Client: E.On Renewables

Humber Gateway Met Mast & Inshore Cable Route Video Survey

Date: June 2010

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Report Title:

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1. Introduction

As part of the ongoing assessments for the Humber Gateway offshore wind farm periodic video surveys have been carried out in the vicinity of the met mast installed in August 2009 in order to provide some indication of scour. In addition, some further video work has been undertaken at the inshore end of the cable route in order to assess sonar contacts recorded during the geophysical surveys which were originally identified as potential areas of the *Sabellaria* reef (an annex 1 habitat under the EU Habitats Directive). This report provides a summary of the work undertaken to date with representative stills from the video surveys and some assessment of the status of the seabed areas covered by the surveys.

2. Methods

Surveys were undertaken using drop down video using a Seaviewer 650 system linked to a Sea-Trak GPS overlay system which was deployed from the survey vessel Lizzard. During the most recent surveys a laser measurement system was also employed which was calibrated to show a pair of laser points approximately 20cm apart. For the met mast assessment the vessel was stationed just off the met mast and the camera lowered to the seabed and allowed to drift past the base of the mast. For the inshore cable route survey the video was lowered to the seabed whilst the vessel drifted along a series of transects throughout the area (Figure 1). Video surveys at the met mast were carried out in early August (just after installation), late august, September, October and November in 2009 and most recently in May 2010. Surveys of the inshore cable route were undertaken August 2009 and May 2010.

Figure 1. Video transects at inshore end of cable route.

3. Results

3.1 Met mast Scour Assessment

A selection of stills from each survey is given in Figures 2 to 6. Visibility was limited in many cases and somewhat poor on some occasions (and particularly in October 2009) and due to the nature of the video deployment the positioning and coverage of the camera will be dictated by local tidal and weather conditions on the day. Consequently, whilst the camera/laser can give an indication of width of the scour (and to some extent depth at the very base of the mast) at various positions around the base there is limited control over exactly where these measurements are taken as the camera is drifted with the tide past the mast rather than dropped vertically. However, there are a number of recognisable features on the seabed (debris, cobbles) which are visually distinct and if recorded on several surveys can allow some direct comparison of scour over time. This approach has been used to compare the video from different surveys on those occasions where tides have permitted the recording of such features on several occasions.

As shown in Figures 2 to 6 the stills indicate that the area of potential scour appears to be relatively small (particularly in the early surveys carried out in August) with a band of bare boulder clay around the base of the mast in contrast to the wider seabed which comprises of a mixed sediment of shell, pebble, cobbles and gravel. The width of this area is variable and in some areas is less than a meter wide but is generally between 1 to 3 metres in diameter. The area immediately adjacent to the base of the mast has a reduced coverage of surficial cobbles and pebbles as opposed to a scour pit although this may in part be due to the initial piling operations rather than scour. Consequently, the differences in depth of this area are relatively small and not likely to be measurable by direct measurement from the platform. It is evident that a slightly deeper area approx 20-30cm wide is immediately adjacent to the base of the mast with some in-fill from cobbles and pebbles. This area is somewhat deeper than the adjacent clay/gravel seabed and in some areas up to 30-40cm in depth. The overall width of the 'scoured' area of bare boulder clay does not appear to have changed dramatically during the course of the survey at points where direct comparison is possible with the area of exposed boulder clay generally a few metres wide. However, there is some indication that compared with the earliest surveys this area has expanded somewhat and on the most recent survey some areas possibly up to 5m wide were recorded. In addition one piece of debris noted adjacent to the mast in previous surveys is now laying against the base of the mast and this and other footage indicates a slight gradient in the clay immediately adjacent to the area in-filled by pebbles against the base of the mast. This may indicate a slight increase in scour over the winter months. However, the limited visibility on the more recent surveys preclude a detailed assessment of these areas and the current survey methodology whilst adequate for provide a quick overview of scour is limited in terms of the extent or positioning possible.

As such it is recommended that now would be an appropriate time to carry out a more detailed survey to fully assess scour around the full extent of the mast. It is suggested that whilst the current methodology is adequate for ad-hoc surveys to give a quick assessment of scour (and can be combined with other surveys if required) it would be beneficial to carry

out periodic surveys using a more detailed survey methodology. We would suggest using an ROV (as used in the borehole investigations) possibly linked with a USBL underwater positioning system to give a more detailed assessment as this would allow much wider coverage as the ROV could be piloted in a structured fashion around the base to allow a more detailed assessment with repeat measurements at certain points. This could also be combined with a small scale bathymetric survey if required. For the latter a swathe bathymetry survey would obviously give the highest accuracy, although given the cost of such surveys it is uncertain whether, in this instance, such an approach is required. Alternatively, a more economic solution would be to carry out a survey around the base of the mast using a AGDS system utilising a multibeam echosounder. This has been used routinely by PMSL staff and would allow greater coverage than a single beam sounder and also provide information on sediment type when groundtruthed with video. This system can rapidly deployed and would give accurate depths to within 0.1m and could be completed relatively quickly so could be undertaken with the ROV survey.

