Image: Marcus Ross

Diver surveys at Berwickshire Marine Protected Area

August 2021

PROJECT BASELINE UNITED KINGDOM

BLUE MARINE FOUNDATION

British Sub-Aqua Jubilee Trust

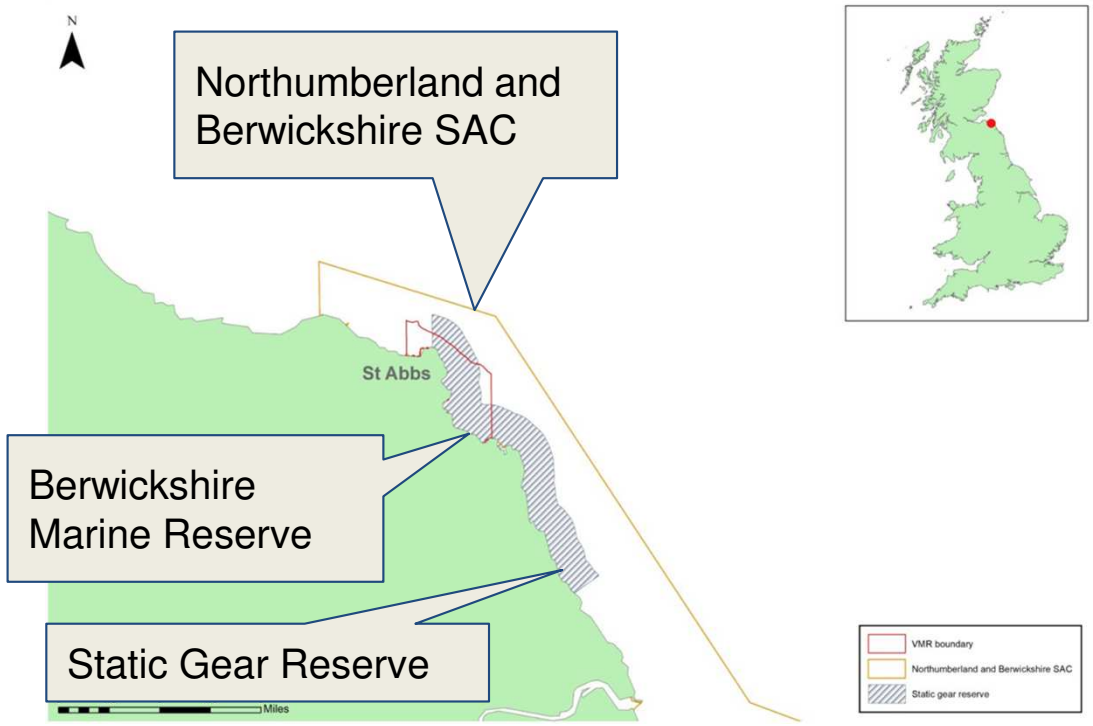
Contents

Berwickshire Marine Protected Area

Blue Marine Foundation (BLUE) has identified the St Abbs and surrounding Berwickshire coastline as a site of both ecological and socio-economic importance.

The Berwickshire Marine Reserve (BMR) was designated in 1984 is the only voluntary marine reserve in Scotland and the second oldest marine reserve in the UK. It extends along 9 km of the Berwickshire coastline in southeast Scotland and encompasses St Abbs. It is notable for its rich marine biodiversity, due to converging northern and southern currents. The area contains sea caves, rocky reefs and kelp forests. The BMR is widely regarded as one of the top dive sites in the UK and is also an important site for commercial static gear fishing.

The BMR itself sits within a multitude of Marine Protected Areas (MPAs) that recognise its national and international importance, which include the Berwickshire and North Northumberland marine Special Area of Conservation (SAC) and a Static Gear Reserve that bans the use of any mobile gear in an area which encompasses the majority of the BMR.



Project aims

The Berwickshire MPA's long history has fostered a strong community voice for improved marine management. However, in recent years, gaps in data persist for many marine habitats, fisheries and stakeholders.

BLUE aims to work with the community of Berwickshire to create a template for well protected and sustainably managed MPAs in Scotland following a Lyme Bay style model, protecting coastal areas at the whole site level.

The aim of this inaugural project week was to explore and build potential collaboration opportunities between Project Baseline UK and BLUE. Project Baseline UK divers aimed to gather survey data to support BLUE's ongoing conservation efforts in Berwickshire, and identify the scope of potential future expeditions.

The objectives of the project were to:

- Ground truth sites within the Berwickshire MPA that are unreachable by towed devices using diver surveys
- Conduct diver video transects and surveys
- Generate media for a short documentary film on the project

