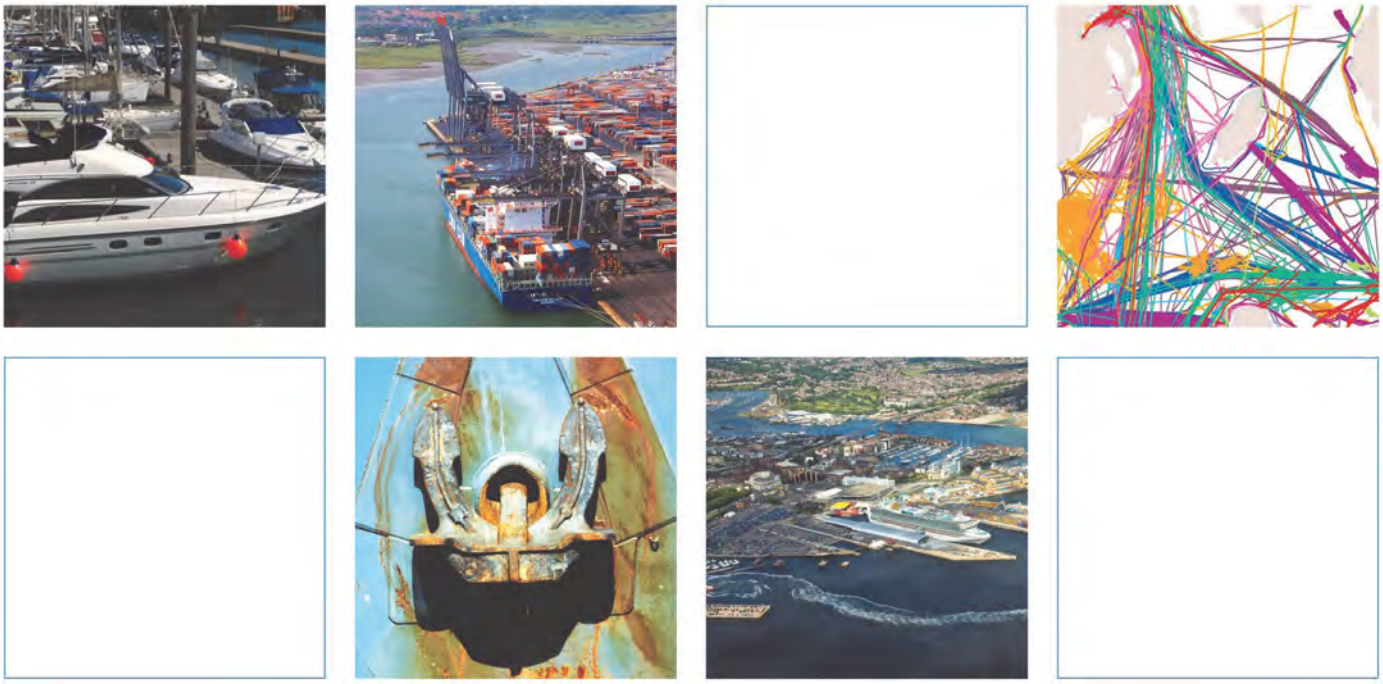
Appendix 7.1 Marine Biodiversity Survey Report

RPS

Fishguard Ferry Port Marine Ecology Surveys

Baseline surveys for the proposed linkspan works

January 2018



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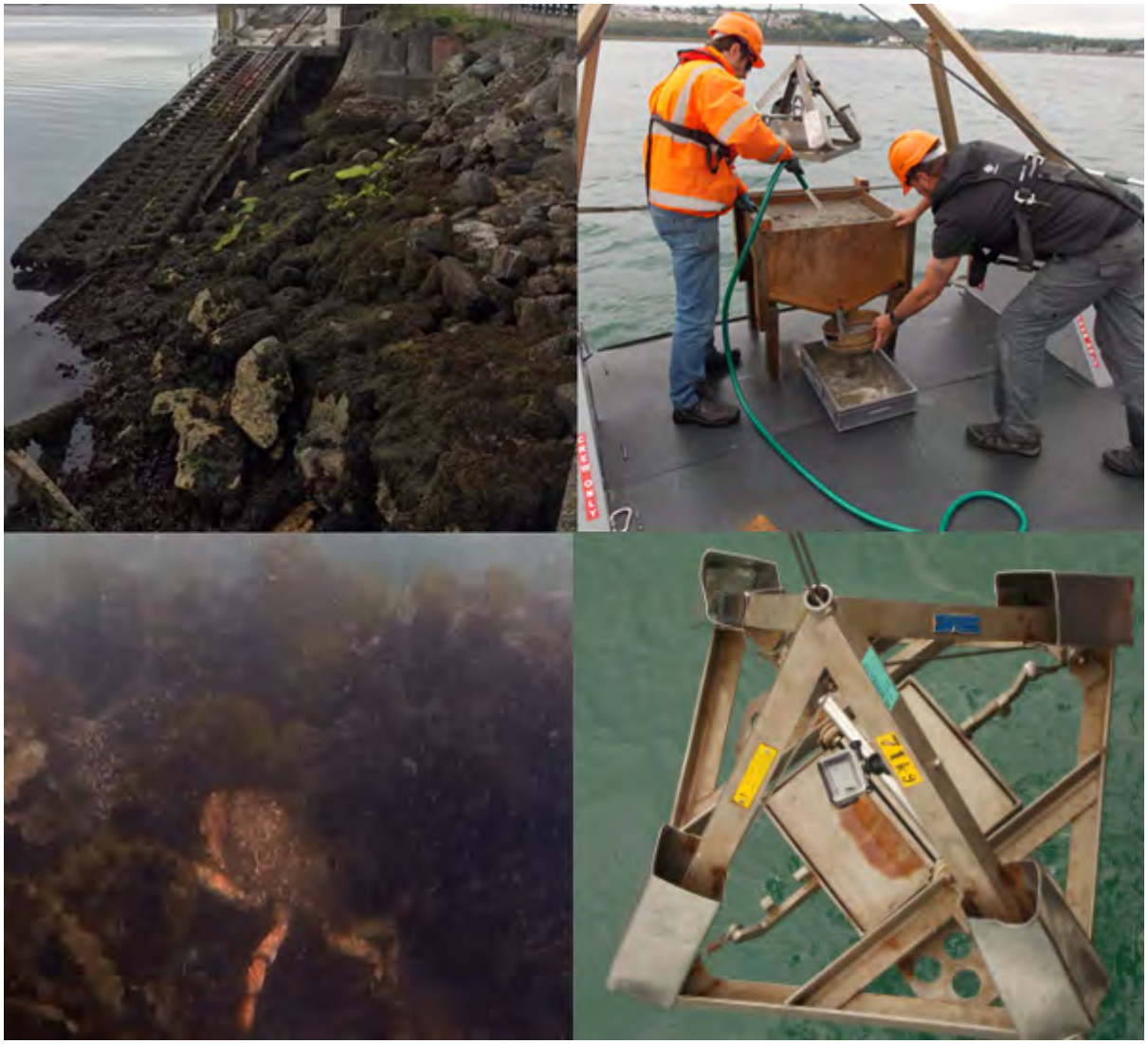

