Dogger Bank Expedition, 2023 cruise report

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Preface

Acknowledgements
The participants of the Doggers Bank cruise Captain Frank Loonstra and his crew (Dirk, Siebren and Piero) for their great flexibility, culinary and maritime skills (in severe weather circumstances), their technical assistance, health service and by creating a pleasant working atmosphere that substantially contributed to the success of this cruise. The support of the engine crew as well as the professional and pleasant cooperation between deck crew, bridge and the Doggerland Foundation and Waardenburg Ecology deck team was good.

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Cruise Participants
1. Emilie Reuchlin, Doggerland Foundation, expedition lead;
2. Jonna van Ulzen, volunteer with Doggerland Foundation;
3. Roos Bol, ARK Rewilding NL;
4. Marijke van der Staak, ARK Rewilding NL;
5. Charles Clover, Blue Marine Foundation;
6. Christoffer Holger Reenberg, WWF Denmark;
7. Danny Copeland, Underwater Media and Conservation;
8. Lisa Hoekema, Waardenburg Ecology;
9. Robin Olde Wolbers, Waardenburg Ecology.

Disclaimer

In this study the presence of protected species of plants and animals has been assessed. This assessment is based on available data, field research and expert judgement. Field research relates to a snapshot at the time of undertaking. Waardenburg Ecology ensures that the research has been carried out by expert researchers according to appropriate and/or standard methods. The company is not liable for sightings of species by third parties or sightings that are recorded after completion of the study.

Contents

1 Introduction

Located in the North Sea, the Dogger Bank (also known as Doggersbank in Dutch, Doggerbanke in Danish and Doggerbank in German) is a shallow area on a sandbank in the Dutch North Sea, German, Danish and UK waters. The international, transboundary Dogger Bank is a recognised area of ecological interest, due to the high biodiversity, production and abundance of fish, cetaceans and seabirds in the area. The Dogger Bank has been designated as Natura 2000 marine protected area by the UK, the Netherlands and Germany. For many years there has been interest among marine biologists, conservationists and film makers to undertake joint expeditions to the Dogger Bank to get more data from this important offshore area.

This cruise report describes the joint expedition that took place 26-29 November 2023. This cruise was led by Doggerland Foundation / Stichting Doggerland, in close cooperation with participating organizations ARK Rewilding Nederland and Blue Marine Foundation. The three organisations together funded the expedition, including hiring Waardenburg Ecology to collect data of the benthic community on the seabed using visual techniques, chartering the MS Tender and employing Danny Copeland to shoot film on board.

1.1 Cruise objectives

The overall goal of the cruise was to *collect scientific data to underpin restoration experiments at scale and design of a (science-based) Dogger Bank transboundary nature restoration plan that includes active and passive restoration.* The subgoals of the 2023 Doggerbank expedition include:

- **Habitat characterisation:** Collect visual data of biotic and abiotic characteristics using visual techniques along large transects on the United Kingdom part of the Dogger Bank: get eyes on the seabed *to see the seascape*.
- **Habitat documentation**: Record habitat variation and precise location data to inform active restoration experiments and restoration planning.
- **Baseline data collection:** obtain pre-restoration data before active restoration commences at seascape level and establish a reference impression.
- **Restoration site selection**: Prioritise and select specific active restoration locations for the first experiments of active restoration at scale.

1.2 Habitat characterisation of four Dogger bank transects

A key principle of the expedition is that data and images are fully shared, meaning the raw data of the drop-down camera were directly provided by Waardenburg Ecology in 2023. A selection of the raw data files was then made by Doggerland Foundation to be further characterised. In this report the four selected transects are described in more detail. To structure the report, the results of the visual observations are reported for each of the four transects as part of the habitat characterisation and a conclusion in relation to site selection is documented. The implications of the results for the research objectives and other relevant information are reported in the discussion section. The Annexes contain background documents that are relevant to the individual transects, and future expeditions.

2 Materials and methods

2.1 Location, sublocations and transects

An expedition to collect field data was organised from the 26th to 29th of November 2023 to the international Dogger Bank. The planned route for inspection with drop-down camera was from Lauwersoog to the English and German part of the Dogger Bank. Originally 12 transects were selected that vary in depth, substrate and other abiotic factors. The transects were selected based on previous expeditions and several scientific research papers about species, habitats and restoration potential of the Dogger Bank (see Appendix I for an overview of all the papers).

Inclement weather changes

Due to inclement weather the team was forced to return earlier than scheduled resulting in a shorter route. The weather conditions at the Dogger Bank turned out to be even more severe than expected, leading to high waves. Due to the high waves, it was impossible to use the drop-down camera at sites, as the construction is only operational with waves less than two meters. On the 27th and 28th of November transects were therefore rescheduled and in total eleven transects were finalized during a two-day period.

Transects selected for habitat characterisation

Not all transects were further analysed. This information is available upon request (ereuchlin@doggerland.earth) and additional information about all transects can be found in Annex VI. Four of o eleven transects were selected for subsequent analyses based on the potential for nature restoration. The four transects are analysed and documented in this report: Transect 6, 7, 10 and 11 (Figure 2.1-2.3). The stormy conditions influenced the visibility underwater, resulting in difficulties with species identification during the analyses of the camera footage. On the 28th of November visibility was worse than November 27, possibly influencing the number of observed species, by which transect 10 and -11 might have an overall lower number than transect 6 and -7 (Tabel 2.1).

Table 2.1 *Four drop-down camera transects selected for further analysis. Images were collected during the Dogger Bank expedition in November 2023.*

Transect number	Date	Time transect start	Time transect end	Duration in minutes (rounded off)	Country	Start coordinates (WGS 84)	End coordinates (WGS 84)	Total length transect
T6	27-11-2023	13:05	14:05	60	UK	**54°32.442'; 1° 30.612'**	**54°32.318'; 1° 29.542'**	1500 meter
T7	27-11-2023	14:35	14:55	20	UK	**54°32.215'; 1° 29.957'**	**54°32.115'; 1° 29.578'**	600-800 meter
T10	28-11-2023	10:45	11:06	21	UK	**54°52.811'; 1° 25.747'**	**54°52.750'; 1° 26.006'**	600 meters
T11	28-11-2023	11:55	12:27	32	UK	**54°49.872'; 1° 29.963'**	**54°50.021'; 1° 29.798'**	475 meters

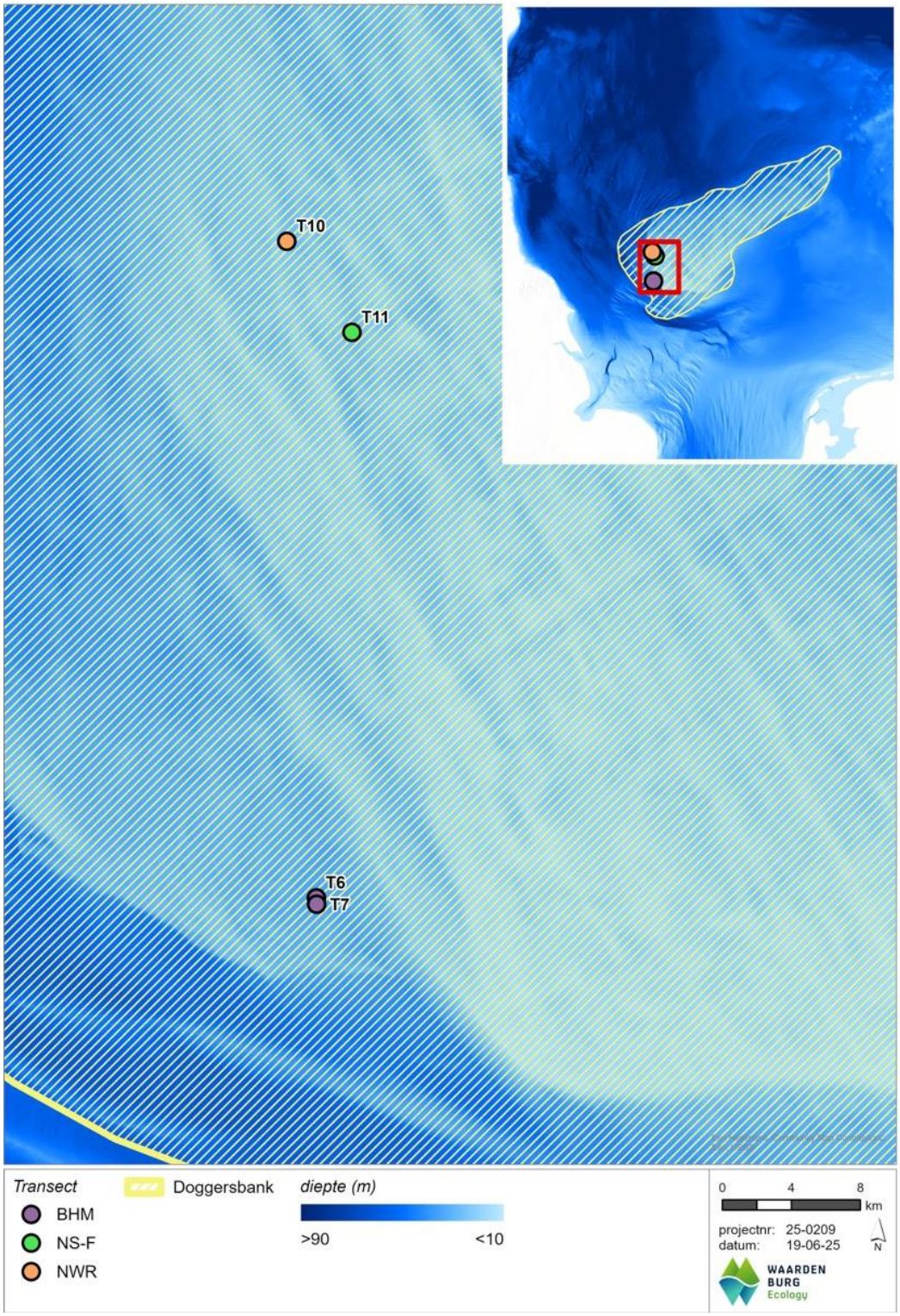


Figure .2.1 *Overview of the four transect locations analysed and described in this report: Transect 6, 7, 10 & 11. The upper right corner of the figure shows the transects relative to the Doger Bank (shaded area). The colours of the transects indicate the sublocations; Blue Half Moon (BHM purple), North Sands (NS-F green) and Northwest Rough (NWR orange).*