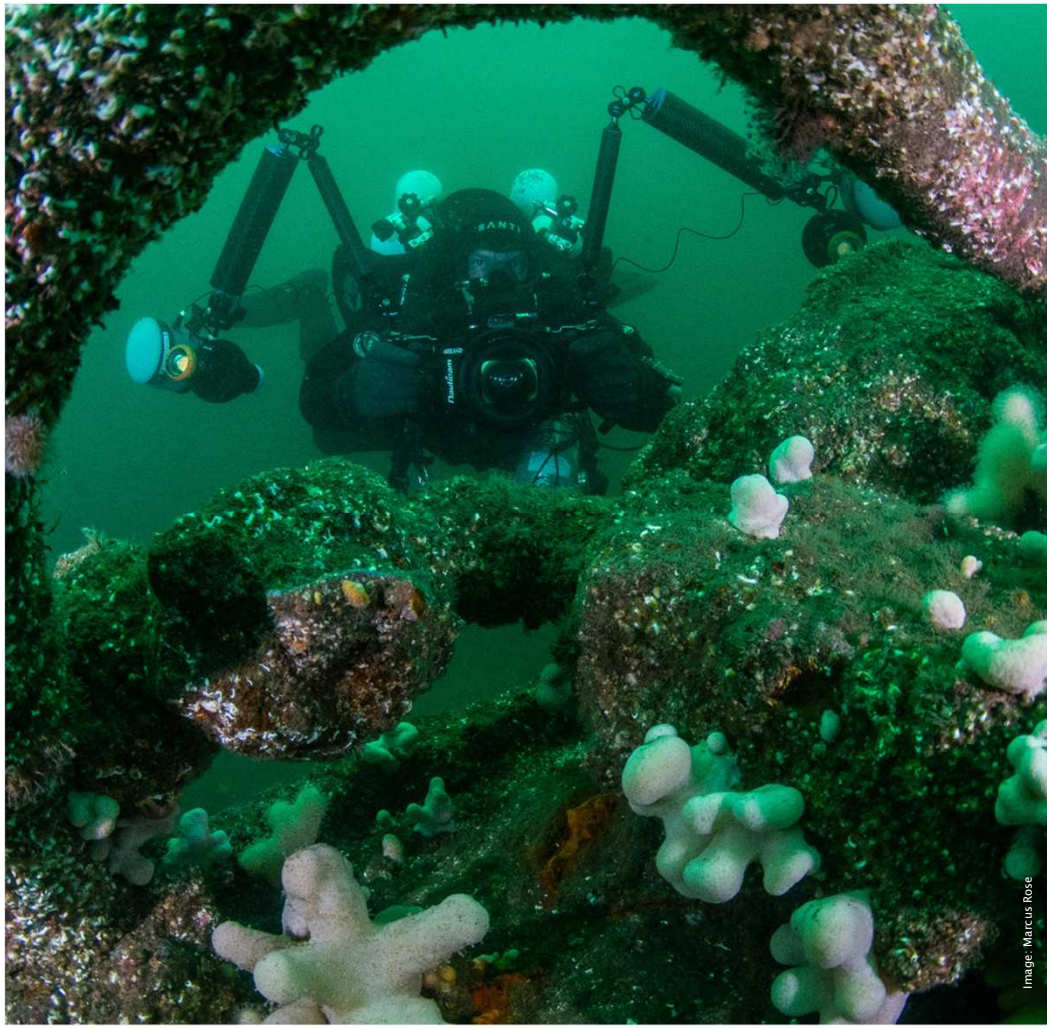


Image: Marcus Rose

Diving

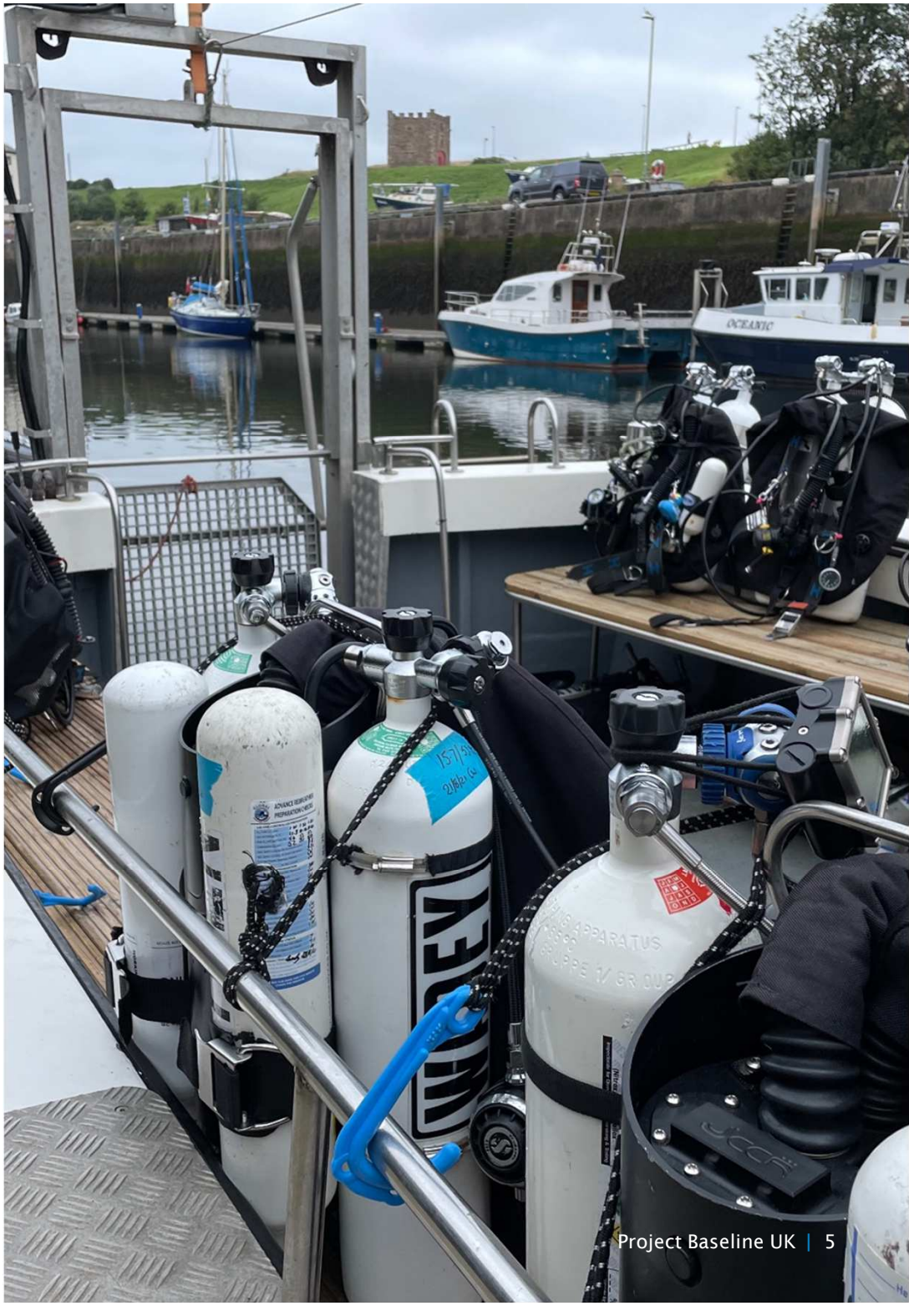
Eight divers participated in the project, all of whom were qualified to use normoxic trimix on open circuit as a minimum due to the depths planned (maximum 51 metres).

