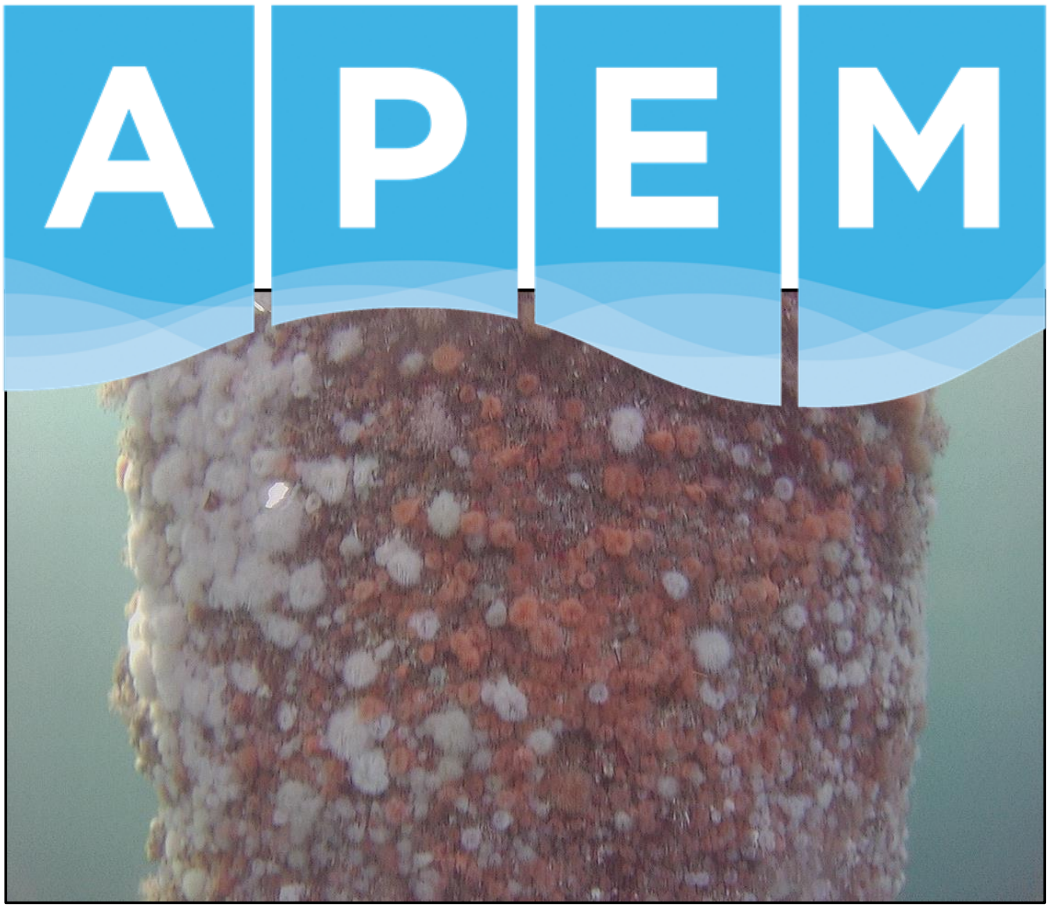

Beatrice Offshore Windfarm Post-construction Monitoring: Turbine Foundation Marine Ecology Survey Report

SSE Renewables and Beatrice Offshore Windfarm Ltd (BOWL) Ltd

APEM Ref: P00004389

September 2021

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This report should be cited as: APEM. 2021. Beatrice offshore wind farm post-construction monitoring: Turbine foundation marine ecology survey report. APEM Ref: P00004389. Report on behalf of Beatrice Offshore Wind Farm Ltd.

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1.0	30/06/21	All	All	Document Creation	MH
2.0	07/09/21	Exec Summary, 3.1, 3.2, 4.2	2, 11, 12, 73	Addressing comments from Nature Scot	MH

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Executive Summary

As part of a post-construction sampling programme to partially discharge Condition 27 of the Beatrice OWF Section 36 consent, APEM Ltd was commissioned by Beatrice Offshore Windfarm Ltd (BOWL) to undertake a Remotely Operated Vehicle (ROV) and Drop Down Video (DDV) survey at the Beatrice Offshore Wind farm (OWF) site in October 2020. These two techniques were utilised to gather qualitative data for community composition of biofouling on the turbine jacket legs, and epibiota on the surrounding seabed. This survey was conducted alongside a benthic grab survey within the OWF site and the results of that survey are reported in APEM (2021).

An ROV and DDV system was deployed at four turbine foundation locations (turbines C04, F06, H08 and K07) which were selected based on a number of criteria (see Section 1.1.3). Each turbine foundation consisted of four jacket legs and associated cross-bracing. The face of each jacket leg was inspected using an ROV from 0 m to approximately 35 - 45 m depth (depending on the length of the leg) with still images taken every 5 m. The ROV was also used to survey the seabed adjacent to the turbine legs for a distance of approximately 45 m along a bearing to the start of the DDV transects. DDV transects were then run to a set distance away from the foundation as follows: Transects were run to the north-northeast and south-southwest (in line with the prevailing current) for a distance of 500 m; transects were run to the east-southeast and west-northwest (perpendicular to the prevailing current) for a distance of 250 m.

There was extensive biofouling on all turbine jacket legs with signs of zonation and successional development. A range of species had colonised the available substrate which was consistent with the colonisation of turbine foundations at other windfarms (e.g. EMU 2008, Whomersley & Picken 2003, Bouma & Lengkeek 2009, Leonhard & Pedersen 2006). It was noted, however, that blue mussel *Mytilus edulis* which often colonise hard structures in the marine environment (e.g. Leonhard & Pedersen 2006, Joschko *et al*. 2008, Bouma & Lengkeek 2009, Coolen *et al* 2015) were not recorded during the Beatrice OWF survey.

Consistent with the colonisation of other turbines in the southern and wider North Sea area, biofouling communities were found to occupy distinct zones dominated by one or two key species and the depth zones in which taxa were recorded were typical of colonisation of other natural and artificial hard substrata (e.g. EMU 2008, Whomersley & Picken 2003, Bouma & Lengkeek 2009, Leonhard & Pedersen 2006). Across all turbine foundations the plumose anemone *Metridium senile* and the keel worm *Spirobranchus triqueter* were the most abundant taxa accounting for the majority of the total biofouling cover and these species occupied the central and lower sections of the jacket legs, respectively. The upper 0-5 m of all turbine foundations were dominated by algal turf, kelp and a range of epiphytic species. Biomass from fouling species typically followed a bell curve distribution with depth, with low biomass at the surface, higher biomass at mid depths and minimal biomass at the base. The zoned pattern of biomass distribution was found across all turbines and is considered likely to remain fairly consistent into the future except for some small-scale variation, or it could vary if new species colonised the turbine foundations, such as blue mussels.

De Mesel et al. (2013) found that zonation and community composition differed little after the first two years of colonisation and that communities would typically contain the same limited

number of species but with some species in high abundances. In contrast, Leonhard & Pedersen (2006) indicated a climax community on introduced hard structures may not be expected until 5-6 years after hard substrate deployment. Further monitoring at Beatrice OWF will elucidate how stable the communities recorded on the jacket legs are over time.

At the base and in the immediate vicinity of the jacket legs, mobile species such as the hermit crab *Pagurus bernhardus*, flatfish and the common sea urchin *Echinus esculentus* were recorded which would suggest the availability of food in the immediate vicinity of the turbine legs (e.g. pseudofaeces and detritus) although no biological material was recorded on the seabed. Material may be rapidly consumed by organisms or relocated due to tidal currents and further monitoring will be required to clarify if biological material builds up over time. Gadoids and flatfish recorded on the ROV footage could not be identified to species level, however, there is potential that some of the gadoids seen were Atlantic cod *Gadus morhua*, and European plaice *Pleuronectes platessa* may have been present (flatfish could not be recorded to species level). Both of these species are included on the Scottish Biodiversity List and Atlantic cod is a Scottish Priority Marine Feature.

During the DDV survey 8,028 m of seabed were surveyed, with 4,953 m of the habitat recorded as Sublittoral coarse sediment (EUNIS code A5.1). This habitat dominated all transects at turbines C04 and H08 and a number of the transects at F06 and K07. A total of 2,807 m of surveyed habitat was recorded as Sublittoral mixed sediments (EUNIS code A5.4) which had greatest coverage at F06. The third habitat type recorded was '*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment' (EUNIS code A5.444) which was recorded at turbine foundation K07 (total extent of 268 m). Most of the habitat recorded in the DDV footage was featureless mixed or sandy habitat with no conspicuous species present, consequently it was generally not possible to characterise habitats beyond EUNIS level 3 although biotopes allocated to nearby grab sample stations based on the results of sample analyses have been indicated within this report (see APEM 2021 for further details). It was possible to assign *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (EUNIS code A5.444) (EUNIS level 5 habitat) as this area was characterised by larger numbers of conspicuous bryozoans and hydroids such *Flustra foliacea* and the hydroid *Hydrallmania falcata*. Several species were identified within this habitat type which were also frequently found on the jacket legs, such as dead man's fingers *Alcyonium digitatum* and the keelworm *S. triqueter*. No Invasive Non-Native Species (INNS) were recorded during the ROV or DDV survey.

Based on the results of the survey there was limited evidence for effects of fouling communities on the epibenthic community composition in the immediate vicinity of the turbines, other than the presence of some mobile species. Further monitoring to be undertaken as part of the post-construction monitoring programme will provide additional information relating to how the turbine jacket legs are colonised over time and help clarify if the organisms on the jacket legs are influencing sediment and habitat type in the vicinity of the turbines.

1. Project Overview

1.1 Scope of Work

1.1.1 Project background

This report presents the results of a pre-construction ecological survey undertaken by APEM Ltd at turbine foundations at the Beatrice Offshore Wind Farm (OWF) site utilising underwater video/stills. The survey was conducted to partially discharge Condition 27 of the Beatrice OWF Section 36 consent which states that the Project Environmental Monitoring Programme (PEMP) must cover, but not be limited to:

"Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post-construction monitoring surveys as relevant in terms of the Environmental Statement and any subsequent surveys for….[6] benthic communities; and [7] (Seabed scour and) local sediment deposition."

The work forms part of the benthic monitoring strategy for the Beatrice OWF.. The wider survey included use of a benthic grab to determine sediment type and invertebrate communities within the OWF site (results of the survey are provided in APEM (2021)). Methods followed those set out in the Benthic Post-Construction Monitoring Strategy (RPS/BOWL 2015), refined following discussion at a meeting of the Moray Firth Regional Advisory Group (MFRAG) on 11th June 2020, and subsequent email correspondence.

1.1.2 Survey objectives

The objective of the survey was to utilise underwater video/stills to provide a visual inspection of the jacket legs of selected turbine foundations and collect data relating to the range of species colonising the jacket legs and species abundance. In addition, a visual inspection of the seabed in the vicinity of these structures was conducted to determine if any debris from the jacket legs was evident on the seabed and to enable an assessment of potential wider effects of biofouling of the jacket legs on the surrounding soft sediments.

The monitoring was designed to address the following question:

- How do the fouling communities associated with the introduction of hard substrate (i.e., foundations) develop in the long term and what, if any, visible effects are there on the epibenthic community composition in the immediate vicinity?

It should be noted that the original wording of this question included consideration of scour protection, however, as scour protection was not installed the question no longer addresses this.

1.1.3 Survey Design

The Beatrice Offshore Windfarm site is located south-west of Wick on the edge of the 12 nm limit in the Northern Moray Firth (Figure 1).

Visual inspection surveys were carried out on the four jacket legs at each of the four turbine foundation locations selected to fulfil the following criteria:

- Locations were within the MoeVen biotope as mapped during the previous survey;
- Two locations were near the border of the wind farm, and two were near the centre, to provide good spatial coverage;
- Locations were close to one of the grab sample stations within the OWF site.

Locations of the turbine foundations surveyed including the seabed transects are indicated in Figure 1. Co-ordinates for the turbines and the start and end point of transects are provided in Appendix 1.

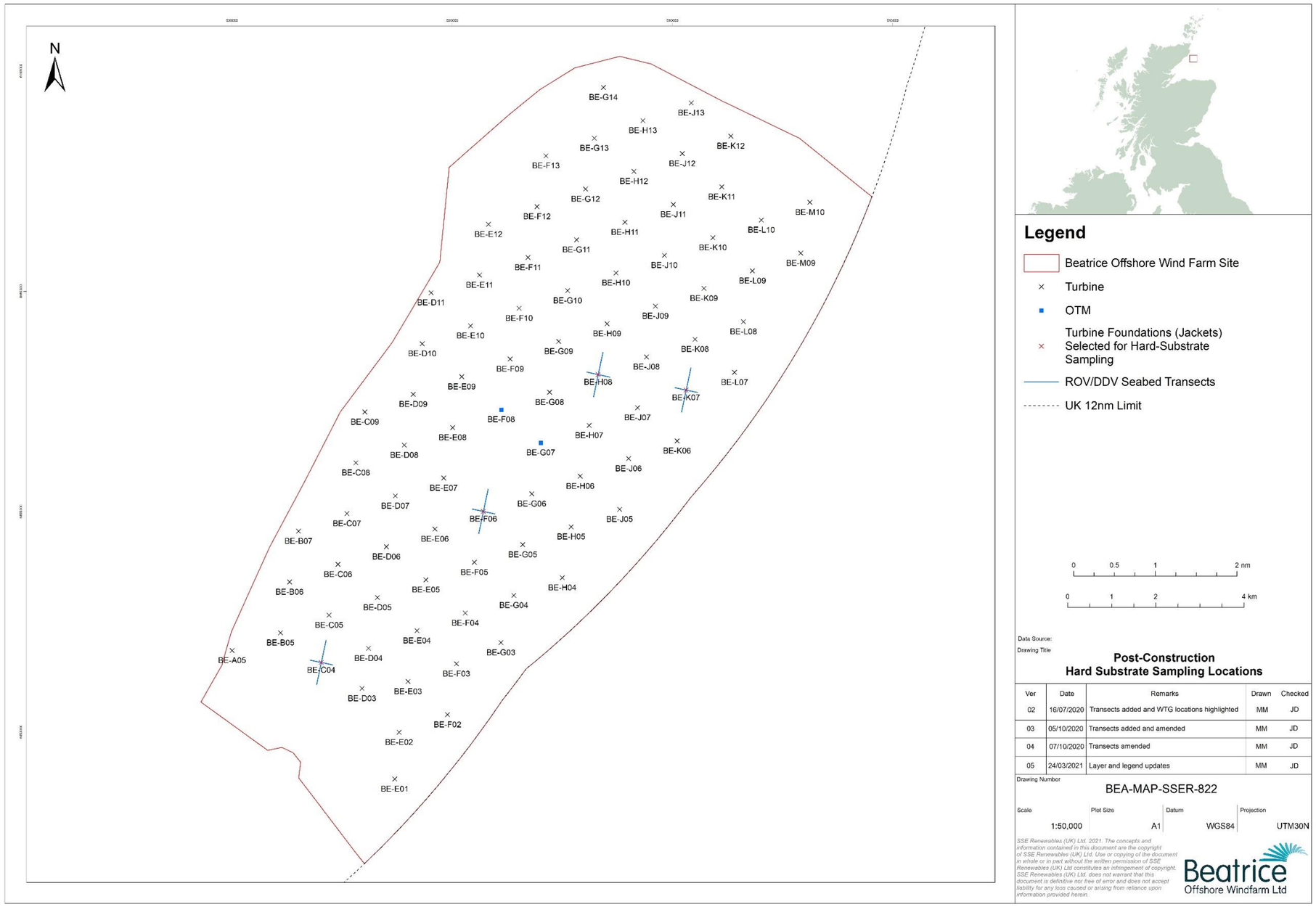


Figure 1. Locations of the four sampled turbine foundations (jackets) and associated seabed transects

2. Methodology

2.1 Survey Vessel and Permissions

The turbine foundation survey was undertaken using the Moray First Marine vessel 'Waterfall' (see Figure 2), mobilising from Montrose. The Waterfall is a 16 m Aluminium Catamaran workboat rated to 60 miles offshore under MCA Category II classification.

The Waterfall has been audited by the International Marine Contractors Association (IMCA) on 25/03/2020 and was audited by Beatrice Offshore Windfarm Ltd (BOWL) for this project.

All survey permissions were obtained by BOWL prior to the survey commencing.

Figure 2. MFM vessel Waterfall used during the turbine foundation survey

2.2 Underwater video/stills acquisition

The survey was conducted between the 10th and 12th October 2020.

Due to the manoeuvrability required, a Remotely Operated Vehicle (ROV) was used to survey the turbine foundations and nearby seabed and a Drop-Down Video (DDV) system was used to survey the wider seabed area around the foundations.

When at the base of each jacket leg the ROV was run out a distance along the seabed (on average out to approximately 45 m) along a bearing consistent with bearing of the associated DDV transect (see Section 2.2.2). The ROV was used due to the logistic difficulty and health

and safety considerations preventing the commencing of a DDV transect at the jacket base. As the ROV did not have a GPS tracking system, due to current movements it may not have been run to the exact starting point of the DDV transect (or end point depending in the direction in which the transect was surveyed), however, based on the distance covered and the bearing followed it is anticipated to provide coverage to a nearby point and the footage obtained is representative of the habitat and species around the base of the turbine foundation.

The DDV was then used to survey the longer seabed transects extending further from the turbine foundations. The approach followed the methodology proposed in the JNCC Marine Monitoring Handbook and guidance produced as part of the Mapping European Seabed Habitats project (MESH) (Coggan *et al*. 2007) and Cooper (2017; RMSPv5 guidance). At the four turbine locations (Figure 1) a DDV "transect" was run to a set distance away from the foundation as follows:

- Distance of 500 m - for transects run to the north-northeast and south-southwest (in line with the prevailing current).
- Distance of 250 m - for transects run to the east-southeast and west-northwest (perpendicular to the prevailing current).

Current roses taken from pre-construction monitoring were reviewed to determine the direction of the prevailing currents at the site (Figure 1). These were taken from ABPmer (2015).

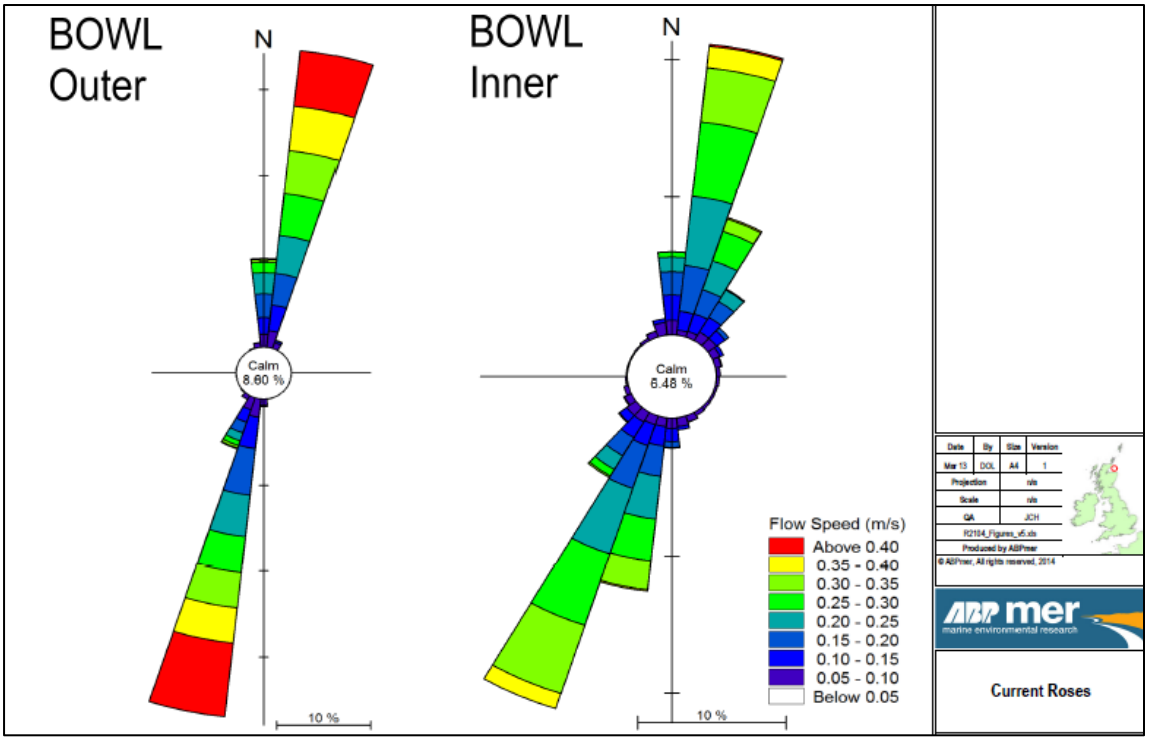


Figure 3. Current roses for BOWL outer and inner.

The ROV used was an Outland 2500 which had a tilting mechanism and LED lighting system providing high resolution outputs and good colour in low light conditions. The ROV recorded

High Definition (HD) 1080 dp video and when descending the turbine foundation the movement of the ROV was halted at five metre depth intervals along the foundation to enable freeze frame images to be captured. The typical length of turbine foundation underwater was 35-45 m.

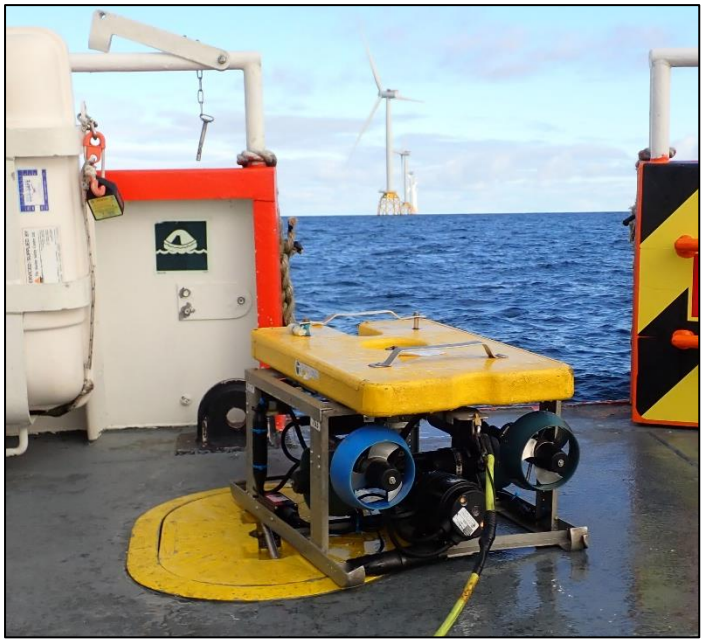


Figure 4. Outland 2500 ROV on deck at BOWL

The DDV survey was conducted using a SeaSpyder Underwater Drop Camera System with a (5184 x 3456 18Mp) stills camera with dual built-in flash and laser pointers for stills and a separate HD video camera, illuminated by 20w LED lamps and laser scaling for simultaneous video capture.

Figure 5. STR SeaSpyder on deck

2.2.1 Survey of turbine foundations and seabed habitat in the immediate vicinity of the turbine foundations

The monitoring strategy for the turbine foundations was developed based on a comprehensive review of monitoring requirements undertaken by RPS Energy in 2015, on behalf of BOWL in consultation with various stakeholders.

The ROV video was recorded continuously and monitored on-board the vessel, with adjustments made to the ROV system as required to maintain image quality. *In situ* assessment of the live footage was conducted by an experienced marine ecologist to record species/habitats. The following data were collected at each of the four turbine locations:

- Video footage from sea surface (including the splash zone) to the seabed for the jacket legs of each turbine foundation.
- Further footage to cover the seabed extending along an associated bearing (i.e. north-northeast, south-southwest, east-southeast or west-northwest direction (see Section 2.2.2)) from the base of the turbine until the DDV transect location was reached (distance varied but was on average approximately 45 m).
- Still images were captured from the 1080p HD video signal at five metre intervals along the turbine foundation and/or at notable changes in species composition. Stills capture was conducted separately to the video so it did not interfere with the recording of the video stream.

2.2.2 Survey of seabed habitat extending from turbine foundations

As indicated above, DDV transects were run in a north-northeast, south-southwest, east-southeast, and west-northwest direction extending from each turbine location.

The video was recorded along the total specified length and direction at each transect, with still images taken at approximately one minute intervals or when there was a change in habitat type. The video was monitored on-board the vessel, with adjustments made to the camera system as required to maintain image quality. *In situ* assessment of the live footage was conducted by APEM's survey lead to note changes in habitat type.

For the ROV and DDV surveys a survey log was completed daily, detailing each drop of the camera equipment, with the following information recorded per deployment:

- Transect number
- Date
- Start time (24-hour format);
- Water depth;
- Tidal state;
- Sea surface conditions;
- Weather conditions;
- Start and end positions;

- Seabed substrate;
- Any conspicuous fauna;
- Presence/absence of Annex I habitats

2.3 Laboratory analysis of video and stills

Detailed laboratory analysis of digital stills and video footage was conducted utilising supplementary notes recorded in the field, positional data, captured images and videos. For the ROV surveys of the jacket legs the locations of any species or habitat changes were indicated in relation to changes in depth. For the DDV benthic habitat survey, still images and video taken along each transect were analysed by viewing in real-time or slower at 1:1 speed, with key habitat changes and species recorded utilising overlayed positional data to georeference the data.

On the turbine foundations the taxonomic abundance data and substrate information for each image and video was noted using 5 m depth bands to subdivide each jacket leg. As no EUNIS habitats are currently designated for artificial substrates, SACFOR data (Appendix 2; from Hiscock, 1996) was used to define vertical zonation where possible.

All taxa were identified to the lowest possible taxonomic level using relevant taxonomic keys and photographic guides. Taxa were counted semi-quantitatively using the SACFOR scale of abundance (Appendix 2; Hiscock, 1996): Super-abundant (S), Abundant (A), Common (C), Frequent (F), Occasional (O), Rare (R) and Present (P). The abundance ratings for each taxon were then assigned for each 5 m depth band along a jacket leg and for each benthic habitat survey transect.

The taxonomic abundance data and substrate information for each DDV transect were used to assign a EUNIS habitat type (EEA, 2020) and cross-referenced with positional data to determine habitat boundaries. GPS track data recorded from the ship's GPS receiver mounted midship during the survey was used for accurate spatial mapping of habitat types. These data were imported into ArcGIS to delimit the habitats present along the GPS track.

3. Results

3.1 Turbine foundations

Specific information is provided in Section 3.3 onwards for each turbine foundation (set of four jacket legs) surveyed. Results are provided separately for each jacket leg and in this report the four jacket legs at each turbine foundation surveyed are termed North, East, South and West respectively, corresponding to the cardinal point to which they are most closely aligned.

Images were reviewed at 5 m intervals down the jacket leg and data are provided for each of these depth intervals in Appendix 3.

When describing the communities present, however, these 5 m depth intervals tended to fall within wider 'zones' of communities and the depth range of these zones has been described in the results section for each jacket leg. Biological zones were determined by taking into account the SACFOR information and the presence/absence of key species. In general terms, with increased depth down the jacket leg there was a shallow algae-dominated zone, a transition zone between an algae-dominated and cnidarian-dominated zone, a cnidarian dominated zone and a spirorbid dominated zone. Biomass generally peaked at the mid-depths. No INNS were recorded on the jacket legs during the ROV survey.

Broad findings for each zone are indicated below although there was some variation across jacket legs.

3.1.1 0 - 5 m

This depth band covered the splash zone +0.5 m / -0.5 m and the upper 5 m of the structure. This depth band was typically dominated by barnacles in the upper 1 m and a range of algae species between 1 and 5 m such as the kelp *Laminaria hyperborea*. Red algal species were present and could not be identified beyond the grouping of red algal turf (Rhodophyta turf) based on the video/stills. In addition to algae, a number of epiphytic species such as bryozoans and hydroids were recorded. The blue mussel *Mytilus edulis* was not recorded on any of the jacket legs.

3.1.2 5 - 10 m

This band usually delineated a transition between the algae-dominated upper leg and the cnidarian-dominated zone on the mid-leg. Although this transition was typically between 5 to 10 m depth (depending on the leg orientation and light availability) the transition was frequently across a greater depth range. This zone typically consisted of a mix of *Laminaria hyperborea* and a red algal turf interspersed with cnidarians such as the plumose anemone *Metridium senile,* the anemone *Sargartia* sp. and dead man's fingers *Alcyonium digitatum*, which is a soft coral.

3.1.3 10 - 25 m

This band was dominated by the cnidarian species *M. senile, Sargartia* sp. and *A. digitatum*. A number of hydroid, sponge and scavenger species were frequently present. Many of the

species were relatively slow growing and typically had higher biomass than within the other zonation bands. It is anticipated that a range of more cryptic and epiphytic species would be present in between the more visible species.

