60%	F2 F3	1 x 5L bucket 1 x 5L bucket		Coarse sand with shell fragments	*L. conchilega*
27	GRAB_C_8	DVV	24	19:00:00	09/05/2019	80% 80%	PC F1	1 x 1L bucket Bags and jars		Coarse sand with shell fragments	*L. conchilega*
28	GRAB_C_8	DVV	24	19:15:00	09/05/2019	80% 80%	F2 F3	1 x 1L bucket 1 x 1L bucket		Coarse sand with shell fragments	*L. conchilega*
29	GRAB_C_7	DVV	24	19:30:00	09/05/2019	70%, 70%	PC F1	3 x 3L bucket Bags and jars		Coarse sand with shell fragments	No conspicuous fauna

Cast	Station	Sampler Used	Water Depth (m)	Time	Date	Volume Recovered (mm box depth)	Sample Name	Container Type and Quantity	Comments	Sediment Description/Stratification	Conspicuous Fauna/Comments
30	GRAB_C_7	DVV	24	19:45:00	09/05/2019	N/S	N/S	N/S	Deployed but no sample, not triggering		
31	GRAB_C_7	DVV	24	20:05:00	09/05/2019	70% 80%	F2 F3	2 x 5L bucket 2 x 5L bucket		Coarse sand with shell fragments	No conspicuous fauna
32	GRAB_C_6	DVV	24	20:27:00	09/05/2019	60% 80%	PC F1	1 x 3L bucket Bags and jars		Coarse sand with shell fragments	No conspicuous fauna
33	GRAB_C_6	DVV	24	21:05:00	09/05/2019	80%, 80%	F2 F3	1 x 3L bucket 1 x 3L bucket		Coarse sand with shell fragments	Urchin
34	GRAB_C_5	DVV	25	05:37:00	11/05/2019	40% 70%	PC F1	1 x 3L + 1x5L bucket Bags and jars		Coarse sand with shell fragments	Gobidae, *Asterias*, Lancelet. *L. conchilega*
35	GRAB_C_5	DVV	25	05:42:00	11/05/2019	70% 70%	F2 F3	2 x 5L bucket 1 x 5L + 1x 3L bucket		Coarse sand with shell fragments	*L. conchilega*, polychaetes, spatangoid
36	GRAB_C_4	DVV	28	06:40:00	11/05/2019	60% 60%	PC F1	1 x 1L bucket Bags and jars		Fine sand with shell debris	*L. conchilega*, polychaetes, spatangoid
37	GRAB_C_4	DVV	28	07:01:00	11/05/2019	70% 70%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with shell debris	*L. conchilega*, polychaetes, spatangoid
38	GRAB_C_3	DVV	28	07:29:00	11/05/2019	N/S	N/S	N/S	Did not trigger		
39	GRAB_C_3	DVV	28	07:36:00	11/05/2019	70% 70%	PC F1	1 x 1L bucket Bags and jars		Very fine sand with minor shell debris	*L. conchilega,* polychaetes
40	GRAB_C_3	DVV	28	07:47:00	11/05/2019	N/S	N/S	N/S	Triggered but no sample		
41	GRAB_C_3	DVV	28	07:49:00	11/05/2019	70% 70%	F2 F3	1 x 1L bucket 1 x 1L bucket		Very fine sand with minor shell debris and soft clay	Anemones, *L. conchilega*, polychaetes, A rubens, spatangoid
42	GRAB_C_2	DVV	27	08:15:00	11/05/2019	70% 70%	PC F1	1 x 5L bucket Bags and jars		Coarse sand and clay	*L conchilega* and polychaetes
43	GRAB_C_2	DVV	28	08:27:00	11/05/2019	70% 40%	F2 F3	1 x 5L bucket 1 x 3L bucket	Razor clams in jaws (F3)	Coarse sand	Razor clams, *L. conchilega*, polychaetes. Lancelet

Cast	Station	Sampler Used	Water Depth (m)	Time	Date	Volume Recovered (mm box depth)	Sample Name	Container Type and Quantity	Comments	Sediment Description/Stratification	Conspicuous Fauna/Comments
44	GRAB_C_1	DVV	28	08:55:00	11/05/2019	60% 60%	PC F1	1 x 3L + 1x5L bucket Bags and jars		Coarse sand and abundant shell debris	Lancelet and polychaetes
45	GRAB_C_1	DVV	28	09:04:00	11/05/2019	60% 40%	F2 F3	1 x 5L bucket 1 x 5L bucket	Razor clams in jaws (F3)	Coarse sand and abundant shell debris	*L. conchilega*, lancelet, polychaetes, porcelain crab
46	GRAB_C_0	DVV	29	09:32:00	11/05/2019	90% 90%	PC F1	2 x 5L bucket Bags and jars	Label for F2 in F1 bucket (2 of 2)	Coarse sand	*L. conchilega*, razor clams and polychaetes
47	GRAB_C_0	DVV	29	09:41:00	11/05/2019	90% 90%	F2 F3	2 x 5L bucket 2 x 5L bucket	Label for F3 in F2 bucket (1 of 2)	Coarse sand	*L. conchilega*, razor clams and polychaetes
48	GRAB_P_15	DVV	13	02:15:00	12/05/2019	60% 60%	PC F1	1 x 1L bucket Bags and jars		Fine sand with shell	Polychaetes
49	GRAB_P_15	DVV	13	02:20:00	12/05/2019	60% 60%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with shell	Polychaetes, sandeel
50	GRAB_P_14	DVV	14	03:05:00	12/05/2019	60% 60%	PC F1	1 x 3L bucket Bags and jars		Fine sand with shell	*Asterias*, Spatangoid, *Ophiura*
51	GRAB_P_14	DVV	14	03:10:00	12/05/2019	60% 60%	F2 F3	1 x 3L bucket 1 x 3L bucket		Fine sand with shell	Spatangoid, *Ophiura*
52	GRAB_P_13	DVV	16	03:30:00	12/05/2019	60% 60%	PC F1	1 x 1L bucket Bags and jars		Fine sand with minor shell debris	Polychaetes
53	GRAB_P_13	DVV	16	03:45:00	12/05/2019	60% 60%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with minor shell debris	*Nereis*, *L. conchilega*, *Ophiura*, Spatangoids
54	GRAB_P_12	DVV	16	04:32:00	12/05/2019	60% 60%	PC F1	1 x 3L bucket Bags and jars		Fine sand with shell debris	*Nereis*, *L. conchilega*, Spatangoids
55	GRAB_P_12	DVV	16	04:42:00	12/05/2019	60% 60%	F2 F3	1 x 3L bucket 1 x 3L bucket		Fine sand with shell debris	*Nereis*, *L. conchilega*, Spatangoids
56	GRAB_P_11	DVV	17	05:03:00	12/05/2019	70% 70%	PC F1	1 x 3L bucket Bags and jars		Fine sand with significant shell debris	*L. conchilega*
57	GRAB_P_11	DVV	17	05:13:00	12/05/2019	70% 70%	F2 F3	1 x 3L bucket 1 x 3L bucket		Fine sand with significant shell debris	*L. conchilega*
58	GRAB_P_10	DVV	17	05:35:00	12/05/2019	60% 60%	PC F1	1 x 1L bucket Bags and jars		Fine sand with shell debris	Polychaetes, *L. conchilega*, *Nereis*

Cast	Station	Sampler Used	Water Depth (m)	Time	Date	Volume Recovered (mm box depth)	Sample Name	Container Type and Quantity	Comments	Sediment Description/Stratification	Conspicuous Fauna/Comments
59	GRAB_P_10	DVV	17	05:44:00	12/05/2019	60% 60%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with shell debris	Polychaetes, *L. conchilega*
60	GRAB_P_9	DVV	19	06:05:00	12/05/2019	60% 60%	PC F1	1 x 3L bucket Bags and jars		Fine sand with shell debris	*Nereis*
61	GRAB_P_9	DVV	19	06:13:00	12/05/2019	60% 60%	F2 F3	1 x 3L bucket 1 x 3L bucket		Fine sand with shell debris	Polychaetes
62	GRAB_C3_0	DVV	24	22:43:00	14/05/2019	60% 60%	PC F1	1x1L bucket		Fine sand with shell debris	*E. cordatum*
63	GRAB_C3_0	DVV	24	22:59	14/05/2019	50% 50%	F2 F3	1 x 1L bucket 1 x 1L bucket		Fine sand with shell debris	*E. cordatum*
64	GRAB_C3_1	DVV	25	23:36:00	14/05/2019	50% 50%	PC F1	1 x 3L bucket Bags and jars		Fine sand with clay beneath	Polychaetes. Poss. piddock holes in clay but no piddocks evident
65	GRAB_C3_1	DVV	25	23:45:00	14/05/2019	50% 50%	F2 F3	1 x 3L bucket 1 x 3L bucket		Fine sand with clay beneath	Polychaetes. Poss. piddock holes in clay but no piddocks evident
66	GRAB_C3_2	DVV	25	00:13:00	15/05/2019	NS NS			Cobbles in jaws		
67	GRAB_C3_2	DVV	25	00:20:00	15/05/2019	50% 50%	PC F1	1 x 3L bucket Bags and jars		sandy gravel	Polychaetes hydroids
68	GRAB_C3_2	DVV	25	00:29:00	15/05/2019	50% NS	F2	1x5L bucket	Cobble in jaws of one bucket	sandy gravel	Polychaetes hydroids
69	GRAB_C3_2	DVV	25	00:36:00	15/05/2019	45%	F3	1x1L bucket	Cobble in jaws of one bucket	sandy gravel	Polychaetes hydroids

APPENDIX D – FIELD OPERATIONS AND SURVEY METHODS

SEABED PHOTOGRAPHY AND VIDEO

Seabed video footage was acquired at 10 transects using a STR Seabug Underwater camera system mounted within a BSL camera sled equipped with a separate strobe, and LED lamps. The camera unit itself is capable of acquiring images at 24MP resolution but was set to a resolution of 5MP (2592 x 1944 pixels) to optimise image upload times during camera operation.

Once at the seabed, the camera would be moved along the length of the transect at no more than 0.5 knots. Stills Photographs were captured remotely using a surface control unit via a sonar cable to the camera system. Still images were uploaded in real time, and saved to the laptop via specialist software. Live video footage, overlaid with the date, time, position and site details was viewed in real-time, and recorded directly onto a media storage device and to the laptop via specialist software. The live video stream was used to assist with targeting of the stills camera. HD footage was saved internally by the video camera; data was downloaded at the end of each day of camera operations and backed-up onto a hard drive.

Full camera specifications can be found in the table below.

Standard Features	Comment
Image Resolution	5 to 14.7 megapixel (up to 4,416 x 3,312 pixels)
Light Sensitivity setting	ISO 60-1600 Auto/Manual Selected
Sensor Type	1 / 1.8” format high density CCD sensor
Light source	4 x 1000 lumen controllable LED lamps Stills strobe TTL controller
Typical settings	Aperture priority at F8, Shutter speed typically 1/125th second, Auto flash mode (TTL)
Framing Video Used	320 Line / 50 Hz PAL
Control System	SES Multiport DTS
Manufacturer	STR
Other sensors	Depth sensor and compass

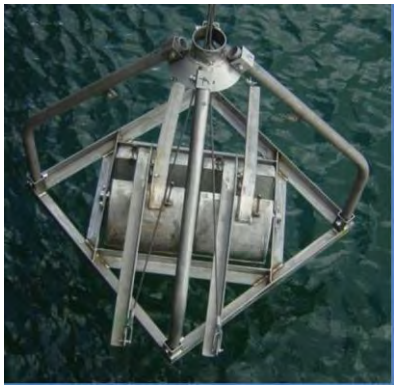
STR Seabug Underwater Camera Specifications

Another STR Seabug underwater camera system was also supplied as a backup. This camera was not used during operations.

GRAB SAMPLING

The BSL double grab was designed and built by BSL for operations in soft sediments, compacted sands and shallow stiff clays. This device consists of two 0.1m^2 samplers set into a ballasted frame, reducing the time required to obtain multiple replicates at a single station.

A BSL Double grab was used for seabed sampling Seagull site and route survey. Two successful deployments were required at each location. Three consecutive 'no sample' deployments were agreed to be the maximum number of attempts at any location before abandoning it. The inner stainless grab buckets were cleaned before deployment at any new station to avoid contamination.


BSL Double Grab

Samples were subject to quality control on recovery and were retained in the following circumstances:

- Water above sample was undisturbed;
- Bucket closure complete (no sediment washout);
- Sampler was retrieved perfectly upright;
- Inspection/access doors had closed properly;
- No disruption of sample;
- Sample was taken inside the acceptable target range (<15m);
- Sample size was greater than 6 litres (ca. 40% of the sampler's capacity);
- No hagfish (*Myxine glutinosa*) and/or mucus coagulants.

Key observations from samples included colour, sediment classification, layering (including redox discontinuity layers), smell (including the presence of H_2S), obvious fauna, evidence of bioturbation and anthropogenic debris.

APPENDIX E – HABITAT ASSESSMENT

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
Grab_C_0				N5a_1_018.jpg, N5a_1_019.jpg, N5a_2_021.jpg, N5a_1_022.jpg	Coarse sand and shell fragments	*Asterias rubens*, *Lanice conchilega*	30	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
Grab_C_1	722598	5954539	11/05/19 02:56:48	Grab_C_1_005.jpg	Coarse sand and shell fragments with *Lanice conchilega* assemblages	*Asterias rubens*, *Liocarcinus* sp., *Lanice conchilega*, Decapoda	28	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	722599	5954538	11/05/19 02:57:27									
Grab_C_2	723694	5954422	11/05/19 03:28:13	Grab_C_2_002.jpg	Coarse sand and shell fragments with *Lanice conchilega* assemblages	*Asterias rubens*, *Liocarcinus* sp., *Lanice conchilega*, *Loligo vulgaris*	28	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	723596	5954422	11/05/19 03:29:04									
Grab_C_3	724589	5954311	11/05/19 04:08:03	Grab_C_3_003.jpg	Fine to medium sand ripples with shell fragments accumulated between ripples	*Asterias rubens*, *Liocarcinus* sp., *Lanice conchilega*	28	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	724590	5954310	11/05/19 04:10:35									
Grab_C_4	725582	5954199	11/05/19 04:34:40	Grab_C_4_002.jpg	Fine to medium sand ripples with shell fragments accumulated between ripples	*Asterias rubens*, *Lanice conchilega*, *Arenicola* sp., Decapoda	28	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	725581	5954200	11/05/19 04:37:18									
Grab_C_5	726576	5954086	11/05/19 05:01:59	Grab_C_5_002.jpg	Coarse sand ripples with small shell fragments accumulated between ripples	*Asterias rubens*, *Liocarcinus sp.*, *Lanice conchilega*, poss. *Callionymus lyra*	25	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	726573	5954088	11/05/19 05:05:12									

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
Grab_C_6	727352	5954243	09/05/19 17:05:54	Grab_C_6_002.jpg	Coarse sand ripples with small shell fragments accumulated between ripples	*Lanice conchilega*	24	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	727353	5954242	09/05/19 17:06:30									
Grab_C_7	728147	5954477	09/05/19 17:33:39	Grab_C_7_004.jpg	Coarse sand ripples with small shell fragments accumulated between ripples	*Lanice conchilega*, *Asterias rubens*	24	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	728148	5954477	09/05/19 17:34:26									
Grab_C_8	729105	5954755	09/05/19 18:00:57	Grab_C_8_005.jpg	Fine to medium sand ripples with small shell fragments accumulated between ripples	Poss. Gobiidae, *Asterias rubens*, *Lanice conchilega*	24	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	729108	5954757	09/05/19 18:01:58									
Grab_C3_0	722231	5952984	14/05/19 21:51:01	Grab_C3_0_002.jpg	Fine to medium sand ripples with small shell fragments accumulated between ripples	*Asterias rubens*, *Lanice conchilega*, Decapoda, *Ammodytes* sp., *Corystes cassivelaunus*, Gobiidae, *Ophiura ophiura*	24	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	722336	5953047	14/05/19 22:00:16									
Grab_C3_1	723807	5953379	14/05/19 21:23:19	Grab_C3_1_001.jpg	Coarse shelly sand with partially buried cobbles and slight sand ripples	Pleuronectiform, *Asterias rubens*	24	n/a	n/a	n/a	n/a	Infralittoral mixed sediment (A5.43) – incl. clay
	723808	5953379	14/05/19 21:24:23									
Grab_C3_2	725366	5953610	14/05/19 20:46:00	Grab_C3_2_0014jpg	Fine to medium sand ripples with small shell fragments that have accumulated between ripples	*Lanice conchilega, Asterias rubens,* poss. *Callionymus lyra,* Pleuronectiformes, *Ammodytes* sp., Paguridae, Decapoda, *Metridium senile, Cancer pagurus,* Actiniaria, *Liocarcinus*	25	Not a Reef	Not a Reef	Not Reef	Not a Reef	Infralittoral fine sand (A5.23)
	725352	5953670	14/05/19 20:51:34									
	725352	5953670	14/05/19 20:51:35	Grab_C3_2_020.jpg	Cobbles overlying coarse sand with occasional boulders			25	10	Low	Low	Infralittoral mixed sediment (A5.43) - no clay
	725347	5953687	14/05/2019 20:52:38									

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
	725347	5953688	14/05/2019 20:52:39	Grab_C3_2_021.jpg	Coarse sand with cobbles	sp., Cerianthidae, *Sertularia* sp.		10	5	Not a Reef	Not a Reef	Infralittoral mixed sediment (A5.43) - no clay
	725343	5953712	14/05/2019 20:54:08									
	725343	5953712	14/05/2019 20:54:09	Grab_C3_2_028.jpg	Occasional cobble over lying coarse sand and infrequent boulders			10	5	Not a Reef	Not a Reef	Infralittoral mixed sediment (A5.43) - no clay
	725333	5953755	14/05/2019 20:57:02									
	725333	5953755	14/05/2019 20:57:03	Grab_C3_2_035.jpg	Cobbles overlying coarse sand with occasional boulders			30	20	Low	Low	Infralittoral mixed sediment (A5.43) - no clay
	725326	5953785	14/05/2019 20:58:50									
Grab_P_0	721647	5954431	02/05/19 17:15:09	Grab_P_0_021.jpg	Coarse sand littered with shell fragments and *Lanice conchilega* assemblages	*Asterias rubens, Lanice conchilega*, Decapoda, Paguridae, Actiniaria, Gobiidae, Cerianthidae	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721595	5954473	02/05/19 17:22:22									
Grab_P_1	721323	5953795	02/05/19 19:00:12	Grab_P_1_006.jpg	Coarse sand with cobbles	Cerianthidae, *Asterias rubens*, Bryozoa	27	n/a	n/a	n/a	n/a	Infralittoral mixed sediment (A5.43) – incl. clay
	721325	5953794	02/05/19 19:01:32									
Grab_P_2	720981	5952753	02/05/19 20:00:37	Grab_P_2_002.jpg	Fine to medium shelly sand with sand ripples	*Lanice conchilega*, *Corystes cassivelaunus*	24	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	720980	5952752	02/05/19 20:02:04									
Grab_P_3	720668	5951799	06/05/19 15:43:57	Grab_P_3_007.jpg	Fine to medium sand forming ripples	*Corystes cassivelaunus*, *Asterias rubens*, *Lanice conchilega*	24	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	720666	5951799	06/05/19 15:47:09									
Grab_P_4	720245	5950807	03/05/19 15:07:42	Grab_P_4_005.jpg	Fine to medium sand formed into sand ripples	Asteroidea, Ophiuroid	22	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	720355	5950855	03/05/19 15:10:32									

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
Grab_P_5	720036	5949903	03/05/19 13:36:49	Grab_P_5_004.jpg	Fine to medium shelly sand with rare cobbles	Paguridae, *Lanice conchilega*, *Asterias rubens*	20	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	720036	5949903	03/05/19 13:38:12									
Grab_P_6	719725	5948952	03/05/19 13:04:18	Grab_P_6_004.jpg	Fine to medium sand with irregular ripples	*Lanice conchilega*, Pleuronectiform	22	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	719729	5948948	03/05/19 13:08:36									
Grab_P_7	719412	5948000	03/05/19 11:18:23	Grab_P_7_005.jpg	Fine to medium sand with irregular ripples	*Lanice conchilega*, *Callionymus lyra*, Ophiuroid	21	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	719411	5948003	03/05/19 11:22:22									
Grab_P_8	719099	5947048	03/05/19 12:05:32	Grab_P_8_005.jpg	Coarse sand and shell debris with irregular ripples	*Lanice conchilega*	21	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	719094	5947051	03/05/19 12:07:34									
Grab_P_9	718861	5945913	11/05/19 22:31:48	Grab_P_9_002.jpg	Coarse sand and shell debris with irregular ripples	*Asterias rubens*, *Lanice conchilega*, *Corystes cassivelaunus*, Actinopterygii	19	n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	718862	5945911	11/05/19 22:33:08									
Grab_P_10	718778	5944917	11/05/19 23:01:57	Grab_P_10_003.jpg	Fine to medium sand	*Asterias rubens*, *Lanice conchilega*	17	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	718778	5944917	11/05/19 23:04:14									
Grab_P_11	718697	5943920	11/05/19 23:30:17	Grab_P_11_009.jpg	Fine to medium sand and shell debris with irregular ripples	Brachyura, *Lanice conchilega*	17	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	718697	5943920	11/05/19 23:32:11									
Grab_P_12	718614	5942925	11/05/19 23:58:12	Grab_P_12_002.jpg	Fine to medium sand and shell debris with irregular ripples	*Asterias rubens*, *Lanice conchilega*, *Callionymus lyra*, Gobiidae, *Actiniaria*, Brachyura, *Cancer pagurus*, *Liocarcinus sp.*	16	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	718615	5942922	12/05/19 00:00:03									

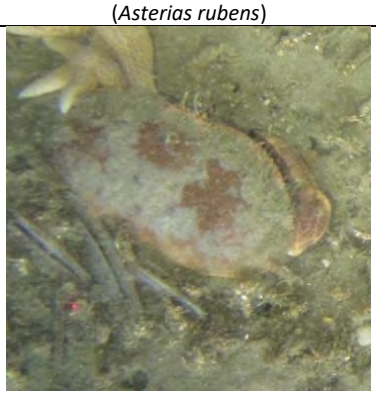
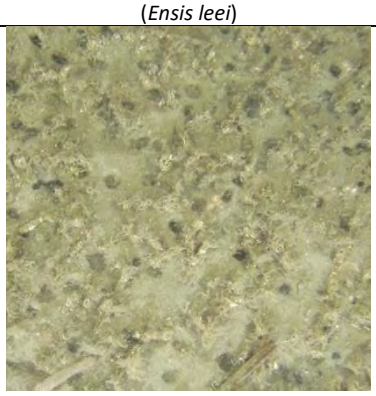
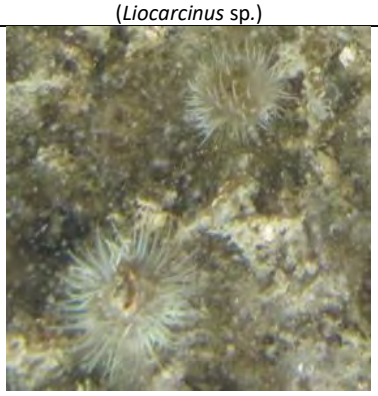
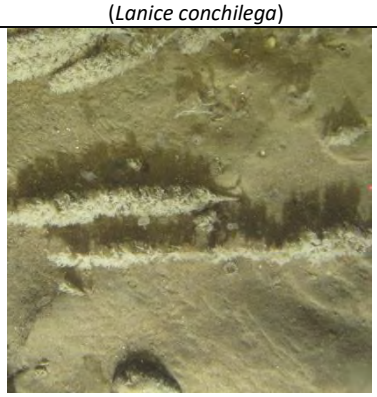
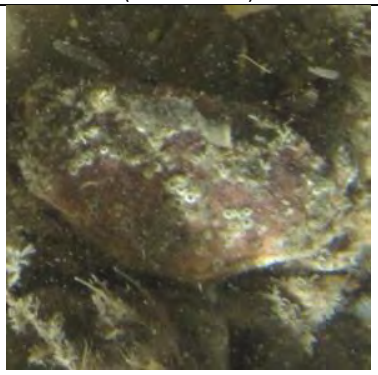
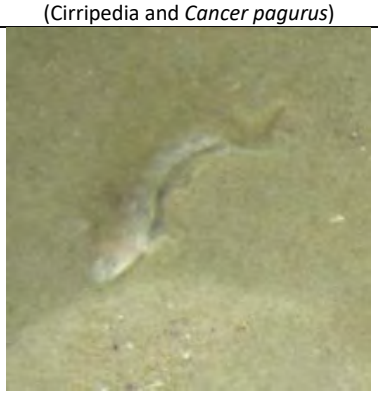
ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
Grab_P_13	718531	5941926	12/05/19 00:30:02	Grab_P_13_005.jpg	Fine to medium sand with irregular ripples	*Asterias rubens*, Ophiuroids, *Lanice conchilega*	16	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	718533	5941928	12/05/19 00:31:30									
Grab_P_14			No visibility									
Grab_P_15	718366	5939934	12/05/19 01:53:30	Grab_P_15_005.jpg	Fine to medium sand with irregular ripples	*Lanice conchilega*, Actinopterygii	13	n/a	n/a	n/a	n/a	Infralittoral fine sand (A5.23)
	718366	5939933	12/05/19 01:55:09									
N5a_1	721585	5954589	11/05/19 01:38:04	N5a_1_014.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed	*Lanice conchilega*, *Ensis* 'burrows', *Leptothecata*, *Actiniaria*, *Cancer pagurus*, *Callionymus lyra*, Paguridae, Actinopterygii, Sepiida, Pleuronectiform, Brachyura, *Sepiola* spp., *Cancer pagurus*, *Metridium senile*, *Ensis* sp., *Liocarcinus sp.*, Cerianthidae	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721626	5954710	11/05/19 01:46:42									
N5a_2	721669	5954631	11/05/19 01:16:25	N5a_2_002.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed	*Asterias rubens*, *Lanice conchilega*, *Cancer pagurus*, Actiniaria, Paguridae, *Ensis sp.*, *Cancer pagurus*, *Pagurus bernhardus*, Brachyura, *Callionymus lyra*, *Metridium senile*,	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721555	5954667	11/05/19 01:24:59									
	721554	5954667	11/05/19 01:25:00	N5a_2_038.jpg				n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
	721552	5954668	11/05/19 01:25:15		Large boulder surrounded by Ensis shells	*Liocarcinus sp.*, Cerianthidae						swept infralittoral sand and mixed gravelly sand (A5.137)
	721551	5954668	11/05/19 01:25:16	N5a_2_039.jpg	Coarse sand ripples			n/a	n/a	n/a	n/a	Infralittoral coarse Sediment (A5.13)
	721544	5954669	11/05/19 01:25:39									
North Transect 1	721487	5954681	11/05/19 00:49:09	N_T_1_002.jpg	Slightly gravelly/shelly coarse sand forming irregular ripples. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed	*Asterias rubens*, *Lanice conchilega*, *Cancer pagurus*, *Pagurus bernhardus*, Actiniaria, Paguridae, *Ensis* sp., Brachyura, Actinopterygii, *Cancer pagurus,* Pleuronectiform, *Limanda limanda*, *Liocarcinus* sp., Cerianthidae	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721425	5954656	11/05/19 00:55:02									
	721425	5954656	11/05/19 00:55:03	N_T_1_021.jpg	Dense aggregations of *Lanice conchilega*, *Asterias rubens* and *Ensis* shells on gravelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed.			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721392	5954643	11/05/19 00:57:24									
	721391	5954643	11/05/19 00:57:25	N_T_1_028.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721363	5954633	11/05/19 00:59:20									