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	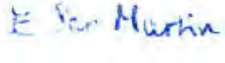	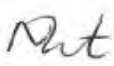

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1 Introduction

This report has been prepared by ABPmer for RPS. It reviews the baseline marine ecological characteristics of the foreshore and subtidal habitat directly within and nearby to the proposed linkspan works at Fishguard Ferry Port (Image 1). The specific objectives of the survey were to achieve the following:

- Map and describe the benthic marine habitats and species that could be impacted by the proposed development; and
- Confirm the presence and distribution of any rare species or protected habitats in the area.

The surveys involved the following components:

- Intertidal Habitat Survey: Habitat mapping of the intertidal zone of the foreshore in the vicinity of the works; and
- Subtidal Habitat Survey: Grab sampling and drop-down video survey of the subtidal habitats in the vicinity of the proposed works.

Further details of the methodologies used for the surveys are provided below in Section 2. The results of the surveys are presented in Section 3 and overall conclusions provided in Section 4.

Image 1. View of part of the foreshore within the survey area

2 Methodology

2.1 Intertidal habitat survey

The Phase 1 intertidal habitat survey was undertaken on 26 June 2017 and was scheduled to coincide with an equinoctial Spring tidal period. The survey approach was based on the standardised Phase 1 mapping methodology as detailed in the Marine Monitoring Handbook, Procedural Guidance No 3-1 (Wyn and Brazier, 2001) and CCW Handbook for Marine Intertidal Phase 1 Survey and Mapping (Wyn *et al.*, 2000). The survey area extended from approximately 70 m south of the old lifeboat jetty to just north of the existing linkspan (see Figure 1).

Figure 1. Extent of the intertidal habitat survey at Fishguard Harbour

Habitats in the area were mapped using a Garmin Global Positioning System (GPS) (average accuracy ±5 m) as polygons using the using the Marine Habitat Classification for Britain & Ireland (MHCBI) 04.05 to biotope class levels 4 or 5 (Conner *et al.,* 2004). Biotopes, or other notable features, covering less than 5 m^2 were recorded using referenced target notes. Following the completion of the survey, the biotope extents across the area were mapped into Geographical Information System (GIS) layers using ArcGIS and using positional information derived from the GPS readings.

2.2 Subtidal habitat survey

The subtidal habitat survey involved two discrete elements. For shallow infralittoral rocky areas along the rock armour and jetty structures, a high definition (HD) Go Pro camera was mounted on a pole and lowered underwater from the foreshore at representative locations within the survey area (Image 2). This survey element was undertaken coincident with the intertidal habitat survey (Section 2.1).

Soft sediment habitat was surveyed through benthic grab sampling. The subtidal grab sampling survey was undertaken on the 27 June 2017. The sampling methods followed the procedures outlined in the Recommended Operational Guidelines (ROG) for Grab Sampling and Sorting and Treatment of Samples (Guerra and Freitas, 2013) and the Marine Monitoring Handbook, Procedural Guideline No 3-9 (Thomas, 2000).

A 0.1 m^2 Day Grab was used to collect sediments samples from six stations (Figure 2). In addition, a Go Pro camera was mounted on the grab to collect wider information about sedimentary conditions and also evidence of epifaunal species (Image 3)

Image 2. Pole mounted Go Pro camera used for shallow subtidal survey

Image 3. Go Pro camera mounted on a 0.1 m^2 Day Grab.

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Figure 2. Location of grab sample stations and results of the habitat mapping survey

At each sample location, two grab samples were collected. One grab sample was collected for infaunal invertebrate analysis. The other grab sample was collected for Particle Size Analysis (PSA) and Total Organic Content (TOC) analysis.

The sediment collected from the infaunal grab sample was washed through two sieves with mesh sizes of 5 mm and 1 mm (Image 3). Sedimentary material and organisms retained were photographed on the respective sieves before being combined in a sample bucket and sent to the laboratory for faunal analysis.

Image 4. Sieving grab samples

At each site up to three attempts were made to retrieve a suitable sample (i.e. a grab containing sufficient volume of sediment for analysis). The sediment depths within the grab which were used for sample acceptance were a minimum of 7 cm for muddy or soft sediments and 5 cm for hard packed or coarse sediments. Anything less than these values was only retained if no other viable sample was collected.

The PSA and TOC sediment samples were placed into bags and then in appropriately labelled containers and sent to the National Laboratory Service (NLS) for analysis. The faunal samples were sent to Seastar Survey Ltd. laboratory for processing.

2.3 Laboratory analysis

The benthic faunal processing was conducted according to the methods set out in Davies *et al.* (2001) and involved washing the sediment through a 500 µm mesh sieve and then temporarily preserving the sample in 5 % formosaline solution. The fauna were then sorted from the sieve residue using a low power binocular microscope. All of the macroinfaunal specimens were identified to species level (where practicable) and enumerated. This work was undertaken in adherence with ISO 16665 standards and the National Marine Biological Analytical Quality Control (NMBAQC) Scheme Guidelines.