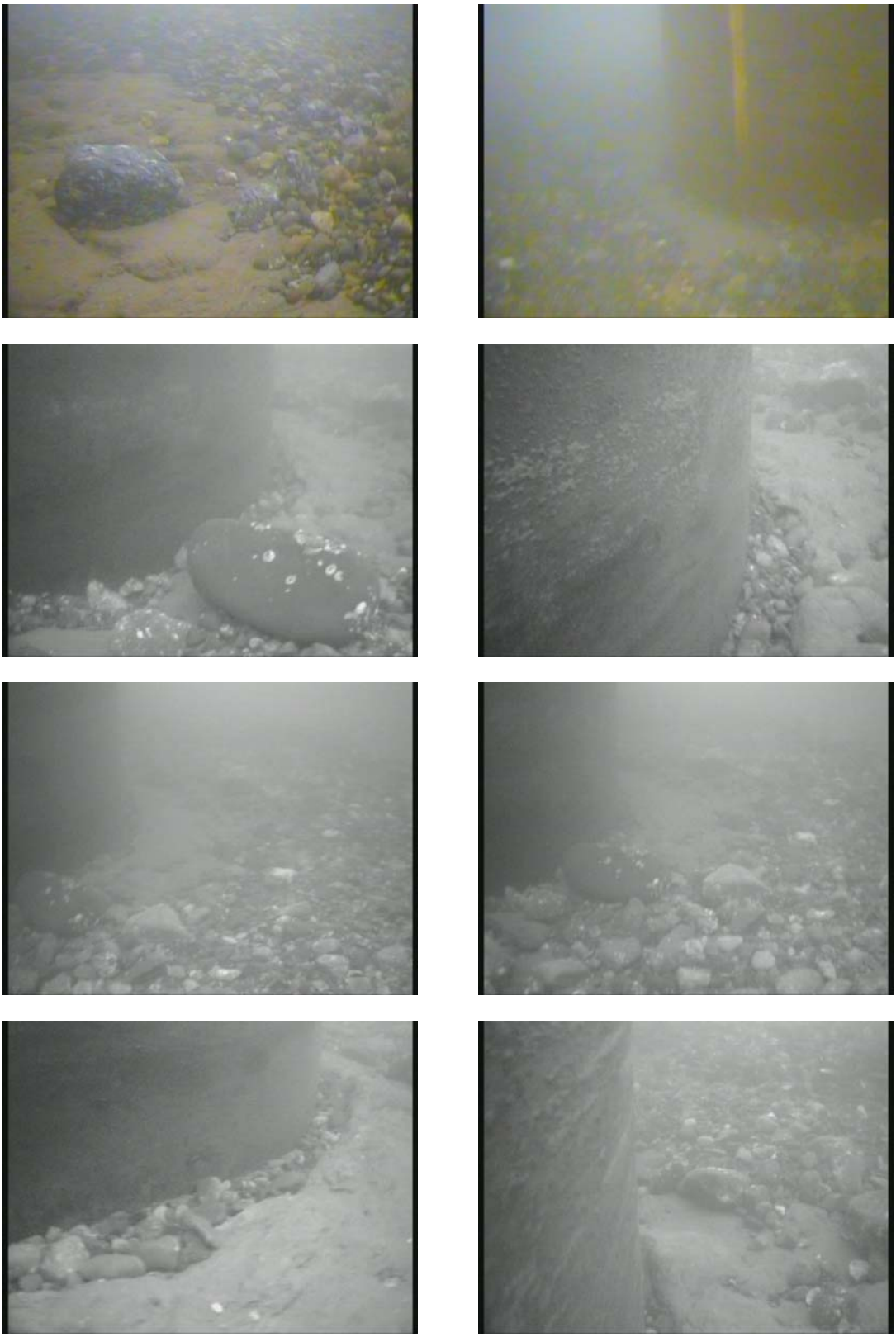

Figure 2. Example stills from early August met mast survey.

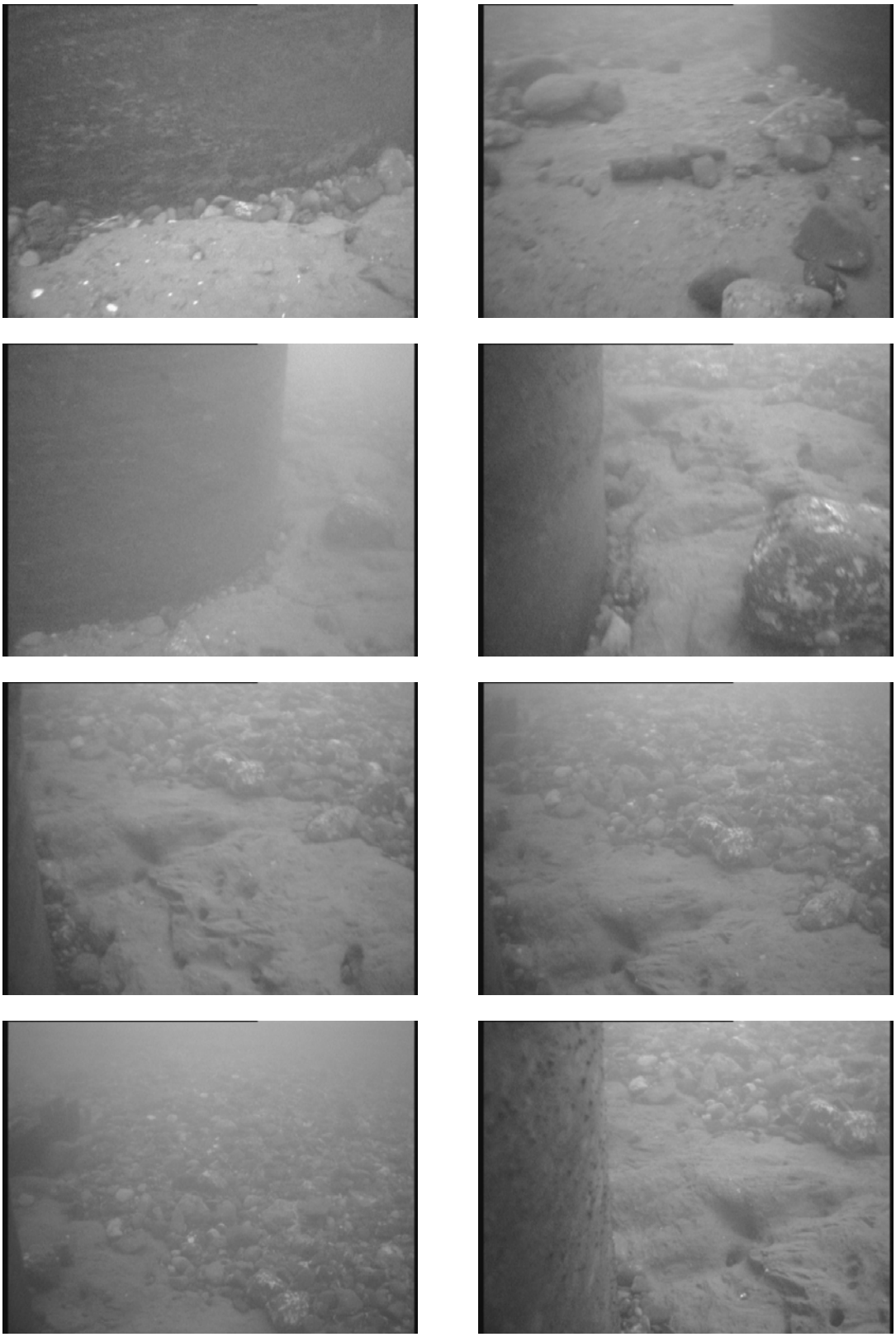

Figure 3. Example stills from late August 2009 met mast survey.

Figure 4. Example stills from September 2009 met mast survey.

