CHERISH
Archaeological Dive Contract 2021

Bronze Bell Wreck

Archaeological Report

MSDS Marine

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Bronze Bell Wreck

Archaeological Report

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1.0 Summary

1.0.1 MSDS Marine Ltd (MSDS Marine) were commissioned by the CHERISH project (CHERISH) to undertake, assist and support the underwater archaeological objectives of CHERISH in relation to the Bronze Bell protected wreck site[1].

1.0.2 The Bronze Bell wreck is designated under the Protection of Wrecks Act 1973 and has been previously monitored by other archaeological dive contractors, Licensees, and avocational divers. The site was excavated by the finders of the wreck following its discovery in 1978.

1.0.3 The wreck is sometimes referred to as the Tal-y-Bont wreck due to its proximity to the village of Tal-y-Bont.

1.0.4 The wreck is likely to be the remains of a Genoese merchant vessel lost in 1709 carrying a large cargo of substantial marble blocks. The site comprises a central mound of stacked marble blocks and is surrounded by a scatter of iron cannon and anchors.

1.0.5 The fieldwork was carried out by a team from MSDS Marine including Alison James, Felix Pedrotti, Jenny Kent, Jessica Mitchell, Mark James, Phoebe Wild, Simon Adey-Davies and Tom Harrison. Top-side filming was provided by George Hopkins and Oliver Pitts. Diving operations were undertaken from *Seakat C* operated by owner Jon Shaw.

1.0.6 The project was managed for MSDS Marine by Alison James, MCIfA. Mark James, MCIfA, was the Diving Supervisor.

1.0.7 This report is a record of the MSDS Marine visit to the site and subsequent research undertaken.

1.1 Acknowledgements

1.1.1 The project was commissioned by CHERISH. The assistance provided by Clare Lancaster, Dr Toby Driver, and their colleagues at CHERISH is gratefully acknowledged, as was the assistance of Dr Julian Whitewright of the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW).

1.1.2 MSDS Marine would also like to thank the following people for their support and assistance during the project:

- Ian Cundy, Malvern Archaeological Diving Unit (MADU)
- Geraint Jones, original finder of the wreck
- Alan Vincent and John Puddle of the Tŷ Gwyn Museum, Barmouth
- The staff of Hafan Pwllheli
- Dr Guiseppe D'Onorio
- Sarah Perruccio

1.1.3 The project was managed for MSDS Marine by Alison James. Fieldwork was carried out by Mark James, Tom Harrison, Phoebe Wild, Jenny Kent, Jessica Mitchell and Simon Adey-Davis. Diving

[1] Coflein (2012) Tal-y-Bont Wreck; Bronze Bell Wreck Available at: https://coflein.gov.uk/en/site/1015. Accessed 10th November 2021.

operations were supervised by Mark James. Phoebe Wild managed the diver tracking. Additional topside filming was carried out by George Hopkins and Oliver Pitts. The report was compiled by Alison James with contributions from Mark James, Phoebe Wild, Jenny Kent and Beccy Austin.

2.0 Introduction

2.0.1 MSDS Marine were appointed by the CHERISH to undertake inspection, survey, investigation, recording and monitoring of the Bronze Bell wreck[2], a previously monitored and designated wreck site in Welsh waters.

2.0.2 A five-day diving project, and associate programme of public engagement, was undertaken between 13th and 17th September 2021.

2.1 Site Location

2.1.1 The site is located approximately 450m off Benar Beach near Tal-y-Bont, Ceredigion, Wales, see Figure 1.

2.1.2 The wreck is designated under the Protection of Wrecks Act 1973 and there is a 300m radius designated area around the wreck. The wreck lies in c.10m of water on a mainly sandy seabed.

2.1.3 The position of the wreck site is given within the designation details as Latitude 52.7791526, Longitude -4.1266942 (WGS 84).

2.1.4 Whilst the site is close to the beach and therefore accessible with a small inflatable boat this is not suitable for access by a full dive team. Access for diving with a hard boat is from Barmouth or Pwllheli harbours. Barmouth is tidally restricted and care must be taken below half-tide, especially during periods of strong south-west winds and ebb tides. Pwllheli is further from the site but is fully accessible at all states of the tide. As a result, Pwllheli was chosen as the base for fieldwork.

[2] Coflein (2012) Tal-y-Bont Wreck; Bronze Bell Wreck Available at: https://coflein.gov.uk/en/site/1015. Accessed 18.06.2021

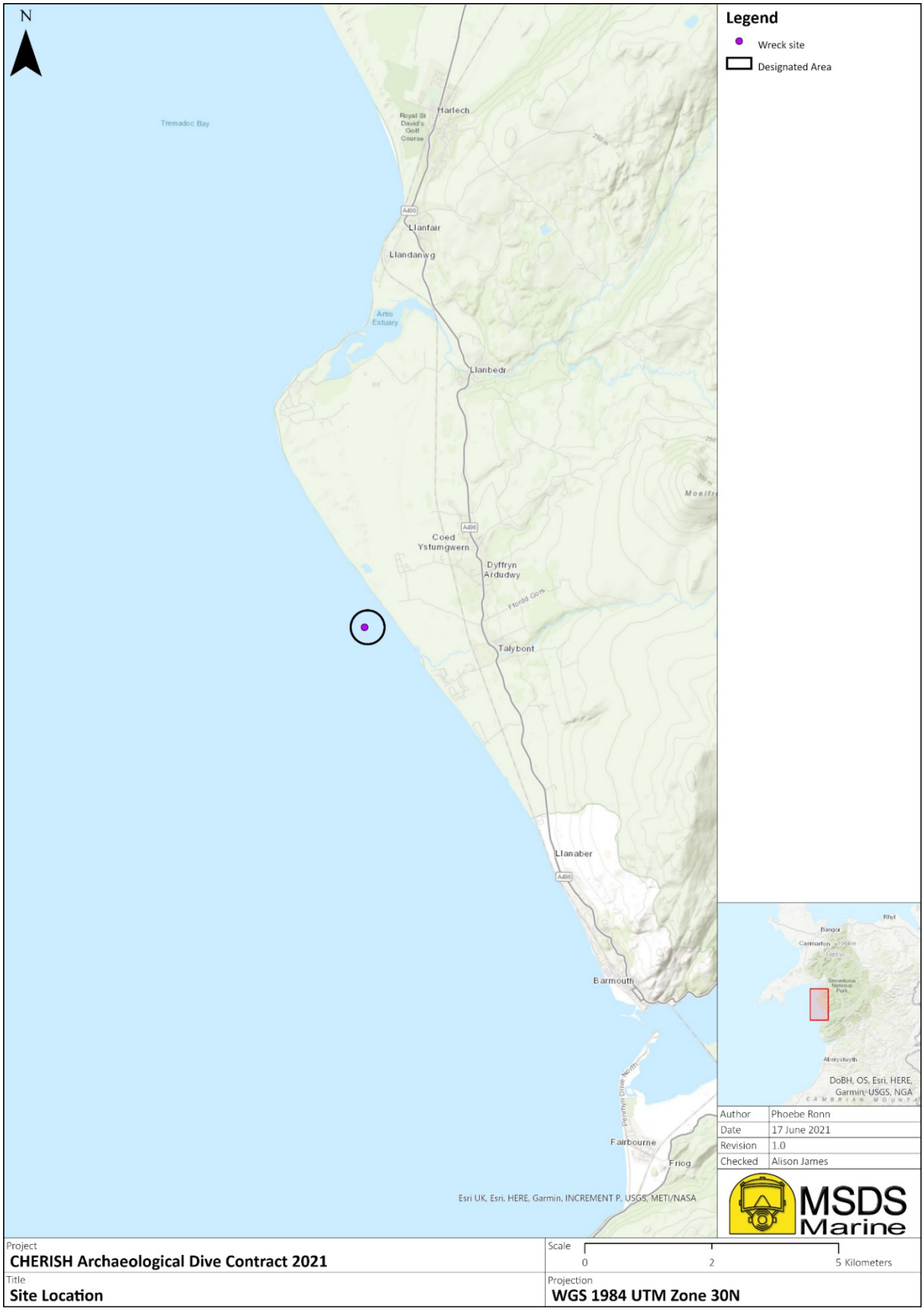


Figure 1: Site Location.

3.0 Site Information

3.0.1 The site was last inspected by an archaeological diving contractor, Wessex Archaeology, in 2004. The 2006 report on the fieldwork clearly establishes a history of investigation on the site to that point and it is not the purpose of this report to repeat that here[3].

3.0.2 There has been much debate about the origins of the vessel with suggestions being both French and Genoese, however, it is now commonly believed the wreck is Genoese in origin.

3.0.3 In summary, the wreck is likely an early 17th century Genoese merchant vessel. *Cambria's Coasting Pilot,* a chart produced by the cartographer Lewis Morris, who lived in Anglesey, was prepared from his earlier surveys conducted between 1741-44 noting the site of a Genoese vessel of "about 700 tons, lost in 1709" which was reportedly carrying marble and paper, see Figure 2.

3.0.4 As well as being a trade centre for Carerra marble in the late 17th and early 18th Centuries, Genoa was an important paper-making centre of early modern Europe[4].

3.0.5 There are several theories as to why such a trade ship was in the area, one being that it had missed the entrance to the English Channel and was bound for London or, it may have been destined for the port of Bristol, at the time the second largest port in England, and missed the Bristol Channel. Wharfage accounts show that vessels travelled from Genoa to unload cargo at Bristol[5]. Another possible destination could have been Dublin.

3.0.6 Approximately 65 tons, or 43 marble blocks, of raw unfinished marble were discovered in differing sizes originating from the quarries of Carrara, part of modern-day Tuscany. Carerra marble was shipped from Genoa and Livorno but the latter was favoured due to the diverse trading links of the city and the decision of Genoa to impose a 20% tax on Carerra marble to promote favour of its own locally sourced marble[6].

3.0.7 Between 1701 and 1714, Europe was at war as part of the War of Spanish Succession with France and Spain against the Grand Alliance, made up of England, the Dutch Republic and the Holy Roman Empire. During this time the Republic of Genoa was an important transportation and supply port for thousands of troops and traders from both sides[7]. The Genoese were autonomous and therefore they could have stopped in a French port on the way to pick up further trade goods before heading for Britain.

3.0.8 This could account for the presence of French coins and pewter on a Genoese vessel.

[3] Wessex Archaeology, 2006. *Tal-y-Bont, Cardigan Bay. Designated Site Assessment Full Report*. Ref 53111.03t
[4] Fahy, C. 2003/2004, *Paper Making in Seventeenth-Century Genoa: The Account of Giovanni Domenico Peri (1651*) in Studies in Bibliography Vol 56
[5]McGrath, P., Douglas, D. & Ralph, E. 1955. *Merchants and Merchandise in Seventeenth-Century Bristol Vol. XIX*
[6] Bates, C. 2015, *The role of British merchants in Livorno in the marble trade between Italy and Britain during the 18thh Century* IN Archeologia Postmedievale
[7] Martoccio, M. P. 2021, *The place for such business': The business of war in the city of Genoa, 1701-1714* in War in History Journal.

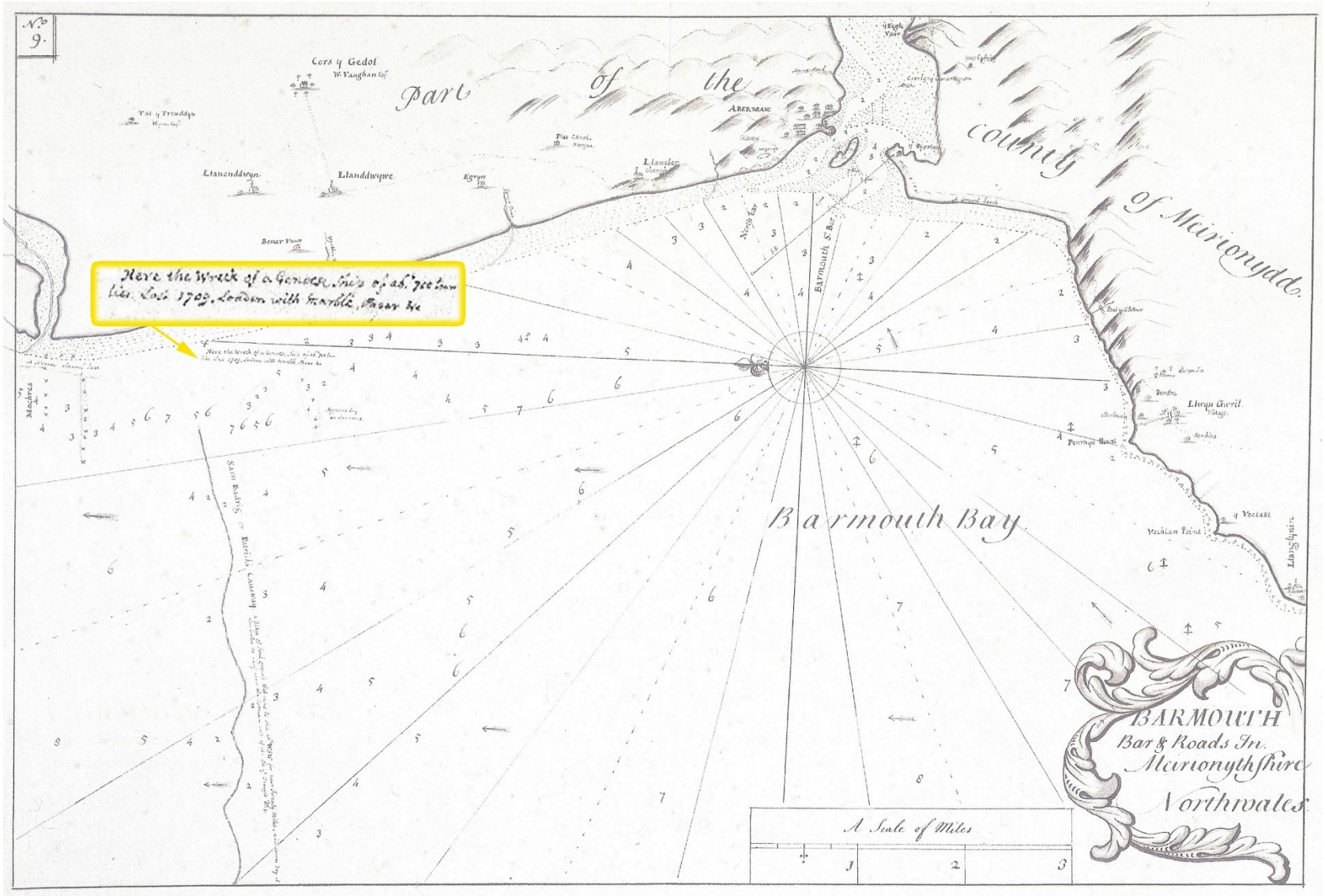


Figure 2: Extract of a chart taken from Cambria's Coasting Pilot, part 2, plate no 2.9, entitled 'Barmouth Bar and Roads in Merionythshire North Wales'. Source: UK Hydrographic Office Archive. This survey imagery is no longer protected by Crown Copyright.

3.1 The Bell

3.1.1 During the course of the project further research was undertaken on the origin of the ships bell. The bell is marked with the date 1677 and is thought to be associated with the main wreck assemblage. It is embossed with a Latin inscription with the first line of Psalm 117, *LAUDATE DOMINUM OMNES GENTES* which translates as *Praise the Lord, all you nations*. Also present is the date *1677* and *IHS*, the monogram for Jesus Christ in Roman Catholic iconography, and two octagonal cameos of the Virgin Mary and Christ. The decoration also features triangles around the outside of images depicting people.