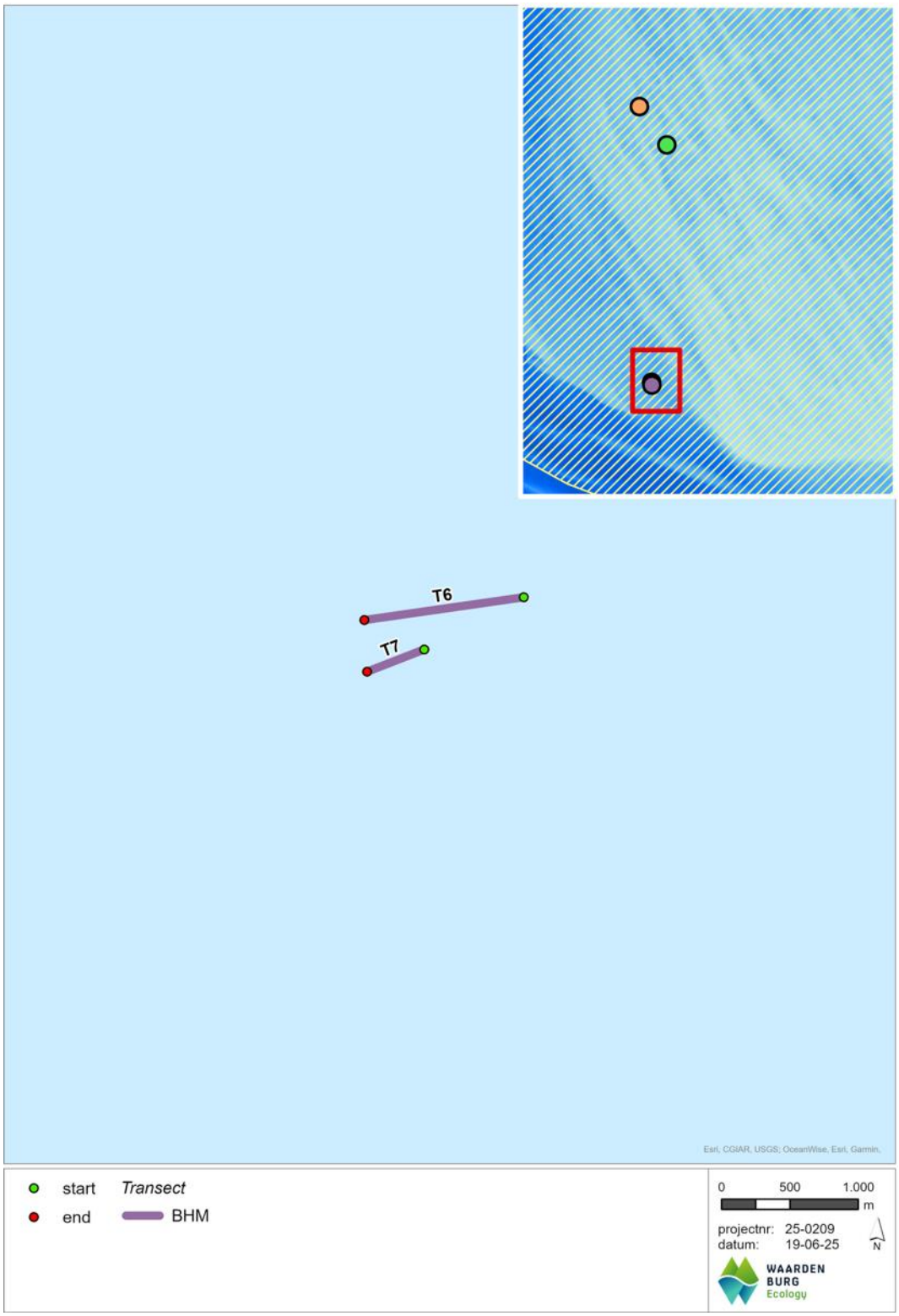


Figure 2.2 *Detailed overview of transect locations 6 and 7 located at sublocation Blue Half Moon (BHM purple). The green dots indicate the start point of the transects and the red dot the finish.*

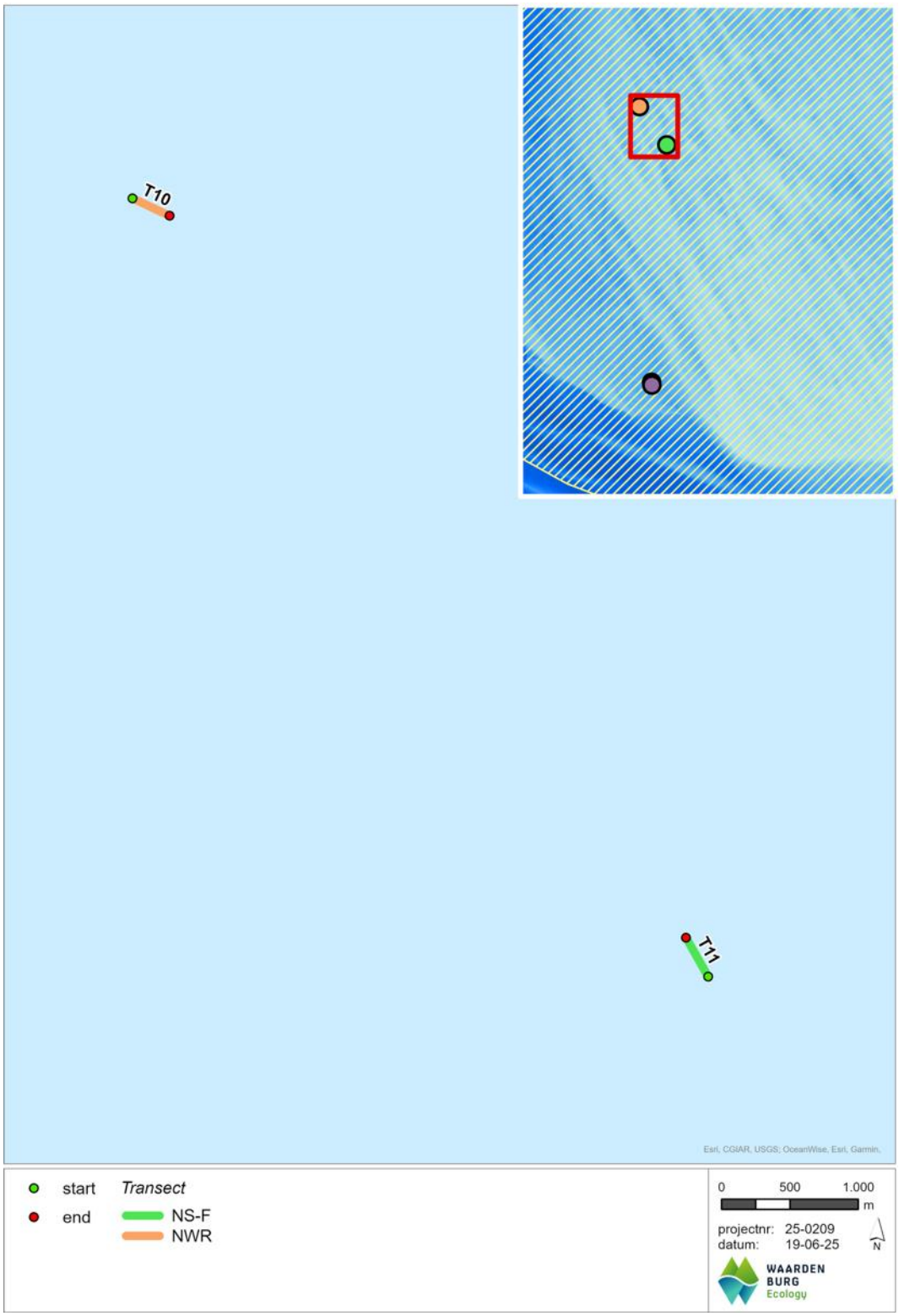


Figure 2.3 *Detailed overview of transect locations 10 and 11 located at sublocations Northern Sands (NS-F green) and Northwest Rough (NWR orange). The green dots indicate the start point of the transects and the red dot the finish. Data collection and analyses*

2.2 Visual technique: drop-down camera

The data was collected using a drop-down camera (model Z CAM E2 series) including a custom-made frame for offshore deployment provided by Waardenburg Ecology (Figure 2.4). With this camera, visual images of the seafloor of the Dogger Bank were recorded along transects of various lengths and time (Table 2.1). The average number of drops varied depending on several factors, such as vessel speed, wave height and other environmental conditions. Overall, favourable abiotic conditions were associated with a higher number of drops.

The purpose of the monitoring is to have eyes on the actual seabed and characterise habitats based on visual aspects of abiotic and biotics across larger and longer areas. The footage recorded by the camera thereby aims to help pinpoint and filter out interesting locations for future active restoration as input for site selection. Larger, longer transects can aid understanding of larger connected areas by their overall visual impression, the status of these areas and what substrates, habitats and species are present.

Figure 2.4 Picture of the drop-down camera used during the Dogger Bank expedition in 2023.

2.3 Visual technique: seabird surveys

The seabird surveys were simultaneously carried out along the transects with the deployment of the drop-down camera. During the survey, a biologist situated him-/herself on the observation deck outside on the research vessel with the best view on the water. All birds that could be identified along the transect were counted. The bird watchers used binoculars and the naked eye to identify individuals to the lowest taxonomic level. In addition to birds, marine mammals were also recorded when observed.

2.4 Analysis

Overall transect analysis

The camera footage of transects 6, 7, 10 and 11 are analysed to identify the presence of species to the lowest taxonomical level possible, up to species level. Next to the identification of species, the prolonged changes in substrate composition was also documented (Appendix II-V).

Detailed analysis of video stills

Shell and/or rocky substrate appears to ensure greater species diversity than mobile sandy substrate, making these areas higher prioritised for active restoration of biogenic reef development and in particular horse mussel reefs. Therefore, smaller video segments were cut out of the total transect footage and stored separately. These smaller segments were used to extract video stills which were used for more detailed species identification. Per transect twenty stills were derived and used for further analyses, with eighty stills in total of four transects.

3 Results

In total, 29 taxa were identified in all the transects together (Table 3.1). The maximum number of species are observed in transect 6, with a total of 21 taxa. Eleven taxa were documented for both transect 7 and 11. Transect 10 has the lowest number of species identified (8 species).

Table 3.1 *Taxa identified within the transect footage. The number per taxon indicates the number of individuals observed per transect. It must be noted that the duration of the footage and transect length varies among the transects.*

Scientific	Species	T6	T7	T10	T11
Bryozoa	bryozoa unid.	4	1		3
Porifera	sponge unid.		1	1	
Urticina felina	dahlia anemone	1			1
Actinaria	anemone unid.	1			1
Alcyonium digitatum	dead man's finger	22	33		12
Serpulidae	tubeworm unid.	1			
Lanice conchilega	sand mason worm	1		3	
Aphrodita aculeata	sea mouse	1			
Asterias rubens	common starfish	28	22	5	1
Astropecten irregularis	sand star	4			
Asteroidea	starfish unid.	8	1		
Pagurus bernhardus	Bernhard's hermit crab	2	1		2
Paguroidea	hermit crab unid.	1	1		1
Portunidea	swimming crab unid.			1	2
Brachyura	crab unid.			4	3
Ctenophora	comb jelly unid.		1		
Teuthida	squid unid.	1			
Branchiostoma lanceolatum	lancelet	1			
Scyliorhinus canicula	lesser spotted dogfish-egg	1			
Rajidae	ray-egg	1			
Callionymus lyra	common dragonet	2			
Callionymidae	dragonet unid.	10	1		
Chelidonichthys lucerna	tub gurnard	1			
Gaidropsarus	rockling unid.	1			
Ammodytidae	sand lance unid.			3	2
Microstomus kitt	lemon sole	1			
Soleidae	sole unid.		1		
Pleuronectiformes	flatfish unid.	2	2	1	3
Actinopterygii	fish unid.			2	
	Total sum	**94**	**65**	**20**	**31**

Transect duration varied from 21 to 60 minutes and appr 300 m to 1200 meters (Table 3.2). Transect 6 had the longest footage of 60 minutes and longest transect length of 1177 meters. The videoclip of transect 11 is longer (32 minutes in total) than transect 7 and 10 (respectively 20 and 21 minutes). Transect 10 is shorter (299 meter) than transect 7 and 11 (449-328 meter).

Table 3.2 Expedition transect lengths, clips and location.
Translation of column headings: 'transect_afstand_m' is distance of transect in meters; 'Clip_afstand_m' is clip distance in meters; 'clip_duur_s' is clip duration in seconds; 'start_x/y_dms' is coordinate of starting point of transect; 'eind_x/y_dms' is coordinate of end point of transect (in WGS84 coordinate system).