3.1.4 25 - 40 m

After approximately 25 m the cnidarian-dominated zone generally started to transition with reduced numbers of *M. senile, Sargartia sp*. and *A. digitatum* (reduced to Occasional and Rare on the SACFOR scale) except on some of the protruding features of the jacket legs where they were still abundant. The lower section of the legs was almost entirely dominated by the keel worm *Spirobranchus triqueter*. Although present at shallow depths *S. triqueter* generally had 80-100% cover of the lower leg. At the base there were some graduated marking lines on the jackets and these were frequently heavily fouled even when there was no fouling on surrounding sections of the jacket.

3.1.5 Seabed

At the base of almost all of the jacket legs and the surrounding seabed the hermit crab *Pagurus bernhardus*, flatfish (*Pleuronectidae*) and other species were present suggesting the presence of a potential food source. No visible biological material, however, was present on the seabed either in the immediate vicinity of the turbines (within 50 m of the base) or along the transects extending further from the turbines.

The seabed habitat type in the immediate vicinity of the turbines (within 50 m) was Sublittoral coarse sediment (EUNIS A5.1) or Sublittoral mixed sediment (EUNIS A5.4) depending on the jacket leg being considered.

3.2 Habitats on the transects extending from the turbine foundations

Three benthic biotopes were recorded along the DDV transects extending further from the turbines (extent on each transect is provided in Appendix 4):

- Sublittoral coarse sediment (EUNIS A5.1);
- Sublittoral mixed sediment (EUNIS A5.4); and
- *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (EUNIS A5.444).

It was generally not possible to determine habitat beyond EUNIS level 3 (i.e. A5.1 or A5.4) due to the lack of conspicuous species present and the fact that higher level allocations are based on the invertebrate communities present under the sediment surface. The exception was the area of A5.444 which was readily determined based on the conspicuous epibiota present.

No INNS were recorded within habitats along the transects during the DDV survey.

3.2.1 *Sublittoral coarse sediment (EUNIS A5.1)*

This habitat is characterised by coarse sediments including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal currents and/or wave action. These habitats are generally found on the open coast or in tide-swept channels of marine inlets. They typically have a low silt content and lack a significant seaweed component. They are characterised by a robust fauna including venerid bivalves (EEA 2020).

3.2.2 *Sublittoral mixed sediments (EUNIS A5.4)*

These habitats encompass a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud. Another 'form' of mixed sediment includes mosaic habitats such as superficial waves or ribbons of sand on a gravel bed (observed frequently in this form during this survey) or areas of lag deposits with cobbles/pebbles embedded in sand or mud. These habitats are less well defined and may overlap into other habitat or biological subtypes. These habitats may support a wide range of infauna and epibiota including polychaetes, bivalves, echinoderms, anemones, hydroids and bryozoans (EEA 2020).

3.2.3 *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (EUNIS A5.444)

Flustra foliacea and the hydroid *Hydrallmania falcata* characterise this biotope with lower abundance of other hydroids such as *Sertularia argentea* and *Nemertesia antennina*, and occasionally *Nemertesia ramose* occurs where suitably stable hard substrata are found. The anemone *Urticina feline* and the soft coral *A. digitatum* may also characterise this biotope. The tube worm *Pomatoceros triqueter* may be present and the robust bryozoans *Alcyonidium diaphanum* and *Vesicularia spinosa* may appear amongst the hydroids at a few sites. *Sabella pavonina* and *Lanice conchilega* may be occasionally found in the coarse sediment around the stones (EEA 2020).

3.3 Turbine C04

A map of benthic habitats around turbine CO4 is indicated in Figure 6. In the sections below, details are provided for the range of biological communities recorded on the turbine foundation jacket for turbine CO4, followed by descriptions of the habitats recorded on the transects along the sea floor heading away from the turbine foundation. The nearest benthic grab station to this turbine was Station 5 at which two replicate samples were allocated the biotope '*Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand' (JNCC code: SS.SCS.ICS.MoeVen; EUNIS code: A5.133) and one was allocated the biotope '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (SS.SSa.CFiSa.EpusOborApri; A5.251), (see APEM 2021 for details).

3.3.1 C04 North

3.3.1.1 C04 North: Turbine jacket leg assessment

0 - 5 m

On the upper jacket leg (0-1 m) patches of uncolonised yellow high-visibility paint were visible and there was a thick band of kelp around 1-4 m. The taxa present were Superabundant kelp *Laminaria hyperborea*, Abundant common starfish *Asterias rubens,* Common barnacles *Balanoidea* and red algae Rhodophyta turf and Occasional red coralline algae *Corallinaceae* (encrusting). In the 4-5 m zone plumose anemone *M. senile* was Common and started to replace most other taxa.

5 - 10 m

This was a transition band between the upper kelp zones and the middle *M. senile*-dominated lower sections. Biofouling in this band was extensive at almost 80-90% cover with a high biomass of invertebrates. In this band *M. senile* was Abundant, *A. rubens* and the bryozoan *Cellaria sp.* were Common and the anemone *Sagartia elegans* was Frequent.

10 - 25 m

This band was dominated by *M. senile*, where it was either Superabundant or Abundant. Biofouling in this band was extensive at almost 90-100% cover with a high biomass of invertebrates. The bryozoan *Cellaria* sp. was Abundant to Common, *A. rubens* was Common and *S. elegans* was Rare. In deeper sections, the keel worm *S. triqueter* increased from Common to Abundant.

25 - 38 m

Lower sections of this leg transitioned into a keel worm-dominated habitat with Abundant *S. triqueter*. The biofouling in this zone was still high but was dominated by taxa with low biomass. This band included Occasional *Cellaria* sp. and Abundant or Common *M. senile* but at the base *Asterias rubens*, *Crisia* sp., *S. triqueter and Suberites* sp. were Common, the hermit crab *P. bernhardus* was Rare and flatfish *Pleuronectidae* were Occasional.

Seabed

On sediment at the base of the jacket leg, hermit crab *P. bernhardus* was Rare and Occasional flatfish (*Pleuronectidae*) and Common *A. rubens* were recorded. There was no evidence, however, of accumulating biological material visible at or around the base. Heading in a north north-westerly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) and *P. bernhardus* and flatfish were recorded.

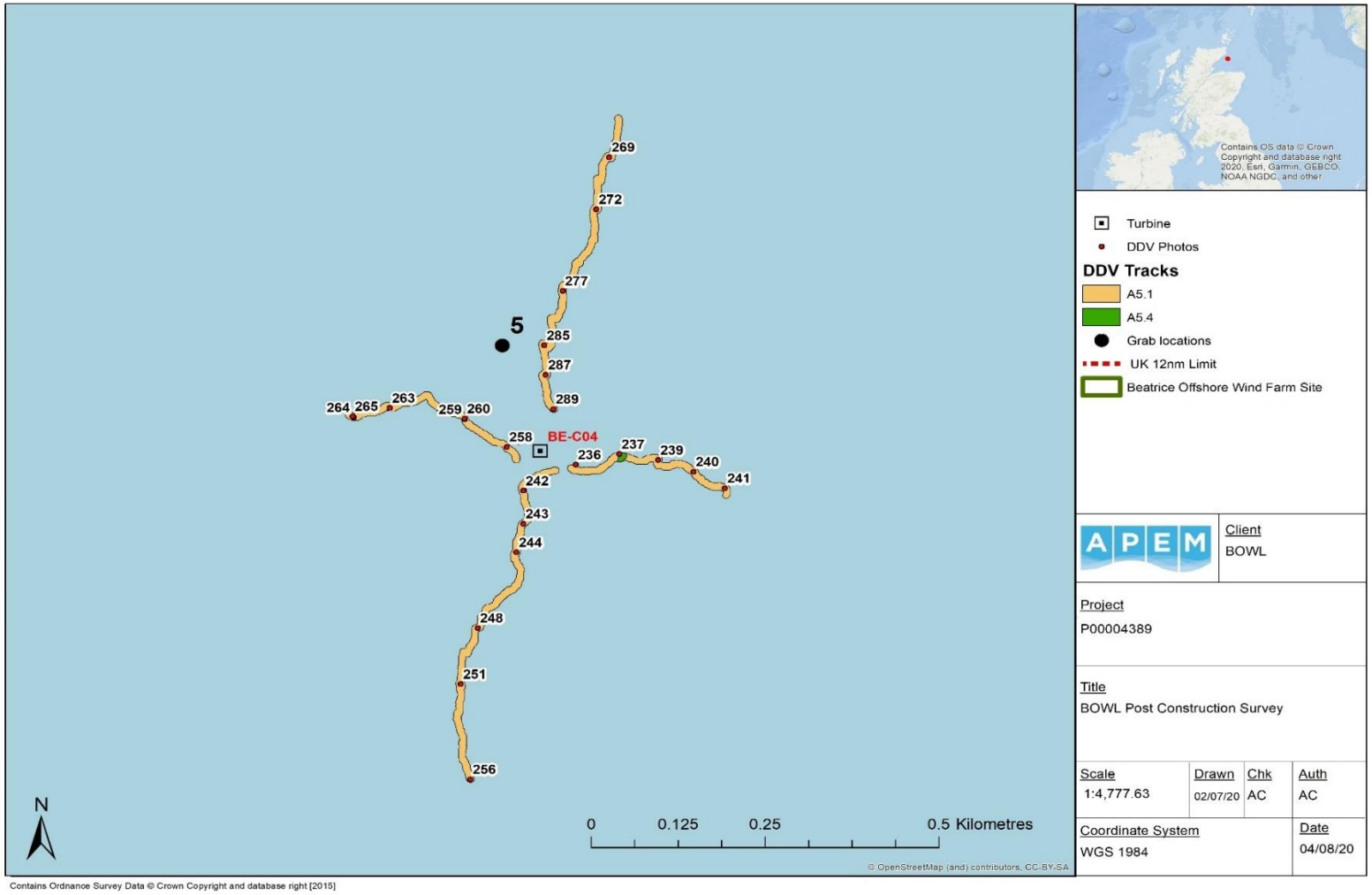


Figure 6. Habitat types present at turbine C04

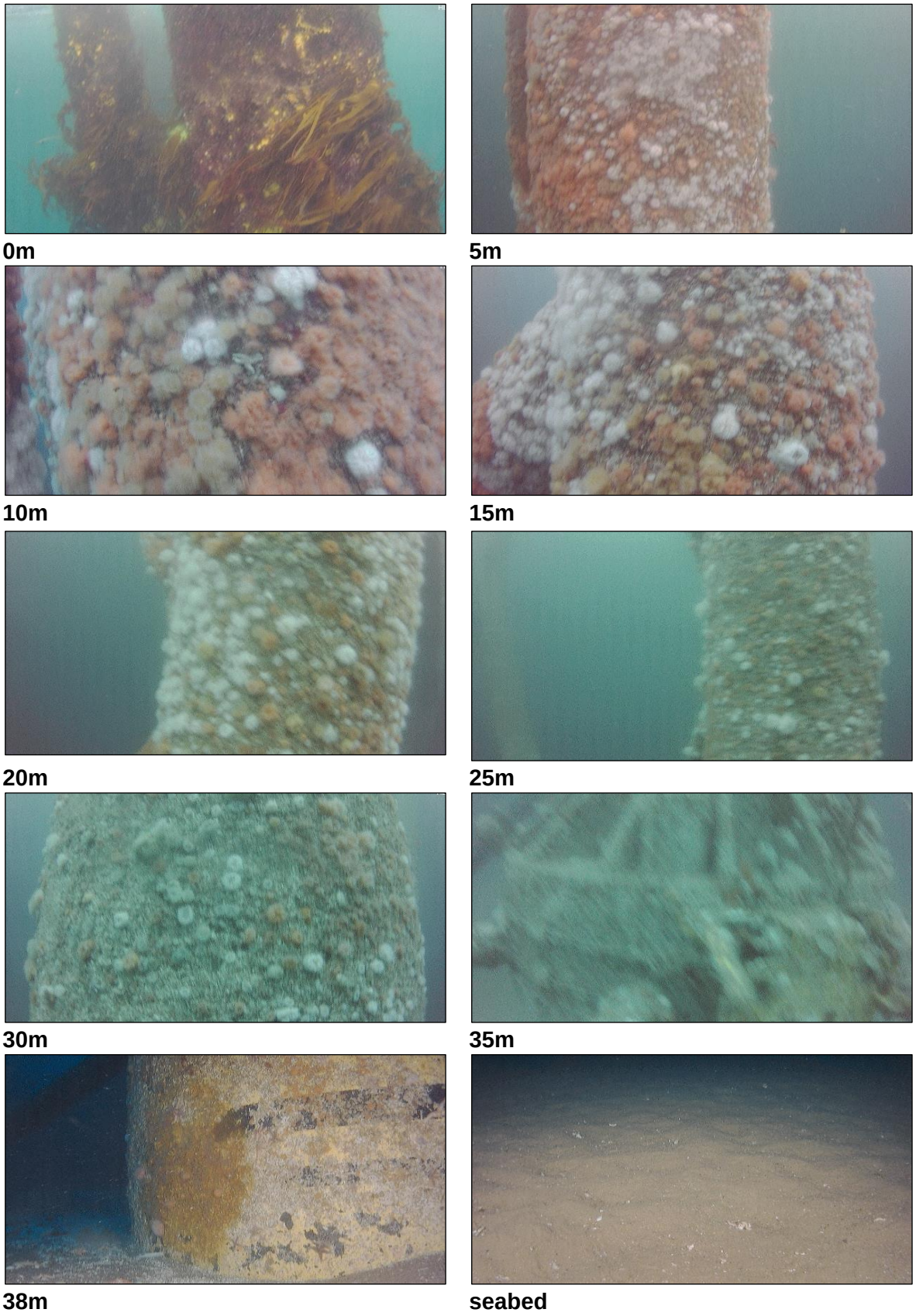
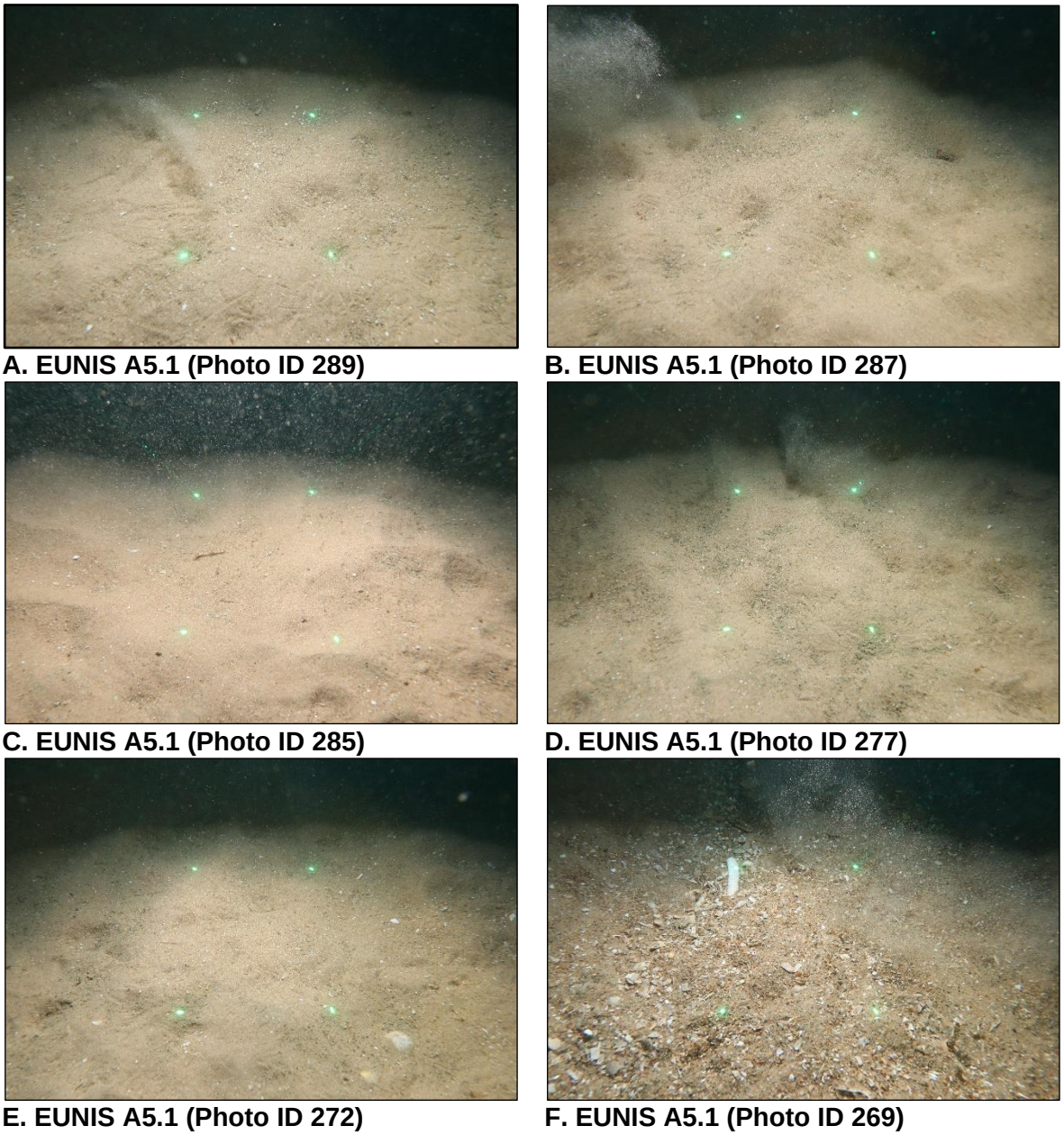


Figure 7. Photos taken at 5 m depth bands at C04N (Figure 6).

3.3.1.2 C04 North: Benthic habitat around turbine

The substrate at C04N was Sublittoral coarse sediment (EUNIS A5.1) including sand, shell and gravel. The only conspicuous fauna identified during the transect were Rare common starfish *A. rubens* and flatfish (*Pleuronectidae*) (note - Photo IDs in Figure 8 below can be cross referenced with locations shown in Figure 6).



A. EUNIS A5.1 (Photo ID 289) **B. EUNIS A5.1 (Photo ID 287)**

C. EUNIS A5.1 (Photo ID 285) **D. EUNIS A5.1 (Photo ID 277)**

E. EUNIS A5.1 (Photo ID 272) **F. EUNIS A5.1 (Photo ID 269)**

Figure 8. Representative seabed images taken at C04N

3.3.2 C04 East

3.3.2.1 C04 East: Turbine jacket leg assessment

0 - 5 m

The upper section of the jacket leg had clear patches of uncolonised yellow high-visibility paint visible between 0-2 m, transitioning into a band of kelp around 1-4 m. There was about 70-80% cover of epibiota in this band. Biofouling in this band was dominated by high biomass taxa such as kelp which creates additional surface area for colonisation.

Present in the 0-2 m zone were Frequent kelp *L. hyperborea*, Common *Balanoidea* and *A. rubens* and Abundant Rhodophyta turf. In the 4-5 m range, *M. senile* was Common and started to replace most other taxa.

5 - 10 m

This was a transition band between the upper kelp zones and the middle *M. senile*-dominated sections. Biofouling was consistent with other legs, with 80-90% coverage of high biomass taxa. Within this band *M. senile* was Superabundant, and Common *S. elegans* and Rhodophyta turf and Occasional *A. rubens* were present.

10 - 25 m

This band was dominated by *M. senile* where it was Superabundant or Abundant. The biofouling in this band was extensive (90-100% cover), including Frequent to Regular dead man's fingers *Alcyonium digitatum* (soft coral), Abundant *S. triqueter*, Common to Frequent *A. rubens*, Common *S. elegans* and Rare *Hydrozoa* sp. A (arborescent). An individual grey seal *Halichoerus grypus* and *Gadidae* (potentially Atlantic cod *Gadus morhua*) were also spotted on this leg.

25 - 38 m

The lower sections of the jacket leg transitioned into a keel worm-dominated habitat with Superabundant *S. triqueter* and at the base this was the only species present. Biofouling in this band was extensive (90-100%) but mainly with low biomass keel worms. *M. senile* was still Frequent, as were *S. elegans* and *Gadidae* juveniles.

Seabed

At the base Occasional flatfish (*Pleuronectidae*) were present, however there was little visible evidence of material falling onto the seabed from the jacket. Heading in an east-southeasterly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) and flatfish were recorded.

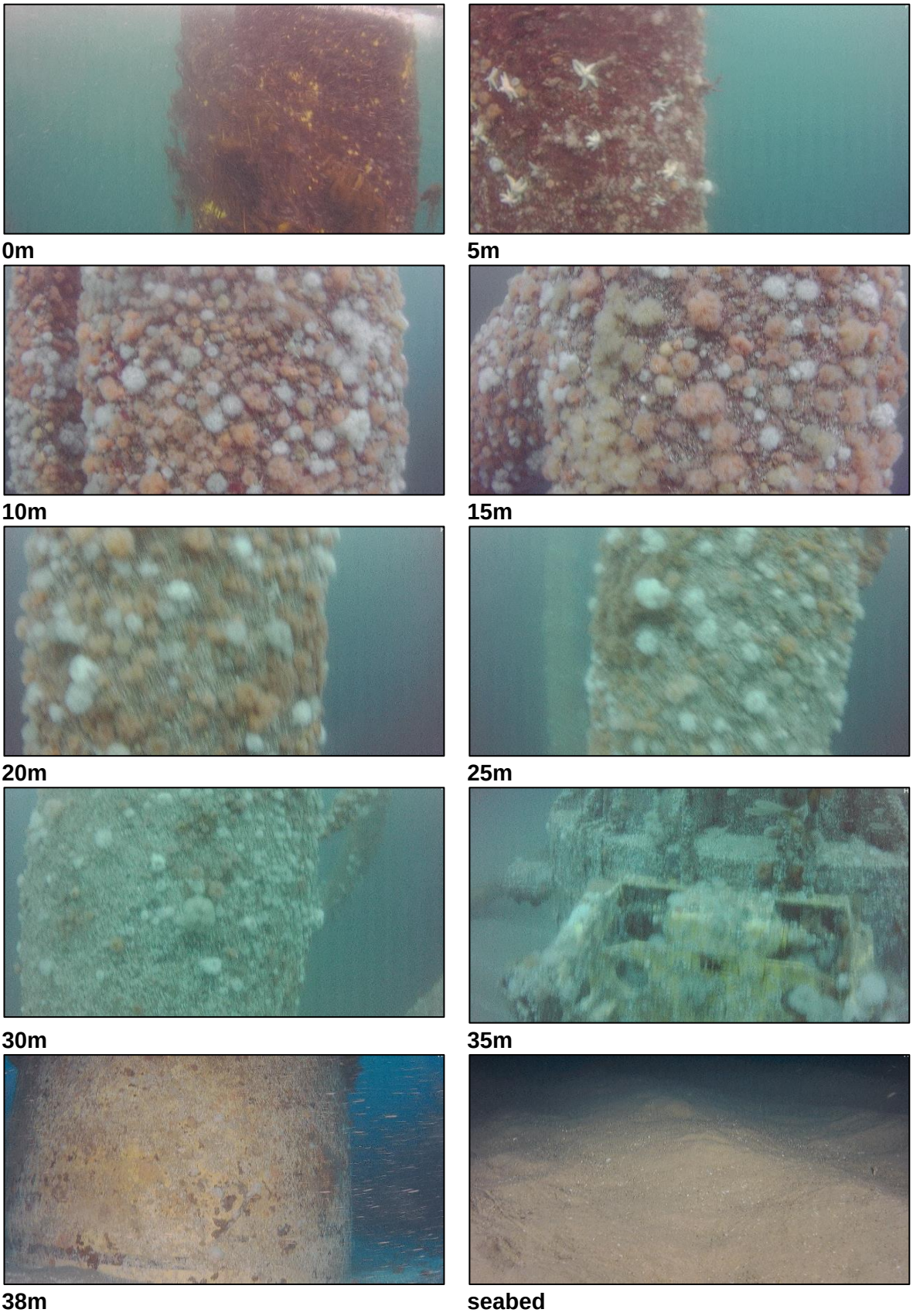


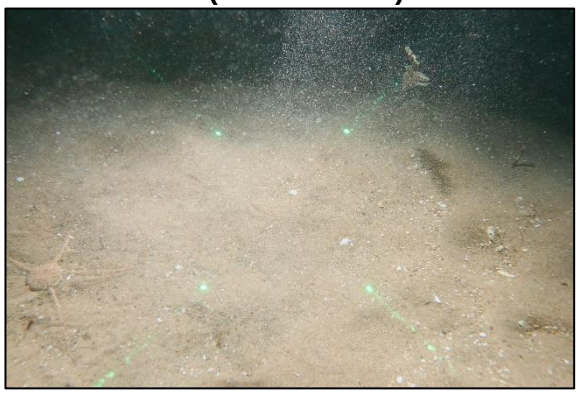
Figure 9. Representative images taken at 5m depth intervals at C04E

3.3.2.2 C04 East: Benthic habitat around turbine

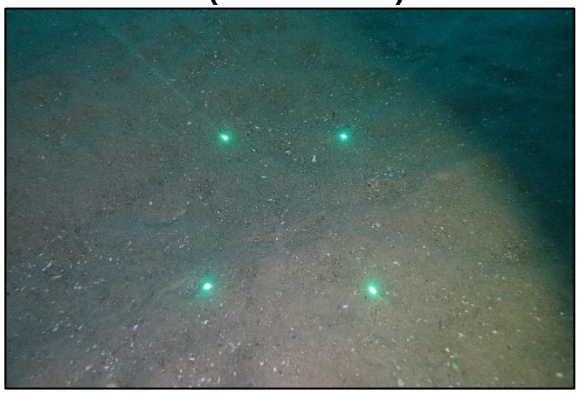
The substrate at C04E was Sublittoral coarse sediment (EUNIS A5.1), including sand, shell and gravel.. There was a small patch of less than 10 m of Sublittoral mixed sediments (EUNIS A5.4) about 70 m from the start of the transect. The only conspicuous fauna identified during the transect were Rare Common starfish *A. rubens,* and Occasional flatfish (*Pleuronectidae*) (note - Photo IDs in Figure 10 below can be cross referenced with locations shown in Figure 6).

A. EUNIS A5.1 (Photo ID 236)

B. EUNIS A5.1 (Photo ID 237)



C. EUNIS A5.1 (Photo ID 239)



D. EUNIS A5.1 (Photo ID 240)

E. EUNIS A5.1 (Photo ID 241)

Figure 10. Representative seabed images taken at CO4E

3.3.3 C04 South

3.3.3.1 C04 South: Turbine jacket leg assessment

0 - 5 m

The upper section of C04S had smaller patches of uncolonised yellow high-visibility paint compared to other legs at C04. C04S had greater diversity than the other C04 jacket legs with more taxa recorded at relatively high density and biomass compared to upper sections of other jacket legs. The upper 1-4 m was dominated by a band of Superabundant *L. hyperborea*. Other taxa found between 0-5 m were Abundant *A. rubens*, *Cellaria* sp. and Rhodophyta turf, Common *Crisia* sp. and edible sea urchin *Echinus esculentus* (juvenile), Occasional *Corallinaceae* (encrusting) and brown seaweed *Chorda filum*, and Rare sea squirt *Diplosoma listerianum* and bryozoan (hornwrack) *Flustra folicaea*.

5 - 10 m

As with other legs at C04 the 5-10 m zone was a transition zone between the upper kelp zone and the middle *M. senile*-dominated sections. Biofouling was consistent with other legs with high coverage (80-90%) of low biomass taxa. Within this band *A. rubens* and *Cellaria* sp. were Common, *S. elegans* was Rare and *M. senile* was Abundant.

10 - 25 m

Although dominated by Superabundant to Common *M. senile* and Abundant to Common *Cellaria* sp. this band had slightly less epibiota than other legs at similar depths, with approximately 80-90% coverage. Biofouling was predominantly by large, high biomass taxa. From approximately 15 m depth *S. triqueter* started to become the most dominant taxon increasing from Common to Superabundant by 25 m. *S. elegans* was also found in small patches and was classified as Rare. *A. rubens* was Common to Occasional.

25 - 38 m

The lower sections of C04S were dominated by Superabundant *S. triqueter*, however *M. senile* was still Abundant to Common and *Cellaria* sp. was Common to Occasional. Biofouling in this band was extensive (95-100%) but consisted of small, low biomass taxa.

Seabed

Common *Crisia* sp., *A. rubens, Spirobranchus triqueter and Suberites* sp. were present at the base as well as Rare *P. bernhardus.* There was no evidence of material falling onto the seabed from the jacket. Heading in a south-southwesterly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) and *P. bernhardus* and flatfish (*Pleuronectidae*) were recorded.