3.1.2 The crown of the bell has similarities to some of those produced by the Marinelli Foundry[8] in Italy, which still operates as a foundry today. The Marinelli Bell Foundry Museum put MSDS Marine in touch with Professore Guiseppe D'Onorio who was able to provide some further information about the bell.

3.1.3 Professore D'Onorio was able to confirm that the bell, from the Bronze Bell Wreck site, was manufactured in Italy. It was common during the period for Italian bells to feature sacred images such as the Virgin Mary and Christ. The bell was most likely cast in Rome or southern Lazio and the decorations, including the crown and the use of octagons, offer some suggestions for possible makers. These include Antonio Mattei and his son Benedetto Mattei. Antonio Mattei was a student of Amedeo Godio Gallio, a master of bell art and all three were resident in Veroli when the bell was cast[9]. There is also an unknown maker who did not sign his work, who was based in Rome who also used octagonal sacred images[10].

Figure 3: Left: The bronze bell from the wreck. Credit: Ian Cundy (from the archive of late Michael Bowyer). Right: A bell from the Marinelli Foundry. Credit: campanemarinelli.com.

[8] http://campanemarinelli.com/en/
[9] D'Onorio, G. 2001 Tolling of Memory. Bells and bell towers of Veroli
[10] D'Onorio, G. 2022, pers comm.

4.0 Methodology

4.1 Diving Operations

4.1.1 The Diving fieldwork was undertaken from the diving support vessel (DSV) *SeeKat C*, owned, and operated by Jon Shaw[11]. *Seekat C* is an MCA Category 2 workboat licensed to carry 12 personnel up to 60nm from a safe haven. The vessel has a large wheelhouse at deck level with a large deck area. The vessel is equipped with a galley, toilet, and heating throughout. The vessel operator has considerable experience of using *Seekat C* for a number of commercial diving operations, including previous archaeological work with MSDS Marine. The vessel has a dive ladder, space for a compressor, a store area for diving equipment, and a large indoor area from which to conduct the diving operation and manage the acoustic tracking.

4.1.2 Diving was undertaken on SCUBA using a six-person dive team. The location of the site, and the environmental conditions, meant it was possible to deploy divers at all states of the tide.

4.2 Acoustic Tracking

4.2.1 Acoustic tracking was used throughout diving fieldwork activities. The system used was the Sonardyne Micro-Ranger 2, an Ultra Short Base Line (USBL) system. This system works by calculating the range and bearing of diver-mounted transponders to the transceiver. The transceiver was mounted to the vessel below the water line on a rear mounted survey pole. The system was linked to a DGPS receiver ensuring a high level of positional accuracy which was mounted to the top of the rear mounted survey pole (typically up to 5% of slant range). The transceiver was interfaced to a control box which was itself connected to a laptop housed in the vessel wheelhouse via an ethernet cable. At least one wireless transponder was deployed per wave of divers, affixed to the BCD of the diver, these automatically activated upon contact with water.

4.2.2 The position visualisation software used was Ranger2, produced by Sonardyne for use with their USBL products. In order to ensure positional accuracy, a range of offsets including position of the rear mounted survey pole on the vessel, the depth of the transceiver and height of the DPGS unit was inputted into Ranger2. Using this program, the position of the diver-mounted transponders could be viewed relative to the vessel location. Ranger2 was linked via a virtual COM port to a project in QGIS which was set up with the multibeam bathymetry collected in 2020 and a preliminary site plan produced prior to fieldwork. The diver routes were projected in real time into the QGIS project and saved as polylines. Using this set up, along with the through-water communication system, divers could be verbally guided around the site.

4.3 Broadcast Quality Photography and Videography

4.3.1 Public engagement with underwater sites is made a lot easier when there are high resolution images and video footage available of the site. To ensure exceptional quality footage was collected, and to feed into the Dive Diaries, a dedicated underwater camera operator, Jessica Mitchell, was fully embedded into the core team.

[11] http://www.seekatcharters.co.uk/

4.3.2 For any filming above the water and the pieces to camera a combination of Panasonic GH5s, and Nikon D810 and D800s were used, filming at 4k resolution where possible. For sound in camera, recording capabilities were used in combination with Lav mics.

4.3.3 For underwater filming a combination of a Nikon D800 in a Sea & Sea housing and a Go Pro 9 were used to capture the content of both stills and video. Keldan video lights were used to provide additional lighting where required, however natural lighting was deemed preferable to reduce backscatter.

4.4 Other Methodologies

4.4.1 The scope of work for the archaeological assessment included a number of tasks,

- The production of an updated georeferenced site plan
- A photogrammetric survey of the site
- A repeat photographic survey
- The gathering of environmental baseline data
- Public engagement

4.4.2 To aid clarity, the methods for these individual scope of works have been included within the individual results sections.

5.0 Results

5.1 Production of a Georeferenced Site Plan

5.1.1 Prior to fieldwork the most recent multibeam survey of the site, undertaken by CHERISH in 2020, was imported into the projects GIS workspace. The multibeam data were then used to identify, and digitise, archaeological features creating a traditional, but georeferenced, 2D site plan. The site plan was then used by divers both for ground truthing and navigation.

5.1.2 Ground truthing, and diver observations, were recorded during the course of fieldwork and the site plan updated as required, and feature orientation and stratigraphy confirmed, see Figure 4.

5.1.3 The 2004 Wessex Archaeology site plan, based on the plan produced by the Cae Nest group, was overlaid on the new site plan so comparisons could be made, see

5.1.4 Figure 5. Whilst there seems to be some offset in the two plans there is general alignment. This can be attributed to the fact that the 2004 plan is a digitisation of a hand-measured and hand-drawn plan; the use of fabric tape measures underwater can often result in minor errors due to the influence of current, and compass measurements for orientation can be affected by the iron content of features e.g., guns and anchors. Misalignment of the orientation of features can ultimately result in inaccuracies in the overall site plan as features were likely measured relative to each other.

5.1.5 Table 1 correlates the 2004 Wessex Archaeology features with the MSDS Marine 2021 features, and details amendments and additions made when updating the 2004 plan. These features are labelled on the site plan in Figure 6.

MSDS ID	Wessex ID	Feature	Amendments/Additions
1	-	Cast Iron Gun	Added to plan
2	WA15	Cast Iron Gun	Orientation corrected
3	WA14	Cast Iron Gun	
4	WA13	Cast Iron Gun	
5	WA12	Cast Iron Gun	
6	WA07	Cast Iron Gun	
7	WA01	Cast Iron Gun	
8	WA02	Anchor	
9	WA06	Anchor Ring	
10	-	Unknown Concreted Rings	Added to plan
11	WA05	Cast Iron Gun	
12	WA03	Anchor	
13	WA04	Cast Iron Gun	Orientation corrected

14	-	Anchor Ring	Added to plan
15	WA10	Cast Iron Gun	
16	WA09	Cast Iron Gun	
17	WA08	Cast Iron Gun	
18	WA16	Cast Iron Gun	
19	WA17	Cast Iron Gun	
20	WA18	Anchor Ring and Partial Shank	
21	WA20	Cast Iron Gun	
22	WA21	Cast Iron Gun	
23	WA19	Cast Iron Gun	
24	WA23	Wrought Iron Swivel Gun	
25	WA22	Cast Iron Gun	
26	WA24	Anchor	
27	WA28	Cast Iron Gun	Position corrected
28	WA29	Cast Iron Gun	Position corrected
29	WA30	Cast Iron Swivel Gun	Position corrected
30	WA31	Cast Iron Swivel Gun	Position corrected
31	WA25	Cast Iron Gun	Orientation corrected
32	WA26	Cast Iron Gun	
33	WA27	Cast Iron Gun	
34	WA32	Cast Iron Gun	
35	-	Unknown Cylindrical Object	Added to plan
-	WA11	Fragment of Anchor Fluke and Arm	Not identified in 2021 survey
-	WA33	Marble Mound	Not plotted in 2021 survey

Table 1: Features within the site.

5.1.6 New archaeological features were identified during diving operations including linear objects, and a feature consisting of a concretion of at least four rings each approximately 23cm in diameter.

5.1.7 Figure 7 illustrates the extent of the diver coverage during fieldwork, as exported from the USBL tracking.

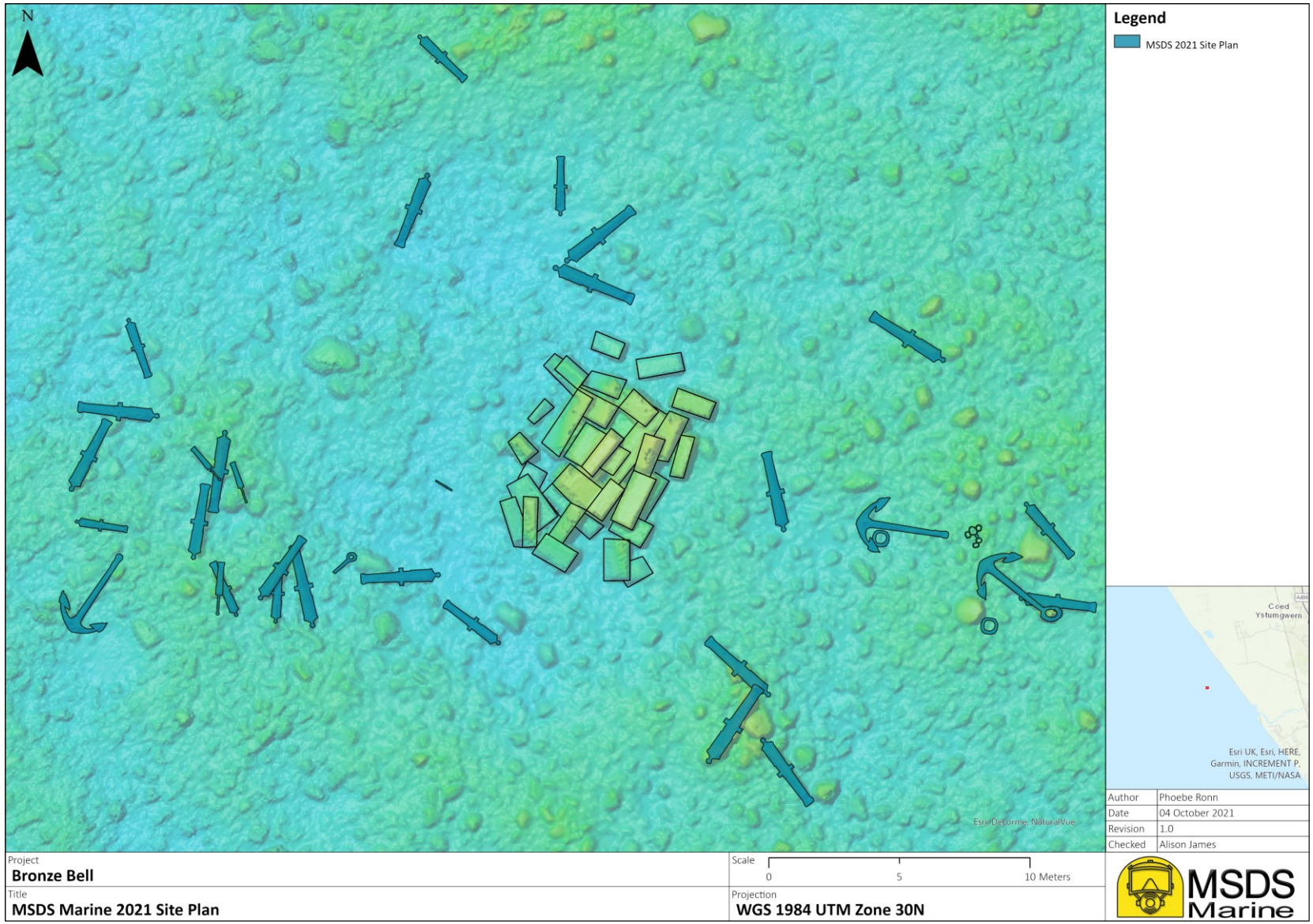


Figure 4: The 2021 site plan overlaid on the 2020 Multibeam collected by CHERISH.

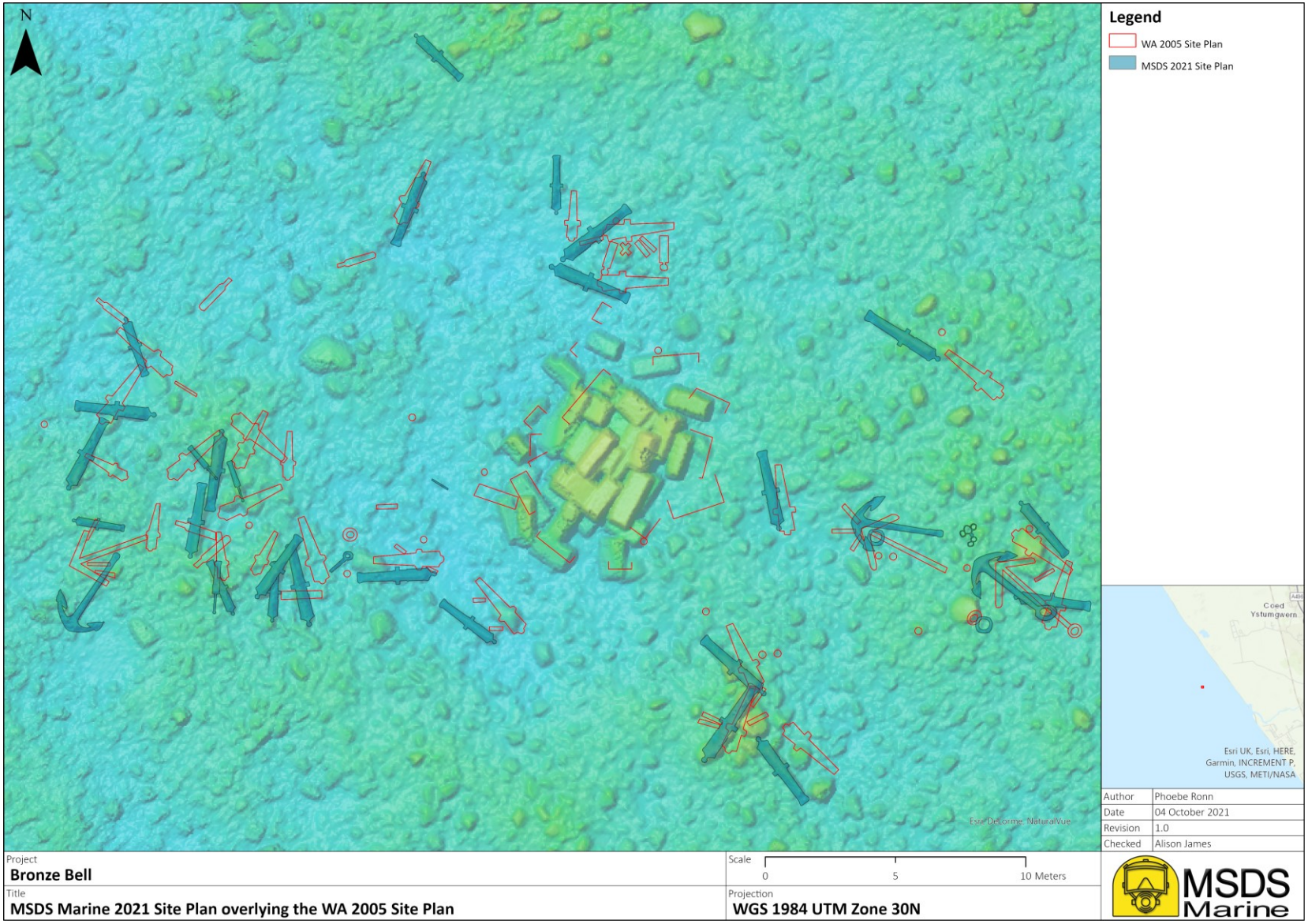


Figure 5: The 2021 site plan overlaid on the 2020 Multibeam collected by CHERISH and the 2004 Wessex Archaeology site plan.