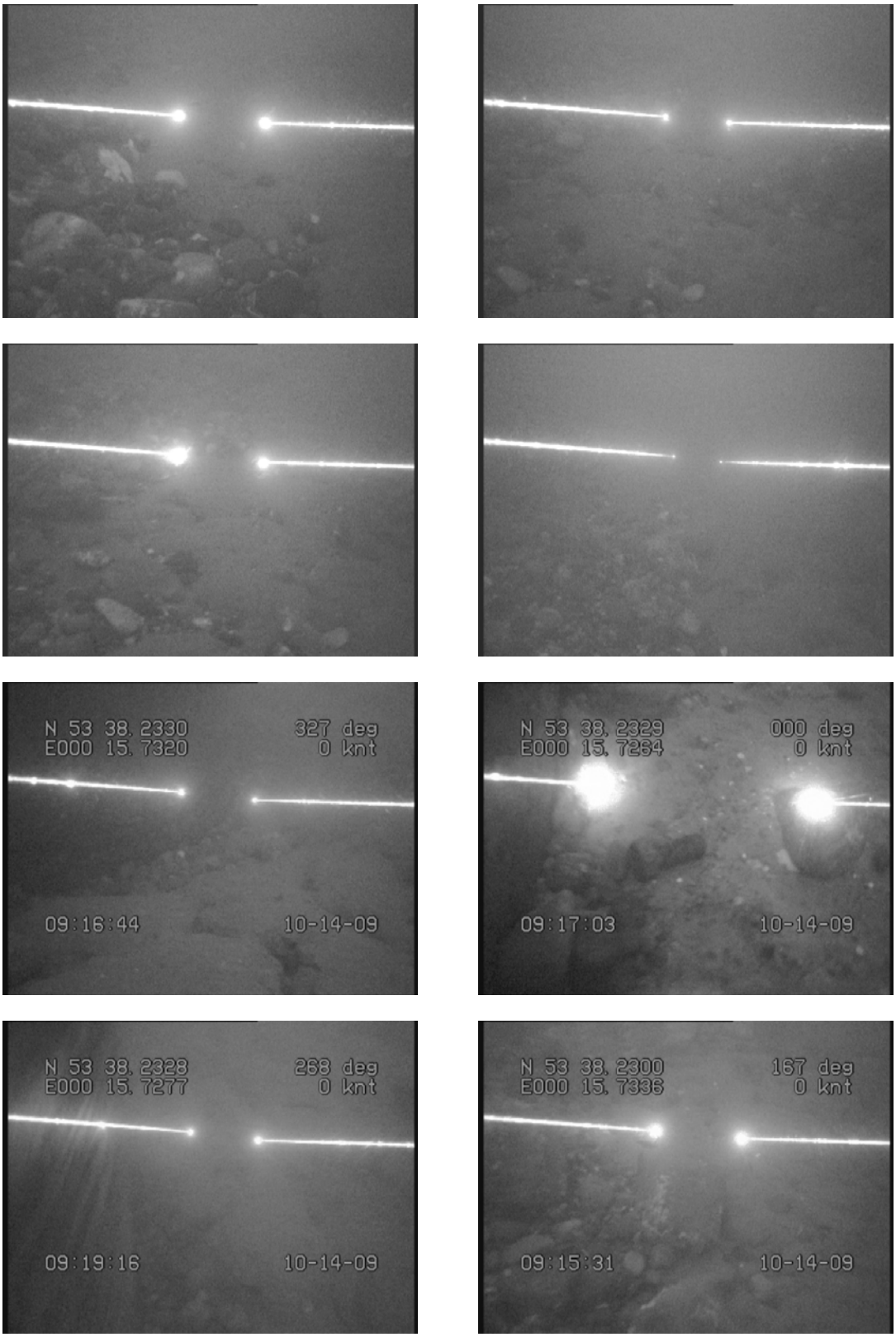

Figure 5. Example stills from October 2009 met mast survey.

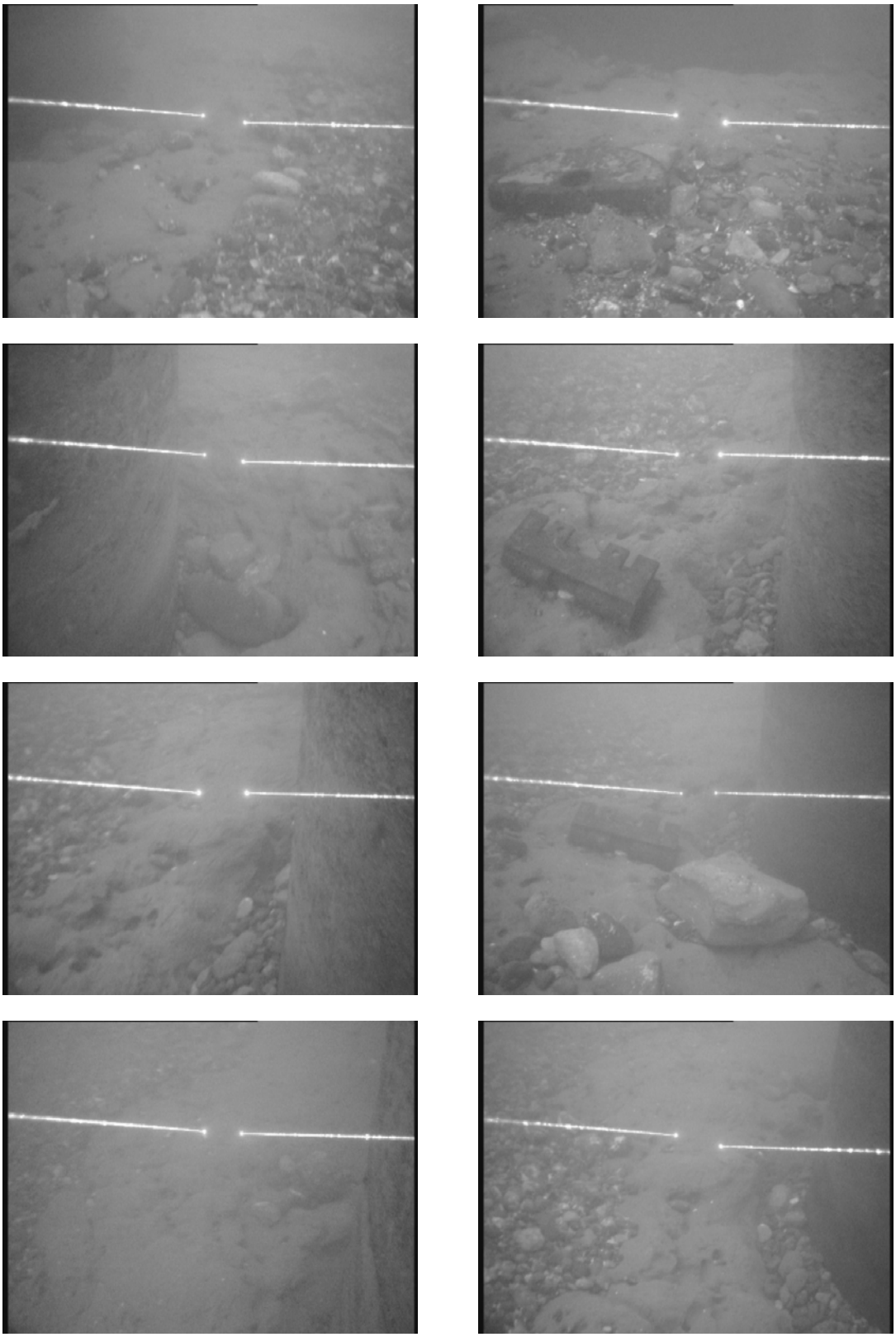

Figure 5. Example stills from November 2009 met mast survey.