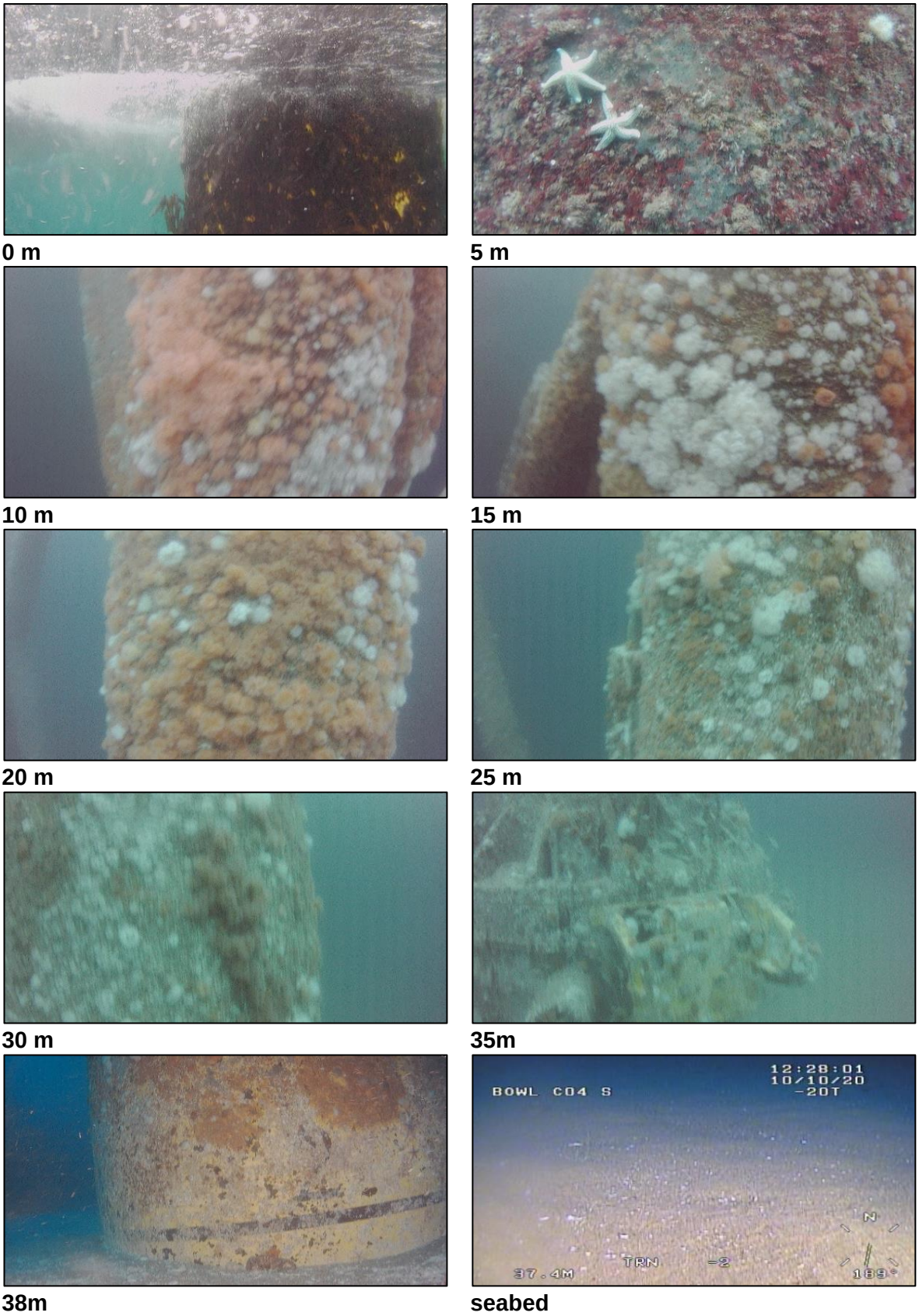
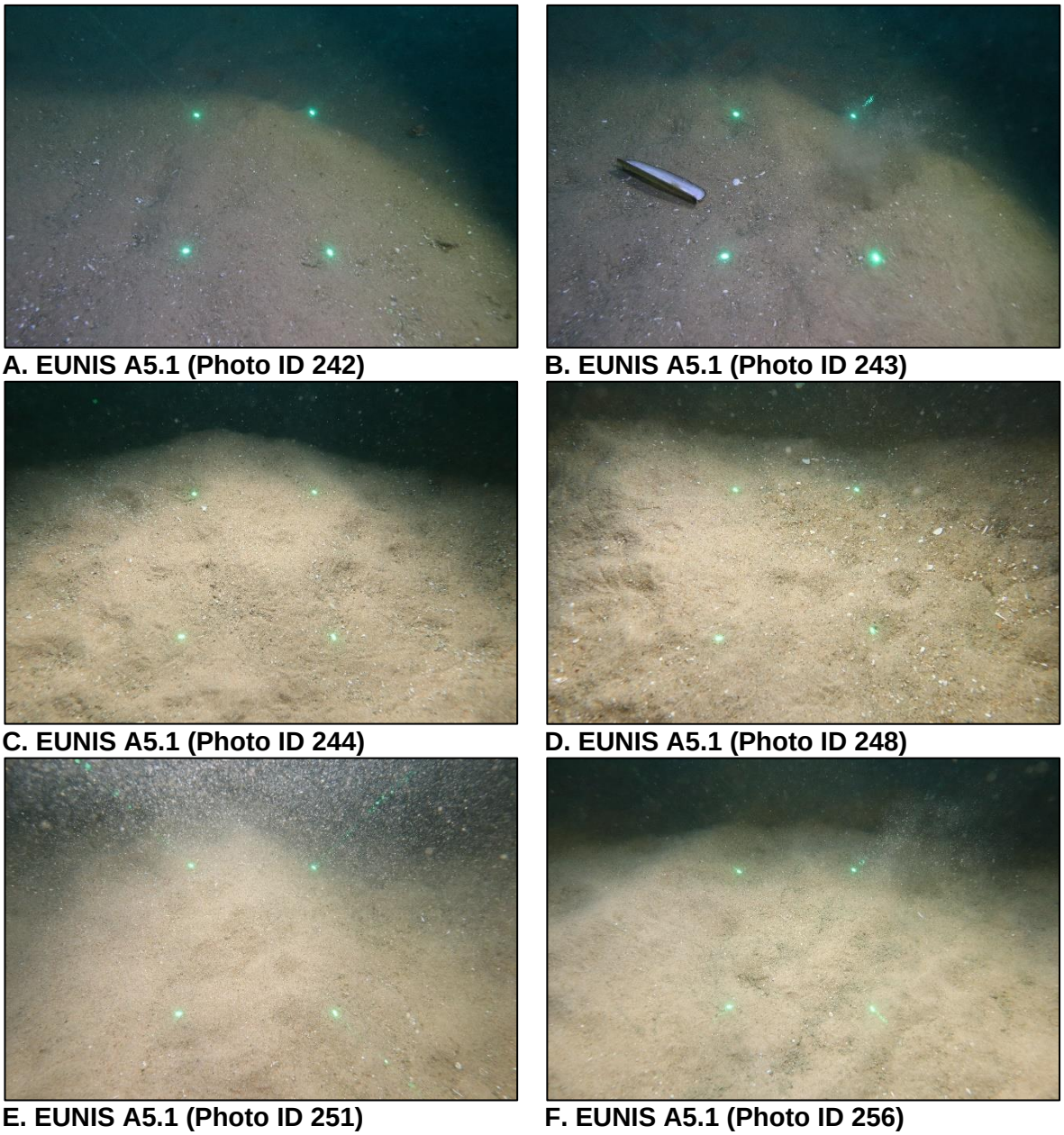


Figure 11. Representative images taken at 5m depth intervals at C04S

3.3.3.2 C04 South: Benthic habitat around turbine

The substrate at C04S was Sublittoral coarse sediment (EUNIS A5.1), including sand, shell and gravel.. The only conspicuous fauna identified during the transect were Rare *A. rubens* and flatfish (*Pleuronectidae*) (note - Photo IDs in Figure 12 below can be cross referenced with locations shown in Figure 6).



A. EUNIS A5.1 (Photo ID 242)

B. EUNIS A5.1 (Photo ID 243)

C. EUNIS A5.1 (Photo ID 244)

D. EUNIS A5.1 (Photo ID 248)

E. EUNIS A5.1 (Photo ID 251)

F. EUNIS A5.1 (Photo ID 256)

Figure 12. Representative seabed images taken at CO4S

3.3.4 C04 West

3.3.4.1 C04 West: Turbine jacket leg assessment

0 - 5 m

The upper section of C04W had fewer patches of uncolonised yellow high-visibility paint in the 0-2 m zone compared to other legs. The 1-4 m zone was dominated by a band of Superabundant Rhodophyta turf and Abundant *L. hyperborea* and *Cellaria* sp. Other taxa recorded between 0-5 m were Common *A. rubens, Crisia* sp. and *Balanoidea* and Occasional *Corallinaceae* (encrusting).

5 - 10 m

Consistent with the other legs at C04 the 5-10 m zone was a transition zone between the upper kelp zones and the middle *M. senile*-dominated zone. Biofouling was similar to levels on the other legs, with high levels of coverage (80-90%) of low biomass taxa. This band had Superabundant *M. senile*, Common *Cellaria* sp. and Occasional *A. rubens*.

10 - 25 m

This band was dominated by superabundant to Common *M. senile* and Abundant to Common *Cellaria* sp. Biofouling was predominantly by large, high biomass taxa such as *M. senile*. From approximately 20 m depth, *S. triqueter* started to become the most abundant taxon increasing from Frequent to Abundant by 25 m. *A. rubens* was also found Occasionally between 20-25 m depth.

25 - 38 m

Lower sections of C04W transitioned into a keel worm-dominated habitat with Superabundant *S. triqueter* contributing to almost 95% of biofouling. Abundant *M. senile* and Common *Cellaria* sp. were still present between areas of *S. triqueter* and on protruding elements of superstructure. *Crisia* sp. was also Common in this band.

Seabed

At the jacket base Occasional *P. bernhardus* and Abundant *Pleuronectidae* were present along with Common *A. rubens*, however there was little visible evidence of material falling onto the seabed from the jacket. Heading in a west-northwesterly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) and *P. bernhardus* and flatfish (*Pleuronectidae*) were recorded.

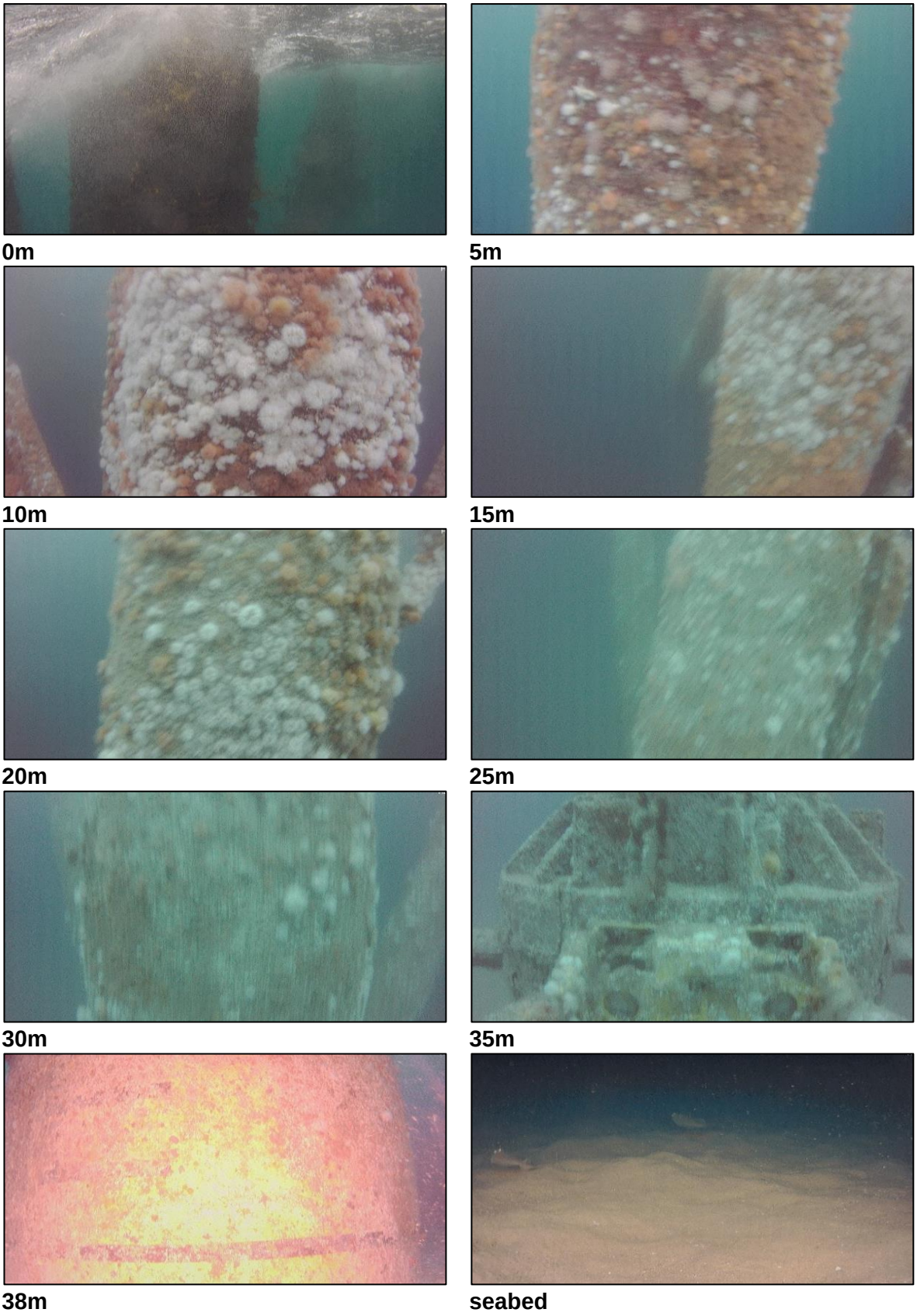
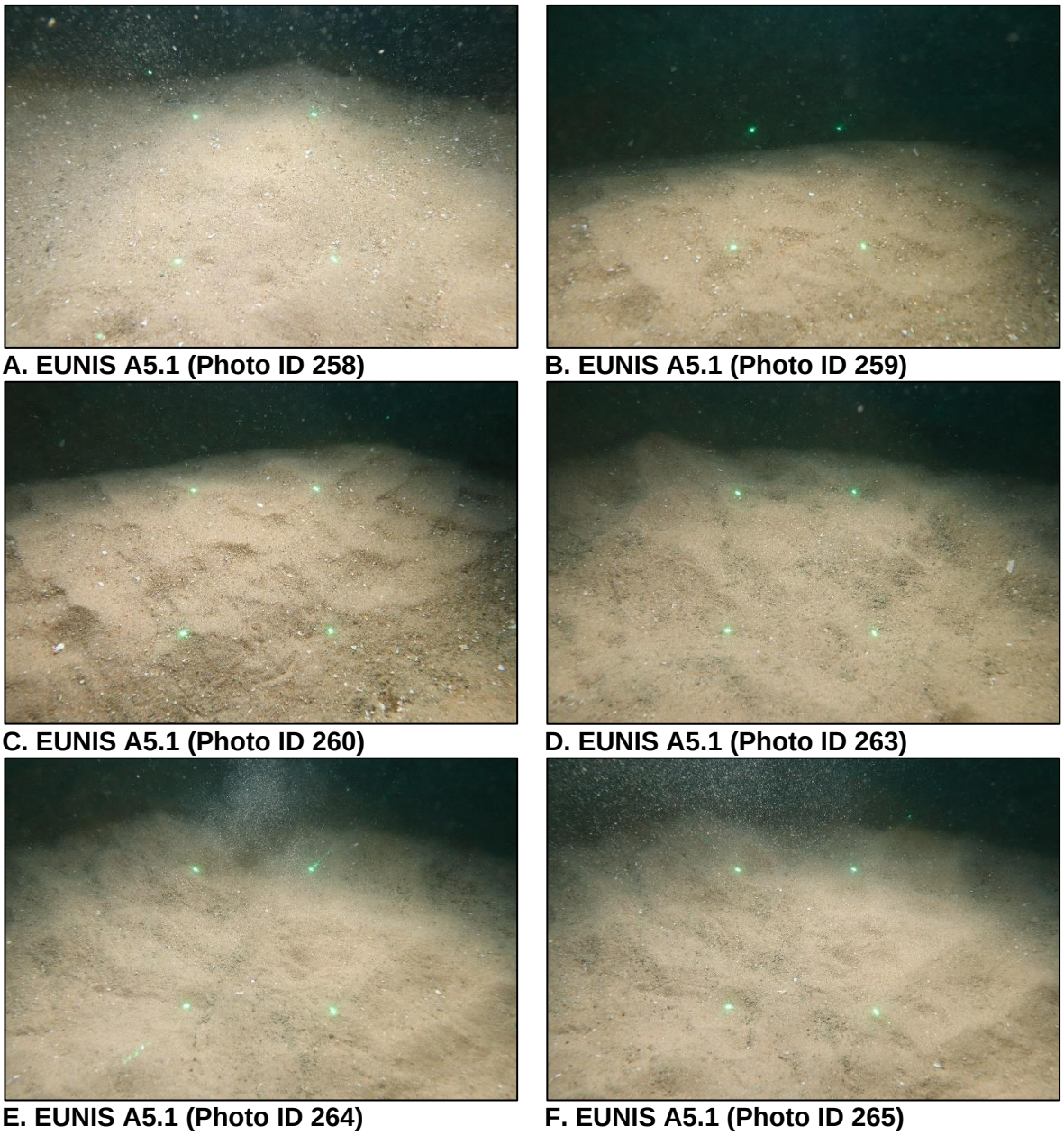


Figure 13. Representative images taken at 5m depth intervals at C04W

3.3.4.2 C04 West: Benthic habitat around turbine

The substrate at C04W was Sublittoral coarse sediment (EUNIS A5.1) including sand, shell and gravel. The only conspicuous fauna identified during the transect were Rare common starfish *A. rubens* (note - Photo IDs in Figure 14 below can be cross referenced with locations shown in Figure 6).



A. EUNIS A5.1 (Photo ID 258)

B. EUNIS A5.1 (Photo ID 259)

C. EUNIS A5.1 (Photo ID 260)

D. EUNIS A5.1 (Photo ID 263)

E. EUNIS A5.1 (Photo ID 264)

F. EUNIS A5.1 (Photo ID 265)

Figure 14. Representative seabed images taken at CO4W

3.4 Turbine F06

A map of benthic habitats around turbine FO6 is indicated in Figure 615. In the sections below, detail is provided for the range of biological communities recorded on the turbine foundation for turbine FO6, followed by descriptions of the habitats recorded on the transects along the sea floor heading away from the turbine foundation. The nearest benthic grab station to this turbine was Station 9 at which all replicate samples were allocated the biotope '*Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand' (JNCC code: SS.SCS.ICS.MoeVen; EUNIS code: A5.133), (see APEM 2021 for details).

3.4.1 F06 North

3.4.1.1 F06 North: Turbine jacket leg assessment

0 - 5 m

The splash zone was sparsely populated and with large areas of uncolonised yellow high-visibility paint. Barnacles *Balanoidea* and kelp *L. hyperborea* were present in low numbers below 1 m. Within this band Rhodophyta turf was Superabundant and *Balanoidea*, the kelp *L. hyperborea* and common starfish *A. rubens* were Abundant. The bryozoan *Cellaria* sp. and encrusting coralline algae *Corallinaceae* (encrusting) were Occasional. In the lower sections *Metridium senile* was Common.

5 - 10 m

This transitional zone contained most of the taxa found in the deeper bands but also some of the shallow algal species were present. Biofouling in this band was extensive (90-100%) with a mixture of high and low biomass taxa. Within this zone *M. senile* was Superabundant, *Cellaria* sp. was Common, *A. rubens* was Occasional, Rhodophyta turf and *L. hyperborea* were Rare.

10 - 25 m

This zone was heavily biofouled by large cnidarians such as Superabundant to Common plumose anemones *M. senile* and Occasional *Sagartia elegans*. In addition, Abundant to Common *Cellaria* sp. and Occasional *A. rubens* were also present. From approximately 17 m the keel worm *S. triqueter* became increasingly more common increasing from Common to Superabundant.

25 - 41 m

The lower sections of F06N were almost entirely covered in Superabundant *S. triqueter*. Common *Cellaria* sp. and Occasional *A. rubens* were present to about 30 m depth along with Occasional sponges (*Suberites* sp.). Common to Occasional *M. senile* were still present until approximately 2-3 m off the seabed. Frequent *A. digitatum* were also found.

Seabed

The presence of Occasional *P. bernhardus*, Pleuronectiformes (small flatfish) and *E. esculentus* (juvenile) would suggest an availability of food on sediment at the base of the jacket although no material was visible. Heading in a north-northwesterly direction for

approximately 45 m the seabed was classified Sublittoral mixed sediments (EUNIS A5.4), with very small patches of Sublittoral coarse sediment (EUNIS A5.1) (a few metres across).

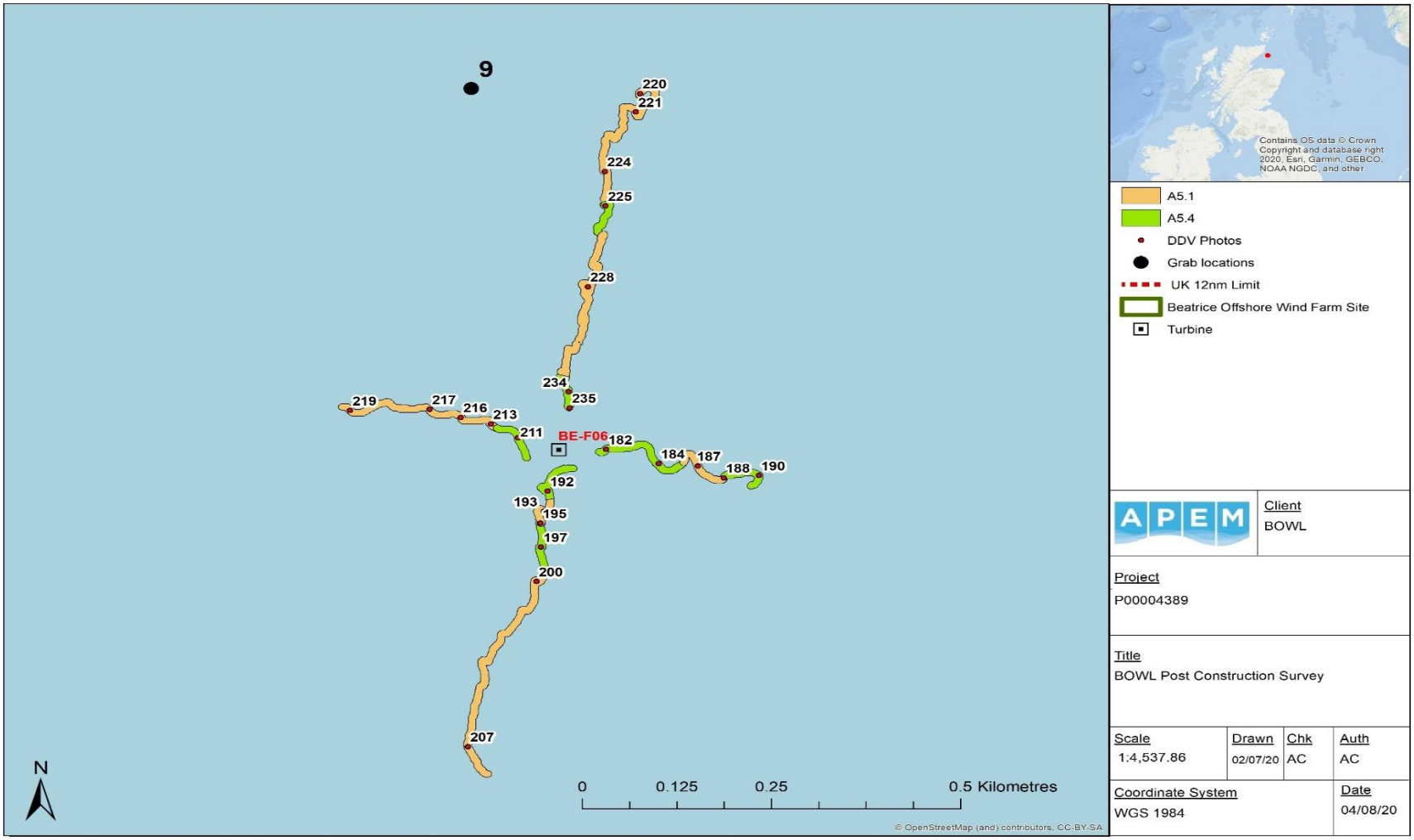


Figure 15. Habitat types present at turbine F06

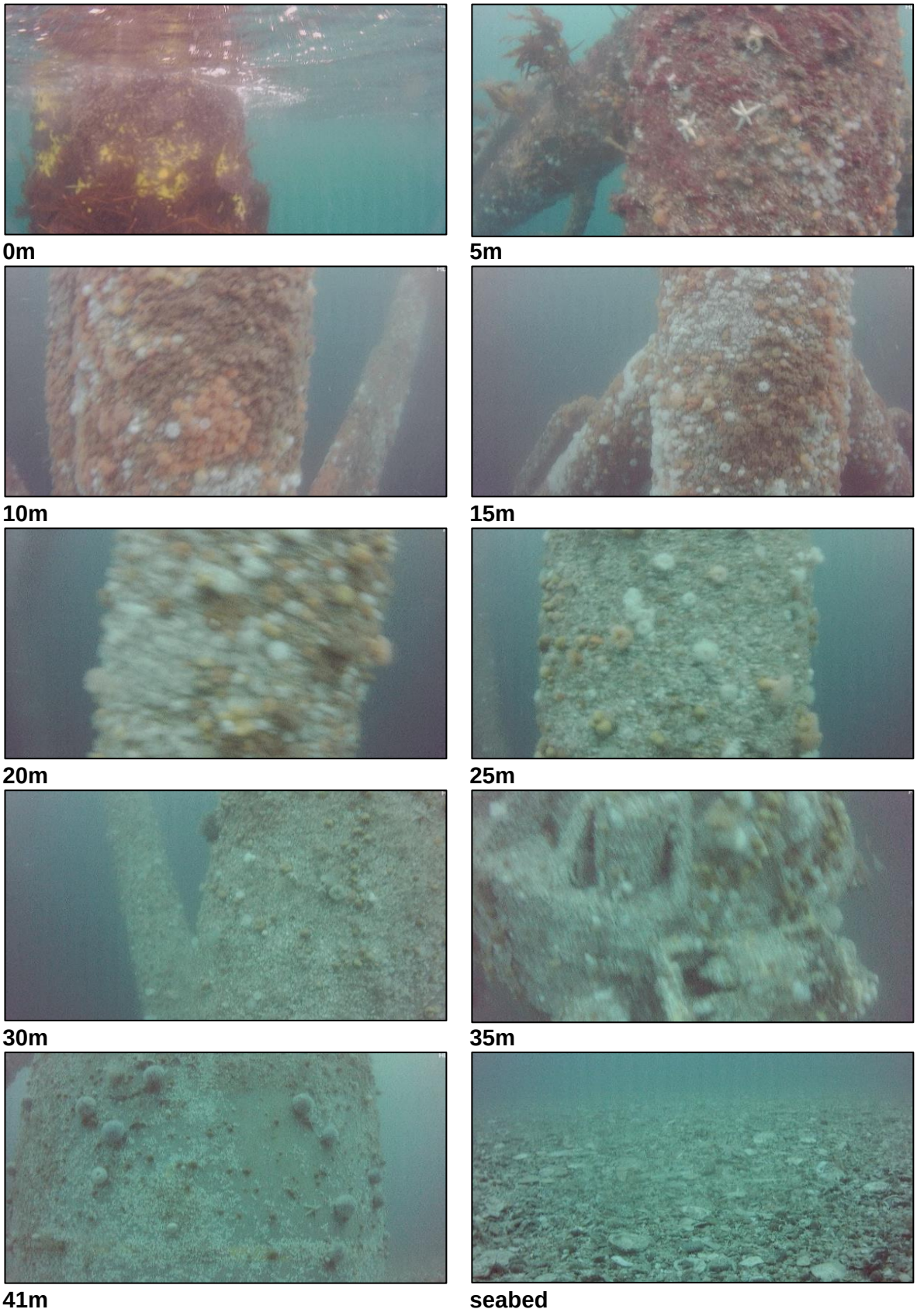
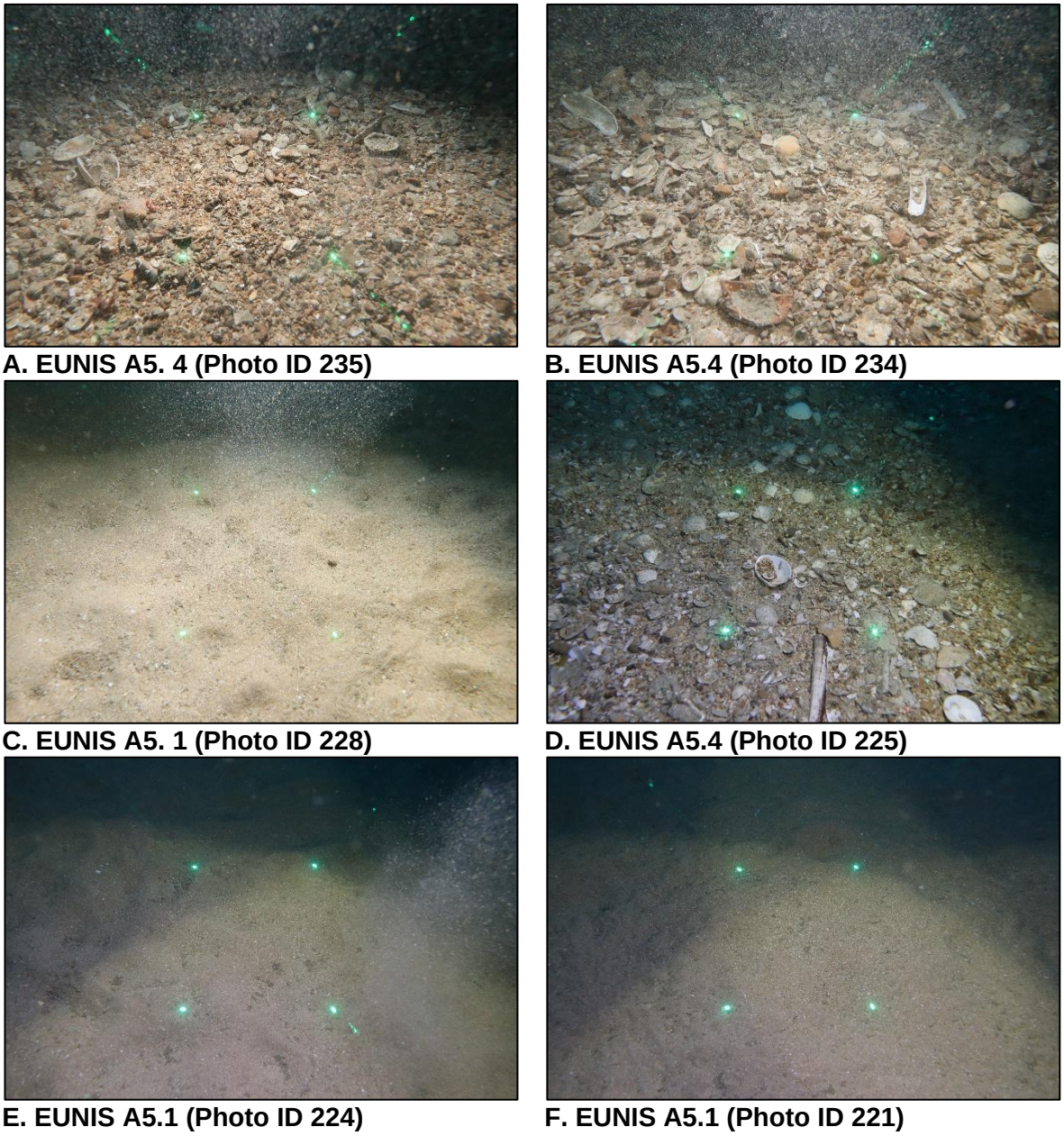


Figure 16 Representative images taken at 5m depth intervals at F06N

3.4.1.2 F06 North: Benthic habitat around turbine

The substrate at F06N varied between Sublittoral coarse sediment (EUNIS A5.1) and Sublittoral mixed sediment (EUNIS A5.4). Running from south to north the transect started in Sublittoral mixed sediment (EUNIS A5.4) with Rare common urchin *Echinus esculentus* and hermit crab *P. bernhardus*. There was then an extensive area of Sublittoral coarse sediment (EUNIS A5.1) with no distinguishable conspicuous fauna identified during that segment of the transect. There was then another patch of Sublittoral mixed sediment before returning to Sublittoral coarse sediment, with Rare *P. bernhardus* present (note - Photo IDs in Figure 17 below can be cross referenced with locations shown in Figure 15).