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
North Transect 2	721609	5954992	11/05/19 00:06:16	N_T_2_003.jpg	Slightly gravelly/shelly coarse sand forming irregular ripples. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed	*Asterias rubens, Lanice conchilega, Cancer pagurus, Pagurus bernhardus, Cancer pagurus, Pleuronectiform, Callionymus lyra, Bachyura, Actiniaria, Sepiidae, Liocarcinus sp., Cerianthidae*	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721618	5955031	11/05/19 00:10:55									
	721617	5955032	11/05/19 00:10:56	N_T_2_014.jpg	Gravelly/shelly coarse sand forming irregular ripples. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721625	5955086	11/05/19 00:14:33									
	721625	5955086	11/05/19 00:14:34	N_T_2_038.jpg	Dense aggregations of *Lanice conchilega*, *Asterias rubens* and *Ensis* shells on gravelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed.			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721631	5955141	11/05/19 00:18:28									
	721631	5955142	11/05/19 00:18:29	N_T_2_041.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721632	5955153	11/05/19 00:19:05									

ED50, UTM 31N, CM 3° E												
Station	Easting (m)	Northing (m)	Date & Time	Example Photograph (file name)	Sediment type	Conspicuous fauna	Depth (m)	Stony Reefiness (After Irving 2009)			Overall Reef Structure	EUNIS Habitat Classification with SBF/Habitat Map Colour Code
								Composition (% cover of cobbles/ boulders)	Elevation (of cobbles/ boulders in cm)	Reef Structure Matrix		
North Transect 3	721902	5954408	11/05/19 02:04:47	N_T_3_010.jpg	Dense aggregations of *Lanice conchilega*, *Asterias rubens* and *Ensis* shells on gravelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed.	*Asterias rubens, Lanice conchilega, Cancer pagurus, Pagurus bernhardus, Cancer pagurus, Pleuronectiform, Actiniaria, Gobiidae, Paguridea, Ensis sp., Limanda, Metridium senile, Liocarcinus sp., Eutrigla gurnardus, Cerianthidae*	29	n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721888	5954432	11/05/19 02:07:32									
	721887	5954432	11/05/19 02:07:33	N_T_3_018.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721865	5954461	11/05/19 02:09:55									
	721865	5954461	11/05/19 02:09:56	N_T_3_039.jpg	Dense aggregations of *Lanice conchilega*, *Asterias rubens* and *Ensis* shells on gravelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed.			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721824	5954518	11/05/19 02:14:38									
	721823	5954519	11/05/19 02:14:39	N_T_3_050.jpg	Slightly gravelly/shelly coarse sand. 'Burrows' formed by *Ensis* retracting below surface when the camera sled comes into contact with the seabed. Infrequent boulders.			n/a	n/a	n/a	n/a	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand (A5.137)
	721801	5954551	11/05/19 02:17:16									

APPENDIX F – CONSPICUOUS SPECIES EXAMPLES FROM SEABED PHOTOGRAPHY

Examples of Conspicuous Fauna		
 Common Starfish (*Asterias rubens*)	 Atlantic Jackknife Clam (*Ensis leei*)	 Swimming Crab (*Liocarcinus* sp.)
 The Edible Crab (*Cancer pagurus*)	 Sand mason worm (*Lanice conchilega*)	 Burrowing anemones (Cerianthidae)
 Hermit Crab (Paguridae)	 Hydroids (*Sertularia*)	 Barnacles on an Edible Crab (Cirripedia and *Cancer pagurus*)
 Sand Eel (*Ammodytes sp.*)	 Burrowing Brittlestar (Ophiuroid)	 Common Dragonet (*Callionymus lyra*)

APPENDIX G – REGIONAL STANDARDS AND BACKGROUND INFORMATION

UK BIODIVERSITY ACTION PLAN

In 1994, the UK published its Biodiversity Action Plan (UKBAP) for the protection and sustainable use of biodiversity. This plan combined new and existing conservation initiatives on objectives for conserving and enhancing species and habitats as well as promoting public awareness and contributing to international conservation efforts. Following the initial strategy publication, 391 Species Action Plans (SAPs) and 45 Habitat Action Plans (HAPs) were later published for the UK's most threatened (i.e. "priority") species and habitats. These plans describe the status of each habitat and species, outlines the threats they face, set targets and objectives for their management, and propose actions necessary to achieve recovery.

Key UKBAP Habitats that may occur in an open water marine environment are as follows:

- Deep-sea Sponge Communities
- Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats
- Blue and Horse Mussel Beds
- Mud Habitats in Deep Water
- *Sabellaria spinulosa* Reefs

The UKBAP habitat most likely to occur in the wider region around the current survey area is deep sea sponge communities. Although sponge communities are usually found in water depths greater than 250 m there have been significant sponge aggregations recorded in depths below 30 m (UKBAP, 2008).

OSPAR COMMISSION

At its Biodiversity Committee (BDC) meeting in 2003, OSPAR agreed to proceed with a programme to collate existing data on the distribution of fourteen key habitats, as part of a wider programme to develop measures for their protection and conservation. The UK agreed to compile the relevant data for its own marine waters and submit these for collation into composite maps on the distribution of each habitat type across the whole OSPAR area. The work is being coordinated by the Joint Nature Conservation Committee (JNCC).

EUROPEAN HABITATS DIRECTIVE

The United Kingdom is a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). To meet their obligations under the convention, the European Community Habitats Directive was adopted in 1992. The provisions of the Directive require Member States to introduce a range of measures including the protection of species listed in the Annexes; to undertake surveillance of habitats and species and produce a report every six years on the implementation of the Directive. The 189 habitats listed in Annex I of the Directive and the 788 species listed in Annex II, are to be protected by means of a network of sites.

Each Member State is required to prepare and propose a national list of sites, which will be evaluated in order to form a European network of Sites of Community Importance (SCIs). These will eventually be designated by Member States as Special Areas of Conservation (SACs), and along with Special Protection Areas (SPAs) classified under the EC Birds Directive, form a network of protected areas known as Natura 2000. The Directive was amended in 1997 by a technical adaptation Directive and latterly by the Environment Chapter of the Treaty of Accession 2003.

The implementation of the Habitats Directive (EHD; 92/43/EEC) in offshore waters commenced in 2000 and highlighted a number of potential habitats for which SACs may be selected in UK offshore waters. The Annex I habitats which are particularly prevalent in this region of UK waters are submarine structures formed by leaking gases.

The Habitats Directive introduces a precautionary principle for protected areas whereby projects can only be permitted where no adverse effect on the integrity of the site can be shown.

The Emerald Network was developed in 1989 within the framework of the Bern Convention (1979), and is an ecological network which comprises areas of special conservation interest (ASCIs; Council of Europe, 2015). The objective of this network is to achieve ensure survival of the species and habitats which require site-specific protection. The EUNIS habitat of "sublittoral sediment" has been designated a resolution 4 habitat type which is used for the designation of Emerald sites throughout Europe where relevant to sensitive habitats or species.

IUCN RED LIST SPECIES

The IUCN Red List classifies species into categories based on their assessed risk of extinction for a particular region. This would assign species to any of the following categories classified as a Red List species; extinct (EX), extinct in the wild (EW), regionally extinct (RE), critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT) or data deficient (DD). Species categorised as CR, EN or VU are additionally described as threatened (IUCN, 2014; Keith *et al.,* 2013).

APPENDIX H – SAMPLE AND SEABED PHOTOGRAPHS

Habitat Summary Information: Grab_P_0

Survey Area: N5a Pipeline

No. of Stills: 27 **Mins of Video: 7** **Track Length: 70m**

Site Selection Criteria

Pipeline Route - Positioned at 1km intervals. Investigating area of mixed reflectivity sediment.

Analogue Interpretation

Variable mixed reflectivity with many raised areas.

Sediment Description

Coarse sand littered with shell fragments and lanice conchilega assemblages.

Conspicuous Fauna

Cnidaria: Actiniaria sp., *Cerianthus* sp., Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** Paguridae sp. , Decapoda sp. **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** Gobiidae sp.

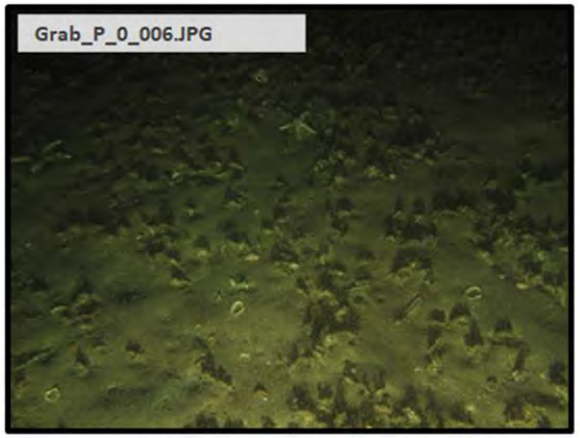


Photo Position: 721647 mE, 5954429 mN

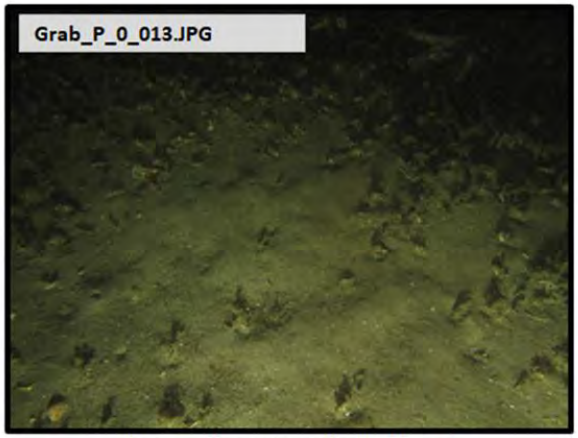


Photo Position: 721634 mE, 5954446 mN

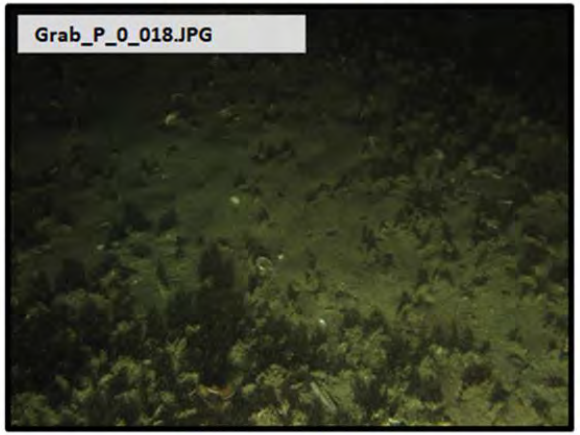


Photo Position: 721620 mE, 5954456 mN

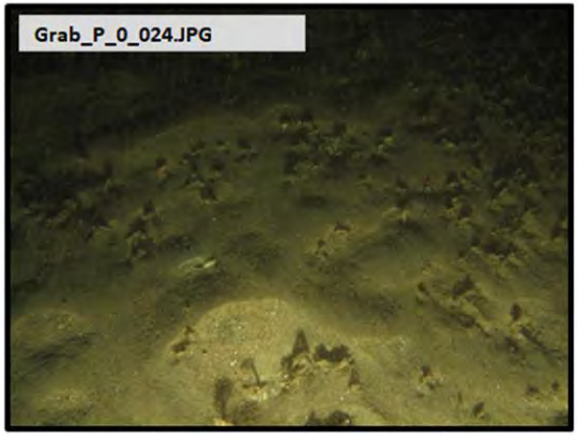
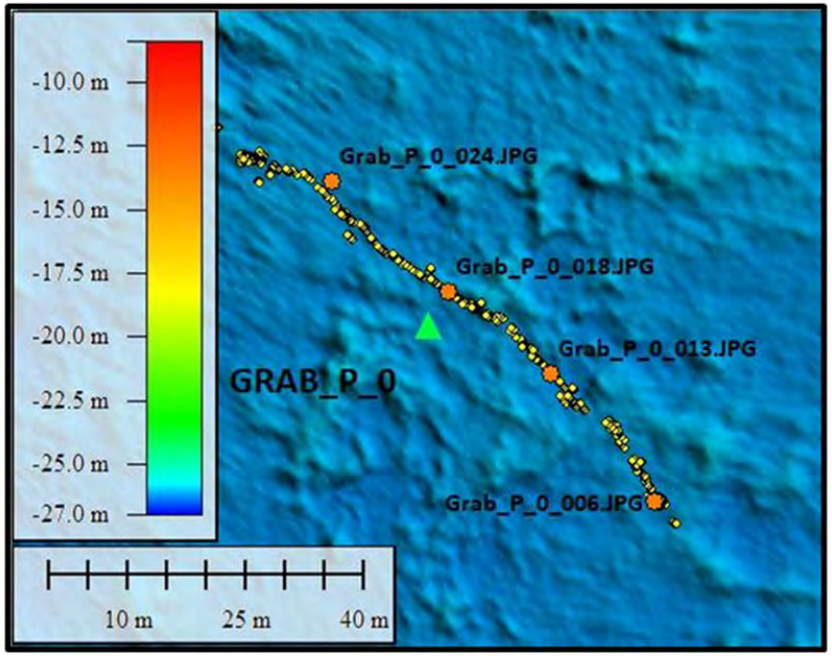


Photo Position: 721606 mE, 5954470 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

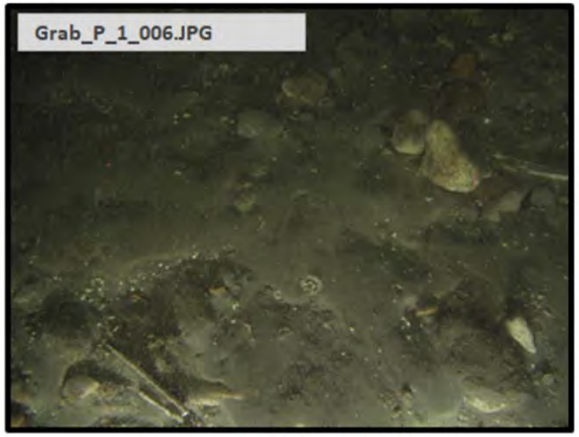


Photo Position: 721325 mE, 5953794 mN

Habitat Summary Information: Grab_P_01

Survey Area: N5a Pipeline

No. of Stills: 1 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Moved from KP in order to investigate area of high reflectivity sediment.

Analogue Interpretation
Area of mixed high reflectivity.

Sediment Description
Coarse sand with cobbles.

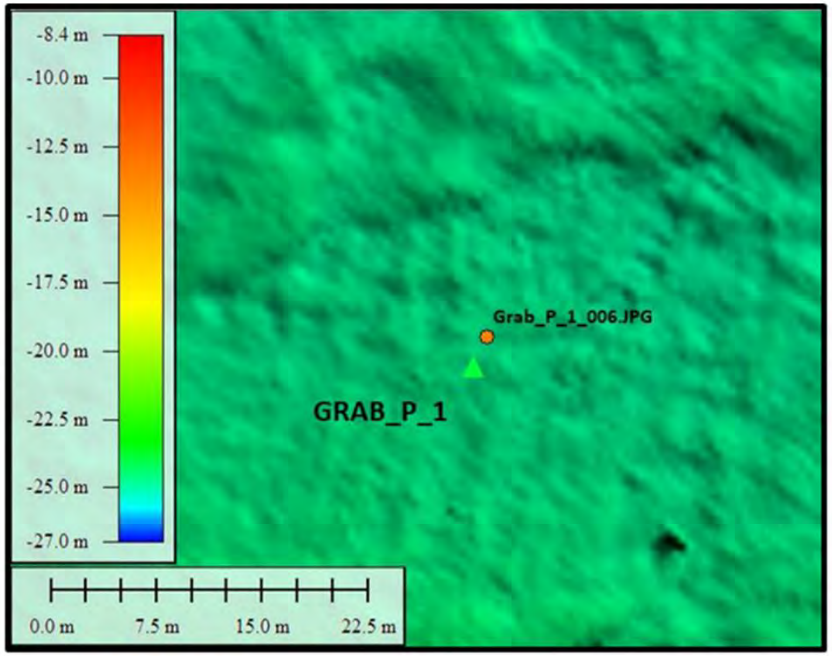
Conspicuous Fauna
Cnidaria: *Cerianthus* sp. **Echinodermata:** *Asterias rubens* (Common starfish). **Bryozoa:** Bryozoa sp.

Only one image taken

Photo Position: 0 mE, 0 mN

Only one image taken

Photo Position: 0 mE, 0 mN



Only one image taken

Photo Position: 0 mE, 0 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_02

Survey Area: N5a Pipeline

No. of Stills: 5 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse shelly sand with sand ribble bedform.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Corystes cassivelaunus* (Masked crab).

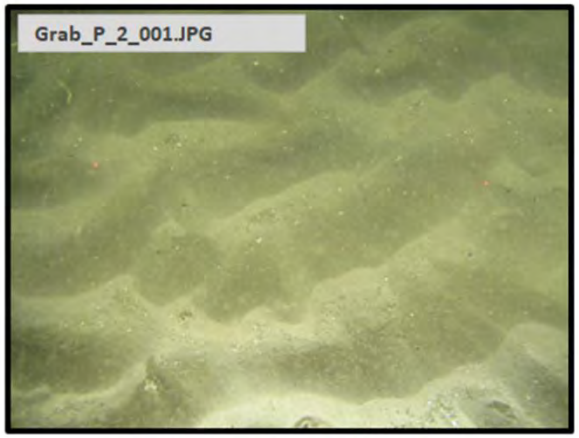


Photo Position: 720980 mE, 5952753 mN

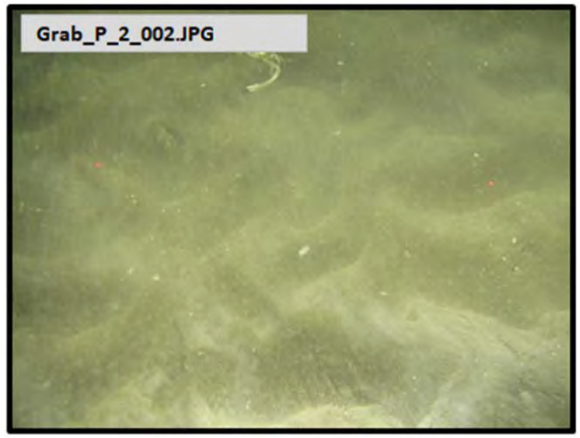


Photo Position: 720979 mE, 5952754 mN

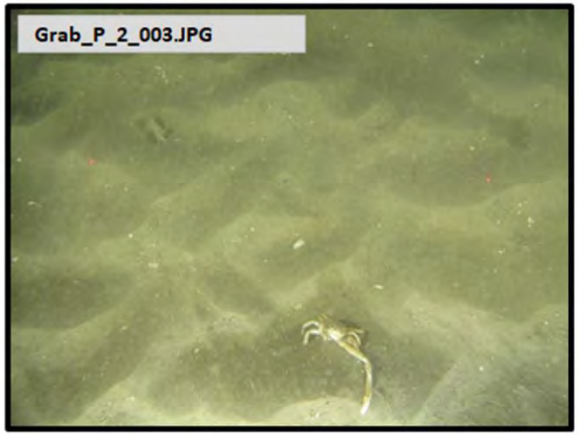
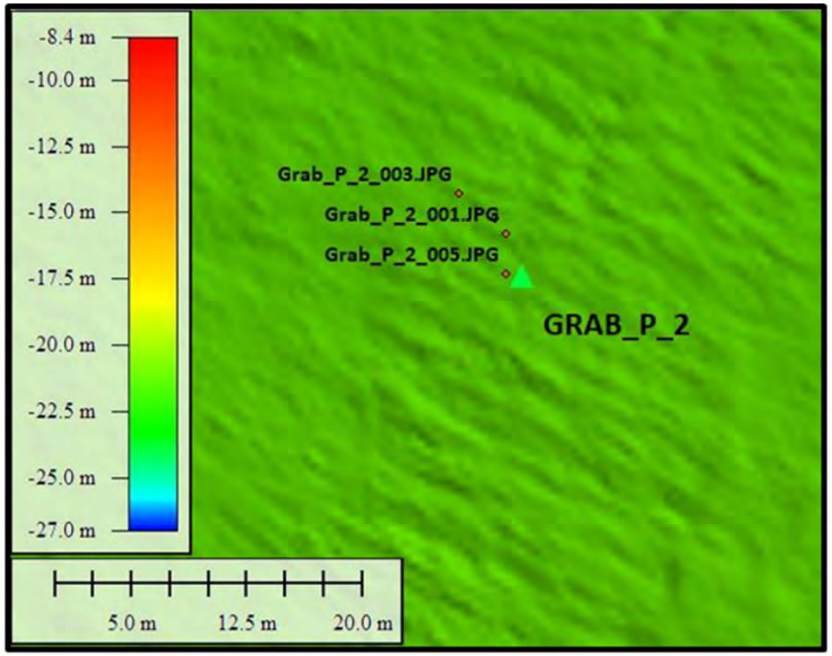


Photo Position: 720977 mE, 5952755 mN



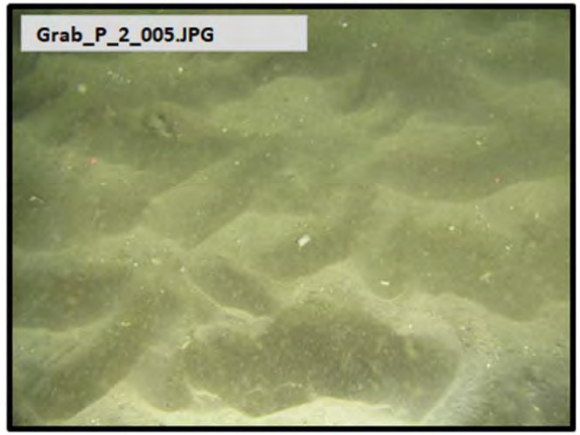


Photo Position: 720980 mE, 5952750 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_03

Survey Area: N5a Pipeline

No. of Stills: 10 **Mins of Video: 3** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand forming ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Corystes cassivelaunus* (Masked crab). **Echinodermata:** *Asterias rubens* (Common starfish).

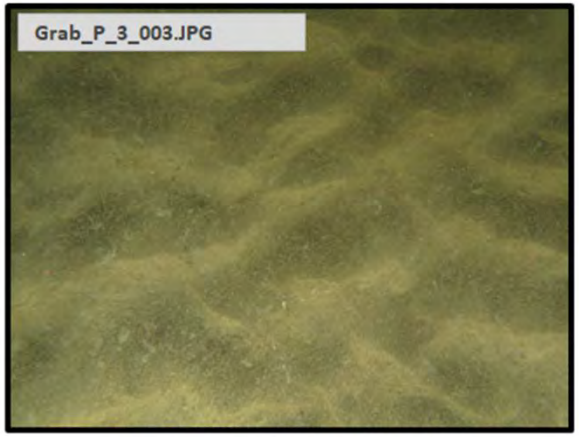


Photo Position: 720668 mE, 5951799 mN

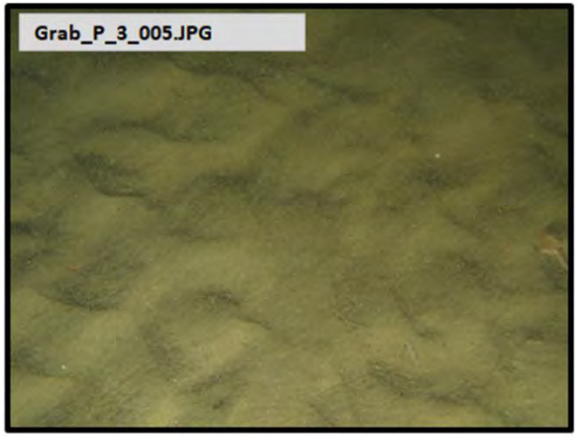


Photo Position: 720664 mE, 5951796 mN

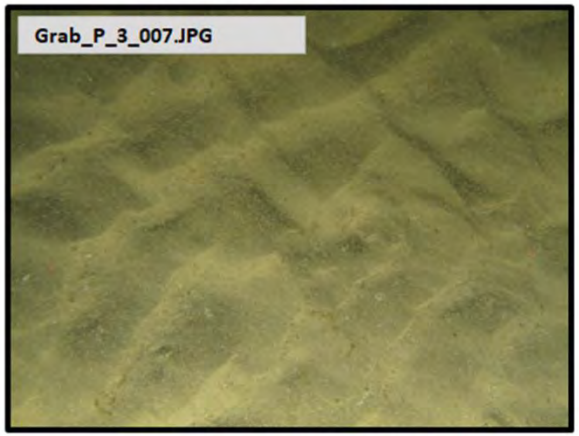


Photo Position: 720664 mE, 5951795 mN

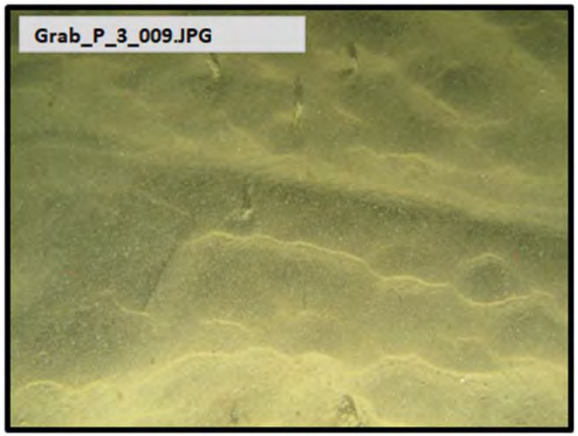
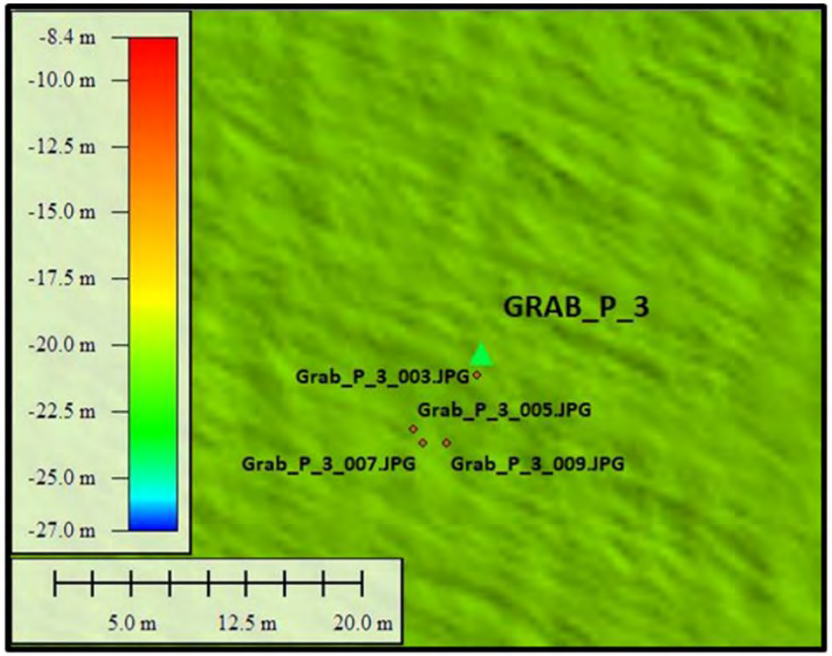


Photo Position: 720666 mE, 5951795 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_04

Survey Area: N5a Pipeline

No. of Stills: 10 **Mins of Video:** 3 **Track Length:** DDV

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Area of variable reflectivity indicating rippling.

