Bring Head

Benthic Video Survey

Version 1

Report to Scottish Sea Farms

Issued by Aquatera Ltd

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Scottish Sea Farms
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1 INTRODUCTION

Scottish Sea Farms (SSF) is considering proposals to expand two fish farm sites in Scapa Flow; Bring Head and Toyness. These facilities have been in operation since 2001 and 2000 respectively (under the ownership of SSF since 2007). This report presents the results of a remotely operated vehicle (ROV) survey conducted on 27 and 28 July 2021 of an area encompassing the Bring Head farm located off the island of Hoy in the north-western part of Scapa Flow, Orkney Islands (Figure 1.1).

To accommodate an increase in production SFF is proposing a reconfiguration and expansion of the farm, replacing the existing infrastructure with larger cages and a feed barge with a larger storage capacity (see Table 1.1 and Figure 1.2). The aim of the survey is to collect baseline benthic habitat information to support an assessment of potential environmental impacts associated with the planned site expansion.

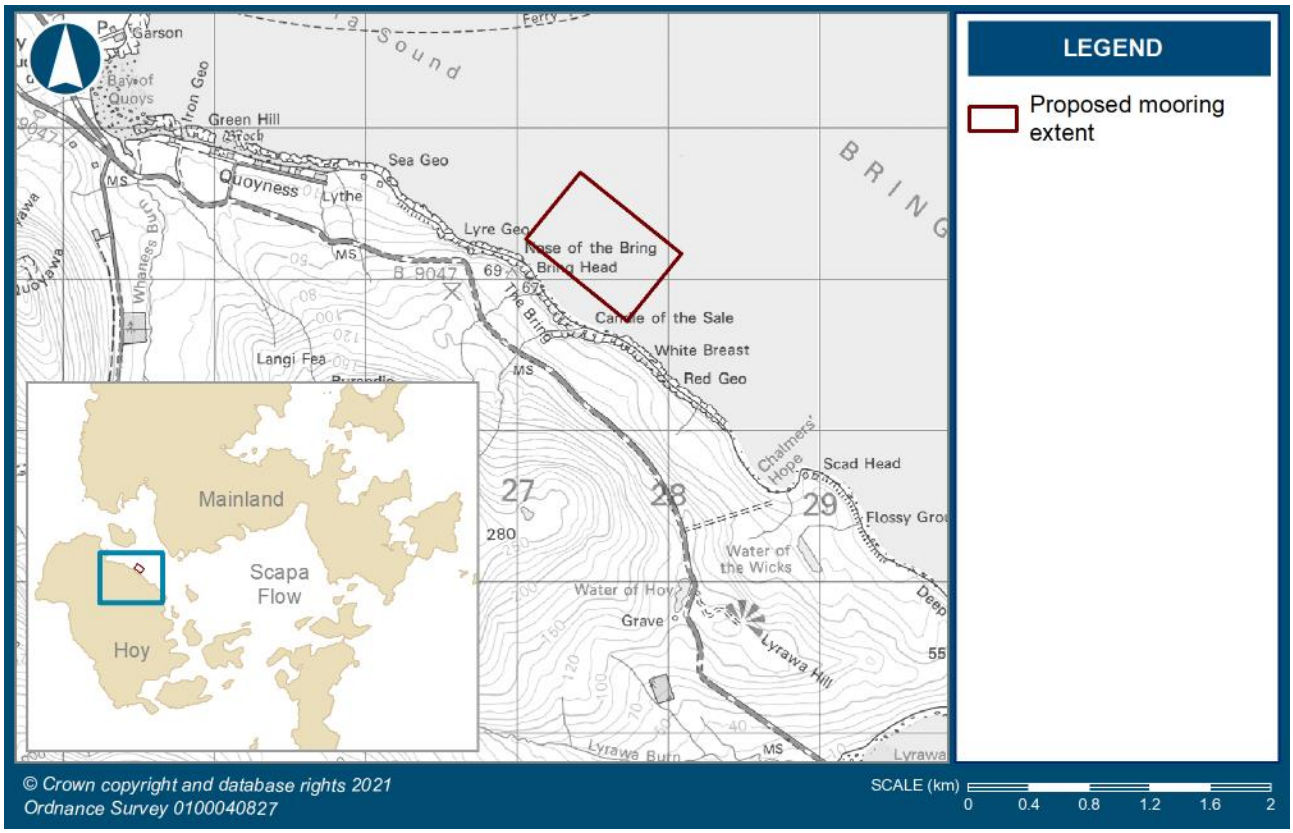


Figure 1.1 Location of Bring Head fish farm

Table 1.1 Details of proposed site expansion at Bring Head

Existing configuration	Proposed expansion
10 x 80 m cages in a 50 m mooring grid	12 x 120 m cages in a 70 m mooring grid
50 tonne capacity feed barge	420 tonne capacity feed barge
Surface area of 5,270 m^2	Surface area of 14,065 m^2
968 tonnes maximum biomass	2,500 tonnes maximum biomass