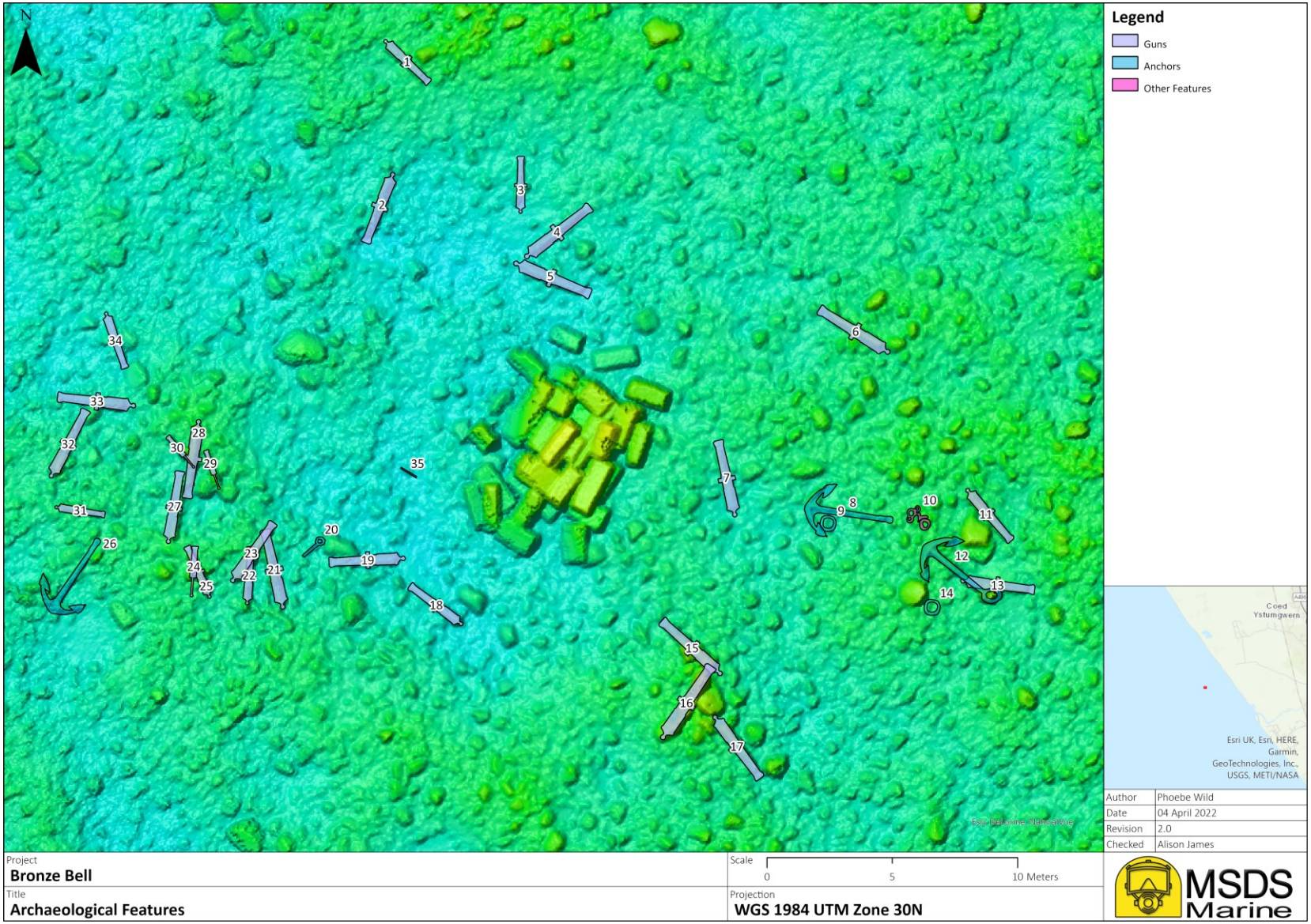


Figure 6: The 2021 site plan overlaid on the 2020 Multibeam with numbered features.

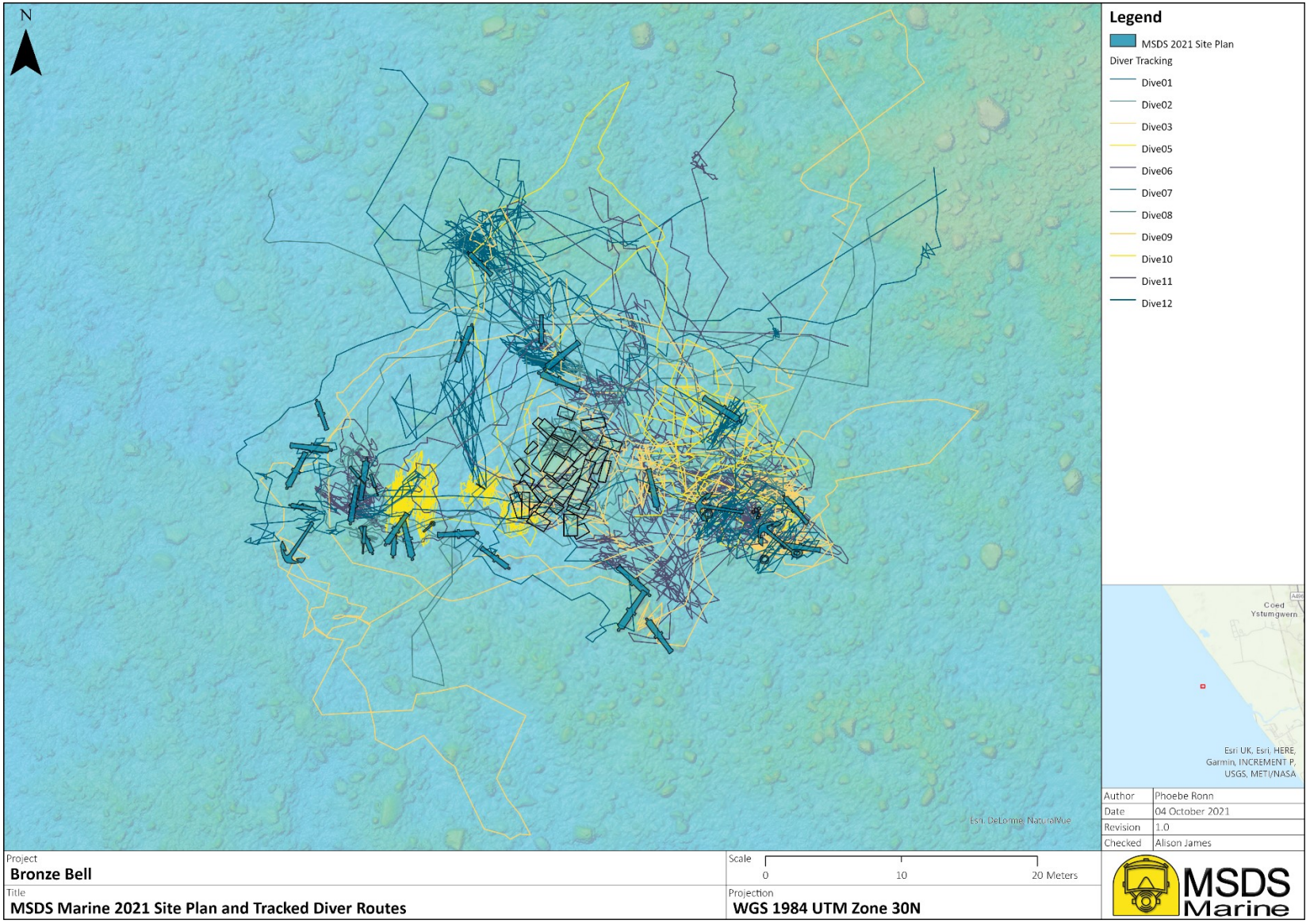


Figure 7: The dive tracking plots from the project overlaid on the site plan.

5.2 Photogrammetry

5.2.1 A photogrammetric survey was undertaken to record the extents of the site.

5.2.2 Digital images were collected using a GoPro Hero 9 Black Wide Angle lens camera. Based on previous, and similar, experience of the conditions on site the following settings were used during data collection;

- Resolution: 3396 x 2952
- Focal length: 3
- F-stop: F/2.5
- ISO: Variable
- Shutter: Variable between 1/120-1/370
- 35mm focal: 15

5.2.3 During data collection the camera was set to time-lapse mode with an image taken every second, the frequency considers an average diving swimming speed, the required overlap, and a practical consideration of not collecting too many images. The data collection followed a cross-hatched pattern, with the diver following a transversal path (vertical) and then a longitudinal path (horizontal) in order to guarantee appropriate overlap between the images.

5.2.4 Around specific archaeological features the diver adjusted the survey path with an auxiliary path aimed to increase survey quality. Figure 8 shows the coordinates of each single image taken during the time period photogrammetric survey was undertaken.

5.2.5 Images were taken at a distance of between 0.5m and 1.3m from the wreck, allowing clear capture of the site, without losing quality due to the medium visibility on site.

5.2.6 Over the course of three days data collection, 7,572 images. The location of the images is detailed in Table 2.

Date	Number of Images	Area of Wreck
13/09/2021	2,590 images	Centre part of wreck, marble blocks
15/09/2021	2,451 images	Western end of wreck
16/09/2021	2,531 images	Eastern end of wreck

Table 2: Images collected during photogrammetry survey.

5.2.7 The photogrammetry survey was hampered by the extensive level of marine growth across the site. Only small areas of the surface remained static throughout the survey with many areas, especially those areas with high concentrations of archaeological artefacts, covered with moving marine growth. The site was highly dynamic during the course of the survey which created high levels of digital noise within the recorded datasets. The roughness map created from the digital elevation model of the photogrammetry shows that around 600m^{2,} or 64% of the area surveyed was covered by marine growth, see Figure 9.

5.2.8 If the survey is repeated in future years, thought should be given to mobilising earlier in the year or removing weed across the site to increase the quality of the photogrammetric output.

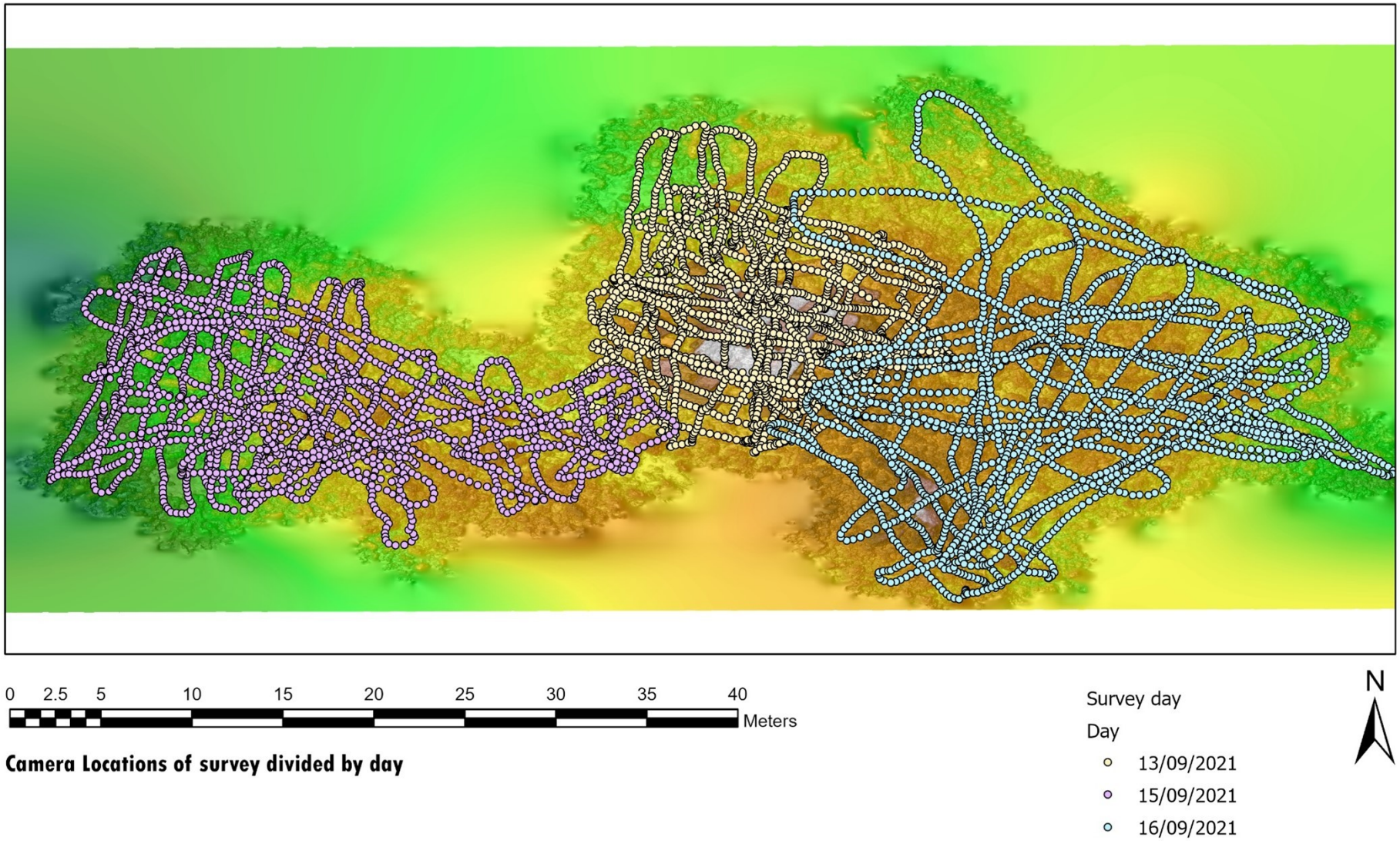


Figure 8: Locations of photos taken during the survey.