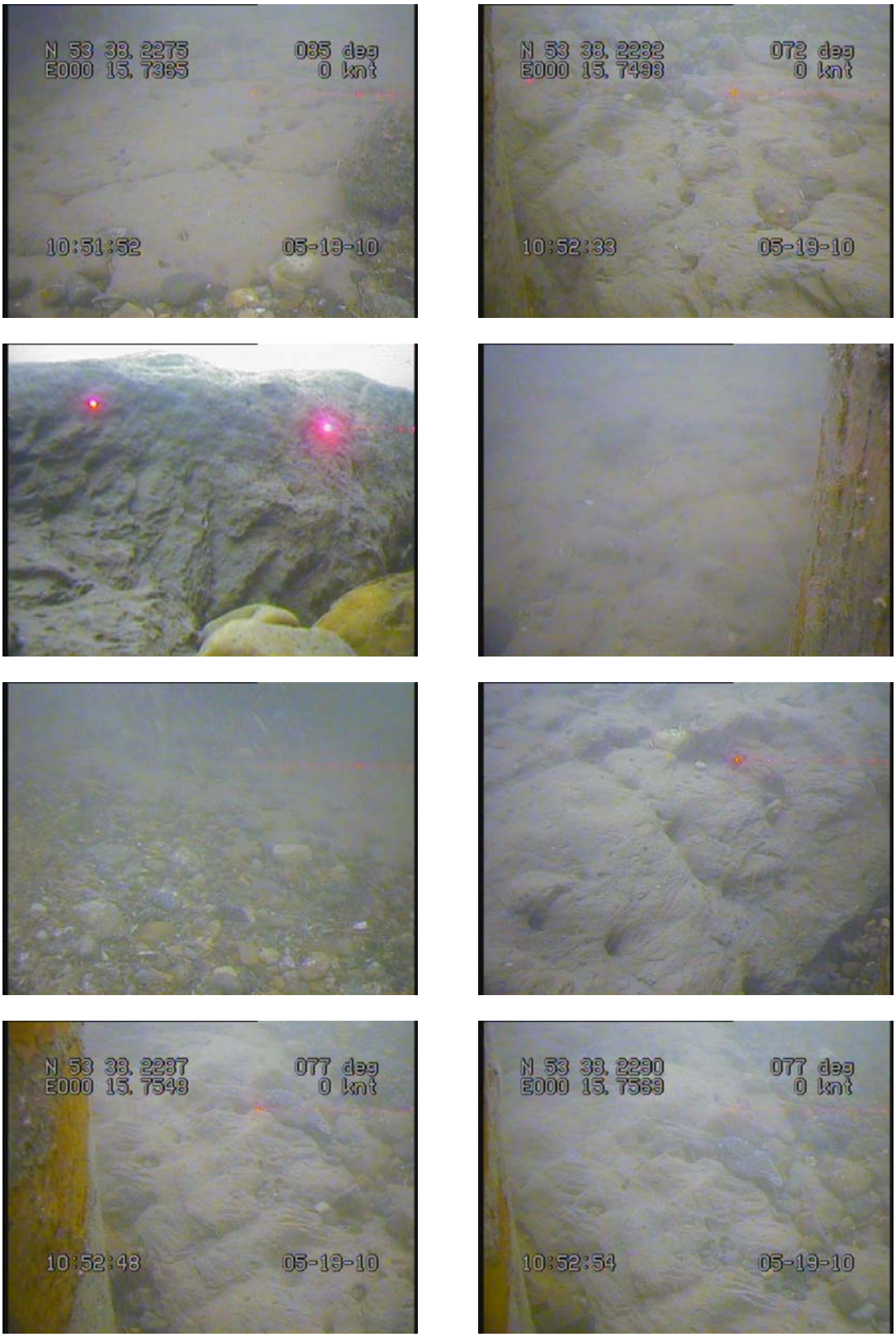

Figure 6. Example stills from May 2010 met mast survey.

3.2 Inshore Cable Route Assessment

Video survey at the extreme inshore end of the cable route is hampered by water clarity which in this region is generally extremely poor for much of the year. However, limited footage was obtained along a number of transects in 2009 with additional footage obtained in May 2010. In this area, good visibility is often restricted to a limited period around slack water and during periods when the inshore turbid zone has retreated closer inshore. A summary of the seabed habitats recorded in this area is given in Figures 7 to 10. Previous surveys in August 2009 indicated a diverse and variable seabed with large areas of boulder and cobble habitat which were often heavily encrusted with epibiota (reef fauna/flora) and also areas of exposed/elevated boulder clay. This was confirmed by the more recent survey which highlighted that the area comprises of a varied and heterogeneous seabed with sediments comprising of areas of rippled sand or shelly/gravelly sand (particularly inshore) which were interspersed with areas of coarser gravel, pebble and cobble with occasional boulders and also areas of exposed boulder clay. Some areas were characterised by more extensive areas of medium to large boulders and cobble whilst the inshore end of the survey area tended to be characterised by rippled sands and gravelly/shelly sand.

Within the survey area shown in Figures 7 to 10 the seabed habitats the seabed habitats are generally characteristic of much of the inshore area of the Holderness coast with a patchy and mixed substratum. Detailed analysis of encrusting epibiota and other epifauna is hampered by reduced visibility in this region but typical animals include a range of echinoderms and anemones on the sandier habitats overlaying cobble or clay whilst a variety of crustacean species were also recorded. Crustacean species included edible crab (*Cancer pagurus*), velvet crab (*Necora puber*) and lobster (*Homarus gammarus*) highlighting the importance of the inshore area for these species within the Holderness shellfishery. Other crustacea included shore crab (*Carcinus maenas*) and swimming crab (*Liocarcinus* spp.). Areas of cobble or boulder were characterised by a range of encrusting organisms including such as barnacles, tube worms (e.g. *Pomatoceros* spp.) hydroids and bryozoa (notably the bryozoan *Flustra foliacea*). In addition, encrusting and erect sponges were also present on some of the larger boulders although species cover on harder substrata tended to be highly variable, with many areas characterised by reduced or limited coverage reflecting the high tidal currents and suspended sediment load in this area.