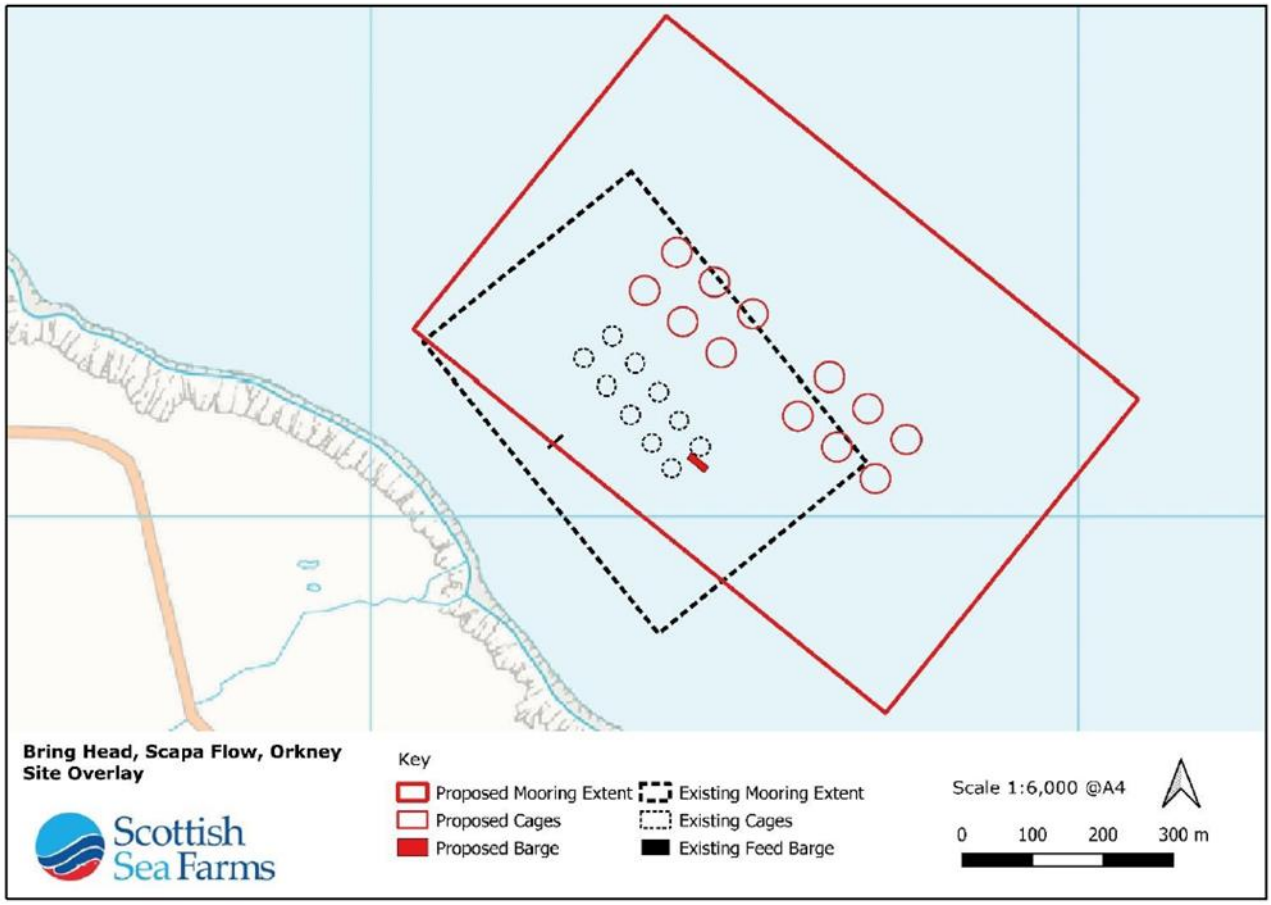


Figure 1.2 Location of proposed expansion of the Bring Head site

2 SURVEY METHODOLOGY

2.1 SURVEY OPERATIONS

Specialist contractors RovingEye Enterprises Ltd conducted a ROV survey on behalf of SSF on 27 and 28 July 2021. Details of the equipment and personnel deployed are summarised in Table 2.1.

Table 2.1 Equipment and personnel summary

Resource	Details
Survey vessel	*MV Advance*
ROV specifications	*Seaeye Falcon* ROV fitted with high-definition and standard definition digital cameras to provide high quality footage for the identification of seabed flora and fauna.
Position fixing	Vessel GPS system and *EIVA Navipac* online navigation system. Easytrak USBL system for subsea ROV positioning. Vessel GPS system and EIVA Navipax online navigation system.
Survey personnel	Skipper – [redacted] Umbilical man/deckhand - [redacted] ROV pilot – [redacted] Marine Scientist/SSF rep – [redacted]
Communications	Vessel VHF radio, mobile telephones.

2.2 SURVEY DESIGN

The overall survey design was established by SSF prior to mobilisation. The ROV survey focused on the collection of footage along five transects, running parallel to the coast and covering the maximum predicted extent of deposition of the proposed expanded facility (Figure 2.1). The ROV was directed over the seabed at a suitable height to provide a general overview of the seabed characteristics. The transit of the ROV was paused to obtain still images of notable seabed features, habitats or species encountered along the survey transects. The location of the actual transects performed during the survey are shown in Figure 2.2.

2.3 VIDEO DATA INTERPRETATION

Video footage was used to describe seabed characteristics in terms of physical structure (i.e. main substrate, sediment composition) and species assemblages in the area. Where possible, species were identified to the highest taxonomic level and quantified using the Marine Nature Conservation Review (MNCR) SACFOR[1] abundance scale (Hiscock, 1996). Descriptions of physical and biological attributes of the seabed were compared to biotope complex and biotope classifications as listed in the Joint Nature Conservation Committee (JNCC) Marine Habitat Classification for Britain and Ireland (JNCC, 2015). Observed habitats were noted for their conservation status, including whether they are a Priority Marine Feature (PMF) designated as nature conservation priorities in Scotland (Tyler-Walters *et al.*, 2016).

[1] The SACFOR abundance scale: S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare. A complete list of species observations using the SACFOR abundance is presented in Appendix B.