A. EUNIS A5. 4 (Photo ID 235) **B. EUNIS A5.4 (Photo ID 234)**

C. EUNIS A5. 1 (Photo ID 228) **D. EUNIS A5.4 (Photo ID 225)**

E. EUNIS A5.1 (Photo ID 224) **F. EUNIS A5.1 (Photo ID 221)**

Figure 17 Representative seabed images taken at F06N

3.4.2 F06 East

3.4.2.1 F06 East: Turbine jacket leg assessment

0 - 5 m

The splash zone was sparsely populated in comparison to other turbines with large areas of uncolonised yellow high-visibility paint. *Balanoidea* and *L. hyperborea* were present in low densities. This band was relatively diverse with nine taxa recorded. Below 1 m there was Superabundant Rhodophyta turf, Abundant *Balanoidea* and *Crisia* sp., the kelp *L. hyperborea,* the bryozoan *Membranipora membranacea*, the brittlestar *Ophiura albida* and common limpet *Patella vulgata* were all Common.

5 - 10 m

This band had a mix of shallow algae species and taxa found deeper on the jacket leg, with extensive biofouling (90-100%) containing a mixture of large and small taxa. Within this zone *M. senile* was Superabundant, *Cellaria* sp. was Common, *A. rubens* was Occasional and Rhodophyta turf was Frequent.

10 - 25 m

This zone was heavily biofouled by large cnidarians such as Superabundant to Common *M. senile.* Also present were Abundant to Common *Cellaria* sp. and Occasional *A. rubens*. From approximately 17 m *S. triqueter* became increasingly more common as depth increased (transitioning from Common to Superabundant). Occasional *Suberites* sp. were also found between 20 and 25m.

25 - 41 m

As with all other legs, the lower sections were almost entirely covered in Superabundant *S. triqueter*. Common to Occasional *M. senile* were also found until approximately 2-3 m off the seabed. Frequent *E. esculentus* (juvenile) and Occasional *A. rubens* and *Suberites* sp. were also present down to the base of the jacket leg. *Crisia* sp. was common on the structure of the lower leg.

Seabed

The presence of Occasional *P. bernhardus*, *E. esculentus* (juvenile) and common *A. rubens* at the base of the jacket leg suggests an availability of food for these taxa although no biological debris was visible on the video footage. Abundant *Pleuronectidae* and Common *A. rubens* were also recorded around the base. Heading in an east-southeasterly direction for approximately 45 m the seabed was classified as Sublittoral mixed sediments (EUNIS A5.4) with *P. bernhardus* and flatfish (Pleuronectidae) recorded.

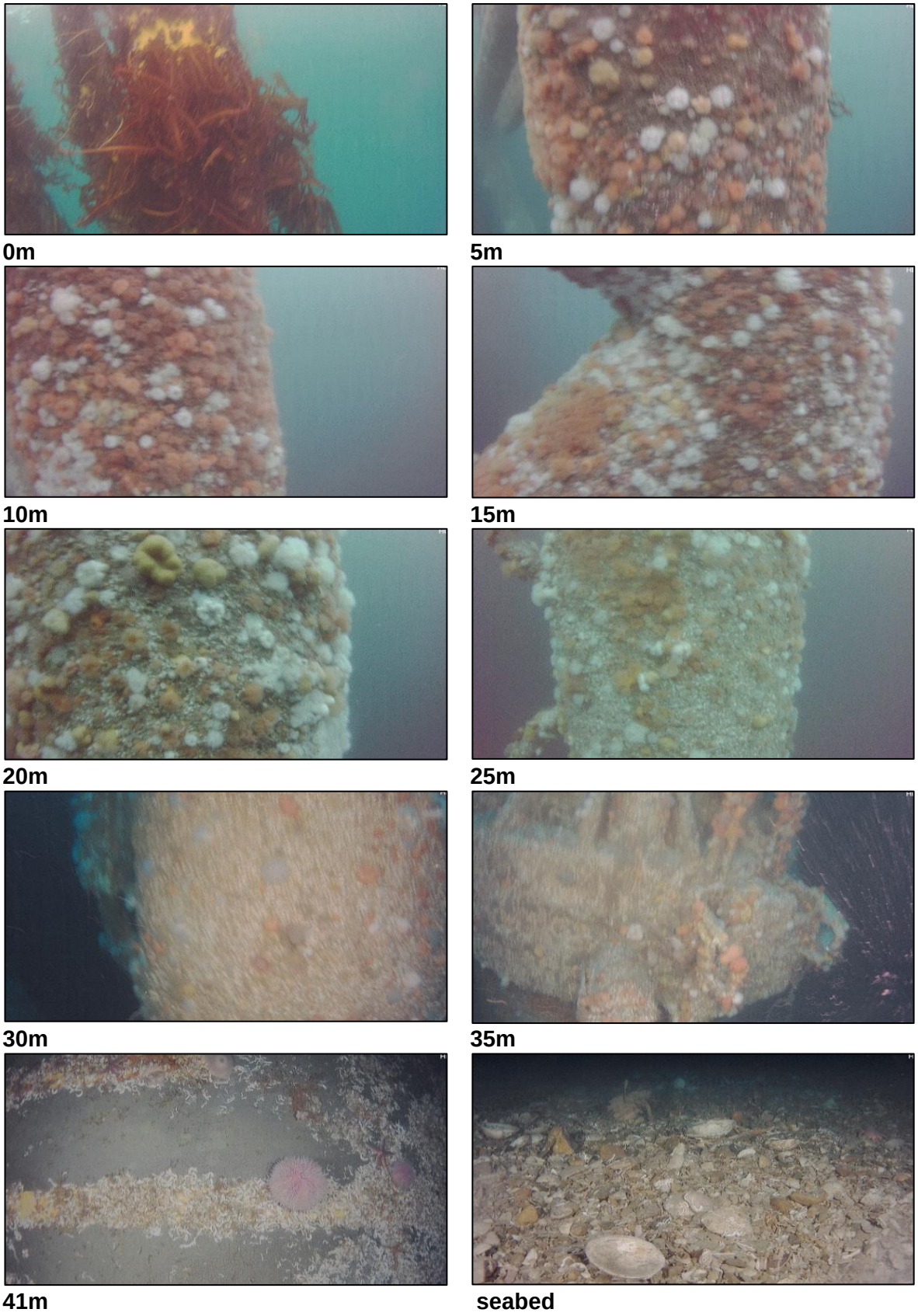


Figure 18. Representative images taken at 5m depth intervals at F06E

3.4.2.2 F06 East: Benthic habitat around turbine

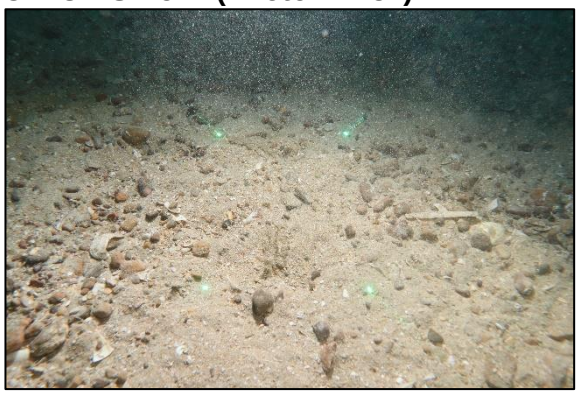
Running from west to east the transect started in Sublittoral mixed sediment (EUNIS A5.4) with large amounts of shell and Rare *A. rubens*. The transect then passed over an area of Sublittoral coarse sediment (EUNIS A5.1) with no distinguishable conspicuous fauna identified during that segment of the transect. The transect then returned to Sublittoral mixed sediment (EUNIS A5.4) with no distinguishable conspicuous fauna (note - Photo IDs in Figure 19 below can be cross referenced with locations shown in Figure 15).

A. EUNIS A5.4 (Photo ID 182)

B. EUNIS A5.4 (Photo ID 184)

C. EUNIS A5. 1 (Photo ID 187)

D. EUNIS A5.1 (Photo ID 188)



E. EUNIS A5.4 (Photo ID 190)

Figure 19 Representative seabed images taken at F06E

3.4.3 F06 South

3.4.3.1 F06 South: Turbine jacket leg assessment

0 - 5 m

As with other legs on the F06 turbine, the splash zone +0.5 to -0.5 m was sparsely populated with large areas of unpopulated yellow high-visibility paint, although *Balanoidea* and *L. hyperborea* were still present in low numbers/biomass. Ten taxa were recorded in this upper band.

Below 1 m Rhodophyta turf was Superabundant and *Balanoidea*, *L. hyperborea* and *Crisia* sp. were Abundant, *A. rubens*, *Obelia* sp. and *P. vulgata* were all Common. *M. membranacea* and *Corallinaceae* (encrusting) were Frequent.

5 - 10 m

As with other legs on turbine F06 this transitional zone included most of the taxa found lower on the leg and kelp species. Biofouling in this band was extensive (90-100%) with a mixture of high and low biomass taxa. Within this zone *Cellaria* sp., *M. senile*, *A. rubens* and *E. esculentus* (juvenile) were all Common. *L. hyperborea* was Rare from approximately 5-8 m.

10 - 25 m

This zone was heavily biofouled with Superabundant to Common *M. senile* and Abundant to Common *Cellaria* sp. and *S. triqueter*. Occasional *A. rubens* were also present, *E. esculentus* (juvenile) was Rare in the 10-15 m zone.

25 - 41 m

As with all other legs, the lower sections were almost entirely covered in Superabundant *S. triqueter*. In addition, Common to Occasional *Celeria* sp. was found until approximately 2-3 m off the seabed. Frequent *M. senile* (juvenile) was present but *M. senile* was Rare near the base. Occasional *A. rubens* were present, increasing to Common at the seabed, and *A. digitatum* was occasional.

Seabed

The presence of Occasional *P. bernhardus* and *E. esculentus* (juvenile) would suggest a potential availability of food at the base of the jacket although no biological material was visible. Heading in a south-southwesterly direction for approximately 45 m the seabed was classified as Sublittoral mixed sediments (EUNIS A5.4) with *P. bernhardus* recorded.

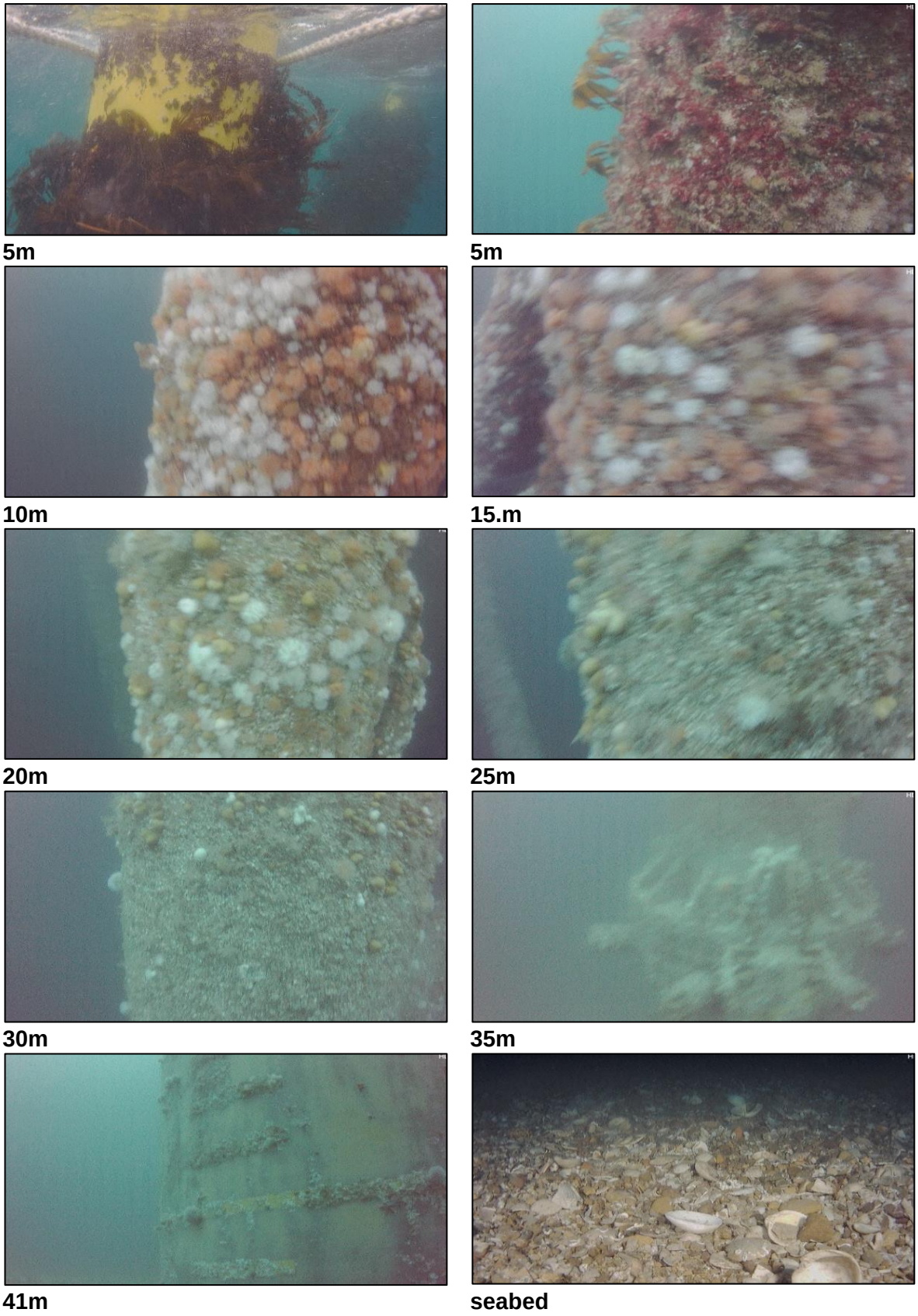
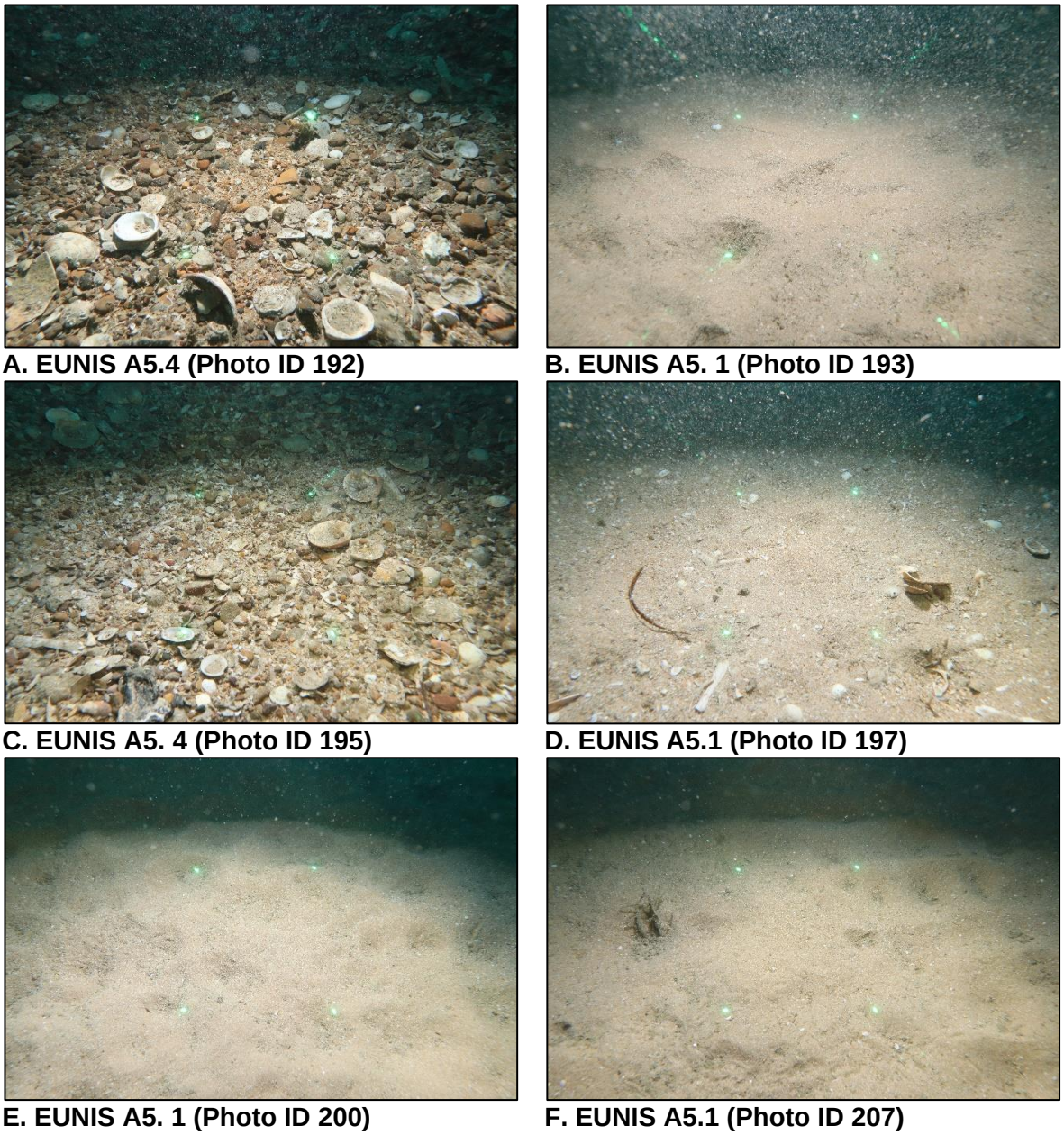


Figure 20 Representative images taken at 5m depth intervals at F06S

3.4.3.2 F06 South: Benthic habitat around turbine

Running from north to south the transect started in Sublittoral mixed sediment (EUNIS A5.4) with large amounts of shell and Rare *A. rubens*. Most of the initial third of the transect was this substrate with a section of Sublittoral coarse sediment (EUNIS A5.1) and other small patches of A5.1 too small to quantify. The remainder of the transect was Sublittoral coarse sediment (EUNIS A5.1) with Frequent *A. rubens* at the start of this section (note - Photo IDs in Figure 21 below can be cross referenced with locations shown in Figure 15).



A. EUNIS A5.4 (Photo ID 192)
B. EUNIS A5. 1 (Photo ID 193)
C. EUNIS A5. 4 (Photo ID 195)
D. EUNIS A5.1 (Photo ID 197)
E. EUNIS A5. 1 (Photo ID 200)
F. EUNIS A5.1 (Photo ID 207)

Figure 21 Representative seabed images taken at F06S

3.4.4 F06 West

3.4.4.1 F06 West: Turbine jacket leg assessment

0 - 5 m

The splash zone (+0.5 to -0.5m) was sparsely populated with large areas of unpopulated yellow high-visibility paint, although *Balanoidea* and *L. hyperborea* were present in low numbers. Below 1 m, Rhodophyta turf was Superabundant, *L. hyperborea*, *A. rubens* and *Crisia* sp. were Abundant and *Balanoidea* was Common. *Cellaria* sp., *Corallinaceae* (encrusting) and *M. senile* were all Occasional.

5 - 10 m

This transition zone was consistent with other jacket legs with extensive biofouling (90-100%) and a mixture of high and low biomass taxa. Within this zone *A. rubens* was Frequent, the starfish *Henrica* sp. was Occasional and *Cellaria* sp., *M. senile*, Rhodophyta turf, parchment worm *Chaetopterus* sp. tubes and *E. esculentus* (juvenile) were all Common.

10 - 25 m

This zone was heavily biofouled with Superabundant to Frequent *M. senile*, Abundant to Common *Cellaria* sp. and *A. rubens* was Occasional. From approximately 17 m *S. triqueter* became increasingly more common, increasing from Common to Superabundant with depth.

25 - 41 m

The lower sections of F06W were almost entirely covered in Superabundant *S. triqueter*. Common to Occasional *Suberites* spp. and Frequent to Occasional *M. senile* were recorded until approximately 1m off the seabed. *E. esculentus* (juvenile) was recorded as Common to Frequent and *A. rubens* was Common to Occasional throughout the zone.

Seabed

The presence of Occasional *P. bernhardus* and juvenile *E. esculentus*, Common adult *E. esculentus* and Abundant *Pleuronectidae* at the base of the jacket leg suggests an availability of food for these taxa, although none was conspicuous on the video footage. Heading in a west-northwesterly direction for approximately 45m the seabed was classified as Sublittoral mixed sediments (EUNIS A5.4) with *P. bernhardus* and flatfish (*Pleuronectidae*) recorded.

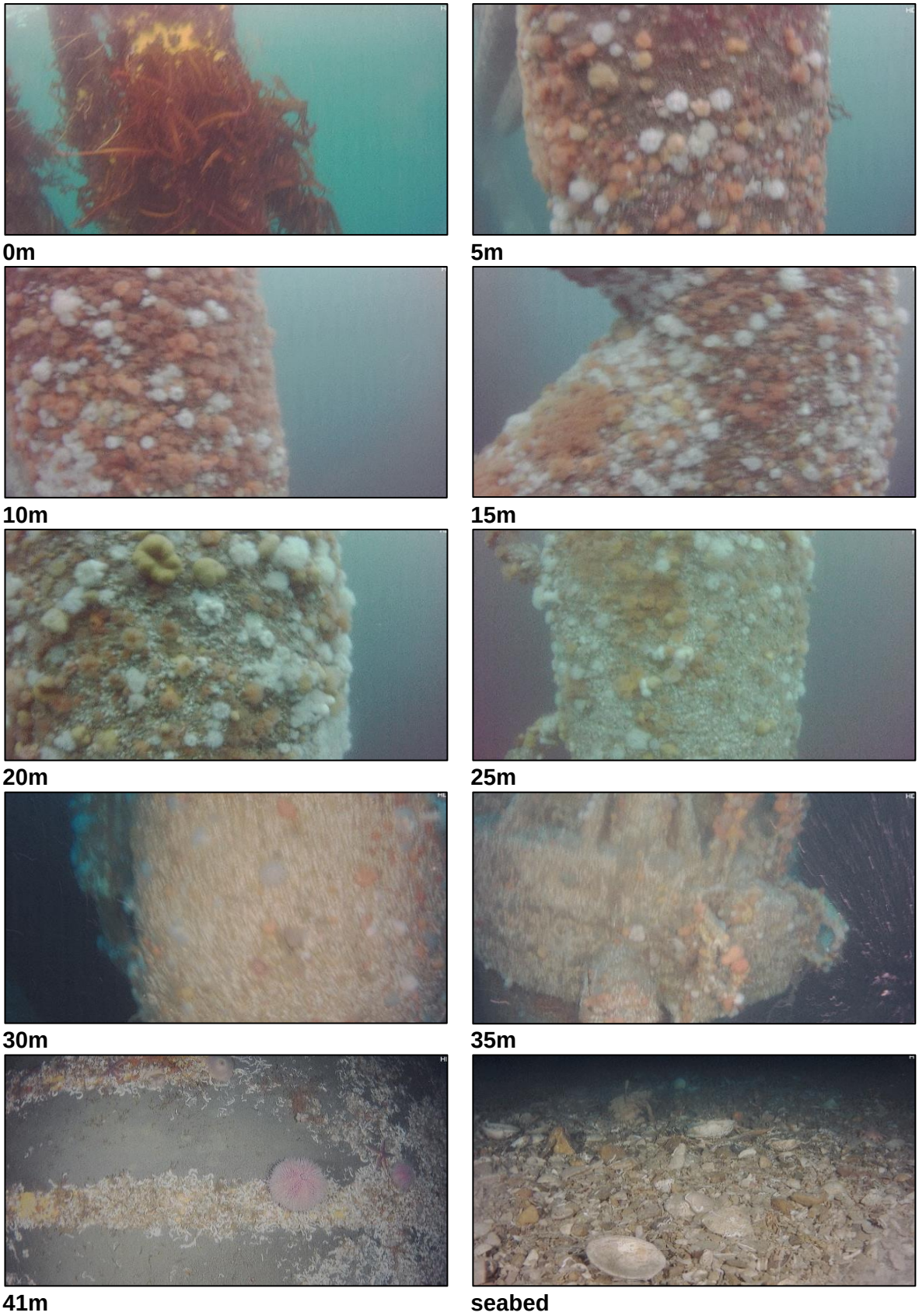
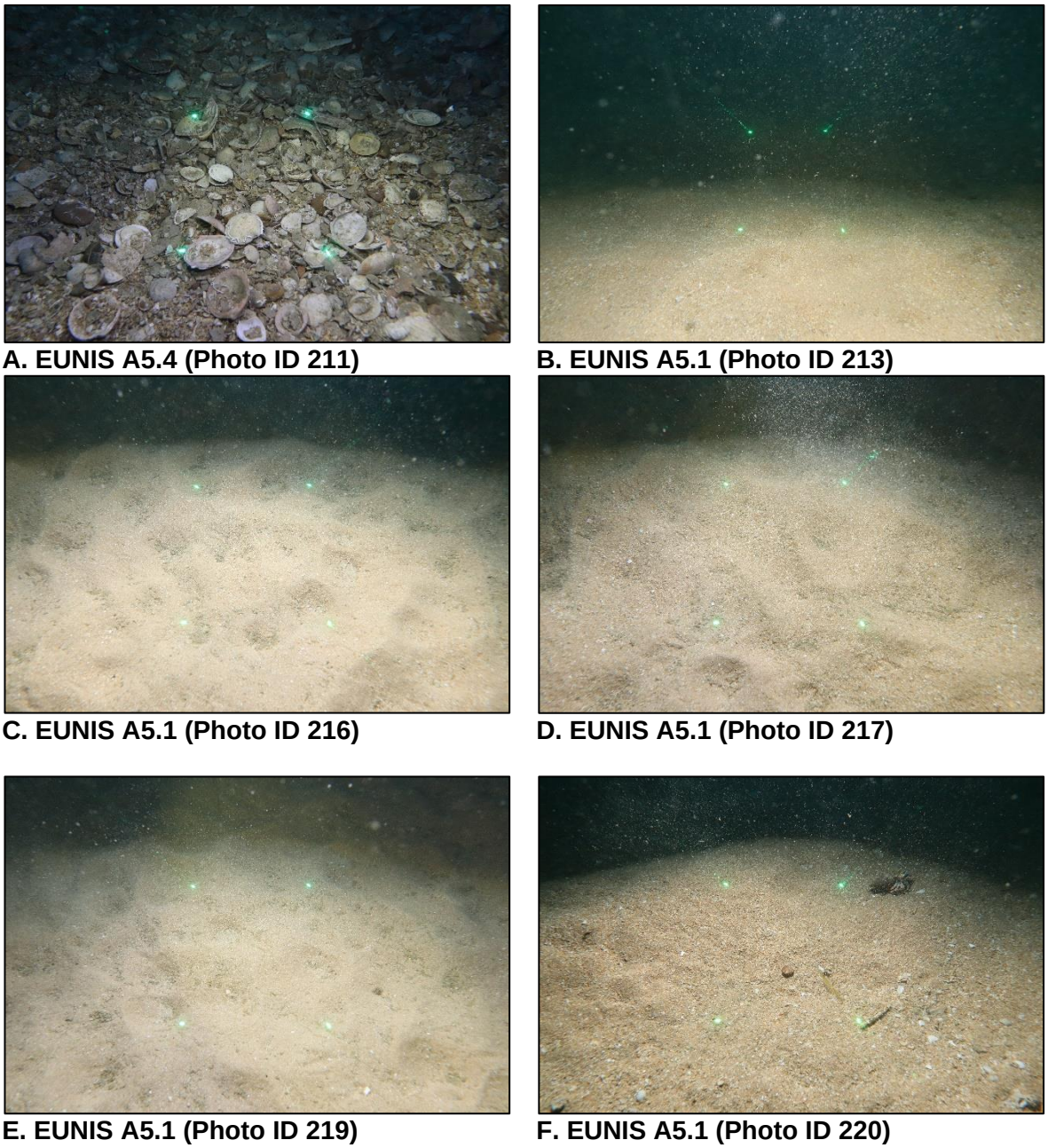


Figure 22. Representative images taken at 5m depth intervals at F06W

3.4.4.2 F06 West: Benthic habitat around turbine

Running from East to West the transect started in Sublittoral mixed sediment (EUNIS A5.4) with Rare spiny dogfish *Squalus acanthias*. The rest of the transect was Sublittoral coarse sediment (EUNIS A5.1) with no conspicuous fauna recorded (Figure 15) (note - Photo IDs in Figure 23 below can be cross referenced with locations shown in Figure 15).



