Seabed Habitat Assessment for Potential Razor Clam Fishery off Exmouth



Devon and Severn Inshore Fisheries and Conservation Authority
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Version 1.0

Version control history			
Officer	**Date**	**Comment**	**Version**
Lauren Parkhouse & James Stewart	13/10/2026	Initial Draft	0.1
Sarah Clark	20/10/2026	First review & edit	0.2
JS & LP	22/10/2026	Addition of charts and additional results (SSS)	0.3
Mat Mander & SCI	23/10/2026	Review and edits	0.4
JS	27/10/2026	Finalised for publication	1.0

Introduction

Local interest has emerged in development of a fishery for razor clams (*Ensis spp.*) off Exmouth, within the District of Devon and Severn Inshore Fisheries and Conservation Authority (D&S IFCA). The development process has included fine-tuning of potential fishery target areas, through discussions between a local fisher, D&S IFCA Officers and Authority Members. This iterative process highlighted three core areas for further study in order to characterise the habitat type(s) present. Habitat characterisation is required as the sediment type, in this case sandier sediment, is an important component of the suitability of an area for the proposed fishery, bearing in mind razor clam habitat preferences, fishery feasibility and environmental considerations such as sensitivity to the proposed fishing gear and recoverability following fishing.

In order to characterise the habitats in the three core areas, Officers initially set out to undertake an underwater video survey. As the underwater video survey technique is restricted in its applicability over a wide area, Officers also sought to supplement this information with a side scan sonar (SSS) survey across a broader area.

The three core survey areas (shown in Figure 1) were subject to further refinement during the course of the surveys as new information was gained, based on surveyed habitat distribution, discussions with the fisher, and more detailed exploration of existing spatial data sources, including Inshore Vessel Monitoring Systems (IVMS).

Overall, the aim was to identify areas that may be suitable for a fishery in line with the premise that the fishery would take place in areas which are (i) composed of mobile sandy sediment, (ii) already subject to existing demersal towed gear activity and (iii) inhabited by razor clams.

Methods

Underwater Video Survey

An area of sea along the coast between Dawlish and Ladram Bay had previously been proposed for Food Standards Agency classification. Within this area, three core survey areas were initially identified (dotted black lines, Figure 1) to be surveyed by Remotely Operated Vehicle (ROV), operated from an 11.95m work boat/fishing vessel.

The ROV surveys were carried out using a Blue Robotics BLUEROV2 in ‘Heavy’ configuration (with additional thrusters for improved stability and control). The ROV was equipped with an integral 1080p primary camera with 110° horizontal field of view, and two side-mounted GoPro (Hero3/Hero5) cameras for secondary image recording. The ROV was ballasted for approximately neutral or slightly negative buoyancy, rigged with a tow line to be used as a drift camera, and was equipped with three remotely-controlled variable-illumination LED lights.

Within each of the three survey areas, survey stations were pseudo-randomly selected from a grid of randomly-generated points. On survey days (24th July 2026, 29th – 30th July 2026, 19th August 2026), the vessel navigated to each survey station in turn and the ROV used while drifting with the current to record video transects, depicted by the blue lines in Figure 1.

At each station, all three cameras were activated in view of a clapperboard containing dive information (station number, deployment number, time and date) before the ROV was deployed from the starboard side of the vessel. The primary camera provided a live feed to an onboard laptop via the tether cable. The latitude and longitude of deployment location were recorded using a handheld GPS unit (Garmin etrex 32x). Manual remote control was then used to navigate to 10 – 30 cm from the seabed before placing the ROV in ‘depth hold mode’, to maintain a near-constant depth while allowing for remote control for obstacle avoidance.

The live feed was then monitored and ROV controlled as required to achieve an approximately straight-line video survey as the vessel and ROV drifted with the current, which provided a suitable speed of movement over ground to allow video analysis. The handheld GPS was monitored for distance travelled, aiming to cover at least 100m of survey per station. At the end of each dive, the latitude and longitude were recorded before the ROV was brought back under manual control and ascended to the surface for recovery and post-dive checks.

Initial video analysis indicated the presence of rocky habitats in an inshore section of the Ladram Bay survey area, so it was suggested to focus additional survey effort on areas further offshore (Figure 1); however, the area offshore in Ladram Bay was later deemed to be unsuitably deep for razor clam fishing by the fisherman, and the remaining seabed type in the Ladram Bay survey area was then deemed by the fisherman to be unsuitable for razor clams. D&S IFCA Members had been informed that the proposed razor clam fishery would take place in areas where there is existing demersal towed gear activity. Further review of existing fishing activity data (IVMS) revealed that the central Sandy Bay area is not fished by demersal towed gear. Therefore, the Sandy Bay area has not been included for consideration of the razor clam fishery at this time. Based on initial video analysis, fisher feedback and updated information on the energy at the seabed (which affects recoverability), the initial habitat survey area off Dawlish was refined to a smaller area shown in Figure 1 (the 'focus habitat survey area'). Therefore, following extensive survey coverage in the three areas (Figure 1), this assessment focuses only on the Dawlish focus habitat survey area as a potential fishery area.