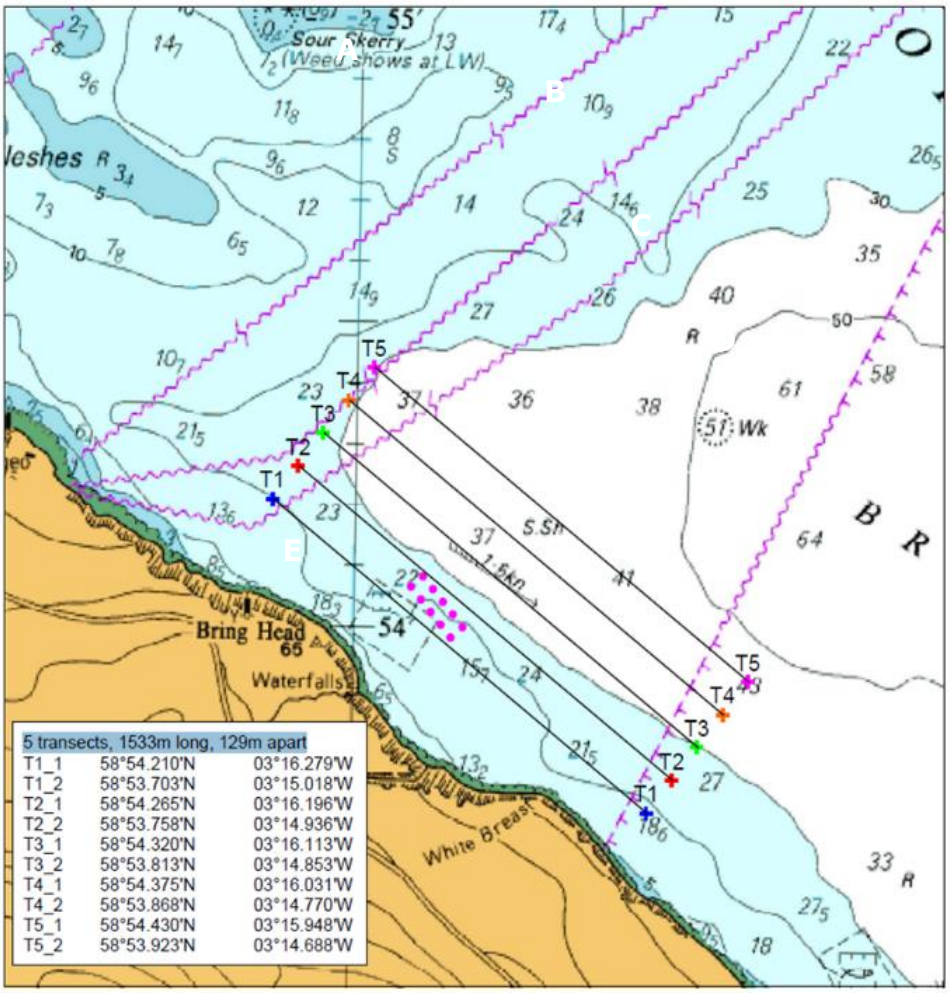


Figure 2.1 Proposed survey transects at Bring Head site

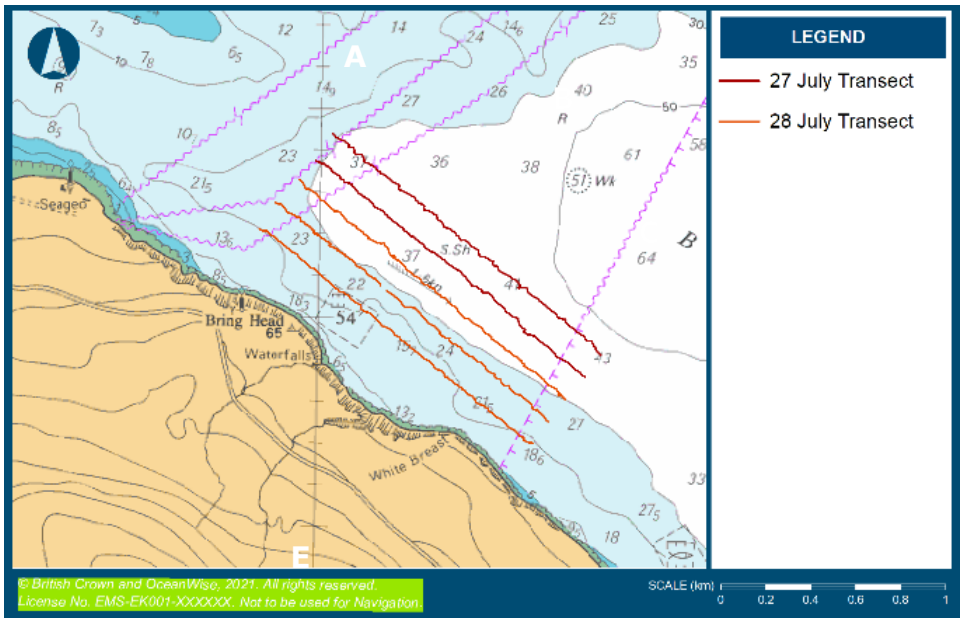


Figure 2.2 Actual survey transects at Bring Head site

3 SURVEY OBSERVATIONS

The seabed characteristics were fairly consistent throughout the Bring Head survey area and dominated by sandy sediments with occasional rock outcrops and areas of shell deposits. In general, water depth increased with distance from the coast, ranging from approximately 20 m along Transect 1 to around 32 m at the northern end of Transect 5 and down to a maximum depth of 45 m at the southern end of Transect 5. The seabed observed in the deeper parts of the survey area (in depths of approximately 40 to 45 m) were primarily composed of muddy sand scattered with pebbles and shells and the occasional rock outcrop. The seabed in intermediate water depths (of around 25 to 40 m) was characterised by mixed medium-fine sands with variable proportions of shell debris, gravel and occasional rocky areas with undulating and rippled fine sands dominating in the shallow waters of transect 1.

Crustaceans were the most frequently observed epibenthic fauna within the survey area, hermit crabs (Paguridae) were present throughout the area and were occasionally seen in large aggregations, other crabs (possibly *Atelecyclus rotundatus* and *Liocarcinus depurator*) were also widely observed. Brittle stars were also recorded throughout the area and the common starfish (*Asterias rubens*) and seven-armed starfish (*Luidia ciliaris*) were occasionally recorded.

Evidence of burrowing infauna was also observed throughout the survey area. Numerous polychaete burrows and mounds (possibly the lugworm *Arenicola marina*) were present in the shallower parts of the survey area (Transects 1 and 2) and a range of small burrowing fauna anemones and polychaetes (possibly *Lanice conchilega*) were observed in mixed sediment areas. The great scallop (*Pecten maximus)* was the only live bivalve found in the area although empty shells of other species were observed (razor shells and clams, possibly *Arctica islandica*). Sparsely scattered dead maerl fragments (*Phymatolithon calcareum)* were observed in sediments in the north of the survey area (at the north end of transects 4 and 5).

Small numbers of unidentified demersal fish and were regularly observed throughout the survey area and larger schools of small fish were seen congregating in sheltered areas around kelp mounds, boulders and moorings.

Areas of hard substrate within the survey area were restricted to gravel patches, infrequent rock outcrops, pebbles and boulders and manmade structures (moorings and power cables). These surfaces were covered with a range of encrusting fauna, mainly barnacles, keel worm (*Pomatoceros triqueter*) and hydroids, and in the north-western corner of the survey area numerous nudibranch (sea slug) egg masses were observed attached to the available hard substrate.

Transects 1 and 2 passed close to the existing Bring Head fish farm site. Evidence of organic waste (fish faeces/waste feed) originating from the facility, accompanied by the presence of patches of white bacterial growth (Beggiatoa) was observed on the seabed within 30 to 50 m from the fish cages.

Footage capture points from the ROV survey are plotted in Figure 3.1, with corresponding seabed images presented in Figure 3.2 to Figure 3.6. Details of all images and a description of observations recorded, including SACFOR abundance estimates where possible, is presented in Appendix B.