A. EUNIS A5.4 (Photo ID 211)
B. EUNIS A5.1 (Photo ID 213)
C. EUNIS A5.1 (Photo ID 216)
D. EUNIS A5.1 (Photo ID 217)
E. EUNIS A5.1 (Photo ID 219)
F. EUNIS A5.1 (Photo ID 220)

Figure 23. Representative seabed images taken at F06W

3.5 Turbine H08

A map of benthic habitats around turbine H08 below is indicated in Figure 24. In the sections below, detail is provided for the range of biological communities recorded on the turbine foundation for turbine HO8, followed by descriptions of the habitats recorded on the transects along the sea floor heading away from the turbine foundation. The nearest benthic grab station to this turbine was Station 1 at which all replicate samples were allocated the biotope '*Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand' (JNCC code: SS.SCS.ICS.MoeVen; EUNIS code: A5.133), (see APEM 2021 for details).

3.5.1 H08 North

3.5.1.1 H08 North: Turbine jacket leg assessment

0 - 5 m

There were large areas of uncolonised yellow high-visibility paint visible to approximately 2 m depth. However, between 1.5-5 m, eleven taxa were recorded, including Superabundant kelp *L. hyperborea* and red algae Rhodophyta turf. There were Common barnacles *Balanoidea*, sea lace *Chorda filum*, bryozoa *M. membranacea* and limpets *P. vulgata* and Abundant starfish *A. rubens*, bryozoa *Crisia* sp. and hydrozoa *Obelia* sp. The bryozoan *Cellaria* sp. and *Corallinaceae* (encrusting) algae were Occasional. A number of the taxa listed were epiphytic on the kelp.

5 - 10 m

Transitioning into the deeper bands, *L. hyperborea* (Frequent) and Rhodophyta turf (Rare) were still present to approximately 7-8 m. In the 5-10 m zone *Cellaria* sp. and plumose anemone *M. senile* were Common, *A. rubens* and *Obelia* sp. were Frequent and *M. membranacea*, *Corallinaceae* (encrusting) and the starfish *Henrica* sp. were all Occasional.

10 - 25 m

In comparison to the other turbines sampled, the amount of biofouling attributed to *M. senile* was much lower (Common to Frequent) in this band, however, slower-growing taxa like dead man's fingers *A. digitatum* and the sponge *Suberites* sp. were both Common. The keel worm *S. triqueter* was also Abundant throughout the band and was present at a shallower depth than was typical on the other turbines. The bryozoan *Cellaria* sp. was Abundant to Frequent, *A. rubens* was Common to Frequent and the sea urchin *E. esculentus* (juvenile) was Common.

25 - 44 m

As with all other turbines sampled, *S. triqueter* was Superabundant in this band and was the dominant taxon with almost 100% cover in some places. *M. senile* was Rare and was not found below 40 m. *E. esculentus* (juvenile) and *Suberites* spp. were both Common, *A. rubens* was Occasional and *A. digitatum* was Common to Occasional.

Seabed

On the seabed, hermit crab *P. bernhardus* and flatfish (*Pleuronectidae*) were Abundant suggesting the presence of food sources but no biological debris was visible in the underwater

footage. Heading in a north-northwesterly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with *P. bernhardus* and adult and juvenile flatfish recorded.

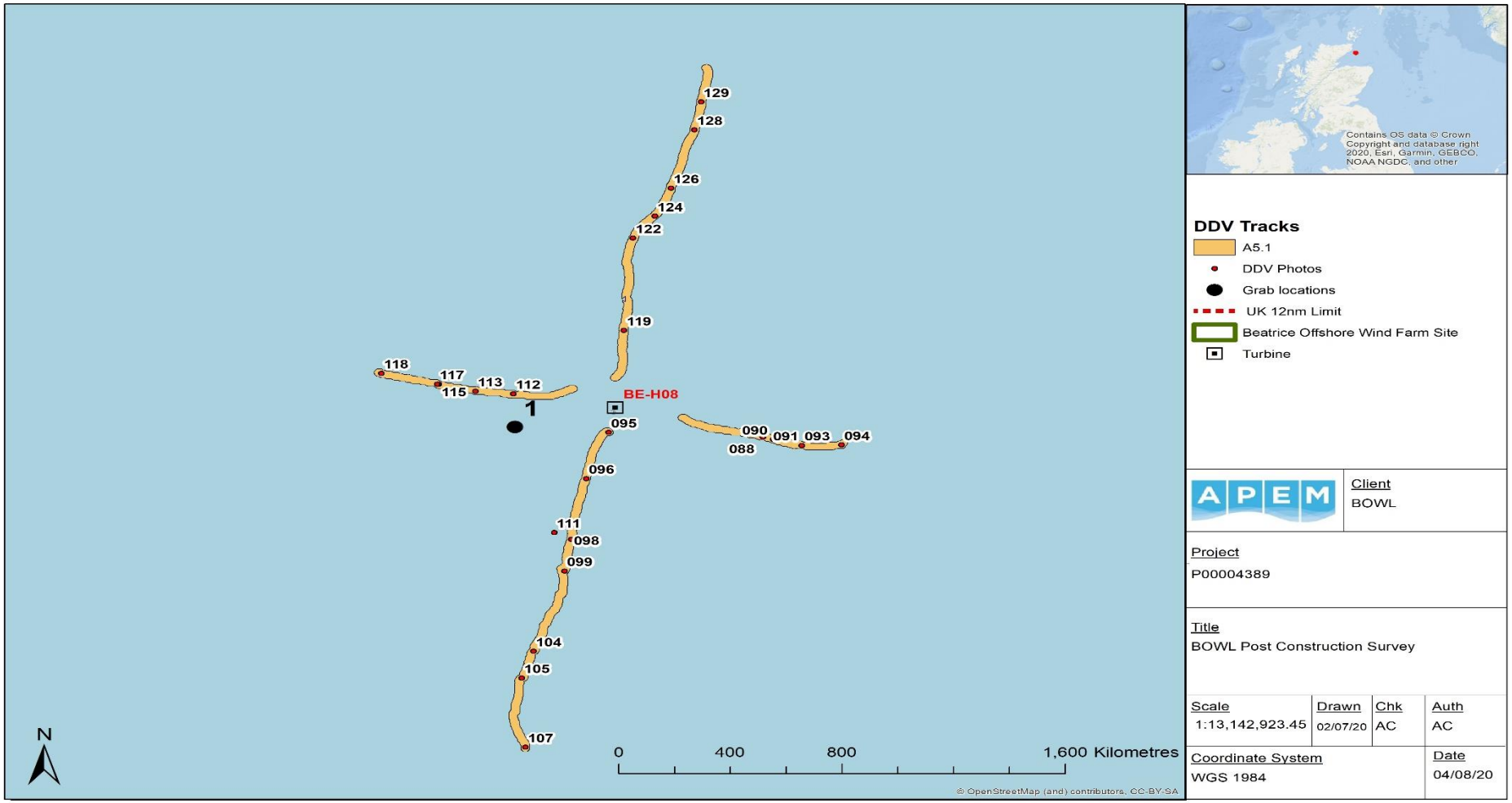


Figure 24. Habitat types present at H08

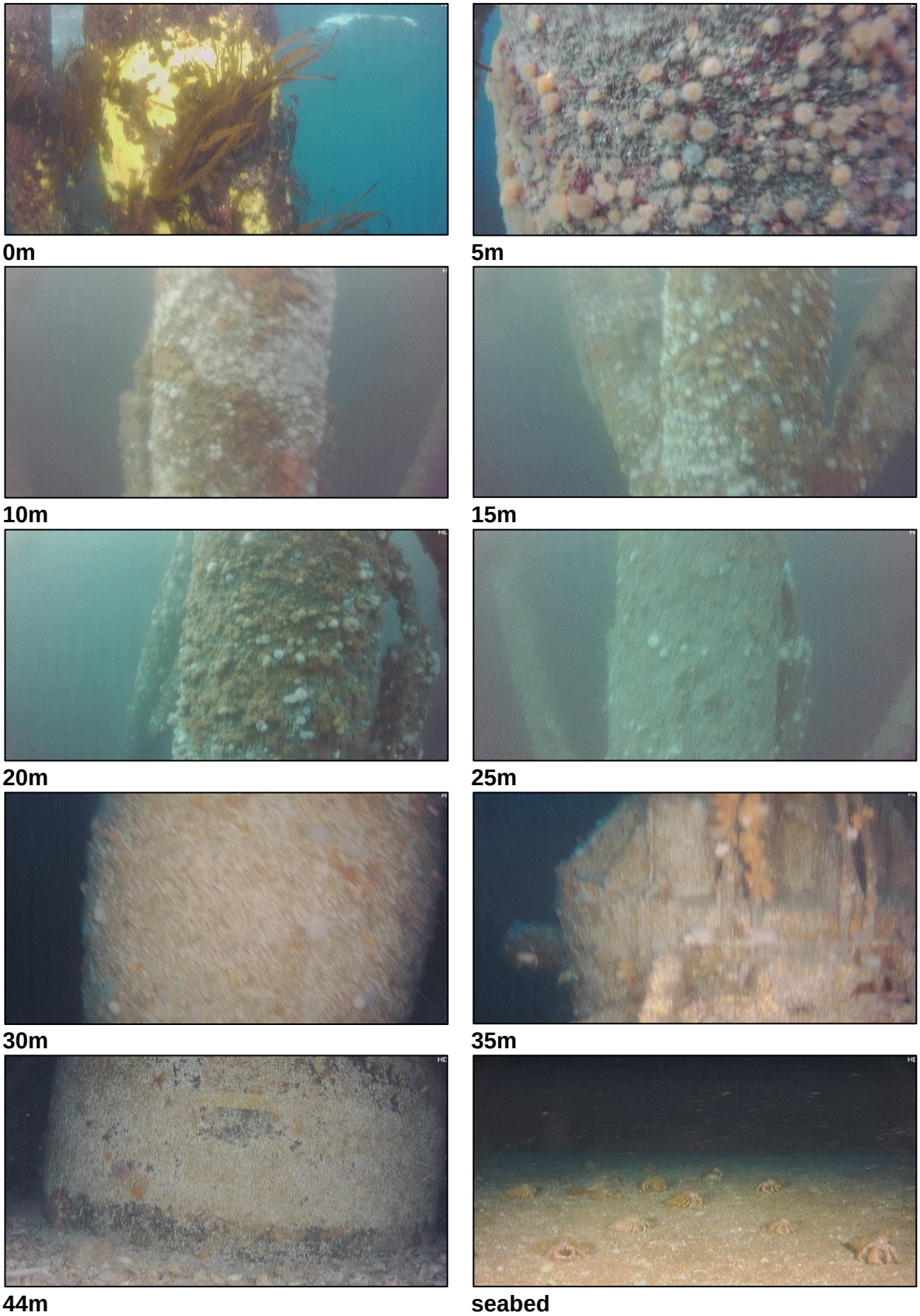
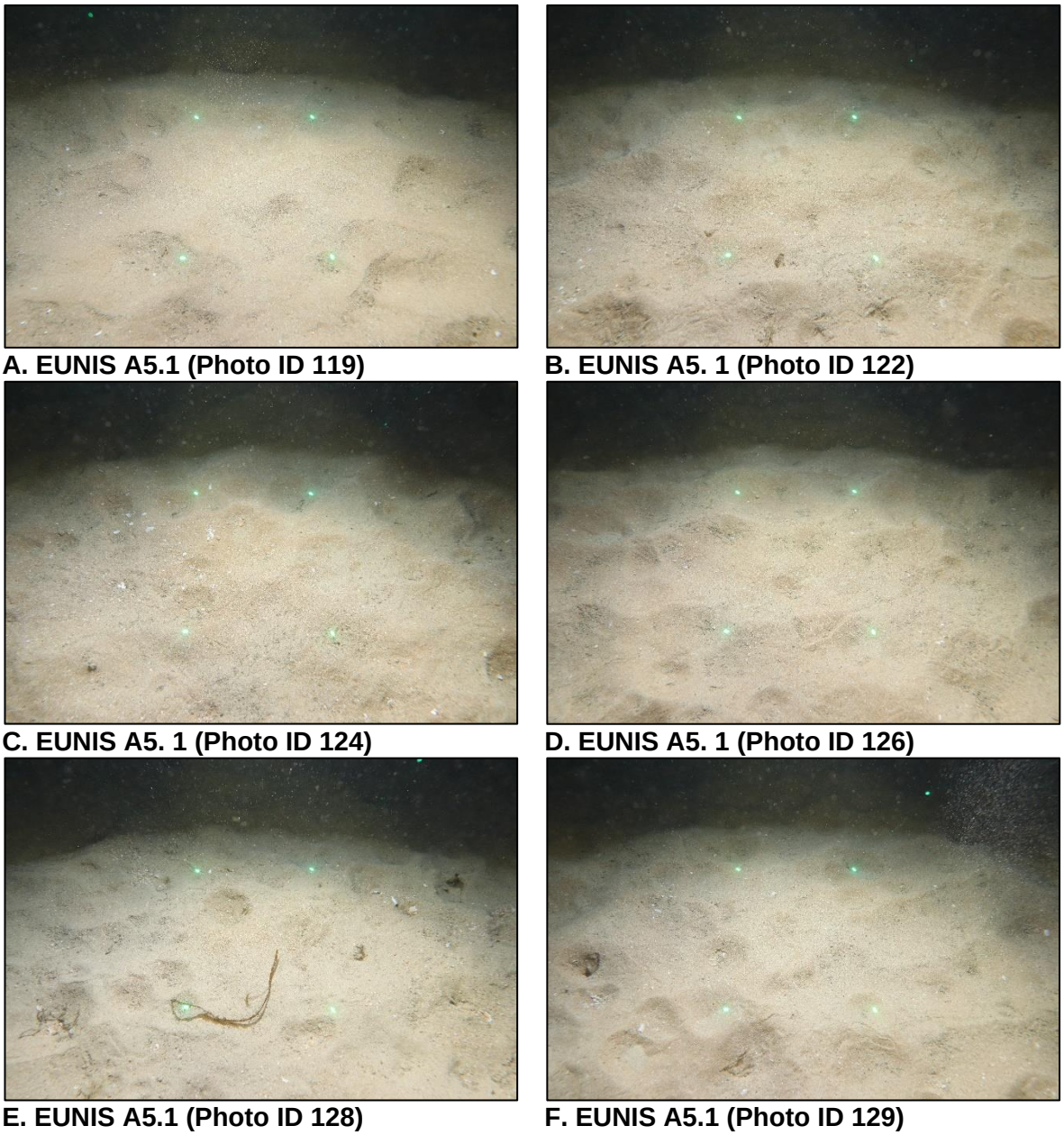


Figure 25. Representative images taken at 5 m depth intervals at H08N

3.5.1.2 H08 North: Benthic habitat around turbine

The whole of the transect was Sublittoral coarse sediment (EUNIS A5.1). Occasional hermit crab *P. bernhardus* and Rare starfish *A. rubens* and flatfish *Pleuronectidae* were recorded (note - Photo IDs in Figure 26 below can be cross referenced with locations shown in Figure 24).



A. EUNIS A5.1 (Photo ID 119)

B. EUNIS A5. 1 (Photo ID 122)

C. EUNIS A5. 1 (Photo ID 124)

D. EUNIS A5. 1 (Photo ID 126)

E. EUNIS A5.1 (Photo ID 128)

F. EUNIS A5.1 (Photo ID 129)

Figure 26. Representative seabed images taken at H08N

3.5.2 H08 East

3.5.2.1 H08 East: Turbine jacket leg assessment

0 - 5 m

In the upper splash zone, there were large areas of uncolonised yellow high-visibility paint visible to approximately 3 m. Between 2-5 m there was Superabundant Rhodophyta turf, Abundant *Balanoidea*, *Crisia* sp. and *Obelia* sp., Common *L. hyperborea* and *M. membranacea*, and Occasional *Cellaria* sp. and *Corallinaceae*.

5 – 10 m

Transitioning into deeper bands the algal taxa become less abundant with both Rhodophyta turf and *L. hyperborea* Rare by approximately 6-7 m. *M. senile* and *S. triqueter* were Abundant, *A. rubens* was Frequent, *Cellaria sp* was Common and *Corallinaceae* (encrusting) was Occasional in this zone.

10 – 25 m

Consistent with H08N the amount of biofouling attributed to *M. senile* was much lower in this zone (it was recorded as Abundant) than at the other turbines sampled, however, slower-growing taxa like *A. digitatum* and *Suberites* sp. were both Common. The keelworm *S. triqueter* was Abundant to Superabundant throughout the band from a much shallower depth than on the foundations at the other turbine locations. *Cellaria* sp. was Abundant to Frequent, *E. esculentus* (juvenile) was Common, *A. rubens* was Common to Frequent and *Balanoidea* was Occasional in this zone.

25 – 44 m

S. triqueter was Superabundant in this band and the dominant taxon resulting in almost 100% cover in some places. In addition, *M. senile* was Rare and was not recorded below 40 m. *E. esculentus* (juvenile) and *Suberites* sp. were Common and *A. rubens* and *A. digitatum* were Occasional (with *A. rubens* Common on the deeper sections).

Seabed

The taxa *P. bernhardus* and *Pleuronectidae* (including small individuals recorded as Pleuronectiformes) were Superabundant at the seabed suggesting food resources were readily available although there was no evidence of biofouling being present on the seabed. Heading in an east-southeasterly direction for approximately 45m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with adult and juvenile flatfish recorded.

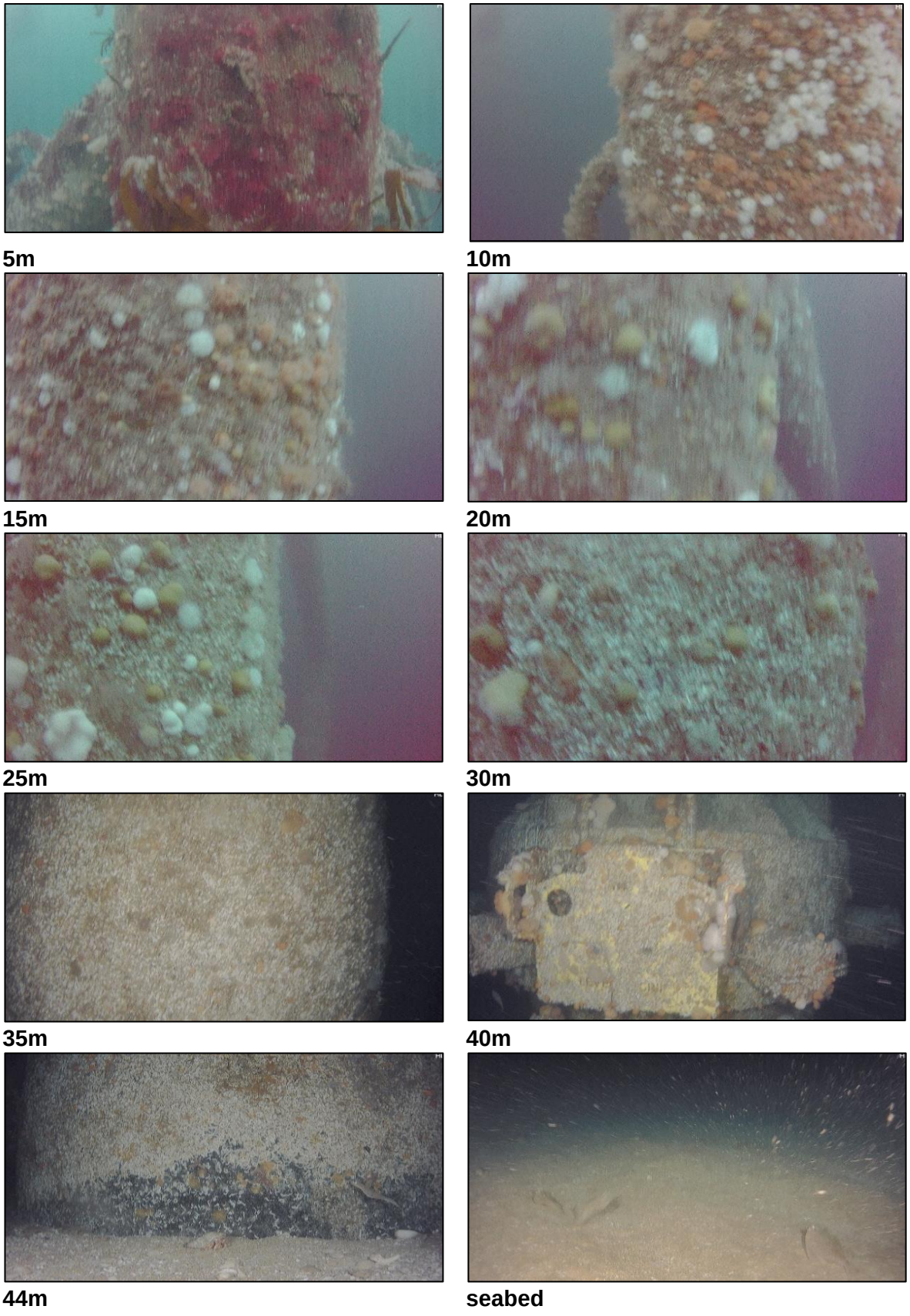
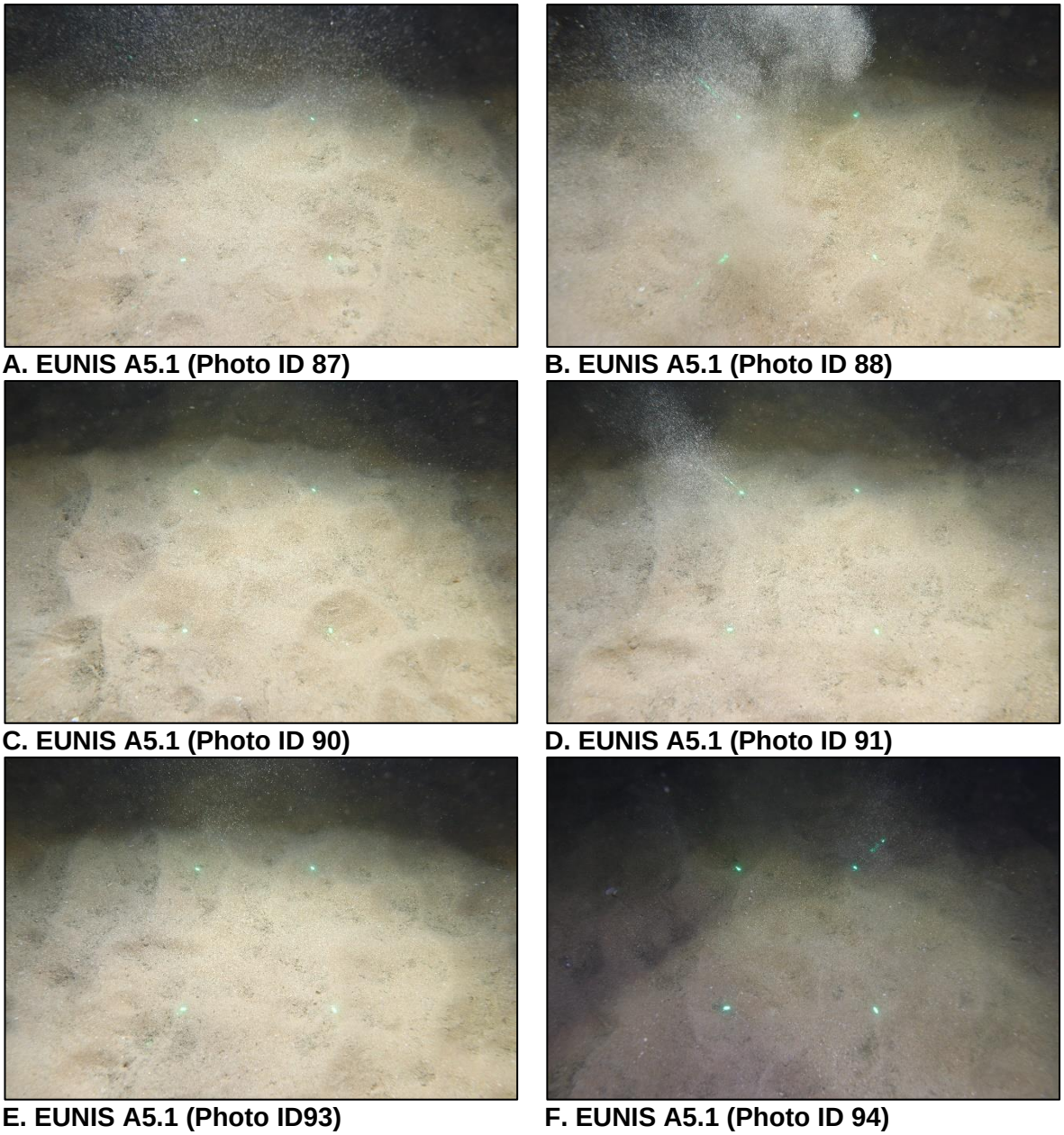


Figure 27. Representative images taken at 5m depth intervals at H08E

3.5.2.2 H08 East: Benthic composition around turbine

The transect was recorded as Sublittoral coarse sediment (EUNIS A5.1). There were Occasional *Pleuronectidae* and Rare starfish *A. rubens* (note - Photo IDs in Figure 28 below can be cross referenced with locations shown on Figure 24).



A. EUNIS A5.1 (Photo ID 87) **B. EUNIS A5.1 (Photo ID 88)**

C. EUNIS A5.1 (Photo ID 90) **D. EUNIS A5.1 (Photo ID 91)**

E. EUNIS A5.1 (Photo ID93) **F. EUNIS A5.1 (Photo ID 94)**

Figure 28. Representative seabed images taken at H08E

3.5.3 H08 South

3.5.3.1 H08 South: Turbine jacket leg assessment

0 - 5 m

The upper splash zone was fairly well colonised in comparison to other jacket legs. Biota present was consistent with other jacket legs with *L. hyperborea* and Rhodophyta turf being Superabundant. *Crisia* sp. and *Obelia* sp. were Abundant, *Corallinaceae* (encrusting), *M. membranacea* and *P. vulgata* were Common, *Balanoidea* and *Cellaria* sp. were Occasional and *A. rubens* was Rare.