The most notable feature of this area was the extensive areas of exposed boulder clay typically present as raised ridges or platforms. Areas of exposed, low lying boulder clay are characteristic of near-shore or an intertidal area of the Holderness coast and this material is relatively close to the surface in many areas. The underlying boulder clay is usually covered by superficial sediments (sand/gravel) but becomes exposed in areas where overlying sediments are scoured by tidal currents or disrupted by storm events/wave action. However, the habitats encountered in the current survey were quite unusual in form and size and were typically present as elevated narrow ridges protruding from the surrounding sediments. Such features were widespread across this area and were quite abundant in some areas with examples recorded at intervals of a few metres to 10-20m. Some of these features exceeded 1 metre in height and were quite extensive (several metres in length). A summary of the distribution of these features is given in Figure 11. These clay ridges were typically pitted with numerous small holes and as reported previously the origin of these

holes is uncertain but is likely to be due to the presence of burrowing bivalve molluscs such as piddocks (e.g. the white paddock Barnea candida or the American piddock Petricola pholadiformis). These species commonly inhabit such substrates and have been recorded in clay habitats from other benthic surveys along the Holderness coast. However, it is uncertain whether these relate to living or relict populations. A number of larger holes are also present in some of these structures and it is thought that adult or juvenile lobster may use these structures (termed 'mud huts' by local fishermen) as burrows for shelter. A variety of hydroids/bryozoans or encrusting sponges are also present on the upper surfaces of such features although generally they exhibit relatively low coverage by encrusting organisms.

These emergent boulder clay structures were noted at the inshore end of cable route during the baseline study and commented on in the Environmental Statement although they dop not appear to have been surveyed by video. The exposure of boulder clay is typical for the Holderness coast and is a remnant of the underlying Quaternary geology in this area (notably the glacial tills of the Bolders Bank Formation). The distribution of these structures on the basis of the current surveys appears to be limited to inshore areas with few examples recorded offshore from the survey box and they also appeared to reduce in density to the south. However, it is uncertain whether these more elevated boulder clay features are limited to the more southern end of the Holderness coast or also extend further north as relatively little underwater video has been undertaken in these areas. It is likely that these features and areas of larger boulders which were heavily colonised by hydroids and bryozoans (such as *Flustra foliacea*) would correlate to the sonar contacts recorded during the geophysical surveys. The conservation status of these features is uncertain and would need to be clarified with Natural England prior to construction in conjunction with other sensitive habitats such as *Sabellaria* reef or stony reef.

As reported previously the surveys also indicated the widespread occurrence of the reef building polychaete worm *Sabellaria*. This species is widespread off the east coast and typically forms a thin crust on harder substrata or agglomerations of tubes within mixed sediment. However, in some areas the species can form larger, more defined reef structures which are of conservation interest. In general, the coverage by this species was limited to patchy, low lying crusts on cobbles and boulder as opposed to true reef forms although the reduced visibility in this area makes definitive identification of this species problematic. The majority of the area surveyed appears to be typical in terms of *Sabellaria* coverage for inshore habitats along the Holderness coast and no significant areas of the higher quality reef which is of conservation importance (and recorded occasionally during the baseline surveys) were recorded. However, whilst this species was widespread, one transect (transect 18) highlighted a slightly higher coverage of the species (albeit during slack water when visibility was improved) and provided an example of more extensive and denser encrustation of *Sabellaria* in this region. On the basis of current guidelines it is possible that this area could qualify as a lower quality example of *Sabellaria* reef as recorded in other inshore areas off the Humber during the baseline surveys although further survey would be required to confirm this.

As reported during the baseline surveys the seabed in this region is also characterised by extensive areas of harder substrata (cobble and boulder) which have the potential to qualify

as stony reef under the Habitats Directive. Although the guidelines for stony reef are still being clarified, examples of these habitats recorded during the baseline studies have been assessed by PMSL and Natural England in order to identify any possible areas of reef. During the current surveys much of the inshore area has relatively high cobble content so would likely qualify as cobble habitat, however, the limited elevation and coverage by epibiota (reef flora and fauna) means that many of these habitats are not likely to quality as reef.