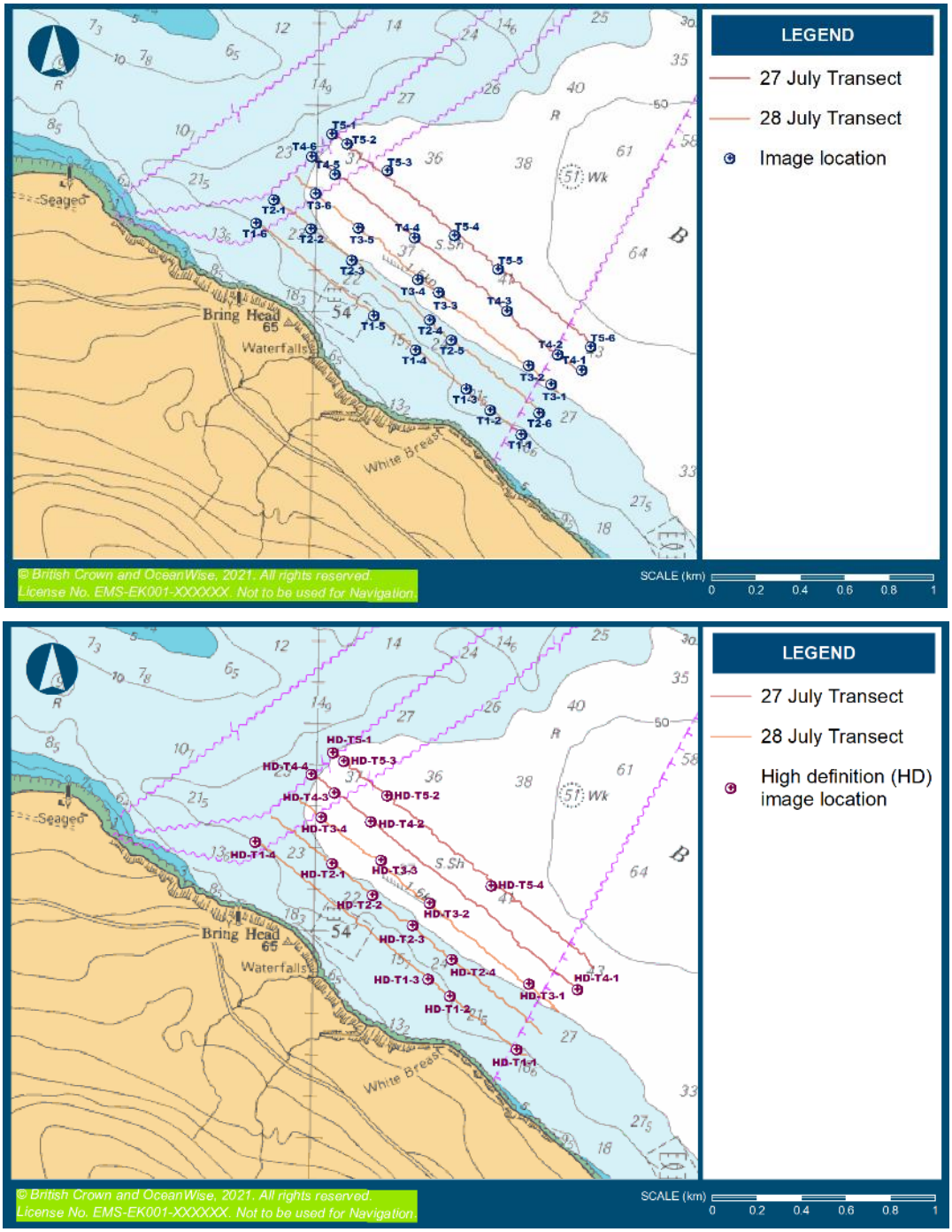


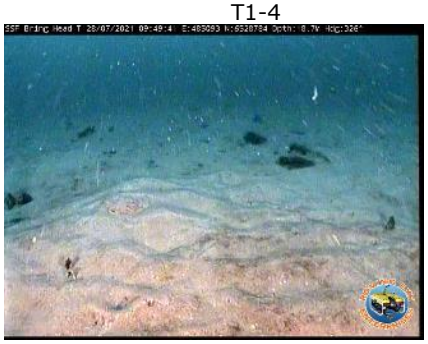
Figure 3.1 Standard and high-definition images, Bring Head, July 2021

T1-1

T1-2

T1-3

T1-4



T1-5

T1-6

High-definition images

HD-T1-1

HD-T1-2

HD-T1-3

HD-T1-4

Figure 3.2 Seabed Images, Transect 1 (southeast-northwest), Bring Head survey, July 2021

T2-1

T2-2

T2-3

T2-4

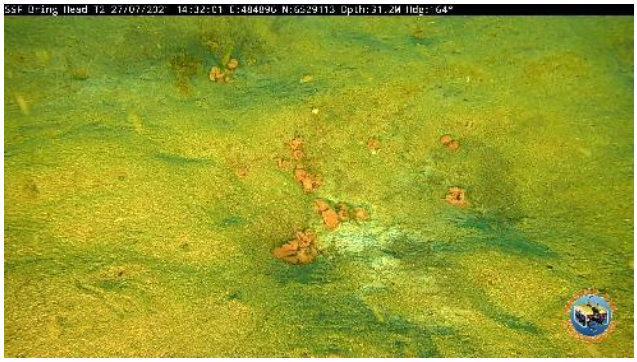
T2-5

T2-6

High-definition images

HD-T2-1

HD-T2-2



HD-T2-3

HD-T2-4

Figure 3.3 Seabed Images, Transect 2 (northwest-southeast), Bring Head survey, July 2021