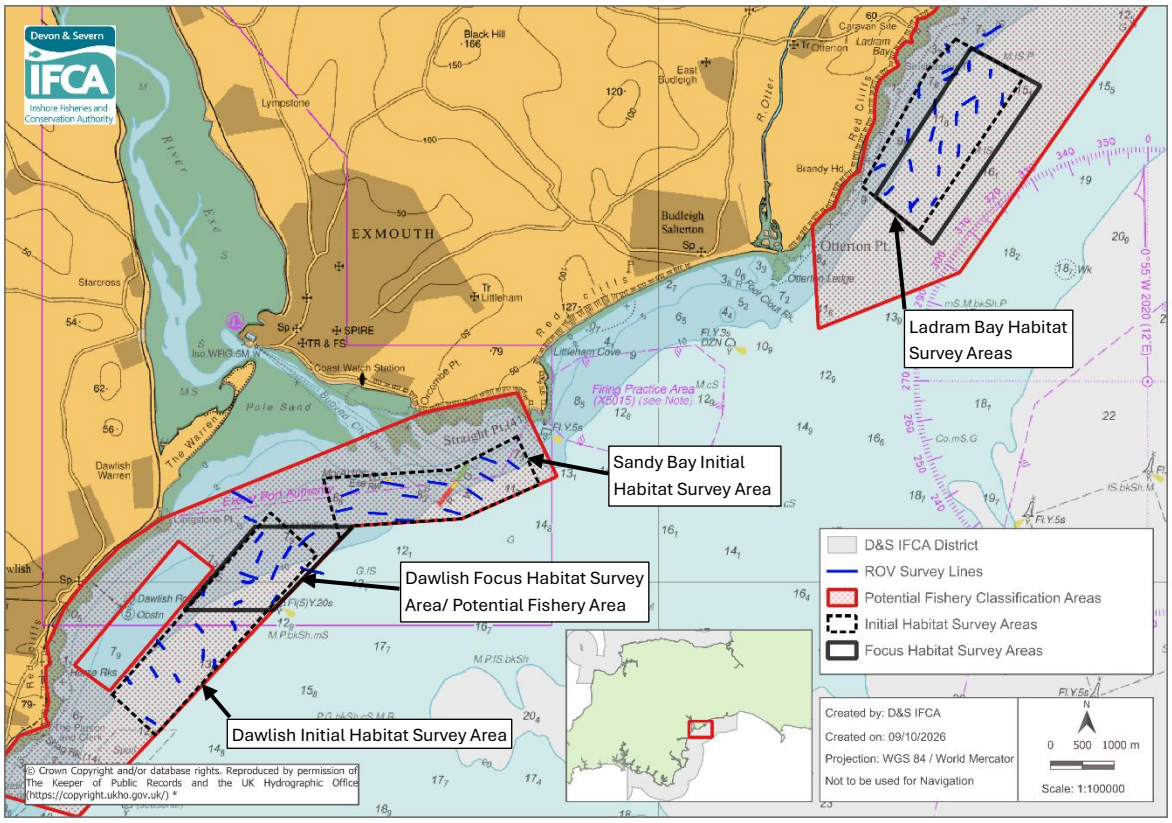


Figure 1. Video survey transects (blue lines) in relation to the three initial core survey areas (dotted black polygons) within the potential classification area for razor clams off Exmouth and Ladram Bay (red polygons). Also shown are adapted habitat survey areas (solid black polygons) created following initial review of video footage in order to focus the remaining survey points on areas of more suitable habitat.

Video Tow Analysis

All seabed imagery analysis was undertaken using VLC media player (https://www.videolan.org/vlc/index.en_GB.html) and following the Joint Nature Conservation Committee (JNCC) epibiota remote monitoring interpretation guidelines (Turner *et al*, 2016). The EUNIS classification system to Level 3 was used for identifying the broadscale habitats.

A proforma was provided to each Officer undertaking the analysis. This proforma included the following information to be recorded:

- Site
- Video no.
- Time ROV reached seabed
- Start and end time of tow/segment
- Duration of tow/segment
- Brief habitat description (physical and biotic)
- Broadscale habitat
- EUNIS code to level 3
- Species

As per the guidelines, each video was watched at least twice. The first viewing was used to assess the quality of each video tow and to split the video into habitat change segments. This first viewing was done at double speed.

Video was classified into one of four quality categories (Excellent, Good, Poor, Very Poor and Zero) following JNCC guidelines (Turner *et al*, 2016). Category details are set out in Appendix 1. Where the objective is to classify the broadscale habitat to EUNIS level 3, video of quality 'Poor' or better may be used, and a judgement could be made if any videos were "very poor" if at least some of the video could be used for EUNIS level 2/3.

In this first viewing if different habitats were observed, the tow was split into segments each representing a "sample" (Figure 2). These segments were for changes larger than approximately 5m. If there were small patches of change less than 5m then they were noted in the description on the proforma along with the video time but not split into a new segment.

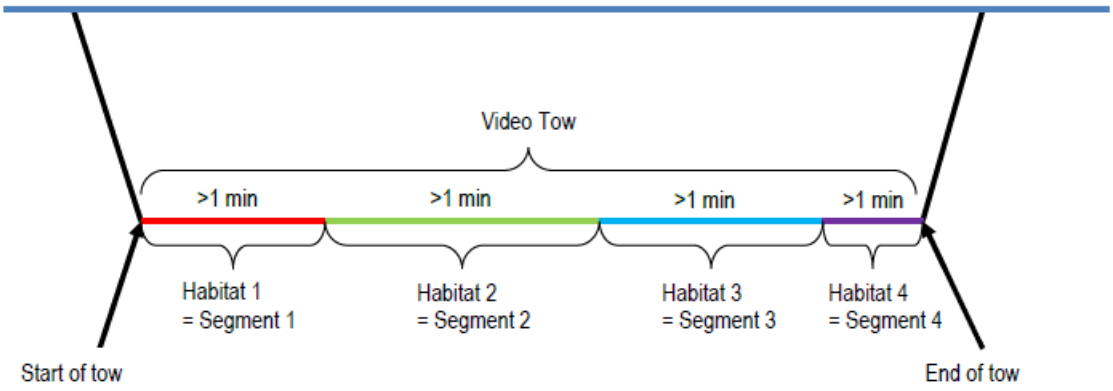


Figure 2. Simplified illustration of method for segmenting seabed video tows based on changes in habitat. Adapted from Marine Recorder Briefing Note, JNCC (Ocean Ecology Limited, 2017)

Once the video was assessed for quality, and split into segments if needed, it was then watched again to undertake the habitat assessment. At this point the video was watched at normal speed or reduced speed. The video could be paused and rewound if needed at any point during the viewing.