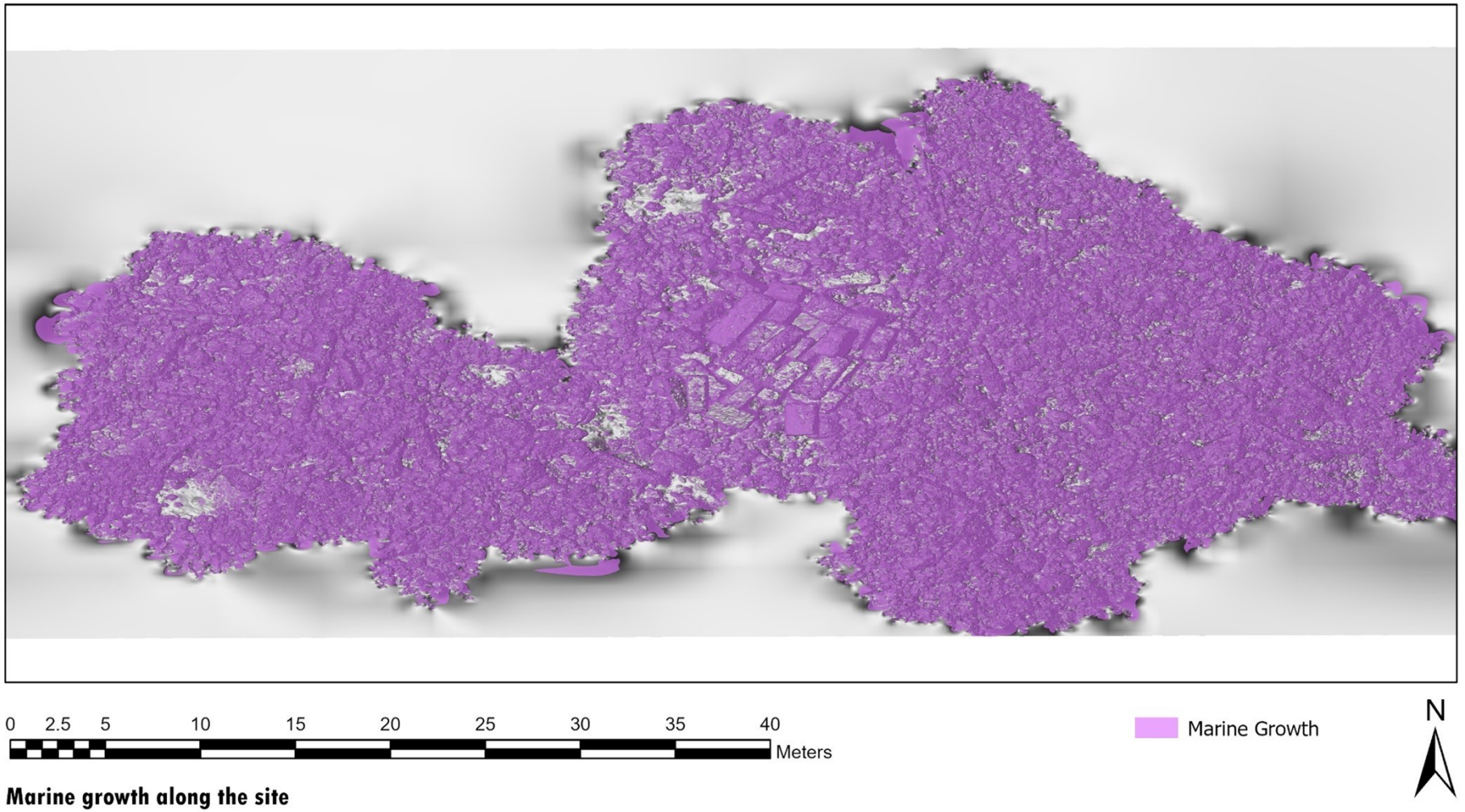


Figure 9: Marine growth across the site

5.2.9 To ensure the optimisation of the data processing a computer with the following specification was used.

Software	Agisoft Metashape Professional
Software version	1.7.3 build 12473
Operating System	Windows 64 bit
RAM	191.93 GB
CPU	Intel(R) Xeon(R) CPU E5-2699 v3 @ 2.30GHz
GPU	Quadro K6000

Table 3: PC Configurations

5.2.10 Prior to processing the images were colour corrected in Adobe Lightroom, the colour correction ensures that the images have the highest chance of aligning, but also compensate for the loss of colour underwater, and the variable environmental conditions. Of the 7,572 images a total of 7,567, 99.93% of the images aligned. following alignment, the images were processed to create a densecloud, then a DEM and an orthmosaic. Following processing, the resulting models were scaled.

5.2.11 To scale the model two methods were used. Firstly, the object was scaled locally (on a local grid). Four scale bars were positioned on the site on each day of survey. Two 0.5m and two 1m scalebars were used. This allowed the photogrammetry specialist to scale all three days of survey with a total of twelve scalebars across a 940.3 m^2 survey area. The overall local error was calculated at +/- 5.9 cm.Secondly, the 2020 high resolution multibeam bathymetry, collected by CHERISH, was used to georeference the photogrammetry. The bathymetry data was imported into a GIS workspace, ten xyz co-ordinates were exported for integration into Agisoft Metashape. This allowed the model to be georeferenced on a geographical scale. The geographical accuracy of the model was calculated at 21.46cm on the x-axis, 9.61cm on the y-axis and 25.4cm on the z-axis, bringing the overall geographical error of the survey to 34.6 cm.

5.2.12 The Digital Elevation Model (DEM) and Orthomosaic were created in Agisoft metashape. The DEM has a resolution of 3.37 mm per pixel, while the Orthomosaic has a resolution of 0.837 mm per pixel, the DEM is presented in Figure 10 and the Orthomosaic in Figure 11.

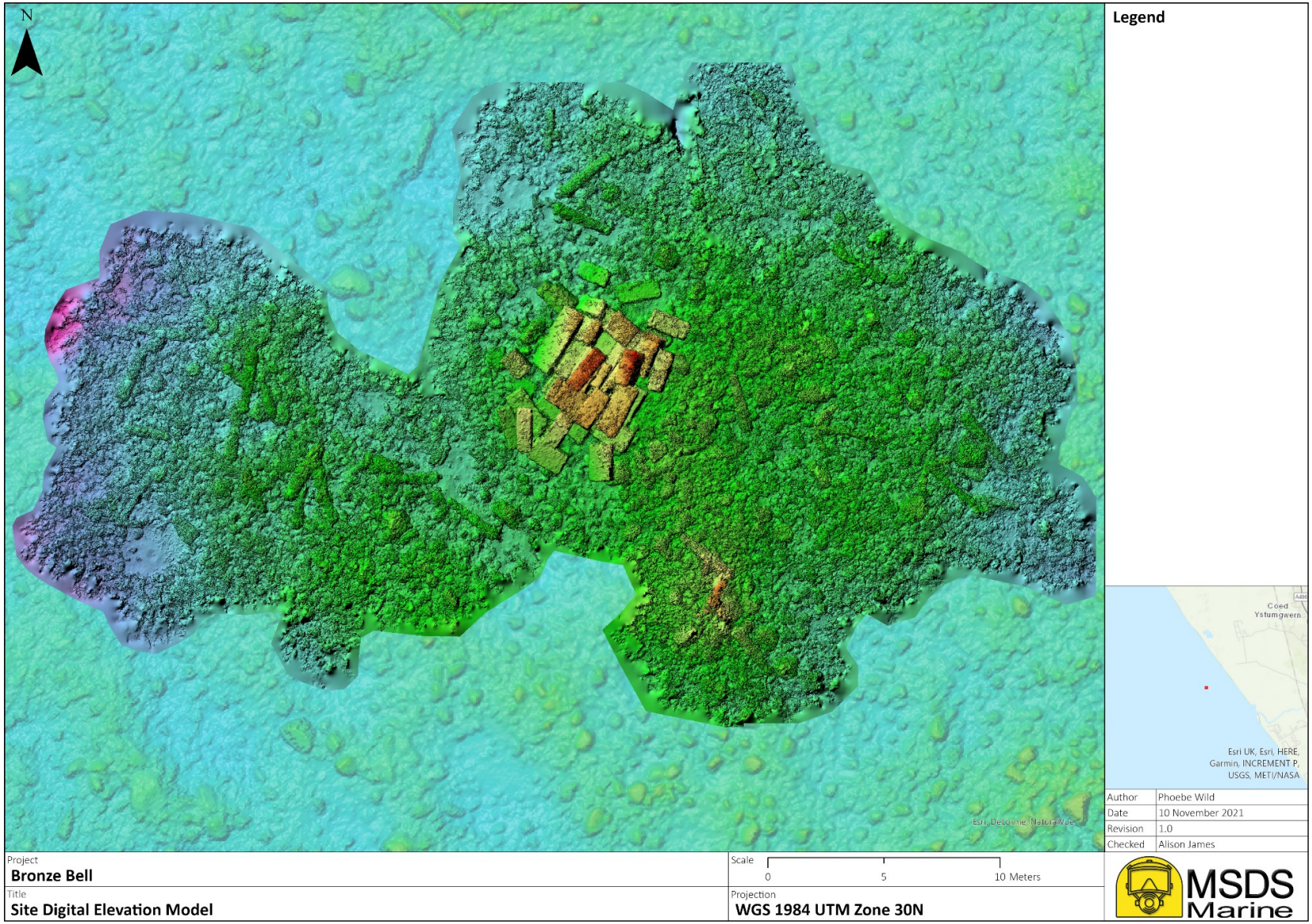


Figure 10: Digital elevation model of the Bronze Bell site.

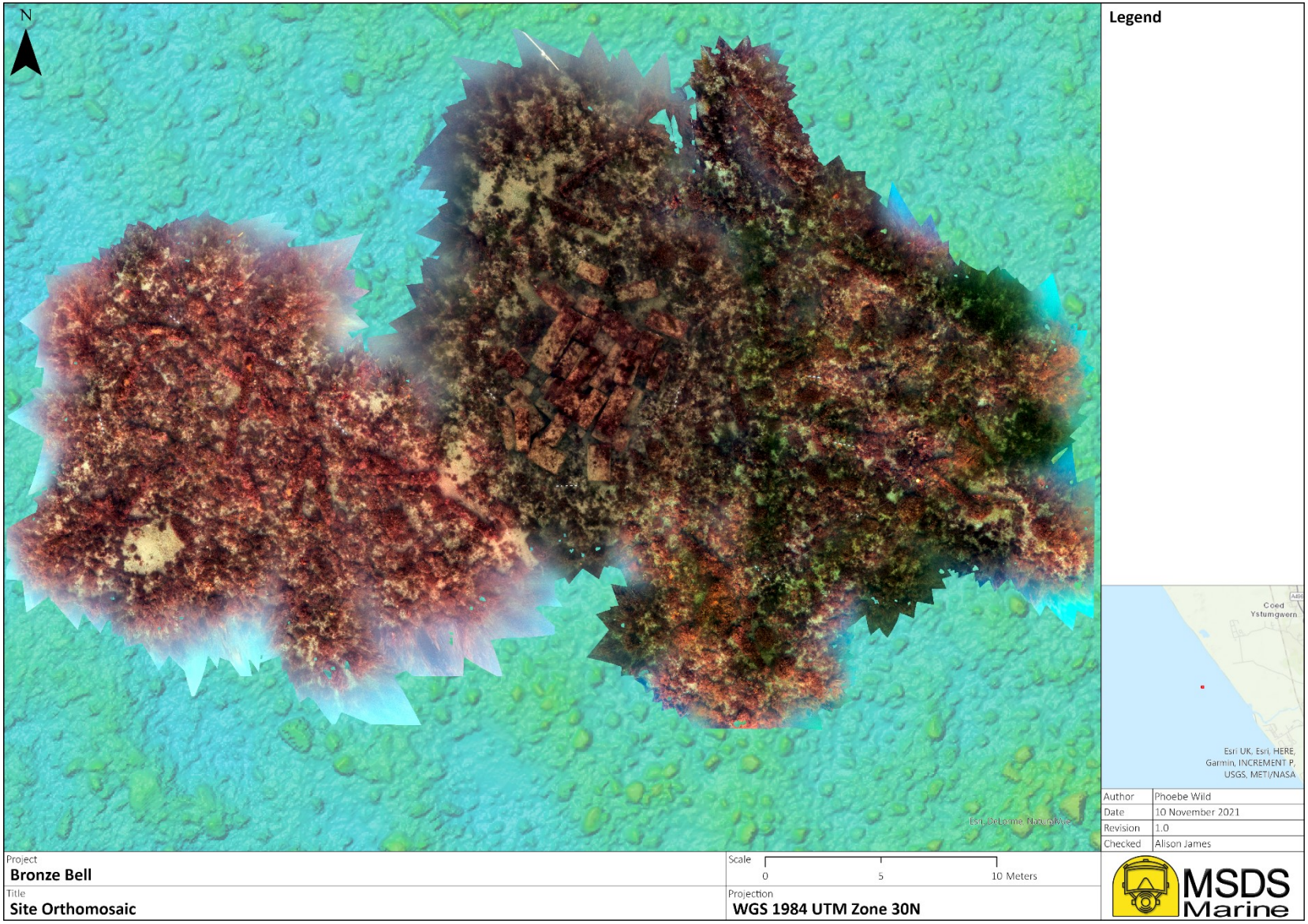


Figure 11: Orthomosaic of the Bronze Bell site.

5.3 Repeat Photographic Survey

5.3.1 The position and direction from which the original 2004 WA photos were taken was determined by comparison between the features visible in the photographs, the feature descriptions, and the feature distribution in the multibeam and the site plans in GIS.

5.3.2 The dive supervisor used the diver tracking to guide divers on site to the photos in order to take repeat photographs. Jenny Kent and Simon Adey-Davis were part of the 2004 and 2021 dive teams. They were able to confirm visibility on site in 2004 had been in excess of 10 metres, however, by comparison visibility was just 1 – 2 metres in 2021.

5.3.3 The 2004 photos have been reproduced from the 2006 Wessex Archaeology report, All the monitoring photos were replicated, with the exception of the following:

- 1c: based on the multibeam it was not possible to identify where this photo was taken from.
- 2e: poor visibility meant that this photo could not be replicated effectively.
- 3e: poor visibility meant that this photo could not be replicated effectively.
- 4d: the features could not be identified in the multibeam or by divers on site.

5.3.4 The results are present in Table 4 below.

Photo Position	2004	2021
1a		
View of the marble mound facing NE		
1b		
View of the marble mound facing WSW		

Photo Position	2004	2021
1c		Not possible to replicate
View of marble blocks, unknown direction.		