Three divers used conventional open circuit scuba throughout the week, diving 32 % nitrox, 21/35 or 18/45 trimix depending on depth, with 50 % nitrox for decompression during the sub-thirty metre dives.

Five divers used closed circuit rebreathers (JJ CCRs in GUE configuration) using 15/55 diluent/bailout and 50% nitrox for bailout decompression.

A team approach to diving was adopted using standard gases and ascent profiles. One diver navigated and laid the tape measure while the second operated the video camera on the return. Where a third diver was part of the team they acted as an assistant helping to control the tape during recording, making notes and taking photographs of the divers surveying. A lazy shot was used during deeper dives. Decompression was limited to 30 minutes on 50 % nitrox.

Diving was carried out from the boats *Silver Sky* and *Jacob George* chartered from Marine Quest in Eyemouth and skippered by Jim and Iain Easingwood.

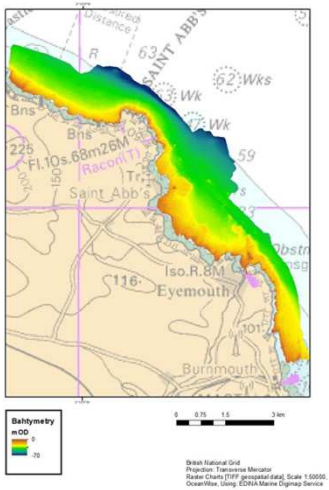


Video transects

The purpose of the diver video surveys was to access areas that are not suitable for towed video devices (e.g. wrecks, pinnacles) and gather additional small-scale ground truth data to support the existing benthic (bottom dwelling) habitat map prepared by the University of St Andrews. The aim was to survey at a similar level of detail as a towed video survey, within an area around each target site, to allow identification of taxa and their abundance. There are some limitations associated with diver survey compared to towed video survey, most notably time available at depth to conduct the survey.

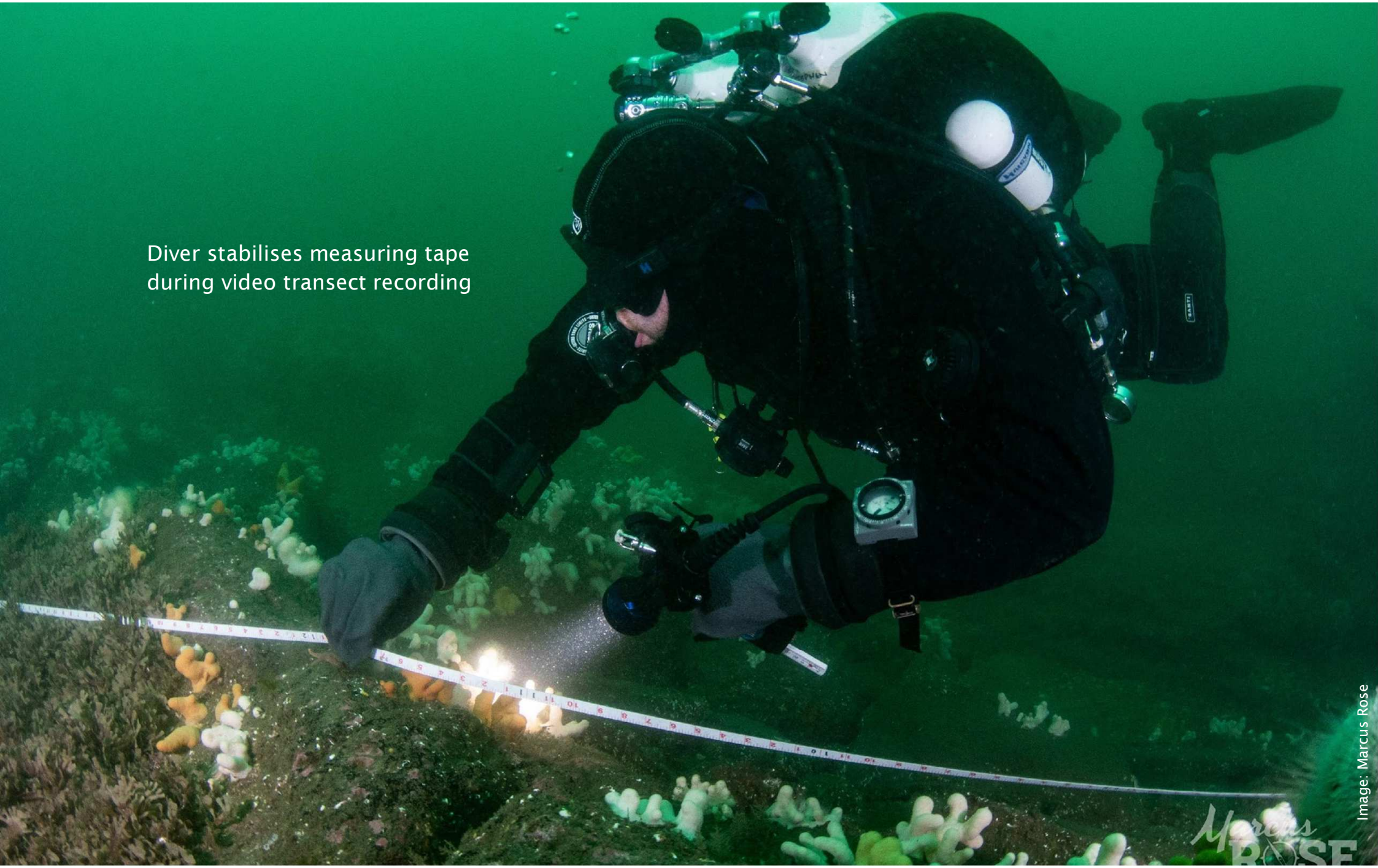
The diver video survey was expected to be used to extract quantitative data and therefore was undertaken on defined transects of known distance and width. The focus was bottom dwelling species, not fish populations.

Due to the nature of the sites it was not possible to install permanent transects. However it is desirable that the transects be repeatable for comparison surveys against baseline conditions. Therefore temporary transects were set out using 50 metre tapes with the start point and orientation noted in order that they could be repeated at a future date.