Transect_nr	Transect_afstand_m	Clip_nr	Clip_afstand_m	Clip_duur_s	start_x_dms	start_y_dms	eind_x_dms	eind_y_dms
T6	1177	S1	371	1052	001° 30' 36.72" E	54° 32' 26.52" N	001° 30' 16.49" E	54° 32' 24.18" N
T6	1177	S2	441	1251	001° 30' 16.49" E	54° 32' 24.18" N	001° 29' 52.44" E	54° 32' 21.39" N
T6	1177	S3	135	384	001° 29' 52.44" E	54° 32' 21.39" N	001° 29' 45.06" E	54° 32' 20.53" N
T6	1177	S4	104	296	001° 29' 45.06" E	54° 32' 20.53" N	001° 29' 39.36" E	54° 32' 19.87" N
T6	1177	S5	126	356	001° 29' 39.36" E	54° 32' 19.87" N	001° 29' 32.52" E	54° 32' 19.08" N
T7	449	S1	112	315	001° 29' 57.42" E	54° 32' 12.9" N	001° 29' 51.73" E	54° 32' 11.4" N
T7	449	S2	119	333	001° 29' 51.73" E	54° 32' 11.4" N	001° 29' 45.73" E	54° 32' 9.81" N
T7	449	S3	160	450	001° 29' 45.73" E	54° 32' 9.81" N	001° 29' 37.6" E	54° 32' 7.67" N
T7	449	S4	24	68	001° 29' 37.6" E	54° 32' 7.67" N	001° 29' 36.38" E	54° 32' 7.35" N
T7	449	S5	34	94	001° 29' 36.38" E	54° 32' 7.35" N	001° 29' 34.68" E	54° 32' 6.9" N
T10	299	S1	69	196	001° 25' 44.82" E	54° 52' 48.66" N	001° 25' 48.39" E	54° 52' 47.82" N
T10	299	S2	187	534	001° 25' 48.39" E	54° 52' 47.82" N	001° 25' 58.1" E	54° 52' 45.53" N
T10	299	S3	43	124	001° 25' 58.1" E	54° 52' 45.53" N	001° 26' 0.36" E	54° 52' 45.0" N
T11	328	S1	13	72	001° 29' 57.78" E	54° 49' 52.32" N	001° 29' 57.38" E	54° 49' 52.68" N
T11	328	S2	60	328	001° 29' 57.38" E	54° 49' 52.68" N	001° 29' 55.58" E	54° 49' 54.3" N
T11	328	S3	17	93	001° 29' 55.58" E	54° 49' 54.3" N	001° 29' 55.07" E	54° 49' 54.76" N
T11	328	S4	117	642	001° 29' 55.07" E	54° 49' 54.76" N	001° 29' 51.55" E	54° 49' 57.95" N
T11	328	S5	122	668	001° 29' 51.55" E	54° 49' 57.95" N	001° 29' 47.88" E	54° 50' 1.26" N

3.1 Transect 6

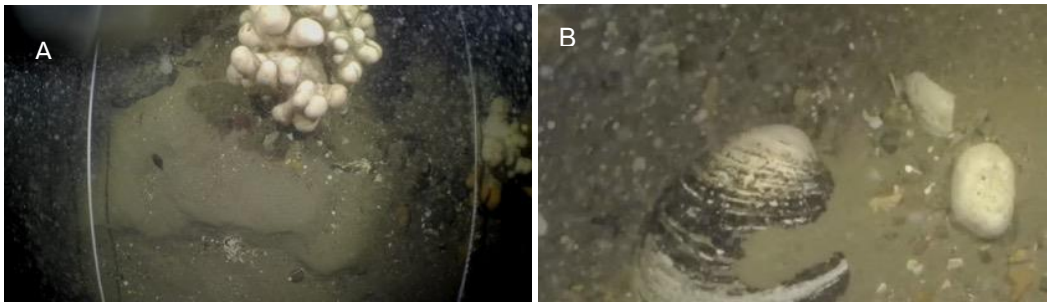


Figure 3.1 Stills from video footage originating from transect 6, A) dead man's finger and B) ocean quahog (found just outside the transect frame).

Transect characterisation: Transect 6 had a footage length of 60 minutes in total, and the longest transect length of 1177 meters (see Figure 3.1 for a visual impression).
Habitat characterisation: A variety of substrate types ranging from fine sand, coarse sand, shells and gravel are documented for this transect (Appendix II). The number of taxa identified in this transect is 21 in total, (Figure 3.2) and 94 counts, with a highest count for

dead man's finger, starfish and dragonet. A high count of benthic fauna was observed on sections with hard substrate (gravel) including anemones and many dead man's finger, a soft coral species. Fish species observed in this transect include common dragonet, lancelet, rockling, flatfish, tub gurnard and lemon sole. Additionally, the transect includes shark- as well as stingray eggs. Unique taxa that are not observed in other transects are a juvenile squid and a sea mouse. Just outside the transect frame the ocean quahog (*Arctica islandica)* was observed. This species is included in the OSPAR List of threatened and/or declining species and habitats with recommendations for furthering protection (OSPAR Agreement 2008-6; OSPAR recommendations 2013/5).

Conclusion for site selection: This transect could be prioritised based on the observed substrate and species variety present. The highest number of species, the highest number of individuals and the highest number of unique species are recorded at this transect in comparison to other transects. It is the only transect with shark and ray eggs, suggesting a nursery function and nearby ocean quahog, a threatened long-lived species. Especially the parts with the gravel could be interesting for active restoration, since the substrate is showing to be more stable and large colonies of dead man's finger are present here.

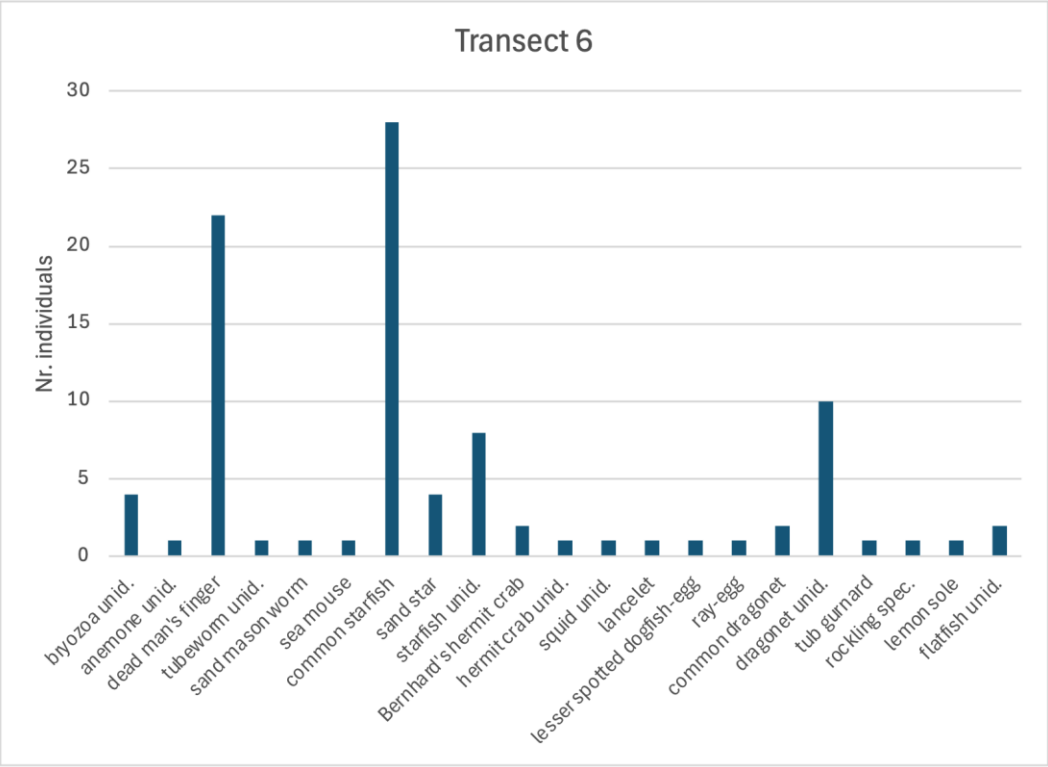


Figure 3.2 *All the species/taxa identified from drop camera footage of transect 6. The bars indicate the number of individual counts per taxon.*

3.2 Transect 7

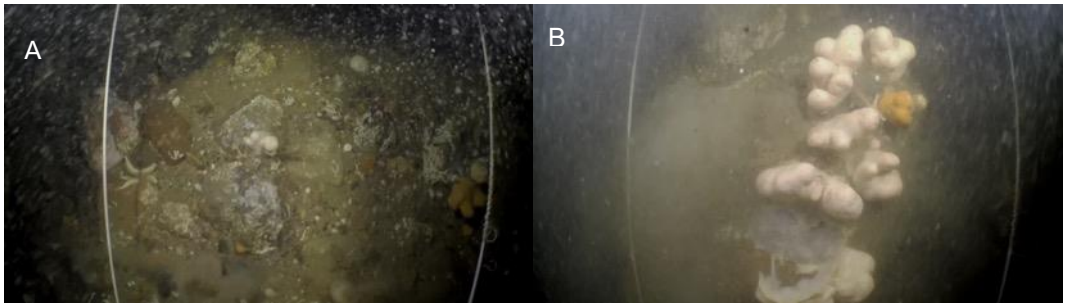


Figure 3.3 *Stills from video footage originating from transect 7, A) gravel material with star fish and B) sandy substrate with dead man's finger.*

Transect characterisation: Transect 7 had a footage length of 20 minutes in total and transect length of 449 meters (see Figure 3.2 for a visual impression).
Habitat characterisation: Transect 7 had a variation of a sandy and gravel substrates (Appendix III). At the gravel substrate several colonies of dead man's finger were identified, see Figure 3.3 for an impression. Along the sandy parts flatfish were observed. A total of 11 taxa were identified with 65 individual counts (Figure 3.4). The highest number of individual counts are attributed to dead man's fingers and common starfish. Species unique for this location are comb jellyfish and sole (not identified to species level), both not observed in any of the other analysed transects.

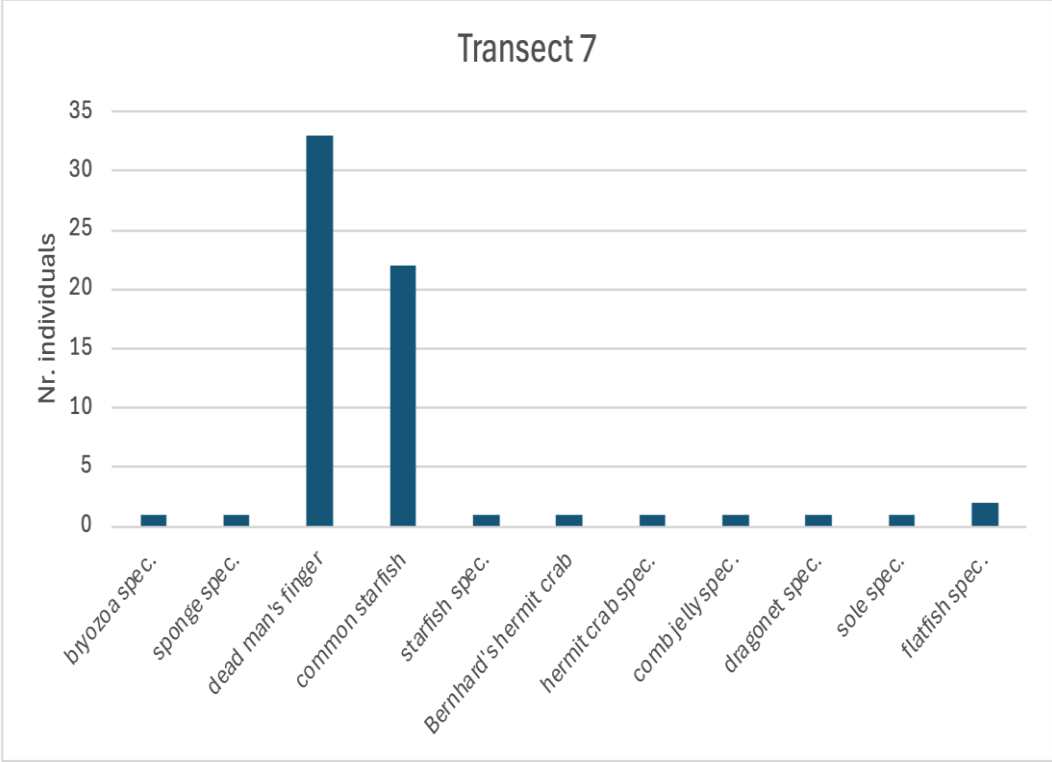


Figure 3.4 *Total species/taxa identified from the drop camera footage of transect 7. The bars indicate the number of individuals counted per species.*

Conclusion for site selection: This transect could be prioritised based on the observed substrate and species diversity present. Although the number of species, number of individual counts and unique species are lower than transect 6, the number of large colonies of dead man's finger on stable gravel substrate are documented as interesting areas for restoration.