The PSA sample analysis was undertaken using the NMBAQC standardised methodology. The analysis was carried out using a Mastersizer laser diffractor which produces detailed sedimentary profiles for fine sediments (clay, sand and silts). The TOC analysis was carried out using an elemental analyser.

3 Results

The habitats and species recorded as part of the intertidal and subtidal surveys are presented in Section 3.1 and Section 3.2 respectively. The extent of the different biotopes mapped as part of the survey is shown in Figure 2.

3.1 Intertidal habitat survey results

This section has been structured so that habitats recorded on the lower shore are described first, followed by mid-shore habitats and finally those habitats observed on the upper shore.

3.1.1 Lower shore habitats

The extreme lower shore was characterised by fronds of oarweed *Laminaria digitata*, red seaweeds (such as Irish moss *Chondrus crispus)* and sea lettuce *Ulva lactuca* attached to large boulders and rubble. Species such as juvenile edible crabs *Cancer pagurus*, broad-clawed porcelain crab *Porcellana platycheles*, barnacles, the star ascidian *Botryllus schlosseri,* sea squirts such as *Aplidium nordmanni* and keel worms *Pomatoceros spp* were recorded under the boulders. Sponges such as *Hymeniacidon perlevis* were also attached to boulders and concrete pillars on the lower shore.

This biotope is most appropriately assigned to IR.MIR.KR.Ldig.Bo (*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders) (Image 5). The habitat recorded under the boulders in this area is characteristic of the UK Biodiversity Action Plan (BAP) Priority Habitat 'Intertidal Under boulder Communities' (UK Biodiversity Action Plan, 2008a). This habitat is also listed as a Habitat of Principal Importance in Wales under the Natural Environment and Rural Communities (NERC) Act 2006 Section 42.

Patches of serrated wrack were also present on the lower shore (LR.MLR.BF.Fser.R: *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock).

Image 5. Oarweed *Laminaria digitata* and boulders on the lower shore

3.1.2 Mid shore habitats

The lower mid shore was characterised by a zone of knotted wrack *Ascophyllum nodosum* covering boulders and quay wall structures in the area ((LR.LLR.F.Asc: *Ascophyllum nodosum* on very sheltered mid eulittoral rock) (Image 6). Above this habitat was spiralled wrack *Fucus spiralis* (LR.LLR.F.Fspi: *Fucus spiralis* on sheltered upper eulittoral rock). Barnacle species, the limpet *Patella vulgata,* the topshell *Gibbula umbilicalis* and periwinkles (such as the common periwinkle *Littorina littorea* and flat periwinkle *L. obtusata)* were recorded attached to rocks.

Image 6. Knotted wrack *Ascophyllum nodosum* and spiralled wrack *Fucus spiralis* on boulders and the old lifeboat jetty

3.1.3 Upper shore habitats

The channelled wrack *Pelvetia canaliculata* was recorded on the upper shore on quay wall structures along with barnacle species (LR.MLR.BF.PelB *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock) (Image 7). Above this zone, green algae and lichens are present (LR.FLR.Lic:Lichens or small green algae on supralittoral and littoral fringe rock).

Image 7. Channelled wrack *Pelvetia canaliculata* on the upper shore.

3.2 Sublittoral fringe and subtidal habitat survey results

3.2.1 Rocky habitat

The habitat along the sublittoral fringe and within the shallow infralittoral directly below the quayside and rock armouring consisted of large boulders and other hard substrate with fronds of sugar kelp *Saccharina latissima* (*Laminaria saccharina*) and oarweed *L. digitata* attached (IR.LIR.K.Lsac.Ldig: *Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock). Other algae recorded in this zone included dead man's rope *Chorda filum* and sea lettuce *U. lactuca* (Image 8). The light bulb sea squirt *Clavelina lepadiformis* was recorded attached to boulder structures.

Several small patches of sugar kelp *S. latissimi* were also present on the sand (SS.SMp.KSwSS.LsacR.S: *Laminaria saccharina* and filamentous red algae on infralittoral sand).

Large spider crabs *Maja brachydactylus* were also recorded in this area on both rocky and sandy habitats (Image 9).

Image 8. Sugar kelp *Saccharina latissima, sea lettuce U. lactuca* and red seaweeds in the shallow sublittoral.

Image 9. Spider crab *Maja brachydactylus* on subtidal muddy sand.

3.2.2 Sedimentary habitat

The results of the invertebrate faunal analysis are presented in Appendix A. The PSA outputs and results of the TOC analysis can be seen in Appendix B. Summary information on the sedimentary and ecological conditions at the sites based on these results are presented in Table 1.

The subtidal sediment habitat in the survey area consisted of slightly gravelly sand and muddy sand with OC in the samples ranging between 0.3 and 1 % (Table 1). Overall, the number of taxa found in the samples ranged from 21 (Station 4) to 66 (Station 6), and the number of individuals from 890 organisms per m^2 (Station 5) to 15,000 organisms per m^2 (Station 1). The range in total species biomass in the samples was between 16 and 188 grams per m^2 with the bivalve *Abra alba* contributing most to the total biomass at all stations (with the exception of Station 4 with the bivalve *Nucula hanleyi* contributing most to total biomass at this site).

The most abundant polychaete worms in the samples were surface deposit feeding bristleworm polychaetes such as *Aphelochaeta marioni, Chaetozone gibber* and *Mediomastus fragilis*. The white furrow shell *Abra alba* was the most abundant bivalve species recorded. This species was recorded in abundances of over 5000 m^2 at Station 1 and 3000 m^2 at Station 6. Other abundant bivalve species recorded in the samples included the wavy hatchet shell *Thyasira flexuosa*, basket shell *Corbula gibba*, *Nucula hanleyi* and *Kurtiella bidentata*. Brittlestars were also recorded at all the sites with *Amphiura filiformis* the most commonly recorded species. These marine species described above dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at the stations. In addition a range of crustaceans were recorded in the samples in low abundances including the common shrimp *Crangon crangon* and amphipods such as *Harpinia antennaria*.