Left: Bathymetric map
(University of St Andrews)

Below: Diver transect setup



Diver stabilises measuring tape during video transect recording

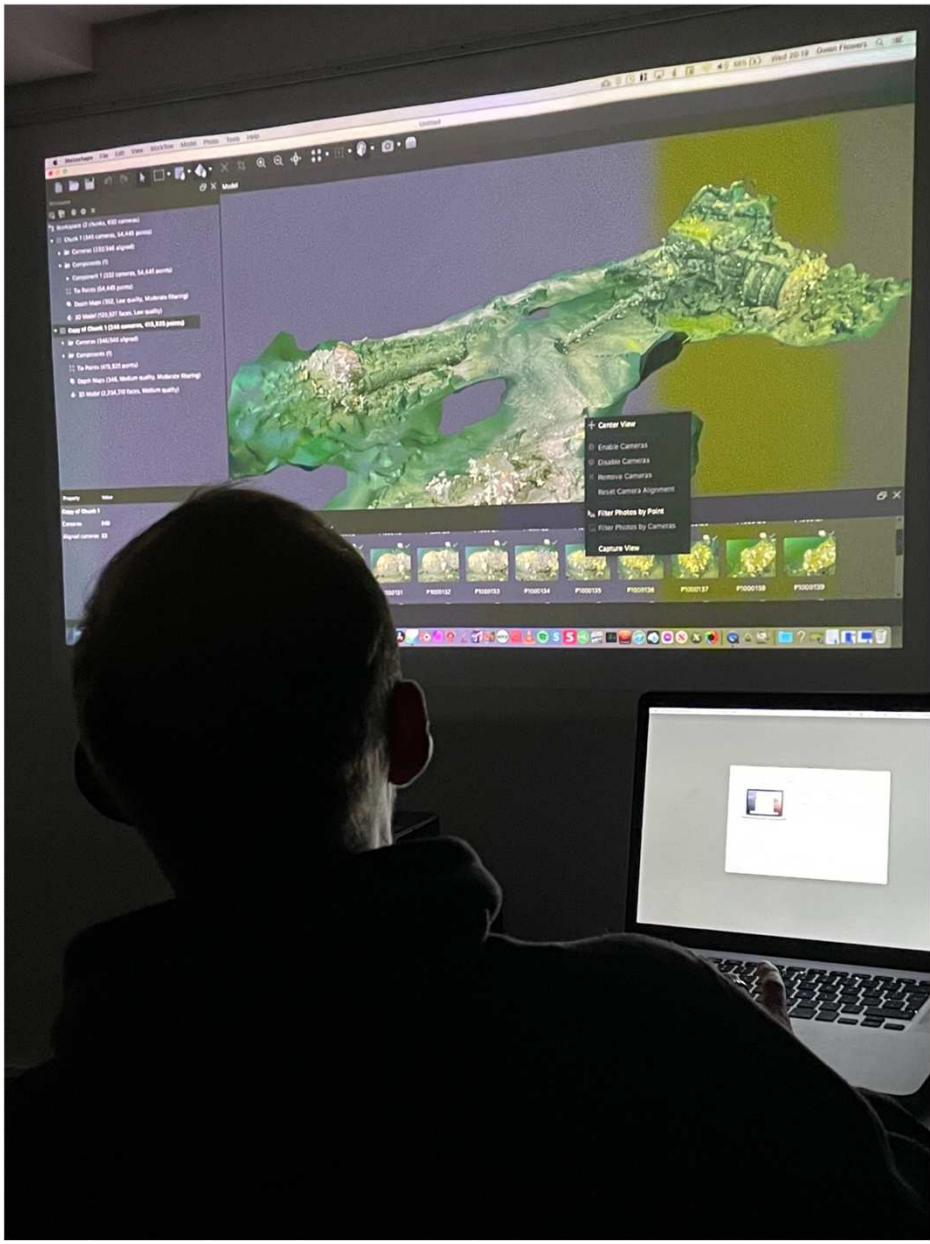
Image: Marcus Rose

Photogrammetry

Photogrammetry is a process that allows 3-D models to be generated by stitching together photographs.

As part of the project transects and wreck features were recorded with video and DSLR photography. Still images were extracted and processed with Agisoft Metashape software to produce fully rotatable and scalable models. The basic analysis workflow was as follows:

1. Load photos into Metashape
2. Create point cloud – during this step Metashape compares each photo to every other photo to allow them to be aligned in a sparse point cloud
3. Create dense point cloud – this is similar to the sparse point cloud but at a higher level of detail
4. Mesh – generate a base model by turning the point cloud into a mesh
5. Texture – create a surface texture based on the loaded photographs
6. Export – generate a file suitable in Sketchfab



Media

During the project week photographs, videos and photogrammetry was shared on BLUE and Project Baseline UK's Facebook and Instagram pages. The content was widely shared typically generating several thousand views.

Interviews were carried out with project participants, and video was recorded underwater and on the surface. A short video suitable for social media that tells the story of the project is currently in preparation.

An evening session was organised at the Hippodrome in Eyemouth to bring together representatives of BLUE, Project Baseline UK, Berwickshire Marine Reserve and St Abbs Marine Station. Each participant give a talk on a topic of interest.