The broadscale habitat for the full tow or tow segment was noted in the proforma. Along with the broadscale habitat, any species were noted and any small changes to the substrate, including any rocks/boulder/pebbles observed amongst the sediment habitats.

A total of 31 video tows were analysed to EUNIS classification level and a further 13 underwent a quick review to describe the habitat in general terms. Locations of all video tows are shown in Figure 1.

Side Scan Sonar

The surveys were carried out onboard a 11.95m work boat/fishing vessel. The side scan sonar (SSS) survey was carried out on 15th September 2026.

The Side Scan Sonar survey was undertaken using a Tritech SeaKing Towfish. Data were collected at a frequency of 600 kHz. The SSS was deployed from the starboard side of the vessel and then tied off to allow for it to be hauled and deployed by hand, once in place. The SSS was towed at a speed of 3-4 knots into the current. The range was set to 50m for all tows, covering a 100m wide swathe. A Digital Yacht GPS160 Trinav GPS was attached to the antenna mast structure of the vessel. No layback was applied during data processing as the offset between GPS and device was 0 for fore/aft, and the device located only 1.5m to starboard of the GPS.

Survey areas were identified prior to the survey in order to cover priority areas off Exmouth and the Dawlish potential fishery area. Within these areas, the individual survey lines were not pre-planned and were decided throughout the survey based on coverage gained, technical limitations and time constraints.

The SSS signature was watched in real time as well as being recorded for processing using Edgetech Discover. An intermittent fault with the SSS device meant that data collection was patchy in some areas; this also meant that the SSS signature was intermittently absent from the plotting screen at the time of the survey, so it was difficult for the skipper to maintain straight parallel lines in some cases. Also, due to time constraints, not all the Dawlish area was surveyed using the side scan sonar.

Data processing was carried out by Cornwall IFCA using Hypack Targeting and Mosaicing. The outputs were GeoTIF files for each survey line, which has geographic positioning information allowing for use in GIS software. The GeoTIF files were then added as layers to a QGIS project (QGIS v.3.44.15), and analysis was undertaken by Officers from D&S IFCA and Cornwall IFCA to identify signatures of different sediment types. The Cornwall IFCA Officer has a wealth of expertise in undertaking, processing and analysing side scan sonar survey data and D&S IFCA Officers gained invaluable experience working with Cornwall IFCA.

SSS tows were carried out in the Sandy Bay initial habitat survey area as well as the Dawlish potential fishery area. The assessment presented here focuses on data from the Dawlish potential fishery area. Despite the intermittent technical issues with the SSS, the areas that were successfully scanned produced good-quality SSS data, enabling D&S IFCA Officers with support from Cornwall IFCA to identity the different substrates reflected in the SSS signatures. This was supported using the video data collected during the ROV survey for ground-truthing.

Results

As stated in the methods, a total of 31 video tows were fully analysed. However, due to the evidence acquired from these surveys and from other sources, certain potential areas initially considered for the fishery were ruled out and only the video tows and SSS data from the Dawlish area are presented in this report.

ROV Video

Within the potential Dawlish fishing area, a total of ten video tows were analysed to EUNIS Level 3, and two tows just outside the area were also analysed to this level (Figure 3). Five of the tows were split into separate segments with different habitats. The visual quality of the tows was rated as poor to good, suitable for classification to EUNIS Level 3.

Based on the ROV video tows, the surveyed area appears to comprise areas of muddy sand as well as areas of mixed sediment, with an area of rock northwest of centre.