Subtidal sediment habitat is most appropriately assigned to the biotope SS.SSa.CMuSa: Circalittoral muddy sand. This habitat is characterised by a wide variety of polychaetes, bivalves such as *A. alba* and *Nucula spp*, and echinoderms such as *Amphiura* spp (Conner *et al.,* 2004). Several small patches of sugar kelp *S. latissimi* were also present on the sand (SS.SMp.KSwSS.LsacR.S: *Laminaria saccharina* and filamentous red algae on infralittoral sand).

Many of the infaunal species recorded in the samples are considered tolerant to physical disturbance. For example, with respect to polychaete worms, *A. marioni* produces high number of offspring (laying up to 500 eggs on sediment) with sexual maturity reached in 1 year and *C. gibber* is an opportunistic species reaching sexual maturity in <1 year, with a short life-span and rapid growth rate. These are all attributes which promote high recoverability (Marine Ecological Surveys Limited, 2008).

With respect to bivalves, commonly recorded species such as *Abra* spp. are considered to recover rapidly following disturbance (Marine Ecological Surveys Limited, 2008). This is because the genus has a relatively short life-span of about 2-3 years and reaches sexual maturity in <1 year. It also has high fecundity (15,000-17,000) and high larval/juvenile dispersal potential (>10 km). *K. bidentata* and *C. gibba* are also known to have a high dispersal potential and high recoverability rates following disturbance (Marshall, 2005; Marine Ecological Surveys Limited, 2008).

However, other species such as the brittlestar *A. filiformis* is long-lived and slow growing (with a life-span of 10 to 20 years and sexual maturity only reached after 3 to 5 years). Therefore, while this species is capable of high initial conisation (producing approximately 50,000 gametes), recovery of the biomass is likely to take as much as 10 years after initial recolonisation of the seabed has taken place. The wavy hatchet shell *T. flexuosa* also has very low dispersal rates and reproduction is protracted in this long lived species (living up to ten years). Therefore, recovery after disturbance is also slow in this species (Marine Ecology Surveys Limited, 2008).

Table 1. Subtidal benthic survey results

Station	Sediment Type	OC (%)	No. of Taxa (per m^2)	No. of Individuals (per m^2)	Total Biomass (g per m^2)	Key Characterising Species (number per m^2 Shown in Brackets)
1	Slightly gravelly sand	1.06	50	15,000	188.2	Polychaete *Aphelochaeta marioni* (1,060) Polychaete *Chaetozone gibber* (2,470) Polychaete *Mediomastus fragilis* (3,240) Bivalve *Nucula hanleyi* (180) Wavy hatchet shell (bivalve) *Thyasira flexuosa* (470) Bivalve *Kurtiella bidentata* (310) White furrow shell (bivalve) *Abra alba* (5,480) Basket shell (bivalve) *Corbula gibba* (260)
2	Slightly gravelly muddy sand	0.49	66	9,090	106.5	Polychaete *Aphelochaeta marioni* (1,710) Polychaete *Chaetozone gibber* (2,320) Polychaete *Mediomastus fragilis* (750) Polychaete *Euclymene oerstedii* (230) Bivalve *Nucula hanleyi* (350) Wavy hatchet shell (bivalve) *Thyasira flexuosa* (300) Bivalve *Kurtiella bidentata* (190) White furrow shell (bivalve) *Abra alba* (1,110) Basket shell (bivalve) *Corbula gibba* (440) Brittlestar *Amphiura filiformis* (220)
3	Slightly gravelly muddy sand	0.32	36	2,040	31.5	Polychaete *Chaetozone gibber* (480) Bivalve *Nucula hanleyi* (200) White furrow shell (bivalve) *Abra alba* (460) Basket shell (bivalve) *Corbula gibba* (240)
4	Slightly gravelly muddy sand	0.41	21	1,080	20.1	Bivalve *Nucula hanleyi* (320) White furrow shell (bivalve) *Abra alba* (290) Basket shell (bivalve) *Corbula gibba* (150)
5	Slightly gravelly sand	0.39	27	890	16	Bivalve *Nucula hanleyi* (130) White furrow shell (bivalve) *Abra alba* (220)
6	Slightly gravelly muddy sand	0.8	45	10,620	185	Polychaete *Aphelochaeta marioni* (180) Polychaete *Chaetozone gibber* (2130) Polychaete *Mediomastus fragilis* (500) Polychaete *Euclymene oerstedii* (330) Bivalve *Nucula hanleyi* (510) Wavy hatchet shell (bivalve) *Thyasira flexuosa* (670) Bivalve *Kurtiella bidentata* (330) White furrow shell (bivalve) *Abra alba* (3,230) Basket shell (bivalve) *Corbula gibba* (440) Brittlestar Ophiuroidea (130) Brittlestar *Amphiura filiformis* (610)

4 Conclusion

The intertidal foreshore within the survey area consisted of boulders and structures such as concrete pillars and quay walls. This habitat was characterised by a range of commonly occurring rocky shore species including sessile epifauna such as barnacles, sponges, sea squirts and marine algae (including *Fucus* spp and a range of green and red seaweeds). Mobile epifaunal species recorded within the intertidal included topshells, periwinkles and crabs (broad-clawed porcelain crab, shore crab and edible crab).

The habitat within the shallow subtidal directly below the quayside and rock armouring consisted of large boulders and other hard substrate with fronds of sugar kelp, oarweed and other marine algae attached. The subtidal sediment habitat in the survey area consisted of slightly gravelly sand and muddy sand. This habitat was characterised by a range of taxa with the most abundant species including polychaete worms, bivalve molluscs and brittlestars. In addition, a range of crustacean species were recorded.