Sediment Description
Coarse sand formed into sand ripples.

Conspicuous Fauna
Echinodermata: *Asterias rubens* (Common starfish), Ophiurida sp.

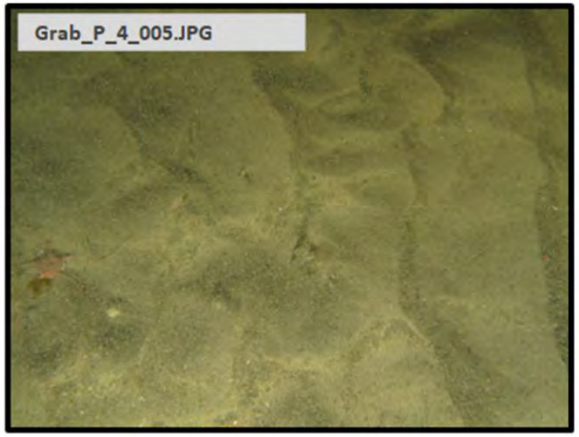


Photo Position: 720356 mE, 5950850 mN

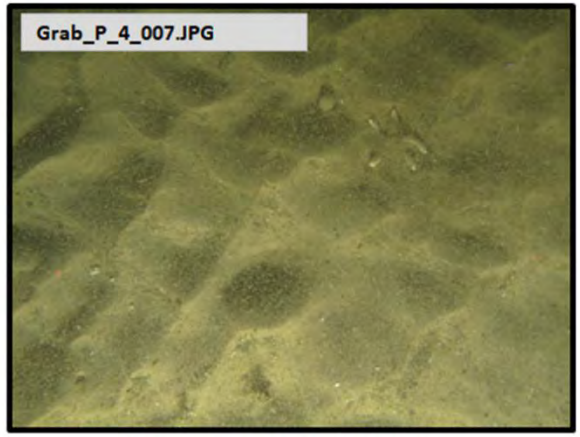


Photo Position: 720355 mE, 5950850 mN

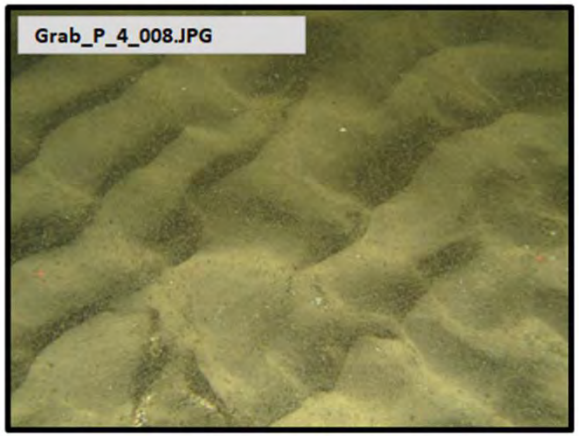


Photo Position: 720355 mE, 5950853 mN

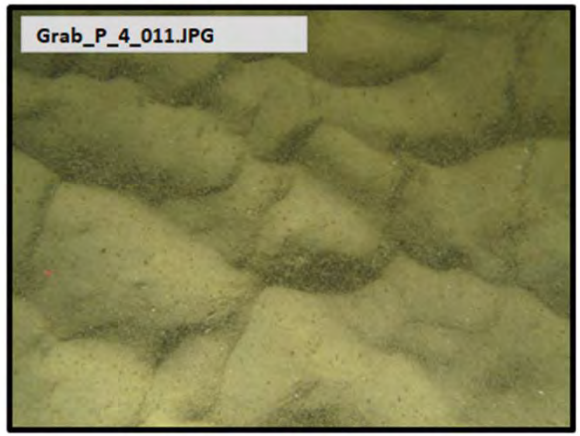
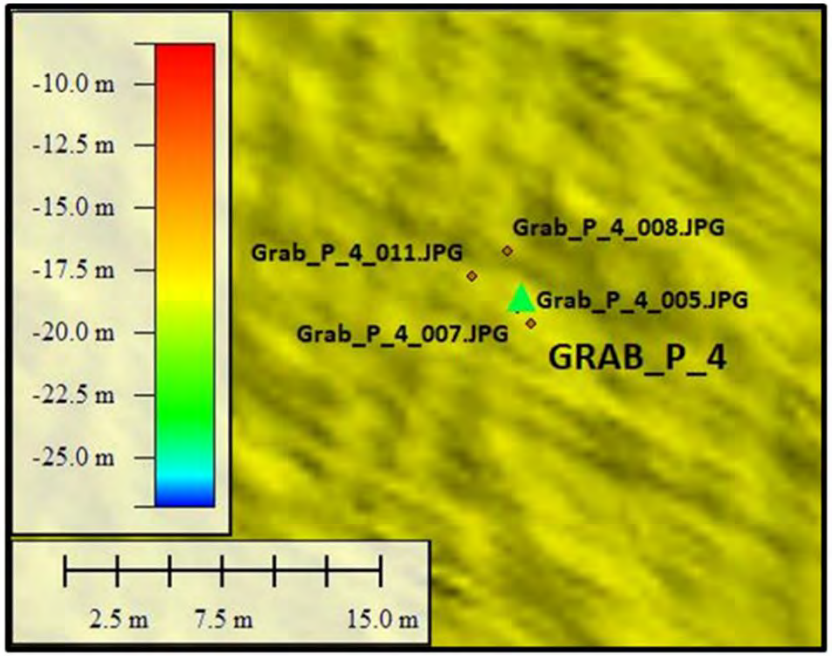


Photo Position: 720353 mE, 5950852 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_05

Survey Area: N5a Pipeline

No. of Stills: 16 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Area of low, variable reflectivity.

Sediment Description
Coarse shelly sand with rare cobbles.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** Paguridae sp. **Echinodermata:** *Asterias rubens* (Common starfish).

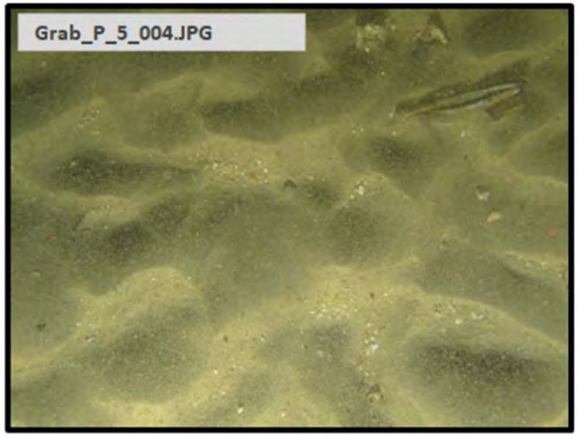


Photo Position: 720039 mE, 5949902 mN

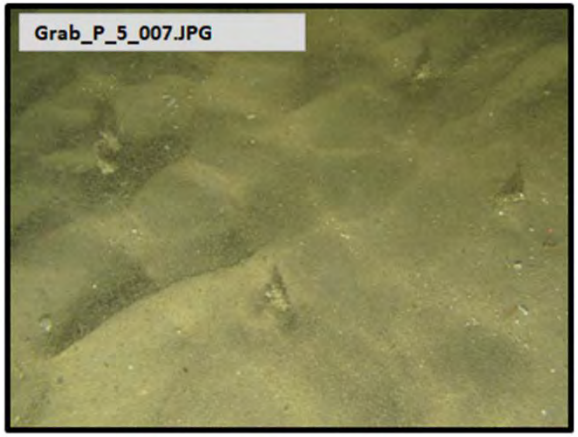


Photo Position: 720044 mE, 5949893 mN

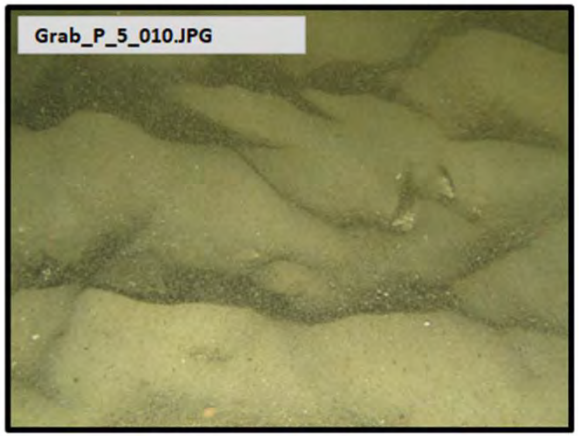


Photo Position: 720021 mE, 5949907 mN

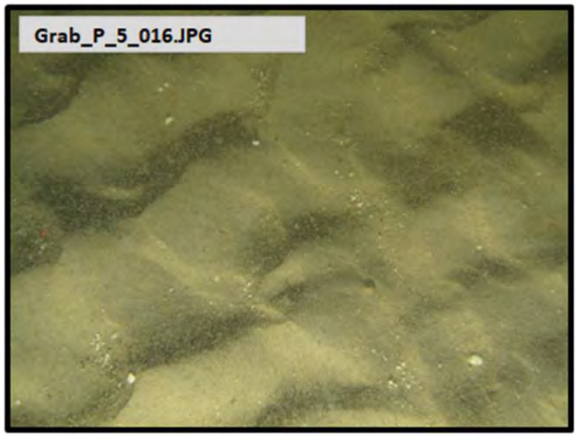
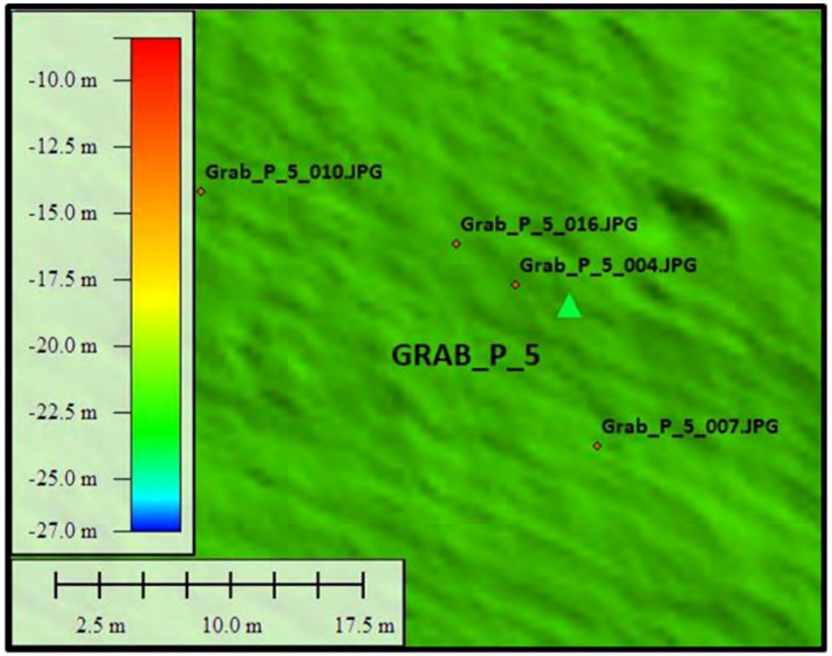


Photo Position: 720036 mE, 5949904 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_06

Survey Area: N5a Pipeline

No. of Stills: 12 **Mins of Video: 4** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Area of slightly variable reflectivity.

Sediment Description
Coarse sand with irregular ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Chordata:** Pleuronectiformes sp.

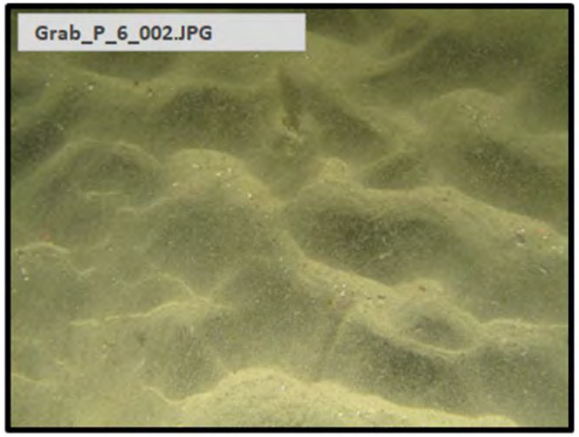


Photo Position: 719727 mE, 5948952 mN

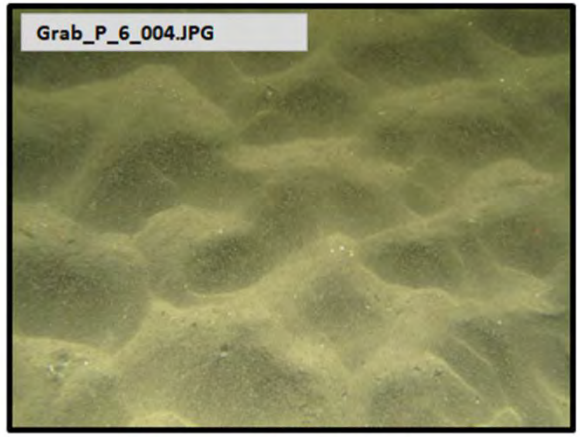


Photo Position: 719728 mE, 5948952 mN

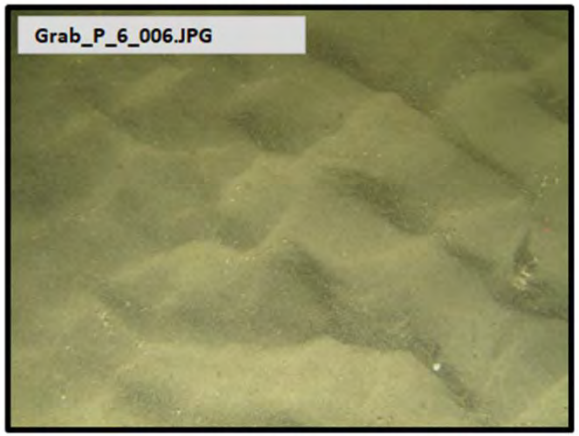


Photo Position: 719688 mE, 5948930 mN

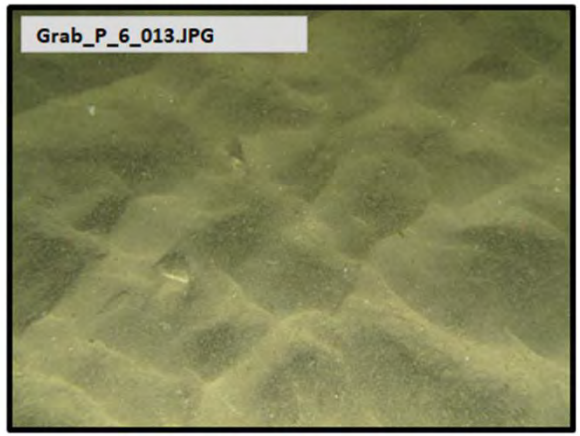
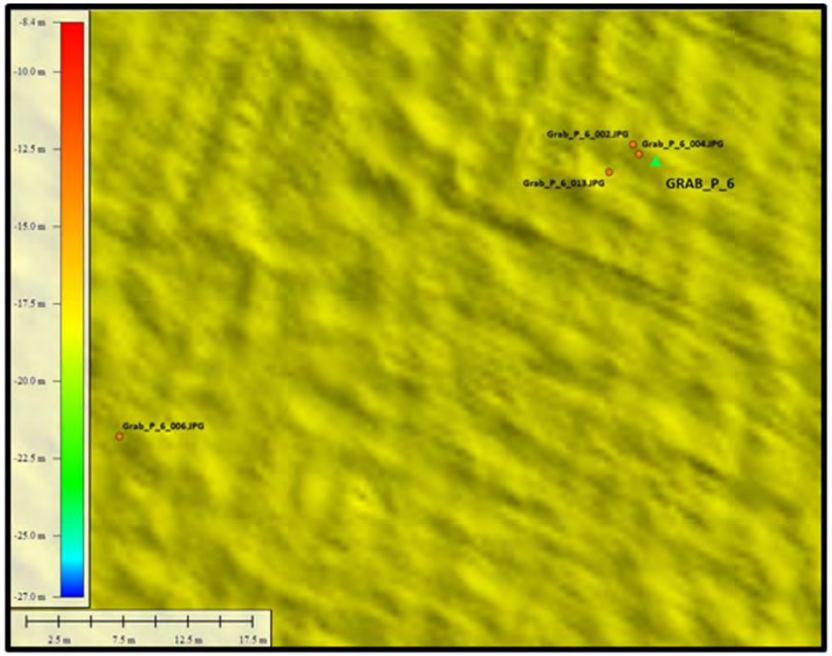


Photo Position: 719726 mE, 5948950 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_07

Survey Area: N5a Pipeline

No. of Stills: 7 **Mins of Video: 4** **Track Length: DDV**

Site Selection Criteria
Moved from KP to investigate mixed reflectivity sediment.

Analogue Interpretation
Area of variable reflectivity with scars in seabed.

Sediment Description
Coarse sand with irregular ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** Ophiurida sp. **Chordata:** *Callionymus lyra* (Common dragonet).

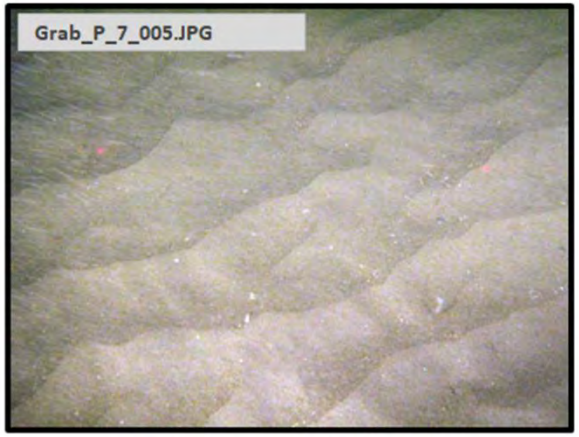


Photo Position: 719408 mE, 5948019 mN

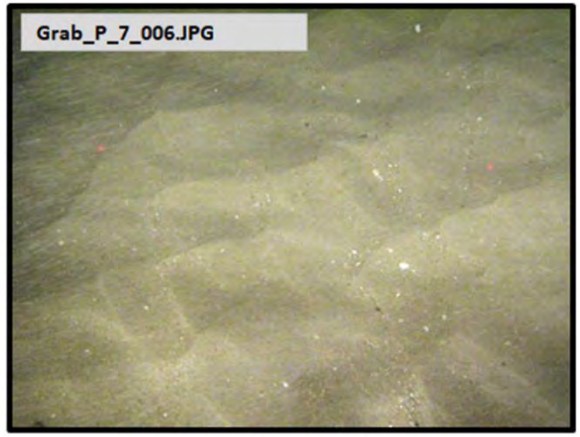


Photo Position: 719411 mE, 5948002 mN

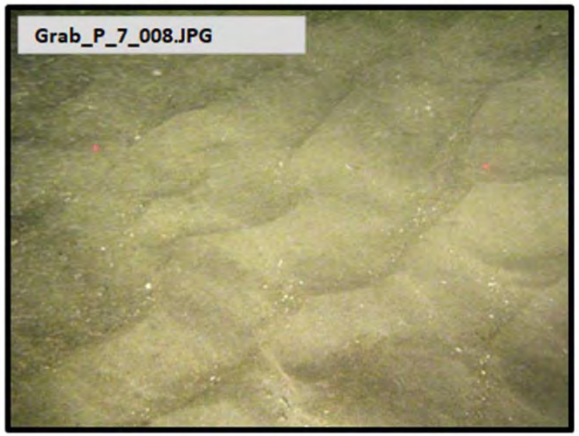
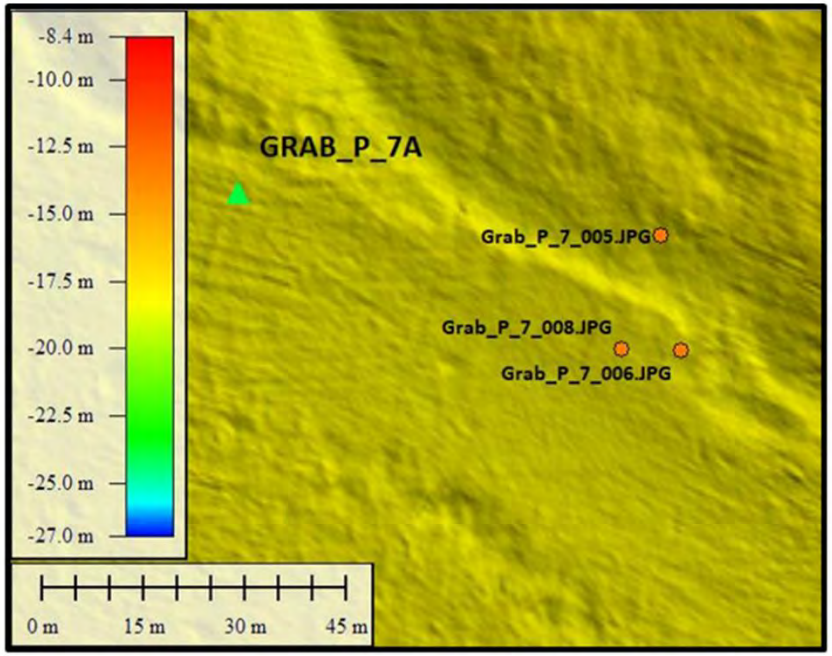


Photo Position: 719403 mE, 5948002 mN



Only 3 good quality seabed images

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_08

Survey Area: N5a Pipeline

No. of Stills: 6 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand and rare shell debris with irregular ripples

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason).

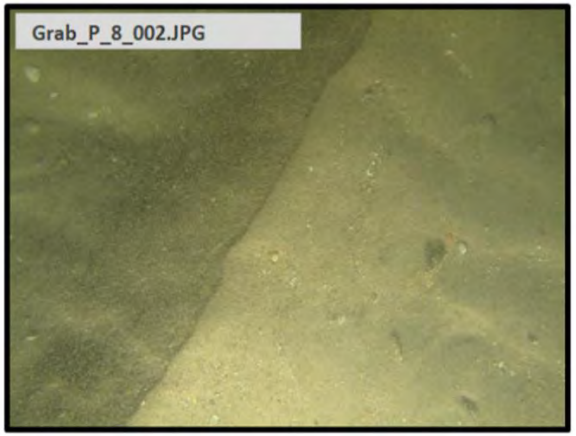


Photo Position: 719097 mE, 5947051 mN

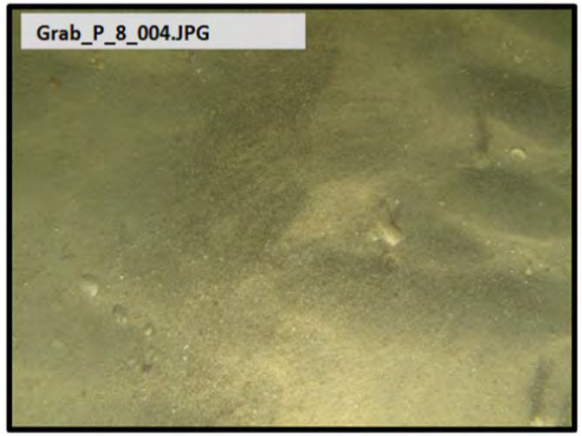


Photo Position: 719076 mE, 5947050 mN

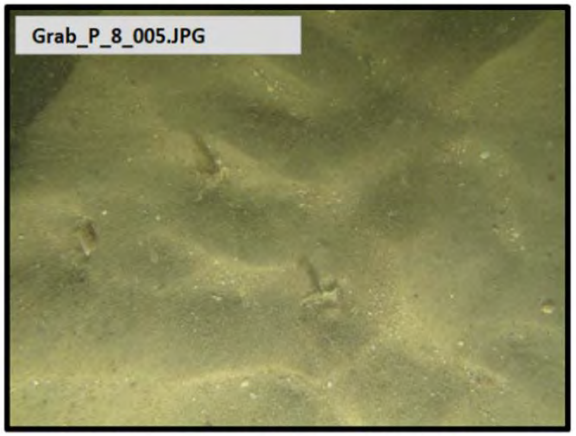


Photo Position: 719125 mE, 5947049 mN

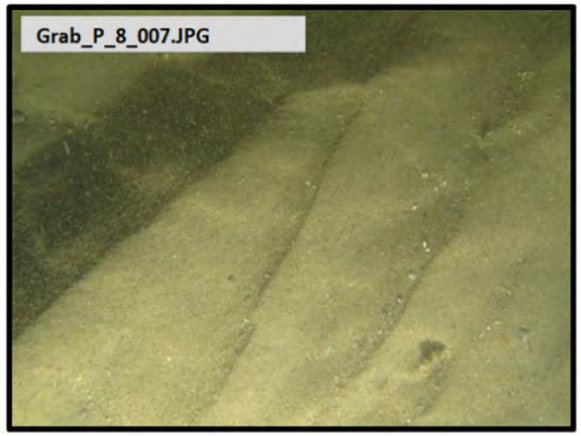
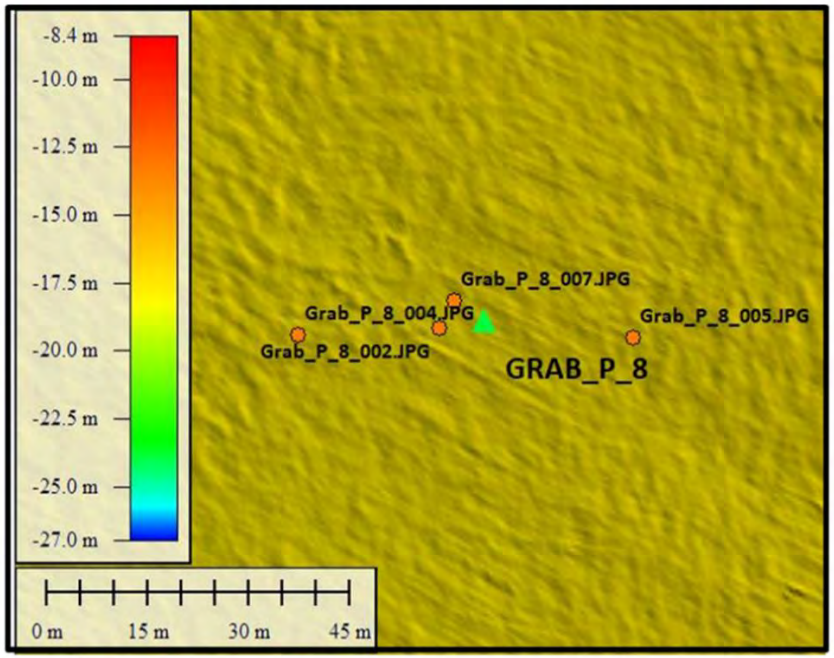


Photo Position: 719099 mE, 5947055 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_09

Survey Area: N5a Pipeline

No. of Stills: 6 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Variable reflectivity with scars in seabed.