3.3 Transect 10

Figure 3.5 *Stills from video footage originating from transect 10, A +B) sandy substrate with shell material of different origin species.*

Transect characterisation: Transect 10 had a footage length of 21 minutes in total and transect length of 299 meters (see Figure 3.5 for a visual impression on).

Habitat characterisation: The substrate of transect 10 consisted mainly of sand with shell substrate in some parts (see Figure 3.5 and Appendix IV). Shell substrate consists of originating from species like *Ensis* and *Spisula* species, with densities ranging from <1 to 20% of the entire transect. Moreover, also gravel material is present in low densities (< 1%). In total, 8 distinct taxa were identified and 20 total counts with a maximum of 5 per taxon (Figure 3.6). The observed taxa consist mainly of typical sandy bottom related taxa like sand lance, flatfish and sand mason worm. In this transect, no unique species were identified.

Conclusion for site selection: Based on the substrate and biodiversity, this transect is not specifically prioritised for active restoration site selection. Stable hard substrate including species like anemones and dead man's finger is absent in this transect. Also, the number of individual counts per species was lowest of all transects indicating a lack of biodiversity hotspots that would be interesting for restoration site selection.

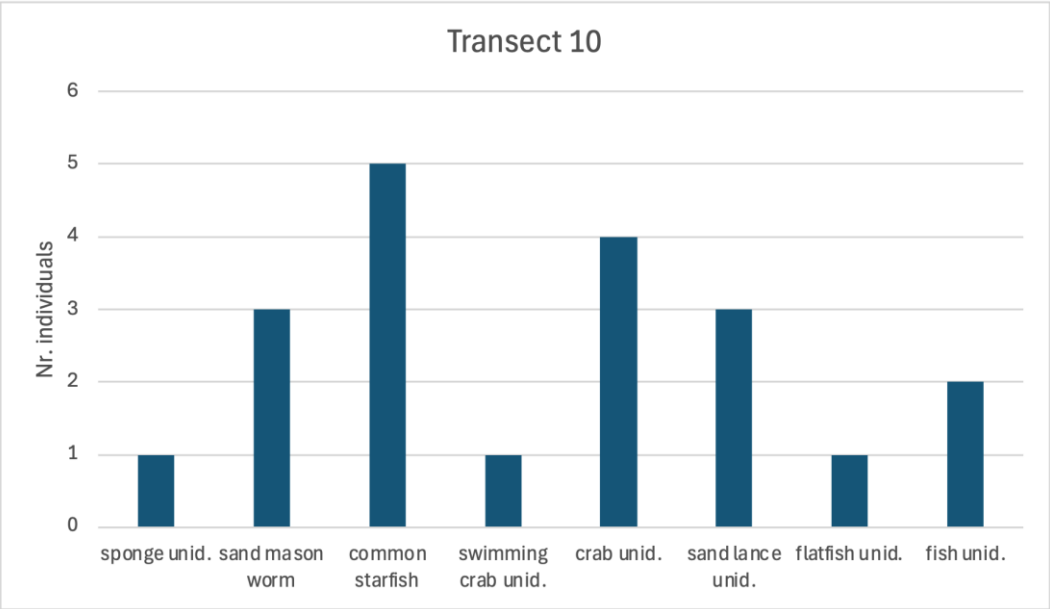


Figure 3.6 *Total species/taxa identified from the drop camera footage of transect 10. The bars indicate the number of individuals counted per species.*

3.4 Transect 11

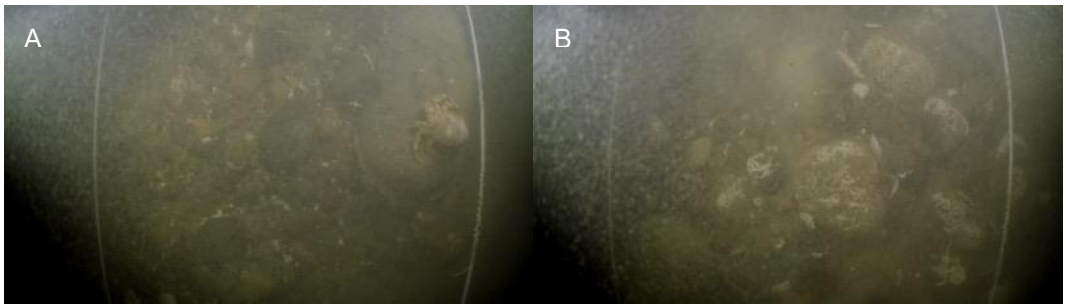


Figure 3.7 *Stills from video footage originating from transect 11, A) gravel with hermit crab and B) poor visibility with gravel substrate.*

Transect characterisation: Transect 11 had a footage length of 32 minutes in total and transect length of 328 meters (see Figure 3.7 for a visual impression).
Habitat characterisation: The substrate of transect 11 consisted of a variety of sand, shell and gravel (Appendix V). Typical hard substrate benthic species were observed like anemones and dead man's finger (Figure 3.8). The total number of taxa is 11, and 31 total counts with a maximum of 12 per taxa (dead man's fingers).
Conclusion for site selection: Transect 11 might be of interest for restoration purposes. A relatively high number of species, including rare species like the dahlia anemone and dead man's fingers are present due to the high variety in substrate types including hard substrate like gravel. The typical important fish species, sand lance was observed, indicative of potential importance of transect 11 for this species.

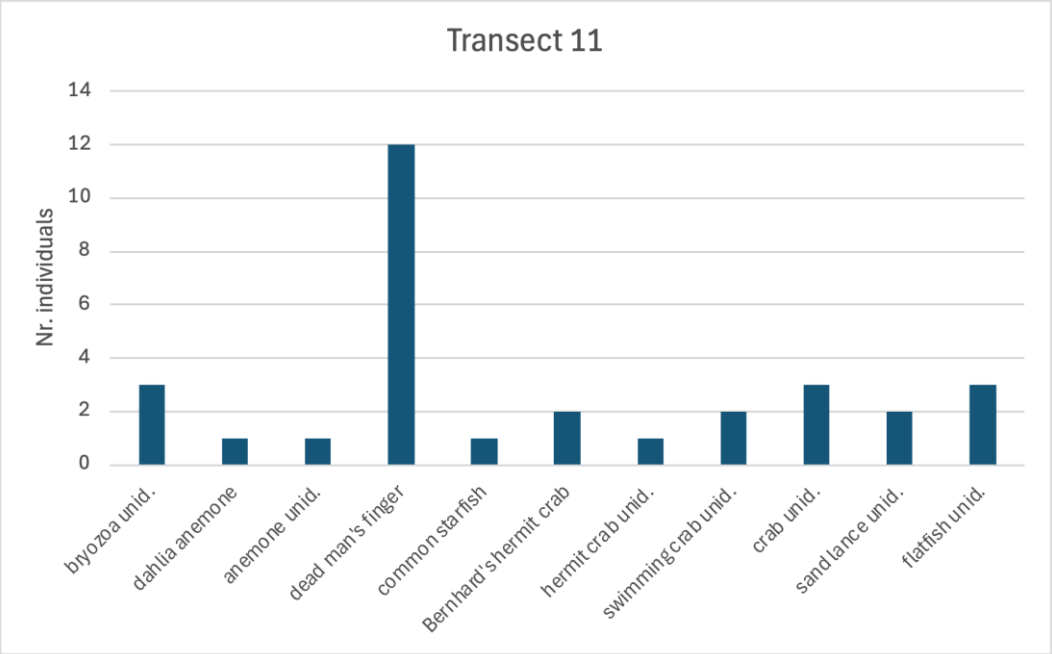


Figure 3.8 *Total species/taxa identified from the drop camera footage of transect 11. The bars indicate the number of individuals counted per species.*

3.5 Birds and mammals

In total six of the eleven transects could be monitored for birds due to the rough weather conditions: T2, T3, T4, T5, T6 and T11 (Table 3.3). The counted birds varied considerably among transects, with T3 and T5 showing the highest overall counts. Primarily guillemots and fulmars are commonly found in these two transects, with T5 showing a higher number of fulmars (50 individuals) and T3 more guillemots (55 individuals). Gannets are most observed in T6 (9 individuals). The highest diversity and the most counts of gulls are recorded in T5 and T6 (kittiwakes, herring gulls and greater black-backed gulls), up to 9 individuals. T4 and T11 exhibit the lowest counts of birds, with only isolated records of a herring gull (T4) and a guillemot (T11).
T5 is the only transect where marine mammals were observed, namely grey seal.

Table 3.3 *Bird species observed during the bird surveys of transect 2, 3, 4, 5, 6 and 11.*

Location	Gannet	Guillemot	Fulmar	Kittiwake	Herring gull	Greater black-backed gull	Little alk	Razorbill	Grey seal
T2S3	1	6	12	2		3			
T3S2 + T3S3	1	55	30	3		3		5	
T4S1					1				
T5S1			20			5			1
T5S2	1	10	30	5	5	8			1
T6S1	4	6	5	3	1	1			
T6S2	3	2	6	7		5	1		
T6S3/S4	2	4		2	9	4			
T6S5			1		1				
T11S3		1							

Figure 3.8 Gannet observed during expedition.

4 Discussion & conclusion

Transect 6 and 7 are located relatively close to each other, as are transect 10 and 11. The highest number of species, as well as individuals are observed at transect 6 and 7. These transects showed especially higher numbers of hard substrate species like dead man's fingers, which makes this sublocation potentially more interesting for active restoration of benthic species. Additionally, a higher diversity of fish (like rockling, dragonet, lemon sole and tub gurnard) is observed in this sublocation. Moreover, transect 6 is the only location where shark and ray eggs are found. Overall, these observations might imply that the primary production is higher than at the other locations and benthic restoration attempts might benefit more species higher in the food chain.

Transect 10 had the least number of species and the lowest number of individuals probably due to the low variety in substrate types consisting of mainly sandy bottom. This location might be of least interest for restoration attempts. However, transect 10 and 11 are the only locations sand lance is observed which might indicate this location is of importance to this species. Besides, transect 11 had a relative high number of species due to the high variety in substrate types including hard substrate like gravel. However, transect 10 and 11 were monitored on the second day of the expedition (in comparison to the footage of transect 6 and 7 which was gathered at the first day), and visibility got way worse due to the weather conditions. This made the analyses of the footage harder, and the actual number of individuals and species might be higher that recorded. Transect 11 can therefore still be of interest for restoration purposes, especially for hard substrate species and sand lance.

Due to the harsh weather conditions and poor visibility, especially on the second day, it was harder to identify species than normal. While analysing the footage it became clear that species were easier to identify with moving footage than directly from stills. Therefor the initial method was adjusted and only the total recordings were used for species identification. The 20 stills per interesting fragments of the transects were still taken and provided to Doggerland Foundation.

Appendix I - Workplan Dogger Bank expedition 2023

Expedition Dogger Bank 2023
See the Seascape

By Emilie Reuchlin, Doggerland Foundation
November 16, 2023

Figure 1 Dogger Bank lobster hiding in wreck - Emilie Reuchlin

Expedition Dogger Bank 'See the Seascape' is organized and lead by Doggerland Foundation – Stichting Doggerland.