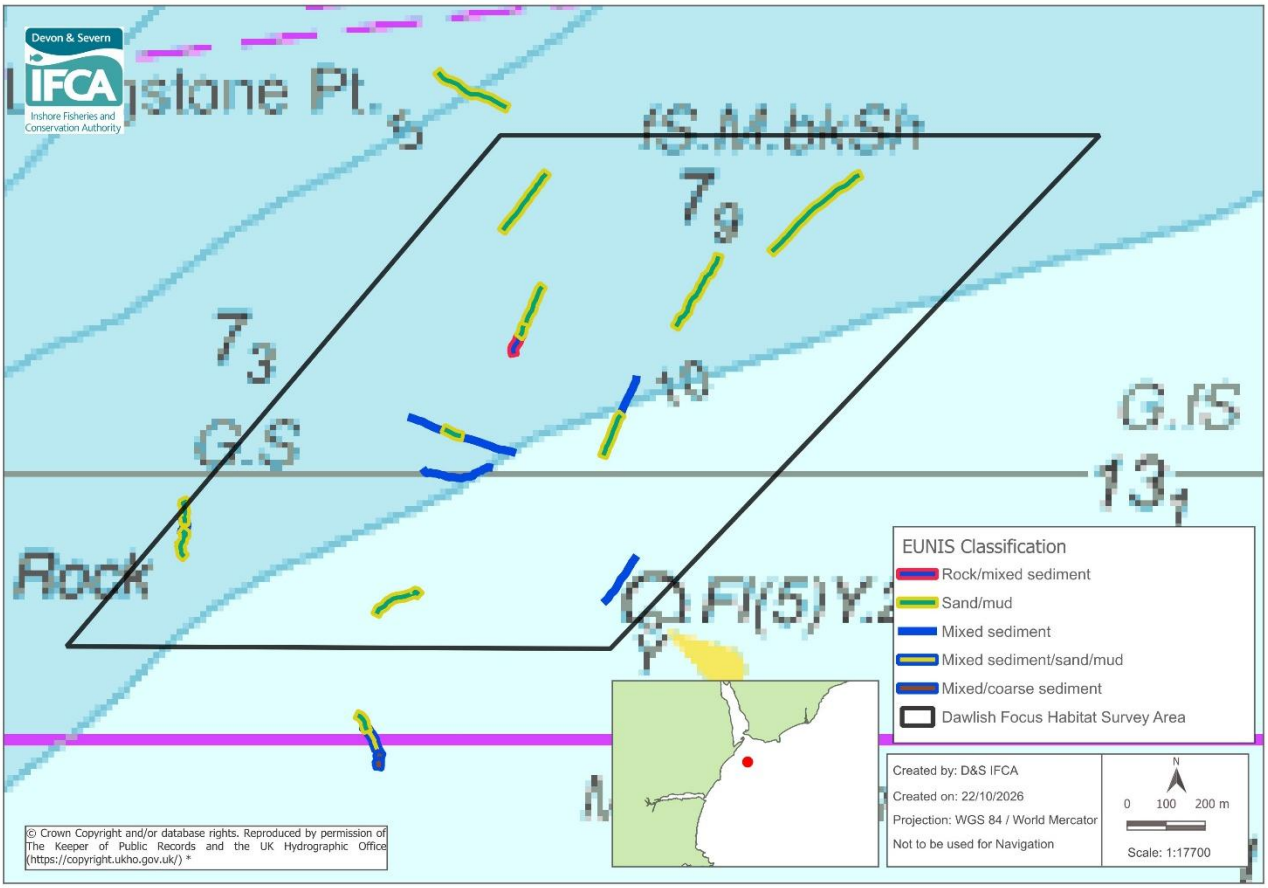


Figure 3. Habitat classification of twelve areas surveyed by ROV video in and around the Dawlish focus habitat survey area. Due to the area having a combination of different habitat types, multiple classifications were assigned (as indicated by more than one colour per area). The EUNIS codes for the habitats shown are: A3.2 Moderate energy infralittoral rock; A5.1 Sublittoral coarse sediment; A5.2 Sublittoral sand; A5.3 Sublittoral mud; A5.4 Sublittoral mixed sediment. The northern third of the area appears to be predominated by muddy sand containing burrows. Areas of muddy sand, mixed sediment, rock and coarse sediment are present in central areas and areas further south.

In Figure 3, the muddy sand is depicted as 'sand/mud'; the distinct habitat types 'A5.2 Subtidal Sand' and 'A5.3 Subtidal Mud' are defined largely by the proportion of different-sized sediment grains that are present. These habitat types are difficult to discern from one another without Particle Size Analysis, and the habitat classification guidelines (Turner *et al.,* 2016) state "*It is recommended that video is not used to distinguish between muddy sands and sandy muds as they can appear very similar*". For the purposes of this project, establishing if the sediment type was fine (sand/mud) or coarse (coarse/mixed) was adequate. Therefore, these areas of sand/mud will be referred to simply as muddy sand, which also correlates with a broader-scale sediment map produced by the British Geological Society (BGS, 2026), while recognising that the proportion of sand and mud may vary.

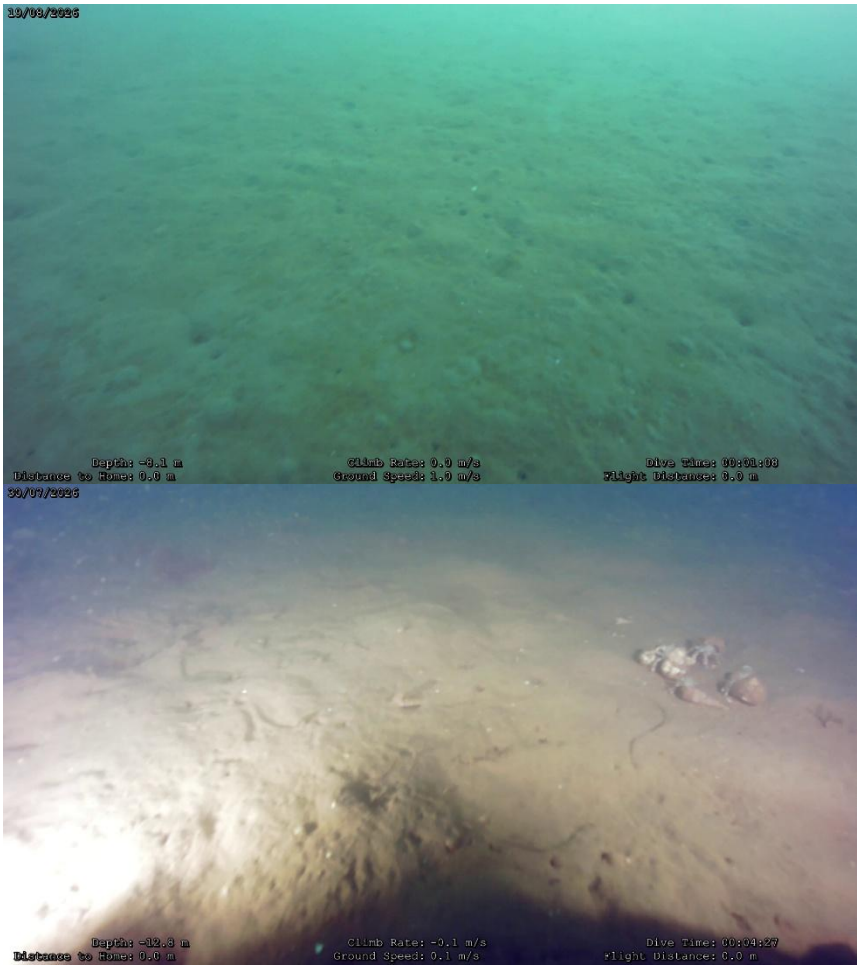
The muddy sand is present in ten out of the 12 video tows in the Dawlish area, comprising approximately 62% of the total tow distance. It is important to note that the JNCC guidelines for habitat classification state that brief changes in habitat (lasting less than a 5 m x 5 m area) should be considered as incidental patches and so may not be logged as separate sections. Some areas of muddy sand within the tows therefore contain small incidental patches of mixed sediment, including larger particles (e.g. pebbles, cobbles).