5 – 10 m

Algal taxa still present within this band were Common *L. hyperborea* and Rare Rhodophyta turf both occurring until approximately 7-8 m but with greatly reduced biomass compared to the 0-5 m zone. In addition, *Cellaria* sp. was Abundant and *Obelia* sp., *M. membranacea*, *M. senile* and *S. triqueter* were all Common, *A. rubens* was Frequent and *Corallinaceae* (encrusting) was Occasional.

10 – 25 m

The band was dominated by large, high biomass individuals such as *M. senile*, *A. digitatum*, *A. rubens*, *Suberites* sp. and *E. esculentus* (juvenile) which were all Common within this depth band. Keel worms *S. triqueter* and the anemone *S. elegans* were Abundant and *Cellaria* sp. was Frequent.

25 – 44 m

S. triqueter was the dominant taxon within this band and was Superabundant throughout. In addition, *Suberites* sp., *P. bernhardus* and *E. esculentus* were Common. *M. senile* was Frequent and *A. rubens*, *A. digitatum* and *Cellaria* sp. were Occasional.

Seabed

At the seabed *P. bernhardus* was Common and flatfish (*Pleuronectidae*) including small individuals (recorded as Pleuronectiformes) were Abundant but there was no evidence of accumulating biological material on the video footage. Heading in a south-southwesterly direction for approximately 45m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with *P. bernhardus* and flatfish recorded.

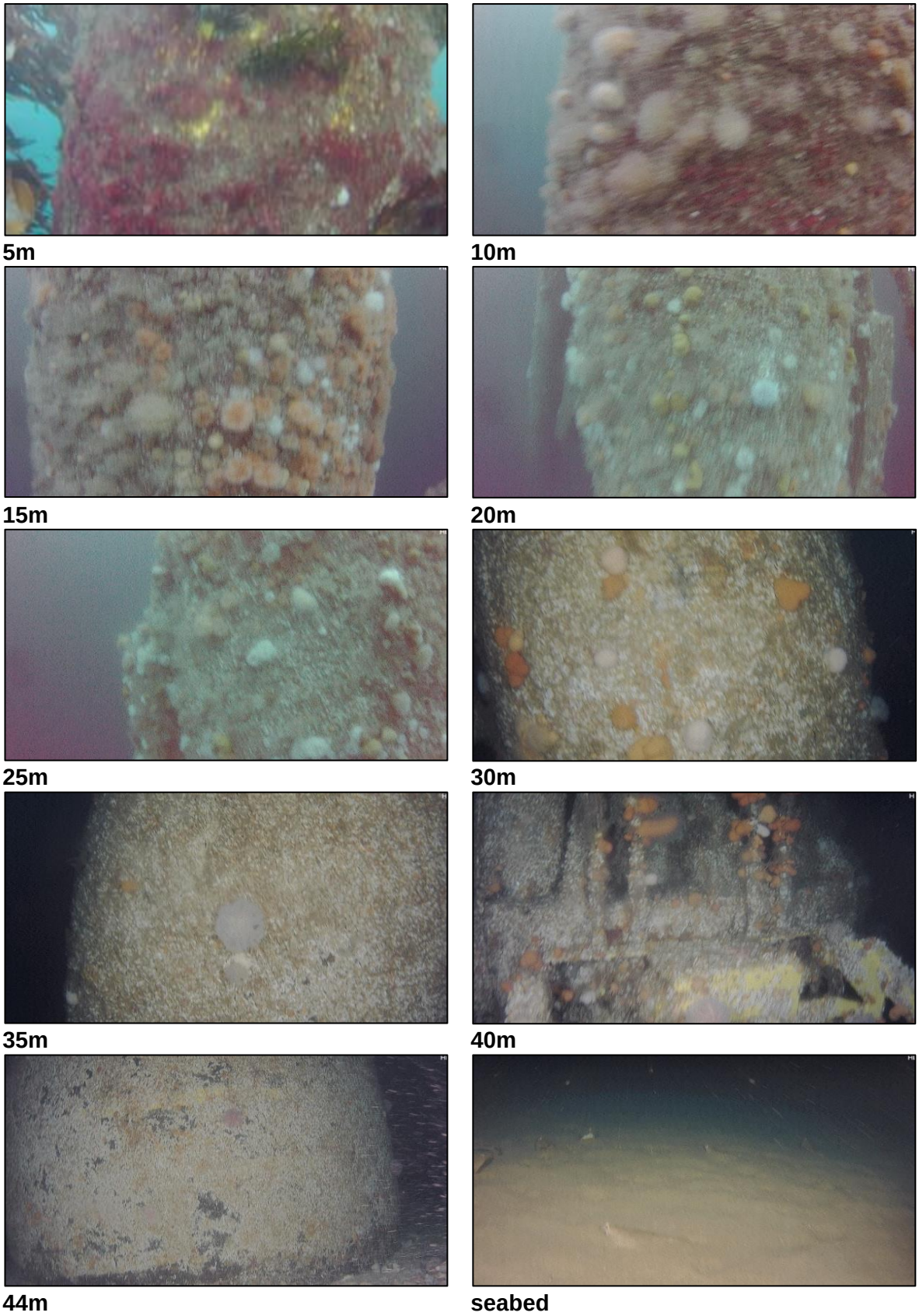
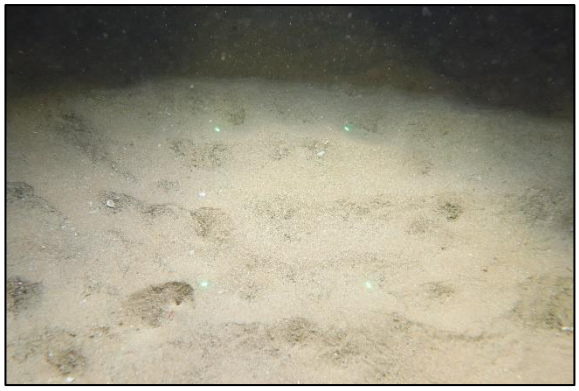


Figure 29. Representative images taken at 5m depth intervals at H08S

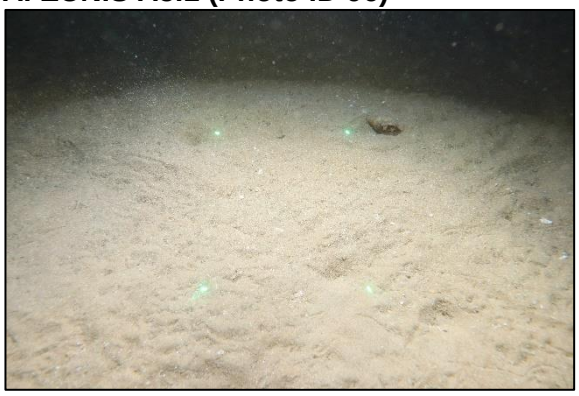
3.5.3.2 H08 South: Benthic composition around turbine

The transect was recorded as Sublittoral coarse sediment (EUNIS A5.1) with *A. rubens* recorded as Rare (note - Photo IDs in Figure 30 below can be cross referenced with locations shown on Figure 24).

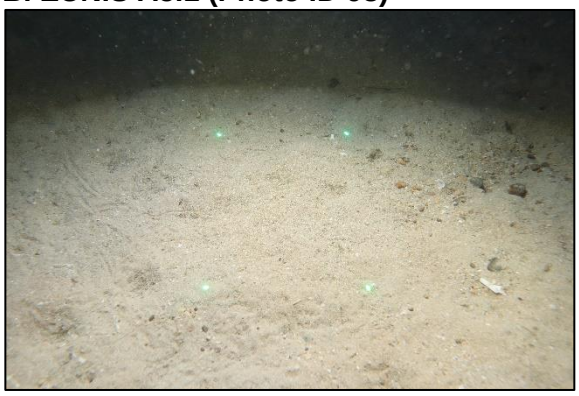


A. EUNIS A5.1 (Photo ID 96)

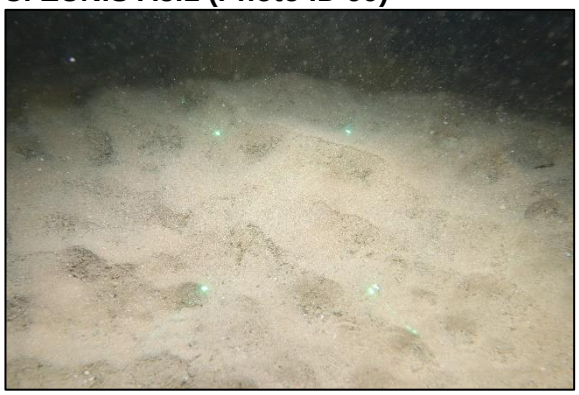
B. EUNIS A5.1 (Photo ID 98)



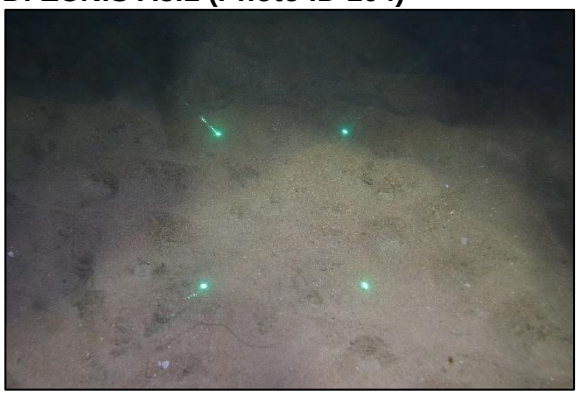
C. EUNIS A5.1 (Photo ID 99)



D. EUNIS A5.1 (Photo ID 104)



E. EUNIS A5.1 (Photo ID 105)



F. EUNIS A5.1 (Photo ID 107)

Figure 30. Representative seabed images taken at H08S

3.5.4 H08 West

3.5.4.1 H08 West: Turbine jacket leg assessment

0 - 5 m

The upper splash zone had areas of uncolonised foundation where yellow high-visibility paint was visible. Bellow 0.5 m algae was abundant, with Rhodophyta turf being Superabundant. *Crisia* sp. and Obelia sp were Abundant, *Corallinaceae* (encrusting), *L. hyperborea*, *M. senile, Balanoidea* and *P. vulgata* were Common and *Cellaria* sp. was Occasional. *A. rubens* was Rare between 2 - 5 m.

5 - 10 m

Biofouling in this band was dominated by *M. senil*e which was Superabundant. *Cellaria* sp. was Abundant throughout this depth band. *Obelia* sp., *L. hyperborea*, *A. digitatum*, *E. esculentus* (juvenile), *M. membranacea*, *S. triqueter* and *S. elegans* were all Common throughout the band. *A. rubens* was Frequent, *Corallinaceae* (encrusting) and the tunicate *Lissoclinum perforatum* was Occasional. Rhodophyta turf was Rare and was not present below 6 m.

10 - 25 m

In contrast to other jacket legs on this turbine, *M. senile* was relatively sparse, ranging from Abundant in shallower water, to Frequent in deeper water. *A. digitatum*, *E. esculentus* (juvenile), *Suberites* sp. and *A. rubens* were all Common within this depth band. *Cellaria* sp. was Abundant to Frequent and *S. triqueter* and *S. elegans* were Abundant. *L. perforatum* was Occasional.

25 - 44 m

S. triqueter became the dominant taxon below 25 m where it was Superabundant. *A. digitatum* was Abundant to Common, *E. esculentus* (including juveniles), *Suberites* sp., *P. bernhardus* and *A. rubens* were all Common. *M. senile* was Frequent to Rare, *Cellaria* sp. was Occasional and *Henrica* sp. was Abundant.

Seabed

A number of taxa were recorded at the base where *P. bernhardus* was Common and *Pleuronectidae* (adult flatfish) and Pleuronectiformes (small flatfish) were Abundant. There was no evidence of accumulating biological material on the video footage. Heading in a west-northwesterly direction for approximately 45m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with *P. bernhardus* and flatfish recorded.

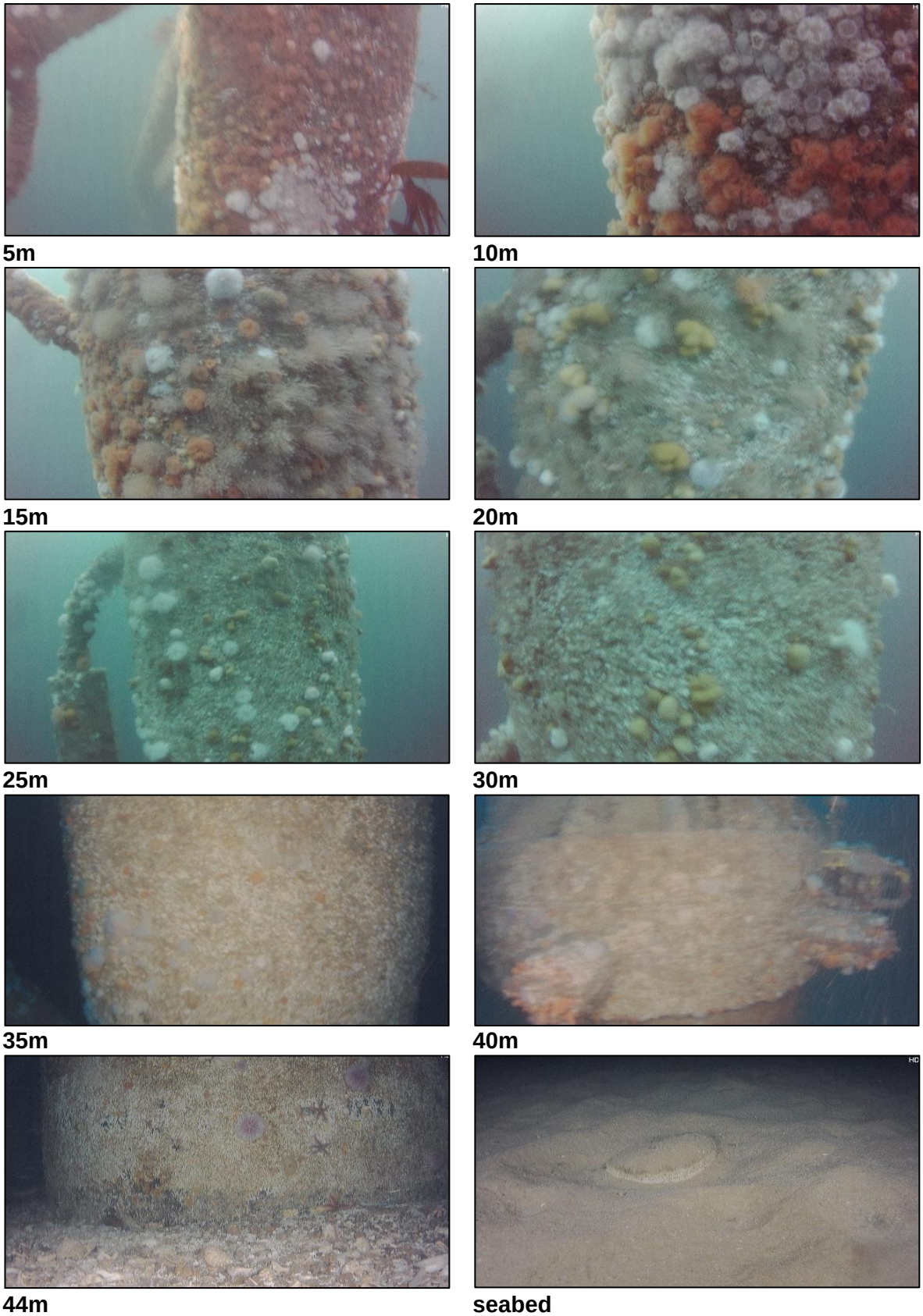
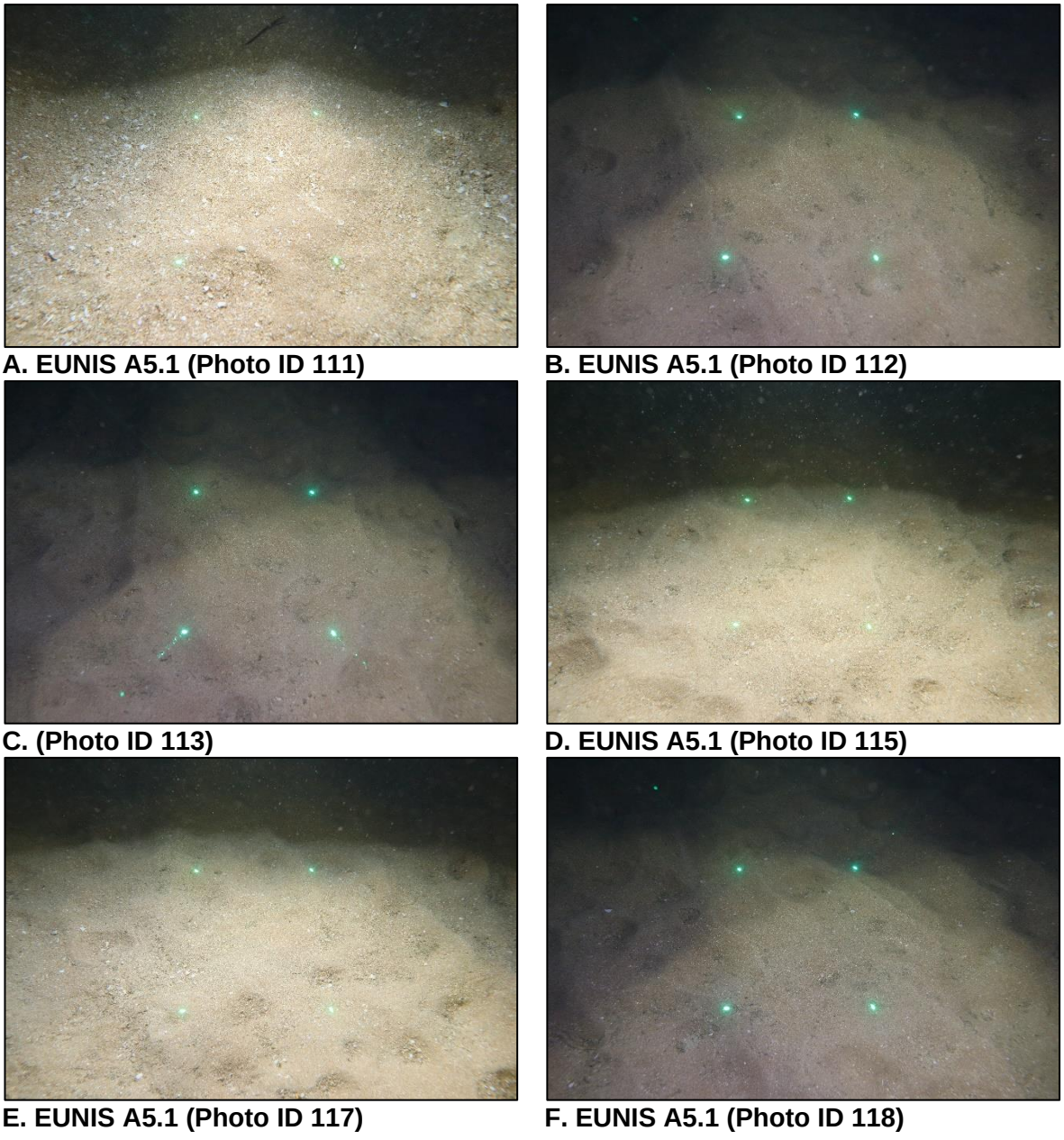


Figure 31. Representative images taken at 5m depth intervals at H08W

3.5.4.2 H08 West: Benthic composition around turbine

The substrate was Sublittoral coarse sediment (EUNIS A5.1) and *A. rubens* was recorded as Rare (note - Photo IDs in Figure 32 below can be cross referenced with locations shown on Figure 24).



A. EUNIS A5.1 (Photo ID 111) **B. EUNIS A5.1 (Photo ID 112)**

C. (Photo ID 113) **D. EUNIS A5.1 (Photo ID 115)**

E. EUNIS A5.1 (Photo ID 117) **F. EUNIS A5.1 (Photo ID 118)**

Figure 32. Representative seabed images taken at H08W

3.6 Turbine K07

A map of benthic habitats around turbine K07 below is indicated in Figure 33. In the sections below, detail is provided for the range of biological communities recorded on the turbine foundation for turbine K07, followed by descriptions of the habitats recorded on the transects along the sea floor heading away from the turbine foundation. The nearest benthic grab station to this turbine was Station 2 at which all replicate samples were allocated the biotope '*Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand' (JNCC code: SS.SCS.ICS.MoeVen; EUNIS code: A5.133), (see APEM 2021 for details).

3.6.1 K07 North

3.6.1.1 K07 North: Turbine jacket leg assessment

0 - 5 m

There were small areas of uncolonised substrate in the top 0.5 m indicated by visible yellow high-visibility paint. Superabundant plumose anemone *M. senile* was recorded at much shallower depths compared to other jacket legs at the K07 location. This band was colonised by Abundant red algae Rhodophyta turf and Frequent kelp *L. hyperborea* while barnacles (*Balanoidea*) were Common and the encrusting algae *Corallinaceae* and bryozoan *Cellaria* sp. were Occasional.

5 - 10 m

Within this transition zone Rhodophyta turf was still Abundant. *M. senile* was Superabundant and was interspersed with Abundant *Cellaria* sp. and Rare dead man's fingers *A. digitatum* and the velvet swimming crab *Necora puber* was Rare.

10 - 25 m

This band was dominated by Abundant to Occasional *M. senile*, although it was recorded in lower densities than on other jacket legs at the K07 location. *Cellaria* sp. and the keel worm *S. triqueter* were Abundant and the urchin *E. esculentus* (juvenile) was Common in the 20 – 25 m band.

25 - 45 m

Descending down the leg, *S. triqueter* was Superabundant and became the dominant taxon replacing the Occasional to Rare *M. senile*. *A. digitatum* was also Frequent, *E. esculentus* (juvenile) and *P. bernhardus* were Common and *Cellaria* sp. was Occasional.

Seabed

On the seabed at the base of the leg Abundant *Pleuronectidae* (adult flatfish), Pleuronectiformes (juvenile flatfish) and Common *P. bernhardus* were recorded. There was, however, no evidence of accumulated biological material on the seabed. Heading in a north-northwesterly direction for approximately 45m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) and *P. bernhardus* and flatfish were recorded.

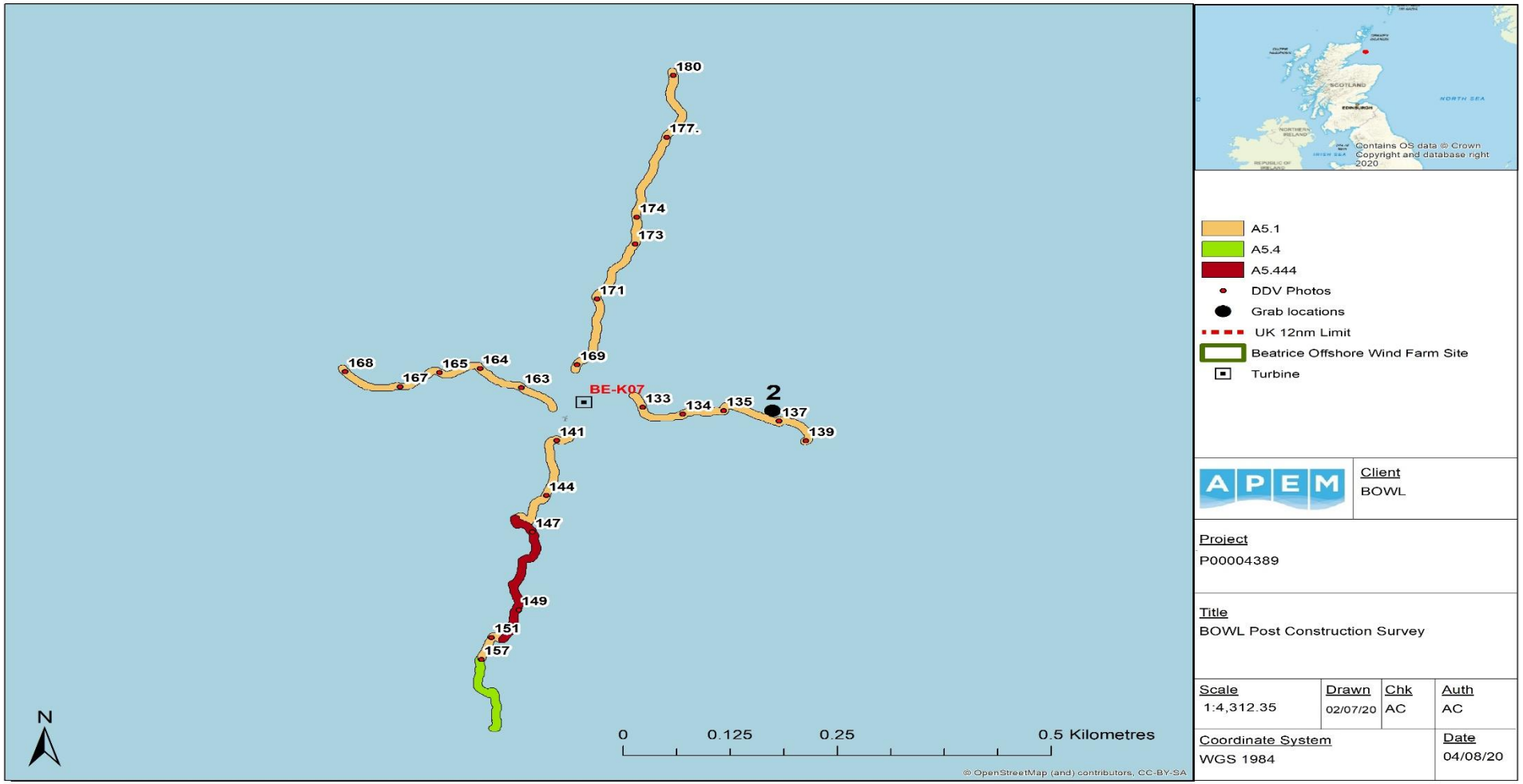


Figure 33. Map of habitats found at K07

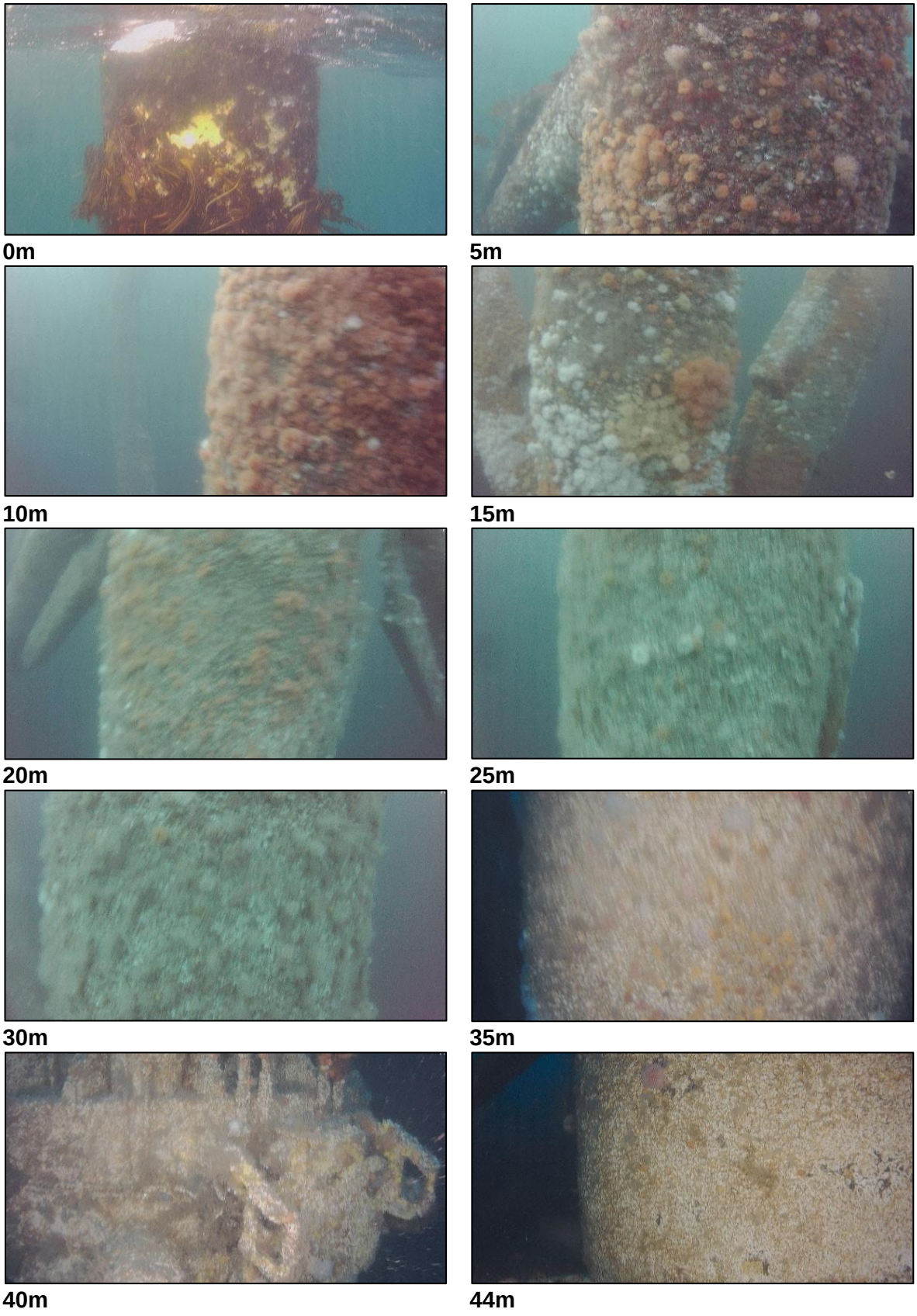


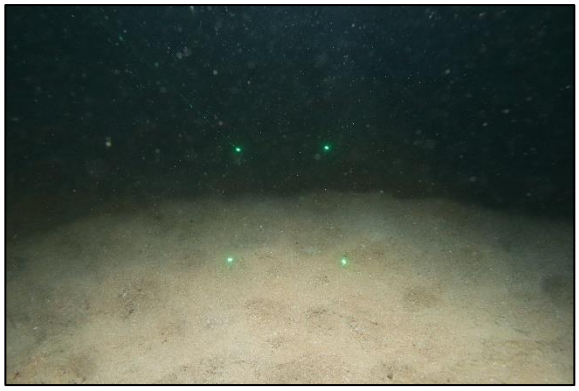
Figure 34. Representative images taken at 5m depth intervals at K07N

3.6.1.2 K07 North: Benthic composition around turbine

The substrate was recorded as Sublittoral coarse sediment (EUNIS A5.1). The only conspicuous species present was *A. rubens* which was Rare (note - Photo IDs in Figure 35 below can be cross referenced with locations shown on Figure 33).