Results

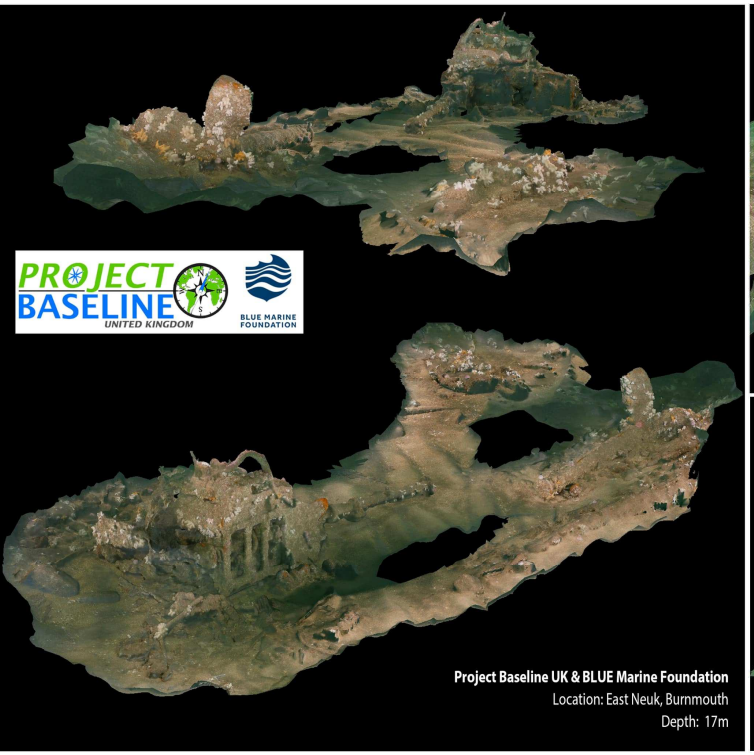
Diving began on Monday 23rd August 2021. Over 20 video transect surveys were completed (two further attempts failed for technical reasons) during 18 dives in water from 6 metres to 50 metres deep on the following sites:

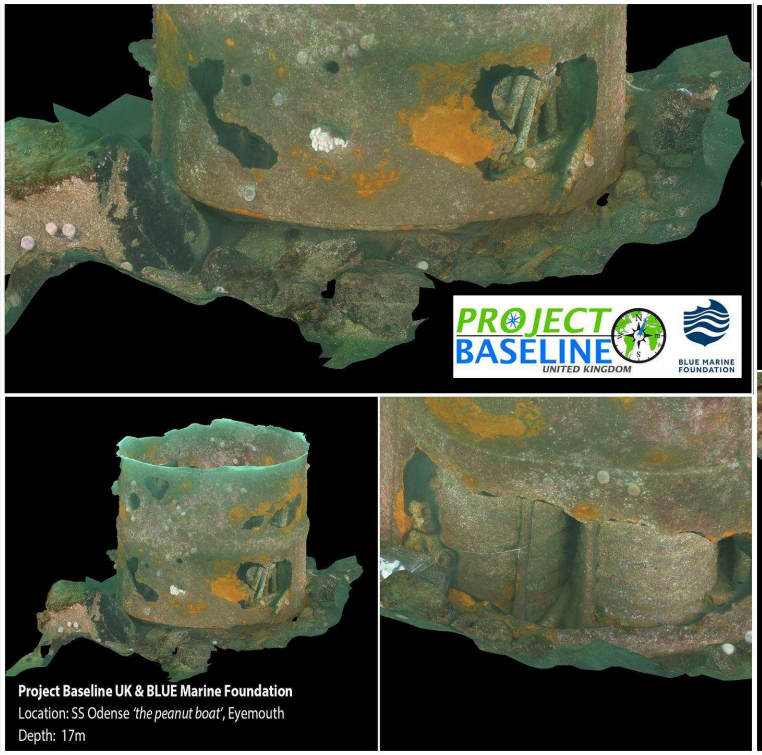
- Glanmire
- Odense
- Fast Castle (reef)
- Dove
- Messina
- Gull Rock (reef)
- East Neuk

The primary aims of the project were achieved and so it was judged to have been a success. The volume of data was well received by BLUE and the analysis by Project Baseline UK divers (Seasearch forms) was judged to be useful initial analysis.

Data is currently being analysed in more detail by BLUE and the University of Plymouth. Preliminary data is shown in the appendix. Seasearch forms are to be completed.