In close cooperation with MS Tender B.V., ARK Foundation – Stichting ARK, Blue Marine Foundation, Waardenburg Ecology B.V.

1. Organization

The dropcamera expedition in November 2023 to the international Dogger Bank Marine Protected Area will be organized and lead by Doggerland Foundation / Stichting Doggerland in close cooperation with participating organizations.

1.1 Participating organizations

Doggerland Foundation will work together with ARK Foundation, Blue Marine Foundation, Waardenburg Ecology, Martijn van Beenen Film Production, Danny Copeland underwater media & conservation and the MS Tender to ensure a successful expedition to the Dogger Bank.

1.2 Role description

Even though every person on board has their own task and responsibility, the expedition truly will be a team effort, and so everyone is expected to help out where they can.

The role of Frank Loonstra, owner of MS Tender:

- Schipper of the MS Tender
- Overseeing crew of MS Tender
- Make available a well-running MS Tender
- Ensure research can be performed
- Health and safety of all on board
- Daily briefing to all on board together with Doggerland and Waardenburg Ecology, with regard to research, weather, safety at sea etc.
- Inform authorities according to regulations, follow permit restrictions

The role of Edwin Kardinaal of Waardenburg Ecology (not on board):

- Liason and projectmanager for Waardenburg Ecology
- Overseeing Waardenburg crew
- Ensuring crew is on board and research can be performed
- Finalization of research report after expedition
- Storage of data of this expedition and (before departure) sharing data of relevant expeditions via external hard drive

Role of Lisa Hoekema, Robin Older Wolbers, Waardenburg Ecology:

- Operating drop-down camera and ROV on board
- Bring van Veen grab on board in case there is time and opportunity
- Ensuring video-camera is fully functioning to foreseen depths of down to 70m
- Repairing any damages or malfunction of underwater camera
- Storage of images and data on external hard-drives
- Provide copy of all raw data to Doggerland Foundation
- Bring data of other relevant expeditions (Dogger Bank 2022, Dogger Bank 2021) to compare on board to newly gathered data
- Help to prepare data collection sheets
- Collecting data in datasheet, including coordinates
- Ensuring safety on board with regard to drop-down camera / working at sea
- Appoint lead person to decide plan with Emilie and Frank for each day
- Daily briefing to all on board together with Doggerland and Schipper with regard to research, weather, safety at sea etc.

Role of Marijke v.d. Staak and Roos Bol of ARK Natuurontwikkeling is to:

- Co-fund the expedition
- Share report and other information and coordinates from 2022 Dogger Bank expedition

- Collect data on board according to drop-down camera data collection sheets
- Review final report written by Waardenburg Ecology
- Help organize evening programme on board

The role of Charles Clover of Blue Marine Foundation is to:

- Co-fund the expedition
- Help collect data
- Shoot film about Dogger Bank with Danny Copeland
- Support and contact UK authorities to request permission for research expedition
- Review final report written by Waardenburg Ecology
- Coordinate communication about the expedition together with Marijke and Emilie

The role of Martijn van Beenen and Danny Copeland is to:

- Film the research expedition
- Volunteer to help where applicable

The role of Christoffer Holger Reenberg

- Help collect data
- Collect footage and photos of crew on board who wish to share their footage and record how this material may be used after the expedition
- Review final report written by Waardenburg Ecology in case he has time

The role of Jonna van Ulzen, volunteer with Doggerland Foundation is to:

- Collect data on board according to drop-down camera data collection sheets
- Review final report written by Waardenburg Ecology in case she has time
- Ensure central logbook (including everyone's observations, notes etc) is filled out at end of each day

The role of Thomas Rammelt of Doggerland is to:

- Point of contact on land in case of emergency

The role of Emilie Reuchlin of Doggerland is to:

- Fundraise to realize the expedition
- Co-fund the expedition
- Lead the expedition
- Create expedition and research plan
- Ensure permission from respective authorities
- Collect data onshore and onboard with team
- Coordinate closely with the skipper about logistics on deck
- Coordinate closely with Waardenburg Ecology teamleader with regard to safety and research plan
- Co-author final expedition report
- Daily briefing to all on board together with Schipper and Waardenburg Ecology, with regard to research, weather, safety at sea etc.
- Point of contact on board for requests, questions, concerns, problems, etc.
- Coordinate communication about the expedition together with Charles and Marijke
- Point of contact for requests, questions, concerns, problems, etc.

2. Objective of expedition

Expedition Dogger Bank 2023 is one in a series of expeditions to **collect the scientific data to underpin restoration experiments at scale and design of a (science-based) Dogger**

Bank transboundary nature restoration plan that includes active and passive restoration.

Considering that:

- Collectively we have a lot of data, including geological surveys, historical data, species surveys, drop-down camera footage, fishing data, data from diving expeditions on wreck locations, transect data; eyes on the ground in Dutch part of Dogger Bank
- Despite a lot of data, we are lacking:
    1. Present-day baseline monitoring of seabed in specific locations
    2. Present-day *eyes* on the seabed for UK, German, Danish parts of the Dogger Bank and therefore no visual indication of restoration potential of these areas. Even though images are available, they often cover specific pinpoint locations, not larger transects.
    3. Selected, specific locations that have potential to do active restoration experiments at scale
    4. Experiments for active restoration at scale

The 2023 Dogger Bank expedition will have the following objectives:

- By means of towing drop-down camera and ROV along large transects on the UK, German and Danish part of the Dogger Bank: get eyes on the seabed to observe biotic and abiotic characteristics; *to see the seascape*.
- Record habitat variations and specific location data to inform active restoration experiments at scale
- Obtain baseline data before active restoration commences at seascape level
- Select specific active restoration locations for the first experiments of active restoration at scale, to commence as early as 2024.

3. Location criteria

3.1 Permission from authorities and staying clear from no-go zones

The expedition will not enter into any no-go zones, which include areas where entry is limited or prohibited, such as windparks (in construction, in operation), oil and gas platforms and other exclusion zones. Doggerland Foundation has filed a request for permission to research the UK, German and Danish parts of the Dogger Bank. Formal response and information can be found in Annex A.

3.2 Criteria for transects

The criteria for the selected transects are based on an analysis of the following information:

1. Research for active restoration potential: Van Moorsel, Godfried. (2022). Doggersbank, mogelijkheden voor actief natuurherstel.
2. Research of Dogger Bank species and habitats: Van Moorsel, Godfried. (2011). Species and habitats of the international Dogger Bank. report ecosub, Doorn. 74 pp.
3. Locations of previous expeditions
4. Historical research, e.g. by Bennema 2022.
5. Scientific literature that holds specific information about locations of the Dogger Bank, including:
    a. Roberts, Callum Michael and Plumeridge, Annabel (2017) Conservation targets in marine protected area management suffer from shifting baseline syndrome: A case study on the Dogger Bank. Marine pollution bulletin. pp. 395-404. ISSN 0025-326X
    b. Variation of endo-benthic communities, as defined in Van Moorsel et al 2011, based on historical sources including historical information regarding spatial

and temporal variability in the distribution of infaunal communities present in association with the Dogger Bank habitats provided by Kröncke (1990, 1991), Kröncke and Rachor (1992), Kröncke and Knust (1995), Wieking and Kröncke (2003, 2005).

c. Areas of interest based on review of various publications by UK, Dutch, German authorities and research institutes (e.g. CEFAS, Rijkswaterstaat, JNCC, Thünen Institute)

4. Research

Expedition Dogger Bank will research the seabed with a drop-down camera, record relevant data, including locations for future active restoration (experiments) at scale.

4.1 Drop down camera

The Drop-down camera on board will be operated through attachment to a winch. The specific information of the camera is listed below in Dutch:

Een 4/3" CMOS sensor met 10-bit kleurenondersteuning en nominaal 11.5 stops dynamisch bereik. De camera ondersteunt het opnemen in MOV/MP4 met H.265 voor 10-bit opnames, terwijl H.264 8-bit opnemen ondersteunt.

- Professionele cinema camera
- UHD 4K tot 30fps
- ZRAW opname
- CMOSW-sensor (4/3", 3840 x 2160 pixels, 1/8000 kortste sluitertijd
- Volledig aluminium behuizing
- Compatibel met iOS app
- Montagepunten voor accessoires aan buitenkant
- Diverse stroombronnen mogelijk
- Actieve MFT-mount

Waardenburg Ecology (WE) will bring a laptop to connect to the Dropcam or ROV. Following specifics will be needed for viewing live images on the ship. The dropcam can film effectively till a waterdepth of ~30-35 m. When waterdepths are below that we will switch to the encased ROV setup.

- Specific software on WE laptop
- HDMI cable to external monitor
- USB-C to VGA converter
- USB-C to HDMI convertor

4.2 The ROV

The ROV is able to take video up to a waterdepth of ~80 m. This will allow us to explore the deeper areas of Dogger Bank. WE has prepared a special casing to house the ROV when the camera is dropped down to the bottom. The cable length is ~150 m.

Procedure using the ROV will be the same as with the Dropcam

4.3 Coordinate system

On board all systems will apply WGS84 coordinate system in degrees, minutes.decimal minutes (graden minuten.decimale minuten). For example location Port of Lauwersoog / Lauwershaven: 53°24.367' N - 6°11.896' E

All systems will apply this same method of pinpointing locations, so that there is no need for on-board conversions of coordinates.

4.4 Data collection and processing procedures

Data collection will be functional to the objective of the expedition. As such, it will not follow precisely relevant scientific standard of video transect survey data (e.g. https://emodnet.ec.europa.eu/sites/emodnet.ec.europa.eu/files/public/gmhm3_video_rog.pdf; https://www.nmbaqcs.org/media/kq2coxng/epibiota-video-summary-recommendations-2014.pdf). The data we will record and the transects to be fared will not be for the purpose to sample representatively in such a way as to extrapolate over an entire area, but to have our eyes on the actual seabed and the actual characteristics across larger and longer areas. The data that we collect by viewing the drop down camera / ROV video, will be recorded data that can help us to pinpoint and filter out interesting locations for active restoration purposes. Larger, longer transects will allow us to understand what larger, connected areas look like now / what is the current status of these areas, what substrate, habitat, species, depth and other information relevant to assess current status and restoration potential. As such, other information relevant to active restoration will also be recorded, e.g. location of wrecks, cables, pipelines, oil rigs, etc.

Because we will record video across larger, longer transects, large data storage capacity is needed and will be brought on board by Waardenburg Ecology.

Data collection step – by – step

1. Prepare drop camera / ROV
2. Check data storage unit
3. Prepare computer
4. Prepare screen on bridge and in mess
5. Prepare winch
6. Inform data collectors of transect number on bridge and in the mess
7. Video the transect number written on wetnote or on cutting board with pencil (write start – transect number – section number on cutting board)
8. Attach drop camera / ROV to winch and lower to seabed
9. Record GPS track
10. Drift between 0-2 knots to record video of seabed for 3 minutes; that makes 1 video section. Each video section of the transect lasts 3 minutes.
11. Fill out meta data in excel on the bridge
12. Fill out transect-section data in the mess
13. Log data in excel file, at least one person looks at the video and calls out information and one person puts the data into excel
14. Take still image on the bridge at start of every new video transect (every 3 minutes) and when interesting feature passes. For example, add extra information when passing by oil rig, information on plotter, etc.
15. Save under waypoint number and ensure waypoint number and associated information is recorded in excel.
16. Hoist up dropcamera / ROV
17. End recording of GPS track
18. Video the transect number written on wetnote or on cutting board with pencil (write end – transect number – section number on cutting board)
19. Inform all of end to transect number x and confirm what was the final section number
20. Store video under: […]
21. Store photo images under: […]
22. Store data under: […] / create back ups

23. At end of day collect data, videofiles, stills and store in right order and create back-up
24. Summarize activities per day in logbook, e.g. who was recording data, who operating the dropcam, were there any special sightings, what did we learn, did everything work properly etc.
25. Plan for next transect with schipper and dropcam operator
26. Start again

Maximum working hours per day is 12. Depending on the weather that may be during daylight (as sunrise to sunset is appr 12 hours) or during night if weather does not permit working during the day. In between the sessions, appropriate resting time will be in place.