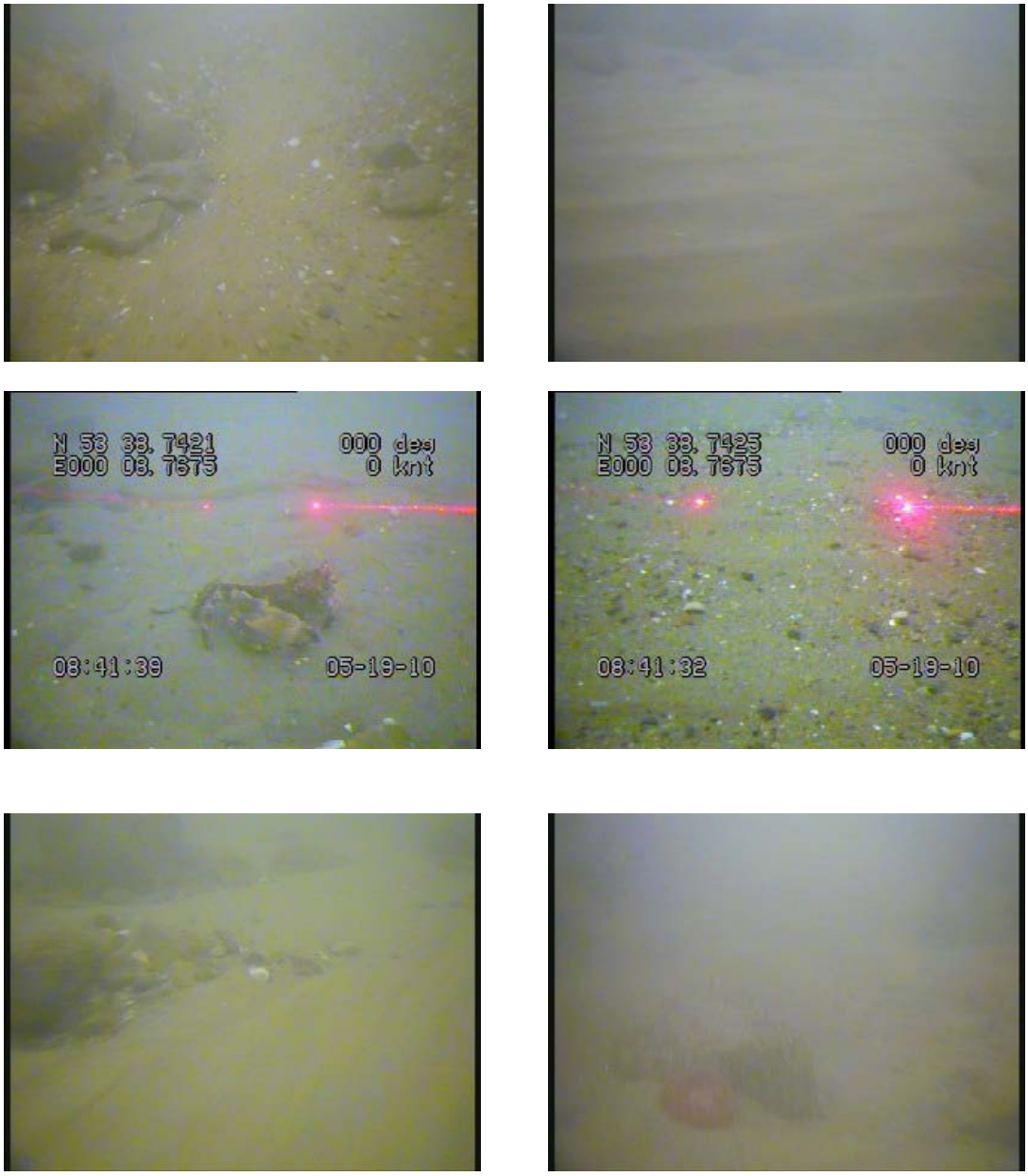

Figure 7. Examples of sandy/gravelly habitats.

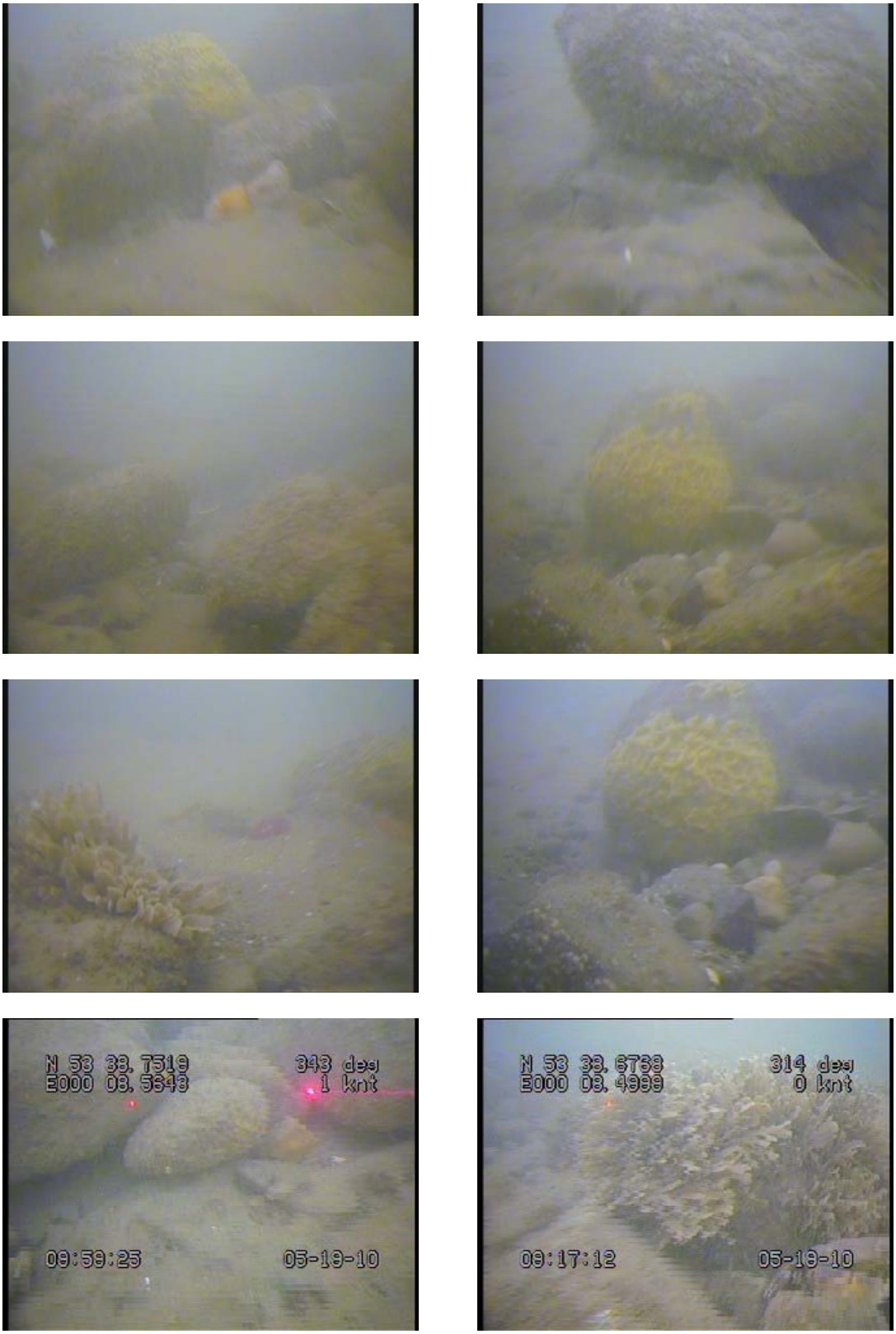

Figure 8. Examples of mixed sediment, pebble, cobble and boulder habitat.