.

A. EUNIS A5.1 (Photo ID 169)



B. EUNIS A5.1 (Photo ID 171)

C. EUNIS A5.1 (Photo ID 173)

D. EUNIS A5.1 (Photo ID 174)

E. EUNIS A5.1 (Photo ID 177)

F. EUNIS A5.1 (Photo ID 180)

Figure 35. Representative seabed images taken at K07N

3.6.2 K07 East

3.6.2.1 K07 East: Turbine jacket leg assessment

0 - 5 m

The area of visible yellow high-visibility paint was relatively large on this jacket leg and extended to approximately 2 m depth, however Rhodophyta turf and *L. hyperborea* were still Superabundant in this depth band. The taxa *Crisia* sp. and *Obelia* sp. were all Abundant and *Balanoidea*, *Corallinaceae* (encrusting), *M. senile* and *P. vulgata* were all Common. *M. senile* was present at much shallower depth compared to other turbines and was Common from approximately 3 m depth.

5 - 10 m

On other jacket legs this was typically a transition zone between the algae dominated upper leg and a slightly deeper area dominated by *M. senile*. On this leg, however, algal species were not present and *M. senile* was already Superabundant throughout this band. *Cellaria* sp. was Abundant, *Obelia* sp., *S. triqueter* and *S. elegans* were all Common and *Corallinaceae* (encrusting) was Occasional in this band.

10 - 25 m

This depth band was dominated by larger, high biomass taxa. *M. senile* was Superabundant to Common, *Cellaria sp.*, *S. triqueter* and *S. elegans* were Abundant and *A. digitatum* and *Suberites* sp. were Common. The species *L. perforatum* was Occasional.

25 - 40 m

Transitioning deeper down the leg, *S. triqueter* became dominant and was Superabundant. *A. digitatum* was Abundant to Common and *Suberites* sp. was Common. *M. senile* transitioned from Rare to Frequent within this zone and *Cellaria* sp. was Occasional.

Seabed

Some mobile taxa were present at the seabed including Abundant *Henrica* sp. and *Pleuronectidae* and Common *E. esculentus*. Heading in an east-southeasterly direction for approximately 45m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with *P. bernhardus* and flatfish recorded.

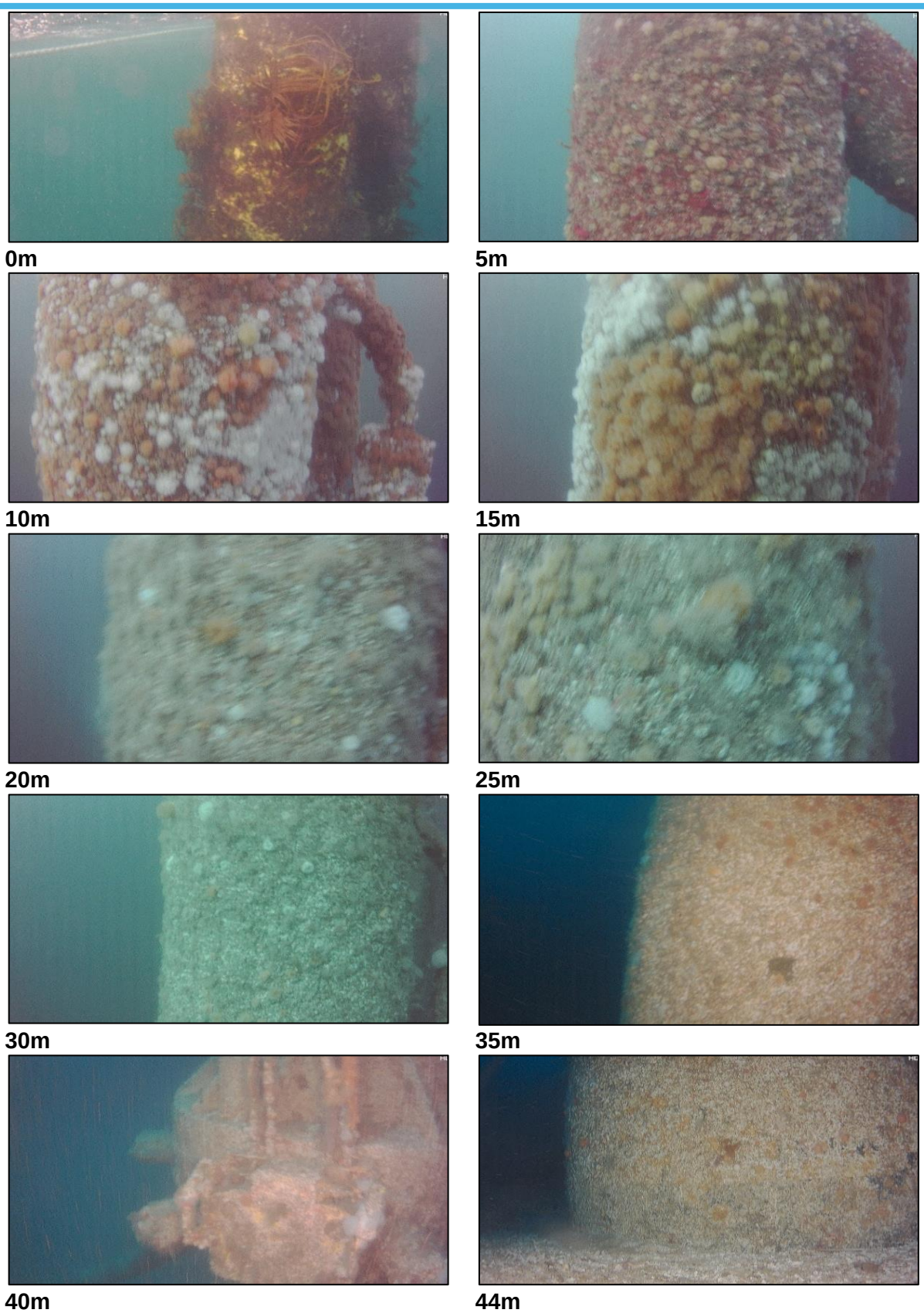
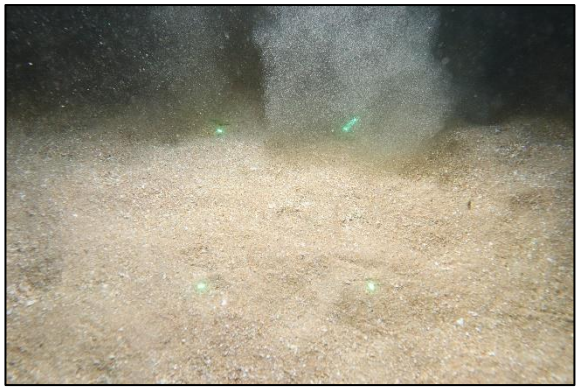


Figure 36. Representative images taken at 5m depth intervals at K07E

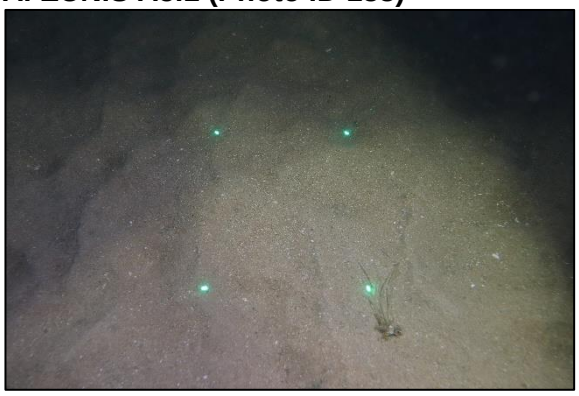
3.6.2.2 K07 East: Benthic composition around turbine

The substrate was Sublittoral coarse sediment (EUNIS A5.1) and *A. rubens* was recorded as Rare and *Pleuronectidae* was Occasional (note - Photo IDs in Figure 37 below can be cross referenced with locations shown on Figure 33).

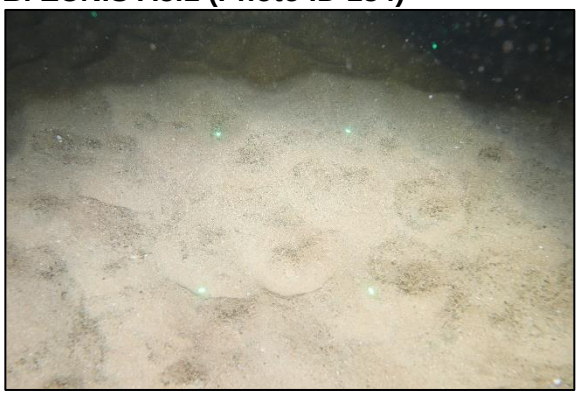


A. EUNIS A5.1 (Photo ID 133)

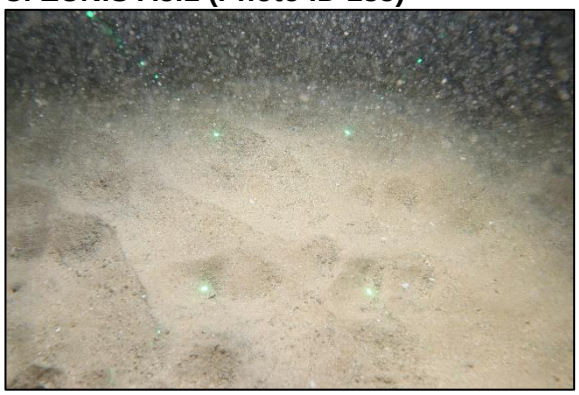
B. EUNIS A5.1 (Photo ID 134)



C. EUNIS A5.1 (Photo ID 135)



D. EUNIS A5.1 (Photo ID 137)



E. EUNIS A5.1 (Photo ID 139)

Figure 37. Representative seabed images taken at K07E

3.6.3 KO7 South

3.6.3.1 K07 South: Turbine jacket leg assessment

0 - 5 m

Some large patches of uncolonised yellow high-visibility paint were visible and Abundant *L. hyperborea* and Rhodophyta turf were present.

5 - 10 m

This band was a transition area between the shallower algae dominated zone where Rhodophyta turf was abundant and the slightly deeper *M. senile* dominated zone where *M. senile* was Superabundant. *A. digitatum* and *Cellaria* sp. were both Abundant.

10 - 25 m

This band was dominated by superabundant *M. senile. Cellaria* sp. and *S. triqueter* were also Abundant, *A. digitatum* was Common and *Sagartia elegans* was Rare.

25 - 40 m

In comparison to other jacket legs, this band was fairly sparsely colonised with a limited number of biofouling taxa. However, *Cellaria sp*, *M. senile* and *S. triqueter* were still Abundant and *A. digitatum* was Common. *S. elegans* was also present (Occasional) between 25-30 m.

Seabed

P. bernhardus, *Pleuronectidae* (adult flatfish) and Pleuronectiformes (juvenile flatfish) were all Abundant on the seabed at the base although no biological material was evident on the seabed. Heading in a south-southwesterly direction for approximately 45 m the seabed was recorded as Sublittoral coarse sediment (EUNIS A5.1) and *P. bernhardus* and flatfish were recorded.

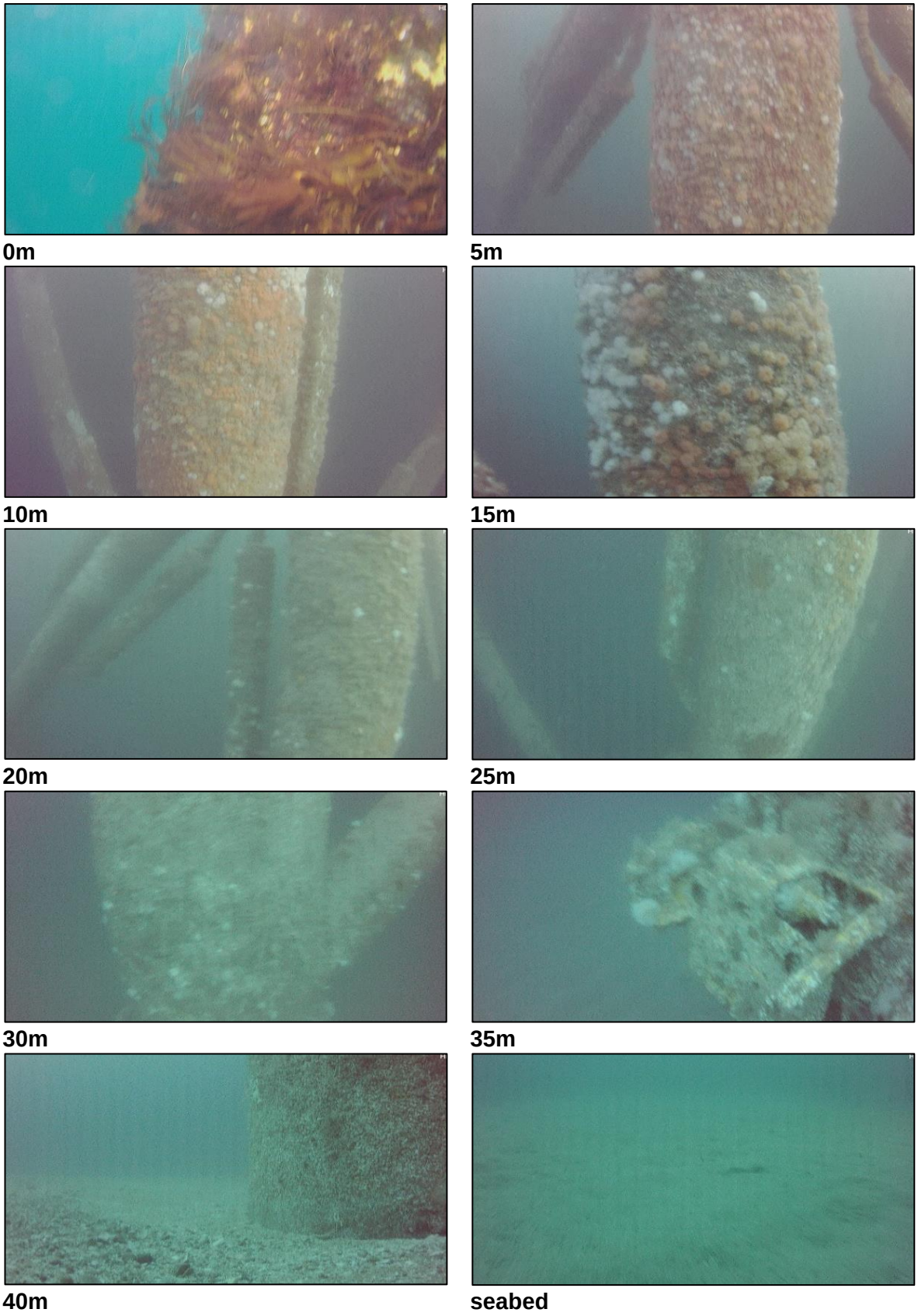


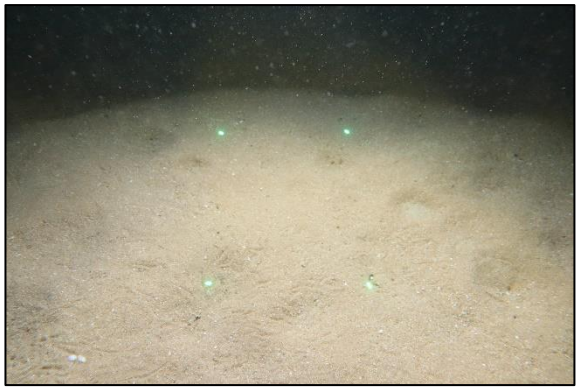
Figure 38. Representative images taken at 5m depth intervals at K07S

3.6.3.2 K07 South: Benthic composition around turbine

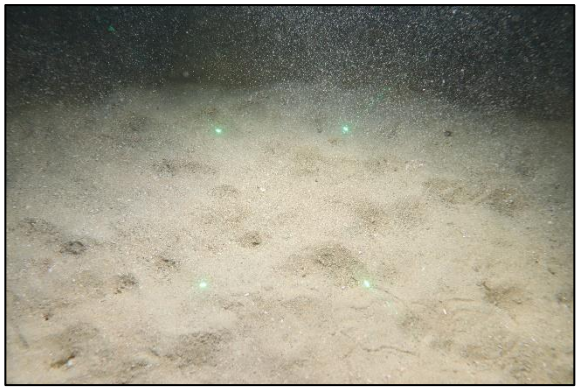
K07 South was the most diverse transect encounter in terms of both taxa present and habitats represented. The transect commenced in Sublittoral coarse sediment (EUNIS A5.1) with Frequent *A. rubens* and Rare sea chervil *Alcyonidium diaphanum*, dead man's fingers *A. digitatum*, *E. esculentus* (juvenile) and *F. foliacea*.

The transect then moved into an area of cobbles characterised by *F. foliacea* and the hydroid *Hydrallmania falcata* which was classified as *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (EUNIS A5.444). A number of conspicuous taxa were identified within this habitat type as follows: Superabundant keel worm *S. triqueter*; Common starfish *A. rubens*, edible sea urchin *E. esculentus* (adults and juveniles), the bryozoan *Flustra folicaea* and the hydrozoans *Hydrallmania falcata* and *Halecium halecinum*; Occasional *A. diaphanum*, dead man's fingers *A. digitatum* and the sponge *Amphilectus fucorum*; Frequent European lobster *Homarus gammarus* and *Hydrozoa sp.* A (Arborescent); and Rare *M. senile*.

The transect then transitioned out of the cobble area and onto a small patch of Sublittoral coarse sediment (EUNIS A5.1) with Frequent *A. rubens* before transitioning again to an area of Sublittoral mixed sediments (EUNIS A5.4) with Frequent *H. falcata*, *S. triqueter* and the hydroids sea beard *Nemertesia antennina* and *Nemertesia ramose* and Rare *A. diaphanum, A. digitatum* and *A. fucorum* (note - Photo IDs in Figure 39 below can be cross referenced with locations shown on Figure 33).

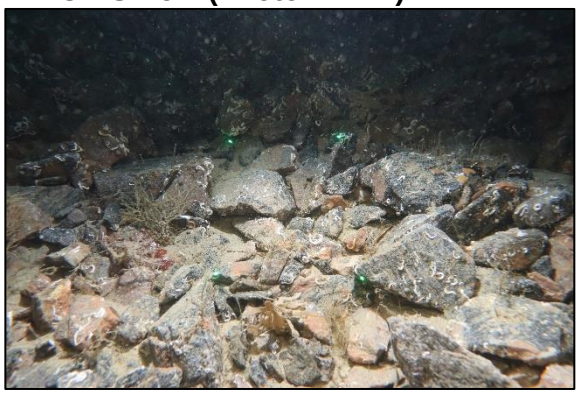


A. EUNIS A5.1 (Photo ID 141)

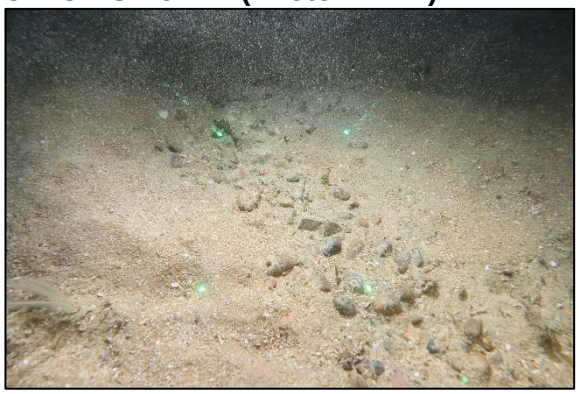


B. EUNIS A5.1 (Photo ID 144)

C. EUNIS A5.444 (Photo ID 147)



D. EUNIS A5.444 (Photo ID 149)



E. EUNIS A5.1 (Photo ID 151)

F. EUNIS A5.4 (start of zone) (Photo ID 157)

Figure 39. Representative seabed images taken at K07S

3.6.4 KO7 West

3.6.4.1 K07 West: Turbine jacket leg assessment

0 - 5 m

Some large patches of uncolonised yellow high-visibility paint were visible and Rhodophyta turf was Abundant.

5 - 10 m

Algae taxa were absent and *M. senile* was Superabundant at shallower depths when compared to other jacket legs at the K07 location. *A. digitatum* and *Cellaria* sp. had greater abundance than was typical for this depth band on the other jacket legs at this location and were recorded as Abundant.

10 – 25 m

This band was dominated by large cnidarians with Superabundant *M. senile* and Common/Occasional *A. digitatum*. *Cellaria* sp. and *S. triqueter* were also Abundant.

25 – 40 m

In comparison to other turbines, this band was sparsely colonised with a limited number of biofouling taxa although *Cellaria* sp. was Abundant, *A. digitatum* was Common and *M. senile* was Frequent. As typically found within this depth band on other turbine foundations, *S. triqueter* was Superabundant.

Seabed

At the sea bed *P. bernhardus* and Pleuronectiformes (small flatfish) were Rare. Heading in a west-northwesterly direction for approximately 45 m the seabed was classified as Sublittoral coarse sediment (EUNIS A5.1) with *P. bernhardus* and small flatfish recorded.

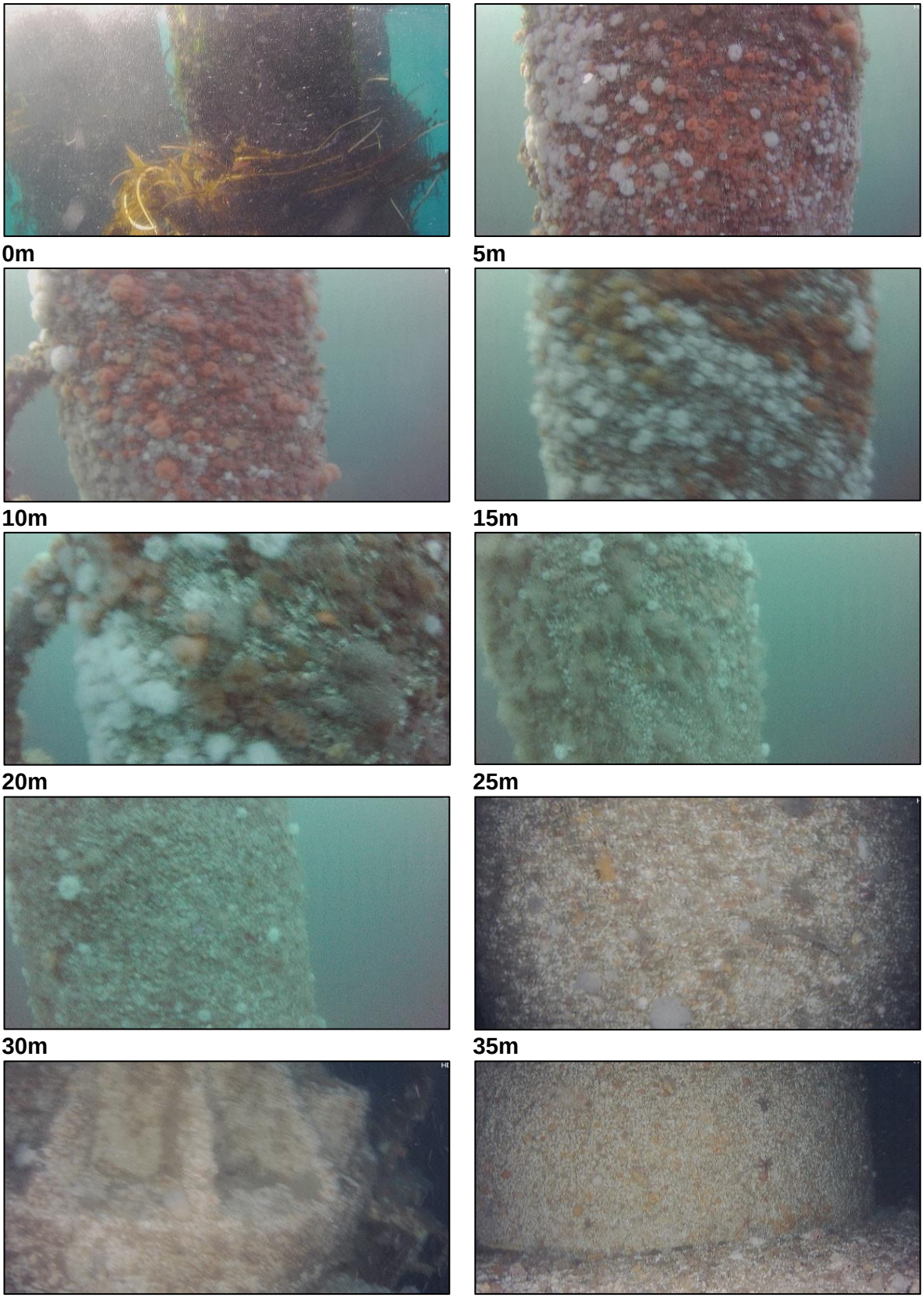
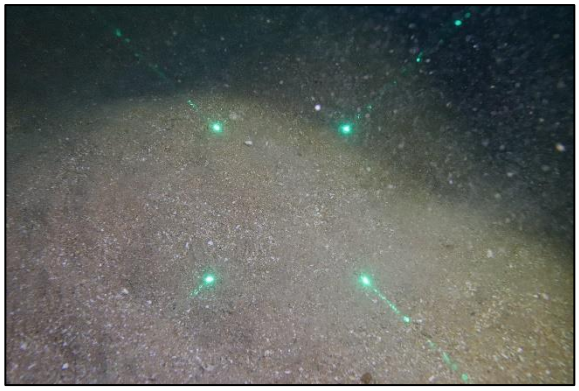


Figure 40. Representative images taken at 5m depth intervals at K07W

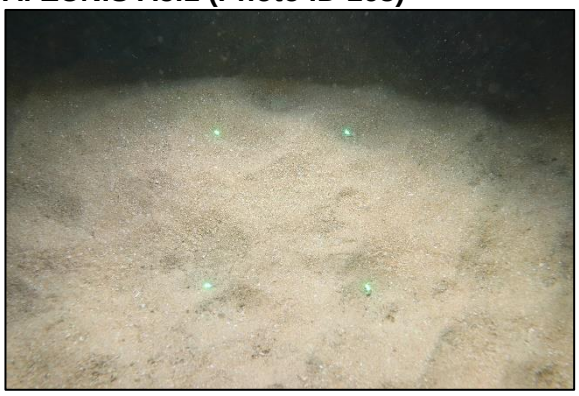
3.6.4.2 K07 West: Benthic composition around turbine

The entirety of the K07W transect was Sublittoral coarse sediment (EUNIS A5.1). The only conspicuous species present was *A. rubens* which was Rare (note - Photo IDs in Figure 41 below can be cross referenced with locations shown on Figure 33).