4.5 Data collection forms

The data collection form that will be filled out during video transects will be sent to crew separately.

4.6 Instructions for using drop down camera / ROV and associated systems

WE will operate the dropcam/ROV. The winch will be operated by the ship's crew.

4.7 Coordination results on board

On board, everyone who can help collect data and perform research will do so. At the end of each day data will be checked and collated into one main excel file. To ensure data can be transferred, usb-c sticks and hard-drives will be brought on board by Waardenburg Ecology. All crew will bring their own computer to record data. Paper data collection sheets will be brought on board as well in case of computer failure. Remarks and paper notes will be processed on the day of the transect. The idea is to have all data collected and properly processed to the maximum extent possible, to ensure efficient report writing can be done after the expedition. This means there is a lot of work to do during the expedition.

4.8 Data storage

Video transect data and excel file will be stored in a format that will be easily accessible to review. The video will show relevant information, including day, time, location. The file will be stored with the name that is referenced in the excel data collection file.

4.9 Final report and data sharing

The final report will describe the research that has been done, the amount and quality of data and key results.

Raw data and footage will be reported in a separate document that will not be made publicly available and will be in possession of Doggerland, ARK and Blue Marine Foundation. They will only share raw data with authorities (as their obligation stipulates) and with third parties, when in fact all 3 organisations give their full consent to share with the respective third party.

5. Logistics

5.1 Vessel

The vessel for Expedition Dogger Bank 2023 is the MS Tender. Below are the specific details for the vessel.

Flag: Dutch
Classification: S I 200 mile Deep Sea
L.O.A 41.20 mtrs
Width 7.50 mtrs
Draught 2.40-3.20 mtrs
Tonnage: GRT 226.75 tons
NRT 104.42 tons
Speed: 11 knots

Propulsion: Main engine 430 HP Werkspoor
Omni Directional Thruster 325 HP 360degr
Auxiliary: 2x Mitsubishi 60 kvA 220/380 V 50 hz AC
2x Scania 450 KVA 220/380 50 hz en 60 hz AC
1x Samova 13 kvA 220/380 V 50 hz AC
Bunker capacity : Fuel 41.000 ltrs
Fresh water 39.000 ltrs

Nautical equipment
GMDSS radio equipment MF/HF + VHF + DSC
Emergency equipment Epirb + Sart + Hand held emergency VHF
2x JRC GPS-Compass / 1x Simrad DGPS
Arpa / Ais Radar ATLAS 1000 X-band
Arpa / Ais / Chart Radar JRC JMA 5310 X-band
AIS ATLAS class A
Autopilot Robertson AP 45
Echo-sounder Furuno + Sonar Wesmar
Site scan Ray Marine
Hull mounted Atlas Deso transducers
Entertainment sys.: Satellite TV system KVH

Accommodation

Single and double berth cabins -20 persons
Survey room 5 x 2 m

Fast rescue boat/MOB- FastAlu 115 HP outboard engine.

Vessel will be suitable for DSV and Survey works, deck space will allow a 20' container and a decompression chamber. Small modifications need to be done to get her on a four point mooring.

Contact Details
Mob. [redacted]
Email: [redacted]

5.2 Crew

- Schipper and owner Frank Loonstra
- Stuurman Dirk
- Stuurman / Matroos Siebren
- Kok Piero
- Martijn van Beenen; Filmproducties Martijn van Beenen
- Stichting ARK; Roos Bol,
- Stichting ARK; Marijke van der Staak;
- Waardenburg Ecology: Lisa Hoekema.
- Waardenburg Ecology: Robin Olde Wolbers
- Doggerland Foundation: Emilie Reuchlin,
- Doggerland Foundation: Jonna van Ulzen
- Blue Marine Foundation: Charles Clover
- Danny Copeland Underwater Media and Conservation
- Volunteer / WWF Denmark: Christoffer Holger Reenberg

5.3 Timing

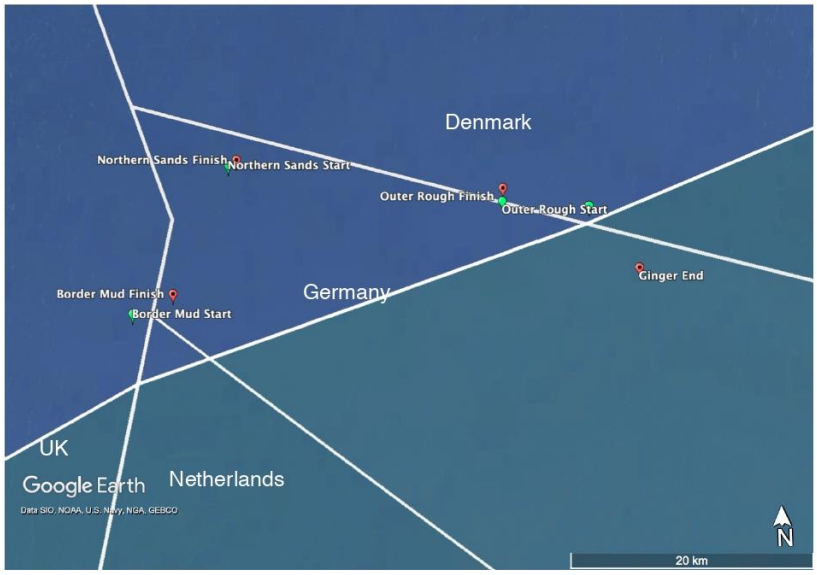
The expedition will start November 25 at noon and finish as late as Dec 4, 2023. Expected port of departure is Lauwersoog. Expected port of arrival is also Lauwersoog.

On November 23, the crew get the final call through whatsapp and/or email whether it is go or no-go and in case of a go, what will be the exact time and location to board MS Tender for loading materials.

5.4 Route

The desired route will not be the final and actual route, as dropcam data collection will depend on drifting with the tides and wind.

The preferred route is the following:
Lauwersoog – Bolders Bank – Blue Half Moon – North Shoal – North West Rough – Apple Sack – Spidsen Wreck – Puffin Patch - Gravel – Border Mud – Northern Sands – Ginger – Outer Rough - Lauwersoog



When doing the video survey, we will be able to do subsets of transects (of at minimum 1 km). Which subsets will be decided on board, depending on working conditions, time, route, environmental conditions etc.

The following coordinates include the start and finish of research lines / areas of interest, within which we will research transects of 1 km. It also includes approximate locations of crossings with cables, pipelines and borders and depth of the area. In reality these locations and depths will often deviate.

Transect North shoal	**Name location**	**N**	**E**
Start	NS-S	54° 32.45'	1° 29.25'
End option 1	NS-F1	54° 49.8'	1° 29.783'
End option 2 (further north and crossing over telecom cable)	NS-F2	54° 50.55'	1° 29.58'
Include specific location NS-A	NS-A	54° 48.03'	1° 29.58'
Include specific location NS-B	NS-B	54° 48.3'	1° 29.6'
TYCOM telecom cable crossing (estimated)	NS-X	54° 50.1'	1° 29.816'
Transect Bolders Bank		**N**	**E**
Start (south)	BB-S	54° 19.65'	1° 36.167'
End (north), which is also measuring station A; red dot	BB-F	54° 30.2'	1° 39.15'
Perenco gas pipe crossing with transect	BB-X	54° 26.033'	1° 39.983'
Wrecks and objects			
WR6801	WR68	54°37,159'	1°29,159'
WR97582	WR97	54°33,094'	1°38,735'
Boulder96221	AS-A	55°10.041'	1°35.681'
Transect Blue half moon		**N**	**E**
Start (east)	BHM-S	54° 32.45'	1° 30.78'
End (west)	BHM-F	54° 31.966'	1° 28.33'
Include specific location BHM-A	BHM-A	54° 32.267'	1° 29.883'
Gaspipe Perenco crossing with transect	BHM-X	54° 32.2167'	1° 29.6167'
Gas pipe (a) north crossing with half moon	BHM-XN	54° 32.33'	1° 29.46'
Gas pipe (b) south crossing with half moon	BHM-XZ	54° 32.05'	1° 29.58'
Transect North West Rough		**N**	**E**
Start south	NWR-S	54° 51'	1° 26'
End north	NWR-F	54° 58'	1° 24.383'
Transect Apple Sack		**N**	**E**
Start SW	AS-S	55° 9.3167'	1° 33.55'
End NE	AS-F	55° 10.0833'	1° 36.383'
Include specific location / Boulder 96221	AS-A	55°10.041'	1°35.681'

Transect Spidsen Wreck		**N**	**E**
Spidsen wreck / Start transect west	SWR-S	55°24.959'	2° 19.900'
Transect end - east	SWR-F	55°25.8'	2° 20.817'
Include specific location	SWR-A	55°25.633'	2° 20.13'
Transect Puffin Patch		**N**	**E**
Start (west)	PP-S	55°19.5'	2° 52.4'
Include specific location mixed sed	PP-A	55°19.48'	2° 53.466'
Include specific location	PP-B	55°19.5'	2° 54.05'
Include specific location	PP-C	55°19.6167'	2° 54.05'
End (east)	PP-F	55°19.733'	2° 54.05'
Transect Gravel		**N**	**E**
Start	GR-S	55°25'	3°13'
End	GR-F	55°25'	3°15'
Border Mud		**N**	**E**
Start	BM-S	55°45.5'	3° 20.67'
Include specific location border UK NL GE	BM-X	55°45.916'	3° 22.23'
End	BM-F	55°46.333'	3° 23.883'
Northern Sands		**N**	**E**
Start	SAND-S	55°51.96'	3° 28.517'
End	SAND-F	55°52.18'	3° 29.16'
Outer Rough		**N**	**E**
Start	OR-S	55°50'	3°50'
End	OR-F	55°50.583'	3°50.067'
Ginger		**N**	**E**
Start (south)	GI-S	55°49.67'	3°56.833'
End (north)	GI-F	55°46.867'	4°0.63'

5.5 Health and Safety

All crew on board has experience with working and being at sea and the vast majority has completed a survival at sea courses no longer than 2 years ago.

Medical materials on board include first aid kit, AED, brancard.

From WE all on board will have completed the STCW course, all have experience at sea.

Robin Olde Wolbers will be on board as the designated HSE officer. The following duties will be part of her role:
• Daily planning and progress meeting with Stichting Doggerland (Emilie) and captain of Tender (Frank)
• Daily briefing with all crew on board with Doggerland en Tender, regarding research planning, weather, safety aty sea etc.
• Oversee safety on deck of WE employees and other crew.

A list of information of each crew members' home contact information will be with Doggerland Foundation, with Emilie Reuchlin. In case of emergency, Doggerland Foundation will manage the contact onshore to communicate with the crew member's respective contact(s). Waardenburg Ecology will have their own contact on shore to aid in case of emergency with its crew members.

Onshore contact Doggerland is: [redacted]
For Waardenburg Ecology [redacted]

Every person has the right to work within personal and general health and safety boundaries.

We will work 12 hours per 24 hours max.

The North Sea in March can be a harsh working environment. Safety is of utmost importance.
When working on deck we will expect you to wear:
- Warm clothing
- Safety boots
- Waterproof / dry suit / sailing suit
- Life vest (preferably with Personal Locator Beacon inside)

When crane work is involved, add the following to this list:
- Gloves (waterproof and insulated)
- Helmet
- Safety glasses when appropriate

Depending on the weather conditions you may add:
- Sun glasses
- Woolen hat
- Buff

The MS Tender has survival suits for all on board. Before departure will do a safety briefing for all on board about what to do in case of an emergency.