Photo Position	2004	2021
2a		
View of guns 31 and 32 facing ENE		

Photo Position	2004	2021
2b		
View of guns 4 and 5 facing WSW		

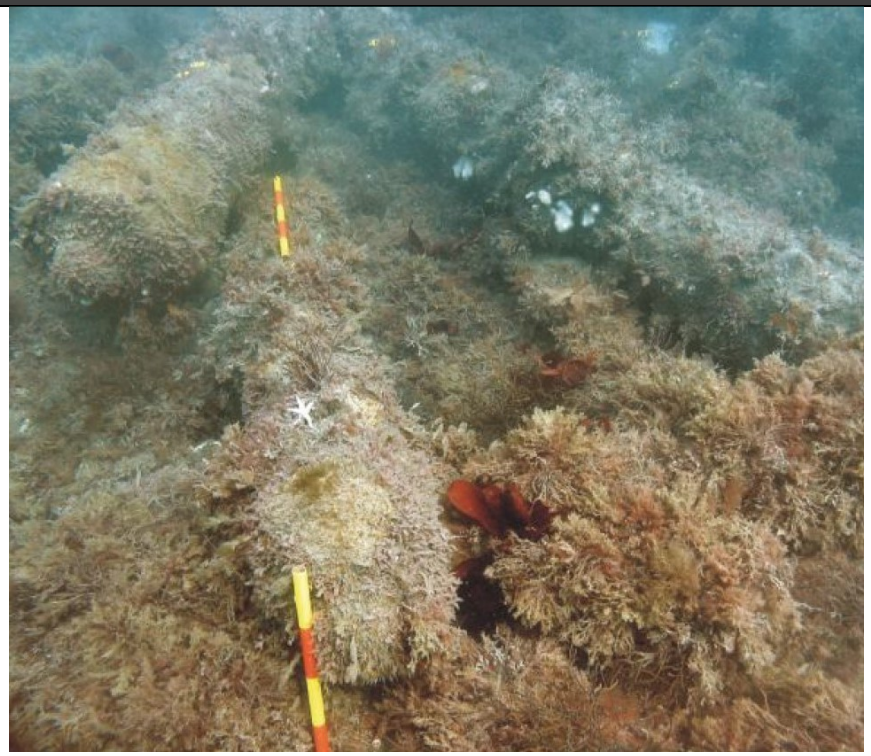
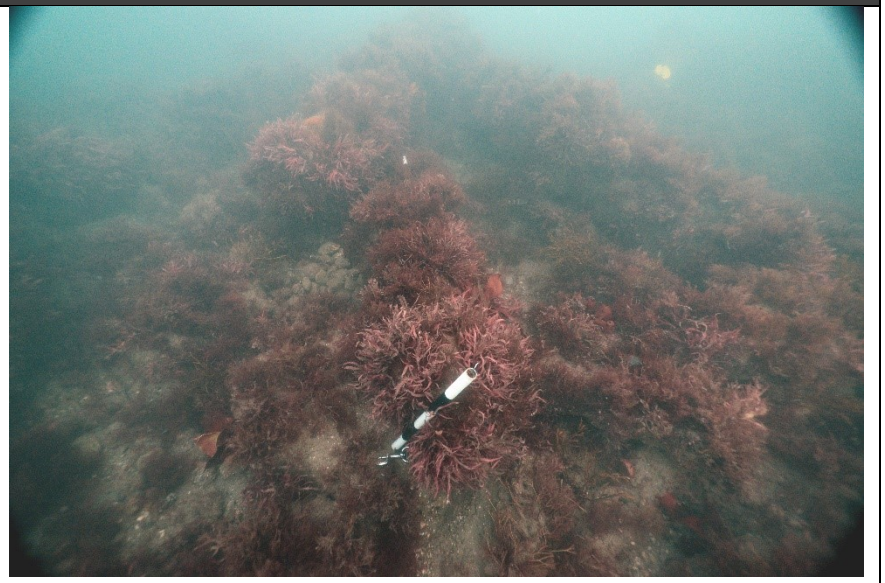
Photo Position	2004	2021
2c		
View of guns 21, 22, and 23 facing north		

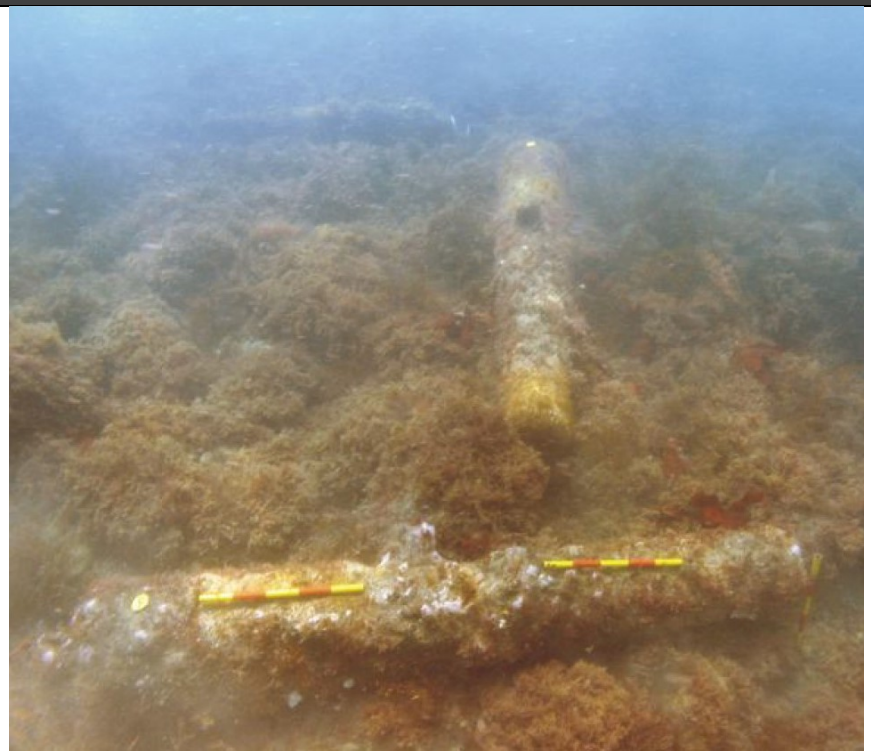
Photo Position	2004	2021
2d		
View of guns 31, 32, and 32 facing south		

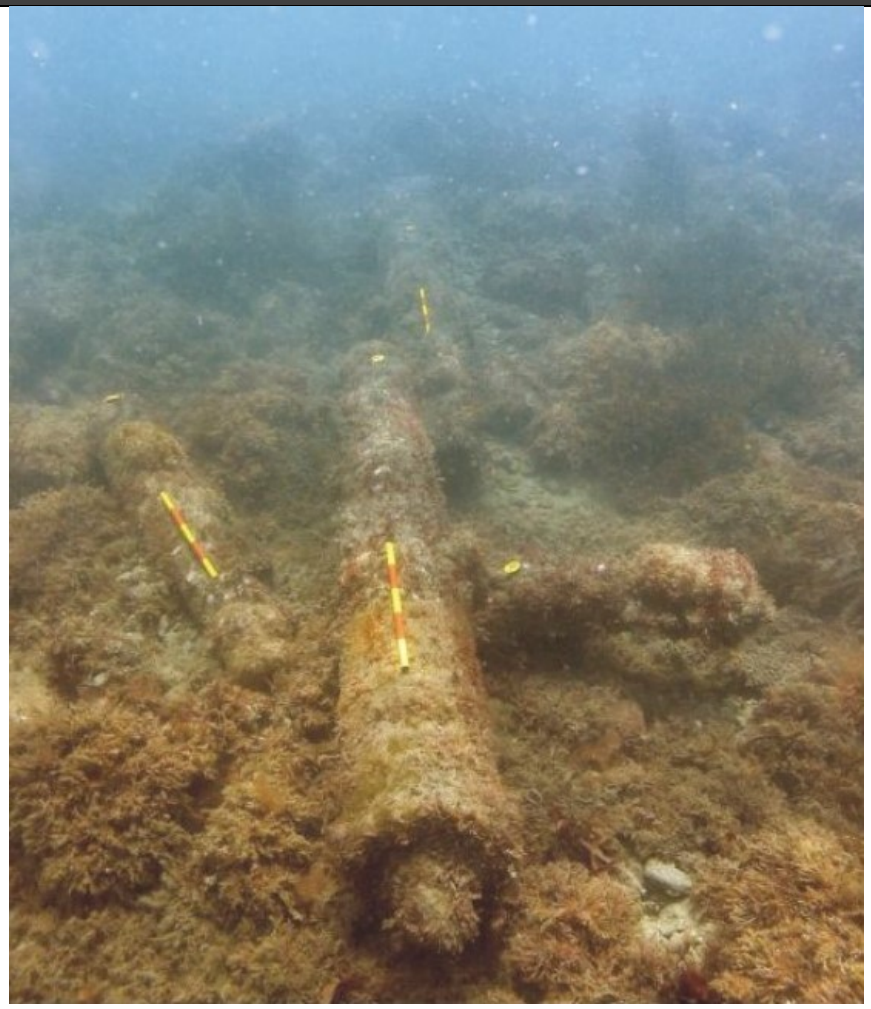
Photo Position	2004	2021
2e		
View of guns 27, 28, 29, and 30 facing S.		

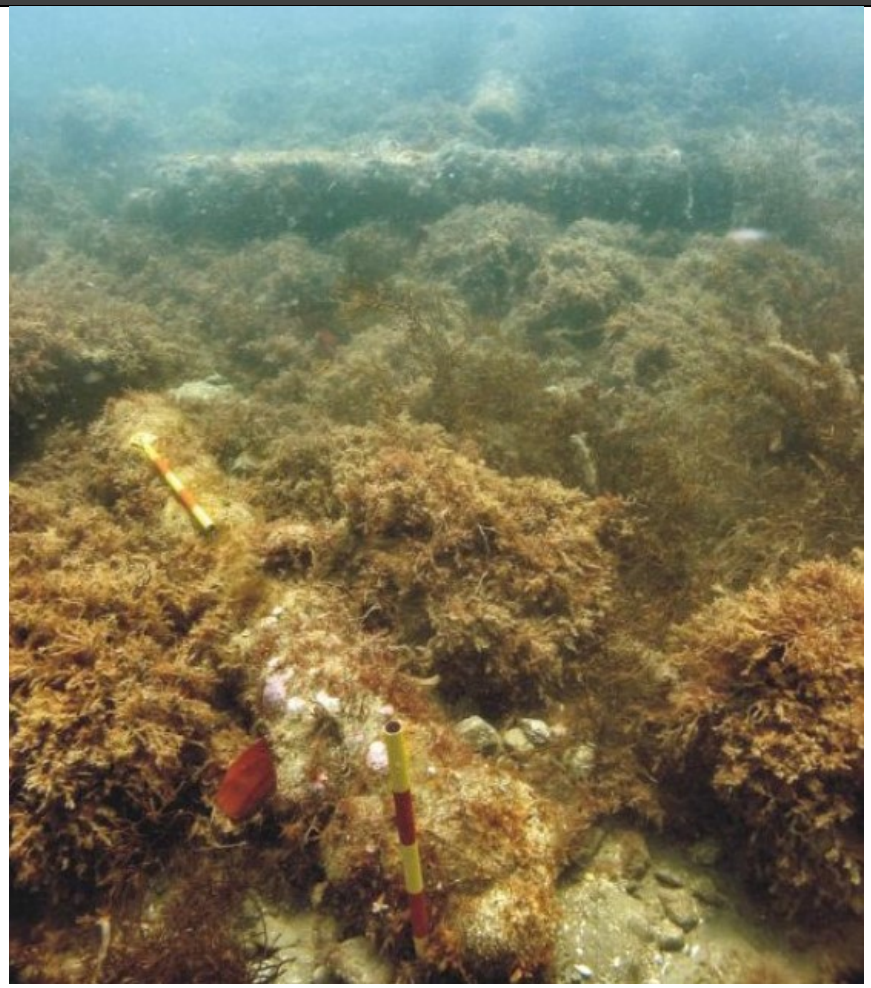
Photo Position	2004	2021
2f		
View of guns 32, 33, and 34 facing S.		

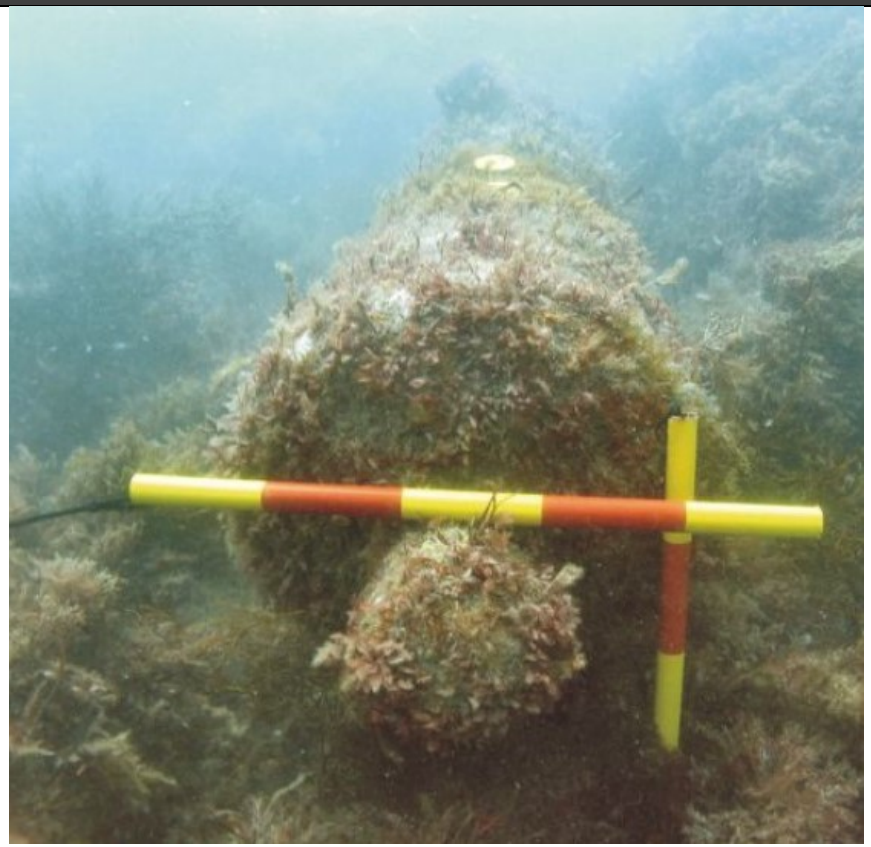
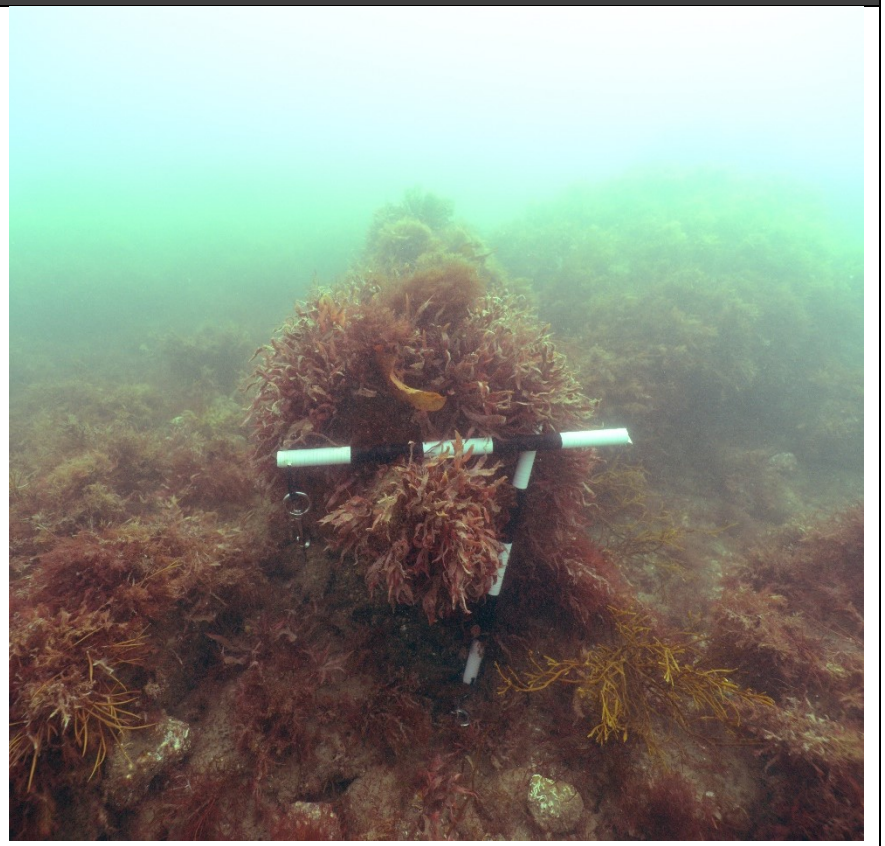
Photo Position	2004	2021
3a		
View of button and base of gun 11 facing SW		