The species and communities recorded in the survey area were considered typical of that found more widely along the Pembrokeshire coast. The intertidal habitat recorded under the boulders in this area is characteristic of the UK BAP Priority Habitat 'Intertidal Under boulder Communities' (UK Biodiversity Action Plan, 2008). This habitat is also listed as a Habitat of Principal Importance in Wales under the NERC Act 2006 Section 42. No other marine species or biotopes which are protected or considered nationally scarce or rare were recorded in the surveys.

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Appendices





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A Subtidal Benthic Infauna Laboratory Results

Seastar Survey Ltd.

Project: ABPmer Fishguard infaunal sample analysis

Job Number: J/17/497

Description: Macrofaunal identification

1	2	3	4	5	6
MA	MA	MA	MA	MA	MA

MCS Code	Taxon/species	Qualifier						
	Foraminifera	Foram test		P		P	P	
	Folliculinidae		P					
D0407	Sertulariidae		P	P	P		P	
D0662	ACTINIARIA							1
J0007	Priapulus caudatus			1				
G0001	NEMERTEA	sp.	2	1				
HD0001	NEMATODA		1					
N0017	Golfingia (Golfingia) vulgaris vulgaris			1				
P0001	**Annelida fragments**		P	P	P	P	P	P
P0067	Malmgrenia arenicolae		1	1				1
P0068	Malmgrenia marphysae				1			
P0092	Pholoe baltica		4	13				42
P0105	Sigalion squamosus						2	
P0106	Sthenelais	sp. (indet.)		3	1			
P0109	Sthenelais limicola		2	1				2
P0114	Phyllodocidae	sp. (indet.)	1	1	1			
P0178	Phyllodoce	sp. (indet.)			1			
P0141	Phyllodoce groenlandica		1					1
P0145	Phyllodoce mucosa				2			
P0164	Eumida bahusiensis			1		1		
P0176	Paranaitis kosteriensis						1	
P0421	Parexogone hebes			1				
P0475	Eunereis longissima		2					
P0494	Nephtys	sp. dam. / juv.		1	1			
P0499	Nephtys hombergii			1		2		5
P0503	Nephtys longosetosa		4		1			
P0568	Lysidice unicornis		1	1				
P0572	Lumbrineris near cingulata		8	1		1		2
P0672	Scoloplos armiger		4	4	5	1	2	2
P0675	Aricidea	sp. dam.		1				
P0718	Poecilochaetus serpens			1				
P0771	Pseudopolydora	sp. dam.				1		
P0772	Pseudopolydora antennata		1	2				1
P0774	Pseudopolydora pulchra		4	7				6
P0776	Pygospio elegans					1	3	
P0789	Paraspio decorata						1	
P0794	Spiophanes bombyx			1			4	
P0804	Magelona alleni			1				1
P0823	Aphelochaeta	sp.	1	6				
P0824	Aphelochaeta marioni		106	171				18
P0832	Chaetozone	sp. dam.		3	2		1	
P0834	Chaetozone setosa				1		2	
P0831	Chaetozone zetlandica		2	4		2	6	1
P0833	Chaetozone gibber		247	232	48	3	6	213
P0878	Diplocirrus glaucus		25	8	1	4	1	15
P0906	Capitella	sp.	4	2				1
P0919	Mediomastus fragilis		324	75	1		3	50
P0920	Notomastus	sp.	5	2				
P0938	Maldanidae	Damaged				1		
P0964	Euclymene oerstedii		11	23	16	1	1	33
P0965	Euclymene	sp. A						11
P0971	Praxillella affinis			4	1		1	
P1014	Ophelina acuminata		2	3		1		
P1026	Scalibregma celticum			1				
P1027	Scalibregma inflatum		4	2				
P1093	Galathowenia oculata				1		2	
P1098	Owenia fusiformis				1			
P1107	Lagis koreni			2	1	1		11
P1118	Ampharetidae	sp. dam.			1			
P1124	Melinna palmata		7	2	1	3	1	3
P1139	Ampharete lindstroemi		1	2				
P1175	Terebellides stroemii		2					
P1195	Lanice conchilega						1	1
P1487	Tubificoides	sp.					1	
P1489	Tubificoides amplivasatus		1	1				1
P1491	Tubificoides brownae			3				
Q0044	Anoplodactylus petiolatus							1
R2412	Ostracoda	sp.		2				
S0177	Leucothoe incisa							1
S0254	Harpinia antennaria		1	5	5	6		10
S0311	Nannonyx goesii							2
S0423	Ampelisca	sp. dam.	3					1
S0429	Ampelisca diadema		1	2				
S0440	Ampelisca tenuicornis		2					2
S0611	Crassicorophium crassicorne				4			
S1203	Iphinoe trispinosa			1				
S1208	Eudorella truncatula		2					6

S1255	Diastylis tumida			1				
S1385	Crangon crangon				1			
S1445	Paguridae	juv.		1				
S1552	Corystes cassivelaunus			2	1	1	1	
S1594	Carcinus maenas	juv.					1	
W0684	Ocenebra erinacea				1			
W0972	Turbonilla acuta		2					
W1568	Nucula hanleyi		18	35	20	32	13	51
W1577	Ennucula tenuis			1				
W1698	Modiolus	juv.	7	7	3			2
W1829	Lucinoma borealis	juv.					2	
W1837	Thyasira flexuosa		47	30	1			67
W1906	Kurtiella bidentata		31	19	4			33
W1961	Cerastoderma edule				1			
W1978	Spisula subtruncata		5	3		1	2	1
W2006	Phaxas pellucidus		1	1	1		2	
W2021	Moerella donacina			3	2		4	
W2059	Abra alba		548	110	46	29	22	323
W2061	Abra nitida		17					15
W2091	Venus casina		1	3				1
W2104	Timoclea ovata			2				
W2157	Corbula gibba		26	44	24	15	3	44
W2239	Cochlodesma praetenue							2
Y423	Schizoporella	sp.					P	
ZB0165	**Ophiuroidea fragments**		P	P	P	P	P	P
ZB0165	Ophiuroidea	sp. dam.	2	7	1			13
ZB0148	Amphiuridae	juv.		12				
ZB0151	Acrocnida brachiata			1				
ZB0152	Amphiura chiajei							1
ZB0154	Amphiura filiformis		4	22		1		61
ZB0167	Ophiocten affinis							2
ZB229	HOLOTHUROIDEA	sp.		1				
ZB290	Synaptidae	sp. dam.	2					
ZB0292	Leptosynapta bergensis		2	2				1
ZD0002	ASCIDIACEA	sp.			1			
ZG0001	Actinopterygii	juv.		1				
ZM001	RHODOPHYTA			P			P	
ZM443	Plocamium cartilagineum			P				P
ZM507	Ceramium	sp.			P		P	
ZS001	CHLOROPHYCOTA	sp.	P	P				P
	Artificial- plastic/foam/paint chips		P	P			P	P
	Artificial- unknown					P		