Sediment Description
Coarse sand and rare shell debris with irregular ripples

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Corystes cassivelaunus* (Masked crab). **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** Actinopterygii sp.

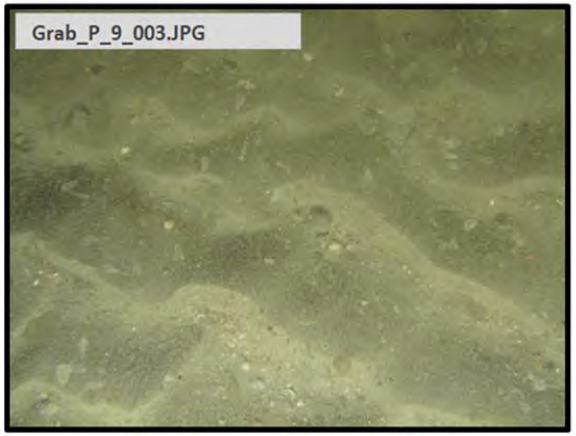


Photo Position: 718861 mE, 5945912 mN

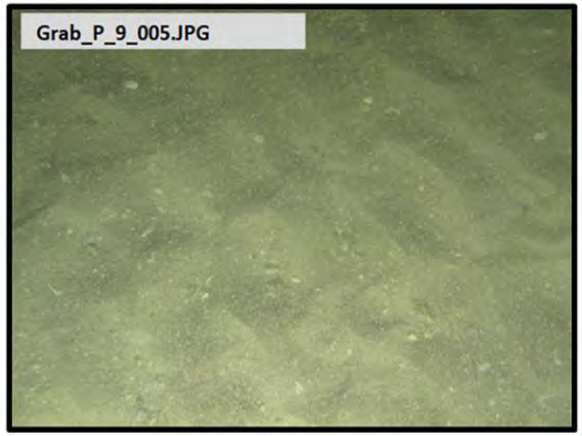


Photo Position: 718862 mE, 5945911 mN

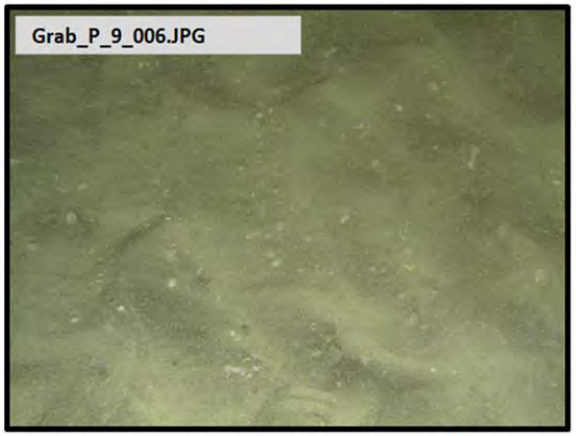


Photo Position: 718863 mE, 5945911 mN

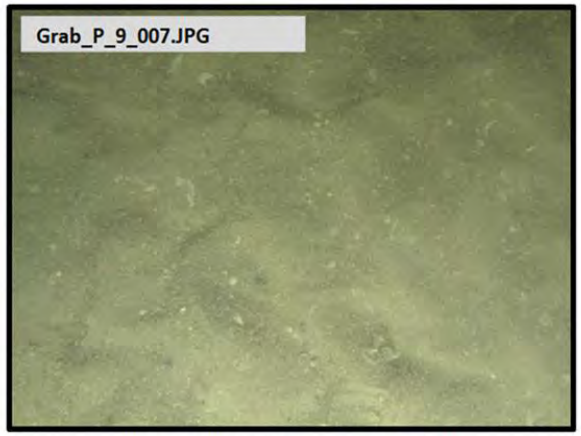
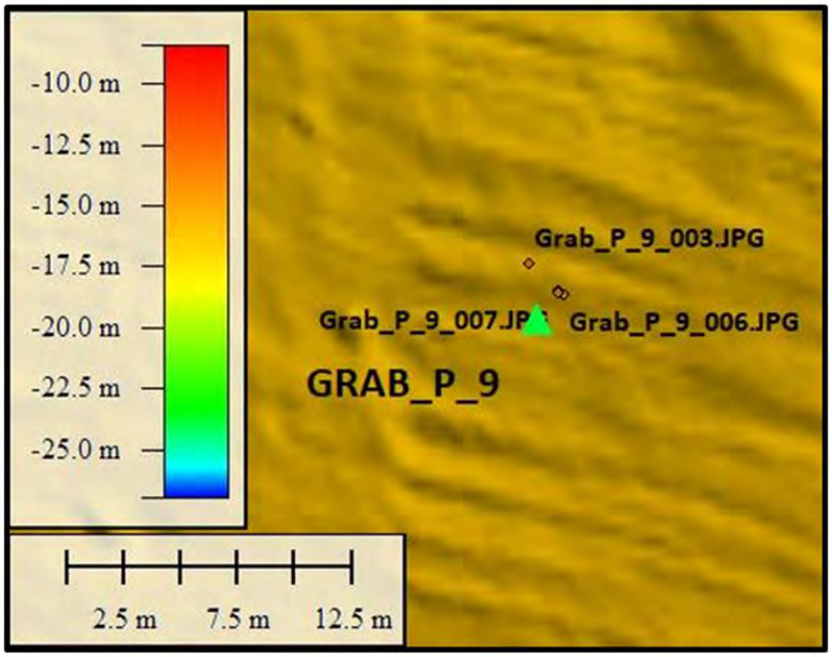


Photo Position: 718862 mE, 5945911 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_010

Survey Area: N5a Pipeline

No. of Stills: 8 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Area of variable reflectivity.

Sediment Description
Coarse sand.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** *Asterias rubens* (Common starfish).

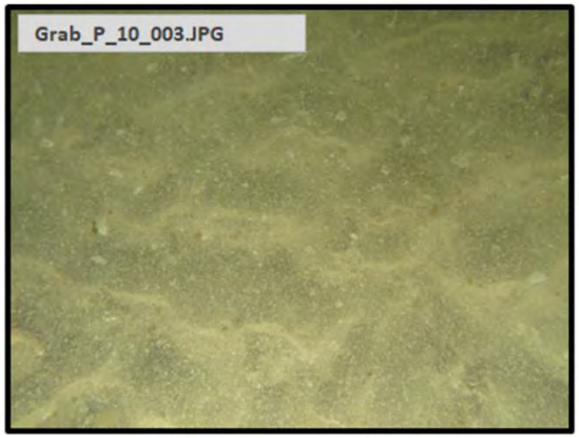


Photo Position: 718778 mE, 5944917 mN

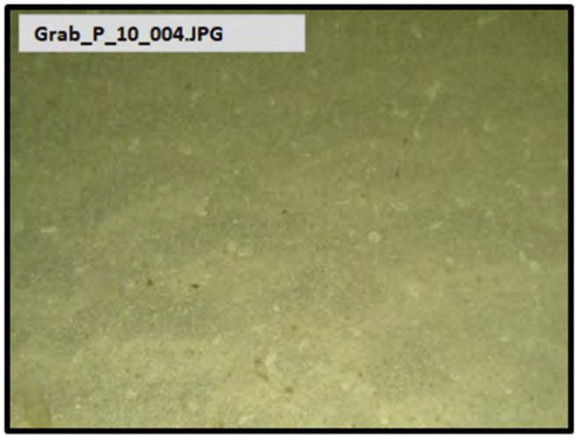
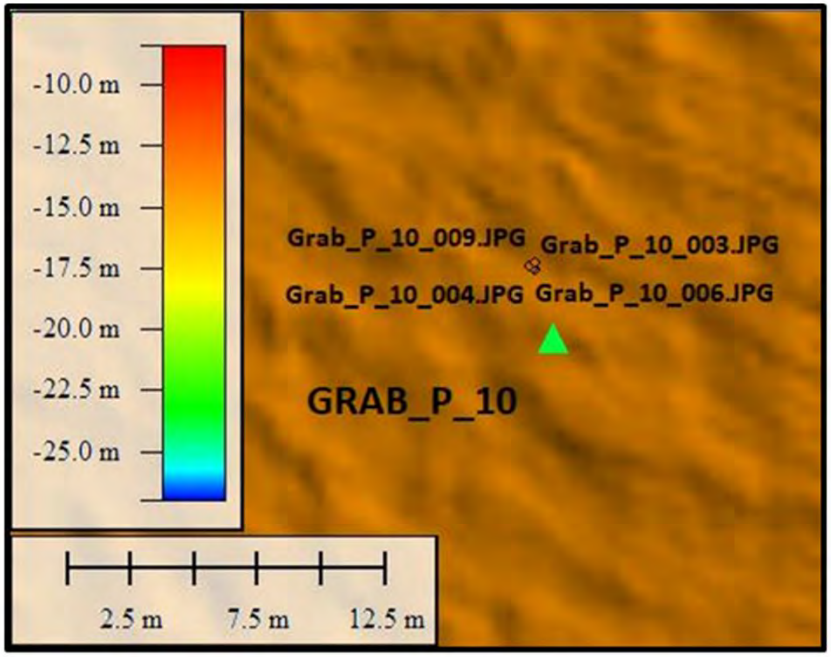


Photo Position: 718778 mE, 5944917 mN

Photo Position: 718778 mE, 5944917 mN



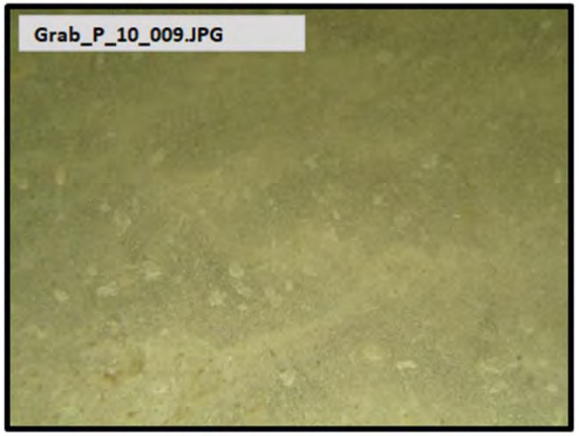


Photo Position: 718778 mE, 5944917 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_011

Survey Area: N5a Pipeline

No. of Stills: 8 **Mins of Video: 2** **Track Length: DDVm**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand and rare shell debris with irregular ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** Brachyura sp.

Grab_P_11_003.JPG

Photo Position: 718696 mE, 5943920 mN

Grab_P_11_004.JPG

Photo Position: 718696 mE, 5943920 mN

Grab_P_11_008.JPG

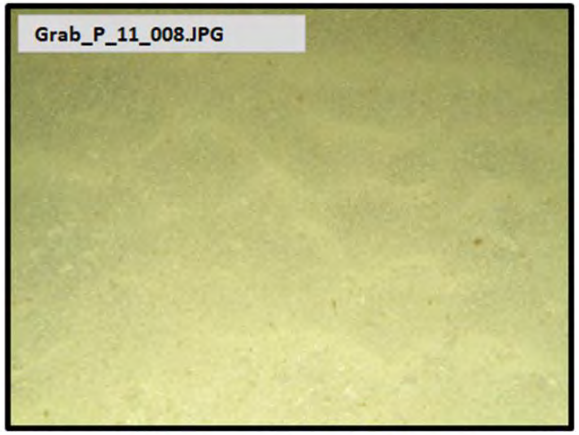


Photo Position: 718697 mE, 5943920 mN

Grab_P_11_009.JPG

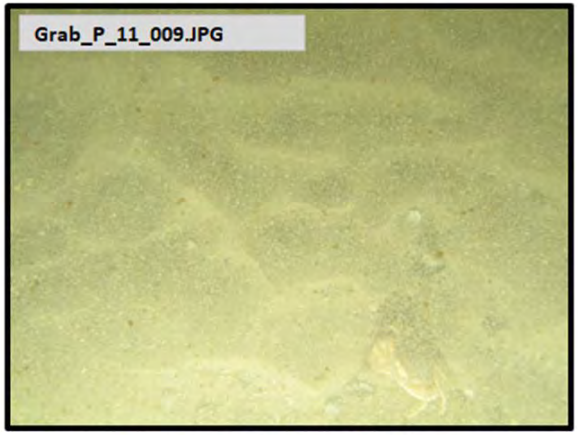
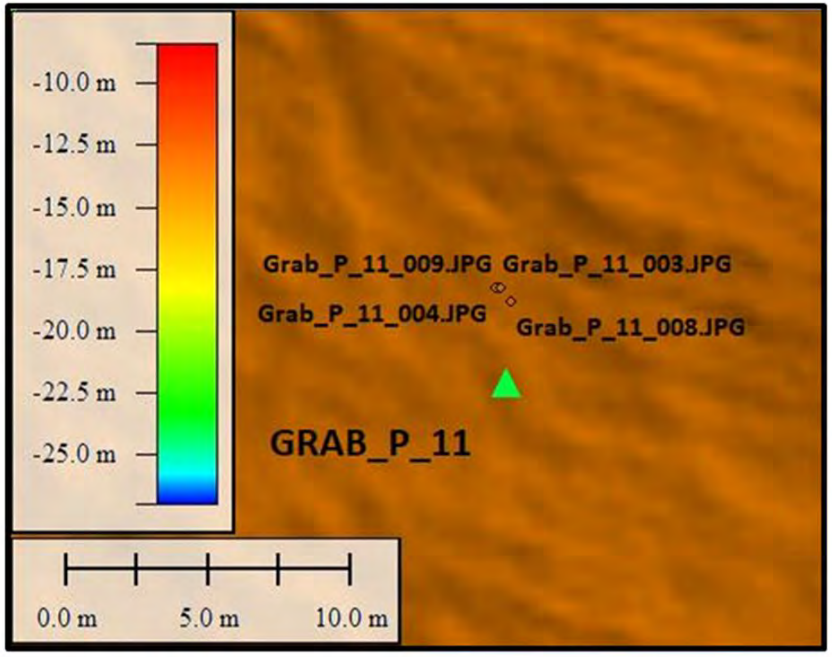


Photo Position: 718697 mE, 5943920 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_012

Survey Area: N5a Pipeline

No. of Stills: 8 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria

Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation

Area of variable reflectivity with depressions.

Sediment Description

Coarse sand and rare shell debris with irregular ripples.

Conspicuous Fauna

Cnidaria: Actiniaria sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Liocarcinus depurator* (Sandy swimming crab), Brachyura sp, *Cancer maenus* . **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** *Callionymus lyra* (Common dragonet), Gobiidae sp.

Photo Position: 718613 mE, 5942924 mN

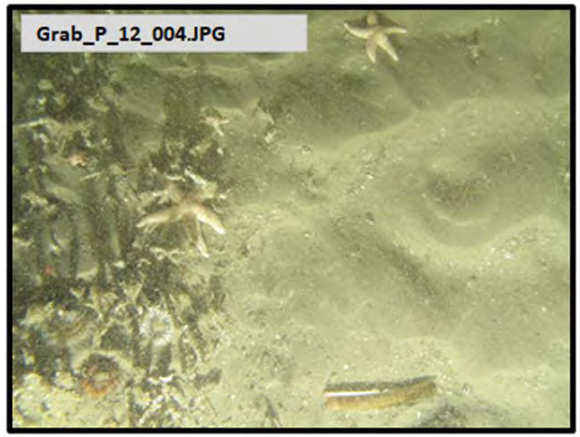


Photo Position: 718614 mE, 5942924 mN

Photo Position: 718614 mE, 5942923 mN

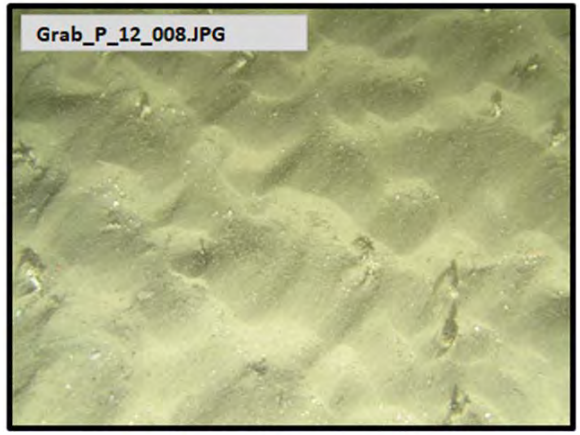
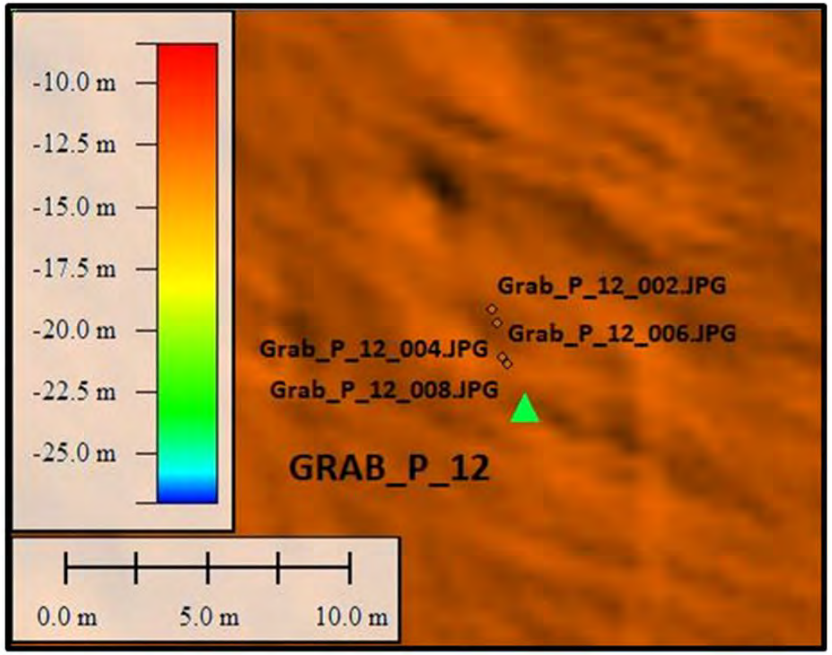


Photo Position: 718614 mE, 5942922 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_013

Survey Area: N5a Pipeline

No. of Stills: 7 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Area of low reflectivity with some potential scarring.

Sediment Description
Coarse sand with irregular ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** *Asterias rubens* (Common starfish), Ophiurida sp.

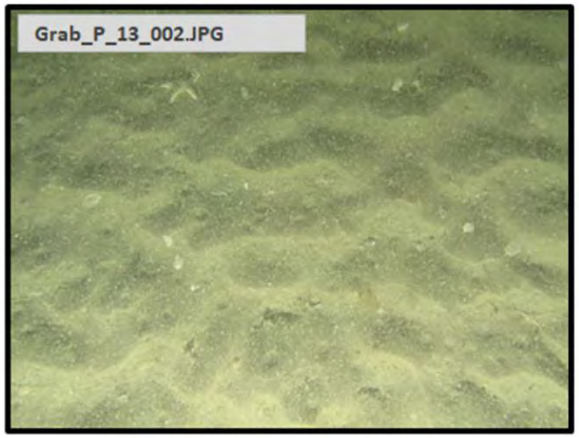


Photo Position: 718531 mE, 5941926 mN

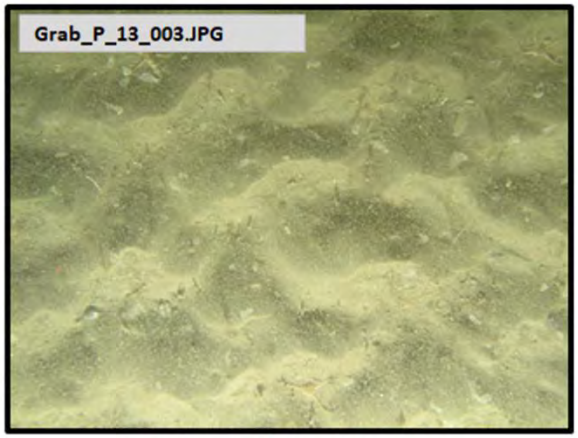


Photo Position: 718531 mE, 5941926 mN

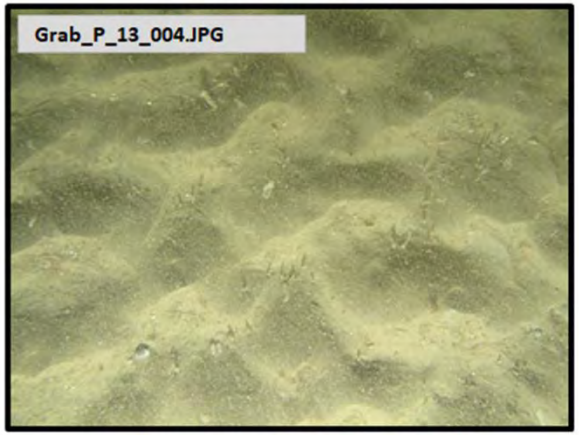
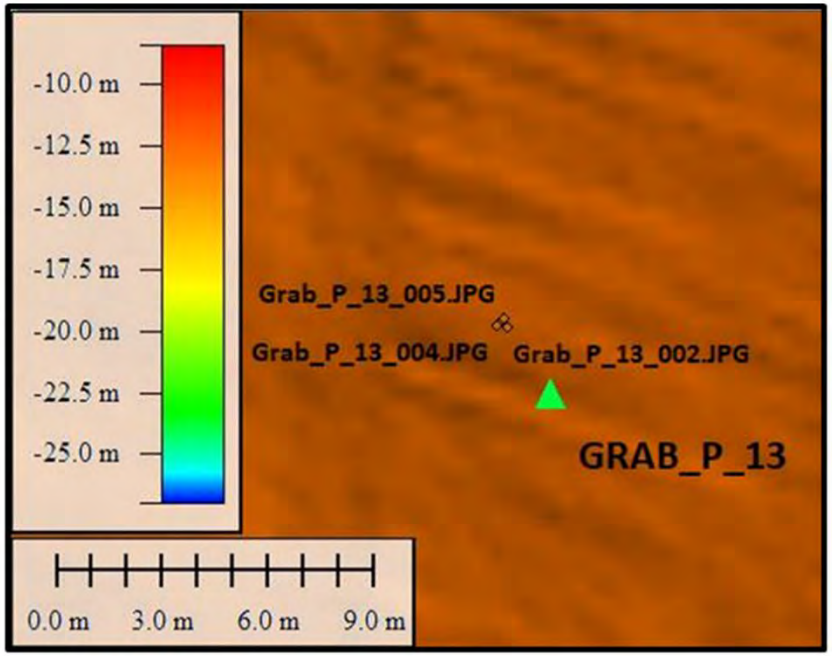


Photo Position: 718531 mE, 5941926 mN



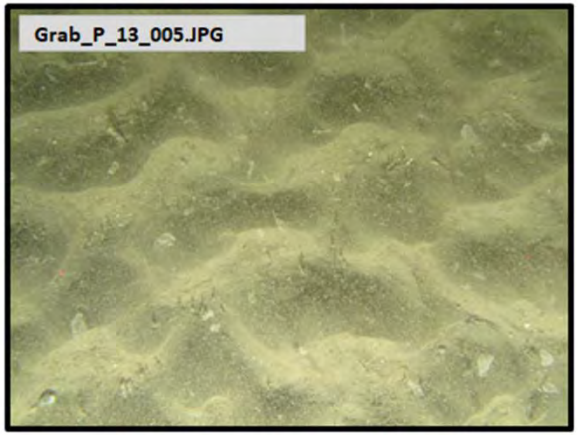
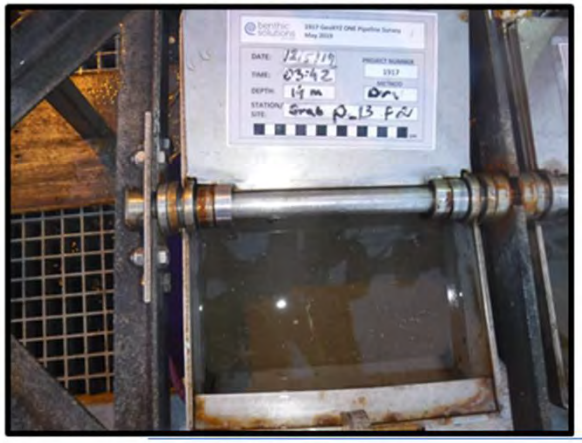


Photo Position: 718531 mE, 5941926 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_014

Survey Area: N5a Pipeline

No. of Stills: 5 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity

Sediment Description
No visiblity

Conspicuous Fauna
No visibility

Grab_P_14_003.JPG

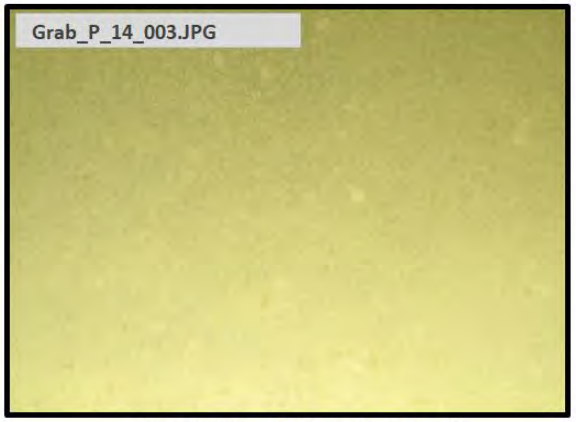


Photo Position: 718449 mE, 5940928 mN

Grab_P_14_004.JPG

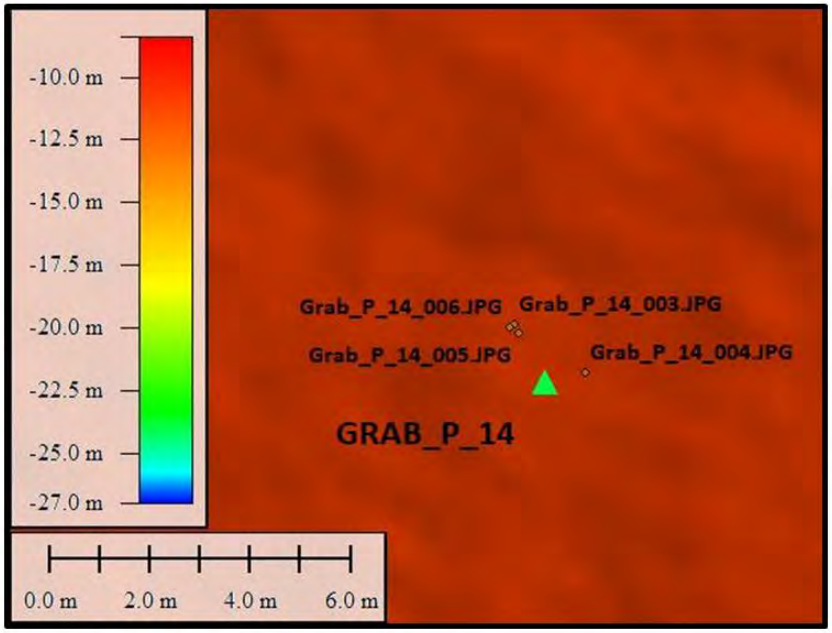
Photo Position: 718451 mE, 5940927 mN

Grab_P_14_005.JPG

Photo Position: 718450 mE, 5940928 mN

Grab_P_14_006.JPG

Photo Position: 718449 mE, 5940928 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_P_015

Survey Area: N5a Pipeline

No. of Stills: 5 **Mins of Video: 2** **Track Length: DDV**

Site Selection Criteria
Pipeline Route - Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand with irregular ripples.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Chordata:** Actinopterygii sp.