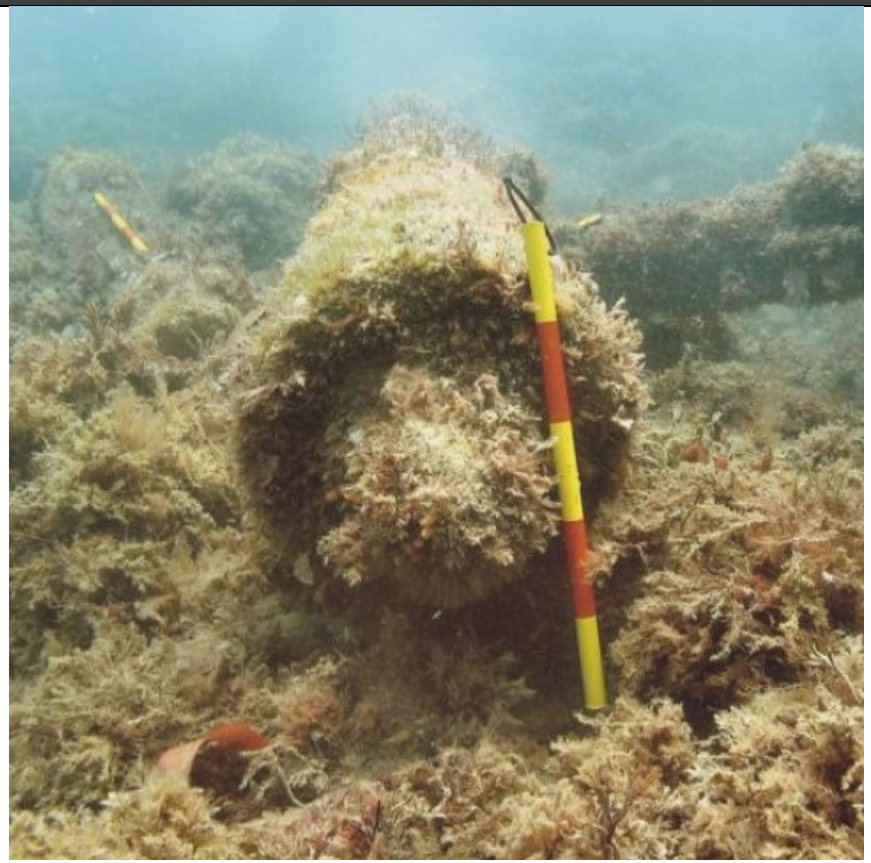
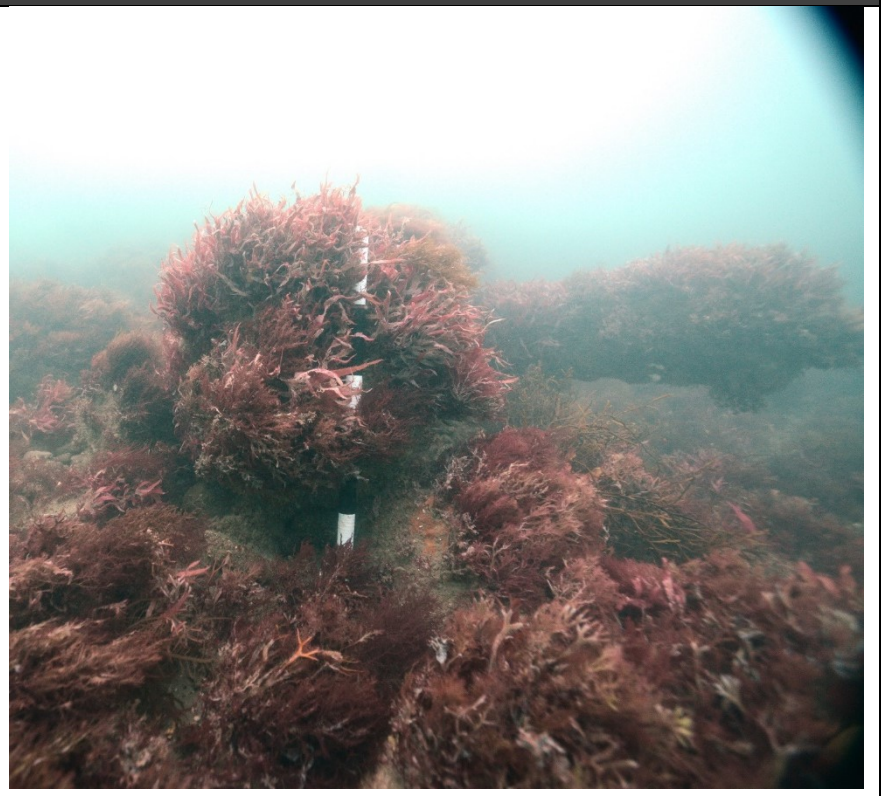
Photo Position	2004	2021
3b		
View of base and button of gun 28, with gun 29 on the right, facing S.		

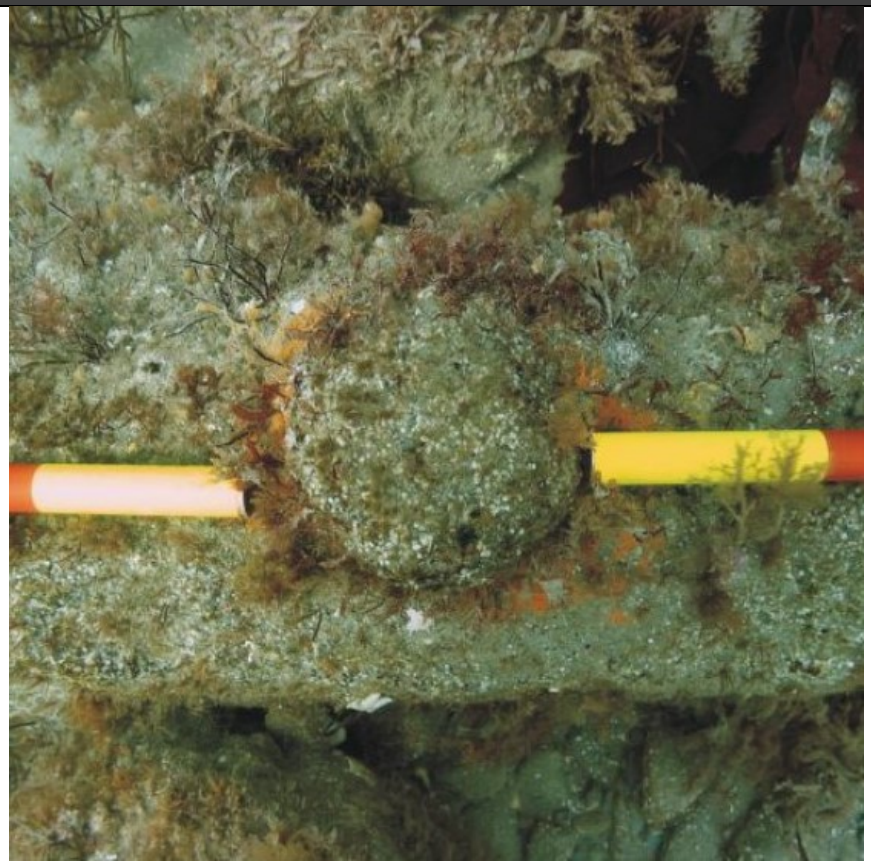
Photo Position	2004	2021
3c		
View of trunion on gun 3 facing E.		

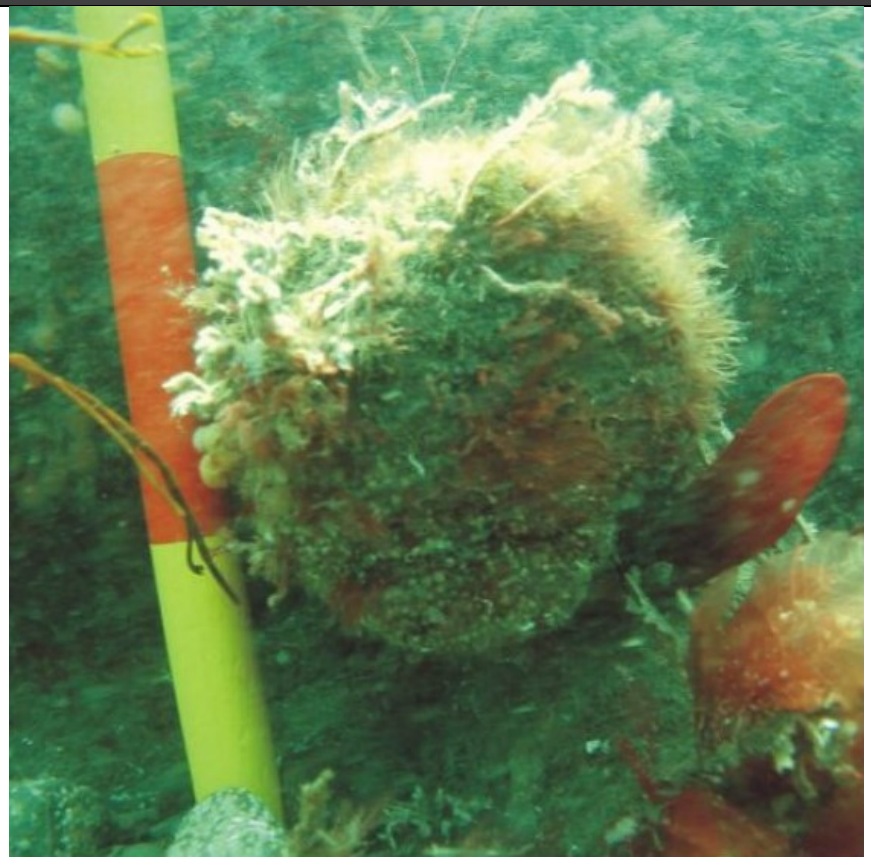
Photo Position	2004	2021
3d		
View of trunion on gun 4 facing SE		

Photo Position	2004	2021
3e		
View of muzzle of gun 3 facing S.		

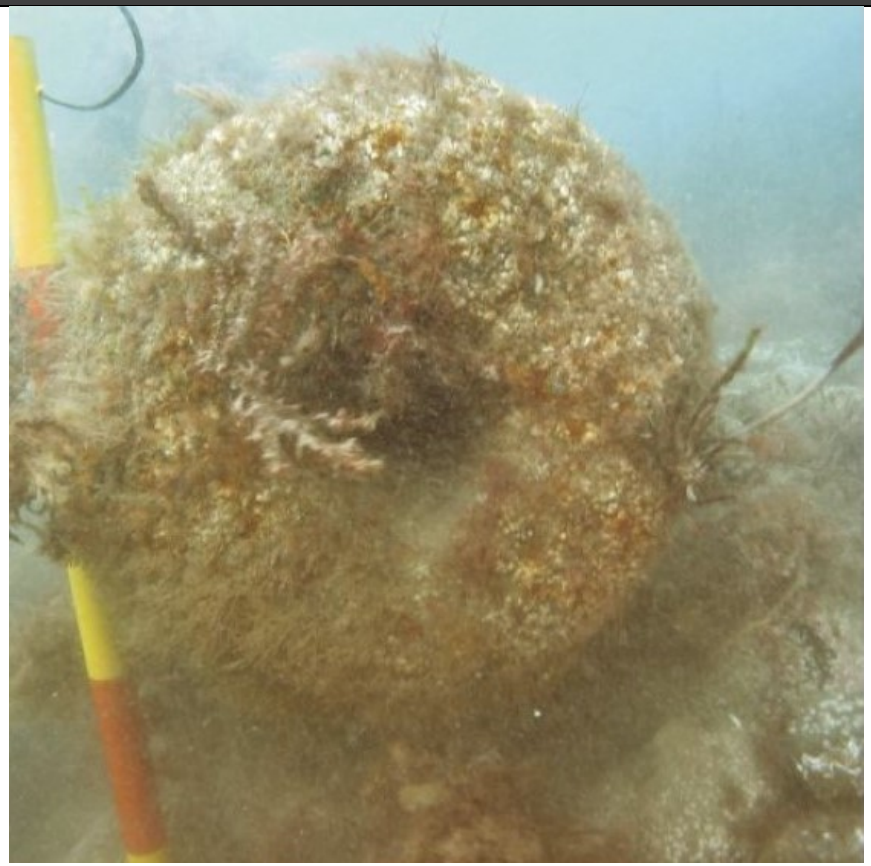
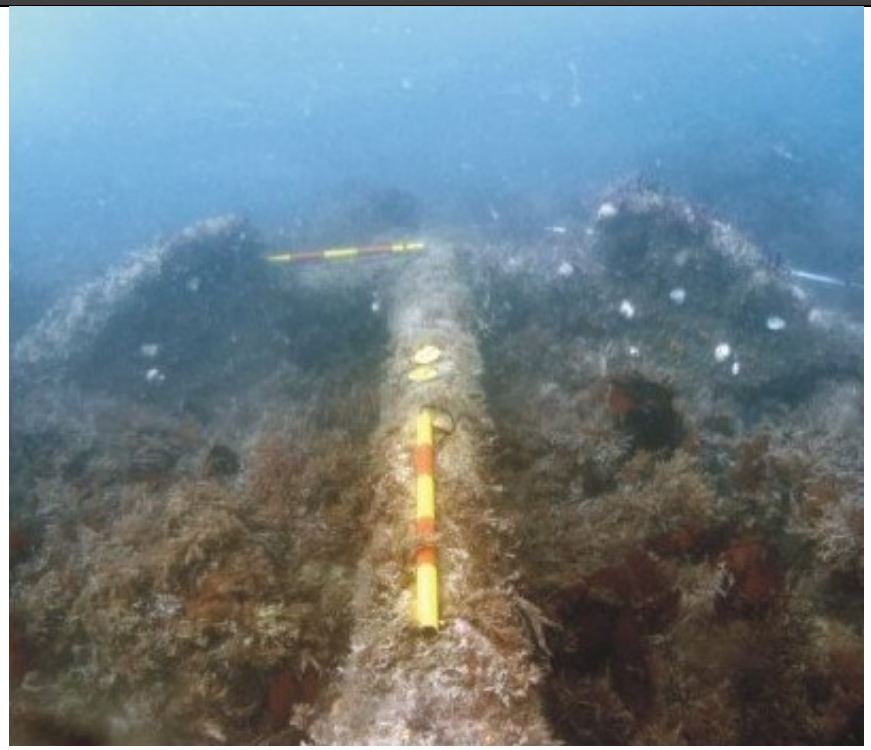
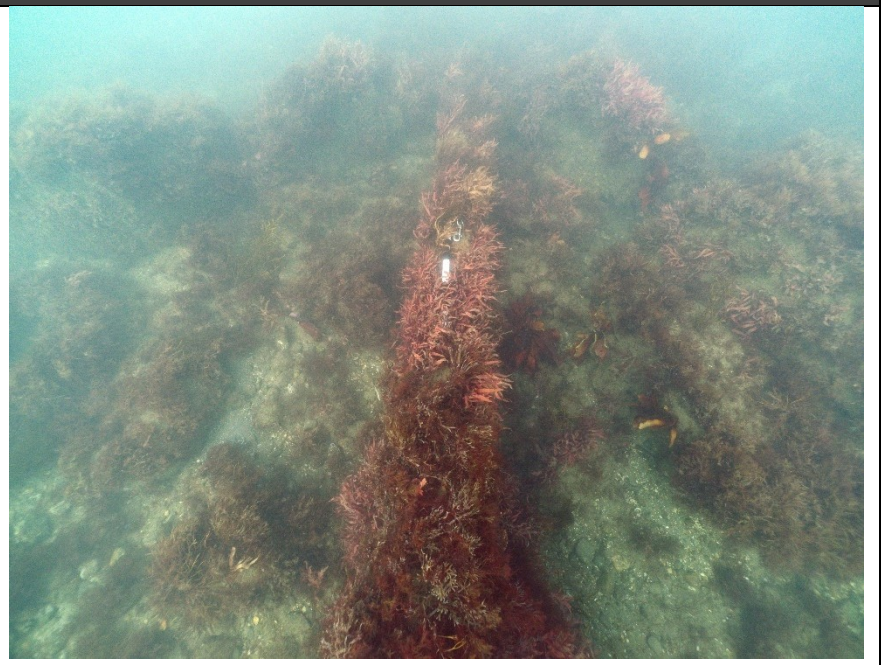
Photo Position	2004	2021
3f		
View of muzzle of gun 13 facing W.		