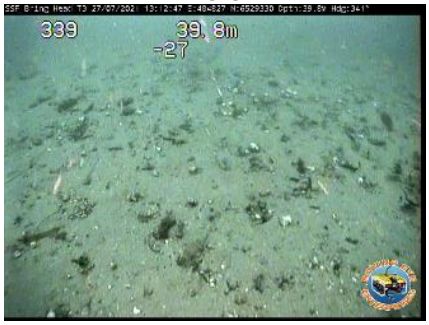
T3-1

T3-2

T3-3

T3-4

T3-5



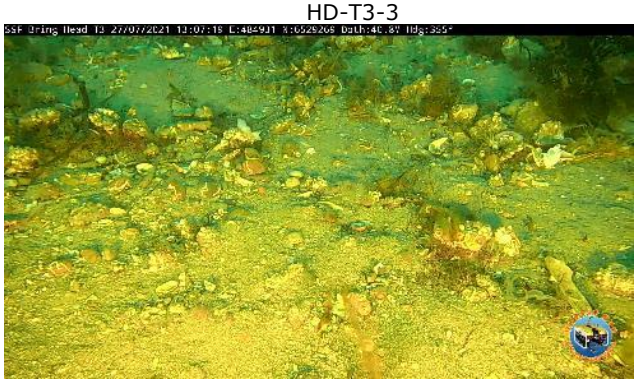
T3-6

High-definition images

HD-T3-1

HD-T3-2

HD-T3-3



HD-T3-4

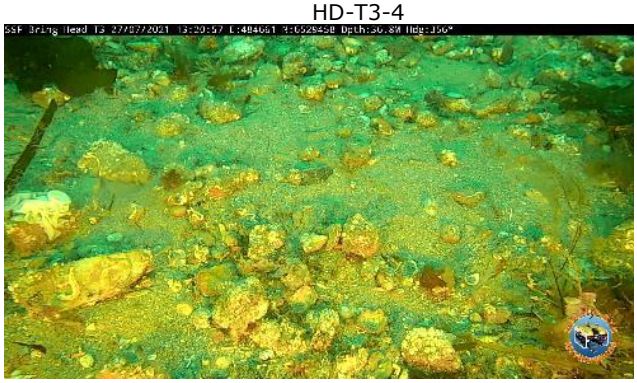
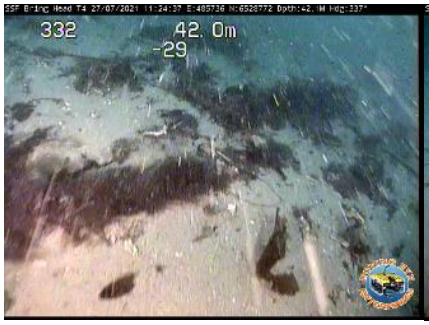


Figure 3.4 Seabed Images, Transect 3 (southeast-northwest), Bring Head, July 2021

T4-1

T4-2



T4-3

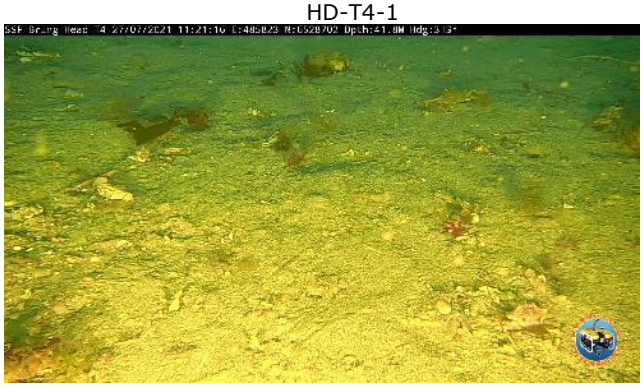
T4-4

T4-5

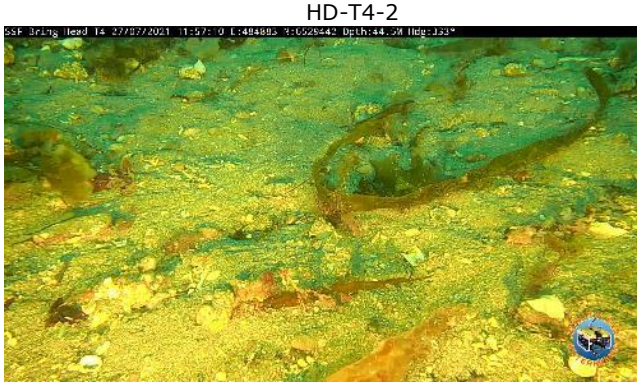
T4-6

High-definition images

HD-T4-1



HD-T4-2



HD-T4-3

HD-T4-4

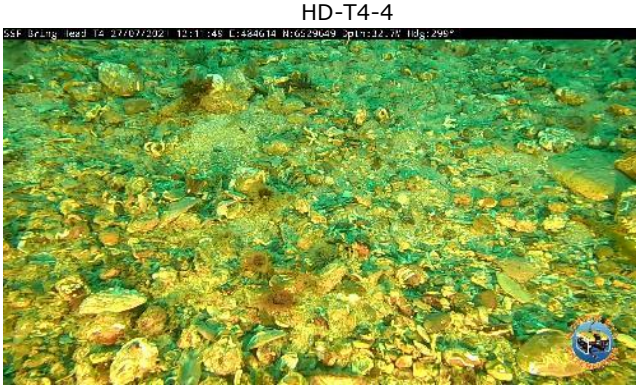
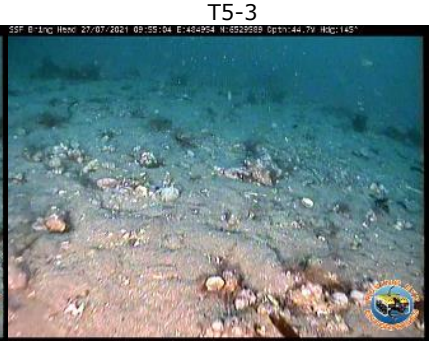


Figure 3.5 Seabed Images, Transect 4 (southeast-northwest), Bring Head, July 2021

T5-1

T5-2

T5-3



T5-4

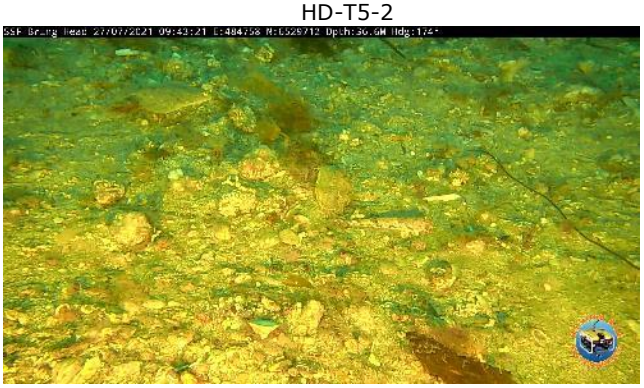
T5-5

T5-6

High-definition images

HD-T5-1

HD-T5-2



HD-T5-3

HD-T5-4

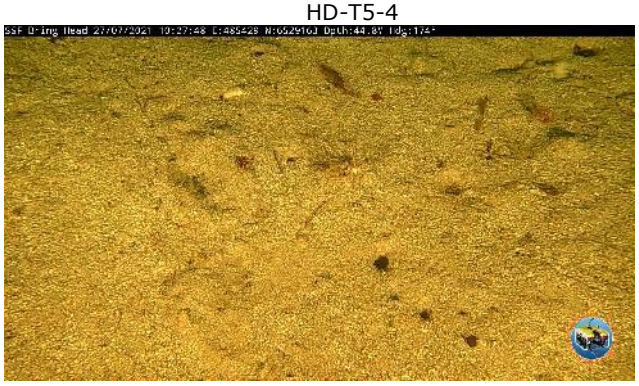


Figure 3.6 Seabed Images, Transect 5 (northwest-southeast), Bring Head, July 2021