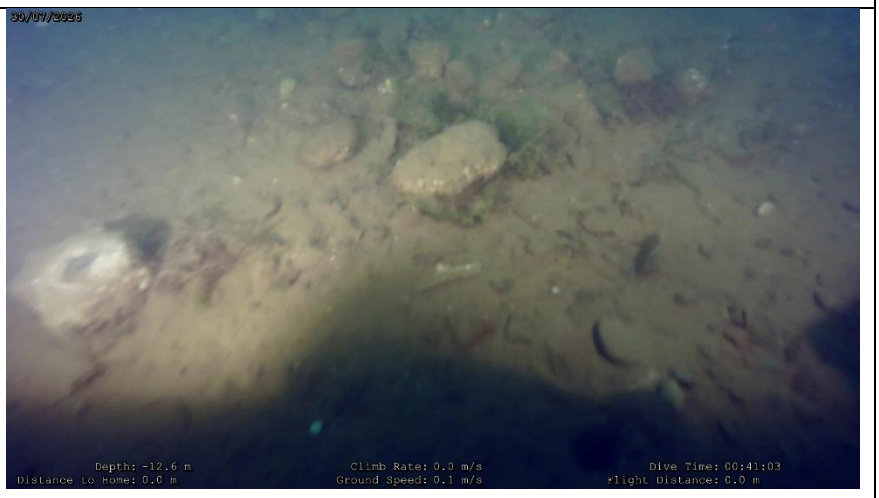
Mixed sediment (EUNIS A5.4) was present in seven out of 12 tows, comprising approximately 38% of the total tow distance. This includes mixed sediment as a mosaic with rock (one tow, approximately 2% of tow distance) and coarse sediment (two tows, approximately 3% of tow distance).

Examples of each of the broadscale habitats identified across the Dawlish area are provided below in Table 1.

Although the video quality and resolution were sufficient to identify broad habitat types as above, it was not sufficient to accurately or reliably quantify species presence or abundance. However, it was possible to note incidental video captures of larger species or individuals. Burrows in the sediment were present in all tows; these had different forms/shapes indicative of different species, with evidence of unidentified burrowing bivalves and burrowing crustacea visible in some tows. King scallops were present in half of the 12 tows, hermit crabs in all tows, spider crabs in nine tows, auger shells present in eight tows and brown crab present in two tows. Small and/or fast-moving species were more difficult to see and identify. Some individual tows were seen to contain skate, flatfish, bass, fan worms and starfish

Table 1. Example images from ROV video survey of main seabed types found in the Dawlish focus habitat survey area.

EUNIS Code	Broadscale Habitat Description	Example Images
A5.2/ A5.3	Subtidal Sand/ Subtidal Mud	
A5.4	Mixed Sediment	

		
A3.2	Infralittoral Rock	
A3.2/ A5.4	Infralittoral Rock/Mixed Sediment Mosaic	

Side Scan Sonar Outputs

Figure 4 shows examples of SSS data from this survey and how they have been assigned a habitat from the signature produced.