Photo Position	2004	2021
4a		
View of anchor 12 facing NW		

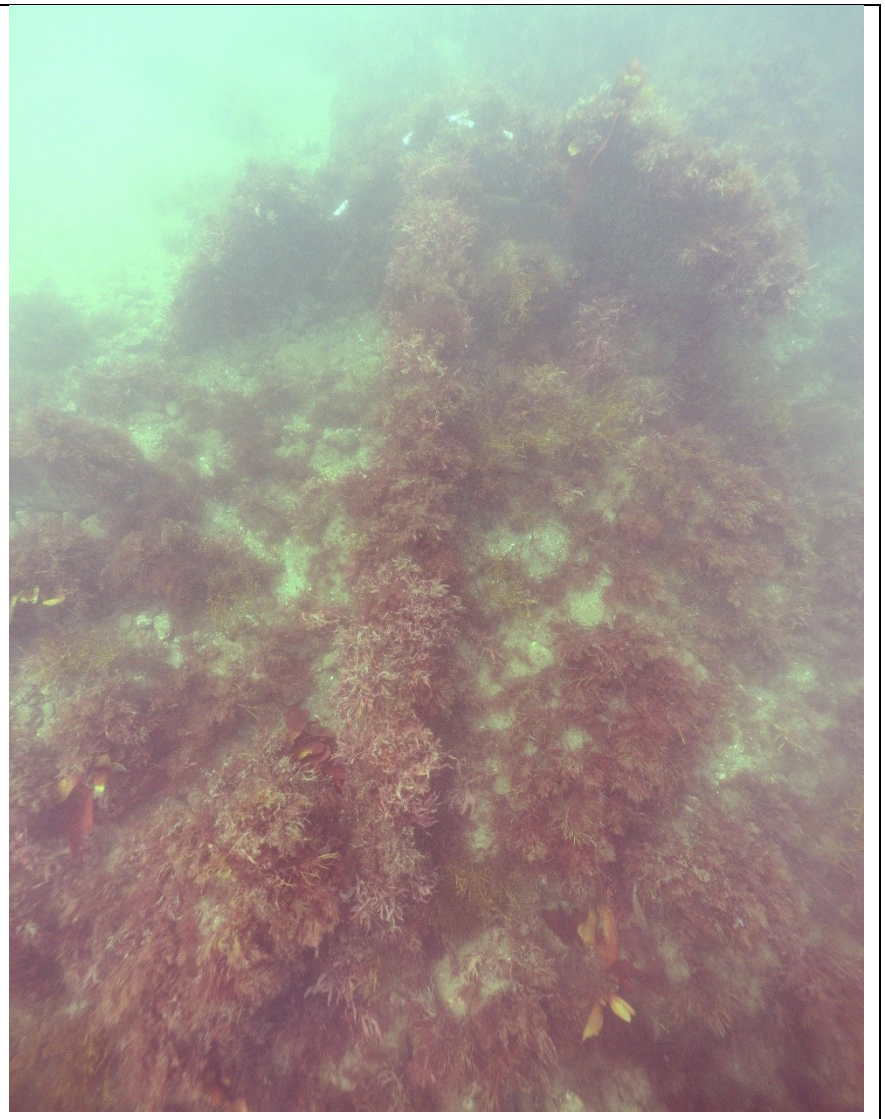
4b		
View of anchor 26 facing SW		

Photo Position	2004	2021
4c		
View of the ring on anchor 12 facing NW		

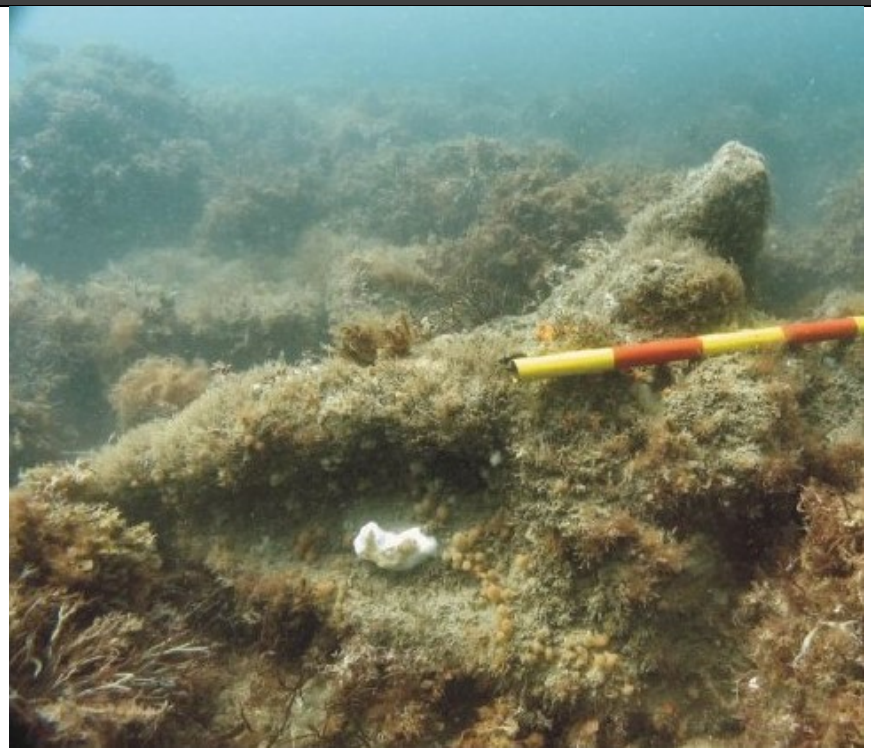
Photo Position	2004	2021
4d		
Unknown features.		

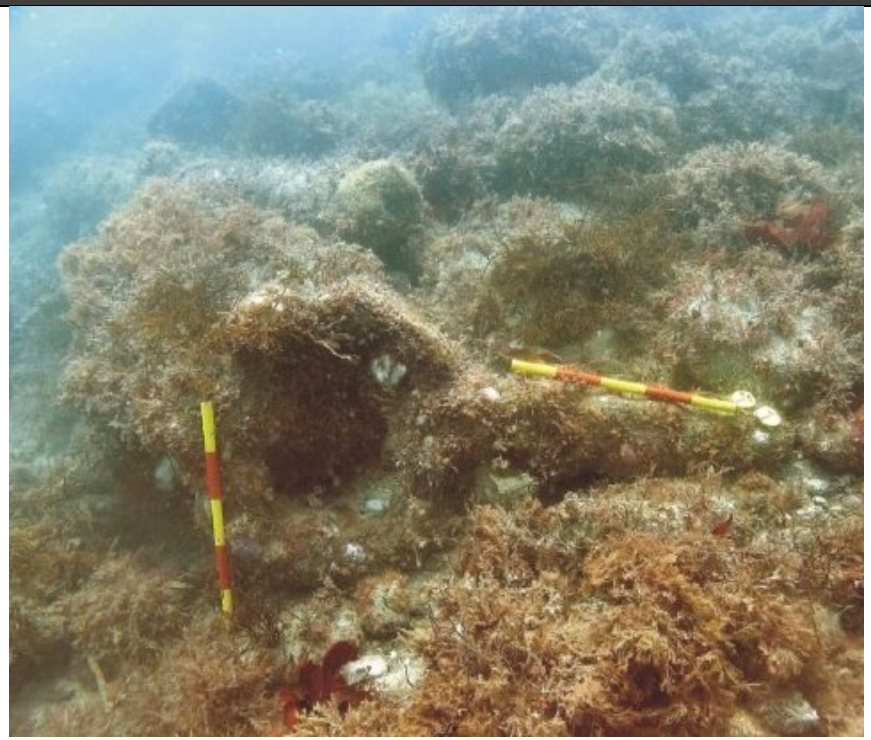
Photo Position	2004	2021
4e		
View of anchor ring 20 with partial shaft, facing SSE.		

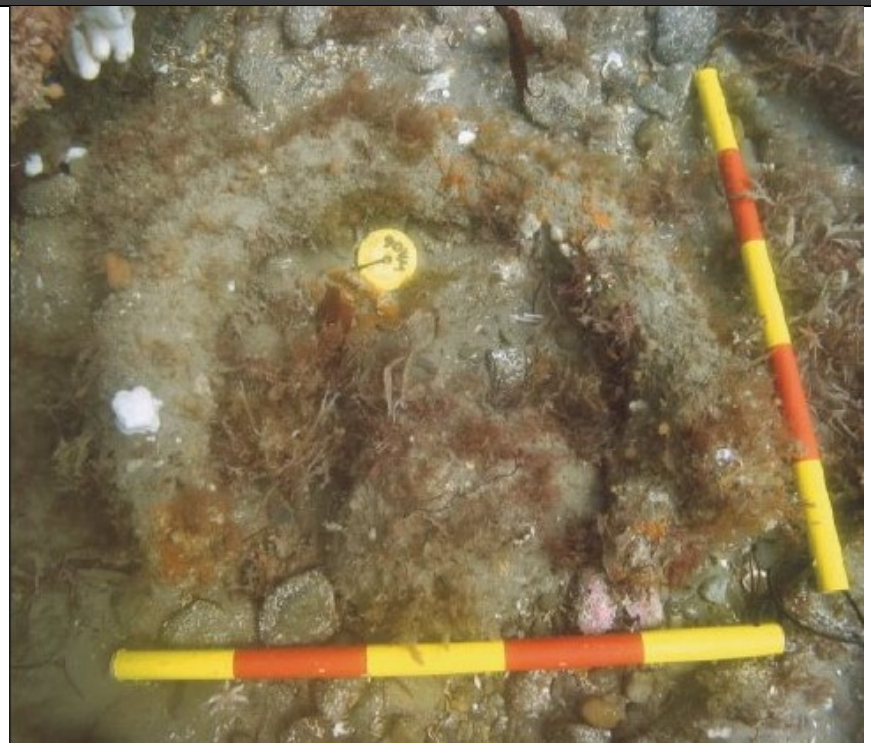
Photo Position	2004	2021
4f		
View of anchor ring 14 facing S.		

Table 4: Repeat photographic survey results.

5.4 Environmental Monitoring

5.4.1 In advance of the project, MSDS Marine undertook bespoke training from Andrew Viduka. The training received was to work with the Gathering Information via Recreational and Technical (GIRT) Scientific Divers12 methodology. The GIRT methodology has been developed to enable better understanding of the condition of wreck sites and the climate change factors driving their preservation or deterioration. It also aims to encourage interested people to have an active and positive public archaeology role.

5.4.2 During fieldwork GIRT recording forms were completed. These are given in Annex C.

5.4.3 The information recorded in these forms will enable repeatable measurements to be undertaken in future by both archaeological contractors and recreational divers.

Baseline Species Audit

5.4.4 Footage was collected by divers using a GoPro video camera on day 2 of the fieldwork, the footage was reviewed after the diving had taken place. Where possible, the marine life on the site was identified. It was possible to identify thirty-two different species using the footage however, there will have been many more present that were either too small to see or that were too difficult to identify using the footage alone.

Fish

5.4.5 Overall, ten species of fish were seen including Corkwing wrasse (*Symphodus melops*), Tompot blenny (*Parablennius gattorugine*), Two-spotted goby (*Gobius ruthensparri*), Goldsinny (*Ctenolabrus rupestris*), Bib (*Trisopterus lusccus*) and Poor cod (*Trisopterus minutus*). Others were observed however, confident identification could not be made. It is possible these included Bream, Cod or Whiting, and a fish which to date, it has not been possible to narrow down to a UK species, see Figure 12.

Figure 12: Unidentified fish at the Bronze Bell wreck site

[12] https://www.girtsd.org/

Crustacea and Mollusca

5.4.6 Three species of crab along with the common lobster (*Homarus Gammarus*) were observed on the site. These crabs included Spiny spider crab *(Maja brachydactyla),* Velvet swimming crab *(Necora puber)* and Edible crab *(Cancer pagurus)*.

5.4.7 It was difficult to observe mollusca due to the quality and definition of underwater footage and the diving being an overview of the site rather than close-ups of the seabed, however, two species could be identified and these were Oyster drill *(Ocenebra erinacea)* and Painted topshell *(Calliostoma zizyphinum)*.

Porifera, Cnidaria and Chordata

5.4.8 Using the GoPro video footage, it was possible to identify six types of sponge on the site with most of these appearing on the marble blocks that were covered with marine growth. Two species of orange sponge could be seen, with one that was possibly Golf Ball sponge (*Tethya aurantium*). White or pink sponges could also be seen including Dead Man's Fingers *(Alcyonium digitatum)* with one of the others thought to be Prawn Cracker sponge (*Axinella infundibuliformis*). The Boring sponge (*Cliona celata*) was also observed on the marble blocks. Marble blocks recovered from the site previously have shown evidence of marine boring species, see Figure 13.

Figure 13: Close up of a marble block recovered from the site showing signs of marine boring organisms

5.4.9 Numerous Snakeslock anemones *(Anemonia viridis)* could be seen on the site. Two species of tunicate could be identified including the Sea Squirt *(Morchellium argus)* and the Leathery Sea Squirt *(Styela clava*).

Algae

5.4.10 In total, eight different species of seaweed could be distinguished using the footage and those that could be identified to species level included Eyelash Weed *(Calliblepharis ciliate)*, Irish Moss *(Chondrus crispus)*, Red Rags *(Dilsea carnosa)* and Sea Oak *(Halydris siliquosa)*.

Species Summary

5.4.11 All of the species identified during the survey are consistent with what would be expected in Cardigan Bay. It has not been possible to confidently identify some species using the footage alone, and as discussed above, one species of fish could not be identified at all.

5.4.12 In future surveys on this, and other wreck sites, a repeatable scientific approach could be used to monitor the marine life and the information collected could be added to national citizen

science initiatives such as the Marine Biological Association's *The Big Seaweed Search* and other sea life surveys.

pH Monitoring

5.4.13 pH measurements were taken daily during fieldwork, from samples collected both at the surface and on the seabed using a handheld probe. They will provide a baseline dataset for repeated monitoring in future years. These are given below in Table 5.

Date	Time	Location	pH
13/09/2021	2:00pm	Seabed	7.81
14/09/2021	2:30pm	Surface	7.92
14/09/2021	3:45pm	Seabed	7.88
15/09/2021	2:00pm	Seabed	7.92
15/09/2021	2:30pm	Surface	7.86
16/09/2021	12:30pm	Surface	7.92
16/09/2021	12:50pm	Seabed	7.89

Table 5: pH measurements

6.0 Public Engagement

6.1 Dive Diaries

6.1.1 During fieldwork the team produced daily dive video diaries and accompanying bilingual blog posts. These were released daily on the CHERISH website[13] and promoted by social media posts.

6.1.2 Videos produced are listed below in Table 6.

Day	Title	Summary	Running Time
0	The Museum	Introducing the fieldwork and history of the wreck with a visit to the Ty Gwyn Museum and Bennar Beach. Interviews with Geraint Jones, Alan Vincent and Ian Cundy.	7:10
1	Scouting the Site	Explaining the objectives of fieldwork. Interview with Alison James.	2:58
2	Photogrammetry	Explaining the purpose and technique of photogrammetry. Interview with Alison James and Felix Pedrotti.	2:37
3	Nature and History	Explaining the purposes of monitoring the site for climate change, looking at change to the site since 2004 and introducing marine wildlife found at the site. Interviews with Alison James, Simon Adey-Davis, Jenny Kent and Jessica Mitchell.	5:52
4	Tracking the Divers	Explaining and demonstrating the role of diver tracking. Interview with Phoebe Wild.	2:56
5	Gear and Logistics	Explaining the process of preparing for fieldwork and showcasing the equipment used by the team. Interview with Tom Harrison.	2:19
Dive Diary Extras	Staying Alive	Explaining how an archaeological project's dive supervisor keeps the divers safe. Interview with Mark James	1:51
Dive Diary Extras	Bronze Bell Team	Introducing the project team	0:28

Table 6: Dive Diaries.