4 DESCRIPTION OF BIOTOPES AND CONSERVATION STATUS

4.1.1 Biotope classifications

The seabed habitats observed within the Bring Head area in July 2021 displayed the characteristics of the following biotope types, as described in the JNCC Marine Habitat Classification for Britain and Ireland (JNCC, 2015):

Infralittoral muddy sand (SS.SSa.IMuSa)

- The medium-fine sandy habitat observed in the nearshore area (in water depths of around 20 m) shares many characteristics with the SS.SSa.IMuSa biotope complex. Burrowing polychaete mounds (possibly the lugworm *Arenicola marina*) were observed throughout the area and areas of rippled sediment were also recorded. Hermit crabs (Paguridae) were the most commonly observed epifauna and brittle stars were also regularly seen on the surface of the sediment. Other characteristic species recorded in the area included common starfish (*Asterias rubens)* and Harbour crab (*Liocarcinus depurator)*. Fine sandy sediments dominated in the shallow water areas however occasional patches of shell debris and hard substrate were also recorded.

Circalittoral mixed sediment (SS.SMx.CMx)

- The medium-fine sands mixed with coarse gravel and shell debris sediments observed in water depths ranging from approximately 25 to 40 m in the central and northern parts of the survey area are representative of the SS.SMx.CMx biotope complex. The brittle stars, crabs, starfish and encrusting and burrowing fauna observed in these areas are all characteristic of the biotope. Areas with increased shell debris and rocks with entangled kelp debris were also encountered in the deeper water areas (<40 m depth) and these also shared the main characteristics of this biotope.

Circalittoral muddy sand (SS.SSa.CMuSa)

- The medium-fine muddy sands that dominated from around 40 m and deeper may be characterised as the circalittoral muddy sand biotope complex (SS.SSa.CMuSa). Visible epifauna were relatively sparse in these areas but echinoderms (brittle stars and starfish) and crabs were the most commonly observed fauna.

Figure 4.1 shows the distribution of indicative biotope types for the Bring Head survey area.

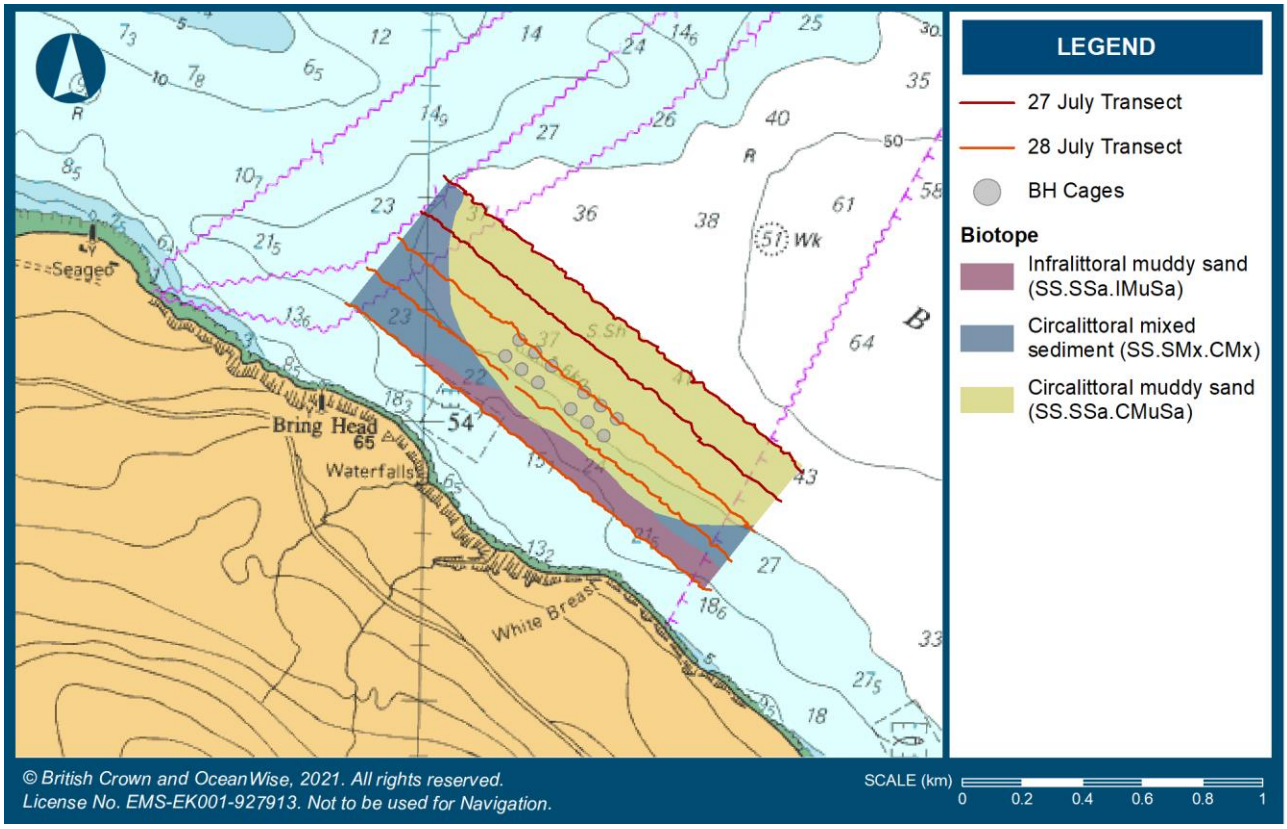


Figure 4.1 Biotope map, Bring Head, July 2021

4.1.2 Conservation Status of habitats and species

The Bring Head site is currently not within any Marine Protected Area designated for benthic habitats or species (Marine Scotland, 2021). The only Priority Marine Feature (PMF - habitats and species designated as nature conservation priorities in Scotland) that may be present in the area is the ocean quahog (*Arctica islandica*), a long-lived mollusc which is found around all Scottish coasts and is known to be present in the Scapa Flow area. An empty shell, possibly from this species, was observed in the survey area along transect T2 (Figure 4.2). These animals live burrowed in the sediment therefore it is not possible to definitively identify the presence of live individuals in the area using video survey techniques.