Seastar Survey Ltd.
Project: ABPmer Fishguard infaunal sample analysis
Job Number: J/17/497
Description: Macrofaunal identification

1	2	3	4	5	6
MA	MA	MA	MA	MA	MA

MCS Code	Taxon/species	Qualifier						
	Foraminifera	Foram test		P		P	P	
	Folliculinidae		P					
D0407	Sertulariidae		P	P	P		P	
D0662	ACTINIARIA							1.02242
J0007	Priapulus caudatus			0.01125				
G0001	NEMERTEA	sp.	0.01441	0.00181				
HD0001	NEMATODA		0.00002					
N0017	Golfingia (Golfingia) vulgaris vulgaris			0.04539				
P0001	**Annelida fragments**		P	P	P	P	P	P
P0067	Malmgrenia arenicolae		0.00703	0.05456				0.13103
P0068	Malmgrenia marphysae				0.00049			
P0092	Pholoe baltica		0.00774	0.03628				0.13304
P0105	Sigalion squamosus						0.13898	
P0106	Sthenelais	sp. (indet.)		0.00642	0.00889			
P0109	Sthenelais limicola		0.01101	0.00948				0.00654
P0114	Phyllodocidae	sp. (indet.)	0.00258	0.00009	0.00026			
P0178	Phyllodoce	sp. (indet.)			0.00005			
P0141	Phyllodoce groenlandica		0.09672					0.13131
P0145	Phyllodoce mucosa				0.00101			
P0164	Eumida bahusiensis			0.00027		0.00232		
P0176	Paranaitis kosteriensis						0.00131	
P0421	Parexogone hebes			0.00002				
P0475	Eunereis longissima		0.74544					
P0494	Nephtys	sp. dam. / juv.		0.00221	0.01859			
P0499	Nephtys hombergii			0.11974		0.21379		0.65801
P0503	Nephtys longosetosa		0.24084		0.02573			
P0568	Lysidice unicornis		0.00195	0.00142				
P0572	Lumbrineris near cingulata		0.05313	0.00968		0.03044		0.02432
P0672	Scoloplos armiger		0.00482	0.00321	0.00471	0.00379	0.00103	0.00741
P0675	Aricidea	sp. dam.		0.00034				
P0718	Poecilochaetus serpens			0.00091				
P0771	Pseudopolydora	sp. dam.				0.00043		
P0772	Pseudopolydora antennata		0.00149	0.00101				0.00087
P0774	Pseudopolydora pulchra		0.00947	0.01809				0.02479
P0776	Pygospio elegans					0.00003	0.00011	
P0789	Paraspio decorata						0.00043	
P0794	Spiophanes bombyx			0.00027			0.00134	
P0804	Magelona alleni			0.02394				0.01469
P0823	Aphelochaeta	sp.	0.00014	0.00407				
P0824	Aphelochaeta marioni		0.02362	0.06171				0.00164
P0832	Chaetozone	sp. dam.		0.00412	0.00106		0.00146	
P0834	Chaetozone setosa				0.00132		0.00464	
P0831	Chaetozone zetlandica		0.00968	0.00945		0.00342	0.00736	0.00694
P0833	Chaetozone gibber		0.41073	0.55011	0.09344	0.00398	0.01589	0.33551
P0878	Diplocirrus glaucus		0.06056	0.03183	0.00732	0.01814	0.00345	0.03663
P0906	Capitella	sp.	0.00295	0.00386				0.00134
P0919	Mediomastus fragilis		0.34944	0.08533	0.00089		0.00219	0.04141
P0920	Notomastus	sp.	0.07163	0.01073				
P0938	Maldanidae	Damaged				0.00024		
P0964	Euclymene oerstedii		0.02433	0.04373	0.01302	0.00407	0.00131	0.13227
P0965	Euclymene	sp. A						0.03529
P0971	Praxillella affinis			0.00526	0.00066		0.00123	
P1014	Ophelina acuminata		0.00367	0.01101		0.00196		
P1026	Scalibregma celticum			0.00175				
P1027	Scalibregma inflatum		0.00613	0.00658				
P1093	Galathowenia oculata				0.00035		0.00082	
P1098	Owenia fusiformis				0.00672			
P1107	Lagis koreni			0.00073	0.00103	0.00293		0.01141
P1118	Ampharetidae	sp. dam.			0.00196			
P1124	Melinna palmata		0.00768	0.00236	0.00222	0.00592	0.01227	0.0021
P1139	Ampharete lindstroemi		0.00222	0.01053				
P1175	Terebellides stroemii		0.03613					
P1195	Lanice conchilega						0.00053	0.00292
P1487	Tubificoides	sp.					0.00006	
P1489	Tubificoides amplivasatus		0.00002	0.00001				0.00002
P1491	Tubificoides brownae			0.00016				
Q0044	Anoplodactylus petiolatus							0.00032
R2412	Ostracoda	sp.		0.00114				
S0177	Leucothoe incisa							0.00114
S0254	Harpinia antennaria		0.00067	0.00646	0.00362	0.00571		0.01286
S0311	Nannonyx goesii							0.02468
S0423	Ampelisca	sp. dam.	0.00407					0.0004
S0429	Ampelisca diadema		0.00426	0.03831				
S0440	Ampelisca tenuicornis		0.00964					0.01262
S0611	Crassicorophium crassicorne				0.00214			
S1203	Iphinoe trispinosa			0.00186				
S1208	Eudorella truncatula		0.00037					0.00168