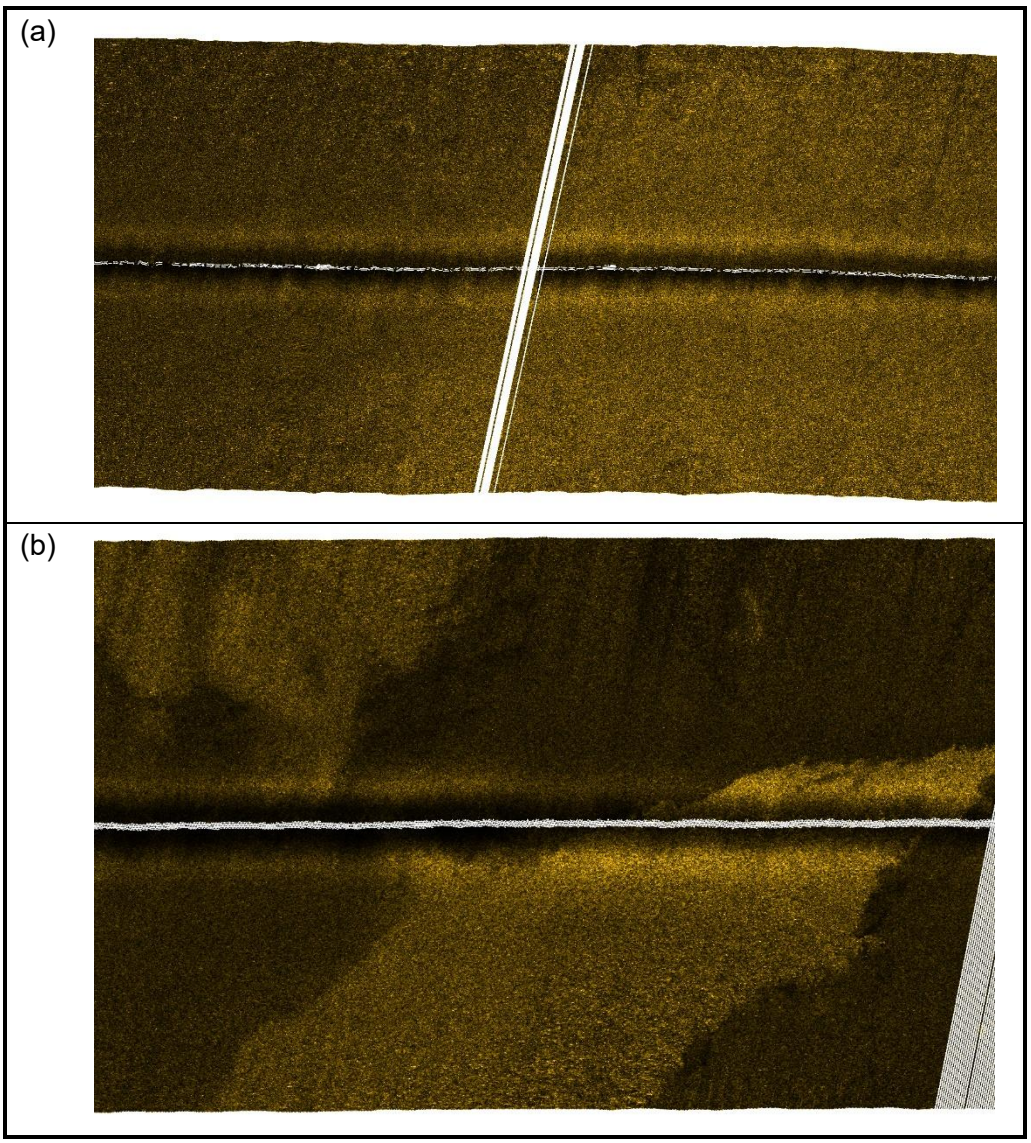


Figure 4. Examples of cropped SSS output. In panel (a) the left-to-right transition of darker to lighter colour shows a left-to-right gradual transition from muddy sand to a slightly coarser substrate type (interrupted by white lines showing intermittent device outage). Panel (b) shows an area of light colouration (mixed sediment) against a darker background indicating muddy sand. The sharp transition between the two sediment types provides confidence in assigning the habitat type of the light area to be harder mixed sediment. The horizontal blank stripe in each panel is a blank area directly underneath the SSS device, where no data are expected to be received.

Figure 5a (overleaf) shows the coverage of the SSS data gathered from the more extensive SSS survey undertaken and Figure 5b shows the Dawlish focus habitat area (zoomed in). These demonstrate that some coverage was patchy due to an intermittent technical fault with the device.

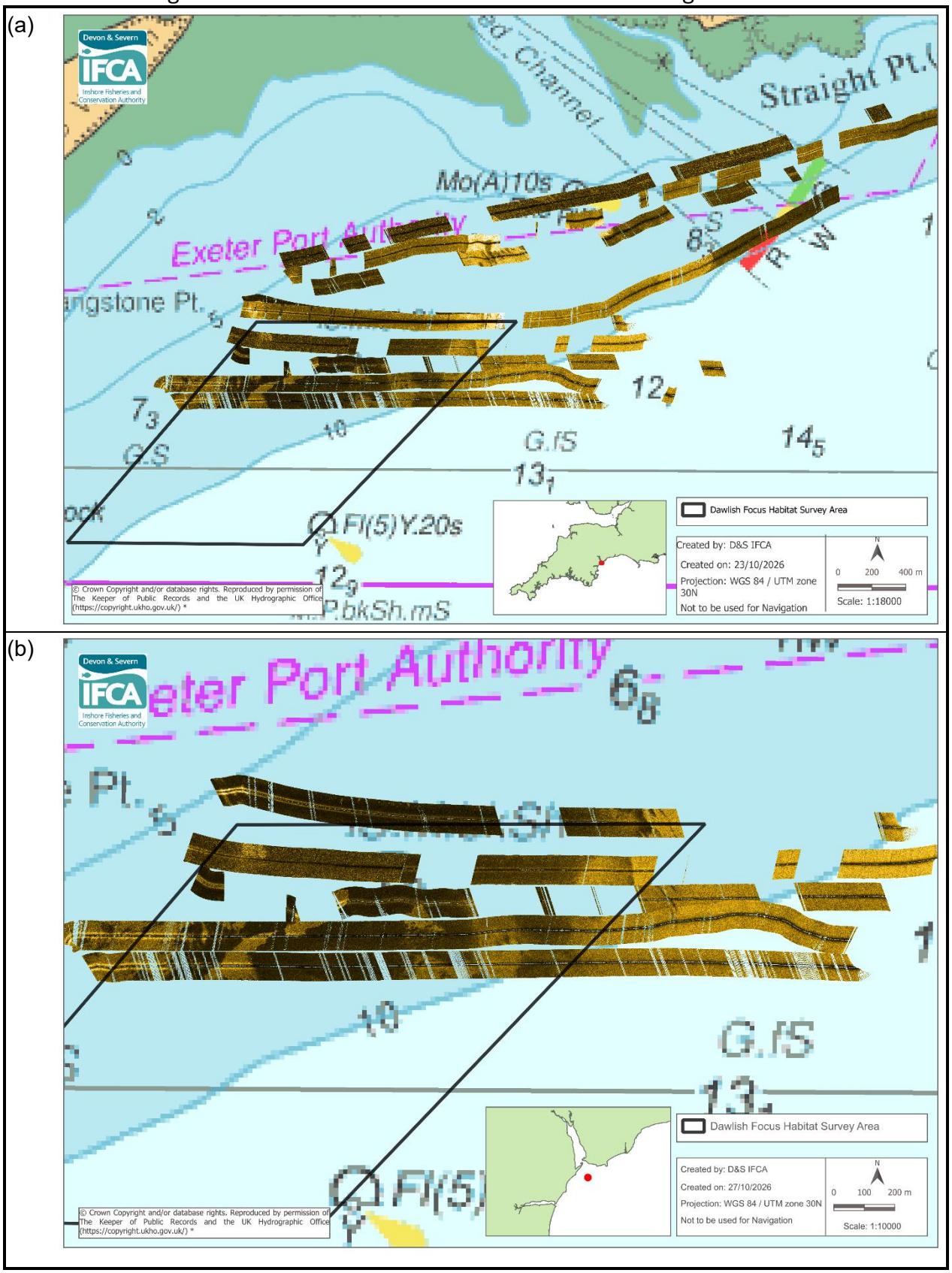


Figure 5. Side Scan Sonar data (black to gold) gathered from (a) the more extensive survey area, and (b) the northern portion of the Dawlish Focus Habitat Survey Area. SSS data can be understood as an acoustic photograph of the seafloor, where sound waves replace light. Harder features reflect back a lot of sound, and so appear brighter, while softer features absorb more sound and appear dark. The dark line in the middle of each track is the water column directly beneath the SSS device and does not provide information on the seabed. The darker areas in (b) should be interpreted as muddy sand, with brighter areas containing coarser mixed sediments. The signature of the tows in the area outside the survey area to the east can be assigned to a sand habitat.