HD-T2-5

Figure 4.2 Seabed Images, showing empty *Arctica islandica* shell

5 REFERENCES

Hiscock, K., (1996) Marine Nature Conservation Review: Rationale and methods. Coasts and seas of the United Kingdom. MNCR series. JNCC [online]. Available from: https://mhc.jncc.gov.uk/media/1009/sacfor.pdf (Accessed 07/08/2021).

JNCC (2015) The Marine Habitat Classification for Britain and Ireland Version 15.03 [online]. Available from: https://mhc.jncc.gov.uk (Accessed 07/08/2021).

Marine Scotland (2021) Biological analyses of seabed imagery from within and around Marine Protected Areas in Orkney, Shetland, Inner Sound, and Islay and Jura in 2019. Scottish Marine and Freshwater Science Vol 12 No 2. Published by Scottish Government ISSN: 2043-7722 DOI: 10.7489/12364-1.

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J., Crawford-Avis, O.T. (2016) Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406 [online]. Available from: https://www.nature.scot/snh-commissioned-report-406-descriptions-scottish-priority-marine-features-pmfs (Accessed 07/08/2021).

APPENDIX A TRANSECT LOCATIONS

Table 5.1 Planned survey transects at the Bring Head site

Transect	Location WGS84			
	Start		End	
	Easting	Northing	Easting	Northing
T1	58°54.210'N	03°16.279'W	58°53.703'N	03°15.018'W
T2	58°54.265'N	03°16.196'W	58°53.758'N	03°14.936'W
T3	58°54.320'N	03°16.113'W	58°53.813'N	03°14.853'W
T4	58°54.375'N	03°16.031'W	58°53.868'N	03°14.770'W
T5	58°54.430'N	03°15.948'W	58°53.923'N	03°14.688'W

Table 5.2 Approximate start-finish transects of the ROV survey, detailing corresponding video files

Transect	Filenames (Standard Def)	Location WGS84					
		Start		Depth (m)	End		Depth (m)
		Easting	Northing		Easting	Northing	
T1	VIDEO_28-07-2021_09-16-26 VIDEO_28-07-2021_09-31-26 VIDEO_28-07-2021_09-46-26 VIDEO_28-07-2021_10-08-52 VIDEO_28-07-2021_10-25-18 VIDEO_28-07-2021_10-40-49	485575	6528409	21.9	484377	6529308	25.3
T2	VIDEO_27-07-2021_13-52-22 VIDEO_27-07-2021_14-07-22 VIDEO_27-07-2021_14-22-23 VIDEO_28-07-2021_08-21-41 VIDEO_28-07-2021_08-39-04 VIDEO_28-07-2021_08-54-04 VIDEO_28-07-2021_09-09-04	484443	6529452	27.3	485662	6528502	28.4
T3	VIDEO_27-07-2021_12-26-55 VIDEO_27-07-2021_12-41-55 VIDEO_27-07-2021_12-58-05 VIDEO_27-07-2021_13-13-05	485738	6528604	33.9	484538	6529560	30.5
T4	VIDEO_27-07-2021_11-17-10 VIDEO_27-07-2021_11-32-10 VIDEO_27-07-2021_11-47-10 VIDEO_27-07-2021_12-02-10	485825	6528705	41.8	484613	6529648	32.7
T5	VIDEO_27-07-2021_09-35-18 VIDEO_27-07-2021_09-50-18 VIDEO_27-07-2021_10-05-18 VIDEO_27-07-2021_10-20-18 VIDEO_27-07-2021_10-35-18 VIDEO_27-07-2021_10-50-18	484688	6529768	29.0	485906	6528824	49.9

APPENDIX B SURVEY IMAGES/OBSERVATIONS LOG

Table 5.3 provides summary observations of substrate and biota observed in footage image captures (presented in Figure 3.2 to Figure 3.6). Descriptions of abundance, where possible, and the corresponding density or percentage cover are based on the SACFOR scale (Superabundant S; Abundant A; Common C; Frequent F; Occasional O; Rare R). Present (P) is used to describe biota observed in footage but where their abundance could not be reliably determined.

Table 5.3 Notes on observations of the RovingEye ROV survey

Image ID	Easting (m E)	Northing (m N)	Depth (m)	Substrate	Biota observed	Estimated Abundance	Density / % cover
T1-1	485575	6528409	21.9	Medium-fine sand and shell debris	Burrowing anemone (Possibly *Cerianthus lloydii*)	O	1-9/100 m^2
					Circular Crab *(Atelecyclus rotundatus).*	O	1-9/100 m^2
					Encrusting fauna on shells, hard substrate.	P	-
T1-2	485434	6528518	23.8	Medium-fine sand and shell debris	Unidentified brittle star species	C	1-9/1 m^2
					Encrusting fauna on shells, hard substrate	P	-
T1-3	485325	6528611	23.0	Medium-fine sand	7 armed starfish (L*uidia ciliaris*)	O	1-9/100 m^2
					Unidentified brittle star species	C	1-9/1 m^2
T1-4	485093	6528784	18.7	Medium-fine sand	Polychaete burrows/mounds (possibly *Arenicola marina*)	P	-
T1-5	484904	6528935	19.5	Medium-fine sand (evidence of organic waste)	Polychaete burrows/mounds (possibly *Arenicola marina*)	P	-
					White bacteria patches - Beggiatoa	P	-
T1-6	484365	6529343	25.3	Medium-fine sand and shell debris	Encrusting fauna on shell debris/hard substrate including unidentified hydroid	P	-
HD-T1-1	485554	6528430	22.6	Medium-fine sand and shell debris	Unidentified brittle star species	C	1-9/1 m^2
					Harbour crab (*Liocarcinus depurator*)	C	1-9/1 m^2
					Encrusting fauna on shells, hard substrate	P	-
HD-T1-2	485249	6528665	21.4	Medium-fine sand and small rock outcrop	Two unidentified crabs (camouflaged by algal growth and hydroids).	O	1-9/100 m^2
					Polychaete burrows/mounds (possibly *Arenicola marina*)	P	-
					Unidentified brittle star species	C	1-9/1 m^2
					Encrusting fauna on shells, hard substrate	P	-