Everyone is asked to be mindful of health and safety. Do not leave phones and computers plugged in unattended to prevent fire, make sure someone knows when you go out on deck by yourself. Tell someone if you are not feeling well. Be aware that we will be far from shore so need to take extra care about health and safety.

5.6 Items to bring

In addition to items listed in section 5.5, make sure you bring:
-Passport (as we cross the border into UK)
-Thermo/very warm and waterproof clothing
-Hat and gloves (extra pair in case you lose them)

-Sleeping bag and towel (not for crew travelling from UK and Denmark; these will be provided)
-Anti seasickness medicine if needed
-Your own medication if needed
-Glasses / extra contacts
-Workboots / workshoes (with integrated steel nose)

Optional items:
-Camera
-Binoculars
-Earplugs (highly recommended for engine noise and karaoke nights)
-Headlight for evening / flashlight for in cabin
-Shower shoes (flip flops/slippers are not safe)
-Water bottle
-Coffee / tea thermos
-Cash to buy snacks and drinks
-Book, game / entertainment / computer and harddrive with some movies to watch
-Download some podcasts as reading when seasick is not a good idea

Consider searching for “offshore what to bring” online to find good packing lists.

5.7 Food

Meals are provided on board. Any dietary restrictions are filled out on the next of kin form and will be communicated by Doggerland Foundation to Schipper Frank.

Any specific foods you need you can bring on board. For example crackers in your cabin when seasick can be helpful. Coca cola is available on board as are other drinks and snacks, which are available for a small fee. Bring cash if you can to pay for snacks and softdrinks or pay with card at the end of the trip.

5.8 Authority approval

To do research inside a marine protected area is subject to the obligation to request a permission and/or a permit to do research or a formal statement from authorities that no permit is in fact needed.

The Danish Authorities, Dutch, German, UK authorities permits will be with Frank and Emilie.

5.9 Risks and insurance

Each crew member will be responsible for their own insurance on board. Particularly it is important to cover repatriation in case of emergency to cover the costs of helicopter, ambulance, SAR or potential other expenses. Other important insurance includes covering injury to others and damage to property.

You will need to contact Emilie via email ereuchlin@doggerland.earth a.s.a.p, if you do not have insurance or are in doubt about coverage.

6. Communication

For this expedition we will draft up a separate communication plan. Thomas Rammelt will coordinate this plan and liaise with crew and organisations about communications.

An idea we discussed is to do a joint blog or some short social media statements, which we can write partially on board, and finalize after the expedition without having to rush. All can share this on their website and social media.

Depending on our expedition results we may do a press release.

When making pictures or content; be aware of the safety equipment that needs to be worn.

! All communication about the expedition, including communication with authorities or external parties about the expedition and specific locations, our route, activities we will do etc. will need approval of Doggerland Foundation. When sharing information, for example this expedition plan be aware that it includes contact information, including emails, phone numbers etc. Depending on who you share this document with, you need to take out private contact information and other information that should not be shared. Contact Emilie to check.

! Public communication, including posting information about the expedition through social media, blogs and other forms of communication will need final approval by Doggerland Foundation, Blue Marine Foundation, ARK, Waardenburg Ecology.

Contact person per organization for consent on communication about the expedition is:
ARK: [redacted]
Doggerland: [redacted]
Blue Marine Foundation: [redacted]
Waardenburg Ecology: [redacted]

6.1 Photo and video

Martijn van Beenen is working on a larger story of the Dogger Bank, for which reason he needs to collect film material also of this expedition. That material will not be used directly. Anyone who wishes to not be on film can express this. Martijn van Beenen will ask for consent to all crew before filming as well. If we want to use the photo's/video's everyone in the frame needs to wear the appropriate gear. Best way to do this: always wear the appropriate gear. Get accustomed to it and there is never a problem. The same goes for the footage that Danny Copeland will shoot.

All video and pictures taken on board can be shared and it should be clear how these materials may or may not be shared (e.g. when you share a folder with film or photo, add a note that states name of maker and how materials can be used).

6.2 Intellectual Property

The actual data and drop-down camera images and footage will be in possession of Doggerland, ARK and Blue Marine Foundation and stored properly by Waardenburg Ecology. None of that material may be used without all three parties consenting to the use. Contact person for this is Emilie Reuchlin (ereuchlin@doggerland.earth).

The final report will contain images and will be signed off by Doggerland, ARK and Blue Marine Foundation, Waardenburg Ecology.

The footage of Martijn van Beenen is in his possession and he is free to use that as he sees fit. If you do not agree, please inform Emilie and/or Martijn. This also goes for Danny Copeland's footage.

7. Important information for next of kin / the homefront

Information MS Tender: IMO number: 8134039 MMSI: 244084000
Satellite phone on board: [redacted](only in case of emergency). Please inform your next of kin of this number and the possibility that a different phone number may show as the call may be rerouted. In short: a strange number could come from a call with the satellite phone.

Contact Detail Schipper Frank Loonstra: [redacted]
Follow the MS Tender: [redacted]
Weather Report: https://www.windy.com/ search: “Dogger Bank”
Departure planned: All can board 25 Nov 10:00-11:30. Safety instructions 11:30. Departure 12:00. Location: Port of Lauwersoog. Final confirmation will come Nov 23, between 12:30-13:30. Arrival planned: Arrival planned 4 Dec at the latest. Location: Port of Lauwersoog most likely.
Contact on shore: [redacted]

Please note there will be no cellphone service (switch off 4G or you get huge bill) and there will be no internet further offshore. Satellite phone is for emergency only. So prepare those at home you will not be available while at sea. Blue Marine Foundation might bring a satellite dish to have access to internet.

Appendix II – Transect 6 species list

Transect nr.	Clip nr.	Time clip	Substrate	Scientific	Species
Transect 6	S1	03:19	Fine sand		
Transect 6	S1	04:07	Fine sand	Paguroidea	hermit crab unid.
Transect 6	S1	04:22	Fine sand	*Astropecten irregularis*	sand star
Transect 6	S1	04:40	Fine sand	Asteroidea	starfish unid.
Transect 6	S1	04:40	Fine sand	Bryozoa	bryozoa unid.
Transect 6	S1	04:54	Gravel		
Transect 6	S1	05:13	Gravel	Callionymidae	dragonet unid.
Transect 6	S1	06:27	Coarse sand		
Transect 6	S1	07:22	Fine sand		
Transect 6	S1	07:48	Fine sand	Asteroidea	starfish unid.
Transect 6	S1	07:52	Fine sand	Asteroidea	starfish unid.
Transect 6	S1	08:17	Fine sand	*Astropecten irregularis*	sand star
Transect 6	S1	08:23	Fine sand	*Branchiostoma lanceolatum*	lancelet
Transect 6	S1	08:29	Fine sand	*Astropecten irregularis*	sand star
Transect 6	S1	08:35	Fine sand	Callionymidae	dragonet unid.
Transect 6	S1	08:42	Fine sand	*Lanice conchilega*	sand mason worm
Transect 6	S1	08:58	Fine sand	Asteroidea	starfish unid.
Transect 6	S1	10:04	Fine sand	*Gaidropsarus*	rockling unid.
Transect 6	S1	12:07	Fine sand	Asteroidea	starfish unid.
Transect 6	S1	12:52	Fine sand	Callionymidae	dragonet unid.
Transect 6	S1	13:23	Fine sand	Callionymidae	dragonet unid.
Transect 6	S1	16:29	Fine sand	*Callionymus lyra*	common dragonet
Transect 6	S1	16:50	Fine sand	*Asterias rubens*	common starfish
Transect 6	S1	17:32	Fine sand	Pleuronectiformes	flatfish unid.
Transect 6	S2	19:00	Shell		
Transect 6	S2	20:46	Shell	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	20:55	Shell	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	21:05	Shell	Asteroidea	starfish unid.
Transect 6	S2	21:34	Shell	*Asterias rubens*	common starfish
Transect 6	S2	22:30	Shell	*Asterias rubens*	common starfish
Transect 6	S2	23:13	Shell	*Astropecten irregularis*	sand star
Transect 6	S2	23:15	Shell	Bryozoa	bryozoa unid.
Transect 6	S2	24:46	Shell	*Asterias rubens*	common starfish
Transect 6	S2	24:46	Shell	*Pagurus bernhardus*	Bernhard's hermit crab
Transect 6	S2	25:02	Shell	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	25:52	Shell	*Asterias rubens*	common starfish
Transect 6	S2	26:19	Sand		
Transect 6	S2	26:54	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	27:40	Sand	*Asterias rubens*	common starfish
Transect 6	S2	28:16	Sand	*Asterias rubens*	common starfish
Transect 6	S2	28:26	Sand	*Asterias rubens*	common starfish
Transect 6	S2	29:51	Sand	Actinaria	anemone unid.

Transect nr.	Clip nr.	Time clip	Substrate	Scientific	Species
Transect 6	S2	30:06	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	30:21	Sand	*Chelidonichthys lucerna*	tub gurnard
Transect 6	S2	30:42	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	30:50	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	31:02	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	31:29	Sand	Bryozoa	bryozoa unid.
Transect 6	S2	31:50	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	33:23	Sand	Bryozoa	bryozoa unid.
Transect 6	S2	33:53	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	34:22	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	34:39	Sand	Asteroidea	starfish unid.
Transect 6	S2	34:42	Sand	*Asterias rubens*	common starfish
Transect 6	S2	34:42	Sand	*Callionymus lyra*	common dragonet
Transect 6	S2	36:08	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	36:12	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	36:14	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	36:19	Sand	*Scyliorhinus canicula*	lesser spotted dogfish-egg
Transect 6	S2	36:31	Sand	*Asterias rubens*	common starfish
Transect 6	S2	36:58	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	37:14	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	37:28	Sand	Teuthida	squid unid.
Transect 6	S2	37:43	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S2	38:23	Sand	*Asterias rubens*	common starfish
Transect 6	S3	39:00	Sand		
Transect 6	S3	40:06	Sand	Callionymidae	dragonet unid.
Transect 6	S3	40:22	Sand	*Asterias rubens*	common starfish
Transect 6	S3	40:37	Sand	*Asterias rubens*	common starfish
Transect 6	S3	41:41	Sand	*Asterias rubens*	common starfish
Transect 6	S3	41:48	Sand	Callionymidae	dragonet unid.
Transect 6	S3	41:54	Sand	*Asterias rubens*	common starfish
Transect 6	S3	42:22	Sand	*Alcyonium digitatum*	dead man's finger
Transect 6	S3	42:27	Sand	*Asterias rubens*	common starfish
Transect 6	S3	42:44	Sand	Rajidae	ray-egg
Transect 6	S3	43:46	Sand	Serpulidae	tubeworm unid.
Transect 6	S3	44:06	Sand	Callionymidae	dragonet unid.
Transect 6	S3	44:47	Sand	*Asterias rubens*	common starfish
Transect 6	S4	45:24	Gravel		
Transect 6	S4	46:16	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	46:28	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	46:33	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	47:06	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	47:13	Gravel	Microstomus kitt	lemon sole
Transect 6	S4	47:18	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	48:06	Gravel	*Asterias rubens*	common starfish
Transect 6	S4	48:09	Gravel	*Pagurus bernhardus*	Bernhard's hermit crab
Transect 6	S4	49:22	Gravel	Pleuronectiformes	flatfish unid.
Transect 6	S4	49:43	Gravel	*Aphrodita aculeata*	sea mouse
Transect 6	S5	50:25	Sand		
Transect 6	S5	52:10	Sand	Callionymidae	dragonet unid.
Transect 6	S5	54:47	Sand	Callionymidae	dragonet unid.
Transect 6	S5	55:15	Sand	Callionymidae	dragonet unid.
Transect 6	S5	55:39			