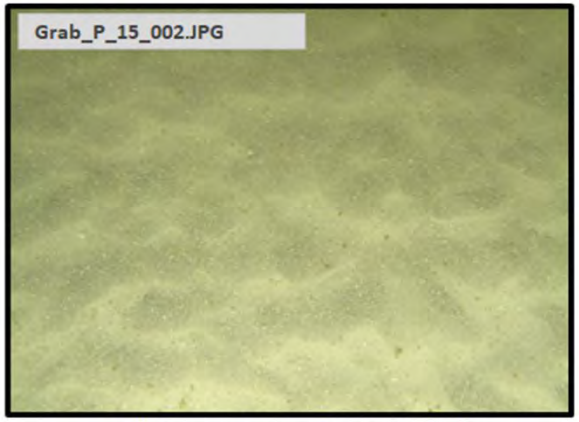


Photo Position: 718366 mE, 5939934 mN

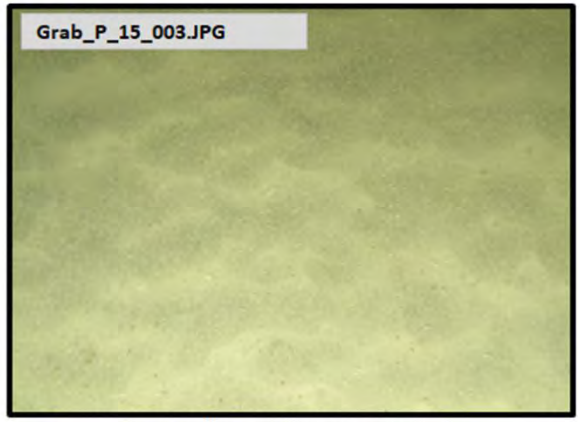


Photo Position: 718366 mE, 5939934 mN

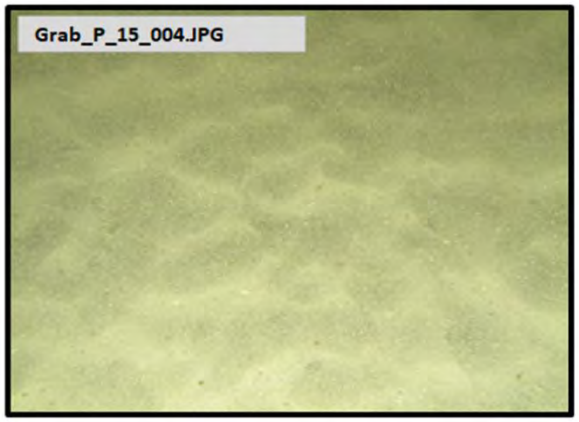


Photo Position: 718366 mE, 5939934 mN

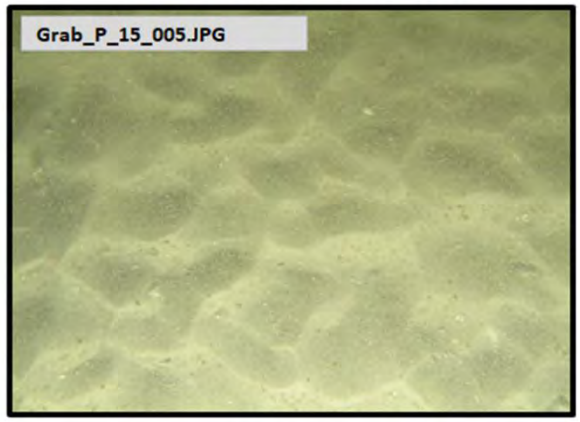
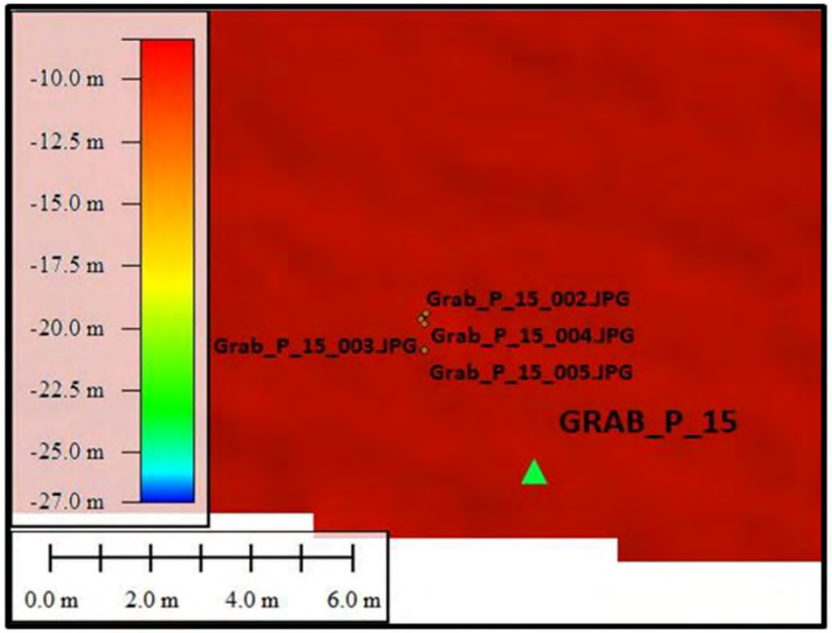


Photo Position: 718366 mE, 5939933 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_0

Survey Area: N5a Cable Route

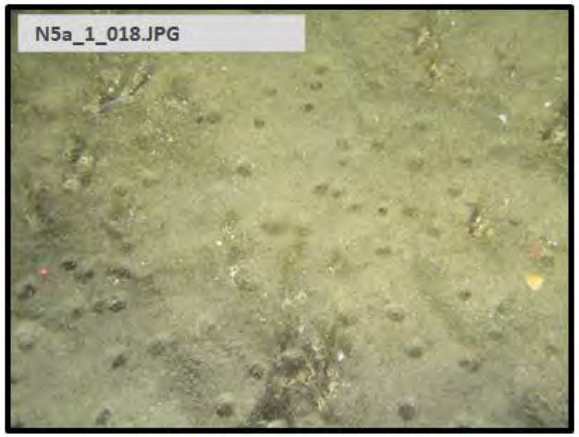


Photo Position: 721606 mE, 5954649 mN

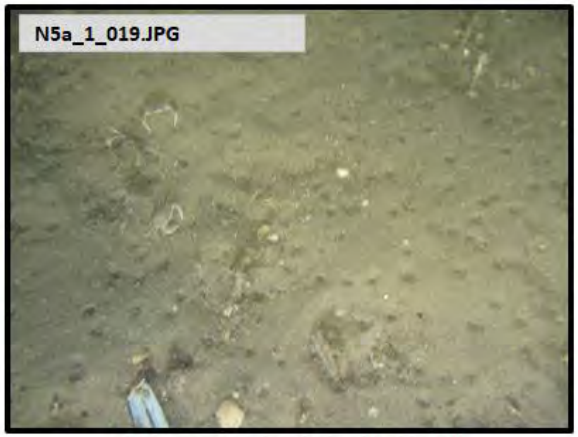


Photo Position: 721607 mE, 5954652 mN

Site Selection Criteria
Original Cable Route and N5a well centre location. Covered using transect N5a_1 and N5a_2.

Analogue Interpretation
Low reflectivity.

Sediment Description
Slightly gravelly/shelly coarse sand.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** *Asterias rubens* (Common starfish).

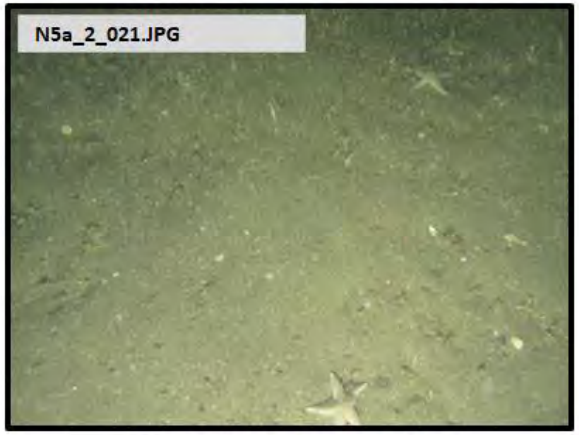
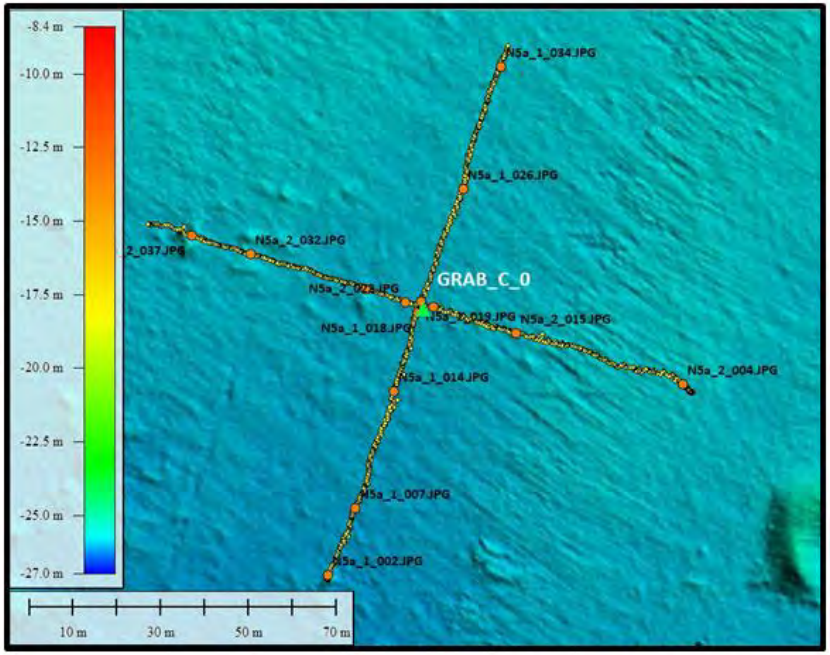


Photo Position: 721610 mE, 5954650 mN



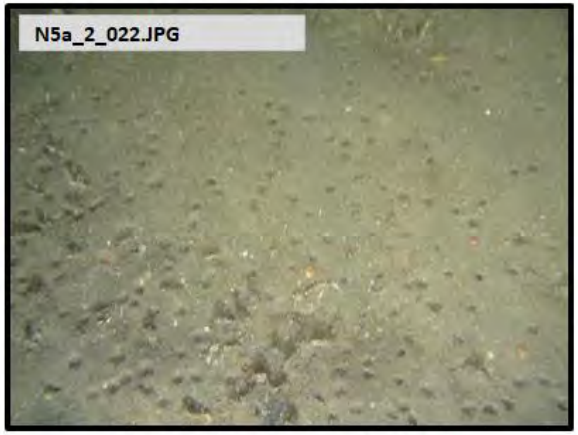


Photo Position: 721603 mE, 5954651 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_01

Survey Area: N5a Cable Route

No. of Stills: 2 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria

Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation

Area of variable high reflectivity with raised area near Grab location.

Sediment Description

Coarse sand littered with shell fragments.

Conspicuous Fauna

Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** Decapoda sp, *Liocarcinus* sp. **Echinodermata:** *Asterias rubens* (Common starfish).

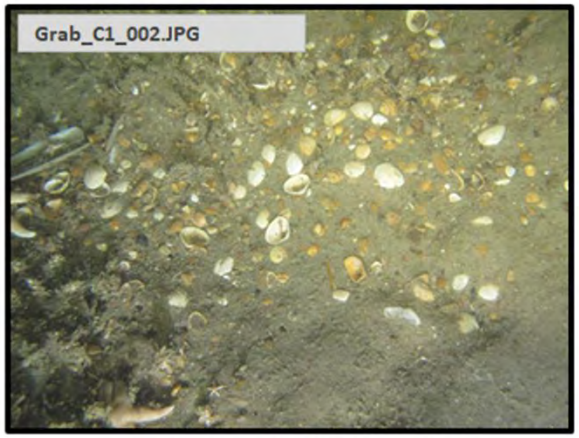


Photo Position: 722598 mE, 5954539 mN

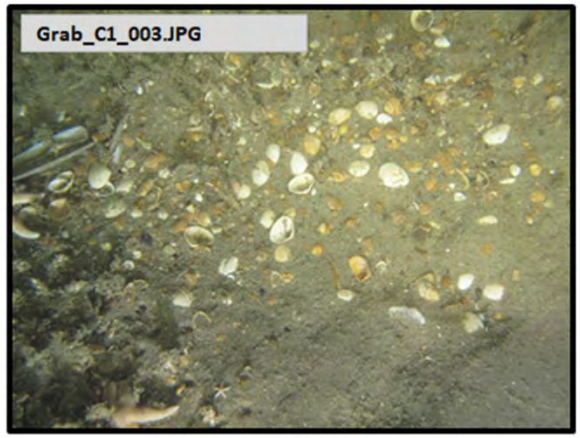


Photo Position: 722598 mE, 5954539 mN

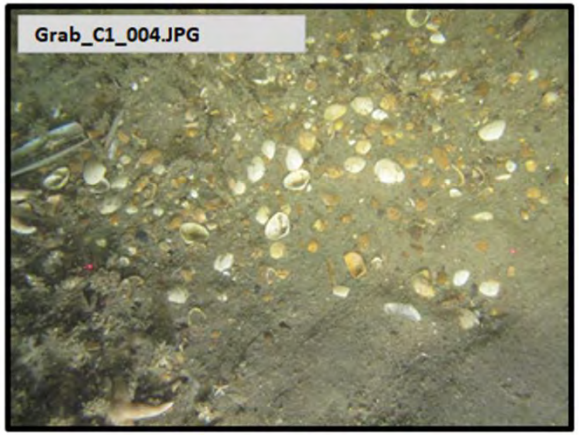


Photo Position: 0 mE, 0 mN

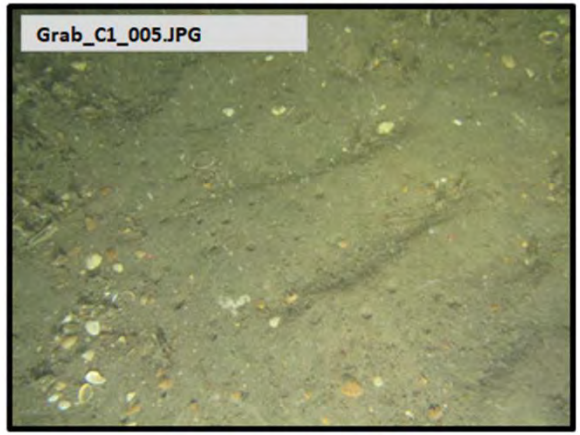
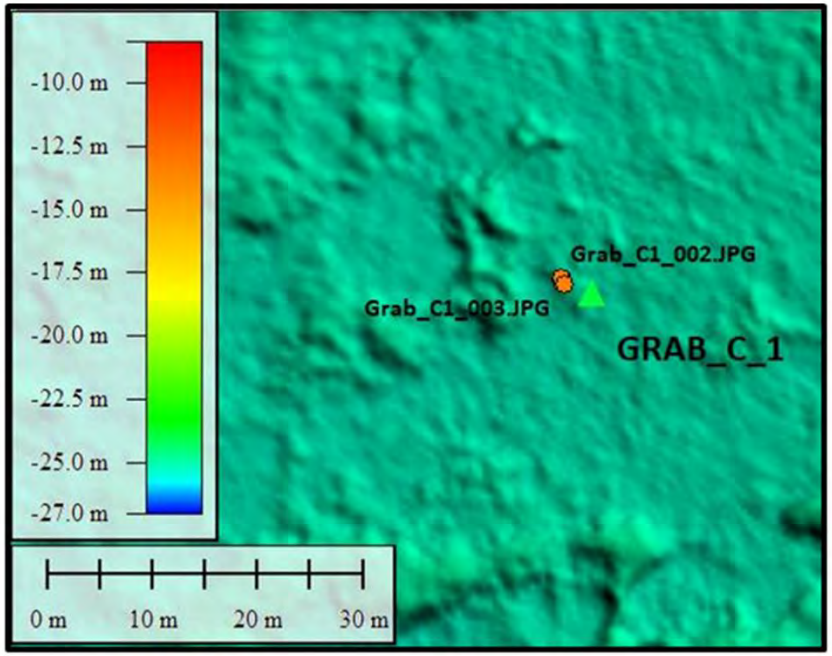


Photo Position: 0 mE, 0 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_02

Survey Area: N5a Cable Route

No. of Stills: 5 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Area of variable reflectivity.

Sediment Description
Coarse sand.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Liocarcinus* sp. **Mollusca:** *Loligo vulgaris* . **Echinodermata:** *Asterias rubens* (Common starfish).

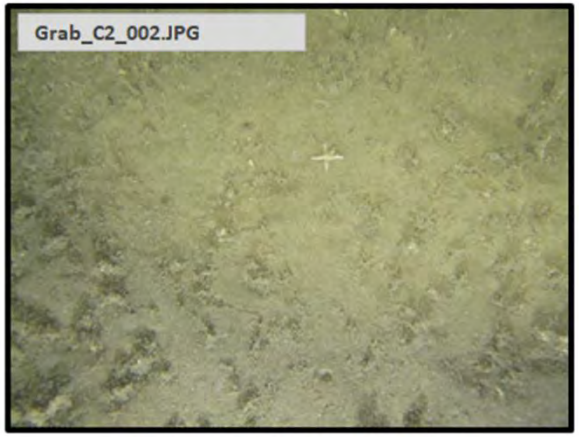


Photo Position: 723594 mE, 5954423 mN

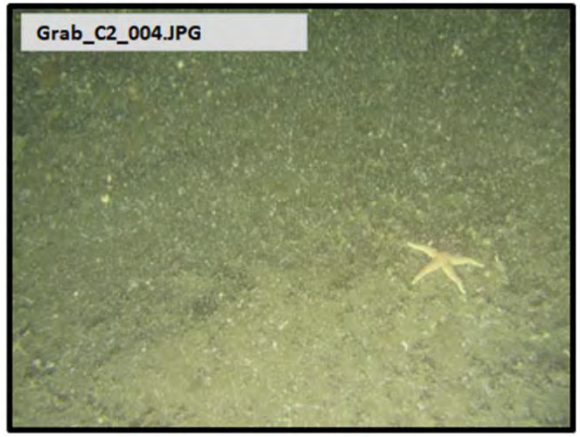


Photo Position: 723594 mE, 5954423 mN

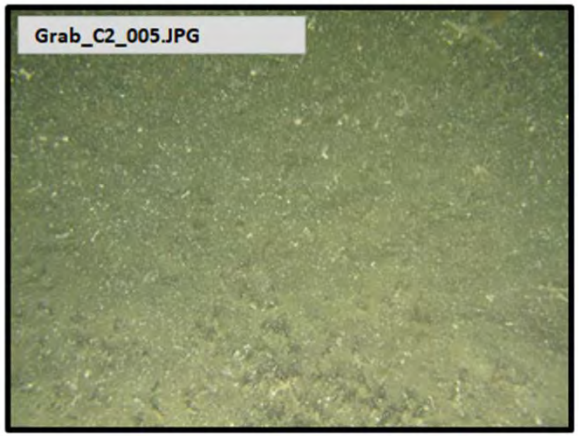


Photo Position: 723596 mE, 5954422 mN

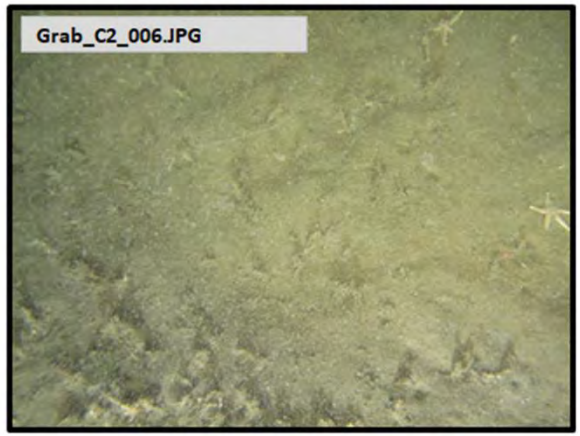
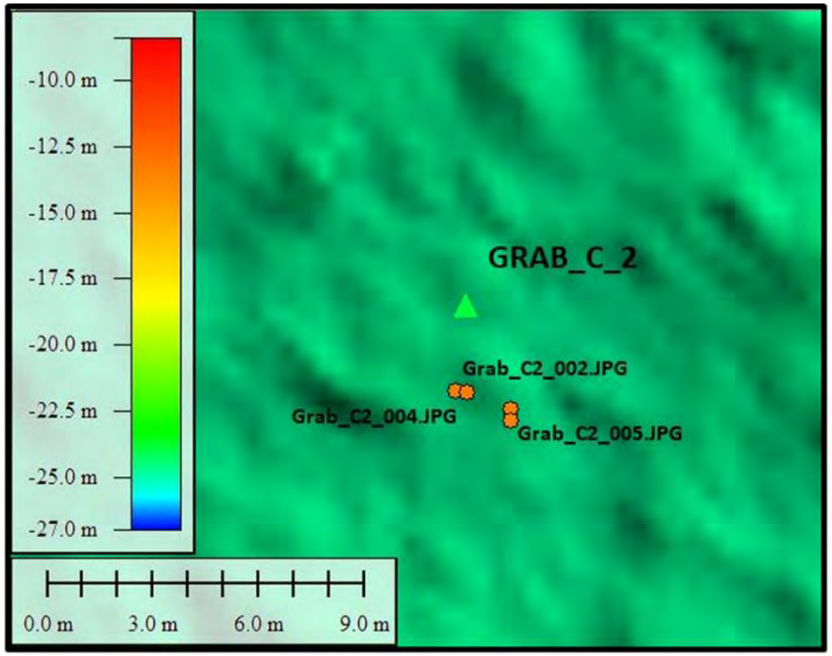


Photo Position: 723596 mE, 5954422 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_03

Survey Area: N5a Cable Route

No. of Stills: 8 **Mins of Video: 3** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand ripples with small shell fragments.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Liocarcinus* sp. **Echinodermata:** *Asterias rubens* (Common starfish).

Photo Position: 724589 mE, 5954311 mN

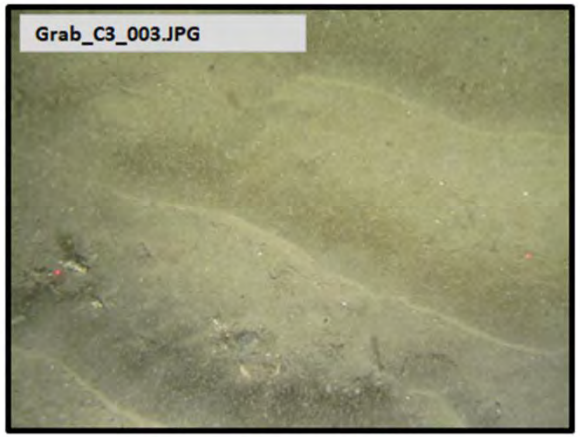
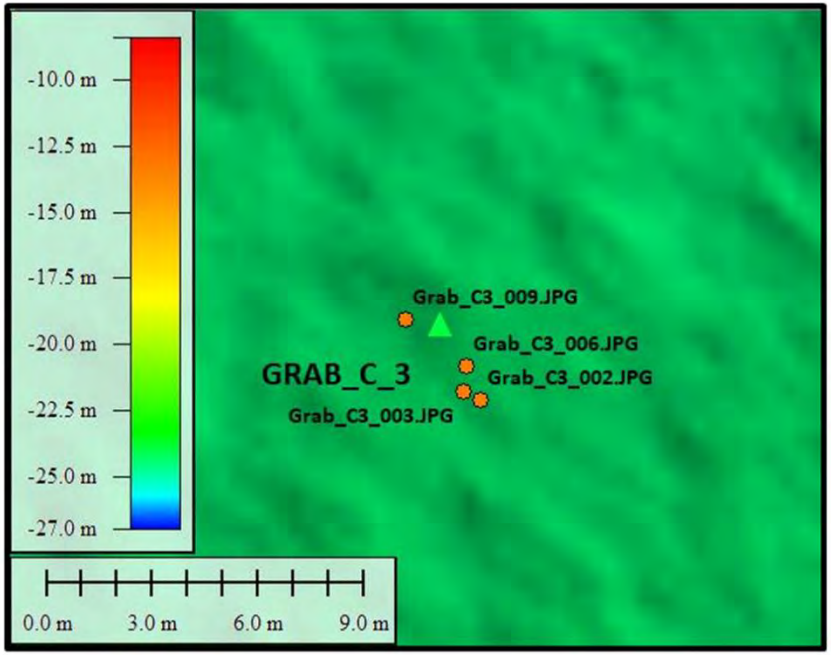


Photo Position: 724589 mE, 5954311 mN

Photo Position: 724589 mE, 5954312 mN

Photo Position: 724587 mE, 5954313 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_04

Survey Area: N5a Cable Route

No. of Stills: 9 **Mins of Video: 3** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand ripples with small shell fragments.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** Decapoda sp. **Echinodermata:** *Asterias rubens* (Common starfish).