There were five ROV video tows which overlapped with the SSS signature in the Dawlish area (Figure 6). Three of these video tows were made up entirely of softer, muddy sand sediments, while one was mostly muddy sand but with a small section of mixed sediment consisting of muddy sand with a gravel, cobble and pebble overlay. There were also three ROV video tows which overlapped partially with SSS data from the Sandy Bay survey further north. Together with expert guidance from Cornwall IFCA, this information allowed Officers to identify that the darker return in the SSS signature represents muddy sand. The brighter returns are generally more likely to represent mixed ground, although joint review with Cornwall IFCA determined that the brighter, more uniform returns to the east represent sand.

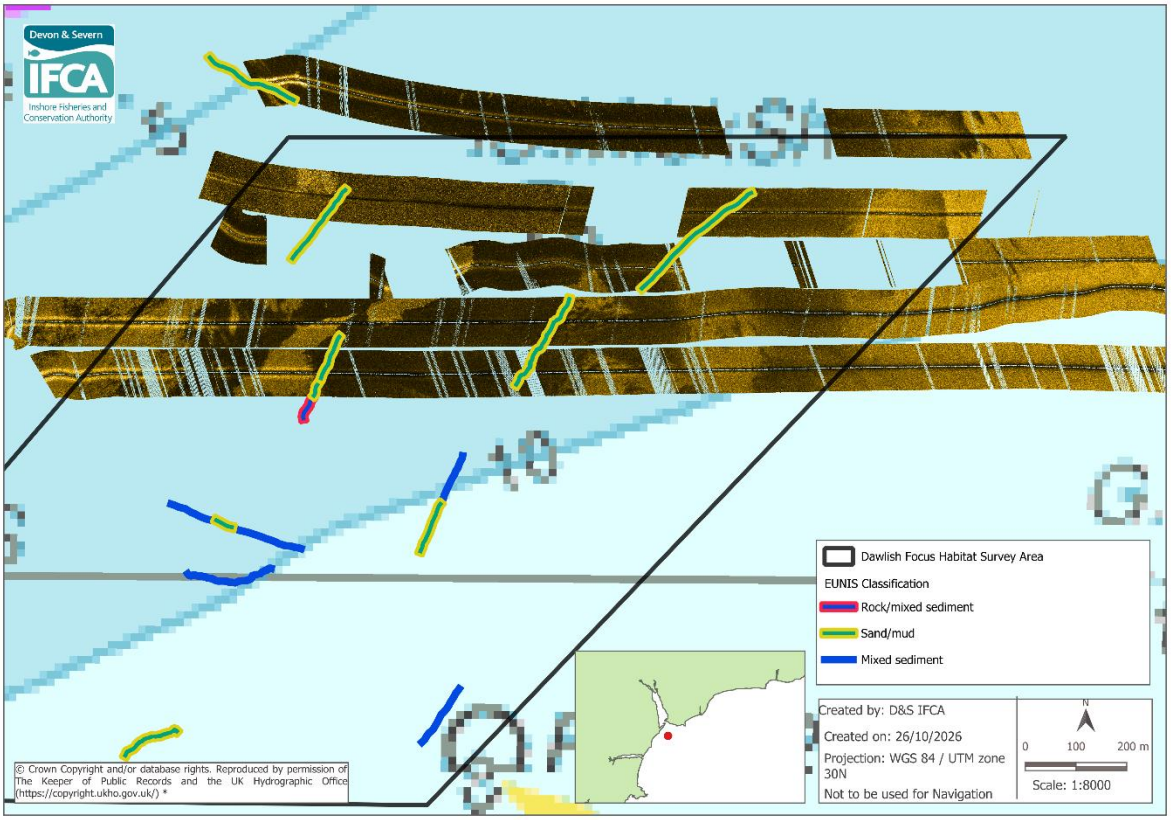


Figure 6. Side Scan Sonar data (black to gold) gathered from the northern portion of the Dawlish Focus Habitat Survey Area, overlaid with ROV video transects and habitat classifications. SSS data can be understood as an acoustic photograph of the seafloor, where sound waves replace light. Harder features reflect back a lot of sound, and so appear brighter, while softer features absorb more sound and appear dark. The dark line in the middle of each track is the water column directly beneath the SSS device and does not provide information on the seabed. Of the overlapping survey lines, the one furthest southwest also contains a small area of mixed sediment (blue) not visible in this graphic due to the scale. A further three overlaps between the ROV and SSS data were available for comparison in the Sandy Bay area.

The data available from the SSS suggests that the Dawlish habitat survey area is made up of areas of muddy sand with some areas consisting of mixed ground. Based on a comparison with SSS data from an area further north in Sandy Bay, it appears likely that the muddy sand areas of the Dawlish habitat survey area have a reasonably high proportion of finer sediment grains as the SSS signature was darker than that of small areas in Sandy Bay which displayed a brighter SSS signature depicting clear ripples which appear to be sand waves.

Officers have a high level of confidence that the darker signature is muddy sands due to the number of video tows which correspond with this signature, and a medium confidence in the mixed sediment areas due to only one short tow overlapping this signature. Confidence in this interpretation is improved due to the expert knowledge provided by Cornwall IFCA.