[13] http://cherishproject.eu/en/project-news/blog-posts/bronze-bell-wreck-dive/

6.2 Heritage Hive

6.2.1 The MSDS Marine Heritage Hive is a dedicated marine outreach trailer. The Heritage Hive is available to take to conferences, events and fieldwork locations during the course of our work. The trailer includes an independent power supply with TV, display space with panels that can be easily removed and updated, and a counter to display material including leaflets and other documents.

6.2.2 The Heritage Hive is packed with hands on activities, Virtual Reality equipment, and other resources designed to engage audiences of all ages. Activities and displays can all be tailored to the project being promoted. The Heritage Hive adds excellent public value to all our projects and enables the team to share what they love with a wider audience.

6.2.3 The Heritage Hive was used during the course of the project to provide a highly visible focal point for all public engagement activities. It was situated at Pwllheli Marina for the duration of the fieldwork and opened daily post dive to engage with the local community. In addition, on the day of fieldwork lost due to weather the dive team were able to open the Heritage Hive for a full day.

6.2.4 During fieldwork we were able to talk to many members of the public, including divers from Southport BSAC. The divers are now keen to become Licensees for the wreck and to undertake regular monitoring visits to aid site management. MSDS Marine are supporting them in their application and in providing advice and support going forwards.

6.3 Social Media

6.3.1 Bilingual local media posts were made via the CHERISH Twitter, Facebook and Instagram channels immediately prior to, and during fieldwork.

6.4 Media

6.4.1 A visit by a presenter, Andy Davies, and camera operator, from Channel 4 news was hosted on the diving support vessel during fieldwork. Project Manager, Alison James, was interviewed for inclusion within the news item. A five-minute feature on the project, and the wider CHERISH project, was broadcast on Channel 4 news on the 21st September 2021[14].

6.5 School Visits

6.5.1 A number of local primary and secondary schools were contacted prior to fieldwork to offer visits. Team members Simon Adey Davis and Alison James visited a local primary school, Ysgol Gynradd Abererch, and provided hands on STEM sessions with all KS1 and KS2 children on Friday 17th September 2021.

6.6 Other Outreach

6.6.1 Following fieldwork Alison James took part in a Mariners Mirror podcast with Dr Julian Whitewright, Senior Maritime Investigator at the Royal Commission for the Ancient and

[14] https://www.channel4.com/news/from-shipwrecks-to-iron-age-forts-how-climate-change-threatens-our-heritage

Historical Monuments of Wales, the episode *The Maritime History of Wales 3: The Bronze Bell Wreck* broadcast on 18th November 2021[15].

6.6.2 Alison James provided a public online lecture as part of the RCAHMS lecture series on 17th February 2022 titled *Diving Back onto the Bronze Bell Wreck*.

[15] https://snr.org.uk/the-mariners-mirror-podcast/the-maritime-history-of-wales-3-the-bronze-bell-wreck/

7.0 Recommendations

7.0.1 The project has been highly successful at forming a partnership between a range of stakeholders for the site, namely CHERISH and its partners, MADU, the Ty Gwyn Museum and MSDS Marine.

7.0.2 The following recommendations are made to ensure proactive management of the site is continued.

7.1 BB Recommendation 1 – Further Diver Survey with Acoustic Tracking

7.1.1 The project was successful in achieving all its aims and has collected baseline environmental data which will enable the effects of climate change on the wreck to be monitored. It is now recommended that further diving takes place to build on the baseline information, ideally, a programme of annual survey should be implemented to enable a long-term picture to be established on the effects of climate change on the wreck. The progress gained in understanding the site should now be maximised to ensure it has long term impact and that the current gains are not wasted.

7.1.2 The high intensity storms of early 2022 may have had a significant impact on the site and it would be beneficial to revisit the site this year to observe their impact.

7.1.3 Any visit would ideally happen earlier in the year to ensure less marine growth is present on the site. Further survey will enable Cadw to ensure the site is managed proactively in future.

7.2 BB Recommendation 2 – A Geophysical Survey Programme

7.2.1 The 2020 multibeam bathymetry survey has enabled high resolution data of the site to be collected. Establishing an annual, or biennial, programme of survey on the site will allow for a greater archive of data to be established from which changes to the seabed and the site can be accurately and visually monitored, and areas of the site prioritised for future works.

7.3 BB Recommendation 3 – A Programme of Limited Excavation

7.3.1 The 2020 multibeam bathymetry data shows a greater depth of water to the east and west of the site which may suggest the vessel ran onto a sand bar and wrecked. In addition, there is a possibility that buried structural remains exist under the cargo mound. A programme of limited excavation on the site would enable these questions to be addressed and result in a greater understanding of both the wrecking process and the remains on site. Further understanding of the site would enable informed, proactive site management in future.

7.4 BB Recommendation 4 – A Physical Dive Trail

7.4.1 A dive trail for the site was first suggested in 2018 by MADU and there is clear merit in this suggestion[16]. The sites' location in 10m of water close to the shore, and the large number of cannon and anchors on the seabed, make it an ideal candidate for the first Welsh underwater dive trail on a historic wreck to be established. In addition, shore access with an inflatable boat

[16] MADU, 2018. *Recommendations for the Management and Administration of a Diver Trail for the Bronze Bell (Tal-y-Bont) Shipwreck Site*?, unpublished report for Cadw

or access from Barmouth, make it a relatively easy site to access. Visiting divers should be encouraged to feed into ongoing site management by contributing to photographic monitoring at key locations. In addition, they could be encouraged to feed into marine flora and fauna surveys to enable climate change monitoring to continue between contractor visits.

7.5 BB Recommendation 5 – A Virtual Dive Trail

CHERISH
Newid Hinsawdd a Threftadaeth yr Arfordir
Climate Change and Coastal Heritage
Athrú Aeráide agus Oidhreacht Chultúrtha

7.5.1 A high level of public interest in the project has been demonstrated by the number of people engaging with the public engagement activities provided. The site now has high resolution multibeam and photogrammetry data that could easily be used as the foundations for a virtual dive trail. Virtual dive trails are now a common feature of English protected wreck sites and the Bronze Bell wreck would benefit from a virtual trail to enable increased public engagement. Any trail created could also be hosted on a touch screen terminal within Ty Gwyn Museum to enable visitors to find out more about the wreck as it is today.

7.6 BB Recommendation 6 – Video Digitisation

7.6.1 During the course of the project, MSDS Marine were approached by diver Chris Holden. Mr Holden has passed ten VHS tapes of the site to the team. The details on these are presented in Table 7 below.

Video number	Date (where known)	Information as written on the box
1	Unknown	Bronze Bell
2	08/08/1986	Marine Archaeology 'Y CLoch Efydd' Bronze Bell Wreck
3	June 2001	Bronze Bell
4	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1107
5	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1108
6	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1111
7	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1112
8	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1115
9	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1121
10	2004?	Wreck Detectives Bronze Bell – Roll #WD11/1122

Table 7: Bronze Bell VHS tapes

7.6.2 Currently MSDS Marine have not been able to watch these videos, as we are unsure of the stability of the media and would wish to undertake digitising first. Therefore, it is recommended that they are digitised and added to the site archive. In addition, a desk-based exercise to view the videos and compare changes to the site over time is recommended. These videos represent a unique opportunity for further study on the site to look for evidence of climate changes over a long period.

7.7 BB Recommendation 7 – Further Historical Research

7.7.1 The work to research the Bronze Bell's origin will continue by MSDS Marine outside of this project. Further research could be undertaken to look at Italian ship building in 1677 to further understand the identity of the wreck.

7.7.2 The site would also benefit from a programme of further archival and historical research to address some of the theories proposed by Tom Bennett in his recent publication about the wreck[17].

[17] Bennett, T. 2018, *Ty Gwyn and the Bronze Bell Wreck*

8.0 Annex A – Dive Details

Dive Number	Date	Diver	Start Time	Max Depth	Bottom Time	Environmental Conditions	Task
1	13/09/21	Tom Harrison	13:52	7.5m	49 minutes	Low wind, sea calm, overcast, good visibility	Photography of features at key points
	13/09/21	Jessica Mitchell	13:52	7.5m	49 minutes		
2	13/09/21	Simon Adey-Davies	15:03	6.6m	43 minutes		Visual inspection to compare how the site has changed since the Wessex Archaeology visit in 2004* note both Jenny and Simon formed part of the 2004 dive team.
	13/09/21	Jenny Kent	15:03	6.6m	43 minutes		
3	13/09/21	Tom Harrison	16:09	7.7m	57 minutes		Photogrammetry
	13/09/21	Felix Pedrotti	16:09	7.7m	57 minutes		
Bottom Time					**298 minutes**		
4	14/09/21	Jessica Mitchell	11:51	6.8m	67 minutes	Sunny, low current, flat/calm sea, excellent visibility	Photography of features at key points
	14/09/21	Tom Harrison	11:51	8.4m	67 minutes		
5	14/09/21	Felix Pedrotti	13:20	7.8m	46 minutes		Photogrammetry and pH sampling
	14/09/21	Simon Adey-Davies	13:20	7.8m	46 minutes		
6	14/09/21	Tom Harrison	14:34	7.9m	61 minutes		Marine species identification
	14/09/21	Jenny Kent	14:34	8.6m	61 minutes		
Bottom Time					**348 minutes**		

7	15/09/21	Tom Harrison	12:00	7.1m	64 minutes	Flat, nil wind, slight mist but gradually clearing, sunny, good visibility.	Photography of features at key points
	15/09/21	Jessica Mitchell	12:00	7.5m	64 minutes		
8	15/09/21	Simon Adey-Davies	13:30	7.6m	56 minutes		Photogrammetry and pH sampling
	15/09/21	Felix Pedrotti	13:30	7.6m	56 minutes		
9	15/09/21	Jessica Mitchell	15:09	8.1m	59 minutes		Videography of marine species
	15/09/21	Jenny Kent	15:09	8.1m	59 minutes		
Bottom Time					**358 minutes**		
10	16/09/21	Tom Harrison	11:42	6.7m	64 minutes	Sunny, excellent visibility, warm, flat calm.	Targeted measurement of key features
	16/09/21	Simon Adey-Davies	11:42	5.9m	64 minutes		
11	16/09/21	Felix Pedrotti	13:17	5.9m	64 minutes		Photogrammetry and Videography
	16/09/21	Jessica Mitchell	13:17	6.1m	64 minutes		
12	16/09/21	Jenny Kent	14:57	7.4m	43 minutes		Marine species identification
	16/09/21	Simon Adey-Davies	14:57	7.9m	43 minutes		
Bottom Time					**342 minutes**		

Total Bottom Time	**1346 minutes**

9.0 Annex B – Archaeological Measurements

9.1 Cannon

MSDS ID	Zone	Type	Material	Orientation	Condition	Muzzle to Base	Trunnion to Base	Base to Button	Diameter of Base	Trunnion to Trunnion	Diameter of Muzzle	Width of Trunnion	Length of Trunnion	Bore	Diameter of Tiller
1	North	Gun	Cast Iron	SE/NW	Concreted										
2	North	Gun	Cast Iron	SSW/NNE	Concreted										
3	North	Gun	Cast Iron	N/S	Concreted										
4	North	Gun	Cast Iron	NE/SW	Concreted										
5	North	Gun	Cast Iron	WSE/WNW	Concreted	2500	1000	170	450	380	270				
6	East	Gun	Cast Iron	NW/SE	Concreted										
7	East	Gun	Cast Iron	NNW/SSE	Concreted										
11	East	Gun	Cast Iron	SE/NW	Concreted	2480			500		280	100			
13	East	Gun	Cast Iron	E/W	Concreted										
15	South	Gun	Cast Iron	NW/SE	Concreted										
16	South	Gun	Cast Iron	NE/SW	Concreted										
17	South	Gun	Cast Iron	SE/NW	Concreted										
18	West	Gun	Cast Iron	NW/SE	Heavily concreted	2470	1030	250	420	270	260	140	110	N/A	N/A
19	West	Gun	Cast Iron	W/E	Heavily concreted	2480	980	190	520	420	330	170	110	N/A	N/A
21	West	Gun	Cast Iron	NNW/SSE	Heavily concreted with attached concreted items	2680	1050	190	430	400	280	150	120		

MSDS ID	Zone	Type	Material	Orientation	Condition	Muzzle to Base	Trunnion to Base	Base to Button	Diameter of Base	Trunnion to Trunnion	Diameter of Muzzle	Width of Trunnion	Length of Trunnion	Bore	Diameter of Tiller
22	West	Gun	Cast Iron	N/S	Heavily concreted with attached concreted items	1830	740	100	350	320	200	100	80	none	
23	West	Gun	Cast Iron	NE/SW	Heavily concreted with attached concreted items	2570	940	150	460	370	340	160	130		
24	West	Swivel Gun	Wrought Iron	N/S	Concreted	1170		360	220		190				80
25	West	Gun	Cast Iron	NNW/SSE	Heavily concreted	1730	700	240	380	320	280	85	70	none	N/A
27	West	Gun	Cast Iron	NNW/SSE	Light concretion	2520	880	180	440	360	320	110	120	none	N/A
28	West	Gun	Cast Iron	SSW/NNE	Light concretion	1770	650	160	300	270	200	100	80	55	
29	West	Swivel Gun	Cast Iron	NNW/SSE	Heavily concreted Trunnion	2510	1050	170	440	370	310	130	100	none	
30	West	Swivel Gun	Cast Iron	NW/SE	Heavily concreted Trunnion	1860	770	150	320	240	220	100	70	none	
31	West	Gun	Cast Iron	E/W	Light concretion	1780	700	180	320	300	210	55	70	50	
32	West	Gun	Cast Iron	NE/SW	Light concretion	2460	880	240	460	380	280	120	100	80	
33	West	Gun	Cast Iron	W/E	Light concretion	2510	1030	190	240	320	290	80	100	80	

MSDS ID	Zone	Type	Material	Orientation	Condition	Muzzle to Base	Trunnion to Base	Base to Button	Diameter of Base	Trunnion to Trunnion	Diameter of Muzzle	Width of Trunnion	Length of Trunnion	Bore	Diameter of Tiller
34	West	Gun	Cast Iron	SSW/NNE	Light concretion	1740	700	180	320	260	240	70	70	70	

* All measurements are in mm.

9.2 Anchors

MSDS ID	Zone	Type	Material	Orientation	Condition	Bill to Shank	Ring Diameter	Internal Ring Diameter	Bar Length	Bar Width
8	East	Anchor	Iron	E/W	Southern fluke broken					
9	East	Anchor Ring	Iron	N/A	Broken in half		700			
12	East	Anchor	Iron	SE/NW	Not recorded					
14	East	Anchor Ring	Iron	N/A	Not recorded					
20	West	Anchor Ring and Shank	Iron	NE/SW	Not recorded		660	370	750	170

9.3 Other Features

MSDS ID	Zone	Type	Material	Orientation	Condition	Length	Width
10	East	Concreted Rings	Iron	N/A	Heavily concreted		
35	West	Cylindrical object	Iron	NW/SE	Not recorded	750	50

10.0 Annex C – GIRT Recording Forms