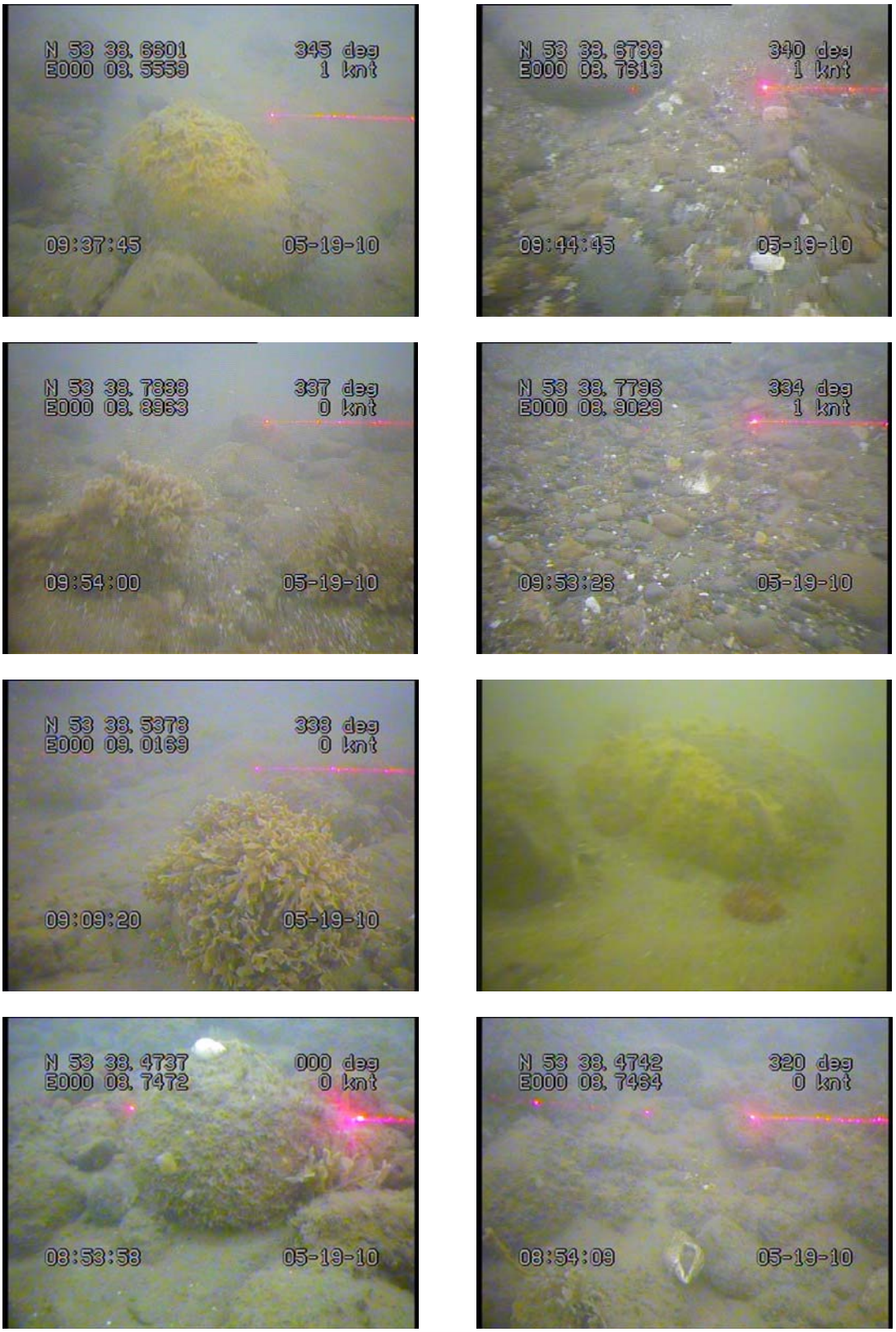

Figure 8 (cont.). Examples of mixed sediment, pebble, cobble and boulder habitat.

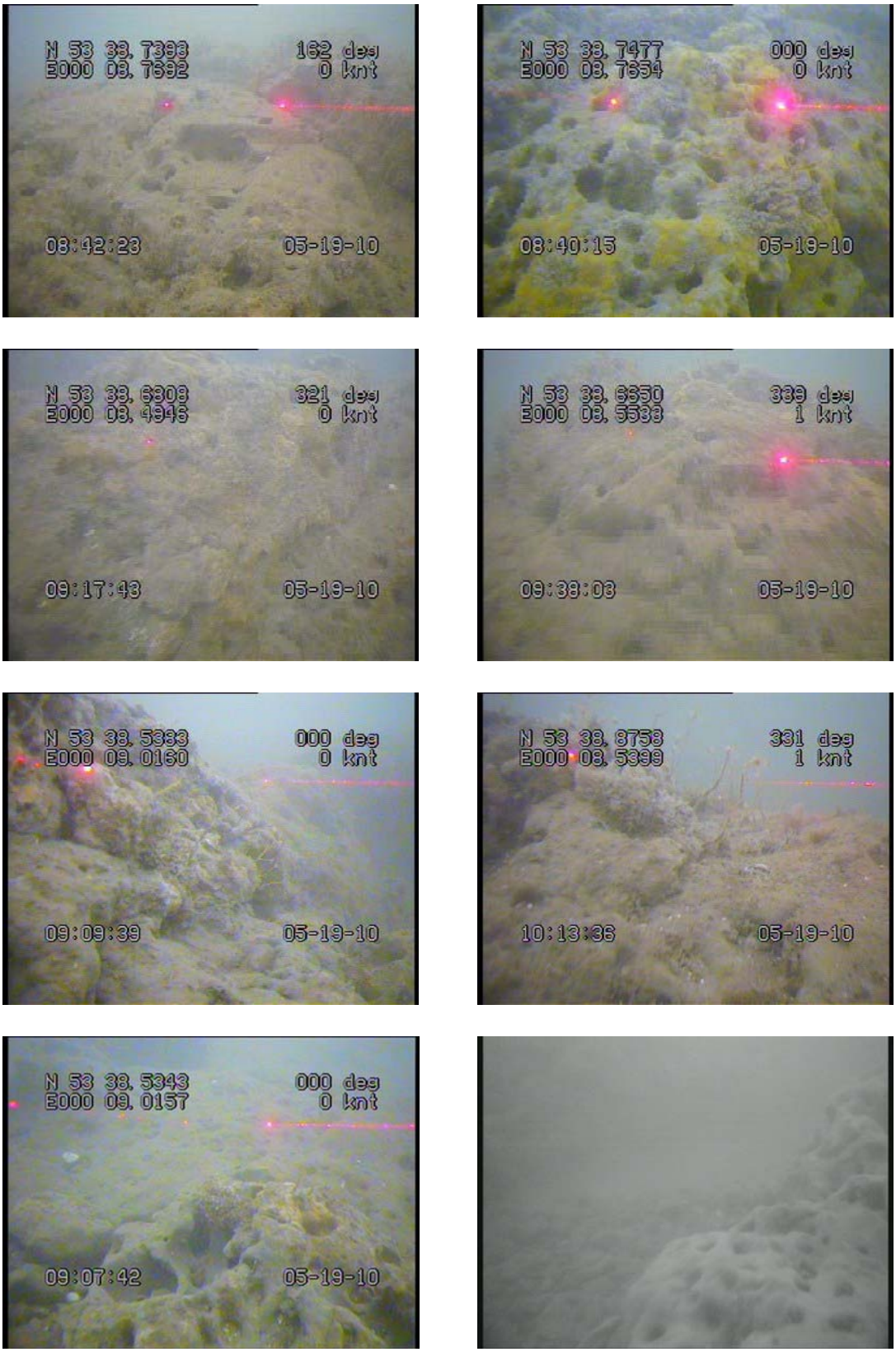

Figure 9. Examples of boulder clay habitat.