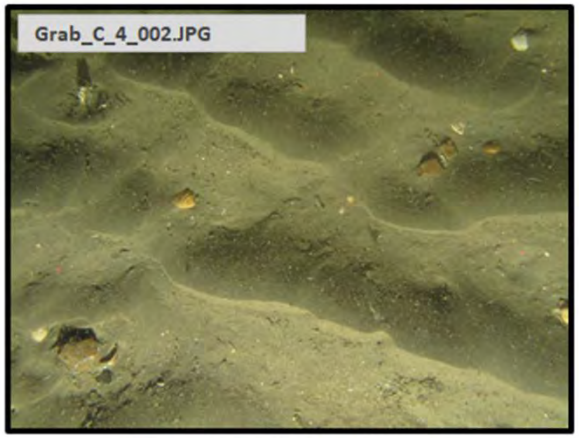


Photo Position: 725582 mE, 5954199 mN

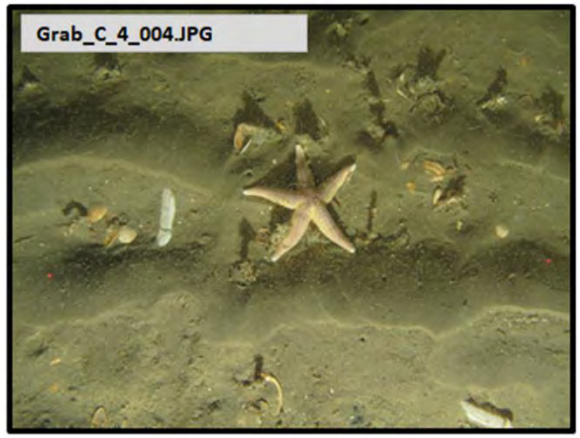


Photo Position: 725583 mE, 5954200 mN

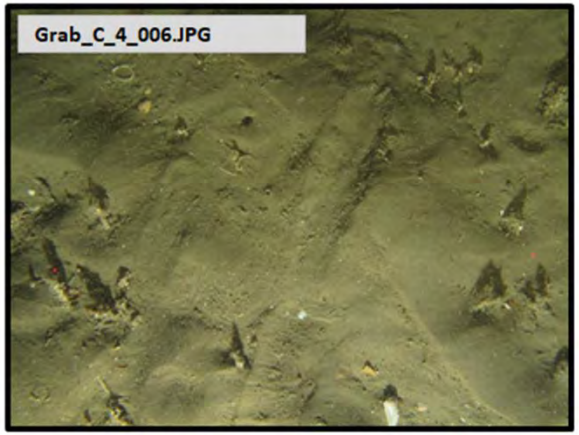
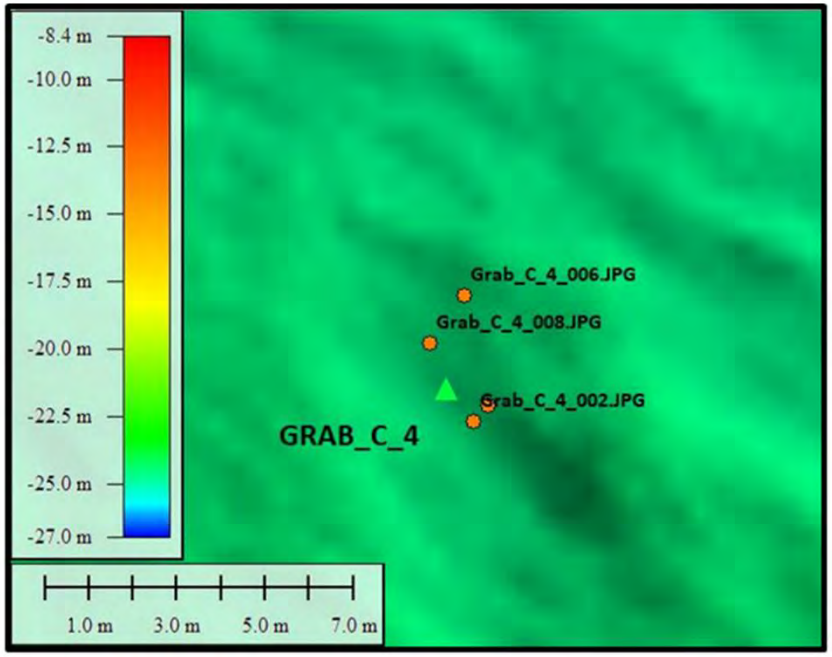


Photo Position: 725582 mE, 5954202 mN



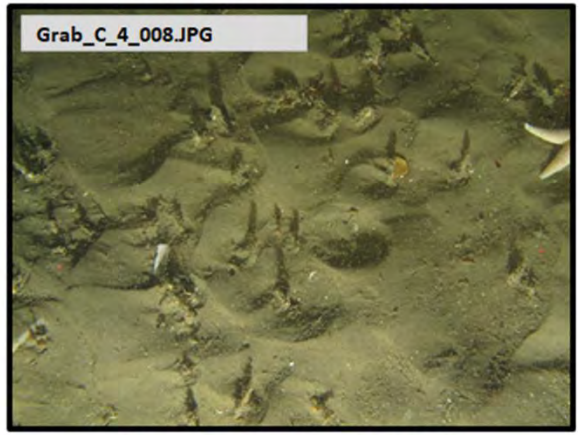


Photo Position: 725581 mE, 5954201 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_05

Survey Area: N5a Cable Route

No. of Stills: 9 **Mins of Video: 3** **Track Length: DDV**

Site Selection Criteria

Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation

Low reflectivity.

Sediment Description

Coarse sand ripples with small shell fragments.

Conspicuous Fauna

Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** *Liocarcinus* sp. **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** possibly *Callionymus lyra* (Common dragonet).

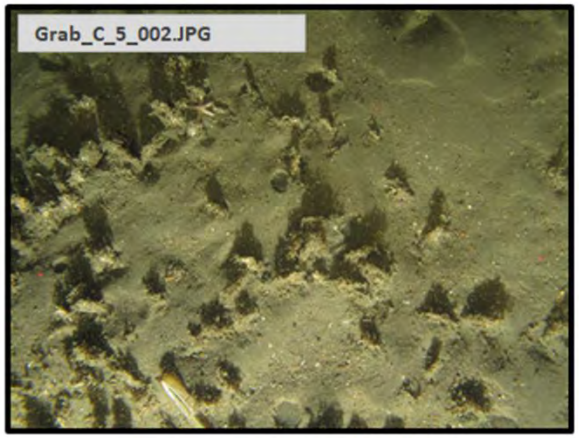


Photo Position: 726576 mE, 5954087 mN

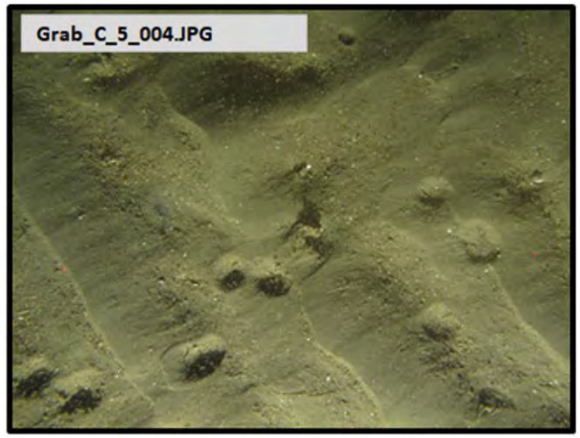


Photo Position: 726578 mE, 5954083 mN

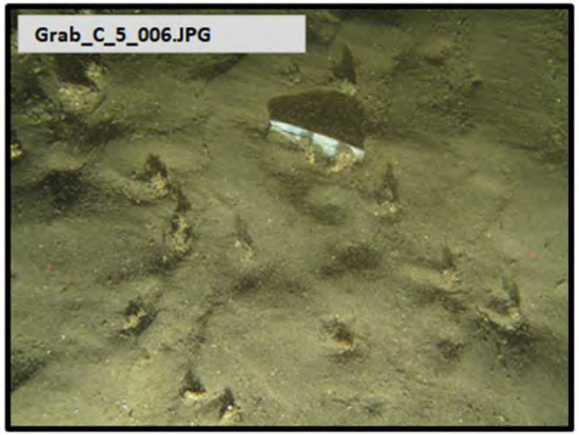


Photo Position: 726575 mE, 5954088 mN

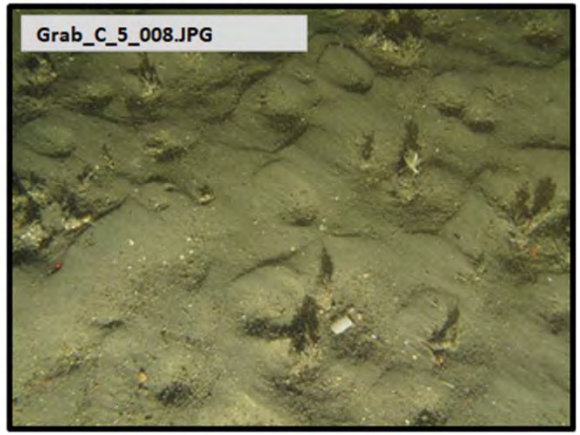
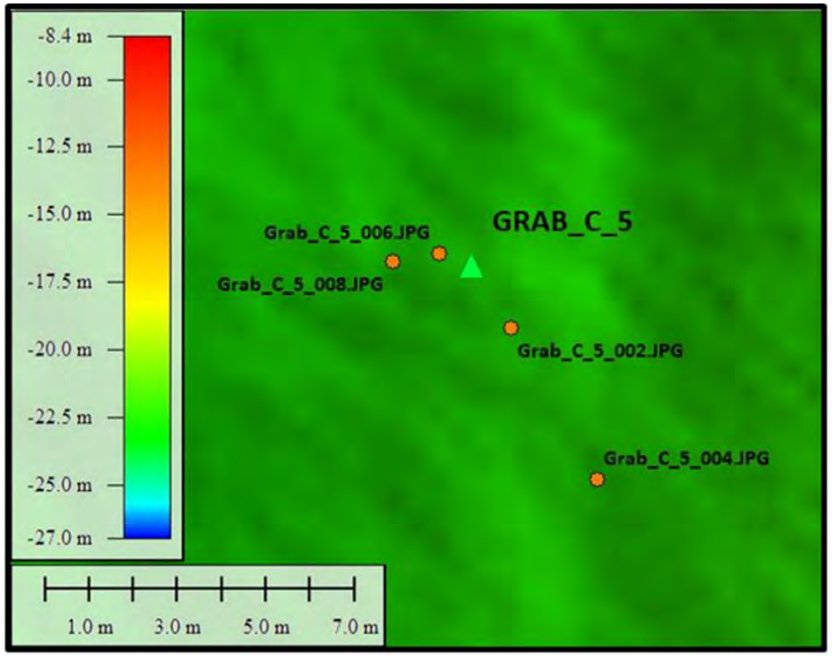


Photo Position: 726574 mE, 5954088 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_06

Survey Area: N5a Cable Route

No. of Stills: 4 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand ripples with small shell fragments that have accumulated within each sand furrow.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason).

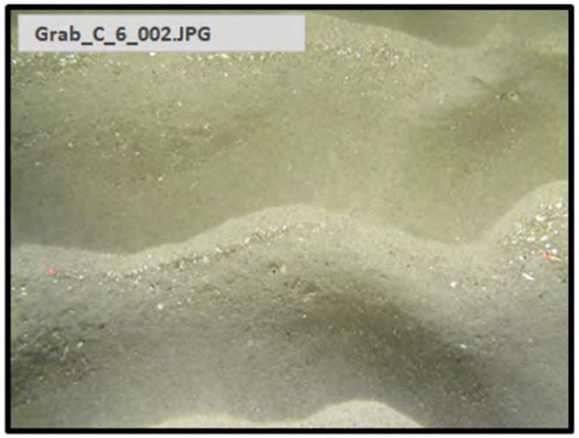


Photo Position: 727352 mE, 5954243 mN

Photo Position: 727352 mE, 5954243 mN

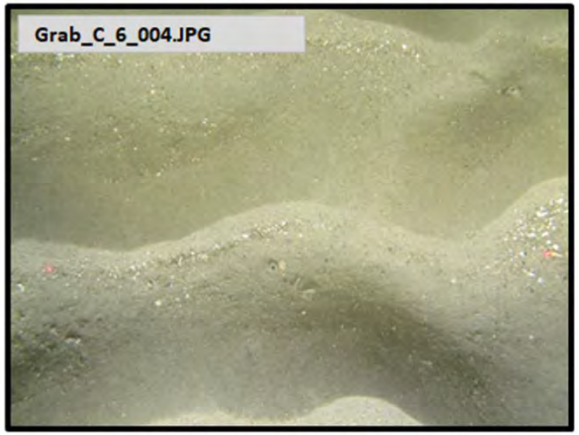


Photo Position: 727352 mE, 5954242 mN

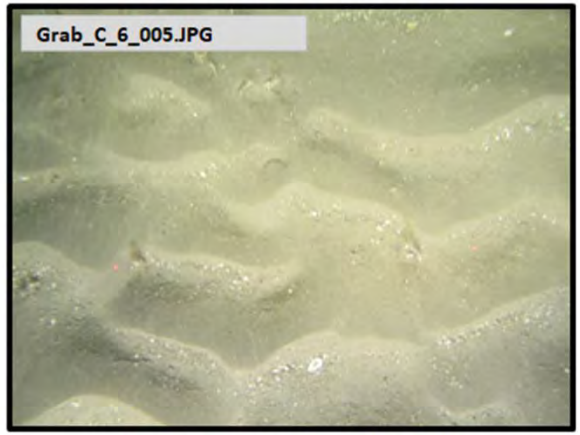
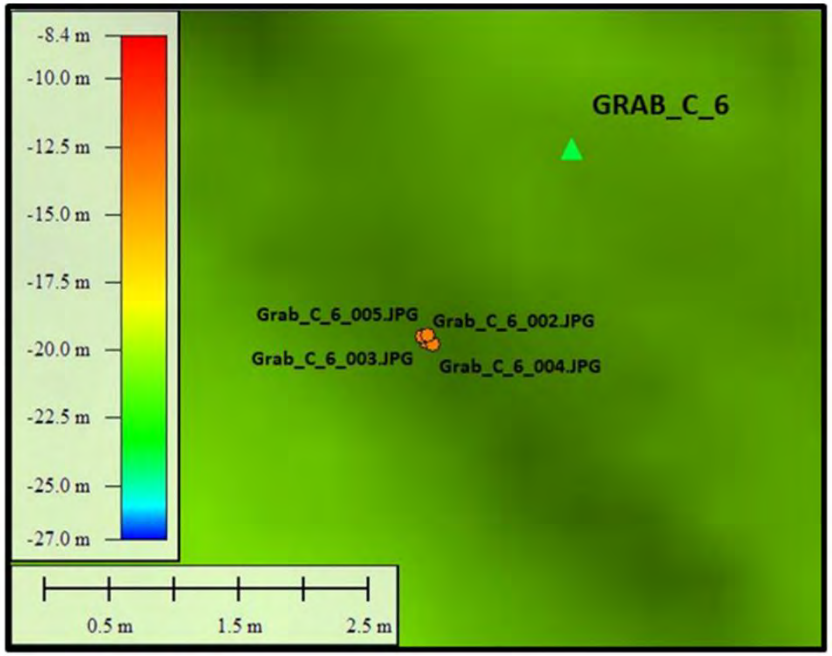


Photo Position: 727352 mE, 5954243 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_07

Survey Area: N5a Cable Route

No. of Stills: 5 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand ripples with small shell fragments that have accumulated within each sand furrow.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** *Asterias rubens* (Common starfish).

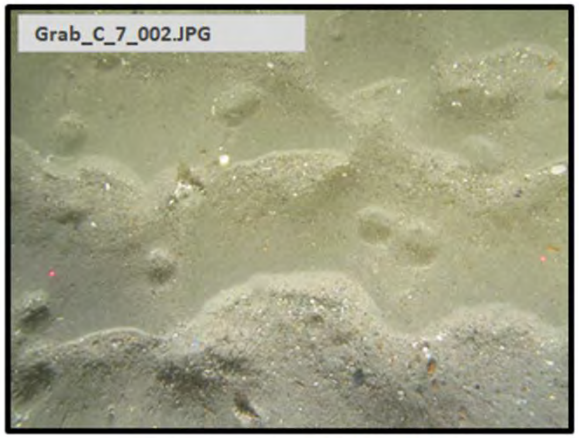


Photo Position: 728147 mE, 5954477 mN

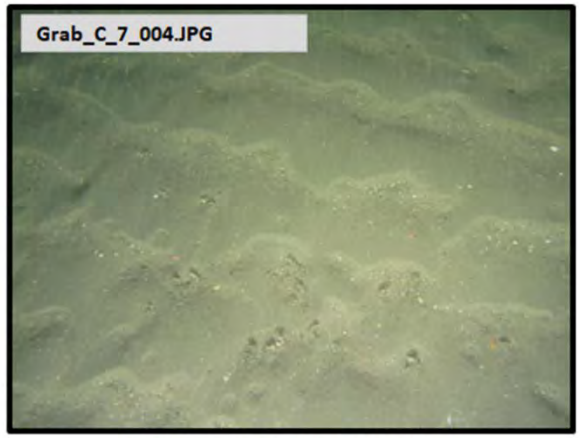


Photo Position: 728147 mE, 5954477 mN

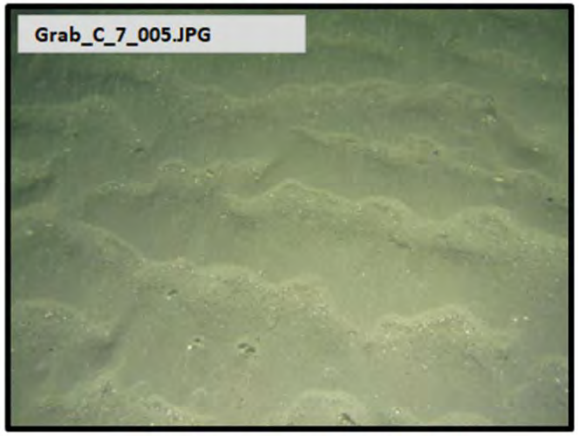


Photo Position: 728147 mE, 5954477 mN

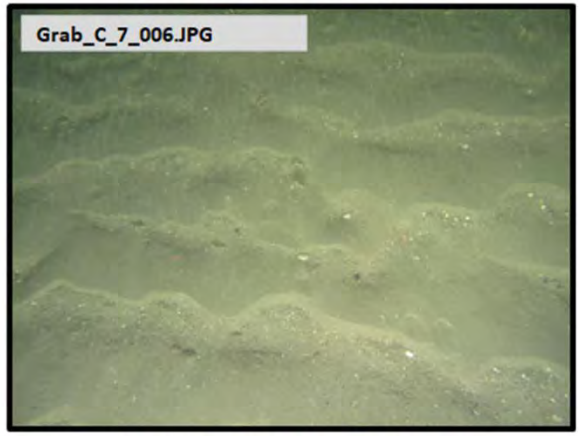
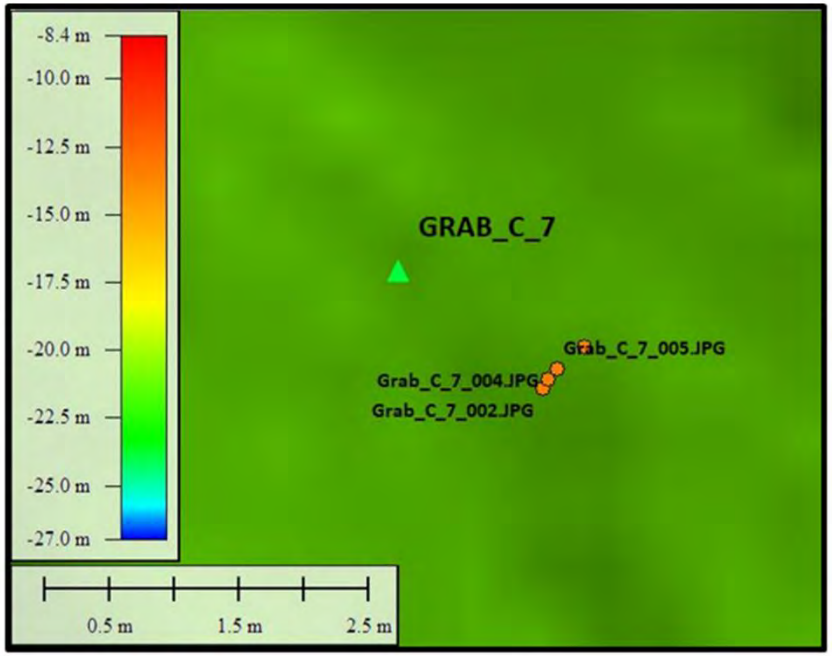
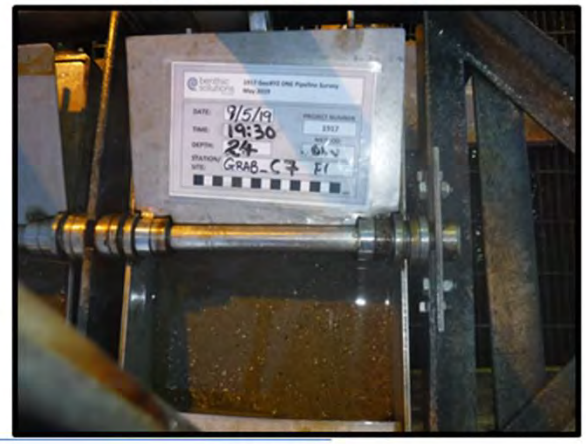


Photo Position: 728148 mE, 5954477 mN



Sediment Example Image



Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C_08

Survey Area: N5a Cable Route

No. of Stills: 5 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Original Cable Route – Positioned at 1km intervals.

Analogue Interpretation
Low reflectivity.

Sediment Description
Coarse sand ripples with small shell fragments that have accumulated within each sand furrow.

Conspicuous Fauna
Annelida: *Lanice conchilega* (Sand Mason). **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** Gobiidae sp.

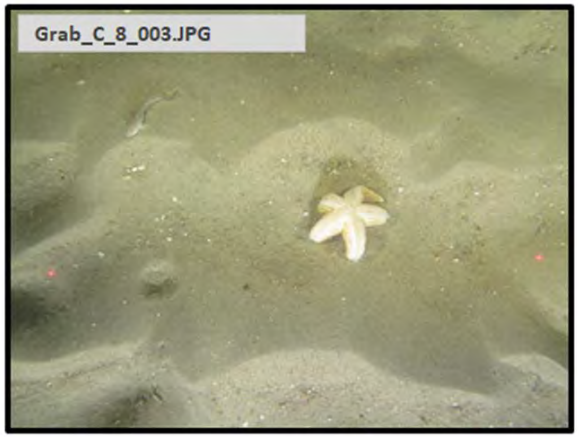


Photo Position: 729107 mE, 5954755 mN

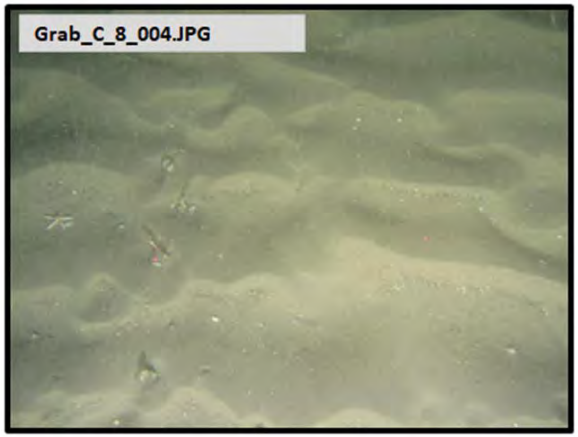


Photo Position: 729107 mE, 5954756 mN

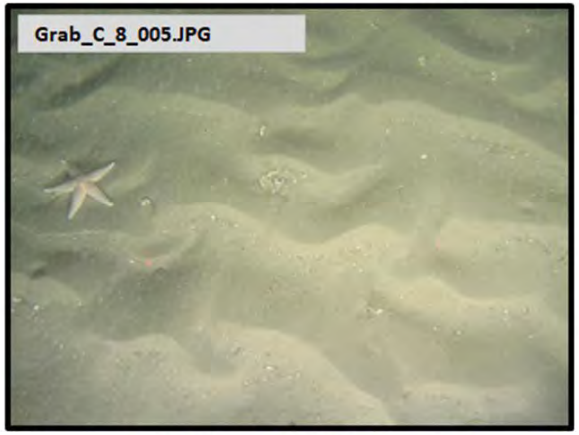
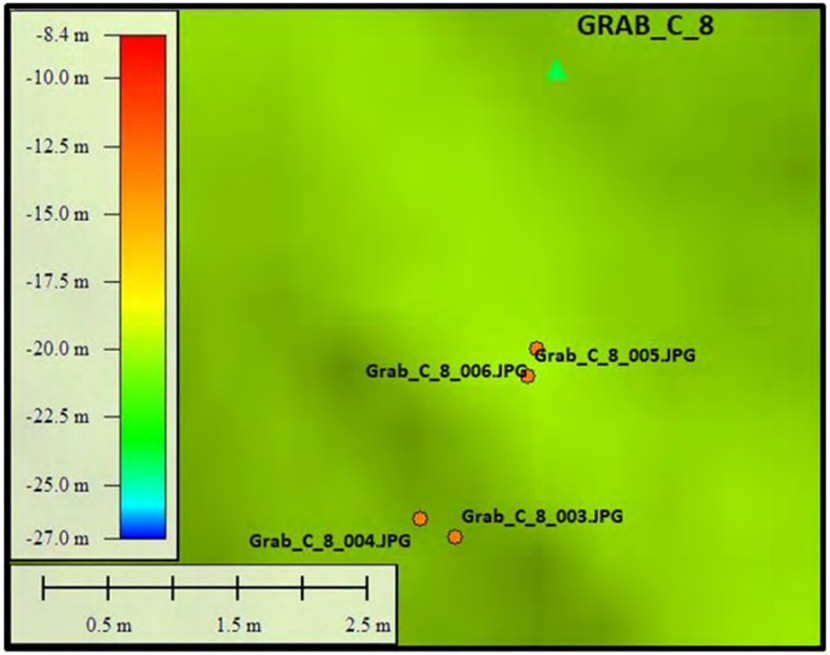


Photo Position: 729108 mE, 5954757 mN

Photo Position: 729108 mE, 5954757 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C3_0

Survey Area: N5a Cable Route

No. of Stills: 36 **Mins of Video: 9** **Track Length: 125m**

Site Selection Criteria

Secondary Cable Route and N5a second potential well centre location.