S1255	Diastylis tumida			0.00605				
S1385	Crangon crangon				0.06749			
S1445	Paguridae	juv.		0.00524				
S1552	Corystes cassivelaunus			0.08712	0.09846	0.03236	0.03236	
S1594	Carcinus maenas	juv.					0.02833	
W0684	Ocenebra erinacea				0.00576			
W0972	Turbonilla acuta		0.0037					
W1568	Nucula hanleyi		0.22077	0.50091	0.60273	0.79469	0.29864	0.89593
W1577	Ennucula tenuis			0.00801				
W1698	Modiolus	juv.	0.01574	0.01714	0.00372			0.00362
W1829	Lucinoma borealis	juv.					0.00195	
W1837	Thyasira flexuosa		0.34519	0.40461	0.00769			0.55621
W1906	Kurtiella bidentata		0.17854	0.07527	0.01852			0.22972
W1961	Cerastoderma edule				0.05915			
W1978	Spisula subtruncata		0.069	0.21844		0.15961	0.22858	0.1281
W2006	Phaxas pellucidus		0.01308	0.05819	0.00566		0.00616	
W2021	Moerella donacina			0.77094	0.10565		0.20268	
W2059	Abra alba		14.67371	3.65744	1.59011	0.60286	0.57719	8.30521
W2061	Abra nitida		0.1197					0.12018
W2091	Venus casina		0.03889	1.2271				2.00154
W2104	Timoclea ovata			0.02701				
W2157	Corbula gibba		0.15992	0.29332	0.35455	0.11686	0.02521	0.57737
W2239	Cochlodesma praetenue							0.01133
Y423	Schizoporella	sp.					P	
ZB0165	**Ophiuroidea fragments**		P	P	P	P	P	P
ZB0165	Ophiuroidea	sp. dam.	0.00068	0.09613	0.00703			0.09303
ZB0148	Amphiuridae	juv.		0.33864				
ZB0151	Acrocnida brachiata			0.07049				
ZB0152	Amphiura chiajei							0.02719
ZB0154	Amphiura filiformis		0.04328	1.03931		0.00315		3.71931
ZB0167	Ophiocten affinis							0.0178
ZB229	HOLOTHUROIDEA	sp.		0.15242				
ZB290	Synaptidae	sp. dam.	0.53813					
ZB0292	Leptosynapta bergensis		0.17954	0.33771				0.02259
ZD0002	ASCIDIACEA	sp.			0.02441			
ZG0001	Actinopterygii	juv.		0.03162				
ZM001	RHODOPHYTA			0.00032			P	
ZM443	Plocamium cartilagineum			P				P
ZM507	Ceramium	sp.			P		P	
ZS001	CHLOROPHYCOTA	sp.	P	P				P
	Artificial- plastic/foam/paint chips		P	P			P	P
	Artificial- unknown					P		