Photogrammetry results





East Neuk

Full model – https://skfb.ly/opKu7

Odense wreck

Full model – https://skfb.ly/opGEA

Odense reef

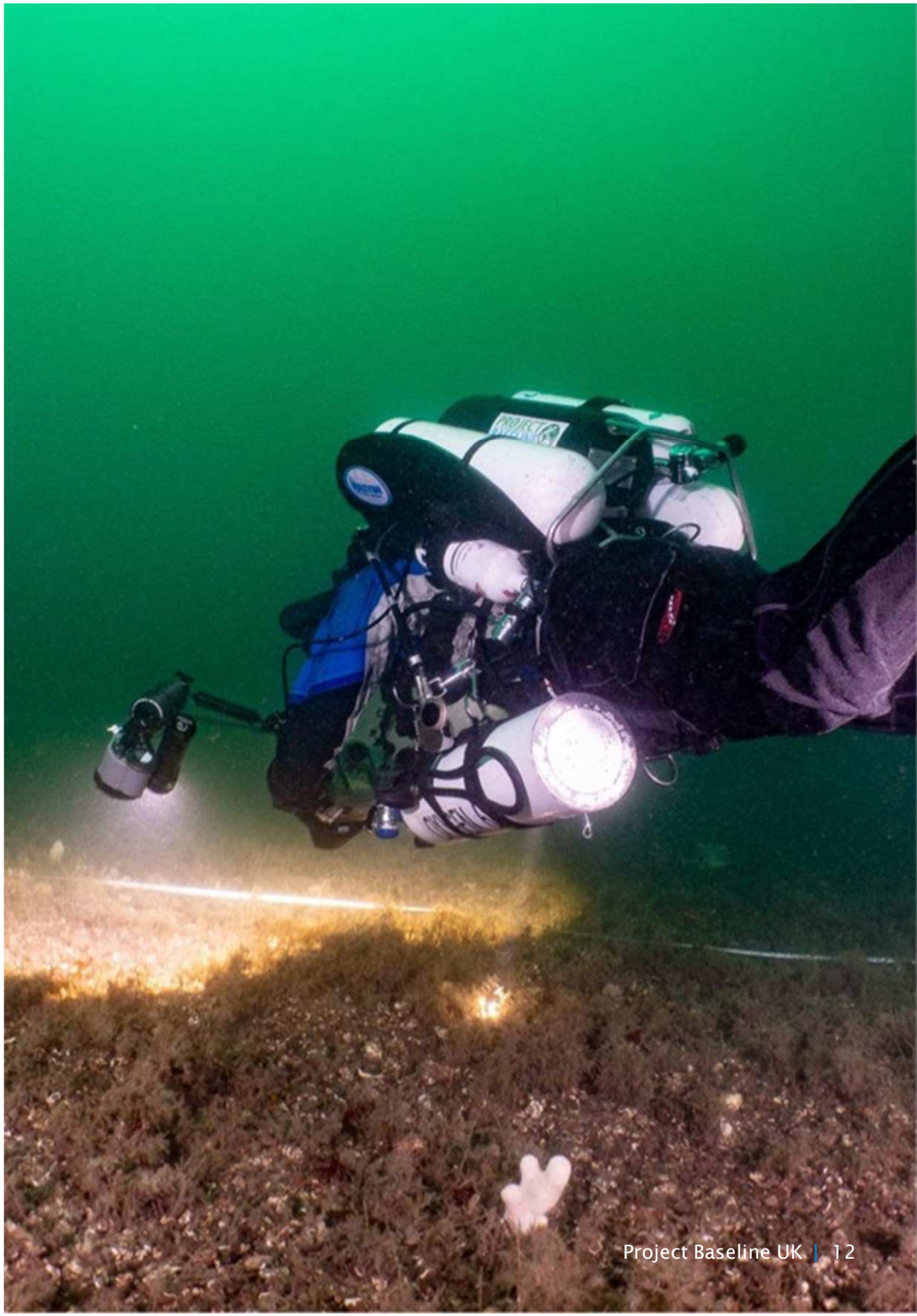
Full model – https://skfb.ly/opFpX

Discussion

During the week we learnt a lot and developed our survey techniques. The experience of Dr Graham Blackmore was invaluable and allowed us to modify our approach as the week progressed. As an example, we developed a technique whereby divers could remain underwater for longer, whilst communicating with the surface to establish when video transects were started and stopped.

Plans are already underway for next year and lessons identified from this year will feed into data gathering techniques to be used. Utilising the same team and having a better understanding of what BLUE are after will ensure data collection efforts can be maximised in future project weeks.

For future years we would like to collaborate with other conservation groups, such as Seasearch, to ensure the best possible data analysis occurs whilst on site.



Acknowledgements

- Project Baseline UK is grateful to the following organisations for supporting this project
  - Blue Marine Foundation
  - British Sub-Aqua Jubilee Trust
  - Halcyon Dive Systems
  - BARDOCreative
- We are also grateful to the volunteer divers who gave up their time to work with us this year

L-R: Iain Easingwood | Curtis Wadey | Macus Rose | Peter Ellwood | Graham Blackmore | Alana Dempsey | Stephen Symington | Martin Maple | Joe Richards | Owen Flowers

Appendix

Summary of data collected

Project data sheet

Date	Site name	lat	long	starting point (i.r shot line, bow, stern of wreck)	Transect name	compass bearing of transect being laid	Group	start time	end time	Transect video file name	Depth	Temp	Habitat Classification	species of interst	Notes
23/08/21	Glanmire	55 55.236	2 08.239	Bow		90	marcus, owen curtis	11.38		Glan_Bow_1.mov	34	11	cobbles, stones,.	horse mussels. Horse mussels shells empty and broken	Lobster
23/08/21	Glanmire			Bow		60	marcus, owen curtis		12.5	Glan_Bow_2.mov	34	11	cobbles, stones,	horse mussels. Horse mussels shells empty and broken.	lobsters
23/08/21	Glanmire			Stern		160	martin, stephen, alana			Glan_Stern_1.mp4			cobbles, stones,	horse mussels. Horse mussels shells empty and broken.	octopus by the engine - 3 videos 1 transect
23/08/21	Glanmire			stern		160	martin, stephen, alana			Glan_Stern_2.mp4					3 videos, sam etransect
23/08/21	Glanmire			stern		160	martin, stephen, alana			Glan_Stern_3. mp4					3 videos same transect
23/08/21	Glanmire			whole wreck			pete and graham			Glan_whole_Wreck.mp4					
23/08/21	Glanmire			boiler			Pet and graham			Glan_Boiler.mp4					zig zag
23/08/21	Pettico Wick - Peanut wreck	55 54.923	2 09.205	Boiler		NE	marcus, owen, curtis	14.2	14.35	Petti_Boiler_1.MOV	17	13	Boulders		bearing esgimated not specific notes not recorded/ recording area
23/08/21	Pettico Wick - Peanut wreck			Boiler		W	marcus, owen, curtis	14.35	14.5	Petti_Boiler_2.MOV	10	13			
23/08/21	Pettico wick			boiler			pete and graham			Petti_DPV_1.MP4			17-21m largely sand		
23/08/21	Pettico Wick			boiler			pete and graham			Petti_DPV_2MP4			Rocky reef		
24/08/21	Fast castle	55 56.036	2 13.626	Shot line		w	pete, graham			Fast_east_1MP4			Rocky reef / boulders / gullies		Compass bearing is the direction which the transect was laid
24/08/21	Fast castle	55 56.036	2 13.626	shot line		w	pete graham			Fast_east_2MP4			Rocky reef / boulders / gullies		This file belongs to the above file. There si a 30 second video and a 5 miniuete one
24/08/21	Fast castle			shot line		E	marcus, owen, curtis	10.51	11.13	Fast_west_1.MOV	18.4	13	Rocky reef / boulders / gullies		
24/08/21	Fast castle			shotline		N	martin, stephen, alana,			Fast _south .MP4					
24/08/21	Dove	55 57.286	2 16.805	circumfrance			pete and graham			Dove _circular.mp4					
24/08/21	Dove			cross section			pete and graham			Dove _zigzag.mp4					
24/08/21	Dove			bow		135	owen, curtis, marcus			Dove_bow_1			Silt,		
24/08/21	Dove			bow		135	owen, curtis, marcus			Dove_bow_2-1					Two part file split for size - 2 transects 3 videos
24/08/21	Dove			bow		E	owen, curtis, marcus			Dove_bow_2-2					
25/08/21	messina			boiler		SE	Owen Curtis	7.58		messina_SE_	49	10	SANDY PEBBLES, BARRON SEDIMENT	Flounder,small sea pen	
25/08/21	messina	55 53.614	2 04.678	boiler		N	Owen, curtis		9.35	messina_N	49	10			SURFACE TEMP 13
25/08/21		55 53.614	2 04.678	boiler		205	alana, martin , Stephen	8.06	9.13	messina_205_.mp4 messina_205-2.mp4	48	10.7	muudy, silt , gravel, few	cuttle fish, squat lobster, scallaps king & queen), sunstar, prawn, flat fish, anemones DMF, Red	
25/08/21		55 53.614	2 04.678	boiler		NE	Pete, Graham	8.09		messina_NE.mp4	47.6	9	coarse sand gravel	cuttle fish juvinile , tiny cuttle, anemones, squatties, nephrops	
25/08/21				boiler		NW	pete , graham	8.29	8.49	messina_NW.MP4	47.6				30m transect
25/08/21	Gull Rock North Brnmouth	55 51.254	2 04.127	from start lat long		NW	pete , graham			Gull_Rock_20min.mp4	11 7.9	14	ROCK, vallies, kelp	WRASSE, POLLACK, KELP, urchins	20minute
	Gull Rock North Brnmouth	55 51.246	2 04.129	Shot line		N	Owen Curtis, marcus	11.1		Gull_Rock_N.Mov	08-Jan	14			
	Gull Rock North Brnmouth	55 51.246	2 04.129	shot line		S	owen, curtis marcus		11.46	Gull_rock_south.mov	6	14	boulders, shely sand, lots of kelp, urchin	15 black fish most likely saither / coaly urchins, small edible	
	Gull Rock North Brnmouth	55 51.246	2 04.129	Shot line		100	alana, stephen Martin	11.35		Gull_rock_100.mp4	9	14	large rocks and boulders, kelp fprrest	lobster, sea urchins, whelks , startfish	
	Gull Rock North Brnmouth	55 51.246	2 04.129	Shot line		180	alana, Stephen, Martin		12.1	Gull_rock_180.mp4	11	14	rocky bottom at start then tailed of finto sand , kelp forrest whole weay through	lobster pot filled with lobster	
	East Neuk	s - 55 50.471	2 03.163				curtis , Graham			East_neuk.MP4					start and end lat long of transect. NO transect
	East Neuk	55 50.479	2 03.168			w	stephen. Alan, martin	13.23		East_neuk_W.mp4	21	13	sandy bottom , rock shelfs vineers	lots of lobster, starfish,DMF edible crabs, feather stars, squid	not many fish, old fish net on boiler
	East Neuk	55 50.479	2 03.168			e	stephen. Alan, martin		14.06	East_neuk_e.mp4					