Appendix III – Transect 7 species list

Transect nr.	Clip nr.	Time clip	Substrate	Scientific	Species
Transect 7	S1	05:15			
Transect 7	S2	05:21	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	05:23	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	06:54	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	07:20	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	07:24	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	07:24	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	07:57	Gravel	Pleuronectiformes	flatfish unid.
Transect 7	S2	07:59	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:00	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:03	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:03	Gravel	Bryozoa	bryozoa unid.
Transect 7	S2	08:03	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	08:07	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:07	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	08:10	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:12	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:13	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	08:39	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	08:48	Gravel	Pleuronectiformes	flatfish unid.
Transect 7	S2	09:05	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 7	S2	09:20	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	09:26	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	09:26	Gravel	Porifera	sponge unid.
Transect 7	S2	10:45	Gravel	*Asterias rubens*	common starfish
Transect 7	S2	10:48	Gravel	*Asterias rubens*	common starfish
Transect 7	S3	11:28	Sand		
Transect 7	S3	12:16	Sand	*Asterias rubens*	common starfish
Transect 7	S3	12:21	Sand	*Alcyonium digitatum*	dead man's finger
Transect 7	S3	12:41	Sand	*Asterias rubens*	common starfish
Transect 7	S3	13:42	Sand	*Asterias rubens*	common starfish
Transect 7	S3	13:58	Sand	*Asterias rubens*	common starfish
Transect 7	S3	15:24	Sand	Asteroidea	starfish unid.
Transect 7	S3	15:20	Sand	*Pagurus bernhardus*	Bernhard's hermit crab
Transect 7	S3	15:41	Sand	Paguroidea	hermit crab unid.
Transect 7	S3	15:57	Sand	Soleidae	sole unid.
Transect 7	S3	17:10	Sand	*Asterias rubens*	common starfish
Transect 7	S3	17:26	Sand	Callionymidae	dragonet unid.
Transect 7	S3	17:33	Sand	*Asterias rubens*	common starfish
Transect 7	S3	18:18	Sand		
Transect 7	S4	18:19	Gravel		
Transect 7	S4	19:26	Gravel	Ctenophora	comb jelly unid.
Transect 7	S5	21:00			

Appendix IV – Transect 10 species list

Transect nr.	Clip nr.	Time clip	Substrate	Scientific	Species
Transect 10	S1	01:00	Sand		
Transect 10	S1	2:41	Sand	Actinopterygii	fish unid.
Transect 10	S1	03:16	Sand	Portunidea	swimming crab unid.
Transect 10	S2	4:30	Shell		
Transect 10	S2	4:59	Shell	*Asterias rubens*	common starfish
Transect 10	S2	5:19	Shell	*Asterias rubens*	common starfish
Transect 10	S2	7:38	Shell	Brachyura	crab unid.
Transect 10	S2	08:01	Shell	Brachyura	crab unid.
Transect 10	S2	08:08	Shell	Actinopterygii	fish unid.
Transect 10	S2	08:29	Shell	Ammodytidae	sand lance unid.
Transect 10	S2	08:43	Shell	Brachyura	crab unid.
Transect 10	S2	09:11	Shell	Ammodytidae	sand lance unid.
Transect 10	S2	10:19	Shell	*Lanice conchilega*	sand mason worm
Transect 10	S2	11:08	Shell	*Lanice conchilega*	sand mason worm
Transect 10	S2	11:35	Shell	*Lanice conchilega*	sand mason worm
Transect 10	S2	11:35	Shell	Ammodytidae	sand lance unid.
Transect 10	S2	12:10	Shell	*Asterias rubens*	common starfish
Transect 10	S3	12:33	Sand		
Transect 10	S3	13:21	Sand	*Asterias rubens*	common starfish
Transect 10	S3	13:23	Sand	*Asterias rubens*	common starfish
Transect 10	S3	13:48	Sand	Pleuronectiformes	flatfish unid.
Transect 10	S3	13:51	Sand	Porifera	sponge unid.
Transect 10	S3	13:51	Sand	Brachyura	crab unid.
Transect 10	S3	14:14	Sand		

Appendix V – Transect 11 species list

Transect nr.	Clip nr.	Time clip	Substrate	Scientific	Species
Transect 11	S1	01:12	Sand		
Transect 11	S2	01:40	Gravel & shell	*Pagurus bernhardus*	Bernhard's hermit crab
Transect 11	S2	02:07	Gravel & shell	*Pagurus bernhardus*	Bernhard's hermit crab
Transect 11	S2	02:44	Gravel & shell	Pleuronectiformes	flatfish unid.
Transect 11	S2	03:13	Gravel & shell	Portunidea	swimming crab unid.
Transect 11	S2	04:02	Gravel & shell	Pleuronectiformes	flatfish unid.
Transect 11	S2	05:00	Gravel & shell		
Transect 11	S2	06:21	Gravel & shell	Bryozoa	bryozoa unid.
Transect 11	S2	06:40	Gravel & shell	Ammodytidae	sand lance unid.
Transect 11	S3	08:13	Sand		
Transect 11	S4	12:00	Gravel		
Transect 11	S4	13:51	Gravel	Paguroidea	hermit crab unid.
Transect 11	S4	14:22	Gravel	Pleuronectiformes	flatfish unid.
Transect 11	S4	14:34	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	14:34	Gravel	Brachyura	crab unid.
Transect 11	S4	14:58	Gravel	Bryozoa	bryozoa unid.
Transect 11	S4	15:00	Gravel	Brachyura	crab unid.
Transect 11	S4	15:00	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:07	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:14	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:18	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:27	Gravel		
Transect 11	S4	15:44	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:54	Gravel	*Asterias rubens*	common starfish
Transect 11	S4	15:54	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	15:54	Gravel	Actinaria	anemone unid.
Transect 11	S4	16:29	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	17:10	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	18:11	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	18:37	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S4	18:44	Gravel	*Urticina felina*	dahlia anemone
Transect 11	S4	18:55	Gravel	*Alcyonium digitatum*	dead man's finger
Transect 11	S5	20:00	Gravel		
Transect 11	S5	23:32	Gravel	Bryozoa	bryozoa unid.
Transect 11	S5	19:22	Gravel		
Transect 11	S5	26:24	Gravel	Brachyura	crab unid.
Transect 11	S5	26:48	Gravel	Ammodytidae	sand lance unid.
Transect 11	S5	29:35	Gravel	Portunidea	swimming crab unid.
Transect 11	S5	30:03	Gravel		

Appendix VI – Additional transect data

TRANSECT INFO				TIME			LOCATION		LENGTH SPEED		CONDITIONS				TEMPERATURE AND DEPTH				
number	transect or route section	maand-jaar)	number of sections	transect start	transect end	in minutes (rounded off)	coordinates in WGS 84 in decimal degrees at time of start (camera in water) LAT N; LON E	coordinates in WGS 84 at time of end (camera out of water)	meters between start and end coordinates (real distance longer due to drifting	velocity (kn)	condition (waves)	(BFT)	(above water)	visibility under water	(grC)	depth (m)	depht (m)	depth	restoration potential
T1	BB	27-11-2023	3	07:13	07:47	37	54°20.071'; 1° 36.516'	54°19.870'; 1° 37.383'	1010	0.7	1	3	0	poor	10.8	44	44	40-50	unknown
T2	BB	27-11-2023	3	08:29	09:01	32	54°21.948'; 1° 36.416'	54°22.072'; 1° 36.872'	550	0.5	0	1	2	poor	10.8	44	41	40-50	unknown
T3	BB	27-11-2023	3	09:35	10:06	31	54°25.968'; 1° 37.697'	54°26.143'; 1° 37.941'	420	0.5	1	1	3	poor	11	50	41	40-50	unknown
T4	BB	27-11-2023	1	10:27	10:38	9	54°28.010'; 1° 38.346'	54°28.080'; 1° 38.331'	131	0.5	1	3	3	poor	11	37	27	30-40	unknown
T5	BB	27-11-2023	1	11:03	11:28	25	54°30.318'; 1° 39.066'	54°30.547'; 1° 38.656'	610	0.5	2	4	3	poor	11	19	18	10-20	unknown
WR-97582		27-11-2023	1	11:49	12:10	21	54°33.10'; 1° 38.73'										19.5	10-20	
T6	BHM	27-11-2023	6	13:05	14:05	60	54°32.442'; 1° 30.612'	54°32.318'; 1° 29.542'	1177	0.6	2	4	2	poor	11	37	34	30-40	high
T7	BHM	27-11-2023	2	14:35	14:55	20	54°32.215'; 1° 29.957'	54°32.115'; 1° 29.578'	449	0.7	2	5	2	poor	11	34	36	30-40	medium
T8	NS-S	27-11-2023	1	15:15	15:26	11	54°32.445'; 1° 29.311'	54°32.313'; 1° 29.123'	320	0.7	2	5	2	poor	11	35	34	30-40	
WR-68				18:26			54°37.15'; 1° 29.15'												
T9	NWR-S	28-11-2023	2	08:58:00	10:03	60	54°56.489'; 1° 24.756'	54°56.432'; 1° 24.922'	206	0.5	2	5	2	poor	10	31	29	30-40	low
T10	NWR	28-11-2023	2	10:45	11:06	21	54°52.811'; 1° 25.747'	54°52.750'; 1° 26.006'	305	0.6	2	5	2	poor	10	29	25	20-30	medium
T11	NS-F	28-11-2023	3	11:55	12:27	32	54°49.872'; 1° 29.963'	54°50.021'; 1° 29.798'	330	0.6	2	5	2	poor	10	32	29	30-40	high

Appendix VII – Logbook Report

Logbook Expedition Report by Emilie Reuchlin, Doggerland Foundation

Sunday 26/11
08:00 Departure Lauwersoog, Netherlands

Monday 27/11
04:30 arrival Dogger Bank BB-S
05:00 start preparing equipment
7:00 adjusting the lights
7:13 first transect BB T1 S1
7:23 BB T1 S2
7:41 BB T1 S3
08:00 new memory card
8:10 daylight
8:26 BB T2 S1
8:42 BB T2 S2
8:54 BB T2 S3
9:04 sail northbound to lower depth
9:17 Cavendish platform in sight
9:39 BB T3 S1
9:49 BB T3 S2
10:00 BB T3 S3 (bird skull)
10:27 BB T4 S1
11:03 BB T5 S1- short video; water in cameralens
11:16 BB T5 S2 - bubble in lens
11:49 WR-97 (ID: 97582) 19.5 m depth
12:10 30 minutes sailing to reach BHM
Lunch
13:07 BHM T6 S1
13:18 BHM T6 S2
13:22 BHM T6 S3
13:38 BHM T6 S4
13:48 BHM T6 S5
13:55 BHM T6 S6
14:34 BHM T7 S1
14:45 BHM T7 S2
15:17 NS-S T8 S1
16:25 sail to wreck after clearing equipment
18:26 WR-68 we find rubble, no complete wreck
18:54 lights off

Tuesday 28-11
02:00 Frank: Weather report does not look good
08:38 Untangling cables
08:46 NWR-S T9 S1 too murky, no visibility
08:58 new NWR T9 S1
09:47 NWR T9 S2
09:59 NWR T9 S3
10:52 NWR T10 S1
11:01 NWR T10 S2
11:53 NS-F T11 S1
12:05 NS-F T11 S2
12:16 NS-F T11 S3
12:27 WE calls off camerawork
18:45 Joint decision to go back
19:03 Message to crew: abort expedition
23:20 4-5 meter waves, heading north as waves from the north BFT 7
Heading north until midnight

Wednesday 29-11
00:00 Heading north still 7-8 BFT wave height 3-4 meter.
02:00 Heading east *haaks om*, snowstorm
06:58 160 nm to go
18:00 Dinner
23:20 Message to homefront: we are returning, karaoke

Thursday 30-11
08:00-9:00 Arrival Lauwersoog
Snow and icy conditions