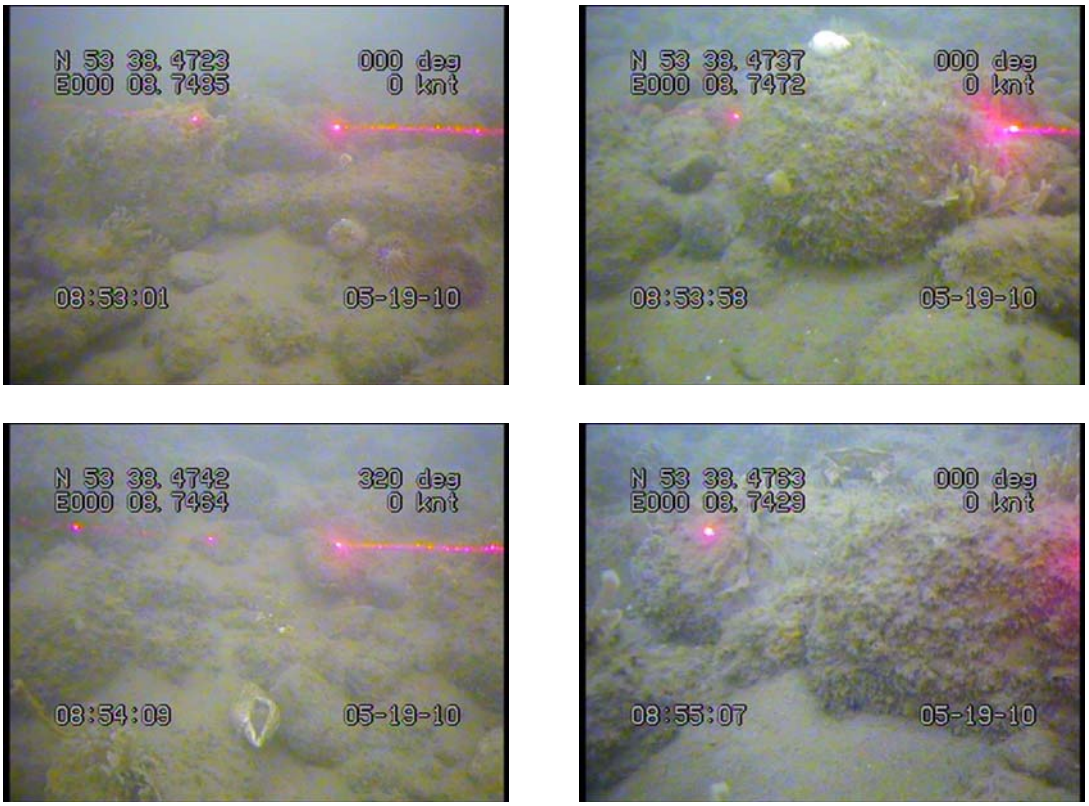

Figure 10. Examples of encrusting *Sabellaria* on cobble/boulder.

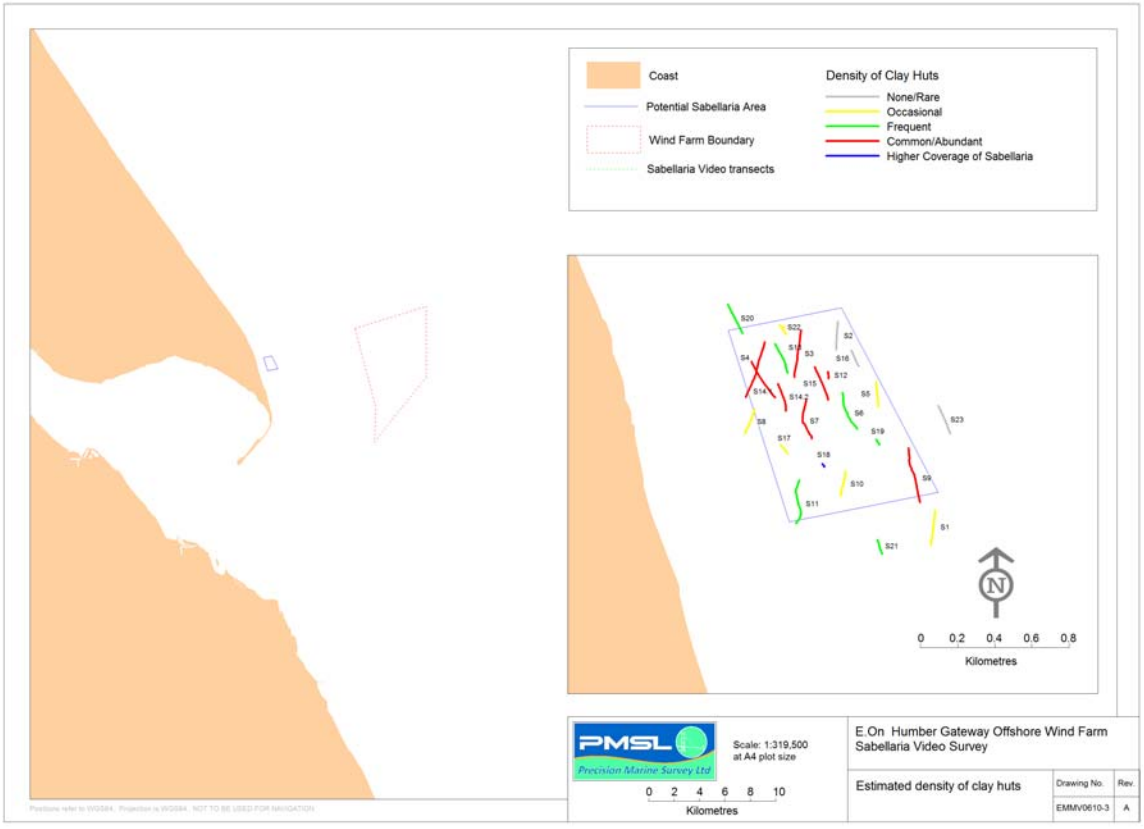

Figure 11. Estimated density of clay huts.

4. Appendices

Example video footage from the May 2010 met mast survey

Example video footage from the inshore cable route survey

Example video footage from the inshore cable route survey showing *Sabellaria*