Seasearch form – Glanmire wreck

Site Name The Glanmire	**Date of Dive**	23 Aug 21
	Start of dive	1140 (24hr)
	Dive duration	70 (mins)
General Location (inc county) Eyemouth, Berwickshire	**Max depth of survey**	34 m
	Sea Temperature	11 °C
	U/W visibility	10 m

Position at start of dive (degrees & decimal minutes only): 55° 55.236 N 002° 08.239 W or E = E

or OS Grid Reference: 2 letters (1 in Ireland), 6 numbers

Position at end of dive (if different only): ° N ° W or E = W

Position derived from (select one): GPS ◉ Chart ○ OS Map ○ Web mapping site ○

Drift dive? ☐ Night dive? ☐

Did you take any photographs? ☐ or video footage? ☑

Types of seabed present: (please select all that you saw and click the button next to the dominant one)

Rocky Reef	Boulders	Cobbles and Pebbles	Mixed Ground	Sand and Gravel	Mud	Wreckage	Other
☐ ○	☐ ○	✔ ○	✔ ○	✔ ○	☐ ○	✔ ◉	☐ ○

Did you notice anything unusual or noteworthy about the seabed or the marine life? (Max. 90 characters)

The seabed was barren on the transects from the stern. The bow transect had lots more life

Was there any litter or were there any man-made objects apparent? (Max. 90 characters)

Discarded rope and trawl net.

What marine life did you see on your dive?

Seabed cover types (tick all those present)

- ☐ **Kelp forest**
- ☐ **Kelp park**
- ☐ **Mixed seaweeds**
- ☐ **Seagrass Bed**
- ☐ **Encrusting pink algae**
- ☐ **Other - specify**
- ✔ **Animal turf on rocks** — ✔ Short; ✔ Tall
- ✔ **Animal Beds** (e.g. mussels, brittlestars, scallops - state which) — ✔ Mussels
- ☐ **Sediment with life apparent** (tubes, burrows etc)
- ☐ **Barren sediment** (no life or structures apparent)

Illustrations by Bob Foster-Smith

Species you saw

Show abundance of each species as **R**are, **O**ccasional, **C**ommon, or if you're unsure, **P**resent.

Species	R, O, C or P
Encrusting sponges	R
Dead men's fingers	C
Hydroids	C
Pomatoceros and Spirorbis spp	C
Common hermit crab (Pagurus bernhac	R
Velvet swimming crab (Necora puber)	R
Edible crab (Cancer pagurus)	R
Horse mussels (Modiolus modiolus)	O
Hornwrack	R
Common sunstar (Crossaster papposus	R
Common sea urchin (Echinus esculentu	R

Seasearch form – the Dove

Site Name	Date of Dive	24 Aug 21
The Dove	Start of dive	1000 (24hr)
	Dive duration	90 (mins)
General Location (inc county)	Max depth of survey	50 m
Eyemouth, Berwickshire	Sea Temperature	10 °C
	U/W visibility	5 m

Position at start of dive (degrees & decimal minutes only): 55° 57.286N N 002° 16.805 W or E: E
or OS Grid Reference (2 letters (1 in Ireland), 6 numbers):
Position at end of dive (if different only): ° N ° W or E: W

Position derived from (select one): GPS (●) Chart ( ) OS Map ( ) Web mapping site ( )
Drift dive? [ ] Night dive? [ ]
Did you take any photographs? [ ] or video footage? [✓]

Types of seabed present: (please select all that you saw and click the button next to the dominant one)

Rocky Reef	Boulders	Cobbles and Pebbles	Mixed Ground	Sand and Gravel	Mud	Wreckage	Other
[ ] ( )	[ ] ( )	[✓] ( )	[ ] ( )	[ ] ( )	[✓] ( )	[✓] (●)	[ ] ( )

Did you notice anything unusual or noteworthy about the seabed or the marine life? (Max. 90 characters)

No

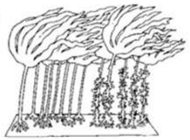
Was there any litter or were there any man-made objects apparent? (Max. 90 characters)

Lots of lost fishing net.