Although there is no ground-truthing of the area, Cornwall IFCA did identify an area to the west which just falls partly inside the Dawlish box of producing a signature which matches closest with harder substrate. This is to the west of the ROV transect which identified some rocky substrate (Figure 6). The SSS received a slightly brighter return in an area to the east of the Dawlish survey area box, which Cornwall IFCA has identified as being composed of sand as opposed to muddy sand (Figure 5).

Discussion

The underwater video surveys detected different sediment types in the proposed fishery area off Dawlish. Muddy sand was the most frequently recorded broadscale habitat type, followed by mixed sediment. The muddy sand in particular contained many burrows, though with limited available evidence of their inhabitants (burrowing bivalves and crustacea). A small, localised area of rock was also identified within the centre of the survey area. Mixed sediment mosaics were identified across the central and southern parts of the study area.

The video surveys provide direct observations of the seabed but only along relatively narrow transects. Consequently, while the surveys are effective at identifying habitat types present within individual tows, they provide limited information regarding the full spatial extent and boundaries of those habitats between survey locations. The side scan sonar survey was conducted specifically to address these limitations by providing broader spatial coverage across the study area. Integration of side scan sonar outputs with video observations allows a more comprehensive assessment of habitat distribution, though SSS outputs were patchy in places.

Together, the video and SSS data demonstrate that the Dawlish habitat survey area consists of areas of muddy sand as well as areas of mixed sediment, which includes grain sizes up to pebble and cobble. There is evidence that the sediment becomes more sand-dominated towards the east of the survey area (based on SSS; Figure 5), with potentially more mixed sediment towards the central part of the survey area (based on video tows; Figure 6) and areas of harder substrate towards the west (SSS and video tows; Figure 6).

These results therefore provide an overview of seabed composition within the area and contribute to the evidence base required to evaluate the potential areas that are suitable for the proposed razor clam fishery and feed into Mobile Fishing Permit Conditions and the Monitoring and Control Plan which are being developed for the fishery.

References

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Turner, J.A., Hitchin, R., Verling, E., van Rein, H. (2016). Epibiota remote monitoring from digital imagery: Interpretation guidelines. Available at https://www.nmbaqcs.org/media/teblpook/nmbaqc_epibiota_interpretation_guidelines_final.pdf

Appendix 1

Seabed imagery analysis methods

All seabed imagery analysis was undertaken following the Joint Nature Conservation Committee (JNCC) epibiota remote monitoring interpretation guidelines (Turner *et al*, 2016). The EUNIS classification system to Level 3 was used for identifying the broadscale habitats.

VLC media player (https://www.videolan.org/vlc/index.en_GB.html) was used to undertake the analysis. This allows for easy viewing including speeding up, slowing down and taking screenshots.

A proforma was provided to each Officer undertaking the analysis. This proforma included the following information to be recorded:

- Site
- Video no.
- Time ROV reached seabed (video time, not dive time)
- Start and end time of tow/segment (video time, not dive time)
- Duration of tow/segment (video time, not dive time)
- Briet habitat description (physical and biotic)
- Broadscale habitat
- EUNIS code to level 3
- Species

As per the guidelines, each video was watched at least twice. The first viewing was used to assess the quality of each video tow and to split the video into habitat change segments. This first viewing was done at double speed.

To assess the quality of the video the guidance from JNCC guidelines (Turner *et al*, 2016) was used which sets out the following:

i. ***Excellent*** - Water is clear, perfect illumination, colour is excellent, camera moving at ideal speed and at a constant angle (or as close to when using drop frames), seabed is visible at all times. There may be very occasional issues with viewing the seabed but these occurrences last for <5 % of the tow. All levels of analysis are expected to be possible;

ii. ***Good*** - Seabed easily observed, small amounts of suspended matter but this does not affect the visibility, speed may occasionally vary, lighting is sufficient to appropriately illuminate organisms. There may be occasional issues with viewing the seabed but these occurrences last for 5-20 % of the tow. This level of quality is not expected to affect analysis, level 5 biotope analysis is likely to be possible;

iii. ***Poor*** - Suspended matter, dense fauna or flora (e.g. kelp) or disturbed sediment results in a partially obscured view of the seabed. Camera speed and distance to the seabed is variable throughout the tow. Constant stop-start, particularly in the case of sledge systems on sediments, can often result in reduced visibility. There is general uncertainty as to whether all target objects can be recorded. These problems are present for 20-50 % of the tow. High level taxonomic identification will be difficult from this point. Quantification of organisms may still be possible, but it is recommended that a qualitative assessment of abundance is used. Broadscale habitat mapping (EUNIS Level 3) is still possible.

iv. ***Very Poor*** - Suspended matter, dense fauna or flora (e.g. kelp) or disturbed sediment obscures most of the seabed. When the seabed is visible the camera is often moving too fast, resulting in constant blurring of organisms. Camera often moves too far from the seabed resulting in a lack of illumination and visibility. These problems are likely to be present for 50-

80 % of the tow. Quantitative or qualitative estimates of organism abundance are not recommended. It may still be possible to determine broadscale habitats.

v. ***Zero*** - For whatever reason (camera too far from the seabed, camera moving too quickly, lack of illumination, sediment disturbance, dense gathering of fauna or flora (e.g. kelp)), there is no view of the seabed at all for >80% of the tow. Data are not usable.

Quality Category	**Proportion of tow negatively affected**	**Organism Enumeration**	**Biotopes**
Excellent	<5 %	Quantitative	Level 5
Good	5-20 %	Quantitative	Level 5
Poor	20-50 %	Qualitative	Level 3
Very Poor	50-80 %	Not recommended	Level 2/3
Zero	>80 %	Data not usable	Data not usable

For the purposes of this analysis the video quality could be “poor” as the objective was to classify the broadscale habitat to EUNIS level 3. A judgement could be made if any videos were “very poor” if at least some of the video could be used for EUNIS level 2/3.