Analogue Interpretation

No analogue data.

Sediment Description

Coarse sand ripples with small shell fragments that have accumulated within each sand furrow.

Conspicuous Fauna

Annelida: *Lanice conchilega* (Sand Mason). **Arthropoda:** Decapoda sp., *Corystes cassivelaunus* (Masked crab). **Echinodermata:** *Asterias rubens* (Common starfish), *Ophiura* sp. **Chordata:** Gobiidae sp. , *Ammodytes* sp. (Sand eel).

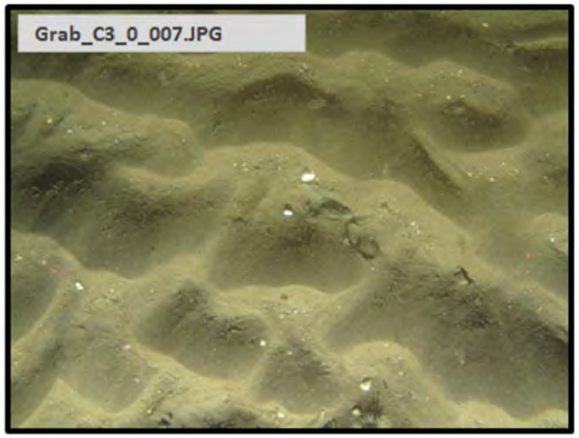


Photo Position: 722245 mE, 5952995 mN

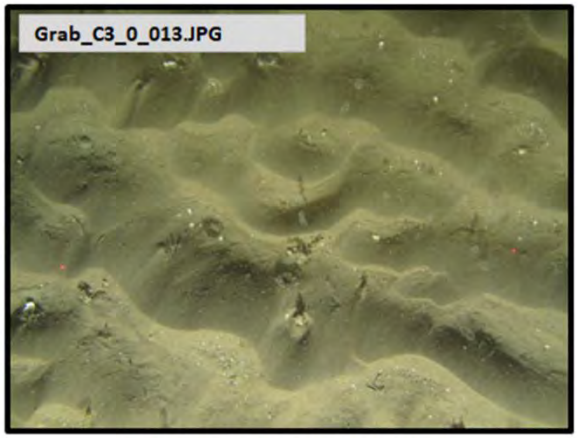


Photo Position: 722260 mE, 5953002 mN

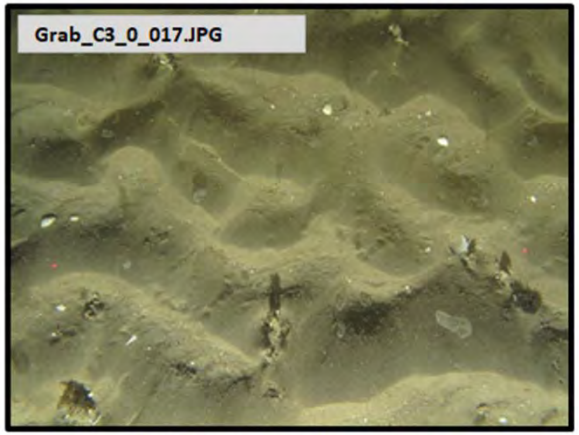
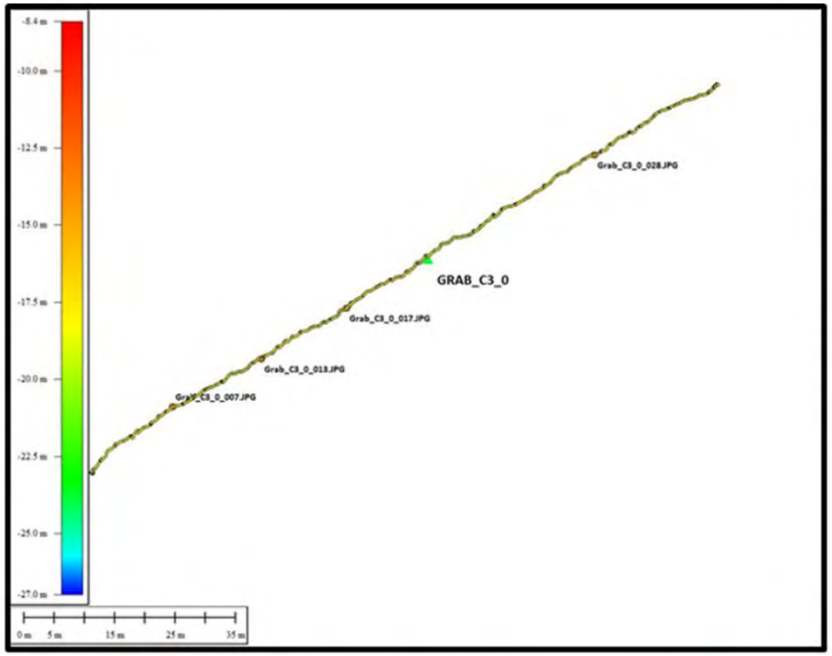


Photo Position: 722274 mE, 5953011 mN



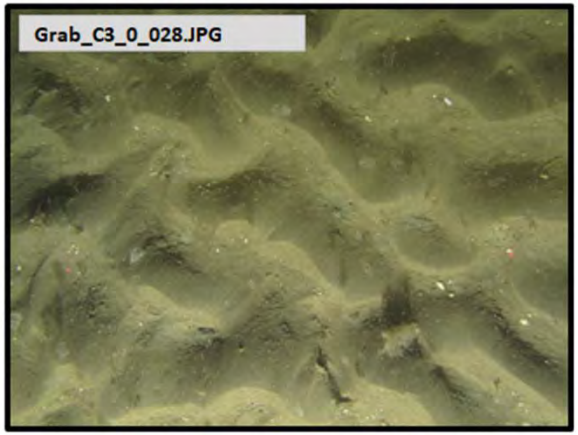


Photo Position: 722315 mE, 5953036 mN

Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C3_01

Survey Area: N5a Cable Route

No. of Stills: 7 **Mins of Video: 1** **Track Length: DDV**

Site Selection Criteria
Secondary Cable Route – Positioned to investigate mixed reflectivity sediment.

Analogue Interpretation
No analogue data.

Sediment Description
Coarse shelly sand with partly buried cobbles and slight sand waves.

Conspicuous Fauna
Echinodermata: *Asterias rubens* (Common starfish). **Chordata:** Pleuronectiformes sp.

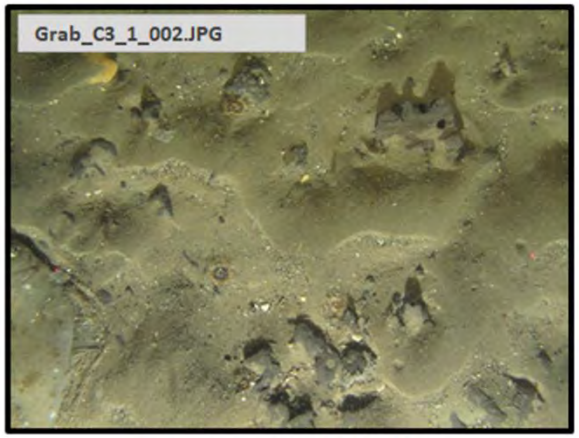


Photo Position: 723807 mE, 5953379 mN

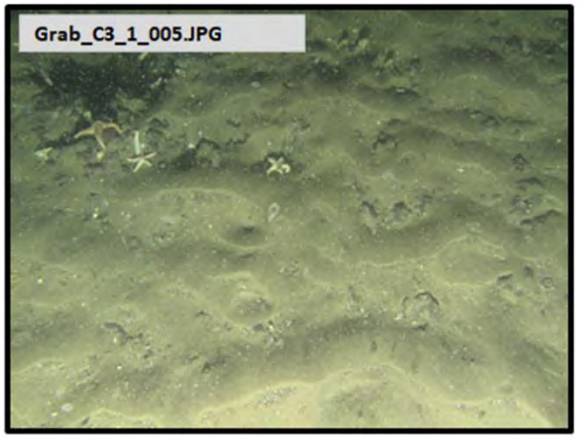


Photo Position: 723807 mE, 5953379 mN

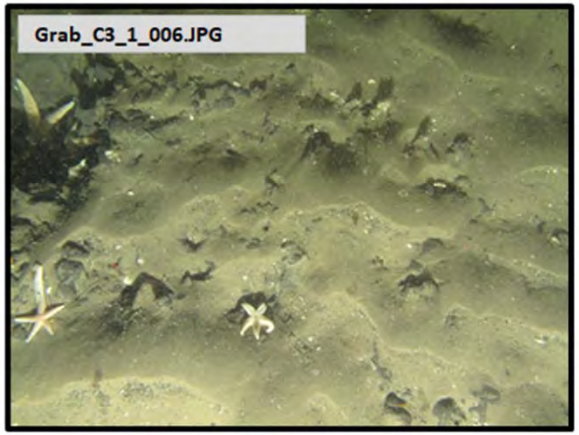


Photo Position: 723808 mE, 5953379 mN

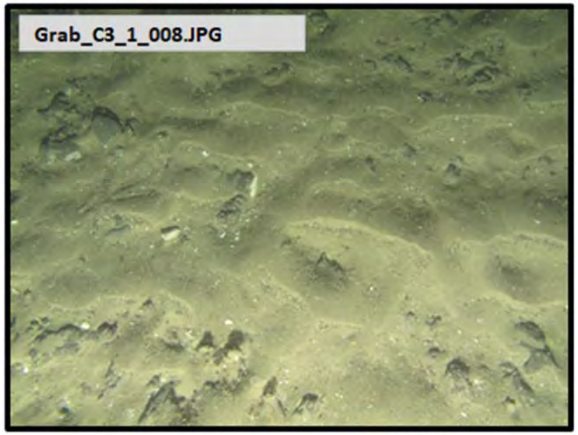
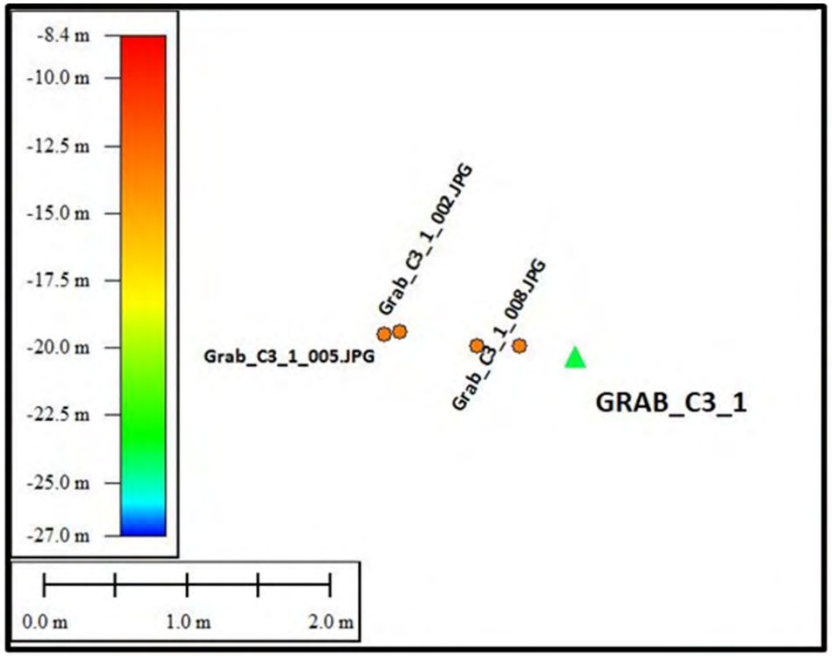


Photo Position: 723808 mE, 5953379 mN



Sediment Example Image

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: Grab_C3_02

Survey Area: N5a Cable Route

No. of Stills: 37 **Mins of Video: 13** **Track Length: 180m**

Site Selection Criteria

Secondary Cable Route – Positioned to investigate high reflectivity sediment.

Analogue Interpretation

Area of variable reflectivity, scarring on seabed (analogue data only available for half of camera line).

Sediment Description

Gravelly and shelly coarse sand.

Conspicuous Fauna

Cnidaria: *Metridium senile* (Plumose Anemone), Actiniaria sp., Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Cancer pagurus* (Edible crab), Paguridae sp., Decapoda sp., Liocarcinus sp. **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** possibly *Callionymus lyra* (Common dragonet), *Ammodytes* sp. (Sand eel), Pleuronectiformes sp.

Photo Position: 725364 mE, 5953617 mN

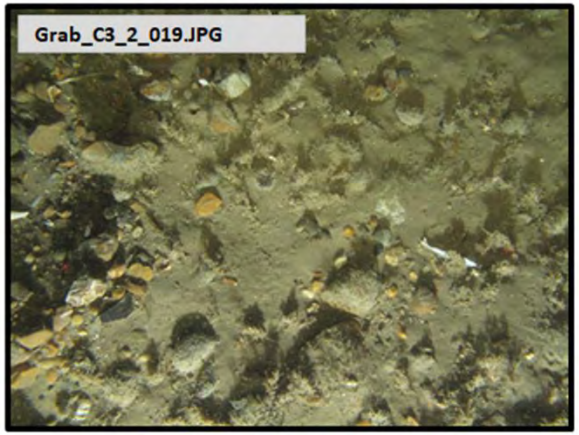


Photo Position: 725352 mE, 5953671 mN

Sediment Example Image

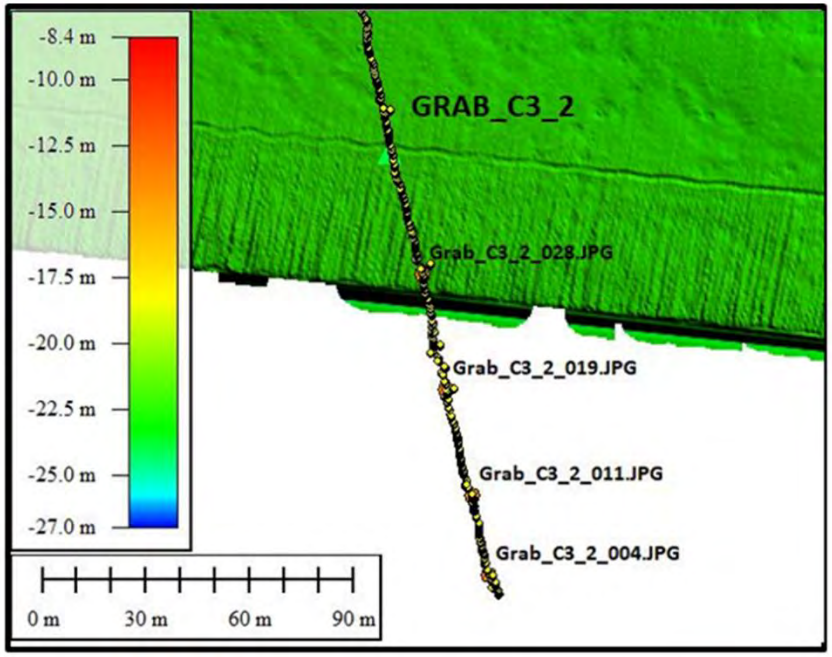


Photo Position: 725359 mE, 5953640 mN

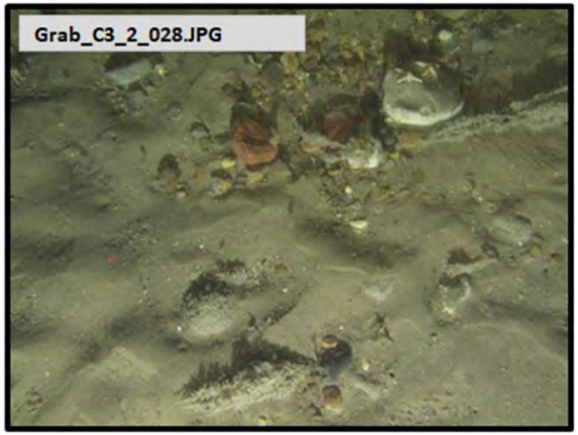


Photo Position: 725345 mE, 5953704 mN

Sieved Sample Image

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: North Transect 1

Survey Area: N5a

No. of Stills: 30 **Mins of Video: 10** **Track Length: 135m**

Site Selection Criteria
Investigating transition from mixed to high reflectivity sediment.

Analogue Interpretation
Area of higher, variable reflectivity with many raised areas.

Sediment Description
Slightly gravelly/shelly coarse sand forming irregular ripples or *Lanice conchilega* aggregations.

Conspicuous Fauna
Cnidaria: Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Cancer pagurus* (Edible crab), *Pagurus bernhardus* (Common hermit crab), Paguridae sp., *Liocarcinus* sp., Brachyura sp., *Cancer maenus* . **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** *Limanda limanda* (Dab), Pleuronectiformes sp., Actinopterygii sp.

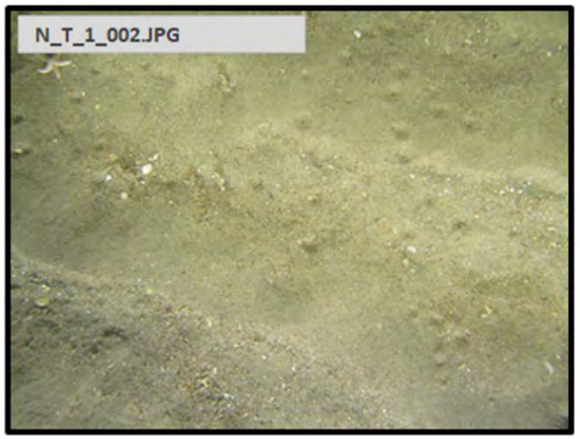


Photo Position: 721487 mE, 5954680 mN

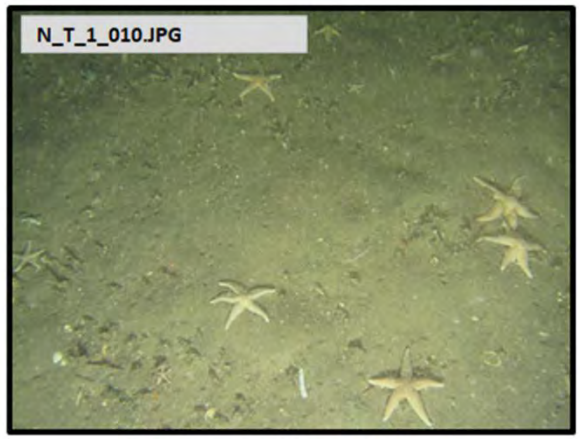


Photo Position: 721453 mE, 5954668 mN

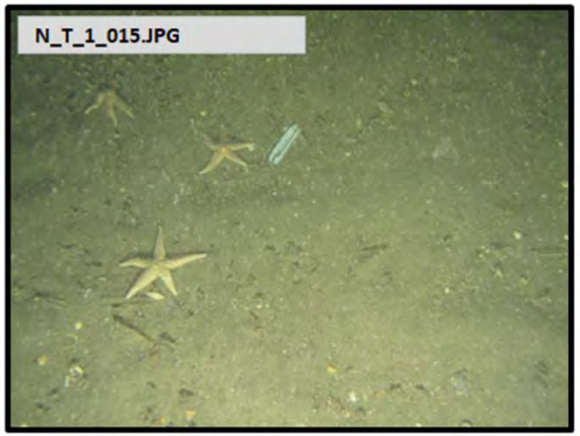


Photo Position: 721432 mE, 5954659 mN

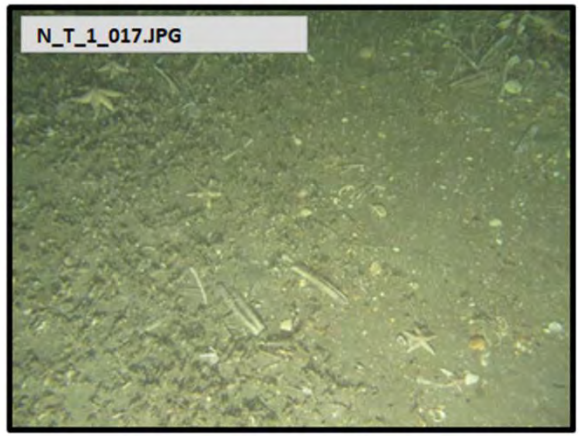


Photo Position: 721423 mE, 5954655 mN

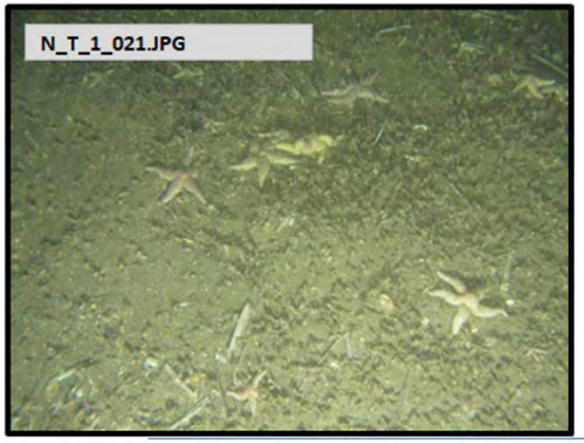


Photo Position: 721406 mE, 5954650 mN

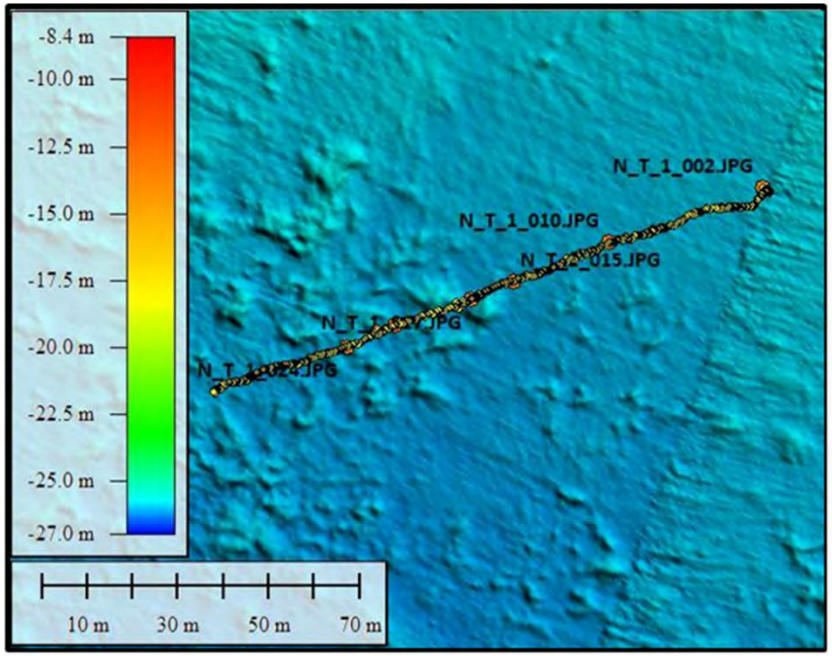


Photo Position: 721395 mE, 5954645 mN

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: North Transect 2

Survey Area: N5a

No. of Stills: 41 **Mins of Video: 13** **Track Length: 165m**

Site Selection Criteria

Investigating transition from low to mixed reflectivity sediment.

Analogue Interpretation

Area of higher, variable reflectivity with raised areas.

Sediment Description

Slightly gravelly/shelly coarse sand forming irregular ripples or *Lanice conchilega* aggregations.

Conspicuous Fauna

Cnidaria: Cerianthidae sp, Cerianthidae sp. **Annelida:** *Lanice conchilega* . **Arthropoda:** *Cancer pagurus* , *Pagurus bernhardus* , Paguridae sp., *Liocarcinus* sp., Brachyura sp., *Cancer maenus* . **Echinodermata:** *Asterias rubens* . **Chordata:** *Callionymus lyra* , Pleuronectiformes sp., Actinopterygii sp.