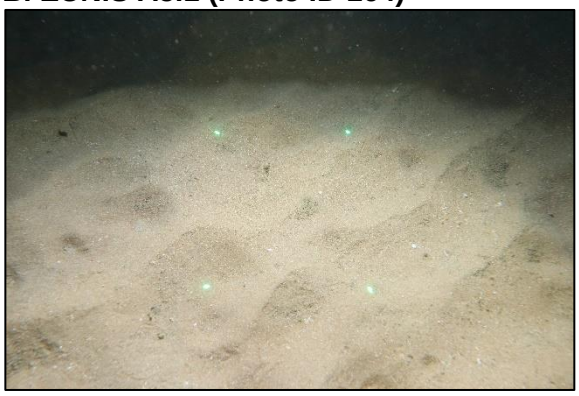
A. EUNIS A5.1 (Photo ID 163)



B. EUNIS A5.1 (Photo ID 164)



C. EUNIS A5.1 (Photo ID 165)



D. EUNIS A5.1 (Photo ID 167)

E. EUNIS A5.1 (Photo ID 168)

Figure 41. Representative seabed images taken at K07W

3.7 Species of conservation importance

Although it is not clear from the images what specific species were present a number of gadoids were recorded which could possibly be Atlantic cod *Gadus morhua*. Atlantic cod is listed on the OSPAR list of threatened or declining species & habitats (OSPAR Convention, 2010) as most stocks are still considered to be outside Safe Biological Limits (SBL), although the situation has improved in recent years. Atlantic cod is a Scottish Priority Marine Feature.

Cod and plaice (which could have been present and recorded as *Pleuronectidae*) have been assessed for the IUCN Red list. However, both species are showing increasing population trends and are therefore listed as being of 'Least Concern' (Cook *et al*. 2015, Freyhof 2014)

The European edible sea urchin *E. esculentus* has also been assessed for the IUCN Red List (World Conservation Monitoring Centre, 1996) and is considered 'Near Threatened'.

4. Discussion

The results in this report provide the first set of post-construction monitoring data for the examination of colonisation of jacket legs at the Beatrice OWF and for characterisation of sediment type, habitats and epibiota in the immediate vicinity of these turbines.

4.1 Colonisation of the jacket legs by epibiota

Biofouling was present and extensive on all turbines and showed signs of zonation and successional development. The successional colonisation of turbine legs was most pronounced on the jackets of turbine foundation K07, where taxon density was comparatively lower than other legs and pioneer species such *S. triqueter* were more abundant across more of the depth profile. This is in keeping with the colonisation of other windfarms (e.g. EMU 2008, Whomersley & Picken 2003, Bouma & Lengkeek 2009, Leonhard & Pedersen 2006), with initial opportunistic taxa (r-strategists) gradually being replaced by slightly slower-growing taxa (K-strategists).

In common with the colonisation of other turbines in the southern North Sea and wider North Sea area, biofouling communities occupied distinct zones dominated by one or two species, with similar depth zones to those reported for natural and artificial hard substrata (e.g. EMU 2008; Whomersley & Picken 2003; Bouma & Lengkeek 2009; Leonhard & Pedersen 2006). Findings were also consistent with depth-related zonation in the community of old gas platforms recorded by Coolen *et al.* (2015), however, blue mussel *M. edulis* was recorded on these platforms and this species was absent on the surveyed turbine jackets at the Beatrice OWF.

De Mesel *et al.* (2013) found that zonation and community composition differed little after the first two years of colonisation and that communities would typically contain the same limited number of species but with some species in high abundances. In contrast, Leonhard & Pedersen (2006) indicated a climax community on introduced hard structures may not be expected within 5-6 years after hard substrate deployment. The turbine jackets at foundations surveyed at Beatrice OWF were installed on the following dates: C04 – 13th December 2017, F06 – 11th September 2017, K07 – 30th December 2017, H08 – 13th September 2017 and further monitoring at Beatrice OWF will elucidate how stable the communities recorded on the jacket legs are over time.

Kerckhof *et al.* (2010) highlighted the importance of timing of the surveys following turbine installation and seasonality of recruitment of different species when comparing the results of monitoring across different years. For example, Kerckhof *et al.* (2010) found different communities in the first year and second year of post-construction monitoring at Thornton Bank in the southern North Sea. This was primarily due to turbines being installed in spring, preventing initial colonisation of species which reproduce early in the year so these species were absent during the first survey. However, prior to the 2020 monitoring the turbine jackets at the Beatrice OWF were in place for three years or just under three years (depending on the turbine foundation jacket), therefore seasonality of initial colonisation is not anticipated to have had a notable effect on the communities present in 2020.

Other studies at offshore wind farms such as Glufke (2015) have found that *M. edulis* dominated the upper zone 0-10 m after the first year of surveying. Although *M. edulis* was not recorded at Beatrice OWF during this initial monitoring period, it is common at other wind farms (e.g. Degraer *et al*. 2013) and considering the pioneering nature of *M. edulis* there is potential for it to be present during subsequent monitoring. If this species does become established it could have implications for the accumulation of pseudofaeces and detritus at the base of the turbines.

Across all turbines *M. senile and S. triqueter* were the most abundant species accounting for the majority of the total biofouling cover and these species occupied the central and lower sections, respectively. Similar findings have been noted for turbines at other North Sea locations and numerous additional species have been recorded including *Jassa herdmanie*, *Tubularia indivisa* and *Tubularia larynx* although for a number of these studies collection of quantitative scrape samples were taken which increased the range of species recorded (e.g. Degraer *et al*. 2013). Hiscock *et al*. (2010) noted that although artificial substrates do often develop towards a climax community consisting of the *M. senile* biotope, they are typically impoverished in comparison to natural equivalent biotopes which typically support a range of epiphytic species.

At the base and in the immediate vicinity of the turbine legs, mobile species such as the hermit crab *P. bernhardus* and the sea urchin *Echinus esculentus* were present which would suggest availability of food (pseudofaeces and a detritus) around the turbine legs. Although no feeding behaviour was observed for these species the number of *P. bernhardus* and *E. esculentus* declined rapidly away from the base of the turbine legs. Pleuronectiformes were also recorded at the base of the turbine, however, numbers were also similar within the surrounding Sublittoral coarse sediment (EUNIS A5.1) habitat.

A study by Bergström *et al*. (2013) found that OWF construction is unlikely to have detrimental effects on demersal fish populations and may even provide long-term benefits by enhancing local ecosystem services. Some fish were present at the Beatrice OWF site and although gadoids and flatfish recorded on the ROV footage could not be identified to species level, there is potential that some of the gadoids seen were Atlantic cod *Gadus morhua*, and European plaice *Pleuronectes platessa* may have been present (flatfish could not be recorded to species level). Both of these species are included on the Scottish Biodiversity List and Atlantic cod is a Scottish Priority Marine Feature.

4.2 Sediment and habitats around turbine foundations

The analysis of underwater video and stills collected from the 16 transects across the four turbines foundations indicated the presence of three broadscale EUNIS habitats.

In total 4,953 m of Sublittoral coarse sediment (EUNIS code A5.1) was recorded and this was the most widespread habitat across the survey area. It was only possible to confidently identify this habitat to EUNIS level 3 (A5.1) due to a lack of conspicuous species, however, it is likely that large areas of the A5.1 habitat support a rich infaunal habitat. For example, the biotope '*Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand' (JNCC code: SS.SCS.ICS.MoeVen; EUNIS code: A5.133) was allocated to some of the grab samples taken

in the vicinity of some of the video transects allocated to Sublittoral coarse sediment (A5.1), APEM (2021).

The second most prevalent habitat type was Sublittoral mixed sediments (EUNIS code A5.4) with 2807 m recorded at nine locations across three turbine foundations during the DDV survey. It is not possible to determine infaunal communities for this habitat from the available data and only one replicate was allocated to 'Faunal communities on full salinity Atlantic infralittoral mixed sediments' (EUNIS Code A5.43) during the benthic grab survey, which was not in the vicinity of the transects.

A short 268 m section of '*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment' (EUNIS habitat A5.444) was recorded in the vicinity of one turbine foundation, K07. K07 south was the most diverse transect in terms of the number of species present. The habitat was characterised by bryozoans such a *F. foliacea* and hydroids such as *H. falcata*. Several conspicuous species were identified within this habitat type, which were also frequently recorded on the jacket legs, such as *A. digitatum and S. triqueter*.

Based on the results of the survey there was limited evidence for effects of fouling communities on the epibenthic community composition in the immediate vicinity of the turbines, other than the presence of some mobile species. In addition, no INNS were recorded during the ROV or DDV survey.

Further monitoring to be undertaken as part of the post-construction monitoring programme will provide additional information relating to how the turbine jacket legs are colonised over time and help clarify if the organisms on the jacket legs are influencing sediment and habitat type in the vicinity of the turbines.

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6. Appendices

Appendix 1 Survey Log

			Start Location		End Location	
Wind Turbine Number	Transect	Length (m)	Longitude (decimal degrees)	Latitude (decimal degrees)	Longitude (decimal degrees)	Latitude (decimal degrees)
BE-C04	C04E	383	-2.961030006	58.20489883	-2.962939978	58.20529938
	C04W	388	-2.966099977	58.20529938	-2.970200062	58.20589828
	CO4N	667	-2.96359992	58.21009827	-2.965169907	58.20600128
	CO4S	726	-2.965130091	58.20510101	-2.967220068	58.20080185
BE-F06	F06E	340	-2.89835	58.2358017	-2.900619984	58.23600006
	F06S	430	-2.903179884	58.23450089	-2.90444994	58.23160172
	FO6N	885	-2.902580023	58.23669815	-2.901449919	58.24060059
	FO6S	244	-2.90328002	58.23509979	-2.903249979	58.23509979
BE-H08	FO6W	336	-2.903569937	58.23600006	-2.907720089	58.23680115
	HO8E	275	-2.856970072	58.26390076	-2.853800058	58.26350021
	HO8N	556	-2.858299971	58.26440048	-2.856479883	58.26869965
	HO8S	581	-2.858419895	58.2635994	-2.860080004	58.25930023
BE-K07	HO8W	290	-2.859119892	58.2643013	-2.862950087	58.26449966
	K07E	337	-2.823329926	58.26089859	-2.819920063	58.2602005
	K07N	550	-2.824480057	58.26119995	-2.822530031	58.26549911
	K07S	673	-2.82562995	58.25790024	-2.824729919	58.26029968

Appendix 2 SACFOR scale

S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare, L = Less than rare indicated by extrapolation

SACFOR cover scale			SACFOR counts scale					
Percentage cover	Growth form		Counts (various spatial unit)	Minimum density at 1000 m2	Size of individuals or colonies (cm)			
	Crust/ Meadow	Massive/ Turf			< 1	1–3	3–15	> 15
> 80%	S		> 1 / 0.001 m2 (1 × 1 cm)	10,000,000	S			
40–79%	A	S	1–9 / 0.001 m2	1,000,000	A	S		
20–39%	C	A	1–9 / 0.01 m2 (10 × 10 cm)	100,000	C	A	S	
10–19%	F	C	1–9 / 0.1 m2	10,000	F	C	A	S
5–9%	O	F	1–9 / m2	1000	O	F	C	A
1–5%	R	O	1–9 / 10 m2 (3.16 × 3.16 m)	100	R	O	F	C
< 1%	L	R	1–9 / 100 m2 (10 × 10 m)	10	L	R	O	F
		L	1–9 / 1000 m2 (31.6 × 31.6 m)	1		L	R	O
			< 1 / 1000 m2 (100 × 100 m)	0.1			L	R
			< 1 / 10,000 m2 (1 km2)	0.01				L

Appendix 3 SACFOR results for ROV survey of turbine foundations

Turbine Foundation: C04

C04N (north leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 38	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)									
Species									
Alcyonium digitatum						R			
Asterias rubens	A	C	C					C	
Balanoidea	C								
Carcinus maenas						R			
Cellaria sp.		C	A	C	C	C	O		
Cliona celata	A								
Corallinaceae (encrusting)	O								
Crisia sp								C	
Laminaria hyperborea	S								
Metridium senile	C	A	S	A	A	A	C		
Pagurus bernhardus								R	C
Pleuronectidae								O	A
Rhodophyta turf	C								
Sagartia elegans		F		R	R				
Spirobranchus triqueter				C	A	A	A	C	
Suberites								C	

C04E (east leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 -38	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)										
Species										
Alcyonium digitatum		C	F	R	R					
A. rubens	C	O	C	F	F					
Balanoidea	C									
Gadidae (juvenile)							F			
Gadidae					R					
Halichoerus grypus					R					
Hydrozoa sp A (Arborescent)			R							
Laminaria hyperborea	F									
Metridium senile	C	S	S	A	A	F	F	F		
Pleuronectidae									O	O
Spirobranchus triqueter			C	A	A	S	S	S		
Rhodophyta turf	A	A								
Sagartia elegans		C	C			F	R			

C04S (south leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 38	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)									
Species									
Amphipoda						O			
A. rubens	A	C	C		O			C	
Cellaria sp	A	C	A	C	C	C	O		
Corallinaceae (encrusting)	O								
Chorda filum	O								
Crisia sp	C							C	
Diplosoma listerianum	R								
Echinus esculentus (juvenile)	C								
Flustra folicaea	R								
Laminaria hyperborea	S								
Metridium senile		A	S	A	C	A	C		
Pagurus bernhardus								R	C
Pleuronectidae									A
Rhodophyta turf	A								
Sagartia elegans		R		R	R				
Spirobranchus triqueter				C	S	S	S	C	
Suberites								C	

C04W (west leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 38	Jacket base	ROV along seabed
Sublittoral coarse sediment (EUNIS A5.1)									
Species									
Amphipoda						O			
A. rubens	C	O			O			C	
Balanoidea	C								
Cellaria sp.	A	C	A	A	C	C			
Corallinaceae (encrusting)	O								
Crisia sp.	C							C	
Laminaria hyperborea	A								
Metridium senile		S	S	A	C	A			
Pagurus bernhardus								O	O
Pleuronectidae								A	A
Rhodophyta turf	S								
Spirobranchus triqueter				F	A	A	S	S	

Turbine Foundation: F06

F06N (north leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 41	Jacket base	ROV along seabed
Seabed habitat: Sublittoral mixed sediments (EUNIS A5.4)										
Species										
Asterias rubens	O	O		O	O	O				C
Balanoidea	A									
Cellaria sp.	O	C	A	A	C	C				
Corallinaceae (encrusting)	O									
Crisia sp.	A									C
Echinus esculentus (juvenile)						F	F	F		O
Laminaria hyperborea	C	R								
Membranipora membranacea	C									
Metridium senile	C	S	S	A	C	C	O	O		
Ophiura albida	C									
Pagurus bernhardus										O
Patella vulgata	C									
Pleuronectiformes										O
Rhodophyta turf	S	R								
Sagartia elegans				O						
Spirobranchus triqueter			C	S	S	S	S	S	S	
Suberites sp.						O				

F06E (east leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral mixed sediments (EUNIS A5.4)										
Species										
Asterias rubens	O	O		O	O	O			C	
Balanoidea	A									
Cellaria sp.		C	A	A	C	C				
Corallinaceae (encrusting)	O									
Crisia sp.	A								C	
Echinus esculentus (juvenile)						F	F	F	O	
Laminaria hyperborea	C									
Membranipora membranacea	C									
Metridium senile		S	S	A	C	C	O	O		
Ophiura albida	C									
Pagurus bernhardus									O	O
Patella vulgata	C									
Pleuronectidae									A	A
Rhodophyta turf	S	F								
Spirobranchus triqueter				C	C	S	S	S		
Suberites sp.		O			O	O	O	O		

F06S (south leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral mixed sediments (EUNIS A5.4)										
Species										
Asterias rubens	C	C		O	O	O		C	C	
Alcyonium digitatum							O			
Balanoidea	A									
Cellaria sp.		C	A	C	C	O		C		
Crisia sp.	A									
Corallinaceae (encrusting)	F									
Echinus esculentus (juvenile)		C	R				C		O	
Laminaria hyperborea	A	R								
Membranipora membranacea	F									
Metridium senile		C	S	C	C	F	R	R		
Obelia sp.	C									
Pagurus bernhardus									O	O
Patella vulgata	C									
Rhodophyta turf	S									
Semibalanus balanoides	C									
Spirobranchus triqueter			C	A	S	S	S	S	S	
Suberites sp.							O	O		

F06W (west leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 41	Jacket base	ROV along seabed
Seabed habitat: Sublittoral mixed sediments (EUNIS A5.4)										
Species										
Asterias rubens	A	F		O	O	O		C		
Alcyonium digitatum				F						
Balanoidea	C									
Cellaria sp.	O	C	A	C	C	O				
Chaetopterus sp.		C								
Corallinaceae (encrusting)	O									
Crisia sp.	A									
Echinus esculentus							C	C	C	
Echinus esculentus (juvenile)		C				F	C	F	O	
Henrica sp.		O								
Laminaria hyperborea	A									
Metridium senile	O	C	S	C	F	F	O	O		
Pagurus bernhardus									O	O
Pleuronectidae									A	A
Rhodophyta turf	S	C								
Sagartia elegans			O							
Spirobranchus triqueter			C	A	S	S	S	S		
Suberites sp.				C		C	C	O		

Turbine foundation: H08

H08N (north leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 44	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Alcyonium digitatum			C	C	C	C	O				
Asterias rubens	A	F		C	F	O	O		C		
Balanoidea	C										
Cellaria sp.	O	C	A	F	F	O					
Chorda filum	C										
Corallinaceae (encrusting)	O	O									
Crisia sp.	A										
Echinus esculentus (juvenile)				C	C	C	C	C	C		
Henrica sp.		O						R			
Laminaria hyperborea	S	F									
Membranipora membranacea	C	O									
Metridium senile		A	C	F	F	R	R	R			
Obelia sp.	A	F									
Pagurus bernhardus									C	C	C
Patella vulgata	C										
Pleuronectidae										A	A
Pleuronectiformes (small flatfish)										A	A
Spirobranchus triqueter			A	A	A	S	S	S	S		
Rhodophyta turf	S	R									
Suberites sp.				C	C	C	C				

H08E (east leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 44	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Alcyonium digitatum			C	C	C	C	O				
Asterias rubens		F		C	F	O	O		C		
Cellaria sp.	O	C	A	F	F	O					
Corallinaceae (encrusting)	O	O	O								
Balanoidea	A			O							
Crisia sp.	A										
Echinus esculentus (juvenile)			C					C	C		
Laminaria hyperborea	C	R									
Membranipora membranacea	C										
Metridium senile		A	A	A	F	R	R	R			
Obelia sp.	A										
Pagurus bernhardus									C	S	S
Pleuronectidae										S	S
Pleuronectiformes (small flatfish)									C	S	S
Rhodophyta turf	S	R									
Spirobranchus triqueter		A	A	A	S	S	S	S	S		
Suberites sp.				C	C	C	C				

H08S (south leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Alcyonium digitatum			C	C	C	C	O				
Asterias rubens	R	F		C	F	O	O		C		
Balanoidea	O										
Cellaria sp.	O	A	A	F	F	O					
Corallinaceae (encrusting)	C	O									
Crisia sp.	A										
Echinus esculentus								C			
Echinus esculentus (juvenile)					C	C	C	C			
Laminaria hyperborea	S	C									
Membranipora membranacea	C	C									
Metridium senile		C	A	C	C	F	F	R			
Obelia sp.	A	C									
Pagurus bernhardus									C	C	C
Patella vulgata	C										
Pleuronectidae										A	A
Pleuronectiformes (small flatfish)										A	A
Spirobranchus triqueter		C	A	A	A	S	S	S	S		
Rhodophyta turf	S	R									
Sagartia elegans			A								
Suberites sp.				C	C	C	C				

H08W (west leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 44	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Alcyonium digitatum		C	C	C	A	A	C				
Asterias rubens	R	F		C			O		C		
Balanoidea	C										
Cellaria sp.	O	A	A	F	F	O					
Corallinaceae (encrusting)	C	O									
Crisia sp.	A										
Echinus esculentus						C	C	C	C		
Echinus esculentus (juvenile)		C			C	C	C	C	C		
Henrica sp.									A		
Laminaria hyperborea	C	C									
Lissoclinum perforatum		O	O								
Membranipora membranacea		C									
Metridium senile	C	S	A	F	C	F	F	R			
Obelia sp.	A	C									
Pagurus bernhardus									C	C	C
Patella vulgata	C										
Pleuronectidae											A
Pleuronectiformes (small flatfish)										A	A
Rhodophyta turf	S	R									
Sagartia elegans		C	A								
Spirobranchus triqueter		C	A	A	A	S	S	S	S		
Suberites sp.				C	C	C	C				

Turbine foundation: K07

K07N (north leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	40 - 45	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)												
Species												
Alcyonium digitatum		R	O	C	F	F						
Balanoidea	C											
Cellaria sp	O	A	A	A	F	O						
Corallinaceae (encrusting)	O											
Echinus esculentus (juvenile)					C	C	C					
Laminaria hyperborea	F											
Metridium senile	S	S	A	F	O	O	R	R				
Necora puber		R										
Pagurus bernhardus									C	A	C	C
Pleuronectidae										A		
Pleuronectiformes (small flatfish)										A	A	A
Rhodophyta turf	A	A										
Sagartia elegans						O						
Spirobranchus triqueter			A	A	A	A	S	S	S			

K07E (east leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Actiniaria (large)									C		
Alcyonium digitatum				C	A	A	C				
Asterias rubens									C		
Balanoidea	C										
Cellaria sp.		A	A	A	F	O					
Corallinaceae (encrusting)	C	O									
Crisia sp	A										
Echinus esculentus										C	
Echinus esculentus (juvenile)										C	
Henrica sp.										A	
Laminaria hyperborea	S										
Lissoclinum perforatum			O								
Membranipora membranacea											
Metridium senile	C	S	S	S	C	F	R	R			
Obelia sp.	A	C									
Pagurus bernhardus									C		C
Patella vulgata	C										
Pleuronectidae										A	A
Pleuronectiformes (small flatfish)											A
Spirobranchus triqueter		C	A	A	A	S	S	S	S		
Rhodophyta turf	S	R									

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)											
Species											
Sagartia elegans		C	A								
Suberites sp.				C	C	C	C				

KO7S (south leg)

Species	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)									
Species									
Alcyonium digitatum		A	O	C	C	C	No video		
Cellaria sp.		A	A	A	A	A	No video		
Laminaria hyperborea	A						No video		
Metridium senile		S	S	A	A	A	No video		
Pagurus bernhardus							No video	A	A
Pleuronectidae							No video	A	A
Pleuronectiformes (small flatfish)							No video	A	A
Spirobranchus triqueter			A	A	A	A	No video		
Rhodophyta turf	A	A					No video		
Sagartia elegans			R			O	No video		

KO7W (west leg)

Depth (m)	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	Jacket base	ROV along seabed
Seabed habitat: Sublittoral coarse sediment (EUNIS A5.1)										
Species										
Alcyonium digitatum		A	O	C	C	C		C		
Cellaria sp.		A	A	A	A	A				
Metridium senile		S	S	A	A	F	F	F		
Pagurus bernhardus									R	R
Pleuronectiformes (small flatfish)									R	R
Spirobranchus triqueter			A	A	A	A	S	S		
Rhodophyta turf	A									

Appendix 4 Transect distances

Table 1. Approximate distances for different habitat types across transects

EUNIS Code	Location	Distance (metres)
Sublittoral coarse sediment **Eunis code: A5.1**	F06E	90
	F06S	430
	FO6N	825
	FO6S	158
	FO6W	267
	HO8E	275
	HO8N	556
	HO8S	581
	HO8W	290
	K07E	337
	K07N	550
	K07S	266
	K07W	328
	C04E	390
	C04W	388
	CO4N	667
	CO4S	726
A5.4 Total		7124
Sublittoral mixed sediment **Eunis code: A5.4**	F06E	253
	FO6N	77
	FO6S	89
	FO6W	70
A5.4 Total		636
***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment** **Eunis code: A5.444**	K07S	268
A5.444 Total		**268**
Total all habitats		**8028**

Appendix 5 Transect SACFOR abundance data

Sol = Start of line; Eol = End of line (Lat Long in degrees decimal minutes)

Turbine Foundation: C04

CO4N (north)

	Sol		Eol	
	58 12.320	02 57.967	58 12.354	02 58.034
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			
*Pleuronectiformes (*small flatfish*)*	R			

CO4E (east)

	Sol		Eol	
	58 12.312	02 57.878	58 12.293	02 57.660
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			
Pleuronectiformes (small flatfish)	O			

CO4S (south)

	Sol		Eol	
	58 12.603	02 57.815	58 12.371	02 57.922
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			
Pleuronectiformes (small flatfish)	R			

CO4W (west)

	Sol		Eol	
	58 12.290	02 57.957	58 12.047	002 58.034
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			

Turbine Foundation: F06

F06N (north)

	Sol		Eol		Sol		Eol		Sol		Eol	
	58 14.486	02 54.040	58 14.374	02 54.107	58 14.374	02 54.107	58 14.349	02 54.109	58 14.349	02 54.109	58 14.206	02 54.158
Species	**Sublittoral coarse sediment (EUNIS A5.1)**				**Sublittoral mixed sediments (EUNIS A5.4)**				**Sublittoral coarse sediment (EUNIS A5.1)**			
Echinus esculentus	R											
Pagurus bernhardus	R								R			

FO6E (east)

	Sol		Eol		Sol		Eol		Sol		Eol	
	58 14.169	02 45.107	58 14.158	02 54.002	58 14.158	02 54.002	58 14.144	02 53.949	58 14.144	02 53.949	58 14.138	02 53.909
Species	**Sublittoral mixed sediments (EUNIS A5.4)**				**Sublittoral coarse sediment (EUNIS A5.1)**				**Sublittoral mixed sediments (EUNIS A5.4)**			
Asterias rubens	R											

FO6S (south)

	Sol		Eol		Sol		Eol		Sol		Eol		Sol		Eol	
	58 14.146	02 54.181	58 14.117	02 54.190	58 14.117	02 54.190	58 14.107	02 54.195	58 14.107	002 54.195	58 14.067	02 54.191	58 14.067	02 54.191	58 13.896	02 54.267
Species	**Sublittoral mixed sediments (EUNIS A5.4)**				**Sublittoral coarse sediment (EUNIS A5.1)**				**Sublittoral mixed sediments (EUNIS A5.4)**				**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R												F			

F06W

	Sol		Eol		Sol		Eol	
	58 14.177	02 54.224	58 14.187	02 54.254	58 14.187	02 54.254	58 14.204	02 54.455
Species	**Sublittoral mixed sediments (EUNIS A5.4)**				**Sublittoral coarse sediment (EUNIS A5.1)**			
Squalus acanthias	R							

Turbine Foundation: H08

H08N (north)

	Sol		Eol	
	58 15.855	02 51.547	58 16.119	02 51.388
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			
Pagurus bernhardus	O			
Pleuronectidae	R			

H08E (east)

	Sol		Eol	
	58 15.829	02 51.412	58 15.810	02 5.228
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	O			

H08S (south)

	Sol		Eol	
	58 15.819	02 51.506	58 15.560	02 51.605
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			

H08W (west)

	Sol		Eol	
	58 15.855	02 51.547	58 15.869	02 51.777
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Actiniaria (large)				
Asterias rubens	R			
Pagurus bernhardus	O			

Turbine Foundation: K07

K07N (north)

	Sol		Eol	
	58 15.653	02 49.400	58 15.613	02 49.195
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
Asterias rubens	R			

K07E (east)

	Sol	Eol	Sol	Eol
	58 15.643	02 49 .496	58 15.676	02 49.746
Species	**Sublittoral coarse sediment (EUNIS A5.1)**		**Sublittoral coarse sediment (EUNIS A5.1) Also A5.4 in very small patches**	
Asterias rubens	R			
Pleuronectidae	O			

K07S (south)

	Sol		Eol		Sol		Eol		Sol		Eol		Sol		Eol	
	58 15.616	02 49 .477	58 15.546	02 58.546	58 15.546	02 58.54A5.446	58 15.543	02 49.540	58 15.543	02 49.540	58 15.444	02 49.557	58 15.444	02 49.557	58 15.368	02 49.569
Species	**Sublittoral coarse sediment (EUNIS A5.1)**				***Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment (EUNIS A5.444)**				**Sublittoral coarse sediment (EUNIS A5.1)**				**Sublittoral mixed sediments (EUNIS A5.4)**			
Alcyonidium diaphanum	R				O								R			
Alcyonium digitatum	R				O								R			
Amphilectus (Esperiopsis) fucorum					O								R			
Asterias rubens	F				C				F				F			
Echinus esculentus					C											
Echinus esculentus (juvenile)	R				C											
Flustra folicaea	R				C											
Halecium halecinum					C											
Homarus gammarus					F											
Hydrallmania falcata					C								F			
Hydrozoa sp.(Arborescent)					F											
Metridium senile					R											
Nemertesia antennina													F			
Nemertesia ramosa													F			
Spirobranchus triqueter					S								F			

K07W (west)

	Sol	Eol	Sol	Eol
	58 15.643	02 49 .496	58 15.676	02 49.746
Species	**Sublittoral coarse sediment (EUNIS A5.1)**			
A. rubens	R			