B PSA and TOC Laboratory Results

	Folder no.	**003914829**	**003914830**	**003914831**	**003914832**	**003914833**	**003914834**
	Project no.	**21696015**	**21696015**	**21696015**	**21696015**	**21696015**	**21696015**
	Project name	**14386 Fishguard sediment analysis**	**14386 Fishguard sediment analysis**	**14386 Fishguard sediment analysis**	**14386 Fishguard sediment analysis**	**14386 Fishguard sediment analysis**	**14386 Fishguard sediment analysis**
	Batch no.	**20110718**	**20110718**	**20110718**	**20110718**	**20110718**	**20110718**
	Comment	**Sample Site 5**	**Sample Site 3**	**Sample Site 2**	**sample Site 4**	**Sample site 1**	**sample Site 6**
	Sample taken	**27-JUN-17 11:00**	**27-JUN-17 11:30**	**27-JUN-17 12:10**	**27-JUN-17 12:30**	**27-JUN-17 12:50**	**27-JUN-17 13:20**
Analyte	***Units***						
Carbon, Organic : Dry Wt as C	%	0.389	0.315	0.491	0.412	1.06	0.839
Sorting Coefficient	Unitless	0.586	1.17	1.71	1.35	2.54	2.14
Particle Diameter : Median	mm	0.165	0.144	0.136	0.127	0.064	0.105
Grain Size Inclusive Mean	mm	0.164	0.139	0.098	0.116	0.0427	0.0591
Particle Diameter : Mean	mm	0.183	0.16	0.156	0.144	0.164	0.123
Kurtosis	Unitless	1.01	2.12	1.8	2.07	0.813	0.946
Grain Size Inclusive Kurtosis	mm	0.498	0.23	0.287	0.238	0.569	0.519
Inclusive Graphic Skewness :- (SKI)	Unitless	-0.019	-0.338	-0.525	-0.397	-0.292	-0.543
Grain Size Fraction : < 0.98 microns : (>10 phi)	%	0	0.15	0.578	0.469	1.96	0.988
Grain Size Fraction : 0.98 to 1.38 microns : (10 to 9.5 ph	%	0	0.1	0.379	0.299	1.17	0.678
Grain Size Fraction : 1.38 to 1.95 microns : (9.5 to 9 phi)	%	0	0.27	0.528	0.419	1.53	0.908
Grain Size Fraction : 1.95 to 2.76 microns : (9 to 8.5 phi)	%	0.0599	0.62	1.08	0.868	2.77	1.8
Grain Size Fraction : 2.76 to 3.91 microns : (8.5 to 8 phi)	%	0.25	1.03	1.68	1.39	4	2.78
Grain Size Fraction : 3.91 to 5.52 microns : (8 to 7.5 phi)	%	0.299	1.28	2.07	1.7	4.72	3.42
Grain Size Fraction : 5.52 to 7.81 microns : (7.5 to 7 phi)	%	0.319	1.32	2.2	1.76	5	3.68
Grain Size Fraction : 7.81 to 11.1 microns : (7 to 6.5 phi)	%	0.399	1.15	2.05	1.62	4.9	3.57
Grain Size Fraction : 11.1 to 15.6 microns : (6.5 to 6 phi)	%	0.469	1.07	1.85	1.54	4.55	3.29
Grain Size Fraction : 15.6 to 22.1 microns : (6 to 5.5 phi)	%	0.339	1.31	1.99	1.67	4.61	3.37
Grain Size Fraction : 22.1 to 31.3 microns : (5.5 to 5 phi)	%	0.0299	1.2	2.03	1.35	4.63	3.29
Grain Size Fraction : 31.3 to 44.2 microns : (5 to 4.5 phi)	%	0	0.31	1.74	0.788	4.63	3.03
Grain Size Fraction : 44.2 to 62.5 microns : (4.5 to 4 phi)	%	0.0399	0.84	2.57	2.9	5.05	3.92
Grain Size Fraction : 62.5 to 88.4 microns : (4 to 3.5 phi)	%	3.24	7.28	7.37	10.6	6.74	8.02
Grain Size Fraction : 88.4 to 125 microns : (3.5 to 3 phi)	%	17.8	20.3	16.3	21.3	9.78	14.8
Grain Size Fraction : 125 to 177 microns : (3 to 2.5 phi)	%	33.3	28.7	22.6	25.3	11.6	18.6
Grain Size Fraction : 177 to 250 microns : (2.5 to 2 phi)	%	29.2	22.2	19.3	17.9	9.57	14.7
Grain Size Fraction : 250 to 354 microns : (2 to 1.5 phi)	%	12.5	9.05	10.2	6.94	5.49	7.11
Grain Size Fraction : 354 to 500 microns : (1.5 to 1 phi)	%	1.42	1.01	2.49	0.718	2.34	1.56
Grain Size Fraction : 500 to 707 microns : (1 to 0.5 phi)	%	0	0.13	0.299	0.02	1.42	0.15
Grain Size Fraction : 707 to 1000 microns : (0.5 to 0 phi)	%	0	0.48	0.239	0.15	0.947	0.0399
Grain Size Fraction : >1000 microns : (<0 phi)	%	0.199	0.234	0.394	0.308	2.58	0.245
Grain Size Fraction : <1000 microns : (>0 phi)	%	99.8	99.8	99.6	99.7	97.4	99.8
Grain Size Fraction : 1000 to 1400 mic : (0 to -0.5phi)	%	0.0573	0.0977	0.157	0.0913	0.696	0.0516
Grain Size Fraction : 1400 to 2000 mic : (-0.5 to -1.0phi)	%	0.0458	0.0682	0.0977	0.0852	0.8	0.049
Grain Size Fraction : 2000 to 2800 mic : (-1.0 to -1.5phi)	%	0.0413	0.0318	0.0384	0.0487	0.495	0.0542
Grain Size Fraction : 2800 to 4000 mic : (-1.5 to -2.0phi)	%	0.0183	0.025	0.0384	0.0264	0.331	0.0696
Grain Size Fraction : 4000 to 5600 mic : (-2.0 to -2.5phi)	%	0.0229	0.0114	0.0628	0.0325	0.203	0.0206
Grain Size Fraction : 5600 to 8000 mic : (-2.5 to -3.0phi)	%	0.0138	0	0	0.0243	0.0548	0
Grain Size Fraction : 8000 to 11200 mic : (-3.0 to -3.5phi	%	0	0	0	0	0	0
Grain Size Fraction : 11200 to 16000 mic : (-3.5 to -4.0pł	%	0	0	0	0	0	0
Grain Size Fraction : 16000 to 22400 mic : (-4.0 to -4.5pł	%	0	0	0	0	0	0
Grain Size Fraction : 22400 to 31500 mic : (-4.5 to -5.0pł	%	0	0	0	0	0	0
Grain Size Fraction : 31500 to 45000 mic : (-5.0 to -5.5pł	%	0	0	0	0	0	0
Grain Size Fraction : 45000 to 63000 mic : (-5.5 to -6.0pł	%	0	0	0	0	0	0
Grain Size Fraction : > 63000 microns : (< -6.0 phi)	%	0	0	0	0	0	0
Particle Size Report	Text	The sample received was a slightly gravelly sand in a 500G pot. The entire sampled was a slightly gravelly muddy sand in a 500G pot. The entire saed was a slightly gravelly muddy sand in a 500G pot. The entire saed was a slightly gravelly muddy sand in a 500G pot. The entire saed was a slightly gravelly sandy mud in a 500G pot. The entire samed was a slightly gravelly muddy sand in a 500G pot. Entire sample analysed					
Dry Solids @ 30°C	%	73.3	73.4	71.4	73.3	66.2	67.1
Accreditation Assessment	No.	2	2	2	2	2	2
Additional Material Present	Text	No additional material	No additional material	No additional material	No additional material	No additional material	No additional material
Drying Method	Text	Air dried at 30°C	Air dried at 30°C	Air dried at 30°C	Air dried at 30°C	Air dried at 30°C	Air dried at 30°C
Rejected Matter Description	Text	No material removed	No material removed	No material removed	No material removed	No material removed	No material removed
Sample Colour	Text	Brown	Brown	Brown	Brown	Brown	Brown
Sample Matrix	Text	Sandy Clay Sediment	Sandy Clay Sediment	Sandy Clay Sediment	Sandy Clay Sediment	Sandy Clay Sediment	Sandy Clay Sediment
Sample Preparation	Text	Homogenised, Jaw Crushed & Sieved to <2mm	Homogenised, Jaw Crushed & Sieved to <2mm	Homogenised, Jaw Crushed & Sieved to <2mm	Homogenised, Jaw Crushed & Sieved to <2mm	Homogenised, Jaw Crushed & Sieved to <2mm	Homogenised, Jaw Crushed & Sieved to <2mm

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