Image ID	Easting (m E)	Northing (m N)	Depth (m)	Substrate	Biota observed	Estimated Abundance	Density / % cover
HD-T1-3	485152	6528740	19.3	Medium-fine sand and small rock outcrop	Cluster of hermit crabs (Paguridae)	C	1-9/1 m^2
HD-T1-4	484365	6529343	25.4	Medium-fine sand and small rock outcrop	Encrusting fauna on shells, hard substrate	P	-
T2-1	484444	6529451	27.3	Mixed sediment and shell debris	Encrusting fauna and algae	P	-
T2-2	484614	6529322	30.5	Mixed sediment and shell debris	Dense cluster of hermit crabs (Paguridae)	A	1-9/0.1 m^2
T2-3	484800	6529183	31.9	Medium-fine sand	Polychaete burrows/mounds (possibly Arenicola marina)	P	-
T2-4	485155	6528919	29.6	Medium-fine sand	Unidentified brittle star species	C	1-9/1 m^2
T2-5	485254	6528829	29.2	Mixed sediment and shell debris	Encrusting fauna and algae.	P	-
T2-6	485655	6528508	28.2	Mixed sediment and shell debris	7 armed starfish (L*uidia ciliaris*) Unidentified brittle star species Encrusting fauna and algae	O C P	1-9/100 m^2 1-9/1 m^2
HD-T2-1	484713	6529252	32.4	Medium-fine sand	Polychaete burrows/mounds (possibly *Arenicola marina*) Unidentified brittle star species	P C	- 1-9/1 m^2
HD-T2-2	484896	6529113	31.2	Medium-fine sand (evidence of organic waste)	Polychaete burrows/mounds (possibly Arenicola marina) White bacteria patches - Beggiatoa	P P	- -
HD-T2-3	485078	6528979	30.9	Medium-fine sand	Unidentified brittle star species	C	1-9/1 m^2
HD-T2-4	485257	6528831	29.5	Mixed sediment and shell debris	Unidentified brittle star species Encrusting fauna and algae Scallop (*Pecten maximus*)	C P C	1-9/1 m^2 - 1-9/1 m^2-
HD-T2-5	485002	6529024	29.7	Medium-fine sand	Empty bivalve shell – possible *Arctica islandica*	P	-
T3-1	485707	6528637	34.9	Medium-fine sand sparse hard substrate	Unidentified brittle star species Encrusting fauna and algae	C P	1-9/1 m^2 -

Image ID	Easting (m E)	Northing (m N)	Depth (m)	Substrate	Biota observed	Estimated Abundance	Density / % cover
T3-2	485604	6528721	35.9	Patch of dense shell debris	Encrusting fauna and algae	P	-
T3-3	485193	6529045	39.6	Medium-fine sand, occasional rock outcrops, kelp debris	Scallop (*Pecten maximus*)	F	1-9/10 m^2
T3-4	485100	6529101	39.5	Clump of entangled kelp debris	School of small fish attracted by shelter	P	-
T3-5	484827	6529330	39.8	Mixed sediment	No identifiable fauna	-	-
T3-6	484632	6529482	34.9	Mixed sediment – coarse sediment dominant	No identifiable fauna	-	-
HD-T3-1	485604	6528725	36.5	Patch of dense shell debris	Encrusting fauna and algae Unidentified crab	P P	- -
HD-T3-2	485152	6529080	40.0	Medium-fine sand	Borrowed anemone Harbour crab (*Liocarcinus depurator*) Unidentified brittle star species Tube worm (possibly *Lanice conchilega*) Flatfish	P O C P P	- 1-9/100 m^2 1-9/10 m^2 - -
HD-T3-3	484931	6529269	40.8	Mixed sediment – coarse sediment dominant	Encrusting fauna and algae (including hydroids, barnacles and keel worm)	P	-
HD-T3-4	484661	6529458	36.8	Mixed sediment – coarse sediment dominant	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Nudibranch egg mass	P	-
T4-1	485844	6528703	41.9	Medium-fine sand	Unidentified brittle star species	C	1-9/10 m^2
T4-2	485736	6528772	42.1	Clump kelp debris on rocky outcrop	Small dogfish	P	-
T4-3	485503	6528964	42.7	Medium-fine sand with kelp fragments	Unidentified brittle star species	C	1-9/10 m^2
T4-4	485083	6529288	43.2	Medium-fine sand with kelp fragments	No identifiable fauna	-	-

Image ID	Easting (m E)	Northing (m N)	Depth (m)	Substrate	Biota observed	Estimated Abundance	Density / % cover
T4-5	484719	6529568	38.7	Mixed sediment	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Several Nudibranch egg masses Sparse dead maerl fragments	P P P	-
T4-6	484614	6529648	32.3	Mixed sediment – coarse sediment dominant	Encrusting fauna and algae (including hydroids, barnacles and keel worm)	P	-
HD-T4-1	485823	6528702	41.8	Medium-fine sand	Harbour crab (*Liocarcinus depurator*)	O	1-9/100 m^2
HD-T4-2	484883	6529442	44.5	Mixed sediment	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Sparse dead maerl fragments	P	-
HD-T4-3	484719	6529568	38.7	Mixed sediment	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Several Nudibranch egg masses Sparse dead maerl fragments	P P P	-
HD-T4-4	484614	6529649	32.7	Mixed sediment	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Sparse dead maerl fragments Small group if unidentified anemones	P P P	-
T5-1	484702	6529751	31.2	Medium-fine sand	No identifiable fauna	-	-
T5-2	484772	6529707	37.3	Mixed sediment – coarse sediment dominant, kelp debris	Encrusting fauna and algae (including hydroids, barnacles and keel worm) Unidentified fish	P -	- -
T5-3	484954	6529589	44.7	Medium-fine sand-coarse sediment patch	Encrusting fauna and algae (including hydroids, barnacles and keel worm)	P	-
T5-4	485262	6529303	44.0	Rocky outcrop with kelp debris	Large unidentified crab	P	-
T5-5	485460	6529153	45.0	Medium-fine sand	Scallop (*Pecten maximus*)	F	1-9/10 m^2

Image ID	Easting (m E)	Northing (m N)	Depth (m)	Substrate	Biota observed	Estimated Abundance	Density / % cover
T5-6	485882	6528810	45.0	Medium-fine sand with rock outcrops and kelp debris	No identifiable fauna	-	-
HD-T5-1	484708	6529748	49.0	Medium-fine sand	No identifiable fauna	-	-
HD-T5-2	484955	6529559	36.6	Mixed sediment	Encrusting fauna and algae (including hydroids, barnacles and keel worm) dead maerl fragments? Flatfish Small benthic fish	P - - 	-
HD-T5-3	484758	6529712	45.2	Medium-fine sand/mixed sediment area	Hermit crab (Paguridae)	P	-
HD-T5-4	485429	6529163	44.8	Medium-fine sand	Polychaete burrows Tube worm (possibly *Lanice conchilega*)	P F	- 1-9/100 m^2