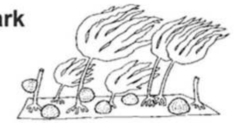
What marine life did you see on your dive?

Seabed cover types (tick all those present)

Kelp forest [ ]



Kelp park [ ]



Mixed seaweeds [ ]

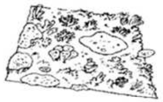
Seagrass Bed [ ]

Encrusting pink algae [ ]

Other - specify [ ]

Animal turf on rocks

[✓] **Short**



[ ] **Tall**

Animal Beds (e.g. mussels, brittlestars, scallops - state which) [ ]

Sediment with life apparent (tubes, burrows etc) [ ]

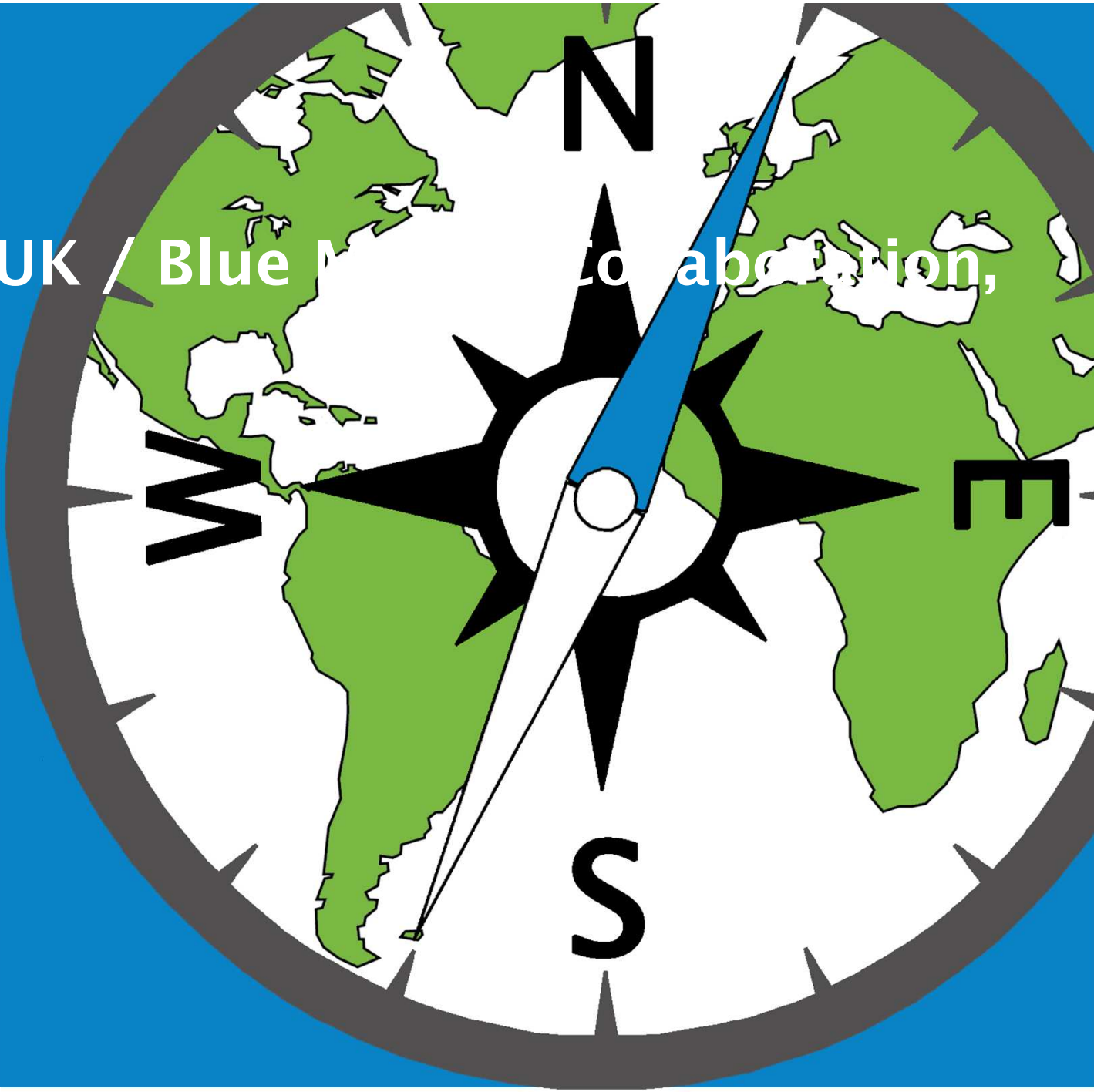
Barren sediment (no life or structures apparent) [✓]

Species you saw

Show abundance of each species as **R**are, **O**ccasional, **C**ommon, or if you're unsure, **P**resent.

Species	R, O, C or P
Common sea urchin (Echinus esculentu	O
Common starfish (Asterias rubens)	O
Dead Men's Fingers (Alcyonium digitatu	O
Common Lobster (Homarus gammarus	R
Velvet Swimming Crab (Necora puber)	R
Hornwrack - can't properly ID	R
Long-clawed squat lobster (Munida rug	R
Bib (Trisopterus luscus)	R
Poor Cod (Trisopterus minutus)	O

Project Baseline UK / Blue M[illegible] Co[illegible]abo[illegible]ion, Eyemouth 2021



Contact
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EXPLORE, DOCUMENT, PROTECT