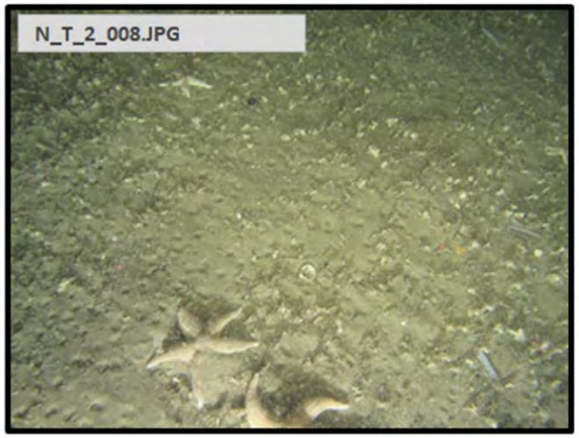


Photo Position: 721613 mE, 5955020 mN

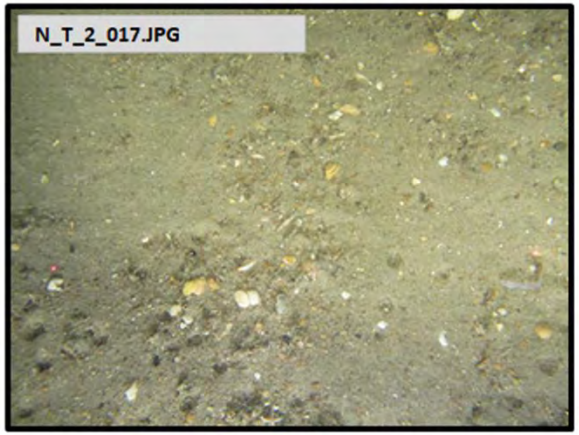


Photo Position: 721620 mE, 5955057 mN

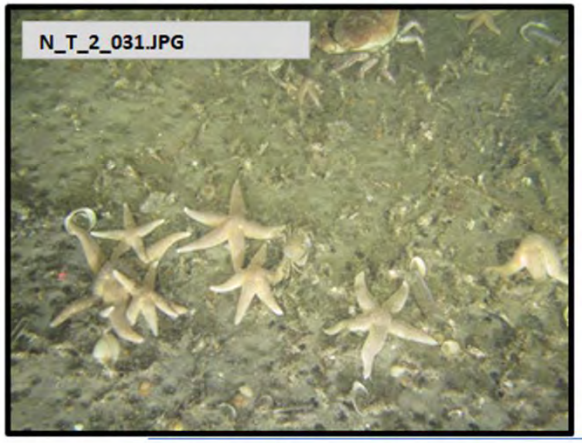
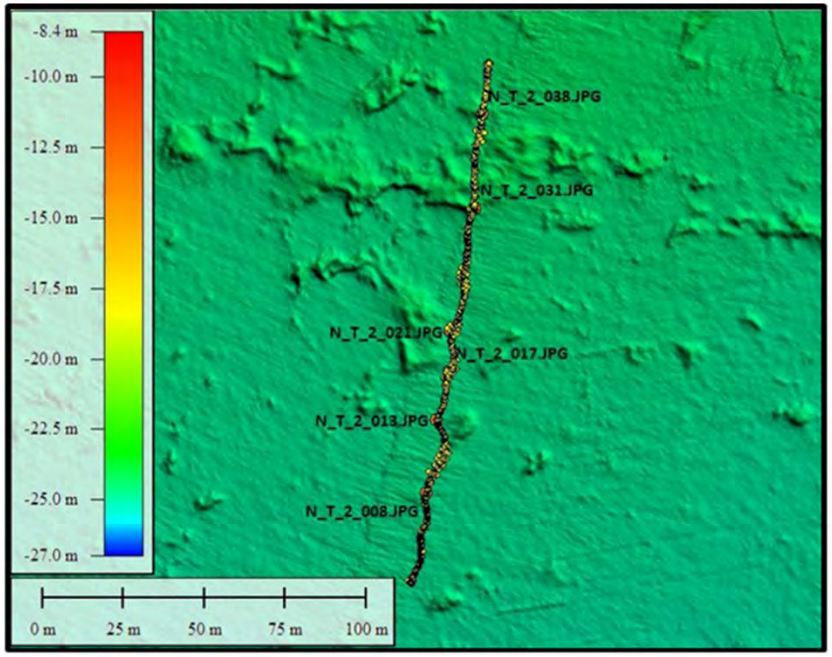


Photo Position: 721628 mE, 5955108 mN



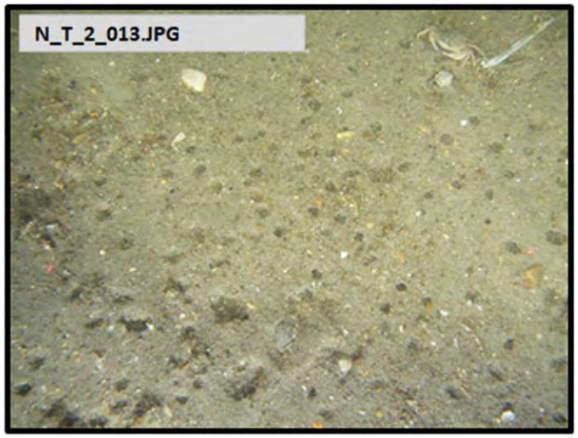


Photo Position: 721616 mE, 5955043 mN

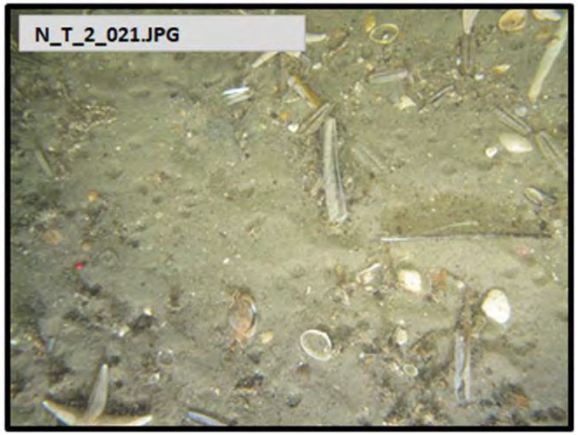


Photo Position: 721621 mE, 5955070 mN

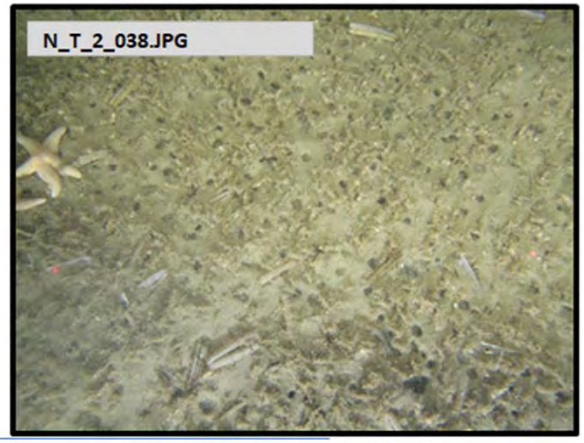


Photo Position: 721630 mE, 5955137 mN

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: North Transect 3

Survey Area: N5a

No. of Stills: 50 **Mins of Video: 13** **Track Length: 175m**

Site Selection Criteria

Investigating transition from mixed to high reflectivity sediment.

Analogue Interpretation

Area of variable reflectivity, some apparent scarring on seabed.

Sediment Description

Slightly gravelly/shelly coarse sand forming irregular ripples or Lanice conchilega aggregations.

Conspicuous Fauna

Cnidaria: *Metridium senile* (Plumose Anemone), Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Cancer pagurus* (Edible crab), *Pagurus bernhardus* (Common hermit crab), Paguridae sp., *Liocarcinus* sp., Brachyura sp., *Cancer maenus* . **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** *Callionymus lyra* (Common dragonet), Gobiidae sp., Pleuronectiformes sp., Actinopterygii sp., *Eutrigla gurnardus* (Grey gurnard).

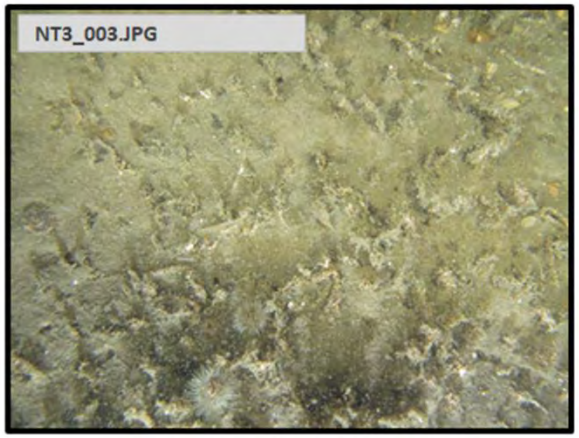


Photo Position: 721903 mE, 5954408 mN

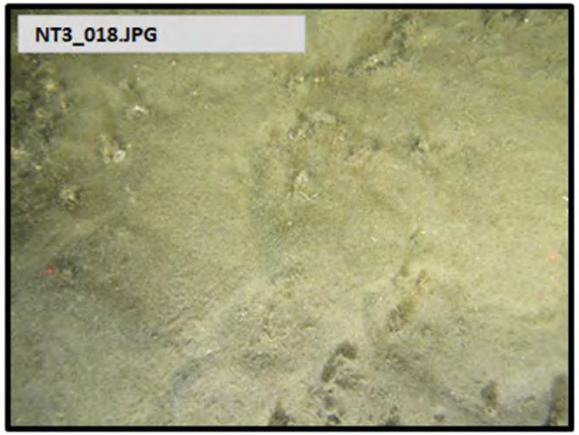
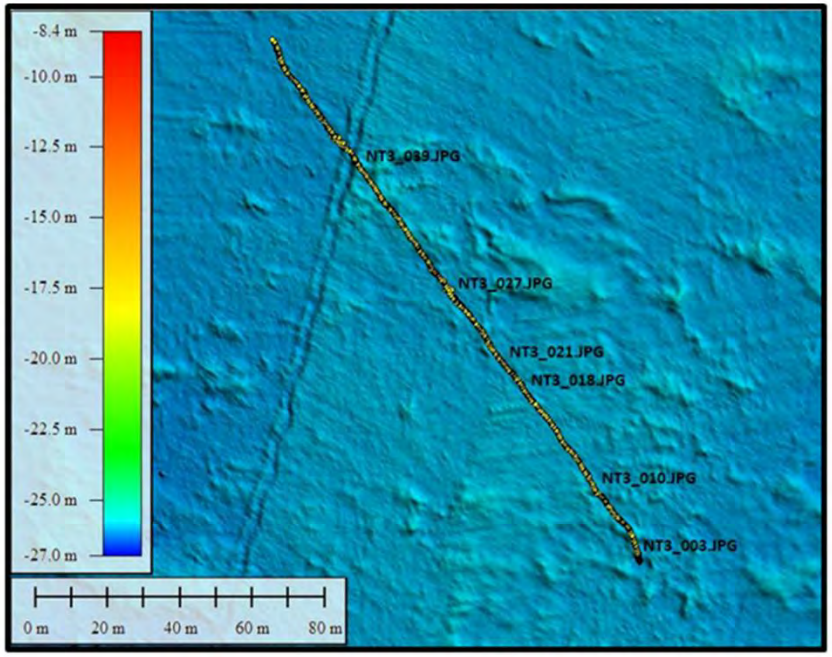


Photo Position: 721872 mE, 5954453 mN

Photo Position: 721852 mE, 5954480 mN



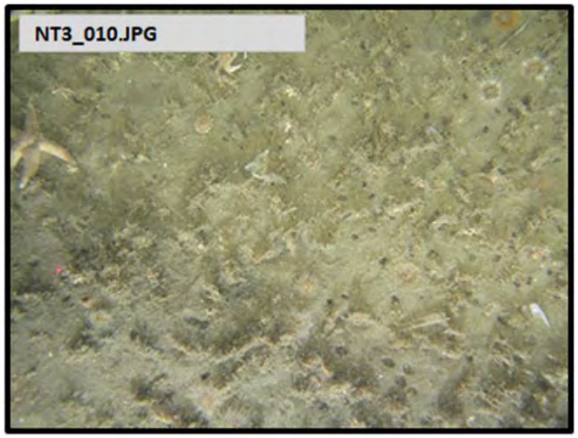


Photo Position: 721891 mE, 5954426 mN

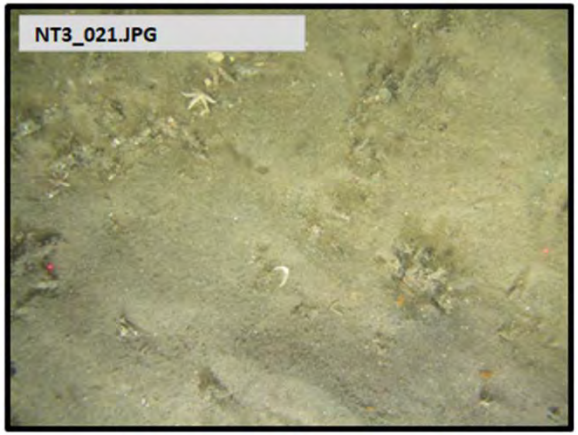


Photo Position: 721866 mE, 5954461 mN

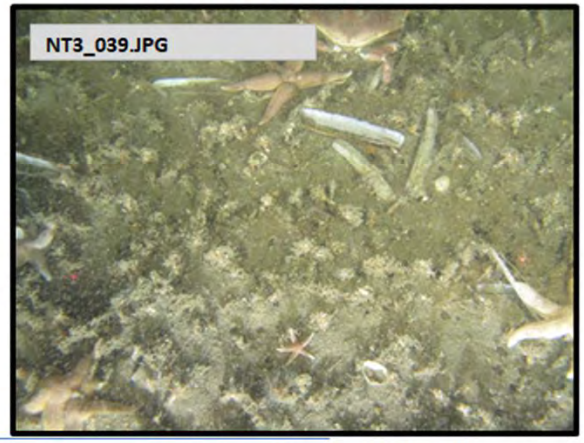


Photo Position: 721852 mE, 5954480 mN

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: N5a Transect 1

Survey Area: N5a

No. of Stills: 35 | Mins of Video: 9 | Track Length: 130m

Site Selection Criteria
Transect across original N5a well location.

Analogue Interpretation
Area of low reflectivity with some scarring.

Sediment Description
Slightly gravelly/shelly coarse sand.

Conspicuous Fauna
Cnidaria: *Metridium senile* (Plumose Anemone), Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Cancer pagurus* (Edible crab), Paguridae sp., *Liocarcinus* sp., Brachyura sp., *Cancer maenus* . **Mollusca:** *Sepiola* sp. **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** *Callionymus lyra* (Common dragonet), Pleuronectiformes sp., Actinopterygii sp., *Eutrigla gurnardus* (Grey gurnard).

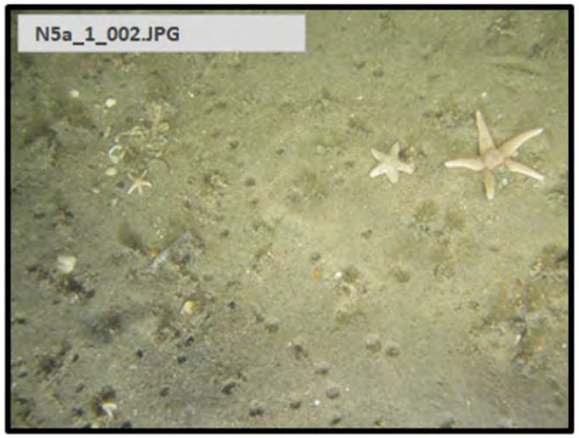


Photo Position: 721585 mE, 5954589 mN

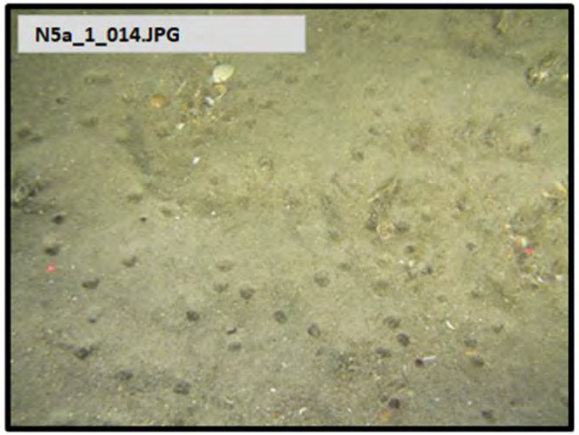


Photo Position: 721600 mE, 5954631 mN

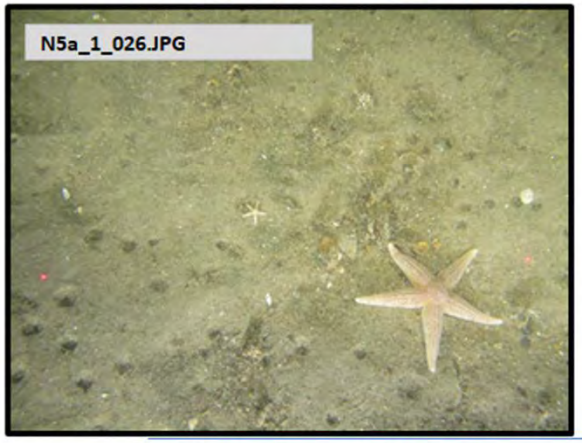
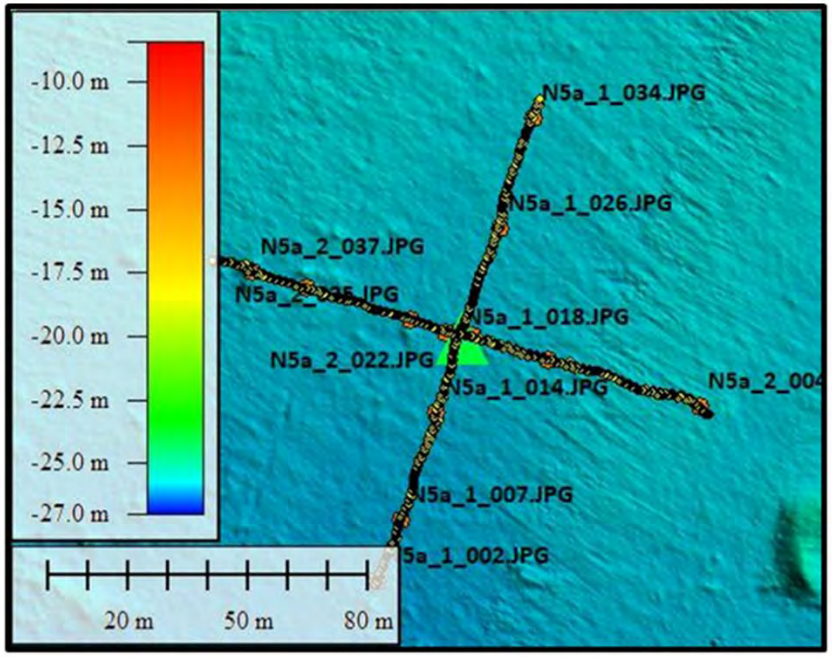


Photo Position: 721616 mE, 5954677 mN



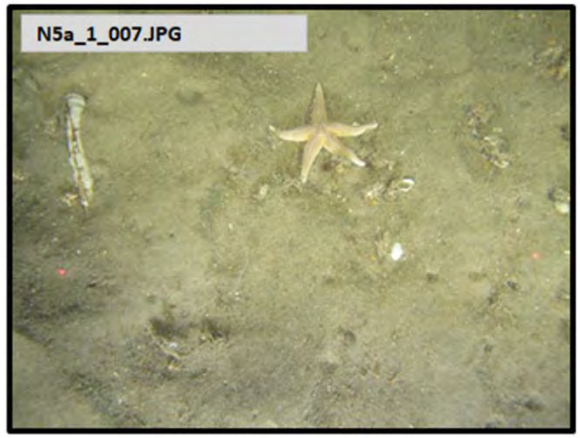


Photo Position: 721592 mE, 5954605 mN

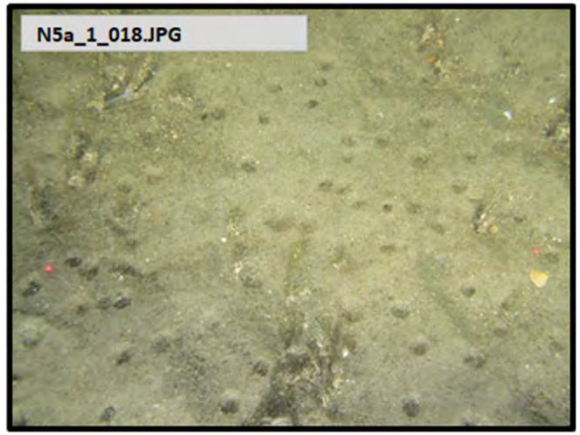


Photo Position: 721606 mE, 5954649 mN

Photo Position: 721625 mE, 5954705 mN

Grab Location | Camera Track | Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

Habitat Summary Information: N5a Transect 2

Survey Area: N5a

No. of Stills: 39 **Mins of Video: 9** **Track Length: 130m**

Site Selection Criteria

Transect across original N5a well location.

Analogue Interpretation

Area of low reflectivity with some scarring.

Sediment Description

Slightly gravelly/shelly coarse sand and aggregations of *Lanice conchilega* .

Conspicuous Fauna

Cnidaria: *Metridium senile* (Plumose Anemone), Cerianthidae sp. **Annelida:** *Lanice conchilega* (Sand Mason). **Arthropoda:** *Cancer pagurus* (Edible crab), Paguridae sp., *Liocarcinus* sp., Brachyura sp., *Cancer maenus* . **Echinodermata:** *Asterias rubens* (Common starfish). **Chordata:** *Callionymus lyra* (Common dragonet), Pleuronectiformes sp., Actinopterygii sp.

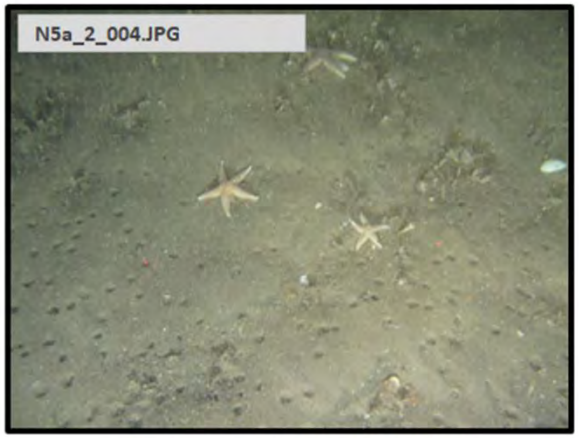


Photo Position: 721613 mE, 5955020 mN

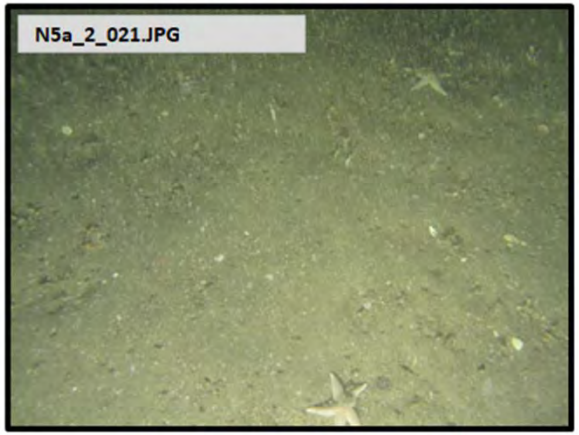


Photo Position: 721620 mE, 5955057 mN

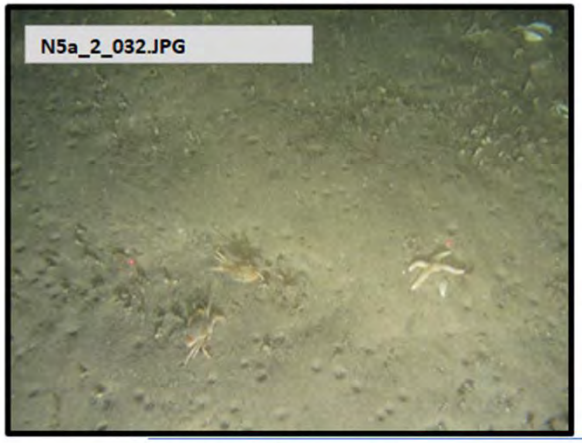
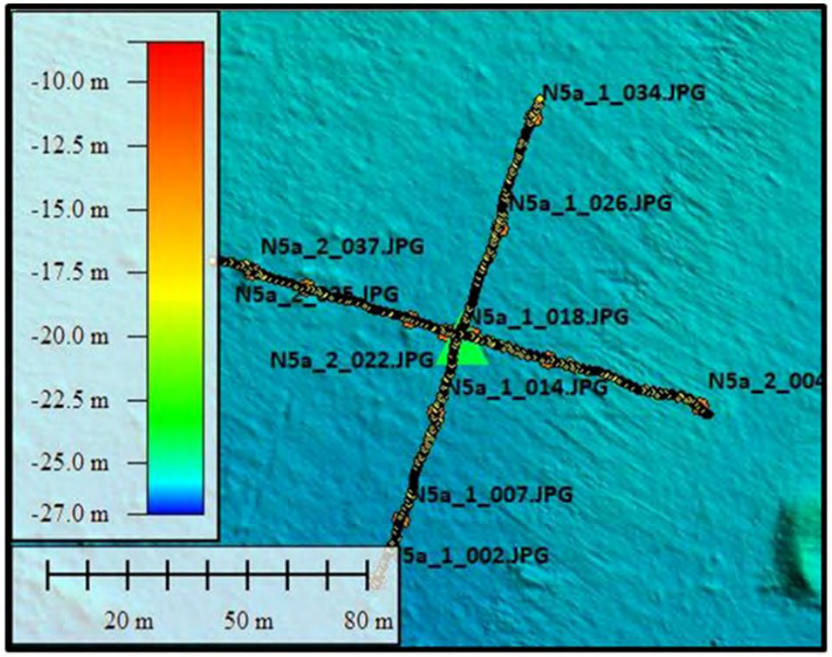


Photo Position: 721628 mE, 5955108 mN



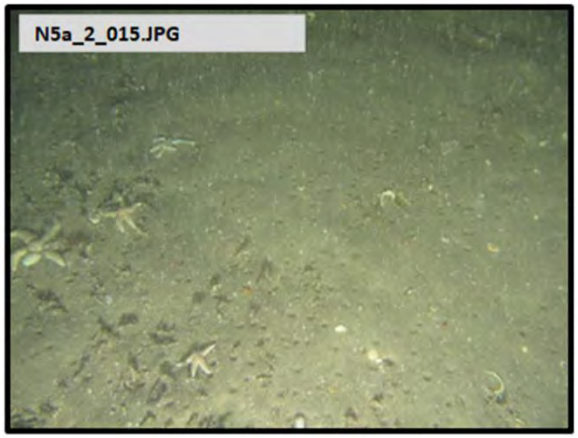


Photo Position: 721616 mE, 5955043 mN

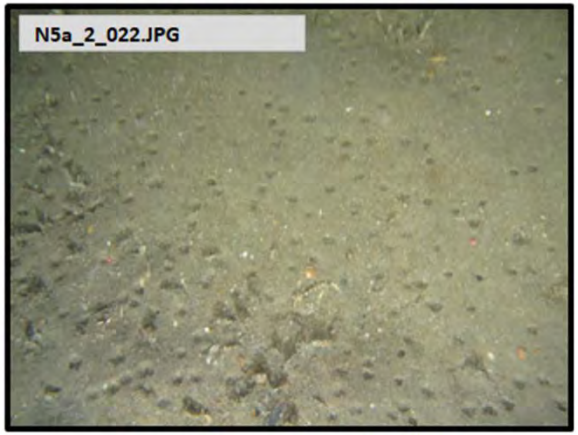


Photo Position: 721621 mE, 5955070 mN

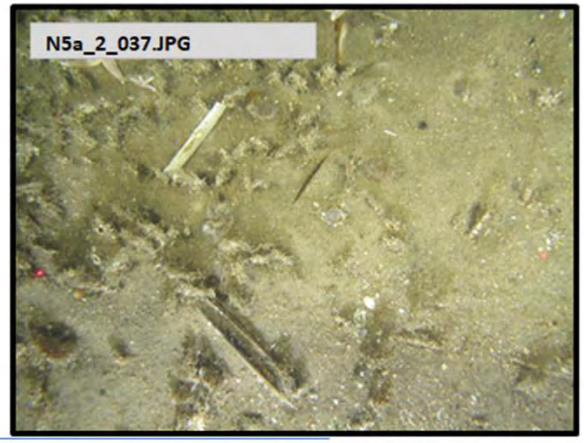


Photo Position: 721630 mE, 5955137 mN

Grab Location Camera Track Selected Underwater Still

Geodetic Infomation: Datum: ED50 Projection: UTM Zone: 31 North Central Meridian: 3° East

APPENDIX I – SERVICE WARRANTY

This report, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with you, our client. If used in other circumstances, some or all of the results may not be valid and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult Benthic Solutions Limited. Please note that all charts, where applicable should not be used for navigational purposes.